

SECTION 17000 - INSTRUMENTATION

PART 1 - GENERAL

1.01 APPLICABLE SECTIONS

- A. The General Conditions, Supplementary General Conditions, alternates and Addenda, applicable drawings and the technical specification herein shall apply to work under this Section.

1.02 SCOPE

- A. It is the intent of this specification to set forth the minimum acceptable requirements for the design, construction, and vendor support, requirements for the controls panels and instrumentation herein specified.
- B. Furnish all labor, material, and equipment associated with the fabrication of the new control panels and associated instrumentation complete in strict accordance with this section of the specification and applicable drawings and subject to the terms and conditions of the contract.
- C. Install, calibrate, and perform functional loop tests prior to plant start up. Start up of instrumentation to coincide with the mechanical equipment and process start up as scheduled by the owner, engineer and general contractor.
- D. Provide owner with any required operator and maintenance training by factory authorized representatives.
- E. Instrumentation equipment, installation, submittal, and record drawings shall be the responsibility of a single party. This party shall be responsible for all parts of this division 17000 and associated requirements.

1.03 WORK INCLUDED

All instruments and all control panels provided for this project. This shall also include vendor and owner supplied equipment.

1.04 SHOP DRAWINGS/SUBMITTALS

- A. Furnish Updated S20 instrumentation specification sheets indicating exact make, model and part number of instrument to be supplied.
- B. Furnish manufacturers specifications and literature on all instruments to be supplied.
- C. Furnish complete working shop drawings of all control systems including individual loop wiring diagrams for each instrument to be supplied. Reference design documents for sequence, basic components and suggested piping and wiring. Review the project with the Engineer prior to making submittal. Submit manufacturer's data sheets for all equipment, devices and materials.
- D. After initial review, make corrections requested and resubmit in clean format. Work only from final review set.
- E. Maintain record drawings in the field. Clean up originals at completion of work and resubmit for Owner's use in operation of the systems.

1.05 OPERATION AND MAINTENANCE MANUALS

O&M manuals shall comply with other sections of this specification. Manuals should include the following:

- A. Full drawn size as built loop diagrams, schematics and control diagrams indicating all conductor information, connection information, and device identification.
- B. As built S20 specification sheets
- C. Calibration sheets
- D. Identification of and lists of all replaceable parts
- E. Periodic service requirements
- F. Start up procedure
- G. Fault reset instruction
- H. Factory manuals

Prior to start up the contractor shall provide owner and owners integrator with items A, B and C.

PART 2 - EXECUTION

2.01 WIRING

- A. All control wiring, 120 volt and below shall be installed in conduit and wiring boxes. The installation of conduits into control panels shall not permit water to enter the control panels from the conduit.
- B. All analog signals shall be terminated on separate terminal blocks from other control conductors. Analog signals should be shielded type conductor as called for on drawings. The shield on each individual conductor should be terminated at one end only in order to prevent ground loops.
- C. All conductors in control panels shall be run within wireways. Each conductor shall be labeled and indicated on as built control drawings. One copy of such as-builts shall be affixed to inside of each control panel.
- D. Contractor shall use care to not exceed the recommended bending radius of all cables.
- E. Contractor shall install and label all termination points for external wiring. This labeling shall coordinate with control as-built drawings.
- F. Use no wire smaller than #14 AWG for 120 volt power and #16 AWG for 120 volt control wiring. Use no wire smaller than #20 AWG for DC voltage or current signal wiring.

2.02 INSTALLATION:

- A. Field mounting and conductor connections shall be provided by the contractor. Piping, tubing and process connections shall be provided by the contractor.

- B. Installation shall be done per the instrument manufacturer's specifications and project drawings and specifications. Any discrepancies shall be brought to the attention of the Owner's engineer for resolution.

2.03 CALIBRATION

- A. All instruments shall be calibrated using the manufacturers recommended calibration procedures and equipment.
- B. All analog instruments shall be calibrated or tested with three process data points.
- C. Factory calibrated equipment shall be tested to verify calibration.
- D. Contractor shall supply owner with a written calibration report on each instrument. Calibration reports shall indicate:
 - 1. Instrument by tag Number
 - 2. Test method used
 - 3. Test equipment used
 - 4. Numerical test results (preferably graphed)
 - 5. Date of test
 - 6. Technician

2.04 FUNCTIONAL LOOP TEST

- A. Contractor shall notify Owner in advance of final loop test. Final loop test shall take place with the participation of Owner, Owner's integrator and engineer.
- B. Owner shall approve final loop check procedures and sign off on check out.
- C. Loop check shall be from instrument to HMI screen indication with actual process connection simulating two or three data points per instrument.

2.05 WARRANTY

The vendor shall furnish a written warranty consisting of the following:

- A. Warranty parts and labor for two years after start up.

2.06 ATTACHMENTS

- A. S20 Instrument data sheets

			Ultrasonic Open Channel Flow Instrument			Sheet	of
						Spec No.	Rev
			Rev	By	Date		
						Contract	Date
						4/12/2001	
						Requisition	P. O.
			BY	CHK'D	APPR.		
1 Tag No. _____							
2 Process Location / Service _____							
General	3 Flume/Weir: Type _____		Size _____				
	4 Max Flow _____ gpm at _____ in Head _____		Exponent for flume _____				
	5 Service Conditions: _____ Indoor _____ Outdoor _____ Corrosive _____		6 High humidity/wet _____ Other _____				
	7 _____ ft Altitude _____		8 _____ to _____ deg f Ambient Temperatures _____				
	9 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____		10 Power Supply _____ Volts _____ Watts _____ Hz _____ DC _____				
	11 Other _____		12 Output _____ 4-20 ma _____ 1-5 v _____ Other _____ Isolated _____				
	13 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes		14 Pulse Outputs: _____ Volts DC _____ Sink _____ Source _____ Programmable value _____				
	15 Transducer Drive: _____ KHz _____ Volts _____ ms Duration _____ ms Repetition		16 Temperature Compensation _____				
	17 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables _____		18 Special Functions Required _____				
	19 _____ Digital Display _____ Digits _____ Analog display _____		20 _____ Range _____ % Accuracy _____				
Transmitter	21 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic _____		22 Manufacturer _____				
	23 Model/Part # _____		Serial # _____				
	24 Process Service _____		25 Face Material _____				
	26 Range _____ Beam Angle _____ deg		27 Cable Length _____ ft Cable Spec. _____				
	28 Internal Temperature Compensation _____ Type _____		29 Mounting: Pipe _____ in Flange _____ in _____ lb Conduit _____ in Wall bracket _____				
	30 Cone or stand pipe required _____ Size _____		31 Blanking Distance Required _____				
	32 Manufacturer _____		Model/Part # _____				
	33 _____		34 _____				
	35 _____		36 _____				
	37 _____						
Notes:							

			Suspended Solids			Sheet	of
			Rev	By	Date	Spec No.	Rev
						Contract	Date
							4/12/2001
						Requisition	P. O.
						BY	CHK'D
							APPR.

General	1 Tag No. _____
	2 Process Location / Service _____
	3 Equipment Located on _____
	4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive _____
	5 _____ to _____ Humidity <input type="checkbox"/> Other _____
	6 _____ ft Altitude
	7 _____ to _____ deg f Ambient Temperatures
	8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____
	9 Power Supply _____ Volts _____ VA/Watts _____ Hz _____ DC
	10 Other _____
	11 _____
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____
	13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____
	14 Relay Outputs: <input type="checkbox"/> Form C <input type="checkbox"/> Form A Rating: _____ Volts _____ Amperes
	15 Alarms <input type="checkbox"/> Control _____ Timer _____ Self and Sensor diagnostics _____
	16 <input type="checkbox"/> Programmable Digital <input type="checkbox"/> Keypad Entry <input type="checkbox"/> PC software and cables
	17 Communications Port: <input type="checkbox"/> RS232 <input type="checkbox"/> RS485 _____ Protocol
	18 Special Functions Required _____
	19 <input type="checkbox"/> Digital Display <input type="checkbox"/> Digits _____ Analog display
	20 Units _____ Range _____ % Accuracy _____ Repeatability
	21 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic
	22 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe
	23 Other _____
	24 _____
	25 Manufacturer _____ Or Equal
26 Model/Part # _____ Serial # _____	
Element	27 Process Service _____
	28 Sensor Type: <input type="checkbox"/> Light absorption <input type="checkbox"/> Back Scattered Light <input type="checkbox"/> 90 deg light Scattering sensor
	29 <input type="checkbox"/> Wetted Materials _____
	30 Cable Length _____ ft Cable Spec. _____
	31 Mounting: <input type="checkbox"/> Handrail pivot pipe <input type="checkbox"/> Flotation mounting _____
	32 <input type="checkbox"/> Submersion mount _____ <input type="checkbox"/> Flow through mounting _____ Line size _____
	33 <input type="checkbox"/> Hot tap assembly with Ball valve _____ Line size _____
34 Manufacturer _____ Or Equal	
35 Model/Part # _____	
Other	36 _____
	37 _____
	38 _____

Notes:

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			Rev	By	Date	Spec No.	Rev	
						Contract	Date	
						Requisition	P. O.	
						BY	CHK'D	APPR.

