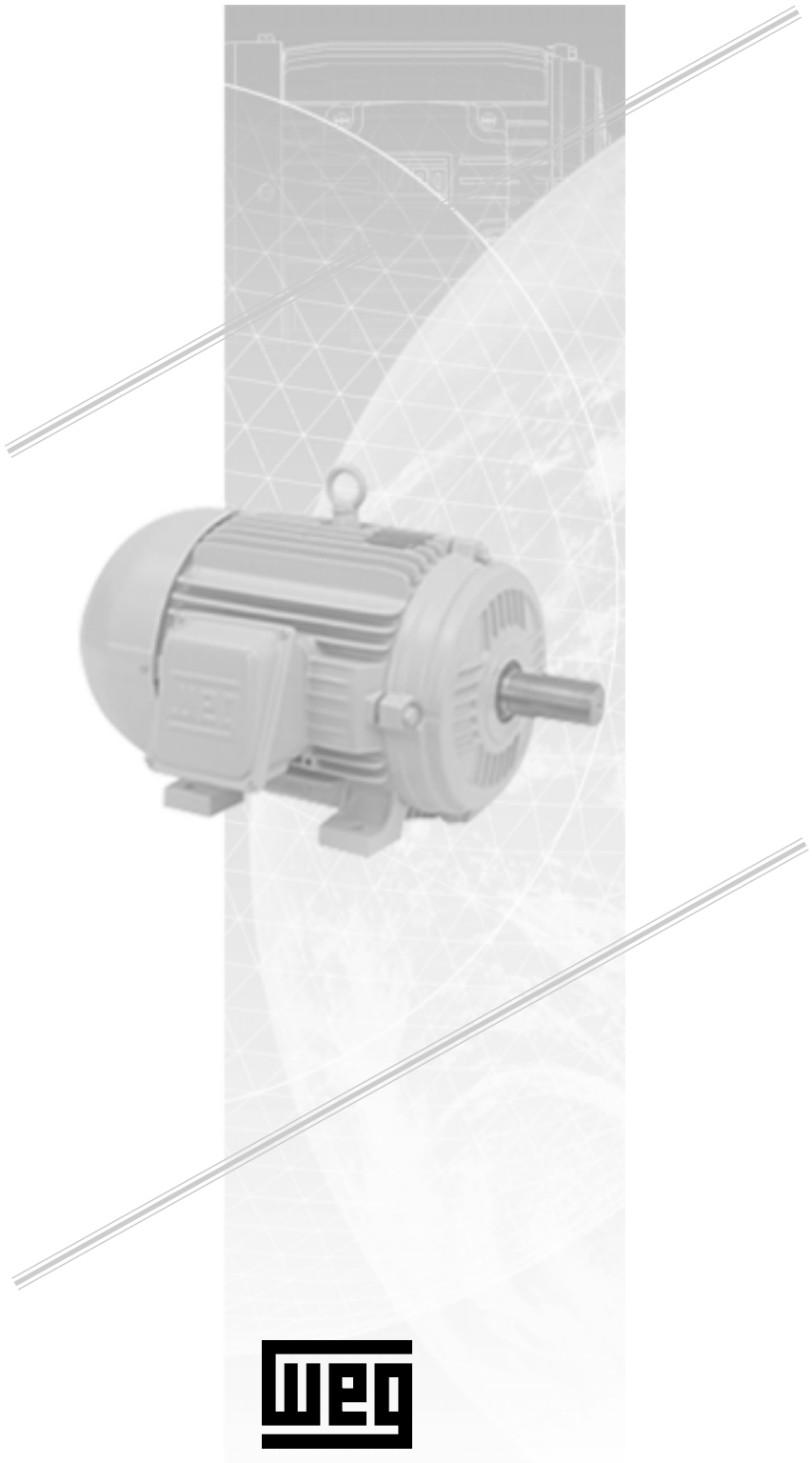

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LPT Model IIIr Pump

Operation and

Maintenance Manual

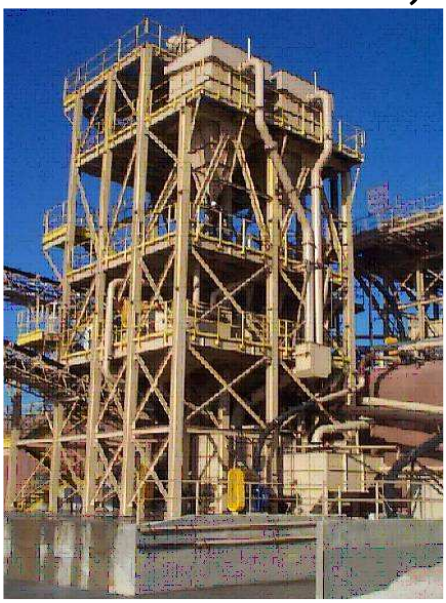
Contents

1. Introduction

Aggregate Processing Division of McLanahan, is a major manufacturer of process plants for the minerals industry. The LPT Model IIIr is the latest generation of successful abrasion/corrosion resistant slurry handling Pumps.

This manual should be carefully read before attempting to install or operate this LPT Model IIIr Pump.

Service, Selection and Support



Total Service

From design to installation and beyond, McLanahan engineers are available to give advice on your slurry pumping needs and problems.

The LPT Model IIIr range has been designed to offer a wide choice of pump sizes to suit most slurry pumping applications. A standard questionnaire is available to ensure that the most complex installation, as well as the more straightforward pumping application, receives individual consideration.

McLanahan can also advise on the ancillary components within the pumping system. The provision of low head loss valves, gland feed pumps, priming devices and flexible bends, all incorporating application specific linings for trouble-free life, are an important aspect of ensuring a totally successful pump installation

Design Specifications and Options

The LPT Model lllr standard casing is designed for a maximum working pressure of 88 psi (6 bar). A high pressure casing is available, rated at 272 psi (18.5 bar). Please contact McLanahan for pressures higher than this.

The pump units in the LPT Model lllr range are designated by the size of suction and discharge ports. Units up to 4" (100mm) have equal size suction and discharge, above this the Model lllr has a larger suction than discharge. Size is given in inches (mm) i.e. 8"/6" (200/150) Model lllr has an 8" (200mm) suction port and a 6" (150mm) discharge port.

Suction and discharge flanges are universal and are available in ASA150 drilling patterns as standard. Other drilling patterns (metric & BS4504) are available to special order. Orientation of discharge to 4 positions according to installation requirements.

The LPT Model lllr pump components are designed and manufactured in accordance with appropriate International Quality Standards, such as lSO9000.

2. Your Pump

<table>
<tr><td colspan="3">Company Name:</td></tr>
<tr><td colspan="2" rowspan="2">Address:</td><td>Tel:</td></tr>
<tr><td>Fax:</td></tr>
<tr><td rowspan="3">Supplier:</td><td colspan="2">Type of Industry:</td></tr>
<tr><td>Pump Model:</td><td>Size:</td></tr>
<tr><td>Serial No:</td><td>Flange Type:</td></tr>
<tr><td>Contact Person:</td><td>Gland Size:</td><td>Drive Style:</td></tr>
<tr><td colspan="3">Start up date/remarks:</td></tr>
</table>

Important Notes

- **The maintenance of rotating machinery should be done by experienced mechanics.**
- **Protective clothing and proper tools and lifting equipment, all in good condition, must be used.**
- **Do not lift heavy weights without mechanical aids.**
- **Do not take any risks with your health and safety.**
- **If a pump has run without discharge, the fluid temperature and pressure may be dangerously high. Refer to paragraph 17.1 and 17.11 c.**
- **The casing suspension arm is fitted as a maintenance aid only. Refer to Note 3, page 17.**
- **The installer must ensure that guards are fitted in accordance with national & local regulations.**

2.1. Design Condition (To be filled in by distributor or owner)

The following data should be completed as a record of the duty for which the pump was originally sold. During its lifetime the pumping requirements may change, if so, the new speed and operating conditions must be carefully engineered. McLanahan engineers are able to assist you in doing this if required. US units are used unless otherwise noted

Details of Solids

Description of Solids = …….

Specific Gravity Solids: S =…… Quantity of Solids M =…….dry Tons/hr.

Particle Size : Topsize =……mesh.(mm) 50% passing size = mesh.(mm)

Details if Liquor

Description of Liquor =……..

Specific Gravity of Liquor: Sl =…….

Details of Slurry

Specific gravity of Slurry: Sm =……

% of solids by volume in slurry: Cv = ……..

% of solids by weight in slurry: Cm = ……

Flow rate of slurry :Q = ……gpm.(l/s, m^3/Hr)

Calculated Design Data

Total Head = … ft. (m) Maximum working Head = …… ft. (m)

NPSHa = …… ft. (m) NPSHr = …… ft. (m)

Pump Speed on Slurry = ……rpm. Derate factor for Slurry = ……

Motor Data

Motor Power rating = ……HP (kW)

Motor Frame size = ……

Motor Speed = ……..rpm.

Motor Shaft size = ……in. (mm)

Vee-Belt Drive Data

Motor pulley O.D. = ……..in. (mm) Pump pulley O.D. = ……in. (mm)

Taper lock Bush No = …… Taper lock Bush No = ……..

Vee-belt = ……..No off…… No of grooves/pulley =……..

Gland Water Requirements (H and P glands only)

Quantity: = ……..gpm (l/s)

Pressure: = ……psi (m)

Technical Data

Pump Mass = ……lbs. (kg)

Motor Mass = ……lbs. (kg)

Pump Shaft Size = ……mm

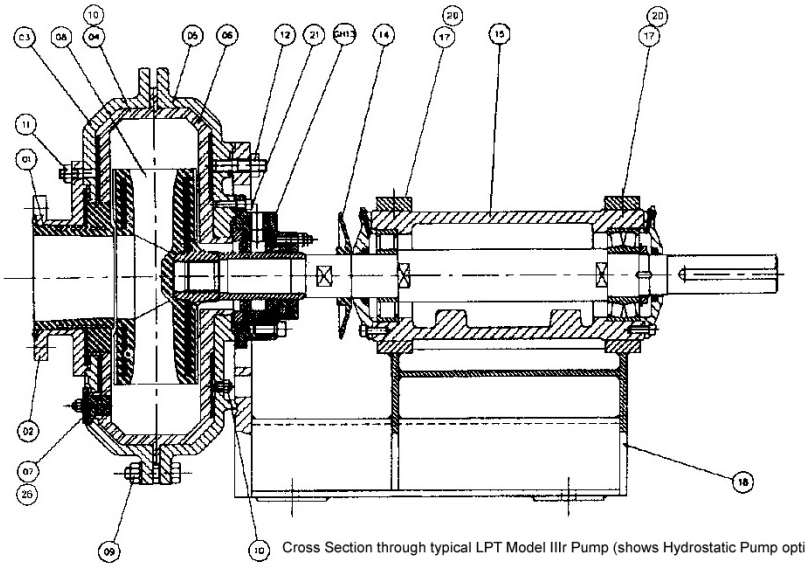
Noise level = ……..db(A) (see page 12)

3. Performance Curve – see Appendix

4. Pump Range – Typical Sectional Arrangements

4.1. Pump Assembly

The actual sectional arrangement drawing for your pump is to be found in the Appendix.



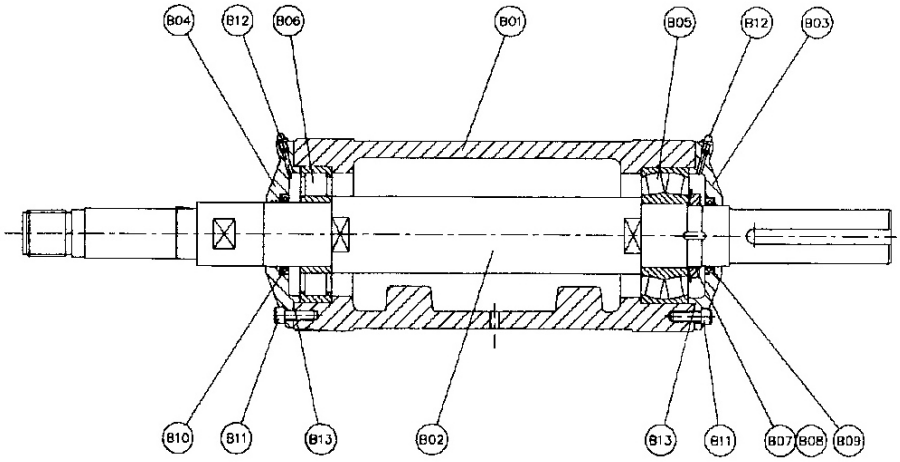
Cross Section through typical LPT Model IIIr Pump (shows Hydrostatic Pump option)

Pump Parts List	
Part No.	Description
*01	Suction Bush Liner
*02	Suction Bush
03	Suction Side Casing
04	Suction Side Liner
05	Gland Side Casing
06	Gland Side Liner
07	Drain Plug
08	Impeller
09	Casing Bolt Set
10	Liner Nut Set
11	Suction Bush Stud Set
12	Casing to Pedestal Stud Set
13	Gland Assembly ("H" Type shown)
14	Flinger
15	Bearing Assembly
16	Motor Platform Assembly (not shown)
17	Pedestal Caps
18	Pedestal
19	Axial Positioning Jack (not shown)
20	Pedestal Cap Screws
21	Gland Holding Screw Set
23	Eyebolt - Casing (not shown)
24	Inside Gland Cover (not shown)
25	S & D Flang Stud Set (not shown)
26	Drain Plug Stud Set (not shown)
31	Shaft Gland (not shown)

Optional Parts (not shown)		
Part No.		Description
28	C01	Suspension Arm
	C02	Crawl
	C03	Supporting Disc
	C04	Supporting Bracket
	C05	Eyebolt
16	M01	C01
	M02	C02
	03	C03
	M04	C04
	M05	Crossbar Support Collar
29		Belt Guard
30		Shaft Spanner

*Removable suction bush & liner from LP6x5 (150/125) upwards.

4.2. Bearing Housing Assembly



Cross Section Through Bearing Assembly

Bearing Assembly Parts List	
Part No.	Description
B01	Bearing Housing
B02	Shaft
B03	End Cover
B04	Front Cover
B05	End Bearing
15 B06	Front Bearing
B07	Tab Washer
B08	Lock Nut
B09	End Grease Seal
B10	Front Grease Seal
B11	Bearing Cover Set Screws
B12	Grease Nipples
B13	Bearing Housing Cover Seals

5. Parts List and Part Reference Numbers

Spare Parts

The part is fully identified by the number on the cross section drawing followed by the discharge branch size. For example an impeller for the 2"/2" (50/50) rubber pump is Part Number 08-050. The material description must also be given i.e. Linatex, nitrile, etc.

Description	1½x1½	2x2	3x3	4x4	6x5	8x6	10x8	12x10
General Pump Parts								
Suction Bush Liner	-	-	-	-	01-125	01-150	01-200	01-250
Suction Bush – MM	-	-	-	-	02-125	02-150	02-200	02-250
Suction Bush - UNC	-	-	-	-	02-125A	02-150A	02-200A	02-250A
Suction Side Casing - MM	03-035	03-050	03-080	03-100	03-125	03-150	03-200	03-250
Suction Side Casing - UNC	03-035A	03-050A	03-080A	03-100A	03-125A	03-150A	03-200A	03-250A
Suction Side Liner c/w Drain Plug	04-035	04-050	04-080	04-100	04-125	04-150	04-200	04-250
Gland Side Casing – MM	05-035	05-050	05-080	05-100	05-125	05-150	05-200	05-250
Gland Side Casing – UNC	05-035A	05-050A	05-080A	05-100A	05-125A	05-150A	05-200A	05-250A
Gland Side Liner	06-035	06-050	06-080	06-100	06-125	06-150	06-200	06-250
Drain Plug	07-050	07-050	07-080	07-100	07-125	07-150	07-200	07-250
Impeller	08-035	08-050	08-080	08-100	08-125	08-150	08-200	08-250
Casing Bolt Set	09-035	09-050	09-080	09-100	09-125	09-150	09-200	09-250
Suction Bush Stud Set	-	-	-	-	11-125	11-150	11-200	11-250
Casing to Pedestal Stud Set	12-050	12-050	12-080	12-100	12-125	12-150	12-200	12-250
Gland Assembly	13-050	13-050	13-080	13-100	13-125	13-150	13-200	13-250
Finger	14-050	14-050	14-080	14-100	14-125	14-150	14-200	14-250
Bearing Assembly	15-050	15-050	15-080	15-100	15-125	15-150	15-200	15-250
Motor Support Assembly	16-050	16-050	16-080	16-100	16-125	16-150	16-200	16-250
Pedestal Caps	17-050	17-050	17-080	17-100	17-125	17-150	17-200	17-250
Pedestal	18-050	18-050	18-080	18-100	18-125	18-150	18-200	18-250
Axial Positioning Jack	19-050	19-050	19-080	19-100	19-125	19-150	19-200	19-250
Pedestal Cap Screw Set	20-050	20-050	20-080	20-100	20-125	20-150	20-200	20-250
Gland Holding Screw Set	21-050	21-050	21-080	21-100	21-125	21-150	21-200	21-250
Eyebolt - Casing	-	-	23-080	23-100	23-125	23-150	23-200	23-250
Inside Gland Cover	-	-	-	-	-	-	24-200	24-250
Suct. & Disch. Flange Stud Set - MM	25-050	25-050	25-080	25-100	25-125	25-150	25-200	25-250
Suct. & Disch. Flange Stud Set -UNC	25-050A	25-050A	25-080A	25-100A	25-125A	25-150A	25-200A	25-250A
Drain Plug Stud Set	26-050	26-050	26-080	26-100	26-125	26-150	26-200	26-250
Crane & Crawl Assembly	-	-	28-080	28-100	28-125	28-150	28-200	-
Belt Guard	29-050	29-050	29-080	29-100	29-125	29-150	29-200	29-250
Shaft Spanner	-	-	30-080	30-100	30-125	30-150	30-200	30-250
Shaft Guard	31-050	31-050	31-080	31-100	31-125	31-150	31-200	31-250
Name Plate	32-050	32-050	32-080	32-100	32-125	32-150	32-200	32-250
Logo Plate	33-050	33-050	33-080	33-100	33-125	33-150	33-200	33-250

Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Bearing Assembly								
Bearing Housing	B01-050	B01-050	B01-080	B01-100	B01-125	B01-150	B01-200	B01-250
Shaft	B02-050	B02-050	B02-080	B02-100	B02-125	B02-150	B02-200	B02-250
End Cover	B03-050	B03-050	B03-080	B03-100	B03-125	B03-150	B03-200	B03-250
Front Cover	B04-050	B04-050	B04-080	B04-100	B04-125	B04-150	B04-200	B04-250
End Bearing	B05-050	B05-050	B05-080	B05-100	B05-125	B05-150	B05-200	B05-250
Front Bearing	B06-050	B06-050	B06-080	B06-100	B06-125	B06-150	B06-200	B06-250
Tab Washer	B07-050	B07-050	B07-080	B07-100	B07-125	B07-150	B07-200	B07-250
Lock Nut	B08-050	B08-050	B08-080	B08-100	B08-125	B08-150	B08-200	B08-250
End Grease Seal	B09-050	B09-050	B09-080	B09-100	B09-125	B09-150	B09-200	B09-250
Front Grease Seal	B10-050	B10-050	B10-080	B10-100	B10-125	B10-150	B10-200	B10-250
Bearing Cover Set Screws	B11-050	B11-050	B11-080	B11-100	B11-125	B11-150	B11-200	B11-250
Grease Nipples	B12-050	B12-050	B12-080	B12-100	B12-125	B12-150	B12-200	B12-250
Bearing Housing Cover Seals	B13-050	B13-050	B13-080	B13-100	B13-125	B13-150	B13-200	B13-250
Complete Assembly	15-050	15-050	15-080	15-100	15-125	15-150	15-200	15-250

Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Dry Gland Assembly								
Gland Housing	D01-050	D01-050	D01-080	D01-100	D01-125	D01-150	D01-200	D01-250
Gland Cover	D02-050	D02-050	D02-080	D02-100	D02-125	D02-150	-	-
Adjusting Sleeve	D03-050	D03-050	D03-080	D03-100	D03-125	D03-150	D03-200	D03-250
Linatex Washer	D04-050	D04-050	D04-080	D04-100	D04-125	D04-150	D04-200	D04-250
Gland Seal	D05-050	D05-050	D05-080	D05-100	D05-125	D05-150	D05-200	D05-250
Adjusting Stud Set	D06-050	D06-050	D06-080	D06-100	D06-125	D06-150	D06-200	D06-250
Sleeve O-Ring	D07-050	D07-050	D07-080	D07-100	D07-125	D07-150	D07-200	D07-250
Gland Sleeve	D08-050	D08-050	D08-080	D08-100	D08-125	D08-150	D08-200	D08-250
Linatex Face Seal	D09-035	D09-050	D09-080	D09-100	D09-125	D09-150	D09-200	D09-250
Face O-Ring	D10-050	D10-050	D10-080	D10-100	D10-125	D10-150	D10-200	D10-250
Wearing Face	D11-050	D11-050	D11-080	D11-100	D11-125	D11-150	D11-200	D11-250
Impeller O-Ring	D12-050	D12-050	D12-080	D12-100	D12-125	D12-150	D12-200	D12-250
Gland Locating Ring	-	-	-	D13-100	-	-	-	-
Gland Cover Set Screw	D14-050	D14-050	D14-080	-	D14-125	D14-150	D14-200	D14-250
Spacer Ring	-	-	-	-	-	-	D15-200	D15-250
Complete Assembly	GD13-035	GD13-050	GD13-080	GD13-100	GD13-125	GD13-150	GD13-200	GD13-250
Hydrostatic Gland Assembly								
Gland Housing	H01-050	H01-050	H01-080	H01-100	H01-125	H01-150	H01-200	H01-250
Gland Cover	H02-050	H02-050	H02-080	H02-100	H02-125	H02-150	-	-
Adjusting Gland	H03-050	H03-050	H03-080	H03-100	H03-125	H03-150	H03-200	H03-250
Resilient Gasket	H04-050	H04-050	H04-080	H04-100	H04-125	H04-150	H04-200	H04-250
Gland Seal	H05-050	H05-050	H05-080	H05-100	H05-125	H05-150	H05-200	H05-250
Adjusting Stud Set	H06-050	H06-050	H06-080	H06-100	H06-125	H06-150	H06-200	H06-250
Sleeve O-Ring	H07-050	H07-050	H07-080	H07-100	H07-125	H07-150	H07-200	H07-250
Gland Sleeve	H08-050	H08-050	H08-080	H08-100	H08-125	H08-150	H08-200	H08-250
Axial Expeller	-	-	H10-080	H10-100	H10-125	H10-150	-	H10-250
Lantern Ring	-	-	-	-	-	-	-	H11-250
Impeller O-Ring	H12-050	H12-050	H12-080	H12-100	H12-125	H12-150	H12-200	H12-250
Gland Locating Ring	H13-050	H13-050	H13-080	H13-100	H13-125	H13-150	H13-200	-
Gland Cover Set Screw	H14-050	H14-050	H14-080	H14-100	H14-125	H14-150	H14-200	H14-250
Complete Assembly	GH13-050	GH13-050	GH13-080	GH13-100	GH13-125	GH13-150	GH13-200	GH13-250

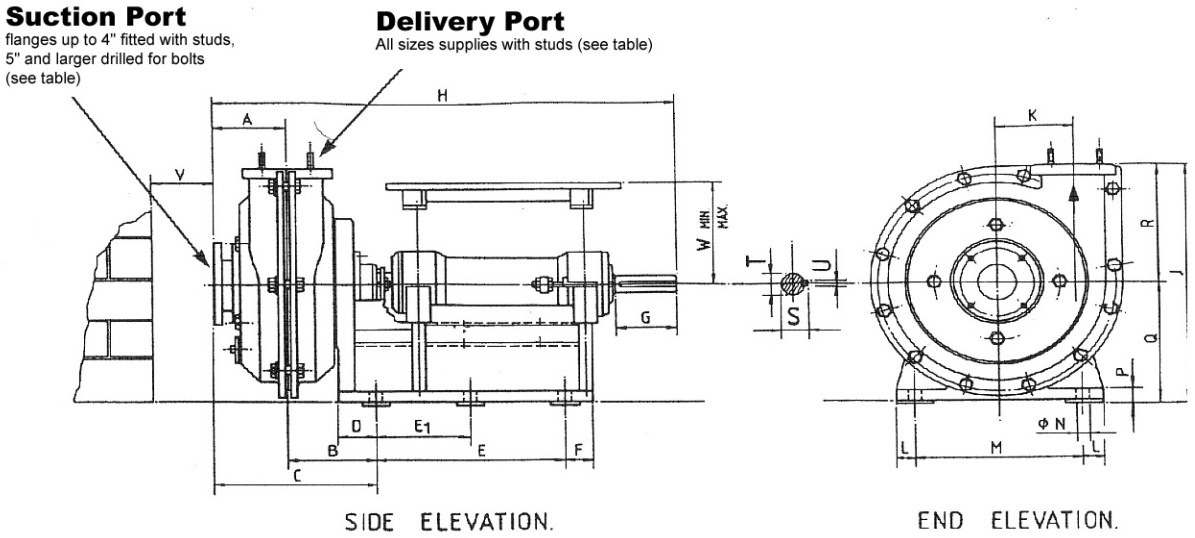
Description	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Packed Gland Assembly								
Gland Housing	P01-050	P01-050	P01-080	P01-100	P01-125	P01-150	P01-200	P01-250
Lantern Ring	P02-050	P02-050	P02-080	P02-100	P02-125	P02-150	P02-200	P02-250
Adjusting Gland	P03-050	P03-050	P03-080	P03-100	P03-125	P03-150	P03-200	P03-250
Packing Rings	P04-050	P04-050	P04-080	P04-100	P04-125	P04-150	P04-200	P04-250
Gland Seal	P05-050	P05-050	P05-080	P05-100	P05-125	P05-150	P05-200	P05-250
Adjusting Stud Set	P06-050	P06-050	P06-080	P06-100	P06-125	P06-150	P06-200	P06-250
Sleeve O-Ring	P07-050	P07-050	P07-080	P07-100	P07-125	P07-150	P07-200	P07-250
Gland Sleeve	P08-050	P08-050	P08-080	P08-100	P08-125	P08-150	P08-200	P08-250
Axial Expeller	-	-	P10-080	P10-100	P10-125	P10-150	-	P10-250
Backing Ring	-	-	-	-	-	-	P11-200	P11-250
Impeller O-Ring	P12-050	P12-050	P12-080	P12-100	P12-125	P12-150	P12-200	P12-250
Gland Locating Ring	-	-	P13-080	P13-100	P13-125	P13-150	P13-200	-
Gland Cover Set Screw	-	-	-	-	-	-	P14-200	P14-250
Complete Assembly	GP13-050	GP13-050	GP13-080	GP13-100	GP13-125	GP13-150	GP13-200	GP13-250
Motor Table & Others Parts								
Motor Platform	M01-050	M01-050	M01-080	M01-100	M01-125	M01-150	M01-200	M01-250
Motor Platform Stud	M02-050	M02-050	M02-080	M02-100	M02-125	M02-150	M02-200	M02-250
Motor Support Crossbar	M03-050	M03-050	M03-080	M03-100	M03-125	M03-150	M03-200	M03-250
Crossbar Support Stud	M04-050	M04-050	M04-080	M04-100	M04-125	M04-150	M04-200	M04-250
Crossbar Support Collar	M05-050	M05-050	M05-080	M05-100	M05-125	M05-150	M05-200	M05-250
Complete Assembly	16-050	16-050	16-080	16-100	16-125	16-150	16-200	16-250
Suspension Arm	-	-	C01-080	C01-100	C01-125	C01-150	C01-200	C01-250
Crawl Assy.	-	-	C02-080	C02-100	C02-125	C02-150	C02-200	C02-250
Supporting Disc	-	-	C03-080	C03-100	C03-125	C03-150	C03-200	C03-250
Supporting Bracket	-	-	C04-080	C04-100	C04-125	C04-150	C04-200	C04-250
Evebolt	-	-	C05-080	C05-100	C05-125	C05-150	C05-200	C05-250
Complete Assembly			28-080	28-100	28-125	28-150	28-200	28-250

6. Pump Dimensions

PUMP SIZE	MASS	ALL DIMENSIONS IN INCHES CONVERTED FROM METRIC																				W	
ins.	lbs	A	B	C	D	E	E1	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	MIN	MAX
1½ 1½		3.425	5.394	8.819	1.949	12.205	-	1.811	2.756	28.543	18.346	4.370	0.787	11.220	0.709	0.669	9.843	8.504	1.693	1.575	0.472	8.661	6.496	8.661
2x2	344	3.642	5.197	8.839	1.949	12.205	-	1.811	2.756	28.543	19.331	4.744	0.787	11.220	0.709	0.669	9.843	9.488	1.693	1.575	0.472	8.661	6.496	8.661
3x3"	719	4.724	7.087	11.811	2.559	13.976	-	1.969	4.724	36.024	23.425	6.614	1.181	14.173	0.866	0.945	11.811	11.614	1.909	1.772	0.551	9.449	9.843	12.205
4x4"	971	5.197	6.654	11.850	2.244	18.110	-	1.575	5.000	39.311	25.984	7.244	1.181	15.748	0.945	0.866	13.228	12.756	2.520	2.362	0.709	10.236	10.709	14.646
6x5	1341	8.307	9.213	17.520	4.331	18.858	-	3.937	7.441	50.630	29.843	8.268	1.181	18.898	0.945	1.102	15.354	14.488	2.736	2.559	0.709	13.780	13.386	17.323
8x6	1623	8.563	8.780	15.768	3.543	18.425	-	2.598	6.850	51.673	32.362	8.740	1.378	19.291	0.945	1.102	16.850	15.512	2.933	2.756	0.787	17.323	13.583	17.520
10x8	2757	12.165	10.630	22.795	4.252	25.984	12.992	2.992	7.874	62.992	37.638	12.638	1.575	25.984	0.945	1.299	21.654	15.984	3.756	3.543	0.984	19.685	16.929	23.031
12x10	4313	12.500	11.220	23.720	2.756	25.197	12.598	2.756	7.874	66.831	42.638	14.488	1.575	29.528	1.102	1.181	23.622	19.016	4.173	3.937	1.102	25.984		

	ASA Inch					
		PCD	Stud Dia.	Hole Dia.	No. Off	Stud Lgth *
1½ x 1½	Suction	3 7/8	½		4	1-¾
	Discharge	3 7/8	½		4	1-¾
2x2	Suction	4 ¾	5/8	-	4	1-¾
	Discharge	4 ¾	5/8	-	4	1-¾
3x3	Suction	6	5/8	-	8	1-¾
	Discharge	6	5/8	-	8	1-¾
4x4	Suction	7 ½	5/8	-	8	2
	Discharge	7 ½	5/8	-	8	1-¾
6x5	Suction	9 ½	-	7/8	8	-
	Discharge	8 ½	¾	-	8	2
8x6	Suction	11 ¾	-	7/8	8	-
	Discharge	9 ½	¾	-	8	2
10x8	Suction	14 ¼	-	1	12	-
	Discharge	11 ¾	¾	-	8	2
12x10"	Suction	17	-	1	12	-
	Discharge	14.25	7/8	-	12	2 ¼

* stud length protruding



SIDE ELEVATION. END ELEVATION.

McLanahan CORPORATION

7. Gland Options & Part Numbers

Gland Seals

The Gland is usually the weakest point on any Pump and requires most attention and maintenance. All glands need cooling and lubrication between the sliding surfaces, so a drip from the glands is normal. All glands must be finally adjusted while the pump is running.

The LPT Glands have been developed to try to minimise the attention and service needed, but this depends on the pressure of the fluid being pumped, the size and shape of the solid particles and the concentration of the solid particles in the liquid. Three unique seal arrangements have been developed and McLanahan engineers can give advice regarding the optimum selection for a specific duty.

7.1. "H" and "P" Glands

The Slurry pressure at the gland is reduced by back pump out vanes on the impeller, and when fitted the Rubber axial expeller, which is a stretch fit on the shaft of the "H" and "P" glands.

The solids are restrained by the outward Centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the "H" Gland, the adjusting gland must be eased **outwards** to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of "digging" onto the gland sleeve.

The gland sealing water must be as clean as possible and at a pressure of about 3 – 5 psi (2 – 4m water gauge) above the discharge pressure. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

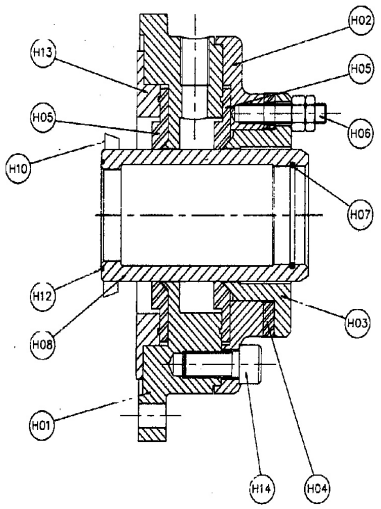
7.2. "D" Gland

This is a unique type of mechanical seal. The Face Seal runs against the hard Wearing Face.

The Face Seal acts as a spring and if any grit particles get between the rotating rubber and stationary Wear Face it is pressed into the Rubber. The Face Seal is a stretch fit on the shaft sleeve. As the gland pressure increases, so the rubber extends axially and increases the pressure at the rubbing interface. So great care must be taken not to over tighten the adjusting sleeve.

When the pump is first started, ensure that the adjusting nuts are finger tight. When the pump runs, adjust the gland nuts so that there are approximately 5 drops per minute from the gland. This should reduce to 1 drop occasionally, and run satisfactorily for up to a year without further attention in a good application.

