Process Operation & Maintenance Manual

for the

Iqaluit Wastewater Treatment Plant –

Conversion & Expansion – Phase 1

Iqaluit, Nunavut

Chapter 1

Year of Completion: 2006

Original Scope: Design and upgrade existing Wastewater Treatment Plant to meet current and future demands.

This manual has been updated to include:

Date	Description of Change

Iqaluit Wastewater Treatment Plant – Conversion & Expansion – Phase 1

Project History

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for the
Iqaluit Wastewater Treatment Plant – Conversion & Expansion – Phase 1
Iqaluit, Nunavut
Chapter 2

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Chapter 3

BACKGROUND AND DESIGN DATA

3.1 General

The discussion in this document includes the background and design data for the process systems provided in the Iqaluit Wastewater Treatment Plant (WWTP) – Conversion & Expansion – Phase 1.

3.2 Background

Earth Tech (Canada) Inc. (ET) was retained by the City of Iqaluit to undertake the design of improvements/upgrades to the Iqaluit WWTP, and provide inspection services during the construction stage of the project.

Further information is provided in the following reports:

- "Structural Review of the Process Tanks at the Iqaluit Reclamation Facility" prepared by CH_2M Gore & Storrie.
- "Sewage Treatment Plant Investigation" prepared by Earth Tech (Canada) Inc.
- "Completion Study for the Iqaluit Wastewater" prepared by CH_2M Hill.

As part of this project, it is the City's intention to address the deficiencies and issues identified in these previous reports. Furthermore, it is the City's desire to convert the existing facility to a conventional activated sludge secondary treatment plant to meet the projected flows and loadings for a 20-year design horizon.

The objectives of the design team are to:

- Provide a complete operation system to meet the needs of the community and also to address the specific characteristics of its location;

- Provide a simple operational design with features suited to the community and avoid processes or equipment that require highly specialized technical skills or sophisticated maintenance procedures;
- Maximize the re-use and integration of salvageable components within the existing facility; and
- Minimize life cycle costs of the facility.

3.3 New Process Description

Phase 1 incorporates only the headworks ("preliminary treatment") of the new WWTP. The new headworks building houses the following components for Preliminary Treatment:

- New influent pumping;
- Relocated existing screw screens;
- New fine screening equipment;
- New valves; and
- New PLC-based control.

3.4 Process (General)

All process systems installed within the new facility are both code compliant and energy efficient. The process is sized to accommodate the as-built requirements and future expansion of the treatment systems and/or pumping requirements of the facility.

3.5 Design Data

3.5.1 Design Capacity

The design of Phase 1 of the new WWTP is for a population of 8,000 for some pieces of equipment and for a population of 12,000 for the larger pieces of equipment. For a population of 8,000 a Peak Hour Flow of 9,600 m^3/d was used and for a population of 12,000 a Peak Hour Flow of 14,400 m^3/d.

3.5.2 Raw Wastewater

The following table shows the raw wastewater characteristics considered for design:

		Stage 1 8,000	**Stage 2** 12,000
BOD			
Average annual per capita load	kg/c/d	0.080	0.080
Average annual load	kg/day	640	960
Maximum month load (PF 1.2)	kg/day	704	1,056
Maximum week load (PF 1.35)	kg/day	864	1,296
Maximum day load (PF 1.5)	kg/day	960	1,440
COD			
Average annual per capita load	kg/c/d	0.160	0.160
Average annual load	kg/day	1,280	1,920
Maximum month load (PF 1.2)	kg/day	1,408	2,112
Maximum week load (PF 1.35)	kg/day	1,728	2,592
Maximum day load (PF 1.5)	kg/day	1,920	2,880

		Stage 1 8,000	Stage 2 12,000
TSS			
Average annual per capita load	kg/c/d	0.080	0.080
Average annual load	kg/day	640	960
Maximum month load (PF 1.2)	kg/day	704	1,056
Maximum week load (PF 1.35)	kg/day	864	1,296
Maximum day load (PF 1.5)	kg/day	960	1,440
TKN			
Average annual per capita load	kg/c/d	0.015	0.015
Average annual load	kg/day	120	180
Maximum month load (PF 1.2)	kg/day	132	198
Maximum week load (PF 1.35)	kg/day	162	243
Maximum day load (PF 1.5)	kg/day	180	270

Raw Wastewater enters the plant through an existing 300 mm main into the influent pumping chamber. There is a basket screen to catch any solids that have a diameter greater then 75mm. The raw wastewater is pumped and metered up to the coarse screens. There is a manual shut off valve in the influent pumping chamber to stop all raw wastewater flow to the plant.

3.5.3 Course Screens

The raw wastewater coming from the influent pumps is screened to 5mm diameter particle size and then flows by gravity to the fine screen. The solids are compacted and dewatered to approximately 20% and are dropped through a hopper into the sludge trailer in the lower level of the headworks building.

3.5.4 Fine Screening

The wastewater from the coarse screens is further screened to 300 micron particle size and then flows by gravity into the retention channel. The solids are compacted and dewatered to approximately 20 to 30% and are dropped through a hopper into the sludge trailer in the lower level of the headworks building.

3.5.5 Effluent

The primary effluent flows through the retention channel, under an underflow weir (to contain any floatable flammables), then over an overflow weir and finally out through the outfall piping located just above the high water mark of Frobisher Bay.

3.5.6 Sludge

The sludge from the screens and the primary filter is dropped into a hopper that should have a two day capacity. The sludge drops from the hopper into the dump trailer which is then taken to the landfill for disposal.

3.6 Existing Mechanical Systems

The facility existing mechanical system consists of several types of systems. The mechanical systems which service the facility include an hydronic (glycol) heating system, ventilation systems, plumbing systems and fuel oil system.

The existing heating system consist of two fuel oil (diesel) fired boilers, two primary pumps and two secondary pumps, servicing a hydronic system utilizing glycol. Heating for the plant areas is accomplished by distribution of glycol through a direct piping system to terminal heating equipment. The primary pumps service the boilers. One secondary pump system services unit heaters located throughout the plant and the second secondary pump system services the existing air handling unit heating coils. The Washroom and Offices are serviced by electric baseboard heaters c/w integral thermostats.

Existing ventilation systems include one air handling unit, one small exhaust fan and a modulating damper system. The air handling unit provides tempered air to the First Floor Blower Room and the Second Floor. The small exhaust fan services the Washroom and discharges into the Bioreactor Room. Generator Room ventilation is provided by openings in the exterior wall and Blower Room wall utilizing motorized dampers based on local thermostat setting.

The existing domestic water system consists of a water storage tank c/w pressure system (jet pump and expansion tank) and electric domestic hot water heater. Domestic water is distributed by copper piping to Washroom fixtures, hand sink and Laboratory sink.

Existing plumbing systems consist of one Washroom containing a water closet, lavatory and shower. Floor drains are located throughout the building. The building main sanitary waste piping has been disconnected from the outdoor sewage holding tank allowing sanitary drainage to flow directly to the ground. The Cake Bin sump services the First Floor, Pump Room and Press Room floor drains. The pumped waste water from the Cake Bin sump is also discharged directly to the outside ground.

The existing fuel oil system consists of one double walled outdoor 9600 litre storage tank, one 450 litre indoor day tank and a fuel oil transfer system that provides fuel for the heating boilers. Secondary containment monitoring of the outdoor storage tank is dependent on a vacuum seal type system. This type of system is not dependable for containment monitoring and should be replaced with a conventional double walled steel tank.

3.7 Facility Mechanical Systems Addition and Upgrades – Phase 1

Along with new mechanical equipment to service the Headworks Building addition in Phase 1, the existing mechanical systems have been upgraded as required to meet operating and applicable code requirements.

3.7.1 Hydronic (Glycol) Heating System Upgrades

Heating systems upgrades include revising of the boilers operation to lead/lag operation with each boiler provide 50% of system capacity at 88°C glycol supply temperature, ensuring full heating capacity at all times. The boilers provide hot glycol to existing and new unit heaters, new wall fin radiation, existing effluent water heat exchanger and new Headworks air handling unit reheat coil.

Other heating systems upgrades include relocation of existing unit heaters to accommodate the Headworks Building addition and new unit heaters to service the Headworks Building. Wall fin radiation have been added to service the new Electrical Room and Laboratory.

One of two existing secondary glycol heating pumps has been replaced and services the Headworks Building. The heating system glycol expansion tank has been replaced to accommodate increased capacity of the heating system.

3.7.2 Ventilation System Upgrades

Ventilation system upgrades include removal of existing exhaust fan and associated ductwork to accommodate the Headworks Building addition and new explosion proof heat recovery air handling unit to service the Headworks Building.

Supply and exhaust ducting and louvers were added to the Emergency Generator Room to serve the Emergency Generator

3.7.3 Plumbing System Upgrades

Plumbing system upgrades include a new sump c/w pumps to service the Headworks Building addition, rerouting of the existing plumbing fixtures and Cake Bin Room sump drainage piping to the Headworks Building new raw water pump vault. The existing domestic water system remains as is.

3.7.4 Process System Upgrades

Process system upgrades include three new effluent water booster pumps and one new effluent pressure tank for cleaning of the process screens and filters.

A heating and pressure boosting system was added to supply hot Filtered Effluent Water (FEW) to the Headworks building.

3.7.5 Fuel Oil System Upgrades

A new double walled fuel day tank was installed in the Emergency Generator room, as well as an automated filling system from the new 10,000 Litre storage tank to be installed in the summer of 2006.

END OF CHAPTER 3

Chapter 4

SCHEMATICS AND FUNCTIONAL DATA

4.1 General

The following tables describe where the components to the various systems are located and the function that each performs. For each table there are drawings that can be referenced to better understand the flow of that part of the Wastewater Treatment Plant.

4.2 Raw Wastewater Flow (Refer to Drawings P-1 at the end of this section)

The following table identifies the components related to the flow of wastewater flow from the influent pump well to the course screens.

Raw Wastewater Flow

No.	Component	Location	Function Performed	Remarks
1	Intake Valve (V101)	RWW Intake Pipe, Influent Pump Well	Shuts off water from City Sanitary distribution system	Normally Open
2	Basket Screen (BSCR101)	RWW Intake Pipe, Influent Pump Well	Used to screen out objects larger then 75mm in diameter	Manual
3	RWW Pump (P-102)	Influent Pump Well	Pumps raw wastewater up to the screw screens (On a VFD)	PLC controlled
4	RWW Pump (P-103)	Influent Pump Well	Pumps raw wastewater up to the screw screens (On a VFD)	PLC controlled
5	RWW Pump (P-104)	Influent Pump Well	Pumps raw wastewater up to the screw screens (On a VFD)	PLC controlled
6	Ball Check Valve (V-102)	On 200 Dia. RS Piping, Influent Pump Well	Stops back flow of raw wastewater in to the influent pumping well	
7	Ball Check Valve (V-104)	On 200 Dia. RS Piping, Influent Pump Well	Stops back flow of raw wastewater in to the influent pumping well	
8	Ball Check Valve (V-106)	On 200 Dia. RS Piping, Influent Pump Well	Stops back flow of raw wastewater in to the influent pumping well	

Raw Wastewater Flow

No.	Component	Location	Function Performed	Remarks
9	Isolation Valve (V-103)	On 200 Dia. RS Piping, Influent Pump Well	Plug valve to isolate ball check V-102 and RWW pump P-102	Normally Open
10	Isolation Valve (V-105)	On 200 Dia. RS Piping, Influent Pump Well	Plug valve to isolate ball check V-104 and RWW pump P-103	Normally Open
11	Isolation Valve (V-107)	On 200 Dia. RS Piping, Influent Pump Well	Plug valve to isolate ball check V-106 and RWW pump P-104	Normally Open
12	Flow Meter (FIT-101)	RS Piping, Lower Floor	Measures the amount of flow into the Plant	PLC controlled
13	Level Indicating Transmitter (LIT-101)	Mounted in the pump well	Indicates the waste water level in the pump well	Signals the PLC
14	Level Switch (LSHH-104)	Mounted in the pump well	Indicates the high high waste water level in the pump well	Signals the PLC

4.3 Screened Wastewater Flow (Refer to Drawings P-2 at the end of this section)

The following table identifies the components related to the flow of wastewater from the course screens to the Primary Filter.

Screened Wastewater Flow

No.	Component	Location	Function Performed	Remarks
1	Coarse Screens tankage	Upper Floor in Headworks	Contains the channels for the screw screens and manual bypass screen	
2	Level Indicating Transmitter (LIT-102)	Mounted on coarse screen tank wall	Indicates the waste water level in the screw screen tank	Signals the PLC
3	Level Switch (LIT-102)	Mounted on coarse screen tank wall	Indicates a high waste water level in the screw screen tank	Signals the PLC
4	Isolation Gate (SG-101)	In coarse screen tankage	Used to isolate screw screen SSCR-105	Normally Open
5	Isolation Gate (SG-102)	In coarse screen tankage	Used to isolate screw screen SSCR-106	Normally Open

Screened Wastewater Flow

No.	Component	Location	Function Performed	Remarks
6	Isolation Gate (SG-103)	In coarse screen tankage	Used to isolate manual bar screen MSCR-107	Normally Closed
7	Screw Screen (SSCR-105)	Upper Floor in Headworks	Coarse screening of the raw sewage	PLC Controlled
8	Screw Screen (SSCR-106)	Upper Floor in Headworks	Coarse screening of the raw sewage	PLC Controlled
9	Manual Bar Screen (MSCR-107)	Upper Floor in Headworks	For manual coarse screening of the raw sewage in case of screw screen shut down	PLC Controlled
10	Motorized Valve (SV-105)	On Screw Screen SSCR-105	Controls the flow of wash water to SSCR-105	PLC Controlled
11	Motorized Valve (SV-106)	On Screw Screen SSCR-106	Controls the flow of wash water to SSCR-106	PLC Controlled
12	Isolation Valve (V-108)	Outlet of SSCR-105	Used to isolate screw screen SSCR-105	Normally Open
13	Isolation Valve (V-109)	Outlet of SSCR-106	Used to isolate screw screen SSCR-106	Normally Open
14	Isolation Valve (V-110)	Outlet of MSCR-107	Used to isolate screw screen MSCR-107	Normally Closed
15	Isolation Valve (V-122A)	Salsnes Filter	Sample port – Salsnes Influent	Normally Closed
15A	Isolation Valve (V-122B)	Salsnes Filter	Sample port – Salsnes Effluent	Normally Closed
16	Isolation Valve (V-112)	On Screened Raw Sewage pipe	Used to bypass the primary filter	Normally Closed

4.4 Primary Filtered Wastewater Flow (Refer to Drawing P-3 and P-4 at the end of this section)

The following table identifies the components related to the flow of wastewater from the Primary Filter to the Ocean Outfall.

Primary Filtered Wastewater Flow

No.	Component	Location	Function Performed	Remarks
1	Isolation Valve (V-111)	Inlet of Primary Filter (PFT-108)	Used to isolate Primary Filter (PFT-108)	Normally Open
2	Primary Filter (PFT-108)	Upper Floor Headworks	Used for the fine screening of the Wastewater	PLC Controlled
3	Isolation Valve (V-113)	Outlet of Primary Filter (PFT-108)	Used to isolate Primary Filter (PFT-108)	Normally Open
4	Isolation Valve (V-120)	Near PFT-108	Used to isolate the hot filtered effluent wash water at PFT-108	Normally Open
5	Isolation Valve (V-121)	Near PFT-108	Used to isolate the cold filtered effluent wash water at PFT-108	Normally Open
6	Primary Effluent Channel	Upper Floor Headworks	Used for retention time, floatable flammable retention and flow splitting	
7	Weir (W-101)	Upper Floor Headworks	Used for flow splitting	
8	Isolation Valve (V-115)	Outlet of Primary Effluent Channel Lower Floor Headworks	Allows Primary Effluent to bypass plant (Normally Open Phase 1 & Normally Closed Phase 2)	Normally Open
9	Isolation Valve (V-123)	On Primary Effluent bypass pipe	Used for a sample port and air release	Normally Closed
10	Isolation Valve (V-201)	Outlet of Primary Effluent Channel Upper Floor Headworks	Allows Primary Effluent into Bioreactor 1 (Normally Closed Phase 1 & Normally Open Phase 2)	Normally Closed
11	Weir (W-102)	Upper Floor Headworks	Used for flow splitting	
12	Isolation Valve (V-202)	Outlet of Primary Effluent Channel Upper Floor Headworks	Allows Primary Effluent into Bioreactor 2 (Normally Closed Phase 1 & Normally Open Phase 2)	Normally Closed

Primary Filtered Wastewater Flow

No.	Component	Location	Function Performed	Remarks
13	Weir (W-103)	Upper Floor Headworks	Used for flow splitting	
14	Isolation Valve (V-203)	Outlet of Primary Effluent Channel Upper Floor Headworks	Allows Primary Effluent into Bioreactor 3 (Normally Closed Phase 1, Phase 2 & Normally Open Phase 3)	Normally Closed
15	Valve Chamber	Near Outfall	For housing the valves that tie-in future Phases	
16	Isolation Valve (V-117)	Exterior Valve Chamber	Isolates Primary Effluent Bypass (Normally Open Phase 1, Normally Closed Phase 2 & Phase 3)	Normally Open
17	Isolation Valve (V-302)	Exterior Valve Chamber	Isolates Future Secondary Effluent from future Clarifiers 1&2	Normally Closed
18	Isolation Valve (V-301)	Exterior Valve Chamber	Isolates Future Secondary Effluent from future Clarifier 3	Normally Closed
19	Ocean Outfall	Exterior of Plant	Routes Plant Effluent to Ocean	

4.5 Sludge Flow
(Refer to Drawing P-5 at the end of this section)

The following table identifies the components related to the flow of sludge from the Course Screen to the Landfill.

Sludge Flow

No.	Component	Location	Function Performed	Remarks
1	Screenings Hopper (HOP-111)	Lower Floor in Headworks	Contains the screenings from the screw screens and primary filter	
2	Isolation Valve (V-116)	Lower Floor in Headworks	Used to stop the flow of screenings to the dump trailer or bin on the lower floor	Normally Open
3	Dump Trailer (TRL-109)	Lower Floor in Headworks	Used to haul screenings to the landfill	
4	Screenings Bin (BIN-110)	Lower Floor in Headworks	Used to contain screenings if the trailer is unavailable	

4.6 Vacuum Flow
(Refer to Drawing P-6 at the end of this section)

The following table identifies the components related to the vacuum flow of wastewater from either the Primary effluent channel or the Pump Well.

Vacuum Flow

No.	Component	Location	Function Performed	Remarks
1	Exterior Cam Lock Connection	Lower Floor outside Headworks	Connection point for vacuum trucks	
2	Isolation Valve (V-119)	Lower Floor in Headworks	Isolate the vacuum line to the lift station	Normally Open
3	Isolation Valve (V-118)	Lower Floor in Headworks	Isolate the vacuum line to the Primary Effluent Channel	Normally Closed
4	Cam Lock Connection	In Raw Waste Water Lift Station	Connection point for vacuum trucks to clean the Raw Wastewater Lift Station above the lift station floor	
5	Cam Lock Connection	On the upper floor of the headworks building	Connection point for vacuum trucks to clean the Primary effluent channel	

4.7 Filtered Effluent Water Storage (Refer to Drawing P-7 at the end of this section)

The following table identifies the components related to the flow of filtered effluent water, until Phase 2 is in place, potable water will be used.

No.	Component	Location	Function Performed	Remarks
1	Exterior Cam Lock Connection	Lower Floor main door	Connection point for Potable Water trucks to provide clean water to the FEW tanks	
2	FEW storage tank (T-505)	In Mechanical Room	Holds filtered effluent water in Phase 2 and potable water in Phase 1 for wash water use by the screenings and general wash down	Stainless Steel
3	FEW storage tank (T-506)	In Mechanical Room	Holds filtered effluent water in Phase 2 and potable water in Phase 1 for wash water use by the screenings and general wash down	Stainless Steel
4	Isolation Valve	In Mechanical Room	Isolate the level indicating transmitter from the FEW tanks	Normally Open
5	Level Indicating Transmitter (LIT-501)	Mounted on FEW tank wall	Indicates the water level in the FEW tank	Signals the PLC
6	Outlet Piping to Mechanical	In Mechanical Room	Outlet to mechanical pressure system which feeds the wash down for the screens, filter etc.	

4.8 Hydronic (Glycol) Heating Flow Schematic (Refer to Drawing M-1 at the end of this section)

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Boiler B-01	Mechanical Room	Provides heating of propylene glycol. Boiler B-01 provides 50 % heating capacity for system	Heating supply temperature set at 88 C
2	Boiler B-02	Mechanical Room	Provides heating of propylene glycol. Boiler B-2 provides 50 % heating capacity for system	Heating supply temperature set at 88 C
3	Isolation Valve	Fuel Oil Common Supply Piping	Valve used for isolation of Fuel Oil to Boilers B-01 & B-02	Normally Open
4	Isolation Valve	Boiler B-01 Fuel Oil Supply Piping	Valve used for isolation of Boiler B-01 Fuel Oil supply	Normally Open
5	Fusible Link Valve	Boiler B-01 Fuel Oil Supply Piping	High temperature protection of fuel oil supply. Automatic shut off of fuel oil supply to Boiler B-01 if preset fusible link temperature limit is exceeded	Normally Open
6	Isolation Valve	Boiler B-02 Fuel Oil Supply Piping	Valve used for isolation of Boiler B-02 Fuel Oil supply	Normally Open
7	Fusible Link Valve	Boiler B-02 Fuel Oil Supply Piping	High temperature protection of fuel oil supply. Automatic shut off of fuel oil supply to Boiler B-02 if preset fusible link temperature limit is exceeded	Normally Open
8	Isolation Valve	Boiler B-01 Supply Piping	Valve used for isolation of Boiler B-01	Normally Open
9	MAV – Manual Air Vent & Isolation Valve	Boiler B-01	Allows for venting/removal of trapped air from Boiler B-01	Normally Closed
10	Isolation Valve	Boiler B-02 Supply Piping	Valve used for isolation of Boiler B-02	Normally Open
11	MAV – Manual Air Vent & Isolation	Boiler B-02	Allows for venting/removal of trapped air from Boiler B-02	Normally Closed

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Location	Function Performed	Remarks
	Valve			
12	Boiler B-01 Heating Recirculation Pump P-01	Mechanical Room	Circulates glycol for Boiler B-01	
13	Isolation Valve	Pump P-01 Suction Piping	Valve used for isolation of Pump P-01	Normally Open
14	Boiler B-01 Heating Recirculation Pump P-02	Mechanical Room	Circulates glycol for Boiler B-02	
15	Isolation Valve	Pump P-02 Suction Piping	Valve used for isolation of Pump P-02	Normally Open
16	FS – Flow Switch	Heating Common Supply Piping	Indication of glycol flow for heating system	
17	TS – Temperature Controller/Sensor	Heating Common Supply Piping	Glycol supply temperature controller/sensor for heating system	Supply temperature set at 88 C
18	T/PI – Temperature/ Pressure Indicator	Heating Common Supply Piping	Visual indication of heating system supply temperature & pressure	
19	Air Separator & Automatic Air Vent (AAV)	Mechanical Room	Automatic separation of trapped air from glycol heating system	
20	Isolation Valve	Air Separator Drain Valve	Valve used for isolation of Air Separator	Normally Open
21	Expansion Tank TK-1	Mechanical Room	Maintains heating system operating pressure	
22	Air Separator/ Expansion Tank Drain Valve	Air Separator/ Expansion Tank Piping	Allows for draining of glycol from Air Separator & Expansion Tank	Normally Closed & Capped
23	Heating Pump P-03	Mechanical Room	Circulates heating glycol for unit heaters	
24	TI – Temperature Indicator	Pump P-03 Suction Piping	Visual indication of heating temperature to Pump P-03	
25	Strainer	Pump P-03 Suction	Provides for removal of solid material from glycol heating	Strainer to be cleaned if

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Location	Function Performed	Remarks
		Piping	system	plugged
26	Isolation Valve	Pump P-03 Suction Piping	Valve used for isolation of Pump P-03	Normally Open
27	Check Valve	Pump P-03 Discharge Piping	Prevents backflow of glycol	
28	Isolation Valve	Pump P-03 Discharge Piping	Valve used for isolation of Pump P-03	Normally Open
29	Bypass/Isolation Valve	Pump P-03 System	Valve used for bypassing of Pump P-03 system if required	Normally Closed
30	Unit Heaters Supply Distribution Header & Isolation Valves		Header used distribution of glycol to unit heaters	
31	Automatic Air Vent Isolation Valve	Unit Heaters Supply Distribution Header	Allows for isolation of Automatic Air Vent	Normally Open
32	AAV – Automatic Air Vent	Unit Heaters Supply Distribution Header	Allows for venting/removal of trapped air from distribution header	
33	Unit Heaters Return Distribution Header & Isolation Valves		Header used distribution of glycol to unit heaters	
34	Automatic Air Vent Isolation Valve	Unit Heaters Return Distribution Header	Allows for isolation of Automatic Air Vent	Normally Open
35	AAV – Automatic Air Vent	Unit Heaters Return Distribution Header	Allows for venting/removal of trapped air from distribution header	
36	Heating Pump P-04	Mechanical Room	Circulates heating glycol for Headworks Building	
37	TI – Temperature Indicator	Pump P-04 Suction Piping	Visual indication of heating temperature to Pump P-04	
38	Strainer	Pump P-04 Suction Piping	Provides for removal of solid material from glycol heating system	Strainer to be cleaned if plugged
39	Isolation Valve	Pump P-04 Suction Piping	Valve used for isolation of Pump P-04	Normally Open

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Location	Function Performed	Remarks
40	Isolation Valve	Pump P-04 Suction Piping	Valve used for isolation of Pump P-04 system during construction	Normally Open
41	Check Valve	Pump P-04 Discharge Piping	Prevents backflow of glycol	
42	Isolation Valve	Pump P-04 Discharge Piping	Valve used for isolation of Pump P-04	Normally Open
43	Bypass/Isolation Valve	Pump P-04 System	Valve used for bypassing of Pump P-04 system if required	Normally Closed
44	TI – Temperature Indicator	Headworks Building Supply Piping	Visual indication of heating supply temperature to Headworks Building	
45	Automatic Air Vent Isolation Valve	Headworks Building Supply Piping	Allows for isolation of Automatic Air Vent	Normally Open
46	AAV – Automatic Air Vent	Headworks Building Supply Piping	Allows for venting/removal of trapped air from Headworks Building system	
47	Automatic Air Vent Isolation Valve	Headworks Building Return Piping	Allows for isolation of Automatic Air Vent	Normally Open
48	AAV – Automatic Air Vent	Headworks Building Return Piping	Allows for venting/removal of trapped air from Headworks Building system	
49	TI – Temperature Indicator	Headworks Building Return Piping	Visual indication of heating return temperature from Headworks Building	
50	Isolation Valve	Effluent Water Heat Exchanger Supply Piping	Valve used for isolation of system for Effluent Water Heat Exchanger	Normally Open
51	Isolation Valve	Effluent Water Heat Exchanger Return Piping	Valve used for isolation of system for Effluent Water Heat Exchanger	Normally Open
52	Glycol Storage Tank	Mechanical Room	Glycol storage	
53	Glycol Fill Charge Pump P-05	Mechanical Room	Transfers glycol from fill tank to heating system	Heating system operation to be monitored during filling of system

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Location	Function Performed	Remarks
54	Isolation Valve	Pump P-05 Discharge Piping	Valve used for isolation of glycol storage tank and charge pump	Normally Closed
55	Pressure Reducing Valve	Pump P-05 Discharge Piping	Valve used for Reducing of pressure during filling of heating system	
56	Strainer	Pump P-05 Discharge Piping	Provides for removal of solid material from glycol fill system	Strainer to be cleaned if plugged
57	Check Valve	Pump P-05 Discharge Piping	Prevents backflow of glycol	
58	Isolation Valve	Pump P-05 Discharge Piping	Valve used for isolation of glycol fill system	Normally Closed
59	T/PI – Temperature/ Pressure Indicator	Heating Common Return Piping	Visual indication of heating system return temperature & pressure	

4.9 Typical Unit Heater & Force Flow Schematic (Refer to Drawing M-2 at the end of this chapter)

Typical Unit Heater & Force Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Unit Heater	Unit heaters located throughout Waste Water Treatment Plant	Provides heating for Waste Water Treatment Plant	
2	T – Thermostat (Room)	Adjacent to unit heater	Temperature control for Unit Heater	Room temperature to be maintained at set point.
3	Manual Air Vent	Unit Heater Return Piping	Allows for venting/removal of trapped air from heating system	
4	Drain Valve	Unit Heater Supply Piping	Allows for draining of glycol from Unit Heater	Normally Closed & Capped
5	Well	Unit Heater Supply Piping	Thermal well used for mounting of controls device	
6	Isolation Valve	Unit Heater Supply Piping	Valve used for isolation of Unit Heater	Normally Open
7	Well	Unit Heater Return Piping	Thermal well used for mounting of controls device	
8	Isolation/Balancing Valve	Unit Heater Return Piping	Valve used for hydronic isolation/balancing of Unit Heater	

4.10 Typ. Air Handling Unit Preheat/Heating Coil Flow Schematic (Refer to Drawing M-3 at the end of this section)

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Preheat & Heating Coils	Air Handling Unit AHU-03	Provides heating for Headworks Building	
2	Temperature Control Valve (3-way)	Preheat & Heating Coil Supply & Return Piping	Regulates glycol flow Preheat or Heating coil provide desired AHU discharge supply air temperature	
3	Duct Mounted Thermostat	AHU Supply Air Discharge Ductwork	Measures AHU Supply Air Discharge Temperature & regulates 3-way control valve	AHU Supply Air Discharge temperature to be maintained at set point
4	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil	Normally Open
5	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil	Normally Open
6	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
7	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
8	Well	Preheat & Heating Coil Return Piping	Thermal well used for mounting of controls device	
9	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
10	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for bypass of Preheat or Heating Coil Temperature Control Valve	Normally Close
11	Balancing/Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for balancing/isolation of Preheat or Heating Coil	Normally Open Valve to be reset to balanced position if used for isolation

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Location	Function Performed	Remarks
12	Well	Preheat & Heating Coil Return Piping	Thermal well used for mounting of controls device	
13	Balancing/Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for balancing/isolation of Preheat or Heating Coil	Normally Open Valve to be reset to balanced position if used for isolation

4.11 Air Handling Unit AHU-03 Flow Schematic (Refer to Drawing M-4 at the end of this section)

Air Handling Unit AHU-03 Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Air Handling Unit AHU-03	Headworks Building	Provides ventilation for Headworks Building	
2	2-Speed Supply Fan	AHU-03	Provide supply air to Headworks Building	
3	TC – Temperature Controller	AHU-03 Discharge Air Ductwork	Measures and controls AHU-03 to maintain discharge temperature set point	
4	TLA – Temperature Low Alarm Sensor	AHU-03 Discharge Air Ductwork	Low supply air temperature protection Shutdown of AHU-03 if low limit is exceeded	
5	Heating Coil	AHU-03	Provides tempering of outside/return air to maintain supply air set point	
6	2-Speed Exhaust Fan	AHU-03	Exhaust air from Headworks Building	
7	Plate Heat Exchanger	AHU-03	Allows for heat recovery	
8	By-Pass Dampers	AHU-03	Allows for heat recovery & defrosting of plate heat exchanger	

Air Handling Unit AHU-03 Flow Schematic

No.	Component	Location	Function Performed	Remarks
9	By-Pass Dampers	AHU-03	Allows for heat recovery & defrosting of plate heat exchanger	
10	30% Filter	AHU-03	Removal of dust & dirt	
11	TLCL – Temperature Low Control Limit	AHU-03	Switching of by-pass dampers for defrosting of the plate heat exchanger	
12	TT – Temperature Transmitter	AHU-03	Measures outside air temperature entering AHU-03	
13	PD – Pressure Differential Indicator	AHU-03	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
14	Intake Hood	Outside Wall	Allows outside air to be supplied to AHU-03	
15	Outside Air Damper Motor & Outside Air Dampers	Outside Wall	Dampers opens to provide outside air for AHU-03	
16	Exhaust Hood	Outside Wall	Allows air to be exhausted to the outside	
17	Exhaust Air Damper Motor & Exhaust Air Dampers	Outside Wall	Dampers opens to allow air to be exhausted to the outside	

4.12 Domestic Water Flow Schematic (Refer to Drawing M-5 at the end of this section)

Domestic Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Domestic Water Storage Tank		Domestic Water Storage Tank for storage of domestic water	
2	LAL – Level Alarm Low	Domestic Water Storage Tank	Alarm indication of low water level for Domestic Water Storage Tank	
3	LALL – Level Alarm Low Low	Domestic Water Storage Tank	Alarm indication of low low water level for Domestic Water Storage Tank	
4	Isolation Valve	Pressure Pump P-06 Suction Piping	Valve used for isolation of Domestic Water System from Domestic Water Storage Tank	
5	Pressure Pump P-06		Provides domestic water system pressure	
6	Isolation Valve	Pressure Pump P-06 Discharge Piping	Valve used for isolation of Pressure Pump P-06	
7	PS – Pressure Switch	Pressure Pump P-06 Discharge Piping	Energizes pressure pump to maintain desired domestic water system pressure	Pressure Switch set to site operating requirements
8	PI – Pressure Indicator	Pressure Pump P-06 Discharge Piping	Visual indication of domestic water system pressure	
9	Pressure/Expansion Tank	Pressure Pump P-06 Discharge Piping	Provides constant domestic water system pressure	
10	Isolation Valve	Pressure Pump P-06 Discharge Piping	Valve used for isolation of Pressure/Expansion Tank	
11	Isolation Valve	Pressure Pump P-06 Discharge Piping	Valve used for isolation of Building Domestic .	