General	1 Tag No. _____ 2 Process Location / Service _____ 3 Equipment Located on _____ 4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive <input type="checkbox"/> High humidity/wet <input type="checkbox"/> Other _____ 5 _____ 6 _____ ft Altitude 7 _____ to _____ deg f Ambient Temperatures 8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____ 9 Power Supply <input type="checkbox"/> Volts <input type="checkbox"/> VA/Watts <input type="checkbox"/> Hz <input type="checkbox"/> DC 10 Other _____ 11 _____
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____ 13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____ 14 Relay Outputs: <input type="checkbox"/> Form C <input type="checkbox"/> Form A Rating: _____ Volts _____ Amperes 15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____ 16 Temperature Compensation _____ 17 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables 18 Communications Port: <input type="checkbox"/> RS232 <input type="checkbox"/> RS485 _____ Protocol 19 Special Functions Required _____ 20 <input type="checkbox"/> Digital Display _____ Digits <input type="checkbox"/> Analog display 21 Range _____ _____ % Accuracy _____ Repeatability 22 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic _____ 23 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe <input type="checkbox"/> Other _____ 24 Other _____ 25 Manufacturer _____ _____ Or Equal 26 Model/Part # _____ Serial # _____
Element	27 Process Service _____ 28 Cell Type: <input type="checkbox"/> Standard <input type="checkbox"/> Differential <input type="checkbox"/> Epoxy body <input type="checkbox"/> Ryton <input type="checkbox"/> Liquid Crystal Polymere Wetted Materials _____ 29 _____ 30 Cable Length _____ ft Cable Spec. _____ 31 <input type="checkbox"/> Internal Temperature Compensation Type _____ 32 Mounting: Handrail pivot pipe _____ Flotation mounting _____ Submersion mount _____ Flow through mounting _____ Line size _____ 33 _____ 34 Hot tap assembly with Ball valve _____ Line size _____ 35 Manufacturer _____ _____ Or Equal 36 Model/Part # _____ Serial # _____
Other	37 _____ 38 _____
Notes:	

			Dissolved Oxygen			Sheet	of	
			Rev	By	Date	Spec No.	Rev	
						Contract	Date	
						Requisition	P. O.	
						BY	CHK'D	APPR.

General	1 Tag No. _____ 2 Process Location / Service _____ 3 Equipment Located on _____ 4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive 5 <input type="checkbox"/> High humidity/wet <input type="checkbox"/> Other _____ 6 _____ ft Altitude 7 _____ to _____ deg f Ambient Temperatures 8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____ 9 Power Supply <input type="checkbox"/> Volts <input type="checkbox"/> VA/Watts <input type="checkbox"/> Hz <input type="checkbox"/> DC 10 Other _____ 11 _____
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____ 13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated _____ 14 Relay Outputs: <input type="checkbox"/> Form C <input type="checkbox"/> Form A Rating: _____ Volts _____ Amperes 15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____ 16 Temperature Compensation _____ 17 <input type="checkbox"/> Programmable Digital <input type="checkbox"/> Keypad Entry <input type="checkbox"/> PC software and cables 18 Communications Port: <input type="checkbox"/> RS232 <input type="checkbox"/> RS485 _____ Protocol 19 Special Functions Required _____ 20 <input type="checkbox"/> Digital Display _____ Digits <input type="checkbox"/> Analog display 21 Range _____ % Accuracy _____ Repeatability _____ 22 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic _____ 23 Other _____ 24 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe 25 Manufacturer _____ Or Equal _____ 26 Model/Part # _____ Serial # _____
Element	27 Process Service _____ 28 Cell Type _____ Wetted Materials _____ 29 Cathode Matl. _____ Anode Matl. _____ Ref Electrode Matl. _____ 30 Cable Length _____ ft Cable Spec. _____ 31 Internal Temperature Compensation _____ Type _____ 32 Mounting: Handrail pivot pipe _____ Flotation mounting _____ 33 Submersion mount _____ Flow through mounting _____ Line size _____ 34 Manufacturer _____ Or Equal _____ 35 Model/Part # _____ Serial # _____
Other	36 _____ 37 _____ 38 _____

Notes:

	Thermal Mass Flow			Sheet	of
	Rev	By	Date	Spec No.	Rev
				Contract	Date
				Requisition	P. O.
				BY	CHK'D

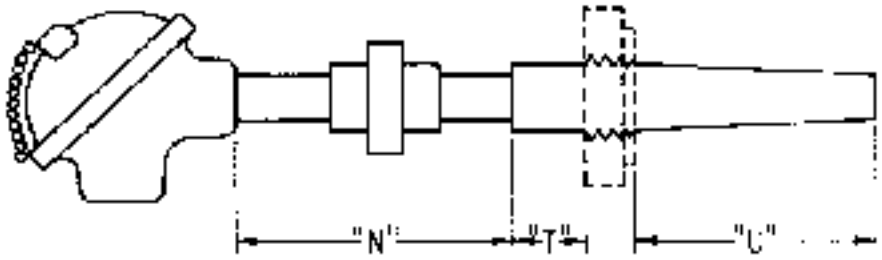
General	1 Tag No. _____ 2 Process Location / Service _____ 3 Line Number _____ Gas _____ 4 Service Conditions: _____ Indoor _____ Outdoor _____ Corrosive _____ 5 _____ High humidity/wet _____ Other _____ 6 _____ ft Altitude 7 _____ to _____ deg f Ambient Temperatures 8 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____ 9 Power Supply _____ Volts _____ VA/Watts _____ Hz _____ DC 10 Other _____ 11 _____
Transmitter	12 Output 1: 4-20 ma _____ 1-5 v _____ Other _____ Isolated _____ 13 Output 2: 4-20 ma _____ 1-5 v _____ Other _____ Isolated _____ 14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes 15 Pulse Outputs: _____ Volts DC _____ Sink _____ Source _____ Programmable value _____ 16 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____ 17 Temperature Compensation _____ 18 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables 19 Communications Port: _____ RS232 _____ RS485 _____ Protocol _____ 20 Totalizer _____ Special Functions Required _____ 21 _____ Digital Display _____ Digits _____ Analog display _____ 22 Range _____ % Accuracy _____ Repeatability _____ 23 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic _____ 24 Other _____ 25 Mounting: _____ Panel _____ Surface _____ Pipe _____ On flow element _____ 26 Manufacturer _____ Or Equal _____ 27 Model/Part # _____ Serial # _____
Flow Element	28 Process Service _____ 29 Flow Range _____ to _____ fps _____ Flow Element Materials _____ 30 Line Pressure _____ Line Temperature _____ degf _____ Process Tap Size _____ in _____ 31 Cable Length _____ ft Cable Spec. _____ 32 Probe Length _____ Probe Diameter _____ Probe Connection _____ 33 Mounting: Hot tap assembly with Ball valve _____ Direct in Line _____ Line size _____ 34 Manufacturer _____ Or Equal _____ 35 Model/Part # _____ Serial # _____
Other	36 _____ 37 _____ 38 _____
Notes:	

