

# **ENGINEER SPECIFICATION MANUAL**

**For**

## **WATER TREATMENT**

**INDEX**

### **SECTION 1**

#### **PRE-OPERATIONAL CLEANING**

- 1. HOT WATER HEATING SYSTEMS**
- 2. CHILLED WATER SYSTEMS**
- 3. HOT AND CHILLED SYSTEMS**
- 4. GLYCOL SYSTEMS**

### **SECTION 2**

#### **STEAM BOILER SYSTEMS**

- 5. BOILER WATER AND CONDENSATE TREATMENT  
100% MAKE-UP USING PULSATRON PACKAGED CHEMICAL  
FEED SYSTEM (SMALL SYSTEMS)**
- 6. BOILER WATER AND CONDENSATE TREATMENT  
100% MAKE-UP USING MILTON ROY PACKAGED CHEMICAL  
FEED SYSTEM (PROCESS/HUMIDIFICATION)**
- 7. STEAM PLANT UNDER 200 H.P. AND LESS THAN 15%  
MAKE-UP**
- 8. STEAM BOILER HEATING PLANTS (EG. HOSPITALS  
AND LARGE BUILDINGS)**
- 9. SPACE HEATING STEAM BOILERS (EG. SCHOOLS AND  
OFFICE BUILDINGS)**

### **SECTION 3**

**COOLING TOWERS**

**10. EVAPORATIVE COOLING SYSTEM TREATMENT**

**11. CONDENSER WATER SYSTEMS**

**12. CONDENSER WATER TREATMENT EQUIPMENT**

**SECTION 4**

**PRODUCT BULLETINS**

- PRE-CLEANERS
  
- CLOSED SYSTEM INHIBITORS
  
- BOILER WATER TREATMENT
  
- COOLING WATER TREATMENT

**SECTION 5**

**MATERIAL SAFETY DATA SHEETS**

**SECTION 6**

**EQUIPMENT SPECIFICATIONS / DRAWINGS**

## **PRE-OPERATIONAL CLEANING**

- 1. Hot Water Heating Systems**
- 2. Chilled Water Systems**
- 3. Hot and Chilled Systems**
- 4. Glycol Systems**

## 1. HOT WATER HEATING SYSTEMS

### 1.0 CHEMICAL TREATMENT

#### 1.1 General:

- .1 Contractor to engage services of **ACCURATE** Water Treatment Specialists to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis, other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided by him to be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.
- .6 **ACCURATE** to witness cleaning of all strainers.
- .7 If any system is to be used for temporary heat, it is to be cleaned as outlined below prior to use for temporary heat and then cleaned again before takeover by the owners. During temporary heat period system to be chemically treated under **ACCURATE** supervision and logs maintained on the chemical balances. Chemicals required during temporary heat period are to be in addition to the quantities listed below.

#### 1.2 Hot Water Heating System Clean Out

- .1 Systems to be cleaned out. A pump on each system may be used to circulate cleaning solution.

Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.

### **Hot Water Heating System Cleanout ( con't )**

- .2 Cleaner to be introduced and circulated from 48 to 72 hours and removed from system by Contractor by dumping and flushing system.
- .3 Each system to be flushed until conductivity of water in system is back to conductivity of make-up water.
- .4 All strainers to be cleaned by the Mechanical Contractor.
- .5 System to be returned to normal operation and required amount of chemical treatment added to provide immediate protection against corrosion.
- .6 System not to be used until cleaning procedure has been carried out and supervised by **ACCURATE** Water Treatment Inc.
- .7 Provide 45.5 litres (10 gallons) of **AQUARIAN M301** Pre-operational Cleaner per 4,546 litres (1,000 gallons) of water in system.

## **1.3 Hot Water Heating System**

### **1.3.1 Chemical Treatment**

**AQUARIAN C405D** corrosion inhibitor is to be introduced into the system through the pot feeder and left to circulate. Sufficient corrosion inhibitor is to be added to the system to bring treatment residual into recommended range. Also leave on site 20 litres (5 gallons) of **AQUARIAN C405D** corrosion inhibitor.

### **1.3.2 Chemical Feed Equipment**

Provide a BF-2 Neptune pot feeder, 1 - LM010 Filterite in-line filter, 1 -  $\frac{3}{4}$ " sight flow indicator and 1 carton of 30 - 30 micron cotton filter cartridges to be installed on each system by the Mechanical Contractor under the supervision of and according to the drawings submitted by **ACCURATE** Water Treatment Inc.

### **1.3.3 Test Equipment**

Provide a Buckman Molybdate test kit and log book for measuring and recording treatment residuals within the recommended 60-80 ppm range.

