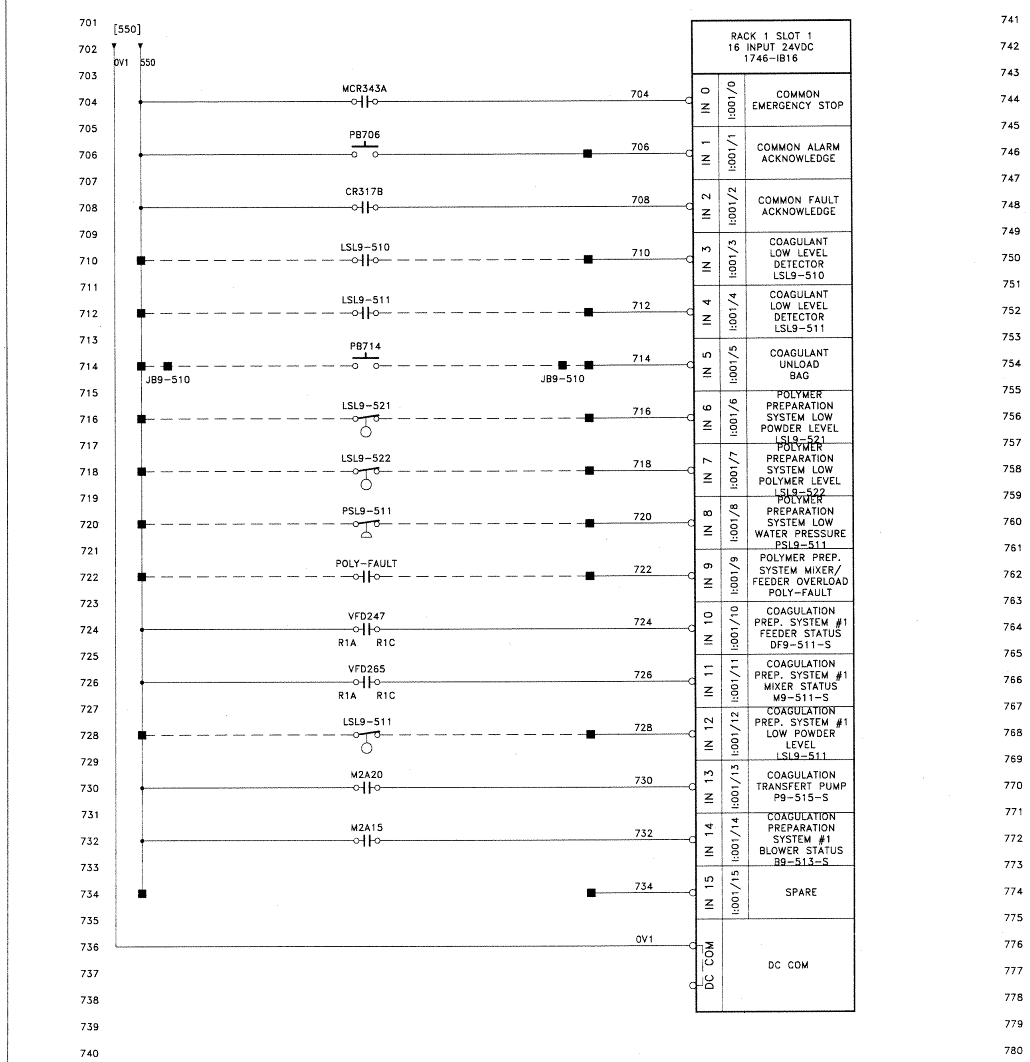


Envitech Automation Inc. *CERTIFIÉ ISO9001*
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENV CH DRAWING: A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/15	JR	JCD		

CONFIDENTIALITY AND INTELLECTUAL PROPERTY NOTICE

DESIGNER | DATE
CHECKER | DATE
ENGINEER | DATE
MANAGER | DATE
SCALE:

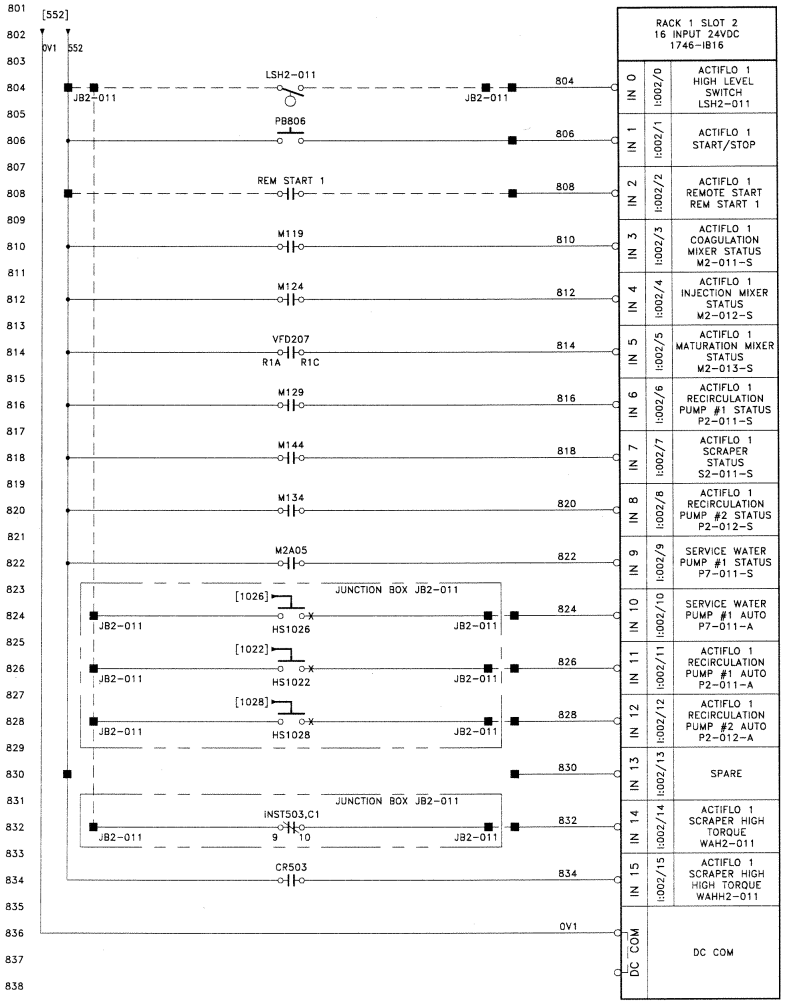
TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT / DRAWING: NC01- 001-E04-007 | SHEET 7 OF 28 | REV B

STD: JMI_22x34_D_ANG | REF:



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
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A	FOR APPROVAL	2009/04/16	JR	JCD		

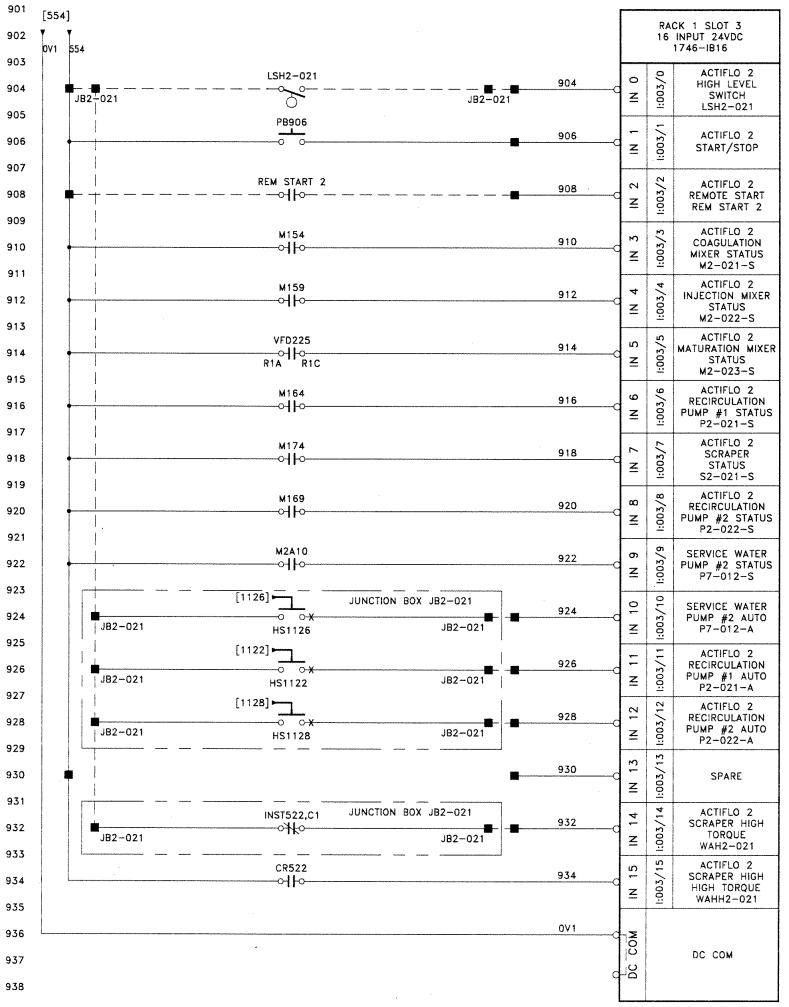
DRAWING A4765A
BAR = 1" AT PLOT SCALE
STD: JMI_22x34_D_ANG
REF:

DESIGNER	DATE	
CHECKER	DATE	
ENGINEER	DATE	
MANAGER	DATE	
SCALE:		

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 3B3 / Tel: (514) 334-7230 / Fax: (514) 334-9078

PROJECT DRAWING: NC01- 001-E04-008
SHEET: 8 OF 28
REV: B



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
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A	FOR APPROVAL	2009/04/16	JR	JCD		

ENVITECH DRAWING A4765A
BAR = 1" AT PLOT SCALE
STD: JMI_22x34_D_ANG
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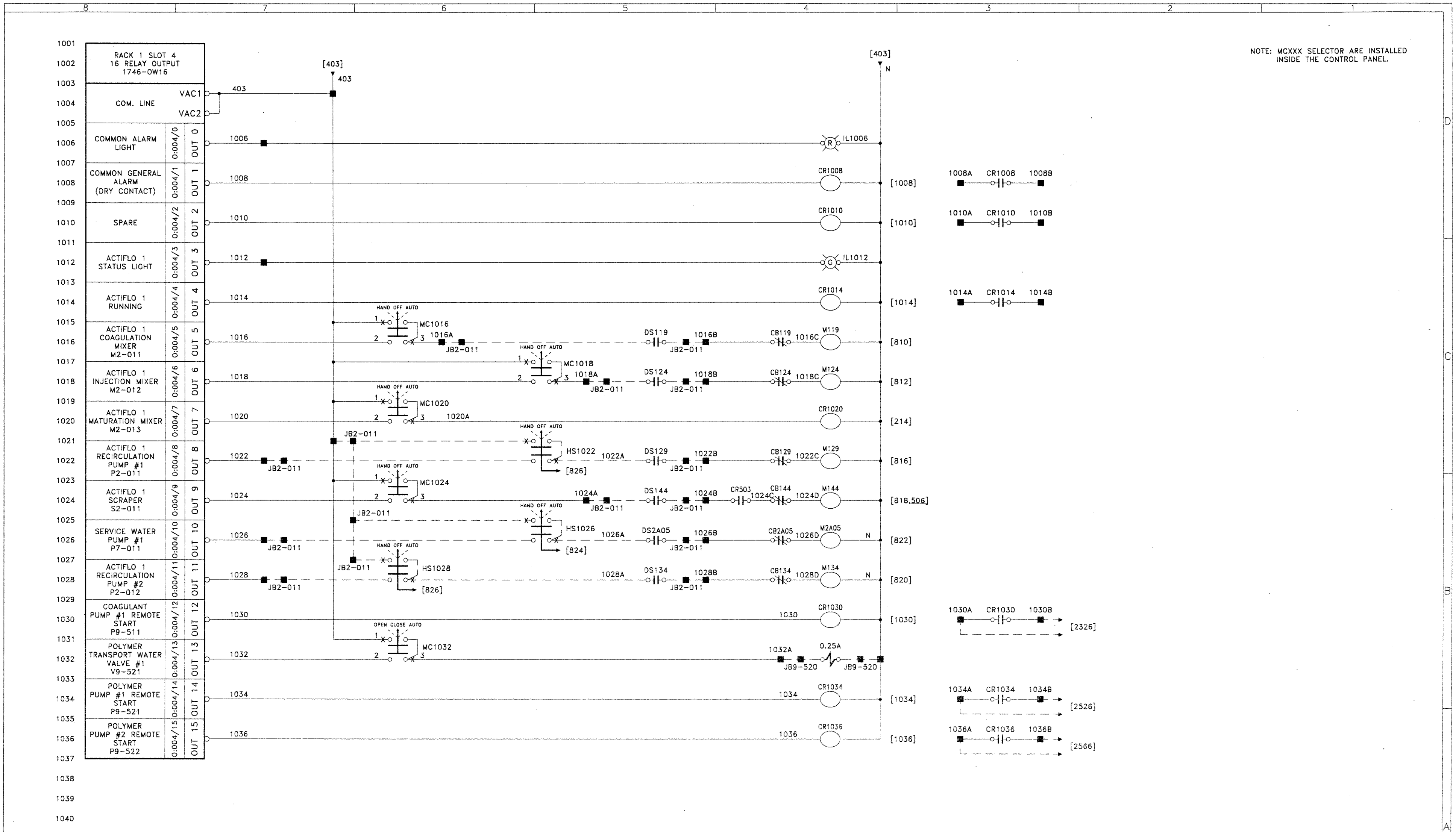
DESIGNER		DATE
CHECKER		DATE
ENGINEER		DATE
MANAGER		DATE
SCALE:		

TITLE: (2) ACTIFLO ACP-70QR ELECTRICAL SCHEMATIC
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, QC, Canada H4S 2B3 / Tel. (514) 334-2238 / Fax. (514) 334-5070

PROJECT	DRAWING	SHEET	REV
NC01-001-E04-009		9 OF 28	B



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A
BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVG	CCN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2008/04/16	JR	JCD		

DESIGNER / DATE / CHECKER / DATE / ENGINEER / DATE / MANAGER / DATE / SCALE:

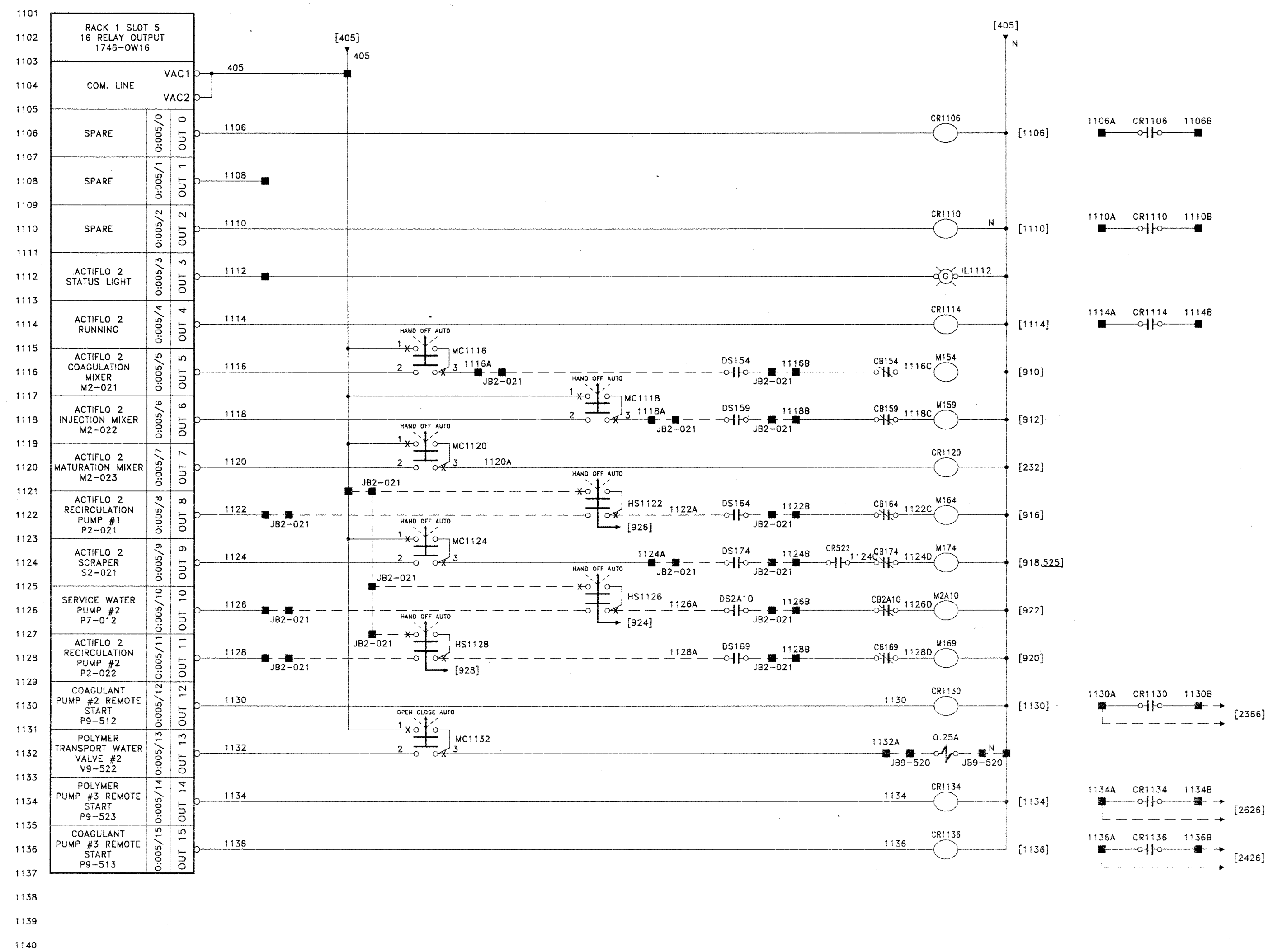
TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT / DRAWING: NC01- 001-E04-010 | SHEET 10 OF 28 | REV B

STD: JMI_22x34_D_ANG | REF:



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER / DATE
CHECKER / DATE
ENGINEER / DATE
MANAGER / DATE
SCALE:

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT / DRAWING: NC01- 001-E04-011

SHEET: 11 OF 28 REV: B

STD: JMI_22x34_D_ANG

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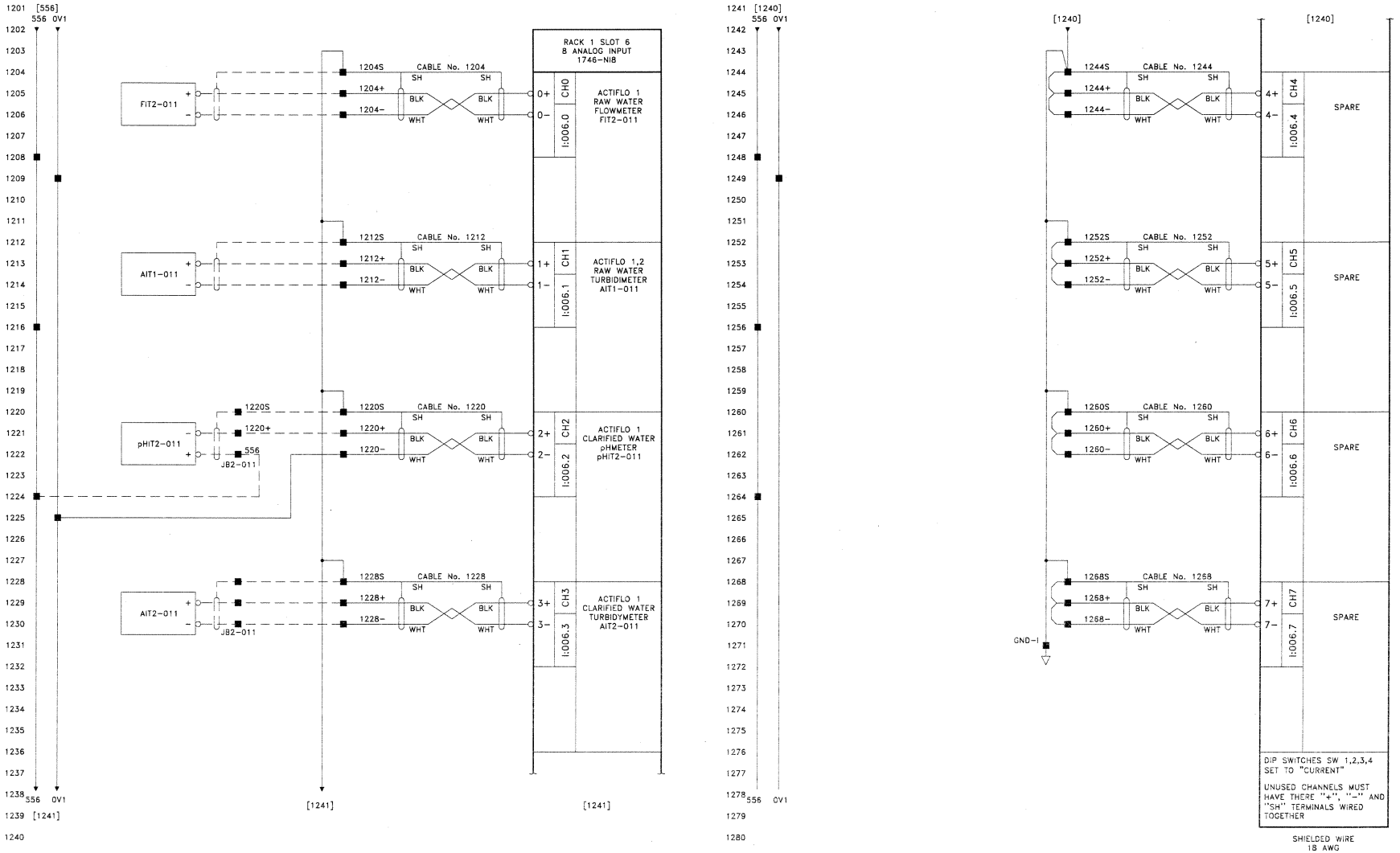


Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF:

		DATE
DESIGNER		
CHECKER		
ENGINEER		
MANAGER		
SCALE:		

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

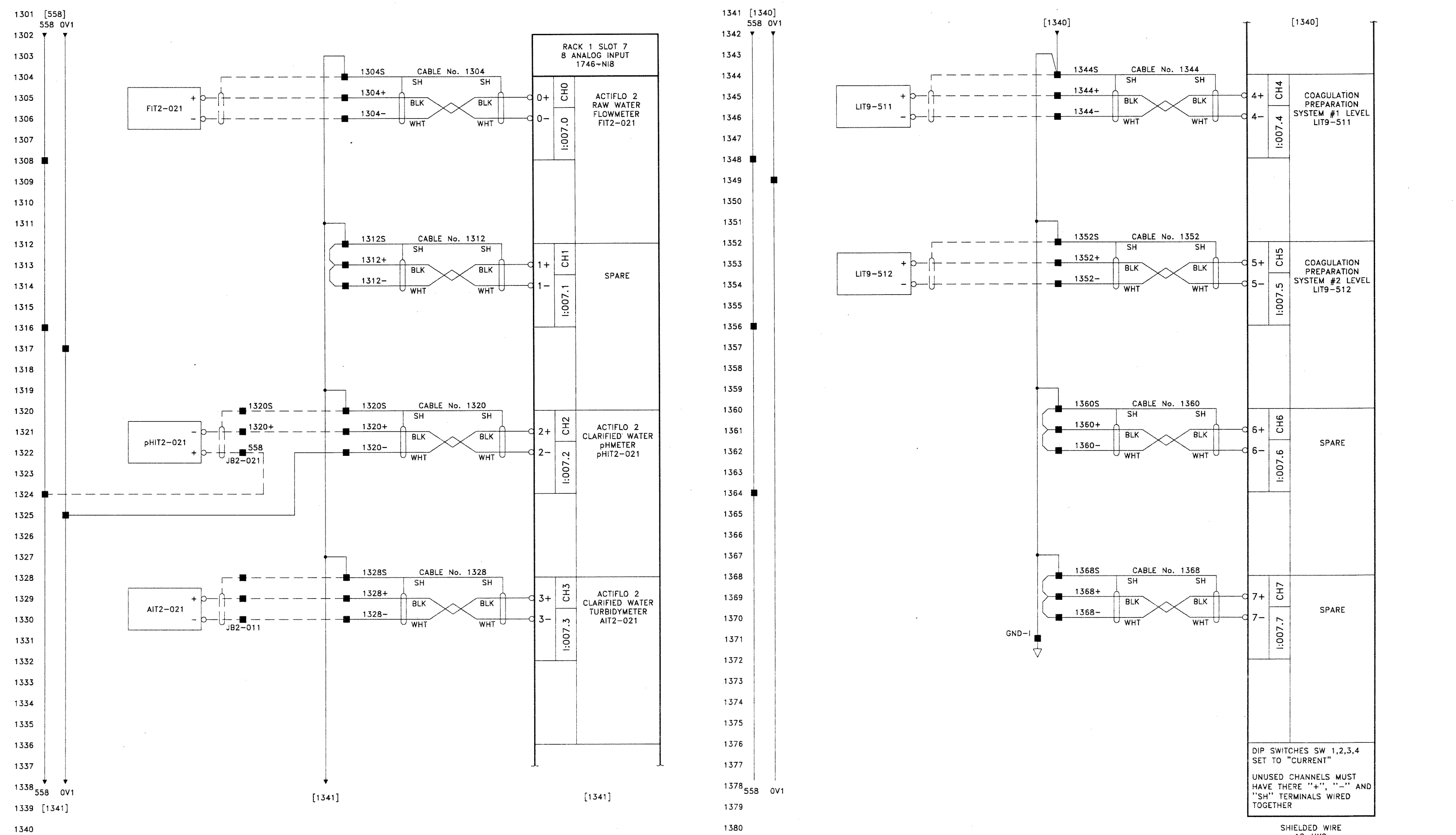
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4150 Sartigan Street, Saint-Laurent, St. Canada H4S 2B3 / tel. (514) 334-2238 / fax. (514) 334-0238

PROJECT: NC01-001-E04-012

SHEET: 12 OF 28

REV: B



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER / DATE — CHECKER / DATE — ENGINEER / DATE — MANAGER / DATE — SCALE:

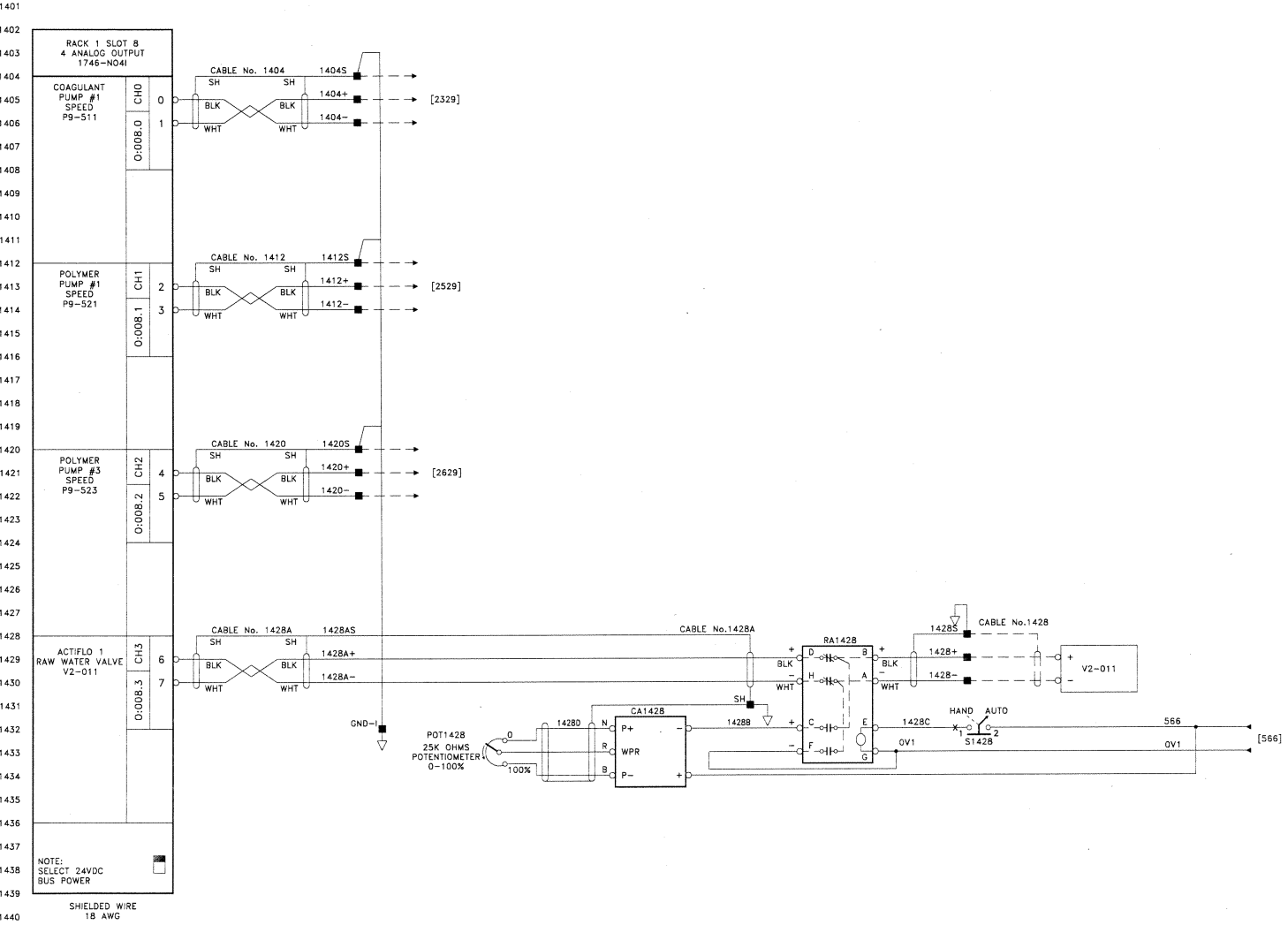
TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT / DRAWING: NC01- 001-E04-013 — SHEET 13 OF 28 — REV B

STD: JMI_22x34_D_ANG — REF:



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

ENVITECH DRAWING A4765A
BAR = 1" AT PLOT SCALE
STD: JMI_22x34_D_ANG
REF:

DESIGNER	DATE	
CHECKER	DATE	
ENGINEER	DATE	
MANAGER	DATE	
SCALE:		

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
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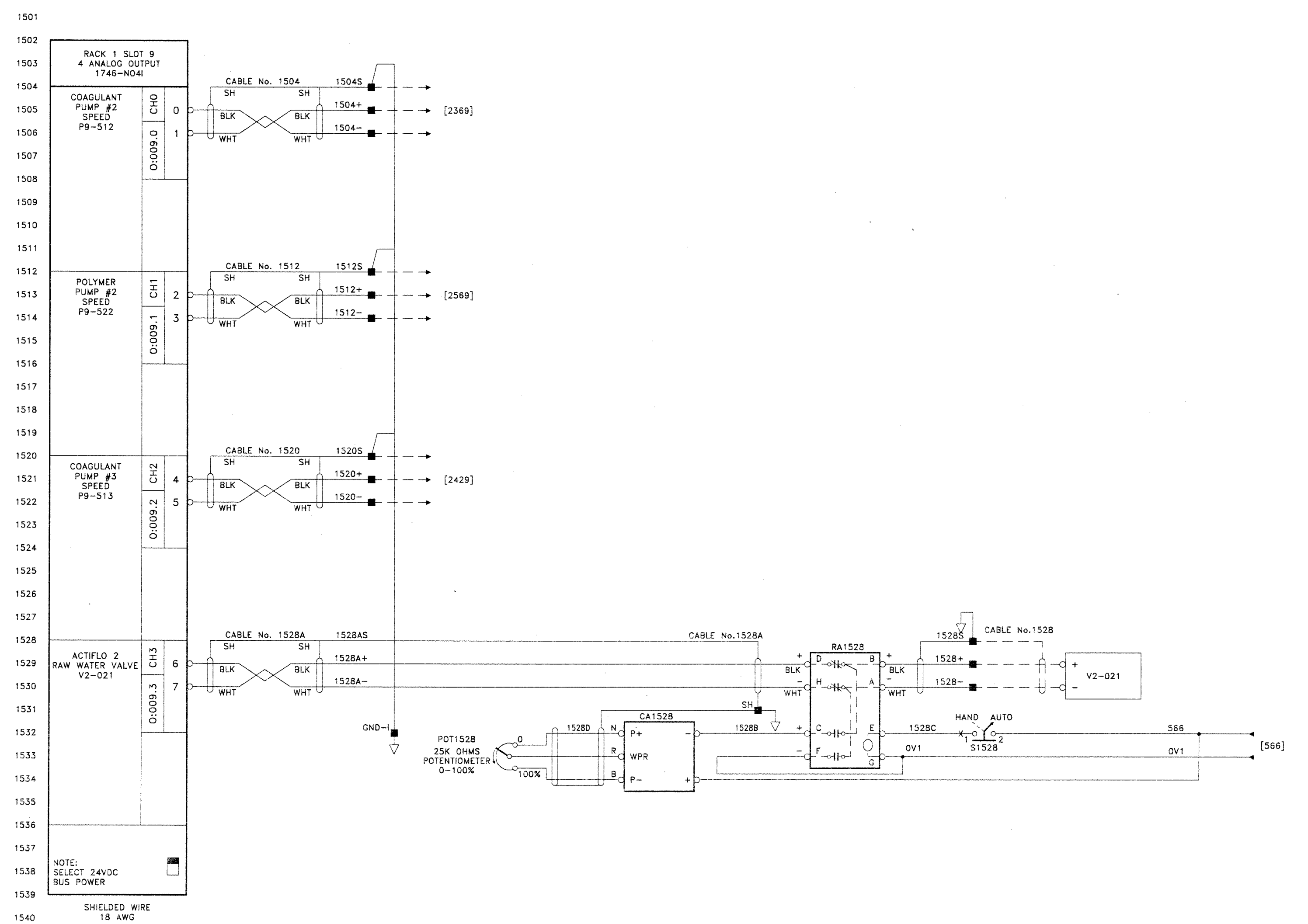
PROJECT DRAWING: NC01 - 001-E04-014
SHEET: 14 OF 28
REV: B



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER	DATE
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
SCALE:	

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING NC01- 001-E04-015

SHEET 15 OF 28

REV B

STD: JMI_22x34_0_ANG

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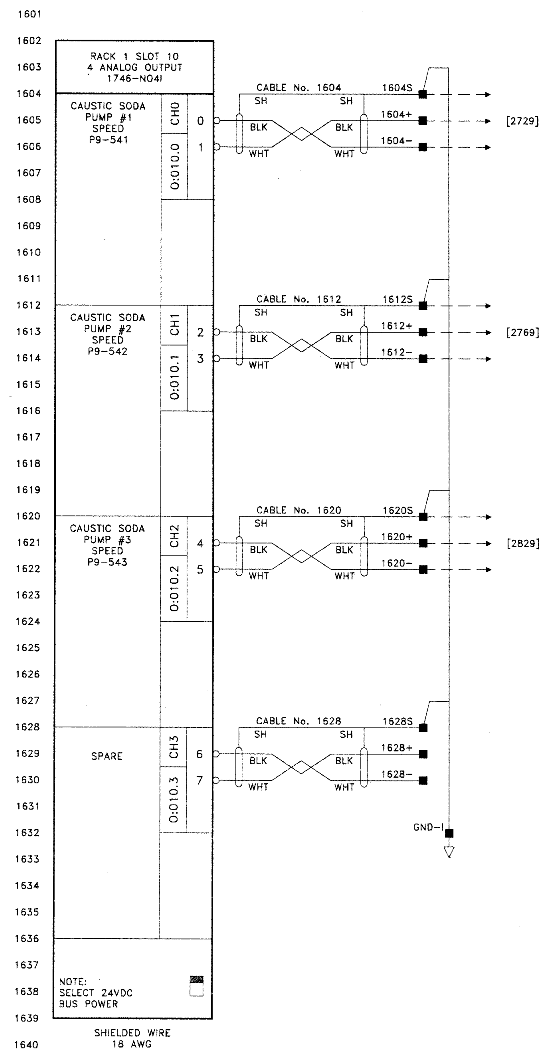

Envitech Automation Inc. *CERTIFIÉ ISO9001*

ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

CONFIDENTIALITY AND INTELLECTUAL PROPERTY NOTICE

DESIGNER DATE | CHECKER DATE | ENGINEER DATE | MANAGER DATE | SCALE:

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-016

SHEET: 16 OF 28

REV: B

STD: JMI_22x34_D_ANG

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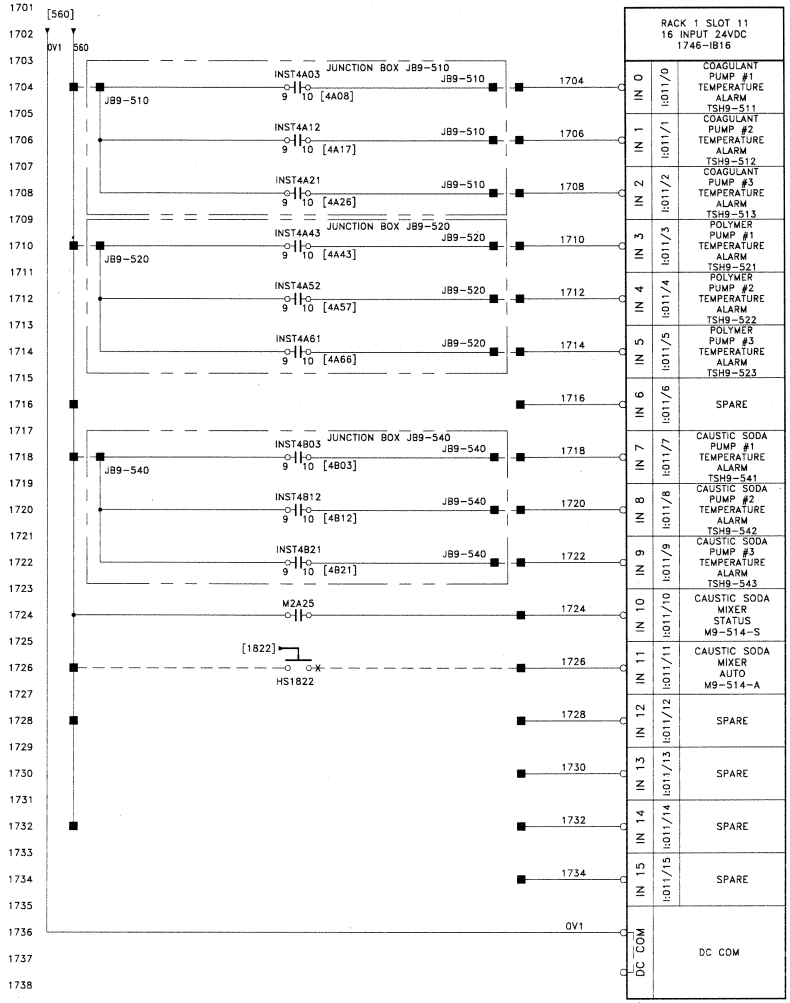


REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

Envitech Automation Inc. *CERTIFIÉ ISO9001*
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF:

DESIGNER		DATE
CHECKER		DATE
ENGINEER		DATE
MANAGER		DATE
SCALE:		

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

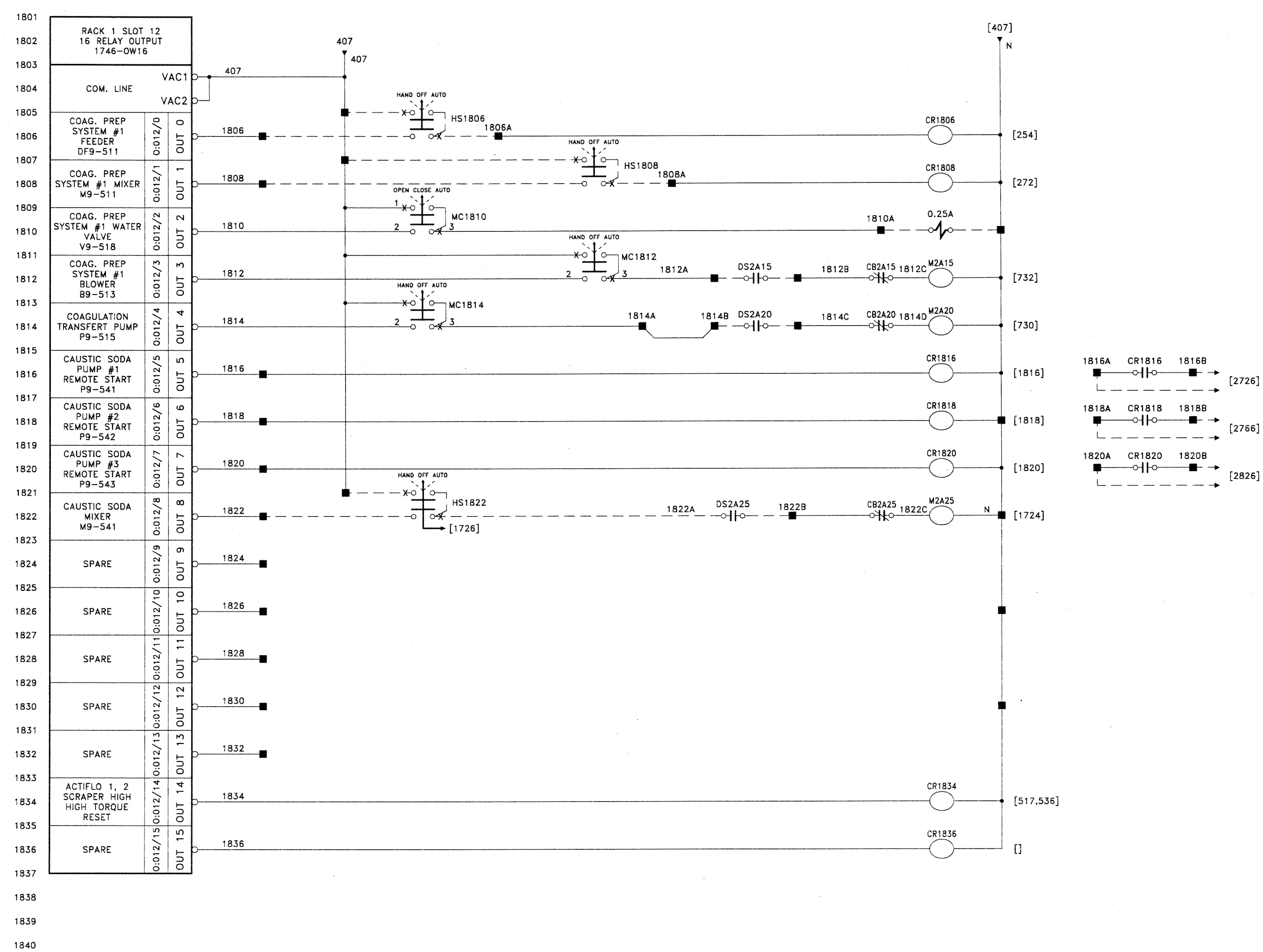
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4126 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-3070

PROJECT DRAWING: NC01- 001-E04-017

SHEET: 17 OF 28

REV: B



Envitech *CERTIFIÉ ISO9001*
Automation Inc.
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

JM DRAWING A4765A
1" AT PLOT SCALE
STD: JMI_22x34_D_ANG
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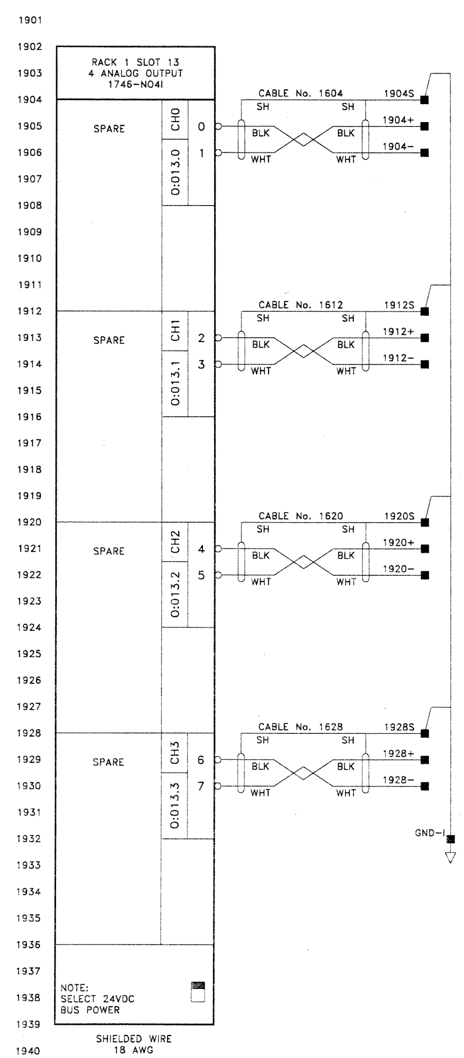
DESIGNER | DATE
CHECKER | DATE
ENGINEER | DATE
MANAGER | DATE
SCALE:

TITLE (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT NC01- DRAWING 001-E04-018 | SHEET 18 OF 28 | REV B



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER DATE
CHECKER DATE
ENGINEER DATE
MANAGER DATE
SCALE

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-019

SHEET: 19 OF 28

REV: B

STD: JMI_22x34_D_ANG

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REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF:

DESIGNER	DATE	
CHECKER	DATE	
ENGINEER	DATE	
MANAGER	DATE	
SCALE:		

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / tel: (514) 334-7230 / fax: (514) 334-3670

PROJECT DRAWING: NC01-001-E04-020

SHEET: 20 OF 28

REV: B

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Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER | DATE
CHECKER | DATE
ENGINEER | DATE
MANAGER | DATE
SCALE:

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-021

SHEET: 21 OF 28

REV: B

STD: JMI_22x34_D_ANG

REF:

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DESIGNER	DATE					
CHECKER	DATE					
ENGINEER	DATE					
MANAGER	DATE					
SCALE:						

TITLE: (2) ACTIFLO ACP-700R
ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4150 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B2 / tel. (514) 334-7220 / Fax (514) 334-7070

PROJECT: NC01-001-E04-022
DRAWING:
SHEET: 22 OF 28
REV: B

Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING: A4765A

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	CDN
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A	FOR APPROVAL	2009/04/16	JR	JCD		

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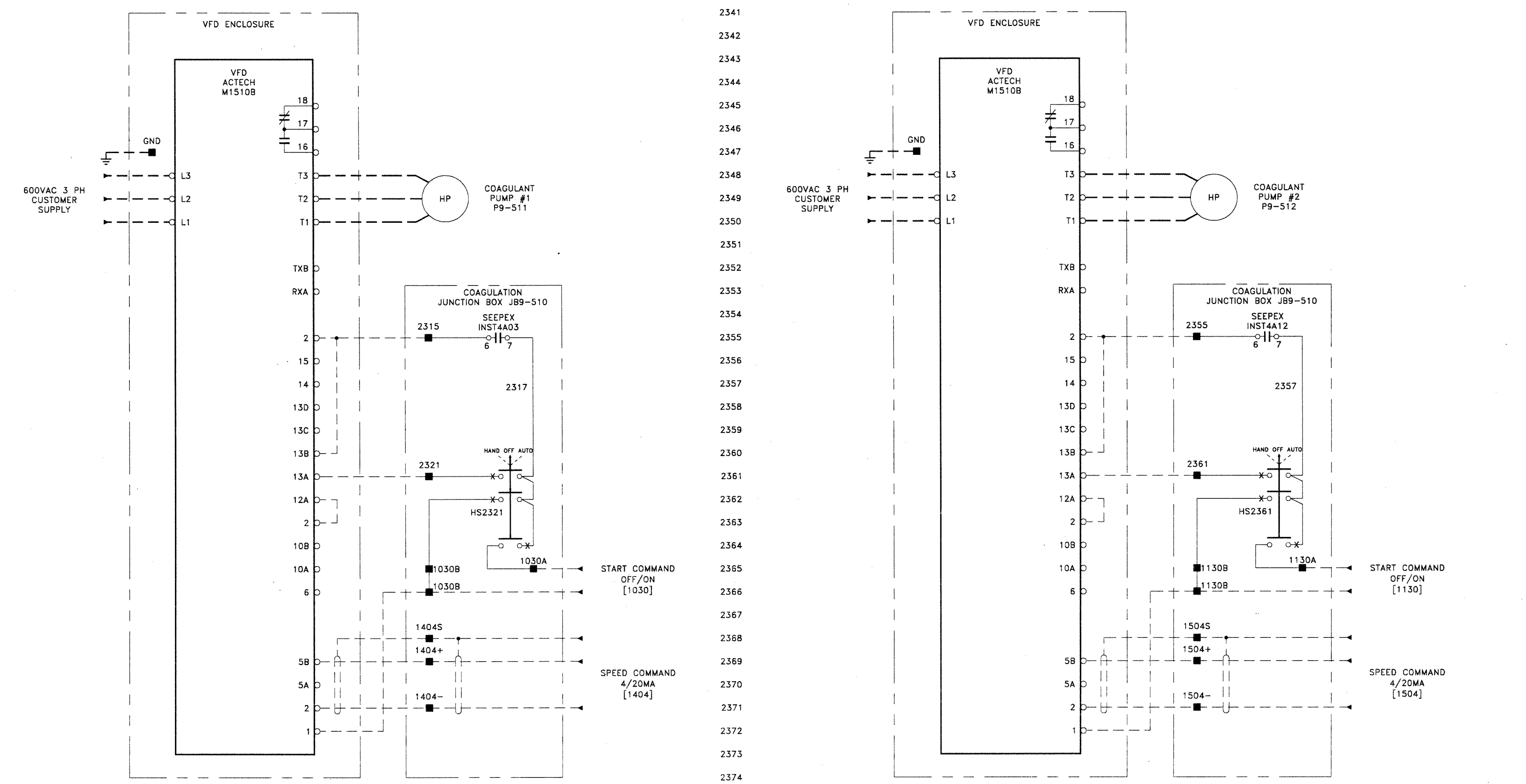

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ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER / DATE
CHECKER / DATE
ENGINEER / DATE
MANAGER / DATE
SCALE:

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-023
SHEET: 23 OF 28
REV: B

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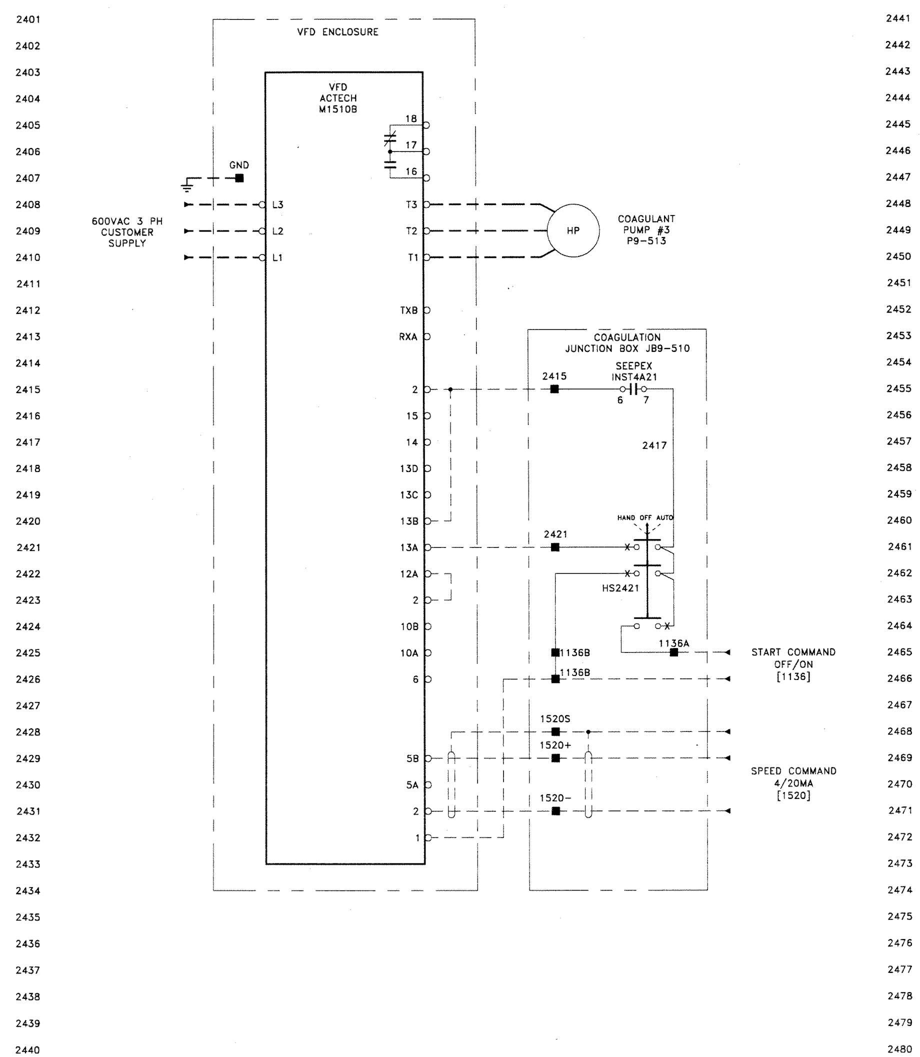


Envitech Automation Inc. *CERTIFIÉ ISO9001*

ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER | DATE
CHECKER | DATE
ENGINEER | DATE
MANAGER | DATE
SCALE:

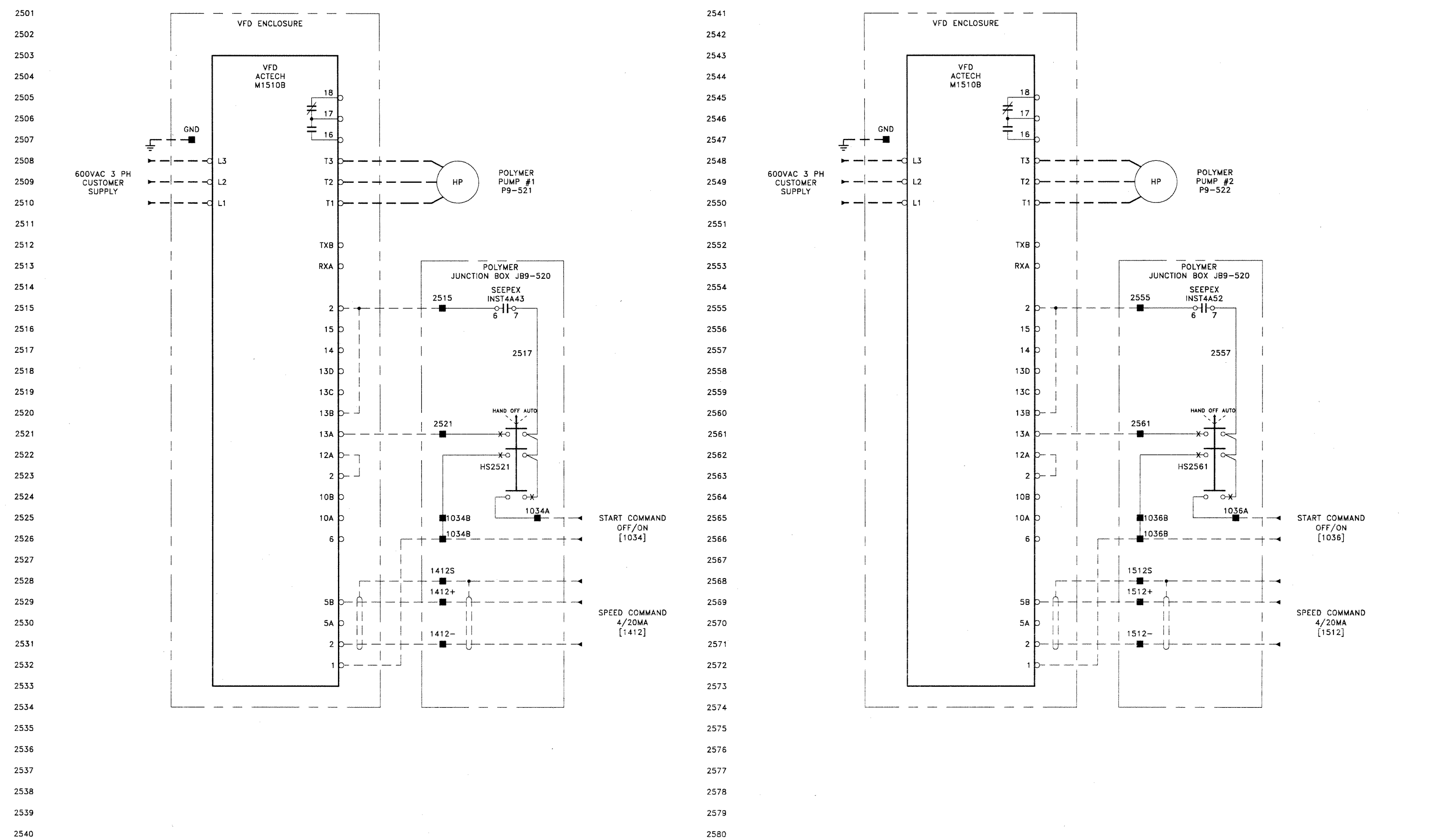
TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-024 | SHEET: 24 OF 28 | REV: B

STD: JMI_22x34_D_ANG | REF:



Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING: A4765A
BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER / DATE
CHECKER / DATE
ENGINEER / DATE
MANAGER / DATE
SCALE:

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- 001-E04-025
SHEET: 25 OF 28
REV: B

STD: JMI_22x34_D_ANG
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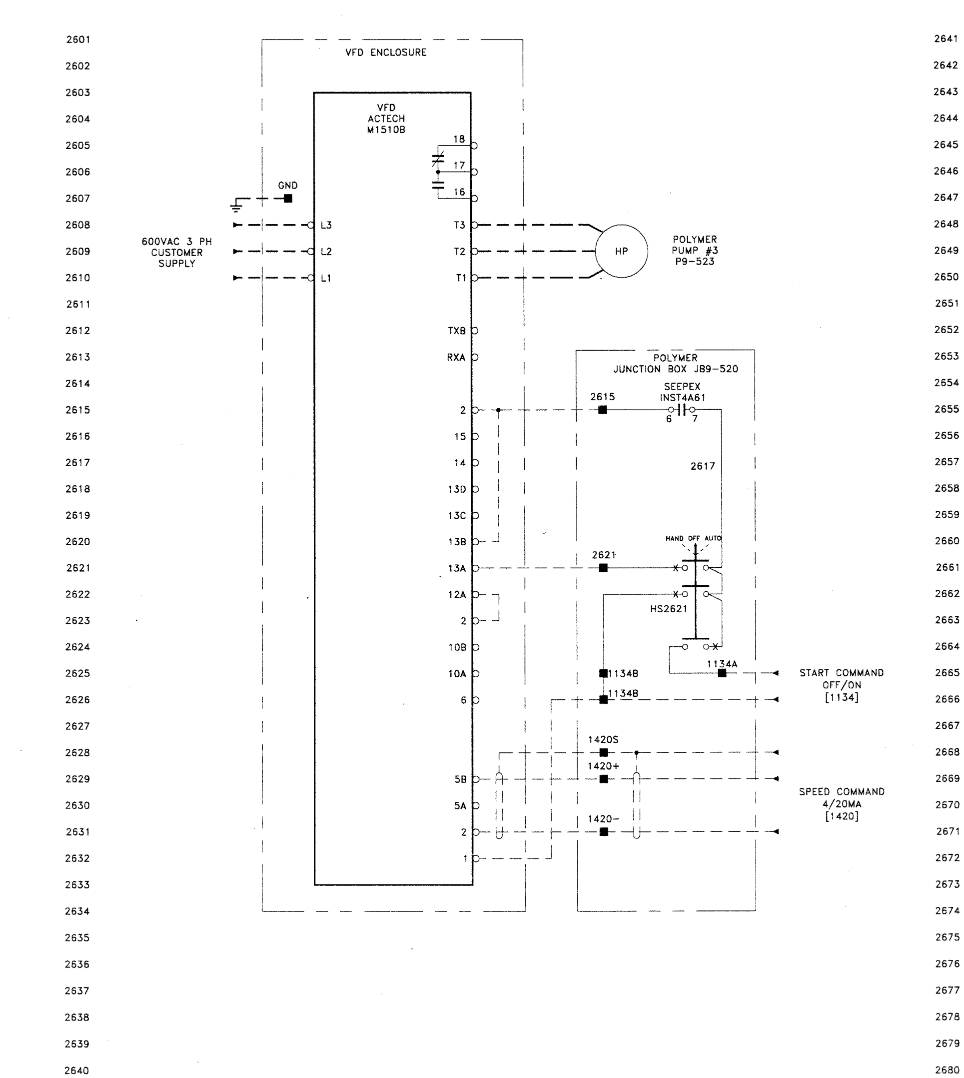

(2) ACTIFLO ACP-700R
ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT / DRAWING: NC01- 001-E04-026

SHEET: 26 OF 28

REV: B

Envitech Automation Inc. CERTIFIÉ ISO9001

ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING: A4765A

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DESIGNER / DATE
CHECKER / DATE
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MANAGER / DATE
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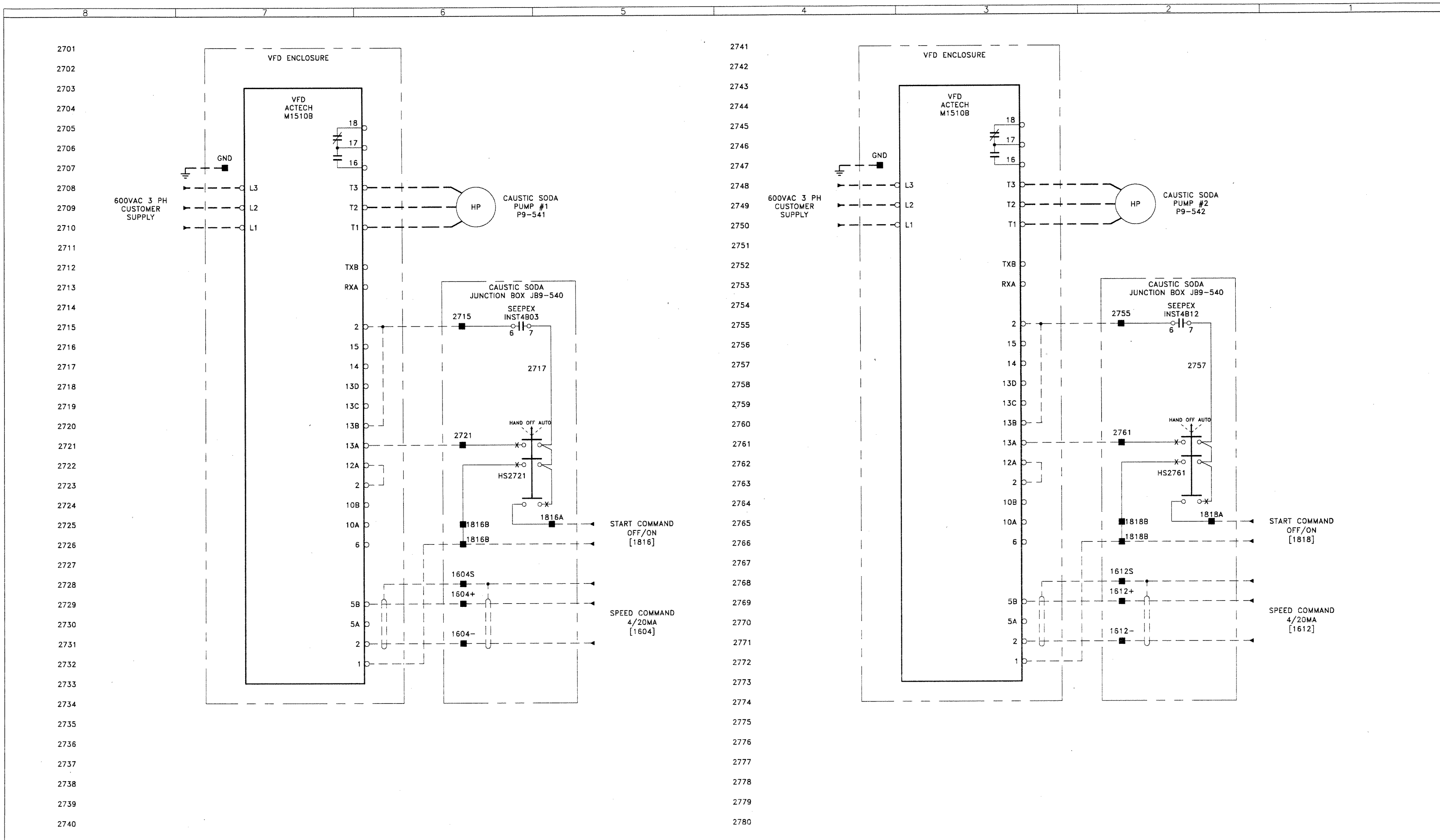


Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

DRAWING A4765A

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

TITLE: (2) ACTIFLO ACP-700R ELECTRICAL SCHEMATIC

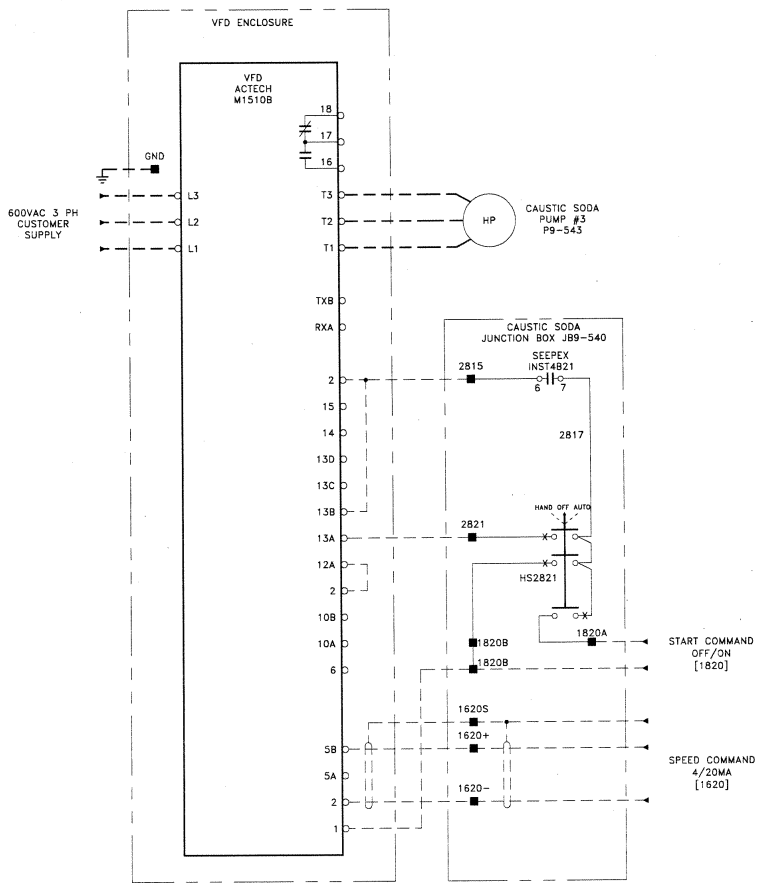
CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000

PROJECT / DRAWING: NC01- 001-E04-027

SHEET: 27 OF 28

REV: B



REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
B	AS BUILT	2009/05/29	JR	JCD		
A	FOR APPROVAL	2009/04/16	JR	JCD		

Envitech Automation Inc. CERTIFIÉ ISO9001
ENVITECH Intégrateurs de systèmes / Systems Integrators

ENVITECH DRAWING A4765A

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF:

DESIGNER	DATE
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
SCALE:	

TITLE: (2) ACTIFLO ACP-700R
ELECTRICAL SCHEMATIC

CLIENT: MEADOWBANK MINING CORP., NWT

JOHN MEUNIER ISO 9001: 2000
4765 Sartoon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel. (514) 334-7030 / Fax: (514) 334-5070

PROJECT: NC01 - 001-E04-028
DRAWING
SHEET: 28 OF 28
REV: B

LEFT BLANK

PROCESS AND INSTRUMENTATION DRAWINGS

LEFT BLANK

FLOWS AND LINES

- NEW MAIN FLOW
- EXISTING MAIN FLOW
- FUTURE MAIN FLOW
- NEW SECONDARY FLOW
- EXISTING SECONDARY FLOW
- FUTURE SECONDARY FLOW
- CHEMICALS
- BY OTHERS
- CS / SS — MATERIAL SPECIFICATION CHANGE
- ( ) AVERAGE FLOW
- [ ] PEAK FLOW

ABBREVIATIONS

A TO C	AIR TO CLOSE
A TO O	AIR TO OPEN
AVG	AVERAGE
B/EL	BOTTOM ELEVATION
CL	CENTER LINE
CFM	CUBIC FEET PER MINUTE
CW	CITY WATER (POTABLE)
DIA	DIAMETER
DWG	DRAWING
EL	ELEVATION
F.C.	FAIL CLOSED
F.O.	FAIL OPEN
FRL	FILTER\REGULATOR\LUBRICATOR
GAL	GALLONS
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HB	HOSE BIB
HG	INCHES OF MERCURY
HI	HIGH
HOA	HAND/OFF/AUTO
HP	HORSEPOWER
IA	INSTRUMENT AIR
ID	INSIDE DIAMETER
INV	INVERT
O	LOW
MH	MANHOLE
MW	MANWAY
N.C.	NORMALLY CLOSED
N.O.	NORMALLY OPEN
OAL	OVERALL LENGTH
O.D.	OUTSIDE DIAMETER
OF	OVERFLOW
PA	PLANT AIR
PSIG	POUNDS PER SQUARE INCH – GAUGE
PW	PLANT WATER
RED	REDUCER
RPM	REVOLUTIONS PER MINUTE
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SG	SPECIFIC GRAVITY
SP	SETPOINT
SSH	STRAIGHT SIDE HEIGHT
STD	STANDARD
SW	SEAL WATER
SWD	SIDE WATER DEPTH
TDH	TOTAL DYNAMIC HEAD(FT OF FLUID)
T/EL	TOP ELEVATION
TYP	TYPICAL
VAC	VACUUM
VSD	VARIABLE SPEED DRIVE
WC	WATER COLUMN
WD	WATER DEPTH
WL	WATER LEVEL
WV	WORKING VOLUME (DOES NOT INCLUDE FREEBOARD OR HEEL)

VALVE SYMBOLS

- ANGLE
- BALL
- BUTTERFLY
- CHECK VALVE
- CHECK
- DIAPHRAGM
- VALVE NOT SPECIFIED
- GLOBE
- KNIFE
- NEEDLE
- PINCH
- PLUG
- PRESSURE REDUCING
- RELIEF ON LINE
- RELIEF
- SQUEEZE
- THREE WAY
- FOUR WAY
- VACUUM BREAKER
- AIR RELEASE
- HOSE BIBB
- INTEGRAL BLOCK & BLEED
- PENSTOCK
- WASTE PLUG
- MULTI-FONCTION VALVE
- CALIBRATION COLUMN
- VENT — EVENT
- AIR TRAP

ACTUATORS

- CYLINDER
- DIAPHRAGM-SPRING
- ELECTRO HYDRAULIC
- ELECTRO PNEUMATIC
- MOTOR
- SOLENOID
- POSITIONER * – TYPE

PIPING AND TUBING MATERIALS

ABS	ACRYLONTRILE BUTADIENE STYRENE TRUSS PIPE
ALM	ALUMINUM PIPE OR TUBING
ARP	ALUMINUM REINFORCED PLASTIC PIPE
BL	BLACK IRON PIPE
BPT	BRAIDED PLASTIC TUBING–PVC
CI	CAST IRON PIPE
CISP	CAST IRON SOIL PIPE
CMCP	CORRUGATED METAL CULVERT PIPE
CMH	CHEMICAL HOSE
CMP	CORRUGATED METAL PIPE
COP	COPPER PIPE
CPVC	CHLORINATED POLYVINYL CHLORIDE PIPE
CS	CARBON STEEL PIPE
DI	DUCTILE CAST IRON PIPE
ERP	EPOXY RESIN PIPE
FRP	FIBERGLASS REINFORCED PLASTIC PIPE
GS	GALVANIZED STEEL PIPE
HOSE	FLEXIBLE HOSE
HSI	HIGH SILICON IRON PIPE
KLS	PVDF LINED STEEL PIPE (KYNAR ® LINED TYPICAL)
KYN	PVDF (KYNAR ® TYPICAL)
MI	CARBON STEEL PIPE W/MALLEABLE IRON FITTINGS
NEO	NEOPRENE HOSE
NI	NICKEL ALLOY PIPE
NLS	NEOPRENE LINED STEEL PIPE
PEP	POLYETHYLENE PIPE
PETB	POLYETHYLENE TUBING
PLS	POLYPROPYLENE LINED STEEL PIPE
POP	POLYPROPYLENE PIPE
PRP	PHENOLIC RESIN PIPE
PVC	POLYVINYL CHLORIDE PIPE
PVC HOSE	POLYVINYL CHLORIDE HOSE
PVDF	POLYVINYLIDENE FLUORIDE PIPE
RBR	RUBBER HOSE
RCCP	REINFORCED CONCRETE CULVERT PIPE
RCP	REINFORCED CONCRETE PIPE
SAR	SARAN TUBING
SLH	SLUDGE HOSE
SLS	SARAN LINED STEEL PIPE
SS	STAINLESS STEEL PIPE OR TUBING
TEF	TEFLON TUBING
TI	TITANIUM ALLOY PIPE
TLS	TEFLON LINED STEEL PIPE
TYB	TYGON ® TUBING–BRAIDED
TYG	TYGON ® TUBING–UNBRAIDED

INSTRUMENTATION AND RELATED ITEMS

- CAPILLARY TUBING
- ELECTRICAL
- HYDRAULIC
- PNEUMATIC
- DATA LINK
- FLUME
- MAGNETIC FLOW METER
- SONIC FLOW METER
- TURBINE FLOW METER
- VENTURI
- WEIR
- VORTEX SENSOR
- ROTAMETER

INSTRUMENT SYMBOLS

	PRIMARY LOCATION ***NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION ***NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS	1 (* IP1**)	2	3
SHARED DISPLAY, SHARED CONTROL	4	5	6
COMPUTER FUNCTION	7	8	9
PROGRAMMABLE LOGIC CONTROL	10	11	12

* SYMBOL SIZE MAY VARY ACCORDING TO THE USER'S NEEDS AND THE TYPE OF DOCUMENT. A SUGGESTED SQUARE AND CIRCLE SIZE FOR LARGE DIAGRAMS IS SHOWN ABOVE. CONSISTENCY IS RECOMMENDED.

** ABBREVIATIONS OF THE USER'S CHOICE SUCH AS IP1 (INSTRUMENT PANEL #1), IC2 (INSTRUMENT CONSOLE #2), CC3 (COMPUTER CONSOLE #3), ETC., MAY BE USED WHEN IT IS NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION.

*** NORMALLY INACCESSIBLE OR BEHIND-THE-PANEL DEVICES OR FUNCTIONS MAY BE DEPICTED BY USING THE SAME SYMBOL BUT WITH DASHED HORIZONTAL BARS, I.E.

PIPING ACCESSORIES

- FUNNEL
- DIAPHRAGM SEAL
- DRESSER COUPLING
- EJECTOR/EDUCTOR
- EXPANSION JOINT
- FLANGED CONNECTION
- FLEXIBLE HOSE
- HOSE CONNECTION
- PIPE TO TUBING ADAPTER
- INSULATION
- INSULATED PIPE WITH ELECTRIC HEAT TRACE
- INSULATED PIPE WITH STEAM HEAT TRACE
- VACUUM BREAKER
- PULSATION DAMPENER
- END CAP DISCONNECT
- QUICK DISCONNECT
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- RUPTURE DISK
- BASKET FILTER
- MIXING VALVE
- SIGHT FLOW INDICATOR
- STRAINER
- UNION
- STEAM TRAP
- AIR FILTER
- AIR LUBRICATOR
- AIR REGULATOR
- COMB. AIR FILTER/ REGULATOR W/GAUGE
- FLOW ORIFICE
- SIGHT FLOW STRAINER
- OPEN — SPECTACLE BLIND
- CLOSE — SPECTACLE BLIND
- PIGTAIL SIPHON
- STATIC MIXER
- INJECTION QUILL
- STOP LOG

ISA INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS	
	PROCESS VARIABLE	MODIFIER (IF NEEDED)	READOUT OR COMPUTER FUNCTION	MODIFIER (IF NEEDED)
A	ANALYSIS		ALARM	
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE
C	USER'S CHOICE		CONTROL	
D	USER'S CHOICE	DIFFERENTIAL		
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)	
F	FLOW RATE	RATIO (FRACTION)		
G	USER'S CHOICE		GLASS, VIEWING DEVICE	
H	HAND			HIGH
I	CURRENT (ELECTRICAL)		INDICATE	
J	POWER	SCAN		
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE	CONTROL STATION	
L	LEVEL		LIGHT	LOW
M	USER'S CHOICE	MOMENTARY		MIDDLE, INTERMEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)	
P	PRESSURE, VACUUM		POINT (TEST CONNECTION)	
Q	QUANTITY	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD	
S	SPEED, FREQUENCY	SAFETY	SWITCH	
T	TEMPERATURE		TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECH. ANALYSIS		VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL	
X	UNCLASSIFIED	X–AXIS	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE OR PRESENCE	Y–AXIS	RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z–AXIS	DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

LEGEND BASED ON ISA STANDARD S 5.1

INSTRUMENT TAG NUMBERS

TIC 103 – INSTRUMENTATION IDENTIFICATION OR TAG NUMBER

103 – LOOP NUMBER

TIC – FUNCTIONAL IDENTIFICATION

NOTE: HYPHENS ARE OPTIONAL AS SEPARATORS

ELECTRICAL AND RELATED ITEMS

- S — SELECTOR SWITCHES
- VFD — VARIABLE FREQUENCY DRIVE
- EM — EMERGENCY POWER
- I — INTERLOCK
- PILOT LIGHT

LINE NUMBER IDENTIFICATION

1"–P–110–CS–I

- INSULATION
- MATERIAL CLASS
- LINE NUMBER
- FLUID SERVICE DESIGNATION
- LINE SIZE

LINE CONTINUATIONS

- INDICATES A LINE GOING TO OR COMING FROM BATTERY LIMITS (CONTRACT LIMITS)
- 5 A/2 — INDICATES CONTINUATION OF LINE IS ON SHEET NUMBER 5 (SAME DRAWING NUMBER) IN ZONE A 2
- SHT 5 — INDICATES CONTINUATION OF A SIGNAL IS ON SHEET NUMBER 5

EQUIPMENT TAG NUMBERS

MXXXX	AGITATORS, AERATORS
BXXXX	AIR HANDLING–BLOWERS, COMPRESSORS, DRYERS
RXXXX	CLARIFIERS, THICKENERS, SEPARATORS
FXXXX	FILTERS–VACUUM, PRESSURE, CENTRIFUGES
PXXXX	PUMPS
TXXXX	TANKS
EXXXX	HEAT EXCHANGER
IXXXXX	SOFTENERS, DEMINERALIZERS
ROXXXX	REVERSE OSMOSIS UNITS
SGXXXX	STEAM GENERATORS

VALVE & ACCESSORY TAG

VXXXX	VALVE
EJXXXX	EXPANSION JOINT
HXXXX	HOSE
FXXXX	FILTER
SXXXX	STRAINER
SBXXXX	SPECTACLE BLIND
STXXXX	STEAM TRAP

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009–06–26			J.T.	
0	FOR INFORMATION	2009–03–23	SA			

DESIGNER	A.V. — DATE 2007–11–27
CHECKER	P.S. — DATE 2007–11–27
ENGINEER	M.S. — DATE 2007–12–03
MANAGER	DATE
SCALE	NONE

TITLE: WATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM LEGEND

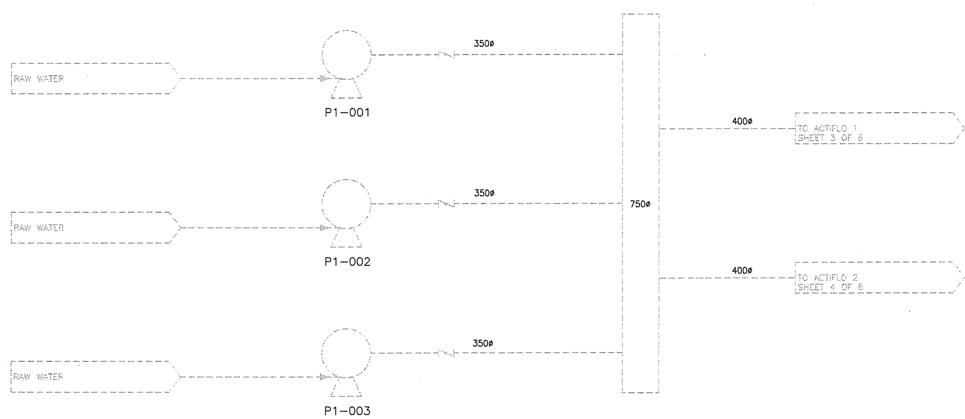
CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT DRAWING: NC01– PI001 — SHEET 1 OF 8 — REV 1

STD: JMI_22x34_D_ANG — REF: RA16 — BAR = 1" AT PLOT SCALE

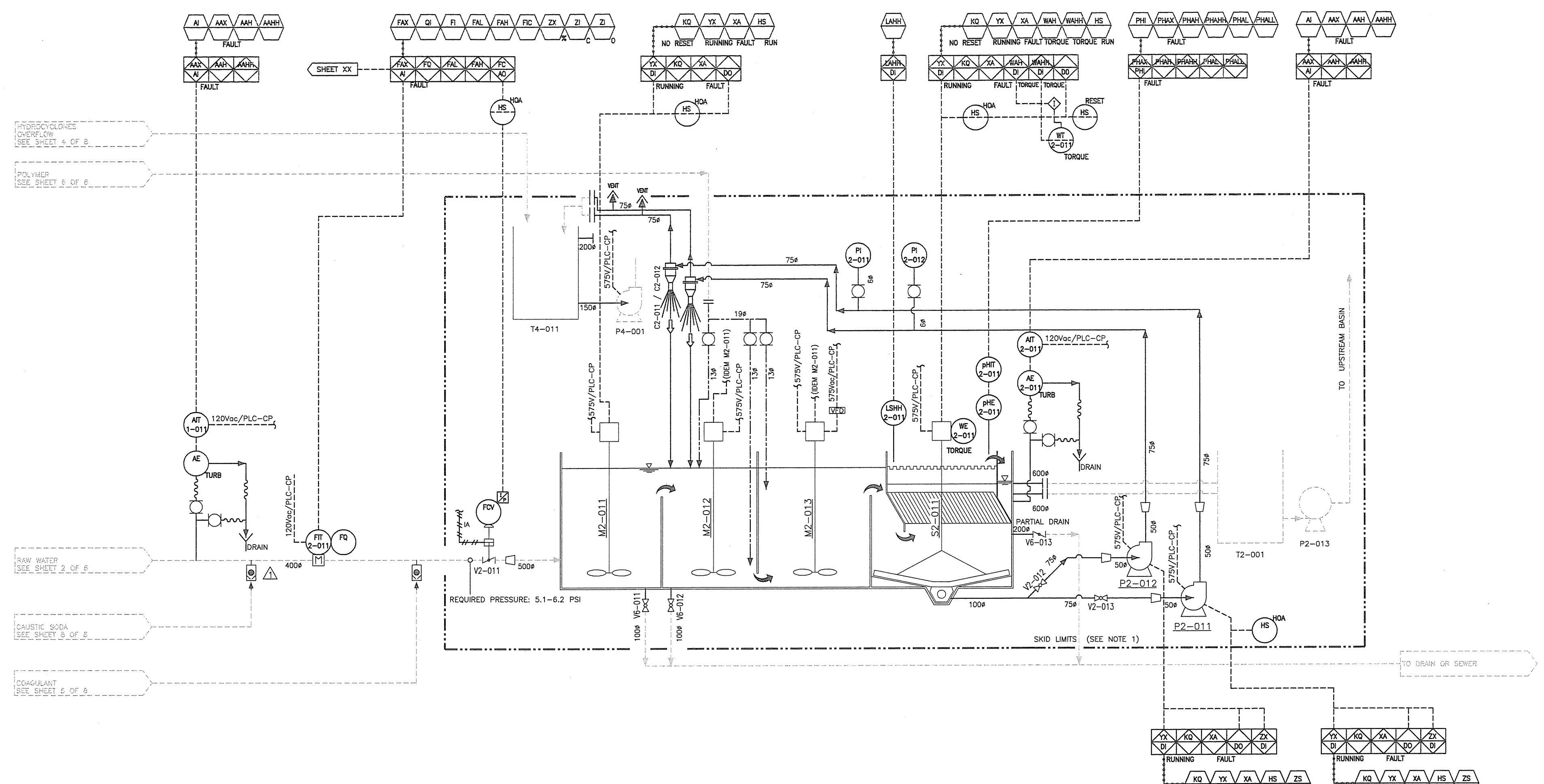


P1-001/P1-002/P1-003
DIESEL RAW WATER PUMP
DESIGN: 20000 m^3/d
(BY OTHERS)

Legend		
* SUPPLIED BY JMI	PNEUMATIC	SCADA (OPTIONAL)
SUPPLIED BY JMI	ELECTRICITY OR CONTROL	LOCAL HMI
SUPPLIED BY JMI	DATA LINK	ON LOCAL PLC
CHEMICALS SUPPLIED BY JMI		DI,DO,AI,AO : PLC I/O
BY OTHERS OR EXISTANT		
SKID LIMITS		
STD: JMI_22x34_D_ANG	REF: RA16	BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

DESIGNER A.V.	DATE 2007-11-27	TITLE WATER TREATMENT SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM RAW WATER
CHECKER P.S.	DATE 2007-11-27	CLIENT MEADOWBANK MINING
ENGINEER	DATE	
MANAGER M.S.	DATE 2007-12-03	JOHN MEUNIER ISO 9001: 2000
SCALE: NONE		PROJECT DRAWING NC01- PI001 / SHEET 2 OF 8 / REV 1



NOTE:

1. EQUIPMENTS MOUNTED ON SKID ARE PRE WIRED (POWER AND CONTROL) TO A JUNCTION BOX
2. THE CAUSTIC SODA INJECTION POINT MUST BE UPSTREAM THE COAGULANT INJECTION POINT AND AS FAR AS POSSIBLE.

T4-011
SLUDGE TANK
CAPACITY: 3400L

M2-011
COAGULATION TANK
MIXER: EVGX 4-3
DRIVER: 3 HP
575V/3Ph/60Hz

M2-012
INJECTION TANK
MIXER: EVGX 4-3
DRIVER: 3 HP
575V/3Ph/60Hz

M2-013
MATURATION TANK
MIXER: EVGX 6-5
DRIVER: 5 HP
575V/3Ph/60Hz

S2-011
SCRAPER
DRIVER: 0.5 HP
575V/3Ph/60Hz

P2-011/P2-012
MICROSAND RECIRCULATION PUMP
DESIGN: 34 m^3/h @ 17 m TDH
DRIVER: 10 HP
575V/3Ph/60Hz

P4-001
SLUDGE PUMP
(BY OTHERS)

P2-013
CLARIFIED WATER PUMP
(BY OTHERS)

T2-001
PUMP BOX
(BY OTHERS)

*	SUPPLIED BY JMI
———	SUPPLIED BY JMI
———	SUPPLIED BY JMI
-·-·-·-	CHEMICALS SUPPLIED BY JMI
- - - -	BY OTHERS OR EXISTANT
▪▪▬▪▪	SKID LIMITS
-//-//-	PNEUMATIC
- - - -	ELECTRICITY OR CONTROL
-o-o-o-	DATA LINK
AI	SCADA (OPTIONAL)
·	LOCAL HMI
·	ON LOCAL PLC

DI,DO,AI,AO : PLC I/O

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF: RA16

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

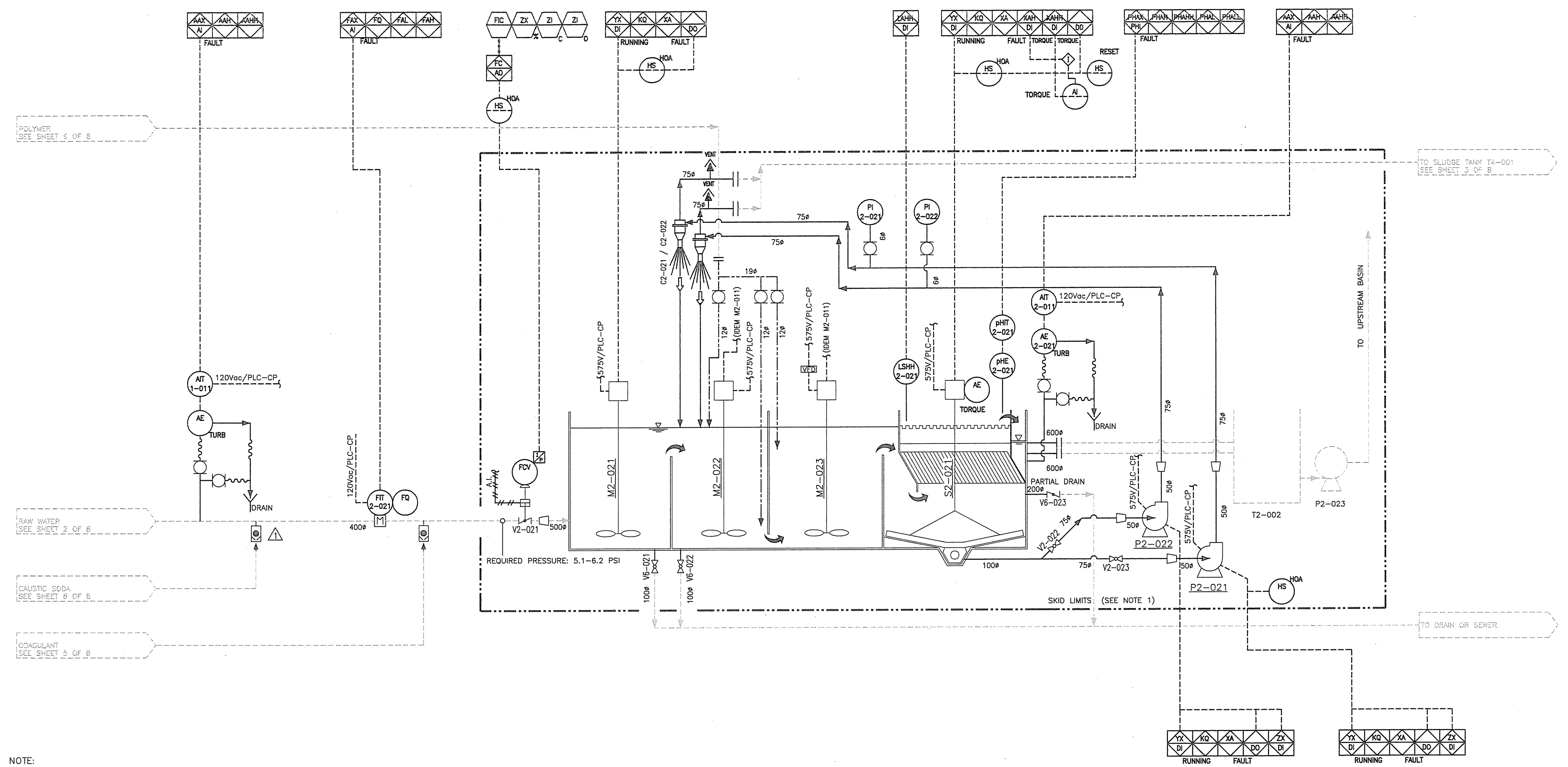
DESIGNER: A.V.	DATE: 2007-11-27
CHECKER: P.S.	DATE: 2007-11-27
ENGINEER	DATE
MANAGER: M.S.	DATE: 2007-12-03
SCALE: NONE	

TITLE: WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
ACP-700R

CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT: NC01- DRAWING: PI001 SHEET: 3 OF 8 REV: 1



NOTE:

1. EQUIPMENTS MOUNTED ON SKID ARE PRE WIRED (POWER AND CONTROL) TO A JUNCTION BOX
2. THE CAUSTIC SODA INJECTION POINT MUST BE UPSTREAM THE COAGULANT INJECTION POINT AND AS FAR AS POSSIBLE.

M2-021
COAGULATION TANK
MIXER: EVGX 4-3
DRIVER: 3 HP
575V/3Ph/60Hz

M2-022
INJECTION TANK
MIXER: EVGX 4-3
DRIVER: 3 HP
575V/3Ph/60Hz

M2-023
MATURATION TANK
MIXER: EVGX 6-5
DRIVER: 5 HP
575V/3Ph/60Hz

S2-011
SCRAPER
DRIVER: 0.5 HP
575V/3Ph/60Hz

P2-021/P2-022
MICROSAND RECIRCULATION PUMP
DESIGN: 34 m³/h @ 17 m TDH
DRIVER: 10 HP
575V/3Ph/60Hz

P2-023
CLARIFIED WATER PUMP
(BY OTHERS)

T2-002
PUMP BOX
(BY OTHERS)

*	SUPPLIED BY JMI
————	SUPPLIED BY JMI
———	SUPPLIED BY JMI
-·-·-·-	CHEMICALS SUPPLIED BY JMI
- - - - -	BY OTHERS OR EXISTANT
▬ ▬ ▪ ▬	SKID LIMITS
-//-//-//-	PNEUMATIC
- - - - - -	ELECTRICITY OR CONTROL
-o-o-o-o-	DATA LINK
(AI hexagon)	SCADA (OPTIONAL)
(hexagon)	LOCAL HMI
(diamond in square)	ON LOCAL PLC

DI,DO,AI,AO : PLC I/O

BAR = 1" AT PLOT SCALE

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

DESIGNER	A.V.	DATE 2007-11-27
CHECKER	P.S.	DATE 2007-11-27
ENGINEER		DATE
MANAGER	M.S.	DATE 2007-12-03
SCALE: NONE		

TITLE: WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
ACP-700R

CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

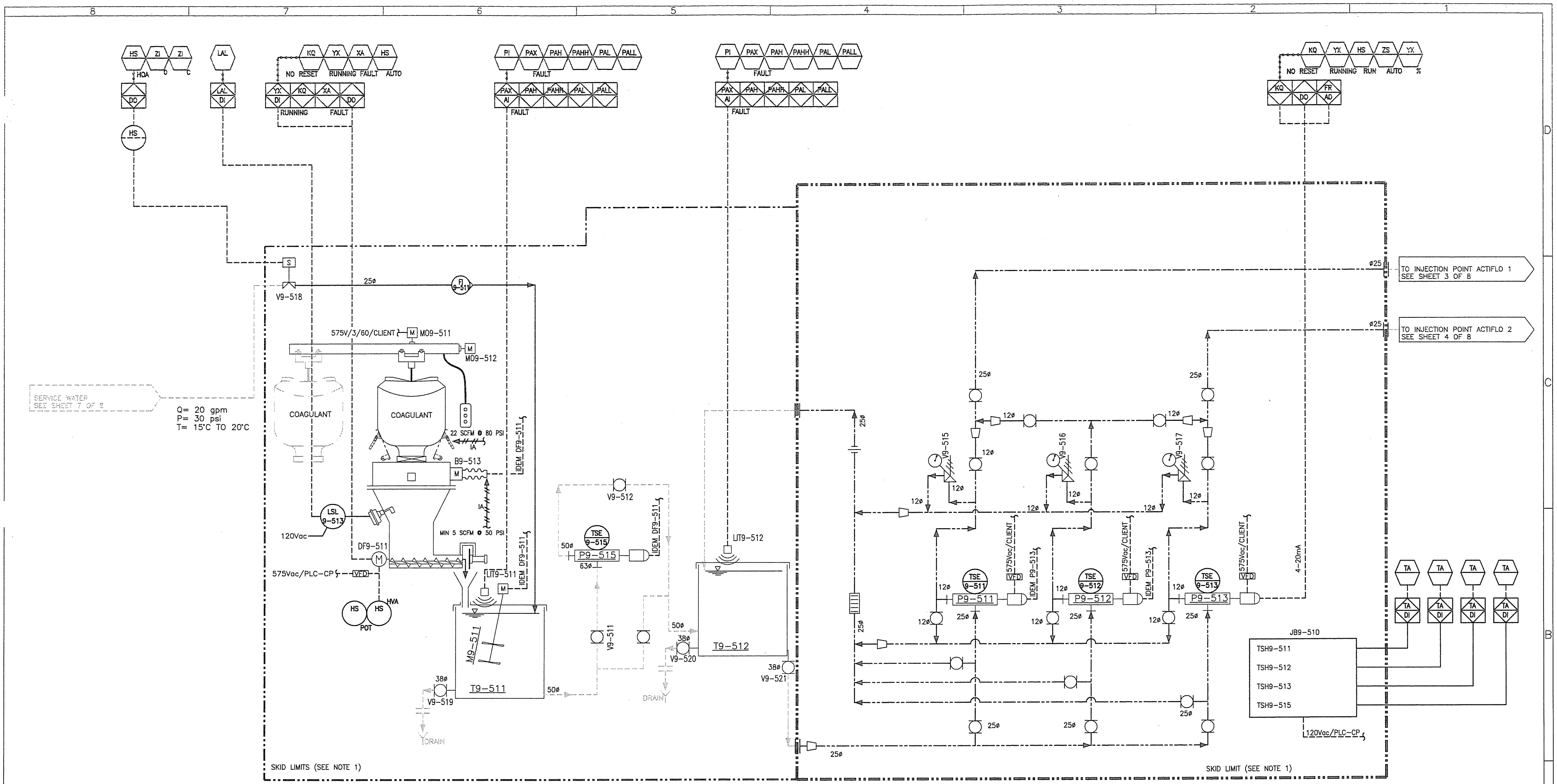
PROJECT / DRAWING: NC01- PI001

SHEET: 4 OF 8

REV: 1

STD: JMI_22x34_D_ANG

REF: RA16



NOTES:

1. EQUIPMENTS MOUNTED ON SKID ARE PRE WIRED (POWER AND CONTROL)

P9-515
COAGULANT TRANSFER PUMPS
CAPACITY: 5000 L/H @ 30 psi
MOTOR: 5HP, 1150 rpm
POWER SUPPLY: 575V/3Ph/60Hz

DF9-511
DRY FEEDER
CAPACITY: 200 KG/H
DRIVER: 0.75HP
POWER SUPPLY: 575V/3Ph/60Hz

T9-511
COAGULANT MATURATION TANK
CAP.TOTAL: 1000 L

M9-511/M9-512
COAGULANT MIXER
DRIVER: 1HP
POWER SUPPLY: 575V/3Ph/60Hz

T9-512
COAGULANT DOSING TANK
CAP: 1000L

P9-511/P9-512/P9-513
COAGULANT METERING PUMP
DESIGN: 9-87 L/H @ 2 BARS
MOTOR: 0.5HP, 1750 RPM, 56C
POWER SUPPLY: 575V/3PH/60Hz

MO9-511
TROLLEY
DRIVER: 0.5 HP
POWER SUPPLY: 575V/3Ph/60Hz

MO9-512
HOIST
DRIVER: 2.4 HP
POWER SUPPLY: 575V/3Ph/60Hz

B9-513
BLOWER
DRIVER: 1.5 HP
POWER SUPPLY: 575V/3Ph/60Hz

* SUPPLIED BY JMI
SUPPLIED BY JMI
SUPPLIED BY JMI
CHEMICALS SUPPLIED BY JMI
BY OTHERS OR EXISTANT
SKID LIMITS

PNEUMATIC
ELECTRICITY OR CONTROL
DATA LINK

SCADA
LOCAL HMI (OPTIONAL)
ON LOCAL PLC
DI,DO,AI,AO : PLC I/O
BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG
REF:

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

DESIGNER: M.M.	DATE: 2008-12-15
CHECKER: N/A	DATE: N/A
ENGINEER: J.T.	DATE:
MANAGER: N/A	DATE: N/A
SCALE: N.T.S.	

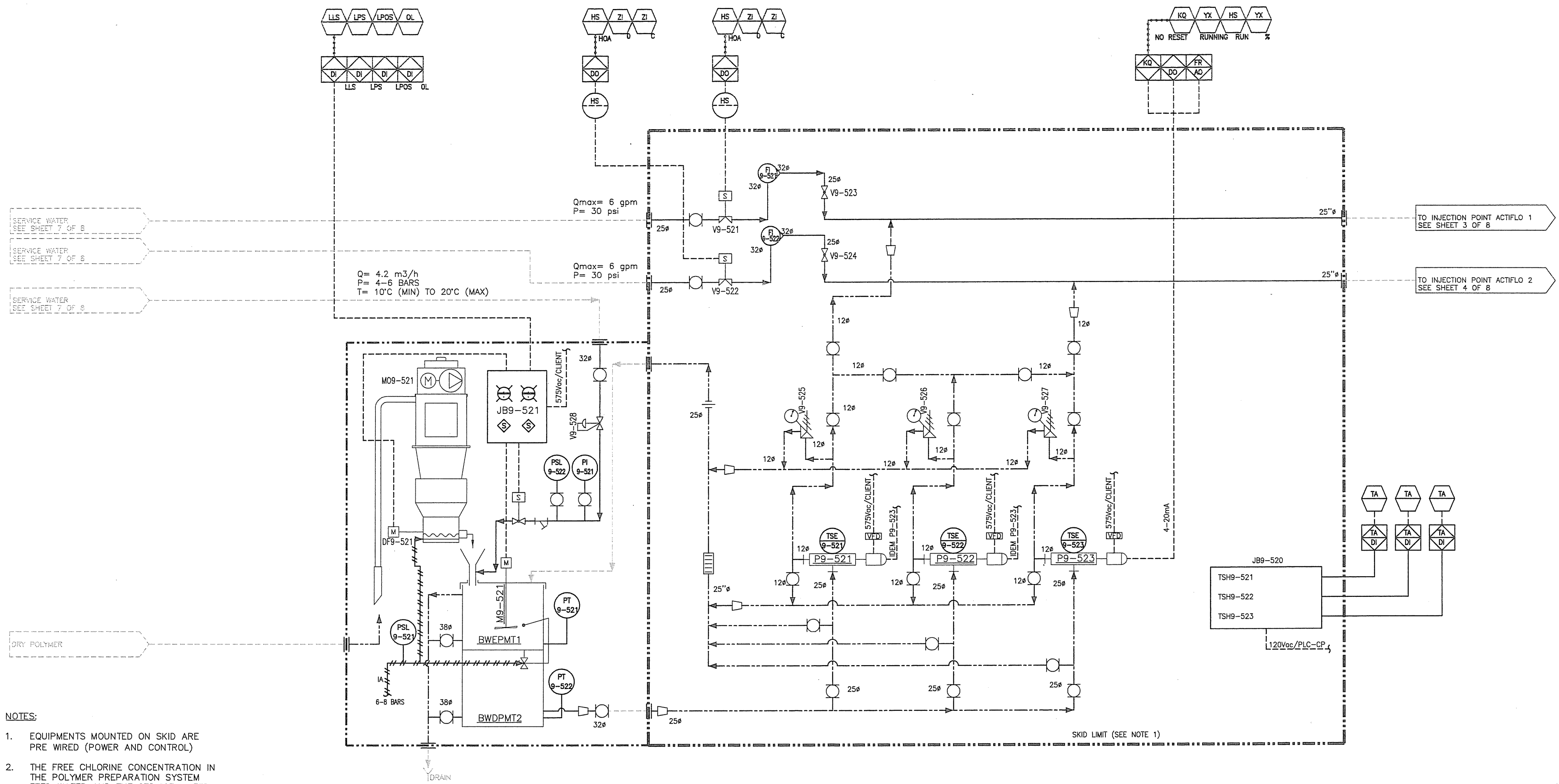
TITLE: WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
COAGULANT PREPARARTION AND DOSING SYSTEM

CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT DRAWING: NC01- PI001
SHEET: 5 OF 8
REV: 1



NOTES:

1. EQUIPMENTS MOUNTED ON SKID ARE PRE WIRED (POWER AND CONTROL)
2. THE FREE CHLORINE CONCENTRATION IN THE POLYMER PREPARATION SYSTEM FEED WATER AND THE SERVICE WATER SHALL NOT EXCEED 1.0 mg/L.

BWEPMT1
POLYMER TANK
CAP: 1000L

BWDPMT2
POLYMER TANK
CAP: 1000L

DF9-521
DRY FEEDER
CAPACITY: 55 Kg/d
DRIVE : 0.25HP
POWER SUPPLY: 575V/3PH/60Hz

M9-521
POLYMER TANK MIXER
DRIVE: 1.0HP
POWER SUPPLY: 575V/3PH/60Hz

MO9-521
VACUUM CONVEYOR
DRIVE : 1.75 HP
POWER SUPPLY: 575V/3PH/60Hz

P9-521/P9-522/P9-523
POLYMER METERING PUMP
DESIGN: 26-260 L/H @ 2 BARS
MOTOR: 0.5HP, 1750 RPM, 56C
POWER SUPPLY: 575V/3PH/60Hz

* SUPPLIED BY JMI
SUPPLIED BY JMI
SUPPLIED BY JMI
CHEMICALS SUPPLIED BY JMI
BY OTHERS OR EXISTANT
SKID LIMITS

PNEUMATIC
ELECTRICITY OR CONTROL
DATA LINK

SCADA
LOCAL HMI (OPTIONAL)
ON LOCAL PLC
DI,DO,AI,AO : PLC I/O
BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG
REF:

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

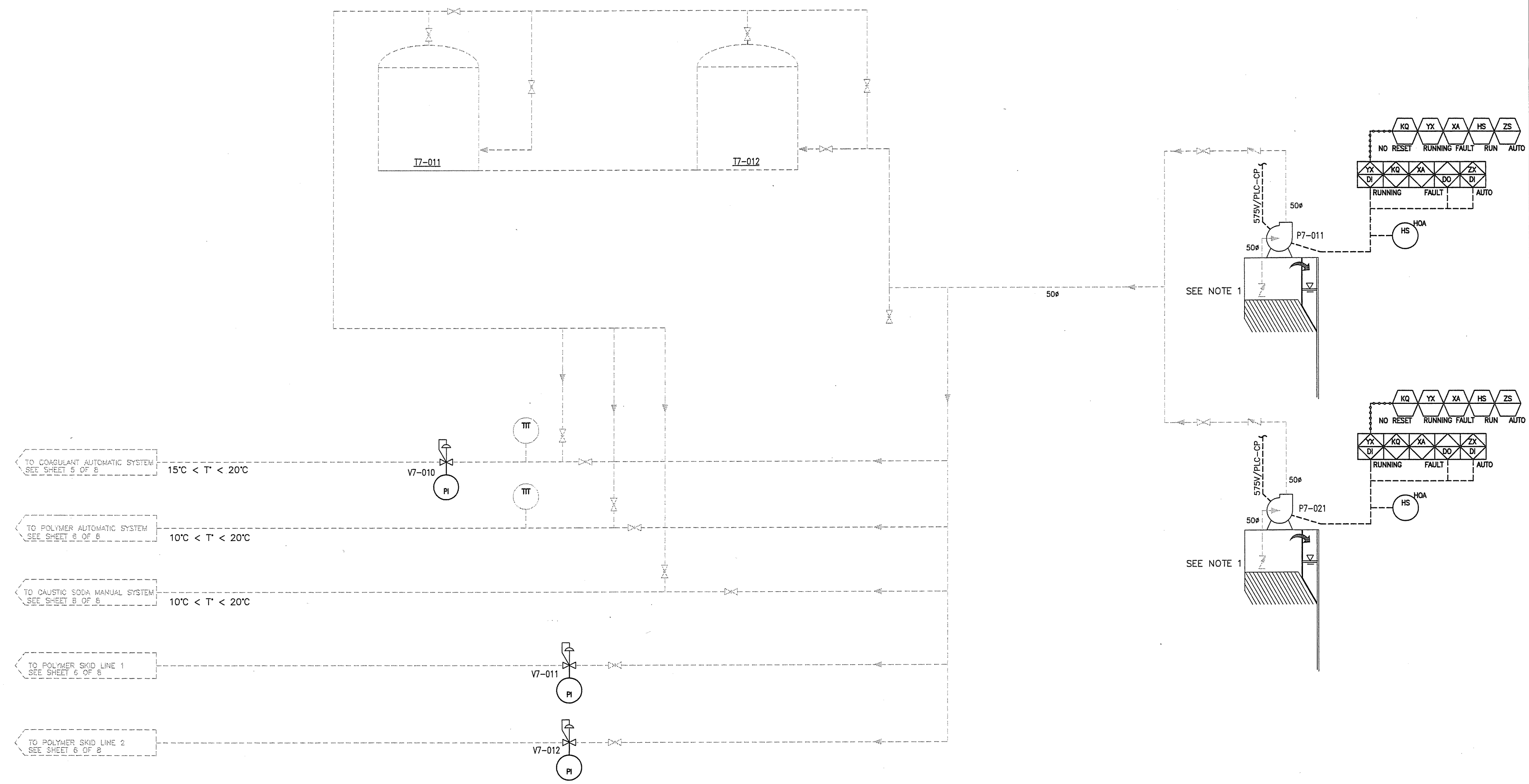
DESIGNER: M.M.	DATE: 2008-12-15
CHECKER: N/A	DATE: N/A
ENGINEER: J.T.	DATE
MANAGER: N/A	DATE: N/A
SCALE: N.T.S.	

TITLE: WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
POLYMER PREPARATION AND DOSING SYSTEM

CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000

PROJECT DRAWING: NC01- PI001
SHEET: 6 OF 8
REV: 1



P7-011/P7-021
SERVICE WATER PUMP
CAPACITY: 52 gpm @ 97 psi
DRIVER: 5 Hp, 3500 rpm, TEFC, 184TC
POWER: 575V/3PH/60Hz

T7-011/012
WATER HEATER
575V/3PH/60Hz
(BY OTHERS)

NOTE:

1. A FOOT CHECK VALVE IS REQUIRED. (BY OTHERS)

- * SUPPLIED BY JMI
- SUPPLIED BY JMI
- SUPPLIED BY JMI
- CHEMICALS SUPPLIED BY JMI
- BY OTHERS OR EXISTANT
- SKID LIMITS

- PNEUMATIC
- ELECTRICITY OR CONTROL
- DATA LINK

- SCADA (OPTIONAL)
- LOCAL HMI
- ON LOCAL PLC

DI,DO,AI,AO : PLC I/O

BAR = 1" AT PLOT SCALE

STD: JMI_22x34_D_ANG

REF: RA16

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-03-23	SA			

DESIGNER	DATE
J.T.	2009-03-20
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
SCALE: NONE	

TITLE
WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
SERVICE WATER

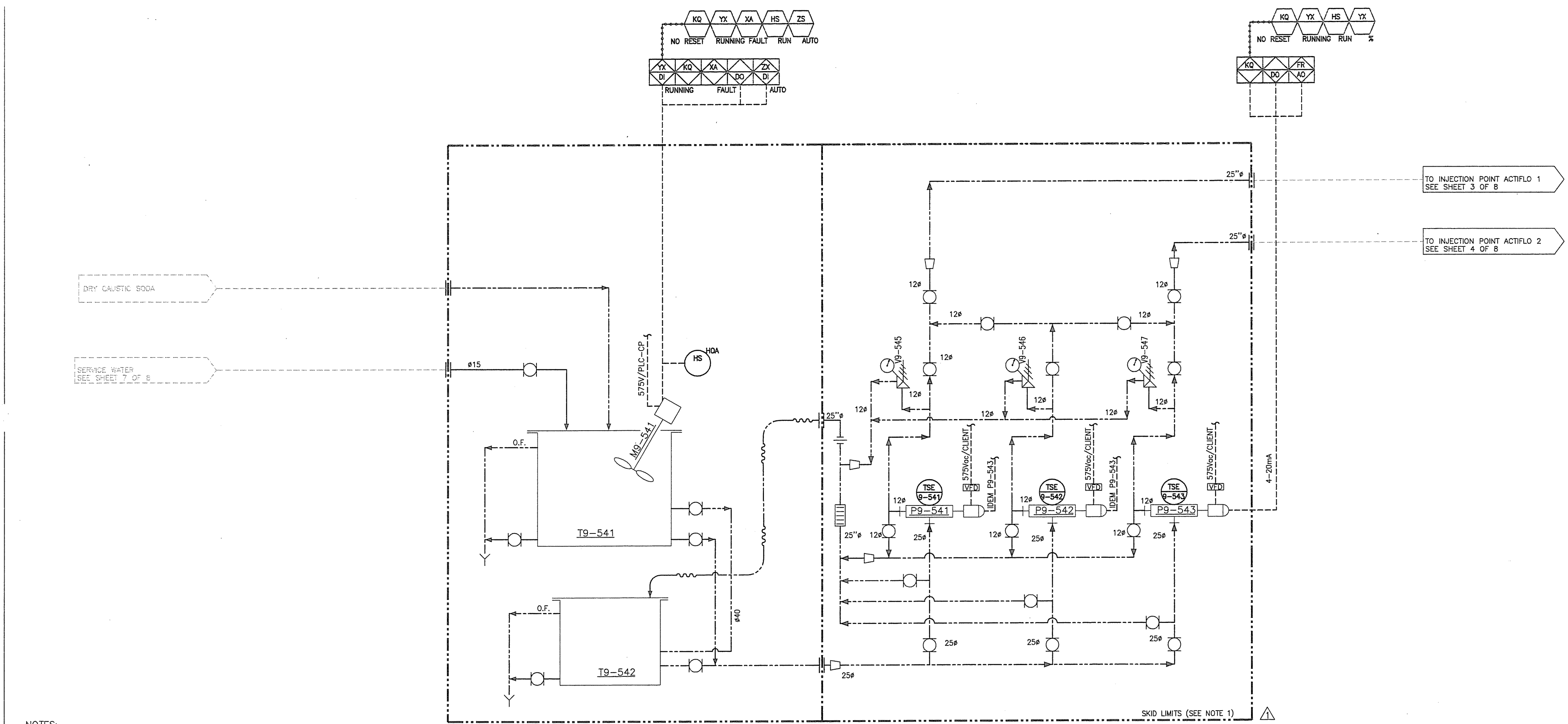
CLIENT
MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT: NC01 - DRAWING: PI001

SHEET: 7 OF 8

REV: 1



NOTES:

1. EQUIPMENTS MOUNTED ON SKID ARE PRE WIRED (POWER AND CONTROL)

T9-541
CAUSTIC SODA PREPARATION
TOTAL CAP: 340 L
MATL: POLYETHYLENE

T9-542
CAUSTIC SODA PREPARATION
TOTAL CAP: 70 L
MATL: POLYETHYLENE

M9-541
CAUSTIC SODA MIXER
DRIVER: 0.5 HP
575V/3Ph/60Hz

P9-541/P9-542/P9-543
CAUSTIC SODA METERING PUMP
DESIGN: 3.3-50 L/h @7 BARS
MOTOR: 0.5HP
POWER SUPPLY: 575V/3PH/60Hz

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	UPDATES	2009-06-26			J.T.	
0	FOR INFORMATION	2009-05-15	O.F.			

DESIGNER	DATE
O.F.	2009-05-15
CHECKER	DATE
ENGINEER	DATE
MANAGER	DATE
SCALE: NONE	

TITLE: WATER TREATMENT SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM
CAUSTIC SODA PREPARATION AND DOSING SYSTEM

CLIENT: MEADOWBANK MINING

JOHN MEUNIER ISO 9001: 2000

4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT / DRAWING: NC01- PI001 | SHEET: 8 OF 8 | REV: 1

STD: JMI_22x34_D_ANG

REF: RA16

BAR = 1" AT PLOT SCALE

VALVES

ST-003

LEFT BLANK

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Valves	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-003	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-003-1	1	2	**RAW WATER VALVE**	V2-011	B36		SA	
				Manufacturer: Bray	V2-021				
				Type: Butterfly valve					
				Model: 31-119 UC (maiximum pressure allowed 50 psig)					
				Connection: lugged flange 125/150 ANSI					
				Body: cast iron					
				Disk: Cast iron nylon coated undercut					
				Stem: Stainless steel 416					
				Seat: EPDM					
				dia: 400 mm (16 in)					
				Actuator:					
				Type: Pneumatic					
				Model: Bray 92-2100					
				c/a positionner 4-20 mA					
	NC01ST-003-2	1	2	**PARTIAL DRAIN VALVE**	V6-013	B40		SA	
				Manufacturer: Bray	V6-023				
				Type: Butterfly valve					
				Model: 31-119 UC (maiximum pressure allowed 50 psig)					
				Connection: lugged flange 125/150 ANSI					
				Body: cast iron					
				Disk: Cast iron nylon coated					
				Stem: Stainless steel 416					
				Seat: EPDM					
				dia: 200 mm (8 in)					
				Actuator: manual					
				Model: 01					
				manual lever operator					
				visual indicator on valve					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Valves	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-003	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-003-3	1	2	**COAGULATION TANK DRAIN VALVE**	V6-011	B40		SA	
				Manufacturer: Milliken	V6-021				
				type: eccentric plug valve					
				Model: 601E Millcentric					
				Connection: flange ANSI B16.1 class 125					
				Body: Cast iron					
				Plug : Cast iron					
				Plug facing: Nitrile (BUNA-N)					
				dia: 100 mm (4 in)					
				Actuator: manual lever					
	NC01ST-003-4	1	2	**INJECTION / MATURATION TANK DRAIN VALVE**	V6-012	B40		SA	
				Manufacturer: Milliken	V6-022				
				type: eccentric plug valve					
				Model: 601E Millcentric					
				Connection: flange ANSI B16.1 class 125					
				Body: Cast iron					
				Plug : Cast iron					
				Plug facing: Nitrile (BUNA-N)					
				dia: 100 mm (4 in)					
				Actuator: manual lever					
	NC01ST-003-5	2	4	**RECIRCULATION PUMP INLET VALVE**	V2-012	B56		SA	
				Manufacturer: Milliken	V2-013				
				type: eccentric plug valve	V2-022				
				Model: 601E Millcentric	V2-023				
				Connection: flange ANSI B16.1 class 125					
				Body: Cast iron					
				Plug : Cast iron					
				Plug facing: Nitrile (BUNA-N)					
				dia: 80 mm (3 in)					
				Actuator: manual lever					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Valves	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 0
	3						
DESSIN /DWG # ST-003	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-003-6	2	4	**MANUAL VALVE - ISOLATION PRESSURE**		B56		SA	
				Type: Ball					
				Size : 1/4 "					
				Connection : NPT					
				Make: CFF					
				Model: SS-1					
				Body: Stainless steel 304					
				Seat: PTFE					
				Stem : Stainless steel 316					
	NC01ST-003-7	1	3	**PRESSURE REDUCING VALVE**	V7-010	140		FI	
				Manufacturer: Watts	V7-011				
				Model: 25-AUB-Z3-GG	V7-012				
				Diameter : 1/2"					
				Connection: NPT threaded female union inlet x NPT female outlet					
				Body: Bronze					
				Integral Strainer: Stainless steel					
				Diaphragm: Reinforced EPDM					
				Valve Disc: EPDM					
				Adjustable Reduced Pressure Range: 25–75psi					
				c/w Gauge tapping and 160psi (11 bar) gauge					
	NC01ST-003-8	1	2	**POLYMER SERVICE WATER SOLENOID VALVE**	V9-521	D48		SA	
				Diameter :	V9-522				
				25 mm (1 in.)					
				Manufacturer:					
				ASCO					
				Body :					
				Brass					
				Connection:					
				FNPT					
				Model:					
				8210G54 Normally closed					
				120 vac 60 Hz, NEMA 4, Pression diff. 0					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Valves	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-003	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-003-9	1	2	**GLOBE VALVE ON POLYMER TRANSPORT WATER**	V9-523	D48		SA	
				Diameter :	V9-524				
				25 mm (1 in.)					
				Supplier:					
				Chemline					
				Material:					
				PVC					
				Connection:					
				Threaded					
				Model:					
				GVA-010T					

BUTTERFLY VALVE

LEFT BLANK

PROCEDURES - SERIES 20/21 BUTTERFLY VALVES

I. Shipment & Storage

A. The seat, disc, stem, and bushing of the butterfly valve should be coated with silicone lubricant as recommended by Bray Technical Bulletin 1028.

B. The disc should be positioned at 10% open.

C. The faces of each valve should be covered with cardboard, plywood, plastic plates, etc. to prevent damage to the seat face, disc edge, or butterfly valve interior.

D. Valves should be stored indoors with face protectors intact. Temperature should preferably be 40 degrees F to 85 degrees F.

E. When valves are stored for a long time, open and close the valves once every 3 months.

F. Ship and store valves so that no heavy loads are applied to the bodies.

II. Installation Considerations - Piping and Valve Orientation and Placement

A. **Piping and Flange Compatibilities** - The Series 20/21 butterfly valves have been designed to be suitable for all types of ANSI 125/150 flanges, whether flat-faced, raised-face, slip-on, weld-neck, etc. (Type C stub-end flanges conform to no standard for the flange face and are not recommended for use with resilient-seated butterfly valves.)These valves have been engineered so that the critical disc chord dimension at the full open position will clear the adjacent inside diameter of most types of piping, including Schedule 40, lined pipe, heavy wall, etc. If in question, one should compare the minimum pipe I.D. with the published disc cord dimension at full open.

B. **Valve Location and Orientation in Piping.**

1. **Valve Location** - Butterfly valves should be installed if possible a minimum of 6 pipe diameters from other line elements, i.e., elbows, pumps, valves, etc. Of course, 6 pipe diameters is not always practical, but it is important to achieve as much distance as possible. Where the butterfly valve is connected to a check valve or pump, use an expansion joint between them to ensure the disc does not interfere with the adjacent equipment.

2. **Valve Orientation**

a. In general, Bray recommends the valve be installed with the stem in the vertical position and the actuator mounted vertically directly above the valve,; however there are those applications as discussed below where the stem should be horizontal. The valve should not be installed upside down.

b. For slurries, sludge, mine tailings, pulp stock, dry cement, and any media with sediment or particles, Bray recommends the valve be installed with the stem in the horizontal position with the lower disc edge opening in the downstream direction.

c. For valve orientation downstream of pump, bend, etc., see Bray Technical Bulletin 1025.

III. Installation Procedure

A. **General Installation**

1. Make sure the pipeline and pipe flange faces are clean. Any foreign material such as pipe scale, metal chips, welding slag, welding rods, etc., can obstruct disc movement or damage the disc or seat.

2. The Bray elastomer seat has molded o-rings on the face of the seat. As a result, no gaskets are required as these o-rings serve the function of a gasket.
3. Align the piping and then spread the pipe flanges a distance apart so as to permit the valve body to be easily dropped between the flanges without contacting the pipe flanges.
4. Check to see that the valve disc has been positioned to a partially open position, with the disc edge about 1/2" to 3/8" from the face of the seat (approximately 10 degrees open.)
5. Insert the valve between the flanges, taking care not to damage the seat faces. Always pick the valve up by the locating holes or by using a nylon sling on the neck of the body. Never pick up the valve by the actuator or operator mounted on top of the valve
6. Place the valve between the flanges, center it, and then span the valve body with all flange bolts, but do not tighten the bolts. Carefully open the disc to the full open position, making sure the disc does not hit the adjacent pipe I.D. Now systematically remove jack bolts on the other flange spreaders, and hand-tighten the flange bolts. Very slowly close the valve disc to ensure disc edge clearance from the adjacent pipe flange I.D. Now open the disc to full open and tighten all flange bolts per specification. Finally repeat a full close to full open rotation of the disc to ensure proper clearances.

B. **Installation with Flange Welding** - When butterfly valves are to be installed between ANSI welding type flanges, care should be taken to abide by the following procedure to ensure no damage will occur to the seat:

1. Place the valve between the flanges with the flange bores and valve body bore aligned properly. The discs should be in the 10 degrees open position
2. Span the body with the bolts.
3. Take this assembly of flange-body-flange and align it properly to the pipe.
4. Tack weld the flanges to the pipe.
5. When tack welding is complete, remove the bolts and the valve from the pipe flanges and complete the welding of the flanges. Be sure to let the pipe and flanges cool before installing the valve.
   NOTE: Never complete the welding process (after tacking) with the valve between pipe flanges. This causes severe seat damage due to heat transfer.

IV. Maintenance and Repair

The many Bray features minimize wear and maintenance requirements. No routine lubrication is required. All components - stem, disc, seat, bushing, stem seal, etc., are field replaceable, no adjustment is required. If components require replacement, the valve may be removed from the line by placing the disc near the closed position, then supporting the valve and removing the flange bolts. No valve maintenance, including removal of manual or power actuators, should be performed until the piping system is completely de-pressurized.

V. Disassembly and Assembly

A. **Disassembly** - Remove handle, manual gear box of actuator from actuator mounting flange. Remove the body bolts and pull the lower body half away from the seat. Pull the seat and disc stem from the upper body half. Remove bushing and seal from the upper body. Push the seat into an oval shape and remove the disc stem by withdrawing the short stem end first.

B. **Assembly** - Push the long stem end of the disc stem into the seat, then push the seat over the disc stem short stem. Place the disc stem and seat into the upper body half. Align the lower body bolt lugs with the upper body lugs and position lower body in the seat. Replace the body bolts and tighten. Install the stem seal, then the stem bushing. Replace handle, manual gear box or actuator on the actuator mounting flange. Note: The body halves have a matching casting node on one side only to ensure correct assembly of body halves.

PROCEDURES - SERIES 30/31/34 BUTTERFLY VALVES

I. Shipment & Storage

A. The seat, disc, stem, and bushing of the butterfly valve should be coated with silicone lubricant as recommended by Bray Technical Bulleting 1028.

B. The disc should be positioned at 10% open.

C. The faces of each valve should be covered with cardboard, plywood, plastic plates, etc to prevent damage to the seat face, disc edge, or butterfly valve interior.

D. Valves should be stored indoors with face protectors intact. Temperature should preferably be 40°F to 85°F.

E. When valves are stored for a long time, open and close the valves once every 3 months.

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   a. In general, Bray recommends the valve be installed with the stem in the vertical position and the actuator mounted vertically directly above the valve,; however there are those applications as discussed below where the stem should be horizontal. The valve should not be installed upside down.

   b. For slurries, sludge, mine tailings, pulp stock, dry cement, and any media with sediment or particles, Bray recommends the valve be installed with the stem in the horizontal position with the lower disc edge opening in the downstream direction.

   c. For valve orientation downstream of pump, bend, etc., see Bray Technical Bulletin

1025.

III. Installation Procedure

A. General Installation

1. Make sure the pipeline and pipe flange faces are clean. Any foreign material such as pipe scale, metal chips, welding slag, welding rods, etc., can obstruct disc movement or damage the disc or seat.
2. The Bray elastomer seat has molded o-rings on the face of the seat. As a result, no gaskets are required as these o-rings serve the function of a gasket.
3. Align the piping and then spread the pipe flanges a distance apart so as to permit the valve body to be easily dropped between the flanges without contacting the pipe flanges.
4. Check to see that the valve disc has been positioned to a partially open position, with the disc edge about 1/2" to 3/8" from the face of the seat (approximately 10 degrees open.)
5. Insert the valve between the flanges, taking care not to damage the seat faces. Always pick the valve up by the locating holes or by using a nylon sling on the neck of the body. Never pick up the valve by the actuator or operator mounted on top of the valve.
6. Place the valve between the flanges, center it, and then span the valve body with all flange bolts, but do not tighten the bolts. Carefully open the disc to the full open position, making sure the disc does not hit the adjacent pipe I.D. Now systematically remove jack bolts on the other flange spreaders, and hand-tighten the flange bolts. Very slowly close the valve disc to ensure disc edge clearance from the adjacent pipe flange I.D. Now open the disc to full open and tighten all flange bolts per specification. Finally repeat a full close to full open rotation of the disc to ensure proper clearances.

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1. Place the valve between the flanges with the flange bores and valve body bore aligned properly. The discs should be in the 10 degrees open position.
2. Span the body with the bolts.
3. Take this assembly of flange-body-flange and align it properly to the pipe.
4. Tack weld the flanges to the pipe.
5. When tack welding is complete, remove the bolts and the valve from the pipe flanges and complete the welding of the flanges. Be sure to let the pipe and flanges cool before installing the valve.
   NOTE: Never complete the welding process (after tacking) with the valve between pipe flanges. This causes severe seat damage due to heat transfer.

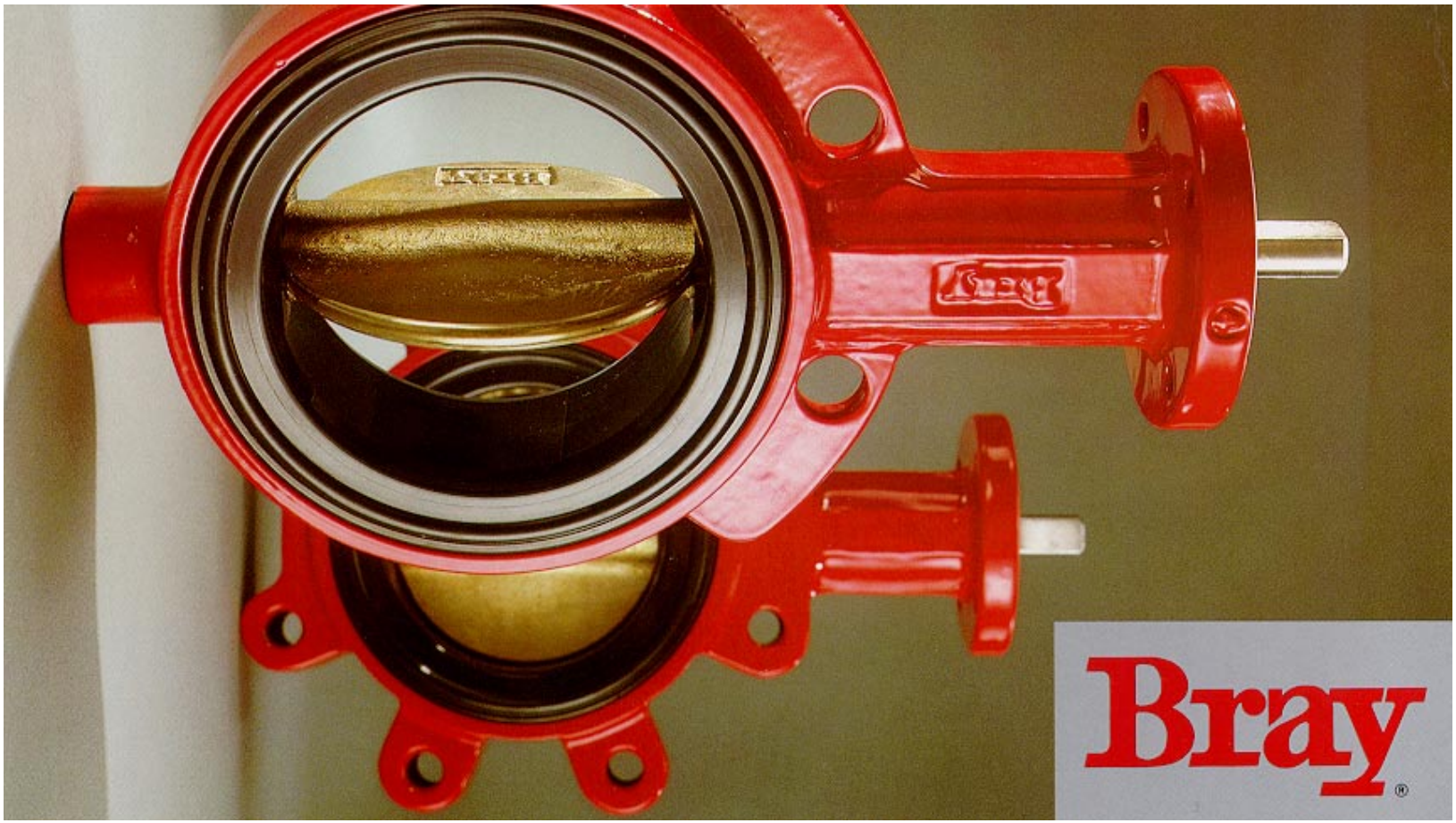
IV. Maintenance and Repair

The many Bray features minimize wear and maintenance requirements. No routine lubrication is required. All components - stem, disc, seat, bushing, stem seal, etc., are field replaceable, no adjustment is required. If components require replacement, the valve may be removed from the line by placing the disc near the closed position, then supporting the valve and removing the flange bolts. No valve maintenance, including removal of manual or power actuators, should be performed until the piping system is completely de-pressurized.

V. Disassembly and Assembly

A. Disassembly - Remove handle, gear operator, or actuator from actuator mounting flange. Remove the "Spirolox" retaining ring and the two C-ring stem retainers from the stem hole, then remove the stem, bushing and seal. Remove the disc from the seat, protecting disc edge at all times. Push the seat into an oval shape, then remove the seat from the body.

B. **Assembly** - Push the valve seat into an oval and push it into the body with seat stem holes aligned to body stem holes. Insert stem seal and bushing. Push stem into the stem hole of body until the bottom of the stem is flush with the inner top edge of the seat. Install a light coating of silicone or grease on the I.D. of seat. Insert the disc into the seat by lining up the disc hole with the stem hole of the seat. NOTE: the broached double "D" flats in the disc must be toward the bottom of the valve body. With a downward pressure and rotating the stem back and forth, push the stem until the stem touches the bottom of the body stem hole. Make certain that when pushing stem through disc bottom, the broached flats of stem and disc are aligned. Replace the stem bushing and two stem retainers, then replace the "Spirolox" retaining ring back into position.



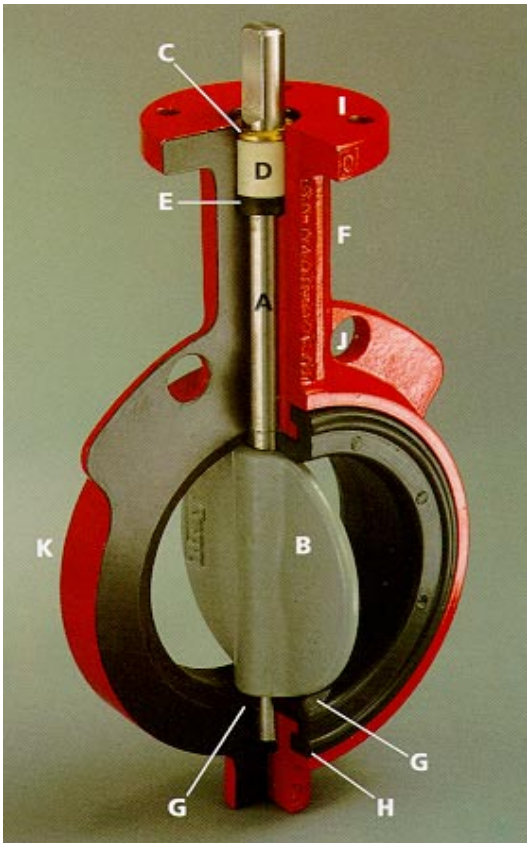
The High Performance Company

BUTTERFLY VALVES
RESILIENT SEATED

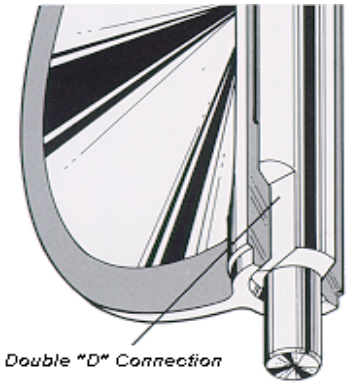
SERIES 30/31 Wafer/Lug
2”-20” (50mm-500mm)

SERIES 30/31

2”-20” (50mm-500mm)
Bray® Controls is proud to offer a high quality line of butterfly valves to meet the requirements of today’s market. Combining years of field experience, research and development, Bray has designed many unique features in the Series 30/31 not previously available. The results are longer service life, greater reliability, ease of parts replacement and interchangeability of components.



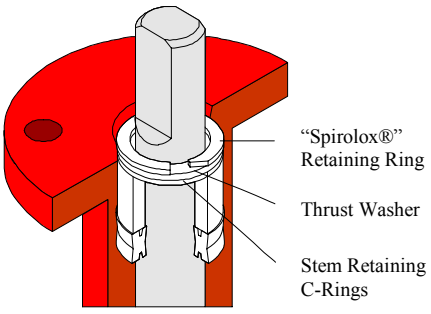
DISC AND STEM CONNECTION (A)
Features a high-strength through stem design. The close tolerance, double "D" connection that drives the valve disc is an exclusive feature of the Bray valve. It eliminates stem retention components being exposed to the line media, such as disc screws



and taper pins, which commonly result in leak paths, corrosion, and vibration failures. Disc screws or taper pins, due to wear and corrosion, often require difficult machining for disassembly. Disassembly of the Bray stem is just a matter of pulling the stem out of the disc. Without fasteners obstructing the line flow, the Series 30/31 Cv values are higher than many other valves, turbulence is reduced, and pressure recovery is increased. The stem ends and top mounting flange are standardized for interchangeability with Bray actuators.

DISC (B)
Casting is spherically machined, hand polished to provide a bubble-tight shut off, minimum torque, and longer seat life. The disc O.D. clearance is designed to work with all standard piping.

"SPIROLOX*" RETAINING RING (C)
The stem is retained in the body by means of a unique Stainless Steel “Spirolox®” retaining ring, a thrust washer and two C-rings, manufactured from brass as standard, stainless steel upon request. The retaining ring may be easily removed with a standard hand tool. The stem retaining assembly prevents unintentional removal of the stem during field service.



*"Spirolox®" designation is a registered trademark of TRW, Inc.

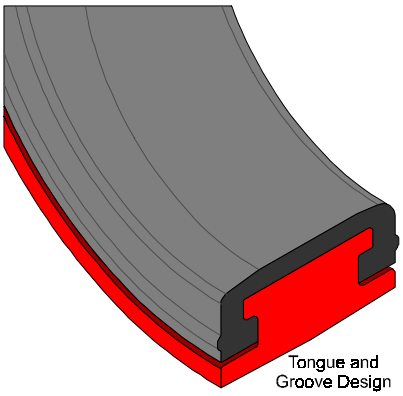
STEM BUSHING (D)
Non-Corrosive, heavy duty acetal bushing absorbs actuator side thrusts.

STEM SEAL (E)
Double "U" cup seal design is self-adjusting and gives positive sealing in both directions. Prevents external substances from entering stem bore.

NECK (F)
Extended neck length allows for 2" of piping insulation and is easily accessible for mounting actuators.

PRIMARY AND SECONDARY SEALS (G)
The Primary Seal is achieved by an interference fit of the molded seat flat with the disc hub. The Secondary Seal is created because the stem diameter is greater than the diameter of the seat stem hole. These seals prevent line media from coming in contact with the stem or body.

BRAY UNIQUE SEAT DESIGN (H)
One of the valve's key elements is Bray's unique "*Tongue-and-Groove*" seat design. This resilient seat features lower torque than many valves on the market today and provides complete isolation of flowing media from the body. The tongue-and-groove seat to body retention method is superior to traditional designs, making field replacement simple and fast. The seat is specifically designed to seal with slip-on or weld-neck flanges. The seat features a molded O-ring which eliminates the use of flange gaskets. An important maintenance feature is that all resilient seats for Bray butterfly valves Series 20, 21, 30, 31, 34 are completely interchangeable.



SERIES 30/31

ACTUATOR MOUNTING FLANGE AND STEM CONNECTION (I)

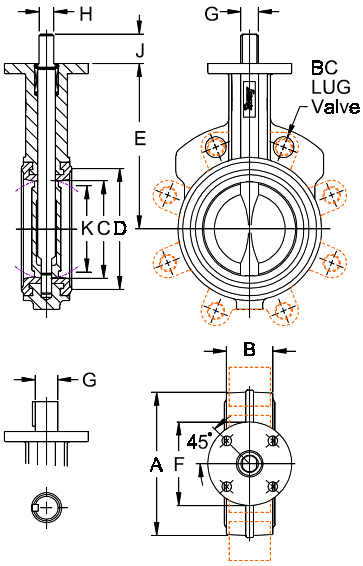
Universally designed to ISO 5211 for direct mounting of Bray® power actuators and manual operators.

FLANGE LOCATING HOLES (J)

Provides quick and proper alignment during installation.

BODY (K)

One-piece wafer or lug style. Epoxy coating for excellent corrosion resistance. Bray valve bodies meet ANSI 150 pressure ratings for hydrostatic shell test requirements.



DESIGN FEATURES

Bray's Series 30 valve is a wafer version with flange locating holes, and the Series 31 is the companion lug version for dead-end service and other flange requirements. All Bray valves are tested to 110% of full pressure rating before shipment.

A major design advantage of Bray valve product lines is international compatibility. The same valve is compatible with most world flange standards - ANSI Class 125/150, BS 10 Tables D&E, BS4504 NP 10/16, DIN ND10/16, AS 2129 and JIS 10. In addition, the valves are designed to comply with ISO 5752 face-to-face and ISO 5211 actuator mounting flanges. Therefore, one valve design can be used in many different world markets. Due to a modular concept of design, all Bray® handles, manual gear operators and pneumatic and electric actuators mount directly to Bray valves. No brackets or adapters are required. Bray interchangeability and compatibility offers you the best in uniformity of product line and low-cost performance in the industry today.

EPOXY COATING CORROSION PROTECTION

Bray's standard product offers valve bodies with an epoxy coating, providing excellent corrosion and wear resistance to the valve's surface. The Bray epoxy coating is a hard, high gloss red finish.

- Chemical Resistance - resists a broad range of chemicals including: dilute aqueous acids and alkalies, petroleum solvents, alcohols, greases and oils. Offers outstanding resistance to humidity and water.
- Weatherability - outdoor tested resistant to ultra-violet radiation.
- Abrasion Resistance - excellent resistance to abrasion.
- Impact Resistance - withstands impact without chipping or cracking.

NYLON 11 COATING

Optionally available for valve bodies where outstanding protection and performance is needed. A thermoplastic produced from a vegetable base, this coating is inert to fungus growth and molds. Nylon 11 is *USDA Approved*, as well as certified to ANSI/NSF 61 for water service.

- Corrosion Resistance - superior resistance to a broad range of chemical environments. Salt spray tested in excess of 2,000 hours and seawater immersion tested for over 10 years without corrosion to metal substrates. Nylon 11 features a very low coefficient of friction and excellent resistance to impact and ultra-violet radiation.

DIMENSIONS SERIES 30 WAFER

Valve Size									Mtg Flange Drilling							Lug Bolting Data		
ins	mm	A	B	C	D	E	F	K	BC	No. Holes	Hole Dia.	G	H	J		BC	No. Holes	Thrds UNC-2B
2	50	3.69	1.62	2.00	2.84	5.50	3.54	1.32	2.76	4	.39	.55	.39	1.25		4.75	4	5/8-11
2½	65	4.19	1.75	2.50	3.34	6.00	3.54	1.91	2.76	4	.39	.55	.39	1.25		5.50	4	5/8-11
3	80	4.88	1.75	3.00	4.03	6.25	3.54	2.55	2.76	4	.39	.55	.39	1.25		6.00	4	5/8-11
4	100	6.06	2.00	4.00	5.16	7.00	3.54	3.57	2.76	4	.39	.63	.43	1.25		7.50	8	5/8-11
5	125	7.12	2.12	5.00	6.16	7.50	3.54	4.63	2.76	4	.39	.75	.51	1.25		8.50	8	3/4-10
6	150	8.12	2.12	5.75	7.02	8.00	3.54	5.45	2.76	4	.39	.75	.51	1.25		9.50	8	3/4-10
8	200	10.50	2.50	7.75	9.47	9.50	5.91	7.45	4.92	4	.57	.87	.63	1.25		11.75	8	3/4-10
10	250	12.75	2.50	9.75	11.47	10.75	5.91	9.53	4.92	4	.57	1.18	.87	2.00		14.25	12	7/8-9
12	300	14.88	3.00	11.75	13.47	12.25	5.91	11.47	4.92	4	.57	1.18	.87	2.00		17.00	12	7/8-9

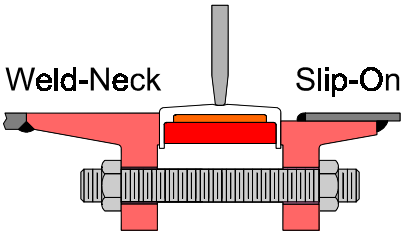
SERIES 31 LUG

Valve Size									Mtg Flange Drilling							Lug Bolting Data		
ins	mm	A	B	C	D	E	F	K	BC	No. Holes	Hole Dia.	G	J	KEY SIZE		BC	No. Holes	Thrds UNC-2B
14	350	17.05	3.00	13.25	15.28	13.62	5.91	13.04	4.92	4	.57	1.38	2.00	.39x.39		18.75	12	1-8
16	400	19.21	4.00	15.25	17.41	14.75	5.91	14.85	4.92	4	.57	1.38	2.00	.39x.39		21.25	16	1-8
18	450	21.12	4.25	17.25	19.47	16.00	8.27	16.85	6.50	4	.81	1.97	2.50	.39x.47		22.75	16	11/8-7
20	500	23.25	5.00	19.25	21.59	17.25	8.27	18.73	6.50	4	.81	1.97	2.50	.39x.47		25.00	20	11/8-7

SELECTION DATA

FLANGE REQUIREMENTS

Bray valves are designed for installation between ANSI Class 125/150 lb. weld-neck or slip-on flanges, BS 10 Tables D&E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10, either flat faced or raised faced. While weld-neck flanges are recommended, Bray has specifically designed its valve seat to work with slip-on flanges, thus eliminating common failures of other butterfly valve designs. When using raised face flanges be sure to properly align valve and flange. Type C stub-end flanges are not recommended.



Note: Flanges on both sides of installed valve must be the same type

PRESSURE RATINGS*

For bi-directional bubble-tight shut off, disc in closed position:

Inches	mm	psig	bar
2-12	50-300	175	12
14-20	350-500	150	10

For Dead-end Service Applications:
With *downstream flanges installed* or with *vulcanized seats,* the dead-end pressure ratings are equal to valve bi-directional ratings as stated above. With no downstream flanges or with seats that are not vulcanized, the dead-end pressure rating for 2"-12" valves is 75 psi (5 bar) for 14"-20" valves, 50 psi (3.5 bar.)

* Pressure Ratings are based on standard disc diameters. For low pressure application, Bray offers a standard reduced disc diameter to decrease seating torques and to extend seat life, thus increasing the valve's performance and reducing actuator costs for the customer.

VELOCITY LIMITS

For On/Off Services
Fluids - 30 ft/sec (9m/s)
Gases - 175 ft/sec (54m/s)

Cv VALUES-VALVE SIZING COEFFICIENT

Valve Size		Disc Position (degrees)								
ins	mm	90°	80°	70°	60°	50°	40°	30°	20°	10°
2	50	144	114	84	61	43	27	16	7	1
21/2	65	282	223	163	107	67	43	24	11	1.5
3	80	461	364	267	154	96	61	35	15	2
4	100	841	701	496	274	171	109	62	27	3
5	125	1376	1146	775	428	268	170	98	43	5
6	150	1850	1542	1025	567	354	225	129	56	6
8	200	3316	2842	1862	1081	680	421	241	102	12
10	250	5430	4525	2948	1710	1076	667	382	162	19
12	300	8077	6731	4393	2563	1594	1005	555	235	27
14	350	10538	8874	5939	3384	2149	1320	756	299	34
16	400	13966	11761	7867	4483	2847	1749	1001	397	45
18	450	17214	14496	10065	5736	3643	2237	1281	507	58
20	500	22339	18812	12535	7144	4536	2786	1595	632	72

Cv is defined as the volume of water in U.S.G.P.M. that will flow through a given restriction or valve opening with a pressure drop of one (1) p.s.i. at room temperature. Recommended control angles are between 25°-70° open. Preferred

EXPECTED SEATING/UNSEATING TORQUES (Lb.-Ins.)

		Full-Rated Pressure Valve				Reduced Disc
Valve Size		rP (PSI)				rP (PSI)
ins	mm	50	100	150	175	50
2	50	125	130	135	140	125
21/2	65	195	205	215	220	195
3	80	260	275	290	297	260
4	100	400	425	450	462	267
5	125	615	670	725	755	410
6	150	783	871	953	1003	537
8	200	1475	1650	1825	1915	983
10	250	2240	2520	2800	2940	1493
12	300	3420	3870	4320	4545	2280
14	350	4950	5700	6450	-	3300
16	400	6400	7700	9000	-	4267
18	450	7850	9850	11850	-	5267
20	500	10300	12900	15500	-	6867

Valve Torque Rating - Bray has classified valve torque ratings according to 3 types: non-corrosive lubricating service, general service, and severe service. Torques listed above are for general services.Consult Bray for torque information corresponding to specific application.

TO USE TORQUE CHART, NOTE THE FOLLOWING:
1) For Bray valves, Series 20, 21, 30, 31 and 34.
2) Review Technical Bulletin No. 1001, Expected Seating/Unseating Torque's, for explanation of the 3 service classes and their related seating/unseating torque values for given pressure differentials of Full-Rated and Reduced Disc Diameter valves.
3) Dynamic Torque values are not considered. See Technical Bulletin No. 1002 for evaluation of Dynamic Torque values vs. Seating/Unseating Torque values.
4) Do not apply a safety factor to above torque values when determining actuator output torque requirement.
5) For 3 way assemblies where on valve is opening and other is closing, multiply torque by 1.5 factor.

SELECTION DATA

RECOMMENDED SPECIFICATIONS FOR BRAY SERIES 30/31 SHALL BE:

• Epoxy coated, cast iron, wafer or lug bodies.
• With flange locating holes that meet ANSI 125/150 (or BS 10 tables D&E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10) drillings.
• Through-stem direct drive double "D" design requiring no disc screws or pins to connect stem to disc with no possible leak paths in disc/stem connection.
• Stem mechanically retained in body neck and no part of stem or body exposed to line media.
• Tongue-and-groove seat design with primary hub seal and a molded o-ring suitable for weld-neck and slip-on flanges. Seat totally encapsulates the body with no flange gaskets required.
• Spherically machined, hand polished disc edge and hub for minimum torque and maximum sealing capability.
• Equipped with non-corrosive bushing and self-adjusting stem seal.
• Bi-directional and tested to 110% of full rating.
• Bi-directional pressure ratings:
2"-12" valves: 175 PSI
14"-20" valves: 150 PSI
Lug bodies for dead end service
With downstream flanges or vulcanized seats, pressure ratings are equal to bi-directional ratings as stated above.
With no downstream flanges or non-vulcanized seats:
2”-12” valves: 75 psi.
14”-20” valves: 50 psi.
• No field adjustment necessary to maintain optimum field performance
• The valve shall be Bray Series 30 wafer / 31 lug or equal.

TEMP. RANGE OF SEATS

Type	Maximum	Minimum
EPDM	+250°F(121°C)	-40°F(-40°C)
Buna-N	+212°F(100°C)	0°F(-18°C)
FKM*	+400°F(204°C)	0°F(-18°C)

MATERIALS SELECTION

2”-20” (50mm-500mm)

BODY:
• Cast Iron ASTM A126 Class B
• Ductile Iron ASTM A536
• Cast Steel ASTM A216 WCB
• Aluminum ASTM B26

SEAT:
• Buna-N - Food Grade
• EPDM - Food Grade
• FKM*
• White Buna-N - Food Grade

STEM:
• Coated Carbon Steel
• 416 SS ASTM A582 Type 416
• 304 SS ASTM A276 Type 304
• 316 SS ASTM A276 Type 316
• Monel

DISC:
• Aluminum Bronze ASTM B148-954
• Coated Ductile Iron ASTM A536 Gr. 65-45-12
• Ductile Iron,Nylon 11 Coated, ASTM A536 Gr. 65-45-12
• Ductile Iron, Halar® Coated, ASTM A536 Gr. 65-45-12
• 316 SS ASTM A351 CF8M
• Hastelloy® C-276 ASTM B575 Alloy N10276

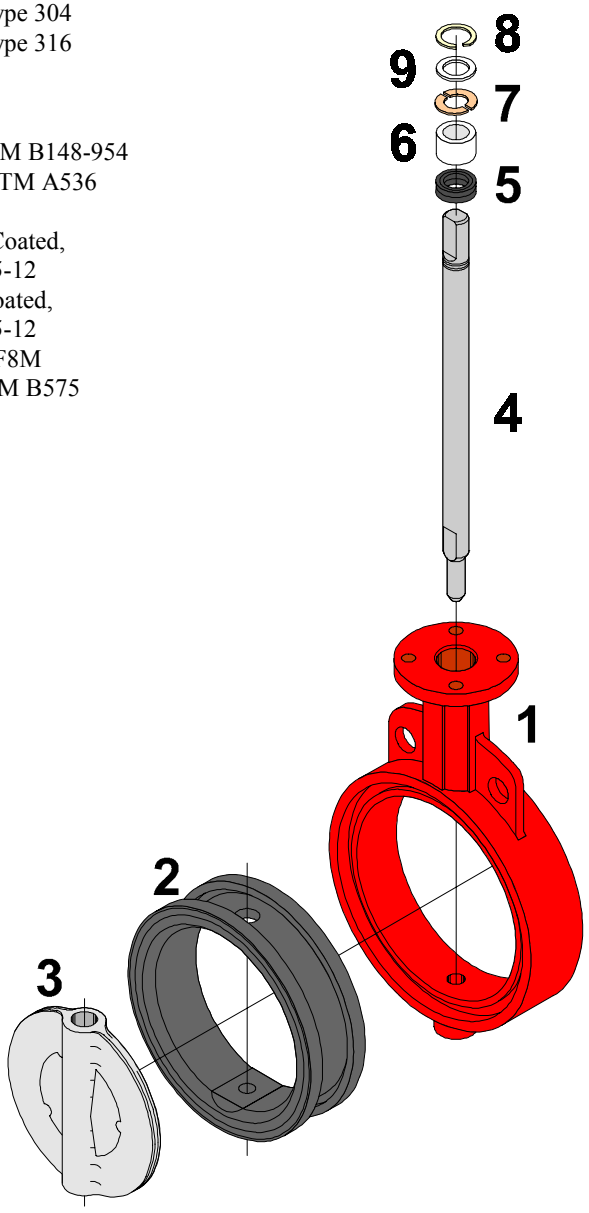
WEIGHTS

Valve Size		Series	Series
ins	mm	30	31
2	50	5.5	7.0
2 1/2	65	7.0	8.0
3	80	7.5	9.0
4	100	11.5	15.0
5	125	14.0	20.0
6	150	17.0	23.0
8	200	34.0	42.0
10	250	49.0	66.0
12	300	67.0	88.0
14	350	95.0	114.0
16	400	135.0	166.0
18	450	200.0	226.0
20	500	260.0	305.0

Weights are in lbs.

COMPONENTS

No.	Qty.	Description
1	1	Body
2	1	Seat
3	1	Disc
4	1	Stem
5	1	Stem Seal
6	1	Stem Bushing
7	2	Stem Retainer
8	1	Thrust Washer
9	1	Retaining Ring



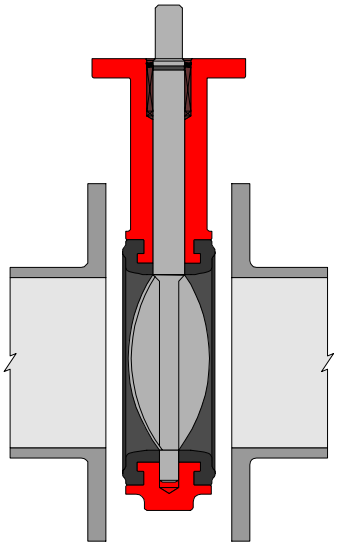
*FKM is the ASTM D1418 designation for Fluorinated Hydrocarbon Elastomers (also called Fluoroelastomers.)
Hastelloy® is a registered trademark of Haynes International, Inc.
Halar® is a registered trademark of Ausimont U.S.A., Inc.

INSTALLATION

Position the disc in the partially open position, maintaining the disc within body face-to-face. Place the body between flanges and install flange bolts. *Do not use flange gaskets.*
Before tightening flange bolts, carefully open the disc to the full open position to ensure proper alignment and clearance of the disc O.D. with the adjacent pipe I.D. Leave disc in the full open position and tighten flange bolts per required specification. Once bolts are tightened, carefully rotate disc to closed position to ensure disc O.D. clearance.

MAINTENANCE AND REPAIR

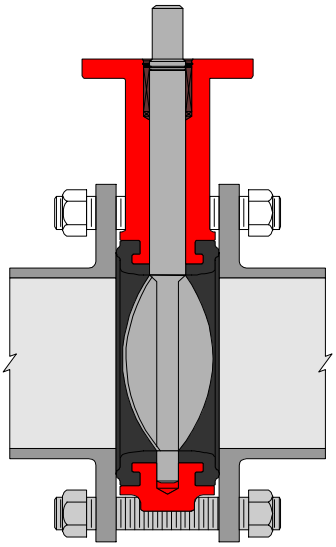
The many Bray features minimize wear and maintenance requirements. No routine lubrication is required. All components-stem, disc, seat, bushing, stem seal, etc., are field replaceable, no adjustment is needed. If components require replacement, remove the valve from the line by placing the disc near the closed position, spread the flanges, support the valve, then remove the flange bolts. No valve maintenance, including removal of manual or power actuators, should be performed until the piping system is completely depressurized.



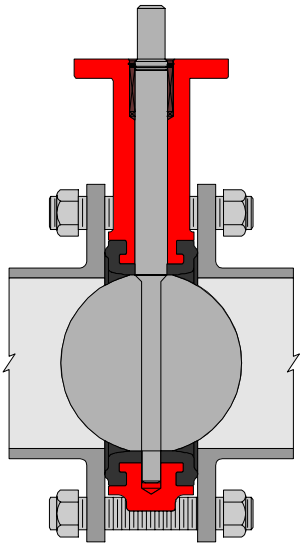
Disc in the Near Closed Position

DISASSEMBLY

Remove handle, gear operator , or actuator from actuator mounting flange. Remove "Spirolox®" retaining ring. Remove stem with its thrust washer and two C-ring stem retainers. Remove bushing and seal. Remove the disc from the seat, protecting disc edge at all times. Push the seat into an oval shape, then remove the seat from the body.



Disc in the Partially Open Position



Disc in the Full Open Position

Assembly

Push the valve seat into an oval and push it into the body with seat stem holes aligned to body stem holes. Push stem into the stem hole of body. For aid in inserting disc, slightly protrude stem beyond the I.D. of the top of the seat. Install a light coating of food grade silicone oil (for silicone free applications use soap and water) on the I.D. of seat. Insert the disc into the seat by lining up the disc hole with the stem hole of the seat. Note: the broached double "D" flats in the disc must be toward the bottom of valve body. (Take special care when lining disc up with stem.) With a downward pressure and rotating the stem back and forth, push the stem until the stem touches the bottom of the body stem hole. Make certain that when pushing the stem through disc bottom, the broached flats of stem and disc are aligned. After the stem has engaged the disc, but before the stem is firmly seated in the body, replace the stem seal and bushing. Install the two C-ring stem retainers in the groove in the stem and thrust washer on top of the C-ring. Seat the stem firmly in the body and install the "Spirolox®" retaining ring back into position.

Bray® CONTROLS

A Subsidiary of BRAY INTERNATIONAL, INC.
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ACTUATOR

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Description of Operation

The Bray Series 92 and 93 Pneumatic Actuators feature a double piston, rack and pinion mechanism designed to automate quarter-turn valves. In the Series 92 Double-Acting Actuator, pressure introduced through Port A (the left port when facing the ports) forces the pistons away from each other and causes the pinion to rotate in a counterclockwise direction. Pressure introduced through Port B (the right port when facing the ports) is directed through an internal passage to the opposite side of the pistons, which forces the pistons together and rotates the pinion in a clockwise direction. Normally, the clockwise rotation (pistons moving together) closes the attached valve, and the counterclockwise rotation (pistons moving apart) opens the attached valve.

In the Series 93 Spring-Return Actuators, spring cartridges have been added to push the pistons together by spring force in the event the compressed air pressure is lost. This spring force normally closes the attached valve. However, in the event that the valve is required to open under spring force, refer to the *fail open* portion of the **installation** section below.

Operating Fluid

The recommended operating medium is clean dry air at 40 - 140 psig (3 - 10 bar). An air line lubricator is suggested for fast cycling applications, i.e. more than 10 cycles per minute. Other media such as hydraulic oil, water, or certain other gases may also be used in some instances, but the factory should be consulted for specific applications.

Operating Temperature

The recommended operating temperature range is -15°F to 200°F (-25°C to 95°C). Below 32°F (0°C) care must be taken to prevent condensed moisture from freezing in the air supply lines. Consider the use of an air dryer if the actuator is installed in cold climates. The air dryer must be capable of lowering the dew point of the air to a temperature lower than that of the surrounding environment.

Installation

Bray Series 92/93 Actuators are designed to mount directly on the top plate of Bray Valves. Before the actuator is mounted on a valve, it is a good practice to lubricate the output bore of the actuator with a thick grease. The grease will make it easier to remove the actuator from the valve stem, even after years of service.

Normally, the actuator is mounted with its long side parallel to the pipe line. A double acting actuator will normally rotate the valve stem clockwise to close, and counterclockwise to open. Spring return actuators will normally rotate the valve stem clockwise to close with the spring stroke, and counterclockwise to open with the air stroke. The normal operation of the spring cartridges is therefore *fail closed.*

Direction of operation may be changed to *fail open* by any one of several different methods. Refer to the Assembly Instructions and Exploded View in Figure 4 on page 7 for more details.

Method 1 - Note: This method works only with concentric disc valves such as the Bray Series 20/21, 22/23 and 30/31 or other valves that allow the disc to be swung through the seat. Turn the actuator so the long side is perpendicular to the pipeline. This will allow the spring cartridges to rotate the valve stem clockwise to open, and the air stroke to rotate the valve stem counterclockwise to close. This is the easiest method if there is sufficient room to mount the actuator.

Method 2 - Note: This method works only with concentric disc valves such as the Bray Series 20/21, 22/23 and 30/31 or other valves that allow the disc to be swung through the seat. See **Assembly** below for detailed instructions on reinstalling the travel stop cam on the pinion. Remove the end caps, spring cartridges and pistons from the actuator. Remove the pinion, rotate it 90°, and reinstall the pinion in the actuator. This will also allow the spring cartridges to rotate the valve stem clockwise to open, and the air stroke to rotate the valve stem counter-

clockwise to close. This is the second easiest method, and allows the actuator to be mounted with its long side parallel to the pipeline.

Method 3 - Note: This method works for all valves but must be used for offset disc valves such as the Bray Series 40/41, 42/43 and 44/45 or other offset disc valves where the disc may only turn clockwise to close. See **Assembly** below for detailed instructions on reinstalling the travel stop cam on the pinion. Remove the end caps, spring cartridges and pistons from the actuator. Rotate the pistons so that the racks turn the pinion counterclockwise as the pistons move toward each other. (With the air input ports of the actuator body facing you, the left hand piston rack should be on the side with the air ports.) This is the third easiest method, and allows the actuator to be mounted with its long side parallel to the pipeline, and clockwise to close rotation to be maintained.

The actuator is attached to the valve by means of the studs and nuts furnished in the mounting kit. Thread the studs into the proper holes before installing the actuator on the valve. The studs should be snug in the bottom of the tapped holes; there is no need to torque them. Install the actuator on the valve making sure that the base of the actuator fits flat against the valve mounting flange. Use the nuts and washers from the kit to complete the installation. Torque the nuts in a diagonal pattern to assure equal loading of the studs.

The final step in the installation process is to check the travel stop settings. The travel stops are set for 90° of travel at the factory, however, each installation is different so they should be checked before putting the valve in service. The actuators are designed with a minimum of 5° over or under travel at each end of rotation. A screwdriver, an open end or box end wrench and a hex wrench, all of the appropriate size, are the only tools required to make the necessary adjustments. Refer to Figure 1 below.

Remove the black position pointer to expose the wrench flats on the top of the pinion.

Rotate the valve to the desired position. If the air supply is available, it may be used to stroke the actuator. If no air is available and the actuator has no springs, a wrench may be used.
CAUTION: Remove the air pressure before making the adjustments.

Loosen the lock nut on the travel stop screw. It is not necessary to remove the nut completely. Using the hex wrench, turn the screw in or out until the desired travel stop position is reached. While holding the screw with the hex wrench, tighten the lock nut with the wrench.

Replace the position indicator making certain the pointer is aligned with the position of the valve, open or closed.

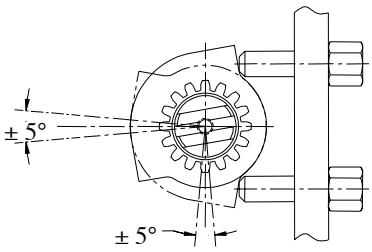


Figure 1

Some valves or operating conditions dictate that the actuator have more that 5° of travel adjustment. For these conditions, the Series 92/93 actuator can be fitted with extended travel stops in the end caps. (See Drawing ES11A-0460 in Figure 3 on page 6) Consult the Bray distributor in your area for this option.

Spring return actuators may be operated with only one air supply connected to Port A, since the spring cartridges will move the pistons when the air pressure in removed. This operation, however, will draw the surrounding atmosphere into the spring chambers through Port B. To prevent contamination from entering the spring chamber, a filter with a 40 micron (or finer) element should be installed in Port B.

Even better service may be obtained on spring return actuators by installing a four-way solenoid, covering both Port A and Port B. A four-way solenoid will fill the spring chambers with compressed air from the

plant air supply with each stroke. The plant air supply is often cleaner than the surrounding atmosphere, especially in heavy industrial or chemical areas.

Maintenance

The rugged components and factory lubrication combine to ensure a long and trouble-free service life for Series 92/93 actuators. Dirt and rust are the most common cause for shortened service life, and they typically enter the actuator through the air supply line. Therefore, it is strongly recommended that an adequately sized filter with a 40 micron (or finer) element be installed adjacent to the inlet of the directional control valve. Air line lubricators are recommended for rapid cycling applications (10 cycles or more per hour.)

Routine maintenance of Series 92/93 actuators consists primarily of maintaining the air supply system by changing filter elements before they start by-passing and adding oil to lubricators before they run dry.

The second most common cause of shortened service life is misalignment between the valve and the actuator. This can cause premature failure due to excessive side loads on the bearings and gear teeth.

Troubleshooting

Table 1 shows several common symptoms and their remedies.

Symptom	Probable Cause	Check	Remedy
Loss of Power	Low air supply pressure, or damaged O-rings	Air supply pressure at actuator, leakage across O-rings	Boost air supply pressure, repair air supply line leaks, replace O-rings
Binding between valve and actuator	Misalignment of coupling	Alignment	Realign coupling
Valve "pops" out of seat and slams open	Valve torque too high, actuator sized too small, or insufficient air supply flow	Valve torque, actuator sizing calculations, size of air supply lines and/or solenoid valve	Repair valve, use proper size actuator, use larger air supply lines and/or solenoid valve with higher flow

Assembly

To identify component names and shapes, refer to the Exploded View of the actuator shown in Figure 4. The numbers in parentheses ( ) refer to the numbered bubbles in Fig. 4 on page 7. Easiest assembly will result from lubricating all bearings and seals as they are installed. The lubricant should be a high pressure or extreme pressure petroleum grease with a lithium based thickener which meets the NLGI[1] grade 2. Grease which meets this specification should be available from any automotive supply store.

Pinion (3) - Install bearing rings (6 &7) and o-rings (18&19) in their appropriate grooves. Insert the pinion through the large hole in the center of the body (1). With the pinion part of the way into the body, slide the cam (23) over the pinion being careful to align the punch mark on the cam with the punch mark(s) on the pinion. For normal installation and rotation, align the single marks. For *fail open* operation described in *Method 2* above, align the single mark on the cam with the two marks on the pinion. For *fail open* operation described in *Method 3* above, align the single marks. Next, install the spacer (24) above the cam. Then insert the pinion through the hole at the top of the body and secure it with the washer (9) and retaining ring (8).

Travel Stop Screws (13) - Slip the o-ring (14) over the flat end of the screw until it is 5-7 threads from the end. Thread the screw into the hole, flat end first. Repeat these steps for the second screw. Thread the lock nuts (12) onto the screws and tighten the nuts against the body. This will seal the

[1] National Lubricating Grease Institute

threads for testing. It is not necessary to set the travel stops at this time as they may have to be re-set when the actuator is installed on the valve.

Pistons (2) - Install the bearing pad (10) on the back of the rack and the o-ring (16) and guide ring (11) in their appropriate piston grooves. The o-ring goes in the groove nearest the rack. With the ports on the actuator body toward you, turn the pinion so that the slot is approximately 45° to the right of perpendicular with the long side of the body. Grasp the pistons in the spring pockets so that the piston in the right hand has the bearing pad toward you and the piston in the left hand has the bearing pad away from you. Slide the pistons into the body so that they both engage the teeth on the pinion at the same time. Apply enough steady force to compress the o-ring into the body bore. At this point, you may continue pushing or use a wrench on the top of the pinion to pull the pistons into the body. Check three things now. Did the pinion turn clockwise as the pistons moved toward the center of the body? Is the slot in the top of the pinion within a few degrees of perpendicular to the long side of the body? Are the pistons the same distance in from the end of the body? (Check this carefully because it is very critical.) If the answer to all three questions is yes, proceed to install the end caps. If the answer to any one question is no, use a wrench on the pinion to drive the pistons out of the body and repeat the insertion process. It is not necessary to remove the pistons from the body unless the answer to the first question is no. It is only necessary to disengage the piston rack from the pinion.

NOTE: The procedure described here is the "standard" method. For fail open actuators, refer to the *Method 2* or *Method 3* above.

End Caps(4) - Install the o-ring (17) in the groove. Attach the end cap to the body with the 4 bolts (15) and washers (20) making certain that the straight part of the o-ring groove is toward the bottom of the body. The air pressure will not flow to the outboard side of the pistons if the straight part of the o-ring groove is at the top.

Position Indicator (21) - Install the position indicator pointer on the top of the pinion and secure it with the flat head screw (22). Normally, the long axis of the pointer will be parallel to the groove in the pinion. If the actuator is installed across the pipe line, as described in Method 1 above, the indicator should be turned so that it is in line with the butterfly valve disc or port in the ball or plug valve.

Final Assembly and Testing

Connect the compressed air supply to the actuator input ports. Cycle the actuator fully open and fully closed to check for proper travel and absence of air leaks. If compressed air is applied to Port A and the actuator reaches the end of travel, there should be no air flow out of Port B, and vice versa. There should be no air flow between the end caps and the body, through the travel stops, or out the top or the bottom of the pinion. A solution of soap and water applied to the sealing points can indicate leaks that are too small to be audible.

Disassembly

Disconnect the compressed air from the actuator. If the actuator is installed on a valve, remove it and take it to a clean work area, if possible. Remove the indicator pointer. Remove both end caps by loosening the hex head end cap bolts. Remove both pistons by rotating the pinion counterclockwise until the piston heads are protruding from the body. Pull the pistons out. Take off the pinion retaining ring and acetal washer, then remove the pinion from the body. The pinion bearings, o-rings, cam and spacer may then be removed.

Adding Spring Cartridges

Move the pinion to the fully closed (0°) position. Remove the end caps and insert the desired number of spring cartridges into the end cap pockets, up to a maximum of six cartridges per end cap. See preferred placement of the spring cartridges below.

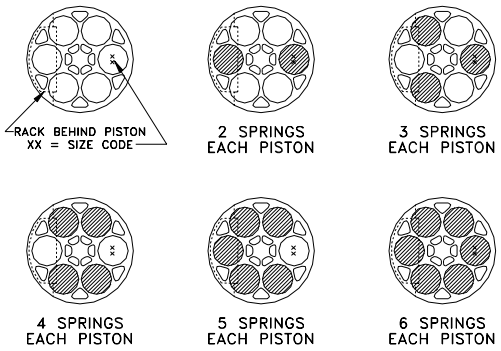


Figure 2

Align the end cap with the body so the spring cartridges fit into the piston pockets. Attach the end caps to the body with the hex head end cap bolts. Tighten the bolts gradually in a diagonal sequence.

Proceed to Final Assembly and Testing.

Removing Spring Cartridges

Disconnect the compressed air from the actuator. An actuator with spring cartridges installed and no compressed air connected will move to the spring fail position. This may be either fully closed (0°) or fully open (90°). In either case, when the spring fail position is reached, remove the end caps by gradually loosening the hex head end cap bolts in a diagonal sequence. Remove the spring cartridges. Replace the end caps and tighten the bolts gradually in a diagonal sequence. CAUTION: Do Not Allow a Single Bolt to Hold the Fully Compressed Springs.

Proceed to Final Assembly and Testing.

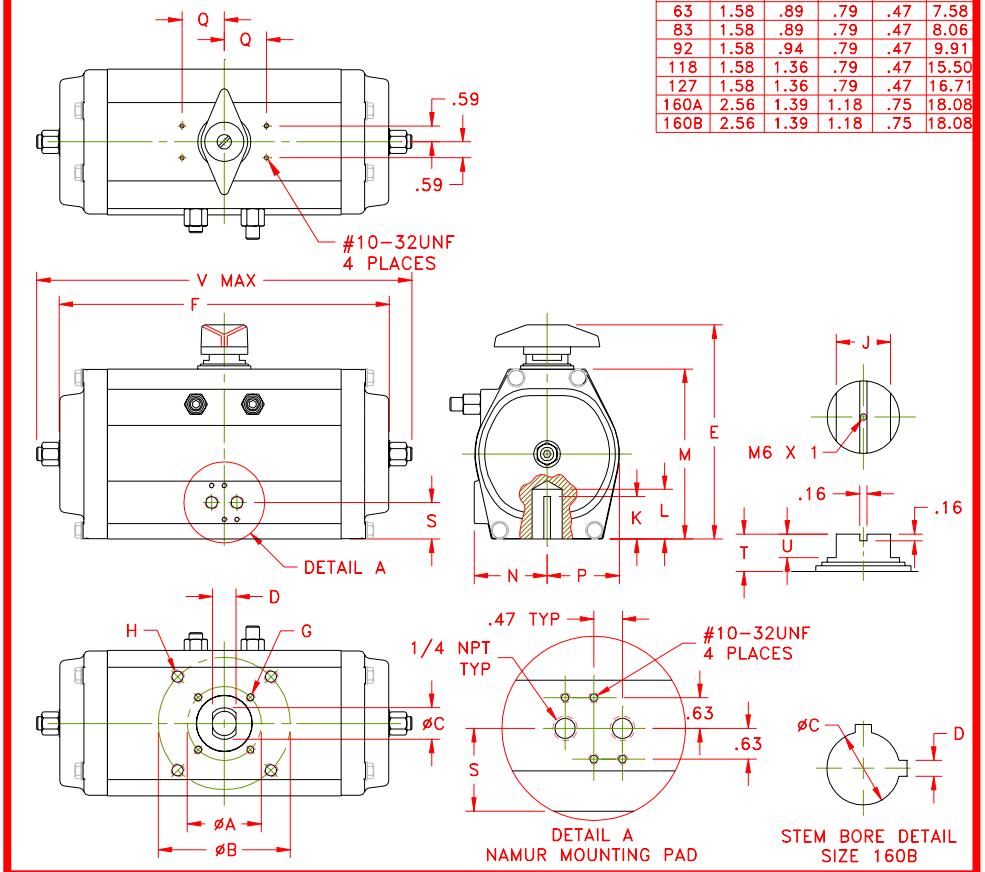
General Pneumatic System Recommendations

To maintain maximum efficiency with the Series 92/93 actuator, as well as many other pneumatic devices, the following suggestions are offered:

- Air supply lines should be run in accordance with a Standard Piping Practice, and should not have exaggerated loops which may trap condensate.
- All pipe ends should be thoroughly cleaned and deburred after cutting to ensure that the pipeline is clear of cuttings.
- Where air pipelines are subjected to extremes of temperature, the system should be fitted with air drying equipment.
- If pipelines are hydraulically tested, the lines should be "blown down" with high pressure air to clear all water prior to connecting the lines to the actuator.
- Where a system is dependent on air filter equipment, the air filters should be in positions that allow easy access for maintenance and/or draining.
- Where pneumatic valve positioners or pneumatic controllers are installed in a valve actuator assembly, oil mist lubricated air should not be used unless the manufacturer states specifically that the positioner or controller is compatible with lubricated air. In general, lubricated air is not recommended for a positioner.
- Where pipe fitting sealants or tapes are used, they should be applied to the male threads only. When applied to female threads, excess compound or tape can be transmitted into the actuator control lines and cause malfunctions in downstream equipment.

Act Size	AIR	A	B	C	D	E	F	G	H	J	K	L	M	N	P
63	1/4	1.97	2.76	.55	.40	4.53	5.58	1/4–20UNC	5/16–18UNC	.38	–	1.38	3.46	1.72	1.38
83	1/4	1.97	2.76	.75	.51	5.43	7.40	1/4–20UNC	5/16–18UNC	.50	–	1.46	4.27	2.02	1.79
92	1/4	1.97	2.76	.75	.51	5.78	8.59	1/4–20UNC	5/16–18UNC	.50	–	1.46	4.61	2.18	1.97
118	1/4	2.76	4.92	1.18	.87	7.28	11.90	5/16–18UNC	1/2–13UNC	1.12	–	2.20	5.52	2.53	2.37
127	1/4	2.76	4.92	1.18	.87	8.09	12.31	5/16–18UNC	1/2–13UNC	1.12	–	2.20	6.32	2.72	2.70
160A	1/4	–	4.92	1.18	.87	9.36	15.54	–	1/2–13UNC	1.12	–	2.20	7.80	3.07	3.39
160B	1/4	–	4.92	1.38	.39	9.36	15.54	–	1/2–13UNC	1.12	2.00	2.38	7.80	3.07	3.39

Act Size	Q	S	T	U	V
63	1.58	.89	.79	.47	7.58
83	1.58	.89	.79	.47	8.06
92	1.58	.94	.79	.47	9.91
118	1.58	1.36	.79	.47	15.50
127	1.58	1.36	.79	.47	16.71
160A	2.56	1.39	1.18	.75	18.08
160B	2.56	1.39	1.18	.75	18.08



NOTES: SERIES 92 ACTUATORS (DOUBLE ACTING) AND SERIES 93 (SINGLE ACTING) ARE DIMENSIONALLY THE SAME.

Customer/Project _____

Inq./P.O. No. _____

Bray Order No. _____

Certified Correct By _____ Date _____

DIMENSIONS (Inches)
PNEUMATIC ACTUATOR, SERIES 92/93, SIZES 63 – 160,
WITH INTERNAL BI-DIRECTIONAL TRAVEL STOP
& EXTERNAL TRAVEL STOPS

Bray CONTROLS
A Division of BRAY INTERNATIONAL, Inc.

SHEET 1 OF 1 | REV. 1
DRAWING NO. ES11A-0460

ERN 7456

Figure 3

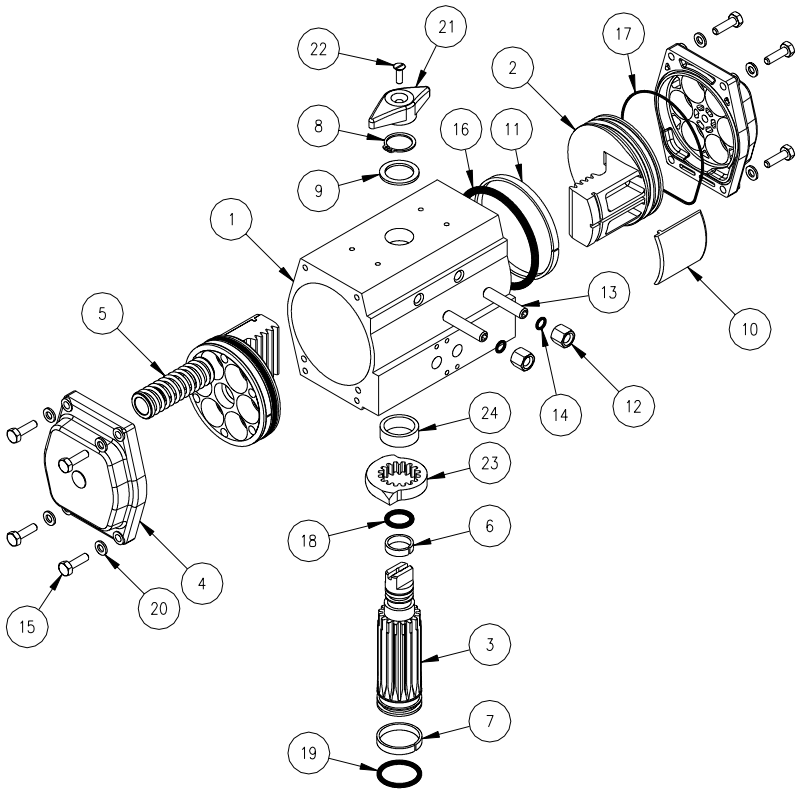


Figure 4
Series 92/93 Exploded-view

Item No	Qty.	Description
1	1	Body
2	2	Piston
3	1	Pinion
4	2	End Cap
5	12 max.	Spring Cartridge
6	1	Upper Pinion Bearing
7	1	Lower Pinion Bearing
8	1	Retaining Ring
9	1	Washer, Acetal
10	2	Bearing Pad, Acetal
11	2	Guide Ring, Acetal
12	2	Lock Nut

Item No	Qty.	Description
13	2	Travel Stop Screw
14	2	O-ring, Travel Stop
15	8	Hex Head Cap Screw
16	2	O-ring, Piston
17	2	O-ring, End Cap
18	1	O-ring, Upper Pinion
19	1	O-ring, Lower Pinion
20	8	Washer, Stainless Steel
21	1	Position Indicator Pointer
22	1	Flat Head Screw
23	1	Cam, Internal Travel Stop
24	1	Spacer, Int. Travel Stop

Bray®

PNEUMATIC ACTUATOR

SERIES 92/93 Rack & Pinion
Double Acting & Spring Return

The
High
Performance
Company

SERIES 92/93

Styling, strength, compactness, and simplicity of design have been combined to produce the best rotary actuator on the market today. Bray Controls introduces this newest line of high performance, highest quality pneumatic actuators, the Series 92/93.

Engineering excellence and precision manufacturing has produced a modular product line with reduced overall size requirements and economic savings. In addition all Brayline Accessories are fully modular and directly mount to the actuator – providing flexibility and efficiency at reduced cost.

Bray Series 92/93 actuators are rack and pinion, opposed-piston actuators available in two versions: double acting for rotation of 90°, 135° and 180°, and spring return for 90° rotation. Their ideal use is actuating butterfly, ball or plug valves, but they can be applied anywhere a rotation of 90°, 135° or 180° is needed. Rotated on low friction acetal bearings, Bray units are well suited to handle offset loads to the gear and output shaft assembly.

The Series 92/93 actuators were designed primarily for pneumatic operation up to a maximum pressure of 140 psig (10 Bar) and for temperature ranges of -40°F (-40°C) to +200°F (+95°C). For higher and lower temperature applications, consult factory.

All double acting and spring return units are suitable for both on-off and throttling applications. Actuators which can be actuated with other media such as hydraulic oil or water are also available as an option.

The Series 92/93 is completely enclosed and self contained. The many features minimize maintenance and provide safe, simple disassembly and assembly.

The INTEGRAL PORTING (**A**) reduces the cost of external tubing that is also easily damaged. The unique, lubricated ACETAL PISTON GUIDES (**B**) and RINGS (**C**). Both have a very low coefficient of friction and absorb the side thrusts of the pistons. The piston cylinder walls in the body are honed to a very fine finish thus reducing the overall coefficient of friction. These features extend the life of the actuator and make the Series 92/93 one of the most efficient actuators on the market.

The OUTPUT SHAFT BEARINGS (**D**) on the top and bottom of the pinion are made of low-friction acetal.

The OUTPUT SHAFT and PINION GEAR (**E**) are one-piece, manufactured from hardened alloy steel and zinc-plated for corrosion protection.

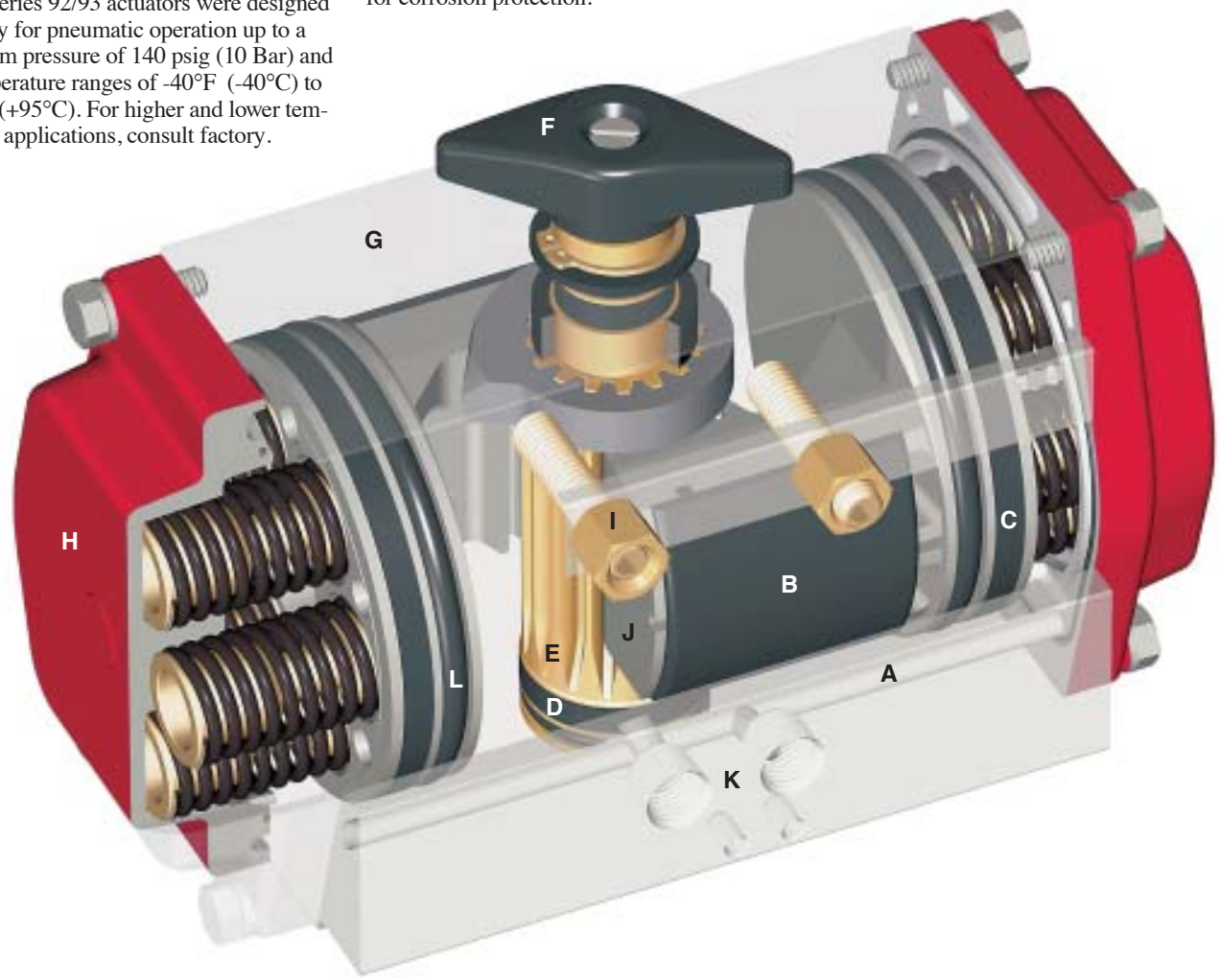
The SHAFT POSITION INDICATOR (**F**) clearly shows open or closed position and is easily removable for MANUAL OVERRIDE FUNCTION of the actuator.

The BODY (**G**) is extruded aluminum with anodized corrosion protective coating. The END CAPS (**H**) are polyester coated for chemical resistance. This coating is resistant to dilute aqueous acids, salts, aliphatic hydrocarbons, detergents, petroleum solvents, alcohols, greases and oils.

The TRAVEL STOP (**I**) adjusting screws limit the travel of the actuator to specific degrees of rotation in both open and closed directions. The PISTONS (**J**) are die-cast aluminum.

The two PNEUMATIC SUPPLY PORTS (**K**) are 1/8" NPT on size 48 actuators. The other sizes have 1/4" NPT ports. NAMUR interface is standard on all actuator sizes.

All Bray Series 92/93 actuators have permanently lubricated factory packed bearings and guides. No further lubrication is necessary under normal operating conditions. All seals, including PISTON SEALS (**L**), are permanently lubricated Buna-N O-rings.



TRAVEL STOP Two independent adjusting screws are located on the center of the output shaft to precisely limit the travel of the actuator to specific degrees of rotation. The travel stops permit bidirectional adjustment of actuator movement in both the open and closed positions.

SPRING RETURN Bray's Series 93 spring return models employ a unique cartridge system. The actuator was designed to save both space and cost. The housing length of the spring return unit is the same as the double acting unit. Converting from double acting to spring return actuation is just a matter of removing the end caps and adding the unique spring cartridges. The actuator can be disassembled and assembled without cumbersome equipment or danger to the installer due to springs releasing. 40, 60, 80, and 100 psi services are standard, optional ratings are available.

DIRECT MOUNTING Bray actuators comply with ISO 5211 dimensions and mount directly to Bray valves without using external linkages. Field installation is simple, misalignment is minimized and contamination buildup between valve and actuator is reduced. Bray can provide linkage for mounting actuators to other devices requiring 90° to 180° rotation.

BrayLINE ACCESSORIES

SERIES 63 3-WAY AND 4-WAY SOLENOID VALVE
For electrical operation of pneumatic actuator on-off functions, Bray Series 63 solenoids are direct-mounted to the actuator by NAMUR interface. The pilot operated spool control valve is convertible from 3-Way (3/2) to 4-Way (5/2). Both watertight (NEMA 4,4X) and explosion proof (NEMA 4,4X,7,9) housings are standard. NPT and IP65 DIN connections are offered with both single and dual coils. The air supply connection is 1/4" NPT and the electrical connection is 1/2" NPT. A manual override screw is located on the top of the valve body. Stainless Steel housings, digital Bus solenoids and a Series 55 speed control that allows independent control in both directions of travel are also available.

VALVE STATUS MONITOR SERIES 50 The Series 50 signals actuator and valve position to local and remote stations. The compact valve status monitor mounts directly to the top of the actuator. Features include finger-touch control cams, captive cover bolts, local position indicator and two conduit entries for easy wiring. Rated for 15 amps at 125 or 250 volts AC, the Series 50 is provided with internal travel switches that are prewired to a terminal block. Standard switches are two single pole double throw (SPDT) micro switches. Available switch options are 4 micro switches, 2 proximity switches, 2 pneumatic switches or potentiometer for continuous read out. The housing is available in waterproof (NEMA 4,4X) or explosion proof (NEMA 4,4X,7,9).

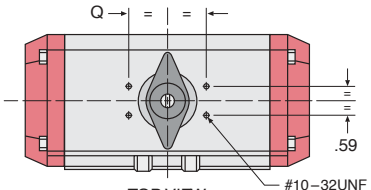
SERIES 52 VALVE STATUS MONITOR
The Bray 2N1 ProxSensor provides 2 inductive proximity sensors in 1 self-contained, fully sealed, compact enclosure. The 2 sensors are completely encapsulated with epoxy resin in a nylon enclosure for superior moisture, chemical and corrosion protection. Features include LED indicators, high visibility pointer for local position indication, non-magnetic target and multi-pin electrical cable connector. The Series 52 mounts directly to Bray actuators or can be mounted to signal valve position of manually operated valves. AC, DC and NAMUR intrinsically safe versions are available. AC Sensor units operate on 20-250 VAC with a maximum load current of 500mA. DC Sensor units operate on 10-65VDC with a maximum load current of 200mA.

SERIES 67 ELECTRO-PNEUMATIC & PNEUMATIC POSITIONERS
The Bray Series 67 positioners feature a modular design that allows the units and accessories to be freely combined. For use with either double or single acting actuators, they provide direct or reverse operating modes and zero and range adjustments can be set separately. The electro-pneumatic analog positioner accepts either a 0-20 mADC or 4-20 mADC input signal. Advanced microprocessor controlled Digital Analog and *Bus*Smart Intelligent electro-pneumatic positioners are offered for digital control.

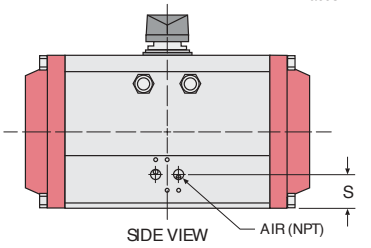
Brayline Accessories and Bray Actuators both comply with VDI/VDE 3845 (NAMUR recommendations).

ENGINEERING

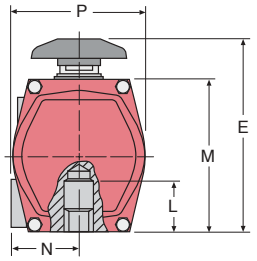
Double Acting/ Spring Return



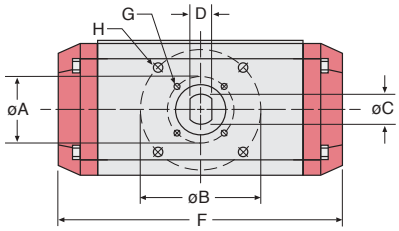
TOP VIEW



SIDE VIEW

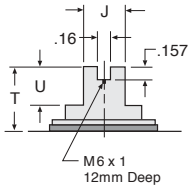


END VIEW

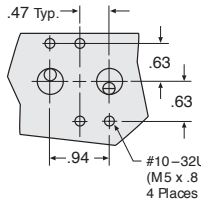


BOTTOM VIEW
ISO 5211 ACTUATOR
MOUNTING PATTERN

NAMUR OUTPUT
SHAFT TOP



NAMUR SOLENOID
MOUNTING



SERIES 92/93 DIMENSIONS

SIZE	48	63	83	92	118	127	160*	210	255‡
AIR NPT	1/8	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
A ISO "F"†	1.42 F 03	1.97 F 05	1.97 F 05	1.97 F 05	2.76 F 07	2.76 F 07	—	4.92 F 12	6.50 F 16
B ISO "F"†	1.97 F 05	2.76 F 07	2.76 F 07	2.76 F 07	4.92 F 12	4.92 F 12	4.92 F 12	6.50 F 16	7.87x4.72 Rect.
C	.55	.55	.75	.75	1.18	1.18	1.18	1.97	2.50
D	.40	.40	.51	.51	.87	.87	.87	.47	.62
E	3.88	4.53	5.43	5.78	7.28	8.09	9.36	11.45	13.35
F	4.00	5.58	7.40	8.59	11.90	12.31	15.54	17.80	26.70
G (UNC)	10-32 x .23	1/4-20 x .32	1/4-20 x .32	1/4-20 x .32	5/16-18 x .46	5/16-18 x .46	—	1/2-13 x .78	M16x2 x 28mm
H (UNC)	1/4-20 x .25	5/16-18 x .40	5/16-18 x .40	5/16-18 x .40	1/2-13 x .69	1/2-13 x .69	1/2-13 x .75	5/8-11 x 1.11	M16x2 x 28mm
J	.38	.38	.50	.50	1.12	1.12	1.12	1.12	1.12
L	1.30	1.38	1.46	1.46	2.20	2.20	2.20	2.76	4.25
M	2.50	3.46	4.27	4.61	5.52	6.32	7.80	10.04	11.89
N	1.60	1.72	2.02	2.18	2.53	2.72	3.07	4.25	4.75
P	2.19	3.11	3.83	4.17	4.91	5.44	6.82	8.83	10.75
Q	1.58	1.58	1.58	1.58	1.58	1.58	2.56	2.56	2.56
S	1.25	.89	.89	.94	1.36	1.36	1.39	1.44	1.50
T	1.10**	.79	.79	.79	.79	.79	1.18	1.18	1.18
U	.47	.47	.47	.47	.47	.47	.75	.75	.75

Note: Double Acting and Spring Return actuators have the same overall dimensions.
† ISO "F" means mounting flange-drilling pattern.
* Dimensions for Size 160A in table. Size 160B (keyed stem version) has C dimension of 1.38 and D dimension of .39.
‡ Dimensions for Size 255A in table. Size 255B actuator has a C dimension of 3.00 and D dimension of .75.
** Size 48 has a T dimension of .79 with use of NAMUR top plate.

Actuator Speeds

SIZE	48	63	83	92	118	127	160	210	255
Open Stroke/ Close Stroke	1/4	1/4	1/4	1/4	1/2	1/2	1	2	2 3/4

Times are in seconds, at 80 PSIG with 6ft. tubing, internal diameter approximately 1/4".

Actuator Weights

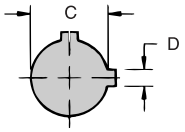
SIZE	48	63	83	92	118	127	160	210	255
Double Acting	1.8	3.4	6.1	8.4	16.4	20.9	38.1	65.0	144.0
Spring Return	2.4	4.1	7.9	10.8	21.7	27.3	52.6	95.3	192.6

Weights are in lbs. Spring Return unit weights are with full set of springs per piston.

Actuator Volumes (ins^3)

SIZE	48	63	83	92	118	127	160	210	255
Counter-clockwise	5.7	9.6	24.8	34.8	73.8	96.7	187.5	360.0	750.0
Clockwise	4.8	13.4	32.6	45.9	95.5	130.8	259.6	450.0	900.0

Counter-clockwise: Air volume in cubic inches required to push pistons apart, full travel.
Clockwise: Air volume in cubic inches required to push pistons together, full travel.

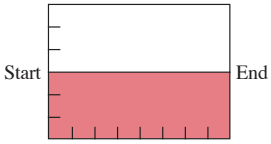


STEM BORE DETAIL
SIZES 210 & 255

TORQUE

DOUBLE ACTING TORQUE CURVE

Series 92 – (Air to Air)



The Series 92 Actuator has a constant output torque throughout travel from start to end, clockwise or counterclockwise rotation.

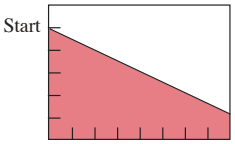
SERIES 92 ACTUATOR TORQUE DATA

Double Acting Pneumatic Operated
Torque Output (Lb.-Ins.)

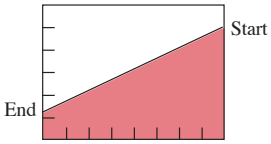
Actuator Size	Air Supply Pressure (PSIG)				
	40	60	80	100	120
48	75	113	150	188	225
63	145	221	297	373	449
83	351	536	721	906	1091
92	493	753	1013	1272	1532
118	1058	1615	2171	2728	3285
127	1410	2152	2894	3636	4378
160	2797	4270	5742	7214	8687
210	5783	8826	11870	14914	17957
255	14211	21691	29171	36650	44130

SINGLE ACTING TORQUE CURVES

Series 93 – (Spring Return)



Counterclockwise (Air Stroke)



Clockwise (Spring Stroke)

SERIES 93 ACTUATOR TORQUE DATA

Air Operated, With Spring Return, Torque Output (Lb.-Ins.)

Actuator Size	No. Springs per Piston	Air Supply Pressure (PSIG)										Spring Stroke	
		40		60		80		100		120			
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
48	1	51	32	89	70	126	107	164	145	201	182	43	24
	2/1	39	10	77	48	114	85	152	123	189	160	65	36
	2			64	27	101	64	139	102	176	139	86	49
	3/2			52	5	89	42	127	80	164	117	108	61
	3					77	21	115	59	152	96	129	73
63	2	91	65	167	141	243	217	319	293	395	369	80	54
	3	64	27	140	103	216	179	292	255	368	331	118	81
	4			113	65	189	141	265	217	341	293	156	108
	5			86	27	162	103	238	179	314	255	194	135
	6					135	65	211	141	287	217	232	162
83	2	210	167	395	352	580	537	765	722	950	907	184	141
	3	156	76	341	261	526	446	711	631	896	816	275	195
	4			281	176	466	361	651	546	836	731	360	255
	5			220	97	405	282	590	467	775	652	439	316
	6					369	185	554	370	739	555	536	352
92	2	310	232	570	492	830	752	1089	1011	1349	1271	261	183
	3	218	101	478	361	738	621	997	880	1257	1140	392	275
	4			386	231	646	491	905	750	1165	1010	522	367
	5			294	94	554	354	813	613	1073	873	659	459
	6					462	229	721	488	981	748	784	551
118	2	692	469	1249	1026	1805	1582	2362	2139	2919	2696	589	366
	3	509	174	1066	731	1622	1287	2179	1844	2736	2401	884	549
	4			883	437	1439	993	1996	1550	2553	2107	1178	732
	5			700	142	1256	698	1813	1255	2370	1812	1473	915
	6					1073	404	1630	961	2187	1518	1767	1098
127	2	880	465	1622	1207	2364	1949	3106	2691	3848	3433	945	530
	3			1357	733	2099	1475	2841	2217	3583	2959	1419	795
	4			1094	261	1836	1003	2578	1745	3320	2487	1891	1058
	5					1568	529	2310	1271	3052	2013	2365	1326
	6					1302	57	2044	799	2786	1541	2837	1592
160	2	1819	1118	3292	2591	4764	4063	6236	5535	7709	7008	1679	978
	3	1399	349	2872	1822	4344	3294	5816	4766	7289	6239	2448	1398
	4			2452	1123	3924	2595	5396	4067	6869	5540	3147	1818
	5			2030	353	3502	1825	4974	3297	6447	4770	3917	2240
	6					3154	1196	4626	2668	6099	4141	4546	2588
210	2	3833	2508	6876	5551	9920	8595	12964	11639	16007	14682	3275	1950
	3	2859	868	5902	3911	8946	6955	11990	9999	15033	13042	4915	2924
	4			4930	2275	7974	5319	11018	8363	14061	11406	6551	3896
	5			3949	638	6993	3682	10037	6726	13080	9769	8188	4877
	6					6022	2031	9066	5075	12109	8118	9839	5848
255	2	9487	6747	16967	14227	24447	21707	31926	29186	39406	36666	7464	4724
	3	7125	3015	14605	10495	22085	17975	29564	25454	37044	32934	11196	7086
	4			12243	6762	19723	14242	27202	21721	34682	29201	14929	9448
	5			9880	3030	17360	10510	24839	17989	32319	25469	18661	11811
	6					14998	6778	22477	14257	29957	21737	22393	14173

SPECIFICATIONS

SPACE SAVING MODULAR PRODUCT LINE

The actuator shall be pneumatically operated and must travel a minimum of 90° in each direction and must be able to overtravel at 3% in each direction past 90°. The actuator shall be totally enclosed and contained in a single enclosure, with no external moving parts. All pneumatic passage ways must be integral to the actuator housing so as to eliminate the need for external tubing. Actuator shall be rack and pinion design, and the output torque shall be linear throughout travel. Actuator shall be provided with pistons that have acetal piston guides and rings thus greatly extending the life of the actuator and reducing friction to the minimum. Actuator must be supplied with two independent travel stop adjustments, the 0° and 90° travel positions have travel adjustments of +5° to –5° (see Diagram A below). The actuator shall be provided with mechanical visual position indicator, and the indicator must be able to be removed easily thus exposing the output shaft for use of manually overriding the actuator when needed. The output shaft and pinion must be of one piece and must be manufactured out of hardened alloy steel and zinc plated for corrosion protection. Actuator shall be able to mount in any position without loss of performance. The actuator shall bolt directly to Bray valve mounting flange without need for any brackets.

Actuator housing shall be anodized aluminum and all external fasteners shall be carbon steel, zinc plated. Springs shall be spring steel, coated for corrosion protection. All seals shall be Buna-N and bearings made of lubricated acetal resin.

The actuator shall be factory lubricated. Actuator design must have smooth housing lines so it will self-drain. The actuator shall be factory tested to ensure proper operation.

STANDARD MATERIALS

Body:	Extruded aluminum alloy, anodized
End Caps:	Die cast aluminum alloy with corrosion resistant polyester coating
Pistons:	Die cast aluminum alloy
Output Shaft/Pinion:	Carbon Steel, zinc plated
Travel Stop:	Alloy Steel
Shaft Bearings:	Acetal
Piston Guides:	Acetal
Fasteners:	Stainless Steel
Springs:	Spring Steel, protective coating
O-Ring Seals:	Buna-N
Options:	Polyester coated body exterior Electroless Nickel plated body exterior Hard Anodized body exterior Stainless Steel pinion

SPRING RETURN – MODULAR DESIGN

The Spring Return System for fail-safe services must be installed in the same housing as the double acting actuator, with no additional housing extensions required, therefore saving weight and space. The spring system must be supplied as a self-contained spring cartridge system. This is a safety feature that ensures disassembly of the actuator without danger of spring release when end caps are removed. Actuator shall be Bray Series 92 or 93 or approved equal.

SERVICE DATA:

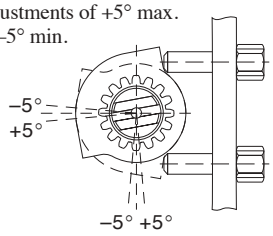
Actuators shall be designed for pneumatic operation up to a maximum pressure of 140 PSIG (10 Bar) and for temperature ranges of -40°F (-40°C) to +200°F (+95°C). Filtered air is recommended but not required. All double acting and spring return units shall be suitable for both on-off and throttling applications. Optional units shall be able to operate with other media such as hydraulic oil or water, consult factory for further information.

OPTIONAL EQUIPMENT

See Bray brochure #1030 for Solenoid, brochures #1011 and #1029 for Pneumatic and Electro-Pneumatic Positioners and brochures #1012 and #1015 for Valve Status Monitors.

Diagram A Travel Stop Adjustments

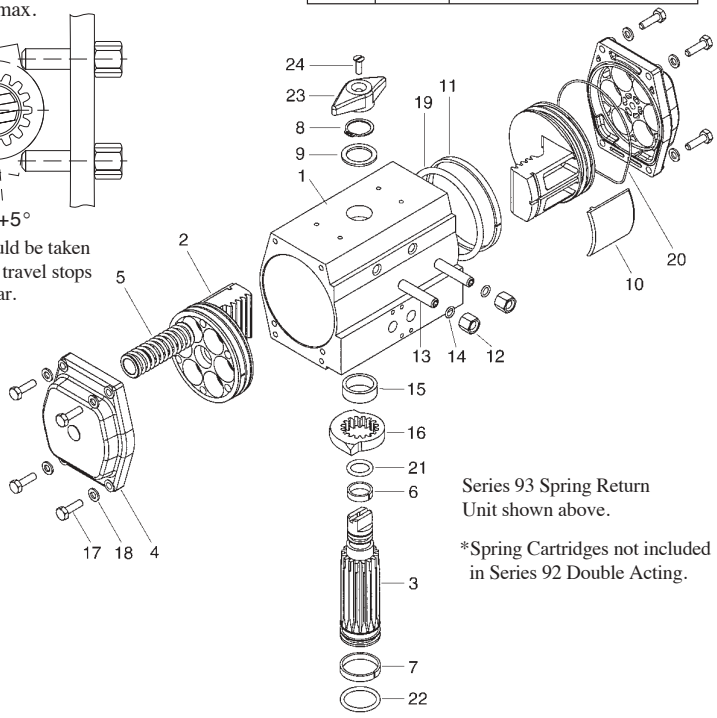
The 0° and 90° travel positions have travel adjustments of +5° max. to –5° min.



Caution: Care should be taken not to over adjust the travel stops in too far or out too far.