			Magnetic Flow Meter			Sheet	of
			Rev	By	Date	Spec No.	Rev
						Date 4/12/2001	
						P. O.	
						BY CHK'D APPR.	
General	1 Process Location / Service _____ Line Number _____						
	2 _____ High humidity/wet _____ Other _____						
	3 _____ ft Altitude _____						
	4 _____ to _____ deg f Ambient Temperatures _____						
	5 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____						
	6 Other _____						
Fluid	7 Fluid _____ Min Conductivity _____ Vacuum possibility _____						
	8 Line Pressure _____ Line Temperature _____ to _____						
	9 Flow Range _____ to _____ gpm Max Velocity _____						
Line Connection	10 Line Pressure _____ Line Material _____ Piping Class/ Schedule _____						
	11 Line Size _____ Connection Type _____ Connection Materials _____						
Flow Meter Tube	12 Tag No. _____						
	13 Tube Material _____ Liner Material _____ Meter Casing _____						
	14 Electrode Type _____ Electrode Material _____ Grounding Type _____						
	15 Enclosure : Nema _____ Power supply _____						
	16 Cable Length _____ ft Cable Spec. _____						
	17 Other _____						
	18 _____						
Transmitter	19 Manufacturer _____ Or Equal _____						
	20 Model/Part # _____ Serial # _____						
	21 Tag No. _____						
	22 Output 1: 4-20 ma _____ 1-5 v _____ Other _____ Isolated _____						
	23 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes						
	24 Pulse Outputs: _____ Volts DC _____ Sink _____ Source _____ Programmable value _____						
	25 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables _____						
	26 Communications Port: _____ RS232 _____ RS485 _____ Protocol _____						
	27 Totalizer _____ Special Functions Required _____						
	28 _____ Digital Display _____ Digits _____ Analog display _____						
	29 Range _____ % Accuracy _____ Repeatability _____						
Other	30 Enclosure : Nema _____ Material : Steel _____ Stainless Steel _____ Non metallic _____						
	31 Power Supply _____ Volts _____ VA/Watts _____ Hz _____ DC _____						
	32 Other _____						
	33 _____						
	34 Mounting: _____ Integral to Flow tube _____ Remote _____ Panel _____ Surface _____ Pipe _____						
	35 Manufacturer _____ Or Equal _____						
	36 Model/Part # _____ Serial # _____						
	37 _____						
38 _____							
Notes:							

			Magnetic Flow Meter			Sheet	of
			Rev	By	Date	Spec No.	Rev
						Date 4/12/2001	
						P. O.	
						BY CHK'D APPR.	
General	1 Process Location / Service _____ Line Number _____						
	2 _____ High humidity/wet _____ Other _____						
	3 _____ ft Altitude _____						
	4 _____ to _____ deg f Ambient Temperatures _____						
	5 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____						
Fluid	6 Other _____						
	7 Fluid _____ Density _____ to _____						
	8 Line Pressure _____ Line Temperature _____ to _____						
Line Connection	9 Flow Range _____ to _____ gpm Max Velocity _____						
	10 Line Pressure _____ Line Material _____ Piping Class/ Schedule _____						
Density Meter Tube	11 Line Size _____ Connection Type _____ Connection Materials _____						
	12 Tag No. _____						
	13 Tube Material _____ Liner Material _____ Meter Casing _____						
	14 Sensor type _____ Sensor Locations _____						
	15 Enclosure : Nema _____ Power supply _____						
	16 Cable Length _____ ft Cable Spec. _____						
	17 Other _____						
Transmitter	18 Manufacturer _____ Or Equal _____						
	19 Model/Part # _____ Serial # _____						
	20 Tag No. _____						
	21 Output 1: 4-20 ma _____ 1-5 v _____ Other _____ Isolated _____						
	22 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes						
	23 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables _____						
	24 Communications Port: _____ RS232 _____ RS485 _____ Protocol _____						
	25 _____ Digital Display _____ Digits _____ Analog display _____						
	26 Range _____ % Accuracy _____ Repeatability _____						
	27 Enclosure : Nema _____ Material : Steel _____ Stainless Steel _____ Non metallic _____						
Other	28 Power Supply _____ Volts _____ VA/Watts _____ Hz _____ DC _____						
	29 Mounting: _____ Integral to Flow tube _____ Remote _____ Panel _____ Surface _____ Pipe _____						
	30 Other _____						
	31 _____						
	32 _____						
	33 Manufacturer _____ Or Equal _____						
34 Model/Part # _____ Serial # _____							
35 _____							
36 _____							
37 _____							
38 _____							
Notes:							

Resistance Temperature Detector			Sheet	of
			Spec No.	Rev
Rev	By	Date	Contract	Date 4/12/2001
			Requisition	P. O.
			BY	CHK'D
				APPR.

General	1 Process Location / Service _____ Line Number _____
	2 _____ High humidity/wet _____ Other _____
	3 _____ ft Altitude
	4 _____ to _____ deg f Ambient Temperatures
Head	5 Area Classification _____ Unclassified Class _____ Division _____ Group _____
	6 Other _____
	7 Complete Assembly _____ Other _____
Element	8 Head Material _____ Conduit Connection _____
	9 Nipple Size _____ Dimension "N" _____ Union _____
	10 Platinum _____ Nickel _____ Copper _____ Other _____ Ice Point Resistance _____ ohm
	11 Temperature Range _____ To _____ deg
	12 Leads: Standard _____ Potted _____ Hermetically Sealed _____
	13 Sheath Material _____ O.D. _____ Mounting Thread _____
	14 Connection: 2-Wire _____ 3-Wire _____ 4-Wire _____
15 Lead Wires _____ Receptacle _____ Bayonet Lock _____	
Well or Tube	16 Other _____
	17 Material _____
	18 Construction: Tapered _____ Straight _____ Drilled _____ Built up _____ Closed End _____
	19 Internal Thread _____ Process Connection _____



Rev.	Tag No.	Process Conn.	Well Dimension		Element Length	Single or Dual	Service
			U	T			

Notes:

			Pressure Instrument			Sheet	of
			Rev	By	Date	Spec No.	Rev
						Contract	Date
						4/12/2001	
						Requisition	P. O.
						BY	CHK'D

General	1 Tag No. _____ 2 Process Location / Service _____ 3 Equipment Located on _____ 4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive 5 <input type="checkbox"/> High humidity/wet <input type="checkbox"/> Other _____ 6 _____ ft Altitude 7 _____ to _____ deg f Ambient Temperatures 8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____ 9 Power Supply <input type="checkbox"/> Volts <input type="checkbox"/> VA/Watts <input type="checkbox"/> Hz <input type="checkbox"/> DC 10 Other _____ 11 _____
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated 13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated 14 Relay Outputs: <input type="checkbox"/> Form C <input type="checkbox"/> Form A Rating: _____ Volts _____ Amperes 15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____ 16 <input type="checkbox"/> Gauge Pres <input type="checkbox"/> Absolute <input type="checkbox"/> Vacuum <input type="checkbox"/> Compound 17 Range _____ To _____ PSIG PSIA _____ in H2O _____ in HG 18 _____ % Accuracy _____ Repeatability 19 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables 20 Communications Port: <input type="checkbox"/> RS232 <input type="checkbox"/> RS485 _____ Protocol 21 Special Functions Required _____ 22 <input type="checkbox"/> Digital Display _____ Digits _____ Analog display 23 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic 24 Other _____ 25 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe <input type="checkbox"/> Yoke 26 Manufacturer _____ Or Equal 27 Model/Part # _____ Serial # _____
Element	28 Process Service _____ 29 Process Pressure: _____ To _____ 30 Process Connection <input type="checkbox"/> 1/4" NPT <input type="checkbox"/> 1/2" NPT _____ Flange 31 <input type="checkbox"/> Gauge Pres <input type="checkbox"/> Absolute <input type="checkbox"/> Vacuum <input type="checkbox"/> Compound 32 Type: <input type="checkbox"/> Diaphragm <input type="checkbox"/> Bourdon <input type="checkbox"/> Helix <input type="checkbox"/> Bellows <input type="checkbox"/> Other _____ 33 Material: <input type="checkbox"/> 316 SS <input type="checkbox"/> Hasteloy <input type="checkbox"/> Ber. Copper <input type="checkbox"/> Other _____ 34 Range: <input type="checkbox"/> Fixed <input type="checkbox"/> Adjustable Set at _____ To _____ 35 Element Range <input type="checkbox"/> Normal <input type="checkbox"/> Max <input type="checkbox"/> Proof 36 Other _____
Other	37 _____ 38 _____
Notes:	

END OF SECTION 17000

SECTION 17111 - FLOAT SWITCHES

PART 1 - GENERAL

1.01 SCOPE

- A. This section includes furnishing all float switches as indicated on the drawings and specified herein.
- B. Related work specified elsewhere includes, but is not limited to, Section 16000, Electrical. Also refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.01 BALL TYPE FLOAT WITH INTEGRAL MERCURY SWITCH AND ATTACHED CABLE.

- A. Float switch shall be direct acting and consist of 316 type stainless steel housing, mounting clamp, a flexible three-conductor cable with a synthetic rubber jacket and a mercury switch. The float housing shall be a sphere of at least 4 1/2 inches in diameter.
- B. The mercury switch shall be embedded in a metal housing inside the float. The cable shall be 3/C #14, "SO" TYPE with 105 strands per conductor, made specifically for underwater use and heavy flexing service.
- C. The mercury switch shall be connected to two of the three conductors of the cable. The third conductor shall be an internal ground and shall be colored green. The switch shall have a 20 ampere rating at 115 volts AC.
- D. An additional synthetic rubber jacket shall act as a hinge between the float and where the cable is held by the stationary clamp. This clamp shall be stainless steel with an adapting fitting and two yokes for mounting on a vertical 1-inch pipe.
- E. A liquid rise of 1 inch from the reset position shall operate the float switch, and reset shall occur when the liquid level drops to 1 inch. Operating temperature shall be 0 degrees F to + 180 degrees F.