## 2. CHILLED WATER SYSTEMS

### 2.0 CHEMICAL TREATMENT

#### 2.1 General:

- .1 Contractor to engage services of **ACCURATE** Water Treatment Specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided will be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.
- .6 **ACCURATE** to witness cleaning of all strainers.
- .7 If any system is to be used for temporary heat, it is to be cleaned as outlined below prior to use for temporary heat and then cleaned again before takeover by the Owners. During temporary heat period system to be chemically treated under **ACCURATE** supervision and logs maintained on the chemical balances. Chemicals required during temporary heat period are to be in addition to the quantities listed below.

## 2.2 Chilled Water System Clean Out

- .1 Systems to be cleaned out. A pump on each system may be used to circulate cleaning solution.  
  
Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.
- .2 Cleaner to be introduced and circulated from 48 to 72 hours and removed from system by Contractor by dumping and flushing system.
- .3 Each system to be flushed until conductivity of water in system is back to conductivity of make-up water.
- .4 All strainers to be cleaned by the Mechanical Contractor.
- .5 System to be returned to normal operation and required amount of chemical treatment added to provide immediate protection against corrosion.
- .6 System not to be used until cleaning procedure has been carried out and supervised by **ACCURATE** Water Treatment Inc.
- .7 Provide 45.5 litres (10 gallons) of **AQUARIAN M301** Pre-operational Cleaner per 4,546 litres (1,000 gallons) of water in system.

## 2.3. Chilled Water System

### 2.3.1 Chemical Treatment

**AQUARIAN C405D** corrosion inhibitor is to be introduced into the system through the pot feeder and left to circulate. Sufficient corrosion inhibitor is to be added to the system to bring treatment residual into recommended range. Also leave on site 20 litres of **AQUARIAN C405D** corrosion inhibitor.

### **2.3.2 Chemical Feed Equipment**

Provide a DBF-2 Neptune pot feeder, 1 - LM010 Filterite in-line filter, 1-  $\frac{3}{4}$ " sight flow indicator and 1 carton of 30 - 50 micron cotton filter cartridges; to be installed on each system by the Mechanical Contractor under the supervision of and according to the drawings submitted by **ACCURATE** Water Treatment Inc.

### **2.3.3 Test Equipment**

Provide a Buckman Molybdate test kit and log book for measuring and recording treatment residuals.



### 3. HOT AND CHILLED SYSTEMS

#### 3.0 CHEMICAL TREATMENT

##### 3.1 General:

- .1 Contractor to engage services of **ACCURATE** Water Solutions Specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided will be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.
- .6 **ACCURATE** to witness cleaning of all strainers.
- .7 If any system is to be used for temporary heat, it is to be cleaned as outlined below prior to use for temporary heat and then cleaned again before takeover by the Owners. During temporary heat period system to be chemically treated under **ACCURATE** supervision and logs maintained on the chemical balances. Chemicals required during temporary heat period are to be in addition to the quantities listed below.

##### 3.2 Hot And Chilled Water System Clean Out

- .1 Systems to be cleaned out. A pump on each system may be used to circulate cleaning solution.

Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.

- .2 Cleaner to be introduced and circulated from 48 to 72 hours and removed from system by Contractor by dumping and flushing system.
- .3 Each system to be flushed until conductivity of water in system is back to conductivity of make-up water.
- .4 All strainers to be cleaned by the Mechanical Contractor.
- .5 System to be returned to normal operation and required amount of chemical treatment added to provide immediate protection against corrosion.
- .6 System not to be used until cleaning procedure has been carried out and supervised by **ACCURATE** Water Treatment Inc.
- .7 Provide 45.5 litres (10 gallons) of **AQUARIAN M301** Pre-operational Cleaner per 4,546 litres (1,000 gallons) of water in system.

### **3.3 Hot And Chilled Water System**

#### **3.3.1 Chemical Treatment**

**AQUARIAN C405D** corrosion inhibitor is to be introduced into the system through the pot feeder and left to circulate. Sufficient corrosion inhibitor is to be added to the system to bring treatment residual into recommended range. Also leave on site 22 litres (5 gallons) of **AQUARIAN C405D** corrosion inhibitor.

#### **3.3.2 Chemical Feed Equipment**

Provide a DBF-2 Neptune pot feeder, 1 - LM010 Filterite in-line filter, 1- ¾" sight flow indicator and 1 carton of 30 - 30 micron cotton filter cartridges to be installed on each system by the Mechanical Contractor under the supervision of and according to the drawings submitted by **ACCURATE** Water Treatment Inc.

#### **3.3.3 Test Equipment**

Provide a Taylor Molybdate test kit and log book for measuring and recording treatment residuals.

## 4. GLYCOL SYSTEMS

### 4.0 CHEMICAL TREATMENT

#### 4.1 General:

- .1 Contractor to engage services of a **ACCURATE** Water Solutions Specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided will be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.
- .6 **ACCURATE** to witness cleaning of all strainers.
- .7 If any system is to be used for temporary heat, it is to be cleaned as outlined below prior to use for temporary heat and then cleaned again before takeover by the Owners. During temporary heat period system to be chemically treated under **ACCURATE** supervision and logs maintained on the chemical balances. Chemicals required during temporary heat period are to be in addition to the quantities listed below.