ACTUATOR COMPONENTS

Item No.	Qty.	Description
1	1	Body
2	2	Piston
3	1	Pinion
4	2	End Cap
5*	12 max.	Spring Cartridge Assembly
6	1	Upper Bearing
7	1	Lower Bearing
8	1	Retaining Ring
9	1	Nylon Washer
10	2	Acetal-Bearing Pad
11	2	Acetal-Guide Ring
12	2	Stop Nut
13	2	Travel Adjusting Screw Stop
14	2	O-Ring–Travel Stop
15	1	Acetal Spacer
16	1	Travel Stop
17	8	Hex Head Cap Screw
18	8	Washer
19	2	O-Ring–Piston
20	2	O-Ring–End Cap
21	1	O-Ring–Shaft-Top
22	1	O-Ring–Shaft-Bottom
23	1	Indicator Pointer
24	1	Indicator Pointer Screw



Series 93 Spring Return Unit shown above.

*Spring Cartridges not included in Series 92 Double Acting.

ISO 9001
Certificate Number: 31938

DISTRIBUTOR

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MANUAL OPERATOR

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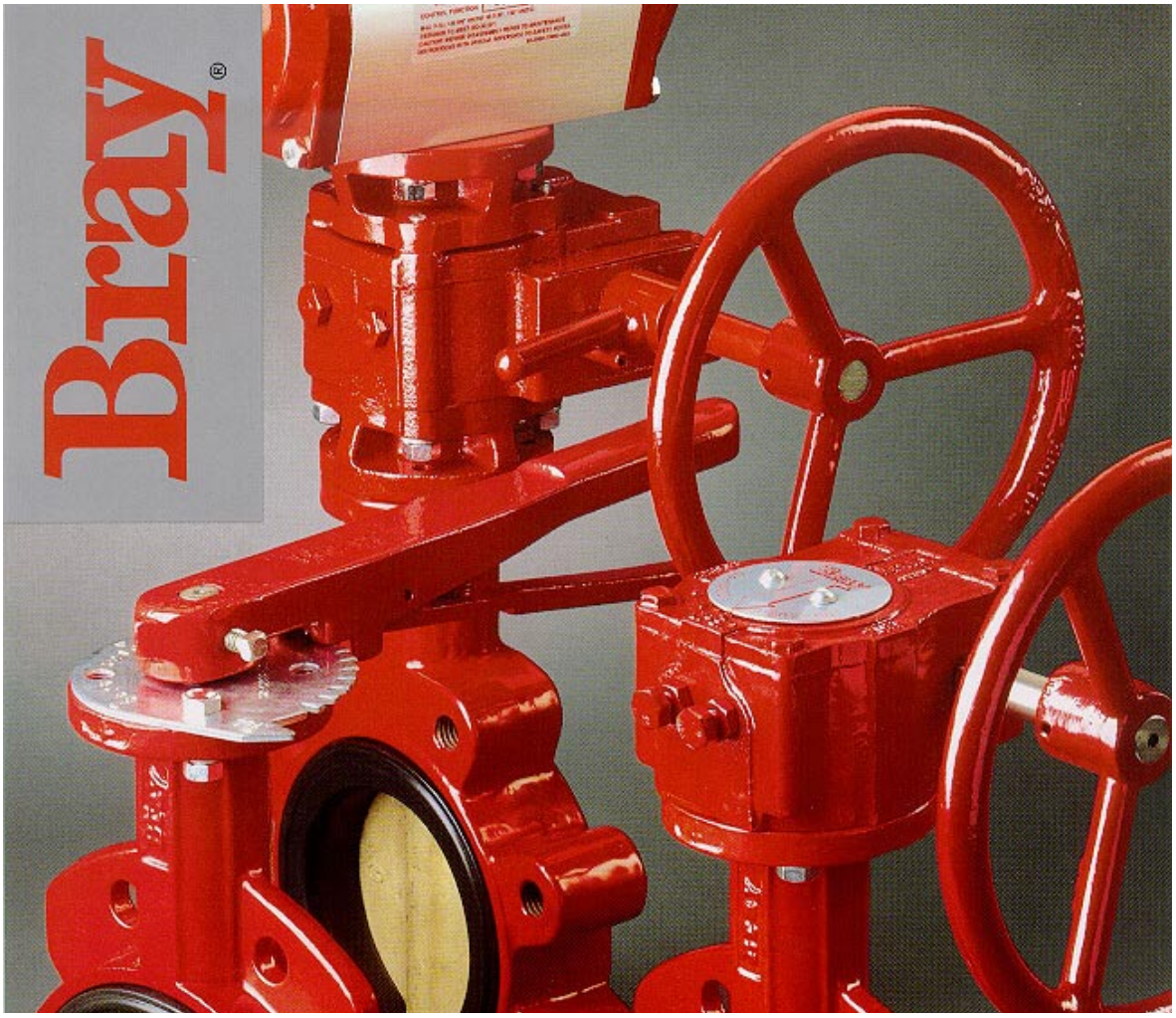

Manual Operators

Handle / Gear Operator / S.S. Gear Operator / Declutchable Gear Operator

Series 1: 1"-12" (25mm-300mm)
Series 4: 2"-54" (50mm-1400mm)
Series 4 Stainless Steel: 1"-16" (25mm-400mm)
Series 5: 2"-36" (50mm-900mm)

Bray Controls proudly offers four operators for manual control of valve position. All manual operators mount directly to Bray valves, and all are epoxy coated for excellent corrosion, abrasion and impact resistance.

SERIES 1 HANDLE & NOTCH PLATE
Bray offers two handles for on-off and throttling service - one for resilient seated valves from 1”-12" (25mm-300mm), and a high torque handle for high pressure valves from 2 ½”-8” (65mm-200mm). These quarter turn handles have a locking spring and a directional pointer for valve disc position indication. Bolted notch plates are offered. For resilient seated valves a 10 position plate is standard. For high pressure valves an 8 position plate is standard. Both contain on-off stops to prevent over rotation of the valve. Optionally available are an infinite position plate, a 180° notch plate, a memory stop, a padlock kit, and a 2” square nut version.

SERIES 4 GEAR OPERATOR
For heavy duty on-off and throttling service of 2”-54” (50mm-1400mm) valves, the Series 4 is self lubricated for smooth, trouble-free operation. The rugged, cast iron body with O-ring body seals is weatherproof to IP65. A self-locking worm and worm gear drive holds the valve in the desired position. Features include a readily accessible handwheel, a valve position indicator and mechanical travel stops which permit field adjustment of valve movement to specific degrees of rotation. Optionally available are chainwheel accessories, padlock kits and 2” square nut versions. A Gear Operator with a Stainless Steel housing is also available for valve sizes 1”-16”.

SERIES 4 STAINLESS STEEL GEAR OPERATOR
Bray Controls is proud to introduce the Series 4 quarter-turn stainless steel gear operator for manual control of valve position. The weatherproof stainless steel housing is ideal for applications in highly corrosive environments as well as in breweries, pharmaceutical and sanitary industries.

SERIES 5 DECLUTCHABLE GEAR OPERATOR
Available for 2”-36” (50mm-900mm) valves, the Series 5 offers the same superior features as the Series 4 gear operator with the added ability to manually override pneumatic actuators or rotate the valve when air pressure is not available. This operator is excellent for the safe handling of spring return actuators. During pneumatic operation, the worm of the gear unit is disengaged. Should the valve require opening or closing in the event of power loss, manual rotation of the declutch lever will provide a camming action and engage the worm to the segmented worm gear, allowing rotation of the valve using the handwheel. The Series 5 can be installed in the filed with existing Bray pneumatic actuators.

The High Performance Company

Standard 10 Position Notch Plate
has been designed to lock the handle securely in place, preventing position change of disc due to line pressure, vibration or shock. *Standard 8 Position Plate for high pressure valves is not shown*.

Infinite Position Notch Plate
for throttling applications, allows for very precise adjustments of valve disc positioning anywhere from 0° to 90°. Positioning is simply a matter of loosening the set knob, moving the handle, then retightening the knob. *For resilient seated valves only.*

Handle and 180° Notch Plate
allows the operator to switch the handle to either side without removing the notch plate from the valve.

Memory Stop
allows the operator to set the maximum amount the valve can open. When set, this limit will remain fixed until the stop is reset.

Padlock Kit
allows the customer to lock the valve in the full open or closed position, tamper proofing the valve. By drilling a new hole in the top plate, the handle can be locked in mid travel.

2" Square nut
is used where the valve is buried under the surface. To rotate valve disc position, the nut is reached with a T handle wrench.

Chainwheel for remote access to valve positioning when the handwheel is not accessible, such as valves positioned high out of reach.
A **Padlock Kit** and a **2" Square Nut** version for buried service are also available with the Series 4 *(not shown)*.

Operation Any residual air pressure in the pneumatic actuator must be vented before operation of the Declutchable Gear Operator. Bray recommends the use of a vent valve to block the incoming air supply and vent residual air. Then engage the declutching lever and rotate the valve using the handwheel. When returning to automatic operation, disengage the manual override by rotating the declutching lever, turning the vent valve to off, then restoring air pressure to the actuator.

SERIES 04 STAINLESS STEEL
FEATURES
For on-off and throttling service of 1"-16" (25mm-400mm) butterfly valves. Torque range is 1,100 to 8,800 lb-in. The self-locking worm and worm gear drive holds the valve in the desired position. Features include an aluminum or stainless steel handwheel, a valve position indicator and mechanical travel stops that permit field adjustment of valve movement to specific degrees of rotation. Offered with a double "D" connection for 1"-12" valves and keyway for 14"-16" valves. Additionally, the Series 4 mounts directly to Bray valves, no brackets or adapters are required.

Bray® CONTROLS

A Subsidiary of BRAY INTERNATIONAL, INC.
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ECCENTRIC MANUAL PLUG VALVE

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MILLIKEN
VALVE COMPANY

Millcentric Operation & Maintenance Manual

Series 600

Milliken Valve Company
2625 Brodhead Avenue, Suite 100
Bethlehem, PA 18020
Phone: (610) 861-8803
Fax: (610) 861-8094
Website: www.millikenvalve.com

WRENCH OPERATED MILLCENTRIC

Wrench operated Millcentric valves close by turning the valve 90 degrees clockwise.

Torque Collar

All wrench operated Millcentric valves are equipped with a multifunction device referred to here as a torque collar. This device serves as:

1. Wrench Adapter-2" square
2. Position Indicator
3. Open Memory Stop
4. Closed Memory Stop
5. Running Torque Adjustment

Position Indicator

The top of the plug has an indicator plate to show the approximate plug position. Cast onto the torque collar is an indicator mark which corresponds to a graduated scale cast on the bonnet of the valve. This scale is divided into 15 degree lines and indicates the exact valve opening from full open to full closed.

Open Memory Stop

The torque collar also incorporates an open memory stop feature. The plug can be set by tightening the open memory stop adjustment bolt after the correct flow is achieved. The valve can then be closed for maintenance and reopened to the proper position without resetting the flow.

Closed Memory Stop

The closed memory stop is provided to allow for adjustment to compensate for wear of either the plug coating or the seat. The closed stop is pre-set at the factory and should not require readjustment unless wear occurs.

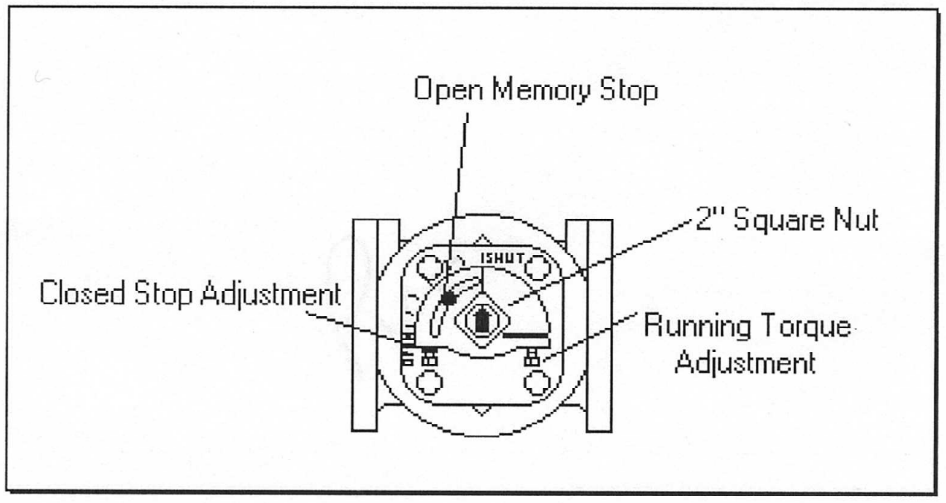
To adjust the plug for excess plug or seat wear simply rotate the closed stop two turns counter-clockwise then rotate the plug (clockwise) further into the seat and check the flow. Should this movement fail to shut off the flow repeat the above step. Afterward re-set the lock nut to prevent the position from being altered.

Running Torque Adjustment

The nature off eccentric plug valves “camming” action eliminates the majority of the torque prior to seating. To prevent the plug from creeping open or slamming closed, the torque collar maintains a constant drag on the shoulder of the valve bonnet. This component is factory adjusted. However, once the valve has been installed, it is recommended that the torque adjustment nut be further tightened to assure proper friction exists to prevent unwanted closure.

To prevent the plug from unnecessary movement rotate the hex head bolt clockwise until there is a substantial drag on the plug but not so much as to prevent the movement of the plug with the supplied wrench.

Wrench Operated Valve with Torque Collar



GEAR OPERATED MILLCENTRIC

Gear operated Millcentric valves close by turning the gear input shaft clockwise until closed. Please see specific valve drawing for the exact number of turns to close.

Position Indicator
(Above ground units only)

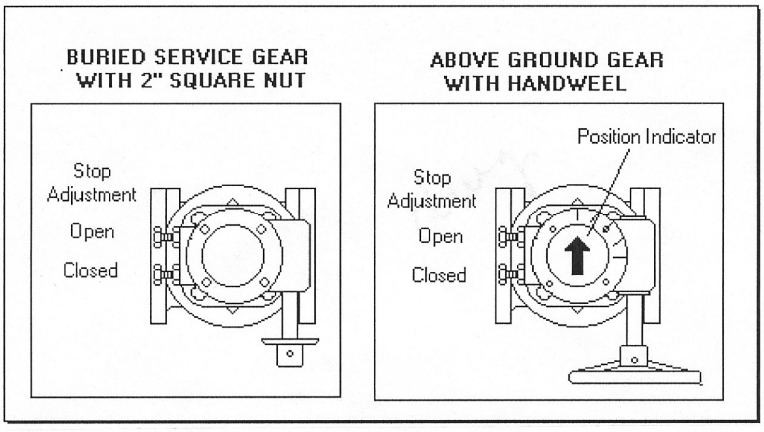
The top of the gear operator has an indicator plate to show the plug position. This scale, cast on to the gear housing, is divided into 15 degree lines and indicates the exact valve opening from full open to full closed. Buried service units are totally enclosed and sealed for use below grade.

Open and Closed Memory Stops

The closed memory stop is provided to allow for adjustment to compensate for wear of either the plug coating or the seat. The closed stop is pre-set at the factory and should not require readjustment unless wear occurs.

To adjust the plug for excess plug or seat wear simply rotate the closed stop two turns counterclockwise the rotate the handwheel or nut (clockwise) to move the plug further into the seat and check the flow. Should this movement fail to shut off the flow repeat the above step. Afterward re-set the lock nut to prevent the position from being altered.

Gear Operated Valve



GEAR OPERATED VALVE

The Millcentric is designed and manufactured to be a long life valve under normal circumstances. It does not require any routine maintenance. Cycling the valve from full open to full closed on an annual basis will increase the life of the valve and operator components.

However if maintenance is required, due to unusual wear or service conditions the following procedure should be followed:

DISASSEMBLY PROCEDURE

BODY

The Millcentric is a top entry valve; therefore the body can remain in line during this operation. Remove the bolts holding the gear operator cap in place. Remove cap and remove the internal bolts fastening the gear operator to the valve body. Remove the gear operator and set aside. With the valve de-pressurized, remove the hexagonal head cap screws the hold the bonnet to the valve body. Remove the bonnet, leaving the plug in the body. At this point the plug, PTFE thrust washers, journal bearings and bonnet “O” ring are accessible and can be removed and replaced.

Care should be taken not to damage the plug elastomer or bonnet “O” rings upon reassembly.

Reverse the above process for reassembling the Millcentric.

STEM SEALS

Remove the bolts holding the gear operator cap in place. Remove the cap and remove the internal bolts fastening the gear operator to the valve body. Remove the gear operator and set aside.

With the valve de-pressurized, using internal snap ring pliers, remove the snap ring and thrust washer. The “U” cup seals can now be pried out of the seal cavity. To replace reverse the above process.

WRENCH OPERATED VALVE

The Millcentric is designed and manufactured to be a long life valve under normal circumstances. It does not require any routine maintenance.

However if maintenance is required, due to unusual wear or service conditions the following procedure should be followed:

DISASSEMBLY PROCEDURE

BODY

The Millcentric is a top entry valve; therefore the body can remain in line during this operation. Remove the star washer fastening the torque collar to the plug stem. Remove the torque collar and set aside. With the valve depressurized, remove the hexagonal head cap screws that hold the bonnet to the valve body. Remove the bonnet, leaving the plug in the body. At this point the plug, PTFE thrust washers, journal bearings and bonnet "O" ring are accessible and can be removed and replaced.

Care should be taken not to damage the plug elastomer or bonnet "O" rings upon reassembly.

Reverse the above process for reassembling the Millcentric.

STEM SEALS

Remove the star washer fastening the torque collar to the plug stem. Remove the torque collar and set aside.

With the valve depressurized, using internal snap ring pliers, remove the snap ring and thrust washer. The "U" cup seals can now be pried out of the seal cavity. To replace reverse the above process.

THREADED WRENCH OPERATED VALVE
½"-2"

The Millcentric is designed and manufactured to be a long life valve under normal circumstances. It does not require any routine maintenance...

However if maintenance is required, due to unusual wear or service conditions the following procedure should be followed:

DISASSEMBLY PROCEDURE

BODY

The Millcentric is a top entry valve; therefore the body can remain in line during this operation. Remove the spring pin fastening the torque collar to the plug stem. Remove the torque collar and set aside. With the valve de-pressurized, rotate the bonnet counterclockwise to loosen the bonnet from the valve body. Remove bonnet leaving the plug in the body. At this point the plug, journal bearings and bonnet "O" ring are accessible and can be removed and replaced.

Care should be taken not to damage the plug elastomer or bonnet "O" rings upon reassembly.

Reverse the above process for reassembling the Millcentric.

STEM SEALS

Remove the spring pin fastening the torque collar to plug stem. Remove the torque collar and set aside. With the valve depressurized, rotate the bonnet counterclockwise to loosen the bonnet from the valve body. Remove the bonnet, leaving the plug in the body. At this point the stem "O" rings are accessible and can be removed and replaced.

Reverse the above process for reassembling the Millcentric

ACTUATED VALVES

The Millcentric is designed and manufactured to be a long life valve under normal circumstances. It does not require any routine maintenance. Cycling the valve from full open to full closed on and annual basis will increase the life of the valve and operator components.

However, if maintenance is required, due to unusual wear or service conditions, the following procedure should be followed:

DISASSEMBLY PROCEDURE

BODY

The Millcentric is a top entry valve; therefore, the body can remain in line during this operation. Remove the bolts holding the actuator bracket to the valve cap. You can then remove the actuator from the valve. With the valve de-pressurized, remove the hexagonal head cap screws that hold the bonnet to the valve body. Remove the bonnet, leaving the plug in the body. At this point the plug, PTFE thrust washers, journal bearings, and bonnet “O” ring are accessible and can be removed and replaced.

Care should be taken not to damage the plug elastomer or bonnet “O” rings upon reassembly.

Reverse the above process for reassembling the Millcentric

STEM SEALS

With the valve de-pressurized, using internal snap pliers, remove the snap ring and thrust washer. The “U” cup seals can now be pried out of the seal cavity. To replace, reverse the above process.

FUNCTION

The Millcentric valve is a non-lubicated eccentric plug valve designed for use in water and waste water applications, and HVAC systems.

TEMPERATURE LIMITS

The operating temperature is controlled by the elastomer specified and are as follows:

Elastomer	***High Temp***	***Low Temp***
Buna N	225 F	-20 F
EPDM	250 F	-35 F
Neoprene	225 F	-20 F
Viton	400 F	-10 F

Pressure Limits

The operating pressure differs with the valve size range and configuration, and are as follows:

FIGURE 600/601-ANSI Class 125

Size Range	***Rated Pressure****	***Shell Hydro***	***Seat Test***
½”-12”	175 psi	350 psi	210 psi
14”-36”	150 psi	300 psi	180 psi
42”-54”	125 psi	250 psi	150 psi

*Pressure Ratings are given at ambient temperatures.

LUBRICATION SCHEDULE

The Millcentric is a low maintenance non-lubricated eccentric plug valve. As such there is no required lubrication of the valve itself.

The manual gear operators, where applicable are also sealed greased lubricated units and should not require any type of periodic lubrication. Should the unit need to have lubricant replaced use **Shell "Alvania" #2**

SAFETY

When the gear actuators have the cover removed, extra caution should be taken to make sure hands or fingers are away from moving parts. Close fitting clothing should be worn so as to avoid getting caught in the moving gears.

STORAGE PROCEDURE

Milliken valves are shipped with the plugs in the open position. Care should be taken to maintain this position while the valves are in storage prior to installation in the pipeline.

Flanged valve end protectors (if supplied) should be kept on the valves until they are ready for installation. Special care should be given to mechanical joint valves to prevent damage to the internal pipe seating area.

Valves should be stored where internal contamination due to sand and mud can be kept to a minimum. Care should be taken to avoid direct sunlight on the plug elastomer during storage.

Electric, hydraulic and pneumatic valve actuators should be cared for in accordance with the storage instructions of the actuator manufacturer.

TROUBLE SHOOTING

WRENCH OPERATED VALVES

SYMPTOM	POSSIBLE CAUSE	ACTION
Valve Will Not Open	Broken or Misadjusted Torque Collar	Adjust or Replace Torque Collar
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Will Not Close	Broken or Misadjusted Torque Collar	Adjust or Replace Torque Collar
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Will Not Shutoff Flow.	Improper Stop Adjustment	Adjust Closed Stop
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Leaks at Plug Stem	Damaged “U” Cup Seal	Replace “U” Cups

SPARE PARTS LIST

COMPONENT	NUMBER PER VALVE
Journal Bearings	2
PTFE Thrust Washers	2
“U” Cup Seals	2
Elastomer Coated Plug	1
Bonnet “O” Ring Seal	1

If required these parts can be ordered from:

Milliken Valve Company, Inc.
Tele: (610) 861-8803
Fax: (610) 861-8094

When ordering please furnish the size, figure number and component name:
For example: 6” Figure 601N1AG-Journal Bearing

TROUBLE SHOOTING

GEAR OPERATED VALVES

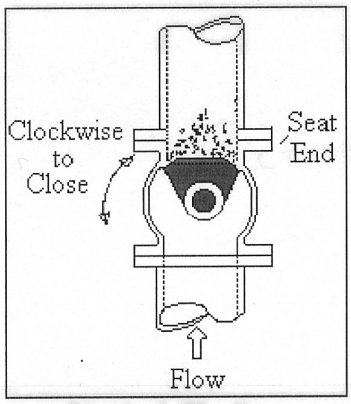
SYMPTOM	POSSIBLE CAUSE	ACTION
Valve Will Not Open	Bent input Shaft	Replace Worm Shaft
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Will Not Close	Bent Input Shaft	Replace Worm Shaft
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Will Not Shutoff Flow	Improper Stop Adjustment	Adjust Closed Stop
	Obstruction in Line	Remove Obstruction
	Excessive Line Pressure	Reduce Pressure
	Elastomer Damage	Replace Plug
Valve Leaks at Plug Stem	Damaged “U” Cup Seal	Replace “U” Cups

INSTALLATION

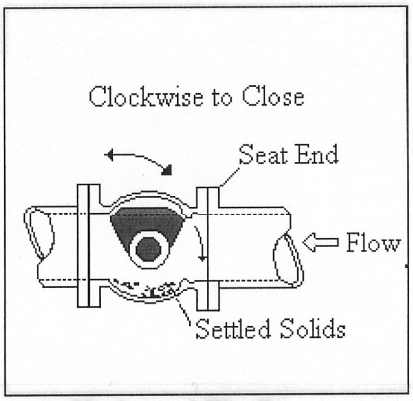
When installing the valves, the seat end should be noted. The seat end of the valve is cast in raised letters on the appropriate flange of the valve. Generally, straightway valves should be installed with the highest pressure applied from the opposite end from the seat. This will tend to push the plug into the seat. On pump discharge installation the seat end should be towards the pump.

In case where shut-off is required in both directions, the valve should be installed so that the highest differential pressure at shut-off is opposite the seat end.

When the service of a clogging type, with suspended solids likely to build up in the valve body, it is recommended that the valve be installed with the media entering the seat end first. In extreme cases, the valve should be installed with the plug horizontal and rotating upward into to the top portion of the valve body cavity to open.



Vertical Pipeline



Horizontal Pipeline

Class 125 flanged end valves have ANSI B16.1 flat faced 125/150 flanges. Standard ANSI B16.21 flanges and gaskets should be used to install the valves in the pipeline. Certain size valves utilize tapped holes on the top and bottom for the flange where a backing nut is not possible. Please check specific drawings for detailed information on sizes and quantities of hexagon head screws required on these valves.

Prior to installing valve, especially ones that are buried, they should be cycled open and closed several times to ensure they are in good working order and have not been damaged during shipment or storage.

ACTUATED VALVES TO REPLACE "U" CUP SEALS

The Millcentric is designed and manufactured to be a long life valve under normal operating conditions. It does not require any routine maintenance. Cycling the valve from full open to full closed on an annual basis will increase the life of the valve and actuator components.

However, if maintenance is required, due to unusual wear or service conditions, the following procedure should be followed:

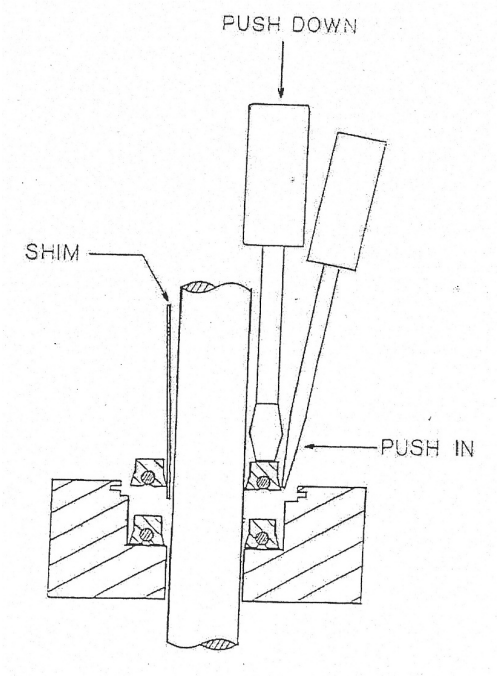
To replace "U" cup seals on actuated Millcentric valves, remove actuator, remove the internal bolts fastening the actuator to the valve body. Remove the actuator and set aside. Remove the external snap ring and support collar.

Remove the internal snap ring using snap ring pliers. Remove thrust washer. The "U" cup seals are now visible. Using a screwdriver, pry out the old seals.

Apply a small amount of silicone or grease to the new "U" cup seals. This will help them slide in the packing cavity. Put a piece of shim stock into the cavity and put the "U" cup over it. Slide the "U" cup over the stem with shim stock against the stem. This will let any trapped air out of the packing cavity. Now, using two screwdrivers, coax the outer lip of the "U" cup into the cavity while pressing down on the top of the "U" cup with the other screwdriver (see attachment). Continue to do this all the way around until the "U" cup is at the bottom of the packing cavity.

Repeat the procedure with the second "U" cup, and replace the thrust washer and snap ring. Now you can remount the actuator on the valve.

To Replace “U” Cup Seals



JULY 1999

MILLIKEN

MILLCENTRIC

ECCENTRIC PLUG VALVE

MILLIKEN

MILLCENTRIC

ECCENTRIC PLUG VALVE

The Milliken criteria of quality, reliability, safety and value are embodied in the MILLCENTRIC Eccentric valve, setting higher standards for dependable performance with excellent features achieved by the utilization of the very latest design and manufacturing techniques.

BODY

Conforming to AWWA C504 wall thickness, the Millcentric valve body casting is in ASTM A126 CL B cast iron using high pressure molding techniques. Alternative flanged, grooved or mechanical joint ends are available.
Flange diameter, thickness and drilling conform to ANSI B16.1 Class 125 or 250.
Grooved ends meet AWWA C-606 for ductile or steel pipe. Mechanical joints to AWWA C111 (ANSI A21.11).

SEAT

The Millcentric valve incorporates as standard, on 3" and larger, a welded nickel seat for corrosion and erosion resistance specially profiled for low torque and extended seat life.
An alternative corrosion resistant epoxy seat is available for general service duties.

STEM SEAL

High integrity sealing by combining the advantages of a resilient and abrasion resistant U-Cup seal. From vacuum to high pressure, the self-adjusting sealing system (per AWWA C504) gives positive, trouble-free service and is retained independently of the plug stem or external torque device.

BEARINGS

The plug rotates in permanently lubricated 316 grade stainless steel bearings located in the body and bonnet, along with upper and lower PTFE thrust washers, which ensure consistently low operating torque.

- Computer Aided Design
- High integrity casting
- CNC manufacturing delivers consistent sizes on all components

All complemented by rigorous Quality Control System

PLUG

Supported on integral trunnions, the plug face is covered with a elastomer that is molded 2 1/2" - 12" and vulcanized on 14" and larger to the casting providing tight shut off even under vacuum conditions. High integrity corrosion-free sealing is achieved by a variety of abrasion resistant elastomers which protect the plug right up to the trunnions. When assembled, the light compression of the elastomers onto PTFE thrust washers, prevents entry of abrasive materials into the bearings.

BONNET SEAL

Superior "O" ring sealing with metal/metal contact means lower bolting stresses compared with compression gaskets.

FLOW

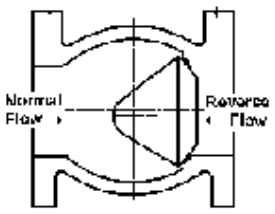
The port design (round on 2 1/2" - 12" and rectangular on 14" and larger) with streamlined internal contours gives high capacity straight through flow in the full open position, reducing turbulence and pressure drop and the effect of erosive media. Handling of sludges and slurries is therefore enhanced.

INTERCHANGEABLE

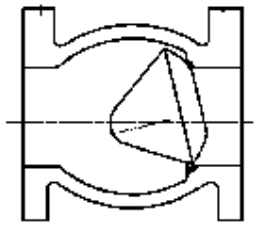
Because of common face to face dimensions with wedge gate valves (3" - 12"), fitting the tight shut-off rotary MILLCENTRIC valve into existing systems is accomplished without pipeline modifications.

TRAVEL STOPS

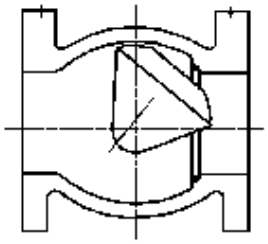
Adjustable open and closed travel stops are fitted as standard on both wrench and gear operated Millcentric valves.



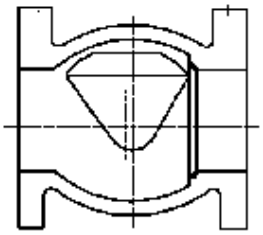
- Valve in closed position for bubble tight shut-off.
- Normal flow direction gives pressure assisted sealing.
- Torques are low even in reverse flow.



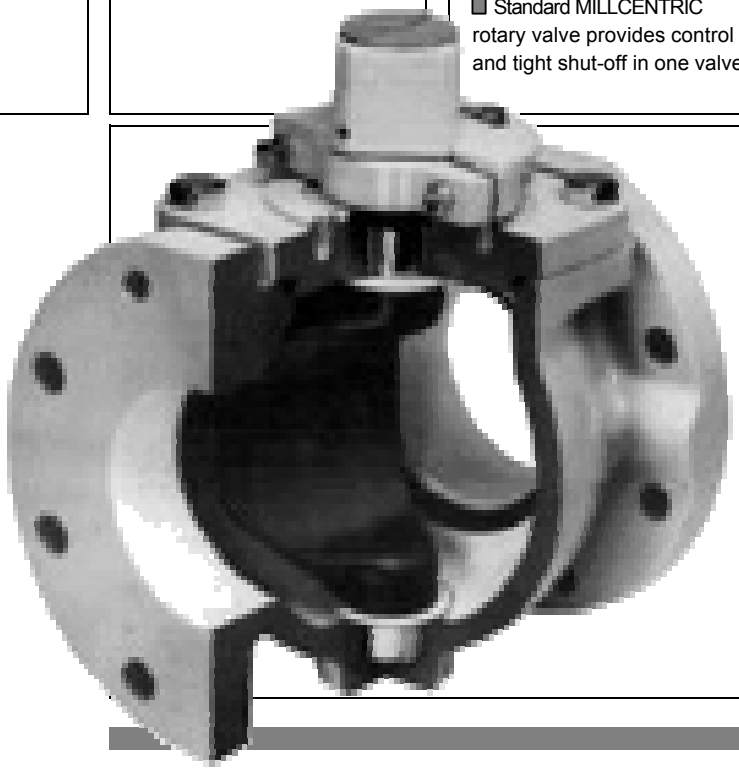
- Plug rotates away from the seat for instant opening.
- Seat wear and operating torque reduced.
- No further seat contact until valve is closed again.



- Design of MILLCENTRIC valve allows modulating control over the full 90° travel.
- Ideally suited for balancing service.
- Standard MILLCENTRIC rotary valve provides control and tight shut-off in one valve.



- Plug is out of the flow path when fully open.
- Straight through, uninterrupted smooth flow.
- Round port reduces turbulence and erosion, lowers pumping costs and can be "pigged" to clean the pipeline.



INSTALLATION

The Millcentric valve is suitable for flow and shut -off in either direction. Seat end downstream is the preferred orientation and any reverse flow requirement should be stated at time of order. For use on fluids with suspended solids, installation with the seat upstream and the valve stem horizontal may be preferable; plug rotation to the top of the valve will ensure smooth operation.

IN-LINE MAINTENANCE

In the unlikely event of gland leakage, the stem seals can be easily replaced without removing the bonnet. Access to the body for cleaning or inspection does not require removal from the line.

MODULAR CONSTRUCTION

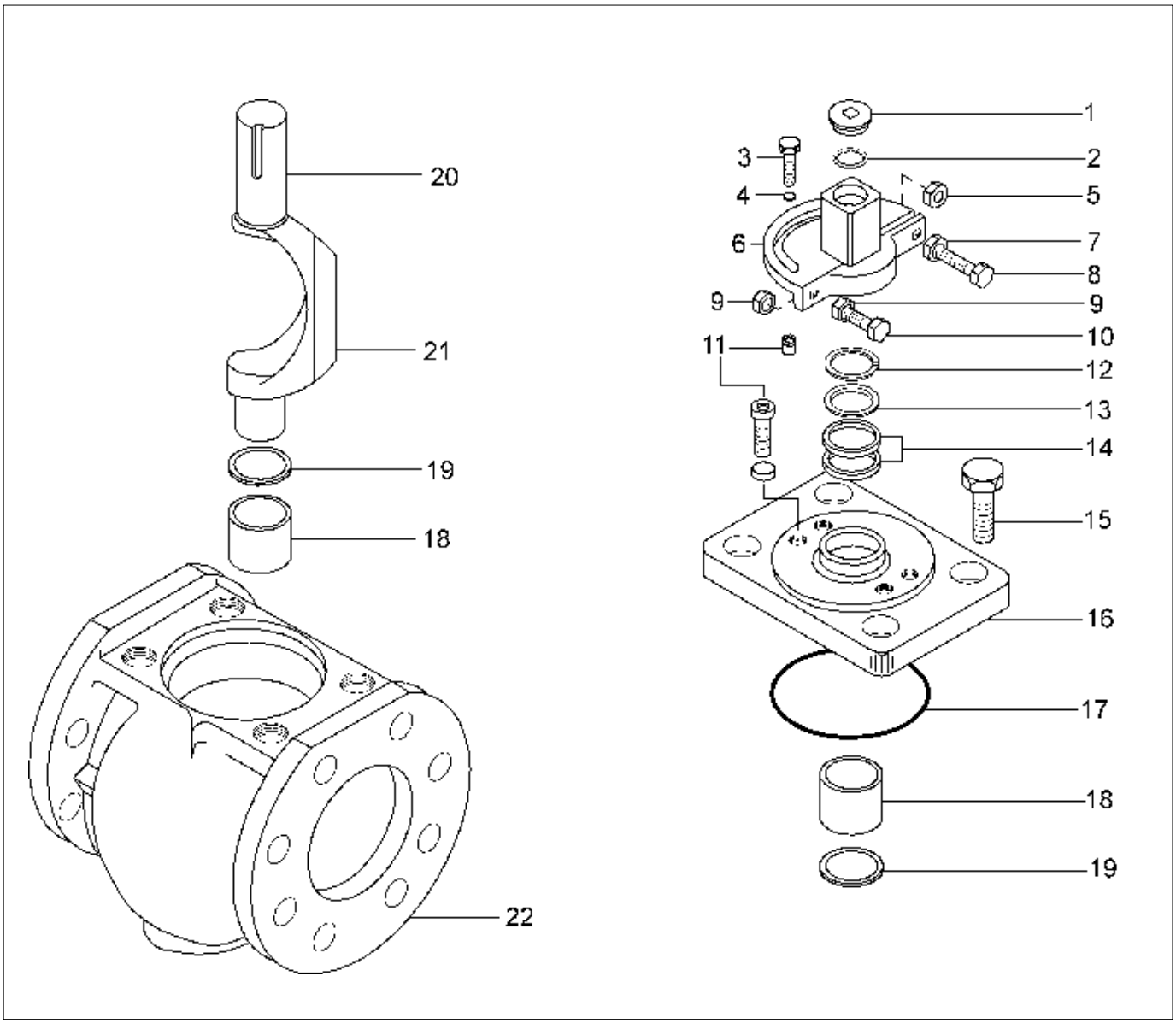
Design of the bonnet and stem allows for on-site adaptation of gear operators, power actuators, or extension devices on to standard valves. Conversion can be easily undertaken without removing the valve bonnet, thereby minimizing downtime.

POWER OPERATION

Pneumatic, electric or hydraulic operation is available, complete with accessories such as limit switches, solenoid valves and positioners when required.

MATERIALS OF CONSTRUCTION

Item	Component	Material	Specification	Item	Component	Material	Specification
1	Indicator Cap	Plastic		12	Snap Ring	Spring Steel	
2	Star Nut	Steel		13	Washer	Brass	ASTM B-138-675
3	Open Stop	Steel		14	U-Cup Seal	Elastomer	Same as Plug
4	Washer	Steel		15	Capscrew	Steel	
5	Nut	Steel		16	Bonnet	Cast Iron	ASTM A-126 Class B
6	Torque Collar	Ductile Iron	ASTM A-536	17	"O" Ring	Elastomer	Same as Plug
7	Lock Nut	Steel		18	Journal Bearing	Stainless Steel	ANSI 316
8	Torque Bolt	Steel		19	Thrust Washer	PTFE	
9	Lock Nut	Steel		20	Plug	Ductile Iron	ASTM A-536 Grade 65-45-12
10	Closed Stop	Steel		21	Plug Coating	Elastomer	As Specified
11	Travel Stop	Steel		22	Body	Cast Iron	ASTM A-126 Class B



ELASTOMERS AVAILABLE FOR MILLCENTRIC VALVE
Natural rubber is also available.

Nitrile

A general purpose material sometimes referred to as BUNA-N or HYCAR with a -20°F to 225°F temperature range. Used on sewage, water, hydrocarbon and mineral oils.

EPDM

An excellent polymer for use on chilled water through to LP steam applications having a temperature range of -35°F to 250°F. Resistance to many acids, alkalies, detergents, phosphate esters, alcohols and glychols is an added benefit.

Neoprene

This versatile material shows outstanding resistance to abrasion and ozone. Chemical resistance to a wide range of petroleum based products and dilute acids and alkalies. Temperature range -20°F to 225°F.

Viton

Retention of mechanical properties at high temperature is an important feature of this elastomer- temperature range is -10°F to 400°F. It also has excellent resistance to oils, fuels, lubricants and most mineral acids and aromatic hydrocarbons.

PRESSURE RATING

12" and smaller	ANSI 125	175 psi
14"-36"	ANSI 125	150 psi
42" and larger	ANSI 125	125 psi
12" and smaller	ANSI 250	400 psi
14"-36"	ANSI 250	300 psi

Body Hydrotest = 200% of rated pressure
Seat Test = 120% of rated pressure

MILLCENTRIC VALVE - SERIES 600

ORDERING INFORMATION

Valve Types	**Designation**
Mechanical Joint	600
ANSI 125 Flanged	601
ANSI 250 Flanged	602
ANSI 125 Grooved End for Steel Pipe	606S
ANSI 125 Grooved End for Ductile Iron Pipe	606D
Seat	
Nickel	N
Epoxy	E
ElastomerTrim	
EPDM	0
Nitrile (Buna)	1
Viton	2
Neoprene	3
Natural	4
Gear Operators	
Buried Gear with 2" nut	BG
Above Ground Gear with Indicator and Handwheel	AG
Memory Stop Gearbox with Handwheel	MG

Example: 4" 601 N3AG
4" ANSI 125 Flanged with Nickel Seat, Neoprene Elastomer and Above Ground Gear with Indicator and Handwheel

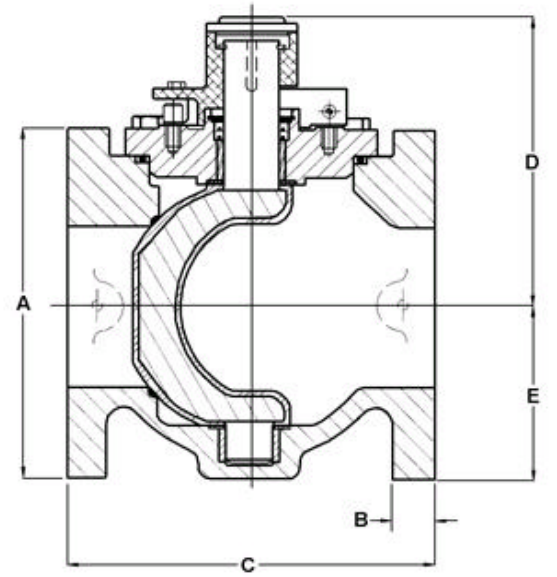
VALVES ARE ONLY SUPPLIED FOR BI-DIRECTIONAL SHUT-OFF IF SPECIFIED AT TIME OF ORDER.

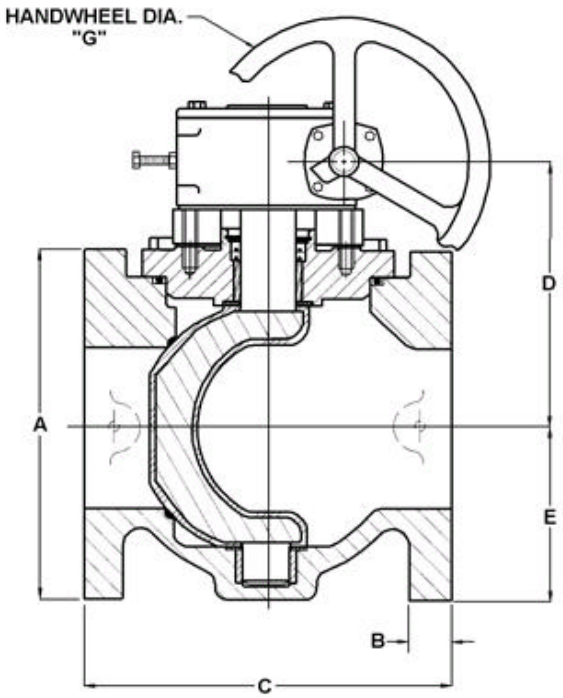
ELASTOMER SELECTION CHART

The chart below is to assist in the selection of elastomers for some common fluids. It doesn't mean other elastomers are not suitable within varying limits. Temperature, concentration, and mixture all affect chemical attack. If there is any doubt regarding compatibility, specific conditions should be referred to engineering for recommendations. The chart below is to serve as a guide only.

Service	Elastomer	Average Uselul Temp. Range
Acetone	EPDM	-35˚F to 250˚F
Air	EPDM	-35˚F to 250˚F
Air w/oil	Nitrile	0˚F to 212˚F
Alcohol, Amyl	EPDM	-35˚F to 250˚F
Alcohol, Aromatic	Viton	10˚F to 250˚F
Alcohol, Butyl	Neoprene	-20˚F to 225˚F
Alcohol, Denatured	Nitrile	0˚F to 212˚F
Alcohol, Ethyl	EPDM	-35˚F to 250˚F
Alcohol, Grain	Nitrile	0˚F to 212˚F
Alcohol, Isosproply	Neoprene	-20˚F to 225˚F
Alcohol, Methyl	EPDM	-35˚F to 250˚F
Ammonia, Anhydrous	Neoprene	-20˚F to 225˚F
Arnmonium Nitrate	EPDM	-35˚F to 250˚F
Ammonia, Water	EPDM	-35˚F to 250˚F
Animal Fats	Nitrile	0˚F to 212˚F
Black Liquor	EPDM	-35˚F to 250˚F
Blast Furnace Gas	Neoprene	-20˚F to 225˚F
Butane	Nitrile	0˚F to 212˚F
Bunker Oil "C"	Nitrile	0˚F to 212˚F
Calcium Chloride	EPDM	-35˚F to 250˚F
Carbon Dioxide.	EPDM	-35˚F to 250˚F
Carbon Monoxide (Cold)	Neoprene	-20˚F to 225˚F
Carbon Monoxide (Hot)	Viton	10˚F to 250˚F
Carbon Tetrachloride	Viton	10˚F to 250˚F
Caustic Soda	EPDM	-35˚F to 250˚F
Cement Sluriy	EPDM	-35˚F to 250˚F
Copper Sulphate	EPDM	-35˚F to 250˚F
Creasote (Coal)	Nitrile	0˚F to 212˚F
Coal Slurry	Nitrile	0˚F to 212˚F
Diesel Fuel No 1	Nitrile	0˚F to 212˚F
Diethylene Glycol	EPDM	-35˚F to 250˚F
Ethylene Glycol	EPDM	-35˚F to 250˚F
Fatty Acid	Nitrile	0˚F to 212˚F
Fuel Oil No 2	Nitrile	0˚F to 212˚F
Fertilizer Liquid ($H_4N_2O_2$)	EPDM	-35˚F to 250˚F
Gasoline, Keg	Nitrile	0˚F to 212˚F
Gas, Natural	Nitrile	0˚F to 212˚F
Glue, Animal	Nitrile	0˚F to 212˚F
Green Liquor	EPDM	-35˚F to 250˚F
Hydraulic Oil (Petro)	Nitrile	0˚F to 212˚F
Hydrogen	Nitrile	0˚F to 212˚F
JP4, JP5	Viton	10˚F to 250˚F
Kerosene	Nitrile	0˚F to 212˚F
Ketone	EPDM	-35˚F to 250˚F
Lime Slurry	EPDM	-35˚F to 250˚F
Methane	Nitrile	0˚F to 212˚F
Methyl Ethy Ketone	EPDM	-35˚F to 250˚F
Naptha (Berzin)	Nitrile	0˚F to 212˚F
Oil, Animal	Nitrile	0˚F to 212˚F
Oil, Mobil Therm Light	Viton	10˚F to 250˚F
Oil, Mobil Therm 600	Viton	10˚F to 250˚F
Oil, Mobil Therm 603	Nitrile	0˚F to 212˚F
Oil, Lubricating	Nitrile	0˚F to 212˚F
Oil, Vegetable	Nitrile	0˚F to 212˚F
Paint, Latex	Nitrile	0˚F to 212˚F
Phosphate Ester	EPDM	-35˚F to 250˚F
Propane	Nitrile	0˚F to 212˚F
Rape Seed Oil	EPDM	-35˚F to 250˚F
Sewage (w/oils)	Nitrile	0˚F to 212˚F
Sodium Hydroxide 20%	EPDM	-35˚F to 250˚F
Starch	EPDM	-35˚F to 250˚F
Steam to 300˚F	EPDM	-35˚F to 250˚F
Sloddard Solvent	Nitrile	0˚F to 212˚F
Sulphuric Acid 10%-50%	Neoprene	-20˚F to 225˚F
Sulphuric Acid 100%	Viton	10˚F to 250˚F
Trichloroethylene Dry	Viton	10˚F to 250˚F
Triethanol Amine	EPDM	-35˚F to 250˚F
Varnish	Viton	10˚F to 250˚F
Water, Fresh	EPDM	-35˚F to 250˚F
Water, Salt	EPDM	-35˚F to 250˚F
Xylene	Viton	10˚F to 250˚F

FLANGED END *FIG.601* *175 PSI*





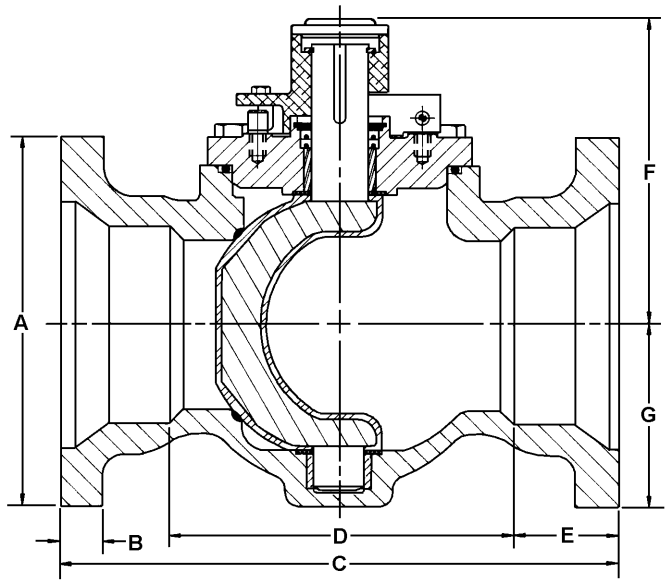
FLANGED END - ANSI 125									
Size	2.5	3	4	5	6	8	10	12	14
A	7	7.5	9	10	11	13.5	16	19	21
B	0.68	0.75	0.93	0.93	1	1.12	1.18	1.25	1.38
C	7.5	8	9	10	10.5	11.5	13	14	17
D	6.18	6.18	7.25	8.38	8.38	10.68	- -	- -	- -
E	3..5	3.75	4.5	5.75	5.75	7.62	8.88	10	13
F	5.38	5.59	6.31	7.56	7.56	9.63	11.63	13.31	13.31
G	6	6	6	6	6	12	12	12	12
Weight (approx.)	*30*	*40*	*70*	*105*	*115*	*190*	*** 345*	*** 440*	*** 510*

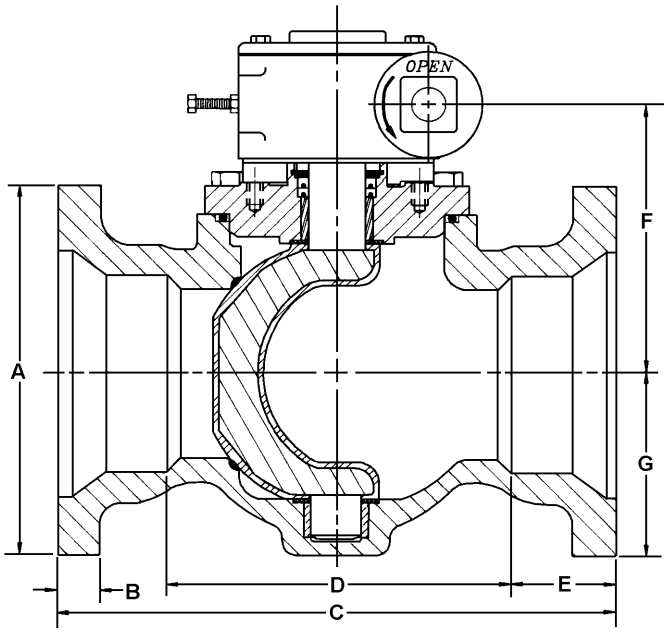
*10" & above have gear operators as standard

** Weight includes gear operator

NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

MECHANICAL JOINT END FIG.600 175 PSI





MECHANICAL JOINT END							
Size	**3**	**4**	**6**	**8**	**10***	**12***	**14***
A	7.68	9.0	11.12	13.38	15.62	17.93	20.31
B	0.93	1.0	1.06	1.12	1.18	1.38	1.31
C	11.5	14.25	15.75	17.38	19.38	20.75	24.50
D	6.5	9.25	10.75	12.38	14.38	15.75	17.50
E	2.5	2.5	2.5	2.5	2.5	2.5	3.5
F	6.18	7.25	8.38	10.68	- -	- -	- -
G	3.84	4.5	5.75	7.62	8.88	10.0	13.00
H	5.62	6.31	7.56	10.12	11.62	13.31	13.31
WT (approx.)	50	80	125	200	** 360	** 480	** 575

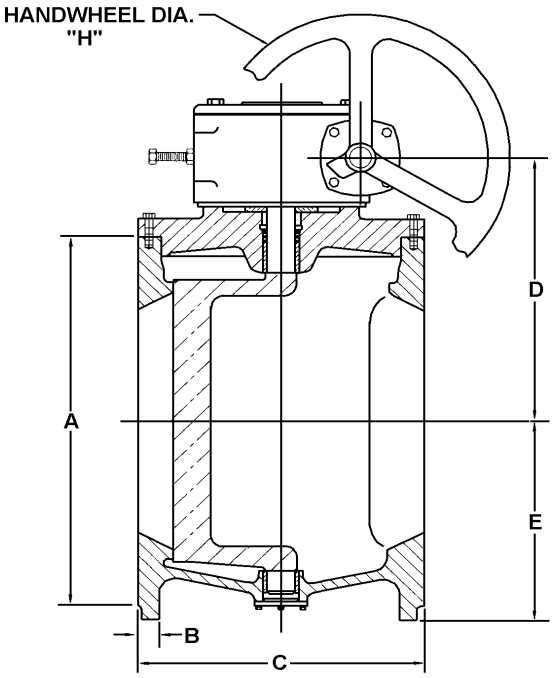
*10” & above have gear operators as standard
** Weight includes gear operator

NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

FLANGED END

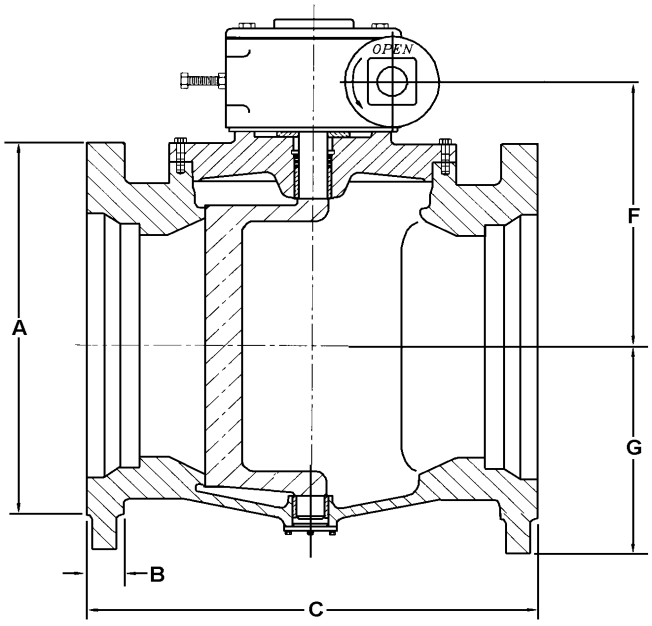
FIG. 601

14" - 36" 150PSI
42" and larger 125 PSI



MECHANICAL JOINT END

FIG. 600



FLANGED END - ANSI 125 / 150										
Size	14	16	18	20	24	30	36	42	48	54
A	21.0	23.25	25.0	27.5	32.0	38.75	46.0	53.0	59.5	66.25
B	1.38	1.43	1.56	1.68	1.88	2.12	2.38	2.62	2.75	3.0
C	17.0	17.75	21.5	23.5	42.0	51.0	60.0	72.0	84.0	96.0
D	15.06	15.81	17.0	20.43	22.88	27.59	33.0	37.62	37.62	37.62
E	13.0	14.0	15.0	16.0	21.62	24.75	29.0	29.0	36.0	36.0
H	18.0	18.0	18.0	18.0	24.0	24.0	24.0	30.0	30.0	30.0
Weight (approx.)	905	1030	1355	1880	3800	5200	6950	10160	13350	15100

Flanged valves meet ANSI B16.1

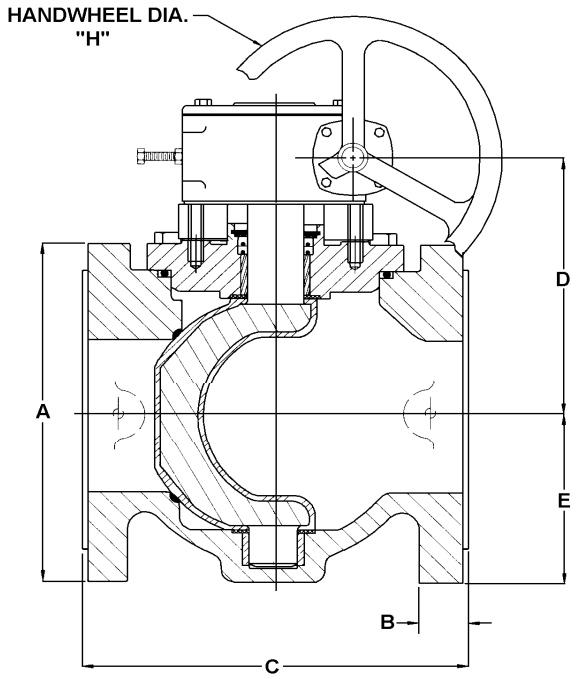
MECHANICAL JOINT END									
Size	14	16	18	20	24	30	36	42	48
A	20.31	22.56	24.84	27.0	31.5	39.12	46.0	53.0	60.0
B	1.31	1.38	1.43	1.50	1.62	1.68	2.0	2.0	2.0
C	24.5	27.25	29.25	31.0	42.0	51.0	60.0	72.0	84.0
F	15.06	15.81	17.0	20.43	22.88	26.93	33.0	37.62	37.62
G	13.0	14.0	15.0	16.0	21.62	24.75	29.0	29.0	36.0
Weight (approx.)	905	1030	1355	1880	3800	5200	6950	10160	13350

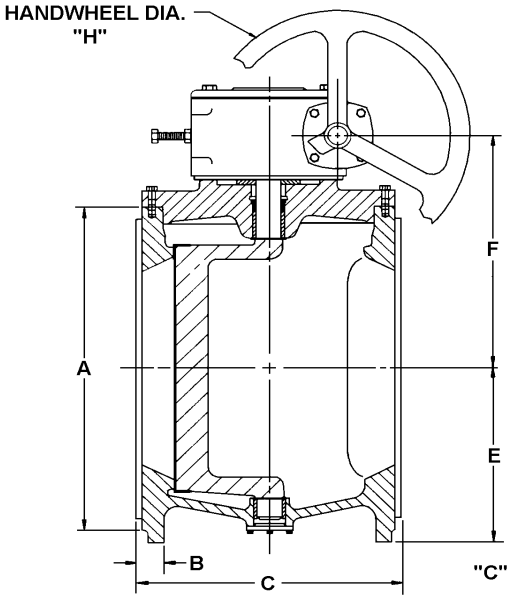
M.J. valves meet ANSI 21.11 & AWWA C-111

Weight includes gear operator
NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

NOTE: Dimensions on 60" and larger available upon request.

FLANGED END *FIG.602* *2 1/2" -12" 400 PSI*
14" -16" 300 PSI





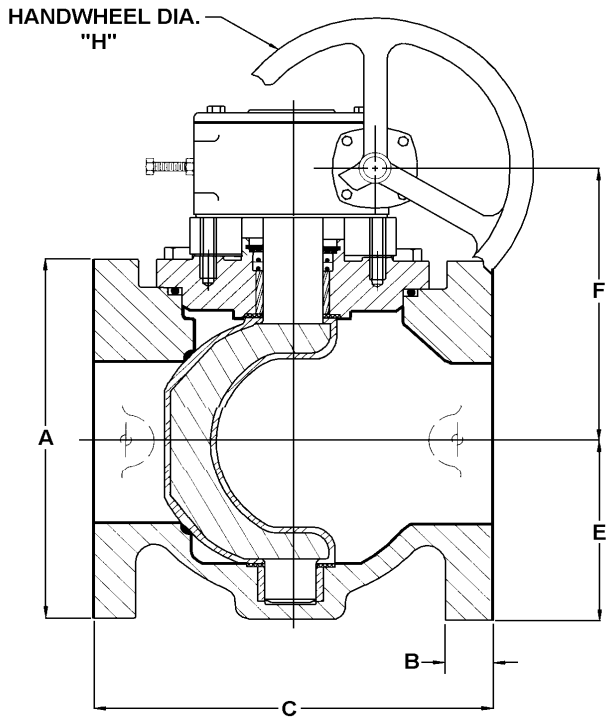
FLANGED END - CLASS 250															
Size	2.5	3	4	5	6	8	10	12	14	16	18	20	24	30	36
A	7.50	8.25	10.00	11.00	12.50	15.00	17.50	20.50	23.00	25.50	28.00	30.50	36.00	43.00	50.00
B	1.06	1.12	1.25	1.38	1.43	1.62	1.88	2.00	2.12	2.25	2.38	2.50	2.75	3.00	3.38
C	9.50	11.12	12.00	15.00	15.88	16.50	18.00	19.75	18.50	19.38	23.12	25.00	42.88	51.88	61.00
E	3.50	3.75	4.50	5.75	5.75	8.25	8.88	10.00	13.00	14.00	15.00	16.00	21.62	24.75	29.00
F	6.00	6.09	7.06	8.31	8.31	10.13	13.88	14.75	15.60	15.81	17.00	20.43	22.88	27.59	33.00
H	6.00	6.00	6.00	6.00	6.00	12.00	12.00	12.00	18.00	18.00	18.00	18.00	24.00	24.00	24.00
Weight (approx.)	40	80	120	162	170	275	398	590	980	1125	1830	2060	4160	5700	7670

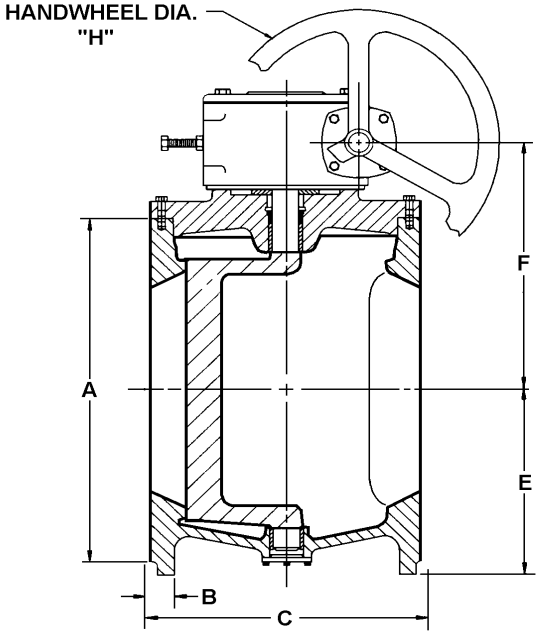
All above have gear operators as standard
Weight includes gear operator

NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

FLANGED END *FIG.601RL*

2 1/2" -12" 175 PSI
14" -16" 150 PSI
42" and larger 125 PSI



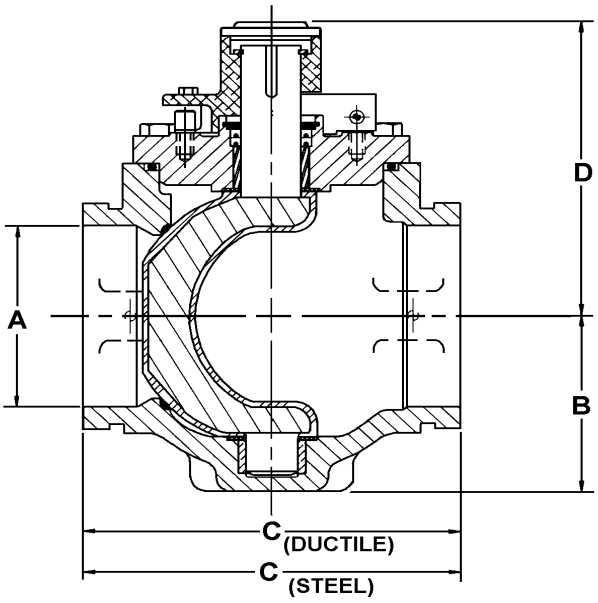


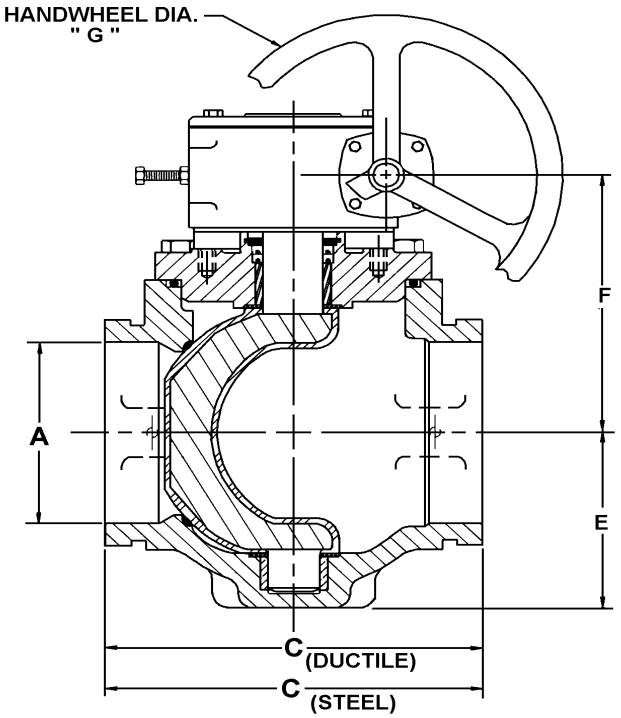
FLANGED END - ANSI 125 RUBBER LINED

Size	2.5	3	4	5	6	8	10	12	14	16	18	20	24	30	36	42
A	7.00	7.50	9.00	10.00	11.00	13.50	16.00	19.00	21.00	23.25	25.00	27.50	32.00	38.75	46.00	53.00
B	0.80	0.88	1.05	1.05	1.12	1.25	1.30	1.38	1.50	1.55	1.68	1.80	2.00	2.25	2.50	2.93
C	7.75	8.25	9.25	10.25	10.75	11.75	13.25	14.25	17.25	18.00	21.75	23.75	42.25	51.25	60.25	72.25
E	3.50	3.75	4.50	5.75	5.75	7.62	8.88	10.00	13.00	14.00	15.00	16.00	21.62	24.75	29.00	31.25
F	6.00	6.09	7.06	8.31	8.31	10.13	15.50	17.19	15.06	15.81	17.00	20.43	22.88	27.59	33.00	37.62
H	6.00	6.00	6.00	6.00	6.00	12.00	12.00	12.00	18.00	18.00	18.00	18.00	24.00	24.00	30.00	30.00
Weight (approx.)	30	70	100	135	145	240	345	440	905	1030	1355	1880	3800	5200	6950	10160

All above have gear operators as standard
Weight includes gear operator
NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

GROOVED END *FIG.606* *175 PSI*





GROOVED END - AWWA 606									
Size	2.5	3	4	5	6	8	10*	12*	14*
A	2.50	3.00	4.00	5.00	6.00	8.00	10.00	12.00	14.00
C - DUCT.	N/A	N/A	10.25	N/A	12.50	14.00	16.56	18.00	21.63
C - STEEL	8.50	8.50	10.13	12.38	12.38	13.88	16.44	18.00	21.50
D	6.18	6.18	7.25	8.38	8.38	10.68	- -	- -	- -
E	3.50	3.75	4.50	5.75	5.75	7.62	8.88	10.00	10.00
F	5.38	5.59	6.31	7.56	7.56	9.63	11.63	13.31	13.31
G	6.00	6.00	6.00	6.00	6.00	12.00	12.00	12.00	18.00
Weight (approx.)	20	30	50	70	80	145	** 325	** 420	** 460

* 10" & above have gear operators as standard

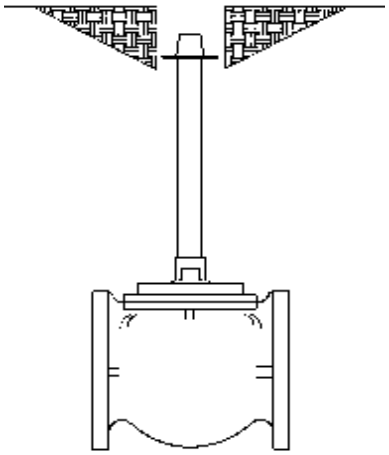
** Weight includes gear operator

NOTE: Drawings are for information purposes only; please request certified drawings before preparing piping diagrams

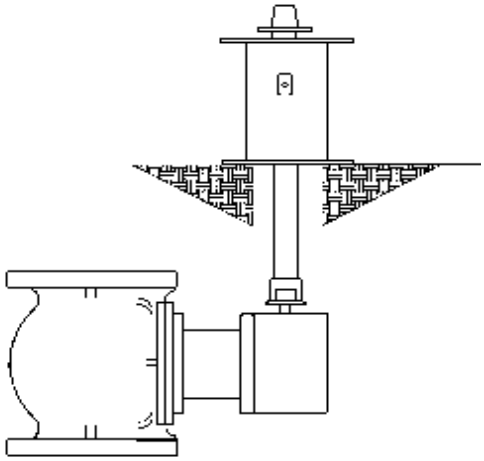
ADAPTATION

A range of extended stems & floor mounted stands for remote operation, particularly in buried service, are available.

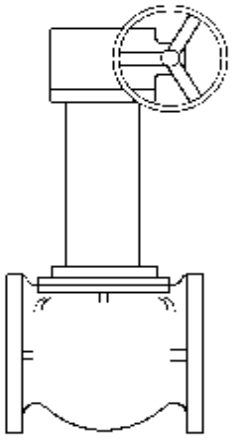
Chainwheel operation & locking devices are redily incorporated onto the MILLCENTRIC valve.



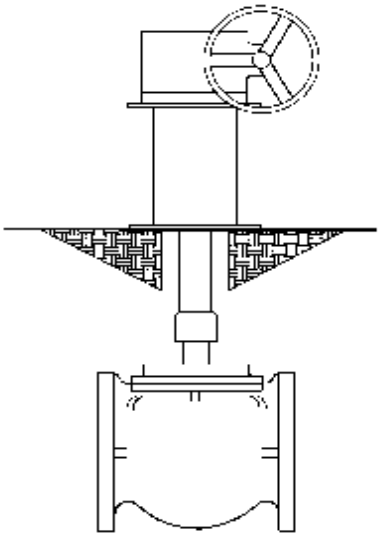
Valve with Extended Stem



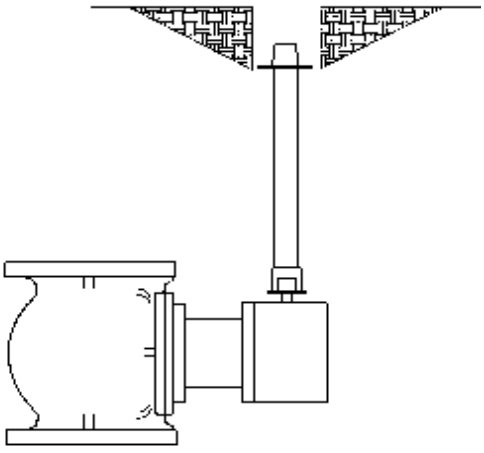
Valve with indicating floorstand



Valve with extended bonnet



Valve with non-indicating floorstand



Valve with extended stem & buried gear

PROPOSED
TECHNICAL SPECIFICATION
Eccentric Plug Valves 3"- 72"

Valves shall be of the non-lubricated, eccentric type. Flanged valves shall be manufactured in accordance with **ANSI B16.1, Class 125/150**, *including* flange thickness as required by **AWWA C504-00, Table 2** and comply with MSS-SP-108 (Eccentric Plug Valves) in all respects. Mechanical joint ends shall be in compliance with **AWWA/ANSI C-111-92.**

Valves shall be designed and manufactured to have a minimum wall thickness compliant to **AWWA C504-00.** Plug shall be round thru 12" and rectangular for sizes 14" and larger. Lay lengths shall be compliant to MSS-SP-108 for all valve sizes.

Valve bodies shall be of **ASTM A-126, Class B** cast iron in accordance with **AWWA C-504-00, Sec. 4.4.2.1. or ASTM A-536 ductile iron**. Valves 3" and larger shall he furnished with a welded-in overlay seat of not less than 90% nickel in accordance with **AWWA C-507-85, Sec. 3.2.3.5.** Nickel thickness shall be not less than .125". Sprayed, plated screwed-in seats are not acceptable.

Plugs shall be of **ASTM A-536, Grade 65-45-12** high strength ductile iron in conformance with **AWWA C-504-00, Sec. 4.4.2.2.** or solid one piece cast iron. Two piece plugs or plugs with internal cavities are not acceptable. The plug shall be of one piece solid construction with PTFE thrust bearings on the upper and lower bearing journals to reduce torque and prevent dirt and grit from entering the bearing and seal area. Valves that do not isolate the bearing area from debris are not acceptable. Valves shall be furnished with replaceable sleeve type bearings conforming to **AWWA C-504-00, Sec. 4.5.6.4** and **AWWA C507-85, Sec. 3.2.4.** Bearings shall be of sintered, oil impregnated type 316 stainless steel **ASTM A-743, Grade CF8M**.

Part areas shall provide for the following minimum flow coefficients or be a minimum of 100% port.

Valve Size	Cv(GPM)	Valve Size	Cv(GPM)
3"	500	14"	6,000
4"	1,000	16"	9,000
5"	2,000	18"	11,000
6"	2,000	20"	13,000
8"	3,000	24"	21,000
10"	6,000	30"	36,000
12"	7,000	36"	47,000

All plug valves, for whatever service, shall he capable of passing "pigging" cleaning equipment in either direction and manufacturer shall so certify that this may he done without the use of special equipment.
Valve Shaft seals shall be of the dual "U" cup type in accordance with **AWWA C-504-00, Sec. 4.5.7.1.** Seals shall be self adjusting and repackable without removing the bonnet from the valve. Packing adjustment shall not result in an increase in plug friction or resulting torque. Packing replacement shall be achieved without need to cut packing during reinstallation and not require cap removal. Single piece packing arrangements are not acceptable.

Wrench operated valves 2 ½"- 8" shall be capable of being converted to worm gear or automated operation without removal of the bonnet or plug from the valve. All wrench operated valves shall be equipped with a 2" square nut for use with removable levers or extended "T" handles. Worm gear operators, where required, shall be of heavy-duty ductile iron construction with ductile iron quadrant supported on top and bottom by oil impregnated bronze bearings. The worm gear and shaft shall be manufactured of hardened steel and run on high efficiency roller bearings. Gear shall have both open and closed stops, shall he flush-mounted to the valve exposing no portion of the plug stem and shall be rated for the valves design pressure rating for bi-directional shut off. Buried service gears shall be designed and certified to withstand input loads of up to 300 ft. lbs. minimum without damage.

Valves shall be designed and manufactured to shut off bubble tight at 175 psi for valves 2 ½" through 12" and at 150 psi for valves 14" through 36". Valves 42" and larger shall be certified bubble tight at 125 psi. Each valve shall be given a bi-directional hydrostatic seat test with the test results being certified by the manufacturer when required. All actuation shall he supplied and full warranted by the plug valve manufacturer.

Certified copies of Proof-of-Design test reports shall be furnished as outlined in **AWWA C-504-00, Section 5,2.4.**

Plug valves shall be **Millcentric Series 601 / 600** as manufactured by **Milliken Valve Company of Bethlehem, PA.**

MILLIKEN
VALVE COMPANY, INC.
1995 Highland Ave. Suite 500, Bethlehem, PA 18020-9081
Phone: 610-861-8803 FAX: 610-861-8094

LEFT BLANK

PRESSURE GAUGE ISOLATION VALVE

LEFT BLANK

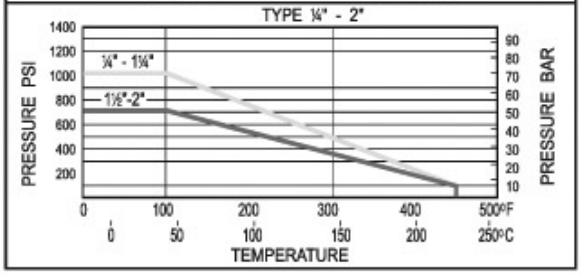
C.F.F. Stainless Steels Inc.

Your North American Stainless Steel Partner

SS-1 316 BALL VALVE

- One Piece Body
- Reduced Port
- Screwed Ends
- Blowout Proof Stem
- Lock Out Handle
- Floating Ball
- 800 P.S.I. W.O.G. (see chart)
- Threads to ANSI B2.1
- Temperature Range -20° to 450° F
- Size Range 1/4" to 2"

PRESSURE/TEMP. RATING



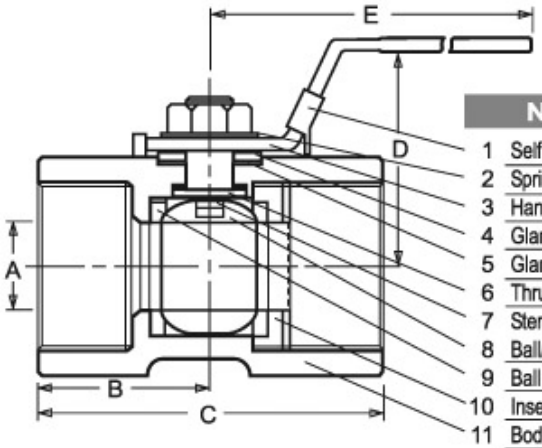
FLOW COEFFICIENT CV

Size (in.)	¼	⅜	½	¾	1	1¼	1½	2
Cv G.P.M.	2.5	4.5	7	9.0	16	24	37	68

DIMENSIONS

	Nominal Size	(mm/in) A	(mm/in) B	(mm/in) C	(mm/in) D	(mm/in) E	(kg/lb) WT
8	¼	5	19.5	39	31	78	0.06
		0.197	0.768	1.535	1.220	3.071	0.13
10	⅜	7	22	44	36	80	0.1
		0.276	0.866	1.732	1.417	3.150	0.22
15	½	9.2	28	56.5	41	99	0.17
		0.362	1.102	2.224	1.614	3.898	0.37
20	¾	12.5	29.5	59	44	99	0.26
		0.492	1.161	2.323	1.732	3.898	0.57
25	1	16	35.5	71	48	112	0.42
		0.630	1.398	2.795	1.890	4.409	0.92
32	1¼	20	39	78	54	112	0.71
		0.787	1.535	3.071	2.126	4.409	1.56
40	1½	24.5	41.5	83	65	140	0.82
		0.965	1.634	3.268	2.559	5.512	1.80
50	2	32	50	100	72	140	1.97
		1.260	1.969	3.937	2.835	5.512	4.33

Design and materials are subject to change without notice.



NAME/MATERIAL

1	Self Locking Nut/ Stainless Steel 304
2	Spring Washer/ Stainless Steel 304
3	Handle/ Stainless Steel 316
4	Gland/ Stainless Steel 316
5	Gland Packing/ GF- PTFE
6	Thrust Gland Washer/ 15% GF- PTFE
7	Stem/ Stainless Steel 316
8	Ball/ Stainless Steel 316
9	Ball Seat/ PTFE + 15% GF- PTFE
10	Insert/ Stainless Steel 316
11	Body/ Stainless Steel 316

Hamilton, Ontario
1840 Burlington St. E.
Hamilton, ON L8H 3L4
Telephone: 905-549-2603
Toll Free: 1-800-263-4511
Fax: 905-549-2994

Kingston, Ontario
11 Harvey St.
Kingston, ON K7K 5C1
Telephone: 613-549-4442
Toll Free: 866-549-4442
Fax: 613-549-4462

Montreal, Quebec
4900 Chemin du Bois Franc
St. Laurent, Quebec
H4S 1A7
Telephone: 514-337-7700
Toll Free: 1-800-361-3379
Fax: 514-337-1595

LEFT BLANK

PRESSURE REDUCING VALVE

LEFT BLANK

For Residential and Commercial Applications

Job Name _____ Contractor _____

Job Location _____ Approval _____

Engineer _____ Contractor's P.O. No. _____

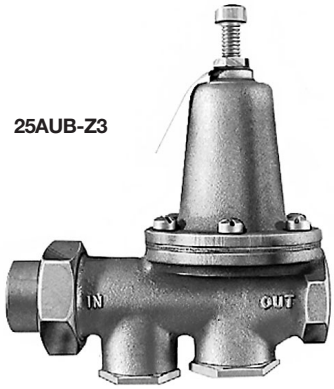
Approval _____ Representative _____

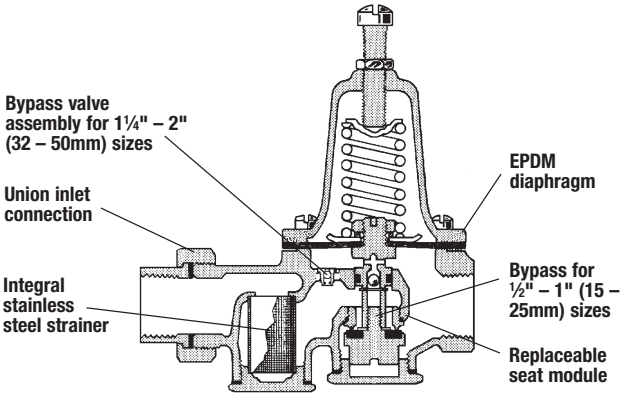
Series 25AUB-Z3

Water Pressure Reducing Valves*

Sizes: ½" – 2" (15 – 50mm)

Series 25AUB-Z3 Water Pressure Reducing Valves are designed to reduce incoming water pressure to a sensible level to protect plumbing system components and reduce water consumption. This series is suitable for water supply pressures up to 300psi (20.7 bar) and may be adjusted from 25 – 75psi (172 – 517 kPa). The standard setting is 50psi (345 kPa). All parts are quickly and easily serviceable without removing the valve from the line. The standard bypass feature permits the flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply.





Features

- Standard construction includes Z3 sealed spring cage and corrosion resistant adjusting & cage screws for accessible outdoor or pit installations
- Union inlet connection
- Integral stainless steel strainer
- Replaceable seat module
- Bronze body construction
- Serviceable in line
- Bypass feature controls thermal expansion pressure**
- High temperature resistant reinforced diaphragm for hot water

Models

25AUB-Z3	NPT threaded female union inlet x NPT female outlet
25AUB-S-Z3	Solder union inlet x NPT female outlet
25AUB-DU-Z3	Double Union – NPT threaded union female inlet and outlet
25AUB-S-DU-Z3	Double Union – Solder union inlet and outlet
25AUB-DU-THDxPEX-Z3	Double Union – NPT threaded female inlet and PEX union outlet
25AUB-DU-CPVC-Z3	Double Union – CPVC union inlet and outlet
25AUB-DU-LF-Z3	Double union body less fittings (¾", 1", 1¼")
25AUB-QC-Z3	Single Union – Quick-Connect union inlet (½", ¾", 1")
25AUB-DU-QC-Z3	Double Union – Quick-Connect inlet and outlet (½", ¾", 1")

Specifications

Standard Specifications: A Water Pressure Reducing Valve with integral strainer shall be installed in the water service pipe near its entrance to the building where supply main pressure exceeds 60psi (413 kPa) to reduce it to 50psi (345 kPa) or lower. The valve shall feature a bronze body suitable for water supply pressures up to 300psi (20.7 bar). Provision shall be made to permit the bypass flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply. Water Pressure Reducing Valve with built-in bypass check valves will be acceptable. Approved valve shall be listed to ASSE 1003 and IAPMO and certified to CSA B356. Valve shall be a Watts Regulator Company Series 25AUB-Z3.*

***A water saving test program concluded that reducing the supply pressure from 80-50psi (551-345 kPa) resulted in a water savings of 30%.**

****The bypass feature will not prevent the pressure relief valve from opening on the hot water supply system with pressure above 150psi (10.3 bar).**

Lead Free Specifications: A Water Pressure Reducing Valve with integral strainer shall be installed in the water service pipe near its entrance to the building where supply main pressure exceeds 60psi (413 kPa) to reduce it to 50psi (345 kPa) or lower. The valve shall feature a bronze body where suitable for water supply pressures up to 300psi (20.7 bar). The combined metal components of the valve contacted by potable water shall contain less than one half of one percent (0.5%) lead by weight. Provision shall be made to permit the bypass flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply. Water Pressure Reducing Valve with built-in bypass check valves will be acceptable. Approved valve shall be listed to ASSE 1003 and IAPMO and certified to CSA B356. Valve shall be a Watts Regulator Company Series LF 25AUB-Z3.

WATTS®

Materials

Body:	Bronze
Seat:	½"–1" (15–25mm) Replaceable engineered polymer (10% glass filled Noryl®) 1¼"–2" (32–50mm) Replaceable stainless steel
Integral Strainer:	Stainless steel
Diaphragm:	Reinforced EPDM
Valve Disc:	EPDM

Note: for LP models where application temperatures exceed 160°F (71°C), but not over 180°F (82°C), a Teflon® protector should be added to sizes 1¼"–2" (32-50mm).

Pressure – Temperature

Temperature Range: 33°F – 160°F (0.5°C – 71°C)
Maximum Working Pressure: 300psi (20.7 bar)
Adjustable Reduced Pressure Range: 25–75psi (172 – 517 kPa)
Standard Reduced Pressure Setting: 50psi (345 kPa)

Options

Add Suffix

G	Gauge tapping, ⅛" (3mm)
GG	Gauge tapping and 160psi (11 bar) gauge
HP	High pressure range 75–125psi (5.2 – 8.6 bar)
LP	Low pressure range 10–35psi (69 – 241 kPa)
Z7	400psi (27.6 bar) initial pressure, ½" (20mm) models only

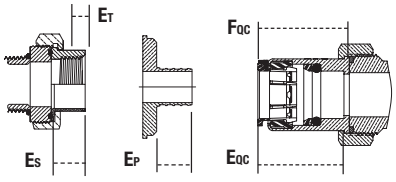
Add Prefix

LF	Lead Free† construction

†The combined metal components of this product contacted by potable water contain less than one half of one percent (0.5%) of lead by weight.

Noryl® is a registered trademark of General Electric Company.
Teflon® is a registered trademark of E.I. Dupont de Nemours & Company.

Dimensions — Weights



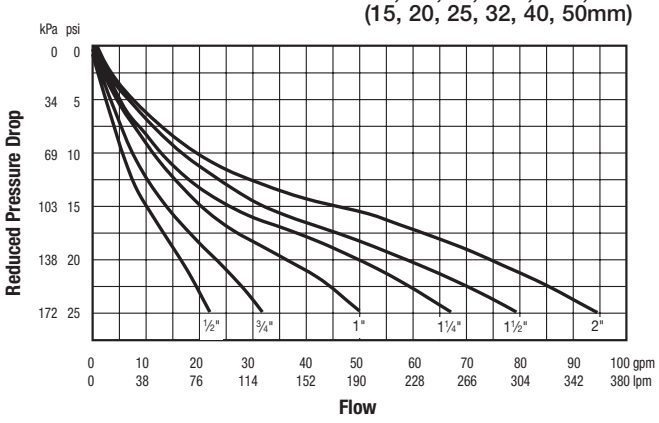
A - 25AUB-Z3
A1 - 25AUB-S-Z3
A2 - 25AUB-DU-LF-Z3
B - 25AUB-DU-Z3
B1 - 25AUB-S-DU-Z3
B2 - 25AUB-DU-THDxPEX-Z3
B3 - 25AUB-DU-QC-Z3
ET - NPT Engagement for tight joint
ES - Female sweat socket depth
EP - PEX end connection
EQC - Quick-Connect union

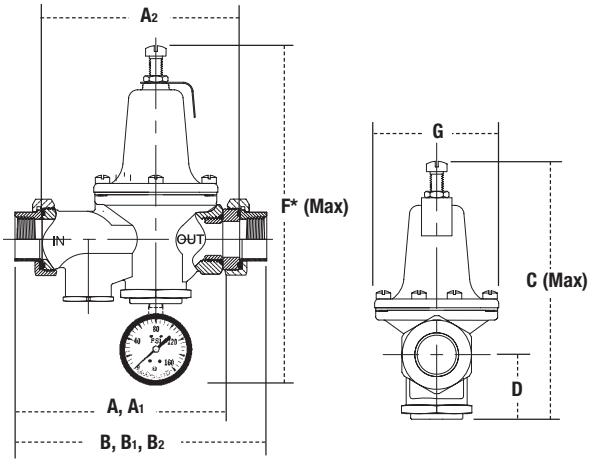
Standards

Meets requirements of ASSE Standard 1003: (ANSI A112.26.2: CSA Standard B356; Southern Standard Plumbing Code and listed by IAPMO.
Military Standard MIL-V-18146B Type I.

Capacity

Sizes: ½", ¾", 1", 1¼", 1½", 2" (15, 20, 25, 32, 40, 50mm)





SIZE (DN)		DIMENSIONS													
		A		A1		A2		B		B1		B2		C	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
½	15	5⅜	137	5⅝	135	5⅜	132	6⅞	164	6⅜	162	–	–	7	178
¾	20	5⅝	135	5½	140	5¼	133	6½	165	6⅞	175	6¾	171	7	178
1	25	6	152	6¼	159	5⅞	149	7⅜	187	7 13/16	198	7 11/16	195	8	203
1¼	32	8¾	222	8 15/16	227	8¼	210	10¾	273	11	279	–	–	9	229
1½	40	8¾	222	9	229	8¼	210	10¾	273	11 3/16	284	–	–	9½	241
2	50	9¾	235	10	254	8¾	222	11 5/16	287	12 1/16	322	–	–	11¼	286

DIMENSIONS														WEIGHT	
D		F *		G		ET		ES		EP		EQC		FQC			
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kgs.
1½	38	9 7/16	240	3⅛	79	½	13	½	13	–	–	1⅞	36	1½	38	3.5	1.6
1½	38	9 7/16	240	3⅛	79	½	13	¾	19	⅝	16	1 9/16	40	1 11/16	42	3.5	1.6
1¾	44	10 7/16	266	3⅝	92	⅝	16	15/16	23	13/16	21	1 11/16	43	1¾	45	6.5	3.0
2⅛	54	11 7/16	291	3⅝	92	⅝	16	1	25	–	–	–	–	–	–	10	4.5
2⅜	60	11 15/16	304	4 1/16	103	⅝	16	1 1/16	28	–	–	–	–	–	–	10	4.5
3¼	83	13 11/16	348	4¾	121	⅝	16	1 5/16	34	–	–	–	–	–	–	15	6.8

* Dimension includes optional gauge

USA: 815 Chestnut St., No. Andover, MA 01845-6098; www.watts.com
Canada: 5435 North Service Rd., Burlington, ONT. L7L 5H7; www.wattscanada.ca

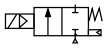
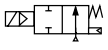
POLYMER SERVICE WATER SOLENOID VALVE

LEFT BLANK

Pilot Operated

General Service Solenoid Valves

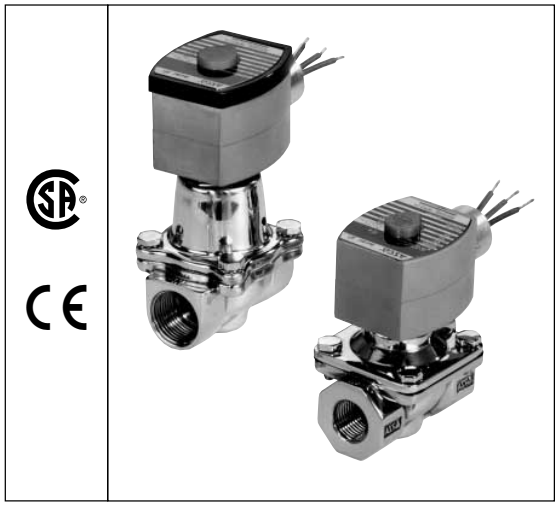
Brass or Stainless Steel Bodies
3/8" to 2 1/2" NPT

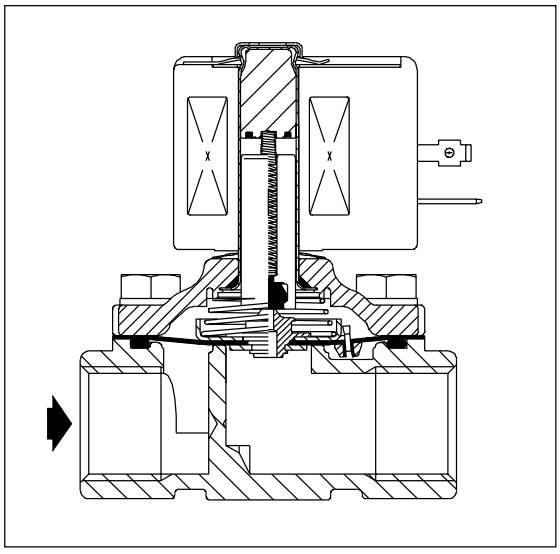
NC 
NO 

2/2
SERIES
8210

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage.
- High Flow Valves for liquid, corrosive, and air/inert gas service.
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps





Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
F	40.6	-	-	-	-	238910		238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering. Other voltages available when required.

Solenoid Enclosures

Standard: Red-Hat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; Red-Hat - Type I.
Optional: Red-Hat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.
(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B57, 8210B58, and 8210B59. Valves not available with Explosionproof enclosures.)
See Optional Features Section for other available options.

Nominal Ambient Temperature Ranges:

Red-Hat II/
Red-Hat AC: 32˚F to 125˚F (0˚C to 52˚C)
Red-Hat II DC: 32˚F to 104˚F (0˚C to 40˚C)
Red-Hat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)
Refer to Engineering Section for details.

Approvals:

CSA certified. Red-Hat II meets applicable CE directives.
Refer to Engineering Section for details.

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi) Min.	Max. AC Air-Inert Gas	Max. AC Water	Max. AC Light Oil @ 300 SSU	Max. DC Air-Inert Gas	Max. DC Water	Max. DC Light Oil @ 300 SSU	Max. Fluid Temp. °F AC	Max. Fluid Temp. °F DC	Brass Body Catalog Number	Brass Body Constr. Ref. No. ④	Brass Body UL ⑤ Listing	Stainless Steel Body Catalog Number	Stainless Steel Body Constr. Ref. No. ④	Stainless Steel Body UL ⑤ Listing	Watt Rating/ Class of Coil Insulation ⑦ AC	Watt Rating/ Class of Coil Insulation ⑦ DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G73 ③	1P	●	8210G36 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G93	5D	❍	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G1	6D	❍	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G6	5D	❍	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G15 ③	2P	●	8210G37 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G94	5D	❍	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G87	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G2	6D	❍	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G7	5D	❍	-	-	-	17.1/F	-
1/2	5/8	4	5	300	300	-	300	300	-	180	125	8210G227	5D	❍	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G88	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G9	9D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G95	8D	❍	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G3	11D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B26 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G26 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B54 ‡	31D	-	8210D89	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G54	41D	●	8210G89	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G4	12D	❍	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G27 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G78 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B55 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G55	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G8	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B56 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G56 ‡	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G22	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G33	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G11 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G34	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G30	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G12 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G35	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G38	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C13	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G13	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B57 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D14	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G14	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B58 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D18	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G18	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B59 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D32	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G32	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-			16.1/F	-

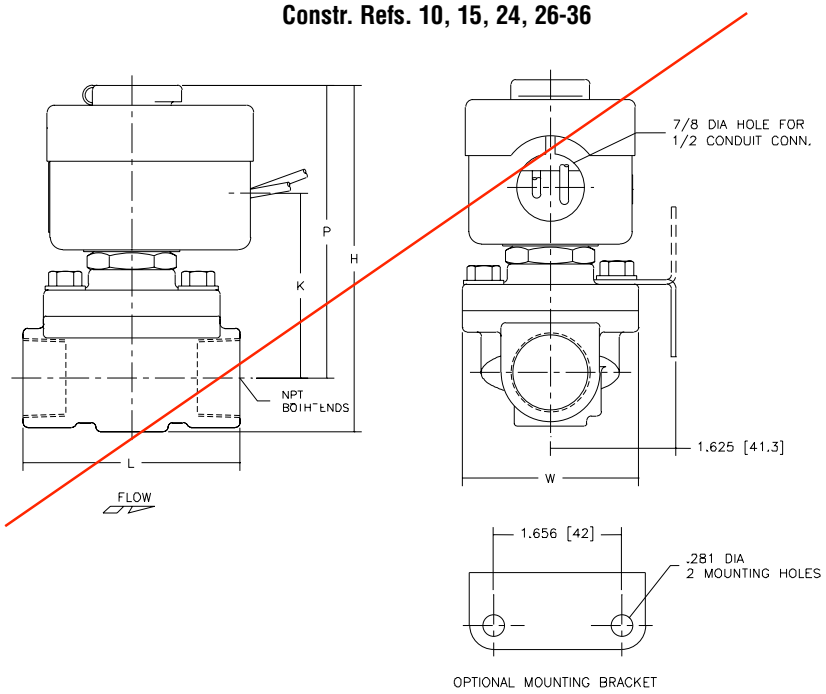
Notes: ① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes UItem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless Steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

Dimensions: inches (mm)

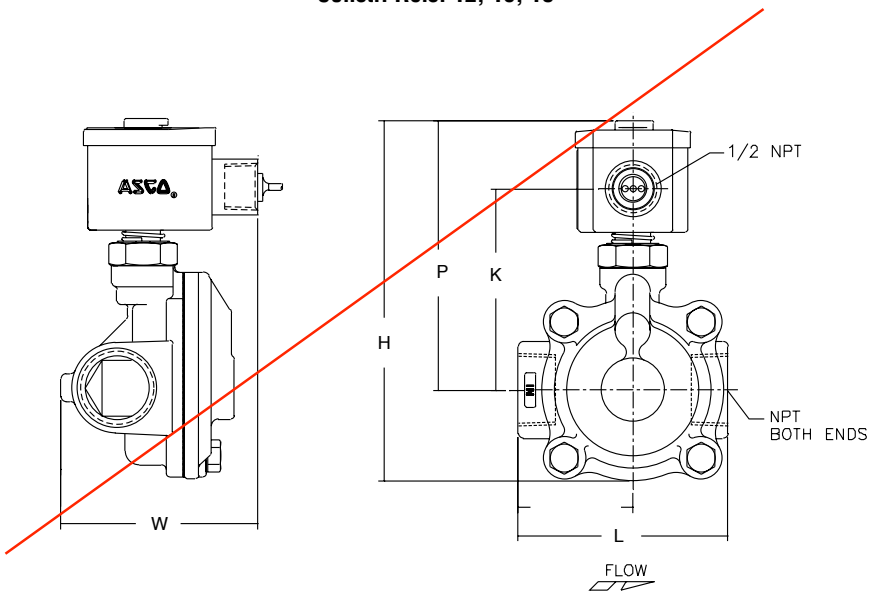
Constr. Ref. No.		H	K	L	P	W
30	ins.	8.22	X	5.06	5.47	4.87
	mm	209	X	129	139	124
31	ins.	5.25	X	3.75	4.44	3.25
	mm	133	X	95	113	83
32	ins.	5.69	X	3.66	4.69	3.25
	mm	145	X	93	119	83
33	ins.	6.06	X	4.38	4.94	3.91
	mm	154	X	111	125	99
34	ins.	6.91	X	3.75	6.09	3.25
	mm	176	X	95	155	83
35	ins.	7.34	X	3.66	6.34	3.25
	mm	186	X	93	161	83
36	ins.	7.66	X	4.38	6.56	3.91
	mm	1.95	X	111	167	99
37	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
38	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
39	ins.	5.42	2.31	2.75	4.86	3.80
	mm	138	59	70	123	97
40	ins.	5.20	3.29	2.81	4.50	2.28
	mm	132	83	71	114	58
41	ins.	5.13	3.10	3.75	4.32	3.25
	mm	130	79	95	110	83
42	ins.	6.43	4.40	3.93	5.62	3.25
	mm	163	112	100	143	83
43	ins.	5.57	3.35	3.66	4.57	3.25
	mm	142	85	93	116	83
44	ins.	5.90	3.57	4.38	4.79	3.91
	mm	150	91	111	122	99
45	ins.	5.26	3.17	3.75	4.38	3.84
	mm	134	81	95	111	98
46	ins.	4.95	3.10	3.84	4.31	2.75
	mm	126	79	98	110	70
47	ins.	6.43	3.59	3.75	4.81	3.52
	mm	163	91	95	122	90
48	ins.	6.43	3.59	3.66	4.81	3.73
	mm	163	91	93	122	95
49	ins.	6.91	3.75	4.38	4.96	4.40
	mm	176	95	111	126	112
50	ins.	8.13	4.15	5.06	5.37	4.87
	mm	207	105	129	136	124
51	ins.	8.13	4.15	5.50	5.37	5.18
	mm	207	105	140	136	132

IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.

Constr. Refs. 10, 15, 24, 26-36



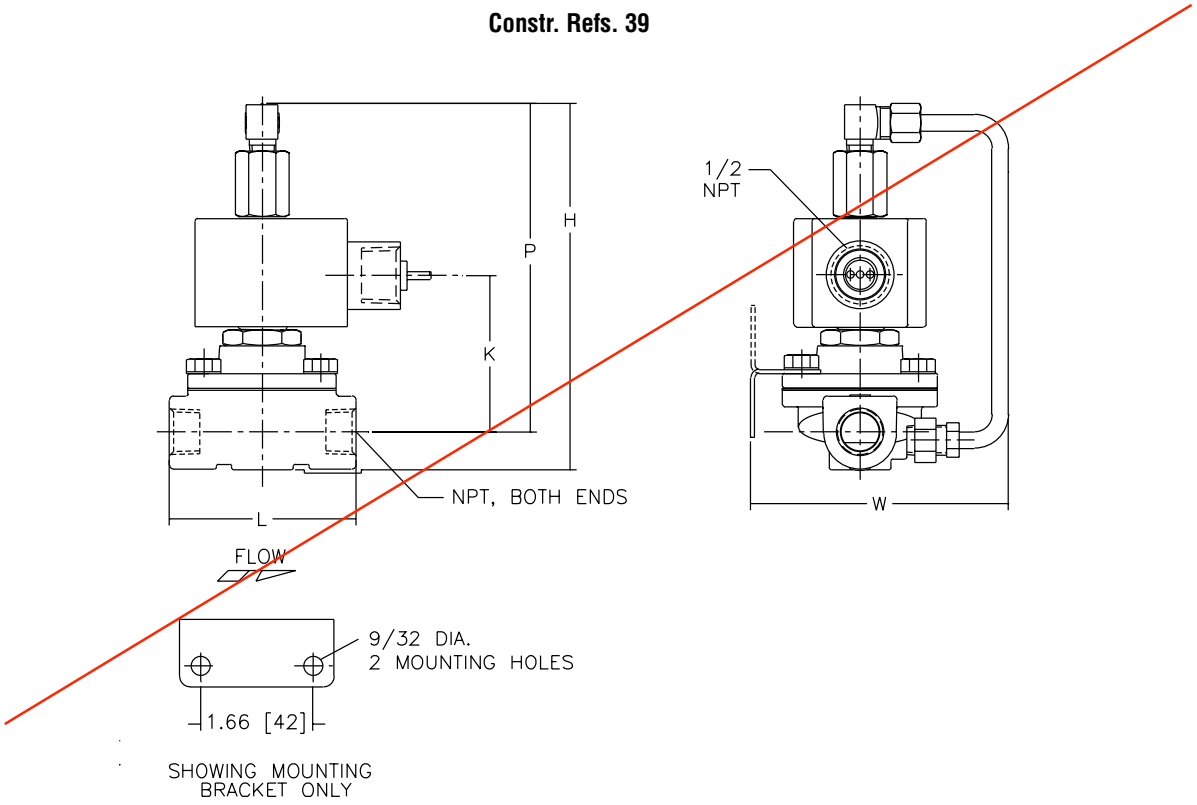
Constr. Refs. 12, 16, 18



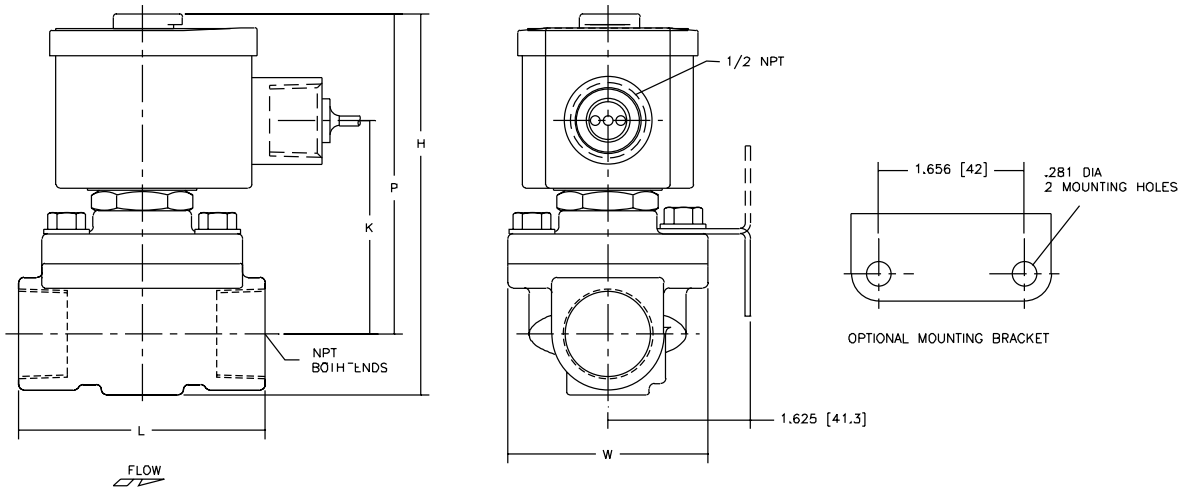
Note: Valve must be mounted with solenoid vertical and upright.

Dimensions: inches (mm)

Constr. Refs. 39



Constr. Refs. 40-51



GLOBE VALVE

LEFT BLANK

PDF Published January 22, 2004

Globe Valves

The Chemline Globe Valve is an economical throttling valve. Its heavy duty design provides for long service life. The in-line globe design causes relatively high pressure drops, however this is a desirable valve due to its economy and reliability.

CHEMLINE Plastics Limited
Your Pipeline To Quality

PVC, PP

SERIES: GV

ENDS: Threaded*, Flanged

SEALS: EPDM†

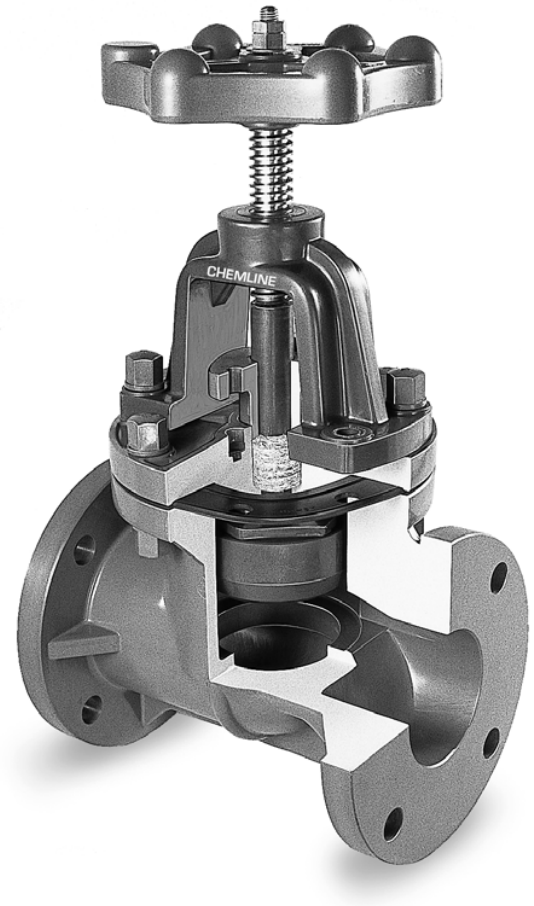
Slow Closing

An Economical Throttling Valve

Features

- **Slow closing – Prevents water hammer in PVC piping**
- **Heavy Duty Construction**
  Long service life

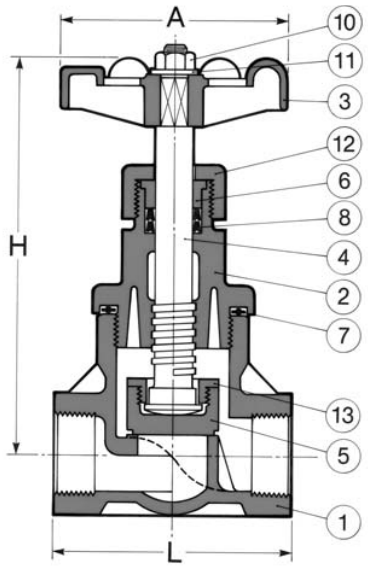
Union Bonnet Design 1/2" – 2"



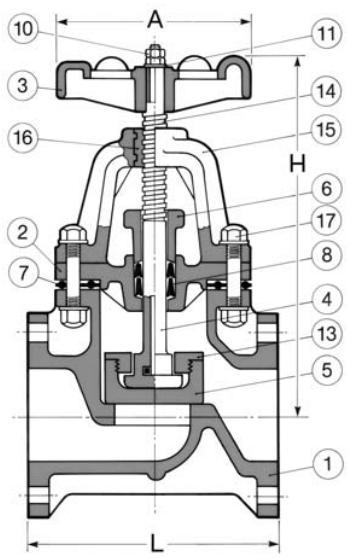
2-1/2" – 4" Outside Spindle and Yolk Type

* Socket ends are available custom basis.
† Other seal materials are available special order.

Globe Valves



1/2" – 2"



2-1/2" – 4"

PARTS

▲Recommended Spare Parts

No.	Part	Pcs.	Materials
1	Body	1	PVC, PP
2	Bonnet	1	PVC, PP
3	Handwheel	1	PP
4	Stem	1	PVC, PP
5	Disc	1	PP
6	Gland	1	PVC, PP
7▲	Bonnet Seal	1	EPDM
8▲	Stem Packing	2	EPDM
10	Nut	1	PVC
11	Washer	1	PVC
12	Gland Nut	1	PVC, PP
13	Disc Retainer	1	PP
14	Stem Top	1	Brass
15	Yolk	1	PP
16	Yolk Sleeve	1	Bronze
17	Bolt & Nut	8 sets	304 SS
18	Stud & Nut	2 sets	304 SS

DIMENSIONS INCHES

C_V VALUES VS % OPEN

WEIGHTS LB.

Size	A	L† Threaded	L* Flanged	H Open	Valve Opening (%) 20	40	60	80	100	No. Turns to Open	PVC Threaded	PVC Flanged	PP Threaded	PP Flanged
1/2"	2.6	3.35	5.3	5.3	2.6	3.5	3.9	4.0	4.1	2.75	.64	1.0	.37	.66
3/4"	2.6	3.74	6.0	5.5	4.0	5.5	6.1	6.3	6.4	3.25	1.1	1.3	.55	.84
1"	3.6	4.33	6.8	6.4	6.1	8.4	9.2	9.5	9.7	3.25	1.1	2.2	.77	1.3
1-1/4"	3.6	5.32	8.2	6.6	11.3	15.5	17.1	17.7	18.	2.5	1.3	2.9	–	–
1-1/2"	5.3	5.51	8.4	9.1	13.8	19.0	20.9	21.6	22.	3.75	2.6	4.6	–	2.9
2"	5.3	7.09	11.0	9.9	18.2	25.0	27.5	28.5	29.	3.25	3.5	5.7	–	3.5
2-1/2"	7.3	–	8.7	13.6	35.7	49.2	54.1	56.1	57.	7.5	–	13.	–	11.
3"	7.3	–	9.5	14.1	48.9	67.3	74.1	76.7	78.	7.5	–	15.	–	11.
4"	7.3	–	11.4	16.5	72.1	99.2	109.	113.	115.	8.5	–	22.	–	18.

WORKING PRESSURES PSI

Size	PVC 0 - 20°C 32 - 68°F	PVC 40°C 104°F	PVC 50°C 122°F	Polypropylene –20 - 20°C –4 - 68°F	Polypropylene 60°C 140°F	Polypropylene 80°C 176°F
1/2"-1-1/2"	150	105	105	105	90	65
2"	150	105	90	105	70	40
2-1/2"-3"	150	105	90	105	60	35
4"	150	80	65	105	60	35

Temperature Ranges: PVC 0 to 60°C (32 to 140°F), **PP** –20 to 90°C (–4 to 194°F).

Note: 1-1/4" size is not available in PP.

†**Threaded** ends are available in PVC 1/2" to 2" and PP 1/2" to 1".

***L Flanged** is for fabricated flanged valves normally supplied 1/2" to 2". Solid flanged (special order) 1/2" to 2" valves have shorter dimensions. Consult Chemline.

ORDERING EXAMPLE

Chemline Globe Valves	GV	A	015	T
Body Material	**A** - PVC **B** - Polypropylene			
Size	**005** - 1/2" **007** - 3/4" **010** - 1" **012** - 1-1/4" **015** - 1-1/2" **020** - 2" **025** - 2-1/2" **030** - 3" **040** - 4"			
Ends	**T** - Threaded **S** - Socket **F** - Flanged			

Example: Chemline Globe Valve, PVC, 1-1/2", threaded ends.

VACUUM RATING

- 29.9 inches mercury

ACCESSORY

- Handwheel lockout

CHEMLINE Plastics Limited

55 Guardsman Road, Thornhill, Ontario, Canada, L3T 6L2
Tel: 905-889-7890 info@chemline.com
Fax: 905-889-8553 www.chemline.com

Your Pipeline To Quality Valves, Piping, Flow Meters and Controls

PROCESS INSTRUMENTATION

ST-004

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Process instrumentation	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 0
	3						
DESSIN /DWG # ST-004	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-004-1	1	2	**LEVEL SWITCH**	LSHH-2-011	B24		SA	
				Model #	LSHH-2-021				
				F7-PP					
				Supplier					
				Dwyer					
				Description					
				material: polypropylene and epoxy (float)					
				polypropylene (stem)					
				max. 220 degrees F (105 degrees C)					
				max. 100 psi (7 bar)					
				application: high level in Actiflo					
	NC01ST-004-2	2	4	**PRESSURE GAUGE**	PI-2-011	B56		SA	
				Model #	PI-2-012				
				761-422	PI-2-021				
				Supplier	PI-2-022				
				Basco					
				Description					
				Pressure gauge lower mount					
				range 0-60 psi (0-400 kPa)					
				diameter 2,5" (63 mm)					
				connection 1/4" MNPT					
				application: Hydrocyclone inlet					
	NC01ST-004-3	1	1	**RAW WATER TURBIDIMETER**	AIT-1-011	A24		FI	
				Model #					
				71210-00					
				Supplier					
				Hach					
				Description					
				Turbidimeter SS7sc, 0-9999 NTU, NEMA 4X enclosure, c/w SC100 interface, 2 x 4-20 mA digital outputs, 115 Vac / 60 Hz, formazine 4000 NTU solution.					

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Process instrumentation	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-004	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-004-4	1	1	**Model #**		A24		FI	
				46680-00					
				Supplier					
				Hach					
				Description					
				Bubble trap					
	NC01ST-004-5	1	1	**Model #**		A24		FI	
				23513-00					
				Supplier					
				Hach					
				Description					
				Standardization plates (2)					
	NC01ST-004-6	1	2	**RAW WATER FLOWMETER**	FIT-2-011	A24		FI	
				No de cat.	FIT-2-021				
				VB154KAA1303210000000					
				Fournisseur/Marque					
				Krohne					
				Description					
				Krohne Enviromag electromagnetic flowmeter. 16" diameter, 150 lbs flange, Hard rubber casing, IP67, Hastelloy C-4 electrodes.					
	NC01ST-004-7	1	2	**No de cat.**		A24		FI	
				VN3144A0460010100000					
				Fournisseur/Marque					
				Krohne					
				Description					
				Krohne IFC100CD converter, tube mounted, total volume and current flow digital display, NEMA 4X/IP65, 115/120 VAC, 0/4-20 mA Hart, 1 output pulse, 2 alarm status contacts, including zero stabilization option for empty pipe condition					

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Process instrumentation	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-004	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-004-8	1	2	**COAGULATION PH-METER**	PHIT-2-011	B24		SA	
				Model #	PHIT-2-021				
				PRO-P3A1N					
				Supplier					
				Hach / GLI					
				Description					
				pH-meter, 24 VDC, digital display, 4-20 mA output, precision +/-0,01pH					
	NC01ST-004-9	1	2	**Model #**	pHE-2-011	B24		SA	
				PD1R1	pHE-2-021				
				Supplier					
				Hach / GLI					
				Description					
				Combined pH sensors (for immersion or in-line mounting), Ryton body, glass electrode for general purpose, automatic temperature compensator, 1" MNPT connection, 15' cable.					
	NC01ST-004-10	1	1	**CLARIFIED WATER TURBIDIMETER**	AIT-2-011	B24		SA	
				Model #	AE-2-011				
				60101-00					
				Supplier					
				Hach					
				Description					
				Turbidimeter 1720E, 0-100 NTU, 0,0001 NTU, c/w SC100 interface, 2 0/4-20mA outlets, 3 alarm dry contacts, NEMA4X / IP66, 120-230 VAC, 50/60 Hz, 40 VA, 6' cable between SC100 and 1720E, 1 liter of stabilized formazine 20 NTU.					

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NOMENCLATURE/ BILL OF MATERIALS

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Process instrumentation	0	SUBMITTAL	Julie Trudel / P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-004	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-004-11	1	1	**Model #**	AE-2-021	B24		SA	
				60101-01					
				Supplier					
				Hach					
				Description					
				Turbidimeter 1720E sensor only, 1 liter of stabilized formazine 20 NTU.					
	NC01ST-004-12	1	1	**Model #**		B24		FI	
				57960-00					
				Supplier					
				Hach					
				Description					
				Extension cable between SC100 and 1720E, 7.7 m (only one extension possible for each 1720E)					
	NC01ST-004-13	1	1	**Model #**		B24		SITE	
				44156-00					
				Supplier					
				Hach					
				Description					
				Calibration kit: calibration cylinder, TenSette pipet and 4000 NTU Formazin (500 mL)					
	NC01ST-004-14	1	1	**Model #**		B24		SITE	
				14060-53					
				Supplier					
				Hach					
				Description					
				Volumetric Flask 1000 mL PP					

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NOMENCLATURE/ BILL OF MATERIALS

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	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-004	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-004-15	1	2	**ROTAMETER (POLYMER DOSING SKID)**	FI9-521	D48		SA	
				Model #	FI9-522				
				FSA01500					
				Supplier					
				Chemline Plastics Ltd.					
				Description					
				Rotameter in PVC 1 1/4"NPT connections with range 150-1500 l/h					
				Application: polymer carry water					
	NC01ST-004-16	1	2	**Model #**		B24		SITE	
				2283449					
				Supplier					
				Hach					
				Description					
				pH 4 buffer , 500 ml					
	NC01ST-004-17	1	2	**Model #**		B24		SITE	
				2283549					
				Supplier					
				Hach					
				Description					
				pH 7 buffer , 500 ml					
	NC01ST-004-18	1	2	**Model #**		B24		SITE	
				2283649					
				Supplier					
				Hach					
				Description					
				pH 10 buffer, 500 ml					

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LEVEL SWITCH

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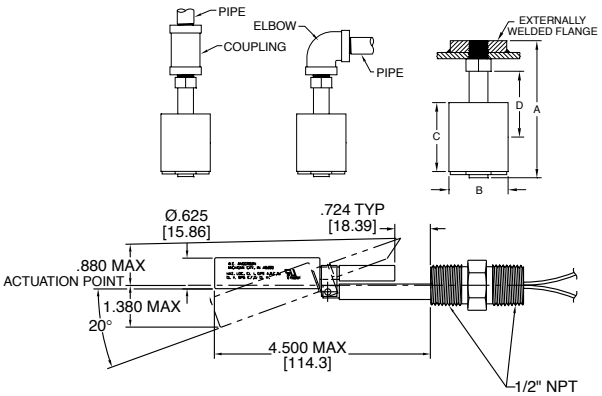
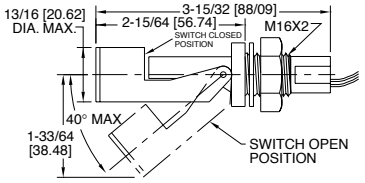
Series F7 Liquid Level Switches

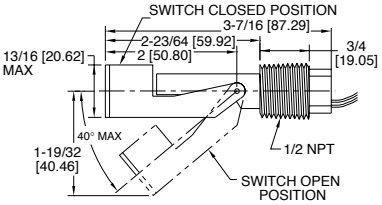
Specifications - Installation and Operating Instructions

(Model F7-SB Shown)





F7-HPS-2, INTERNAL HORIZONTAL MOUNT



F7-HPS-2, EXTERNAL HORIZONTAL MOUNT

Series F7 Level Switches provide simple, inexpensive control of liquid level within tanks or similar vessels. Switch ratings are suitable for many solid state control systems and monitors or alarms. Simple relay interfaces can be used for higher current applications. Two basic styles offer a choice of vertical or horizontal mounting. Hermetically sealed reed switches are actuated by magnets permanently bonded inside the float and can be easily adapted to open or close a circuit on rising or falling levels.

SWITCH ACTION (Normally open/Normally closed)

Vertical Models

Vertical mount models are shipped with normally open switch contacts which close as the float rises toward the mounting threads. Reverse switch action by removing the float, rotating it end-for-end and replacing it on the stem.

Horizontal Models

Contacts in horizontal models F7-HPS-1 (internal mount) and F7-HPS-2 (external mount), are normally open when the float is down and normally closed when the float is up. Models F7-HPS-1 and -2 also have indicating arrows on the stem end to confirm float alignment. See installation notes on reverse. Horizontal model F7-HSS is in the normally open position when the indicating arrow points up, and normally closed when the arrow points down.

INSTALLATION

Choose a location away from fill pipes, drains, or other areas where turbulence or wave motion might occur. Turbulence will cause false actuations and shorten contact life. Excess contaminants in fluid may inhibit float operation and occasional wipe-down may be necessary. Care should be taken that switches are always operated within electrical ratings. Read and understand all safety precautions on back of this sheet before installing.

MOUNTING

Install vertical mount models in an appropriate 1/8″ NPT fitting. Vertical models mount internally, oriented within 30° of vertical, or select optional fittings for external mounting. Model F7-HPS-1 must be mounted internally, which means the switch must be secured to the wall of the tank or vessel from the inside. Install horizontal model F7-HPS-1 in a 5/8″ (16 mm) hole and secure with nut provided. Tank wall should not exceed 1/8″ (3 mm). Model F7-HPS-2 requires a horizontal 1/2″ NPT(F) fitting and can be fitted to the tank or vessel from the outside. Model F7-HSS requires a horizontal 1/2″ NPT(F) fitting and can be mounting from the inside or outside (internally or externally) of the tank or vessel.

PHYSICAL DATA

Electrical Rating (Maximum):

F7-SB, -SS2 AC: 25VA, 1.0A, 200V DC: 10W, 1.0A, 200V.
F7-PP, -BT, -HSS AC: 30W, 0.14A, 220V DC: 0.28A, 24V; 0.07A, 120V.
F7-HPS-1, -2 AC/DC: 15VA, 220V, 1.0A max.
(F7-HSS is rated explosion-proof for Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III).

Mounting Connections: 1/8″ NPT(M) (all vertical mount), 1/2″ NPT(M) (F7-HPS-2, F7-HSS), M16 x 2 (F7-HPS-1).

Wire Leads: 22 AWG x 18″ (46 cm), vertical mount models, 22 AWG x 39″ (1 m), models F-7-HPS-1, -2, 22 AWG x 24″ (61 cm) model F7-HSS.

Magnet: Alnico® (F7-SB, -PP, -BT, -HPS), ceramic (F7-SS2, -HSS).

Weight: F7-SB, 2 oz. (58 g); F7-SS2, 1.2 oz. (34 g); F7-PP, 0.8 oz. (23 g); F7-BT, 0.7 oz. (20 g); F7-HPS-1, 1.5 oz. (43 g); F7-HPS-2, 2 oz. (57 g); F7-HSS, 3 oz. (94 g).

DIMENSIONS,INCHES (mm)

Model Number	(A) Stem Length	(B) Float Diameter	(C) Float Height	(D) Actuation from HEX
F7-SB	2.75 (70)	1.38 (35)	1.13 (29)	1.2 (31)
F7-SS2	2.06 (52)	1.0 (25)	1.0 (25)	0.73 (19)
F7-PP	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)
F7-BT	2.18 (55)	1.18 (30)	1.0 (25)	0.69 (18)

PHYSICAL DATA

Model No.	Material Float/Stem	Max Temp.	Max Press.	Min S.G.	Approx. Deadband
Vertical Mount					
F7-SB	Buna-N & Epoxy/316SS	220°F 105°C	150 PSIG 10 Bar	0.60	1/16″ 2 mm
F7-SS2	316SS (CYC)/316SS	300°F 149°C	450 PSIG 31 Bar	0.75	1/16″ 2 mm
F7-PP	Polypropylene & Epoxy/Polypropylene	220°F 105°C	100 PSIG 6.89 Bar	0.60	1/8″ 4 mm
F7-BT	Buna-N & Epoxy/PBT*	220°F 105°C	150 PSIG 10 Bar	0.45	1/8″ 4 mm
Horizontal Mount					
F7-HPS -1, -2	Polysulfone/ Polysulfone	185°F 85°C	150 PSIG 10 Bar	0.85	3/16″ 5 mm
F7-HSS	316SS/316SS	392°F 200°C	300 PSIG 20.7 Bar	0.60	1/8″ 4 mm

*PBT - Polybutylene Terephthalate

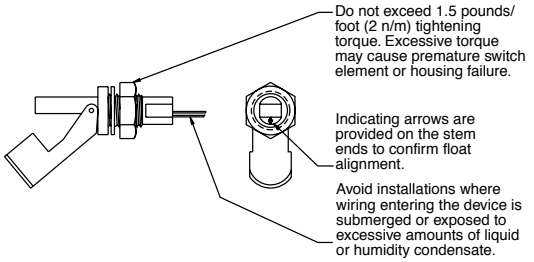
Optional Fittings (for Exterior Mounting of Vertical Models)

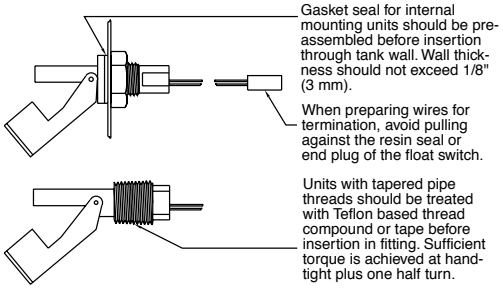
A-347, 1/8″ x 1 1/4″ NPT C.S. Adapter.
A-347-SS, 1/8″ x 1 1/4″ NPT 316SS Adapter.
A-348, 1/8″ x 1 1/2″ NPT C.S. Adapter.
A-348-SS, 1/8″ x 1 1/2″ NPT 316SS Adapter.

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000
Fax: 219/872-9057
Lit-By Fax: 888/891-4963
www.dwyer-inst.com
e-mail: info@dwyer-inst.com

Installation Notes - Do not subject reed switch controls to excessive shock or vibration or any of the following:

- Bending or placing force loads on reed switch housing.
- Over-torquing fittings on reed switch housing.
- Placing pull-out force on lead wires.





CIRCUIT INFORMATION FOR REED SWITCH PROTECTION

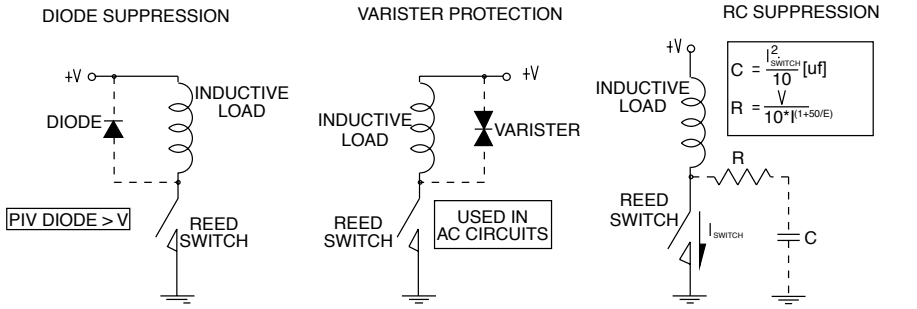
Read information below before installing your new reed switch control!

Exceeding the current capacity of this Reed Switch control may cause FAULTY OPERATION! Be aware of the inductive and capacitive or lamp loads you may be placing on you Reed Switch Control. The circuits below outline possible solutions to preventing overloads due to inrush or surge currents exceeding maximum or when the switch current and product of the inductive back EMF exceed the switch's power rating. Also the circuit for prevention of overload when switching filament lamps (low "cold" resistance) is outlined below. Failure to follow these measures to protect Reed Switch Contacts may cause the contacts to weld together or result in premature wear.

Possible Circuit Solutions Indicated by Dashed Lines

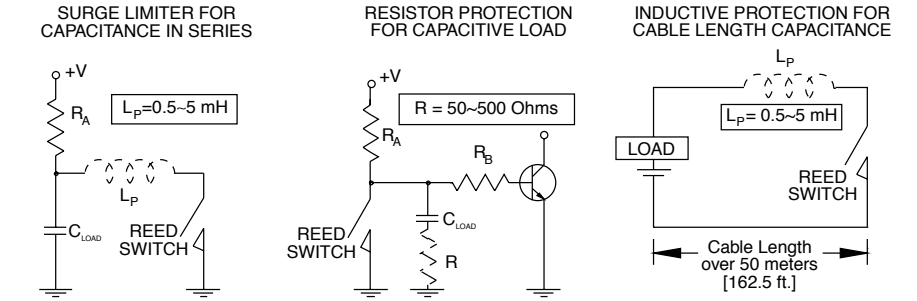
Inductive Loads

Possible causes -
An electromagnetic relay, electromagnetic solenoid, electromagnetic counter with inductive component as circuit load.



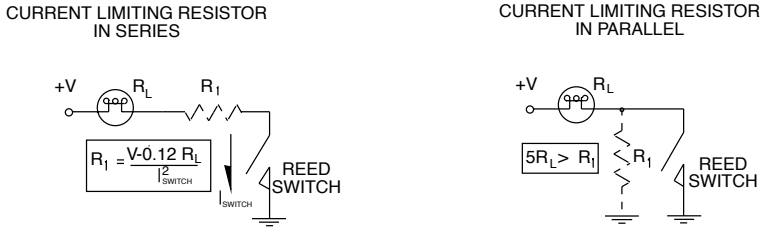
Capacitive Loads

Possible causes -
A capacitor connected in series or parallel with Reed Switch control. In a closed circuit, a cable length (usually greater than 50m [162.5 ft.]) used to connect reed switch may also introduce static capacitance.



Lamp Loads

Possible causes -
A tungsten filament lamp load.



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PRESSURE GAUGE

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BASCO® Gauges

For general use - 63mm (2½")

760 Series, 2% Full scale accuracy, Grade B (3-2-3)

Glycerine filled, acrylic lens

- Case : IP50, stainless steel
- Ring : stainless steel
- Dial : aluminum, white background, black (psi) and blue (kPa) graduations
- Dial : double, lb/in² (psi) and kPa
- Resolution : ½ division
- Bourdon Tube : brass (less than 600 psi), bronze (over 800 psi)
- Fitting : brass, ¼" NPT
- Working and process temperature : -10 to 50°C, less than 80% RH

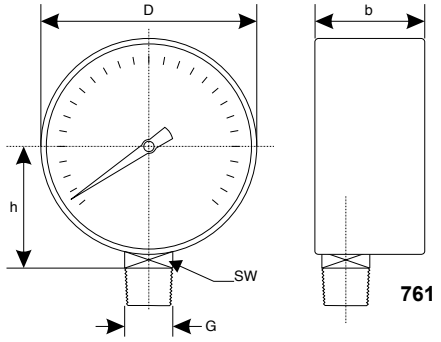
Model	Dia mm	Dia inches	Fitting
761	63 mm	2½"	lower mount (lm)
764	63 mm	2½"	center back mount (cbm)
766	model 764 with front flange (cbm)		
767	model 764 with clamp ring (cbm)		

OPTIONS

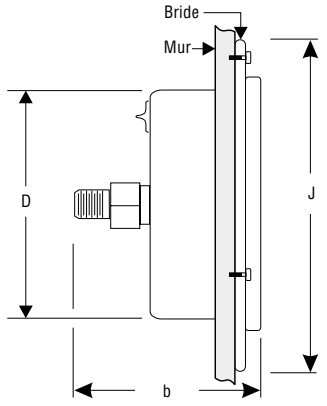
019039	front flange
019091	clamp-ring

Front flange

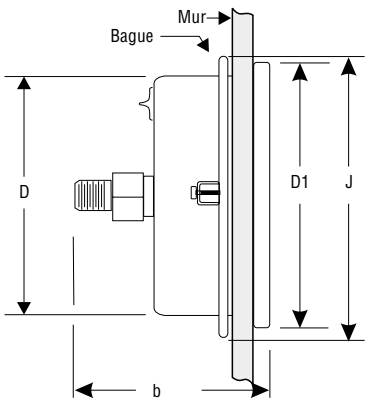
Clamp-ring



761



764 +019039 = 766



764 + 019091 = 767

How to order

☐ – ☐

Model — Range Code

Example : **761** – **423** = 63mm, 1/4"NPT, 0/100 psi 0/700 kPa

Range Code	"Hg and psi Range	kPa Range	"Hg Divisions	psi Divisions	kPa Divisions
401	-30/0"Hg	-100/0	0,5		2
417	0/15	0/100		0,25	2
420	0/30	0/200		0,5	5
422	0/60	0/400		1	10
423	0/100	0/700		2	20
425	0/160	0/1100		2	20
426	0/200	0/1400		5	50
427	0/300	0/2100		5	50
429	0/500	0/3400		10	100
430	0/600	0/4200		10	100
432	0/1000	0/7000		20	200
436	0/3000	0/21000		50	500
438	0/5000	0/34000		100	1000
439	0/6000	0/40000		100	1000
441	0/10000	0/70000		200	2000

Options

- ABS case
- U-Clamp (from factory only)
- Your logo on the dial (minimum quantity required)

	D	D1	b	h	G	SW	J
761	63			38	1/4"NPT	14	
764	63	66,8	55		1/4"NPT	14	
766	63	66,8	55		1/4"NPT	14	88,9
767	63	66,8	55		1/4"NPT	14	68,8

dimensions in millimeters

Other models, styles and fittings available on request

Fax : (514) 327-0604

LEFT BLANK

RAW WATER TURBIDIMETER

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Surface Scatter® 7 sc Turbidimeter

Use the Hach Surface Scatter 7 sc Turbidimeter to monitor high range turbidity with greater accuracy and reliability than ever before. The optics never touch the sample in the Hach Surface Scatter 7 Turbidimeter so it's virtually maintenance free.

Features and Benefits

Less Fouling for Easy Maintenance

The Hach Surface Scatter 7 sc Turbidimeter (SS7) is uniquely designed so that the light source and photocell never come in contact with the sample. In fluids with high loads of suspended solids this makes sample cell cleaning and replacement unnecessary.

Built to Last

All wetted parts of the Hach SS7 turbidimeter are made with corrosion-resistant materials for extended life. The photo-detector and light source assemblies are protected from the effects of corrosive vapors. The SS7 turbidimeter is warranted against defects in materials or workmanship for two years from the date of shipment.

Two Models for Different Applications

Surface Scatter 7 sc Turbidimeter—Use the SS7 to establish and maintain optimum process control and for reliable monitoring.

- *Drinking water influent*
- *Wastewater effluent*
- *Flocculation and sedimentation*
- *Industrial process water*
- *Food processing waste containing starch, fat, or oil*

Surface Scatter 7 sc High Sample Temperature (HST) Turbidimeter—This is an SS7 turbidimeter designed to monitor samples with temperatures of up to 70°C. An innovative moist air removal system is useful where a difference between the sample temperature and the ambient temperature causes condensation and fogging. For use in applications such as:

- *Fluids ranging from raw water influent to corrosive white liquor*
- *High temperature samples—up to 70°C*
- *Corrosive white, black, and green liquor in paper mills*
- *Produced water in oil fields containing oil and hydrogen sulfide*
- *Wherever temperature differences cause condensation and fogging*

Wide Measurement Range

The SS7 turbidimeter can reliably measure turbidity from 0 to 9999 NTU in samples that vary from clear water to corrosive and high temperature paper mill and oil field samples.

Backed by a 2-year Warranty

Consistent with its long-standing reputation for quality and customer service, Hach Company warrants all SS7 turbidimeters against defects in materials or workmanship for two years from the date of shipment.

Specifications*

Range
0 to 9999 Nephelometric Turbidity Units (NTU)

Accuracy
±5% of reading or ±0.1 NTU (whichever is greater) from 0 to 2000 NTU; ± 10% of reading from 2000 to 9999 NTU

Resolution
0.01 NTU below 100 NTU

0.1 NTU between 100 to 9999.9 NTU

Repeatability
1.0% or ±0.04 NTU, whichever is greater

Response Time
Initial response in 45 seconds

Sample Flow Required
1.0 to 2.0 L/min (15 to 30 gal/hr)

Sample Temperature
SS7: 0 to 50°C (32 to 122°F)

SS7/HST: 0 to 70°C (32 to 158°F), intermittent 70 to 80°C (158 to 176°F) (an optional heat exchanger is available to reduce sample temperature)

Ambient Temperature
0 to 50°C

Humidity
5 to 95% non-condensing

Power Requirements
100/230 VAC, 50/60 Hz, auto selecting; 40 VA

Installation Category
Category II

Sample Inlet Fitting
3/4-inch NPT female

Overflow Drain Fitting
1-inch NPT female

Body Drain Fitting
3/4-inch NPT female

Air Purge Fitting
3/4-inch compression fitting; 0-50 SCFH airflow clean instrument air

Enclosure
Sample unit: NEMA-12 plastic instrument enclosure suitable for indoor installation

Mounting
Wall mount

Dimensions
64.2 x 67.5 x 19.0 cm (25.3 x 26.6 x 7.5 in.)

Weight
SS7: 15.8 kg (35 lbs.)

SS7/HST: 18 kg (40 lbs.)

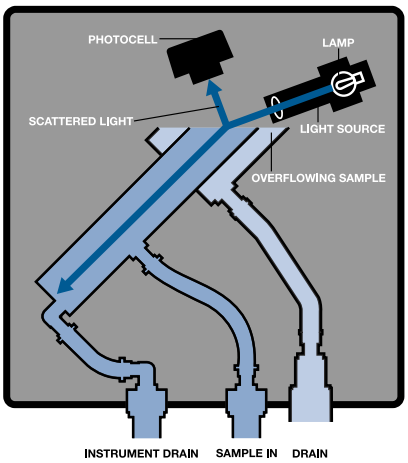
**Specifications subject to change without notice.*

Principle of Operation

The sample is introduced into the center sample tube of an inclined turbidimeter body at a flow rate of 1 to 2 liters per minute (1/4 to 1/2 gallon per minute). As the fluid spills over the top of the turbidimeter body, a stable, flat surface of liquid forms and becomes the measuring surface.

A high-intensity light source is directed at the surface of the liquid at an acute angle. Light is scattered by particles in the sample and is detected by a photocell positioned directly over the point where the light enters the liquid. The light is scattered at or near the surface and very little is absorbed by the liquid. The amount of light scattered changes in direct proportion to turbidity.

Most of the light directed at the surface of the sample is reflected up into the instrument cabinet and absorbed, or refracted down into the turbidimeter body. A small amount of the light is scattered by the particles suspended in the fluid. The photocell assembly detects light scattered at 90° from the incident beam. The electronic signal generated by the photocell is directly related to the concentration of particles suspended in the sample.



Engineering Specifications

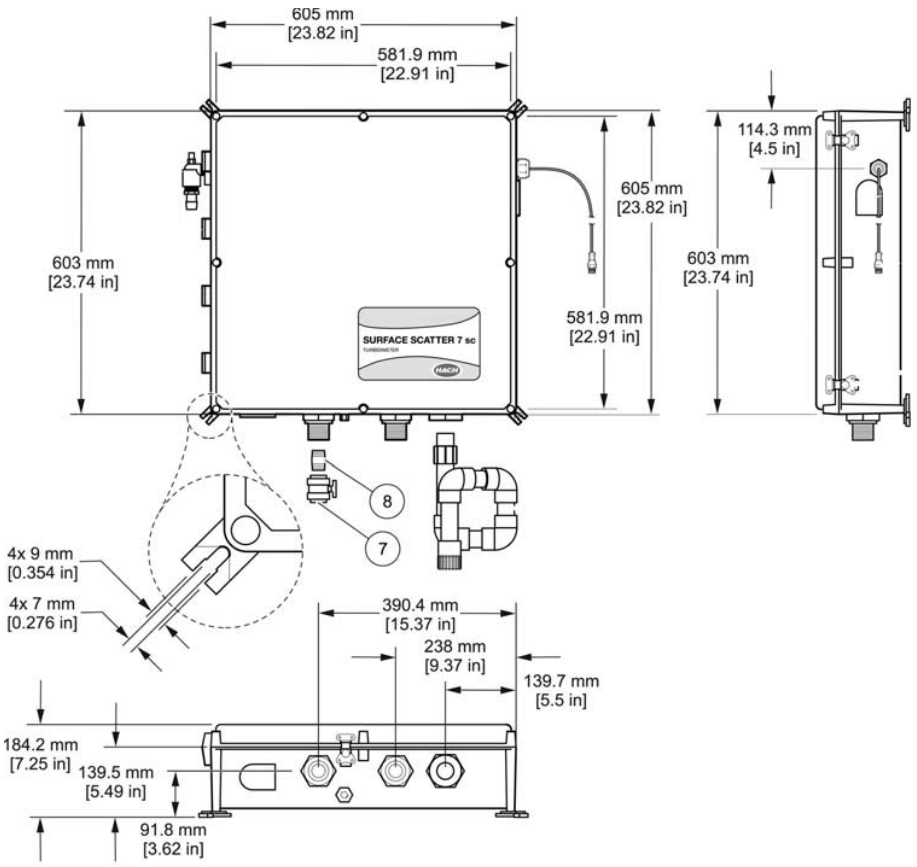
1. The turbidimeter shall be a continuous-reading, on-line instrument using the nephelometric method of measurement.
2. The turbidimeter shall consist of two main components: a sample unit and a control unit.
3. The turbidimeter shall utilize a single silicon photodiode to detect 90 degree scattered light.
4. The turbidimeter shall be equipped with a digital display with automatic decimal point placement reading from 0-9999 NTU.
5. The accuracy of the turbidimeter shall be better than ±0.1 NTU or ±5% from 0 to 2000 NTU which ever is greater; ±10% from 2000 to 9999 NTU.
6. The resolution of the turbidimeter shall be 0.01 NTU.
7. Calibration of the turbidimeter shall be based on formazin.
8. The turbidimeter shall be sold with a warranty against defects in materials and workmanship for two years from date of shipment.
9. All optical and hydraulic components shall be housed in the sample unit.
10. The optics of the turbidimeter shall never touch the sample.
11. The light source shall be directed to the surface of the water source, eliminating the use of a glass window or flow cell.
12. The sampling unit shall be constructed of corrosion-resistant structural plastic.
13. The sampling unit shall be powered from the control unit and require no separate power source.
14. The sampling unit shall be housed in a NEMA-12 industrial plastic enclosure suitable for indoor installation.

Engineering Specifications *continued*

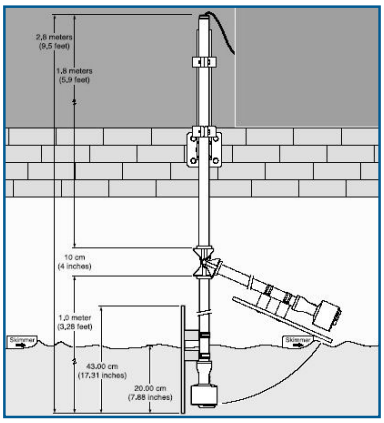
15. The control unit shall be equipped with linear output signal that can be programmed to span all or any portion of the 0-9999 NTU range.
16. The control unit shall be equipped with two turbidity alarm set points adjustable over the entire range of the instrument with a SPDT relay with unpowered contacts rated for 6 A.
17. A bubble rejection algorithm shall be provided to eliminate spikes in measurement due to transient sample conditions.
18. The control unit shall be housed in a NEMA-4X industrial enclosure suitable for indoor installation
19. The turbidimeter shall be the Model Surface Scatter 7 sc Turbidimeter manufactured by Hach Company.

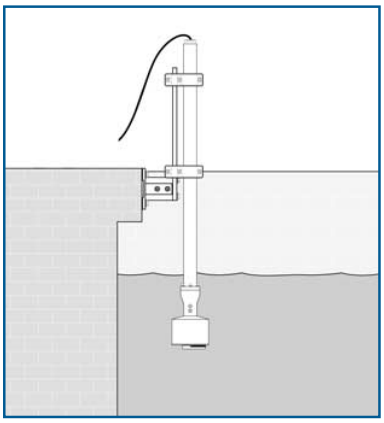
Dimensions

The Hach Surface Scatter 7 sc Turbidimeter should be located as close to the sampling point as possible. The control unit and sample unit can be bench- or wall-mounted indoors and away from direct sunlight. Best performance will result if the ambient temperature does not change rapidly. Equipped with an 4-conductor 6-foot (2 m) sensor cable expandable up to 30 feet (10m).



Installation





Ordering Information

All Surface Scatter 7 Turbidimeters are shipped with calibration cup, 4000 NTU Formazin calibration standard, installation accessories, and instruction manual (power cords must be ordered separately).

71210-00	Surface Scatter 7 sc Turbidimeter; with Hach sc100 Controller*
71215-00	Surface Scatter 7 sc High Sample Temperature (HST) Turbidimeter; with Hach sc100 Controller*

**Refer to Hach lit #2463 for more information about the sc100 Controller.*

Sensor Only

LPV431.52.00002	Surface Scatter 7 sc Turbidimeter
LPV432.52.00002	Surface Scatter 7 sc High Sample Temperature (HST) Turbidimeter

Sample Conditioning Options

466912-12	Auto Flush Kit; 120 Vac
466912-22	Auto Flush Kit; 240 Vac
46680-00	Bubble Trap, Head Regulator
40284-00	Flow Meter; 100 to 1600 mL/minute

Calibration Standards

71216-49	400 NTU StablCal; 500 mL
2461-49	4000 NTU Formazin; 500 mL

Cables

57960-00	Sensor Cable Extension; 7.6 m (25 ft.)
46306-00	Power Cord; 125 Vac, 10 A, 1.83 m (6 ft.)
46308-00	Power Cord; 250 Vac, 10 A, 1.83 m (6 ft.)

Optional Accessories

687-00	Cylinder Brush; size 2
45021-00	Calibration Cup
23513-00	Verification Plates
58690-00	Sun Shield, sc100 controller
23513-00	Standardization Plate Kit, uncalibrated

Lit. No. 2509
F62.5 Printed in U.S.A.

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

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E-mail: info@hach-lange.de
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HACH®

Be Right™

sc100 Controller

The Model sc100 Controller receives data from one or two sensors. Its plug-and-play, mix-and-match operation lets it fit into any facility or workflow. Digital communication with any Hach digital sensor or probe is simple and reliable.

Features and Benefits

One Controller for One or Two Sensors

The Hach sc100 Controller receives data from up to two sensors. Use any of Hach's line of digital sensors for pH/ORP, conductivity, dissolved oxygen, or turbidity.

One Controller for One or Two Parameters

Not only can the sc100 controller be used for up to two sensors, but the sensors need not be the same. Mix and match any combination of parameters.

One Controller for Many Options

Communications using RS485/MODBUS® or RS232/MODBUS® protocols or the wireless infrared port are available. (Contact your Hach representative for other communication protocols.) Multiple control functions include built-in PID, control contacts, and alarm functions.

"Plug and Play" Operation

There's no complicated wiring or set up procedures with the sc100 controller. Just plug the sensor in and it's ready for use without special ordering or software configuration.

Simple, Reliable Data Collection

A built-in data logger collects measurement at user selectable intervals (1 to 15 minutes), together with calibration and verification points, alarm history, and instrument setup changes for up to 6 months. With a two-year warranty, the Hach sc100 Controller is built to last.

Specifications*

Ambient Conditions

Operation
With less than 7 W sensor load:
-20 to 60° C (-4 to 140° F); 0 to 95% relative humidity, non-condensing

With less than 25 W sensor load:
-20 to 40° C (-4 to 104° F); 0 to 95% relative humidity, non-condensing

Storage
-20 to 70° C (-4 to 158° F); 0 to 95% relative humidity, non-condensing

Power Requirements

100 to 230 Vac, 50/60 Hz; Power: 11W with 7W sensor load; 35W with 25W sensor load

Display

Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting

Relays

Three SPDT, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum

Outputs

Two analog 4-20 mA, maximum impedance 500 Ohms, optional digital network connection

Control

PID, High/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay

Alarms

Low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay

Communication (Optional)

RS-232 (MODBUS®): Configure and retrieve measured data for one analyzer using IBM-compatible PC

RS-485 (MODBUS®): Advanced communications/networking with PLC or SCADA system directly from analyzer.

Memory Backup

All user settings are retained indefinitely in memory (non-volatile) (EEPROM)

Mounting Configurations

Surface, panel, and pipe (horizontal and vertical)

Enclosure

NEMA 4X/IP66; metal enclosure with corrosion-resistant finish

Dimensions

1/2 DIN; 144 x 144 x 150 mm (5.7 x 5.7 x 5.9 in.)

Weight

1.6 kg (3.5 lbs.)

Certifications

ETL to UL 61010A-1 and CSA C22.2 No. 1010.1

**Specifications subject to change without notice.*

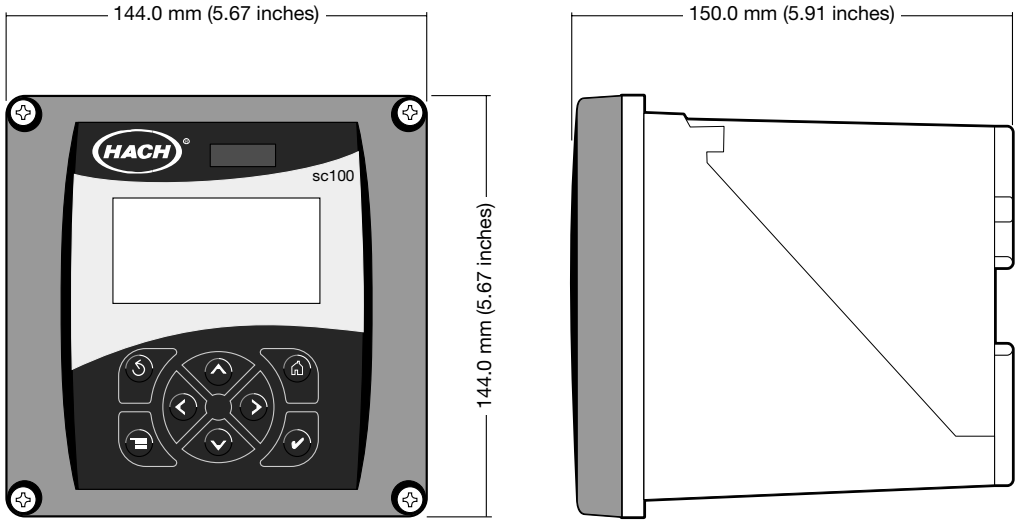
Engineering Specifications

1. The controller shall be a microprocessor-based instrument.
2. Connections between the sensors and the controller shall be “plug and play.”
3. The controller shall have the option for RS232/MODBUS® or RS485/MODBUS® serial input/output capability for two-way communication to a computer and have wireless downloading capability through an IR Port located on the interface unit to download and print realtime data, calibration history, and current set points in a CSV format.
4. The Interface unit shall allow operators to control sensor and interface functions with menu-driven software.
5. The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller.
5. The interface unit shall include two analog 4-20 mA outputs and 3 unpowered SPDT form ‘C’ alarm contacts.
7. The interface unit shall include two independent PID control functions.
8. The interface unit shall be housed in a NEMA-4X/IP66 metal enclosure with corrosion-resistant finish.
9. The controller shall be mounted horizontal or vertical on surface, panel, or pipe.
10. The AC power supply shall be housed in the interface unit and automatically accept input in the range of 100 to 230 Vac, 50/60 Hz.
11. All system components shall be certified by ETL to UL 61010A-1, CSA C22.2 No. 1010.1.
12. The controller shall be warranted for two full years against defects in material and workmanship.
13. The controller shall be Hach Company Model sc100 Controller.

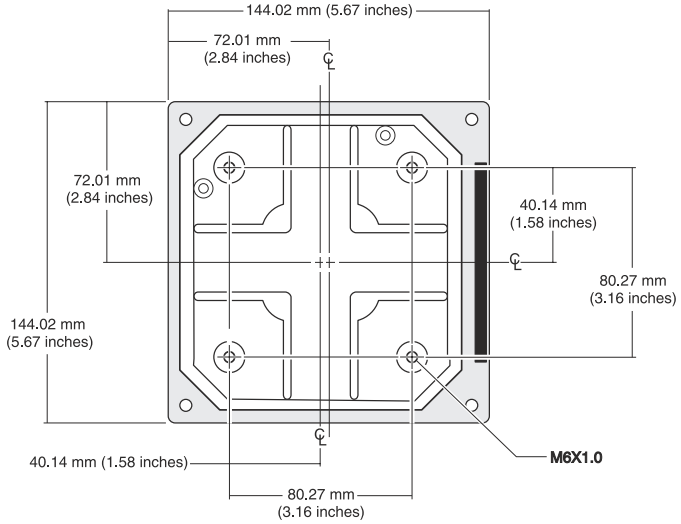
Dimensions

The sc100 controller unit can be installed on a surface, panel, or pipe (horizontally or vertically). No tools are needed to connect the controller unit to any Hach digital sensor.

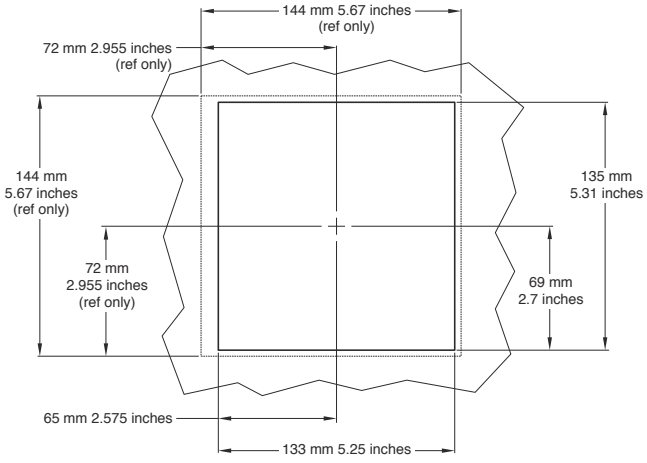
Front and Side Views



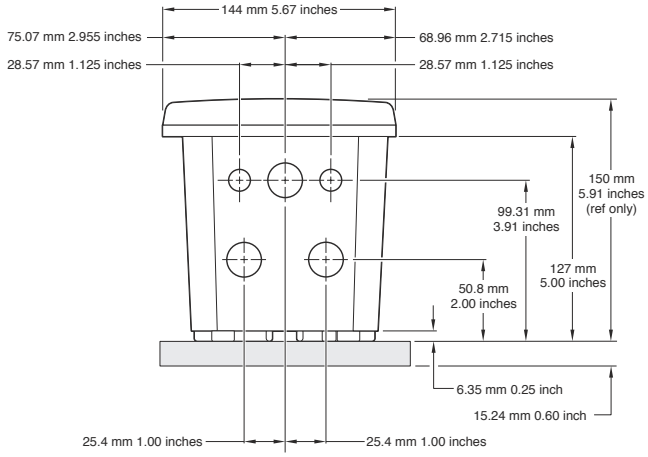
Back View



Panel Mount Cut-Out Dimensions



Conduit Hole Dimensions



Ordering Information

LXV401.52.00002 sc100 Controller Standard

LXV401.52.01002 sc100 Controller with RS-232 (MODBUS®)

LXV401.52.02002 sc100 Controller with RS-485 (MODBUS®)

Note: Power cords must be ordered separately.

Note: Other communication options are available. Please contact Hach Technical Support or your Hach representative.

Power Cords

54488-00	Power Cord with strain relief, 125 Vac
54489-00	Power Cord with strain relief, 230 Vac, European-style plug

Accessories

58690-00	Sun Shield, for controller

To complete your measurement system, choose from Hach's family of digital sensors...

Lit. No. 2463
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At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

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Make it simple.

Be right.

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HACH®

Be Right™

Catalog Number DOC026.53.00769

Surface Scatter® 7 sc Turbidimeter

USER MANUAL

Edition 1 May 2006

te/kt

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice

Range	0.01–9999.9 nephelometric turbidity units (NTU)
Accuracy	± 5% of reading or ± 0.1 NTU (whichever is greater) from 0.01 to 2000 NTU; ± 10% of reading from 2000 to 9999 NTU
Resolution (displayed)	0.01 NTU up to 999.99 NTU; 0.1 NTU from 1000.0 to 9999.9 NTU
Repeatability	Better than ± 1.0% of reading or ± 0.04 NTU, whichever is greater for each range.
Response time	Initial response in 45 seconds
Sample flow required	1.0 to 2.0 L/min (0.3 to 0.5 gal/min) (15 to 30 gal/hr)
Sensor storage temperature	–20 to 80 °C (–4 to 140 °F); 95% relative humidity, non-condensing.
Operating temperature	0 to 50 °C (32 to 122 °F) for one SS7 sc on an sc100; 0 to 40 °C (32 to 104 ° F) for one SS7 sc and another smart sensor that consumes less than 5 watts on a single sc100. See Figure 1 on page 6.
Sample temperature range	0 to 50 °C (32–122 °F); HST model—0 to 70 °C, intermittent 70 to 80 °C. (An approved heat exchanger is available to reduce sample temperature.)
Operating humidity	5 to 95% non-condensing
Power requirements	12 VDC ±5%, 20 watts maximum (provides by sc100)
Sample inlet fitting	¾-in. NPT female
Overflow drain fitting	1-in. NPT female
Body drain fitting	¾-in. NPT female
Alr purge fitting	¼-in. quick-connect compression fitting; 0–50SCFH airflow of clean instrument air
Signal average (filter) time	No averaging, 6, 30, 60 and 90 seconds, user selectable. Default is 30 seconds.
Sensor dimensions	64.2 x 67.5 x 19.0 cm (25.3 x 26.6 x 7.5 in.)
Sensor cable length	2 m (6.6 ft); Optional 7.62 m (25 ft) extension cable. Maximum cable length is 9.62 m (31.6 ft).
Sensor cable rating	Cable: 105 °C, 300 V, PVC jacket Wires: 22 AWG, PVC jacket
Mounting options	Wall
Shipping weight	SS7 sc—15.8 kg (34.8 lb); SS7 sc-HST—18 kg (39.6 lb)
Calibration method	Formazin – user-prepared primary or wet calibration of the instrument
Verification (dry) method	Standardization plates with approximate values of 100 or 1000 NTU. Unique value is assigned when dry verification is done immediately after calibration and is used with pass/fail criteria for subsequent verifications.
Recommended cleaning intervals	Mandatory before calibration Optional before verification Mandatory upon verification failure
Languages	English (default), German, French, Spanish, Italian, Swedish, Polish, Korean, Chinese, Japanese
Installation environment	Indoor
Primary compliance method	USEPA 180.1; Hach Method 8195; ASTM D 6698; Standard Methods 2130B

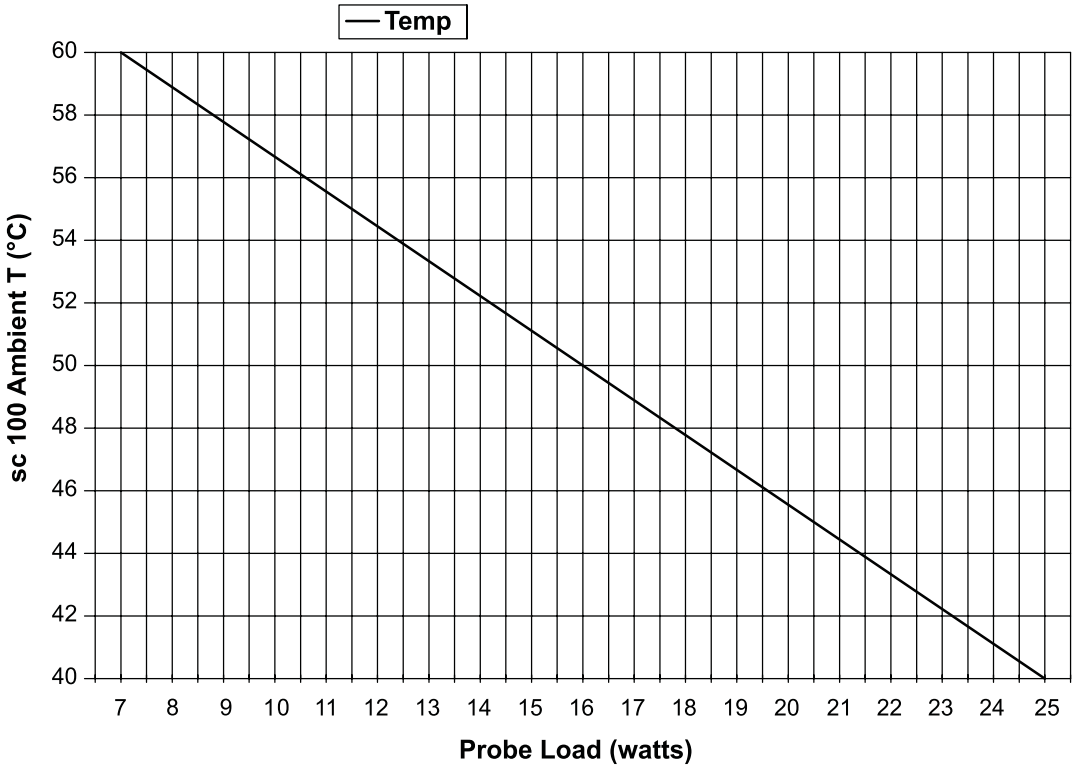


Figure 1 Maximum ambient temperature vs. probe load

Section 2 General information

2.1 Safety information

Please read this entire manual before unpacking, setting up or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: *Information that requires special emphasis.*

Note: *Information that supplements points in the main text.*

2.1.2 Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol, if noted on the instrument, will be included with a danger or caution statement in the manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of life equipment to the Producer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories and all auxiliary items for proper disposal.*
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol, when noted on the product, indicated the presence of devices sensitive to Electro-static Discharge (ESD) and indicated that care must be taken to prevent damage with the equipment.

2.2 General product information

2.2.1 Instrument description

The Surface Scatter® 7 sc (SS7 sc) Turbidimeter is a sensitive, continuous-monitoring instrument designed for measuring turbidity in fluids. The instrument design is based on the nephelometric principle, where light scattered by particles suspended in the fluid is measured to determine the relative amount of particulate matter in the fluid. It meets all U.S. Environmental Protection Agency (USEPA) design criteria, features an automatic-ranging digital display and is capable of measuring turbidities from 0–9999 NTU. Calibration is based on formazin, the primary turbidity reference standard adopted by the APHA Standard Methods for the Examination of Water and Wastewater and the USEPA. The instrument consists of a control unit and a sample unit (Figure 2).

DANGER
The SS7 sc and SS7 sc-HST Turbidimeters are not designed for use with samples that are flammable or explosive in nature. If any sample solution other than water is used in this product, test the sample/product compatibility to assure user safety and proper product performance.

DANGER
The SS7 sc/sc100 product configuration is not intended for installation in hazardous locations. See the sc100 installation control drawing 58600-78 for approved hazardous location sensors.

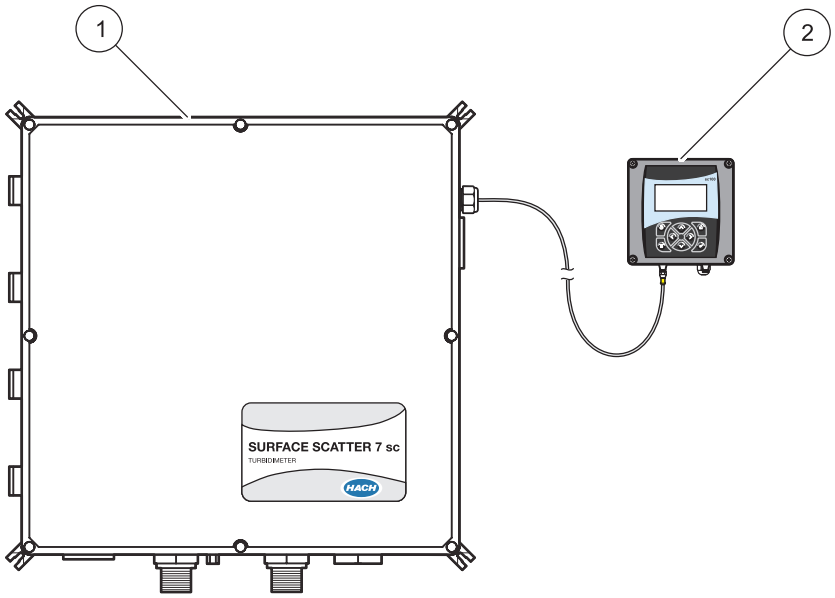


Figure 2 SS7 sc Turbidimeter

1	Sample unit	**2**	Control unit

2.2.1.1 Controller

The SS7 sc and SS7 sc-HST operate in conjunction with an sc100 controller. The controller enclosure houses the keypad, display, microprocessor board and power supply components.

Operating controls and indicators are on the controller. The controller is used to program the instrument for turbidity level alarm set points and to perform diagnostic self-tests and programming operations.

Sample turbidity is displayed continually by the digital display during normal operation. Because of the automatic decimal point positioning, no range selection is needed. Indicators of turbidity level alarm conditions, certain critical system malfunctions or other possible malfunctions are also on the controller.

Programmable alarm circuits provide three relay closures, both normally open and normally closed, for selectable turbidity alarm level set points. Set points can be programmed by the operator anywhere within the overall range. The alarm circuits can be programmed for Alarm, Feeder Control, Event Control, PWM Control, Frequency Control and Warning. Refer to the sc100 manual for setup and use of these different settings. An alarm relay can be programmed in the sc100 to control the optional Auto Flush Kit.

The sc100 controller is designed to meet NEMA 4X water-tight requirements. It is constructed of corrosion-proof materials. It is suitable for indoor installation. Mounting hardware is included with the sc100 to provide the capability to wall mount, pipe mount and panel mount the controller without affecting the environmental integrity of the case. Electrical access holes are sized for ½-in. conduit.

2.2.1.2 Sample unit

Sample flows through the sample unit (Figure 3) where sample turbidity is measured. The sample unit enclosure contains all the electronics for measuring the turbidity. A NEMA 12, corrosion-proof case protects the optical components and hydraulics from industrial environments and supplies the measurement signal to the control unit. The case is designed for wall mounting with external mounting blocks.

Hydraulic connections to the sample unit are at the bottom of the enclosure. An air purge fitting is installed in the enclosure bottom. Air purge is suggested to control condensation inside the enclosure.

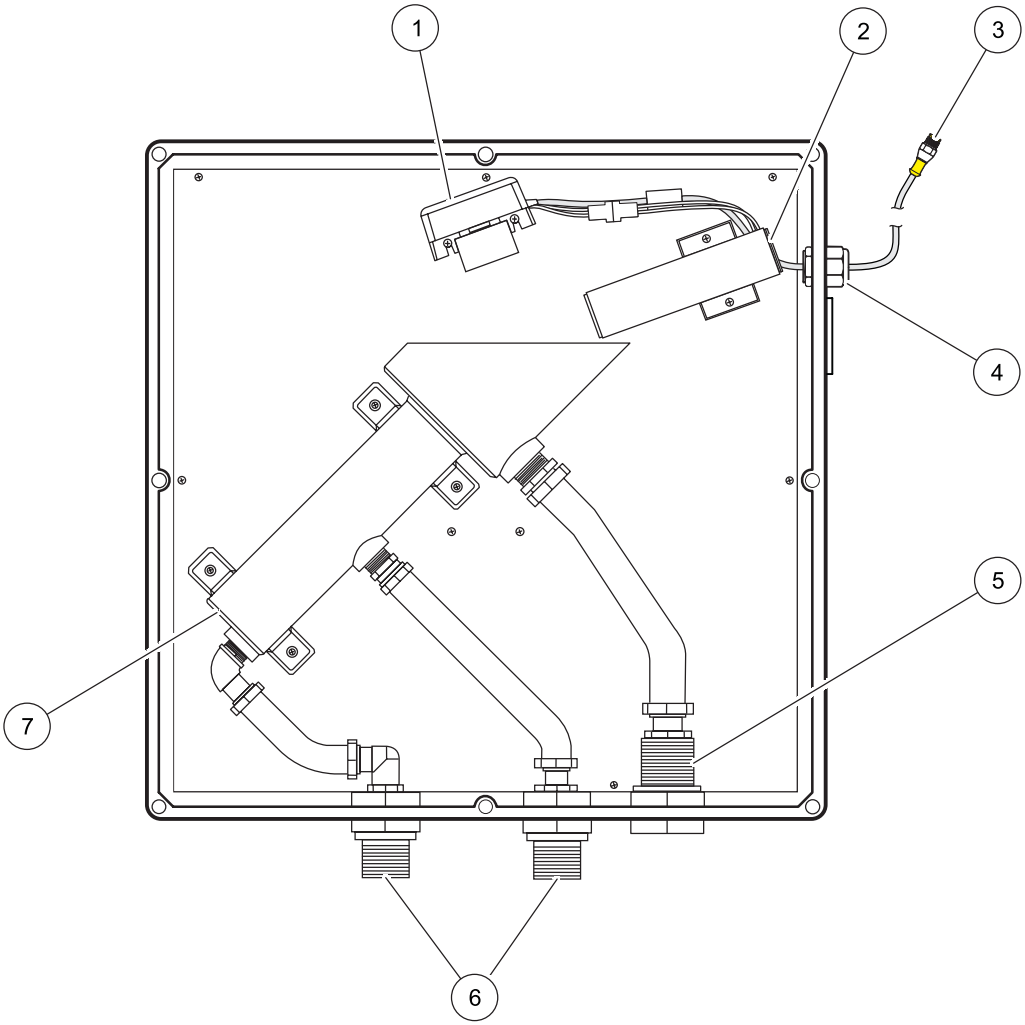


Figure 3 SS7 sc components

1	Detector assembly (Cat. No. 71221-00)	**5**	Bulkhead fitting, 1-in. NPT (Cat. No. 40355-00)
2	Light source assembly (Cat. No. 45004-00)	**6**	Bulkhead fittings, ¾-in. NPT (Cat. No. 40311-00)
3	To sc100	**7**	Turbidimeter body (Cat. No. 45002-00)
4	Cord grip (Cat. No. 61287-01)		

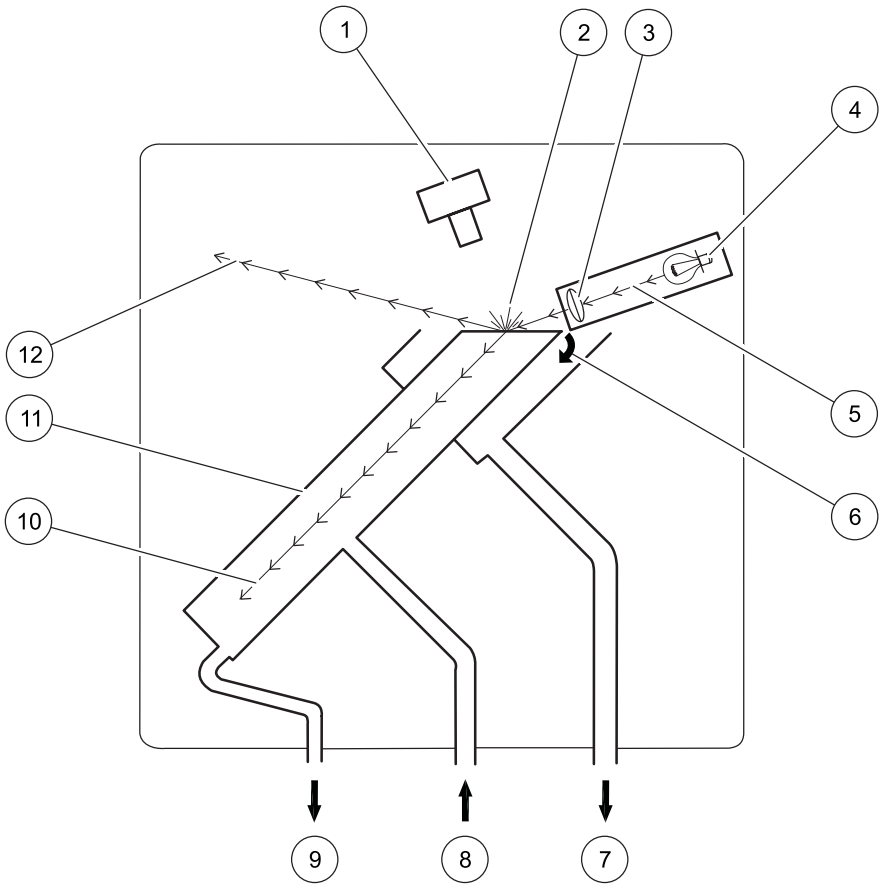


Figure 4 Optical diagram

1	Detector assembly	**5**	Light beam	**9**	Instrument drain
2	Scattered light	**6**	Over-flowing sample	**10**	Refracted light
3	Lens	**7**	Overflow drain	**11**	Turbidimeter body
4	Lamp	**8**	Sample in	**12**	Reflected light

2.2.2 Surface Scatter 7 sc High Sample Temperature

The Surface Scatter 7 sc High Sample Temperature Turbidimeter (SS7 sc-HST) has been designed for high sample temperature. The basic design and principle of operation are the same as the standard SS7 sc model. Differences between the standard and HST models will be noted in this manual where appropriate.

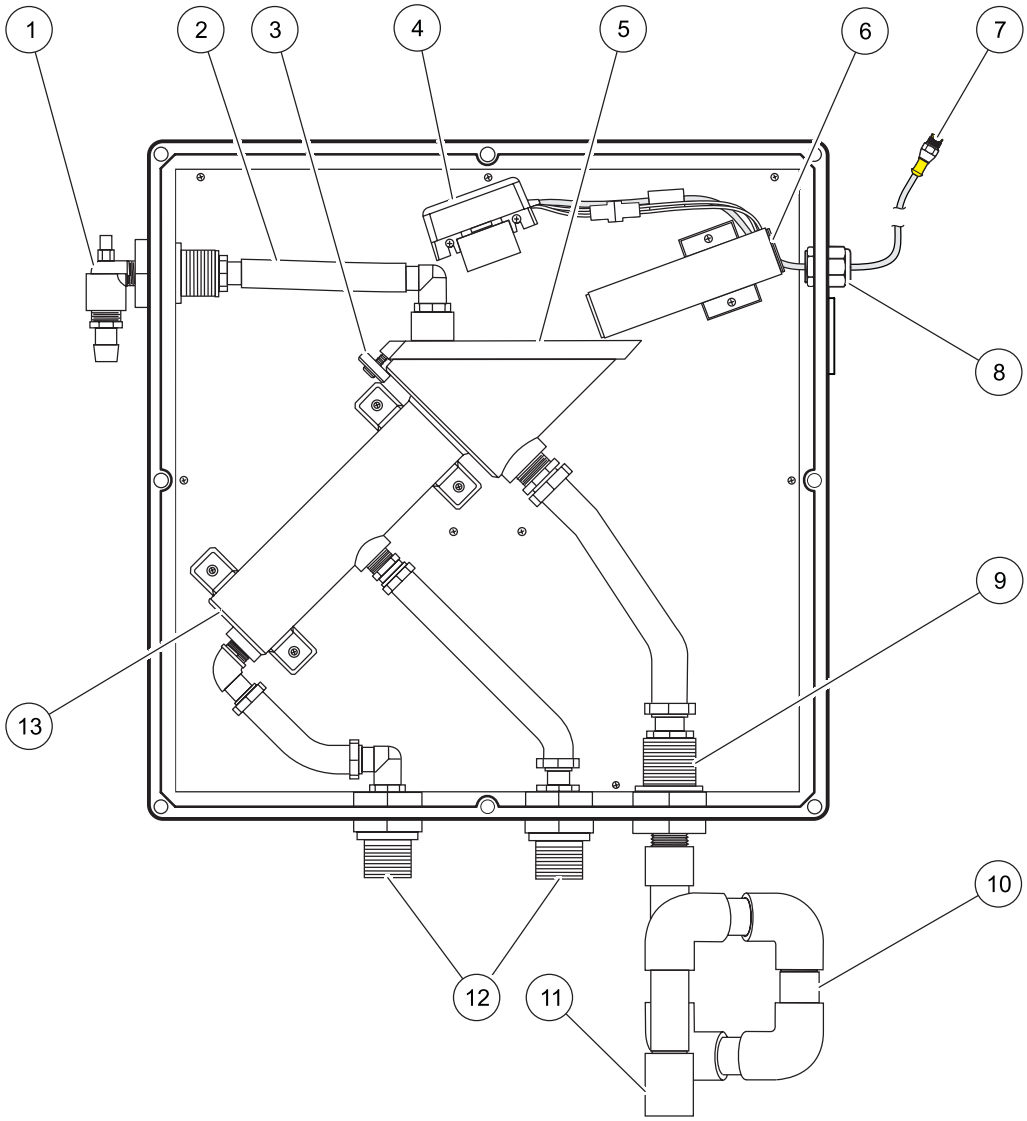


Figure 5 SS7 sc-HST components

1	Flow multiplier	**8**	Cord grip (Cat. No. 61287-01)
2	¾-in. hose	**9**	Bulkhead fitting, 1-in. NPT (Cat. No. 40355-00)
3	Threaded disk (Cat. No. 40299-00) with ¼-in. screw (Cat. No. 7858-11)	**10**	Drain trap
4	Detector assembly (Cat. No. 71221-00)	**11**	1-in. NPT gravity drain
5	Vent cover (Cat. No. 40294-00)	**12**	Bulkhead fittings, ¾-in. NPT (Cat. No. 40311-00)
6	Light source assembly (Cat. No. 45004-00)	**13**	Turbidimeter body (Cat. No. 45002-00)
7	To sc100		

Section 3 Installation

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual. The SS7 sc/sc controller product configuration is not intended for installation in hazardous locations.

The tasks described in this section requires individuals to be technically knowledgeable of the associated dangers. Burns, shock, eye damage, fire and chemical exposure may occur if this work is not done by qualified personnel. Always review appropriate Material Safety Data Sheets (MSDS) before working with chemicals.

3.1 Basic installation overview

1. Unpack the SS7 sc or SS7 sc-HST Turbidimeter (section 3.2).
2. Review the environmental requirements and select the mounting location (section 3.3.2 on page 15).
3. Mount the sample unit (section 3.3.3 on page 15).
4. Install the optional heat exchanger, if required (section 3.3.4 on page 17).
5. Install the 3-way ball valve, if required (section 3.3.5 on page 18).
6. Connect the sample in, body drain and overflow drain (section 3.5 on page 19).
7. Connect the air purge valve (section 3.6 on page 22).
8. Connect the sample unit to the controller to supply power to the system (section 3.7.2 on page 22).

3.2 Unpacking the instrument

1. Remove the instrument from the shipping carton.
2. Verify that no visible damage has occurred during shipment. Be sure the following items are included in the carton:
   - Sample unit
   - Instruction manual
   - Installation kit items (Figure 6)

Contact the manufacturer immediately to report missing or damaged items.

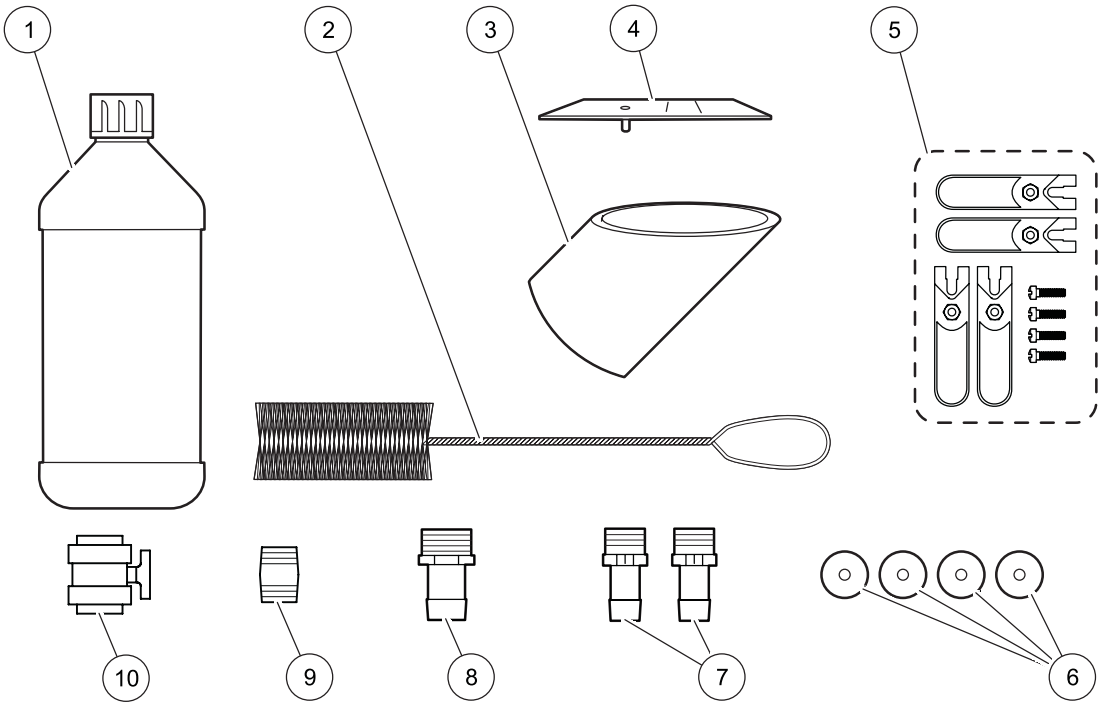


Figure 6 Installation kit items[1]

1	Formazin stock solution, 4000 NTU, 500 mL	**6**	Washer, ¼ ID x 1.00 OD (4x)
2	Brush, cylinder, size 2	**7**	Adapter, barb fitting, ¾" NPT to ¾" ID hose barb (2x)
3	Calibration cup, SS7 sc	**8**	Adapter, barb fitting, 1" NPT to 1" ID hose
4	Light source alignment plate	**9**	Nipple, ¾" NPT
5	Wall mounting kit	**10**	Drain valve

[1] See Section 8 Replacement parts and accessories on page 49.

3.3 Mechanical installation

3.3.1 Environmental requirements

The SS7 sc and SS7 sc-HST enclosures are designed for general-duty, indoor installation. Ambient temperatures within specifications are allowed, but best performance will result if temperature does not change rapidly. Do not mount in direct sunlight. Shield from dripping water.

The controller enclosure is designed to protect the electronics from typical conditions in water treatment and industrial facilities.

3.3.2 Selecting the installation location

Turbidimeters should always be located as close to the sampling point as possible. The shorter the distance traveled by the sample to the turbidimeter, the faster the turbidimeter can respond and indicate changes in sample turbidity.

Dimensions and other installation information are shown in Figure 7 on page 16, Figure 8 on page 17 and Figure 9 on page 18. The control and sample unit are designed for wall mounting. The turbidimeter sensor must be mounted within six feet of the controller unless an extension cable is used. Maximum cable length is 9.6 m (31.5 ft).

3.3.3 Mounting the SS7 sc or SS7 sc-HST

1. To ensure proper performance, the sample unit must be level (Figure 8 on page 17). Use a small level across the top opening of the turbidimeter body to verify that the instrument does not slope left-to-right or front-to-back.
2. Use one rubber washer (supplied) at each wall mounting block between the block and the wall. Mounting blocks are secured to the four corners of the sample unit to facilitate wall mounting without affecting the integrity of the enclosure protection.
3. Attach the sample unit to the wall with four customer-supplied mounting bolts.

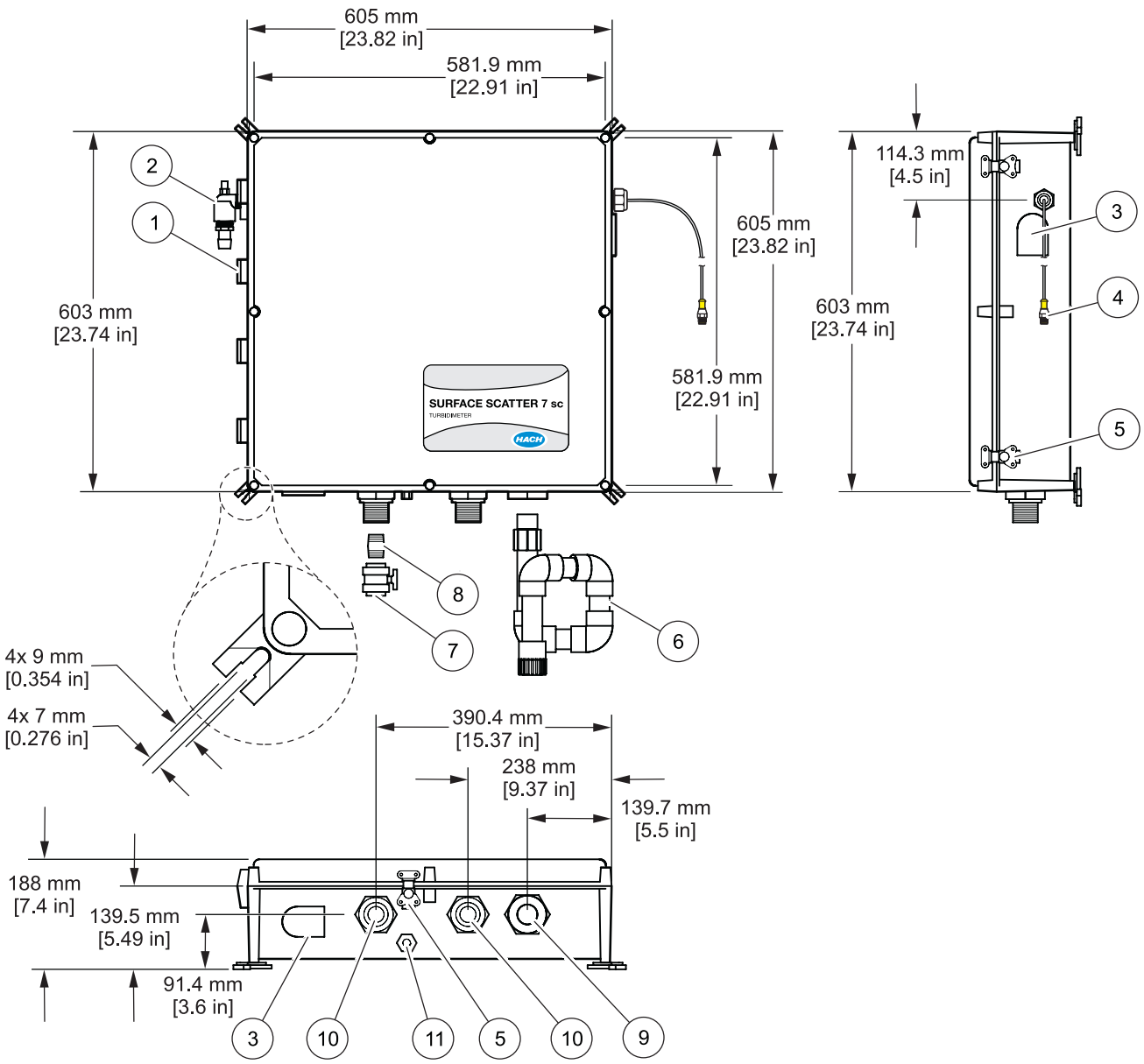


Figure 7 SS7 sc and SS7 sc-HST installation drawing

1	Door hinges (4x)	**7**	Ball valve
2	Flow multiplier (SS7 sc-HST only)	**8**	¾-in. NPT nipple
3	Ventilator (2x)	**9**	1-in. NPTF bulkhead fitting
4	Cable assembly	**10**	¾-in. NPTF bulkhead fitting
5	Enclosure door latch (4x)	**11**	Air purge fitting
6	Drain trap (SS7 sc-HST only)		

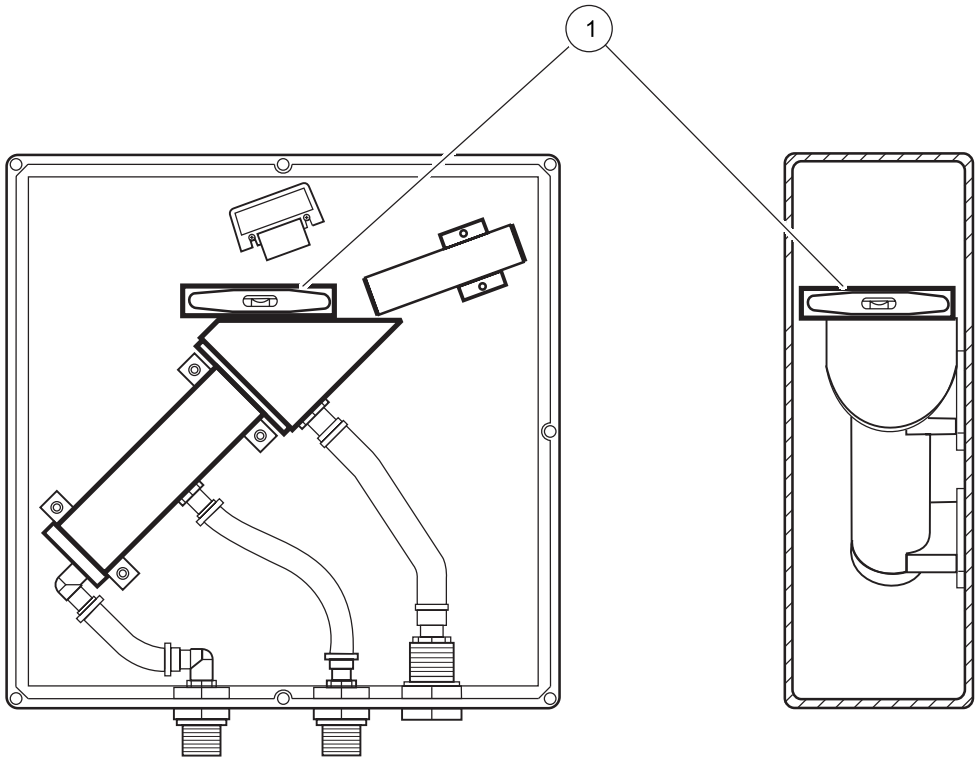


Figure 8 Instrument leveling

1	Level

3.3.4 Installing the optional heat exchanger

An optional heat exchanger (Cat. No. 48551-00) is available for the SS7 sc-HST (Figure 9 on page 18). The heat exchanger reduces sample temperatures that exceed the temperature requirements of the instrument. It can reduce sample temperatures of up to 100 °C but is not suitable for steam or super-heated water. A source of cooling water is required. The heat exchanger is made of 316 stainless steel and has ¾" MNPT pipe connections. The large plumbing connections help eliminate clogging.

- Allow adequate space below and to the right (latch) side of the sample unit to make hydraulic connections.
- See Figure 9 on page 18 for installation dimensions.
- See Figure 11 on page 20 for heat exchanger connections.

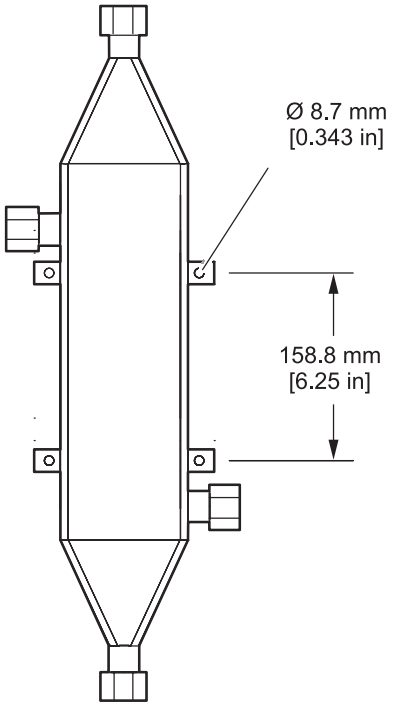


Figure 9 Heat exchanger dimensions

3.3.5 Installing the 3-way ball valves

CAUTION
Installation should be performed by qualified technical personnel to ensure adherence to all applicable electrical and plumbing codes.

Refer to the Auto Flush Kit Instruction Sheet (Cat. No. 46692-88) for complete installation instructions.

3.4 Installing a sample line

Sample lines diameter must be appropriate for the sample type. Choose a line size that minimizes lag time, but also minimizes plugging with solids.

- Route the sample line as directly as possible.
- Using long or large diameter sample lines will result in a significant lag time between actual process conditions and instrument measurements.
- When larger diameter sample lines or long distances are unavoidable, increase flow to the instrument and bypass excess flow to the drain or back to process.
- Install sample line taps into larger process pipes to minimize the chances of ingesting sediment from the pipe-line bottom or air bubbles from the top. A tap projecting into the center of the pipe is ideal. Figure 10 shows both good and poor methods of installing a sample tap.

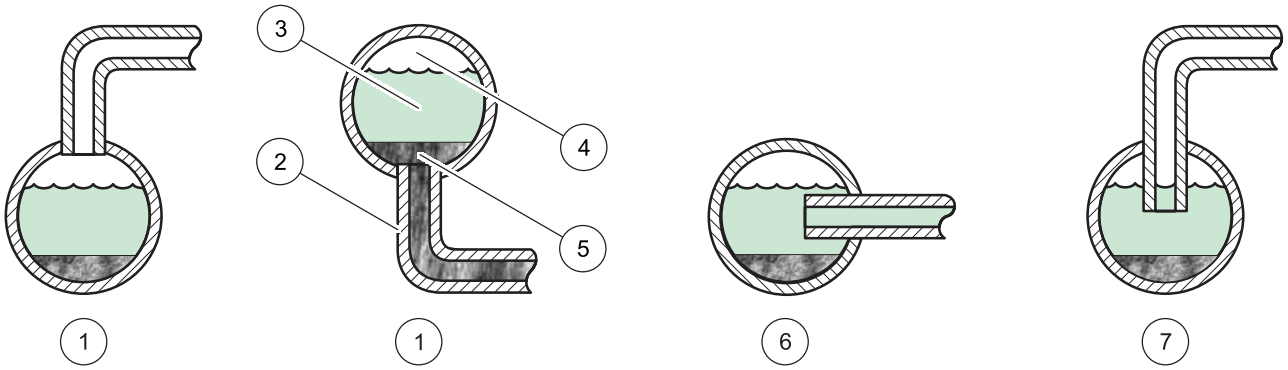


Figure 10 Sampling techniques

1	Poor	**5**	Sediment (typical)
2	Sampling line to sample unit	**6**	Good
3	Sample flow	**7**	Best
4	Air (typical)		

3.5 Connecting hydraulics

Note: *When connecting the hydraulics to the bottom of the unit, hold the ¾-in. bulkhead adapters on the inside of the enclosure with the door open.*

The sample in, body drain and overflow drain are connected to the instrument as shown in Figure 4 on page 11. The sample inlet port is fitted with a ¾" NPT female fitting with ¾" ID hose barb adapter fitting. A ball valve is supplied with the instrument to drain the turbidimeter body. Hose barb adapter fittings for sample in and both drain fittings are also supplied.

A Bubble Trap/Head Regulator (Cat. No. 46680-00) is recommended if the sample cannot be delivered bubble-free to the analyzer. The device may also be used as to dampen fluctuations in flow due to pulses from a pump and/or sample pressure.

Using the Bubble Trap/Head Regulator will increase response time to changes in sample concentration. The increase in response time may vary from 1–2 minutes at 2 L/min. For fastest response time, use the highest flow practical for sample conditions. Higher flows decrease the effectiveness of bubble removal. The need for fast response time and bubble removal must be balanced for optimum performance.

Install the Bubble Trap/Head Regulator so the overflow is at least five inches above the top of the sample unit enclosure (Figure 11 on page 20). However, installation height can vary based on local sample conditions and flow requirements. See the installation instructions supplied with the Bubble Trap/Head Regulator for more information.

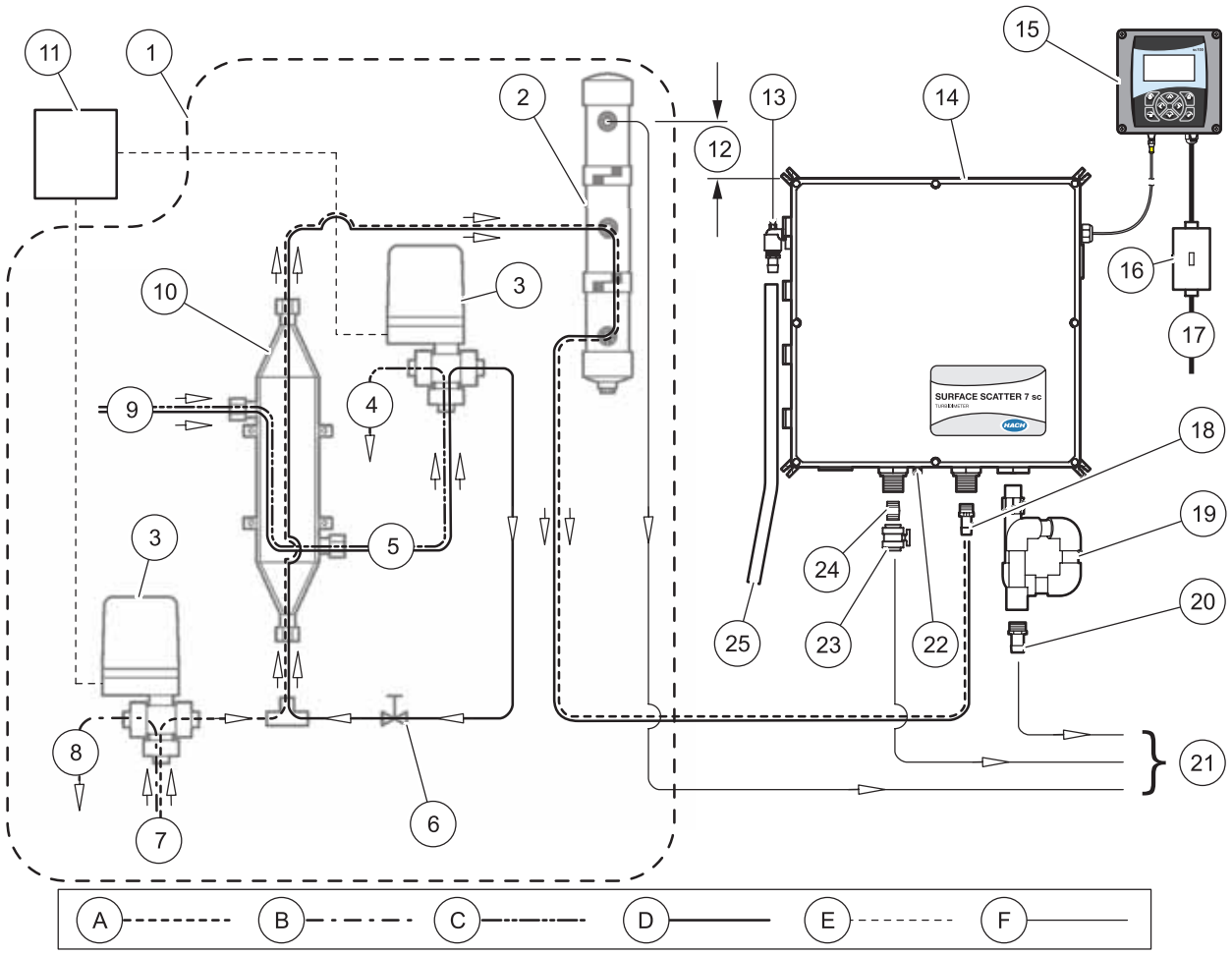


Figure 11 SS7 sc-HST plumbing diagram

1	Optional items	**14**	Sample unit
2	Bubble trap	**15**	sc100
3	3-way ball valve (Auto Flush Kit)	**16**	Customer supplied power on/off switch box (NEMA 4X) required for agency compliance
4	Cooling water to drain	**17**	Power in for sc100
5	Cooling water out	**18**	¾-in. NPT adapter (supplied)
6	Flow control valve	**19**	Drain Trap (Customer-supplied)
7	Sample in	**20**	1-in. NPT adapter (supplied)
8	Sample bypass during flush cycle	**21**	To drain
9	Cooling water in	**22**	¼-in. air purge fitting (50 SCFH instrument air max)
10	Heat exchanger	**23**	Ball valve (supplied)
11	Electrical box connection	**24**	¾-in. NPT nipple (supplied)
12	127 mm (5 in.) minimum	**25**	Customer supplied hose to drain
13	Customer supplied air for flow multiplier		

A	Sample during normal operation	**D**	Cooling water during auto flush
B	Sample bypass during auto flush	**E**	Electrical
C	Cooling water in normal operation	**F**	Drain

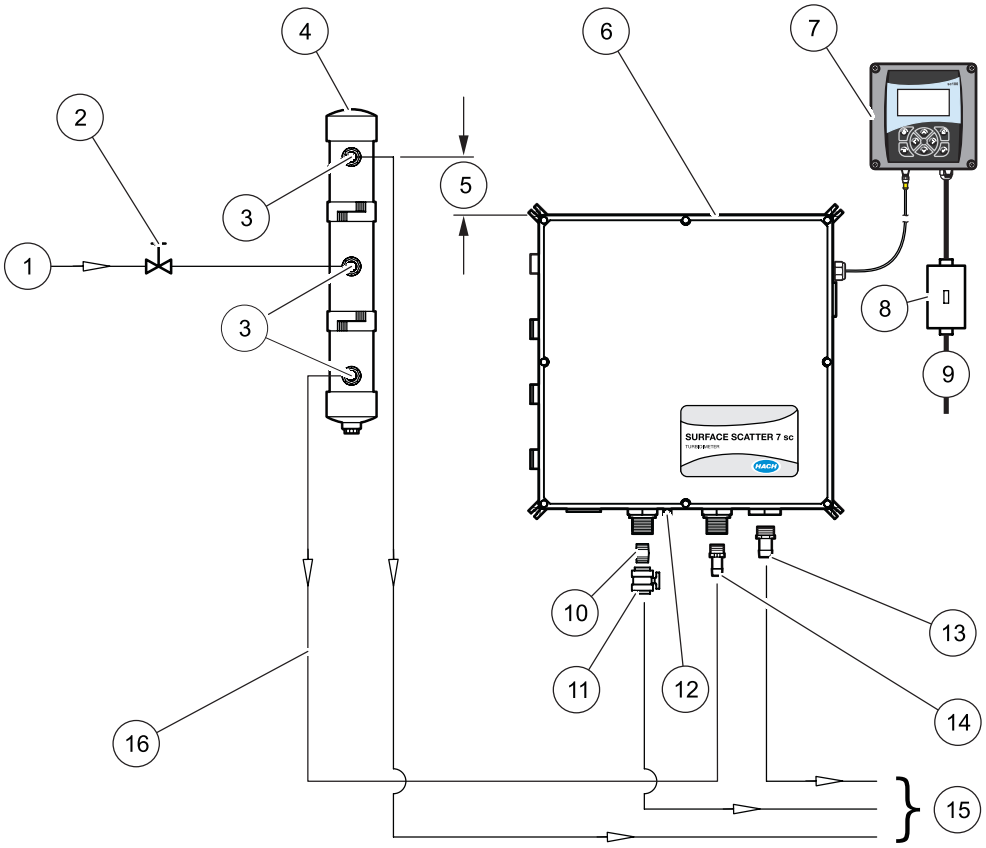


Figure 12 SS7 sc plumbing diagram

1	Sample in	**9**	Power in for sc100
2	Flow control valve (recommended)	**10**	¾-in. NPT nipple (supplied)
3	¾-in.NPT x ¾-in. ID Hose Adapter (supplied with bubble trap)	**11**	Ball valve (supplied)
4	Bubble trap (optional)	**12**	¼-in. air purge fitting (50 SCFH instrument air max)
5	127 mm (5 in.) minimum	**13**	1-in. NPT nipple (supplied)
6	Sample unit	**14**	¾-in. NPT nipple (supplied)
7	sc100	**15**	To drain
8	Customer supplied power on/off switch box (NEMA 4X) required for agency compliance	**16**	¾-in. ID hose (customer supplied)

3.6 Connecting the air purge fitting

Air purge helps control condensation and corrosive vapors within the sample unit and is recommended. Use dry instrument air only. See Figure 11 and Figure 12 for installation details.

3.7 Electrical installation

3.7.1 Wiring safety information

When making any wiring connections to the instrument, the following warnings and notes must be adhered to, as well as, any warnings and notes found throughout the individual installation sections. For more safety information refer to section 2.1 on page 7.

DANGER
Always disconnect power to the sc controller when making electrical connections.

3.7.1.1  Electrostatic discharge (ESD) considerations

Important Note: *To minimize hazards and ESD risks, maintenance procedures not requiring power to the analyzer should be performed with power removed.*

Delicate internal electronic components can be damaged by static electricity, resulting in degraded instrument performance or eventual failure.

The manufacturer recommends taking the following steps to prevent ESD damage to your instrument:

- Before touching any instrument electronic components (such as printed circuit cards and the components on them) discharge static electricity by touching an earth-grounded metal surface such as the chassis of an instrument or a metal conduit or pipe.
- To avoid static electricity buildup and to keep it discharged, wear a wrist strap connected by a wire to earth ground.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
    - Handle all static-sensitive components in a static-safe area. If possible, use anti-static floor pads and work bench pads.

3.7.2 Connecting/wiring the SS7 sc or SS7 sc-HST to the sc100 controller

3.7.2.1 Attaching the SS7 sc with a quick-connect fitting

The SS7 sc/SS7 sc-HST cable is supplied with a keyed quick-connect fitting for easy attachment to the controller (Figure 13). Retain the connector cap to seal the connector opening in case the cable must be removed. The original six-foot cable may be extended by a maximum of 9.6 m (31.2 ft), see Replacement parts and accessories on page 49.