Domestic Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
			Water System	
12	Isolation Valve	Domestic Water Heater DWH-1 Supply Piping	Valve used for isolation of Domestic Water Heater DWH-1	
13	Domestic Water Heater DWH-1		Provides domestic hot water for WWTP	
14	Pressure Relief Valve	DWH-1 – Domestic Water Heater	Automatic relief of water heater pressure if Pressure Relief Valve preset limit is exceeded	

4.13 FEW Water Flow Schematic (Refer to Drawing M-6 at the end of this section)

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Exterior Cam Lock Connection	Lower Floor main door	Connection point for Potable Water trucks to provide clean water to the FEW tanks	
2	FEW Tanks	Mechanical Mezzanine	Supply for FEW System	Existing SS Tanks
3	Isolation Valve	Piping from FEW Tank to FEW Pumps	Isolates discharge of FEW Tank	
4	Isolation Valve	Inlet piping for FEW Pump1	Isolates Inlet of FEW Pump 1	
5	Y-Strainer	Inlet piping for FEW Pump1	Protects FEW Pump 1	
6	FEW Pump 1	Lower Mechanical Room	Supplies FEW to Plant	
7	PI - Pressure Gauge	Discharge piping for FEW Pump 1	Measures FEW Pump 1 Discharge Pressure	

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
8	Check Valve	Discharge piping for FEW Pump 1	Prevents backflow through FEW Pump 1	
9	Isolation Valve	Discharge piping for FEW Pump 1	Isolates Discharge of FEW Pump 1	
10	Isolation Valve	Inlet piping for FEW Pump2	Isolates Inlet of FEW Pump 2	
11	Y-Strainer	Inlet piping for FEW Pump2	Protects FEW Pump 2	
12	PI - Pressure Gauge	Inlet piping for FEW Pump2	Measures FEW Pump Inlet Pressure	
13	FEW Pump 2	Lower Mechanical Room	Supplies FEW to Plant	
14	PI - Pressure Gauge	Discharge piping for FEW Pump2	Measures FEW Pump 2 Discharge Pressure	
15	Check Valve	Discharge piping for FEW Pump2	Prevent s backflow through FEW Pump 2	
16	Isolation Valve	Discharge piping for FEW Pump2	Isolates Discharge of FEW Pump 2	
17	Isolation Valve	Inlet piping for FEW Pump3	Isolates Inlet of FEW Pump 3	
18	Y-Strainer	Inlet piping for FEW Pump3	Protects FEW Pump 3	
19	FEW Pump 3	Lower Mechanical Room	Supplies FEW to Plant	
20	PI - Pressure Gauge	Discharge piping for FEW Pump3	Measures FEW Pump 3 Discharge Pressure	
21	Check Valve	Discharge piping for FEW Pump3	Prevent s backflow through FEW Pump 3	
22	Isolation Valve	Discharge piping for FEW Pump3	Isolates Discharge of FEW Pump 3	

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
23	Pressure Relief Valve	Inlet Piping to FEW Pressure/Expansion Tank		
24	Hose Bib	Inlet Piping to FEW Pressure/Expansion Tank		
25	Pressure Switch	Inlet Piping to FEW Pressure/Expansion Tank	Starts and Stops Lead FEW Pump	
26	Pressure Switch	Inlet Piping to FEW Pressure/Expansion Tank	Starts and Stops Lag FEW Pump	
27	Pressure/Expansion Tank	Lower Mechanical Room	Prevents short cycling of FEW Pumps	
28	Solenoid Valve	Lower Mechanical Room	Opens when Potable Water Tank full to indicate to truck operator	
29	Isolation Valve	Inlet Piping to FEW Filter	Isolates inlet of FEW Filter for maintenance	
30	FEW Filter	Mechanical Mezzanine	Filters FEW to protect downstream equipment	
31	Motorized Valve	Backwash Discharge Piping of FEW Filter	Automatically backwashes FEW Filter	
32	Isolation Valve	Discharge Piping from FEW Filter	Isolates discharge of FEW Filter for maintenance	
33	Isolation Valve	Mechanical Mezzanine	Bypasses FEW Filter for maintenance	
34	Isolation Valve	Inlet piping of P-21	FEW Makeup Isolation	
35	Isolation Valve	Inlet piping of P-21	P-21 Inlet Isolation	
36	Y-Strainer	Inlet piping of P-21	Protects P-21	

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
37	P-21	Mechanical Mezzanine	Recirculates Hot FEW through Heat Exchanger	
38	TI - Temperature Indicator	Mechanical Mezzanine	Measures Recirculated Hot FEW Temperature	
39	Check Valve	P-21 Discharge Piping	Prevents backflow through P-21	
40	Isolation Valve	P-21 Discharge Piping	P-21 Discharge Isolation	
41	Heat Exchanger	Mechanical Mezzanine	Heats FEW	
42	Check Valve	HWS piping to Heat Exchanger	Prevents backflow of HWS	
43	Control Valve	HWS piping to Heat Exchanger	Hot Water Supply Control Valve	Normally Open - disconnected
44	Isolation Valve	FEW Tank 1A Inlet Piping	FEW Tank 1A Inlet Isolation	
45	Control Valve	FEW Tank 1A Inlet Piping	Controls flow into FEW Tank 1A	
46	FEW Tank 1A	FEW Heating Mezzanine	Stores Hot FEW	
47	Drain Valve	FEW Tank 1A	Drains FEW Tank 1A	
48	Pressure/Temperature Safety Valve	FEW Tank 1A	Protects FEW Tank 1A	
49	Air/Vacuum Relief Valve	FEW Tank 1A	Protects FEW Tank 1A	
50	TI - Temperature Indicator	FEW Tank 1 Discharge Piping	Indicates FEWT1A Discharge Temperature	
51	Isolation Valve	FEW Tank 1A Discharge Piping	FEW Tank 1A Discharge Isolation	
52	Isolation Valve	FEW Tank 1B Inlet Piping	FEW Tank 1B Inlet Isolation	

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
53	Control Valve	FEW Tank 1B Inlet Piping	Controls flow into FEW Tank 1B	
54	FEW Tank 1B	FEW Heating Mezzanine	Stores Hot FEW	
55	Drain Valve	FEW Tank 1B	Drains FEW Tank 1B	
56	Pressure/Temperature Safety Valve	FEW Tank 1B	Protects FEW Tank 1B	
57	Air/Vacuum Relief Valve	FEW Tank 1B	Protects FEW Tank 1B	
58	TI - Temperature Indicator	FEW Tank 1B Discharge Piping	Indicates FEWT1B Discharge Temperature	
59	Isolation Valve	FEW Tank 1B Discharge Piping	FEW Tank 1B Discharge Isolation	
60	Isolation Valve	FEW Tank 1C Inlet Piping	FEW Tank 1C Inlet Isolation	
61	Control Valve	FEW Tank 1C Inlet Piping	Controls flow into FEW Tank 1C	
62	FEW Tank 1C	FEW Heating Mezzanine	Stores Hot FEW	
63	Drain Valve	FEW Tank 1C	Drains FEW Tank 1C	
64	Pressure/Temperature Safety Valve	FEW Tank 1C	Protects FEW Tank 1C	
65	Air/Vacuum Relief Valve	FEW Tank 1C	Protects FEW Tank 1C	
66	TI - Temperature Indicator	FEW Tank 1C Discharge Piping	Indicates FEWT1C Discharge Temperature	
67	Isolation Valve	FEW Tank 1C Discharge Piping	FEW Tank 1C Discharge Isolation	
68	Isolation Valve	P-20 Inlet Piping		
69	Y-Strainer	P-20 Inlet Piping		

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
70	P-20	FEW Heating Mezzanine		
71	Check Valve	P-20 Discharge Piping		
72	Isolation Valve	Inlet Piping to TK-3	Hot FEW Pressure Tank Inlet Isolation Valve	
73	Isolation Valve	Inlet Piping to TK-3	Isolates Hot FEW Pressure Gauge for maintenance	
74	Pressure Gauge	Inlet Piping to TK-3	Measures FEW System Pressure	
75	Drain Valve	Inlet Piping to TK-3	Hot FEW Pressure Tank Drain Valve	
76	TK-3	FEW Heating Mezzanine	Hot FEW Pressure Tank	
77	Isolation Valve	FEWH1 Inlet Piping	FEW Temperature Booster Inlet Isolation Valve	
78	FEW Booster FEWH1	FEW Heating Mezzanine	FEW Temperature Booster	
79	Drain Valve	FEWH1	Drain Valve for FEWH1	
80	Pressure/Temperature Safety Valve	FEWH1 Discharge Piping	Protects FEW Booster	
81	TI - Temperature Gauge	FEWH1 Discharge Piping	Indicates FEWH1 Discharge Temperature	
82	PI - Pressure Gauge	FEWH1 Discharge Piping	Indicates FEWH1 Discharge Pressure	
83	TS - Temperature Switch	FEWH1 Discharge Piping	Controls FEW Booster Operation	
84	FS - Flow Switch	FEWH1 Discharge Piping	Measures FEWH1 Discharge Flow	

FEW Water Flow Schematic

No.	Component	Location	Function Performed	Remarks
85	Isolation Valve	FEWH1 Discharge Piping	FEW Temperature Booster Discharge Isolation Valve	
86	PS - Pressure Switch	FEWH1 Discharge Piping	Controls P-20 Operation	
87	Bypass Valve	FEWH1 Discharge Piping	Allows bypassing FEWH1 for maintenance	
88	PSV	P-20 Discharge Piping	Protects P-20 from over-pressure	

4.14 Headworks Service Piping Flow Schematic (Refer to Drawing M-7 at the end of this section)

Headworks Service Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Hose Bib	Headworks Floor	Supplies Hot FEW for Plant Washdown	
2	Hose Bib	Headworks Floor	Supplies Cold FEW for Plant Washdown	
3	Compressed Air Station	Headworks Floor	Supplies Compressed Air for Maintenance	
4	Hose Bib	Screw Screens	Supplies Cold FEW for Screw Screen Washdown	
5	Isolation Valve	Screw Screens	Isolates All Hot FEW at Screw Screens	
6	Isolation Valve	Screw Screens	Isolates All Cold FEW at Screw Screens	
7	Isolation/Mixing Valve	Screw Screens	Isolates Hot FEW for Screw 1 Lower Nozzles and Spray Bar	

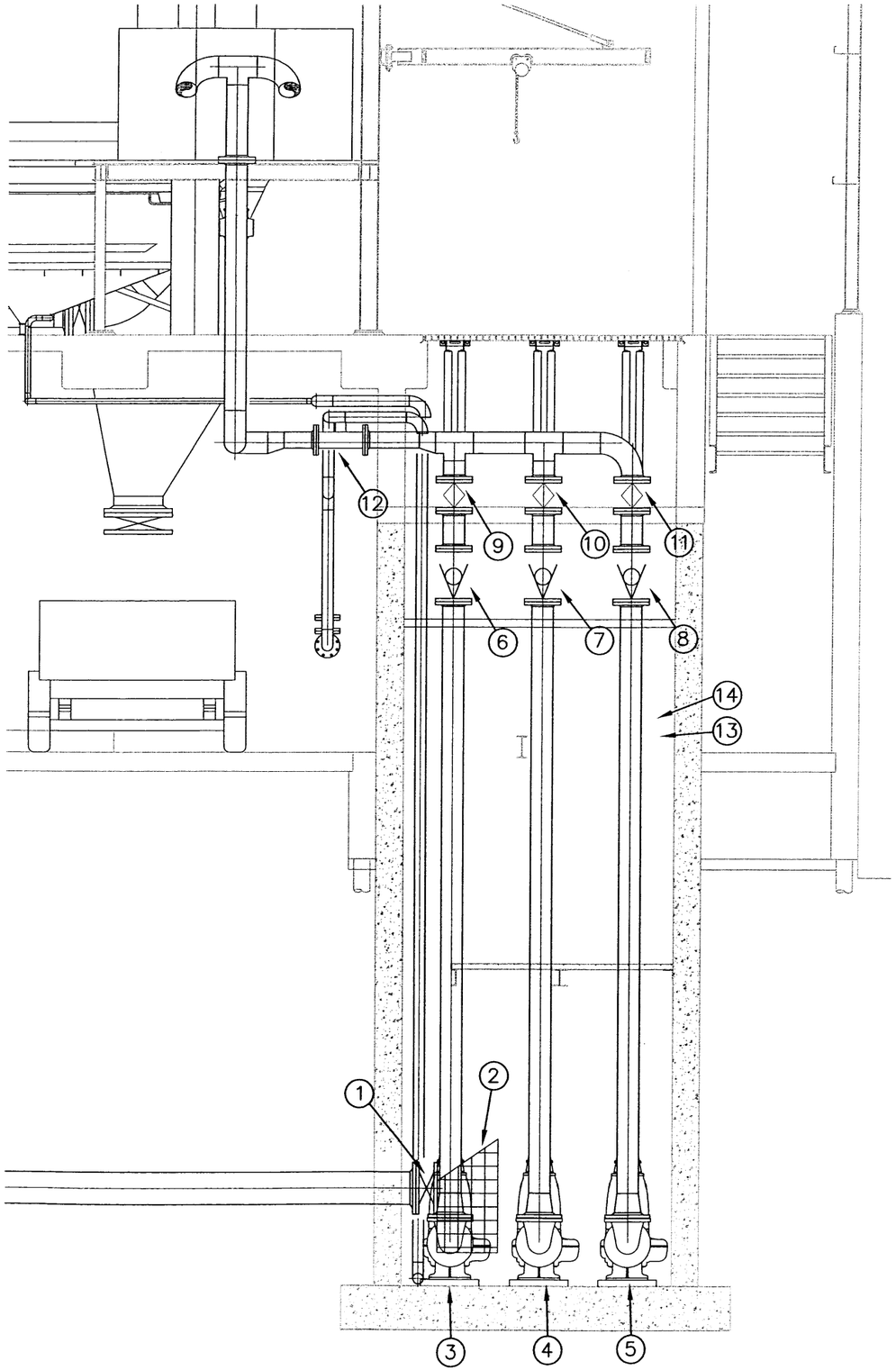
Headworks Service Flow Schematic

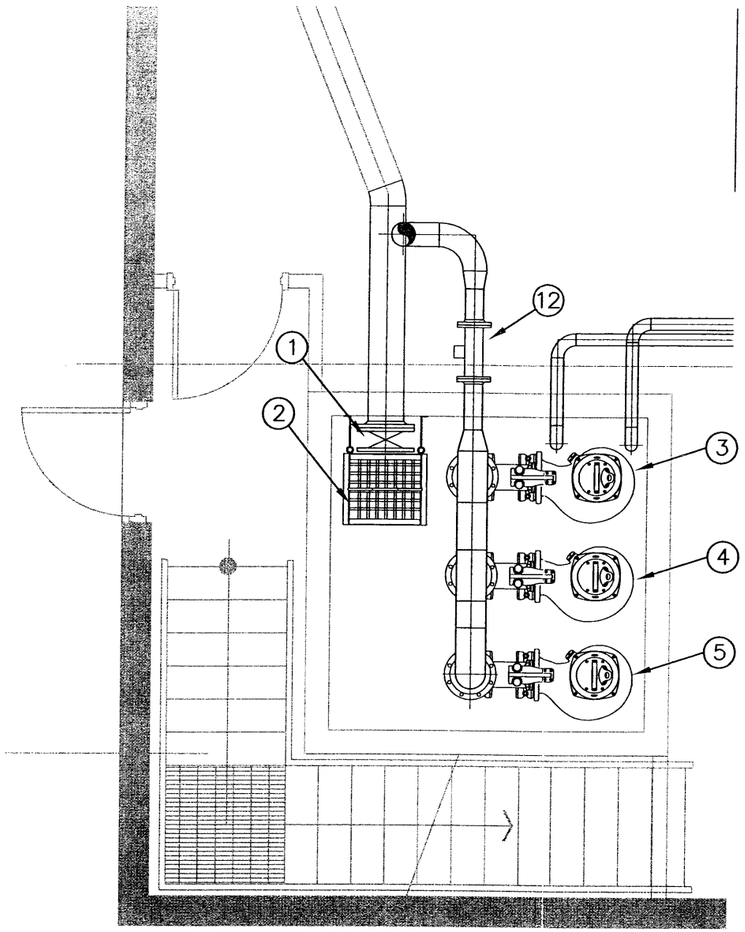
No.	Component	Location	Function Performed	Remarks
8	Isolation/Mixing Valve	Screw Screens	Isolates Cold FEW for Screw 1 Lower Nozzles and Spray Bar	
9	Motorized Control Valve	Screw Screens	Controls FEW Flow to Screw 1 Lower Nozzles and Spray Bar	
10	Isolation Valve	Screw Screens	Isolates Hot FEW for Screw 2 Lower Nozzles and Spray Bar	
11	Isolation Valve	Screw Screens	Isolates Cold FEW for Screw 2 Lower Nozzles and Spray Bar	
12	Motorized Control Valve	Screw Screens	Controls FEW Flow to Screw 2 Lower Nozzles and Spray Bar	
13	Isolation Valve	Screw Screens	Controls Hot Few to Screw 1 Upper Nozzles	
14	Isolation Valve	Screw Screens	Controls Cold Few to Screw 1 Upper Nozzles	
15	Isolation Valve	Screw Screens	Controls Hot Few to Screw 2 Upper Nozzles	
16	Isolation Valve	Screw Screens	Controls Cold Few to Screw 2 Upper Nozzles	
17	Isolation Valve	Hot FEW Piping to Primary Filter	Isolates Hot FEW Solenoid Valve for maintenance	
18	Temperature Indicator	Hot FEW Piping to Primary Filter	Measures Hot FEW Temperature	
19	Pressure Indicator	Hot FEW Piping to Primary Filter	Measures Hot FEW Pressure	
20	Y-Strainer	Hot FEW Piping to Primary Filter	Protects downstream equipment	
21	Solenoid Valve	Hot FEW Piping to Primary Filter	Controls Hot Water Wash	

Headworks Service Flow Schematic

No.	Component	Location	Function Performed	Remarks
22	Isolation Valve	Cold FEW Piping to Primary Filter	Isolates Cold FEW Solenoid Valve for maintenance	
23	Y-Strainer	Cold FEW Piping to Primary Filter	Protects downstream equipment	
24	Solenoid Valve	Cold FEW Piping to Primary Filter	Controls Cold Water Flush	
25	Solenoid Valve	Cold FEW Piping to Primary Filter	Controls Pinch Valve	
26	Hose Bib	Basement	Supplies Cold FEW for Plant Washdown	
27	Compressed Air Station	Basement	Supplies Compressed Air for Maintenance	

END OF CHAPTER 4

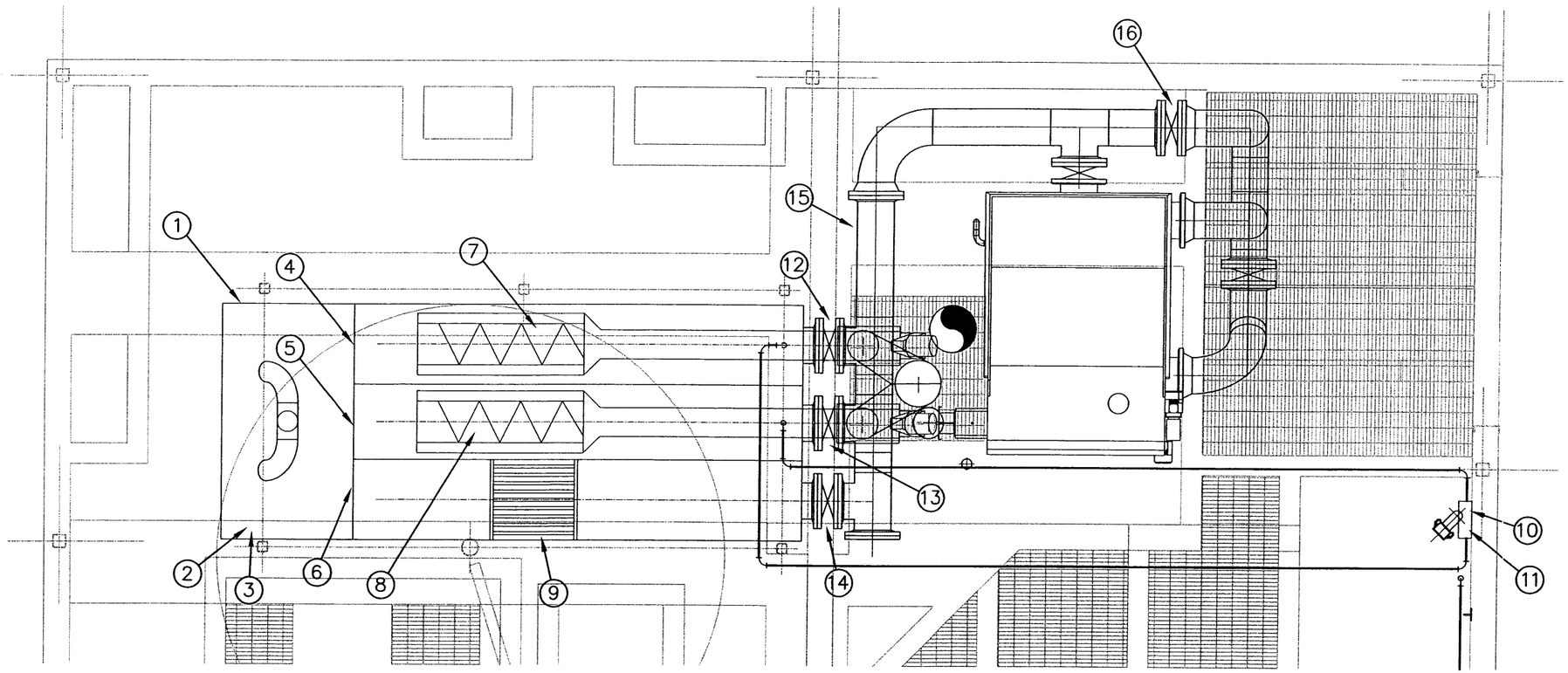




RAW WASTE WATER FLOW COMPONENTS

SCALE: N.T.S.

Iqaluit	DRAWING	EARTH TECH
	P–1	Earth Tech (Canada) Inc. Edmonton, AB 780-488-6800 Yellowknife, NWT 867-873-6316



SCREENED WASTE WATER FLOW COMPONENTS

SCALE: N.T.S.

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DRAWING

P-2

EARTH TECH

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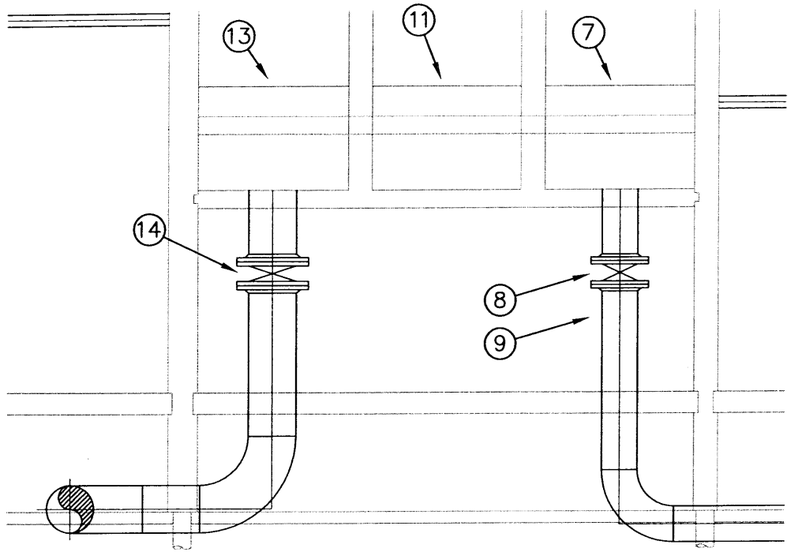

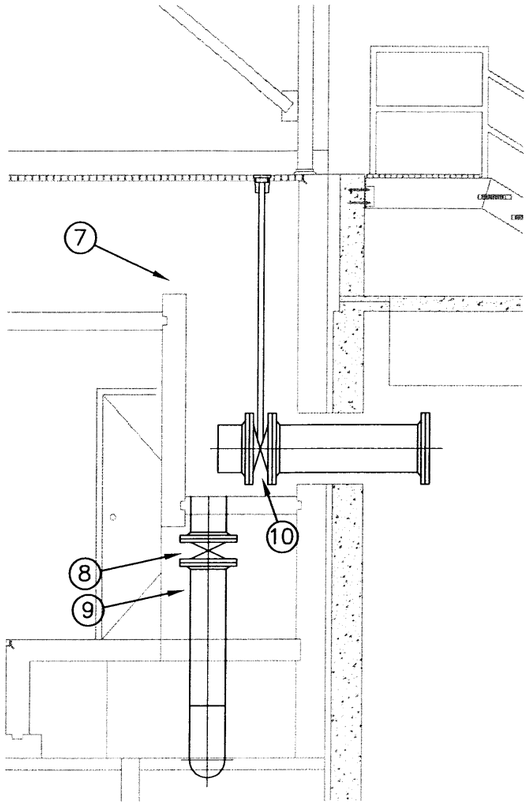

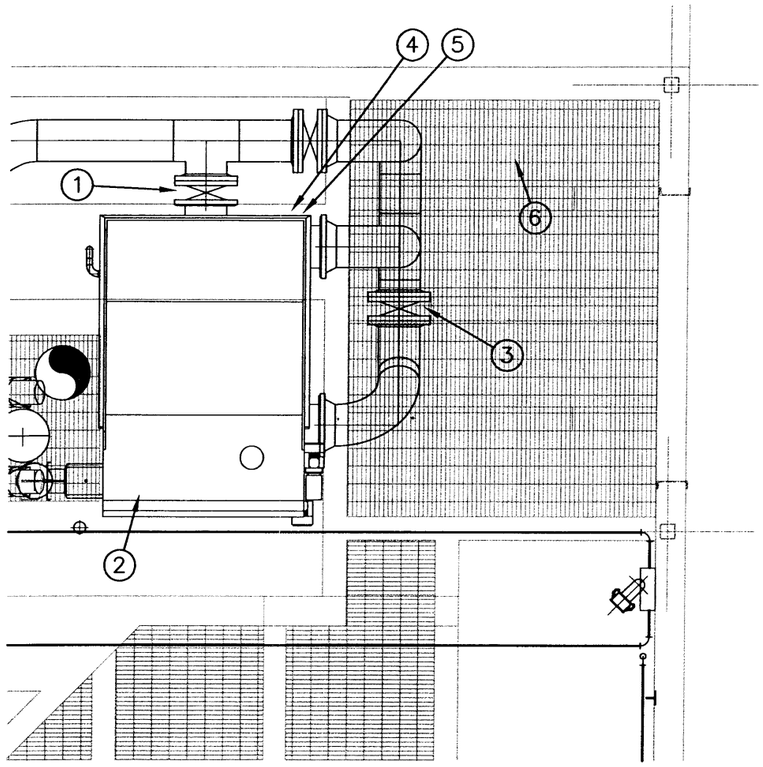

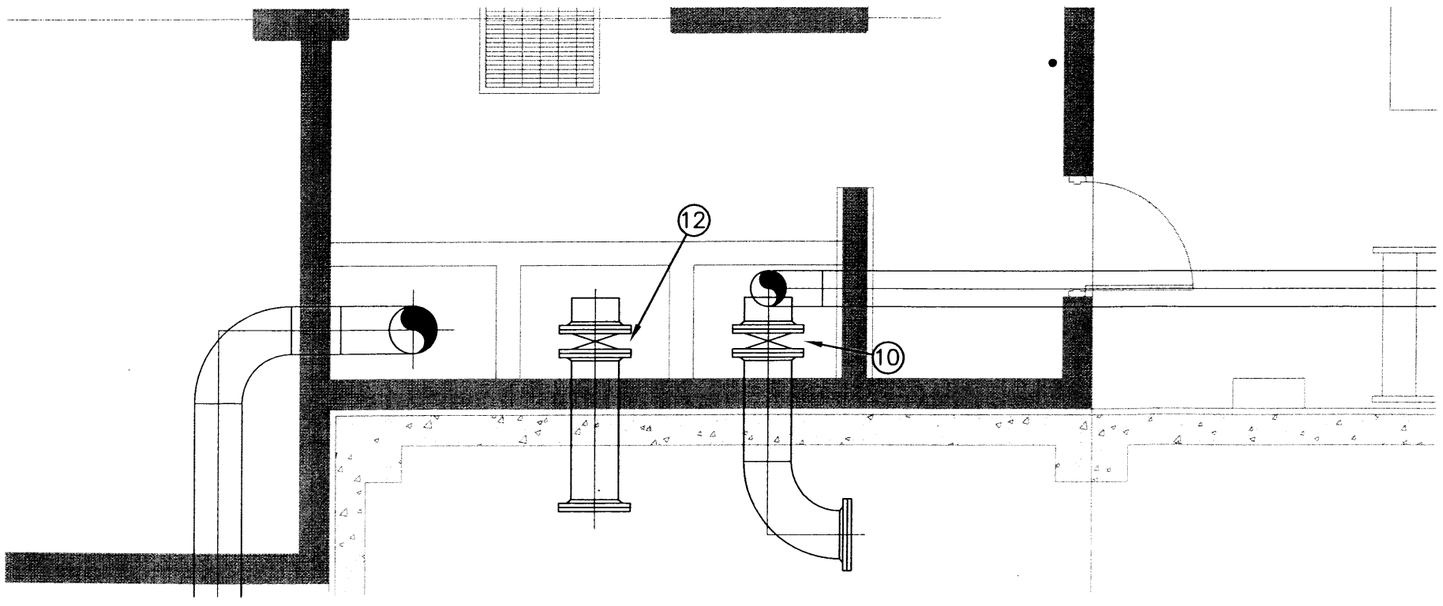

PRIMARY FILTERED WASTE WATER FLOW COMPONENTS

SCALE: N.T.S.

Iqaluit	DRAWING	EARTH TECH
	P–3	Earth Tech (Canada) Inc. Edmonton, AB 780-488-6800 Yellowknife, NWT 867-873-6316

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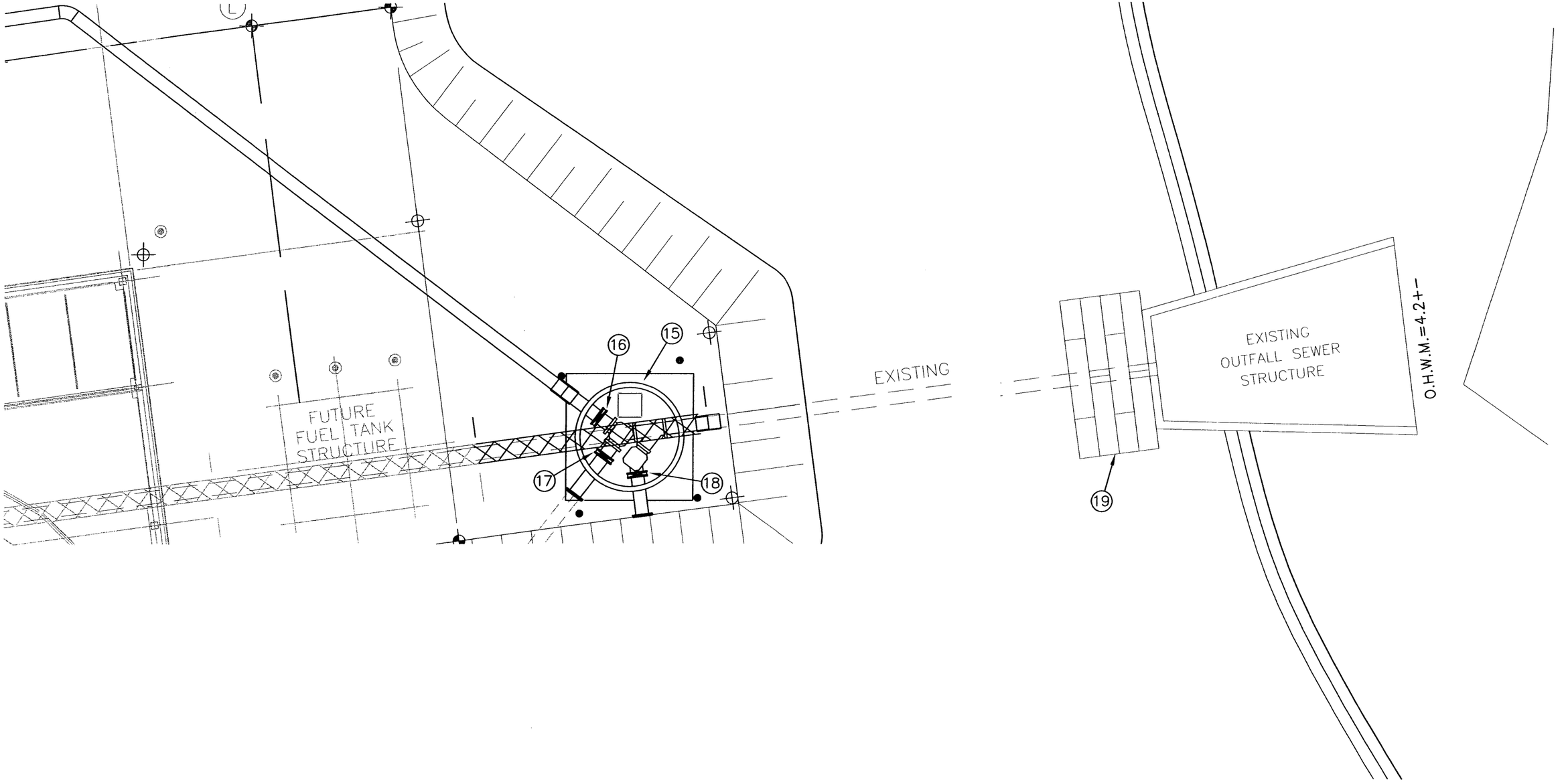

PRIMARY FILTERED WASTE WATER FLOW COMPONENTS

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Iqaluit	DRAWING	EARTH TECH
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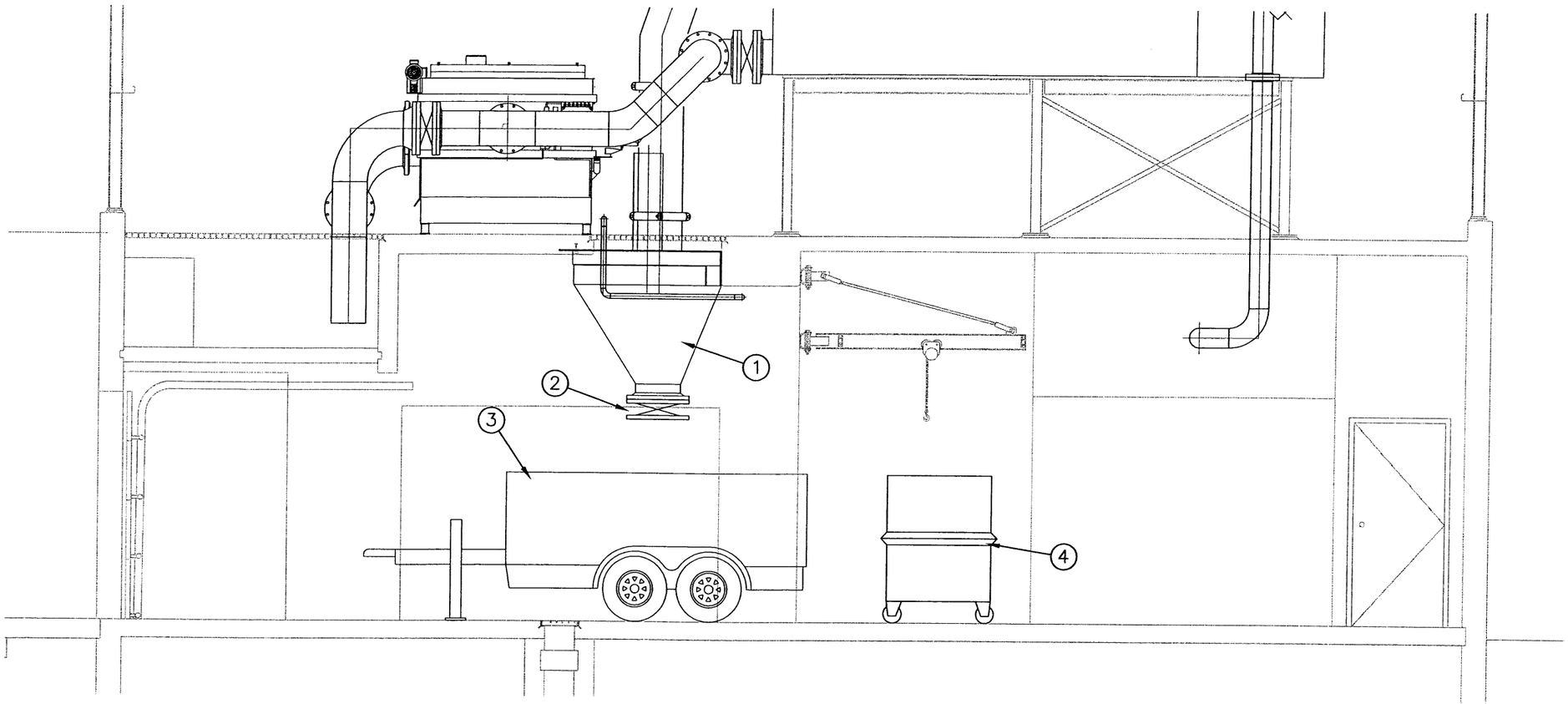

SLUDGE FLOW COMPONENTS

SCALE: N.T.S.

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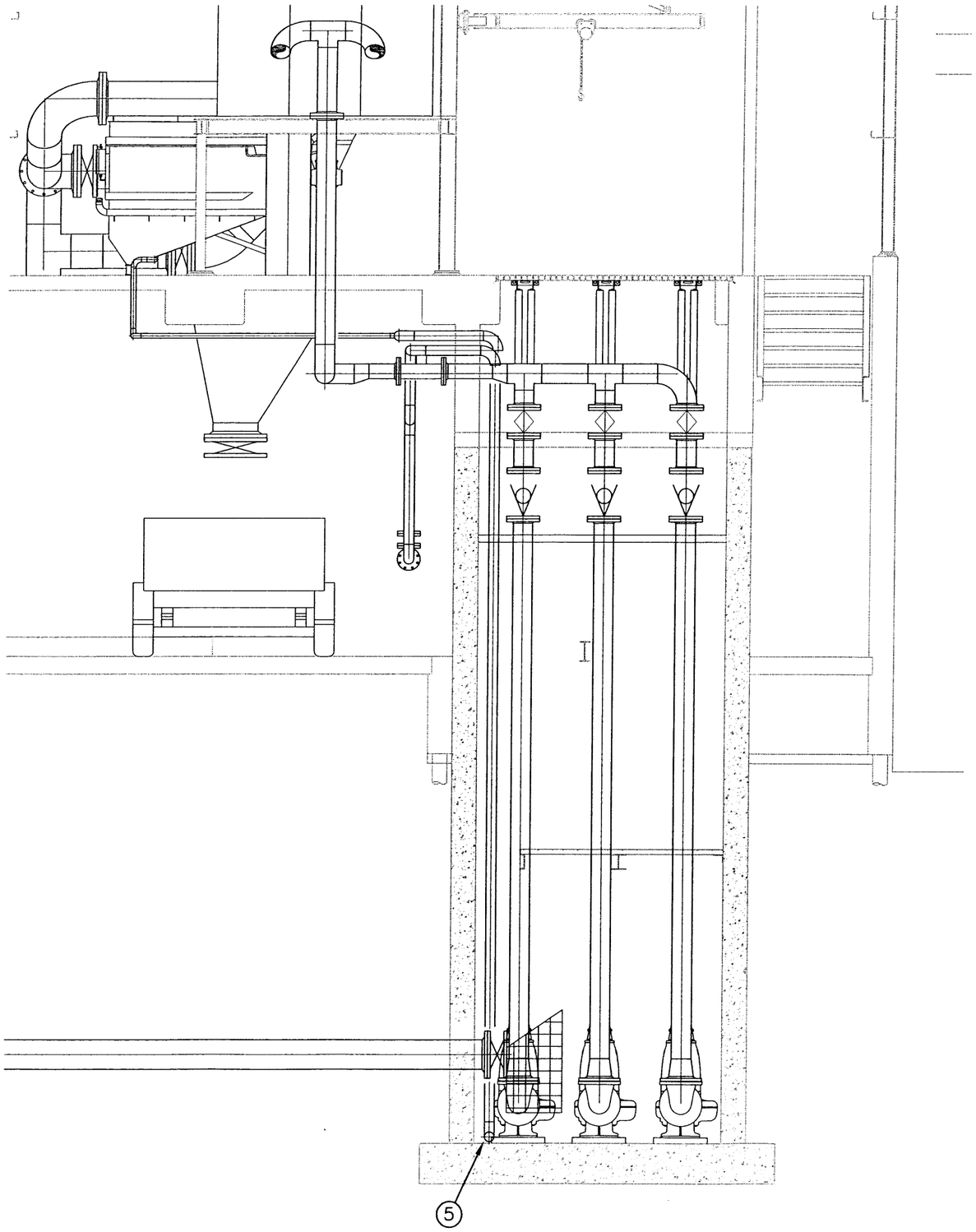

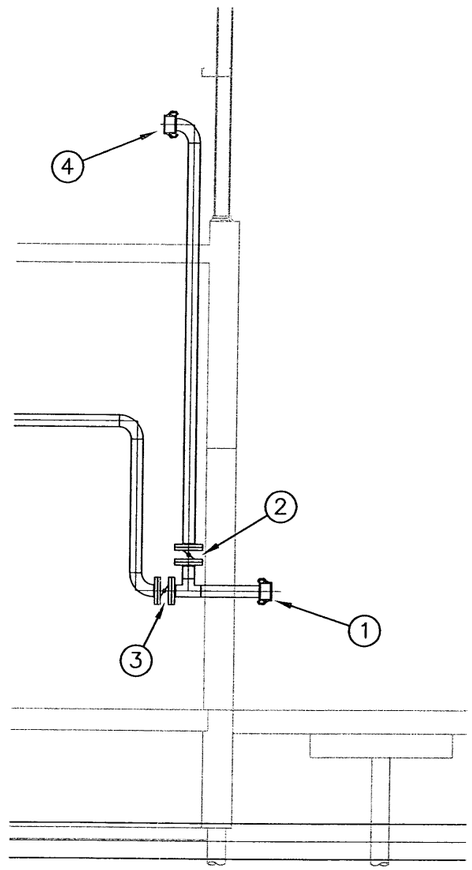

VACUUM FLOW COMPONENTS

SCALE: N.T.S.