#### 4.2 Glycol System Clean Out

- .1 Systems to be cleaned out. A pump on each system may be used to circulate cleaning solution.

Balancing valves on pump discharges to be regulated to ensure against operating pumps out of their normal operating range.

- .2 Cleaner to be introduced and circulated from 48 to 72 hours and removed from system by Contractor by dumping and flushing system.
- .3 Each system to be flushed until conductivity of water in system is back to conductivity of make-up water.
- .4 All strainers to be cleaned by the Mechanical Contractor.
- .5 System to be returned to normal operation and required amount of chemical treatment added to provide immediate protection against corrosion.
- .6 System not to be used until cleaning procedure has been carried out and supervised by **ACCURATE** Water Treatment Inc.
- .7 Provide 45.5 litres (10 gallons) of **AQUARIAN M301** Pre-operational Cleaner per 4,546 litres (1,000 gallons) of water in system.

### **4.3 Glycol System**

#### **4.3.1. Chemical Treatment**

No chemical treatment is required after the completion of the system cleaning. After the system cleaning, flushing and draining introduce the recommended inhibited propylene or ethylene glycol mixture, immediately.

#### **4.3.2. Chemical Feed Equipment**

Provide 1 - LM010 Filterite in-line filter, 1- ¾" sight flow indicator and 1 carton of 30 - 30 micron cotton filter cartridges to be installed on each system by the Mechanical Contractor under the supervision of and according to the drawings submitted by **ACCURATE** Water Solutions Inc.

#### **4.3.3 Test Equipment**

Glycol test kit to be provided by glycol supplier.

## **BOILER SYSTEMS**

- 5. Boiler Water Treatment Considerations**
- 6. Boiler and Condensate Treatment**  
**100% MAKE-UP SYSTEMS (SMALL SYSTEMS)**
- 7. Boiler and Condensate Treatment**  
**100% MAKE-UP SYSTEMS (LARGE SYSTEMS)**
- 8. Steam Plant Under 200 H.P. and Less Than 15%  
Make-up**
- 9. Large Steam Boiler Heating Plants**
- 10. Space Heating Systems**

## 5. BOILER WATER AND CONDENSATE TREATMENT

### 5.1 General Treatment Considerations

All boiler feedwater, including those having highly purified demineralized make-up, require further chemical treatment for the prevention of deposits and corrosion in the feedwater, boiler and condensate systems.

The particular treatment program selected will be based on a number of factors including feedwater composition, boiler pressure, size and type, end use of steam produced, convenience and economics.

In general, a treatment program will consist of the following:

- (a) Chemicals to precipitate hardness from the raw water make-up (or residual trace hardness from softened waters) as a sludge in the boilers.
- (b) Control of boiler water alkalinity to assist the softening chemicals while preventing foaming or the possibility of caustic embrittlement.
- (c) Special sludge conditioners to produce a fluid, non-adherent boiler sludge readily removed by routine blowdown.
- (d) Oxygen scavengers to protect the feedwater and boiler systems from oxygen corrosion.
- (e) Filming and/or neutralizing amines to protect the condensate system from corrosion and to minimize the amount of corrosion products being returned to the boilers.
- (f) An antifoam agent, where required, to assist in the production of clean, dry steam.
- (g) A comprehensive surveillance program by qualified water conditioning treatment specialists to assure optimum results from the chemical treatment program.

Because of the many factors involved, a simple chart cannot be presented which would cover all situations, particularly the special requirements of larger installations. However, the following "specifications" will cover the requirements of most commercial, institutional and industrial plants in the major Canadian industrial centres.

**ACCURATE** Water Treatment Inc. would be pleased to assist in setting forth specifications for larger plants or unusual water supplies.

## **100% MAKE-UP USING PULSATRON PACKAGED CHEMICAL FEED SYSTEM (SMALL SYSTEMS)**

### **6. STEAM BOILER**

#### **6.1 Pretreatment**

- .1 Mechanical Contractor to provide a pre-determined sized automatic water softener complete with brine tank on the make-up line to the feedwater tank, and or boiler. A soft water line is to be run to the boiler water feed tank.

