Mechanical Operation & Maintenance Manual

for the

Iqaluit Water Treatment Plant

Iqaluit, Nunavut

Year of Completion: 2004

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

This manual has been updated to include:

Date	Description of Change

Iqaluit Water Treatment Plant

Project History

The City of Iqaluit:	**City of Iqaluit Public Works & Engineering** **P.O. Box 460** **Iqaluit, NU X0A 0H0** **Mr. Brad Sokach** **Phone: (867) 975-8505** **Fax: (867) 975-8500**
Project Engineer:	**Earth Tech Canada Inc.** **P.O. Box 1259** **Yellowknife, NT X1A 2N9** **Mr. R.H. Boon, P.Eng.** **Phone: (867) 873-6316** **Fax: (867) 873-6407**
General Contractor:	**90 North Construction & Development Ltd.** **Suite 106, 6131-6th Street S.E.** **Calgary, AB T2H 1L9** **Mr. Kirk Steward** **Phone: (403) 215-1760** **Fax: (403) 215-1769**
Mechanical Subcontractor:	**Schendel Mechanical Contracting Ltd.** **20310-107 Avenue** **Edmonton, AB T5T 3L7** **Mr. Oskar Schendel** **Phone: (780) 447-3400** **Fax: (780) 447-4313**
Electrical Subcontractor:	**KRT Electric** **P.O. Box 1259** **Iqaluit, NU X0A 0H0** **Mr. Rick Smith** **Phone: (867) 979-2639** **Fax: (867) 979-0195**
Instrumentation Subcontractor:	**Vector Electric & Controls** **3524-78 Avenue** **Edmonton, AB X1A 2P4** **Mr. Dave Nielson** **Phone: (780) 469-7900** **Fax: (780) 469-2122**

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for the

Iqaluit Water Treatment Plant

Iqaluit, Nunavut

Chapter 1

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Chapter 3

BACKGROUND AND DESIGN DATA

3.1 General

Due to the population growth in the City of Iqaluit, the existing water treatment plant cannot meet current daily demands. To meet current and future demands, the existing water treatment plant will require upgrading. Upgrading of the existing water treatment plant will also require an upgrade in the mechanical systems to properly support plant operation.

3.2 Existing Mechanical Systems

The facility existing mechanical systems consists of several types of systems. The mechanical systems which services the facility includes a hydronic (glycol) heating system, ventilation system and fuel oil system.

The existing heating system consist of two fuel oil (diesel) fired boilers servicing a hydronic system using glycol. Heating for the plant areas is accomplished by distribution of glycol through a direct piping system to terminal heating units (unit heaters, force flow heaters, baseboard radiation). The terminal heating units exhibits corrosion and is near end of average life expectancy. The heating boilers were replaced in 1993.

The existing ventilation system provided minimal ventilation for the plant areas which consist of an exhaust fan and natural vent opening to service the filter floor level. No ventilation had been provided to service the pump floor level. The plant operating equipment exhibits excessive corrosion due to the lack of ventilation to remove the humidity build-up within the plant.

The existing fuel oil system consist of an outdoor storage tank, indoor day tank and fuel oil transfer system provides fuel for the heating boilers. The existing day tank is not equipped with a containment dike to meet current code requirements. The day tank steel support structure also does not meet minimum fire code requirements.

3.3 Facility Mechanical Systems Upgrades

Along with the plant upgrade, the mechanical systems will be upgraded to meet heating, ventilation, safety, miscellaneous mechanical and applicable code requirements.

3.3.1 Hydronic (Glycol) Heating System Upgrades

Two existing diesel fired, glycol heating boilers located in the Mechanical Room serves as the primary heating source for the building via hydronic system utilizing glycol. Each boiler provides 100 % of system capacity at 88^{o}C glycol supply temperature ensuring full heating capacity at all times. The boilers provides hot glycol to the air handling units heating coils, reheat coils, unit heaters, force flow heaters and wall radiation located throughout the building. Two primary glycol pumps circulates the glycol to the heating equipment as required.

Heating systems upgrades will include removal of three existing unit heaters and associated piping located in the reservoir, replacement of four existing unit heaters with three and replacement of existing stairwell force flow heater at the Pump Floor Level, replacement of six existing unit heaters with five at the Filter Floor Level with addition of two new unit heaters to service the new Filter Level Addition. The new unit heaters will be provided with stainless steel components where possible for corrosion resistance. Each unit heater has a heating capacity of 14.3 kW (49,000 Btu/hr). The force flow heater has a heating capacity of 15.0 kW (51,000 Btu/hr).

Other heating upgrades includes replacement of the wall radiation in the existing Office/Laboratory and Washroom and addition of wall radiation for the New Office. The wall radiation has a heating capacity range of 1.13 to 1.44 kW/m (1,200 Btu/hr/ft to 1,500 Btu/hr/ft) depending on the location of the radiation.

Two reheat coils will be added to the ductwork of the new air handling units to service the Office/Laboratory and New Office. Each reheat coil has a heating capacity of 1.7 kW (5,800 Btu/hr).

The direct heating piping distribution system will be revised to a reverse return system to provide more efficient heating fluid flow control, prevent short cycling of system and lack of hot heating fluid at the farthest terminal heating unit.

The two existing heating re-circulation pumps will be replaced and upgraded to meet the requirements of the upgraded heating system with addition of an air separator to remove air from the heating system. The flow capacity of each pump is 6.0 l/s (79 Imp. gpm) with each pump providing 100% of system flow requirements.