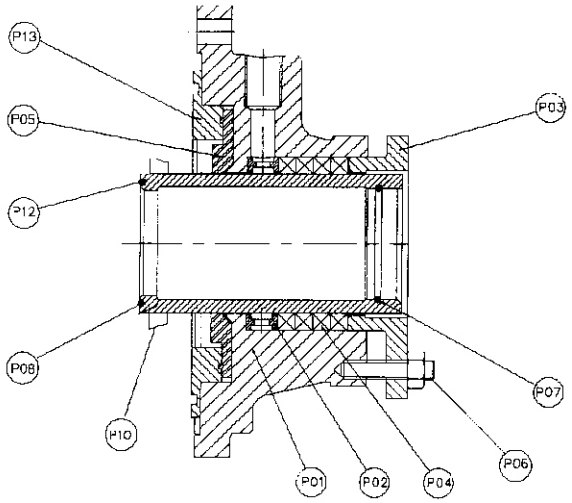
7.3. Sectional Arrangement – "H" Gland Assembly



Note on operation:
Loosen H06 to increase sealing.

Hydrostatic Gland Assembly	
Part No.	Description
H01	Gland Housing Hose Connector
H02	Gland Cover
H03	Adjusting Gland
H04	Resilient Gasket
H05	Gland Seal
H06	Adjusting Stud Set
H07	Sleeve O-Ring
H08	Gland Sleeve
H10	Axial Expeller
H11	Lantern Ring (not shown) 12"/10" (300/250) only
H12	Impeller O-Ring
H13	Gland Locating Ring
H14	Gland Cover Set Screw

7.4. Sectional arrangement – "P" Gland Assembly

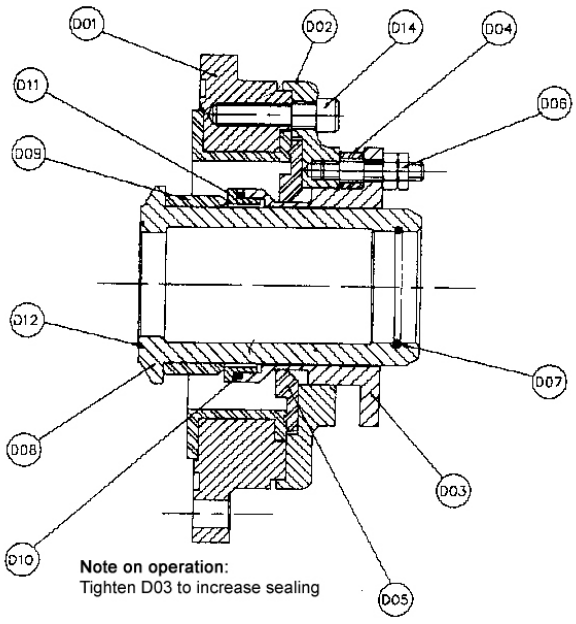


Note on operation: Tighten P03 to increase sealing

Packed Gland Assembly	
Part No.	Description
P01	Gland Housing Hose Connector
P02	Lantern Ring
P03	Adjusting Gland
P04	Packing Rings
P05	Gland Seal
P06	Adjusting Stud Set
P07	Sleeve O-Ring
P08	Gland Sleeve
P10	Axial Expeller
P11*	Backing Ring (not shown)
P12	Impeller O-Ring
P13	Gland Locating Ring
P14*	Gland Cover Set Screw Set

*used on 10x8 (250/200) and 12x10 (300/250)

7.5. Sectional Arrangement - "D" Gland Assembly



D Gland Assembly	
Part No.	Description
D01	Gland Housing
D02	Gland Cover
D03	Adjusting Sleeve
D04	Linatex Washer
D05	Gland Seal
D06	Adjusting Stud Set
D07	Sleeve O-Ring
D08	Gland Sleeve
D09	Linatex Face Seal
D10	Face O-Ring
D11	Wearing Face
D12	Impeller O-Ring
D13	Gland Locating Ring (not shown) only on (4”/4”
D14	(100/100)
D15	Gland Cover Set Screw Spacer Ring (not shown) Only on 10”/8” (250/200) and 12”/10” (300/250)

Do not overtighten the adjusting nuts part D06

8. "Pumptec" Computer Software

Many complex calculations are needed In order to

- size a pump
- establish the optimum pipeline carrying velocity
- de-rate the pump for a slurry duty
- calculate pipeline friction head losses
- calculate power absorbed,
- analyze the system head

To perform these calculations, McLanahan Corporation uses unique software named "Pumptec".

Where McLanahan Corporation has selected the Pump using Pumptec, a printout of the operating conditions; pipe configuration and curve is included in the Appendix of this manual.

When any change of duty is envisaged, the pump can usually accommodate it with a change of V-belt sheave ratios and a different speed, but it is essential to recalculate all the duty parameters and to check that the motor and drive will not be overloaded under any normal operating condition.

When making any change to your pump system, please refer these changes to McLanahan Corporation so the correct combination of speed and power is selected.

Input criteria required:

- Volume to be pumped
- Percent solids
- Gradation of solids (top size & 50% passing size)
- Specific Gravity of Solids
- Specific Gravity of Liquid
- Temperature of Liquid
- Elevation above sea level
- Height of liquid level in tank
  (if negative suction, height from liquid surface to centre line of pump inlet)
- Vertical height from Pump inlet to discharge point
- Pressure required at delivery point
- Pipe diameter (inside diameter important)
- Pipe material
- Pipe fittings – type and quantity

9. General Pump Suction Requirements

A pump does not “suck” as fluid has no tensile strength. The centrifugal expulsion of fluids creates a low pressure area at the eye of the impeller, and atmospheric pressure, plus any static head, pushes fluid into the pump. It is therefore essential that suction systems do not restrict flow from the sump into the pump. With slurries, this is even more important as the solids themselves can settle and cause obstructions to flow.

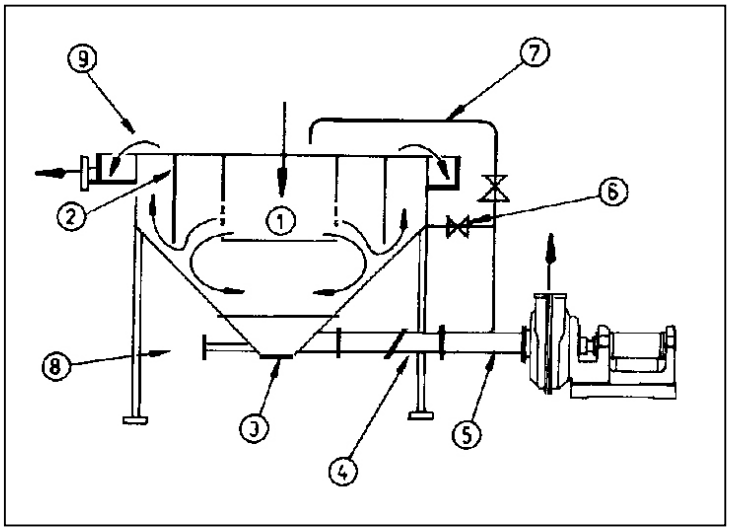
Short unobstructed pipelines with facilities for easy draining, removal and cleaning are essential.

A trap to remove tramp material is desirable.

Air entrained in the slurry reduces the pump’s capacity and head, and an air vent pipe on the suction pipe close to the pump inlet is often essential.

The pump will operate best if the flow velocity approaching the impeller is evenly distributed across the suction eye, and is sensibly axial and without swirl. Intake conditions in the sump, such as the formation of vortices, or in the suction pipeline, such as a sharp bend just before the pump, cause an uneven flow over the eye of the impeller, and impair pump performance.

The Desliming and Feed Regulating Sump shown below incorporates the best features in good sump design.



1. Feed Distribution Box/Tramp Material Trap.
2. Anti-Turbulence/Air Release Baffles.
3. Replaceable Lined Suction Box.
4. Removable Split Pipe or Flexible Hose to facilitate maintenance.
5. Short Simple Suction Piping.
6. Start Up Suction Line (Optional)
7. Air Vent Line (Optional).
8. Injection Water Line (Optional) or Drain/Dump Port.

10. Installation

The following notes cover most situations, but certain installations will require additional checks.

10.1. Noise

Because of its heavy construction, rigid bearing housing and the sound attenuation due to the rubber lining, the noise generated by a bare shaft LPT pump is low, less than 70dB(A).

The noise emission from a complete pump and drive unit will be dependent upon various factors including that from the motor, its fan and the V-belt drive. To obtain an indication of the noise level generated by a specific complete unit take the highest component noise level, generally the motor, and multiply by 1.15. I.e. dB (A) pump + dB (A) motor + dB (A) drive = 1.15 x dB (A) motor.

Other factors, including the piping system and hydraulically generated noise as well as any reflected noise, will affect the final installed figure.

10.2. Foundations

Holding down bolts, bolt holes in steel work or pockets in concrete must be checked for location and dimension to match the pump certified drawing. The foundations must be rigid.

The pump base must be set level in its final position, and be rigidly supported at each holding down bolt before the holding down bolts are tightened. It is unacceptable to twist the base by uneven tightening of the holding down bolts.

10.3. Pipe work

The suction and delivery pipe work must be independently supported, and the pump must not be used as an anchor to pull the pipes into position.

Provision for simple removal of suction and delivery pipe work to facilitate unblocking and servicing the pump, and dumping solids in an emergency situation should be checked.

Areas that could cause restriction on the suction side should be checked.

The possibility of thermal expansion in the pipe work causing undue loads on the pump should be checked.

Check that the pipe work matches up to the pump without strain.

The lining on the LPT Model IIIr is continued out to form gaskets on the suction and discharge flanges, therefore the use of joint rings or additional gaskets is not necessary. Connections to the pump should be made using flat faced flanges only.

When fitting LPT pumps to rubber-lined equipment such as valves, hose or lined pipe, a steel gasket must be used.

10.4. Power

Check that the motor voltage, power and starter rating and supply match.

10.5. Gland Services

If gland sealing water is required, the quantity, quality and availability should be checked.

10.6. Access

Crane capacity and access routes from the delivery point should be checked. Access for maintenance, protection from flooding, and ventilation for motor cooling must be checked.

10.7. Impeller Adjustment Axially

The position of the rotating element must be set so that there is a minimum running clearance, approximately 1mm, between the suction bush and the impeller, the bearing housing must then be locked in position. This clearance should be checked by bolting a dummy flange or stub pipe to the suction flange this ensures any movement of the rubber lining on connection is allowed for. Once connected to suction and delivery lines, the unit should be checked for free rotation.

10.8. Coupling Alignment

The pump and motor couplings must be aligned in accordance with good engineering practice and axial or radial run out must be less than 0.05 mm total indicated reading on a clock gauge. With Vee-belt pulleys, the faces of the couplings must be exactly in line, and the shafts must be parallel to each other. A check with a straight edge or string line across the pulley faces should have no visible gap.

10.9. Motor Rotation

Before the belts are fitted or the couplings are connected, the direction of rotation of the motor must be checked. Incorrect motor rotation can cause the impeller to screw off and destroy the pump.

10.10. Tension V-belts

When the motor's direction of rotation is correct, fit the V-belts and tension them in accordance with the maker's recommendation. In general, a quarter to a half twist of the belt will be possible at the centre of the belt using a finger and a thumb. Check the tension again after a few hours running.

10.11. Belt Guard

The belt guard provided with this pump unit is manufactured with the shaft aperture fully closed with mesh. On installation of the vee belt drive and determination of pulley centres, the shaft guard is offered up and the mesh relieved locally to allow the shafts to pass through. Allowance may be required for movement of shafts when belt tensioning.

The mesh should be relieved and a guard should be fitted in a manner which prevents accidental contact with the rotating parts of the drive assembly.

The installer must ensure the guard is installed in the accordance with national and local regulations.

10.12. Gland Service

Check that gland water supply and protection systems are working, when these are fitted.

10.13. Greased Bearings

The pump bearings will have been greased at the factory and over greasing can cause them to overheat, so check the bearings, but do not over grease them. Suitable grease types are Shell Alvania 3, Mobil EP2, Caltex LS3 or their equivalents.

10.14. Final Checks

Check that all nuts and bolts are tight; the gland adjusting nuts are finger tight; that no loose material is lying around the pump set; that the guards are securely fitted and the pump is safe to start.

THE RUNNING SPEED OF THE PUMP MUST NOT EXCEED THE FOLLOWING:

Pump	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
MAX RPM.	2750	2400	2100	1600	1400	1200	1200	900

10.15. Electrical Installation

This equipment must be installed and controlled in accordance with applicable national and local regulations.

11. Gland Services

On the hydrostatic gland and also on the packed gland, it is usually necessary to have a clean water flushing supply to the gland.

The pressure should be 3 – 5 psi (2 – 4 m) water gauge above the pump discharge pressure (remember to include the S.G. of the slurry) and the flow rate should be approximately in accordance with the table below.

Pump	units	1½x1½	2x2	3x3n	4x4	6x5	8x6	10x8	12x10
Water flow.	USgpm	1	1	1	2	2	2	3	4
Water flow.	liter/sec	0.04	0.04	0.05	0.07	0.07	0.09	0.1	0.2

The gland flushing water should be clean. The life of the gland and gland sleeve is related to the cleanliness of the flushing water, and although a few particles will not do instant damage, the seal life will be reduced. Slurry must not be used.

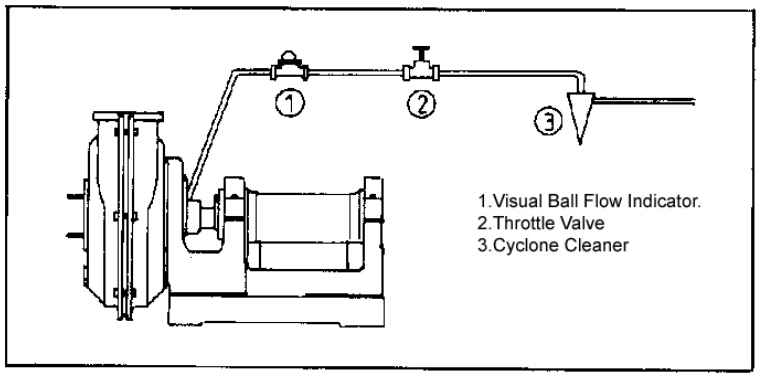
There are many combinations of flow control devices which may be used, and a few of these are shown on the next diagram. The objective is to maintain a secure supply of clean flushing water to extend the gland life.

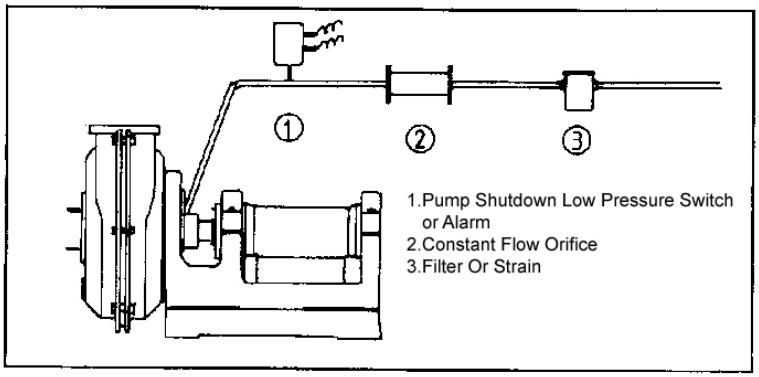
With pumps in series, there are three main ways of supplying gland service water.

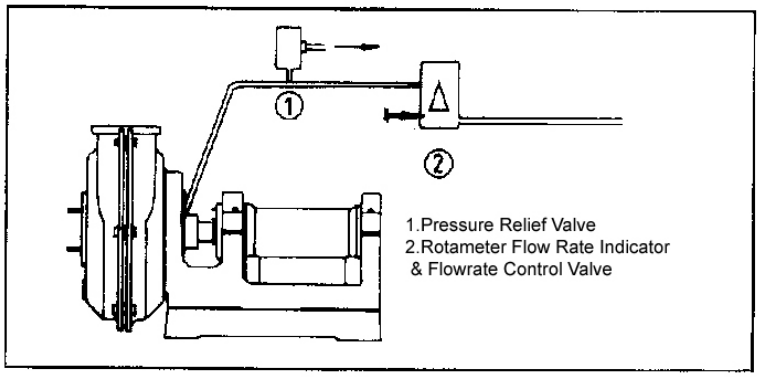
- Individual dedicated pumps at the correct pressure and flow rate.
- One large pump at the highest pressure throttling down the supply to each pump in the series.
- One multi-stage pump tapping off a supply at a different stage to each pump in the series.

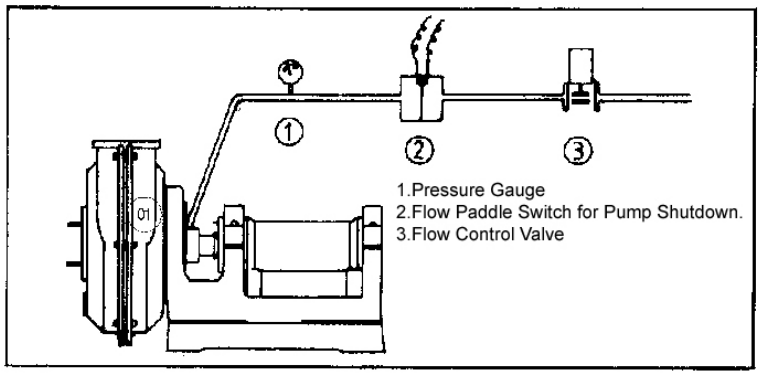
11.1. Gland Service Water Systems

Below are some typical Gland Service systems. Any selection of items may be combined.









12. Lubrication and Cooling

The bearings are grease lubricated and additional grease need only be added about twice a year. Do not over grease the bearings.
The bearing assemblies are all checked in the factory to prove that they are correctly assembled

The bearings are designed to run at high temperatures, maximum 120° C, and the grease has to be compatible with this operating condition. Clean grease must be used.

If water gets into the bearings, the assembly must be stripped, thoroughly dried and regreased, and any seal failure corrected.

Recommended greases are Shell Alvania 3, Mobile EP2, Caltex LS3 or their equivalents.

13. Start up Procedure

It is recommended to follow this routine every time a pump is started although it is appreciated that many units will be operated remotely.

a. Check the free rotation of the pump.
b.
c. Check gland services water is running, if required.
d.
e. At first start, or after any work on the electric motor terminal box, check direction of rotation **WITH DRIVE BELTS REMOVED**
f.
g. Check the pump is primed.
h.
i. Check that all guards are in place and that the pump is safe to run.
j.
k. Start the pump.
l.
m. If the pipeline is empty and there is no discharge valve (i.e. due to abrasive nature of the product), the pump motor may be overloaded for a period and the pump may cavitate. This condition should be examined to evaluate the possible long term effect on the equipment.
n.
o. Check the pump for noise, vibration or any hot spots.
p.
q. Adjust the gland to maintain a drip, which is necessary for lubrication and for cooling.

14. Shutdown Procedure

This depends ultimately on the system and process flow requirements, but the following procedure is recommended.
a. Stop the flow of solids into the sump.
b. Turn the sluicing water or run system on water only to wash out the pump and delivery pipeline.
c. Shut down the pump.
d. Shut down the gland service water system

In cold weather, the pump and auxiliary equipment should be drained to prevent freezing damage.

15. Disassembly Procedure

Check that all power is switched off and isolated, and that it is safe electrically and mechanically to work the pump.

The following sequence is a general guide to stripping the pump for inspection. Refer to Cross Section drawings in Appendix. Where a gland part is mentioned the part for the H gland is referred to.

On sizes up to the 4x4 (100/100) there is no separate suction bush and liner.

a. Remove the suction pipe and inspect for wear.
b. Check the suction bush liner **01** for wear, noting any uneven wear pattern and position. Check the axial clearance
c. Between the suction bush liner **01** and the eye of the impeller **08** (or on smaller pumps between the casing liner and eye of the impeller.)
d. Remove nuts **11** and suction bush **02**. The suction bush liner **01** is pushed out of the suction bush **02** from the suction side. Some water spread under the lip of the suction bush liner **01** will lubricate its passage out of suction bush **02**.
e. Remove casing bolts **09** having supported the suction side casing **03**. Lift off the suction side casing **03**. A crane is necessary on the larger pumps.
f. Remove liner nuts **10** and inspect the suction side liner **04**. Note unusual wear patterns, cracks, tears or deterioration of the lining.
g. The impeller **08** is exposed for inspection. Hold the shaft **B02** using a spanner, which is a good fit, on the flats between the gland **13** and the flinger **14**. The impeller **08** is screwed onto the shaft **B02** with an Acme right hand thread. The impeller **08** may be very tightly locked onto the shaft **B02** and may need an impact force or a long lever to loosen it. If the impeller is to be used again, protect the rubber against damage. Inspect the impeller **08** and note unusual wear patterns in the flow passages and back or front pump out vanes. Check that the "O" ring behind the impeller **08** has sealed against the gland sleeve **H08** and slurry has not corroded the impeller or shaft thread. This "O" ring **H12** should be replaced at every strip-down.
h. Remove the axial expeller **H10,** which is a stretch fit on the gland sleeve **H08**. If 'D' gland is fitted the gland sleeve should be removed at this point.
i. Support the gland side casing **05**, undo the casing to pedestal nuts **12** and remove casing half along with the gland assembly **13**. Undo the gland holding screws **21** and remove the gland assembly **13**. Undo liner nuts **10**, the casing liner can now be removed for inspection, note any unusual wear patterns.
j. Remove bearing pedestal caps **17**, and fixings **20** and unfasten the axial positioning jack **19**, to enable bearing assembly to be removed.
k. To disassemble the bearing assembly, remove the gland sleeve **H08**, the flinger **14** and the bearing covers **B03** and **B04**. The bearings can be inspected at this stage. If there is no sign of damage, the bearings should not be disturbed, and the bearings should merely be washed out with mild solvent oil and regreased.
l. Press the shaft **B02** with the bearing **B05** still fitted out of the bearing housing **B01**. Push the shaft from the impeller side out of the bearing housing. The inner ring of front bearing **B06** will still be attached to the shaft and can be removed later.
m. The remainder of the front bearing **B06** can then be withdrawn from housing **B01.**
n. Loosen the tab washer B07 undo locknut B08 and pull the end bearing **B05** off the shaft.

Notes:

1. The 2x2 (50/50), 3x3 (80/80) and 4x4 (100/100) pumps do not have a loose suction bush liner **01** and suction bush **02**.
2. The 10x8 (250/200) and larger sizes have an Inside Gland Cover **24** which is held in position by **H14** / **P14** / **D14**. Undo **H14** and withdraw the Inside Gland Cover **24** from the impeller side.
3. The Casing Suspension Arm is fitted as a maintenance aid ONLY and as such may be used to support singularly, either of the Casing Halves and its associated liner, or the Impeller. It must not be used for any other purpose. (Suspension arm not fitted to 1½x1½ and 2x2 (50/50) pump.)

Wear and Replacement of Parts

To obtain the best service and performance from the pump, periodic routine inspections should be carried out and the pump has been particularly designed for this purpose. It is not possible to state at what intervals these inspections should be made because the rate of wear varies considerably from one application to the next. However, it is suggested that initially the pump be allowed to run for a period of say, three months, and an examination of the pump will then give some idea of the length of life which may be expected from the rubber covered parts.

16. Assembly Procedure

Before assembly, ensure all parts are clean and free of old grease and dirt. The new bearings or replacement bearings should be generously filled with grease between the rollers. Check the Neoprene grease seals **B09** and **B10** are sound, and not soft or distorted. Replace if necessary.

a. Clamp the shaft **B02** horizontally in a vice. Heat the spherical roller end bearing **B05** in an oil bath or induction heater to 240˚F (115˚C) and fit it to the drive end of the shaft **B02** using clean insulated gloves. Ensure the inner ring of the bearing **B05** is hard against its seat by tapping it with a brass pin. Fit the tab washer **B07** and the lock nut **B08.**

b. Fit the inner ring of the front bearing **B06** to the impeller end of the shaft **B02** ensuring that it is hard against its seat, by tapping with a brass pin.

c. Clamp bearing housing **B01** securely, grease bearing **B05**. Fit shaft **B02** and end bearing **B05** assembly into housing. Ensure outer race of bearing **B05** is hard against seat.

d. Fit neoprene seal **B09** and bearing cover seal **B13** to end cover **B03** and fix to bearing housing **B01** using set screws **B11**.

e. Mount bearing housing **B01** vertically with front end upwards and wedge shaft **B02** so it is central in the housing. Fill front bearing **B06** with grease and carefully tap outer ring into bearing housing **B01**.

f. Fit neoprene seal **B10** and bearing seal cover **B13** to front cover **B04** and fix to bearing housing **B01** using set screws **B11**. Fit V-Ring Seal **B17** to Shaft **B02** and place with slight tension against Front Cover **B04**. Fit Flinger Ring **14** to Shaft **B02** and locate in position using Screw Clamp supplied with Flinger Ring.

g. Set bearing housing assembly into pedestal **18** and loosely assemble bearing pedestal caps **17** with pedestal cap screws **20** and fit axial positioning jack **19**. Very occasionally, shims are required for shaft alignment; if factory fitted, the thickness of shim required will be stamped on the vertical face of the pedestal adjacent to the pedestal cap stud.

h. If 'D' gland is to be fitted – Loosely assemble gland components as shown on page 10 taking care not to damage the wearing face when fitting, leaving out at this stage the gland sleeve **D08**, 'O' rings **D12** and **D07** and face seal **D09**. Fit the gland side liner **06** into the gland side casing **05** securing with liner nuts **10**. Bolt the gland assembly loosely to the casing **05**. Fit the casing **05** and gland assembly to the pedestal **18** using fixings **12**, taking care not to damage the wearing face against the shaft **B02** on assembly. Fit the 'O' rings **D12**, **D07** and face seal **D09** to gland sleeve **D08** and slide home onto shaft, through casing and into the gland assembly. Carefully align gland components (specifically check concentricity of gland parts relative to the shaft) and tighten all fixings.

i. If 'H' or 'P' gland is to be fitted – Fit 'O' rings **H12** / **P12** and **H07** / **P07** to gland sleeve **H08** / **P08** and slide home on to the shaft. Loosely assemble gland components as shown on pages 9 and 10, slide over shaft **B01** and onto the gland sleeve. Fit the gland side liner **06** into the gland side casing **05** securing with liner nuts **10**. Fit the casing **05** to the pedestal **18** using fixings **12**. Carefully align the components of the gland assembly (specifically check concentricity of gland parts relative to the shaft) and fit to the casing **05**. The axial expeller **H10** / **P10** a stretch fit over the gland sleeve can then be fitted.

j. Smear the Impeller thread on the shaft **B02** with protective long life graphite grease before screwing on the impeller, ensuring that the Impeller 'O' ring is fitted into the Gland Sleeve.

k. Fit the suction side liner **04** in the suction side casing **03** using liner nuts **10**.

l. Fit the suction bush liner **01** inside the suction bush **02** (using soapy water assists this process) and bolt it to the suction side casing **03** using the bolts **11**. Match up the suction side casing to the gland side casing, and bolt the two side casings together. Check the two half liners match up, and press back the liners into the casings to ensure a minimum mismatch at the joint line and at the delivery flange.

m. Check the concentricity of the fit between suction bush liner **01** and the impeller **08**.

n. Using the axial positioning jack **19** adjust the impeller **08** towards the suction bush liner **01** keeping the holding down studs **20** loose. Check the axial clearance between the impeller and the suction bush liner **01**. A steel ring or dummy flange should be bolted to the suction flange to simulate any distortion in the suction bush liner **01** when connected to the suction pipe, before the axial clearance is checked. This clearance should be set at approximately 1/32" (1mm). Rotate the shaft to ensure effective clearance.

o. Tighten the bearing holding down nuts **20** and the axial positioning jack **19**.

17. Troubleshooting

IF A PUMP FAILS TO PUMP THROUGH A BLOCKAGE SWITCH OFF IMMEDIATELY AND READ THESE FAULT FINDING NOTES CAREFULLY TO RECTIFY THE SITUATION.

TAKE EXTREME CARE AS THE PUMP MAY BE FILLED WITH SCALDING STEAM AND SOLIDS AT A HIGH PRESSURE.

17.1. No Discharge When Pump Runs

THE PUMP MUST NOT BE ALLOWED TO RUN IF IT DOES NOT DISCHARGE. If by mischance the pump has been allowed to run for more than a few minutes without discharge then **STOP IT AT ONCE.**

TAKE EXTREME CARE IN DISMANTLING AFTER SUCH AN OCCURRENCE DUE TO HIGH TEMPERATURE AND PRESSURE WHICH MAY BE PRESENT IN THE PUMP CASING. DO NOT REMOVE THE DRAIN PLUG UNTIL THE FLUID TEMPERATURE IN THE PUMP HAS DROPPED. (SEE 17.11c).

a. Air Lock
The commonest cause of failure of a newly installed pump to discharge when run for the first time is an air lock in the casing. Even when a pump is well below water level, (drawing from a Feed Regulating Sump for instance), it may retain a large bubble inside the casing which prevents the start of pumping. This phenomenon is far more likely with horizontal undershot discharge branch arrangements than any other practical configuration. It is least likely with horizontal overshot arrangements.

If you suspect air lock as the cause of failure to pump, start and stop pump several times to drive the air out, a fraction at a time. When using this procedure ensure that you do not damage the motor starter or burn out the motor itself by trying too many starts in a short period of time. The number of permissible attempts will vary with the equipment installed but usually it is safe to try one start every three to four minutes.

b. Inadequate Prime
In installations where the pump has to be primed, either by jet or venturi effect in the suction pipe, or by vacuum pump on the delivery side, failure to pump may be caused by inadequate prime. This is usually rectified, by allowing more time for priming to occur.

It is possible when “jet priming” to have such a small amount of priming water that the pump will never prime, and in this case more water for the priming operation will be needed.

Usually, the diameter of the priming branch should be at least one third of the diameter of the suction pipe [2” (50mm) will prime 6” (150mm), 3” (80mm) will prime 8” (200mm) etc.], and the minimum water required is about 30% of the **Pump** capacity.

If priming is by vacuum pump there must be a valve or at least an air-lock on the delivery side and the vacuum pump must be able to “beat” the air leakage through the gland. To assist in this, always attempt to prime with the gland water running – no matter what style of priming is being attempted.

c. Installation Faults
Failure to discharge on start-up can be caused by installation faults of which the commonest is inadequate sump capacity. The result of installing a sump with inadequate capacity is to risk repeated air-locks of the pump. This can happen when the pump reduces the water level, either allowing a vortex to form – which air-locks the pump – or (when water is introduced to the sump) it entrains so much air that it produces the same effect.

A small sump can easily prevent any discharge reaching the end of the pump discharge line. The only remedy is to extend the sump capacity. We recommend sumps of at least one minute’s pumping time as a minimum. (This recommendation does not apply to feed regulating sumps in sand plants where greater capacity is required).

Other installation faults are more obvious – such as tramp material lodged over a pump suction or a kinked suction hose.

17.2. Brief Discharge Only

a. Air Lock

A pump with a suction lift and partial air lock will often start to pump at a greatly reduced rate after each start, then give up altogether. At the discharge end of the pipe this may appear as a brief surge followed by failure.

This problem can only be overcome by closer attention to the priming system.

b. Obstructed Suction

If the suction line is obstructed either by tramp material or a delaminated suction hose lining, the pump may start well but when the discharge rate rises the suction obstruction so throttles the pump that it quickly fails by gross cavitation.

Detection of this sort of condition is difficult, and generally the only certain way of finding out what is happening is the use of a vacuum gauge immediately before the pump suction. An obstructed suction line will be indicated by a sudden increase in vacuum reading immediately before the failure.

c. Lack of Delivery Resistance

A pump which is required to pump with a suction lift or with a fair length of suction pipe, but with practically no resistance on the delivery side, (e.g. short, open-ended, discharge branch or nozzle), may pump briefly then fail. The reason for this is that centrifugal pumps on open discharge need positive pressure on the suction eye to prevent gross cavitation. If the installation does not provide sufficient positive pressure on the suction side the pump will fail.

Usually, the easiest way to overcome this difficulty is to artificially create resistance on the delivery side, by extending the pipe work or introducing a valve or other resistance, such as an orifice.

17.3. Pumps Water But Not Solids

a. Air Leaks on Suction Side

Badly made joints in the suction line or air entrainment with feed into a sump may be insufficient in themselves, to prevent a pump from pumping water satisfactorily. However, when solids are introduced – particularly, coarse solids – the pump has a more arduous duty; it has to entrain the solids into the fast moving stream in the suction pipe. In effect it has to “dredge” the solids into the stream. Even if the solids were already moving in the right general direction, they must be accelerated up to the water velocity and thus they act as a suction resistance for the pump.

The result of the introduction of solids into an aerated system, which the pump can only marginally handle, when pumping water alone, will cause failure.

Air leaks can usually be detected as water leaks when the pump is not running; where water can get out air can get in. Air entrainment with the feed can sometimes be overcome by the use of baffles in the sump, such that the air bubbles have time to rise to the surface before being drawn down to the suction.

b. Poor Suction Line

A long suction line, or a line of too small a diameter, or a line with a restriction (sudden step-downs in diameter are the worst) may allow a pump to appear to handle water adequately, but not allow it to handle solids. The reasons for this are explained in 17.3(a) above.

Rework of the suction line is the only solution to this problem. If the line is increased in diameter it should be brought to the pump inlet diameter by a specially rolled flanged taper pipe. It must not be stepped down by a mismatch.

c. Electric Motor Wrongly Wired

Most Squirrel Cage Induction motors can be wired in two ways: “Star” or “Delta”. In order to reduce the surge in current when a motor is brought “on line”, some users start their motors in “Star” because this mode gives good starting torque and a reduced starting current surge, and then change to running their motors in “Delta” once smooth starting has been achieved. The “Delta” mode of powering the motor increases the speed close to synchronous speed – which is maximum – and maintains practically a constant speed under variations in load.