#### **6.2 Boil Out**

- .1 **ACCURATE** to supervise the boil out of each steam boiler.
- .2 All labour to be provided by the Mechanical Contractor who will also arrange for qualified personnel to operate equipment during boil out.
- d.3 Boilers is to be filled to operating level with zero soft water from pre-treatment equipment supplied by others.
- .4 Boil out compound, **AQUARIAN B101**, shall be introduced into the boiler according to instructions provided on site by the water treatment consultant, and be heated by firing the boiler to bring pressure up to desired operating pressure.
- .5 Throughout boil out period, steam is to be vented in order to re-fire boiler and maintain circulation in the boiler. Labour for a piped vent line to atmosphere to be provided by Mechanical Contractor. Blowdown from all blowdown valves is to be conducted a minimum of once every 4 hours to remove all grease, oil and debris from boiler.
- .6 On completion of boil out, boilers to be cooled, flushed, drained and opened for inspection.
- .7 Provide 2 litres of **AQUARIAN B101** for each 100 litres in the boiler.
- .8 Mechanical Contractor shall give water treatment consultant at least one weeks notice prior to start-up so they can be on site.

## 6. STEAM AND CONDENSATE SYSTEM

Mechanical Contractor to install a Carlon water meter Model JSJ 075 with impulse contactor on the make-up line between the softener and the boiler feedwater tank and or boiler.

The impulse contactor shall send a signal to a Metex MX-222 Dry Contact Input Timer, which shall control the chemical feed pump. The chemical feed pump shall also be equipped with a hand-off automatic selector switch.

Electrical Contractor shall wire all motors and switches.

### 6.1 Chemical Feed Equipment

.1 Provide a package chemical feed system consisting of:

- (a) 114 L polyethylene chemical solution tank
- (b) Pulsatron chemical pump (max.80 psig, 0.5 USGPH )
- (c) **ACCURATE** sample cooler (Orchem) to be installed on the continuous blowdown line on the boiler
- (d) Carlon water meter Model JSJ 075 with contact every \_\_\_\_ U.S.gallons.
- (e) 1 - Code 61-1003 on-off auto selector switch.
- ( f ) 1- Metex MX-222 Dry Contact Timer

### 6.2 Chemical Treatment

.1 Provide the following:

100 kg **AQUARIAN B177W** boiler water treatment.

### 6.3 Test Kits:

- 1 - Hardness Test Kit
- 1 - Alkalinity Test Kit
- 1 - Molybdenum Test Kit



#### 6.4 Start-up and Training

**ACCURATE** to supervise the start-up of the chemical feed system and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures and report the call in writing to Consultant, Contractor and Owner.

Provide sample points in the following systems:

Softener Discharge  
Feedwater  
Boilers

## **100% MAKE-UP USING MILTON ROY PACKAGED CHEMICAL FEED SYSTEM**

### **7. STEAM BOILER**

#### **7.1 Pretreatment**

- .1 Mechanical Contractor to provide a predetermined sized automatic water softener complete with brine tank on the make-up line to the feedwater tank, and or boiler. A soft water line is to be run to the boiler water feed tank.

#### **7.2 Boil Out**

- .1 **ACCURATE** to supervise the boil out of each steam boiler.
- .2 All labour to be provided by the Mechanical Contractor who will also arrange for qualified personnel to operate equipment during boil out.
- .3 Boilers is to be filled to operating level with zero soft water from pre-treatment equipment supplied by others.
- .4 Boil out compound **AQUARIAN B101** shall be introduced into the boiler according to instructions provided on site by the water treatment consultant, and be heated by firing the boiler to bring pressure up to desired operating pressure.
- .5 Throughout boil out period, steam is to be vented in order to re-fire boiler and maintain circulation in the boiler. Labour for a piped vent line to atmosphere to be provided by Mechanical Contractor. Blowdown from all blowdown valves is to be used to remove all grease, oil and debris from boiler.
- .6 On completion of boil out, boilers to be cooled, then drained and opened for inspection.
- .7 Provide 2 litres of **AQUARIAN B101** per 100 litres, in the boiler.
- .8 Mechanical Contractor shall give water treatment consultant at least one weeks notice prior to start-up so they can be on site.

## 7. STEAM AND CONDENSATE SYSTEM

Mechanical Contractor to install a Carlon water meter Model JSJ 075 with impulse contactor on the make-up line between the softener and the boiler feedwater tank and or boiler.

The impulse contactor shall send a signal to a Metex MX-222 Dry Contact Input timer, which shall control the chemical feed pump. The chemical feed pump shall also be equipped with a hand-off automatic selector switch. An on-off starter shall be supplied for the agitator motor.

Electrical Contractor shall wire all motors and switches.