Iqaluit

DRAWING

P-6

EARTH TECH

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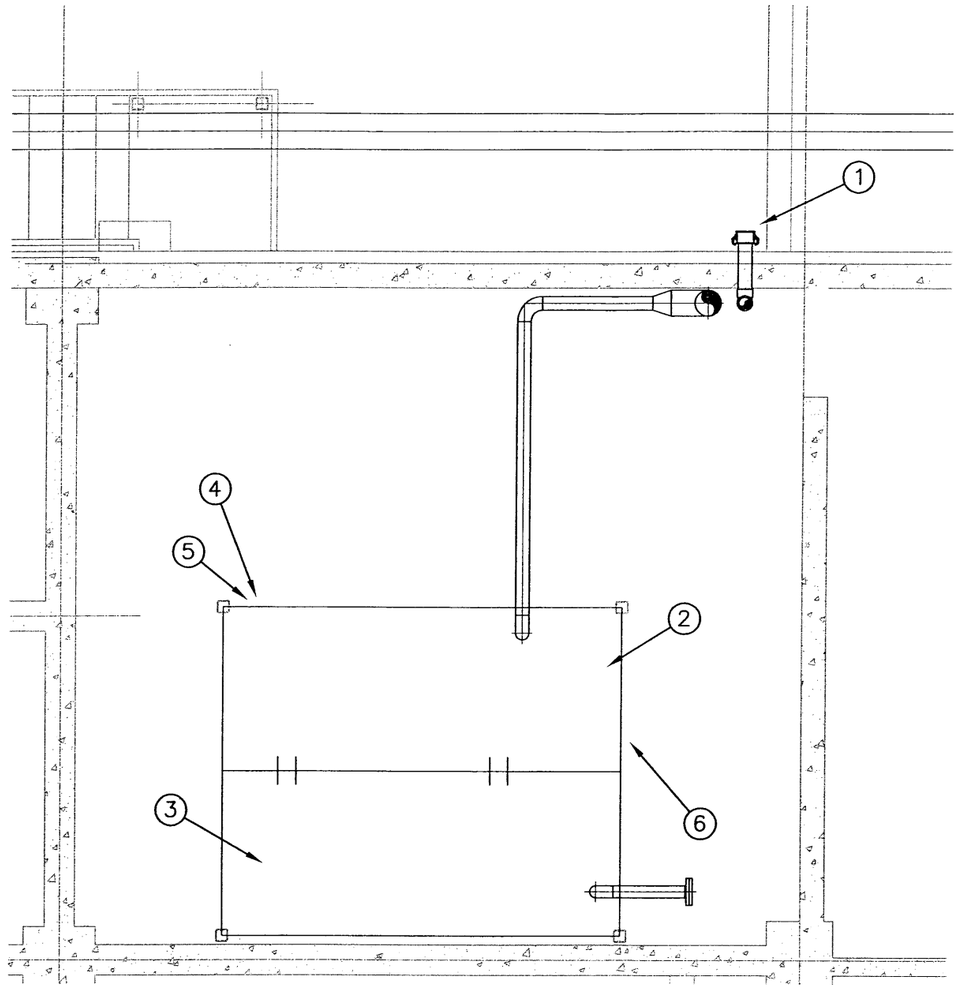


FILTERED EFFLUENT WATER FLOW COMPONENTS

SCALE: N.T.S.

Iqaluit	DRAWING	EARTH TECH
ᐃᖃᓗᐃᑦ	P-7	Earth Tech (Canada) Inc. Edmonton, AB 780-488-6800 Yellowknife, NWT 867-873-6316

Chapter 5

COMPONENT DETAILS

5.1 General Overview

The following tables describe the components of the various systems and provide some basic details and settings. For each table there are drawings that can be referenced to better understand in what part of the Wastewater Treatment Plant the components are located.

5.2 Raw Wastewater Flow (Refer to Drawings P-1 at the end of Chapter 4)

The following table identifies the components related to the flow of wastewater from the influent pump well to the coarse screens.

Raw Wastewater Flow

No.	Component	Details	Setting	Remarks
1	Intake Valve (V101)	Orbinox Series 20 Knifegate with a non-rising stem		
2	Basket Screen (BSCR101)			
3	RWW Pump (P-102)	Flygt NP3153 MT submersible pump		Supplier: Flygt
4	RWW Pump (P-103)	Flygt NP3153 MT submersible pump		Supplier: Flygt
5	RWW Pump (P-104)	Flygt NP3153 MT submersible pump		Supplier: Flygt
6	Ball Check Valve (V-102)	HDL Ball check		Supplier: Flygt
7	Ball Check Valve (V-104)	HDL Ball check		Supplier: Flygt
8	Ball Check Valve (V-106)	HDL Ball check		Supplier: Flygt

Raw Wastewater Flow

No.	Component	Details	Setting	Remarks
9	Isolation Valve (V-103)	Dezurik Eccentric Plug Valve		Supplier: Provan Control Assoc.
10	Isolation Valve (V-105)	Dezurik Eccentric Plug Valve		Supplier: Provan Control Assoc.
11	Isolation Valve (V-107)	Dezurik Eccentric Plug Valve		Supplier: Provan Control Assoc.
12	Flow Meter (FIT-101)	Yokogawa AXF Magnetic Flow meter		
13	Level Indicating Transmitter (LIT-101)	Multi-Ranger		
14	Level Switch (LSHH-104)	Magnetrol Echotel 910		

5.3 Screened Wastewater Flow (Refer to Drawings P-2 at the end of Chapter 4)

The following table identifies the components related to the flow of wastewater from the Coarse Screens to the Primary Filter.

Screened Wastewater Flow

No.	Component	Details	Setting	Remarks
1	Coarse Screens tankage	Stainless Steel custom built tanks		
2	Level Indicating Transmitter (LIT-102)	Multi-Ranger with XPS-10/15 F series transducer		
3	Level Switch (LSHH-103)	Magnetrol Echotel 910		
4	Isolation Gate (SG-101)	Custom built stainless steel slides		
5	Isolation Gate (SG-102)	Custom built stainless steel slides		

Screened Wastewater Flow

No.	Component	Details	Setting	Remarks
6	Isolation Gate (SG-103)	Custom built stainless steel slides		
7	Screw Screen (SSCR-105)	SCS-50 Screw Screen with 3mm perforated plate	77 l/s	Supplier: ProAqua Engineering
8	Screw Screen (SSCR-106)	SCS-50 Screw Screen with 5mm perforated plate	77 l/s	Supplier: ProAqua Engineering
9	Manual Bar Screen (MSCR-107)			
10	Motorized Valve (SV-105)	Belimo LF 24 US		
11	Motorized Valve (SV-106)	Belimo LF 24 US		
12	Isolation Valve (V-108)	Orbinox Series 10 Knifegate		
13	Isolation Valve (V-109)	Orbinox Series 10 Knifegate		
14	Isolation Valve (V-110)	Orbinox Series 10 Knifegate		
15	Isolation Valve (V-122)	Appollo Ball Valve		
16	Isolation Valve (V-112)	Appollo Ball Valve		
17	Isolation Valve (V-111)	Orbinox Series 10 Knifegate for Primary Filter isolation		

5.4 Primary Filtered Wastewater Flow (Refer to Drawing P-3 and P-4 at the end of Chapter 4)

The following table identifies the components related to the flow of Primary Filtered Wastewater.

Primary Filtered Wastewater Flow

No.	Component	Details	Setting	Remarks
1	Isolation Valve (V-111)	Orbinox Series 10 Knifegate for Primary Filter isolation		
2	Primary Filter (PFT-108)	Salsnes SF6000		Supplier: Aquapure
3	Isolation Valve (V-113)	Orbinox Series 10 Knifegate for Primary Filter isolation		
4	Isolation Valve (V-120)	Burkert 5282 A1		Solenoid Valve
5	Isolation Valve (V-121)	Burkert5282 A1		Solenoid Valve
6	Primary Effluent Channel	Concrete with underflow and overflow baffles for floatable containment		
7	Weir (W-101)	Flow adjustment		
8	Isolation Valve (V-115)	Orbinox Series 10 Knifegate		
9	Isolation Valve (V-123)	Burkert 0330		Solenoid Valve
10	Isolation Valve (V-201)	Orbinox Series 20 Knifegate with a non-rising stem		
11	Weir (W-102)	Flow adjustment		
12	Isolation Valve (V-202)	Orbinox Series 20 Knifegate with a non-rising stem		
13	Weir (W-103)	Flow adjustment		

Primary Filtered Wastewater Flow

No.	Component	Details	Setting	Remarks
14	Isolation Valve (V-203)	Orbinox Series 20 Knifegate with a non-rising stem		
15	Valve Chamber	Access Vault on outfall piping		Supplier: Berlie-Falco
16	Isolation Valve (V-117)	Orbinox Series 10 Knifegate		
17	Isolation Valve (V-302)	Orbinox Series 10 Knifegate		
18	Isolation Valve (V-301)	Orbinox Series 10 Knifegate		
19	Ocean Outfall			

5.5 Sludge Flow (Refer to Drawing P-5 at the end of Chapter 4)

The following table identifies the components related to the flow of Sludge.

Sludge Flow

No.	Component	Details	Setting	Remarks
1	Screenings Hopper (HOP-111)	Custom steel hopper c/w epoxy coating & high abrasion resistant coating on the interior		
2	Isolation Valve (V-116)	Orbinox Series 10 Knifegate		Air Operated Cylinder
3	Dump Trailer (TRL-109)	Puma 10000 with hydraulic dump and cover		
4	Screenings Bin (BIN-110)	Steel bin with wheels		

5.6 Vacuum Flow
(Refer to Drawing P-6 at the end of Chapter 4)

The following table identifies the components related to the Vacuum flow of wastewater from either the Primary Effluent Channel or the Pump Well.

No.	Component	Details	Setting	Remarks
1	Exterior Cam Lock Connection	For connection to a sewage truck	3"	
2	Isolation Valve (V-119)	Plug valve		
3	Isolation Valve (V-118)	Plug valve		
4	Cam Lock Connection	Connection to clean the primary effluent channel	3"	
5	Cam Lock Connection	Connection to clean the wetwell	3"	

5.7 Filtered Effluent Water Storage
(Refer to Drawing P-7 at the end of Chapter 4)

The following table identifies the components related to the flow of filtered effluent water, until Phase 2 is in place potable water will be used.

No.	Component	Details	Setting	Remarks
1	Exterior Cam Lock Connection	For a connection to a Water Truck	3"	
2	FEW storage tank (T-505)	Stainless Steel Tank		
3	FEW storage tank (T-506)	Stainless Steel Tank		
4	Isolation Valve	Ball Valve to isolate LIT-501		
5	Level Indicating Transmitter (LIT-501)	Yokogawa Pressure transmitter Model EJA530A		
6	Outlet Piping to Mechanical			

5.8 Hydronic (Glycol) Heating Flow Schematic (Refer to Drawing M-1 at the end of Chapter 4)

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Details	Setting	Remarks
1	Boiler B-01			
2	Boiler B-02			
3	Isolation Valve			
4	Isolation Valve			
5	Fusible Link Valve			
6	Isolation Valve			
7	Fusible Link Valve			
8	Isolation Valve			
9	MAV – Manual Air Vent & Isolation Valve			
10	Isolation Valve			
11	MAV – Manual Air Vent & Isolation Valve			
12	Boiler B-01 Heating Recirculation Pump P-01			
13	Isolation Valve			
14	Boiler B-01 Heating Recirculation Pump P-02			
15	Isolation Valve			
16	FS – Flow Switch			
17	TS – Temperature Controller/Sensor			

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Details	Setting	Remarks
18	T/PI – Temperature/ Pressure Indicator			
19	Air Separator & Automatic Air Vent (AAV)			
20	Isolation Valve			
21	Expansion Tank TK-1			
22	Air Separator/ Expansion Tank Drain Valve			
23	Heating Pump P-03			
24	TI – Temperature Indicator			
25	Strainer			
26	Isolation Valve			
27	Check Valve			
28	Isolation Valve			
29	Bypass/Isolation Valve			
30	Unit Heaters Supply Distribution Header & Isolation Valves			
31	Automatic Air Vent Isolation Valve			
32	AAV – Automatic Air Vent			
33	Unit Heaters Return Distribution Header & Isolation Valves			

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Details	Setting	Remarks
34	Automatic Air Vent Isolation Valve			
35	AAV – Automatic Air Vent			
36	Heating Pump P-04			
37	TI – Temperature Indicator			
38	Strainer			
39	Isolation Valve			
40	Isolation Valve			
41	Check Valve			
42	Isolation Valve			
43	Bypass/Isolation Valve			
44	TI – Temperature Indicator			
45	Automatic Air Vent Isolation Valve			
46	AAV – Automatic Air Vent			
47	Automatic Air Vent Isolation Valve			
48	AAV – Automatic Air Vent			
49	TI – Temperature Indicator			
50	Isolation Valve			
51	Isolation Valve			

Hydronic (Glycol) Heating Flow Schematic

No.	Component	Details	Setting	Remarks
52	Glycol Storage Tank			
53	Glycol Fill Charge Pump P-05			
54	Isolation Valve			
55	Pressure Reducing Valve			
56	Strainer			
57	Check Valve			
58	Isolation Valve			
59	T/PI – Temperature/ Pressure Indicator			

5.9 Typical Unit Heater & Force Flow Heater Flow Schematic (Refer to Drawing M-1 at the end of Chapter 4)

Typical Unit Heater & Force Flow Heater Flow Schematic

No.	Component	Details	Setting	Remarks
1	Unit Heater			
2	T – Thermostat (Room)			
3	Manual Air Vent			
4	Drain Valve			
5	Well			
6	Isolation Valve			
7	Well			
8	Isolation/Balancing Valve			

5.10 Typ. Air Handling Unit Preheat/Heating Coil Flow Schematic (Refer to Drawing M-3 at the end of Chapter 4)

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Details	Setting	Remarks
1	Preheat & Heating Coils			
2	Temperature Control Valve (3-way)			
3	Duct Mounted Thermostat			
4	Isolation Valve			
5	Isolation Valve			
6	Isolation Valve			
7	Isolation Valve			

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Details	Setting	Remarks
8	Well			
9	Isolation Valve			
10	Isolation Valve			
11	Balancing/Isolation Valve			
12	Well			
13	Balancing/Isolation Valve			

5.11 Air Handling Unit AHU-03 Flow Schematic (Refer to Drawing M-4 at the end of Chapter 4)

Air Handling Unit AHU-03 Flow Schematic

No.	Component	Details	Setting	Remarks
1	Air Handling Unit AHU-03			
2	2-Speed Supply Fan			
3	TC – Temperature Controller			
4	TLA – Temperature Low Alarm Sensor			
5	Heating Coil			
6	2-Speed Exhaust Fan			
7	Plate Heat Exchanger			
8	By-Pass Dampers			
9	By-Pass Dampers			
10	30% Filter			

Air Handling Unit AHU-03 Flow Schematic

No.	Component	Details	Setting	Remarks
11	TLCL – Temperature Low Control Limit			
12	TT – Temperature Transmitter			
13	PD – Pressure Differential Indicator			
14	Intake Hood			
15	Outside Air Damper Motor & Outside Air Dampers			
16	Exhaust Hood			
17	Exhaust Air Damper Motor & Exhaust Air Dampers			

5.12 Domestic Water Flow Schematic (Refer to Drawing M-5 at the end of Chapter 4)

Domestic Water Flow Schematic

No.	Component	Details	Setting	Remarks
1	Domestic Water Storage Tank			
2	LAL – Level Alarm Low			
3	LALL – Level Alarm Low Low			
4	Isolation Valve			
5	Pressure Pump P-06			
6	Isolation Valve			
7	PS – Pressure Switch			

Domestic Water Flow Schematic

No.	Component	Details	Setting	Remarks
8	PI – Pressure Indicator			
9	Pressure/Expansion Tank			
10	Isolation Valve			
11	Isolation Valve			
12	Isolation Valve			
13	Domestic Water Heater DWH-1			
14	Pressure Relief Valve			

5.13 FEW Water Flow Schematic (Refer to Drawing M-6 at the end of this section)

FEW Water Flow Schematic

No.	Component	Details	Setting	Remarks
1	Exterior Cam Lock Connection			
2	FEW Tanks			
3	Isolation Valve			
4	Isolation Valve			
5	Y-Strainer			
6	FEW Pump 1			
7	PI - Pressure Gauge			
8	Check Valve			
9	Isolation Valve			

FEW Water Flow Schematic

No.	Component	Details	Setting	Remarks
10	Isolation Valve			
11	Y-Strainer			
12	PI - Pressure Gauge			
13	FEW Pump 2			
14	PI - Pressure Gauge			
15	Check Valve			
16	Isolation Valve			
17	Isolation Valve			
18	Y-Strainer			
19	FEW Pump 3			
20	PI - Pressure Gauge			
21	Check Valve			
22	Isolation Valve			
23	Pressure Relief Valve			
24	Hose Bib			
25	Pressure Switch			
26	Pressure Switch			
27	Pressure/Expansion Tank			
28	Solenoid Valve			
29	Isolation Valve			
30	FEW Filter			

FEW Water Flow Schematic

No.	Component	Details	Setting	Remarks
31	Motorized Valve			
32	Isolation Valve			
33	Isolation Valve			
34	Isolation Valve			
35	Isolation Valve			
36	Y-Strainer			
37	P-21			
38	TI - Temperature Indicator			
39	Check Valve			
40	Isolation Valve			
41	Heat Exchanger			
42	Check Valve			
43	Control Valve			
44	Isolation Valve			
45	Control Valve			
46	FEW Tank 1A			
47	Drain Valve			
48	Pressure/Temperature Safety Valve			
49	Air/Vacuum Relief Valve			
50	TI - Temperature Indicator			

FEW Water Flow Schematic

No.	Component	Details	Setting	Remarks
51	Isolation Valve			
52	Isolation Valve			
53	Control Valve			
54	FEW Tank 1B			
55	Drain Valve			
56	Pressure/Temperature Safety Valve			
57	Air/Vacuum Relief Valve			
58	TI - Temperature Indicator			
59	Isolation Valve			
60	Isolation Valve			
61	Control Valve			
62	FEW Tank 1C			
63	Drain Valve			
64	Pressure/Temperature Safety Valve			
65	Air/Vacuum Relief Valve			
66	TI - Temperature Indicator			
67	Isolation Valve			
68	Isolation Valve			
69	Y-Strainer			
70	P-20			

FEW Water Flow Schematic

No.	Component	Details	Setting	Remarks
71	Check Valve			
72	Isolation Valve			
73	Isolation Valve			
74	Pressure Gauge			
75	Drain Valve			
76	TK-3			
77	Isolation Valve			
78	FEW Booster FEWH1			
79	Drain Valve			
80	Pressure/Temperature Safety Valve			
81	TI - Temperature Gauge			
82	PI - Pressure Gauge			
83	TS - Temperature Switch			
84	FS - Flow Switch			
85	Isolation Valve			
86	PS - Pressure Switch			
87	Bypass Valve			
88	PSV			

5.14 Headworks Service Piping Flow Schematic (Refer to Drawing M-7 at the end of this section)

Headworks Service Flow Schematic

No.	Component	Details	Setting	Remarks
1	Hose Bib			
2	Hose Bib			
3	Compressed Air Station			
4	Hose Bib			
5	Isolation Valve			
6	Isolation Valve			
7	Isolation/Mixing Valve			
8	Isolation/Mixing Valve			
9	Motorized Control Valve			
10	Isolation Valve			
11	Isolation Valve			
12	Motorized Control Valve			
13	Isolation Valve			
14	Isolation Valve			
15	Isolation Valve			
16	Isolation Valve			
17	Isolation Valve			
18	Temperature Indicator			
19	Pressure Indicator			

Headworks Service Flow Schematic

No.	Component	Details	Setting	Remarks
20	Y-Strainer			
21	Solenoid Valve			
22	Isolation Valve			
23	Y-Strainer			
24	Solenoid Valve			
25	Solenoid Valve			
26	Hose Bib			
27	Compressed Air Station			

END OF CHAPTER 5

Chapter 6

OPERATING PROCEDURES

6.1 General

The operations portion of this manual should be read in conjunction with Chapter 6 of the Electrical & Instrumentation and Mechanical Operations and Maintenance Manuals. The operating procedures described in this section will relate to the WWTP Process and Mechanical systems.

6.2 Wastewater Treatment Process Controls System

The WWTP operates on a continuous basis and in automatic mode. When the plant is called to start and all equipment is in automatic mode, the Main PLC controls and operates the plant. Various conditions of alarms will be detected and reported to the main PLC. Some will shut the plant equipment down and others will turn on back-up equipment. See the Electrical & Instrumentation Operations and Maintenance Manual for further information on the plant control system.

The following sections discuss both the normal automatic operation of the equipment, as well as manual operation through the HMI and manual operation in the field where this is possible.

6.3 Raw Wastewater Pumping

(Refer to Drawing P-1)

6.3.1 Normal Operation

Under normal operation, the Raw Wastewater (RWW) pumps, P-102, P-103, and P-104 operate in a lead/lag/standby configuration. The lead/lag pumps start and stop based on fixed level points in the wastewater lift station, detected by a level transmitter monitoring the RWW lift station fluid level. The RWW lift station level transmitter communicates the level of wastewater in the lift station to the PLC.

The PLC starts the lead RWW pump at a set level and then throttles the speed of the VFD for the lead pump, to maintain a level set point. When inlet flow exceeds the capacity of a single RWW pump the level will rise. When the level rises to the set level for the lag RWW pump start, the PLC will start the lag pump to maintain the new level set point (SP).

Under normal operation, when the inlet flow is less than the capacity of the lead and lag RWW pumps operating at minimum speed, the level in the lift station will fall. When the level falls to the lag pump stop set level, the PLC will stop the lag pump and then throttle the speed of the VFD for the lead pump alone to maintain the level SP.

Should the inlet flow further decrease to a volume where the lead pump alone, operating at minimum speed, is not able to maintain the level SP, the level will fall to the lead pump stop set level and the PLC will shut down the lead pump. At this inlet flow volume, the control system will wait for the level to rise to the lead pump start level and the above sequence will repeat.

The control system is configured to allow each of the RWW pumps, P-102, P-103, and P-104 to operate as the lead, lag, or standby pumps. In the event of a RWW pump failure the PLC will alarm the pump as failed on the HMI system, and assign the standby pump to operate in the failed pump's function, provided the standby pump is available. Should the standby pump not be operable, the PLC will generate a second alarm to indicate that only one RWW pump is operational and generate an auto dialer call.

The RWW supply to the plant is measured using the magnetic flow meter, FE/FIT-101, located on the discharge side of the RWW pumps on the 200 mm diameter forcemain feeding the screening process.

The pump controls are not rated for hazardous locations and are located on a control panel outside the Headworks Room. Each pump has an HOA Switch (HS-102A, 103A, 104A), a Speed Control Potentiometer (HS-102B, 103B, 104B), Speed Indicator (SI-102, 103, 104) and an ESD Switch (HS-102C, 103C, 104C) on this panel. The controls on the VFD Panel in MCC 2 are inactive.

On the wall above the pumps is a second ESD for each pump (HS-102D, 103D, 104D)

6.3.2 Controls

The Raw Sewage Pumps are controlled by the PLC. They are driven by VFDs located in MCC 2. HOA, Local speed control and indication are provided at a local control panel located in the hallway outside the Headworks Room. ESD Switches are provided on the LCP as well as in the headworks room, adjacent to the pumps. The HMI has controls as described in Section 6.3.8 below.

6.3.3 Normal Valve and Switch Positions

Tag	Description	Position
V-102	Raw Sewage Pump 1 Discharge Valve	Open
HS-102A	Raw Sewage Pump 1 HOA Switch at LCP	AUTO
HS-102B	Raw Sewage Pump 1 Speed Pot at LCP	N/A
HS-102C	Raw Sewage Pump 1 ESD Switch at LCP	Inactive (Out)
HS-102D	Raw Sewage Pump 1 Local ESD Switch	Inactive (Out)
V-103	Raw Sewage Pump 2 Discharge Valve	Open
HS-103A	Raw Sewage Pump 2 HOA Switch at LCP	AUTO
HS-103B	Raw Sewage Pump 2 Speed Pot at LCP	N/A
HS-103C	Raw Sewage Pump 2 ESD Switch at LCP	Inactive (Out)
HS-103D	Raw Sewage Pump 2 Local ESD Switch	Inactive (Out)
V-104	Raw Sewage Pump 3 Discharge Valve	Open
HS-104A	Raw Sewage Pump 3 HOA Switch at LCP	AUTO
HS-104B	Raw Sewage Pump 3 Speed Pot at LCP	N/A
HS-104C	Raw Sewage Pump 3 ESD Switch at LCP	Inactive (Out)
HS-104D	Raw Sewage Pump 3 Local ESD Switch	Inactive (Out)

6.3.4 Manual Operation – HOA Switch in HAND

When the HOA Switch is in the HAND position, the pump will run, regardless of the level in the Wetwell. Speed of the pump is set by the speed control potentiometer on the same panel. Either ESD Switch will stop the pump.

When the HOA Switch is in OFF, the pump will not run.

6.3.5 Automatic Operation – HOA Switch in AUTO

When the HOA Switch is in AUTO and the HMI controls are in AUTO, the pumps are controlled by the PLC, based on level in the Wetwell. The operator selects Lead, Lag and Standby Duty for the pumps at the HMI.

Details of the control strategy and pump sequences are given in Section 6.4.2 of the Electrical & Instrumentation O&M Manual.

The pump will start when both of the ESD switches are inactive, the HOA Switch is in AUTO and the pump is called to run by the PLC.

The pump will shut down when stopped by the PLC, if either of the ESD switches is activated or if the HOA Switch is set to OFF.

6.3.6 Manual Operation – HOA Switch in AUTO

When the HOA Switch is in AUTO and the HMI controls are in HAND, the pumps are controlled by the PLC, but the operator selects the speed of the pump, using the slider control on the pump controller at the HMI. The pump runs as long as a speed of greater than 0 is selected.

6.3.7 HMI Screens and Alarm Indication

The operator interface for these pumps is on the **Lift Station** screen on the HMI.

The top left-hand corner shows the date and time, as well as the logged in operator. (1)

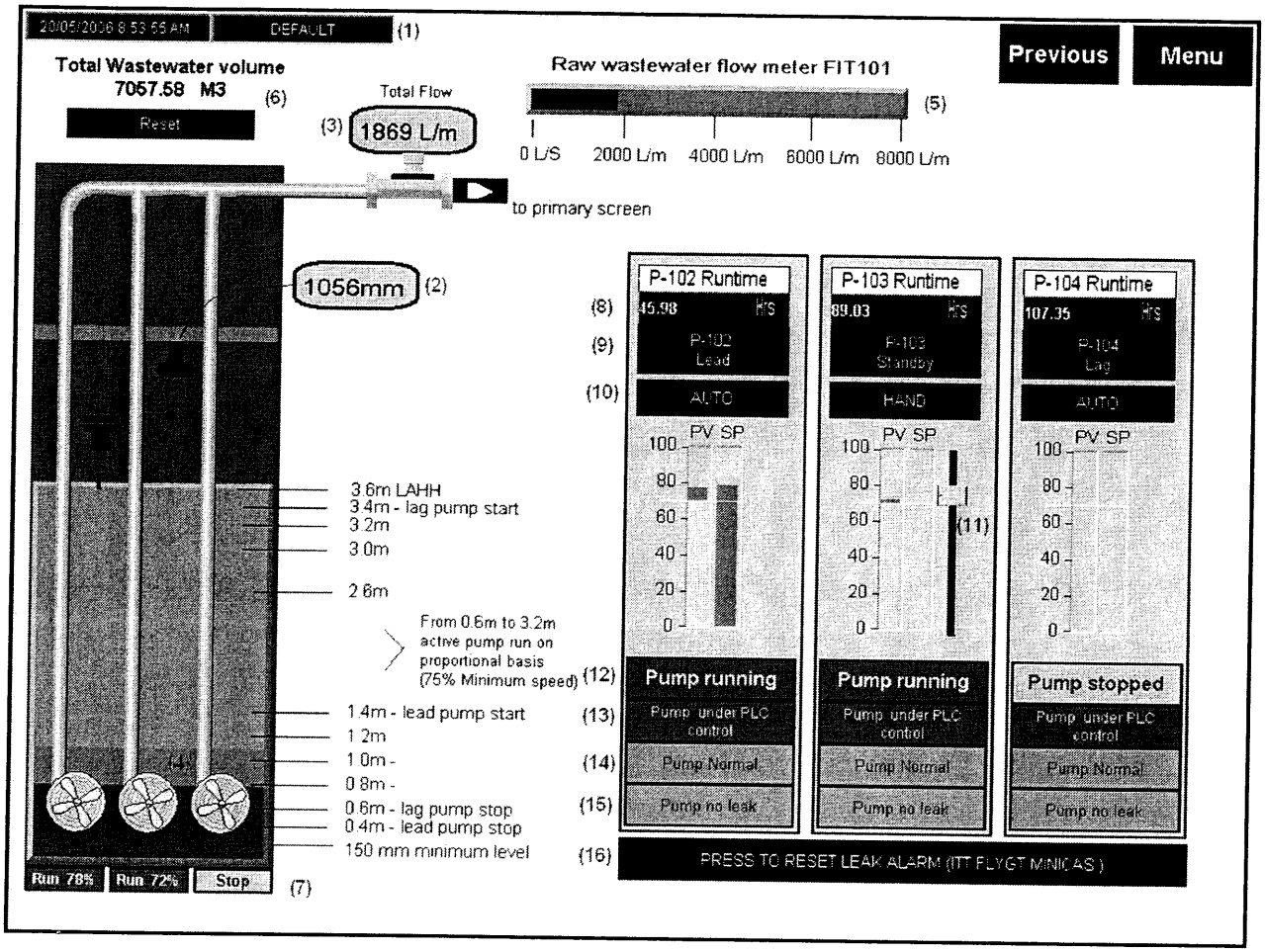
The graphic on the left shows the pumps and their run status. It also shows the present Wetwell level (2), as well as the present pumped flow rate (3). Wetwell level is shown graphically in green in the wetwell (4). Flow rate is also shown on a slider at the top (5). Flow is totalized in the top left-hand corner (6). This number is operator re-settable and will normally be reset on a daily basis after the previous day's total has been recorded. Pump Run Status and speed are shown beneath each pump (7).

A Pump Controller for each pump is shown. The controller indicates pump run status, speed set point and present value. Present value is shown in yellow below 70%, as the pumps do not start pumping until this speed is reached. Accumulated Pump Runtime is shown at the top of the individual controllers (8).

Lead, Lag and Standby Duty are operator selectable by clicking on the Duty button (9). Each click cycles the button to the next duty. The other pump duties are changed to ensure that two pumps are not called to perform the same duty.

HAND and AUTO modes can be selected by clicking on the Mode button (10). In HAND, a slider becomes visible and active on the selected controller (11). The speed of the pump is selected by moving the slider to the desired speed.

There are four information boxes at the bottom of the controller. The first indicates Run Status – either Running or Stopped (12). The second will indicate "Pump on Local Operation or E-Stop pressed" if either condition is present (13). The third box indicates a motor fault at the VFD (14). The fourth box will indicate the presence of a leak at the pump motor (15). A common Reset Button is located at the bottom of the controller, and is used to reset a Leak Alarm (16).



6.3.8 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
Lift station Pump 102 VFD in Fault	Local annunciation
Lift station Pump 102 Leak Alarm	Local annunciation
Lift station Pump 103 VFD in Fault	Local annunciation
Lift station Pump 102 Leak Alarm	Local annunciation
Lift station Pump 104 VFD in Fault	Local annunciation
Lift station Pump 102 Leak Alarm	Local annunciation
Lift Station High Level Alarm (more than 3600mm)	Local annunciation & Dialer callout
Lift Station Transmitter Failure (LIT101 Fail)	Local annunciation & Dialer callout
Lift Station Low Level Alarm (less than 300mm)	Local annunciation & Dialer callout
Lift Station Pump Failure (only one remaining)	Local annunciation & Dialer callout

6.4 Wastewater Treatment Screening Process

(Refer to Drawing P-2 & M7)

6.4.1 Normal Operation

During normal operation, the screening process is controlled through the Main PLC. Raw wastewater from the RWW pumps discharges into the screening channels upstream of the screw screens, SSCR-105 and SSCR-106. The screw screen drives start and stop based on pre-set levels as measured by the level transmitter, LIT-102, located in the upstream common channel at the inlet of the individual screening channels. When the common channel level reaches the high level set point (SP), both screen drives will operate. When the level falls to the low SP the screen drives will be stopped. Under normal equipment conditions the two screens will operate in parallel. However each screen can be isolated for service purposes.

The screw screen drives are also monitored by a timer. If the screw screens have not been operated within an operator adjustable time period (i.e. 1 hour), the screw screen drives will be called to start, and will operate for a period of 5 minutes. The screens are cleaned with a spray system. The water is provided by the Filtered Effluent Water (FEW) system; for phase one, this water is potable water from the FEW tank. This process is initiated simultaneously with operation of the screen drives and the duration is operator adjustable (i.e. 2 minutes). When screw screen SSCR-105 drive is operating, solenoid valve SV-105 will be energized to provide the required cleaning. When screw screen SSCR-106 drive is operating, solenoid valve SV-106 will be energized to provide the required cleaning.

The screenings are discharged to common hopper with the Primary Filter to a dump trailer (TRL-109) located below the screw screens on the first floor of the headwork's building.

6.4.2 Controls

There are three sets of controls for the Screw Screens. The MCC has an HOA Switch, Forward, Reverse and Stop pushbuttons. A second set of controls is located in pendants stations at the Screw Screens. These controls include an HOA Switch, a Forward/Reverse Switch, a Jog pushbutton and an E-Stop button. The HMI has controls as described in Section 6.4.8 below.

6.4.3 Normal Valve and Switch Positions

Tag	Description	Position
SG-101	Screw Screen 1 Inlet Gate	Open
HS-105A	Screw Screen 1 MCC HOA Switch	AUTO
HS-105B	Screw Screen 1 MCC FWD Pushbutton	N/A
HS-105C	Screw Screen 1 MCC REV Pushbutton	N/A
HS-105D	Screw Screen 1 Local STOP Pushbutton	N/a
HS-105E	Screw Screen 1 Local HOA Switch	AUTO
HS-105F	Screw Screen 1 Local FWD/REV	N/A
HS-105G	Screw Screen 1 Local Jog Pushbutton	N/A
HS-105H	Screw Screen 1 Local ESD Switch	Inactive (Out)
V-108	Screw Screen 1 Discharge Valve	Open
SG-102	Screw Screen 2 Inlet Gate	Open
HS-106A	Screw Screen 2 MCC HOA Switch	AUTO
HS-106B	Screw Screen 2 MCC FWD Pushbutton	N/A
HS-106C	Screw Screen 2 MCC REV Pushbutton	N/A
HS-106D	Screw Screen 2 Local STOP Pushbutton	N/a
HS-106E	Screw Screen 2 Local HOA Switch	AUTO
HS-106F	Screw Screen 2 Local FWD/REV	N/A
HS-106G	Screw Screen 2 Local Jog Pushbutton	N/A
HS-106H	Screw Screen 2 Local ESD Switch	Inactive (Out)
V-109	Screw Screen 2 Discharge Valve	Open
SG-103	Manual Screen Inlet Gate	Closed
V110	Manual Screen Discharge Valve	Open

6.4.4 Manual Operation – MCC HOA Switch

Control from the MCC HOA Switch is only possible if the HOA Switch at the Pendant Station is in AUTO and the ESD switch on the Pendant Station is not activated.

With the switch in HAND, push the Forward pushbutton to start the Screw Screen running in the forward direction. The unit will run in the forward direction until the Stop pushbutton is pressed or the HOA Switch is placed in the AUTO or OFF position.

With the switch in HAND, push the Reverse pushbutton to start the Screw Screen running in the reverse direction. The unit will run in the reverse direction until the Stop pushbutton is pressed or the HOA Switch is placed in the AUTO or OFF position. This operation mode should only be used to free a jam in the screw, but is not recommended. Freeing the screw is best done from the Local pendant station, where the screw can be observed.

The associated Wash Water valve will open while the screw is running, whether it is running in forward or reverse.

6.4.5 Manual Operation – Pendant Station HOA Switch

Regardless of the position of the HOA Switch at the MCC, the pendant station can be used to control the Screw Screen.

With the local HOA Switch in HAND and the Forward/Reverse switch in the Forward position, the screw will run forward while the Jog pushbutton is depressed. The screw will stop when the Jog pushbutton is released.

With the local HOA Switch in HAND and the Forward/Reverse switch in the Reverse position, the screw will run in reverse while the Jog pushbutton is depressed. The screw will stop when the Jog pushbutton is released.

The associated Wash Water valve will open while the screw is running, whether it is running in forward or reverse.

When the ESD button is depressed, the Screw Screen cannot be started from any station.

6.4.6 Automatic Operation – Pendant Station HOA Switch in Auto

When the Pendant Station HOA Switch is in AUTO and the HMI controls are in AUTO, the Screw Screens are controlled by the PLC, based on level in the common feed channel.

The operator selects a Wash Cycle Period (length of time the screw will run) and a Maximum Interval between operations at the HMI. The operator is also able to adjust the Start Level (Begin Wash) and the Stop Level (End Wash) at the HMI.

When the level in the channel reaches the Start Level (Begin Wash), both screws will start (if enabled) and the Wash Water valves will open. The screws will run for the Wash Cycle Period or until the level in the common feed channel reaches the Stop Level (End Wash), whichever is longer.

If the screws do not run within an operator selectable time, they will start and then run for the operator selectable minimum run time (Wash Cycle Period).

6.4.7 Manual Operation – Pendant Station HOA Switch in Auto

When the MCC HOA Switch and the local HOA Switch are in AUTO and the HMI controls are in HAND, the Screw Screens are controlled from the PLC by the operator. The Screw Screen is started by "depressing" the button labeled "Press to wash and Rotate" and stops when the button is released. The button is depressed by clicking and holding with the left mouse button.

6.4.8 HMI Screens and Alarm Indication

The operator interface for the Screw Screens is on the **Primary Screen** screen on the HMI.

The top left-hand corner shows the date and time, as well as the logged in operator (1).

The graphic at the top left shows the screws. The image of the screw moves slowly, when the screw is running (2).

Below this graphic is another graphic that represents the common feed channel. It shows the present channel level, both numerically (3) and graphically (4). The Begin Wash level can be adjusted with the associated Up and Down buttons on the controls at the bottom (5) and the Begin Wash level is shown graphically (6). Awash Cycle Counter (7) is located beside the numeric level indicator. This number should be recorded daily and then reset with the Reset button (8) located below it.

A controller for each screw is shown on the right. The controller shows control mode, run status, as well as fault status bars. Accumulated Screw Runtime is shown at the top of the individual controllers.

Auto or Hand mode is operator selectable by clicking on the Mode button (9). When the screw is in Hand, a control button labeled "Press to wash and Rotate" becomes visible below the Mode button (10). The screw will run in the forward direction as long as this button is depressed.

There are five information boxes at the bottom of the controller. The first indicates Control Status – either Local or PLC. HOA Switch on the Pendant Station in OFF or HAND, as well as ESD activated will be shown as Local Control (11).

