TECHNICAL SPECIFICATION 2385-MS-W200
OIL WATER SEPARATORS

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TECHNICAL SPECIFICATION 2385-MS-W200

OIL WATER SEPARATORS

1. SCOPE

This specification establishes the requirements for the design, manufacture, testing, inspection and delivery of gravity flow, effluent-type, double-wall parallel corrugated plate oil/water separators and accessories. The requirements of this specification are the minimum for the equipment and are to be supplemented by the Seller's own requirements. Separators are to be located below ground. Quantity of separators shall be as specified in TABLE 1, OIL WATER SEPARATOR DESIGN DATA, hereinafter referred to as TABLE 1.

2. GENERAL REQUIREMENTS

2.1 Work to be provided

Design, fabricate and deliver to the site double-wall oil/water separators, complete with all specified and required accessories.

Perform all required calculations and engineering to satisfy site and foundation requirements.

Perform all required tests and inspections.

Package and deliver the equipment to the specified destination.

Furnish all submittals required by this Specification.

2.2 Equipment and services provided by Others

Reinforced concrete anchor pad and anchor bolts

Receiving, handling and storage of equipment

Installation of oil/water separator and accessories

Field testing of installed equipment

Electrical power supply at 480V, 3 phase, high resistance grounded shall be provided at the main disconnect of the control panel.

Interconnecting control wiring between the control panels and the plant DCS.

2.3 Applicable Publications

The latest edition and addenda of the following publications in effect on the date of the Contract Award are a part of the Specification and, where referred to by title or basic designation only, are applicable to the extent indicated by the specific reference:

American Society for Testing and Materials (ASTM)

ASTM Standards as required for materials of construction selected by the Seller.

American Petroleum Institute (API)

API Pub. 421 Monograms on Refinery Environmental Control-Management of Water Discharges; Designs and Operation of Oil/Water Separators

American Welding Society (AWS)

AWS Standards as required for fabrication as selected by the Seller

National Fire Protection Agency (NFPA)

NFPA STD 30 Flammable and Combustible Liquids Code

NFPA STD 70 National Electrical Code

American National Standards Institute (ANSI)

Instrument Society of America (ISA)

Standard Building Code - SBC-97

Steel Tank Institute (STI)

Specification for Protection of Underground Storage Tanks

Underwriters Laboratory (UL)

UL STD 58 Standard for Safety, Steel Underground Tanks for Flammable and Combustible Liquids

U.S. Department of Labor Code of Federal Regulations (CFR)

29CFR-1910 Occupational Safety and Health Standards

3. DETAILED REQUIREMENTS

3.1 Description of Service

The source of the influent to the separators shall be as specified in TABLE 1.

3.2 General Design

Seller shall design and fabricate gravity displacement oil/water separators for direct burial. They shall be complete with all required components and accessories in accordance with the Specification requirements.

The Seller shall design the oil/water separators for a minimum 30-year life.

The separators shall be designed for gravity separation of free oils (hydrocarbons and/or petroleum products) along with some settleable solids from wastewater.

The oil separator vessels shall be designed for the separation and storage of flammable and combustible liquids.

The separators shall have the structural strength to withstand static and dynamic loads while empty and during operating conditions. The loads shall be both external due to live load, earth cover and seismic, and internal due to hydraulic flows.

Process design data shall be as shown in TABLE 1.

The separators shall be standard pre-packaged, pre-engineered units (fabricated by the Seller), ready for installation.

3.3 Design Conditions

3.4 Materials

Materials shall be selected by the Seller and shall be suitable for the operating conditions specified in TABLE 1.

3.5 Design and Construction Features

Separators shall be cylindrical UL-58 double wall, below grade, horizontal type steel tanks.

Two rectangular flanged manways shall be provided for access into the interior of each separator. One shall be provided in the vicinity of the parallel corrugated plate coalescer and impingement coalescer. The other shall be in the vicinity of the effluent pumps. Manways shall be sized to permit removal of coalescers and pumps, but no less than 24" in diameter. Design shall allow hatch to be locked in the open position during maintenance/cleaning.

Trunk extensions shall be provided to extend hatches above grade. Internal ladders shall be provided inside the manways down to one foot above the bottom of the separator tank interior.

The separators shall be designed for a burial depth as specified in TABLE 1.