3.3.2 Ventilation System Upgrades

Ventilation system upgrades will include addition of one air handling unit to service the Pump and Filter Floor Levels, addition of one air handling unit and two exhaust fans to service the Filter Addition. The existing washroom exhaust fan will be replaced with addition of exhaust fan to service New Chlorine Room. Ventilation for the Pump/Filter Level is provided by an air handling unit c/w heating coil interlocked with an exhaust damper. Ventilation for the Filter Level is provided by an air handling unit c/w pre-heat and heating coils interlocked with an exhaust fan. Additional Filter Level ventilation is provided by a second exhaust fan interlocked with the process aeration (air scour) blowers.

3.3.3 Fuel Oil System Upgrades

Fuel oil system upgrades will include replacement of the existing day tank with ULC approved self-contained storage tank. Other fuel oil system upgrades includes replacement of day tank existing steel support structure with a new support structure capable of maintaining its integrity for a minimum of two hours during a fire. The replacement day tank is a Durex double wall tank with a storage capacity of 1136 litres (250 Imp. gal.).

Since the scope of this project is an upgrade to existing systems, this mechanical operation and maintenance manual will address only items pertaining to the upgrades.

END OF CHAPTER 3

Chapter 4

SCHEMATICS AND FUNCTIONAL DATA

4.1 Typical Unit Heater & Force Flow Heater Flow Schematic (Refer to Drawing M-1 at the end of this section)

Typical Unit Heater & Force Flow Heater Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Unit Heaters & Force Flow Heaters	Pump & Filter Levels	Provides heating for Pump & Filter Levels	
2	Room Thermostat	Pump & Filter Levels	Temperature control for Unit Heater or Force Flow Heater	Room temperature to be maintained at set point.
3	Manual Air Vent	Unit Heater & Force Flow Heater Return Piping	Allows for venting/removal of trapped air from heating system	
4	Drain Valve	Unit Heater & Force Flow Heater Supply Piping	Allows for draining of glycol from Unit Heater or Force Flow Heater	Normally Closed & Capped
5	Union	Unit Heater & Force Flow Heater Supply Piping	Allows for removal of Unit Heater or Force Flow Heater from heating system.	
6	Union	Unit Heater & Force Flow Heater Return Piping	Allows for removal of Unit Heater or Force Flow Heater from heating system	
7	Isolation Valve	Unit Heater & Force Flow Heater Supply Piping	Valve used for isolation of Unit Heater or Force Flow Heater	Normally Open
8	Balancing/Isolation Valve	Unit Heater & Force Flow Heater Return Piping	Valve used for balancing/isolation of Unit Heater or Force Flow Heater	Normally Open Valve to be reset to balanced position if used for isolation

4.2 Typical Reheat Coil Flow Schematic (Refer to Drawing M-2 at the end of this section)

Typical Reheat Coil Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Reheat Coils	Air Handling Unit-1 Ductwork	Provides heating for Office/Laboratory & New Office	
2	Room Thermostat	Office/Laboratory & New Office	Temperature control for Reheat Coil	Room temperature to be maintained at set point.
3	Control Valve (2-way)	Reheat Coil Supply Piping	Regulates glycol flow to Reheat Coil	
4	Manual Air Vent	Reheat Coil Return Piping	Allows for venting/removal of trapped air from heating system	
5	Drain Valve	Reheat Coil Supply Piping	Allows for draining of glycol from Reheat Coil	Normally Closed & Capped
6	Union	Reheat Coil Supply Piping	Allows for removal of Reheat Coil from heating system	
7	Union	Reheat Coil Return Piping	Allows for removal of Reheat Coil from heating system	
8	Isolation Valve	Reheat Coil Supply Piping	Valve used for isolation of Reheat Coil	Normally Open
9	Balancing/Isolation Valve	Reheat Coil Return Piping	Valve used for balancing/isolation of Reheat Coil	Normally Open Valve to be reset to balanced position if used for isolation

4.3 Typical Air Handling Unit Preheat & Heating Coils 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	Pump & Filter Levels	Provides heating for Pump & Filter Levels	
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	Union	Preheat & Heating Coil Supply Piping	Allows for removal of Preheat or Heating Coil from AHUs	
7	Union	Preheat & Heating Coil Return Piping	Allows for removal of Preheat or Heating Coil from AHUs	
8	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
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 isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Location	Function Performed	Remarks
11	Isolation Valve	Preheat & Heating Coil Return Piping	Valve used for bypass of Preheat or Heating Coil Temperature Control Valve	Normally Close
12	Isolation Valve	Preheat & Heating Coil Supply Piping	Valve used for isolation of Preheat or Heating Coil Temperature Control Valve	Normally Open
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

4.4 Heating Pumps Flow Schematic (Refer to Drawing M-4 at the end of this section)

Heating Pumps Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Primary Heating Pump P-3	Mechanical Room	Circulates glycol throughout heating system	
2	Check Valve	Pump P-3 Discharge Piping	Prevents backflow of glycol	
3	Balancing/Isolation Valve	Pump P-3 Discharge Piping	Valve used for balancing/isolation of Pump P-3	Normally Open Valve to be reset to balanced position if used for isolation
4	Strainer	Strainer provided within Air Separator (No.15)	Provides for removal of solid material from glycol heating system	Strainer to be cleaned if plugged
5	FS – Flow Switch	Pump P-3 Discharge Piping	Indication of glycol flow for Pump P-3	
6	Isolation Valve	Pump P-3 Suction Piping	Valve used for isolation of Pump P-3	Normally Open
7	PI – Pressure Indicator	Pump P-3 Suction & Discharge Piping	Visual indication of Pump P-3 operating pressures and strainer condition	
8	Primary Heating Pump P-4	Mechanical Room	Circulates glycol throughout heating system	
9	Check Valve	Pump P-4 Discharge Piping	Prevents backflow of glycol	
10	Balancing/Isolation Valve	Pump P-4 Discharge Piping	Valve used for balancing/isolation of Pump P-4	Normally Open Valve to be reset to balanced position if used for isolation
11	Strainer	Strainer provided within Air Separator (No.15)	Provides for removal of solid material from heating system	Strainer to be cleaned if plugged