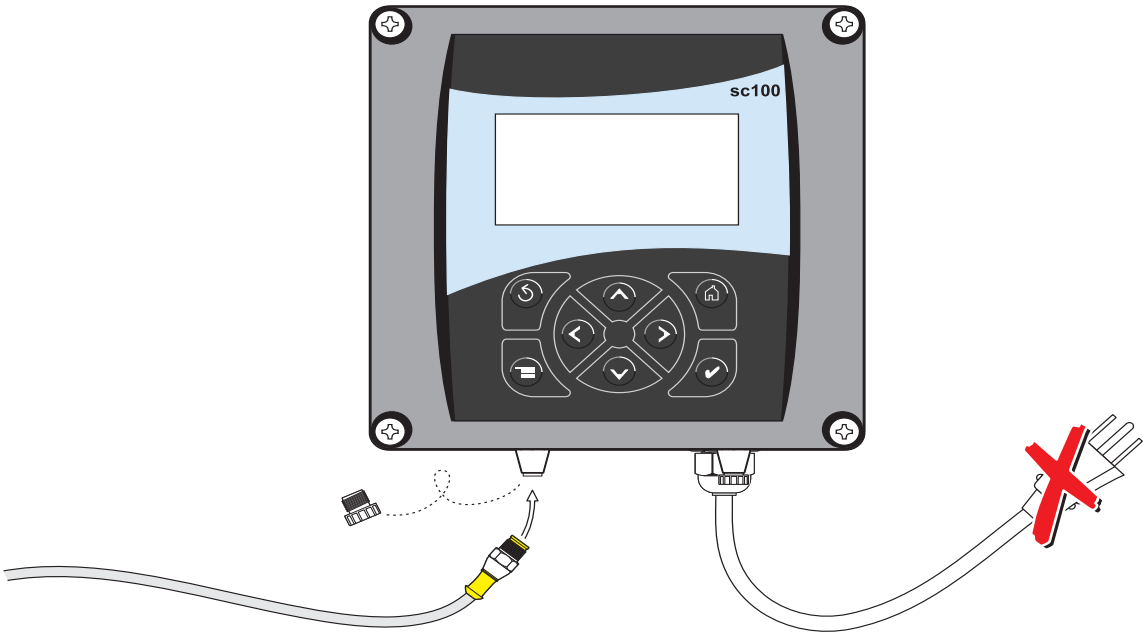


Figure 13 Attaching the SS7 sc/SS7 sc-HST using the quick-connect fitting

3.7.2.2 Hard-wiring the SS7 sc to the sc100 controller

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing wires between the quick-connect and terminal strip J5 (Figure 14).
4. Remove the quick-connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.
5. Cut the connector from the SS7 sc cable.
6. Strip the insulation on the cable back 1-inch. Strip ¼-in. of each individual wire end.
7. Pass the cable through conduit and a conduit hub or a strain relief fitting (Cat. No. 16664-00) and an available access hole in the controller enclosure. Tighten the fitting.
8. Use of strain relief fitting other than Cat. No. 16664-00 may result in a hazard. Use only the recommended strain relief fitting to assure the continued NEMA 4X enclosure rating.
9. Reinstall the plug on the sensor access opening to maintain the environmental rating.
10. Wire as shown in Table 1 and Figure 14.
11. Close and secure the cover.

Table 1 Wiring the SS7 sc at terminal block J5

Terminal number	Terminal designation	Wire color
1	Data (+)	Blue
2	Data (–)	White
3	Service request	No connection
4	+12 V dc	Brown
5	Circuit common	Black
6	Shield	Shield (gray wire in existing quick disconnect fitting)

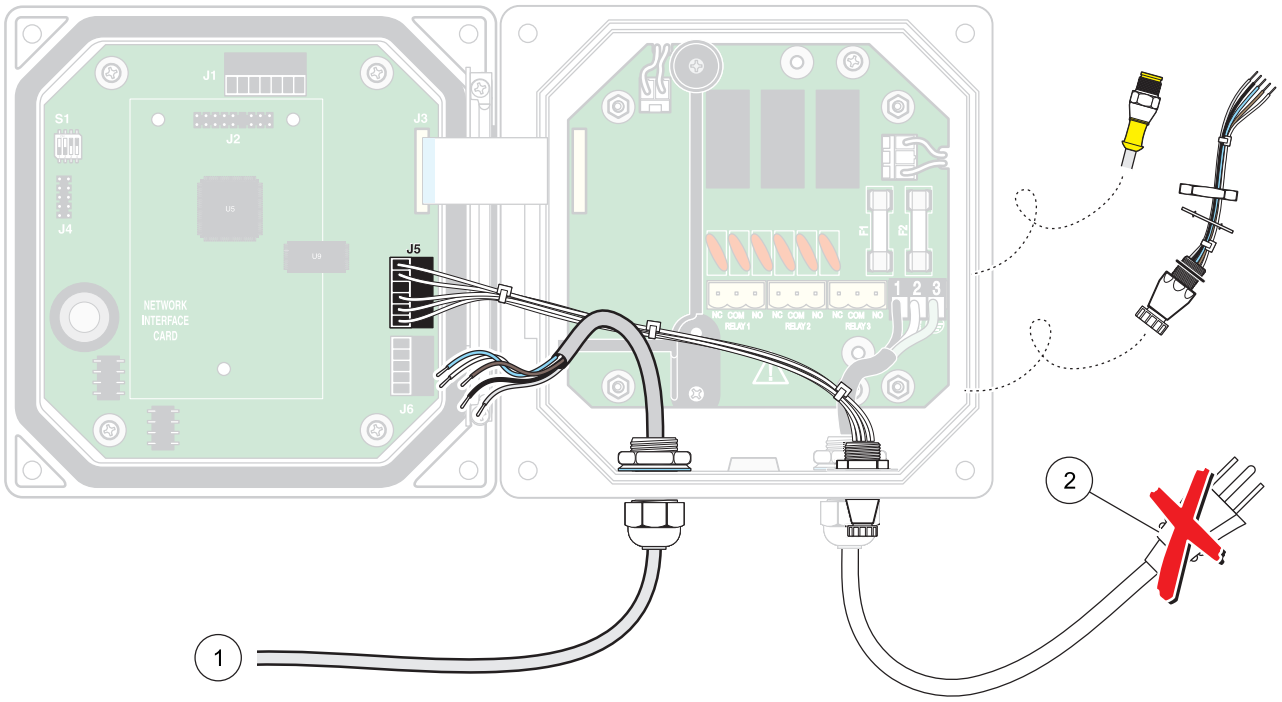


Figure 14 Hard-wiring the SS7 sc

1	From SS7 sc	**2**	Disconnect power

Section 4 System startup

4.1 General operation

1. Plug the SS7 sc/SS7 sc-HST into the unpowered controller by aligning the orientation tab on the cable connector with the channel in the controller connector.
2. Push in and turn the threaded collar to secure the connection. Tug gently to check the connection.
3. After all plumbing and electrical connections have been completed and checked, supply power to the system.
4. Ensure the sample unit door is securely latched when power is applied, since dark readings are measured at this time. If power is applied while the door is open, cycle the power with the door closed. The dark readings are measured again one hour after the power-up.
5. The first time a controller is powered up, a language selection menu will appear. Select the correct language from the displayed options.
6. Following language selection and upon power-up, the controller will search for connected sensors. The display will show the main measurement screen.

4.2 Starting sample flow

1. Start sample flow through the instrument by opening the sample supply valve.
2. Allow the turbidimeter to run long enough for the tubing and body to become completely wetted and the reading on the display to stabilize. One to two hours or longer may be required initially for complete stabilization.
3. Allow measurements to become stable through adequate conditioning before completing instrument settings or performing calibrations.

Section 5 Operation

5.1 Sensor setup

When a sensor is initially installed, the sensor name will be displayed. To change the sensor name refer to the following instructions:

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CONFIGURE and confirm.
4. Select EDIT NAME and edit the name. Confirm or cancel to return to the Sensor Setup menu

5.1.1 Configuring the bubble reject

Bubble Reject eliminates high measurements that are likely due to air trapped in the sample.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Highlight the appropriate sensor if more than one sensor is attached and confirm.
3. Select CONFIGURE and confirm.
4. Select BUBBLE REJECT and confirm.
5. Select YES or NO and confirm.
   - When NO is selected, all measurements within the Signal Average window will be averaged to determine the measured value.
   - Choosing YES eliminates a percentage of the high values and averages the remaining values to determine the measured value.

5.1.2 Configuring the signal average

The Signal Average function creates a running average of the previous 6, 30, 60 or 90 seconds or no averaging, depending on the selected signal average.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Highlight the appropriate sensor if more than one sensor is attached and confirm.
3. Select CONFIGURE and confirm.
4. Select SIGNAL AVG and confirm.
5. Select the signal average time interval and confirm.

5.2 Sensor data logging

The controller provides two data logs (one for each sensor) and two event logs (one for each sensor). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through the digital network port, service port or the IrDA port. DataCom (Cat. No. 59256-00 or download from www.hach.com) is needed for downloading logs to a computer. If the datalogging frequency is set to 15 minute intervals, the instrument can continue to store data for approximately six months.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. Highlight the appropriate sensor if more than one sensor is attached and confirm.
3. Select CONFIGURE and confirm.
4. Select the datalog interval (5 seconds, 30 seconds, 1 minute, 2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 60 minutes or 4 hours). Confirm.

5.3 Sensor diagnostics menu

SELECT SENSOR	
ERROR LIST	See section 7.1 on page 45.
WARNING LIST	See section 7.2 on page 45.

5.4 Sensor setup menu

SELECT SENSOR (if more than one sensor is attached)	
CALIBRATE	
PERFORM CAL	Calibration using 4000 NTU stock solution
VERIFICATION	Perform a verification, set the pass/fail criteria and view the verification history.
0 ELECTRONICS	Zero electronics
CAL HISTORY	View the last 12 entered calibrations. Confirm to move to the next history entry. See section 5.6 on page 34 for more information.
CONFIGURE	
BUBBLE REJECT	Choose Yes or No to enable/disable bubble reject. Default: Yes
SIGNAL AVG	Choose no averaging or specify the amount of time for signal averaging. Available options are: no averaging, 6 sec., 30 sec., 60 sec. or 90 sec. Default is 30 seconds.
MEAS UNITS	Select the appropriate measurement units to display. Choose from mg/L, NTU, FTU and NO UNITS. Default: NTU
EDIT NAME	Enter up to a 12-digit name in any combination of symbols and alpha or numeric characters. Confirm when the entry is complete. The name will be displayed on the status line above the measurement value on the main display. Default is SS7.
SET RESOLUTION	Set the number of significant digits to display. Default is one significant digit.
DATALOG INTRVL	Choose the amount of time between saving data points to the data log. Default: 15 min.; Options: 5 seconds, 30 seconds, 1 minute, 2 minutes, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 60 minutes or 4 hours.

5.4 Sensor setup menu (continued)

DIAG/TEST	
INST STATUS	Displays the software and hardware versions.
SERIAL NUMBER	Displays the serial number of the sensor.
INT TEMP	Displays the internal temperature of the sensor electronics in °C.
DEFAULT SETUP	Restores the sensor factory default settings. Calibration is not affected.
POWER CHECK	Displays the electrical statistics for the sensor.
SERVICE MODE	Allows SS7 sc to be run in normal or service mode. Analog outputs can be in ACTIVE, HOLD or TRANSFER mode. Data logging is disabled. Protected by MAINTENANCE password.
SERVICE DIAG	Accessible with service password only.

5.5 Sensor calibration and verification

5.5.1 Standardization and calibration

DANGER
To become familiar with handling precautions, dangers and emergency procedures, always review the Material Safety Data Sheets prior to handling containers, reservoirs and delivery systems that contain chemical reagents and standards. Protective eye wear is always recommended when contact with chemicals is possible.

Note: *Due to the ease with which the calibration cylinder method calibration can be performed, better accuracy can be maintained by performing a calibration at monthly intervals instead of the standardization check. Periodic calibration with a formazin primary standard is recommended for best absolute accuracy.*

5.5.2 Calibration

The manufacturer recommends calibrating the Surface Scatter 7 sc instrument at least every three months or any time the light source is replaced or adjusted. If calibration is performed with a formazin standard, refer to section 5.5.2.1 on page 30.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CALIBRATE and confirm.
4. Select PERFORM CAL and confirm. Select the available Output Mode (Active, Hold or Transfer) and confirm.
5. Enter the STD VALUE and confirm. Confirm to continue.
6. Follow the display prompt and place standard into the calibration cup. Close the sensor door and confirm to continue.
7. The TURB value displayed is the standard value determined using the gain from the previous calibration. Confirm to accept and continue with the calibration.

8. If no selection is made for a set period of time, the screen will prompt to remix the standard to avoid a change in the value of the standard.
   a. Open the SS7 sc and remix the standard.
   b. Close the door and confirm to continue.
9. Confirm to calibrate. When the calibration is completed successfully, confirm to accept the calibration.
10. Enter the initials of the user performing the calibration and confirm.

Note: *After confirmation of return to measurement mode, the instrument will equilibrate for 2 minutes before the output mode changes. Instrument measurements will show on the display, but the value will flash and a "OUT MODE WARN" warning will display until the 2-minute equilibration period is complete.*

5.5.2.1 Calibration cylinder method

A calibration cylinder and a 500-mL bottle of 4000 NTU formazin primary standard solution are included for convenient calibration of the SS7 sc. After the formazin standard is added to the cylinder, the instrument is set to the value of the standard.

1. Prepare the formazin standard solution at the desired NTU value. The 4000-NTU standard supplied with the instrument can be used at full strength and only requires mixing (by inverting the bottle repeatedly). If a dilution of the 4000-NTU standard is desired, the manufacturer recommends it be no lower than 300 NTU. Dilutions must be made just prior to use. Dilute formazin solutions are unstable and should be discarded when calibration is complete. Use filtered sample or demineralized water for dilution.
2. Turn off sample flow to the instrument and drain the turbidimeter body. Insert the calibration cylinder into the top of the body (Figure 15 on page 31).
   a. Select the PERFORM CAL menu entry and confirm.
   b. Select the Active, Hold or Transfer output mode and confirm.
   c. Edit the standard value and confirm.
3. Follow the display prompts and pour the formazin standard solution into the cylinder, allowing it to overflow. Only allow the solution to stand long enough to allow bubbles on or near the surface to dissipate.
4. Close the sample unit door tightly. Confirm to continue.
5. The TURB value displayed is the standard value determined using the gain from the previous calibration. Confirm to accept and continue with the calibration.
6. If no selection is made for a set period of time, the screen will prompt to remix the standard to avoid a change in the value of the standard.
   a. Open the SS7 sc and remix the standard.
   b. Close the door and confirm to continue.

7. Confirm to calibrate. When the calibration is completed successfully, the display will show GOOD CAL! and the new calibration gain value. Confirm to accept the calibration.
8. Follow the prompt and enter the initials of the user performing the calibration. Confirm.
9. The controller will prompt for NEW BASELINE. Confirm to establish a new baseline or press **BACK** to exit.
10. Remove the calibration cylinder from the body. The instrument is now calibrated.
11. Close the drain valve and restore the sample flow. If no verification is done, the display will prompt to return to measurement mode. Confirm to continue measurements.

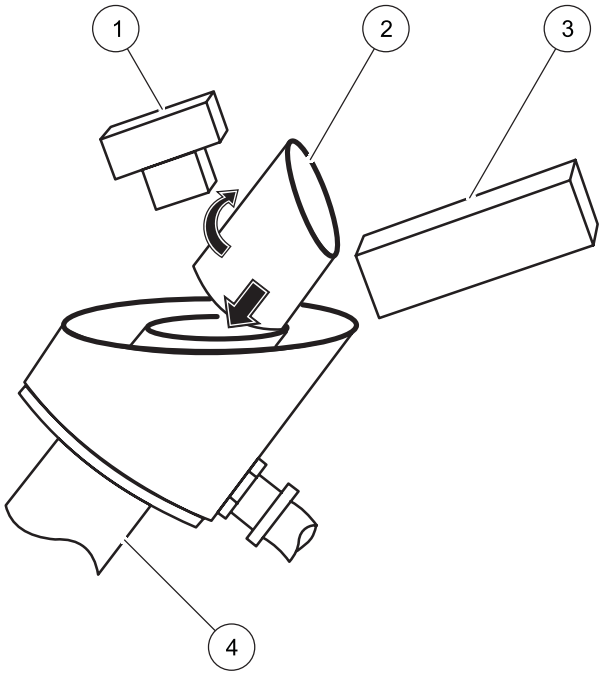


Figure 15 Installing the calibration cylinder

1	Detector assembly	**3**	Light source assembly
2	Calibration cylinder	**4**	Turbidimeter body

5.5.2.2 Comparison method

The comparison method transfers the calibration of a laboratory instrument to the on-line instrument and the practice is approved by the EPA and Standard Methods for the Examination of Water and Wastewater. Calibration by comparison should not be used if sample turbidity is less than 2 NTU.

Before performing this method, make sure the laboratory turbidimeter used is calibrated properly with primary turbidity standards according to manufacturer directions. Sample cells for the laboratory instrument must be free from dirt, fingerprints and scratches. For greater convenience, the laboratory instrument should be moved to a location close to the on-line unit(s) to be

calibrated. Take a grab sample from the on-line instrument drain or sample inlet line and immediately measure its turbidity in the laboratory instrument. If the on-line instrument reading is off by more than 5%, use the calibration procedure detailed in section 5.5.2 on page 29 to input the new standard value. If this calibration method is used, it is not necessary to use the calibration cylinder.

5.5.2.3 Calibration failure

If gain criteria for the calibration are not met, the screen will display BAD CAL! Confirm to repeat the calibration.

5.5.3 Setting the verification baseline

When the SS7 sc has been successfully calibrated, a baseline can be determined using standardization plates. The standardization plates are composed of opaque backing, a plate glass covering and a center filling of Gelex, a stable secondary turbidity standard. The standardization plates are not calibrated when shipped from the factory. The value of the plate is determined after calibration and stored internally in the SS7 sc. The calibration can be verified later by reading the plate value and comparing it to the value following calibration.

Important Note: *Always verify calibration with the same standardization plate that was used to establish the baseline. The manufacturer recommends assigning a serial number (up to 4 characters) to each plate. The serial number can be marked on the back of the plate.*

1. Perform a calibration (section 5.5.2).
2. Confirm to perform a baseline using a standardization plate.
3. The serial number for the last standardization plate used will appear on the display. Confirm to accept or enter the serial number of the plate to be used and confirm.
4. Follow the controller prompts:
   a. Remove the calibration cylinder and wipe off the top of the sample cylinder.
   b. Place the standardization plate on top of the sample cylinder so that the light beam strikes the center of the plate. Note the orientation of the plate and always place it in the same position when using it to check standardization.
   c. Close the door to eliminate stray light. Confirm to continue.
5. When the measured value becomes stable, confirm to establish an expected value for the plate.

   Note: *Future measured values will be compared to the stored expected value. If the established PASS criteria are not met, a new calibration should be performed.*

6. Open the SS7 sc to remove the plate. Restart the sample flow and close the door. Confirm to return the instrument to measurement mode.

Note: *After confirmation of return to measurement mode, the instrument will equilibrate for 2 minutes before the output mode changes. Instrument measurements will show on the display, but the value will flash and a "OUT MODE WARN" warning will display until the 2-minute equilibration period is complete.*

5.5.4 Instrument verification

Instrument verification is intended as a simple check to ensure SS7 sc functionality between calibrations. Verifications should be performed on a monthly basis using a manufacturer-provided standardization plate.

A verification directly after calibration is used to establish the baseline. Any verification afterwards, until the next calibration, that uses the same verification standard will reference the recorded value from the baseline verification as the "expected" value. In order for the verification to pass, the measured value should be within the limits set by the Pass/Fail Criteria of the baseline value.

Before starting the verification, read section 5.5.3.

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CALIBRATE and confirm.
4. Select VERIFICATION and confirm.
5. Select PERFORM VER and confirm.
6. The serial number on the standardization plate to be used for verification should match the serial number listed on the VALID SN screen. Confirm to accept the displayed serial number.

Important Note: *If the serial numbers do not match, a verification baseline (section 5.5.3) must be established before verification can be performed.*

7. Select the available Output Mode (Active, Hold or Transfer) from the list box and confirm.
8. Position the plate on top of the sample cylinder:
   a. Shut down the sample flow and wipe off the top of the sample cylinder.
   b. Place the standardization plate on top of the sample cylinder so that the light beam strikes the center of the plate. Note the orientation of the plate and always place it in the same position when using it to check standardization.
   c. Close the door to eliminate stray light. Confirm to continue.

9. When the displayed turbidity value is stable, confirm to select the measured reading. After confirming the reading:
   - GOOD VER! will be displayed if the verification is good, with an option to continue or to abort. Confirm to continue. Enter the operator initials and confirm.
   - BAD VER! will be displayed if the verification is bad, with an option to repeat or exit. To repeat the verification, confirm to return to the VALID SN screen (step 6).
10. Open the SS7 sc to remove the plate. Restart the sample flow and close the door. Confirm to return the instrument to measurement mode.

Note: *After confirmation of return to measurement mode, the instrument will equilibrate for 2 minutes before the output mode changes. Instrument measurements will show on the display, but the value will flash and a "OUT MODE WARN" warning will display until the 2-minute equilibration period is complete.*

5.5.4.1 Care of standardization plates

Clean standardization plates to remove fingerprints, dust and dirt.

- Clean plates using water and dry with a clean, lint-free cloth.
- Do not use abrasive cleaners or cleaning solvents.

Store the plates in a clean, dry place to prevent scratching or damage. Replace the plates if they become scratched or broken.

5.6 Calibration and verification history

The calibration and verification history logs contain information on the last 12 calibrations and the last 12 verifications. The calibration history log shows the gain value, the time and date of the calibration and the initials of the operator performing verification.

Note: *Restoring default settings from the DIAG/TEST menu will return the turbidimeter to its non calibration state (gain = 1.0) but it will not remove the previous calibration history from memory.*

The calibration history log is accessed from the Calibrate menu. The verification history log is accessed from the Verification menu (a submenu of the Calibrate menu).

Each verification history entry shows the serial number of the verification device, the value of the verification standard, the time and date of the verification and the initials of the operator performing the verification.

To view calibration history:

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CALIBRATE and confirm.
4. Select CAL HISTORY and confirm. The most recent calibration will be displayed on the screen.

5. Confirm to view the previous calibrations. After scrolling through all 12 histories, the display will return to the calibration menu level.

To view verification history:

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CALIBRATE and confirm.
4. Select VERIFICATION and confirm.
5. Select VER HISTORY and confirm. The most recent verification will be displayed on the screen.
6. Confirm to view previous verifications. After scrolling through all 12 histories, the display will return to the calibration menu level.

To view baseline history:

1. From the Main Menu, select SENSOR SETUP and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select CALIBRATE and confirm.
4. Select VERIFICATION and confirm.
5. Select BASELINE HIST and confirm. The most recent baseline, including the Gelex plate serial number and expected value, will be displayed on the screen.
6. Confirm to view previous verifications. After scrolling through all 12 histories, the display will return to the calibration menu level.

When the instrument is received from the factory, there will be one entry for the calibration and verification history information. As calibrations and verifications are performed, the history information will grow until there are 12 entries.

When the log is full, the newest entry is stored and the oldest entry in the log is deleted.

5.7 Operating the SS7 sc-HST

- If condensation forms in the enclosure, increase the air pressure (and flow) by increasing the air pressure setting of the pressure regulator for the flow multiplier.
- Make sure the bubble trap is working. Bubbles on the surface of the liquid will cause incorrect readings.
- If deposits accumulate inside the unit, wash the inside with warm water spray.
- The vent cover at the top of the turbidimeter body (Figure 5 on page 12, item 5) can be removed for cleaning if necessary. Loosen the light source before removing the cover. Check the alignment of the light after reinstalling the cover using the new alignment plate included in the kit (section 6.4.1 on page 38). Make sure the cover sits flat on top of the slant tube when installed.
- Calibrate the instrument using the calibration cup and formazin as described in section 5.5.2 on page 29.

Note: *Do not operate the instrument without the cover. Do not operate the instrument if the flow multiplier is not working.*

Section 6 Maintenance

DANGER
Only qualified personnel should conduct the tasks described in this section of the manual.

The nature of tasks described in this section of the manual requires individuals to be technically knowledgeable of the associated dangers. Burns, shock, eye damage, fire and chemical exposure may occur if this work is not done by qualified personnel. Always review appropriate Material Safety Data Sheets (MSDS) before working with chemicals.

6.1 Scheduled maintenance

Scheduled periodic maintenance requirements of the SS7 sc Turbidimeter are minimal. Standardization checks and calibration are the primary requirements. Several other activities should be performed on a regular basis, but the schedule for these may depend on the installation and sample.

6.2 Removing a sensor from the system

Prior to physically removing a sensor from the system, record all user defined settings such as relays, signal averaging, etc. Turn off power to the sc100 and SS7 sc, then disconnect the sensor at the controller.

6.3 Installing a sensor on the system

To return the system to normal operation following a software upgrade or sensor repair, perform the following procedure:

1. Detach all sensors from the sc100 controller.
2. From the Main Menu, press the **DOWN** key to highlight TEST/MAINT and confirm.
3. Use the **DOWN** key to scroll to SCAN SENSORS and confirm.
4. Remove attached sensors by selecting the corresponding serial number or select “All”.
5. **Power down the sc100 controller, then attach the sensor(s) to be used.**

   Note: *Clean sensors before installing on the system.*

6. Supply power to the sc100 controller. The system will initialize automatically.

6.3.1 Cleaning

Sediment may collect in the turbidimeter body and on the overflow weir. Algae may also form. The turbidimeter body should be drained and flushed—on a schedule determined by visual inspection—to remove accumulated sediment. Algae can be removed with a large bottle brush and a sterilizing solution such as dilute chlorine bleach.

Samples containing large amounts of settleable solids may cause frequent accumulation of solids in the turbidimeter body. To minimize cleaning frequency, the analyzer can be operated with the drain ball valve partially or completely open and the sample flow increased accordingly to provide continuous flushing of solids from the turbidimeter body. If the drain is left partially open, the ball valve supplied should be replaced with a valve designed for flow control. Operating the ball valve in a partially open position may damage the valve or cause plugging of the drain line.

When used in conjunction with the Auto-flush Kit (section 8.2 on page 49), the flush cycle feature may be used to operate a solenoid valve to divert sample and provide a periodic clear water flush.

The inside enclosure of the SS7 sc can be washed down with warm water spray if deposits accumulate inside the unit. The vent cover at the top of the SS7 sc-HST turbidimeter body can also be removed for cleaning as necessary.

Note: *Loosen the light source to remove or install the vent cover on the SS7 sc-HST. Use the alignment plate included in the unit to check the alignment of the light after installing the cover. Make sure the cover sits flat on top of the slant tube when installed.*

6.4 Unscheduled maintenance

Important Note: *Disconnect power to the instrument before removing any cover. To reduce the possibility of ESD damage to the equipment, avoid contact with electrical components. All replacement components must meet or exceed original equipment specifications to maintain applicable safety standards and certifications and ensure proper instrument performance.*

6.4.1 Lamp replacement

The lamp is located in the light source assembly block in the sample unit. It comes with attached leads terminated in a two-pin connector. The lamp is replaced as follows:

1. Set the power switch in the control unit to off. Disconnect power to the sc100 controller.
2. Open the sample unit door. Disconnect the lamp cable at the connector.
3. Remove the two screws that secure the lamp source assembly to the back plate. Remove the lamp source assembly (Figure 16).
4. Remove the four screws securing the end plate to the light source assembly housing. Remove the end plate with gasket, the notched spacer and the lamp.

5. Wipe the replacement lamp clean to remove any dust and fingerprints. Fingerprints left on the glass bulb can permanently damage the lamp. Install the lamp in the light source block.
6. Slide the notched spacer over the lamp cable with the notch away from the lamp base. Route the lamp cable through the notches. Install the lamp and spacer into the end of the housing with the spacer notch aligned with the notch in the housing.
7. Install the end plate using the two screws removed in step 3.
8. Install the assembled light source assembly in the sample unit using the two screws removed in step 2. Connect the lamp cable connector.
9. Using the alignment template supplied with the turbidimeter, verify that the light source assembly is positioned properly as follows:
    a. Be sure the lamp door is closed tightly. Apply power to the sc100 controller. Wait for the display to show the current turbidity reading before continuing.
    b. Install the calibration cylinder in the top of the turbidimeter body (Figure 15 on page 31).
    c. Place the alignment template on top of the calibration cylinder with the guide pin down and against the flat notch on the inside of the cylinder (Figure 17). The back edge of the template should be against the sample unit back plate.
    d. Check the position of the lamp image on the alignment template surface. It should fall on the target area so the center of the beam is centered between the lines (Figure 17).
    e. If the light source assembly needs adjustment, loosen the two mounting screws enough to adjust the position of the lamp image. Tighten when aligned properly.
10. Calibrate the instrument as described in section 5.5 on page 29.

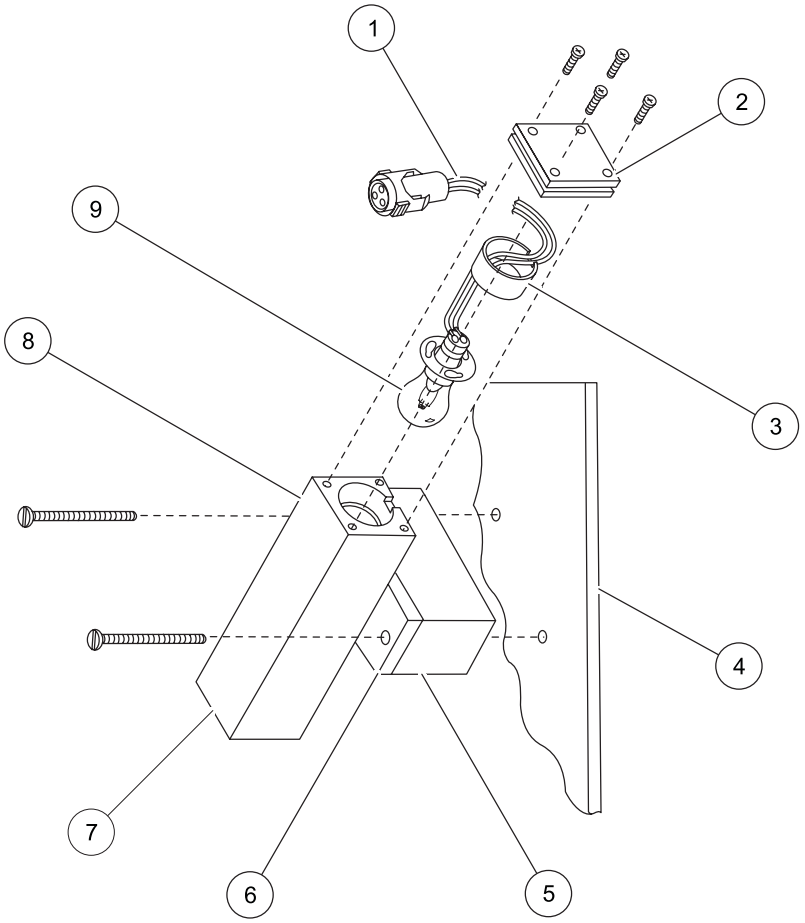


Figure 16 Lamp replacement

1	Lamp cable	**6**	Spacer
2	End plate	**7**	Housing
3	Notched spacer	**8**	Light source assembly
4	Back plate	**9**	Lamp
5	Base		

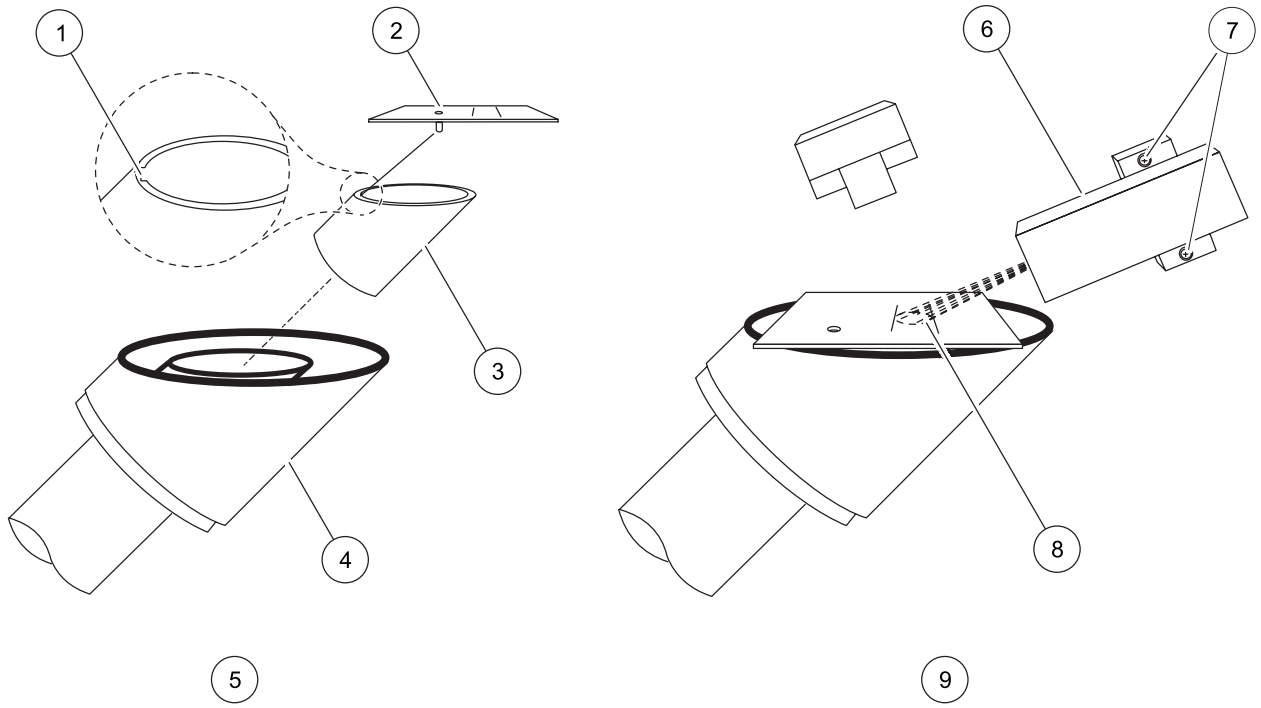


Figure 17 Alignment details

1	Flat notch	**6**	Light source assembly
2	Alignment template	**7**	Mounting screws
3	Calibration cylinder	**8**	Target area
4	Turbidimeter body	**9**	Adjust light source to align light beam in target area
5	Install calibration cylinder and alignment template		

6.4.2 Light source assembly maintenance

No maintenance of the light source assembly is normally necessary beyond changing the lamp. The lamp, several lenses, apertures and other components are located in the light source housing. If these components are removed for any reason, they must be installed exactly as they were removed. Placing any of the components in the wrong position or orientation can cause measurement errors and lack of alignment. Figure 18 illustrates the correct installation and orientation of the components. If difficulty is experienced in reassembly, contact Technical Support for assistance. Refer to Section 9 on page 51.

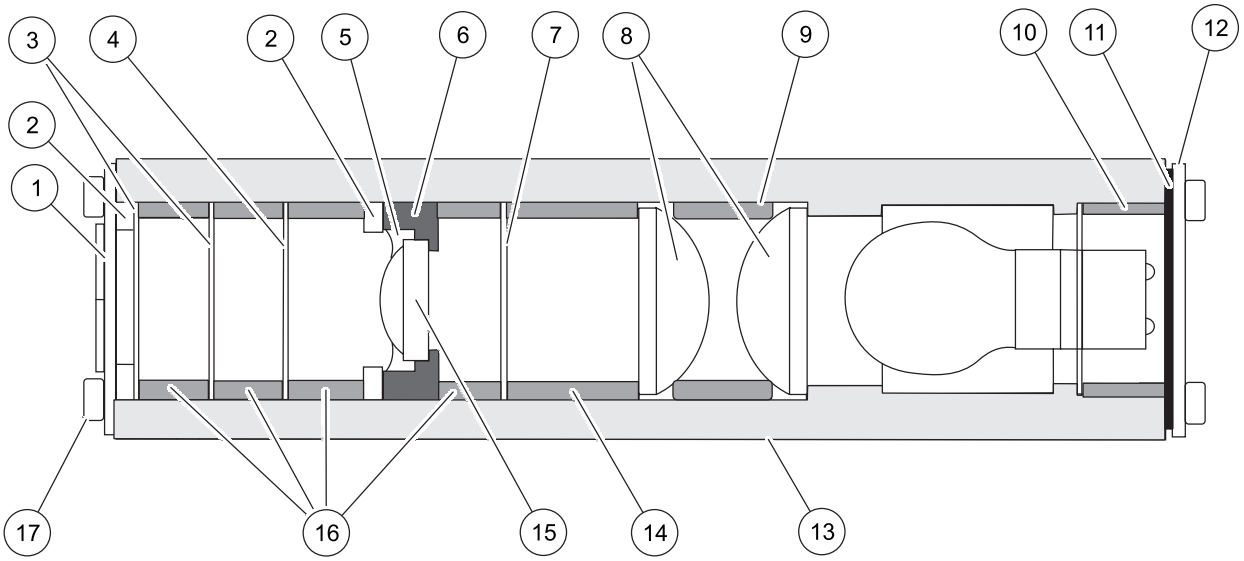


Figure 18 Light source assembly

1	Shield assembly (Cat. No. 45299-00)	**10**	Spacer, light source (Cat. No. 45039-00)
2	Wavy washer (2x) (Cat. No. 45042-00)	**11**	Gasket (Cat. No. 45033-00)
3	Medium aperture (Cat. No. 45044-00)	**12**	End plate (Cat. No. 45032-00)
4	Large aperture (Cat. No. 45045-00)	**13**	Body (Cat. No. 45027-00)
5	Retaining ring (Cat. No. 45041-00)	**14**	Large spacer (Cat. No. 45037-00)
6	Lens holder (Cat. No. 45040-00)	**15**	Small lens (Cat. No. 31465-00)
7	Small aperture (Cat. No. 45043-00)	**16**	Small spacer (4x) (Cat. No. 45038-00)
8	Large lens (2x) (Cat. No. 44114-00)	**17**	Screws (8x) (Cat. No. 5584-11)
9	Medium spacer (Cat. No. 45036-00)		

6.4.3 Detector assembly replacement

The detector assembly, listed as a replacement item in section 8.1 on page 49, is a sealed unit that is replaced entirely (Figure 19).

1. Write down the controller setup for all analog outputs and/or relays used with the SS7 sc.
2. Turn off the controller and disconnect it from power.
3. Disconnect the detector cable from the controller. Unscrew the nut (Figure 19, item 8) and remove it from the disconnected detector cable.
4. Open the SS7 sc enclosure door. Using a blunt object (¼-inch diameter or less, e. g. the blunt end of a pen) push on the bushing from the inside of the enclosure until it is free of the strain relief and clamping fingers. Remove the grommet from the detector cable.
5. Pull the detector cable through the strain relief. Open the cable clamps (Figure 19, item 3) and remove the cable.

6. Remove the two screws securing the detector assembly to the wall of the SS7 sc enclosure. Remove the complete detector assembly (Figure 19, item 1).
7. Use the two screws removed in step 6 to secure the new detector to the wall of the SS7 sc enclosure. Secure the cable with the cable clamps.
8. Thread the detector cable through the strain relief. Replace the split grommet (note the orientation in Figure 19) onto the detector cable. At the clamping fingers, rotate the grommet counter-clockwise while pushing the grommet back into place in the strain relief.
9. Thread the nut onto the detector cable and secure onto the strain relief.
10. Close the SS7 sc enclosure door. Attach the detector cable to the controller.
11. Apply power to the controller and turn it on. The controller will prompt the user that the SS7 cannot be found. The old detector serial number will be displayed.
12. Use the arrow keys to select the old detector serial number and remove it. The controller will then install the new detector assembly.
13. Establish the setup for all analog outputs and/or relays to be used with the SS7 sc. Use the settings recorded in step 1.
14. Calibrate the instrument (section 5.5 on page 29).

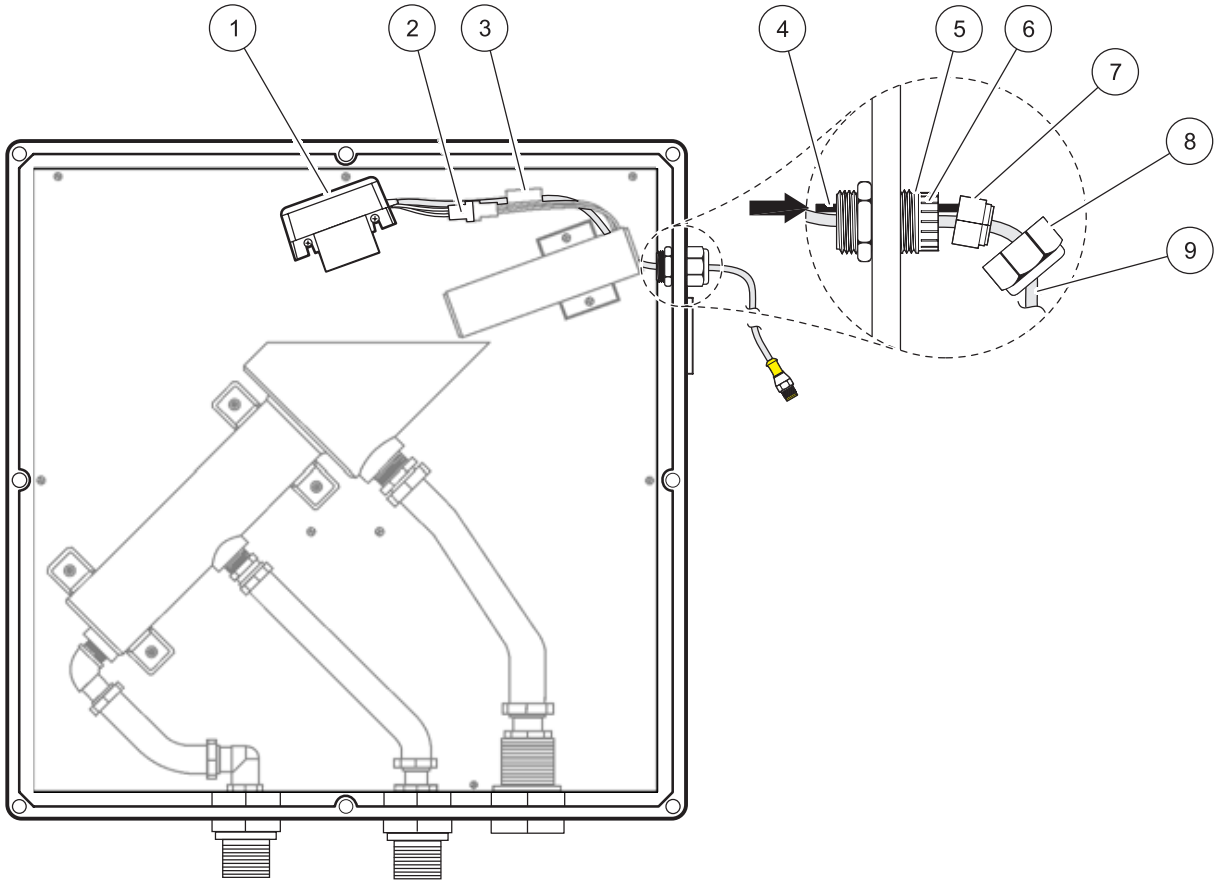


Figure 19 Detector assembly replacement

1	Detector assembly (Cat. No. 71221-00)	**6**	Clamping fingers
2	Light source assembly power connector	**7**	Bushing
3	Cable clamp	**8**	Nut
4	Blunt object	**9**	Detector assembly cable
5	Strain relief		

Section 7 Troubleshooting

7.1 Error Codes

Errors are indicated by a flashing measurement value and a flashing warning icon. Errors are defined in Table 2.

1. From the Main Menu, select SENSOR DIAG and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select ERROR LIST and confirm. All active errors will display.

Table 2 Error codes

DIsplayed error	Definition
ADC FAIL	The ADC has failed. Try cycling power. If cycling power does not work, replace the detector assembly (Cat. No. 71221-00).
LAMP FAIL	The light source has failed. See section 6.4.1 on page 38 for lamp replacement instructions.
FLASH FAIL	Datalog and event log will not work.

7.2 Warnings

Warnings are indicated by a flashing measurement value and a flashing warning icon. Warnings are defined in Table 3.

1. From the Main Menu, select SENSOR DIAG and confirm.
2. If multiple sensors are attached to the controller, choose SELECT SENSOR>SS7 SETUP and confirm.
3. Select WARNING LIST and confirm. All active warnings will display.

Table 3 Warning Codes

Warning Number	Displayed Warning	Definition/Resolution
1	DARK WARNING	Dark reading detects too much light. Close the SS7 sc enclosure and perform ZERO ELECTRONICS (under the CALIBRATION menu).
2	TEMP WARNING	Sensor head internal temperature is higher than specified. Contact the Technical Support Department. (> 70 °C)
3	DATA LOG FULL	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
4	EVENT LOG FULL	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
5	5 VOLT WARN	Monitored voltage is outside the range of 4.5–5.5 V.
6	VIN WARN	Monitored instrument input voltage from sc100 is outside the range of 9.08–14.3 V. Check cables. Make sure only one SS7 sc is connected to sc100 and if any other probe is connected it can only draw 4 watts maximum.
7	LAMP VOLT WARN	Monitored voltage is outside the range of 3.96–4.48 V.
8	LAMP CURR WARN	Monitored current is outside the range of 1.67–2.75 Amps.
9	OUTPUT MODE WARN	Activated when the sensor is not in normal measurement mode (such as when in calibration or verification mode).
10	AC UPDATE FAIL	The application code update failed.
11	EXT FLASH FAIL	External copy of the application code has failed. Self recovery should occur.

Table 3 Warning Codes (continued)

Warning Number	Displayed Warning	Definition/Resolution
12	INT FLASH FAIL	Internal copy of the application code has failed. Self-recovery should occur.
13	ENGLISH ONLY	English only device driver file. Update the device driver with the latest version.
14	VREF WARN	ADC voltage reference is out of specification.
15	SERVICE WARN	SS7 sc is currently in service mode

Table 4 presents sensor warnings displayed in the Event Log, possible causes and corrective actions.

Table 4 General Troubleshooting

Sensor Error or Warning	Possible Cause	Corrective Action
LAMP FAIL	Lamp burned out	Replace the lamp. See section 6.4.1 on page 38.
	Lamp unplugged	Restore connection
	+12 V connection loose at controller	Restore connection
	Dislodged lamp	Reinstall lamp
	Bad circuit board in turbidimeter head	Contact the Technical Support Department.
Low Readings	Detector coated/dirty	See section 6.3.1 on page 38. Contact the Technical Support Department.
	Lens coated/dirty	Clean the lens using isopropyl alcohol and a cotton swab.
	Obstructed light path	Remove obstruction
	See LAMP FAIL causes above	See LAMP FAIL corrective actions above
VIN FAIL	Loose connection at sc100	Tighten connection of cable at sc100
	SS7 sc to sc100 cable too long	Make sure that if an extension cable is used, only one is present and is no longer than 7 meters (approximately 30 feet).
	Fluctuation in voltage	Turn instrument power off and back on.
	Bad detector assembly	Replace detector assembly (Cat. No. 71221-00).
ADC FAIL	Fluctuation in voltage	Turn instrument power off and back on.
	Bad detector assembly	Replace detector assembly (Cat. No. 71221-00).
DARK WARNING	Light Leak—SS7 sc enclosure door is open during Power Up or Zero Electronics	Make sure the door is closed, then perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Bad detector Assembly	Replace detector assembly (Cat. No. 71221-00).

Table 5 presents additional malfunctions which may not be recorded in the Event Log.

Table 5 Additional malfunctions not recorded in the event log

Symptom	Possible cause	Corrective action
Continuous underrange	The calibration standard was either improperly prepared or was unstable at the time the calibration was accepted.	Verify the accuracy of calibration standards and calibrate the instrument. See Low Readings in Table 4.
Continuous overrange	The calibration standard was either improperly prepared or was unstable at the time the calibration was accepted.	Verify the accuracy of calibration standards and recalibrate the instrument.
Erratic readings	Inadequate bubble removal from sample	Verify the accuracy of calibration standards and recalibrate the instrument. Increase the signal averaging time to a longer interval. Make sure the Bubble Reject feature is turned on. Slow the flow of sample into the instrument.
High readings	Dirty instrument Calibration standard was low Flow rate is too high causing bubbles	Clean the instrument. Check the value and expiration date on the calibration standard Verify the flow is within specifications Recalibrate the instrument.

7.3 Event codes

Events are automatically invoked to document major actions during normal instrument operation. Event codes are not displayed on controller and must be downloaded from the event log using Data Com software. Troubleshooting actions are provided in Table 4 on page 46.

Table 6 Event log list

Event	Event #	Data1	Data2	Data3
Bubble reject change	0	0 = OFF 1= ON	—	—
Signal avg	1	0 = 1, 1 = 6, 2 = 30, 3 = 60, 4 = 90	—	—
Data log interval change	2	0 = 5 sec, 1 = 30 sec, 2 = 1 min, 3 = 2 min, 4 = 5 min, 6 = 15 min, 7 = 30 min, 8 = 1 hr, 9 = 4 hr	—	—
Power on	3	—	—	—
Calibration	4	Std	Gain	Operator
Verification	5	Expected Value	Meas Value	Operator
Dark event	6	A/D counts	—	—
Temperature	7	Present	Min	Max
Volt warn	8	Vin	5V	Vref
Lamp warn event	9	Lamp V	Lamp I	—
A2D fail event	10	—	—	—
Lamp fail	11	Lamp V	Lamp I	—
Output mode change	12	0 = Normal, 1 = Active 2 = Hold, 3 = Transfer	—	—

Table 6 Event log list (continued)

Event	Event #	Data1	Data2	Data3
Baseline	13	Serial Number	Expected	Operator
AC update start	14	—	—	—
AC update done	15	—	—	—
AC update fail	16	—	—	—
AC internal fail	17	—	—	—
AC external fail	18	—	—	—
Flash erase	19	—	—	—
DD update	20	—	—	—
Service mode	21	0 = Off, 1 = On	—	—

Example of event log download using DataCom

15:00 01/09/06	BUBBLE REJECT	0	1			
1/9/2006 15:00	BUBBLE REJECT	0	0			
1/9/2006 15:00	SIGNAL AVG	1	2			
1/9/2006 15:00	SIGNAL AVG	1	1			
1/9/2006 15:00	DATALOG INTRVL	2	9			
1/9/2006 15:01	OUT MODE EVENT	12	1			
1/9/2006 15:01	CALIBRATION	4	2100	1.51	G7	
1/9/2006 15:01	BASELINE EVENT	13	7	2090.4	G7	
1/9/2006 15:02	OUT MODE EVENT	12	2			
1/9/2006 15:02	VERIFICATION	5	7	2090.4	2091.1	GS7

7.4 Data log

Measured data is automatically logged based on the setting of the data log interval. If, however, there is a calibration or verification being performed, the data log will be interrupted since the values of the measurements do not represent the normal process. The data log interval in the following example is set at 15 minutes.

Example of data log download using DataCom

Serial Number: FFFFFFFFFFFF

Device ID: 26

Manufacture ID: 0

Time	Channel 1
1/18/2006 12:15	2009.04
1/18/2006 12:30	2009.71
1/18/2006 12:45	2010.316
1/18/2006 13:00	2009.096

Section 8 Replacement parts and accessories

8.1 Replacement parts

Description	Cat. No.
Surface Scatter® 7 sc Installation Kit:	
Adapter, barb fitting, ¾" NPT to ¾" ID hose barb (2x)	40439-00
Adapter, barb fitting, 1" NPT to 1" ID hose	40372-00
Brush, cylinder, size 2	687-00
Calibration cup, SS7 sc	45021-00
Drain Valve	45073-00
Formazin Stock Solution, 4000 NTU, 500 mL	2461-49
Light Source Template	45076-00
Nipple, ¾" NPT	31551-00
Washer, ¼ ID x 1.00 OD (4x)	44173-00
Wall Mounting kit	44247-00
Light Source Shield Assemblies (2x)	45299-00
Detector Assembly	71221-00
Lamp Assembly, Surface Scatter 7 sc	45034-00
Manual	DOC026.53.00769
Quick Reference Document	DOC016.53.00769
Tubing Replacement Kit	46691-00

8.2 Accessories

Description	Cat. No.
Auto Flush Kit (120V)	46692-12
Auto Flush Kit (220V)	46692-22
Bubble Trap/Head Regulator	46680-00
Cable Extension for Sensor, 7.6 m (25 ft)	57960-00
DataCom (CD-rom)	59256-00
Formazin Stock Solution, 4000 NTU, 500 mL	2461-49
Heat Exchanger Unit (Sample cooler)	48551-00
Latch, replacement, SS6	44993-00
Manual, SS7 sc, English	DOC026.53.00769
Manual, SS7 sc, Chinese	DOC026.80.00769
Manual, SS7 sc, Japanese	DOC026.81.00769
Manual, SS7 sc, Korean	DOC026.84.00769
Power Cord, 125 VAC, 10A, 1.83 m (6 ft)	46306-00
Power Cord, 250 VAC, 10A, 1.83 m (6 ft)	46308-00
StablCal, 400 NTU, 500 mL	71216-49
Standardization Plate Kit, uncalibrated	23513-00
Sun Shield, sc100 Controller	LZ961.54
Upgrade Kit, Converting Standard SS7 sc to a SS7 sc-HST (High Sample Temperature)	45000-43

Section 9 How to order

U.S.A. customers

By telephone:
6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By fax:
(970) 669-2932

By mail:
Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.
Ordering information by e-mail: orders@hach.com

Information required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

International customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an e-mail to: intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

Technical and customer service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:
Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:
Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

In Latin America, the Caribbean, the Far East,
Indian Subcontinent, Africa, Europe or the Middle East:
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of two years from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 12 Certification

Hach Company certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100 with SS7 sc or SS7 sc-HST Sensor** has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 Listed by ETL (cETLus safety mark)
CSA C22.2 No. 61010.1 Certified by ETL (cETLus safety mark)
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for Industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 2004/108/EC EMC:** Supporting test records and compliance certification by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria A)
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **2004/108/EC** EMC: **EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment

EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11) Class “A” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records and compliance certification by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference- Causing Equipment Regulations.

Cet appareil numÈrique de la classe A respecte toutes les exigences du RËglement sur le matÈriel brouilleur du Canada.

FCC PART 15, Class “A” Limits

Supporting test records and compliance certification by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Controller from its power source to verify that it is or is not the source of the interference.
2. If the Controller is connected into the same outlet as the device with which it is interfering, try another outlet.
3. Move the Controller and SS7 sc sensor away from the device receiving the interference.
4. Reposition the device receiving the interference.
5. Try combinations of the above.

Appendix A Modbus register

Tag Name	Register #	Data Type	Length	R/W	Description
TURB	40001	Float	2	R	Measured turbidity value
TURB INT	40003	Unsigned Integer	1	R	Integer turbidity value
TURB INT X 100	40004	Unsigned Integer	1	R	Integer turbidity * 100
SENSOR NAME	40005	String	6	R/W	Sensor name or location
BUBBLE REJECT	40011[1]	Unsigned Integer	1	R/W	Bubble reject status (0=OFF; 1=ON)
SIGNAL AVG	400121	Unsigned Integer	1	R/W	Signal average (0=1; 1=6sec; 2=30sec;3=60sec;4=90sec)
DATALOG INTRVL	400131	Unsigned Integer	1	R/W	Datalog interval (0=5sec;1=30sec;2=1min;3=2min;4=5min;6=10 min;7=15min;8=30min;9=60min, 10=4hr)
RESOLUTION	40014	Unsigned Integer	1	R/W	Maximum number of decimal places (0=xxxxx, 1=xxxx.x, 2=xxx.xx)
P/F CRITERIA	400151	Unsigned Integer	1	R/W	Pass / Fail criteria for verification. (1 to 10 percent)
TURB UNIT	40016	Unsigned Integer	1	R/W	Turb units (0=mg/L:7=NTU;42=FTU)
SERVICE MODE	400181	Unsigned Integer	1	R/W	Used to determine if the instrument is in the service mode (0 = disabled; 1= enabled)
SERIAL NUMBER	40021	String	6	R	Instrument serial number
CODE VERSION	40027	Float	2	R	Software version
DD Firmware	40029	Unsigned Integer	1	R	Device driver firmware version
DD CONTENT	40030	Unsigned Integer	1	R	Device driver content version
HW VERSION	40031	Unsigned Integer	1	R	Hardware version of pc board
TEMP	40032	Float	2	R	Temperature measurement in Celsius
DARK	40034	Unsigned Integer	2	R	Dark turbidity A/D counts.
RAW TURB	40036	Float	2	R	Turbidity value with dark offset and gain applied.
TURB COUNTS	40038	Unsigned Integer	2	R	Turbidity A/D counts
TEMP MAX	40040	Float	2	R	Maximum temperature
TEMP MIN	40042	Float	2	R	Minimum temperature
LAMP V	40044	Float	2	R	Lamp voltage
LAMP CURR	40046	Float	2	R	Lamp current (amps)
Plus 5V	40048	Float	2	R	Plus five volt measurement
INPUT V	40050	Float	2	R	Input voltage (~12V)
VREF	40052	Float	2	R	Voltage reference measurement (2.5V)
CAL GAIN	40067	Float	2	R	Calibration gain factor - used to convert A/D counts to turbidity
INITIALS	40083	String	2	R	Initials used for the latest calibration
LAST CAL DATE	40085	Time2	2	R	Time of the latest calibration
CAL VALUE	40087	Float	2	R	The standard value used for the latest calibration

[1] In order to write to these tags, write 46478 to register 49938

Appendix B Theory of operation

B.1 SS7 sc principle of operation

The Surface Scatter 7 sc Turbidimeter is a sensitive and precise instrument designed to measure the light scattered by particles suspended in the sample fluid. The sample flows up through the turbidimeter body at a rate between 1 and 2 liters per minute (¼ to ½ gallon per minute). As the fluid spills over the top of the turbidimeter body, a stable, flat surface of fluid forms and becomes the measuring surface.

Because there is no contact between the fluid being analyzed and any of the optical surfaces, the instrument can monitor even highly turbid samples without frequent cleaning. Electrically and mechanically, the Surface Scatter 7 sc Turbidimeter has been constructed to ensure reliable operation in adverse environments.

The lamp, powered by a regulated voltage source, provides a high intensity beam of light that is adjusted to strike the fluid surface at an angle. Most of the light striking the surface of the fluid is either reflected into the upper left hand corner of the cabinet and absorbed, or refracted down into the turbidimeter tube (Figure 3 on page 10). A small amount of the light is scattered by the particles suspended in the fluid. Light scattered at 90 degrees from the incident beam is detected by the detector assembly. The electronic signal generated by the detector assembly is directly related to the concentration of particles suspended in the fluid.

Directing the light beam at the fluid surface at an angle and placing the detector assembly directly over the point where the light enters the fluid is a very important design feature. Because the light is scattered at or near the surface, only a minimum amount of scattered light is absorbed by the fluid before it reaches the detector assembly. Therefore, the amount of light scattered will increase with increasing turbidity, regardless of how high the turbidity becomes. This allows the instrument to measure very high, as well as very low, levels of turbidity.

B.2 SS7 sc-HST principle of operation

The SS7 sc-HST instrument is designed for high temperature samples, or in applications where a significant difference between the sample temperature and the ambient temperature causes condensation and fogging in the unit. The SS7 sc-HST functions in the same manner as the SS7 sc, but accommodates samples of higher temperature and a moist air removal system has been added.

The moist air removal system contains an air flow multiplier that creates a vacuum to draw moisture away from the sample tube and remove the moisture from the enclosure. The moisture removal system requires the customer to provide a source of air pressure, such as compressed air, shop air, or an on-site air compressor. The air line is connected to the top of the flow multiplier (Figure 4, item 1).

HACH® Instruction Sheet

Bubble Trap/Head Regulator Cat. No. 46680-00

Instructions for Installation and Use

The Hach Bubble Trap/Head Regulator is designed for use with Hach Surface Scatter 6 Turbidimeters and other process instruments to reduce or eliminate gas bubbles that may interfere with measurement. The device may also be used as a head regulator to dampen fluctuations in flow due to pulsations from a pump and/or sample pressure.

Using the Bubble Trap/Head Regulator will in-crease response time to changes in sample turbidity or concentration. The body of the unit holds approximately 3 liters (3/4 gal.). Response time may vary from one to two minutes at high flow rate (2 L/minute) to five minutes or more at flow rates less than 1 L/minute. For best response time, use the highest flow practical for the sample conditions. High flow rates decrease effectiveness of bubble removal. The need for response time and bubble removal must be balanced for optimum performance.

Description

The Bubble Trap/Head Regulator is constructed of PVC (polyvinyl chloride) plastic and is resistant to most chemicals. The device should not be used for samples containing solvents such as tetrahydrofuran, toluene, trichloroethylene or methyl acetone. The unit body is equipped with four 3/4-inch female NPT ports for plumbing connections—one in the bottom comes with a factory installed plug. Three 3/4-inch NPT-to-hosebarb fittings are supplied and must be installed on the side ports. See Figure 1.

Installation

Note: *The Bubble Trap/Head Regulator can also be installed with smaller user-supplied plumbing connections. Using smaller plumbing connections and tubing requires the Bubble Trap/Head Regulator to be installed at a greater height above the process instrument. Each foot of head height will create a static pressure of 0.433 psi.*

The Bubble Trap/Head Regulator is designed for wall mounting with the two pipe hangers provided with the unit. Refer to Figure 1 and install the unit as follows:

1. Mount the pipe hangers approximately 11 inches apart, one above the other, using two 3/8-inch bolts or screws for each. Position the pipe hangers so that the overflow fitting of the Bubble Trap/Head Regulator is above the top water level of the turbidimeter or analyzer. Allow approximately 6-inches of clearance at the top to facilitate cleaning.
2. Install the 3/4-inch NPT-to-hosebarb fittings in the side ports of the Bubble Trap/Head Regulator. Teflon thread tape (not supplied) is recommended.
3. Position the body of the Bubble Trap/Head Regulator in the hangers so that the fittings do not interfere with the pipe hangers when they close. When in position, press the body firmly against the back of the hangers. The hangers will close and lock.
4. Connect the sample line to the center hose barb fitting on the side of the device.
5. Using flexible tubing or hard piping, connect the sample outlet fitting on the Bubble Trap/Head Regulator (lowest side fitting) to the sample inlet of the turbidimeter or analyzer.
6. Connect a sample overflow line to the highest side fitting and run it to a drain.

Maintenance

Remove the top cap of the Bubble Trap/Head Regulator to clean the body. Remove the bottom plug to drain the instrument without disturbing other plumbing connections. Use a mild soap solution or dilute acid rinses to remove accumulated sediment and scale.

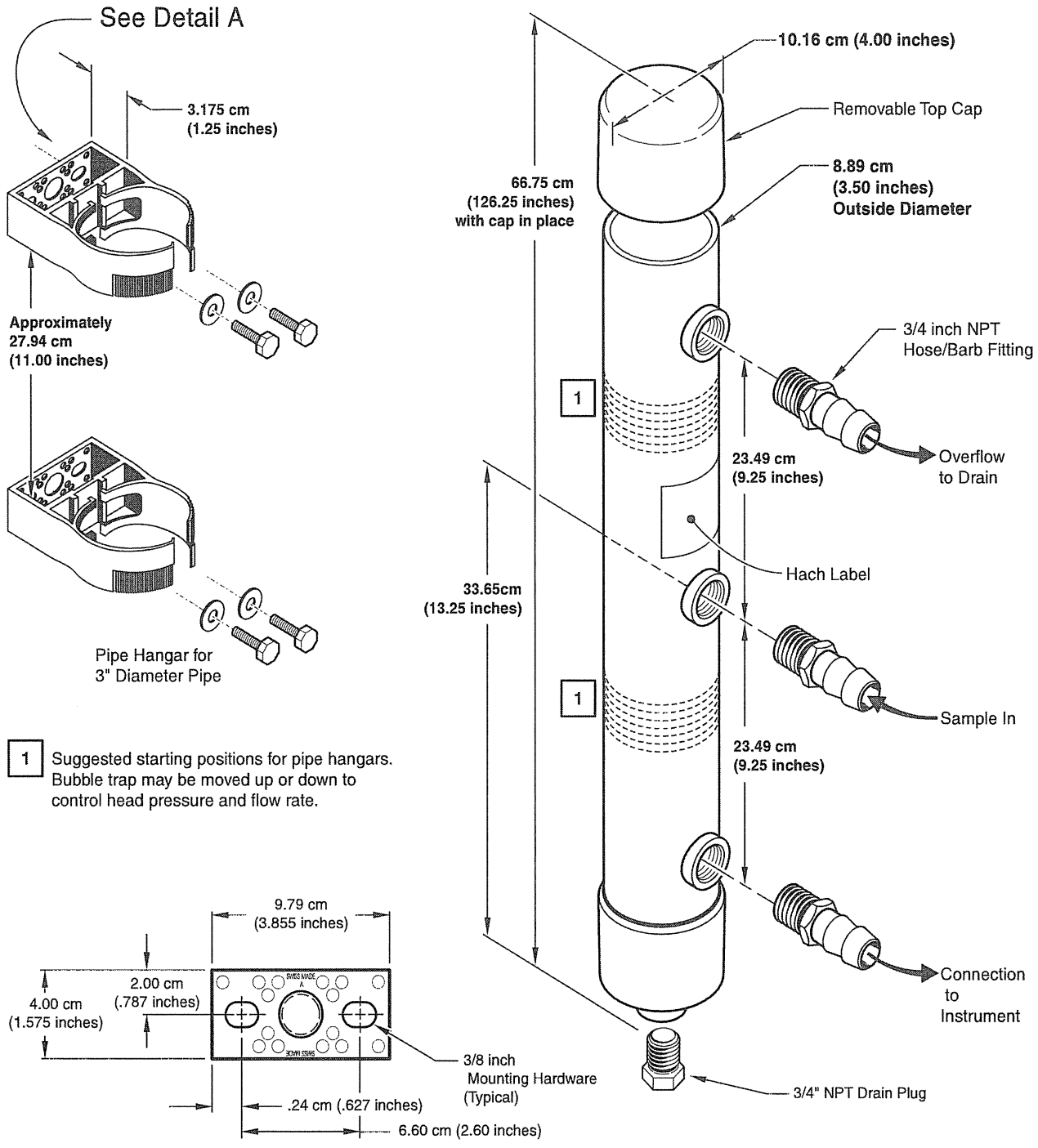
To remove the Bubble Trap/Head Regulator from the pipe hangers, pry the notched straps apart with a screwdriver or other suitable tool while spreading the holder.

Replacement Parts

Description	Cat. No.
Plug, threaded, 3/4-inch NPT	46676-00
Cap, Bubble Trap/Head Regulator top	46678-00
Pipe hanger, 3-inch iron pipe size	46685-00
Fitting, 3/4-inch NPT to hosebarb	31569-00

Bubble Trap/Head Regulator

Figure 1 Installing the Bubble Trap/Head Regulator



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RAW WATER FLOWMETER

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ENVIROMAG
Electromagnetic Flowmeters

...for water and wastewater measurements

KROHNE

Electromagnetic flowmeters

The modular system with the ENVIROMAG Hardrubber and Polyurethane primary head

The modular system will have the right electromagnetic flowmeter for your specific application – right from both the flowmetering and the economic viewpoint.

The ENVIROMAG primary head is compatible with all **KROHNE** signal converters:

IFC 010 F	IFC 010 K
IFC 020 F+ E	IFC 020 K
IFC 090 F	IFC 090 K
IFC 110 F	

Full signal converter data are specified in the relevant Data Sheets.

Type code

IFM	Electromagnetic flowmeter
IFS	Primary head
IFC	Signal converter
E	Separate system (19" plug-in)
F	Separate system (field housing)
K	Compact system

ENVIROMAG

Hardrubber and Polyurethane

Compact systems

010 K / 020 K

090 K

Separate systems

Primary head

ENVIROMAG

Signal converters

010 F
020 F
020 E

IFC 010 F / IFC 020 F+ E

090 F

IFC 090 F

110 F

IFC 110 F

KROHNE

ENVIROMAG

Hardrubber and Polyurethane

Primary head

Economic • standard-setting

Quality

Flowmeters are manufactured by KC to ISO 9000 - certified quality assurance standards.

Economic Benefits

- **Low investment and operating costs**
- Meter size 1” - 60” **flange connections** to DIN and ANSI
- **Measuring tube liner:**
  Hardrubber: 1” - 60”
  Polyurethane: 1” - 40”
- **Easy, quick, low-cost installation**
- **Short delivery times, allowing just-in-time purchasing**
- **Absolutely maintenance-free, reliable, no mechanically moving parts**

Wide scope of application

- **Suitable for water and wastewater**
- **For process temperatures up to 176°F**
- **For pressures up to 580 psig**
- **IP 67 protection equivalent to NEMA 6,** suitable for short-time submersion
- Its **favorable price/performance payoff and low operating costs** means that the flowmeter will quickly pay for itself even in applications where it was previously not possible to carry out measurements at all or only by means of other methods.

KROHNE

ENVIROMAG
Hardrubber

Technical data

Meter sizes	1" – 60"
Pipe flanges	
to ANSI B 16.5	1" – 24" / Class 150 lb / RF
to AWWA	28" – 60" / Class B / RF
Electrical conductivity	⩾ 20 µS/cm

Temperatures	Ambient temperature	Process temperature
Compact systems	- 13 to + 140°F	- 13 to + 140°F
ENVIROMAG (separate)		
Hardrubber (DN 100 - 1500...4" - 60")	- 13 to + 140°F	- 13 to + 176°F
In storage	- 13 to + 140°F	

Limits for pressure and temperature

Liner	Flange Standard	Nominal diameter	Pressure rating Class	S O	Max. Operating pressure in psi at a process temperature of... < 68°F	< 104°F	< 140°F	< 176°F	< 194°F
Hardrubber	ANSI B 16.5	1" - 6"	150 lb	S	285.7	284.2	275.5	271.2	—
			300 lb	O	on request				
		8"	150 lb	S	285.7	284.2	275.5	271.2	—
			300 lb	O	342.6	342.6	339.3	326.3	—
		10"	150 lb	S	285.7	284.2	275.5	271.2	—
			300 lb	O	465.5	465.5	465.5	465.5	—
		12"	150 / 300 lb	S / O	285.7	284.2	275.5	265.4	—
		14"	150 / 300 lb	S / O	258.1	258.1	255.2	245.1	—
		16"	150 / 300 lb	S / O	226.2	226.2	223.3	214.6	—
		18"	150 / 300 lb	S / O	200.1	200.1	198.7	190.0	—
		20"	150 / 300 lb	S / O	179.8	179.8	178.3	171.1	—
		24"	150 / 300 lb	S / O	205.9	205.9	204.5	197.2	—
	AWWA	28" – 60"	D	O	145.0	145.0	145.0	145.0	—

S = Standard
O = Option

Vacuum load

Liner	Meter size	Max. Allowed vacuum load in psig at product temperature of ... < 68°F	< 104°F	< 140°F	< 176° F
Hardrubber	1" - 60"	3.6	3.6	5.8	5.8

Insulation class of field coils	E
Electrodes design	
1" - 60"	flat elliptical electrodes, solidly fitted, surface-polished
Protection category	IP 67 and IP 68
Materials	
Measuring tube	stainless steel 1.4301 (AISI 304)
Electrodes	AISI 316 L (option HC and Titanium)
Housing	steel SAE 1008, paint finish
Grounding rings	stainless steel 1.4435 (AISI 316) / 1.4301 (AISI 304)
Terminal box	die-cast aluminium

KROHNE

ENVIROMAG
Polyurethane

Technical data

Meter sizes	1" – 40"
Pipe flanges	
to ANSI B 16.5	1" – 24" / Class 150 lb / RF
to AWWA	28" – 40" / Class D / RF
Electrical conductivity	⩾ 5 µS/cm

Temperatures		Ambient temperature	Process temperature
Compact systems		- 13 to + 140°F	- 13 to + 140°F
ENVIROMAG (separate)			
Polyurethane	1" – 40"	- 13 to + 140°F	- 13 to + 140°F
In storage		- 13 to + 140°F	

Limits for pressure and temperature

Liner	Flange Standard	Nominal diameter	Pressure rating Class	S O	Max. Operating pressure in psi at a process temperature of ...				
					< 68°F	< 104°F	< 140°F	< 176°F	< 194°F
Polyurethane	ANSI B 16.5	1" – 3"	150 lb	S	285.7	284.2	275.5	—	—
			300 lb	O	on request				
	ANSI B 16.5	4" – 6"	150 lb	S	285.7	284.2	275.5	—	—
			300 lb	O	on request				
		8"	150 lb	S	285.7	284.2	275.5	—	—
			300 lb	O	342.6	342.6	339.3	—	—
		10"	150 lb	S	285.7	284.2	275.5	—	—
			300 lb	O	465.5	465.5	465.5	—	—
		12"	150 / 300 lb	S / O	285.7	284.2	275.5	—	—
		14"	150 / 300 lb	S / O	258.1	258.1	255.2	—	—
		16"	150 / 300 lb	S / O	226.2	226.2	223.3	—	—
		18"	150 / 300 lb	S / O	200.1	200.1	198.7	—	—
		20"	150 / 300 lb	S / O	179.8	179.8	178.3	—	—
		24"	150 / 300 lb	S / O	205.9	205.9	204.5	—	—
	AWWA	28" – 40"	D	O	145.0	145.0	145.0	—	—

S = Standard
O = Option

Vacuum load	max. allowed vacuum load 7,2 psig (< 104°F)
Insulation class of field coils	E
Electrodes design	exchangeable electrodes
Protection category	IP 67 and IP 68
Materials	
Measuring tube	stainless steel 1.4301 (AISI 304)
Electrodes	AISI 316 L (option HC, Tantalum, Titanium)
Housing	steel SAE 1008, paint finish
Grounding rings	stainless steel 1.4435 (AISI 316) / 1.4301 (AISI 304)
Terminal box	die-cast aluminium

Technical Information

Selection of meter size

The optimum flow velocity should be 6 – 9 ft/s. For products with solids contents between 9 and 15 ft/s. The exact flow velocity can be determined from the columns in the tables.

v = 40 ft/s as shown in the following example:

- Meter size: 3”
- Desired measuring range:
  200 US Gal/min
  From the table obtain for
  v = 40 ft/s the flow rate of 955.9 US Gal/min at 3” meter size

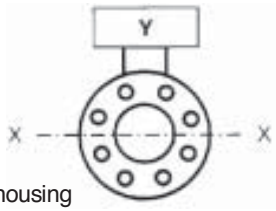
$$v = \frac{200 \text{ US Gal/min}}{955.9 \text{ US Gal/min}} \times 40 \text{ ft/s}$$

v = 8.37 ft/s

Meter size	$Q_{100\%}$ in US Gal/min	
	v = 1 ft/s	v = 40 ft/s
inch	(minimum)	(maximum)
1	2.334	93.34
1 1/2	5.979	239.0
2	9.339	373.5
3	23.90	955.6
4	37.35	1,493
5	58.38	2,334
6	84.05	3,361
8	149.43	5,975
10	233.4	9,334
12	336.2	13,442
14	464.8	18,593
16	597.9	23,899
20	933.9	37,345
24	1,345	53,781
28	1,919	76,760
30	2,203	88,133
32	2,507	100,272
36	3,173	126,904
40	3,917	156,672
42	4,121	164,693
48	5,464	218,560
54	6,807	272,255
60	8,405	336,114

Recommendations for installation

- **Location and position as required,** but electrode axis **x–·–·–·–x** must be approximately horizontal in a horizontal pipe run.



Y terminal box or converter housing

- **Measuring tube must be completely filled at all times.**
- **Direction of flow is arbitrary.**
- **Stud bolts and nuts:** to fit, make sure there is sufficient room next to the pipe flanges.
- **Vibration**: support the pipeline on both sides of the compact flowmeter.
- **Do not expose to direct sunlight,** fit a sunshade if necessary, not included with flowmeter, to be provided by customer.
- **Large meter sizes (≥ 8”)**: use adapter pipes to allow axial shifting of the counterflanges and to facilitate installation.
- **Strong electromagnetic fields,** avoid in vicinity of flowmeter.
- **Straight inlet run minimum of 5 x DN and outlet run minimum of 2 x DN,** (DN = meter size), measured from the electrode axis.
- **Vortex and corkscrew flow:** increase length of inlet and outlet runs or install flow conditioners.
- **Mixing different process liquids:** install flowmeter upstream of mixing point or at an adequate distance downstream (minimum of 30 x DN), otherwise display may be unsteady.
- **Plastic pipes and internally coated metal pipelines:** grounding rings required.
- **Insulated pipeline:** do not insulate flowmeter.
- **Zero setting not necessary:** To check, it should be possible to set “zero” flow velocity in the completely filled measuring tube. Shutoff valves should therefore, be provided either downstream of the flowmeter or upstream and downstream of the flowmeter.

Grounding rings

For process flow measurement reasons the product must be grounded. Such as grounding system is lacking in pipes upstream and downstream of the primary head which feature a corrosion-resistant internal coating or liner, or are made entirely of plastic material. In such cases, grounding rings must be fitted on both sides of the primary head.

ENVIROMAG Hardrubber and Polyurethane

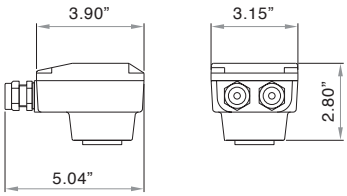
Dimensions and weights

The **total dimension for the height** is obtained from **dimension B** (see table) **plus the height** of the terminal box or the signal converter, see drawings.

The **total weight** is made up of the weight of the primary head (see table) **plus** the weight of the terminal box or signal converter, see below.

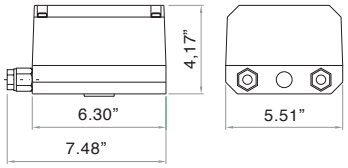
Terminal Box

Weight approx. 1.1 lb



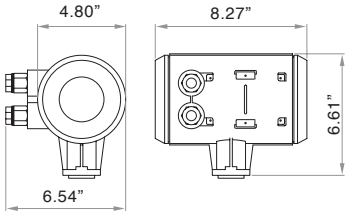
IFC 010 K and IFC 020 K

Signal converters
Weight approx. 3.6 lb



IFC 090 K

Signal converter
Weight approx. 5.1 lb



Flange connections to			**Dimensions** in inch
ANSI B 16.5	1” – 24”	150 lb / RF	see table
		⩾ 300 lb / RF	information supplied on request
AWWA	⩾ 28”	Class B, D / RF	information supplied on request

Dimension “A”: Gaskets not included with flowmeter
With Grounding Rings: Dimension A + 2 x thickness of the gasket + 2 x 0.12” (thickness of grounding rings)

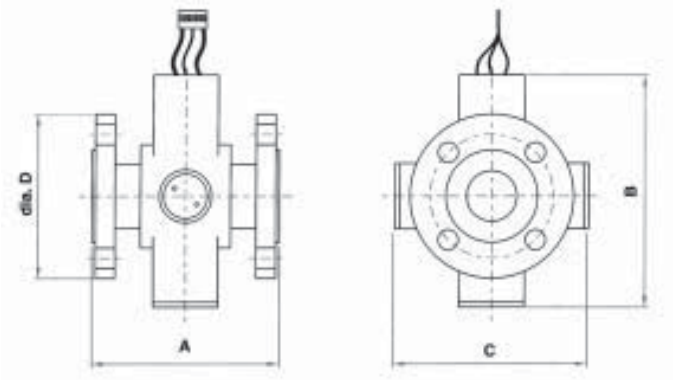
Nominal Diameter	Dimensions in inch								Weight
ANSI	A		B		C		D		approx.
Inch	DIN ISO	ANSI	DIN. ISO	ANSI	DIN. ISO	ANSI	DIN. ISO	ANSI	lb
1”	5.91	5.91	9.21	9.21	5.12	5.12	4.53	4.25	6.90
1 1/2”	5.91	5.91	9.21	9.21	5.12	5.12	5.91	5.00	13.20
2”	7.87	7.87	7.52	7.28	6.50	6.00	6.50	6.00	17.60
3”	7.87	7.87	8.23	8.03	7.87	7.50	7.87	7.50	37.50
4”	9.84	9.84	10.04	10.24	8.66	8.98	8.66	8.98	41.90
5”	9.84	9.84	11.03	11.10	9.84	10.00	9.84	10.00	48.50
6”	11.81	11.81	11.81	11.69	11.22	10.98	11.22	10.98	57.30
8”	13.78	13.78	14.06	14.17	13.39	13.50	13.39	13.50	110.20
10”	15.75	15.75	16.97	17.20	15.55	16.00	15.55	16.00	161.00
12”	19.69	19.69	19.02	19.76	17.52	19.02	17.52	19.02	218.30
14”	19.69	19.69	21.30	21.85	19.88	21.00	19.88	21.00	251.30
16”	23.62	23.62	24.92	24.92	22.24	23.50	22.24	23.50	337.30
18”	23.62	23.62	26.22	26.54	24.21	25.00	24.21	25.00	374.80
20”	23.62	23.62	28.11	28.62	26.38	26.38	26.38	27.50	418.90
24”	23.62	23.62	33.07	33.66	30.71	32.00	30.71	32.00	551.10
28”	27.56	27.56	36.61	37.68	35.24	36.50	35.24	36.50	661.40
30”	31.50	31.50	–	42.91	–	38.75	–	38.75	793.70
32”	31.50	31.50	41.34	42.24	39.96	41.75	39.96	41.75	1,003.00
36”	35.43	35.43	45.91	47.09	43.90	46.00	43.90	46.00	1,212.50
40”	39.37	39.37	50.16	50.91	48.43	50.75	48.43	50.75	1,385.00
42”	51.18	51.18	–	55.40	–	53.00	–	53.00	1,541.00
48”	51.18	51.18	59.91	62.13	57.28	59.50	57.28	59.50	1,995.00
54”	62.99	62.99	–	68.11	–	66.25	–	66.25	2,275.00
60”	66.93	66.93	–	73.82	–	73.00	–	73.00	3,858.00

Obs: 1” to 24” – weight with ANSI flanges
28” to 40” – weight with AWWA Class D flanges
42” to 60” – weight with AWWA Class B flanges

ENVIROMAG Hardrubber and Polyurethane

Dimensions

1” – 1 1/2”



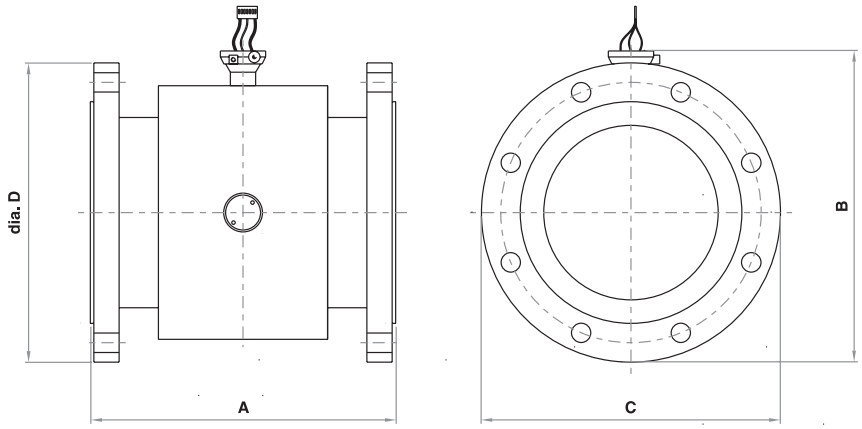
Tolerance details for fitting length dimensions “A”

ANSI B 16.5

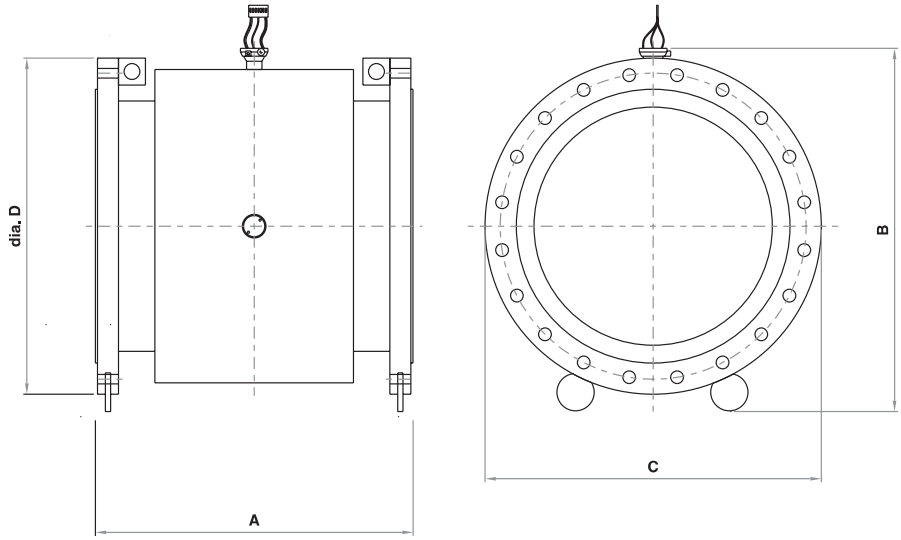
⩽ 12” : ± 0.5%, min. ± 0.04”

⩾ 14” : ± 0.5%

2” – 12”



14” – 60”



Electro magnetic flow sensor ENVIROMAG 2000 F

For connection to signal converter : IFC 010 C/W & IFC 300 C / W /F / R.
DC-field operation for liquids with conductivity≥ 20 µS/cm

ENVIROMAG 2000
DN 200 - DN 450 / 8" - 1[illegible]"

Code

Primary Head

VB15 4 **Nominal Diameter**

→ **E**	2000 F	DN 200 / 8"	**Hardrubber**
F	2000 F	DN 250 / 10"	**Hardrubber**
G	2000 F	DN 300 / 12"	**Hardrubber**
H	2000 F	DN 350 / 14"	**Hardrubber**
K	2000 F	DN 400 / 16"	**Hardrubber**
L	2000 F	DN 450 / 18"	**Hardrubber**
M	2000 F	DN 500 / 20"	**Hardrubber**
N	2000 F	DN 600 / 24"	**Hardrubber**

Nominal pressure

→ **A**	ASME 150 lbs RF:	DN > 250 (10") : max.operating pressure 10 bar (higher on request)	**see Flange Options Page A**
B	ASME 300 lbs RF:	DN > 250 (10") : max.operating pressure 10 bar (higher on request)	**see Flange Options Page A**
W	**AWWA C207 Class D**		**see Flange Options Page B**

Others on request

*** NOTE : Grounding ring DN200 / 8" up see Ring Options Page C**

Approval (in combination with IFC 300 for Ex only)

0 non Ex

→ **A** CSA Ordinary Locatior

System design

→ **1**	Compact with aluminum converter housing	/ at converter
2	Compact with stainless steel converter housing	/ at converter
4	Separate with aluminum connection box	/ 1/2" NPT
A	Separate with stainless steel connection box	/ 1/2" NPT

Converter model

0	Without / modular		
→ **1**	IFC 010 C	(compact design)	
2	IFC 010 W	(wall mount version)	
C	IFC 300 C	(compact design)	
D	IFC 300 F	(field mount version)	
E	IFC 300 W	(wall mount version)	
F	IFC 300 R	(rack mount version)	*** In preparation / pending

Lining

→ **0** Hardrubber (standard)

Electrodes

2	316 L (standard)	
→ **3**	Hastelloy C4	
4	Hastelloy B2	
5	Tantalum	
6	Titanium	
7	Platinum	

Construction of electrodes			
2	Exchangeable (except Ex approval)		
Material of Flange			
1	Carbon Stee		
2	Stainless Steel 1.4306 (304 L		see Flange Options Page A
3	Stainless Steel 1.4404 (316 L		see Flange Options Page A
6	Stainless Steel 1.4435 (316		see Flange Options Page A
7	Stainless Steel 1.4301 (304		see Flange Options Page A
Protection category			
0	IP 67		
2	IP 68	(only with stainless steel connection box)	
Cable			
0	Compact - without / separate D:		see Cable Options Page E
1	Separate BTS		see Cable Options Page E
Cable lenght			
0	Compact - none / separate - 5 m - 15 ft		0
1	10 m - 30 ft		see Cable Options Page E
2	15 m - 45 ft		see Cable Options Page E
3	20 m - 60 ft		see Cable Options Page E
4	25 m - 75 ft		see Cable Options Page E
5	30 m - 90 ft		see Cable Options Page E
6	40 m - 120 ft		see Cable Options Page E
7	50 m - 150 ft		see Cable Options Page E
8	100 m - 300 ft		see Cable Options Page E
Calibration			
0	Standard		
1	Stainless Steel 1.4301 (304) tagplat		
Ring / Material			
0	Whithout		
2	Ring #1 / Hastelloy C		see Ring Options Page C
6	Ring #1 / 1.4404 - 316 L		see Ring Options Page C
E	Ring #3 / 1.4404 - 316 L		see Ring Options Page C
P	Protection ring #2 / 1.4404 - 316 L		see Ring Options Page C
Construction requirements			
0	Standard		
1	Group 1	*** In preparation / pending	pending
2	Group 2	*** In preparation / pending	pending
3	Group 3	*** In preparation / pending	pending
QA / QC requirements			
0	Standard		
1	Group 1	*** In preparation / pending	pending
2	Group 2	*** In preparation / pending	pending
3	Group 3	*** In preparation / pending	pending
VB15		**Complete ordering code**	

KROHNE
The Level and Flow Company

KROHNE Inc.
7 Dearborn Road
Peabody, MA 01960
(978) 535-6060
(800) 356-9464
http://www.krohne.com

KROHNE

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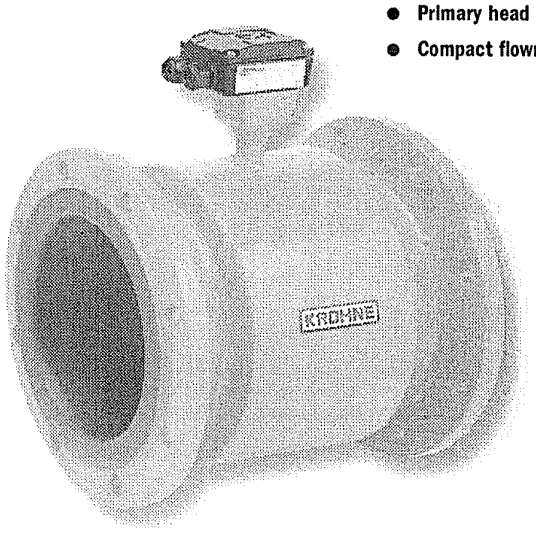
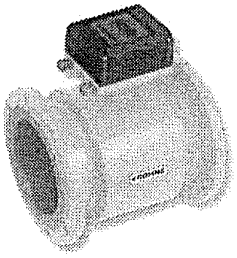
Installation and operating instructions

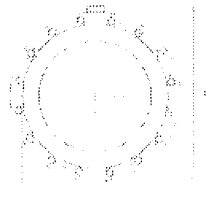
ENVIROMAG IFS 4000 KC F 010 K 020 K 080 K

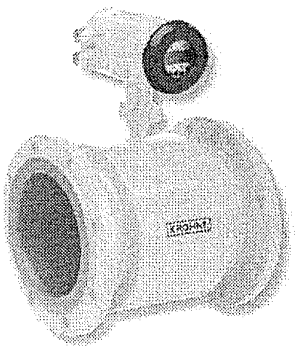
Electromagnetic flowmeters for water and sewage

- Primary head
- Compact flowmeter









Subject to change without notice.

- Variable area flowmeters
- Vortex flowmeters
- Flow controllers
- **Electromagnetic flowmeters**
- Ultrasonic flowmeters
- Mass flowmeters
- Level measuring instruments
- Communications technology
- Engineering systems & solutions
- Switches, counters, displays and recorders
- Heat metering
- Pressure and temperature

General advice on safety

- Do not install, operate or maintain this flow meter without reading, understanding and following the factory-supplied instructions, otherwise injury or damage may result.
- Read these instructions carefully before starting installation and save them for future reference.
- Observe all warnings and instructions marked on the product.
- Use only mains supply with protective earthing connected.
- Do not use the product with removed covers under wet conditions.
- Consider handling and lifting instructions to avoid damage.
- Install the product securely and stable.
- Install and connect cabling proper to exclude damage or harmful situations.
- If the product does not operate normally, refer to the service instructions or refer to qualified KROHNE service engineers.
- There are no operator-serviceable parts inside the product.

The following symbols may appear in this manual or on the product

ATTENTION: Refer to operating and installation instructions!

DANGER: Risk of electric shock!

PROTECTIVE EARTH (PE) conductor terminal!

These terms may appear in this manual or on the instrument:

WARNING statement: Identify conditions or practice that could result in injury or loss of life.

CAUTION statement: Identify conditions or practice that could result in damage to the instrument or other property.

Disclaimer

- This document contains important information on the instrument. KROHNE attempts to be as accurate and up-to-date as possible but assumes no responsibility for errors or omissions. Nor does KROHNE make any commitment to update the information contained herein. This manual and all other documents are subject to change without prior notice.
- KROHNE will not be liable for any damage of any kind by using its instrument, including, but not limited to direct, indirect, incidental, punitive and consequential damages.
- This disclaimer does not apply in case KROHNE has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.
- Any instrument purchased from KROHNE is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.
- KROHNE reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

Product liability and warranty

IFS 4000 KC electromagnetic flowmeters are designed solely for measuring the volumetric flowrate of electrically conductive, liquid process products.
Flowmeters with IFS 4000 KC flow sensors are not certified for use in hazardous locations. Other flowmeters series are available for such applications.
Responsibility as to suitability and intended use of these electromagnetic flowmeters rests solely with the operator.
Improper installation and operation of the flowmeters (systems) may lead to loss of warranty.
In addition, the "General conditions of sale" forming the basis of the purchase contract are applicable.
If IFS 4000 KC flowmeters need to be returned to Krohne, please note the information given on the last-but-one page of this manual. KROHNE regrets that they cannot repair or check your flowmeter(s) unless accompanied by the completed form sheet

- Responsibility for suitability and intended use of this ultrasonic flow meter rests solely with the user. Improper installation and operation of the flow meter (system) may lead to loss of warranty.
- In addition, the Terms and Conditions of Sale are applicable and are the basis for the purchase contract.
- If flow meters need to be returned to KROHNE, please note the information given on the last pages of the installation and operating instructions. KROHNE regrets that they cannot repair or check flow meter(s) unless accompanied by the completed form (see last pages of the installation and operating instructions).

Contents

System description

IFS 4000 KC electromagnetic flowmeters are precision measuring instruments designed for the linear flow measurement of process liquids.
The process liquids must be electrically conductive: ≥ 20 µS/cm for demineralized cold water
The full-scale range Q100% can be set as a function of the meter size:
IFS 4000 KC 010 K / 020 K / 080 K 1" - 040" Q100% = 0.1 - 033 900 m3/hr = 0.02 - 1156 640 US GPM
IFS 4000 KC 1 - 120" Q100% = 0.1 - 305 000 m3/hr = 0.02 - 1 400 000 US GPM
This is equivalent to a flow velocity of 0.3 - 12 m/s, or 1 - 40 ft/s

Standards and approvals

Please refer to the installation and operating instructions for the signal converter.

Items supplied

IFS 4000 KC F flow sensors

- flow sensor in the size as ordered
- Connecting wires for grounding, refer to Section 7 "Grounding"
- Certificate of calibration data
- Grounding rings (optional), if ordered
- Installation instructions

IFS 4000 KC 010 K, 020 K and 080 K compact flowmeters

- Compact flowmeter in the size as ordered
- Connecting wires for grounding, see
- Section 7 "Grounding"
- Certificate of calibration data
- Grounding rings (optional), if ordered
- Installation instructions
- Installation and operating instructions for the signal converter
- Items included with supply

Fitting accessories (stud bolts, nuts, gaskets, etc.) are not supplied with the flowmeter. These are to be provided by the customer!

IFS 4000 KC 010 K, 020 K and 080 K compact flowmeters

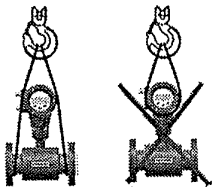
- Compact flowmeter in the size as ordered
- Connecting wires for grounding, see
- Section 7 "Grounding"
- Certificate of calibration data
- Grounding rings (optional), if ordered
- Installation instructions
- Installation and operating instructions for the signal converter
- Items included with supply

Handling

Do not lift the signal converter housing or the terminal box.
Check the weight of the flow meter as indicated on the type plate before handling the unit.
When handling the flow meter avoid hard blows, jolts or impacts

Do not set flowmeter down on signal converter housing or terminal box.

PLEASE NOTE the temperature limits for storage and transport.



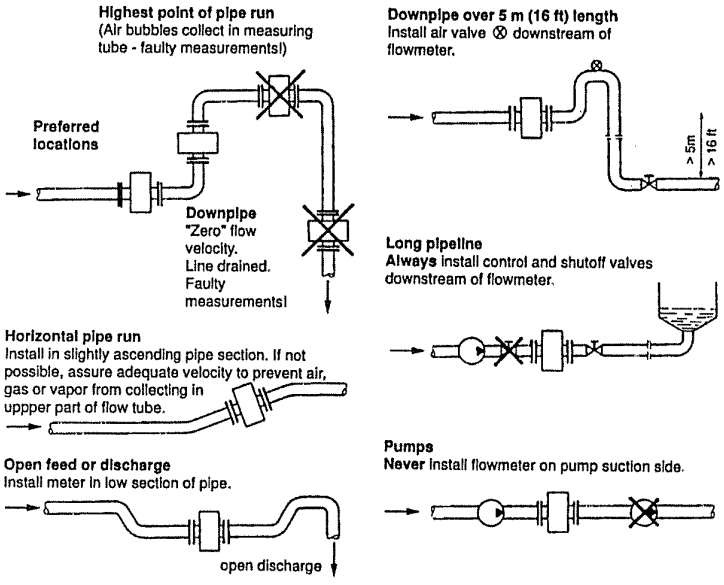
1 1 Important information for installation:

PLEASE NOTE !

- Location and position as required, but electrode axis X – • – • – • – X must be approximately horizontal in a horizontal pipe run.
- Y terminal box or converter housing
- Measuring tube must be completetly filled at all times.
- Direction of flow is arbitrary. Arrow on flowmeter can normally be ignored. For exceptions, refer to Section "Factory settings" in the installation and operating instructions for the signal converter.
- Stud bolts and nuts: to fit, make sure there is sufficient room next to the pipe flanges.
- Vibration: support the pipeline on both sides of the compact flowmeter. Level of vibration in conformity with IEC 068-2-34: below 2.2g for compact flowmeters in the frequency range of 20-50 Hz with the IFC 010 K / IFC 020 K and 20-150 Hz with the IFC 090 K.
- Do not expose to direct sunlight, fit a sunshade if necessary, not included with flowmeter, to be provided by customer.
- Large meter sizes (≥ DN 200 / ≥ 8"): use adapter pipes to allow axial shifting of the counterflanges and to facilitate installation.
- Use only solventless detergents to clean the signal converter housing (polycarbonate).
- Strong electromagnetic fields, avoid in vicinity of flowmeter
- Straight inlet run minimum of 5 × DN and outlet run minimum of 2 × DN, (DN = meter size), measured from the electrode axis.
- Vortex and corkscrew flow: increase length of inlet and outlet runs or install flow conditioners.
- Mixing different process liquids: install flowmeter upstream of mixing point or at an adequate distance downstream (minimum of 30 × DN), otherwise display may be unsteady.
- Plastic pipes and internally coated metal pipelines: grounding rings required, see Section 7 "Grounding".
- Insulated pipeline: do not insulate flowmeter
- Zero setting not necessary. To check, it should be possible to set "zero" flow velocity in the completely filled measuring tube. Shutoff valves should therefore be provided either downstream of the flowmeter or upstream and downstream of the flowmeter.

2 Suggestions for installation

To avoid measuring errors due to gas/air inclusion or to pipe running empty, please observe the following:



3 Instrument nameplate

IFS 4000 KC F
separate flow sensor

4 Flowmeter versions

IFS 4000 KC F, Separate flow sensor (F), electrically connected to the signal converter by signal and field current cables.
IFS 4000 KC 010 K, Compact flowmeter (K), IFC 010 K or IFC 020 K signal converter mounted
IFS 4000 KC 020 K, direct on the flow sensor.
IFS 4000 KC 080 K; Compact flowmeter (K), IFC 090 K signal converter mounted direct on the flow sensor.

5 Installation in the pipeline

- Installation material not included, to be provided by customer (stud bolts, nuts, gaskets, etc.)
- Pipe flanges and operating pressure: refer to tables on "limits" in Section 11.
- Distance between pipe flanges
  see fitting dimension "a", in Section 10 "Dimensions and weights".
- Position of flanges Install flowmeter in line with the pipe axis. Pipe flange faces must be parallel to each other, max. permissible deviation:
- Lmax – Lmin $\leq$ 0.5 mm $\leq$ 0.02"
- Gaskets
  Use gaskets suitable for the application and appropriate to the liner, not included with flowmeter, to be provided by customer.
- Grounding rings / protective rings (option)
  On plastic pipes and internally coated metal pipelines, grounding rings must form the conductive connection with the fluid. Refer to Section 7 "Grounding for electrical connection.

6 Torques

- Tighten stud bolts uniformly in diagonally opposite sequence, see table for number and type.
- 10 Nm ~ 1.0 kpm ~ 7.23 ft × lbf
- Note: Process pressure must not exceed ANSI

7 Grounding

- All flowmeters must be properly grounded to avoid personnel shock hazard.
- The ground conductor should not transmit any interference voltages, therefore do not ground any other electrical devices together with this conductor.

IFS 4000 KCF separate flow sensor with terminal box

- An FE functional ground must always be connected.
- Signal converter with field power supply > 125 mA / 60 V a PE protective conductor must be connected to the flow sensor, because of the higher field current from the signal converter. See grounding diagrams below.

IFS 4000 KC010 K, 020 K and 080 K compact systems

Supply power > 50 V AC

- Grounding is via **the PE protective ground conductor** incorporated in the power supply cable, see also Section "Connection to power" in the installation and operating instructions for the signal converter.
- **EXCEPTION: Do not connect up the PE protective ground conductor in the terminal box** if e.g. compact units are operated in the proximity of electric furnaces, electrolysis plants, etc., and large potential differences occur in the pipeline system. An FE functional ground must simultaneously take over the function of the protective conductor (combined protective/functional ground). Refer to appropriate national codes for specific requirements for this type of installation, which may require the addition of a ground fault detection circuit interrupter.

Power supply 24 V AC or DC

- Protective separation (PELV) must be ensured (VDE 0100 / VDE 0106 or IEC 364 / IEC 536 or equivalent national regulations).
- An FE functional ground conductor must be connected for measurement reasons.

8 Replacement of the separate flow sensor

Switch off power source before commencing work !

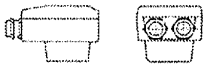
1) Note down terminal assignment before dismantling the "old" flow sensor.
2) Install the new flow sensor as described in the supplied installation instructions.
3) Make electrical connection at the signal converter as described in the installation and operating instructions for the signal converter.
4) Specific calibration data are defined during factory calibration for each flow sensor, which are indicated on the instrument nameplate.
   This includes the primary constant GK and the magnetic field frequency. These data need to be reset in the signal converter.
5) If the size of flow sensor is also different from the old one, the full-scale range Q100% and the meter size will need to be reset.
6) After resetting the signal converter, carry out a zero point check.
7) If necessary, reset the internal electronic totalizer of the signal converter.

9 Technical data

Meter sizes		
Compact syste	1" – 040"	
IFS 4000 KCF (separate)	1" – 60"	
Pipe flanges		
to DIN 2501 (= BS 4504)		
to ANSI B16.5	1" – 24" / Class 150 lb / RF	
to AWWA	28" – 60" / Class B or D / FF	
Electrical conductivity	≥ 20 µS/cm	
Temperatures	Ambient temperature	Process temperature
Compact systems		
	– 13 to +140°F	– 13 to ≤ +140°F
	– 13 to +140°F	– 13 to +140°F
IFS 4000 KCF (separate)	– 13 to +140°F	– 13 to +176°F
Max. allowable operating data	Process temperature, operating pressure and vacuum load for the liner, refer to Page 3 "Limits"	
Insulation class of field coils	E	
Electrode design		
1" – 60"	flat elliptical electrodes, solidly fitted, surface-polished	
Protection category (EN 60 529 / IEC 529)		
Standard	IP 67, equivalent to NEMA 6	
Option	IP 68, equivalent to NEMA 6	
Grounding rings	available as an option	
Materials		
Measuring tube	stainless steel 1.4301 (or higher materials number), equivalent to SS 304	
Liner		
1 - 40"	polyurethane	
1" – 60"	hard rubber	
Electrodes		
Standard	Hastelloy C4	
Option	stainless steel 1.4571 or SS 316 Ti, titanium	
Connecting flanges*		
ANSI	steel ASTM A 105 N	
Terminal box*		
IFS 4000 KCF (separate)	die-cast aluminium	
Grounding rings (option)	stainless steel 1.4571or SS 316 Ti	
* with polyurethane coating		

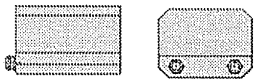
10 Dimensions and weights

Terminal box



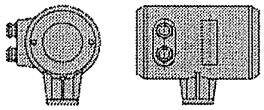
Weight approx. 0.5 kg (1.1 lb)

IFC 010 K and IFC 020 K signal converters



Weight approx. 1.6 kg (3.6 lb)

IFC 090 K s9ignal converter



Weight approx. 2.3 kg (5.1 lb)

Flange connections to...			Dimensions in inch
ANSI B 16.5	1" - 24"	150 lb / RF	see table
		≥ 300 lb / RF	dimensions supplied on request
AWWA	≥ 28"	Class B, D / FF	dimensions supplied on request

Dimension "a" without flange gaskets:
Not included with flowmeter to be provided by customer

Nominal Diameter	Dimensions in inches (ANSI)								Weight
ANSI	A		B		C		D		approx.
Inch	DIN ISO	ANSI	DIN ISO	ANSI	DIN ISO	ANSI	DIN ISO	ANSI	lb
1	5.91	5.91	9.21	9.21	5.12	5.12	4.53	4.25	6.90
1 1/2	5.91	5.91	9.21	9.21	5.12	5.12	5.91	5.00	13.20
2	7.87	7.87	7.52	7.28	6.50	6.00	6.50	6.00	17.60
3	7.87	7.87	8.23	8.03	7.87	7.50	7.87	7.50	37.50
4	9.84	9.84	10.04	10.24	8.66	8.98	8.66	8.98	41.90
6	11.81	11.81	11.81	11.69	11.22	10.98	11.22	10.98	57.30
8	13.78	13.78	14.06	14.17	13.39	13.50	13.90	13.50	110.20
10	15.75	15.75	16.97	17.20	15.55	16.00	15.55	16.00	161.00
12	19.69	19.69	19.02	19.76	17.52	19.02	17.52	19.02	218.30
14	19.69	19.69	21.30	21.85	19.88	21.00	19.88	21.00	251.30
16	23.62	23.62	24.92	24.92	22.24	23.50	22.24	23.50	337.30
18	23.62	23.62	26.22	26.54	24.21	25.00	24.21	25.00	374.80
20	23.62	23.62	28.11	28.62	26.38	26.38	26.38	27.50	418.90
24	23.62	23.62	33.07	33.66	30.71	32.00	30.71	32.00	551.10

If you need to return flowmeters for testing or repair to KROHNE

Your electromagnetic flowmeter

- has been carefully manufactured and tested by a company with ISO 9001 certification
- and volumetrically calibrated in one of the world's most accurate test rigs.

If installed and operated in accordance with these operating instructions, your flowmeter will rarely present any problems.

Should you nevertheless need to return a flowmeter for checkout or repair, please pay strict attention to the following points:

Due to statutory regulations concerning protection of the environment and the health and safety of our personnel, Krohne may only handle, test and repair returned flowmeters that have been in contact with liquids if it is possible to do so without risk to personnel and environment. This means that Krohne can only service your flowmeter if it is accompanied by a certificate in line with the following model confirming that the flowmeter is safe to handle.

If the flowmeter has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested

- to check and ensure, if necessary by rinsing or neutralizing, that all cavities in the flowmeter are free from such dangerous substances.
  (Directions on how you can find out whether the primary head has to be opened and then flushed out or neutralized are obtainable from Krohne on request.)
- to enclose a certificate with the flowmeter confirming that the flowmeter is safe to handle and stating the liquid used.

Krohne regret that they cannot service your flowmeter unless accompanied by such a certificate.

SPECIMEN certificate

Company: ..... Address: .....

Department: ..... Name: .....

Tel. No.: ..... Fax No.: .....

The enclosed instrument

Type: .....

KROHNE Order No. or Series No .....

has been operated with the following liquid: .....

Because this liquid is
water-endangering * / toxic * / caustic * / flammable *
we have
- checked that all cavities in the instrument are free from such substances *
- flushed out and neutralized all cavities in the flowmeter *

(* delete if not applicable)

We confirm that there is no risk to man or environment through any residual liquid contained in the instrument.

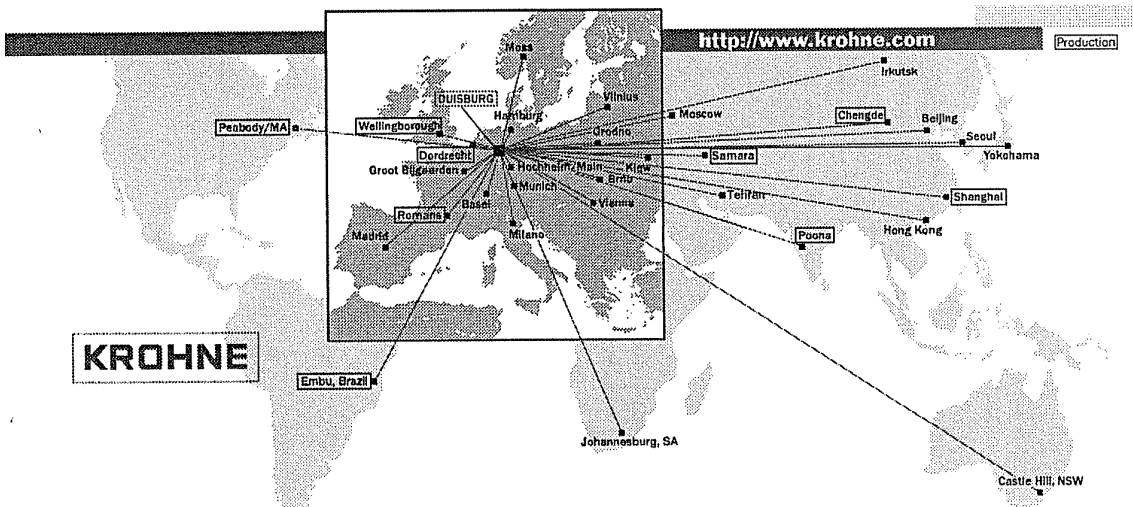
Date: ..... Signature: .....

Company stamp:

Notes

http://www.krohne.com

Production



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Estonia	Portugal
Finland	Saudi Arabia
French Antilles	Senegal
Greece	Slovakia
Guinea	Slovenia
Hong Kong	Sweden
Hungary	Taiwan
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Subject to change without notice

IFC 100 Technical Datasheet

Electromagnetic Flow Converter

- Quick and easy to install and operate
- Diagnostics of application and instrument
- Extremely quick signal conversion

KROHNE

The more than economical solution

The **IFC 100** offers a broad range of performance with an outstanding price/performance ratio.

The **IFC 100** has been developed for applications requiring an economical solution for the measuring task at a high technological level.

1 Large, illuminated graphic display with intuitive operation
2 For AC and DC operation

Highlights

- Quick and easy to install and operate
- Large, illuminated graphic display with intuitive operation
- Multiple user languages as standard
- Maintenance-free
- Outstanding price/performance ratio
- Extremely quick signal conversion

Industries

- Agriculture
- Heating, Ventilation & Air Conditioning
- Machinery
- Power Plants
- Water
- Wastewater

Applications

- Measuring homogeneous media
- Water distribution networks and spray-irrigation systems
- Water treatment
- Environmental technology

Options and variants

Modular converter concept

Despite its somewhat different appearance, the IFC 100 has many of the same functions as its "big brother", the IFC 300. The diagnostics function, conductivity measurement and simple menu navigation, to mention just a few. This latest member of the transformer family also has a large number of fully-developed functions:

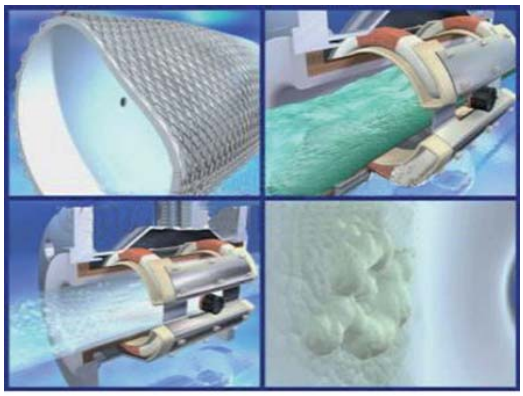
- various auxiliary power supply versions (AC, DC, AC/DC)
- HART as standard
- optional Ex version available

Compact design in various versions

The IFC 100 C in the 0° version is ideal for installation in vertical pipes. The 45° version, on the other hand, allows draining of liquids when it is installed in horizontal pipes. The angled design also improves the readability of the display.
The backlit display provides excellent readability from long distances. The 4 softkeys enable easy operation, start-up and parametrization.
Both housing versions can be rotated in 90° increments, allowing customer-specific installation positions.

Signal converter in wall version

With the IFC 100 W, remote installation is possible in the case of temperature effects, vibration or difficult-to-reach locations. A signal cable is used to connect the sensor and the converter for the purposes of power supply and signal processing. The electronics can be used in all housing versions without reparametrization.



Diagnosis

The IFC 100 has been equipped with an extensive diagnostic tool for device function and application tests.

- Conductivity measurement
- Electrode error
- Process or ambient temperature too high

Technical data

Measuring system

Measurement principle	Faraday's law of induction
Function	Continuous measurement of current volume flow, flow velocity, conductivity, mass flow (at constant density), coil temperature of the measuring sensor
Modular construction	The measurement system consists of a measuring sensor and a signal converter
Signal converter	
Compact version (C)	IFC 100 C (0° & 45° version)
Remote version (W)	IFC 100 W
Measuring sensor	
OPTIFLUX 1000	IFC 100 C & W: DN10...150 / 3/8" 6"
OPTIFLUX 2000	IFC 100 C & W: DN25...1200 / 1" 48"
OPTIFLUX 4000	IFC 100 C: DN2.5...1200 / 1/10" 48"; IFC 100 W: DN10...1200 / 3/8" 48";
OPTIFLUX 5000	IFC 100 C: DN2.5...250 / 1/10" 12"; IFC 100 W: DN10...250 / 3/8" 12"
OPTIFLUX 6000	IFC 100 C: DN2.5...150 / 1/10" 6"; IFC 100 W: DN10...150 / 3/8" 6"
Communication	
Outputs	Current (incl. HART®), pulse, frequency, status output and/or limit switch
Counter	2 internal counters with a max. of 8 counter places (e.g. for counting volume and/or mass units)
Verification	Integrated verification, diagnosis functions: flowmeter, empty pipe detection, stabilization
Display and user interface	
Graphic display	LC display, backlit white; size: 128x64 pixels, corresponds to 59x31 mm = 2.32"x1.22"
Display functions	2 measured value pages, 1 status page, 1 graphic page (measured values and depictions adjustable as required)
Units	Metric, British and US units selectable as required from lists for volume / mass flow and counting, flow speed, electrical conductivity, temperature
Language of display texts	English, French, German (others on request)
Operating elements	4 keys for operator control of the signal converter without opening the housing

Measuring accuracy

Maximum measuring error	±0.3% of the measured value ±1 mm/s, depending on the measuring sensor (see accuracy curves)
Repeatability	±0.1%

Operating conditions

Temperature	
Process temperature	See also data sheet for the measuring sensor
Ambient temperature	-40 +65°C / -40 +149°F (ambient temperature 55°C / 131°F and higher: protect electronics against self-heating, because an increase in the electronics temperature in 10°C / 50°F steps leads to a corresponding reduction of the electronics' service life by a factor of two.)
Storage temperature	-50 +70°C / -58 +158°F
Electrical conductivity	
All media except for water	Min. 5 µS/cm (see also data sheet for the measuring transformer)
Water	Min. 20 µS/cm

Materials

Die-cast aluminium (polyurethane-coated)	Standard

Electrical connection

Voltage	Standard: 100 230 VAC (-15% / +10%), 50/60 Hz
	Option 1: 24 VDC (-55% / +30%)
	Option 2: 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%)
Power consumption	Standard: 8 VA
	Option 1: 4 W
	Option 2: AC 8 VA; DC: 4 W
Signal cable	Only for remote versions
A: type DS 300	Max. length: 600 m / 1950 ft (depending on electrical conductivity and measuring sensor version)
Cable entries	Standard: M20 x 1.5
	Option: ½" NPT, PF ½

Outputs

Current output		
Function	Measurement of volume and mass (at constant density), HART® communication	
Settings	**Without HART®**	**With HART®**
	Q = 0%: 0 15 mA	Q = 0%: 4 15 mA
	Q = 100%: 10 21.5 mA	Q = 100%: 10 21.5 mA
	Error identification: 0 22 mA	Error identification: 3.5 22 mA
Operating data		
Active	$U_{int,nom}$ = 24 VDC I ≤ 22 mA R_L ≤ 750 Ω	
Passive	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≤ 2 V at I = 22 mA	
Pulse or frequency output		
Function	Can be set as a pulse output (e.g.- for volume or mass counting) or frequency output	
Settings	For Q = 100%: 0.01...10000 pulses per second or pulses per unit volume	
	Pulse width: setting automatic, symmetric or fixed (0.05...2000 ms)manual	
Operating data		
Passive	U_{ext} ≤ 32 VDC	
	100 Hz < f_{max} ≤ 10 kHz: I ≤ 20 mA open: I ≤ 0.1 mA at U_{ext} = 5 V I ≤ 0.5 mA at U_{ext} = 24 V I ≤ 0.7 mA at U_{ext} = 32 V closed: U_0 ≤ 0.8 V at I = 1 mA U_0 ≤ 1.5 V at I = 10 mA U_0 ≤ 3.5 V at I = 100 mA f ≤ 1 kHz: R_L ≤ 10 kΩ f ≤ 10 kHz: R_L ≤ 2 kΩ	

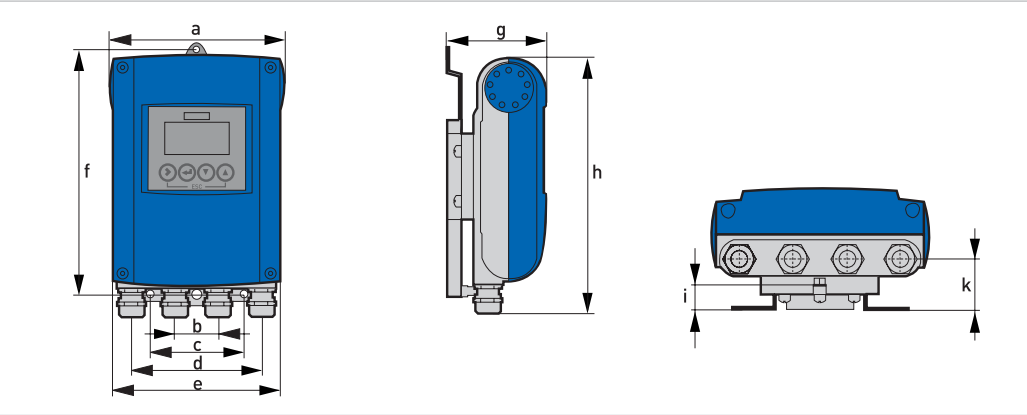
Status output / limit switch	
Function and settings	Settable as automatic measuring range change, indicator for direction of flow, overflow, error, operating point or empty pipe detection
	Valve control with activated dosing function
	Status and/or control: ON or OFF
Operating data	
Passive	$U_{ext} \leq 32$ VDC $I \leq 100$ mA open: $I \leq 0.05$ mA at $U_{ext} = 32$ VDC closed: $U_0 \leq 0.2$ V at I = 10 mA $U_0 \leq 2$ V at I = 100 mA
Low-flow cutoff	
On	0...±9.999 m/s; 0...20.0%, settable in 0.1% steps, separately for each current and pulse output
Off	0...±9.999 m/s; 0...19.0%, settable in 0.1% steps, separately for each current and pulse output
Time constant	
Function	Can be set together for all flow indicators and outputs, or separately for: current, pulse and frequency output, and for limit switches and the 2 internal counters
Time setting	0 100 seconds, settable in 0.1 second steps

Approvals

Hazardous areas	
Non-Ex	Standard
EEx - Zone 1/2	In preparation
SAA version Ex Zone 1/2	In preparation
TIIS - Zone 1/2	In preparation
Protection category to IEC 529 / EN 60529	
All versions	IP 66 / 67 (corresponds to NEMA 4X/6)

Dimensions and weights

Wall-mounted version



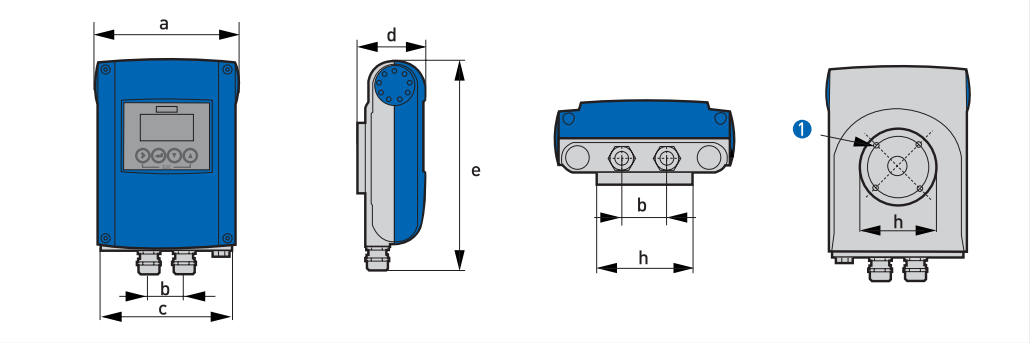
Dimensions and weight in mm and kg

	Dimensions [mm]										Weight [kg]
	a	b	c	d	e	f	g	h	i	k	
Wall-mounted version	161	40	87.2	120	155	241	95.2	257	19.3	39.7	Std: 1.9 Ex: 2.4

Dimensions and weight in inches and lbs

	Dimensions [inches]										Weight [lbs]
	a	b	c	d	e	f	g	h	i	k	
Wall-mounted version	6.34	1.57	3.43	4.72	6.10	241	9.49	10.12	0.76	1.56	Std: 4.2 Ex: 5.3

Compact 0° version



1 4 x M 6

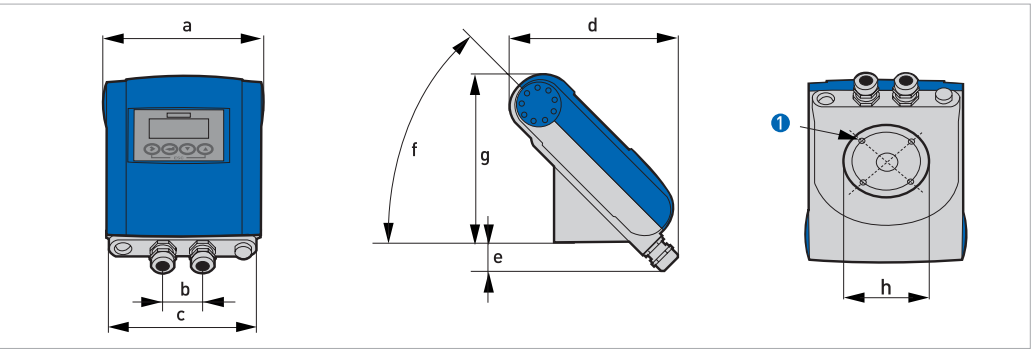
Dimensions and weight in mm and kg

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
0° version	161	40	155	81.5	257	-	-	Ø72	Std: 1.9 Ex: 2.4

Dimensions and weight in inches and lbs

	Dimensions [inches]								Weight [lbs]
	a	b	c	d	e	f	g	h	
0° version	6.34	1.57	6.1	3.21	10.12	-	-	Ø2.83	Std: 4.2 Ex: 5.3

Compact 45° version



1 4 x M 6

Dimensions and weight in mm and kg

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
45° version	161	40	155	184	27.4	45°	186	Ø72	Std: 2.1 Ex: 2.6

Dimensions and weight in inches and lbs

	Dimensions [inches]								Weight [lbs]
	a	b	c	d	e	f	g	h	
45° version	6.34	1.57	2.17	2.74	1.08	45°	7.32	Ø2.83	Std: 4.6 Ex: 5.7

Flow tables

Flow rate in m/s and m^3/h

	$Q_{100\ \%}$ in m^3/h			
v [m/s]	0.3	1	3	12
DN [mm]	Min. flow	Nominal flow		Max. flow
2.5	0.01	0.02	0.05	0.21
4	0.01	0.05	0.14	0.54
6	0.03	0.10	0.31	1.22
10	0.08	0.28	0.85	3.39
15	0.19	0.64	1.91	7.63
20	0.34	1.13	3.39	13.57
25	0.53	1.77	5.30	21.21
32	0.87	2.90	8.69	34.74
40	1.36	4.52	13.57	54.29
50	2.12	7.07	21.21	84.82
65	3.58	11.95	35.84	143.35
80	5.43	18.10	54.29	217.15
100	8.48	28.27	84.82	339.29
125	13.25	44.18	132.54	530.15
150	19.09	63.62	190.85	763.40
200	33.93	113.10	339.30	1357.20
250	53.01	176.71	530.13	2120.52
300	76.34	254.47	763.41	3053.64
350	103.91	346.36	1039.08	4156.32
400	135.72	452.39	1357.17	5428.68
450	171.77	572.51	1717.65	6870.60
500	212.06	706.86	2120.58	8482.32
600	305.37	1017.90	3053.70	12214.80
700	415.62	1385.40	4156.20	16624.80
800	542.88	1809.60	5428.80	21715.20
900	687.06	2290.20	6870.60	27482.40
1000	848.22	2827.40	8482.20	33928.80
1200	1221.45	3421.20	12214.50	48858.00

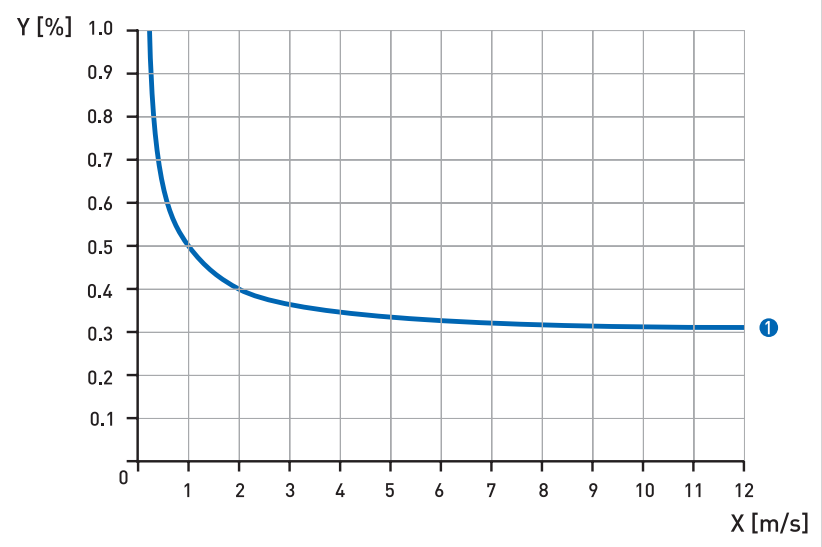
Flow rate in ft/s and gallons/min

	$Q_{100\ \%}$ in .US gallons/min			
v [ft/s]	1	3.3	10	40
DN [inch]	Min. flow	Nominal flow		Max. flow
1/10	0.02	0.09	0.23	0.93
1/8	0.06	0.22	0.60	2.39
1/4	0.13	0.44	1.34	5.38
3/8	0.37	1.23	3.73	14.94
1/2	0.84	2.82	8.40	33.61
3/4	1.49	4.98	14.94	59.76
1	2.33	7.79	23.34	93.36
1.25	3.82	12.77	38.24	152.97
1.5	5.98	19.90	59.75	239.02
2	9.34	31.13	93.37	373.47
2.5	15.78	52.61	159.79	631.16
3	23.90	79.69	239.02	956.09
4	37.35	124.47	373.46	1493.84
5	58.35	194.48	583.24	2334.17
6	84.03	279.97	840.29	3361.17
8	149.39	497.92	1493.29	5975.57
10	233.41	777.96	2334.09	9336.37
12	336.12	1120.29	3361.19	13444.77
14	457.59	1525.15	4574.93	18299.73
16	597.54	1991.60	5975.44	23901.76
18	756.26	2520.61	7562.58	30250.34
20	933.86	3112.56	9336.63	37346.53
24	1344.50	4481.22	13445.04	53780.15
28	1829.92	6099.12	18299.20	73196.79
32	2390.23	7966.64	23902.29	95609.15
36	3025.03	10082.42	30250.34	121001.37
40	3734.50	12447.09	37346.00	149384.01
48	5377.88	17924.47	53778.83	215115.30

Accuracy

Reference conditions

- Medium: water
- Temperature: 20°C / 68°F
- Pressure: 1 bar / 14.5 psi
- Inlet run: ≥ 5 DN



- X [m/s]: flow velocity
- Y [%]: deviation from the actual measured value (mv)

	DN [mm]	DN [inch]	Accuracy	Curve
OPTIFLUX 2100 / 4100 / 5100 / 6100	10 1200	3/8 48	0.3% of mv +1 mm/s	1
OPTIFLUX 1100	10 150	3/8 6	0.4% of mv +1 mm/s	as 1 + 0.1%
OPTIFLUX 4100 / 5100 / 6100	2.5 6	1/10 1/4		

KROHNE Product Overview

- Electromagnetic flowmeters
- Variable area flowmeters
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KROHNE

IFC 100 Handbook

Signal converter for electromagnetic flowmeters

KROHNE

IMPRINT

1.1 Safety instructions from the manufacturer

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The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.1.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the flowmeters for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the flowmeters (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.1.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local the manufacturer office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.1.5 Display conventions

The following symbols are used to help you navigate this documentation more easily:

WARNING!
These warning signs must be observed without fail. Even only partial disregarding such warnings can result in serious health damage, damage to the device itself or to parts of the operator's plant.

DANGER!
This symbol designates safety advice on handling electricity.

CAUTION!
These warnings must be observed without fail. Even only partial disregarding such warnings can lead to improper functioning of the device.

LEGAL NOTICE!
This symbol designates information on statutory directives and standards.

NOTE!
This symbol designates important information for the handling of the device.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ CONSEQUENCE
This symbol designates all important consequences of the previous actions.

1.2 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

NOTE!
Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to your local office.

NOTE!
Check the packing list to make sure that you have received your complete order.

NOTE!
Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.

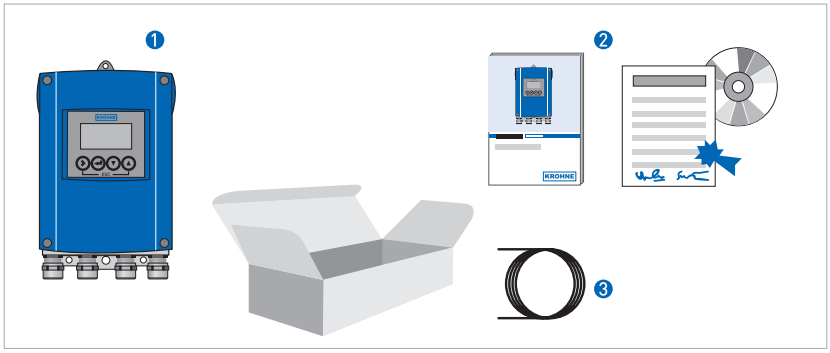


Figure 2-1: **Scope of delivery**

1. Device in the version as ordered
2. Documentation (calibration report, Quick Start directions, CD-ROM with product documentation for measuring sensor and signal converter)
3. Signal cable (only for remote version)

2.2 Instrument description

Electromagnetic flowmeters are exclusively suitable for measurement of flow rates and the conductivity of electrically conductive liquid media.

Your measuring device is supplied ready for operation. The factory settings for the operating data have been made in accordance with your order specifications.

The following versions are available:

- Compact version (the signal converter is mounted directly on the measuring sensor)
- Remote version (electrical connection to the measuring sensor via field current and signal cable)

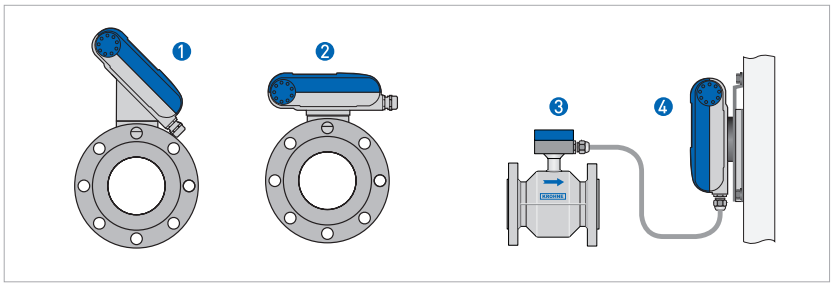


Figure 2-2: **Device versions**

1. Compact 45° version
2. Compact 0° version
3. Measuring sensor with outlet box
4. Wall-mounted version

2.2.1 Wall version

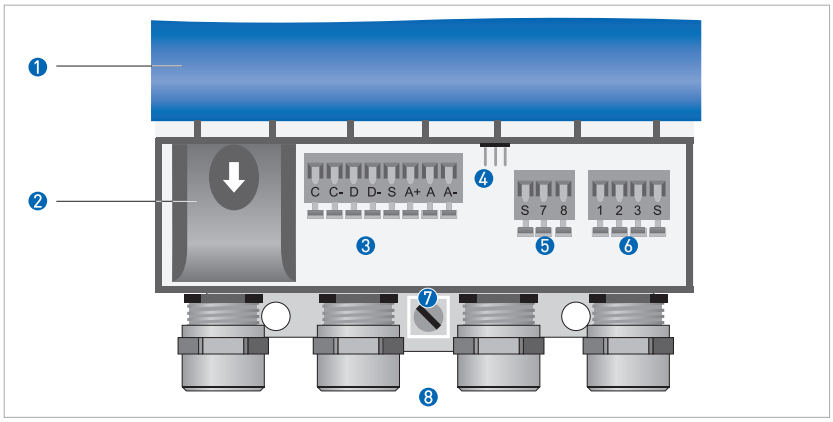


Figure 2-3: **Structure of wall-mounted version**

1. Open housing cover
2. Terminal compartment for power with safety cover (shock-hazard protection)
3. Connection terminals of the outputs
4. GDC bus interface (for Service only)
5. Connection terminals of the field current cable
6. Connection terminals of the signal cable
7. Connection screw for grounding the housing
8. Cable entries; example for remote version (for compact version the two outer cable entries are omitted)

2.3 Nameplates

NOTE!
Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.

2.3.1 Nameplate (example)

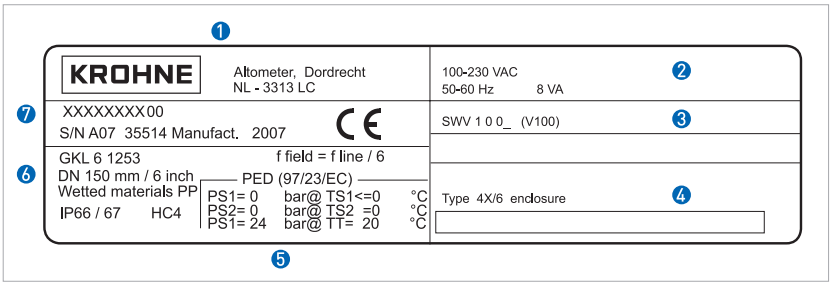


Figure 2-4: **Example of a nameplate**

1. Manufacturer
2. Power supply information
3. Software version
4. Tag name
5. Approvals-related pressure and temperature thresholds
6. GK/GKL values (measuring sensor constants); size (mm /inches); field frequency; protection category; materials of parts in contact with media
7. Product designation, serial number and date of manufacture

3.1 Notes on installation

NOTE!
Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to your local office.

NOTE!
Check the packing list to make sure that you have received your complete order.

NOTE!
Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.

3.2 Storage

- Store the device in a dry, dust-free location.
- Avoid continuous direct sunlight.
- Store the device in its original packaging.

3.3 Installation specifications

NOTE!
The following precautions must be taken to ensure reliable installation.

- Make sure that there is adequate space to the sides.
- Protect the signal converter from direct sunlight and install a sun shade if necessary.
- Signal converters installed in control cabinets require adequate cooling, for example fans or heat exchangers.
- Do not subject the signal converter to heavy vibrations. The flowmeters are tested for a vibration level in accordance with IEC 68-2-3.

3.4 Transport

Signal converter

- No special requirements.

Compact versions

- Do not lift the flowmeter by the signal converter housing.
- Do not use lifting chains.
- To transport flange devices, use lifting straps. Wrap these around both process connections.

3.5 Mounting of the compact version

NOTE!
The signal converter is mounted directly on the measuring sensor. For installation of the flowmeter, please observe the instructions in the supplied product documentation for the measuring sensor.

3.6 Mounting the wall-mounted housing, remote version

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

3.6.1 Wall mounting

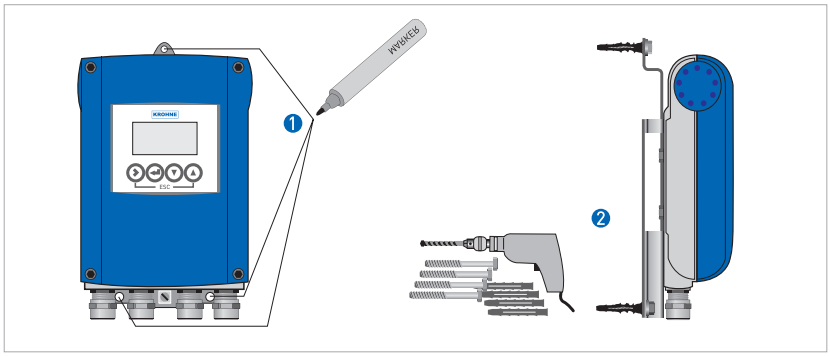
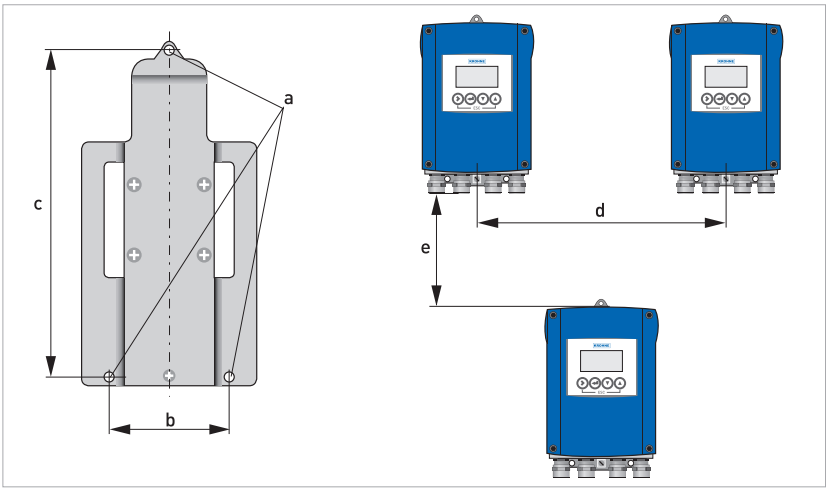


Figure 3-1: **Mounting the wall-mounted housing**

1. Prepare the holes with the aid of the mounting plate. Additional information refer to *Mounting plate, wall-mounted version* on page 85.
2. Fasten the device securely to the wall with the mounting plate.

NOTE!
Mounting multiple devices next to each other:



	[mm]	[inches]
a	Ø6.5	Ø0.26
b	87.2	3.4
c	241	9.5
d	310	12.2
e	257	10.1

4.1 Safety instructions

DANGER!
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

DANGER!
Observe national installation regulations!

WARNING!
Observe the regional occupational health and safety regulations without fail. Only work on the device electrics if you are appropriately trained.

NOTE!
Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.

4.2 Important notes on electrical connection

DANGER!
Electrical connection is carried out in conformity with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national regulations.

NOTE!

- *Use suitable cable entries for the various electrical cables.*
- *The measuring sensor and signal converter have been calibrated together at the factory! The devices should therefore always be installed in pairs. Make sure that the measuring sensor constants GK/GKL have identical settings (see nameplates).*
- *In the event of separate delivery or the installation of devices that have not been calibrated together, the signal converter must be set to the DN size and GK/GKL of the measuring sensor, refer to Function tables* on page 51.

4.3 Electrical cables for remote device versions, notes

4.3.1 Notes on signal cable A

NOTE!
Signal cable A (type DS 300) with double shielding ensures proper transmission of measured values.

Observe the following notes:

- Lay the signal cable with fastening elements.
- It is permissible to lay the signal cable in water or in the ground.
- The insulating material is flame-retardant to EN 50625-2-1, IEC 60322-1.
- The signal cable does not contain any halogens and is unplasticized, and remains flexible at low temperatures.
- The connection of the inner shield is carried out via the stranded drain wire (1).
- The connection of the outer shield (60) is carried out via the stranded drain wire (6).

4.3.2 Notes on field current cable C

DANGER!
*A shielded two-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the measuring sensor and signal converter.*

NOTE!
The field current cable is not part of the scope of supply.

4.3.3 Using other signal cables

NOTE!
When other signal cables are used, the following electrical values must be observed.

Electrical safety

- To EN 60811 (Low Voltage Directive) or equivalent national regulations.

Capacitance of the insulated conductors

- Insulated conductor / insulated conductor < 50 pF/m
- Insulated conductor / shield < 150 pF/m

Insulation resistance

- R_{iso} > 100 GΩ x km
- U_{max} < 24 V
- I_{max} < 100 mA

Test voltages

- Insulated conductor / inner shield 500 V
- Insulated conductor / insulated conductor 1000 V
- Insulated conductor / outer shield 1000 V

Twisting of the insulated conductors

- At least 10 twists per meter, important for screening magnetic fields.

4.4 Preparing the signal and field current cables

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

4.4.1 Signal cable A (type DS 300), construction

- Signal cable A is a double-shielded cable for signal transmission between the measuring sensor and signal converter.
- Bending radius: ≥ 50 mm / 2"

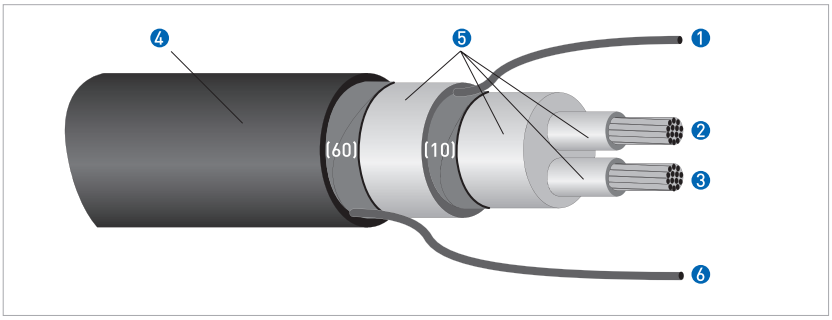


Figure 4-1: **Construction of signal cable A**

1. Stranded drain wire (1) for the inner shield (10), 1.0 mm^2 Cu / AWG 17 (not insulated, bare)
2. Insulated wire (2), 0.5 mm^2 Cu / AWG 20
3. Insulated wire (3), 0.5 mm^2 Cu / AWG 20
4. Outer sheath
5. Insulation layers
6. Stranded drain wire (6) for the outer shield (60)

4.4.2 Preparing signal cable A, connection to signal converter

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

- Connection of the two shields in the signal converter is carried out via the stranded drain wires.
- Bending radius: ≥ 50 mm / 2"

Required materials

- PVC insulation tubing, Ø2.5 mm / 0.1"
- Heat-shrinkable tubing
- 2x wire end ferrules to DIN 46 228: E 1.5-8 for the stranded drain wires (1, 6)
- 2x wire end ferrules DIN 46 228: E 0.5-8 for the insulated conductors (2, 3)

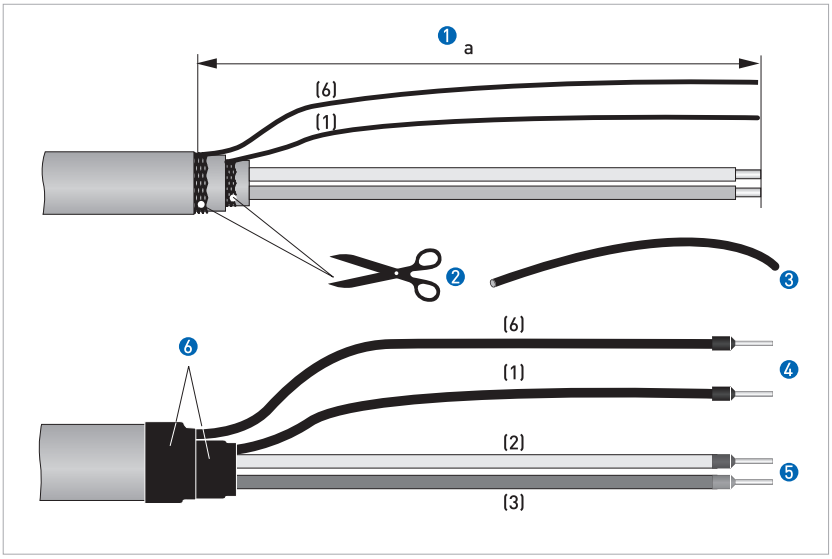


Figure 4-2: **Preparation of signal cable A**

- a = 80 mm / 3.15"

1. Strip the conductor to dimension a.
2. Cut off the inner shield (10) and the outer shield (60). Make sure not to damage the stranded drain wires (1, 6).
3. Slide the insulation tubing over the stranded drain wires (1, 6)
4. Crimp the wire end ferrules onto the stranded drain wire.
5. Crimp the wire end ferrules onto the conductors (2, 3).
6. Pull the heat-shrinkable tubing over the prepared signal cable

4.4.3 Length of signal cable A

NOTE!
For temperatures of the medium above 150° C / 300° F, a special signal cable and a ZD intermediate socket are necessary. These are available including the changed electrical connection diagrams.

Measuring sensor	Size		Min. electrical conductivity [µS/cm]	Curve for signal cable A
	DN [mm]	[inch]		
OPTIFLUX 1000 F	10...150	3/8...6	5	A1
OPTIFLUX 2000 F	25...150	1...6	20	A1
	200...1200	8...48	20	A2
OPTIFLUX 4000 F	10...150	3/8...6	1	A1
	200...1200	8...48	1	A2
OPTIFLUX 5000 F	25...100	1...4	1	A1
	150...250	6...10	1	A2
OPTIFLUX 6000 F	25...150	1...6	1	A1

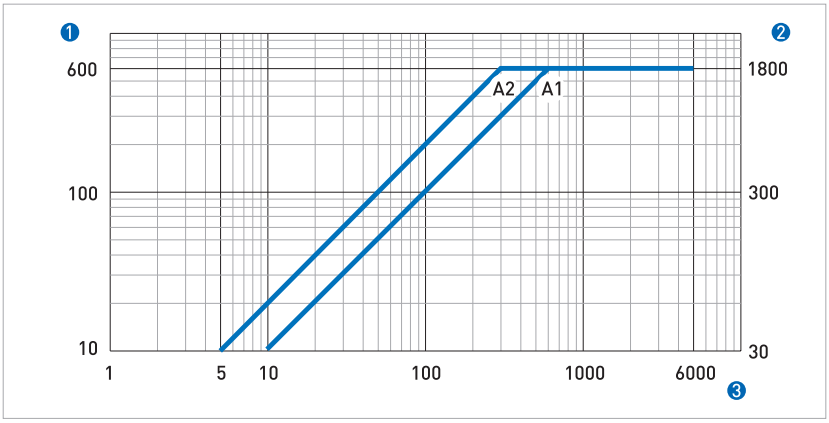


Figure 4-3: **Maximum length of signal cable A**

1. Maximum length of signal cable A between the measuring sensor and signal converter [m]
2. Maximum length of signal cable A between the measuring sensor and signal converter [ft]
3. Electrical conductivity of the medium being measured [µS/cm]

4.4.4 Preparing field current cable B, connection to signal converter

DANGER!
*A shielded two-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the measuring sensor and signal converter.*

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

- Field current cable C is not part of the scope of supply.
- Bending radius: ≥ 50 mm / 2"

Required materials:

- Shielded, at least 2-wire copper cable with suitable heat-shrinkable tubing
- Insulating tubing, size according to the cable being used
- DIN 46 228 wire end ferrules: size according to the cable being used

Length and cross-section of field current cable C

Length		Cross-section A_F (Cu)	
[m]	[ft]	[mm²]	[AWG]
0...150	0...500	2 x 0.75 Cu ❶	2 x 18
150...300	500...1000	2 x 1.50 Cu ❶	2 x 14
300...600	1000...2000	2 x 2.50 Cu ❶	2 x 12

❶ Cu = copper cross-section

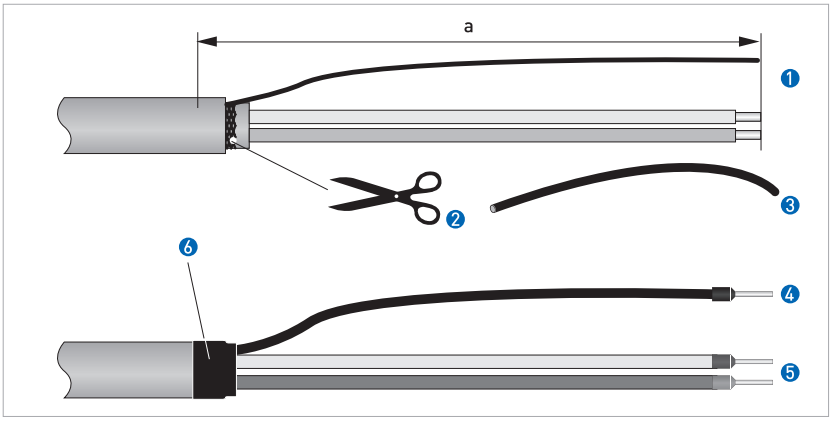


Figure 4-4: **Field current cable C, preparation for the signal converter**

- a = 80 mm / 3.15"

1. Strip the conductor to dimension a.
2. If a stranded drain wire is present, remove the shield that is present. Make sure not to damage the stranded drain wire.
3. Slide an insulating tube over the stranded drain wire.
4. Crimp a wire end ferrule onto the stranded drain wire.
5. Crimp wire end ferrules onto the conductors.
6. Pull a shrinkable tube over the prepared cable.

4.4.5 Prepare signal cable A, connect to measuring sensor

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

- The outer shield (60) is connected in the terminal compartment of the measuring sensor directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials

- PVC insulation tubing, Ø2.0...2.5 mm / 0.08...0.1"
- Heat-shrinkable tubing
- Wire end ferrule to DIN 46 228: E 1.5-8 for the stranded drain wire (1)
- 2x wire end ferrules DIN 46 228: E 0.5-8 for the insulated conductors (2, 3)

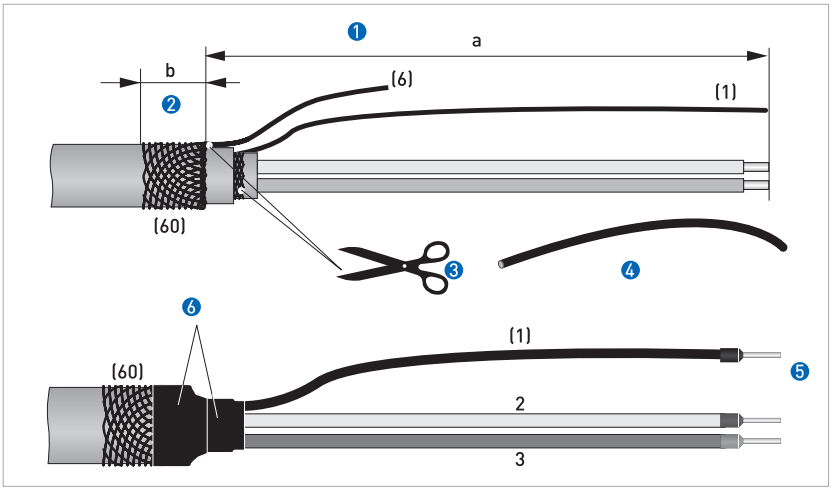


Figure 4-5: **Prepare signal cable A, connect to measuring sensor**

- a = 50 mm / 2"
- b = 10 mm / 0.39"

1. Strip the conductor to dimension a.
2. Trim the outer shield (60) to dimension b and pull it over the outer sheath.
3. Remove the stranded drain wire (6) of the outer shield and the inner shield (10). Make sure not to damage the stranded drain wire (1) of the inner shield.
4. Slide an insulating tube over the stranded drain wire (1).
5. Crimp the wire end ferrules onto conductors 2 and 3 and the stranded drain wire (1).
6. Pull the heat-shrinkable tubing over the prepared signal cable

4.4.6 Preparing field current cable C, connection to measuring sensor

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

- The field current cable is not part of the scope of supply.
- The shield is connected in the terminal compartment of the measuring sensor directly via the shield and a clip.
- Bending radius: ≥ 50 mm / 2"

Required materials

- Shielded 2-wire insulated copper cable
- Insulating tubing, size according to the cable being used
- Heat-shrinkable tubing
- DIN 46 228 wire end ferrules: size according to the cable being used

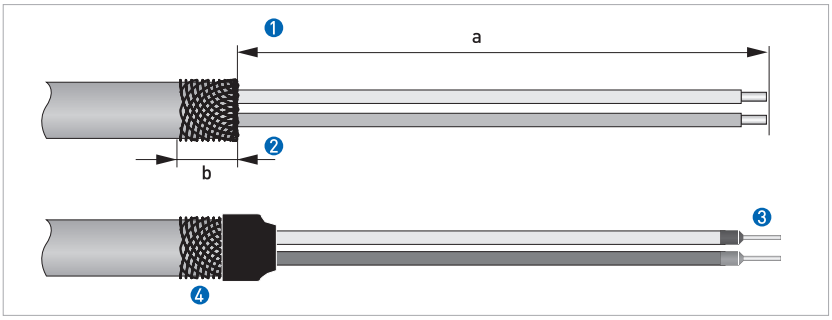


Figure 4-6: **Preparation of field current cable C**

- a = 50 mm / 2"
- b = 10 mm / 0.4"

1. Strip the conductor to dimension a.
2. Trim the outer shield to dimension b and pull it over the outer sheath.
3. Crimp wire end ferrules onto both conductors.
4. Pull a shrinkable tube over the prepared cable.

4.5 Connecting the signal and field current cables

DANGER!
The signal and field current cables may only be connected when the auxiliary power supply is switched off

DANGER!
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the special Ex instructions.

WARNING!
Observe the regional occupational health and safety regulations without fail. Only work on the device electrics if you are appropriately trained.

4.5.1 Connecting the signal and field current cables to the signal converter, remote version

INFORMATION!
The compact version is supplied preassembled from the factory.

Open housing

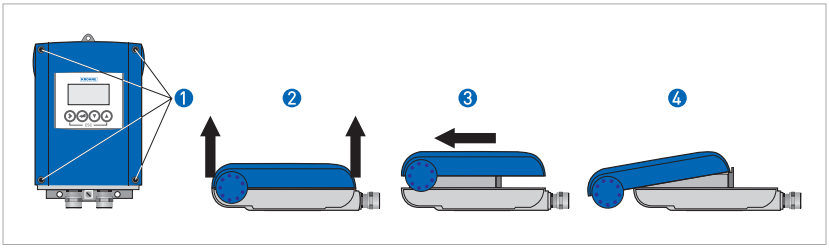


Figure 4-7: **Open housing**

1. Loosen the 4 screws with a suitable tool
2. Lift the housing at the top and bottom at the same time.
3. Slide the housing cover upward.
4. The housing cover is guided and held by the inside hinge.

Connecting the signal and field current cables

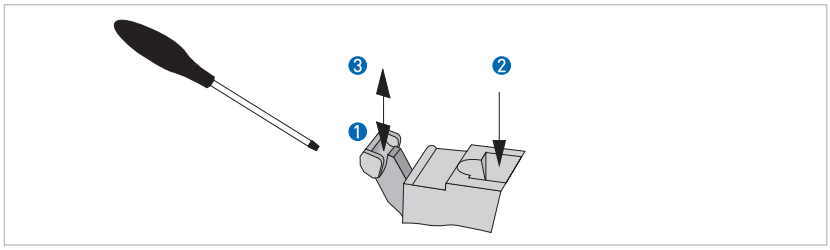


Figure 4-8: **Function of the electrical connection terminal**

Connect the electrical conductors as follows:

1. Push the lever downwards with a screwdriver in good condition (blade: 3.5 mm wide and 0.5 mm thick).
2. Insert the electrical conductor into the plug.
3. The conductor will be clamped as soon as the lever is released.

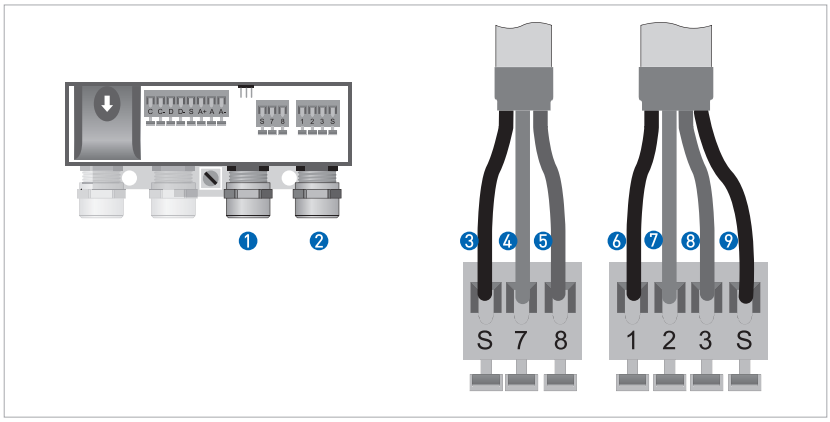


Figure 4-9: **Connecting the signal and field current cables**

1. Cable entry for field current cable
2. Cable entry for signal cable
3. Connection of the shield for the field current cable
4. Electrical conductor (7)
5. Electrical conductor (8)
6. Stranded drain wire (1) of the inner shield (10) of the signal cable
7. Electrical conductor (2)
8. Electrical conductor (3)
9. Stranded drain wire (S) of the outer shield (60)

4.5.2 Connection diagram for signal and field current cable

DANGER!
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

- A shielded two-wire copper cable is used as the field current cable. The shielding **MUST** be connected in the housing of the measuring sensor and signal converter.
- The outer shield (60) is connected in the terminal compartment of the measuring sensor directly via the shield and a clip.
- Bending radius of signal and field current cable: ≥ 50 mm / 2"
- The following illustration is schematic. The positions of the electrical connection terminals may vary depending on the housing version.

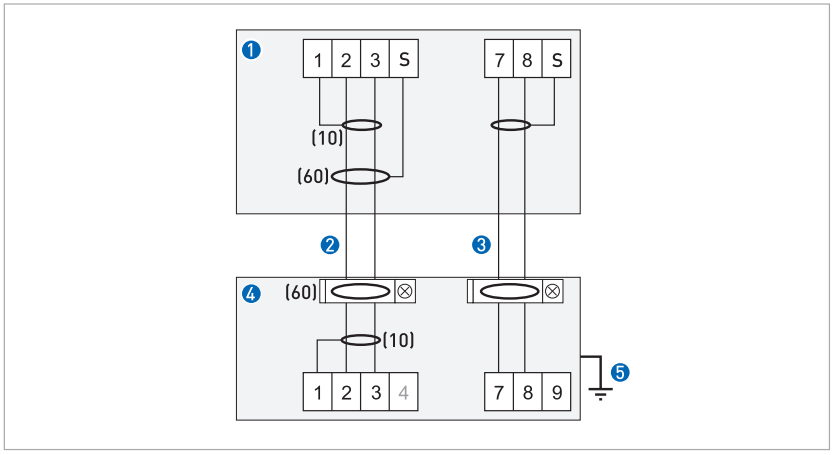


Figure 4-10: **Connection diagram for signal and field current cable**

1. Electrical terminal compartment for signal and field current cable in signal converter.
2. Signal cable A
3. Field current cable C
4. Electrical terminal compartment in measuring sensor
5. Functional ground FE

4.6 Grounding the measuring sensor

4.6.1 Classical method

DANGER!
There should be no difference in potential between the measuring sensor and the housing or protective earth of the signal converter!

- The measuring sensor must be properly grounded.
- The grounding cable should not transmit any interference voltages.
- Do not use the grounding cable to connect more than one device to ground at the same time.
- The measuring sensors are connected to ground by means of a functional grounding conductor FE.
- Special grounding instructions for the various measuring sensors are provided in the separate installation instructions for the measuring sensors.
- The installation instructions for the measuring sensors also contain descriptions on how to use grounding rings and how to install the measuring sensors in metal or plastic pipes or in pipes which are coated on the inside.

4.7 Connecting the power

DANGER!
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

- The housings of the flowmeters, which are designed to protect the electronic equipment from dust and moisture, should be kept well closed at all times. Creepage distances and clearances are dimensioned to VDE 0110 and IEC 664 for pollution severity 2. Supply circuits are designed for overvoltage category III and the output circuits for overvoltage category II.
- Fuse protection ($I_N \leq 16$ A) for the infeed power circuit, and also a disconnecting device (switch, circuit breaker) to isolate the signal converter must be provided.

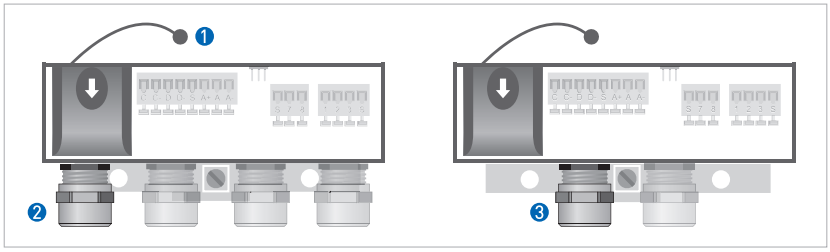


Figure 4-11: **Terminal compartment for power supply**

1. Retaining band of the cover
2. Cable entry for power supply, remote version
3. Cable entry for power supply, compact version

- Open the cover of the electrical terminal compartment by pressing down and pulling forwards at the same time.

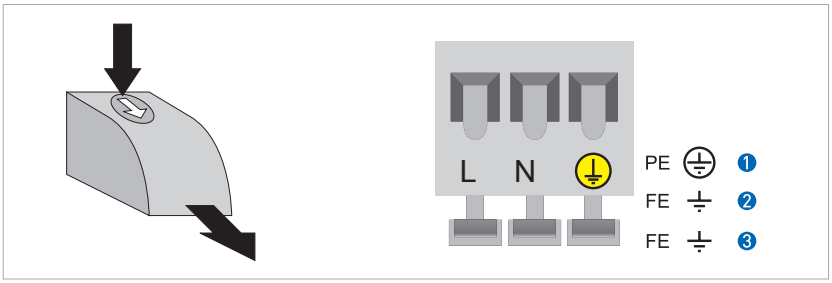


Figure 4-12: **Connection to power**

1. 100...230 VAC (-15% / +10%), 8 VA
2. 24 VDC (-55% / +30%), 4 W
3. 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%), 8 VA and 4 W

- Close the cover after the power has been connected.

100...230 VAC (tolerance range: -15% / +10%)

- Note the power supply voltage and frequency (50...60 Hz) on the nameplate.

NOTE!
240 VAC+5% is included in the tolerance range.

24 VDC (tolerance range: -55% / +30%)
24 VAC/DC (tolerance ranges: AC: -15% / +10%; DC: -25% / +30%)

- Note the data on the nameplate!
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (acc. to VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or relevant national regulations).

NOTE!
For 24 VDC, 12 VDC-10% is included in the tolerance range.

4.8 Description of the outputs

4.8.1 Current output

- All outputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be set.
- Passive mode: external power $U_{ext} \leq 32$ VDC $I \leq 22$ mA
- Active mode: load impedance $R_L \leq 750\ \Omega$ at $I \leq 22$ mA
- Self-monitoring: interruption or load impedance too high in the current output loop
- Error message possible via status output, error indication on LCD display.
- Current value error detection can be set.
- Automatic range function via threshold. The setting range for the threshold is between 5% and 80%of $Q_{100\%}$, ± 0...5% hysteresis (corresponding ratio from smaller to larger range of 1:20 to 1:1.25).
  Signaling of the active range possible via a status output (settable).
- Forward / reverse flow measurement (F/R mode) is possible

INFORMATION!
Additional information refer to Connection diagrams of outputs on page 40 and refer to *Technical data* on page 75.

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the special Ex instructions.

4.8.2 Pulse and frequency output

- All outputs are electrically isolated from each other and from all other circuits.
- All operating data and functions can be set.
- Passive mode:
  External power supply required: $U_{ext} \leq 32$ VDC
  $I \leq 20$ mA at $f \leq 10$ kHz (overflow up to $f_{max} \leq 12$ kHz)
  $I \leq 100$ mA at $f \leq 100$ Hz
- Scaling:
  Frequency output: in pulses per unit time (e.g. 1000 pulses/s at $Q_{100\%}$);
  Pulse output: in pulses per unit volume (e.g. 100 pulses/m^3).
- Pulse width:
  symmetrical (pulse duty factor 1:1, independent of output frequency)
  automatic (with fixed pulse width, duty factor approx. 1:1 at $Q_{100\%}$), or
  fixed (pulse width adjustable as required from 0.05 ms...2 s)
- Forward / reverse flow measurement (F/R mode) is possible
- The pulse and frequency outputs can also be used as a status output / limit switch.

INFORMATION!
Additional information refer to Connection diagrams of outputs on page 40 and refer to *Technical data* on page 75.

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the special Ex instructions.

4.8.3 Status output and limit switch

- The status outputs / limit switches are electrically isolated from each other and from all other circuits.
- The output stages of the status outputs / limit switches behave like relay contacts.
- All operating data and functions can be set.
- Passive mode: external power required:
  $U_{ext} \leq 32$ VDC; $I \leq 100$ mA
- For information on the operating states refer to *Function tables* on page 51 that can be set.

INFORMATION!
Additional information refer to Connection diagrams of outputs on page 40 and refer to *Technical data* on page 75.

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the special Ex instructions.

4.9 Electrical connection of the outputs

NOTE!
Mounting materials and tools are not part of the scope of supply. Use the mounting material and tools in compliance with the applicable occupational health and safety directives.

4.9.1 Electrical connection of the outputs

DANGER!
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

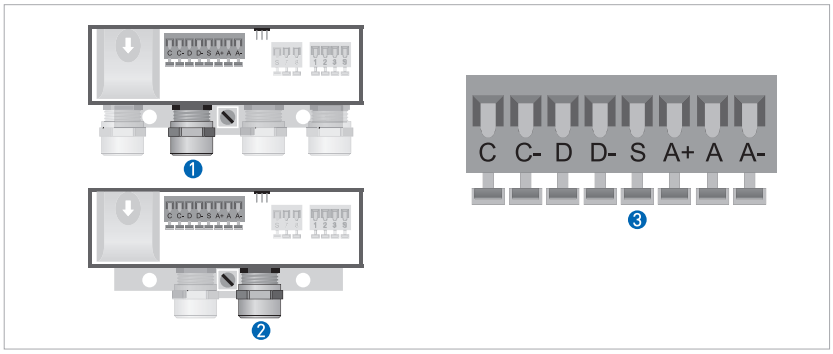


Figure 4-13: **Connection of outputs**

1. Cable entry, remote version
2. Cable entry, compact version
3. Terminal S for shield

- Open the housing cover
- Push the prepared cables through the cable entries and connect the necessary conductors.
- Connect the shield.
- Close the housing cover.

NOTE!
Ensure that the housing seal is properly fitted, clean and undamaged.

4.9.2 Laying electrical cables correctly

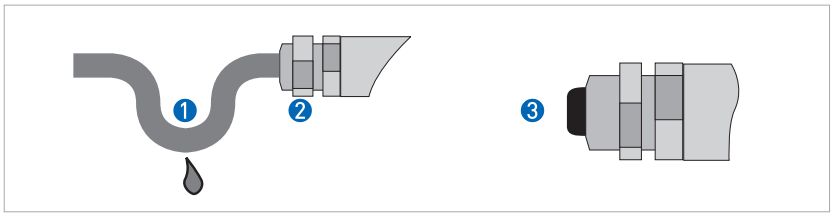


Figure 4-14: **Protect housing from dust and water**

1. For compact versions with nearly horizontally-oriented cable entries, lay the necessary electric cables with a drip loop as shown in the illustration.
2. Tighten the screw connection of the cable entry securely.
3. Seal cable entries that are not needed with a plug.

4.10 Connection diagrams of outputs

4.10.1 Description of the electrical symbols

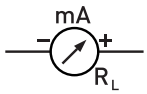
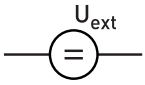
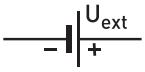
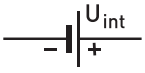
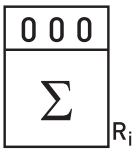
	Milliammeter 0...20 mA or 4...20 mA and others R_L also includes the line resistances
	DC voltage source (U_{ext}), external power supply, any connection polarity
	DC voltage source (U_{ext}), connection polarity as shown in the diagrams
	Internal DC voltage source
	Controlled internal power source in the device
	Electronic or electromagnetic counter At frequencies above 100 Hz, shielded cables must be used to connect the counters. R_i Internal resistance of the counter
	Button, NO contact or similar

Table 4-1: **Description of symbols**

4.10.2 Basic outputs

INFORMATION!
Additional information refer to Description of the outputs on page 35 and refer to *HART® connection* on page 44.

Current output active (HART®)

- $U_{int,nom}$ = 20 VDC
- I ≤ 22 mA
- R_L ≤ 750 Ω

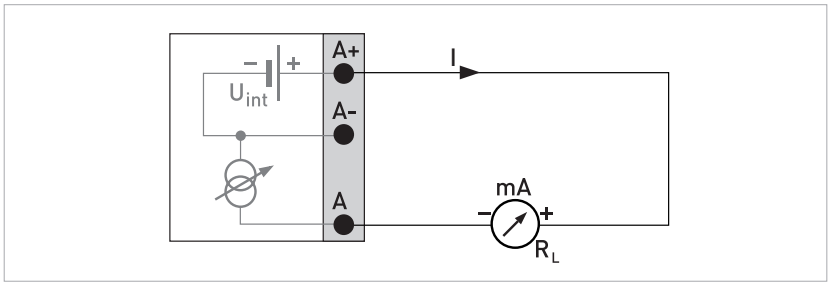


Figure 4-15: **Current output active I_a**

Current output passive (HART®)

- U_{ext} ≤ 32 VDC
- I ≤ 22 mA
- U_0 ≤ 2 V at I = 22 mA

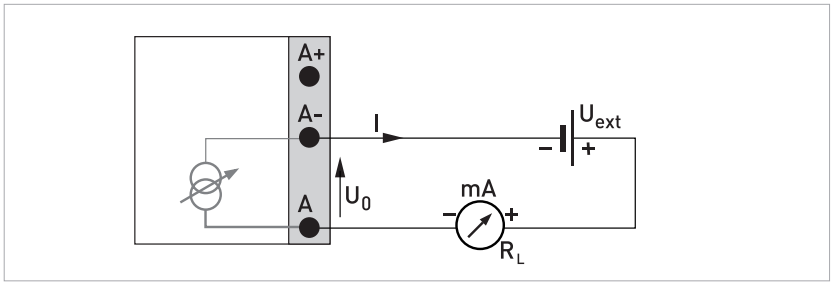


Figure 4-16: **Current output passive I_p**

INFORMATION!
At frequencies above 100 Hz, shielded cables must be used. Shielding takes place at the electrical connection (S) of the output terminal block.

Pulse/frequency output passive

- $U_{ext} \leq 32$ VDC
- 100 Hz < $f_{max} \leq 10$ kHz:
  I ≤ 20 mA
  open:
  I ≤ 0.1 mA at U_{ext} = 5 V
  I ≤ 0.5 mA at U_{ext} = 24 V
  I ≤ 0.7 mA at U_{ext} = 32 V
  closed:
  $U_0 \leq 0.8$ V at I = 1 mA
  $U_0 \leq 1.5$ V at I = 10 mA
  $U_0 \leq 3.5$ V at I = 100 mA
- R is required if the internal resistance of the counter does not reach the maximum load resistance R_L.
  f ≤ 1 kHz: $R_L \leq 10$ kΩ
  f ≤ 10 kHz: $R_L \leq 2$ kΩ
- Can also be set as a status output; for the electrical connection see status output connection diagram.

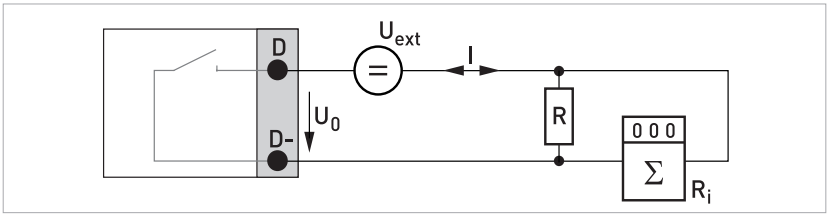


Figure 4-17: **Pulse frequency output passive P_p**

Status output / limit switch passive

- $U_{ext} \leq 32$ VDC
- $I \leq 100$ mA
- $R_L \leq 10$ kΩ
- open:
  $I \leq 0.1$ mA at $U_{ext} = 5$ V
  $I \leq 0.5$ mA at $U_{ext} = 24$ V
  $I \leq 0.7$ mA at $U_{ext} = 32$ V
  closed:
  $U_0 \leq 0.8$ V at $I = 1$ mA
  $U_0 \leq 1.5$ V at $I = 10$ mA
  $U_0 \leq 3.5$ V at $I = 100$ mA
- The output is closed when the device is de-energized.

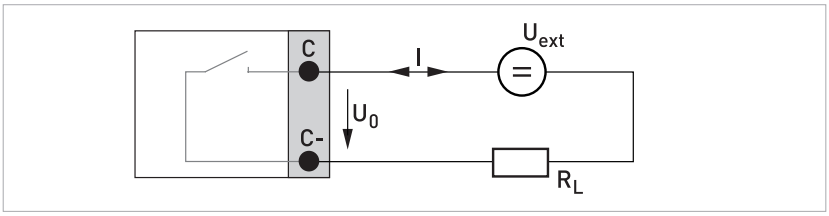


Figure 4-18: **Status output / limit switch passive S_p**

4.10.3 HART® connection

INFORMATION!

- *The current output at connection terminals A+/A-/A always has HART® capability.*

HART® connection active (point-to-point)

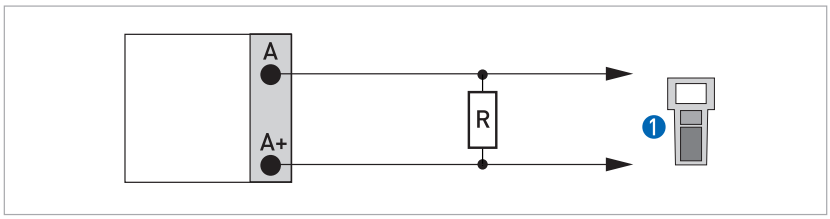


Figure 4-19: **HART® connection active (I_a)**

1 HART® communicator

The shunt resistor for the HART® communicator must have R ≥ 230 Ω.

HART® connection passive (multidrop mode)

- I: $I_{0\%}$ = 4 mA
- Multidrop I: I_{fix} = 4 mA
- $U_{ext} \leq$ 32 VDC
- RL ≤ 230 Ω

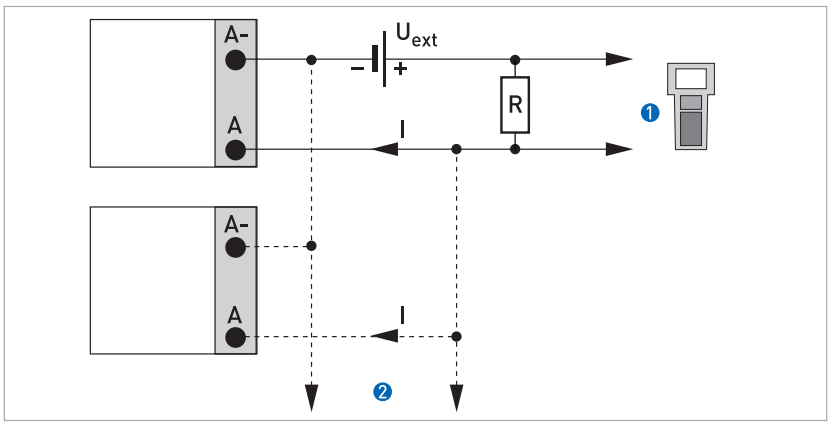


Figure 4-20: **HART® connection passive (I_p)**

1 HART® communicator
2 Additional devices with HART® capability

5.1 Switching on the power

Before connecting to power, please check that the system has been correctly installed. This includes:

- The flowmeter must be mechanically safe and mounted in compliance with the regulations.
- The power connections must have been made in compliance with the regulations.
- The electrical terminal compartments must be secured and the covers have been screwed on.
- Check that the electrical operating data of the power supply are correct.

- Switch the power on.

5.2 Starting the signal converter

The measuring device, consisting of the measuring sensor and the signal converter, is supplied ready for operation. All operating data have been set at the factory in accordance with your order specifications.

When the power is switched on, a self test is carried out. After that the flowmeter immediately begins measuring, and the current values are displayed.

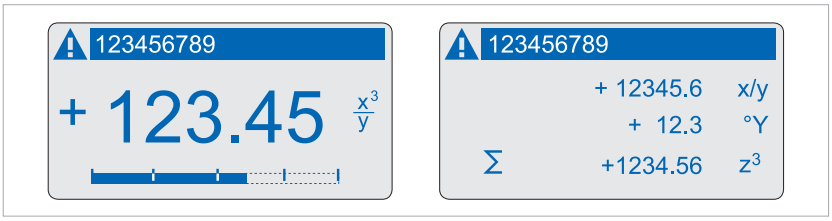


Figure 5-1: **Display in measuring mode, examples**

It is possible to change between the 1st and 2nd measured values windows, the trend display and (if present) the list with the status messages by pressing the keys ↑ and ↓. Possible status messages, their meaning and cause refer to *Status messages and diagnostic information* on page 69.

6.1 Display and operator input elements

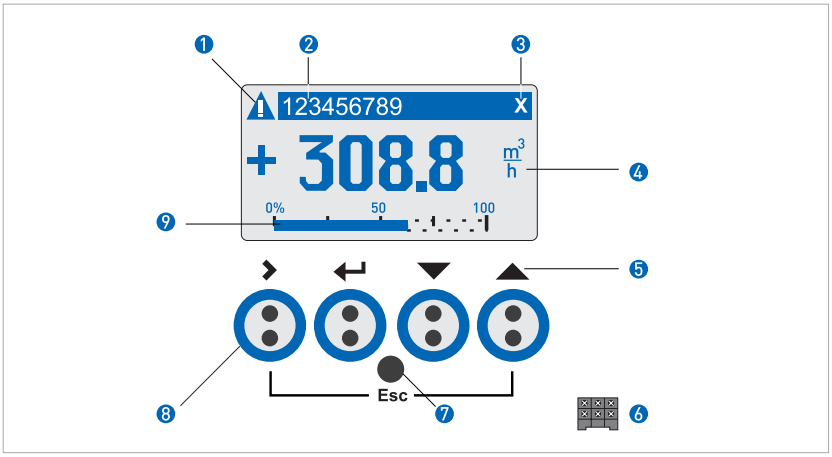


Figure 6-1: **Display and operational elements, example with flow indication**

1. Signals a status message in the status bar
2. The measuring point number (tag) is only indicated if this number was entered previously by the operator.
3. Indicates when a key has been pressed
4. 1st and 2nd display line for indication of different measured variables (here large depiction of only one measured variable)
5. Symbols of the operator input keys
6. Interface to the GDC bus (not present in all signal converter versions)
7. Infrared sensor (not present in all signal converter versions)
8. Operator input keys (see table below for description)
9. 3rd display line (here bargraph)

Symbol	Meas. mode	Menu mode	Function mode	Data mode
>	Switch from measuring mode to menu mode; press key for 2.5 s, then "Quick Start" menu displayed	Entry into selected menu displayed, then 1st function of the menu	Entry into displayed selected function or subfunction	For numerical values, move cursor (blue) one place to the right
↵	-	Return to measuring mode, preceded by query whether changed data to be accepted	Press 1 - 3 times, return to menu mode with data acceptance	Return to function or subfunction with acceptance of data
↓↑	Alternate between display measured value pages 1 + 2, trend and any status list(s), if provided	Select menu	Select function or subfunction	Blue cursor... - change number - change unit - change property - change decimal point
Esc (> + ↑)	-	-	Return to menu mode without data acceptance	Return to function or subfunction without acceptance of data

Table 6-1: **Function of keys**

6.1.1 Time-out functions

In Operator Control mode

- After 5 minutes without key op., return to meas. mode.
  Prev. changed data are not accepted.

In Test Menu mode

- After 60 minutes without key op., return to meas. mode.
  Prev. changed data are not accepted.

6.1.2 Display in measuring mode

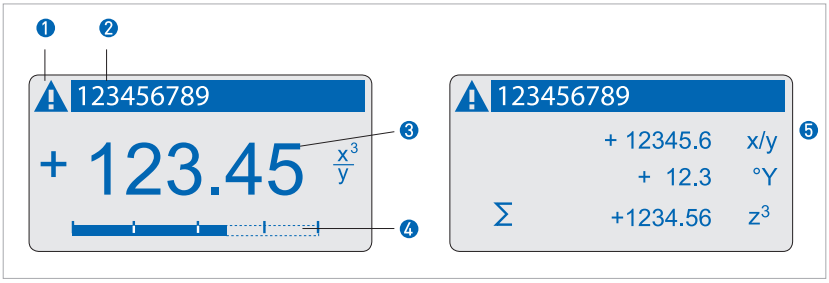


Figure 6-2: **Example for display in measuring mode**

1. Signals a status message in the status list
2. Measuring point number (tag); is only indicated if this number was assigned previously by the operator.
3. 1st measured value (depiction of the 1st measured value via the 1st and 2nd display lines)
4. 3rd display line as a bargraph
5. 3 measured values (depiction of 3 different measured values in display lines 1...3)

6.1.3 Display for selection of menu and functions

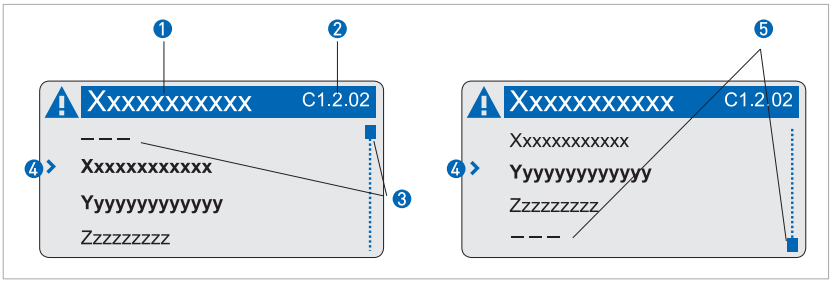


Figure 6-3: **Display for selection of menu or function**

1. Menu description
2. Function number (only in setup menu C)
3. Position within the menu or function list (here the beginning)
4. Current function (open: →; forward/back: ↑↓)
5. Position within the menu or function list (here the end)

6.1.4 Display for setting of data and functions

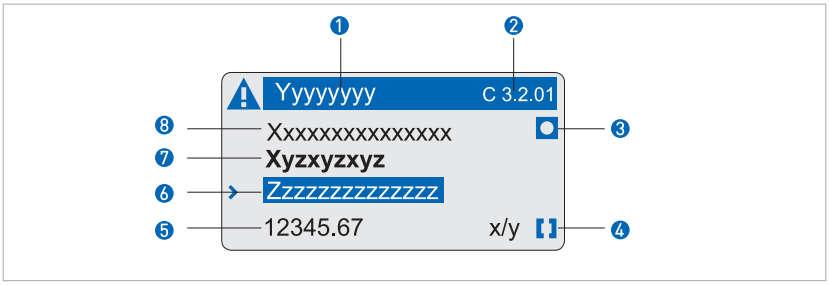


Figure 6-4: **Display for setting of data and functions**

1. Current menu
2. Function number (only in setup menu C)
3. Identifies factory settings
4. Identifies permitted value range
5. Next function or permissible value range for numeric values
6. Value, unit or function set at present (in white lettering on a blue background when selected →) The value is changed here.
7. Current (sub)function (open: →)
8. Factory setting of the current (sub)function (for information only, cannot be changed)

6.1.5 Display after change of data and functions

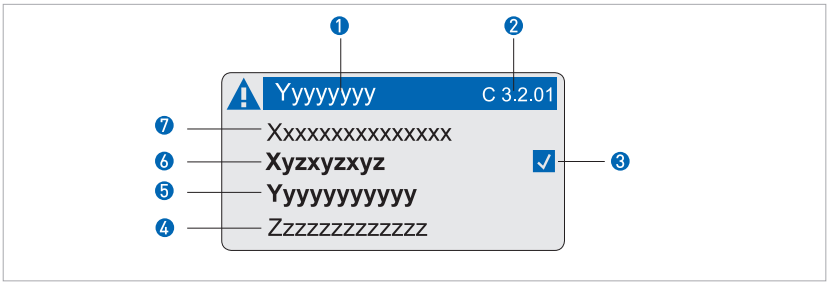


Figure 6-5: **Display after change of data and functions**

1. Current menu
2. Function number (only in setup menu C)
3. Indicates a change to a (sub)function; simple check of the changed data by paging through the (sub)function lists
4. Next function or permissible value range for numeric values
5. Value, unit or function set at present (in white lettering on a blue background when selected →)
6. Current (sub)function (open: →)
7. Factory setting of the current (sub)function (for information only, cannot be changed)

6.2 Program structure

Measuring mode		Select menu ↓↑		Select function and/or subfunction ↓↑				Set data ↓↑
↵	Press > 2.5 s							
	A Quick setup	> ↵	A1 Language			> ↵		
			A2 Tag					
			A3 Reset					
			A4 Analog outputs					
			A5 Digital outputs					
↵	B Test	> ↵	B1 Simulation			> ↵		
			B2 Actual values					
			B3 Information					
↵	C Setup	> ↵	C1 Process input	> ↵	1.1 Calibration	> ↵		
					1.2 Filter			
					1.3 Self test			
					1.4 Information			
					1.5 Simulation			
↵		> ↵	C2 Inputs/outputs (I/Os)	> ↵	2.1 Hardware	> ↵		
					2.☐ Current output X			
					2.☐ Frequency output X			
					2.☐ Pulse output X			
					2.☐ Status output X			
					2.☐ Limit switch X			
↵		> ↵	C3 I/O counter	> ↵	3.1 Counter 1	> ↵		
					3.2 Counter 2			
↵		> ↵	C4 I/O HART	> ↵	4.1 PV is...	> ↵		
					4.2 SV is...			
					4.3 TV is...			
					4.4 4V is...			
↵		> ↵	C5 Device	> ↵	5.1 Device info	> ↵		
					5.2 Display			
					5.3 Meas. page 1			
					5.4 Meas. page 2			
					5.5 Graphic page			
					5.6 Special functions			
					5.7 Units			
					5.8 HART			
					5.9 Quick setup			
	↓↑		↓↑		↓↑			↓↑ >

6.3 Function tables

INFORMATION!
Depending on the device version, not all functions are available.

6.3.1 Menu A, quick setup

No.	Function	Setting / description

A1 Language

A1	Language	Language selection depends on the device version.

A2 Tag

A2	Tag	Measuring point identifier (Tag No.) (also for HART® operation), appears in the LCD display header (up to 8 places).

A3 Reset

A3	Reset	
A3.1	Error reset	Reset error? Select: No/Yes
A3.2	Reset counter 1	Reset counter? Select: No / Yes (available if activated in C5.9.1)
A3.3	Reset counter 2	Reset counter? Select: No / Yes (available if activated in C5.9.2)

A4 Analog outputs (only for HART®)

A4	Analog outputs	Applicable to current output (term. A), frequency output (term. D), limit switches (term. C and / or D) and display page 1 / line 1
A4.1	Measurement	1) Measurement selection: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
		2) Use for all outputs? (also use this output for the fcts. A4.2...A4.5!) Setting: No (applies only to the main current output) / Yes (applies to all analog outputs)
A4.2	Unit	Selection of the unit from a list, depending on the measured variable
A4.3	Range	1) Setting for main current output (measuring range: 0...100%) Setting: 0...x.xx (format and unit, depending on the measured variable, see A4.1 and A4.2 above)
		2) Use for all outputs? Make setting, see Fct. A4.1 above!
A4.4	Low flow cutoff	1) Setting for main current output (sets output value to "0") Setting: x.xxx ± x.xxx% (range: 0.0...20%) (1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
		2) Use for all outputs? Make setting, see Fct. A4.1 above!
A4.5	Time constant	1) Setting for main current output (applicable to all flow rate measurements) Setting: xxx.x s (setting range: 000.1...100 s)
		2) Use for all outputs? Make setting, see Fct. A4.1 above!

No.	Function	Setting / description

A5 Digital outputs

A5	Digital outputs	Applicable to pulse output (term. D) and counter 1
A5.1	Measured value	1) Select measurement: volume flow / mass flow
		2) Use for all outputs? (also use this output for the fcts. A5.2 to A5.4!) Setting: No (only for pulse output D) / Yes (for all digital outputs)
A5.2	Pulse value unit	Selection of the unit from a list, depending on the measured variable
A5.3	Value p. pulse	1) Setting for pulse output D (volume or mass value per pulse) Setting: xxx.xxx in l/s or kg/s
		2) Use for all outputs? Make setting, see Fct. A5.1 above!
A5.4	Low flow cutoff	1) Setting for pulse output D (sets output value to "0") Setting: x.xxx ± x.xxx% (setting range: 0.0…20%) (1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
		2) Use for all outputs? Make setting, see Fct. A5.1 above!

6.3.2 Menu B, test

No.	Function	Setting / description

B1 Simulation

B1	Simulation	Displayed values are simulated
B1.1	Flow speed	Flow speed simulation
		Break (exit function without simulation)
		Set value (range: -12…+12 m/s; unit selection in Fct. C5.7.7)
		Query: Start simulation?
		Settings: No (exit function without simulation) / Yes (start simulation)
B1.2	Volume flow	Volume flow simulation, sequence and settings similar to B1.1, see below!
		[X stands for one of the connection terminals A, C or D] ☐ stands for Fct. No. B1.3...1.6
B1.☐	Current out X	Simulation X Sequence and settings similar to B1.1, see below! [X stands for one of the connection terminals A, C or D] For pulse output a set number of pulses is output once in 1s!
B1.☐	Pulse output X	
B1.☐	Frequency out X	
B1.☐	Limit switch X	
B1.☐	Status output X	

No.	Function	Setting / description

B2 Actual values

B2	Actual values	Display the current values; exit the displayed function with the ↵ key.
B2.1	Operating hours	
B2.2	Act. flow speed	
B2.3	Act. coil temp.	See also Fcts. C1.1.7...C1.1.8
B2.4	Electronic temperature	
B2.5	Act. conductivity	See also Fcts. C1.3.1...C1.3.2
B2.6	Act. electr. noise	See also Fcts.C1.3.13...C1.3.15
B2.8	Act. coil resistance	Current resistance of the field coils according to the current coil temperature

B3 Information

B3	Information	LCD display
		1st line: ID No. of the circuit board
		2nd line: software version
		3rd line: date of calibration/manufacture
B3.1	C number	Electronics type
B3.2	Process input	Process input section
B3.3	Device	Electronics and HART® software
B3.4	Display	User interface
B3.5	"Interface"	"Bus interface" (in preparation)

6.3.3 Menu C, setup

No.	Function / subfunction	Settings / descriptions

C1 Process input

C1.1 Calibration

C1.1	Calibration	
C1.1.1	Zero calibration	Display of current zero value (zero)
		Query: calibrate zero?
		Setting: break (return with ↵) /standard (factory setting) / manual (display last value, set new value, range: -1.00…+1 m/s) / automatic (shows the current value as the new zero value)
C1.1.2	Size	Select from size table; range: DN2.5...1200 mm / 1/10...48"
C1.1.5	GKL	Set value acc. to nameplate; range: 0.5…12 (20)
C1.1.7	Coil resistance Rsp	Field coil resistance at 20°C; range: 10.00...220 Ω
C1.1.8	Calib. coil temp.	The coil temperature is derived from the coil resistance at the reference temperature.
		Set coil temperature: Break return with ↵ key Standard (= 20°C) Automatic (set current temperature); range: -40.0…+200°C
		Set coil temperature: Break (return with ↵ key) Standard (= setting from Fct. C1.1.7) Automatic (= calibration with the current resistance)
C1.1.9	Density	Calculation of mass flow with constant density of product; range: 0.1…5 kg/l
C1.1.10	Target conduct.	Reference value for on-site calibration; range: 1.000...50000 µS/cm
C1.1.11	EF electr. factor	For calculation of the conductivity based on the electrode impedance
		Query: calibrate EF? Break (return with ↵ key)
		Set value in the following: Standard (with factory setting) / Manual (set desired value) / Automatic (determines EF according to the setting in Fct. C1.1.10)
C1.1.13	Field frequency	Setting as on measuring sensor nameplate = Line frequency x value (from the following list):
		2; 4/3; 2/3; 1/2; 1/4; 1/6; 1/8; 1/12; 1/18; 1/36; 1/50
C1.1.14	Select settling	Select settling (special function)
		Select: Standard (fixed allocation) / Manual (manual time setting for the settling time for the field current)
C1.1.15	Settling time	Only when "Manual" selected under Fct. C1.1.14; range: 1.0…250 ms
C1.1.16	Line frequency	Set line frequency
		Automatic (measuring & setting; for DC systems fixed setting 50 Hz)
		Select: 50 Hz or 60 Hz (fixed setting)
C1.1.17	Act. coil resistance	Display of the current value for calculation of the temperature

No.	Function / subfunction	Settings / descriptions

C1.2 Filter

C1.2	filter	
C1.2.1	limitation	Limitation of all flow values, before smoothing by time constant, affects all outputs
		Settings: -xxx.x / +xxx.x m/s; condition: 1st value < 2nd value
		Range 1st value: -100.0 m/s ≤ value ≤ -0.001 m/s
		Range 2nd value: +0.001 m/s ≤ value ≤ +100 m/s
C1.2.2	flow direction	Define polarity of flow values
		Forwards (according to the arrow on the measuring sensor) or backwards (in the opposite direction to the arrow)
C1.2.3	Time constant	For all flow measurements and outputs
		xxx.x s; range: 0.0…100 s
C1.2.4	Pulse filter	Suppresses noise due to solids, air/gas bubbles and sudden changes in pH
		Select: Off (without pulse filter) / On (with pulse filter)
C1.2.5	Pulse width	Only when pulse filter switched on, Fct. C1.2.4
		Length of interference and delays to be suppressed on sudden changes in flow
		xx.x s; range: 0.01...10 s
C1.2.6	Pulse limitation	Dynamic limitation from one measured value to the next, only when pulse filter switched on, Fct. C1.2.4 effective.
		xx.x s; range: 0.01...100 m/s
C1.2.7	Noise filter	Suppresses noise at low conductivity, high solids content, air and gas bubbles, and chemically inhomogeneous media
		Select: Off (without noise filter) / On (with noise filter)
C1.2.8	Noise level	Range within which changes are evaluated as noise, and outside of which changes are evaluated as flow (only with noise filter switched on, Fct. C1.2.7)
		xx.xx m/s; range 0.01…10 m/s
C1.2.9	Noise suppression	Set noise suppression (only when noise filter switched on, Fct. C1.2.7)
		Range: 1…10, noise suppression factor [min = 1...max = 10]
C1.2.10	Low flow cutoff	Sets output value of all outputs to "0":
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value

No.	Function / subfunction	Settings / descriptions

C1.3 Self test

C1.3	Self test	
C1.3.1	Empty pipe	Switch conductivity measurement off and on (measurement of the electrode resistance)
		Select: off / on
		Additional setting necessary when "on":
		Cond. + empty pipe [F] (conductivity measurement and empty pipe indication, error category [F] application); Flow indication "= 0" when pipe empty
		Cond. + empty pipe [S] (conductivity measurement and empty pipe indication, error category [S] measurement outside of specification); Flow indication "≠ 0" when pipe empty
C1.3.2	Act. conductivity	Only available when empty pipe activated [..] in Fct. C1.3.1
		Current conductivity is indicated. Activation takes place only after setting mode is exited!
C1.3.3	Limit empty pipe	Only available when empty pipe activated [..] in Fct. C1.3.1
		Range: 0.0...9999 µS (set max 50% of the lowest occurring conductivity in operation. Conductivity below this value = signal as empty pipe)
C1.3.9	Coil current	Automatic test switched off / on, select: off / on
C1.3.13	Electrode noise	Automatic test switched off/on, select: off / on
C1.3.14	Limit electr. noise	Only with electrode noise activated, see Fct. C1.3.13
		Range: 0.000...12 m/s (noise above this threshold generates an error of category [S])
C1.3.15	Act. electr. noise	Only available when electrode noise "on" activated in Fct. C1.3.13. Activation takes place only after the setting mode is exited!
C1.3.17	Diagnosis value	Select diagnosis value for testing the various analog outputs.
		Select: off (no diagnosis) / electrode noise (activate Fct. C1.3.13)
		Terminal 2 (electrode DC voltage) / Terminal 3 (electrode DC voltage)

C1.4 Information

C1.4	Information	
C1.4.1	Liner	Shows material of the liner
C1.4.2	Electr. material	Shows material of the electrodes
C1.4.3	Calibration date	Not available at this time
C1.4.4	Serial no. sensor	Shows serial no. of the measuring sensor
C1.4.5	V no. sensor	Shows the order number of the measuring sensor
C1.4.6	Sensor electr. info	Shows the serial no. and calibration date of the electronics and the software version

No.	Function / subfunction	Settings / descriptions

C1.5 Simulation

C1.5	Simulation	
C1.5.1	Flow speed	Sequence see Fct. B1.1
C1.5.2	Volume flow	Sequence see Fct. B1.2

No.	Function / subfunction	Settings / descriptions

C2 Inputs/outputs (I/Os)

C2.1 Hardware

C2.1	Hardware	Assignment of connection terminals dependent on signal converter version: active / passive / NAMUR
C2.1.1	Terminal A	Select: off (switched off) / current output / frequency output / pulse output / status output / limit switch
C2.1.3	Terminal C	Select: off (switched off) / current output / status output / limit switch
C2.1.4	Terminal D	Select: off (switched off) / frequency output / pulse output / status output / limit switch

C2.☐ Current output X

C2.☐	Current output X	X stands for connection terminal A ☐ stands for Fct. No. C2.2 (A)
C2.☐.1	Range 0%...100%	Current range for the selected measured variable, e.g. 4...20 mA, corresponds to 0...100%
		xx.x ... xx.x mA; Range: 0.00...20 mA (condition: 0 mA ≤ 1st value ≤ 2nd value ≤ 20 mA)
C2.☐.2	Extended range	Exceeding the min. and max. limits
		xx.x...xx.x mA; range: 03.5...21.5 mA (condition: 0 mA ≤ 1st value ≤ 2nd value ≤ 21.5 mA)
C2.☐.3	Error current	Specify error current
		xx.x mA; range: 0.00...22 mA (condition: 0 mA ≤ value ≤ 25 mA, outside of extended range)
C2.☐.4	Error condition	The following error conditions can be selected
		Select: error in device (error category [F]) / application error (error category [F]) / out of specification (error category [S])
C2.☐.5	Measurement	Measured variables for activating the output
		Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
C2.☐.6	Range	0...100% of the measured variable set in Fct. C2.☐.5
		0...xx.xx _ _ _ (format and unit depend on the measured variable, see above)
C2.☐.7	Polarity	Set measured value polarity, please note flow direction in C1.2.2!
		Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (use for the output)

No.	Function / subfunction	Settings / descriptions
C2.☐.8	Limitation	Limitation before applying the time constant
		±xxx … ±xxx%; range: -150…+150%
C2.☐.9	Low flow cutoff	Sets output value to "0"
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = operating point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C2.☐.10	Time constant	Range: 000.1…100 s
C2.☐.11	Special function	Automatic range; select:
		off (switched off)
		automatic range (range is changed automatically, extended lower range, only makes sense together with a status output)
C2.☐.12	Threshold	Appears only when Fct. C2.☐.11 is activated Threshold between extended and normal range. The automatic range function always changes from the extended to the normal range when 100% current is reached
		The upper 100% value of the hysteresis is then = 0. The threshold is then the hysteresis value, instead of "threshold ± hysteresis" as shown in the display.
		Range: 5.0%…80%
		(1st value = operating point / 2nd value = hysteresis), condition: 2nd value ≤ 1st value
C2.☐.13	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board
C2.☐.14	Simulation	Sequence see B1.☐ Current output X
C2.☐.15	4mA trimming	Trimming of the current at 4 mA
		Resetting to 4 mA restores the factory calibration.
		Used for HART® setting.
C2.☐.16	20mA trimming	Trimming of the current at 20 mA
		Resetting to 20 mA restores the factory calibration.
		Used for HART® setting.