The separators shall have an oil storage volume of at least 40% of the total vessel volume and an emergency spill capacity equal to 80% of the total vessel volume.

The separators shall be designed in accordance with Stokes Law and the API Publication 421 for the Design and Operation of Oil/Water Separators.

Preferred separator design will contain a corrugated "plate pack" to aid the separation process. Plate pack consists of multiple corrugated fiberglass plates, inclined at an angle of approximately 45° to the horizontal. Number of plates shall be as needed to meet performance requirements. Plate pack shall be fully removable as a single unit.

3.5.1 Process Components and Connections

The oil/water separators shall have the following construction features for process:

A flanged influent connection at the inlet end of the separators.

A flanged effluent water outlet.

One flanged recovered oil outlet.

One flanged gas vent.

A velocity head diffusion baffle and wear plate assembly at the inlet.

A sediment chamber to disperse flow inside the vessel.

A sludge baffle to retain solids and sediment which has settled out of the flow.

An oil/water separation chamber containing an inclined plate coalescer with removable, corrugated protected steel plates sloped toward the sediment chamber.

A sectionalized removable impingement coalescer.

Two 100% capacity effluent discharge pumps.

A separate effluent discharge compartment.

Isolation spool pieces at all tank connections.

Exterior tank lifting lugs for handling and installation.

External tank nylon hold-down straps, turnbuckles and dielectric liners.

The oil/water separator construction shall conform to the requirements of NFPA Std. 30 "Flammable and Combustible Liquids Code".

Separator capacities, dimensions, and construction shall be in strict accordance with Underwriters Laboratories UL-58 "Standard

for Safety, Steel Underground Tanks for Flammable and Combustible Liquid" Type 1 - Double wall construction with 360° steel secondary containment. Tank thickness shall be in accordance with UL-58, except where heavier walls are required due to exterior loads, for the secondary containment. The inner tank shall be completely enclosed by the outer steel tank such that a double steel wall tank is provided with an interior space between the inner and outer walls.

3.5.2 Seismic Loads

Seismic loads shall be calculated in accordance with Standard Building Code SBC-97 (as amended by 1999 Arkansas Fire Prevention Code, Volume II). The Criteria for the Dell, Arkansas Site shall be used, where Av=0.30 and Aa=0.20. The Seismic Hazard Exposure group shall be Group II.

3.5.3 Overburden and Live Loads

The design backfill (dry) weight shall be based on a soil density of 120 pounds per cubic foot. The separators will be installed under paved areas and shall be designed to withstand HS20-44 truck loading, as defined by the AASHTO Standard Specifications for Highway Bridges. A minimum live load surcharge of 300 pounds per square foot, applied at ground level, shall be included in the design to provide for construction loads or other temporary loads.

3.5.4 Electrical and Instrumentation Requirements

All furnished system designs shall be the Seller's standard with proven operating service and shall conform to the requirements of the National Electrical Code. The components shall be UL approved when required by Code.

All furnished equipment shall be in accordance with the requirements of Specification 2385-ES-014, Motors Below 2300 Volts and Specification 2385-ES-009, Electrical Equipment Furnished With Mechanical Equipment.

The control panel shall include, but not limited to, main power disconnect, motor starters, system wiring, switches, indicating lights, push button controls. The panel components shall be mounted in a single common NEMA 4 electrical enclosure panel for

each separator. All control circuits shall be rated for 120 volts AC, single phase service.

The space between the inner and outer steel walls shall be monitored for leakage with an approved leak detection system.

Electrical instrumentation systems to control, monitor and test shall include the following:

a. Level alarms (audible and visible) for high and high-high oil levels with individual contacts for remote alarm. Level settings shall be adjustable.

b. Leak between the intersticial space between inner and outer tank walls with audible and visual annunciation.

c. Local level indicators for both separated oil and effluent water compartments.

d. Level alarm (audible and visible) for low water level.

e. Duplex pump control.

The control panel shall include but not be limited to:

1. Indicating lights and alarms for:

   - High oil level
   - High-High oil level

   Tank leak detection

2. Pushbuttons for:

   Alarm Test

   - Alarm Silence

3. Contact for remote DCS to indicate activation of local alarm.

All exterior interconnecting wiring shall be routed in conduit and shall be suitable for outdoor service and/or direct burial.