Heating Pumps Flow Schematic

No.	Component	Location	Function Performed	Remarks
12	FS – Flow Switch	Pump P-4 Discharge Piping	Indication of glycol flow for Pump P-4	
13	Isolation Valve	Pump P-4 Suction Piping	Valve used for isolation of Pump P-4	Normally Open
14	PI – Pressure Indicator	Pump P-4 Suction & Discharge Piping	Visual indication of Pump P-4 operating pressures and strainer condition	
15	Air Separator c/w Strainer	Mechanical Room	Automatic separation of trapped air from glycol heating system	
16	AAV – Automatic Air Vent	Air Separator	Automatic removal of trapped air from glycol heating system	
17	Drain Valve	Air Separator	Allows for draining of glycol from Air Separator	Normally Closed & Capped
18	Isolation Valve	Air Separator Outlet Piping	Valve used for isolation of Air Separator	Normally Open
19	Isolation Valve	Supply Header Supply Piping	Valve used for isolation of Heating System from Main Supply	Normally Open
20	TI – Temperature Indicator	Pumps P-3 & P-4 Common Supply Piping	Visual indication of heating system glycol supply temperature	
21	TI – Temperature Indicator	Heating System Common Return Piping	Visual indication of heating system glycol return temperature	
22	Isolation Valve	Return Header Return Piping	Valve used for isolation of Heating System from Main Return	Normally Open

4.5 Air Handling Unit AHU-1 Flow Schematic (Refer to Drawing M-5 at the end of this section)

Air Handling Unit AHU-1 Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Air Handling Unit AHU-1	Filter Floor Level	Provides ventilation for Pump & Filter Floor Level	
2	Supply Fan	AHU-1	Provides flow of air	
3	Intake Hood	Outside Wall	Allows outside air to be supplied to AHU-1	
4	Outside Air Damper Motor & Outside Air Dampers	AHU-1	Dampers opens to provide outside air for AHU-1	Dampers Normally Closed
5	Return Air Damper Motor & Return Air Dampers	AHU-1	Dampers opens to provide return air for AHU-1	Dampers Normally Open
6	30% Filter – Summer Position	AHU-1	Removal of dust & dirt 30% Filters to be installed at this location during summer time	
7	PD-1 – Pressure Differential Indicator	AHU-1	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
8	TS-1 – Temperature Sensor – Mixed Air	AHU-1	Measures and modulates outside & return air dampers to maintain mixed air set point	
9	30% Filter – Winter Position	AHU-1	Removal of dust & dirt 30% Filters to be installed at this location during winter time	
10	PD-2 – Pressure Differential Indicator	AHU-1	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged

Air Handling Unit AHU-1 Flow Schematic

No.	Component	Location	Function Performed	Remarks
11	Heating Coil	AHU-1	Provides tempering of outside/return air to maintain supply air set point	
12	65% Final Filter	AHU-1	Removal of dust & dirt	Filters to be replaced if plugged
13	LTA – Low Temperature Alarm	AHU-1	Low supply air temperature protection Shutdown of AHU-1 if low limit is exceeded	
14	TS-2 – Temperature Sensor – Supply Air	AHU-1	Measures and modulates heating coil control valve to maintain supply air set point	
15	Room Thermostat	Filter Floor Level	Measures and controls AHU-1 to maintain room temperature set point	
16	Exhaust Hood	Outside Wall	Allows air to be relieved	
17	Relief Air Damper Motor & Relief Air Dampers	Filter Floor Level	Dampers opens to relieve air	Dampers Normally Closed
18	Exhaust Hood	Outside Wall	Allows air to be relieved	
19	Barometric Relief Air Dampers	Filter Floor Level	Dampers opens to relieve air	Dampers Normally Closed

4.6 Air Handling Unit AHU-2 Flow Schematic (Refer to Drawing M-6 at the end of this section)

Air Handling Unit AHU-2 Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Air Handling Unit AHU-2	Filter Floor Level	Provides ventilation for Filters Area	Interlocked with EF-2
2	Supply Fan	AHU-2	Provides flow of air	
3	Intake Hood	Outside Wall	Allows outside air to be supplied to AHU-2	
4	Outside Air Damper Motor & Outside Air Dampers	AHU-2	Dampers opens to provide outside air for AHU-2	Dampers Normally Closed
5	30% Filter – Summer Position	AHU-2	Removal of dust & dirt 30% Filters to be installed at this location during summer time	
6	PD- – Pressure Differential Indicator	AHU-2	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
7	Preheat Coil	AHU-2	Provides tempering of outside air to maintain supply air set point	
8	LTA – Low Temperature Alarm	AHU-2	Low supply air temperature protection Shutdown of AHU-2 if low limit is exceeded	
9	30% Filter – Winter Position	AHU-2	Removal of dust & dirt 30% Filters to be installed at this location during winter time	
10	PD – Pressure Differential Indicator	AHU-2	Visual indication of pressure differential across filter to indicate condition of filter	Filters to be replaced if plugged
11	Heating Coil	AHU-2	Provides tempering of outside air to maintain supply air set point	