- F. Weight and buoyancy shall be such that contaminants like a cake of grease will not result in the float switch changing operating level more than 1 inch.
- G. A cast aluminum, NEMA 4 junction box shall be supplied for termination of the float cable(s), to allow conventional wiring and conduit to be run from the junction box to a control panel. It shall have terminal blocks for the required number of circuits and shall accept sealed fittings furnished with the float switch.
- H. Float switches shall be as manufactured by Consolidated Electric Co., or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified and as shown on the drawings. Contractor shall coordinate with Mechanical and Structural for optimum location of float switches.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications.

END OF SECTION 17111

SECTION 17120 - PRESSURE TRANSMITTERS

PART 1 - GENERAL

1.01 SCOPE

- A. This section includes furnishing Pressure Transmitters as shown on the Plans and specified herein.
- B. Related work specified elsewhere includes, but is not limited to Section 16000, electrical. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Submit instrument Data sheet for each instrument provided.
 - 3. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

1.04 MANUFACTURERS

- A. Pressure transmitter manufacturers shall be KPSI, Rosemount, Foxboro, or Approved equal.

PART 2 - PRODUCTS

2.01 PRESSURE TRANSMITTER

- A. Provide pressure transmitters with ½" NPT process connection, isolation valve, and local indicator scaled in engineering units.
- B. Transmitters shall be of a two-wire type, 24 VDC powered, producing a 4 to 20 mA output proportional to the calibrated pressure range of the instrument. Transmitters shall be capable of driving a 500 ohm loop load.
- C. Instrument accuracy shall be within plus or minus 0.5% of span, and 0.2% repeatability. Dead band shall be within 0.1% of span.
- D. Instrument enclosure shall be NEMA 4, with 316 stainless steel wetted parts.
- E. Submersible pressure transducers shall be constructed of 316 stainless steel.

- F. Submersible pressure transmitters for waste water applications shall have a diaphragm larger than 2", and shall have a protective covering over the diaphragm.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed, connected, and tested in accordance with the manufacturers' recommendations, and as shown on the Plans. Contractor shall coordinate with other trades to insure proper connection to piping and other mechanical equipment.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation.

Attachments Instrument Data Sheet

END OF SECTION

Pressure Transmitter Instrument Data Sheet

		Pressure Instrument			Sheet	of
		Rev	By	Date	Spec No.	Rev
					Contract	Date 4/12/2001
					Requisition	P. O.
					BY	CHK'D APPR.
General	1 Tag No. _____					
	2 Process Location / Service _____					
	3 Equipment Located on _____					
	4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive					
	5 <input type="checkbox"/> High humidity/wet <input type="checkbox"/> Other _____					
	6 _____ ft Altitude					
	7 _____ to _____ deg f Ambient Temperatures					
	8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____					
	9 Power Supply _____ Volts _____ VA/Watts _____ Hz _____ DC					
	10 Other _____					
	11 _____					
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated <input type="checkbox"/>					
	13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ Isolated <input type="checkbox"/>					
	14 Relay Outputs: _____ Form C _____ Form A Rating: _____ Volts _____ Amperes					
	15 Alarms _____ Control _____ Timer _____ Self and Sensor diagnostics _____					
	16 <input type="checkbox"/> Gauge Pres <input type="checkbox"/> Absolute <input type="checkbox"/> Vacuum <input type="checkbox"/> Compound					
	17 Range _____ To _____ PSIG _____ PSIA _____ in H2O _____ in HG					
	18 _____ % Accuracy _____ Repeatability					
	19 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables					
	20 Communications Port: _____ RS232 _____ RS485 _____ Protocol					
	21 Special Functions Required _____					
	22 <input type="checkbox"/> Digital Display _____ Digits _____ Analog display					
	23 Enclosure: Nema _____ Material: Steel _____ Stainless Steel _____ Non metallic					
	24 Other _____					
	Element	25 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe <input type="checkbox"/> Yoke				
26 Manufacturer _____ Or Equal						
27 Model/Part # _____ Serial # _____						
28 Process Service _____						
29 Process Pressure: _____ To _____						
30 Process Connection _____ 1/4" NPT _____ 1/2" NPT _____ Flange						
31 <input type="checkbox"/> Gauge Pres <input type="checkbox"/> Absolute <input type="checkbox"/> Vacuum <input type="checkbox"/> Compound						
32 Type: <input type="checkbox"/> Diaphragm <input type="checkbox"/> Bourdon <input type="checkbox"/> Helix <input type="checkbox"/> Bellows <input type="checkbox"/> Other _____						
Other	33 Material: <input type="checkbox"/> 316 SS <input type="checkbox"/> Hasteloy <input type="checkbox"/> Ber. Copper <input type="checkbox"/> Other _____					
	34 Range: <input type="checkbox"/> Fixed <input type="checkbox"/> Adjustable _____ Set at _____ To _____					
	35 Element Range _____ Normal _____ Max _____ Proof _____					
	36 Other _____					
	37 _____					
	38 _____					
Notes:						

SECTION 17121 - PRESSURE SWITCHES

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers Pressure Switches as shown on the Plans.
- B. Related work specified elsewhere includes, but is not limited to Section 16000, electrical. Also refer to requirements of General Conditions for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for and guarantee performance of the equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the equipment.
- B. Reference standards shall be the latest edition, including addends, supplements and revisions. Applicable reference publications include the following:
 - 1. NEC
 - 2. NEMA

1.03 SUBMITTALS

- A. Submit product information cut sheets containing manufacturer's specifications, Operations and maintenance data, instrument enclosure type, installation location, and process pressure range to be supplied. Indicate product part number in full.
- B. Provide submittals in accordance with Section 16000, and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 PRESSURE SWITCHES

- A. Pressure switches shall have snap action, single-pole, double-throw switching elements with an electrical rating of at least 10 amperes at 120 VAC. Switches shall be enclosed in a NEMA 4X housing for outdoor use.
- B. Operating pressures and set points shall be determined in the field, unless otherwise indicated on the Plans.
- C. Set points shall be fully adjustable and shall be in the middle of the working range. Accuracy shall be plus or minus 1/2 of one per cent of adjustable range.
- D. For pressures up to 80 PSIG pressure sensing element shall be of the diaphragm or bellows type, and shall have a proof pressure of at least twice the maximum working pressure. Diaphragms or bellows shall be of stainless steel.
- E. Pressure switches shall be as manufactured by Barksdale Controls, Mercoïd, Union Electric Controls Company, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified and shown on the drawings. Contractor shall coordinate with Mechanical and Piping to insure proper connection to piping and/or other mechanical equipment.

3.02 ACCEPTANCE

- A. As a condition precedent to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

END OF SECTION

- D. Diaphragms for sewage, sludge and liquids containing solids shall be 316 stainless steel for pressures above 15 psi and elastomer for pressures below 15 psi. Diaphragms shall be Ashcroft model 101, Rosemount model 1199 or approved equal.
- E. For chemical solutions, seals shall have a PVC body for removable mounting at 200 psi, with type 316 stainless steel bolts and nuts, ½ inch inlet and ¼ inch outlet, liquid filled with a Teflon diaphragm for pressure and suitable elastomer diaphragm for vacuum service. Diaphragms shall be by Plast-O-Matic Valves, Inc. or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified and shown on the drawings. Contractor shall coordinate with Mechanical and Piping to insure proper connection to piping and/or other mechanical equipment.

3.02 ACCEPTANCE

- A. As a condition precedent to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

END OF SECTION 17122

SECTION 17122 - PRESSURE GAUGES

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. General. The CONTRACTOR shall provide pressure gauges, complete and operable, in accordance with the Contract Documents.
- B. The requirements of Section 17000 - Process Control and Instrumentation Systems apply to this Section.

1.02 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 17000.