3.6 Corrosion Protection

The separator shall be protected by a corrosion control system in strict accordance with STI-P3 specifications of the Steel Tank Institute (STI) and shall be in accordance with the National Asociation of Corrosion Engineer's code and applicable local codes. The corrosion protection systems shall include:

a. Isolation spool pieces

b. Dielectric isolation gaskets and bushings

c. External surfaces commercial sand-blasted, coated with 10 mils DFT-100% Polyurethane or 125 mils DFT fiberglass reinforced polyester.

d. Cathodic protection system, using zinc anodes

e. Tank corrosion monitoring capability

f. Internal surfaces commercial sand blasted, coated with 10 mils DFT-100% polyurethane.

3.7 Quality Assurance

The quality manual submitted shall be developed to satisfy the applicable Code or regulatory requirements specified in this Specification. Where the work requires ASME Code authorization, a copy of the code authorization shall be included in the manual. The quality program, as defined in the manual, shall be supplemented by detailed procedures where necessary to permit evaluation. Procedures related to the manual or providing supporting direction for the accomplishment of manual requirements shall be appropriately referenced in the manual.

Oil and water separators shall be the product of a well established Seller who is fully experienced, reputable, and qualified in the manufacture of the particular equipment to be furnished. The Seller shall have a minimum of five (5) years' experience in the manufacture of oil and water separators as specified herein. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications as applicable.

It is the Seller's responsibility to obtain copies of all documents referenced in this specification. Unless specific exception is requested formally by the Seller, and formally granted by the Purchaser, these referenced documents shall be binding.

Purchaser reserves the right to inspect the product and audit materials and processes at any of the Seller's facilities that are performing work in support of this specification. Products and services supplied under this specification are subject to Purchaser's final inspection acceptance and release.

3.8 Marking

Each piece of equipment shall be assigned a tag number and have a permanent stamped metal tag bearing the "Tag Number" securely attached to it. These numbers will be assigned, by the Engineer, after the release of a purchase order and after the Seller has supplied a complete list of equipment to be supplied.

Tags shall be attached either by welding or riveting to the equipment body if the body is large enough to do so. The method of attachment shall not degrade the pressure rating of the equipment. Tag attachment to smaller equipment or valve bodies shall be by minimum 20 gauge stainless steel wire. All tags shall be made of stainless steel plate and attached to the equipment so as to be visible after equipment installation.

A stainless steel identification plate shall be permanently mounted on each oil/water separator and shall be located on an access hatch or other portion of the separator which will be above ground and plainly visible after the separator has been buried. It shall include the following essential information:

Seller's Name

Seller's Shop Order Number

Seller's Serial or STI identifying number

Date of Manufacture

Design Pressure (if applicable)

Design Temperature (if applicable)

Equipment Number

Hydrostatic Test Pressure (if applicable)

Other essential information at Seller's option.

3.9 Packaging and Shipping

Care shall be taken in loading and transporting to prevent damage to the oil/water separators and accessories. The equipment will be examined upon receipt at the jobsite, and no piece will be installed which is found defective. Seller shall immediately replace or repair the defective item. Any damage shall be repaired as acceptable to the Owner, Engineer, and Purchaser.

Prior to shipping, the open ends of all items shall be closed to prevent entry of foreign material.

3.10 Storage and Handling Procedures

Seller shall provide procedures to cover the handling, storage and preservation of the equipment supplied under this Specification. They shall include recommendations for short term (less than three months) and long term (three months and longer) on-site storage.

4. INSTALLATION

All installation work including all storage and handling after delivery to the site, will be by Others.

5. TESTING

5.1 Material Tests

Seller shall submit certificates of conformance for the fabrication steels used in the construction of the oil/water separator.

5.2 Shop Tests

Seller shall hydrostatic test and inspect all completely assembled vessels and welds for leakage. All defective or leaking welds shall be repaired and re-hydrostatic tested in the completely assembled vessel.

Seller shall functionally test the completely assembled unit to ensure that all components function in accordance with design requirements.

Testing shall be conducted at the design flow to verify satisfactory operation mechanically and electrically of the furnished equipment. This shall include but not be limited to:

Operation of all panel indicating lights and alarms automatically and/or manually (for test) as required by the system design.

Operation of the leak detection system.

Satisfactory completion of all performed functional tests shall be documented with a certified test report and submitted to the Purchaser.