Air Handling Unit AHU-2 Flow Schematic

No.	Component	Location	Function Performed	Remarks
12	65% Final Filter	AHU-2	Removal of dust & dirt	Filters to be replaced if plugged
13	TS-1 – Temperature Sensor – Supply Air	AHU-2	Measures and modulates preheat & heating coil control valves to maintain supply air set point	
14	Room Thermostat	Filters Area	Measures and controls AHU-2 to maintain room temperature set point	
15	Exhaust Fan EF-2	Filters Area	Provides exhaust for filters area	Interlocked with AHU-2
16	Exhaust Fan EF-2 Damper motor & Dampers	Filters Area	Dampers open to exhaust air	Dampers Normally Closed
17	HS-1 – Humidity Sensor Exhaust Air	EF-2 Ductwork	Measures humidity of the exhaust air	
18	Exhaust Fan EF-4	Filters Area	Provides exhaust for Air Scour Blowers	Interlocked with Air Scour Blowers
19	Exhaust Fan EF-4 Damper motor & Dampers	Filters Area	Dampers open to exhaust air	Dampers Normally Closed

4.7 Exhaust Fan EF-3 Flow Schematic (Refer to Drawing M-7 at the end of this section)

Exhaust Fan EF-3 Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Exhaust Fan EF-3	Chlorine Storage Room	Provides exhaust for Chlorine Storage Room	
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Chlorine Storage Room	Dampers opens to exhaust air	Dampers Normally Closed
3	Manual Push Button	Entrance Lobby	Allows start-up & shutdown of EF-3	

4.8 Fuel Oil (Diesel) Flow Schematic (Refer to Drawing M-8 at the end of this section)

Fuel Oil (Diesel) Flow Schematic

No.	Component	Location	Function Performed	Remarks
1	Exhaust Fan EF-3	Chlorine Storage Room	Provides exhaust for Chlorine Storage Room	
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Chlorine Storage Room	Dampers opens to exhaust air	Dampers Normally Closed

END OF CHAPTER 4

Chapter 5

COMPONENT DETAILS

5.1 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 Heaters & Force Flow Heaters	Engineered Air Unit Heaters: H Series: M/N: H-3 Force Flow: CUH Series: M/N: CUH-7		Supplier: Engineered Air Edmonton, AB
2	Room Thermostat	Robertshaw M/N: 501-501C		Supplier: Automatic Controls Edmonton, AB
3	Manual Air Vent			Supplier: Bartle & Gibson Edmonton, AB
4	Drain Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
5	Union			Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
8	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

5.2 Typical Reheat Coil Flow Schematic (Refer to Drawing M-2 at the end of Chapter 4)

Typical Reheat Coil Flow Schematic

No.	Component	Details	Setting	Remarks
1	Reheat Coils	Engineered Air Custom Built for Project		Supplier: Engineered Air Edmonton, AB
2	Room Thermostat	Invensys M/N: TA168-001		Supplier: Automatic Controls Edmonton, AB
3	Control Valve (2-way)	Invensys Reheat Coil: M/N: VS-2213-536-9-02 Wall Radiation: M/N: VM2233P23A000		Supplier: Automatic Controls Edmonton, AB
4	Manual Air Vent			Supplier: Bartle & Gibson Edmonton
5	Drain Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Union			Supplier: Bartle & Gibson Edmonton
8	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
9	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

5.3 Typical Air Handling Unit Preheat & Heating Coils 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	Engineered Air Custom Built for Project Inclusive of Air Handling Units		Supplier: Engineered Air Edmonton, AB
2	Temperature Control Valve (3-way)	Invensys M/N: VS-2313-536-9-03 or 05		Supplier: Automatic Controls Edmonton, AB
3	Duct Mounted Thermostat	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB
4	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
5	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
6	Union			Supplier: Bartle & Gibson Edmonton
7	Union			Supplier: Bartle & Gibson Edmonton
8	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
9	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
10	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
11	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton
12	Isolation Valve	M.A. Steward & Sons Kitz – Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton

Typical Air Handling Unit Preheat & Heating Coils Flow Schematic

No.	Component	Details	Setting	Remarks
13	Balancing/Isolation Valve	Dahl Brothers Canada Ltd. M/N: 13013		Supplier: Bartle & Gibson Edmonton

5.4 Heating Pumps Flow Schematic (Refer to Drawing M-4 at the end of Chapter 4)

Heating Pumps Flow Schematic

No.	Component	Details	Setting	Remarks
1	Primary Heating Pump P-3	Armstrong M/N: Series 4360 3D		Supplier: Wolsely Mechanical Group Edmonton, AB
2	Check Valve	Val-Matic M/N: Series 1400		Supplier: Robins Flow Tech Edmonton, AB
3	Balancing/Isolation Valve	Armstrong M/N: CBV-G Straight		Supplier: Bartle & Gibson Edmonton, AB
4	Strainer/Air Separator	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
5	FS – Flow Switch	MacDonnell M/N: Series FS4-3		Supplier: Emco Edmonton, AB
6	Isolation Valve	Apollo M/N: Series 143		Supplier: M.A. Steward & Sons Edmonton, AB
7	PI – Pressure Indicator	H.O. Trerice Co. M/N: 620B		Supplier: Ener-tech Mechanical Sales Edmonton, AB
8	Primary Heating Pump P-4	Armstrong M/N: Series 4360 3D		Supplier: Wolsely Mechanical Group Edmonton, AB
9	Check Valve	Val-Matic M/N: Series 1400		Supplier: Robins Flow Tech Edmonton, AB
10	Balancing/Isolation Valve	Armstrong M/N: CBV-G Straight		Supplier: Bartle & Gibson Edmonton, AB
11	Strainer/Air Separator	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
12	FS – Flow Switch	MacDonnell M/N: Series FS4-3		Supplier: Emco Edmonton, AB
13	Isolation Valve	Apollo M/N: Series 143		Supplier: M.A. Steward & Sons Edmonton, AB