### 7.1 Chemical Feed Equipment

- .1 Provide a package chemical feed system consisting of:
  - (a) 205 L **ACCURATE** polyethylene chemical solution tank complete with steel stand, pump mounting shelf, agitator bracket and lid.
  - (b) A Milton Roy R110 chemical pump complete with foot valve and suction line to be mounted on chemical tank by Mechanical Contractor. Pump motor to be .19 KW single-phase 110V 6Hz.
  - (c) A Neptune agitator, complete with 102 mm four blade stainless steel propeller, 914 mm long x 13 mm diameter stainless steel shaft, motor coupling and .19 KW totally enclosed single-phase 110 V 6 Hz motor.
- .2 Mechanical Contractor to run a make-up water line to the chemical tank. Make-up to be from discharge of pre-treatment equipment.
- .3 The packaged chemical feed system shall be used to pump chemical treatment to the feedwater tank or boiler.
- .4 A **ACCURATE** sample cooler is to be installed on the continuous blowdown line on the boiler.
- .5 Metex MX-222 Dry Contact Timer
- .6 Carlon Model JSJ075 contact head make-up meter ( \_\_\_\_ USG per contact).
- .7 On-off -auto Selector Switch

## 7.2 Chemical Treatment

Provide one-year supply of the following:

205 L drum **AQUARIAN B134** Oxygen Scavenger.

205 L drum **AQUARIAN B145** Sludge Conditioner

## 7.3 Test Kits

1 - Low Total Hardness Test Kit

1 - Alkalinity Test Kit

1 - Sulphite Test Kit

## 7.4 Start-up and Training

**ACCURATE** to supervise the start-up of the chemical feed system and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures and report the call in writing to Consultant, Contractor and Owner.

Provide sample points in the following systems:

Softener Discharge

Feedwater

Boilers

## 8. STEAM PLANT UNDER 200 H.P. AND LESS THAN 15% MAKE-UP CHEMICAL TREATMENT

### 8.1 General:

- .1 Contractor to engage services of **ACCURATE** Water Solutions Specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, Contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided will be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.

### 8.2 Steam Boiler

#### 8.2.1 Boil Out

- .1 **ACCURATE** to supervise the boil out of each steam boiler.
- .2 All labour to be provided by the Mechanical Contractor who will also arrange for qualified personnel to operate equipment during boil out.
- .3 Boiler is to be filled to operating level with zero soft water from pre-treatment equipment supplied by others.
- .4 Boil out compound **AQUARIAN B101** shall be introduced into the boiler according to instructions provided on site by the water treatment consultant, and be heated by firing the boiler to bring pressure up to desired operating pressure.

### Steam Boiler Boil Out (Cont.)

- .5 Throughout boil out period, steam is to be vented in order to refire boiler and maintain circulation in the boiler. Labour for a piped vent line to atmosphere to be provided by Mechanical Contractor. Blowdown from all blowdown valves is to be used to remove all grease and oil from boiler.
- .6 On completion of boil out, boilers to be cooled, drained, opened, washed down and inspected.
- .7 Provide 2 litres of **AQUARIAN B101** per 100 litres in the boiler.
- .8 Mechanical Contractor shall give water treatment consultant at least one weeks notice prior to start-up so they can be on site.

### 8.3 Boiler Feedwater Pretreatment Equipment

The softeners and dealkalizers are to be supplied by the Mechanical Contractor.

#### 8.3.3 Chemical Feed Equipment

- .1 Provide a packaged chemical feed system consisting of:
  - (a) 205 L **ACCURATE** polyethylene chemical solution tank complete with steel stand, pump mounting shelf, agitator bracket and hinged lid.
  - (b) A Milton Roy R110 chemical pump complete with foot valve and suction line to be mounted on chemical tank by Mechanical Contractor. Pump motor to be .19 KW single-phase 110V 6Hz.
  - (c) A Neptune agitator, complete with 102 mm four blade stainless steel propeller, 914 mm long x 13 mm diameter stainless steel shaft, motor coupling and .19 KW totally enclosed single-phase 110 V 6Hz motor.
- .2 Mechanical Contractor to run a make-up water line to the chemical tank. Make-up to be from discharge of pre-treatment equipment.
- .3 The packaged chemical feed system shall be used to pump chemical treatment to the feedwater tank or boiler.
- .4 An **ACCURATE** sample cooler is to be installed on the continuous blowdown line on each boiler.

### **8.3.4 Chemical Treatment**

Provide one-year supply of the following:

205 L Drum **AQUARIAN B134**

205 L Drum **AQUARIAN B145**

205 L Drum **AQUARIAN B120**

### **8.3.4 Test Kits**

Provide the following:

1- Conductivity (TDS ) meter

1- Low Hardness Test Kit

1- Alkalinity Test Kit

1- Sulphite Test Kit

1- Phosphate Test Kit

### **8.3.5 Start-up and Training**

Accurate to supervise the start-up of the chemical feed system and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures and report the call in writing to Consultant, Contractor and Owner.

Provide sample points in the following systems:

Boilers  
Softener Discharge  
Condensate  
Feedwater

**9. STEAM BOILER HEATING PLANTS (EG. HOSPITALS AND LARGE BUILDINGS)  
CHEMICAL TREATMENT**

**9.1 General:**

- .1 Contractor to engage services of **ACCURATE** Water Treatment specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide same but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 **ACCURATE** to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 **ACCURATE** to make regular call-backs to check on procedures being followed and report each call in writing to Consultant, Contractor and Owners during first year's operation.
- .4 **ACCURATE** to guarantee all mechanical equipment provided by him to be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.