C2.☐ Frequency output X

C2.☐	Frequency out X	X stands for connection terminal D ☐ stands for Fct. No. C2.5 (D)
C2.☐.1	Pulse shape	Specify the pulse shape
		Select: symmetric (about 50% on and 50% off) / automatic (constant pulse with about 50% on and 50% off at 100% pulse rate) / fixed (fixed pulse rate, see below Fct. C2.☐.3 100% pulse rate)
C2.☐.2	Pulse width	Only available if set to "fixed" in Fct. C2.☐.1
		Range: 0.05…2000 ms
		Note: max. setting value Tp [ms] ≤ 500 / max. pulse rate [1/s], Gives the pulse width = time where the output is activated
C2.☐.3	100% pulse rate	Pulse rate for 100% of the measuring range
		Range: 0.0…10000 1/s
		Limitation 100% pulse rate ≤ 100/s: $I_{max} \leq 100$ mA Limitation 100% pulse rate > 100/s: $I_{max} \leq 20$ mA

No.	Function / subfunction	Settings / descriptions
C2.☐.4	Measurement	Measured variables for activating the output
		Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
C2.☐.5	Range	0…100% of the measured variable set in Fct. C2.☐.4
		0…xx.xx _ _ _ (format and unit depend on the measured variable, see above)
C2.☐.6	Polarity	Set measured value polarity, please note flow direction in C1.2.2!
		Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (use for the output)
C2.☐.7	Limitation	Limitation before application of the time constant
		± xxx … ± xxx%; range: -150…+150%
C2.☐.8	Low flow cutoff	Sets output value to "0":
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C2.☐.9	Time constant	Range: 000.1…100 s
C2.☐.10	Invert signal	Select:
		off (activated output generates a high current at the output, switch closed)
		on (activated output generates a low current at the output, switch open)
C2.☐.12	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board
C2.☐.13	Simulation	Sequence see B 1.☐ Frequency out X

C2.☐ Pulse output X

C2.☐	Pulse output X	X stands for connection terminal D ☐ stands for Fct. No. C2.5 (D)
C2.☐.1	Pulse shape	Specify the pulse shape
		Select: symmetric (about 50% on and 50% off) / automatic (constant pulse with about 50% on and 50% off at 100% pulse rate) / fixed (fixed pulse rate, setting see below Fct. C2.☐.3 100% pulse rate)
C2.☐.2	Pulse width	Only available if set to "fixed" in Fct. C2.☐.1
		Range: 0.05…2000 ms
		Note: max. setting value Tp [ms] ≤ 500 / max. pulse rate [1/s], Gives the pulse width = time where the output is activated
C2.☐.3	100 % pulse rate	Pulse rate for 100% of the measuring range
		Range: 0.0…10000 1/s
		Limitation 100% pulse rate ≤ 100/s: I_{max} ≤ 100 mA Limitation 100% pulse rate > 100/s: I_{max} ≤ 20 mA
C2.☐.4	Measurement	Measured variables for activating the output
		Select: volume flow / mass flow
C2.☐.5	Pulse value unit	Selection of the unit from a list, depending on the measured variable
C2.☐.6	Value p. pulse	Set value for volume or mass per pulse
		xxx.xxx, meas. range in [l] or [kg] (volume or mass for current output C2.☐.6)
		At max. pulse rate see above 2.☐.3 Pulse output

No.	Function / subfunction	Settings / descriptions
C2.☐.7	Polarity	Set measured value polarity, please note flow direction in C1.2.2!
		Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (use for the output)
C2.☐.8	Low flow cutoff	Sets output value to "0"
		x.xxx ± x.xxx%; range: 0.0…20%
		(1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C2.☐.9	Time constant	Range: 000.1…100 s
C2.☐.10	Invert signal	Select:
		off (activated output generates a high current at the output, switch closed)
		on (activated output generates a low current at the output, switch open)
C2.☐.12	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board
C2.☐.13	Simulation	Sequence see B 1.☐ Pulse output X

C2.☐ Status output X

C2.☐	Status output X	X (Y) stands for one of the connection terminals C or D ☐ stands for Fct. No. C2.4 (C) / C2.5 (D)
C2.☐.1	Mode	The output shows the following measuring conditions:
		Out of specification (output activated, signals application error or error in device refer to *Status messages and diagnostic information* on page 69 / Application error (output activated, signals application error or error in device refer to *Status messages and diagnostic information* on page 69 / Polarity flow (polarity of the current flow) / Over range flow (over range of the flow) / Counter 1 preset (activates counter X when preset value is reached) / Counter 2 preset (activates counter X when preset value is reached) / Output A (activated by the status of output Y, additional output data see below) / Output C (activated by the status of output Y, additional output data see below) / Output D (activated by the status of output Y, additional output data see below) / Off (switched off) / Empty pipe (when empty pipe, output active) / Error in device (when error, output activated)
C2.☐.2	Current output Y	Only appears if output A is set under "mode (see above)", and this output is a "current output".
		Polarity (is signaled)
		Over range (is signaled)
		Automatic range signals lower range
C2.☐.2	Frequency out Y and pulse output Y	Only appears if output D is set under "mode (see above)" and this output is a "frequency / pulse output".
		Polarity (is signaled)
		Over range (is signaled)
C2.☐.2	Status output Y	Only appears if output C or D is set under "mode (see above)" and this output is a "status output".
		Same signal (like other connected status output, signal can be inverted, see below)

No.	Function / subfunction	Settings / descriptions
C2.☐.2	Limit switch Y	Only appears if output C or D is set under "mode (see above)", and this output is a "limit switch".
		Status off (is always selected here if status output X is connected with a limit switch.
C2.☐.2	off	Only appears if output A, C or D is set under "mode (see above)" and this output is switched off.
C2.☐.3	Invert signal	off (activated output supplies a high current, switch closed)
		on (activated output supplies a low current, switch open)
C2.☐.4	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board
C2.☐.5	Simulation	Sequence see B 1.☐ Status output X

C2.☐ Limit switch X

C2.☐	Limit switch X	X stands for one of the connection terminals C or D ☐ stands for Fct. No. C2.4 (C) / C2.5 (D)
C2.☐.1	Measurement	Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
C2.☐.2	Threshold	Switching level, set threshold with hysteresis
		xxx.x ±x.xxx (format and unit depend on the measured variable, see above)
		(1st value = threshold / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C2.☐.3	Polarity	Set measured value polarity, please note flow direction in C1.2.2!
		Select: both polarities (plus and minus values are displayed) / positive polarity (display for negative values = 0) / negative polarity (display for positive values = 0) / absolute value (use for the output)
C2.☐.4	Time constant	Range: 000.1…100 s
C2.☐.5	Invert signal	Select:
		off (activated output generates a high current, switch closed)
		on (activated output generates a low current, switch open)
C2.☐.6	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board
C2.☐.7	Simulation	Sequence see B 1.☐ Limit switch X

No.	Function / subfunction	Settings / descriptions

C3 I/O counter

C3.1	Counter 1	Set function of counter ☐ ☐ stands for 1, 2 (= counter 1, 2) The basic version (standard) has only 2 counters!
C3.2	Counter 2	
C3.☐.1	Function of counter	Select: sum counter (counts positive and negative values) / +counter (counts only the positive values) / -counter (counts only the negative values) / off (counter is switched off) /
C3.☐.2	Measurement	Selection of the measured variable for counter ☐
		Select: volume flow / mass flow
C3.☐.3	Low flow cutoff	Sets output value to "0".
		Range: 0.0%...20%
		(1st value = operating point / 2nd value = hysteresis); condition: 2nd value ≤ 1st value
C3.☐.4	Time constant	Range: 0.1...100 s
C3.☐.5	Preset value	If this value is reached (positive or negative), a signal is generated that can be used for a status output at which "preset counter X" has to be set
		Preset value (max. 8 places) x.xxxxx in selected unit, see C5.7.10 + 13
C3.☐.6	reset counter	Sequence see Fcts. A 3.2 and A 3.3
C3.☐.7	Set counter	Set counter ☐ to the desired value
		Select: break (exit function) / set value (opens the editor to make the entry)
		Query: set counter?
		Select: no (exit function without setting the value) / yes (sets the counter and exits the function)
C3.☐.8	Stop counter	Counter ☐ stops and holds the current value
		Select: no (exits the function without stopping the counter) / yes (stops the counter and exits the function)
C3.☐.9	Start counter	Start counter ☐ after that counter is stopped
		Select: no (exits the function without starting the counter) / yes (starts the counter and exits the function)
C3.☐.10	Information	Serial number of the I/O circuit board, software version number and calibration date of the circuit board

No.	Function / subfunction	Settings / descriptions

C4 I/O HART

C4	I/O HART	Selection / display of the 4 dynamic variables (DV) for HART®
		The HART® current output (Term. A basic I/Os or Term. C EExi I/Os) always has a fixed link to the primary variables (PV). Fixed links of the other DVs (1-3) are only possible if 1 additional analog output (frequency) is available; if not, the measured variable may be freely selected from the following list: see Fct. A4.1 "Measurement"
		☐ stands for 1, 3 or 4 X stands for connection terminals A, C or D
C4.1	PV is _ _ _	Current output (primary variable)
C4.2	SV is _ _ _	(secondary variable)
C4.3	TV is _ _ _	(tertiary variable)
C4.4	4V is _ _ _	(4th variable)
C4.☐.1	Current output X	Shows the current analog measured value of the linked frequency output. The measured variable cannot be changed!
C4.☐.1	Frequency output X	Shows the current analog measured value of the linked frequency output, if present. The measured variable cannot be changed!
C4.☐.1	HART dynam. var.	Measurements of the dynamic variables for HART®
		Linear measured variables: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
		Digital measured variables: counter 1 / counter 2 / operating hours

No.	Function / subfunction	Settings / descriptions

C5 Device

C5.1 Device info

C5.1	Device info	
C5.1.1	Tag	Settable characters (max. 8 places): A…Z; a…z; 0…9; / - , .
C5.1.2	C number	Electronic type, cannot be changed
C5.1.3	Device serial no.	Serial no. of the system
C5.1.4	Electronic serial no.	Serial no. of the electronic assembly, cannot be changed
C5.1.5	Information	Serial no. of the circuit board, version no. of the main software, date of manufacture of the circuit board

No.	Function / subfunction	Settings / descriptions

C5.2 Display

C5.2	Display	
C5.2.1	Language	Language selection depends on the device version.
C5.2.2	Contrast	Adjust display contrast for extreme temperatures. Setting: -9…0…+9
		This change takes place immediately, not just when setting mode is exited!
C5.2.3	Default display	Specification of the default display page that is returned to after a short delay period.
		Select: None (the current page is always active) / 1. meas. page (show this page) / 2. meas. page (show this page) / Status page (show only status messages) / Graphics page (trend display of the 1st measurement)
C5.2.4	Self test	Not available at this time
C5.2.5	Information	Serial no. of the circuit board, user software version no., date of manufacture of the circuit board

C5.3 and C5.4 meas. page 1 and 2

C5.3	1. meas. page	☐ stands for 3 = meas. page 1 and 4 = meas. page 2
C5.4	2. meas. page	
C5.☐.1	Function	Specify number of measured value lines (font size)
		Select: one line / two lines / three lines
C5.☐.2	Measurement 1.line	Specify measured variable for 1st line
		Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity
C5.☐.3	Range	0…100% of the measured variable set in Fct. C5.☐.2
		0…xx.xx _ _ _ (format and unit depend on the measured variable)
C5.☐.4	Limitation	Limitation before application of the time constant
		xxx%; range: -120…+120%
C5.☐.5	Low flow cutoff	Sets output value to "0": x.xxx ± x.xxx % Range: 0.0…20 %
		(1st value = operating point / 2nd value = hysteresis) Condition: 2nd value ≤ 1st value
C5.☐.6	Time constant	Range: 0.1…100 s
C5.☐.7	Format 1.line	Specify decimal places
		Select: Automatic (adaptation carried out automatically) / X (= none) …X.XXXXXXXX (max. 8 places)
C5.☐.8	Measurement 2.line	Specify measured variable for 2nd line (only available if this 2nd line is activated)
		Select: bar graph (for the measured variable selected in the 1st line) / volume flow / mass flow / diagnosis value / flow speed / counter 1 / counter 2 / conductivity / coil temperature
C5.☐.9	Format 2.line	Specify decimal places
		Select: Automatic (adaptation carried out automatically) / X (= none) …X.XXXXXXXX (max. 8 places)

No.	Function / subfunction	Settings / descriptions
C5.☐.10	Measurement 3.line	Specify measured variable for 3rd line (only available if this 3rd line is activated)
		Select: volume flow / mass flow / diagnosis value / flow speed / coil temperature / conductivity / counter 1 / counter 2
C5.☐.11	Format 3.line	Specify decimal places
		Select: Automatic (adaptation carried out automatically) / X (= none) ...X.XXXXXXXX (max. 8 places)

C5.5 Graphic page

C5.5	Graphic page	
C5.5.1	Select range	Graphic page always shows trend curve of the measurement of the 1st page / 1st line, see Fct.. C5.3.2
		Select: Manual (set range in Fct. C5.5.2) / Automatic (automatic depiction based on the measured values) Reset only after parameter change or after switching off and on.
C5.5.2	Range	Set the scaling for the Y axis. Only available if "Manual" is set in C5.5.1.
		+xxx ±xxx%; range: -100...+100%
		(1st value = lower limit / 2nd value = upper limit), condition: 1st value ≤ 2nd value
C5.5.3	Time scale	Set the time scaling for the X axis, trend curve
		xxx min; range: 0...100 min

C5.6 Special functions

C5.6	Special functions	
C5.6.1	Reset errors	Reset error?
		Select: No / Yes
C5.6.2	Save settings	Save current settings Select: break (exit function without saving) / backup 1 (save in storage location 1) / backup 2 (save in storage location 2)
		Query: go on with copy? (cannot be undone) Select: No (exit function without saving) / Yes (copy current settings to storage backup 1 or backup 2)
C5.6.3	Load settings	Load saved settings Select: break (exit function without loading) / factory settings (load in state as delivered) / backup 1 (load data from storage location 1) / backup 2 (load data from storage location 2)
		Query: go on with copy? (cannot be undone) Select: No (exit the function without saving) Yes (load data from the selected storage location)
C5.6.4	Password quick setup	Password required to change data in the quick setup menu
		0000 (= to quick setup menu without password)
		xxxx (password required); range 4place: 0001...9999
C5.6.5	Password setup	Password required to change data in the setup menu
		0000 (= to quick setup menu without password)
		xxxx (password required); range 4place: 0001...9999

No.	Function / subfunction	Settings / descriptions

C5.7 Units

C5.7	Units	
C5.7.1	Volume flow	m³/h; m³/min; m³/s; l/h; l/min; l/s (l = liters); ft³/h; ft³/min; ft³/s; gal/h; gal/min; gal/s; free unit (set factor and text in the next two functions, sequence see below)
C5.7.2	Text free unit	Text refer to *Set free units* on page 67 to be specified:
C5.7.3	[m³/s] × factor	Specification of the conversion factor, based on m³/s:
		xxx.xxx refer to *Set free units* on page 67
C5.7.4	Mass flow	kg/s; kg/min; kg/h; t/min; t/h; g/s; g/min; g/h; lb/s; lb/min; lb/h; ST/min; ST/h (ST = Short Ton); LT/h (LT = Long Ton); free unit (set factor and text in the next two functions, sequence see below)
C5.7.5	Text free unit	Text refer to *Set free units* on page 67 to be specified:
C5.7.6	[kg/s] × factor	Specification of the conversion factor, based on kg/s:
		xxx.xxx refer to *Set free units* on page 67
C5.7.7	Flow speed	m/s; ft/s
C5.7.8	Conductivity	µS/cm; S/cm
C5.7.9	Temperature	°C; °F; K
C5.7.10	Volume	m³; l (liters); hl; ml; gal; IG; in³; ft³; yd³; free unit (set factor and text in the next two functions, sequence see below)
C5.7.11	Text free unit	Text refer to *Set free units* on page 67 to be specified:
C5.7.12	[m³] × factor	Specification of the conversion factor, based on m³:
		xxx.xxx refer to *Set free units* on page 67
C5.7.13	Mass	kg; t; mg; g; lb; ST; LT; oz; free unit (set factor and text in the next two functions, sequence see below)
C5.7.14	Text free unit	Text refer to *Set free units* on page 67 to be specified:
C5.7.15	[kg] × factor	Specification of the conversion factor, based on kg:
		xxx.xxx refer to *Set free units* on page 67
C5.7.16	Density	Kg/cm³; kg/l; kg/m³; lb/ft³; lb/gal; free unit (set factor and text in the next two functions, sequence see below)
C5.7.17	Text free unit	Text refer to *Set free units* on page 67 to be specified:
C5.7.18	[kg/m³] × factor	Specification of the conversion factor, based on kg/m³:
		xxx.xxx refer to *Set free units* on page 67

No.	Function / subfunction	Settings / descriptions

C5.8 HART®

C5.8	HART	
C5.8.1	HART	Switch HART® communication on/off:
		Select: on (HART® activated) current = 4…20 mA / off (HART® not activated) current = 0…20 mA
C5.8.2	Address	Set address for HART® operation:
		Select: 00 (point to point operation, current output has normal function, current = 4…20 mA) / 01...15 (multidrop operation, current output has a constant setting of 4 mA)
C5.8.3	Message	Set required text:
		A…Z ; a…z ; 0…9 ; / - + , . *
C5.8.4	Description	Set required text:
		A…Z ; a…z ; 0…9 ; / - + , . *

C5.9 Quick setup

C5.9	Quick setup	Activate quick access in quick setup menu:
		Select: yes (switched on) / no (switched off)
C5.9.1	Reset counter 1	Reset counter 1 in quick setup menu?
		Select: yes (activated) / no (switched off)
C5.9.2	Reset counter 2	Reset counter 2 in quick setup menu?
		Select: yes (activated) / no (switched off)

6.3.4 Set free units

Free units	Sequences to set tests and factors
Texts	
Volume flow, mass flow and density:	3 places before and after the slash xxx/xxx (max. 3 places before / after the slash)
Volume, mass	xxx (max. 3 places)
Permissible characters:	A…Z; a…z; 0…9; / - + , . *; @ $ % ~ () [] _
Conversion factors	
Desired unit	= [unit see above] × conversion factor
Conversion factor	Max. 9 places
Shift decimal point:	↑ to the left and ↓ to the right

6.3.5 Reset counter in Quick Setup menu

INFORMATION!
It may be necessary to activate resetting of the counter in the Quick Setup menu in function C5.9.

Key	Display	Description and setting
→	Quick setup	Time counts backwards from 2.5...0.0 s, after that release the key.
→	Language	
2 x ↓	Reset?	
→	Reset error?	
↓	Reset counter 1	Select desired counter
↓	Reset counter 2	
→	Reset counter	
→	No	
↓ or ↑	Yes	
↵	Reset counter	Counter has been reset
2 x ↵	Measuring operation	

6.3.6 Deleting error messages in the Quick Setup menu

NOTE!
The detailed list of the possible error messages refer to Status messages and diagnostic information on page 69.

Key	Display		Description and setting
→	Quick setup		Time counts backwards from 2.5...0.0 s, after that release the key.
→	Language		
2 x ↓	Reset?		
→	Reset error?		
→	Reset?	no	
↓ or ↑	Reset?	Yes	
↵	Reset errors		Error has been reset
2 x ↵	Measuring operation		

6.4 Status messages and diagnostic information

Operational faults in device

Messages on the display	Description	Actions
Status: F _ _ _ _ _	**Operational fault in device, mA output ≤ 3.6 mA or set fault current (depending on the seriousness of the fault), status output open, pulse / frequency output: no pulses**	**Repair necessary.**
F error in device	Fault or failure of device. Parameter or hardware error. No measurement possible.	Group message, when one of the following or some other severe error occurs.
F IO 1	Error, operational fault in IO 1. Parameter or hardware error. No measurement possible.	Load settings (Fct. C4.6.3) (Backup 1, Backup 2 or factory settings). If status message still does not disappear, replace electronic unit.
F parameter	Error, operational fault of data manager, parameter or hardware error. Parameters no longer usable.	
F IO 2	Error, operational fault in IO 2. Parameter or hardware error. No measurement possible.	
F configuration	Invalid configuration: display software, bus parameter or main software do not match existing configuration.	If device configuration unchanged: defective, replace electronic unit.
F display	Error, operational fault in display. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F sensor electronic	Error, operational fault in sensor electronics. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit.
F sensor global	Data error in the global data of the sensor electronic equipment.	Load settings (Fct. C5.6.3, (Backup 1, 2 or factory settings). If status message still does not disappear, replace electronic unit.
F sensor local	Data error in the local data of the sensor electronic equipment.	Defective, replace electronic unit.
F field current local	Data error in the local data of the field current supply	Defective, replace electronic unit.
F current output A	Error, operational fault in current output. Parameter or hardware error. No measurement possible.	Defective, replace electronic unit
F software user interface	Fault revealed by CRC check of operator software.	Replace electronic unit.
F hardware settings	The set hardware parameters do not match the identified hardware. A dialogue appears in the display.	Answer queries in dialogue mode, follow directions. Defective, replace electronic unit.
F hardware detection	Existing hardware cannot be identified.	Replace electronic unit.
F RAM/ROM error IO1	A RAM or ROM error is detected during the CRC check.	Defective, replace electronic unit.
F RAM/ROM error IO2		
F Fieldbus	Malfunction of the fieldbus interface	

Measurements out of specification

Messages on the display	Description	Actions
Status: S _ _ _ _ _	**Out of specification, measurement continues, accuracy possibly less.**	**Maintenance required.**
S uncertain measurement	Device maintenance necessary; measured values only conditionally usable.	Group message, when errors as described below or other influences occur.
S empty pipe	1 or 2 measuring electrodes are not in contact with the medium: measured value is set to zero. Measurement continues.	Filling level of EMF less than 50% or electrodes completely insulated. If "0" to be indicated when pipe is empty, activate under Fct. C 1.3.1 "cond.+empty pipe [F]".
	The two empty pipe messages cannot appear at the same time. The difference lies in whether the measured value is also set to zero upon the detection of an empty pipe. The sensor electronics will use one or the other function (setting to zero or further measurement) depending on a selection made by the user.	
Electrode noise	Noise on the electrodes too high. Measured values are still supplied. No message when empty pipe.	a) Electrodes extremely soiled; b) Conductivity too low: activate noise or pulse filter Fct. C1.2.4, C1.2.7; c) Gas bubbles, solids or chem. reactions in medium: activate noise or pulse filter Fct. C1.2.4, C1.2.7; d) Electrode corrosion (if message also appears when flow is zero): use sensor with suitable electrode material
S gain error	Preampfl. not equal to the calibrated value; check calibration. Measured values are still supplied.	Defective, replace electronic unit.
S electrode symmetry	Impedance of the two measuring electrodes not equal. Measured values are still supplied.	Deposits in measuring tube or electrode short-circuit to ground. Clean and check measuring tube!
S field coil broken	Field coil resistance too high.	Check field coil connections to the electronic module (for remote versions: field current cable) for open circuit / short circuit
S field coil bridged	Field coil resistance too low.	
S field current deviation	Measured field current not equal to the calibrated value. Check calibration. Measured values are still supplied. No message if coil broken or bridged.	Check field current connections. If OK: defect, replace electronic unit.
S electronic temperature	Upper limit for the permissible electronic temperature has been exceeded.	Ambient temperature too high, direct solar radiation or, for C version, process temp. too high.
S coil temperature	Upper limit for the permissible coil temperature has been exceeded. No message if coil broken/bridged.	Process and ambient temperature too high.
S overflow counter 1	This is counter 1 or FB2 (with Profibus). Counter has overrun and started again at zero.	
S overflow counter 2	This is counter 2 or FB3 (with Profibus). Counter has overrun and started again at zero.	
S backplane invalid	The data record on the backplane is invalid. The CRC check has revealed a fault.	No data can be loaded from the backplane when the electronics are replaced. Replace housing.

Simulation of the measured values

Messages on the display	Description	Actions
Status: C _ _ _ _ _	**Output values partially simulated or fixed**	**Maintenance required.**
C checks in progress	Test mode of the device. Measured values are possibly simulated values or values with fixed settings.	Message depending on the situation via HART® or FDT.
Test sensor	Test function of the measuring sensor electronics active.	
Field bus simulation	Values on the field bus interface foundation are simulated.	

Information

Messages on the display	Description	Actions
Status: I _ _ _ _ _	**Information (current measurement OK)**	
I counter 1 stopped	This is counter 1 or FB2 (with Profibus). The counter has stopped.	If counter to continue counting, activate "yes" in Fct. C2.y.9 (Start counter).
I counter 2 stopped	This is counter 2 or FB3 (with Profibus). The counter has stopped.	
I power fail	The device was not in operation for an unknown period of time, because the emergency current was switched off. This message is for information only.	Temporary line failure, during which counters stop counting.
I over range display 1	1st line on page 1 (2) of display limited by filter setting.	Menu display Fct. C4.3 and/or C4.4, select meas. page 1 or 2 and increase values in functions C4.z.3 Meas. range and/or C4.z.4 Limitation
I backplane sensor	The sensor data on the backplane are not usable because they have been generated with an incompatible version.	
I backplane settings	The global settings on the backplane are not usable because they have been generated with an incompatible version.	
I backplane difference	The data on the backplane differ from the data in the display. If the data are usable, a dialogue is indicated in the display.	
I write cycles overfl.	The maximum number of write cycles of the EEPROM or FRAMS on the Profibus DP PCB has been exceeded.	
I baudrate search	The baudrate of the Profibus DP interface is searched for.	
I no data exchange	There is no data exchange between the signal converter and the Profibus.	
I conductivity off	Conductivity measurement switched off.	Changing of settings in Fct. C1.3.1.
I diagnosis channel off	Diagnosis value switched off.	Changing of settings in Fct. C1.3.17.

7.1 Spare parts availability

The manufacturer adheres to the basic principle that operational spare parts for each flowmeter or each important accessory part will be kept available for period of 10 (ten) years after delivery of the last production run for that device.

Operational spare parts are defined as parts that are subject to faults in normal operation.

7.2 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, technical support and training.

NOTE!
For more precise information, please contact your local representative.

7.3 Returning the device to the manufacturer

7.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

CAUTION!
If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

7.3.2 Form (for copying) to accompany a returned instrument

Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.		
Date:		Signature:
Stamp:		

7.4 Disposal

CAUTION!
Disposal must be carried out in accordance with legislation applicable in your country.

8.1 Technical data

Measuring system

Measurement principle	Faraday's law of induction
Function	Continuous measurement of current volume flow, flow velocity, conductivity, mass flow (at constant density), coil temperature of the measuring sensor
Modular construction	The measurement system consists of a measuring sensor and a signal converter
Signal converter	
Compact version (C)	IFC 100 C (0° & 45° version)
Remote version (W)	IFC 100 W
Measuring sensor	
OPTIFLUX 1000	IFC 100 C & W: DN10...150 / 3/8"...6"
OPTIFLUX 2000	IFC 100 C & W: DN25...1200 / 1"...48"
OPTIFLUX 4000	IFC 100 C: DN2.5...1200 / 1/10"...48"; IFC 100 W: DN10...1200 / 3/8"...48";
OPTIFLUX 5000	IFC 100 C: DN2.5...250 / 1/10"...12"; IFC 100 W: DN10...250 / 3/8"...12"
OPTIFLUX 6000	IFC 100 C: DN2.5...150 / 1/10"...6"; IFC 100 W: DN10...150 / 3/8"...6"
Communication	
Outputs	Current (incl. HART®), pulse, frequency, status output and/or limit switch
Counter	2 internal counters with a max. of 8 counter places (e.g. for counting volume and/or mass units)
Verification	Integrated verification, diagnosis functions: flowmeter, empty pipe detection, stabilization
Display and user interface	
Graphic display	LC display, backlit white; size: 128x64 pixels, corresponds to 59x31 mm = 2.32"x1.22"
Display functions	2 measured value pages, 1 status page, 1 graphic page (measured values and depictions adjustable as required)
Units	Metric, British and US units selectable as required from lists for volume / mass flow and counting, flow speed, electrical conductivity, temperature
Language of display texts	English, French, German (others on request)
Operating elements	4 keys for operator control of the signal converter without opening the housing

Measuring accuracy

Maximum measuring error	±0.3% of the measured value ±1 mm/s, depending on the measuring sensor (see accuracy curves)
Repeatability	±0.1%

Operating conditions

Temperature	
Process temperature	See also data sheet for the measuring sensor
Ambient temperature	-40…+65°C / -40…+149°F (ambient temperature 55°C / 131°F and higher: protect electronics against self-heating, because an increase in the electronics temperature in 10°C / 50°F steps leads to a corresponding reduction of the electronics' service life by a factor of two.)
Storage temperature	-50…+70°C / -58…+158°F
Electrical conductivity	
All media except for water	Min. 5 µS/cm (see also data sheet for the measuring transformer)
Water	Min. 20 µS/cm

Materials

Die-cast aluminium (polyurethane-coated)	Standard

Electrical connection

Voltage	Standard: 100…230 VAC (-15% / +10%), 50/60 Hz
	Option 1: 24 VDC (-55% / +30%)
	Option 2: 24 VAC/DC (AC: -15% / +10%; DC: -25% / +30%)
Power consumption	Standard: 8 VA
	Option 1: 4 W
	Option 2: AC 8 VA; DC: 4 W
Signal cable	Only for remote versions
A: type DS 300	Max. length: 600 m / 1950 ft (depending on electrical conductivity and measuring sensor version)
Cable entries	Standard: M20 x 1.5
	Option: ½" NPT, PF ½

Outputs

Current output		
Function	Measurement of volume and mass (at constant density), HART® communication	
Settings	**Without HART®**	**With HART®**
	Q = 0%: 0…15 mA	Q = 0%: 4…15 mA
	Q = 100%: 10…21.5 mA	Q = 100%: 10…21.5 mA
	Error identification: 0…22 mA	Error identification: 3.5…22 mA
Operating data		
Active	$U_{int,nom}$ = 24 VDC I ≤ 22 mA R_L ≤ 750 Ω	
Passive	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≤ 2 V at I = 22 mA	
Pulse or frequency output		
Function	Can be set as a pulse output (e.g.- for volume or mass counting) or frequency output	
Settings	For Q = 100%: 0.01...10000 pulses per second or pulses per unit volume	
	Pulse width: setting automatic, symmetric or fixed (0.05...2000 ms)manual	
Operating data		
Passive	U_{ext} ≤ 32 VDC	
	100 Hz < f_{max} ≤ 10 kHz: I ≤ 20 mA open: I ≤ 0.1 mA at U_{ext} = 5 V I ≤ 0.5 mA at U_{ext} = 24 V I ≤ 0.7 mA at U_{ext} = 32 V closed: U_0 ≤ 0.8 V at I = 1 mA U_0 ≤ 1.5 V at I = 10 mA U_0 ≤ 3.5 V at I = 100 mA f ≤ 1 kHz: R_L ≤ 10 kΩ f ≤ 10 kHz: R_L ≤ 2 kΩ	

Status output / limit switch	
Function and settings	Settable as automatic measuring range change, indicator for direction of flow, overflow, error, operating point or empty pipe detection
	Valve control with activated dosing function
	Status and/or control: ON or OFF
Operating data	
Passive	$U_{ext} \leq 32$ VDC $I \leq 100$ mA open: $I \leq 0.05$ mA at $U_{ext} = 32$ VDC closed: $U_0 \leq 0.2$ V at I = 10 mA $U_0 \leq 2$ V at I = 100 mA
Low-flow cutoff	
On	0...±9.999 m/s; 0...20.0%, settable in 0.1% steps, separately for each current and pulse output
Off	0...±9.999 m/s; 0...19.0%, settable in 0.1% steps, separately for each current and pulse output
Time constant	
Function	Can be set together for all flow indicators and outputs, or separately for: current, pulse and frequency output, and for limit switches and the 2 internal counters
Time setting	0...100 seconds, settable in 0.1 second steps

Approvals

Hazardous areas	
Non-Ex	Standard
EEx - Zone 1/2	In preparation
SAA version Ex Zone 1/2	In preparation
TIIS - Zone 1/2	In preparation
Protection category to IEC 529 / EN 60529	
All versions	IP 66 / 67 (corresponds to NEMA 4X/6)

8.2 Flow tables

Flow rate in m/s and m^3/h

	$Q_{100\ \%}$ in m^3/h			
v [m/s]	0.3	1	3	12
DN [mm]	Min. flow	Nominal flow		Max. flow
2.5	0.01	0.02	0.05	0.21
4	0.01	0.05	0.14	0.54
6	0.03	0.10	0.31	1.22
10	0.08	0.28	0.85	3.39
15	0.19	0.64	1.91	7.63
20	0.34	1.13	3.39	13.57
25	0.53	1.77	5.30	21.21
32	0.87	2.90	8.69	34.74
40	1.36	4.52	13.57	54.29
50	2.12	7.07	21.21	84.82
65	3.58	11.95	35.84	143.35
80	5.43	18.10	54.29	217.15
100	8.48	28.27	84.82	339.29
125	13.25	44.18	132.54	530.15
150	19.09	63.62	190.85	763.40
200	33.93	113.10	339.30	1357.20
250	53.01	176.71	530.13	2120.52
300	76.34	254.47	763.41	3053.64
350	103.91	346.36	1039.08	4156.32
400	135.72	452.39	1357.17	5428.68
450	171.77	572.51	1717.65	6870.60
500	212.06	706.86	2120.58	8482.32
600	305.37	1017.90	3053.70	12214.80
700	415.62	1385.40	4156.20	16624.80
800	542.88	1809.60	5428.80	21715.20
900	687.06	2290.20	6870.60	27482.40
1000	848.22	2827.40	8482.20	33928.80
1200	1221.45	3421.20	12214.50	48858.00

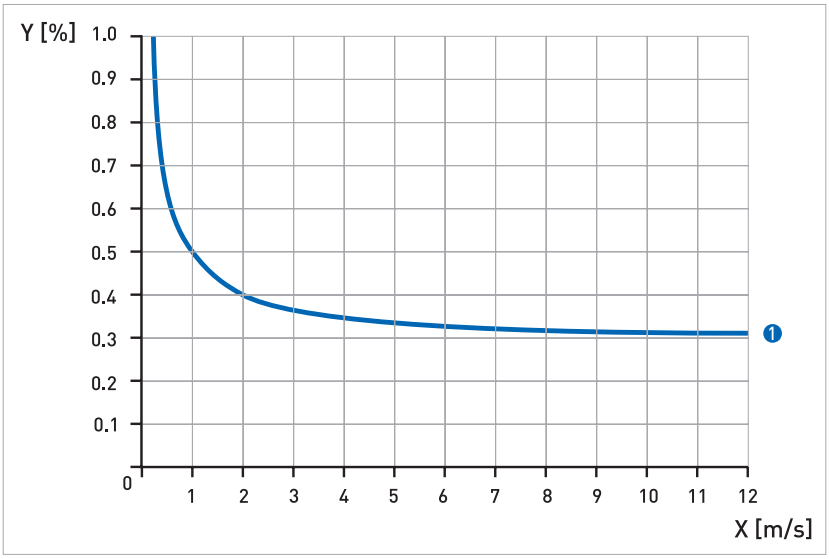
Flow rate in ft/s and gallons/min

	$Q_{100\ \%}$ in .US gallons/min			
v [ft/s]	1	3.3	10	40
DN [inch]	Min. flow	Nominal flow		Max. flow
1/10	0.02	0.09	0.23	0.93
1/8	0.06	0.22	0.60	2.39
1/4	0.13	0.44	1.34	5.38
3/8	0.37	1.23	3.73	14.94
1/2	0.84	2.82	8.40	33.61
3/4	1.49	4.98	14.94	59.76
1	2.33	7.79	23.34	93.36
1.25	3.82	12.77	38.24	152.97
1.5	5.98	19.90	59.75	239.02
2	9.34	31.13	93.37	373.47
2.5	15.78	52.61	159.79	631.16
3	23.90	79.69	239.02	956.09
4	37.35	124.47	373.46	1493.84
5	58.35	194.48	583.24	2334.17
6	84.03	279.97	840.29	3361.17
8	149.39	497.92	1493.29	5975.57
10	233.41	777.96	2334.09	9336.37
12	336.12	1120.29	3361.19	13444.77
14	457.59	1525.15	4574.93	18299.73
16	597.54	1991.60	5975.44	23901.76
18	756.26	2520.61	7562.58	30250.34
20	933.86	3112.56	9336.63	37346.53
24	1344.50	4481.22	13445.04	53780.15
28	1829.92	6099.12	18299.20	73196.79
32	2390.23	7966.64	23902.29	95609.15
36	3025.03	10082.42	30250.34	121001.37
40	3734.50	12447.09	37346.00	149384.01
48	5377.88	17924.47	53778.83	215115.30

8.3 Accuracy

Reference conditions

- Medium: water
- Temperature: 20°C / 68°F
- Pressure: 1 bar / 14.5 psi
- Inlet run: ≥ 5 DN



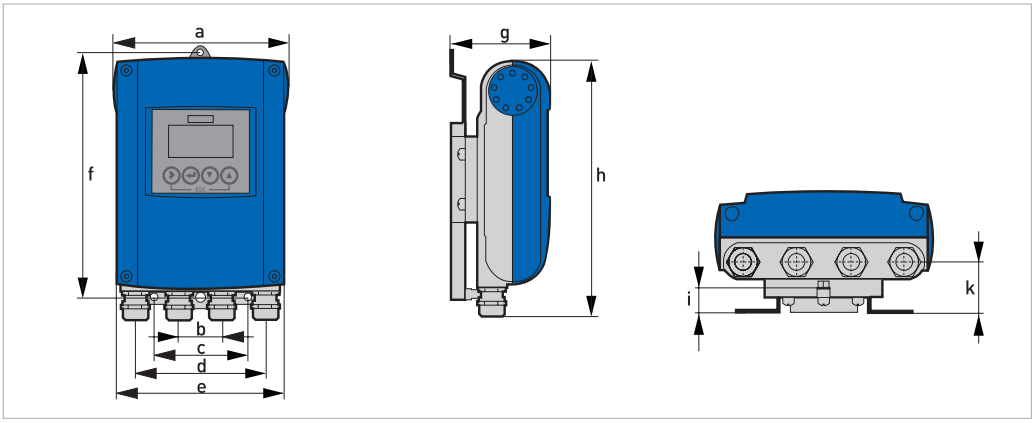
- X [m/s]: flow velocity
- Y [%]: deviation from the actual measured value (mv)

	DN [mm]	DN [inch]	Accuracy	Curve
OPTIFLUX 2100 / 4100 / 5100 / 6100	10…1200	3/8…48	0.3% of mv +1 mm/s	1
OPTIFLUX 1100	10…150	3/8…6	0.4% of mv +1 mm/s	as 1 + 0.1%
OPTIFLUX 4100 / 5100 / 6100	2.5…6	1/10…1/4		

8.4 Dimensions and weights

8.4.1 Housing

Wall-mounted version



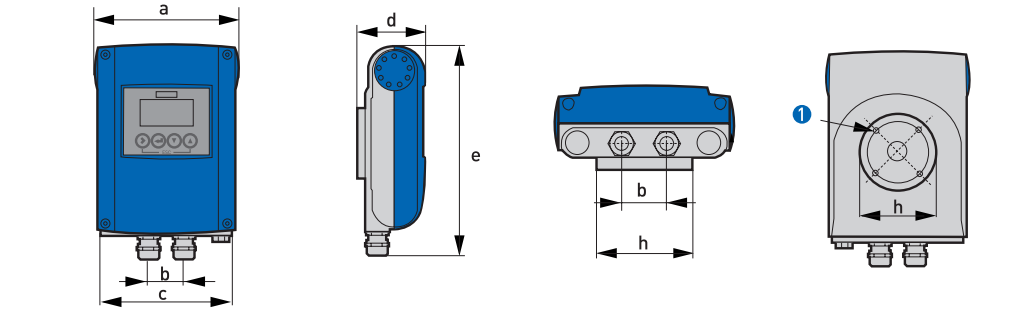
Dimensions and weight in mm and kg

	Dimensions [mm]										Weight [kg]
	a	b	c	d	e	f	g	h	i	k	
Wall-mounted version	161	40	87.2	120	155	241	95.2	257	19.3	39.7	Std: 1.9 Ex: 2.4

Dimensions and weight in inches and lbs

	Dimensions [inches]										Weight [lbs]
	a	b	c	d	e	f	g	h	i	k	
Wall-mounted version	6.34	1.57	3.43	4.72	6.10	9.50	3.75	10.12	0.76	1.56	Std: 4.2 Ex: 5.3

Compact 0° version



1 4 x M 6

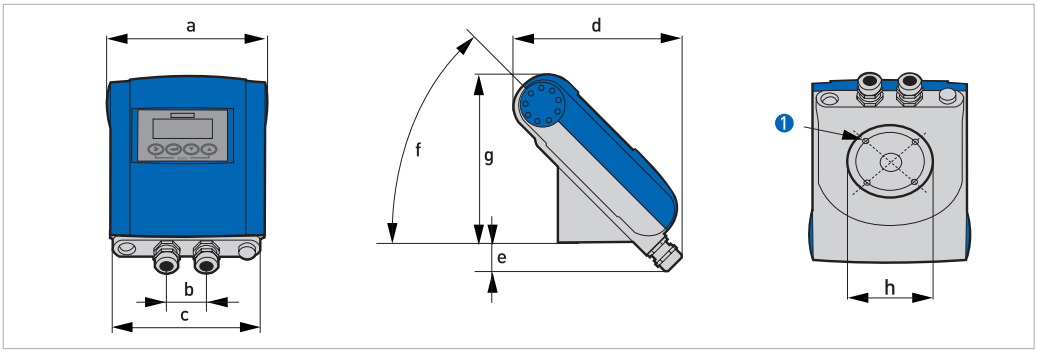
Dimensions and weight in mm and kg

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
0° version	161	40	155	81.5	257	-	-	Ø72	Std: 1.9 Ex: 2.4

Dimensions and weight in inches and lbs

	Dimensions [inches]								Weight [lbs]
	a	b	c	d	e	f	g	h	
0° version	6.34	1.57	6.1	3.21	10.12	-	-	Ø2.83	Std: 4.2 Ex: 5.3

Compact 45° version



1 4 x M 6

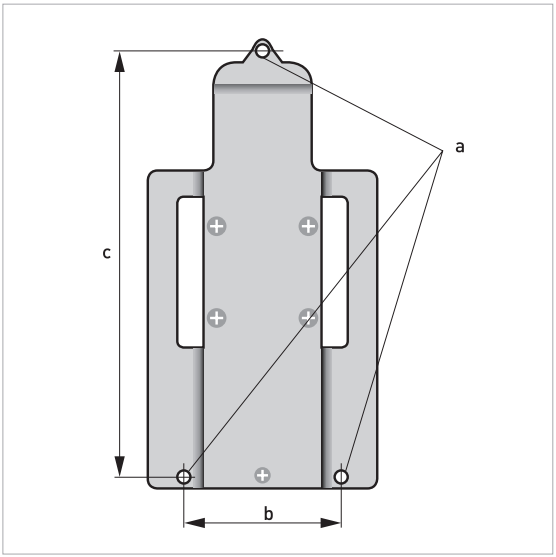
Dimensions and weight in mm and kg

	Dimensions [mm]								Weight [kg]
	a	b	c	d	e	f	g	h	
45° version	161	40	155	184	27.4	45°	186	Ø72	Std: 2.1 Ex: 2.6

Dimensions and weight in inches and lbs

	Dimensions [inches]								Weight [lbs]
	a	b	c	d	e	f	g	h	
45° version	6.34	1.57	6.10	7.24	1.08	45°	7.32	Ø2.83	Std: 4.6 Ex: 5.7

8.4.2 Mounting plate, wall-mounted version



Dimensions in mm and inches

	[mm]	[inches]
a	Ø6.5	Ø0.26
b	87.2	3.4
c	241	9.5

KROHNE Product Overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers
- Level measuring instruments
- Pressure gauges
- Temperature measuring instruments
- Water solutions & analysis
- Oil and gas turnkey solutions

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KROHNE

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COAGULATION PH METER

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Technology For Solutions

GLI International

Data Sheet PRO-P3/1001
Supersedes PRO-P3/501

PRO-series pH/ORP Transmitter

(Model PRO-P3 measures pH or ORP)

CE

Certified Compliant to
European Community Standards

■ **Multiple Measurements.**
The PRO-P3 transmitter can be selected to measure pH or ORP (oxidation reduction potential). Measured pH and temperature values can be displayed separately or together. The corresponding 4-20 mA analog output can also be shown.

■ **Versatile Hookup Capability.**
PRO-series transmitters can be wired in a two, three or four-wire hookup arrangement to meet your application requirement.

■ **Compact Size and NEMA 4X Universal Mounting.**
The compact PRO-series transmitter can be panel, wall, pipe or integral sensor mounted.

■ **Electromagnetic Conformance.**
All PRO-series transmitters exceed U.S. and meet European standards for EMI and RFI emissions and immunity.

■ **Multiple Language Capability.**
All screens can be selected for display in English or Spanish. (Different languages such as French or German may also be substituted.)

■ **"Menu-guided" Operation.**
The simple keypad and logical menu structure make this transmitter easy to use. Menu screens guide you through setup, operation, calibration, and test/maintenance functions.

■ **Passcode-protected Access.**
For security, use the passcode feature to restrict configuration and calibration settings to only authorized personnel.

■ **Isolated 4-20 mA Output.**
The isolated 4-20 mA analog output can represent the measured pH or temperature (or ORP). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.

■ **Versatile Sensor Capability.**
The PRO-P3 transmitter can be used with any GLI Differential Technique pH or ORP sensor, or any conventional combination pH or ORP electrode.

■ **Auto/Manual Temperature Compensation.**
Automatic temperature compensation is provided when using NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD temperature elements. For applications requiring fixed temperature compensation, the PRO-P3 can be manually set to a desired temperature.

■ **Simple Interactive Diagnostics.**
Built-in diagnostics continuously test transmitter and sensor operation.

■ **OEM Versions Available.**
PRO-series transmitters can be packaged or configured to accommodate OEM-specific needs.

Specifications

Operational:

Display ..... Two-line by 16 character LCD

NOTE: *The measured pH (or ORP) and temperature can be separately displayed or shown together on one screen. The corresponding 4-20 mA analog output value can also be shown.*

Measurement	Selectable Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
Temperature	-4.0 to +392.0°F or -20.0 to +200.0°C
Analog Outputs	4.00-20.00 mA

Ambient Conditions ..... Operation: -4 to +140°F (-20 to +60°C); 0 to 95% relative humidity, non-condensing
Storage: -22 to +158°F (-30 to +70°C); 0 to 95% relative humidity, non-condensing

Temperature Compensation ..... Automatic from 14.0 to 230.0°F (-10.0 to +110.0°C) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element, or manually fixed at a user-entered temperature; additional selectable temperature correction factors (ammonia, morpholine or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0-50.0°C

Sensor-to-Analyzer Distance:
- GLI Differential Technique Sensor ..... 3000 ft. (914 m) maximum
- Conventional Combination Electrode with Preamp ..... 985 ft. (300 m) maximum
- Conventional Combination Electrode without Preamp ..... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF/foot

Power Requirements (Class 2 Power Supply) ..... Two-wire Hookup: 16-30 VDC; Three-wire Hookup: 14-30 VDC*; Four-wire Hookup: 12-30 VDC*
*16 VDC minimum with RS-485 serial communication.

Calibration Methods:
- 2-point Buffer (pH only) ..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.
- 1-point Buffer (pH only) ..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

**Buffer Sets: 4.00, 7.00, and 10.00 or DIN standard (1.09, 4.65, 6.79, 9.23, and 12.75)*

NOTE: *When using buffers that are not included in either buffer set, calibrate using only the Sample method (1 or 2).*

- 2-point Sample (pH only) ..... Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values.
- 1-point Sample (pH and ORP) ..... Enter one known sample value (determined by laboratory analysis or comparison reading), or one known pH buffer value (or, for ORP measurement, one known reference solution value)

Analog Output ..... Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *Output can represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA output values are desired (range expand). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.*

Maximum Loop Load ..... Dependent on power supply voltage, transmitter hookup arrangement, and wire resistance:

Maximum Permissible Loads							
Transmitter Hookup Arrangement	Power Supply Voltage						
	12 VDC	14 VDC	16 VDC	20 VDC	24 VDC	28 VDC	30 VDC
Two-wire Hookup	- - - -	- - - -	100 ohms	300 ohms	500 ohms	700 ohms	800 ohms
Three-wire Hookup	- - - -	500 ohms	600 ohms	800 ohms	1000 ohms	1200 ohms	1300 ohms
Four-wire Hookup	400 ohms	500 ohms	600 ohms	800 ohms	1000 ohms	1200 ohms	1300 ohms

Memory (non-volatile) ..... All user settings are retained indefinitely in memory without battery backup

EMI/RFI Conformance ..... Exceeds U.S. and meets European standards for conducted and radiated emissions and immunity; certified CE compliant for applications as specified by EN 50081-2 for emissions and EN 50082-2 for immunity

Electrical Certifications:
- General Purpose (pending) ..... UL, C-UL, FM, and CENELEC
- Division 2 (pending) ..... UL, C-UL, and FM: Groups A, B, C, D, F, and G

Analyzer Performance(Electrical, Analog Outputs):

Accuracy** ..... ± 0.1% of span
Sensitivity** ..... ± 0.05% of span
Repeatability** ..... ± 0.05% of span
Temperature Drift** ..... Zero and Span: ± 0.02% of span per °C
Response Time ..... 1-60 seconds to 90% of value upon step change (with output filter setting of zero)

**These performance specifications are typical at 25°C.

Mechanical:

Enclosure ..... Polycarbonate; NEMA 4X general purpose; choice of included mounting hardware
Mounting Configurations ..... Panel, wall, pipe or integral sensor mounting
Dimensions ..... With Back Cover: 3.75 in. W x 3.75 in. H x 2.32 in. D (95 mm W x 95 mm H x 60 mm D)
Without Back Cover for Panel Mount: 3.75 in. W x 3.75 in. H x 0.75 in. D (95 mm W x 95 mm H x 19 mm D)
Net Weight ..... 10 oz. (280 g) approximately

Ordering Information

MODEL NUMBER (see Notes 1 and 3)

- **PRO-P3A** pH/ORP transmitter with wall/pipe/integral sensor mount kit (see Note 2)
- **PRO-P3B** pH/ORP transmitter with panel mount kit (includes gasket, retainer plate, and four screws)
- **PRO-P3C** Basic pH/ORP transmitter (without mounting hardware -- electronics only)

RESERVED CATEGORY

EQUIPMENT TAGGING (specify tag data)

- **N** None
- **P** Paper
- **S** Stainless steel

1 **Product Number**

Choose item from each category.

Ordering Notes:

1. The standard on-screen languages for PRO-series transmitter operation are English and Spanish. A different language (French, German, etc.) may be substituted for Spanish. Please specify the desired language.
2. This mounting kit includes all hardware needed to wall, pipe or integral sensor mount the transmitter. When integrally mounting the transmitter onto a GLI sensor, please specify the sensor part number with a "PRO1" suffix to ensure a correct sensor cable length and coupling. When the coupling is not required (replacement sensor), please specify the sensor part number with a "PRO2" suffix.
3. Each transmitter is supplied with a CD-ROM containing operating manuals (in PDF-file format) for all of the PRO-series transmitters. Paper manuals are also available (see Accessories at right).

Accessories (order separately):

- **Retrofit Wall/Pipe/Integral Sensor Mount Kit 1000A3457-001**

  This hardware kit enables an existing panel-mounted PRO-series transmitter to be wall, pipe or integral sensor mounted.

- **Retrofit Panel Mount Kit 1000A3455-001**

  This hardware kit enables an existing wall, pipe or integral sensor-mounted PRO-series transmitter to be panel mounted.

- **Couplings to Retrofit Transmitter onto Sensor**

Installed Sensor	Required Coupling	
	Part Number	Size
pHD™-series:		
Convertible (tee mount)	3P2120-125	1 x 1/2-inch
Convertible (union mount)	None required	- - - -
Sanitary	3P2120-125	1 x 1/2-inch
Insertion	Not available	- - - -
LCP-series:		
Convertible	3P2120-130	1-1/2 x 1/2-inch
Union mount	3P2120-130	1-1/2 x 1/2-inch
PC-series 3/4-inch Combination	3P2120-122	3/4 x 1/2-inch

- **Operating Manual No. PRO-P3**

  A paper booklet operating manual for the PRO-P3 pH/ORP transmitter.

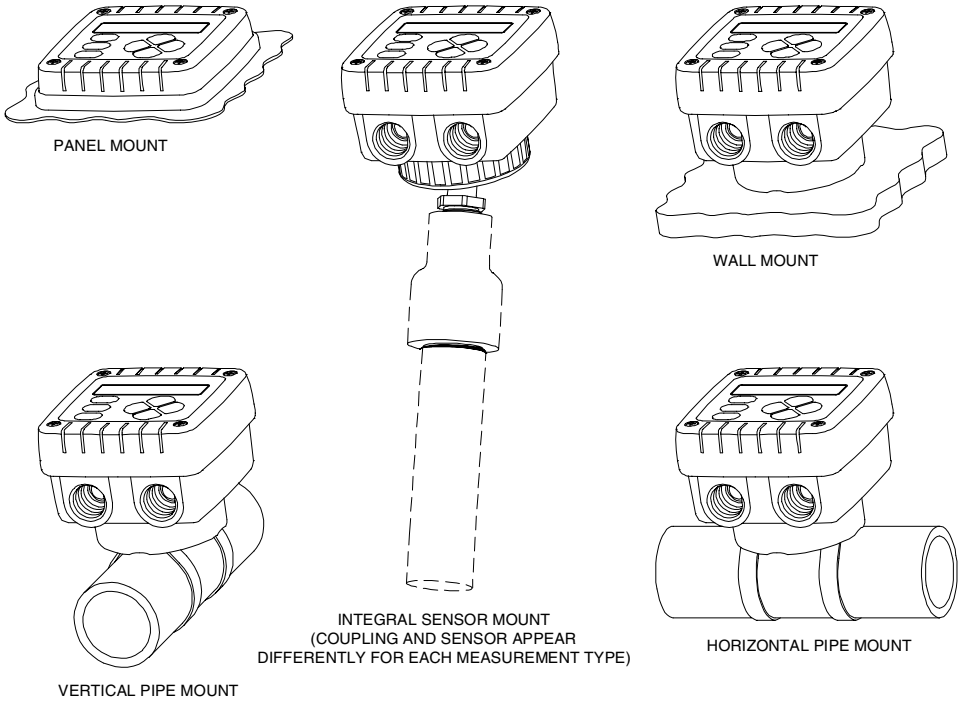
pH and ORP Sensors

For various styles of GLI pH and ORP sensors, refer to these data sheets for complete details: PD, LRE, 6000P0, FTA, HPW, PC or PR6300M.

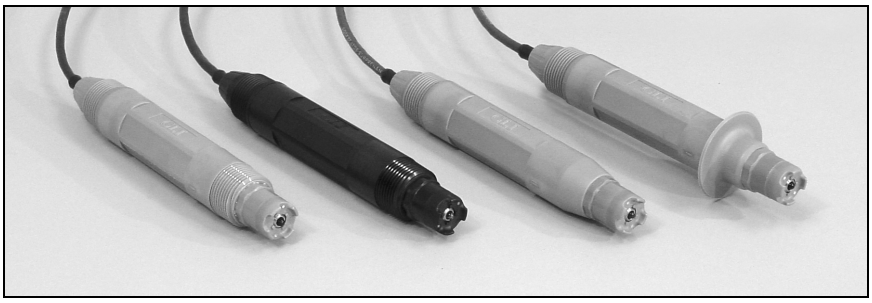
Engineering Specification

1. The microprocessor-based transmitter shall accept any GLI 5-wire Differential Technique pH or ORP sensor, or any conventional combination pH or ORP electrode.
2. The transmitter shall measure pH and process temperature or ORP.
3. The transmitter shall be operable in multiple languages.
4. The transmitter shall have a two-line by 16 character LCD. It shall display measured pH and temperature separately or together on a single screen. The corresponding 4-20 mA analog output value shall also be shown.
5. The transmitter shall have these calibration methods:
   a) 2-point Buffer Method (pH only): Automatic calibration and buffer recognition using two buffers from a selected buffer set.
   b) 1-point Buffer Method (pH only): Automatic calibration and buffer recognition using one buffer from a selected buffer set.
   c) 2-point Sample Method (pH only): Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values.
   d) 1-point Sample Method (pH and ORP): Enter one known sample value (determined by laboratory analysis or comparison reading) or one known pH buffer value (or, for ORP measurement, one known reference solution value).
6. The transmitter shall have a passcode to restrict configuration and calibration settings only to authorized personnel.
7. The transmitter shall have two temperature compensation methods:
   a) Automatic: When the pH sensor has an NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD temperature element, the pH measurement is automatically compensated for process temperature.
   b) Manual: The transmitter can be set to compensate the pH measurement to a fixed, user-entered temperature.
8. The transmitter shall have user-test diagnostics for transmitter and sensor operation without requiring special test equipment.
9. The transmitter shall have an RS-485 data communication port.
10. The transmitter shall have an isolated 4-20 mA analog output that can be assigned to represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA analog output values are desired (range expand). During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.
11. The transmitter shall be GLI International, Inc. Model PRO-P3.

Mounting Configurations



GLI pHD™ Differential pH and ORP Sensors
(for use with PRO-P3 Transmitter



For complete details and specifications, refer to Data Sheet PD.

Data Sheet PRO-P3

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Web: www.gliint.com

Represented By:

Differential pH and ORP Sensors

Hach Digital pHD sc sensors are available in convertible (PEEK® or Ryton®), insertion, and sanitary body styles. Three electrodes are used in these sensors to increase measurement accuracy and eliminate sensor ground loops.

Features and Benefits

Differential Electrode Measurement Technique

This field-proven technique uses three electrodes instead of the two normally used in conventional pH sensors. Process and reference electrodes measure the pH differentially with respect to a third ground electrode. The end result is unsurpassed measurement accuracy, reduced reference junction potential, and elimination of sensor ground loops. These sensors provide greater reliability, resulting in less downtime and maintenance.

Patented Technology

The former GLI, now a Hach Company brand, invented the Differential Electrode Technique for pH measurement in 1970. The pHD™ sensor series (U.S. Patent Number 6395158B1, dated May 28, 2002) takes this field-proven technology to a new level.

Replaceable Salt Bridge/Protector

The unique, replaceable salt bridge holds an extraordinary volume of buffer to extend the working life of the sensor by protecting the reference electrode from harsh process conditions. The salt bridge simply threads onto the end of the sensor if replacement is needed.

Built-in Encapsulated Preamp

Encapsulated construction protects the sensor's built-in preamp from moisture and humidity, ensuring reliable sensor operation. The preamp in the pHD analog sensor produces a strong signal, enabling the sensor to be located up to 1000 m (3280 ft.) from the analyzer.

Durable Body Materials

Both the digital and analog pH and ORP differential sensors feature a durable PEEK® body for chemical compatibility with most process solutions. For less aggressive solutions, Hach offers a Ryton® sensor in a convertible style for pH and ORP measurement. A sensor with a stainless steel body is available for immersion applications.

Digital Electronics Modules

Sensors are available with integral digital electronics or with a gateway module for high temperature (above 70°C) applications.

Versatile Mounting Styles

Sensors are available in four mounting styles—convertible, insertion, immersion, and sanitary. Please turn to page 5 for more information.

Full Featured "Plug and Play" sc100 Digital Controller

There's no complicated wiring or set up procedures with the Hach sc100 controller. Just plug in any Hach digital sensor and it's ready to use—it's "plug and play."

One or two sensors—Use the sc100 Digital Controller to receive data from up to two Hach digital sensors in any combination.

Communications—Multiple alarm/control schemes are available using three relays and two PID control outputs. Communications use analog 4-20 mA and digital MODBUS®/RS485, MODBUS®/RS232 protocols. (Other digital protocols are available. Contact your Hach representative for details.) Every sc100 controller is equipped with wireless communication through an infrared port.

Data logger—A built-in data logger collects measurement data, calibration, verification points, and alarm history for up to 6 months.

Specifications*

pH Sensors

Most pH applications fall in the 2.5 to12.5 pH range. A Hach pHD sc Differential pH sensor with the wide-range glass process electrode performs exceptionally well in this range. Some industrial applications require accurate measurement and control below 2 or above 12 pH. In these special cases, please contact Hach Technical Support for further details.

Measuring Range
-2 to 14 pH

Sensitivity
± 0.01 pH

Stability
0.03 pH per 24 hours, non-cumulative

Operating Temperature
Digital Sensor: -5 to 70ºC (23 to 158ºF)
Analog Sensor with Digital Gateway: -5 to 105ºC (23 to 221ºF)
Immersion Sensor: 0 to 50ºC (32 to 122ºF)

Flow Rate
3 m (10 ft.) per second, maximum

Sensor Pressure/Temperature Limits
Digital: 6.9 bar at 70ºC (100 psi at 158ºF)
Analog: 6.9 bar at 105ºC (100 psi at 221ºF)

Built-in Temperature Element
NTC 300 ohm thermistor for automatic temperature compensation and analyzer temperature readout

Transmission Distance
100 m (328 ft.), maximum
1000 m (3280 ft.), maximum when used with a termination box

Sensor Cable (integral)
4 conductor cable with one shield and polyurethane jacket; rated to 105ºC (221ºF); 10 m (33 ft.) standard length

Wetted Materials
PEEK® or Ryton® (PVDF), salt bridge of matching material with Kynar® junction, glass process electrode, titanium ground electrode, and Viton® O-ring seals

(pH sensor with optional HF-resistant glass process electrode has 316 stainless steel ground electrode, and perfluoroelastomer wetted O-rings; consult factory for other available wetted O-ring materials)

ORP (Redox) Sensors

For best ORP measuring results in solutions containing zinc, cyanide, cadmium or nickel, Hach recommends using the pHD sc ORP sensor equipped with an optional gold electrode.

Measuring Range
-1500 to +1500 mV

Sensitivity
± 0.5 mV

Stability
2 mV per 24 hours, non-cumulative

Operating Temperature
Digital Sensor: -5 to 70ºC (23 to 158ºF)
Analog Sensor with Digital Gateway: -5 to 105ºC (23 to 221ºF)
Immersion Sensor: 0 to 50ºC (32 to 122ºF)

Flow Rate
3 m (10 ft.) per second, maximum

Sensor Pressure/Temperature Limits
Digital: 6.9 bar at 70ºC (100 psi at 158ºF)
Analog: 6.9 bar at 105ºC (100 psi at 221ºF)

Built-in Temperature Element
NTC 300 ohm thermistor for analyzer temperature readout only—no automatic temperature compensation necessary for ORP measurement

Transmission Distance
100 m (328 ft.), maximum
1000 m (3280 ft.), maximum when used with a termination box

Sensor Cable (integral)
4 conductor cable with one shield and polyurethane jacket; rated to 105ºC (221ºF); 10 m (33 ft.) standard length

Wetted Materials
PEEK® or Ryton® (PVDF), salt bridge of matching material with Kynar® junction, glass and platinum (or plastic and gold) process electrode, titanium ground electrode, and Viton® O-ring seals

**Specifications subject to change without notice.*

Engineering Specifications

PEEK® Sensor

1. The pH or ORP sensor shall be of Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall have a hex-shaped body to facilitate mounting, and shall be constructed of PEEK® material for exceptional chemical resistance and mechanical strength. This material shall enable the sensor to be installed in metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
3. The sensor shall have a:
   a) Convertible body style featuring 1-inch NPT threads on both ends to mount into a standard 1-inch pipe tee, into a Hach adapter pipe for union mounting with a standard 1-1/2 inch tee, or onto the end of a pipe for immersion into a vessel.
   b) Insertion body style featuring 1-inch NPT threads only on the cable end to mount into a Hach ball valve hardware assembly, enabling the sensor to be inserted into or retracted from the process without stopping the process flow.
   c) Sanitary body style featuring an integral 2-inch flange to mount into a Hach 2-inch sanitary tee. The sanitary body style sensor shall include a special cap and EDPM compound gasket for use with the Hach sanitary hardware.
4. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
5. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
6. The sensor signal shall have an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in process temperature.
7. The ORP sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
8. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Ryton® Sensor

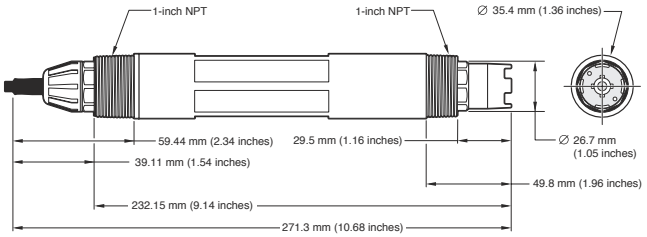
1. The pH or ORP sensor shall be of Differential Electrode Technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall have a hex-shaped body to facilitate mounting, and shall be constructed of Ryton® material for exceptional chemical resistance and mechanical strength. This material shall enable the sensor to be installed in metal fittings without leakage usually caused by heating and cooling cycles when dissimilar materials are threaded together.
3. The sensor shall have a convertible body style featuring 1-inch NPT threads on both ends to mount into a standard 1-inch pipe tee, into a Hach adapter pipe for union mounting with a standard 1-1/2 inch tee, or onto the end of a pipe for immersion into a vessel.
4. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
5. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
6. The sensor signal shall have an integral temperature sensor. The pH sensor shall automatically compensate measured values for changes in process temperature.
7. The ORP sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
8. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Stainless Steel Sensor

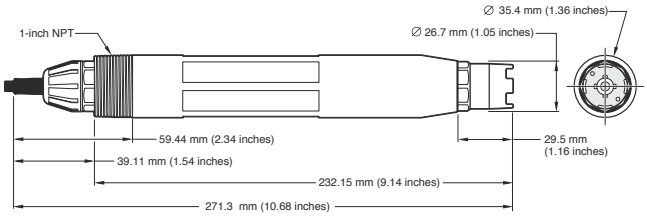
1. The pH or ORP sensor shall be of differential electrode technique design using two measuring electrodes to compare the process value to a stable internal reference standard buffer solution. The standard electrode shall have non-flowing and fouling-resistant characteristics.
2. The sensor shall be capable of chain mounting for immersion applications, and shall be constructed of 316 stainless steel.
3. The built-in electronics of the sensor shall be completely encapsulated for protection from moisture and humidity.
4. The sensor shall have a built-in preamplifier to enable the signal to be transmitted up to 100 m (328 ft.) with standard cabling and up to 1000 m (3280 ft.) with a termination box.
5. The sensor signal shall have an integral temperature sensor to automatically compensate measured values for changes in process temperature.
6. The sensor shall include a titanium ground electrode (standard) to eliminate ground loop currents in the measuring electrodes.
7. The sensor shall be Hach Company Model pHD sc or pHD for pH or ORP measurement.

Dimensions

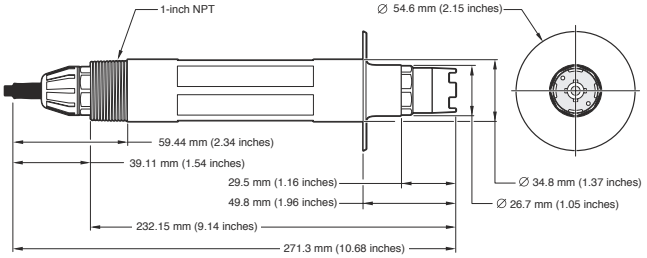
Convertible Style



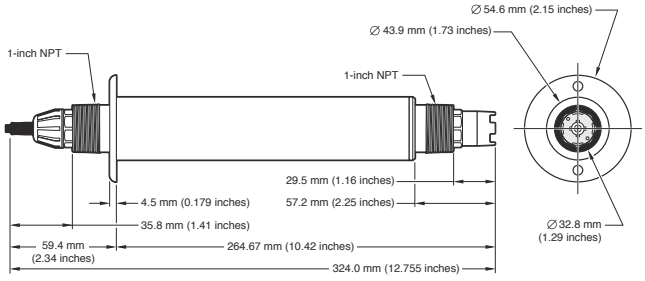
Insertion Style



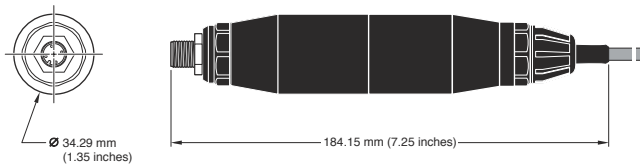
Sanitary Style



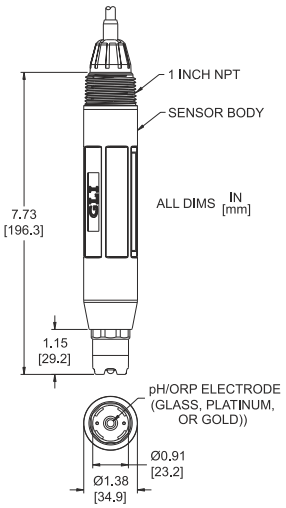
Immersion Style



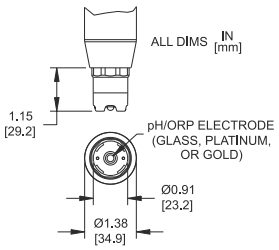
Digital Gateway



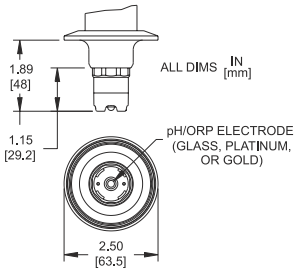
Analog Convertible Style



Analog Insertion Style



Analog Sanitary Style



Ordering Information

pHD sc Digital Differential pH/ORP Sensors

All digital sensors include built-in digital electronics and integral 10 m (33 ft.) cable terminated with connector for the sc100 digital controller. Body styles:

- *Convertible – 1-inch NPT threads at both ends, designed for tee-mounting or other flow through mountings, and pipe mounting for immersion*
- *Insertion – no threads on the electrode end, designed for use with insertion valve assembly*
- *Sanitary – 2-inch flange for a tri-clover style fitting*
- *Immersion – used with chain mounting or pipe mounting*

pH Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
DPD1P1	PEEK[1]	Convertible	Glass, General Purpose	70°C (158°F)
DPD1P3	PEEK[1]	Convertible	Glass, HF-resistant	70°C (158°F)
DPD2P1	PEEK[1]	Insertion	Glass, General Purpose	70°C (158°F)
DPD3P1	PEEK[1]	Sanitary	Glass, General Purpose	70°C (158°F)
DPD1R1	Ryton[2]	Convertible	Glass, General Purpose	70°C (158°F)
DPD1R3	Ryton[2]	Convertible	Glass, HF-resistant	70°C (158°F)
DPS1	Stainless Steel	Immersion	Glass, General Purpose	50°C (122°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

ORP Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
DRD1P5	PEEK[1]	Convertible	Platinum	70°C (158°F)
DRD1P6	PEEK[1]	Convertible	Gold	70°C (158°F)
DRD2P5	PEEK[1]	Insertion	Platinum	70°C (158°F)
DRD1R5	Ryton[2]	Convertible	Platinum	70°C (158°F)
DRD1R6	Ryton[2]	Convertible	Gold	70°C (158°F)
DRS5	Stainless Steel	Immersion	Platinum	50°C (122°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

Digital Gateway

6120500 Digital Gateway, convert pHD analog sensors to digital output for connecting to sc100 digital controller

pHD Analog Sensors

All analog sensors include built-in preamplifier and integral 4.5 m (15 ft.) cable terminated with stripped and tinned wires.

Definitions of body styles:

- *Convertible – 1-inch NPT threads at both ends, designed for tee-mounting or other flow through mountings, and pipe mounting for immersion*
- *Insertion – has no threads on the electrode end, designed for use with insertion valve assembly*
- *Sanitary – has a 2-inch flange for a Tri-Clover style fitting*

pH Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
PD1P1	PEEK[1]	Convertible	Glass, General Purpose	95°C (203°F)
PD1P3	PEEK[1]	Convertible	Glass, HF-resistant	95°C (203°F)
PD2P1	PEEK[1]	Insertion	Glass, General Purpose	95°C (203°F)
PD3P1	PEEK[1]	Sanitary	Glass, General Purpose	95°C (203°F)
PD1R1	Ryton[2]	Convertible	Glass, General Purpose	95°C (203°F)
PD1R3	Ryton[2]	Convertible	Glass, HF-resistant	95°C (203°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

ORP Sensors

Product Number	Body Material	Body Style	Electrode Material	Max Temp
RD1P5	PEEK[1]	Convertible	Platinum	95°C (203°F)
RD1P6	PEEK[1]	Convertible	Gold	95°C (203°F)
RD2P5	PEEK[1]	Insertion	Platinum	95°C (203°F)
RD1R5	Ryton[2]	Convertible	Platinum	95°C (203°F)
RD1R6	Ryton[2]	Convertible	Gold	95°C (203°F)

[1]Polyetheretherketone [2]Polyphenelene Sulfide

Ordering Information *continued*

pHD sc Digital and pHD Analog Sensor Accessories

Cables

Extension cables are used only with digital sensors or digital gateways when connecting to the sc100 Digital Controller.

61224-00 Digital Extension Cable, 1 m (3.2 ft.)

57960-00 Digital Extension Cable, 7.7 m (25 ft.)

57961-00 Digital Extension Cable, 15 m (50 ft.)

57962-00 Digital Extension Cable, 31 m (100 ft.)

Interconnect cables are used only with analog sensors, junction box, and controller.

1W11-00 Analog Interconnect Cable, order per foot

Digital Termination Box

Required when the length of cable between the digital sensor/digital gateway and sc100 Digital Controller is between 100 m (328 ft.) and 1000 m (3280 ft.)

58670-00 Digital Termination Box

Analog Junction Box

Required when the length of cable between the analog sensor and analog controller is greater than standard length of sensor cable. Each junction box includes terminal strip and gasket.

60A2053 Junction Box, Surface-mount, aluminum (includes mounting hardware)

60A9944 Junction Box, Pipe-mount, PVC (for 1/2-inch diameter pipe, includes mounting hardware)

60G2052 Junction Box, Pipe-mount, PVC (for 1-inch diameter pipe, includes mounting hardware)

76A4010-001 Junction Box, NEMA 4X (no mounting hardware included)

Protector for Convertible style sensor

1000F3374-002 PEEK protector

1000F3374-003 Ryton protector

Salt Bridges

The double junction salt bridge on the standard cell of all Hach pHD sensors is field-replaceable. Each salt bridge has a ceramic inner junction, Viton® O-ring, and contains binary, equi-transferrant fill solution. Salt bridges are shipped in a salt solution.

Product Number	*pHD sc and pHD Sensor Body Material*	*Salt Bridge Materials*	
		Body	*Outer Junction*
SB-P1SV	PEEK	PEEK	Kynar (PVDF)
SB-P2SV	PEEK	PEEK	Ceramic
SB-P1SP[1]	PEEK	PEEK	Kynar (PVDF)
SB-R1SV	Ryton	Ryton	Kynar (PVDF)

[1]*Special perfluoroelastomer O-ring in place of the Viton® O-ring*

Cleaning Systems for pHD sc and pHD Sensors

Self-Contained Air Blast Cleaning System
Includes Kynar® (PVDF) washer head with 7.6 m (25 ft.) tubing for air delivery, a quick-disconnect tube fitting, and a compressor housed in a NEMA 4X enclosure.

1000A3335-005 For 115 VAC operation
1000A3335-006 For 230 VAC operation

Air/Water Blast Cleaning Washer Head
Intended only for immersion applications with a user-supplied air or water wash system.

1000A3335-004 Kynar (PVDF) washer head includes 1/4-inch barb fitting

pHD sc Digital and pHD Analog Sensor Reagents and Standards

25M1A1025-115 Standard Cell Solution, to replenish standard cell chamber in Hach pHD sensors while replacing salt bridge, 500 mL

25M8A1002-101 Gel Powder, for high temperature applications, 2 g

pH Buffers

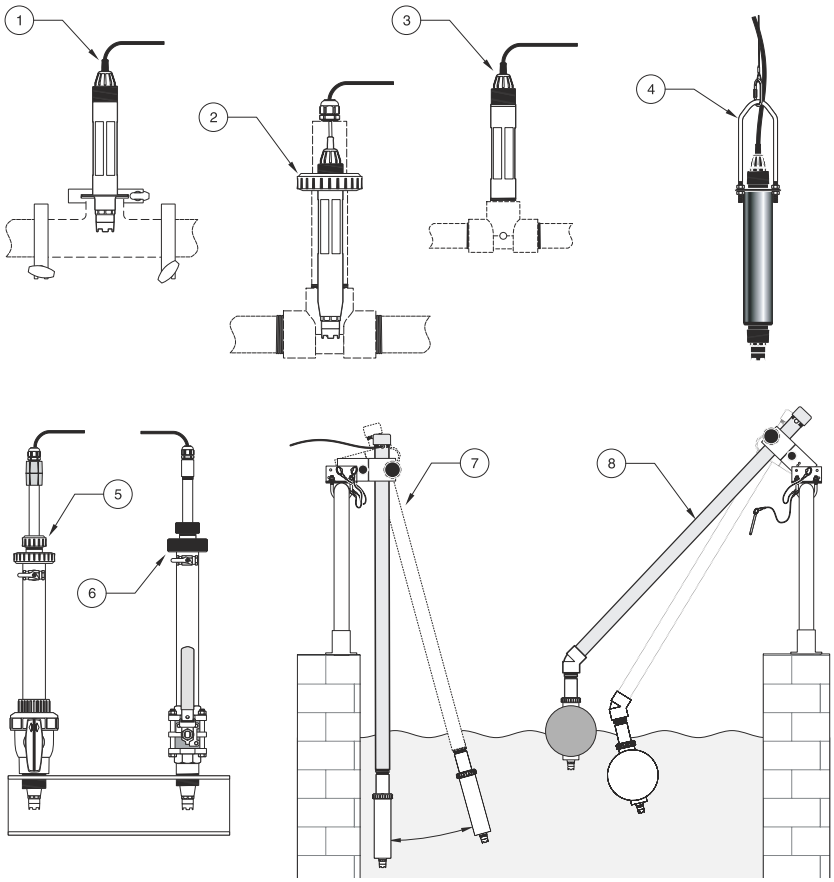
Product Number	*Description*	*Volume*
22835-49	pH 7	500 mL (1 pint)
22834-49	pH 4	500 mL (1 pint)
22836-49	pH 10	500 mL (1 pint)

ORP Reference Solutions (in resealable plastic bottles)

Product Number	*Description*	*Volume*
25M2A1001-115	200 mV	500 mL (1 pint)
25M2A1002-115	600 mV	500 mL (1 pint)

Ordering Information *continued*

Mounting Hardware for pHD sc Differential Sensors



1. Sanitary mount
2. Union mount
3. Flow-through mount
4. Hanging stainless steel sensor with the bail
5. PVC Insertion mount
6. Stainless steel insertion mount
7. Immersion mount
8. Immersion mount, ball float

Sanitary Mount

MH018S8SZ 316 SS
Includes 2-inch sanitary tee and heavy-duty clamp. Special cap and EPDM compound gasket are supplied with sensor but can be separately ordered.

Union Mount

61313-00 CPVC
61314-00 316 SS
Includes standard 1-1/2 inch tee, special union pipe with adapter, sealing hub, and lock ring in respective material, and Viton® O-ring.

Flow-through Mount

MH334N4NZ CPVC
MH314N4MZ 316 SS
Includes a standard 1-inch tee in respective material.

Insertion Mount

Digital		*Analog*	
61367-00	CPVC	**MH736M4MZ**	CPVC
61368-00	316 SS	**MH716M4MZ**	316 SS

Includes a 1-1/2 inch ball valve in respective material, 1-1/2 inch NPT close nipple, sensor adapter with two Viton® O-rings and wiper, extension pipe, pipe adapter, back tube, and lock ring.

Immersion Mount

Standard Hardware

Digital		*Analog*	
61364-00	CPVC	**MH434A00B**	CPVC
61365-00	316 SS	**MH414A00B**	316 SS

Includes 1-inch diameter by 4 ft. long pipe and 1-inch x 1-inch NPT coupling in respective material. (Pipe-mount junction box with terminal strip included in analog hardware.)

Handrail Hardware

MH236B00Z CPVC
Includes 1-1/2 inch diameter by 7.5 ft. long CPVC pipe, and a unique swivel/pivot/ pipe clamp assembly.

Chain Mount Hardware

2881900 316 ss
Includes stainless steel bail, nuts, and washers. Does not include chain. To be used with stainless steel immersion sensor only.

NOTE

Contact Hach Technical Support or your Hach representative for information about retro fit hardware for existing installations.

To complete your pH and ORP measurement system, choose the sc100 Controller...

Model sc100 Controller

(see Lit. #2463)

There's no complicated wiring or set up procedures with the Hach sc100 controller. Just plug in any Hach digital sensor and it's ready to use—it's "plug and play" with one or two sensors. A built-in data logger collects measurements at user selectable intervals of one to 15 minutes. Local display, recall, graphing and trending in CSV format make chart recorders redundant. No analog/digital conversion is required—it communicates via MODBUS® or IR port. Two PID controllers and three form 'C' relay contacts for alarm or control are available.

LXV401.52.00002 sc100 Controller Standard

LXV401.52.01002 sc100 Controller with RS-232 MODBUS®

LXV401.52.02002 sc100 Controller with RS-485 MODBUS®

At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water—it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

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HACH®

Be Right™

OPERATING MANUAL

PRO-series Model P3
pH/ORP Transmitter

(for pH and ORP measurement)

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A2852 ISO 9001
GLI INTERNATIONAL, INC.

This operating manual and other GLI operating manuals are available on GLI's web site at gliint.com when viewed using Adobe's free Acrobat reader. To get this reader, link to Adobe through GLI's web site or visit Adobe's web site at adobe.com.

WARRANTY

GLI International, Inc. warrants the PRO-series Model P3 to be free from defects in material or workmanship for a period of 2 years (24 months) from the date of shipment of this product from our facility. A warranty claim will not be honored if defects are not reported within the warranty period, or if GLI International determines that defects or damages are due to normal wear, misapplication, lack of maintenance, abuse, improper installation, alteration, or abnormal conditions. GLI International's obligation under this warranty shall be limited to, at its option, replacement or repair of this product. The product must be returned to GLI International, freight prepaid, for examination. The product must be thoroughly cleaned and any process chemicals removed before it will be accepted for replacement or repair. GLI International's liability shall not exceed the cost of the product. Under no circumstances will GLI International be liable for any incidental or consequential damages, whether to person or property. GLI International will not be liable for any other loss, damage or expense of any kind, including loss of profits, resulting from the installation, use, or inability to use this product.

Declaration of Conformity

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: GLI International, Inc.

Manufacturer's Address: 9020 West Dean Road
P.O. Box 245022
Milwaukee, Wisconsin 53224, USA

declares that the products:

Product Names:
PRO-series pH/ORP Transmitter
PRO-series Dissolved Oxygen Transmitter
PRO-series Electrodeless Conductivity Transmitter
PRO-series Contacting Conductivity Transmitter
PRO-series Flow Transmitter

Model Numbers: PRO-P3xxx, PRO-D3xxx, PRO-E3xxx, PRO-C3xxx, PRO-F3xxx

conforms to the following Product Specifications:

EMC: **EN 50081-2 : 1993**
Generic Emission Standard (Industrial Environment)

EN 55011 : 1998 / CISPR 11 : 1999		Group 1, Class A

EN 61000-6-2 : 1999
Generic Immunity Standard (Industrial Environment)

EN 61000-4-2 : 1995 -	ESD Immunity	4 kV CD, 8kV AD
EN 61000-4-3 : 1997 -	Radiated Immunity	10 V/m, 80% AM (1 kHz)
EN 61000-4-4 : 1995 -	EFT/B Immunity	1.0 kV Signal & Power Lines
EN 61000-4-6 : 1996 -	Conducted Immunity	10 V, 80% AM (1 kHz)

Supplementary Information:

The products herewith comply with the requirements of the following directives and carry the CE marking accordingly:

EMC Directive 89/336/EEC

Products were tested in typical configurations. Specific test configurations and results are published in L.S. Compliance's Test Report Numbers: 301140, 301222, 301256 and EMC Testing Wisconsin's Test Report Number 00340.

These devices comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

These devices comply with U.S. UL Standard 1604 (USL) and Canadian National Standard C22.2 No. 213-M1987 (CNL). All devices are UL Listed (Control Number 9NX6) and hold a Class I, Division 2, Groups A, B, C, and D Hazardous Locations rating.

For Compliance Information ONLY, contact:

Product Regulations Manager
GLI International
9020 West Dean Road
Milwaukee, Wisconsin 53224, USA

IMPORTANT SAFETY INFORMATION

Please read and observe the following:

- The transmitter can be located in a Class 1, Division 2, Group A, B, C or D hazardous area.
- Since the transmitter is powered by only low DC voltage, it is completely safe to handle.
- Install the transmitter in accordance with relevant local codes and instructions contained in this operating manual. Also, note and comply with the transmitter's technical specifications and ratings.
- Whenever it appears that transmitter safety is questionable, disable the transmitter to ensure against any unintended operation. For example, an unsafe condition is likely when:
    1) The transmitter appears visibly damaged.
    2) The transmitter fails to operate properly or provide the intended measurements.
    3) The transmitter has been stored for long periods at temperatures above 158°F (70°C).
- Only qualified personnel should perform wiring or repairs, and only when the transmitter is not powered.

HELPFUL IDENTIFIERS

In addition to information on installation and operation, this instruction manual may contain WARNINGS pertaining to user safety, CAUTIONS regarding possible instrument malfunction, and NOTES on important, useful operating guidelines.

WARNING:

A WARNING LOOKS LIKE THIS. IT WARNS YOU OF THE POTENTIAL FOR PERSONAL INJURY.

CAUTION:

A CAUTION LOOKS LIKE THIS. IT ALERTS YOU TO POSSIBLE INSTRUMENT MALFUNCTION OR DAMAGE.

☞ ***NOTE:*** *A note looks like this. It alerts you to important operating information.*

CONDENSED OPERATING INSTRUCTIONS

This manual contains details for all operating aspects of the instrument. The following condensed instructions are provided to assist you in getting the instrument started up and operating as quickly as possible. **These condensed instructions only pertain to basic pH measurement operation using a GLI Differential pH sensor.** To measure ORP, or use a conventional combination electrode or specific features of the instrument, refer to the appropriate sections in this manual for instructions.

A. CONNECTING SENSOR/CONFIGURING SENSOR TYPE AND TEMPERATURE ELEMENT

1. After properly mounting the transmitter (PART TWO, Section 2), connect the GLI Differential Technique pH sensor, matching wire colors to terminals as indicated:

Sensor Wire Colors	Connect to TB2
White	Terminal 1
- - - -	Terminal 2 (unused)
Inner Shield and Black	Terminal 3
Yellow	Terminal 4
Green	Terminal 5
- - - -	Terminal 6 (unused)
Red	Terminal 7
Outer Shield (see Note)	Earth Ground

NOTE: *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

For systems not requiring CE compliance and lacking an earth ground, connect the outer shield to Terminal 3 on TB2.

2. The transmitter is factory-set for use with a GLI Differential Technique pH sensor. To use another type of pH sensor or an ORP sensor, change the sensor type. For details, see PART THREE, Section 3.2, subheading “SELECT SENSOR Type.”

3. The transmitter is factory-set for automatic temperature compensation using the 300 ohm (NTC300) temperature element built into all GLI Differential sensors (except GLI 6006P4-2000 pure water pH sensor system which uses a PT 1000 RTD). To use a sensor with a different temperature element, or if you want fixed MANUAL temperature compensation, change the temperature element type. For details, see PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type.”

B. CONNECTING DC POWER

Refer to PART TWO, Section 3.2, 3.3, 3.4, or 3.5 to connect DC power to the transmitter.

C. CONFIGURING BUFFER TYPE/CALIBRATING THE TRANSMITTER

The transmitter must be calibrated so that measured values will correspond to actual process values. Before calibrating for the first time, select the buffer set you intend to use. Then, calibrate using the recommended “2 POINT BUFFER” method which provides the most accurate pH measurements.

1. The transmitter is factory-set for the common 4.00, 7.00, and 10.00 pH buffer set. To use DIN 19267 standard value buffers, change the buffer set. For details, see PART THREE, Section 3.2, subheading “SELECT BUFFER Set for pH Calibration.”

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE TRANSMITTER -- (continued)

NOTE: *When using buffers that are not included in either of these buffer sets, use only the "2 POINT SAMPLE" method for calibration. Refer to that subheading in PART THREE, Section 4.2 for instructions.*

2. Immerse the sensor in the first buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

   NOTE: *An in-progress calibration can always be aborted by pressing the **ESC key**. After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

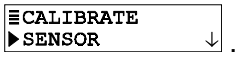
   - *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).*
   - *Use ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

   Calibration Tip! *If, at any time during calibration, the "2 POINT BUFFER: CONFIRM FAILURE?" screen appears, press **ENTER key** to confirm. Then, use the ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do <u>one</u> of the following:*

   - *With the "2 POINT BUFFER? (CAL: EXIT)" screen selected, press **ENTER key**. Then, after the "2 POINT BUFFER: CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
   - *With the "2 POINT BUFFER? (CAL: REPEAT)" screen selected, press **ENTER key** to repeat calibration of this point.*

3. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use ⇧ **or** ⇩ **key** to display it.

4. Press **ENTER key** to display 

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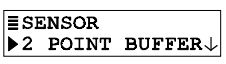
5. Press **ENTER key** again to display 

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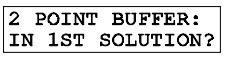
6. Press **ENTER key** again to display 

. With the sensor in the first buffer, press **ENTER key** again to confirm this.

   NOTE: *During calibration, the analog output is automatically "held" at the last measured value.*

(continued on next page)

CONDENSED OPERATING INSTRUCTIONS

C. CALIBRATING THE ANALYZER -- (continued)

7. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT1 = 7.00 pH` appears for 5 seconds to confirm calibration of this point.

   NOTE: *Any time the "PLEASE WAIT" screen appears during calibration you can manually complete calibration of the point by pressing the* ***ENTER key****. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with clean water, and immerse it in the second buffer (typically pH 4). Then press **ENTER key** to confirm this.

9. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like this `2 POINT BUFFER: PT2 = 4.00 pH` appears for 5 seconds to confirm calibration of this point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to gauge sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance.

11. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

12. Install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT BUFFER" calibration. The transmitter is now ready to measure pH.

D. COMPLETING TRANSMITTER CONFIGURATION

To further configure the transmitter to your application requirements, use the appropriate CONFIGURE screens to make selections and "key in" values. Refer to PART THREE, Section 3 for complete configuration details.

T A B L E O F C O N T E N T S

P A R T O N E - I N T R O D U C T I O N

P A R T T W O - I N S T A L L A T I O N

P A R T T H R E E - O P E R A T I O N

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

ILLUSTRATIONS

TABLES

PART ONE - INTRODUCTION

SECTION 1
GENERAL INFORMATION

1.1 Capability Highlights

Sensor Input

The transmitter can be used with any GLI Differential Technique pH or ORP sensor, or any conventional combination electrode. The transmitter accepts the common temperature compensator elements used in these sensors (NTC 300 ohm thermistor, Pt 1000 RTD or Pt 100 RTD).

MEASURE Screen

The MEASURE screen (normal display mode) can provide different readouts of measured data. With the MEASURE screen displayed, press ⇦ **and** ⇨ **key** to show:

When Used as pH Transmitter	When Used as ORP Transmitter
• Measured pH • Measured temperature (°C or °F) • Measured pH and temperature • Measured analog output value (mA)	• Measured ORP • Measured analog output value (mA)

Passcode-protected Access

For security, you can enable a passcode feature to restrict access to configuration and calibration settings to authorized personnel only. See PART THREE, Section 3.5 for details.

Calibration Methods

Four methods are available to calibrate the transmitter for pH. See PART THREE, Section 4.2 for details. For ORP calibration, refer to Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Analog Output

The transmitter's isolated 4-20 mA analog output can be assigned to represent the measured pH or temperature. (When measuring ORP, the output only represents ORP.)

Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA analog output values are desired (range expand). For analog output setup details, see PART THREE, Section 3.4.

☞ ***NOTE:*** *During calibration, the analog output is automatically held at the last measured value and, upon completion, returned to its active state.*

1.2 Transmitter Safety

The transmitter is completely safe to handle. Only low DC voltage is present.

NOTE: *The transmitter can be located in a Class 1, Div. 2 hazardous area.*

1.3 Retained Configuration Values

All user-entered configuration values are retained indefinitely, even if power is lost or turned off. The non-volatile transmitter memory does not require battery backup.

1.4 Transmitter Serial Number

A label with the transmitter model number, serial number, and build date is located between the terminal blocks.

1.5 EMC Conformance

The transmitter is designed to provide protection from most normally encountered electromagnetic interference. This protection exceeds U.S. standards and meets European IEC 1000 (EN 61000) series testing for electromagnetic and radio frequency emissions and immunity. Refer to Figure 1-1 and the specifications in Section 2.1 for more information.

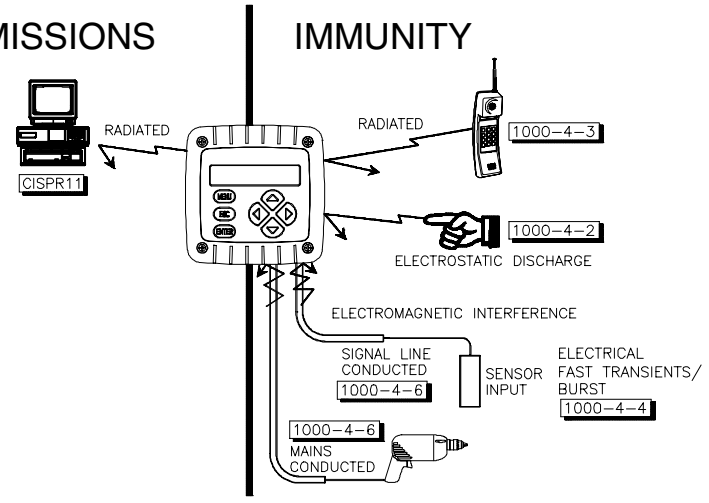


FIGURE 1-1 EMC Diagram

SECTION 2
SPECIFICATIONS

2.1 Operational

Display..... Two-line by 16 character LCD

NOTE: *The measured pH and temperature can be displayed separately or shown together on a single screen. The corresponding 4-20 mA analog output value can also be shown.*

Measurement	Ranges
pH	-2.0 to 14.0 pH or -2.00 to 14.00 pH
ORP	-2100 to +2100 mV
Temperature	-4.0 to +392.0°F or -20.0 to +200.0°C
Analog Output	4.00-20.00 mA

Ambient Conditions:
- Operation..... -4 to +140°F (-20 to +60°C); 0-95% relative humidity, non-condensing
- Storage..... -22 to +158°F (-30 to +70°C); 0-95% relative humidity, non-condensing

Temperature Compensation ..... Automatic from 14.0 to 230.0°F (-10.0 to +110.0°C) with selection for NTC 300 ohm thermistor, Pt 1000 ohm RTD or Pt 100 ohm RTD temperature element; or manually fixed at a user-set temperature; additional selectable temperature correction factors (ammonia, morpholine or user-defined pH/°C linear slope) available for pure water automatic compensation from 0.0-50.0°C

Sensor-to-Transmitter Distance:
- GLI Differential
  - Technique Sensor ..... 3000 ft. (914 m) maximum
- Conventional Combination
  - Electrode with preamp ..... 985 ft. (300 m) maximum
- Conventional Combination
  - Electrode w/o preamp ..... 100 ft. (30 m) maximum with electrode cable capacitance of less than 30 pF per foot

Power Requirements (Class 2 Power Supply):
- Two-wire Hookup ..... 16-30 VDC
- Three-wire Hookup..... 14-30 VDC (16 VDC min. with RS-485 comm.)
- Four-wire Hookup..... 12-30 VDC (16 VDC min. with RS-485 comm.)

Calibration Methods:
- 2 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using two buffers from a selected buffer set*.

  NOTE: *When using buffers that are not included in either transmitter buffer set, use only the "2 POINT SAMPLE" method for calibration.*

  **Buffer Sets: 4.00, 7.00, and 10.00 or DIN 19267 standard (1.09, 4.65, 6.79, 9.23, and 12.75)*

- 1 POINT BUFFER (for pH only)..... Automatic calibration and buffer recognition using one buffer from a selected buffer set*.

  NOTE: *When using a buffer that is not included in either transmitter buffer set, use only the "1 POINT SAMPLE" method for calibration.*

- 2 POINT SAMPLE (for pH only)..... Enter two known sample values (determined by laboratory analysis or comparison reading) or two known pH buffer values

1 POINT SAMPLE (for pH or ORP) ..... Enter one known sample value (determined by laboratory analysis or comparison reading) or one known pH buffer value (or, for ORP measurement, one known reference solution value)

Analog Output ..... Isolated 4-20 mA output with 0.004 mA (12-bit) resolution

NOTE: *The output can be assigned to represent the measured pH or temperature (or ORP). Parameter values can be entered to define the endpoints at which the 4 mA and 20 mA output values are desired (range expand). During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.*

Maximum Loop Load ..... Dependent on power supply voltage, transmitter hookup arrangement, and wire resistance (see load resistance charts for respective hookup diagrams in PART TWO, Section 3.2, 3.3 or 3.4)

Memory (non-volatile) ..... All user settings are retained indefinitely without battery backup

Certifications:
- European Community EMC ..... Certified CE compliant for conducted and radiated emissions (EN 50081-2) and immunity (EN 61000-6-2)
- General Purpose ..... UL, C-UL, and FM
- Class I, Div. 2 ..... UL, C-UL, and FM

2.2 Transmitter Performance (Electrical, Analog Outputs)

Accuracy* ..... ± 0.1% of span
Sensitivity* ..... ± 0.05% of span
Repeatability* ..... ± 0.05% of span
Temperature Drift ..... Zero and Span: ± 0.02% of span per °C
Response Time ..... 1-60 seconds to 90% of value upon step change (with sensor filter setting of zero)

*These performance specifications are typical at 25°C.

2.3 Mechanical

Enclosure ..... Polycarbonate, NEMA 4X general purpose; choice of included mounting hardware

Mounting Configurations ..... Panel, wall, pipe or integral sensor mounting

Dimensions ..... With Back Cover:
3.75 in. W x 3.75 in. H x 2.32 in. D
(95 mm W x 95 mm H x 60 mm D)
Without Back Cover for Panel Mount:
3.75 in. W x 3.75 in. H x 0.75 in. D
(95 mm W x 95 mm H x 19 mm D)

Net Weight ..... 10 oz. (280 g) approximately

PART TWO - INSTALLATION

SECTION 1
UNPACKING

Unpack and examine the equipment even if you do not use it immediately. If there is evidence of damage, notify the transit carrier immediately. **Recommendation: Save the shipping carton and packing materials in case the instrument must be stored or re-shipped.**

SECTION 2
MECHANICAL REQUIREMENTS

2.1 Location

1. It is recommended to locate the transmitter as close as possible to the installed sensor. Depending on the sensor type, the maximum allowable distance between the sensor and transmitter is:

GLI Differential Technique Sensor	Conventional Combination Electrode **with** Preamp	Conventional Combination Electrode **without** Preamp
3000 feet (914 m)	985 feet (300 m)	*100 feet (30 m)

*An external GLI Model 714 preamp can be used to extend this distance to 3000 feet (914 m), but the preamp must be located within 100 feet (30 m) of the electrode.

☞ ***NOTE:*** *The transmitter is suitable for use in a Class 1, Div. 2 hazardous area.*

2. Mount the transmitter in a location that is:

   - ➥ Clean and dry where there is little or no vibration.
   - ➥ Protected from corrosive fluids.
   - ➥ Within ambient temperature limits (-4 to +140°F or -20 to +60°C).

CAUTION:

EXPOSING THE TRANSMITTER TO DIRECT SUNLIGHT MAY INCREASE THE OPERATING TEMPERATURE ABOVE ITS SPECIFIED LIMIT, AND DECREASE DISPLAY VISIBILITY.

2.2 Wall and Pipe Mounting

Figure 2-1 illustrates how to wall or pipe mount the transmitter using the supplied GLI hardware kit. Determine the mounting method, and attach the hardware as shown.

1. Fasten the wall/pipe adapter to the wall or pipe.
2. Using a blunt tool, open both cable entry knockout holes in the back cover.
3. Insert-and-twist the back cover onto the installed wall/pipe adapter, and tighten its two screws to lock back cover onto the adapter.
4. Attach transmitter to back cover using its four captive screws.

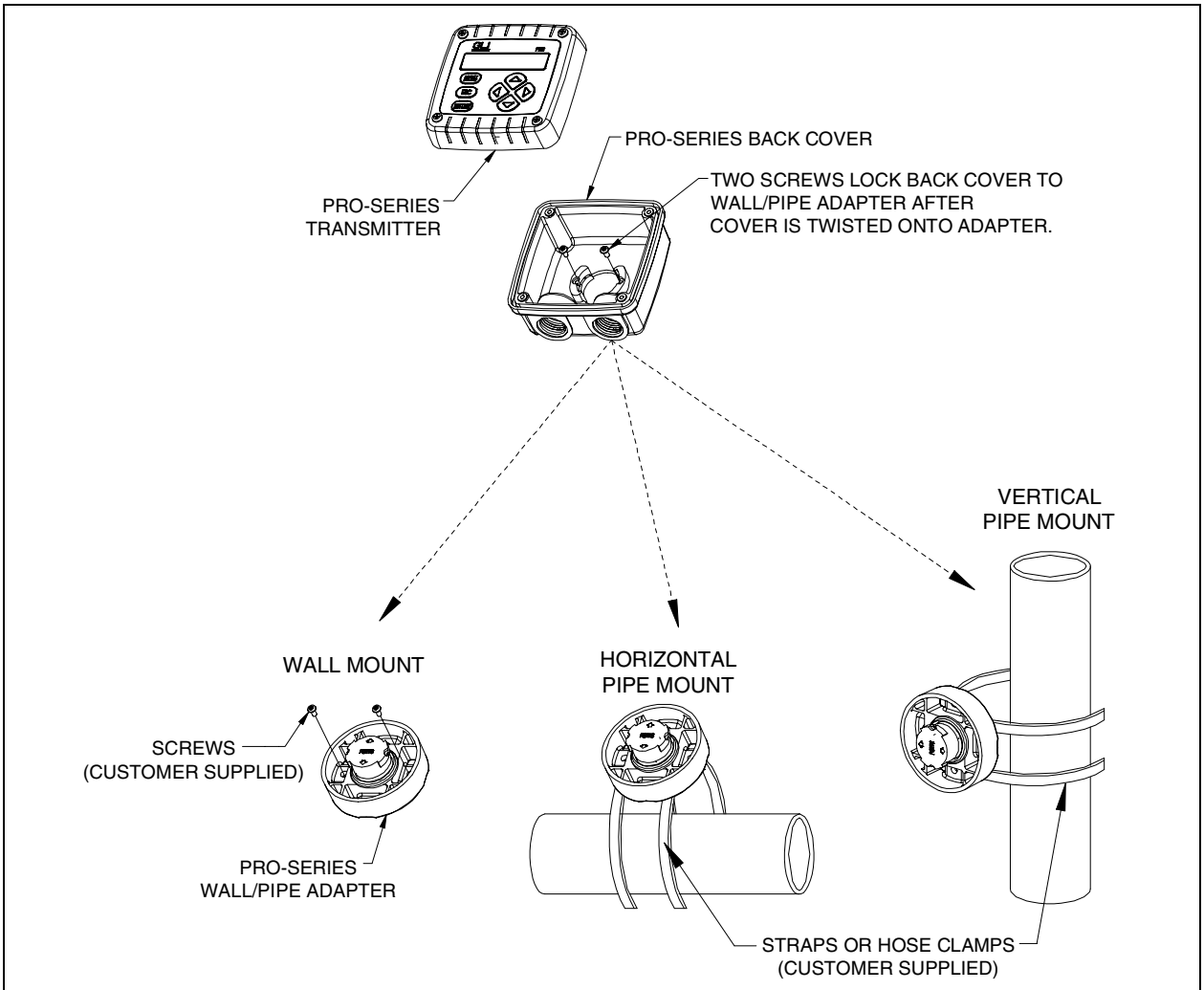


FIGURE 2-1 Wall and Pipe Mounting Details

2.3 Panel Mounting

Figure 2-2 illustrates how to panel mount the transmitter using the supplied GLI panel mount hardware kit.

1. Cut a 3.30-inch (84 mm) square cutout hole in panel.
2. Position panel-mount gasket over cutout in front of panel, and place retainer plate behind panel with its four threaded inserts facing away from back of panel.
3. Attach transmitter to retainer plate using its four captive screws.

NOTE: *If panel is too thick, remove captive screws from transmitter, and use longer screws provided in hardware kit.*

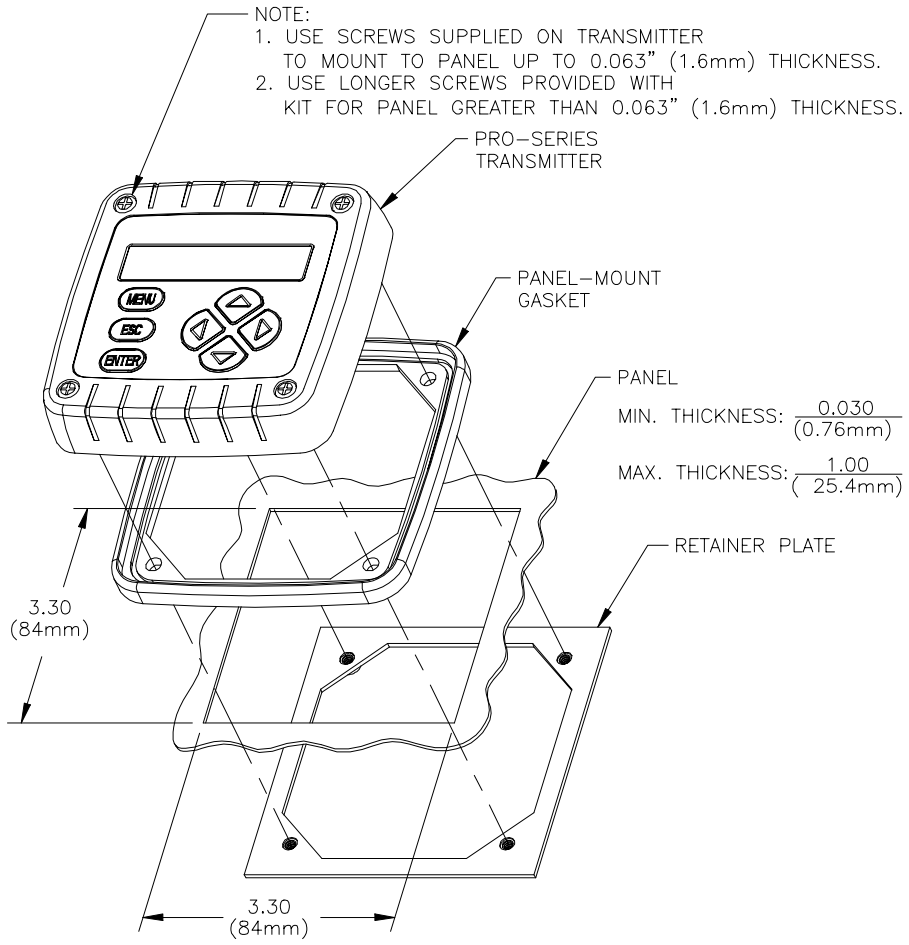


FIGURE 2-2 Panel Mounting Details

2.4 Integral Sensor Mounting

Figure 2-3 illustrates how to integrally mount the transmitter onto a sensor using the supplied GLI mounting hardware kit.

1. Using a blunt tool, open knockout hole in bottom of swivel ball for routing the sensor cable.

2. Attach swivel-mount assembly onto back end of sensor using coupling provided with GLI sensor (only sensors with “PRO1” suffix in their part number) or an appropriately-sized coupling that you provide.

3. Insert-and-twist the back cover onto the installed swivel-mount assembly. Tighten its two screws to lock the back cover onto the swivel-mount assembly.

NOTE: *To change mounting angle, loosen swivel-mount assembly by lifting tab on bottom of swivel nut. Position to desired angle and re-tighten swivel nut.*

4. Attach transmitter to back cover using its four captive screws.

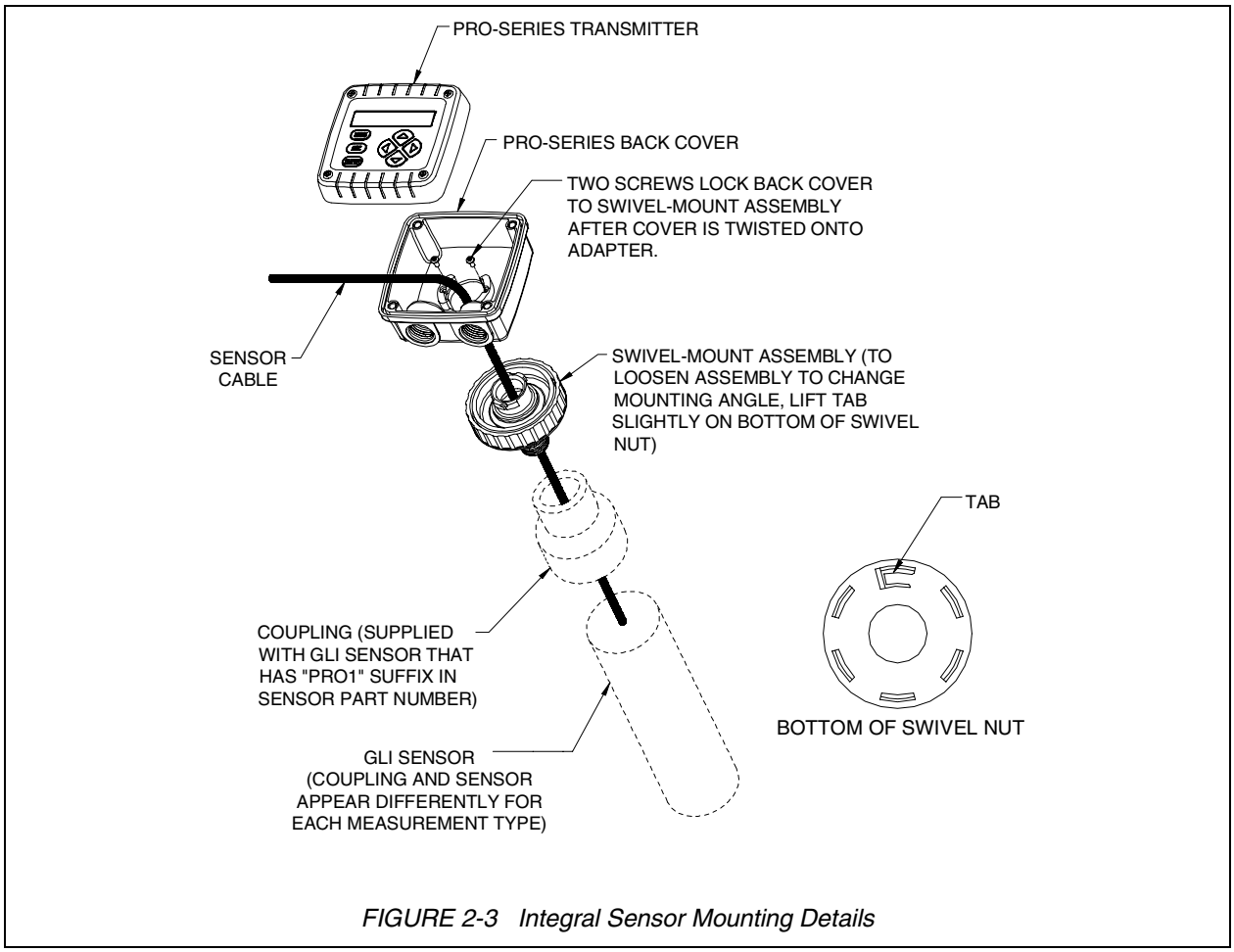


FIGURE 2-3 Integral Sensor Mounting Details

SECTION 3
ELECTRICAL CONNECTIONS

Figure 2-4 shows the terminal block arrangement and terminal designations for the transmitter.

☞ ***NOTE:*** *All terminals are suitable for single wires up to 14 AWG (2.5 mm^2).*

☞ **Wiring Tip!** To comply with European Community (CE) electromagnetic compatibility requirements, follow these general wiring guidelines:

1. Locate transmitter as far as possible from motors and other non-CE certified devices with excessive electromagnetic emissions.
2. Use GLI-specified ferrites and cables. Failure to do so may eliminate compliance. **Locate all ferrites as close as possible to the transmitter.**
   - ◆ DC Power Supply Cable (GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702, or equivalent).
   - ◆ Sensor Cable: Keep cable shields as short as possible. At the transmitter end, connect the outer shield to earth ground, and the inner shield to the SHIELD terminal. If sensor cable has one shield, connect it to the SHIELD terminal. In either case, clamp ferrite (Steward #28A2025-OAO, Fair-Rite Corp. #0431164281, or equivalent) on sensor cable.
   - ◆ Analog mA Output Cable (four-wire hookup only -- GLI 1W0980 two-conductor plus shield): Connect cable shield to earth ground at the supply end. Loop cable 2-1/2 times through ferrite (Steward #28B0686-200, Fair-Rite Corp. #2643665702, or equivalent).

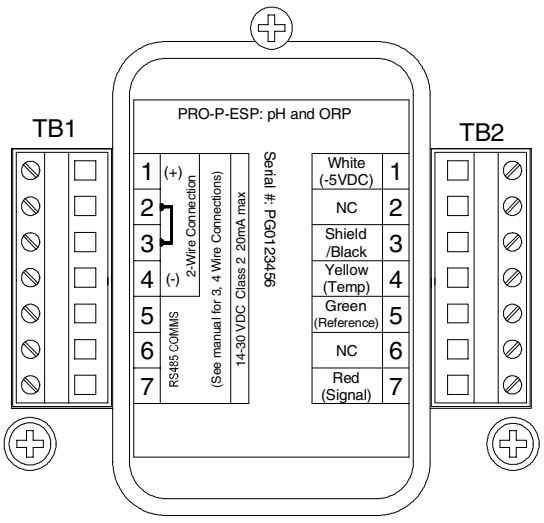


FIGURE 2-4 Transmitter Terminal Designations

3.1 pH or ORP Sensor

Depending on how transmitter is mounted, route the sensor (or interconnect) cable into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through left side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB2 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through swivel ball knockout hole and center hole in back cover. (Do not open left side cable entry knockout hole in back cover.)

GLI Differential Technique Sensor

All GLI Differential Technique sensors have a built-in temperature element for automatic temperature compensation and for measuring process temperature.

☞ **Wiring Tip!** Route the sensor cable in 1/2-inch, grounded metal conduit to protect it from moisture, electrical noise, and mechanical damage.

For installations where the distance between sensor and transmitter exceeds the sensor cable length, indirectly connect the sensor to the transmitter using a junction box and interconnect cable.

☞ ***NOTE:*** *Do not route the sensor cable in any conduit containing AC or DC power wiring ("electrical noise" may interfere with the sensor signal).*

Refer to Figure 2-5 and connect the sensor (or interconnect) cable wires as shown, matching colors as indicated.

☞ ***NOTE:*** *For GLI Differential sensors with only one shield wire, always connect it to Terminal 3 on TB2.*

For systems not requiring CE compliance and lacking an earth ground, connect the outer shield to Terminal 3 on TB2.

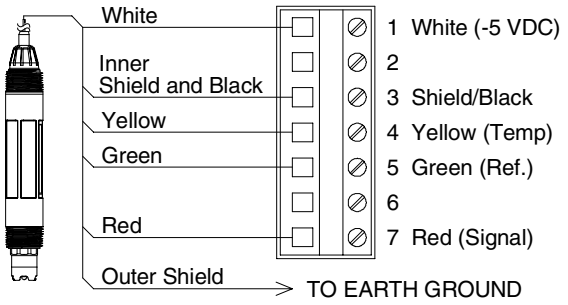


FIGURE 2-5
Connecting GLI Differential Technique Sensor

Conventional Combination Electrode

The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-6 and directly connect the electrode's coaxial cable to the transmitter.

1. Connect the electrode's reference signal -- braided shield wire of coaxial cable (black insulated wire for GLI electrode) -- to Terminal 5 on TB2.

2. Connect the electrode's active signal -- center wire of coaxial cable (clear insulated wire for GLI electrode) -- to Terminal 7 on TB2.

3. Connect a jumper between Terminals 3 and 5 on TB2.

4. Connect the electrode's temperature element (typically white and red insulated wires for GLI electrode) to Terminals 3 and 4 on TB2, attaching either wire to either terminal.

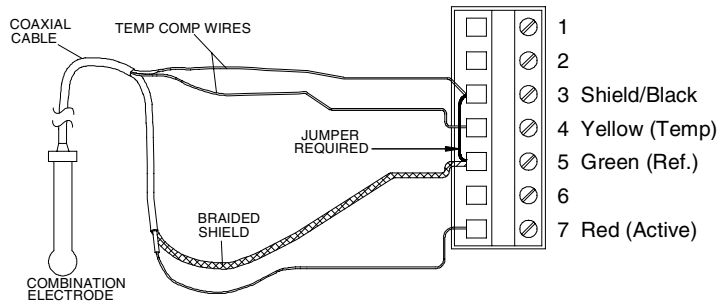


FIGURE 2-6
Connecting Conventional Combination Electrode

Conventional Combination Electrode with Ground Rod

Some applications require that an external ground rod be used with the combination electrode. The electrode must be within 100 ft. (30 m) of the transmitter (985 ft./300 m for electrode with preamp). Refer to Figure 2-7 and directly connect the electrode's coaxial cable to the transmitter.

Connect the electrode and temperature element wires in the same way as described in the previous "Conventional Combination Electrode" subheading -- and also connect the ground rod wire to Terminal 3 on TB2.

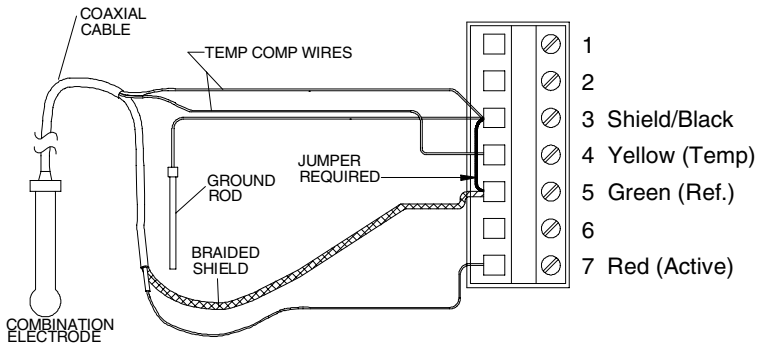


FIGURE 2-7
Connecting Conventional Combination Electrode with Ground Rod

3.2 Two-wire Hookup

In a two-wire hookup, at least 16 VDC is required for operation. A load device can be connected in the current loop (see Figure 2-8 for details).

Depending on how the transmitter is mounted, route the DC power/analog output wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

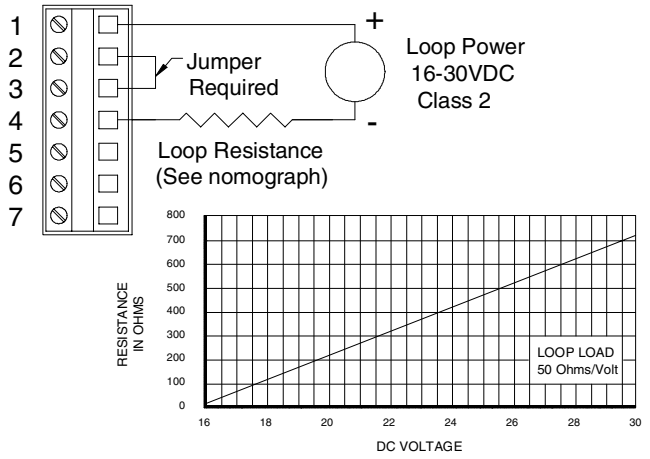


FIGURE 2-8
Two-wire Hookup

3.3 Three-wire Hookups

In a three-wire hookup, the transmitter can be wired four ways depending on load “sinking” or “sourcing” and whether or not RS-485 serial communication is used. At least 14 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the three-wire hookup that meets your application requirements, and connect the transmitter accordingly.

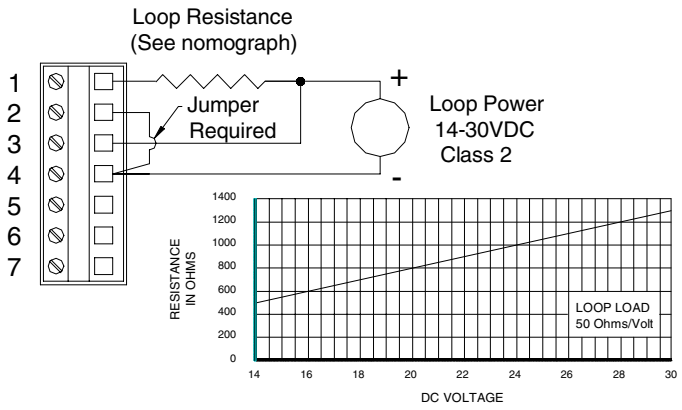


FIGURE 2-9
Three-wire Hookup -- Load Sinking

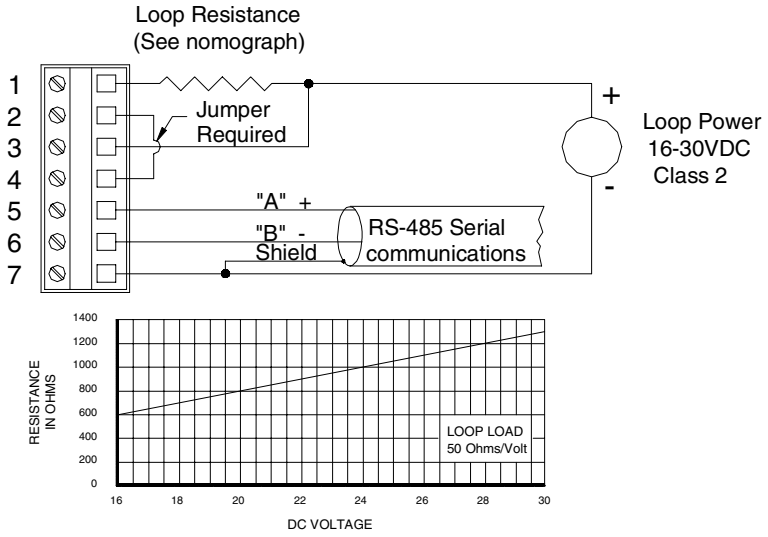


FIGURE 2-10
Three-wire Hookup -- Load Sinking with RS-485 Serial Communication

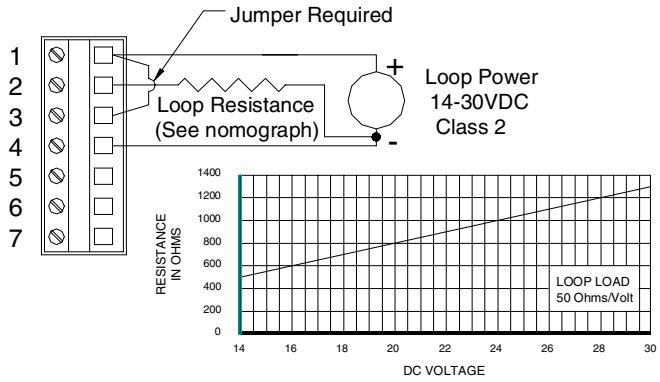


FIGURE 2-11
Three-wire Hookup -- Load Sourcing

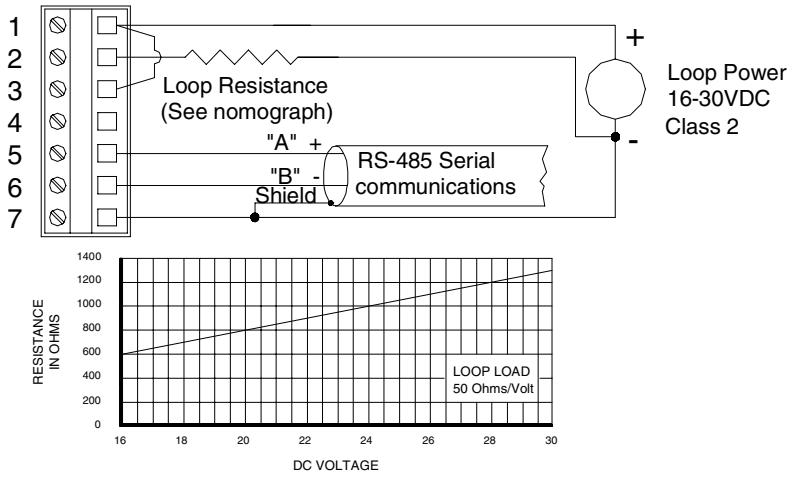


FIGURE 2-12
Three-wire Hookup -- Load Sourcing with RS-485 Serial Communication

3.4 Four-wire Hookups

In a four-wire hookup, the transmitter can be wired two ways depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power, analog output, and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.

- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the four-wire hookup that meets your application requirements, and connect the transmitter accordingly.

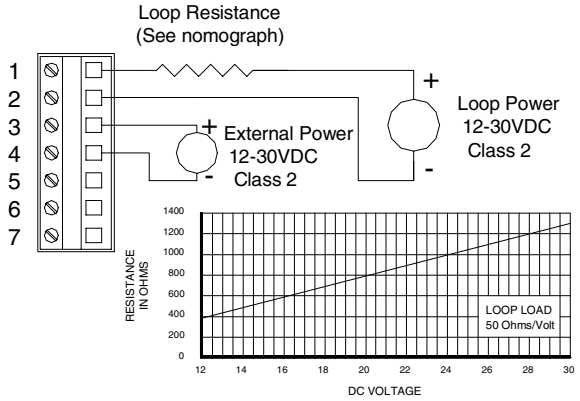


FIGURE 2-13
Four-wire Hookup without RS-485 Serial Communication

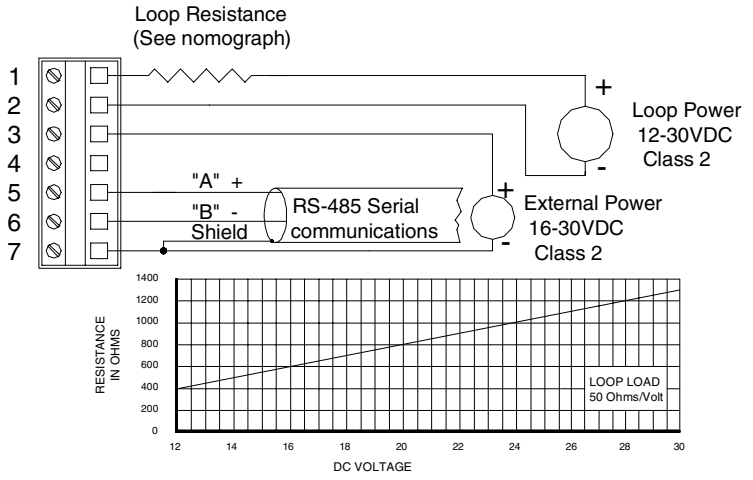


FIGURE 2-14
Four-wire Hookup with RS-485 Serial Communication

3.5 Monitor Mode Hookups (without current loop)

The transmitter can be wired two ways in a monitor mode hookup (without current loop), depending on whether or not RS-485 serial communication is used. At least 12 VDC is required for operation (16 VDC with serial communication). When using RS-485, consult GLI for Command Set.

Depending on how the transmitter is mounted, route the DC power and RS-485 serial communication wiring into the transmitter as follows:

- **Wall/Pipe-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover.
- **Panel-mounted Transmitter:** Route cable behind panel to the exposed TB1 terminal strip.
- **Integral Sensor-mounted Transmitter:** Route cable through right side cable entry knockout hole in the back cover. (Do not open left side cable entry knockout hole in cover.)

☞ **Wiring Tip!** Use high quality, shielded instrumentation cable.

Refer to the monitor mode hookup that meets your application requirements, and connect the transmitter accordingly.

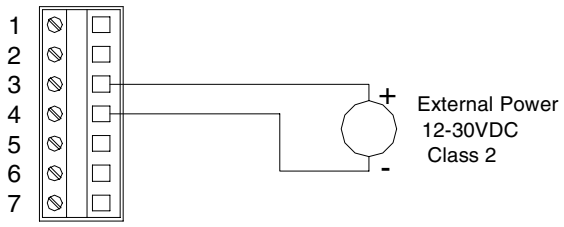


FIGURE 2-15
Monitor Mode Hookup (without Current Loop) -- without RS-485 Serial Communication

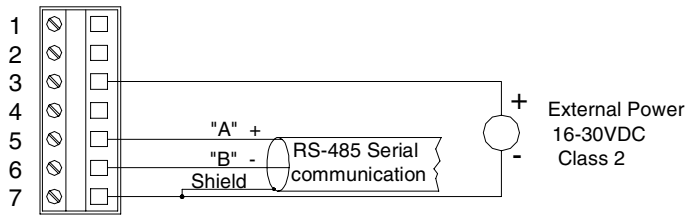


FIGURE 2-16
Monitor Mode Hookup (without Current Loop) -- with RS-485 Serial Communication

PART THREE - OPERATION

SECTION 1
USER INTERFACE

The user interface consists of a two-line LCD display and a keypad with **MENU**, **ENTER**, **ESC**, ⇦, ⇨, ⇧, **and** ⇩ **keys**.

1.1 Display

By using the keypad, you can display three types of screens:

- **MEASURE Screens:** The normal display mode shows the measured pH (or ORP). Pressing the ⇨ **key** sequentially scrolls through these other measurement readouts:
  - ✓ Measured process temperature
  - ✓ Measured pH and temperature

  } not provided when using transmitter to measure ORP
  - ✓ Measured analog output mA value
- **MENU Screens:** These top-level and lower-level (sub-menu) screens within the three main branches of the menu tree are used to access edit/selection screens for configuration. (EXIT screens at the end of each menu branch enable you to move up one level in the menu tree by pressing the **ENTER key**. This is functionally the same as pressing the **ESC key**.)
- **Edit/Selection Screens:** These screens enter values/choices to calibrate, configure, and test the transmitter.

1.2 Keypad

The keypad enables you to move throughout the transmitter menu tree. The keys and their related functions are:

1. **MENU key:** Pressing this key with the MEASURE screen displayed shows the "MAIN MENU ▶ CALIBRATE" screen. To display the CONFIGURE or TEST/MAINT top-level main branch screen, press the ⇩ **key**. Pressing the **MENU key** with a menu screen displayed always shows the top-level screen in that branch. (Pressing the **MENU key** also "aborts" the procedure to change values or selections.)

2. **ENTER key:** Pressing this key does two things: it displays submenu and edit/selection screens, and it enters (saves) configuration values/selections.

3. **ESC key:** Pressing this key always takes the display up one level in the menu tree. (Example: With the "MAIN MENU" screen displayed, pressing the **ESC key** once takes the display up one level to the MEASURE screen.) The **ESC key** can also "abort" the procedure to change a value or selection.

4. ⇦ **and** ⇨ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: Changes readout (in continuous loop sequence) to show different measurements.
   - Menu Screens: These keys are non-functional.
   - Edit/Selection Screens: Moves cursor left or right to select digit for adjustment with ⇧ **and** ⇩ **keys**.

5. ⇧ **and** ⇩ **keys:** Depending on the type of displayed screen, these keys do the following:
   - MEASURE Screen: These keys are non-functional.
   - Menu Screens: Moves up or down respectively between other same-level menu screens.
   - Edit/Selection Screens: Adjusts selected digit value up or down, or moves up or down between choices.

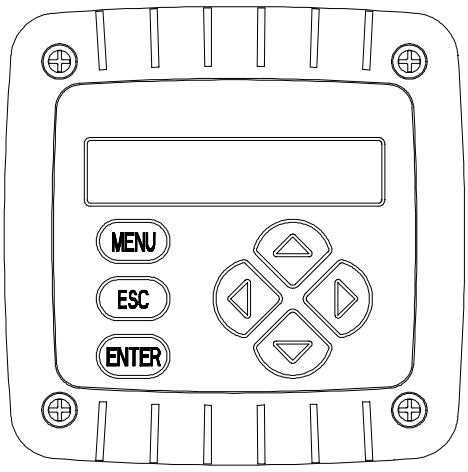
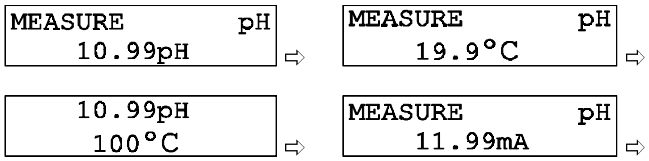


FIGURE 3-1 Transmitter Keypad

1.3 MEASURE Screen (normal display mode)

The MEASURE screen is normally displayed. Pressing the **MENU key** temporarily replaces the MEASURE screen with the top-level "MAIN MENU ▶ CALIBRATE" branch selection screen. Using the keypad, you can then display other screens to calibrate, configure or test the transmitter. **If the keypad is not used within 30 minutes, except during calibration or while using specific transmitter test/ maintenance functions, the display will automatically return to the MEASURE screen.** To display the MEASURE screen at any time, press the **MENU key** once and then press the **ESC key** once.

When using the transmitter to measure pH, the MEASURE screen can show four different readout versions. To select between them, in continuous loop sequence, press the ⇦ **or** ⇨ **key**. These are examples of the different versions:



☞ ***NOTE:*** *If pure water temperature compensation was selected (PART THREE, Section 3.2, subheading "Select PURE H2O COMP") the MEASURE screen will show an asterisk after the pH reading to indicate it is being applied.*

When using the transmitter to measure ORP, only two readouts are shown: measured mV and the mA output. The two screens showing temperature are not available.

☞ ***NOTE:*** *When the transmitter returns to its normal MEASURE screen mode, the appearing readout is always the version last selected.*

Note that three MEASURE screen readout examples show the factory-default "PH" notation on their top lines, illustrating the transmitter notation feature. To create your own notation, refer to PART THREE, Section 3.2, subheading "ENTER NOTE (top line of MEASURE screen)."

When the measured value is beyond the transmitter measuring range, a series of " + " or " - " screen symbols appear, respectively indicating that the value is above or below range.

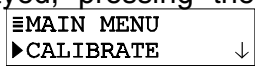
SECTION 2
MENU STRUCTURE

The transmitter menu tree is divided into three main branches: CALIBRATE, CONFIGURE, and TEST/MAINT. Each main branch is structured similarly in layers with top-level screens, related lower-level submenu screens and, in many cases, sub-submenu screens.

Each layer contains an EXIT screen to return the display up one level to the previous layer of screens.

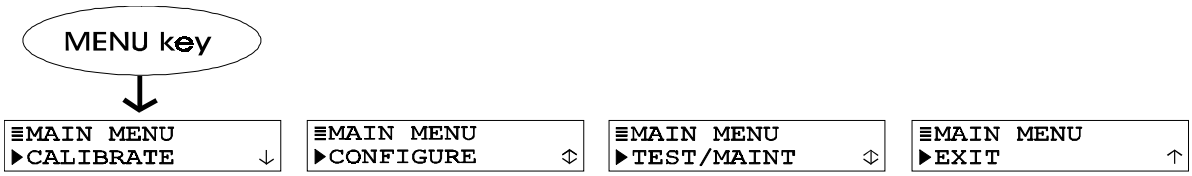
☞ **Menu Structure Tip!** For operating convenience, the layers within each main branch are organized with the most frequently used function screens at their beginning, rather than the function screens used for initial startup.

2.1 Displaying Main Branch Selection Screens

1. With the MEASURE screen displayed, pressing the **MENU key** always shows the 

branch selection screen. (Pressing the **MENU key** with any other type of screen displayed always returns the display to the top of that respective menu branch).

2. Press ⇩ **and** ⇧ **keys** to select between the three MAIN MENU branch selection screens (CALIBRATE, CONFIGURE or TEST/MAINT), or the EXIT screen:

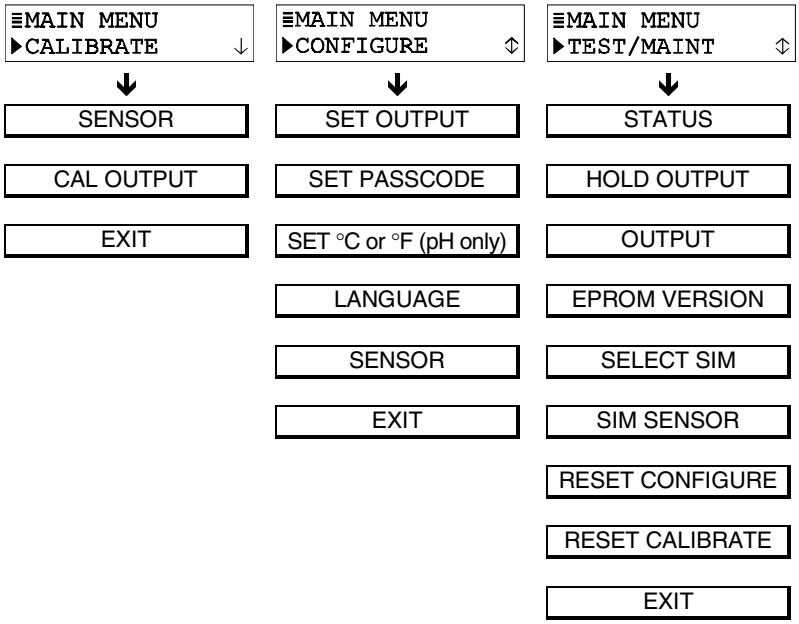


3. With the desired MAIN MENU branch selection screen displayed, press **ENTER key** to display the first top-level menu screen within that branch.

2.2 Displaying Top-level Menu Screens

With the first top-level menu screen of the desired main branch displayed, use the ⇩ **and** ⇧ **keys** to scroll through other top-level screens to access a desired screen.

The top-level menu screens for each main branch are:



☞ **Menu Structure Tip!** A menu screen with a horizontal bar symbol (≣) at the start of its first line indicates there is a related submenu or edit/selection screen.

A menu screen with a "▶" symbol at the start and a "↓" symbol at the end of its second line indicates that you can select other screens within the same layer by pressing the ⇩ **key**. A "↕" symbol at the end of the second line indicates that you can move up or down between screens by respectively pressing the ⇧ **or** ⇩ **key**. When a "↑" symbol appears, it indicates you have reached the end of the screens in that layer. You can select previous screens using the ⇧ **key**.

2.3 Displaying Submenu Screens

After selecting a top-level menu screen, press the **ENTER key** to display a related submenu or edit/selection screen:

- **Submenu Screens** are usually linked to other related same-level screens. Pressing the ⇩ **key** displays these other related menu screens.

  Example: With this submenu screen displayed:

  ```
  ≣SET OUTPUT
  ▶SET PARAMETER ↓
  ```

  pressing the ⇩ **key** displays this related, same-level submenu screen:

  ```
  ≣SET OUTPUT
  ▶SET 4mA VALUE ↕
  ```

- **Edit/Selection Screens** always have a first line ending with a "?". Pressing the ⇩ **or** ⇧ **key** changes the value/ choice enclosed by parenthesis (second line on screen).

  Example: With this submenu screen displayed:

  ```
  SET °C OR °F?
  (°C              )
  ```

  pressing the ⇩ **key** displays this related choice:

  ```
  SET °C OR °F?
  (°F              )
  ```

2.4 Adjusting Edit/Selection Screen Values

Use **arrow keys** to edit/change the value/choice enclosed by parenthesis (examples shown above and below).

```
SET PARAMETER?
(SENSOR          )
```

```
SET 4mA VALUE?
(12.33 pH        )
```

A choice can be changed by simply using the ⇧ **and** ⇩ **keys**. Numerical values can be adjusted using the ⇦ **and** ⇨ **keys** to select a digit, and ⇧ **and** ⇩ **keys** to adjust its value.

2.5 Entering (Storing) Edit/Selection Screen Values/Choices

With the desired value/choice displayed, press the **ENTER key** to enter (store) it into the non-volatile transmitter memory. The previous screen will then re-appear.

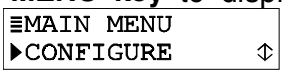
☞ ***NOTE:*** *You can always press the **ESC key** to abort saving a new setting. The original setting will be retained.*

SECTION 3
TRANSMITTER CONFIGURATION

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to enter a configuration setting.*

3.1 Selecting LANGUAGE to Operate Transmitter

The transmitter is normally equipped to display screens in English and Spanish (Español). However, another language such as French (Français), German (Deutsche), etc. may be substituted for Spanish. The transmitter is factory-set for English. To select the other language:

1. Press **MENU key** to display a "MAIN MENU screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** until 

screen appears.

4. Press **ENTER key** to display 

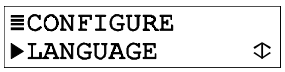
. Use ⇩ **or** ⇧ **key** to select a language, and press **ENTER key** to enter it.

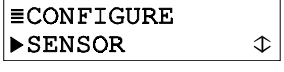
☞ ***NOTE:*** *After a language is selected and entered, all screens are displayed in that language.*

3.2 Configuring Sensor Characteristics

The transmitter must be configured to define the sensor used with it, and other related items such as the display format, desired buffer set for calibration, temperature element, input signal filtering, etc.

SELECT SENSOR Type

1. With the 

screen displayed, press ⇩ **key** <u>once</u> to display 

.

2. Press **ENTER key** to display `≡SENSOR ▶SELECT SENSOR ↓`.

3. Press **ENTER key** again to display a screen like `SELECT SENSOR? (DIFF pH )`. Use ⇩ **and** ⇧ **keys** to select the type of sensor to be used with the transmitter, and press **ENTER key** to enter it:

   - **DIFF pH:** Selects GLI Differential pH sensor.
   - **COMBINATION pH:** Selects conventional combination pH electrode.
   - **ORP:** Selects ORP sensor (either a GLI Differential ORP sensor or a conventional combination ORP electrode).

WARNING:

CHANGING THE SENSOR TYPE AUTOMATICALLY REPLACES ALL USER-ENTERED CONFIGURATION VALUES WITH FACTORY-DEFAULTS.

Select DISPLAY FORMAT

When using the transmitter to measure ORP, this function is not provided. (The ORP display format is fixed to show mV values as only whole numbers.) For pH measurement, select the desired display format (XX.XX or XX.X) for the MEASURE screen. This format setting has no effect on edit/selection screens, which always show pH values in a XX.XX format.

1. With the `≡SENSOR ▶SELECT SENSOR ↓` screen displayed, press ⇩ **key** once to display `≡SENSOR ▶DISPLAY FORMAT⇕`.

2. Press **ENTER key** to display a screen like `DISPLAY FORMAT? (XX.XX pH )`. Use ⇩ **and** ⇧ **keys** to select the desired format (XX.XX or XX.X), and press **ENTER key** to enter it.

SELECT BUFFER Set for pH Calibration

When using the transmitter to measure ORP, this function is not provided. For pH measurement, configure the transmitter to use one of these buffer sets for pH calibration:

- 4.00, 7.00, and 10.00
- DIN 19267 Standard (1.09, 4.65, 6.79, 9.23, and 12.75)

☞ ***NOTE:*** *When using buffers that are not included in either of the transmitter buffer sets, disregard selecting the buffer set. In this case, use only the "1 (or) 2 POINT SAMPLE" method for pH calibration.*

The transmitter automatically recognizes pH values from the selected buffer set and uses its associated built-in table of pH-versus-temperature values to improve measurement accuracy. To select a buffer set:

1. With the `≡SENSOR ▶DISPLAY FORMAT⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶SELECT BUFFER ⇕`.

2. Press **ENTER key** to display a screen like `SELECT BUFFER? (4,7,10 )`. Use ⇩ **and** ⇧ **keys** to select a buffer set (4, 7, 10 or DIN 19267) for use during calibration, and press **ENTER key** to enter it.

Select PURE H2O COMP (only for special applications)

When using the transmitter to measure ORP, this function is not provided. When measuring pH in solutions with the weakly dissociating electrolytes ammonia or morpholine, built-in tables provide a correction factor for pure water temperature compensation. This special compensation is specifically for use in power plant applications. It adds an associated temperature-dependent offset, from the selected table, to the measured pH. If custom compensation is required for pure water applications, a "user-defined" pH/°C linear slope factor can be applied to the measured pH.

☞ ***NOTE:*** *The selected pure water temperature compensation is limited to 50°C. If the process temperature is higher, the offset corresponding to 50°C is used.*

1. With the `≡SENSOR ▶SELECT BUFFER ⇕` screen displayed, press ⇩ **key** <u>once</u> to display `≡SENSOR ▶PURE H2O COMP ⇕`.

2. Press **ENTER key** to display
```
≣PURE H2O COMP
▶SELECT TYPE    ↓
```
.

3. Press **ENTER key** again to display a screen like
```
PURE H2O COMP?
(NONE           )
```
. Use ⇩ **and** ⇧ **keys** to select the desired pure water temperature compensation (NONE, AMMONIA, MORPHOLINE or USER DEFINED), and press **ENTER key** to enter it.

4. If "USER DEFINED" was selected, you must set the specific pH/°C linear slope:

   A. With the
```
≣PURE H2O COMP
▶SELECT TYPE    ↓
```
screen displayed, press ⇩ **key** once to display
```
≣PURE H2O COMP
▶SET SLOPE      ⇳
```
.

   B. Press **ENTER key** to display a screen like
```
SET SLOPE?
(0.0000 pH/°C  )
```
. Use **arrow keys** to adjust to a desired slope, and press **ENTER key** to enter it.

☞ ***NOTE:*** *The MEASURE screen will show an asterisk after the pH reading to indicate pure water temperature compensation was selected and is being applied.*

SET FILTER Time

A time constant (in seconds) can be set to filter or "smooth out" the sensor signal. A minimum value of "0 seconds" has no smoothing effect. A maximum value of "60 seconds" provides maximum smoothing. Deciding what sensor signal filter time to use is a compromise. The higher the filter time, the longer the sensor signal response time will be to a change in the actual process value.

1. With the
```
≣SENSOR
▶PURE H2O COMP ⇳
```
screen displayed, press ⇩ **key** once to display
```
≣SENSOR
▶SET FILTER     ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS      )
```
. Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

ENTER NOTE (top line of MEASURE screen)

The top line of the MEASURE screen readouts that separately show the measurement, temperature, and analog output values are factory set to read "PH." This notation can be changed, for example, to "BASIN 1" to tailor the transmitter MEASURE screen to the application. The top line would then be "MEASURE BASIN 1." The notation is limited to eight characters which can be a combination of capital letters A through Z, numbers 0 through 9, spaces, # symbols, hyphens, and periods.

1. With the
```
≡SENSOR
▶SET FILTER      ⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡SENSOR
▶ENTER NOTE      ⇳
```
.

2. Press **ENTER key** to display
```
ENTER NOTE?
([P]H            )
```
. Create the desired notation on the second line:

   A. Starting with extreme left character position, use ⇧ **and** ⇩ **keys** to select the desired first character.

   B. Press ⇨ **key** <u>once</u> to select the next character, and use ⇧ **and** ⇩ **keys** to select its desired character.

   C. Repeat procedure until desired notation is displayed.

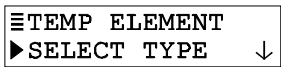
3. Press **ENTER key** to enter the displayed notation.

Select TEMP ELEMENT Type

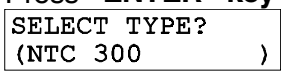
When using the transmitter to measure ORP, this function is not provided since ORP measurement does not require temperature compensation. When measuring pH, configure the transmitter for either automatic temperature compensation (by defining the sensor's built-in temperature element or an external element) or fixed MANUAL temperature compensation. When using MANUAL you must determine and enter a specific temperature.

☞ ***NOTE:*** *When a temperature element type has been selected but the element is not connected to the transmitter, a "WARNING: CHECK STATUS" message will appear. To prevent or clear the message, connect the element or select "MANUAL."*

1. With the
```
≡SENSOR
▶ENTER NOTE      ⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≡SENSOR
▶TEMP ELEMENT    ⇳
```
.

2. Press **ENTER key** to display 

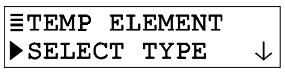
.

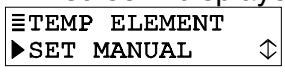
3. Press **ENTER key** again to display a screen like 

. Use ⇩ **and** ⇧ **keys** to select the type of temperature element used with the pH sensor to compensate the measurement, and press **ENTER key** to enter it:

   - **NTC300:** Selects automatic temperature compensation using only a NTC 300 ohm thermistor temperature element (in all GLI Differential pH sensors -- except Model 6006P4-2000 pure water pH sensor systems which use a Pt 1000 RTD).
   - **PT1000:** Selects automatic temperature compensation using only a Pt 1000 RTD temperature element.
   - **PT100:** Selects automatic temperature compensation using only a Pt 100 RTD temperature element.
   - **MANUAL:** For pH measurement only -- selects fixed manual temperature compensation (disregards temperature element -- see step 4).

4. If "MANUAL" was selected, you must set the specific manual temperature compensation value:

   A. With the 

screen displayed, press ⇩ **key** <u>once</u> to display 

.

   B. Press **ENTER key** to display a screen like 

. Use **arrow keys** to adjust to a desired temperature for fixed MANUAL compensation, and press **ENTER key** to enter it.

3.3 SET °C OR °F (temperature display format)

When using the transmitter to measure ORP, this function is not provided. When measuring pH, the temperature can also be displayed. The MEASURE screen can be set to display temperature values in °C or °F. In either case, display resolution for measured temperature is always "XX.X."

1. With the ≣TEMP ELEMENT / ▶SELECT TYPE ↓ or ≣TEMP ELEMENT / ▶SET MANUAL ⇳ screen displayed, press **ESC key** <u>twice</u> to display ≣CONFIGURE / ▶SENSOR ⇳.

2. Press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE / ▶SET °C OR °F ⇳.

3. Press **ENTER key** to display a screen like SET °C OR °F? / (°C). Use ⇩ **and** ⇧ **keys** to select the displayed temperature units (°C or °F), and press **ENTER key** to enter it.

3.4 Configuring Analog Output

The transmitter provides an isolated 4-20 mA analog output. During normal measurement operation, the output is active but can be held at the last measured value for up to 30 minutes by using the "HOLD OUTPUT" function in the TEST/MAINT menu. (See PART THREE, Section 5.2 for details.) During calibration, the output is automatically held at the last measured value and, upon completion, returned to its active state.

SET PARAMETER (representation)

When using the transmitter to measure ORP, this function is not provided. (The output always represents the measured ORP.) When measuring pH, the output can be assigned to represent the SENSOR (measured pH) or measured TEMPERATURE.

1. With the ≣CONFIGURE / ▶SET °C OR °F ⇳ screen displayed, press ⇧ **key** -- not ⇩ **key** -- <u>twice</u> to display ≣CONFIGURE / ▶SET OUTPUT ↓.

2. Press **ENTER key** to display ≣SET OUTPUT / ▶SET PARAMETER ↓.

3. Press **ENTER key** again to display SET PARAMETER? / (SENSOR). Use ⇩ **and** ⇧ **keys** to select the parameter the output will represent, press **ENTER key** to enter it.

SET 4 mA and 20 mA VALUES (range expand)

Parameter values can be set to define the endpoints at which the 4 mA and 20 mA analog output values are desired.

1. With the
```
≣SET OUTPUT
▶SET PARAMETER ↓
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≣SET OUTPUT
▶SET 4mA VALUE ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET 4mA VALUE?
(7.00 pH      )
```
. Use **arrow keys** to set the value at which 4 mA is desired, and press **ENTER key** to enter it.

3. After the
```
≣SET OUTPUT
▶SET 4mA VALUE ⇳
```
screen re-appears, press ⇩ **key** <u>once</u> to display
```
≣SET OUTPUT
▶SET 20mA VALUE⇳
```
.

4. Press **ENTER key** to display a screen like
```
SET 20mA VALUE?
(12.33 pH     )
```
. Use **arrow keys** to set the value at which 20 mA is desired, and press **ENTER key** to enter it.

☞ ***NOTE:*** *If the same values are set for 4 mA and 20 mA, the output automatically goes to, and remains at, 20 mA.*

SET FILTER Time

A time constant (in seconds) can be set to filter or “smooth out” the analog output signal. A minimum value of “0 seconds” has no smoothing effect. A maximum value of “60 seconds” provides maximum smoothing. Deciding what output filter time to use is a compromise. The higher the filter time, the longer the analog output signal response time will be to a change in the measured value.

1. With the
```
≣SET OUTPUT
▶SET 20mA VALUE⇳
```
screen displayed, press ⇩ **key** <u>once</u> to display
```
≣SET OUTPUT
▶SET FILTER    ⇳
```
.

2. Press **ENTER key** to display a screen like
```
SET FILTER?
(0 SECONDS    )
```
. Use **arrow keys** to adjust to a desired filter time, and press **ENTER key** to enter it.

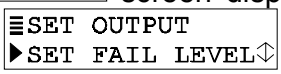
SET FAIL LEVEL Mode (off, 4 mA or 20 mA)

When a "WARNING CHECK STATUS" message appears, indicating that a system problem may exist, the analog output can be set to respond in one of three ways:

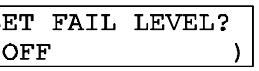
- **OFF:** Output remains active.
- **4mA:** Output automatically goes to and remains at 4 mA.
- **20mA:** Output automatically goes to and remains at 20 mA.

To SET FAIL LEVEL mode to suit your application:

1. With the 

screen displayed, press ⇩ **key** <u>once</u> to display 

.

2. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to select a response mode (OFF, 4mA or 20mA), and press **ENTER key** to enter it.

3.5 SET PASSCODE (feature enabled or disabled)

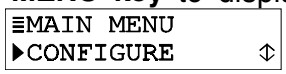
The transmitter has a passcode feature to restrict access to configuration settings and calibration to only authorized personnel.

- **DISABLED:** With the passcode feature disabled, all configuration settings can be displayed and changed, and the transmitter can be calibrated.

- **ENABLED:** With the passcode feature enabled, all configuration settings can be displayed -- but they cannot be changed -- and the CALIBRATE and TEST/MAINT menus cannot be accessed without the passcode. When you attempt to change a setting in the CONFIGURE menu by pressing the **ENTER key**, a displayed notification requests passcode entry. A valid passcode entry saves the changed setting and returns the display to the "MAIN MENU" branch selection screen. An incorrect passcode entry causes the display to momentarily show an error notification before returning to the "MAIN MENU" branch selection screen. There is no limit on attempts to enter a valid passcode.

The passcode is factory-set to "**3 4 5 6**." It cannot be changed.

To enable or disable the passcode feature:

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

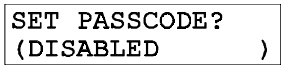
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press ⇩ **key** once to display 

.

4. Press **ENTER key** to display 

. Use ⇩ **and** ⇧ **keys** to select the desired passcode mode (DISABLED or ENABLED), and press **ENTER key** to enter it.

3.6 Configuration Setting Summary

TABLE A lists all configuration settings and their entry ranges/choices and factory defaults, categorized by basic functions.

TABLE A -- Transmitter Configuration Settings (Ranges/Choices and Defaults)

Displayed Screen Title	Entry Range or Choices (where applicable)	Factory Default	Your Setting
LANGUAGE Setting			
LANGUAGE?	ENGLISH and SPANISH (French, German, etc. may be substituted for Spanish)	ENGLISH	
SENSOR Settings			
SELECT SENSOR?	DIFF pH, COMB pH or ORP	DIFF pH	
DISPLAY FORMAT?	pH: XX.XX pH or XX.X pH ORP: Fixed at XXXX mV	pH: XX.XX pH ORP: XXXX mV	
SELECT BUFFER?	pH: 4, 7, 10 or DIN 19267 ORP: Screen not applicable/provided.	pH: 4, 7, 10 ORP: Not applicable	
PURE H2O COMP SELECT TYPE?	pH: NONE, AMMONIA MORPHOLINE or USER DEFINED ORP: Screen not applicable/provided.	pH: NONE ORP: Not applicable	
SET FILTER?	0-60 seconds	0 seconds	
ENTER NOTE?	pH: Replace PH with up to eight characters ORP: Replace ORP with up to eight characters	pH: PH ORP: ORP	
TEMP ELE: SELECT TYPE?	pH: NTC300, PT1000, PT100 or MANUAL ORP: Screen not applicable/provided.	pH: NTC300 ORP: Not applicable	
TEMP ELE: SET MANUAL?	pH: 0.0-100.0°C ORP: Screen not applicable/provided.	pH: 25.0°C ORP: Not applicable	
TEMPERATURE Display Setting			
SET °C OR °F?	pH: °C or °F ORP: Screen not applicable/provided.	pH: °C ORP: Not applicable	
OUTPUT Settings			
SET PARAMETER?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SET 4mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 0.00 pH ORP: 0 mV TEMP: 0.0°C or 32.0°F	
SET 20mA VALUE?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	pH: 14.00 pH ORP: +2100 mV TEMP: 200.0°C or 392.0°F	
SET FILTER?	0-60 seconds	0 seconds	
SET FAIL LEVEL?	OFF, 4 mA or 20 mA	OFF	
PASSCODE Setting			
SET PASSCODE?	DISABLED or ENABLED	DISABLED	
TEST/MAINT Simulation Function Settings			
SELECT SIM?	pH: SENSOR or TEMPERATURE ORP: Screen not applicable/provided.	pH: SENSOR ORP: Not applicable	
SIM SENSOR?	pH: -2.00 to +14.00 pH ORP: -2100 to +2100 mV TEMP: -20.0 to +200.0°C or -4.0 to 392.0°F	Present measured value of sensor's selected parameter (pH, ORP or temperature)	

SECTION 4
TRANSMITTER CALIBRATION

4.1 Important Information

Four methods are available for pH calibration (Section 4.2). To calibrate ORP, use only the 1-POINT SAMPLE method described in Section 4.3. The analog output loop can also be calibrated (Section 4.4).

Calibrate Periodically

To maintain best measurement accuracy, periodically calibrate the transmitter. Performance of the pH or ORP sensor slowly degrades over time, eventually causing inaccurate readings. The time period between calibrations, and the rate of system drift, can vary considerably with each application and its specific conditions.

Calibration Tip! Establish a maintenance program to keep the sensor relatively clean and the transmitter calibrated. The daily, weekly or monthly intervals between performing maintenance will be influenced by the characteristics of the process solution, and can only be determined by operating experience.

Temperature-corrected pH Measurement

The transmitter is factory-calibrated for accurate temperature measurement. It will provide pH readings that are automatically corrected for temperature changes when the transmitter:

- Receives a temperature signal from a pH sensor that has a built-in temperature element (all GLI Differential sensors) or from an external temperature element.
- Has been correctly set for the type of temperature element being used for automatic compensation.

NOTE: *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the transmitter.*

An in-progress calibration can always be aborted by pressing the ESC key. *After the "ABORT: YES?" screen appears, do <u>one</u> of the following:*

- *Press **ENTER key** to abort. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).*
- *Press ⇧ **or** ⇩ **key** to choose "ABORT: NO?" screen, and press **ENTER key** to continue calibration.*

Calibration Tip! If a "CONFIRM FAILURE?" screen appears during calibration, press **ENTER key** to confirm. Then, use ⇧ **or** ⇩ **key** to select between "CAL: EXIT" or "CAL: REPEAT" and do one of the following:

- With "(CAL: EXIT)" selected, press **ENTER key**. After the "CONFIRM ACTIVE?" screen appears, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).
- With "(CAL: REPEAT)" selected, press **ENTER key** to repeat calibration of the point.

4.2 pH Calibration

Based on convenience and your application requirements, use one of the four methods provided for pH calibration.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *When calibrating a sensor for the first time, always use a two-point method for best accuracy.*

2 POINT BUFFER Method

This recommended method requires two buffers, typically pH 7 and pH 4. (pH 10 buffer is also readily available but is not as stable, particularly at extreme temperatures.) This method automatically recognizes buffers from the selected buffer set. **Therefore, you must use buffers that match values in the buffer set** (see PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for details.)

NOTE: *When using buffers that are not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "2 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the first pH buffer (preferably pH 7). **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≡MAIN MENU ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≡CALIBRATE ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≡SENSOR ▶2 POINT BUFFER↓`.

5. Press **ENTER key** again to display `2 POINT BUFFER: IN 1ST SOLUTION?`. With the sensor in the first buffer, press **ENTER key** again to confirm this.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

6. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like `2 POINT BUFFER: PT1 = 7.00 pH` appears for 5 seconds to confirm calibration of this point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

7. After the `2 POINT BUFFER: IN 2ND SOLUTION?` screen appears, remove the sensor from the first buffer, rinse it with <u>clean</u> water, and immerse it in the second buffer (typically 4 pH). Then press **ENTER key** to confirm this.

8. While the `2 POINT BUFFER: PLEASE WAIT` screen is displayed, the

transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates this point. Thereafter, a screen like

```
2 POINT BUFFER:
PT2 = 4.00 pH
```

appears for 5 seconds to confirm calibration of this point.

9. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

10. Press **ENTER key** to end calibration ("2 POINT BUFFER: CONFIRM CAL OK?" screen appears).

11. Re-install the sensor into the process.

12. Press **ENTER key** to display the active measurement reading on the "2 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT BUFFER" calibration.

1 POINT BUFFER Method

This method is similar to the 2 POINT BUFFER method except that only one buffer is used to calibrate one point. This method also automatically recognizes buffers from the buffer set you selected. Therefore, you must use a buffer that matches a value in the buffer set. (See PART THREE, Section 3.2, subheading "SELECT BUFFER Set for pH Calibration" for selection details.)

☞ ***NOTE:*** *When using a buffer that is not included in either of the transmitter buffer sets, disregard this calibration method. Instead, use only the "1 POINT SAMPLE" calibration method.*

1. Immerse the sensor in the pH buffer. **Important: Allow the sensor and buffer temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≣MAIN MENU ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≣CALIBRATE ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≣SENSOR ▶2 POINT BUFFER↓`.

5. Press ⇩ **key** <u>once</u> to display `≣SENSOR ▶1 POINT BUFFER⇕`.

6. Press **ENTER key** to display `1 POINT BUFFER: SAMPLE READY?`. With the sensor in the buffer, press **ENTER key** to confirm this.

☞ ***NOTE:*** *During calibration, the analog output is automatically "held" at the last measured value.*

7. While the `1 POINT BUFFER: PLEASE WAIT` screen is displayed, the transmitter waits for the pH and temperature signals to stabilize, measures the buffer value, and automatically calibrates the point. Thereafter, a screen like `1 POINT BUFFER: PT = 7.00 pH` appears for 5 seconds to confirm calibration of the point.

☞ ***NOTE:*** *Any time the "PLEASE WAIT" screen appears during calibration, you can <u>manually</u> complete calibration of the point by pressing the **ENTER key**. However, this is not recommended because the pH and temperature signals may not be fully stabilized, resulting in a less accurate calibration.*

8. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the

slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

9. Press **ENTER key** to end calibration ("1 POINT BUFFER: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

11. Press **ENTER key** to display the active measurement reading on the "1 POINT BUFFER: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "1 POINT BUFFER" calibration.

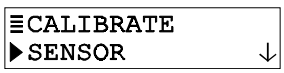
2 POINT SAMPLE Method

This method requires you to enter the known pH values of two process samples (or two pH buffers). Determine sample values using laboratory analysis or comparison readings.

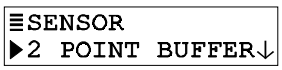
1. Immerse the sensor in the first solution (sample or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the 

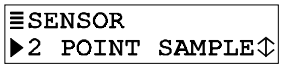
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display 

.

4. Press **ENTER key** again to display 

.

5. Press ⇩ **key** twice to display 

.

6. Press **ENTER key** to display `2 POINT SAMPLE: IN 1ST SOLUTION?` . With the sensor in the first sample, press **ENTER key** again to confirm this. This active `2 POINT SAMPLE: PT1 = X.XX pH` screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

8. Determine the pH value of the first solution. For a sample, use laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

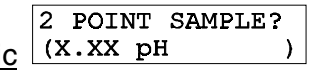
9. With the static `2 POINT SAMPLE? (X.XX pH )` screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the first solution (sample or buffer). Then press **ENTER key** to enter it, completing calibration of the first point.

10. After the `2 POINT SAMPLE: IN 2ND SOLUTION?` screen appears, remove the sensor from the first solution, and rinse it with clean water.

11. Immerse the sensor in the second solution, and press **ENTER key** to confirm. This active `2 POINT SAMPLE: PT2 = X.XX pH` screen appears showing the measurement reading.

12. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `2 POINT SAMPLE? (X.XX pH )` screen appears showing the "last" measured value.

13. Determine the pH value of the second solution.

14. With the static 

screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the second solution. Then press **ENTER key** to enter it, completing calibration of the second point.

15. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

16. Press **ENTER key** to end calibration ("2 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

17. Re-install the sensor into the process.

18. Press **ENTER key** to display the active measurement reading on the "2 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "2 POINT SAMPLE" calibration.

1 POINT SAMPLE Method

This method is similar to the 2 POINT SAMPLE method except that only one sample (or buffer) is used to calibrate one point. This method requires you to enter the known pH value of the sample (or pH buffer). Determine the sample value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or buffer). **Important: Allow the sensor and sample temperatures to equalize.** Depending on their temperature differences, this may take 30 minutes or more.

2. Press **MENU key** to display a "MAIN MENU" screen. If the
```
≡MAIN MENU
▶CALIBRATE          ↓
```
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display
```
≡CALIBRATE
▶SENSOR             ↓
```
.

4. Press **ENTER key** again to display
```
≡SENSOR
▶2 POINT BUFFER     ↓
```
.

5. Press ⇩ **key** three times to display
```
≡SENSOR
▶1 POINT SAMPLE     ⇕
```
.

6. Press **ENTER key** to display
```
1 POINT SAMPLE:
SAMPLE READY?
```
. With the sensor in the sample, press **ENTER key** to confirm this. This active
```
1 POINT SAMPLE:
PT = X.XX pH
```
screen appears showing the measurement reading.

7. Wait for the reading to stabilize which may take up to 30 minutes. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static
```
1 POINT SAMPLE?
(X.XX pH            )
```
screen appears showing the "last" measured value.

8. Determine the pH value of the sample using laboratory analysis or a calibrated portable pH meter. (When using a pH buffer, refer to the table on the buffer bottle to find the exact pH value corresponding to the temperature of the buffer.)

9. With the static
```
1 POINT SAMPLE?
(X.XX pH            )
```
screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known pH value of the sample (or buffer). Then press **ENTER key** to enter it, completing calibration of the point.

10. A "pH SLOPE XX.X mV/pH" screen appears, indicating a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to

improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

11. Press **ENTER key** to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

12. Re-install the sensor into the process.

13. Press **ENTER key** to display the active measurement reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** again to return the analog output to its active state (MEASURE screen appears).

This completes "1 POINT SAMPLE" calibration.

4.3 ORP Calibration

Calibrate for ORP measurement using only this "1 POINT SAMPLE" method.

CAUTION:

WHEN USING A NEW SENSOR OR REPLACING THE STANDARD CELL SOLUTION AND SALT BRIDGE ON AN EXISTING GLI DIFFERENTIAL SENSOR, ALWAYS PERFORM A "RESET CALIBRATE" USING THE TEST/MAINT MENU (PART THREE, SECTION 5.8) BEFORE CALIBRATING.

NOTE: *A two-point calibration method is purposely excluded since it could provide bad results. Immersing the sensor into one reference solution and then into the other could contaminate electrochemical components of the sensor.*

The "1 POINT SAMPLE" method requires you to enter the known mV value of a sample (or reference solution).

Determine the sample mV value using laboratory analysis or a comparison reading.

1. Immerse the sensor in the sample (or reference solution).

2. Press **MENU key** to display a "MAIN MENU" screen. If the `≡MAIN MENU / ▶CALIBRATE ↓` screen is not showing, use ⇩ **or** ⇧ **key** to display it.

3. Press **ENTER key** to display `≡CALIBRATE / ▶SENSOR ↓`.

4. Press **ENTER key** again to display `≡SENSOR / ▶1 POINT SAMPLE↓`.

5. Press **ENTER key** again to display `1 POINT SAMPLE: / SAMPLE READY?`. With the sensor in the sample (or reference solution), press **ENTER key** to confirm this. This active `1 POINT SAMPLE: / PT = XXXX mV` screen appears showing the measurement reading.

6. Wait for the reading to stabilize. Then press **ENTER key**. The "PLEASE WAIT" screen may appear if the reading is still too unstable. After the reading has stabilized, this static `1 POINT SAMPLE? / (XXXX mV )` screen appears showing the "last" measured value.

7. If not using an ORP reference solution, determine the mV value of the sample using laboratory analysis or a calibrated portable ORP meter.

8. With the static `1 POINT SAMPLE? / (XXXX mV )` screen displayed, use **arrow keys** to adjust the displayed value to exactly match the known mV value of the sample (or reference solution). Then press **ENTER key** to enter it, completing calibration of the point.

9. Press **ENTER key** again to end calibration ("1 POINT SAMPLE: CONFIRM CAL OK?" screen appears).

10. Re-install the sensor into the process.

11. Press **ENTER key** to display the active measurement

reading on the "1 POINT SAMPLE: CONFIRM ACTIVE?" output status screen. When the reading corresponds to the actual typical process value, press **ENTER key** to return the analog output to its active state (MEASURE screen appears).

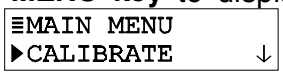
This completes ORP calibration.

4.4 Analog Output Calibration

The transmitter analog output is factory-calibrated. However, it can be re-calibrated if desired.

☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to calibrate the analog output.*

Also, the transmitter adjustment range for output values during calibration is ± 2 mA.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

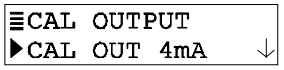
screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

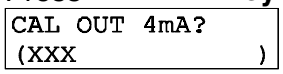
.

3. Press ⇩ **key** <u>once</u> to display 

.

4. Press **ENTER key** to display 

.

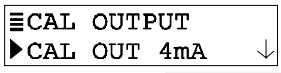
5. Press **ENTER key** again to display a screen like 

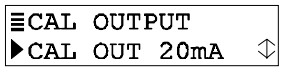
. The displayed value is "counts" -- not mA -- that dynamically change as the output is adjusted.

6. Connect a calibrated digital multimeter <u>in</u> <u>series</u> with the loop load to measure the actual <u>minimum</u> mA output in the loop.

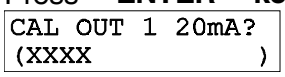
7. Use **arrow keys** to adjust the minimum output value to read <u>exactly</u> "4.00 mA" on the <u>digital</u> <u>multimeter</u> -- not

the transmitter display, and press **ENTER key** to complete calibration of the minimum endpoint value.

8. After the 

screen re-appears, press ⇩ **key** <u>once</u> to display 

.

9. Press **ENTER key** to display a screen like 

. Once again, the displayed value is “counts” -- not mA -- that dynamically change as the output is adjusted.

10. Now measure the actual <u>maximum</u> mA output in the loop with the digital multimeter.

11. Use **arrow keys** to adjust the maximum output value to read <u>exactly</u> “20.00 mA” on the <u>digital</u> <u>multimeter</u> -- not the transmitter display, and press **ENTER key** to complete calibration of the maximum endpoint value.

This completes analog output calibration.

SECTION 5
TEST/MAINTENANCE

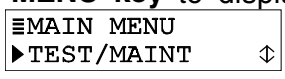
The transmitter has TEST/MAINT menu screens to:

- Check operating status of the transmitter and sensor.
- Hold analog output at its last measured value.
- Provide analog output test signal to confirm operation of connected device.
- Identify transmitter firmware EPROM version.
- Simulate a pH (or mV) or temperature signal to exercise the measurement loop.
- Reset configuration -- not calibration -- values to defaults.
- Reset calibration -- not configuration -- values to defaults.

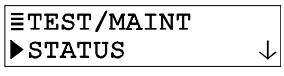
☞ ***NOTE:*** *When the passcode feature is enabled (Section 3.5), you must successfully enter the passcode before attempting to use the TEST/MAINT menu screens.*

5.1 STATUS Check (transmitter and sensor)

The system diagnostic capabilities of the transmitter enable you to check the operating status of the transmitter and sensor. The MEASURE screen will flash the "WARNING: CHECK STATUS" message when a system diagnostic "fail" condition has been detected. To determine the condition causing the warning, display the "STATUS" screens.

1. Press **MENU key** to display a "MAIN MENU" screen. If the 

screen is not showing, use ⇩ **or** ⇧ **key** to display it.

2. Press **ENTER key** to display 

.

3. Press **ENTER key** again to display "STATUS: ANALYZER OK" screen. This screen confirms that the transmitter is operating properly. If "FAIL" appears, it may mean:
   - Analog-to-digital converter not responding.
   - Internal serial communications failure.

4. Press **ENTER key** once to view "STATUS: SENSOR OK" screen. If "FAIL" appears, it indicates that the sensor is inoperative or its signal is out of range (more than + 480 mV or less than -480 mV for pH, or more than +2100 mV or less than -2100 mV for ORP).

5. Press **ENTER key** once to view "STATUS: SLOPE" screen, which indicates a slope value to measure sensor performance. The slope should be between 54 and 62 mV/pH for optimal sensor performance. Typically, as the sensor ages and/or becomes dirty, its slope decreases. When the slope is less than 54 mV/pH, clean the sensor to improve its performance. If you are using a GLI Differential sensor and the slope remains low, replace the salt bridge and standard cell solution (see sensor operating manual for details). If using a conventional combination electrode, consider replacing it.

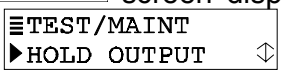
6. Press **ENTER key** once to view the "STATUS: TEMP OK" screen. If "FAIL" appears, it indicates that the temperature element in the sensor is inoperative, disconnected or incorrectly wired.

7. To end status checking, press **ESC key** or **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.2 HOLD OUTPUT

The HOLD OUTPUT function conveniently holds the analog output at its last measured value for up to 30 minutes to suspend operation of any connected device.

1. With the 

screen displayed, press ⇩ **key** once to display 

.

2. Press **ENTER key** to immediately hold the analog output ("HOLD OUTPUT: ENTER TO RELEASE" screen appears, acknowledging hold is applied).

NOTE: *If the keypad is not used within 30 minutes, the analog output will automatically change back to its active state and the display will return to the MEASURE screen.*

3. To release the hold at any time and return the analog output back to its "active" state, press **ENTER key** (display returns to previous level of TEST/MAINT menu branch).

5.3 OUTPUT Test Signal

The OUTPUT function provides an analog output test signal of a desired mA value to confirm operation of a connected device.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶OUTPUT ⇳ screen appears.

2. Press **ENTER key** to display a screen like OUTPUT? (XX.XXmA) .

NOTE: *The mA output test signal is now active. Its value is shown on this screen.*

3. Use **arrow keys** to adjust the displayed value to obtain the desired mA test signal.

4. To remove the output test signal and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.4 Firmware (EPROM VERSION) Check

The EPROM VERSION function checks the version of firmware used in the transmitter.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶EPROM VERSION ⇳ screen appears.

2. Press **ENTER key** to view the EPROM version screen.

3. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.5 SELECT SIM Measurement

The SELECT SIM function selects a type of simulated measurement. It is used in conjunction with the SIM SENSOR function (Section 5.6) to simulate a measured value, making the analog output respond accordingly. **(When using the transmitter to measure ORP, the SELECT SIM function is not provided because the simulated measurement always represents mV.)**

1. With the
```
≡TEST/MAINT
▶STATUS              ↓
```
screen displayed, press ⇩ **key** until
```
≡TEST/MAINT
▶SELECT SIM          ⇕
```
screen appears.

2. Press **ENTER key** to display a screen like
```
SELECT SIM?
(SENSOR              )
```
. Use ⇩ **and** ⇧ **keys** to select the type of simulated measurement, and press **ENTER key** to enter it:
   - **SENSOR:** Selects simulated measurement to be pH.
   - **TEMPERATURE:** Selects simulated measurement to be temperature.

5.6 SIM SENSOR Setting

After selecting the type of simulated measurement (Section 5.5), use the SIM SENSOR function to set the desired simulation value.

1. With the
```
≡TEST/MAINT
▶SELECT SIM          ⇕
```
screen displayed, press ⇩ **key** once to display
```
≡TEST/MAINT
▶SIM SENSOR          ⇕
```
.

2. Press **ENTER key** to display a screen like
```
SIM SENSOR?
(X.XX pH             )
```
.

☞ ***NOTE:*** *The analog output signal is now active. It has a mA value that corresponds to the measurement value shown on this screen.*

3. Use **arrow keys** to adjust the displayed simulation value to the desired value.

4. To remove the simulated output and return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.7 RESET CONFIGURE Values to Factory Defaults

The RESET CONFIGURE function resets stored configuration settings (all at the same time) -- **but not calibration settings** -- to their factory-set defaults shown in TABLE A.

NOTE: *Resetting configuration values also excludes the SELECT SENSOR function (DIFF pH, COMB pH or ORP) which remains as is until you change it.*

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CONFIGURE screen appears.
2. Press **ENTER key** to display the "RESET CONFIGURE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)
3. Press **ENTER key** to reset stored configuration settings -- **not calibration settings** -- to factory defaults. The "RESET CONFIGURE: DONE" screen appears, acknowledging that reset has occurred.
4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

5.8 RESET CALIBRATE Values to Factory Defaults

The RESET CALIBRATE function resets stored calibration settings -- **but not configuration settings** -- to factory-set defaults.

1. With the ≣TEST/MAINT ▶STATUS ↓ screen displayed, press ⇩ **key** until ≣TEST/MAINT ▶RESET CALIBRATE screen appears.
2. Press **ENTER key** to display the "RESET CALIBRATE: ARE YOU SURE?" screen, asking if you really intend to perform this extreme action. (To abort this procedure, press **ESC key** now.)
3. Press **ENTER key** to reset all stored calibration settings -- **not configuration settings** -- to factory defaults. The "RESET CALIBRATE: DONE" screen appears, acknowledging that reset has occurred.
4. To return to the previous level of the TEST/MAINT menu branch, press **ESC key** or **ENTER key**.

PART FOUR - SERVICE AND MAINTENANCE

SECTION 1
GENERAL INFORMATION

If a measurement problem exists and you suspect the sensor cable, inspect it for physical damage. If an interconnect cable is used, check the junction box, then disconnect the cable at both ends (sensor and transmitter) and, using an ohmmeter, check its wires for continuity and internal shorts.

SECTION 2
PRESERVING MEASUREMENT ACCURACY

2.1 Keeping Sensor Clean

To maintain measurement accuracy, periodically clean the sensor. Operating experience will help you determine when to clean the sensor (daily, weekly or monthly intervals). Use the recommended cleaning procedure described in the GLI sensor operating manual.

2.2 Keeping Transmitter Calibrated

Depending on application circumstances, periodically calibrate the transmitter to maintain measurement accuracy.

Maintenance Tip! Upon startup, frequently check the system until operating experience can determine the optimum time between calibrations that provides acceptable measurement results.

- pH: Calibrate using one of the methods described in PART THREE, Section 4.2.
- ORP: Calibrate using only the method described in PART THREE, Section 4.3.

Calibrating with old, contaminated or diluted pH buffers may cause measurement errors. **Do not reuse buffers.** Never pour the portion of buffer used for calibration back into the buffer bottle -- always discard it. Note that the pH value of a buffer changes as its temperature changes. (Always refer to the pH value-versus-temperature table on the buffer bottle.) Therefore, always allow the temperatures of the sensor and buffer to equalize while calibrating.

2.3 Avoiding Electrical Interference

Recommendation: Do not run the sensor cable (and interconnect cable, if used) in the same conduit with AC or DC power wiring. Also, connect cable shielding as recommended (PART TWO, Section 3.1).

Maintenance Tip! Excess cable should not be coiled near motors or other equipment that may generate electrical or magnetic fields. Cut cables to proper length during installation to avoid unnecessary inductive pickup ("electrical noise" may interfere with sensor signal).

SECTION 3
TROUBLESHOOTING

3.1 Ground Loops

The transmitter may be affected by a "ground loop" problem (two or more electrically grounded points at different potentials).

Symptoms Indicating a Possible Ground Loop

- Transmitter reading is offset from the actual value by a consistent amount, or ....
- Transmitter reading is frozen on one value, or ....
- Transmitter reading is "off scale" (upscale or downscale).

Although the source of a ground loop is difficult to determine, there are several common causes.

Common Causes of a Ground Loop

- Components, such as recorders or computers, are connected to non-isolated analog outputs.
- Not using shielded cabling or failure to properly connect all cable shields.
- Moisture or corrosion in a junction box.

Determining if Ground Loop Exists

The following simple test can help to determine if there is a ground loop:

1. With the pH (or ORP) MEASURE screen displayed, immerse the sensor in a non-conductive container (plastic or glass) filled with a pH buffer (or ORP refer-

ence solution) of known value. Note the transmitter reading for this solution.

2. Connect one end of a wire to a known earth ground such as a metal water pipe. Place the other end of this wire into the buffer next to the sensor.

3. Note the transmitter reading now and compare it with the reading taken in step 1. If the reading changed, a ground loop exists.

Finding Source of Ground Loop

Sometimes the source of a ground loop is easy to find, but it usually takes an organized approach to isolate the problem.

Troubleshooting Tip! Use a systematic troubleshooting method. If possible, start by grounding all shields and electrical grounds at one stable point. One at a time, turn off all pumps, motors, and switches that are in contact with the process. Each time you do this, check if the ground loop still exists. Since the process media being measured is electrically conductive, the source of the ground loop may not be readily apparent.

3.2 Isolating Measuring System Problem

When experiencing problems, try to determine the primary measurement system component causing the problem (sensor, transmitter or interconnect cable, if used):

Checking Electrical Connections

1. Verify that adequate DC voltage exists at the appropriate transmitter TB1 terminals.

2. Check all transmitter wiring to ensure proper connections.

Verifying Sensor Operation

To verify sensor operation, refer to the procedure in the troubleshooting section of the sensor operating manual. Or replace the suspect sensor with a known new or working sensor and perform calibration

Verifying Transmitter Operation

1. After disconnecting DC power from the transmitter, disconnect the sensor (and interconnect cable, if used).

2. Depending on the type of sensor, refer to the appropriate category below and follow the steps to simulate a pH (or ORP) input signal and a temperature signal:

For GLI Differential Technique Sensor

A. Connect a jumper between Terminal 3 (shield/black) and Terminal 5 (green) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 5 (green) and Terminal 7 (red) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 301 ohm resistor between Terminals 4 (yellow) and 5 (green) on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure transmitter is configured for a 300 ohm NTC temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

For Conventional Combination Electrode

A. Connect a jumper between Terminal 3 and Terminal 5 (reference) on TB2.

B. Connect a millivolt generator (or a jumper, if generator is not available) between Terminal 3 and Terminal 7 (active) on TB2, with the (+) lead on Terminal 7.

C. When using the transmitter to measure pH, connect a 1% tolerance, 1000 ohm resistor between Terminals 3 and 4 on TB2. **When using transmitter to measure ORP, disregard this step.**

D. Make sure the transmitter is configured for a Pt 1000 temperature element (PART THREE, Section 3.2, subheading “Select TEMP ELEMENT Type”).

3. Reconnect DC power to the transmitter.

4. Set millivolt generator to provide each of the following outputs, checking the transmitter MEASURE screen each time for these corresponding pH (or mV) readings:

Generator Output	Corresponding Transmitter Reading	
	For pH	For ORP
Zero mV	7 pH (approximately)	0 mV
(-)175 mV	10 pH (approximately)	(-)175 mV
(+)175 mV	4 pH (approximately)	(+)175 mV
When Using Jumper Only (not generator)		
- - - -	7 pH (approximately)	0 mV

5. When using the transmitter to measure pH, change the transmitter MEASURE screen to show temperature. **When using transmitter to measure ORP, disregard this step.**

   - For a GLI Differential Technique sensor, the temperature value should be approximately “25°C.”
   - For a conventional combination electrode, the temperature value should be approximately “0°C.”

If these readings are achieved, the transmitter is operating properly, but the interconnect cable (if used) may be faulty.

Verifying Interconnect Cable Integrity

1. Disconnect DC power, the millivolt generator, and temperature simulation resistor from the transmitter.

2. Reconnect the sensor directly to the transmitter (purposely bypassing the interconnect cable and junction box, if used).

3. Reconnect DC power to the transmitter.

4. Use a <u>two-point</u> <u>method</u> to calibrate the transmitter. (For ORP measurement, use only the “1 POINT SAMPLE” method described in PART THREE, Section 4.3.) If calibration was:

   - **Successful:** The transmitter and sensor are operating properly, but the interconnect cable is probably faulty.
   - **Unsuccessful:** The sensor is probably inoperative.

SECTION 4
TRANSMITTER REPAIR/RETURN

4.1 Customer Assistance

If you need assistance in troubleshooting or repair service, please contact your local GLI representative, or GLI Customer Service at:

GLI International, Inc.
9020 West Dean Road
Milwaukee, WI 53224

Phone: [800] 543-8907
Fax: [414] 355-8346
E-mail: info@gliint.com

— GLI CUSTOMER SERVICE HOURS —

	Eastern Std. Time	Central Std. Time	Mountain Std. Time	Pacific Std. Time
Monday through Thursday	8:30 a.m. to 5:30 p.m.	7:30 a.m. to 4:30 p.m.	6:30 a.m. to 3:30 p.m.	5:30 a.m. to 2:30 p.m.
Friday	8:30 a.m. to 4:00 p.m.	7:30 a.m. to 3:00 p.m.	6:30 a.m. to 2:00 p.m.	5:30 a.m. to 1:00 p.m.

4.2 Repair/Return Policy

Call GLI Customer Service before returning a transmitter for repair. Many problems can be diagnosed and resolved over the telephone. GLI will issue a Return Material Authorization (RMA) number for a transmitter being returned. **All returned transmitters must be freight prepaid and include:**

1. A clearly written description of the malfunction.
2. Name of person to contact and the phone number where they can be reached.
3. Proper return address to ship transmitter back. Include preferred shipping method (UPS, Federal Express, etc.) if applicable.
4. A purchase order if transmitter(s) is out of warranty to cover costs of repair.

☞ ***NOTE:*** *If the transmitter is damaged during return shipment because of inadequate packaging, the customer is responsible for any resulting repair costs. (**Recommendation:** Use the original GLI shipping carton or an equivalent.)*

Also, GLI will not accept transmitters returned for repair or replacement unless they are thoroughly cleaned and all process material is removed.

CLARIFIED WATER TURBIDIMETER

LEFT BLANK

THE NEW

1720E

experience + accuracy + simplicity

What can the unsurpassed

WORLD LEADER IN TURBIDITY

measurement do for you?

The 1720E TURBIDIMETER

is the newest in a long line of successful Hach turbidimeters from the unsurpassed world leader in turbidity measurement.

HACH®

Be Right™

THE NEW

1720E

experience + accuracy + simplicity

EXPERIENCE

The Model 1720E Low Range Turbidimeter reflects an astounding 45 years of Hach leadership in turbidity measurement science. Metropolitan water treatment systems, rural water utilities, wastewater treatment plants large and small, and industrial processes of every kind - all have relied on Hach turbidimeters for nearly five decades. In fact, Hach has the largest turbidimeter installation base in the world.

Operators and engineers alike know they can count on the performance of Hach turbidimeters and calibration standards as well as the experienced Hach personnel designing, manufacturing, selling, installing, and supporting these systems. Additionally, Hach offers a 2-year warranty on the 1720E, compared to the 1-year warranty offered with many other turbidimeters on the market. Hach is not only the world's turbidity leader, but also your partner in turbidity measurement, filtration management, and treatment process optimization solutions.

ACCURACY

Now, the 1720E Turbidimeter combines Hach's proven design, demonstrated accuracy and reliability, plus innovative elements that add more power and utility to your low-level turbidity monitoring program:

> Built-in bubble removal system - eliminates falsely high readings at low levels

> Sensitivity - fast response to fine changes in low-level turbidity

> Repeatability -not effected by sample flow and pressure

SIMPLICITY

> Simplified two-module design - sensor and controller interface with simple plug & play connection

> Reduced instrumentation - controller accepts two sensors; adding a second 1720E sensor unit gives you two complete turbidimeters

> Easy, calibration and verification - with no interruption in sample flow

THE BEST TOOL FOR EFFLUENT MONITORING REQUIREMEN

PRINCIPLE OF OPERATION

NEPHELOMETRIC MEASUREMENT

Incandescent light directed from the sensor head assembly down into the turbidimeter body is scattered by suspended particles in the sample. The sensor's submerged photocell detects light scattered at 90° from the incident beam.

SAMPLE FLOW PATH

Sample enters the center column of the turbidimeter, rises into the measuring chamber and spills over the weir into the drain port. This configuration results in an optically flat surface free of turbulence.

SIMPLIFIED CALIBRATION

One-point calibration with prepared StablCal™ Stabilized Formazin Solution eliminates the errors of formazin suspension dilution, takes less than two minutes per sensor, and is a USEPA-accepted method.

BUILT-IN BUBBLE REMOVAL

Continuously flowing sample flows through the patented* bubble removal system, which vents entrained air from the sample stream and eliminates the most significant interference in low-level turbidity measurement. The built-in bubble removal system is immune to changes in sample flow and pressure.

COMPLIANT DESIGN

The 1720E Low Range Turbidimeter applies the instrument design and meets performance criteria established by the U.S. Environmental Protection Agency (USEPA) in Method 180.1, making it suitable for regulatory reporting.

*U.S. patent 5,831,727

SIMPLE RELIABLE CALIBRATION TOOLS

ICE-PIC VERIFICATION MODULE

The ICE-PIC Module is a newer, faster way to calibrate and check the performance of Hach 1720 series turbidimeters. The benefits of using the ICE-PIC Module include:

- Saves time - verify performance in less than one minute
- Accurate - factory calibrated, with a certificate of accuracy provided
- Cost effective - a one-time investment, with no consumables
- Small and lightweight - great for spot verification around the facility
- Available in 20 and 1.0 NTU

TS!

STABLCAL® STABILIZED FORMAZIN PRIMARY STANDARDS

- Disposable and non-toxic
- Avoid preparation and dilution of formazin standards with StablCal standards
- Can be used to calibrate any turbidimeter
- Guaranteed shelf life of two years
- Low level certified standards available in 1 L or 3.78 L (1 Gallon)
- Low level standards range from 0.06 to 1 NTU

POWERFUL DATA MANAGEMENT AND COMMUNICATIONS

DATA COLLECTION AND DISPLAY

The 1720E Turbidimeter sc100 Controller receives data from one or two sensors. Its built-in data logger collects turbidity measurements at user selectable intervals (1-15 minutes), along with calibration and verification points, alarm history, and instrument setup changes for 6 months. Local display, recall, graphing, and trending in CSV format make chart recorders redundant.

DIRECT DIGITAL COMMUNICATION

This revolutionary smart controller is a new standard for Hach instruments. Not only will it accept a rapidly increasing number of Hach anaylytical tools; but it will reduce your operator training load as a wide variety of instruments will share the same interface and control method.

The sc100 Controller also offers optional DigitalDirect solutions for direct measurement from sensor to control room - no analog/digital conversion. Choose from MODBUS® /RS485, MODBUS/RS232, LonWorks protocols, or the wireless IR port.

MORE OUTPUT FEATURES

Meet your specific application needs with even more data management and communication features:

- > Two analog outputs; three set-point alarms
- > Wireless IR port communication
- > Compatibility with existing AquaTrend® Networks
- > Data is downloadable in user-selected time intervals; stores up to 6 months of data

THE LARGEST SURFACE WATER TREATMENT PLANT

in the world has been using Hach process turbidimeters for years.

The city of Chicago has two plants that currently have more than 300 Hach 1720D turbidimeters installed to meet the high volume demand and NPDWR regulatory rules. Why Hach? According to John Spatz, the Bureau of Water Supply Deputy Commissioner, the instruments have proven to be "very accurate and dependable."

The facility has found that the 1720D turbidimeters need very little maintenance and are easy to operate. Spatz says they rarely refer back to the manual once the instrument is installed. "The instruments are very user-friendly" according to Spatz. He also likes the idea of having data back-up in the unit, in case the SCADA system is not operational.

During the purchasing research, the city looked at several turbidimeters, then chose Hach because the 1720D best fit the facilities' needs. The plants also use several Hach bench-top turbidimeters.

HACH®

Be Right™

1720E SPECIFICATIONS*

Range	0.001-100 Nephelometric Turbidity Units (NTU)
Accuracy**	± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 10 NTU; ± 5% of reading from 10 to 40 NTU; ± 10% of reading from 40 to 100 NTU
Displayed Resolution	0.0001 NTU from 0 to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU
Repeatability**	Better than ± 1.0% of reading or ± 0.002 NTU, whichever is greater
Response Time	For a full-scale step change, initial response in 1 minute, 15 seconds
Signal Average Time	User Selectable ranging from 6, 30, 60, 90 seconds; user default 30 seconds
Sample Flow Required	200 to 750 mL/minute (3.1 to 11.9 gal/hour)
Storage Temperature	-20 to +60° C (-4 to 140° F)
Operating Temperature	0 to 50° C (32 to 122° F) for single sensor system, 0 to 40° C (32 to 104° F) for two sensor system
Operating Humidity	5 to 95% non-condensing
Sample Temperature	0 to 50° C (32 to 122° F)
Recorder Outputs	Two selectable for 0-20 mA or 4-20 mA. Output span programmable over any portion of the 0-100 NTU range; built into the sc100 Controller
Alarms	Three set-point alarms, each equipped with an SPDT relay with unpowered contacts rated 5A resistive load at 230 VAC; built into the sc100 Controller
Power Requirements	100-230 VAC, 50/60 Hz, auto selecting; 40 VA
Sample Inlet Fitting	1/4" NPT female, 1/4" compression fitting (provided)
Drain Fitting	1/2" NPT female, 1/2" hose barb (provided)
Enclosures	NEMA-4X/IP66 Controller
Digital Communications	Network card compatible; MODBUS/RS485, MODBUS/RS232, LonWorks® protocol (optional)
Wireless Communication	IR Port on the sc100 Controller to download into a handheld Personal Digital Assistant (PDA) or laptop computer via MODBUS
Compliance	Standard Methods 2130B, USEPA 180.1, Hach Method 8195
Certification	
Safety:	Listed by ETL to UL 61010A-1: Certified by ETL to CSA C22.2 No. 1010.1: CE certified by Hach Company to EN 61010-1
Immunity:	CE certified by Hach Company to EN61326 (industrial levels)
Emissions	
Class A:	EN 61326, CISPR 11, FCC Part 15, Canadian Interference-Causing Equipment Regulation ICES-003
Dimensions	Turbidimeter Body and Cap: 10 x 12 x 16 inches (25.4 x 30.5 x 40.6 cm) sc100 Controller: 5.67 x 5.67 x 5.91 inches (14.4 X 14.4 X 15.0 cm)
Mounting	Turbidimeter Body and Head Assembly: wall and floor stand sc100 Controller: wall, pole, panel, and floor stand
Shipping Weight	1720E Turbidimeter and sc100 Controller: 13.5 lbs. (6.12 kg) 1720E Turbidimeter: 10 lbs. (4.54 kg)

* Subject to change without notice.

** Defined according to ISO 15839.

Typical Proposal Specifications: 1720E Low Range Turbidimeter

GENERAL

The turbidity monitoring system shall include at least one Turbidimeter and one interface unit. The system shall be capable of functioning as a single sensor system and also be easily expanded up to two turbidimeters per interface unit. The connections between the turbidimeter and interface unit will include plug & play connections.

TURBIDIMETER

The turbidimeter shall measure turbidity in the range of 0.001-100 NTU and be a microprocessor-based, continuous-reading, on-line nephelometric instrument meeting all design and performance criteria specified by USEPA method 180.1. Light shall be directed through the surface of the sample and the detector shall be immersed in the sample, eliminating glass windows and flow cells. Optical components shall be mounted in a sealed head assembly that can be removed easily for calibration/service, without disturbing sample flow. The turbidimeter body shall be constructed of corrosion-resistant polystyrene, and shall include an internal bubble removal system to vent entrained air from the sample stream. The turbidimeter shall offer the choice of formazin-based (20 or 1 NTU) or instrument comparison-based calibration methods. Accuracy shall be ± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 10 NTU; ± 5% of reading from 10 to 40 NTU; ± 10% of reading from 40 to 100 NTU. Displayed resolution shall be 0.0001 NTU from 0 to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU and repeatability shall be better than ± 1.0% of reading or ± 0.002 NTU (whichever is greater). User selectable signal averaging, bubble removal, alarm and recorder output hold, and self-test diagnostics shall be provided. All turbidimeters on the network shall have the option for MODBUS/RS232, MODBUS/RS485, LonWorks serial input/output capability for two-way communication to a computer or have wireless downloading capability through the IR Port located on the interface unit to download and print real-time turbidity data, calibration history, and current set points in a CSV format.

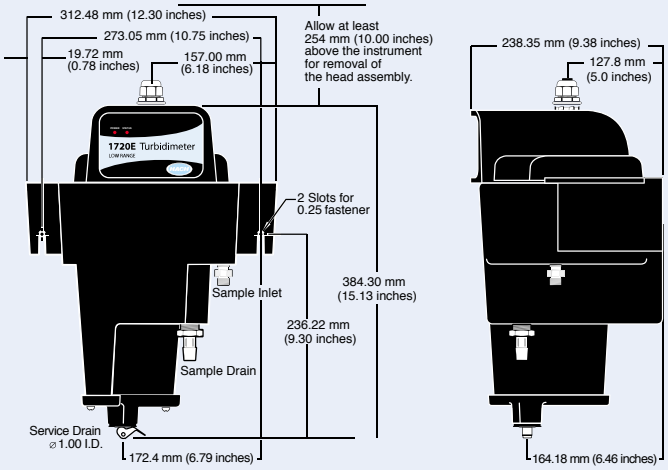
INTERFACE MODULE

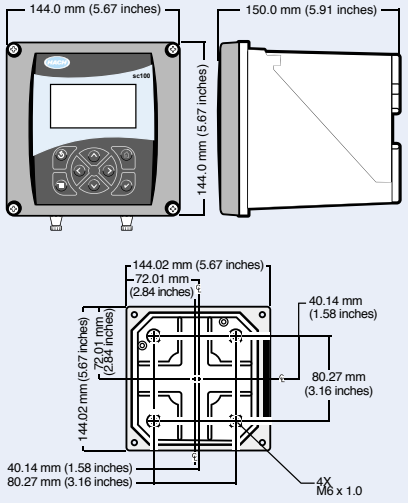
The Interface unit shall allow operators to control sensor and interface functions with user-friendly, menu-driven software, and shall provide data logging of measurement data from up to two turbidimeters for 15 minutes, 1 hour, 24 hours, 30 days, or 180 days and the capability to transfer data to a computer or printer via direct MODBUS communications or directly into a Personal Digital Assistant (PDA) via a wireless IR Port. The interface unit will also have a built-in data logger with the storage capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller. Each interface will also include two analog outputs and 3 un-powered SPDT alarm contacts. The interface unit and the DC power supply shall be housed in a NEMA-4X (indoor) industrial metal/plastic enclosure, and the power supply shall automatically accept input in the range of 100 to 230 Vac, 50/60 Hz.

SAFETY AND ELECTRICAL DESIGN STANDARDS

All system components are ETL listed to UL 61010A-1, certified by ETL to CSA C22.2 No. 1010.1, and CE certified by manufacturer for safety to EN 61010-1. For EMC immunity and emissions, system components are CE certified by manufacturer to EN 61326 (industrial levels), for North America to FCC Part 15, and Canadian Interference-Causing Equipment Regulation ICES-003, and for rest of world to CISPR 11 Class A levels.

INSTALLATION





HOW TO ORDER

60101-00	1720E Turbidimeter with sc100 Controller
60101-01	1720E Turbidimeter, Sensor Only

1720E with DigitalDirect communications

60101-02	1720E/sc100 with MODBUS/RS485 output
60101-03	1720E/sc100 with MODBUS/RS232 output
60101-04	1720E/sc100 with LonWorks output

CABLES*

57960-00	25 ft. (7.7 M) Extension Cable
46306-00	Power Cord with Strain Relief (125 VAC)
46308-00	Power Cord with Strain Relief (230 VAC), European Style Plug

*Note: Power cables must be ordered separately.

OPTIONAL ACCESSORIES
ICE-PIC Verification Module/1720E:

52250-00	20 NTU
52215-00	1 NTU

STABLCAL COMPARATIVE CALIBRATION STANDARDS (for 1720E, 1720D, and 1720C Turbidimeters)***

26601-53	20.0 NTU, 1 L each

*** Note: Calibration Cylinder must be ordered separately.

STABLCAL VERIFICATION STANDARDS

26598-53	1.0 NTU, 1 L each
27463-53	40.0 NTU, 1 L each
26979-53	0.3 NTU, 1 L each
26980-53	0.5 NTU, 1 L each
27233-53	0.1 NTU, 1 L each

FORMAZIN CALIBRATION STANDARDS

44156-00	Formazin Calibration Kit for user-prepared calibration includes 4000 NTU Formazin, (500 mL), TenSette® Pipet, and Calibration Cylinder
2461-49	Formazin Primary Standard, 4000 NTU, 500 mL, replacement for kit #44156-00
44153-000	Calibration Cylinder, 1L
57432-00	Floor Stand

Lit. No. 2446
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At Hach, it's about learning from our customers and providing the right answers. It's more than ensuring the quality of water – it's about ensuring the quality of life. When it comes to the things that touch our lives...

Keep it pure.

Make it simple.

Be right.

For current price information, technical support, and ordering assistance, contact the Hach office or distributor serving your area.

In the United States, contact:

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 800-227-4224
Fax: 970-669-2932
E-mail: orders@hach.com
Website: www.hach.com

U.S. exporters and customers in Canada, Latin America, sub-Saharan Africa, Asia, and Australia/New Zealand, contact:

HACH Company
World Headquarters
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A.
Telephone: 970-669-3050
Fax: 970-461-3939
E-mail: intl@hach.com
Website: www.hach.com

In Europe, the Middle East, and Mediterranean Africa, contact:

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D-40549 Düsseldorf
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Fax: +49 (0) 211-5288-143
E-mail: kundenservice@drlange.de
www.drlange.com

HACH®

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sc100 Controller

The Model sc100 Controller receives data from one or two sensors. Its plug-and-play, mix-and-match operation lets it fit into any facility or workflow. Digital communication with any Hach digital sensor or probe is simple and reliable.

Features and Benefits

One Controller for One or Two Sensors

The Hach sc100 Controller receives data from up to two sensors. Use any of Hach's line of digital sensors for pH/ORP, conductivity, dissolved oxygen, or turbidity.

One Controller for One or Two Parameters

Not only can the sc100 controller be used for up to two sensors, but the sensors need not be the same. Mix and match any combination of parameters.

One Controller for Many Options

Communications using RS485/MODBUS® or RS232/MODBUS® protocols or the wireless infrared port are available. (Contact your Hach representative for other communication protocols.) Multiple control functions include built-in PID, control contacts, and alarm functions.

"Plug and Play" Operation

There's no complicated wiring or set up procedures with the sc100 controller. Just plug the sensor in and it's ready for use without special ordering or software configuration.

Simple, Reliable Data Collection

A built-in data logger collects measurement at user selectable intervals (1 to 15 minutes), together with calibration and verification points, alarm history, and instrument setup changes for up to 6 months. With a two-year warranty, the Hach sc100 Controller is built to last.

DW = drinking water WW = wastewater municipal PW = pure water / power
IW = industrial water E = environmental C = collections FB = food and beverage

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Specifications*

Ambient Conditions

Operation
With less than 7 W sensor load:
-20 to 60° C (-4 to 140° F); 0 to 95% relative humidity, non-condensing

With less than 25 W sensor load:
-20 to 40° C (-4 to 104° F); 0 to 95% relative humidity, non-condensing

Storage
-20 to 70° C (-4 to 158° F); 0 to 95% relative humidity, non-condensing

Power Requirements

100 to 230 Vac, 50/60 Hz; Power: 11W with 7W sensor load; 35W with 25W sensor load

Display

Graphic dot matrix LCD, 128 x 64 pixels with LED backlighting

Relays

Three SPDT, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum

Outputs

Two analog 4-20 mA, maximum impedance 500 Ohms, optional digital network connection

Control

PID, High/low phasing, setpoint, deadband, overfeed timer, off delay, and on delay

Alarms

Low alarm point, low alarm point deadband, high alarm point, high alarm point deadband, off delay, and on delay

Communication (Optional)

RS-232 (MODBUS®): Configure and retrieve measured data for one analyzer using IBM-compatible PC

RS-485 (MODBUS®): Advanced communications/networking with PLC or SCADA system directly from analyzer.

Memory Backup

All user settings are retained indefinitely in memory (non-volatile) (EEPROM)

Mounting Configurations

Surface, panel, and pipe (horizontal and vertical)

Enclosure

NEMA 4X/IP66; metal enclosure with corrosion-resistant finish

Dimensions

1/2 DIN; 144 x 144 x 150 mm (5.7 x 5.7 x 5.9 in.)

Weight

1.6 kg (3.5 lbs.)

Certifications

ETL to UL 61010A-1 and CSA C22.2 No. 1010.1

**Specifications subject to change without notice.*

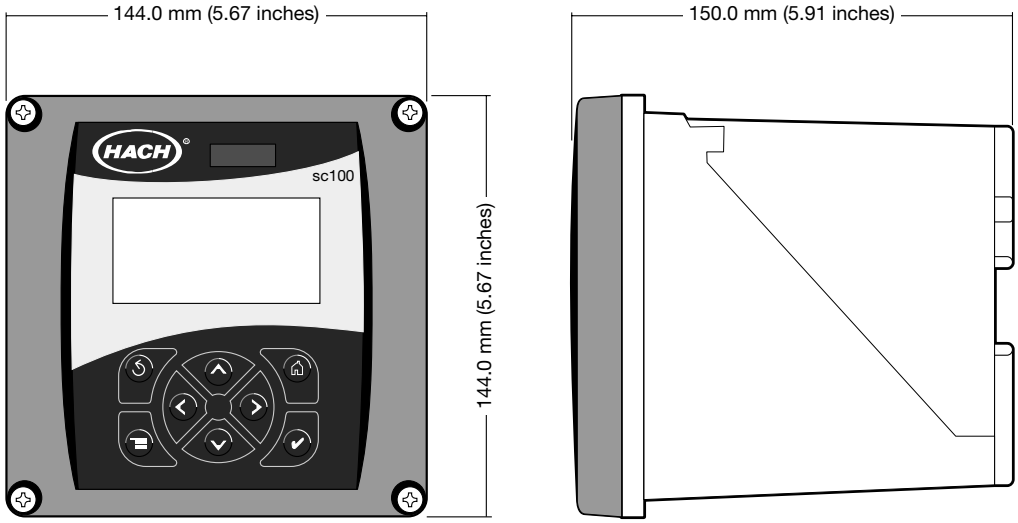
Engineering Specifications

1. The controller shall be a microprocessor-based instrument.
2. Connections between the sensors and the controller shall be “plug and play.”
3. The controller shall have the option for RS232/MODBUS® or RS485/MODBUS® serial input/output capability for two-way communication to a computer and have wireless downloading capability through an IR Port located on the interface unit to download and print realtime data, calibration history, and current set points in a CSV format.
4. The Interface unit shall allow operators to control sensor and interface functions with menu-driven software.
5. The interface unit shall have a built-in data logger with the capacity to store data on 15-minute intervals for up to 6 months with two sensors per controller.
5. The interface unit shall include two analog 4-20 mA outputs and 3 unpowered SPDT form ‘C’ alarm contacts.
7. The interface unit shall include two independent PID control functions.
8. The interface unit shall be housed in a NEMA-4X/IP66 metal enclosure with corrosion-resistant finish.
9. The controller shall be mounted horizontal or vertical on surface, panel, or pipe.
10. The AC power supply shall be housed in the interface unit and automatically accept input in the range of 100 to 230 Vac, 50/60 Hz.
11. All system components shall be certified by ETL to UL 61010A-1, CSA C22.2 No. 1010.1.
12. The controller shall be warranted for two full years against defects in material and workmanship.
13. The controller shall be Hach Company Model sc100 Controller.

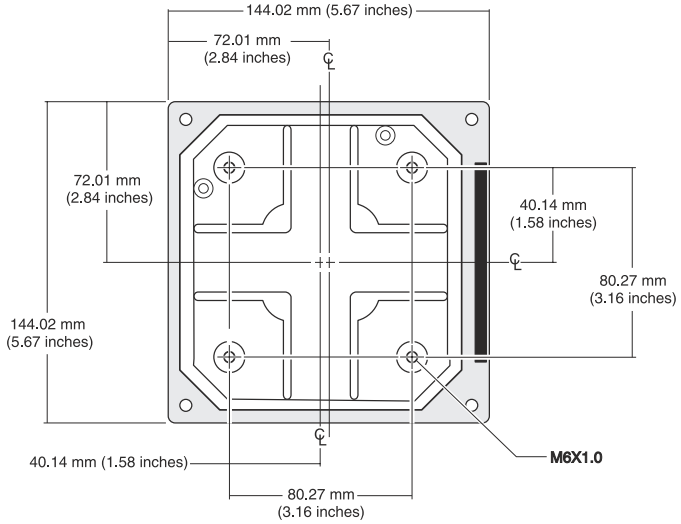
Dimensions

The sc100 controller unit can be installed on a surface, panel, or pipe (horizontally or vertically). No tools are needed to connect the controller unit to any Hach digital sensor.

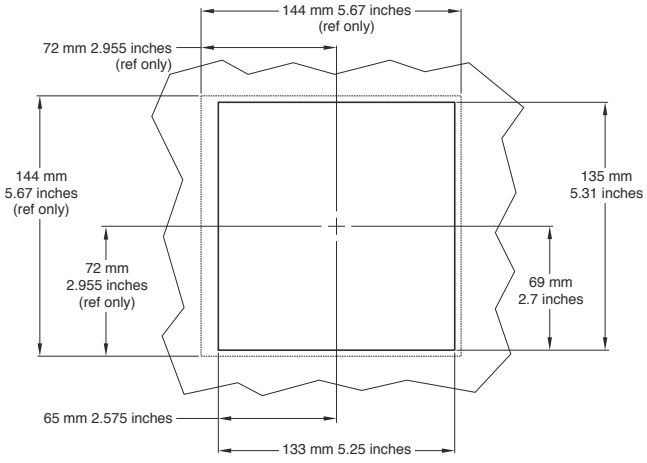
Front and Side Views



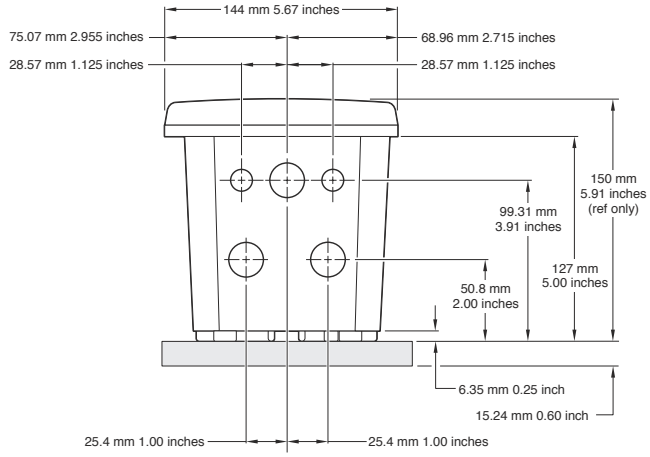
Back View



Panel Mount Cut-Out Dimensions



Conduit Hole Dimensions



Ordering Information

LXV401.52.00002 sc100 Controller Standard

LXV401.52.01002 sc100 Controller with RS-232 (MODBUS®)

LXV401.52.02002 sc100 Controller with RS-485 (MODBUS®)

Note: Power cords must be ordered separately.

Note: Other communication options are available. Please contact Hach Technical Support or your Hach representative.

Power Cords

54488-00	Power Cord with strain relief, 125 Vac
54489-00	Power Cord with strain relief, 230 Vac, European-style plug

Accessories

58690-00	Sun Shield, for controller

To complete your measurement system, choose from Hach's family of digital sensors...

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Catalog Number 60100-18

Hach sc100™ 1720E Analysis System

Instrument Manual

11/03 2ed

Table of Contents

Section 1 Specifications

Specifications are subject to change without notice.

