
PROCESS MEASUREMENT DEVICES

1. GENERAL

1.1 INTENT

- .1 All field instruments required including:
1. Electromagnetic Flow Meters
 2. Pressure Indicating Transmitters
 3. Hydrostatic Pressure Transmitters
 4. Radar Level Transmitters
 5. Float Level Switches
 6. Turbidity/pH Analyzers
 7. Temperature Sensors
 8. Humidity Sensors
 9. Conductivity Level Switches
 10. Smoke Detectors
 11. Door Contacts
 12. Pressure Indicators
 13. Motor Operated Actuators for Isolation Valves (On/Off)
 14. Motor Operated Actuators for Modulating Valves

1.2 RELATED SECTIONS

- .1 Division 23 – Mechanical, all sections
- .2 Division 26 – Electrical, all sections

1.3 UNIFORMITY OF INSTRUMENTS

- .1 Instruments of one manufacturer to be used throughout to the extent practical. Variations will be permitted only where the major supplier cannot supply a particular instrument as specified.
- .2 Note that where the specifications specify a variety of instrument manufacturers, these are to establish standards of quality.
- .3 All instruments must be CSA approved and meet all applicable industry standards and codes.

1.4 DRAWINGS AND DESIGN

- .1 The drawings are intended to show the major details of the controls and instrumentation work but it is the Contractor's responsibility to examine the electrical, mechanical, structural and architectural drawings before beginning the work and report to the Owner's Representative any discrepancies or interferences which may occur.
- .2 Control and instrumentation system layouts shown on the drawings are generally diagrammatic and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing and air headers to be governed by the mechanical, structural and architectural conditions which prevail.

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- .3 The Owner's Representative reserves the right to change the location of any piece of equipment without extra payment therefore, providing only that the change is requested before installation and that the new location is within 1.5 meters of the original location.

1.5 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings.
- .2 Indicate:
 - .1 Instrument manufacturer's name, type, model, year, and serial number.
 - .2 The manufacturer's specifications for each instrument.
 - .3 Outline and arrangement drawings.
 - .4 Cross-sectional drawings.
 - .5 Materials of construction.
 - .6 Available range and accuracy.
 - .7 All other pertinent product information and data.

1.6 OPERATION & MAINTENANCE DATA

- .1 Provide operating & maintenance data for incorporation into the Operation and Maintenance Manual.
- .2 Data to Include:
 - .1 Manufacturer's name, type, model year, capacity and serial number.
 - .2 Details on operation, servicing and maintenance.
 - .3 As-built wiring diagrams.
 - .4 Available range, accuracy and rating information of instrument.

2. PRODUCTS

2.1 GENERAL

- .1 Manufacturer and Supplier:
 - .1 All instruments shall be of a manufacturer/supplier with service facilities in Southern Alberta.
- .2 NSF Certification:

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- .1 All instruments in contact with water being treated or potable water, shall have NSF 61 certification.
- .3 Serial Numbers and Nameplates:
 - .1 Each piece of equipment shall be stamped with a serial number, prior to shop performance testing.
 - .2 Each piece of equipment shall be provided with a substantial steel or brass nameplate attached to the unit, clearly inscribed with the manufacturer's name, year of manufacture and the principal rating data.
- .4 Painting:
 - .1 Not applicable.
- .5 Instrument Isolation Valves
 - .1 Where indicated on P&I drawings, provide instruments with block valves, block and bleed valves, or 3-valve manifolds.
 - .2 Use 316 stainless steel valves on stainless steel and carbon steel piping, bronze-body valves on copper piping, and PVC ball valves on PVC piping.
 - .3 Acceptable Material
 - .1 Century CM2 block valve (316 SS)
 - .2 Century CM29 block and bleed valve (316SS)
 - .3 Chemline model OMP (PVC)
 - .4 Century CM3 (3-valve 316 SS)
 - .5 Crane 9302 (Bronze)
- .6 Instrument Description:
 - .1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the P & I drawings and mechanical drawings for reference.

2.2 ELECTROMAGNETIC FLOWMETERS

- .1 General
 - .1 All meters within this subsection shall be provided by the same manufacturer.
 - .2 The flow indicating transmitter shall be suitable, in all respects, for use with specified application.
 - .3 The flow indicating transmitter shall be suitable for use with the specified flow and accuracy. Supplier to verify sizing based parameters listed in this specification.
- .2 Applicable Equipment: FIT 010, FIT 165, FIT 185

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- .1 Liquid Type:
 - .1 FIT 010, FIT 165, FIT 185: Raw Water.
- .2 Size:
 - .1 FIT 010: 200 mm.
 - .2 FIT 165: 200 mm.
 - .3 FIT 185: 250 mm.
- .3 Location:
 - .1 FIT 010: Cell 1 Inlet.
 - .2 FIT 165: Outlet Header.
 - .3 FIT 185: Cell 1 Recirculation.
- .4 Acceptable Supplier:
 - .1 Endress & Hauser
- .5 Operating Conditions:
 - .1 Temperature: 1 to 25 °C
 - .2 Flow Rates:
 - .1 FIT 010: Max: 231 L/s, Normal: 100 L/s, Min: 11 L/s
 - .2 FIT 165: Max: 231 L/s, Normal: 100 L/s, Min: 11 L/s
 - .3 FIT 185: Max: 150 L/s, Normal: 115 L/s, Min: 60 L/s
 - .3 Operating Pressure:
 - .1 FIT 010: 60 kPag
 - .2 FIT 165: 1000 kPag
 - .3 FIT 185: 160 kPag
- .6 Transducer:
 - .1 Pressure Rating: 1500 kPa
 - .2 Body Material: Carbon Steel.
 - .3 Mounting: ANSI 150 Flange
 - .4 Liner material: Polyurethane.
 - .5 Electrode: 316 Stainless Steel.
 - .6 Grounding Rings: Required in non-metallic or metallic coated piping.
- .7 Bidirectional Capability:
 - .1 FIT 010, FIT 165, FIT 185: No
- .8 Transmitter:
 - .1 Output: 4-20 mA
 - .2 Power: 24 VDC
 - .3 Accuracy: 0.5% of full span.
 - .4 Mounting:
 - .1 FIT 010, FIT 165, FIT 185: Integral
 - .5 Output meter scale: LCD
 - .6 Calibration Range:
 - .1 FIT 010: 0 to 240 L/s
 - .2 FIT 165: 0 to 240 L/s
 - .3 FIT 185: 0 to 160 L/s