1.03 SUBMITTALS

- A. Submit product information cut sheets containing manufacturer's specifications, Operations and maintenance data, instrument enclosure type, installation location, and process pressure range to be supplied. Indicate product part number in full.
- B. Provide submittals in accordance with Section 16000, and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

- A. Pressure gauges shall be 4-1/2 inches in diameter, liquid-filled bottom connected, with white laminated dials and black graduations. Windows shall be shatterproof glass acrylic. Gauges shall have a blowout disc and be encased in phenolic, steel, or cast iron. Measuring element shall be a stainless steel bourdon tube with welded, stress-relieved joints. Socket shall have wrench flats. Movements shall be rotary geared stainless steel material. Pressure gauges shall be provided with a pulsation snubber constructed of 316 stainless steel and an isolation valve. Gauges shall be calibrated to read in applicable units. Accuracy shall be plus and minus ½ percent range to 150 percent of the working pressure or vacuum of the pipe or vessel to which they are connected.
- B. Pressure gauge ranges shown on the Instrumentation Schedule in the drawings are approximate and shall be coordinated with the equipment where the pressure is being monitored.
- C. Provide diaphragm seals for pressure gauges that are connected to process types that contain sewage, sludge, liquids containing solids, pulsating flows or chemical solutions. Seals shall consist of bottom housing, lower ring, diaphragm capsule, fill screw, flushing connection, and a top housing. Type 316 stainless steel nuts and bolts. Fill connection and valved flush port size ¼ inch NPT, capable of disassembly without the loss of filler fluid. Fill fluids shall be rated for plus and minus 20% of the rated ambient temperature which is typically -20°C to 50°C for outdoors and 0°C to 50°C for indoors. The fill fluid rating would then typically be as a minimum -35°C to 65°C for outdoors and -10°C to 60°C for indoors.

SECTION 17123 - ULTRASONIC LEVEL TRANSMITTER

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers the Ultrasonic Level Transmitters and Controllers to be provided where indicated on the Plans.
- B. Related work specified elsewhere includes, but is not limited to section 16000 Electrical. Also, refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.01 ULTRASONIC LEVEL CONTROLLER

- A. The ultrasonic level controller system shall be comprised of a transmitter in a NEMA 4X housing, an ultrasonic transducer, and cabling. The system shall be of the non-contact type for continuous measurement and control of liquid and solid levels.
- B. The transmitter shall include a front panel mounted, 4 digit LCD indicator, scaleable in engineering units. The transmitter shall provide a 4-20 mA DC analog output signal which is proportional to level. The unit shall also have 5 form 'C' SPDT relays assignable for level control, totalizing, sampling, and alarming. The LCD shall provide messages for loss of echo, and cabling trouble. The transmitter shall be designed to operate from -20 degrees C to +50 degrees C.
- C. The transducer shall be encapsulated in chemical and corrosion resistant material, such as Kynar, Teflon, or TEFZEL, and be capable of operating from -40 degrees C to +73 degrees C. The unit shall be ambient temperature compensated. The transducer shall be compatible with the level range as indicated on the Plans, and shall operate with up to 1200 feet of separation from the transmitter.
- D. The transducer shall be capable of measuring a span of up to 33 feet. The span and range shall be set in the field. Accuracy shall be +/-0.25 percent of range.

- E. The system shall operate on 120 VAC, and shall be Milltronics HydroRanger 200, or approved equal.
- F. Differential level controllers, where indicated on the Plans, shall be Milltronics Hydromanager 200, or Approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The Contractor shall coordinate the installation with the other trades, to insure proper installation of the transducer, transmitter, and associated conduit and cables.
- B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

3.03 SPARE PARTS

- A. Provide the Owner with a list of the manufacturers' recommended spare parts.

END OF SECTION 17123

SECTION 17125–RADAR LEVEL METER

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers Radar Level Meters as shown on the Plans and specified herein.
- B. Furnish and install the Level Transmitter and all appurtenances suitable for the service identified, complete and operable and capable of continuous operation.
- C. Related work specified elsewhere includes, but is not limited to Section 16000, General Electrical Requirements. Refer to requirements of General Conditions for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for and guarantee performance of the equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the equipment.
- B. Reference standards shall be the latest edition, including addends, supplements, and revisions. Applicable reference publications include the following:
 - 1. NEC
 - 2. NEMA

1.03 SUBMITTALS

- A. Submit product information cut sheets containing manufacturer's specifications, Operations and maintenance data, instrument enclosure type, installation location, and process pressure range to be supplied. Indicate product part number in full.
- B. Provide submittals in accordance with Section 16000, and elsewhere in the Contract Documents.

PART 2 - PRODUCTS

2.01 RADAR LEVEL TRANSMITTER

- A. Graphics Display:
 - 1. Multi-Segment Alphanumeric LCD with bar graph
- B. Data Entry:
 - 1. IR Keypad – To be provided with each unit
- C. Outputs:
 - 1. One 4-20 mA outputs with hart communications
- D. Enclosure:
 - 1. NEMA 4X enclosure
 - 2. 24 VDC

3. -40 to 176 degree F
4. Class I Div1 rated with barrier, Class II Div 1 rated.

2.02 RADAR ELEMENT

- A. Level Measurement:
1. Radar Range: 1-65 ft
 2. Accuracy $\pm 0.1\%$; of range

2.03 MANUFACTURER

- A. The Radar Level Meter shall be Siemens SITRANS Probe LR or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified and shown on the Plans. Contractor shall coordinate with Mechanical and Piping to insure proper connection to piping and/or other mechanical equipment.

3.02 ACCEPTANCE

- A. As a condition precedent to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

END OF SECTION 17125

SECTION 17134 - FLOW SWITCHES

PART 1 - GENERAL

1.01 SCOPE

- A. This section covers flow switches to be furnished as indicated on the Plans.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance, of equipment furnished. However, this shall not be construed as relieving the Contractor from their responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer in accordance with the Contract Documents, and Section 16000.

PART 2 - PRODUCTS

2.01 FLOW SWITCHES

- A. Flow switches for pump discharge monitoring shall be thermal dispersion type, made of stainless steel, and shall give a no-flow signal when the flow drops below the set actuating flow rate. The flow switch enclosure shall meet NEMA 4 standards. The switch contact output shall be SPDT rated at 4 amps. Flow switches shall be Magnetrol, Thermatel or equal.
- B. Eyewash and shower flow switches shall be stainless steel, installed in the potable waterline, and shall indicate eyewash or shower operation.
- C. Flow switches for pump seal water lines shall actuate at 0.04 gpm to provide an indication of seal water flow to the pump. The lower housing of the switch body shall be brass, and shall be leakproof. The snap switch shall be magnetically actuated. The machined tee flow section, and other wetted parts, shall be stainless steel. An adjustable bypass valve shall set the trip point of the switch. Pipe connections shall be ½ inch NPT. Flow switch shall be Dwyer/Anderson Low Flow Model V6, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed as shown on Plans.

3.02 GUARANTEE

- A. Contractor shall fully guarantee all work under this section for a period of one year from date of final acceptance by the owner against faulty workmanship and failure or malfunction of materials and/or equipment due to faulty or imperfect workmanship. This guarantee shall be given in writing to the owner at the time of issuing final certificate.

Work, materials or equipment found to be defective within this period shall be replaced without cost to the owner.

3.03 ACCEPTANCE

- A. As a condition precedent to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

END OF SECTION 17134

SECTION 17135 - ULTRASONIC OPEN CHANNEL FLOWMETER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This section covers the Ultrasonic Open Channel Flowmeter to be provided where indicated on the Plans.
- B. Related work specified elsewhere includes, but is not limited to section 16000 Electrical. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 – PRODUCTS

2.01 ULTRASONIC OPEN CHANNEL FLOWMETER

- A. The ultrasonic open channel flowmeter system shall be comprised of a transmitter in a NEMA 4X housing, an ultrasonic transducer, and cabling. The system shall be of the non-contact type for continuous measurement and control of liquid and solid levels.
- B. The ultrasonic open channel flowmeter shall include a front panel mounted, 4 digit LCD indicator, scaleable in engineering units. The ultrasonic open channel flowmeter shall provide a 4-20 mA DC analog output signal which is proportional to level. The unit shall also have 5 form 'C' SPDT relays assignable for level control, totalizing, sampling, and alarming. The LCD shall provide messages for loss of echo, and cabling trouble. The ultrasonic open channel flowmeter shall be designed to operate from - 20 degrees C to + 50 degrees C.
- C. The ultrasonic open channel flow element shall be encapsulated in chemical and corrosion resistant material, such as Kynar, Teflon, or TEFZEL, and be capable of operating from - 40 degrees C to + 95 degrees C. The unit shall be ambient temperature compensated.

- D. The ultrasonic open channel flowmeter shall have a capable range from 1 ft. to 4 ft. The span and range shall be set in the field. Accuracy shall be +/-1mm/m with a resolution of 0.007 inches.
- E. The system shall operate on 115 VAC, and shall be Milltronics OCM III or Hydromanager 200.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, as required by the manufacturer, and as shown on the Plans. The Contractor shall coordinate the installation with the other trades, to insure proper installation of the ultrasonic open channel flowmeter and associated conduit and cables.
- B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

3.03 SPARE PARTS

- A. Provide the Owner with a list of the manufacturers' recommended spare parts.