Heating Pumps Flow Schematic

No.	Component	Details	Setting	Remarks
14	PI – Pressure Indicator	H.O. Trerice Co. M/N: 620B		Supplier: Ener-tech Mechanical Sales Edmonton, AB
15	Air Separator/Strainer	Armstrong M/N: VAS-3		Supplier: Wolsely Mechanical Group Edmonton, AB
16	AAV – Automatic Air Vent			Supplier: Bartle & Gibson Edmonton, AB
17	Drain Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
18	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
19	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB
20	TI – Temperature Indicator	H.O. Trerice Co. M/N: BX-9		Supplier: Ener-tech Mechanical Sales Edmonton, AB
21	TI – Temperature Indicator	H.O. Trerice Co. M/N: BX-9		Supplier: Ener-tech Mechanical Sales Edmonton, AB
22	Isolation Valve	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB

5.5 Air Handling Unit AHU-1 Flow Schematic (Refer to Drawing M-5 at the end of Chapter 4)

Air Handling Unit AHU-1 Flow Schematic

No.	Component	Details	Setting	Remarks
1	Air Handling Unit AHU-1	Engineered Air Custom Built for Project M/N: LM-3-C		Supplier: Engineered Air Edmonton, AB
2	Supply Fan	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
3	Intake Hood			
4	Outside Air Damper Motor & Outside Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
5	Return Air Damper Motor & Return Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
6	30% Filter – Summer Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
7	PD-1 – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
8	TS-1 – Temperature Sensor – Mixed Air	Invensys M/N: TS-8405		Supplier: Automatic Controls Edmonton, AB
9	30% Filter – Winter Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
10	PD-2 – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
11	Heating Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
12	65% Final Filter	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
13	LTA – Low Temperature Alarm	Johnson Controls M/N: A70BA		Supplier: Automatic Controls Edmonton, AB
14	TS-2 – Temperature Sensor – Supply Air	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB

Air Handling Unit AHU-1 Flow Schematic

No.	Component	Details	Setting	Remarks
15	Room Thermostat	Invensys M/N: MN-S4		Supplier: Automatic Controls Edmonton, AB
16	Exhaust Hood			
17	Relief Air Damper Motor & Relief Air Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
18	Exhaust Hood			
19	Barometric Relief Air Dampers	Ruskin M/N: MD35		Supplier: Aqua Air Systems Ltd Edmonton, AB

5.6 Air Handling Unit AHU-2 Flow Schematic (Refer to Drawing M-6 at the end of Chapter 4)

Air Handling Unit AHU-2 Flow Schematic

No.	Component	Details	Setting	Remarks
1	Air Handling Unit AHU-2	Engineered Air Custom Built for Project M/N: LM-3-C-MV		Supplier: Engineered Air Edmonton, AB
2	Supply Fan	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
3	Intake Hood			
4	Outside Air Damper Motor & Outside Air Dampers	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
5	30% Filter – Summer Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
6	PD- – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
7	Preheat Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
8	LTA – Low Temperature Alarm	Johnson Controls M/N: A70BA		Supplier: Automatic Controls Edmonton, AB
9	30% Filter – Winter Position	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
10	PD – Pressure Differential Indicator	Engineered Air Inclusive of Air Handling Unit Dwyer: Series 2000		Supplier: Engineered Air Edmonton, AB
11	Heating Coil	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
12	65% Final Filter	Engineered Air Inclusive of Air Handling Unit		Supplier: Engineered Air Edmonton, AB
13	TS-1 – Temperature Sensor – Supply Air	Invensys M/N: TS-8201		Supplier: Automatic Controls Edmonton, AB
14	Room Thermostat	Invensys M/N: MN-S4		Supplier: Automatic Controls Edmonton, AB

Air Handling Unit AHU-2 Flow Schematic

No.	Component	Details	Setting	Remarks
15	Exhaust Fan EF-2	Penn Ventilation M/N: WFX10B		Supplier: Aqua Air Systems Ltd Edmonton, AB
16	Exhaust Fan EF-2 Damper motor & Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
17	HS-1 – Humidity Sensor – Exhaust Air	Invensys M/N: RH200A03		Supplier: Automatic Controls Edmonton, AB
18	Exhaust Fan EF-4	Penn Ventilation M/N: WFX08B		Supplier: Aqua Air Systems Ltd Edmonton, AB
19	Exhaust Fan EF-4 Damper motor & Dampers	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB

5.7 Exhaust Fan EF-3 Flow Schematic (Refer to Drawing M-7 at the end of Chapter 4)

Exhaust Fan EF-3 Flow Schematic

No.	Component	Details	Setting	Remarks
1	Exhaust Fan EF-3	Twin City Fan & Blower M/N: 909 RBA		Supplier: Aqua Air Systems Ltd Edmonton, AB
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	Damper Motor: Belimo M/N: LF120 or NF120 Damper: Tamco M/N: Series 9000		Supplier: E.H. Price Edmonton, AB
3	Manual Push Button	Allen Bradley M/N: Series 800H		Supplier: Westburne Edmonton, AB

5.8 Fuel Oil (Diesel) Flow Schematic (Refer to Drawing M-8 at the end of Chapter 4)

Fuel Oil (Diesel) Flow Schematic

No.	Component	Details	Setting	Remarks
1	Exhaust Fan EF-3	Watts M/N: V.A.G.S.T. Capacity: 250 Gallons		Supplier: Durex Steel & Alloy Industries Edmonton, AB
2	Exhaust Fan EF-3 Damper Motor & Dampers & End Switch	M.A. Steward & Sons Kitz-Super B M/N: 600WOG/150WSP		Supplier: Bartle & Gibson Edmonton, AB

END OF CHAPTER 5

Chapter 6

OPERATING PROCEDURES

6.1 General

Two existing diesel fuel oil, glycol heating boilers located in the Mechanical Room serves as the primary source of heating in the building with each boiler providing 100% of the system capacity. The use of glycol as a heating agent helps to prevent freeze-up in the system.