PROCESS MEASUREMENT DEVICES

- .7 Flow Rate Units: liters/sec
- .8 Totalizer Units: cubic meters
- .9 Communications: HART
- .9 Accessories:
 - .1 Flanged 10S stainless steel spool for meter run to be installed in the event the meter needs to be removed from service.
 - .2 Factory supplied stainless steel tag.
 - .3 PC configuration software for instrument setup
 - .4 Cabling required for remote indicators and totalizers.
 - .5 Grounding Rings as per manufacturer's recommendations

2.3 PRESSURE INDICATING TRANSMITTERS

- .1 General
 - .1 Pressure indicating transmitters must be suitable for service and application. Use isolation diaphragms where required.
- .2 Applicable Equipment: PIT 160, PIT 180
 - .1 Liquid Type:
 - .1 PIT 160: Raw Water
 - .2 PIT 180: Raw Water
 - .2 Location:
 - .1 PIT 160: Outlet Header
 - .2 PIT 180: Cell 1 Recirculation Header
 - .3 Acceptable Manufacturer:
 - .1 Endress & Hauser, ABB, or approved equivalent.
 - .4 Specified Equipment:
 - .1 Type: conventional gauge pressure transmitter c/w smart electronics.
 - .2 Interface: digital numeric display with pushbuttons capable of configuring device.
 - .3 Mounting: Direct.
 - .4 Process Connection: ½" NPT.
 - .5 Material (Wetted Parts): 316 Stainless Steel.
 - .6 Housing: Aluminum NEMA 4X.
 - .7 Power: Loop powered 2-wire - 24VDC unit.
 - .8 Output: 4-20mA to PLC.
 - .9 Accuracy: 0.15%.
 - .10 Calibrated Range:
 - .1 PIT 160: 0 - 150 PSI.
 - .2 PIT 180: 0 - 30 PSI.
 - .11 Communications: HART.
 - .5 Tag #s: PIT 160, PIT 180

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2.4 SUBMERSIBLE PRESSURE TRANSMITTERS

- .1 Applicable Equipment: LT 355,
 - .1 Liquid Type: Raw Water
 - .2 Location:
 - .1 LT 355: Groundwater Manhole.
 - .3 Mounting: As shown on drawings.
 - .4 Specified Equipment:
 - .1 Manufacturer: Vega, PMC, Endress & Hauser or approved equivalent
 - .2 Type: Submersible hydrostatic gauge pressure
 - .3 Accuracy: 0.1% of full scale
 - .4 Housing Material: 316L Stainless Steel
 - .5 Power: Loop powered 24 VDC
 - .6 Output: 4-20mADC
 - .7 Cable: Molded Polyurethane Jacket
 - .8 Cable Length: As required to accommodate mounting depth.
 - .5 Measurement Range: 20 PSI - 0 to 10.0 m depth
 - .6 Approved Manufacturer:
 - .1 Vega, PMC, Endress & Hauser or approved equivalent

2.5 RADAR LEVEL TRANSMITTERS

- .1 Applicable Equipment: LT 104, LT 415, LT 710, LT 720
- .2 Liquid Type:
 - LT 104: Raw Water
 - LT 415: Aluminum Sulfate
 - LT 710: Potable Water
 - LT 720: Sewage
- .3 Location:
 - LT 104: Pump Cell 1
 - LT 415: Chemical Tank
 - LT 710: Potable Water Storage Tank
 - LT 720: Septic Tank
- .4 Mounting: As per manufacturer's requirements and as indicated on drawings.
- .5 Specified Equipment:
 - .1 Manufacturer: Vega or approved equivalent
 - .2 Model: C21
 - .3 Type: Radar W-band 80 GHz
 - .4 Range: 20 meters
 - .5 Accuracy: +/- 2 mm
 - .6 Enclosure: NEMA 4X
 - .7 Connections: NPT
 - .8 Power: Loop powered 24 VDC
 - .9 Output: 4-20mADC, HART
 - .10 Cable: Molded Polyurethane Jacket
 - .11 Cable Length: As required to accommodate mounting depth.

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- .6 Measurement Range: 0-3.0 m.
- .7 Accessories:
 - .1 Manufacturer supplied support brackets where required for installation.

2.6 FLOAT LEVEL SWITCHES

- .1 Applicable Equipment: LSLL 101, LSHH 102, LSLL 365, LSHH 370, LSLL 420, LSLL 710, LSHH 720.
- .2 Liquid Type:
 - .1 LSLL 101: Raw Water.
 - .2 LSHH 102: Raw Water.
 - .3 LSLL 365: Ground Water.
 - .4 LSHH 370: Ground Water.
 - .5 LSLL 420: Aluminum Sulfate.
 - .6 LSLL 710: Potable Water.
 - .7 LSHH 720: Sewage.
- .3 Location:
 - .1 LSLL 101: Pump Cell 1.
 - .2 LSHH 102: Pump Cell 1.
 - .3 LSLL 365: Groundwater Manhole.
 - .4 LSHH 370: Groundwater Manhole.
 - .5 LSLL 420: Chemical Tank.
 - .6 LSLL 710: Potable Water Tank.
 - .7 LSHH 720: Septic Tank.
- .4 Specified Equipment LSLL 710:
 - .1 Manufacturer: SJE Rhombus.
 - .2 Model: Pump Master.
 - .3 Type: Liquid level regulator.
 - .4 Output: to PLC.
- .5 Specified Equipment LSLL 101, LSHH 102, LSLL 365, LSHH 370,, LSLL 420, LSHH 720:
 - .1 Manufacturer: Flygt or equivalent.
 - .2 Model: ENH-10.
 - .3 Type: Liquid level regulator.
 - .4 Output: to PLC.

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- .6 Accessories:
 - .1 Appropriately sized weights as required.
 - .2 Cable as required.
- .7 Mounting: As per manufacturer's requirements.