**9.2 Steam Boiler**

**9.2.1 Boil Out**

- .1 **ACCURATE** to supervise the boil out of each steam boiler.
- .2 All labour to be provided by the Mechanical Contractor who will also arrange for qualified personnel to operate equipment during boil out.
- .3 Boiler is to be filled to operating level with zero soft water from pre-treatment equipment supplied by others.
- .4 Boil out compound, **AQUARIAN B101**, shall be introduced into the boiler according to instructions provided on site by the water treatment consultant, and be heated by firing the boiler to bring pressure up to desired operating pressure.



### Steam Boiler Boil Out (cont)

- .5 Throughout boil out period, steam is to be vented in order to re-fire boiler and maintain circulation in the boiler. Blowdown from all blowdown valves is to be used to remove all grease and oil from boiler. Steam vent piping to be supplied and installed by Mechanical Contractor.
- .6 On completion of boil out, boilers to be cooled, drained, opened, washed down and inspected.
- .7 Provide 2 litres of **AQUARIAN B101** per 100 litres, in the boiler.
- .8 Mechanical Contractor shall give water treatment consultant at least one week's notice prior to start-up so they can be on site.

### 9.3 Boiler Feedwater Pretreatment Equipment

The softeners and dealkalizers (if required) are to be supplied by the Mechanical Contractor.

### 9.4 Boiler Feedwater Treatment

Provide a **ACCURATE** package chemical feed system consisting of a 45 gal poly (205 L) tank c/w steel stand hinged lid, pump shelf and agitator bracket.

A Milton Roy R110A chemical pump c/w foot valve and suction pipe. Pump motor shall be 0.25 kW totally enclosed single phase 110V 60 Hz.

A Neptune agitator, tank mounted c/w 102 mm four blade stainless steel propeller 914 mm x 13 mm diameter stainless steel shaft motor coupling and motor 0.19 kW totally enclosed single phase 110V 60 Hz.

Chemical feed system to be used to pump **AQUARIAN** oxygen scavenger and sludge conditioner to the storage section of the deaerator or boiler feedwater tank.

## 9.5 Boiler Water Treatment

Provide an Accurate packaged chemical feed system for each boiler consisting of a 45 gal poly (205 L) tank c/w steel stand hinged lid, pump shelf and agitator bracket.

### Boiler Water Treatment (Cont.)

A Milton Roy R110A chemical pump c/w foot valve and suction pipe. Pump motor shall be 0.25 kW totally enclosed single phase 110V 60 Hz.

A Neptune agitator, tank mounted c/w 102 mm four blade stainless steel propeller 914 mm x 13 mm diameter stainless steel shaft motor coupling and motor 0.19 kw totally enclosed single phase 110V 60 Hz.

A chemical feed system is to be used to pump **AQUARIAN** caustic and amine directly to each boiler.

Mechanical Contractor to run a make-up water line to each chemical tank. Make-up to be from discharge of pre-treatment equipment.

A **ACCURATE** sample cooler is to be installed on the continuous blowdown line of each boiler, the boiler feedwater, and condensate line.

### 9.5.1 Chemical Treatment

Provide the following for a period of one year.

**AQUARIAN B134**  
**AQUARIAN B103**

**AQUARIAN B145**  
**AQUARIAN B120**

### 9.5.2 Test Equipment

#### .1 Provide:

Conductivity (TDS) meter	Sulphite Test Kit
Alkalinity Test Kit	Low Hardness Test Kit
Phosphate Test Kit	

### 9.5.3 Start Up and Training

**ACCURATE** to supervise the start up of the chemical feed systems and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures.

Report the call in writing to the Mechanical Contractor and Consultant.

Provide sample points on the following systems:

Boilers  
Softener discharge  
Dealkalizer discharge  
Condensate  
Feedwater

## 10. SPACE HEATING STEAM BOILERS (SCHOOLS AND OFFICE BUILDINGS) CHEMICAL TREATMENT

### 10.1 General:

- .1 Contractor to engage services of **ACCURATE** Water Treatment specialist to conduct water treatment analysis and supervise installation of equipment and initial start-up of treatment procedures. If, from analysis other treatment is required, provide it but submit proposed treatment to Consultant for approval prior to start-up of any system.
- .2 Accurate to provide training in use of test equipment, establish treatment ranges, and provide log sheets with training in their use.
- .3 Accurate to make regular callbacks to check on procedures being followed and report each call in writing to Consultant, Contractor and Owners during first year's operation.
- .4 Accurate to guarantee all mechanical equipment provided by him to be free of defects for one year from date of start-up.
- .5 A complete operating manual to be provided indicating all phases of water conditioning program. Manual to include detailed schematic drawings showing all special fittings, timers, controllers, etc. for each system.