The second indicates screw status, either Standby or Running (12).

The third box indicates Wash Valve status, either Standby or Wash in Progress (13).

The fourth box indicates Start Fault status, either No Start Fault or Screw Start Fault (14).

The fifth box indicates Torque Fault status, either No Torque Fault or Torque Fault (15).

Maximum Time without Screw Cycle (16) and Wash Cycle Period (17) can be adjusted with the associated Up and Down buttons on the controls at the bottom.

6.4.9 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
Screw Motor 105 Fault	Local annunciation
Screw Motor 106 Fault	Local annunciation
Both Screw Fail (Primary Screen)	Local annunciation & Dialer Callout
Primary Screen High Level Alarm (More than 750mm)	Local annunciation & Dialer Callout
Primary Screen Transmitter Failure (LIT 102)	Local annunciation & Dialer Callout

6.5 Wastewater Primary Filter

(Refer to Drawing P-3 & M-7)

6.5.1 Normal Operation

In normal operation, the Primary Filter (PF-108) is controlled by the PLC. HOA switches are provided on the Salsnes LCP to allow manual operation.

Screened sewage discharges by gravity from the screening system into the primary treatment filtration unit. The primary treatment filtration unit is sized to handle Phase 2 peak flows with no standby. There is a manual bypass around the primary treatment filtration unit for shutdown and maintenance purposes. The screenings are discharged to the same dump trailer as for the screw screens, TRL-109, which is located on the lower floor of the headworks building.

The operation of the screen is determined by the level of sewage upstream of the screen. The screen starts at an operator selectable level, at an operator selectable minimum speed. The speed increases linearly to a maximum at an operator selectable level.

The wastewater flow continues through the Primary Filter to the primary effluent channel. The channel will be used to split the flow to the bioreactors in phase 2. In phase 1, the primary effluent is directed through the plant bypass piping to the Ocean outfall.

6.5.2 Controls

The Salsnes Filter is controlled by the PLC through the Salsnes Local Control Panel (LCP). The Salsnes LCP gets its power from the Salsnes block in MCC 2. This block is equipped with an HOA switch. The switch must be in the HAND or AUTO position to provide power to the Salsnes LCP.

The LCP contains the VFDs for the Filter as well as the contactors for the Air Scour Blower and Fan. There is a Power Switch on the face of the LCP that must be in the ON position to energize the controls and power the equipment.

There are HOA switches for the Belt Drive, Auger Drive, and Belt Wash. The Filter Air Blower and Blower Fan operate with the Belt Drive from the same HOA switch. The solenoid valves SV114 and SV121 can be operated with a button mounted on the side of the solenoid.

There is a local E-Stop on the front of the filter. This switch is on a cable to allow it to move with the auger compartment. This switch will prevent operation of all of the filter equipment.

6.5.3 Normal Valve and Switch Positions

Tag	Description	Position
HS-108	Local E-Stop for Salsnes Filter	Inactive (Out)
HS-108A	MCC HOA Switch for Salsnes Power	HAND
HS-108B	LCP On/Off Switch for Salsnes Controls/Equipment	ON
HS-108C	LCP Reset/ACK Pushbutton for Salsnes Control Panel	N/A
HS-108D	LCP HOA Switch for Belt Drive and Air Scour Blower	AUTO
HS-108E	LCP HOA Switch for Auger Drive	AUTO
HS-108F	LCP HOA Switch for Wash Solenoid Valve	AUTO
V-111	Salsnes Influent Valve	Open
V-112	Salsnes Bypass Valve	Closed
V-113	Salsnes Effluent Valve	Open
V-120	Hot FEW Isolation Valve	Open
V-121	Cold Few Isolation Valve	Open
V-122A	Salsnes Influent Sample Valve	Closed
V-122B	Salsnes Efffluent Sample Valve	Closed

6.5.4 Manual Operation – HOA Switches on Salsnes LCP in HAND

All of the equipment associated with this process can be manually operated from the HMI. The only time that Hand operation will be required is for maintenance purposes or PLC failure.

The Filter Belt Drive and Filter Air Blower, the Auger Drive, and the Belt Wash can be operated manually by placing the associated HOA switch on the Salsnes LCP in the HAND position.

In HAND, the Belt Drive operates continuously, at full speed, through the VFD. The Filter Air Blower runs at the same time.

In HAND, the Auger Drive operates continuously.

In Hand, The Belt Wash Solenoid Valve is open.

6.5.5 Manual Operation – HOA Switches on Salsnes LCP in AUTO

Belt Wash and Bottom Flush cycles can be manually initiated from the HMI.

The Belt and Auger can be manually operated from the HMI.

6.5.5.1 Manually Initiated Belt Wash

A Belt Wash cycle can be manually initiated by clicking on the "*Press to Wash Filter Now*" button at the bottom right of the Primary Filter Screen.

When this button is activated, a normal Belt Wash cycle is started. It differs from an automatically initiated cycle only in that the belt speed can be selected by the operator using the *Up* and *Down* buttons at the bottom of the Filter Belt Drive Controller.

When in a manually initiated cycle, the button changes to read "*Flush in Progress (press to stop)*". Clicking on this button again will stop the cycle.

If the water level reaches the Wash Cycle Start Level during a time initiated cycle, the manual cycle is aborted and a normal cycle starts (see section 6.5.5.5 below).

6.5.5.2 Manually Initiated Bottom Flush

A Bottom Flush cycle can be manually initiated by clicking the "*Standby, Press to Flush Now*" button at the bottom of the Cold Water Bottom Flush Controller.

When this button is activated, a normal Bottom Flush cycle is started. This cycle will run for the time selected on the Bottom Flush Duration Controller.

When in a manually initiated cycle, the button changes to read "*Flush in Progress, press to abort*". Clicking on this button again will stop the cycle.

6.5.5.3 Manually Operating the Filter Belt Drive and Filter Air Blower

The Filter Belt Drive can be manually operated from the HMI, independently of all of the other equipment. Press the button labeled "*AUTO*" to start the drive. A slider control becomes visible beside the speed indicator on the Belt Drive controller. Drag this slider with the mouse to select drive speed. The Filter Air Blower runs when the Filter Belt Drive runs.

When pressed, the *AUTO* button changes to read "*HAND*". Pressing this button again returns control to the PLC and stops the Filter Belt Drive if it is not being called to run.

If Filter Belt is set to *HAND* on the HMI, it will be automatically reset to *AUTO* after 2 minutes

6.5.5.4 Manually Operating the Auger Drive

The Auger Drive can be manually operated from the HMI, independently of all of the other equipment. Press the "*Dewatering Conveyor in AUTO*" button to start the drive. The drive will run continuously at the speed selected on the VFD.

When pressed, the "*Dewatering Conveyor in AUTO*" button changes to read "*Dewatering Conveyor in Manual (on all the time)*". Pressing this button again returns control to the PLC and stops the drive if it is not being called to run.

6.5.5.5 Automatic Operation – HOA Switches on Salsnes LCP in AUTO

The Salsnes Filter and its accessories are normally operated in full Automatic mode.

Filter Belt Drive

As the filter belt accumulates filtered material on its surface, the flow through the belt will be reduced and the upstream water level will rise. When it reaches the Start Level the belt will start at the calculated speed based on level. This speed is linear from 10% at the Start level to 100% at the Start Wash Cycle level.

As the water level drops, the speed will decrease linearly until it reaches 10% speed at the Start Level. The belt will maintain this minimum speed as the level drops further. At the Stop Level, the Belt Drive stops.

Filter Belt Wash Cycle

If the water level upstream of the belt reaches the "*Wash Cycle Start Level*" set on the Primary Filter screen, a Wash Cycle is initiated. The belt runs at the speed set on the Filter Controller and for the time set on the "*Screen Wash Duration*" on the Primary Filter screen. The Hot Water solenoid valve opens for this duration. At the end of the Wash Cycle, all equipment operates at the calculated speed for the present water level.

If a Belt Wash Cycle has not run for the time set on the "*Screen Wash Interval*", a cycle is initiated. It runs for the length of time set in the "*Filter Wash Duration*". The Belt Drive runs at the speed set on the "*Wash Cycle Belt Speed*" on the Primary Filter screen.

If the water level reaches the "*Wash Cycle Start Level*" during a time initiated cycle, the cycle timer is reset and the belt speed increases to calculated speed for the present water level.

Filter Air Blower

The Filter Air Blower and Fan run when the Belt Drive runs.

Filter Auger Drive

The Filter Auger runs when the Filter Belt Drive runs. It continues to run after the belt drive stops, for the time set in the "Auger After-Run Duration" on the Primary Filter screen.

Cold Water Bottom Flush

Any solids that accumulate in the downstream compartment of the filter fall to a channel at the bottom. These solids are removed periodically on a timed cycle. After the time (since the last flush), set in the Bottom Flush Interval on the Primary Filter screen, the Bottom Flush Valve and the Cold Water solenoid valve open. They remain open for the time set on the Bottom Flush Duration.

6.5.5.6 Abnormal Operation

If the Raw Sewage Pumps are started on High-High Level (or if the pumps are restarted after maintenance, with a high level in the Pump Station) the Salsnes Filter will start at high speed. This avoids overflow caused by the rapid change in flow and the normal slow response of the speed controller. After ___ minutes, speed control is returned to normal, responding to upstream level in the filter.

6.5.6 HMI Screens and Alarm Indication

The operator interface for the Primary Filter is on the **Primary Filter** screen on the HMI. The graphic on the top left shows the Salsnes Filter with both a graphic (1) and numeric (2) depiction of the upstream water level. The scale for the level is shown on the left of the graphic and spans -200 to 340 mm. The 0 line is the weir level to the effluent sewer (normal minimum level in the filter). -200 is the minimum measurable by the level instrumentation.

Below the Filter graphic, is a re-settable indicator (3) that counts the number of Wash Cycles. A Reset button (4) is located below it. This number should be recorded daily and the counter reset. Variations from the norm will indicate unusual situations or malfunctions.

In the bottom left hand corner is a table that indicates status of all of the component equipment controlled by the PLC.

The top box (5) indicates that the ON/OFF switch on the Salsnes LCP is in the ON position ("*Remote Switch On*"). In the OFF position, the message will change to "*Remote Switch Off or E-Stop Pressed*". This message will also appear if the HOA switch at the MCC is OFF.

The column on the left gives run status for the Filter Belt (6), Auger (7), Blower (8), Blower Fan (9), and the Hot (10) and Cold (11) Solenoid Valves. The column on the right gives alarm status for the Filter Belt (12), Auger (13), Blower (14) and Blower Fan (15).

The remainder of the screen is made up of a controller for the Filter Belt and set point input and status indicators.

The Filter Belt Controller has a Wash Cycle Start Level set point input box (16) at the top. The Start set point can be adjusted with the Up and Down buttons. This controls the level at which a Belt Wash Cycle is initiated.

The controller itself has a Mode Select button (17) that allows selection of AUTO or HAND operation. In HAND, a Speed Slider control becomes visible (17A on the second illustration).

The bottom of the controller has an input box for Wash Cycle Belt Speed (18). This is the speed that the belt will run at during a Wash Cycle, regardless of filter level.

Beside the Filter controller there are two input boxes for selecting the Start (19) and Stop (20) levels for the Filter Belt.

Below these input boxes is the input box for selecting how long the Auger will run after the belt is stopped. Below this is a button (22) that allows the operator to run the Auger manually. When the button is clicked, the Auger will run and the button text will change

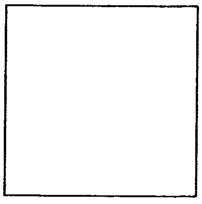
to indicate that the Auger is in manual. When the button is clicked again, the Auger control is returned to AUTO.

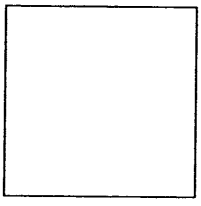
If a Wash Cycle is not initiated based on level within an operator selectable time, a cycle will be initiated. The interval is selected using the Screen Wash Interval selector (23). Time remaining until the next time initiated cycle is also displayed on this control. The time is reset when a wash is initiated, whether it is initiated on level or time.

Screen Wash Duration is selected on the control next to this (24). This time is the minimum duration for a wash cycle, whether initiated on level or time. Time remaining in a cycle is also displayed on this control.

Below this is a button (25) that allows the operator to start a Wash Cycle manually. When the button is clicked, the Wash Cycle will start and the button text will change to indicate that a manual cycle is in progress. If the button is clicked again, the Wash Cycle will be terminated, regardless of the duration remaining.

The top right-hand corner of the screen contains input boxes for selecting how often a Bottom Flush is initiated (26) and the duration of the flush (27). Below this is a button (28) that allows the operator to start a Flush Cycle manually. When the button is clicked, the Flush Cycle will start and the button text will change to indicate that a manual cycle is in progress. If the button is clicked again, the Flush Cycle will be terminated, regardless of the duration remaining.





6.5.7 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
Primary Filter Blower Alarm	Local annunciation & Dialer Callout
Primary Filter Blower Fan Alarm	Local annunciation & Dialer Callout
Primary Filter , Filter Belt Drive VFD Fail	Local annunciation & Dialer Callout
Primary Filter , Auger Drive VFD Fail	Local annunciation & Dialer Callout

6.6 Screenings & Sludge Handling

(Refer to Drawing P-5)

6.6.1 Normal Operation

Screenings from the Screw Screens and pressed sludge from Primary Filter drop through a common chute into the Sludge Hauling Trailer below. The trailer can be moved somewhat to help distribute the screenings and sludge. When it is full, it is hauled to the Landfill. While the trailer is being dumped, a portable container can be placed under the hopper, or the knife-gate valve at the bottom of the hopper can be closed.

6.6.2 Controls

The only controls associated with this system are the air operator for the hopper isolation valve and the dump control on the trailer.

6.6.3 Normal Valve and Switch Positions

Tag	Description	Position
	Hopper Isolation Valve	Open

6.6.4 Hopper Isolation Valve Operation

The Hopper Valve is a pneumatically operated knife-gate valve. It is operated with the control lever located on the wall. The up position opens the valve, the down position closes the valve. The middle position is the neutral "Park" position.

6.6.5 Trailer Dump Operation

The trailer is dumped with an electrically operated lifting device. It operates on 12 VDC, supplied by a battery mounted on the trailer. The battery is charged by the towing vehicle, through the lighting harness.

Press the button with the white dot to raise the trailer. The trailer stays in the last position. Press the black button to lower the trailer.

6.7 Vacuum System

(Refer to Drawing P-6)

A system of piping has been installed that allows a sewage vacuum truck to connect to the plant and remove materials from either the Raw Sewage Lift Station or the Primary Effluent Channel with the use of a sewage vacuum truck.

The truck connection is located adjacent to the roll up door to the lower floor sludge handling bay. It is a 4" cam-lock fitting.

The piping from the Raw Sewage Lift Station extends to the bottom of the pump chamber and can be used to drain the chamber. The piping to the Primary Effluent Channel terminates above the floor in the Headworks Room. It is a 4" cam-lock connection and requires a hose for operation

6.7.1 Controls

There are no controls associated with this system.

6.7.2 Normal Valve and Switch Positions

Tag	Description	Position
V-101	Raw Sewage Influent Isolation Valve	Open
V-118	Isolation Valve to Primary Effluent Channel	Closed
V-119	Isolation Valve to Raw Sewage Lift Station	Closed

6.8 Lift Station Hoist

A 1000 kg electric hoist is provided for removing the Raw Sewage Pumps and the Inlet Basket Screen. It is mounted on a rotating jib with a free wheeling trolley that moves the full length of the jib

6.8.1 Hoist Operation

The jib can be swung out over the load. Once attached to the load, the hoist will remain centered over it.

6.8.2 Controls

The hoist is controlled from a pendant station attached to the hoist. The cable is sufficiently long to allow operation from a safe distance from the load.

There are two momentary buttons on the pendant station labeled "Hoist Up" and "Hoist Down". These are the only controls for the system.

Power for the system is supplied from Panel 6B in Electrical Room 3.

6.8.3 Attaching to and Detaching from Load

The Raw Sewage Pumps and the Basket Screen are equipped with short chains that are tethered with nylon string. A Flygt Grip Eye is provided to grab this chain.

The Grip Eye is attached to the lifting hook of the hoist. The nylon tether is fed through the eye loop of the Grip Eye and pulled tight. The Grip Eye is then lowered down to the load. When the Grip Eye has passed over the chain, the nylon tether is allowed to fall slack. Do not drop the end of the tether.

Slowly raise the hoist and ensure that the chain is engaged.

6.9 Glycol Heating System Operation

6.9.1 Glycol Type

The type and concentration of glycol utilized in the heating system is 50/50 propylene glycol/water solution.

6.9.2 Glycol Heating Boilers B-01 and B-02

(Refer to Drawing M-1)

Two existing Weil McLain diesel fuel oil, glycol heating boilers located in the Mechanical Room have been provided to serve as the primary source of heating in the building with each boiler providing 50% of the system capacity. The use of glycol as a heating agent helps to prevent freeze-up in the system.

The boilers, through unit heaters, provide heating of the air in the building, through bare fin radiation provide heating of the selected areas and through the heat exchanger provide tempering of the Effluent Water.

Since these boilers are the only heating source for the building, it is important to ensure proper operation and maintenance is performed.

The boilers have been reconfigured for lead/lag operation. The boilers are controlled utilizing Programmable Logic Controller (PLC) control with Operator Work Station located in the Plant Office.

The duty boiler will provide a heating glycol supply temperature of 88°C (190°F) if the outdoor air temperature is below -5°C (23°F). If the outdoor temperature is above 10°C (50°F), the heating glycol supply temperature is reset to 60°C (140°F).

6.9.3 Boilers & Heating System Safety Controls

In order for these boilers to operate in a safe and reliable manner, the following controls and safety components have been provided. The boiler controls are auto-resetting in event of a power failure.

Pilot Ignition

Each boiler is equipped with an electronic pilot arrangement for burner ignition. This means the pilot is electronically lit when heating is required. If the pilot light does not light, the main burner will not be allowed to light. If this happens, follow the lighting instructions in the Boiler Owner's Operation & Maintenance Manual. The unit should be checked regularly by qualified personnel to maintain system integrity.

Low Water Level Cut-off Safety Control

A low water (glycol) cut-off safety control is mounted on each boiler above the minimum safe water level for the boiler. This unit is intended to ensure that if the glycol level drops too low, the boiler will not be able to start-up and locked out with an alarm activated. After correction of problem, the low water cut-off safety control will have to be manually reset for the boiler to start.

High Pressure Safety Valve

This is a mechanical device connected to each boiler that senses the pressure of the heating system. If the system pressure rises above the setting shown on the tag on the valve, the valve will blow the excess glycol back to Glycol Storage Tank until such time as the pressure drops to about 20.6 kPa (3 psi) below the safety valve setting. The valve should be tested at least once a year by a qualified agency. In testing this valve, only open the flapper when the boiler is firing and at maximum temperature. This will lessen the possibility of having the valve leak afterward.

Low Flow Switch

To prevent damage to the boilers, a flow switch located on the glycol common supply line from the boilers will not allow the boilers to operate if there is no glycol flow.

Check this control every two months by momentarily closing the discharge valve of the boiler when it is operating. The loss of glycol flow should be sensed by the flow switch which will shut down the boilers.

Low Limit Safety Control

A low limit safety control located on the glycol common supply line from the boilers is set at 30 °C (86 °F). If, for any reason, the boiler water temperature drops below this set-point, an alarm will be activated.

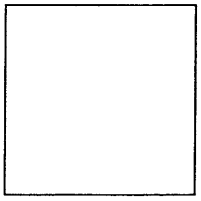
High Limit Safety Control

A high limit safety controller mounted on each boiler is set at 100°C (210°F). If, for any reason, the boiler supply temperature rises above this set-point, the controller will shut off and lock out the boiler with an alarm activated. After correction of problem, the high limit safety control will have to be manually reset for the boiler to start.

6.9.4 HMI Screens and Alarm Indication

The lower right corner of the **FEW and Boiler** screen shows status for the Boiler System.

Status for the boilers is indicated on each boiler (19). Glycol Loop Temperature is indicated (20). Boiler Temperature is indicated (21). Winter Boiler Temperature Set Point can be adjusted by the operator using the input boxes supplied (22). Circulator status is indicated (23).



6.9.5 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
HEATING, LOW GLYCOL TEMPERATURE < 30°C	Local annunciation & Dialer Callout
Trailer Room Low Temperature (less than 1°c)	Local annunciation & Dialer Callout

6.9.6 Glycol Circulation Pumps P-01, P-02, P-03 and P-04

Two primary boiler and two secondary glycol circulation pumps located in the Mechanical Room have been provided to handle the heating glycol circulation for the building, with each pump providing 100% of the required glycol flow for the heating system.

The glycol circulation pumps are controlled utilizing Programmable Logic Controller (PLC) control with Operator Work Station located in the Plant Office. The secondary pumps will be activated if the outdoor air temperature is below 16°C (61°F). Status is indicated on the HMI **FEW and Boiler** screen as indicated above.

6.9.7 Expansion Tank

The expansion tank is located in the Mechanical Room and sized to allow for full operating temperature range of the system. This tank is required because the circulated glycol expands when it is heated and the additional glycol volume must have a place to be stored. The expansion tank is used to house this excess volume. As the system must remain under positive pressure at all times to prevent the introduction of air into the system, the bladder in the expansion tank is filled with air providing a cushion against which the glycol is always pressing. The air pressure must be the same as the system glycol pressure at the tank.

Check the expansion tank bladder pressure with a pressure gauge on a monthly basis to ensure that air did not leak out of the bladder through the air fill valve. If the bladder pressure is low, re-pressurize the bladder to system operating requirements

6.9.8 Air Separator

The air separator with automatic air vent is provided to automatically remove entrapped air from the heating system reducing the possibility of corrosion within the system. Additional automatic and manual air vents provided at high locations of the heating system to assist in removal of entrapped air from the system.

6.9.9 Heating Glycol Chemical Treatment

Pre-operational cleaning, degreasing, flushing and testing of the heating system components and piping have been completed before filling the system with glycol and start up of the heating system. After initial heating system start-up, the glycol concentration has been tested and adjusted with chemical treatment added to meet operating requirements.

Since the glycol heating system is a closed loop system, the requirement for chemical treatment should be minimal, however, it is a very important aspect of mechanical system maintenance. Regular, continuous monitoring of the system conditions by a qualified water treatment personnel or experienced building operations staff will greatly benefit the heating circuit functions.

6.9.10 Glycol Fill Tank System

The glycol make-up system is a packaged unit consisting of a Glycol Storage Tank and Glycol Charge Pump P-05. The unit operates automatically from self contained controls. It is not interfaced with the plant control system.

The unit is equipped with a pressure switch and a low level switch. The pump is enabled when there is glycol in the tank and is disabled on low level. The pump starts and stops in response to the pressure switch to maintain system pressure.

The operator should monitor the glycol level and replenish the supply with 50/50 glycol when it drops below ½.

6.9.11 Unit Heaters

(Refer to Drawing M-2)

Unit heaters are located throughout the building provide heat for the building. Each unit heater fan circuit is energized from a local disconnect switch with a local wall mounted electric thermostat cycling the unit heater fan motor to maintain the desired space temperature.

6.9.12 Air Handling Unit AHU-03 Reheat Coil

(Refer to Drawing M-3)

Refer to Air Handing Unit AHU-03 below.

6.9.13 Wall Fin Radiation Operation

Wall fin radiation provide heating for the Electrical Room and Laboratory. Wall mounted local thermostats modulate the wall fin radiation control valves to maintain the desired room temperature.

6.9.14 Additional Heating Equipment

Additional equipment that has been installed to protect the heating system includes an air separator c/w strainer, flow switches and check valves. Check valves located at the discharge of the pumps will prevent backflow of the system and flow switches to ensure there is system flow before the boilers are allow to start. A strainers located at the suction of the pumps will filter out any solid material circulating in the heating system. The automatic air vent (AAV) will automatically remove entrapped air from the system reducing possibility of corrosion within the system.

6.10 Filtered Effluent Water Systems

The Filtered Water System (FEW) provides water for washing the Screw Screens, the Primary Filter and other general wash-down. It consists of a storage tank, a pumping system and a heating system. Both hot and cold FEW is piped to the areas where it is required. Hot and cold FEW can be selected or mixed for use at the Screw Screens with local valves.

6.10.1 FEW Tank Operation

(Refer to Drawing P-7 & M-6)

Under normal operation, the FEW Tank will be filled with potable water during Phase 1, in the same way that the normal Potable Water system is filled.

It is equipped with a level transmitter connected to the PLC. The fill piping is extended outside the building for Water Truck connection. The fill piping is provided with an air gap above the upper level floor next to the upper level roll-up door. This prevents any chance of cross-contamination of the Potable Water Trucks for the period that they will be used to fill the system.

A red beacon, a blue beacon and an alarm horn are located on the outside of the building, above the fill piping. The red beacon lights to indicate a low level in the tank. The blue beacon lights to indicate that the tank has reached its full level. The horn alarms when overflow of the FEW Tank is imminent.

When the tank reaches a low level, a minor alarm is annunciated at the HMI. If a critically low level is reached, affected equipment is inhibited from operation and the Dialer initiates a call-out to the operator.

6.10.2 FEW Pump Operation

(Refer to Drawing M-6)

The Cold FEW system consists of three multistage centrifugal pumps (FEW-1, FEW2 and FEW3) and a pressure tank. They are controlled from HOA Switches at MCC 2.

6.10.2.1 Normal Operation

The pumps are controlled by two pressure switches for lead and lag pump operation. Under normal operation, the FEW Pumps, FEW-1, FEW-2 and FEW-3, operate in a lead/lag/standby configuration. The Lead and Lag pumps start and stop based on the pressure in the system The lead pump starts when the pressure drops to the low level as detected by Pressure Switch FPS-1 and the lag pump starts when the pressure drops to the low-low level as detected by Pressure Switch FPS-2. The pumps run until the high pressure set-point of the associated switch is met.

The pressure tank buffers the system and reduces the number of starts of the pumps.

6.10.2.2 Controls

The pumps are equipped with HOA Switches at MCC 2. There is also a Local Control Panel (LCP) adjacent to the boilers. There is a Lead/Lag/Standby Selector Switch and an HOA Switch on this panel. The HAND position of the HOA Switch allows local control and activates the local Lead/Lag/Standby Switch. The AUTO position allows full control from the PLC. In either mode, control is based on two local pressure switches set up for Lead/Lag operation.

FEW Tank level is monitored by the PLC and pump operation is inhibited on low FEW level.

6.10.2.3 Normal Valve and Switch Positions

Tag	Description	Position
	FEW Tank Discharge Valve	Open
	FEW-1 HOA Switch at MCC 2	AUTO
	FEW-1 Inlet Isolation Valve	Open
	FEW-1 Discharge Isolation Valve	Open
	FEW-2 HOA Switch at MCC 2	AUTO
	FEW-2 Inlet Isolation Valve	Open
	FEW-2 Discharge Isolation Valve	Open
	FEW-3 HOA Switch at MCC 2	AUTO
	FEW-3 Inlet Isolation Valve	Open
	FEW-3 Discharge Isolation Valve	Open
	FEW Filter Inlet Isolation Valve	Open
	FEW Filter Discharge Isolation Valve	Open
	FEW Filter Bypass Isolation Valve	Closed

6.10.2.4 Manual Operation – MCC HOA Switch in HAND or OFF

When the MCC HOA Switch is in HAND, the pump will run, regardless of the pressure in the system or the level in the FEW Storage Tank.

When the MCC HOA Switch is in OFF, the pump will not run, regardless of the pressure in the system or the level in the FEW Storage Tank

6.10.2.5 Automatic Operation – MCC HOA Switch in AUTO

When the MCC HOA Switch is in AUTO, control of the FEW Pumps is determined by the position of the local HOA Switch on the FEW and Boiler LCP, as described below.

6.10.2.6 Automatic Operation –Local HOA Switch in HAND

When the local HOA Switch is in HAND, the pump is controlled directly from the two pressure switches, based on the Lead/Lag/Standby assignment selected with the local Lead/Lag/Standby switch. The Lead/Lag/Standby assignment is shown in the following table:

Switch Position	FEW Pump 1	FEW Pump 2	FEW Pump 3
1	Lead	Lag	Standby
2	Standby	Lead	Lag
3	Lag	Standby	Lead

When low pressure switch FPS-1 reaches its start pressure, the Lead pump starts. When this pressure switch reaches its stop pressure, the Lead pump stops. If the pressure continues to drop, low-low pressure switch FPS-2 will reach its start pressure and the Lag pump will start. When this pressure switch reaches its stop pressure, the Lag pump stops.

If the Lead or Lag pump is called to run and fails, the Standby Pump will not run in its place.

Pump operation is not affected by the level in the FEW Tank.

6.10.2.7 Automatic Operation –Local HOA Switch in AUTO

When the local HOA Switch is in AUTO, the pump is controlled by the PLC. Lead/Lag/Standby assignment is made from the PLC as described in section 6.8.8 below. The local Lead/Lag/Standby switch has no effect on operation.

When low pressure switch FPS-1 reaches its start pressure, the Lead pump starts. When this pressure switch reaches its stop pressure, the Lead pump stops. If the pressure continues to drop, low-low pressure switch FPS-2 will reach its start pressure and the Lag pump will start. When this pressure switch reaches its stop pressure, the Lag pump stops.

If the Lead or Lag pump is called to run and fails, the Standby pump will run in its place.

The pumps will not run if the level of water in the FW Tank is below the Low-Low Alarm level.

6.10.2.8 HMI Screens and Alarm Indication

The operator interface for the FEW Pumps is on the **FEW and Boiler** screen on the HMI (see 6.10.3.6).

The top left-hand corner shows the date and time, as well as the logged in operator (1).

The graphic at the top left shows the FEW Tank. The level is indicated both numerically (2) and graphically (3).

The external Alarm Beacons are mimicked below the tank (4). The blue "Full" beacon is an indication only. When the red "Empty" lamp turns off, it indicates that the tank requires refilling. A minor alarm is annunciated locally at the HMI. If the level continues to fall and reaches the Low-Low Level, the FEW Pumps are stopped and the Dialer initiates a call-out to the operator.

Below this graphic is another graphic that illustrates the pumps, as well as status boxes for the two pressure switches (Pressure Switch 1 ON or OFF, Pressure Switch 2 ON or OFF) (5).

Below this, a Pump Controller is shown for each pump. The controller indicates pump run status, lead/lag/standby assignment, as well as fault status bars. Accumulated Pump Runtime is shown at the top of the individual controllers (6).

LEAD, LAG and Standby Duty are operator selectable by clicking on the Duty button (8). Each click cycles the button to the next duty. The other pump duties are changed to ensure that two pumps are not called to perform the same duty.

Below the Duty Button is a status box that indicates whether the pump is ready to run or running (9).

The next box indicates whether the pump is ready or faulted (10). If a pump has been faulted, the associated Fault Reset Button (11) must be depressed after the fault has been corrected, to put the pump back in sequence.

6.10.2.9 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
FEW Pump #1 Fail	Local annunciation & Dialer Callout
FEW Pump #2 Fail	Local annunciation & Dialer Callout
FEW Pump #3 Fail	Local annunciation & Dialer Callout
Filtered Effluent Water Critical Low level < 300mm	Local annunciation & Dialer Callout
Filtered Effluent Water Critical Low Level < 200mm , All Pumps Stop	Local annunciation & Dialer Callout
Filtered Effluent Water Critical Low Pressure (FEWPSL-2 - ON > 10 min)	Local annunciation & Dialer Callout

6.10.3 FEW Line Filter Operation

6.10.3.1 General

To reduce the chance of plugging in downstream nozzles (particularly when the system starts using recycled effluent) a line filter has been installed in the FEW makeup water piping. It is automatically back-flushed every 24 hours.

6.10.3.2 Controls

The filter backwash is controlled entirely from the PLC.

6.10.3.3 Normal Valve and Switch Positions

Tag	Description	Position
	Filter Inlet Isolation Valve	Open
	Filter Discharge Isolation Valve	Open
	Filter Bypass Valve	Closed
	Filter Back-flush Valve	PLC Controlled

6.10.3.4 Manual Operation

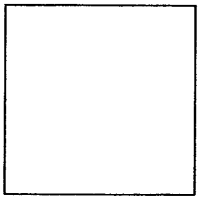
The Filter Backwash cannot be manually controlled except through the PLC. To perform a manual back-flush, click on the "*Press to Flush Filter Now*" button on the HMI (see below).

6.10.3.5 Automatic Operation

The filter is backwashed for a preset length of time every 24 hours by the PLC.

6.10.3.6 HMI Screens and Alarm Indication

The upper right corner of the **FEW and Boiler** screen contains a control box for the FEW Line Filter. It has a counter that shows the time remaining before an automatic flush. It also has a manual flush button (18) labelled "Press to Flush Filter Now". Click on this button to initiate a manual flush. When a manual flush is in progress, the text on the button will change to "Flush in Progress (press to stop). The flush will continue until the button is clicked again.



6.10.3.7 Alarms

There are no alarms associated with this equipment:

6.11 FEW Heating System

(Refer to Drawing M-6)

The Salsnes Filter requires wash water at 4 – 7 bar (60 - 100 psi) and 70 - 90 °C. A water heating and storage system for FEW is provided for this purpose. It is comprised of three 225 L (60 usgal) hot water storage tanks (FEWT1A, FEWT1B and FEWT1C), a heat exchanger and circulation pump and an electric booster heater (FEWH1) and pressure pump (P-20). It also feeds the Screw Screen Wash System as well as a hot water hose bib in the Headworks.

Hot water from the boilers circulates through the hot side of the heat exchanger. Water from the hot water storage tanks is circulated through the cold side of the heat exchanger by a progressing cavity FEW Circulation Pump, P-21. This pump is equipped with an inline y-strainer on the circulation line, a discharge Pressure Relief Valve and inlet & discharge isolation valves

Make-up FEW is supplied from the FEW Pump System, through a 300 μm inline filter. This filter is automatically flushed daily with a motorized valve by the PLC. The operator can also perform extra flushes with a button on the HMI ("Press to Wash Filter Now" on FEW and Boiler screen). The flush is stopped by pressing the button again. The flush will automatically stop after 2 minutes if the button is not pressed again.

The storage tanks are connected in parallel and can be individually isolated. They are equipped with Pressure/Temperature Safety Valves, Combination Air/Vacuum Relief Valves, temperature indicators and motorized control inlet valves.

The pressure system feeding the Headworks area is controlled by a pressure switch set at 690 kPa. Progressing cavity FEW Booster Pump, P-20, is started and stopped to maintain this pressure. A 25 gal pressure tank is installed to buffer the system and prevent rapid cycling of the pump. The system is equipped with a Pressure Indicator and a Pressure Relief Valve.

Booster Heater FEWH1 is a 60 kW electric heater that is used to boost the heated water temperature to 93 °C. It is equipped with a Pressure Indicator, Temperature Indicator and a Pressure/Temperature Safety Valve set for 862 kPa and 100 °C. It has isolation valves on the inlet and outlet, and a valve that allows bypassing the unit for maintenance.

6.11.1 General

Hot water from the Boilers is continuously circulated through the Heat Exchanger.

The Hot FEW Circulating Pump (P-21) is controlled independently of the PLC. There is future provision to add a "Drawdown Mode" with control through the PLC.

The Hot FEW Circulating Pump is run to maintain stored water temperature, based on the temperature switch on Hot FEW Storage Tank FEWT3A. Cold FEW is introduced at the inlet of this pump to make up for water used from the system.

When water is drawn from the system at the Headworks, the Booster Pump (p-20) is run to maintain pressure. If the Salsnes Filter is in a Wash Cycle, FEWH1 is enabled and runs based on the downstream Temperature Switch.

6.11.2 Circulating Pump (P-21) Operation

6.11.2.1 Controls

The "local" controls for the FEW Circulating Pump are located in an LCP in the FEW Heating area above the office. It has an HOA Switch on the front, as well as Run and Stop indicator lamps.

6.11.2.2 Normal Valve and Switch Positions

Tag	Description	Position
	P-21 HOA Switch	AUTO
	P-21 Inlet Isolation Valve	Open
	P-21 FEW Make-up Isolation Valve	Open
	P-21 Discharge Isolation Valve	Open
	FEWT1A Inlet Isolation Valve	Open
	FEWT1A Recirculation Outlet Isolation Valve	Open
	FEWT2A Inlet Isolation Valve	Open
	FEWT2A Recirculation Outlet Isolation Valve	Open
	FEWT3A Inlet Isolation Valve	Open
	FEWT3A Recirculation Outlet Isolation Valve	Open

6.11.2.3 Manual Operation

When the HOA Switch is in HAND, the pump will run, regardless of the Hot FEW temperature. If valves are closed, the discharge Pressure Relief Valve will open.

When the HOA Switch is in OFF, the pump will not run, regardless of the Hot FEW temperature.

If the Local Isolation Switch is off, the pump will not run. However, the PLC will still see the status of the motor starter, which may not reflect the status of the pump.

6.11.2.4 Automatic Operation

When the HOA Switch is in AUTO, the pump is controlled by the Temperature Switch on FEWT3A. When the temperature drops below the set point, the pump will start. When the temperature reaches the set point, the pump will stop.

The PLC will inhibit operation of the pump if the FEW Tank is at Low-Low level.

6.11.2.5 HMI Screens and Alarm Indication

The upper right corner of the **FEW and Boiler** screen shows status for the FEW Heating System equipment (see 6.10.3.6).

The status block for the Hot FEW Circulating Pump (12) normally reads "FEW Hot Water Circulating Pump P-21 Normal". If the pump has not run for 6 hours, this will change to "FEW Hot Water Recirculating Pump P-21 Probably Defective (Not run within 6 hrs)". The PLC does not have command or failure status on this pump. It monitors pump run, so this alarm only flags the fact the pump has not run for this length of time.

The run time for this pump is displayed below the status bars (15).

6.11.2.6 Alarms

There are no alarms associated with this equipment:

6.11.3 Hot FEW Booster Pump (P-20) Operation

6.11.3.1 Controls

The "local" controls for the Hot FEW Booster Pump are combined with the controls for the FEW Booster Heater, and are located in an LCP in the FEW Heating area above the office. It has an HOA Switch on the front, as well as Run and Stop indicator lamps.