2.7 TURBIDIMETER/pH ANALYZER

- .1 Applicable Equipment: AIT/AE 031, AIT/AE 175, AIT/AE 186
 - .1 Liquid Type: Raw Water
 - .2 Location:
 - AIT/AE 031: Inlet Line
 - AIT/AE 175: Outlet Header
 - AIT/AE 186: Cell 1 Recirculation Header
 - .3 Specified Equipment:
 - .1 Manufacturer: Hach
 - .2 Model: DPMP-TUPHD
 - .3 Type: Dual Parameter Monitoring Panel for Turbidity and pH
 - .4 Turbidity Type: Laser
 - .5 Turbidity Range: 0-700 NTU
 - .5 pH Range: 2.0-14.0
 - .6 Sample Flow Required: 200 –750 ml/minute
 - .9 Outputs: Three selectable 4-20 mA outputs for turbidity, pH, temperature.
 - .11 Power: 120 VAC, 60 Hz
 - .12 Sample Inlet Fitting: ¼" NPT female
 - .13 Drain Fitting: ½" NPT female
 - .14 Enclosures: Nema-4X
 - .15 Accessories:
 - .1 Automatic cleaning module for turbidity sensor.
 - .2 Provide piping from the turbidimeter as required by the manufacturer to allow for calibration of the unit. Pipe drain water from analyzer to floor funnel and pipe floor funnel to floor drain and to sump.
 - .3 Operational Manual
 - .4 Provide ball valve, needle type flow control valve and flow indicator on inlet side of each turbidimeter in order to limit flow through the unit.
 - .5 Sample port on piping to sensors.
 - .6 pH standard cell solution pH 7.0 500mL
 - .7 Turbidity standards kit 10 NTU, 20 NTU, 600 NTU
 - .8 PC configuration software for instrument setup
 - .9 Provide 10 PSI pressure regulator for each turbidimeter.
 - .16 Commissioning: Contractor to arrange for the services of the equipment manufacturers technical representative to come to site and commission the turbidity analyzers.

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2.8 TEMPERATURE SENSORS

- .1 Applicable Equipment: TE 790, TE791.
- .2 Type: RTD element c/w connection head with terminals.
- .3 Location:
 - .1 TE 790: Pump Room Ambient.
 - .2 TE 791: Electrical Room Ambient.
- .4 Specified Equipment TE 790, TE 791:
 - .1 Supplier: WIKA Instruments LTD
 - .2 Model: Drawing No. ATS-17932-sheet no.1
 - .3 Type: Wall mount NEMA 4
 - .4 Electrical connection: ¾"NPT
 - .5 Output: RTD

2.9 HUMIDITY SENSOR

- .1 Applicable Equipment: AT 797
- .2 Equipment: Wall mount Humidity Sensor.
- .3 Operating voltage: 24 VDC 4- 20 mA
- .4 Location: Wall near control panel
- .5 Manufacturer: Honeywell H7635C

2.10 CONDUCTIVITY LEVEL SWITCHES

- .1 Applicable Equipment: LSH 780
- .2 Liquid Type: Potable Water
- .3 Location: Pump Station
- .4 Specified Equipment:
 - .1 Manufacturer: Ametek B/W Controls
 - .2 Type: Shielded Wire Suspension Electrodes
 - .3 Holder: Cord Grip
 - .4 Wetted Parts Material: Stainless Steel
 - .5 Relay Power: 120 VAC
 - .6 Relay Type: High Level Alarm
 - .7 Relay Mounting: Standard 8 pin octal base
 - .8 Part Numbers:
 - .1 Electrodes: 6013-W6 (Quantity 2 per installation).

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- .2 Wire: 6013-SW-[length in feet as required].
- .3 Cord Grip Electrode Holders: 6012-CG2.
- .4 Relay: 5400-A-L1.
- .5 Relay Base: 5400-SR.
- .6 Mounting: As per manufacturer's requirements.

2.11 SMOKE DETECTORS

- .1 Applicable Equipment: ASH 761, ASH 762, ASH 763, ASH 764
 - .1 Equipment: Smoke Detector.
 - .2 Location: Ceiling height, and as indicated on drawings.
 - .1 ASH 761: Pump Room Northwest.
 - .2 ASH 762: Pump Room Northeast.
 - .3 ASH 763: Pump Room South.
 - .4 ASH 764: Mech/Elect Room.
 - .5 ASH 765: Washroom.
 - .3 Operation: Capable of detecting products of combustion, unaffected by change in temperature, humidity, and pressure.
 - .4 Type: Plug-in photoelectric smoke detector with fixed temperature heat sensor.
 - .5 Electrical: Power 24VDC c/w relay contacts for remote monitoring.
 - .6 Approved Products: System Sensor i3 Series Model C4WTR-BA.

2.12 DOOR CONTACTS

- .1 Applicable Equipment: ZSC 752, ZSC 753, ZSC 754, ZSC 755.
- .2 Equipment: Magnetic door contact.
- .3 Location:
 - ZSC 752: Pump Room Overhead Door.
 - ZSC 753: Pump Room Mandoor East.
 - ZSC 754: Pump Room Mandoor West.
 - ZSC 755: Mechanical/Electrical Room Mandoor.
- .4 Specified Equipment:
 - .1 Manufacturer: GRI- George Risk Industries Inc
 - .2 Model: 4402- standard
 - .3 Switch Type: SPDT 30VDC
 - .4 Connection: Unit c/w jacketed cable and flying leads
 - .5 Operation: Contact close on opening of door