Table 1 Turbidimeter Specifications

<table>
<tr><td>Method of Detection</td><td>Nephelometric light scatter at 90 degrees relative to the incident light beam. The incident light beam is composed of a tungsten filament light source with a color temperature between 2200 and 3000K.</td></tr>
<tr><td>Range</td><td>0.001–100 nephelometric turbidity units (NTU)</td></tr>
<tr><td>Accuracy</td><td>± 2% of reading or ± 0.015 NTU (whichever is greater) from 0 to 40 NTU;
± 5% of reading from 40 to 100 NTU</td></tr>
<tr><td>Linearity</td><td>Better than 1% 0–40 NTU on formazin. Allows for accurate calibration at high turbidity values. Temperature dependent ±2 °C.</td></tr>
<tr><td>Resolution (Displayed)</td><td>0.0001 NTU up to 9.9999 NTU; 0.001 NTU from 10.000 to 99.999 NTU</td></tr>
<tr><td>Repeatability</td><td>Better than ±1.0% of reading or ±0.002 NTU, whichever is greater for each range.</td></tr>
<tr><td>Response Time</td><td>For a full-scale step change, initial response in 1 minute, 15 seconds. Varies with flow rate, see the table below. The response time is also dependent on the signal averaging time, which is user selectable.
<table>
<tr><th rowspan="2">% Step Change</th><th colspan="3">Flow Rate</th></tr>
<tr><th>750</th><th>500</th><th>250</th></tr>
<tr><td>10</td><td>1¼ minutes</td><td>1½ minutes</td><td>2½ minutes</td></tr>
<tr><td>50</td><td>2 minutes</td><td>2½ minutes</td><td>6 minutes</td></tr>
<tr><td>90</td><td>3½ minutes</td><td>3½ minutes</td><td>9 minutes</td></tr>
<tr><td>99</td><td>4 minutes</td><td>5 minutes</td><td>12 minutes</td></tr>
</table></td></tr>
<tr><td>Sample Flow Required</td><td>200 to 750 mL/minute (3.2 to 11.9 gal/hour)</td></tr>
<tr><td>Sensor Storage Temperature</td><td>–20 to 60 °C (–4 to 140 °F); 95% relative humidity, non-condensing.</td></tr>
<tr><td>Operating Temperature</td><td>0 to 50 °C (32–122 °F) for single sensor system, 0 to 40 °C (32–104 °F) for two sensor system</td></tr>
<tr><td>Sample Temperature Range</td><td>0 to 50 °C (32–122 °F)</td></tr>
<tr><td>Operating Humidity</td><td>5 to 95% non-condensing</td></tr>
<tr><td>Power Requirements</td><td>12 V dc ±5%, 12.5 watts maximum</td></tr>
<tr><td>Sample Inlet Fitting</td><td>¼-inch NPT female. ¼-inch compression fitting (supplied)</td></tr>
<tr><td>Drain Fitting</td><td>½-inch NPT female, ½-inch hose barb (supplied)</td></tr>
<tr><td>Signal Average (Filter) Time</td><td>no averaging, 6, 30, 60, and 90 seconds, user selectable. Default is 30 seconds.</td></tr>
<tr><td>Sensor Dimensions</td><td>Turbidimeter body and cap: 25.4 x 30.5 x 40.6 cm (10 x 12 x 16 inches)</td></tr>
<tr><td>Sensor Cable Length</td><td>2 m (6.6 ft); Optional 7.62 m (25 ft) extension cable. Maximum cable length is 9.62 m (31.6 ft).</td></tr>
<tr><td>Sensor Cable Rating</td><td>Cable: 105 °C, 300 V, PVC jacket
Wires: 22 AWG, PVC jacket</td></tr>
<tr><td>Mounting Options</td><td>Wall; floor stand</td></tr>
<tr><td>Shipping Weight</td><td>1720E Turbidimeter and Controller: 6.31 kg (13.5 lb); 1720E Turbidimeter only: 4.71 kg (10 lb)</td></tr>
</table>

Table 1 Turbidimeter Specifications (continued)

Calibration Methods	**1.** StablCal® (stabilized formazin) – primary or wet calibration of the instrument **2.** Formazin – user-prepared primary or wet calibration of the instrument **3.** Multi-sensor calibration – Performed with a specialized calibration procedure for up to eight sensors on a single set of fresh StablCal® standards.
Verification (Wet) Method	**1.** StablCal® (stabilized formazin) – recommended for verification in the appropriate application range of measurement. For regulatory verification, standards of 0.1. 0.3. 0.5 and 1.0 NTU are available. **2.** Formazin – fresh user-prepared standard
Verification (Dry) Method	**1.** ICE-PIC™ Verification Module with factory-set values of 20.0 or 1.0 ±25%. Unique value is assigned when dry verification is done immediately after calibration and is used as pass/fail criteria for subsequent verifications.
Recommended Cleaning Intervals	**1.** Mandatory before calibration **2.** Optional before verification **3.** Mandatory upon verification failure
Languages	English (default), German, Spanish, Nederlands
Installation Environment	Indoor
Primary Compliance Method	USEPA 180.1; Hach Method 8195; ASTM D 6698; Standard Methods 2130B
Limit of Detection	0.0032 NTU (according to criteria specified by ISO 15839)

Table 2 Controller Specifications

Component Description	Microprocessor-controlled measuring unit with measured value display, temperature display (for some parameters), and menu-driven system
Controller Operating Temperature	–20 to 60 °C (–4 to 140 °F); 95% relative humidity, non-condensing with sensor load <7 W; –20 to 40 °C (–4 to 104 °F) with sensor load <25 W
Controller Storage Temperature	–20 to 70 °C (–4 to 158 °F); 95% relative humidity, non-condensing
Enclosure	NEMA 4X/IP66 metal enclosure with a corrosion-resistant finish
Power Requirements	100–230 V ac ±10%, 50/60 Hz; Power: 11 W with 7 W sensor load, 35 W with 25 W sensor load
Pollution Degree/Installation Category	II; II
Outputs	Two (Analog outputs, each selectable for 0–20mA or 4–20 mA), maximum impedance 500 ohm. Output span programmable over any portion of the 0–100 NTU range. Optional digital network connection[1]. Infrared Data Acquisition (IrDA).
Relays	Three SPDT, user-configurable contacts rated 100–230 V ac, 5 Amp resistive maximum.
Controller Dimensions	½ DIN—144 x 144 x 150 mm (5.7 x 5.7 x 5.9 inches)
Controller Weight	1.6 kg (3.5 lb)

1. See Replacement Parts and Accessories on page 55.

Section 2 General Information

2.1 Safety Information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

Use of Hazard Information
DANGER: Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation that may result in minor or moderate injury.

Note: Information that requires special emphasis.

Precautionary Labels
Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).

2.2 General Product Information

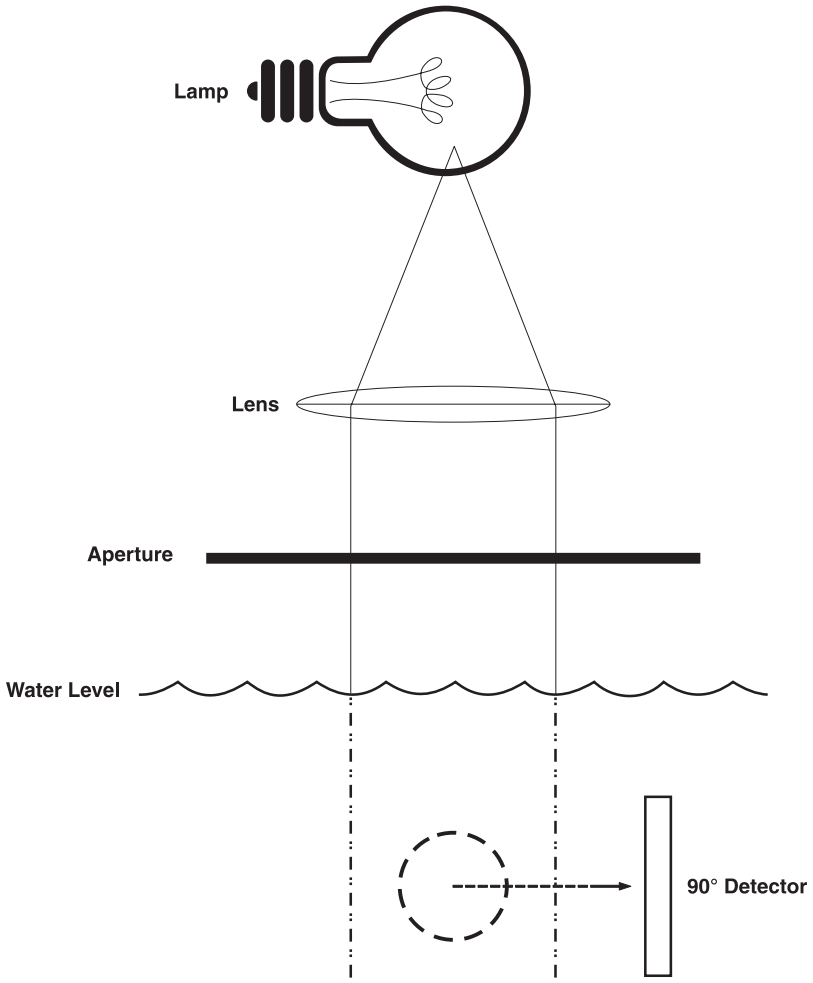
The controller enclosure is NEMA4X/IP66-rated and has a corrosion-resistant finish designed to withstand corrosive environmental constituents such as salt spray and hydrogen sulfide. The controller display shows the current turbidity reading if connected to a single sensor, or two readings when two sensors are connected.

The 1720E Turbidimeter is a continuous-reading nephelometric turbidimeter designed for low-range turbidity monitoring. This process turbidimeter is capable of measuring turbidity from 0.001 to 100.0 NTU. Calibration is based on formazin, the primary turbidity reference standard adopted by the APHA *Standard Methods for the Examination of Water and Wastewater* and the U.S. Environmental Protection Agency (EPA) and on StablCal® which is also recognized as a primary standard.

2.3 Theory of Operation

The 1720E Turbidimeter measures turbidity by directing a strong beam of collimated light from the sensor head assembly down into the sample in the turbidimeter body. Light scattered at 90° relative to the center line of incident light by suspended particles in the sample is detected by the submerged photocell (see Figure 1).

Figure 1 90 Degree Detector



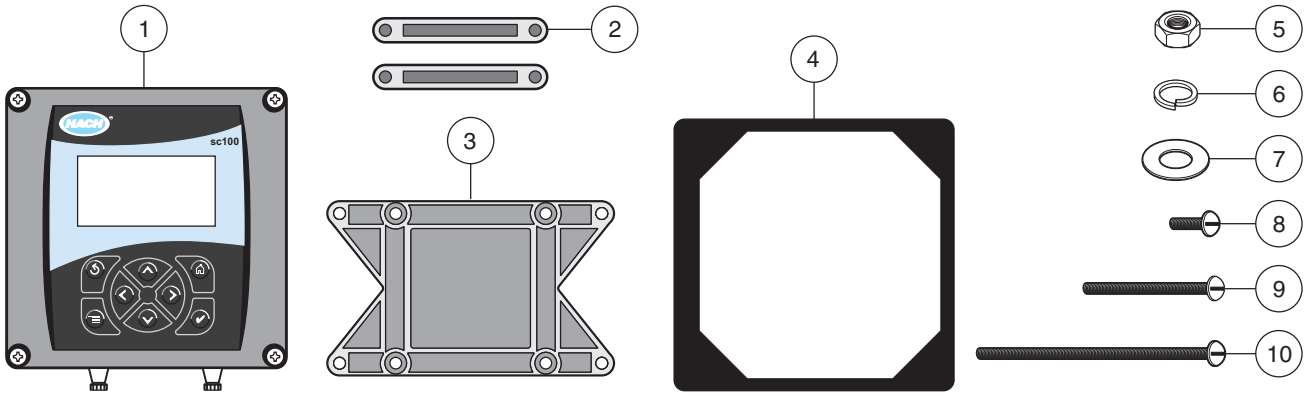
The amount of light scattered is proportional to the turbidity of the sample. If the turbidity of the sample is negligible, little light will be scattered and detected by the photocell and the turbidity reading will be low. High turbidity, on the other hand, will cause a high level of light scattering and result in a high reading.

Sample enters the turbidimeter body and flows through the baffle network of the bubble trap. The flow allows bubbles to either cling to surfaces of the baffle system or rise to the surface and vent to atmosphere. After traveling through the bubble trap, sample enters the center column of the turbidimeter body, rises into the measuring chamber and spills over the weir into the drain port. A reading is taken once per second.

Section 3 Installation

DANGER
Only qualified personnel should conduct the installation tasks described in this section of the manual. The 1720E/sc100 product configuration is not intended for installation in hazardous locations.

Figure 2 Controller Mounting Components



1. Controller	**6.** Lock washer, ¼-inch I.D. (4), Cat. No. 8H1336
2. Mounting foot for panel mounting (2), Cat. No. 1000B4F3222	**7.** Flat washer, ¼-inch I.D. (4), Cat. No. 8H1346
3. Bracket for panel and pipe mounting, Cat. No. 1000C4F3217-101	**8.** Pan head screws (4), M6 x 1.0 x 20 mm, Cat. No. 58674-00
4. Gasket for panel mounting, rubber, Cat. No. 1000A4F3249-101	**9.** Pan head screws (4), M6 x 1.0 x 100 mm, Cat. No. 5867500
5. Hex nut, M6 (4), Cat. No. 5867300	**10.** Pan head screws (4), M6 x 1.0 x 150 mm, Cat. No. 5867600

Table 3 Customer-supplied Items

Item
14-AWG wire for electrical power connections in conduit or if allowed by local electrical codes, 115 or 230 V ac power cord plus a NEMA 4X-rated strain relief
High-quality, shielded instrumentation cable for connecting the analog outputs plus a NEMA 4X-rated strain relief
Mounting hardware for the sensor
Sun shield for mounting configurations where the sun strikes the front of the display (available from the manufacturer, order separately). See Figure 8 on page 11.
Common hand tools

3.1 Mechanical Installation

Install in an environment that is protected from corrosive fluids. The sensor is adversely affected by ClO_2. Install the sensor in an area well ventilated from any corrosive liquids or gasses.

3.1.1 Controller Dimension Illustrations

Figure 3 Controller Dimensions

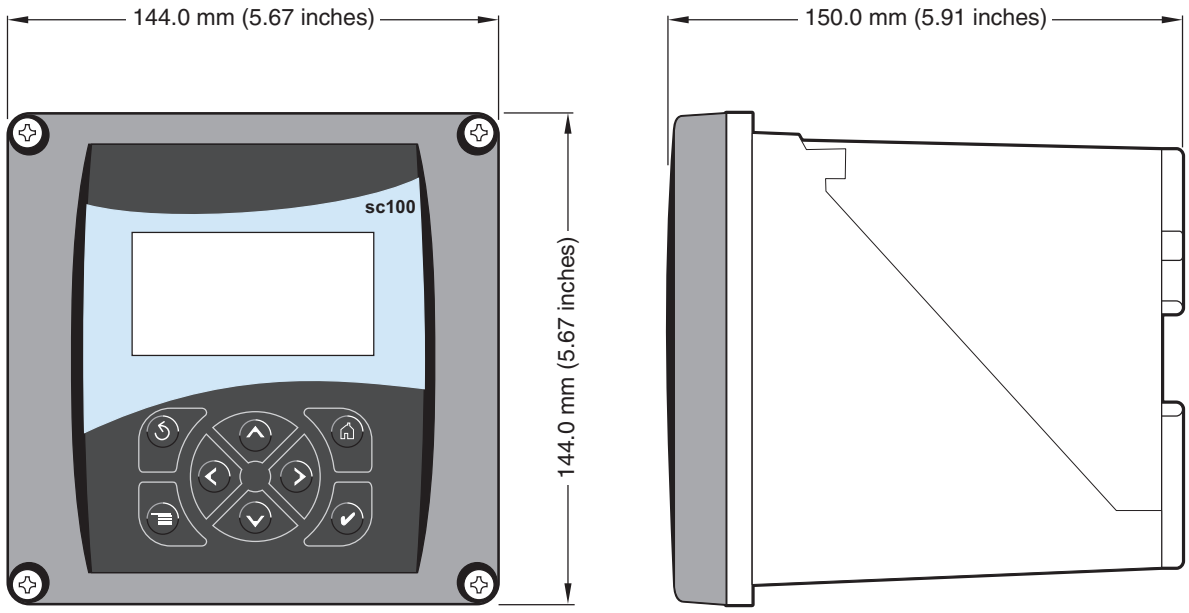


Figure 4 Controller Mounting Dimensions

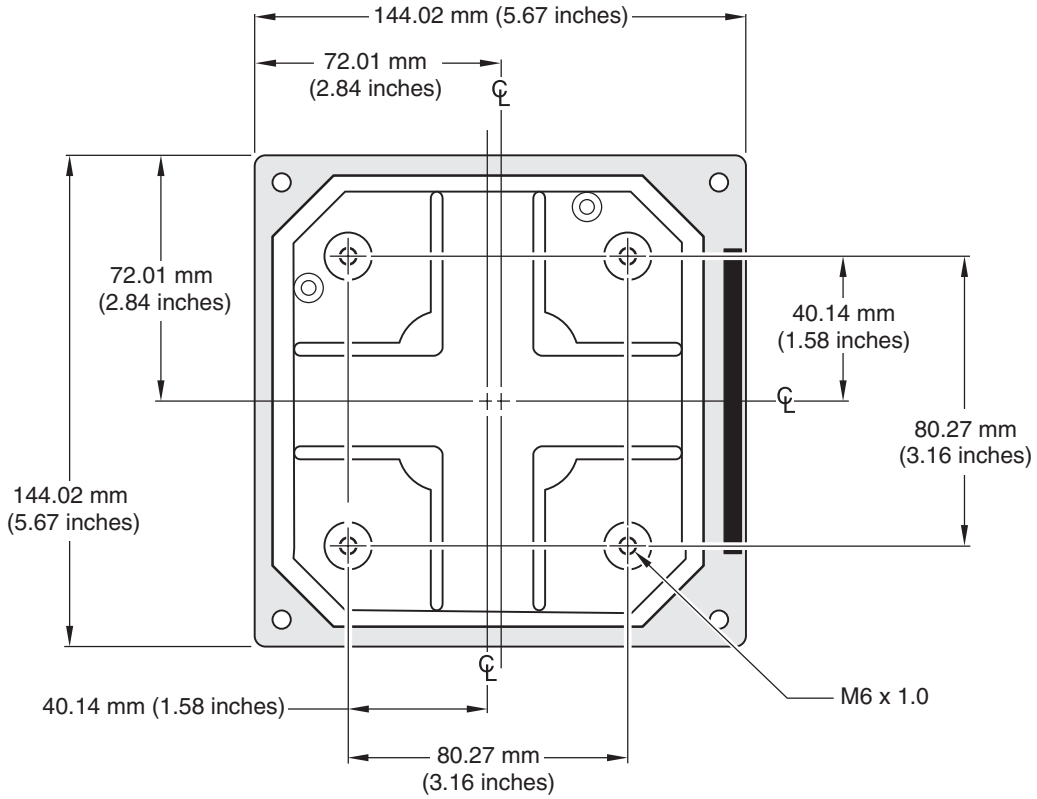


Figure 5 Panel Mount Cut-out Dimensions

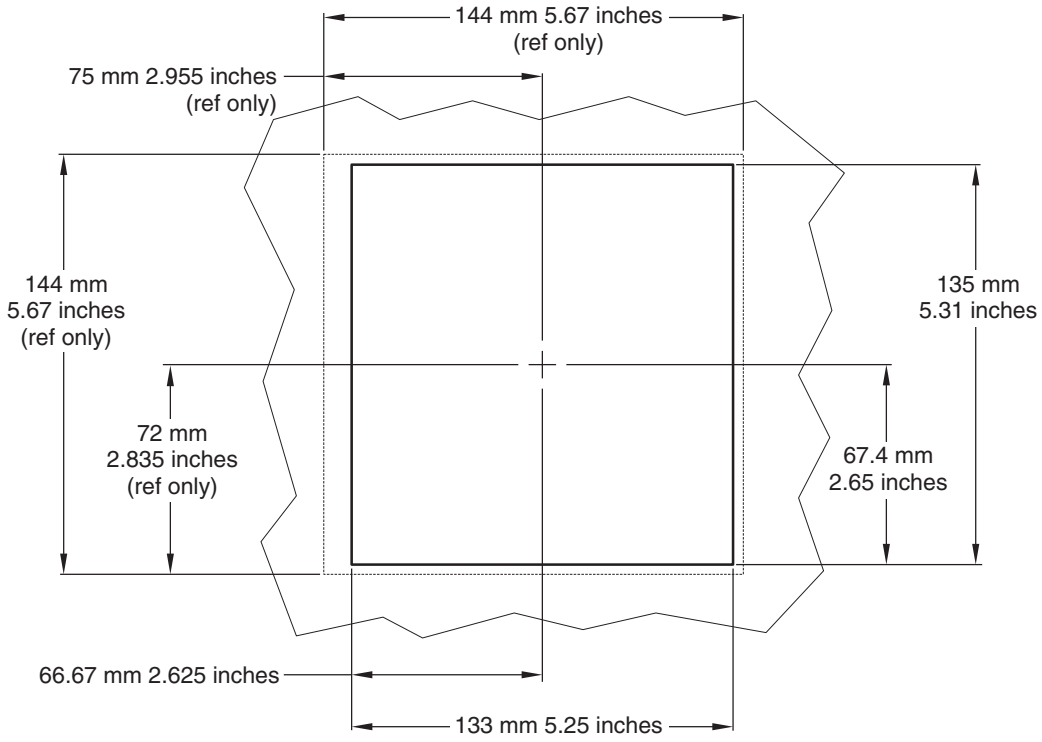
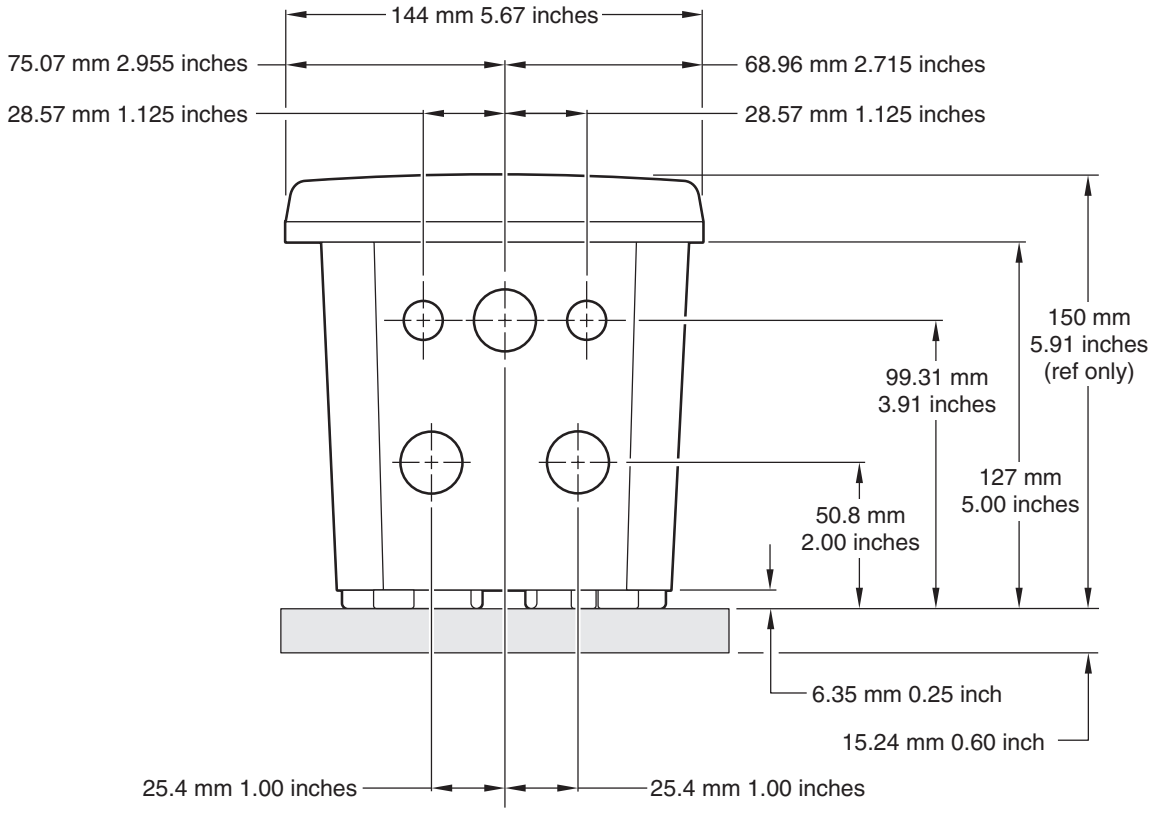


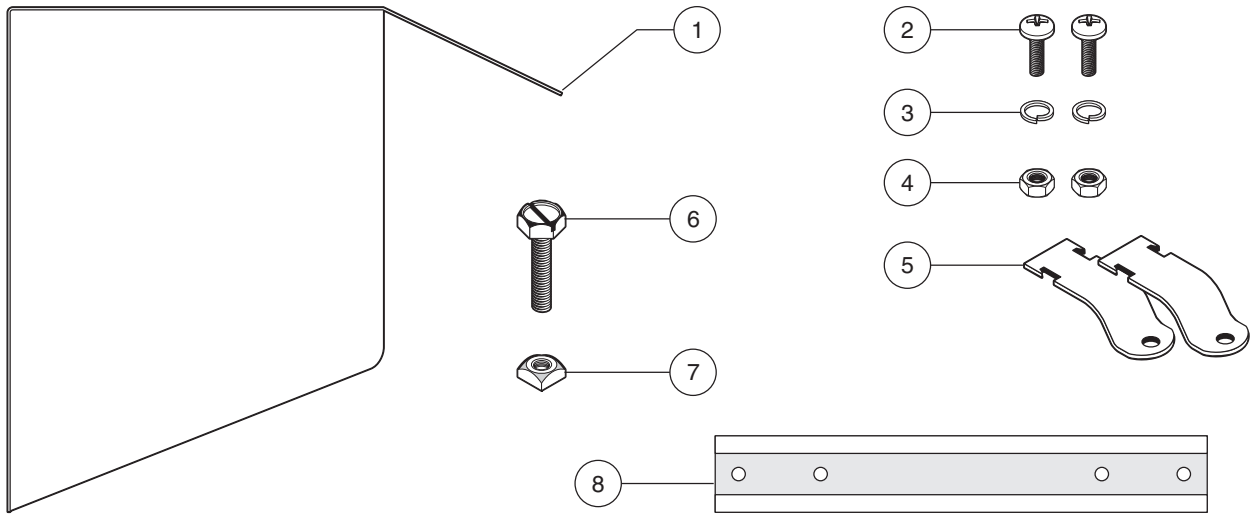
Figure 6 Conduit Hole Dimensions



3.1.2 Using the Optional Sun Shield

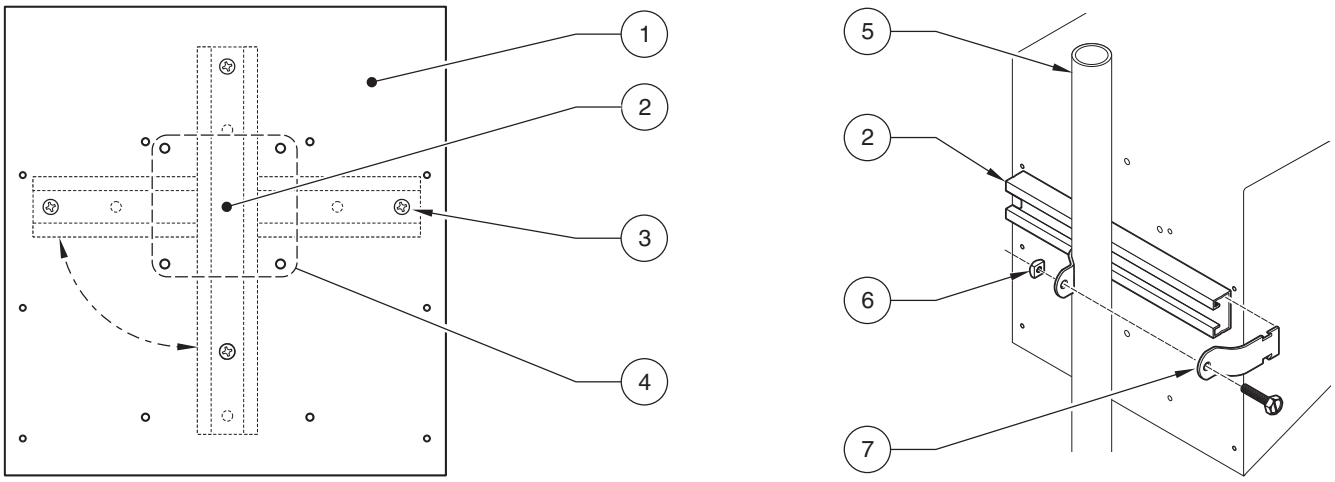
The optional sun shield was designed to increase the readability of the display by screening it from direct sunlight. See Replacement Parts and Accessories on page 55 for ordering information.

Figure 7 Sun Shield Kit Components



1.	Sun shield	**5.**	Pipe mounting brackets (2), includes items 6 and 7, Cat. No. 9H1079
2.	Pan head screws, M6 x 1.0 x 12 mm (6), Cat. No. 200-1025	**6.**	Hex/slotted head screw, 5/16-inch x 1.0-inch (supplied with item number 5)
3.	Lock washers, ¼-inch I.D. (2), Cat. No. 8H1336	**7.**	Square nut, 5/16-inch (supplied with item number 5)
4.	Hex nuts, M6 x 1.0 (2), Cat. No. 5867300	**8.**	Uni-strut, 27 cm (10.5 inch) length, Cat. No. 276F1227

Figure 8 Mounting the Controller in the Sun Shield

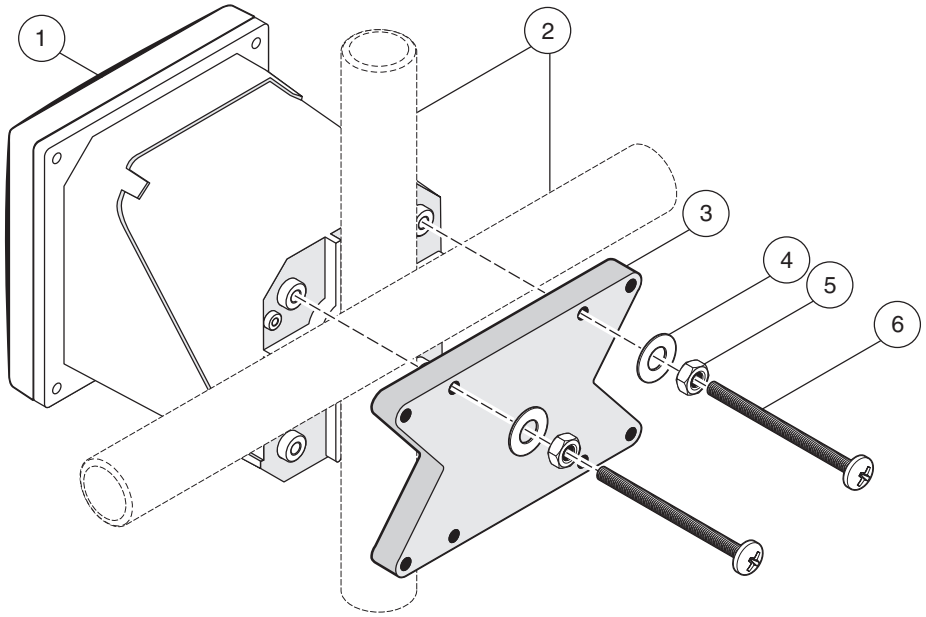


1.	Sun shield	**4.**	Hole pattern for mounting controller	**7.**	Slide mounting brackets into the uni-strut as shown. Place the mounting brackets around the pipe and fasten the hardware.
2.	Uni-strut (rotate 90° as required)	**5.**	Pipe (vertical or horizontal as required)		
3.	Pan head screw, lock washer (2 each)	**6.**	Hex/slotted head screw and square nut		

3.1.3 Mounting the Controller

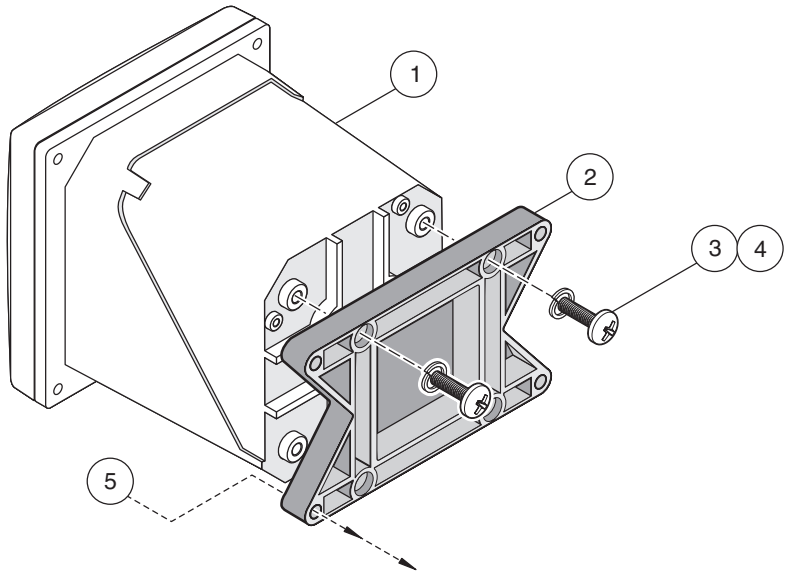
Attach the controller to a rail or wall or mount it in a panel. Supplied mounting hardware is shown in Figure 9, Figure 10, and Figure 11.

Figure 9 Vertical or Horizontal Pipe Mounting the Controller



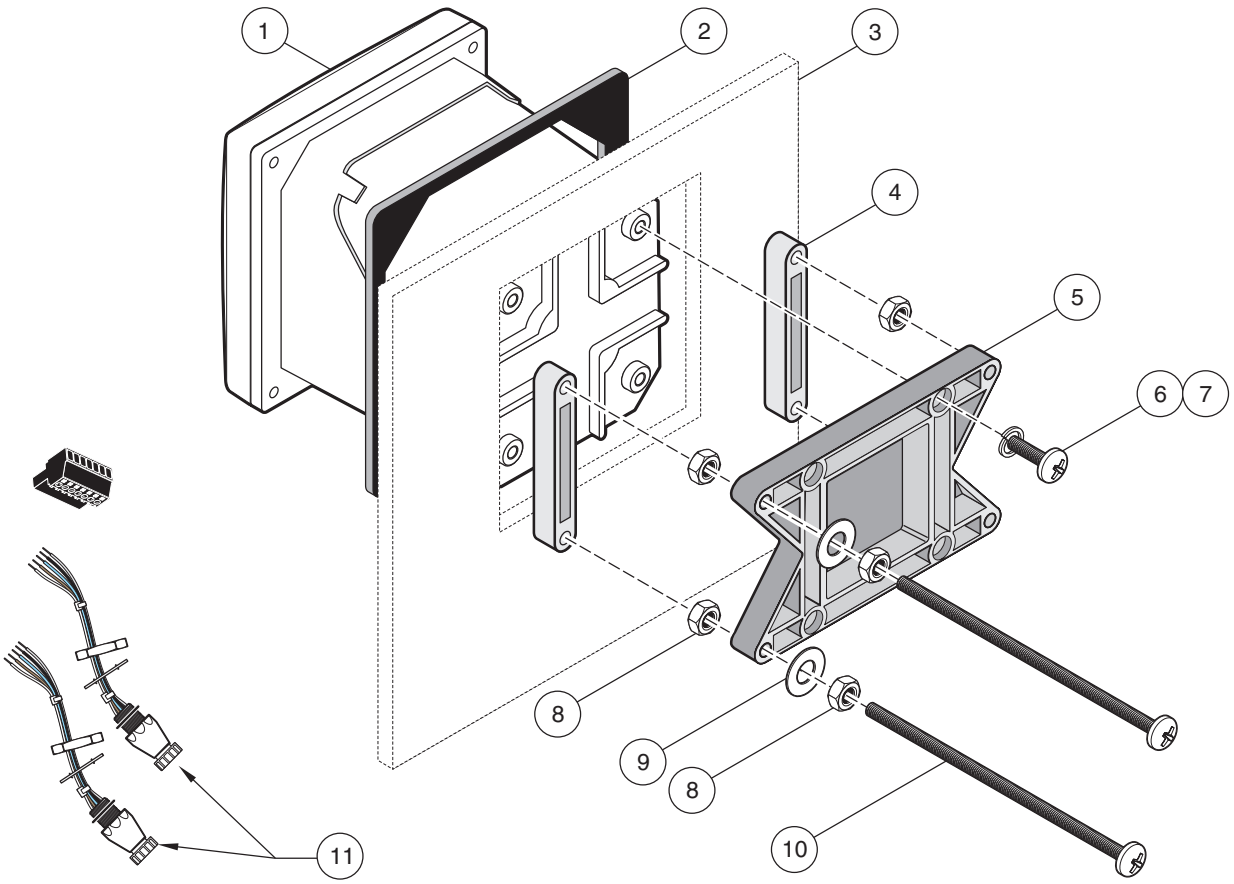
1.	Controller	**4.**	Flat washer, ¼-inch I.D. (4), Cat. No. 8H1346
2.	Pipe (vertical or horizontal)	**5.**	Hex nut, M6 (4), Cat. No. 5867300
3.	Bracket, pipe mounting, Cat. No. 1000C4F3217-101	**6.**	Pan head screw, M6 x 1.0 x 100 mm (4), Cat. No. 5867400

Figure 10 Wall Mounting the Controller



1.	Controller	**4.**	Pan head screw, M6 x 1.0 x 20 mm (4), Cat. No. 5867400
2.	Bracket, Cat. No. 1000C4F3217-101	**5.**	Customer-supplied hardware for wall mounting
3.	Lock washer, ¼-inch I.D., Cat. No. 8H1336		

Figure 11 Panel Mounting the Controller



1.	Controller	**7.**	Lock washer, ¼-inch I.D., (4) Cat. No. 8H1336
2.	Gasket, rubber, panel mount, Cat. No. 1000A4F3249-101	**8.**	Hex nut (4), Cat. No. 5867300
3.	Panel (maximum thickness is 9.5 mm (3/8 inch))	**9.**	Flat washer (4), Cat. No. 8H1346
4.	Mounting Foot (2), Cat. No. 1000B4F3222	**10.**	Pan head screw, M6 x 1.0 x 150 mm (4), Cat. No. 5867600
5.	Mounting bracket, controller, Cat. No. 1000C4F3217-101	**11.**	It may be necessary to remove the sensor connectors. See procedure below.
6.	Pan head screw (4), Cat. No. 5867400		

To remove the sensor connectors before inserting the controller enclosure into the panel cut-out:

1. Disconnect power to the controller.

1. Disconnect the wires at terminal block J5, see Figure 21 on page 21.

2. Loosen and remove the nut securing the sensor connector inside the enclosure. Remove the sensor connector and wires. Repeat step 1 and 2 for the other sensor connector.

3. After the controller is in place in the panel, reinstall the sensor connectors and reconnect the wiring to terminal J5 as shown in Figure 21 on page 21.

3.2 Electrical Installation

DANGER
The instrument must be installed by qualified technical personnel for adherence to all applicable electrical codes. The 1720E/sc100 product configuration is not intended for installation in hazardous locations.

High-voltage wiring for the controller is conducted behind the high voltage barrier in the controller enclosure. The barrier must remain in place unless a qualified installation technician is installing wiring for power, alarms, or relays. See Figure 12 for barrier removal information.

3.2.1 Installation in Conduit

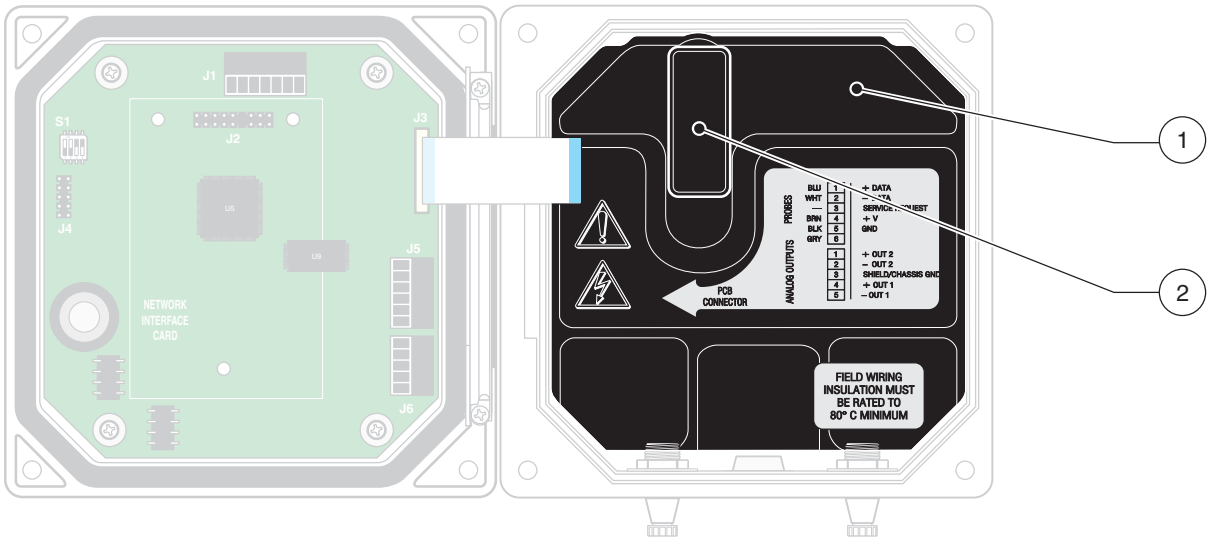
In hard-wired electrical applications, the power and safety ground service drops for the instrument must be 18 to 12 AWG. See Figure 13 on page 15 for strain relief and conduit opening sealing plug information. See section 3.2.3 on page 15 for wiring information.

3.2.2 Installation Using a Power Cord

DANGER
Use of power cords is not permitted in hazardous locations.

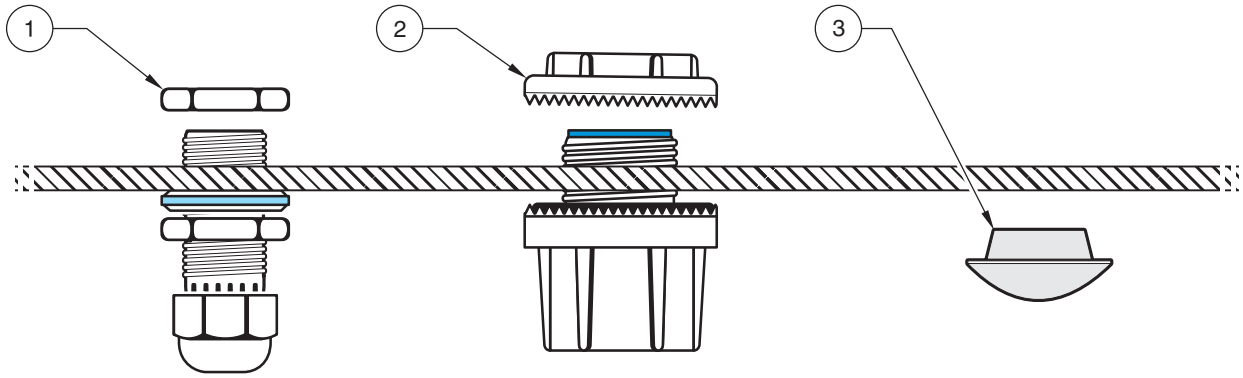
Where permitted by local electrical codes, a sealing-type strain relief to maintain the NEMA 4X/IP66 environmental rating and a power cord less than 3 meters (10 feet) in length with three 18-gauge conductors (including a safety ground wire) can be used, see Replacement Parts and Accessories on page 55. See Figure 13 on page 15 for strain relief and conduit opening sealing plug assembly. See section 3.2.3 on page 15 for wiring information.

Figure 12 Removing Voltage Barrier



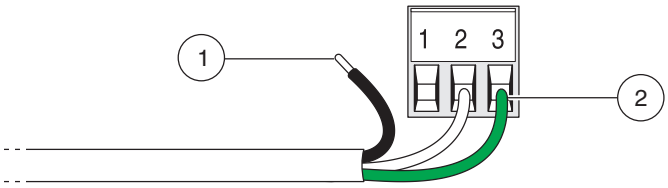
1. High voltage barrier	**2.** Unsnap the barrier latch then pull out to remove the barrier.

Figure 13 Using the Optional Strain Relief and Conduit Plug



1. Power cord strain relief	**2.** Conduit strain relief	**3.** Conduit opening sealing plug

Figure 14 Proper Wire Preparation and Insertion



1. Strip ¼-inch of insulation.	**2.** Seat insulation against connector with no bare wire exposed.

3.2.3 Wiring for Power at the Controller

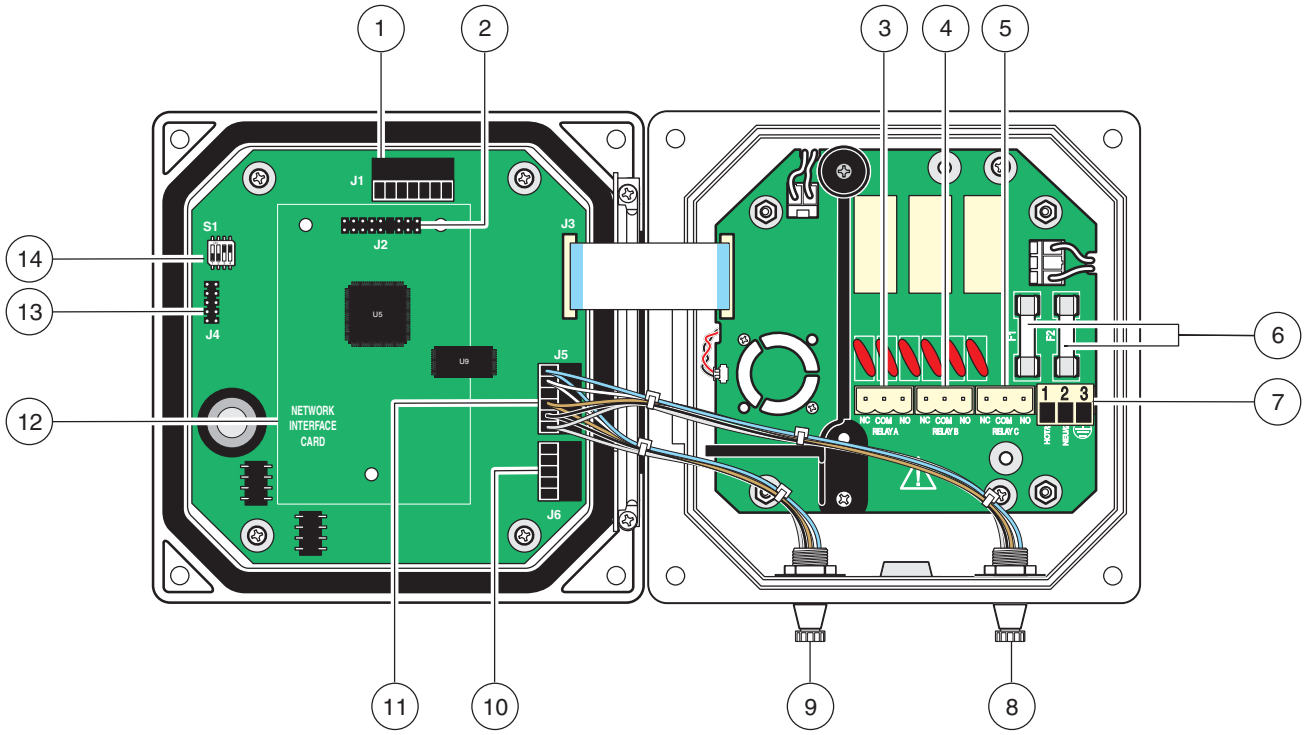
Wire the instrument for line power by hard-wiring in conduit or by wiring to a power cord if local code allows. Regardless of the type of wire used, the connections are made at the same terminal. A local disconnect designed to meet local electrical code is required and must be identified for all types of installation. See Figure 16 and Figure 17 on page 17 for suggested local disconnect configurations.

1. Obtain appropriate fittings with NEMA 4X/IP66 environmental rating.
2. Loosen the screws using a phillips-head screwdriver and open the hinged controller cover.
3. Remove the high-voltage barrier (see Figure 12 on page 14).
4. Insert the wires through the strain relief fitting or conduit hub located in the right-rear access hole in the bottom of the enclosure. Tighten the strain relief if used, to secure the cord.
5. Properly prepare each wire (Figure 14) and insert each wire into the terminal according to Table 4. Tug gently after each insertion to ensure the connection is secure.
6. Seal any unused openings in the controller box with conduit opening sealing plugs, see Replacement Parts and Accessories on page 55.
7. Reinstall the high-voltage barrier and latch to secure.

Table 4 Power Wiring Information

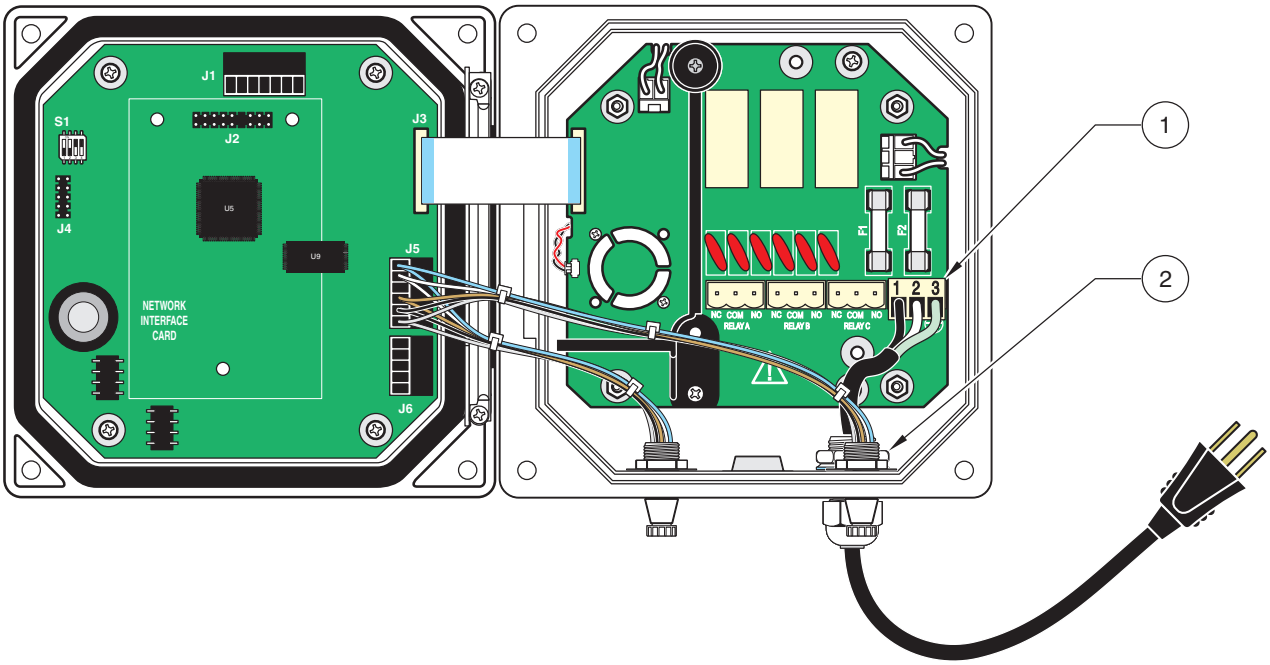
Terminal Number	Terminal Description	Wire Color Code for North America	Wire Color Code for Europe
1	Hot (L1)	Black	Brown
2	Neutral (N)	White	Blue
3	Protective Earth (PE)	Green	Green w/yellow tracer

Figure 15 Wiring Connections



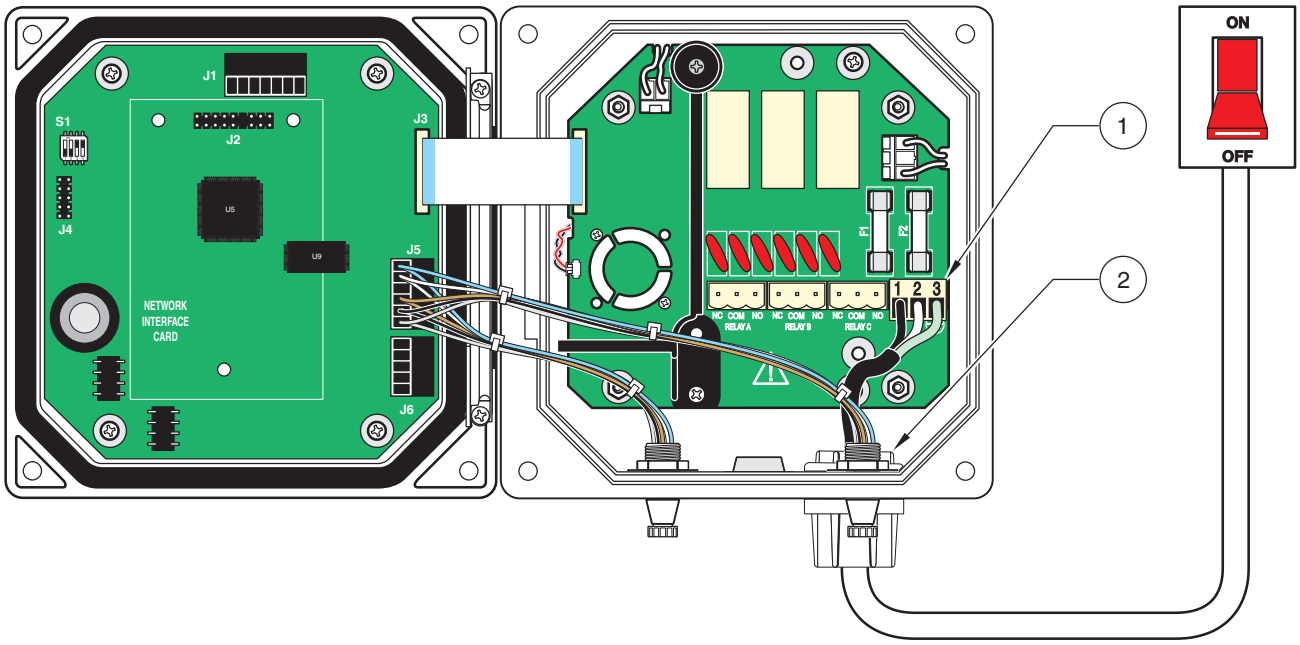
1. J1—Network connector	**8.** Sensor connector
2. J2—Header for optional network interface card	**9.** Sensor connector
3. J5—Relay A connector	**10.** J6—Analog output (4–20 mA) connector
4. J6—Relay B connector	**11.** J5—Sensor connector for hard-wiring
5. J7—Relay C connector	**12.** Position for network interface card
6. Fuses (F1, F2)	**13.** Service port
7. J8—ac Power connections	**14.** Sensor terminator selector/service port configuration

Figure 16 Local Disconnect for Power Cord



1. Power terminal	**2.** Power cord strain relief

Figure 17 Local Disconnect for Hard-wired Line Power



1. Power terminal	**2.** Conduit strain relief

3.3 Alarms and Relays

The controller is equipped with three unpowered relays rated 100–230 V ac, 50/60 Hz, 5 amp resistive maximum.

3.3.1 Connecting the Relays

The relay connector accepts 18–12 AWG wire (as determined by load application). Wire gauge less than 18 AWG is not recommended.

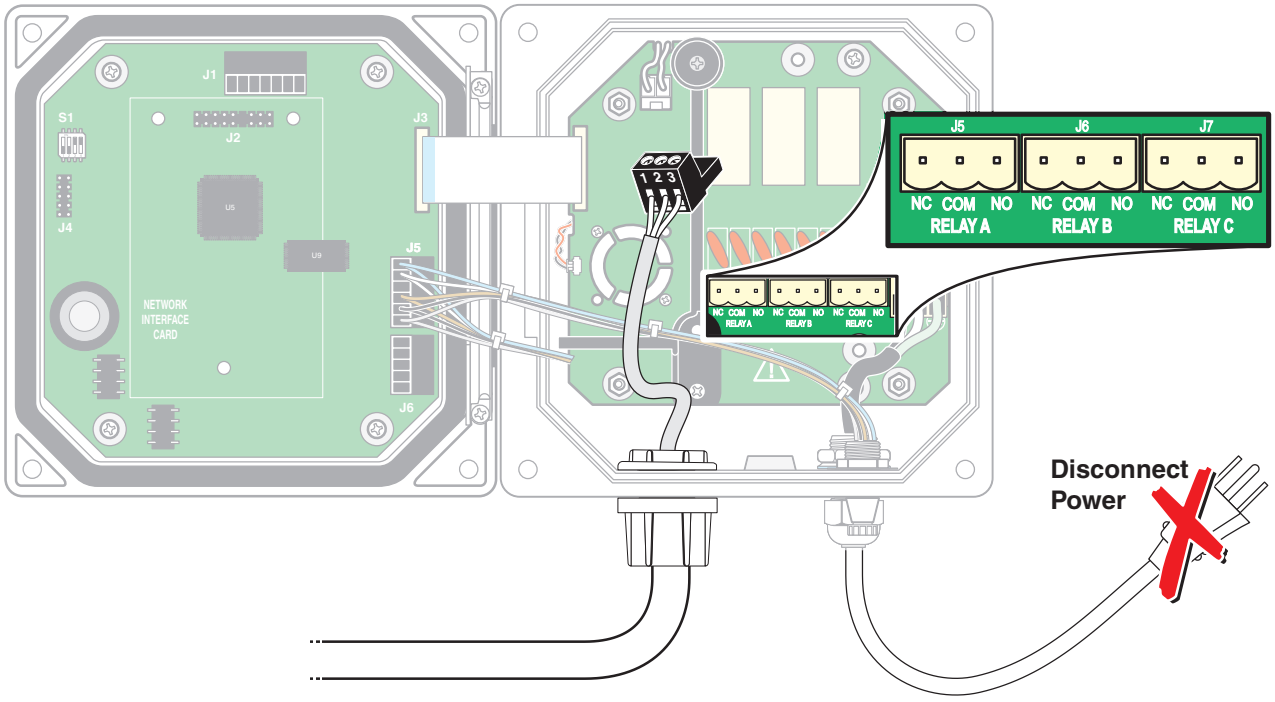
Danger: Relay loads must be resistive. User must externally limit current to the relays to 5 Amps by use of a fuse or breaker.

The controller contains three relays designed for use with high voltage (greater than 30V-RMS and 42.2V-PEAK or 60 V dc). Refer to Figure 18 for connection information. The wiring is not designed for low voltage connections. Relay must not be powered from the same wiring used to power the controller. See section 4.6 on page 34 for relay setup details.

Danger: ac power terminals are designed for single wires. Do not use more than one wire in each terminal.

The Normally Open (NO) and Common (COM) relay contacts will be connected when an alarm or other condition is active. The Normally Closed (NC) and Common relay contacts will be connected when an alarm or other condition is inactive or when power is removed from the controller.

Figure 18 Alarm and Relay Connections



3.3.2 Connecting the Analog Outputs

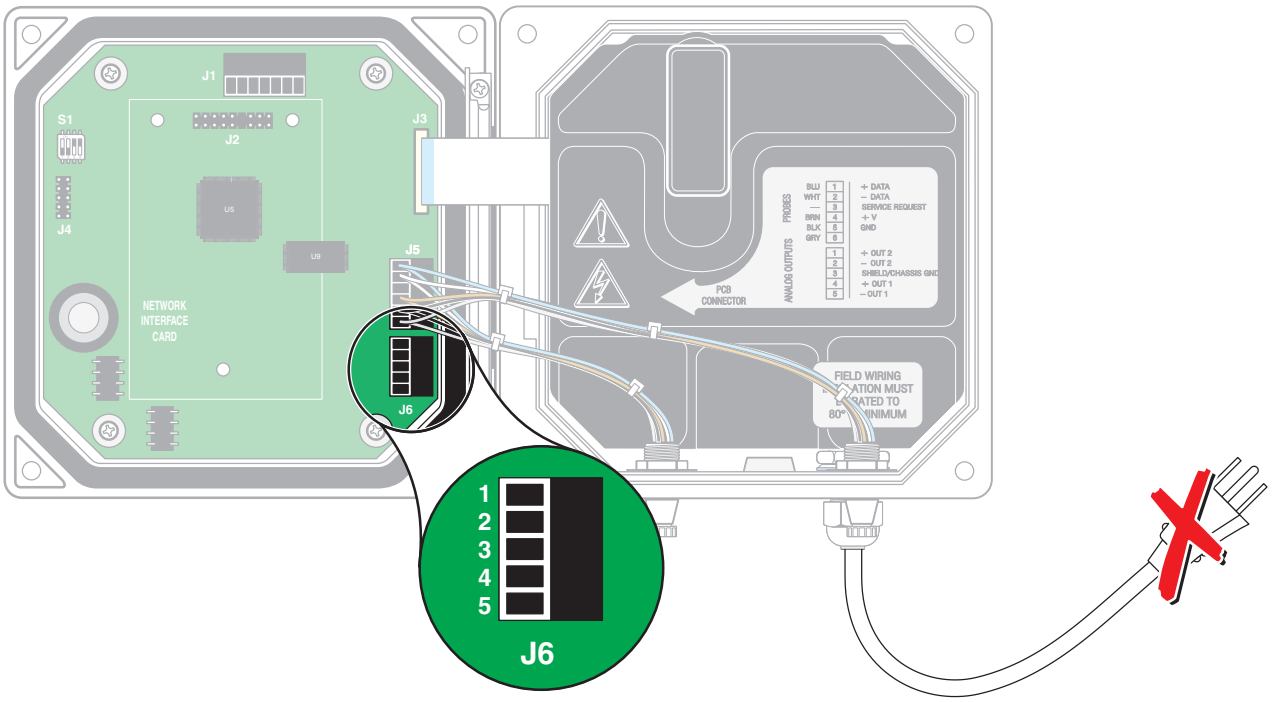
Two isolated analog outputs (1 and 2) are provided, see Figure 19. Each output can be set to 0–20 or 4–20 mA, and can be assigned to represent the measured parameter or secondary measurement such as temperature. Make connections with twisted-pair shielded wire and connect the shield at the controlled component end or at the control loop end. Do not connect the shield at both ends of the cable. Use of non-shielded cable may result in radio frequency emission or susceptibility levels higher than allowed. Maximum loop resistance is 500 ohm. Refer to section 4.5 on page 32 for output software setup.

Make wiring connections at the analyzer end as shown in Figure 19.

Table 5 Output Connections at Terminal Block J6

Recorder Wires	Circuit Board Position
Output 2 +	1
Output 2 –	2
Shield	3
Output 1 +	4
Output 1 –	5

Figure 19 Analog Output Connections



3.4 Connecting/Wiring the Sensor Cable

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller, see Figure 20. Retain the connector cap to seal the connector opening in case the sensor must be removed.

The 1720E sensor cable may be extended by a maximum of 7.62 m (25 ft), see Replacement Parts and Accessories on page 55.

Modify the controller for sensor hard-wiring as follows:

1. Remove all power to the controller.
2. Open the controller cover.

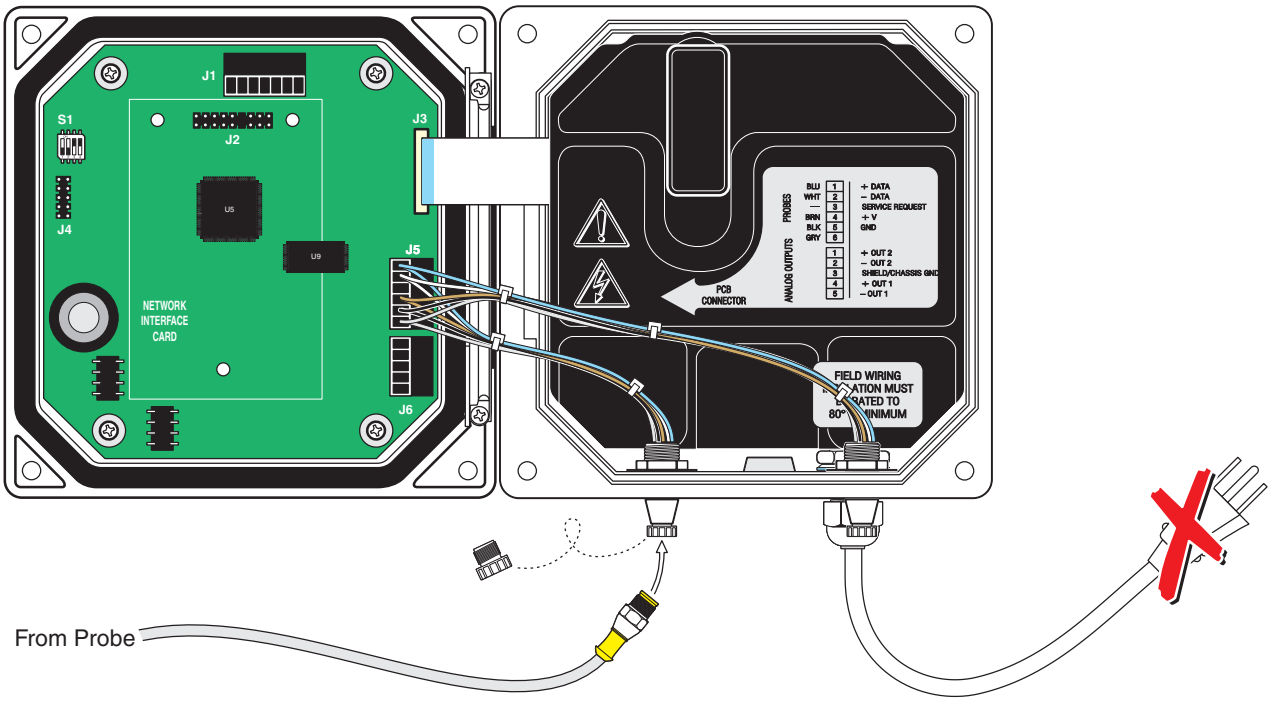
3. Disconnect and remove the existing wires between the quick connect and terminal block J5, see Figure 21 on page 21.

4. Remove the quick connect fitting and wires and install the threaded plug on the opening to maintain the environmental rating.

Table 6 Wiring the Sensor at Terminal Block J5

Terminal Number	Terminal Designation	Wire Color
1	Data (+)	Blue
2	Data (–)	White
3	Service Request	No Connection
4	+12 V dc	Brown
5	Circuit Common	Black
6	Shield	Shield (grey wire in existing quick disconnect fitting)

Figure 20 Attaching the Sensor using the Quick-connect Fitting



5. Cut the connector from the sensor cable.

6. Reinstall the plug on the sensor access opening to maintain the environmental rating.

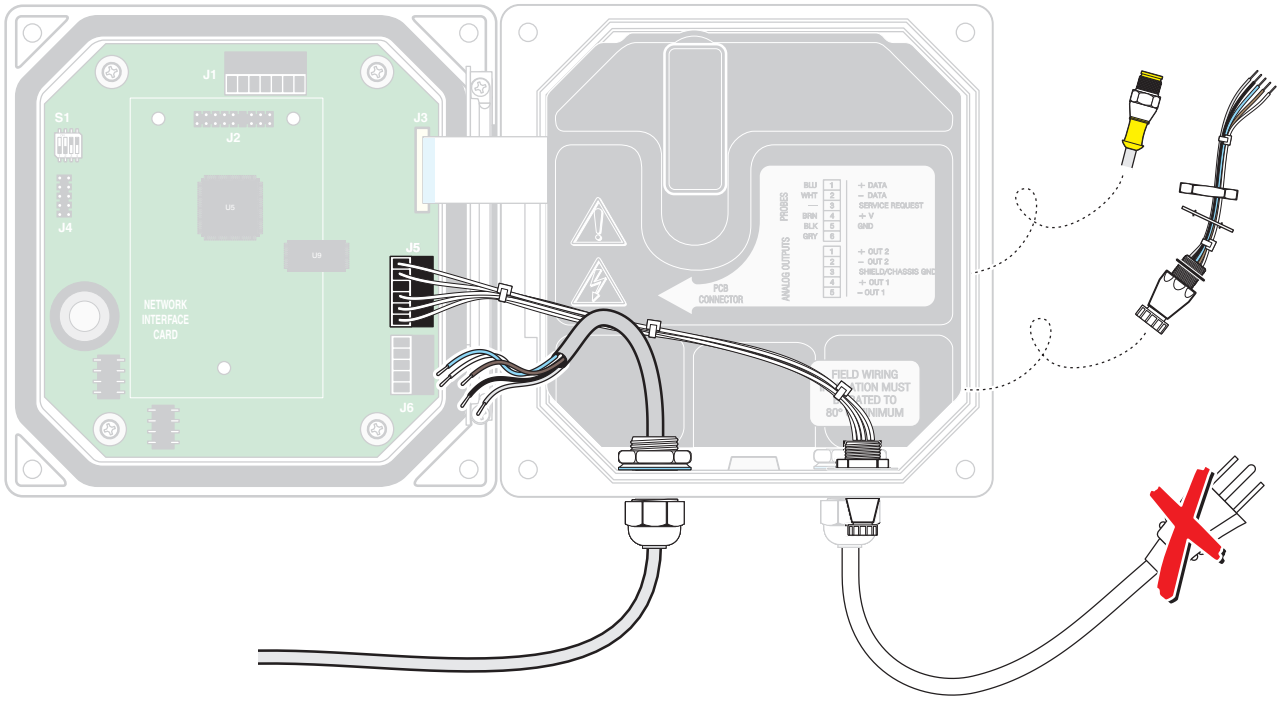
7. Strip the insulation on the cable back 1-inch. Strip ¼-inch of each individual wire end.

8. Wire as shown in Table 6.

9. Pass the cable through conduit and a conduit hub or a strain relief fitting and an available access hole in the controller enclosure. Tighten the fitting.

10. Close and secure the cover.

Figure 21 Hard-wiring the Sensor



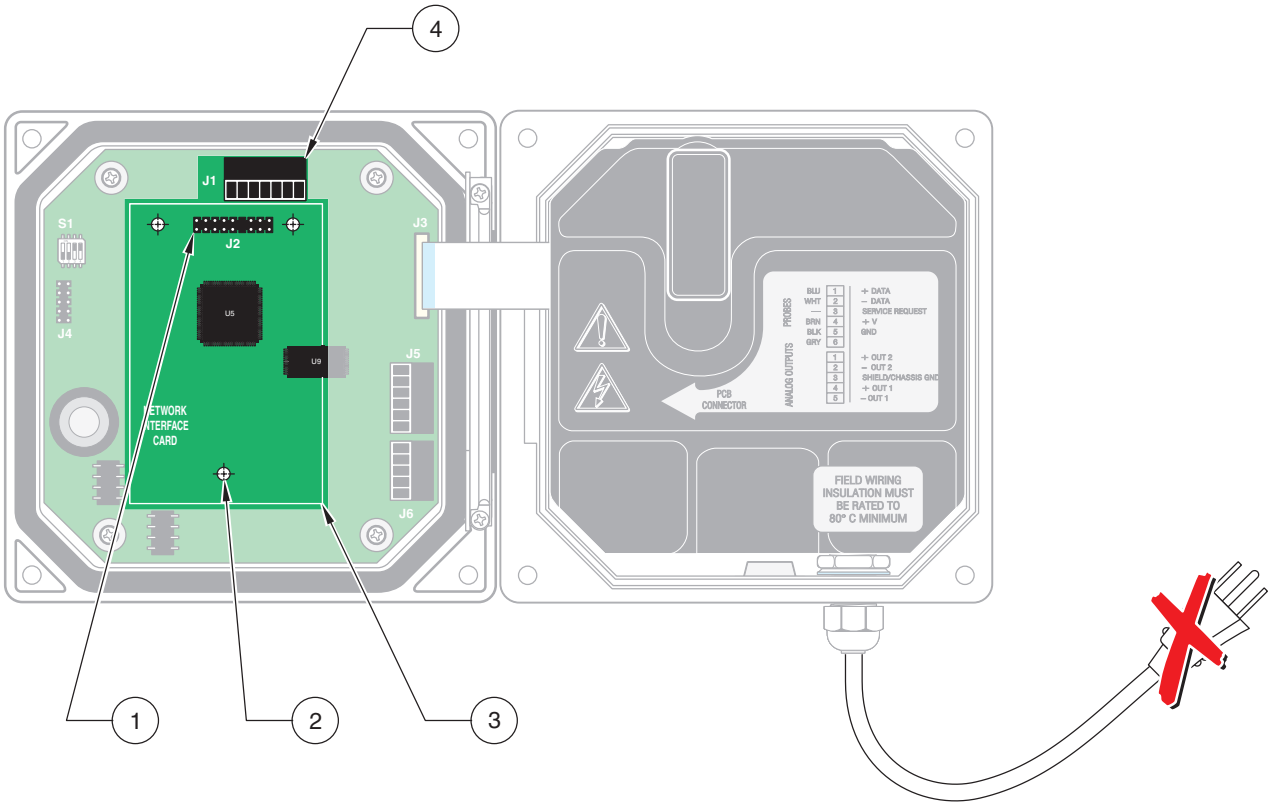
3.5 Connecting the Optional Digital Output

At this time, the manufacturer supports ModBUS RS485 and ModBUS RS232 communication protocols. The optional digital output card is installed in the location indicated in Figure 22 on page 22. Terminal block J1 provides user connection to the optional network card. The terminal connection is based on the selected network card. Refer to the instructions supplied with the network card for more details.

Table 7 Network Connections at Terminal Block J1

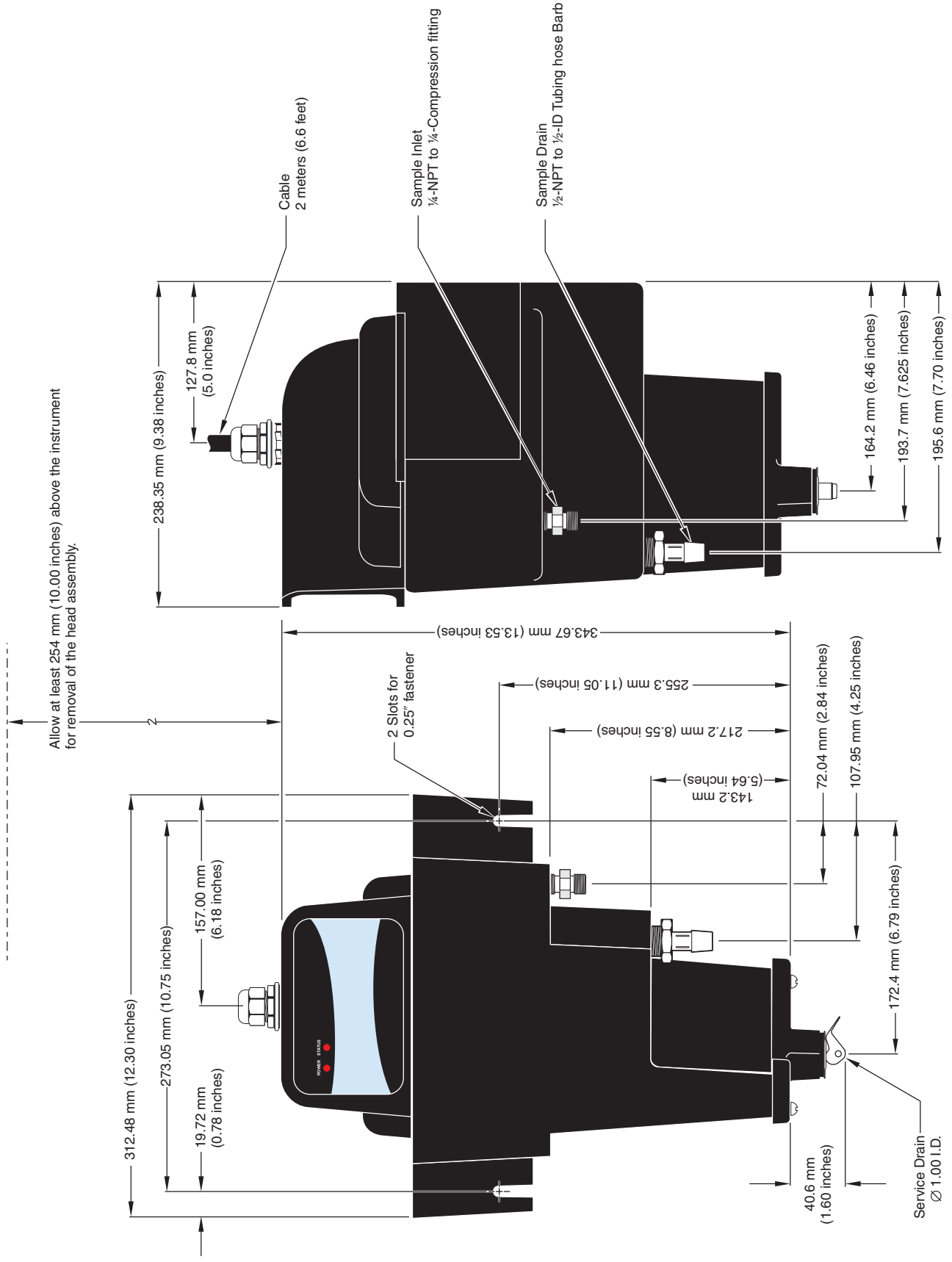
Terminal Number	ModBUS RS485	ModBUS RS232
1	In +	—
2	In –	—
3	Out +	—
4	Out –	—
5	Common	Common
6	No connection	No connection
7	Shield	Shield

Figure 22 Network Card Position in the Controller



1. J2—Network card header	**2.** Mounting hole (3)	**3.** Network card placement	**4.** J1 Terminal

Figure 23 1720E Dimensions



3.6 Turbidimeter Installation Information

The turbidimeter body is designed for wall-mounting (although it may be mounted on the optional floor stand). The turbidimeter sensor must be mounted within six feet of the controller unless an extension cable is used. Maximum cable length is 9.6 m (31 feet).

3.6.1 Mounting the Turbidimeter Body

Locate the turbidimeter as close to the sampling point as possible. A shorter distance for the sample to travel results in a faster response time.

Clean the turbidimeter body and bubble trap before installation using the instructions supplied in section 6.4.3, Cleaning the Turbidimeter Body and Bubble Trap on page 48. Slotted mounting brackets are integral parts of the turbidimeter body. Install customer-supplied hardware appropriate for the installation environment using the criteria detailed below:

- Install in a location that is isolated from vibration.
- Allow at least 22 cm (approximately 10 inches) clearance for removal of the head assembly and bubble trap cover from the top of the turbidimeter body.
- Leave enough room below the turbidimeter body to remove the bottom plug and to place a container under the drain when calibrating or cleaning.

Note: *Make sure the top of the turbidimeter body is level.*

- Install two ¼-20 bolts 10-3/4 inches apart (on center). Leave at least ¼-inch of the bolt head exposed.
- Make sure the bolts are installed level.

Slide the slotted mounting brackets of the turbidimeter body onto the bolts.

3.6.2 Installing the Head Assembly

After the turbidimeter body has been mounted, install the bubble trap cover, then place the head assembly on the turbidimeter body with the label facing the front. Move the head assembly back and forth slightly to ensure it is properly seated on the body of the instrument. Failure to properly seat the head will result in light leakage and erroneous readings.

The rear portion of the head assembly has a molded “lip” which may be used to hang the head assembly on the turbidimeter body edge for routine maintenance.

3.7 Installing a Sample Line

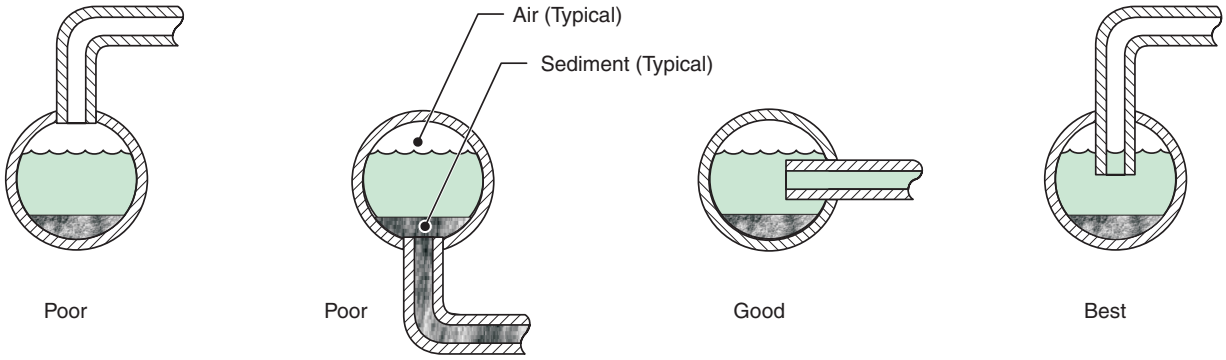
DANGER
This turbidimeter is not designed for use in hazardous locations or with samples that are flammable or explosive in nature. If any sample solution other than water is used in this product, test the sample/product compatibility to ensure user safety and proper product performance.

One-fourth inch O.D. rigid or semi-rigid tubing is recommended for sample lines. Run them as directly as possible between the turbidimeter body and the sampling point to minimize sample flow lag time.

Install sample line taps into larger process pipes to minimize interference from air bubbles or pipeline bottom sediment. A tap projecting into the center of the pipe is ideal. Figure 24 shows examples of sample tap installations.

Note: *When setting the flow rate, take care to avoid sweeping air “micro-bubbles” through the internal bubble trap. Observe the sample flow inside the turbidimeter body. If small air bubbles can be seen flowing up through the center, reduce the flow rate.*

Figure 24 Sampling Techniques



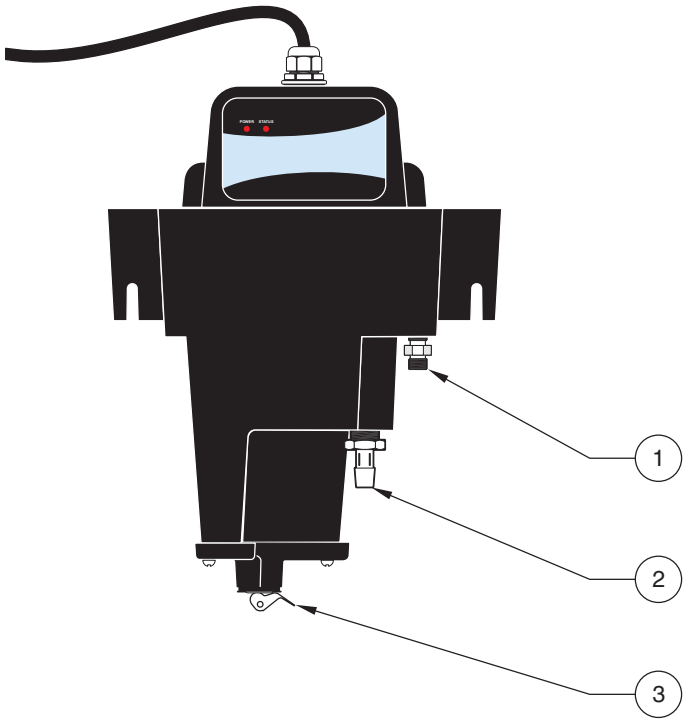
3.8 Sample Connections

Sample inlet and drain connections are made on the turbidimeter body. The sample inlet fitting installed in the body is a ¼-inch NPT x ¼-inch compression fitting. One additional fitting supplied with the instrument is a ½-inch NPT-to-hose fitting for use with ½-inch ID flexible plastic tubing on the drain.

Note: *For samples with high solids content (high turbidity), operate at the highest flow rate possible. For samples with low solids content (low expected turbidity), operate at a low flow rate (200–300 mL/min).*

The required flow rate is 200 to 750 mL/minute (4.0 to 11.9 gal/hour). Flow rate into the turbidimeter may be controlled with a flow restriction device on the inlet line. Flow rates below 200 mL/min will reduce response time and cause inaccurate readings. Flow rates above 750 mL/min will cause the turbidimeter to overflow, indicating the flow rate is too high.

Figure 25 Sample Connections

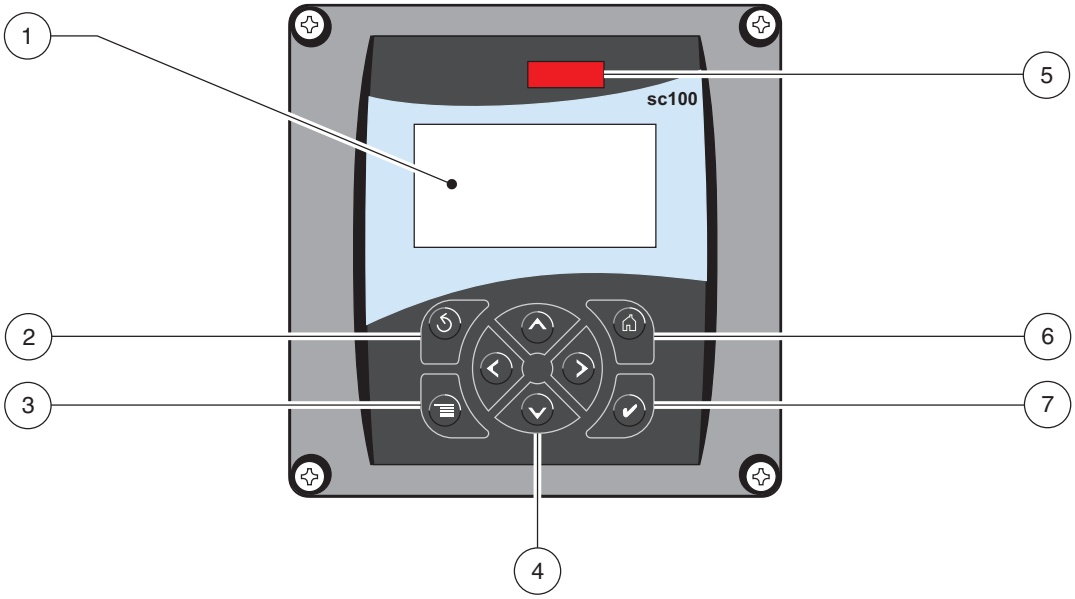


1. Sample Inlet, ¼-28 NPT x ¼-inch Compression fitting	**2.** Drain, ½-inch NPT fitting	**3.** Service Drain

4.1 Using the Keypad

The front of the controller is shown in Figure 26. The keypad consists of the eight keys described in Table 8.

Figure 26 Front of the Controller



1. Instrument Display	**4.** Right, Left, Up, and Down keys	**7.** Enter key
2. Back key	**5.** IrDA (Infrared Data Acquisition) window	
3. Menu key	**6.** Home key	

Table 8 Controller Key Functions/Features

Number	Key	Function
2	back	Move back one level in the menu structure.
3	menu	Move to the main menu from other menus. This key is not active in menus where a selection or other input must be made.
4		Navigate through the menus, change settings, and increment and decrement digits.
5	home	Move to the Main Measurement screen from any other screen. This key is not active in menus where a selection or other input must be made.
6	enter	Accept an input value, updates, or accepts displayed menu options.

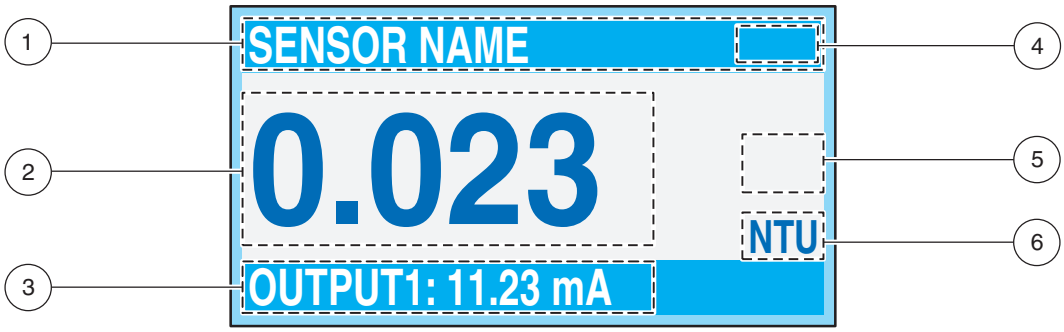
4.2 Controller Display Features

When the controller is in measurement mode, measurements for each connected sensor are displayed.

The display will flash on startup, when the hold outputs function has been activated, and when the filter function (signal average) is changed to a different value.

An active system warning will cause the warning icon (a triangle with an exclamation point inside) to be displayed on the right side of the display.

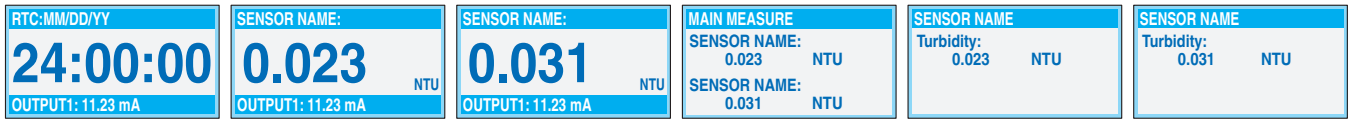
Figure 27 Display



1.	Status bar. Indicates the sensor name and status of relays. The relay letter is displayed when the relay is energized.	**4.**	Energized relay indicator
2.	Main measurement	**5.**	Warning icon area
3.	Secondary measurement/output information	**6.**	Measurement units

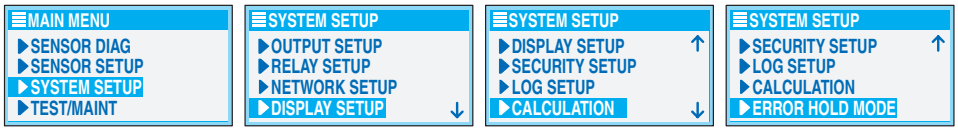
4.2.1 Important Key Presses

- Press the **HOME** key then the **RIGHT** or **LEFT** key to display two readings when two sensors are connected. Continue to press the **RIGHT** or **LEFT** key to toggle through the available display options as shown below.



- Press the **UP** and **DOWN** keys to toggle the status bar at the bottom of the measurement display to display the output information.

- In Menu mode, an arrow may appear on the right side of the display to indicate that more items are available. Press the **UP** or **DOWN** key (corresponding to the arrow direction) to display additional menus.



4.3 Instrument Setup

4.3.1 Software Text Abbreviation Conventions

Abbreviation	Meaning	Abbreviation	Meaning
Adj	Adjust	P/F	Pass/Fail
Cal	Calibration	Pass	Password
Cont.	Continue	Preped	Prepared
Cyl	Cylinder	SN	Serial Number
Dflt	Default	Std	Standard
Diag	Diagnostic	Temp	Temperature
Int	Internal	Ver	Verification
Meas.	Measurement	Xfer	Transfer

4.3.2 Adjusting Display Contrast

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	DISPLAY SETUP	enter
4	—	ADJ CONTRAST	enter
5	⌃ ⌄	(+0–50)	enter
6	menu home	MAIN MENU or Main Measurement Screen	—

4.3.3 Specifying the Displayed Language

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	DISPLAY SETUP	enter
4	⌄	LANGUAGE	enter
5	⌃ ⌄	select language	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.3.4 Setting the Time and Date

4.3.4.1 Setting the Time

Note: *The time is available only in 24-hour (military) format.*

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	DISPLAY SETUP	enter
4	⌄	SET DATE/TIME	enter
5	⌄	highlight TIME	enter
6	‹ ›	select character to edit	enter
	⌃ ⌄	choose appropriate number	
7	menu home	Main Menu or Main Measurement Screen	—

4.3.4.2 Setting the Date Format and Date

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		DISPLAY SETUP	
4		SET DATE/TIME	
5	—	highlight DATE FORMAT	
6		choose appropriate date format	
7		Highlight DATE	
8		select character to edit	—
		choose appropriate number	
9		Main Menu or Main Measurement Screen	—

4.4 Changing the Sensor Name

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SENSOR SETUP	
3		highlight sensor of interest if more than one sensor is attached	
4		CONFIGURE	
5		EDIT NAME	
6		select character to edit	—
		choose appropriate alpha/numeric digit	
7		Main Menu or Main Measurement Screen	—

4.4.1 Setting Up System Security

The sc100 has a passcode feature to restrict unauthorized access to Network Setup, Security Setup, Log Setup, and Test/Maint menus. In addition, the passcode also regulates function selection for relay options. The passcode is factory set to **sc100** (the five digits must be followed by a space to remove the trailing asterisk). The passcode may be changed, see section 4.4.1.1.

The following two options are available:

Disabled: All configuration settings and calibrations can be changed. This is the default setting.

Enabled: All configuration settings can be displayed but not changed. Network Setup, Security Setup, Log Setup, and Test/Maint menus cannot be accessed without the passcode.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	SECURITY SETUP	enter
4	—	SET PASSCODE	enter
5	⌄	highlight ENABLED	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.4.1.1 Editing the Passcode

If the passcode is enabled, it may be edited. The passcode can consist of up to six digits (alpha and/or numeric and available characters). If a passcode is forgotten, obtain the Master passcode from the Technical Consulting Services Department, see Technical and Customer Service (U.S.A. only) on page 57.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SYSTEM SETUP	enter
3	⌄	highlight SECURITY SETUP	enter
4	‹ ›	ENTER (current or default) PASSCODE	—
	⌄	EDIT PASSCODE	enter

Step	Select	Menu Level/Instructions	Confirm
5		Change the existing passcode	
6		Main Menu or Main Measurement Screen	—

4.5 Output Options

The controller provides two isolated analog outputs (Output 1 and Output 2). Customize the outputs using the table in section 4.5.1 on page 32.

4.5.1 Output Setup Menu (from System Setup)

1.	Select OUTPUT 1 or 2
SELECT SOURCE	
	Press **ENTER** to access a list of all connected sensors. Choose the sensor to associate with the output.
SET PARAMETER	
	Highlight the appropriate displayed parameter and press **ENTER.**
SET FUNCTION	
	Select LINEAR CONTROL for current output to track the measurement value. Select PID CONTROL for the sc100 to operate as a PID controller.
SET TRANSFER	
	Each analog output is normally active, responding to the measured value of its assigned parameter. However, during calibration, each output can be transferred to this preset transfer value. Default: 4mA; Range: 0–20
SET FILTER	
	Allows the user to average the analog outputs over time Default: 0; Range: 0–120 seconds
SCALE 0 mA/4 mA	
	Select 0 mA or 4 mA for minimum current (outputs will be set to 0–20 mA or 4–20 mA).
ACTIVATION	
	FUNCTION set to LINEAR CONTROL
	If LINEAR CONTROL was selected in SET FUNCTION, set the low and the high values for the current output here. Defaults: Low = 0; High = 100; Low Value Range: 0–100, High Value Range: 0–100.
	FUNCTION set to PID CONTROL
	If PID CONTROL was selected in SET FUNCTION, configure the PID Control as follows: **1.** Set MODE: AUTO or MANUAL. Manual output default: 100% **2.** Set PHASE: DIRECT or REVERSE controller operation. **3.** SET SETPOINT: enter the set point the PID control will control the process to. Default: 100; Range: 0–100 **4.** PROP BAND: control the proportional band for the PID control. Default: 5.00; Range: 0–1000 **5.** INTEGRAL: control the integral action time period in minutes. Range: 0–999 **6.** DERIVATIVE: control the settings for the rate control. Range: 0–999

4.5.2 Hold/Transfer Outputs

When cleaning or servicing the instrument, the analog outputs can be held at the last measured values. To hold the output until released:

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		TEST/MAINT	
		Enter Passcode if enabled	
3		HOLD OUTPUTS	
4	—	SET OUTMODE	
5		Select HOLD OUTPUTS or XFER OUTPUTS	
6		SET CHANNELS	
7		Select ALL or 1720E	
8		ACTIVATION	
9	—	LAUNCH	
10		Main Menu or Main Measurement Screen	reading will flash

During calibration, the analog outputs can remain active, be held, or be transferred to a preset mA value. When output hold or transfer is enabled during a calibration, the hold or transfer is automatically released when calibration is completed. See section 5.3, Sensor Calibration and Verification on page 40.

4.5.3 Release Outputs

Step	Select	Menu Level	Confirm
1		MAIN MENU	—
2		TEST/MAINT	
3		HOLD OUTPUTS	
4		ACTIVATION	

Step	Select	Menu Level	Confirm
5	—	RELEASE	
6		Main Menu or Main Measurement Screen	—

4.6 Relay Options

Step	Select	Menu Level	Confirm
1		MAIN MENU	—
2		SYSTEM SETUP	
3		RELAY SETUP	
4	—	Customize the options using the information in section 4.6.1	—

4.6.1 Relay Setup Menu (from System Setup)

1. Select Relay A, B, or C	
SELECT SOURCE	
	Choose from the available options (none, installed sensors, real time clock (RTC)).
SET PARAMETER	
	Choose from the available options.
SET FUNCTION	
	Source set to sensor
	Alarm: Operates relays in response to the measured parameter. Contains separate High and Low Alarm points, deadbands, and ON/OFF delay. Defaults: Low = 0.000 NTU, high = 100.00 NTU, low deadband = 5.000 NTU, high deadband = 5.000 NTU, on/off delays default to zero seconds; Range: 0–999 sec. **Feeder Control**: Operates in response to the measured parameter. Can be set for phasing, set point, deadband, overfeed timer, and ON/OFF delay. **Event Control**: Controls a cleaning system (or equivalent) on a timed basis. **Warning**: Activated when the analyzer detects a sensor warning.
	Source set to RTC
	Timer: Sets the timer for a cleaning system (or equivalent). Controls the output hold, interval, duration and off delay.
SET TRANSFER	
	Normally, each control or alarm relay is active, responding to the measured value of its assigned parameter. During calibration, however, the relay can be transferred to a preset on/off state to suit the application requirements. Select Energize or De-energize and press **ENTER**.

4.6.1 Relay Setup Menu (from System Setup) (continued)

ACTIVATION	
Function set to ALARM	
LOW ALARM	Sets the value where the relay will turn on in response to decreasing measured value. For example: if the low alarm is set for 1.0 and the measured value drops to 0.9, the relay will be activated. Range: 0.00–100 NTU
HIGH ALARM	Sets the value where the relay will turn on in response to increasing measured value. For example: if the high alarm is set for 4.0 and the measured value increases to 4.2, the relay will be activated. Range: 0.00–100 NTU
LOW DEADBAND	Sets the range where the relay remains on after the measured value increases above the low alarm value. Default is 20% of the range. For example: if the low alarm is set for 1.0 and the low deadband is set for 0.5, then the relay remains on between 1.5 and 1.0. Range: 0.00–100 NTU
HIGH DEADBAND	Sets the range where the relay remains on after the measured value decreases below the high alarm value. For example: if the high alarm is set for 4.0 and the high deadband is set for 0.5, then the relay remains on between 3.5 and 4.0. Range: 0.00–100 NTU
OFF DELAY	Sets a time to delay the relay from normally turning off. Off Delay Range: 0–999 seconds
ON DELAY	Sets a time to delay the relay from normally turning on. On Delay Range: 0–999 seconds
Function set to FEEDER CONTROL	
PHASE	“High” phase assigns the relay setpoint to respond to an increasing measured value; conversely, a “Low” phase assigns the relay setpoint to respond to a decreasing measured value.
SET SETPOINT	Sets the value where the relay will turn on. Default: 100 NTU; Range: 0–100
DEADBAND	Sets the range where the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay). Default: 5 NTU; Range: 0–100 NTU
OVERFEED TIMER	Sets the time to limit how long the relay can remain “on.” Default: 5 minutes; Range: 0–999 minutes
OFF DELAY	Sets a time to delay the relay from normally turning off. Default: 0 seconds; Range: 0–999 seconds
ON DELAY	Sets a time to delay the relay from normally turning on. Default: 0 seconds; Range: 0–999 seconds
Function set to EVENT CONTROL	
PHASE	“High” phase assigns the relay setpoint to respond to increasing measured value; conversely, a “Low” phase assigns the relay setpoint to respond to decreasing measured value.
SET SETPOINT	Sets the value where the relay will turn on. Default: 100; Range: 0–100
DEADBAND	Sets the range where the relay remains on after the measured value decreases below the setpoint value (high phase relay) or increases above the setpoint value (low phase relay). Default: 5 NTU; Range: 0–100 NTU,
OnMax TIMER	Sets the time to limit the time the relay can remain “on.” Default: 0 seconds; Range: 0–999 seconds
OffMax TIMER	Sets a time to delay the relay from normally turning off. Default: 0 seconds; Range: 0–999 seconds
OnMin TIMER	Sets the time to limit the time the relay can remain “on.” Default: 0 seconds; Range: 0–999 seconds
OffMin TIMER	Sets the time to limit the time the relay can remain “off.” Default: 0 seconds; Range: 0–999 seconds
Function set to TIMER CONTROL (RTC selected in SELECT SOURCE)	
HOLD OUTPUTS	Set OUTMODE to select output hold operation and select the channels that cause the outputs to be held.
INTERVAL	Set the off time for the relay. Default: 5 minutes; Range: 0–999 minutes
DURATION	Set the on time for the relay. Default: 30 seconds; Range: 0–999 seconds
OFF DELAY	Set the time for additional hold/output time after the relay has been turned off. Default: 1 second; Range: 0–999 seconds
Function set to WARNING CONTROL	
WARNING LEVEL	Set the warning level that will trigger a relay. Range: 0–32 (warnings assigned to 1-9 for 1720E). For example: Set the warning level to 0 to allow all warnings to trigger the relay; set the warning level to 5 to allow warnings 6 and above to trigger the relay. Set the warning level to 9 or greater to not trigger the relay on any warning. See Table 10 on page 52 for a full list of warnings.

4.7 Data and Event Logging Options

The sc100 provides two data logs (one for each sensor) and two event logs (one for each sensor). The data logs store the measurement data at selected intervals. The event log stores a variety of events that occur on the devices such as configuration changes, alarms, and warning conditions. The data logs are stored in a packed binary format and the event logs are stored in a CSV format. The logs can be downloaded through either the digital network port or the IrDA port using the file transfer program available from the manufacturer.

The default datalogging frequency is 15 minutes. If the datalogging frequency is set to 15 minute intervals, the instrument can continue to store data for approximately six months.

4.7.1 Data Logging Options

Sensor Data Log:

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2		SENSOR SETUP	enter
3		Highlight sensor of interest if more that one sensor is attached.	enter
4		CONFIGURE	enter
5		DATALOG INTERVAL (select from 30 sec., 1 min., 5 min., 10 min., 15 min.)	enter
6	menu home	Main Menu or Main Measurement Screen	—

4.8 Digital Network Options

The sc100 provides two digital communication methods with the controller (the digital network port and the IrDA port). Either of the digital ports can be used to access setup data, measurement data, or data/event logs. For the features available for each individual digital network port, refer to the instruction sheet supplied with the selected network card.

4.9 Menu Structure

4.9.1 Sensor Diagnostics Menu

SELECT SENSOR		
	ERROR LIST	Displays a list of errors that are present. See section 7.1 on page 52.
	WARNING LIST	Displays a list of warnings that are present. See section 7.2 on page 52.

4.9.2 Sensor Setup Menu

CALIBRATE		
SELECT SENSOR (if more than one sensor is attached)		
	USER PREPD CAL	Calibration using 4000 NTU stock solution diluted to 20.00 NTU formazin.
	STABLCAL CAL	Calibration using 20 NTU StablCal Stabilized Formazin Standard
	VERIFICATION	Perform a verification, set the pass/fail criteria, and view the verification history.
	0 ELECTRONICS	Zero electronics
	SET DFLT GAIN	Return instrument to default calibration.
	CAL HISTORY	View the last 12 entered calibrations. Press the ENTER key to move to the next history entry. See section 5.5 on page 46 for more information.
CONFIGURE		
	BUBBLE REJECT	Choose Yes or No to enable/disable bubble reject. Default: Yes
	SIGNAL AVG	Choose no averaging or specify the amount of time for signal averaging. Available options are: no averaging, 6 sec., 30 sec., 60 sec., or 90 sec. Default is 30 seconds.
	MEAS UNITS	Select the appropriate measurement units to display. Choose from mg/L, NTU, TE/F, and FTU. Default: NTU
	EDIT NAME	Enter up to a 12-digit name in any combination of symbols and alpha or numeric characters. Press **ENTER** when the entry is complete. The name will be displayed on the status line above the measurement value on the main display.
	SET RESOLUTION	Set the number of significant digits to display. Default is three significant digits.
	DATALOG INTRVL	Choose the amount of time between saving data points to the data log. Default: 15 min.; Options: 30 sec., 1 minute, 5 minutes, 10 minutes, or 15 minutes.
DIAG/TEST		
	SOFTWARE VERS.	Displays the software version number.
	DRIVER VERS	Displays the software driver version number.
	SERIAL NUMBER	Displays the serial number of the sensor.
	INT TEMP	Displays the internal temperature of the sensor electronics in °C.
	DEFAULT SETUP	Restores the sensor's factory default settings and invalidates the current calibration.
	POWER CHECK	Displays the electrical statistics for the sensor.
	CAL VALUE	Displays the gain and zero electronics values for the current calibration.

4.9.3 System Setup Menu

OUTPUT SETUP (see section 4.5 on page 32 for expanded menu information)		
SELECT OUTPUT 1 or 2		
	SELECT SOURCE	Press **ENTER** to access a list of all connected sensors and select the sensor that will drive the output.
	SET PARAMETER	Press **ENTER** to select from the displayed parameters.
	SET FUNCTION	Select LINEAR CONTROL for current output to track the measurement valve. Select PID CONTROL for the sc100 to operate as a PID controller.
	SET TRANSFER	Each analog output is normally active, responding to the measured value of its assigned parameter. However, during calibration, each output can be transferred to this preset transfer value.
	SET FILTER	Average measurements over time (0–120 seconds). Default: 0 seconds.
	SCALE 0 mA/4 mA	Select 0 mA or 4 mA for minimum current (outputs will be set to 0–20 mA or 4–20 mA).
	ACTIVATION	Dependent on Function selected previously. See section 4.5 on page 32 for additional information.

4.9.3 System Setup Menu (continued)

RELAY SETUP (See section 4.6 on page 34 for expanded menu information.)		
SELECT RELAY A, B, or C		
	SELECT SOURCE	Select from none, any connected sensor, or the real time clock (RTC).
	SET PARAMETER	Press **ENTER** to select from the displayed parameters.
	SET FUNCTION	Select from the available options to customize the relay functions. See section 4.6.1 on page 34 for additional details.
	SET TRANSFER	Sets the relay to Energize or De-energize (user-selectable).
	ACTIVATION	Activate the relays from this menu (dependent on Function selected).
NETWORK SETUP (this menu appears only if a network card is installed in the controller)		
	MODBUS ADDRESS	Highlight sc100 Analyzer, or either connected sensor then press **ENTER** to select. Choose a number between 1 and 247 as the address (each source must have a different address) then press **ENTER**.
	BAUD RATE	Select a baud rate of 9600, 19200, 38.4K, 57.6K, or 115.2K. Default: 19200
	STOP BITS	Select 1 or 2 stop bits. Default: 1
	MODBUS MODE	Select RTU or ASCII. Default: RTU
	DATA ORDER	Select NORMAL or SWAPPED.
DISPLAY SETUP		
	ADJ CONTRAST	Use the **UP** and **DOWN** keys to increase or decrease the contrast, see section 4.3.2 on page 28. Range = 0–50
	LANGUAGE	The default is English. Choose from the available options to allow all menus to appear in the selected language.
	SET DATE/TIME	Use this menu to select the date format and to set the date and time (24-hour (military) format), see section 4.3.4 on page 29.
SECURITY SETUP (Enter a 6-digit passcode)		
SET PASSCODE		
	ENABLE	Enables system security. See section 4.4.1 on page 31.
	DISABLE	Disables system security. See section 4.4.1 on page 31.
LOG SETUP (Not used for 1720E system. Enable datalogging from the sensor setup menu for 1720E)		
	DATALOG SETUP	Set up datalogging of data and events. See section 4.7.1 on page 36.
ERROR HOLD MODE		
	HOLD OUTPUTS	Holds outputs when unable to communicate with the sensor.
	XFER OUTPUTS	Goes to transfer state when unable to communicate with the sensor.

4.9.4 Test/Maint Menu

STATUS		
	Indicates the status of each relay and indicates which sensors are connected to the controller.	
OUTPUT CAL		
	SELECT OUTPUT 1 or 2	
		Calibrate Analog Output by specifying values to correspond to 4 mA and 20 mA.
HOLD OUTPUTS		
	SET OUTMODE	Choose Hold Outputs or Xfer Outputs.
	SET CHANNELS	Choose any individual attached sensor or all attached sensors to be held or transferred.
	ACTIVATION	Select Launch or Release.

4.9.4 Test/Maint Menu (continued)

OVERFEED RESET		
	Reset the overfeed time out.	
TEST OUTPUT		
	SELECT OUTPUT 1 or 2	
		User selectable mA value. 0–20 mA
TEST RELAY		
	SELECT RELAY A, B, or C	
		Energize or de-energize the selected relay.
RESET CONFIG		
		Reset to default configuration of the controller
SIMULATION		
	SELECT SOURCE, SET PARAMETER, SET SIM VALUE	
		Simulate sensor measurement values for testing the outputs and relays.
SCAN SENSORS		
	Manually scans for sensors to determine if sensors have been added or removed.	
MODBUS STATS		
	Indicates the communication statistics for use with an external network.	
CODE VERSION		
	Indicates the controller software version.	

Section 5 System Startup

5.1 General Operation

Plug the sensor into the unpowered controller by aligning the orientation tab on the cable connector with the channel in the controller connector. Push in and turn to secure the connection. Tug gently to check the connection.

After all plumbing and electrical connections have been completed and checked, place the head on the body and supply power to the system. Ensure the head is seated on the body when power is applied, since dark readings are measured at this time. If power is applied while the sensor head is off the turbidimeter body, cycle the power with the sensor head on the body.

The first time a controller is powered up, a language selection menu will appear. The user must select the correct language from the displayed options.
Use the **UP** and **DOWN** keys to highlight the appropriate language and press **ENTER** to select.

Following language selection and upon power-up, the controller will search for connected sensors. The display will show the main measurement screen. Press the **MENU** key to access the menus.

5.2 Starting Sample Flow

Start sample flow through the instrument by opening the sample supply valve. Allow the turbidimeter to run long enough for the tubing and body to become completely wetted and the reading on the display to stabilize. One to two hours or longer may be required initially for complete stabilization. Allow measurements to become stable through adequate conditioning before completing instrument settings or performing calibrations.

5.3 Sensor Calibration and Verification

The manufacturer offers two EPA-approved calibration methods one using user-prepared formazin and the other using StablCal® stabilized formazin. Two verification methods (wet and dry) are also offered.

The 1720E Turbidimeter is factory-calibrated using StablCal® Stabilized Formazin before shipment. The instrument must be recalibrated before use to meet published accuracy specifications. In addition, recalibration is recommended after any significant maintenance or repair and at least once every three months during normal operation. **The turbidimeter body and bubble trap must be thoroughly cleaned and rinsed before initial use and prior to each calibration.**

Tips to achieve the most accurate calibrations:

- Optimum performance is achieved when calibration is performed in the turbidimeter body. Accurately prepare the standard then add it to the turbidimeter body at the appropriate step in the procedure. Do not prepare the standard in the body.
- Stop sample flow, drain, and clean the turbidimeter body before beginning the calibration procedure.
- Always clean the photocell window per the instructions in section 6.4.2 on page 48. Rinse the photocell with deionized water and dry with a soft, lint-free cloth before calibrating.

- Always clean the turbidimeter body or calibration cylinder per the instructions in section 6.4.3 on page 48. Rinse with deionized water before calibrating.
- Store the calibration cylinder upside-down to minimize contamination between calibrations.
- Pour the calibration standard into the turbidimeter body at the inflow end (left side when facing the instrument).
- Gently invert StablCal standards for 1 minute before opening. Do not shake. This ensures a consistent turbidity of the standard.
- If the 20.0 NTU StablCal standard is allowed to sit in the calibration cylinder or turbidimeter body for more than 15 minutes, it must be remixed (gently swirled in the calibration cylinder) before use to ensure a consistent turbidity.
- Discard all standards after use per the instructions on the container. Never transfer the standard back into its original container. Contamination will result.
- Always recalibrate after restoring default settings.

5.3.1 User-prepared Calibration

Before starting the calibration, read and apply the tips in section 5.3.

Follow the procedure as written (using 1 L of deionized water and 5.0 mL of 4000 NTU formazin) **if using a calibration cylinder** for calibration.

If using the turbidimeter body for the user-prepared calibration follow the procedure below using 20 NTU formazin in step 6c. Prepare the standard as follows**:**

1. Stop the sample flow, then drain and clean the body.
2. Prepare a 20 NTU standard by adding 5.0 mL of 4000 NTU formazin to a 1-L flask. Dilute to the mark with deionized water and invert gently to mix.
3. Drain the deionized water and pour the prepared 20 NTU standard into the turbidimeter body at step 6c. Do not add additional 4000 NTU formazin.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	⌄	SELECT SENSOR (if more than one sensor is connected)	enter
4	⌄	CALIBRATE	enter
5	—	USER PREPD CAL	enter

Step	Select	Menu Level/Instructions	Confirm
6		OUTPUT MODE Select ACTIVE, HOLD, or TRANSFER	
	a	Stop sample flow. Drain body and clean the body and bubble trap. FILL CYL WITH 1 L DI WATER. REPLACE HEAD.	
	b	Measured reading (based on a gain of 1.0) displayed	
	c	(Remove head) ADD 5 ML OF 4000 NTU FORMAZIN INTO CAL CYLINDER.	
	d	Measured reading (based on a gain of 1.0) displayed	
	e	GOOD CAL! GAIN: X.XX ENTER TO CONT	 (to store)
	f	Verify CAL? (see Note below)	 to verify  exit no verify
7		Select VERIFICATION type (begin at step 7 in section 5.4.1 on page 44 or section 5.4.2 on page 45) or enter initials to complete calibration.	
8	—	RETURN SENSOR TO MEASURE MODE	
9		Main Menu or Main Measurement Screen	—

Note: *If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal labeled value associated with the dry verification device.*

5.3.2 Calibration with StablCal®

Before starting the calibration, read and apply the tips in section 5.3 on page 40.

Step	Select	Menu Level/Instructions	Confirm
1		MAIN MENU	—
2		SENSOR SETUP	

Step	Select	Menu Level/Instructions	Confirm
3	—	CALIBRATE	enter
4		STABLCAL CAL	enter
5		OUTPUT MODE Select ACTIVE, HOLD, or TRANSFER	enter
6	**a**	Drain/clean/rinse the turbidimeter body or cal cylinder. POUR 20 NTU STD INTO CYL/BODY. REPLACE HEAD	enter
	b	Measured reading and reading based on 1.0 gain displayed	enter
	c	GOOD CAL! GAIN: X.XX ENTER TO CONT	enter (to store)
	d	Verify CAL? (see Note below)	enter to verify/ back exit no verify
	e	Select VERIFICATION type (begin at step 7 in section 5.4.1 on page 44 or section 5.4.2 on page 45) or enter initials to complete calibration.}	enter
7	—	RETURN SENSOR TO MEASURE MODE	enter
8		Main Menu or Main Measurement Screen	—

Note: *If a dry verification is performed directly after a calibration, the measured value is assigned as the expected value for future verifications (when using the dry verification device with the same serial number). As long as the verification exists within the verification history, the expected value will be retained. Otherwise, the expected value will be the nominal value associated with the dry verification device.*

5.4 Instrument Verification

Instrument verification is intended as a simple check to ensure turbidimeter functionality between calibrations. A verification is initially performed directly after a calibration and subsequent independent verifications are referenced to the initial verification. The pass/fail criteria is set and subsequent verifications are deemed good or bad, when compared to the initial verification. All verifications are based on the current calibration and must be repeated when the instrument is recalibrated or when the pass/fail criteria is not met.

Two types of verifications are offered. The dry verification is performed using a “dry” calibration device such as the ICEPIC™. A wet verification is performed using a standard with a predetermined value such as StablCal® Stabilized Formazin or a user-prepared standard with a value that has been verified on an independent device such as a laboratory turbidimeter.

5.4.1 Dry Verification

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	⌄	CALIBRATE	enter
4	⌄	VERIFICATION	enter
5	—	PERFORM VER	enter
6	⌃ ⌄	OUTPUT MODE Choose ACTIVE, HOLD, or TRANSFER	enter
7	—	VER TYPE Select DRY	enter
8	⌃ ⌄	DRY VERIFY select 1 NTU STD or 20 NTU STD or verify SN of previously used calibration device	enter
		Set Head on Standard	enter
		Reading Displayed	enter (to accept)
		GOOD VER!	enter (to store)
9	⌃ ⌄	ENTER INITIALS (user input)	enter
10	—	RETURN SENSOR TO MEASURE MODE	enter
11	menu home	MAIN MENU or Main Measurement Screen	—

5.4.2 Wet Verification

Before starting the verification, read and apply the appropriate tips in section 5.3 on page 40.

Step	Select	Menu Level/Instructions	Confirm
1	menu	MAIN MENU	—
2	⌄	SENSOR SETUP	enter
3	—	CALIBRATE	enter
4	⌄	VERIFICATION	enter
5	—	PERFORM VER	enter
6	⌃ ⌄	OUTPUT MODE Choose ACTIVE, HOLD, TRANSFER	enter
7	⌄	Select VER TYPE Select WET	enter
8	⌃ ⌄	Enter Std Turbidity	enter
	a.	DRAIN AND CLEAN SENSOR BODY. ENTER TO CONT	enter
	b.	POUR STANDARD INTO CYL/BODY. PLACE HEAD ON. ENTER TO CONT	enter
	c.	Reading Displayed	enter (to accept)
	d.	GOOD VER!	enter
9	⌃ ⌄	ENTER INITIALS	enter
10	⌃ ⌄	RETURN SENSOR TO MEASURE MODE	enter
11	menu home	Main Menu or Main Measurement Screen	—

5.5 Calibration and Verification History

The calibration and verification history logs contain information on the last 12 calibrations and the last 12 verifications. The calibration history log shows the gain value, the time and date of the calibration, and the initials of the operator performing verification.

Note: *Restoring default settings from the DIAG/TEST menu will return the turbidimeter to its non calibration state (gain = 1.0) but it will not remove the previous calibration history from memory.*

The calibration history log is accessed from the Calibrate menu. The verification history log is accessed from the Verification menu (a submenu of the Calibrate menu).

Each verification history entry shows the serial number of the verification device (dry verification) or the value of the verification standard (wet verification), the time and date of the verification, and the initials of the operator performing the verification.

Scroll through the entries by pressing the **ENTER** key. After scrolling through all 12 histories, the display will return to the calibration menu level.

When the instrument is received from the factory, default values or blank spaces will be shown for the calibration and verification history information. Those values will be replaced with real data as the history log is filled.

The data is retained as first in, first out. When the log is full, the newest entry is stored and the oldest entry in the log is deleted.

Section 6 Maintenance

DANGER
Only qualified personnel should conduct the maintenance tasks described in this section of the manual.

6.1 Maintenance Schedule

Maintenance Task	Frequency
Clean the sensor	Before each calibration and as needed. Depends on sample characteristics.
Calibrate Sensor (as required by regulatory agency)	Per agency-dictated schedule.

Scheduled periodic maintenance requirements of the 1720E are minimal and include calibration and cleaning of the photocell window, bubble trap, and body. Check and clean the bubble trap and turbidimeter body (as described in section 6.4.3) if visual inspection shows that it is necessary. Perform other maintenance on a regular basis; experience will dictate scheduling and may depend on the installation, sample type, and season.

It is very important to maintain the cleanliness of the interior and exterior of the turbidimeter body, head assembly, the integral bubble trap, and the surrounding area. Doing so will ensure accurate, low-level turbidity measurements.

Clean the body before calibration and verification (especially when measurements are being made at 1.0 NTU or lower).

Check and/or perform a calibration periodically (as experience dictates) using one of the methods described in section 5.3 on page 40. A calibration history menu option is available under Sensor Setup/Calibrate.

6.2 Removing a Sensor from the System

Prior to physically removing a sensor from the system, record all user defined settings such as relays, signal averaging, etc. Disconnect the sensor connector at the controller.

6.3 Reinstalling a Sensor on the System

To return the system to normal operation following a software upgrade or sensor repair perform the following procedure:

1. Detach all sensors from the sc100 controller.
2. From the main menu, press the down arrow key to highlight TEST/MAINT. Press **ENTER**.
3. Use the down arrow key to scroll to SCAN SENSORS and press **ENTER**.
4. Remove attached sensors by selecting the corresponding serial number or select “All”.
5. **Power down the sc100 then attach the 1720E.**
6. Supply power to the sc100. The system will initialize automatically.

Note: *Clean sensors before reinstallation on the system.*

6.4 Cleaning

6.4.1 Cleaning the Controller

With the enclosure securely closed, wipe the exterior with a damp cloth.

6.4.2 Cleaning the Photocell Window

Occasional cleaning of the photocell window is required. The frequency will depend on the nature and concentration of dissolved and suspended solids in the sample. Biological activity is a primary factor in mineral scale deposit on the window and the amount differs with sample temperature. In general, more growth will occur in warm temperatures and less in cold.

Note: *Take care to not scratch the photocell window.*

Inspect the photocell window often to determine cleaning needs. Remove any organic growth or film on the photocell window before standardization or calibration. Use a cotton swab and isopropyl alcohol or a mild detergent (such as Liqui-nox®) to remove most sediment and dirt. Mineral scale buildup may require cleaning with a mild acid applied with a cotton swab followed by a detergent wash. **Do not use abrasive cleaners.**

6.4.3 Cleaning the Turbidimeter Body and Bubble Trap

Sediment may collect in the turbidimeter body after extended use. Noise (fluctuation) in the reading could indicate the need to clean the body and/or bubble trap. The 1720E bubble trap and bottom plate may be removed to make cleaning easier. Drain and clean the turbidimeter body before each calibration. Establish a regular schedule or perform cleaning as determined by visual inspection.

Cleaning the Turbidimeter Body

Note: *The turbidimeter body, bubble trap, and detector must be cleaned before each calibration.*

1. Turn off sample flow to the turbidimeter body.
2. Remove the head assembly and bubble trap cover from the body. Remove the bubble trap by lifting it vertically. Set it aside to be cleaned separately.
3. Drain the body by removing the plug from the bottom of the body.
4. Replace the drain plug and fill the body to the weir with cleaning solution. This cleaning solution can consist of dilute chlorine solution (25 mL of household bleach in 3.78 liters of water) or a laboratory detergent such as Liqui-nox (1 mL detergent in 1 liter of water).
5. Use a soft brush to clean the inside surfaces of the body.
6. Remove the drain plug again and thoroughly flush the turbidimeter body with ultra-filtered deionized water. Clean and replace the plug.

Cleaning the Bubble Trap

1. Prepare a cleaning solution (as in step 4 above) in a container large enough to submerge the entire bubble trap.
2. Using a test tube brush such as Cat. No. 690-00, clean each surface.
3. Rinse the bubble trap thoroughly with ultra-filtered deionized water and reinstall it in the turbidimeter body.
4. Replace the bubble trap cover and head assembly on the top of the body.

5. Restore sample flow to the instrument.

6. Calibrate the instrument using one of the methods in section 5.3 on page 40.

If the above cleaning procedures have been performed and the turbidimeter readings are still noisy, the bottom plate and gasket may need to be removed and cleaned. Carefully perform the following procedure to ensure the turbidimeter body integrity is maintained.

1. Turn off sample flow to the turbidimeter body.

2. Remove the head assembly, bubble trap cover, and bubble trap (by lifting it vertically) from the body.

3. Drain the body by removing the plug from the bottom of the body.

4. Lift the body off of its mounting screws.

5. With the body turned upside-down, remove the two Phillips-head screws holding the bottom plate.

6. Lift the bottom plate off the body; set the gasket aside for use in reassembly.

7. Use a soft brush and a dilute cleaning solution (as prepared above) to clean the bottom plate and inside surfaces of the turbidimeter body. Rinse the entire body and bottom plate with ultra-filtered deionized water.

8. Reassemble by inserting the gasket into the molded channel in the bottom plate.

9. Fit the bottom plate onto the turbidimeter body.

10. Reinstall both screws and carefully tighten to 15 inch-lb maximum.

11. Reinstall the turbidimeter onto the wall mounting screws.

12. Replace the bubble trap, bubble trap cover, and head assembly on the top of the body.

13. Restore sample flow to the instrument.

6.4.4 Replacing the Lamp Assembly

The Lamp Assembly is located on the head assembly. Under normal use, Hach recommends replacing the lamp once a year to maintain peak performance. Replacement bulbs have been “burned-in” at the factory and are ready for installation and use.

To change the lamp, refer to Figure 28 on page 50 and perform the following steps:

1. Disconnect power to the controller to remove all power to the turbidimeter.

2. Disconnect the lamp leads by unplugging the connector.

3. After the bulb has cooled, remove as follows:

a. Wear cotton gloves to protect your hands and to avoid fingerprints on the bulb.

b. Grasp the bulb.

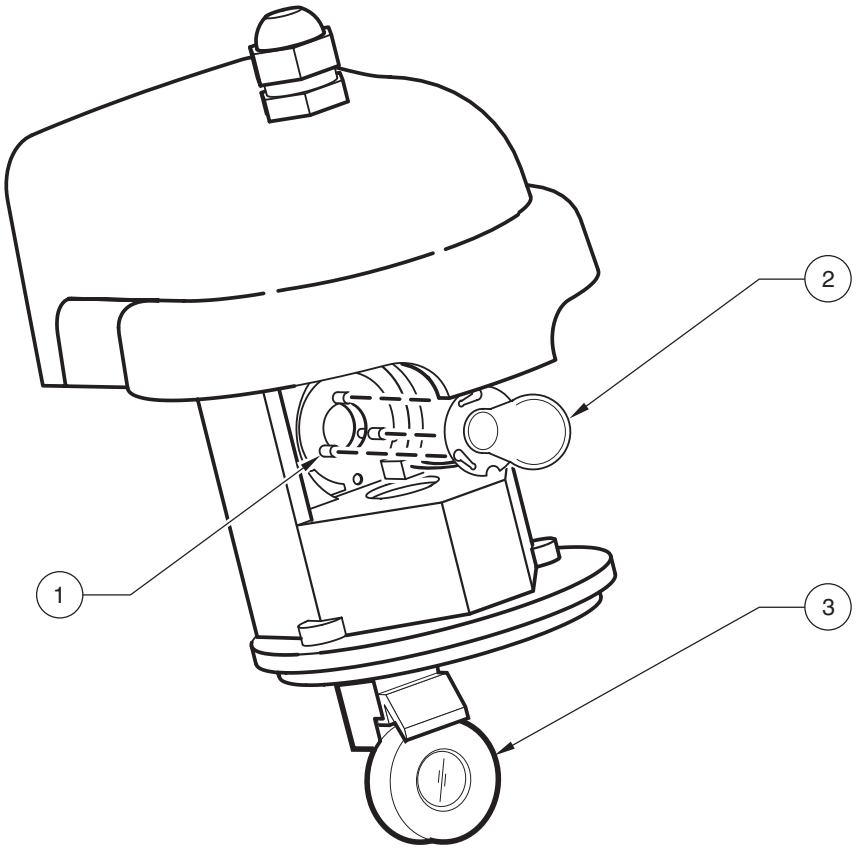
c. Twist the bulb in a counterclockwise direction, pulling out slightly, until it is released from the housing.

d. Pull the lamp leads and connector through the hole in the lamp housing.

Do not touch the new bulb with bare hands. Etched glass and reduced lamp life will result. Wear cotton gloves or grasp the lamp assembly with a tissue to avoid contamination. If contamination occurs, clean the glass bulb portion with isopropyl alcohol.

Replace the bulb by reversing the above instructions. The bulb base only fits one way; align the notch in the metal bulb flange with the hole in the lamp holder.

Figure 28 Lamp Replacement



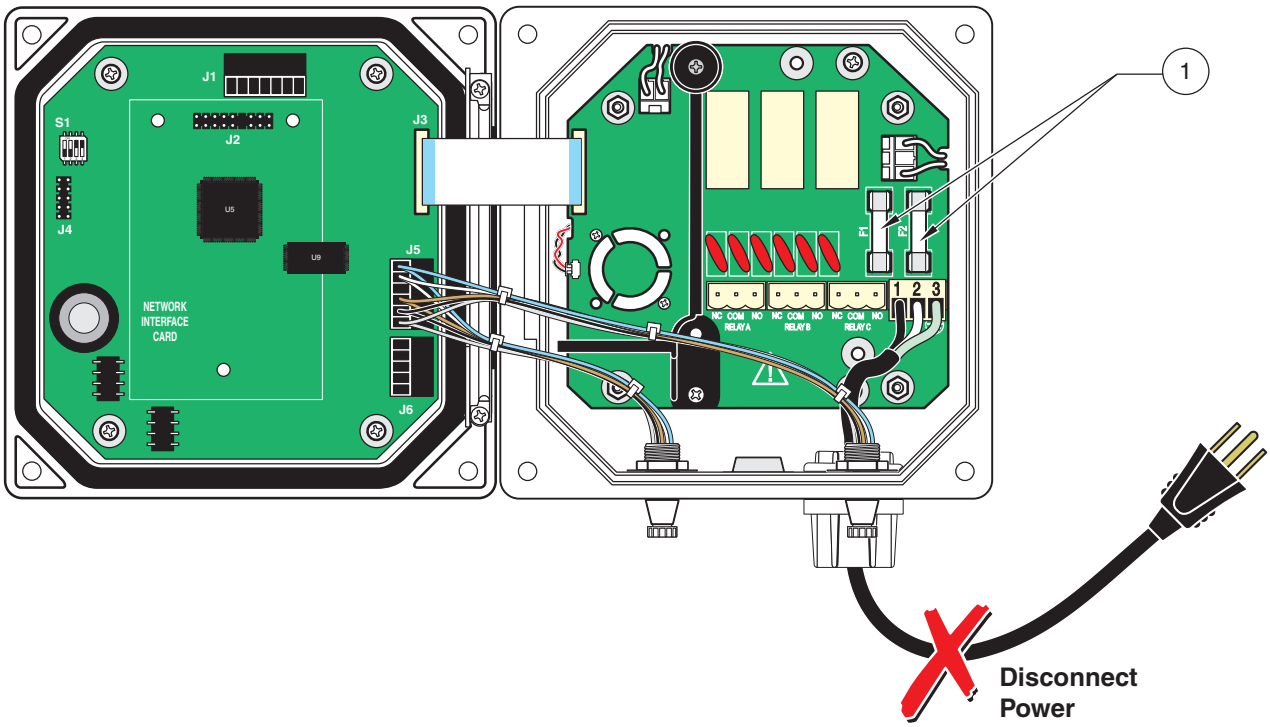
1. Lamp Housing	**2.** Lamp Assembly	**3.** Photo Detector

6.5 Fuse Replacement

The controller contains two mains fuses. Failed fuses are an indication that an equipment problem could exist. Problem resolution and fuse replacement should only be performed by qualified service personnel. Refer to Figure 29 and perform the following steps to replace the fuses:

1. Disconnect power to the controller (including power to relays if powered).
2. Open the hinged controller cover by completely loosening all four captive screws in the cover.
3. Remove the high voltage barrier; pull out on the lever of the captive fastener then pull straight out on the barrier. Set the barrier aside for reinstallation.
4. Remove the fuses and install new fuses of the same type and rating (T, 1.6A, 250 V, slow blow).
5. Reinstall the high voltage barrier.
6. Close the controller cover and hand-tighten the four screws.
7. Reconnect all power to the instrument.

Figure 29 Fuse Replacement



1.	Fuses F1 and F2, 1.6 A

Section 7 Troubleshooting

7.1 Error Codes

When a sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and all relays and analog outputs associated with the sensor will be held.

Highlight the Probe Diag menu and press **ENTER**. Highlight Errors and press **ENTER** to determine the case of the error. Errors are defined in Table 9.

Table 9 Error Codes

Displayed Error	Definition
A/D Fail	Failed A/D converter. Call the Service Department.
Lamp Fail	The light source has failed. See section 6.4.4 on page 49 for instructions for replacing it.
Flash Fail	Datalog and event log will not work.

7.2 Warnings

A sensor warning will leave all menus, relays, and outputs functioning normally, but will cause a warning icon to flash on the right side of the display. Highlight the Probe Diag menu and press **ENTER** to determine the cause of the error. Warnings are defined in Table 10.

A warning may be used to trigger a relay and users can set warning levels to define the severity of the warning. Errors are defined in Table 10.

Table 10 Warning Codes

Warning Number	Displayed Warning	Definition/Resolution
1	Dark Reading Warning	Dark reading detects too much light.
2	Temperature Warning	Sensor head internal temperature is higher than specified. Contact the Service Department.
3	Data Log Full Warning	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
4	Event Log Full Warning	Sensor data log is full. No additional data will be logged until sensor log is downloaded into controller memory.
5	5 Volt Warning	Monitored voltage is outside the range of 4.5 – 5.5 V @ microprocessor input -> 698 to 854 counts from the microprocessor ADC.
6	Voltage in Warning	Monitored voltage is outside the range of 9.08 – 14.3 V @ microprocessor pin -> 279 to 435 counts from the microprocessor ADC.
7	Lamp V Warning	Monitored voltage is outside the range of 3.96 – 4.48 V @ microprocessor pin -> 614 to 385 counts from the microprocessor ADC.
8	Lamp I Warning	Monitored voltage is outside the range of 1.67 – 2.75 V @ microprocessor pin -> 39 to 64 counts from the microprocessor ADC.
9	Output Mode Not Normal	Activated when the sensor is not in normal measurement mode (such as when in calibration or verification mode).

Table 11 presents sensor warnings displayed in the Event Log, possible causes, and corrective actions.

Table 11 Troubleshooting

Sensor Warning	Possible Cause	Corrective Action
Bad Lamp	Lamp burned out	Replace the lamp. See section 6.4.4 on page 49.
	Lamp unplugged	Restore connection
	+12 V connection loose at controller	Restore connection
	Dislodged lamp	Reinstall lamp
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
Low Signal	Photocell coated/dirty	See Cleaning the Photocell Window on page 48. Contact the Customer Service Department.
	Photocell wires disconnected	Reconnect wires
	Photocell broken/cracked	Replace photocell Contact the Customer Service Department.
	Lens coated/dirty	Clean the lens using isopropyl alcohol and a cotton swab.
	Obstructed light path	Remove obstruction
	Sample turbidity >100 NTU	Switch to a high range turbidimeter
	See Bad Lamp causes above	See Bad Lamp corrective actions above
Bad System Voltage	Improper wiring at controller	See the controller wiring instructions in section 3.2, Electrical Installation on page 14.
	Turbidimeter head cable shortened to improper length	Contact the Customer Service Department.
	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Service Department
A/D Converter Timeout	Fluctuation in voltage	Turn instrument power off and back on.
	Bad circuit board in turbidimeter head	Contact the Customer Service Department.
High Dark Counts	Light Leak—Turbidimeter head not on turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is on the turbidimeter body and properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Light Leak—Turbidimeter head not properly aligned on the turbidimeter body or calibration cylinder during Power Up or Zero Electronics	Make sure the turbidimeter head is properly aligned and repower instrument or perform ZERO ELECTRONICS in the CALIBRATION MENU.
	Photocell broken/cracked	Contact the Customer Service Department.

The following table presents additional malfunctions which may not be recorded in the Event Log.

Table 12 Additional Malfunctions Not Recorded in the Event Log

Symptom	Possible Cause	Corrective Action
Continuous Underrange (negative reading)	Calibration standards not in the correct order or incorrect dilution	Verify the accuracy of calibration standards and recalibrate the instrument. See Low Signal in Table 11.
Continuous Overrange (100 NTU)	Calibration standards not in the correct order or incorrect dilution	Verify the accuracy of calibration standards and recalibrate the instrument.

Table 12 Additional Malfunctions Not Recorded in the Event Log (continued)

Symptom	Possible Cause	Corrective Action
Erratic Readings	Calibration standards have the same value Inadequate bubble removal from sample	Verify the accuracy of calibration standards and recalibrate the instrument. Increase the signal averaging time to a longer interval. Make sure the Bubble Reject feature is turned on. Slow the flow of sample into the instrument.
High Readings	Deionized water turbidity is greater than 0.5 NTU	Clean the instrument. Access Calibration History for turbidity value of ultra-filtered water. Verify the flow is between 200–750 mL/min. Recalibrate the instrument.

7.3 Event Codes

Event codes are not displayed on the screen of the sc100 and must be downloaded from the event log to be viewed. See section 4.7 on page 36 for additional information. Troubleshooting actions are given in section Table 11 on page 53.

Table 13 Event Log List

Event	Event #	Data1	Data2	Data3
Bubble Reject Change	0	0 = OFF 1= ON	—	—
Filter Size Change	1	0 = No avg 1 = 6 sec 2 = 30 sec 3 = 60 sec 4 = 90 sec	—	—
Data Log Interval Change	2	0 = 30 sec 1 = 1min 2 = 5 min 3 = 10 min 4 = 15 min	—	—
Power On	3	1	—	—
Calibration	4	Cal Gain	Initials	—
Verification	5	Expected Value	Meas Value	Initials
Dark Reading Warning	6	Measured Value	—	—
Temperature Warning	7	Temperature Value	—	—
Voltage Warning	8	16 = +5V high 32 = +5V low 64 = V in high 128 = V in low	—	—
Lamp Warning	9	1 = lamp V high 2 = lamp V low 4 = lamp I high 8 = lamp I low	—	—
A/D Fail	10	1	—	—
Lamp Fail	11	2	—	—
Flash Fail	12	3	—	—
Output Mode Change	13	1 = Hold 2 = Transfer	—	—

Section 8 Replacement Parts and Accessories

Replacement Items

Item	Cat. No.
Fuse, T, 1.6 A, 250 V	52083-00
Instruction Manual, sc100 Controller, English	58600-18
Instruction Manual, 1720E Turbidimeter System, English	60100-18
Installation kit, sc100 Controller	58672-00
Lamp Assembly	18950-00
sc100 Controller	58600-00

Optional Accessories

Cable, sensor extension, 7.7 m (25 ft)			57960-00
Cap, Connector Receptacle	each		52100-00
Deionized (demineralized) water	1 L		272-56
Digital Output Card for ModBUS RS232 communication			59200-00
Digital Output Card for ModBUS RS485 communication			59200-01
Drain plug for the 1720E body	each		44116-00
Filter, 0.45 µm, to produce ultra-filtered water for cleaning and calibration	each		26705-00
Filter, 0.2 µm, to produce ultra-filtered water for calibration standard preparation	each		23238-10
Formazin Calibration Kit includes:			
Calibration Cylinder, TenSette® Pipet, 4000 NTU Formazin Primary Standard (500 mL)	each		44156-00
Floor Stand	each		57432-00
Flow meter, 500–700 mL/min	each		40282-00
ICE-PIC Module for Calibration and Calibration Verification			
20 NTU	each		52250-00
1 NTU	each		52215-00
0.5 NTU	each		52225-00
Lid, Bubble Trap, 1720E	each		52012-00
Photocell Replacement Kit for the 1720E	each		52180-00
Pipet tips for 19700-01 TenSette Pipet	50/pkg		21856-96
Pipet tips for 19700-10 TenSette Pipet	50/pkg		21997-96
Plug, conduit opening			58687-00
Power Cord with strain relief, 115 V			54488-00
Power Cord with strain relief, 230 V			54489-00
Power Cord Kit, 10A-125V, 1.8 m (6 ft), UL/CSA listed	each		46306-00
Power Cord Kit, 10A-230V, 1.8 m (6 ft), European-style plug, VDE approved	each		46308-00
StablCal Calibration Set for the 1720 Series Turbidimeter			
Includes: StablCal Standards, < 0.1 NTU, 20.0 NTU	1 L/each		26596-00
StablCal Standard, 0.1 NTU	1 L		27233-53
StablCal Standard, 0.3 NTU	1 L		26979-53
StablCal Standard, 0.5 NTU	1 L		26980-53
StablCal Standard, 1.0 NTU	1 L		26598-53
Strain relief, Heyco			16664
Sun shield			58690-00
Swabs, Cotton, presterilized for cleaning the photodetector	100/pkg		25543-00
TenSette Pipet, 0.1 to 1.0 mL	each		19700-01
TenSette Pipet, 1.0 to 10.0 mL	each		19700-10
Tubing, Inlet, ¼ inch O.D., Polyethylene	per foot		51322-00
Tubing, Outlet, ½ inch I.D., ¾ inch O.D., Tygon R3603	per foot		51263-00

Calibration and Verification Standards and Accessories

Item	Qty	Cat. No.
Calibration Cylinder	each	44153-00
Formazin Calibration Standards		
Formazin, 4000 NTU Stock Solution	500 mL	2461-49
Calibration/Verification Modules		
ICE-PIC™ Module, 1 NTU	1 each	52215-00
ICE-PIC™ Module, 20 NTU	1 each	52250-00
StablCal® Calibration Standards		
StablCal® Stabilized Formazin Standard, 1 NTU	1 L	26598-53
StablCal® Stabilized Formazin Standard, 20 NTU	1 L	26601-53
StablCal® Stabilized Formazin Standard, <0.1 NTU	1 L	26597-53
StablCal® Stabilized Formazin Set, four 1-L bottles 20-NTU and four 1-L bottles <0.1 NTU	1 L each	26596-00
StablCal® Stabilized Formazin Standard, 40 NTU	1 gallon (3.78 L)	27463-56
StablCal® Stabilized Formazin Standard, 0.1 NTU	1 gallon (3.78 L)	27233-56

Section 9 How to Order

U.S.A. Customers

By Telephone:
6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:
(970) 669-2932

By Mail:
Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.

Ordering information by e-mail: orders@hach.com

9.1 Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- billing address
- Shipping address
- Catalog number
- Quantity

9.2 International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send e-mail to intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

9.3 Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 10 Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:
Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:
Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

In Latin America, the Caribbean, the Far East, the
Indian Subcontinent, Africa, Europe, or the Middle East:
Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 11 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, subject to the pro-rated schedule above, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- **Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction**
- **Damage caused by misuse, neglect, accident or improper application or installation**
- **Damage caused by any repair or attempted repair not authorized by Hach Company**
- **Any product not used in accordance with the instructions furnished by Hach Company**
- **Freight charges to return merchandise to Hach Company**
- **Freight charges on expedited or express shipment of warranted parts or product**
- **Travel fees associated with on-site warranty repair**

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 10 Compliance Information

Hach Co. certifies this instrument was tested thoroughly, inspected and found to meet its published specifications when it was shipped from the factory.

The **Model sc100 with 1720E Sensor** has been tested and is certified as indicated to the following instrumentation standards:

Product Safety

UL 61010A-1 (ETL Listing # 65454)
CSA C22.2 No. 1010.1 (ETLc Certification # 65454)
Certified by Hach Co. to EN 61010-1 Amds. 1 & 2 (IEC1010-1) per 73/23/EEC, supporting test records by Intertek Testing Services.

Immunity

This equipment was tested for Industrial level EMC per:

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) **per 89/336/EEC EMC:** Supporting test records by Hach Company, certified compliance by Hach Company.

Standards include:

IEC 1000-4-2:1995 (EN 61000-4-2:1995) Electro-Static Discharge Immunity (Criteria B)
IEC 1000-4-3:1995 (EN 61000-4-3:1996) Radiated RF Electro-Magnetic Field Immunity (Criteria A)
IEC 1000-4-4:1995 (EN 61000-4-4:1995) Electrical Fast Transients/Burst (Criteria B)
IEC 1000-4-5:1995 (EN 61000-4-5:1995) Surge (Criteria B)
IEC 1000-4-6:1996 (EN 61000-4-6:1996) Conducted Disturbances Induced by RF Fields (Criteria A)
IEC 1000-4-11:1994 (EN 61000-4-11:1994) Voltage Dip/Short Interruptions (Criteria B)

Additional immunity Standard/s include:

ENV 50204:1996 Radiated Electro-Magnetic Field from Digital Telephones (Criteria A)

Emissions

This equipment was tested for Radio Frequency Emissions as follows:

Per **89/336/EEC** EMC: **EN 61326:1998** (Electrical Equipment for measurement, control and laboratory use—EMC requirements) Class “A” emission limits. Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

Standards include:

EN 61000-3-2 Harmonic Disturbances Caused by Electrical Equipment
EN 61000-3-3 Voltage Fluctuation (Flicker) Disturbances Caused by Electrical Equipment

Additional Emissions Standard/s include:

EN 55011 (CISPR 11) Class “A” emission limits

Canadian Interference-causing Equipment Regulation, IECS-003, Class A

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This Class A digital apparatus meets all requirements of the Canadian Interference- Causing Equipment Regulations.

Cet appareil numÈrique de la classe A respecte toutes les exigences du RËglement sur le matÈriel brouilleur du Canada.

FCC PART 15, Class “A” Limits

Supporting test records by Hewlett Packard, Fort Collins, Colorado Hardware Test Center (A2LA # 0905-01) and certified compliance by Hach Company.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. The following techniques of reducing the interference problems are applied easily.

1. Disconnect the Model sc100 Controller from its power source to verify that it is or is not the source of the interference.

2. If the Model sc100 Controller is connected into the same outlet as the device with which it is interfering, try another outlet.

3. Move the Model sc100 Controller and 1720E sensor away from the device receiving the interference.

4. Reposition the device receiving the interference.

5. Try combinations of the above.

Appendix A ModBUS Register Information

Table 14 Controller ModBUS Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Measurements	Calculated Value	40001	Float	2	R	Value calculated from two sensor measurements
Setup	Language	40003	Unsigned Integer	1	R/W	Current System Language
Setup	Date Format	40004	Unsigned Integer	1	R/W	Current Data Display Format (0 = DD/MM/YY; 1 = MM/DD/YY; 2 = DD-MM-YY; 3 = MM-DD-YY)
Setup	Error Hold Mode	40005	Unsigned Integer	1	R/W	Error Mode Hold State (0 = Hold outputs; 1 = Transfer outputs to predefined value)
Setup/Analog Output 1	Source	40006	Unsigned Integer	1	R/W	Selects data source for this output (0 = None; 2 = sensor; 4 = Calculation)
Setup/Analog Output 1	Sensor Select	40007	Unsigned Integer	1	R/W	Selects sensor source when Source = Sensor (0 = sensor1; 1 = sensor2)
Setup/Analog Output 1	Measurement Select	40008	Unsigned Integer	1	R/W	Selects measurement on the sensor (0 = Meas1.. 3 = Meas4)
Setup/Analog Output 1	Type	40009	Unsigned Integer	1	R/W	Selects output type (0 = Linear output; 1 = PID control)
Setup/Analog Output 1	Transfer Value	40010	Float	2	R/W	Sets the transfer value
Setup/Analog Output 1	Filter	40012	Unsigned Integer	1	R/W	Sets the output filter value in seconds (0 to 120 sec.)
Setup/Analog Output 1	0mA - 4mA Select	40013	Unsigned Integer	1	R/W	Selects 0mA/4mA for min output (0 = 0mA; 1 = 4mA)
Setup/Analog Output 1/Linear	Min Setting	40014	Float	2	R/W	Sets the min output value
Setup/Analog Output 1/Linear	Max Setting	40016	Float	2	R/W	Sets the max output value
Setup/Analog Output 1/PID	PID Mode	40018	Unsigned Integer	1	R/W	Sets the PID mode (0 = auto; 1 = manual)
Setup/Analog Output 1/PID	PID Manual Set	40019	Float	2	R/W	Sets the PID manual output value (0.0 to 100.0%)
Setup/Analog Output 1/PID	PID Setpoint	40021	Float	2	R/W	Sets the PID setpoint
Setup/Analog Output 1/PID	PID Phase	40023	Unsigned Integer	1	R/W	Sets the PID phase (0 = Direct; 1 = Reverse)
Setup/Analog Output 1/PID	PID Proportional Band	40024	Float	2	R/W	Sets the PID proportional band
Setup/Analog Output 1/PID	PID Integral Time	40026	Unsigned Integer	1	R/W	Sets the PID integral time (min)
Setup/Analog Output 1/PID	PID Derivative Time	40027	Unsigned Integer	1	R/W	Sets the PID derivative time (min)
Setup/Analog Output 2	Source	40028	Unsigned Integer	1	R/W	Selects data source for this output (0 = None; 2 = Sensor; 4 = Calculation)
Setup/Analog Output 2	Sensor Select	40029	Unsigned Integer	1	R/W	Selects sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Analog Output 2	Measurement Select	40030	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Analog Output 2	Type	40031	Unsigned Integer	1	R/W	Selects output type (0 = Linear output; 1 = PID control)
Setup/Analog Output 2	Transfer Value	40032	Float	2	R/W	Sets the transfer value
Setup/Analog Output 2	Filter	40034	Unsigned Integer	1	R/W	Sets the output filter value in seconds (0 to 120 sec)
Setup/Analog Output 2	0mA - 4mA Select	40035	Unsigned Integer	1	R/W	Selects 0mA/4mA for min output (0 = 0mA; 1 = 4mA)
Setup/Analog Output 2/Linear	Min Setting	40036	Float	2	R/W	Sets the min output value
Setup/Analog Output 2/Linear	Max Setting	40038	Float	2	R/W	Sets the max output value
Setup/Analog Output 2/PID	Mode	40040	Unsigned Integer	1	R/W	Sets the PID mode (0 = auto; 1 = manual)
Setup/Analog Output 2/PID	Manual Set	40041	Float	2	R/W	Sets the PID manual output value (0.0 to 100.0%)
Setup/Analog Output 2/PID	Setpoint	40043	Float	2	R/W	Sets the PID setpoint
Setup/Analog Output 2/PID	Phase	40045	Unsigned Integer	1	R/W	Sets the PID phase (0 = Direct; 1 = Reverse)
Setup/Analog Output 2/PID	Proportional Band	40046	Float	2	R/W	Sets the PID proportional band
Setup/Analog Output 2/PID	Integral Time	40048	Unsigned Integer	1	R/W	Sets the PID integral time (min)
Setup/Analog Output 2/PID	Derivative Time	40049	Unsigned Integer	1	R/W	Sets the PID derivative time (min)
Setup/Relay 1	Source	40050	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 1	Sensor Select	40051	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 1	Measurement Select	40052	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)
Setup/Relay 1	Type	40053	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 1	Transfer Setting	40054	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 1/Alarm	High Alarm	40055	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 1/Alarm	Low Alarm	40057	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 1/Alarm	High Deadband	40059	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 1/Alarm	Low Deadband	40061	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 1/Alarm	On Delay	40063	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 1/Alarm	Off Delay	40064	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 1/Control	Setpoint	40065	Float	2	R/W	Sets the controller setpoint

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 1/Control	Phase	40067	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 1/Control	Deadband	40068	Float	2	R/W	Sets the controller deadband
Setup/Relay 1/Control	Overfeed Timer	40070	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 1/Control	On Delay	40071	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 1/Control	Off Delay	40072	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 1/Control	Reset Overfeed Timer	40073	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 1/Event	Setpoint	40074	Float	2	R/W	Sets the event setpoint
Setup/Relay 1/Event	Phase	40076	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 1/Event	Deadband	40077	Float	2	R/W	Sets the event deadband
Setup/Relay 1/Event	On Max Time	40079	Unsigned Integer	1	R/W	Sets the max on time (mins)
Setup/Relay 1/Event	On Min Time	40080	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 1/Event	Off Max Time	40081	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 1/Event	Off Min Time	40082	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 1/Timer	Hold Type	40083	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 1/Timer	Sensor Select	40084	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 1/Timer	Hold Mode	40085	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time
Setup/Relay 1/Timer	Duration Time	40086	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 1/Timer	Period Time	40087	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 1/Timer	Off Delay	40088	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 1/Status	Level	40089	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Setup/Relay 2	Source	40090	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 2	Sensor Select	40091	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 2	Measurement Select	40092	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 2	Type	40093	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 2	Transfer Setting	40094	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 2/Alarm	High Alarm	40095	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 2/Alarm	Low Alarm	40097	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 2/Alarm	High Deadband	40099	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 2/Alarm	Low Deadband	40101	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 2/Alarm	On Delay	40103	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 2/Alarm	Off Delay	40104	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 2/Control	Setpoint	40105	Float	2	R/W	Sets the controller setpoint
Setup/Relay 2/Control	Phase	40107	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 2/Control	Deadband	40108	Float	2	R/W	Sets the controller deadband
Setup/Relay 2/Control	Overfeed Timer	40110	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 2/Control	On Delay	40111	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 2/Control	Off Delay	40112	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 2/Control	Reset Overfeed Timer	40113	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 2/Event	Setpoint	40114	Float	2	R/W	Sets the event setpoint
Setup/Relay 2/Event	Phase	40116	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 2/Event	Deadband	40117	Float	2	R/W	Sets the event deadband
Setup/Relay 2/Event	On Max Time	40119	Unsigned Integer	1	R/W	Sets the max on time (mins)
Setup/Relay 2/Event	On Min Time	40120	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 2/Event	Off Max Time	40121	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 2/Event	Off Min Time	40122	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 2/Timer	Hold Type	40123	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 2/Timer	Sensor Select	40124	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 2/Timer	Hold Mode	40125	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 2/Timer	Duration Time	40126	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 2/Timer	Period Time	40127	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 2/Timer	Off Delay	40128	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 2/Status	Level	40129	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Setup/Relay 3	Source	40130	Unsigned Integer	1	R/W	Selects data source for this relay (0 = None; 1 = Real Time Clock; 2 = Sensor; 4 = Calculation)
Setup/Relay 3	Sensor Select	40131	Unsigned Integer	1	R/W	Selects Sensor source when Source = Sensor (0 = Sensor1; 1 = Sensor2)
Setup/Relay 3	Measurement Select	40132	Unsigned Integer	1	R/W	Selects measurement on the Sensor (0 = Meas1 .. 3 = Meas4)
Setup/Relay 3	Type	40133	Unsigned Integer	1	R/W	Selects the relay type (0 = Alarm; 1 = Control; 2 = Status; 3 = Timer; 4 = Event)
Setup/Relay 3	Transfer Setting	40134	Unsigned Integer	1	R/W	Selects the transfer value for the relays (0 = De-energized; 1 = Energized)
Setup/Relay 3/Alarm	High Alarm	40135	Float	2	R/W	Sets the high alarm setpoint
Setup/Relay 3/Alarm	Low Alarm	40137	Float	2	R/W	Sets the low alarm setpoint
Setup/Relay 3/Alarm	High Deadband	40139	Float	2	R/W	Sets the high alarm deadband
Setup/Relay 3/Alarm	Low Deadband	40141	Float	2	R/W	Sets the low alarm deadband
Setup/Relay 3/Alarm	On Delay	40143	Unsigned Integer	1	R/W	Sets the on delay time
Setup/Relay 3/Alarm	Off Delay	40144	Unsigned Integer	1	R/W	Sets the off delay time
Setup/Relay 3/Control	Setpoint	40145	Float	2	R/W	Sets the controller setpoint
Setup/Relay 3/Control	Phase	40147	Unsigned Integer	1	R/W	Sets the controller phase (0 = Low; 1 = High)
Setup/Relay 3/Control	Deadband	40148	Float	2	R/W	Sets the controller deadband
Setup/Relay 3/Control	Overfeed Timer	40150	Unsigned Integer	1	R/W	Sets the overfeed timer value (mins)
Setup/Relay 3/Control	On Delay	40151	Unsigned Integer	1	R/W	Sets the on delay time (sec)
Setup/Relay 3/Control	Off Delay	40152	Unsigned Integer	1	R/W	Sets the off delay time (sec)
Setup/Relay 3/Control	Reset Overfeed Timer	40153	Unsigned Integer	1	R/W	Resets the overfeed timer
Setup/Relay 3/Event	Setpoint	40154	Float	2	R/W	Sets the event setpoint
Setup/Relay 3/Event	Phase	40156	Unsigned Integer	1	R/W	Sets the event phase (0 = Low; 1 = High)
Setup/Relay 3/Event	Deadband	40157	Float	2	R/W	Sets the event deadband
Setup/Relay 3/Event	On Max Time	40159	Unsigned Integer	1	R/W	Sets the max on time (mins)

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Setup/Relay 3/Event	On Min Time	40160	Unsigned Integer	1	R/W	Sets the min on time (mins)
Setup/Relay 3/Event	Off Max Time	40161	Unsigned Integer	1	R/W	Sets the max off time (mins)
Setup/Relay 3/Event	Off Min Time	40162	Unsigned Integer	1	R/W	Sets the min off time (mins)
Setup/Relay 3/Timer	Hold Type	40163	Unsigned Integer	1	R/W	Sets which Sensor outputs are affected during timer on time (0 = None; 2 = Selected Sensor; 13 = All Sensors)
Setup/Relay 3/Timer	Sensor Select	40164	Unsigned Integer	1	R/W	Selects which Sensor outputs are being held/transferred during the timers on time (this is used when Hold type is set for single Sensor)
Setup/Relay 3/Timer	Hold Mode	40165	Unsigned Integer	1	R/W	Selects hold outputs vs. set transfer value during timers on time
Setup/Relay 3/Timer	Duration Time	40166	Unsigned Integer	1	R/W	Sets the timer on duration time (sec)
Setup/Relay 3/Timer	Period Time	40167	Unsigned Integer	1	R/W	Sets the period between timer on events (mins)
Setup/Relay 3/Timer	Off Delay	40168	Unsigned Integer	1	R/W	Sets the time the affected Sensor outputs are held/transferred after the timer turns off (sec)
Setup/Relay 3/Status	Level	40169	Unsigned Integer	1	R/W	Sets the status level which will trigger the relay
Comm/Net Card	Mode	40170	Unsigned Integer	1	R/W	Sets the Modbus mode (0 = RTU; 1 = ASCII)
Comm/Net Card	Baud	40171	Unsigned Integer	1	R/W	Sets the Modbus baud rate (0 = 9600; 1 = 19200; 2 = 38400; 3 = 57600; 4 = 115200)
Comm/Net Card	Stop Bits	40172	Unsigned Integer	1	R/W	Sets the number of stop bits (1,2)
Comm/Net Card	Data Order	40173	Unsigned Integer	1	R/W	Sets the register data order for floats (0 = Normal; 1 = Reversed)
Comm/Net Card	Min Response Time	40174	Unsigned Integer	1	R/W	Sets the minimum response time (0 to 30 sec)
Comm/Net Card	Max Response Time	40175	Unsigned Integer	1	R/W	Sets the maximum response time (100 to 1000 sec)
Comm/Net Card/Addresses	sc100	40176	Unsigned Integer	1	R/W	Sets the sc100 Modbus Address
Comm/Net Card/Addresses	Sensor 1	40177	Unsigned Integer	1	R/W	Sets the Sensor 1 Modbus Address
Comm/Net Card/Addresses	Sensor 2	40178	Unsigned Integer	1	R/W	Sets the Sensor 2 Modbus Address
Comm/Net Card/Stats	Good Messages	40179	Unsigned Integer	2	R/W	Number of good messages
Comm/Net Card/Stats	Bad Messages	40181	Unsigned Integer	2	R/W	Number of failed messages
Comm/Net Card/Stats	% Good Mesg	40183	Float	2	R/W	% of good messages

Table 14 Controller ModBUS Registers (continued)

Group Name	Tag Name	Register #	Data Type	Length	R/W	Description
Comm/Service Port	Mode	40185	Unsigned Integer	1	R/W	Sets the Modbus mode (0 = RTU; 1 = ASCII)
Comm/Service Port	Baud	40186	Unsigned Integer	1	R/W	Sets the Modbus baud rate (0 = 9600; 1 = 19200; 2 = 38400; 3 = 57600; 4 = 115200)
Comm/Service Port	Stop Bits	40187	Unsigned Integer	1	R/W	Sets the number of stop bits (1,2)
Comm/Service Port	Data Order	40188	Unsigned Integer	1	R/W	Sets the register data order for floats (0 = Normal; 1 = Reversed)
Comm/Service Port	Min Response Time	40189	Unsigned Integer	1	R/W	Sets the minimum response time (0 to 30 sec)
Comm/Service Port	Max Response Time	40190	Unsigned Integer	1	R/W	Sets the maximum response time (100 to 1000 sec)
Comm/Service Port/Addresses	sc100	40191	Unsigned Integer	1	R/W	Sets the sc100 Modbus Address
Comm/Service Port/Addresses	Sensor 1	40192	Unsigned Integer	1	R/W	Sets the Sensor 1 Modbus Address
Comm/Service Port/Addresses	Sensor 2	40193	Unsigned Integer	1	R/W	Sets the Sensor 2 Modbus Address
Comm/Service Port/Stats	Good Messages	40194	Unsigned Integer	2	R/W	Number of good messages
Comm/Service Port/Stats	Bad Messages	40196	Unsigned Integer	2	R/W	Number of failed messages
Comm/Service Port/Stats	% Good Mesg	40198	Float	2	R/W	% of good messages
Comm/Sensor/ Sensor1 Stats	Good Messages	40200	Unsigned Integer	2	R/W	Number of good messages
Comm/Sensor/ Sensor1 Stats	Bad Messages	40202	Unsigned Integer	2	R/W	Number of failed messages
Comm/Sensor/ Sensor1 Stats	% Good Mesg	40204	Float	2	R/W	% of good messages
Comm/Sensor/ Sensor2 Stats	Good Messages	40206	Unsigned Integer	2	R/W	Number of good messages
Comm/Sensor/ Sensor2 Stats	Bad Messages	40208	Unsigned Integer	2	R/W	Number of failed messages
Comm/Sensor/ Sensor2 Stats	% Good Mesg	40210	Float	2	R/W	% of good messages
Calibration	Output1 4mA count	40212	Unsigned Integer	1	R/W	Calibration counts for the 4mA output 1
Calibration	Output1 20mA count	40213	Unsigned Integer	1	R/W	Calibration counts for the 20mA output 1
Calibration	Output2 4mA count	40214	Unsigned Integer	1	R/W	Calibration counts for the 4mA output 2
Calibration	Output2 20mA count	40215	Unsigned Integer	1	R/W	Calibration counts for the 20mA output 2

Table 15 Sensor ModBUS Registers

Group Name	Tag Name	Register #	Data Type	Length	R/W	Units (U)	Range
Measurements	Cal Gain	40013	float	2	R	none	0.5 to 2.0
Verification	PF Criteria	40062	Integer	1	R/W	—	—
Measurements	Turbidity	40001	Float	2	R	NTU	0/100
Diagnostics	Temperature	40005	Float	2	R	Deg C	—
Diagnostics	Dark Reading	40009	Float	2	R	NTU	0/100
Diagnostics	Raw Turbidity	40011	Float	2	R	NTU	—
Diagnostics	Lamp Voltage	40018	Float	2	R	Volts	—
Diagnostics	Lamp Current	40020	Float	2	R	Amps	—
Diagnostics	Plus 5V	40022	Float	2	R	Volts	—
Diagnostics	Voltage In	40024	Float	2	R	Volts	—
Setup	Software Version	40015	Float	2	R	—	—
Setup	Bubble Rej	40017	Integer	1	R/W	—	On/Off
Setup	DataLog Interval	40026	Integer	1	R/W	Sec or Min	30 sec, 1 min, 5 min, 10 min, 15 min
Setup	Sensor Name	40027	String	6	R/W	—	—
Setup	Filter Size	40033	Integer	1	R/W	sec	no averaging, 6, 30, 60, 90
Setup	Sensor Ser Num	40036	String	6	R/W	—	12 digits
Setup	Output Mode	40042	Integer	1	R/W	—	—
Setup	Set Resolution	40061	Integer	1	R/W	decimal places	4, 3, or 2

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ROTAMETER

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PDF Published June 11, 2008

Variable Area Flow Meters

Chemline F Series Variable Area Flow Meters are ideal for plastic piping. They provide a combination of accurate visual flow rate measurement and clear flow indication from a distance. Optional limit switches allow the units to signal a low or high flow alarm. An optional flow transmitter provides a 4 to 20 mA signal output. These flow meters must be installed vertically with flow upward.

Low Cost Visual Indication

For Water, Chemicals or Gas

CHEMLINE Plastics Limited

Your Pipeline To Quality

SERIES: FC – Compact – 5" Single Scale
FS – Full Size – 7" Dual Scale[1]

MATERIALS:

Tube: Clear PVC, Polyamide (PA), Polysulfone (PSU), or PVDF[2]

Float: PVDF

Ends: PVC, CPVC, PP, PVDF Socket, Threaded, Flanged, Butt or ChemFlare™[3]

O-Rings: EPDM, FPM (Viton®)

CAPACITIES: Up to 220 USGPM (50,000 litres per hour)

CRN REGISTERED
CONSULT CHEMLINE

Features

- **Clear Visual Indication**
  – Large orange float is visible from a distance
  – Range indicators slide along dovetail track
- **Easy Installation and Maintenance**
  Just unscrew union nuts and tube slides out of line
- **Choice of Four Tube Materials for Many Applications:**
  Clear PVC – For Water or Chemicals up to 60°C (140°F) – High Chemical resistance at low cost.
  Polyamide (PA) – For Water or Air up to 75°C (167°F) – High impact strength and optical clarity.
  Polysulfone (PSU) – For Chemicals and Gases up to 100°C (212°F) – High impact strength and good chemical resistance.
  PVDF [2] – For Chemicals and Ultrapure fluids up to 110°C (230°F) – High impact strength and excellent chemical resistance.
- **Ideal for All Types of Plastic Piping**
  All types of end connections in PVC, CPVC, PP & PVDF
- **Low Pressure Drop**
- **Good Measuring Accuracy – Class IV**
  ± 3% of indicated value, plus ± 1% of full scale.
  – Read scale at top (largest diameter) of float
- **Non Fouling** – Float is self supporting in the flow. No guide rod (which can cause the float to jam) is necessary.

Standard Full Size

Compact

[1] USGPM and litres per hour (water) scale is supplied as standard on full size meters.
[2] Because PVDF is translucent, a magnetic float and limit switches are usually used.
[3] For ChemFlare™ end connectors, consult Chemline.

Variable Area Flow Meters

NOTES:

PVDF flow meters are available in all sizes. Change third letter in item number to **K**.
[1] ΔP = Pressure loss through flow meter with water at 20°C (68°F).
[2] Dimension **L** is for PVC Socket ends.

FC SERIES – COMPACT SIZE – 5" SCALE

Single USGPM (water) scale is supplied standard.

End Conn. Size	Item Number			Flow Range (water)		Dimensions (inches)			Pressure Drop (psi)[1]	
	PVC Tube	Polyamide Tube	Polysulfone Tube	USGPM	Litres per hour	A	L[2]	D	Water	Air
3/8"	FCA00020	FCT00020	FCP00020	0.0132 – 0.106	3 – 24	6.50	8.2	1.38	0.05	0.07
	FCA00060	FCT00060	FCP00060	0.022 – 0.264	5 – 60	6.50	8.2	1.38	0.05	0.07
	FCA00100	FCT00100	FCP00100	0.04 – 0.44	10 – 100	6.50	8.2	1.38	0.05	0.07
	FCA00250	FCT00250	FCP00250	0.11 – 1.10	25 – 250	6.50	8.2	1.38	0.05	0.07
1/2"	FCA00051	FCT00051	FCP00051	0.02 – 0.22	5 – 50	6.69	8.7	1.69	0.04	0.06
	FCA00151	FCT00151	FCP00151	0.07 – 0.66	15 – 150	6.69	8.7	1.69	0.04	0.06
	FCA00251	FCT00251	FCP00251	0.11 – 1.10	25 – 250	6.69	8.7	1.69	0.04	0.06
	FCA00401	FCT00401	FCP00401	0.18 – 1.76	40 – 400	6.69	8.7	1.69	0.04	0.06
3/4"	FCA00152	FCT00152	FCP00152	0.07 – 0.66	15 – 150	7.28	9.6	2.09	0.09	0.12
	FCA00402	FCT00402	FCP00402	0.22 – 1.76	40 – 400	7.28	9.6	2.09	0.09	0.12
	FCA00602	FCT00602	FCP00602	0.26 – 2.64	60 – 600	7.28	9.6	2.09	0.09	0.12
	FCA01002	FCT01002	FCP01002	0.44 – 4.40	100 – 1,000	7.28	9.6	2.09	0.09	0.12
1"	FCA00253	FCT00253	FCP00253	0.11 – 1.10	25 – 250	7.87	10.5	2.36	0.09	0.12
	FCA00403	FCT00403	FCP00403	0.18 – 1.76	40 – 400	7.87	10.5	2.36	0.09	0.12
	FCA01003	FCT01003	FCP01003	0.44 – 4.40	100 – 1,000	7.87	10.5	2.36	0.09	0.12
	FCA01503	FCT01503	FCP01503	0.66 – 6.60	150 – 1,500	7.87	10.5	2.36	0.09	0.12

FS SERIES – STANDARD FULL SIZE – 7" SCALE

Dual USGPM (water) and litres per hour scales are supplied standard.

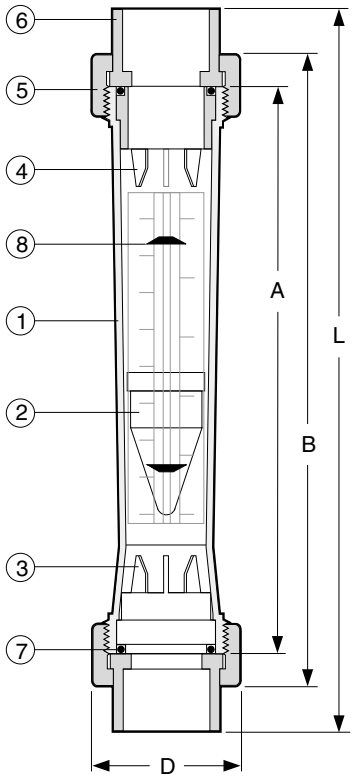
End Conn. Size	Item Number			Flow Range (water)		Dimensions (inches)			Pressure Drop (psi)[1]	
	PVC Tube	Polyamide Tube	Polysulfone Tube	USGPM	Litres per hour	A	L[2]	D	Water	Air
1"	FSA00150	FST00150	FSP00150	0.07 – 0.66	15 – 150	13.78	16.3	2.36	0.18	0.23
	FSA00300	FST00300	FSP00300	0.13 – 1.32	30 – 300	13.78	16.3	2.36	0.18	0.23
	FSA00600	FST00600	FSP00600	0.26 – 2.64	60 – 600	13.78	16.3	2.36	0.18	0.23
	FSA01000	FST01000	FSP01000	0.44 – 4.40	100 – 1,000	13.78	16.3	2.36	0.18	0.23
1-1/4"	FSA01500	FST01500	FSP01500	0.66 – 6.60	150 – 1,500	13.78	16.6	2.83	0.18	0.23
	FSA02500	FST02500	FSP02500	1.10 – 11.00	250 – 2,500	13.78	16.6	2.83	0.18	0.23
1-1/2"	FSA02000	FST02000	FSP02000	0.88 – 8.80	200 – 2,000	13.78	16.8	3.27	0.18	0.23
	FSA03000	FST03000	FSP03000	1.32 – 13.20	300 – 3,000	13.78	16.8	3.27	0.18	0.23
2"	FSA04000	FST04000	FSP04000	1.76 – 17.60	400 – 4,000	13.78	17.2	4.06	0.32	0.39
	FSA06000	FST06000	FSP06000	2.64 – 26.40	600 – 6,000	13.78	17.2	4.06	0.32	0.39
	FSA10000	FST10000	FSP10000	4.40 – 44.00	1,000 – 10,000	13.78	17.2	4.06	0.32	0.39
2-1/2"	FSA15000	FST15000	FSP15000	6.60 – 66.00	1,500 – 15,000	13.78	17.7	4.80	0.49	0.58
	FSA25000	FST25000	FSP25000	11.00 – 110.00	2,500 – 25,000	13.78	17.7	4.80	0.49	0.58
	FSA50000	FST50000	FSP50000	44.00 – 220.00	10,000 – 50,000	13.78	17.7	4.80	0.49	0.58

CONVERSION CHART – FLOW UNITS

From To	m^3/hr	litres/hr	USGPM	ImpGPM	ft^3/min
m^3/hr	1	1000	4.4029	3.6662	0.5886
litres/hr	0.001	1	.004403	.003666	.000589
USGPM	0.2271	227.12	1	0.8327	0.1337
ImpGPM	0.2728	272.77	1.2009	1	0.1605
ft^3/min	1.6990	1699	7.4806	6.2289	1

†Values based on water at 20°C (68°F).

Variable Area Flow Meters



PARTS

▲ Recommended Spare Parts

No.	Part	Pcs.	Materials
1	Tube	1	Polyamide (PA), Polysulfone (PSU), Clear PVC, PVDF
2	Float	1	PVDF (standard or magnetic)
3	Lower Float Stop	1	PVDF
4	Upper Float Stop	1	PVDF
5	Union Nut	2	PVC, PPG, PVDF
6	End Connector	2	PVC, CPVC, PP or PVDF
7▲	O-Rings	2	EPDM, FPM (Viton®)
8▲	Range Indicator	2	ABS

ACCESSORIES

- **Limit Switches** – One switch for both maximum or minimum. A magnetic float is required.
- **Switch Ratings** – P (max) = 10 VA, E (max) = 470VAC, I (max) = 0.5A
- **Throttling Valve** for flow control
- **4–20 mA Output Signal Unit** must be factory calibrated for specific service

OPTIONS

- **Custom Direct Reading Scale** for services other than water
- **Alternate O-Rings** – ie. FPM (Viton®)
- **End Size Reduction** – Accuracy is not significantly affected by end reduction
- **Other Ends** – Threaded, socket or flanged end connections in PVC, CPVC, PP or PVDF. Butt ends in PP or PVDF.

MAXIMUM WORKING PRESSURES AND TEMPERATURE RANGES

Construction (‡ = Optional Materials)				Maximum	
Tube	O-Rings	Union Nuts	Ends	Pressure[2]	Temperature Range
PVC	EPDM	PVC	PVC	150 psi	0 to 60°C (32 to 140°F)
Polyamide (PA)	EPDM	PVC	PVC	150 psi	0 to 60°C (32 to 140°F)
Polyamide (PA)	EPDM	PPG‡	PP or CPVC‡	150 psi	0 to 75°C (32 to 167°F)
Polysulfone (PSU)	EPDM	PVC	PVC	150 psi	0 to 60°C (32 to 140°F)
Polysulfone (PSU)	EPDM	PPG‡	PP or CPVC‡	150 psi	0 to 90°C (32 to 194°F)
PVDF	FPM(Viton®)	PVDF	PVDF	150 psi	–40 to 110°C (–40 to 230°F)

[2] 150 psi is not recommended at maximum temperatures. Consult Chemline.

Flow Meter Sizing – Liquid Flow

Standard Scale values are for clean water flow at 20°C (68°F). For liquids with densities and viscosities similar to water (ie. specific gravity of 1.0 and viscosities between 0.5 cP and 1.3 cP) the standard water scale will be accurate enough.

The table below shows correction factors to be applied for liquids with specific gravities other then 1.0. Multiply the correction factor by the water scale value to obtain actual flow rate. Example: For a liquid of specific gravity of 1.66, the correction factor is 0.740. For water flow range of 100 to 1000 litres/hr, corrected range becomes 74 to 740 litres/hr. Viscosity should be between 0.5 cP and 1.3 cP for standard scales to be accurate.

For "sizing" liquid flows ie. determining actual flow range of a tube, please advise the **chemical name, concentration, temperature, specific gravity** and **viscosity.** Custom direct reading scales in any units are available special order.

SCALE CORRECTION FACTORS – FOR LIQUIDS WITH SPECIFIC GRAVITIES OTHER THAN 1.00

Specific Gravity	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
	Scale Correction Factor									
0.4	1.647	1.626	1.605	1.585	1.565	1.548	1.529	1.513	1.495	1.479
0.5	1.462	1.447	1.433	1.418	1.404	1.391	1.377	1.364	1.351	1.339
0.6	1.326	1.316	1.304	1.292	1.282	1.271	1.259	1.250	1.239	1.229
0.7	1.220	1.211	1.202	1.192	1.183	1.175	1.167	1.157	1.149	1.142
0.8	1.134	1.125	1.117	1.111	1.104	1.096	1.089	1.082	1.075	1.068
0.9	1.062	1.055	1.048	1.042	1.035	1.030	1.024	1.017	1.011	1.005
1.0	1.000	0.994	0.988	0.982	0.978	0.972	0.967	0.962	0.956	0.951
1.1	0.947	0.943	0.936	0.932	0.927	0.923	0.917	0.913	0.909	0.904
1.2	0.900	0.895	0.891	0.887	0.883	0.878	0.874	0.870	0.866	0.862
1.3	0.858	0.854	0.850	0.846	0.842	0.838	0.835	0.831	0.827	0.824
1.4	0.820	0.818	0.814	0.810	0.806	0.803	0.800	0.797	0.794	0.791
1.5	0.787	0.784	0.781	0.778	0.776	0.773	0.770	0.767	0.764	0.759
1.6	0.756	0.754	0.751	0.748	0.745	0.742	0.740	0.737	0.734	0.730
1.7	0.728	0.726	0.723	0.720	0.717	0.714	0.712	0.709	0.706	0.704
1.8	0.701	0.699	0.696	0.694	0.691	0.689	0.686	0.684	0.682	0.679
1.9	0.677	0.674	0.672	0.669	0.667	0.665	0.663	0.661	0.658	0.657
2.0	0.654	0.652	0.650	0.648	0.646	0.644	0.641	0.604	0.637	0.636

Variable Area Flow Meters

Flow Meter Sizing – Gas Flow

FLOW RANGES FOR AIR – AT STANDARD CONDITIONS (atmospheric pressure 14.7 psia/20°C).

FC SERIES – COMPACT SIZE – 5" SCALE

Flow Meter Item No.	Normal m^3/hr	Standard CFM
FCT00020	0.2 – 1.0	0.1 – 0.6
FCT00060	0.2 – 2.5	0.1 – 1.5
FCT00100	0.6 – 3.6	0.4 – 2.1
FCT00250	0.5 – 9.0	0.3 – 5.3
FCT00051	0.4 – 2.8	0.2 – 1.6
FCT00151	0.8 – 6.2	0.5 – 3.6
FCT00251	0.9 – 9.5	0.5 – 5.6
FCT00401	2.0 – 15.0	1.2 – 8.8
FCT00152	0.5 – 5.5	0.3 – 3.2
FCT00402	2.0 – 14.0	1.2 – 8.2
FCT00602	2.5 – 22.0	1.5 – 12.9
FCT01002	4.0 – 34.0	2.4 – 20.0
FCT00253	1.0 – 8.0	0.6 – 4.7
FCT00403	2.0 – 14.0	1.2 – 8.2
FCT01003	4.0 – 34.0	2.4 – 20.0
FCT01503	5.0 – 50.0	2.9 – 29.4

FS SERIES – STANDARD FULL SIZE – 7" SCALE

Flow Meter Item No.	Normal m^3/hr	Standard CFM
FST00150	0.7 – 5.5	0.4 – 3.2
FST00300	1 – 10	0.6 – 5.9
FST00600	2.5 – 20	1.5 – 12
FST01000	4 – 34	2.4 – 20
FST01500	5 – 50	2.9 – 29
FST02000	8.5 – 76	5.0 – 45
FST02500	8 – 70	4.7 – 41
FST03000	10 – 90	5.9 – 53
FST04000	14 – 125	8.2 – 74
FST06000	22 – 190	13 – 112
FST10000	35 – 300	21 – 177
FST15000	50 – 500	29 – 294
FST25000	80 – 720	47 – 424
FST50000	400 – 1,500	234 – 883

SCALE CORRECTION FACTORS – FOR AIR AT NON-STANDARD TEMPERATURES AND PRESSURES

Air density is dependent on the actual pressure and temperature.
Calculate the Scale Correction Factor using either Method 1 or 2. Multiply the standard air flow ranges above by the Factor to obtain actual flow rates.

Method 1

Calculate the Factor with the following formula.

$$\text{Factor} = \frac{1}{3.7005}\sqrt{\frac{\text{psia}}{(1+0.00367t)}}$$

psia = pressure of the air absolute
= psig + 14.7 (atmospheric pressure = 14.7 psia)
t = temperature of the air °C

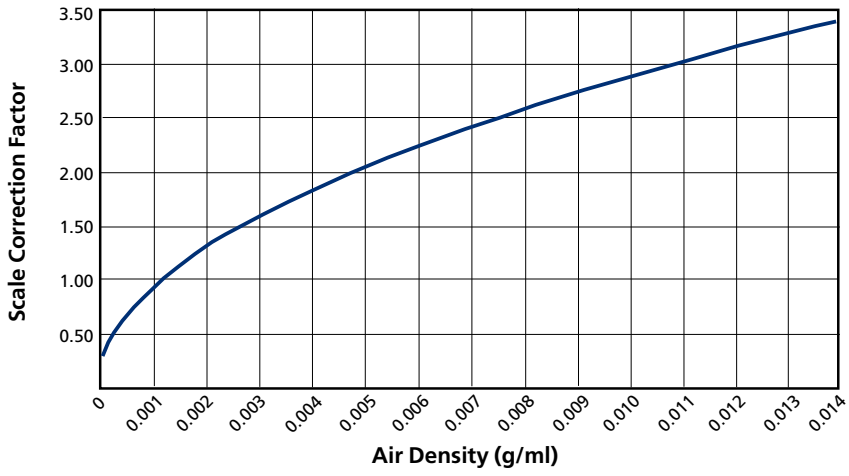
Method 2

Calculate the density of the air at conditions and find factor from the chart below.

$$\text{Air Density (g/ml)} = \frac{\text{psia}}{11{,}360\ (1+0.00367t)}$$

psia = pressure of the air absolute
= psig + 14.7 (atmospheric pressure = 14.7 psia)
t = temperature of the air °C

Air Density vs. Flow Factor



CHEMLINE Plastics Limited
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Your Pipeline To Quality Valves, Piping, Flow Meters and Controls

SCRAPER

ST-010

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Scraper	0	SUBMITTAL	P. Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-010	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-010-1	1	2	**SCRAPER GEARBOX**	S2-011	B68		SA	
				Manufacturer:	S2-021				
				SEW Eurodrive					
				Model:					
				RF97AD4ZR-FA47DT71D4					
				Combination Flanged Helical Gear					
				Helical gear motor with load cell arrangement					
				Rotational shaft speed (output):					
				1,6 rpm (fixed)					
				Ratio :					
				1101:1					
				Running torque:					
				623 lb-ft (845 Nm) equivalent force on load cell 247 N					
				Alarm torque:					
				934,5 lb-ft (1267Nm) equivalent force on load cell 370 N					
				Shutt-off torque:					
				1246 lb-ft (1689Nm) equivalent force on load cell 494 N					
				Mounting position :					
				M4 TB-0 CE-1					
				Mounting flange Dia. :					
				300 mm Bolt Circle diameter (AJ)					
				Output shaft Dia. :					
				2 3/8" x 120 mm					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Scraper	0	SUBMITTAL	P. Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-010	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
				Motor Model:					
				DT71D4					
				Type:					
				squirrel cage motor/ IEC standard					
				Service:					
				continuous					
				Insulation class :					
				F					
				Motor speed :					
				1800 rpm nominal					
				Power :					
				0,375 kW (0,5 HP)					
				Electrical feed					
				575V/3ph/60Hz					
				Full Load amp					
				1.0 A					
				S.F. motor:					
				1,2					
				Total weight (motoreducteur + oil)					
				138 kg (304 lbs)					
				Lubrifiant:					
				(14 + 1.9) liters food grade oil type					
				Protection					
				IP55					
				KS1 and KS2 protection					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Scraper	0	SUBMITTAL	P. Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-010	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-010-2	1	2	**LOAD CELL**		B68		FI	
				Supplier:					
				SEW Eurodrive					
				Model:					
				BLH alpha load beam					
				Range					
				500Newtons					
	NC01ST-010-3	1	2	**CONTROL MODULE :**		B68		FI	
				Strain Gauge transmitter					
				Model :					
				HPL220					
				Electrical feed :					
				24Vdc					
				Output signal :					
				4-20 mA 1000 ohms max					
				Insulation (box):					
				N/A installed wihtin junction box					
	NC01ST-010-4	1	2	**REDUCER BOX**		B68		SA	
				Supplier					
				John Meunier Inc.					
				Ratio :					
				4,59:1					
				Rotational output speed					
				0,35 rpm (fixed)					

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SCRAPER

GEARBOX

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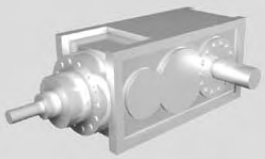
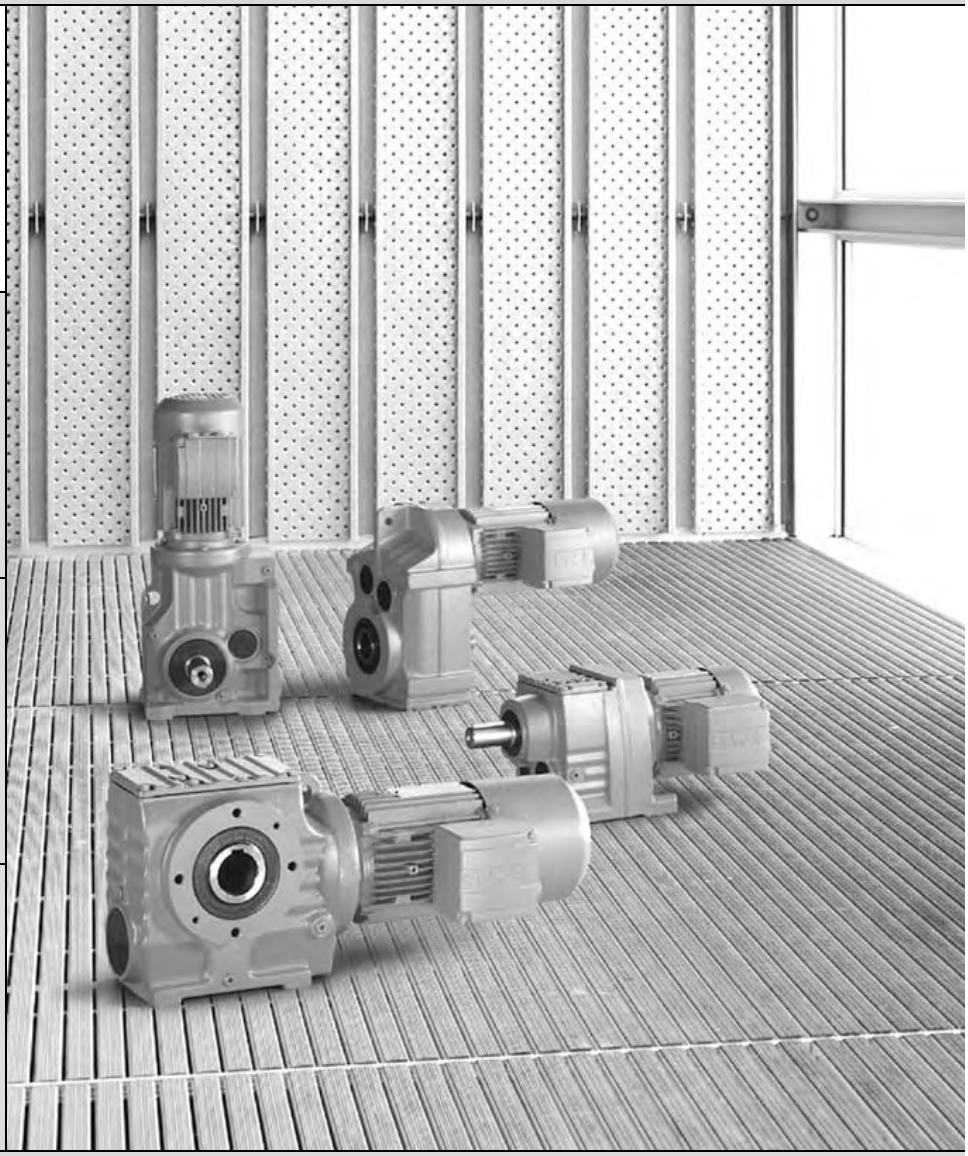
SEW EURODRIVE





Gear Units, R..7, F..7, K..7, S..7 Series, SPIROPLAN® W

A6.B01

Edition 05/2004

11226811 / EN

Operating Instructions

SEW EURODRIVE

Contents

1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Tips and useful information.

You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under guarantee

Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the gear unit.

- Adjust the lubricant fill volume and position of the breather valve accordingly in the event of a change of mounting position (see Sec. "Lubricants" and "Mounting Positions").
- Follow the instructions in Sec. "Mechanical installation" / "Installing the gear unit"!

Waste disposal

Please follow the latest instructions: Dispose of the following materials in accordance with the regulations in force:

- Steel scrap:
  - Housing parts
  - Gears
  - Shafts
  - Anti-friction bearing
  - Gray-cast iron (if there is no special collection)
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears as appropriate.
- Collect waste oil and dispose of it correctly.

2 Safety Notes

Preface

The following safety notes are primarily concerned with the use of gear units. If using **gearmotors**, please also refer to the safety notes for motors in the relevant operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, gearmotors, gear units and motors have:

- Live parts
- Moving parts
- Hot surfaces (may be the case)

Only qualified personnel may carry out the following work:

- Transportation
- Putting into storage
- Installation / assembly
- Connection
- Startup
- Maintenance
- Servicing

The following information and documents must be observed during these processes:

- Relevant operating instructions and wiring diagrams
- Warning and safety signs on the gear unit / gearmotor
- System-specific regulations and requirements
- National / regional regulations governing safety and the prevention of accidents

Serious injuries and property damage may result from:

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

Gearmotors / gear units from SEW are intended for industrial systems. They correspond to the applicable standards and regulations.

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential that you follow all the instructions!

Transportation

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be that you are not permitted to startup the drive due to the damage.

Tighten installed eyebolts. The eyebolts are only designed for the weight of the gearmotor / gear unit. Do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. The loads and regulations specified in this standard must always be observed. If two eyebolts are available, use both of them for transport. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Extended storage of gear units

Gear units of the "extended storage" type have:

- An oil fill suitable for the mounting position so the unit is ready to run (mineral oil CLP and synthetic oil CLP HC). You should still check the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").
- A higher oil level in some cases (synthetic oil CLP PG / food grade oil). Correct the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").

Comply with the storage conditions specified in the following table for extended storage:

Climate zone	Packaging[1)]	Storage location	Storage time
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

Installation / assembly	Observe the instructions in the sections "Installation" and "Assembly/Removal"!
Startup / operation	Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates. Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode. Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW-EURODRIVE if necessary.
Inspection / maintenance	Follow the instructions in the section "Inspection and Maintenance"!

3.2 Basicstructure of parallel shaft helical gear units

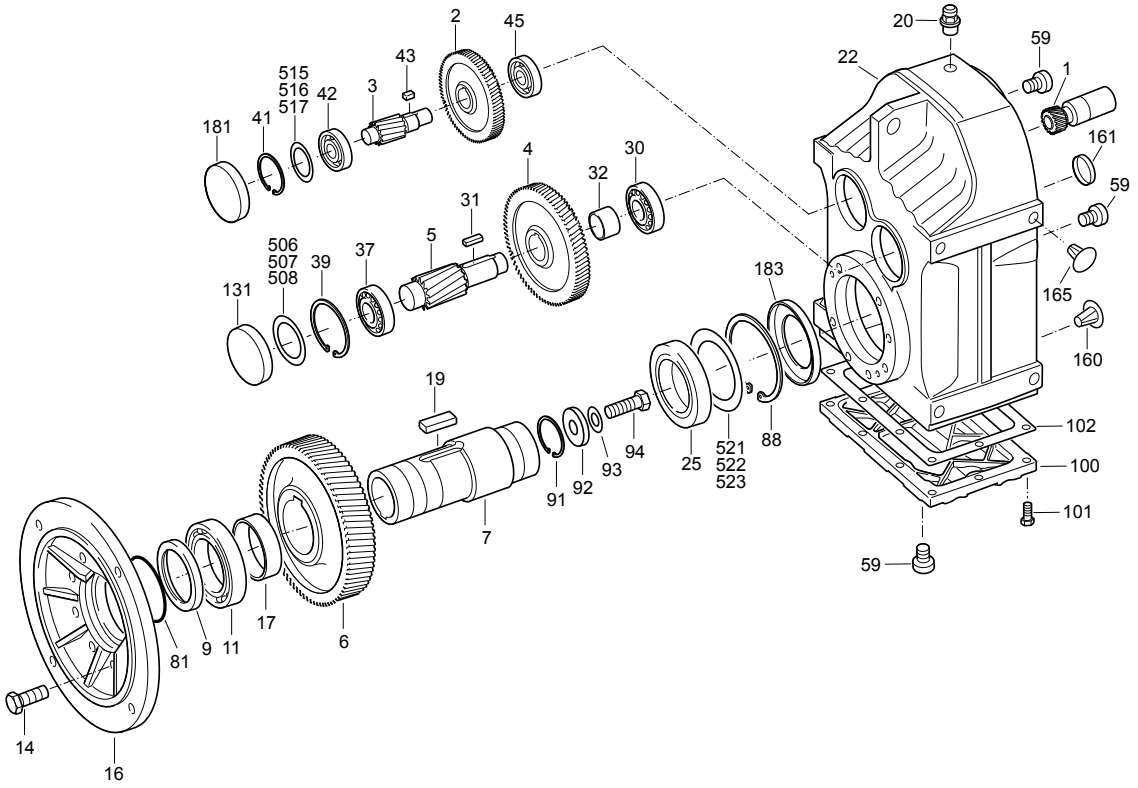


Figure 2: Basic structure of parallel shaft helical gear units

Key

1	Pinion	22	Gearcase	91	Circlip	506	Shim ring
2	Gear	25	Anti-friction bearing	92	Washer	507	Shim ring
3	Pinion shaft	30	Anti-friction bearing	93	Lock washer	508	Shim ring
4	Gear	31	Key	94	Hex head bolt	515	Shim ring
5	Pinion shaft	32	Spacer	100	Gearcase cover	516	Shim ring
6	Gear	37	Anti-friction bearing	101	Hex head bolt	517	Shim ring
7	Hollow shaft	39	Circlip	102	Gasket	521	Shim ring
9	Oil seal	41	Circlip	131	Closing cap	522	Shim ring
11	Anti-friction bearing	42	Anti-friction bearing	160	Closing plug	523	Shim ring
14	Hex head bolt	43	Key	161	Closing cap		
16	Output flange	45	Anti-friction bearing	165	Closing plug		
17	Spacer	59	Screw plug	181	Closing cap		
19	Key	81	O-ring	183	Oil seal		
20	Breather valve	88	Circlip				

3.3 Basic structure of helical-bevel gear units

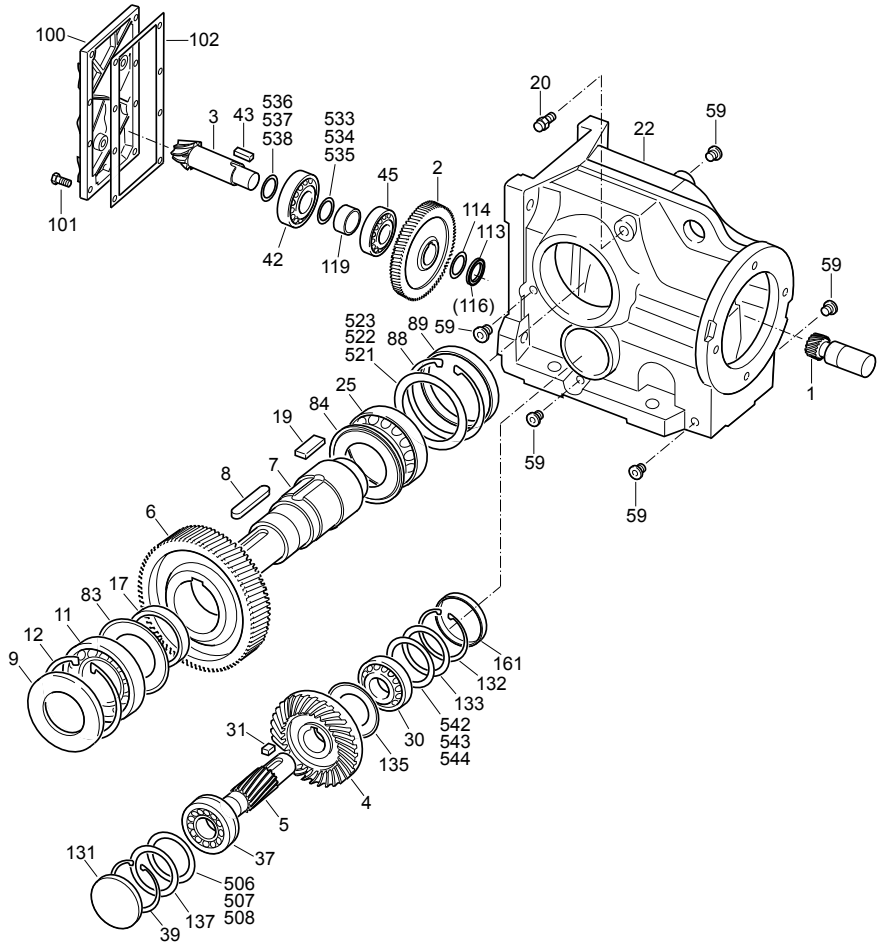


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Figure 3: Basic structure of helical-bevel gear units

Key

1 Pinion	25 Anti-friction bearing	102 Adhesive and sealing compound	522 Shim ring
2 Gear	30 Anti-friction bearing	113 Slotted round nut	523 Shim ring
3 Pinion shaft	31 Key	114 Multi-tang washer	533 Shim ring
4 Gear	37 Anti-friction bearing	116 Thread lock	534 Shim ring
5 Pinion shaft	39 Circlip	119 Spacer	535 Shim ring
6 Gear	42 Anti-friction bearing	131 Closing cap	536 Shim ring
7 Output shaft	43 Key	132 Circlip	537 Shim ring
8 Key	45 Anti-friction bearing	133 Spacer	538 Shim ring
9 Oil seal	59 Screw plug	135 Nilos ring	542 Shim ring
11 Anti-friction bearing	83 Nilos ring	161 Closing cap	543 Shim ring
12 Circlip	84 Nilos ring	506 Shim ring	544 Shim ring
17 Spacer	88 Circlip	507 Shim ring	
19 Key	89 Closing cap	508 Shim ring	
20 Breather valve	100 Gearcase cover	521 Shim ring	
22 Gearcase	101 Hex head bolt	521 Shim ring	

3.6 Nameplate, unit designation

Sample nameplate

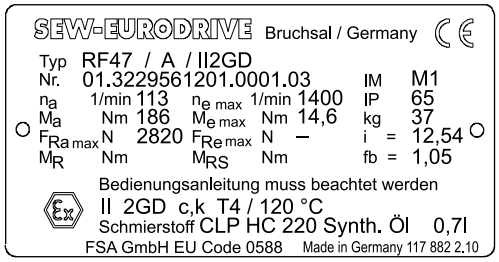

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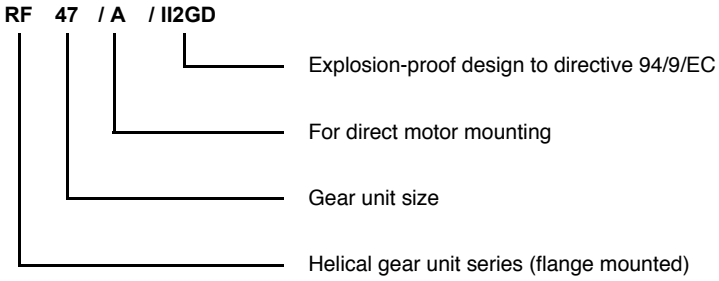
Figure 6: Sample nameplate

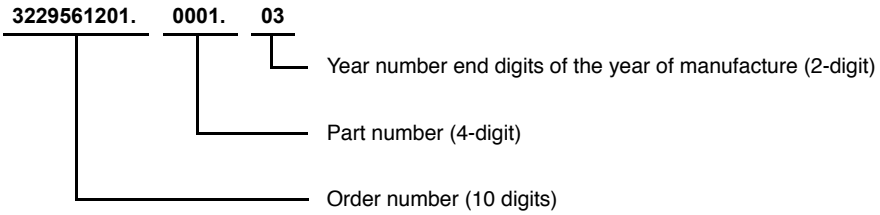
f_b		= Service factor
$F_{Ra\,max}$	[N]	= Maximum overhung load on the output side
$F_{Re\,max}$	[N]	= Maximum overhung load on the input side (with input shaft assembly AD)
i		= Gear unit reduction ratio
IM		= Mounting position
IP..		= Enclosure
$n_{e\,max}$	[1/min]	= Maximum input speed
n_a	[1/min]	= Output speed
$M_{e\,max}$	[Nm]	= Maximum input torque
M_a	[Nm]	= Output torque
M_R	[Nm]	= Overload torque when using an AR adapter
M_{RS}	[Nm]	= Locking torque of the backstop

Unit designation

Example: Helical gear unit, category II2GD



Example: Serial number



4 Mechanical Installation

4.1 Required tools / aids

- Set of spanners
- Torque wrench for:
  - Shrink discs
  - AQH motor adapter
  - Input shaft assembly with centering shoulder
- Mounting device
- Shims and distance rings if necessary
- Fixing devices for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt adhesive (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not part of the delivery

Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 • ISO k6 for solid shafts with ∅ ≤ 50 mm • ISO m6 for solid shafts with ∅ > 50 mm • ISO H7 for hollow shafts • Center bore in accordance with DIN 332, shape DR	Centering shoulder tolerance in accordance with DIN 42948 • ISO j6 with b1 ≤ 230 mm • ISO h6 with b1> 230 mm

4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The data on the nameplate of the gearmotor matches the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:
  - **For standard gear units:**
    Ambient temperature according to the lubricant table in Sec. "Lubricants" (see standard).
    The drive must not be assembled in the following ambient conditions:
    - Potentially explosive atmosphere
    - Oil
    - Acids
    - Gas
    - Vapors
    - Radiation
  - **For special versions:**
    The drive configured in accordance with the ambient conditions.
  - **For helical-worm / SPIROPLAN® W gear units:**
    No large external mass moments of inertia which could exert a retrodriving load on the gear unit.
    [At η' (retrodriving) = $2 - 1/\eta < 0.5$ self-locking]

- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not let the solvent come into contact with the sealing lips of the oil seals – danger of damage to the material!
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

4.3 Installing the gear unit

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. SPIROPLAN® gear units are not dependent on the mounting position.

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

Maximum permitted flatness error for foot and flange mounting (approximate values with reference to DIN ISO 1101):

- Gear unit size ≤ 67: max. 0.4 mm
- Gear unit size 77 ... 107: max. 0.5 mm
- Gear unit size 137 ... 147: max. 0.7 mm
- Gear unit size 157 ... 187: max. 0.8 mm

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads!

Secure the gearmotors with bolts of quality 8.8.

Secure the following gearmotors with bolts of quality 10.9:

- RF37, R37F with flange ∅ 120 mm
- RF47, R47F with flange ∅ 140 mm
- RF57, R57F with flange ∅ 160 mm

The oil checking and drain screws and the breather valves must be freely accessible!

At the same time, also check that the oil fill is as specified for the mounting position (see Sec. "Lubricants" / "Lubricant fill quantities" or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position.

Please contact our SEW customer service if you change the mounting position of K gear units to M5 or M6 or between M5 and M6.

Please contact our SEW customer service if you change the mounting position of size S47 S97 S gear units to mounting position M2.

Use plastic inserts (2 ... 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical bleeder resistor < 10^9 Ω. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also install the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

Installation in damp locations or in the open

Drives are supplied in corrosion-resistant versions for use in damp areas or in the open air. Repair any damage to the paint work (e.g. on the breather valve).

When mounting the motors onto AM, AQ, AR, AT adapters, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.

Gear unit venting

No breather plug is required for the following gear units:

- R07 in mounting positions M1, M2, M3, M5 and M6
- R17, R27 and F27 in mounting positions M1, M3, M5 and M6
- SPIROPLAN® W gear units

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

Exceptions:

1. SEW supplies the following gear units with a screw plug on the vent hole provided:
   - Gear units for extended storage
   - Pivoted mounting positions, if possible
   - Gear units for mounting on a slant

   The breather valve is located in the motor terminal box. Before startup, you must replace the highest screw plug with the breather valve supplied.
2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

Activating the breather valve

As a rule, the breather valve is already activated at the factory. If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture
2. Remove the transport fixture
3. Breather valve activated

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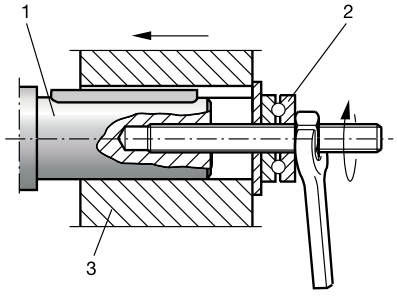
Painting the gear unit

If you paint or respray the drive, ensure that you cover the breather valve and oil seals carefully. Remove the strips of tape after completing the painting work.

4.4 Gear unit with solid shaft

Installing input and output elements

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.



1) Gear shaft end
2) Thrust bearing
3) Coupling hub

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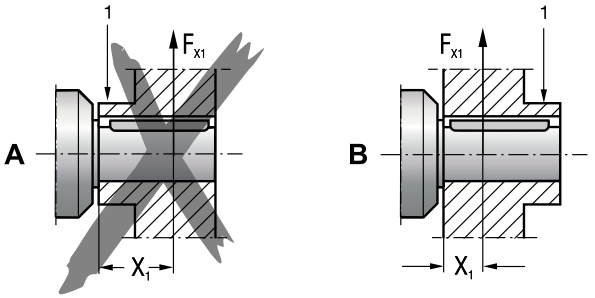
Avoid impermissibly high overhung loads: Install the gear or chain sprocket according to figure **B**.



1 = Hub

A = Unfavorable
B = Correct

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- Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer This will damage the bearings, housing and the shaft!**
- **In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotor" or "Explosion-Proof Drives" catalogs for permitted values).

Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly (to 80 ... 100 °C).

Installing couplings

Couplings must be mounted and balanced according to the information provided by the coupling manufacturer:

a) Maximum and minimum clearance

b) Axial misalignment

c) Angular misalignment

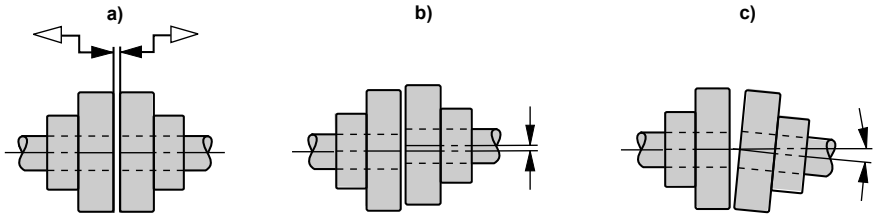

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Figure 7: Clearance and misalignment for coupling installation

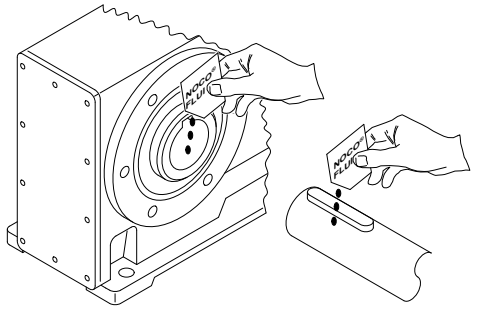
Input and output elements such as belt pulleys, couplings, etc. must be protected against contact!