END OF SECTION 17135

SECTION 17137 - MAGNETIC FLOWMETERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers the Magnetic Flowmeters to be provided where indicated on the Drawings. The flowmeters shall consist of two parts with manufacturer supplied interconnecting wiring, the field installed flow element and the flow indicating transmitter.
- B. Related work specified elsewhere includes, but is not limited to section 16000 Electrical. Also, refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Submit Instrument Data Sheet for each instrument provided.
 - 3. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

PART 2 - PRODUCTS

2.01 MAGNETIC FLOWMETERS:

- A. Acceptable Manufacturers:
 - 1. Endress and Hauser, Promag 53 Series, with remote mount transmitter unless specified as compact version.
 - 2. Siemens SITRANS F, Mag 5100W Series, with remote mount transmitter unless specified as compact version.
 - 3. ABB MagMaster Plus MFF Series, with remote mount transmitter unless specified as compact version.
 - 4. Or Approved Equal.

B. Materials:

1. All mounting hardware shall be 316 stainless steel, the instrument enclosure and the spool mag shall be rated NEMA 4X, the flow sensor liner shall be Polyurethane lined, and the electrode material shall be 316 stainless steel.
2. Spool size shall be as specified on the drawings
3. All applications with flow element below grade where no de-watering means or in submersible applications shall provide the flow element as nema 6P (IP-67).

C. Design and fabrication

1. Utilize characterized field principle of electromagnetic induction to produce signal directly proportional to flow rate.
2. Provide flanged end connections per ANSI B16 rated for piping system operating and test conditions.
3. Operating pressure: 150 psi.
4. Operating temperature: 122 DegF.
5. Grounding requirements:
 - a. Inlet and outlet grounding rings of same material as electrode.
6. Provide cable between magnetic flowmeter and transmitter.
7. Pulsed DC magnetic field excitation.
8. Automatic zero
9. Adjustable low flow cutoff.
10. 16-character alphanumeric display shall indicate user-defined flow units and total flow. All menu advice and commands shall be viewed on this display.
11. Minimum signal lock (empty tube zero) to prevent false measurement when tube is empty.
12. Accuracy:
 - a. +/- 0.5 percent of rate above 1 fps.
 - b. +/- 0.01 fps below 1.0 fps.
 - c. 4-20 mA DC isolated output into maximum 800 ohms.
 - d. Scaled frequency output, 24 VDC.
 - e. Power supply: 117 V +/- 10 percent, 60 HZ.
 - f. Meter operable as specified in liquids with 5.0 micromho/cm or more conductivity.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The Contractor shall coordinate the installation with the other trades, to insure proper installation of the flow element, transmitter, and associated conduit and cables.
- B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

3.03 SPARE PARTS

- A. Provide the Owner with a list of the manufacturers' recommended spare parts.

Attachment Instrument Data Sheet

END OF SECTION 17137

SECTION 17139 - INSERTION MASS FLOWMETERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section covers the Insertion Mass Flowmeters to be provided where indicated on the Drawings.
- B. Related work specified elsewhere includes, but is not limited to section 16000 General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the CONTRACTOR from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the ENGINEER prior to installation as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the CONTRACTOR shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.
 - 3. Submit Instrument Data Sheet for each instrument provided.

PART 2 - PRODUCTS

2.01 INSERTION MASS FLOWMETERS:

- A. Acceptable Manufacturers:
 - 1. Sierra Instruments 640S Series with Display or approved equal.
- B. Materials:
 - 1. All mounting hardware shall be 316 stainless steel, and the instrument enclosure shall be rated NEMA 4X.
- C. Design and fabrication:
 - 1. Velocity Range: 0-18,000 SFPM (300 SFPS), air at standard conditions of 25_C and 760 mmHg.
 - 2. Velocity Measurement Accuracy: +/- 2% of reading from 10 to 100% of calibrated range.

3. Output 4-20ma signal proportional to flow rate. 700 ohms maximum resistance.
4. Power Supply 18 to 30 VDC
5. Repeatability: 0.25% or better.
6. Process Temperature Rating: -10 Deg C to +120 Deg C.
7. Process Pressure Rating: 150 PSIG.
8. Sensor Material: 316L Stainless Steel, all welded construction.
9. Sensor Support Material: 316L Stainless Steel all-welded construction.
10. Insertion Length: Per manufacturer's recommendations.
11. Process Line Sizes: 3" pipe and larger.
12. Sensor Electronics Enclosure: NEMA 4X, Class I, Div. 1, Groups B, C, D:
13. Sensor Enclosure Temperature Rating: -20 Deg C to +50 Deg C.
14. Process Connection: 316 Stainless Steel Compression Fitting to fit 1" FNPT Fitting on pipe (by customer).
15. Field Wiring: 1 pair of twisted and shielded 14-18 gauge wire having a maximum loop resistance of 4 ohms.
16. Safety approvals: Non-incentive: Class I, Div.2, GPS A,B,C,D,T5;CSA pending;
Explosion-proof: Class I, Div. I, GPS B,C,D,T4, CSA pending; Flameproof: Eex d IIC T4;
CENELEC pending.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The CONTRACTOR shall coordinate the installation with the other trades, to insure proper installation of the flow element, transmitter, and associated conduit and cables.
- B. The CONTRACTOR shall calibrate the instruments to the proper ranges, as required by the OWNER and the ENGINEER. Where analog signals are connected to local, or remote monitoring equipment, the CONTRACTOR shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the CONTRACTOR shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

Attachment Instrument Data Sheet

END OF SECTION 17139

Insertion Mass Flow Instrument Data Sheet

			Mass Flow			Sheet	of
			Rev	By	Date	Spec No	Rev
						Contract	Date
						Requestion	P. O.
						BY	CHK'D APPR.
General	1 Tag No _____						
	2 Process Location / Service _____						
	3 Line Number _____ Gas _____						
	4 Service Conditions _____ Indoor _____ Outdoor _____ Corrosive _____						
	5 _____ High Humidity/wet _____ Other _____						
	6 _____ ft altitude _____						
	7 _____ to _____ deg F Ambient Temperatures _____						
	8 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____						
	9 Power Supply _____ Volts _____ VAC/Hz _____ Hz _____ DC _____						
	10 Other _____						
	11 _____						
Transmitter	12 Output 1: 4-20 mA _____ 1-5 v _____ Other _____ Isolated _____						
	13 Output 2: 4-20 mA _____ 1-5 v _____ Other _____ Isolated _____						
	14 Relay Outputs: _____ Form C _____ Form A _____ Rating: _____ Volts _____ Amperes						
	15 Pulse Outputs: _____ Volts DC _____ Sink _____ Source _____ Programmable value _____						
	16 Alarms: _____ Control _____ Timer _____ Self and Sensor diagnostics _____						
	17 Temperature Compensation _____						
	18 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables _____						
	19 Communications Port: _____ RS232 _____ RS485 _____ Protocol _____						
	20 Totalizer _____ Special Functions Required _____						
	21 _____ Digital Display _____ Digits _____ Analog display _____						
	22 Range _____ % Accuracy _____ Repeatability _____						
Flow Element	23 Enduse: _____ Name _____ Material _____ Steel _____ Stainless Steel _____ Non metallic _____						
	24 Other _____						
	25 Mounting: _____ Panel _____ Surface _____ Pipe _____ On flow element _____						
	26 Manufacturer _____ Or Equal _____						
	27 Model/Part # _____ Serial # _____						
	28 Process Service _____						
	29 Flow Range _____ to _____ lps _____ Flow Element Materials _____						
	30 Line Pressure _____ Line Temperature _____ deg F _____ Process Tap Size _____ in _____						
	31 Cable Length _____ ft _____ Cable Spec _____						
	32 Probe Length _____ Probe Diameter _____ Probe Connection _____						
	33 Mounting: Hot tap assembly with Ball valve _____ Direct in Line _____ Line size _____						
Other	34 Manufacturer _____ Or Equal _____						
	35 Model/Part # _____ Serial # _____						
	36 _____						
37 _____							
38 _____							
Notes _____							

850-105

SECTION 17140 – TEMPERATURE SENSOR AND TRANSMITTER

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This section covers the Insertion Temperature Sensors and Transmitters to be provided where indicated on the Drawings.
- B. Related work specified elsewhere includes, but is not limited to section 16000 General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the CONTRACTOR from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the ENGINEER prior to installation as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the CONTRACTOR shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.
 - 3. Submit Instrument Data Sheet for each instrument provided.