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2.13 PRESSURE INDICATORS

- .1 Applicable Equipment: PG 030, PG 055, PG 115, PG 125, PG 135, PI 155, PI 215, PG 225
 - .1 Liquid Type: Raw Water
 - .2 Location:
 - .1 PG 030: Inlet
 - .2 PG 055: Pig Launcher
 - .3 PG 115: Pump VP110 Discharge
 - .4 PG 125: Pump VP120 Discharge
 - .5 PG 135: Pump VP130 Discharge
 - .6 PG 155: Pump VP150 Discharge
 - .7 PG 215: Pump VP210 Discharge
 - .8 PG 225: Pump VP220 Discharge
 - .3 Required Pressure Range:
 - .1 0 to 200 kPag: PG 030, PG 055
 - .2 0 to 300 kPag: PG 155
 - .3 0 to 1500 kPag: PG 115, PG 125, PG 135, PG 215, PG 225
 - .4 Specified Equipment:
 - .1 Manufacturer: Ashcroft or approved equivalent
 - .2 Model: 63-1008AL-02L
 - .3 Accuracy: 1% of span
 - .4 Dial Size: 63 mm (2.5") or larger
 - .5 Case: 304 Stainless Steel
 - .6 Fill Fluid: Glycerin
 - .7 Ring: 304 Stainless Steel
 - .8 Window: Polycarbonate
 - .9 Dial: Black figures on white background
 - .10 Display Units: kPa and PSI
 - .11 Pointer: Black, aluminum
 - .12 Bourdon Tube: "C" shaped bronze
 - .13 Operating Temperature: -7 C to 65 C
 - .14 Connections: 13 mm NPT lower mount connection
 - .15 Accessories:
 - .1 Gauges to come with stainless steel body, TFE seat and seal, SS ball and stem, screwed ball valve.
 - .2 All connections as required.
 - .5 Approved alternative: WIKA

2.14 MOTOR OPERATED ACTUATORS FOR ISOLATION VALVES (ON/OFF)

- .1 Applicable Equipment: FV 018, FV 035
 - .1 For valves to be actuated, refer to valve specification.

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- .2 Location:
 - .1 FV 018: Cell 1 Inlet to Reservoir
 - .2 FV 035: Cell 1 Inlet to Pump Wetwell
- .3 Specified Equipment:
 - .1 Manufacturer: Bray
 - .2 Model: Series 70
 - .3 Type: Quarter Turn
 - .4 Output Torque: Suitable for specified valve
 - .5 Power: 120VAC single phase
 - .6 Enclosure: NEMA 4
 - .7 Manual Handwheel: Required – Handwheel engagement to disable remote control
 - .8 Local Position Indicator: Required
 - .9 Control Input: Open/Close
 - .10 Feedback1: Dry contacts providing opened and closed status
 - .11 Feedback2: Dry contact providing local/remote operation (handwheel disengaged/engaged)

2.15 MOTOR OPERATED ACTUATORS FOR MODULATING VALVES

- .1 Applicable Equipment: FCV 015
 - .1 For valves to be actuated, refer to valve specification.
 - .2 Location:
 - .1 FCV 015: Cell 1 Inlet
 - .3 Specified Equipment:
 - .1 Manufacturer: Bray
 - .2 Model: Series 70
 - .3 Type: Quarter Turn
 - .4 Output Torque: Suitable for specified valve
 - .5 Power: 120VAC single phase
 - .6 Enclosure: NEMA 4
 - .7 Manual Handwheel: Required – Handwheel engagement to disable remote control
 - .8 Local Position Indicator: Required
 - .9 Control Input: 24VDC mA
 - .10 Feedback1: 24VDC mA indicating valve position
 - .11 Feedback2: Dry contact providing local/remote operation (handwheel disengaged/engaged)

3. EXECUTION

3.1 INSTALLATION

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- .1 The Contractor to be responsible for the correct installation and assemble of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.
- .2 Any damage resulting from failure to observe the installation instruction or as a result of proceeding without sufficient knowledge of proper installations techniques will be the Contractor's responsibility.
- .3 Mounting of Instruments & Accessories:
 - .1 Instruments to be installed in accordance with the drawings. Instruments shall be rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping and electrical work.
 - .2 Instruments not to be installed until heavy construction work adjacent to the instruments has been completed.
 - .3 Instruments devices, including accessories, to be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments to face toward and within reading distance of a normal operating area.
 - .4 Sufficient clearance to be allowed for removal of equipment for maintenance and repair.
 - .5 Field located instruments to be mounted on building columns and walls or pipe stands and/or other means of support as required in accordance with manufacturer's instructions and the Contract Drawings.

3.2 TESTING, ADJUSTING AND COMMISSIONING

- .1 Testing, adjusting and commissioning of all instruments shall be in accordance with Section 40 90 00.

END OF SECTION

PROCESS MEASUREMENT DEVICES

1. GENERAL

1.1 INTENT

- .1 All field instruments required including:
 - 1. Electromagnetic Flow Meters
 - 2. Float Level Switches
 - 3. Turbidity/pH Analyzers
 - 4. Pressure Indicators
 - 5. Motor Operated Actuators for Modulating Valves
 - 6. Solenoid Valves

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- .2 Indicate:

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- .1 Instrument manufacturer's name, type, model, year, and serial number.
- .2 The manufacturer's specifications for each instrument.
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- .3 Serial Numbers and Nameplates:
 - .1 Each piece of equipment shall be stamped with a serial number, prior to shop performance testing.

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- .2 Each piece of equipment shall be provided with a substantial steel or brass nameplate attached to the unit, clearly inscribed with the manufacturer's name, year of manufacture and the principal rating data.
- .4 Painting:
 - .1 Not applicable.
- .5 Instrument Isolation Valves
 - .1 Where indicated on P&I drawings, provide instruments with block valves, block and bleed valves, or 3-valve manifolds.
 - .2 Use 316 stainless steel valves on stainless steel and carbon steel piping, bronze-body valves on copper piping, and PVC ball valves on PVC piping.
 - .3 Acceptable Material
 - .1 Century CM2 block valve (316 SS)
 - .2 Century CM29 block and bleed valve (316SS)
 - .3 Chemline model OMP (PVC)
 - .4 Century CM3 (3-valve 316 SS)
 - .5 Crane 9302 (Bronze)
- .6 Instrument Description:
 - .1 All instruments are given a description "Tag #". The Tag # refers to the description relative to the P & I drawings and mechanical drawings for reference.