Seller's facilities shall be subject to inspection by the Purchaser at any time during the progress of the work. Seller shall provide access and any labor, materials, and equipment required by Purchaser in order to inspect all phases of the work.

5.3 Field Tests

Field tests will be performed by Others after installation and connection of all services. The objective of these tests will be to verify equipment performance in accordance with specification requirements.

Seller shall prepare test procedure for field tests by Others and submit to the Purchaser for review.

Seller may witness such tests at his option.

6. INFORMATION TO BE SUBMITTED

In addition to the data and documentation required by 2385-ES-009 and 2385-ES-014, Seller shall provide submittals in accordance with this section of this specification.

6.1 Submittals With Bid

The Seller shall identify any exceptions to this specification or its references and include detailed justification. The Seller shall notify Purchaser of any modifications to his standard design required to meet this specification.

The Seller shall provide all information required to properly evaluate the design. Below is a list of the minimum information required with the proposal:

Completed "TECHNICAL DATA SUBMITTED BY BIDDER" sheets.

Plan and cross-section views of the Equipment.

Materials used, including coating and lining specifications.

Seller's technical data sheets.

A detailed scope of supply and work not included.

Outline drawings, including overall dimensions, estimated weights, piping connections sizes, required maintenance space, and foundation requirements, including anchor and hold-down bolts and any specific burial instructions.

System requirements (power, air, electrical, etc.).

Estimated weights broken down into parts shipped separately and maximum lifts to assemble and do maintenance.

A detailed Process and Instrumentation Diagram (P&ID).

6.2 Submittals After Award

A detailed Process and Instrumentation (P&ID) diagram indicating the proper connection of customer piping and electrical service to Seller-supplied oil/water separator.

Seller is to supply recommended installation details and all necessary installation materials including straps. Straps, excluding the concrete, shall be included in the bid.

Details of all inlet and outlet boundary connections.

The Seller shall provide I/O lists, schematics, electrical drawings, and bill of materials. Schematics shall also detail all monitoring and alarming functions.

Submit drawings required for a complete oil/water separator system for approval to the Engineer.

Submit copies of layouts, general assembly, components, dimensions, weights, clearances, and methods of assembly.

Provide copies of all final as-built drawings to the Engineer. All final drawings are required with delivery of the equipment.

TYPE OF DOCUMENT	TYPE OF SUB.	DOC SUB SCHEDULE, WEEKS ARO
Assembly Drawings	FR, F	4,8
Detail Drawings	FR,F	4,8
Loose Components List and Drawings	FR,F	4,8
Base Loading for Foundation Design	FR,F	4,8
Anchor Bolt Requirements and Arrangement	FR,F	4,8
Equipment Drawings (Tank, Pumps, etc.)	FR,F	4,8
Certificate of Conformance for Materials	FR,F	4,8
Installation/Operation/Maintenance Manuals	R	2 WKS BEFORE SHIPMENT
Certified Shop Test Reports	R	1 WK BEFORE SHIPMENT
Storage and Handling Procedures	R	2 WKS BEFORE SHIPMENT

FR - FOR REVIEW R - REFERENCE F - FINAL CERTIFIED (AS SHIPPED) ARO - AFTER RECEIPT OF ORDER

NOTE: FOR REVIEW, documents requiring revision and additional review are to be resubmitted two (2) weeks after the return date.

TABLE 1
OIL WATER SEPARATOR DESIGN DATA
Sheet 1 of 4

I - GENERAL	
Project Name	TPS Dell
Project Location	Dell, Arkansas
Separator Tag Number	OWW-S-001
Quantity	1
Description of Service	Steam Turbine Bldg. Trench Floor Drain
II - FLOW CONDITIONS	
Influent flow (gravity/pumped)	Gravity
Effluent water flow (gravity/pumped)	Pumped
Pump Total Dynamic Head	50 feet
Recovered oil flow (gravity/pumped)	Pumped (by others)
Flow rate, maximum (gpm) per separator	55
Flow rate, minimum (gpm)	0
Flow rate, average (gpm)	Later
Flow conditions (intermittent/continuous)	Intermittent
Total separator storage capacity (gal.)	550
Type of water (fresh/salt)	Fresh
Influent temp. range (°F)	Ambient (40 - 140 °F)