### 10.2 Steam Boiler

#### 10.2.1 Boil Out

- .1 **ACCURATE** to supervise the boil out of each steam boiler.
- .2 All labour to be provided by the Mechanical Contractor who will also arrange for qualified personnel to operate equipment during boil out.
- .3 Boiler is to be filled to operating level with zero soft water from pre-treatment equipment supplied by others.

- .4 Boil out compound, **AQUARIAN B101**, shall be introduced into the boiler according to instructions provided on site by the water treatment consultant, and be heated by firing the boiler to bring pressure up to desired operating pressure.

#### **Steam Boiler Boil Out (Cont.)**

- .5 Throughout boil out period, steam is to be vented in order to re-fire boiler and maintain circulation in the boiler. Blowdown from all blowdown valves is to be used to remove all grease and oil from boiler. Steam vent piping to be supplied and installed by Mechanical Contractor.
- .6 On completion of boil out, boilers to be cooled, drained, opened, washed down and inspected.
- .7 Provide 2 litres of **AQUARIAN B101**, per 100 litres in the boiler.
- .8 Mechanical Contractor shall give water treatment consultant at least one week's notice prior to start-up so they can be on site.

#### **10.2.2 Chemical Feed Equipment**

A Neptune DBF-2 pot feeder is to be provided and installed on each boiler feedwater line by the Mechanical Contractor.

A chemical addition funnel consisting of ¾" nipple, ¾" valve, ¾" nipple and ¾" x 2" reducing coupling are to be provided and installed by the Mechanical Contractor on the feed water tank.

#### **10.2.3 Chemical Treatment**

Provide the following:

120 kg **AQUARIAN B179W** Boiler Water Treatment  
1 - Taylor Molybdate Test Kit

#### **10.2.4 Start-up and Training**

Accurate to supervise the start-up of the chemical feed system and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures and report the call in writing to Consultant, Contractor and Owner.

Provide sample points in the following systems:

Condensate

Feed water

Boilers

## **COOLING TOWERS**

### **11. EVAPORATIVE COOLING WATER SYSTEMS**

#### **11.1 General**

The most common scale deposit encountered in cooling systems is calcium carbonate, formed as a result of thermal decomposition of the calcium bicarbonate in the make-up water. The evaporation of water from open recirculating systems results in a concentration of the mineral solids originally dissolved in the supply water, thereby increasing the possibility and severity of deposition. Other mineral deposits such as calcium sulphate may be formed by waters high in sulphate ions or with excessive cycles of concentration where sulphuric acid is employed to reduce carbonate scale formation.

Micro-organisms, such as algae, fungi and slime-forming bacteria, find ideal temperature and nutrient conditions in open recirculating systems and can rapidly form voluminous slime masses in the tower or heat exchange equipment. In addition to impeding heat transfer and water flow, these slime deposits may significantly increase corrosion rates by preventing contact of the applied corrosion inhibitor with the metal surface and by shielding corrosion producing bacteria.

Since a cooling tower functions, in effect, as a giant air washer, airborne solids will be removed into the water phase where, in combination with silt and sediment introduced through the use of turbid make-up water, they may settle and form deposits in areas of low velocity or be trapped in slime deposits to increase the bulk and density of the slime. In addition, because of the intimate contact between the water and air, the water will be saturated with oxygen and may collect other corrosive gasses such as sulphur dioxide, hydrogen sulphite or carbon dioxide released from nearby smoke-stacks or industrial processes.

#### **11.2 Objectives of a Cooling Water Treatment Program**

A complete treatment program should include methods to combat these four major problem areas of scale deposition, corrosion, slime and fouling due to deposition of sediment.

#### **11.3 Scale Deposition**

The most common method of scale prevention in larger systems involves the addition of sulphuric acid to convert the calcium and magnesium bicarbonate in the make-up water to the much more soluble sulphate. Bleed-off volume is then adjusted to maintain the calcium sulphate concentration within a soluble range.

Where the use of an acid is not desired, chemical inhibitors such as polyphosphates, chelates or organic sequestrants may be applied. Some of these products, such as the polyphosphates, may perform a dual role of scale and corrosion inhibition by forming a thin protective film on metal surfaces. The use of these materials is generally restricted to smaller systems due to the improved economics and over-all protection objectionable with an acid-inhibitor program.

#### **11.4 Corrosion Inhibition**

Although the use of acidic materials for scale control will increase the corrosion potential of the water, the corrosion characteristics are changed from a pitting type attack to a more readily controlled general surface attack. Most current proprietary corrosion inhibitors are multi-component formulations which function by forming a protective film on the metal surface. The most common is:

- (a) the recently developed organic inhibitors

Polyphosphates may be used in very small systems or in food processing plants where the cooling water might contact the food product. The new organic inhibitors are finding rapid acceptance due to their excellent corrosion protection and ease of handling and disposal.