PART 2 – PRODUCTS

2.01 TEMPERATURE SENSORS AND TRANSMITTERS:

- A. Acceptable Manufacturers:
 - 1. Moore Industries RTI2 Series with R1Y Transmitter with 1000 ohm platinum RTD or approved equal.
- B. Materials:
 - 2. All mounting hardware shall be 316 stainless steel, and the instrument enclosure shall be rated NEMA 4X.
- C. Design and fabrication:

3. Temperature Range -200 to 630 Deg C. 1000 Ohm Platinum RTD with Stainless Steel Thermal Well.
4. Velocity Measurement Accuracy: +/- 2% of reading from 10% to 100% of calibrated range.
5. Output 4-20ma signal proportional to temperature span. 700 ohms maximum resistance.
6. Power Supply 18 to 30 VDC
7. Process Temperature Rating: -10 Deg C to +120 Deg C.
8. Process Pressure Rating: 150 PSIG.
9. Sensor Material: 316 Stainless Steel.
10. Sensor Support Material: 316L Stainless Steel.
11. Insertion Length: Per manufacturer's recommendations.
12. Process Line Sizes: 3" pipe and larger.
13. Sensor Electronics Enclosure: NEMA 4X, Class I, Div. 1, Groups B, C, D:
14. Sensor Enclosure Temperature Rating: -40 Deg C to +180 Deg C.
15. Process Connection: 316 Stainless Steel fitting to fit 1/2" MNPT fitting in pipe tap (by customer).
16. Field Wiring: 1 pair of twisted and shielded 14-18 gauge wire having a maximum loop resistance of 4 ohms.
17. Safety approvals: Non-incentive: Class I, Div.2, GPS A,B,C,D,T5;CSA pending; Explosion-proof: Class I, Div. I, GPS B,C,D,T4, CSA pending; Flameproof: Eex d IIC T4; CENELEC pending.

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans. The CONTRACTOR shall coordinate the installation with the other trades, to insure proper installation of the flow element, transmitter, and associated conduit and cables.
- B. The CONTRACTOR shall calibrate the instruments to the proper ranges, as required by the OWNER and the ENGINEER. Where analog signals are connected to local, or remote monitoring equipment, the CONTRACTOR shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the CONTRACTOR shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications. This requirement is in addition to the manufacturer's guarantee.

Attachment Instrument Data Sheet

END OF SECTION 17140

Temperature Instrument Data Sheet

			Temperature			Sheet	of
			Rev	By	Date	Spec No	Rev
						Contract	Date
						Requestion	P. O.
						BY	CHK'D
						APPR.	
General	1 Tag No _____						
	2 Process Location / Service _____						
	3 Line Number _____ Gas _____						
	4 Service Conditions _____ Indoor _____ Outdoor _____ Corrosive _____						
	5 _____ High humidity/wet _____ Other _____						
	6 _____ ft altitude _____						
	7 _____ to _____ deg F Ambient Temperatures _____						
	8 Area Classification _____ Unclassified _____ Class _____ Division _____ Group _____						
	9 Power Supply _____ Volts _____ VAC/Hz _____ Hz _____ DC _____						
	10 Other _____						
	11 _____						
Transmitter	12 Output 1: 4-20 mA _____ 1-5 v _____ Other _____ Isolated _____						
	13 Output 2: 4-20 mA _____ 1-5 v _____ Other _____ Isolated _____						
	14 Relay Outputs: _____ Form C _____ Form A _____ Rating: _____ Volts _____ Amperes						
	15 Pulse Outputs: _____ Volts DC _____ Sink _____ Source _____ Programmable value _____						
	16 Alarms: _____ Control _____ Timer _____ Self and Sensor diagnostics _____						
	17 Temperature Compensation _____						
	18 _____ Programmable Digital _____ Keypad Entry _____ PC software and cables _____						
	19 Communications Port: _____ RS232 _____ RS485 _____ Protocol _____						
	20 Totalizer _____ Special Functions Required _____						
	21 _____ Digital Display _____ Digits _____ Analog display _____						
	22 Range _____ % Accuracy _____ Repeatability _____						
Temperature Element	23 Enclosure: _____ Name _____ Material _____ Steel _____ Stainless Steel _____ Non-metallic _____						
	24 Other _____						
	25 Mounting: _____ Panel _____ Surface _____ Pipe _____ On element _____						
	26 Manufacturer _____ Or Equal _____						
	27 Model/Part # _____ Serial # _____						
	28 Process Service _____						
	29 Temp Range _____ to _____ Deg C / F _____ Temp Element Materials _____						
	30 Line Pressure _____ Line Pressure _____ PSI _____ Process Tap Size _____ in _____						
	31 Cable Length _____ ft _____ Cable Spec _____						
	32 Probe Length _____ Probe Diameter _____ Probe Connection _____						
	33 Mounting: Hot tap assembly with Ball valve _____ Direct in Line _____ Line size _____						
Other	34 Manufacturer _____ Or Equal _____						
	35 Model/Part # _____ Serial # _____						
	36 _____						
37 _____							
38 _____							
Notes _____							

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SECTION 17222 - SIGNAL CONDITIONERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section contains specifications for analog (4-20 mA DC) signal conditions, used for loop isolation, protection, and switching. Refer to the Plans and provide the devices as indicated.
- B. Related work specified elsewhere includes, but is not limited to section 16000 General Electrical Requirements. Refer to requirements of General Conditions for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

1.04 MANUFACTURERS

- A. Products specified herein shall be as manufactured by AGM Electronics, or equal.

PART 2 - PRODUCTS

2.01 CURRENT-TO-CURRENT CONVERTER

- A. Current-to-current converters shall provide electrical isolation between the input and output. Current-to-current converters shall be supplied where indicated on the Plans, and wherever the circuit impedance exceeds the capability of a transmitter.
- B. The converter shall receive a 4-20 mA DC analog current input signal and produce an identical 4-20 mA DC output signal into a 0-1000 ohm load. Accuracy shall be +/-0.1 percent of span. The converter shall be provided with an enclosure suitable for back of panel mounting.
- C. Power requirements shall be 120 VAC, or 24 VDC, as indicated on the Plans.

2.02 DUAL CHANNEL CURRENT ISOLATOR

- A. Dual channel current isolators shall provide electrical isolation between the input and output. The instruments shall receive a 4-20 mA DC analog current input signal and produce two identical 4-20 mA DC output signals.
- B. Each channel shall be fully isolated, and capable of driving a 0-650 ohm load. Accuracy shall be +/-0.1 percent of span. The isolators shall be provided with an enclosure suitable for back of panel mounting.
- C. Power requirements shall be 120 VAC, or 24 VDC, as indicated on the Plans.

2.03 SET POINT RELAY

- A. The set point relays shall be solid state devices, and shall provide dual output relay contact closures from a 4-20 mA DC input. Each relay shall be controlled by an adjustable set point from a 10-turn potentiometer.
- B. The dual deadbands shall be adjustable from 0 to 100 percent. The output relay shall be DPDT with contacts rated 10 amps at 120 VAC. Accuracy and repeatability shall be within 0.1 percent of span.
- C. The instruments shall be immune to humidity and line voltage regulation problems. Power requirements shall be 120 VAC, or 24 VDC. The unit shall be housed in a general purpose type housing suitable for subpanel mounting in a control panel enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed and connected as specified, and as shown on the Plans.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation under the conditions set forth in these specifications.

3.03 WARRANTY

- A. The equipment listed in this section shall have a seven year warranty from the manufacturer.

END OF SECTION 17222

SECTION 17300 – ORP SENSOR AND ANALYZER/TRANSMITTER

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This section includes furnishing and installing ORP analyzers and transmitters in the locations indicated on the plans and specified herein.
- B. Related work specified elsewhere includes, but is not limited to, Section 16000, General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

- A. The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:
 - 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
 - 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.

1.04 MANUFACTURERS

- A. Hach model pHD-sc ORP system and sc100 controller or sc1000 controller or approved equal

PART 2 - PRODUCTS

2.01 ORP ANALYZERS

- A. The Controller operates using 117 VAC +/- 15%, 50/60 Hz power.
- B. The Controller displays ORP in mv and temperature in Celsius or Fahrenheit.
- C. The Controller is equipped with temperature compensation.
- D. The Controller can support up to two probes. (One probe per controller if Temperature is requested.)
- E. All user settings of the controller are retained indefinitely in memory (non-volatile, EEPROM)
- F. Three SPDT relays, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum.
- G. Two analog 4-20 mA outputs and/or optional selectable digital I/O, maximum impedance 500 Ohms.
- H. Communication

1. RS-232 (optional)
2. RS-485 (MODBUS): Advanced communications/networking with PLC or SCADA system directly from analyzer.