If a motor is left to run continuously in “Star” it will vary its speed dramatically with load. Hence, if a mistake has been made in the wiring of the motor it may well appear that the pump pumps water but will not pick up solids, the reason being that on “Star” the motor speed drops when the solids load comes on.

To detect this fault the easiest method is to check the speed of the motor shaft and compare it with the Nameplate rating. There should not be more than a few RPM difference between Nameplate RPM rating and actual speed – no matter what load the pump is pulling.

Correction of this fault is a matter for an electrician.

17.4. Overloads for Motor Trip Out

a. Wrong Pump Speed

The power drawn by a centrifugal pump discharging through a given delivery system is approximately proportional to the cube of its speed. If the speed is changed by, say 20% to 1.2 times the original speed, you can expect its power demand to rise by the cube of 1.2, i.e. 1.728, or nearly 73% above the original. Even a rise in speed of 10% to 1.1 times the original speed, will give a rise of 33% in power demanded by the pump.

The relationship is not exact but is close enough for field calculations purposes.

If a pump is run at the wrong speed it can make a very considerable difference to the load drawn from the motor.

Calculation of the correct pump speed is based on:

- Flow rate to be pumped;
- Difference in height between pump and discharge points;
- Length, diameter, and inner surface of pipeline through which pump must deliver;
- Number of elbows, bends, valves, other fittings in pipeline;
- Equipment at end of pipeline such as hydrocyclones, pressurised distributors, jets etc.;
- Grading, tonnage, and specific gravity of solids to be pumped;
- Pump performance curves.

As far as fault finding is concerned, the actual RPM of a pump should be compared with the RPM specified. Corrections to pump speed can be made by pulley changes.

b. Changed Pipeline System

It is not uncommon for a pump speed to be calculated on the basis of a pipeline system intended to be used at the time of the negotiations for the purchase of the pump, but to be commissioned into service with a very different pipeline system. A client may say “But, it’s not such a high lift so the pump does not have to work so hard”. Unfortunately, at a given pump speed a pump will pump a larger gallon age through a shorter pipeline, (or lesser vertical height), and will take more power – not less.

When confronted with this situation, the only thing to do is to calculate the correct Head and RPM and make a pulley change. The affinity rule explained under 17.4 a) can be used or the drive recalculated.

c. Low Voltage

The power consumed by an electric motor is the product of the voltage, amperage and power factor for the motor. Without going too deeply into the matter, if a pump demands a certain power from the motor, the motor in turn will demand corresponding amperage from the electric supply system. If, however, the voltage of the electric supply system happens to be lower than normal, then the motor will draw extra amps to meet the pump's power demand. In this way the power consumed by the motor, (the product of voltage, amperage and power factor) remains unchanged.

The sort of circumstances where lower than standard voltages might be encountered are:

- When power supply is from a generator set
- At the end of a long trailing cable;
- At the end of an electric supply system remote from the nearest transformer substation;
- In an area where very heavy start-up loads can occur, such as near large crusher stations or long conveyor installations.

Low voltage can readily cause a motor overload by drawing higher than expected amps, this being in no way related to the pump.

If low voltage is suspected as the cause of motor overload, a qualified electrician should be called in.

d. Wrongly Set Overload Protection

All motor starting equipment has some form of overload protection equipment built into the system so that a burnt out motor or locked-rotor motor does not cause more extensive damage. If a motor repeatedly drops out on overload, and there is no other readily apparent reason, the electrical overload protection equipment should be checked.

e. Mechanical Fault in Pump

The pump shaft should be free to turn by hand. Remove the Vee-belts and check the pump shaft for freedom to turn. If there is no resistance the fault must be in the motor. If a jarring or resistance can be felt when attempting to turn the pump shaft, drop off the suction pipe and check the clearance between the impeller and suction plate, and for blockages.

If this proves clear, then remove the suction bush and look for marks on the surface of the impeller which might indicate if the impeller has been rubbing. If this proves clear rotate the shaft again to ascertain if the resistance is still present and if it is then remove the impeller, and inspect the gland side liner. If there is still no evidence of rubbing, rotate the shaft by hand again to check that the resistance is still present, then remove the gland sleeve. If the resistance can still be felt by hand it can only be the bearings of the pump.

The remedy for the faults which may be revealed by this step-by-step approach are:

- Impeller rubs on suction bush: release bearing housing, set impeller to suction bush clearance by adjusting position of bearing housing until impeller runs free. Tighten bearing housing. Replace suction pipe. Realign belt drive.
- Impeller rubs on gland half lining; reset the suction bush clearance. Check for movement of casing liner.
- Seizure in the gland area. Strip and inspect.
- Shaft tight in bearings; there is no simple field remedy if the pump shaft is found to be tight in the bearings, the rotating assembly must be removed and stripped for inspection of the bearings and grease seals.

f. Air Entrainment

In sump-fed pump systems air entrainment with the pump feed can produce periodic overloads on the motor by the following sequence of events:

- Air entrainment with feed gives the pump a “spongy” pulp which reduces the pump throughput and power.
- Flow through the sump is reduced allowing air in the feed now entering the sump to escape to surface. Solids, of course, reach the pump suction.
- The pump now has a largely de-aired pulp of far greater percentage solids than intended, and the power demand rises. At this stage the pump may choke. This is a dangerous condition.
- Pump entrains the accumulated solids into suction pipeline and begins to pump normally again, increasing throughput through sump.
- Air entrainment begins to reach pump suction again and sequence repeats.
- Air entrainment can permanently reduce slurry throughput and make it appear as if the pump is not working.

In small installations this surge may be repeated at three minute intervals, and in large installations it may take as long as five minutes for the full cycle to be completed. If the cycle terminates at stage (3) the pump may explode, if allowed to run blocked.

12.1 Pump Handles Only A Limited Percentage Solids

g. Pump Speed Incorrect

With increasing solids feed into a pumping system three major factors will limit the percentage solids handled:

- Friction resistance increases leaving less pressure on the delivery side to maintain the velocity in the pipeline;
- Critical (settling) velocity for the pulp in the pipeline increases;
- Pump performance “drops” so that the total head generated by the pump diminishes.

Clearly if the pump speed has been calculated for water only, then increasing tonnages of solids are fed into the system, the combination of factors (1) & (3) above may soon produce a situation where the pipeline velocity is too low to maintain movement of the solids (factor 2). See 17.11c).

h. Air Entrainment

Under 17.3(a) above there is an explanation of how a pump can handle water, but fails when solids are introduced to the system, due to air entrainment. The same fault can sometimes explain why a pump performs apparently satisfactorily on pulp up to a certain percentage solids, then “gives up” when this is passed. See previous.

i. Poor Suction Line

A suction line layout as described in 17.3 b) is far worse as the percentage solids is increased and can become completely blocked. See 17.11c).

j. Cavitation

If a pump is expected to draw relatively coarse solids from a sump below the pump centreline, depending on the speed of the pump and its capacity in relation to the flow rate being handled, it may suffer from cavitation. When this happens, (and the onset is often quite sudden and sharp), the total head generated by the pump diminishes dramatically. As described previously, the conditions for blocking a line are suddenly created, namely; reduced delivery pressure for maintaining flow combined with increased requirement for velocity in the pipeline.

Generally, if cavitation is the source of the trouble there is ample evidence: audible cavitation “rattle” in the pump or from the bearings, sudden reduction in power demand, the gland leaks or draws air, and there is a dramatic drop in delivery pressure.

The solution to the problem is to make the suction arrangements as smooth as possible without restrictions, and to arrange for the feed to come gradually up to load without sudden surges of solids. If these measures do not overcome the problem it may be necessary to change the suction line to a size larger and fit a flat topped taper-piece to the pump suction. If trouble persists, a larger pump will have to be installed. Something effective must be done as the situation is potentially dangerous.

17.5. Gland Will Not Seal Adequately

a. Poor Adjustment

The outer seal of a Hydrostatic gland assembly must be allowed to rub lightly on the gland sleeve for an effective seal to be maintained. If the gland adjuster is pushed in too far this will lift the seal off the sleeve and the gland will leak profusely. Most people when seeing a leaking gland immediately think to "tighten it up". *With the Hydrostatic gland the gland adjuster must be moved outwards to reduce leakage*.

Type D and P glands, should be tightened for reduction of leakage in the same way as standard packed glands in water pumps. *Over tightening should be avoided, especially on 'D' glands* as a drip is always necessary to lubricate the rubber face seal.

b. Dry Running

The glands will not be damaged by a few seconds running without lubrication and cooling by water, but if either gland is run for any length of time without water in the pump there is danger of melting the rubber seals. If a Type D gland has been correctly adjusted this is a fairly remote danger because without hydraulic pressure to force the rubber seal against the gland seat, the seal should run without touching the seat. However, in general terms, do not run a Linatex pump in dry conditions because of the danger of damaging the gland seals.

Once seals have been damaged in this way they have to be replaced.

c. Too Much Sealing Pressure

Too much water pressure in either type of gland can make the glands almost impossible to seal reliably. With Hydrostatic glands the solution to the problem is to insert a pressure control in the gland water line. With Type D glands the problem usually only arises with pumps being run in series or as booster pumps. In either case, the only solution is to convert the pump over to H gland or P gland and provide suitably pressured gland water.

d. Inadequate Prime

The "snore" condition for operating a pump is very difficult to seal without unacceptable leakage. Under this condition a pump continuously receives a good proportion of air drawn in with the pulp from the sump, in which the level is too low, or the sump has inadequate capacity, or both. The sump should contain a minimum of one minute's pumping time.

17.6. Excessive Heat in Drive

a. Slack V-belts

The commonest cause for generation of heat in the drive to a newly installed pump is undoubtedly lack of tension in the V-belts. All V-belts should be tensioned periodically, and newly commissioned drives should be re-tensioned an hour or so after start up.

This fault is easily detected, (pulleys are the hottest part of the drive), as the belts will have been slipping.

b. Hot Pump Bearings

On high speed duties it is to be expected that the bearings will run hotter than on low speed duties. Providing the shaft is free spinning by hand, the heat generated while running under power is probably immaterial. At 150°F (65°C) the assembly will be uncomfortable to the hands for more than a second or two, but this is not unduly hot for the bearing assemblies. If the bearing is failing the shaft will not run free.

c. Inadequate Lubrication of Pump Bearings

The bearings will be charged with grease before despatch from the factory. Details of lubricants are given in this Manual. See section 12.

Addition of grease should be tried if bearings become very hot or noisy. Excess greasing should be avoided.

d. Motor Runs Hot

The usual reason for motors running hot is that they are intended to! With Continuous Maximum Rated motors the temperature rises are surprising and are allowed for in the design of the motor and the selection of the insulation in it.

Generally, heat from a motor can be safely ignored provided the amperage drawn is lower or equal to the nameplate rating. Many motors are fitted with Thermistors in the windings, which sense the temperature rise and are wired to operate a cut-out relay if the temperature exceeds a safe limit.

If a pump is choked when the motor starts the protection must trip out the supply to the motor.

Bearing troubles in motors are generally indicated by noise as well as heat, and can sometimes be detected by use of a long-stemmed screwdriver. The blade of the screwdriver is pushed against the bearing cover and the ear of the investigator pushed up to the handle. With a limited amount of experience bearing "rumble" can quite easily be detected.

17.7. Sudden Reduction in Discharge

a. Change in Feed Conditions

Operators do not always recognise a pump as simply one element in a complete system and any change in that system will bear on all the parts of it. For instance, if a screen, rejecting plus ¼" (6 mm) material is worn and passes 1" (25 mm) stones, this affects the pump performance. The suction resistance of the larger stones will cause the suction pressure to reduce and have less head available for pushing the pulp through the delivery side piping.

At the pump, the larger stones will make a significant difference to the pump performance, decreasing flow and potentially causing damage to Impeller and Linings.

In the pipeline, the large stones will probably progress by "saltation", that is, leaping along the bottom of the pipe. The rest of the pulp is fully in suspension and has to flow past these slow moving obstacles. Overall this means the resistance of the pipeline to flow has increased. Thus again reducing flow.

So a simple fault like a screen cloth with a hole in it can cause a sudden reduction in discharge. If it causes the pipeline to block, the condition is potentially dangerous. See 17.11 c).

Other changes in the feed conditions which must be investigated are; increased tonnage of solids, change of grading of solids, change in manner of introduction of solids to pump system. On this last count, a plant which was started up in summer, and is bin-fed via a vibrating feeder, will perform differently in winter, when the wetter feed "hangs up" in the feed bin and collapses down onto the feeder intermittently in larger dollops.

b. Air Leaks on the Suction Pipe

A pipe which has been steadily wearing away from the inside may break through to the open air near a flange, (in a welded area), at the bottom of the pipe, (where the coarsest solids run). In a suction pipe this will almost certainly allow air into the pipe with all the resultant ills described elsewhere

Frequently, a pinhole leak will not let enough air into a pump for any of the five faults listed to become critical. So operators, being human, postpone the repair or replacement of the worn pipe. The last chapter of the saga occurs surprisingly quickly and usually on nightshift – when fault produces a blocked pipeline.

c. Suction Blockage

In dredging applications there is always the danger that the pump suction will be suddenly submerged in collapsed solids from the surrounding pit contours. When pumping from a sump the same thing can happen when solids, which have been clinging precariously to the steel sides of the sump, subside and momentarily block the pump suction.

If the pump is feeding a fair length of delivery piping, it will not be possible for the long column of pulp in that piping to come instantly to rest when the suction gets blocked. It will be appreciated that the pulp in an 8" (200 mm) pipe, way 1000 ft (300 m) long, moving at 10ft/sec (3 m/sec) has considerable momentum. It just cannot be stopped dead in the same short length of time it takes to block the suction.

The result is a massive reduction in pressure throughout the system. It can cause a massive "water hammer" and surges that can split the pump casing, valves and piping. This can cause hoses to collapse – delivery as well as suction, and almost invariably leads to a great gulp of air being sucked through the pump gland. Usually this is sufficient to air lock the pump.

Often, operators attribute the pump failure to the gland, instead of to the conditions at the end of the suction pipe, and this seems the logical explanation to a person standing beside a pump, who heard the air hiss into gland, and then has to contend with the resultant air-lock. However, the trouble starts at the end of the suction pipe, the gland collapse occurs afterwards.

In dredging applications the answer is to exercise better control over the pit development. In sump-fed systems, the feed pulp can sometimes be directed to flush away any build-up of solids on the sides or valleys of the sump. If this is not possible, a larger capacity take-off box at the base of the sump must improve the situation. The blocked pipeline situation is potentially dangerous. See 17.11c)

d. Tramp Material

The simplest explanations of a fault should never be overlooked. If the complaint is a sudden reduction in discharge: drain the sump and before removing any pipe work or dismantling the pump in any way, have a look at the take-off box at the base of the sump. Loose rubber, house bricks, steel off-cuts have all been found at the outlet to the pump at one time or another. Plastic garden hose inside the impeller passages was found to have a dramatic effect on pump capacity, in an installation which had given satisfaction for the previous three years.

12.2 Sudden Increases in Power Demand

e. Damage Inside Pump

If a client has not had occasion to open his pump before he may not realise what can happen to the inside of his pump as it wears away day by day. The following list gives the results of abrasion which will give an increase in power demand, in order of frequency of occurrence.

- Excessive gap between impeller and suction bush.
- Cut or ripped rubber in suction bush or casing gland rubbing against impeller.
- Worn out cutwater.
- Worn out or broken casing liners.
- Impeller worn through back shroud.
- Impeller passages worn significantly wider than intended.

f. Change in Pipeline System

Clients may alter a discharge pipe layout so the static lift is reduced or the length of pipe shortened, thinking to themselves "the pump won't have to work so hard now". Actually, in these circumstances the pump pumps a larger gallonage and takes more power not less.

g. Low Voltage

A new installation near the pump site can make a significant difference to the voltage available, depending on the electric distribution system in the area. Lower volts mean higher current for the same power output of the motor.

h. Changed Pump Speed
It has been known for electricians who have been called in to do maintenance on a motor to dismount both pump and motor pulleys, then when reassembling the pumpset, to mistakenly interchange the pulleys. Depending on the pulley ratio this may have spectacular results.

i. Air Entrainment
In sump-fed pump systems air entrainment can produce cyclic pump overload as explained in 17.4f). This fault can be caused by a change in the gallonage fed to sump, or the direction in which it is fed to a sump. It can also be caused by a casual change to the feed type baffle arrangement in the sump.

17.8. Rapid Component Wear

a. Air Entrainment
As an experiment place some sand in an empty bottle, fill the bottle to the very top with water, place the palm of one hand over the top and shake the bottle. You will find it difficult to move the sand vigorously against your hand. Now tip out a third of the water, and repeat the test. You will undoubtedly feel the sand in the air-water froth hitting your palm.

The point of the experiment is to show how much more readily sand can move around in froth than it can in water without air bubbles. Therefore any air leaks in the suction side accelerate abrasion.

If air entrainment is severe enough to produce an air lock in the presence of solids and water, the result is an escalation of the abrasion rate.

Air entrainment can also cause severe abrasion indirectly. As explained in 17.2, with cyclic changes in pulp density due to air, the pump may have to handle, periodically, far denser pulp than intended. This also is an abrasive accelerator.

b. Properties of the Solids
Some solids have worse properties from the point of view of abrasion than others.

- Sharp edged particles are worse than round particles, so crushed materials are generally worse than natural sands.
- Course gradings are worse than fines.
- The specific gravity of the material makes a difference.

When confronted with a rapid abrasion problem, always reduce pump speed if possible. A larger pump with its larger diameter impeller will be rotating slower at the suction eye of the impeller for a given head than a smaller pump. So, if wear on the leading edge of the vanes is a problem, a larger pump would help.

c. Change in Feed Conditions
If a pump operates satisfactorily for some time then suddenly begins to wear out components in quick succession, look for some change in feed conditions. Extra tonnage, coarser grading, higher proportion of crushed material, and so on. Sometimes an operator is unaware that conditions have changed for the pump.

A case in point would be a rod mill circuit producing crushed sand minus 4 mesh (5 mm) from a feed which is minus 3/8" (10 mm). If a pump is used to pump the rod mill discharge to some screening equipment and the screen oversize returns to the mill, a reduction in capacity of this screening equipment will make a big change in the duty for the pump. However, to the operator, the same tonnage rate throughput is maintained by the circuit, so the pump duty is unchanged in his mind. In fact, a reduction in screen capacity (for instance, by partial blinding, of the screen cloth) will produce an increase in circulating load and a corresponding increase in pump pulp density.

Another less involved example would be the pumping of sand from a river deposit. These deposits are notoriously variable, so the proportion of crushed sand in relation to natural can vary widely. To the

operator however, sand is sand, and the fact that the pump is now handling, say 80% crushed material, while three months ago it was 60% natural sand may not appear significant.

If there is a permanent change in feed conditions which makes component life unsatisfactory, look into modifying the pump.

If there is no suitable pump selection, the pump duty may have to be split up, and a two stage pumpset installed. Each pump will run at about 70% of the speed of a single unit for the same duty and this speed reduction will make a very significant change to the abrasion rate.

d. Shaft Misalignment

After some years of service it occasionally happens that the saddles on the pedestal which support the bearing housing get worn and thus allow the shaft to point downwards. If this problem is severe enough the eccentricity of the shaft through the gland will be such that the gland will not seal properly. A further problem will be that there will be a misalignment between the eye of the impeller and the suction bush, which will detract from pump performance. If this happens, the best answer is to buy a new pedestal. This will almost certainly be cheaper and quicker than trying to build up the saddles and then remachining. A temporary expedient is to pack the saddles with shims, but inevitably these get lost during impeller adjustment.

17.9. Mechanical Failure

a. Broken Shaft

Typically, the only broken shafts in LPT pumps are those where there has been tramp material in the feed, or a bearing has seized, or slurry has worn through the gland sleeve and wear has weakened the shaft, in each case it is easy to see the cause.

b. Broken Pedestal or Casing

The front bracket of the pump pedestal although quite massive to look at can be broken from the box section of the pedestal by the simple expedient of starting the pump backwards. If this is done the impeller begins to unscrew from the shaft and, as it does so, strikes the suction bush. This is immovable, being trapped by the flange of the suction pipe work. So something has to give.

Occasionally, with older shafts, the thread in the shaft is stripped instead of the pedestal being broken.

We do not recommend attempting to weld broken pedestals, alignment problems are too difficult. The cheapest and quickest way out for a customer is to buy a new pedestal.

The running backwards of a pump is an electrical problem. It is very simply overcome and no electrician worth his salt will allow this to happen as they are supposed to check motor direction of rotation prior to fitting the V-belts onto the pulleys.

c. Pump Explodes

The centrifugal pump – LPT or any other – can potentially explode by running it with pulp, or water, in the casing but no discharge. An example of how this can happen is in a pump drawing pulp from a sump and pumping to a cyclone or through a rising pipeline. If the pump gets a sudden surge of solids, which blocks off the suction, flow will cease. In the delivery line the solids will settle in the rising pipe, but will be unable to enter the casing because the impeller is still spinning there.

We now have a plug in the suction pipe, and in the delivery pipe, with a spinning impeller in between. The pump goes on absorbing power as the impeller rotates and the power raises the fluid temperature. Ultimately, the water will boil and the pressure generated may be enough to explode the pump head or destroy the rubber.

This is an extremely dangerous situation, and if a pump head feels unusually warm and is not discharging, switch off the power, immediately. Under no circumstances approach the pump until the pump head has been relieved of pressure – preferably through the suction or discharge pipe work by flushing away the

solids plugs. If a pump is going to explode, there is almost certainly considerable leakage of steam from the gland.

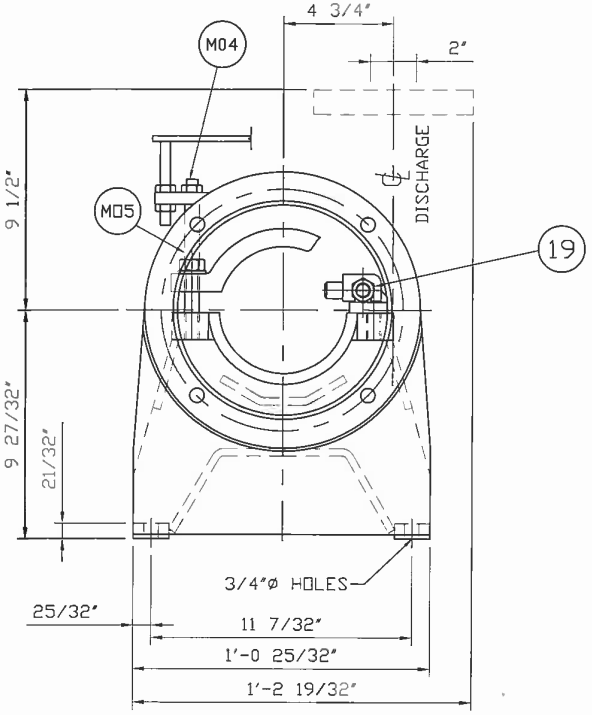
Important Note: *Even if the pump does not feel hot, take extreme care when dismantling as the pump may be full of scalding water.*

Do not remove the drain plug until certain the fluid temperature in the pump has reduced. If in doubt carefully clear blockages in manner described above.

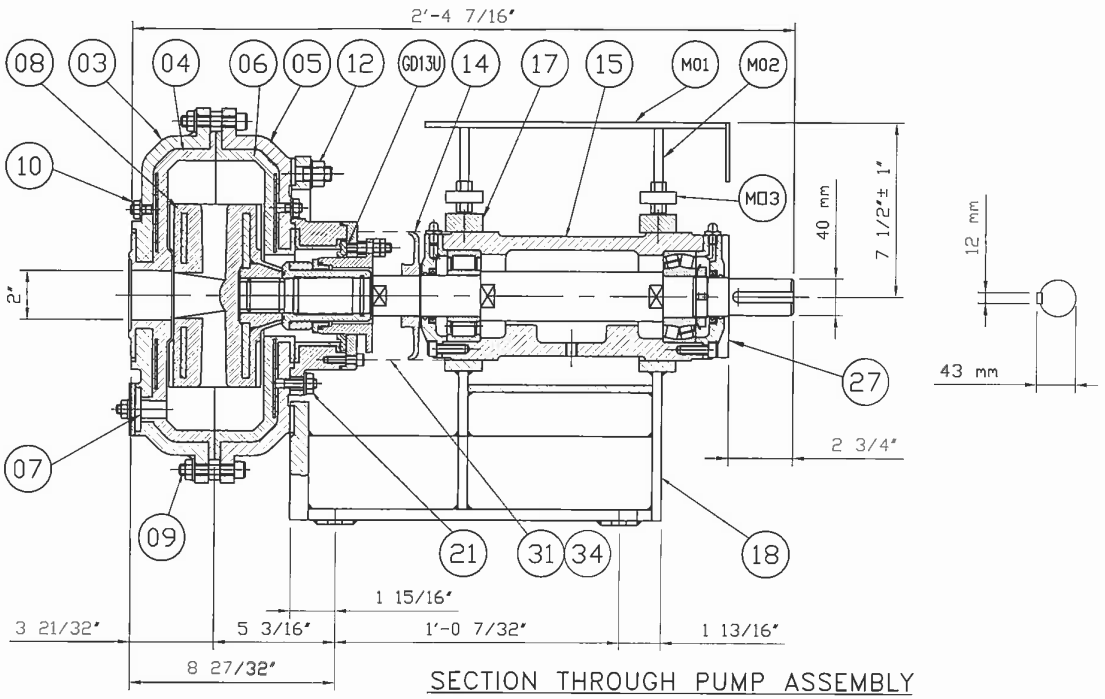
18. Notes

NOTE:
SUCTION & DISCHARGE CONNECTIONS ARE STD 150# DRILLING FLANGES.

NO.	DATE	REVISIONS	BY
4	6/16/97	ADD NEW PART NUMBERS	SP
5	6-29-00	REVISED ASS'Y GD13 TO GD13U	CW
5A	08/17/00	REV'D QTY. & DESC. PER BOM	CW
1	9/19/95	DRAWING NUMBER WAS B-2395	RGS
2	11/8/95	REVISED MOTOR PLATFORM ASSEMBLY	RGS
3	12/9/96	ADD ITEMS 27 & 34	DES



FRONT VIEW ON PEDESTAL



SECTION THROUGH PUMP ASSEMBLY

ITEM	QTY	DESCRIPTION	OLD PART#	NEW PART#
15	1	BEARING ASSEMBLY	15-050	09110002116
14	1	FLINGER	14-050	09110002115
GD13U	1	GLAND ASSEMBLY	GD13U-050	
12	1	CASING TO PEDESTAL STUD SET - SET (4)	12-050	09110002113
10	1	LINER NUT SET - SET (6)	10-050	
09	1	CASING BOLT SET - SET (5)	09-050	09110002111
08	1	IMPELLER	08-050	09110002110
07	1	DRAIN PLUG	07-050	
06	1	GLAND SIDE LINER	06-050	09110002109
05	1	GLAND SIDE CASING	05-050	09110002108
04	1	SUCTION SIDE LINER	04-050	09110002106
03	1	SUCTION SIDE CASING	03-050	09110002105

ITEM	QTY	DESCRIPTION	OLD PART#	NEW PART#
M05	4	CROSSBAR SUPPORT COLLAR	M05-050	
M04	4	CROSSBAR SUPPORT STUD	M04-050	
M03	2	MOTOR SUPPORT CROSSBAR	M03-050	
M02	4	MOTOR PLATFORM STUD	M02-050	
M01	1	MOTOR PLATFORM	M01-050	
34	2	PROTECTIVE STRIP	34-050	09110002137
31	1	SHAFT GUARD	31-050	09110002130
27	1	PULLEY SHAFT GUARD	27-050	09110002139
21	1	GLAND HOLDING SCREW SET - SET (3)	21-050	09110002121
19	1	AXIAL POSITIONING JACK	19-050	09110002120
18	1	PEDESTAL	18-050	09110002119
17	2	PEDESTAL CAPS	17-050	09110002118

ALL TOLERANCES TO BE MAINTAINED UNLESS OTHERWISE NOTED.

FRACTION ±1/64
WELDMENTS ±1/16
CAST SURFACES ±1/16

ALL WELDING TO BE PER ANSI STANDARDS
SURFACE FINISH √125

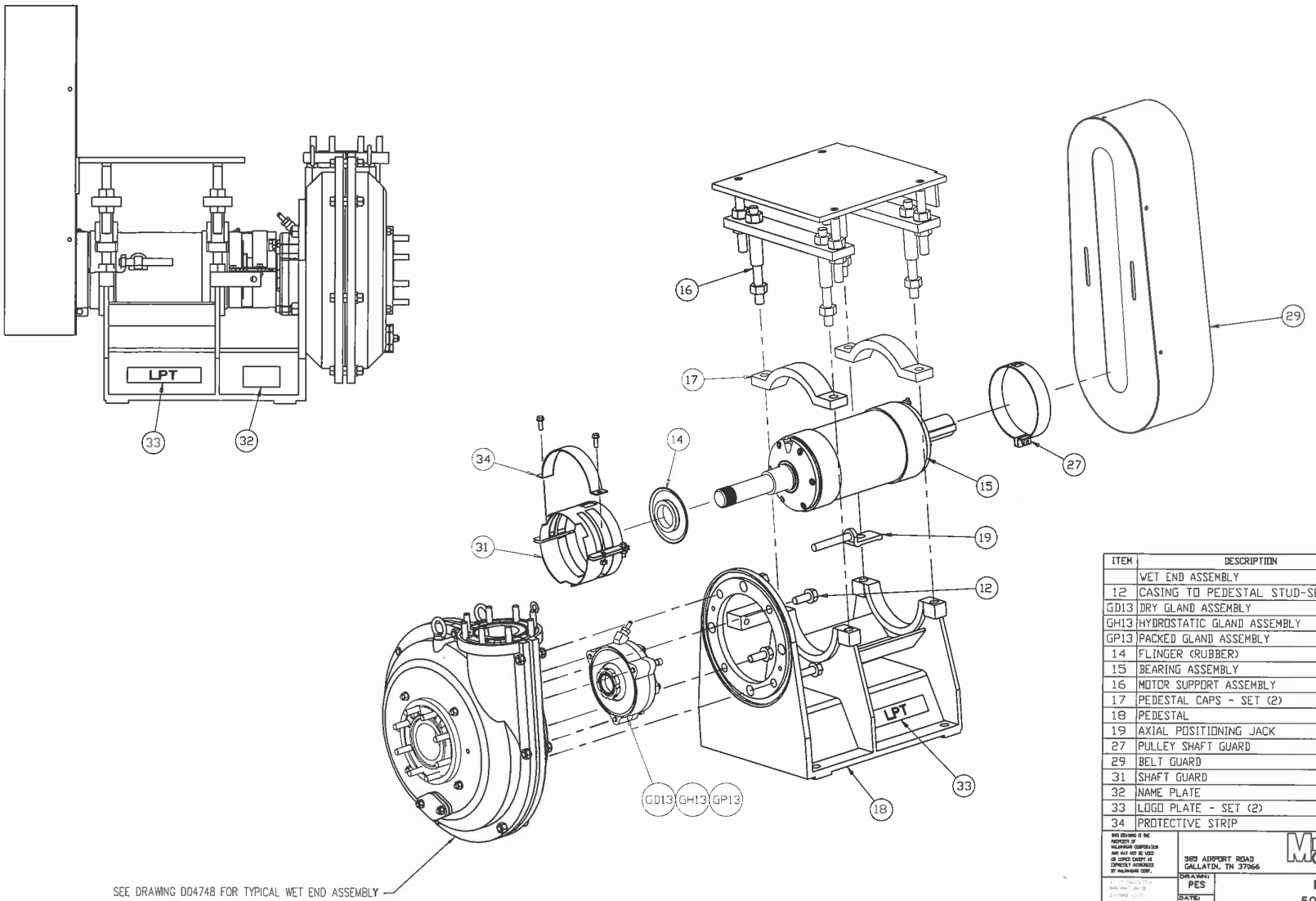
McLanahan CORPORATION
200 WALL STREET
HOLLIDAYSBURG, PA 16648
(814)695-9807
(814)695-6684 FAX

DRAWN: SP
DATE: 11-7-94
CHECKED: AC

GENERAL ARRANGEMENT
50 X 50 (2"x 2") McLANAHAN PUMP WITH DRY GLAND

PART NUMBER	SCALE:	DRAWING NO.	REV.
09100002001	3/16" = 1"	GAD50/50A 1of1	5A

IF IN DOUBT REFER TO DRAWING OFFICE



SEE DRAWING D04748 FOR TYPICAL WET END ASSEMBLY

ITEM	DESCRIPTION	OLD PART #	USA PART #
	WET END ASSEMBLY		
12	CASING TO PEDESTAL STUD-SET(4)	12-50	09110002113
GD13	DRY GLAND ASSEMBLY	GD13U-50	
GH13	HYDROSTATIC GLAND ASSEMBLY	GH13-50	
GP13	PACKED GLAND ASSEMBLY	GP13-50	
14	FLINGER (RUBBER)	14-50	09110002115
15	BEARING ASSEMBLY	15-50	09110002116
16	MOTOR SUPPORT ASSEMBLY	16-50	09110002117
17	PEDESTAL CAPS - SET (2)	17-50	09110002118
18	PEDESTAL	18-50	09110002119
19	AXIAL POSITIONING JACK	19-50	09110002120
27	PULLEY SHAFT GUARD	27-50	09110002139
29	BELT GUARD	29-50	09110002128
31	SHAFT GUARD	31-50	09110002130
32	NAME PLATE	32-50	09110002131
33	LOGO PLATE - SET (2)	33-50	09110002132
34	PROTECTIVE STRIP	34-50	09110002137