2.2 ELECTROMAGNETIC FLOWMETERS

- .1 General
 - .1 All meters within this subsection shall be provided by the same manufacturer.
 - .2 The flow indicating transmitter shall be suitable, in all respects, for use with specified application.
 - .3 The flow indicating transmitter shall be suitable for use with the specified flow and accuracy. Supplier to verify sizing based parameters listed in this specification.
- .2 Applicable Equipment: FIT 105, FIT 115, FIT 125, FIT 135
 - .1 Liquid Type:
 - .1 FIT 105, FIT 115, FIT 125, FIT 135: Raw Water.
 - .2 Size:
 - .1 FIT 105: 300 mm.
 - .2 FIT 115: 150 mm.
 - .3 FIT 125: 300 mm.
 - .4 FIT 135: 150 mm.

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- .3 Location:
 - .1 FIT 105: Regional.
 - .2 FIT 115: Wells 14,15.
 - .3 FIT 125: West Wells Field.
 - .4 FIT 135: Well 6.
- .4 Acceptable Supplier:
 - .1 Endress & Hauser
- .5 Operating Conditions:
 - .1 Temperature: 1 to 25 °C
 - .2 Flow Rates:
 - .1 FIT 105: Max: 231 L/s, Normal: 100 L/s, Min: 11 L/s
 - .2 FIT 115: Max: 30 L/s, Normal: 15 L/s, Min: 8 L/s
 - .3 FIT 125: Max: 100 L/s, Normal: 60 L/s, Min: 30 L/s
 - .4 FIT 135: Max: 30 L/s, Normal: 15 L/s, Min: 8 L/s
 - .3 Operating Pressure:
 - .1 FIT 105: 60 kPag
 - .2 FIT 115: 60 kPag
 - .3 FIT 125: 60 kPag
 - .4 FIT 135: 60 kPag
- .6 Transducer:
 - .1 Pressure Rating: 1500 kPa
 - .2 Body Material: Carbon Steel.
 - .3 Mounting: ANSI 150 Flange
 - .4 Liner material: Polyurethane.
 - .5 Electrode: 316 Stainless Steel.
 - .6 Grounding Rings: Required in non-metallic or metallic coated piping.
 - .7 Meter to provide full stated accuracy with zero diameter straight lengths of pipe upstream and downstream.
- .7 Bidirectional Capability:
 - .1 FIT 105, FIT 115, FIT 125, FIT 135: No
- .8 Transmitter:
 - .1 Output: 4-20 mA
 - .2 Power: 24 VDC
 - .3 Accuracy: 0.5% of full span.
 - .4 Mounting:
 - .1 FIT 105, FIT 115, FIT 125, FIT 135: Integral
 - .5 Output meter scale: LCD
 - .6 Calibration Range:
 - .1 FIT 105: 0 to 240 L/s
 - .2 FIT 115: 0 to 40 L/s
 - .3 FIT 125: 0 to 110 L/s
 - .4 FIT 135: 0 to 40 L/s
 - .7 Flow Rate Units: liters/sec

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- .8 Totalizer Units: cubic meters
- .9 Communications: HART
- .9 Accessories:
 - .1 Flanged 10S stainless steel spool for meter run to be installed in the event the meter needs to be removed from service.
 - .2 Factory supplied stainless steel tag.
 - .3 PC configuration software for instrument setup
 - .4 Cabling required for remote indicators and totalizers.
 - .5 Grounding Rings as per manufacturer's recommendations

2.3 FLOAT LEVEL SWITCHES

- .1 Applicable Equipment: LSH 161, LSHH 162.
- .2 Liquid Type:
 - .1 LSH 161: Raw Water.
 - .2 LSHH 162: Raw Water.
- .3 Location:
 - .1 LSH 161: Floor Sump.
 - .2 LSHH 162: Floor Sump.
- .4 Specified Equipment LSH 161, LSHH 162:
 - .1 Manufacturer: Flygt or equivalent.
 - .2 Model: ENH-10.
 - .3 Type: Liquid level regulator.
 - .4 Output: to PLC.
- .5 Accessories:
 - .1 Appropriately sized weights as required.
 - .2 Cable as required.
- .6 Mounting: As per manufacturer's requirements.

2.4 TURBIDIMETER/pH ANALYZER

- .1 Applicable Equipment: AIT/AE 108, AIT/AE 148
 - .1 Liquid Type: Raw Water
 - .2 Location:

PROCESS MEASUREMENT DEVICES

AIT/AE 108: Line Sampler
AIT/AE 148: Combined Inlet Header

- .3 Specified Equipment:
- .1 Manufacturer: Hach
 - .2 Model: DPMP-TUPHD
 - .3 Type: Dual Parameter Monitoring Panel for Turbidity and pH
 - .4 Turbidity Type: Laser
 - .5 Turbidity Range: 0-700 NTU
 - .5 pH Range: 2.0-14.0
 - .6 Sample Flow Required: 200 –750 ml/minute
 - .9 Outputs: Three selectable 4-20 mA outputs for turbidity, pH, temperature.
 - .11 Power: 120 VAC, 60 Hz
 - .12 Sample Inlet Fitting: ¼" NPT female
 - .13 Drain Fitting: ½" NPT female
 - .14 Enclosures: Nema-4X
 - .15 Accessories:
 - .1 Automatic cleaning module for turbidity sensor.
 - .2 Provide piping from the turbidimeter as required by the manufacturer to allow for calibration of the unit. Pipe drain water from analyzer to floor funnel and pipe floor funnel to floor drain and to sump.
 - .3 Operational Manual
 - .4 Provide ball valve, needle type flow control valve and flow indicator on inlet side of each turbidimeter in order to limit flow through the unit.
 - .5 Sample port on piping to sensors.
 - .6 pH standard cell solution pH 7.0 500mL
 - .7 Turbidity standards kit 10 NTU, 20 NTU, 600 NTU
 - .8 PC configuration software for instrument setup
 - .9 Provide 10 PSI pressure regulator for each turbidimeter.
 - .16 Commissioning: Contractor to arrange for the services of the equipment manufacturers technical representative to come to site and commission the turbidity analyzers.