4.6 Mounted gear unit with keyway or splined hollow shaft

For the configuration of customer shafts, please also refer to the design notes in the Gearmotors catalog!

Installation notes

1. Apply NOCO® fluid.



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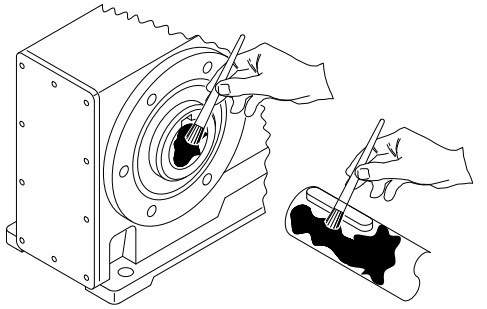
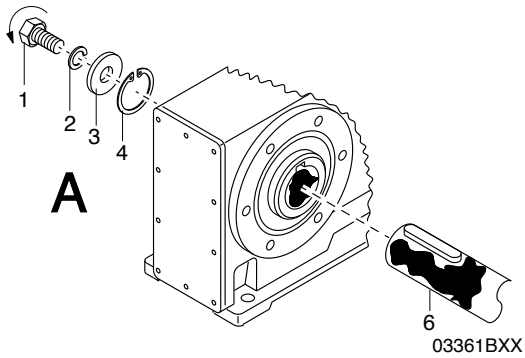
2. Distribute the NOCO® fluid carefully.



02043AXX

3. Install the shaft and secure it axially
   (mounting is facilitated by using a mounting device)
   3A: Mounting with standard scope of delivery

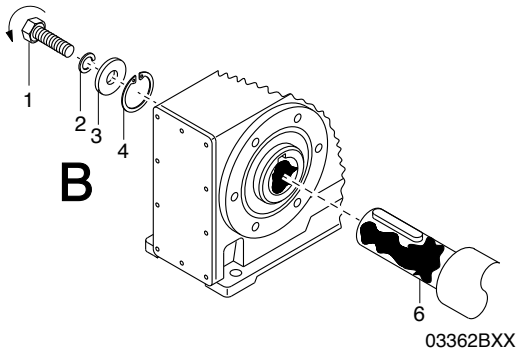


03361BXX

1 Short retaining bolt (standard scope of delivery)
2 Lock washer
3 Washer
4 Circlip
6 Customer shaft

3B: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

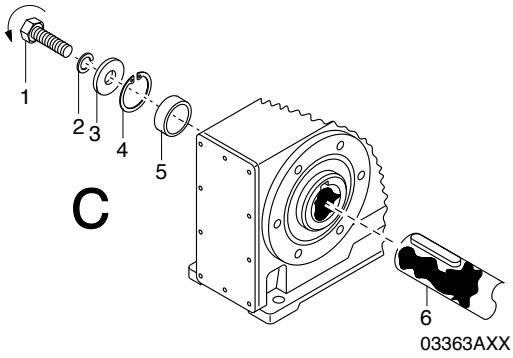
– Customer's shaft **with** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
6 Customer's shaft with contact shoulder

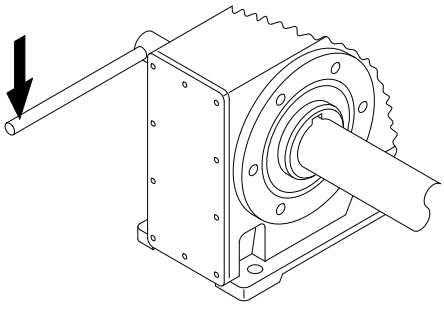
3C: Assembly with SEW-EURODRIVE assembly/disassembly kit (→ page 26)

– Customer's shaft **without** contact shoulder



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer's shaft without contact shoulder

4. Tighten the retaining bolt to the appropriate torque (see table).



Bolt	Tightening torque [Nm]
M5	5
M6	8
M10/12	20
M16	40
M20	80
M24	200

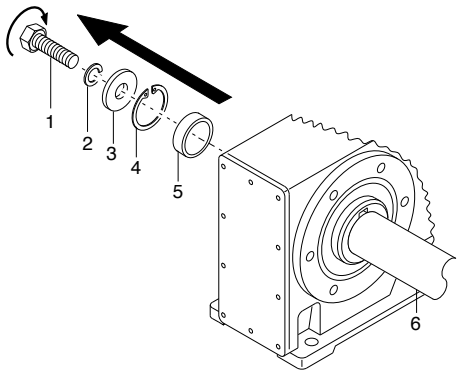
Note:

To avoid contact corrosion, we recommend that the customer's shaft should additionally be recessed between the two contact surfaces!

Removal notes

This description is only applicable when the gear unit was assembled using the installation/removal kit from SEW-EURODRIVE(→ page 26) (see the previous description, point 3B or 3C).

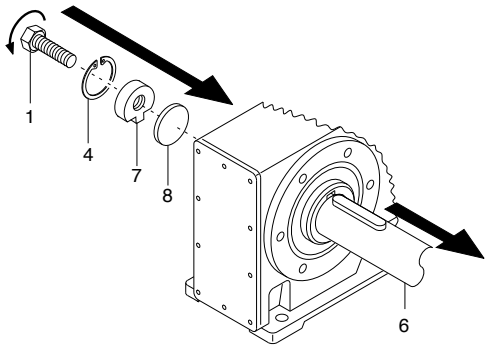
1. Loosen the retaining bolt [1].
2. Remove parts 2 to 4 and, if fitted, spacer 5.



1 Retaining bolt
2 Lock washer
3 Washer
4 Circlip
5 Spacer
6 Customer shaft

03366AXX

3. Insert the forcing washer [8] and the fixed nut [7] from the SEW-EURODRIVE installation/removal kit between the customer's shaft [6] and the circlip [4].
4. Re-insert the circlip [4].
5. Screw the retaining bolt [1] back in. Now you can force the gear unit off the shaft by tightening the bolt.

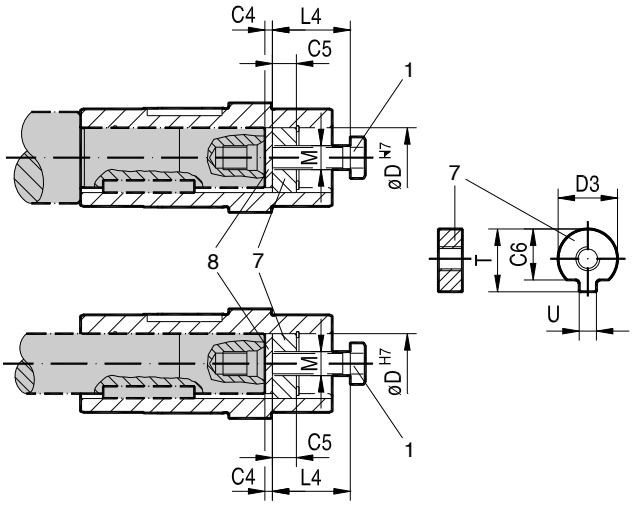


1 Retaining bolt
4 Circlip
6 Customer shaft
7 Fixed nut
8 Forcing washer

03367AXX

SEW installation/removal kit

The SEW-EURODRIVE installation/removal kit can be ordered under the following part number.



03394AXX

Figure 12: SEW-EURODRIVE installation/removal kit

1 Retaining bolt
7 Fixed nut for disassembly
8 Forcing washer

Type	D^{H7} [mm]	M[1)]	C4 [mm]	C5 [mm]	C6 [mm]	$U^{-0.5}$ [mm]	$T^{-0.5}$ [mm]	$D3^{-0.5}$ [mm]	L4 [mm]	Part number of installation/removal kit
WA..10	16	M5	5	5	12	4.5	18	15.7	50	643 712 5
WA..20	18	M6	5	6	13.5	5.5	20.5	17.7	25	643,682 X
WA..20, WA..30, SA..37	20	M6	5	6	15.5	5.5	22.5	19.7	25	643 683 8
FA..27, SA..47	25	M10	5	10	20	7.5	28	24.7	35	643 684 6
FA..37, KA..37, SA..47, SA..57	30	M10	5	10	25	7.5	33	29.7	35	643 685 4
FA..47, KA..47, SA..57	35	M12	5	12	29	9.5	38	34.7	45	643 686 2
FA..57, KA..57, FA..67, KA..67, SA..67	40	M16	5	12	34	11.5	41.9	39.7	50	643 687 0
SA..67	45	M16	5	12	38.5	13.5	48.5	44.7	50	643 688 9
FA..77, KA..77, SA..77	50	M16	5	12	43.5	13.5	53.5	49.7	50	643 689 7
FA..87, KA..87, SA..77, SA..87	60	M20	5	16	56	17.5	64	59.7	60	643 690 0
FA..97, KA..97, SA..87, SA..97	70	M20	5	16	65.5	19.5	74.5	69.7	60	643 691 9
FA..107, KA..107, SA..97	90	M24	5	20	80	24.5	95	89.7	70	643 692 7
FA..127, KA..127	100	M24	5	20	89	27.5	106	99.7	70	643 693 5
FA..157, KA..157	120	M24	5	20	107	31	127	119.7	70	643 694 3

1) Retaining bolt

The SEW assembly kit for mounting the customer shaft is a recommendation from SEW-EURODRIVE. You must always check whether this design can compensate the axial loads. In particular applications (e.g. mounting mixer shafts), a different design may have to be used to secure the shaft axially. In these cases, customers can use their own devices. However, you must ensure that these designs do not cause potential sources of combustion according to DIN EN 13463 (for example, impact sparks).

5 Startup

Prior to startup check that the oil level is as specified for the mounting position. The oil checking and drain screws and the breather valves must be freely accessible.

5.1 Startup of helical-worm and SPIROPLAN® W gear units

Note: The direction of rotation of the output shaft in series S..7 helical-worm gear units has been changed from CW to CCW; this is different from the S..2 series. Change direction of rotation: Swap over two motor feeder cables.

Run-in period

SPIROPLAN® and helical-worm gear units require a run-in period of at least 24 hours before reaching their maximum efficiency. A separate run-in period applies for each direction of rotation if the gear unit is operated in both directions of rotation. The table shows the average power reduction during the run-in period.

No. of starts	Worm		Spiroplan®	
	Power reduction	i range	Power reduction	i range
1 start	ca. 12 %	ca. 50...280	ca. 15 %	approx. 40 ... 75
2 start	ca. 6 %	ca. 20...75	ca. 10 %	ca. 20...30
3 start	ca. 3 %	ca. 20...90	ca. 8 %	ca. 15
4 start	-	-	ca. 8 %	ca. 10
5 start	ca. 3 %	ca. 6...25	ca. 5 %	ca. 8
6 start	ca. 2 %	ca. 7...25	-	-

5.2 Startup of helical, parallel shaft helical and helical-bevel gear units

No special startup instructions are required for helical, parallel shaft helical and helical-bevel gear units providing the gear units have been installed in accordance with Sec. "Mechanical Installation".

6 Inspection and Maintenance

6.1 Inspection and maintenance intervals

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months.	• Check oil and oil level. • Check the seals visually for leakage. • For gear units with a torque arm: Check the rubber buffer and change it, if necessary
• Depending on the operating conditions (see chart below), every 3 years at the latest. • According to oil temperature.	• Change mineral oil.
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Depending on the operating conditions (see chart below), every 5 years at the latest. • According to oil temperature.	• Change synthetic oil
	• Replace anti-friction bearing grease (recommendation). • Replace oil seal (do not install it in the same track).
• Gear unitsR07, R17, R27, F27 and Spiroplan® are have lubrication for life and are therefore maintenance-free	
• Varying (depending on external factors).	• Touch up or renew the surface/anticorrosion coating.

6.2 Lubricant change intervals

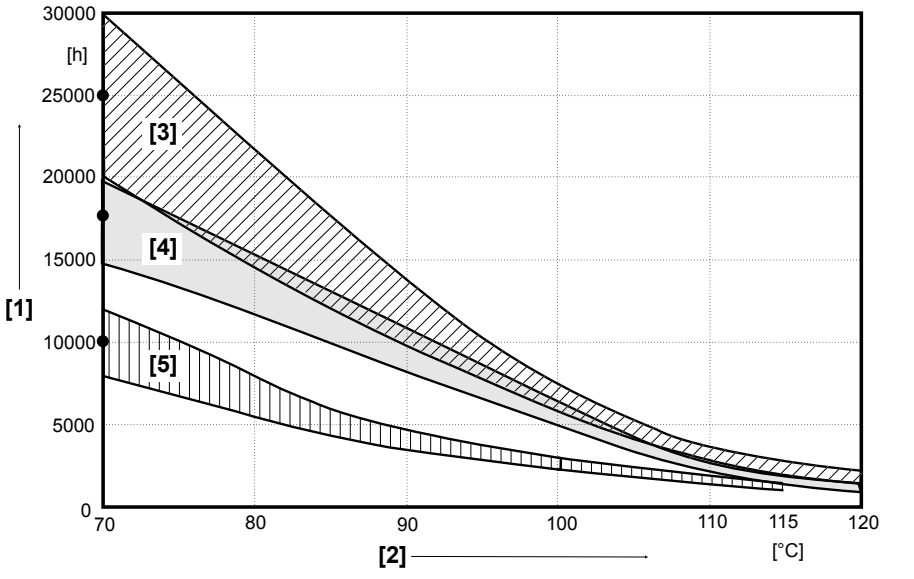


Figure 13: Oil change intervals for standard gear units under normal environmental conditions

[1] Operating hours
[2] Sustained oil bath temperature
- Average value per oil type at 70 °C

[3] CLP PG
[4] CLP HC / HCE
[5] CLP / HLP / E

6.3 Inspection and maintenance of the gear unit

Do not intermix synthetic lubricants and do not mix synthetic and mineral lubricants together!

The standard lubricant is mineral oil (except for Spiroplan® gear units).

The position of the oil level and oil drain plug and the breather valve depends on the mounting position. Refer to the diagrams of the mounting positions.

Checking the oil level

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Refer to Sec. "Installing the gear unit" when changing the mounting position!
3. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Checking the oil

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. Remove a little oil from the oil drain plug.
3. Check the oil consistency.
   - Viscosity
   - If you can see that the oil is heavily contaminated, we recommend that you change the oil even if this is outside the service intervals specified in "Inspection and maintenance periods".
4. For gear units with an oil level plug: Remove the oil level plug, check the fill level and correct it if necessary. Screw the oil level plug back in.

Changing the oil

Only change the oil when the gear unit is at operating temperature.

De-energize the gearmotor and secure it to prevent it from being switched back on inadvertently!

Wait until the gear unit cools down - Danger of burns!

Note: The gear unit must still be warm otherwise the high viscosity of excessively cold oil will make it harder to drain the oil correctly.

With oil drain plug / oil level screw

1. Place a container underneath the oil drain plug
2. Remove the oil level plug, breather plug/breather valve and oil drain plug.
3. Drain all the oil.
4. Screw in the oil drain plug.
5. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   - Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
   - Check at the oil level plug.
6. Screw the oil level plug back in
7. Screw in the breather plug/breather valve.

Without oil drain plug / oil level plug

1. Remove cover plate.
2. Drain the oil through the cover plate opening.
3. Pour in new oil of the same type through the vent hole (if changing the oil type, please first contact our customer service). Do not mix synthetic lubricants.
   – Pour in the volume of oil in accordance with the mounting position (see Sec. "Lubricant fill quantities") or as specified on the nameplate.
4. Check the oil level (→ Sec. "Check oil level for gear units with oil level plug")
5. Attach cover plate (observe the tightening torque and series → Sec. "Check the oil level for gear units without an oil level plug")

Changing the oil seal

1. **De-energize the gearmotor and secure it to prevent it from being switched on inadvertently!**

   Wait until the gear unit has cooled off – Danger of burns!
2. When changing the oil seal, ensure that there is a sufficient grease reservoir between the dust lip and protective lip, depending on the type of gear unit.
3. If you use double oil seals, the space has to be filled one-third with grease.

6.4 Inspection / maintenance of AM / AQA adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check torsional play • Visually check the elastic annular gear • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease • Replace oil seal (do not install it in the same track) • Change the elastic annular gear.

6.5 Inspection / maintenance of AD adapters

Frequency	What to do?
• Every 3000 machine hours, at least every 6 months	• Check running noise for possible bearing damage • Check the adapter visually for leakage
• After 25000 - 30000 machine hours	• Renew the anti-friction bearing grease
	• Change the oil seal

7 Malfunctions

Customer service

Please have the following information to hand if you require the assistance of our customer service:
- Data from the nameplate (complete)
- Nature and extent of the fault
- Time and peripheral circumstances of the fault
- Presumed cause

7.1 Gear unit malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	A Meshing/grinding noise: Bearing damage. B Knocking noise: Irregularity in the gearing	A Check the oil (see Sec. "Inspection and Maintenance"), change bearings B Contact customer service
Unusual, irregular running noise	Foreign bodies in the oil	• Check the oil (see Sec. "Inspection and Maintenance") • Stop the drive, contact customer service
Oil leaking[1)] • From the gear cover plate • From the motor flange • From the motor oil seal • From the gear unit flange • From the output end oil seal	A Rubber seal on the gear cover plate leaking B Seal defective C Gear unit not vented	A Tighten the bolts on the gear cover plate and observe the gear unit. Oil still leaking: Contact customer service B Contact customer service C Vent the gear unit (see Sec. "Mounting Positions")
Oil leaking from breather valve	A Too much oil B Drive operated in incorrect mounting position C Frequent cold starts (oil foams) and/or high oil level	A Correct the oil level (see Sec. "Inspection and Maintenance") B Mount the breather valve correctly (see Sec. "Mounting Positions") and correct the oil level (see "Lubricants")
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send in the gear unit/gearmotor for repair

1) Short-term oil/grease leakage at the oil seal is possible in the run-in phase (24 hours running time).

7.2 AM / AQA / AL adapter malfunctions

Problem	Possible cause	Remedy
Unusual, regular running noise	Meshing/grinding noise: Bearing damage	Contact SEW-EURODRIVE customer service
Oil leaking	Seal defective	Contact SEW-EURODRIVE customer service
Output shaft does not turn although the motor is running or the input shaft is rotated	Connection between shaft and hub in gear unit interrupted	Send the gear unit to SEW-EURODRIVE for repair.
Change in running noise and / or vibrations occur	A Annular gear wear, short-term torque transfer through metal contact B Bolts to secure hub axially are loose.	A Change the annular gear B Tighten the bolts
Premature wear in annular gear	A Contact with aggressive fluids / oil; ozone influence; too high ambient temperatures etc, which can cause a change in the physical properties of the annular gear. B Impermissibly high ambient/contact temperature for the annular gear; maximum permitted temperature –20 °C to +80 °C. C Overload	Contact SEW-EURODRIVE customer service

8 Mounting Positions

8.1 General information on mounting positions

Mounting position designation

SEW differentiates between six mounting positions M1 ... M6 for gear units. The following figure shows the spatial orientation of the gearmotor in mounting positions M1 ... M6.

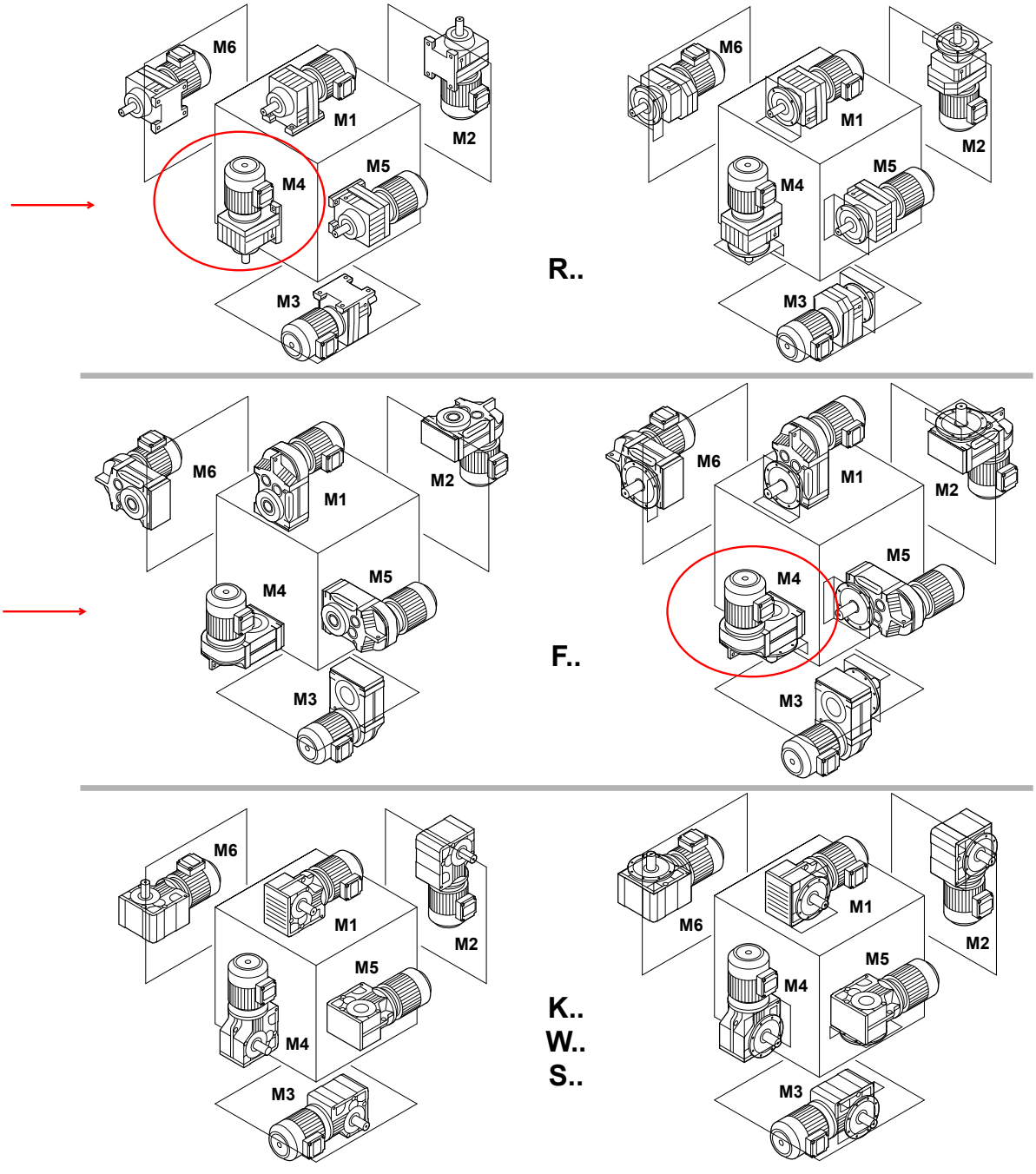


Figure 14: Depiction of mounting positions M1 ... M6

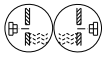
8.2 Key to the mounting position sheets

SPIROPLAN® gearmotors do not depend on any particular mounting position. However, mounting positions M1 to M6 are also shown for SPIROPLAN® gearmotors to assist you in working with this documentation.

Important: SPIROPLAN® gearmotors cannot be equipped with breather valves, oil level plugs or drain plugs.

Symbols used

The following table shows the symbols used in the mounting position sheets and what they mean:

Symbol	Meaning
	Breather valve
	Oil level plug
	Oil drain plug

Churning losses

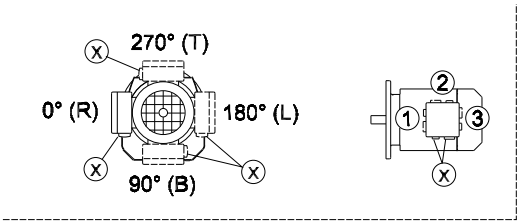
*

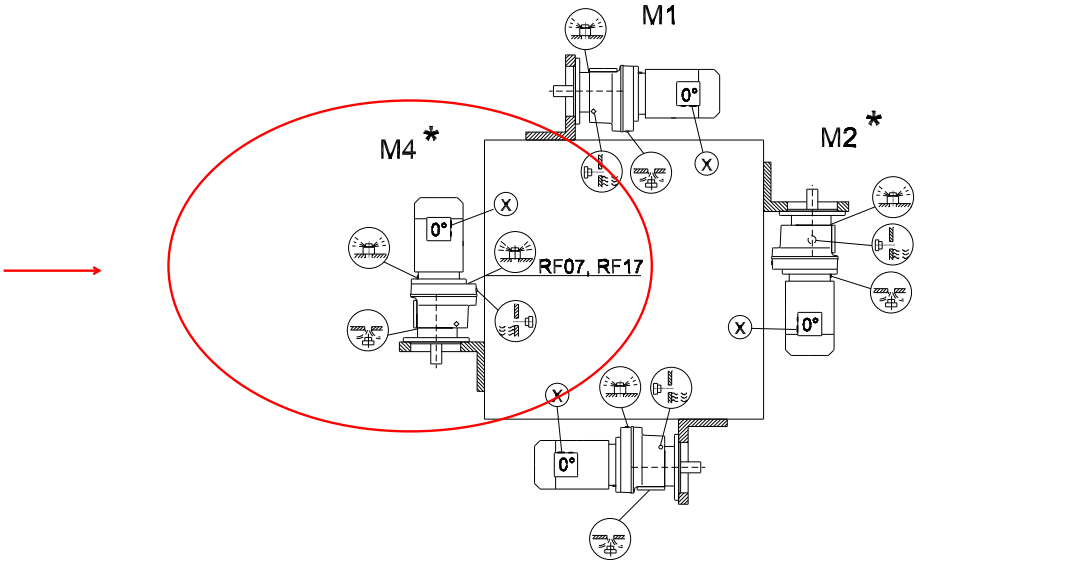
Increased churning losses may arise in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

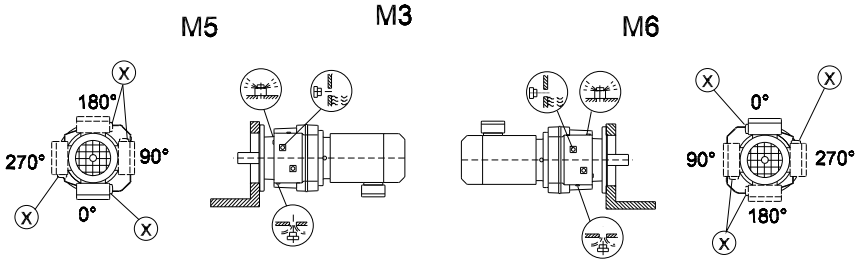
Mounting position	Gear unit type	Gear unit size	Input speed [1/min]
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

RF07-RF167

04 041 200





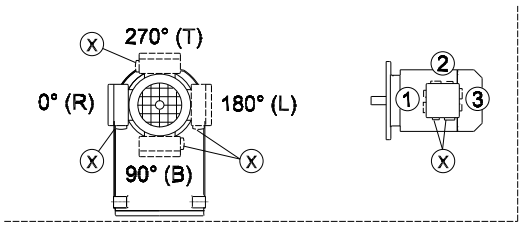


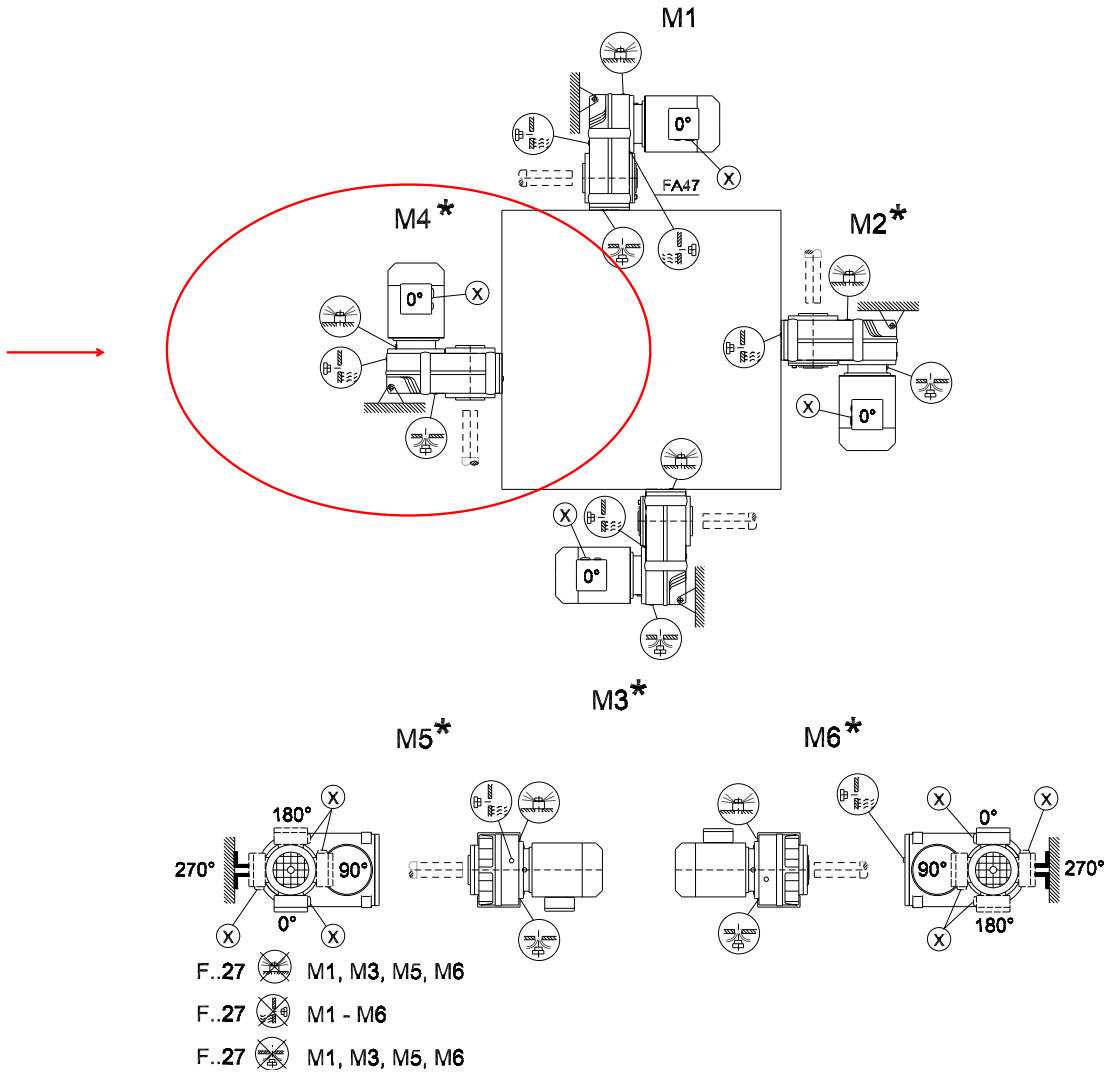
RF07		M1, M2 , M3 , M5 , M6
RF17, RF27		M1, M3 , M5 , M6
RF07, RF17, RF27		
RF47, RF57		M5

* → page 51

FA/FH27-157, FV27-107, FT37-97

42 044 200





F..27 M1, M3, M5, M6

F..27 M1 - M6

F..27 M1, M3, M5, M6

* → page 51

9 Lubricants

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 ... M6, → Sec. "Mounting Positions and Important Order Information") specified when ordering the drive. You must adapt the lubricant fill to any subsequent changes made to the mounting position (→ Lubricant fill quantities).

9.1 Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Please note the following key to the lubricant table.

Key to the lubricant table

Abbreviations used, meaning of shading and notes:

CLP	= Mineral oil
CLP PG	= Polyglycol (W gear units, conforms to USDA-H1)
CLP HC	= Synthetic hydrocarbons
E	= Ester oil (water pollution danger category WGK 1)
HCE	= Synthetic hydrocarbons + ester oil (USDA-H1 certification)
HLP	= Hydraulic oil
	= Synthetic lubricant (= synthetic anti-friction bearing grease)
	= Mineral lubricant (= mineral-based anti-friction bearing grease)
1)	Helical-worm gear units with PG oil: Please contact SEW
2)	Special lubricant for Spiroplan® gear units only
3)	Recommendation: Select SEW $f_B \geq 1.2$
4)	Pay attention to critical starting behavior at low temperatures!
5)	Low-viscosity grease
6)	Ambient temperature
	Lubricant for the food industry (food grade oil)
	Biodegradable oil (lubricant for use in agriculture, forestry and water resources)

Anti-friction bearing greases

The anti-friction bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing anti-friction bearings with a grease fill at the same time as changing the oil.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in gear unit	-20 °C ... +60 °C	Mobil	Mobilux EP 2
	-40 °C ... +80 °C	Mobil	Mobiltemp SHC 100
Anti-friction bearing in motor	-20 °C ... +80 °C	Esso	Unirex EQ3
	-20 °C ... +60 °C	Shell	Alvania RL3
	+80 °C ... +100 °C	Klüber	Barrierta L55/2
	-45 °C ... -25 °C	Shell	Aero Shell Grease 16
Special greases for anti-friction bearings in gear units:			
	-30 °C ... +40 °C	Aral	Eural Grease EP 2
	-20 °C ... +40 °C	Aral	Aralube BAB EP2

The following grease quantities are required:

- For fast-running bearings (motor and gear unit input end): Fill the cavities between the rolling elements one third full with grease.
- For slow-running bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two thirds full with grease.

Lubricant table

01 805 892

	6) °C -50 0 +50 +100	DIN (ISO)	ISO,NLGI	Mobil®	Shell	Klüber	Aral	BP	Tribol	TEXACO		FUCHS
R...	Standard -10 +40	CLP(CC)	VG 220	Mobilgear 630	Shell Omala 220	Klüberoil GEM 1-220	Aral Degol BG 220	BP Energol GR-XP 220	Tribol 1100/220	Meropa 220	Optigear BM 220	Renolin CLP 220
K...(HK...)	-25 +80	CLP PG	VG 220	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220	Aral Degol GS 220	BP Enersyn SG-XP 220	Tribol 800/220	Synlube CLP 220	Optiflex A 220	
	4) -40 +80	CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Klübersynth EG 4-220	Aral Degol PAS 220		Tribol 1510/220	Pinnacle EP 220	Optigear Synthetic A 220	Renolin Unisyn CLP 220
	4) -40 +40		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth EG 4-150				Pinnacle EP 150		
F...	-20 +25	CLP (CC)	VG 150 VG 100	Mobilgear 627	Shell Omala 100	Klüberoil GEM 1-150	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 150	Optigear BM 100	Renolin CLP 150
	-30 +10	HLP (HM)	VG 68-46 VG 32	Mobil D.T.E. 13M	Shell Tellus T 32	Klüberoil GEM 1-68	Aral Degol BG 46		Tribol 1100/68	Rando EP Ashless 46	Optigear 32	Renolin B 46 HVI
	4) -40 +10	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46		
	4) -40 -20	HLP (HM)	VG 22 VG 15	Mobil D.T.E. 11M	Shell Tellus T 15	Isoflex MT 30 ROT		BP Energol HLP-HM 15		Rando HDZ 15		
S...(HS...)	Standard 0 +40	CLP (CC)	VG 680	Mobilgear 636	Shell Omala 680	Klüberoil GEM 1-680	Aral Degol BG 680	BP Energol GR-XP 680	Tribol 1100/680	Meropa 680	Optigear BM 680	Renolin CLP 680
	-20 +60	CLP PG	VG 680 1)		Shell Tivela S 680	Klübersynth GH 6-680		BP Enersyn SG-XP 680	Tribol 800/680	Synlube CLP 680		
	4) -30 +80	CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460	Klübersynth EG 4-460				Pinnacle EP 460		
	4) -40 +10		VG 150	Mobil SHC 629	Shell Omala HD 150	Klübersynth EG 4-150				Pinnacle EP 150		
	-20 +10	CLP (CC)	VG 150 VG 100	Mobilgear 627	Shell Omala 100	Klüberoil GEM 1-150	Aral Degol BG 100	BP Energol GR-XP 100	Tribol 1100/100	Meropa 100	Optigear BM 100	Renolin CLP 150
	-25 +20	CLP PG	VG 220 1)	Mobil Glygoyle 30	Shell Tivela S 220	Klübersynth GH 6-220			Tribol 800/220	Synlube CLP 220	Optiflex A 220	
	4) -40 0	CLP HC	VG 32	Mobil SHC 624		Klüber-Summit HySyn FG-32				Cetus PAO 46		
R...,K...(HK...), F...,S...(HS...)	4) -30 +40	HCE	VG 460		Shell Cassida Fluid GL 460	Klüberoil 4UH1-460 N	Aral Eural Gear 460				Optileb GT 460	
	-20 +40	E	VG 460			Klüberbio CA2-460	Aral Degol BAB 460				Optisynt BS 460	
W...(HW...)	Standard -20 +40	SEW PG	VG 460 2)			Klüber SEW HT-460-5						
	4) -40 +10	API GL5	SAE 75W90 (~VG 100)	Mobilube SHC 75 W90-LS								
	-20 +40	CLP PG	VG 460 3)			Klübersynth UH1 6-460						
R32 R302	-25 +60	DIN 51 818 5)	00	Glygoyle Grease 00	Shell Tivela GL 00	Klübersynth GE 46-1200				Multifak 6833 EP 00		
	Standard -15 +40		000 - 0	Mobilux EP 004	Shell Alvania GL 00		Aralub MFL 00	BP Energrease LS-EP 00		Multifak EP 000	Longtime PD 00	Renolin SF 7 - 041

9.2 Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil capacity**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 ... M6.

Helical (R) gear units

Gear unit type R.., R..F	Fill quantity in liters					
	M1[1)]	M2[1)]	M3	M4	M5	M6
R07/R07F	0.12	0.20	0.20	0.20	0.20	0.20
R17/R17F	0.25	0.55	0.35	0.55	0.35	0.35
R27/R27F	0.25/0.40	0.70	0.50	0.70	0.50	0.50
R37/R37F	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47/R47F	0.70/1.50	1.60	1.50	1.65	1.50	1.50
R57/R57F	0.80/1.70	1.90	1.70	2.10	1.70	1.70
R67/R67F	1.10/2.30	2.60/3.50	2.80	3.20	1.80	2.00
R77/R77F	1.20/3.00	3.80/4.10	3.60	4.10	2.50	3.40
R87/R87F	2.30/6.0	6.7/8.2	7.2	7.7	6.3	6.5
R97	4.60/9.8	11.7/14.0	11.7	13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	25.0
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0
Gear unit type RF.. / RM..	**Fill quantity in liters**					
	M1[1)]	**M2[1)]**	**M3**	**M4**	**M5**	**M6**
RF07	0.12	0.20	0.20	0.20	0.20	0.20
RF17	0.25	0.55	0.35	0.55	0.35	0.35
RF27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.50	1.65	1.50	1.50
RF/RM57	0.80/1.70	1.80	1.70	2.00	1.70	1.70
RF/RM67	1.20/2.50	2.70/3.60	2.70	2.60	1.90	2.10
RF/RM77	1.20/2.60	3.80/4.10	3.30	4.10	2.40	3.00
RF/RM87	2.40/6.0	6.8/7.9	7.1	7.7	6.3	6.4
RF/RM97	5.1/10.2	11.9/14.0	11.2	14.0	11.2	11.8
RF/RM107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF/RM137	9.5/25.0	27.0	29.0	32.5	25.0	25.0
RF/RM147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF/RM167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The output end gear unit of multi-stage gear units must be filled with the larger oil volume.

FA.., FH.., FV.., FAF.., FHF.., FVF.., FAZ.., FHZ.., FVZ..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.70	3.50	2.10	3.40	2.90	3.00
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	39.0	54.5	34.0	61.0	45.0	46.5
F..157	68.0	103.0	62.0	104.0	85.0	77.0

Helical-bevel (K) gear units

K.., KA..B, KH..B, KV..B:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.25	0.95	0.95
K..47	0.80	1.30	1.50	2.00	1.60	1.60
K..57	1.20	2.30	2.50	2.80	2.60	2.40
K..67	1.10	2.40	2.60	3.45	2.60	2.60
K..77	2.20	4.10	4.40	5.8	4.20	4.40
K..87	3.70	8.0	8.7	10.9	8.0	8.0
K..97	7.0	14.0	15.7	20.0	15.7	15.5
K..107	10.0	21.0	25.5	33.5	24.0	24.0
K..127	21.0	41.5	44.0	54.0	40.0	41.0
K..157	31.0	62.0	65.0	90.0	58.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	143.0

KF..:

Gear unit type	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
KF37	0.50	1.10	1.10	1.50	1.00	1.00
KF47	0.80	1.30	1.70	2.20	1.60	1.60
KF57	1.30	2.30	2.70	3.15	2.90	2.70
KF67	1.10	2.40	2.80	3.70	2.70	2.70
KF77	2.10	4.10	4.40	5.9	4.50	4.50
KF87	3.70	8.2	9.0	11.9	8.4	8.4
KF97	7.0	14.7	17.3	21.5	15.7	16.5
KF107	10.0	21.8	25.8	35.1	25.2	25.2
KF127	21.0	41.5	46.0	55.0	41.0	41.0
KF157	31.0	66.0	69.0	92.0	62.0	62.0

10 Appendix

10.1 Index of changes

The following additions and changes have been made compared to the previous edition of the "Explosion-Proof Gear Units R..7, F..7, K..7, S..7, SPIROPLAN® W" (publication number: 1055520x, edition 11/2002) operating instructions:

General additions and corrections.

Mechanical installation

- Installing the gear unit: Data on flatness error
- Installing torque arms for mounted gear units: Data on retaining bolts
- Mounted gear units with shrink disks: Information on assembly / removal has been added
- Mounted gear units with TorqLOC®
- AM adapter coupling: Point A

Inspection and maintenance

- Lubricant change intervals

11 Index

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au

Austria			
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Belgium			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.caron-vector.be info@caron-vector.be

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	Additional addresses for service in Brazil provided on request!		

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	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Street LaSalle, Quebec H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew-eurodrive.ca
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Assembly **Sales** **Service**	**Santiago de Chile**	SEW-EURODRIVE CHILE LTDA. Las Encinas 1295 Parque Industrial Valle Grande LAMPA RCH-Santiago de Chile P.O. Box Casilla 23 Correo Quilicura - Santiago - Chile	Tel. +56 2 75770-00 Fax +56 2 75770-01 sewsales@entelchile.net

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Switzerland			
Assembly **Sales** **Service**	**Basel**	Alfred Imhof A.G. Jurastrasse 10 CH-4142 Münchenstein bei Basel	Tel. +41 61 41717-17 Fax +41 61 41717-00 http://www.imhof-sew.ch info@imhof-sew.ch

Thailand			
Assembly **Sales** **Service**	**Chon Buri**	SEW-EURODRIVE (Thailand) Ltd. Bangpakong Industrial Park 2 700/456, Moo.7, Tambol Donhuaroh Muang District Chon Buri 20000	Tel. +66 38 454281 Fax +66 38 454288 sewthailand@sew-eurodrive.co.th

Tunisia			
Sales	**Tunis**	T. M.S. Technic Marketing Service 7, rue Ibn EI Heithem Z.I. SMMT 2014 Mégrine Erriadh	Tel. +216 1 4340-64 + 1 4320-29 Fax +216 1 4329-76

Turkey			
Assembly **Sales** **Service**	**Istanbul**	SEW-EURODRIVE Hareket Sistemleri Sirketi Bagdat Cad. Koruma Cikmazi No. 3 TR-34846 Maltepe ISTANBUL	Tel. +90 216 4419163 + 216 4419164 + 216 3838014 Fax +90 216 3055867 sew@sew-eurodrive.com.tr

USA			
Production **Assembly** **Sales** **Service**	**Greenville**	SEW-EURODRIVE INC. 1295 Old Spartanburg Highway P.O. Box 518 Lyman, S.C. 29365	Tel. +1 864 439-7537 Fax Sales +1 864 439-7830 Fax Manuf. +1 864 439-9948 Fax Ass. +1 864 439-0566 Telex 805 550 http://www.seweurodrive.com cslyman@seweurodrive.com
Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

Venezuela			
Assembly **Sales** **Service**	**Valencia**	SEW-EURODRIVE Venezuela S.A. Av. Norte Sur No. 3, Galpon 84-319 Zona Industrial Municipal Norte Valencia, Estado Carabobo	Tel. +58 241 832-9804 Fax +58 241 838-6275 sewventas@cantv.net sewfinanzas@cantv.net

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Dimensions
Type RF Gearmotors - Flange Mounted

FIG. I

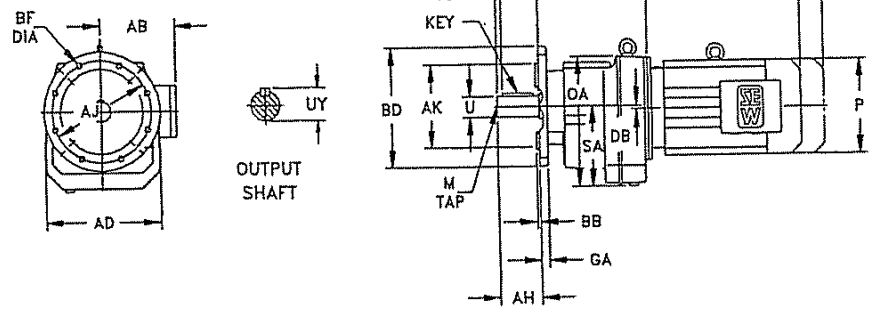
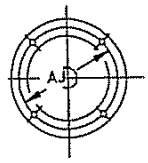


FIG. II



Drawing Notes:

Dimension AB is to conduit box.

Dimension LB is for motor brake option.

Eyebolts are supplied for motor sizes ≥ DV112 and reducer sizes ≥ RX67 and are removable.

Gearcase

Model	AD	DB	OA	Q	SA
RF97	13.70	0.40	14.72	17.32	9.06
	348	10.2	374	440	230
RF107	16.10	0.80	16.26	19.49	10.04
	409	20.4	413	495	255

Output Shaft Inch Series/*Optional Metric Series*

U	UY	V	VO	Key	M
$2.375^{+0}_{-.001}$	2.65	4.72	0.51	$5/8 \times 5/8 \times 3\,5/8$	$3/4 - 10 \times 1.61$
$60^{+.030}_{+.011}$	*64*	*120*	*5*	*18 x 11 x 110*	*M20 x 42*
$2.875^{+0}_{-.001}$	3.20	5.51	0.67	$3/4 \times 3/4 \times 4\,1/8$	$3/4 - 10 \times 1.61$
$70^{+.030}_{+.011}$	*74.5*	*140*	*7.5*	*20 x 12 x 125*	*M20 x 42*

Flange (Specify BD dimension when ordering)

Model		AH	AJ	AK	BB	BD	BF	GA
RF97	Fig. I	4.72	15.75	$13.780^{+0}_{-.001}$	0.20	17.72	0.69	1.00
		120	400	$350^{+0}_{-.036}$	5	450	17.5	25.5
	Fig. II	4.72	11.81	$9.843^{+0}_{-.001}$	0.20	13.78	0.69	0.93
		120	300	$250^{+0}_{-.029}$	5	350	17.5	23.5
RF107	Fig. I	5.51	15.75	$13.780^{+0}_{-.001}$	0.20	17.72	0.69	0.93
		140	400	$350^{+0}_{-.036}$	5	450	17.5	23.5
	Fig. II	5.51	11.81	$9.843^{+0}_{-.001}$	0.20	13.78	0.69	0.79
		140	300	$250^{+0}_{-.029}$	5	350	17.5	20

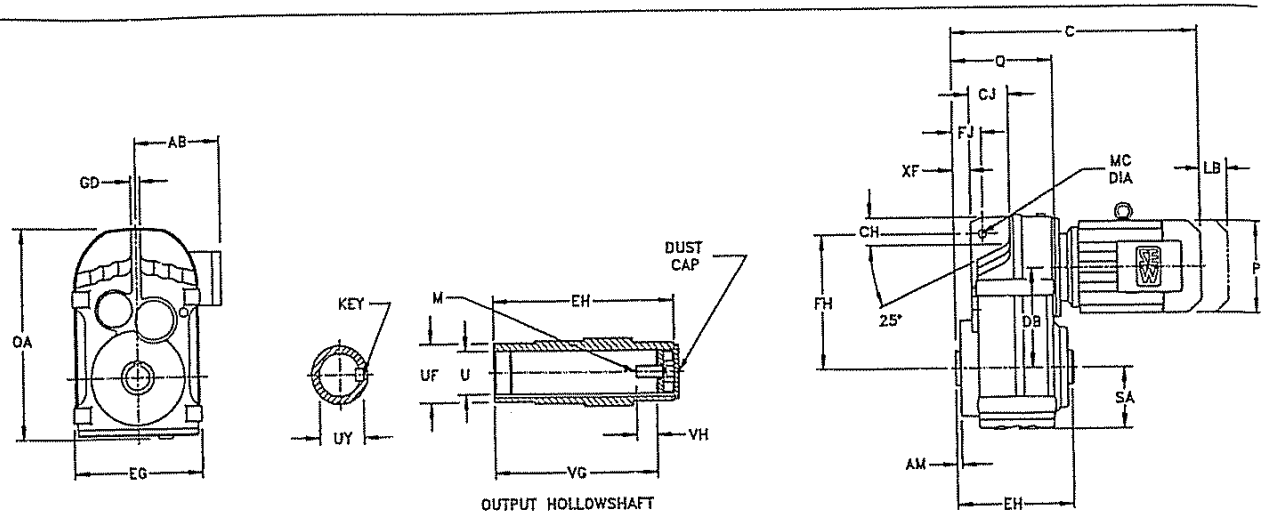
Motor

Model		DT			DV								
		80	90	100	112M	132S	132M	132ML	160M	160L	180	200	225
	AB	5.43	6.73	6.89	7.40	7.40	9.13	9.13	9.13	10.04	10.55	11.81	11.97
		138	171	175	188	188	232	232	232	255	268	300	304
	LB	2.52	3.35	3.35	3.15	3.15	4.41	4.41	4.41	6.14	6.14	6.14	6.14
		64	85	85	80	80	112	112	112	156	156	156	156
	P	5.71	7.76	7.76	8.70	8.70	10.83	10.83	10.83	13.03	13.03	15.51	15.51
		145	197	197	221	221	275	275	275	331	331	394	394
RF97	C	26.42	27.20	29.21	30.59	32.36	33.15	35.51	35.51	37.40	40.24	42.09	—
		671	691	742	777	822	842	902	902	950	1022	1069	—
RF107	C	—	—	31.10	32.52	34.29	35.08	37.44	37.44	39.33	42.17	44.02	47.24
		—	—	790	826	871	891	951	951	999	1071	1118	1200

Dimensions are inch / mm

See page 122 for available output shaft sizes.

Dimensions
Type FA Gearmotors - Shaft Mounted



Drawing Notes:

Dimension AB is to conduit box.

Dimension LB is for motor brake option.

Eyebolts are supplied for motor sizes ≥ DV112 and reducer sizes ≥ R67 and are removable

Gearcase

Model		AM	CH	CJ	DB	EG	FH	FJ	GD	MC	OA	Q	SA	XF
FA37		0.02	1.18	1.81	4.41	6.65	6.22	1.24	0.47	0.55	9.92	4.33	2.99	0.59
		0.5	30	46	112	169	158	31.5	12	14	252	110	76	15
FA47		0.04	0.87	2.52	5.04	7.28	6.69	1.26	0.47	0.55	10.59	5.24	3.03	0.47
		1	22	64	128.1	185	170	32	12	14	269	133	77	12
FA57		0.04	1.22	2.36	5.35	8.07	7.80	1.59	0.55	0.55	12.48	5.91	3.66	0.77
		1	31	60	136	205	198	40.5	14	14	317	150	93	19.5
FA67		0.04	1.57	2.56	6.28	8.54	8.58	1.61	0.63	0.55	13.50	6.34	3.82	0.83
		1	40	65	159.5	217	218	41	16	14	343	161	97	21

Output Shaft Inch Series/*Optional Metric Series* For solid shaft design see page 242.

Model	EH	U	UF	UY	VG	VH	Key	M
FA37	4.72	1.250 $^{+.0005}_{-0}$	1.77	1.37	4.13	0.67	$\frac{1}{4} \times \frac{1}{4} \times 1\frac{11}{16}$	$\frac{7}{16}$–14 × 1
	120	*30* $^{+.021}_{-0}$	*45*	*33.3*	*105*	*17*	*8 x 7 x 40*	*M10 x 25*
FA47	5.91	1.375 $^{+.0005}_{-0}$	1.97	1.52	5.20	0.65	$\frac{5}{16} \times \frac{5}{16} \times 1\frac{13}{16}$	$\frac{1}{2}$–13 × 1
	150	*35* $^{+.025}_{-0}$	*50*	*38.3*	*132*	*22*	*10 x 8 x 45*	*M12 x 30*
FA57	7.09	1.500 $^{+.0005}_{-0}$	2.17	1.67	6.14	1.36	$\frac{3}{8} \times \frac{3}{8} \times 2\frac{1}{4}$	$\frac{5}{8}$–11 × 1$\frac{3}{4}$
	180	*40* $^{+.025}_{-0}$	*55*	*43.3*	*156*	*29*	*12 x 8 x 50*	*M16 x 40*
FA67	7.09	1.500 $^{+.0005}_{-0}$	2.17	1.67	6.14	1.36	$\frac{3}{8} \times \frac{3}{8} \times 2\frac{1}{4}$	$\frac{5}{8}$–11 × 1$\frac{3}{4}$
	180	*40* $^{+.025}_{-0}$	*55*	*43.3*	*156*	*29*	*12 x 8 x 50*	*M16 x 40*

Motor

Model		DT				DV	
		71	80	90	100	112M	132S
	AB	5.43 138	5.43 138	6.73 171	6.89 175	7.40 188	7.40 188
	LB	2.52 64	2.52 64	3.35 85	3.35 85	3.15 80	3.15 80
	P	5.71 145	5.71 145	7.76 197	7.76 197	8.70 221	8.70 221
FA37	C	12.40 315	14.37 365	15.16 385	17.24 438	— —	— —
FA47	C	13.31 338	15.28 388	16.06 408	18.15 461	— —	— —
FA57	C	13.74 349	15.71 399	16.50 419	18.46 469	19.84 504	21.73 552
FA67	C	14.17 360	16.14 410	16.93 430	18.90 480	20.28 515	22.17 563

Dimensions are $\frac{\text{inch}}{\text{mm}}$

See page 238 for torque arm details

See page 241 for available output shaft sizes.

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MOTOR

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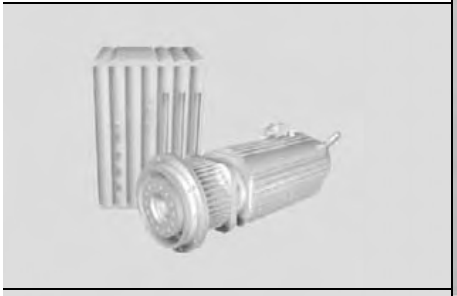
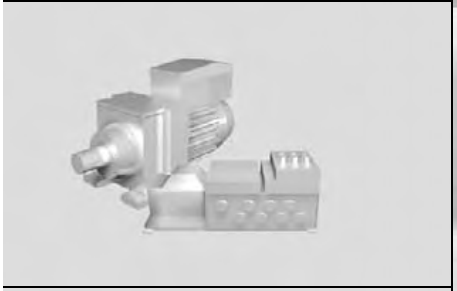
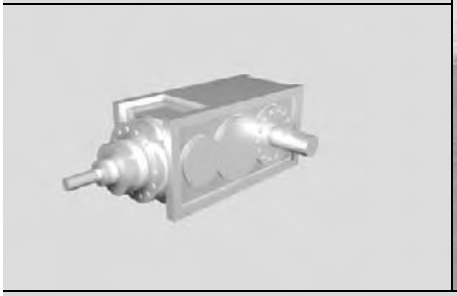
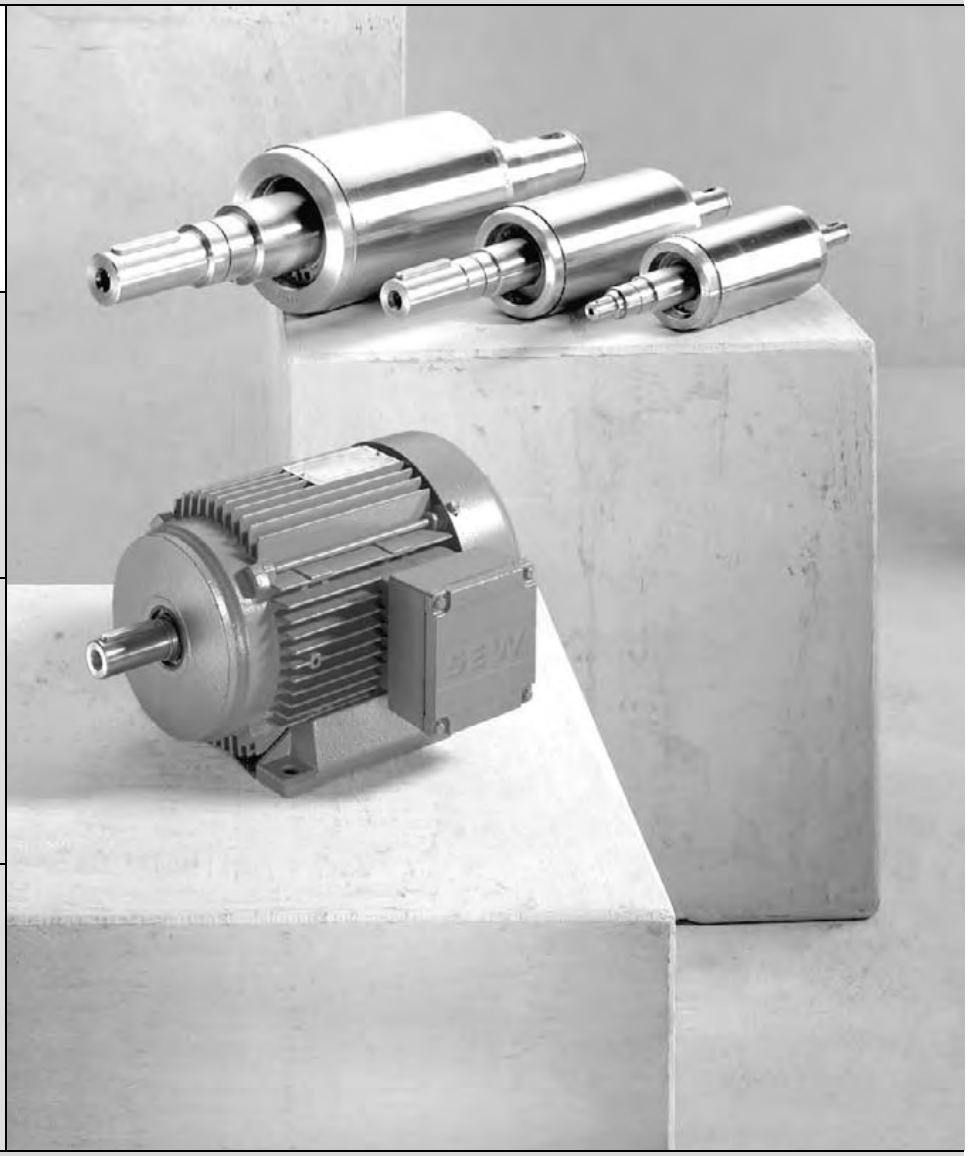
SEW EURODRIVE









AC Motors DR/DV/DT/DTE/DVE, Asynchronous Servo Motors CT/CV

A6.C01

Edition 08/2004

11291613 / EN

Operating Instructions

SEW EURODRIVE

1 Important Notes

Safety and warning notes

Always follow the safety and warning instructions in these operating instructions!

Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Tips and useful information.

You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under limited warranty

Consequently, read the operating instructions before you start operating the drive!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the drive.

Waste disposal

Dispose of the following materials in accordance with the regulations in force:

- Iron
- Aluminum
- Copper
- Plastic
- Electronic components

2 Safety Notes

Preface

The following safety notes are concerned with the use of motors. If using **gearmotors**, also refer to the safety notes for gear units in the corresponding operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, motors and gearmotors have live and moving parts and their surfaces may be hot.

All work related to transport, putting into storage, setting up/mounting, connection, startup, maintenance and repair may only be performed by trained personnel observing

- The corresponding detailed operating instructions and wiring diagrams
- The warning and safety signs on the motor/gearmotor
- The specific regulations and requirements for the system
- The national / regional regulations governing safety and accident prevention

Severe injuries and damage to property may result from

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

These electric motors are intended for industrial systems. They fulfill the applicable standards and regulations:

- Low voltage directive 73/23/EEC

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential to observe all the specified information!

Transportation

Inspect the shipment for damage as soon as you receive the delivery. Inform the shipping company immediately. It may be necessary to preclude startup.

Tighten installed eyebolts. They are only designed for the weight of the motor/gearmotor; do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. Observe the loads and regulations specified in this standard. If the gearmotor is equipped with two suspension eye lugs or lifting eyebolts, then both of the suspension eye lugs should be used for transportation. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Installation / assembly

Follow the instructions in the section "Mechanical Installation"!

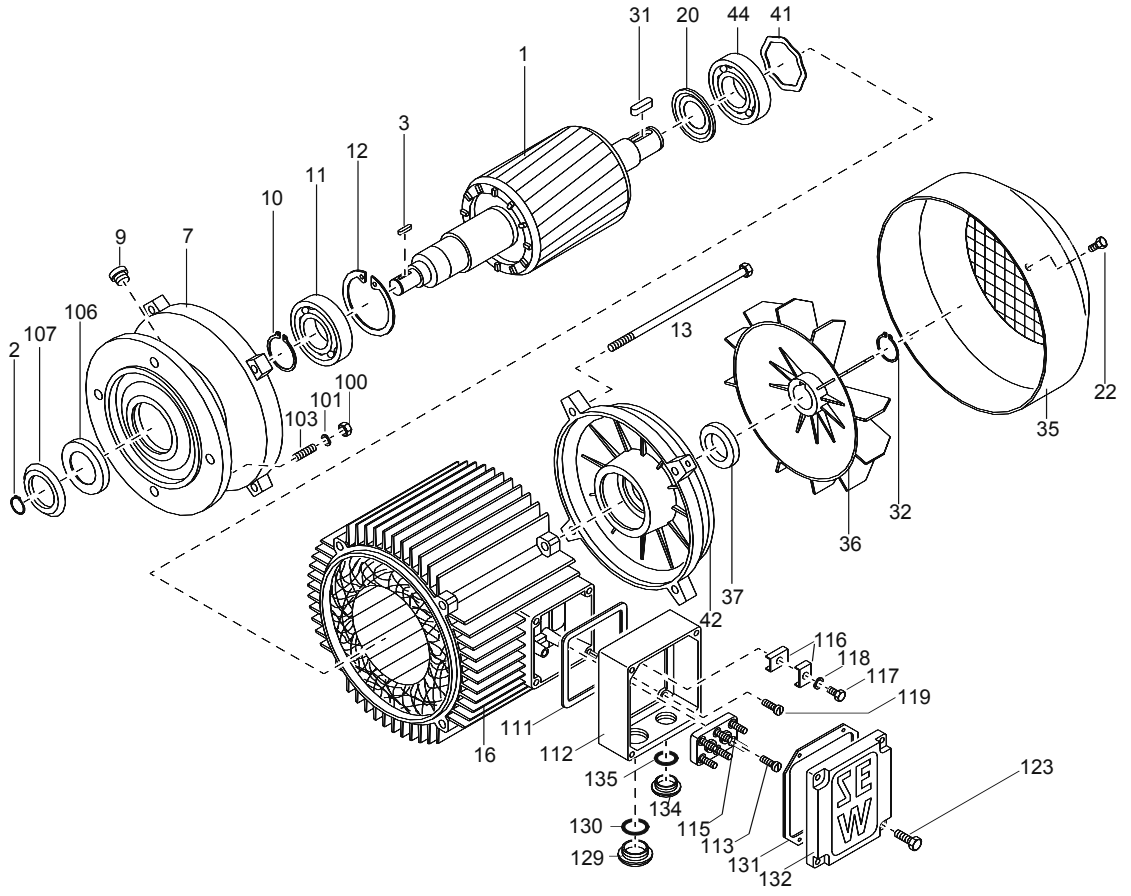
Inspection / maintenance

Follow the instructions in the section "Inspection and Maintenance"!

3 Motor Design

The following illustration is intended to explain the general structure. Its only purpose is to facilitate the assignment of components to the spare parts lists. Discrepancies are possible depending on the motor size and version!

3.1 Basic structure of AC motors



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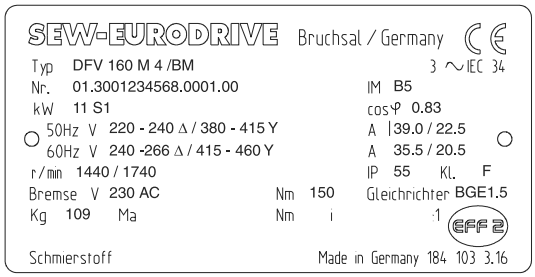
[1] Rotor, cpl.
[2] Circlip
[3] Key
[7] Flanged end shield
[9] Screw plug
[10] Circlip
[11] Grooved ball bearing
[12] Circlip
[13] Hex head screw (tie rod)
[16] Stator, cpl.
[20] Nilos ring
[22] Hex head bolt
[31] Key
[32] Circlip
[35] Fan guard
[36] Fan
[37] V-ring
[41] Equalizing ring
[42] Non drive-end bearing shield
[44] Grooved ball bearing
[100] Hex nut
[101] Lock washer
[103] Stud
[106] Oil seal
[107] Oil-flinger ring
[111] Gasket
[112] Terminal box lower part
[113] Machine screw
[115] Terminal board
[116] Terminal yoke
[117] Hex head bolt
[118] Lock washer
[119] Machine screw
[123] Hex head bolt
[129] Screw plug
[130] Sealing washer
[131] Sealing washer
[132] Terminal box cover
[134] Screw plug
[135] Sealing washer

3.2 Nameplate, unit designation

Nameplate

Example: DFV 160 M4 /BM brake motor



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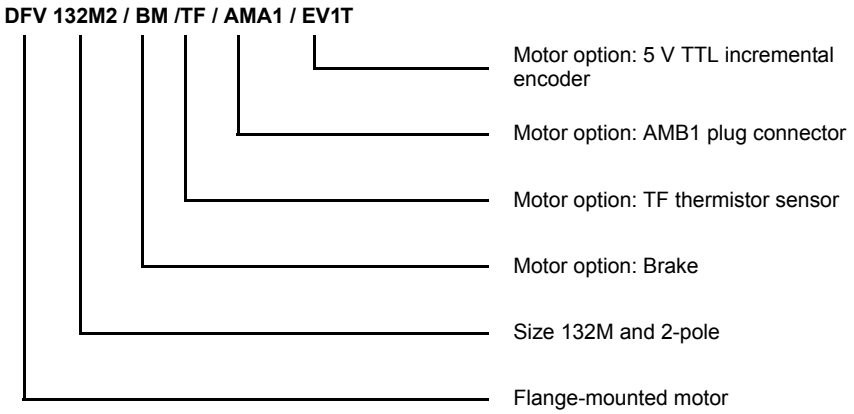
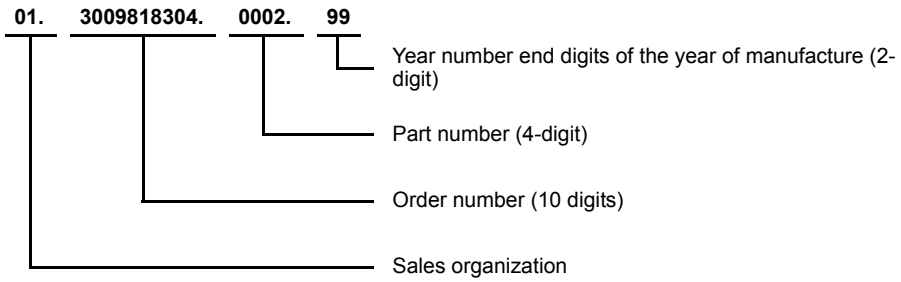
Unit designation

Example: DR / DT / DV / DTE / DVE AC (brake) motors

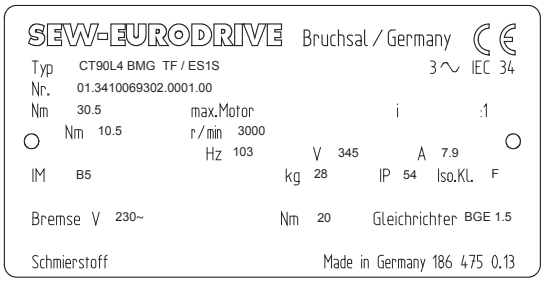


Example: Serial number



Nameplate

Example: CT90L4 / BMG / TF / ES1S servo brake motor



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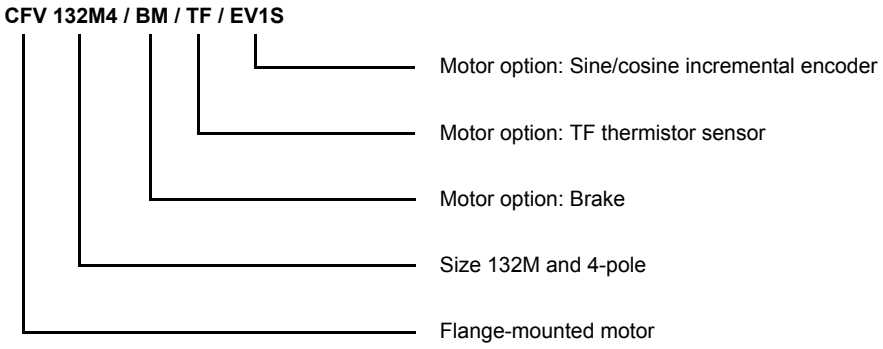
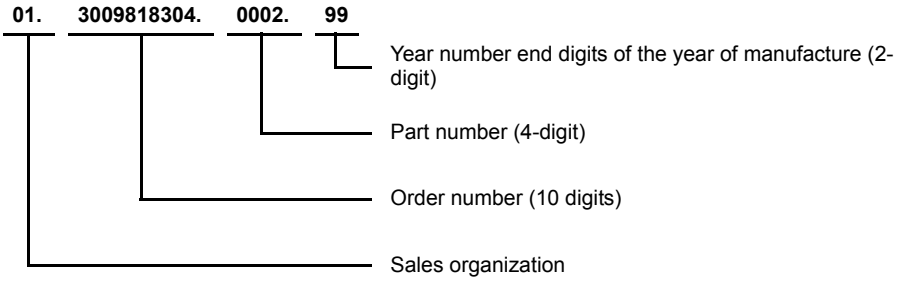
Unit designation

Examples: Servo (brake) motors CT / CV



Example: Serial number



4 Mechanical Installation

It is essential to comply with the safety notes in Section 2 during installation!

4.1 Before you begin

The drive may only be installed if

- The entries on the nameplate of the drive and/or the output voltage of the frequency inverter match the voltage supply system
- The drive is undamaged (no damage caused by transportation or storage)
- It is certain that the following requirements have been met:
  - Ambient temperature between –20 °C and +40 °C[1)]
  - No oil, acid, gas, vapors, radiation, etc.
  - Installation altitude max. 1000 m above sea level
  - Note the restrictions for encoders
  - Special versions: Drive configured in accordance with the ambient conditions

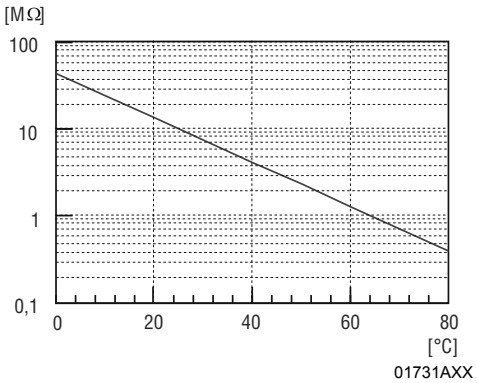
4.2 Preliminary work

Motor shaft ends must be thoroughly cleaned of anti-corrosion agents, contamination or similar (use a commercially available solvent). Do not allow the solvent to penetrate the bearings or shaft seals – this could cause material damage!

Extended storage of motors

- Please note the reduced grease utilization period of the ball bearings after storage periods exceeding one year.
- Check whether the motor has absorbed moisture as a result of being stored for a long time. Measure the insulation resistance to do this (measuring voltage 500 V).

The insulation resistance (→ following figure) varies greatly depending on the temperature! The motor must be dried if the insulation resistance is not adequate.

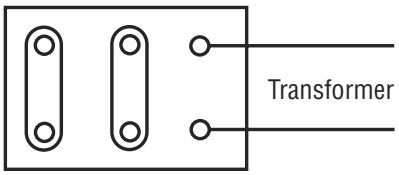


1) Minimum temperature for motors with backstop: –15 °C. Note that the temperature range of the gear unit may also be restricted (→ gear unit operating instructions)

Drying the motor

Heat up the motor

- with hot air or
- using an isolation transformer
  - Connect the windings in series (→ following figure)
  - Auxiliary AC voltage supply max. 10 % of the rated voltage with max. 20 % of the rated current



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The drying process is finished when the minimum insulation resistance has been attained.

Check the terminal box to see whether

- The inside is clean and dry
- The connections and fixing parts are free from corrosion
- The joint seals are OK
- The cable glands are sound, otherwise clean or replace them.

4.3 Installing the motor

The motor or gearmotor may only be mounted or installed in the specified mounting position on a level and torsionally rigid support structure which is not subjected to shocks.

Carefully align the motor and the driven machine to avoid placing any unacceptable strain on the output shafts (observe permissible overhung load and axial thrust data!).

Do not butt or hammer the shaft end.

Use an appropriate cover to protect motors in vertical mounting positions from objects or fluids entering (protection cowl C).

Ensure an unobstructed cooling air supply and that air heated by other apparatus cannot be drawn in or reused.

Balance components for subsequent mounting on the shaft with a half key (motor shafts are balanced with a half key).

Any condensation drain holes will be sealed by plastic plugs and should only be opened when necessary; open condensation drain holes are not permitted, as this would invalidate higher classes of enclosure.

If using brake motors with manual brake release, screw in either the hand lever (with self-reengaging manual brake release) or the setscrew (with lockable manual brake release).

Note the following for encoder mounting:

Foot-mounted motors CT/DT71, CT/DT90, CV/DV132M, CV/DV160L must be mounted on supports because the radius of the cover is greater than the shaft height.

For foot-mounted (brake) motors sizes DTE90L and DVE132M, the shaft height corresponds to the IEC standard motor of the next higher power level (100 mm or 160 mm). The foot dimensions of DTE90, DVE180, and DVE225 motors differ from the IEC dimensions; see Sec. "Dimension Sheet Notes" in the Gearmotors catalog.

Installation in damp locations or in the open

If possible, arrange the terminal box so the cable entries are pointing downwards.

Coat the threads of cable glands and pocket caps with sealant and tighten them well – then coat them again.

Seal the cable entry well.

Thoroughly clean the sealing surfaces of terminal boxes and terminal box covers prior to reassembly; gaskets must be glued in on one side. Install new gaskets to replace embrittled ones!

Restore the anticorrosive coating if necessary.

Check the enclosure.

4.4 Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 • ISO k6 at Ø ≤ 50 mm • ISO m6 at Ø > 50 mm • Center bore in accordance with DIN 332, shape DR..	Centering shoulder tolerance in accordance with DIN 42948 • ISO j6 at Ø ≤ 230 mm • ISO h6 at Ø > 230 mm

5 Electrical Installation

It is essential to comply with the safety notes in section 2 during installation!

Switch contacts in utilization category AC-3 to EN 60947-4-1 must be used for switching the motor and the brake.

Using the wiring diagrams

The motor must only ever be connected as shown in the wiring diagram included with the motor. **Do not connect or start up the motor if this wiring diagram is missing.** You can obtain the valid wiring diagram free of charge from SEW-EURODRIVE.

5.1 Wiring notes

Comply with the safety notes during installation.

Protecting brake control systems against interference

Do not route brake cables alongside switched-mode power cables, as otherwise there is a risk of disrupting brake control systems.

Switched-mode power cables include in particular:

- Output cables from frequency and servo controllers, converters, soft start units and brake units
- Feeder cables for brake resistors and similar options

Protecting motor protection devices against interference

To protect SEW motor protection devices (temperature sensors TF, winding thermostats TH) against interference:

- Route separately shielded feeder cables together with switched-mode power lines in one cable
- Do not route unshielded feeder cables together with switched-mode power lines in one cable

5.2 Special aspects for operation with a frequency inverter

When motors are powered from inverters, you must adhere to the wiring instructions issued by the inverter manufacturer. It is essential to observe the operating instructions for the frequency inverter.

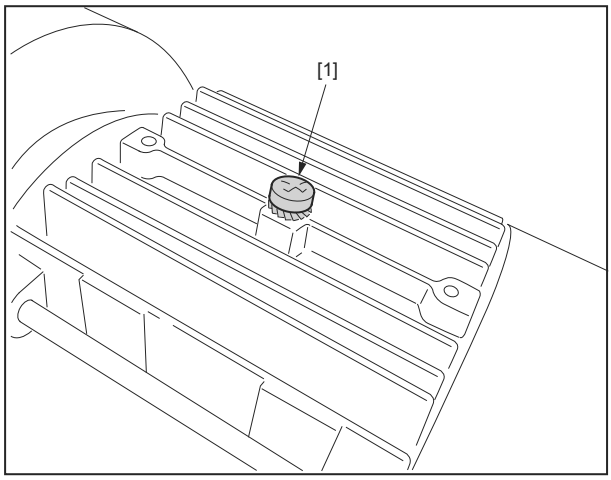
5.3 Special aspects of single-phase motors

Bear in mind that SEW single-phase motors are supplied without accessory equipment such as capacitors, starting relays or centrifugal switches (exception: ET56L4 → Sec. "Single-phase version ET56"). Any parts you need must be obtained from your dealer and connected according to the corresponding instructions and wiring diagrams.

5.4 Improving the grounding (EMC)

For improved, low-impedance grounding at high frequencies, we recommend using the following connections with the DR/DV/DT AC motors:

- Sizes DT71 ... DV 132S: [1] M5x10 thread rolling screw and 2 serrated lock washers to DIN 6798 in the stator housing.



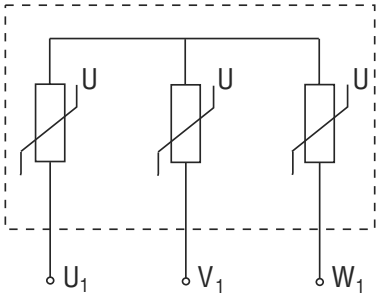
- Sizes DV112M ... DV280: Screw and 2 serrated lock washers in the bore of the eye bolt.

  Thread size of the eye bolt:

  – DV112 / 132S: M8
  – DV132M ... 180L: M12
  – DV200 ... 280: M16

5.5 Special aspects of torque motors and low-speed motors

Due to the design of torque motors and low-speed motors, very high induction voltages may be generated when they are switched off. Consequently, SEW-EURODRIVE recommends using the varistor circuit shown below for protection. The size of the varistors depends, amongst other factors, on the starting frequency – note for project planning!



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5.6 Special aspects in switching operation

When the motors are used in switching operation, possible interference of the switchgear must be excluded by ensuring suitable wiring. According to EN 60204 (electrical equipment of machines), motor windings must have interference suppression to protect the numerical or programmable logic controllers. As it is primarily switching operations that cause interference, SEW-EURODRIVE recommends installing protective circuitry in the switching devices.

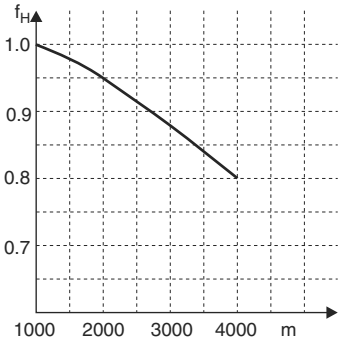
5.7 Environmental conditions during operation

Ambient temperature

The temperature range of -20 °C to +40 °C must be ensured unless specified otherwise on the nameplate. Motors intended for use in higher or lower ambient temperatures have the appropriate designation on the nameplate.

Altitude

The maximum installation altitude of 1000 m above sea level must not be exceeded as otherwise this causes a derating as specified in the following diagram.



Hazardous radiation

Motors must not be subjected to hazardous radiation. Contact SEW-EURODRIVE if necessary.

5.8 Connecting the motor

In case of operation with electronic control units, it is essential to adhere to the corresponding operating instructions / wiring diagrams!

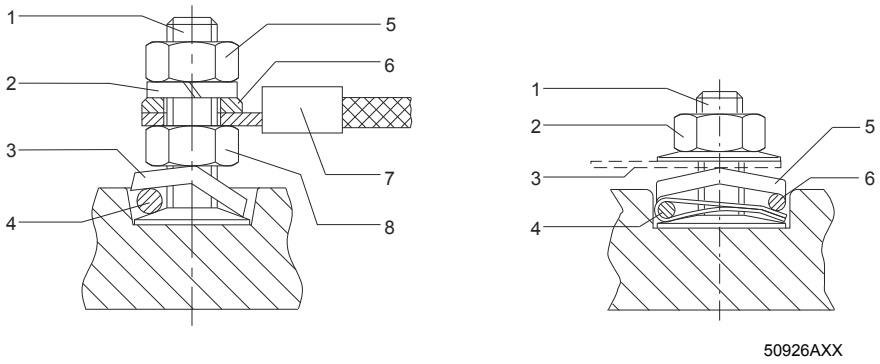
Connecting the motor via terminal boxes

- According to the circuit diagram provided
- Check the line cross section
- Arrange terminal links correctly
- Screw connections and protective earth conductors on firmly
- In terminal boxes: Check winding connections and tighten them if necessary

Small connection accessories

Note: In the case of motor sizes DR63 - DV132S, the small connection accessories (connection nuts for feeder cables, terminal links, lock washer and washers) are supplied in a bag. Depending on the type of terminal board, install the parts in accordance with the figure below. In the connection type shown on the right in the figure below, the second retaining nut, the lock washer and the washer are not used. The external connection [6] can be installed directly or as a lug [4] below the connection disk [5]. The tightening torque of the hex net in the figure on the right is:

- 1.6 Nm ± 20 % for M4
- 2 Nm ± 20 % for M5



1 Terminal stud
2 Lock washer
3 Connection disk
4 Motor terminal lead
5 Top nut
6 Washer
7 External connection
8 Bottom nut

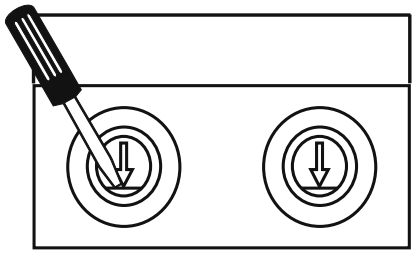
1 Terminal stud
2 Hex nut with flange
3 Terminal link
4 Motor connection with Stocko connection
5 terminal
6 Connection disk
External connection

The asynchronous servomotors of the CT/CV series are supplied with connected terminal links according to the nameplate.

5.9 Preparing motor sizes 56 and 63 – knockout

Important: Wear safety glasses – danger of injury from fragments!

- Put on the terminal box cover and screw it into place
- Define which cable entries to open
- Open the cable entries
  - with a chisel or similar (hold at an angle)
  - by a light tap with a hammer



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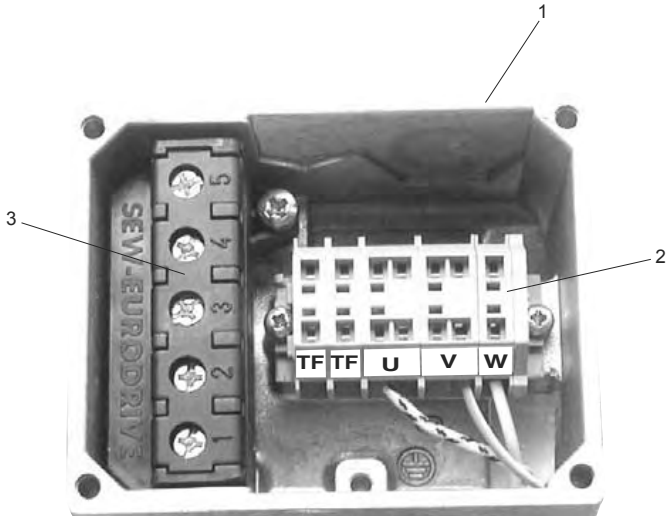
Caution – Do not knock through into the inside of the terminal box!

- Open the terminal box, remove the knockout cover if it has broken off
- Secure the cable screw fittings with the supplied lock nuts

5.10 Connecting DT56 motor...+/BMG

The motor has a star point with three fixed connection points in the winding overhang. The supply system leads (L1, L2, L3) are connected to a spring cage terminal block [2] in the terminal box [1]. The BMG02 brake is controlled using the BG1.2 brake rectifier [3]. As an alternative, the brake can be controlled from the switch cabinet using BM series rectifiers.



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5.11 Single-phase version ET56

The ET56 single-phase motor is supplied with a running capacitor that is mounted and connected:

1~230 V, 50 Hz C_B = 4 µF

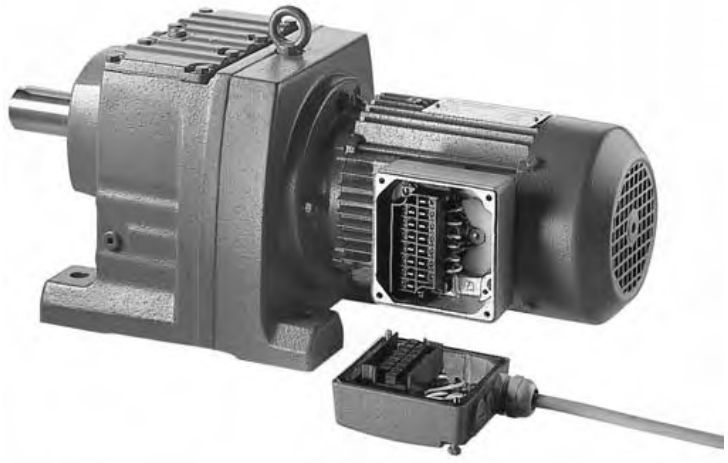
1~230 V, 60 Hz C_B = 4 µF

1~110 V, 60 Hz C_B = 20 µF

STOP

No full-load startup is possible with the running capacitor alone! The single-phase motor cannot be combined with a TF.

5.12 Connecting the motor using the IS plug connector



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The IS plug connector is supplied from the factory with its base fully wired-up, including additional features such as a brake rectifier. The upper section of the IS connector is included in the scope of delivery and must be connected as shown in the wiring diagram.

The IS plug connector has CSA approval up to 600 V. Note for application according to CSA regulations: Tighten the M3 terminal screws to a torque of 0.5 Nm! See the following table for American Wire Gauge (AWG) line cross sections!

Line cross section

Make sure the type of line corresponds to the applicable regulations. The rated currents are specified on the motor nameplate. The line cross sections that can be used are listed in the following table.

Without variable terminal link	With variable terminal link	Link cable	Double assignment (Motor and brake/SR)
0.25 - 4.0 mm^2	0.25 - 2.5 mm^2	max. 1.5 mm^2	max. 1 x 2.5 and 1 x 1.5 mm^2
23 - 12 # AWG	23 - 14 # AWG	max. 16 # AWG	max. 1 x 14 # and 1 x 16 # AWG

Wiring the upper section of the plug connection

- Loosen the housing cover screws
  - Remove the housing cover
- Remove the screws from the upper section of the plug connector
  - Remove the upper section of the plug connector from the cover
- Strip the insulation off the connection lead
  - Strip about 9 mm insulation off the connecting leads
- Pass the cable through the cable gland

Wiring up as shown in circuit diagram DT82, DT83

- Connect the lines as shown in the circuit diagram
  - Tighten the clamping screws carefully!
- Install the plug connector (→ Sec. "Installing the plug connector")

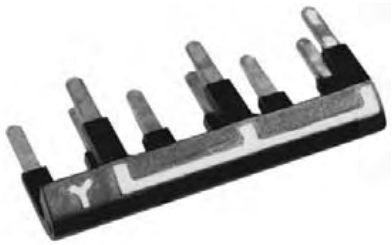
Wiring up as shown in wiring diagram DT81

For ⅄ / △ startup:

- Connect with 6 lines
  - Tighten the clamping screws carefully!
  - Motor contactors in the switch cabinet
- Install the plug connector (→ Sec. "Installing the plug connector")

For ⅄ or △ operation:

- Connect as shown in the wiring diagram
- Install the variable terminal link as shown in the following figures according to the required motor operation (△ or ⅄)
- Install the plug connector (→ Sec. "Installing the plug connector")



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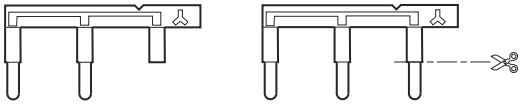
Brake control system BSR – preparing the variable terminal link

For ⅄ operation:

On the ⅄ side of the variable terminal link as shown in the following figure: Remove only the bare metal pin of the marked prong horizontally – touch guard!



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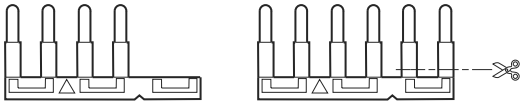
For △ operation:

On the △ side of the variable terminal link as shown in the following figure: Completely remove two prongs horizontally.



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Wiring according to the DT81 wiring diagram for ⅄ or △ operation with double terminal assignment

- At terminal point for double assignment:
  - Connect the link cable
- When operation is as required:
  - Insert the link cable in the variable terminal link
- Install the variable terminal link
- At terminal point for double assignment:
  - Connect the motor lead above the variable terminal link
- Connect the other lines as shown in the wiring diagram.
- Install the plug connector (→ Sec. "Installing the plug connector")

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Installing the plug connector

The housing cover of the IS plug connector can be screwed onto the lower section of the plug connector depending on the required position of the cable lead. The upper section of the plug connector shown in the following figure must first be installed in the housing cover so it will match the position of the lower section of the plug connector:

- Define the required mounting position
- Install the upper section of the plug connector into the housing cover in accordance with the mounting position
- Close the plug connector
- Tighten the cable gland

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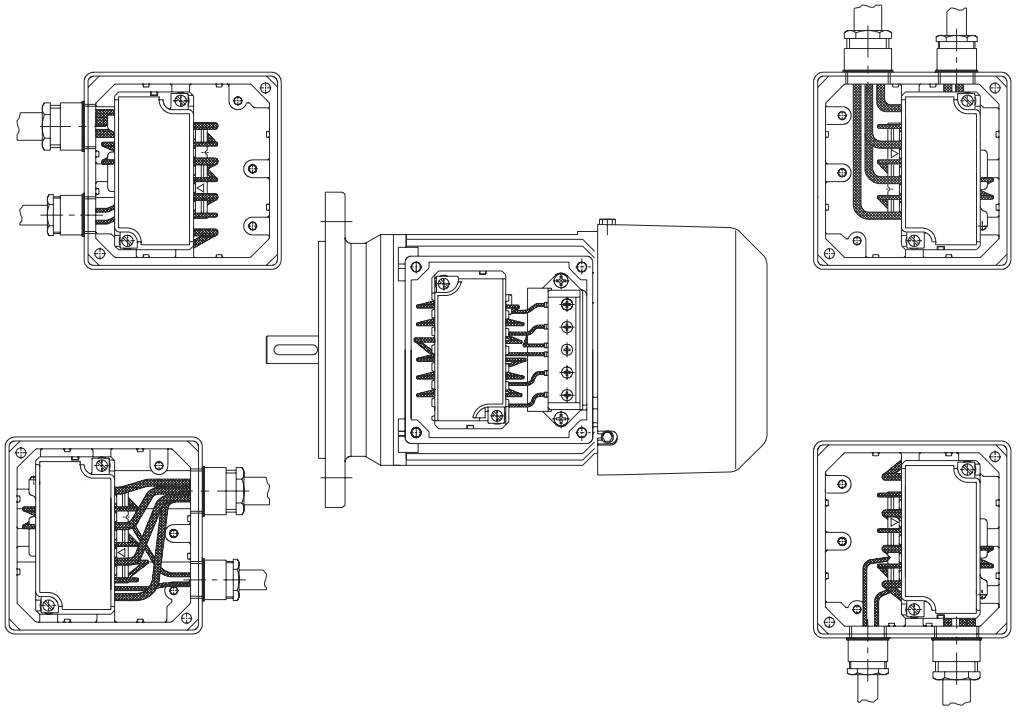
Mounting position of the upper section of the plug connection in the housing cover



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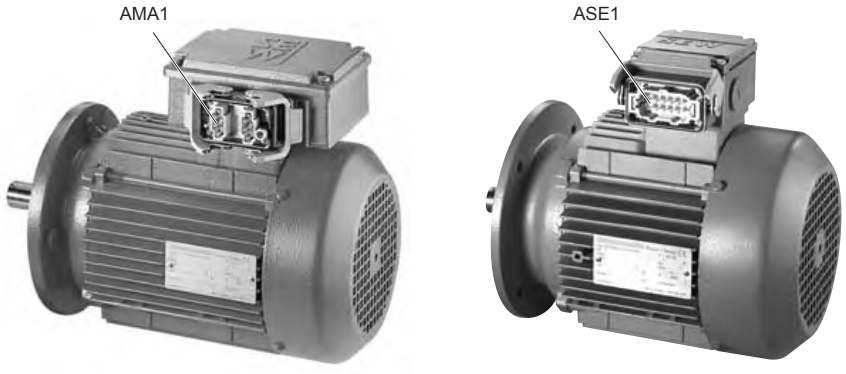
5.13 Connect the motor using plug connectors AB.., AD.., AM.., AS



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The installed plug connector systems AB.., AD.., AM.., AC.. and AS.. are based on the plug connector systems made by Harting.

- AB.., AD.., AM.. → Han Modular®
- AC.., AS.. → Han 10E / 10ES

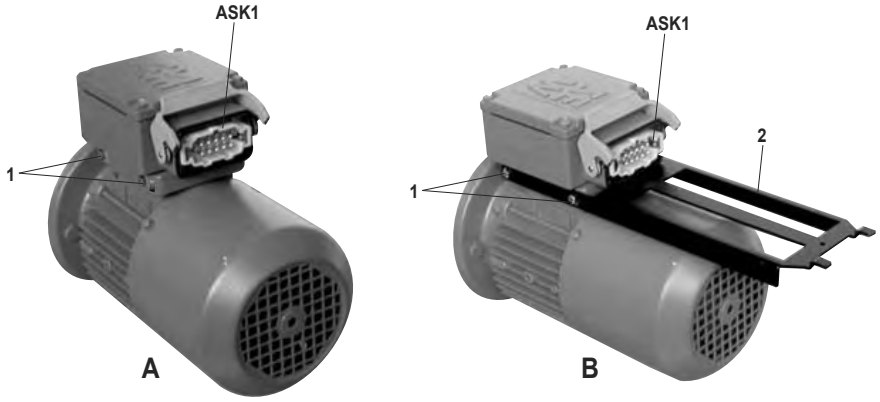
The plugs are mounted on the side of the terminal box. They are locked either using two clamps or one clamp on the terminal box.

UL approval has been granted for the plug connectors.

The mating connectors (sleeve housing) with contact tubes are not included in the scope of delivery.

The enclosure is only applied when the mating connector is mounted and locked.

5.14 Connecting the motor using ASK1 plug connector



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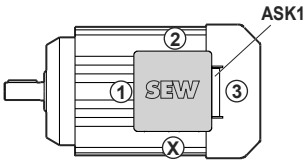
Drives with ASK1 plug connectors are certified according to the ECOFAST specification (version 1.1). Switchgear or control units which also have to be certified can be connected to SEW-EURODRIVE motors using a pre-fabricated system cable or a carrier plate (installation integrated in the motor → Fig. B). The ASK1 plug connector with single-clip locking is mounted on the side of the terminal box and is supplied from the

factory fully wired up, including additional features such as a brake rectifier.

- **The customer must obtain the system cable pre-fabricated according to the ECOFAST specification from a specialist retailer.**
- **For installation integrated in the motor according to the ECOFAST specification, the customer must obtain the carrier plate from SEW-EURODRIVE by quoting part number 0187 390 3. Carrier plates from other manufacturers do not fit on SEW-EURODRIVE motors.**

Position of the plug connector

Possible positions of the ASK1 plug connector are "X" (= normal position), "1", "2" or "3". Unless specified otherwise, the unit is supplied with the plug connector in position "3". For installation integrated in the motor (using the carrier plate), units are exclusively supplied with the plug connector in position "3".



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Installing the carrier plate

- Unscrew and remove four retaining screws [1] below the terminal box (→ Fig. A)
- Place the carrier plate [2] against the holes for the retaining screws and install it by screwing in the four retaining screws [1] (→ Fig. B).

5.16 Accessory equipment

Connect supplied accessory equipment according to the wiring diagrams included.

TF temperature sensor

Do not apply voltage!

The positive temperature coefficient (PTC) thermistors comply with DIN 44082.

Resistance measurement (measuring instrument with V ≤ 2.5 V or I < 1 mA):

- Standard measured values: 20...500 Ω, thermal resistance > 4000 Ω
- Measured values pole-changing with separate winding: 40...1000 Ω,
  Thermal resistance > 4000 Ω

When using the temperature sensor for thermal monitoring, the evaluation function must be activated to maintain reliable isolation of the temperature sensor circuit. If the temperature reaches an excessive level, the thermal protection function must be effective immediately.

TH winding thermostats

The thermostats are connected in series as standard and open when the permitted winding temperature is exceeded. They can be connected in the drive monitoring loop.

	V_{AC}		V_{DC}	
Voltage U [V]	250	400	60	24
Current (cos φ = 1.0) [A]	2.5	0.75	1.0	1.6
Current (cos φ = 0.6) [A]	1.6	0.5		
Contact resistance max. 1 ohm at 5 V = / 1 mA				

Forced cooling fan

Motor sizes 71 - 132S

VS system

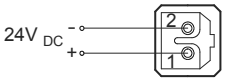
- 1 x 230 V_{AC}, 50 Hz
- Connection in separate terminal box
- Max. connection cross section 3 x 1.5 mm^2
- Cable screw fitting M16x1.5

Refer to the VS wiring diagram for information about connecting the VS forced cooling fan (order number: 0975 8385).

VR system

- 24 V_{DC} ± 20 %
- Plug connector
- Max. connection cross section 3x1 mm^2
- Pg7 cable gland with 7 mm inside diamater

The **VR forced cooling fan** is available for 24 V DC voltage and for 100 ... 240 V AC voltage.



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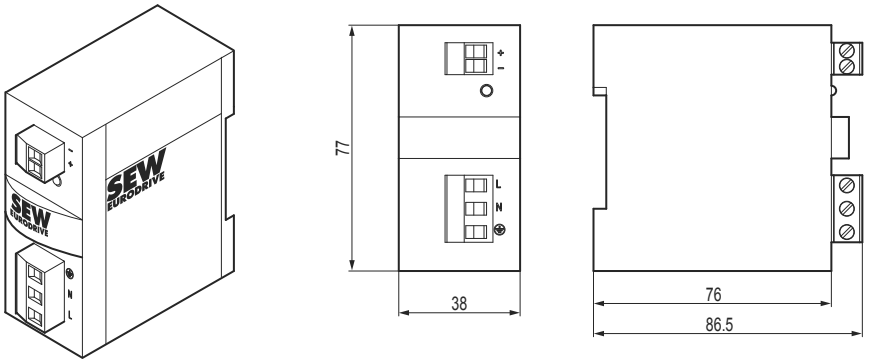
The AC voltage type includes a VR forced cooling fan and the UWU51A switch-mode power supply (→ following figure).

- Input: 90 ... 265 V_{AC} – 6 % / + 10 %, 50/60 Hz
- Output: 24 V_{DC} – 1 % / + 2 %, 1.3 A
- Connection: Terminal screws 0.2 ... 2.5 mm^2, separable
- Enclosure: IP20; mounted on mounting rail EN 60715TH35 in the switch cabinet



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Refer to the VR wiring diagram for information about connecting the VR forced cooling fan (order number: 0880 3198)

Motor size 132M - 280

V system

- 3 x 400 V_{AC}, 50 Hz
- Connection in separate terminal box
- Max. connection cross section 4 x 1.5 mm^2
- Cable gland M16x1.5

Refer to the V wiring diagram for information about connecting the V system (order number: 0975 8385).

A transformer may be present in the VS system to adapt to a voltage other than the standard. The VS and V systems are also available for 60 Hz.

Overview of encoders

Encoder	For SEW motor	Encoder type	Shaft	Specification	Supply	Signal
EH1T[1)]	DR63...	Encoder	Hollow shaft	-	5 V_{DC} regulated	5 V_{DC} TTL/RS-422
EH1S[2)]					24 V_{DC}	1 V_{ss} sin/cos
EH1R						5 V_{DC} TTL/RS-422
EH1C						24 V_{DC} HTL
ES1T[1)]	CT/DT/CV/DV71...100 DTE/DVE90...100	Encoder	Spreadshaft	-	5 V_{DC} regulated	5 V_{DC} TTL/RS-422
ES1S[2)]					24 V_{DC}	1 V_{ss} sin/cos
ES1R						5 V_{DC} TTL/RS-422
ES1C						24 V_{DC} HTL
ES2T[1)]	CV/DV(E)112...132S				5 V_{DC} regulated	5 V_{DC} TTL/RS-422
ES2S[2)]					24 V_{DC}	1 V_{ss} sin/cos
ES2R						5 V_{DC} TTL/RS-422
ES2C						24 V_{DC} HTL
EV1T[1)]	CT/CV71...200 DT/DV71...280 DTE/DVE90...225		Solid shaft		5 V_{DC} regulated	5 V_{DC} TTL/RS-422
EV1S[2)]					24 V_{DC}	1 V_{ss} sin/cos
EV1R						5 V_{DC} TTL/RS-422
EV1C						24 V_{DC} HTL
NV11	DT/DV71...132 DTE/DVE90...132S	Proximity sensor	Solid shaft	A track	24 V_{DC}	1 pulse/revolution, normally open contact
NV21				A+B tracks		
NV12				A track		2 pulses/revolution, normally open contact
NV22				A+B tracks		
NV16				A track		6 pulses/revolution, normally open contact
NV26				A+B tracks		
AV1Y	CT/CV71...200 DT/DV71...280 DTE/DVE90...225	absolute encoder	Solid shaft	-	15/24 V_{DC}	MSSI interface and 1 V_{ss} sin/cos
AV1H[3)]		HIPERFACE® encoder			12 V_{DC}	RS485 interface and 1 V_{ss} sin/cos

1) Recommended encoder for operation with MOVITRAC® 31C

2) Recommended encoder for operation with MOVIDRIVE®

3) recommended encoder for operation with MOVIDRIVE® compact

- Refer to the following wiring diagrams for information about connecting ES1./ES2./EV1./EH1. encoders and AV1Y and AV1H absolute encoders:
  - Wiring diagrams for ES1./ES2./EV1./EH1. encoders: Order number 0918 6832
  - Wiring diagram AV1Y absolute encoder: Order number 0918 6808
  - Wiring diagram AV1H absolute encoder: Order number 1052 9705

- Maximum oscillation load for encoder ≤ 10 g ≈ 100 m/s^2 (10 Hz ... 2 kHz)
- Shock resistance ≤ 100 g ≈ 1000 m/s^2

Encoder connection

When connecting the encoders to the inverters, always follow the operating instructions for the relevant inverter!

- Maximum line length (inverter - encoder):
  - 100 m with a capacitance per unit length ≤ 120 nF/km
- Core cross section: 0,20 ... 0.5 mm^2
- Use a shielded cable with twisted pairs of insulated conductors (exception: cable for HTL sensor) and connect the shield over a large surface area at both ends:
  - to the encoder in the cable gland or in the encoder plug
  - to the inverter on the electronics shield clamp or to the housing of the sub D plug
- Install the encoder cables separately from the power cables, maintaining a distance of at least 200 mm.

6 Startup

6.1 Prerequisites for startup

It is essential to comply with the safety notes in Sec. 2 during startup!

Before startup, make sure that

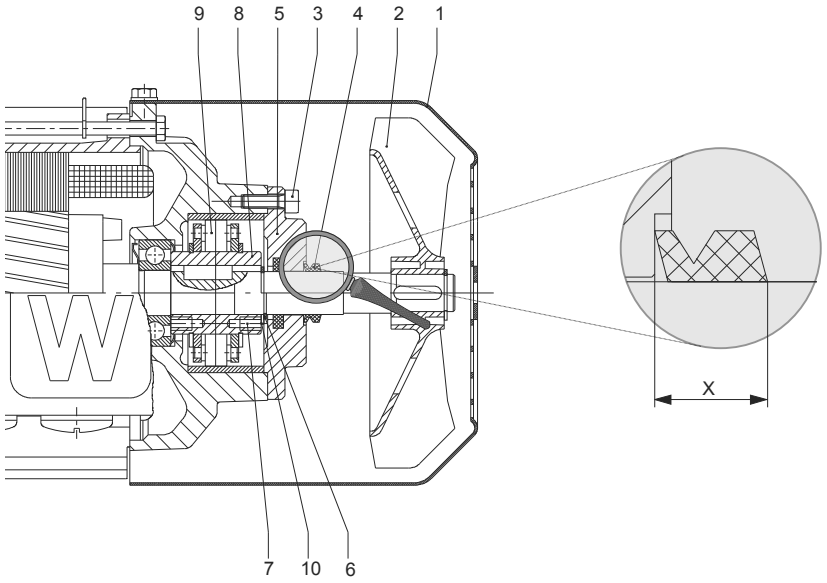
- The drive is undamaged and not blocked
- The measures stipulated in the "Preliminary work" section are performed after extended storage
- All connections have been made properly
- The direction of rotation of the motor/gearmotor is correct
  - (motor rotating clockwise: U, V, W to L1, L2, L3)
- All protective covers have been fitted correctly
- All motor protection equipment is active and set for the rated motor current
- The self-reengaging manual brake release is used in case of hoist drives
- There are no other sources of danger present

During startup, make sure that

- The motor is running correctly (no overload, no speed fluctuation, no loud noises, etc.)
- The correct braking torque is set according to the specific application (→ Sec. "Technical Data")
- In case of problems (→ Sec. "Malfunctions")

In brake motors with self-reengaging manual brake release, the manual brake release lever must be removed after startup. A bracket is provided for storing the lever on the outside of the motor.

6.2 Altering the blocking direction on motors with a backstop



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[1] Fan guard
[2] Fan
[3] Hexagon socket head cap screw
[4] V-ring
[5] Felt ring
[6] Circlip
[7] Threaded hole
[8] Carrier
[9] Wedge element train
[10] Equalizing ring

Dimension "x" after installation

Motor	Dimension "x" after installation
DT71/80	6.7 mm
DT90/DV100	9.0 mm
DV112/132S	9.0 mm
DV132M-160M	11.0 mm
DV160L - 225	11.0 mm
DV250-280	13.5 mm

Do not start up the motor in the blocking direction (note the phase angle when connecting). Note the direction of rotation of the output shaft and the number of stages when mounting the motor on a gear unit. The backstop can be operated once in the blocking direction at half the motor voltage for checking purposes.

1. **Isolate the motor from the supply, safeguarding it against unintentional power-up.**
2. Remove fan guard [1] and fan [2], unscrew hexagon socket head cap screws [3]
3. Remove the V-ring [4] and sealing flange with felt ring [5]. (Collect the grease for subsequent use.)
4. Remove the circlip [6] (not for DT71/80); for DV132M-160M, also remove the equalizing rings [10].
5. Pull the carrier [8] and wedge element train [9] completely off the threaded holes [7], turn them by 180° and press them back on.
6. Refill the grease.

7. **Important: Do not exert pressure on or hit the wedge element train – danger of damaging the material!**
8. During the press-in operation – shortly before the wedge element penetrates the locking collar – slowly turn the rotor shaft by hand in the direction of rotation. This allows the wedge element to slide into the locking collar more easily.
9. Install the remaining parts of the backstop by following steps 4. to 2. in reverse order. Note the installation dimension "x" for the V-ring [4].

7 Malfunctions

7.1 Motor Malfunctions

Problem	Possible cause	Remedy
Motor does not start up	Interruption in connecting harness	Check connections, correct if necessary
	Brake does not release	→ Sec. "Brake Problems"
	Fuse blown	Replace fuse
	Motor protection has tripped	Check motor protection for correct setting, correct error if necessary.
	Motor protection does not switch, error in control	Check motor protection control, correct error if necessary.
Motor does not start or only with difficulty	Motor designed for delta connection but used in star connection	Correct circuit
	Voltage and frequency deviate markedly from setpoint, at least during switch-on	Provide better power supply system; check cross section of connecting harness
Motor does not start in star connection, only in delta connection	Torque not sufficient in star connection	Switch on directly if delta inrush current is not too great; otherwise use a larger motor or a special version (contact SEW)
	Contact fault on star delta switch	Rectify fault
Incorrect direction of rotation	Motor connected incorrectly	Swap over two phases
Motor hums and has high current consumption	Brake does not release	→ Sec. "Brake Problems"
	Winding defective	Send motor to specialist workshop for repair
	Rotor rubbing	
Fuses blow or motor protection trips immediately	Short circuit in line	Rectify short circuit
	Short circuit in motor	Send motor to specialist workshop for repair
	Lines connected incorrectly	Correct circuit
	Ground fault on motor	Send motor to specialist workshop for repair
Severe speed loss under load	Overload	Perform power measurement, use larger motor or reduce load if necessary
	Voltage drops	Increase cross section of connecting harness
Motor heats up excessively (measure temperature)	Overload	Perform power measurement, use larger motor or reduce load if necessary
	Inadequate cooling	Correct cooling air supply or clear cooling air passages, retrofit forced cooling fan if necessary
	Ambient temperature is too high	Adhere to permitted temperature range
	Use delta connection for motor rather than star connection as provided for	Correct circuit
	Loose contact in connecting harness (one phase missing)	Rectify loose contact
	Fuse blown	Look for and rectify cause (see above); replace fuse
	Supply voltage deviates from rated motor voltage by more than 5 %. A higher voltage has a particularly unfavorable effect in motors with a low-speed winding since in these, the no-load current is already close to the rated current even when the voltage is normal.	Adapt motor to supply voltage
	Rated operation type (S1 to S10, DIN 57530) exceeded, e.g. through excessive starting frequency	Adjust rated operation type of motor to required operating conditions; if necessary call in a specialist to determine correct drive
Excessively loud	Ball bearing compressed, contaminated or damaged	Re-align motor, inspect ball bearing (→ Sect. "Permitted ball bearing types"), grease if necessary (→ Sect. "Lubricant Table for Anti-Friction Bearings of SEW Motors"), replace
	Vibration of rotating parts	Rectify cause, possibly imbalance
	Foreign bodies in cooling air passages	Clean the cooling air passages

7.2 Brake problems

Problem	Possible cause	Remedy
Brake does not release	Incorrect voltage on brake control unit	Apply correct voltage
	Brake control unit failed	Install a new brake control system, check internal resistance and insulation of brake coil, check switchgear
	Max. permitted working air gap exceeded because brake lining worn down	Measure and set working air gap
	Voltage drop along connecting harness > 10 %	Provide for correct connection voltage; check cable cross section
	Inadequate cooling, brake overheats	Replace type BG brake rectifier with type BGE
	Brake coil has interturn fault or short circuit to exposed conductive part	Replace complete brake and brake control system (specialist workshop), check switchgear
	Rectifier defective	Replace the rectifier and brake coil
Motor does not brake	Working air gap not correct	Measure and set working air gap
	Brake lining worn down	Replace entire brake disk
	Incorrect braking torque	Change the braking torque (→ Sect. "Technical Data") • By the type and number of brake springs • BrakeBMG 05: By installing the same brake coil body design as in brakeBMG 1 • BrakeBMG 2: By installing the same brake coil body design as in brakeBMG 4
	BM(G) only: Working air gap so large that setting nuts come into contact	Set the working air gap
	Only BR03, BM(G): Manual brake release device not set correctly	Set the setting nuts correctly
Brake is applied with time lag	Brake is switched on AC voltage side	Switch on DC and AC voltage sides (e.g. BSR); please refer to wiring diagram
Noise in the brake area	Gearing wear caused by jolting startup	Check project planning
	Pulsating torques due to incorrectly set frequency inverter	Check/correct setting of frequency inverter according to operating instructions

7.3 Malfunctions during operation with a frequency inverter

The symptoms described in the "Motor Malfunctions" section may also occur when the motor is operated with a frequency inverter. Please refer to the frequency inverter operating instructions for the significance of the problems which occur and to find information about rectifying the problems.

Customer service

Please have the following information to hand if you require the assistance of our customer service:
- Data from the nameplate (complete)
- Nature and extent of the fault
- Time and peripheral circumstances of the fault
- Presumed cause

8 Inspection / Maintenance

- Use only genuine spare parts in accordance with the valid parts list!
- Always install a new brake control system at the same time as replacing the brake coil!
- Motors can become very hot during operation danger of burns!
- Secure hoist drives or lower them (danger of falling).
- Isolate the motor and brake from the supply before starting work, safeguarding them against unintentional power-up!

8.1 Inspection and maintenance intervals

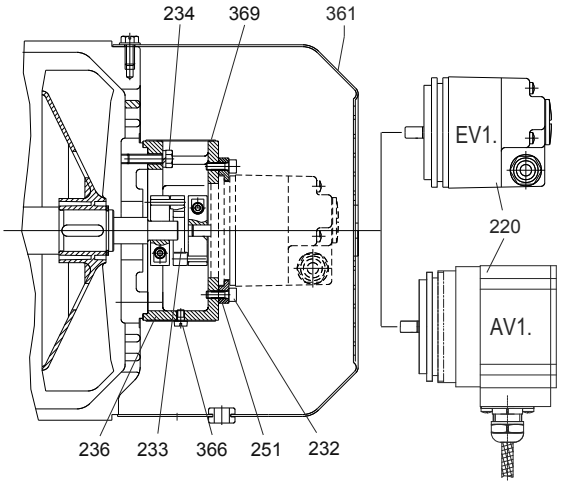
Unit / unit part	Frequency	What to do?
Brake BMG02, BR03, BMG05-8, BM15-62	• **If used as a working brake:** At least every 3000 hours of operation[1)]	Inspect the brake • Measure the brake disk thickness • Brake disk, lining • Measure and set working air gap • Pressure plate • Carrier / gearing • Pressure rings
	• **If used as a holding brake:** Every 2 to 4 years, depending on operating conditions [1)]	• Extract the abraded matter. • Inspect the switch elements and change if necessary (e.g. in case of burn-out)
Motor	• **Every 10,000 hours of operation**	Inspect the motor: • Check ball bearings and change if necessary • Change the oil seal • Clean the cooling air passages
Motor with backstop		• Change the low-viscosity grease in the backstop
Tacho-generator		• Inspection / maintenance as described in the enclosed operating instructions
Drive	• Varies (depending on external factors)	• Touch up or renew the surface/anticorrosion coating.

1) The periods of wear are affected by many factors and may be short. The machine designer must calculate the required inspection/maintenance intervals individually in accordance with the project planning documents (e.g. "Drive Planning").

8.2 Preliminary work for motor and brake maintenance

Isolate the motor and brake from the power supply before starting work, safeguarding them against unintentional power-up!

Removing the EV1. incremental encoder / AV1H absolute encoder



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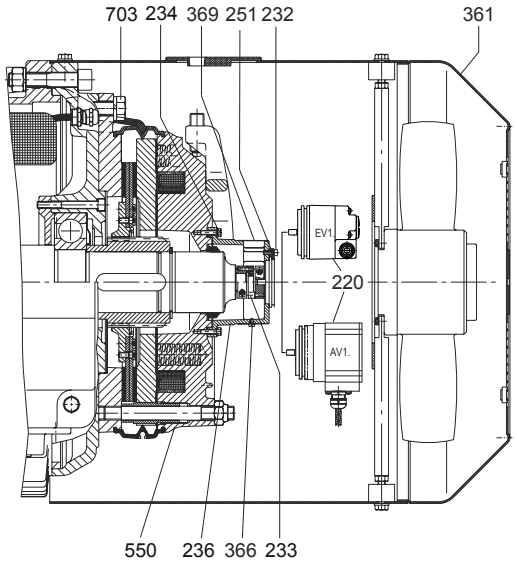
Removing EV1. / AV1 encoders from motors up to size 225



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Removing EV1. / AV1 encoders from motors from size 250 upwards

[220] Encoder
[232] Hexagon socket head cap screw
[233] Coupling
[234] Hex head screw
[236] Adapter flange
[251] Conical spring washer
[361] Protective canopy / fan guard
[366] Hexagon socket head cap screw
[369] Cover plate
[550] Brake
[703] Hex head screw

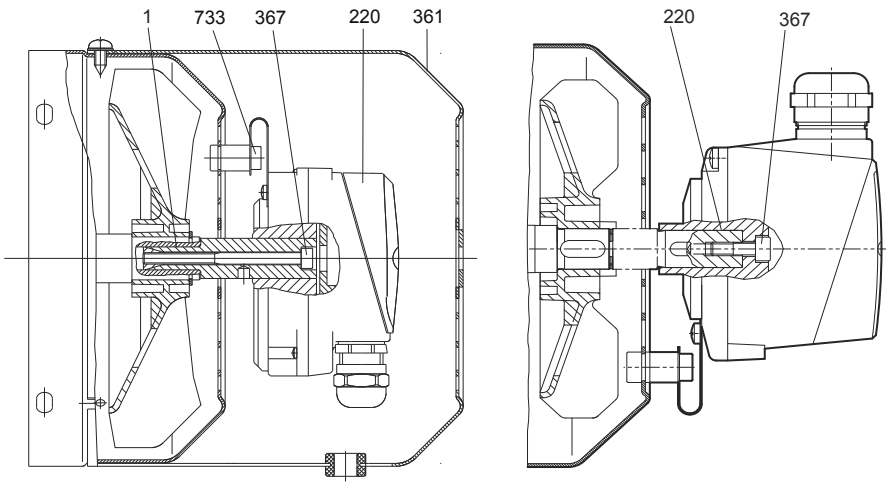
- Remove the protective canopy [361]. If a forced cooling fan is fitted, remove it first.
- Unscrew the screw [366] from the adapter flange and remove the cover plate [369].
- Unscrew the clamping hub connection of the coupling.
- Loosen the retaining screws [232] and turn the conical spring washers [251] outwards.
- Remove the encoder [220] together with the coupling [233].
- Lever off the intermediate flange [236] after removing the screws [234].

Note:

During re-assembly, make sure the runout of the shaft end is ≤ 0.05 mm.

Brakes for the encoder mounting must be completely replaced.

Incremental encoder ES1. Removing / ES2. / EH1.



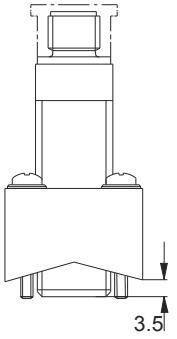
[220] Encoder
[367] Retaining screw
[361] Protective canopy
[733] Retaining screw for torque arm

- Remove the protective canopy [361].
- Unscrew the retaining screws [733] for the torque arm.
- Open the screw cover at the rear of the encoder [220].
- Unscrew the central retaining screw [367] by about 2-3 turns and loosen the cone by tapping lightly on the head of the screw. Then unscrew the retaining screw and pull off the encoder.

During re-assembly:

– Apply Noco® fluid to the encoder spigot
– Tighten the central retaining screw [367] to 2.9 Nm.

Removing the proximity sensor NV1. / NV2.



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STOP

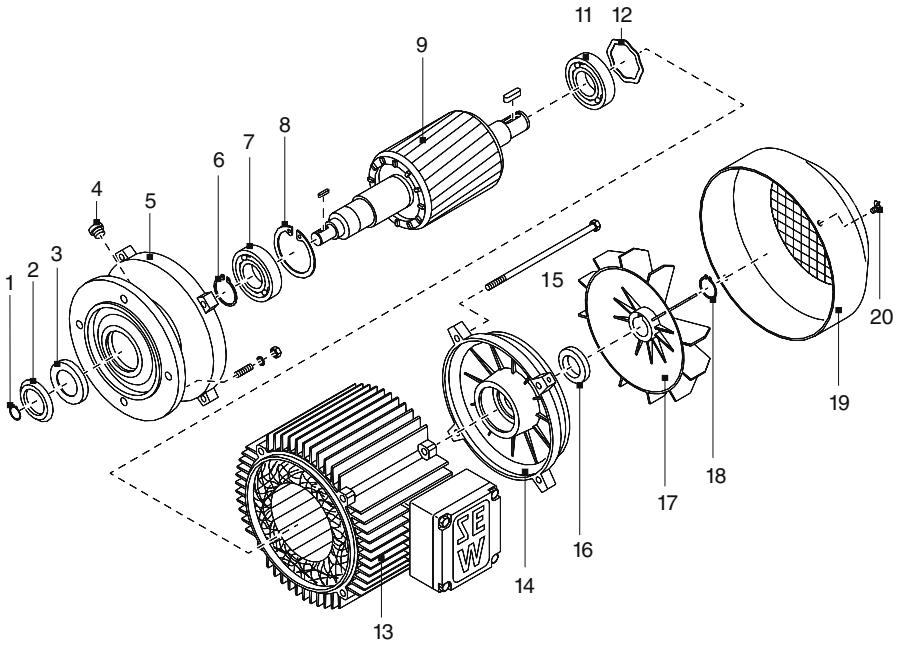
Caution! It is essential for the fan wheel to be stationary!

- Disconnect plug
- Pull off the fan guard including NV1. / NV2. Do not tilt it, in order to avoid damaging the proximity switch.
- If the mounting block has been removed from the fan guard or has come loose, it is essential to ensure the following during re-assembly:

  The switching surface of the proximity switch must be calibrated to a distance of 3.5 mm from the edge of the prismatic block (→ figure above).

8.3 Inspection / maintenance on the motor

Example: Motor DFT90



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Key

1	Circlip	8	Circlip	16	V-ring
2	Oil-flinger ring	9	Rotor	17	Fan
3	Oil seal	11	Ball bearing	18	Circlip
4	Screw plug	12	Equalizing ring	19	Fan guard
5	Drive end bearing end shield	13	Stator	20	Housing screw
6	Circlip	14	Non drive-end bearing shield		
7	Ball bearing	15	Hex head bolt		

Sequence

Isolate the motor and brake from the supply, safeguarding them against unintentional power-up!

1. Remove the forced cooling fan and encoder, if installed (→ Sec. "Preliminary work for motor and brake maintenance")
2. Remove flange or fan guard [19], fan [17].
3. Remove the hex head bolt [15] from the drive end bearing end shield [5] and the non-drive end bearing end shield [14], release the stator [13] from the drive end bearing end shield.
4. **Motors with BM/BMG brake:**
   - Open the terminal box cover, unfasten the brake cable from the rectifier
   - Push the non-drive end bearing end shield and the brake off the stator and carefully lift them off (if necessary, run the brake cable along with trailing wire)
   - Pull the stator back by approx. 3 to 4 cm
5. **Motors with BMG02, BR03 brake:**
   - Remove the complete brake with the releasing lever (on version with manual brake release)
6. Visual inspection: Are there traces of gear oil or condensation inside the stator?
   - If not, continue with 9
   - If there is condensation, continue with 7
   - If there is gear oil, have the motor repaired by a specialist workshop
7. If there is moisture inside the stator:
   - With gearmotors: Remove the motor from the gear unit
   - With motors without a gear unit: Remove the drive end flange
   - Remove the rotor [9]
8. Clean the winding, dry it and check it electrically (→ Sec. "Preliminary work")
9. Replace the ball bearings [7], [11] (only use authorized ball bearings → Sec. "Permitted ball bearing types")
10. Reseal the stator seat ("Hylomar L Spezial") and grease the V-ring or labyrinth seal (DR63)
11. Install the motor, brake and accessories
12. Check the gear unit (→ gear unit operating instructions)

Lubrication of the backstop

The backstop is supplied with Mobil LBZ low-viscosity grease as a lubricant and anticorrosion protection. If you want to use a different grease, make sure it complies with NLGI class 00/000, with a base oil viscosity of 42 mm^2/s at 40 °C on a lithium saponified and mineral oil base. The temperature range extends from –50 °C to +90 °C. See the following table for the amount of grease required.

Motor type	71/80	90/100	112/132	132M/160M	160L/225	250/280
Grease [g]	9	15	15	20	45	80

9.5 Operating currents

The current values I_H (holding current) specified in the tables are r.m.s. values. Use only units to measure the r.m.s. values. The inrush current (acceleration current) I_B only flows for a short time (max. 120 ms) when the brake is released or during voltage dips below 70 % of rated voltage. There is no increased inrush current if the BG brake rectifier is used or if there is a direct DC voltage supply – both are only possible with brakes up to motor size BMG4.

BMG02, BR03 brake

	BMG02	BR03
Motor size	56	63
Max. braking torque [Nm]	1.2	3.2
Braking power [W]	25	25
Inrush current ratio I_B/I_H	-	4

Rated voltage V_N		BMG02		BR03	
V_{AC}	V_{DC}	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
	24	-	0.72	-	0.72
24 (23-26)	**10**	-	-	1.5	1.80
42 (40-45)	**18**	-	-	0.81	1.01
48 (46-50)	**20**	-	-	0.72	0.90
53 (51-56)	**22**	-	-	0.64	0.80
60 (57-63)	**24**	-	-	0.57	0.72
67 (64-70)	**27**	-	-	0.50	0.64
73 (71-78)	**30**	-	-	0.45	0.57
85 (79-87)	**36**	-	-	0.40	0.51
92 (88-98)	**40**	-	-	0.35	0.45
110 (99-110)	**44**	-	-	0.31	0.40
120 (111-123)	**48**	-	-	0.28	0.36
133 (124-138)	**54**	-	-	0.25	0.32
147 (139-154)	**60**	-	-	0.22	0.29
160 (155-173)	**68**	-	-	0.20	0.25
184 (174-193)	**75**	-	-	0.17	0.23
208 (194-217)	**85**	-	-	0.16	0.20
230 (218-243)	**96**	0.14	0.18	0.14	0.18
254 (244-273)	**110**	-	-	0.12	0.16
290 (274-306)	**125**	-	-	0.11	0.14
318 (307-343)	**140**	-	-	0.10	0.13
360 (344-379)	**150**	-	-	0.09	0.11
400 (380-431)	**170**	0.08	0.10	0.08	0.10
460 (432-500)	**190**	0.07	0.09	0.07	0.09

Key

- I_B Accelerator current – brief inrush current
- I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier
- I_G Direct current with direct DC voltage supply with rated voltage V_N
- V_N Rated voltage (rated voltage range)

BMG 05 - BMG 4 brake

	BMG05	BMG1	BMG2	BMG4
Motor size	71/80	80	90/100	100
Max. braking torque [Nm]	5	10	20	40
Braking power [W]	32	36	40	50
Inrush current ratio I_B/I_H	4	4	4	4

Rated voltage V_N		BMG05		BMG 1		BMG 2		BMG 4	
V_{AC}	V_{DC}	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]	I_H [A_{AC}]	I_G [A_{DC}]
	24		1.38		1.54		1.77		2.20
24 (23-25)	**10**	2.0	3.3	2.4	3.7	-	-	-	-
42 (40-46)	**18**	1.14	1.74	1.37	1.94	1.46	2.25	1.80	2.80
48 (47-52)	**20**	1.02	1.55	1.22	1.73	1.30	2.00	1.60	2.50
56 (53-58)	**24**	0.90	1.38	1.09	1.54	1.16	1.77	1.43	2.20
60 (59-66)	**27**	0.81	1.23	0.97	1.37	1.03	1.58	1.27	2.00
73 (67-73)	**30**	0.72	1.10	0.86	1.23	0.92	1.41	1.14	1.76
77 (74-82)	**33**	0.64	0.98	0.77	1.09	0.82	1.25	1.00	1.57
88 (83-92)	**36**	0.57	0.87	0.69	0.97	0.73	1.12	0.90	1.40
97 (93-104)	**40**	0.51	0.78	0.61	0.87	0.65	1.00	0.80	1.25
110 (105-116)	**48**	0.45	0.69	0.54	0.77	0.58	0.90	0.72	1.11
125 (117-131)	**52**	0.40	0.62	0.48	0.69	0.52	0.80	0.64	1.00
139 (132-147)	**60**	0.36	0.55	0.43	0.61	0.46	0.70	0.57	0.88
153 (148-164)	**66**	0.32	0.49	0.39	0.55	0.41	0.63	0.51	0.79
175 (165-185)	**72**	0.29	0.44	0.34	0.49	0.37	0.56	0.45	0.70
200 (186-207)	**80**	0.26	0.39	0.31	0.43	0.33	0.50	0.40	0.62
230 (208-233)	**96**	0.23	0.35	0.27	0.39	0.29	0.44	0.36	0.56
240 (234-261)	**110**	0.20	0.31	0.24	0.35	0.26	0.40	0.32	0.50
290 (262-293)	**117**	0.18	0.28	0.22	0.31	0.23	0.35	0.29	0.44
318 (294-329)	**125**	0.16	0.25	0.19	0.27	0.21	0.31	0.25	0.39
346 (330-369)	**147**	0.14	0.22	0.17	0.24	0.18	0.28	0.23	0.35
400 (370-414)	**167**	0.13	0.20	0.15	0.22	0.16	0.25	0.20	0.31
440 (415-464)	**185**	0.11	0.17	0.14	0.19	0.15	0.22	0.18	0.28
500 (465-522)	**208**	0.10	0.15	0.12	0.17	0.13	0.20	0.16	0.25

Key

I_B Accelerator current – brief inrush current

I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier

I_G Direct current with direct DC voltage supply

V_N Rated voltage (rated voltage range)

BMG 8 - BM 32/62 brake

	BMG8	BM 15	BM30/31; BM32/62
Motor size	112/ 132S	132M-160M	160L-225
Max. braking torque [Nm]	75	150	600
Braking power [W]	65	95	120
Inrush current ratio I_B/I_H	6.3	7.5	8.5

Rated voltage V_N		BMG8	BM 15	BM 30/31; BM 32/62
V_{AC}	V_{DC}	I_H [A_{AC}]	I_H [A_{AC}]	I_H [A_{AC}]
	24	2.77[1)]	4.15[1)]	4.00[1)]
42 (40-46)	**-**	2.31	3.35	-
48 (47-52)	**-**	2.10	2.95	-
56 (53-58)	**-**	1.84	2.65	-
60 (59-66)	**-**	1.64	2.35	-
73 (67-73)	**-**	1.46	2.10	-
77 (74-82)	**-**	1.30	1.87	-
88 (83-92)	**-**	1.16	1.67	-
97 (93-104)	**-**	1.04	1.49	-
110 (105-116)	**-**	0.93	1.32	1.78
125 (117-131)	**-**	0.82	1.18	1.60
139 (132-147)	**-**	0.73	1.05	1.43
153 (148-164)	**-**	0.66	0.94	1.27
175 (165-185)	**-**	0.59	0.84	1.13
200 (186-207)	**-**	0.52	0.74	1.00
230 (208-233)	**-**	0.46	0.66	0.90
240 (234-261)	**-**	0.41	0.59	0.80
290 (262-293)	**-**	0.36	0.53	0.71
318 (294-329)	**-**	0.33	0.47	0.63
346 (330-369)	**-**	0.29	0.42	0.57
400 (370-414)	**-**	0.26	0.37	0.50
440 (415-464)	**-**	0.24	0.33	0.44
500 (465-522)	**-**	0.20	0.30	0.40

1) Direct current in BSG operation

Key

I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier

I_B Accelerator current – brief inrush current

I_G Direct current with direct DC voltage supply

V_N Rated voltage (rated voltage range)

BMG61, BMG122 brake

	BMG61	BMG122
Motor size	250M...280S	
Max. braking torque [Nm]	600	1200
Braking power [W]	200	
Inrush current ratio I_B/I_H	6	

Rated voltage V_N **V_{AC}**	**BMG61/122** **I_H [A_{AC}]**
208 (194-217)	1.50
230 (218-243)	1.35
254 (244-273)	1.20
290 (274-306)	1.10
318 (307-343)	1.00
360 (344-379)	0.85
400 (380-431)	0.75
460 (432-484)	0.65
500 (485-500)	0.60

Key

I_B Accelerator current – brief inrush current

I_H Holding current r.m.s. value in the connecting harness to the SEW brake rectifier

V_N Rated voltage (rated voltage range)

9.6 Permitted ball bearing types

Motor type	Drive-end bearing (AC motor, brakemotor)			Non drive-end bearing (foot-mounted, flange-mounted, gearmotors)	
	Flange-mounted motor	Gearmotor	Foot-mounted motor	AC motor	Brake motor
DT56	-	6302-2Z-J	-	6001-2RS-J	6001-2RS-J
DFR63	6203-2Z-J	6303-2Z-J	-	6202-2Z-J	6202-2RS-J-C3
DT71 - DT80	6204-2Z-J	6303-2Z-J	6204-2Z-J	6203-2Z-J	6203-2RS-J-C3
DT(E)90 - DV(E)100		6306-2Z-J		6205-2Z-J	6205-2RS-J-C3
DV(E)112 - 132S	6208-2Z-J	6307-2Z-J	6208-2Z-J	6207-2Z-J	6207-2RS-J-C3
DV(E)132M - 160M	6309-2Z-J-C3			6209-2Z-J-C3	
DV(E)160L - 180L	6312-2Z-J-C3			6213-2Z-J-C3	
DV(E)200 - 225	6314-2Z-J-C3			6314-2Z-J-C3	
DV250-280	6316-2Z-J-C3			6315-2Z-J-C3	

9.7 Lubricant table for anti-friction bearings of SEW motors

The bearings are 2Z or 2RS closed bearings and cannot be regreased.

	Ambient temperature	Manufacturer	Type
Anti-friction bearing in motor	–20 °C ... +80 °C	Esso	Polyrex EM[1)]
	+20 °C ... +100 °C	Klüber	Barrierta L55/2[2)]
	–40 °C ... +60 °C	Klüber	Asonic GHY72[2)]

1) Mineral lubricant (= mineral-based anti-friction bearing grease)

2) Synthetic lubricant (= synthetic-based anti-friction bearing grease)

10 Appendix

10.1 Index of changes

The following additions and changes have been made since the last edition of the "DR/DV/DT/DTE/DVE AC Motors, CT/CV Asynchronous Servomotors" operating instructions (publication number: 10567917, Edition 02/2003):

General updates and revisions.

Motor design	• Nameplate, unit designation: Example has been changed.
Mechanical installation	• Before you start: Ambient temperature.
Electrical installation	• Using wiring diagrams. • Improving the grounding (EMC). • Ambient conditions during operation. • Connecting the motor: Tightening torques. • Connecting the motor via the plug connectors AB.., AD.., AM.., AS. • Optional equipment: VR forced cooling fan.
Inspection / maintenance	• Inspection / maintenance of the BMG61/122 brake.

10.2 Index

Australia			
Assembly **Sales** **Service**	**Melbourne**	SEW-EURODRIVE PTY. LTD. 27 Beverage Drive Tullamarine, Victoria 3043	Tel. +61 3 9933-1000 Fax +61 3 9933-1003 http://www.sew-eurodrive.com.au enquires@sew-eurodrive.com.au
	Sydney	SEW-EURODRIVE PTY. LTD. 9, Sleigh Place, Wetherill Park New South Wales, 2164	Tel. +61 2 9725-9900 Fax +61 2 9725-9905 enquires@sew-eurodrive.com.au

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Belgium			
Assembly **Sales** **Service**	**Brüssel**	CARON-VECTOR S.A. Avenue Eiffel 5 B-1300 Wavre	Tel. +32 10 231-311 Fax +32 10 231-336 http://www.caron-vector.be info@caron-vector.be

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	Additional addresses for service in Brazil provided on request!		

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	Vancouver	SEW-EURODRIVE CO. OF CANADA LTD. 7188 Honeyman Street Delta. B.C. V4G 1 E2	Tel. +1 604 946-5535 Fax +1 604 946-2513 b.wake@sew-eurodrive.ca
	Montreal	SEW-EURODRIVE CO. OF CANADA LTD. 2555 Rue Leger Street LaSalle, Quebec H8N 2V9	Tel. +1 514 367-1124 Fax +1 514 367-3677 a.peluso@sew-eurodrive.ca
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China			
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Assembly **Sales** **Service**	**San Francisco**	SEW-EURODRIVE INC. 30599 San Antonio St. Hayward, California 94544-7101	Tel. +1 510 487-3560 Fax +1 510 487-6381 cshayward@seweurodrive.com
	Philadelphia/PA	SEW-EURODRIVE INC. Pureland Ind. Complex 2107 High Hill Road, P.O. Box 481 Bridgeport, New Jersey 08014	Tel. +1 856 467-2277 Fax +1 856 845-3179 csbridgeport@seweurodrive.com
	Dayton	SEW-EURODRIVE INC. 2001 West Main Street Troy, Ohio 45373	Tel. +1 937 335-0036 Fax +1 937 440-3799 cstroy@seweurodrive.com
	Dallas	SEW-EURODRIVE INC. 3950 Platinum Way Dallas, Texas 75237	Tel. +1 214 330-4824 Fax +1 214 330-4724 csdallas@seweurodrive.com
	Additional addresses for service in the USA provided on request!		

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Frame Size	P_n hp	P_n kW	n_n rpm	I_n Amp 230V	I_n Amp 460V	I_n Amp 575V	I_a/I_n %	T_n lb-in.	T_a/T_n %	T_k/T_n %	Cos φ	η %	Code Letter	J_m lb-ft² *	J_m lb-ft² **	Z_o Starts/hr. BG[2]	Z_o Starts/hr. BGE[3]	T_B lb-in.	Weight lbs. *	Weight lbs. **
DT71K4	0.25	0.18	1700	1.10	0.55	0.44	340	8.95	185	225	0.67	62	G	.0062	.0084	9000	9000	22	13	19
DT71C4	0.33	0.25	1720	1.32	0.66	0.53	490	12.3	265	280	0.66	72	J	.0104	.0125	7800	9000	44	15	22
DT71D4	0.5	0.37	1700	2.00	1.00	0.80	400	18.4	215	225	0.71	68	H	.0104	.0125	5200	9000	44	15	22
DT80K4	0.75	0.55	1700	2.90	1.45	1.16	445	27.3	245	270	0.67	74	H	.0156	.0177	3700	8000	88	22	28
DT80N4	1	0.75	1700	3.70	1.85	1.48	490	37.3	300	270	0.69	75.5	J	.0207	.0228	2800	7500	88	25	32
DT90S4	1.5	1.1	1740	5.20	2.60	2.10	610	53.4	300	340	0.69	77	K	0594	.0722	2000	5000	177	35	57
DT90L4	2	1.5	1720	6.2	3.10	2.50	700	73.7	325	340	0.76	80	K	.0789	.0936	1500	3800	177	40	62
DT100LS4	3	2.2	1720	8.6	4.30	3.45	640	108	300	305	0.80	81.5	J	.101	.114	1000	2700	354	51	73
DT100L4	5	3.7	1680	13.6	6.8	5.4	570	186	260	250	0.84	81.5	G	.126	.139	800	2000	354	60	82
DV112M4	5.4	4.0	1730	14.0	7.0	5.6	700	195	280	285	0.82	85.5	J	.233	.262	—	1400	487	84	110
DV132S4	7.5	5.5	1720	18.8	9.4	7.5	670	270	275	275	0.85	86.5	H	.416	.445	—	1200	664	106	139
DV132M4	10	7.5	1740	27.4	13.7	11.0	545	363	255	225	0.78	88.5	G	655	.769	—	1000	885	146	198
DV132ML4	12.5	9.2	1740	32.8	16.4	13.1	600	444	260	220	0.80	88.5	G	783	.887	—	900	1328	165	220
DV160M4	15	11	1740	40.8	20.4	16.3	530	534	280	215	0.78	87.5	G	945	1.049	—	700	1328	185	240
DV160L4	20	15	1760	53.6	26.8	21.5	540	720	300	210	0.79	88.5	G	2.197	2.449	—	560	1770	326	419
DV180M4	25	18.5	1760	63.5	31.6	25.3	575	888	285	200	0.80	88.5	G	2.660	2.912 3.164[1]	—	450	2655 2655[1]	386	476 485[1]
DV180L4	30	22	1760	81.2	40.6	32.5	505	1056	290	195	0.79	87.5	F	3.064	3.316 3.567[1]	—	400	2655 2655[1]	410	503 512[1]
DV200L4	40	30	1760	95	47.5	38	580	1441	280	200	0.89	90.2	F	5.558	5.809 6.061[1]	—	330	2655 5310[1]	538	650 659[1]
DV225S4	50	37	1760	118	59	47	560	1777	310	190	0.89	91.0	F	7.149	7.400 7.652[1]	—	250	2655 5310[1]	653	765 774[1]
DV225M4	60	45	1760	140	70	57	620	2161	310	200	0.88	91.7	G	8.479	8.730 8.982[1]	—	200	2655 5310[1]	717	831 840[1]

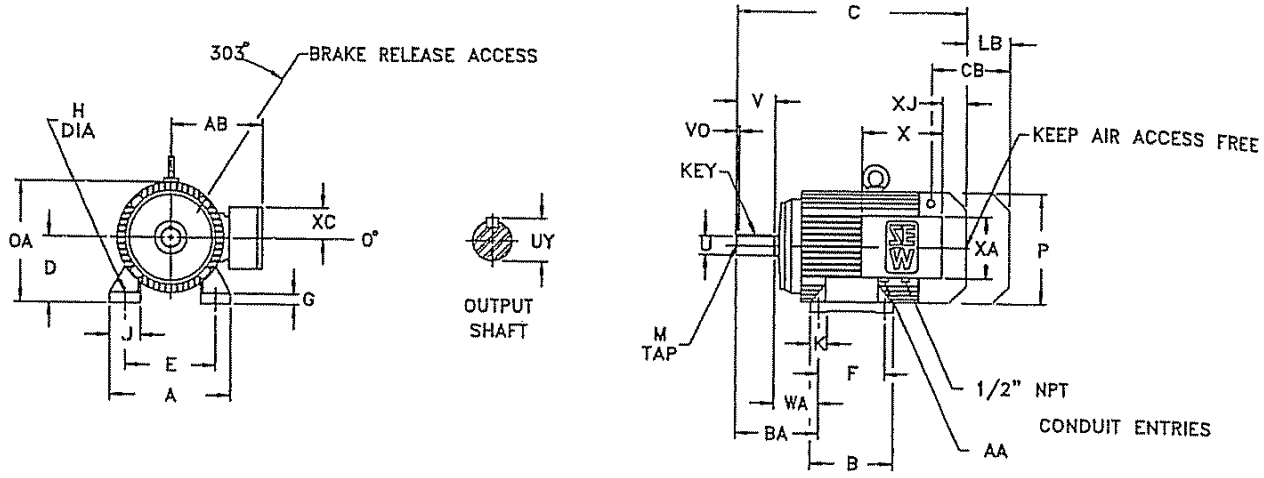
* Without Brake
** With Brake
1) Double Disc Brake
2) Values with BG rectifier (standard for frame size 100L and smaller)
3) Values with BGE rectifier (standard for frame size 112M and larger)

Abbreviations

P_n Rated Power
n_n Full Load Speed
I_n Full Load Current
I_a/I_n Starting Current Ratio (Locked Rotor)
T_n Full Load Torque
T_a/T_n Starting Torque Ratio
T_k/T_n Breakdown Torque Ratio
Cos φ Power Factor
η Motor Efficiency
J_m Motor Inertia
Z_o Permissible no-load starting frequency at 50% ED
T_B Maximum Brake Torque

SEW EURODRIVE

Dimensions
Type DT/DV Motors and Brakemotors - Foot Mounted



Motor

Model	A	B	BA	C	CB	D	E	F	G	H	J	K	LB	OA	P	WA
DT71	5.67	4.53	2.95	9.13	2.32	2.80 $^{+0}_{-.02}$	4.41	3.54	0.20	0.28	1.22	1.26	2.52	5.67	5.71[1]	1.77
	144	115	75	232	59	71 $^{+0}_{-.5}$	112	90	5	7	31	32	64	144	145[1]	45
DT80	5.87	4.92	3.54	11.50	2.32	3.15 $^{+0}_{-.02}$	4.92	3.94	0.39	0.35	1.30	1.10	2.52	6.02	5.71	1.97
	149	125	90	292	59	80 $^{+0}_{-.5}$	125	100	10	9	33	28	64	153	145	50
DT90	6.93	5.98	4.17	12.72	2.72	3.54 $^{+0}_{-.02}$	5.51	4.92[2]	0.31	0.35	1.26	1.26	3.35	7.44	7.76[1]	2.20
	176	152	106	323	69	90 $^{+0}_{-.5}$	140	125[2]	8	9	32	32	85	189	197[1]	56
DT100	7.40	6.69	4.84	14.61	2.72	3.94 $^{+0}_{-.02}$	6.30	5.51	0.47	0.47	1.50	1.38	3.35	7.83	7.76	2.48
	188	170	123	371	69	100 $^{+0}_{-.5}$	160	140	12	12	38	35	85	199	197	63
DV112M	8.66	6.69	5.12	16.10	3.82	4.41 $^{+0}_{-.02}$	7.48	5.51	0.55	0.47	1.73	1.38	3.15	8.78	8.70	2.76
	220	170	130	409	97	112 $^{+0}_{-.5}$	190	140	14	12	44	35	80	223	221	70

Output Shaft

Model	U	UY	V	VO	Key	M
DT71	0.551 $^{+.0005}_{-0}$	0.63	1.18	0.16	.20 x .20 x .87	M5 x .49
	14 $^{+.012}_{+.001}$	16	30	4	5 x 5 x 22	M5 x 12.5
DT80	0.748 $^{+.0006}_{+.0001}$	0.85	1.57	0.16	.24 x .24 x 1.26	M6 x .63
	19 $^{+.015}_{+.002}$	21.5	40	4	6 x 6 x 32	M6 x 16
DT90	0.945 $^{+.0005}_{+.0001}$	1.06	1.97	0.20	.31 x .28 x 1.57	M8 x .75
	24 $^{+.015}_{+.002}$	27	50	5	8 x 7 x 40	M8 x 19
DT100	1.102 $^{+.0006}_{+.0001}$	1.22	2.36	0.20	.31 x .28 x 1.97	M10 x .87
	28 $^{+.015}_{+.002}$	31	60	5	8 x 7 x 50	M10 x 22
DV112M	1.102 $^{+.0006}_{+.0001}$	1.22	2.36	0.20	.31 x .28 x 1.97	M10 x .87
	28 $^{+.015}_{+.002}$	31	60	5	8 x 7 x 50	M10 x 22

Conduit Box

AA	AB	X	XA	XC	XJ
½ *NPT*	5.43	5.79	4.53	2.24	0.55
—	138	147	115	57	14
½ *NPT*	5.43	5.79	4.53	2.24	0.55
—	138	147	115	57	14
½ *NPT*	6.73	5.79	4.53	2.24	1.10
—	171	147	115	57	28
¾ *NPT*	6.89	6.57	4.84	2.40	1.22
—	175	167	123	61	31
¾ *NPT*	7.40	6.57	4.84	2.40	1.85
—	188	167	123	61	47

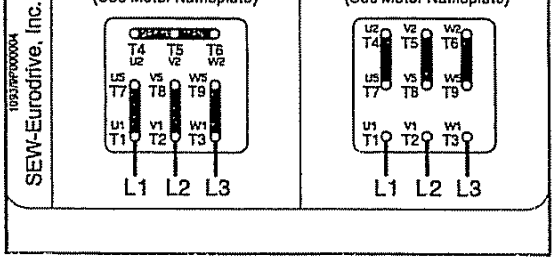
[1] Fan Guard flattened at base.
[2] Not per IEC for DT90S motors.

Dimensions are $\frac{\text{inch}}{\text{mm}}$
Dimension LB is for brake option.
Dimension CB is for brake release access.
Eye bolts are removable.

Dual-Voltage Motors
(single-speed)

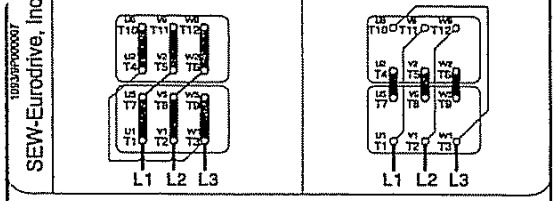
Frame Size	Low Voltage	High Voltage
DT71 thru DV180	230V - 60Hz	460V - 60Hz
	200V - 50Hz	400V - 50Hz

SEW-Eurodrive, Inc. USA — Single-Speed / Dual-Voltage — Connection Diagram DT79



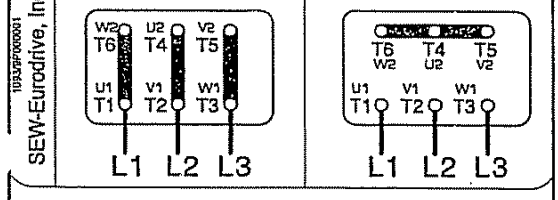
Frame Size	Low Voltage	High Voltage
DV200 thru DV225	230V - 60Hz	460V - 60Hz

SEW-Eurodrive, Inc. USA — Single-Speed / Dual-Voltage — Connection Diagram DT72



Frame Size	Low Voltage	High Voltage
DT71 thru DV225	200V - 50Hz	346V - 50Hz
	208V - 60Hz	360V - 60Hz
	220V - 50Hz	380V - 50Hz
	230V - 50Hz	400V - 50Hz
	240V - 50Hz	415V - 50Hz
	330V - 60Hz	575V - 60Hz

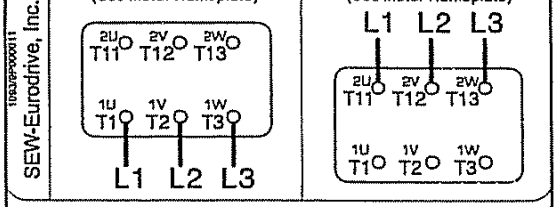
SEW-Eurodrive, Inc. USA — Single-Speed / Dual-Voltage — Connection Diagram DT13



Single-Voltage Motors
(two-speed)

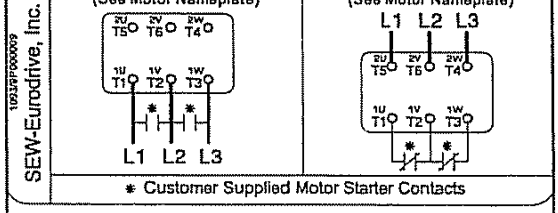
Frame Size: DT71 thru DV225

SEW-Eurodrive, Inc. USA — Two-Speed / Two-Winding — Connection Diagram DT43



Frame Size: DT71 thru DV132S

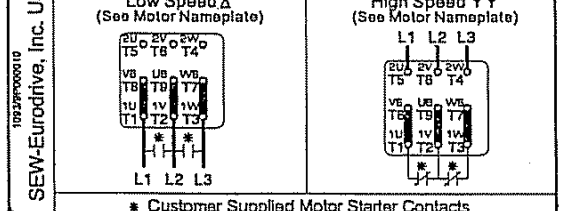
SEW-Eurodrive, Inc. USA — Two-Speed / Single-Winding — Connection Diagram DT33



* Customer Supplied Motor Starter Contacts

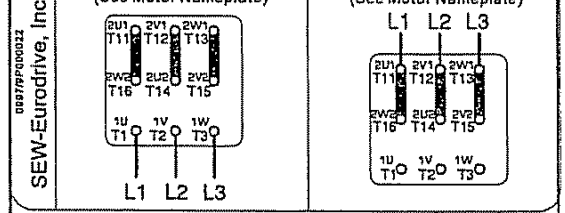
Frame Size: DV132M thru DV225

SEW-Eurodrive, Inc. USA — Two-Speed / Single-Winding — Connection Diagram DT53



* Customer Supplied Motor Starter Contacts

SEW-Eurodrive, Inc. USA — Two-Speed / Two-Winding — Connection Diagram DT48



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LOAD CELL ARRANGEMENT

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Model Alpha Load Beam

Vishay BLH

Load Beam Transducer

FEATURES

- Capacity range: 5.5,11, 22, 34, 56, and 112 lb (25, 50, 100, 150, 250, 500 N)
- Precision accuracy and repeatability
- Environmentally sealed for washdown applications
- Fast, easy 2 bolt installation
- FM, CSA and OIML approved
- OIML certification for 11 to 112 pound capacities

DESCRIPTION

The Alpha Beam is a low capacity differential bending beam transducer designed for use in a wide range of medical, industrial, and testing applications. It's unique features are a combination of superb accuracy and performance in a package that is very well sealed against moisture and solvents. Alpha Beams meet both OIML requirements for accuracy and IP 67 requirements for moisture protection.

Rated force capacities range from approximately 5.5 to 112 pounds (25 to 500 Newtons). Within capacity range, Alpha Beams measure force bidirectionally, producing an output mV/V signal directly proportional to the force applied.

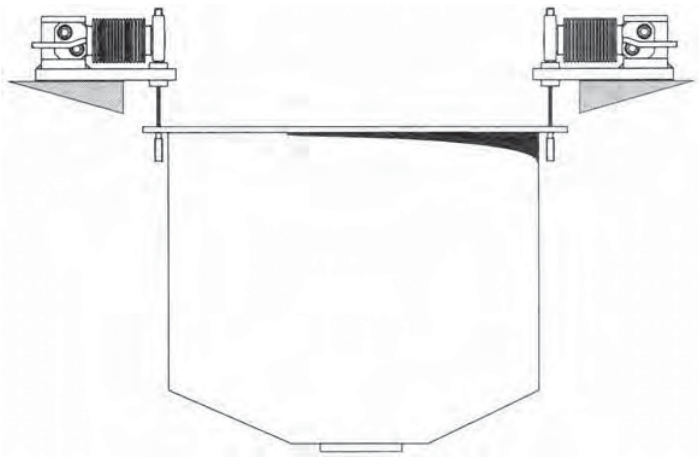
The heart of the patented Alpha Beam is the BLH developed SR-4® foil strain gage. Strain Gages are electrically connected to form a balanced Wheatstone Bridge. Compensation resistors maintain the accuracy of the bridge over a wide range of temperatures. The gaged element within the beam metal bellows is environmentally sealed against all adverse conditions, including water immersion.

Alpha Load Beams are approved by Factory Mutual Research (FM) and the Canadian Standards Association (CSA) for use in Class I, II, and III, Division 1 and 2 hazardous locations. They also are OIML tested and approved in accordance with paragraph 8.1 of the European Standard on Metrological aspects of nonautomatic weighing instrument EN 45501:1992 and by application of the OIML International Recommendation R 60 (Edition 1991).

APPLICATIONS

- Bench & portable scales
- Low capacity batching
- Medical weighing systems
- Pull/tear strength testing

CONFIGURATION



Model Alpha Load Beam

Vishay BLH — Load Beam Transducer

SPECIFICATIONS

Performance

Capacity	5.5,11, 22, 34, 56, 112 lb (25, 50, 100,150, 250, 500 N)
Rated Output (R.O.)	3mV/V nominal
Nonlinearity	0.02% R.O.
Hysteresis	0.02% R.O.
Repeatability	0.01% R.O.
Creep (20 minutes)	0.05% R.O.

Temperature

Safe Temperature	-15 to 175°F
Compensated Range	0 to + 150°F
Effect On Zero Balance	0.0008% RO/°F
Effect On Rated Output	0.0008% Load/°F

Electrical

Recommended Excitation	10 Vac/dc
Maximum Excitation	20 Vac/dc
Zero Balance	2.0% RO
Input Resistance	350ohms +/-3.5 ohms
Output Resistance	350ohms +/-3.5 ohms
Insulation Resistance	2 G-ohms
Electrical Connection	5-ft, 4 conductor shielded cable

Adverse Load Ratings

Safe Overload	175% RO
Ultimate Overload	300% RO

Materials

Element	Electroless nickel-plated berylium copper
Bellows	Tin-plated brass

Deflection at Rated Output

11 to 56lb	0.01 inch
112lb	0.017 inch

Sealing

IP67	all capacities

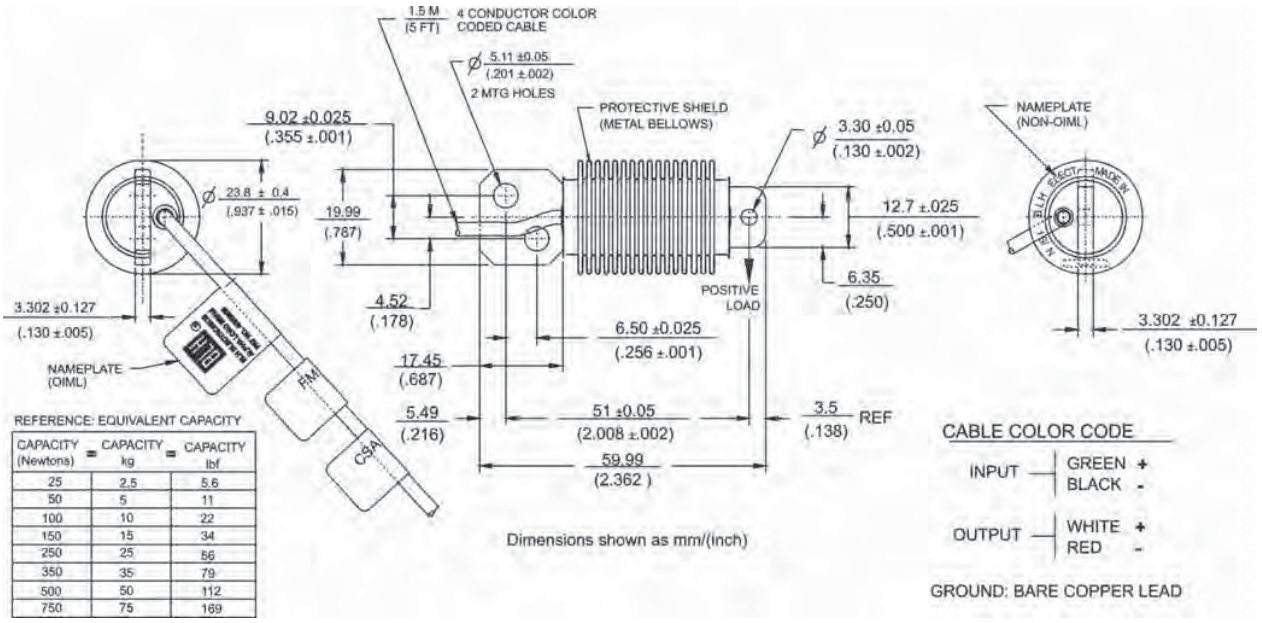
Approvals

FM	3611
CSA	C22.2 (all applicable sections)
OIML	EN 45501: 1992 (11-112lb)

Mechanical

Unit Weight	approx. 2 ounces

DIMENSIONS



REFERENCE: EQUIVALENT CAPACITY

CAPACITY (Newtons)	= CAPACITY kg	= CAPACITY lbf
25	2.5	5.6
50	5	11
100	10	22
150	15	34
250	25	56
350	35	79
500	50	112
750	75	169

Vishay BLH is continually seeking to improve product quality and performance. Specifications may change accordingly.

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FAX: +886-2-2696-4965
vt.roc@vishaymg.com
*Asia except China

Load Cell Arrangement
Mounting Instructions
Rigid mounted reducer size 100 or larger with FA47

1.To prevent fretting corrosion, "Never Seeze" or an equivalent corrosion retarding grease, should be applied to the input shaft of the rigid mounted reducer.

2. Install the 5mm spacer against the shoulder of the input shaft. Slide the FA47 reducer onto the input shaft. Secure the FA47 reducer screwing the ½"-13, 2"long retaining bolt into the centre tap of the input shaft. Bolt through the spring washer and disc, against snap ring.

3.Depending on the mounting position, remove one of the bolts that secure the input shaft assembly to the gear case, so that in this mounting position no static load is applied to the load cell. Replace this bolt with the one supplied with two spot faces on socket head. Mount spring washer and nut on bolt.

4.Mount the load cell on the support step. Apply "Loctite 242" to the two M5 socket head screws and tighten them utilizing two spring washers.

5.Mount the load cell support on the FA47 reducer lug using the fasteners supplied (one bolt, two plain washers and two nuts). The load cell tip must be aligned with the socket head of the bolt.

6.Using a wrench on the bolt spot faces, adjust it, so that the load cell tip is inserted into the socket head, and there is a 2 mm gap between the bolt head and the metal bellows.
Tighten spring washer and nut on bolt.

Notes:
-For indoor locations, use steel fasteners of property class 8.8 or higher.
-For outdoor locations, stainless steel fasteners of minimum property class 70 are recommended. A hood protecting the load cell is also suggested.

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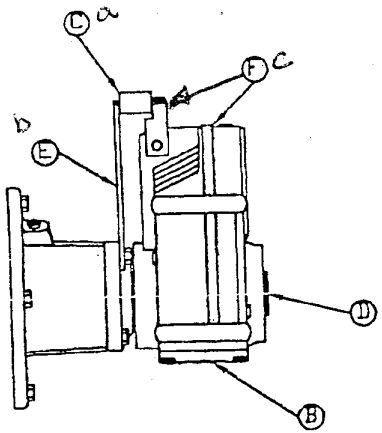

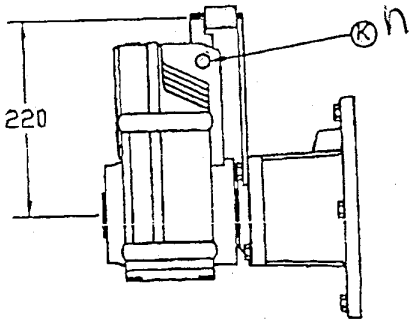

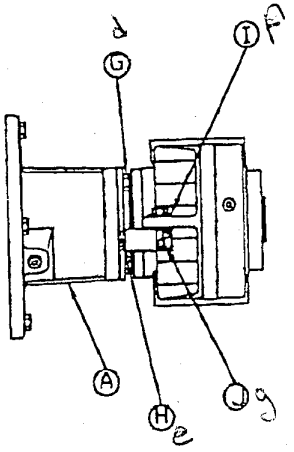

110 Nm MAXIMUM OUTPUT

K	HEXHEAD CAPSCREW M12X30-8.8	1
J	HEXHEAD CAPSCREW M5X10-0.8	2
I	LOCK WASHER 1/2"	1
H	HEXHEAD CAPSCREW M3X5-0.5	1
G	HEXHEAD CAPSCREW M12X40-8.8	2
F	FA47 / AD4 BRACKET 011011.03.A	1
E	FA47 / AD4 PLATE 011011.02.A	1
D	AD4 SHAFT 011012.02.A	1
C	ALPHA 100LB LOAD BEAM	1
B	FA47 ASSEMBLY	1
A	AD4ZR ASSEMBLY	1

SEE ASSEMBLY INSTRUCTION

	Name	Date
dwn	TYSON J	
chkd		

SCALE

Material

Old part Nr.

Unit Type

Title: LOAD CELL ASSEMBLY

SEW EURODRIVE BRAMALEA, ONT

011023.01.A

Page 1 OF 1

Mounting hardware

Rigid mounted reducer size 100 or larger with FA47

8.8 steel fasteners

Specific of this combination:

- 1 custom built load cell support.
- 1 modified socket head bolt, M16 , DIN 912 , length to suit.
- 1 spacer, o.d. 50mm, i.d. 1.375", width 5mm
- 1 hexagon bolt 1/2"-13 UNC, 2" long, stock # 9881441
- 1 hexagon nut, M16, DIN 934, stock # 102032
- 1 spring lock washer, M16, DIN 127 B, stock # 109959

Additional repetitive set:

- 2 socket head screws, M5-12, DIN 912, stock # 110485
- 2 spring lock washers, M5, DIN 127B, stock # 102555
- 1 hexagon bolt, M12-50, DIN 931, stock # 110302
- 2 plain washers, M12, DIN 125 A, stock # 102393
- 2 hexagon nuts, M12, DIN 934, stock # 102016

Shipped inside the FA47 hollow shaft (as per parts list):

- 1 standard retaining bolt
- 1 spring lock washer
- 1 disc
- 1 snap ring

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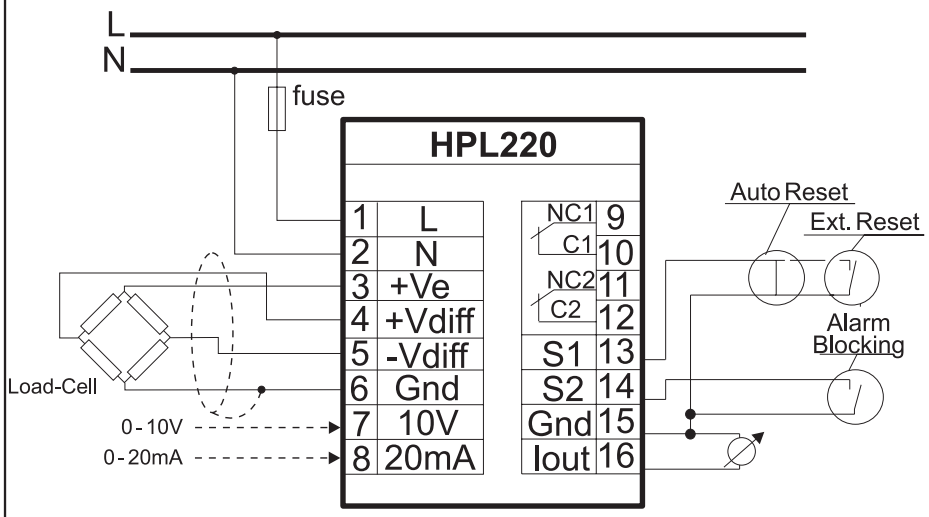
Display & Programming.

Mode	Function	Parameter	▼	▲	Display	Default
Meas'mt	Display measurement		Min. peak	Max. peak	Meas'mt [%]	
Limits	Limit 1 prog./display	Off,5-100%	Decrease	Increase	Limit 1	80
Limits	Limit 2 prog./display	Off,5-100%	Decrease	Increase	Limit 2	Off
Ts [S]	Start timer	0.0-25.0 Sec.	Decrease	Increase	Ts [Sec]	2.0 Sec.
Tr [S]	Alarm reaction timer 1	0.0-25.0 Sec.	Decrease	Increase	Tr [Sec]	0.1 Sec.
Tr [S]	Alarm reaction timer 2	0.0-25.0 Sec.	Decrease	Increase	Tr [Sec]	0.1 Sec.
Hyst's	Hysteresis 1	5-50%	Decrease	Increase	Hyst's [%]	10
Hyst's	Hysteresis 2	5-50%	Decrease	Increase	Hyst's [%]	10
Units						
Full scale	Max. input	20-100%	Decrease	Increase	'Full scale'	100
Offset	Offset adjustment ±	±10%(F.S.)	Decrease	Increase	Meas'mt [%]	---
Input	Input select	Vdiff, 10V, 20mA	Vdiff-10V-20mA	20mA-10V-Vdiff	"Inp"	Vdiff

HPL220 is programmed by the use of only three keys located on the front panel, see the paragraph about programming on page 2. All parameters as well as their range are listed in the table above. The parameters are stored in EEPROM. When no key has been activated for about 5 seconds, the display returns to the „Meas'mt" position, except for the offset adjustment, where the display continuously shows the actual measurement for adjustment.

Note: The unit is equipped with accellerator on the keys, so the function of the keys is repeated if the keys are held down continuously.

Note! Only one of the inputs (vDiff, 0-10V, 0-20mA) may be used.



Example: HPL220 connected to a load-cell

Unipower HPL220

Version 4.0

Technical information — English edition

Technical Specifications

Mechnical

Housing
Makrolon 8020 (30% GV), UL94V-1 (housing). Makrolon 2800, UL94V-2 (connector + front).

Mounting
Snap-on construction for 35mm DIN-rail or wall mounting.

Protection class
IP40 (housing).
IP20 (connector).

Temperature range: -15 - +50 °C.
Weight: Ca. 450g.
Dimensions: D 110 x W 56 x H 75 mm.

Electrical

Supply
See technical info on the unit.
Also available:
1 x 120 VAC -> 1 x 240 VAC

Measurement range
Vdiff: 20 - 100mV full scale, 100kΩ
10V: 0-10V, 850kΩ
20mA: 0-20mA, 5Ω

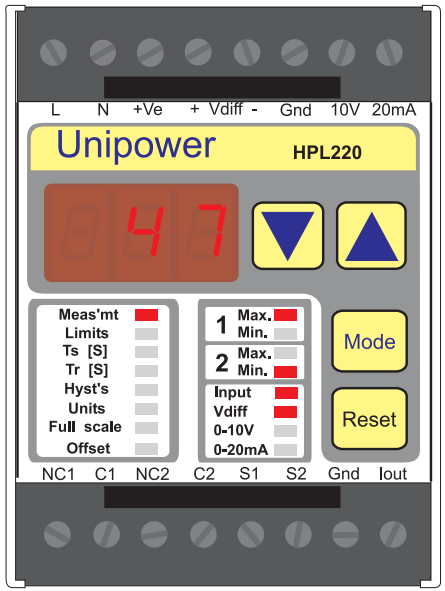
Consumption: 2 VA

Transducer Supply
10V stabilized max. load 330Ω.

Relay: 250Vac, 5Amp.

Analogue output.
0-20mA, 0-400Ω.
The output is NOT electrically isolated from the measurement system.

CE-mark to:
EN50081-1, EN50082-2, EN61010-1



The CONCEPT

The Unipower HPL220 is a member of a family of ***"Intelligent Control Units"*** which is based upon the latest advance in the Microcontroller Technology. The HPL220 operates as both a measurement transducer and a signal conditioner for many different types of transducers. The device includes 2 trip points and associated relay outputs, timers and hysteresis functions which makes it an extremely flexible control unit. The HPL220 accepts 3 different types of transducer signals: 0-100 mV differential, 0-10V and 0-20mA. Each signal range is scalable with respect to span and offset. The lowest measurement range is 20mV F.S. The unit has a stabilized 10V supply for the transducer. The display shows the measurement in % of the range.

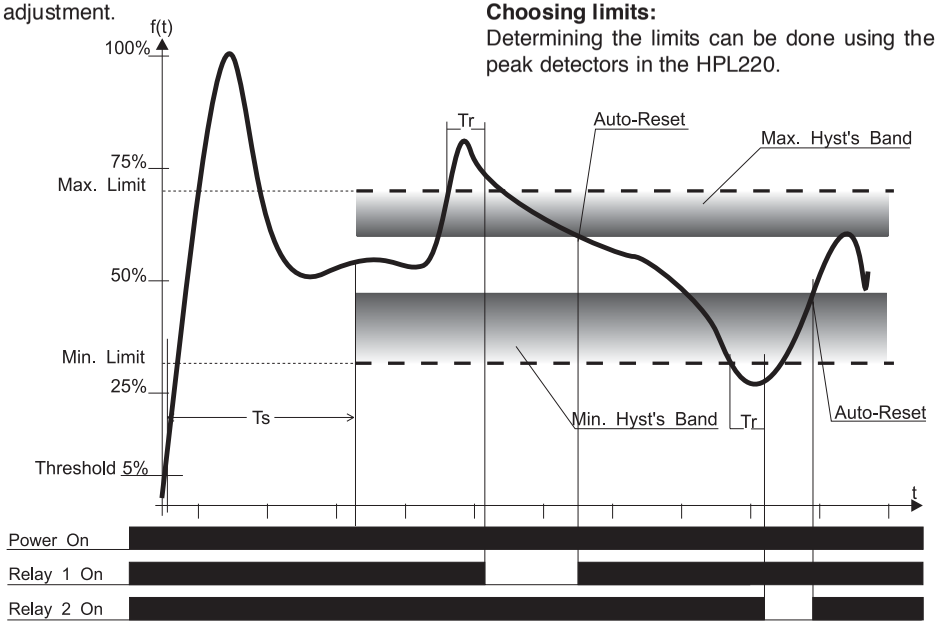
WENtechnology
Raleigh, NC, USA
(919) 954-1004 ***www.wentec.com***

Generally

The HPL220 is often used together with a load-cell to protect motor driven machinery against overload etc. Other members of the HPL-family realize the same function from the measurement of the power consumption of the motor. The HPL220 is used in special cases where the power-consumption of the motor varies little as a function of the change of load. This is for example true when the motor uses a gear with a very large exchange ratio. The drawing below shows a possible load curve of a machine taken immediately after starting.

Programming:
HPL220 is programmed by the use of only three keys located on the front panel. The „Mode"-key is used to select one of the programmable parameters: When a parameter is selected its value may be altered using the arrow keys.

Measurement range:
Setting up the measurement range for the HPL220 consists of three settings: Selecting input (transducer output), Full scale and offset adjustment.



Input:
Using the arrow keys to select the 'input' to match the output of the transducer. The transducer is interfaced to the HPL220 terminals, which corresponds to the input selected.

Full scale:
The arrow keys are used to change the range continuously between 20% and 100%.

Offset adjustment:
The offset must be adjusted with the input signal = 0. The display shows the actual measurement. Using the arrow keys adjust the offset, until the display shows 0. At full scale above 50mV the arrow keys typically needs to be activated more than once to provide a change in the measurement.
Note! Adjustment only applies to Vdiff-input.

Absolute measurement:
The HPL220 measures bipolar input signal, but is able to show only up to 10% of full scale below zero. If the Dip. Sw. 2 is set to pos. 'On' negative signals are inverted.

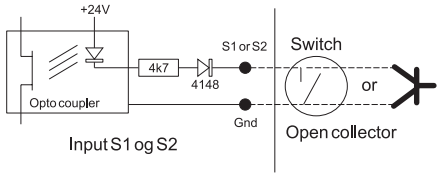
Choosing limits:
Determining the limits can be done using the peak detectors in the HPL220.

Peak detectors:
Leave the system running at normal load and read the peak values by activating the arrow keys in „Meas'mt"-mode. The Max.peak is shown by arrow-up and the Min.Peak by arrow down. Place the Min limit appropriately below the Min peak value. Peak values are set to actual measurement by expiration of Ts. They may be reset separately by pressing the relevant arrow key and at the same time activate the Reset key.

Ts: Start timer
The start timer (Ts) is used to avoid alarms at system start. The Ts delay function is activated after the input signal reaches 5%. When Ts expires the limits, hysteresis and Tr become active. If the input signal drops below 5%, the supervision is switched off again.

Tr: Reaction timer
The figure shows how the reaction timer (Tr) is activated after the limit is exceeded. Tr is used to avoid alarms, unless the limit has been exceeded for a certain time. If Tr is set to 0, Tr ~ 50ms.

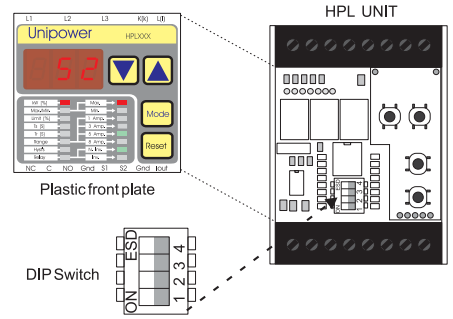
Reseting alarms:
Alarms may be reset by the reset key on the front panel or by Input S1.
Input S1: Auto or external reset
External reset: S1 is connected to Gnd using a switch or optocoupler output. See fig. below.
Auto reset: If S1 is connected to Gnd, Auto reset mode is enabled, which leads to reset of alarms by hysteresis.



Hysteresis:
The figure to the left shows how a possible hysteresis band is placed relative to the limits; Always above a Min limit and below a Max limit. Hysteresis is activated when an alarm is generated and the external reset is active (Input S1, Auto reset mode).

Input S2: Blocking of alarms
Like Ts blocks for alarms during start up, alarms can be ignored by connecting S2 to Gnd.
Ex. 1: If a brief overload is expected, a PLC output or the like may be used to block for a short period of time.
Ex. 2: If the Min. limit is used, a spare break switch from the Motor Switch must be connected between the S2 input and Gnd, otherwise an alarm is generated each time the motor is switched off on purpose.

DIP switch:
The DIP switch is found immediately below the front plate (see the figure below).



1. Turn off the unit.
2. Remove the plastic front plate (use a small screwdriver).
3. Make the changes and reassemble the unit.

DIP Switch Usage		
SW 1	Programming protection off	Off
SW 1	Programming protection on	On
SW 2	Bipolar mode	Off
SW 2	Unipolar (absolute) mode	On
SW 3	Limit 1 = Max. Limit	Off
SW 3	Limit 1 = Min. Limit	On
SW 4	Limit 2 = Max. Limit	Off
SW 4	Limit 2 = Min. Limit	On

LED-usage:

LED Usage	
Limit 1 active	Max/Min 1 LED On
Limit 2 active	Max/Min 2 LED On
Alarm 1 active	Max/Min 1 LED flashes
Alarm 2 active	Max/Min 2 LED flashes
Start delay active	Ts LED On
Alarm delay active	Tr LED On

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference : NC01

MICROSAND

ST-011

VEOLIA WATER
Solutions & Technologies

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NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Microsand	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	**NC01** **Rev.** **0**
	3						
DESSIN /DWG # **ST-011**	4					**Date:**	2009-03-26

REV.	ITEM		QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-011-	**1**	3	6	**MICROSAND**		Y44		SITE	
					Effective size:					
					135 microns					
					1 wooden pallet (about 48 bags of 50 lbs each)					
					Total quantity: 6 pallets					

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Material Safety Data Sheet

Revised:

September 2002

Section 1 – Product Identification

Trade Names:	Silica Sand-All Grades, Vita-S, RRW, Tip Top
Common Names/Synonyms:	Sand, Silica Sand, Quartz, Crystalline Silica, Flint, Ground Silica
Product Use:	Foundry Molds, Abrasive Blasting, Glass and Ceramic Melt Sand, Aggregate Filler, Filtration Media
Manufacturers Name:	Manley Bros. of Indiana, Inc
Manufacturers Address:	P.O. Box 80, 300 South Vermillion Street Troy Grove, IL 61372
Manufacturers Telephone:	(815) 539-7486
Date Revised:	September 2002
Emergency Number:	(815) 539-7486 (7:00 am – 4:00 pm Central Time, Monday-Friday)

Section 2 – Composition and Information on Ingredients

Hazardous Ingredient Name:	Silica, Quartz, SiO_2	
CAS Number:	14808 - 60- 7	
Concentration (%)	>95%	
Exposure Limits in Air:		
OSHA - PEL	10 mg/m^3 % SiO_2+2	(8-Hour Time Weighted Average)
ACGIH – TLV	0.05 mg/cubic meter	(8-Hour Time Weighted Average)
NIOSH	0.05 mg/cubic meter	(10-Hour Time Weighted Average, 40-hour work week)

Exposure Limits refer to the respirable fraction.

Silica is classified as hazardous under Occupational Safety and Health Administration (OSHA) regulations (29 CFR 1910.1200).

CAUTION:
Crystalline silica exists in several forms, the most common of which is quartz. If crystalline silica (quartz) is heated to more than 870°C it can change to a form of crystalline silica known as trydimite, and if crystalline silica (quartz) is heated to more than 1470°C, it can change to a form of crystalline silica known as cristobalite. Crystalline silica as trydimite and cristobalite are more fibrogenic than crystalline silica as quartz. The OSHA PEL for crystalline silica as trydimite and cristobalite is one-half the PEL for crystalline silica (quartz); the ACGIH TLV for crystalline silica as trydimite and cristobalite is one-half the TLV for crystalline silica as quartz.

Section 3 – Hazards Identification

Emergency Overview

Manley Bros. Silica Sand is a light buff to white sand with no odor. It is not flammable, combustible, or explosive. It can cause irritation to the eyes. A single exposure will not result in serious adverse health effects.

Potential Health Effects
Inhalation:

a. Silicosis: Respirable crystalline silica (quartz) can cause silicosis, a fibrosis (scarring) of the lungs. Silicosis may be progressive; it may lead to disability and death.

b. Cancer: Crystalline silica (quartz) inhaled from occupational sources in sufficient concentrations is classified as carcinogenic to humans. In its Ninth Annual Report on Carcinogens, the National Toxicology Program (NTP) listed crystalline silica as a known human carcinogen, based on sufficient evidence of carcinogenicity from studies in humans indicating a casual relationship between exposure to respirable crystalline silica and increased lung cancer rates in workers exposed to crystalline silica dust. The International Agency for Research on Cancer (IARC) has evaluated crystalline silica and determined that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (Group 1)."

c. Scleroderma: There is evidence that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of scleroderma, an autoimmune disorder manifested by a fibrosis (scarring) of the skin and internal organs.

d. Tuberculosis: Silicosis increases the risk of tuberculosis.

e. Nephrotoxicity: There are several studies suggesting that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of kidney disorders.

Eye Contact: Crystalline silica (quartz) may cause abrasion of the cornea.

Skin Contact: Not applicable.

Ingestion: Not applicable.

Chronic Effects: The adverse health effects -- silicosis, cancer, scleroderma, tuberculosis, and nephrotoxicity -- are chronic effects.

Signs and Symptoms of Exposure: There are generally no signs or symptoms of exposure to crystalline silica (quartz). Often, chronic silicosis has no symptoms. The symptoms of chronic silicosis, if present, are shortness of breath, wheezing, cough and sputum production. The symptoms of acute silicosis are the same as those associated with chronic silicosis; additionally, weight loss and fever may also occur. The symptoms of scleroderma include thickening and stiffness of the skin, particularly in the fingers, shortness of breath, difficulty swallowing and joint problems.

Medical Conditions Generally Aggravated by Exposure: The condition of individuals with lung disease (e.g., bronchitis, emphysema, chronic obstructive pulmonary disease) can be aggravated by exposure.

See Section 11, Toxicological Information, for additional detail on potential adverse health effects.

Section 4 – First Aid Procedures

Inhalation – There is no specific treatment because the health effects associated with silica are chronic. If gross inhalation of silica occurs, remove the person to fresh air, perform artificial respiration as needed, and obtain medical attention as needed.

Eye – Wash the eye with water. If irritation persists, seek medical attention.

Skin – N/A

Ingestion – If large amounts are ingested, seek medical attention.

Section 5 – Fire Fighting Measures

Flashpoint:	None
Upper/Lower Explosive Limit:	None (N/A) (not combustible)
Autoignition Temperature:	None
Unusual Fire and Explosion Habits:	None
Extinguishing Media:	Compatible with all media; use the medium appropriate to the surrounding fire.
Special Fire Fighting Procedures:	None with respect to this product.
Hazardous Combustion Products:	None

Section 6 – Accidental Release Measures

Wear appropriate personal protective equipment as described in Section 8 of this document. Collect the material using a method which does not produce dust [High-Efficiency Particulate Air (HEPA) vacuum or thoroughly wetting down the silica]. Place the silica in a covered container appropriate for disposal. Dispose of the silica according to federal, state, and local regulations.

Section 7 – Handling and Storage

Do not breathe dust which may be created during the handling of this product. Do not rely on vision to determine whether respirable silica is present in the air, as it may be present without a visible cloud. Use good housekeeping procedures to prevent the accumulation of silica dust in the workplace. Avoid the creation of respirable dust.

Use adequate ventilation and dust collection equipment. Ensure that the dust collection system is adequate to reduce dust levels to below the appropriate occupational health limit.

In accordance with the U.S. Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (29 CFR 1910.1200, 1915.99, 1917.28, 1918.90, 1926.59, 1928.21), state, and/or local right-to-know laws and regulations, familiarize your employees with this MSDS and the information contained herein. Warn your employees of the potential health risks associated with the use of this product and train them in the appropriate use of personal protective equipment and engineering controls which will reduce their risks of exposure.

Section 8 – Exposure Controls/Personal Protection

Ventilation: Use local exhaust as required to maintain exposures below the occupational exposure limits; see also ACGIH, Industrial Ventilation – Recommended Practice (latest edition).

Respiratory Protection: NIOSH recommends that workers wear the type CE supplied air abrasive blasting respirator operated in the positive-pressure mode (assigned protection factor (APF) of 2,000) during abrasive blasting operations that involve crystalline silica sand. Avoid breathing dust produced during the use and handling of this product. The following chart specifies the types of respirators which may provide respiratory protection for crystalline silica. This chart is based on the OSHA PEL, assuming that the material involved is 98% crystalline silica, therefore resulting in a PEL of 0.1 mg/m^3.

CONDITION Particulate Concentration	**MINIMUM RESPIRATORY PROTECTION REQUIRED TO MEET THE CONDITION OSHA PEL FOR CRYSTALLINE SILICA (0.1 mg/m^3)**
Less than or equal to 1.0 mg/m^3 (10 x PEL)	• Any air-purifying respirator with a P100 filter approved by NIOSH.
Less than or equal to 2.5 mg/m^3 (25 x PEL)	• Any powered, air-purifying respirator with a P100 filter approved by NIOSH, or • Any supplied-air respirator equipped with a hood or helmet and operated in a continuous-flow mode (for example, type CE abrasive blasting respirators operated in the continuous flow mode) approved by NIOSH

CONDITION Particulate Concentration	MINIMUM RESPIRATORY PROTECTION REQUIRED TO MEET THE CONDITION OSHA PEL FOR CRYSTALLINE SILICA (0.1 mg/m³)
Less than or equal to 5.0 mg/m³ (50 x PEL)	• Any air-purifying respirator with a P100 filter approved by NIOSH, or • Any powered, air-purifying respirator with a tight-fitting facepiece and a P100 filter approved by NIOSH.
Less than or equal to 100 mg/m³ (1,000 x PEL)	• Any supplied-air respirator equipped with a half-mask and operated in a pressure-demand or other positive pressure mode.
Less than or equal to 200 mg/m³ (2000 x PEL)	• Any supplied-air respirator equipped with a half-mask and operated in a pressure-demand or other positive-pressure mode (for example, a type CE abrasive blasting respirator operated in a positive-pressure mode)
Planned or emergency entry into environments containing unknown concentrations or concentrations less than or equal to 1,000 mg/m³ (10,000 x PEL)	• Any self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode, or • Any supplied-air respirator equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode
Firefighting	• Any self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode approved by NIOSH
Escape only	• Any air-purifying respirator with a P100 filter approved by NIOSH, or • Any appropriate escape-type, self-contained breathing apparatus

See also ANSI standard Z88.2 (latest revision) "American National Standard for Respiratory Protection," 29 CFR 1910.134 and 1926.103, and 42 CFR 84.

Permissible Exposure Levels:

Exposure Guidelines for Crystalline Silica						
OSHA		ACGIH		NIOSH		
TWA	STEL	TWA	STEL	TWA	STEL	Unit
$\frac{10\ mg/m^3}{\%\ SiO_2+2}$	None	0.05	None	0.05	None	mg/m³

If the workplace airborne crystalline silica concentration is unknown for a given task, conduct air monitoring to determine the appropriate level of respiratory protection. Consult with a certified industrial hygienist, your insurance risk manager, or the OSHA Consultative Services group for detailed information. Ensure appropriate respirators are worn during and following the task, including clean-up or whenever airborne dust is present, to insure ambient dust levels are below occupational health limits.

Gloves:Recommended in situations where abrasion from sand may occur.

Eye: Goggles recommended where airborne dust is produced.

Other: Protective clothing as appropriate for the work environment. Dusty clothing should be laundered before it is reused. Do not take dusty clothing home.

Section 9 – Physical and Chemical Properties

Appearance:	Light Buff to White Sand
Odor:	None
Physical State:	Granular Solid
pH:	Not Applicable
Vapor Pressure	Not Applicable
Vapor Density:	Not Applicable
Boiling Point or Range, °F:	Above 3500°F
Melting Point or Range, °F:	Above 2000°F
Solubility In Water:	Insoluble
Specific Gravity:	2.65 Crystalline

Section 10 – Stability and Reactivity

Stability:	Stable
Materials to Avoid:	Strong Oxidizing Agents
Hazardous Decomposition Products:	None
Hazardous Polymerization:	Will not occur

Section 11 – Toxicological Information

A. SILICOSIS

The major concern is silicosis (lung disease), caused by the inhalation and retention of respirable crystalline silica dust. Silicosis can exist in several forms, chronic (or ordinary), accelerated, or acute.

Chronic or Ordinary Silicosis is the most common form of silicosis, and can occur after many years of exposure to levels above the occupational exposure limits for airborne respirable crystalline silica dust. It is further defined as either simple or complicated silicosis.

Simple silicosis is characterized by lung lesions (shown as radiographic opacities) less than 1 centimeter in diameter, primarily in the upper lung zones. Often, simple silicosis is not associated with symptoms, detectable changes in lung function or disability. Simple silicosis may be progressive and may develop into complicated silicosis or progressive massive fibrosis (PMF).

Complicated silicosis or PMF is characterized by lung lesions (shown as radiographic opacities) greater than 1 centimeter in diameter. Although there may be no symptoms associated with complicated silicosis or PMF, the symptoms, if present, are shortness of breath, wheezing, cough and sputum production. Complicated silicosis or PMF may be associated with decreased lung function and may be disabling. Advanced complicated silicosis or PMF may lead to death. Advanced complicated silicosis or PMF can result in heart disease secondary to the lung disease (corpumonale).

Accelerated Silicosis can occur with exposure to high concentrations of respirable crystalline silica over a relatively short period; the lung lesions can appear within five (5) years of the initial exposure. The progression can be rapid. Accelerated silicosis is similar to chronic or ordinary silicosis, except that the lung lesions appear earlier and the progression is more rapid.

Acute Silicosis can occur with exposures to very high concentrations of respirable crystalline silica over a very short time period, sometimes as short as a few months. The symptoms of acute silicosis include progressive shortness of breath, fever, cough and weight loss. Acute silicosis is fatal.

B. CANCER

IARC - The International Agency for Research on Cancer ("IARC") concluded that there was "*sufficient evidence* in humans for the carcinogenicity of crystalline silica in the forms of quartz or cristobalite from occupational sources", and that there is "*sufficient evidence* in experimental animals for the carcinogenicity of quartz and cristobalite." The overall IARC evaluation was that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans (Group 1)*." The IARC evaluation noted that "carcinogenicity was not detected in all industrial circumstances studies. Carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs." For further information on the IARC evaluation, see IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 68, "Silica, Some Silicates..." (1997).

NTP - The National Toxicology Program, in its Ninth Annual Report on Carcinogens, concluded that respirable crystalline silica is known to be a human carcinogen, based on sufficient evidence of carcinogenicity from studies in humans indicating a casual relationship between exposure to respirable crystalline silica and increased lung cancer rates in workers exposed to crystalline silica dust.

There is substantial literature on the issues of the carcinogenicity of crystalline silica, which the reader should consult for additional information. A summary of the literature is set forth in "Exposure to crystalline silica and risk of lung cancer; the epidemiological evidence", Thorax, Volume 51, pp. 97-102 (1996). The official statement of the American Thoracic Society on the issue of silica carcinogenicity was published in "Adverse Effects of Crystalline Silica Exposure", American Journal of Respiratory and Critical Care Medicine, Volume 155, pp. 761-765 (1997). The official statement concluded that "The available data support the conclusion that silicosis produces increased risk for bronchogenic carcinoma. The cancer risk may also be increased by smoking and other carcinogens in the workplace. Epidemiologic studies provide convincing evidence for increased cancer risk among tobacco smokers with silicosis. Less information is available for never-smokers and for workers exposed to silica but who do not have silicosis. For workers with silicosis, the risks for lung cancer are relatively high and consistent among various countries and investigators. Silicosis should be considered a condition that predisposes workers to an increased risk of lung cancer." Id. at 763.

C. SCLERODERMA
There is evidence that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of scleroderma, an immune system disorder manifested by a fibrosis (scarring) of the lungs, skin and other internal organs. Recently, the American Thoracic Society noted that "there is persuasive evidence relating scleroderma to occupational silica exposures in setting where there is appreciable silicosis risk." The following may be consulted for additional information on silica, silicosis and scleroderma (also known as progressive systemic sclerosis): Occupational Lung Disorders, Third Edition, Chapter 12, entitled "Silicosis and Related Diseases", Parkes, W. Raymond (1994). "Adverse Effects of Crystalline Silica Exposure", American Journal of Respiratory and Critical Care Medicine, Volume 155, pp. 761-765 (1997).

D. TUBERCULOSIS
Individuals with silicosis are at increased risk to develop tuberculosis, if exposed to persons with tuberculosis. The following may be consulted for further information: Occupational Lung Disorders, Third Edition, Chapter 12, entitled "Silicosis and Related Diseases", Parkes, W. Raymond (1994). "Adverse Effects of Crystalline Silica Exposure", American Journal of Respiratory and Critical Care Medicine, Volume 155, pp. 761-765 (1997).

E. NEPHROTOXICITY
There are several recent studies suggesting that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of kidney disorders. The following may be consulted for additional information on silica, silicosis and nephrotoxicity: Occupational Lung Disorders, Third Edition, Chapter 12, entitled "Silicosis and Related Diseases", Parkes, W. Raymond (1994). "Further evidence of human silica nephrotoxicity in occupationally exposed workers", British Journal of Industrial Medicine, Vol. 50, No. 10, pp. 907-912 (1993). "Adverse Effects of Crystalline Silica Exposure", American Journal of Respiratory and Critical Care Medicine, Volume 155, pp. 761-765 (1997).

Section 12 – Ecological Information

Crystalline silica is not known to be ecotoxic.

Section 13 – Disposal Considerations

General: Crystalline silica may be landfilled. Material should be placed in covered containers to minimize generation of airborne dust.

RCRA: Crystalline silica (quartz) is not classified as a hazardous waste under the Resource Conservation and Recovery Act, or its regulations, 40 CFR §261 et seq.

The above information applies to Manley Bros. Silica Sand only as sold. The product may be contaminated during use, and it is the responsibility of the user to assess the appropriate disposal method in this situation.

Section 14 – Transport Information

Crystalline silica (quartz) is not a hazardous material for purposes of transportation under the U. S. Department of Transportation Table of Hazardous Materials, 49 CFR §172.101.

Section 15 – Regulatory Information

UNITED STATES (FEDERAL AND STATE)

TSCA No.: Crystalline silica (quartz) appears on the EPA TSCA inventory under the CAS No. 14808-60-7.

RCRA: Crystalline silica (quartz) is not classified as a hazardous waste under the Resource Conservation and Recovery Act, or its regulations, 40 CFR §261 et seq.
CERCLA: Crystalline silica (quartz) is not classified as a hazardous substance under regulations of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), 40 CFR §302.
Emergency Planning and Community Right to Know Act: Crystalline silica (quartz) is not an extremely hazardous substance under Section 302 and is not a toxic chemical subject to the requirements of Section 313.
Clean Air Act: Crystalline silica (quartz) mined and processed was not processed with or does not contain any Class I or Class II ozone depleting substances.
FDA: Silica is included in the list of substances that may be included in coatings used in food contact surfaces, 21 CFR §175.300(b)(3)(xxvi).
NTP: Respirable crystalline silica (quartz) is classified as known to be a human carcinogen.
OSHA Carcinogen: Crystalline silica (quartz) is not listed.
California Proposition 65: Crystalline silica (quartz) is classified as a substance known to the state of California to be a carcinogen.

CANADA

Domestic Substances List: Silica, as a naturally occurring substance, is on the Canadian DSL.
WHMIS Classification: D-2A

OTHER

EINECS No.: 231-545-4
EEC Label (Risk/Safety Phrases): R 48/20, R 40/20, S22, S38
IARC: Crystalline silica (quartz) is classified in IARC Group 1.
National, state, provincial or local emergency planning, community right to know or other laws, regulations or ordinances may be applicable--consult applicable national, state, provincial or local laws.

Section 16 – Other Information

Hazardous Material Information System (HMIS):

Health	*
Flammability	0
Reactivity	0
Protective Equipment	E

* For further information on health effects, see Sections 3 and 11 of this MSDS.

More information on the effects of crystalline silica exposure may be obtained from the following:

National Institute for Occupational Safety and Health (NIOSH)-----Phone: 1-800-35-NIOSH
Website: http://www.cdc.gov/niosh

National Toxicology Program (NTP)-----Phone: 1-919-541-0530
Website: http://ntp-server.niehs.nih.gov

Occupational Safety and Health Administration (OSHA)-----Phone: 1-800-321-OSHA
Website: http://www.osha.gov

MANLEY BROS. OF INDIANA, INC. COMPANY DISCLAIMER

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. The information and recommendations set forth herein are based on technical data that Manley Bros. of Indiana, Inc. believes reliable. It is intended for use by persons having technical skill and at their own discretion and risk. Since conditions of use are outside the control of Manley Bros. of Indiana, Inc., no warranties, expressed or implied, are made and no liability is assumed in connection with any use of this information. Any use of this data and information must be determined by the user to be in accordance with federal, state, and local laws and regulations. Customers and users of silica must comply with all applicable health and safety laws, regulations, and orders.

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Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference : NC01

COAGULANT DOSING

ST-051

VEOLIA WATER
Solutions & Technologies

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NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE		Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining		
Coagulant dosing		0	SUBMITTAL	Julie Trudel	J.T.	2009-03-26				
		1								
		2					REF. No.	NC01	Rev.	0
		3								
DESSIN /DWG #	ST-051	4					Date:	2009-03-26		

REV.	ITEM		QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-051-	**1**	1	1	**Coagulant automatic preparation system**	DF9-511	D56		FI	
					Manufacturer:					
					Hapman					
					Delivery rate					
					Up to 200 kg/h					
					Wetted material:					
					Stainless steel					
					Including:					
					One (1) Bulk Bag Unloader, hoist and trolley					
					One (1) Automatic Bag Agitator Assembly					
					One (1) Hapman U-Trough Feeder					
					One (1) Dust colletor					
					One (1) Mix Tank (1000L)					
					One (1) Use Tank (1000L)					
					Two (2) Tank level transmitters					
					One (1) Mix tank mixer					
	NC01ST-051-	**2**	1	1	**COAGULANT TRANSFER PUMP**	P9-515	D56		FI	
					Model #					
					BW 10 / A4-A7-A7-F0-GA-X					
					Supplier					
					Seepex					
					Description					
					Progressive cavity pump : 5000 L/H @ 2 bars, 541 rpm pump max speed. Progressive cavity pump with 2" NPT suction, 2" NPT discharge, stainless steel wetted casing parts and rotor, mechanical seal. Starting Direct On Line, 5 HP, 1150 rpm, 575V/3ph/60Hz.					

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NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Coagulant dosing	0	SUBMITTAL	Julie Trudel	J.T.	2009-03-26		
	1						
	2					REF. No.	NC01 Rev. 0
	3						
DESSIN /DWG # ST-051	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-051-3	1	3	**COAGULANT METERING PUMP**	P9-511	D56		SA	
				Model #	P9-512				
				MD 012-12 / A6-A7-A7-F0-GA-X	P9-513				
				Supplier					
				Seepex					
				Description					
				Progressive cavity pump : 9 - 87 L/H @ 2 bars, 242 rpm pump max speed. Progressive cavity pump in stainless steel construction with 1" NPT suction, 1/2" NPT discharge, stainless steel wetted casing parts and rotor, mechanical seal. Motor inverter duty, 0.5 HP, 1750 rpm, 575V/3ph/60Hz. Including a dry running protection and a 1 HP AC Tech/Jacmar drive, model ESV751N06TXC, Nema 4x.					
	NC01ST-051-4	1	3	**SAFETY RELIEF VALVE**	V9-515	D56		SA	
				Model #	V9-516				
				TVPR50-PVC-G	V9-517				
				Supplier					
				Primary Fluid					
				Description					
				Relief valve PVC, 1/2" FNPT c/w glycerine pressure gauge 0-60 psi with PVC Viton isolator.					
	NC01ST-051-5	1	1	**CALIBRATION TUBE**		D56		SA	
				Model #					
				PV#2-1000ml					
				Supplier					
				Primary Fluid					
				Description					
				Calibration tube; PVC; 1000 ml, connection 1/2" NPT at both ends					

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NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Coagulant dosing	0	SUBMITTAL	Julie Trudel	J.T.	2009-03-26		
	1						
	2					REF. No.	NC01 Rev. 0
	3						
DESSIN /DWG # ST-051	4					Date:	2009-03-26

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-051-6	1	2	**CORPORATION STOPS**		D56		FI	
				Model #					
				CCS-56-PVC					
				Supplier					
				Primary Fluid System					
				Description					
				QUILL 6", Body PVC, Ball Check ceramic Check spring in SS 316					

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AUTOMATIC PREPARATION SYSTEM

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HAPMAN

Ideas that move.

BULK BAG FRAMES

INSTALLATION,
OPERATION
&
MAINTENANCE
MANUAL

REV 9/07

All owners and operators should read this manual and/or be instructed on safe operating and maintenance procedures before attempting to uncrate, install, operate, adjust or service this equipment

Following are symbols used in this manual along with a description of their meanings

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or severe injury.

WARNING indicates a potentially hazardous situation which, if not avoided, will result in death or severe injury

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor/moderate injury and/or damage to equipment.

HAPMAN

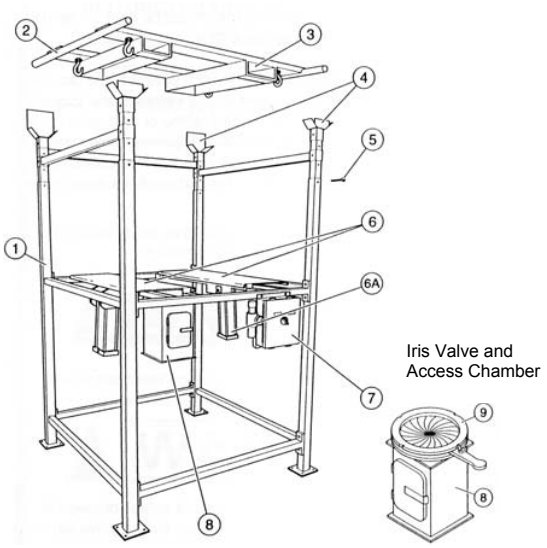
BULK BAG FRAMES

Table of Contents

Major Features Index

Forklift Model

Figure 4



1. Frame
2. Lifting Apparatus (Transporter)
3. Fork Pockets (optional)
4. Transporter Rest Pads
5. Height Adjustment Pin
6. Agitator Assembly (optional)

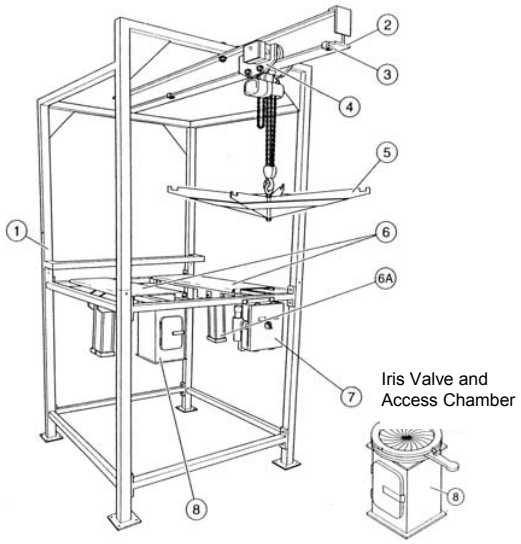
6-A. Agitator Cylinder

7. Agitator Control Panel
8. Access Chamber
9. Iris Valve

Note: The marker numerical designations listed in this illustration are for reference purposes only within this manual.

Hoist & Trolley Model

Figure 5



1. Frame
2. I-Beam
3. Adjustable Stop
4. Hoist/Trolley (optional)
5. Lifting Apparatus
6. Agitator Assembly (optional)

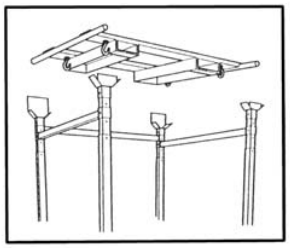
6-A. Agitator Cylinder

7. Agitator Control Panel (optional)
8. Access Chamber
9. Iris Valve

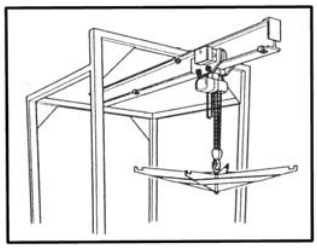
Note: The marker numerical designations listed in this illustration are for reference purposes only within this manual.

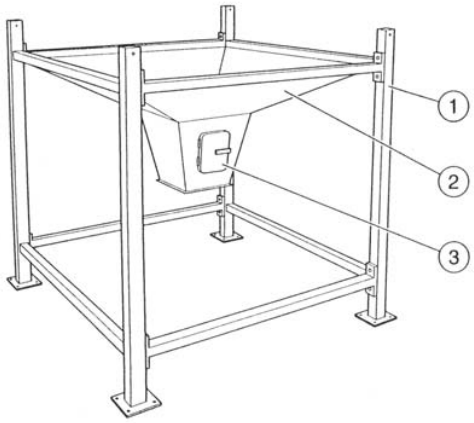
Hopper Model
Figure 6

Forklift Model Frame Option



Hoist & Trolley Model Frame Option





1. Frame

2. Hopper

3. Access Door

Note: For Forklift Model or Hoist/Trolley Model frame options, see page 4.

Note: The marker numerical designations listed in this illustrations are for reference purposes only within this manual.

Agitator Frame
Without Hoist/Trolley or Forklift Lifting Apparatus
Figure 7

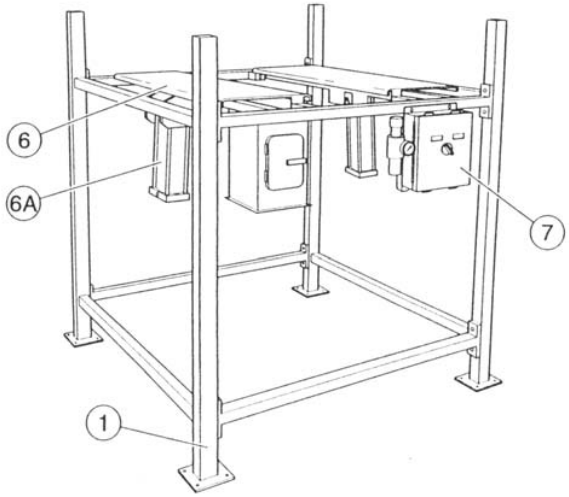
Note: Customer is responsible for providing bag lifting and suspension equipment.

1. Frame

6. Agitator Assembly

6-A. Agitator Cylinder

7. Agitator Air Control Panel



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1.0 - WARRANTY

Equipment manufactured by Hapman is warranted to be free of defective material and workmanship under the use and service quoted for a period of one year after date of shipment. This warranty is void if serviced by anyone other than Hapman service personnel.

Hapman agrees to replace or repair any defective parts it has manufactured as covered under this warranty. F.O.B. our plant, subject to inspection of the part in question by Hapman's personnel. No article may be returned to Hapman without Hapman's written consent.

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In no event shall Hapman be liable for costs incurred due to equipment malfunction such as consequential damages, lost production or the expenses or losses incurred due to geographical location or fault of the product, difficulty of access to the product as installed, or time urgency on the part of the user and/or buyer of the equipment.

NOTICE:
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For further information regarding installation, operation and maintenance please contact the factory service department.

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Phone: 269-343-1675
U.S. Toll Free: 800-427-6260
Fax: (269) 382 8266
e-mail: service@HAPMAN.com

2.0 - General Information

This manual provides complete instructions of how to install, operate and maintain the equipment supplied by Hapman.

Assistance on part orders or service calls may be obtained from Hapman. Address and phone numbers are located on the last page of this manual. When calling or writing for parts or service, please reference the equipment serial number. This number is stamped on the Hapman nameplate

affixed to each piece of equipment. (space is provided on the last page of this manual for the recording of equipment identification.)