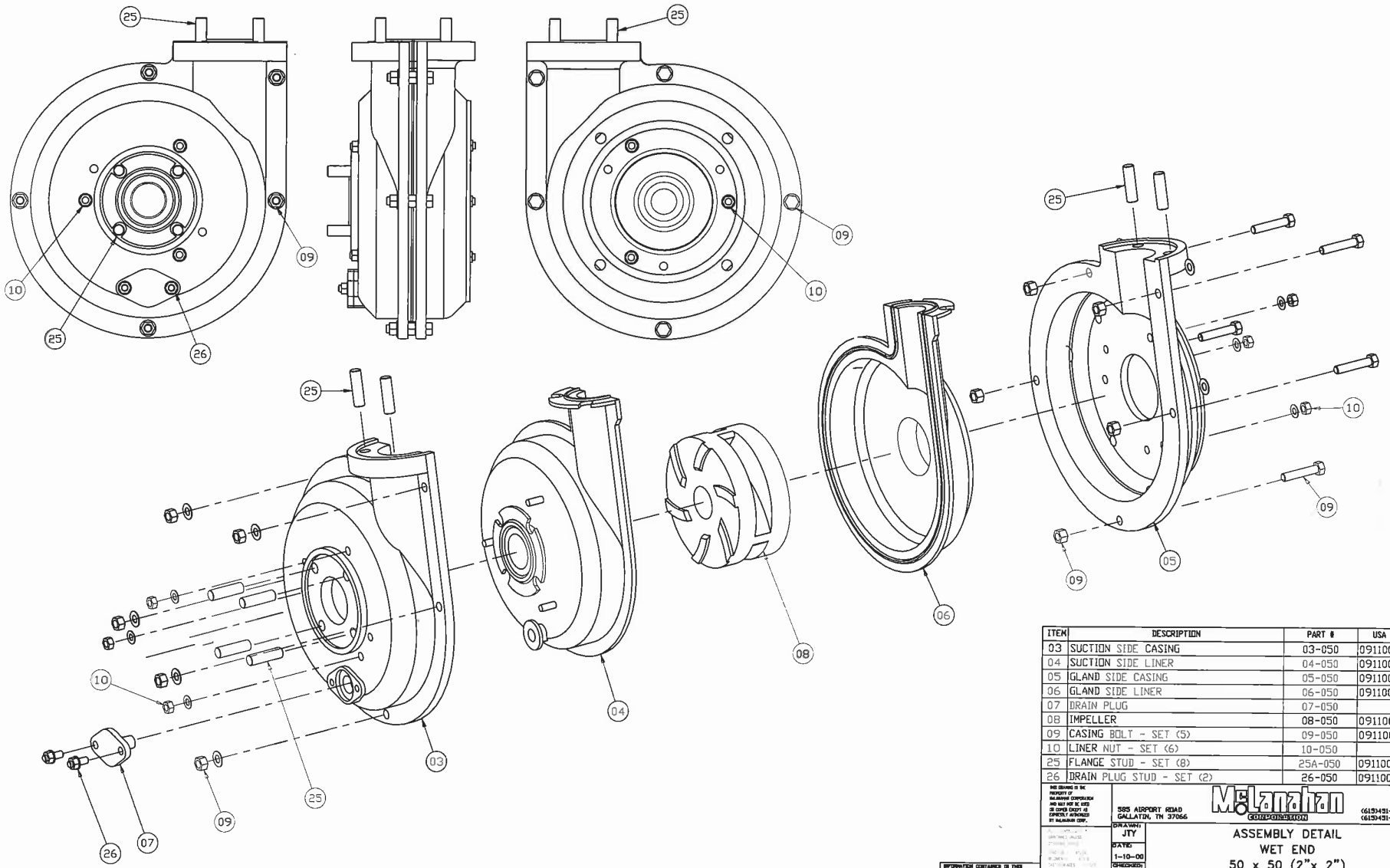
McLanahan CORPORATION
380 AIRPORT ROAD
GALLATIN, TN 37066
(615)451-4440
(615)451-4461 FAX

DRAWN: PES
DATE: 9-28-05
CHECKED:

PUMP ASSEMBLY
50 X 50 (2" X 2")
McLANAHAN PUMP

PART NUMBER	SCALE:	SIZE	DRAWING NO. 1of1	REV.
	N.T.S.	D	D04749	0

IF IN DOUBT REFER TO DRAWING OFFICE



ITEM	DESCRIPTION	PART #	USA PART #
03	SUCTION SIDE CASING	03-050	09110002105
04	SUCTION SIDE LINER	04-050	09110002106
05	GLAND SIDE CASING	05-050	09110002108
06	GLAND SIDE LINER	06-050	09110002109
07	DRAIN PLUG	07-050	
08	IMPELLER	08-050	09110002110
09	CASING BOLT - SET (5)	09-050	09110002111
10	LINER NUT - SET (6)	10-050	
25	FLANGE STUD - SET (8)	25A-050	09110002125
26	DRAIN PLUG STUD - SET (2)	26-050	09110002126

595 AIRPORT ROAD
GALLATIN, TN 37066
McLanahan CORPORATION
(615)451-4440
(615)451-4461 FAX

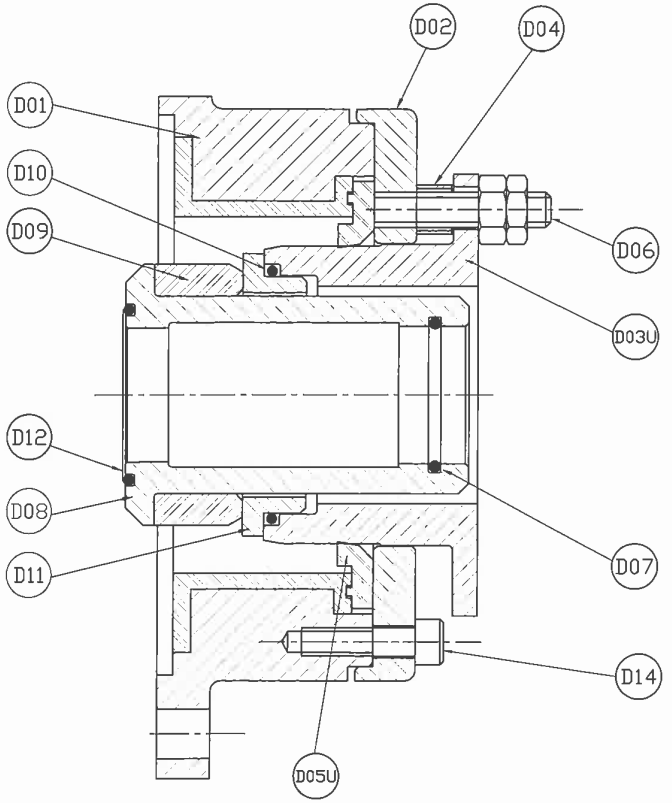
DRAWN: JTY
DATE: 1-10-00
CHECKED:

ASSEMBLY DETAIL
WET END
50 x 50 (2"x 2")
McLANAHAN PUMP

PART NUMBER	SCALE	SIZE	DRAWING NO. 1of1	REV.
	N.T.S.	D	D04748	0

ITEM	QTY	DESCRIPTION	OLD PART#	NEW PART#	
D14	1	GLAND COVER SET SCREW - SET (3)	D14-050	09110002314	
D12	1	"O" RING-45 MM I.D. x 3 MM	D12-050	09110002312	*
D11	1	HARD WEARING FACE	D11-050	09110002311	*
D10	1	"O" RING-67 MM I.D. X 3.5 MM	D10-050	09110002310	#
D09	1	LINATEX FACE SEAL	D09-050	09110002309	*
D08	1	GLAND SLEEVE	D08-050	09110002308	*
D07	1	"O" RING-39 MM I.D. x 3 MM	D07-050	09110002307	*
D06	1	ADJUSTING STUD SET - SET (3)	D06-050	09110002306	*
D05U	1	GLAND SEAL	D05U-050	09110002305	*
D04	1	LINATEX WASHERS - SET (3)	D04-050	09110002304	*
D03U	1	ADJUSTING SLEEVE	D03U-050	09110002303	*
D02	1	GLAND COVER	D02-050	09110002302	
D01	1	GLAND HOUSING	D01-050	09110002301	

NOTE: 1. REPAIR KIT No. 09110002321 CONSISTS OF PARTS LABELED BY ASTERISK (*).
2. PART INCLUDED WITH HARD WEARING FACE IS LABELED BY POUND (#).



NO.	DATE	REVISION	BY
2A	08/17/00	REV'D QTY. & DESC. PER BOM	CW
2	6/28/00	REV'D ADJUST. SLEEVE & GLAND SEAL : ADDED NOTE	CW
1	6/16/97	ADD NEW PART NUMBERS	SP

McLanahan CORPORATION
200 WALL STREET
HOLLIDAYSBURG, PA 16648
(814)695-9807
(814)695-6684 FAX

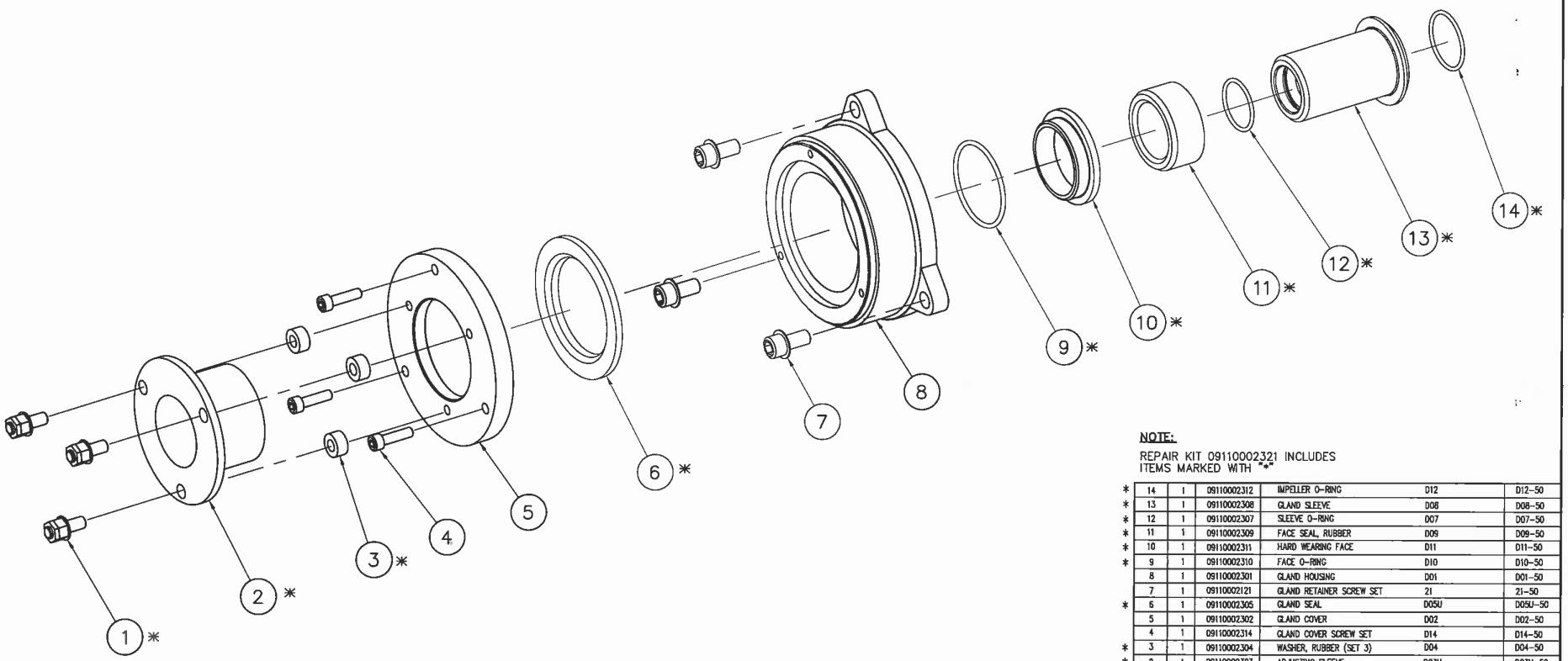
DRY GLAND ASSEMBLY
50 x 50 McLANAHAN PUMP
(2" x 2")

MACHINED DIMENSIONS 1/64 EXCEPT WHERE NOTED, FINISH 125 EXCEPT WHERE NOTED

FILE:

PART NUMBER	DRAWN: DES	DATE: 12/11/96	DRAWING NO. 1 of 1	REV.
GD13U-050	CHECKED: AC	SCALE: 3/4"=1"	GD13U-50	2A

IF IN DOUBT REFER TO DRAWING OFFICE



NOTE:

REPAIR KIT 09110002321 INCLUDES ITEMS MARKED WITH "*"

	ITEM	QTY.	PART NUMBER	DESCRIPTION		DWG.
*	14	1	09110002312	IMPELLER O-RING	D12	D12-50
*	13	1	09110002308	GLAND SLEEVE	D08	D08-50
*	12	1	09110002307	SLEEVE O-RING	D07	D07-50
*	11	1	09110002309	FACE SEAL, RUBBER	D09	D09-50
*	10	1	09110002311	HARD WEARING FACE	D11	D11-50
*	9	1	09110002310	FACE O-RING	D10	D10-50
	8	1	09110002301	GLAND HOUSING	D01	D01-50
	7	1	09110002121	GLAND RETAINER SCREW SET	21	21-50
*	6	1	09110002305	GLAND SEAL	D05U	D05U-50
	5	1	09110002302	GLAND COVER	D02	D02-50
	4	1	09110002314	GLAND COVER SCREW SET	D14	D14-50
*	3	1	09110002304	WASHER, RUBBER (SET 3)	D04	D04-50
*	2	1	09110002303	ADJUSTING SLEEVE	D03U	D03U-50
*	1	1	09110002306	ADJUSTING STUD SET (SET 3)	D06	D06-50

MATERIAL LIST

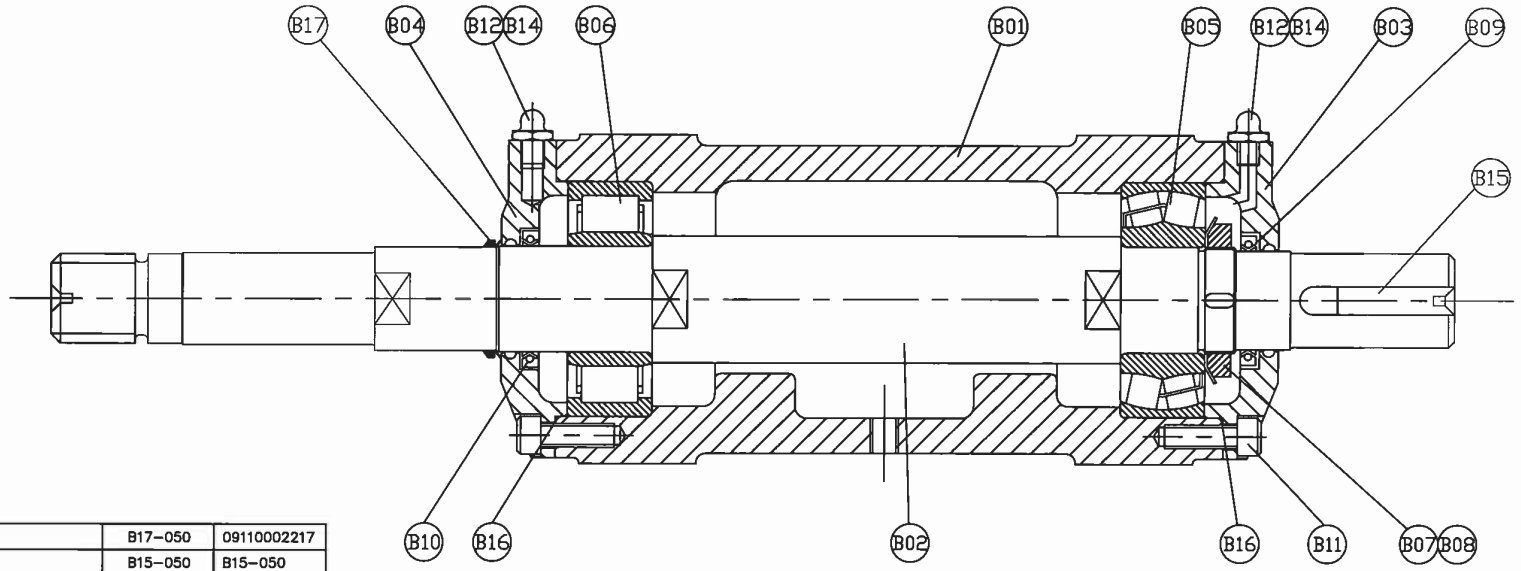
525 AIRPORT ROAD
GALLATIN, TN 37066
McLanahan CORPORATION
(615)451-4440
(615)451-4461 FAX

DRAWN: JTY
DATE: 12-18-96
CHECKED:

DRY GLAND ASSEMBLY
50 X 50 McLANAHAN PUMP
(2" X 2")

PART NUMBER	SCALE	SIZE	DRAWING NO. 1of1	REV.
	N.T.S.	D	GD13U-50-EXP	0

NO.	DATE	REVISIONS	BY
1	7/95	CHANGE DRAWING NUMBER	RGS
2	12/13/96	DELETE ITEM B13, ADD B14, B15, B16 & B17	DES
3	6/16/97	ADD NEW PART NUMBERS	SP
3A	08/03/00	REPLACED ITEM B16 WITH B13	CW
3B	08/17/00	REV'D QTY. & DESC. PER BOM	CW



SECTION THROUGH BEARING ASSEMBLY

ITEM	QTY	DESCRIPTION	OLD PART#	NEW PART#
B17	1	V-RING SEAL	B17-050	09110002217
B15	1	SHAFT KEY	B15-050	B15-050
B14	1	GREASE	B14-050	
B13	2	BEARING COVER SEAL	B13-050	09110002213
B12	2	GREASE NIPPLES	B12-050	09110002212
B11	1	BEARING COVER SET SCREWS - SET (6)	B11-050	09110002211
B10	1	FRONT GREASE SEAL	B10-050	09110002210
B09	1	END GREASE SEAL	B09-050	09110002209
B08	1	LOCK NUT	B08-050	09110002208
B07	1	TAB WASHER	B07-050	09110002207
B06	1	FRONT BEARING	B06-050	09110002206
B05	1	END BEARING	B05-050	09110002205
B04	1	FRONT COVER	B04-050	09110002204
B03	1	END COVER	B03-050	09110002203
B02	1	PUMP SHAFT C/W KEY	B02-050	09110002202
B01	1	BEARING HOUSING	B01-050	09110002201

LPT GROUP, INC.
Division of McLanahan Corp.

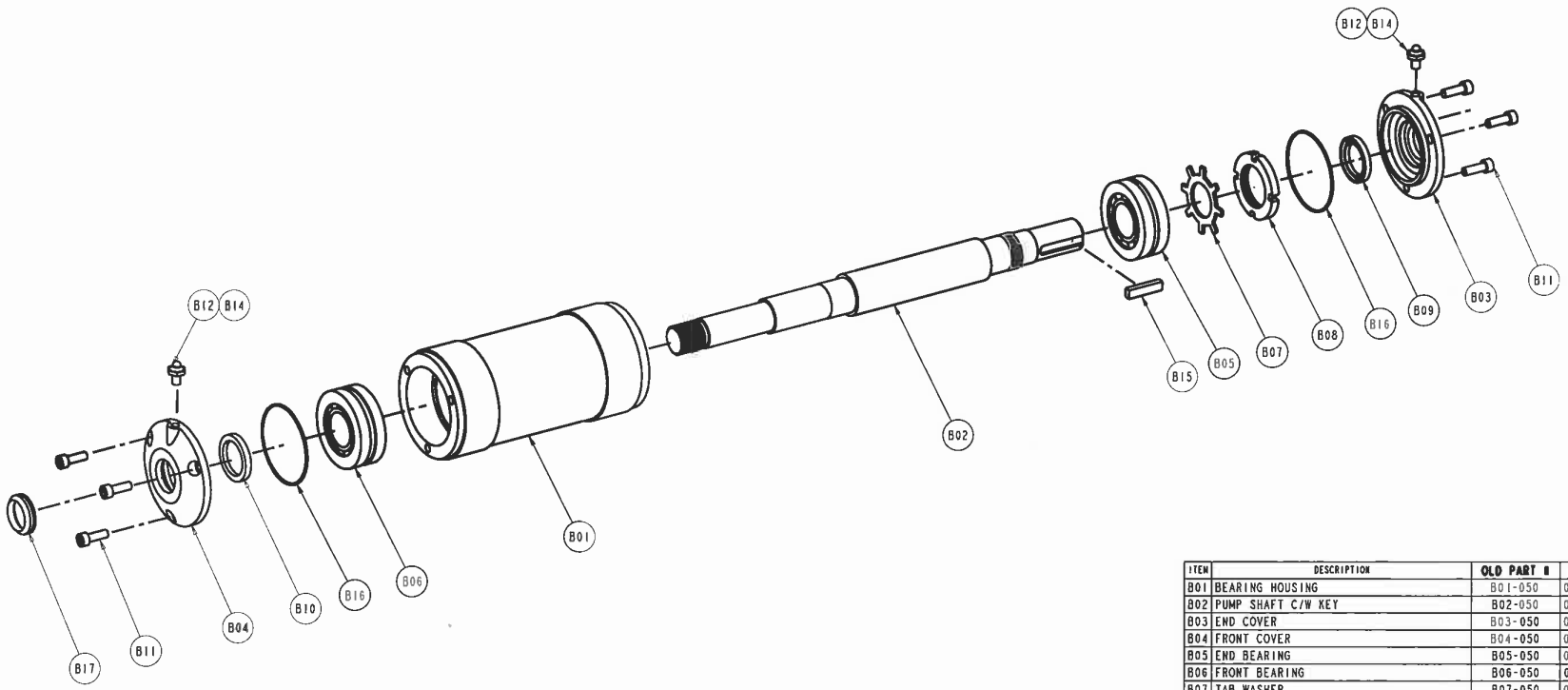
DRAWN: SP
DATE: 11/8/94
CHECKED: AC

BEARING ASSEMBLY
LPT GROUP PUMP
2" x 2" (50 X 50) AND
1 1/2" X 1 1/2" (35 X 35)

PART NUMBER	SCALE:	SIZE	DRAWING NO.	REV.
09110002116	1/2"=1'	B	15-50 1of1	3B

IF IN DOUBT REFER TO DRAWING OFFICE

NO.	DATE	REVISIONS	BY
0	12/27/99	ORIGINAL DRAWING	JTY



ITEM	DESCRIPTION	OLD PART #	USA PART #
B01	BEARING HOUSING	B01-050	09110002201
B02	PUMP SHAFT C/W KEY	B02-050	09110002202
B03	END COVER	B03-050	09110002203
B04	FRONT COVER	B04-050	09110002204
B05	END BEARING	B05-050	09110002205
B06	FRONT BEARING	B06-050	09110002206
B07	TAB WASHER	B07-050	09110002207
B08	LOCK NUT	B08-050	09110002208
B09	END GREASE SEAL	B09-050	09110002209
B10	FRONT GREASE SEAL	B10-050	09110002210
B11	BEARING COVER SET SCREW - SET (6)	B11-050	09110002211
B12	GREASE NIPPLES - SET (2)	B12-050	09110002212
B14	GREASE	B14-050	-
B15	SHAFT KEY	B15-050	
B16	BEARING HOUSING COVER SEAL - SET (2)	B16-050	09110002213
B17	V-RING SEAL	B17-050	09110002217

IPT GROUP, INC.
Division of McLanahan Corp.

DRAWN BY: JTY
DATE: 12/27/99
CHECKED: -

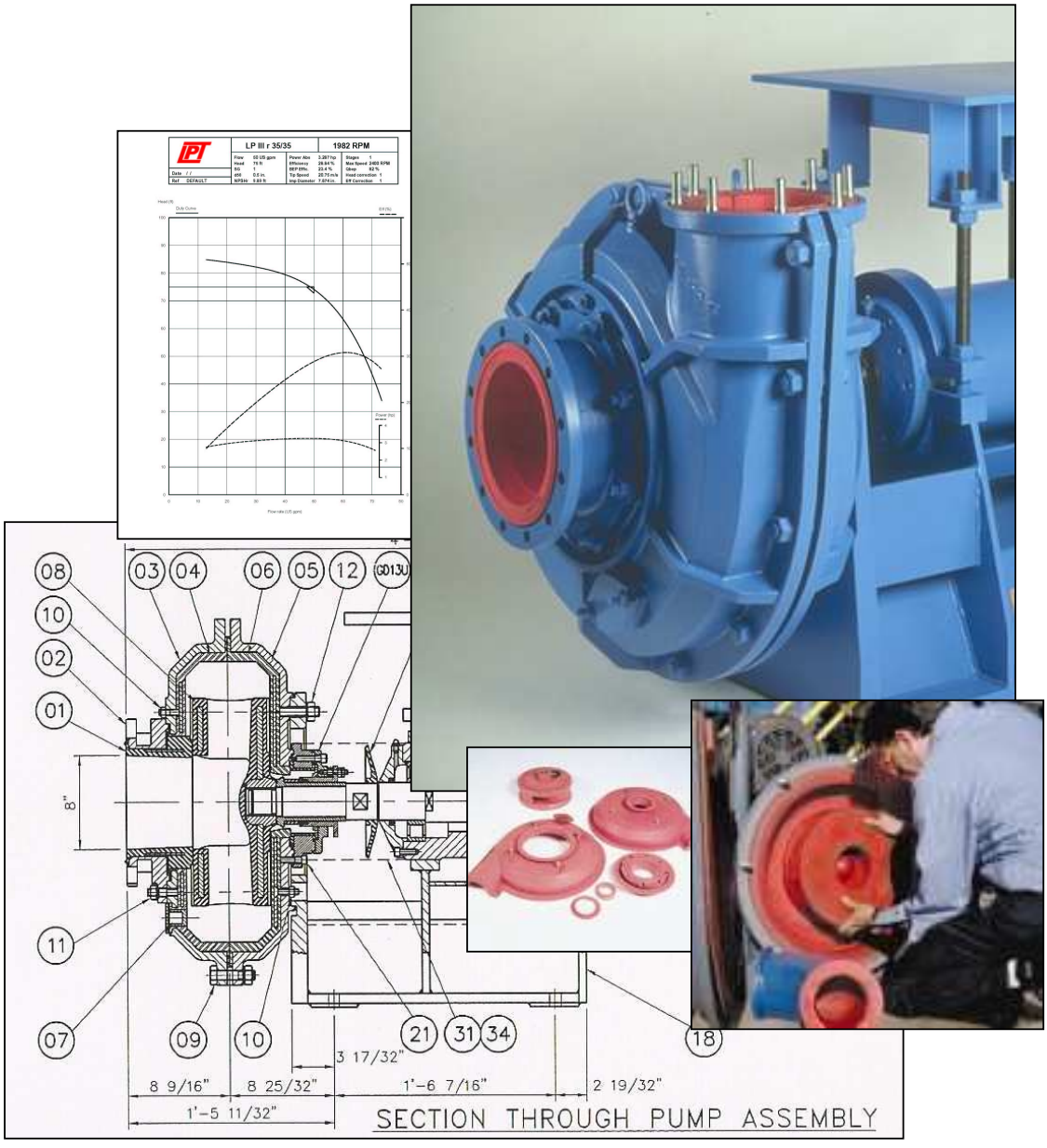
BEARING ASSEMBLY
50 X 50 (2" X 2") LINAPUMP IIIr

PART NUMBER	SCALE:	SIZE:	DRAWING NO.	SHEET	REV.
09110002116	3/8"=1"	D	B-50-IIIP	1 of 1	0

McLanahan CORPORATION

AGGREGATE PROCESSING DIVISION

CENTRIFUGAL SLURRY PUMPS



Equipment, systems & process innovation – since 1835

website: www.mclanahan.com e-mail: sales@mclanahan.com

McLanahan CORPORATION

AGGREGATE PROCESSING DIVISION

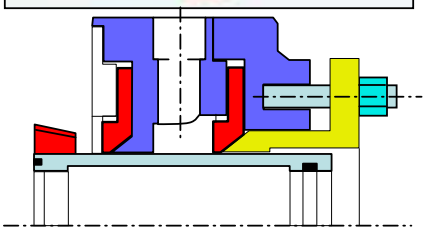
CENTRIFUGAL PUMPS

The McLanahan 'LPT' range of horizontal spindle, centrifugal slurry pumps are ruggedly designed for the most arduous duties. Vertical configuration on special order; Vortex Flow Impellers available for fibrous materials.

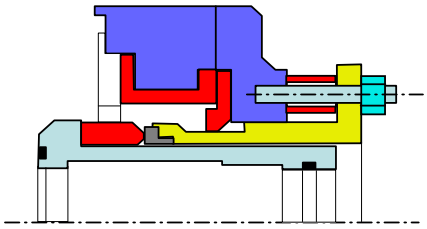
Linings:

Field replaceable, wet end linings are available in Natural Rubber, white Food Grade Rubber, Nitrile and High Chrome Iron.

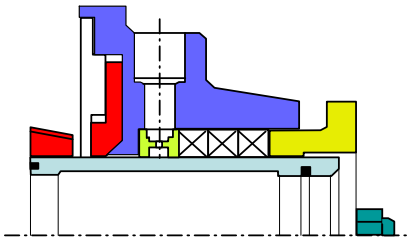
Gland configurations include:



- **Dry Gland** – a unique self lubricating design that does not require an external water supply.



- **Hydrostatic Gland** – a simple, low maintenance design; requires minimal external flushing water.



- **Packed Gland** – for the traditionalist; requires external flushing water

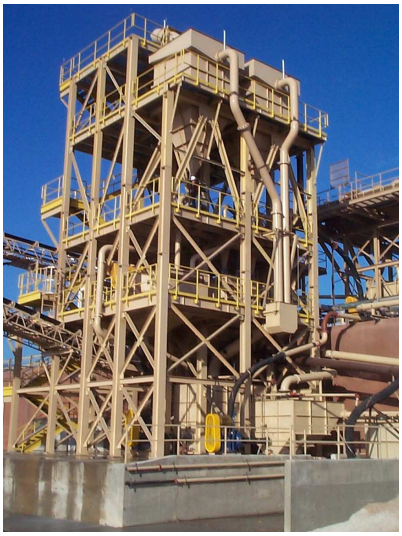
Equipment, systems & process innovation – since 1835

website: www.mclanahan.com

e-mail: sales@mclanahan.com

McLanahan CORPORATION

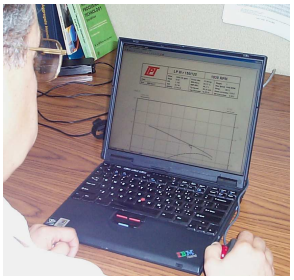
AGGREGATE PROCESSING DIVISION

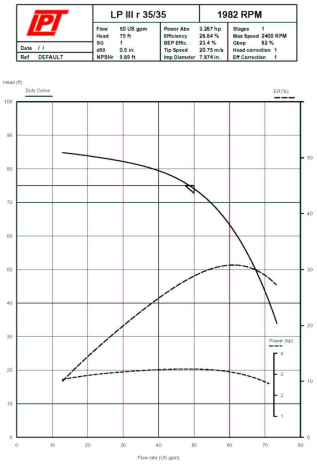


PUMP SERVICE

Total Service

From design to installation and beyond, McLanahan engineers are available to give advice on your slurry pumping needs and problems. The IIIr range has been designed to offer a wide choice of pump sizes to suit most slurry pumping applications.





Pumptec: Computer Aided Support

To complement and facilitate optimum selection of your slurry system, LPT uses "Pumptec".

This unique computer program:

- Analyzes the effects of changing slurry density
- Calculates the P_{50} particle size from a sieve analysis
- Calculates settling velocities and select pipe sizes
- Calculates pipeline frictional losses in various pipe materials and pipe fittings
- Calculates the pump duty and selects a pump and drive based on input parameters
- Prints full application and selection data including NPSH, BEP, RPM, HP, etc.

Troubleshooting is made easier using Pumptec to evaluate different scenarios.

McLanahan CORPORATION

AGGREGATE PROCESSING DIVISION

LPT PUMP APPLICATIONS

Sand plants

Feeding sand and water to all types of classification and dewatering plants; effluent water transfer duties.

Coal preparation plants

For dense medium circuits; feeding hydrocyclones; filtrate pumping; handling the underflow from thickeners; disposal of effluent, etc.

Chemical manufacturing & Environmental applications

LPT pumps, by virtue of their various rubber linings, are suitable for pumping many chemical solutions, acid or alkaline, at moderate temperatures and for the disposal of effluent.

Cement manufacture

Slurry feed to : tube mill circuits; thickener feed and underflow; flotation plant circuits.

Metalliferous mining

Mill circuits; feeding hydrocyclones; cyanide plant filter residues; concentrates; tailings disposal and other pulp and slurry handling duties.

Irrigation systems and dredging

Silt removal in dams and canal sand traps.

Paper mills

China clay slurries; paper stock; effluent disposal.

Steel works and manufacturing applications

Pickling acid distribution circuits in plate and wire de-scaling plants; abrasive wet scrubber blow-down.

Power stations

Boiler house ash disposal; de-scaling plants.

China clay production

Feeding slurry to hydrocyclones and for general use in the preparation of china clay.

Glass manufacturing

Feeding polishing media; sand plants; handling effluent.