Two air handling units, two exhaust fan and relief air openings located in the plant provides ventilation for the Pump and Filter Floor Levels with additional exhaust fans servicing the Washroom and Chlorine Room.

Since the equipment is only heating and ventilation source for the building, it is important to ensure proper operation and maintenance is performed.

6.2 Glycol Heating System Operation

6.2.1 Unit Heaters and Force Flow Heaters (Refer to Drawing M-1)

Unit heaters and force flow heaters are located in the plant providing heat to various areas. Each heater fan circuit is energized from a local disconnect switch with a local wall mounted electric thermostat cycling the heater fan motor to maintain the desired space temperature.

6.2.2 Reheat Coil (Refer to Drawing M-2)

Two reheat coils located in Air Handling Unit AHU-1 distribution ductwork provides further tempering of the supply air as required for the Office/Laboratory and New Office. Each office has a local wall mounted thermostat controlling both reheat coil and wall radiation zone valves to provide room heating to the desired room temperature.

6.2.3 Air Handling Unit Preheat & Heating Coils (Refer to Drawing M-3)

Refer to Air Handling Units AHU-1 & AHU-2 in this section.

6.2.4 Heating Pumps P-3 and P-4 (Refer to Drawing M-4)

Two 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. A manual switch on the Pump Control Panel will allow selection of either Pump P-3 or P-4 to operate. Only one pump is allowed to operate at a time and runs continuously once a pump is selected. Failure of the duty pump will activate the standby pump and sound alarm horn at the Pump Control Panel. The alarm horn will be silenced when the duty pump is manually switched over at the Pump Control Panel.

Additional equipment have 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 within the air separator will filter out any solid material circulating in the heating system. The air separator with automatic air vent (AAV) will automatic remove entrapped air from the system reducing possibility of corrosion within the system.

6.3 Ventilation System Operation

6.3.1 Air Handling Unit AHU-1 System (Refer to Drawing M-5)

Air Handling Unit AHU-1 and two relief dampers provides ventilation for the Pump and Filters Level. The system is initially started by a local wall mounted thermostat to maintain the desired space temperature. When the supply fan status is proven, the mixed air dampers (outside & return dampers) will modulate to provide 20% (operator adjustable) minimum fresh air. The mixed air temperature sensor will modulate the mixed air dampers as required to maintain the mixed air set point which is limited to 9^{o}C

(48°F). The supply air discharge sensor will modulate the 3-way heating coil valve to maintain the supply air set point based on the space temperature reset schedule. The supply air set point of 23°C (73°F) is scheduled when the space temperature is below -1°C (30°F) or set point of 13°C (55°F) when the space temperature is above 1°C (34°F). When the supply fan is off, the mixed air dampers will close and the heating coil valve will modulate to maintain a mixed air temperature of 13°C (55°F).

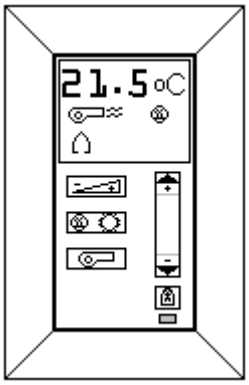
The motorized relief damper will open and modulate in conjunction with the mixing dampers to provide proper building pressurization. The barometric relief damper will open as required to relieve excess building pressure.

If the heating coil discharge temperature falls below 4°C (39°F), the low temperature thermostat will stop the supply fan to prevent cold air from being supplied. The thermostat must be manually reset before the system can resume normal operation after inspection of low temperature problem.

An AHU-1 thermostat/controller user guide is provided in the following pages for operational reference.

AHU-1 MN-S4

User's Guide



Automatic Controls Ltd.
9010 20th. Street
Edmonton, Alberta
T6P - 1K8
Phone (780) 417- 7000
Fax (780) 417-7001

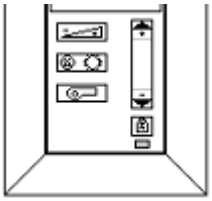
Using The MN-S4 Sensor

The IA Micronet MN-S4 sensor is your direct link to the IA MicroNet equipment controllers. This manual describes the sensor's functions and operation.

The Display

There are many elements on the MN-S4 display. The default screen displays the current space temperature. As you perform different functions, the display will change to indicate the current function. Various icons will appear on screen. Each icon will be described as it is encountered in the directions below.

The Keypad



SETPOINT ADJUST

Enters setpoint mode or cycles through the setpoint screens

HEAT/COOL

Selects either an override for the Heating Coil Valve OR for the Mixed Air Dampers

FAN CONTROL

Toggles command to the supply fan

OVERRIDE

Enables a five minute override for either the heating coil or for the dampers

SCREEN PAGING / ADJUSTMENT

Scrolls through the four display screens or used to adjust analog values

Press the **SCREEN PAGING / ADJUSTMENT** key to switch screens on the display. When you press this key, the display will show **–1-, -2-, -3-, -4-.** Once you release the key, the display will change to screen 1, 2, 3, or 4 respectively.