6.11.3.2 Normal Valve and Switch Positions

Tag	Description	Position
	FEWT1A Discharge Isolation Valve	Open
	FEWT2A Discharge Isolation Valve	Open
	FEWT3A Discharge Isolation Valve	Open
	Booster HOA Switch	AUTO
	P-20 Inlet Isolation Valve	Open
	FEWH1 Inlet Isolation Valve	Open
	FEWH1 Bypass Isolation Valve	Closed
	FEWH1 Discharge Isolation Valve	Open

6.11.3.3 Manual Operation

When the HOA Switch is in HAND, the Booster Pump will run, based on the pressure switch on the discharge side of the FEW Booster Heater. If downstream valves are closed, the discharge Pressure Relief Valve, downstream of the discharge check valve, will open.

When the HOA Switch is in OFF, the pump will not run.

6.11.3.4 Automatic Operation

When the HOA Switch is in AUTO, the Booster Pump is enabled if the Slasnes Hot Water Solenoid Valve is commanded to open (Wash Cycle started) and will run if the when the downstream pressure drops below the pressure set point of 690 kPa. The pump runs until the pressure switch reaches its set point pressure. A pressure tank is installed downstream of the pump to prevent rapid cycling.

6.11.3.5 HMI Screens and Alarm Indication

The upper right corner of the **FEW and Boiler** screen shows status for the FEW Heating System equipment (see 6.10.3.6).

The status block for the Hot FEW Circulating Pump (13) normally reads "FEW Hot Water Booster Pump P-20 Normal". If the pump has not run for 6 hours, this will change to "FEW Hot Water Booster Pump P-20 Probably Defective (Not run within 5 minutes of demand)". The PLC does not have command or failure status on this pump. It monitors pump run, so this alarm only flags the fact the pump has not run for this length of time after a Wash Cycle has started. This could also indicate a closed valve or defective solenoid valve.

The run time for this pump is displayed below the status bars (16).

6.11.3.6 Alarms

There are no alarms associated with this equipment:

6.11.4 FEW Booster Heater (FEWH1) Operation

6.11.4.1 Controls

The "local" controls for the FEW Booster Heater are combined with the controls for the Hot FEW Booster Pump, and are located in an LCP in the FEW Heating area above the office. It has an HOA Switch on the front, as well as Run and Stop indicator lamps.

6.11.4.2 Normal Valve and Switch Positions

Tag	Description	Position
	FEWT1A Discharge Isolation Valve	Open
	FEWT2A Discharge Isolation Valve	Open
	FEWT3A Discharge Isolation Valve	Open
	Booster HOA Switch	AUTO
	P-20 Inlet Isolation Valve	Open
	FEWH1 Inlet Isolation Valve	Open
	FEWH1 Bypass Isolation Valve	Closed
	FEWH1 Discharge Isolation Valve	Open

6.11.4.3 Manual Operation

When the HOA Switch is in HAND, the Booster Heater will not operate.

When the HOA Switch is in OFF, the Booster Heater will not operate.

6.11.4.4 Automatic Operation

When the HOA Switch is in AUTO, the Booster Heater will run if the Salsnes Filter is in a Wash Cycle and the downstream temperature drops below the temperature start set point of 70 °C. The Booster Heater will stop when the downstream temperature rises to the shutoff temperature set point of 80 °C.

6.11.4.5 HMI Screens and Alarm Indication

The upper right corner of the **FEW and Boiler** screen shows status for the FEW Heating System equipment (see 6.10.3.6).

The status block for the Hot FEW Booster Heater (14) normally reads "FEW Hot Water Electrical Booster Normal". The PLC does not have command or failure status on this heater.

The run time for this heater is displayed below the status bars (17).

6.11.4.6 Alarms

There are no alarms associated with this equipment:

6.12 Ventilation System Operation

6.12.1 Air Handling Unit AHU-03 System

(Refer to Drawing M-3 & M-4)

Air Handling Unit AHU-03 consist of a two speed supply and return air fans, reheat coil, heat recovery section and filter section. The air handling unit is controlled utilizing Programmable Logic Controller (PLC) control with Operator Work Station located in the Plant Office. This 100% outdoor air unit provides ventilation for the Headworks Building Clarify Room.

6.12.2 Automatic Operation (LOA Switch in AUTO)

The unit is started on low speed when the building lights are turned on, indicating building occupancy. Upon system start-up, the outdoor air dampers will open. When outdoor air damper status is proven, the return fan will start at low speed with supply fan to start at low speed after return fan status is proven. Space temperature is controlled by a transmitter located in the discharge duct to control the discharge temperature. The reheat coil control valve will modulate to maintain desired discharge temperature.

The supply and return air fans will switch to high speed when a Gas Alarm is generated.

The unit will switch to "Defrost Mode" upon sensing of low temperature by the averaging type freeze-stat. In Defrost Mode, the Defrost Damper opens and blows warm building air across the coil. The set-point temperature, the delay time and the length of the Defrost Cycle are operator selectable from the HMI.

6.12.3 Local Operation (LOA Switch in LOCAL)

In Local Mode, the unit is controlled by the position of the Low Speed/Defrost/High Speed Switch.

In the Low Speed position, the dampers will open and the fans will run at low speed. The Temperature Modulating Valve will control to maintain the set point temperature.

In the High Speed position, the dampers will open and the fans will run at high speed. The Temperature Modulating Valve will control to maintain the set point temperature.

In the Defrost position, the Defrost damper opens while the switch is in the Defrost position. The fan will run at the last speed set on the Speed/Defrost/High Speed Switch. To change the defrost fan speed, set the Speed/Defrost/High Speed Switch to the desired speed, then set it back to the Defrost position.

6.12.4 HMI Screens and Alarm Indication

The operator interface for the Air Handling Unit is on the **Ventilation** screen at the HMI.

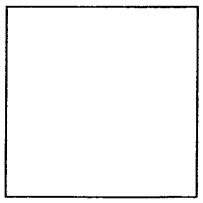
The top left-hand corner shows the date and time, as well as the logged in operator (1).

The graphic at the top left shows the Air Handling Unit and its components. Outside air temperature (2), supply air temperature (3) and exhaust air temperature (4) are displayed, as well as the modulating valve position (5).

A box to the right of the Air Handling Unit graphic allows the operator to select the set-point Supply Air temperature (6).

The box below the Air Handling Unit graphic indicates Normal/Defrost operation and has selectors for Defrost Set-point (7), Defrost delay (8) and Defrost Duration (9). To the left of this box is an indicator that displays the Air Handling Unit speed status and the control that has caused it to run (10).

Below this are two individual controls that give fan status. The top boxes display motor run time (11). The indicator below this gives run status (Ready, Low Speed, High Speed) (12). The bottom box indicates alarm status (13).



6.12.5 Alarms

The alarms associated with this system are summarized below:

Alarm	Annunciation
Gas Alarm - AHU to High Speed	Local annunciation & Dialer Callout
AHU EXHAUST FAN FAIL	Local annunciation & Dialer Callout
AHU FREEZE (BELOW 0°C, MORE THEN 5 MIN)	Local annunciation & Dialer Callout
AHU SUPPLY FAN FAIL	Local annunciation & Dialer Callout

6.13 Plumbing Systems Operation

(Refer to Drawing M-5)

A domestic water storage tank, pressure pump, hydro-pneumatic tank system and an electric domestic hot water heater supply domestic cold and hot domestic water for plant use.

The domestic hot water supply is produced by hot water heater DHW-1. The heater is a self-contained unit with its own operating and safety control. The temperature controller for the heater is a thermostat located on the side of the heater. This thermostat energizes the heating element to heat the water whenever the tank water temperature drops below the thermostat set-point. This set-point should be set to provide a hot water supply temperature of approximately 60°C (140°F).

The pressure safety valves provided on the domestic hot water heater should be tested periodically to ensure that they will function under emergency conditions.

6.14 Fuel Oil System

(Refer to Drawing M-8)

6.14.1 Fuel Storage

A 10,000 Litre double containment fuel storage tank will be provided in the summer of 2006. Detailed operating procedures will be supplied at that time.

6.14.2 Fuel Day Tank & Transfer System

A new ___ L double walled day tank was provided to replace the original single walled tank. A new Fuel Transfer Pump system was supplied to replace the gravity system previously used.

6.15 Basement Sump Pumps

The sludge handling basement is equipped with a floor sump, two sump pumps and a duplex pump controller. The pumps are controlled directly from the pump controller and are not interfaced with the plant control system.

Each sump pump has a discharge check valve. The pumps discharge into common discharge piping that discharges into the Raw Sewage Lift Station.

6.15.1 Automatic Operation (HOA Switches in AUTO)

The sump pumps operate in Lead/Standby configuration and are automatically alternated. On rising level, the standby pump is started. Amber lamps on the face of the control panel light when a pump is running.

6.15.2 Local Operation (HOA Switch in HAND OR OFF)

In HAND, the pump will run, regardless of the sump level. Amber lamps on the face of the control panel light when a pump is running.

In OFF, the pump will not run, regardless of sump level.

6.15.3 Alarms

Each pump is equipped with a leak detector that is monitored by the duplex controller. A leak is indicated on the control panel with a red indicator lamp, but is not alarmed elsewhere.

A high level fault is indicated on the control panel with a red indicator lamp but is not alarmed elsewhere.

A three position alarm switch is provided on the control panel. In the Test position, it lights the alarm lamps. In the off position, the alarm lamps do not function. In the Auto position, the alarm lamps light in the event of an alarm.

6.16 Mechanical System Troubleshooting

6.16.1 Alarms

The Waste Water Treatment Plant mechanical systems and equipment are continuously monitored with the appropriate alarms indicated if there is a system or equipment failure.

6.16.1.1 Alarms

Alarms with dial out to plant operator have been provided for the boiler system in event of a heating system failure.

Two separate alarms are called out. The first is for the Air Handling unit and includes a Start Failure and Low Supply Air Temperature. It also includes an alarm if the unit is set to high speed by the Gas Detection System.

The second alarm is for the Heating System and includes alarms for Low Glycol Temperature and Low Building Temperature as measured in the Sludge Handling basement.

6.16.2 Heating Operation Failure

6.16.2.1 Unit Heaters Not Operational

- Check for power to unit heater motor.
- Check unit heater thermostat control and setting.
- Check for possible obstructions in the heating piping including closed isolation valves.
- Check for air lock in heating system.
- Correct fault as required.

6.16.2.2 Air Handling Unit Heating Coil Not Operational

- Check control valve operation.
- Check control valve control system operating parameters and settings.
- Check for possible obstructions in the heating piping including closed isolation valves.

- Check for air lock in heating system.
- Correct fault as required.

6.16.2.3 Heating Pumps Will Not Start Up

- Check for power to heating pump.
- Check heating pump control system operating parameters and settings.
- Correct fault as required.

6.16.2.4 Boilers Locked Out On Low Flow

- Check flow switch operation.
- Check heating pump operation.
- Check for possible obstructions in the heating piping including closed isolation valves.
- Check strainers.
- Correct fault as required.

6.16.3 Air Handling Unit Operation Failure

6.16.3.1 Air Handling Unit Will Not Start Up

- Check low discharge temperature lockout controller.
- Check AHU control system operating parameters and settings.
- Check dampers, damper motors, linkages and end switches
- Correct fault as required.

6.16.3.2 Air Handling Unit Supply Fan Will Not Start Up

- Check for power to motor.
- Check for broken belts.
- Check blower wheel bearings and binding of blower wheel.
- Correct fault as required.

6.16.3.3 Air Handling Unit Low Supply Air Discharge Temperature

- Check AHU heating control system operating parameters and settings.
- Refer to Item 7.2.3 in this chapter
- Correct fault as required.

6.16.3.4 Air Handling Unit Low Discharge Air Volume

- Check for dirty/plugged filters.
- Check for dirty/plugged preheat/heating coils.
- Correct fault as required.

6.16.4 Exhaust Fan Operation Failure

6.16.4.1 Exhaust Fan Will Not Start Up

- Check control system operating parameters, settings and interlocks.
- Check dampers, damper motors, linkages and end switches
- Check for power to exhaust fan motor.
- Check for broken belts.
- Check blower wheel bearings and binding of blower wheel.
- Correct fault as required.

6.16.5 Sump Pump Failure

See the troubleshooting guide for the duplex controller in Section 9 of this manual.

END OF CHAPTER 6

Chapter 7

MAINTENANCE

7.1 General Maintenance

To ensure uninterrupted use, equipment should be regularly inspected, tested, and proper repairs made and recorded. The objective is to minimize equipment operating problems and prevent failures by making minor or necessary repairs before major difficulties occur. The importance of record keeping cannot be over-emphasized. Good maintenance protects the owner's interest with manufacturer warranties, continuity, or maintenance despite staff turnovers and equipment reliability track record.

Environmental and operating conditions are key elements affecting proper and reliable operation of equipment. Costly repairs can be minimized if the following items are attended to:

KEEP IT CLEAN

KEEP IT TIGHT

7.1.1 Keep it Clean

Day-to day accumulation of normal atmospheric particles, lint, metallic particles form mechanical equipment cause problems with equipment over a long period of time. An accumulation affects equipment reliability and operating life. ALL equipment should be regularly cleaned.

7.1.2 Keep it Tight

All contactors and control devices operate with high speed movement. This motion creates vibration that can loosen hardware and other parts. External vibration from equipment may cause the loosening of hardware and connections in any equipment. All hardware and connections should be tightened regularly. This simple procedure takes only a small amount of time and can save hours of searching for intermittent problems.

All rotating equipment such as motors are affected by vibrations. This can cause alignment problems, which can result in bearing failures.

7.1.3 Renewal Parts

Availability of parts can be a major problem these days as distributors are keeping very low inventories in a move to economize. This may make any part a long delivery item. For this reason local distributors should be contacted and parts availability assessed.

Any critical part affecting the reliability of the system should be ordered, recorded and stored by the maintenance department.

7.1.4 Parts and Equipment Ordering Procedure

During the first year of operation, the Contractor should be contacted for any replacement parts required. This will ensure that parts covered by warranty will be replaced under warranty. Failure to contact the Contractor may result in difficulties in obtaining warranty replacement.

Following the first year of operation, it is recommended that the Contractor also be contacted as many of the suppliers have a wholesale only policy. If it is necessary to purchase parts directly from the original supplier, the following information is required.

- **Make**
- **Model No.**
- **Year of Installation**
- **Installing Contractor**
- **Description of Part Required (i.e. Fan Bearing)**
- **Part No. if Available.**

When quoting a part number contained in manufacturer's catalogue, always provide the date of the catalogue you are referring to, as these numbers are often subject to change. The equipment supplier will have the latest edition of the manufacturer's catalogue.

If the original supplier is no longer in business, contact the contractor who will be able to suggest an alternate source of supply.

7.2 Scheduled Preventative Maintenance

Scheduled preventive maintenance is an effective means to improve services from systems and equipment. Where failure of equipment can result in shutdown, scheduled preventive maintenance is an economical alternative.

Causes of Equipment Failure

An effective maintenance program will attempt to remove or reduce causes of equipment failure. Common failure initiating causes are:

1. Loose and broken belts
2. Misaligned pulleys
3. Dirty or plugged filters
4. Dirty or plugged coils
5. Worn bearings
6. Improper lubrication and oiling or lack of
7. Persistent overloading
8. Above normal temperatures
9. Below normal temperatures
10. Obstruction of ventilation by foreign objects or material (blockage of air, dirt on components etc.)
11. Normal deterioration from age
12. Severe weather conditions.

The scheduled preventive maintenance suggestions presented will be applicable to most equipment, but all of the suggestions given in any one section may not be applicable to the particular mechanical component being maintained. Most of the work may be done by the building operator but some may have to be left to the discretion of the building operator.

When equipment repair is necessary, please refer to the Manufacturer Data section provided in this manual. The frequency, which the tasks should be done as indicated.

Most maintenance can be done by average personnel, with a minimum need for specialized service.

7.2.1 Maintenance Legend

D	Daily
W	Weekly
M	Monthly
A	Annually
AN	As Needed
PMI	Per Manufacturer's Instructions

7.3 General Maintenance

Item	Maintenance Operations	Frequency	Remarks
Valves	Exercise and check for proper operation	A	
Motorized Valves	Follow maintenance schedule in the manufacturer's manual	PMI	
Raw Sewage Lift Station	Check wetwell for grease accumulation	D	
	Check pump operation and switch between duty and stand-by	M	
	Record voltage and amperage	A	
	Check terminals for corrosion or loose leads	A	
Screw Screens	Check Screw Brushes for rag accumulation	D	
	Check nozzles for plugging	D	
	Check upper screen for plugging	W	
	Record voltage and amperage	A	
	Check terminals for corrosion or loose leads	A	
	Follow maintenance schedule in the manufacturer's manual	PMI	
Primary Filter	Wash inside of Filter Compartment	D	
	Wash inside of Auger Compartment	D	

Item	Maintenance Operations	Frequency	Remarks
Primary Filter (cont'd)	Wash Compacter Screen	D	
	Check Belt Tracking	D	
	Record voltage and amperage	A	
	Check terminals for corrosion or loose leads	A	
	Follow maintenance schedule in the manufacturer's manual and other items listed below	PMI	
Air Blower	Check discharge pressure and filter differential pressure	D	
	Clean/Change Blower Inlet Filter	AN	
	Check Oil Levels/Top Up Oil	W/AN	
	Change Oil	PMI	
	Check Belt Tension	W	
	Re-tension/Replace Belt	AN	

7.3.1 Raw Sewage Lift Station Maintenance Procedures

7.3.1.1 Procedure to Clean Basket Strainer

The Basket Strainer must be completely removed from the Lift Station to be cleaned. See Section 6.8 for removal and reinstallation procedures.

Once removed, the basket must be lowered to the Main Process Room floor. Rag material will be wrapped around the bars of the screen. Use rubber gloves to remove the rag material and place in a bucket for removal. The bucket can be emptied into the chute that carries compacted sludge from the Primary Filter to the trailer below.

7.3.1.2 Procedure to Drain Raw Sewage Lift Station

The Raw Sewage Lift Station can only be drained if all influent flow is stopped. To do this, all flow must be diverted to the lagoon. This is done by opening the slide gate in the upstream influent manhole.

The Lift Station can be drained with the Raw Sewage Pumps to within about 300 mm from the bottom. Final draining will have to be done with a portable pump.

To drain the Drain Raw Sewage Lift Station with the Vacuum System, the Raw Sewage Influent Isolation Valve (V-101) must be closed. This is done from the Headworks Room floor, using a valve key placed on the valve stem under the grating.

Open V-119 when the sewage vacuum truck is connected to the truck connection. Apply suction from the vacuum truck until the chamber is empty. Close V-118 before disconnecting the vacuum truck. Final draining will have to be done with a portable pump.

7.3.1.3 Procedure for Grease Removal from the Raw Sewage Lift Station

In time, grease will accumulate in the Raw Sewage lift Station as water is pumped out from beneath it. This material can be removed by a sewage vacuum truck and then blown back into the feed channel of the Screw Screens.

A suction hose long enough to reach from the Primary Effluent Channel vacuum connection to well into the Lift Station is required. A rope on the open end will be helpful for directing the suction. An additional rope to suspend the hose in the approximate position requires is also recommended.

If the level of the water in the Lift Station is allowed to rise somewhat, it may make it easier manipulate the end of the hose (shorter free length). A dedicated operator will be required to start and stop the pumps to maintain this level.

Use all normal confined space entry procedures for entering the Lift Station. It will likely require two operators at the lower landing level to manipulate the hose. Do not attempt this work without adequate manpower. Note that the hose will "buck" significantly as it sucks water and solids from the chamber.

If the grease is mostly floating material, pre-cleaning of the walls may not be required. However, if there are large areas where grease is adhering to the walls, pre-cleaning with hot water may be beneficial. Hot water is available at the hose bib on the south wall of the Headworks Room.

Ensure that the hose is properly and safely secured before starting the vacuum. Open V-118 when the hose is connected to the interior cam-lock connection and the sewage vacuum truck is connected to the truck connection.

When the floatables have been removed, or when the vacuum truck is full, the hose will have to be removed from the Lift Station and secured to discharge into the inlet channel of the Screw Screens. When it is safely secured, the sewage vacuum truck can apply air pressure to discharge the load.

If there is more material to remove from the Lift Station, re-secure the hose and repeat the above steps.

7.3.2 Screw Screen Maintenance Procedures

7.3.2.1 Wash Screw Brushes

The lower section of the screws are equipped with brushes on the edges of the screws to clean the perforated screens. Debris will hang up on these brushes. A hose bib is supplied on the wash water piping manifold. Hose down the brushes daily.

1. Set the screws to run manually with the associated pendant station HOA switch set to HAND.
2. If the debris cannot be removed with the hose, use the following procedure to manually clean the brushes.

7.3.2.2 Manually Clean Screw Brushes

1. Lock out the screw with the ESD on the associated pendant station.
2. Remove all of the exposed debris with rubber gloves and deposit in a bucket.
3. Pull out the ESD. Rotate the screw with the HOA Switch in HAND and the FOR/REV Switch in FOR, by pressing the JOG button. Lock out the screw with the ESD.
4. Remove all of the exposed debris and repeat these steps as necessary.

7.3.2.3 Clean Spray Nozzles

1. Lock out the screw with the ESD on the associated pendant station.
2. Remove blocked nozzles and clean with compressed air.

7.3.2.4 Clean Upper Screen

1. Lock out the screw with the ESD on the associated pendant station.
2. Remove screen cover
3. Use garden hose to wash all debris and off screen and inside of compartment.
4. Ensure that water is expressed through the screen during auger operation.
5. Replace lid, open hot water valve.

7.3.3 Primary Filter Maintenance Procedures

7.3.3.1 Wash Compactor Screen

1. To prevent injury, close hot water valve for this procedure.
2. Remove lid of dewatering unit.
3. Use garden hose to wash all debris and off screen and inside of compartment.
4. Ensure that water is expressed through the screen during auger operation.
5. Replace lid, open hot water valve.

7.3.3.2 Wash Inside of Auger Compartment

1. Pull auger compartment out about 6 inches. Ensure that discharge is still over hopper. Auger may be allowed to run during this procedure.
2. DO NOT INSERT TOOLS OR HANDS IN COMPARTMENT WHILE EQUIPMENT IS OPERATING.
3. Use garden hose to wash down exposed surfaces.
4. If there is a grease build-up, use hot water to remove grease.
5. Flip external scraper bar handle. Wash scraper bar at top.
6. Close auger compartment

7.3.3.3 Wash Inside of Filter Compartment

1. Raise lid of filter compartment.
2. Hose down exposed surfaces.
3. Check belt tracking (below).
4. Close lid of filter compartment.

7.3.3.4 Belt Tracking

1. Run Belt and observe seam. If seam starts to skew, follow applicable procedures manufacturer's instructions for changing belt to correct the problem.

Manufacturer's instructions for Weekly Maintenance are listed in Section 9.1 of the "Operating Manual for Salsnes Filter System Model 6000".

7.3.3.5 Check/Clean Spray Nozzles

1. To prevent injury, close hot water valve for this procedure.
2. Disconnect hose from spray bar.
3. Press E-stop to prevent belt operation while spray bar is being removed.
4. Undo bolts on both ends of spray bar.
5. Remove spray bar.
6. Reconnect hose to spray bar and stand spray bar on floor.
7. Start Manual Wash Cycle from HMI.
8. Open hot water valve to check spray pattern. Marl plugged nozzles.
9. Close hot water valve.
10. Remove plugged nozzles and clean with high pressure air.
11. Replace and tighten nozzles.
12. Press E-stop to prevent belt operation while spray bar is being replaced.
13. Replace Spray bar and bolt in place.
14. Open hot water valve.
15. Pull E-stop to allow normal operation

7.3.3.6 Check/Wash Air Knife

1. Undo bolts on end of Air Knife.
2. Pull auger compartment fully out to clear Air Knife slot.
3. Remove Air Knife
4. Reconnect air hose to Air Knife and secure Air Knife.
5. Close auger compartment.
6. Pull E-stop to allow belt operation.
7. When belt cycle starts, wash Air Knife slot with hose. Air will blow loose material and water away from the slot.
8. DO NOT STAND IN FRONT OF AIR KNIFE DURIING THIS OPERATION.
9. Press E-stop to prevent belt operation while Air Knife is being replaced.
10. Remove air hose from Air Knife.
11. Pull auger compartment fully out to clear Air Knife slot.
12. Replace Air Knife (a thin piece of sheet metal between the Air Knife and the belt to depress the belt makes it easier to insert).
13. Replace bolts on end of Air Knife and reconnect air hose to Air Knife.
14. Close auger compartment.
15. Pull E-stop to allow normal operation

7.3.4 Procedure to Skim Floatable and Settled Material from Primary Effluent Channel

Any floatable material that passes the Primary Filter will be trapped behind the underflow baffle in the Primary Effluent Channel. With time, an deposit of fine settleable material may also accumulate in the channel.

These can be removed though the Vacuum System by a sewage vacuum truck. A suitable hose must be attached to the cam-lock fitting in the Headworks Room and be manually directed to remove the material.

Open V-118 when the hose is connected to the interior cam-lock connection and the sewage vacuum truck is connected to the truck connection. Apply suction from the vacuum truck until the material has been removed. Close V-118 before disconnecting the vacuum truck.

7.4 Heating System

7.4.1 Unit Heater

Refer to Unit Heater Operation and Maintenance Data.

Check controls and thermostat	M
Clean unit heating coil	M
Visually inspect fan operation and electrical connections	M
Replace or clean force flow heater filters	M

7.4.2 Heating Pumps

Refer to Heating Pump Operation and Maintenance Data.

Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A
Check and clean strainers	AN

7.4.3 Removal of Heating Pump for Service

If the duty pump will not start, it may be necessary to remove the duty pump for servicing.

- Switch over to the Backup Heating Pump for duty service and open isolation valves.
- Close the pump isolation valves to isolate the pump and have an electrician disconnect the pump.
- After repair of the pump is completed, reinstall the pump in reverse order.
- Start-up pump to verify operation.
- The Heating pumps can be left as is, making the Backup Heating Pump as the duty pump or returning the heating pumps back to normal operating condition.

7.5 Ventilation System

7.5.1 Air Handling Units and Exhaust Fans

Refer to Air Handling Units and Exhaust Fans Operation and Maintenance Data.

Check for unusual noise or vibration and if observed, check bearings and belt	M
Check for belt slipping and wear	M
Check pulley sheaves for wear	A
Lubricate bearings	PMI
Check fan blades/wheel for grease and dirt and clean as required	A
Check all bolts and fasteners	M
Check filters and clean or replace as required	M
Check and clean preheat and heating coil fins	M
Check that outside air intake screens are clean	M
Check that all dampers operates without binding	M
Ensure spring tension is adequate to close dampers	M
Check motor amperage draw	A
Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A

7.5.2 Controls

Check safety controls and ensure shut down is activated	D
Check temperature sensor calibration	M
Clean all points and contacts on control system	M
Check control valves for positive shut off	M

7.6 FEW System

7.6.1 FEW Pumps

Refer to FEW Pump Operation and Maintenance Data.

Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A
Check and clean strainers	AN

7.6.2 Removal of FEW Pump for Service

- Set pump to Standby Duty at the HMI. Turn HOA Switch at MCC to OFF. Turn Breaker at MCC to OFF
- Close the pump isolation valves to isolate the pump and have an electrician disconnect the pump.
- After repair of the pump is completed, reinstall the pump in reverse order.
- Start-up pump to verify operation.

7.6.3 FEW Circulating Pump, FEW Hot Water Booster Pump

Record voltage and amperage	A
Check terminals for corrosion or loose leads	A
Blow out motor windings with compressed air	A

7.6.4 Removal of FEW Circulating/Hot Water Booster Pump for Service

- Turn HOA or On/Off Switch to OFF. Turn breaker for pump off
- Close the pump isolation valves to isolate the pump and have an electrician disconnect the pump.
- After repair of the pump is completed, reinstall the pump in reverse order.
- Start-up pump to verify operation

END OF CHAPTER 7

Chapter 8

TESTING AND CERTIFICATION DATA

8.1 CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE (10P).

8.2 MECHANICAL SPARE PARTS .

END OF CHAPTER 8

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: PRIMARY FILTER SYSTEM
SALSNES FILTER, KAESER BLOWER.

TAG NO: PF-108

REFERENCE SPECIFICATION: 11510.

(Authorized Signing Representative of the Supplier) — Date: May 16/06

(Authorized Signing Representative of the Contractor) — Date: MAY 16 2006

(Authorized Signing Representative of the Engineer) — Date: MAY 16/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

SIGNED PENDING RESOLUTION OF HCH DEFICIENCY

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: RAW SEWAGE PUMPS

TAG NO: P-102, P-103, P-104

REFERENCE SPECIFICATION: 11346.

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — Date: MAY 24 2006

(Authorized Signing Representative of the Engineer) — Date: MAY 23/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. ~~No defects in the equipment were found.~~ The equipment is therefore classed as "conforming".
WITH DEFICIENCIES AS NOTED.

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: SCREW SCREENS

TAG NO: SSCR-105, SSCR106

REFERENCE SPECIFICATION: 11025

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — Date: MAY 24 2006

(Authorized Signing Representative of the Engineer) — Date: MAY 23/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: MOTOR CONTROL CENTRES

TAG NO: MCC-2

REFERENCE SPECIFICATION: 01735 2.3,

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — MAY 24-2006 — Date

(Authorized Signing Representative of the Engineer) — MAY 23/2006 — Date

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. ~~No defects in the equipment were found.~~ The equipment is therefore classed as "conforming".
WITH DEFICIENCIES AS NOTED

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: PROCESS AND PLANT CONTROL SYSTEM

TAG NO:

REFERENCE SPECIFICATION: 01735 - 2.3

(Authorized Signing Representative of the Supplier)	Date
(Authorized Signing Representative of the Contractor)	May 24, 2006
(Authorized Signing Representative of the Engineer)	May 23/2006
(Authorized Signing Representative of the Owner)	Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. ~~No defects in the equipment were found~~. The equipment is therefore classed as "conforming".
WITH DEFICIENCIES AS NOTED

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: HEATING & VENTILATION SYSTEM.

TAG NO: VARIOUS

REFERENCE SPECIFICATION: 01735 - 2.3

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — MAY 01 2006 Date

(Authorized Signing Representative of the Engineer) — MAY 23/2006 Date

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. ~~No defects in the equipment were found~~. The equipment is therefore classed as "conforming".
WITH DEFICIENCIES AS NOTED

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: PLANT SERVICE WATER SYSTEM (FSW) INCLUDING FSW HEATING.

TAG NO: VARIOUS

REFERENCE SPECIFICATION: 01735 - 2.3

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — May 24 - 2006 — Date

(Authorized Signing Representative of the Engineer) — May 23/2006 — Date

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found. The equipment is therefore classed as "conforming".

PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: CHEMICAL PREPARATION & METERING

TAG NO:

REFERENCE SPECIFICATION: 01735 - 2.3

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — Date: May 24-2006

(Authorized Signing Representative of the Engineer) — Date: May 23/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

We certify that the equipment listed below has been continuously operated for at least fourteen (14) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. ~~No defects in the equipment were found.~~ The equipment is therefore classed as "conforming".
WITH DEFICIENCIES AS NOTED.

PROJECT: IQALUIT WWTP - PHASE I

ITEM OF EQUIPMENT: MONITORS & ALARMS

TAG NO: VARIOUS

REFERENCE SPECIFICATION: 01735 - 2.3

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — Date: MAY 24-2006

(Authorized Signing Representative of the Engineer) — Date: MAY 23/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

EQUIPMENT INSTALLATION

CERTIFICATE OF SATISFACTORY EQUIPMENT PERFORMANCE
FORM 103

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PROJECT: IQALUIT WWTP - PHASE 1

ITEM OF EQUIPMENT: TREATMENT PROCESSES

TAG NO: VARIOUS

REFERENCE SPECIFICATION: 01735 -2.3

(Authorized Signing Representative of the Supplier) — Date

(Authorized Signing Representative of the Contractor) — Date: MAY 24 2006

(Authorized Signing Representative of the Engineer) — Date: MAY 23/2006

(Authorized Signing Representative of the Owner) — Date

END OF SECTION

spare parts plc


SIFEC NORTH INC.

from: 20010victor ,Mirabel , J7J-1P4

Tel: 450-437-4001 fax450/430-7106

Spare parts List

Waste water treatment plant phase 1. Iqaluit Nunavut
May 30, 2006

OUTSTANDING SPARE PARTS

On site	Product #	Description
	09911	1 4-Litre can of each type and color of stain and finish coating:
1		Light Blue - Wall
1		Dark Blue - Wall
1		Dark Blue - Door & Frame
1		Red - Pipe
1		Black - Pipe
	11346	Provide:
1		1 - Seal Set
1		1- Set of motor bearings
1		1- Set of pump bearings
1		1- Impeller
	15100	Provide 1 spare valve:
2		3/4" motorized ball valve
0	or other	2" pinch valve or repair kit ho-matic ag dn 50
1		3/4" SS NPT Solenoid Valve (Salsnes)
		1/4" Br NPT Solenoid Valve (Salsnes)
1		1/2" Br NPT Solenoid Valve
0	or other 17300	LEL Calibration Gas
0	or other	LEL Calibration Gas Regulator
1		Laptop Computer asus A3A
		complete with all software to operate the plant
		RSView Studio and RSView Studio ME station
		Allen Bradley RS Logix 500
		original of all software(2) and token (3) left on site
12		spare nozzles for sscr

19/07/06

8.2

Chapter 9 SCREW SCREENS

MANUFACTURER/DISTRIBUTOR:

EURODRIVE
MONTREAL 514-367-1124
MORE DETAIL SECTION 9.5 (LAST PAGE)

9.1 TECHNICAL SPECIFICATION.

9.2 GEAR REDUCERS "SEW EURODRIVE".

9.3 ELECTRIC MOTOR "600V 1800 RPM".

9.4 OPERATION AND MAINTENANCE MANUAL.

9.5 COMMISSIONING AND SERVICING.

END OF CHAPTER 9

IQALUIT WATER RECLAIMATION FACILITY

IQALUIT, NUNAVUT

SUBMITTAL PACKAGE FOR:

ML ENGINEERING

SCS-50 SCREW SCREEN

Submitted by: Pro Aqua Engineering
2800 John Street, Suite 13A
Markham, ON, L3R 0E2

Tel: (905) 513-0222
Fax: (905) 513-6839

Contact: Geoff Coate

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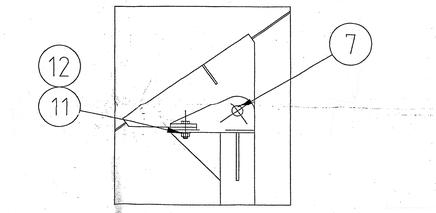

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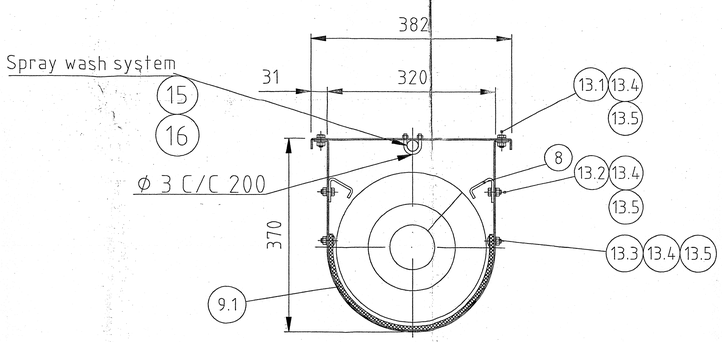

B-B

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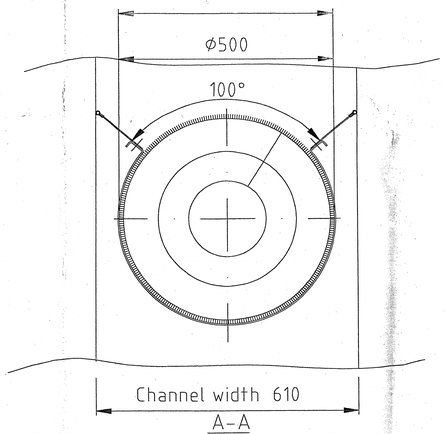

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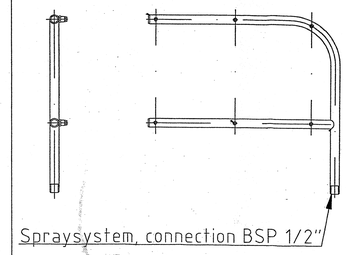


Dewafering spray systems.

Item No.	Qty.	Description	Material	Dimension	Remark
16	4	U-Clamp	SS 304	ϕ 22	M8
15	1	Spraysystem BSP 1/2	SS 304	21,6x2,6	L=1582
14	4	Chemical anchor	SS 304	M 12	
13.5	44	Washer	SS 304	Rb 8,4	
13.4	30	Nut	SS 304	M6M 8	
13.3	16	Screw	SS 304	MVBF 8x20	
13.2	4	Screw	SS 304	M6S 8x20	
13.1	10	Screw	SS 304	M6S 8x15	
12	24	Washer	SS 304	Rb 10,5	
11	13	Nut	SS 304	M6M 10	
10	11	Screw	SS 304	M6S 10x30	
9.2	1	Lining, t=8	Polyurethan	3-19817	
9.1	1	Lining, t=8	Polyurethan	4-4065	L=1682
8	2	Guider		3-4898	
7	1	Shaft		4-19824	
6	1	Cover		3-19816	
5	1	Cover		4-3285	L=1682
4	1	Support		2-19823	
3	1	Screen		1-19807	hole=3mm
2	1	Trough (assembly dwg.)		1-19810	
1	1	Driveunit		2-19819	

Eng.	Dr'n.	Copy	Ch'd.	Stand.	Appd.	Scale
	PK					1:20

ML-ENGINEERING AB
QUALITY PRODUCTS FOR SEPARATION AND CONVEYING

Iqaluit SCS
SCREENSCREW
SCS 50
Assembly drawing

Replaces	Projection
Replaced by	E
1842	Date 990505
Drg. No. 2-32056	Rev.

Rev.	Details of changes and/or change note No.	Date	Sign.	Appd.