3.0 Introduction And Principles Of Operations

The Hapman Bulk Bag Frame is intended to receive and support large bulk bags, sometimes called supersacks, in a position to allow for the contents of the bag to flow into some other device such as a flexible screw conveyor, pneumatic or a tubular conveyor. Usually, such a device is equipped with an access chamber and iris valve. Both units are typically mounted on a hopper above the inlet of the conveyor.

Once the bulk bag is placed in the frame (suspended above – but not resting on the agitator assembly) the discharge spout of the bag is placed through the iris valve. This is done by opening the door of the access chamber and completely opening the iris valve allowing the discharge spout of the bag to be placed through the iris valve body. Once the spout is placed through the iris valve, the iris valve should be tightly closed prior to removing the tie string on the discharge spout. Now, close the access chamber door and gradually open the iris valve to introduce material into the conveyor inlet.

Hapman Bulk Bag Frames come in four styles being differentiated by the method of elevating and positioning the bag or by hopper design and agitator assembly. All units are covered in this manual.

4.0 Safety Instructions

⚠ CAUTION

All Hapman furnished equipment must be installed, operated and maintained in accordance with service instructions. Failure to follow these instruction may result in serious personal injury or property damage.

1. Once the Bulk Bag Frame has been properly positioned in the plant and in the desired location with other equipment such as conveyors, the frame must be securely fastened (anchored) to the floor or load cell before attempting to suspend a bulk bag from the frame.

2. The Bag Frame must be anchored to floor using (16) 5/8” dia. anchors – (4) per foot pad located on each corner of the frame. Floor anchor shall be suitable for this type of equipment and be designed to prevent movement and/or tipping over of the frame. Recommended anchor – Hilti HVA Adhesive Anchor System (or equivalent). Each anchor must have minimum pull out rating of 300 pounds.

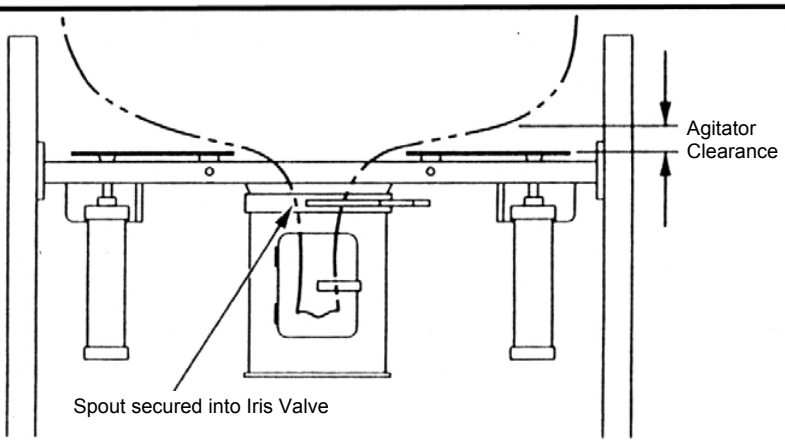
3. Never exceed the maximum weight bearing capacity – 4000 pounds of the Bulk Bag Frame (Forklift Model and Hoist & Trolley Model). This capacity is clearly marked on the frame of the Forklift Model and the I-Beam of the Hoist & Trolley Model.

⚠ CAUTION

4. It is especially critical that the height of the Forklift Model be set properly before placing a full bulk bag (mounted on the Transporter) in the frame. The frame is equipped with adjustable mounting

holes (set a five (5) inch increments) and pins to secure the frame. Position the frame so that the bag does not rest on the optional agitator assembly. The bag should be suspended several inches above the agitator. (See Figure 9) Failure to do this could result in the agitator being severely bent and non-operational.

Figure 9



5. Before attaching the bag to the lifting apparatus, always inspect the lifting loops on the bulk bag to ensure they are secure and do not show excessive wear and weakness. If the lifting loops are frayed, damaged, loose or torn, they may not hold the bag in place when the entire bag is lifted or positioned in the frame.

6. Always attach all four (4) of the lifting loops to the lifting apparatus.

⚠ WARNING

7. The pneumatically operated agitator assembly is often purchased with the Bulk Bag Frame. When the Agitator assembly is installed, never operate the agitator control panel when personnel are near the equipment.

8. Use extreme care when lifting and positioning the bulk bag to ensure no one is between the bag and any portion of the frame.

9. Never attempt to release or untie the bulk bag discharge spout without placing the spout properly into the access chamber and securing it into the iris valve. If your unit is a Hopper Model, use the access door on the hopper to untie the bulk bag spout before quickly closing and securing the door.

10. Periodically inspect the bolts and welds of the frame to ensure their continued integrity and tightness.

11. When adjusting the height of the supporting frame of the Forklift Model, use care to hold and squarely lift (or lower) the frame and reinsert the retaining pins before easing the lifting unit out of the way.

5.0 Operation - Forklift Model

Loading Procedure
Reference Figure 4

A full bulk bag is usually delivered on a skid to the vicinity of the Bulk Bag Frame. Inspect the lifting loops for signs of wear, fraying or weakness.

Make sure the frame is adjusted to the proper height for the bulk bag being loaded. Frame will be designed for a specific bag size but also accommodate bags one size larger or smaller. There is a 10 inch vertical frame adjustment provided on this model. Adjustment holes (4) are positioned at 2-1/2" increments.

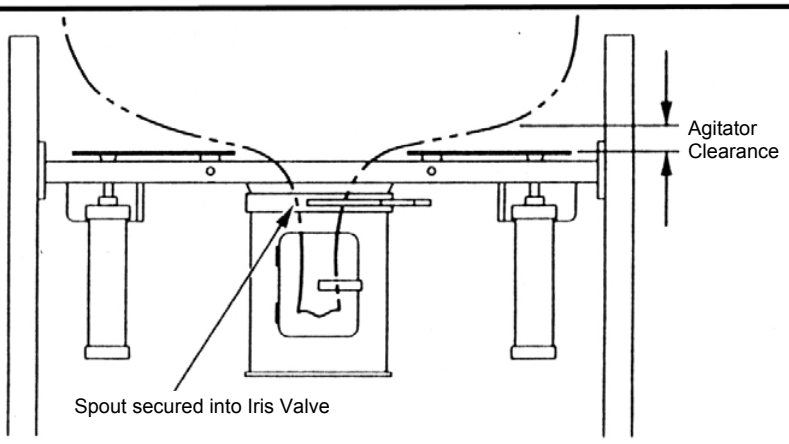
Make sure the total weight of the bulk bag and contents does not exceed the frames capacity (4,000 pounds). The not-to-exceed capacity is clearly marked on the frame.

With a forklift, position the bulk bag Transporter lifting apparatus (which is designed to fit on the forks of the forklift), over the bag. Lower the Transporter to the bag and hook the lifting loops over the hooks on the Transporter. **Note:** if the bag is equipped with a liner, secure it properly to the tensioner at this time.

Gently lift the bulk bag to make sure the lifting loops are secure. Then elevate the Transporter with the bag to a height that will allow the Transporter to clear the top of the frame.

Move the forklift forward and position the Transporter's four corners over the four Transporter rest pads at the top of the frame. Then lower the Transporter until it firmly rests in the frame on the Transporter's rest pad. **Make sure the bulk bag does not rest on the agitator assembly. (See Figure 12)**

Figure 12



With the bulk bag correctly placed on the Bulk Bag Frame (suspended above the agitator assembly when furnished), place the discharge spout of the bag through the iris valve using the access chamber door. Close the iris valve, (See Figure 12) securing the discharge spout of the bag in the access chamber prior to removing the tie string on the spout. If this is not done correctly, the contents of the bulk bag discharge onto the floor.

6.0 Operation - Hoist & Trolley Model

Loading Procedure
Reference Figure 5

Full bulk bag is usually delivered on a skid to the Bulk Bag Frame and positioned directly under the extended portion of the I-Beam. Inspect the lifting loops for signs of wear, fraying or weakness.

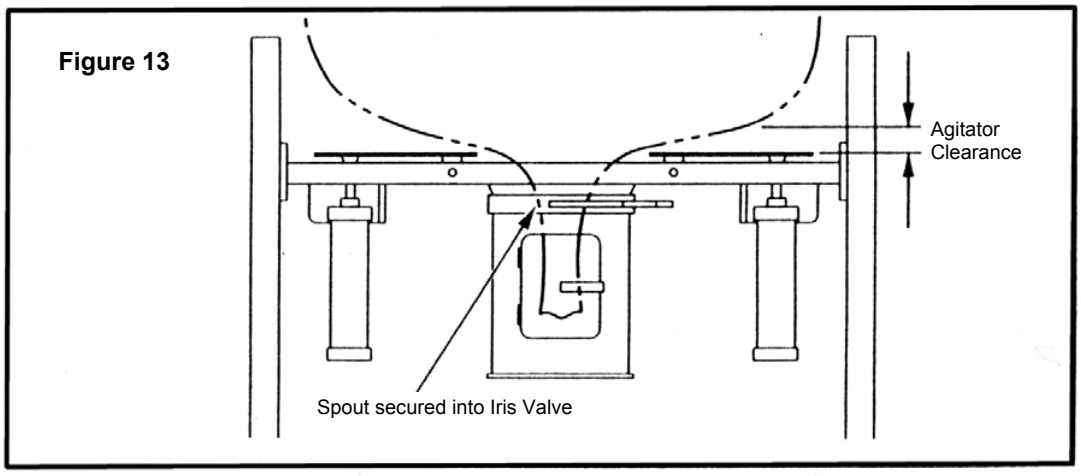
Make sure the total weight of the bulk bag and contents does not exceed the frame's capacity (4,000 pounds). The not-to exceed capacity is clearly labeled (or stenciled) on the I-Beam.

With lifting apparatus attached to the hoist cable, lower the apparatus over the bulk bag and attach the lifting loops of the bag to the apparatus**. Note:** If the bag is equipped with a liner, secure it properly to the tensioner at this time. With the hoist, gently lift the bulk bag to make sure the lifting loops are secure. Then elevate the apparatus, with the attached bag, to a height that will clear the frame. It is critical to have the bag elevated to the correct height before using the trolley to move it into the frame. The height is determined by the elevation and location of the bag agitator assembly.

The I-Beam is equipped with adjustable stops on both ends to facilitate positioning of the hoist. Once the bulk bag is elevated to the proper height, use the trolley (manual, electric or pneumatic) to move the load to its proper position over the receiving equipment.

Lower the bulk bag to a position that will allow for the placement of the discharge spout through the iris valve and into the access chamber. **Do not allow the bag to rest on the agitator assembly**. Place the discharge spout of the bag through the iris valve (See Figure 13) sing the door of the access chamber. Close the iris valve securing the discharge spout of the bag into the access chamber prior to removing the tie string on the spout. If this is not done correctly, the contents of the bag may discharge onto the floor.

Figure 13



7.0 Operation - Hopper Model

Loading Procedure For Forklift Option
Reference Figure 5

A full bulk bag is usually delivered on a skid to the vicinity of the Bulk Bag Frame. Inspect the lifting loops for signs of wear, fraying or weakness. Make sure the frame is adjusted to the proper height for the bulk bag being loaded. Frame will be designed for a specific bag size but also accommodate

bags one size larger or smaller. There is a 10 inch vertical frame adjustment provided on this model. Adjustment holds (4) are positioned at 2-1/2" increments.

Make sure the total weight of the bulk bag and contents does not exceed the frame's capacity (4,000 pounds). The not-to-exceed capacity is clearly marked on the frame.

With a forklift, position the bulk bag Transporter lifting apparatus (which is designed to fit on the forks of the forklift), over the bag. Lower the Transporter to the bag and hook the lifting loops over the hooks on the Transporter**. Note:** if the bag is equipped with a fitted liner, secure it properly to the tensioner at this time.

Gently lift the bulk bag to make sure the lifting loops are secure. Then elevate the Transporter with the bag to a height that will allow the Transporter to clear the top of the frame.

Move the forklift forward and position the Transporters four corners over the four Transporter rest pads at the top of the frame. The lower the Transporter until it firmly rests in the frame on the Transporters rest pad.

With the bulk bag correctly placed on the Bulk Bag Frame (suspended slightly) above and not supported by the hopper, position the discharge spout of the bag within the hopper by using the access chamber door. Once in position, the tie string securing the spout can be untied and removed. Immediately, the material in the bulk bag will begin to discharge into the hopper, so it's important to quickly close and secure the access door to prevent the material from discharging onto the floor.

Loading Procedure For Hoist & Trolley Option
Reference Figure 5 & 6

Full bulk bag is usually delivered on a skid to the Bulk Bag Frame and positioned directly under the extended portion of the I-Beam. Inspect the lifting loops for signs of wear, fraying or weakness.

Make sure the total weight of the bulk bag and contents does not exceed the frame's capacity (4,000 pounds). The not-to-exceed capacity is clearly labeled (or stenciled) on the I-Beam.

With lifting apparatus attached to the hoist cable, lower the apparatus over the bulk bag and attach the lifting loops of the bag to the apparatus**. Note:** if the bag is equipped with a fitted liner, secure it properly to the tensioner at this time.

With the hoist, gently lift the bulk bag to make sure the lifting loops are secure. Then elevate the apparatus, with the attached bag, to a height that will clear the frame. It is critical to have the bag elevated to the correct height before using the trolley to move it into the frame. The height is determined by the elevation and location of the hopper.

The I-Beam is equipped with adjustable stops on both ends to facilitate positioning of the hoist. Once the bulk bag is elevated to the proper height, use the trolley (manual electric or pneumatic) to move the load to its proper position over the receiving hopper.

Lower the bulk bag to a position that will allow for the placement of the discharge spout into the receiving hopper. With the bulk bag correctly placed on the Bulk Bag Frame (suspended slightly above and not supported by the hopper), position the discharge spout of the bag within the hopper by using the access chamber door. Once in position, the tie string securing the spout can be untied and removed. Immediately, the material in the bulk bag will begin to discharge into the hopper, so its important to quickly close and secure the access door to prevent the material from discharging onto the floor.

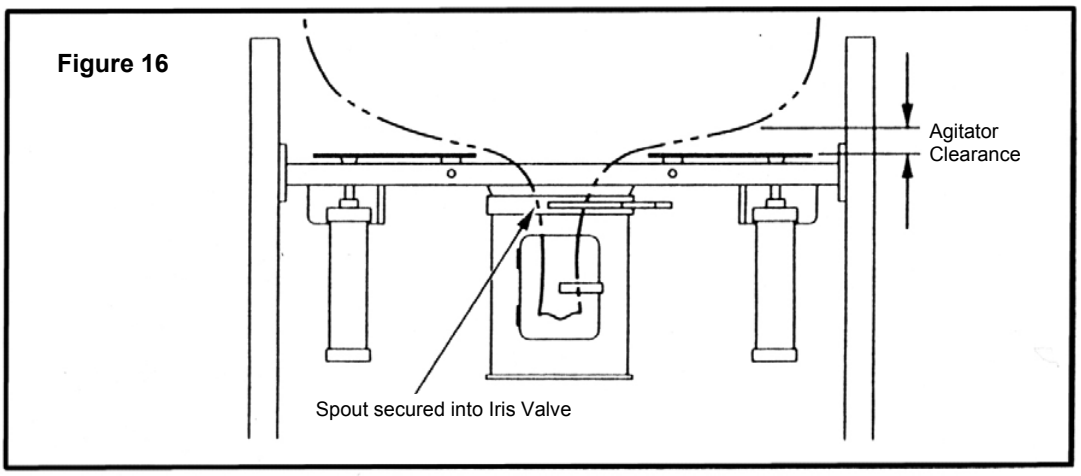
8.0 Operation - Agitator Frame

Loading Procedure
Reference Figure 7

Using customer-supplied lifting equipment, position the bulk bag above the agitator frame. Lower the bulk bag to a position that will allow for the placement of the discharge spout through the iris valve and into the access chamber. **Do not allow the bag to rest on the agitator assembly.**

Place the discharge spout of the bag through the iris valve **(See Figure 16)** using the access chamber door. Close the iris valve, securing the discharge spout of the bag into the access chamber prior to removing the tie string on the spout. If this is not done correctly, the contents of the bag may discharge onto the floor.

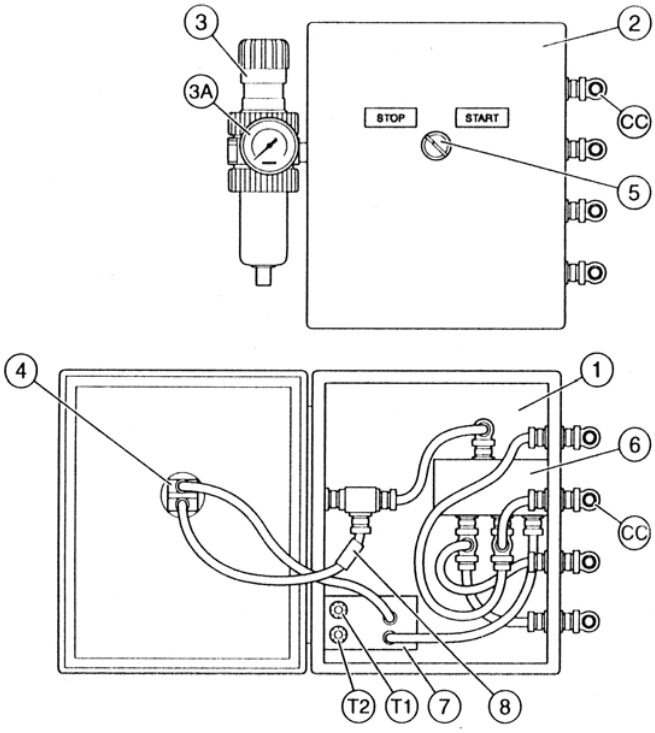
Figure 16



9.0 Agitator Air Control Panel Components

The following is a list of major components used on the agitator air control panel. These components are the most likely to need servicing should an operational problem arise.

Agitator Air Control Panel
1. Back Panel
2. Enclosure
3. Filter/Regulator
3A. System Pressure Gage
4. Pneumatic on/off Valve
5. Start/Stop Switch
6. Directional Valve
7. Oscillator Control
8. Air Filter
CC. Cylinder Connection
T1. Extend Time/Delay
T2. Retract Time/Delay



10.0 Air Panel Operation

Compressed air (80 PSIG at 225 CFM and not to exceed 150 PSIG) is provided to the unit by the customer. Do not use compressed gases. When the pneumatic switch (#5) is in the stop position, several things happen. First, the air passes through the filter/regulator (#3). At this point the air is filtered to 40 Micron. Gage pressure should be adjusted to read 65-75 PSI. The filtered/regulated air passes through the directional valve (#6) from port 1 to port 2. The valve (#6) is considered to be in its normal position at this time. When the air passes from port 1 to port 2 the cylinders are forced to return to the fully retracted position. The system should be at a stand still.

To put the system into the cycle mode the switch (#5) needs to be put into the start position. Pilot air is now allowed to pass through an additional filter (#8) in which 99.9%+ of the aerosols and submicron particles are removed from the air system. The purpose of this filter is to keep the air extremely clean going into the logic portion of the system. Please make sure to change this filter periodically.

With the cylinders still in the retract position, the pilot air makes its way to the oscillator control (#7). This unit controls the amount of time that the pilot signal is on and off to the main valve (#6). Please make sure that this is not the amount of time for the cylinder to extend or retract. It is however, the total amount of time that is allowed for the cylinder to both extend and dwell (or retract and dwell). The total “Extend/Dwell” time is controlled with the knob labeled “T1”. The total “Retract/Dwell” time is considered with the knob labeled “T2”.

Also note that the increments on the control are not in seconds or any particular unit. They are simply for reference. When a pilot signal is received from the oscillator control (#7), the valve (#6) shifts and air is allowed to pass from port 1 to port 4. Thus, the cylinders are forced to extend.

After fully extending, the unit will dwell (depending on the speed of the cylinder) while the oscillator (#7) finishes “counting”. The amount of the “count” is based on the position of the knob “T1”. When the counting is complete, the pilot signal is turned off for a period of time based on the position of the knob “T2”.

When there is not a pilot signal to the directional valve (#6), the valve shifts back and the air flow is from port 1 to port 2. The cylinders are again forced to retract. After the retract and dwell, the process repeats.

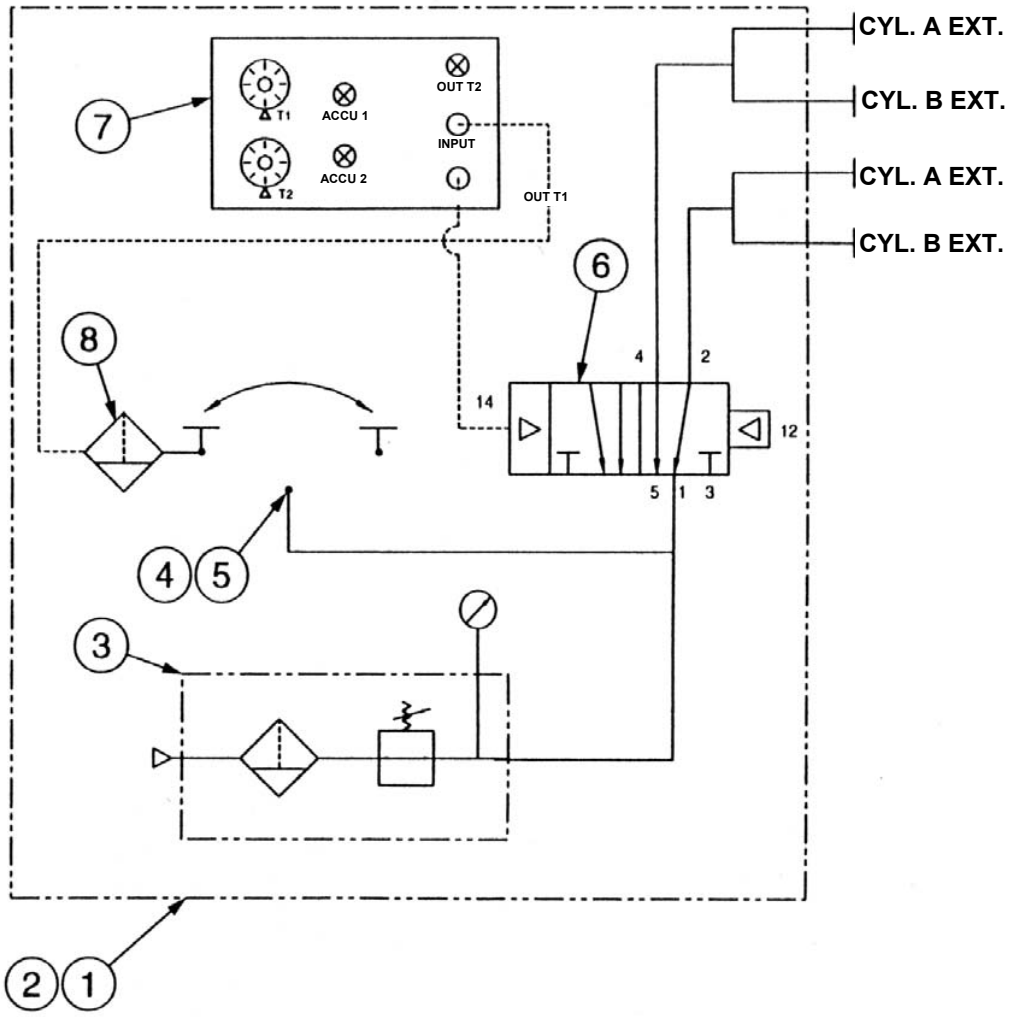
As you increase the number on “T1” the total “Extend/Dwell time” will increase. Also note that the knob may be turned more than one full revolution. The same is true for the “Retract/Dwell Time”. To increase or decrease this time, do so by adjusting the knob labeled “T2” accordingly.

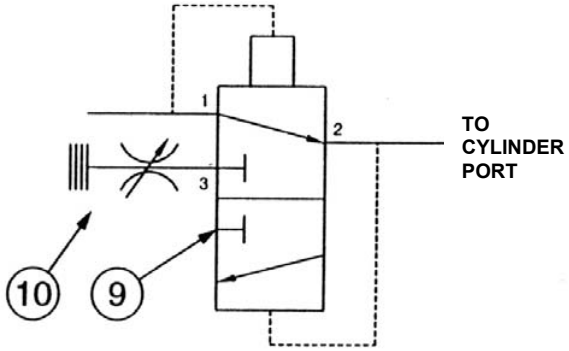
To change the cylinder speed, you adjust the flow control valve that is located in the quick exhaust valve at each of the cylinder ports. Thus, you can individually control the speeds for each of the cylinders; extend and retract. These quick exhaust valves are used so that the air is exhausted back to atmosphere and not back into the enclosure.

Please note that this system can cause injury if precautions are not taken. It is an understanding the operator assumes full responsibility when operating this equipment.

Air Panel Schematic

Figure 20





Bulk Bag Frame Components

#	Description – Forklift Model	Unit Quantity
2	Lifting Apparatus (Transporter)	
4	Transporter Rest Pad	1
5	Adjustable Height Pins	4
6	Agitator Assembly	1
6A	Agitator Cylinder	1
9	Iris Valve	

#	Description – Hoist & Trolly Model	Unit Quantity
3	Adjustable Stops	2
5	Lifting Apparatus	
6	Agitator Assembly	1
6A	Agitator Cylinder	1
9	Iris Valve	

#	Agitator Air Control Panel Components	Unit Quantity
1	Back Panel	1
2	Enclosure	1
3	Filter/Regulator	1
4	Pneumatic On/Off Valve	1
5	Pneumatic Switch Lever	1
6	Directional Valve	1
7	Oscillator	1
8	Filter	1
9	Quick Exhaust	4
10	Flow Control	4

Record Of Important Information For This Machine

Serial Number_____

Model Number_____

For Operational Information In This Plant Contact

Name_____

Department / Phone Number_____

Notes

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

HAPMAN

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Ph 269-343-1675 • 800-427-6260 • Fax 269-349-2477 • www.hapman.com

HAPMAN

Ideas that move.

PosiPortion™ Feeders

INSTALLATION,
OPERATION
&
MAINTENANCE
MANUAL

REV 8/07

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HAPMAN

PosiPortion™ Feeders

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For further information regarding installation, operation and maintenance please contact the factory service department.

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6002 E. Kilgore Rd
Kalamazoo, MI 49048-2321 U.S.A.
Phone: 269-343-1675
U.S. Toll Free: 800-427-6260
Fax: (269) 382 8266
e-mail: service@HAPMAN.com

2.0 – Assembly

UNPACKING

In general the box contains:
One (1) HAPMAN PosiPortion™ Feeder
One (1) Feed Screw
One (1) Nozzle
One (1) Nozzle Clamp
One (1) Safety Grate
One (1) Instruction Manual

If ordered, small parts are packed in the flexible hopper. Larger parts are packed separately (e.g. extension hoppers).

ASSEMBLING

1. The feed screw must be inserted through the molded hopper discharge and turned clockwise onto the threaded hopper shaft.

2. When a nozzle is supplied, it must be inserted into the hopper until it is flush with the end of the feed screw. Tighten the band clamp around the molded hopper discharge to fix the position of the nozzle.

3. Verify that the back panel (side opposite discharge) is in place and secure. This panel covers sprocket and roller chain components and must remain covered for safe operation.

4. For your convenience, unit is provided with a length of power cable which may be routed directly into control cabinet and terminated. A junction box on the feeder is located under left side panel (when looking in the direction of material flow).

Note: motors are wired to match the output of the drive panel, if so equipped. Otherwise the motor will be wired in accordance with the power requirements specified and documented in the equipment proposal. Alternative power supplies can be accommodated (see motor nameplate for wiring configurations).

3.0 - Definitions & Safety Recommendations

The HAPMAN PosiPortion™ Feeder is a machine developed for the purpose of dosing dry bulk ingredient on a volumetric basis.

When coupled with load cells or a scale platform for the purpose of controlling the feed, the HAPMAN PosiPortion™ Feeder is said to be operating in a Gravimetric mode.

Gravimetric feeding can be accomplished by monitoring a loss-in-weight signal from the feeder or a gain-in-weight signal at a downstream container or device.

When a HAPMAN PosiPortion™ Feeder is to be applied in a hazardous environment it must include such provisions as recommended for the area concerned such as, but not limited to, explosion proof motor construction.

When a HAPMAN PosiPortion™ Feeder is used to move dusty product, it is considered good practice to include sealed construction and appropriate ventilation equipment to remove, filter and exhaust airborne particulate.

When a HAPMAN PosiPortion™ Feeder is to be filled manually, care should be taken to position the product-inlet at a comfortable working height such that employees can safely perform their task.

Everyone working with the HAPMAN PosiPortion™ Feeder is strongly encouraged to make use of all appropriate personal protective equipment such as safety glasses and shoes, dust mask, gloves etc.

When using a lift truck to position the HAPMAN PosiPortion™ Feeder care should be taken to place forks under the feeder between the leveling pads. Note that leveling pads are intended for primarily for vertical support, thus may be damaged if exposed to excessive side loading such as may be caused when pushing or dragging unit into position.

Do not start the HAPMAN PosiPortion™ Feeder without the cover or protective screen being in place. These items are intended to minimize risk of personal injury as may be caused when coming in contact with the rotating feeding screw.

The HAPMAN PosiPortion™ Feeder should only be operated when access panels are in place and secured to all four sides.

Always use appropriate lock-out, tag-out procedures when servicing your HAPMAN PosiPortion™ Feeder.

4.0 - Cautionary Statements

- READ THE CONTENTS OF THIS MANUAL THOROUGHLY BEFORE USING THE HAPMAN POSIPORTION™ FEEDER
- DO NOT OPERATE THIS MACHINE WITHOUT THE COVER OR SAFETY GRID IN PLACE OVER THE FLEXIBLE HOPPER
- NEVER USE THE MACHINE WITHOUT ALL SIDE PANELS MOUNTED AND SECURED
- NEVER TOUCH MOVING PARTS
- DISCONNECT THE POWER SUPPLY BEFORE OPENING THE CONTROL BOX
- KEEP THIS MANUAL HANDY AT ALL TIMES TO REFER TO IF NECESSARY
- KEEP FOREIGN OBJECTS OUT OF THE FLEXIBLE HOPPER
- DISCONNECT AND LOCK OUT THE POWER WHEN SERVICING THE FEEDER
- ROUTE POWER SUPPLY CABLES SUCH THAT THEY ARE OUT OF THE NORMAL TRAFFIC PATTERN AND UNEXPOSED TO ANY CUTTING OR ABRADING POTENTIAL

- PROTECT YOURSELF AGAINST INHALATION OF DUST PARTICLES
- PROTECT YOUR BODY WITH GLOVES, SAFETY BOOTS, GLASSES AND STRONG WORK CLOTHING
- TAKE CARE TO ESTABLISH A RELIABLE GROUND-WIRE TO THE MACHINE, FOR SAFETY AND TO MINIMIZE ANY DETRIMENTAL EFFECTS OF STATIC CHARGE ACCUMULATION.

5.0 - Adjustments For Operation

> PosiPortion™ With <u>One</u> Motor <

The HAPMAN PosiPortion™ Feeder is suitable dosing a variety of dry bulk ingredients. Due to specific material properties, each application requires fine tuning to achieve optimum performance.

When the HAPMAN PosiPortion™ Feeder is assembled and installed, the hopper may be filled with material and energized.

Whereas control systems are as varied as the number of customer applications, the following is intended as a general guide. Depending on features of the individual control system, the following procedure may need to be expanded.

KEEP HANDS AND LOOSE CLOTHING AWAY FROM MOVING PARTS AT ALL TIMES

Control set up for HAPMAN PosiPortion™ Feeder - single drive type:

1. Energize the feeder.
2. Verify that the feed screw is turning in the right direction (material should move toward discharge).
3. If the screw is turning in wrong direction disconnect power and switch two motor leads or toggle reversing switch on VFD, if so equipped. Re-energize.
4. Access the variable frequency drive module adjustment and set to minimum.
5. Using a bucket, test scale and stop watch, gradually increase auger speed until the desired discharge rate is achieved.
6. Make a record of the drive speed setting and auger size. If the application requires multiple settings to accommodate several material types, rates and/or screw sets, change over time can be minimized by recording the various settings and components in chart form, then mounting it on or near the control panel for convenient reference.

> PosiPortion™ With <u>Dual</u> Motors <

HAPMAN PosiPortion™ Feeders with two drives are better suited for those applications with poorly flowing dry bulk products. The independently driven agitator enables up and down adjustment to achieve the right degree of agitation necessary to ensure continuous product flow for the specific product(s).

KEEP HANDS AND LOOSE CLOTHING AWAY FROM MOVING PARTS AT ALL TIMES

Control for HAPMAN PosiPortion™ Feeder 2-motor type:

1. Energize the feeder.

2. Verify that the feed screw is turning in the right direction (material should move toward discharge).

3. If the screw is turning in wrong direction disconnect power and switch two motor leads or toggle reversing switch on VFD, if so equipped. Re-energize.

4. Access the variable frequency drive module adjustment for both the screw and agitator and set both to 10 hertz.

5. Using a bucket, test scale and stop watch, determine optimum agitation setting by increasing the frequency of agitation, 10 hertz at a time until the highest discharge rate is observed. Record the agitation setting.

6. Repeat step 5 for every 10 hertz Increase in the screw rate.

7. Gradually adjust auger speed until the desired discharge rate is achieved for a given material type. Repeat steps 4 through 8 for each material type.

8. Make a record of the drive speed setting and auger size (if that changes to accommodate specific materials). If the application requires multiple settings for multiple material types, rates and/or screw sets, change over time can be minimized by recording the various settings and components in chart form, then mounting it on or near the control panel for convenient reference.

6.0 - Maintenance And General Checks

HAPMAN PosiPortion™ Feeders are designed and built using only high grade, industrial duty components, suitable for application in demanding environments. Nevertheless, it may be necessary to replace certain parts after long periods of hard use. To avoid exaggerated damage and more costly repairs, HAPMAN recommends several checks and simple maintenance.

Whereas every application is different, the frequency of necessary maintenance checks is hard to define. Duty cycle, material type and environmental issues all impact wear, thus influence the need for periodic inspection and maintenance.

Recommended maintenance and control checks:

- Periodically inspect the seal in the hopper bearing. Replace when cracks, tears, etc. are visible and/or when signs of material migration behind seal become evident.

- Periodically clean & inspect the hopper bearing for obvious signs of wear. Replace if excessive play is observed when dovetail arbor is inserted

- Periodically inspect guide rails on agitation forks. Replace guides when cracks, erosion or deterioration becomes evident.

- When the feeder is used in harsh environments (corrosive, elevated temperatures, etc.) inspect the insulation on wiring for cracks. Replace as necessary.

- Check the condition of chain(s) and sprockets regularly.
- Lubricate chain and sprockets every 3 months (or more if necessary).
- Inspect roller chain for slack. Play should not exceed 3/16" (lay a straight edge across sprocket teeth as a point of reference). Adjust tensioner sprocket accordingly.

320 Series Machines To reduce excess chain slack, loosen gear motor mounting bolts slightly and slide sideways. Re-tighten.

Bearings Three types of bearings are found in all HAPMAN PosiPortion™ Feeders

1. Self-lubricated bronze journal bearings (bearings on the agitation paddles);
2. Polyethylene bearings (hopper bearing, guide on fork);
3. Maintenance free ball bearings (all others).

It is unusual for these components to require replacement. However, in the event that they do, the procedure is fairly straight forward for the Poly and ball type bearings. Note that bronze bearings are pressed into collars and require added care. Use appropriate tools for extraction and insertion of replacements.

When chain and sprockets need replacement, it is generally considered good practice to replace them as a complete set. Take care to assure that all sprockets driven by the same roller chain are realigned using a straight edge.

7.0 - Removing Parts

⚠ WARNING

MAKE CERTAIN THAT POWER IS DISCONNECTED AND LOCKED OUT BEFORE PERFORMING ANY CLEANING, SERVICING OR INTERIOR INSPECTION

Because of the Quick-Disconnect-System it is easy to remove the screw and hopper.

Removing the feed screw:
1. Remove nozzle clamp.
2. Remove nozzle.
3. Turn screw counter clockwise until is detaches from arbor.

Removing side panels:
Panels are held in place by quarter-turn fasteners which are easily released by turning the fastener counter clockwise with a standard straight blade screwdriver.

Removing the flexible hopper:
1. Remove the nozzle clamp.
2. Remove the front panel.
3. Pull hopper away from the drive. If the hopper has been installed for a while, hopper may stick to frame and require a slight lifting action to loosen it before it can be pulled free.

Removing the hopper bearing:
1. Remove the flexible hopper as described above.

2. Loosen bearing retaining clamp.
3. Pull out the hopper bearing.

Mounting nozzles

1. Slide nozzle clamp loosely onto molded hopper.
2. Insert nozzle until feed screw is flush with discharge face of nozzle.
3. Position nozzle clamp such that it fully engages metallic hopper saddle under hopper and tighten.

8.0 - Troubleshooting

WARNING

MAKE CERTAIN THAT POWER IS DISCONNECTED AND LOCKED OUT BEFORE PERFORMING ANY CLEANING, SERVICING OR INTERIOR INSPECTION

Feeder will not run:

- Make sure that power is supplied to the control cabinet and from the cabinet to the feeder and that all wires are terminated appropriately.
- Verify that the machine's power button or switch is turned to the on or run position.
- Verify that the disconnect is in the on position.
- Check to see that the VFD is not set to 0 Hz.
- Check over load circuits. If fuses or overloads are tripped open, verify that the power supply matches the control and motor requirement.
- Look to see if there is any kind of error message on the display of the VFD.

Feeder runs irregularly:

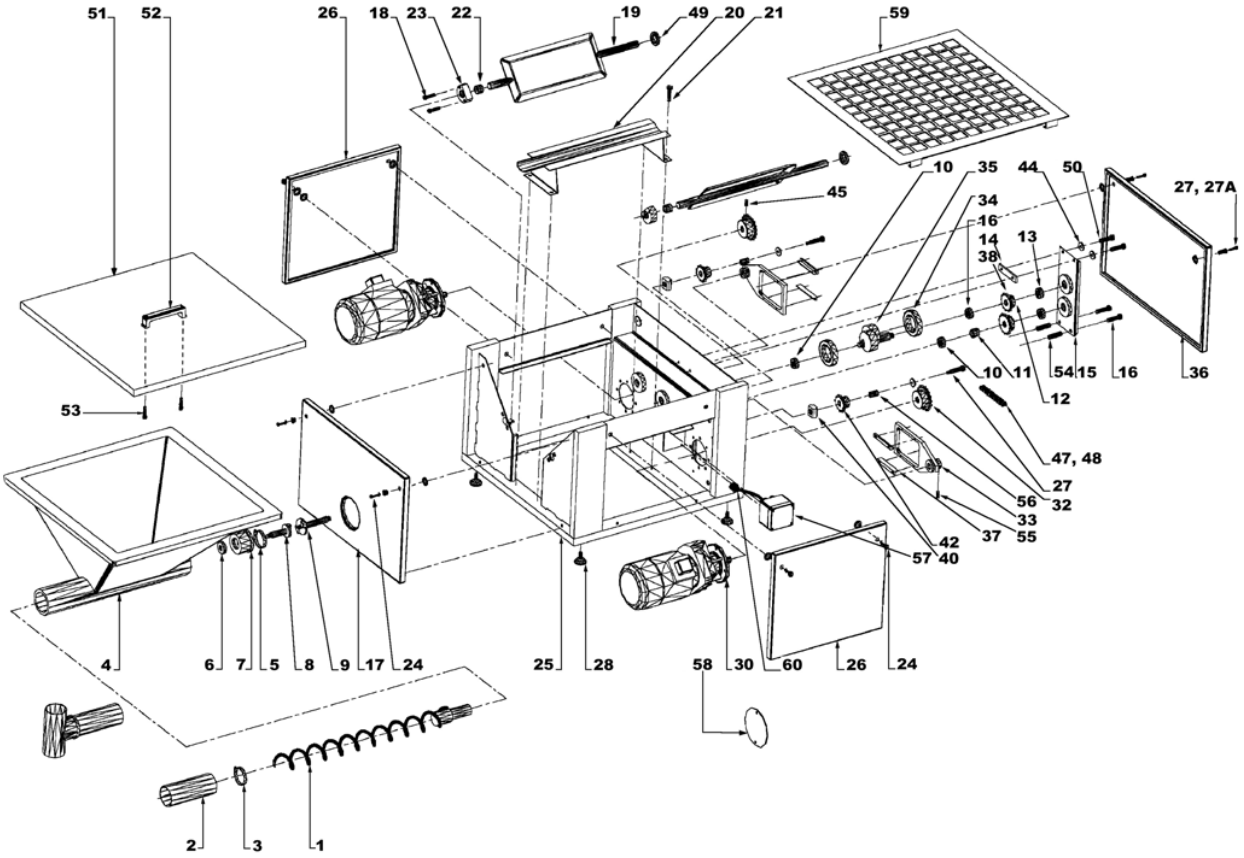
- Verify that no mechanical obstructions exist, either in the feed screw or the driven parts (e.g. sprockets, chain, etc.)
- Check for any deformation of the feed screw- roll it on a flat surface and check its concentricity.
- Check roller chain for sufficient slack (the chain should have some but not more that about 3/16".
- Verify that the gear motor runs smoothly by removing the roller chains.
- Check incoming power for surges, etc.

Control panel does not respond to adjustments or responds inappropriately:

- Check the wiring inside the control panel by comparing it to schematic diagrams and look for bad or loose contacts.
- Verify that the power supply does not vary from the rated voltage by more than 10 %.

- Check to see if there is a fault code displayed on the VFD. If there is, look up its meaning in the VFD manual and take appropriate steps for clearing the fault.
- Check all remote devices such as limits switches, level sensors, etc. for proper operation.
- Check periphery for stray EMC which may be causing interference.

PARTS EXPLODED DRAWING



Parts List

Item No.	Description		Part Number 3 Digit Part/ Model No. (1st segment)			Part No. (2nd segment)	No. of Parts Required w/ 1 motor	w/2 motors	Wear Item?
1	Screw	SC	160	240	320	-diameter	1	2	Yes
2	Nozzle	NO	160	240	320	-diameter SC	1	2	Yes
3	Outer clamp		160	240	320	-506-00	1	2	
4	Flexible Hopper		160	240	320	-510-00	1	-	Yes
5	Inner clamp		160	240	320	-507-00	1	-	
6	Seal		160	240	320	-503-00	1	-	Yes
7	Hopper bearing		160	240	320	-005-00	1	-	Yes
8	Hopper shaft		160	240	320	-006-00	1	-	Yes
9	Main drive shaft		160	204	320	-007-00	1	-	
10	Bearing main drive shaft front		160	240	320	-501-00	1	-	
11	Bush		160	240	320	-017-00	1	-	
12	Sprocket main drive shaft		160	240	320	-514-15	1	-	Yes
13	Bearing MDS back & ECC, axis both		160	240		-502-00	3	-	
13	Bearing main drive shaft back				320	-502-00	1	-	
14	Plate bearing support		160	240	320	-023-00	1	-	
15	Bearing support		160	240	320	-009-01	1	-	
15 S	Bearing support	sus304	160	240	320	-009-02	1	-	
16	Bolt bearing support		160	240	320	-519-00	2	-	
17	Front panel		160	240	320	-013-00	1	-	
17 S	Front panel	sus304	160	240	320	-013-01	1	-	
18	Bold/paddle bearing		160	240	320	-529-00	4	-	
19	Paddle Left or Right		160	240	320	-004-00 L/R	2	-	
19 S	Paddle Left or Right	sus304	160	240	320	-004-01 L/R	2	-	
20	Hopper support		160	240	320	-014-00	1	-	
20 S	Hopper support	sus304	160	240	320	-014-01	1	-	
21	Bolt hopper support		160	240	320	-528-00	4	-	
22	Bearing paddle back		160	240	320	-505-00	4	-	yes
23	Front paddle bearing holder		160	240	320	-500-01	2	-	
24	¼ Turn lock assembly		160	240	320	-511-00	8	-	
24 S	¼ Turn lock assembly	sus304	160	240	320	-511-05	8	-	
25	Frame		160	240	320	-001-14	1	-	
25 S	Frame	sus304	160	240	320	-001-15	1	-	
26	Side panel		160	240	320	-011-00	2	-	
26 S	Side panel	sus304	160	240	320	-011-01	2	-	
27	Back panel lock bush		160	240	320	-511-28	2	-	

27 A	Lock screw	sus304	160	240	320	-511-30	2	-	
28	Adjustable foot		160	240	320	-508-01	4	-	
28 S	Adjustable foot	sus304	160	240	320	-508-02	4	-	
30	Motor		160	240	320	-512-00	1	2	
31	Bolt for motor		160	240	320	-525-00	4	8	
32	Sprocket motors		160			-513-24	1	2	
32	Sprocket motors			240		-513-18	1	2	
32	Sprocket motors				320	-513-21	1	2	Yes
33	Fork		160	240	320	-010-04	2		Yes
34	Bearing eccentric		160	240	320	-504-00	2	-	Yes
35	Eccentric sprocket				320	-018-00	2	-	
35	Eccentric set		160	240		-018-00	1	-	
36	Back panel		160	240	320	-011-02	1	-	
36 S	Back panel	sus304	160	240	320	-011-03	1	-	
37	Guide on fork		160	240	320	-501-02	4	-	
38	Sprocket agitation		160	240	320	-515-18	1	-	yes
39	Eccentric axis				320	-008-00	1	-	
40	Guide nut		160	240		-022-00	1	2	
41	Bearing eccentric axis				320	-502-01	4	-	
42	Sprocket span		160	240		-516-12	1	2	yes
43	Bold span		160	240		-526-00	1	2	
44	Washer		160	240	320	-527-00	9	10	
45	Set screw		160	240	320	-518-00	5	6	
47	Chain		160	240	320	-517-00	1	2	yes
48	Chain locker		160	240	320	-518-00	2	4	
49	Lock ring		160	240	320	-500-03	2	-	
50	Bolt bearing support		160	240	320	-531-00	2	-	
51	Lid		160	240	320	-015-00	1	-	
51 S	Lid	sus304	160	240	320	-015-01	1	-	
52	Grip		160	240		-509-00	1	-	
52	Grip				320	-509-00	2	-	
53	Bolt for grip		160	240		-509-01	2	-	
53	Bold for grip				320	-509-01	4	-	
54	Bush bearing support		160	240	320	-519-01	2	-	
55	Pin		160	240	320	-010-05	2	-	
56	Bearing span		160	240		-532-00	1	2	
57	Connection box		160	240	320	-650-01	1	-	
58	Protection plate		160	240	320	-533-01	1	0	
59	Safety grid		160	240	320	-003-01	1	-	
60	Cable sleeve/plug		160	240	320	-650-05	1	-	

DRIVE SPECIFICATIONS		❒ Model 160	❒ Model 240	❒ Model 320
Gear Motor Horsepower (std.)		1/6	1/3	3/4
Power Supply (std.)	VAC	*all wired for 230-460 v/ 3 ph/ 60 hz*		
Operating Current	Amps	0.78	1.4	2.4
Nominal Input	rpms	1700	1700	1700
Nominal Output	rpms	100	100	100
Gear Ratio		17:1	17:1	17:1
Protection	NEMA/IP	12/IP55	12/IP55	12/IP55

CONTROL SPECIFICATIONS ❒ Model 160 ❒ Model 240 ❒ Model 320

Refer to attached schematic diagrams, if controls were supplied by HAPMAN.

MECHANICAL SPECIFICATIONS	❒ Model 160	❒ Model 240	❒ Model 320
Screws and nuts	*all to international stds. (ISO,DIN,NEN,etc.)*		
Chain and sprockets	*all to international stds. (DIN 8187)*		
Dimensions	8 x 3mm	1/2" x 5/16"	3/4" x 7/16"
Flexible hopper	*all models modified polyurethane*		
Recommended max static strain	*all models 1%*		
By agitation caused dynamic strain	*all models 1%*		
Maximum allowable strain	*all models 2.5 %*		
Total weight one motor	66 pounds	174 pounds	364 pounds
Total weight two motors	82 pounds	192 pounds	415 pounds

Electric rotating machinery and high voltage can cause serious or fatal injury if improperly installed, operated or maintained. Responsible personnel should be familiarized with NEMA MG2: Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators: National Electric Code and all local safety requirements.

When servicing, all power sources to the motor and to the accessory devices should be de-energized and disconnected and all rotating parts should be at a standstill.

Record Of Important Information For This Machine

Serial Number_____

Model Number_____

For Operational Information In This Plant Contact

Name_____

Department / Phone Number_____

Notes

_____

_____

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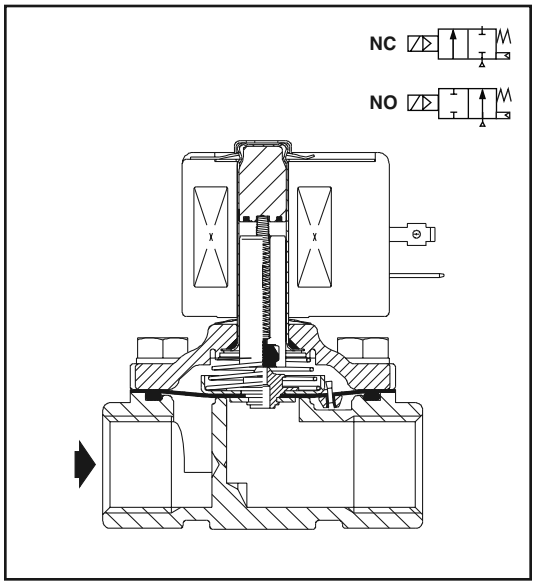
HAPMAN

6002 E Kilgore Road • Kalamazoo, MI 49048

Ph 269-343-1675 • 800-427-6260 • Fax 269-349-2477 • www.hapman.com

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage
- High Flow Valves for liquid, corrosive, and air/inert gas service
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps



Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
H	40.6	-	-	-	-	238910	-	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
Other voltages available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.

Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.

(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B057, 8210B058, and 8210B059, which are not available with Explosionproof enclosures.)
See Optional Features Section for other available options.

Nominal Ambient Temp. Ranges

RedHat II/
RedHat AC: 32˚F to 125˚F (0˚C to 52˚C)

RedHat II DC: 32˚F to 104˚F (0˚C to 40˚C)
RedHat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)

Refer to Engineering Section for details.

Approvals

CSA certified. RedHat II meets applicable CE directives.
Refer to Engineering Section for details.

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi)							Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/ Class of Coil Insulation ⑦	
			Min.	Max. AC			Max. DC												
				Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Const. Ref. ④	UL ⑤ Listing	Catalog Number	Const. Ref. ④	UL ⑤ Listing	AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G073 ③	1P	●	8210G036 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G093	5D	❍	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G001	6D	❍	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G006	5D	❍	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G015 ③	2P	●	8210G037 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G094	5D	❍	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G087	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G002	6D	❍	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G007	5D	❍	-	-	-	17.1/F	-
1/2	3/4	4	5	-	300	-	-	300	-	180	125	8210G227	5D	❍	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G088	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G009	9D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G095	8D	❍	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G003	11D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B026 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G026 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B054 ‡	31D	-	8210D089	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G054	41D	●	8210G089	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G004	12D	❍	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G027 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G078 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B055 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G055	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G008	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G056	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G022	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G033	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G011 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G034	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G030	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G012 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G035	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G038	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C013	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G013	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B057 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D014	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G014	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B058 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D018	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G018	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B059 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D032	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G032	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210 103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210 104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-			16.1/F	-

① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes Ultem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

Specifications (Metric units)

Pipe Size (ins.)	Orifice Size (mm)	Kv Flow Factor (m3/h)	Operating Pressure Differential (bar)							Max. Fluid Temp. °C		Brass Body			Stainless Steel Body			Watt Rating/ Class of Coil Insulation ⑦	
				Max. AC			Max. DC												
			Min.	Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Const. Ref. ④	UL ⑤ Listing	Catalog Number	Const. Ref. ④	UL ⑤ Listing	AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	10	1.29	①	10	9	-	3	3	-	82	65	8210G073 ③	1P	●	8210G036 ③	1P	●	6.1/F	11.6/F
3/8	16	2.57	0	10	10	-	3	3	-	82	65	8210G093	5D	❍	-	-	-	10.1/F	11.6/F
3/8	16	2.57	0.3	14	10	9	9	7	7	82	65	8210G001	6D	❍	-	-	-	6.1/F	11.6/F
3/8	16	2.57	0.3	21	21	21	-	-	-	79	-	8210G006	5D	❍	-	-	-	17.1/F	-
1/2	11	1.89	①	10	9	-	3	3	-	82	65	8210G015 ③	2P	●	8210G037 ③	2P	●	6.1/F	11.6/F
1/2	16	3.43	0	10	10	-	3	3	-	82	65	8210G094	5D	❍	-	-	-	10.1/F	11.6/F
1/2	16	3.43	0	10	10	9	3	3	-	79	65	-	-	-	8210G087	7D	●	17.1/F	11.6/F
1/2	16	3.43	0.3	14	10	9	9	7	7	82	65	8210G002	6D	❍	-	-	-	6.1/F	11.6/F
1/2	16	3.43	0.3	21	21	21	-	-	-	79	-	8210G007	5D	❍	-	-	-	17.1/F	-
1/2	19	3.43	0.3	-	21	-	-	21	-	82	52	8210G227	5D	❍	-	-	-	17.1/F	40.6H
3/4	16	3.86	0	10	10	9	3	3	-	79	65	-	-	-	8210G088	7D	●	17.1/F	11.6/F
3/4	19	4.29	0.3	9	9	9	7	6	5	82	65	8210G009	9D	❍	-	-	-	6.1/F	11.6/F
3/4	19	4.29	0	10	10	-	3	3	-	82	65	8210G095	8D	❍	-	-	-	10.1/F	11.6/F
3/4	19	5.57	0.3	17	10	7	9	9	9	82	65	8210G003	11D	❍	-	-	-	6.1/F	11.6/F
3/4	19	5.14	0	-	-	-	14	12	12	-	25	8210B026 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	19	5.14	0	24	21	14	-	-	-	93	-	8210G026 ② ‡	40P	●	-	-	-	16.1F	-
1	25	11.14	0	-	-	-	7	7	6	-	25	8210B054 ‡	31D	-	8210D089	15D	-	-	30.6/H
1	25	11.14	0	10	9	9	-	-	-	82	-	8210G054	41D	●	8210G089	45D	●	16.1/F	-
1	25	11.14	0.3	10	10	7	9	9	9	82	65	8210G004	12D	❍	-	-	-	6.1/F	11.6/F
1	25	11.57	0	21	16	8	-	-	-	93	-	8210G027 ‡	42P	●	-	-	-	20.1/F	-
1	25	11.57	0.7	21	21	21	-	-	-	79	-	8210G078 ②	13P	-	-	-	-	17.1/F	-
1 1/4	29	12.86	0	-	-	-	7	7	6	-	25	8210B055 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	29	12.86	0	10	9	9	-	-	-	82	-	8210G055	43D	●	-	-	-	16.1/F	-
1 1/4	29	12.86	0.3	10	10	7	9	9	9	82	65	8210G008	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	32	19.29	0	-	-	-	7	7	6	-	25	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	32	19.29	0	10	9	9	-	-	-	82	-	8210G056	44D	●	-	-	-	16.1/F	-
1 1/2	32	19.29	0.3	10	10	7	9	9	9	82	65	8210G022	18D	●	-	-	-	6.1/F	11.6/F
2	44	36.86	0.3	10	9	6	3	3	3	82	65	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	44	38.57	0.3	10	9	6	3	3	3	82	65	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	16	2.57	0.0	10	10	9	9	9	6	82	65	8210G033	23D	●	-	-	-	10.1/F	11.6/F
3/8	16	2.57	0.3	17	14	14	17	14	14	82	82	8210G011 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	16	3.43	0	10	10	9	9	9	6	82	65	8210G034	23D	●	-	-	-	10.1/F	11.6/F
1/2	16	2.57	0	10	10	7	9	9	6	82	65	-	-	-	8210G030	37D	●	10.1/F	11.6/F
1/2	16	3.43	0.3	17	14	14	17	14	14	82	82	8210G012 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	19	4.71	0	10	10	9	9	9	6	82	65	8210G035	25D	●	-	-	-	10.1/F	11.6/F
3/4	16	2.57	0	10	10	7	9	9	6	82	65	-	-	-	8210G038	38D	●	10.1/F	11.6/F
3/4	19	5.57	0.3	-	-	-	17	14	14	-	82	8210C013	24D	●	-	-	-	-	16.8/F
3/4	19	5.57	0.3	17	14	14	-	-	-	82	-	8210G013	46D	●	-	-	-	16.1/F	-
1	25	11.14	0	9	9	9	-	-	-	82	-	8210B057 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	25	11.14	0.3	-	-	-	9	9	9	-	82	8210D014	26D	●	-	-	-	-	16.8/F
1	25	11.14	0.3	10	10	9	-	-	-	82	-	8210G014	47D	●	-	-	-	16.1/F	-
1 1/4	29	12.86	0	9	9	9	-	-	-	82	-	8210B058 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	29	12.86	0.3	-	-	-	9	9	9	-	82	8210D018	28D	●	-	-	-	-	16.8/F
1 1/4	29	12.86	0.3	10	10	9	-	-	-	82	-	8210G018	48D	●	-	-	-	16.1/F	-
1 1/2	32	19.29	0	9	9	9	-	-	-	82	-	8210B059 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	32	19.29	0.3	-	-	-	9	9	9	-	82	8210D032	29D	●	-	-	-	-	16.8/F
1 1/2	32	19.29	0.3	10	10	9	-	-	-	82	-	8210G032	49D	●	-	-	-	16.1/F	-
2	44	36.86	0.3	-	-	-	9	9	9	-	65	8210 103	30P	●	-	-	-	-	16.8/F
2	44	36.86	0.3	9	9	9	-	-	-	82	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	44	38.57	0.3	-	-	-	9	9	9	-	65	8210 104	27P	●	-	-	-	-	16.8/F
2 1/2	44	38.57	0.3	9	9	9	-	-	-	82	-	8210G104	51P	●	-	-	-	16.1/F	-

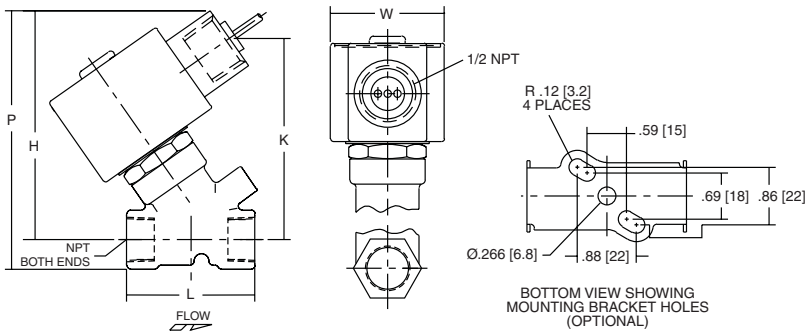
① 0.3 bar on Air; 0.0 bar on Water.
② Valve provided with PTFE main disc.
③ Valve includes Ultem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

Dimensions: inches (mm)

Const. Ref.		H	K	L	P	W
1*	ins.	3.85	3.00	1.91	3.41	1.69
	mm	98	76	49	87	43
2*	ins.	4.17	3.25	2.28	3.63	1.69
	mm	106	83	58	92	43
5	ins.	3.84	2.31	2.75	3.28	2.28
	mm	98	59	70	83	58
6*	ins.	3.38	1.94	2.75	2.80	2.28
	mm	86	49	70	71	58
7	ins.	4.19	2.50	2.81	3.47	2.39
	mm	106	64	71	88	61
8	ins.	4.13	2.47	2.81	3.44	2.29
	mm	105	63	71	87	58
9*	ins.	3.66	2.10	2.81	2.96	2.28
	mm	93	53	71	75	58
10*	ins.	5.25	X	2.81	4.59	2.31
	mm	133	X	71	117	59
11*	ins.	4.16	2.66	3.84	3.52	2.75
	mm	106	68	98	89	70
12	ins.	5.64	3.15	3.75	4.01	3.36
	mm	143	80	95	102	85
13	ins.	4.44	3.22	3.75	4.19	5.81
	mm	113	82	95	106	147
15*	ins.	5.34	X	3.75	4.47	3.84
	mm	136	X	95	114	98
16	ins.	5.64	3.15	3.66	4.01	3.56
	mm	143	80	93	102	90
18	ins.	6.11	3.30	4.38	4.16	3.92
	mm	155	84	111	106	100
20*	ins.	7.33	3.71	5.06	4.57	4.87
	mm	186	94	129	116	124
21*	ins.	7.33	3.71	5.50	4.57	4.87
	mm	186	94	140	116	124
23	ins.	4.35	2.65	2.75	3.79	2.28
	mm	110	67	70	96	58
24	ins.	5.06	X	3.78	4.44	2.75
	mm	129	X	96	113	70
25	ins.	4.64	2.81	2.81	3.94	2.28
	mm	118	71	71	100	58
26	ins.	6.53	X	3.75	4.91	3.19
	mm	166	X	95	125	81
27	ins.	8.22	X	5.50	5.47	4.87
	mm	209	X	140	139	124
28	ins.	6.53	X	3.66	4.91	3.19
	mm	166	X	93	125	81
29	ins.	7.03	X	4.38	5.06	4.40
	mm	179	X	111	129	112

* DC dimensions slightly larger.
IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.

Const. Ref. 1, 2



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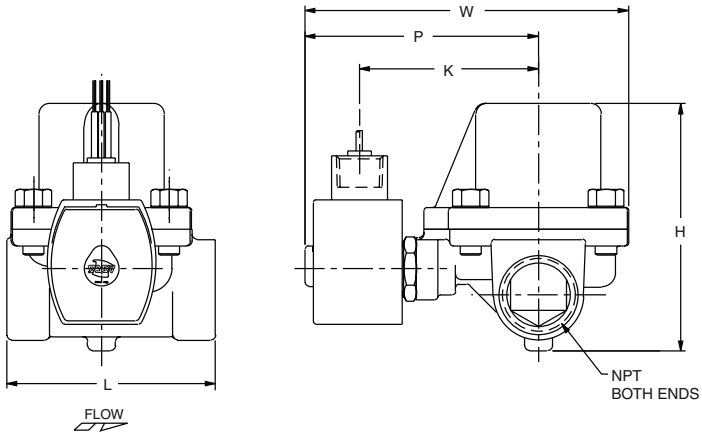

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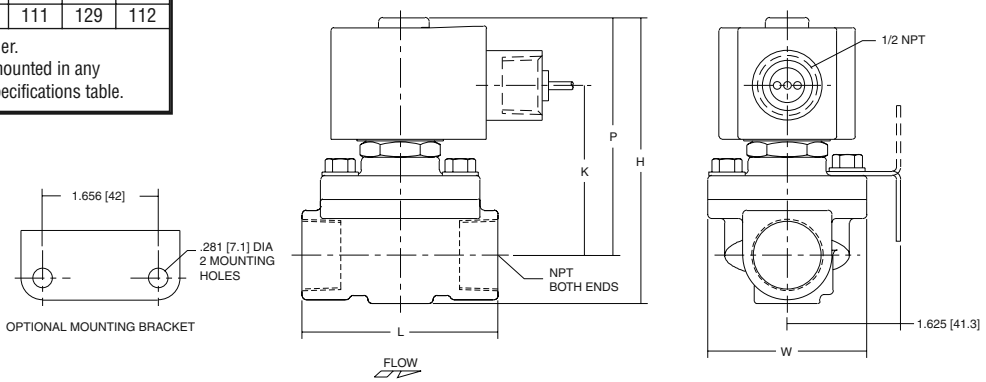
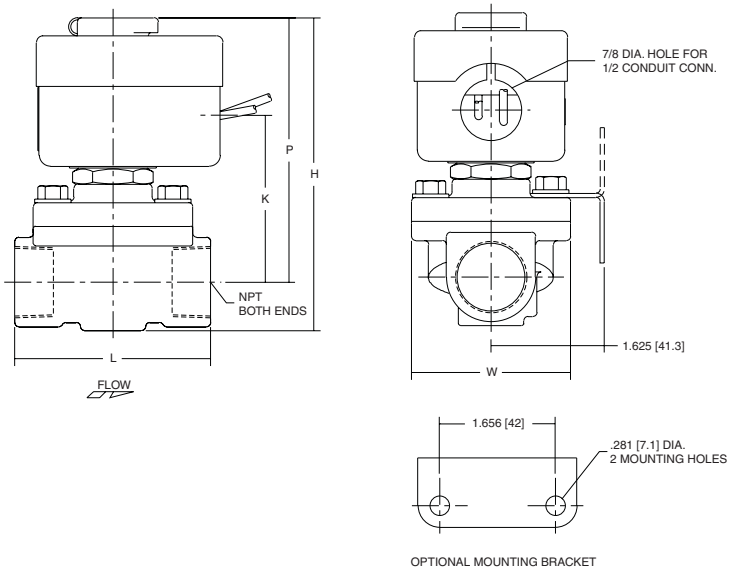


Dimensions: inches (mm)

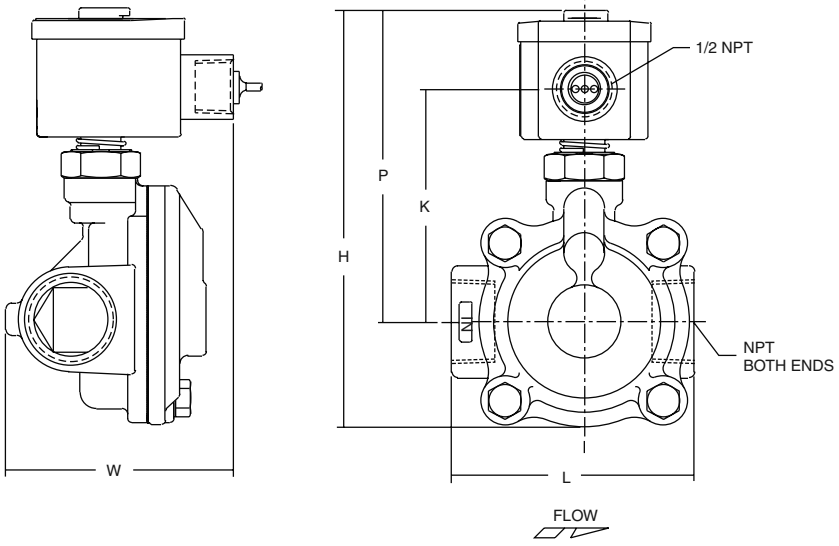
Const. Ref.		H	K	L	P	W
30	ins.	8.22	X	5.06	5.47	4.87
	mm	209	X	129	139	124
31	ins.	5.25	X	3.75	4.44	3.25
	mm	133	X	95	113	83
32	ins.	5.69	X	3.66	4.69	3.25
	mm	145	X	93	119	83
33	ins.	6.06	X	4.38	4.94	3.91
	mm	154	X	111	125	99
34	ins.	6.91	X	3.75	6.09	3.25
	mm	176	X	95	155	83
35	ins.	7.34	X	3.66	6.34	3.25
	mm	186	X	93	161	83
36	ins.	7.66	X	4.38	6.56	3.91
	mm	1.95	X	111	167	99
37	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
38	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
39	ins.	5.42	2.31	2.75	4.86	3.80
	mm	138	59	70	123	97
40	ins.	5.20	3.29	2.81	4.50	2.28
	mm	132	83	71	114	58
41	ins.	5.13	3.10	3.75	4.32	3.25
	mm	130	79	95	110	83
42	ins.	6.43	4.40	3.93	5.62	3.25
	mm	163	112	100	143	83
43	ins.	5.57	3.35	3.66	4.57	3.25
	mm	142	85	93	116	83
44	ins.	5.90	3.57	4.38	4.79	3.91
	mm	150	91	111	122	99
45	ins.	5.26	3.17	3.75	4.38	3.84
	mm	134	81	95	111	98
46	ins.	4.95	3.10	3.84	4.31	2.75
	mm	126	79	98	110	70
47	ins.	6.43	3.59	3.75	4.81	3.52
	mm	163	91	95	122	90
48	ins.	6.43	3.59	3.66	4.81	3.73
	mm	163	91	93	122	95
49	ins.	6.91	3.75	4.38	4.96	4.40
	mm	176	95	111	126	112
50	ins.	8.13	4.15	5.06	5.37	4.87
	mm	207	105	129	136	124
51	ins.	8.13	4.15	5.50	5.37	5.18
	mm	207	105	140	136	132

IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.

Const. Ref. 10, 15, 24, 26-36

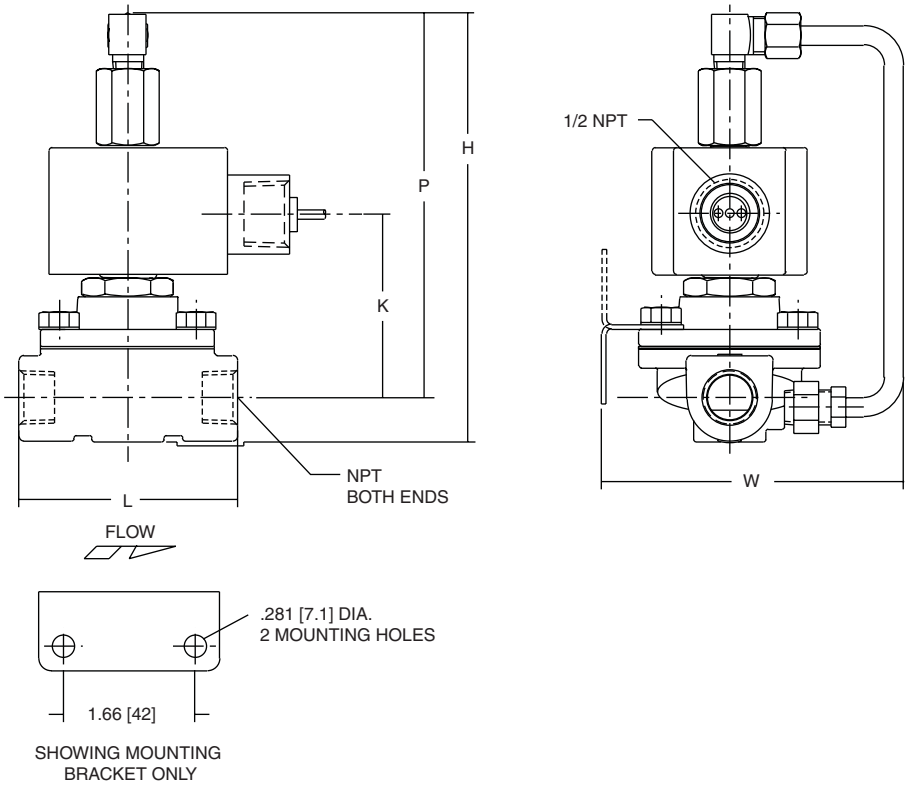


Const. Ref. 12, 16, 18



Dimensions: inches (mm)

Const. Ref. 39



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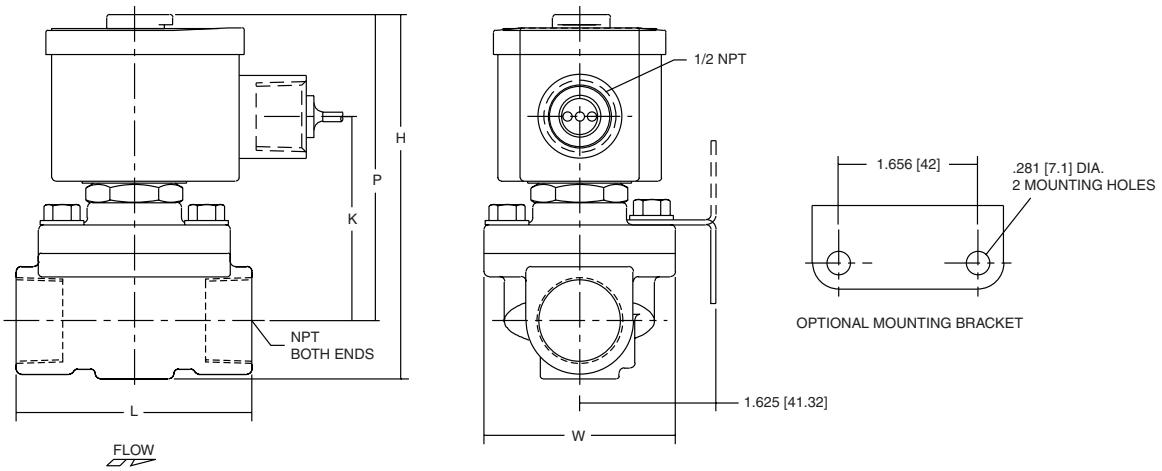


ERNST®
FLOW INDUSTRIES

www.ernstflow.com

Mailing Address - P.O. Box 925 • Farmingdale, NJ 07727-0925 • Shipping Address - 116 Main Street • Farmingdale, NJ 07727-1495
Toll Free: 800-992-2843 • Tel: (732) 938-5641 • Toll Free Fax: 888-992-2843 • E-mail: info@ernstflow.com

Basic
(Brass Construction Shown)

High Temperature
(Brass Construction Shown)

EFI INFLO
flow rate monitors

available in BASIC (Style B or G)
or HIGH TEMPERATURE (Style H or J)

Construction: Aluminum, Brass or Stainless Steel

FEATURES:

- All wetted parts are sealed within a high pressure casing. Outer window tube with scale does not come in contact with medium.
- Unrestricted mounting...install the monitor in any orientation-horizontal, vertical or inverted
- Can be used with oil or opaque liquids
- Uses the variable annular orifice technique in tandem with a transfer magnet and compression spring. A sharp-edged Stainless Steel orifice provides excellent measurement stability for viscosities from 0–500 SSU*
- Has a measuring accuracy of ±2.5% of full scale in the center third of the measuring range, and a ±4% of full scale accuracy over the entire flow measuring range
- Weather-tight external construction (BASIC style only, when used with Buna-N window seals) for use outdoors and/or on systems where wash downs are required
- Will provide years of maintenance-free performance
- **Five year limited warranty**

* Flow monitors can be specially calibrated for viscosities from 500 to 2000 SSU upon request ... contact EFI

EFI INFLO SPECIFICATIONS

BASIC (Style B...for Liquid) or (Style G...for Air & Gas)
HIGH TEMPERATURE (Style H...for 400˚F) or (Style J...for 600˚F)

MATERIALS OF CONSTRUCTION

(Wetted Components)

	ALUMINUM	BRASS	STAINLESS STEEL
High-Pressure Casing, End Ports and Tapered Shaft	Aluminum	Brass	Type 304 Stainless Steel
Seals...(Style B or G)	Buna-N...(Std.) EPR, Viton® or Kalrez® ...(Optional)	Buna-N...(Std.) EPR, Viton® or Kalrez® ...(Optional)	Viton® with PTFE backup ...(Std.) Buna-N, EPR or Kalrez® ...(Optional)
...(Style H) ...(Style J)	Viton® with PTFE backup Kalrez® with PTFE backup	Viton® with PTFE backup Kalrez® with PTFE backup	Viton® with PTFE backup Kalrez® with PTFE backup
Transfer Magnet	PTFE coated Alnico	PTFE coated Alnico	PTFE coated Alnico
Floating Orifice Disk	Type 304 Stainless Steel	Type 304 Stainless Steel	Type 304 Stainless Steel
Spring	Type 316 Stainless Steel	Type 316 Stainless Steel	Type 316 Stainless Steel
Pilot Disk	Type 304 or 316 Stainless Steel	Type 304 or 316 Stainless Steel	Type 304 or 316 Stainless Steel
Retainer Ring	Type 316 Stainless Steel	Type 316 Stainless Steel	Type 316 Stainless Steel

(Non-Wetted Components)

Window Tube ...(Style B or G) ...(Style H or J)	Lexan®...(Std.) Pyrex®...(Optional) Pyrex®	Lexan®...(Std.) Pyrex®...(Optional) Pyrex®	Lexan®...(Std.) Pyrex®...(Optional) Pyrex®
Window Seals ...(Style B or G) ...(Style H or J)	Buna-N...(Std.) PTFE...(Optional) PTFE	Buna-N...(Std.) PTFE...(Optional) PTFE	Buna-N...(Std.) PTFE...(Optional) PTFE

PERFORMANCE

Maximum Operating Pressure*: For Liquid...3500 PSIG (240 Bar) Aluminum or Brass
...6000 PSIG (410 Bar) Stainless Steel

For Air & Gas...600 PSIG (40 Bar) Aluminum or Brass
...1000 PSIG (70 Bar) Stainless Steel

*For Style H or J, see Temperature/Pressure Derating Chart for Aluminum or Brass Monitors

Maximum Operating Temperature: 240˚F (116˚C) Style B or *G
400˚F (204˚C) Style H
600˚F (315˚C) Style J

*For Air & Gas applications operating to 400˚F or 600˚F, Style H or J can be substituted

Port (Connection) Sizes: See Ordering Information Form

Flow Ranges: See Ordering Information Form

Reading: Direct Reading...360˚ Black Reference Line (Non-Electrical)

Installation Orientation: Horizontal, Vertical or Inverted (Scaled Vertically)

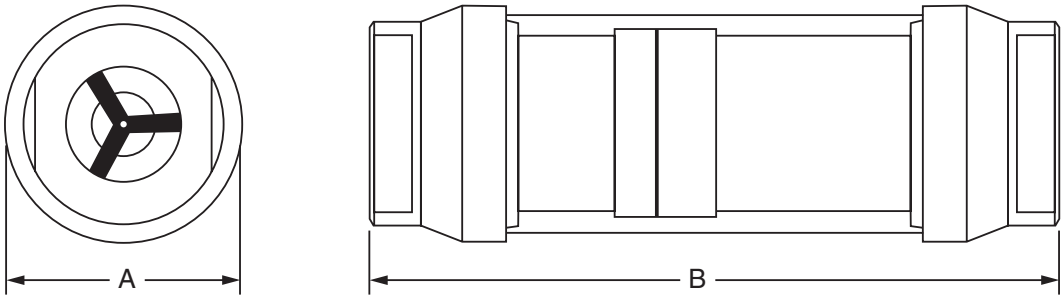
Measuring Accuracy: ±2.5% of full scale in the center third of the measuring range;
±4% of full scale over the entire measuring range

(continued on next page)

Repeatability: 1% of full scale

Standard Calibration Fluids: Oil Monitors: Mobil DTE 25 @ 110˚F (43˚C), 0.873 sg
Water Monitors: tap water @ 70˚F (21˚C), 1.0 sg
Air Monitors: air @ 70˚F (21˚C), 1.0 sg and 100 PSIG (6.8 Bar)

Pressure Differential: See graphs



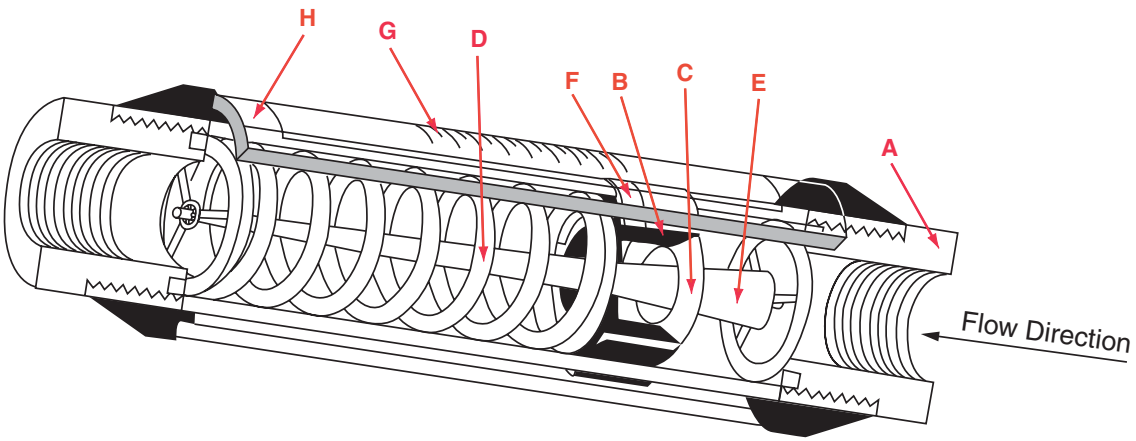
DIMENSIONS

	Size Code			
DIM	**3**	**4**	**5**	**5**
A	1-7/8" (48 mm)	2-3/8" (60 mm)	3-1/2" (90 mm)	3-1/2" (90 mm)
B	6-9/16" (167 mm)	7-5/32" (182 mm)	10-1/8" (258 mm)	12-5/8" (322 mm)
Port (Connection) Sizes	NPTF: 1/4", 3/8", 1/2" SAE: #6, #8, #10	NPTF: 3/4", 1" SAE: #12, #16	NPTF: 1-1/4", 1-1/2" SAE: #20, #24	NPTF: 2" SAE: #32

NOTE: SAE connections not available for Brass Monitors

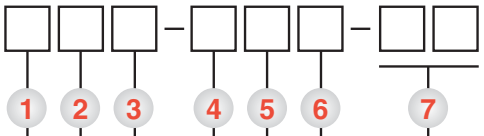
OPERATING PRINCIPLE

Enclosed within a high pressure casing (A), a high strength magnet (B) in tandem with the sharp-edged annular orifice disk (C), is pressed towards the zero flow rate position by a linear rate compression spring (D). A tapered metering shaft (E) is positioned concentrically within the annular orifice disk and provides a variable-area opening that increases by the square of linear displacement of the orifice disk. Fluid flow creates a pressure differential across the orifice disk, pressing the magnet/orifice disk duo against the compression spring. Flow rate is read by aligning the magnetically coupled follower (F) with the graduated scale (G) located within the environmentally sealed window (H). The variable-area orifice design provides pressure differentials and orifice displacements that are linearly proportional to fluid flow rate.



ORDERING INFORMATION FORM

EFI INFLO Model



When placing an inquiry or purchase order for an EFI INFLO monitor, please specify the following information:

Style
B = Basic For Liquid
G = Basic For Air and Gas
H = Hi-Temp 400˚F
J = Hi-Temp 600˚F

Size Code
3 = 1/4" to 1/2"
4 = 3/4" to 1"
5 = 1-1/4" to 2"

Material
A = Aluminum
B = Brass
S = Stainless Steel

Pressure Rating
4 = 600 PSIG Max.
Air & Gas (Aluminum/Brass)
5 = 1000 PSIG Max.
Air & Gas (Stainless Steel)
6 = 3500 PSIG Max.
Liquids (Aluminum/Brass)
7 = 6000 PSIG Max.
Liquids (Stainless Steel)

Example:
EFI INFLO Model **B4B-6WD-30**
Description:
1. Style: Basic For Liquids
2. Size Code: 3/4" to 1" NPT
3. Material: Brass
4. Pressure Rating: 3500 PSIG Max.
5. Fluid Media: Water
6. Connection: 1" NPT
7. Flow Range: 3-30 GPM

Connections (All Female)

	Size Code
S = 1/4" NPT	3
A = 3/8" NPT	3
B = 1/2" NPT	3
C = 3/4" NPT	4
D = 1" NPT	4
E = #6 SAE	3
F = #8 SAE	3
G = #10 SAE	3
H = #12 SAE	4
J = #16 SAE	4
K = 1-1/4" NPT	5
L = 1-1/2" NPT	5
M = 2" NPT	5
N = #20 SAE	5
P = #24 SAE	5
Q = #32 SAE	5

Note: SAE connections not available for brass monitors

Fluid Media
A = Air and Gases
H = Oil and 0.873 Specific Gravity
W = Water and 1.0 Specific Gravity

Flow Ranges

Liquid (Oil and Water)	Air (@ 100 PSIG)	Size Code
01 = 0.05-1 GPM (Oil Only)	1.5-12 SCFM	3
0.1-1 GPM (Water Only)		3
02 = 0.2-2 GPM	4-23 SCFM	3
0.2-2.6 GPM	2-30 SCFM	4
05 = 0.5-5 GPM	5-50 SCFM	3
0.5-5 GPM	6-60 SCFM	4
10 = 1-10 GPM	10-100 SCFM	3 & 4
15 = 1-15 GPM	15-150 SCFM	3 & 4
20 = 2-20 GPM	20-215 SCFM	4
25 = 2-25 GPM	20-250 SCFM	4 & 5
30 = 3-30 GPM	30-330 SCFM	4
40 = 4-40 GPM	30-400 SCFM	4
50 = 5-50 GPM	40-500 SCFM	4
5-50 GPM	30-470 SCFM	5
75 = 8-75 GPM	30-750 SCFM	5
88 = 10-100 GPM (Oil Only)	150-900 SCFM	5
15-90 GPM (Water Only)		5
99 = 20-150 GPM	150-1300 SCFM	5

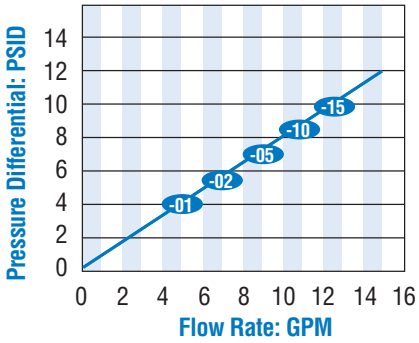
Note: Contact EFI® for the following:
A. Optional materials for wetted or non-wetted components (See Specifications)
B. Special scales and custom units.

YOUR FUTURE IS IN SIGHT®

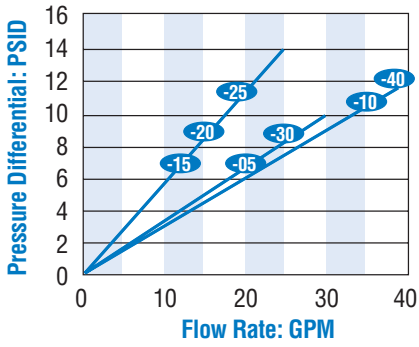
PRESSURE DIFFERENTIAL vs. FLOW RATE GRAPHS

For Style B, H or J Liquid Applications

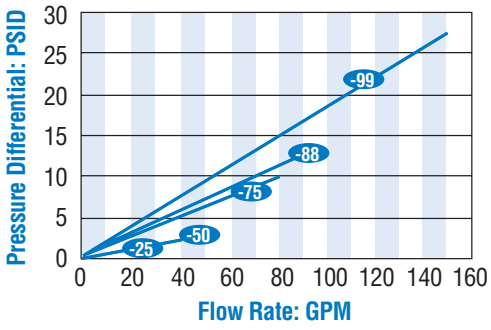
Size Code 3 Monitors (1/4" to 1/2")



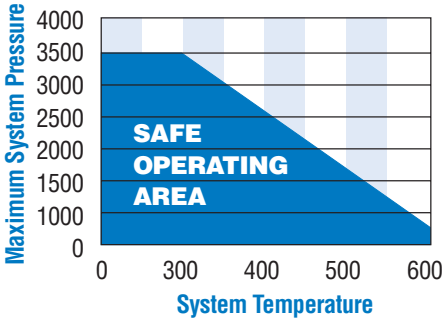
Size Code 4 Monitors (3/4" to 1")



Size Code 5 Monitors (1-1/4" to 2")



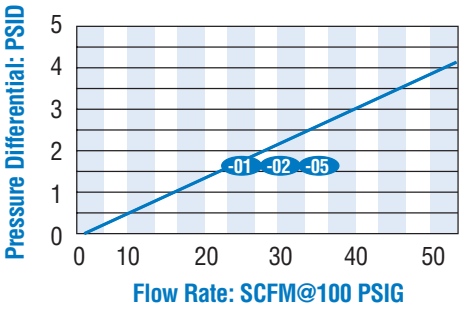
(For Style H or J ONLY)
Temperature/Pressure Derating for Aluminum or Brass Monitors



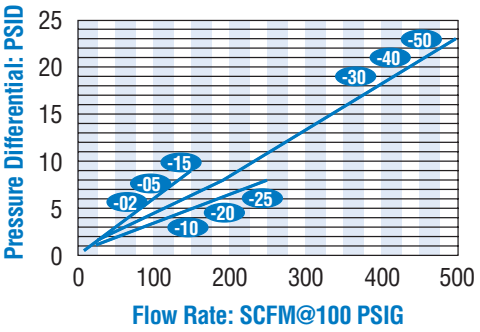
NOTE: -30 (Example) designates Flow Range code.
See Ordering Information Form for available Flow Ranges.

For Style G Air & Gas Applications

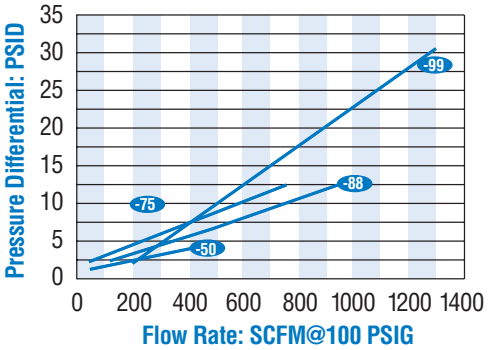
Size Code 3 Monitors (1/4" to 1/2")



Size Code 4 Monitors (3/4" to 1")



Size Code 5 Monitors (1-1/4" to 2")



GUIDELINES WHEN CONSIDERING STYLE G (Air & Gas Application) MONITORS

There are three factors that affect the density of a gas: specific gravity, pressure and temperature. EFI INFLO Monitors are calibrated for air (specific gravity of 1.0) at 70˚F and 100 PSIG.

EFI® products are designed for pneumatic systems where pressures between 90-110 PSIG are used. In these common applications, an EFI® monitor with a standard calibration can be read directly without applying corrections.

Correction Factors

If an EFI® monitor is installed in a system where conditions differ from the standard listed above, correction factors will need to be applied to retain the design accuracy of the monitor. The appropriate correction factor equations are detailed in the chart indicated below. To assure the best monitoring accuracy, pressure and temperature measurements should be taken directly at the monitor's inlet port (connection).

Selecting the Proper Monitor

To order a pneumatic flow rate monitor the following information is required:

- port (connection) size
- media (air, nitrogen, argon, etc.) – for material compatibility and specific gravity considerations
- approximate flow range required
- system pressure: nominal, maximum, minimum
- system temperature

Installation Do's and Don'ts

To obtain satisfactory operation from an EFI® pneumatic flow rate monitor, the following points should be considered:

Do...

- install a pressure gage near the inlet of the monitor
- place throttling valves at the outlet of the monitor
- use pipe sealer on the connections
- install a union on one side of the monitor for easy removal for maintenance and calibration
- install solenoid valves at the monitor outlet (as far downstream as possible)
- mount in any orientation: vertical, horizontal or upside down

Do Not...

- install restrictions between pressure gages and the monitor inlet
- install solenoid valves at the monitor inlet
- place restrictions between the monitor's pressure gage and the monitor inlet
- use in systems where reverse flow is possible
- place monitor in non-aligned piping
- over-flow the monitor by more than 150% of maximum reading
- operate at pressures and temperatures greater than specified

Chart 1 - Density Correction Factors

SCFM (indicated) X (CF) = SCFM (actual) CF = (f_1) X (f_2) X (f_3) Note: all correction factors need not be used.

Table 1. (f_1) Pressure correction factors (inlet pressure)

psig	25	50	75	100	125	150	175	200
f_1	.56	.75	.88	1.0	1.11	1.2	1.29	1.37

$$f_1 = \sqrt{\frac{14.7 + psig}{114.7}}$$

Table 2. (f_2) Temperature correction factors

˚F	10˚	30˚	50˚	70˚	90˚	110˚	130˚	150˚
f_2	1.08	1.04	1.02	1.0	.98	.96	.95	.93

$$f_2 = \sqrt{\frac{530}{460 + ˚F}}$$

Table 3. (f_3) Specific Gravity correction factor

$$f_3 = \sqrt{\frac{1}{Sp.\ Gr.}}$$

f_1 = correction factor for other than 100 PSI inlet.
f_2 = correction factor for other than 70˚F.
f_3 = correction factor for other than air at 1.0 Sp. Gr.

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2M/12/07

VORTEX® IRIS VALVE™

The patented Vortex® Iris Valve is designed specifically to handle dry bulk solids in gravity discharge of free-flowing material from bins, bulk bags, chutes, and hoppers. The Vortex® Iris Valve is constructed with stainless steel control rings, metal handle and trigger lock, and nylon shim for durability and smooth actuation. A form fitted fabric sleeve provides a dust tight seal and product barrier, which prevents material leakage to atmosphere. The Iris Valve is designed to eliminate problems, enabling you to meet your objectives by increasing production, while decreasing labor and equipment costs.

Vortex® Iris Valve Features

- No Binding or Galling. Smooth Actuation
- Unobstructed Bore for Unrestricted Flow of Material
- Fabric Sleeve Prevents Material Degradation
- Easy Installation and Maintenance

Valve Specifications

Size/Bore Options	4", 6", 8", 10", 12", 15", and 18", Diameters
Media	Powder, Pellets, Granulars
Connection Options	Std. Flange Pattern, Tube Stub, or Ferrule Couplings
Media Temperature	Up to 120°F continuous to 250°F intermittent service
Media Pressure	0 PSIG, Gravity Flow Only
Metal Construction Options	304 or 316L Stainless Steel, and/or Aluminum
Sleeve Material Options	Nylon, Teflon, Urethane, or Rubber
Drive/Actuation Options	Infinite Position Hand Lever , Quick Lock Hand Lever, or Tote Handle
Position Confirmation	Visual, Proximity Switch
Compliance/Approvals	CE, FDA
Industry Use	Plastics, Petrochemicals, Chemicals, Foods, Minerals, Textiles, Agriculture

Patent No. 7021604

Application Specific Modifications

SC	All steel material contact components are 304 Stainless Steel alloy.
S-SC	All steel material contact components are 316L Stainless Steel alloy.
UR	Valve Sleeve is a 4 oz. nylon that is urethane coated.
TF	Valve Sleeve is an 8 oz. Teflon material.
FP	Optional bolt-hole pattern is specified.

EMI Incorporated
Heritage Park Rd., Box 912
Clinton, CT 06413-0912
(203) 669-1199
Fax (203) 669-7461
800-243-1188

Bulletin No. OM-1

CLAMP-ON
PORTABLE MIXERS RG, RAG, RH & RA SERIES
OPERATING AND MAINTENANCE INSTRUCTIONS

Handling

The mixer should be lifted with care. Usually the drive unit, shaft (6) and impellers (7) are separated when packed. If the mixer is moved with the impeller shaft assembled, the shaft should be adequately supported when not in the vertical position. Do not, at any time, attempt to lift the mixer by means of the shaft.

Assemble shaft (6) to the motor by means of the arbor (26). Check all set screws (5) for tightness.

Mixer Impeller Assembly

If your mixer is shipped from the factory with impeller(s) not assembled, carefully follow the instructions in this paragraph.

Care should be taken when mounting the impeller (7) on the shaft (6), that the driving face of the impeller is down. In other words, the impeller generally pumps towards the bottom of the vessel.

The single impeller is mounted on the mixer shaft just above the spiral pin (8). The spiral pin has been placed at the end of the mixer shaft to insure against the impeller dropping off the shaft into the product.

The lower impeller in a multiple configuration is mounted on the mixer's shaft in the same way as a single impeller. The spacing of the impeller is significant with respect to stability, fluid regime and the horsepower drawn by the impellers. The best impeller spacing peculiar to the particular application will be given by EMI. Generally, the minimum spacing is two impeller diameters with an optimum spacing of four impeller diameters.

NOTE: On gear driven models equipped with a hydrofoil impeller rather than a marine type propeller, be sure the impeller is secured to the shaft right side up. The hub of the impeller is marked "TOP" and should be facing you when viewed from the drive end of the mixer.

Mounting

See Figure A below, for proper positioning.

Install the portable mixer on the tank edge or other suitable support by tightening the clamp (39) thumbscrew.

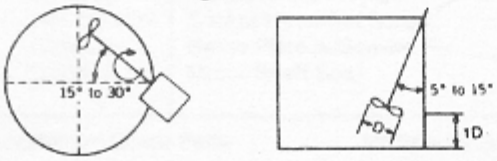
Position the portable mixer as shown in Figure A for best top to bottom flow, this is accomplished through the ratchet handle (34) in the ball and socket. Rotate the handle clockwise to tighten; counter-clockwise to loosen. To release spring loaded ratchet, pull up on the handle. This will enable you to move the handle freely without tightening or loosening.

Power Supply

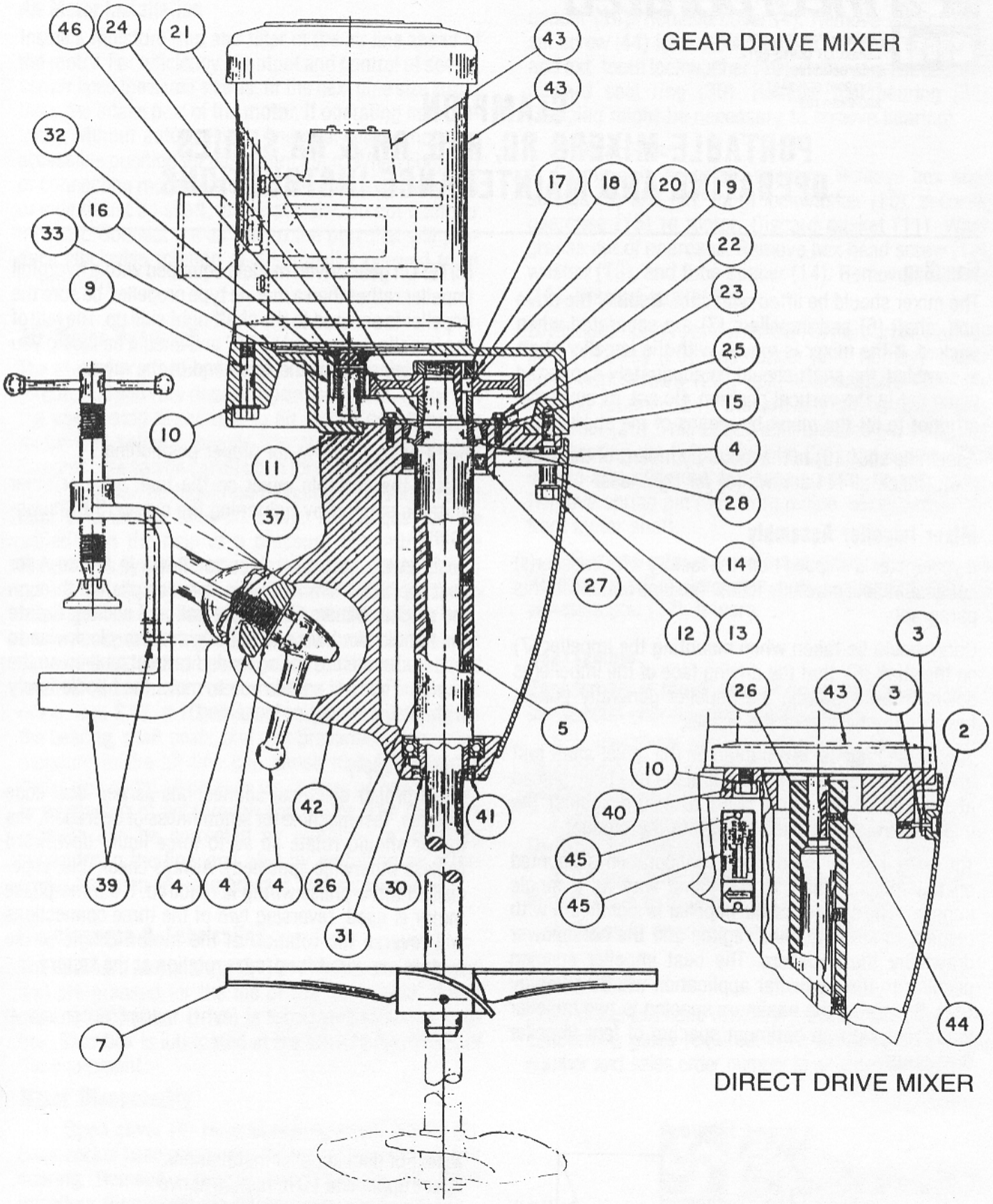
Make proper electrical connections as per local code dictates. Test machine for smoothness of operation. The motor should rotate so as to force liquid downward (unless otherwise specified). Always check this, especially if three-phase wiring is required. If a three-phase motor is used, reversing two of the three connections will reverse the rotation of the motor. Single phase motors are wired for proper rotation at the factory.

(continued on page 4)

Figure A



Note: For dual impeller installations, space upper one 1 D minimum above lower, or 1 D minimum below surface of liquid.


GEAR DRIVE MIXER
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DIRECT DRIVE MIXER
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2
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40
45
45
44

PORTABLE MIXERS RG, RAG, RH, RS & RA SERIES
PARTS LIST

Ref. Number	Part Number	Description	# Per Assembly	
			Direct	Gear
2	330010	Panel Screw	1	1
3	330011	Retaining Ring	1	1
	330012	Retaining Washer	1	1
4	311083	Cover	1	1
5	320160P47	Set Screw	4	4
6	**317083	Shaft ¾"	1	1
	**317084	Shaft 1"	1	1
	**317085	Shaft 1¼"	1	1
7	***313850	Impellers	1-2	1-2
8	320108P13	Spiral Pin ¾"	1	1
	320108P8	Spiral Pin 1"	1	1
	320108P5	Spiral Pin 1¼"	1	1
9	320032P42	Hex Head Screw	0	3
10	330001P08	Ext. Tooth Washer	3	6
11	*314459	Gasket	0	2
12	320032P41	Hex Head Screw	1	1
13	320156P11	Washer	1	1
14	313821	Tube Spacer	1	1
15	311084	Gearcase	0	1
16	*314459	Gasket	0	1
17	*315385	Locknut	0	1
18	*329387P01	Lockwasher	0	1
19	*310151	Gear	0	1
20	*310268	Key, Gear	0	1
21	311088	Spacer	0	1
22	320217P62	Socket Head Cap Screw	0	4
23	320050P26	Lockwasher	0	4
24	310265	Bearing Retainer	0	1
25	*330005-1	Shims (.005")	0	A/R
	*330005-2	Shims (.007")	0	A/R
	*330005-3	Shims (.020")	0	A/R
26	322969P2	Arbor ¾" (Gear Drive)	0	1
	322969P1	Arbor 1" (Gear Drive)	0	1
	322968P1	Arbor 1¼" (Gear Drive)	0	1
26A	322970P2	Arbor ¾" (Direct Drive)	1	0
	322970P1	Arbor 1" (Direct Drive)	1	0
	322971P1	Arbor 1¼" (Direct Drive)	1	0
27	*320216P16	Seal Upper	0	1
28	*330014/15	Bearing Set (Upper)	0	1
29	323680	Grease (1 Lb.) (Not Shown)	0	1
30	*330006-3	Seal Ring ¾"	1	1
	*330006-2	Seal Ring 1"	1	1
	*330006-1	Seal Ring 1¼"	1	1
31	*322852P1	Bearing	1	1
32	*330498-77	Spring Pin	0	1
33	*313828	Pinion	0	1
34	323402P1	Ratchet Handle Assembly w/Locking Shoe & Washer	1	1
37	330420	Vibration Pad	1	1
39	†323783A1	C-Clamp Assembly	1	1
	†315158	Cup Plate Mount	1	1
40	320032P37	Hex Head Screw	3	3
41	*320216P12	Seal, Lower	1	1
42	311082	Bearing Support (RG/RAG)	0	1
42	311090	Bearing Support (RH/RA)	1	0
43	313865	Motor, Electric	1	1
	313866	Motor, Air (RA/RAG)	1	1
44	320160P29	Socket Head Set Screw	2	0
45	330526	Name Plate w/Screws	1	1
46	*330412-1	Motor Shaft Seal	1	1

* Recommended Spare Parts
*** Specify Bore, Diameter & Material When Ordering
** Specify Length When Ordering
† Specify Which Mounting Type When Ordering

NOTE: When Ordering Replacement, Specify H.P. Current Characteristics, Enclosure, EMI Sales Order Number and Model Number.

(continued from page 1)

Air Motor Installation

Install a moisture trap and filter in the air line ahead of the motor. For efficiency of output and control of speed, use air lines the same size as, or the next pipe size larger than, the intake port of the motor. If operating intermittently without automatic air line oiler, place motor in accessible position for easy lubrication. When coupling or connecting motor to a driven member, avoid any end or side thrust on shaft, and especially, do not hammer on shaft. Connect the air line to the port that will produce clockwise rotation of the impeller (viewed from motor end).

Air Motor Operation

The stalled or starting torque is less than the running torque, and will vary depending on the position at which the vanes stop in relation to air intake port. Operate motor well below available line pressure, so that full line pressure can be called upon for overloads on motor. The speed can be regulated by using a pressure regulator or a simple shut-off valve. The torque can be varied with the help of a pressure regulating valve (diaphragm type). For moderate speeds (under 2,000 r.p.m.), or intermittent operation, 1 squirt of oil in bearing oilers per day will suffice. If the duty is continuos, or speed is high, use an automatic air line oiler set to feed 1 to 3 drops per minute. The bearing will receive oil from the rotor chamber during automatic oiling. Use SAE #10 oil. Lubrication is necessary for the bearing, shaft seals, and rust prevention. Excessive moisture in the air line can cause rust formation in motor and might also cause ice to form on muffler, due to expansion of air through the motor. The moisture problem can be corrected by installing a moisture separator in the line, and also by installing an aftercooler between the compressor and air receiver.

Maintenance & Lubrication

The outboard ball bearing (31) in either model is sealed and pre-greased for the life of the equipment. Upper bearing (28) (Gear Drive) is lubricated from the gear box. Gear box is lubricated at the factory for the life of the equipment.

Mixer Disassembly

1. Open cover (4) by unscrewing panel screw (2). Back socket head set screws (5) well off shaft to prevent scoring. Remove shaft (6) and impellers (7). Slide impellers from shaft. Do not remove spiral pins (8).

2A. Direct Drive:

Remove hex head screw (12), washer (13) and tube spacer (14). Remove cover (4). Remove socket head set screw (44) from arbor. Remove hex head screw (40) and ext. tooth lockwasher (10). Remove arbor (26) and discard seal ring (30). Remove ball bearing (31). (Tapping might be necessary to remove bearing).

2B. Gear Drive:

A. Clamp unit in upright position. Remove hex head screws (9) and ext. tooth lockwasher (10), securing gearcase (15) to motor. Discard gasket (11). Wash grease out of gearcase. Remove hex head screw (12), washer (13), and tube spacer (14). Remove gearcase (15). Discard gasket (16).

B. Remove nut (17) and washer (18) from arbor. Remove gear (19), key (20), and spacer (21). Remove socket head cap screws (22), split lockwashers (23) and bearing retainer (24). Discard any shims (25). Press out arbor (26). This action also presses out seal (27), and bearing set (28). Seal ring (30) and bearing (31) should also slide out, but tapping may be necessary. Remove spring pin (32) from pinion. Slide pinion (33) from motor shaft.

3. Remove ratchet handle assembly w/washer and locking shoe (34). Remove c-clamp assembly. Replace vibration pad (37), if worn.

Reassembly

Reassembly is the reverse of disassembly, except for the special characteristics noted below.

1. If applicable, distance between double impellers must remain the same as described in the **Mixer Impeller Assembly** paragraph.

2. On gear drive models, pack gearcase with SHELL DARINA EP GREASE 2, approximately 1 pint.

3. On gear drive models, shim under bearing retainer in gear drive to obtain .002-.006 end play.

4. Press fit bearings into place using the arbor.

Spare Parts

Refer to the exploded view and parts list for information concerning parts required. Give the mixer assembly number and sales order number in any correspondence.

EMI Incorporated
Heritage Park Rd., Box 912
Clinton, CT 06413-0912
(203) 669-1199
Fax (203) 669-7461
800-243-1188

2M-3/95

TRANSFER PUMP

LEFT BLANK

seepex.com

Operating and Maintenance Instructions
Progressive Cavity Pump

range **size**

BW **10**

commission-No.

822812

Job # 2109552

This operating and maintenance instruction includes important safety information and instructions for installation, commissioning, operation and maintenance of the seepex machinery.

1.0
General

1.1
Application

These operating instructions contain basic information on the installation, commissioning and maintenance of seepex machines. Compliance with the work steps described in the individual sections is essential.

1.2
Details of the seepex machines

1.2.1
Operating Instructions

The Commission Number (comm. no) assigns the operating instructions to a particular seepex machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Point 9.

1.2.2
Manufacturer

The machines were manufactured by seepex.

1.2.3
Range, Size, Version

of the machines are stated in the appended data sheet, Point 9.

1.2.4
Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

1.2.5
Release Date of the Operating Instructions

is stated on the cover sheet of the operating instructions.

1.2.6
Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with seepex, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

1.2.7
EEC Machine Directive

1.2.7.1
Manufacturer's Declaration

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The seepex machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

1.2.7.2
Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/EEC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:
EN 809, EN292T1, EN292T2
Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

CAUTION

This documentation must be kept available for at least 10 years.

1.2.8
Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

1.2.9
Specifications Required for Inquiries and Orders

The following information must be included when inquiring about replacement parts or placing orders:
- comm. no.
- / machine type
This information is given on the type plate mounted the machine.

1.2.10
Technical Data Sheet
see Point 9.

1.2.11
Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Point 9.

1.2.12
Sound Pressure Level

The sound pressure level and/or noise characteris-tics of the seepex machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

1.2.13
Operating Range

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Point 9. seepex cannot accept liability for damage arising through failure to comply with this operating range.

1.3
Supplementary Information

1.3.1
Accessories, Optional Extras

Please refer to the data sheet, Point 9.

1.3.2
Company Address, Service Addresses

see Point 11

2.0
Safety

These operating instructions contain basic requirements to be observed during the installation, operation and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

2.1
Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:

safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:

safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

CAUTION

Always comply with instructions mounted directly on the machine, e.g.
- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

2.2
Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks. The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Furthermore, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

2.3
Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-observance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

2.4
Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules.

2.5
Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer´s premises.

- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.

- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.

- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

2.6
Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machines or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

2.7
Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

2.8
Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

3.0
Transport and Intermediate Storage

3.1
Safety Precautions

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

3.2
Transport

Depending on its weight, the seepex machine must be transported manually or with appropriate transport means. Comply with the transport instructions on the packing.

3.3
Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

3.4
Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, seepex machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with seepex.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, seepex must be consulted.

CAUTION

Pumps of the range MAP
If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Point 7.

3.5
Protection against Environmental Influences

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

4.
Description of the seepex Progressive Cavity Pump and Accessories

4.1
General Description, Design and Mode of Operation

Like all progressive cavity pumps, seepex pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this
sealing between the suction and pressure sides.

4.2
Mechanical Design

Please consult the sectional drawing, Point 9, for the mechanical design of the pump. The data sheet, Point 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. __, for information on the design of the shaft seal.

The data sheet, specifies details of the design of the drive engine. Further details are
given in the appended manufacturer's documents, Point 10.

4.3
Accessories

Consult the data sheet for information.

4.4
Dimensions, Weight

Consult the appended dimensional drawing,

4.5
Design Variants

Refer to the data sheet, Point 9, for the design of the seepex progressive cavity pump. Other design variants are possible, whereby seepex must first check whether a particular pump is suitable for the intended purpose.

4.6
Operating Site Specifications

Operating site specifications are listed in the data sheet, Point 9. Details of the space required for installation, operation and maintenance are given in Point 5.2.1.

5.1 Mounting tools/lifting gear

CAUTION

Pump falling over
Slight injury or damage to property may result.

- ➢ Adhere to the lifting tool's starting point.
- ➢ Pay attention to the dimensions, weight and centre of gravity of the pump
- ➢ Use suitable mounting tools/lifting gear.

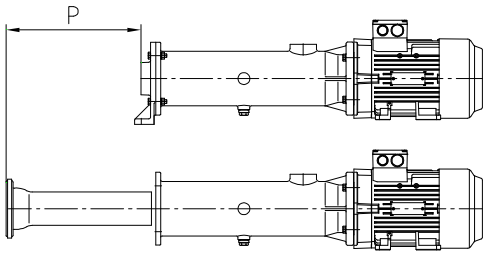
5.2 Required space

The required space should be determined by considering the following factors:

- Dimensions and weight.
- Requisite transport and lifting equipment.
- Pipe routing – dismantling (stator construction dimensions).

5.3 Stator construction dimensions (P)

- Refer to the dimensional drawing.



5.4 Erection of the complete mounted pump

- ➢ Erect in accordance with technical data (Chapter 3.0).
- ➢ Heed dimensional drawing.

Tension-free mounting of the pump
- ➢ Balance unevenness with suitable supports.
- Applies to mounting on foundations/load-bearing elements.
- Total areas of all pump bearing areas are resting on the surface.

Correct position of the drives
- All drives are set up ready for operation and mounted.
- Correct slipping of the drive during transport/installation of the pump by adjusting/fixing the drive motor.

CAUTION

Safety protection equipment.
Slight injury or damage to property may result.

- ➢ Connect safety protection equipment and activate.

5.5 Energy supply to the seepex pump

DANGER

Supply voltage and power frequency
Death or serious injury will result.

- Heed type plate on the pump.
- Pay attention to manufacturer's directions (Chapter 14.0).
- Pay attention to safety regulations.

5.6 Pipe work

5.6.1 Suction and pressure connection

- Refer to the dimension drawing for the position, nominal pipe size and norm.
- Heed rotational direction/direction of flow.

5.6.2 Dimensioning of pipe work

- Adhere to specifications regarding pressure in the pressure or suction connection.
- Heed technical data (Chapter 3.0).
- Nominal pipe size of suction pipe = nominal pipe size of suction connection of pumps

5.6.3 Residue-free pipe work

NOTICE

Damage to property through assembly residue
No claims under guarantee if violated.

- Keep all pipe work free of foreign objects.
- Remove weld spatters, screws, steel chips etc.

5.6.4 Tension-free mounting

- Assemble pipe work and other components in a tension-free manner.

6.0
Commissioning/De-commissioning

6.1
Engineering Data

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Point 9.

To guarantee the correct assignment of documentation to pump, the commission number on the
- cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

6.1.1
See Point 7.2.2 for Lubricant Chart

6.2
Preparation for Operation

6.2.1
Bearing

6.2.1.1
See Point 7.2.1.4 for pump bearing.

6.2.1.2
See manufacturer's documents, Point 10, for drive bearings.

6.2.2
Shaft Sealing

See document OM.SEA.__,.

6.2.3
Filling Up of Suction Side to Avoid Dry Running at Startup

CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

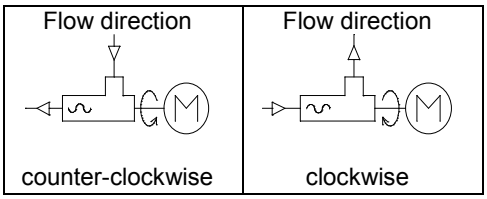
6.2.4
Electric/Hydraulic Connections

The connections are listed in the appended manufacturer's documents, Point 10.

The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.

6.2.5
Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.



Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

6.3
Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Point 10, for information on commissioning.

6.3.1
Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by seepex or other manufacturers, see manufacturer's documents.

6.3.2
Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications, Point 10. Pay attention to the operating specifications in the data sheet.

6.4
Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional. A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.

- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation. Prior to activation of the pump, check the proper function of all protective equipment.

6.5
Commissioning

6.5.1
Initial Startup/Re-starting

CAUTION

Every seepex progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the seepex pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by seepex.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by seepex.

6.5.2
Avoid Dry Running of Pump

CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the seepex dry running protection device TSE, available as an optional accessory.

6.5.3
Check Pressure at Suction and Pressure Flanges

6.5.3.1
Safeguard Pump Against Excessive Pressure at the Suction Flange

The seepex pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.

For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact mano-meters that deactivate the pump.

6.5.3.2
Safeguard Pump Against Excessive Pressure at the Pressure Flange

The seepex pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.

6.5.4
Drive Engine

Consult the attached manufacturer's operating instructions, Point 10, for information on commissioning the drive engine.

6.5.5
Establish Clear Passage Through Pipelines

CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

6.6
De-commissioning

6.6.1
De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.

6.6.2
Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

6.6.3
Evacuation of the Pump

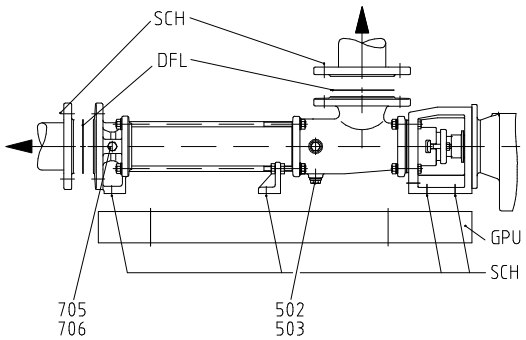
The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503). Casings without screwed plug must be evacuated by the connection branch (SAG and DRS). Refer to the data sheet and the sectional drawing of the associated operating instruction, Point 9, for information on the pump design. Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. If conveying aggressive or hazardous media, therefore, wear appropriate protective gear during all installation work.

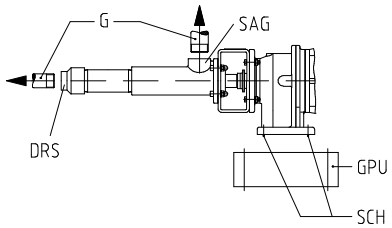
6.6.4
Disassembling the Pump

Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet.

Block-design pumps with direct flange-mounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.





6.6.5
Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

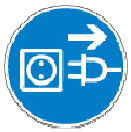
Range: **BW**
Size: **5-10**

9.1.1 Prepare the pump for dismantling

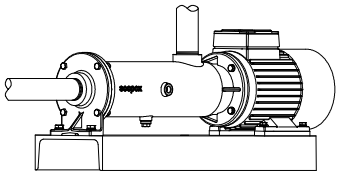
DANGER

Dangerous voltage.
Death or serious injury will result.

- Heed safety regulations.
- Disconnect pump from all sources of energy.
- Secure electrical connections against restarting.



- Empty pipes.
- Allow pipes to cool down.
- Remove pipe connections (suction side/pressure side).
- Heed decommissioning (Chapter 6._).

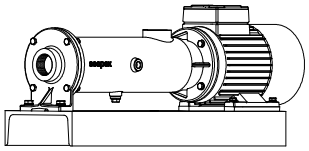


9.1.2 Demontage

WARNING

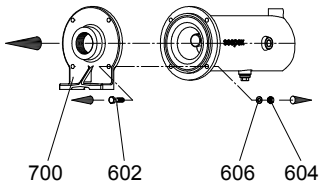
Tilting or falling pump
Injuries and/or damage to equipment. Death or serious injury can result.

- Secure the pump.



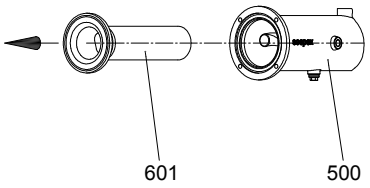
9.1.2.1 Druckstutzen (700) – Demontage

- Dismantle pressure branches (700).



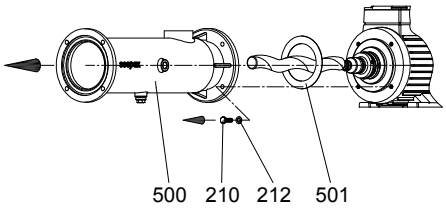
9.1.2.2 Stator (601) – dismantling

Remove stator (601) from suction casing (500).



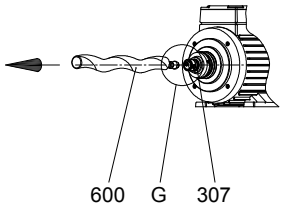
9.1.2.3 Suction Casing (500) – dismantling

- Dismantle suction casing (500).
- Remove casing gasket (501).



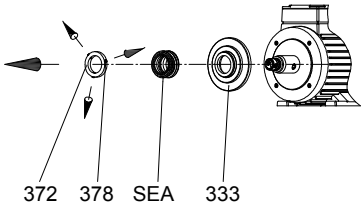
9.1.2.4 Rotor (600) – dismantling

- Remove Rotor (600) from plug in shaft (307).
- Dismantling of joint (G)
  - Rotating unit – individual parts (Chapter 9_)



9.1.2.5 Mechanical Seal (SEA) – dismantling

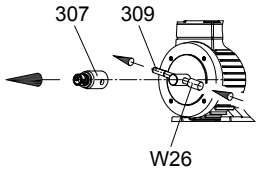
- Detasch set screws (378).
- Dismantle set collar (372), Mechanical seal (SEA) and mechanical seal retainer (333).
- Dismantle shaft sealing (Chapter 9._)



9.1.2.6 Plug in Shaft (307) – dismantling

	Tool (W26/assembly mandrel)

- Remove plug in shaft pin (309) from plug in shaft (307) with tool (W26).
- Remove plug in shaft (307).

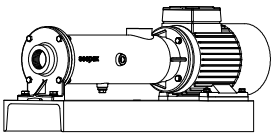


9.1.3 Reassembly

WARNING

Tilting or falling pump/pump parts
Injuries and/or damage to equipment. Death or series injury may result.

➢ Secure the pump.



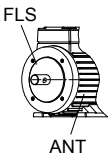
CAUTION

Danger of fingers being crushed
Slight injury may result.

➢ Do not grasp between connections.

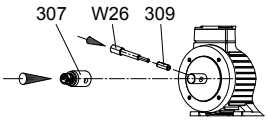
9.1.3.1 Plug in Shaft (307) – reassembly

➢ Clean the flange mechanism surfaces (FLS) and output pivots of the drive (ANT).



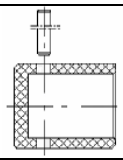
➢ Slide on plug in shaft (307).

Tool (W26/assembly mandrel)

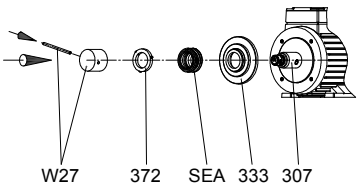


➢ Insert the plug in shaft pin (309) into the plug in shuft with tool (W26).

9.1.3.2 Mechanical Seal (SEA) - reassembly

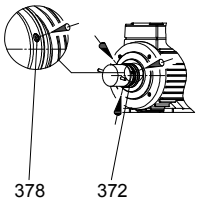


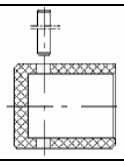
Tool (W27/Mounting sleeve with assembly mandrel)

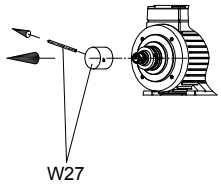


➢ Gleitringdichtungs-Aufnahme (333), Gleitringdichtung (SEA) und Stellring (372) auf Steckwelle (307) schieben.
➢ Secure Mechanical Seal (SEA) with tool (W27)..

➢ Tighten the set collar (372) with set screws (378).



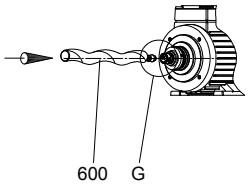
	Tool (W27/Mounting sleeve with assembly mandrel)



- Dismantle tool (W27)..

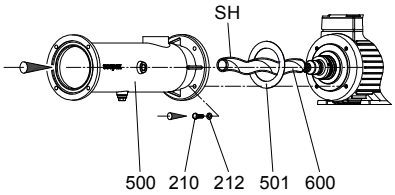
9.1.3.3 Rotor (600) – reassembly

- Assmble rotor (600).
- Joint (G) reassembly
  - Rotating unit – individual parts (Chapter 9_).



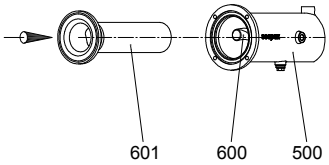
9.1.3.4 Sauggehäuse (500), Sauggehäusedichtung (501) – reassembly

- Provide rotor (600) with protective cover (SH).
- Slide on casing gasket (501).
- Assemble and adjust the pressure casing (500) (water level).



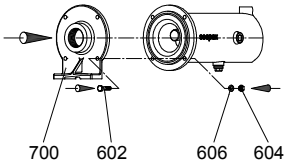
9.1.3.5 Stator (601) – reassembly

- Support rotor (600) with base (S) to prevent it falling down.
- Add lubricant (liquid soap) to the opening on the pressure branch side between the rotor (600) and stator (601).
- Turn rotor (600) in the “right” rotating direction.
-
-
- Add lubricant (liquid soap) to the opening on the pressure branch side between the rotor (600) and stator (601).
- Turn Stator (601) in the „right“ rotating direction and slide on the rotor (600).
- Slide on the Stator (601) up to the collar of the pressure casing (500).



9.1.3.6 Suction branch (700) – reassembly

- Assemble suction (700) branch.



9.2.1 Dismantling

9.2.1.1 Dimantling of holding band (406, 407)

CAUTION

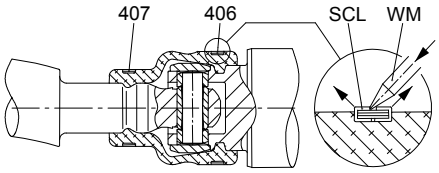
Danger of injury
Possible ejection of parts.
Slight injury or damage to property may result.

➢ Wear protective goggles.

➢ Detach holding band strap (SCL).
- Use suitable tool (WM).

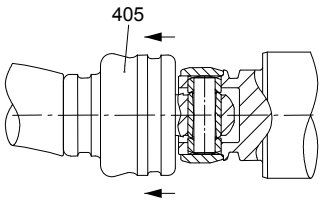
➢ Push out strap part of holding band (SCL).

➢ Remove holding band (406, 407).



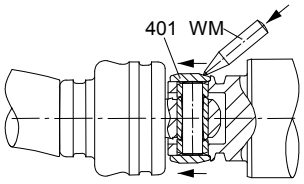
9.2.1.2 Universal joint sleeve (405) – dismantling

➢ Pull back universal joint sleeve (405).



9.2.1.3 Retaining sleeve (401) – dismantling

➢ Knock back retaining sleeve (401).
- Use suitable tool (WM).



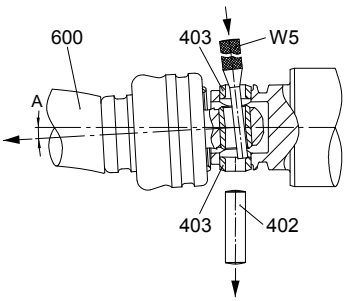
9.2.1.4 Detach joint

➢ Eject coupling rod pins (402).

➢ Remove Rotor (600).


Tool (W5/ Drift)

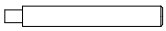
➢ Knock guide bushing (403) out with tool (W5).

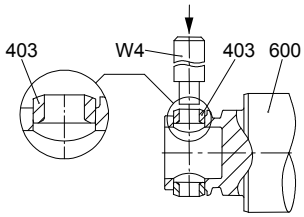


9.2.2 Rotating unit (RTE) – prepare individual parts for reassembly

9.2.2.1 Rotor (600)

- Remove existing damage.
- Clean the rotor (600).

	Tool (W4/assembly mandrel)

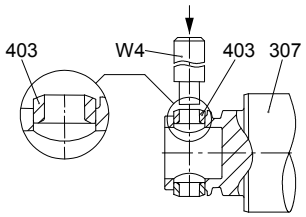


- Press in the guide bushing (403)
  - Use tool (W4).

9.2.2.2 Plug-in shaft (307)

- Remove existing damage.
- Clean the plug-in shaft (307).

	Tool (W4/assembly mandrel)



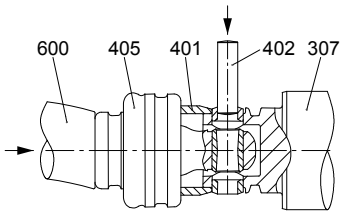
- Press in the guide bushing (403)
  - Use tool (W4).

9.2.3 Rotating unit (RTE) – individual parts – reassembly

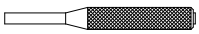
HINWEIS
Faulty functioning of joints Malfunctioning and/or destruction of joints. Damage to property may result. ➢ Replace the coupling rod pins (402) and guide bushing (403) jointly.

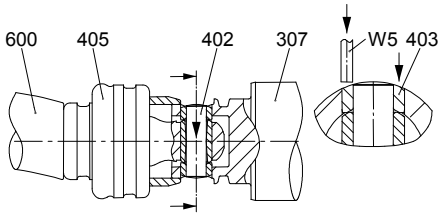
9.2.3.1 Rotor (600) / Plug in shaft (307) – reassembly

- Slide the universal joint sleeve (405) onto the Rotor (600).
- Fill the joint head with seepex joint grease.
- Side on retaining sleeve (401).



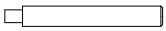
- Insert coupling rod pins (402).
- Connect the Rotor (600)/plug in shaft(307).
- Slide in coupling rod pins (402).

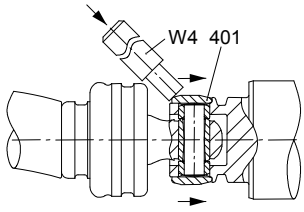
	Tool (W5/ Drift).



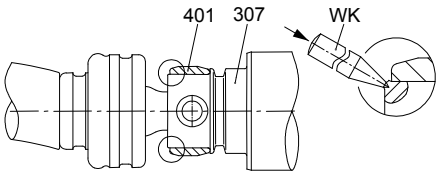
- Knock the guide bushing (403) in.
  - Use tool (W5).

9.2.3.2 Retaining sleeve (401) - reassembly

	Tool (W4/ assembly mandrel)



- Knock back the retaining sleeve (401).
  - Use tool (W4).

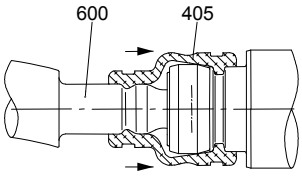


- Secure the retaining sleeve (401) in a displaced manner (2x180°).
  - Use suitable tool (WK).

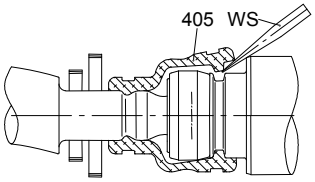
	Tool (W15/Mounting plate)

- Remove tool (W15).

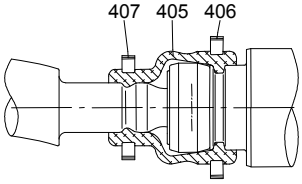
9.2.3.3 Universal joint sleeve (405) – reassembly



- Moisten the surface of the coupling rod (400)/ interior of the universal joint sleeve (405) with joint grease (maintenance, Chapter 7.0).
- Slide on the universal joint sleeve (405).



Vent the inside area of the joint.
Use suitable tool (WS).



Assemble holding band
Holding band assembly (Chapter 9._).

Holding Band (HBD) - Assembly

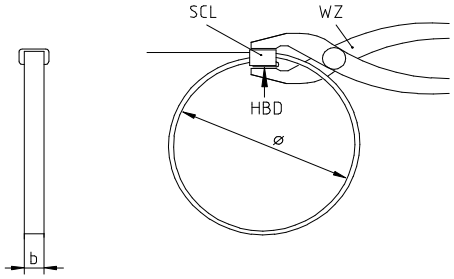
Tools required for the re-assembly, see document OM.SPT.01.

- Prepare holding band

  Only prefabricated double-band holding bands should be used. The diameter (∅) and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

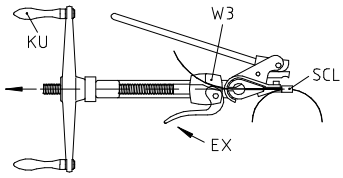
- Test holding band

  The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure with the tool/pliers (WZ).

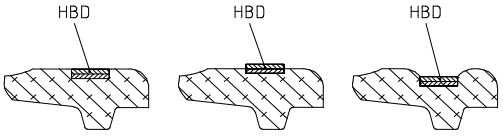


- Assembly of holding band

  Insert holding band in tool (W3/ see Point 9). Hold free end of holding band with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



- Correct holding band tension (HBD)



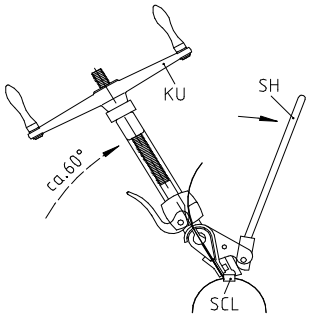
Correct
Holding band (HBD) has slightly con-tracted outer form of univers-al joint sleeve and is stuck in position.

Incorrect
Holding band (HBD) is too slack and liable to slip.

Incorrect
Holding band (HBD) is too tight. Universal joint sleeve will be damaged/sheared off.

- Folding back the holding band (HBD)

  Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).

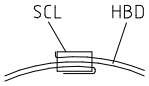


- Shearing off holding band (HBD) made of material AISI 304 and AISI 316

  A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

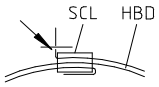
  CAUTION

  Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



- Shearing off holding band (HBD) made of Hastelloy C

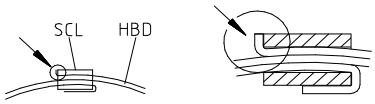
  The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



- Check after mounting of holding band

  The holding band must run all the way round the groove of the universal joint sleeve.

  The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.



Breakdown											
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks	seepex progressive cavity pumps will operate trouble-free if they are used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:	
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies
				X			X			a	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor. Then turn the pump by means of the tool W2 .
X										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.
X	X	X			X	X				c	Suction pipe or shaft sealing leak. Eliminate the leakage.
X	X	X				X				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve fully.
X	X	X								e	Viscosity of the liquid too high. Check and accommodate per data sheet.
		X		X			X			f	Wrong pump speed. Correct pump speed per data sheet.
	X	X								g	Avoid inclusions of air in the conveying liquid.
		X		X	X		X	X		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.
X	X	X			X			X		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.
						X	X			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.
X		X								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.
X	X					X				l	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.
						X				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT.__.
X		X		X	X			X		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.
X		X	X		X					o	Stator or rotor worn. Dismantle the pump and replace defective parts.
X		X			X	X				p	Joint parts worn. Replace worn parts and fill with special pin joint grease .
X		X			X			X		q	Suction pipework partially or completely blocked. Clean suction pipework.
X				X	X		X	X		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.
X		X		X			X		X	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.
X				X	X			X		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.
X				X				X	X	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.
X				X	X			X	X	v	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.
				X	X		X	X		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.
						X			X	x	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.
									X	y	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.

9.0
Auxiliary seepex documentation

seepex.com

Inc.

seepex
Inc.
511 Speedway Drive
Enon, OH 45323
Phone (937) 864-7150
Fax (937) 864-7157
sales@seepex.net
www.seepex.com

Data Sheet 822812

seepex			
date	05/12/09	**commission no.**	822812
customer	John Meunier.		
seepex job no.	2109552	**item/denomination**	5357/0506 item 3
project	PO # 015382		
1 of	**seepex progressive cavity pump type BW 10 / A4-A7-A7-F0-GA-X X=02R, 0802**		

conveying product C/289/CH

denomination	poly aluminum silicate sulfate		
rate of solids	no advice	**viscosity**	no advice
size of solids	no advice	**pH-value**	assumed neutral
density	no advice	**temperature**	32 to 113°F
composition	no advise		
remarks			

performance data	**nom.**	**min**	**max**	
conveying capacity	5000	-	-	**L/h**
pump speed	541	-	-	**rpm**
press in press. branch	2	-	-	**bar**
press in suct. branch	assumed flooded			

differential pressure	2	**bar**	**operating torque**	18	**lb. ft.**
required drive power	.96	**Hp**	**starting torque**	12	**lb. ft.**
remarks					

technical pump data

range	BW	**kind of install.**	horizontal
size	10	**direction of rot.**	clockwise
pressure stage	0	**pos. of branch**	1

component	**material**	**design/option**
suction casing	1.4308 / AISI 304	
suction connection		2” NPT thread
pressure branch	1.4308 / AISI 304	
pressure connection		2” NPT thread
joint	standard	standard
joint seal	NBR Perbunan	standard
joint grease	30321	standard
rotor	1.4571 / AISI 316Ti	standard
stator	NBR Perbunan	standard
seal casing	1.4308 / AISI 304	Single Acting Mechanical Seal
seal		Burgmann MG1-G60-055-Q1Q1-VGG
plug-in shaft	1.4571 / AISI 316Ti	drilled ϕ28x55
special designs		

Data Sheet 822812

general operating data

kind of operation	24 hr. /day operation
site of installation	indoor dry atmosphere
remarks	

drive

type	No Gear, Direct connected AC motor		
make		**ratio**	**i=1.0**
model			**nom./ min- max**
mounting position	IEC 132 – B14	**output speed**	1160 / - **rpm**
flange dia	200 mm	**motor speed**	1160 / - **rpm**
output shaft	716/0100-007A4	**frequency**	60 / - **Hz**
special			

electric motor

manufacturer	Baldor	**voltage**	3 X **575** VAC
nominal power	5 Hp	**rated frequency**	60 Hz.
mounting position	B3/B14	**protection**	TEFC
starting	Direct on freq. inverter	**thermal class**	F
special	IEC face, Super E, model number (6 pole motor) Baldor # 37L860Y762G1		

painting

execution	standard
color	RAL 5013 (blue)
remarks	

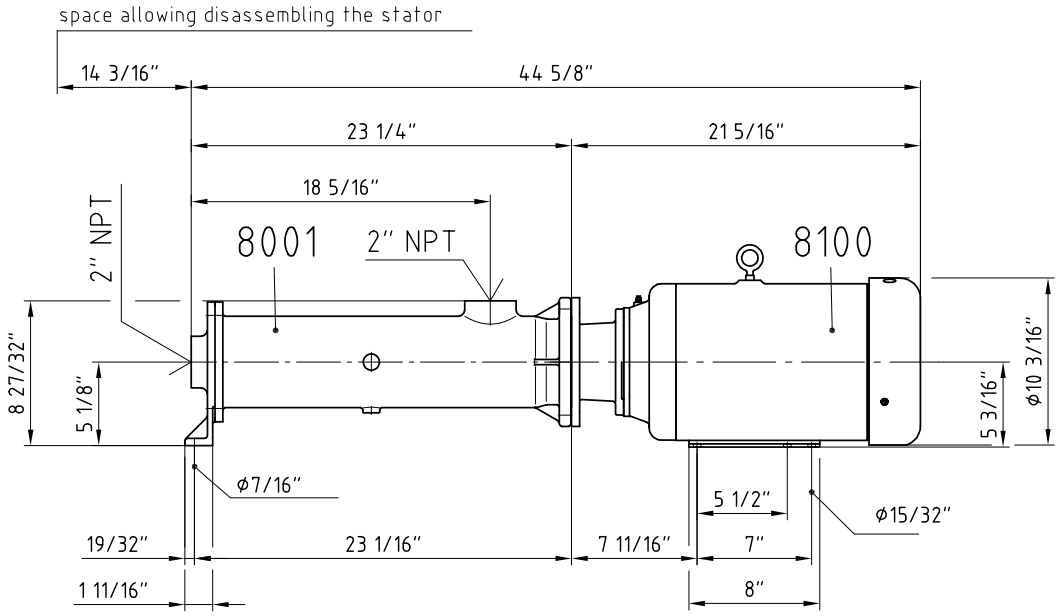
packing

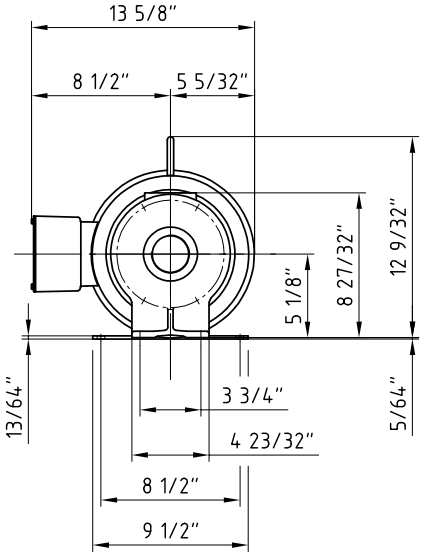
packing type	Skid
marking	2109552

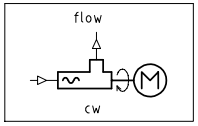
documentation

dimensional drawing no.	86958	**operating manual**	1 copy English
sectional drawing no.	106-003_2		
shaft sealing sect. View	106-0GB/0100-0-080_4		
remarks			

additional accessories / special designs / remarks







Stück Quant.	Bezeichnung Denomination	Pos. Item	Werkstoff Material	Bemerkung Note	Gewicht / kg Weight / kg
1	motor : Baldor IEC 132 5Hp B14	8100			
1	pump: BW 10	8001			34

	Name/Name	Tag/Day	Maßstab/Scale	Gewicht/Weight	Bezeichnung/Denomination
2007 Bearbeitet Drawn	sbe	03.09.	◎▱ 1:10		Maßzeichnung dimensional drawing
Geprüft Checked	goe	03.09.	EDV-Nr./EDP-No. 86958.dwg		Zeichnungs-Nr./Drawing-no. 106-C44/0100-0-002A4

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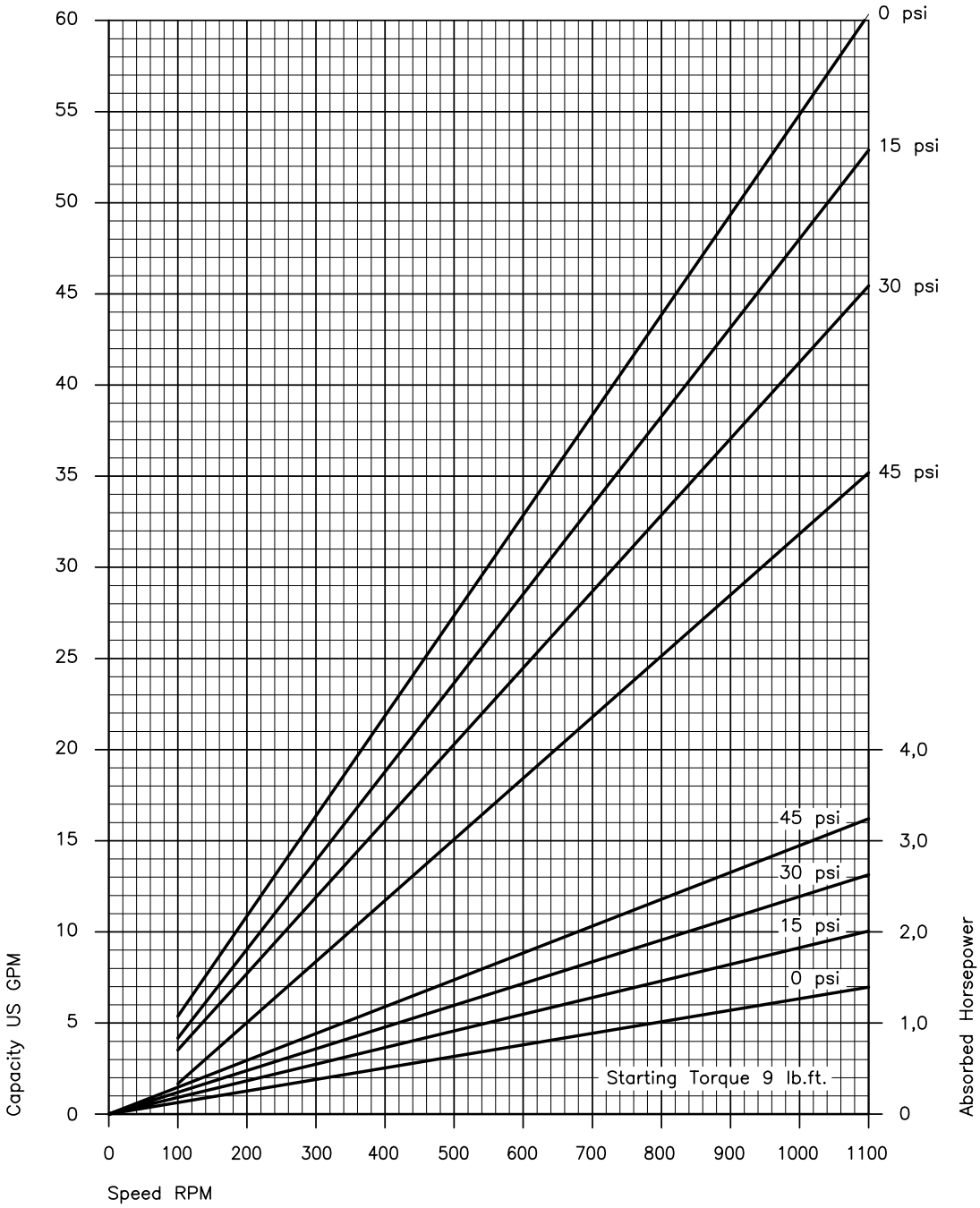
seepex, Inc.
511 Speedway Drive
Enon, OH 45323
www.seepex.com

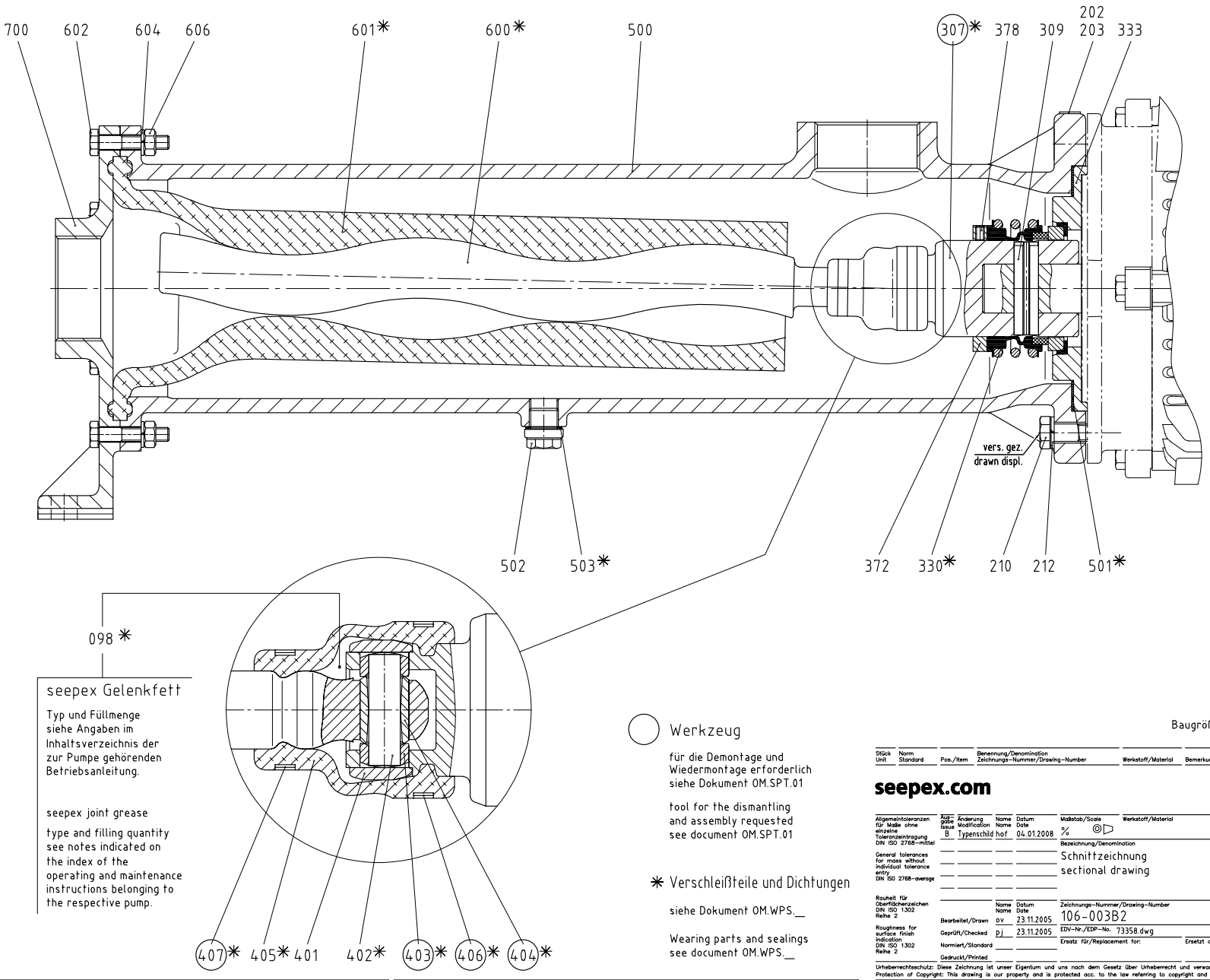
Maßänderungen vorbehalten / changes of dimensions reserved

Characteristic Curves
Size
BW 10



Values based upon water 68°F

CHA.BW10/5–6L A 05.06us



seepex Gelenkfett

Typ und Füllmenge
siehe Angaben im
Inhaltsverzeichnis der
zur Pumpe gehörenden
Betriebsanleitung.

seepex joint grease

type and filling quantity
see notes indicated on
the index of the
operating and maintenance
instructions belonging to
the respective pump.

Werkzeug

für die Demontage und
Wiedermontage erforderlich
siehe Dokument OM.SPT.01

tool for the dismantling
and assembly requested
see document OM.SPT.01

* Verschleißteile und Dichtungen

siehe Dokument OM.WPS._

Wearing parts and sealings
see document OM.WPS._

Baugröße / size : BW10

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

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Ausgabe Issue	Änderung Modification	Name Name	Datum Date
B	Typenschild	hof	04.01.2008

Maßstab/Scale: %

Bezeichnung/Denomination: Schnittzeichnung / sectional drawing

	Name Name	Datum Date
Bearbeitet/Drawn	ov	23.11.2005
Geprüft/Checked	pj	23.11.2005
Normiert/Standard		
Gedruckt/Printed		

Zeichnungs-Nummer/Drawing-Number: 106-003B2

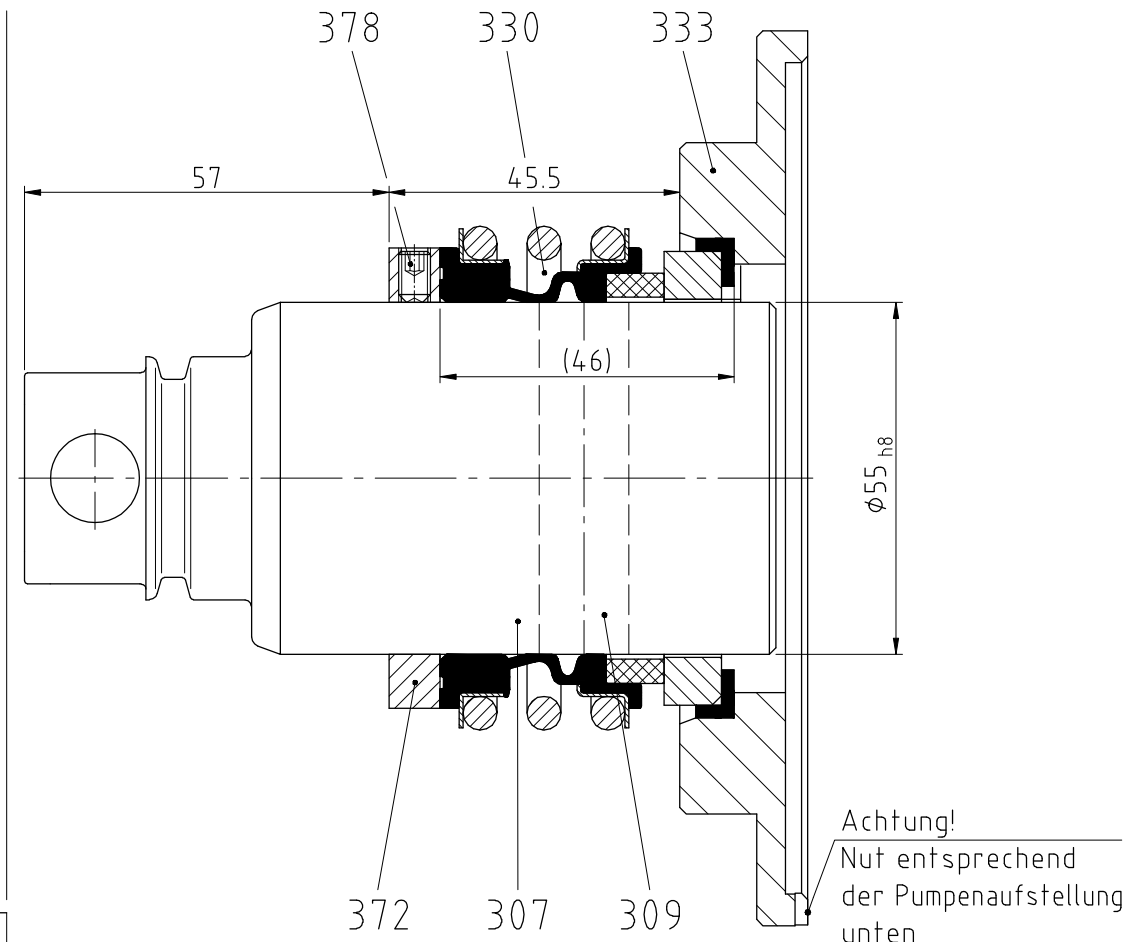
EDV-Nr./EDP-No. 73358.dwg

Ersatz für/Replacement for:

Ersetzt durch/Replacement by:

Stückliste
Parts List
Liste des pièces

Stck.	Pos.	DE **Baureihe BW** **Schnittzeichnung Nr. 106-003_2** **Benennung Stck. / Pos.**	EN **range BW** **sectional drawing No. 106-003_2** **denomination Qty. / item**	FR **série BW** **plan no. 106-003_2** **désignation Qté. / Poste**
2	202	Halbrundnägel	round head pins	rivet
1	203	Typenschild	type plate	plaque signalique
4	210	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Spannstift	spring pin	goupille fendue
1	330	Gleitringdichtung	mechanical seal	garniture mécanique
1	333	GLRD-Aufnahme	mechanical seal retainer	logement de la garniture mécanique
1	372	Stellring	set collar	anneau ajustable
3	378	Gewindestift	set screw	vis sans tête
1	401	Gelenkhülse	retaining sleeve	douille d'articulation
1	402	Kuppelstangenbolzen	coupling rod pin	axe d´articulation
2	403	Führungsbuchse	guide bushing	douille de guidage
1	404	Kuppelstangenbuchse	coupling rod bushing	chemise d´axe
1	405	Manschette	universal joint sleeve	manchette
1	406	Halteband	holding band	collier de serrage
1	407	Halteband	holding band	collier de serrage
1	500	Druckgehäuse	pressure casing	carter de refoulement
1	501	Gehäusedichtung	casing gasket	étanchéité du carter de refoulement
1	502	Verschlussschraube	casing gasket	étanchéité du carter d'aspiration
1	503	Dichtring	screwed plug	bouchon de vidange
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
4	602	6kt-Schraube	hexagon bolt	vis
4	604	Federring	spring washer	rondelle frein
4	606	6kt-Mutter	hexagon nut	écrou
1	700	Saugstutzen	suction branch	bride d´aspiration
	098	seepex Gelenkfett Typ und Füllmenge: Betriebs- und Wartungsanleitung entnehmen	seepex joint grease type and filling quantity: see Operating and Maintenance Instruction	seepex graisse d' articulations sommaire pour type et quantité: voir Instructions de service et d'entretien
		Verschleißteile und Dichtungen: Betriebs- und Wartungsanleitung entnehmen	Wear parts and sealings: see Operating and Maintenance Instruction	pièces d'usure et étanchéités: voir Instructions de service et d'entretien
		Werkzeuge: Betriebs- und Wartungsanleitung entnehmen	Tools: see Operating and Maintenance Instruction	Outils: voir Instructions de service et d'entretien



Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs–Nummer/Drawing–Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
3		378	Gewindestift / set screw		M5 x 8	
1		372	Stellring / set collar 062-372/0100-0-001_4			
1		333	GLRD-Aufnahme / mechanical seal retainer 106-333/0100-0-001_3			
1		330	GLRD / mechanical seal MG1-ϕ55-G60		Fabrikat / make : Burgmann	
1		309	Spannstift / spring pin		ϕ14x52-A	
1		307	Steckwelle / plug-in shaft 106-307/0100-0-001_3			

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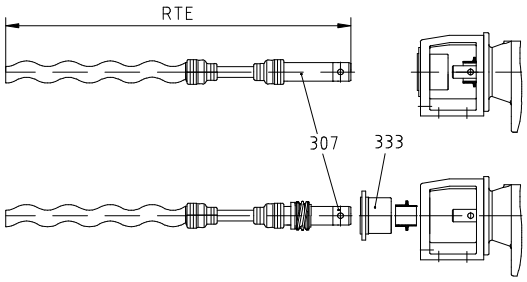
Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768–mittel General tolerances for mass without individual tolerance entry DIN ISO 2768–average	Ausgabe Issue	Änderung Modification	Name Name	Datum Date	Maßstab/Scale 1:1	Werkstoff/Material	Gewicht/Weight
					Bezeichnung/Denomination GLRD-Schnittzeichnung mechanical seal sectional drawing Burgmann MG1-ϕ55-G60 BW10		
Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2 Roughness for surface finish indication DIN ISO 1302 Reihe 2			Name Name	Datum Date	Zeichnungs–Nummer/Drawing–Number 106-0GB/0100-0-080A4		
		Bearbeitet/Drawn	tea	18.05.2009			
		Geprüft/Checked	hgg	18.05.2009	EDV–Nr./EDP–No. 100118.dwg		
		Normiert/Standard			Ersatz für/Replacement for:	Ersetzt durch/Replacement by:	
		Gedruckt/Printed					

7.0
Disassembly / Reassembly

7.1
Disassembly

- Remove flushing connections at shaft seal housing (SEA).
- Lift / displace splash ring (310) and eject plug-in shaft pin (309) horizontally.
- Withdraw rotating unit (RTE) together with shaft seal parallel from output shaft of drive and avoid chocking.
- Clean plug-in shaft (307) and remove burrs etc., which may damage sealing elements. Moisten plug-in shaft (307) with slip additive (diluted fluid soap).
- Loosen axial safety device of mechanical seal (330 or 372) and withdraw mechanical seal (330) from plug-in shaft (307).
- Remove mechanical seal housing (333) from lantern (200).
- Press counter-ring of mechanical seal with o-ring out of mechanical seal housing (333).



7.2
Reassembly

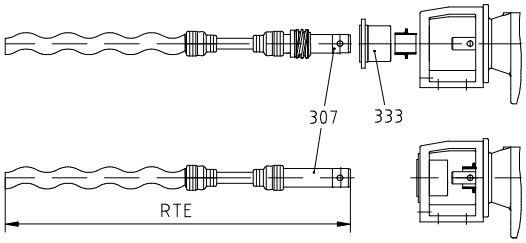
ATTENTION

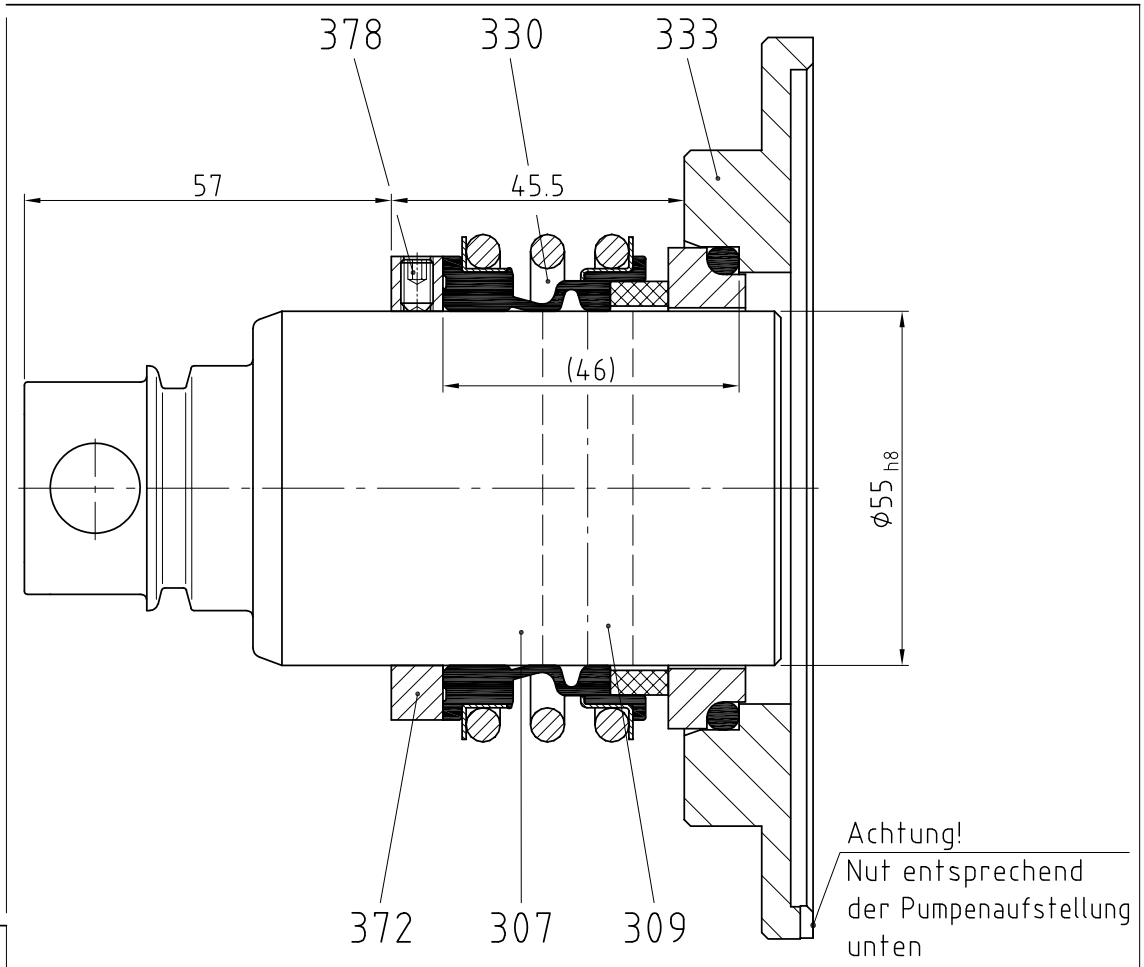
Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- Clean mechanical seal housing (333)
- Evenly press counter-ring with o-ring into mechanical seal housing (333). To facilitate assembly, the o-ring should be moistened with a lubricant (diluted fluid soap).

ATTENTION

- Oil or grease must not be used to facilitate assembly.
- Install mechanical seal housing (333) to lantern (200) and onsure correct position of flushing connections.
- Remove plug-in shaft (307), burrs and roughness and clean the unit.
- Check / adjust set dimension of mechanical seal on plug-in shaft (307). Moisten plug-in shaft (307) and elastomer parts of mechanical seal with lubricant (diluted fluid soap).
- Slip mechanical seal onto plug-in shaft (307) as far as set ring.
- Lubricate drive shaft (ANT) with antiseize graphite petroleum.
- Moisten splash ring (310) and plug-in shaft (307) with pin joint grease, (for type, please see index) and slip splash ring (310) onto output shaft of drive. Note installating position of splash ring and refer to description on splash ring.
- Move rotating unit (RTE) through mechanical seal housing (333) and splash ring (310) and slip splash ring (310) onto output shaft of drive (ANT). Push in plug-in shaft pin (309) in horizontal position.
- Position of splash ring:
  Collar of splash ring shall be fitted in a distance of about 0.5 mm to lantern (200).





Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs–Nummer/Drawing–Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
3		378	Gewindestift / set screw		M5 x 8	
1		372	Stellring / set collar 062-372/0100-0-001_4			
1		333	GLRD-Aufnahme / mechanical seal retainer 106-333/0100-0-001_3			
1		330	GLRD / mechanical seal GA-ϕ55		Fabrikat / make : seepex	
1		309	Spannstift / spring pin		ϕ14x52-A	
1		307	Steckwelle / plug-in shaft 106-307/0100-0-001_3			

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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768–mittel General tolerances for mass without individual tolerance entry DIN ISO 2768–average Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2 Roughness for surface finish indication DIN ISO 1302 Reihe 2	Ausgabe Issue	Änderung Modification	Name Name	Datum Date
	B	STW gekürzt	ov	20.11.2006
Bearbeitet/Drawn			ov	25.01.2006
Geprüft/Checked			hue	25.01.2006
Normiert/Standard				
Gedruckt/Printed				

Maßstab/Scale	Werkstoff/Material	Gewicht/Weight
1:1		

Bezeichnung/Denomination

GLRD-Schnittzeichnung
mechanical seal sectional drawing
seepex GA-ϕ55
BW10

Zeichnungs–Nummer/Drawing–Number

106-0GA/0100-0-001B4

EDV–Nr./EDP–No. 74502.DWG

Ersatz für/Replacement for:

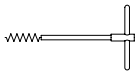
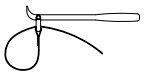
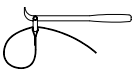
Ersetzt durch/Replacement by:

Range: **BW**
Sizes: **5 to 10**

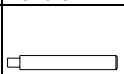
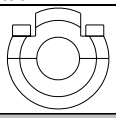
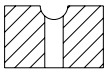
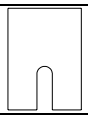
To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommend the acquisition of a set of wearing parts and a set of gaskets.
The table below shows the contents of these sets.

Part designation	small set of wearing parts	big set of wearing parts	set of gaskets	Item number acc. to sectional drawing of pump and parts list
	Number			
Rotor		1		600
Stator	1	1		601
Universal joint sleeve		1		405
Coupling rod pin		1		402
Holding band, small 1) 2)		1		407
Holding band, big 1)		1		406
Casing gasket			1	501
Sealing ring			1	503
Mechanical seal			1	330
Flushing ring			1	310
Plug-in shaft 1)		-		307
Special joint grease				098 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech. specifications 1. Kart.
Tool				Essential for assembly, see document OM.SPT.01

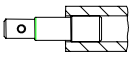
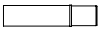
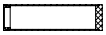
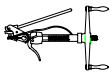
1) see tools document OM.SPT.01
2) only BW 10

	Allgemeine normierte Werkzeuge / Standardized tools						
Werkzeug Nr. tool No.	W1	W2	W5	W6	W9	W11	W13
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general	Mutter für Teflon-manschette nut for teflon universal joint sleeve	Stator Stator 1)
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever	Bandschlüssel strap wrench	Bandschlüssel strap wrench
Baugröße **size**							
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	PKZ XX 000 0000 0 X35M0	**Siehe W 13** **see W 13**					WKZ BDS 027 0 430
025-12, 025-24 05-12, 1-6L	PKZ XX 000 0000 0 X0FQ0	KRZ XX Z55 0250 0 00000 KEZ XX Z55 0250 0 00000	DHS XX 020 0000 0 A2620		2 Stück 2 pieces MHL XX SA 610		
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L			DHS XX 050 0000 0 A2620	BLZ XX 020 0008 0 A2619			
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	PKZ XX 000 0000 0 XOHV0		DHS XX 050 0000 0 A2620	BLZ XX 020 0010 0 A2619			
5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48		KRZ XX Z55 0300 6 00000 KEZ XX Z55 0300 6 00000	DHS XX 100 0000 0 A2620	BLZ XX 020 0010 0 A2619			
14-12, 26-6L, 40-6LT 10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	PKZ XX 000 0000 0 XA01A		DHS XX 120 0000 0 A2620	BLZ XX 025 0012 0 A2619		WKZ BDS 027 0 430	
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R 5-48		KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000	DHS XX 160 0200 0 A2620	BLZ XX 030 0012 0 A2619			
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48 200-6L			DHS XX 200 0200 0 A2620	BLZ XX 035 0012 0 A2619			
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48		KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619			
240-12, 300-12T 130-18, 130-24 35-48/70-48							

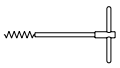
1) Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

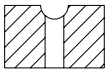
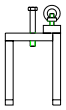
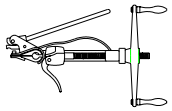
	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. **Recommended seepex tools** Due to the design recommended for certain repairs, these tools partially replace the standardized tools.							
Werkzeug Nr. tool No.	W4	W7	W8	W10	W12	W14	W15	W16
zur Montage von: tool for mounting of:	Gelenk joint	Lager bearing	Schmier-nippel lubrication nipple	Steckwelle plug-in shaft	Teflon-manschette teflon universal joint sleeve	Kuppelstangen-buchsen coupling rod bushing	Manschette universal joint sleeve	Lippendichtung lip seal
Benennung: denomination:	Montagedorn assembly mandrel	Montage-hülse mounting sleeve	Einschlag-hülse drive-in sleeve	Demontage-werkzeug dismantling tool	Montage-werkzeug mounting tool	Presswerkzeug pressing tool	Montageplatte mounting plate	Montagehülse Mounting sleeve
Baugröße **size**								
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	MTD L2 060 M120 0 XXXXX 2)						MTP A7 703 M500 0 002XX	MTH B7 703 M120 0 W0260
025-12, 025-24 05-12, 1-6L	MTD L2 060 M500 0 XXXXX	MTH M8 060 M500 0 XXXXX		AZV B2 262 M500 0 XXXXX			MTP A7 703 M500 0 002XX	
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L	MTD L2 060 0020 0 XXXXX	MTH M8 060 0020 0 XXXXX		AZV B2 262 0020 0 XXXXX	MMT M8 060 0020 0 XXXXX	PWZ C6 060 0020 0 XXXXX		
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	MTD L2 060 0050 0 XXXXX	MTH M8 060 0050 0 XXXXX		AZV B2 262 0050 0 XXXXX	MMT M8 060 0050 0 XXXXX	PWZ C6 060 0050 0 XXXXX		
5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48	MTD L2 060 0100 0 XXXXX	MTH M8 060 0100 0 XXXXX		AZV B2 262 0100 0 XXXXX	MMT M8 060 0100 0 XXXXX	PWZ C6 060 0100 0 XXXXX		
14-12, 26-6L, 40-6LT	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX		AZV B2 262 0170 0 XF5XX		PWZ C6 060 1400 0 XXXXX		
10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	MTD L2 060 0170 0 XXXXX	MTH M8 060 0170 0 XXXXX	ESH N0 000 0000 0 A01A4	AZV B2 262 0170 0 XG0XX	MMT M8 060 0170 0 XXXXX	PWZ C6 060 0170 0 XXXXX		
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48	MTD L2 060 0350 0 XXXXX	MTH M8 060 0350 0 XXXXX		AZV B2 262 0350 0 XH0XX		PWZ C6 060 0350 0 XXXXX		
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L	MTD L2 060 0700 0 XXXXX	MTH M8 060 0700 0 XXXXX		AZV L7 703 0700 0 XK0XX		PWZ C6 060 0700 0 XXXXX		
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX				PWZ C6 060 1300 0 XXXXX		
240-12, 300-12T 130-18, 130-24 35-48/70-48						PWZ C6 060 2400 0 XXXXX		

2) entfällt ab Pumpen-Herstellungsdatum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. **Recommended seepex tools** Due to the design recommended for certain repairs, these tools partially replace the standardized tools.								**Spezial-werkzeuge** **Special tools**
Werkzeug Nr. tool No.	W17	W18	W19	W20	W22	W23	W24	W25	W3
zur Montage von: tool for mounting of:	Lippendichtung lip seal	Gleitlager-buchse plain bearing bush	Wellen-schonhülse shaft securing sleeve	Cartridge-Einheit cartridge-unit	Wellen-dichtring lip seal	Wellen-dichtring lip seal	Antriebs-gehäuse drive casing	Steckwellen-bolzen plug-in shaft pin	Halteband holding band
Benennung: denomination:	Schlagzylinder Zentrierdorn Montagebolzen cylinder centering mandrel mounting pin	Montagedorn mounting mandrel	Montagehülse mounting sleeve	Aufnahme intake	Montage-werkzeug mounting tool	Montage-werkzeug mounting tool	Aufhänge-vorrichtung suspension device	Montagedorn mounting mandrel	Montage-werkzeug mounting tool
Baugröße **size**									
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L, 025-12T, 05-6LT	ZSH B7 703 M120 0 W0171 ZDR B7 703 M120 0 W0172 MBL A7 703 M120 0 W0173								MHB WH A00 1WHV 0 01000
025-12, 025-24 05-12, 1-6L									
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L								MTD L8 703 0050 0 SXX0J	
2-24, 2-12V									
5-12, 8-12T 10-6L, 15-6LT 05-48									
5-24, 5-12V									
10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48								MTD L8 703 0170 0 SXX0J	
14-12, 26-6L, 40-6LT									
10-24, 10-12V									
17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R, 2-48			SPT B4 703 0170 0 01000	SPT M8 703 0170 0 00900	SPT B4 703 0170 0 01100				
17-24, 17-12V									
35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48								MTD L8 703 0350 0 SXX0J	
35-24, 35-12V									
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L		SPT M8 703 1300 0 01000	SPT M8 703 1300 0 01100	SPT M8 703 1300 0 00900	SPT B4 703 1300 0 0A200	SPT B4 703 1300 0 0A300		MTD L8 703 0700 0 SXX0J	
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48								MTD L8 703 1300 0 SXX0J	
240-12, 300-12T 130-18, 130-24 35-48/70-48							SPT M8 703 2400 0 01400		

BIG Baugrößen / BIG sizes

	Allgemeine normierte Werkzeuge / Standardized tools				
Werkzeug Nr. tool No.	W1	W2	W5	W6	W9
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever
Baugröße **size**					
240-6C	PKZ XX 000 0000 0 XA01A	KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619	2 Stück 2 pieces MHL XX SA 610
300-3TR					
400-3TN					
500-3LA					
240-9C					
300-9TR					
400-6TN					
400-6TR					
500-6LA					
240-12C					
300-12TR					
240-18L					
400-12TR					
300-18TU					
300-24TV					
300-27TH					
400-18TU					

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. **Recommended seepex tools** Due to the design recommended for certain repairs, these tools partially replace the standardized tools.						**Spezialwerkzeuge** **Special tools**
Werkzeug Nr. tool No.	W4	W7	W8	W14	W24	W25	W3
zur Montage von: tool for mounting of:	Gelenk joint	Lager bearing	Schmiernippel lubrication nipple	Kuppelstangen-buchsen coupling rod bushing	Antriebs-gehäuse drive casing	Steckwellen-bolzen plug-in shaft pin	Halteband holding band
Benennung: denomination:	Montagedorn assembly mandrel	Montagehülse mounting sleeve	Einschlaghülse drive-in sleeve	Presswerkzeug pressing tool	Aufhänge-vorrichtung suspension device	Montagedorn mounting mandrel	Montagewerkzeug mounting tool
Baugröße **size**							
240-6C				PWZ C6 060 1300 0 XXXXX		MTD L8 703 1300 0 SXX0J	
300-3TR							
400-3TN							
500-3LA							
240-9C	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX	ESH N0 000 0000 0 A01A4	PWZ C6 060 2400 0 XXXXX	SPT M8 703 130B 0 01400		MHB WH A00 1WHV 0 01000
300-9TR							
400-6TN							
400-6TR							
500-6LA							
240-12C							
240-12L							
300-12TU							
300-12TR							
240-18L					SPT M8 703 2400 0 01400		
400-12TR							
300-18TU							
300-24TV							
300-27TH							
400-18TU							

1 Scope

Size	Period of Storing	Preservation acc. to.
025-12 ... 130-6L	> 3 months ≤ 9 months	Measures for preservation 1
	> 9 months	Measures for preservation 2
130-12 ... 500-6L	> 3 months ≤ 9 months	Measures for preservation 1
	> 9 months	Measures for preservation 2

2 Description

2.1 Measures for preservation 1

2.1.1 Storing of the pump

- in dry and closed rooms
- free from vibration

Particular adjacent influences have to be advised by the customer and have to be checked and released by seepex before storage.

2.1.2 Protection of the stator

change the position of the once per month:

- Remove fan cover on the electric motor.
- Rotate the fan shaft 1/4 turn.

Fan shaft and fan must not be damaged! If necessary remove the fan and protect the shaft against damage during this procedure.

2.1.3 Gear

Note instruction of the manufacturer.

- Follow advice on the gear.

  - Reduce quantity of lubricant to the quantity stipulated for the operation before commissioning!
  - Reinstall vent screw during commissioning.

Belt Variable Speed Drive:

Store the belt separate (relevant standard ISO 2230):

- dry
- constant tempered at 10-15°C (max. 25°C)
- protected against light / stored in darkness (e.g. in a closed case or packed accordingly)

2.1.4 Motor

By the turn of the fan shaft (see point 2.1.2) a protection of the bearing in the motor is obtained at the same time.

2.1.5 Recommissioning

NOTICE

Before starting work read the operating instruction.

- Pay attention to a correct re-assembly of parts dismantled before.

2.2 Measures for preservation 2

In case of the correct storage and under consideration of the preservation measures, a storage of the pump is possible for max. 2 years.

NOTICE

In case of a longer storage period, the dimensions and shore hardness can change.
The function of the pump can be impaired.

➢ Bevor recommissioning Elastomere parts (stator, joint seal, gaskets, ...) have to be checked for crack formation and change of the surface.

2.2.1 Storing of the pump/pump parts

- in dry and closed rooms
- free from vibration

Particular adjacent influences have to be advised by the customer and have to be checked and released by seepex before storage.

2.2.2 Storing of the stator

Store the stator separate (relevant standard ISO 2230):

- dry
- constant tempered at 10-15°C (max. 25°C)
- protected against light / stored in darkness (e.g. in a closed case or packed accordingly)

2.2.3 Gear

Note instruction of the manufacturer.

- Follow advice on the gear.

  - Reduce quantity of lubricant to the quantity stipulated for the operation before commissioning!
  - Reinstall vent screw during commissioning.

Belt Variable Speed Drive:

Store the belt separate (relevant standard ISO 2230):

- dry
- constant tempered at 10-15°C (max. 25°C)
- protected against light / stored in darkness (e.g. in a closed case or packed accordingly)

2.2.4 Motor

Turn the fan shaft once a month to protect the bearing:

- Remove fan cover on the electric motor.
- Rotate the fan shaft 1/4 turn.

Fan shaft and fan must not be damaged! If necessary remove the fan and protect the shaft against damage during this procedure.

2.2.5 Recommissioning

NOTICE

Before starting work read the operating instruction.

- Pay attention to a correct re-assembly of parts dismantled before.

3 Advices and annotations

Guarantee-/Warranty claims cannot be derived from this document.

4 Alteration service

This document is subject to the alteration service of the engineering department (TE) and ist relevant valid issue is released by the quality assurance (QA). All alteration requests are handled and checked by engineering.

10.0
Manufacturer's documents from sub-supplier

Burgmann
INDUSTRIES

OPERATING MANUAL

This document was drawn up observing the EC directives
"Machinery" 98/37/EC, EN ISO 12100-2 and the German Standard VDI 4500

In case of this mechanical seal is operated in **explosion area an appropriate additional operating manual,** following EC directives 94/9/EC (ATEX 95), has to be observed **by all means**! If required this could be ordered at BURGMANN.

BURGMANN MECHANICAL SEAL (M.S.)

Type MG1/dw-00 and versions

applies to all mechanical seals of the same series

dw = specified shaft diameter

These instructions are intended for the assembly, operating and control personnel and should be kept at hand on site.

PLEASE READ this manual carefully and OBSERVE the information contained as to:

- **Safety**
- **Installation**
- **Transport / Storage**
- **Operation**
- **Information about the product**
- **Servicing**

If there are any unclear points please contact BURGMANN by all means!

Table of Contents

Keywords and Symbols

Following symbols for particularly important information are used:

"Attention, please pay special attention to these sections of text"

DANGER! Draws attention to a direct hazard that will lead to injury or death of persons

WARNING! Draws attention to the risk that a hazard could lead to serious injury or death of persons

CAUTION! Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment

ATTENTION! Identifies a potentially dangerous situation. If it is not avoided the product or something in its vicinity could be damaged

IMPORTANT! Identifies tips for use and other particularly useful information.

GENERAL SAFETY NOTES

Any person being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Instruction Manual and in particular the safety notes. We recommend the user to have this confirmed.

BURGMANN Mechanical Seals are manufactured on a **high quality level** (quality management EN ISO 9001: 2000) and they keep a **high working reliability**. Yet, if they are **not operated** within their **intended purpose** or handled **inexpertly** by untrained personnel they may cause **risks**.

The machine has to be set up in such a way that seal leakage can be led off and disposed properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the **operational safety** of the mechanical seal is not permitted.

Unauthorised modifications or alterations are **not permitted** as they affect the **operational safety** of the mechanical seal.

BURGMANN mechanical seals must be installed, operated, maintained, removed or repaired by **authorised**, **trained and instructed personnel only.**

The **responsibilities** for the respective jobs to be done **have to be determined clearly and observed** in order to prevent unclear competencies from the point of **security**.

Any work to be done on the mechanical seal is **generally** only **permitted** when the seal is **neither operating nor pressurised**.

WARNING! Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

Apart from the notes given in this manual the general **regulations for worker's protection and those for prevention of accidents** have to be observed.

Instructions for worker's protection

WARNING! If the **medium to be sealed** and/or the **supply liquid** is subject to the **Hazardous Substances Regulation** (GefStoffV), the **instructions for handling dangerous substances** (safety data sheets to EU Directive 91/155/EEC) and the **accident prevention regulations** have be observed.

Medium to be sealed and/or **supply medium may escape** if the seal **fails**. Injury of persons and environment may be **prevented by the user** providing for splash protection and wearing safety goggles. Care has to be taken by the user for **proper disposal** of the leakage. The user has to control these measures.

The **user** has to **check** what **effects a failure** of the mechanical seal might have and what safety measures have to be taken to prevent **personal** injury or damage to the environment.

TRANSPORT / STORAGE

Transport

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

In addition seaworthy packing may become necessary.

Notes for income inspection:
- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

The mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

ATTENTION! If the machine as well as the mechanical seal installed into the machine are transported together the shaft has to be protected from deflection and shocks.

Packing and storage

The following recommendations apply to all BURGMANN mechanical seals which have been supplied and stored in their **undamaged original packaging**, as well as to seals which have been installed in a machine (e.g. pump, compressor, agitator, etc.) but have not yet been put into operation.

BURGMANN mechanical seals and spare parts are super finished and repeatedly tested machine elements. For the storage special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the mechanical seals. Yet, this may be avoided by observing the storage instructions.

For the stock keeping of elastomers special conditions are required. For all rubber-elastic parts the rules of DIN 7716 resp. of ISO 2230-1973 (E) are valid.

Conveniences for storing of mechanical seals
- dust free
- moderately ventilated
- constantly tempered
  - relative air humidity below 65 %,
  - temperature between 15 °C and 25 °C.

Protect the seal from
- direct exposure to heat (sun, heating)
- **ultraviolet light** (halogen or fluorescent lamps, sunlight, arc welding)
- presence or development of **ozone** (arc welding, mercury vapour lamps, high-voltage devices, electric motors)

➢ **risk of embrittlement** of elastomeric materials

It has to be differentiated between:
- ▫ **M.S. stored** in the stock room
- ▫ **M.S. installed** in the machine, but not yet in operation.

☐ **M.S. in the stock**

IMPORTANT! Store the **seal in the original packing** lying on a **flat surface**.

- Check the packaging periodically for damages.
- Plastic sheet packagings with humidity indicators have to be checked every 8 weeks. The check has to be recorded.

➢ Packings **exceeding 50 % rel. humidity** values have to be sent to the manufacturer or the **nearest BURGMANN service centre** for inspection and new packaging.

Duly stored mechanical seal:
- Latest 3 years after delivery of the mechanical seal
- For reasons of safety shipment of the M.S. to BURGMANN resp. nearest BURGMANN service centre for

➢ Exchange of all secondary seals and springs
➢ Verification of the flatness of the faces
➢ Perhaps static pressure test.

☐ **M.S. installed into the machine:**

ATTENTION! A **preservation** of the BURGMANN mechanical seals is **not allowed**.

Check in case of a preservation of complete machines with mechanical seals installed BURGMANN has to be contacted.
- **Do not** use corrosion protection agents.

➢ Risk of deposition and possibly chemical attack of the secondary seals.

Due to longer erecting times of new designed plants the period between delivery of the mechanical seal and on the other hand its installation and start up may exceed the period of 2-3 years.

Latest after 3 years and in time before the planned start-up of the plant the seal has to be dismantled and to be sent to the manufacturer or the nearest BURGMANN service centre where it can be checked and reconditioned, if necessary.

Damages caused by **improper** storage may **not** be claimed with reference to the **warranty** on the BURGMANN company**.**

INFORMATION ABOUT THE PRODUCT

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

Manufacturer and country of origin

Burgmann Industries GmbH & Co. KG
Äußere Sauerlacher Str. 6-10
D - 82515 Wolfratshausen

Germany

Declaration by the manufacturer

within the meaning of the EC-directive "MACHINERY" 98/37/EG

A mechanical seal does **not function independently**. It is intended to be incorporated into or assembled with machinery.

Type designation

BURGMANN Mechanical Seal **MG1/dw-00**

Designated use

This mechanical seal is **exclusively** designed for the use in the specified application. A **different utilisation** or a utilisation going beyond the specification is considered **contrary to its designated use** and excludes a liability by the manufacturer.

Operation under conditions lying **outside** those limits stated in paragraph **"Operating limits"** is considered **contrary to its designated use**.

Should the seal be **operated under different conditions or at a different application** BURGMANN has to be asked for **recognition as safe in advance**.
- **Changes** to operating conditions **have to** be documented.

Operating limits

ATTENTION! Operating limits depend on the materials, the media to be sealed and the diameter of the sealing. (If there are any unclear points please contact BURGMANN.)

Shaft diameter	(dw)	:	10 - 100 mm
Pressure to be sealed	(p1)	:	12 bar g
Temperature to be sealed	(t1)	:	-20 ... 120° C
Max. sliding speed	(vg)	:	10 m/s

Operation under several limit values **simultaneously** should be **avoided** as higher loads (pressure, temperature, speed) can increase wear or lead to **damage** of sliding faces or elastomers. This could result in a shorter service life and in the **risk** of a sudden seal failure **endangering** men and environment.

The **selection** of the mechanical seal (type, suitability, materials) should be done **by BURGMANN staff** or other **authorised** persons. A wrong selection by unauthorised persons is **not covered by** BURGMANN's **warranty**.

Further information about the operating conditions can be found in the BURGMANN assembly drawing MG1/dw-00 or in the specification sheets of the machine manufacturer.

Materials

The materials of the mechanical seal depend on the application and are fixed in the order.

Drawings, diagrams

Assembly drawing MG1/dw-00

The original assembly drawing in its latest edition (latest revision) only is decisive for both the design of M.S. as well as the utilisation of this manual.

In the following description all figures in parentheses, e.g. (2) define the respective part item no. in fig. 1. The part item no. may vary from those stated in the assembly drawing.

Versions

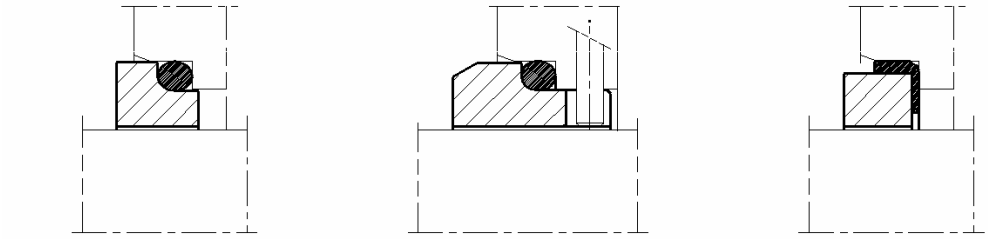
- **MG12/…**
- **MG13/…**
- **MG1S20/…**
- **RMG12/…**
- **MG1 MULTIPLE M.S.**

The mechanical seal type MG1 can also be used as **multiple mechanical seal** (also in combination with seal types of other series) in **tandem arrangement** with quench (API, plan 52) or as **dual mechanical seal** with barrier fluid (API, plan 53). Consultation with the BURGMANN company is recommended.

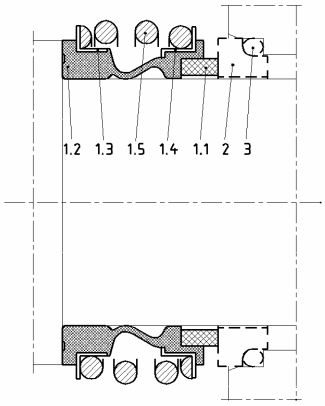
ATTENTION! PTFE o-rings or double-PTFE-wrapped o-rings **may** not be used at seat versions **without torsion lock**.

This operating manual applies also to the mentioned seal versions with slight modifications and/or to combinations with seats not stated in this manual.

Seat Versions



Description and function



- **single seal**
- **unbalanced**
- **bi-directional**
- **stationary seat** (2)
- **o-ring** (3)
- **rotating seal face** (1.1)
- **elastomeric bellow** (1.2)
- **cylindrical single spring** (1.5)
- **no glued joints**
- **materials of the sliding parts replaceable**
- **for media containing solids** (e.g. sewage applications)
- **rotating, torsion-free elastomeric bellows** serving as
  - face housing
  - secondary sealing element
  - drive collar
- **torque transmission** from the seal face by means of "L"-rings and a rotating, cylindrical single spring
- **axial movability**
  d_w: 10 … 12 mm ±0,5 mm
  d_w: 14 … 18 mm ±1,0 mm
  d_w: 20 … 26 mm ±1,5 mm
  d_w: 28 … 100 mm ±2,0 mm

Required space, connecting dimensions

The required mounting space for the mechanical seal is decisive for the design of the housing parts by the machine manufacturer. The connecting dimensions have to be checked by the machine manufacturer by means of the BURGMANN drawing before mounting the mechanical seal.

Supply of M.S.

The mechanical seal has to be constantly wetted by liquid medium. The medium to be sealed must not damage the M.S. neither chemically (e.g. corrosion, embrittlement) nor physically (e.g. erosion, abrasion).

For a safe operation of the mechanical seal we recommend to apply **at inboard** the most suitable **type of circulation** described in **API 610 / 682**. This measure protects the seal cavity from deposition of solids.

To operate multiple seals special supply systems are required. Please contact BURGMANN.

Emissions

A mechanical seal is a **dynamic seal** that **cannot be free of leakage** due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems there is **few leakage**.

WARNING! If the **medium to be sealed** and/or the **supply liquid** is subject to the **Hazardous Substances Regulation** (GefStoffV), the **instructions for handling dangerous substances** (safety data sheets to EU Directive 91/155/EEC) and the **accident prevention regulations** have be observed.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

If this is not the case or if there are other malfunctions the mechanical seal has to be shut down, removed and checked for reasons of safety.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

IMPORTANT! Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

INSTALLATION

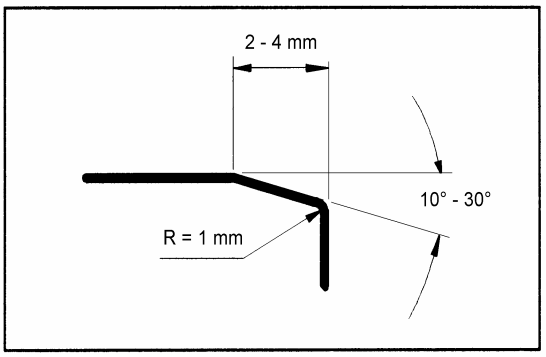
Assembly utilities

- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- o-ring lifter
- water and washing up liquid
- cardboard discs

Preparation for assembly

ATTENTION! The seal should remain **packed** until the following working steps have been completely **terminated**.

Check the parts of the machine for:



- **chamfered edges**
  (sliding cones i.e. 2 mm / 30° or in accordance with EN 12756)
- radiused transitions
- **mating fits** and o-ring surfaces:
  fine finished **Rz 10 µm** (= N7 = CLA 63)

- **Shaft surface** in the area of the mechanical seal finished according to EN 12756: **Ra = 0.8 µm** (= N6 = CLA 32).
- **Shoulder** or stop device for the bellows of the mech. seal to take up axial forces

Check at the machine:
- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

Run-out accuracy of the shaft (acc. to DIN ISO 5199):
- Shaft diameters up to 50 mm: max. 0.05 mm
- Shaft diameters 50 mm - 100 mm: max. 0.08 mm

- Prepare the place of assembly, take away any not required tool, cuttings, dirty cleaning wool etc.

- Cover the work bench with a piece of clean, non-fibrous cardboard.

Assembly / installation

BURGMANN mechanical seals are super-finished and repeatedly tested machine elements whose handling during assembly in particular of sliding materials and elastomers requires special care during several procedures.

For installation the assembly drawing of mechanical seal has to be observed.

IMPORTANT! The mechanical seal has to be installed under the cleanest conditions and very carefully.

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- ➢ Never place the seal faces or seats on their sliding faces without having covered them adequately.

- Check before starting assembly:
  - complete availability of all components by means of the drawing
  - all components have to be clean and in perfect condition.

- Sprinkle the elastomer bellows and the shaft with low-surface-tension water (add washing up liquid) or ethyl alcohol to decrease frictional force during assembly of the seal.

⚠

Oil or grease as assembly agent is not permitted in any case.

ATTENTION! **Do never force** during installation.

ATTENTION! **Avoid unnecessary rotation** of the shaft (damage of the sliding faces is possible).

ATTENTION! **Avoid knocking the seal!** Damage to mechanical seals has an adverse effect on their safe operation.

Possible installation order:

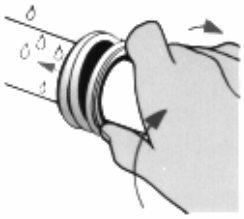
- Feed the **degreased** sealing element (o-ring, rubber cup) onto the seat.

If present:
- At the seat mark the position of the rear slot beside the sliding face.
- Align the seat with the torque transmission pin.

- Cover the sliding face of the seat with a cardboard washer
- Press the seat slowly and without interruption into its position.
  - ➢ Use plenty of water or alcohol as lubricant.
  - ➢ Use a distance sleeve, if necessary.
- Remove the cardboard washer from the sliding face.
- Check the rectangular position of the seat to the shaft axis.

- Mount the seal cover with the seat installed before.
- Clean the sliding faces thoroughly with ethyl alcohol and paper tissues (**no fabric, no cloths!**).

➢ In case of material **"BUKO"** (carbon graphite) wipe it until the paper tissues stay clean.
➢ Do not touch the sliding faces any more with bare fingers.
➢ Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!



- Push rotating seal unit (bellows unit) with a slow clockwise turn onto the shaft.
- Stick to the dimensions in the assembly drawing!

➢ If necessary use a mounting sleeve.
➢ For long pushing distances add liquid several times.

- Check "L" rings, spring and seal face for correct fit.

- Mount stop device for bellows unit to take up axial forces.

➢ Stick to the dimensions in the assembly drawing **by all means!**

- Further assembly of the machine in accordance with the instructions of the machine manufacturer.

OPERATION

Instructions for safe operation

For a single mechanical seal the **pressure in the seal chamber** (stuffing box pressure) has to be **higher** than the ambient pressure at the machine at any time. Otherwise the machine will **suck in air** via the sliding faces, which will result in **dry-running** and consequent **failure** of the mechanical seal.

Damages due to dry-running are excluded from the warranty.

During every state of operation the mechanical seal has to be constantly wetted by the **medium** to be sealed **in its liquid form**, in particular when the machine is **started** or **stopped**. The machine design has to be such as to take this necessity into consideration.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the machine the stuffing box has to be flushed with suitable clean liquid. The flow and the liquid should be determined by the user.

If the operation limit values and the instructions given in this manual are followed a trouble-free operation of the mechanical seal can be expected.

Instructions for start up

Safety checks before start up

- Torque transmission between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

For a safe operation of the mechanical seal we recommend to apply **at inboard** the most suitable **type of circulation** described in **API 610 / 682**. This measure protects the seal cavity from deposition of solids.

- Flood machine and seal cavity (stuffing box) with medium and vent thoroughly.

▫ Now the seal is ready for operation.

SERVICING

Maintenance

A correctly operated mechanical seal needs **low maintenance**. Wear parts, however, have to be replaced, if necessary.

A duly operation includes a regular check of the following parameters:
- Temperature
- Leakage (drainage) rate of the mechanical seal

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by responsible BURGMANN personnel.

If the mechanical seal is removed during a revision of the plant it has to be replaced by a new one.

Directives in case of failure

Try to define the kind of failure and record it.

- In the event of **excessive leakage**, note changes in the leakage amount and switch the pump off if necessary.
- If a constant amount is leaking in a steady flow, the mechanical seal is damaged.
- In the event of a **inadmissible temperature rise**, the machine **has to** be stopped for safety reasons.

If there is a **malfunction** which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest **BURGMANN agency**, a BURGMANN service centre or the BURGMANN headquarters.

During the **warranty period** the BURGMANN mechanical seal must only be disassembled with approval of the manufacturer or when a representative is present.

After-sales service by BURGMANN

BURGMANN's customer service department offers a comprehensive service package covering consultancy, engineering, standardisation, installation, commissioning as well as damage analysis right through to seminars on sealing technology.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

Address of headquarters:

Burgmann Industries GmbH & Co. KG
Postfach 1240
D - 82515 Wolfratshausen

Germany

☎ +49 (0) 81 71-23 0
Fax +49 (0) 81 71-23 12 14
www.burgmann.com

Reconditioning (repair)

If **reconditioning** is necessary, the complete **seal** should be sent **to the manufacturer**, as this is the best way to find out which components can be reconditioned or which parts must be replaced in order to ensure an optimum tightness.

If, **for compelling reasons**, **a reconditioning** has to be carried out **on site** (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by **trained** personnel of the user under the direction of **BURGMANN mechanics**.

Disassembly / removal

- Stop the machine as instructed, allow to cool, depressurise and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the machine is at a standstill and depressurised.
- There must be no product on the M.S. ⇒ if necessary drain the machine and rinse it out.
- Isolate the machine to prevent it starting up unexpectedly.
- Comply with the safety notes (safety data sheets).

IMPORTANT! When removing, please observe **by all means**:

- current **accident prevention regulations**
- **regulations for handling hazardous substances**

WARNING! Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

IMPORTANT! The packaging used to transport the seal must

- be **identified** with the relevant **hazard symbol** and
- **include** the **safety data sheet** for the product and/or supply medium

The order of disassembly to remove the mechanical seal out of the machine depends on the design of the machine and should be determined by the machine manufacturer.

- Remove the seal in the reverse sequence as described for assembly (set up).

Spare parts

- Only BURGMANN original spare parts must be used. Otherwise
  - **Risks** of a seal failure, **endangering** persons and environment.
  - The BURGMANN guarantee for the mechanical seal **lapses**.
- For a quick exchange a complete **spare seal** should be on stock.

Required details for enquiries and orders

For enquiries and orders the following details are required:

- BURGMANN commission no.
- Drawing no. of M.S. **MG1/dw-00**
  dw = specified shaft diameter
- Part item no., designation, material, number of pieces with reference to the drawing.

Address of headquarters product field **FA**
Standard Mechanical Seals

Burgmann Industries GmbH & Co. KG
Postfach 1240
D - 82502 Wolfratshausen

Germany

☎ +49 (0) 81 71 - 23 0
Fax +49 (0) 81 71 - 23 14 44

Disposal of the BURGMANN mechanical seal

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

CAUTION! Material containing fluorine must not be burnt.

IMPORTANT! Some of the synthetic materials, divided into the different groups can be recycled.

Copyright

We reserve the right to carry out technical modifications of the product, even if they have not yet been considered in this manual.

June 13, 2006
Department Technical Documentation

BALDOR • RELIANCE

Integral Horsepower
AC Induction Motors
ODP, WPI, WPII Enclosure
TEFC Enclosure
Explosion Proof

Installation & Operating Manual

2/07 MN400

Table of Contents

Section 1
General Information

Overview This manual contains general procedures that apply to Baldor Motor products. Be sure to read and understand the Safety Notice statements in this manual. For your protection, do not install, operate or attempt to perform maintenance procedures until you understand the Warning and Caution statements. A Warning statement indicates a possible unsafe condition that can cause harm to personnel. A Caution statement indicates a condition that can cause damage to equipment.

Important: **This instruction manual is not intended to include a comprehensive listing of all details for all procedures required for installation, operation and maintenance. This manual describes general guidelines that apply to most of the motor products shipped by Baldor. If you have a question about a procedure or are uncertain about any detail, Do Not Proceed. Please contact your Baldor distributor for more information or clarification.**

Before you install, operate or perform maintenance, become familiar with the following:

- NEMA Publication MG-2, Safety Standard for Construction and guide for Selection, Installation and Use of Electric Motors and Generators.
- The National Electrical Code
- Local codes and Practices

Limited Warranty

1. Most Baldor products are warranted for 18 months from the date of shipment to Baldor's customer from Baldor's district warehouse or, if applicable, from Baldor's factory. Baldor Standard-E® standard efficient motors are warranted for 24 months. Standard-E is limited to three phase, general purpose, 1-200 HP ratings that fall under the Energy Policy Act (EPAct). Baldor Super-E® premium efficient motors are warranted for 36 months. Baldor IEEE841 motors are warranted for 60 months. All warranty claims must be submitted to a Baldor Service Center prior to the expiration of the warranty period.
2. Baldor will, at its option repair or replace a motor which fails due to defects in material or workmanship during the warranty period if:
   a. the purchaser presents the defective motor at or ships it prepaid to, the Baldor plant in Fort Smith, Arkansas or one of the Baldor Authorized Service Centers and
   b. the purchaser gives written notification concerning the motor and the claimed defect including the date purchased, the task performed by the Baldor motor and the problem encountered.
3. Baldor will not pay the cost of removal of any electric motor from any equipment, the cost of delivery to Fort Smith, Arkansas or a Baldor Authorized Service Center, or the cost of any incidental or consequential damages resulting from the claimed defects. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.) Any implied warranty given by laws shall be limited to the duration of the warranty period hereunder. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)
4. Baldor Authorized Service Centers, when convinced to their satisfaction that a Baldor motor developed defects in material or workmanship within the warranty period, are authorized to proceed with the required repairs to fulfill Baldor's warranty when the cost of such repairs to be paid by Baldor does not exceed Baldor's warranty repair allowance. Baldor will not pay overtime premium repair charges without prior written authorization.
5. The cost of warranty repairs made by centers other than Baldor Authorized Service Centers **WILL NOT** be paid unless first authorized in writing by Baldor.
6. Claims by a purchaser that a motor is defective even when a failure results within one hour after being placed into service are not always justified. Therefore, Baldor Authorized Service Centers must determine from the condition of the motor as delivered to the center whether or not the motor is defective. If in the opinion of a Baldor Authorized Service Center, a motor did not fail as a result of defects in material or workmanship, the center is to proceed with repairs only if the purchaser agrees to pay for such repairs. If the decision is in dispute, the purchaser should still pay for the repairs and submit the paid invoice and the Authorized Service Center's signed service report to Baldor for further consideration.
7. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Safety Notice:

This equipment contains high voltage! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt installation, operation and maintenance of electrical equipment.

Be sure that you are completely familiar with NEMA publication MG-2, safety standards for construction and guide for selection, installation and use of electric motors and generators, the National Electrical Code and local codes and practices. Unsafe installation or use can cause conditions that lead to serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury. National Electrical Code and Local codes must be carefully followed.

WARNING: Avoid extended exposure to machinery with high noise levels. Be sure to wear ear protective devices to reduce harmful effects to your hearing.

WARNING: This equipment may be connected to other machinery that has rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt to install operate or maintain this equipment.

WARNING: Do not by-pass or disable protective devices or safety guards. Safety features are designed to prevent damage to personnel or equipment. These devices can only provide protection if they remain operative.

WARNING: Avoid the use of automatic reset devices if the automatic restarting of equipment can be hazardous to personnel or equipment.

WARNING: Be sure the load is properly coupled to the motor shaft before applying power. The shaft key must be fully captive by the load device. Improper coupling can cause harm to personnel or equipment if the load decouples from the shaft during operation.

WARNING: Use proper care and procedures that are safe during handling, lifting, installing, operating and maintaining operations. Improper methods may cause muscle strain or other harm.

WARNING: Before performing any motor maintenance procedure, be sure that the equipment connected to the motor shaft cannot cause shaft rotation. If the load can cause shaft rotation, disconnect the load from the motor shaft before maintenance is performed. Unexpected mechanical rotation of the motor parts can cause injury or motor damage.

WARNING: Disconnect all electrical power from the motor windings and accessory devices before disassembly of the motor. Electrical shock can cause serious or fatal injury.

WARNING: Do not use non UL/CSA listed explosion proof motors in the presence of flammable or combustible vapors or dust. These motors are not designed for atmospheric conditions that require explosion proof operation.

Safety Notice Continued

WARNING: **Motors that are to be used in flammable and/or explosive atmospheres must display the UL label on the nameplate along with CSA listed logo.**

Specific service conditions for these motors are defined in NFPA 70 (NEC) Article 500.

WARNING: **UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.**

Caution: **To prevent premature equipment failure or damage, only qualified maintenance personnel should perform maintenance.**

Caution: **Do not over-lubricate motor as this may cause premature bearing failure.**

Caution: **Do not lift the motor and its driven load by the motor lifting hardware. The motor lifting hardware is adequate for lifting only the motor. Disconnect the load from the motor shaft before moving the motor.**

Caution: **If eye bolts are used for lifting a motor, be sure they are securely tightened. The lifting direction should not exceed a 20° angle from the shank of the eye bolt or lifting lug. Excessive lifting angles can cause damage.**

Caution: **To prevent equipment damage, be sure that the electrical service is not capable of delivering more than the maximum motor rated amps listed on the rating plate.**

Caution: **If a HI POT test (High Potential Insulation test) must be performed, follow the precautions and procedure in NEMA MG1 and MG2 standards to avoid equipment damage.**

If you have any questions or are uncertain about any statement or procedure, or if you require additional information please contact your Baldor distributor or an Authorized Baldor Service Center.

Receiving

Each Baldor Electric Motor is thoroughly tested at the factory and carefully packaged for shipment. When you receive your motor, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your motor.
2. Verify that the part number of the motor you received is the same as the part number listed on your purchase order.

Storage

If the motor is not put into service immediately, the motor must be stored in a clean, dry and warm location. Several precautionary steps must be performed to avoid motor damage during storage.

1. Use a “Megger” periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
2. Do not lubricate bearings during storage. Motor bearings are packed with grease at the factory. Excessive grease can damage insulation quality.
3. Rotate motor shaft at least 10 turns every two months during storage (more frequently if possible). This will prevent bearing damage due to storage.
4. If the storage location is damp or humid, the motor windings must be protected from moisture. This can be done by applying power to the motors’ space heater (if available) while the motor is in storage.

Unpacking

Each Baldor motor is packaged for ease of handling and to prevent entry of contaminants.

1. To avoid condensation inside the motor, do not unpack until the motor has reached room temperature. (Room temperature is the temperature of the room in which it will be installed). The packing provides insulation from temperature changes during transportation.
2. When the motor has reached room temperature, remove all protective wrapping material from the motor.

Handling

The motor should be lifted using the lifting lugs or eye bolts provided.

1. Use the lugs or eye bolts provided to lift the motor. Never attempt to lift the motor and additional equipment connected to the motor by this method. The lugs or eye bolts provided are designed to lift only the motor. Never lift the motor by the motor shaft or the hood of a WPII motor.
2. When lifting a WPII (Weather Proof Type 2) motor, do not lift the motor by inserting lifting lugs into holes on top of the cooling hood. These lugs are to be used for hood removal only. A spreader bar should be used to lift the motor by the cast lifting lugs located on the motor frame.
3. If the motor must be mounted to a plate with the driven equipment such as pump, compressor etc., it may not be possible to lift the motor alone. For this case, the assembly should be lifted by a sling around the mounting base. The entire assembly can be lifted as an assembly for installation. Do not lift using the motor lugs or eye bolts provided.

   If the load is unbalanced (as with couplings or additional attachments) additional slings or other means must be used to prevent tipping. In any event, the load must be secure before lifting.