Screen Display Legend:
-1- Space Temperature
-2- Supply Air Temperature
-3- Mixed Air Temperature

-4- Supply Air Setpoint

Changing The Setpoint

Press the **SETPOINT ADJUST** key to access the various setpoint screens. When the key is pressed once, you will toggle to the first adjust screen. To scroll to the other adjustment screens, press the **SETPOINT ADJUST** key again. By pressing the key repeatedly, you will be able to cycle through all the adjust screens.

Screen Setpoint Adjustment Legend:
-1- Occupied Space Setpoint
-2- Supply Air Setpoint Adjustment (adds the adjustment value to the setpoint)
-3- Minimum Outside Air percentage (adjustable between 10% to 50%)
-4- Override Value of either the Heating Coil Valve or Mixed Air Dampers (depends on selection)

After you have cycled to the desired adjustment screen, the setpoint value will start blinking. You may now press the **SCREEN PAGING / ADJUSTMENT** key to adjust the current setpoint. As you press the **SCREEN PAGING / ADJUSTMENT**, the setpoint value changes. When you are ready to lock in the setpoint, release the keys and wait a few seconds. The display will stop blinking and the setpoint will now lock in.

Example of Changing the Minimum Outside Air Percentage:

- Press the **SETPOINT ADJUST** key three times (since it corresponds to the third adjustment screen).
- The screen will display –3– and then a blinking value will appear
- Press the **SCREEN PAGING / ADJUSTMENT** key either up or down to make the setpoint adjustment.
- Release the key and wait until the new setpoint stops blinking
- Display screen will revert back to the default screen of the space temperature.

Overriding the Heat Valve or Dampers

A five-minute override of either the heating valve or mixed air dampers can be made at the MN-S4 sensor. To start the override request, you must first press the OVERRIDE button. A five-minute counter will start. Pressing the **HEAT/COOL** button will bring up a mode selection screen. There will be a heat icon, a cool icon, or AUTO. By pressing the **SCREEN PAGING / ADJUSTMENT** key repeatedly, the different icons will begin to flash and select the override mode.

- Heat Icon = Heat Valve Override
- Cool Icon (Snowflake) = Damper Override
- Auto (Line) = No Override

After the override mode has been selected, you will need to set the override value of the selected equipment. Press the **SETPOINT ADJUST** key four times (since the override value corresponds to the fourth adjustment screen).

6.3.2 Air Handling Unit AHU-2 System (Refer to Drawing M-6)

Air Handling Unit AHU-2 and Exhaust Fans EF-2 and EF-4 provides ventilation for the Filters Area Level. The system is initiated by switching the fan control to Auto Mode on the local wall mounted thermostat to open EF-2 exhaust dampers and start exhaust fan in low speed. When EF-2 fan status is proven, AHU-2 outside air dampers will modulate open and start supply fan in low speed. The supply air discharge sensor will modulate the 3-way preheat and heating coil valves in sequence to maintain the supply air set point of 12^{o}C (54^{o}F) which is adjustable at the thermostat. When the system is off, the preheat and heating coil valves will modulate 100% open.

When the supply fan status is proven and after a 15 minute delay, the humidity controls will be enabled. Both the supply and exhaust fans will switch to high speed if the exhaust air humidity rises above 40% RH. When the exhaust air humidity falls below 30%, both the supply and exhaust fans will be stopped for 30 seconds and then restarted in low speed.

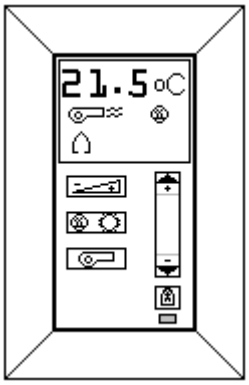
If the preheat coil discharge temperature falls below 4^{o}C (39^{o}F), the low temperature thermostat will stop the supply and exhaust fans. The thermostat must be manually reset before the system can resume normal operation after inspection of low temperature problem.

Exhaust Fan EF-4 interlocked with the Scour Blowers to start when either Scour Blower is started. When the system is activated, EF-4 normally closed discharge dampers will open to allow discharge damper end switch to make allowing EF-4 to start.

An AHU-2 thermostat/controller user guide is provided in the following pages for operational reference.

AHU-2 MN-S4

User's Guide



Automatic Controls Ltd.
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Phone (780) 417- 7000
Fax (780) 417-7001

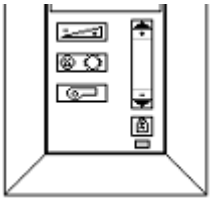
Using The MN-S4 Sensor

The IA Micronet MN-S4 sensor is your direct link to the IA MicroNet equipment controllers. This manual describes the sensor's functions and operation.

The Display

There are many elements on the MN-S4 display. The default screen displays the current space temperature. As you perform different functions, the display will change to indicate the current function. Various icons will appear on screen. Each icon will be described as it is encountered in the directions below.

The Keypad



SETPOINT ADJUST

Enters setpoint mode or cycles through the setpoint screens

HEAT/COOL

Selects either an override for the Preheat Coil Valve or the Heating Coil Valve

FAN CONTROL

Toggles command to the supply fan

OVERRIDE

Enables a five minute override for either the heating coil or for the dampers

SCREEN PAGING / ADJUSTMENT

Scrolls through the four display screens or used to adjust analog values

Press the **SCREEN PAGING / ADJUSTMENT** key to switch screens on the display. When you press this key, the display will show **–1-, -2-, -3-.** Once you release the key, the display will change to screen 1, 2, or 3 respectively.

Screen Display Legend:
-1- Space Temperature
-2- Exhaust Air Humidity
-3- Supply Fan Status

Changing The Setpoint

Press the **SETPOINT ADJUST** key to access the various setpoint screens. When the key is pressed once, you will toggle to the first adjust screen. To scroll to the other adjustment screens, press the **SETPOINT ADJUST** key again. By pressing the key repeatedly, you will be able to cycle through all the adjust screens.