Section 1

Screw Screen

Model SCS-50

PLANT: Iqaluit, Pro Aqua DATE: 990416

TECHNICAL SPECIFICATION FOR ML SCREENSCREW SCS 50

General:	Type SCS 50 shaftless screwscreen with dewateringpress. Inclined at 35 degrees and designed for installation in a 610 mm wide and 1219 mm deep channel. Discharge height 2000 mm. Total approximate length 4670 mm.
Capacity:	77 l/s.
Duty:	To separate, transport and dewater municipal screenings.
Screw:	Shaftless spiral made of cold rolled flatbars in SB400D. Outer dia. 285, pitch 140. Lower part is provided with an exchangeable brushunit for rinsing of the screenholes. Pipe insert in the screen part of the spiral.
Trough:	320 mm trough in 3 mm thick stainless steel SS 304. The trough is provided with drilled flanges at each end. Trough section equipped with spray system.
Press section:	Designed as a special-slotted pipe to the trough. An outer casing with access door and 3" drainage is provided. Equipped with spray system.
Trough liner:	Trough lined in 8 mm polyurethane.
Screenunit:	920 long x 500 wide, made of a semicircular 3 mm slotted perforated plate. Screen unit is flange connected to the trough. Equipped with spray system.
Supports:	One frame for bolting to foundation. Stainless steel expander bolts are included.
Driveunit:	Spurgear SEW FAF 77. Speed 8,5 rpm. Electric motor 1,5 kW, 575 Volts, 60 Hz.
Overload guard:	1 No electronic overload guard is included for installation in a holding circuit in the control panel.
Material:	Trough, press section, flanges and supports SS 304.
Surface-treatment:	Steel parts are painted in accordance with Swedish standard RS 8. Driveunit is improved. Colour RAL 5017 blue. Trade components according to respective manufacturers standard.

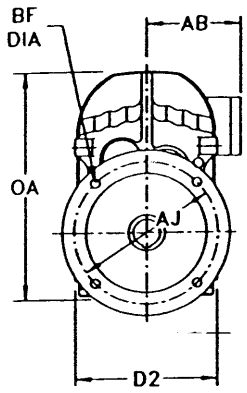
Section 2

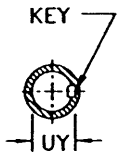
Gear Reducers

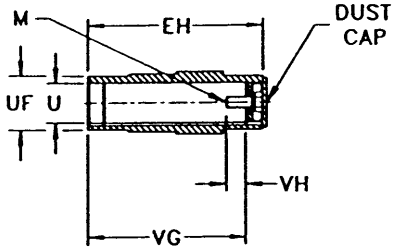
Gear Reducers

Manufacturer:	SEW Eurodrive
Model:	FAF 77
Output Speed:	8.5 rpm

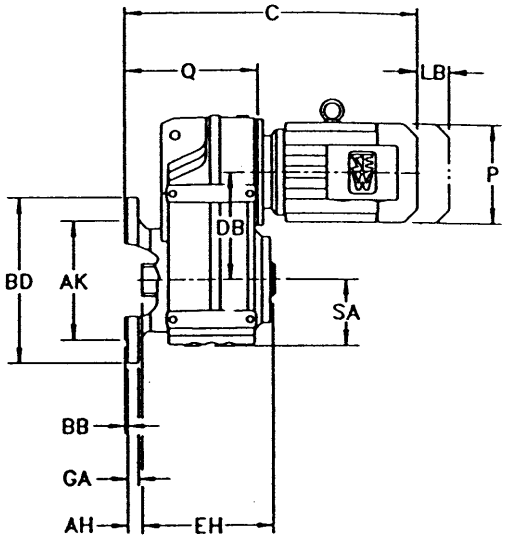
Dimensions
Type FAF Gearmotors - Flange Mounted with Hollowshaft







OUTPUT HOLLOWSHAFT



Gearcase

Model	D2	DB	OA	Q	SA
FAF77	10.63	7.87	16.77	9.21	4.76
	270	200	426	234	121

Flange (Specify BD dimension when ordering)

	Standard							Alternate[1]						
Model	AH	AJ	AK	BB	BD	BF	GA	AH	AJ	AK	BB	BD	BF	GA
FAF77	1.46	10.43	9.055 $^{+.0006}_{-.0005}$	0.16	11.81	0.55	0.63	1.46	8.46	7.087 $^{+.0006}_{-.0004}$	0.16	9.84	0.55	0.59
	37	265	230 $^{+.016}_{-.013}$	4	300	14	16	37	215	180 $^{+.014}_{-.011}$	4	250	14	15

Output Shaft

Inch Series/*Optional Metric Series* For solid shaft design see page 200.

Model	EH	U	UF	UY	VG	VH	Key	M
FAF77	8.27	2.000 $^{+.001}_{-0}$	2.76	2.23	7.20	1.16	½ x ½ x 2⅝	⅝–11 x 1¾
	210	*50* $^{+.025}_{-0}$	*70*	*53.8*	*183*	*32*	*14 x 9 x 80*	*M16 x 45*

Motor

		DT				DV				
Model		71	80	90	100	112M	132S	132M	132ML	160M
	AB	5.43 138	5.43 138	6.73 171	6.89 175	7.40 188	7.40 188	9.13 232	9.13 232	9.13 232
	LB	2.52 64	2.52 64	3.35 85	3.35 85	3.15 80	3.15 80	4.41 112	4.41 112	4.41 112
	P	5.71 145	5.71 145	7.76 197	7.76 197	8.70 221	8.70 221	10.83 275	10.83 275	10.83 275
FAF77	C	16.81 427	18.78 477	19.49 495	21.46 545	22.87 581	24.65 626	25.43 646	27.80 706	27.80 706

Dimensions are $\frac{\text{inch}}{\text{mm}}$

Dimension **AB** is to motor conduit box

Dimension **LB** is for brake option

Eye bolts are removable

See page 199 for available output shaft options.

[1] This flange option reduces the gearbox torque rating - contact SEW-Eurodrive for details.

92-3

SCREW SCREEN

Conveying zone

The shaftless screw is combined with a high quality wear liner for long life and low noise levels. The length of the conveying zone is determined by the required discharge height.

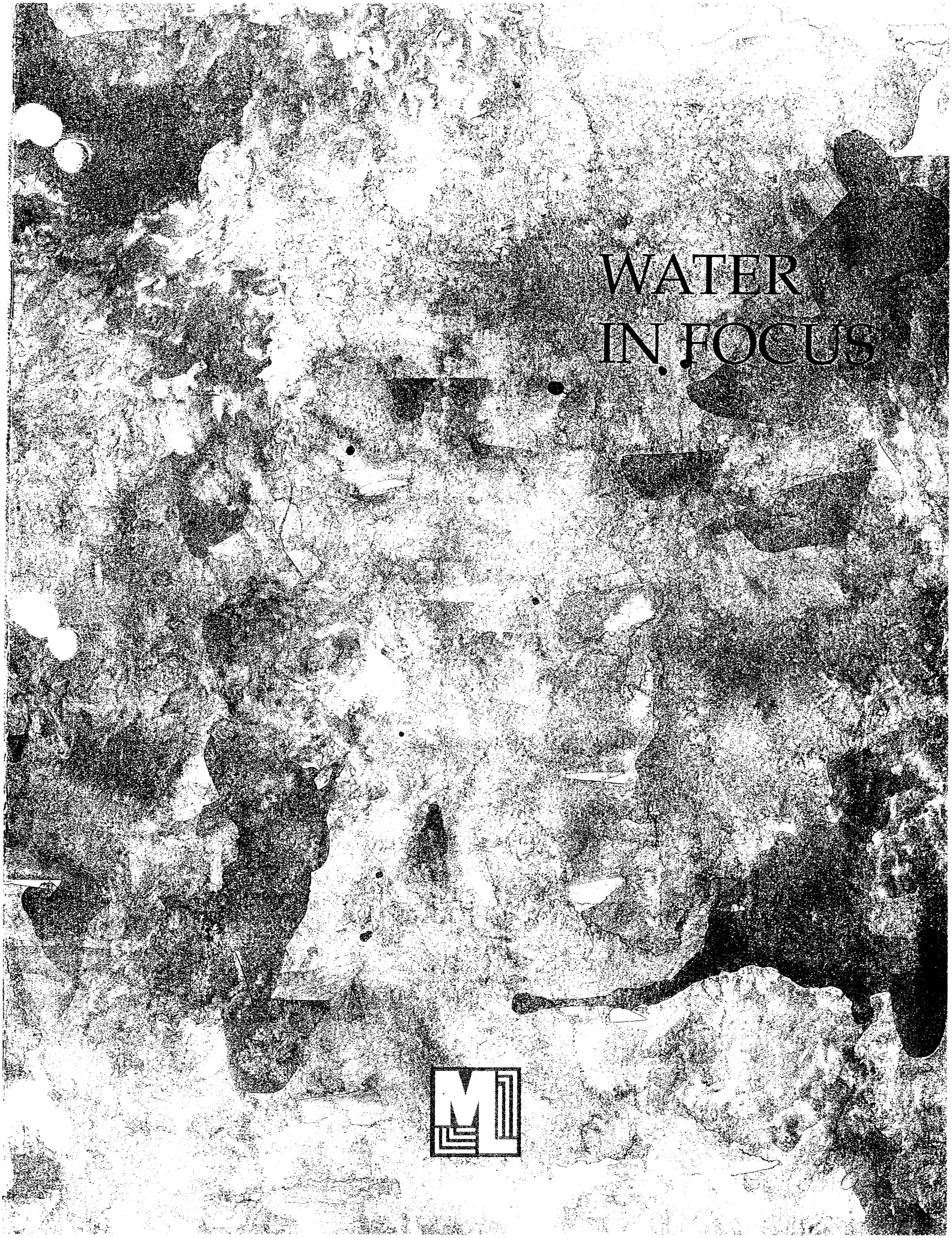
Dewatering zone

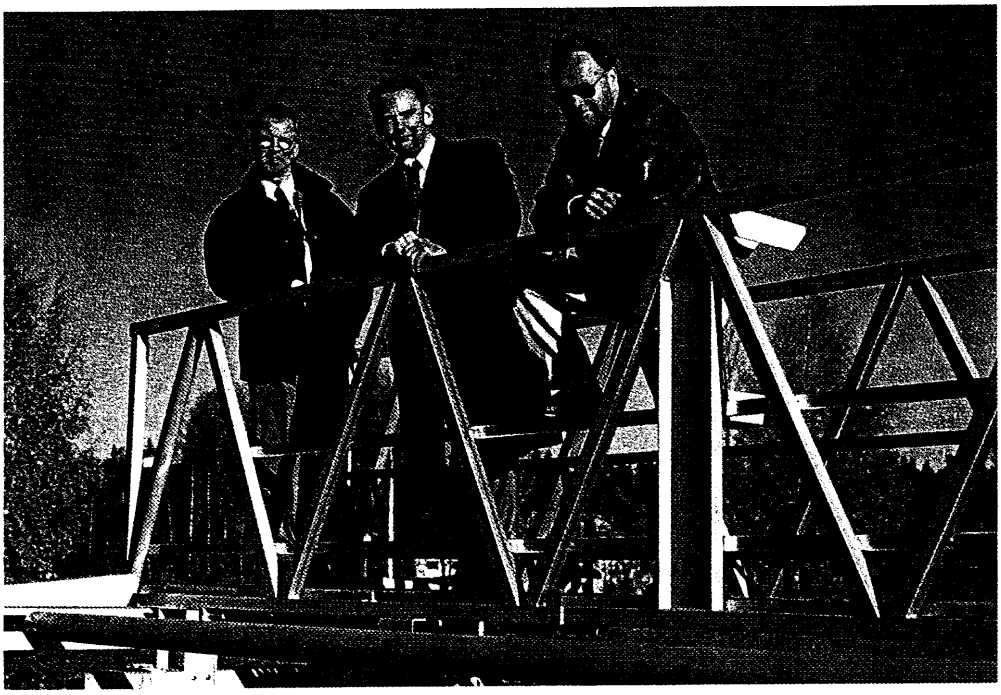
The pressing zone, incorporating a tapping system, has a wedge wire construction for optimal dewatering. Dewatered screenings are discharged to a container or are further conveyed.

Screening zone

The screen consists of a stainless steel perforated basket in diameters up to 500 mm and apertures up to 6 mm. The screenings are transported using a shaftless screw incorporating a self cleaning brush system.

The ML screw screen offers fine screening, conveying and dewatering in one cost efficient and space saving unit. Every unit is designed according to the flow conditions of the site and the requirements for screening and discharge height. Easy, dry maintenance is provided through access covers and a central pivot. Options include washing of screenings and heating and insulation of the pressing zone.


WATER
IN FOCUS



A bridge to the world

ML Engineering is concerned with the supply of mechanical equipment solutions for waste water treatment. Our products are used for physical separation, material handling and aeration for all process stages in both the municipal and the industrial markets.

After 25 years in this field we have, through working closely with our customers, extensive experience and competence. Taking on new projects from around the world enhances this knowledge and provides the opportunity to develop new products and applications to improve waste water treatment.

Our objective is always to give our customers the best possible service and quality. Such a goal provides us with a stimulating challenge. Working in an important environmental field is a further source of motivation.

More than 80% of our production is exported. Our international network of representatives is our bridge to the world. Local partners who share our objectives and ideas can more effectively convey the right approach to each market.

Steps for success

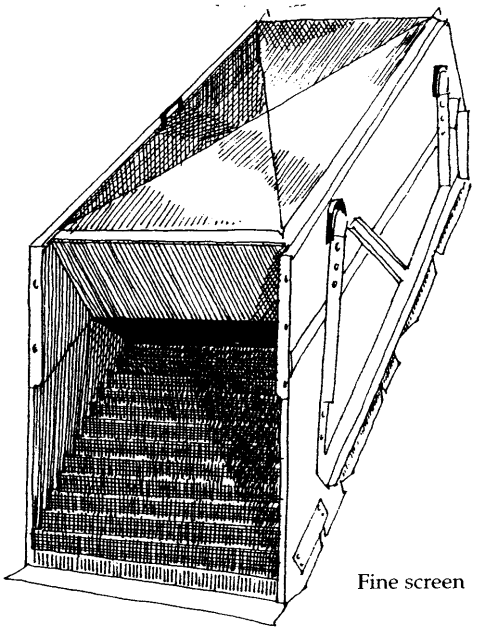
ML has its head office with manufacturing, design and development facilities in Ruda, south east Sweden. A base in Sweden provides access both to expertise in stainless steel production and to many of the latest developments in water treatment.

The strength of our organisation is our people. The team-based structure and focus on training lead to the right professional skills and personal development. The objective is to have control over all aspects of our work so as to complete every project to the satisfaction of the customer.

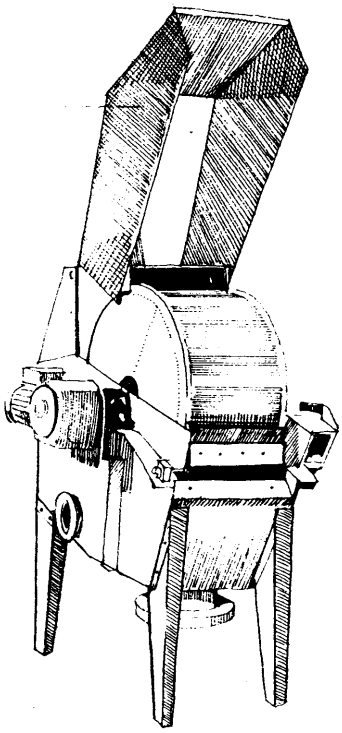
We have the ability to respond to the different needs of each of our business partners. In many situations we work with municipalities, water companies or industry. Just as often it is a contractor or a consultant that is the principal contact. Such an open dialogue gives many mutual benefits.

Solutions for all stages

Together with our customers we have developed a wide range of complementary standard products in stainless steel. Our extensive applications knowledge means that the programme can be used across all treatment stages and processes and can be tailored to the requirements of every project.



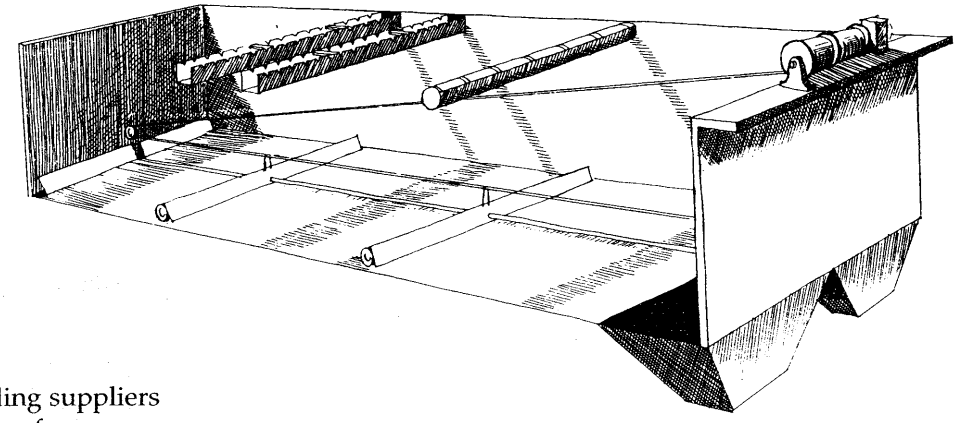
Fine screen



Drumsieve

Screens and sieves

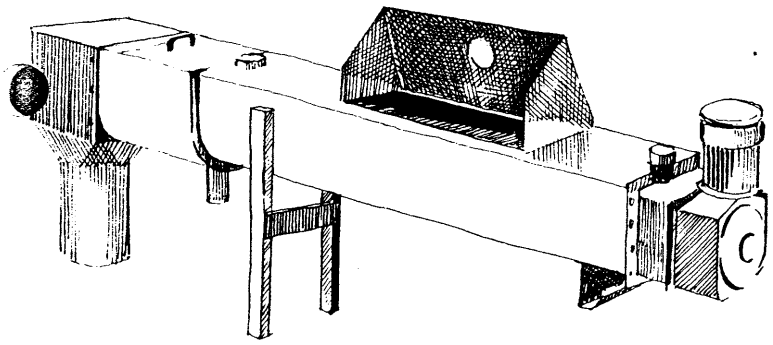
The ML range of screening products is designed to cover almost all conceivable requirements. From the rotary drum sieves for separation below 1.5 millimetres, through fine screens based on the stepping principle, to a variety of bar screens of up to 100 millimetres slot widths. Efficient and robust designs mean low running and maintenance costs. The range is also complemented by the screw screen. This combines fine screening with conveying and dewatering in a single unit.



Wire driven scraper

Clarifiers

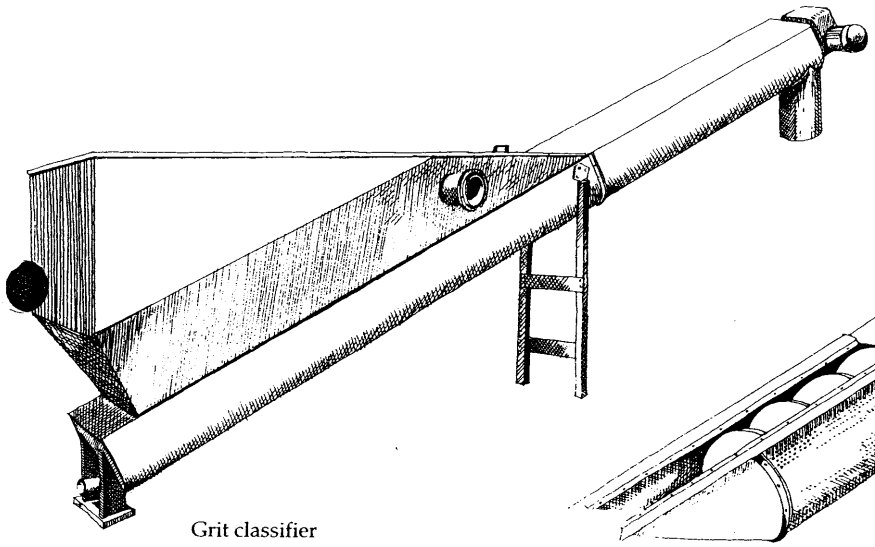
ML is one of Scandinavia's leading suppliers of clarifiers. The range consists of scrapers, suction scrapers and thickeners to fit circular and rectangular tanks of all dimensions. Of particular interest is ML's patented wire driven scraper for rectangular tanks. This simple but ingenious design remains a market leader 10 years and almost 1000 installations after its conception.



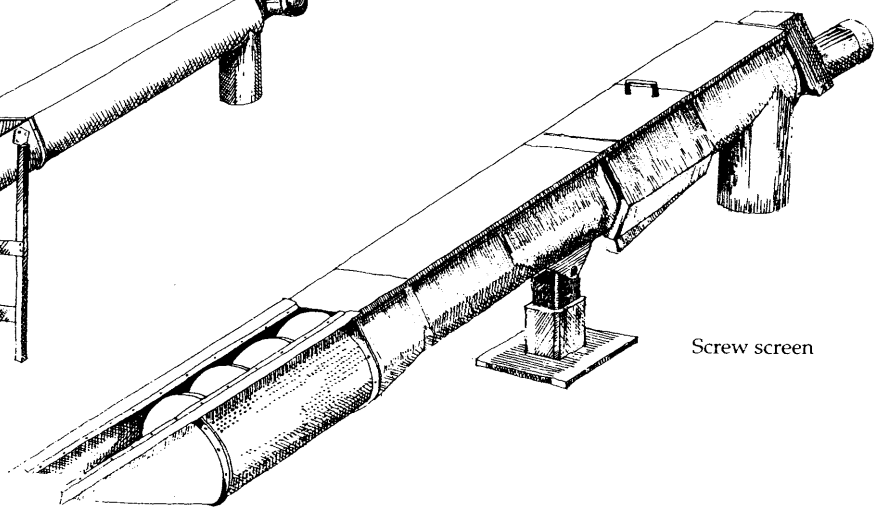
Conveyor with dewatering zone

Shaftless screw based products

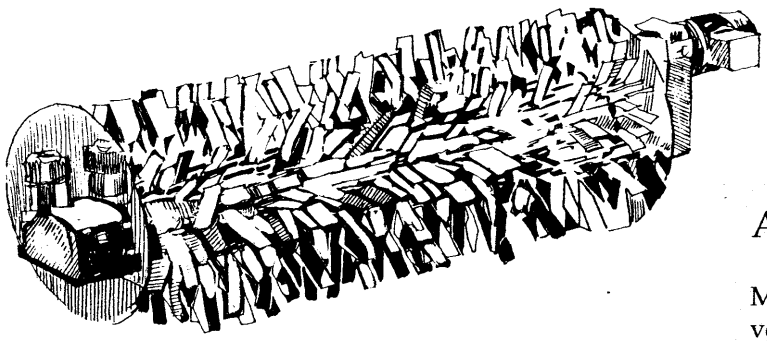
ML was one of the pioneers of the use of shaftless screw conveyors to handle materials with a high risk of clogging. The conveyors, often specified together with screens, are available in various diameters up to 580 millimetres. Grit classifiers and conveyors with a dewatering zone are also available. Further developments have included the screw screen mentioned above, vertical conveyors to increase flexibility with plant layout and screenings washers for the removal of faecal matter from screenings.



Grit classifier



Screw screen



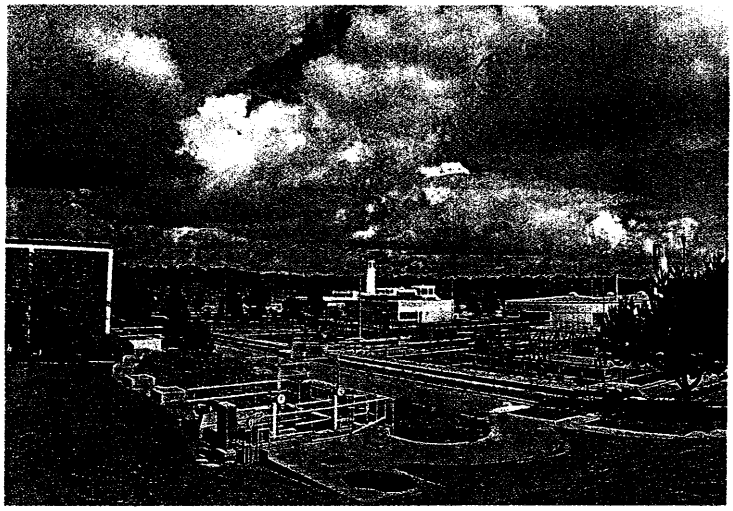
Brush aerator

9.2.9

Aerators

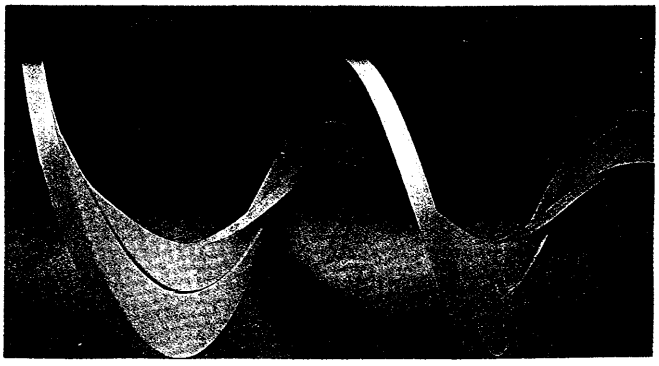
ML has drawn upon wide experience to develop its own range of aerators. In addition to vertical aerators, ML's brush aerator represents a cost effective option, particularly for aeration on larger denitrification plants. It is available in lengths of up to 9 metres with stainless steel bolt connected blades to give a robust and proven design

The global market



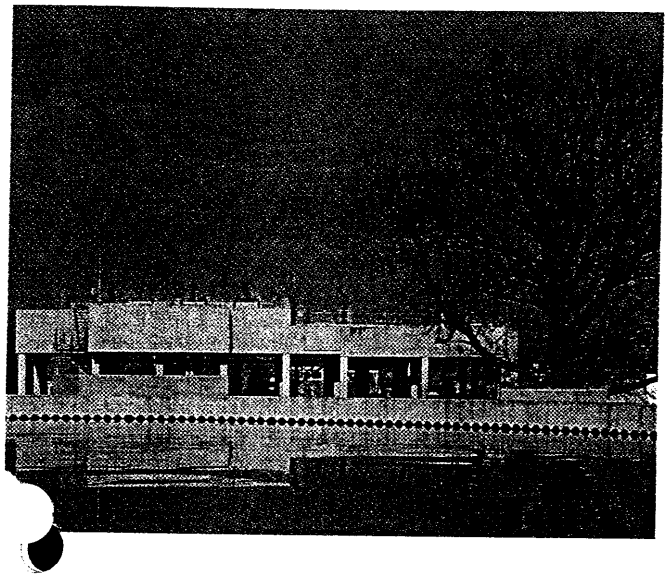
Toronto is Canada's largest city with three million inhabitants. It lies on the shore of Lake Ontario, part of the largest inland water system in the world. ML equipment has played an important part in assisting the city develop its sewage treatment plants. A number of these plants discharge directly into Lake Ontario so that the requirements for treatment of waste water are extremely high.

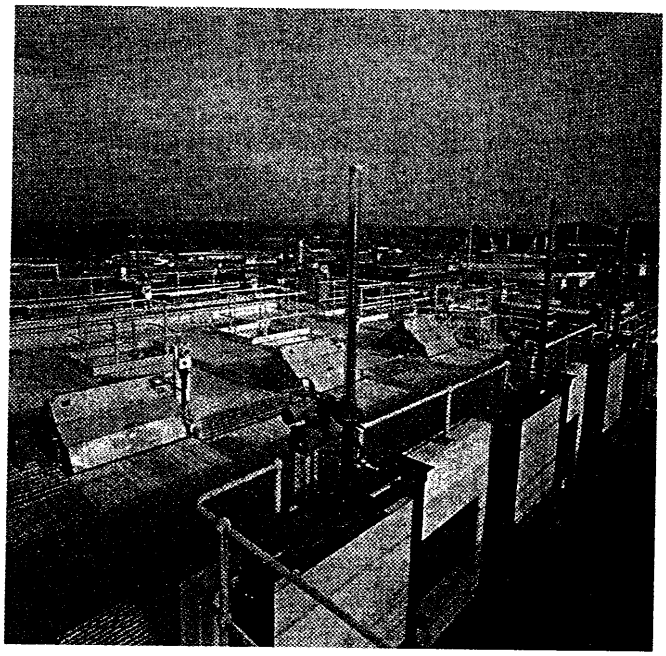
For the Highland Creek plant, ML has delivered five of its climber screens in one of the largest screen installations in North America. The screens each have a capacity of 6,250 cubic metres per hour. They replaced existing screens and were installed and commissioned while the plant was in operation.



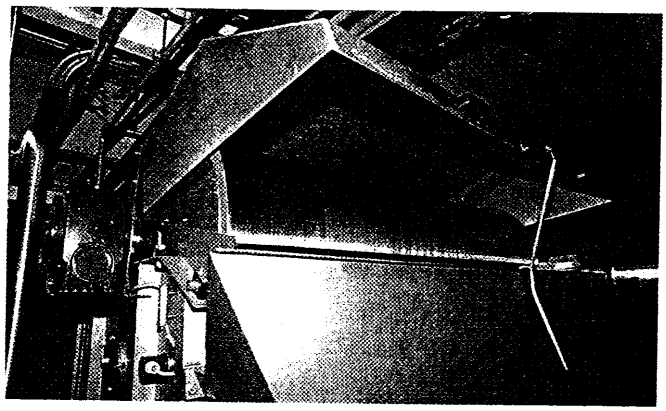
ML was also selected to supply 36 screw conveyors in a complete conveying system for handling screenings and sand for the Humber treatment plant in Toronto. The conveyors, with capacities of up to 7.5 cubic metres per hour, replaced a system of belt conveyors to enhance efficiency of transport and operating conditions.

There has been significant expenditure in the UK in recent years to bring the standard of water and waste water treatment in line with European requirements. This has been true for both industrial and municipal markets. ML equipment has been used in the upgrading of food processing, pharmaceutical and textile plants in addition to a large number of sewage treatment works.

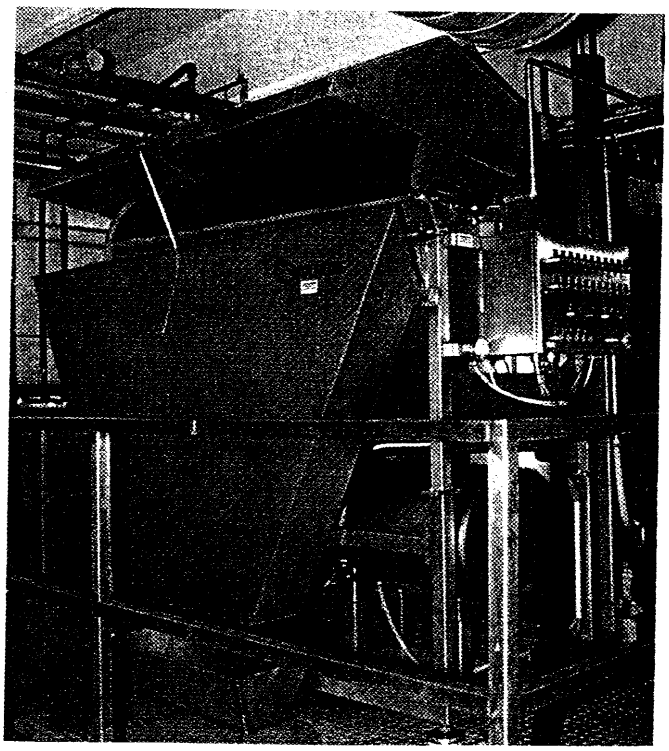




ML has more than thirty screen installations in the UK including Wargrave in the south of England. For this site three fine screens, with a slot width of 6 millimetres, were supplied for 1.5 metre wide channels. Each screen has a capacity of 1200 litres per second. The project, completed in 1993, was a modernisation of the plant to increase capacity to 45,000 person equivalents (pe).

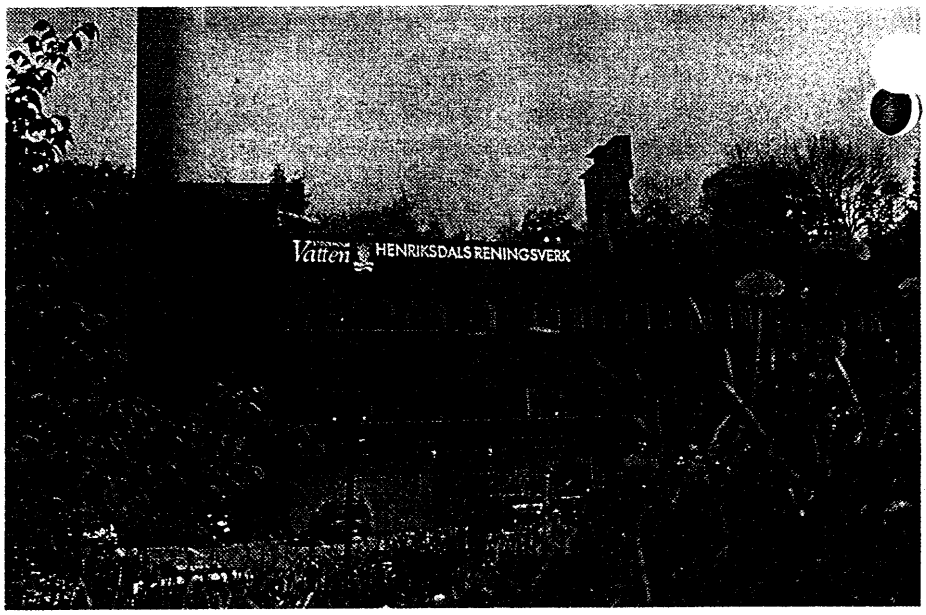


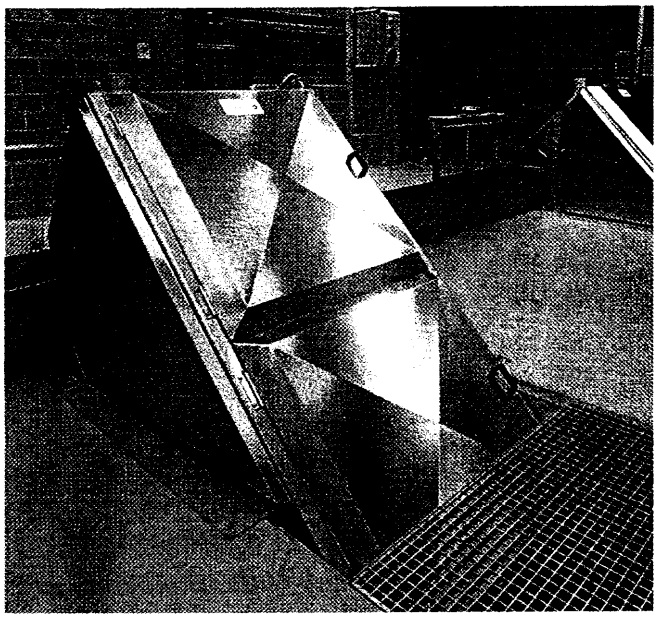
Wolfking Denmark AS is an international supplier of automated food processing systems. During 1994 they provided a complete system to the Vestfold Buskerud animal processing plant in Norway. ML's drumsieve was an integral part of that system. It is used to remove material from the outflow from the plant so that water can be recycled. The unit has a capacity of 85 litres per second and a slot width of 0.5 millimetres.



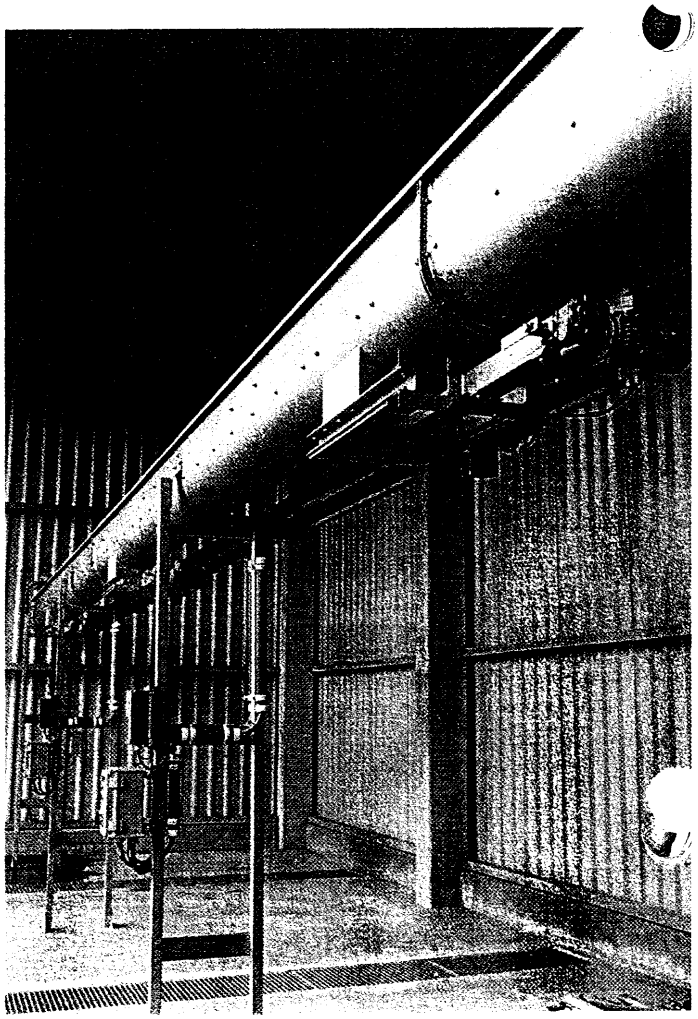
9.8-11

Henriksdal is Sweden's largest waste water treatment plant and is one of three plants that serve the city of Stockholm. Every treatment stage in the plant uses ML's wire driven sludge scrapers. ML has recently supplied an additional 12 wirescrapers as part of the project to extend the plant to include nitrogen reduction. This brings the total number installed at the plant to 86.