McLanahan CORPORATION

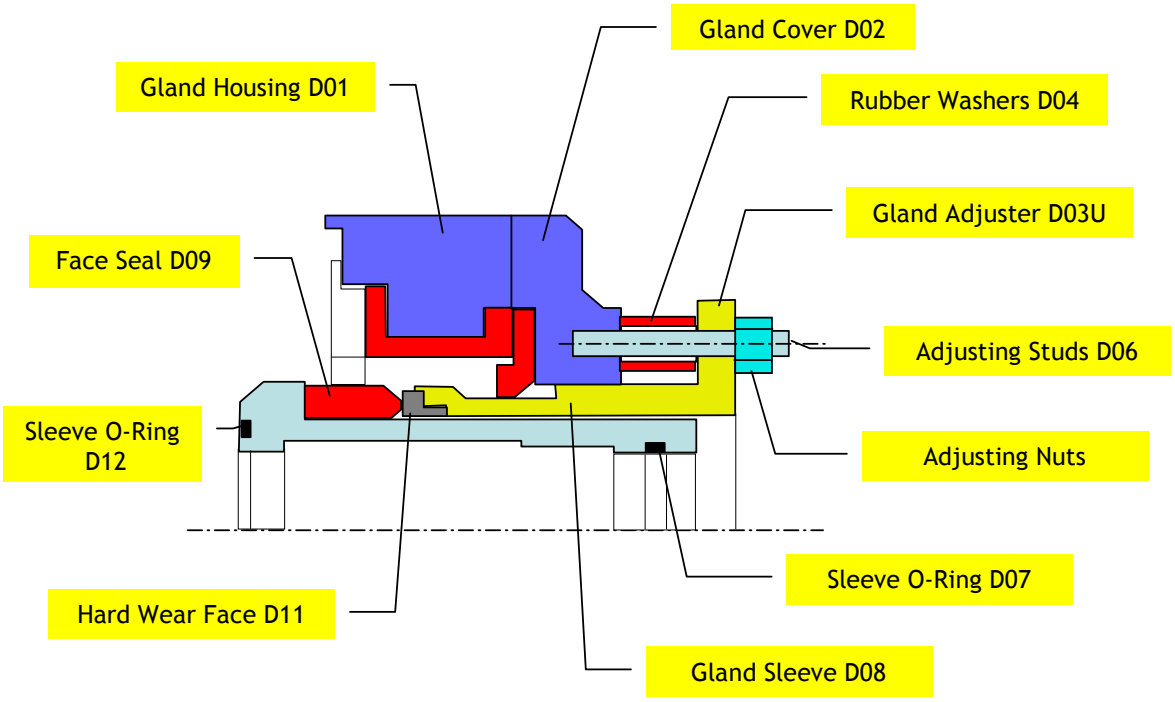
AGGREGATE PROCESSING DIVISION

'DRY' GLAND

a.k.a. 'D' type Gland

Is a unique proprietary design and is unlike conventional mechanical seals. A rotating rubber 'Face Seal' is adjusted against a static 'Hard Wear Face'; it is 'self-lubricating' in that pressure from inside the Pump head forces small amounts of liquid between the surfaces for lubrication.

Note: The term 'dry' is derived from the fact that the gland needs no external water source to lubricate the gland, small amounts of water and fines do exit the pump and accumulate at its base.



The Face Seal acts as a spring and if any grit particles get between the rotating rubber and stationary Wear Face it is pressed into the Rubber. The Face Seal is a stretch fit on the shaft sleeve. As the gland pressure increases, so the rubber extends axially and increases the pressure at the rubbing interface.

When the pump is running, adjust the gland nuts so that there are approximately 5 drops per minute from the gland. This should reduce to 1 drop occasionally, and run satisfactorily for up to a year without further attention in a typical application.

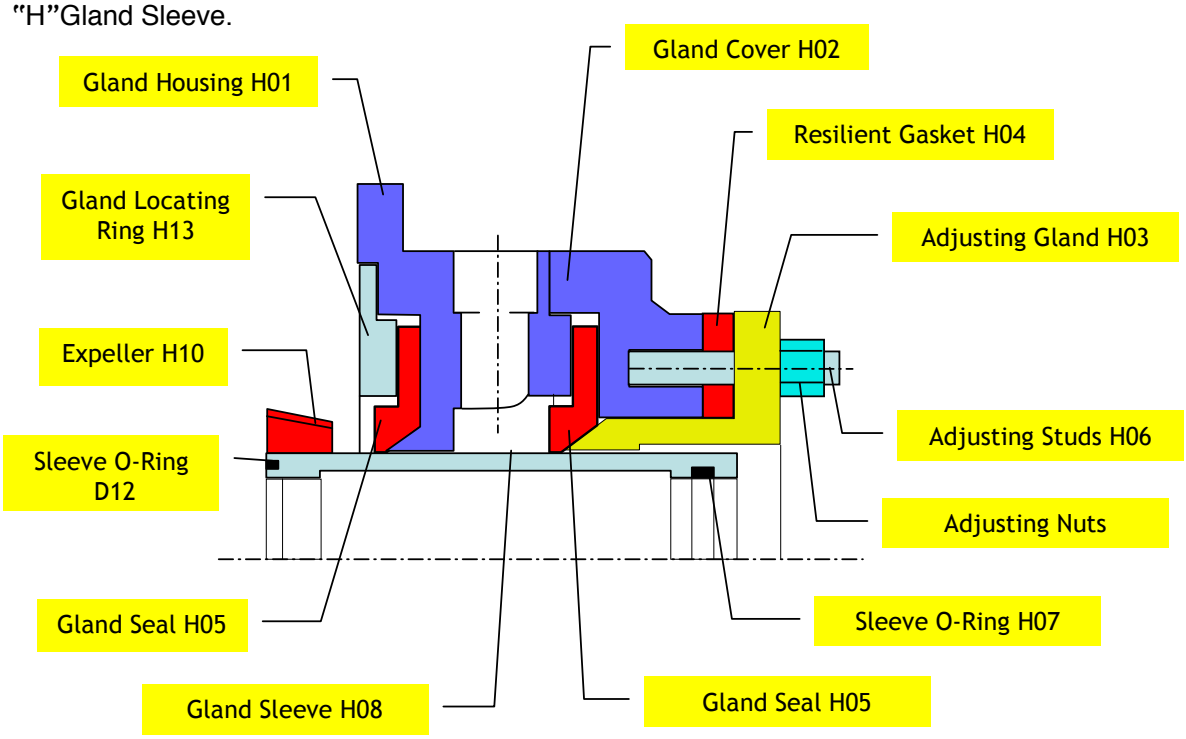
McLanahan CORPORATION

AGGREGATE PROCESSING DIVISION

HYDROSTATIC GLAND

a.k.a. 'H' type Gland

Is a unique proprietary design with the lowest maintenance and longest life, the unique rubber gland seal is designed to deflect inwards to provide and effective seal. The Slurry pressure at the gland is reduced by back pump out vanes on the impeller, and, when fitted, the Rubber axial expeller, which is a stretch fit on the shaft of the "H"Gland Sleeve.



The solids are restrained by the outward centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the 'H' Gland, the adjusting gland must be eased outwards to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of 'digging' onto the gland sleeve.

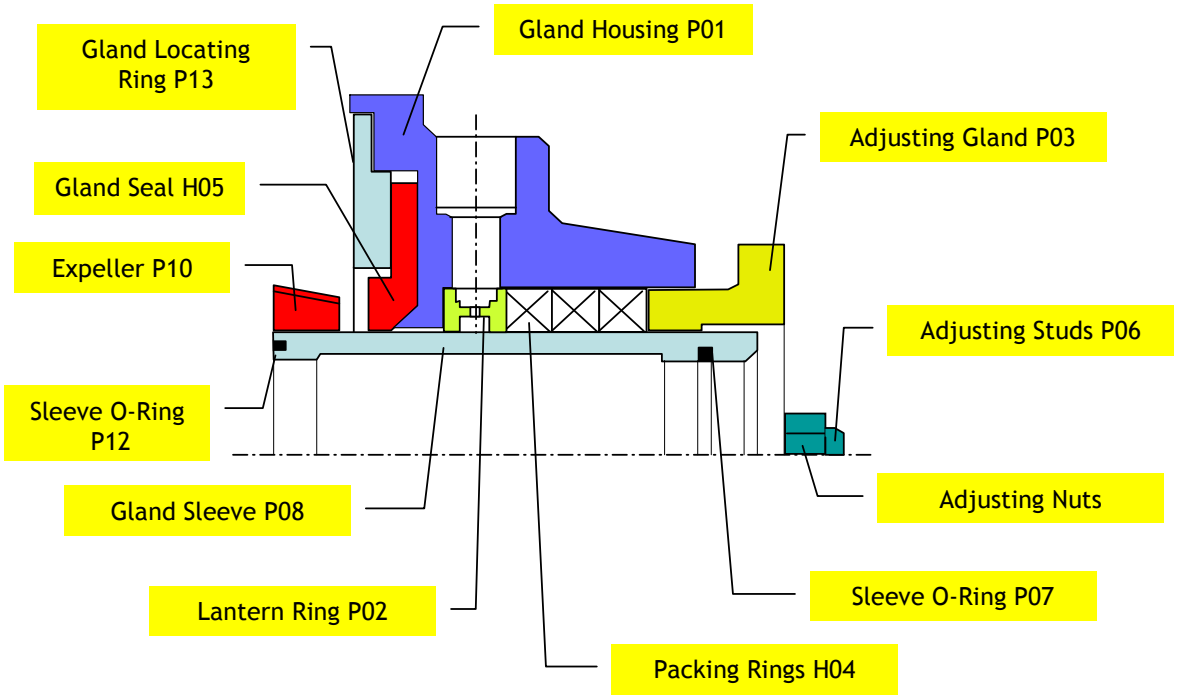
The gland sealing water must be as clean as possible at a pressure of about 5 psi (4m water gauge) above the discharge pressure and at a volume of between 1 to 5 gpm depending on pump size. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

McLanahan CORPORATION

AGGREGATE PROCESSING DIVISION

PACKED GLAND

a.k.a. 'P' type Gland
Is a classic 'stuffing box' design where sealing is obtained by compressing the gland packing rings onto the shaft sleeve. The gland offers the capacity to seal the pump even at high pressures, for instance in series pumping.



The solids are restrained by the outward centrifugal swirl behind the impeller, the axial expeller and the restricted path to the seal interface.

With the 'P' Gland, the adjusting gland must be adjusted inwards to increase the sealing pressure. The geometric shape of the Gland Seal is carefully designed to give a good seal, while limiting the amount of "digging" onto the gland sleeve.

The gland sealing water must be as clean as possible at a pressure of about psi (4m water gauge) above the discharge pressure and at a volume of between 1 to 5 gpm depending on pump size. With a high flushing water pressure you get greater water use and greater dilution of the pumped slurry without any benefit to the seal.

A pressure fed grease supply can be used with the 'P' gland, but then care must be taken to use synthetic rubber parts which are a special order.

JOHN MEUNIER

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference : NC01

STEEL TANKS

ST-103

VEOLIA WATER
Solutions & Technologies

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Project Summary	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-103	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-103-1			**ACTIFLO TANK**					
				GENERAL					
				Model:					
				ACTIFLO ACP- 700R					
				Material:					
				Carbon Steel, G40,21M-300W					
				SURFACE PREPARATION					
				Internal:					
				SSPC-SP-10					
				External:					
				SSPC-SP-6					
				COATING					
				Internal:					
				1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
				3 to 6 dry mils per coat - #B58LX600 Light blue					
				1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
				5 to 10 dry mils per coat - #B58WX610 Mill white					
				1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
				5 to 10 dry mils per coat - #B58LX600 Light blue					
				External:					
				1 coat of Macropoxy 646 NSF, SHERWIN WILLIAMS					
				5 to 10 dry mils per coat - #B58LX600 Light blue					
				1 coat of UV resistant Acrolon 218 HS, B65-650 Semi-Gloss					
				SHERWIN WILLIAMS, 3 to 6 dry mils per coat					
				color #B65TL0218712					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Project Summary	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-103	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
				GRATING					
				Quantity:					
				covering coagulation, injection and maturation tanks also give access to scraper drive					
				Material:					
				FRP					
				Manufacturer:					
				Fibergrate					
				Model:					
				Square Mesh color grey - finish grit top					
				Dimension:					
				1 1/2" x 1 1/2" x 1 1/2"					
				HANDRAIL					
				Quantity:					
				Surrounding grating except for opening for access					
				Material:					
				Galvanized Steel					
				STAIRS					
				Quantity:					
				1 set of stairs and 1 intermediate platform					
				Material:					
				Galvanized Steel with Fibergrate grating and stairs					

JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Project Summary	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | 0
	3						
DESSIN /DWG # ST-103	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
				COLLECTION TROUGHS					
				Quantity:					
				4 per unit					
				Material:					
				Stainless Steel 304					
				Manufacturer:					
				John Meunier inc.					
				collection trough have non-adjustable notch					
				SCRAPER					
				Quantity:					
				1 per unit					
				Material:					
				Scraper shaft, rake arms and discharge cone scraper are in galvanized steel					

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THE SHERWIN-WILLIAMS COMPANY

Industrial and Marine Coatings

Certified to ANSI/NSF 61

MACROPOXY® 646 NSF
FAST CURE EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART B	B58VX600	HARDENER

INDUSTRIAL & MARINE COATINGS

PRODUCT INFORMATION

Revised 5/2002

PRODUCT DESCRIPTION

MACROPOXY 646 NSF FAST CURE EPOXY is a high solids, high build, fast drying, polyamide epoxy certified by NSF to Standard 61 as a tank lining for potable water storage tanks. The high solids content ensures adequate protection of sharp edges, corners, and welds.

- Approved by NSF to Standard 61 for potable water storage tanks of 1,500 gallons and larger and pipe interiors of 36" and greater
- Suitable for use in USDA inspected facilities

RECOMMENDED USES

- As an interior tank lining for potable storage water tanks
- Immersion service - potable water tanks: Meets NSF Standard 61 for use in potable water storage tanks
- Suitable for use with cathodic protection systems

PRODUCT CHARACTERISTICS

Finish: Semi-Gloss

Color: Mill White and Light Blue

Volume Solids: 72% ± 2%, mixed
Mill White

Weight Solids: 85% ± 2%, mixed
Mill White

VOC (EPA Method 24): Unreduced: 235 g/L; 1.96 lb/gal
mixed Reduced 10%: 290 g/L; 2.41 lb/gal

Mix Ratio: 1:1 by volume

Recommended Spreading Rate per coat:

Wet mils:	7.0 - 13.5
Dry mils:	5.0 - 10.0*
Coverage:	116 - 232 sq ft/gal approximate

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

* See Recommended Systems

Drying Schedule @ 7.0 mils wet and 50% RH:

	@ 40°F	@ 77°F	@ 100°F
To touch:	4-5 hours	2 hours	1½ hours
To handle:	48 hours	8 hours	4½ hours
To recoat:			
minimum:	48 hours	8 hours	4½ hours
maximum:	3 months	3 months	3 months
Cure for			
service:	10 days	7 days	4 days
immersion:	14 days	7 days	4 days

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity and film thickness dependent.

Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

Shelf Life: 36 months

Flash Point: 60°F, TCC, mixed

Reducer/Clean Up: Reducer, R7K15

PERFORMANCE CHARACTERISTICS

System Tested: (unless otherwise indicated)
Substrate: Steel
Surface Preparation: SSPC-SP10
1 ct. Macropoxy 646 NSF Fast Cure Epoxy @ 6.0 mils dft

Abrasion Resistance:
Method: ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load
Result: 84 mg loss

Accelerated Weathering - QUV, Zinc Clad II HS Primer:
Method: ASTM D4587, QUV-A, 12,000 hours
Results: passes

Adhesion:
Method: ASTM D4541
Result: 830 psi

Corrosion Weathering, Zinc Clad II HS Primer:
Method: ASTM D5894, 36 cycles, 12,000 hours
Result: Rating 10 per ASTM D714 for blistering
Rating 9 per ASTM D610 for rusting

Direct Impact Resistance:
Method: ASTM D2794
Result: 30 in. lb.

Dry Heat Resistance:
Method: ASTM D2485
Result: 250°F

Exterior Durability:
Method: 1 year at 45° South
Result: Excellent, chalks

Flexibility:
Method: ASTM D522, 180° bend, 3/4" mandrel
Result: Passes

Immersion:
Method: 1 year fresh and salt water
Result: Passes, no rusting, blistering, or loss of adhesion

Irradiation-Effects on Coatings used in Nuclear Power Plants
Method: ANSI 5.12 / ASTM D4082-89
Result: Passes

Pencil Hardness:
Method: ASTM D3363
Result: 3H

Permeability Rating:
Method: ASTM D1653
Result: 0.154 mg/cm²

Salt Fog Resistance, Zinc Clad II HS Primer::
Method: ASTM B117, 6,500 hours
Result: Rating 10 per ASTM D610 for rusting
Rating 9 per ASTM D1654 for corrosion

Slip Coefficient, Mill White:
Method: AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts
Result: Class A, 0.36

Epoxy coatings may darken or discolor following application and curing.

continued on back

THE SHERWIN-WILLIAMS COMPANY

INDUSTRIAL & MARINE COATINGS

Industrial and Marine Coatings

NSF®

Certified to ANSI/NSF 61

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MACROPOXY® 646 NSF

FAST CURE EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART B	B58VX600	HARDENER

PRODUCT INFORMATION

RECOMMENDED SYSTEMS

Immersion and atmospheric:

Steel:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

Steel, Shop Applied System, New Construction, AWWA D102:
1 ct. Macropoxy 646 NSF @ 3.0 - 6.0 mils dft
1-2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 milds dft/ct

Concrete/Masonry, smooth:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

Concrete Block:
1 ct. Kem Cati-Coat HS Epoxy Filler/Sealer @ 10.0 - 20.0 mils dft, as needed to fill voids and provide a continuous substrate.
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

Maximum dry film thickness allowed by NSF for Macropoxy 646 NSF Fast Cure Epoxy is 20 mils for two coats.

Atmospheric:

Steel:
1 ct. Recoatable Epoxy Primer @ 4.0 - 6.0 mils dft
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

Steel:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct
1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct
or Hi-Solids Polyurethane @ 3.0 - 5.0 mils dft/ct

Steel:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct
1-2 cts. Tile-Clad HS Epoxy @ 2.5 - 4.0 mils dft/ct
or Armor-Tile HS @ 2.5 - 4.0 mils dft/ct

Steel:
1 ct. Zinc Clad II HS @ 3.0 - 6.0 mils dft
1 ct. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft
1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Zinc Clad III HS @ 3.0 - 5.0 mils dft
or Zinc Clad IV HS @ 3.0 - 5.0 mils dft
1 ct. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft
1-2 cts. Acrolon 218 Polyurethane @ 3.0 - 6.0 mils dft/ct

Aluminum:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

Galvanizing:
2 cts. Macropoxy 646 NSF @ 5.0 - 10.0 mils dft/ct

The systems listed above are representative of the product's use. Other systems may be appropriate.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure good adhesion.
Refer to product Application Bulletin for detailed surface preparation information.
Minimum recommended surface preparation:

Iron & Steel	
Atmospheric:	SSPC-SP2/3
Immersion:	SSPC-SP10, 2-3 mil profile
Aluminum:	SSPC-SP1
Galvanizing:	SSPC-SP1
Concrete & Masonry	
Atmospheric:	SSPC-SP13/NACE 6
Immersion:	SSPC-SP13/NACE 6-4.3.1 or 4.3.2

TINTING

Tinting is not recommended for immersion service.

APPLICATION CONDITIONS

Temperature:	40°F minimum, 110°F maximum (air, surface, and material) At least 5°F above dew point
Relative humidity:	85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	
Part A:	1 and 5 gallon containers
Part B:	1 and 5 gallon containers
Weight per gallon:	12.7 ± 0.2 lb mixed, may vary by color

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

THE SHERWIN-WILLIAMS COMPANY

INDUSTRIAL & MARINE COATINGS

Industrial and Marine Coatings

NSF®

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4.56A

MACROPOXY® 646 NSF

FAST CURE EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART B	B58VX600	HARDENER

APPLICATION BULLETIN

Revised 5/2002

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Iron & Steel, Atmospheric Service:
Minimum surface preparation is Hand Tool Clean per SSPC-SP2. Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. For better performance, use Commercial Blast Cleaning per SSPC-SP6, blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils). Prime any bare steel within 8 hours or before flash rusting occurs.

Iron & Steel, Immersion Service:
Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2-3 mils). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned.

Aluminum
Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1.

Galvanized Steel
Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1 (recommended solvent is VM&P Naphtha). When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned.

Concrete and Masonry, Atmospheric Service:
For surface preparation, refer to NACE 6/SSPC-SP13. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F. Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Fill bug holes, air pockets and other voids with a cement patching compound. Weathered masonry and soft or porous cement board must be brush blasted or power tool cleaned to remove loosely adhering contamination and to get to a hard, firm surface. Laitance must be removed by etching with a 10% muriatic acid solution and thoroughly neutralized with water.

Concrete and Masonry, Immersion Service:
For surface preparation, refer to SSPC-SP13/NACE 6, Section 4.3.1 or 4.3.2.

Previously Painted Surfaces
If in sound condition, clean the surface of all foreign material. Smooth, hard or glossy coatings and surfaces should be dulled by abrading the surface. Apply a test area, allowing paint to dry one week before testing adhesion. If adhesion is poor, or if this product attacks the previous finish, removal of the previous coating may be necessary. If paint is peeling or badly weathered, clean surface to sound substrate and treat as a new surface as above.

APPLICATION CONDITIONS

Temperature:	40°F minimum, 110°F maximum (air, surface, and material) At least 5°F above dew point
Relative humidity:	85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer/Clean Up ..... Reducer R7K15

Airless Spray
- Pump 30:1
- Pressure ..... 2800 - 3000 psi
- Hose ..... 1/4" ID
- Tip ..... .017" - .023"
- Filter ..... 60 mesh
- Reduction ..... as needed up to 10% by volume

Conventional Spray
- Gun ..... DeVilbiss MBC-510
- Fluid Tip ..... E
- Air Nozzle 704
- Atomization Pressure .... 60-65 psi
- Fluid Pressure ..... 10-20 psi
- Reduction ..... as needed up to 10% by volume
- Requires oil and moisture separators

Brush
- Brush..... Nylon/Polyester or Natural Bristle
- Reduction ..... as needed up to 10% by volume

Roller
- Cover ..... 3/8" woven with phenolic core
- Reduction ..... as needed up to 10% by volume

If specific application equipment is listed above, equivalent equipment may be substituted.

continued on back

THE SHERWIN-WILLIAMS COMPANY

INDUSTRIAL & MARINE COATINGS

Industrial and Marine Coatings

Certified to ANSI/NSF 61

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MACROPOXY® 646 NSF

FAST CURE EPOXY

PART A	B58WX610	MILL WHITE
PART A	B58LX600	LIGHT BLUE
PART B	B58VX600	HARDENER

APPLICATION BULLETIN

APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine one part by volume of Part A with one part by volume of Part B. Thoroughly agitate the mixture with power agitation. Allow the material to sweat-in as indicated prior to application. Re-stir before using.

If reducer solvent is used, add only after both components have been thoroughly mixed, after sweat-in.

Apply paint to the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

Wet mils:	7.0 - 13.5
Dry mils:	5.0 - 10.0*
Coverage:	116 - 232 sq ft/gal approximate

NOTE Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

* See Recommended Systems

Drying Schedule @ 7.0 mils wet and 50% RH:

	@ 40°F	@ 77°F	@ 100°F
To touch:	4-5 hours	2 hours	1½ hours
To handle:	48 hours	8 hours	4½ hours
To recoat:			
minimum:	48 hours	8 hours	4½ hours
maximum:	3 months	3 months	3 months
Cure for			
service:	10 days	7 days	4 days
immersion:	14 days	7 days	4 days

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity and film thickness dependent.

Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer R7K15.

Tinting is not recommended for immersion service.

Quik-Kick Epoxy Accelerator is acceptable for atmospheric use. **Do not use Quik-Kick Epoxy Accelerator for immersion service when NSF certification is required.** See data page 4.99 for details.

Refer to Product Information sheet for additional performance characteristics and properties.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer R7K15. Clean tools immediately after use with Reducer R7K15. Follow manufacturer's safety recommendations when using any solvent.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

MATERIAL SAFETY DATA SHEET

B58W610
08 00

Section 1 -- PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NUMBER	DATE OF PREPARATION	HMIS CODES	
		Health	3*
B58W610	03-SEP-07	Flammability	3
		Reactivity	0

PRODUCT NAME
MACROPOXY® 646 Fast Cure Epoxy Coating (Part A), Mill White

MANUFACTURER'S NAME
THE SHERWIN-WILLIAMS COMPANY
101 Prospect Avenue N.W.
Cleveland, OH 44115

TELEPHONE NUMBERS and WEBSITES
Product Information
www.sherwin-williams.com
Regulatory Information
(216) 566-2902 www.paintdocs.com
Medical Emergency
(216) 566-2917
Transportation Emergency for Chemical Emergency ONLY (spill, leak,
(800) 424-9300 fire, exposure, or accident)

Section 2 -- COMPOSITION/INFORMATION ON INGREDIENTS

% by WT	CAS No.	INGREDIENT			UNITS	VAPOR PRESSURE
3	100-41-4	Ethylbenzene				
			ACGIH TLV	100	ppm	7.1 mm
			ACGIH TLV	125	ppm STEL	
			OSHA PEL	100	ppm	
			OSHA PEL	125	ppm STEL	
15	1330-20-7	Xylene				
			ACGIH TLV	100	ppm	5.9 mm
			ACGIH TLV	150	ppm STEL	
			OSHA PEL	100	ppm	
			OSHA PEL	150	ppm STEL	
11	68410-23-1	Polyamide				
			ACGIH TLV	Not Available		
			OSHA PEL	Not Available		
9	14807-96-6	Talc				
			ACGIH TLV	2	mg/m3 as Resp. Dust	
			OSHA PEL	2	mg/m3 as Resp. Dust	
31	13463-67-7	Titanium Dioxide				
			ACGIH TLV	10	mg/m3 as Dust	
			OSHA PEL	10	mg/m3 Total Dust	
			OSHA PEL	5	mg/m3 Respirable Fraction	

Continued on page 2

Section 3 -- HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

EYES: Irritation.

SKIN: Prolonged or repeated exposure may cause irritation.

INHALATION: Irritation of the upper respiratory system.

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.

Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic skin reaction in susceptible persons.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

Section 4 -- FIRST AID MEASURES

EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention.

SKIN: Wash affected area thoroughly with soap and water. Remove contaminated clothing and launder before re-use.

INHALATION: If affected, remove from exposure. Restore breathing. Keep warm and quiet.

INGESTION: Do not induce vomiting. Get medical attention immediately.

Section 5 -- FIRE FIGHTING MEASURES

FLASH POINT	LEL	UEL
85 F PMCC	1.0	7.0

FLAMMABILITY CLASSIFICATION

RED LABEL -- Flammable, Flash below 100 F (38 C)

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat.

Application to hot surfaces requires special precautions.

During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used.

Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

Continued on page 3

Section 6 -- ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Remove all sources of ignition. Ventilate the area.

Remove with inert absorbent.

Section 7 -- HANDLING AND STORAGE

STORAGE CATEGORY

DOL Storage Class IC

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are FLAMMABLE. Keep away from heat, sparks, and open flame.

During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.

Consult NFPA Code. Use approved Bonding and Grounding procedures.

Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

Section 8 -- EXPOSURE CONTROLS/PERSONAL PROTECTION

PRECAUTIONS TO BE TAKEN IN USE

Use only with adequate ventilation.

Avoid contact with skin and eyes. Avoid breathing vapor and spray mist.

Wash hands after using.

This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

RESPIRATORY PROTECTION

If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

Wear gloves which are recommended by glove supplier for protection against materials in Section 2.

EYE PROTECTION

Wear safety spectacles with unperforated sideshields.

OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

Continued on page 4

Section 9 -- PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT	12.19 lb/gal	1460 g/l
SPECIFIC GRAVITY	1.47	
BOILING POINT	277 - 292 F	136 - 144 C
MELTING POINT	Not Available	
VOLATILE VOLUME	29 %	
EVAPORATION RATE	Slower than ether	
VAPOR DENSITY	Heavier than air	
SOLUBILITY IN WATER	N.A.	

VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged)

2.11 lb/gal	253 g/l	Less Water and Federally Exempt Solvents
2.11 lb/gal	253 g/l	Emitted VOC

Section 10 -- STABILITY AND REACTIVITY

STABILITY -- Stable

CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

Section 11 -- TOXICOLOGICAL INFORMATION

CHRONIC HEALTH HAZARDS

Ethylbenzene is classified by IARC as possibly carcinogenic to humans (2B) based on inadequate evidence in humans and sufficient evidence in laboratory animals. Lifetime inhalation exposure of rats and mice to high ethylbenzene concentrations resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations. There is no evidence that ethylbenzene causes cancer in humans.

Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary and reproductive systems.

IARC's Monograph No. 93 reports there is sufficient evidence of carcinogenicity in experimental rats exposed to titanium dioxide but inadequate evidence for carcinogenicity in humans and has assigned a Group 2B rating. In addition, the IARC summary concludes, "No significant exposure to titanium dioxide is thought to occur during the use of products in which titanium is bound to other materials, such as paint."

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

TOXICOLOGY DATA

Continued on page 5

CAS No.	Ingredient Name				
100-41-4	Ethylbenzene				
		LC50	RAT	4HR	Not Available
		LD50	RAT		3500 mg/kg
1330-20-7	Xylene				
		LC50	RAT	4HR	5000 ppm
		LD50	RAT		4300 mg/kg
68410-23-1	Polyamide				
		LC50	RAT	4HR	Not Available
		LD50	RAT		8000. mg/kg
14807-96-6	Talc				
		LC50	RAT	4HR	Not Available
		LD50	RAT		Not Available
13463-67-7	Titanium Dioxide				
		LC50	RAT	4HR	Not Available
		LD50	RAT		Not Available

Section 12 -- ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

No data available.

Section 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD

Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261.

Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.

Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

Continued on page 6

Section 14 -- TRANSPORT INFORMATION

US Ground (DOT)
1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D
Larger Containers are Regulated as:
UN1263, PAINT, 3, PG III, (ERG#128)

DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities
Ethyl benzene 1000 lb RQ
Xylenes (isomers and mixture) 100 lb RQ

Bulk Containers may be Shipped as (check reportable quantities):
RQ, UN1263, PAINT, 3, PG III, (XYLENES (ISOMERS AND MIXTURE)), (ERG#128)

Canada (TDG)
UN1263, PAINT, CLASS 3, PG III, LIMITED QUANTITY, (ERG#128)

IMO
UN1263, PAINT, CLASS 3, PG III, (29 C c.c.), EmS F-E, S-E

Section 15 -- REGULATORY INFORMATION

SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
100-41-4	Ethylbenzene	3	
1330-20-7	Xylene	15	

CALIFORNIA PROPOSITION 65
WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
TSCA CERTIFICATION
All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

Section 16 -- OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

THE SHERWIN-WILLIAMS COMPANY

Industrial and Marine Coatings

INDUSTRIAL & MARINE COATINGS

ACROLON™ 218 HS

ACRYLIC POLYURETHANE

PART A	B65-600	GLOSS SERIES
PART A	B65-650	SEMI-GLOSS SERIES
PART B	B65V600	HARDENER

PRODUCT INFORMATION

Revised 2/04

PRODUCT DESCRIPTION

ACROLON 218 HS acrylic polyurethane is a VOC compliant, polyester modified, aliphatic, acrylic polyurethane formulated specifically for in-shop applications. Also suitable for industrial applications. A fast drying, high gloss urethane that provides color and gloss retention for exterior exposure.

- Can be used directly over organic zinc rich primers (epoxy zinc primer and moisture cure urethane zinc primer)
- Suitable for use in USDA inspected facilities
- Color and gloss retention for exterior exposure
- Fast dry

RECOMMENDED USES

Specifically formulated for in-shop applications.

For use over prepared metal and masonry surfaces in industrial environments such as:

- Structural steel
- Rail cars and locomotives
- Conveyors
- Bridges
- Offshore platforms - exploration and production
- Tank exteriors
- Pipelines
- Ships

PRODUCT CHARACTERISTICS

Finish: High Gloss or Semi-Gloss

Color: Wide range of colors available

Volume Solids: 65% ± 2%, mixed, may vary by color
Ultra White

Weight Solids: 78% ± 2%, mixed, may vary by color
Ultra White

VOC (EPA Method 24): Pure White, mixed

Unreduced:	287 g/L; 2.4 lb/gal
Reduced 10%:	336 g/L; 2.8 lb/gal
Reduced 15%:	360 g/L; 3.0 lb/gal

Mix Ratio: 6:1 by volume, 1 gallon or 5 gallon mixes premeasured components

Recommended Spreading Rate per coat:

Wet mils:	4.5 - 9.0
Dry mils:	3.0 - 6.0
Coverage:	175 - 346 sq ft/gal approximate

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet @ 50% RH:

	@ 50°F	@ 77°F	@ 120°F
To touch:	2 hours	30 minutes	20 minutes
To handle:	10 hours	6 hours	4 hours
To recoat:			
minimum:	12 hours	8 hours	6 hours
maximum:	3 months	3 months	3 months
To cure:	14 days	7 days	5 days

Drying time is temperature, humidity, and film thickness dependent.

Pot Life: 4 hours | 2 hours | 45 minutes
(reduced 5% with Reducer R7K15)

Sweat in Time: none | none | none
If maximum recoat time is exceeded, abrade surface before recoating.