Section 2
Installation & Operation

Overview

Installation should conform to the National Electrical Code as well as local codes and practices. When other devices are coupled to the motor shaft, be sure to install protective devices to prevent future accidents. Some protective devices include, coupling, belt guard, chain guard, shaft covers etc. These protect against accidental contact with moving parts. Machinery that is accessible to personnel should provide further protection in the form of guard rails, screening, warning signs etc.

Location

It is important that motors be installed in locations that are compatible with motor enclosure and ambient conditions. Improper selection of the motor enclosure and ambient conditions can lead to reduced operating life of the motor.

Proper ventilation for the motor must be provided. Obstructed airflow can lead to reduction of motor life.

1. **Open Drip-Proof/WPI** motors are intended for use indoors where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. **Totally Enclosed and WPII** motors may be installed where dirt, moisture or dust are present and in outdoor locations.

Severe Duty, IEEE 841 and Washdown Duty enclosed motors are designed for installations with high corrosion or excessive moisture conditions. These motors should not be placed into an environment where there is the presence of flammable or combustible vapors, dust or any combustible material, unless specifically designed for this type of service.

Mounting

The motor must be securely installed to a rigid foundation or mounting surface to minimize vibration and maintain alignment between the motor and shaft load. Failure to provide a proper mounting surface may cause vibration, misalignment and bearing damage.

Foundation caps and sole plates are designed to act as spacers for the equipment they support. If these devices are used, be sure that they are evenly supported by the foundation or mounting surface.

After installation is complete and accurate alignment of the motor and load is accomplished, the base should be grouted to the foundation to maintain this alignment.

The standard motor base is designed for horizontal or vertical mounting. Adjustable or sliding rails are designed for horizontal mounting only. Consult your Baldor distributor or authorized Baldor Service Center for further information.

Alignment

Accurate alignment of the motor with the driven equipment is extremely important.

1. **Direct Coupling**
   For direct drive, use flexible couplings if possible. Consult the drive or equipment manufacturer for more information. Mechanical vibration and roughness during operation may indicate poor alignment. Use dial indicators to check alignment. The space between coupling hubs should be maintained as recommended by the coupling manufacturer.
2. **End-Play Adjustment**
   The axial position of the motor frame with respect to its load is also extremely important. The motor bearings are not designed for excessive external axial thrust loads. Improper adjustment will cause failure.
3. **Pulley Ratio**
   The pulley ratio should not exceed 8:1.
4. **Belt Drive**
   Align sheaves carefully to minimize belt wear and axial bearing loads (see End-Play Adjustment). Belt tension should be sufficient to prevent belt slippage at rated speed and load. However, belt slippage may occur during starting.

   Caution: Do not over tension belts.
5. Sleeve bearing motors are only suitable for coupled loads.

Doweling & Bolting

After proper alignment is verified, dowel pins should be inserted through the motor feet into the foundation. This will maintain the correct motor position should motor removal be required. (Baldor motors are designed for doweling.)

1. Drill dowel holes in diagonally opposite motor feet in the locations provided.
2. Drill corresponding holes in the foundation.
3. Ream all holes.
4. Install proper fitting dowels.
5. Mounting bolts must be carefully tightened to prevent changes in alignment. Use a flat washer and lock washer under each nut or bolt head to hold the motor feet secure. Flanged nuts or bolts may be used as an alternative to washers.

Power Connection

Motor and control wiring, overload protection, disconnects, accessories and grounding should conform to the National Electrical Code and local codes and practices.

Conduit Box

For ease of making connections, an oversize conduit box is provided. The box can be rotated 360° in 90° increments. Auxiliary conduit boxes are provided on some motors for accessories such as space heaters, RTD's etc.

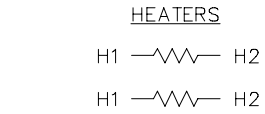
AC Power

Connect the motor leads as shown on the connection diagram located on the name plate or inside the cover on the conduit box. Be sure the following guidelines are met:

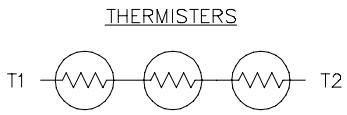
1. AC power is within ±10% of rated voltage with rated frequency. (See motor name plate for ratings).
   OR
2. AC power is within ±5% of rated frequency with rated voltage.
   OR
3. A combined variation in voltage and frequency of ±10% (sum of absolute values) of rated values, provided the frequency variation does not exceed ±5% of rated frequency.

Performance within these voltage and frequency variations are shown in Figure 2-2.

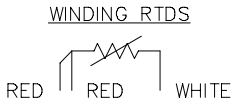
Figure 2-1 Accessory Connections



One heater is installed in each end of motor.
Leads for each heater are labeled H1 & H2.
(Like numbers should be tied together).



Three thermisters are installed in windings and tied in series.
Leads are labeled T1 & T2.

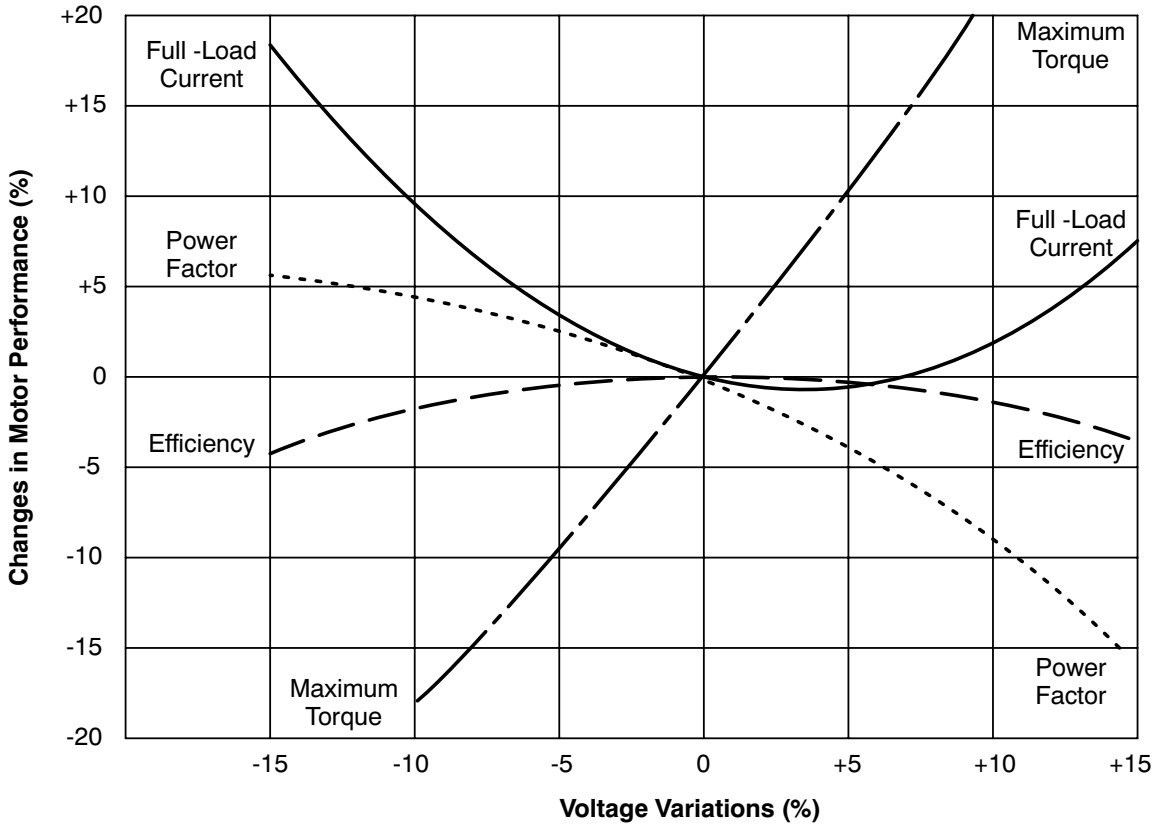


Winding RTDs are installed in windings (2) per phase.
Each set of leads is labeled W1, W2, W3, W4, W5, & W6.

* One bearing RTD is installed in Drive endplate (PUEP), leads are labeled RTDDE.
* One bearing RTD is installed in Opposite Drive endplate (FREP), leads are labeled RTDODE.

* Note RTD may have 2-Red/1-White leads; or 2-White/1-Red Lead.

Figure 2-2 Typical Motor Performance VS Voltage Variations



First Time Start Up

Be sure that all power to motor and accessories is off. Be sure the motor shaft is disconnected from the load and will not cause mechanical rotation of the motor shaft.

1. Make sure that the mechanical installation is secure. All bolts and nuts are tightened etc.
2. If motor has been in storage or idle for some time, check winding insulation integrity with a Megger.
3. Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity.
4. Be sure all shipping materials and braces (if used) are removed from motor shaft.
5. Manually rotate the motor shaft to ensure that it rotates freely.
6. Replace all panels and covers that were removed during installation.
7. Momentarily apply power and check the direction of rotation of the motor shaft.
8. If motor rotation is wrong, be sure power is off and change the motor lead connections. Verify rotation direction before you continue.
9. Start the motor and ensure operation is smooth without excessive vibration or noise. If so, run the motor for 1 hour with no load connected.
10. After 1 hour of operation, disconnect power and connect the load to the motor shaft. Verify all coupling guards and protective devices are installed. Ensure motor is properly ventilated.

Coupled Start Up

This procedure assumes a coupled start up. Also, that the first time start up procedure was successful.

1. Check the coupling and ensure that all guards and protective devices are installed.
2. Check that the coupling is properly aligned and not binding.
3. The first coupled start up should be with no load. Apply power and verify that the load is not transmitting excessive vibration back to the motor though the coupling or the foundation. Vibration should be at an acceptable level.
4. Run for approximately 1 hour with the driven equipment in an unloaded condition.

The equipment can now be loaded and operated within specified limits. Do not exceed the name plate ratings for amperes for steady continuous loads.

Jogging and Repeated Starts Repeated starts and/or jogs of induction motors generally reduce the life of the motor winding insulation. A much greater amount of heat is produced by each acceleration or jog than by the same motor under full load. If it is necessary to repeatedly start or jog the motor, it is advisable to check the application with your local Baldor distributor or Baldor Service Center.

Heating - Duty rating and maximum ambient temperature are stated on the motor name plate. Do not exceed these values. If there is any question regarding safe operation, contact your local Baldor distributor or Baldor Service Center.

Section 3
Maintenance & Troubleshooting

WARNING: UL Listed motors must only be serviced by UL Approved Authorized Baldor Service Centers if these motors are to be returned to a hazardous and/or explosive atmosphere.

General Inspection

Inspect the motor at regular intervals, approximately every 500 hours of operation or every 3 months, whichever occurs first. Keep the motor clean and the ventilation openings clear. The following steps should be performed at each inspection:

WARNING: Do not touch electrical connections before you first ensure that power has been disconnected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the installation, operation and maintenance of this equipment.

1. Check that the motor is clean. Check that the interior and exterior of the motor is free of dirt, oil, grease, water, etc. Oily vapor, paper pulp, textile lint, etc. can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.
2. Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. Immediately investigate any significant drop in insulation resistance.
3. Check all electrical connectors to be sure that they are tight.

Relubrication & Bearings

Bearing grease will lose its lubricating ability over time, not suddenly. The lubricating ability of a grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Good results can be obtained if the following recommendations are used in your maintenance program.

Type of Grease

A high grade ball or roller bearing grease should be used. Recommended grease for standard service conditions is Polyrex EM (Exxon Mobil).

Equivalent and compatible greases include:
Texaco Polystar, Rykon Premium #2, Pennzoil Pen 2 Lube and Chevron SRI.

Relubrication Intervals

Recommended relubrication intervals are shown in Table 3-1. It is important to realize that the recommended intervals of Table 3-1 are based on average use.

Refer to additional information contained in Tables 3-2, 3-3 and 3-4.

Table 3-1 Relubrication Intervals *

NEMA / (IEC) Frame Size	Rated Speed - RPM					
	10000	6000	3600	1800	1200	900
Up to 210 incl. (132)	**	2700 Hrs.	5500 Hrs.	12000 Hrs.	18000 Hrs.	22000 Hrs.
Over 210 to 280 incl. (180)		**	3600 Hrs.	9500 Hrs.	15000 Hrs.	18000 Hrs.
Over 280 to 360 incl. (225)		**	* 2200 Hrs.	7400 Hrs.	12000 Hrs.	15000 Hrs.
Over 360 to 5800 incl. (300)		**	*2200 Hrs.	3500 Hrs.	7400 Hrs.	10500 Hrs.

* Relubrication intervals are for ball bearings.
For vertically mounted motors and roller bearings, divide the relubrication interval by 2.

** For motors operating at speeds greater than 3600 RPM, contact Baldor for relubrication recommendations.

Table 3-2 Service Conditions

Severity of Service	Hours per day of Operation	Ambient Temperature Maximum	Atmospheric Contamination
Standard	8	40° C	Clean, Little Corrosion
Severe	16 Plus	50° C	Moderate dirt, Corrosion
Extreme	16 Plus	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion, Heavy Shock or Vibration
Low Temperature		<-29 ° C **	

* Special high temperature grease is recommended (Dow Corning DC44). Note that Dow Corning DC44 grease does not mix with other grease types. Thoroughly clean bearing & cavity before adding grease.

** Special low temperature grease is recommended (Aeroshell 7).

Table 3-3 Relubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Some motor designs use different bearings on each motor end. This is normally indicated on the motor nameplate. In this case, the larger bearing is installed on the motor Drive endplate. For best relubrication results, only use the appropriate amount of grease for each bearing size (not the same for both).

Table 3-4 Bearings Sizes and Types

Frame Size NEMA (IEC)	Bearing Description (These are the "Large" bearings (Shaft End) in each frame size)			
	Bearing	Weight of Grease to add * oz (Grams)	Volume of grease to be added	
			in^3	teaspoon
56 to 140 (90)	6203	0.08 (2.4)	0.15	0.5
140 (90)	6205	0.15 (3.9)	0.2	0.8
180 (100-112)	6206	0.19 (5.0)	0.3	1.0
210 (132)	6307	0.30 (8.4)	0.6	2.0
250 (160)	6309	0.47 (12.5)	0.7	2.5
280 (180)	6311	0.61 (17)	1.2	3.9
320 (200)	6312	0.76 (20.1)	1.2	4.0
360 (225)	6313	0.81 (23)	1.5	5.2
400 (250)	6316	1.25 (33)	2.0	6.6
440 (280)	6319	2.12 (60)	4.1	13.4
5000 to 5800 (315-450)	6328	4.70 (130)	9.2	30.0
5000 to 5800 (315-450)	NU328	4.70 (130)	9.2	30.0
360 to 449 (225-280)	NU319	2.12 (60)	4.1	13.4
AC Induction Servo				
76 Frame 180 (112)	6207	0.22 (6.1)	0.44	1.4
77 Frame 210 (132)	6210	0.32 (9.0)	0.64	2.1
80 Frame 250(160)	6213	0.49 (14.0)	0.99	3.3

* Weight in grams = .005 DB of grease to be added

Note: Not all bearing sizes are listed. For intermediate bearing sizes, use the grease volume for the next larger size bearing.

Caution: To avoid damage to motor bearings, grease must be kept free of dirt. For an extremely dirty environment, contact your Baldor distributor or an authorized Baldor Service Center for additional information.

Relubrication Procedure

Be sure that the grease you are adding to the motor is compatible with the grease already in the motor. Consult your Baldor distributor or an authorized service center if a grease other than the recommended type is to be used.

Caution: Do not over-lubricate motor as this may cause premature bearing failure.

With Grease Outlet Plug

1. With the motor stopped, clean all grease fittings with a clean cloth.
2. Remove grease outlet plug.

Caution: Over-lubricating can cause excessive bearing temperatures, premature lubrication breakdown and bearing failure.

3. Add the recommended amount of grease.
4. Operate the motor for 15 minutes with grease plug removed. This allows excess grease to purge.
5. Re-install grease outlet plug.

Without Grease Provisions

Note: Only a Baldor authorized and UL or CSA certified service center can disassemble a UL/CSA listed explosion proof motor to maintain it's UL/CSA listing.

1. Disassemble the motor.
2. Add recommended amount of grease to bearing and bearing cavity. (Bearing should be about 1/3 full of grease and outboard bearing cavity should be about 1/2 full of grease.)
3. Assemble the motor.

Sample Relubrication Determination

Assume - NEMA 286T (IEC 180), 1750 RPM motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 3-1 list 9500 hours for standard conditions.
2. Table 3-2 classifies severity of service as "Severe".
3. Table 3-4 shows that 1.2 in^3 or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.

Table 3-5 Troubleshooting Chart

Symptom	Possible Causes	Possible Solutions
Motor will not start	Usually caused by line trouble, such as, single phasing at the starter.	Check source of power. Check overloads, fuses, controls, etc.
Excessive humming	High Voltage.	Check input line connections.
	Eccentric air gap.	Have motor serviced at local Baldor service center.
Motor Over Heating	Overload. Compare actual amps (measured) with nameplate rating.	Locate and remove source of excessive friction in motor or load. Reduce load or replace with motor of greater capacity.
	Single Phasing.	Check current at all phases (should be approximately equal) to isolate and correct the problem.
	Improper ventilation.	Check external cooling fan to be sure air is moving properly across cooling fins. Excessive dirt build-up on motor. Clean motor.
	Unbalanced voltage.	Check voltage at all phases (should be approximately equal) to isolate and correct the problem.
	Rotor rubbing on stator.	Check air gap clearance and bearings.
		Tighten “Thru Bolts”.
	Over voltage or under voltage.	Check input voltage at each phase to motor.
	Open stator winding.	Check stator resistance at all three phases for balance.
	Grounded winding.	Perform dielectric test and repair as required.
	Improper connections.	Inspect all electrical connections for proper termination, clearance, mechanical strength and electrical continuity. Refer to motor lead connection diagram.
Bearing Over Heating	Misalignment.	Check and align motor and driven equipment.
	Excessive belt tension.	Reduce belt tension to proper point for load.
	Excessive end thrust.	Reduce the end thrust from driven machine.
	Excessive grease in bearing.	Remove grease until cavity is approximately $^3/_4$ filled.
	Insufficient grease in bearing.	Add grease until cavity is approximately $^3/_4$ filled.
	Dirt in bearing.	Clean bearing cavity and bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.
Vibration	Misalignment.	Check and align motor and driven equipment.
	Rubbing between rotating parts and stationary parts.	Isolate and eliminate cause of rubbing.
	Rotor out of balance.	Have rotor balance checked are repaired at your Baldor Service Center.
	Resonance.	Tune system or contact your Baldor Service Center for assistance.
Noise	Foreign material in air gap or ventilation openings.	Remove rotor and foreign material. Reinstall rotor. Check insulation integrity. Clean ventilation openings.
Growling or whining	Bad bearing.	Replace bearing. Clean all grease from cavity and new bearing. Repack with correct grease until cavity is approximately $^3/_4$ filled.

Suggested bearing and winding RTD setting guidelines

Most large frame AC Baldor motors with a 1.15 service factor are designed to operate below a Class B (80°C) temperature rise at rated load and are built with a Class H winding insulation system. Based on this low temperature rise, RTD (Resistance Temperature Detectors) settings for Class B rise should be used as a starting point. Some motors with 1.0 service factor have Class F temperature rise.

The following tables show the suggested alarm and trip settings for RTDs. Proper bearing and winding RTD alarm and trip settings should be selected based on these tables unless otherwise specified for specific applications.

If the driven load is found to operate well below the initial temperature settings under normal conditions, the alarm and trip settings may be reduced so that an abnormal machine load will be identified.

The temperature limits are based on the installation of the winding RTDs imbedded in the winding as specified by NEMA. Bearing RTDs should be installed so they are in contact with the outer race on ball or roller bearings or in direct contact with the sleeve bearing shell.

Winding RTDs - Temperature Limit In °C (40°C Maximum Ambient)

Motor Load	Class B Temp Rise ≤ 80°C (Typical Design)		Class F Temp Rise ≤ 105°C		Class H Temp Rise ≤ 125°C	
	Alarm	Trip	Alarm	Trip	Alarm	Trip
≤ Rated Load	130	140	155	165	175	185
Rated Load to 1.15 S.F.	140	150	160	165	180	185

Note: • Winding RTDs are factory production installed, not from Mod-Express.
• When Class H temperatures are used, consider bearing temperatures and relubrication requirements.

Bearing RTDs - Temperature Limit In °C (40°C Maximum Ambient)

Bearing Type Oil or Grease	Anti-Friction		Sleeve	
	Alarm	Trip	Alarm	Trip
Standard*	95	100	85	95
High Temperature**	110	115	105	110

Note: * Bearing temperature limits are for standard design motors operating at Class B temperature rise.
** High temperature lubricants include some special synthetic oils and greases.

Greases that may be substituted that are compatible with Polyrex EM (but considered as "standard" lubricants) include the following:

- Texaco Polystar
- Rykon Premium #2
- Chevron SRI #2
- Mobilith SHC-100
- Pennzoil Pennzlube EM-2
- Chevron Black Pearl
- Darmex 707
- Darmex 711
- Petro-Canada Peerless LLG

See the motor nameplate for replacement grease or oil recommendation.
Contact Baldor application engineering for special lubricants or further clarifications.

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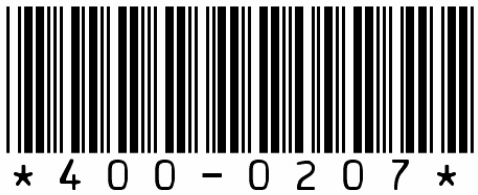

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DOSING PUMP

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Operating and Maintenance Instructions
Progressive Cavity Pump

range | size | pressure stage | 17.01.2006

MD

commission-No.

822813-822815

Job#

2109552

This operating and maintenance instruction includes important safety information and instructions for installation, commissioning, operating and maintenance of the seepex machinery. It is essential therefore, that the responsible specialist refers to it before starting any work on the machinery as well as prior to commissioning. Futhermore, this instruction must always be available on site.

1.0
General

1.1
Application

These operating instructions contain basic information on the installation, commissioning and maintenance of seepex machines. Compliance with the work steps described in the individual sections is essential.

1.2
Details of the seepex machines

1.2.1
Operating Instructions

The Commission Number (comm. no) assigns the operating instructions to a particular seepex machine. The operating instructions are produced in relation to a specific job/commission and are valid only for the machine whose comm. no. is identical with that indicated on the cover sheet and possessing the associated data sheet, Point 9.

1.2.2
Manufacturer

The machines were manufactured by seepex.

1.2.3
Range, Size, Version

of the machines are stated in the appended data sheet, Point 9.

1.2.4
Machine Comm. No. and Year of Construction

are stated on the type plate at the machine.

1.2.5
Release Date of the Operating Instructions

is stated on the cover sheet of the operating instructions.

1.2.6
Modifications, Notes of Modification

If modifications to the machines are carried out in agreement with seepex, a new set of operating instructions will be provided, or the existing operating instructions will be supplemented by an additional sheet together with a new cover sheet. The date of modification and modification index will be noted on the new cover sheet.

1.2.7
EEC Machine Directive

1.2.7.1
Manufacturer's Declaration

seepex Manufacturer's Declaration as required by the EEC Machine Directive 89/392/EEC, Appendix II B:

The seepex machines delivered in accordance with our design are intended to be fitted in one machine or assembled together with other machines to form one machine/plant. The commissioning of the machine is forbidden until such a time as has been established that the entire machine/plant satisfies the requirements of the EEC Directive for Machines as amended 91/368/EEC and 93/44/EEC.

Particular attention must be paid to the safety requirements specified in EN809 (s and Equipment for Fluids) as well as the information in these operating instructions.

1.2.7.2
Declaration of Conformity

seepex machines possessing no safety accessories do not fulfill the requirements of the EEC Machine Directive 89/392/EEC as amended 91/368/EEC and 93/44/EEC.

For this reason, no Declaration of Conformity as required by the EEC Machine Directive 89/392/EEC, Appendix IIA can be issued before appropriate safety devices have been installed/mounted on the machine and/or plant with due regard to the information given in these operating instructions.

The following harmonized standards are particularly applicable:
EN 809, EN292T1, EN292T2
Applicable national standards and specifications must be taken into consideration.

Following assessment of the conformity of the machine/plant with the EEC Machine Directive, customers may on their own initiative place on the full machine/plant the EEC symbol 'CE' as defined in Identification Directive 93/68/EEC.

CAUTION

This documentation must be kept available for at least 10 years.

1.2.8
Copyright and Industrial Property Rights

These operating instructions are copyrighted. The reproduction, in particular by photocopying, of these instructions is not permitted (§§ 54, 54 UrhG) and constitutes a criminal offence (§ 106 UrhG). Proceedings will be instituted if the copyright is violated.

1.2.9
Specifications Required for Inquiries and Orders

The following information must be included when inquiring about replacement parts or placing orders:
- comm. no.
- / machine type
This information is given on the type plate mounted the machine.

1.2.10
Technical Data Sheet
see Point 9.

1.2.11
Performance Data, Load Index, Power Consumption

are indicated in the associated data sheet, Point 9.

1.2.12
Sound Pressure Level

The sound pressure level and/or noise characteris-tics of the seepex machines are ascertained in accordance with DIN 45635. The measuring guidelines are largely identical with the international standards ISO 3740-1980 and ISO 3744-1981.

1.2.13
Operating Range

Employment of the machine is not permissible for purposes other than those stated in the data sheet, see Point 9. seepex cannot accept liability for damage arising through failure to comply with this operating range.

1.3
Supplementary Information

1.3.1
Accessories, Optional Extras

Please refer to the data sheet, Point 9.

1.3.2
Company Address, Service Addresses

see Point 11

2.0
Safety

These operating instructions contain basic requirements to be observed during the installation, operation and maintenance of the machine. Therefore, the instructions must be read by the mechanical fitter and by the technical personnel/operator responsible for the machine prior to assembly and commissioning, and kept available at the operating site of the machine/plant at all times.

Compliance is required not only with the general safety instructions given in this section but also with the detailed instructions, e.g. for private usage, given under the other main headings in these operating instructions.

2.1
Labeling of Advice in the Operating Instructions

In these operating instructions safety advice whose non-observance could lead to danger for life or limb is labeled with the following general hazard symbol:

safety symbol acc. to ISO 3864 - B.3.1

Warnings regarding electric power are labeled with:

safety symbol acc. to ISO 3864 - B.3.6

Safety instructions whose non-observance could jeopardize the machine and its functions are labeled by the word

CAUTION

Always comply with instructions mounted directly on the machine, e.g.
- rotational direction arrow
- fluid connection indicators

and ensure that the information remains legible.

2.2
Personnel Qualifications and Training

Personnel charged with operation, maintenance, inspection and assembly must be in possession of the appropriate qualifications for the tasks. The company operating the machine must define exact areas of responsibility, accountabilities and personnel supervision schemes. Personnel lacking the required skills and knowledge must receive training and instruction. If necessary, the opera-ting company may commission the manufacturer/ supplier to conduct these training courses. Furthermore, the operating company must ensure that the personnel fully understand the contents of the operating instructions.

2.3
Dangers Resulting from Failure to Observe Safety Instructions

Failure to comply with the safety instructions may lead to hazards to life and limb as well as dangers for the environment and the machine. Non-observance of safety instructions can invalidate the right of claim to damages.

The following are just some **examples** of possible dangers resulting from failure to comply with the safety instructions:

- Failure of important machine/plant functions
- Failure of prescribed methods of service and maintenance
- Danger to life and limb due to electrical, mechanical and chemical influences
- Danger to the environment due to the leakage of hazardous substances

2.4
Safety-conscious Working

Always comply with the safety instructions listed in this document, the existing national accident prevention regulations and any company-internal work, operating and safety rules.

2.5
Safety Instructions for the Operating Company/Machine Operator

- Any potentially hazardous hot or cold machine parts must be provided with protection against accidental contact at the customer´s premises.

- Protective guards for moving parts (e.g. coupling) must never be removed while the machine is in operation.

- Leakages (e.g. in the shaft seal) of hazardous conveying liquids (e.g. explosive, toxic, hot) must be drained in such a way that no danger arises for persons or for the environment. Always observe the relevant statutory requirements.

- The risk of exposure to electrical power must be eliminated (for details, see the VDE regulations, for example, or those of the local power supply company).

2.6
Safety Instructions for Maintenance, Inspection and Assembly Work

The operator must ensure that all maintenance, inspection and assembly tasks are carried out by authorized and qualified personnel who have studied the operating instructions closely and become sufficiently familiar with the machine.

As a basic rule, the machine must be brought to a standstill before work is carried out. Always comply with the de-commissioning procedure described in this document.

Any machiness or assemblies conveying media that are detrimental to health must be decontaminated.

Immediately following completion of work, all safety and protective devices must be replaced in position and, where applicable, re-activated.

Before re-starting the machine, observe the points listed under the heading "Initial Startup".

2.7
Unauthorized Modification and Manufacture of Replacement Parts

Conversions or modifications of the machine are permissible only in consultation with the manufacturers. Original manufacturer replacement parts and manufacturer-approved accessories enhance the operational safety of the machine. The usage of unauthorized parts may lead to the nullification of the manufacturer's liability for any resultant damages.

2.8
Impermissible Modes of Operation

The operational safety of the machines supplied is warranted only for employment in accordance with the intended use as defined in Section 1 - General - of these operating instructions. Never allow the threshold values specified in the data sheet to be exceeded.

3.0
Transport and Intermediate Storage

3.1
Safety Precautions

Employ appropriate transport means, hoists and tools when transporting and storing the machine, always observing the safety instructions.

3.2
Transport

Depending on its weight, the seepex machine must be transported manually or with appropriate transport means. Comply with the transport instructions on the packing.

3.3
Unpacking

The design of the packing is such that the equip-ment can be removed manually or, if demanded by the weight, by means of appropriate hoists.

Any screw fittings between the machine and the packing must be undone. Comply with the attached information notices and symbols.

3.4
Intermediate Storage/Preservation

Unless otherwise indicated in the data sheet, seepex machines are provided with preservation only for the duration of transport. If a long period of intermediate storage is foreseen before the machine is commissioned, it is necessary to pro-vide supplementary preservation. If necessary, the appropriate measures should be drawn up in consultation with seepex.

Intermediate storage in extreme climatic conditions is permissible only for machine whose design is appropriate to the circumstances. If necessary, seepex must be consulted.

CAUTION

Pumps of the range MAP
If the period from supply and subsequent storage until the commissioning is more than 4 weeks, the hoses should be dismantled, refer to Point 7.

3.5
Protection against Environmental Influences

To afford protection against environmental influences, the intermediate storage location must be dry, enclosed and free from frost.

4.
Description of the seepex Progressive Cavity Pump and Accessories

4.1
General Description, Design and Mode of Operation

Like all progressive cavity pumps, seepex pumps belong to the rotating positive-displacement pump family. The characteristic attribute of these pumps is the special formation and arrangement of the two conveying elements, namely the rotor and the stator.

The difference in the number of threads possessed respectively by the rotor and stator produces a chamber that opens and closes alternately in line with the constant turning motion of the rotor, effecting the continuous transportation of the conveying product from the suction side to the pressure side.

The geometrical formation of the two conveying elements combined with the constant contact that exists between them result in sealing lines that effect an airtight seal between the suction and pressure side in every position of the eccentric screw, even when the pump is stationary. The pump owes its high suction capacity to this
sealing between the suction and pressure sides.

4.2
Mechanical Design

Please consult the sectional drawing, Point 9, for the mechanical design of the pump. The data sheet, Point 9, gives information on the design of the pump housing, stator, rotor and rotating components.

Refer to document OM. SEA. __, for information on the design of the shaft seal.

The data sheet, specifies details of the design of the drive engine. Further details are
given in the appended manufacturer's documents, Point 10.

4.3
Accessories

Consult the data sheet for information.

4.4
Dimensions, Weight

Consult the appended dimensional drawing,

4.5
Design Variants

Refer to the data sheet, Point 9, for the design of the seepex progressive cavity pump. Other design variants are possible, whereby seepex must first check whether a particular pump is suitable for the intended purpose.

4.6
Operating Site Specifications

Operating site specifications are listed in the data sheet, Point 9. Details of the space required for installation, operation and maintenance are given in Point 5.2.1.

5.0
Assembly / Installation

5.1
Mounting Tools / Hoists

No special tools are required for the assembly and installation of the pump.

The customer must check the dimensions and weight of the seepex progressive cavity pump to ascertain whether the available hoisting apparatus is sufficient for the assembly and fitting of the pump.

5.2
Initial Assembly

5.2.1
Inspection Prior to Commencement of Assembly

5.2.1.1
Location

The place of installation for the pump must con-form with the site stated in the data sheet in Point 9. Any change of location must be checked and approved by seepex.

5.2.1.2
Space Requirements

Customers are responsible for determining the space requirements; the following factors must be taken into consideration:

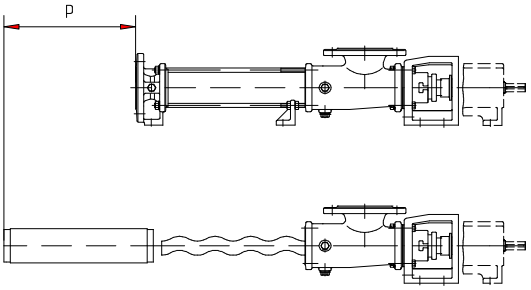
- dimensions and weight of the machine
- required transport and hoisting equipment
- possible piping layout with allowance for the space allowing disassembly of the rotor as defined in 5.2.1.3
- freedom of movement to:
  operate the drive /
  speed regulation
  read speed and pressure indicators
  adjust a stator retensioning device, if fitted
  operate a buffer fluid supply unit, if fitted
- space required for lubrication / renewal of lubricants
- disassembly of mechanical protective devices, e.g. V-belt or coupling protection
- space required for handling the mounting tools, e.g. sufficient wall clearance

5.2.1.3
Space Allowing Disassembly of Stator P

A specific space must be allowed for exchanging the stator. The required dimension "P" is indicated in the index of these operating instructions or in the appended dimensional drawing, Point 9.

CAUTION

Ensure also that the pipe work can be dismounted at this location too.



5.2.2
Installation of the Fully Assembled Pump

- Installation in conformity with data sheet
  Installation of the pump is permissible only in accordance with the data sheet specifications and the associated basic drawing, see Point 9. Any change in the position must be checked and approved by seepex.

- Tension-free mounting of pump
  This rule applies to pumps with and without drives, to versions with and without baseplate, for mounting on the foundation or other bearing elements. The entire area of all bearing surfaces of the machine must rest on the ground. Any unevenness must be corrected by appropriate supports.

- Correct seating of drives
  All drives have been aligned ready for operation and mounted by seepex. However, displace-ments may occur during transport or installation. For this reason, check that the alignment and fastening of the drive and coupling are correct.

- Protective devices
  On completion of the assembly and installation work, immediately mount all safety and protective devices in their proper locations and set them in operation.

5.2.3
Protective and Controlling Equipment

Information on equipment of this nature, where fitted, is provided in the data sheet, Point 9. Consult the attached manufacturer's specifications, Point 10, for instructions on assembly and installation.

5.2.4
Electric Connection of Electric Motor and Frequency Converter

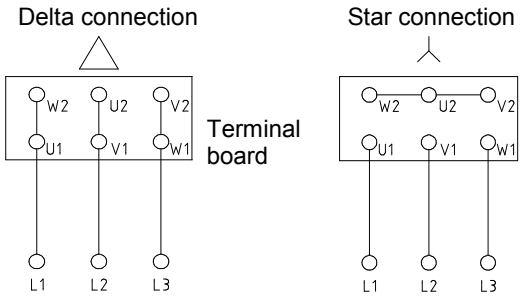
The electric connections must be established in accordance with the manufacturer's specifications, Point 10, as well as the safety specifications applying at the installation site. The mains voltage and frequency must match the ratings indicated on the type and rating plates.

- Switch on electric motor „direct-on-line“

CAUTION

An increased starting torque is necessary due to the clamping between the rotor and stator conveying elements. This means the electric motors that drive the progressive cavity pumps must always be switched on directly. As a rule, star-delta startup is not possible unless special arrangements have been made with seepex.

Three-phase cage motor



low . . . high . . .
. . . voltage indicated on rating plate

- Speed regulation via frequency inverter
  When progressive cavity pumps with frequency-controlled drives are started up problems may occur due to unsuitable or wrongly set frequency inverters. For this reason we recommend the purchase of the complete drive, including frequency inverter, from seepex, so that the frequency inverter can be tuned on the seepex test field along with a trial run.

  Ensure that customer-supplied frequency inverters comply with the starting torque and running power specified in the appended data sheet, Point 9.

CAUTION

Consult the appended document TI.FRU.01, see Point 9, for further information on the electric connection and the setting of frequency inverter and variable-speed motor.

5.2.5
Piping

5.2.5.1
Suction and Pressure Flanges

The position, nominal width and standard of the suction and pressure flange of the progressive cavity pump are specified in the dimension drawing, Point 9, and data sheet, Point 9. Always observe the rotational direction and flow direction defined in Point 6.2.5.

5.2.5.2
Piping Dimensioning

CAUTION

The pipe diameters on the suction and pressure sides must be dimensioned in accordance with the customer's pressure-loss calculation in such a way that the pressures specified in the data sheet, Point 9, are not exceeded. The nominal width of the suction pipe should at least match that of the pump suction flange.

5.2.5.3
Residue-free Piping

CAUTION

Prior to starting up the pump, ensure that all pipelines are free from foreign bodies. Installation residues (such as weld spatter, screws, steel chips etc.) will lead to damage of the **seepex** pump for which guarantee claims will not be accepted.

5.2.5.4
Tension-free Mounting

CAUTION

Pipelines and other components requiring to be connected with the pump must be mounted without stresses.

5.2.5.5
Fluid Connections for Optional Extras

Consult the data sheets, Point 9, for information regarding the optional extras, if any, that are fitted. The technical description is given under Point 9.

6.0
Commissioning/De-commissioning

6.1
Engineering Data

Details regarding all technical specifications and operating conditions are given in these operating instructions together with the data sheet, Point 9.

To guarantee the correct assignment of documentation to pump, the commission number on the
- cover sheet
- and data sheet of these operating instructions must match the commission number stated on
- the nameplate of the pump.

6.1.1
See Point 7.2.2 for Lubricant Chart

6.2
Preparation for Operation

6.2.1
Bearing

6.2.1.1
See Point 7.2.1.4 for pump bearing.

6.2.1.2
See manufacturer's documents, Point 10, for drive bearings.

6.2.2
Shaft Sealing

See document OM.SEA.__,.

6.2.3
Filling Up of Suction Side to Avoid Dry Running at Startup

CAUTION

Before switching on the pump, fill the suction-sided pump casing with fluid so that the first rotations will lubricate the conveying elements immediately. A small quantity of fluid is sufficient for lubrication; the subsequent operation of the pump is self-priming, even if an air column up to the liquid level remains.

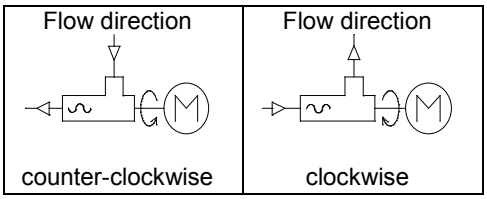
6.2.4
Electric/Hydraulic Connections

The connections are listed in the appended manufacturer's documents, Point 10.

The risk of exposure to electrical hazards must be ruled out. Always observe the safety regulations valid at the site of installation.

6.2.5
Checking Direction of Rotation

The rotational direction of the pump determines the flow direction of the conveying medium.



Prior to commissioning the rotational direction of the pump must be checked for compliance with the data sheet specification and the rotational direction arrow on the type plate of the pump.

6.3
Control and Monitoring Equipment

Where applicable, please refer to the associated documents, Point 10, for information on commissioning.

6.3.1
Performance Check

Any optional extras must be subjected to a performance check in conformity with the specifications by seepex or other manufacturers, see manufacturer's documents.

6.3.2
Setting

Unless already performed in the factory, setting must be carried out in accordance with the appended manufacturer's specifications, Point 10. Pay attention to the operating specifications in the data sheet.

6.4
Equipment for Protection of Persons

Machines must be fitted with mechanical protective devices complying with DIN EN 809.

- Moving or working parts must be protected against accidental contact.
- However, safety considerations demand it be possible at all times to check without hindrance whether the shaft seal is fully functional. A protective guard is necessary in this area only if components are mounted on the rotating, smooth shaft.

- If pumps are operated with an open suction flange/feed hopper, a suitable protective guard complying with DIN EN 294 must be mounted.
- Country-specific protective regu-lations must be observed at the site of installation. Prior to activation of the pump, check the proper function of all protective equipment.

6.5
Commissioning

6.5.1
Initial Startup/Re-starting

CAUTION

Every seepex progressive cavity pump is designed for the specific operating conditions documented in the data sheet. Commissioning is permissible only if the operating conditions conform with those indicated in the data sheet. Although the potential usages of the seepex pump are not confined to the specified operating conditions, any change in the original conditions must be checked and approved by seepex.

The right to make claims under the warranty agreement will be annulled if operating conditions are changed without prior approval by seepex.

6.5.2
Avoid Dry Running of Pump

CAUTION

The dry running of a pump increases the friction between rotor and stator, quickly causing an unacceptably high temperature to develop on the inner surface of the stator. This overheating leads to burning of the stator material and the total failure of the pump.

For this reason it is necessary to ensure that the suction-sided flow never dries up completely. If a continuous flow cannot be guaranteed for the plant, it is essential to fit the seepex dry running protection device TSE, available as an optional accessory.

6.5.3
Check Pressure at Suction and Pressure Flanges

6.5.3.1
Safeguard Pump Against Excessive Pressure at the Suction Flange

The seepex pump is designed to operate with the pressure at the suction flange (suction head or inlet pressure) specified in the data sheet. Deviating pressure conditions may lead to the failure and/or destruction of the shaft seal or entire pump.

For this reason the suction pressure specified in the data sheet must be guaranteed. Appropriate monitoring devices are oil-filled contact mano-meters that deactivate the pump.

6.5.3.2
Safeguard Pump Against Excessive Pressure at the Pressure Flange

The seepex pump operates according to the positive displacement principle. Operation of the pump against an excessive pressure caused by closed valves, by high pressure losses in the piping or by product sedimentation will lead to the destruction of the pump, drive, pipe work and/or downstream equipment. Every progressive cavity pump must therefore be protected against overpressure. Safety valves with bypass pipes or oil-filled contact manometers that disactivate the pump are appropriate protective devices.

6.5.4
Drive Engine

Consult the attached manufacturer's operating instructions, Point 10, for information on commissioning the drive engine.

6.5.5
Establish Clear Passage Through Pipelines

CAUTION

To prevent damage to the pump the unhindered flow of liquid must be guaranteed between the points of entry to and exit from the pipeline. For this reason, open all relevant valves etc. prior to activation of the pump.

6.6
De-commissioning

6.6.1
De-activation

The electric connections must be switched off and protected against accidental re-activation. Observe the safety regulations applying to the plants.

6.6.2
Stationary Pump

The pump and all optional equipment must be provided with the following protection modes while at a standstill:

- Frost protection
- Protection against solid particle deposits
- Protection against sedimentation of the medium
- Corrosion protection for parts in contact with the medium

We recommend that the pipeline and pump be emptied for the duration of the plant standstill. Following evacuation, the pump should be preserved.

6.6.3
Evacuation of the Pump

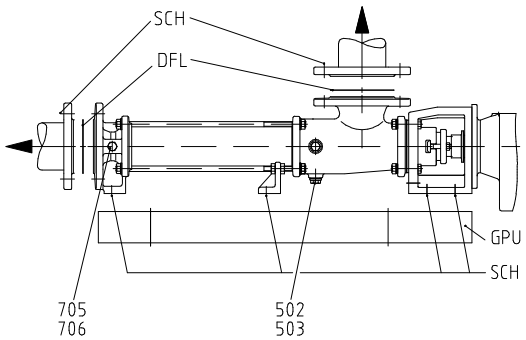
The pipeline must be evacuated on the suction and pressure side or shut-off directly behind the pump connections. Drain any residual liquid in the pump casing by opening/ removing the screwed sealing plugs (705) and (502), sealing rings (706) and (503). Casings without screwed plug must be evacuated by the connection branch (SAG and DRS). Refer to the data sheet and the sectional drawing of the associated operating instruction, Point 9, for information on the pump design. Conveying medium residues always remain in the rotor/ stator chambers and may run out during transport or disassembly of the pump. If conveying aggressive or hazardous media, therefore, wear appropriate protective gear during all installation work.

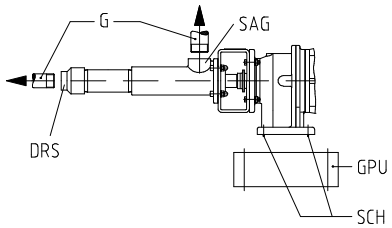
6.6.4
Disassembling the Pump

Dismantle the pipe work by removing the flange bolts (SCH) and flange seals (DFL) or the threaded connections (G).

Disassemble the pump together with the baseplate (GPU) or, as applicable, without the baseplate (GPU) following removal of the bolts (SCH) at the pump feet.

Block-design pumps with direct flange-mounted drive engine are liable to become unstable during disassembly. Stability can be restored by propping up the drive engine.





6.6.5
Preservation/Storage

The pump must be preserved prior to storage. Appropriate preservation measures must be agreed with **seepex**. Always state the pump commission number when making inquiries.

These operating instructions are valid for range MD (stainless steel-design) size 0015-24 to 012-24

7.0
Service and Maintenance

Contents
7.1 General Instructions
7.2 Service and Inspection
7.3 Dismantling
7.4 Re-assembly

The sectional drawing and parts list relevant for Points 7.3 and 7.4 can be found in Point 9.

7.1
General Instructions

A requirement for the reliable operation of any pump is service and maintenance in compliance with instructions. Maintenance personnel must therefore have access to these operating instructions and adhere to them meticulously. seepex will accept no liability for damages arising through non-observance of these operating instructions.

7.2
Maintenance and Inspection

7.2.1
Lubrication

7.2.1.1
Rotor and Stator

The rotor and stator are lubricated by the conveying medium.

7.2.1.2
Shaft Sealing

Consult document OM.SEA.__ for information on lubricating the shaft seal.

7.2.1.3
Pin Joint

The pin joints are filled with special grease and lubricated for the expected duration of service. The seepex joint grease specified in the index of these operating instructions should be used exclusively for any required maintenance work.

CAUTION

Usage of other grease types will lead to premature joint failure and render invalid any right to claims under guarantee.

7.2.1.4
Bearing of the Pump/Drive Engine

The bearing of the rotating pump parts is effected by the drive engine. Lubrication instructions are therefore included in the appended drive engine operating instructions.

7.2.2
Lubricant Filling Levels

Details are specified in the index.

7.2.3
Drives and Optional Extras

For maintenance and inspection specifications, see the appended manufacturer's documents.

7.2.4
Supervision during Operation

7.2.4.1
Shaft Sealing

See document OM.SEA.__.

7.2.4.2
Optional Extras

These must be monitored in accordance with the separate documents, Point 9/Point 10.

7.2.4.3
Drive Engines

These must be monitored in accordance with the separate manufacturer's documents, Point 10.

7.2.5
Preventive Measures

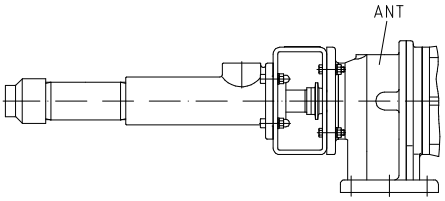
To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommends the acquisition of a set of wearing parts and a set of gaskets. The contents are listed in the document OM.WPS.40.

7.3
Dismantling the seepex Progressive Cavity Pump

Tools are required for dismantling and re-assembly. These tools are listed in Point 9 of the document OM.SPT.01.

The stator (601) and the rotating pump parts can be exchanged in site. The rotating pump parts can be dismantled as a complete rotating unit (RTE) (Point 7.3.4) or as individual components (Point 7.3.5).

Before commencing the dismantling of pump parts, safeguard the pump against tipping over or falling down by fastening it at the drive (ANT).

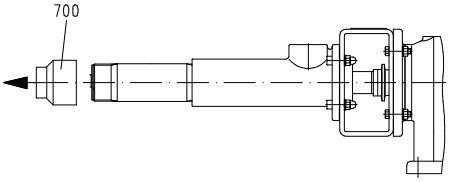


7.3.1
Pressure Flange (700) - Dismantling

Prior to dismantling see Point 7.3.2

CAUTION

Pressure branch (700) is glued in place with an adhesive of medium strength.
Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C.

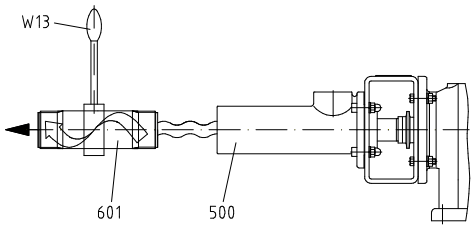


7.3.2
Stator (601) - Dismantling

- Maintenance tip:
  Disassembly of the stator can be made considerably easier by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap). Before removing the pressure flange (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably.
- Lock drive shaft against rotation.

CAUTION

Stator (601) is glued in place with an adhesive of medium strength. Therefore, to break the seal / adhesive compound it is recommended to heat upto a maximum of 80 °C. Dismantling the stator (601) with tool (W13/see Point 9).



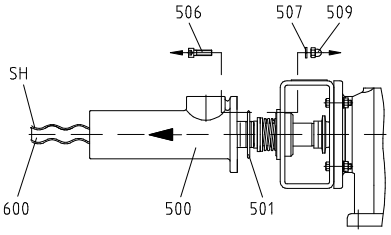
7.3.3
Suction Casing (500), Casing Gasket (501) - Dismantling

Fit the rotor (600) with a protective cover (SH).

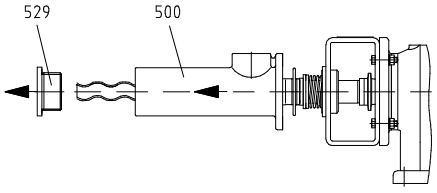
CAUTION

Suction casing (500) with reducing unit (529)
Reducing unit (529) is glued in place with an adhesive of medium strength.
Therefore, to break the seal /adhesive compound it is recommended to heat upto a maximum of 80°C.

Suction casing (500) **without** reducing unit (529)



Suction casing (500) **with** reducing unit (529)

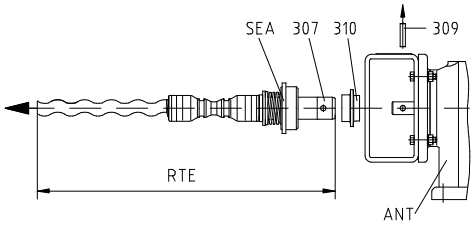


7.3.4
Rotating Unit (RTE) - Dismantling

CAUTION

Before dismantling the rotating unit it is essential to comply with the specifications in document OM.SEA.__ Shaft Seal Dismantling, see Point 9..

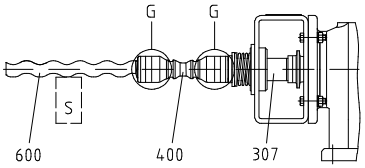
- Remove flushing connections at shaft seal housing (SEA).
- Raise/shift splash ring (310) and eject plug-in shaft pin (309) in horizontal direction.
- Remove rotating unit (RTE)/plug-in shaft (307), together with shaft seal (SEA) from output shaft of the drive (ANT). See Document OM.SPT.01, in Point 9 for tool (W10) used for pulling off.
- See in document OM.SEA.__ for removal of the shaft seal (SEA) from the plug-in shaft (307).



7.3.5
Rotating Pump Parts - Dismantling

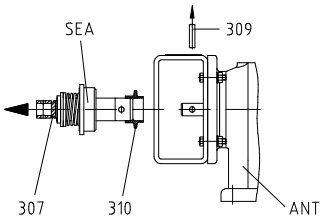
7.3.5.1
Rotor (600), Coupling Rod (400)

Detach the rotor (600) and coupling rod (400) from the plug-in shaft (307) by dismantling the joint (G) in accordance with Point 7.3.6.



7.3.5.2
Plug-in Shaft (307)

The plug-in shaft (307) is removed in the same way as the rotating unit (RTE), see Point 7.3.4.



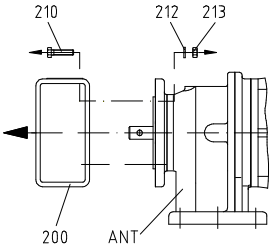
7.3.6
Dismantling of Joint

see document OM.PJT.04 Point 1.

7.3.7
Shaft Sealing

See document OM.SEA.__ for information on dismantling the shaft sealing.

7.3.8
Lantern (200)/Drive (ANT) - Dismantling

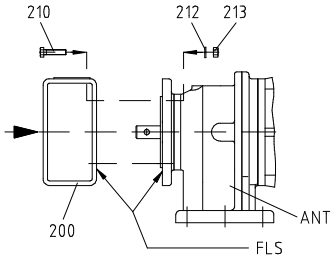


7.4
Re-assembly

Before commencing the re-assembly, fasten the drive (ANT) in such a way that it cannot tip over or fall down during the re-assembly of the drive and all pump components.

7.4.1
Lantern (200)/Drive (ANT) - Assembly

Clean flange bearing surfaces (FLS), centering diameter and output pivot of the drive (ANT).

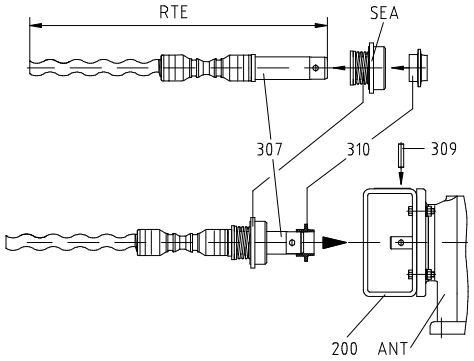


7.4.2
Rotating Unit (RTE) - Re-assembly

The rotating unit (RTE) has been assembled in accordance with the description in document OM.PJT.04

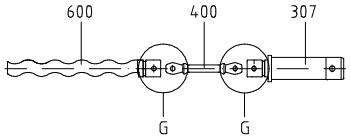
- Mount shaft seal (SEA) on plug-in shaft (307) in the way described in document OM.SEA.__, see Point 9.

- Moisten splash ring (310) and plug-in shaft (307) with joint grease (see index for type) and slide splash ring (310) onto plug-in shaft (307), observing the fitting position of the splash ring, (see lettering on the splash ring).
- Apply antiseize graphite petroleum to the output pivot of the drive (ANT) and slide on the rotating unit (RTE). Insert plug-in shaft pin (309) horizontally.
- Splash ring position (310)
  Outer edge of splash ring (310) has to occlude with outer edge of plug-in shaft (309).



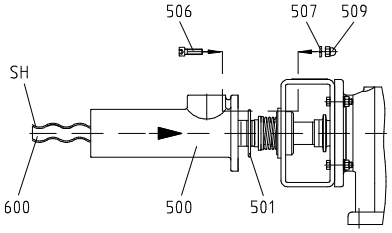
7.4.3
Rotating Pump Parts - Re-assembly

Prepare main components:
Prepare rotor (600), coupling rod (400) and plug-in shaft (307) as described in document OM.PJT.04 Point 2. to 2.3
Joint (G) re-assembly as described in document OM.PJT.04 Point 3.



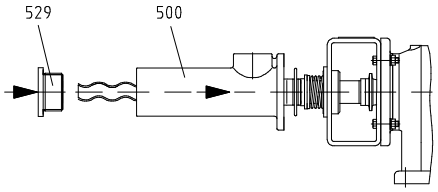
7.4.4
Suction Casing (500), Casing Gasket (501) - Re-assembly

Fit protective cover (SH) on rotor (600).
Assemble casing gasket (501) and suction casing (500).



CAUTION

Install reducing unit (529) to suction casing (500) with an adhesive of medium strength

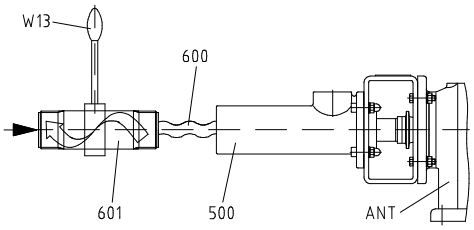


7.4.5
Stator (601) - Assembly / Re-assembly

Maintenance tip:
Disassembly of the stator can be facilitated considerably by first moistening the inner surface of the stator with antiseize agent (soft or liquid soap).
Before removing the pressure flanges (700), pour the antiseize agent into the opening between rotor and stator on the pressure flange side. Several clockwise (see Point 6.2.5) revolutions of the rotor will then distribute the antiseize agent over the inner surface of the stator and reduce the friction between rotor and stator considerably
Lock drive (ANT) shaft against rotation.

CAUTION

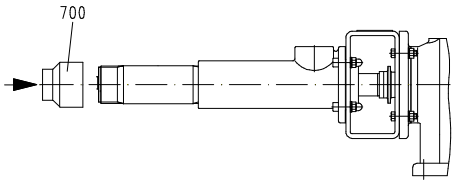
Install external thread of stator (601) with an adhesive of medium strength. Turn stator (601) to the right using a tool (W13/see Point 9), slip it onto rotor (600) and screw it into the suction casing (500) at the same time.



7.4.6
Pressure Flange (700) - Assembly

CAUTION

Install pressure branch (700) with an adhesive of medium strength



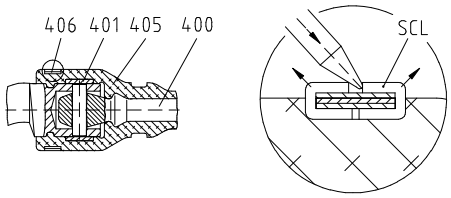
1.0
Dismantling of Joint

1.1
Holding Band (406) - Dismounting

Cut through loop (SCL) of the holding band (406) with a metal saw.

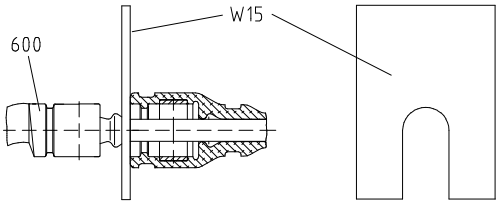
Wear protective goggles when squeezing out the two halves of the holding band loop (SCL).

Remove holding band (406).



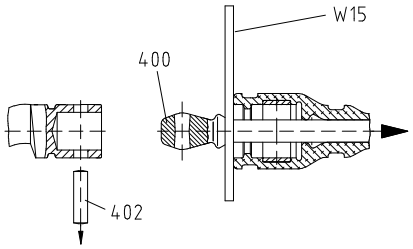
1.2
Rotor (600) - Dismantling

Withdraw universal joint sleeve (405) with retaining sleeve (401) in coupling rod direction and fix it by using a special maintenance tool (W15/see document OM.SPT.01)

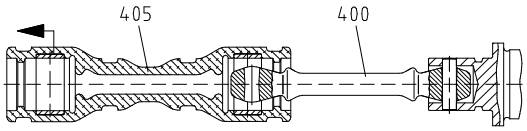


- **Separation of Joint**

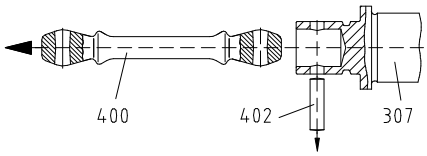
  Eject coupling rod pins (402). Pull coupling rod (400) out of joint top.



1.3
Universal Joint Sleeve (405)

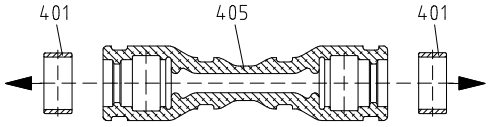


1.4
Coupling Rod (400)



1.5
Retaining Sleeve (401)

Remove retaining sleeve (401) from universal joint sleeve (405).



2.0
Prepare main components for Re-assembly

2.1
Rotor (600) - Preparation for Joint Assembly

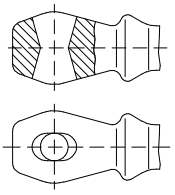
First remove any burr, flaws or similar defects from the rotor, then clean it.
If the hole for the coupling rod pin (402) has worn out, a new rotor (600) has to be installed.

2.2
Coupling Rod (400) - Preparation for the Joint Assembly

Clean coupling rod and check top drilling regarding wear.

CAUTION

If the top drilling shows wear, a new coupling rod will have to be used.



Correct top drilling

2.3
Plug-in Shaft (307) - Preparation for Joint Assembly

Remove any burr, flaws or similar defects from the plug-in shaft (307), then clean it.
If the hole for the coupling rod pin (402) has worn out, a new plug-in shaft (307) has to be installed.

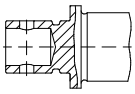
3.0
Joint - Re-assembly

CAUTION

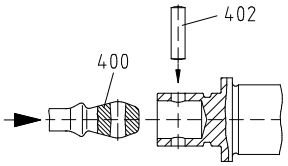
To ensure a perfect operation of the joints, coupling rod pins (402) and coupling rods (400) showing wear should be replaced. Refer to Point 2.2

3.1
Joint Grease (098)

Joint head at rotor (600) and plug-in shaft (307)
Fill joint head with joint grease (098).
(Regarding joint grease (098) refer to index of operating instruction)

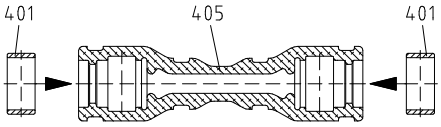


3.2
Coupling Rod (400)



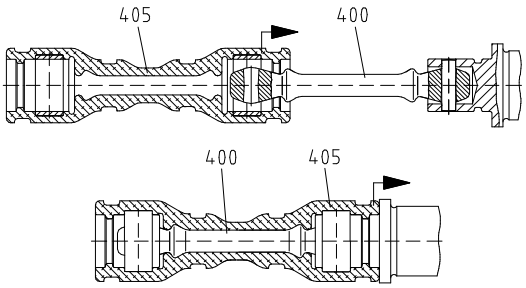
3.3
Retaining Sleeve (401)

Moisten both sides of retaining sleeve (401) with joint grease and insert this unit in universal joint sleeve (405).



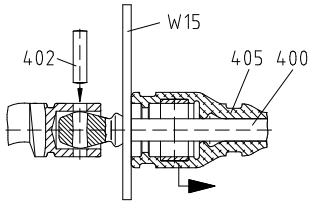
3.4
Universal Joint Sleeve (405)

Moisten surface of coupling rod (400) and inner surface of universal joint sleeve with joint grease Regarding joint grease (098) refer to index of operating instruction.
Slip universal joint sleeve (405) with fitted retaining sleeves (401) onto coupling rod (400) and joint head.



3.5
Rotor (600)

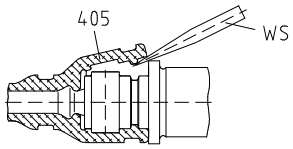
Push back universal joint sleeve (405) at rotor side towards coupling rod (400) and fix it using the relevant tool (W15/refer to document OM.SPT.01).



Slip universal joint sleeve (405) onto joint head.

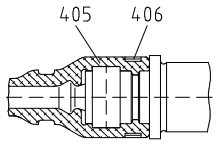
3.6
Universal Joint Sleeve - Deaeration

Deaerate interior space of joint at the side of plug-in shaft and rotor using relevant tool/screw driver (WS)



3.7
Holding Band Re-assembly

Mount holding band (406) using tool (W3/OM:SPT.01) as described in document OM.HBD.01.



Holding Band (HBD) - Assembly

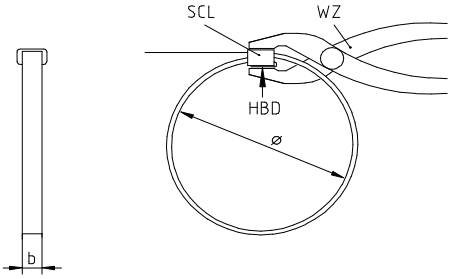
Tools required for the re-assembly, see document OM.SPT.01.

- Prepare holding band

  Only prefabricated double-band holding bands should be used. The diameter (∅) and in particular the breadth (b) of the holding band is matched to the universal joint sleeve.

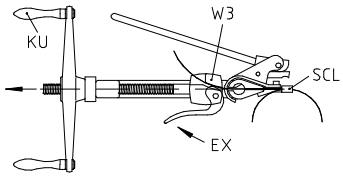
- Test holding band

  The bent holding band (HBD) must fit against the holding band loop (SCL), if necessary apply pressure with the tool/pliers (WZ).

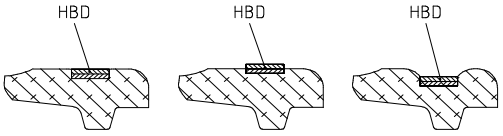


- Assembly of holding band

  Insert holding band in tool (W3/ see Point 9). Hold free end of holding band with control lever (EX), turn crank (KU) until the holding band is strained and fitting against the holding band loop (SCL). Carefully contract holding band until it fits inside the circular groove of the universal joint sleeve.



- Correct holding band tension (HBD)



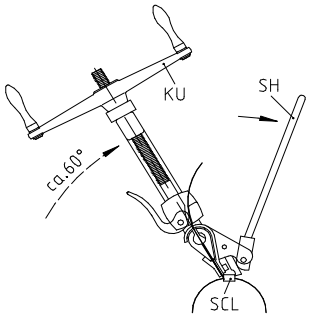
Correct
Holding band (HBD) has slightly con-tracted outer form of univers-al joint sleeve and is stuck in position.

Incorrect
Holding band (HBD) is too slack and liable to slip.

Incorrect
Holding band (HBD) is too tight. Universal joint sleeve will be damaged/sheared off.

- Folding back the holding band (HBD)

  Slowly swivel mounting tool upward by 60°, at the same time slackening the crank (KU) by approximately one half revolution. Swivel cutting lever (SH) forward until the pressure plate fits against the holding band loop (SCL).

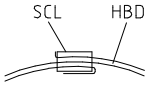


- Shearing off holding band (HBD) made of material AISI 304 and AISI 316

  A blow with the palm of the hand against the cutting lever (SH) causes the end of the holding band behind the loop (SCL) to be folded back and sheared off. If the holding band on the sheared off side is slightly raised as a result, it must be straightened carefully.

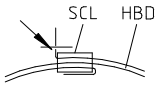
  CAUTION

  Never tap or hammer against the loop of the holding band (SCL), otherwise damage to the universal joint sleeve may occur.



- Shearing off holding band (HBD) made of Hastelloy C

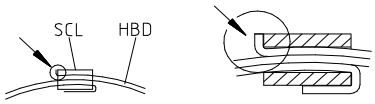
  The high strength of this material makes it impossible to shear off the holding band (HBD) with the cutting lever (SH). Once the end of the holding band is folded back, cut off the holding band (HBD), file off projecting edges and remove burr.



- Check after mounting of holding band

  The holding band must run all the way round the groove of the universal joint sleeve.

  The holding band (HBD) must be bent back and sheared off at the holding band loop (SCL) in such a way that the holding band (HBD) is unable to slip back through the holding band loop (SCL). If this has not been accomplished, then the holding band (HBD) must be replaced by a new one.



Breakdown											
pump has no suction	pump conveys irregularly	the conveying capacity is not achieved	pressure is not achieved	pump does not start	pump has seized or has stopped conveying	pump operates noisily	motor becomes too warm	the stator wears out early	shaft sealing leaks	seepex progressive cavity pumps will operate trouble-free if they are used in accordance with our data sheet (see item 9) and our operating and maintenance instructions:	
1	2	3	4	5	6	7	8	9	10		Reasons / Remedies
				X			X			a	Adhesion between rotor and stator excessive (as delivered). Lubricate (soft soap, genuine soap) between stator and rotor. Then turn the pump by means of the tool W2 .
X										b	Check rotational direction of the pump per data sheet and nameplate. In case of wrong direction, change wiring of motor.
X	X	X			X	X				c	Suction pipe or shaft sealing leak. Eliminate the leakage.
X	X	X				X				d	Suction head too high (item 6.5.3.1). Check suction head with vacuum gauge. Increase the suction pipe diameter and fit larger filters. Open the suction valve fully.
X	X	X								e	Viscosity of the liquid too high. Check and accommodate per data sheet.
		X		X			X			f	Wrong pump speed. Correct pump speed per data sheet.
	X	X								g	Avoid inclusions of air in the conveying liquid.
		X		X	X		X	X		h	Pressure head too high (point 6.5.3.2). Check pressure head with manometer. Reduce the pressure head by increasing the pressure pipe diameter or by shortening the pressure pipe.
X	X	X			X			X		i	Pump runs partially or completely dry (point 6.5.2). Check flow in the suction chamber. Install dry running protection TSE.
						X	X			j	Check coupling, possibly pump shaft is misaligned to drive. Check whether coupling gear is worn. Realign coupling. The coupling gear has perhaps to be replaced.
X		X								k	Speed too low. Increase the speed when high suction performances are required and when the liquid is very thin.
X	X					X				l	Speed too high. Reduce the speed when pumping products with high viscosities - danger of cavitation.
						X				m	Check the axial play in the coupling rod linkage. Check that the bush has been installed correctly see document OM.PJT.__.
X		X		X	X			X		n	Check for foreign substances in the pump. Dismantle the pump, remove foreign substances and replace worn parts.
X		X	X		X					o	Stator or rotor worn. Dismantle the pump and replace defective parts.
X		X			X	X				p	Joint parts worn. Replace worn parts and fill with special pin joint grease .
X		X			X			X		q	Suction pipework partially or completely blocked. Clean suction pipework.
X				X	X		X	X		r	Temperature of the pumping liquid too high. Excessive expansion of the stator. Check temperature and install rotor with diameter smaller than specified.
X		X		X			X		X	s	Gland packing too strongly tightened or worn. Ease or tighten stuffing box. Replace defective packing rings.
X				X	X			X		t	Solid contents and/or size of solids too large. Reduce pump speed and install perhaps a screen with suitable meshes. Increase fluid share.
X				X				X	X	u	When the pump is non operational the solids settle out and become hard. Clear and flush the pump immediately.
X				X	X			X	X	v	The liquid becomes hard when temperature falls below a certain limit. Heat the pump.
				X	X		X	X		w	Stator swollen and unsuitable for the pumped liquid. Select a suitable stator material. Use perhaps rotor with diameter smaller than specified.
						X			X	x	The bearing in the drive casing of the pump or in the drive engine is defective. Replace bearing.
									X	y	Mechanical seal defective. Check seal faces and O-rings. If necessary replace corresponding defective parts.

9.0
Auxiliary seepex documentation

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Inc.

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Inc.
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Enon, OH 45323
Phone (937) 864-7150
Fax (937) 864-7157
sales@seepex.net
www.seepex.com

Data Sheet 822813-822815 Page 1

seepex			
date	05/12/09	**commission no.**	822813-822815
customer	John Meunier		
seepex job no.	2109552	**item/denomination**	5357/0500 item 3
project	P.O. 015382		
3 of	**seepex progressive cavity pump** **type MD 012-12 / A6-A7-A7-F0-GA-X** **X = 0802, 17T, 20A7**		

conveying product			C.289.CH
denomination	Poly Aluminum Silicate Sulphate		
rate of solids	no advice	**viscosity**	ass < 500 cPs
size of solids	no advice	**pH-value**	ass. 5 – 9
specific gravity	ass. 1.0	**temperature**	32 – 113 F
composition	no advice		
remarks			

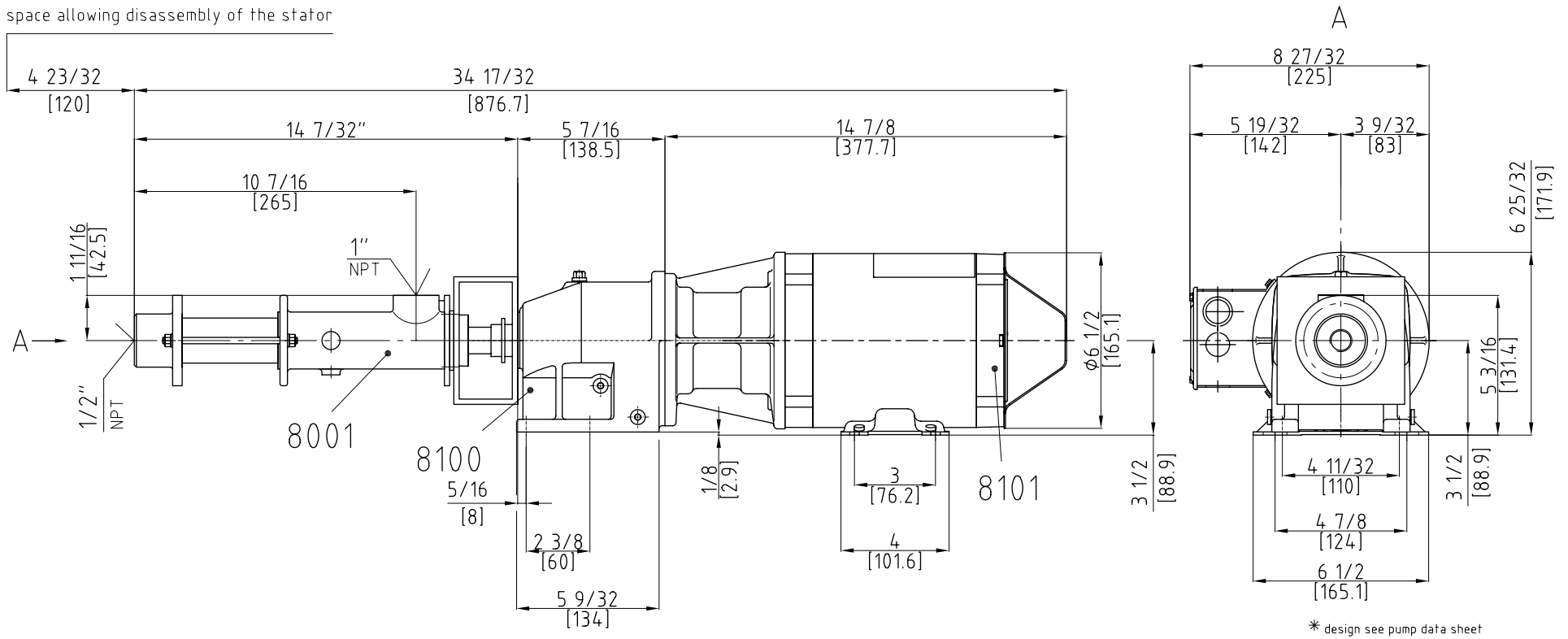
performance data	**nom.**	**min**	**max**	
conveying capacity	-	9	87	**l/h**
pump speed	-	25	242	**rpm**
press in press. branch	-	30	30	**psig**
press in suct. branch	flooded suction ass.			
differential pressure	30 **psi**	**operating torque**	1	**lb. ft.**
required drive power	0.01 **Hp**	**starting torque**	8	**lb. ft.**
remarks				

technical pump data			
range	MD	**kind of install.**	horizontal
size	012	**direction of rot.**	counter clockwise
pressure stage	12	**pos. of branch**	1

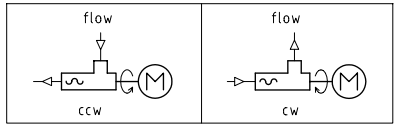
component	**material**	**design/option**
lantern	steel St 37-2	standard
suction casing	1.4408 / 316	standard
suction connection		1” NPT
pressure branch	1.4408 / 316	
pressure connection		1/2” NPT
joint	standard	standard
grease	30321	
joint seal	NBR - Perbunan	
coupling rod	1.6582	standard
rotor	1.4571 / 316Ti	standard
stator	NBR - Perbunan	TSE Design / Stainless steel sleeve
o-ring	FPM - Viton	
mechanical seal casing	1.4571 / 316Ti	Single Acting Mechanical Seal
mechanical seal		Burgmann MG1-025/G60 AQ1 VGG
plug-in shaft	1.4571 / 316Ti	drilled ϕ19x35
special designs	**TSE controller and pump end components**	

general operating data				
kind of operation	continuous operation - 8 h/day			
site of installation	indoor dry atmosphere			
remarks				
drive				
type	Gearbox			
make	Nord	**ratio**	**i=11.27**	
model	SK02XF-56C		**nom. / min- max**	
mounting position	B3/B5	**output speed**	155 / 25 - 242	**rpm**
flange dia	120 mm	**motor speed**	1750 / 282 - 2727	**rpm**
output shaft	716/M120-002C4	**frequency**	60 / 8 - 78	**Hz**
electric motor				
manufacturer	Marathon	**voltage**	3x 575 VAC	
nominal power	1/2 Hp	**rated frequency**	60 Hz.	
mounting position	B5	**protection**	IP55	
starting	direct at freq inv.	**thermal class**	F	
special	**Black Max Y555 (56H17T5311); Frame Size 56C**			
dry running protection device				
model	TSE – 115 VAC	**voltage**	110-115 VAC / 50/60 Hz.	
delivery scope				
remarks	TSE with NPT connections			
painting				
execution	standard			
color	Blue (RAL 5013)			
remarks				
packing				
packing type	Box			
marking	2109552			
documentation				
dimensional drawing no.	100116	**operating manual**	1 copy English	
sectional drawing no.	103-007_2			
shaft sealing sect. view	103-0GB/M120-0-129A4			
remarks				

additional accessories / special designs / remarks



* design see pump data sheet



all dimensions in [....] are in millimeters

Quant.	Denomination	Item	Material	Note	Weight / kg
1	motor: Marathon Y555	8101			18
1	gear: SK02XF-56C	8100			20
1	pump: MD/MDP 012-12 / 025-6L / 025-12T / 05-12T	8001			4

		Name	Day	Scale	Weight	Denomination
2009	Drawn	aon	15.05	◎▷ 1:5	42 kg	dimensional drawing
	Checked	sbe	18.05	EDP-No. 100116.dwg		Drawing-no. 103-C37/M120-C-704A4

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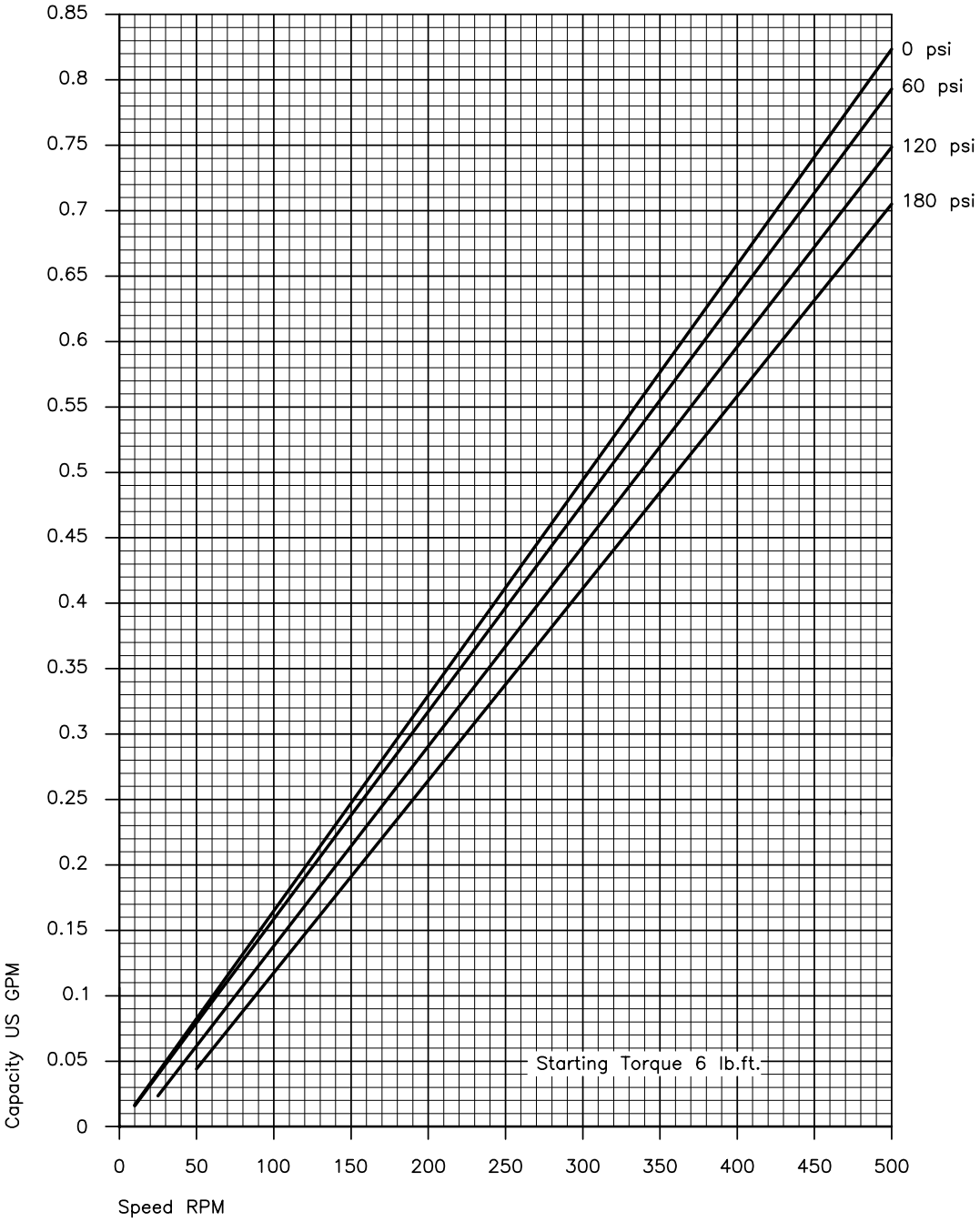
511 Speedway Drive
Enon, OH 45323
www.seepex.com

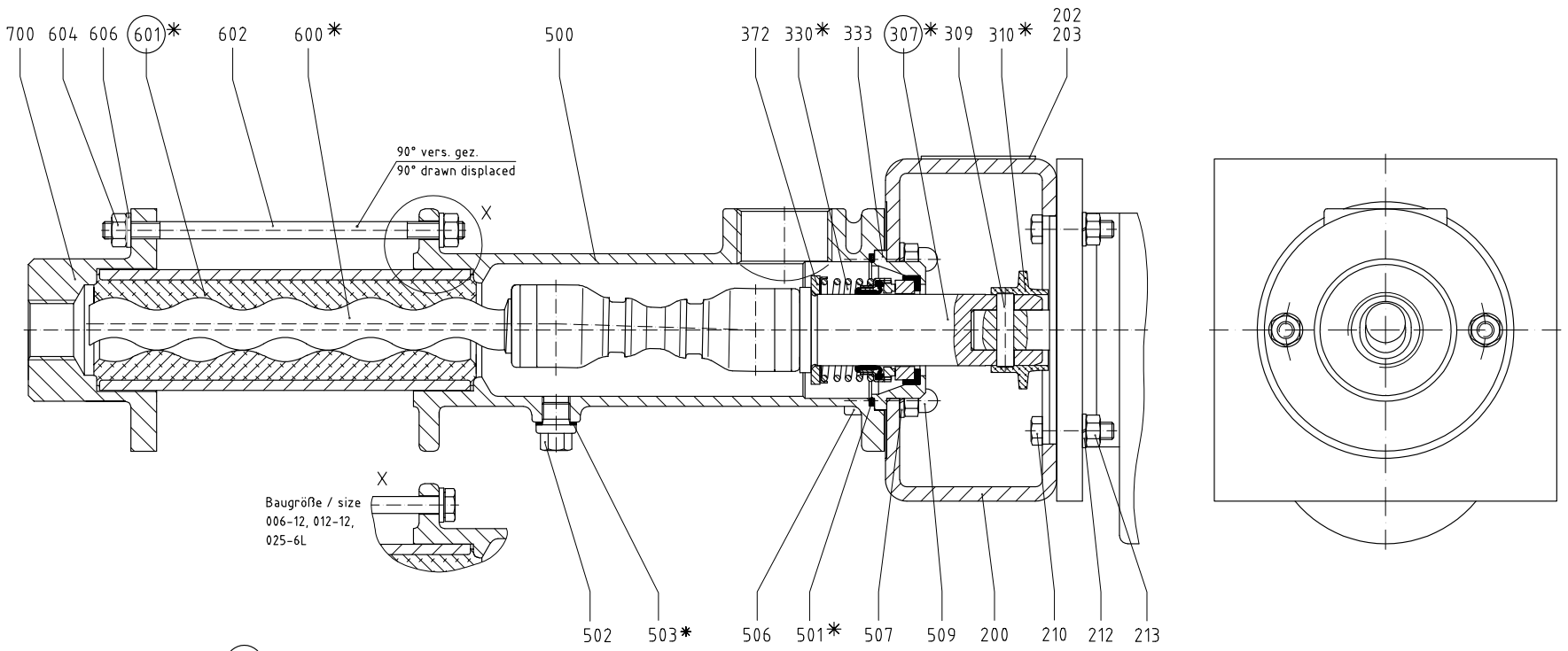
changes of dimensions reserved

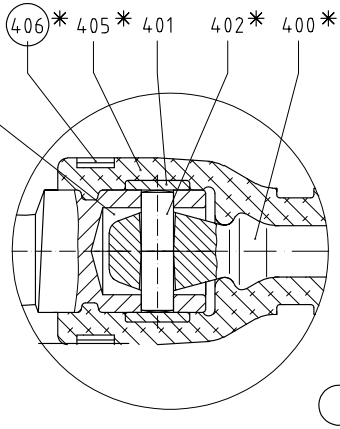
Characteristic Curves
Size
012–12



Values based upon water 68°F

CHA.012–12.s B 01.03us





seepex Gelenkfett

Typ und Füllmenge:
Betriebs- und Wartungsanleitung entnehmen

seepex joint grease

type and filling quantity:
see operating and maintenance instruction

Werkzeug
Betriebs- und Wartungsanleitung entnehmen

tool
see operating and maintenance instruction

* Verschleißteile und Dichtungen
Betriebs- und Wartungsanleitung entnehmen

Wearing parts and sealings
see operating and maintenance instruction

Werkstoff-Ausführung 4440-,
material-construction 4440-,

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

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seepex
GmbH + Co KG
Schornhölzstraße 344
46240 Bottrop
www.seepex.com

	Ausgabe Issue	Änderung Modification	Name Name	Datum Date

Maßstab/Scale: %

Werkstoff/Material

Gewicht/Weight

Bezeichnung/Denomination
Schnittzeichnung Baureihe "MD"
sectional drawing range "MD"
mit 2 Spannschrauben
with 2 tie bolts

	Name Name	Datum Date
Bearbeitet/Drawn	ov	18.08.1997
Geprüft/Checked	hue	18.08.1997
Normiert/Standard		
Gedruckt/Printed		

Zeichnungs-Nummer/Drawing-Number
103-007A2

EDV-Nr./EDP-No. L:\LFDZCHNG.245\24646

Ersatz für/Replacement for:

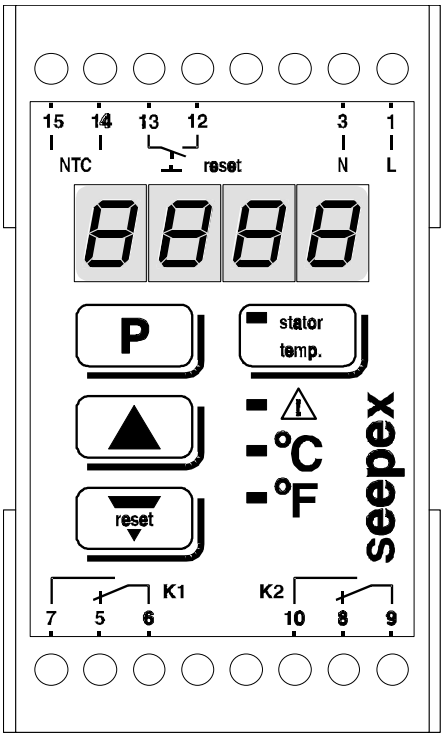
Ersetzt durch/Replacement by:

Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel
General tolerances for mass without individual tolerance entry DIN ISO 2768-average

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2
Roughness for surface finish indication DIN ISO 1302 Reihe 2

Stückliste
Parts List
Liste des pièces

Stck.	Pos.	DE **Baureihe MD** **Schnittzeichnung Nr. 103-007_2** **Benennung Stck. / Pos.**	GB **range MD** **sectional drawing No. 103-007_2** **denomination Qty. / item**	FR **série MD** **plan no. 103-007_2** **désignation Qté. / Poste**
1	200	Laterne	lantern	lanterne
2	202	Halbrundkerbnägel	round head grooved pin	rivet
1	203	Typenschild	type plate	plaque signalitique
4	210	6kt-Schraube	hexagon bolt	vis
4	212	Federring	spring washer	rondelle frein
4	213	6kt-Mutter	hexagon nut	écrou
1	307	Steckwelle	plug-in shaft	arbre à broche
1	309	Steckwellenbolzen	plug-in shaft pin	cheville pour arbre à broche
1	310	Spritzring	splash ring	bague de projection
1	330	Gleitringdichtung	mechanical seal	garniture mécanique
1	333	Gleitringdichtungsgehäuse	mechanical seal casing	carter de la garniture mécanique
1	372	Stützring	support ring	bague d'appui
1	400	Kuppelstange	coupling rod	barre d'accouplement
2	401	Gelenkhülse	retaining sleeve	douille d'articulation
2	402	Kuppelstangenbolzen	coupling rod pin	axe d'articulation
1	405	Manschette	universal joint sleeve	manchette
2	406	Halteband	holding band	collier de serrage
1	500	Sauggehäuse	suction casing	carter d'aspiration
1	501	Sauggehäusedichtung	casing gasket	étanchéité du carter d'aspiration
4	506	Zylinderschraube	socket screw	vis à tête cylindrique
4	507	Federring	spring washer	rondelle frein
4	509	6kt-Mutter	hexagon nut	écrou
1	600	Rotor	rotor	rotor
1	601	Stator	stator	stator
2	602	6kt-Schraube	hexagon bolt	vis
2	604	6kt-Mutter	hexagon nut	écrou
2	606	Scheibe	washer	rondelle
1	700	Druckstutzen	pressure branch	bride de refoulement
	098	seepex Gelenkfett Typ und Füllmenge: Betriebs- und Wartungsanleitung entnehmen	seepex joint grease type and filling quantity: see Operating and Maintenance Instruction	seepex graisse d' articulations sommaire pour type et quantité: voir Instructions de service et d'entretien
		Verschleißteile und Dichtungen: Betriebs- und Wartungsanleitung entnehmen	Wear parts and sealings: see Operating and Maintenance Instruction	pièces d'usure et étanchéités: voir Instructions de service et d'entretien
		Werkzeuge: Betriebs- und Wartungsanleitung entnehmen	Tools: see Operating and Maintenance Instruction	Outils: voir Instructions de service et d'entretien
		versetzt gezeichnet	drawn displaced	plan separé



CONTENTS:

1.0 General

1.1 Introduction

Progressive cavity pumps should generally be protected against dry-running. Due to the increased friction between the main conveying elements ie. rotor and stator, which occurs in the event of dry-running the pump, the temperature at the internal surface of the stator can quickly rise depending on the pump speed.
When exceeding the max. permissible operating temperature the internal surface of the stator will burn and cease operation. If this occurs the stator needs to be replaced. The possible malfunction of an progressive cavity pump can be easily avoided by using the patented dry-running protection device TSE.

1.2 Function

The general operating principle of the dry-running protection device TSE is to continuously monitor the temperature in the stator and to trip the pump when reaching a limit temperature. The temperature in the pump stator is compared with the pre-set trip temperature via a NTC temperature sensor, which is fitted in the stator of the pump as well as the TSE control device, which is positioned in the control panel. In case of dry-running of the pump and a temperature increase in the stator up to the pre-set switch-off value, two relays will switch.

The drive motor of the pump will be switched-off via the potential-free changeover contacts and a fault message will be released. After rectification of the cause of the dry-running and the cooling down of the stator, the fault message at the TSE device can be acknowledged and the pump can be switched on again.

By acknowledging the fault message an automatic re-connection without inspection and correction of the cause of the dry-running is avoided.

2. 0 Technical Data

2.1 Temperature Sensor

The NTC thermister is installed in a stainless steel protection sleeve in the stator of the pump.
Permissible Temperature Range: 0-150 ºC
Standard Resistance: 10 kOhm at 25 ºC

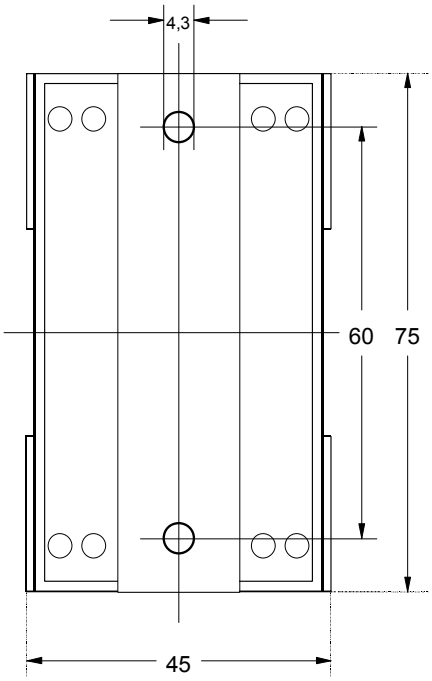
Temp. °C	Resistance Ohm	Temp. °C	Resistance Ohm
0	32.650	70	1.752
10	19.900	80	1.255
20	12.490	90	915
25	**10.000**	100	678
30	8.057	110	510
40	5.327	120	389
50	3.603	130	301
60	2.488	140	235

2.2 TSE Control Device for Installation in Control Panel

2.2.1 Technical Data

Type:	SGRTSE 230 AC, SGRTSE 115 AC, SGRTSE 24 AC, SGRTSE 24 DC
Temperature Range:	0-150 ºC
Input:	NTC temperature sensor 10 kOhm (at 25 ºC) with sensor breaking protection at - 25 ºC.
Relay Output: changeover	2 potential-free contacts (K1,K2), breaking capacity 500 VA at 110/230 V Ohmic load.
Deliverable Operating Voltage:	24V, 115V, 230V AC; 24V DC
Power Consumption:	max. 4VA
Sensor Circuit:	No load voltage max. 2.5 VDC Short circuit current 0.5 mA DC
Display at Device:	Fault/Dry Running Trip temperature Stator temperature
Operation at Device:	Adjustment of trip temperature. Reset of fault message.
Casing Material:	ABS
Fastening:	Mounting on standard rail 35 mm acc. to standards or screw fixings acc. to standards
Kind of Protection:	Casing IP 40 Terminals IP 20
Ambient Temperature:	0-50 ºC
Dimension:	45x75x110 mm (WxHxD)
EMV (89/336/EEC)	CE conform acc. to standards

2.2.2
Dimensions and Wall Mounting



Installation Depth = 110 mm

3.0
Electrical Connection of the TSE

3.1
Installation Instructions

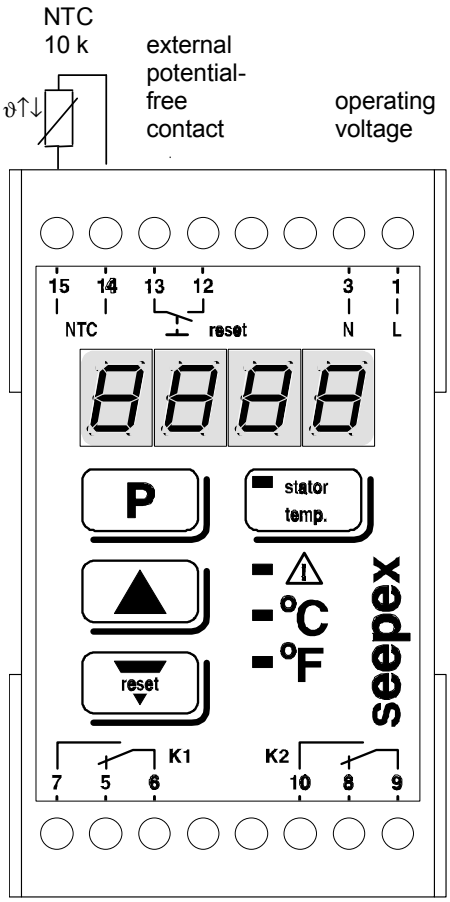
Prior to the connection and the commissioning of the device it has to be ensured that the supply voltage corresponds to the nominal voltage shown on the name plate. Nominal voltage fluctuations are permissible in the range of +/- 10 % of the device's nominal voltage.

The electrical connections have to be carried out in accordance with the wiring diagram and the regulation of the local EVV or the VDE directions.

In case of power fluctuations which lead to a malfunction of the device, adequate procedures have to be taken to avoid its reoccurrence. Alternatively these errors could be filtered out by an external supply filter. The device has to be provided with an internal supply filter.

Sensor leads have to be shielded. The shield has to be earthed at one end.

3.2
Connection Diagram of TSE Control Device



Should the TSE control device be reset after a dry-running from the control panel door or another remote position, a button ("make contact") at the terminals 12 +13 can be used.

3.3.
Relay Function

Actual temperature ‹ trip temperature
(trouble free operation)
Contacts 6 to 7 and 9 to 10 closed
Contacts 6 to 5 and 9 to 8 open

Actual temperature › trip temperature
(Malfunction/Dry Running)
Contacts 6 to 5 and 9 to 8 closed
Contacts 6 to 7 and 9 to 10 open

Relays K1 and K2 are switched parallel to each other and operate simultaneously. K1 is integrated in the motor contactor control serving as a switch-off provision. K 2 is optional as stand by for additional connection to a fault indicator or as a reserve to the process control computer.

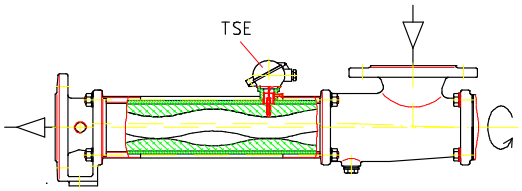
4.0
Procedures prior to Commissioning

4.1
Check Position of the Temperature Measuring Point at the Pump

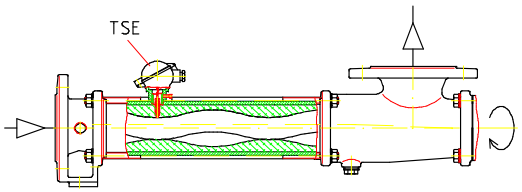
Considering the rotating direction and thus the conveying direction of the pump, the temperature sensor is fitted in our factory as per the following figures.

When changing direction of the pump and when replacing the stator the specified installation position of the temperature measuring point has to be checked. The temperature sensor must always be installed at the product entry side of the stator as the quickest temperature increase in case of dry-running will arise at this point.

4.1.1
Pump "counter clockwise rotation" - standard construction



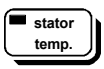
4.1.2
Pump "clockwise rotation" special construction



4.2
Function Check

After the electrical connection of the TSE and prior to the initial operation of the pump the following function check has to be carried out.

Switch-on control voltage at terminals 1 and 3 (Digital display at the TSE control device illuminates).



Press and hold button "stator temp" and read the temperature value.

If the shown temperature correspond to the ambient temperature in the pump the TSE is functioning correctly. In case of deviation proceed as per paragraph 7 - Malfunctioning.

4.3
Approximate Adjustment of Trip Temperature

The TSE control device is pre-set to a trip temperature of 50 ºC prior to leaving our factory. In order to achieve the shortest trip time after a dry-run and thus the max. protection of the pump stator, the trip temperature at the TSE control device has to be set as low as possible.

For the initial commissioning the temperature value pre-set in our factory should be maintained. Should the product have higher temperatures the value has to be adjusted to 20 to 30 ° C above the temperature of the conveying product.

Switch on control voltage. After self-check of the control device the actual pre-set temperature will show at the display.

Press and release button. Adjusting Mode is activated. The displays shows alternately "set" and the last set trip temperature.

Increasing the trip temperature - press button and release.
The adjusted temperature increases by + 1ºC. Press button and hold approx. 3 seconds in + 10 ° C steps.

Decreasing of trip temperature - press button and release.
The adjusted temperature decreases by - 1º C. Press button and hold approx. 3 sec. in - 10º C steps.

Press and release button. Return the unit to the operating mode. The adjusted trip temperature is transferred to a continuous memory and shown on the display.

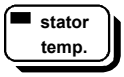
Note: During the adjusting mode, if a button is not pressed within 10 seconds the controller automatically returns to the operating mode and disregards any previous adjustment.

Following the above approximate instruction, the seepex pump can operate for a limited period of time (approx. 1 hour). Then a correction of the adjustment according to paragraph 5 - Fine Adjustment - has to be carried out.

5.0 Commissioning and Operation

5.1 Fine Adjustment of the Trip Temperature

Following the instruction for approximate adjustment in paragraph 4.3 the seepex pump has to operate for at least 30 to 60 minutes to allow the operating temperature in the stator become stable.



While the pump is in operation the temperature of the pump is shown on the display of the TSE controller by continuously pressing the button.

The final trip temperature has now to be set 10 ºC higher then the indicated operating temperature according to the instructions in paragraph 4.3.

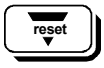
Attention

For all adjustments the max. product temperature occurring during operation has always to be considered. In case of a product temperature higher than 40 ºC, it always has to be checked if this is mentioned in the data sheet of the pump and has therefore been considered in the rotor/stator design. If the temperature shown on the data sheet does not correspond to the actual temperature, please contact seepex.

5.2 Resetting of the Control Device after Dry-Running

In the event of dry-running of the pump and temperature increase in the stator above the pre-set limit value, the installed relays trip and maintain locked in this position. After the pump has cooled down the remaining fault message (red LED) has to be acknowledged using one of the following procedures, so that the relay will be reset.

5.2.1



Press at the TSE control device for at least 1 sec.

5.2.2

Switch-off operating voltage at TSE control device (terminals 1-3).

5.2.3

With external contact (reset button, closed for at least 1 sec.)

5.3 Changeover of the Display from ºC to ºF.

Press and hold button for 10 secs. until display changes over.

The selected temperature units are shown via an LED next to the Symbol ºC or ºF.

6.0 Replacement of Stator

6.1 Order of Replacement Stator

When ordering a replacement stator for a seepex pump, please quote:

Stator drilled for TSE fitted with sensor sleeve in 1.4571.

If the pump is used to convey highly corrosive products where 1.4571 material is not resistant, a sensor sleeve made of 2.4610 (Hastelloy C4) has to be ordered.

Attention

The sensor sleeve is fitted in our factory. It is pre-set for operation and may not be adjusted.

6.2 Dismantling/Re-Assembly of the Connection Head and Temperature Sensor.

The following drawings apply:

- For TSE in elastic stators:
  Drawing No. 702-000/0000-0-009 __
  for pump sizes 006-12 and 025-6L.

  Drawing No. 702-000/0000-0-008 __
  for pump sizes 025-12 to 500-6LA.

- For TSE in fixed stators:
  Drawing No. 702-000/0000-0-005 __

6.2.1 Dismantling

Lift the cover of the connection head and disconnect wires of the temperature sensor. After having loosened the side screw slide the connection head off the threaded sleeve. Remove threaded sleeve from the stator and remove clamping ring, rubber ring and temperature sensor from sensor sleeve. The temperature sensor cannot be re-used and can thus be disposed off with the damaged stator.

6.2.2
Re-Assembly

The items mentioned in paragraph 6.2.1 have to be re-installed into the new stator. It is vital to consider the temperature measuring point when installing the stator (refer to paragraph 4.1).

Do not further adjust or change the sensor sleeve setting as this has already been done in our factory.

Remove protective pipe (protective transport packaging).

Push the thermistor sensor with clamping screws and rubber ring to the bottom of the sensor sleeve and adjust.

Screw the threaded sleeve with 2 O-Rings in the tapped hole at the stator.

When installing the connection head, the connection wires of the thermistor sensor must be threaded through the hole in the junction box. After fastening the connection head on the threaded stator barred, recannect wires and put the cover back onto the connection head.

7.0
Malfunction

7.1
General

Fault messages and switch-off of the pump without actual dry-running or overload might be caused by a defect in the temperature sensor wire, the TSE control device or other electrical switch devices.

The following reasons might have caused this error alarm at the TSE control device:

break of sensor or line
short circuit of sensor or line
measuring range (-25 ...150°C) is exceeded or remained under

The following procedure is recommended to check the TSE control device and the sensor circuit including temperature sensor:

7.2
Function Check of Sensor Circuit

Disconnect the temperature sensor wire at the TSE control device terminals 14 and 15 and connect a resistance measuring device (Multimeter or Ohmmeter). The measured electrical resistance must conform with the value in the table shown in paragraph 2.1 in accordance with the pump temperature. In case of deviations of the resistance value of more than 10% of the set value, measure the resistance at the connection head of the TSE at the pump. To do this the wire to the control device at the connection head of the pump needs to be removed. If the same deviations occur when measuring the resistance at the temperature sensor
directly at the pump, the temperature sensor is damaged and needs to be replaced (refer to paragraph 6.2 and 6.3).

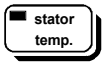
Should the resistance check at the temperature sensor show correct values, then damage to the connection cable or the connection terminal is the cause of malfunction.

7.3
Function Check of TSE Control Device

If an trouble-free sensor circuit has been determined during the testing according to paragraph 7.2, damage to the TSE control device is most likely. In order to carry out the check, remove the sensor wires at terminals 14 and 15 and connect a commercial deposited carbon or metal film resistor as per the following list.:

Resistance (Ohm)	Switching Temp. °C
10.000	25
5.600	39
2.200	63
1.000	87
560	107
220	143

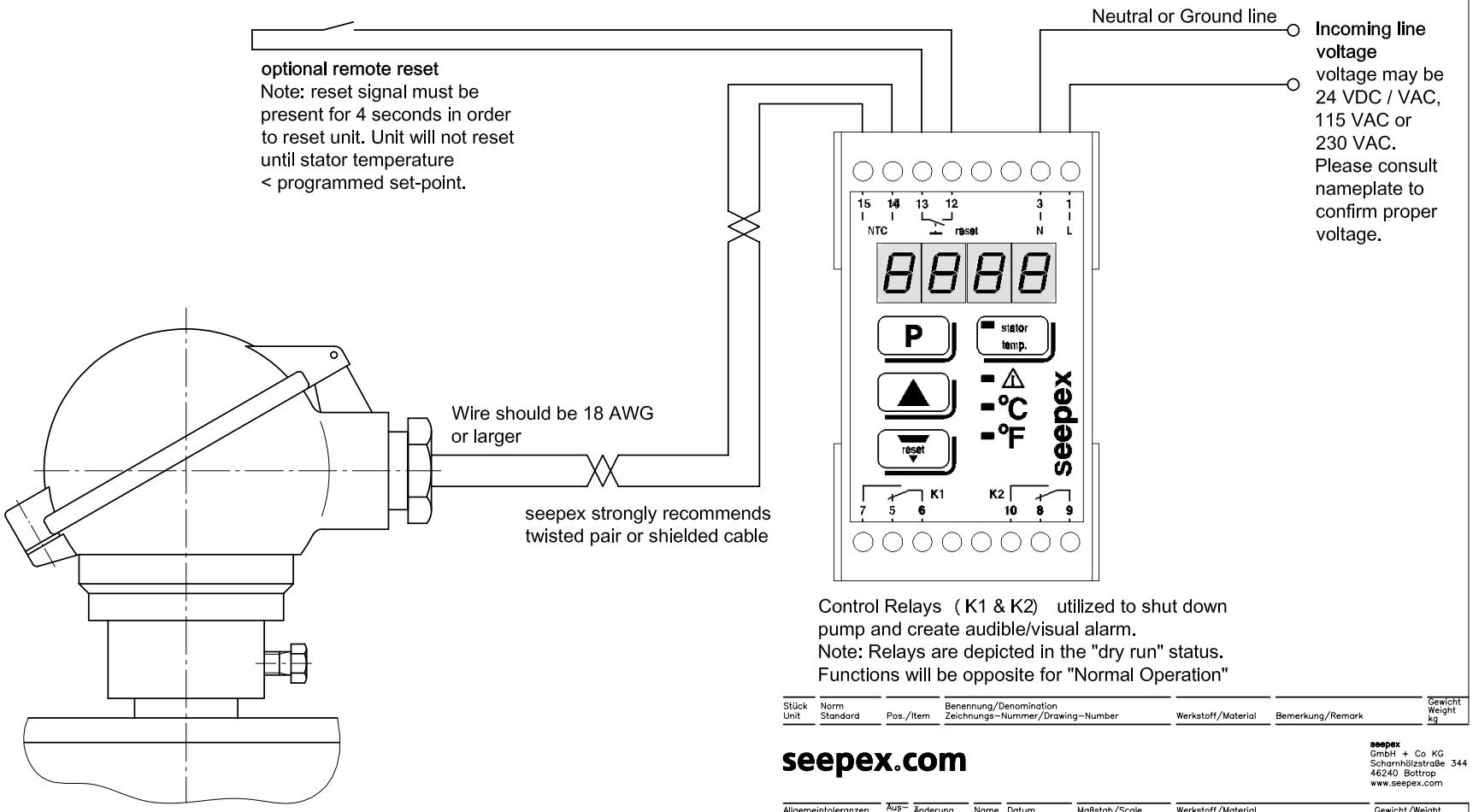
Switch-on control voltage at terminal 1+3
(Digital Display at the TSE device illuminates)



Press and hold button “stator temp.” and read the temperature value.

The shown value must correspond to the switch temperature, which applies to the resistance used. Should the shown value deviate by more than 5-10 ºC or should the value be absent at all, the TSE control device must be sent to seepex for repair.

TSE Control Unit



Control Relays (K1 & K2) utilized to shut down pump and create audible/visual alarm.
Note: Relays are depicted in the "dry run" status. Functions will be opposite for "Normal Operation"

TSE Pump side parts

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

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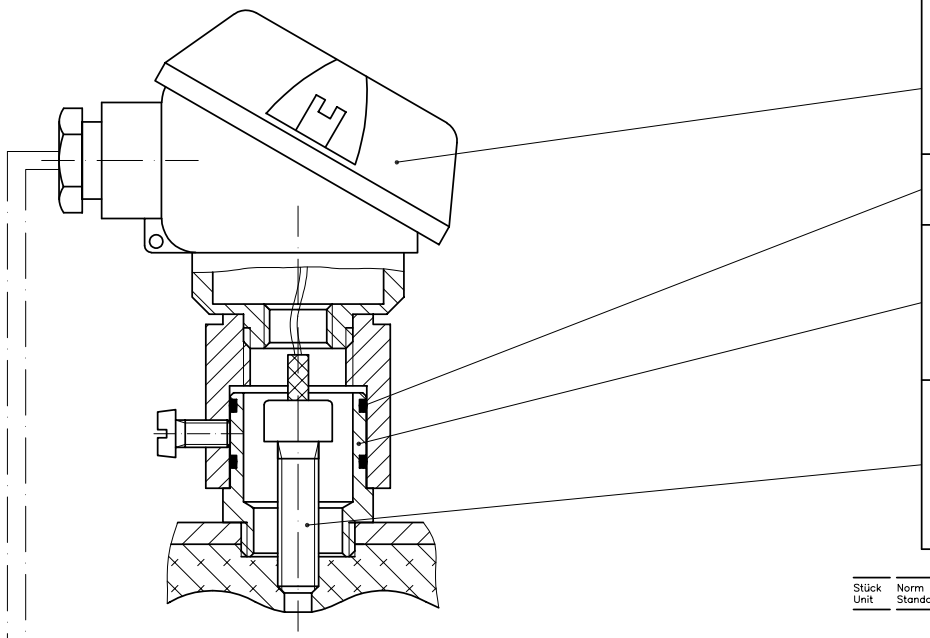
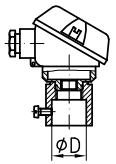
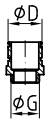
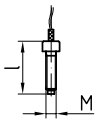
Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel General tolerances for mass without individual tolerance entry DIN ISO 2768-average	Ausgabe Issue	Änderung Modification	Name Name	Datum Date	Maßstab/Scale %	Werkstoff/Material	Gewicht/Weight
					Bezeichnung/Denomination: Simplified wiring instruction for seepex TSE dry running protection (seepex Inc.)		

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2 Roughness for surface finish indication DIN ISO 1302 Reihe 2		Name Name	Datum Date	Zeichnungs-Nummer/Drawing-Number
	Bearbeitet/Drawn	hof	20.03.2006	711-TSE/0000-0-005A3
	Geprüft/Checked	ham	20.03.2006	EDV-Nr./EDP-No. 75657.dwg
	Normiert/Standard			Ersatz für/Replacement for: / Ersetzt durch/Replacement by:
	Gedruckt/Printed			



Elektrischer Anschluß siehe TSE-Betriebs- und Montageanleitung
Electric connection see TSE operating and assembly instructions

			Pumpen-Baugröße pumpe size
			006-12 006-24 012-12 012-24 025-6L
	Anschlußkopf connection head	Pos. item	650
		Typ type	MA
		ØD	20.1+0.2
	O-ring o-ring	Pos. item	651
		Größe size	ø16x1.5
	Gewindehülse screw socket	Pos. item	652
		ØD	ø19.9-0.1
		ØG	G3/8"
	Thermistor- Fühlerschraube thermistor sensor screw	Pos. item	653
		Größe size	F6-25
		M	M6
		l	31

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel

General tolerances for mass without individual tolerance entry DIN ISO 2768-average

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2

Roughness for surface finish indication DIN ISO 1302 Reihe 2

Ausgabe Issue	Änderung Modification	Name Name	Datum Date
B	überarbeitet	hof	17.06.1996
C	Baugröße 01-48	ov	23.09.1998
D	01-48 entfällt	hof	15.12.1998
E	Nachtrag 025-6L	hof	06.01.1999
F	025-12T,05-6LT	hof	29.04.2002
G	025-12,05-6LT raus	hof	18.02.2003

	Name Name	Datum Date
Bearbeitet/Drawn	hof	17.06.1996
Geprüft/Checked	wgr	18.06.1996
Normiert/Standard		
Gedruckt/Printed		

Maßstab/Scale 1:1

Werkstoff/Material

Gewicht/Weight

Bezeichnung/Denomination

TSE / Pumpenseitige Teile
TSE / pumpsided parts
für elastische Statoren / for elastic stators

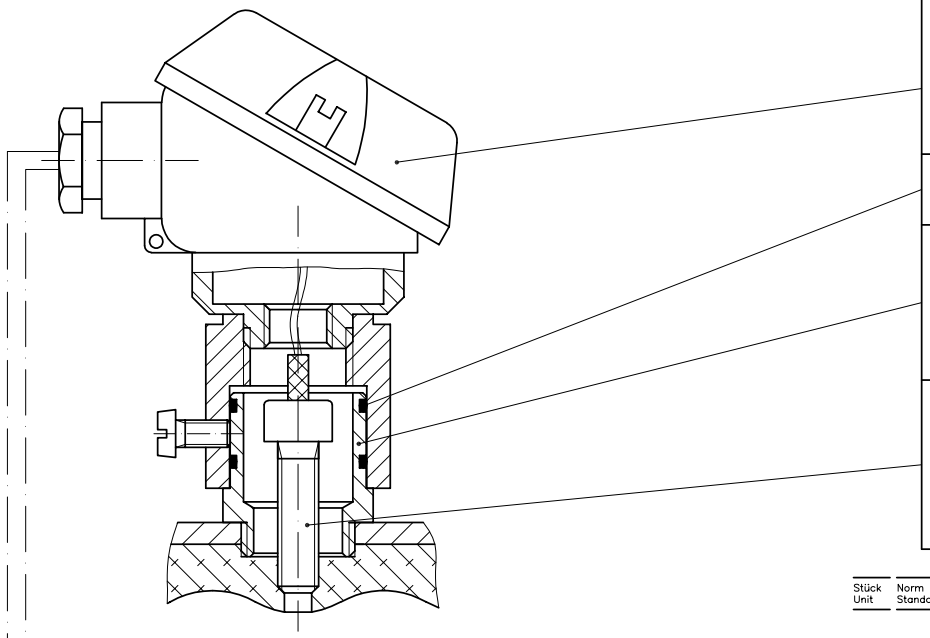
Zeichnungs-Nummer/Drawing-Number

702-000/0000-0-009G3

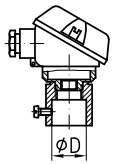
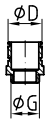
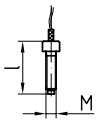
EDV-Nr./EDP-No. 14998.dwg

Ersatz für/Replacement for: A2428-4

Ersetzt durch/Replacement by:



Elektrischer Anschluß siehe TSE-Betriebs- und Montageanleitung
Electric connection see TSE operating and assembly instructions

			Pumpen-Baugröße pumpe size
			006-12 006-24 012-12 012-24 025-6L
	Anschlußkopf connection head	Pos. item	650
		Typ type	MA
		ØD	20.1+0.2
	O-ring o-ring	Pos. item	651
		Größe size	ø16x1.5
	Gewindehülse screw socket	Pos. item	652
		ØD	ø19.9-0.1
		ØG	G3/8"
	Thermistor- Fühlerschraube thermistor sensor screw	Pos. item	653
		Größe size	F6-25
		M	M6
		l	31

Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg

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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel

General tolerances for mass without individual tolerance entry DIN ISO 2768-average

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2

Roughness for surface finish indication DIN ISO 1302 Reihe 2

Ausgabe Issue	Änderung Modification	Name Name	Datum Date
B	überarbeitet	hof	17.06.1996
C	Baugröße 01-48	ov	23.09.1998
D	01-48 entfällt	hof	15.12.1998
E	Nachtrag 025-6L	hof	06.01.1999
F	025-12T,05-6LT	hof	29.04.2002
G	025-12,05-6LT raus	hof	18.02.2003

	Name Name	Datum Date
Bearbeitet/Drawn	hof	17.06.1996
Geprüft/Checked	wgr	18.06.1996
Normiert/Standard		
Gedruckt/Printed		

Maßstab/Scale 1:1

Werkstoff/Material

Gewicht/Weight

Bezeichnung/Denomination

TSE / Pumpenseitige Teile
TSE / pumpsided parts
für elastische Statoren / for elastic stators

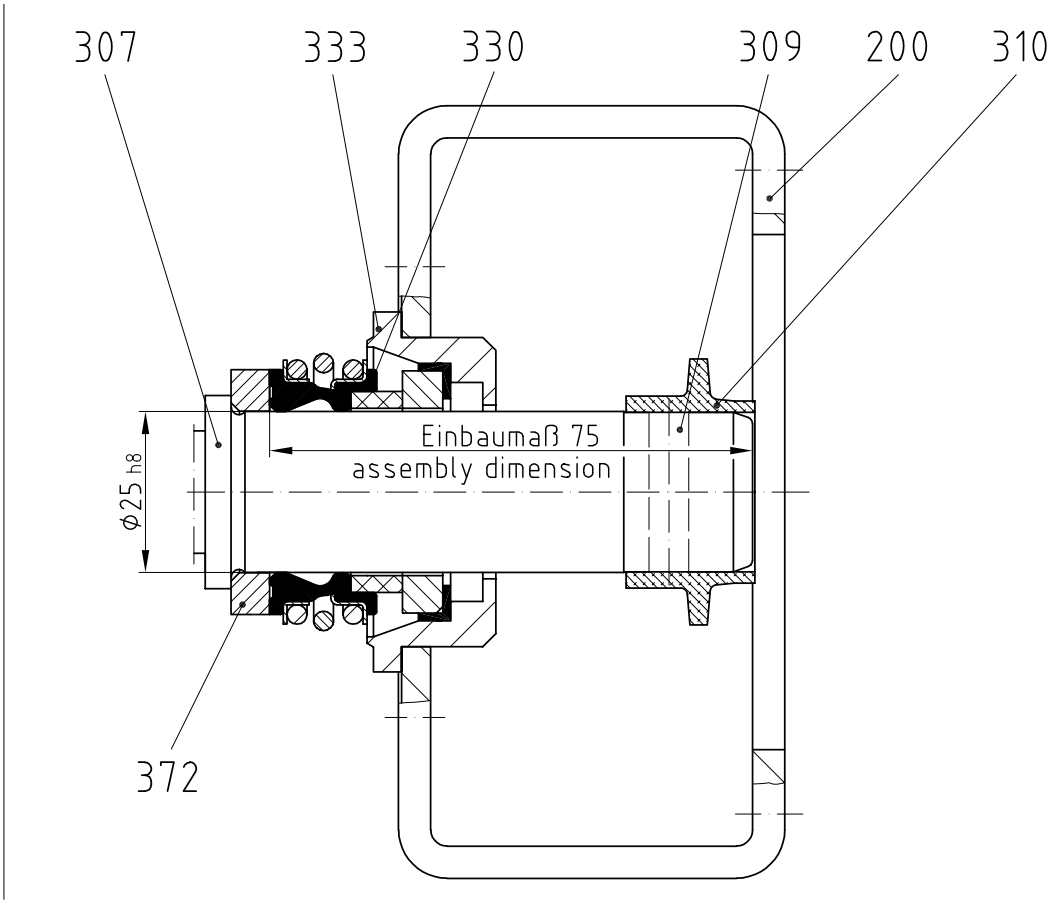
Zeichnungs-Nummer/Drawing-Number

702-000/0000-0-009G3

EDV-Nr./EDP-No. 14998.dwg

Ersatz für/Replacement for: A2428-4

Ersetzt durch/Replacement by:



Stück Unit	Norm Standard	Pos./Item	Benennung/Denomination Zeichnungs-Nummer/Drawing-Number	Werkstoff/Material	Bemerkung/Remark	Gewicht Weight kg
1		372	Stützring / support ring 062-372/M120-0-060A4			
1		333	GLRD-Gehäuse / mechanical seal casing 103-333/M120-0-005A4			
1		330	GLRD / mechanical seal MG1/ϕ25-G60		Fabrikat / make : Burgmann	
1		310	Spritzring / splash ring 062-310/M120-0-001A4			
1		309	Steckwellenbolzen / plug-in shaft pin 062-309/M120-0-001A4			
1		307	Steckwelle / plug-in shaft 103-307/M120-0-304E4			
1		200	Laterne / lantern 103-200/M120-0-____			

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Allgemeintoleranzen für Maße ohne einzelne Toleranzeintragung DIN ISO 2768-mittel

General tolerances for mass without individual tolerance entry DIN ISO 2768-average

Rauheit für Oberflächenzeichen DIN ISO 1302 Reihe 2

Roughness for surface finish indication DIN ISO 1302 Reihe 2

Ausgabe Issue	Änderung Modification	Name Name	Datum Date

	Name Name	Datum Date
Bearbeitet/Drawn	hgg	28.05.2004
Geprüft/Checked	kno	28.04.2004
Normiert/Standard		
Gedruckt/Printed		

Maßstab/Scale: 1:1 ◎▷

Werkstoff/Material:

Gewicht/Weight:

Bezeichnung/Denomination

GLRD Schnittzeichnung
mechanical seal sectional drawing

Burgmann MG1/ϕ25/G60 für Sondermaterial / for special material
mit erhöhter Vorspannung/ with increased pre-clamping

Zeichnungs-Nummer/Drawing-Number: 103-0GB/M120-0-129A4

EDV-Nr./EDP-No. 62810.dwg

Ersatz für/Replacement for:

Ersetzt durch/Replacement by:

1.
General

- Please take the appertaining drawing from respective pump data sheet.

- The mechanical seal is suitable for the operating conditions indicated in the pump data sheet. Modifications are only admissible after the customer has consulted with **seepex**. Additionally, attention must be paid to the manufacturer's operating manual.

2.
Safety

Any mode of operation impairing the operating safety of the mechanical seal has to be avoided.

The operator is advised to consider the possible effects on the environment which could be caused by a defective mechanical seal and what additional measures must be taken to protect the environment and the public.

The pump must be mounted and operated in such a way that operation with a defective mechanical seal will not result in injury or harm to the public and that any leakage can be safely and properly dealt with.

Mechanical seals are often used to seal hazardous material (chemicals, drugs, etc.). It is essential that rules pertaining to the handling of hazardous materials are adhered to.

Modifications effected by the customer himself and changes influencing the safety of the mechanical seal are not allowed.

3.
Emissions

A mechanical seal is a dynamic seal and leakage is unavoidable.

ATTENTION

Components that may contact leakage must be resistant to corrosion or be protected accordingly.

Mechanical seal leakage must be drained in a safe and proper manner.

1.0
General

- Please take the appertaining drawing from respective pump data sheet.
- The mechanical seal is suitable for the operating conditions indicated in the pump data sheet. Modifications are only admissible after the customer has consulted with seepex. Additionally, attention must be paid to the manufacturer's operating manual.

2.0
Safety

Any mode of operation impairing the operating safety of the mechanical seal has to be avoided.

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3.0
Emissions

A mechanical seal is a dynamic seal and leakage is unavoidable.

ATTENTION

Components that may contact leakage must be resistant to corrosion or be protected accordingly.

Mechanical seal leakage must be drained in a safe and proper manner.

4.0
Flushing or circulation of single-acting mechanical seals

Single-acting mechanical seals contacting the conveying liquid require no additional flushing or a circulation pipe because sufficient flushing and heat exchange occurs around the seal due to the conveying liquid.

However, in particular cases, a direct flushing pipe can be installed into the flushing connection on the mechanical seal housing.

5.0
Commissioning

Regardless of the pump's operating status, the conveying medium to be sealed must always be in liquid form at the mechanical seal. This particularly applies to the pump's commissioning and its placing out of service.

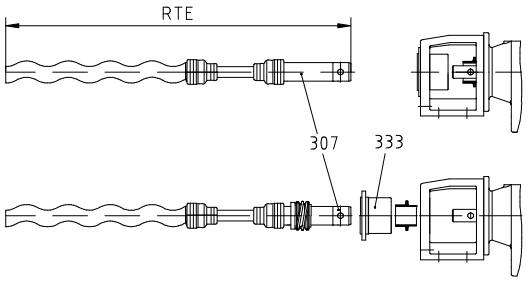
6.0
Maintenance

When operating the pump according to the instructions, no maintenance is required.

**7.0
Disassembly / Reassembly**

**7.1
Disassembly**

- Remove flushing connections at shaft seal housing (SEA).
- Lift / displace splash ring (310) and eject plug-in shaft pin (309) horizontally.
- Withdraw rotating unit (RTE) together with shaft seal parallel from output shaft of drive and avoid chocking.
- Clean plug-in shaft (307) and remove burrs etc., which may damage sealing elements. Moisten plug-in shaft (307) with slip additive (diluted fluid soap).
- Loosen axial safety device of mechanical seal (330 or 372) and withdraw mechanical seal (330) from plug-in shaft (307).
- Remove mechanical seal housing (333) from lantern (200).
- Press counter-ring of mechanical seal with o-ring out of mechanical seal housing (333).



**7.2
Reassembly**

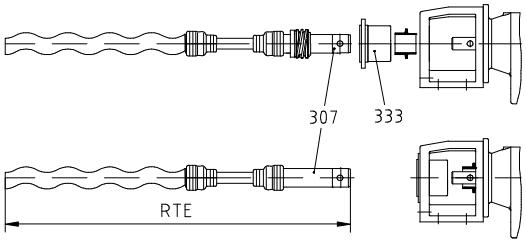
ATTENTION

Mechanical seals are precision parts of high quality. Therefore, the installation must be effected with care. Gentle handling and extreme neatness are essential.

- Clean mechanical seal housing (333)
- Evenly press counter-ring with o-ring into mechanical seal housing (333). To facilitate assembly, the o-ring should be moistened with a lubricant (diluted fluid soap).

ATTENTION

- Oil or grease must not be used to facilitate assembly.
- Install mechanical seal housing (333) to lantern (200) and onsure correct position of flushing connections.
- Remove plug-in shaft (307), burrs and roughness and clean the unit.
- Check / adjust set dimension of mechanical seal on plug-in shaft (307). Moisten plug-in shaft (307) and elastomer parts of mechanical seal with lubricant (diluted fluid soap).
- Slip mechanical seal onto plug-in shaft (307) as far as set ring.
- Lubricate drive shaft (ANT) with antiseize graphite petroleum.
- Moisten splash ring (310) and plug-in shaft (307) with pin joint grease, (for type, please see index) and slip splash ring (310) onto output shaft of drive. Note installating position of splash ring and refer to description on splash ring.
- Move rotating unit (RTE) through mechanical seal housing (333) and splash ring (310) and slip splash ring (310) onto output shaft of drive (ANT). Push in plug-in shaft pin (309) in horizontal position.
- Position of splash ring:
  Collar of splash ring shall be fitted in a distance of about 0.5 mm to lantern (200).

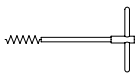
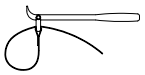
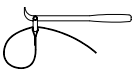


Range: MD, MDF

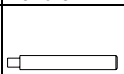
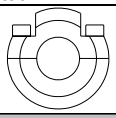
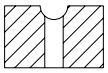
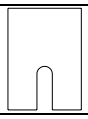
To avoid the expenses incurred by lengthy stop periods of the pump, seepex recommend the acquisition of a set of wearing parts and a set of gaskets.
The table below shows the contents of these sets.

Part designation	small set of wearing parts	big set of wearing parts	set of gaskets	Item number acc. to sectional drawing of pump and parts list
	Number			
Rotor		1		600
Stator 2)	1	1		601
Universal joint sleeve		1		405
Coupling rod pin		2		402
Guide bush 2)		-		-
Coupling rod		1		400
Coupling rod bush 2)		-		-
Casing gasket			1	501
Holding band, small 2)		-		-
Holding band, large 2)		2		406
Packing ring set 2) 3)	1	1		301
Mechanical seal 3)			1	330
Sealing ring			4	571, 726
Splash ring			1	310
O-ring			1	572
Plug-in shaft 2)		1		307
Special joint grease				098 1 cart. 300 gr (c. 315cm³) grease quantity per pin joint, see tech.
Tool				Essential for assembly, see Point 9, document OM.SPT.01

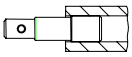
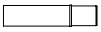
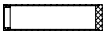
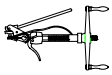
2) see tools Point 9., document OM.SPT.01
3) Item 330 and item 301 (as an alternative) depend on the pump design. With regard to the pump design, refer to the appertaining data sheet and the sectional drawing. See Point 9.

	Allgemeine normierte Werkzeuge / Standardized tools						
Werkzeug Nr. tool No.	W1	W2	W5	W6	W9	W11	W13
zur Montage von: tool for mounting of:	Packung packing	Stator stator	Gelenk joint	Lager bearing	allgemein general	Mutter für Teflon-manschette nut for teflon universal joint sleeve	Stator Stator 1)
Benennung: denomination:	Packungszieher packing lever	Ketten-Rohrzange + Ersatzkette chain pipe wrench +replacement chain	Durchschlag drift	Bolzen pin	Montierhebel mounting lever	Bandschlüssel strap wrench	Bandschlüssel strap wrench
Baugröße **size**							
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	PKZ XX 000 0000 0 X35M0	**Siehe W 13** **see W 13**					WKZ BDS 027 0 430
025-12, 025-24 05-12, 1-6L	PKZ XX 000 0000 0 X0FQ0	KRZ XX Z55 0250 0 00000 KEZ XX Z55 0250 0 00000	DHS XX 020 0000 0 A2620		2 Stück 2 pieces MHL XX SA 610		
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L			DHS XX 050 0000 0 A2620	BLZ XX 020 0008 0 A2619		WKZ BDS 027 0 430	
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	PKZ XX 000 0000 0 XOHV0		DHS XX 050 0000 0 A2620	BLZ XX 020 0010 0 A2619			
5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48		KRZ XX Z55 0300 6 00000 KEZ XX Z55 0300 6 00000	DHS XX 100 0000 0 A2620	BLZ XX 020 0010 0 A2619			
14-12, 26-6L, 40-6LT 10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	PKZ XX 000 0000 0 XA01A		DHS XX 120 0000 0 A2620	BLZ XX 025 0012 0 A2619			
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R 5-48		KRZ XX Z55 0300 8 00000 KEZ XX Z55 0300 8 00000	DHS XX 160 0200 0 A2620	BLZ XX 030 0012 0 A2619			
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48 200-6L			DHS XX 200 0200 0 A2620	BLZ XX 035 0012 0 A2619			
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48		KRZ XX Z55 0301 2 00000 KEZ XX Z55 0301 2 00000	DHS XX 240 0250 0 A2620	BLZ XX 040 0015 0 A2619			
240-12, 300-12T 130-18, 130-24 35-48/70-48							

1) Gilt nur für Pumpen in Edelstahl Ausführung / only valid for pumps in special steel design

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. **Recommended seepex tools** Due to the design recommended for certain repairs, these tools partially replace the standardized tools.							
Werkzeug Nr. tool No.	W4	W7	W8	W10	W12	W14	W15	W16
zur Montage von: tool for mounting of:	Gelenk joint	Lager bearing	Schmier-nippel lubrication nipple	Steckwelle plug-in shaft	Teflon-manschette teflon universal joint sleeve	Kuppelstangen-buchsen coupling rod bushing	Manschette universal joint sleeve	Lippendichtung lip seal
Benennung: denomination:	Montagedorn assembly mandrel	Montage-hülse mounting sleeve	Einschlag-hülse drive-in sleeve	Demontage-werkzeug dismantling tool	Montage-werkzeug mounting tool	Presswerkzeug pressing tool	Montageplatte mounting plate	Montagehülse Mounting sleeve
Baugröße **size**								
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L 025-12T, 05-6LT	MTD L2 060 M120 0 XXXXX 2)						MTP A7 703 M500 0 002XX	MTH B7 703 M120 0 W0260
025-12, 025-24 05-12, 1-6L	MTD L2 060 M500 0 XXXXX	MTH M8 060 M500 0 XXXXX		AZV B2 262 M500 0 XXXXX			MTP A7 703 M500 0 002XX	
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L	MTD L2 060 0020 0 XXXXX	MTH M8 060 0020 0 XXXXX		AZV B2 262 0020 0 XXXXX	MMT M8 060 0020 0 XXXXX	PWZ C6 060 0020 0 XXXXX		
2-24, 2-12V 5-12, 8-12T 10-6L, 15-6LT 05-48	MTD L2 060 0050 0 XXXXX	MTH M8 060 0050 0 XXXXX		AZV B2 262 0050 0 XXXXX	MMT M8 060 0050 0 XXXXX	PWZ C6 060 0050 0 XXXXX		
5-24, 5-12V 10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48	MTD L2 060 0100 0 XXXXX	MTH M8 060 0100 0 XXXXX		AZV B2 262 0100 0 XXXXX	MMT M8 060 0100 0 XXXXX	PWZ C6 060 0100 0 XXXXX		
14-12, 26-6L, 40-6LT	MTD L2 060 0140 0 XXXXX	MTH M8 060 0140 0 XXXXX		AZV B2 262 0170 0 XF5XX		PWZ C6 060 1400 0 XXXXX		
10-24, 10-12V 17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R 2-48	MTD L2 060 0170 0 XXXXX	MTH M8 060 0170 0 XXXXX	ESH N0 000 0000 0 A01A4	AZV B2 262 0170 0 XG0XX	MMT M8 060 0170 0 XXXXX	PWZ C6 060 0170 0 XXXXX		
17-24, 17-12V 35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48	MTD L2 060 0350 0 XXXXX	MTH M8 060 0350 0 XXXXX		AZV B2 262 0350 0 XH0XX		PWZ C6 060 0350 0 XXXXX		
35-24, 35-12V 70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L	MTD L2 060 0700 0 XXXXX	MTH M8 060 0700 0 XXXXX		AZV L7 703 0700 0 XK0XX		PWZ C6 060 0700 0 XXXXX		
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48	MTD L2 060 1300 0 XXXXX	MTH M8 060 1300 0 XXXXX				PWZ C6 060 1300 0 XXXXX		
240-12, 300-12T 130-18, 130-24 35-48/70-48						PWZ C6 060 2400 0 XXXXX		

2) entfällt ab Pumpen-Herstellungsdatum 01.04.93 / can be omitted as from 01.04.93 (pump manufacturing date)

	Empfohlene seepex Werkzeuge Aufgrund der Ausführung für bestimmte Montagen empfohlen, durch allgemeine normierte Werkzeuge bedingt ersetzbar. **Recommended seepex tools** Due to the design recommended for certain repairs, these tools partially replace the standardized tools.								**Spezial-werkzeuge** **Special tools**
Werkzeug Nr. tool No.	W17	W18	W19	W20	W22	W23	W24	W25	W3
zur Montage von: tool for mounting of:	Lippendichtung lip seal	Gleitlager-buchse plain bearing bush	Wellen-schonhülse shaft securing sleeve	Cartridge-Einheit cartridge-unit	Wellen-dichtring lip seal	Wellen-dichtring lip seal	Antriebs-gehäuse drive casing	Steckwellen-bolzen plug-in shaft pin	Halteband holding band
Benennung: denomination:	Schlagzylinder Zentrierdorn Montagebolzen cylinder centering mandrel mounting pin	Montagedorn mounting mandrel	Montagehülse mounting sleeve	Aufnahme intake	Montage-werkzeug mounting tool	Montage-werkzeug mounting tool	Aufhänge-vorrichtung suspension device	Montagedorn mounting mandrel	Montage-werkzeug mounting tool
Baugröße **size**									
0005-24, 0015-24 003-12/-24 006-12/-24 012-12/-24 025-6L, 025-12T, 05-6LT	ZSH B7 703 M120 0 W0171 ZDR B7 703 M120 0 W0172 MBL A7 703 M120 0 W0173								MHB WH A00 1WHV 0 01000
025-12, 025-24 05-12, 1-6L									
05-24, 01-48, 025-48, 1-12, 2-6L 1-24, 1-12V 2-12, 5-6L								MTD L8 703 0050 0 SXX0J	
2-24, 2-12V									
5-12, 8-12T 10-6L, 15-6LT 05-48									
5-24, 5-12V									
10-12, 17-6L, 30-6LT, 15-12T, 10-24R, 1-48								MTD L8 703 0170 0 SXX0J	
14-12, 26-6L, 40-6LT									
10-24, 10-12V									
17-12, 35-6L, 26-12, 52-6L, 55-6LT, 75-6LT 30-12T, 10-24, 17-24R, 2-48			SPT B4 703 0170 0 01000	SPT M8 703 0170 0 00900	SPT B4 703 0170 0 01100				
17-24, 17-12V									
35-12, 52-12, 70-6L, 100-6L, 110-6LT, 55-12T 34-24R, 5-48								MTD L8 703 0350 0 SXX0J	
35-24, 35-12V									
70-12, 130-6L, 200-6L, 110-12T 70-24R, 10-48, 200-6L		SPT M8 703 1300 0 01000	SPT M8 703 1300 0 01100	SPT M8 703 1300 0 00900	SPT B4 703 1300 0 0A200	SPT B4 703 1300 0 0A300		MTD L8 703 0700 0 SXX0J	
130-12, 202-6L, 300-6L, 200-12T 70-18, 100-18, 130-18 70-24, 70-12V 130-24R 17-48								MTD L8 703 1300 0 SXX0J	
240-12, 300-12T 130-18, 130-24 35-48/70-48							SPT M8 703 2400 0 01400		

10.0
Manufacturer's documents from sub-supplier

Burgmann
INDUSTRIES

OPERATING MANUAL

This document was drawn up observing the EC directives
"Machinery" 98/37/EC, EN ISO 12100-2 and the German Standard VDI 4500

In case of this mechanical seal is operated in **explosion area an appropriate additional operating manual,** following EC directives 94/9/EC (ATEX 95), has to be observed **by all means**! If required this could be ordered at BURGMANN.

BURGMANN MECHANICAL SEAL (M.S.)

Type MG1/dw-00 and versions

applies to all mechanical seals of the same series

dw = specified shaft diameter

These instructions are intended for the assembly, operating and control personnel and should be kept at hand on site.

PLEASE READ this manual carefully and OBSERVE the information contained as to:

- **Safety**
- **Installation**
- **Transport / Storage**
- **Operation**
- **Information about the product**
- **Servicing**

If there are any unclear points please contact BURGMANN by all means!

Table of Contents

Keywords and Symbols

Following symbols for particularly important information are used:

"Attention, please pay special attention to these sections of text"

DANGER! Draws attention to a direct hazard that will lead to injury or death of persons

WARNING! Draws attention to the risk that a hazard could lead to serious injury or death of persons

CAUTION! Draws attention to a hazard or unsafe method of working that could lead to personal injury or damage to equipment

ATTENTION! Identifies a potentially dangerous situation. If it is not avoided the product or something in its vicinity could be damaged

IMPORTANT! Identifies tips for use and other particularly useful information.

GENERAL SAFETY NOTES

Any person being involved in assembly, disassembly, start up, operation and maintenance of the BURGMANN Mechanical Seal must have read and understood this Instruction Manual and in particular the safety notes. We recommend the user to have this confirmed.

BURGMANN Mechanical Seals are manufactured on a **high quality level** (quality management EN ISO 9001: 2000) and they keep a **high working reliability**. Yet, if they are **not operated** within their **intended purpose** or handled **inexpertly** by untrained personnel they may cause **risks**.

The machine has to be set up in such a way that seal leakage can be led off and disposed properly and that any personal injury caused by spurting product in the event of a seal failure is avoided.

Any operation mode that affects the **operational safety** of the mechanical seal is not permitted.

Unauthorised modifications or alterations are **not permitted** as they affect the **operational safety** of the mechanical seal.

BURGMANN mechanical seals must be installed, operated, maintained, removed or repaired by **authorised**, **trained and instructed personnel only.**

The **responsibilities** for the respective jobs to be done **have to be determined clearly and observed** in order to prevent unclear competencies from the point of **security**.

Any work to be done on the mechanical seal is **generally** only **permitted** when the seal is **neither operating nor pressurised**.

WARNING! Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

Apart from the notes given in this manual the general **regulations for worker's protection and those for prevention of accidents** have to be observed.

Instructions for worker's protection

WARNING! If the **medium to be sealed** and/or the **supply liquid** is subject to the **Hazardous Substances Regulation** (GefStoffV), the **instructions for handling dangerous substances** (safety data sheets to EU Directive 91/155/EEC) and the **accident prevention regulations** have be observed.

Medium to be sealed and/or **supply medium may escape** if the seal **fails**. Injury of persons and environment may be **prevented by the user** providing for splash protection and wearing safety goggles. Care has to be taken by the user for **proper disposal** of the leakage. The user has to control these measures.

The **user** has to **check** what **effects a failure** of the mechanical seal might have and what safety measures have to be taken to prevent **personal** injury or damage to the environment.

TRANSPORT / STORAGE

Transport

If not specified differently by contract the BURGMANN standard packing is used which is suitable for dry transport by truck, train or plane. The warning signs and notes on the packing must be observed.

In addition seaworthy packing may become necessary.

Notes for income inspection:
- Check packaging for visible damages.
- Open packaging carefully. Do not damage or lose parts supplied separately.
- Check if consignment is complete (delivery note). Inform the supplier immediately in writing if parts are damaged or missing.

The mechanical seal has to be protected from damage during transport and storage. The transport case in which the seal is supplied is well suited for this purpose and should be kept for a possible return transport.

ATTENTION! If the machine as well as the mechanical seal installed into the machine are transported together the shaft has to be protected from deflection and shocks.

Packing and storage

The following recommendations apply to all BURGMANN mechanical seals which have been supplied and stored in their **undamaged original packaging**, as well as to seals which have been installed in a machine (e.g. pump, compressor, agitator, etc.) but have not yet been put into operation.

BURGMANN mechanical seals and spare parts are super finished and repeatedly tested machine elements. For the storage special conditions have to be followed.

Sliding materials and elastomers are subject to material-specific and time-based alterations (distortion, ageing) which might reduce the full efficiency of the mechanical seals. Yet, this may be avoided by observing the storage instructions.

For the stock keeping of elastomers special conditions are required. For all rubber-elastic parts the rules of DIN 7716 resp. of ISO 2230-1973 (E) are valid.

Conveniences for storing of mechanical seals
- dust free
- moderately ventilated
- constantly tempered
  - relative air humidity below 65 %,
  - temperature between 15 °C and 25 °C.

Protect the seal from
- direct exposure to heat (sun, heating)
- **ultraviolet light** (halogen or fluorescent lamps, sunlight, arc welding)
- presence or development of **ozone** (arc welding, mercury vapour lamps, high-voltage devices, electric motors)

➢ **risk of embrittlement** of elastomeric materials

It has to be differentiated between:
- ▫ **M.S. stored** in the stock room
- ▫ **M.S. installed** in the machine, but not yet in operation.

☐ **M.S. in the stock**

IMPORTANT! Store the **seal in the original packing** lying on a **flat surface**.

- Check the packaging periodically for damages.
- Plastic sheet packagings with humidity indicators have to be checked every 8 weeks. The check has to be recorded.

➢ Packings **exceeding 50 % rel. humidity** values have to be sent to the manufacturer or the **nearest BURGMANN service centre** for inspection and new packaging.

Duly stored mechanical seal:
- Latest 3 years after delivery of the mechanical seal
- For reasons of safety shipment of the M.S. to BURGMANN resp. nearest BURGMANN service centre for

➢ Exchange of all secondary seals and springs
➢ Verification of the flatness of the faces
➢ Perhaps static pressure test.

☐ **M.S. installed into the machine:**

ATTENTION! A **preservation** of the BURGMANN mechanical seals is **not allowed**.

Check in case of a preservation of complete machines with mechanical seals installed BURGMANN has to be contacted.
- **Do not** use corrosion protection agents.

➢ Risk of deposition and possibly chemical attack of the secondary seals.

Due to longer erecting times of new designed plants the period between delivery of the mechanical seal and on the other hand its installation and start up may exceed the period of 2-3 years.

Latest after 3 years and in time before the planned start-up of the plant the seal has to be dismantled and to be sent to the manufacturer or the nearest BURGMANN service centre where it can be checked and reconditioned, if necessary.

Damages caused by **improper** storage may **not** be claimed with reference to the **warranty** on the BURGMANN company**.**

INFORMATION ABOUT THE PRODUCT

All technical information given is based on the results of extensive testing and on BURGMANN's long term practical experience. However, in view of the great diversity of possible applications the technical data can only be taken as being of approximate nature. We can only guarantee the safe and efficient functioning in individual cases if we have been comprehensively informed of the operating conditions to which they will be subject, and if this has been confirmed in a separate agreement.

Manufacturer and country of origin

Burgmann Industries GmbH & Co. KG
Äußere Sauerlacher Str. 6-10
D - 82515 Wolfratshausen

Germany

Declaration by the manufacturer

within the meaning of the EC-directive "MACHINERY" 98/37/EG

A mechanical seal does **not function independently**. It is intended to be incorporated into or assembled with machinery.

Type designation

BURGMANN Mechanical Seal **MG1/dw-00**

Designated use

This mechanical seal is **exclusively** designed for the use in the specified application. A **different utilisation** or a utilisation going beyond the specification is considered **contrary to its designated use** and excludes a liability by the manufacturer.

Operation under conditions lying **outside** those limits stated in paragraph **"Operating limits"** is considered **contrary to its designated use**.

Should the seal be **operated under different conditions or at a different application** BURGMANN has to be asked for **recognition as safe in advance**.
- **Changes** to operating conditions **have to** be documented.

Operating limits

ATTENTION! Operating limits depend on the materials, the media to be sealed and the diameter of the sealing. (If there are any unclear points please contact BURGMANN.)

Shaft diameter	(dw)	:	10 - 100 mm
Pressure to be sealed	(p1)	:	12 bar g
Temperature to be sealed	(t1)	:	-20 ... 120° C
Max. sliding speed	(vg)	:	10 m/s

Operation under several limit values **simultaneously** should be **avoided** as higher loads (pressure, temperature, speed) can increase wear or lead to **damage** of sliding faces or elastomers. This could result in a shorter service life and in the **risk** of a sudden seal failure **endangering** men and environment.

The **selection** of the mechanical seal (type, suitability, materials) should be done **by BURGMANN staff** or other **authorised** persons. A wrong selection by unauthorised persons is **not covered by** BURGMANN's **warranty**.

Further information about the operating conditions can be found in the BURGMANN assembly drawing MG1/dw-00 or in the specification sheets of the machine manufacturer.

Materials

The materials of the mechanical seal depend on the application and are fixed in the order.

Drawings, diagrams

Assembly drawing MG1/dw-00

The original assembly drawing in its latest edition (latest revision) only is decisive for both the design of M.S. as well as the utilisation of this manual.

In the following description all figures in parentheses, e.g. (2) define the respective part item no. in fig. 1. The part item no. may vary from those stated in the assembly drawing.

Versions

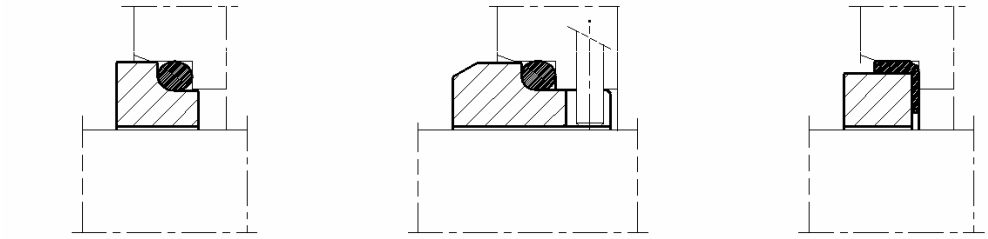
- **MG12/…**
- **MG13/…**
- **MG1S20/…**
- **RMG12/…**
- **MG1 MULTIPLE M.S.**

The mechanical seal type MG1 can also be used as **multiple mechanical seal** (also in combination with seal types of other series) in **tandem arrangement** with quench (API, plan 52) or as **dual mechanical seal** with barrier fluid (API, plan 53). Consultation with the BURGMANN company is recommended.

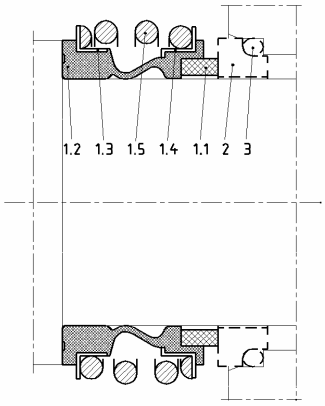
ATTENTION! PTFE o-rings or double-PTFE-wrapped o-rings **may** not be used at seat versions **without torsion lock**.

This operating manual applies also to the mentioned seal versions with slight modifications and/or to combinations with seats not stated in this manual.

Seat Versions



Description and function



- **single seal**
- **unbalanced**
- **bi-directional**
- **stationary seat** (2)
- **o-ring** (3)
- **rotating seal face** (1.1)
- **elastomeric bellow** (1.2)
- **cylindrical single spring** (1.5)
- **no glued joints**
- **materials of the sliding parts replaceable**
- **for media containing solids** (e.g. sewage applications)
- **rotating, torsion-free elastomeric bellows** serving as
  - face housing
  - secondary sealing element
  - drive collar
- **torque transmission** from the seal face by means of "L"-rings and a rotating, cylindrical single spring
- **axial movability**
  d_w: 10 … 12 mm ±0,5 mm
  d_w: 14 … 18 mm ±1,0 mm
  d_w: 20 … 26 mm ±1,5 mm
  d_w: 28 … 100 mm ±2,0 mm

Required space, connecting dimensions

The required mounting space for the mechanical seal is decisive for the design of the housing parts by the machine manufacturer. The connecting dimensions have to be checked by the machine manufacturer by means of the BURGMANN drawing before mounting the mechanical seal.

Supply of M.S.

The mechanical seal has to be constantly wetted by liquid medium. The medium to be sealed must not damage the M.S. neither chemically (e.g. corrosion, embrittlement) nor physically (e.g. erosion, abrasion).

For a safe operation of the mechanical seal we recommend to apply **at inboard** the most suitable **type of circulation** described in **API 610 / 682**. This measure protects the seal cavity from deposition of solids.

To operate multiple seals special supply systems are required. Please contact BURGMANN.

Emissions

A mechanical seal is a **dynamic seal** that **cannot be free of leakage** due to physical and technical reasons. Seal design, manufacture tolerances, operating conditions, running quality of the machine, etc. mainly define the leakage value. In fact, compared to other sealing systems there is **few leakage**.

WARNING! If the **medium to be sealed** and/or the **supply liquid** is subject to the **Hazardous Substances Regulation** (GefStoffV), the **instructions for handling dangerous substances** (safety data sheets to EU Directive 91/155/EEC) and the **accident prevention regulations** have be observed.

A possibly increased leakage during start-up will decrease to a normal quantity after the running-in period of the sliding faces.

If this is not the case or if there are other malfunctions the mechanical seal has to be shut down, removed and checked for reasons of safety.

The leakage can be liquid or gaseous. Its aggressiveness corresponds to that of the medium to be sealed.

Leakage of mechanical seal at outboard side has to be drained and disposed properly.

IMPORTANT! Components which may get in contact with the leakage have to be corrosion-resistant or have to be adequately protected.

INSTALLATION

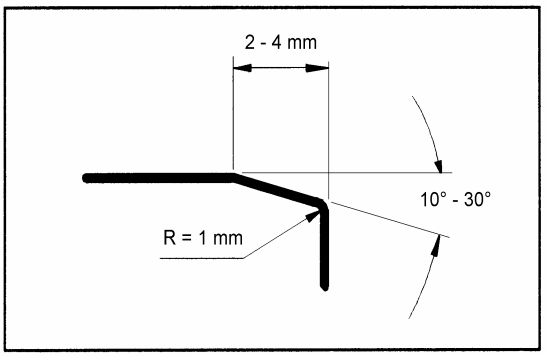
Assembly utilities

- ethyl alcohol
- cellulose-tissue (no rag, no cloth!)
- o-ring lifter
- water and washing up liquid
- cardboard discs

Preparation for assembly

ATTENTION! The seal should remain **packed** until the following working steps have been completely **terminated**.

Check the parts of the machine for:



- **chamfered edges**
  (sliding cones i.e. 2 mm / 30° or in accordance with EN 12756)
- radiused transitions
- **mating fits** and o-ring surfaces:
  fine finished **Rz 10 µm** (= N7 = CLA 63)

- **Shaft surface** in the area of the mechanical seal finished according to EN 12756: **Ra = 0.8 µm** (= N6 = CLA 32).
- **Shoulder** or stop device for the bellows of the mech. seal to take up axial forces

Check at the machine:
- damage of connecting surfaces to the M.S.
- mating dimensions, rectangularity and concentricity to the shaft axis.

Run-out accuracy of the shaft (acc. to DIN ISO 5199):
- Shaft diameters up to 50 mm: max. 0.05 mm
- Shaft diameters 50 mm - 100 mm: max. 0.08 mm

- Prepare the place of assembly, take away any not required tool, cuttings, dirty cleaning wool etc.

- Cover the work bench with a piece of clean, non-fibrous cardboard.

Assembly / installation

BURGMANN mechanical seals are super-finished and repeatedly tested machine elements whose handling during assembly in particular of sliding materials and elastomers requires special care during several procedures.

For installation the assembly drawing of mechanical seal has to be observed.

IMPORTANT! The mechanical seal has to be installed under the cleanest conditions and very carefully.

- Unpack the seal and check seal face, seat and elastomer bellows for possible damages.
- ➢ Never place the seal faces or seats on their sliding faces without having covered them adequately.

- Check before starting assembly:
  - complete availability of all components by means of the drawing
  - all components have to be clean and in perfect condition.

- Sprinkle the elastomer bellows and the shaft with low-surface-tension water (add washing up liquid) or ethyl alcohol to decrease frictional force during assembly of the seal.

⚠

Oil or grease as assembly agent is not permitted in any case.

ATTENTION! **Do never force** during installation.

ATTENTION! **Avoid unnecessary rotation** of the shaft (damage of the sliding faces is possible).

ATTENTION! **Avoid knocking the seal!** Damage to mechanical seals has an adverse effect on their safe operation.

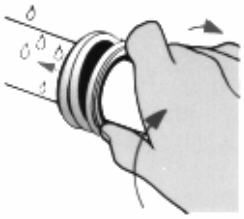
Possible installation order:

- Feed the **degreased** sealing element (o-ring, rubber cup) onto the seat.

If present:
- At the seat mark the position of the rear slot beside the sliding face.
- Align the seat with the torque transmission pin.

- Cover the sliding face of the seat with a cardboard washer
- Press the seat slowly and without interruption into its position.
  - ➢ Use plenty of water or alcohol as lubricant.
  - ➢ Use a distance sleeve, if necessary.
- Remove the cardboard washer from the sliding face.
- Check the rectangular position of the seat to the shaft axis.

- Mount the seal cover with the seat installed before.
- Clean the sliding faces thoroughly with ethyl alcohol and paper tissues (**no fabric, no cloths!**).
- ➢ In case of material **"BUKO"** (carbon graphite) wipe it until the paper tissues stay clean.
- ➢ Do not touch the sliding faces any more with bare fingers.
- ➢ Mount the sliding faces absolutely dry, dust-free and clean. Do not use any lubricants!



- Push rotating seal unit (bellows unit) with a slow clockwise turn onto the shaft.
- Stick to the dimensions in the assembly drawing!
- ➢ If necessary use a mounting sleeve.
- ➢ For long pushing distances add liquid several times.

- Check "L" rings, spring and seal face for correct fit.

- Mount stop device for bellows unit to take up axial forces.
- ➢ Stick to the dimensions in the assembly drawing **by all means!**

- Further assembly of the machine in accordance with the instructions of the machine manufacturer.

OPERATION

Instructions for safe operation

For a single mechanical seal the **pressure in the seal chamber** (stuffing box pressure) has to be **higher** than the ambient pressure at the machine at any time. Otherwise the machine will **suck in air** via the sliding faces, which will result in **dry-running** and consequent **failure** of the mechanical seal.

Damages due to dry-running are excluded from the warranty.

During every state of operation the mechanical seal has to be constantly wetted by the **medium** to be sealed **in its liquid form**, in particular when the machine is **started** or **stopped**. The machine design has to be such as to take this necessity into consideration.

If the medium to be pumped builds deposits or tends to solidify during cooling down or standstill of the machine the stuffing box has to be flushed with suitable clean liquid. The flow and the liquid should be determined by the user.

If the operation limit values and the instructions given in this manual are followed a trouble-free operation of the mechanical seal can be expected.

Instructions for start up

Safety checks before start up

- Torque transmission between mechanical seal and shaft duly installed
- Supply connections tightened pressure-sealed
- Disposal connections installed environmentally safe

For a safe operation of the mechanical seal we recommend to apply **at inboard** the most suitable **type of circulation** described in **API 610 / 682**. This measure protects the seal cavity from deposition of solids.

- Flood machine and seal cavity (stuffing box) with medium and vent thoroughly.

▫ Now the seal is ready for operation.

SERVICING

Maintenance

A correctly operated mechanical seal needs **low maintenance**. Wear parts, however, have to be replaced, if necessary.

A duly operation includes a regular check of the following parameters:
- Temperature
- Leakage (drainage) rate of the mechanical seal

An inspection of the mechanical seal should be carried out during a revision of the complete plant. We recommend to have this inspection be performed by responsible BURGMANN personnel.

If the mechanical seal is removed during a revision of the plant it has to be replaced by a new one.

Directives in case of failure

Try to define the kind of failure and record it.

- In the event of **excessive leakage**, note changes in the leakage amount and switch the pump off if necessary.
- If a constant amount is leaking in a steady flow, the mechanical seal is damaged.
- In the event of a **inadmissible temperature rise**, the machine **has to** be stopped for safety reasons.

If there is a **malfunction** which you cannot correct on your own, or if the cause of malfunction is not clearly recognisable please immediately contact the nearest **BURGMANN agency**, a BURGMANN service centre or the BURGMANN headquarters.

During the **warranty period** the BURGMANN mechanical seal must only be disassembled with approval of the manufacturer or when a representative is present.

After-sales service by BURGMANN

BURGMANN's customer service department offers a comprehensive service package covering consultancy, engineering, standardisation, installation, commissioning as well as damage analysis right through to seminars on sealing technology.

Addresses are listed in the known BURGMANN Design Manuals as well as in various other BURGMANN brochures.

Address of headquarters:

Burgmann Industries GmbH & Co. KG
Postfach 1240
D - 82515 Wolfratshausen

Germany

☎ +49 (0) 81 71-23 0
Fax +49 (0) 81 71-23 12 14
www.burgmann.com

Reconditioning (repair)

If **reconditioning** is necessary, the complete **seal** should be sent **to the manufacturer**, as this is the best way to find out which components can be reconditioned or which parts must be replaced in order to ensure an optimum tightness.

If, **for compelling reasons**, **a reconditioning** has to be carried out **on site** (e.g. no. spare seal on stock, long transport, problems with customs) the seal may be repaired in a clean room by **trained** personnel of the user under the direction of **BURGMANN mechanics**.

Disassembly / removal

- Stop the machine as instructed, allow to cool, depressurise and ensure that pressure cannot build up again.
- Work on the M.S. is only permitted when the machine is at a standstill and depressurised.
- There must be no product on the M.S. ⇒ if necessary drain the machine and rinse it out.
- Isolate the machine to prevent it starting up unexpectedly.
- Comply with the safety notes (safety data sheets).

IMPORTANT! When removing, please observe **by all means**:

- current **accident prevention regulations**
- **regulations for handling hazardous substances**

WARNING! Seals that have been used with **hazardous substances must be properly cleaned** so that there is no possible **danger** to people or to the environment.

IMPORTANT! The packaging used to transport the seal must

- be **identified** with the relevant **hazard symbol** and
- **include** the **safety data sheet** for the product and/or supply medium

The order of disassembly to remove the mechanical seal out of the machine depends on the design of the machine and should be determined by the machine manufacturer.

- Remove the seal in the reverse sequence as described for assembly (set up).

Spare parts

- Only BURGMANN original spare parts must be used. Otherwise
  - **Risks** of a seal failure, **endangering** persons and environment.
  - The BURGMANN guarantee for the mechanical seal **lapses**.
- For a quick exchange a complete **spare seal** should be on stock.

Required details for enquiries and orders

For enquiries and orders the following details are required:

- BURGMANN commission no.
- Drawing no. of M.S. **MG1/dw-00**
  dw = specified shaft diameter
- Part item no., designation, material, number of pieces with reference to the drawing.

Address of headquarters product field **FA**
Standard Mechanical Seals

Burgmann Industries GmbH & Co. KG
Postfach 1240
D - 82502 Wolfratshausen

Germany

☎ +49 (0) 81 71 - 23 0
Fax +49 (0) 81 71 - 23 14 44

Disposal of the BURGMANN mechanical seal

Usually, the BURGMANN mechanical seals can be easily disposed after a thorough cleaning.

- Metal parts (steels, stainless steels, non-ferrous heavy metals) divided into the different groups belong to scrap metal waste.
- Ceramic materials (synthetic carbons, ceramics, carbides) belong to waste products. They can be separated from their housing materials, as are physiologically recognised as safe.
- Synthetic materials/plastics (elastomers, PTFE) belong to special waste.

CAUTION! Material containing fluorine must not be burnt.

IMPORTANT! Some of the synthetic materials, divided into the different groups can be recycled.

Copyright

We reserve the right to carry out technical modifications of the product, even if they have not yet been considered in this manual.

June 13, 2006
Department Technical Documentation

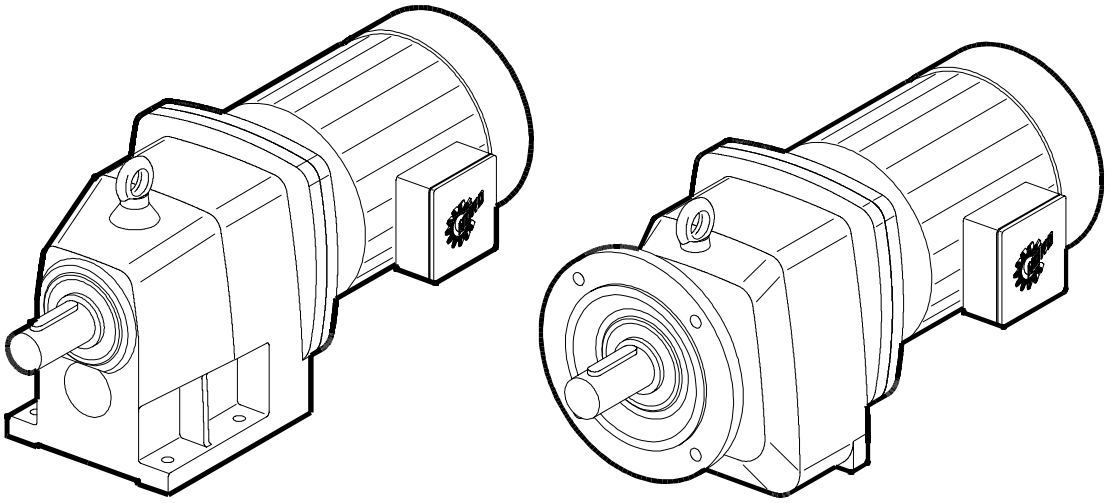
UNICASE® Helical Inline Gearboxes
Installation and Maintenance Instructions

BIM 1010

USA

CDN

Retain These Safety Instructions For Future Use



INSPECTION OF UNIT

Thoroughly inspect the equipment for any shipping and handling damage before accepting shipment from the freight company. If any of the goods called for in the bill of lading or express receipt are damaged or the quantity is short, do not accept until the freight or express agent makes an appropriate notation on your freight bill or express receipt. If any concealed loss or damage is discovered later, notify your freight carrier or express agent at once and request him to make an inspection. We will be very happy to assist you in collecting claims for loss or damage during shipment; however, this willingness on our part does not remove the transportation company's responsibility in reimbursing you for collection of claims or replacement of material. Claims for loss or damage in shipment must not be deducted from the NORD Gear invoice, nor should payment of the NORD Gear invoice be withheld awaiting adjustment of such claims, as the carrier guarantees safe delivery.

If considerable damage has been incurred and the situation is urgent, contact the nearest NORD Gear Sales Office for assistance. Please keep a written record of all communications.

RECORD NAMEPLATE DATA

Locate the gear reducer nameplate and record all nameplate data for future reference.

SK _____ S/N _____

RATIO _____ MAX TORQUE _____ RPM _____ MTG. POS _____

STORAGE

PROPER STORAGE UNTIL INSTALLED

Keep unit in a dry, temperature controlled area. If stored other than said, long term storage methods must be applied to the unit including complete fill with lubricant. Protect machined surfaces and rotate shafts periodically. Prior to putting unit into service, drain lubricant and refill to proper level as determined by the mounting position.

PROPER HANDLING OF THE UNIT

Exercise care to prevent damage to the unit when moving. Lift only at designed lifting points. Do not attach other machinery and lift by the unit lifting points. The lifting points are to be used to lift the unit only. Insure that adequate safety measures are taken to protect personnel during transportation. Protect the mounting surface from damage.

INSTALLATION OF UNIT

To ensure long service and dependable performance, an enclosed gear drive must be rigidly supported and the shafts accurately aligned. The following describes the minimum precautions required to accomplish this end.

FOUNDATION
The responsibility for the design and construction of the foundation lies with the user. The foundation must be adequate to withstand normal operating loads and possible overloads while maintaining alignment to attached system components under such loads.

MOUNTING POSITION
Unless a unit is specifically ordered for inclined mounting, the foundation must be level and flat. The lubrication system may not operate properly if the unit is not mounted in the position for which it is designed. It may be desirable to elevate the foundation to facilitate oil drainage.

CONCRETE FOUNDATION
If a concrete foundation is used, steel mounting pads and bolts of sufficient size to distribute the stress into the concrete should be grouted into the foundation.

STEEL FOUNDATION
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit.

FOOT MOUNTED UNITS
Use shims under the feet of the unit to align the output shaft to the driven equipment. Make sure that all feet are supported so that the housing will not distort when it is bolted down. Improper shimming will reduce the life of the unit and may cause failure. Dowel pins may be installed to prevent misalignment and ensure proper realignment if removed for service.

FLANGE MOUNTED UNITS
If a structural steel foundation is used (i.e. wide flange beams or channels), a base plate or sole plate of suitable thickness should be used and should extend under the entire unit. If a bulk head plate is used it should be of proper strength to minimize buckling distortions.

Flange Pilot 'AK' or 'AK1' tolerance
Metric (mm)

> ∅ 50 ≤ ∅ 80 = +0.012/-0.007
> ∅ 80 ≤ ∅ 120 = +0.013/-0.009
> ∅ 120 ≤ ∅ 180 = +0.014/-0.011
> ∅ 180 ≤ ∅ 230 = +0.016/-0.013
> ∅ 230 ≤ ∅ 315 = +0.000-0.032
> ∅ 315 ≤ ∅ 400 = +0.000/-0.036
> ∅ 400 ≤ ∅ 500 = +0.000/-0.040

Inch

> ∅ 1.969 ≤ ∅ 3.150 = +0.005/-0.0003
> ∅ 3.150 ≤ ∅ 4.724 = +0.005/-0.0004
> ∅ 4.724 ≤ ∅ 7.087 = +0.006/-0.0004
> ∅ 7.087 ≤ ∅ 9.055 = +0.006/-0.0005
> ∅ 9.055 ≤ ∅ 12.402 = +0.000/-0.0013
> ∅ 12.402 ≤ ∅ 15.748 = +0.000/-0.0014
> ∅ 15.748 ≤ ∅ 19.685 = +0.000/-0.0016

BOLT STRENGTH
Bolt size, strength and quantity should be verified to insure proper torque reaction capacity whatever the mounting arrangement.

PRIME MOVER MOUNTING
Align the prime mover to the reducer-input shaft using shims under the feet. Make sure that the feet are supported. Dowel the prime mover to its foundation.

SHAFT CONNECTIONS
When connecting shafts to either the input or output of the reducer, consider the following instructions.

FITS
Clearance or interference fits for coupling hubs should be in accordance with ANSI/AGMA 9002-A86 or as follows.

Output and Input shaft Diameter tolerance
Metric (mm)

≤ ∅ 18 = +0.012/+0.001
> ∅ 18 ≤ ∅ 30 = +0.015/+0.002
> ∅ 30 ≤ ∅ 50 = +0.018/+0.002
> ∅ 50 ≤ ∅ 80 = +0.030/+0.011
> ∅ 80 ≤ ∅ 120 = +0.035/+0.013
> ∅ 120 ≤ ∅ 180 = +0.040/+0.015

Inch

≤ ∅ 1.750 = +0.0000/-0.0005
> ∅ 1.750 = +0.0000/-0.0010

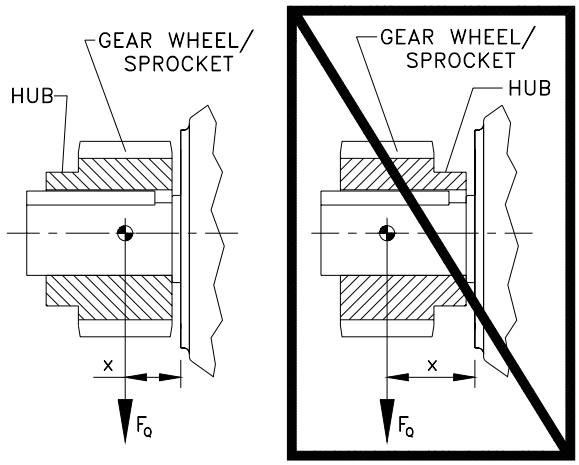
Output and Input shaft Drill and tap shaft end
Metric (mm)

≤ ∅ 16 = M5
> ∅ 16 ≤ ∅ 21 = M6
> ∅ 21 ≤ ∅ 24 = M8
> ∅ 24 ≤ ∅ 30 = M10
> ∅ 30 ≤ ∅ 38 = M12
> ∅ 38 ≤ ∅ 50 = M16
> ∅ 50 ≤ ∅ 85 = M20
> ∅ 85 ≤ ∅ 130 = M24

Inch

≤ ∅ 0.438 = #10-24 x 0.4 deep
> ∅ 0.438 ≤ ∅ 0.813 = ¼-20 x 0.6 deep
> ∅ 0.813 ≤ ∅ 0.938 = 5/16-18 x 0.7 deep
> ∅ 0.938 ≤ ∅ 1.125 = 3/8-16 x 0.9 deep
> ∅ 1.125 ≤ ∅ 1.375 = 1/2-13 x 1.1 deep
> ∅ 1.375 ≤ ∅ 1.875 = 5/8-11 x 1.4 deep
> ∅ 1.875 ≤ ∅ 3.250 = 3/4-10 x 1.7 deep
> ∅ 3.250 = 1-8 x 2.2 deep

Outboard pinion and sprocket fits should be as recommended by the pin sprockets with interference fits should be heated according to the manufacturer's recommendations, generally 250°F to 300°F, (120°C to 150° C) before assembling to the shaft.



LOCATION
Coupling hubs should be mounted flush with the shaft ends, unless specifically ordered for overhung mounting. Pinions, sprockets and sheaves should be mounted as close as possible to the unit housing to minimize bearing loads and shaft deflections.

COUPLING ALIGNMENT
Shaft couplings should be installed according to the coupling manufacturer's recommendations for gap, angular and parallel alignment. In many installations, it is necessary to allow for thermal and mechanical shaft movement when determining shaft alignment. The coupling manufacturer's recommendations should be followed.

AXIAL DISPLACEMENT
The gap between shaft ends should be the same as the specified coupling gap unless overhung mounting of the coupling hub is specified. The coupling gap and shaft gap must be sufficient to accommodate any anticipated thermal or mechanical axial movement.

ANGULAR ALIGNMENT
Insert a spacer or shim stock equal to the required coupling gap between the coupling hub faces and measure the clearance using feeler gauges. Repeat this at the same depth at 90-degree intervals to determine the amount of angular misalignment.

PARALLEL ALIGNMENT
Mount a dial indicator to one coupling hub, and rotate this hub, sweeping the outside diameter of the other hub. The parallel misalignment is equal to one-half of the total indicator reading. Another method is to rest a straight edge squarely on the outside diameter of the hubs at 90-degree intervals and measure any gaps with feeler gauges. The maximum gap measurement is the parallel misalignment.

CHECKING ALIGNMENT
After both angular and parallel alignments are within specified limits, tighten all foundation bolts securely and repeat the above procedure to check alignment. If any of the specified limits for alignment are exceeded, realign the coupling.

SPROCKET OR SHEAVE ALIGNMENT
Align the sheaves or sprockets square and parallel by placing a straight edge across their faces. Alignment of bushed sheaves and sprockets should be checked after bushings have been tightened. Check horizontal shaft alignment by placing a level vertically against the face of the sheave or sprocket. Adjust belt or chain tension per the manufacturer's specified procedure.

OUTBOARD PINION ALIGNMENT
Align the pinion by adjusting the gear tooth clearance according to the manufacturer's recommendations and checking for acceptable outboard pinion tooth contact. The foundation bolts may have to be loosened and the unit moved slightly to obtain this contact. When the unit is moved to correct tooth contact, the prime mover should be realigned.

RECHECK ALIGNMENT
After a period of operation, recheck alignment and adjust as required.

1. Properly install unit on a rigid foundation
   - adequately supported
   - securely bolted into place
   - leveled so as not to distort the gear case
2. Properly install couplings suitable for the application and connected equipment.
3. Ensure accurate alignment with other equipment.
4. Furnish and install adequate machinery guards as needed to protect operating personnel and as required by the applicable standards of the Occupational Safety and Health Administration (OSHA), and by other applicable safety regulations;
5. Ensure that driving equipment is running in the correct direction before coupling to reducers with backstops (designed to operate only in a specific direction) or machinery designed to operate only in one direction.

CHANGES IN PERFORMANCE SPECIFICATIONS

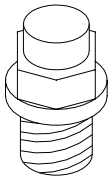
Owner has the responsibility to consult with NORD GEAR if such items such as applied loads, operating speeds or other operating conditions have changed.

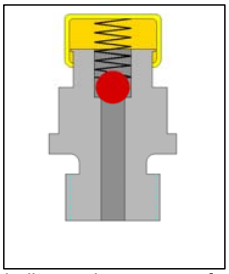
WARNING:
LOCK OUT POWER before any maintenance is performed. Make absolutely sure that no voltage is applied while work is being done on the gearbox.

START-UP

1. Ensure that switches, alarms, heaters, coolers and other safety and protection devices are installed and operational for their intended purpose.
2. Verify that the installed mounting position is the same as the nametag mounting position. If not, adjust the oil level accordingly and relocate the vent plug, fill plug and drain plug according to the mounting position. See following.

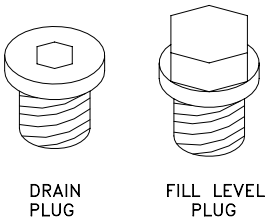
AUTOVENT PLUG
The Autovent plug is brass in color and will be located at the highest point on the gearbox. It operates like a check-valve to allow the reducer to relieve internal pressure while preventing lubricant contamination during cooling. A spring presses a ball or plunger against a machined orifice until pressure exceeds 2 psi. Above 2 psi the air is allowed to escape depressurizing the gearcase. When internal pressure drops below 2 psi, the autovent re-seals closing the unit to the outside environment. After shutdown, the reducer cools along with the air inside the reducer. The unit will temporarily maintain a slight vacuum until normalization occurs. NORD Gear supplies an Autovent as a standard feature.


AUTOVENT PLUG


The Autovent releases built-up air pressure from inside the gearbox (Max. pressure 2 psi).

FILL LEVEL & DRAIN PLUGS

The drain plugs are metric socket head cap screws. They will be located at the lowest part of the gearbox for ease of draining. The fill level plug is a hex head cap screw. It will be located between the Autovent and drain plug. Both types of plugs will have gaskets included to prevent oil from leaking.



Two types of plugs for maintenance

LUBRICANT

All NORD reducers are shipped from the factory properly filled with lubricant and all plugs are installed according to the mounting position given on the reducer nametag. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

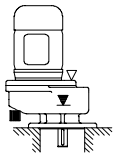
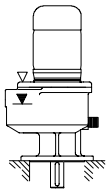
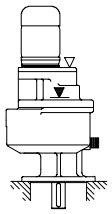
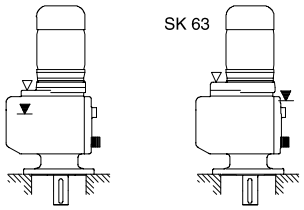
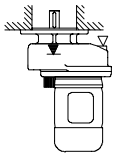
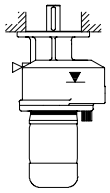
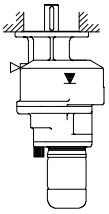
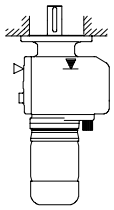
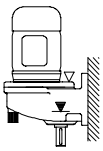
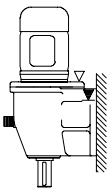
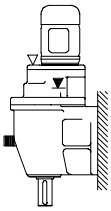
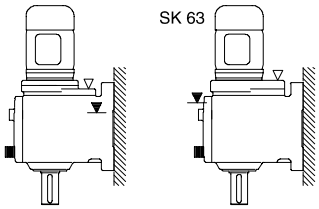
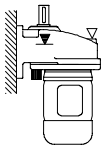
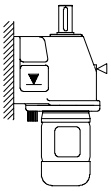
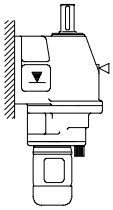
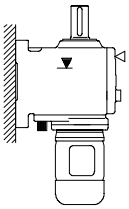
OPERATION AND MAINTENANCE CHECKLIST

1. Operate the equipment as it was intended to be operated
2. Do not overload.
3. Run at correct speed.
4. Maintain lubricant in good condition and at proper level.
5. Dispose of used lubricant in accordance with applicable laws and regulations.
6. Apply proper maintenance to attached equipment at prescribed intervals recommended by the manufacturer.
7. Perform periodic maintenance of the gear drive as recommended by NORD.

MOUNTING POSITIONS

These charts detail the mounting positions for horizontal and vertical mounting. The Autovent, oil fill plug and drain plug are indicated on each mounting position picture. The factory set mounting position and plug locations match that shown on the gearbox nametag. For mounting orientations other than shown consult NORD Gear.

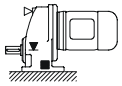
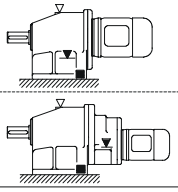
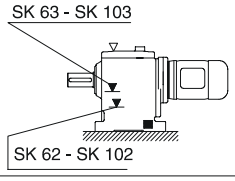
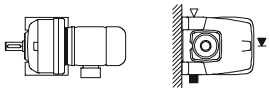
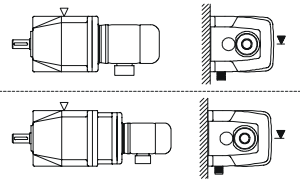
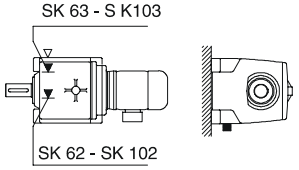
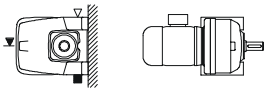
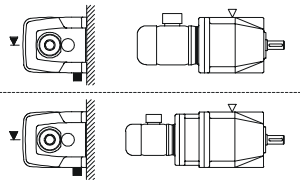
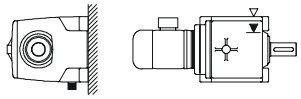
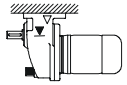
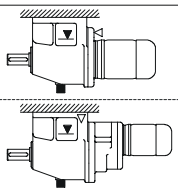
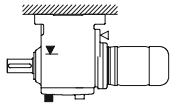
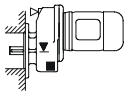
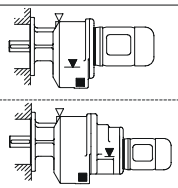
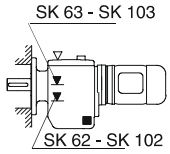
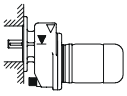
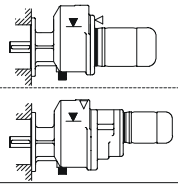
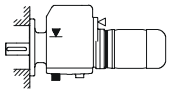
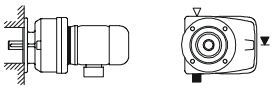
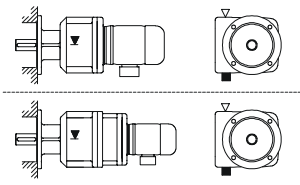
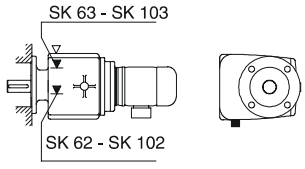
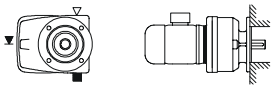
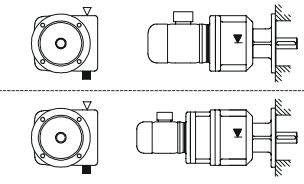
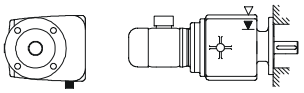
VERTICAL POSITION

	SK 11E - SK 51 E	SK 02 - SK 52	SK 03 - SK 53	SK 62 - SK 103
V1 *				
V3				
V5 *				
V6				

Symbols: ▽ Vent plug ▼ Oil level ■ Drain plug ▨ Mounting surface

* Mounting position V1 or V5 with lubricant expansion unit

HORIZONTAL POSITION

	SK 11 E - SK 51 E	SK 02 - SK 52 SK 03 - SK 53	SK 62 - SK 103
B3			
B6			
B7			
B8			
B5			
B5I			
B5II			
B5III			

Symbols: ▽ Vent plug ▼ Oil level ■ Drain plug ▨ Mounting surface

MAINTENANCE

Mineral lubricant should be changed every 10,000 service hours or after two years. For synthetic oils, the lube should be changed every 20,000 service hours or after four years. In case of extreme operating (e.g. high humidity, aggressive environment or large temperature variations), shorter intervals between changes are recommended.

OIL SPECIFICATIONS

NORD supplies all reducers filled with oil from the factory. Consult the sticker adjacent to the fill plug to determine the type of lubricant installed at the factory. Standard lubricant is ISO VG220 mineral-based oil. However, some units have special lubricants designed to operate in certain environments or to extend the service life of the lubricant. If in doubt about which lubricant is needed, contact NORD Gear.

STANDARD OIL – ISO VG220

Ambient Temperature	Formulation
20 to 104°F (-5 to 40°C)	Mineral

TYPICAL OILS

Viscosity ISO NLGI	Formulation	Service Temperature Range	Mobil	Shell	Castrol	KLÜBER LUBRICATION	bp	Tribol
VG 460	Conventional Mineral	20°C to +50°C 68F to +122°F	Mobilgear 634	Omala 460	7EP	Klüberoil GEM 1-460	Energol GR-XP 460	Tribol 1100/460
	Synthetic PAO	-30°C to +80°C -22°F to +176°F	Mobil SHC 634	Omala 460 HD	Isolube EP 460	Klübersynth EG 4-460	N/A	Tribol 1510/460
VG 320	Conventional Mineral	0°C to +30°C 32°F to +86°F	Mobilgear 632	Omala 320	6EP	Klüberoil GEM 1-320	Energol GR-XP 320	Tribol 1100/320
	Synthetic PAO	-35°C to +80°C -31°F to +176°F	Mobil SHC 632	Omala 320 HD	Isolube EP 460	Klübersynth EG 4-320	N/A	Tribol 1510/320
VG 220	Conventional Mineral	-5°C to +40°C +20°F to +104°F	Mobilgear 630	Omala 220	5EP	Klüberoil GEM 1-220	Energol GR-XP 220	Tribol 1100/220
	Synthetic PAO	-34°C to +80°C -30°F to +176°F	Mobil SHC 630	Omala 220 HD	Isolube EP 220	Klübersynth EG 4-220	N/A	Tribol 1510/220
VG 150 & VG 100	Conventional Mineral	-15°C to +25°C 5°F to +77°F	Mobilgear 629	Omala 100	4EP	Klüberoil GEM 1-150	Energol GR-XP 100	Tribol 1100/100
	Synthetic PAO	-37°C to +10°C -35°F to +50°F	Mobil SHC 629	Omala 150 HD	Isolube EP 150	Klübersynth EG 4-150	N/A	N/A
VG 68	Conventional Mineral	-15°C to +25°C 5°F to +77F	Mobilgear 626	Omala 68	2EP	Klüberoil GEM 1-68	Energol GR-XP 68	Tribol 1100/68
	Synthetic PAO	-40°C to +10°C -40°F to +50F	Mobil SHC 626	N/A	Isolube EP 68	N/A	N/A	N/A
VG 32	Synthetic PAO	-40°C to +10°C -40°F to +50°F	Mobil SHC 624	N/A	N/A	Klüber-Summit HySyn FG-32	N/A	N/A

PAO = Poly Alpha Olefin

SPECIAL PURPOSE LUBRICANTS

Ambient Temperature	Formulation	Manufacturer	Oil Brand Name
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	Chevron	FM ISO 220
20 to 104°F (-5 to 40°C)	*Food Grade* Oil - Synthetic	OilJAX	Magnaplate 85W140-FG
5 to 125°F (-20 to 50°C)	Fluid Grease	Mobil	Mobilux EP023
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Mobil	Mobilith SHC 007
-30 to 140°F (-35 to 60°C)	Fluid Grease - Synthetic	Shell	Albida LC

STANDARD BEARING GREASE – NLGI 2EP Lithium

Ambient Temperature	Formulation
-20 to 140°F (-30 to 60°C)	Mineral

OPTIONAL BEARING GREASES

Ambient Temperature	Formulation	Manufacturer	Grease Brand Name
-40 to 230°F (-40 to 110°C)	Synthetic	Shell	Aeroshell 6
-40 to 230°F (-40 to 110°C)	*Food Grade* - Synthetic	Lubriplate	SFL1

LUBRICANT CAPACITY

Each reducer has the oil level and oil quantity adjusted according to the mounting position shown in the tables. When replacing the oil, consult the tables below to determine the proper amount of oil to be installed according to the reducer size and mounting position. Note that this is approximate and the final level will be adjusted when the reducer is installed. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads.

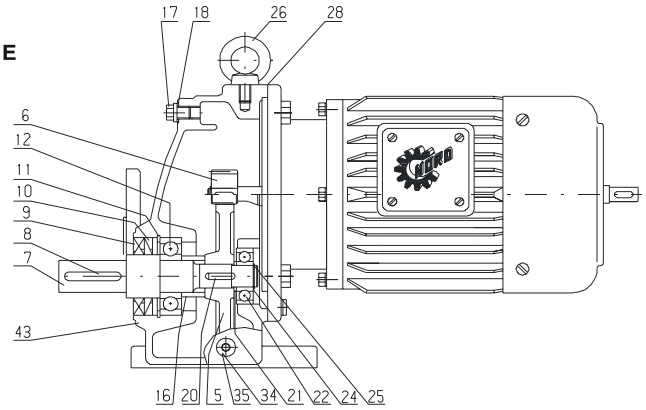
LUBRICATION CAPACITY – HELICAL INLINE GEARBOXES

Mounting position		*Horizontal position*								*Vertical position*			
		single reduction											
		B 3	**B 6**	**B 7**	**B 8**	**B 5**	**B 5I**	**B 5II**	**B 5III**	**V 1**	**V 3**	**V 5**	**V 6**
SK 11E	quarts	0.26	0.37	0.37	0.58	0.32	0.53	0.42	0.42	0.32	0.37	0.42	0.53
	liters	0.25	0.35	0.35	0.55	0.30	0.50	0.40	0.40	0.30	0.35	0.40	0.50
SK 21E	quarts	0.63	1.06	1.06	1.27	0.53	1.16	0.95	0.95	0.74	1.48	1.06	1.27
	liters	0.60	1.00	1.00	1.20	0.50	1.10	0.90	0.90	0.70	1.40	1.00	1.20
SK 31E	quarts	1.16	1.80	1.80	2.32	0.85	1.74	2.11	2.11	1.16	1.37	2.43	2.85
	liters	1.10	1.70	1.70	2.20	0.80	1.65	2.00	2.00	1.10	1.30	2.30	2.70
SK 41E	quarts	1.80	2.75	2.75	3.49	1.06	2.96	3.49	3.49	1.69	2.75	2.64	2.75
	liters	1.70	2.60	2.60	3.30	1.00	2.80	3.30	3.30	1.60	2.60	2.50	2.60
SK 51E	quarts	2.32	3.59	3.59	4.97	1.90	4.33	4.02	4.02	3.17	3.70	4.23	4.65
	liters	2.20	3.40	3.40	4.70	1.80	4.10	3.80	3.80	3.00	3.50	4.00	4.40
Mounting position		**double reduction**											
		B 3	**B 6**	**B 7**	**B 8**	**B 5**	**B 5I**	**B 5II**	**B 5III**	**V 1**	**V 3**	**V 5**	**V 6**
SK 02	quarts	0.16	0.42	0.42	0.74	0.26	0.63	0.53	0.53	0.63	0.63	0.63	0.63
	liters	0.15	0.40	0.40	0.70	0.25	0.60	0.50	0.50	0.60	0.60	0.60	0.60
SK 12	quarts	0.26	0.53	0.53	0.90	0.37	0.95	0.63	0.63	0.95	0.90	0.79	0.79
	liters	0.25	0.50	0.50	0.85	0.35	0.90	0.60	0.60	0.90	0.85	0.75	0.75
SK 22	quarts	0.53	1.43	1.43	2.11	0.74	2.11	1.64	1.64	1.90	2.11	1.90	1.90
	liters	0.50	1.35	1.35	2.00	0.70	2.00	1.55	1.55	1.80	2.00	1.80	1.80
SK 32	quarts	0.95	2.11	2.11	3.17	1.37	3.49	2.54	2.54	3.28	3.06	3.06	2.64
	liters	0.90	2.00	2.00	3.00	1.30	3.30	2.40	2.40	3.10	2.90	2.90	2.50
SK 42	quarts	1.37	3.38	3.38	4.76	1.90	4.76	3.91	3.91	4.23	4.65	4.54	6.13
	liters	1.30	3.20	3.20	4.50	1.80	4.50	3.70	3.70	4.00	4.40	4.30	5.80
SK 52	quarts	2.64	5.39	5.39	7.19	3.17	6.55	5.92	5.92	7.82	7.19	7.19	7.40
	liters	2.50	5.10	5.10	6.80	3.00	6.20	5.60	5.60	7.40	6.80	6.80	7.00
SK 62	quarts	6.87	15.85	15.85	13.74	7.40	14.79	16.91	16.91	19.55	15.85	16.91	15.85
	liters	6.50	15.00	15.00	13.00	7.00	14.00	16.00	16.00	18.50	15.00	16.00	15.00
SK 72	quarts	9.51	24.30	24.30	19.02	10.57	19.55	24.30	24.30	29.59	24.30	27.47	24.30
	liters	9.00	23.00	23.00	18.00	10.00	18.50	23.00	23.00	28.00	23.00	26.00	23.00
SK 82	quarts	14.79	33.81	33.81	28.53	15.85	30.64	36.46	36.46	47.55	39.10	46.49	36.98
	liters	14.00	32.00	32.00	27.00	15.00	29.00	34.50	34.50	45.00	37.00	44.00	35.00
SK 92	quarts	26.42	54.95	54.95	49.66	27.47	49.66	54.95	54.95	82.42	77.14	80.31	77.14
	liters	25.00	52.00	52.00	47.00	26.00	47.00	52.00	52.00	78.00	73.00	76.00	73.00
SK 102	quarts	38.04	75.02	75.02	69.74	42.27	69.74	76.08	76.08	109.90	85.59	107.78	83.48
	liters	36.00	71.00	71.00	66.00	40.00	66.00	72.00	72.00	104.00	81.00	102.00	79.00
Mounting position		**triple reduction**											
		B 3	**B 6**	**B 7**	**B 8**	**B 5**	**B 5I**	**B 5II**	**B 5III**	**V 1**	**V 3**	**V 5**	**V 6**
SK 03	quarts	0.32	0.63	0.63	0.85	0.53	0.95	0.85	0.85	1.16	0.86	0.95	1.32
	liters	0.30	0.60	0.60	0.80	0.50	0.90	0.80	0.80	1.10	0.81	0.90	1.25
SK 13	quarts	0.63	0.74	0.74	1.16	0.85	1.27	1.00	1.00	1.27	1.27	1.27	1.32
	liters	0.60	0.70	0.70	1.10	0.80	1.20	0.95	0.95	1.20	1.20	1.20	1.25
SK 23	quarts	1.37	1.69	1.69	2.43	2.64	1.59	2.96	2.96	2.96	2.75	2.48	2.54
	liters	1.30	1.60	1.60	2.30	2.50	1.50	2.80	2.80	2.80	2.60	2.35	2.40
SK 33	quarts	1.69	2.43	2.43	3.38	2.01	3.70	2.75	2.75	4.65	3.59	4.44	3.06
	liters	1.60	2.30	2.30	3.20	1.90	3.50	2.60	2.60	4.40	3.40	4.20	2.90
SK 43	quarts	3.17	3.80	3.80	5.49	3.70	5.28	4.33	4.33	6.45	6.02	6.97	5.92
	liters	3.00	3.60	3.60	5.20	3.50	5.00	4.10	4.10	6.10	5.70	6.60	5.60
SK 53	quarts	4.76	6.34	6.34	8.14	5.49	7.40	7.08	7.08	9.40	8.88	9.19	9.19
	liters	4.50	6.00	6.00	7.70	5.20	7.00	6.70	6.70	8.90	8.40	8.70	8.70
SK 63	quarts	10.57	13.74	13.74	11.62	11.62	12.68	14.79	14.79	19.02	14.79	16.91	15.32
	liters	10.00	13.00	13.00	11.00	11.00	12.00	14.00	14.00	18.00	14.00	16.00	14.50
SK 73	quarts	14.79	21.13	21.13	18.49	14.79	19.02	21.13	21.13	29.06	23.78	28.53	21.13
	liters	14.00	20.00	20.00	17.50	14.00	18.00	20.00	20.00	27.50	22.50	27.00	20.00
SK 83	quarts	23.25	34.87	34.87	27.47	24.30	28.53	35.93	35.93	42.27	35.93	39.10	32.76
	liters	22.00	33.00	33.00	26.00	23.00	27.00	34.00	34.00	40.00	34.00	37.00	31.00
SK 93	quarts	42.27	51.78	51.78	46.49	42.27	46.49	51.78	51.78	78.19	73.97	76.08	73.97
	liters	40.00	49.00	49.00	44.00	40.00	44.00	49.00	49.00	74.00	70.00	72.00	70.00
SK 103	quarts	58.12	70.80	70.80	58.12	58.12	62.34	70.80	70.80	104.61	82.42	102.50	75.02
	liters	55.00	67.00	67.00	55.00	55.00	59.00	67.00	67.00	99.00	78.00	97.00	71.00

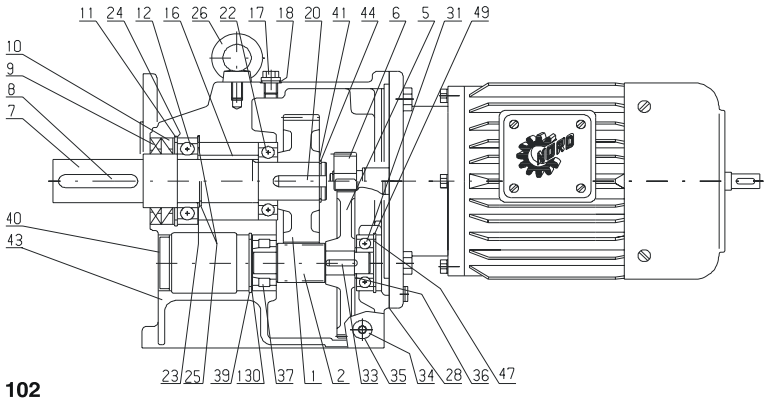
Note: Filling quantities are approximate figures. Oil level must be checked according to oil level plug after final installation. Acceptable oil fill level is within ½ inch of the bottom of the fill plug threads For mounting angles not shown, consult factory.

PARTS LIST

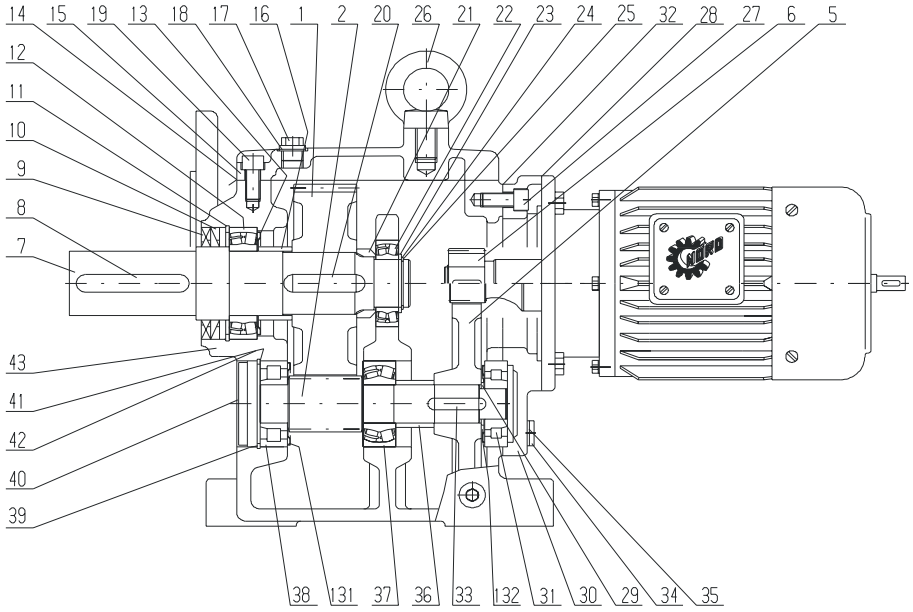
SK 11 E - SK 51 E



SK 02 - SK 52



SK 62 - SK 102



1	Driven gear
2	Pinion shaft
5	Driving gear
6	Driving pinion
7	Output shaft
8	Key
9	Shaft seal
10	Shaft seal
11	Circlip
12	Output shaft bearing
13	NILOS ring
14	Seal
15	Gearcase cover
16	Spacer
17	Vent plug
18	Seal
19	Socket head screw
20	Key
21	Spacer
22	Output shaft bearing
23	Supporting disc
24	Shim
25	Circlip
26	Flanged eye bolt
27	Bolt
28	Seal
29	Spacer
30	Gearbox cover
31	Pinion shaft bearing
32	Seal
33	Key
34	Drain plug
35	Seal
36	Spacer
37	Pinion shaft bearing
38	Pinion shaft bearing
39	Circlip
40	Locking cap
41	Shim
42	Supporting disc
43	Gear case
44	Circlip
47	Shim
49	Circlip
130	Shim
131	NILOS ring
132	NILOS ring

RECOMMENDED SPARE PARTS

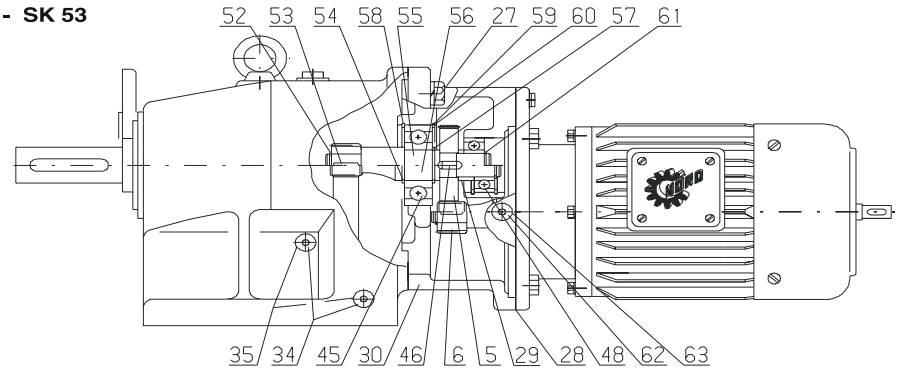
Bearings – *all* Gaskets – *all* Shims – *all*
Seals – *all* Seal Plugs – *all*

IMPORTANT!

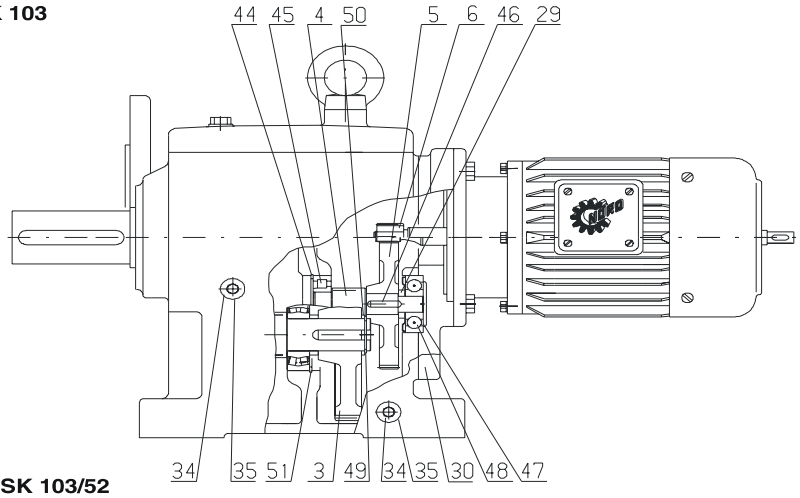
When ordering parts, it is necessary to have the ***NORD SERIAL NUMBER*** from the unit the parts are for. The serial number will dictate the correct parts for that particular unit. The gearbox nameplate will have the serial number on it.

PARTS LIST

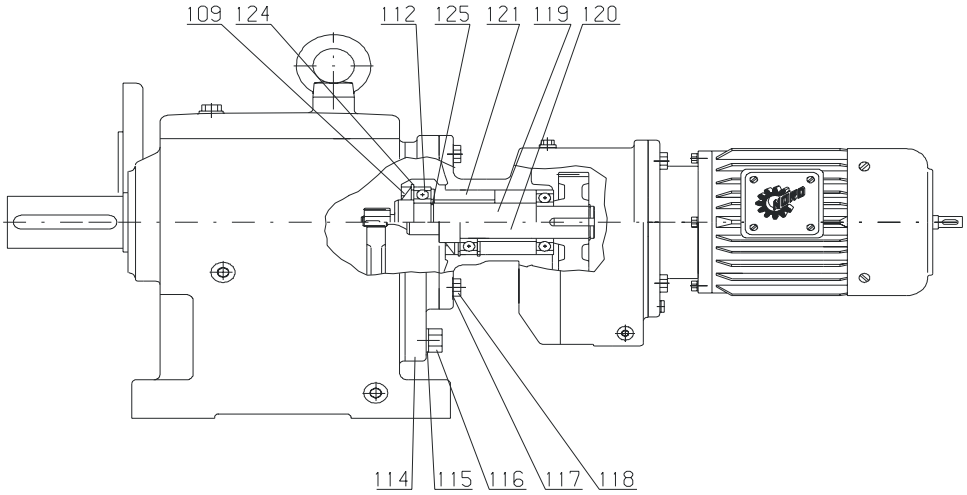
SK 03 - SK 53



SK 63 - SK 103



SK 12/02 - SK 103/52



3	Driven gear
4	Pinion shaft SK 63 - SK 103
5	Driving gear
6	Driving pinion
27	Fixing bolt
28	Seal
29	Spacer
30	Third reduction gearcase
34	Drain plug
35	Seal
44	Circlip
45	Ball bearing
46	Key
47	Shim
48	Ball bearing
49	Circlip
50	Supporting disc
51	Circlip
52	Circlip
53	Key
54	Circlip
55	Intermediate shaft, plain
56	Intermediate shaft, gearcut
57	Circlip
58	Circlip
59	Shim
60	Circlip
61	Circlip
62	Oil-plug
63	Seal
109	Shaft seal
112	Ball bearing
114	Intermediate flange
115	Spring washer
116	Bolt
118	Bolt
119	Intermediate shaft, plain
120	Intermediate shaft, gearcut
121	Bearing sleeve
124	Circlip
125	Circlip

NOTES

TROUBLE SHOOTING

PROBLEM WITH THE REDUCER		POSSIBLE CAUSES	SUGGESTED REMEDY
Runs Hot	Overloading	Load exceeds the capacity of the reducer	Check rated capacity of reducer, replace with unit of sufficient capacity or reduce load
	Improper lubrication	Insufficient lubrication	Check lubricant level and adjust up to recommended levels
		Excessive lubrication	Check lubricant level and adjust down to recommended levels
		Wrong lubrication	Flush out and refill with correct lubricant as recommended
Runs Noisy	Loose foundation bolts	Weak mounting structure	Inspect mounting of reducer. Tighten loose bolts and/ or reinforce mounting and structure
		Loose hold down bolts	Tighten bolts
	Worn RV Disc	Overloading unit may result in damage to disc	Disassemble and replace disc. Recheck rated capacity of reducer.
	Failure of Bearings	May be due to lack of lubricant	Replace bearing. Clean and flush reducer and fill with recommended lubricant.
		Overload	Check rated capacity of reducer.
	Insufficient Lubricant	Level of lubricant in the reducer not properly maintained.	Check lubricant level and adjust to factory recommended level.
Output Shaft Does Not Turn	Internal parts are broken	Overloading of reducer can cause damage.	Replace broken parts. Check rated capacity of reducer.
		Key missing or sheared off on input shaft.	Replace key.
		Coupling loose or disconnected.	Properly align reducer and coupling. Tighten coupling.
Oil Leakage	Worn Seals	Caused by dirt or grit entering seal.	Replace seals. Autovent may be clogged. Replace or clean.
		Overfilled reducer.	Check lubricant level and adjust to recommended level.
		Autovent clogged.	Clean or replace, being sure to prevent any dirt from falling into the reducer.
		Improper mounting position, such as wall or ceiling mount of horizontal reducer.	Check mounting position. Name tag & verify with mounting chart in manual.

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