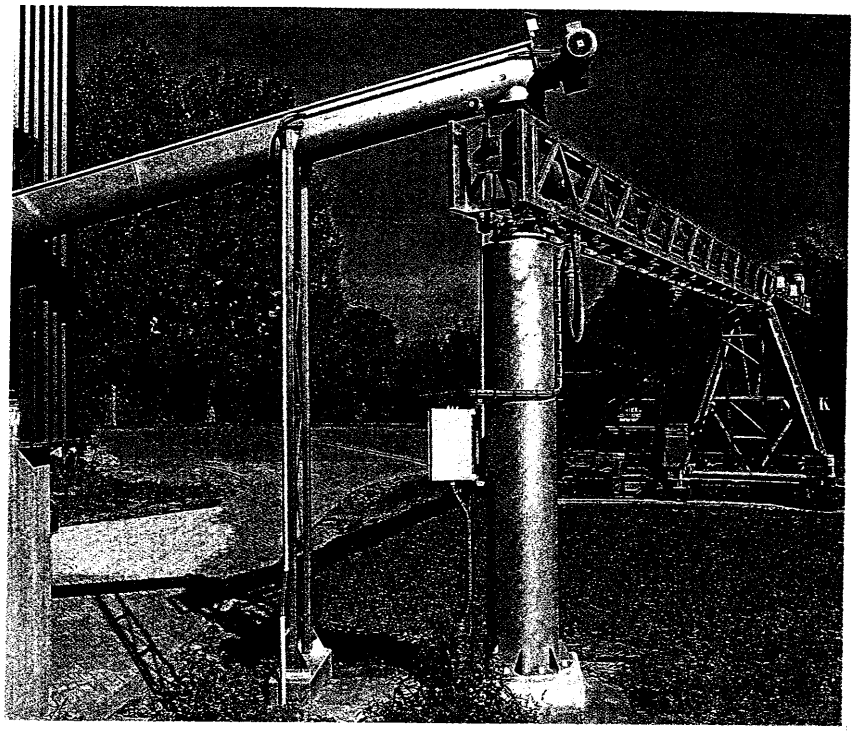
The new waste water treatment plant for the city of Eeklo in Belgium was completed at the end of 1994 with a capacity of 47,500 pe. ML provided two fine screens with a discharge height of 2.4 metres, a width of 1.0 metre and a slot width of 6 millimetres. A screenings transportation and dewatering unit and a complete sludge conveying system were also supplied. The sludge conveyors, including one unit 18.5 metres in length, were fully automated and capable of handling 3 cubic metres per hour of dewatered sludge.



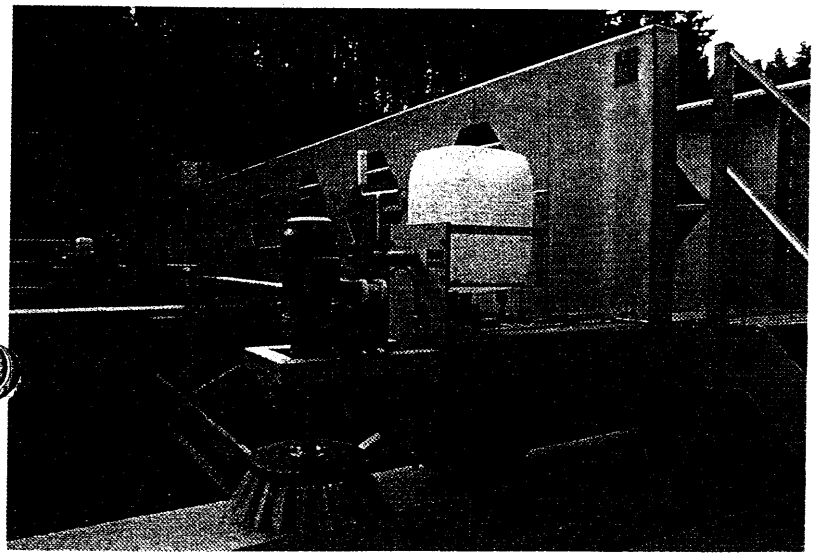
For many years Holland has been a leading country in the environmental field. Equipment supplied to this market must always be of the highest standard and is often for use in innovative applications. ML products have been used extensively for both municipal and industrial installations.

One municipal example is the plant at Nieuwegien in the province of Utrecht. Here a conveying system for handling 3 cubic metres of dewatered sludge per hour was provided. The longest screw conveyor was almost 17 metres in length and mounted on a movable frame to feed a number of containers.

Industrial projects have included animal manure recovery, vegetable processing and even transport of aircraft catering waste at Schiphol airport in Amsterdam.



Daun is a health resort to the north of the Mosel valley in the district of Eifel, western Germany. The new waste water treatment plant for the town was completed in 1992 with a capacity of 20,000 pe. Through our subsidiary, ML Klärtechnik GmbH, we delivered a range of equipment in stainless steel. The principal elements were a fine screen, a sand clarifier, a sand dewatering unit and a 12 metre scraper bridge over two presedimentation basins.



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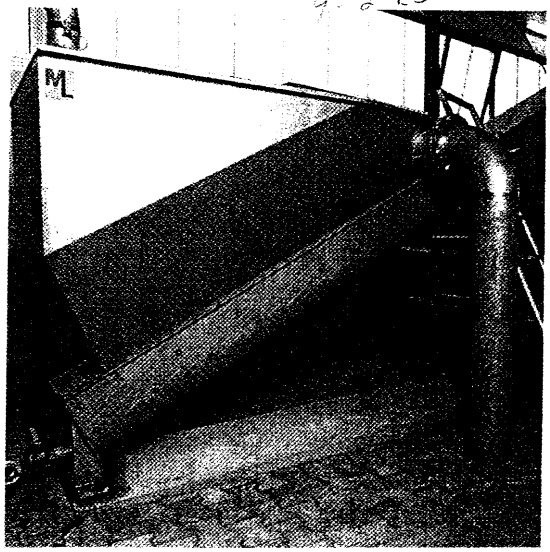
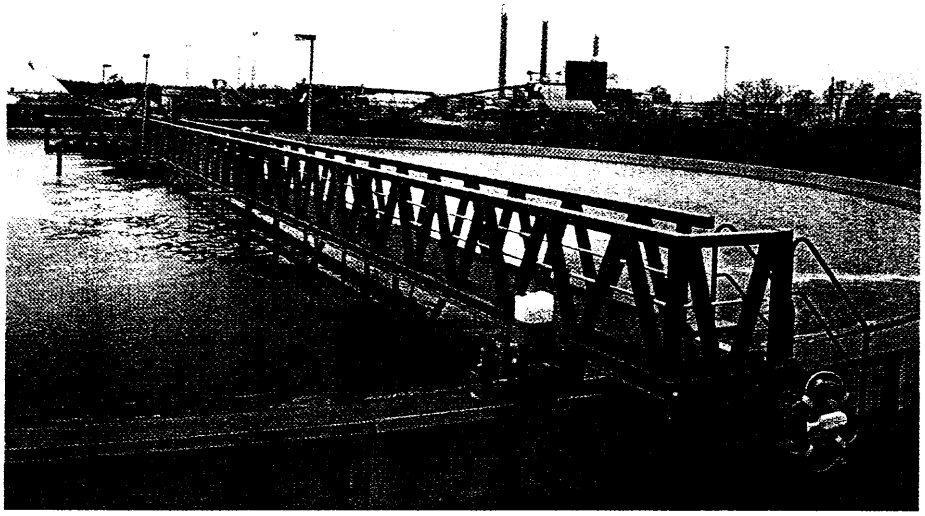


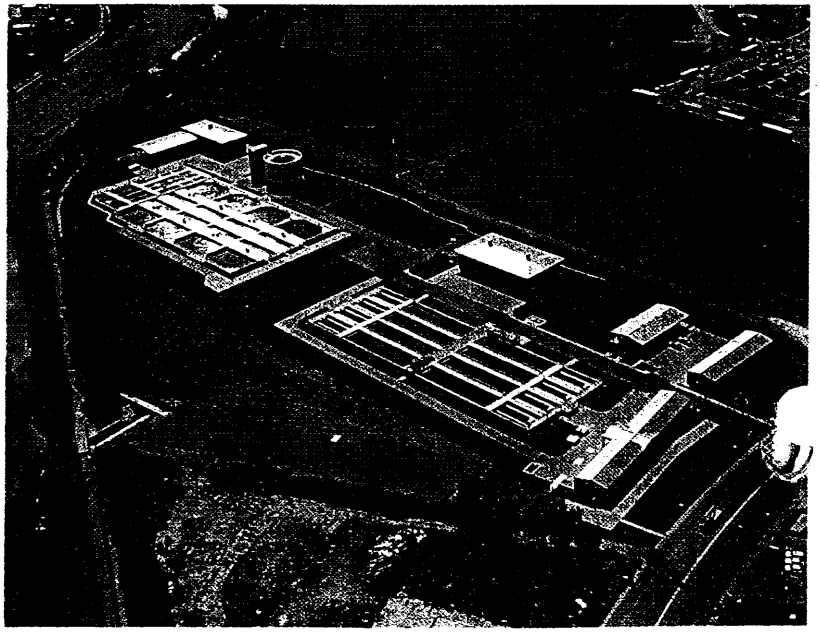
The Stora Nymölla pulp and paper mill in south east Sweden produces fine quality paper from its own chlorine free pulp. The process requires 1 cubic metre of water per second which is mechanically and biologically treated before leaving the plant.

ML supplied three bridge scrapers for circular clarifiers for the removal and recirculation of secondary sludge. Each scraper has a diameter of 55 metres and a maximum sludge capacity of 1200 litres per second. The sludge is removed at 20 suction points on every scraper using syphon systems rather than pumping. This solution provides much faster reuse of the sludge in the treatment process than with conventional sedimentation.



During the last ten years the district of Århus has been ML's largest customer in Denmark. Products have been delivered to more than 10 treatment plants of varying sizes in the area.

A good example is the Åby treatment plant. This modern plant is dimensioned for 93,000 pe and includes nitrogen reduction and effluent polishing. ML has delivered fine screens and conveyors together with a dewatering and washing system for screenings, a sand dewatering unit, two sand classifiers and eight wirescrapers with surface scum discharge systems.

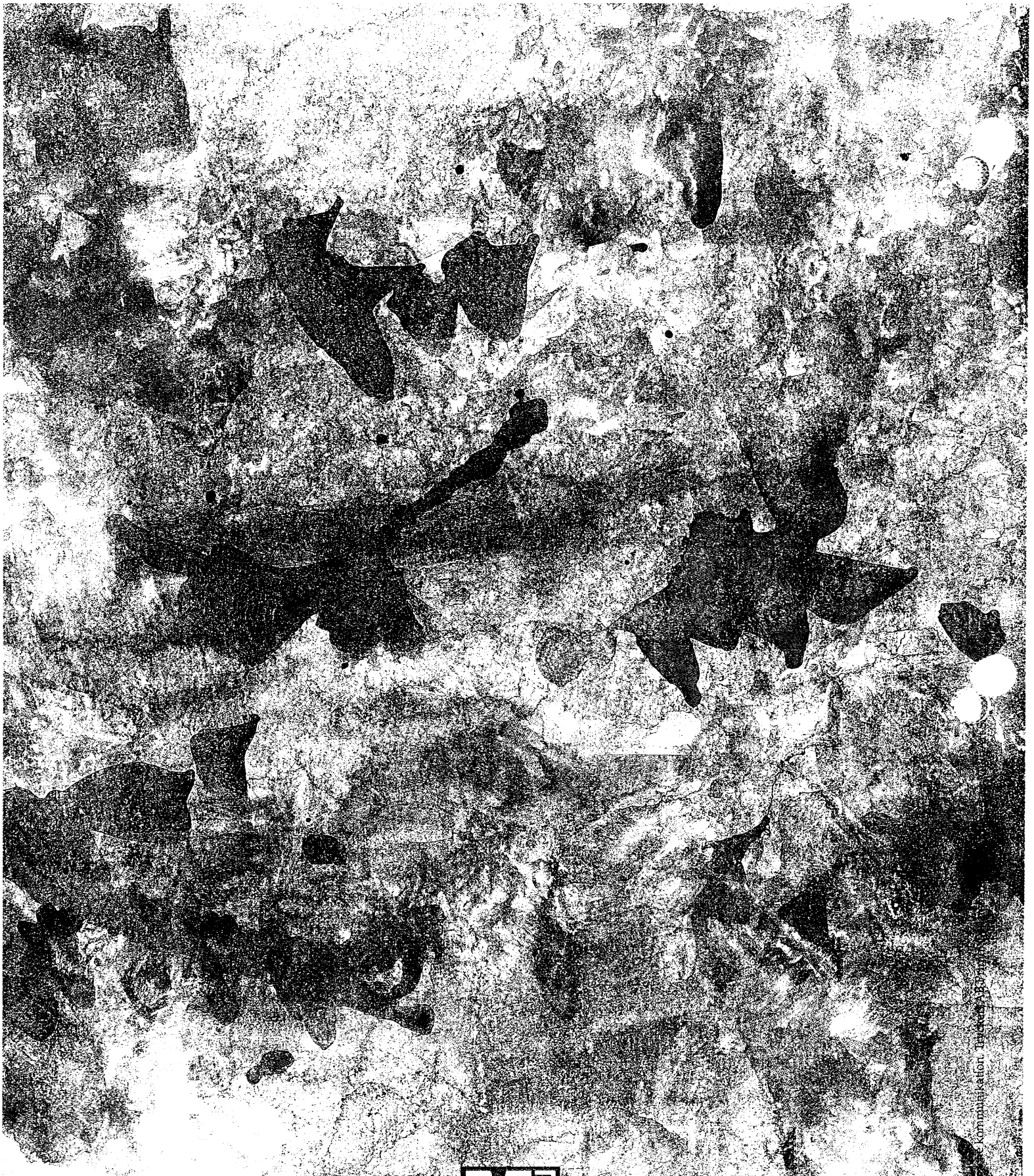


The wider perspective

ML Engineering is part of the Linatex Division of the international group Harrisons & Crosfield plc. Linatex is a worldwide group of companies specialising in wear resistant materials and equipment for the handling of solids and liquids. With this background, ML has both strong financial support and access to broad technical and marketing expertise.

The challenge for the future is to expand ML's business across the world and to use our experience wherever required. We shall continue to strengthen our base and work with an open, responsive attitude now and in the future.

9-2-15



Linatex worldwide

Products for waste water treatment

ML Engineering AB, PO Box 36, S-570 76 Ruda, Sweden.
Telephone +46 491 224 00. Fax +46 491 225 01.

Electric Motor Technical Description

Manufacturer:	SEW Eurodrive
Model:	DFT90L4
Quantity:	2
Power:	1.5 kW
Classification:	Class I, Division II, Gr C&D
Speed:	1760 rpm
Voltage:	575/3/60

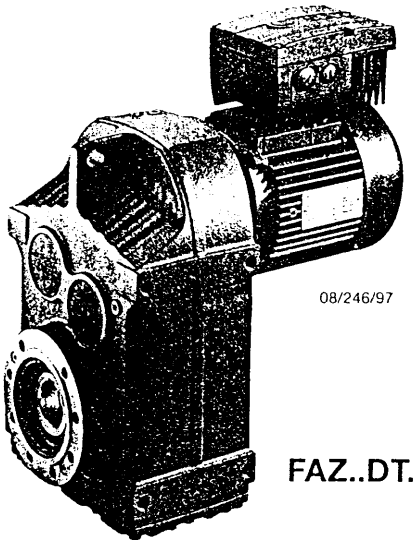
Screw Screen Technical Data

Manufacturer:	ML Engineering
Model:	SCS 50
Quantity:	2
Screen Perforations:	3mm and 5mm
Washing System:	Transport
	Dewatering
Motor:	1.5 kW

Gear Reducer Technical Data

Manufacturer:	SEW Eurodrive
Model:	FAF77
Quantity:	2

SEW



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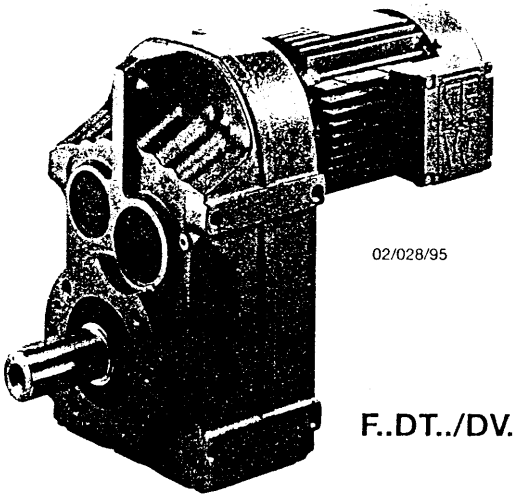

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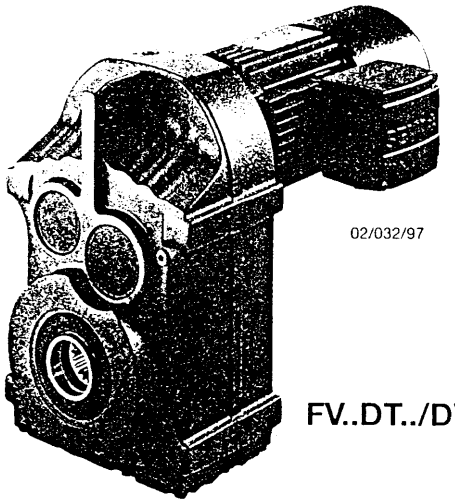

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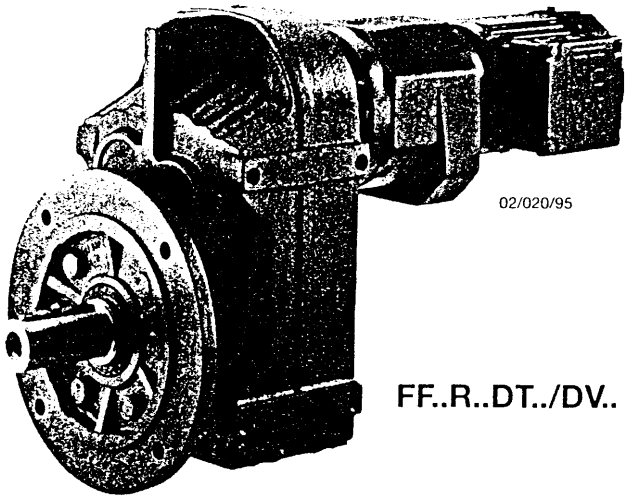

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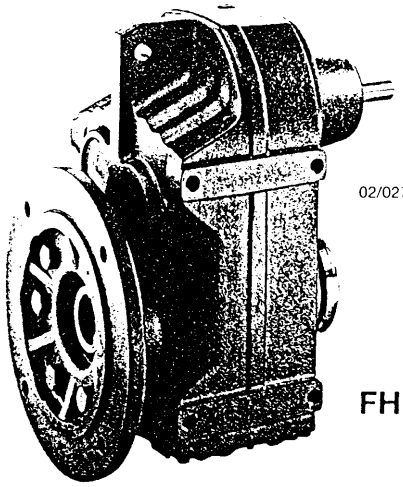

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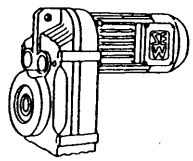
FHF..

SEW



P_m [kW]	n_a [1/min]	M_a [Nm]	i	F_{Ra} [1)] [N]	SEW-f_B	Typ Size Type		m [kg]	Maße Dimens. Cotes	Preis Nr. Price ref. Prix N°
1.5	→ **8.5**	1690	166.47	14300	0.90	**FA 77**	**DT 90L4***	70	F15	F0126
	9.9	1450	142.27	16100	1.05	**FAF77**	**DT 90L4***	76	F8	
	11	1320	130.42	16800	1.15	**F 77**	**DT 90L4***	75	F1	
	12	1160	114.45	17600	1.30	**FF 77**	**DT 90L4***	83	F12	
	13	1100	108.46	17900	1.35	**FA 77**	**DT 90L4***	70	F15	F0127
	15	960	94.93	18400	1.55	**FAF77**	**DT 90L4***	76	F8	
	16	870	85.52	18800	1.75	**F 77**	**DT 90L4***	75	F1	
	19	760	75.02	19100	1.95	**FF 77**	**DT 90L4***	83	F12	
	19	735	72.50	19200	2.0					
	21	675	66.46	19300	2.2					
	24	595	58.32	19500	2.5					
	26	560	55.27	19600	2.7					
	29	490	48.37	19700	3.0					
	32	445	43.58	19800	3.4					
	37	390	38.23	19900	3.9					
	39	370	36.58	19900	3.0	**FA 77**	**DT 90L4***	68	F15	F0128
	45	320	31.51	20000	4.3	**FAF77**	**DT 90L4***	73	F8	
						F 77	**DT 90L4***	72	F1	
						FF 77	**DT 90L4***	80	F12	
	16	920	90.59	9300	0.90	**FA 67**	**DT 90L4***	49	F15	F0129
	18	810	79.76	10400	1.00	**FAF67**	**DT 90L4***	53	F8	
	21	685	67.65	11400	1.20	**F 67**	**DT 90L4***	51	F1	
	23	620	61.07	11800	1.30	**FF 67**	**DT 90L4***	56	F12	
	26	545	53.73	12200	1.50					
	28	515	50.74	12300	1.60					
	33	440	43.20	12700	1.85					
	36	400	39.26	12800	1.95					
	39	370	36.30	12900	2.2	**FA 67**	**DT 90L4***	47	F15	F0130
	44	325	32.08	13000	2.5	**FAF67**	**DT 90L4***	51	F8	
	51	280	27.41	13000	2.9	**F 67**	**DT 90L4***	49	F1	
	56	255	25.13	13000	3.2	**FF 67**	**DT 90L4***	54	F12	
	33	435	42.86	575	0.90	**FA 47**	**DT 90L4***	33	F15	F0131
	39	370	36.61	6300	1.10	**FAF47**	**DT 90L4***	36	F8	
	41	350	34.29	6580	1.15	**F 47**	**DT 90L4***	34	F1	
	49	295	28.88	6500	1.35	**FF 47**	**DT 90L4***	37	F12	
	46	315	30.86	6550	1.30	**FA 47**	**DT 90L4***	32	F15	F0132
	48	300	29.32	6510	1.35	**FAF47**	**DT 90L4***	35	F8	
	55	260	25.72	6390	1.55	**F 47**	**DT 90L4***	33	F1	
	65	220	21.82	6230	1.80	**FF 47**	**DT 90L4***	36	F12	
	72	200	19.70	6110	2.0					
	81	176	17.33	5970	2.3					
	86	166	16.36	5900	2.4					
	101	142	13.93	5700	2.8					
	69	210	20.57	3410	0.95	**FA 37**	**DT 90L4***	28	F15	F0133
	73	196	19.27	3410	1.00	**FAF37**	**DT 90L4***	29	F8	
	83	173	17.03	3400	1.15	**F 37**	**DT 90L4***	28	F1	
	98	146	14.33	3350	1.35	**FF 37**	**DT 90L4***	30	F12	
	110	131	12.87	3310	1.55					
	127	113	11.08	3250	1.70					
	135	106	10.42	3220	1.75					
	157	91	8.97	3140	1.90					
	176	81	8.01	3080	2.1					
	209	69	6.74	2920	2.0					
	233	62	6.05	2850	2.2					
	271	53	5.21	2770	2.4					
	288	50	4.90	2730	2.4					
	334	43	4.22	2640	2.6					
	374	38	3.77	2570	2.7					

Abtriebsdrehzahlen sind Richtwerte. Bitte Hinweise zu den Drehzahlen in der Katalogeinführung beachten.
1) Querkraft für Fußgetriebe.
Bitte beachten Sie weitere Informationen zu den Querkräften im Kapitel "Zulässige Quer- und Axialkräfte bei Getrieben und Getriebemotoren" in der Einführung.
* Auch mit EExe-Motoren lieferbar, Leistung siehe Kapitel "Ex-Motoren".

The output speeds are guide values. Please refer to the notes on speeds in the catalogue introduction.
1) Overhung load for foot mounted units.
Please observe the information regarding overhung loads, from the introduction, in section "Permissible overhung and axial shaft loads for gear units and geared motors".
* Also available with EExe motors, power rating, see chapter "Ex Motors".

Les vitesses de sortie indiquées sont des valeurs arrondies. Voir remarques concernant les vitesses dans les pages d'introduction du catalogue.
1) Charge radiale pour exécution à pattes.
Voir également les remarques concernant les charges radiales dans les pages d'introduction du catalogue sous "Charges radiales et axiales admissibles".
* Egalement disponible avec moteurs EExe, puissance voir chapitre "Moteurs Ex".

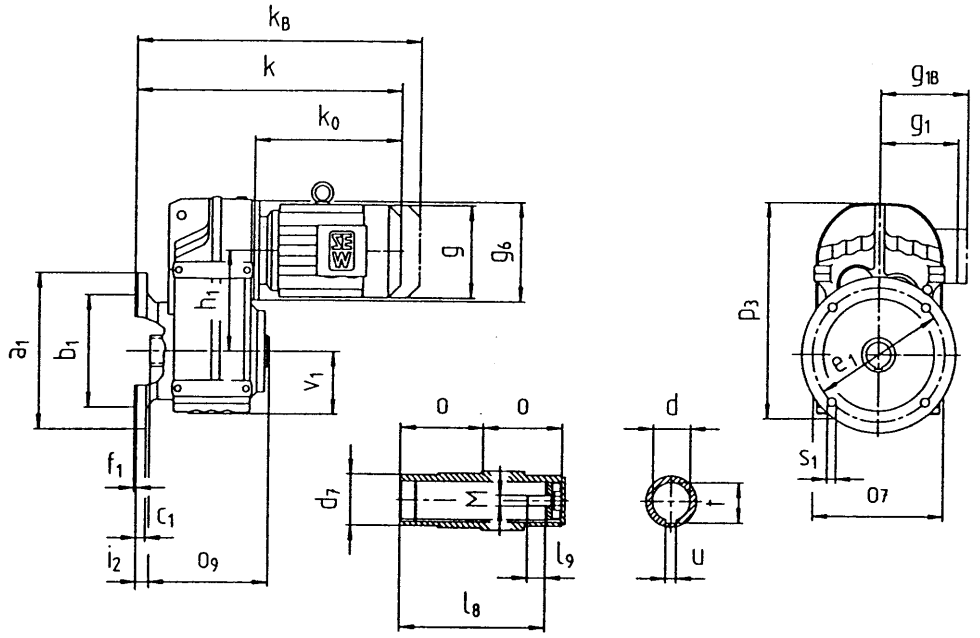
B5-Flanschausführung mit Hohlwelle

Helical Geared Motors B5 Flange Mounted With Hollow Shaft

parallèles Exécution à flasque-bride selon B5 avec arbre creux

SEW

42 014 095



Typ Size Type		a1	b1	c1	e1	f1	g	g1	g1B	g6	h1 i2	k	kB	k0	o o7	o9 p3	s1 v1	d d7	l8 l9	t u	M
	DT63..						127	95	95			334	366	196							
	DT71D						145	121	127		112	343	407	205	60	123	9	30	105	33.3	
FAF37	DT80..	160	110	10	130	3.5	145	121	127	120		393	457	255							M10
	DT90..						197	155	161		24	413	498	275	165	252	76	45	17	8	
	DT100..						197	163	169			466	551	328							
	DT63..						127	95	95			358	390	196							
	DT71D						145	121	127		128.1	367	431	205	75	153	11	35	132	38.3	
FAF47 [1]	DT80..	200	130	12	165	3.5	145	121	127	120		417	481	255							M12
	DT90..						197	155	161		25	437	522	275	180	269	77	50	22	10	
	DT100..						197	163	169			490	575	328							
	DT63..						127	95	95			378	410	190							
	DT71D						145	121	127		159.5	387	451	199	90	184	13.5	40	156	43.3	
	DT80..						145	121	127			437	501	249							
FAF67	DT90..	250	180	15	215	4	197	155	161	160		457	542	269							M16
	DT100..						197	163	169			507	592	319							
	DV112M						221	176	182		23	542	622	354	212	343	97	55	29	12	
	DV132S						221	176	182			590	670	402							
	DT63..						127	95	95			418	450	184							
	DT71D						145	121	127		200	427	491	193	105	213	13.5	50	183	53.8	
	DT80..						145	121	127			477	541	243							
→	DT90..						197	155	161			495	580	261							
FAF77 [2]	DT100..	300	230	16	265	4	197	163	169	200		545	630	311							M16
	DV112M						221	176	182			581	661	347							
	DV132S						221	176	182			626	706	392							
	DV132M						275	230	230			646	758	412							
	DV132ML						275	230	230		37	706	818	472	270	426	121	70	32	14	
	DV160M						275	230	230			706	818	472							
	DT80..						145	121	127			497	561	238							
	DT90..						197	155	161		246.7	516	601	257	120	243	17.5	60	210	64.4	
	DT100..						197	163	169			566	651	307							
	DV112M						221	176	182			601	681	342							
FAF87	DV132S	350	250	18	300	5	221	176	182	250		646	726	387							M20
	DV132M						275	230	230			666	778	407							
	DV132ML						275	230	230			726	838	467							
	DV160M						275	230	230			726	838	467							
	DV160L						331	253	253		30	774	930	515	330	531	152	85	36	18	
	DV180..						331	253	253			845	1001	586							

[1] Getriebe mit Hohlwellendurchmesser von FAF40 auf Anfrage.

[2] Getriebe mit Flanschabmessungen von FAF70 auf Anfrage.

Bitte Hinweise zu den Maßblättern in der Katalogeinführung ab Seite 107 beachten.

Allen Hohlwellengetrieben (außer mit Schrumpfscheibe) wird kostenlos NOCO®-FLUID, die Paste gegen Passungsrost, beigelegt.

[1] Gear units with hollow-shaft diameters of FAF40 on request.

[2] Gear unit with flange dimensions of FAF70 on request.

Please refer to the notes appertaining to dimension sheets in the catalogue introduction from page 107.

All hollow-shaft gear units (except with shrink disc) include NOCO®-FLUID contact corrosion inhibitor at no extra charge.

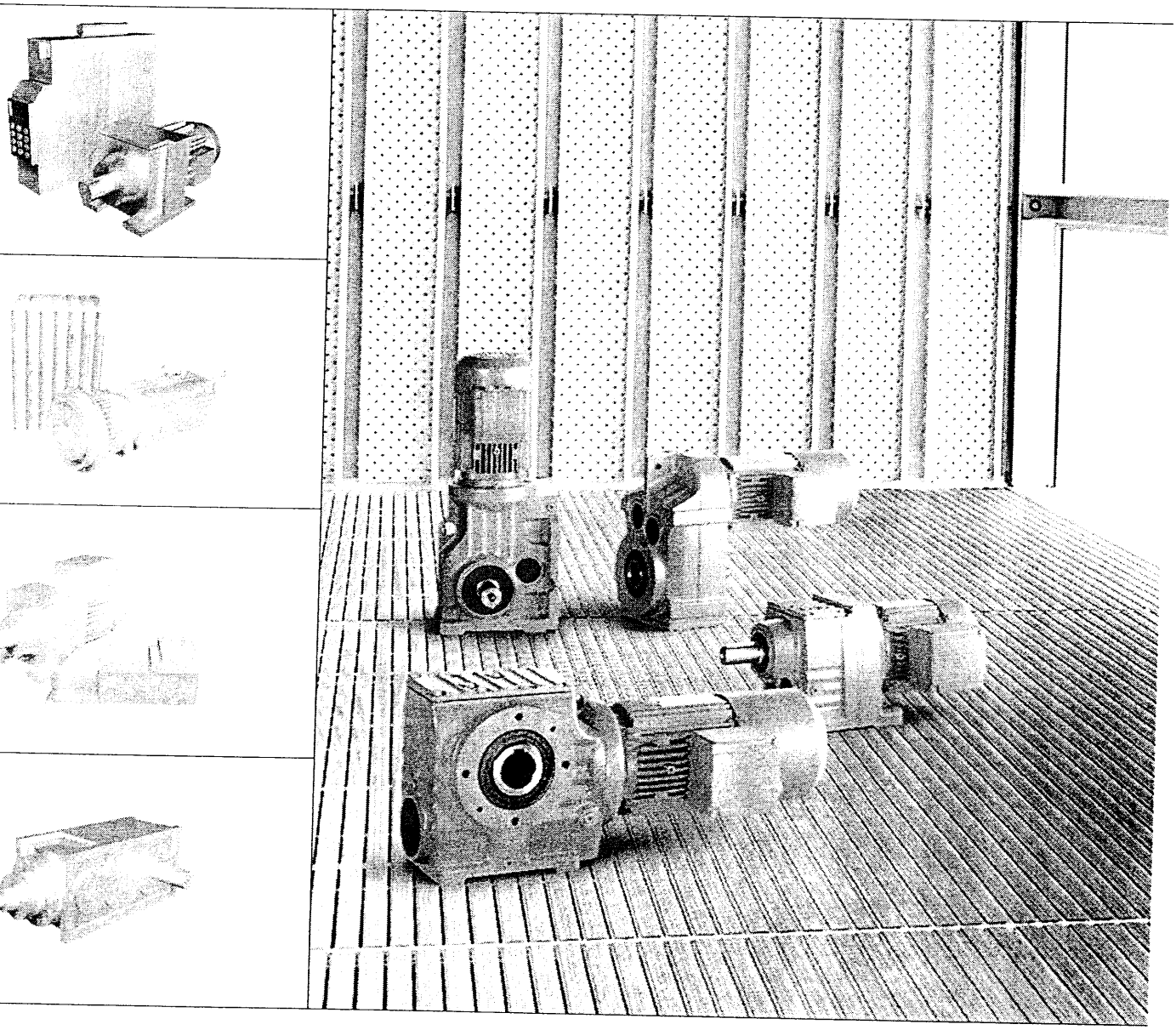
[1] Réducteurs avec diamètre d'arbre creux pour FAF40 sur demande.

[2] Réducteurs avec cotes flasque pour FAF70 sur demande.

Voir remarques concernant les feuilles de cotes dans les pages d'introduction à partir de page 107.

Une pâte spéciale contre la corrosion de contact, NOCO®-FLUID, est fournie gratuitement avec tous les réducteurs à arbre creux (sauf exécutions avec frette de serrage).

SEW EURODRIVE



Gear Units, R..7, F..7, K..7, S..7 Series, SPIROPLAN® W

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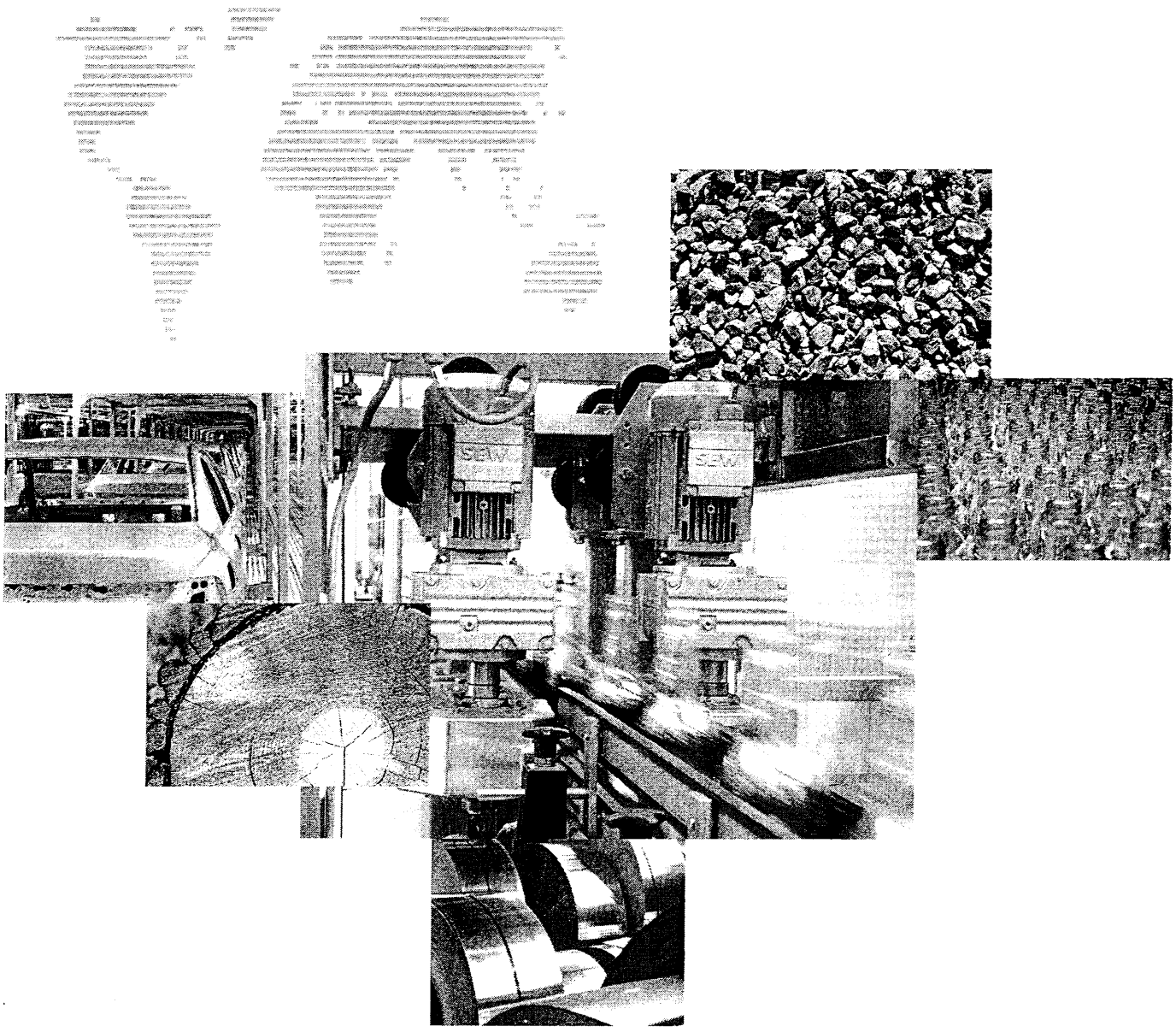
Edition 05/2004
11226811 / EN

Operating Instructions

9.2



SEW
EURODRIVE

9.2

1 Important Notes

Safety and warning instructions

Always follow the safety and warning instructions in this publication!

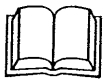
Electrical hazard
Possible consequences: Severe or fatal injuries.

Hazard
Possible consequences: Severe or fatal injuries.

Hazardous situation
Possible consequences: Slight or minor injuries.

Harmful situation
Possible consequences: Damage to the drive and the environment.

Tips and useful information.



You must adhere to the operating instructions to ensure:

- Trouble-free operation
- Fulfillment of any rights to claim under guarantee

Consequently, read the operating instructions before you start working with the gear unit!

The operating instructions contain important information about servicing. Therefore, keep the operating instructions close to the gear unit.

- Adjust the lubricant fill volume and position of the breather valve accordingly in the event of a change of mounting position (see Sec. "Lubricants" and "Mounting Positions").
- Follow the instructions in Sec. "Mechanical installation" / "Installing the gear unit"!

9.2

4

Waste disposal

Please follow the latest instructions: Dispose of the following materials in accordance with the regulations in force:

- Steel scrap:
  - Housing parts
  - Gears
  - Shafts
  - Anti-friction bearing
  - Gray-cast iron (if there is no special collection)
- Parts of the worm gears are made of non-ferrous metals. Dispose of the worm gears as appropriate.
- Collect waste oil and dispose of it correctly.