Shelf Life:
Part A: 36 months, unopened
Part B: 12 months, unopened
Store indoors at 40°F to 100°F

Flash Point: 55°F, Seta, mixed

Reducer/Clean Up:

Spray	Reducer R7K15
Brush/Roll	Reducer #132, R7K132

PERFORMANCE CHARACTERISTICS

System Tested: (unless otherwise indicated)
Substrate: Steel
Surface Preparation: SSPC-SP10
1 ct. Macropoxy 646 @ 6.0 mils dft
1 ct. Acrolon 218 HS Gloss @ 4.0 mils dft

Abrasion Resistance: [1]
Method: ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load
Result: 43 mg loss

Accelerated Weathering, with Diamond-Clad Clear Coat:
Method: ASTM D4587, QUV-A, 10,000 hours
Results: 100% gloss retention

Adhesion:
Method: ASTM D4541
Result: 975 psi

Corrosion Weathering: [2]
Method: ASTM D5894, 9 cycles, 3024 hours
Result: Rating 10 per ASTM D610, for rusting
Rating 10 per ASTM D714, for blistering

Direct Impact Resistance: [1]
Method: ASTM D2794
Result: 50 in. lb.

Dry Heat Resistance: [1]
Method: ASTM D2485, Method A
Result: 200°F

Flexibility: [1]
Method: ASTM D522, 180° bend, 1/8" mandrel
Result: Passes

Humidity Resistance: [2]
Method: ASTM D4585, 100°F, 1500 hours
Result: Rating 10 per ASTM D610 for rusting
Rating 10 per ASTM D714 for blistering

Pencil Hardness:
Method: ASTM D3363
Result: 3H

Salt Fog Resistance: [2]
Method: ASTM B117, 7000 hours
Result: Rating 10 per ASTM D610 for rusting
Rating 9 per ASTM D714 for blistering

[1] Finish coat only tested
[2] Primer: Zinc-Clad II HS
Intermediate: Macropoxy 646
Finish: Acrolon 218 HS

Meets the requirements of SSPC Paint No. 36, Level 3.

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THE SHERWIN-WILLIAMS COMPANY

Industrial and Marine Coatings

INDUSTRIAL & MARINE COATINGS

ACROLON™ 218 HS
ACRYLIC POLYURETHANE

PART A	B65-600	GLOSS SERIES
PART A	B65-650	SEMI-GLOSS SERIES
PART B	B65V600	HARDENER

PRODUCT INFORMATION

RECOMMENDED SYSTEMS

Steel:
1 ct. Macropoxy 646 @ 5.0 - 10.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Zinc Clad II HS @ 3.0 - 5.0 mils dft
1 ct. Macropoxy 646 @ 5.0 - 10.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Zinc Clad IV @ 3.0 - 5.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Corothane I - GalvaPac Zinc Primer @ 3.0 - 4.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Epoxy Mastic Aluminum II @ 6.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Steel:
1 ct. Recoatable Epoxy Primer @ 4.0 - 6.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Concrete/Masonry:
1 ct. Kem Cati-Coat HS Epoxy Filler/Sealer @ 10.0 - 20.0 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

Aluminum/Galvanizing:
1 ct. DTM Wash Primer @ 0.7 - 1.3 mils dft
1-2 cts. Acrolon 218 HS Acrylic Polyurethane @ 3.0 - 6.0 mils dft/ct

The systems listed above are representative of the product's use. Other systems may be appropriate.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:
* Iron & Steel: SSPC-SP6, 1-2 mils profile
* Galvanizing: SSPC-SP1
* Concrete & Masonry: SSPC-SP13/NACE 6

* Primer required

TINTING

Tint with 844 Colorants.
- Extra white tints at 100% tint strength
- Ultradeep base tints at 150% tint strength

Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

APPLICATION CONDITIONS

Temperature:	40°F minimum, 120°F maximum (air, surface, and material)
	At least 5°F above dew point
Relative humidity:	85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	1 gallon mix:	5 gallon mix:
Part A:	.86 gal	4.29 gal
Part B:	.14 gal	0.71 gal
(premeasured components)		
Weight per gallon:	11.2 ± 0.2 lb mixed, may vary with color	

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

THE SHERWIN-WILLIAMS COMPANY

INDUSTRIAL & MARINE COATINGS

Industrial and Marine Coatings

ACROLON™ 218 HS
ACRYLIC POLYURETHANE

PART A	B65-600	GLOSS SERIES
PART A	B65-650	SEMI-GLOSS SERIES
PART B	B65V600	HARDENER

APPLICATION BULLETIN

Revised 2/04

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Iron & Steel

Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (1-2 mils). Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Aluminum

Remove all oil, grease, dirt, oxide and other foreign material by Solvent Cleaning per SSPC-SP1. Primer required

Galvanized Steel

Allow to weather a minimum of six months prior to coating. Solvent Clean per SSPC-SP1. When weathering is not possible, or the surface has been treated with chromates or silicates, first Solvent Clean per SSPC-SP1 and apply a test patch. Allow paint to dry at least one week before testing adhesion. If adhesion is poor, brush blasting per SSPC-SP7 is necessary to remove these treatments. Rusty galvanizing requires a minimum of Hand Tool Cleaning per SSPC-SP2, prime the area the same day as cleaned or before flash rusting occurs.

Poured Concrete

New

For surface preparation, refer to SSPC-SP13/NACE 6. Surfaces must be clean, dry, sound and offer sufficient profile to achieve adequate adhesion. Minimum substrate cure is 28 days at 75°F. Remove all form release agents, curing compounds, salts, efflorescence, laitance, and other foreign matter by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. Refer to ASTM D4260. Rinse thoroughly to achieve a final pH between 6.0 and 10.0. Allow to dry thoroughly prior to coating.

Old

Surface preparation is done in much the same manner as new concrete, however, if the concrete is contaminated with oils, grease, chemicals, etc., they must be removed by cleaning with a strong detergent. Refer to ASTM D4258. Form release agents, hardeners, etc. must be removed by sandblasting, shotblasting, mechanical scarification, or suitable chemical means. If surface deterioration presents an unacceptably rough surface, Kem Cati-Coat Epoxy HS Filler/Sealer is recommended to patch and resurface damaged concrete.

Fill all cracks, voids and bugholes with Sher-Plate Epoxy Patch.

Always follow the ASTM methods listed below:

ASTM D4258 Standard Practice for Cleaning Concrete.
ASTM D4259 Standard Practice for Abrading Concrete.
ASTM D4260 Standard Practice for Etching Concrete.
ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete.
SSPC-SP 13/Nace 6 Surface Preparation of Concrete.

APPLICATION CONDITIONS

Temperature:	40°F minimum, 120°F maximum (air, surface, and material) At least 5°F above dew point
Relative humidity:	85% maximum

APPLICATION EQUIPMENT

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compatible with the existing environmental and application conditions.

Reducer/Clean Up:
Spray ..... Reducer R7K15
Brush/Roll ..... Reducer #132, R7K132
If reducer is used, reduce at time of catalyzation.

Airless Spray
Pressure ..... 2500 - 2800 psi
Hose ..... 3/8" ID
Tip ..... .013" - .017"
Filter ..... 60 mesh
Reduction ..... As needed up to 15% by volume

Conventional Spray
Gun ..... Binks 95
Cap 63P
Atomization Pressure .. 50 - 70 psi
Fluid Pressure ..... 20 - 25 psi
Reduction ..... As needed up to 15% by volume

Brush
Brush ..... Natural Bristle
Reduction ..... As needed up to 15% by volume

Roller
Cover ..... 3/8" woven with phenolic core
Reduction ..... As needed up to 15% by volume

If specific application equipment is listed above, equivalent equipment may be substituted.

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THE SHERWIN-WILLIAMS COMPANY

Industrial and Marine Coatings

INDUSTRIAL & MARINE COATINGS

ACROLON™ 218 HS

ACRYLIC POLYURETHANE

PART A	**B65-600**	**GLOSS SERIES**
PART A	**B65-650**	**SEMI-GLOSS SERIES**
PART B	**B65V600**	**HARDENER**

APPLICATION BULLETIN

APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Mix contents of each component thoroughly with power agitation. Make certain no pigment remains on the bottom of the can. Then combine six parts by volume of Part A with one part by volume of Part B (premeasured components). Thoroughly agitate the mixture with power agitation. Re-stir before using.

If reducer is used, reduce at time of catalyzation.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

Wet mils:	4.5 - 9.0
Dry mils:	3.0 - 6.0
Coverage:	175 - 346 sq ft/gal approximate

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 6.0 mils wet @ 50% RH:

	50°F	**@ 77°F**	**@ 120°F**
To touch:	2 hours	30 minutes	20 minutes
To handle:	10 hours	6 hours	4 hours
To recoat:			
minimum:	12 hours	8 hours	6 hours
maximum:	3 months	3 months	3 months
To cure:	14 days	7 days	5 days
Pot Life:	4 hours	2 hours	45 minutes
(reduced 5% with Reducer R7K15)			
Sweat in Time:	none	none	none

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

PERFORMANCE TIPS

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and adhesion.

Do not apply the material beyond recommended pot life.

Do not mix previously catalyzed material with new.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Reducer #132, R7K132.

Mixed coating is sensitive to water. Use water traps in all air lines. Moisture contact can reduce pot life and affect gloss and color.

E-Z Roll Urethane Defoamer is acceptable for use. See data page 5.99 for details.

Refer to Product Information sheet for additional performance characteristics and properties.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Reducer #132, R7K132. Clean tools immediately after use with Reducer #132, R7K132. Follow manufacturer's safety recommendations when using any solvent.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

MATERIAL SAFETY DATA SHEET

B65T604
09 00

Section 1 -- PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NUMBER	DATE OF PREPARATION	HMIS CODES	
		Health	2*
B65T604	03-SEP-07	Flammability	3
		Reactivity	0

PRODUCT NAME
ACROLON™ 218 HS Polyurethane - Gloss (Part A), Ultradeep/Clear Tint Base

MANUFACTURER'S NAME
THE SHERWIN-WILLIAMS COMPANY
101 Prospect Avenue N.W.
Cleveland, OH 44115

TELEPHONE NUMBERS and WEBSITES
Product Information
www.sherwin-williams.com
Regulatory Information
(216) 566-2902 www.paintdocs.com
Medical Emergency
(216) 566-2917
Transportation Emergency for Chemical Emergency ONLY (spill, leak,
(800) 424-9300 fire, exposure, or accident)

Section 2 -- COMPOSITION/INFORMATION ON INGREDIENTS

% by WT	CAS No.	INGREDIENT			UNITS	VAPOR PRESSURE
0.4	100-41-4	Ethylbenzene				
			ACGIH TLV	100	ppm	7.1 mm
			ACGIH TLV	125	ppm STEL	
			OSHA PEL	100	ppm	
			OSHA PEL	125	ppm STEL	
2	1330-20-7	Xylene				
			ACGIH TLV	100	ppm	5.9 mm
			ACGIH TLV	150	ppm STEL	
			OSHA PEL	100	ppm	
			OSHA PEL	150	ppm STEL	
1	64742-94-5	Medium Aromatic Hydrocarbons				
			ACGIH TLV	Not Available		0.12 mm
			OSHA PEL	Not Available		
0.2	91-20-3	Naphthalene				
			ACGIH TLV	10	ppm	1 mm
			ACGIH TLV	15	ppm STEL	
			OSHA PEL	10	ppm	
			OSHA PEL	15	ppm STEL	
4	78-93-3	Methyl Ethyl Ketone				
			ACGIH TLV	200	ppm	70 mm
			ACGIH TLV	300	ppm STEL	
			OSHA PEL	200	ppm	
			OSHA PEL	300	ppm STEL	

Continued on page 2

10	123-86-4	n-Butyl Acetate				
		ACGIH TLV	150	ppm		10 mm
		ACGIH TLV	200	ppm STEL		
		OSHA PEL	150	ppm		
		OSHA PEL	200	ppm STEL		
6	108-65-6	1-Methoxy-2-Propanol Acetate				
		ACGIH TLV	Not Available			1.8 mm
		OSHA PEL	Not Available			
31	14808-60-7	Quartz				
		ACGIH TLV	0.05	mg/m3 as Resp. Dust		
		OSHA PEL	0.1	mg/m3 as Resp. Dust		

Section 3 -- HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

EYES: Irritation.

SKIN: Prolonged or repeated exposure may cause irritation.

INHALATION: Irritation of the upper respiratory system.

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists.

Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic respiratory and/or skin reaction in susceptible persons or sensitization. This effect may be delayed several hours after exposure.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

Section 4 -- FIRST AID MEASURES

EYES: Flush eyes with large amounts of water for 15 minutes. Get medical attention.

SKIN: Wash affected area thoroughly with soap and water. Remove contaminated clothing and launder before re-use.

INHALATION: If any breathing problems occur during use, LEAVE THE AREA and get fresh air. If problems remain or occur later, IMMEDIATELY get medical attention.

INGESTION: Do not induce vomiting. Get medical attention immediately.

Section 5 -- FIRE FIGHTING MEASURES

FLASH POINT	LEL	UEL
55 F PMCC	0.8	13.1

FLAMMABILITY CLASSIFICATION

RED LABEL -- Flammable, Flash below 100 F (38 C)

Continued on page 3

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat.

Application to hot surfaces requires special precautions.

During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used.

Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

Section 6 -- ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

Remove all sources of ignition. Ventilate the area.

Remove with inert absorbent.

Section 7 -- HANDLING AND STORAGE

STORAGE CATEGORY

DOL Storage Class IB

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are FLAMMABLE. Keep away from heat, sparks, and open flame.

During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition.

Consult NFPA Code. Use approved Bonding and Grounding procedures.

Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

Section 8 -- EXPOSURE CONTROLS/PERSONAL PROTECTION

PRECAUTIONS TO BE TAKEN IN USE

NO PERSON SHOULD USE THIS PRODUCT, OR BE IN THE AREA WHERE IT IS BEING USED, IF THEY HAVE CHRONIC (LONG-TERM) LUNG OR BREATHING PROBLEMS OR IF THEY EVER HAD A REACTION TO ISOCYANATES.

Use only with adequate ventilation.

Avoid contact with skin and eyes. Avoid breathing vapor and spray mist.

Wash hands after using.

This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

Continued on page 4

RESPIRATORY PROTECTION

Where overspray is present, a positive pressure air supplied respirator (TC19C NIOSH/MSHA approved) should be worn. If unavailable, a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2 may be effective. Follow respirator manufacturer's directions for use. Wear the respirator for the whole time of spraying and until all vapors and mists are gone. NO PERSONS SHOULD BE ALLOWED IN THE AREA WHERE THIS PRODUCT IS BEING USED UNLESS EQUIPPED WITH THE SAME RESPIRATOR PROTECTION RECOMMENDED FOR THE PAINTERS.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

To prevent skin contact, wear gloves which are recommended by glove supplier for protection against materials in Section 2.

EYE PROTECTION

Wear safety spectacles with unperforated sideshields.

OTHER PROTECTIVE EQUIPMENT

Use barrier cream on exposed skin.

OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

Section 9 -- PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT	10.64 lb/gal	1275 g/l
SPECIFIC GRAVITY	1.28	
BOILING POINT	174 - 415 F	78 - 212 C
MELTING POINT	Not Available	
VOLATILE VOLUME	36 %	
EVAPORATION RATE	Slower than ether	
VAPOR DENSITY	Heavier than air	
SOLUBILITY IN WATER	N.A.	

VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged)

2.66 lb/gal	319 g/l	Less Water and Federally Exempt Solvents
2.66 lb/gal	319 g/l	Emitted VOC

Section 10 -- STABILITY AND REACTIVITY

STABILITY -- Stable

CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

Continued on page 5

Section 11 -- TOXICOLOGICAL INFORMATION

CHRONIC HEALTH HAZARDS

Ethylbenzene is classified by IARC as possibly carcinogenic to humans (2B) based on inadequate evidence in humans and sufficient evidence in laboratory animals. Lifetime inhalation exposure of rats and mice to high ethylbenzene concentrations resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations. There is no evidence that ethylbenzene causes cancer in humans.

Crystalline Silica (Quartz, Cristobalite) is listed by IARC and NTP. Long term exposure to high levels of silica dust, which can occur only when sanding or abrading the dry film, may cause lung damage (silicosis) and possibly cancer.

Methyl Ethyl Ketone may increase the nervous system effects of other solvents.

Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary, blood forming and reproductive systems.

Persons sensitive to isocyanates will experience increased allergic reaction on repeated exposure.

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

TOXICOLOGY DATA

CAS No.	Ingredient Name					
100-41-4	Ethylbenzene					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		3500	mg/kg
1330-20-7	Xylene					
		LC50	RAT	4HR	5000	ppm
		LD50	RAT		4300	mg/kg
64742-94-5	Medium Aromatic Hydrocarbons					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		Not Available	
91-20-3	Naphthalene					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		Not Available	
78-93-3	Methyl Ethyl Ketone					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		2740	mg/kg
123-86-4	n-Butyl Acetate					
		LC50	RAT	4HR	2000	ppm
		LD50	RAT		13100	mg/kg
108-65-6	1-Methoxy-2-Propanol Acetate					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		8500	mg/kg
14808-60-7	Quartz					
		LC50	RAT	4HR	Not Available	
		LD50	RAT		Not Available	

Continued on page 6

Section 12 -- ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION
No data available.

Section 13 -- DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD
Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261.
Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers.
Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

Section 14 -- TRANSPORT INFORMATION

US Ground (DOT)
1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D
Larger Containers are Regulated as:
UN1263, PAINT, 3, PG II, (ERG#128)

DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities
Xylenes (isomers and mixture) 100 lb RQ

Bulk Containers may be Shipped as (check reportable quantities):
UN1263, PAINT, 3, PG II, (ERG#128)

Canada (TDG)
UN1263, PAINT, CLASS 3, PG II, (ERG#128)

IMO
UN1263, PAINT, CLASS 3, PG II, (13 C c.c.), EmS F-E, S-E

Section 15 -- REGULATORY INFORMATION

SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
100-41-4	Ethylbenzene	0.4	
1330-20-7	Xylene	2	
91-20-3	Naphthalene	0.2	

CALIFORNIA PROPOSITION 65
WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.
TSCA CERTIFICATION
All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

Continued on page 7

Section 16 -- OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.

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JOHN MEUNIER

Meadowbank mining Corp.
ACP-700R
Technical Data Sheet
Reference : NC01

HYDROCYCLONE

ST-150

VEOLIA WATER
Solutions & Technologies

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Hydrocyclones	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-150	4					Date:	2009-03-11

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-150-1	2	4	**HYDROCYCLONES**	C2-011	B60		SA	
				Manufacturer:	C2-012				
				Krebs	C2-021				
				Model:	C2-022				
				U6-10-1758					
				Material:					
				Urethane					
				Inlet (vortex finder):					
				dia. 2,25" (57,2 mm)					
				Outlet (apex):					
				dia. 1,25" (31,8 mm)					
				must include the victaulic 4" x 3" at discharge					
				PERFORMANCES					
				Anticipated performance:					
				Recovery of solids greater than					
				50 microns in diameter					
				Operating conditions :					
				Feed at 150 usgpm (34m^3/h) at					
				19 psig (131 kPa) theoritical pressure					
				Feed characteristics:					
				Sludge mixture :Water, 135 microns microsand, settle solids and polymers.					
				Flow split:					
				20 % at Apex (underflow)					
				80 % at vortex finder (overflow)					

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FLSmidth Krebs
5505 W Gillette Rd • Tucson, AZ 85743-9501 • USA
Tel +1 520 744 8200 • Fax +1 520 744 8300
www.krebs.com

MAY 13, 2009

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

4 MODEL U6-10-1758 KREBS CYCLONES
SERIAL NUMBERS: 114486U – 114489U
FOR
JOHN MEUNIER, INC.
PO NUMBER: NC01-042945

SALES ENGINEER: MIKE WILKINS **mike.wilkins@flsmidth.com**

URETHANE

KREBS ENGINEERS

GENERAL

KREBS Cyclones are the result of an intensive research and development program initiated in 1950. Each unit represents a product of advanced design, careful engineering, quality materials and the finest workmanship.

The information in the following pages is directed toward a better understanding of cyclone principles and operation, so that the potential for every KREBS Cyclone is realized.

KREBS engineers cyclone installations by studying the operating data and customer objectives. The cyclone selections are based on the large amount of operating data accumulated by our staff of engineers and our continuing research. When data is not available or is incomplete, studies in our laboratory and pilot plant are recommended. The pilot plant is equipped for complete, full-scale cyclone classification studies. Predictable performances resulting from these studies have been proven in numerous subsequent field installations. An important part of this service is the analysis of the test results by our staff of metallurgical and chemical engineers as related to the overall plant operation.

You are invited to avail yourself of these facilities and services for the study of your classification problems.

KREBS ENGINEERS

Installation

Small KREBS Cyclones are crated and shipped completely assembled. When removing the cyclone from the shipping crate, care should be taken to account for all of the parts. This can be checked against the packing slip.

Pump, Sump and Piping

Correct design of the pump and sump is probably the most important factor in establishing an efficient cyclone operation.

Conversion of flow and velocity to kinetic energy in a cyclone is derived from the energy supplied from the pump. Each adjustment of the cyclone variables will influence the pumping to some degree. This will be discussed in the section entitled "Operation". A constant volume to the cyclone is important. Momentary fluctuations are generally the result of entrained air in the slurry.

A constant level in the sump is critical, but by no means an indication that the cyclone is receiving a constant and uniform volume of feed. If the needle of the pressure gauge fluctuates rapidly, it is a definite indication that there is entrained air in the pump discharge slurry. To correct this problem, the entering stream should be prevented from carrying entrapped air to the suction of the pump. This can be done by mounting a sloping plate in the sump, well below the normal level of the slurry. An annular opening between the plate and the edges of the sump of about one inch around its entire periphery will generally be sufficient to allow the total volume of slurry to pass from the upper compartment to the lower section.

It is permissible to return part or all of the overflow product to the sump to maintain a constant level. It must be remembered that the greater the slime content of the feed slurry to a cyclone, the more difficult it becomes to make a given separation. The use of recycled overflow product should be handled with caution, as there is always a danger of recirculating an excess quantity and consequently increasing the slime content of the feed slurry.

Where water is available and the overflow product is an important consideration, fresh water should be added as a means of volume control.

The overflow product should discharge to atmosphere as close to the cyclone as possible. If the overflow pipe is carried directly to an elevation below the inlet of the cyclone, a siphoning action can be created. This will cause coarser particles to be carried to the cyclone overflow product. The overflow should be available for sampling.

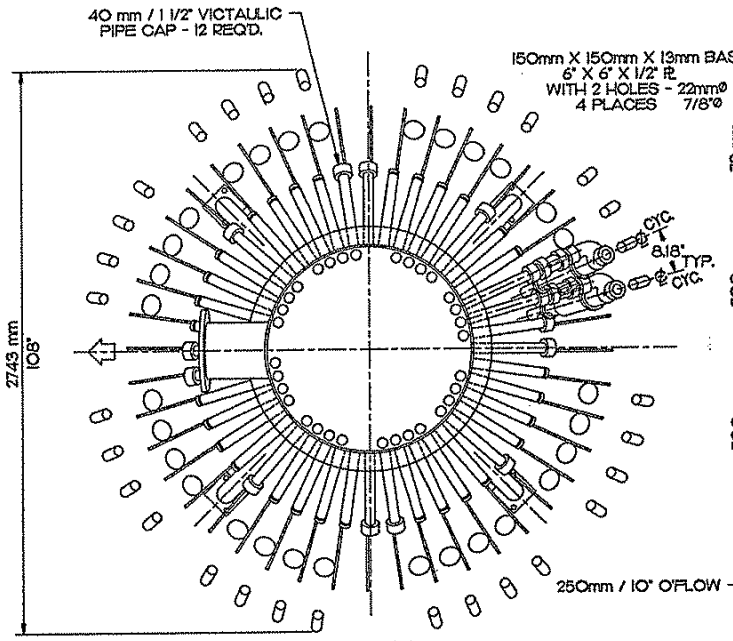
The underflow discharge should be open for visual inspection, as it is important to be able to observe the characteristics of this flow. The underflow should be maintained with a 20-30 degree spray discharge. A "rope" discharge is an indication that there is excess crowding of solids at the apex orifice. This will cause coarse oversize solids to be carried into the overflow product. The underflow product should also be available for sampling.

Installation (cont'd)

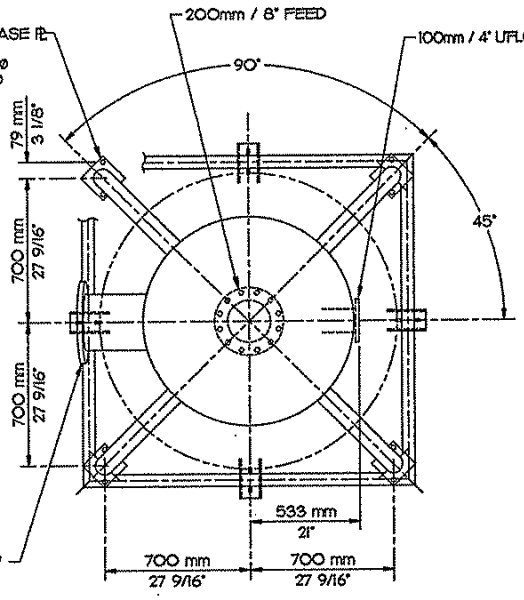
Multiple Installations

A radial manifold system assures an even feed distribution to each cyclone. The take-offs should be equally spaced around the perimeter of the central distribution pot. The overflow and underflow launders must be properly sized to allow for collection and distribution of the streams. KREBS ENGINEERS will design and fabricate radial manifolds. Drawing number M1440 illustrates a typical radial manifold system for small diameter cyclones.

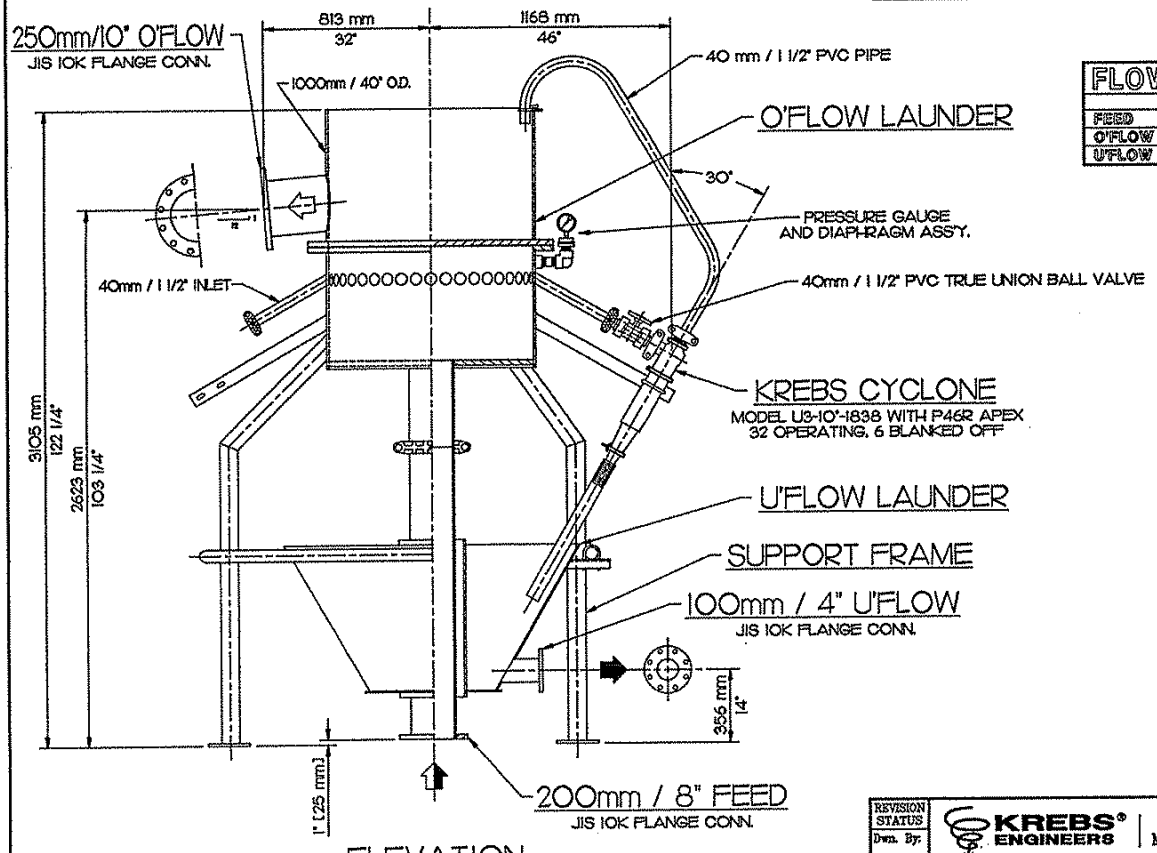
An inline manifold system can be used if the feed is very dilute and not subject to segregating in the system. An inline system is generally easier to design and build than a radial system and consequently is less expensive. An inline system does not assure equal feed to each cyclone. Drawing number M1536 illustrates a typical inline manifold system.



PLAN



ANCHOR BOLT PLAN



ELEVATION

(FOR TRUE PIPING ORIENTATIONS, SEE PLAN VIEW)

FLOW CHART		
	GAL/MIN	FT/SEC
FEED	1213	7.79
O'FLOW	1178	4.80
U'FLOW	35	.88

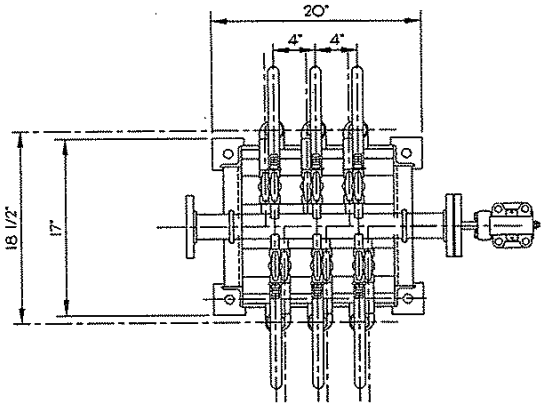
NOTES:
1. FOR CYCLONE DIMENSIONS, SEE DRAWING S1838-M1440
2. ALL CONNECTING FITTINGS ARE 150# ANSI FLANGES.
3. WEIGHTS: BARE = OPERATING = FLOODED =

TOLERANCE SCHEDULE: UNLESS OTHERWISE NOTED.		
-24"=±1/4"	+24" thru 100"=±1/2"	+100"=±1"

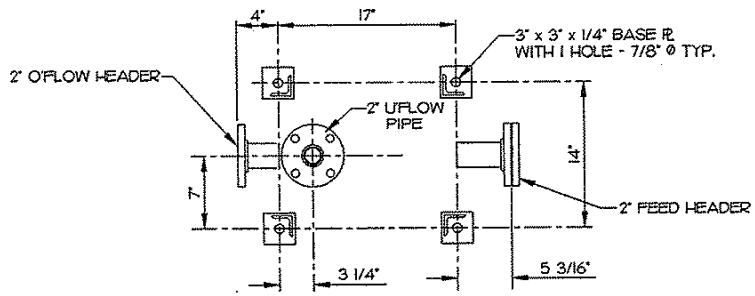
REVISION STATUS	KREBS® ENGINEERS	1205 CHRYSLER DR. MENLO PARK, CA. 94025			
Dwn. By:					
Date:	Scale: ----	Dwn. By: MEP	Date: 8-30-93	Appvd. By: SCF	M.O. 1041I-PAT
Appvd. By:	GENERAL ARRANGEMENT 36 MODEL U3-10"-1838 KREBS CYCLONES RADIAL MANIFOLD SYSTEM				
R.N. M1440SAA	C			DWG. NO.	M1440

DWG. NO. M1440

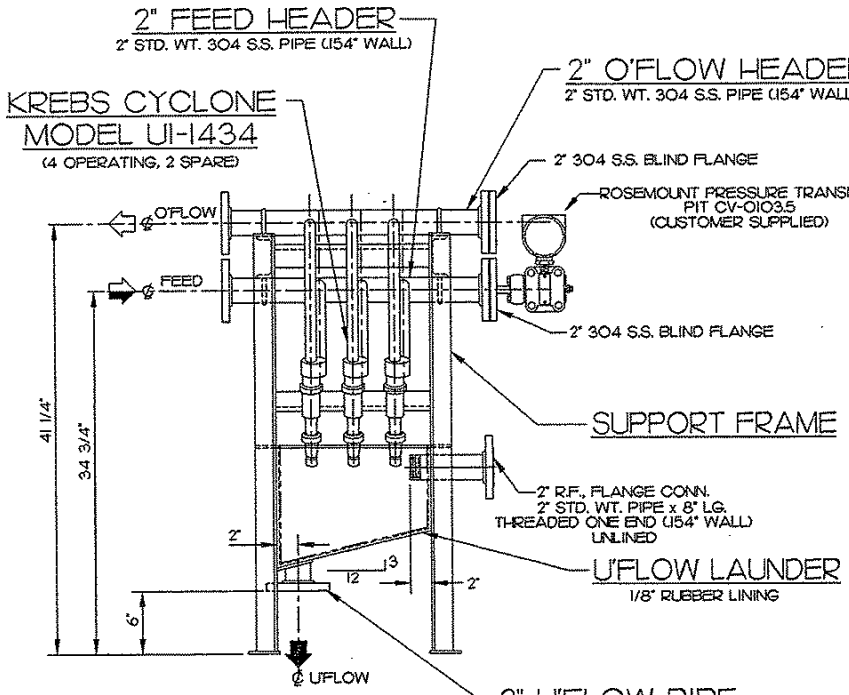
KREBS ENGINEERS



PLAN

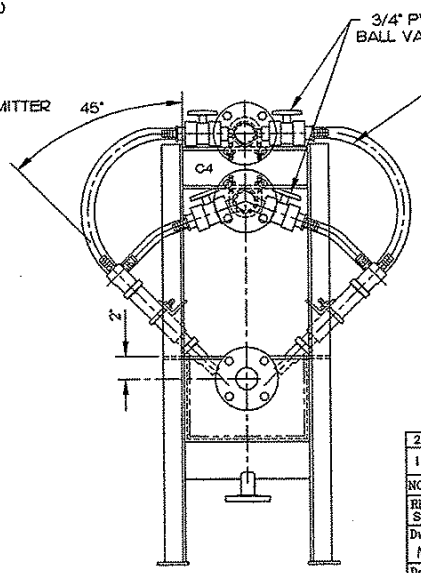


ANCHOR BOLT PLAN



ELEVATION

FLOW CHART		
	GAL/MIN	FT/SEC
FEED	19.30	6.18
O'FLOW	14.10	4.52
U'FLOW	5.20	3.33



END ELEVATION

CERTIFIED FOR_____
P.O. No._____
REQ. No._____ S.O. No._____
BY_____ DATE_____

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, ARIZONA 85743
PHONE: (520) 744-8200 FAX: (520) 744-8300

EQUIP. NO. CV-0103.5

NOTES:

1. FOR CYCLONE DIMENSIONS SEE DRAWING SI434-MI536
2. CONNECTING FITTINGS ARE 150# ANSI R.F. FLANGES UNLESS OTHERWISE NOTED.
3. FURNISHED WITH THIS MANIFOLD ARE 12 - 3/4" PVC BALL VALVES.
4. WEIGHTS: BARE = OPERATING = FLOODED =

TOLERANCE SCHEDULE: UNLESS OTHERWISE NOTED.			
~24"=±1/4"	±24" thru 100"=±1/2"	±100"=±1"	

NO	DATE	REVISION DESCRIPTION
2	7-23-97	ROTATED CYCLONES TO 45 DEGREES
1	5-14-97	CHANGED O'FLOW HEADER TO 2" PIPE & FLANGES AND CHANGED U'FLOW PIPE TO 2" PIPE & FLANGE. ADDED 4" TO FRAME.