#### **11.5 Slime Deposits**

Because of the constant re-contamination of a cooling tower with airborne micro-organisms, it is usually impractical to maintain a completely sterile system. The objective of a slime control program is to keep the total number of objectionable organisms below a troublesome level and prevent the sudden flare-up of voluminous slime masses. This is accomplished by shock feeding of one or more biocides at intervals varying from several days to several weeks. A two-biocide program is generally employed with the biocides being alternated to prevent acclimation of the organisms to one chemical. Where applicable, chlorine may be used to control specific organisms or reduce the overall treatment costs.

#### **11.6 Fouling**

The use of detergent-dispersant type chemicals, either continuously or on an intermittent basis, can effectively prevent the accumulation of sediment in areas of low flow. By dispersing sediment and slime masses, thus keeping the metal surfaces clean, both the slime and corrosion control programs are improved.

Any sediment introduced into the system must eventually be removed by bleed-off to prevent its deposition. The use of dispersants will increase the level of suspended solids that can be tolerated in a system, however, the use of external equipment such as side-stream filters or, preferably, the Lakos Solids Separator is recommended to remove the sediment held in suspension by the dispersant chemicals.

### **11.7 Bleed-off**

The evaporation of water from an open recirculating system results in concentration of the mineral solids originally present in the make-up water. Reduction of the system pH with acid or the application of stabilizing chemicals can increase the allowable concentration. However, without some bleed-off, the system water would eventually become supersaturated with minerals and scale deposition would result.

As the bleed-off volume is increased (and concentration ratio reduced) the amount of chemical required to maintain the recommended residuals will increase. Below a concentration ratio of about 3, the treatment costs increase rapidly. Above a ratio of 5, only small chemical savings can be realized, however, potential scale deposition increases rapidly. Therefore, for most systems, a practical concentration ratio would be in the range of 3 to 6.



## 12. CONDENSER WATER SYSTEMS

### 12.1 Cleanout

Condenser water system to be thoroughly flushed out by Mechanical Contractor. No cleaning compound to be pumped over cooling tower.

### 12.2 Chemical Feed Equipment

For each system provide the following:

- .1 A Carlon water meter with register and impulse contactor set to give a contact every \_\_\_\_ litres ( \_\_\_\_U.S. gallons) of water is to be installed by the Mechanical Contractor on the make-up line to the condenser water system.
- .2 An **ACCURATE** custom control panel. Panel to be totally enclosed 16 ga (1.6 mm) steel wall mounted panel, factory wired and painted. Panel to contain circuit breaker, chemical pump starter, Manual-Off-Auto selector switches for chemical pump and solenoid valve and timers for chemical pumps and solenoid valve.
- .3 Provide terminal strip for connection of wiring to power supply, water meter contactor, and chemical pump and solenoid valve. All devices to be mounted on hinged door and identified with engraved lamacoid nameplates.
- .4 Provide a Pulsatron chemical feed pump complete with foot valve and suction and discharge piping. Mechanical Contractor to mount pump on chemical tank.
- .5 Provide a 25 gallon poly tank, complete with lid.
- .6 Provide a solenoid valve and strainer to be installed with a three valve by-pass on the bleed-off line. Valves to be supplied by Mechanical Contractor.
- .7 Wiring from control panel to water meter, chemical pump and solenoid valve to be by Electrical Contractor.
- .8 Provide a Neptune DBF-2 type pot feeder installed across condenser pump for biocide shock feed.
- .9 **Optional:** Automatic biocide feed with two Pulsatron pumps and a Metex MX-7DT-2 Dual Biocide timer.

### 12.3 Chemical Treatment

- .1 For corrosion and scale control provide 205 litres (45 gallons) **AQUARIAN C436** liquid phosphonate to be pumped into the system, from solution tank, with timer controlled pump. Timer to be activated by water meter so that phosphonate will be added to system in proportion to make-up water.
- .2 For control of algae, slime and biological activity, **AQUARIAN C403** and **AQUARIAN C414** is to be shock fed directly into the condenser water system. The Accurate Representative will ensure biological control is maintained and a dosage schedule provided.

### 12.4 Test Equipment

- .1 Provide one **AQUARIAN** phosphonate and alkalinity test kit.

### 12.5 Start Up And Training

**ACCURATE** to supervise the start up of the chemical feed system and provide operating personnel with both written and verbal instruction on equipment operation and treatment and testing procedures and report the call in writing to Consultant and Contractor.

Provide sample points on the following system:

Condenser Water

### 11.6 Chemical Treatment Requirements

**ACCURATE** will provide the following chemical treatment necessary for a one year supply:

- a) **AQUARIAN C436** Cooling Water Treatment
- b) **AQUARIAN C403** and **C414** Cooling Water Microbiostat
- c) **AQUARIAN C426** Bio-dispersant