2.5 PRESSURE INDICATORS

- .1 Applicable Equipment: PG 100, PG 110, PG 120, PG 130, PG 143
- .1 Liquid Type: Raw Water
 - .2 Location:
 - .1 PG 100: Regional Supply Line
 - .2 PG 110: Wells 14,15 Supply Line
 - .3 PG 120: West Well Field Supply Line
 - .4 PG 130: Well 6 Supply Line
 - .5 PG 143: Combined Header
 - .3 Required Pressure Range:
 - .1 0 to 200 kPag: PG 100, PG 110, PG 120, PG 130, PG 143

PROCESS MEASUREMENT DEVICES

- .4 Specified Equipment:
 - .1 Manufacturer: Ashcroft or approved equivalent
 - .2 Model: 63-1008AL-02L
 - .3 Accuracy: 1% of span
 - .4 Dial Size: 63 mm (2.5") or larger
 - .5 Case: 304 Stainless Steel
 - .6 Fill Fluid: Glycerin
 - .7 Ring: 304 Stainless Steel
 - .8 Window: Polycarbonate
 - .9 Dial: Black figures on white background
 - .10 Display Units: kPa and PSI
 - .11 Pointer: Black, aluminum
 - .12 Bourdon Tube: "C" shaped bronze
 - .13 Operating Temperature: -7 C to 65 C
 - .14 Connections: 13 mm NPT lower mount connection
 - .15 Accessories:
 - .1 Gauges to come with stainless steel body, TFE seat and seal, SS ball and stem, screwed ball valve.
 - .2 All connections as required.
- .5 Approved alternative: WIKA

2.6 MOTOR OPERATED ACTUATORS FOR MODULATING VALVES

- .1 Applicable Equipment: FCV 107
 - .1 For valves to be actuated, refer to valve specification.
 - .2 Location:
 - .1 FCV 015: Regional Supply
 - .3 Specified Equipment:
 - .1 Manufacturer: Bray
 - .2 Model: Series 70
 - .3 Type: Quarter Turn
 - .4 Output Torque: Suitable for specified valve
 - .5 Power: 120VAC single phase
 - .6 Enclosure: NEMA 4
 - .7 Manual Handwheel: Required – Handwheel engagement to disable remote control
 - .8 Local Position Indicator: Required
 - .9 Control Input: 24VDC mA
 - .10 Feedback1: 24VDC mA indicating valve position
 - .11 Feedback2: Dry contact providing local/remote operation (handwheel disengaged/engaged)

2.7 SOLENOID VALVES

- .1 Applicable Equipment: FV 106, FV 116, FV 126, FV 136

PROCESS MEASUREMENT DEVICES

- .1 Liquid Type: Raw Water
- .2 Operating Pressure: 60 kPag
- .3 Operating Flow: 1 L/min
- .4 Location:
 - .1 FV 106: Regional Supply
 - .2 FV 116: Wells 14,15 Supply
 - .3 FV 126: West Well Field Supply
 - .4 FV 136: Well 6 Supply
- .5 Specified Equipment:
 - .1 Manufacturer: Asco or approved equivalent
 - .2 Model:
 - .3 Type: 2 way Direct Acting
 - .4 Operation: Normally Closed
 - .5 Minimum Pressure Differential: 0 psi
 - .6 Process Connection: ½" NPT
 - .7 Valve Body Material: Stainless Steel
 - .8 Power: 24VDC
 - .9 Enclosure: NEMA 4
 - .10 Electrical Conduit Connection: ½" NPT

3. EXECUTION

3.1 INSTALLATION

- .1 The Contractor to be responsible for the correct installation and assemble of all items of equipment. Manufacturer's instructions to be carefully read and rigidly adhered to in the installation.
- .2 Any damage resulting from failure to observe the installation instruction or as a result of proceeding without sufficient knowledge of proper installations techniques will be the Contractor's responsibility.
- .3 Mounting of Instruments & Accessories:
 - .1 Instruments to be installed in accordance with the drawings. Instruments shall be rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping and electrical work.
 - .2 Instruments not to be installed until heavy construction work adjacent to the instruments has been completed.
 - .3 Instruments devices, including accessories, to be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments to face toward and within reading distance of a normal operating area.

PROCESS MEASUREMENT DEVICES

- .4 Sufficient clearance to be allowed for removal of equipment for maintenance and repair.
- .5 Field located instruments to be mounted on building columns and walls or pipe stands and/or other means of support as required in accordance with manufacturer's instructions and the Contract Drawings.

3.2 TESTING, ADJUSTING AND COMMISSIONING

- .1 Testing, adjusting and commissioning of all instruments shall be in accordance with Section 40 90 00.

END OF SECTION

INSTRUMENTATION FOR PROCESS SYSTEMS

1.0 GENERAL

1.1 Description:

1.1.1 Section 40 70 00 refers to those portions of the work that are unique to the installation of process system instrumentation not defined in Division 26 or elsewhere. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.1.2 All details not specifically covered in this Section to comply with respective AWWA, ASTM, or CSA standards and/or manuals of practice as specified in Contract Documents.

1.2 Reference Sections:

1.2.1 Division 26: Electrical

1.2.2 Division 40: Process Interconnections

1.2.3 Division 43: Process Gas and Liquid Handling Equipment

1.2.4 Division 46: Water and Wastewater Process Equipment

1.3 Reference Standards:

1.3.1 Instrument Systems and Automation Society, ISA-S50.1, current edition, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

1.3.2 ISA Standard S20: Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

1.3.3 ISA Standard S20: Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

1.3.4 Underwriter Laboratories, UL508, Standards for Industrial Control Equipment.

1.3.5 National Electrical Manufacturers Association (NEMA), Pub. No. ICS-6, enclosures for industrial controls and systems.

1.3.6 Canadian Standards Association (CSA).

1.3.7 Canadian Electrical Code (CEC)

1.3.8 International Electrotechnical Commission Standardized, International (or Ingress) Protection Code (IP Code).

1.4 Shop Drawings

1.4.1 Submit shop drawings indicating:

INSTRUMENTATION FOR PROCESS SYSTEMS

- a) Complete part number and nomenclature
- b) Dimensional information, dimensional drawing, process and conduit connections.
- c) Options selected and factory ordering codes.
- d) Instrument performance specifications and factory setpoints.
- e) Operation and maintenance manuals.
- f) Electrical, control and wiring information, including area class rating
- g) Installation and maintenance requirements.
- h) Enclosure ratings, voltage, amperage, wattage. Provide proof of CSA certification.
- i) Instrument factor cable lengths, control panel size and design.