2.02 ORP SENSORS (SCB)

- A. The Sensor is made of polybutyl methacrolate.
- B. The Probe is made of foamed PEEK® and 316 stainless steel.
- C. The Probe is entirely corrosion-resistant and fully immersible.
- D. The Probe does not require sample conditioning or electrolyte solutions.
- E. Operating Procedure
 1. Probe: -5 to 95 degrees C
 2. Controller: -20 to 60 degrees C
- F. Relative humidity: 95%, non condensing
- G. Immersion pressure: 100 PSI, maximum
- H. The probe shall have built in 1000 ohm pt RTD for temperature compensation.
- I. Distance, analyzer to sensor: 300 meters, maximum
- J. The probe includes a three-year warranty from the date of shipment.
- K. The sensor shall have a measuring range of -1500 to 1500 mv.
- L. Provide mounting hardware and spare parts as recommended by the manufacturer and approved by the OWNER. If immersion is required provide proper equipment.
- M. The sensor shall be threaded to facilitate mounting to a pipe.
- N. Cable shall be provided with no splices as required to reach the controller where installed by contractor

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed, connected, and tested in accordance with the manufacturers' recommendations, and as shown on the Plans. Contractor shall coordinate with other trades to insure proper connection to piping and other mechanical equipment.
- B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation.

END OF SECTION 17300

SECTION 17310 – DO SENSOR AND ANALYZER/TRANSMITTER

PART 1 - GENERAL

1.01 SCOPE

- A. This section includes furnishing and installing Luminescent DO analyzers and transmitters in the locations indicated on the plans and specified herein.
- B. Related work specified elsewhere includes, but is not limited to, Section 16000, General Electrical Requirements. Refer to requirements of Contract Documents for testing, adjusting and balancing of systems.

1.02 QUALITY ASSURANCE

- A. Equipment to be furnished under this section shall be the product of firms regularly engaged in the design and manufacture of this type of equipment. Manufacturer shall assume responsibility for, and guarantee performance of equipment furnished. However, this shall not be construed as relieving the Contractor from responsibility for the proper installation and functioning of the work.

1.03 SUBMITTALS

The following material shall be submitted to the Engineer prior to installation, in accordance with Section 16000, and as required elsewhere in the Contract Documents:

- 1. Where applicable, provide complete manufacturer's part number, identifying scaling, operating range, housing and wetted parts materials, NEMA rating, product options, consumable materials, and other pertinent information.
- 2. Prior to Final Acceptance of the work, the Contractor shall provide Operations and Maintenance Manuals, in accordance with the Contract Documents.
- 3. Submit instrument data sheets for each instrument provided.

1.04 MANUFACTURERS

- A. Hach model LDO Probe and sc100 controller or sc1000 controller or approved equal

PART 2 - PRODUCTS

2.01 DO ANALYZERS

- A. The Controller operates using 117 VAC +/- 15%, 50/60 Hz power.
- B. The Controller displays dissolved oxygen measurement in ppm or mg/l and temperature in Celsius or Fahrenheit.
- C. The Controller is equipped with temperature compensation.
- D. The Controller can support up to two probes. (One probe per controller if Temperature is requested.)
- E. All user settings of the controller are retained indefinitely in memory (non-volatile, EEPROM)
- F. Three SPDT relays, user-configurable contacts rated 100 to 230 Vac, 5 Amp resistive maximum.
- G. Two analog 4-20 mA outputs and/or optional selectable digital I/O, maximum impedance 500 Ohms.

- H. Communication
 - 1. RS-232 (optional)
 - 2. RS-485 (MODBUS): Advanced communications/networking with PLC or SCADA system directly from analyzer.

2.02 DO SENSORS (SCB)

- B. The Sensor is made of polybutyl methacrylate.
- C. The Probe is made of foamed Noryl® and 316 stainless steel.
- D. The Probe is entirely corrosion-resistant and fully immersible.
- E. The Probe does not require sample conditioning or electrolyte solutions.
- F. Operating temperature:
 - 1. Probe: 0 to 50 degrees C
 - 2. Controller: -20 to 60 degrees C
- G. Relative humidity: 95%, non condensing
- H. Immersion depth: 100 meters, maximum
- I. Immersion pressure: 1050 kPa, maximum
- J. Distance, analyzer to sensor: 300 meters, maximum
- K. The probe includes a three-year warranty from the date of shipment.
- L. The sensor shall have a measuring range of 0.00 to 20.00 g/lh.
- M. Provide mounting hardware and spare parts as recommended by the manufacturer and approved by the OWNER.
- N. The sensor shall be threaded to facilitate mounting to a pipe.
- O. Cable shall be provided with no splices as required to reach the controller where installed by contractor

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Equipment and materials specified in this section shall be installed, connected, and tested in accordance with the manufacturers' recommendations, and as shown on the Plans. Contractor shall coordinate with other trades to insure proper connection to piping and other mechanical equipment.
- B. The Contractor shall calibrate the instruments to the proper ranges, as required by the Owner and the Engineer. Where analog signals are connected to local, or remote monitoring equipment, the Contractor shall verify that the calibrated ranges and scaling of the local and remote indicators are correct.

3.02 ACCEPTANCE

- A. Prior to final acceptance of the work, the Contractor shall certify the equipment and installation included under this section to be free of defects, and suitable for trouble-free operation.

Attachment Instrument Data Sheet

END OF SECTION
Dissolved Oxygen Sensor and Analyzer Instrument Data Sheet

			Dissolved Oxygen			Sheet	of
			Rev	By	Date	Spec No.	Rev
						Date	4/12/2001
						P. O.	
					BY	CHK'D	APPR.
General	1 Tag No. _____						
	2 Process Location / Service _____						
	3 Equipment Located on _____						
	4 Service Conditions: <input type="checkbox"/> Indoor <input type="checkbox"/> Outdoor <input type="checkbox"/> Corrosive						
	5 <input type="checkbox"/> High humidity/wet <input type="checkbox"/> Other _____						
	6 _____ ft Altitude						
	7 _____ to _____ deg f Ambient Temperatures						
	8 Area Classification <input type="checkbox"/> Unclassified Class _____ Division _____ Group _____						
	9 Power Supply <input type="checkbox"/> Volts <input type="checkbox"/> VA/Watts <input type="checkbox"/> Hz <input type="checkbox"/> DC						
	10 Other _____						
	11 _____						
Transmitter	12 Output 1: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ <input type="checkbox"/> Isolated						
	13 Output 2: 4-20 ma <input type="checkbox"/> 1-5 v <input type="checkbox"/> Other _____ <input type="checkbox"/> Isolated						
	14 Relay Outputs: <input type="checkbox"/> Form C <input type="checkbox"/> Form A Rating: _____ Volts <input type="checkbox"/> Amperes						
	15 Alarms <input type="checkbox"/> Control <input type="checkbox"/> Timer <input type="checkbox"/> Self and Sensor diagnostics _____						
	16 Temperature Compensation _____						
	17 <input type="checkbox"/> Programmable Digital <input type="checkbox"/> Keypad Entry <input type="checkbox"/> PC software and cables						
	18 Communications Port: <input type="checkbox"/> RS232 <input type="checkbox"/> RS485 _____ Protocol						
	19 Special Functions Required _____						
	20 <input type="checkbox"/> Digital Display <input type="checkbox"/> Digits <input type="checkbox"/> Analog display						
	21 Range _____ % Accuracy _____ Repeatability _____						
	22 Enclosure: Nema _____ Material: <input type="checkbox"/> Steel <input type="checkbox"/> Stainless Steel <input type="checkbox"/> Non metallic						
23 Other _____							
24 Mounting: <input type="checkbox"/> Panel <input type="checkbox"/> Surface <input type="checkbox"/> Pipe							
25 Manufacturer _____ <input type="checkbox"/> Or Equal							
26 Model/Part # _____ Serial # _____							
Element	27 Process Service _____						
	28 Cell Type _____ Wetted Materials _____						
	29 Cathode Matl. _____ Anode Matl. _____ Ref Electrode Matl. _____						
	30 Cable Length _____ ft Cable Spec. _____						
	31 Internal Temperature Compensation _____ Type _____						
	32 Mounting: <input type="checkbox"/> Handrail pivot pipe <input type="checkbox"/> Flotation mounting						
	33 <input type="checkbox"/> Submersion mount <input type="checkbox"/> Flow through mounting Line size _____						
	34 Manufacturer _____ <input type="checkbox"/> Or Equal						
	35 Model/Part # _____ Serial # _____						
	36 _____						
	Other	37 _____					
38 _____							
Notes:							