REVISION STATUS

KREBS® ENGINEERS | 5505 WEST GILLETTE ROAD TUCSON, AZ 85743

Dwn. By:	Date:	Scale:	Dwn. By:	Date:	Apprd. By:	S.O.
MWH	7-23-97	—	GK	4-2-97		

Apprd. By: 2

GENERAL ARRANGEMENT
6 MODEL UI-1434 KREBS CYCLONES
IN-LINE MANIFOLD SYSTEM

R.N. M5536ANC | C | | DWG. NO. MI536

Operation

The primary consideration in selecting the proper size and design of cyclone is the classification objective, not the capacity. The proper relationship between the inlet orifice the vortex finder diameter, and the apex diameter is engineered by the staff of KREBS Engineers for each specific classification objective.

There is seldom any necessity for changing the size of these orifices unless the classification objectives or plant operating conditions are altered.

Numerous factors influence the operation of a cyclone. Following is a brief discussion of some factors influencing cyclone operation (which the operator is normally able to control while the cyclone is operating).

Feed Dilution

Feed dilution is the most effective control available. The use of additional dilution water will always result in a finer and sharper separation. The dilution water can also be adjusted to maintain a constant level in the sump, although the operator must be aware of the potential change in the separation. For very dilute feeds, the change in the separation will be minimal.

Pressure Management

Pressure drop across the cyclone is the pressure differential between the cyclone inlet and overflow. When the cyclone discharges to atmosphere, a condition we usually recommend, the inlet pressure is the pressure drop.

The pressure drop is merely an indication of the energy required to force a given volume through the cyclone and not an indication of a developed force-pattern or throughput. Excessive pressure results in high pump operating and maintenance costs and should be avoided. We generally do not recommend pressure drops above 50 psi.

The higher the pressure drop, the greater the throughput capacity of the cyclone. A higher pressure drop will also produce a finer separation.

Cyclone Orifices

The following describes the effect the various orifices have on the cyclone performance. Changing the orifice requires shutting down the system.

Inlet Orifice

The main function of the inlet orifice is to provide a smooth flow pattern at the point of entry into the cyclone. All of KREBS Cyclones are designed with an involuted entry that preorients the solids prior to reaching the tangential point of contact with the cylinder wall. This minimizes turbulence and allows KREBS Cyclones to produce finer and sharper separations.

An increase in the inlet area will increase the capacity of the cyclone. It will also coarsen the separation slightly. All of KREBS Cyclones, three inches and smaller in diameter, have fixed inlet areas.

Operation (cont'd)

Vortex Finder

The vortex finder has the greatest impact on the operating results of all the orifices. The vortex finder also has a large effect on the cyclone capacity at a given pressure drop. It also affects the cyclone separation significantly.

The larger the vortex finder diameter, the greater the cyclone capacity at a given pressure drop. A larger diameter vortex finder will also coarsen the cyclone separation.

Apex Orifice

The only function of the apex orifice is to discharge the coarse solids in such a manner that the maximum underflow density and smoothness of discharge are obtained. The apex should be large enough to produce a 20-30 degree cone discharge, but should not be used to control the cyclone separation. The apex should never be so small that a "rope" discharge exists. A "rope" discharge is an indication that the apex is not allowing all of the coarse solids out and consequently some are being forced out the cyclone overflow. Both fixed and manually adjustable apexes are available on KREBS small diameter cyclones.

Maintenance

It is important to maintain smooth surfaces on the interior of the cyclone. The cyclones should be inspected on a regular basis. When the interior surfaces become worn or uneven, the part should be replaced. After experience has been gained in operating the cyclones under given conditions, a regular maintenance schedule can be determined.

Once the apex opens more than 10% of it's original size, it should be replaced.

Common Problems and Solutions

Problem 1:

There are very coarse solids in the cyclone overflow.

Solution:

This is normally an indication that the apex is too small and coarse solids are being forced to the cyclone overflow. The apex diameter should be increased until a constant 30 degree cone angle is obtained on the discharge. The fixed apexes can be cut off to increase the diameter. An adjustable apex will have to be replaced with a larger one if it is in the full open position.

Problem 2:

The cyclone pressure drop fluctuates wildly.

Solution:

This is an indication that a constant level in the sump is not being maintained or that air is entrained in the slurry. If the pump is pumping more feed volume than is going to the slump, the sump level will go down. Eventually the pump will cavitate and the pressure drop across the cyclone will be very erratic. Slowing the pump down or increasing the dilution water to the sump will maintain a constant sump level.

Air usually enters the pump suction because the feed to the sump is pointing directly down into the pump suction. Change the feed so that it angles against a side wall of the sump or install a baffle plate as described in the installation section.

Problem 3:

The separation is not fine enough.

Solution:

Increase the dilution water to the feed. If the feed is already dilute or if diluting the feed is not possible, increase the cyclone pressure drop. This will require speeding up the pump and installing a smaller diameter vortex finder. If the separation is still not fine enough, smaller diameter cyclones will probably required.

Problem 4:

The underflow is too dilute.

Solution:

This is an indication that the apex is too large. Decrease the apex diameter until a 30 degree cone discharge is obtained. Do not decrease the apex diameter to the point of "roping" the discharge. The adjustable apexes can be decreased by tightening the worm driven clamp. The fixed apexes will have to be replaced with a smaller size.

Calculations

TONNAGE:

1) Solids: $TPH = GPM\ SLURRY \times S.G.\ SLURRY \times \%\ SOLIDS$

Slurry: $\frac{TPH\ SOLIDS}{\%\ SOLIDS}$

2) PULP SPECIFIC GRAVITY:

$$S.G.\ PULP = \frac{100 \times S.G.\ SOLIDS \times S.G.\ LIQUID}{100 \times S.G.\ SOLIDS - \%\ SOLIDS\ (S.G.\ SOLIDS - S.G.\ LIQUID)}$$

3) PERCENT SOLIDS IN PULP

$$\% = \frac{TPH\ SOLIDS}{TPH\ SLURRY} \times 100$$

4) GALLONS PER MINUTE:

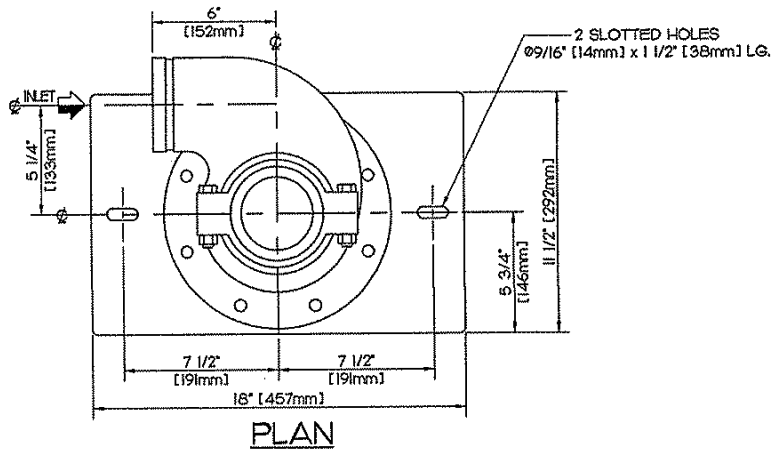
$$GPM\ SLURRY = \frac{TPH\ SOLIDS \times 4}{S.G.\ SLURRY \times \%\ SOLIDS}$$

5) $$\%\ SOLIDS\ BY\ VOLUME = \frac{\%\ SOLIDS\ BY\ WEIGHT \times S.G.\ PULP}{S.G.\ SOLIDS}$$

6) $$\frac{GPM}{ONE\ TPH\ SOLIDS} = \frac{4}{\%\ SOLIDS \times S.G.\ PULP}$$

KREBS ENGINEERS

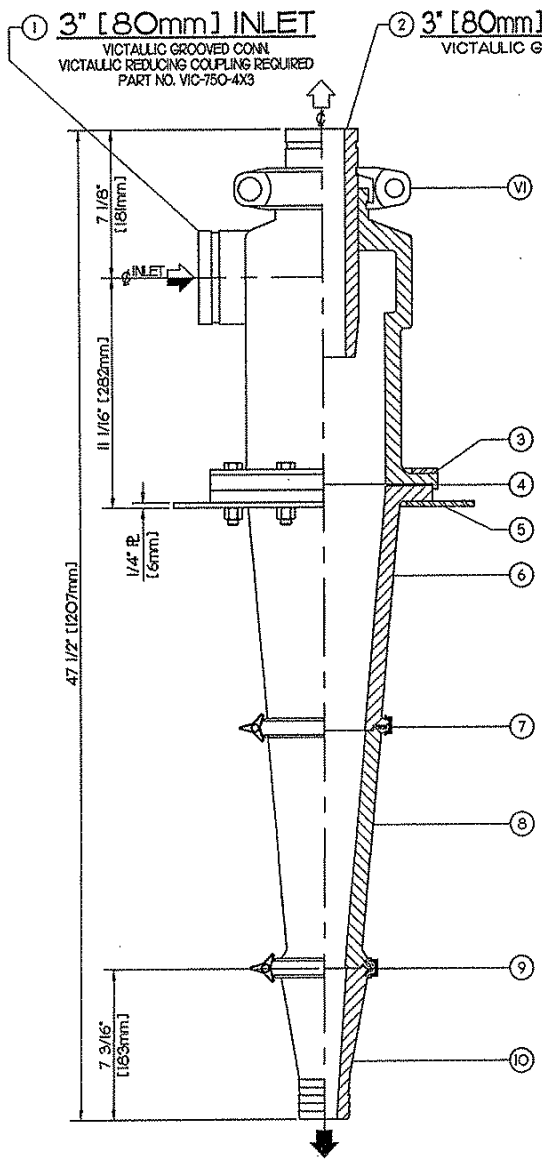
FASTENER REQUIREMENTS						
CONNECTION	DESCRIPTION	SIZE	LENGTH	QTY	SPARE	TOTAL
1 & 3 TO 5 & 6	HEX BOLT & NUT	1/2-13	2 3/4"	8	1	9



PLAN

FASTENER NOTES:

1. ALL BOLTS AND NUTS, TO BE ANSI GRADE 5 ZINC PLATED. (OTHER GRADE/PLATING CAN BE OFFERED)
2. WASHERS TO BE USED ON ALL SLOTTED HOLES.
3. PLEASE NOTIFY CUSTOMER SERVICES OF ANY DEVIATION IN THIS LIST.
4. NO PAYMENT FOR CUSTOMER MODIFICATIONS, BACK CHARGES, OR ANY OTHER CHANGES WILL BE ACCEPTED, UNLESS PREVIOUSLY AUTHORIZED BY FLSmidth KREBS.
5. QUANTITIES SHOWN ARE FOR THE ASSEMBLY OF ONE CYCLONE.



JOHN MEUNIER INC.
CUSTOMER P.O. NO: NC01-042945 / SERIAL NO: 114486U - 114489U

ITEM No.	PART NUMBER	DESCRIPTION
VI.	VIC-750-4X3	VICTAULIC REDUCER COUPLING, 4"X3" SIZE, STEEL.
1.	C6856-RU-3.3	INLET HEAD WITH 3" INLET VIC. CONN, 3.3 SQ. IN. INLET ORIFICE, URETHANE, SIZES AVAILABLE: 1.5", 2.2", & 3.3".
2.	C3802-RU-2.25	VORTEX FINDER/O'FLOW INSERT WITH 3" VIC. CONN, 2.25" SIZE, URETHANE, SIZES AVAILABLE: 1.5", 1.75", 2", 2.25", & 2.5".
3.	C1846-ST	BACKING PLATE HALF RING, STEEL, 2 - SET.
4.	C5011G-RN	GASKET, NEOPRENE.
5.	C1848-ST	MOUNTING PLATE, STEEL.
6.	C6807-RU	CONE SECTION, URETHANE.
7.	C7712-SS	CLAMP WITH HAND WHEEL, STAINLESS STEEL.
8.	C1703-RU	CONE SECTION, URETHANE.
9.	C7710-SS	CLAMP WITH HAND WHEEL, STAINLESS STEEL.
10.	C1681-RU-1.25	APEX, 1.25" SIZE, URETHANE, SIZES AVAILABLE: .25", .375", .5", .625", .75", 1", 1.063", 1.25", 1.375", & 1.5".

FINAL CERTIFICATION

CERTIFIED FOR John Meunier, Inc.
P.O. No. NC01-042945
REQ. No. _____ S.O. No. 110272
QUAN. 4 MODEL U6-10-1758
SERIAL NO. 114486U - 114489U
BY _____ DATE 05-13-09
FLSmidth KREBS
5505 WEST GILLETTE ROAD TUCSON, ARIZONA 85743
PHONE (520) 744-8200 FAX (520) 744-8300

NOTES:

1. PAINT ALL STEEL PARTS PER: EN-SPEC-4-3041
2. BARE WEIGHT: 50# [23 kg]
   SHIPPING WEIGHT: 110# [50 kg]

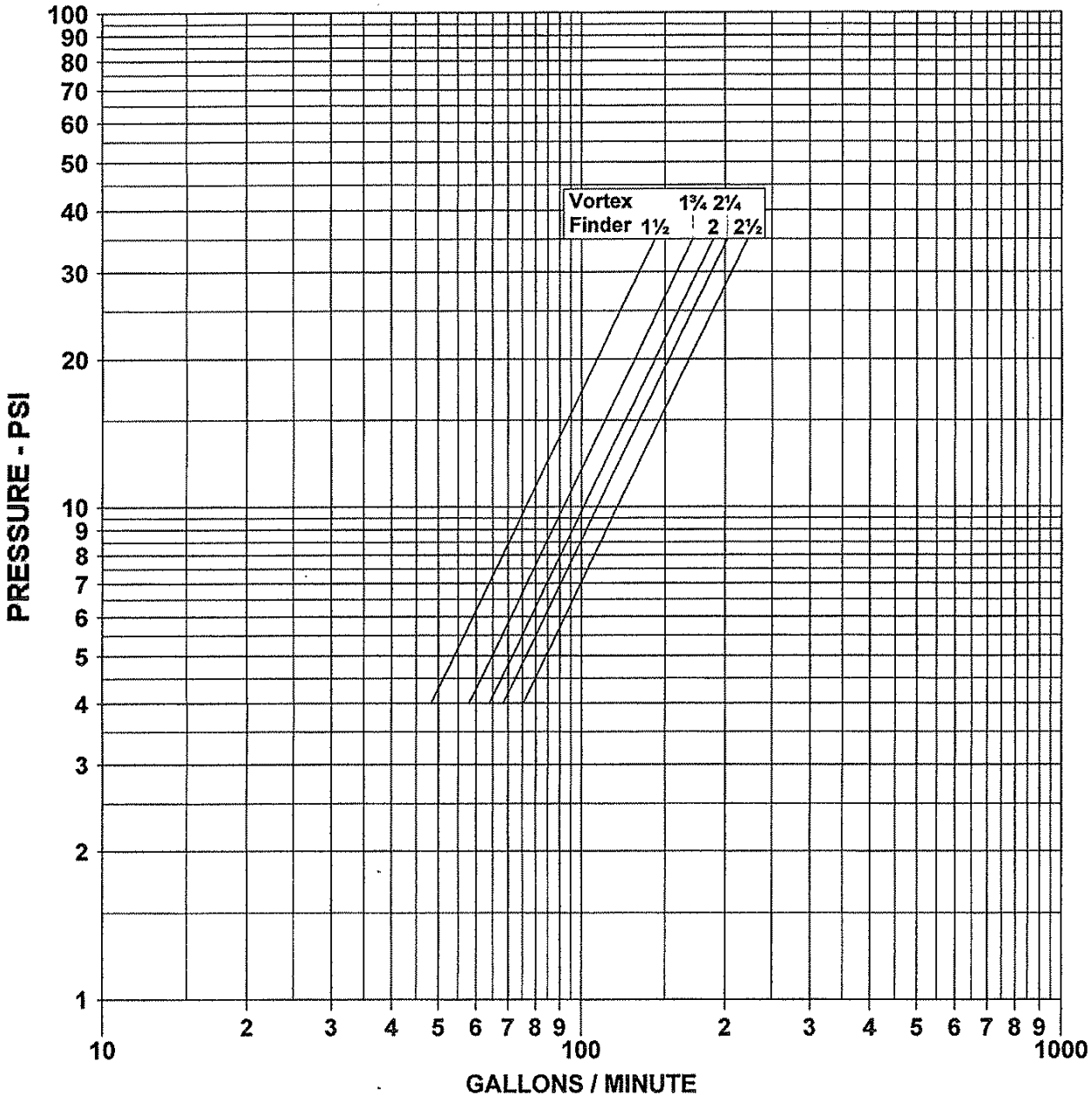
TOLERANCE SCHEDULE: UNLESS OTHERWISE SPECIFIED.		
-24"=±1/4"	+24" thru 100"=±1/2"	+100"=±1"
[-600mm = ±6mm]	[+600mm thru 2500mm = ±12mm]	[+2500mm = ±25mm]

REVISION STATUS	FLSmidth KREBS	5505 WEST GILLETTE ROAD TUCSON, AZ 85743 www.krebs.com			
Dwn. By:					
Date:	Scale: —	Dwn. By: TFP	Date: 3-26-09	Appvd. By: WR DAN	S.O.
Appvd. By:	GENERAL PARTS ARRANGEMENT KREBS CYCLONE MODEL U6-10-1758 WITH FIXED APEX ASSEMBLY NO. C1681				
C		DWG. NO.	SI758-114486U		

Krebs Cyclone
Model No.: U6-10°

CAPACITY CURVE
No.: U6-10°-3.3-12/02

3.30 SQ. IN. INLET ORIFICE



CAPACITY IS BASED ON WATER AT AMBIENT TEMPERATURE AND APEX DIAMETER EQUAL TO ONE HALF THE VORTEX FINDER DIAMETER, AND MAY VARY AT DIFFERENT RATIOS

KREBS ENGINEERS
5505 West Gillette Road
Tucson, AZ 85743
TEL: (520) 744-8200
FAX: (520) 744-8300
e-mail: www.krebs.com

KREBS ENGINEERS

SHEET: 1
DATE: 06-Mar-09
BY: BLP

Client: John Meunier

Problem: Maximum recovery of sand to the U/F with 20% of the feed volume in the U/F. Waste water sand.

Number, Model Krebs Cyclones: 1 operating Krebs Model U6-10 Hydrocyclone

Orifices:	Inlet Area	Vortex Finder	Apex	Pressure Drop
	3.3 sq. in.	2.25 in.	1.25	19 PSI

Specific Gravity: Solids: 2.7 Liquid: 1.0 Temperature: Amb. °F Viscosity: 1 Cps

	FEED	OVERFLOW	UNDERFLOW
STPH Solids	4.9	0.0	4.9
STPH Liquids	35.7	30.0	5.7
STPH Slurry	40.6	30.0	10.6
Wt Solids	12.0	0.0	46.0
S.G. Slurry	1.082	1.000	1.408
Vol% Solids	4.8	0.0	24.0
GPM Slurry	150.0	120.0	30.0
M3/Hr. Slurry	34.1	27.3	6.8

Ref: 20.2 1.0 53.0*

Mesh	Micron	FEED			OVERFLOW			UNDERFLOW			ACT. REC.	
		Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH	Cum. % +	Ind. % +	STPH		
40	425.0	1.4	1.4	0.1	0.0	0.0	0.0	1.4	1.4	0.1	100.0	
50	300.0	14.6	13.2	0.6	0.0	0.0	0.0	14.6	13.2	0.6	100.0	
70	212.0	47.2	32.6	1.6	0.7	0.7	0.0	47.3	32.7	1.6	100.0	
100	150.0	84.4	37.2	1.8	17.2	16.5	0.0	84.5	37.2	1.8	99.9	
140	106.0	99.5	15.1	0.7	76.1	58.9	0.0	99.5	15.0	0.7	99.2	
200	75.0	99.9	0.4	0.0	83.2	7.1	0.0	99.9	0.4	0.0	96.5	
200	-75.0	100.0	0.1	0.0	100.0	16.8	0.0	100.0	0.1	0.0	67.4	
TOTAL				4.9			0.0			4.9	99.8	

KREBS ENGINEERS
5505 WEST GILLETTE ROAD TUCSON, AZ 85743
TEL: (520) 744-8200 FAX: (520) 744-8300
www.krebs.com

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LAMELLA PACK

ST-151

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Setling lamella modules	0	SUBMITTAL	P.Ste-Marie	P.S.M.	2009-03-26		
	1						
	2					REF. No.	NC01 / 0
	3						
DESSIN /DWG # ST-151	4					Date:	2009-01-07

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-151-1	1	2	**SETTLING LAMELLA**		B64		SA	
				Material:					
				High impact Polystyrene					
				Type: Impact PS 6200					
				Model:					
				DH-35					
				Colorant:					
				Spartech 10189 BLACK (BK 21102)					
				(FDA approuved)					
				Opening:					
				35 mm (1,35 in)					
				DIMENSIONS					
				Width x length x height					
				tag A : 610 mm x 1554 mm x 762 mm					
				tag B: 580mm x 1554 mm x 762 mm					
				tag C: 507 mm x 799 mm x 762 mm					
				tag D: 507 mm x 1376 mm x 762 mm					

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Prospector
www.ides.com/prospector

Impact PS 6200

INEOS NOVA LLC - High Impact Polystyrene

Thursday, September 18, 2008

General Information

General			
Material Status	• Commercial: Active		
Availability	• North America		
Features	• Good Drawdown	• Good Toughness	• Ultra High Impact Resistance
Uses	• Cups • Decorative Displays	• Lids • Packaging	
Agency Ratings	• FDA 21 CFR 177.1640 [1]		
Forms	• Pellets		
Processing Method	• Injection Molding		

ASTM and ISO Properties [2]

Physical	Nominal Value (English)	Nominal Value (SI)	Test Method
Specific Gravity	1.04	1.04	ASTM D792
Melt Mass-Flow Rate (MFR) (200°C/5.0 kg)	3.0 g/10 min	3.0 g/10 min	ASTM D1238
Molding Shrinkage			ASTM D955
Flow, Injection Molded, 73°F (23°C)	0.0040 to 0.0070 in/in	0.40 to 0.70 %	
Mechanical	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Tensile Modulus			ASTM D638
73°F (23°C), Injection Molded	310000 psi	2140 MPa	
Tensile Strength			ASTM D638
Yield, 73°F (23°C), Injection Molded	3630 psi	25.0 MPa	
Tensile Elongation			ASTM D638
Break, 73°F (23°C), Injection Molded	50 %	50 %	
Flexural Modulus			ASTM D790
73°F (23°C), Injection Molded	285000 psi	1960 MPa	
Flexural Strength			ASTM D790
73°F (23°C), Injection Molded	4930 psi	34.0 MPa	
Impact	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Notched Izod Impact [3]			ASTM D256
73°F (23°C), 0.125 in (3.18 mm), Injection Molded	4.20 ft·lb/in	224 J/m	
Hardness	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Rockwell Hardness (L-Scale)	49	49	ASTM D785
Thermal	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Deflection Temperature Under Load			ASTM D648
264 psi (1.8 MPa), Annealed	185 °F	85.0 °C	
Vicat Softening Temperature	212 °F	100 °C	ASTM D1525
Electrical	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Dielectric Constant (1E+6 Hz)	2.590	2.590	ASTM D150
Flammability	**Nominal Value (English)**	**Nominal Value (SI)**	**Test Method**
Flame Rating - UL	HB	HB	UL 94
Additional Properties			
Dielectric Strength, 0.125in: 500			

Impact PS 6200

INEOS NOVA LLC - High Impact Polystyrene

Processing Information		
Injection	**Nominal Value (English)**	**Nominal Value (SI)**
Processing (Melt) Temp	374 to 525 °F	190 to 274 °C
Mold Temperature	100 to 180 °F	38.0 to 82.0 °C

Notes

[1] When used unmodified for the manufacture of food contact articles, Impact PS 6200 will comply with Food Additive Regulations FDA 21 CFR 177.1640 under the U.S. Food, Drug and Cosmetic Act. Such uses are subject to good manufacturing practices and any other limitations which are part of the statute or regulations. These should be consulted for complete details.

[2] Typical properties: these are not to be construed as specifications.

[3] Notch Depth: 9.8 mil (0.25 mm)

INEOSNOVA

Material Safety Data Sheet

Material Name: **Impact Polystyrene, Natural Grades**

MSDS ID: INEOS-NOVA-0056

Section 1 - Product and Company Identification

Synonyms: Impact modified polystyrene, HIPS
Chemical Name: Benzene, ethenyl-, polymer with 1,3-butadiene
Chemical Family: Polymer
Material Use: Petrochemical industry: Plastics
Chemical Formula: $(C_8H_8\ C_4H_6)_x$

INEOS NOVA
25846 SW Frontage Road
Channahon, Illinois, USA 60410

EMERGENCY Telephone Numbers:

1-800-424-9300, 703-527-3887 (CHEMTREC-USA) (24 hours)

Product Information: 1-866-890-6354
MSDS Email: psinfo@ineos-nova.com

Section 2 - Hazards Identification

HMIS Ratings: Health: 0 **Fire:** 1 **Physical Hazard:** 0
*Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard*
NFPA Ratings: Health: 0 **Fire:** 1 **Reactivity:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Emergency Overview

Product is a white, inert, solid bead or pellet with slight odor. This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. Slipping hazard.

Potential Health Effects: Eyes

Contact with hot or molten material may cause severe thermal injury, including in extreme contact possible blindness. Contact of powder or fines with eye may cause mechanical irritation.

Potential Health Effects: Skin

Contact with hot or molten material may cause severe thermal burns. Contact of powder or fines with skin may cause mild irritation, that is increased by mechanical rubbing or if skin is dry.

Potential Health Effects: Ingestion

Ingestion of this product is unlikely. However, ingestion of product may produce mild gastrointestinal irritation and disturbances.

Potential Health Effects: Inhalation

Inhalation of fine particles may cause respiratory irritation. Fumes produced during thermal processing may cause irritation to the respiratory system.

Section 3 - Composition / Information on Ingredients

CAS #	Component	Percent by Wt.
9003-55-8	Styrene-Butadiene polymer	94-100

Additional Information

This product may be regulated, have exposure limits or other information identified as the following: Nuisance particulates.
This product is NOT considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
This material is NOT a controlled product under Canadian WHMIS regulations.
This material is NOT REGULATED as a hazardous material/dangerous goods for transportation.

See Section 8 for applicable exposure limits. See Section 11 for applicable toxicity data.

Section 4 - First Aid Measures

First Aid: Eyes

Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.

First Aid: Skin

For skin contact, wash affected area with soap and water. Seek medical attention, if symptoms develop or persist. In case of contact with molten product, cool rapidly with water and seek immediate medical attention. Do not attempt to remove molten product, or molten product that has cooled, from skin without medical assistance.

First Aid: Inhalation

Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, unconscious or if any other symptoms persist.

First Aid: Ingestion

Material is not expected to be absorbed from the gastrointestinal tract. DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

First Aid: Notes to Physician

Burns should be treated as thermal burns. Molten resin will come off as healing occurs; therefore, immediate removal from skin is not necessary. Treatment for overexposure should be directed at controlling the symptoms and clinical condition of the patient. After adequate first aid, no further treatment is necessary, unless symptoms reappear. Ingested material should pass through the digestive system without injury.

Section 5 - Fire Fighting Measures

See Section 9: Physical Properties for flammability limits, flash point and autoignition information.

General Fire Hazards

This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. High concentration of airborne powders or dust may form explosive mixture with air.

Explosion Hazards

Accumulated fine dusts may form an explosive mixture with air. Take precautionary measures to prevent contact with electrostatic discharges. Risk of dust/air explosion is increased if flammable vapors are present.

Hazardous Combustion Products

Styrene, butadiene, carbon dioxide, carbon monoxide.

Extinguishing Media

Dry chemical, foam, carbon dioxide, or water fog or spray. Avoid high pressure, direct water stream that may spread molten or burning resins.

Fire Fighting Equipment/Instructions

Position upwind. Keep unnecessary personnel away. Move containers from fire area if you can do so without risk. Fight fire from maximum distance or use unmanned holders or monitor nozzles. Fire fighters should wear full-face, self-contained breathing apparatus and thermal protective clothing. Avoid inhaling any smoke and combustion products. Cool containers with flooding quantities of water until well after the fire is out. Control runoff waters to prevent entry into sewers, drains, underground or confined spaces and waterways.

Section 6 - Accidental Release Measures

Evacuation Procedures

Isolate area. Keep unnecessary personnel away.

Spills

Stop leak and contain spill. Prevent entry into sewers, drains, underground or confined spaces, and waterways. Spilled product may create a dangerous slipping hazard. Use appropriate tools to put the spilled solid in an appropriate recovery or waste disposal container. Reuse or recycle where possible. Meet any applicable regulations.

Special Procedures

Contact local police and appropriate emergency telephone numbers provided in Section 1. Ensure statutory and regulatory reporting requirements in the applicable jurisdiction are met.

Wear appropriate protective equipment and clothing during clean up. Individuals without appropriate protective equipment should be excluded from area of spill until cleanup has been completed.

See Section 8 for recommended Personal Protective Equipment and see Section 13 for waste disposal considerations.

Section 7 - Handling and Storage

Handling Procedures

Handle in contained and properly designed equipment systems. Use with adequate ventilation. Avoid ingestion and inhalation. Keep away from uncontrolled heat and incompatible materials. Ground all material handling and transfer equipment to dissipate build-up of static electricity. Keep handling areas free of loose pellets and dust accumulation. Mechanical operations involving this material should be done in such a manner as to prevent or minimize dust generation. Small amounts of fines or dust contained in granular resins may accumulate in material handling systems. If permitted to accumulate, these fines or dust can, under certain conditions, pose an explosion hazard. Every effort should be made to prevent suspension, concentration or accumulation of fines or dusts in, or around, material handling systems. For additional information on control of static and minimizing potential dust and fire hazards, refer to NFPA 654, "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, 2006 Edition." Spilled product may create a dangerous slipping hazard.

Storage Procedures

Storage area should be clearly identified, well illuminated, and clear of obstruction. Adequate security must be provided so that unauthorized personnel do not have access to product. Store in grounded, properly designed and approved vessels and away from incompatible materials. Store and use away from heat, sparks, open flame, or any other ignition source. Use non-sparking ventilation systems, approved explosion-proof equipment, and intrinsically safe electrical systems.

DO NOT enter filled bulk containers and attempt to walk over product, due to risk of slipping and possible suffocation. Use a fall arrest system when working near open bulk storage containers.

See Section 8 for recommended Personal Protective Equipment and see Section 10 for information on incompatibilities.

Section 8 - Exposure Controls / Personal Protection

Exposure Guidelines

A: General Product Information

Refer to published exposure limits - utilize effective control measures and PPE to maintain worker exposure to concentrations that are below these limits. Ensure that eyewash stations and safety showers are proximal to the workstation location.

B: Component Exposure Limits

ACGIH, OSHA, NIOSH, EPA, Alberta, and Ontario exposure limit lists have been checked for major components listed with CAS registry numbers. Other exposure limits may apply, check with proper authorities.

Styrene-Butadiene polymer (9003-55-8)

ACGIH:	10 mg/m3 TWA (inhalable particles, recommended); 3 mg/m3 TWA (respirable particles, recommended) (related to Particulates (insoluble or poorly soluble) not otherwise specified (PNOS))
OSHA:	15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction) (related to Particulates not otherwise regulated)
Alberta:	10 mg/m3 TWA (total particulate); 3 mg/m3 TWA (respirable particulate) (related to Particulates not otherwise regulated)
Ontario:	10 mg/m3 TWAEV (inhalable); 3 mg/m3 TWAEV (respirable) (related to Particulates (insoluble or poorly soluble) Not Otherwise Classified (PNOC))

ENGINEERING CONTROLS

Maintain worker exposure below recommended exposure limits by providing adequate local exhaust ventilation. Use non-sparking, grounded ventilation systems separate from other exhaust systems. Ensure that eyewash stations and safety showers are proximal to the workstation location.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear safety glasses during normal handling. Wear full-face shield during thermal processing if contact with molten material is likely.