1.5 Requirements

- 1.5.1 To provide all components, hardware, software, labour and necessary services to provide fully functional instrumentation systems. Supply all items and accessories specified by the drawings or the specifications in the quality and quantity required.
- 1.5.2 The Contractor shall be ultimately responsible and shall provide for the supply, installation, certification, adjustment, calibration, tuning and commissioning of complete, functional instrumentation components and instrumentation communication systems.
 - a) Where noted below, material shall be supplied by electrical contractor and shall be installed into the process by mechanical contractor

1.6 Quality Assurance

- 1.6.1 Provide instrumentation of rugged construction designed for the site conditions. Provide only new, standard, first-grade materials throughout, conforming to standards established by Underwriter's Laboratories (cUL), Inc., CSA approved and so marked or labelled, together with manufacturer's brand or trademark.
- 1.6.2 Provide material and equipment in accordance with applicable codes and standards, except as modified by the specifications.
- 1.6.3 Use single source manufacturer for each instrument type. Use the same manufacturer for different instrument types whenever possible.

INSTRUMENTATION FOR PROCESS SYSTEMS

- 1.6.4 Coordinate instrumentation to assure proper interface and system integration. Provide signal processing equipment, to include, but not be limited to, process sensing and measurement, transducers, signal converters, conditioners, transmitters, receivers and power supplies.
- 1.7 Delivery, Storage and Handling
 - 1.7.1 Provide and securely attach the tag number and instructions for proper field handling and installation to each instrument prior to packaging.
 - 1.7.2 Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.
 - 1.7.3 Include a shipping label which contains the following information:
 - a) Tag number and description.
 - b) Instructions for unloading, transporting, storing and handling at the site.
- 1.8 Warranty and Guarantees:
 - 1.8.1 The Contractor shall be responsible for providing and honouring issues that fall within the manufacturer equipment warranty and performance, as specified herein.
 - 1.8.2 Supply, install, commission, and provide a two-year warranty for all instrumentation, equipment, component subsystems and appurtenances specified in this and other sections of the specifications.
 - 1.8.3 Providing the proposed equipment is installed in accordance with the instructions contained in the Manufacturer's installation manual, the Contractor shall replace or repair all components that fail or become defective. The Contractor shall be liable for the direct labour and material cost of such repair or replacement issues that fall under the warranty.
 - 1.8.4 All instruments to have a manufacturer warranty as defined in Division 01.

2.0 PRODUCTS

- 2.1 General
 - 2.1.1 Design Criteria
 - a) Provide instruments with conformably coated printed circuit boards if available from the listed manufacturers in order to prevent damage by dust, moisture, fungus and airborne contaminants.

INSTRUMENTATION FOR PROCESS SYSTEMS

- b) Provide instruments complete with mounting hardware, supports, anchors, and wall brackets as required by the manufacturer.
- c) Provide instrument enclosures NEMA/EEMAC or IP rated for the environment. In hazardous areas, meet the Area and zone rating as shown or specified. In areas subject to flooding, provide submergence rated enclosures.
- d) Provide each instrument with a stainless-steel tag with easy to read lettering identifying the individual tag number as identified on the Drawings.

2.2 Flow Meter & Transmitter (Pump Discharge Header – Magnetic)

2.2.1 Acceptable Manufacturer

- a) Use Endress and Hauser Promag W400 or approved equal

2.2.2 Design Criteria

- a) Flow Meter Type: Electromagnetic
- b) Ensure flow meter sizing is within manufacturer velocity guidelines for optimal accuracy. Meter shall provide optimal flow measurement accuracy with velocities down to the 0.20 to 0.30m/sec range.
- c) Commodity Details:
 - (i) Type: Raw Water
 - (ii) Temperature Range: 1 to 40°C
 - (iii) Conductivity: 100 to 8000 µS/cm
 - (iv) pH Range: 7.0 to 8.5
- d) Operating Flow Rate:

Flow Meter	FE-010/020	FE-185/285	FE-165
Minimum flow rate:	11 L/s	60 L/s	11 L/s
Normal flow rate:	100 L/s	115 L/s	100 L/s
Maximum flow rate:	231 L/s	150 L/s	231 L/s
Meter size:	200mm	250mm	200mm
Operating Pressure:	60kPag	160kPag	1000kPag
Design Pressure:	1035kPag	1035kPag	1500kPag

- e) Flow Range Factory Calibration: 0 (4mA) to 150 L/sec (20mA)
- f) Units of Measurement: L/sec and m³/sec

INSTRUMENTATION FOR PROCESS SYSTEMS

- g) Units of Totalization: L and m³
- h) Accuracy: $\pm 0.5\%$
- i) Flanges: ANSI/ASME Class 150
- j) Electrode Type: Stainless Steel
- k) Liner Material: Polyurethane
- l) Tag: Provide factory supplied SS tag
- m) Provide flanged 10S stainless steel spool for meter run (including upstream and downstream obstruction-free distances) to be installed in the event the meter needs to be removed from service.

2.2.3 Electrical and Controls

- a) System to include factory supplied grounding rings.
- b) Transmitter system to include operator interface HMI c/w LCD display.
- c) Output: Analog 4 to 20mA.
- d) Secondary Communication: HART
- e) Power source: 24VDC. See electrical for wiring, conduit and junction layout.
- f) Enclosure shall be rated to IP68 for temporary submergence.
- g) Rated for Class 1 Zone 2 Group D
- h) Flow meter shall be CSA certified.

2.3 Level Bulbs (Wet Well and Groundwater Manhole- Suspended Cable Type)

- Material to be supplied by electrical contractor, mechanical contractor to install

2.3.1 Acceptable Manufacturer

- a) Use Flygt (Xylem) model ENM-10 or approved equal for raw sewage applications.

2.3.2 Design Criteria

- a) All bulb body and cable materials shall be suitable for the intended application and with municipal wastewater. Use polypropylene body c/w PVC cables.
- b) Regulator length to be sized for process commodity with SG of 1.0 (minimum).