Screen Setpoint Adjustment Legend:
-1- Supply Air Setpoint (Between 8°C and 12°C)
-2- Override Value of either the Heating Coil Valve or Preheat Coil Valve(depends on selection)

After you have cycled to the desired adjustment screen, the setpoint value will start blinking. You may now press the **SCREEN PAGING / ADJUSTMENT** key to adjust the current setpoint. As you press the **SCREEN PAGING / ADJUSTMENT**, the setpoint value changes. When you are ready to lock in the setpoint, release the keys and wait a few seconds. The display will stop blinking and the setpoint will now lock in.

Example of Changing the Supply Air Setpoint:

- Press the **SETPOINT ADJUST** key once (since it corresponds to the first adjustment screen).
- The screen will display –1– and then a blinking value will appear
- Press the **SCREEN PAGING / ADJUSTMENT** key either up or down to make the setpoint adjustment.
- Release the key and wait until the new setpoint stops blinking
- Display screen will revert back to the default screen of the supply air temperature.

Overriding the Heat Valve or the Preheat Valve

A five-minute override of either the preheat valve or heating valve can be made at the MN-S4 sensor. To start the override request, you must first press the OVERRIDE button. A five-minute counter will start. Pressing the **HEAT/COOL** button will bring up a mode selection screen. There will be a heat icon, a cool icon, or AUTO. By pressing the **SCREEN PAGING / ADJUSTMENT** key repeatedly, the different icons will begin to flash and select the override mode.

- Heat Icon = Preheat Valve Override
- Cool Icon (Snowflake) = Heat Valve Override
- Auto (Line) = No Override

After the override mode has been selected, you will need to set the override value of the selected equipment. Press the **SETPOINT ADJUST** key twice (since the override value corresponds to the second adjustment screen) and then enter the override percentage.

6.3.3 Exhaust Fan EF-3 (Refer to Drawing M-7)

Exhaust Fan EF-3 provides ventilation for the Chlorine Storage Room. The system is initiated by a manual switch located in the Entrance Lobby. When the system is activated, EF-3 normally closed inlet and discharge dampers will open to allow discharge damper end switch to make allowing EF-3 to start.

6.4 Fuel Oil System Operation

6.4.1 Fuel Oil System (Refer to Drawing M-8)

The fuel oil required to operate the boilers is diesel fuel. The diesel fuel is stored in an outside above ground storage tank located adjacent to the building with a 1100 litre (250 Imp. Gal.) double walled day tank located inside the building. The fuel oil is pumped from the outside tank to the day tank and gravity supplied to the boilers. The existing four level switches have been reinstalled on the new day tank and set at 10%, 20%, 80% and 90% tank full levels.

6.5 Troubleshooting

6.5.1 Alarms

The Water Treatment Plant process, mechanical and electrical operating systems and equipment is continuously monitored with the appropriate alarms indicated if there is a system or equipment failure.

6.5.1.1 Alarms

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

The heating pumps system have been provided with a local alarm in event of a heating pump failure.

A fuel oil low level alarm is provided for the fuel oil system day tank.

6.5.2 Heating Operation Failure

6.5.2.1 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.

6.5.2.2 Reheat Coils Not Operational

- Check 2-way valve operation.
- Check 2-way valve thermostat control 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.

6.5.2.3 Air Handling Units Preheat & Heating Coils Not Operational

- Check 3-way valve operation.
- Check 3-way 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.

6.5.2.4 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.

6.5.2.5 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.

6.5.3 Air Handling Unit Operation Failure

6.5.3.1 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.

6.5.3.2 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.

6.5.3.3 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.

6.5.3.4 Air Handling Unit Low Discharge Air Volume

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

6.5.4 Exhaust Fan Operation Failure

6.5.4.1 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.

6.5.5 Relief Damper Operation Failure

6.5.5.1 Relief Damper Will Not Open Up

- Check control system operating parameters, settings and interlocks.
- Check dampers, damper motors, linkages and end switches

END OF CHAPTER 6

Chapter 7

MAINTENANCE

7.1 General

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.

7.2 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.

7.3 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 (ie. 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.

7.4 Scheduled Preventive Maintenance Program

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.

7.4.1 Causes of Equipment Failure

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

- Loose and broken belts
- Misaligned pulleys
- Dirty or plugged filters
- Dirty or plugged coils
- Worn bearings
- Improper lubrication and oiling or lack of
- Persistent overloading
- Above normal temperatures
- Below normal temperatures
- Obstruction of ventilation by foreign objects or material (blockage of air, dirt on components etc.)
- Normal deterioration from age
- 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.

7.4.2 Maintenance Legend

D	Daily
W	Weekly
M	Monthly
SA	Semi-Annually
A	Annually
PMI	As per Manufacturer's Instructions
AN	As Necessary

7.5 Heating System

7.5.1 Unit Heaters and Force Flow Heaters

Refer to Unit Heater and Force Flow 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

7.5.2 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

7.5.3 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.

7.6 Ventilation System

7.6.1 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

7.6.2 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

END OF CHAPTER 7

Chapter 8

TESTING AND CERTIFICATION DATA

8.1 General

Paragraph Text

END OF CHAPTER 8

Chapter 9

MANUFACTURER DATA AND SERVICE INFORMATION

9.1 General

Paragraph Text

END OF CHAPTER 9

Chapter 10

APPENDIX

10.1 General

Paragraph Text

10.2 Photographs

Paragraph Text

10.3 Drawings

Paragraph Text

END OF CHAPTER 10