Personal Protective Equipment: Skin/Hands/Feet

Use impervious gloves when handling product. Wear safety footwear with good traction to help prevent slipping. Work clothing that sufficiently prevents skin contact should be worn, such as coveralls and/or long sleeves and pants.

Personal Protective Equipment: Respiratory

If engineering controls and ventilation is not sufficient to prevent build up of aerosols, vapors or dusts, appropriate NIOSH/MSHA approved air-purifying respirators or self-contained breathing apparatus (SCBA) appropriate for exposure potential should be used. Air supplied breathing apparatus must be used when oxygen concentrations are low or if airborne concentrations exceed the limits of the air purifying respirators.

Personal Protective Equipment: General

Personal protective equipment (PPE) should not be considered a long-term solution to exposure control. Employer programs to properly select, fit, maintain, and train employees to use equipment must accompany PPE. Consult a competent industrial hygiene resource, the PPE manufacturer's recommendation, and/or applicable regulations to determine hazard potential and ensure adequate protection.

Section 9 - Physical & Chemical Properties

Physical State and Appearance:	Solid, beads or pellets	**Color:**	White
Odor:	Slight odor	**pH:**	Not applicable
Vapor Pressure:	Not applicable	**Vapor Density @ 0ºC (Air=1):**	Not applicable
Melting Point:	105ºC-135ºC (221ºF-275ºF)	**Boiling Point:**	Not applicable
Solubility (H2O):	Insoluble	**Specific Gravity (Water=1):**	1.04 g/cc, 104 kg/m
Dispersion Properties:	Is not dispersed in cold water	**Softening Point:**	79ºC-127ºC (174ºF-261ºF)
Flash Point:	345ºC-360ºC (653ºF-680ºF) (Combustible Flash Ignition Temperature)	**Flammability Classification:**	Not considered flammable according to OSHA.
Flash Point Method:	Not available	**Auto Ignition:**	427ºC (800ºF)
Lower Flammable Limit (LFL):	Not available	**Upper Flammable Limit (UFL):**	Not available

Section 10 - Stability & Reactivity Information

Chemical Stability

This material is stable under normal use conditions for shock, vibration, pressure, and ambient temperature.

Instability

Decomposition temperature: 300ºC (572ºF)

Chemical Stability: Conditions to Avoid

Avoid processing material over 300ºC (572ºF).

Incompatibility

Not resistant to oxidizing agents, dissolves in organic solvents.

Hazardous Polymerization

Will not occur.

Corrosivity

Not expected to be corrosive.

Hazardous Decomposition

Styrene, butadiene, carbon dioxide, carbon monoxide

Section 11 - Toxicological Information

A: Acute Toxicity - General Material Information

Material is considered essentially inert and non-toxic. Exposure to high levels of dusts may be irritating to the eyes. Skin/eye contact with molten or heated material may cause burns. Vapors/heated fumes may be irritating to the respiratory system.

B: Acute Toxicity - LD50/LC50

No LD50/LC50's are available for this product's components.

C: Chronic Toxicity - General Material Information

No additional information available.

D: Chronic Toxicity - Carcinogenic Effects

ACGIH, EPA, IARC, OSHA, and NTP carcinogen lists have been checked for selected similar materials or those components with CAS registry numbers.

Styrene-Butadiene polymer (9003-55-8)

IARC: Supplement 7, 1987; Monograph 19, 1979 (Group 3 (not classifiable))

Section 12 - Ecological Information

Ecotoxicity

The information below is based on knowledge of this product's components and the ecotoxicity of similar products. Sewer/waterway obstruction: If aquatic animals ingest pellets, digestive tract obstruction may occur. Product is not expected to be toxic, but small particles may cause adverse physical effects in aquatic and terrestrial organisms.

Environmental Fate/Mobility

Sinks in water. Pellets are persistent in aquatic and terrestrial systems. Product should be recovered from water and land following spills. This product has not been found to migrate through soils.

Persistence/Degradability

Pellets are persistent in aquatic and terrestrial systems. Do not allow product to enter sewer or waterways. Not expected to biodegrade.

Bioaccumulation/Accumulation

Pellets may accumulate in the digestive systems of birds and aquatic life, causing injury and possible death due to starvation.

Section 13 - Disposal Considerations

U.S./Canadian Waste Number & Descriptions

A: General Product Information

This product, if discarded, is not expected to be hazardous waste according to US or Canadian regulations. Check Local, State, Federal and Provincial Environmental Regulations prior to disposal.

The recommended disposal methods for polymers in order of preference are: 1) clean and reuse if possible; 2) contact resin broker; 3) contact plastic recycler; 4) incinerate with waste heat recovery and/ or 5) landfill. Reuse, recycling, storing, transportation, and disposal must be in accordance with applicable federal, state/ provincial and local regulations. DO NOT ATTEMPT TO DISPOSE OF BY UNCONTROLLED IGNITION.

See Section 7: Handling and Storage and Section 8: Exposure Controls/Personal Protection for additional information that may be applicable for safe handling and the protection of employees.

Waste generator is advised to carefully consider hazardous properties and control measures needed for other materials that may be found in the waste.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Section 14 - Transportation Information

Transportation Information

This material is not regulated as a hazardous material for transportation.

Section 15 - Regulatory Information

A: International Regulations

The monomers are listed by EINECS for styrene-butadiene copolymer.

Component Analysis - International Inventory Status

Component	CAS #	US - TSCA	CANADA - DSL	EU - EINECS
Styrene-Butadiene polymer	9003-55-8	Yes	Yes	Exempt

B: USA Federal & State Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or State regulations. Check for applicable regulations.

USA OSHA Hazard Communication Class

This product is not considered hazardous under 29 CFR 1910.1200 (Hazard communication).

USA Right-to-Know - Federal

None of this product's components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

USA Right-to-Know - State

None of this product's components are listed on the state lists from NJ or PA. Some components (including those present only in trace quantities, and therefore not listed in this document) may be included on the Right To Know lists of other U.S. states. The reader is therefore cautioned to contact his or her INEOS NOVA representative for further U.S. State Right-To-Know information.

C: Canadian Regulations - Federal and Provincial

Canadian Environmental Protection Act (CEPA): The components of this product are on the Domestic Substances List (DSL), or are exempt, and are acceptable for use under the provisions of CEPA.

WHMIS Ingredient Disclosure List (IDL)

No components are listed in the WHMIS Ingredient Disclosure List (IDL).

WHMIS Classification

Workplace Hazardous Materials Information Systems (WHMIS): This product has been classified in accordance with Canadian Controlled Product Regulations (CPR) hazard criteria and this MSDS contains complete CPR-required information. Not controlled under WHMIS (Canada).

Provincial Regulations

Ongoing occupational hygiene, medical surveillance programs, or site emission or spill reporting may be required by Federal or Provincial regulations. Check for applicable regulations.

Section 16 - Other Information

Label Information

PRECAUTIONS: Product is a white, inert, solid bead or pellet with slight odor. This product is not considered flammable according to OSHA, but will burn on prolonged exposure to flame or high temperature. Slipping hazard.

FIRST AID:
SKIN: For skin contact, wash affected area with soap and water. Seek medical attention, if symptoms develop or persist. In case of contact with molten product, cool rapidly with water and seek immediate medical attention. Do not attempt to remove molten product, or molten product that has cooled, from skin without medical assistance.
EYES: Remove contact lenses, if it can be done safely. Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention if symptoms develop or persist.
INHALATION: Move affected individual to non-contaminated air. Loosen tight clothing such as a collar, tie, belt or waistband to facilitate breathing. Seek immediate medical attention if the individual is not breathing, unconscious or if any other symptoms persist.
INGESTION: Material is not expected to be absorbed from the gastrointestinal tract. DO NOT INDUCE VOMITING. Loosen tight clothing such as a collar, tie, belt or waistband. Seek immediate medical attention.

IN CASE OF A LARGE SPILL: Stop leak and contain spill. Prevent entry into sewers, drains, underground or confined spaces, and waterways. Spilled product may create a dangerous slipping hazard. Use appropriate tools to put the spilled solid in an appropriate recovery or waste disposal container. Reuse or recycle where possible. Meet any applicable regulations.

References

Available on request.

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; BOD = Biochemical Oxygen Demand; CAS = Chemical Abstracts Service; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; CPR = Controlled Products Regulations; DOT = Department of Transportation; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Chemical Substances; EPA = Environmental Protection Agency; EU = European Union; FDA = Food and Drug Administration; IARC = International Agency for Research on Cancer; IDL = Ingredient Disclosure List; Kow = Octanol/water partition coefficient; LEL - Lower Explosive Limit; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; RCRA = Resource Conservation and Recovery Act; SARA Superfund Amendments and Reauthorization Act; TDG = Transportation of Dangerous Goods; TSCA = Toxic Substances Control Act.

MSDS Prepared by: INEOS NOVA

MSDS Information Phone Number: 1-866-890-6354

MSDS Information Email: psinfo@ineos-nova.com

Other Information

Notice to Reader

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This is the end of MSDS # INEOS-NOVA-0056.

PRODUCT INFORMATION

Issued: October 31, 2008

DESCRIPTION:

PRODUCT NAME: Black Polystyrene Colour Concentrate

PRODUCT CODE: 10189 BLACK (BK 21102)

PHYSICAL PROPERTIES:

CARRIER RESIN

TYPE: Crystal Polystyrene

MELT INDEX 7.0 g/10 min. ASTM D-1238, Cond. 200/5

DENSITY: 1.04 g/cm^3

MASTERBATCH

PIGMENTATION: 25% (Nominal)

FOOD APPROVAL STATUS:

FDA: The ingredients in this product are regulated for use by the FDA according to the guidelines of paragraphs 177.1640, 178.3297, and 178.2010 of Title 21 of the Code of Federal Regulations.

577 Erie St., Stratford, Ont. N5A 2N7 Tel. (519) 271•1680 / 1•800•265•4338 / Fax (866) 364•5172

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SLUDGE TANK

ST-999

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JOHN MEUNIER

NOMENCLATURE/ BILL OF MATERIALS

TITRE/ TITLE	Rev.	DESCRIPTION	PAR/ BY:	APPR:	DATE:	Affaire / Contract	Meadowbank Mining
Sludge tank	0	SUBMITTAL	Julie Trudel	J.T.	2009-03-26		
	1						
	2					REF. No.	NC01 | | 0
	3						
DESSIN /DWG # ST-999	4					Date:	2009-01-07

REV.	ITEM	QTE/QTY. Unit.	QTE/QTY. Total	DESCRIPTION	P&ID I.D./TAG	CAT. ACCPAC	SOURCE	FA/SA FI SITE	P / N
	NC01ST-999-1	1	1	**SLUDGE TANK**	T4-011	B80		FI	
				Material:					
				High Density Polyethylene					
				Supplier					
				Aco Container					
				Model:					
				OT-750					
				Capacity:					
				3400L					
				Top:					
				Open (no lid)					
				Dimensions:					
				70” diameter X 58” tall					
				Weight:					
				250 Lbs					
				Nozzles:					
				1x 6” HDPE gusseted flange					
				1x 8” HDPE gusseted flange					

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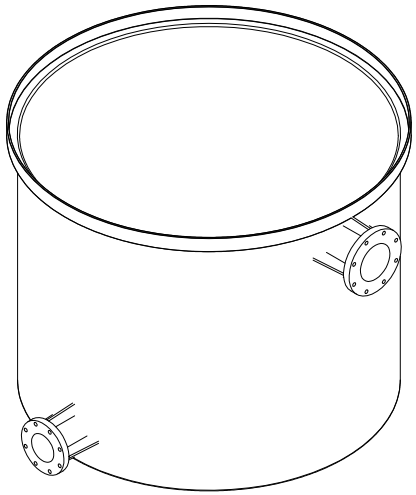
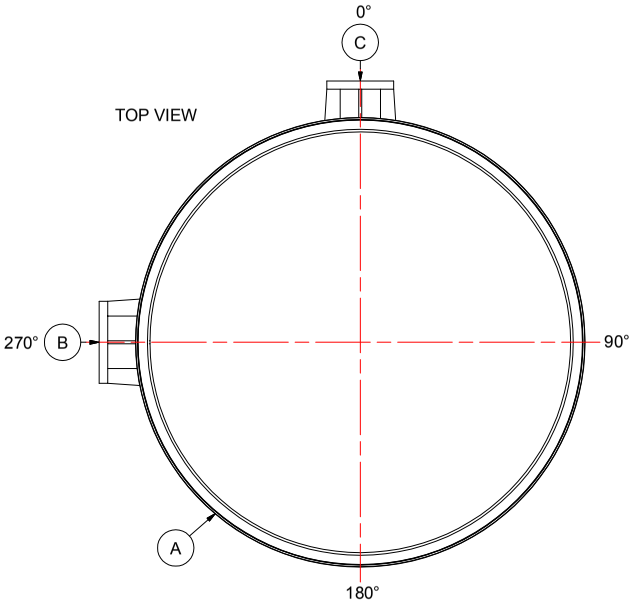
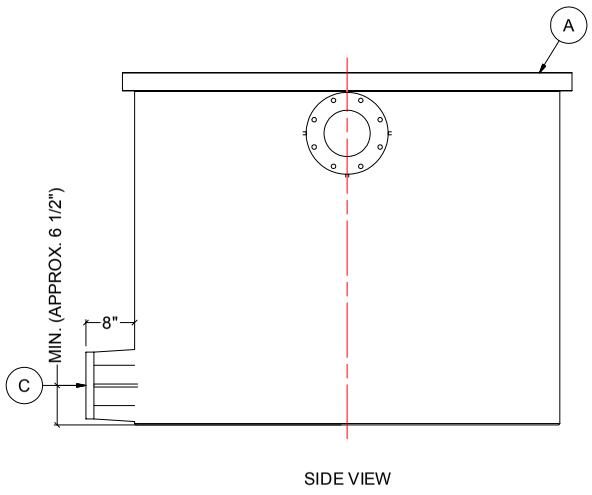




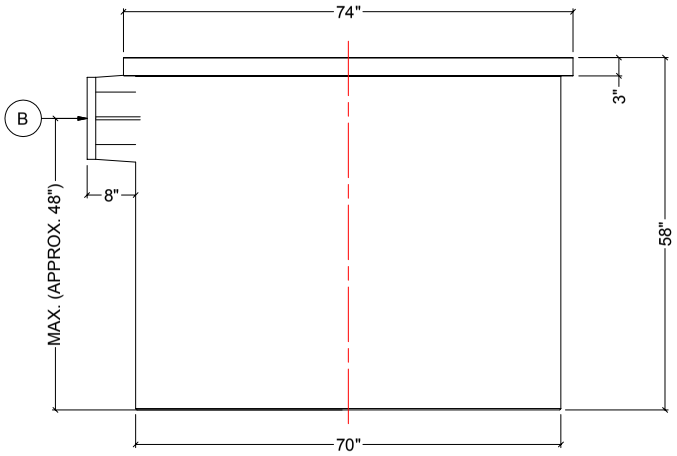
MATERIALS LIST		
ITEMS	DESCRIPTION	NOTES
A	OT-750 HDPE OPEN TOP TANK	
B	8" HDPE GUSSETED FLANGE	
C	6" HDPE GUSSETED FLANGE	

NOTES:

1. TANK IS MANUFACTURED FROM HDPE. (1.5 SG)
2. TANK IS MANUFACTURED TO ASTM-D-1998 STANDARD.
3. ACO RECOMMENDS FLANGE GASKETS TO BE MIN. 1/4" THICK.



SIDE VIEW



FRONT VIEW

APPROVED

REV	DATE	DESCRIPTION	BY	APPD	REVD

REVISIONS

CUSTOMER: JOHN MEUNIER / VEOLIA WATER

TITLE: OT-750 TANK WITH FITTINGS

ACO JOB NO: 55724
PURCHASE ORDER NO: 015374
PURCHASER'S EQUIP. NO:

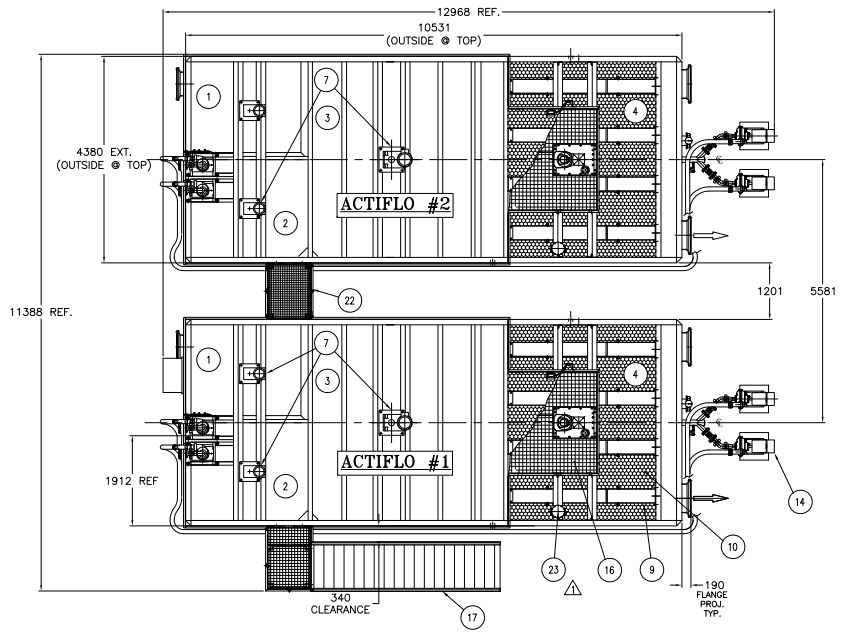
ENGINEERS SEAL

ACO CONTAINER SYSTEMS LTD.
PICKERING - ONTARIO - CANADA
ACO CONTAINER SYSTEMS LTD.
794 MCKAY RD.
PICKERING, ONTARIO, CANADA
L1W 2Y4
TEL. 905-683-8222
FAX 905-683-2959

DESIGNED	
DRAWN	WM
CHECKED	
APPROVED	
SCALE	N.T.S.
DATE	07-06-09

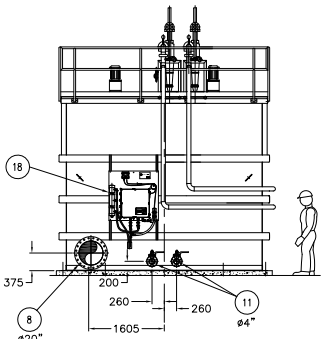
DWG No: OT-750-55724
REV: 0

GENERAL ARRANGEMENT DRAWINGS

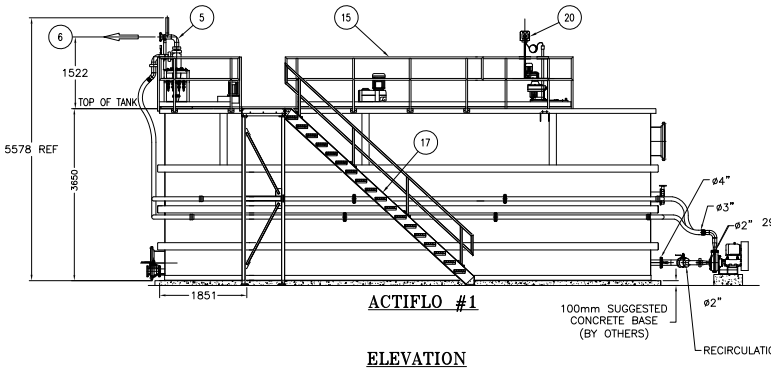


PLAN VIEW

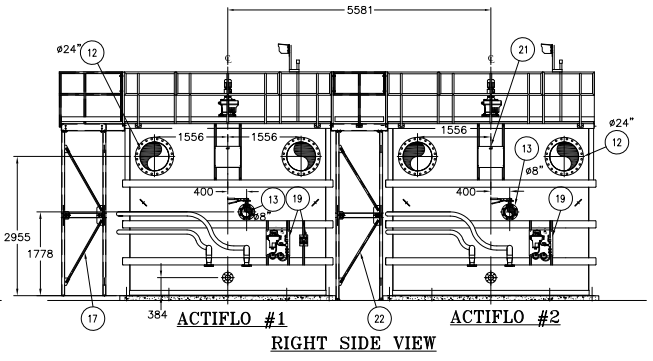
1. COAGULATION TANK
2. INJECTION TANK
3. MATURATION TANK
4. SETTLING TANK
5. HYDROCYCLONE
6. HYDROCYCLONE SLUDGE OUTLET
7. MIXER
8. RAW WATER INLET
9. CLARIFIED WATER TROUGH
10. LAMELLA
11. DRAIN
12. CLARIFIED WATER OUTLET
13. PARTIAL DRAIN
14. MICROSAND RECIRCULATION PUMPS
15. HANDRAIL
16. GRATING
17. STAIRS
18. RAW WATER TURBIDIMETER
19. CLARIFIED WATER TURBIDIMETER
20. PH MITER
21. JUNCTION BOX
22. PLATFORM
23. SERVICE WATER PUMPS



LEFT SIDE VIEW
ACTIFLO #1



ELEVATION



RIGHT SIDE VIEW
(PUMPS NOT SHOWN FOR CLARITY)

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
1	SERVICE WATER PUMPS ADDED	2009-04-10	O.F.	N/A	P.S.M.	N/A
0	FOR INFORMATION	2009-03-10	O.F.	N/A	M.S.	N/A

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DESIGNER	M. DELORME
DATE	2007-04-27
CHECKER	N/A
DATE	N/A
ENGINEER	M. SABOURIN
DATE	2007-12-03
MANAGER	N/A
DATE	N/A
SCALE:	1 : 50

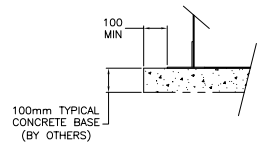
TITLE: ACP-700R
GENERAL ARRANGEMENT

CLIENT: MEADOWBANK MINING

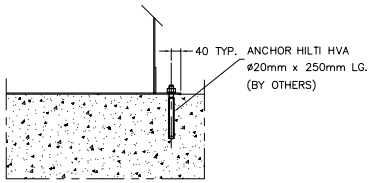
JOHN MEUNIER ISO 9001:2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT	DRAWING	INTERNAL	SHEET	REV
	NC01-GA100	ACP700R	1 OF 1	1

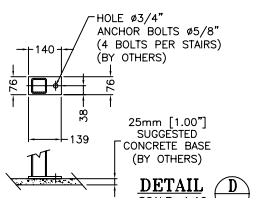
STD: "D" 22x34 | REF: RA16, RC01 | BAR = 1" AT PLOT SCALE



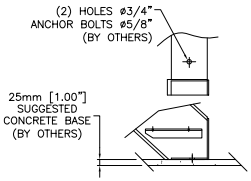
SECTION A



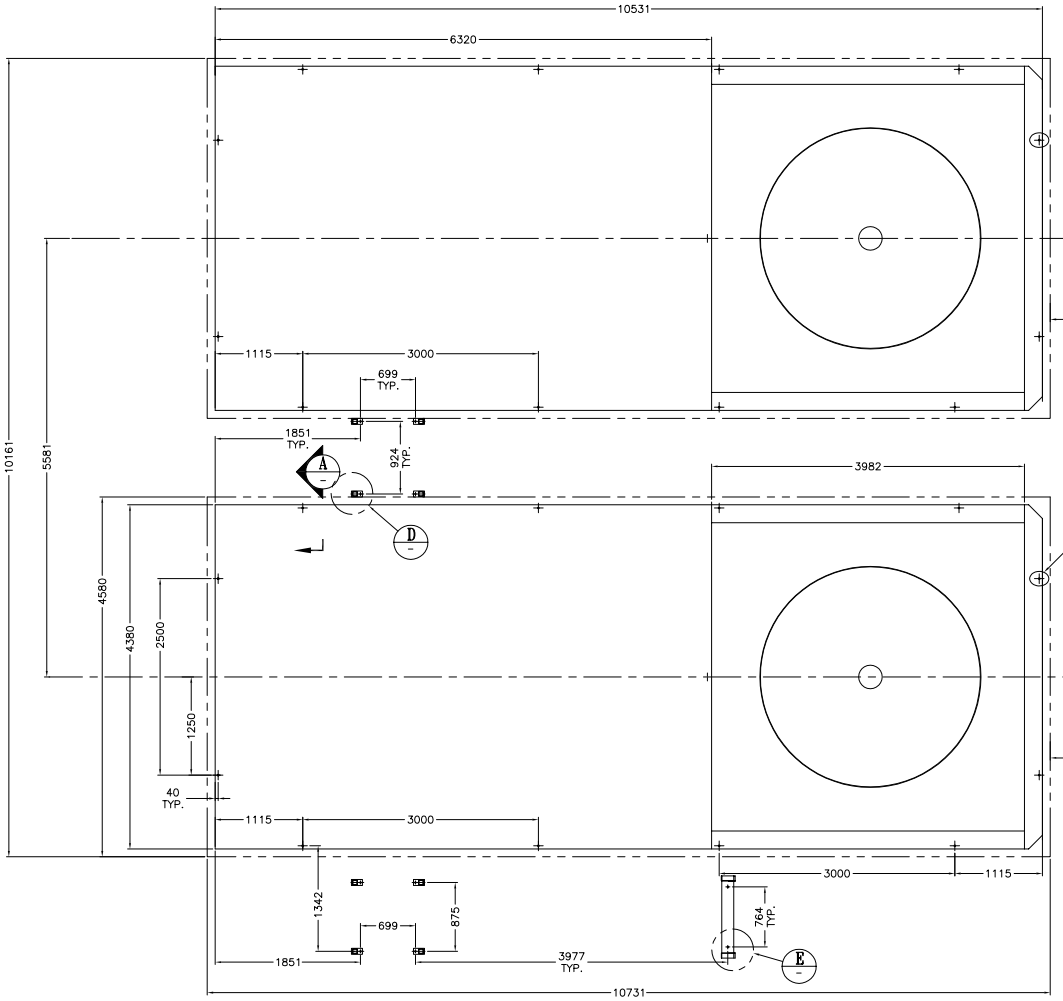
DETAIL B



DETAIL D
SCALE: 1:10



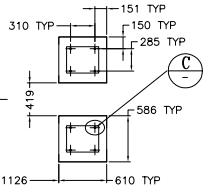
DETAIL E
SCALE: 1:10



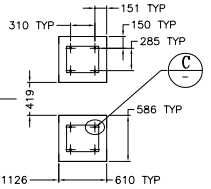
FOOTING VIEW

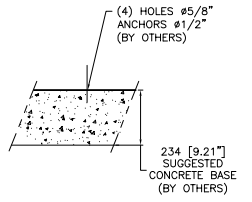
NOTES:

1. SEE DRAWING GA100 FOR REFERENCES
2. TOTAL UNIT WEIGHT EMPTY: 46 200 Lbs
   (21 000 Kg)
3. TOTAL UNIT WEIGHT IN SERVICE (FULL OF WATER):
   381 000 Lbs
   (173 000 Kg)



SEE DETAIL "B"
(12) HOLES ø22mm
ANCHOR BOLT ø20mm
(BY OTHERS)





DETAIL C

REV	DESCRIPTION	DATE	DWN	CHKD	APVD	ECN
0	FOR INFORMATION	2009-03-10	O.F.	N/A	M.S.	N/A

	DATE
DESIGNER O.F.	2006-07-14
CHECKER N/A	N/A
ENGINEER M.S.	2007-12-03
MANAGER N/A	N/A
SCALE: 1:30	

TITLE: ACTIFLO ACP-700R
FOOT PRINT

CLIENT: MEADOWBANK MINING

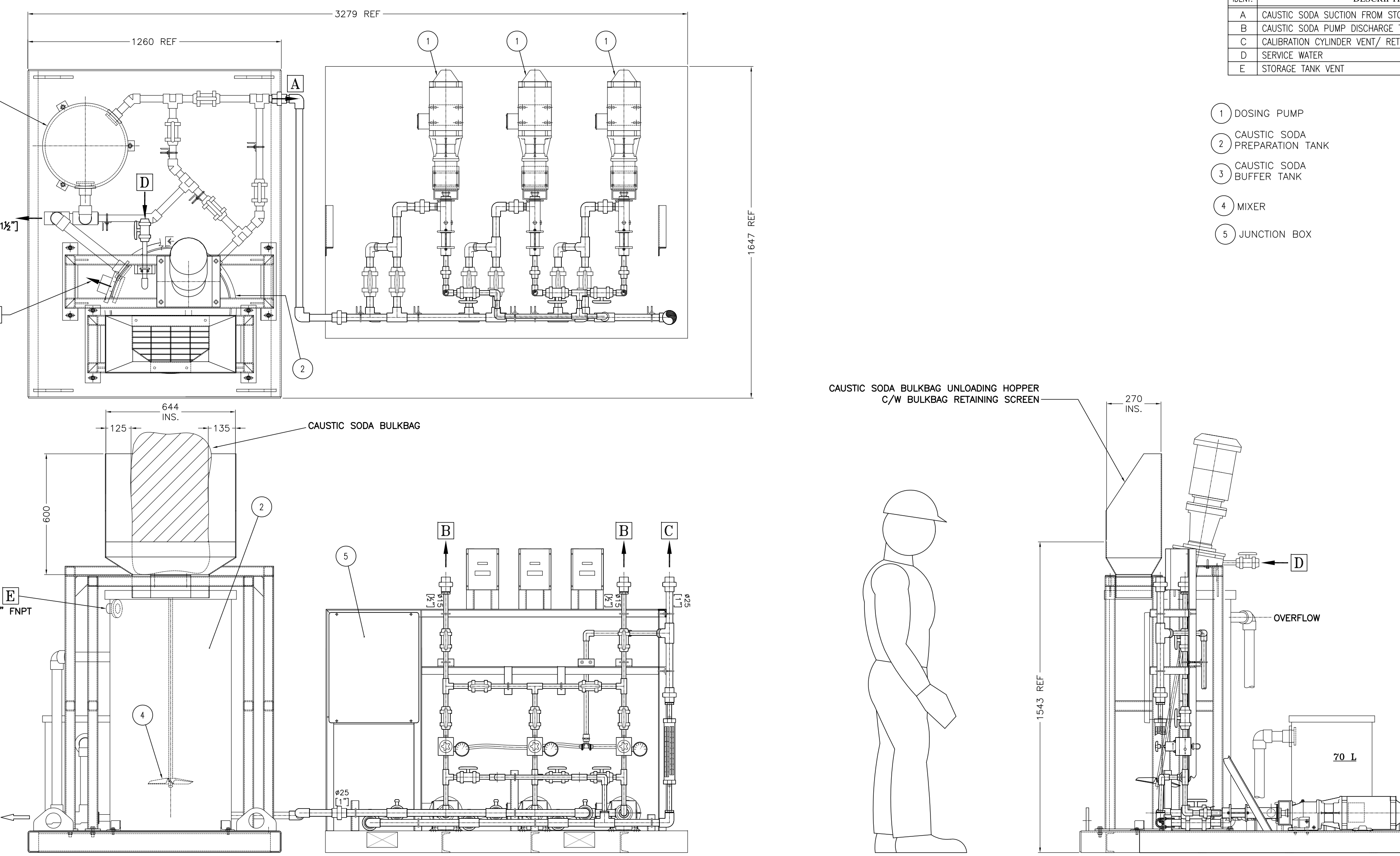
JOHN MEUNIER ISO 9001: 2000
4105 Sartelon Street, Saint-Laurent, Qc, Canada H4S 2B3 / Tel: (514) 334-7230 / Fax: (514) 334-5070

PROJECT	DRAWING	INTERNAL	SHEET	REV
NC01-GA101	ACP700R	1	1 OF 1	0

STD: "D" 22x34 | REF: RA16, RC01 | BAR = 1" AT PLOT SCALE

IDENT.	DESCRIPTION	DIA
A	CAUSTIC SODA SUCTION FROM STORAGE TANK	ø25
B	CAUSTIC SODA PUMP DISCHARGE TO INJECTION POINT	ø15
C	CALIBRATION CYLINDER VENT/ RETURN TO SODA TANK	ø25
D	SERVICE WATER	ø15
E	STORAGE TANK VENT	ø50

1. DOSING PUMP
2. CAUSTIC SODA PREPARATION TANK
3. CAUSTIC SODA BUFFER TANK
4. MIXER
5. JUNCTION BOX



RÉV.	DESCRIPTION	DATE	DESSINÉ	VÉRIFIÉ	APPROUVÉ	ECN
1	FOR APPROVAL	2009-05-19	M.M.	N/A	J.T.	N/A
0	FOR INFORMATION	2009-05-15	M.D.	N/A	J.T.	N/A

STD: "D" 22x34 REF: BAR = 1" À L'ÉCHELLE D'IMPRESSION

AVIS DE CONFIDENTIALITÉ ET DE PROPRIÉTÉ INTELLECTUELLE

DESSINÉ	DATE
VÉRIFIÉ N/A	DATE N/A
INGÉNIEUR Julie T.	DATE 2009-05-15
DIRECTEUR N/A	DATE N/A
ÉCHELLE: 1:10	

TITRE: ACTIFLO ACP-700R
CAUSTIC SODA DOSING SYSTEM

CLIENT: MEADOWBANK MINING

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

PROJET	DESSIN No	INTERNE	FEUILLET	RÉV.
NC01-	GA200		1 DE 1	1