9.2

2 Safety Notes

Preface

The following safety notes are primarily concerned with the use of gear units. If using **gearmotors**, please also refer to the safety notes for motors in the relevant operating instructions.

Please also consider the supplementary safety notes in the individual sections of these operating instructions.

General information

During and after operation, gearmotors, gear units and motors have:

- Live parts
- Moving parts
- Hot surfaces (may be the case)

Only qualified personnel may carry out the following work:

- Transportation
- Putting into storage
- Installation / assembly
- Connection
- Startup
- Maintenance
- Servicing

The following information and documents must be observed during these processes:

- Relevant operating instructions and wiring diagrams
- Warning and safety signs on the gear unit / gearmotor
- System-specific regulations and requirements
- National / regional regulations governing safety and the prevention of accidents

Serious injuries and property damage may result from:

- Improper use
- Incorrect installation or operation
- Unauthorized removal of necessary protection covers or the housing

Designated use

Gearmotors / gear units from SEW are intended for industrial systems. They correspond to the applicable standards and regulations.

Technical data and information about the permitted conditions can be found on the nameplate and in the documentation.

It is essential that you follow all the instructions!

9.2

Transportation

Inspect the shipment for any damage that may have occurred in transit as soon as you receive the delivery. Inform the shipping company immediately. It may be that you are not permitted to startup the drive due to the damage.

Tighten installed eyebolts. The eyebolts are only designed for the weight of the gearmotor / gear unit. Do not attach any additional loads.

The installed lifting eyebolts comply with DIN 580. The loads and regulations specified in this standard must always be observed. If two eyebolts are available, use both of them for transport. In this case, the tension force vector of the slings must not exceed a 45° angle in accordance with DIN 580.

Use suitable, sufficiently rated handling equipment if necessary. Remove any transportation fixtures prior to startup.

Extended storage of gear units

Gear units of the "extended storage" type have:

- An oil fill suitable for the mounting position so the unit is ready to run (mineral oil CLP and synthetic oil CLP HC). You should still check the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").
- A higher oil level in some cases (synthetic oil CLP PG / food grade oil). Correct the oil level before startup (see Sec. "Inspection / Maintenance" / "Inspection and maintenance of the gear unit").

Comply with the storage conditions specified in the following table for extended storage:

Climate zone	Packaging[1)]	Storage location	Storage time
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	With roof, protected against rain and snow, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain, no shock loads.	Up to three years with regular checks on the packaging and moisture indicator (relative atmospheric humidity < 50 %).
	Open	With roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50 % relative atmospheric humidity). No sudden temperature fluctuations and controlled ventilation with filter (free from dirt and dust). No aggressive vapors and no shock loads. Protection against insect damage.	Two years or more given regular inspections. Check for cleanliness and mechanical damage as part of the inspection. Check corrosion protection.

1) Packaging must be performed by an experienced company using the packaging materials that have been expressly specified for the particular application.

9.2

Installation / assembly	Observe the instructions in the sections "Installation" and "Assembly/Removal"!
Startup / operation	Check that the direction of rotation is correct in **decoupled** status. Listen out for unusual grinding noises as the shaft rotates. Secure the shaft keys for test mode without drive components. Do not render monitoring and protection equipment inoperative even for test mode. Switch off the gearmotor if in doubt whenever changes occur in relation to normal operation (e.g. increased temperature, noise, vibration). Determine the cause; contact SEW-EURODRIVE if necessary.
Inspection / maintenance	Follow the instructions in the section "Inspection and Maintenance"!

9.2

3 Gear Unit Structure

The following figures are block diagrams. Their purpose is only to make it easier to assign components to the spare parts lists. Discrepancies may occur depending on the gear unit size and version!

3.1 Basic structure of helical gear units

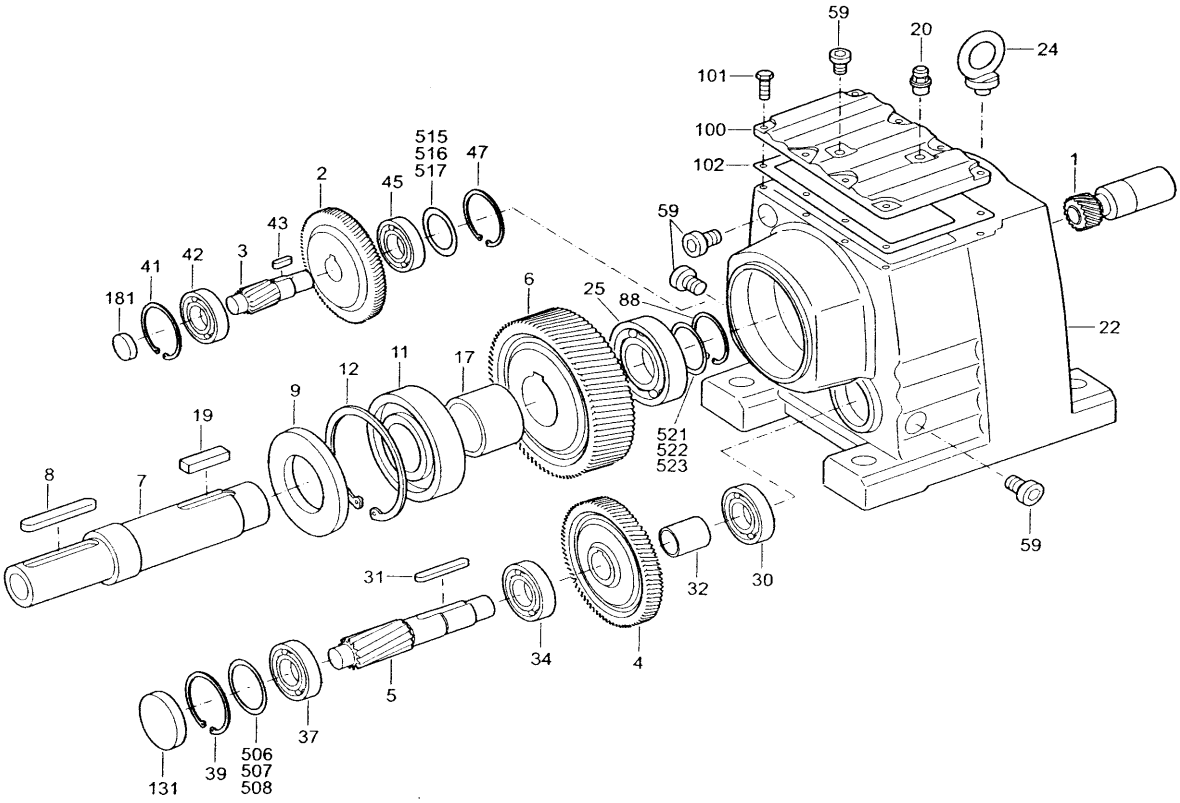


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Figure 1: Basic structure of helical gear units

Key

1	Pinion	19	Key	42	Anti-friction bearing	507	Shim ring
2	Gear	20	Breather valve	43	Key	508	Shim ring
3	Pinion shaft	22	Gearcase	45	Anti-friction bearing	515	Shim ring
4	Gear	24	Lifting eyebolt	47	Circlip	516	Shim ring
5	Pinion shaft	25	Anti-friction bearing	59	Screw plug	517	Shim ring
6	Gear	30	Anti-friction bearing	88	Circlip	521	Shim ring
7	Output shaft	31	Key	100	Gearcase cover	522	Shim ring
8	Key	32	Spacer	101	Hex head bolt	523	Shim ring
9	Oil seal	34	Anti-friction bearing	102	Gasket		
11	Anti-friction bearing	37	Anti-friction bearing	131	Closing cap		
12	Circlip	39	Circlip	181	Closing cap		
17	Spacer	41	Circlip	506	Shim ring		

9.2

3.2 Basicstructure of parallel shaft helical gear units

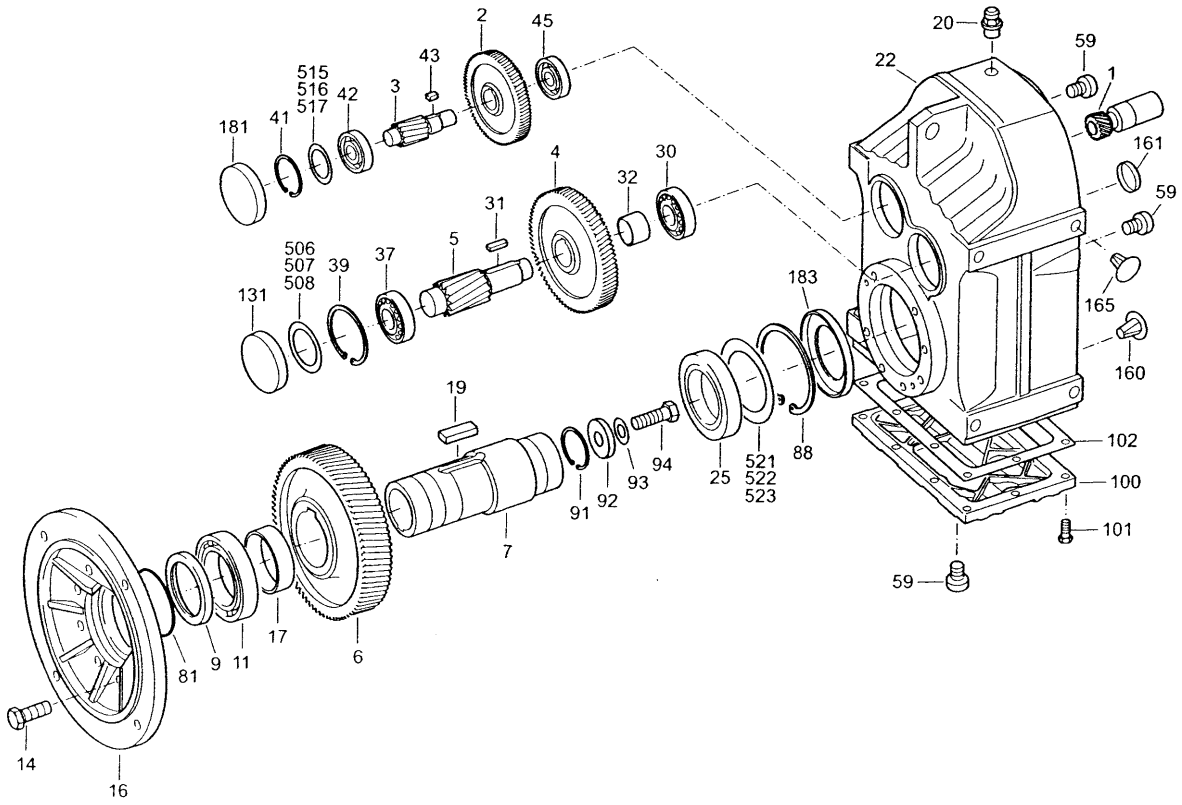

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Figure 2: Basic structure of parallel shaft helical gear units

Key

1	Pinion	22	Gearcase	91	Circlip	506	Shim ring
2	Gear	25	Anti-friction bearing	92	Washer	507	Shim ring
3	Pinion shaft	30	Anti-friction bearing	93	Lock washer	508	Shim ring
4	Gear	31	Key	94	Hex head bolt	515	Shim ring
5	Pinion shaft	32	Spacer	100	Gearcase cover	516	Shim ring
6	Gear	37	Anti-friction bearing	101	Hex head bolt	517	Shim ring
7	Hollow shaft	39	Circlip	102	Gasket	521	Shim ring
9	Oil seal	41	Circlip	131	Closing cap	522	Shim ring
11	Anti-friction bearing	42	Anti-friction bearing	160	Closing plug	523	Shim ring
14	Hex head bolt	43	Key	161	Closing cap		
16	Output flange	45	Anti-friction bearing	165	Closing plug		
17	Spacer	59	Screw plug	181	Closing cap		
19	Key	81	O-ring	183	Oil seal		
20	Breather valve	88	Circlip				

3.3 Basic structure of helical-bevel gear units

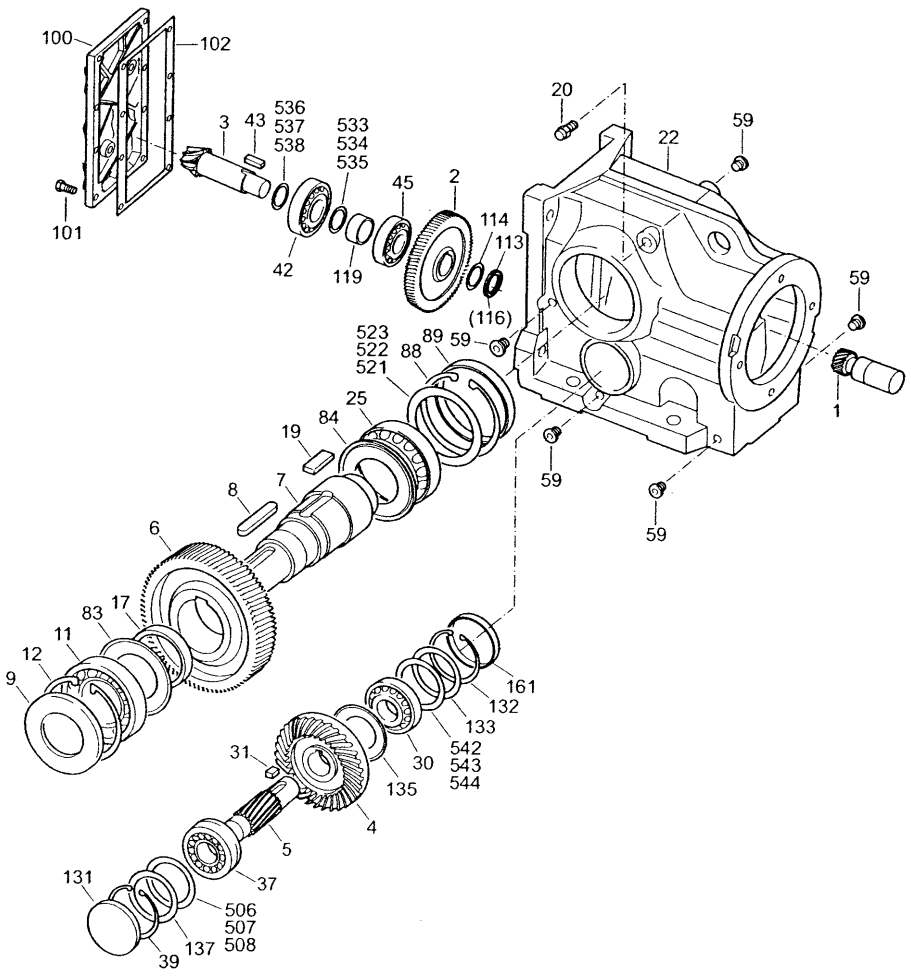

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Figure 3: Basic structure of helical-bevel gear units

Key

1 Pinion	25 Anti-friction bearing	102 Adhesive and sealing compound	522 Shim ring
2 Gear	30 Anti-friction bearing	113 Slotted round nut	523 Shim ring
3 Pinion shaft	31 Key	114 Multi-tang washer	533 Shim ring
4 Gear	37 Anti-friction bearing	116 Thread lock	534 Shim ring
5 Pinion shaft	39 Circlip	119 Spacer	535 Shim ring
6 Gear	42 Anti-friction bearing	131 Closing cap	536 Shim ring
7 Output shaft	43 Key	132 Circlip	537 Shim ring
8 Key	45 Anti-friction bearing	133 Spacer	538 Shim ring
9 Oil seal	59 Screw plug	135 Nilos ring	542 Shim ring
11 Anti-friction bearing	83 Nilos ring	161 Closing cap	543 Shim ring
12 Circlip	84 Nilos ring	506 Shim ring	544 Shim ring
17 Spacer	88 Circlip	507 Shim ring	
19 Key	89 Closing cap	508 Shim ring	
20 Breather valve	100 Gearcase cover	521 Shim ring	
22 Gearcase	101 Hex head bolt	521 Shim ring	

9.2

3.4 Basic structure of helical-worm gear units

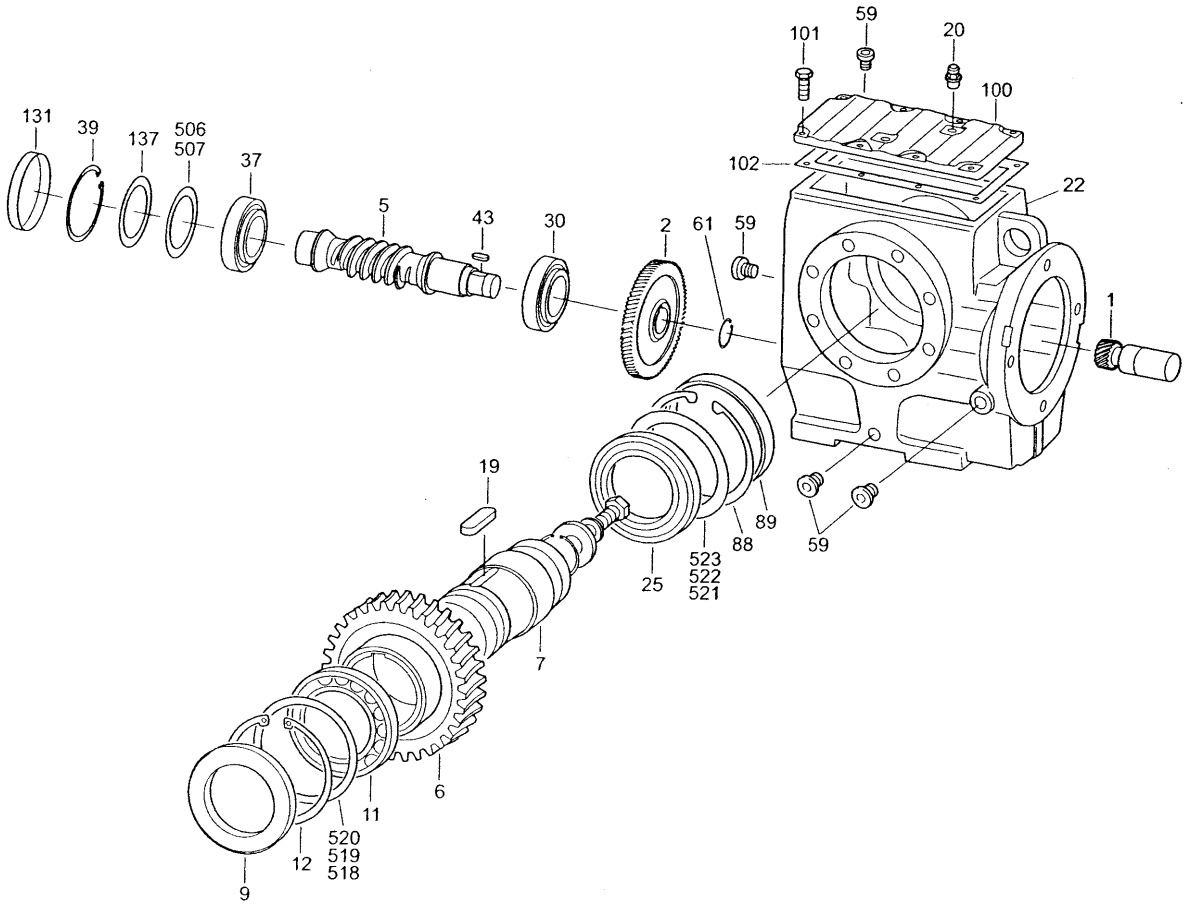

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Figure 4: Basic structure of helical-worm gear units

Key

1	Pinion	20	Breather valve	88	Circlip	518	Shim ring
2	Gear	22	Gearcase	89	Closing cap	519	Shim ring
5	Worm	25	Anti-friction bearing	100	Gearcase cover	520	Shim ring
6	Worm gear wheel	30	Anti-friction bearing	101	Hex head bolt	521	Shim ring
7	Output shaft	37	Anti-friction bearing	102	Rubber seal	522	Shim ring
9	Oil seal	39	Circlip	131	Closing cap	523	Shim ring
11	Anti-friction bearing	43	Key	137	Spacer		
12	Circlip	59	Screw plug	506	Shim ring		
19	Key	61	Circlip	507	Shim ring		

9.2

3.5 Basic structure of SPIROPLAN® gear units

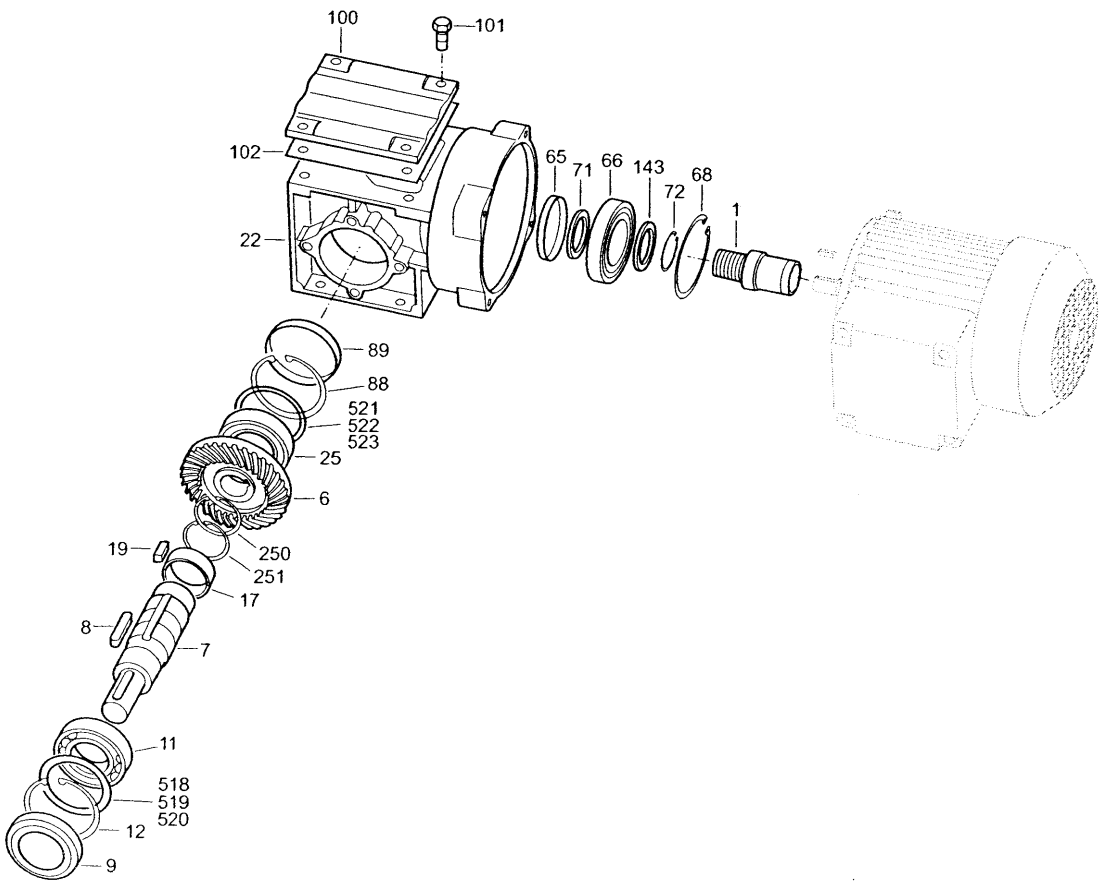

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Figure 5: Basic structure of SPIROPLAN® gear units

Key

1	Pinion	19	Key	88	Circlip	251	Circlip
6	Gear	22	Gearcase	89	Closing cap	518	Shim ring
7	Output shaft	25	Anti-friction bearing	100	Gearcase cover	519	Shim ring
8	Key	65	Oil seal	101	Hex head bolt	520	Shim ring
9	Oil seal	66	Anti-friction bearing	102	Gasket	521	Shim ring
11	Anti-friction bearing	71	Spacer	132	Circlip	522	Shim ring
12	Circlip	72	Circlip	183	Oil seal	523	Shim ring
17	Spacer	143	Spacer	250	Circlip		

9.2

3.6 Nameplate, unit designation

Sample nameplate

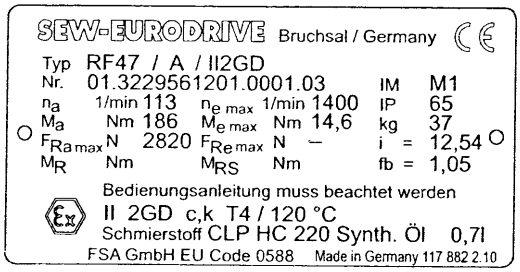

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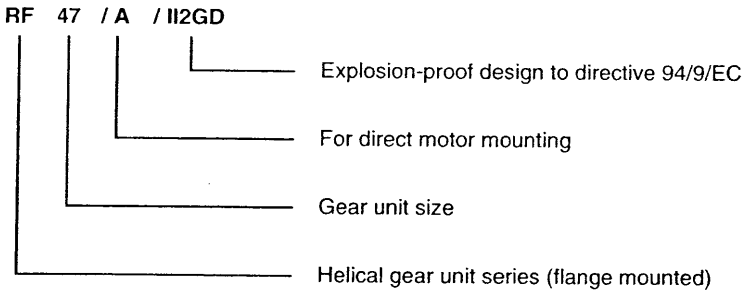
Figure 6: Sample nameplate

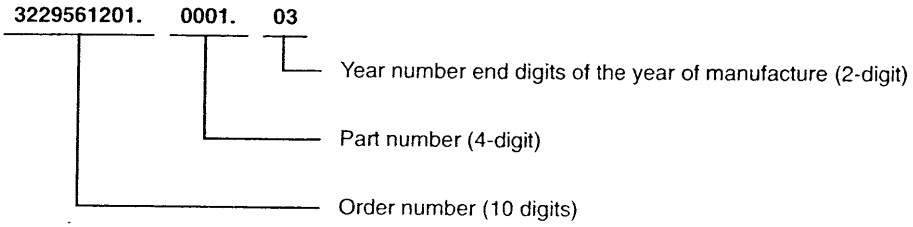
f_b		= Service factor
$F_{Ra\,max}$	[N]	= Maximum overhung load on the output side
$F_{Re\,max}$	[N]	= Maximum overhung load on the input side (with input shaft assembly AD)
i		= Gear unit reduction ratio
IM		= Mounting position
IP..		= Enclosure
$n_{e\,max}$	[1/min]	= Maximum input speed
n_a	[1/min]	= Output speed
$M_{e\,max}$	[Nm]	= Maximum input torque
M_a	[Nm]	= Output torque
M_R	[Nm]	= Overload torque when using an AR adapter
M_{RS}	[Nm]	= Locking torque of the backstop

Unit designation

Example: Helical gear unit, category II2GD



Example: Serial number



9.2

4 Mechanical Installation

4.1 Required tools / aids

- Set of spanners
- Torque wrench for:
  - Shrink discs
  - AQH motor adapter
  - Input shaft assembly with centering shoulder
- Mounting device
- Shims and distance rings if necessary
- Fixing devices for input and output elements
- Lubricant (e.g. NOCO® Fluid)
- Bolt adhesive (for input shaft assembly with centering shoulder), e.g. Loctite® 243
- Standard parts are not part of the delivery

Installation tolerances

Shaft end	Flanges
Diameter tolerance in accordance with DIN 748 • ISO k6 for solid shafts with Ø ≤ 50 mm • ISO m6 for solid shafts with Ø > 50 mm • ISO H7 for hollow shafts • Center bore in accordance with DIN 332, shape DR	Centering shoulder tolerance in accordance with DIN 42948 • ISO j6 with b1 ≤ 230 mm • ISO h6 with b1> 230 mm

4.2 Prerequisites for assembly

Check that the following conditions have been met:

- The data on the nameplate of the gearmotor matches the voltage supply system.
- The drive has not been damaged during transportation or storage.
- Ensure that the following requirements have been met:
  - **For standard gear units:**
    Ambient temperature according to the lubricant table in Sec. "Lubricants" (see standard).
    The drive must not be assembled in the following ambient conditions:
    - Potentially explosive atmosphere
    - Oil
    - Acids
    - Gas
    - Vapors
    - Radiation
  - **For special versions:**
    The drive configured in accordance with the ambient conditions.
  - **For helical-worm / SPIROPLAN® W gear units:**
    No large external mass moments of inertia which could exert a retrodriving load on the gear unit.
    [At η' (retrodriving) = 2 – 1/η < 0.5 self-locking]

9.2

- You must clean the output shafts and flange surfaces thoroughly to ensure they are free of anti-corrosion agents, contamination or similar. Use a commercially available solvent. Do not let the solvent come into contact with the sealing lips of the oil seals – danger of damage to the material!
- When the drive is installed in abrasive ambient conditions, protect the output end oil seals against wear.

4.3 Installing the gear unit

The gear unit or gearmotor is only allowed to be installed in the specified mounting position. SPIROPLAN® gear units are not dependent on the mounting position.

The support structure must have the following characteristics:

- Level
- Vibration damping
- Torsionally rigid

Maximum permitted flatness error for foot and flange mounting (approximate values with reference to DIN ISO 1101):

- Gear unit size ≤ 67: max. 0.4 mm
- Gear unit size 77 ... 107: max. 0.5 mm
- Gear unit size 137 ... 147: max. 0.7 mm
- Gear unit size 157 ... 187: max. 0.8 mm

Do not tighten the housing legs and mounting flanges against one another and ensure that you comply with the permitted overhung and axial loads!

Secure the gearmotors with bolts of quality 8.8.

Secure the following gearmotors with bolts of quality 10.9:

- RF37, R37F with flange ∅ 120 mm
- RF47, R47F with flange ∅ 140 mm
- RF57, R57F with flange ∅ 160 mm

The oil checking and drain screws and the breather valves must be freely accessible!

At the same time, also check that the oil fill is as specified for the mounting position (see Sec. "Lubricants" / "Lubricant fill quantities" or refer to the information on the nameplate). The gear units are filled with the required oil volume at the factory. There may be slight deviations at the oil level plug as a result of the mounting position, which are permitted within the manufacturing tolerances.

9.2

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Adjust the lubricant fill volumes and the position of the breather valve accordingly in the event of a change of mounting position.

Please contact our SEW customer service if you change the mounting position of K gear units to M5 or M6 or between M5 and M6.

Please contact our SEW customer service if you change the mounting position of size S47 S97 S gear units to mounting position M2.

Use plastic inserts (2 ... 3 mm thick) if there is a risk of electrochemical corrosion between the gear unit and the driven machine. The material used must have an electrical bleeder resistor < 10^9 Ω. Electrochemical corrosion can occur between various metals, for example, cast iron and high-grade steel. Also install the bolts with plastic washers! Ground the housing additionally – use the grounding bolts on the motor.

Installation in damp locations or in the open

Drives are supplied in corrosion-resistant versions for use in damp areas or in the open air. Repair any damage to the paint work (e.g. on the breather valve).

When mounting the motors onto AM, AQ, AR, AT adapters, seal the flange areas with a suitable sealing compound, e.g. Loctite® 574.

9.2

Gear unit venting

No breather plug is required for the following gear units:

- R07 in mounting positions M1, M2, M3, M5 and M6
- R17, R27 and F27 in mounting positions M1, M3, M5 and M6
- SPIROPLAN® W gear units

SEW-EURODRIVE supplies all other gear units with the breather valve installed and activated according to the particular mounting position.

Exceptions:

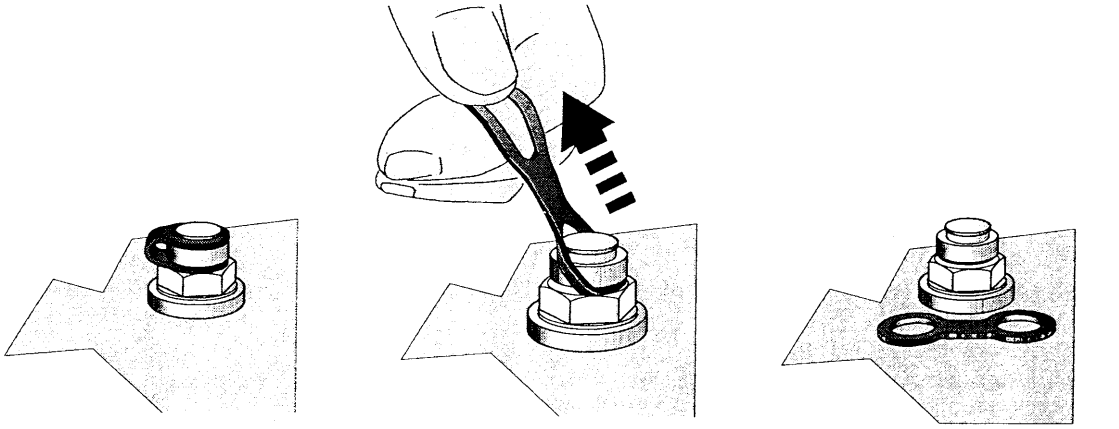
1. SEW supplies the following gear units with a screw plug on the vent hole provided:
   - Gear units for extended storage
   - Pivoted mounting positions, if possible
   - Gear units for mounting on a slant

   The breather valve is located in the motor terminal box. Before startup, you must replace the highest screw plug with the breather valve supplied.
2. SEW supplies a breather valve in a plastic bag for **gear head units** requiring venting on the input end.
3. **Enclosed gear units** are supplied without a breather valve.

Activating the breather valve

As a rule, the breather valve is already activated at the factory. If the breather valve has not been activated, you must remove the transport fixture from the breather valve before starting up the gear unit!

1. Breather valve with transport fixture
2. Remove the transport fixture
3. Breather valve activated



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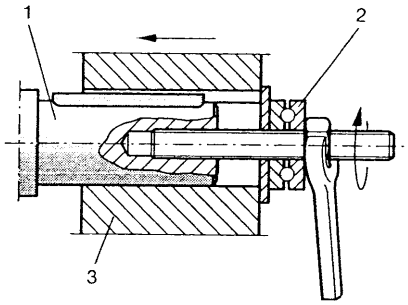
Painting the gear unit

If you paint or respray the drive, ensure that you cover the breather valve and oil seals carefully. Remove the strips of tape after completing the painting work.

4.4 Gear unit with solid shaft

Installing input and output elements

The following figure shows a mounting device for installing couplings or hubs on gear unit or motor shaft ends. It may be possible to dispense with the thrust bearing on the mounting device.



1) Gear shaft end
2) Thrust bearing
3) Coupling hub

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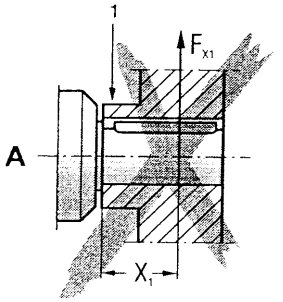
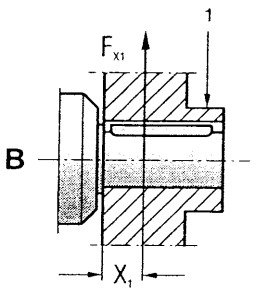
Avoid impermissibly high overhung loads: Install the gear or chain sprocket according to figure **B**.





1 = Hub

A = Unfavorable
B = Correct

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- Only use a mounting device for installing input and output elements. Use the center bore and the thread on the shaft end for positioning.
- **Never drive belt pulleys, couplings, pinions, etc. onto the shaft end by hitting them with a hammer This will damage the bearings, housing and the shaft!**
- **In the case of belt pulleys, make sure the belt is tensioned correctly in accordance with the manufacturer's instructions.**
- Power transmission elements should be balanced after fitting and must not give rise to any impermissible radial or axial forces (see the "Gearmotor" or "Explosion-Proof Drives" catalogs for permitted values).

Note:

Assembly is easier if you first apply lubricant to the output element or heat it up briefly (to 80 ... 100 °C).

9.2

Installing couplings

Couplings must be mounted and balanced according to the information provided by the coupling manufacturer:

a) Maximum and minimum clearance

b) Axial misalignment

c) Angular misalignment

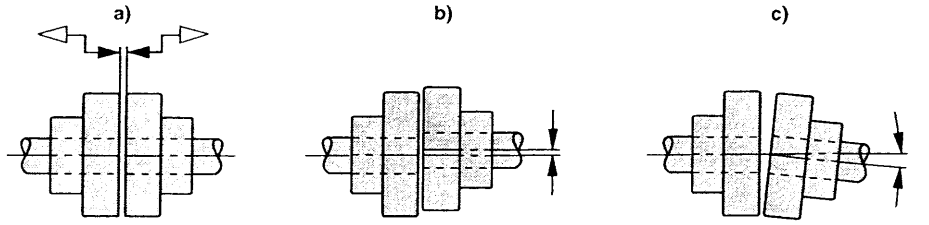

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Figure 7: Clearance and misalignment for coupling installation

Input and output elements such as belt pulleys, couplings, etc. must be protected against contact!

9.2

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4.5 Torque arms for mounted gear units

Do not place torque arms under strain during installation!

Parallel shaft helical gear units

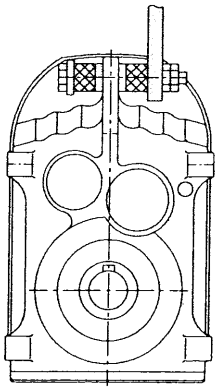

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Figure 8: Torque arm for parallel shaft helical gear units

Helical-bevel gear units

- Bush with bearings on both ends → (1).
- Install connection end B as a mirror image of A.

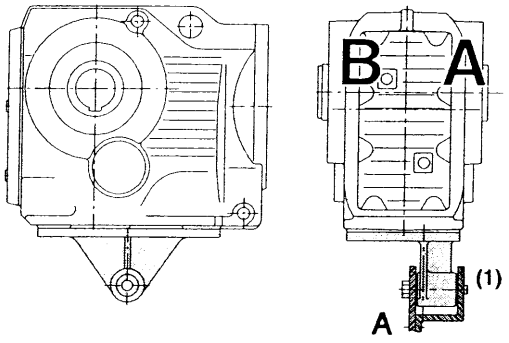

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Figure 9: Torque arm for helical-bevel gear units

Gear unit	Bolts	Tightening torque
KA37	4 × M10 × 25 – 8.8	48 Nm
KA47	4 × M10 × 30 – 8.8	48 Nm
KA67	4 × M12 × 35 – 8.8	86 Nm
KA77	4 × M16 × 40 – 8.8	210 Nm
KA87	4 × M16 × 45 – 8.8	210 Nm
KA97	4 × M20 × 50 – 8.8	410 Nm
KA107	4 × M24 × 60 – 8.8	710 Nm
KA127	4 × M36 × 130 – 8.8	2500 Nm
KA157	4 × M36 × 130 – 8.8	2500 Nm

9.2