TABLE 1
OIL WATER SEPARATOR DESIGN DATA
Sheet 2 of 4

III - OIL DATA

Type	Various
Specific gravity	0.70 - 0.95
Influent oil concentration (ppm)	Variable
Influent oil particle size (micron)	50+
Emergency oil spill capacity	80%
Storage capacity required	40%

IV - CONTAMINANTS

Type	dirt, sand, metal filings
Total suspended solids (ppm)	0 - 500
Particle size, minimum (micron)	5
Particle size, maximum (micron)	150
Detergents	Yes
Chemical emulsions	None
Mechanical emulsions	None
Volatile organic compounds (VOC's)	None
Miscellaneous compounds	None

V - EFFLUENT QUALITY

TABLE 1
OIL WATER SEPARATOR DESIGN DATA
Sheet 3 of 4

Daily average oil concentration (ppm)	15
Maximum oil concentration (ppm)	20
Daily average solids content (ppm)	30
Maximum solids content (ppm)	100
Maximum particle size (microns)	50
Maximum oil droplet size (micron)	20

VI - INSTALLATION

Location (above/below ground)	below-ground
Grade Elevation	El. 242'-6"
Groundwater Elevation	Assumed at Grade
SBC Seismic	Per SBC-97 (See paragraph 3.5.2 of spec)
Physical size limitations (L x W x H)	N/A
Burial depth (ft)	Min. 5' from Grade to top of separator tank
Hold down straps required (Yes/No)	Yes
Allowable vertical bearing pressure on soil	2300 psf

VII - ACCESSORIES

TABLE 1
OIL WATER SEPARATOR DESIGN DATA
Sheet 4 of 4

Accessory	Req'd?	Accessory	Req'd?
Influent pump	No	Control panel	Yes
Effluent pump	Yes	Leak detection	Yes
Oil pump (w/ on/off switch)	No	Air stripper	No
Sludge pump	No	Emulsion breaking	No
Level indication	Yes	Handrail (OSHA acceptable)	No
Carbon adsorption	No	Ladder (OSHA acceptable)	Yes
Cathodic protection	Yes		

VIII - CONSTRUCTION

Material	Seller design
Welding	Continuous
Internal coating	sand-blast, 10 mils DFT 100% polyurethane
External coating	sand-blast, ~~10~~ 15 mils DFT 100% polyurethane ~~or 125 mils DFT fiberglass reinforced polyester~~
Wall (single/double)	double wall

TECHNICAL DATA SUBMITTED BY BIDDER
OIL WATER SEPARATOR

The following technical data sheets for the oil water separator equipment shall be completed by the Bidder

Seller: Highland Tank

Type: Underground

Service: _____

Location: _____

Bidder to provide a listing of various government agencies (state, city, local, etc.) which have approved and accepted the offered type oil water separator equipment.

1. Number of Separators to be Provided: 1

2. Dimensions

a.	Separator diameter (ft)	3′ / 6″
b.	Separator length (ft)	10′ / 9″
c.	Capacity (gallons)	550 /

3. Weight

a.	Shipment Weight (lb)	3500
b.	Operating Weight (lb)	/

4. Performance

Guaranteed oil water separator performance based on design conditions:

a.	Effluent free oil/grease	
	Concentration (mg/liter)	10 / ppm
b.	Largest oil droplet size	
	Discharged (micron)	/

TECHNICAL DATA SUBMITTED BY BIDDER
OIL WATER SEPARATOR
Sheet 2 of 2

5. Operating Ranges

a. Design Flow Rate (gpm) 55

b. Maximum Flow Rate (gpm) under Emergency conditions 55

c. Maximum Oil Holding Capacity (gallons) 60% of Volume

6. Construction Features

a. Design Code UL 58

b. Material
Inner wall Carbon Steel
Outer wall Carbon Steel

c. Inner Tank Wall Thickness (in.) 3/16

d. Outer Tank Wall Thickness (in.) 9/64

e. External Surface Coating System 15 mils Polyurethane

f. Tank Warranty Period (years) 30 yr External Corrosion

Electrical/I&C Components

a. Design Code

b. Oil Level Measurement Instruments

Seller/Model Number Clinton Controls
Wagner Sales/Warrick
2-Float Oil Interface level sensor-Warrick

c. Oil Leakage Detection Instruments

Seller/Model Number Clinton Controls
Wagner Sales/Warrick

TECHNICAL SPECIFICATION NO. 2385-ES-014

TECHNICAL DATA SUPPLIED BY BIDDER

Each motor proposed
Shall have separate completed data sheets

I. GENERAL DATA

1. Quantity: 1
2. Manufacturer: AO Smith
3. Manufacturer's Designation:
4. Manufacturer's Frame Number:

II. MECHANICAL DATA

Driven Equipment: 3885 Pump

Bearings:

a. Type: Ball

b. Catalog Numbers:

3. Ventilation Type:
4. Lubricant Type: Oil
5. Recommended Intervals for Replacing Lubricant:

8 Pints

6. Quantity of Lubricant Required:

TECHNICAL SPECIFICATION NO. 2385-ES-014

TECHNICAL DATA SUPPLIED BY BIDDER

III. ELECTRO-MECHANICAL DATA

1.	Rated Horsepower	1.5
2.	Speed	3500
3.	Time Rating	
4.	Service Factor	
5.	Rotation Limitations (if any)	
6.	Full Load Torque	
7.	Pull Up Torque	
8.	Breakdown Torque	132.5
9.	Locked Rotor Torque	113.3

IV. ELECTRICAL DATA

1.	Voltage	460
2.	Number of Phases	3
3.	Frequency	60
4.	Code Letter	K
5.	Design Letter	Ball
6.	Full Load Current	4.6
7.	Efficiency at Full Load	77.5
9.	Power Factor at Full Load	
10.	Insulation Class	B

IV. ELECTRICAL DATA (Cont.)

11. Full Load Temperature Rise _____

12. Safe Stalled Time _____

13. Terminal Connectors:

    a. Lug Type _____

    b. Catalog Numbers _____

14. Internal Power Lead Sizes _____

15. Phase Rotation of Power Leads _____

16. Grounding Means:

    a. Location _____

    b. Connection Type _____

17. Limitations (if any) on Frequency of Starting:

    20 per Hour

18. Space Heaters:

    a. Quantity _____

    b. Watts/Volts _____

V. PHYSICAL DATA

1. Enclosure ODP

2. Net Weight of Motor _____

3. Conduit Opening Size _____

TECHNICAL SPECIFICATION NO. 2385-ES-009

TECHNICAL DATA SUPPLIED BY BIDDER

SHEET 1 OF 3

Each section of mechanical equipment proposed shall have separate completed data sheets

I. CONTROL BOARDS AND CABINETS

1. Type Nema 4 Enclosure

2. Dimensions and Weights:

	Length	Depth	Height	Weight
Board No. ____	30	8	36	55
Board No. ____				
Board No. ____				

3. Structural Details:

Material Steel

USS Gage 14

Construction Features of Fire Barriers:

II. TECHNICAL DATA SUPPLIED BY BIDDER FOR MOTORS

As per Technical Data Sheets attached to the motor specification(s).

TECHNICAL DATA SUPPLIED BY BIDDER

III. CIRCUIT BREAKERS

Manufacturer: Square D

Type: FAL34015

Interrupting Capacity (Amperes): 10,000@120V & 65,000@480V

IV. MOTOR STARTERS

Manufacturer: Square D

Mfr's Catalog No.: 8536-SA012V02S

NEMA Size: OO

Minimum Closing Voltage (Magnetic only): 109

Control Transformer Size: 150VA

V. MISCELLANEOUS ELECTRICAL EQUIPMENT

ITEM	MFR.	TYPE	CAT. NO.
Control Switches	Square D	ZB4J21	ZB4J21
Pushbutton Stations	Square D	ZB4AJ21	ZB4AJ21
Indicating Lights	Square D	ZB4BV63	ZB4BV63
Transformers	ACME	TA	TA281212
Fuse Blocks/Fuses	Marathon Littlefuse	2P KLDR	6M30A2SPQ
Terminal Blocks	Buchanan	600V	0725
Wire Terminators			

VI. CONTROL WIRING

Manufacturer	Allied
Type	MTW
Insulation Material	PVC
Jacket Material	PVC
Flame-Retardant Characteristics	105°C

VII. SOLENOID VALVE OPERATORS

Manufacturer	
Type	
Insulation Material	
Minimum Operating Voltage	90% of Rated Voltage

VIII. PROGRAMMABLE CONTROLLERS

Manufacturer	
Model No.	

IX. M/A CONTROL STATIONS

Manufacturer	
Model No.	