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- c) Provide stainless steel mounting hardware and hangers to provide easily adjusted set points for cable suspended bulbs. See Drawings for initial level setpoints.
- d) Level bulbs to be provided with 316 stainless steel sway rings and installed in accordance with manufacturer's recommendations.
- e) Selection of bulb length shall ensure no actuation interference between adjacent bulbs or structures.

2.3.3 Electrical and Controls

- a) Provide factory supplied cables suitable for proposed instrument depth and junction locations. See electrical for details. Shop drawings shall clearly indicate manufacturer cable lengths.
- b) Power Source: 24VDC. See electrical for wiring, conduit and junction layout.
- c) Switches shall be 3-wire, NO and NC
- d) All bulbs and cables within wet wells shall have an IP68 enclosure
- e) All level switches shall be CSA certified.

2.4 Level Bulbs (Chemical – Suspended Cable Type):

2.4.1 Acceptable Manufacturer Dwyer CFS or approved equal for compatibility with sodium hypochlorite.

2.4.2 Design Criteria

- (b) All float body and cable materials shall be suitable for the intended application. Use polypropylene body c/w PVC cables.
- (c) Regulator length to be sized for process commodity with SG of 1.0.
- (d) Provide plastic mounting hardware and brackets. See *Drawings* for level setpoints.

2.4.3 Electrical and Controls

- (a) Provide factory supplied cables suitable for proposed instrument depth and junction locations. See electrical for details. Shop drawings shall clearly indicate manufacturer cable lengths.
- (b) All floats shall be rated for 24VDC. See electrical for wiring, conduit and junction layout.

INSTRUMENTATION FOR PROCESS SYSTEMS

- (c) All floats and cables within tanks shall have enclosures rated for continuous submergence in sodium hypochlorite.
- (d) All float switches shall be CSA certified.

2.5 Level Measurement (Wet Well - Radar):

- Material to be supplied by electrical contractor, mechanical contractor to install

2.5.1 Acceptable Manufacturer / Qualifications

- (e) Vega Vegamet 341 controller with C23 sensor approved equal.
- (f) Other acceptable manufacturers include Miltronics,

2.5.2 Design Criteria

- (a) Provide suspended type level sensor for radar level measurement.
- (b) Provide hermetically welded PVDF sensor, weather resistant and flood-proof (IP68).
- (c) Accuracy distance measurement shall be +/- 2mm +0.17% with resolution distance of 1mm.
- (d) Minimum required clearances for sensor location to be confirmed with manufacturer and provided by *Contractor* during install.
- (e) Provide mounting accessories for cable support as required.

2.5.3 Electrical and Controls

- (a) Power Source: 24VDC. See electrical for wiring, conduit and junction layout.
- (b) Panel mount LCD display to be provided and installed in control panel
- (c) Instrument and assembly to be rated for Class 1, Zone 2 Group 2
- (d) Instrument output signals 4-20 mA (level), discrete signal (transmitter alarm),HART.
- (e) Provide factory cable length sufficient for installation requirement.
- (f) Level transmitter shall be CSA certified.

2.6 Level Measurement (Hydrostatic – Ground Water Manhole)

2.6.1 Acceptable Manufacturer

INSTRUMENTATION FOR PROCESS SYSTEMS

- (a) Endress and Hauser Deltapilot FMB63 with RIA15 indicator for secondary process display installed at the control panel or approved equal.

2.6.2 Design Criteria

- (a) Probe to be 22mm diameter Type 316 stainless steel housing with robust ceramic sensor measuring cells. Install sensor within PVC guide tube for ease of operator access.
- (b) All submerged instrument seals shall be FKM Viton.
- (c) Provide sensor with polyethylene encased cable factory order to the wet well depths as shown on the *Drawings*.
- (d) Provide mounting accessories for cable support as required.
- (e) Ensure the pressure compensation tube is installed per manufacturer recommendations and terminated within the control panel (or alternate location where termination is not prone to freezing temperatures) using a manufacturer-supplied termination kit and gland.

2.6.3 Electrical and Controls

- (a) See *Electrical Drawings* for power requirements and communications routing and junction locations.
- (b) Provide the unit with a remote-mounted transmitter head or process display located in the control cabinet as per the drawings. The display shall be rated for IP66 with a weatherproof enclosure.
- (c) Instrument output signals 4-20 mA (level) and HART secondary communications for instrument status and remote access. See *Electrical Drawings* for wiring and power requirements.
- (d) Accuracy shall be 0.2% of the span. The instrument shall be factory-configured to measure mH₂O and kPa units.
- (e) Provide factory cable length sufficient for installation requirements.
- (f) Instrument shall be CSA rated.

2.7 Level Measurement (Radar for Chemical Tank):

2.7.1 Acceptable Manufacturer / Qualifications

- (a) ProMinent Dulcolevel or approved equal.
- (b) Other acceptable manufacturers include Siemens, Krohne.

INSTRUMENTATION FOR PROCESS SYSTEMS

2.7.2 Design Criteria

- (a) Provide top mounted type level sensor for radar level measurement.
- (b) Provide hermetically welded PVDF sensor, weather resistant and flood-proof (IP68).
- (c) Accuracy distance measurement shall be +/- 2mm +0.17% with resolution distance of 1mm.
- (d) Provide mounting accessories for cable support as required.

2.7.3 Electrical and Controls

- (a) All devices powered by 24VDC and bear CSA certifications. See Electrical Drawings for power and communications routing and junction locations.
- (b) Transmitter to be Class 1, Division 2 rated c/w with IP68 enclosure.
- (c) Instrument output signals 4-20 mA (level), and discrete signal (transmitter alarm).
- (d) Provide factory cable length sufficient for installation requirement.

2.8 Pressure Indicator

2.8.1 Provide inline pressure indicator as per the drawings, suitable for municipal raw water service.

2.8.2 All gauges shall be installed with an isolation ball valve and flushable diaphragm seals.

2.8.3 Acceptable Manufacturer / Qualifications

- (e) Ashcroft, Wika, or approved equal.

2.8.4 Design Criteria

- (f) Gauge shall be Bourdon Tube design. Sensor case, internal components and process connection to be 316 stainless steel. Used 13mm diameter process connection. Gauge window shall be manufactured from safety glass. Gauge face shall have a minimum diameter of 63mm or larger.
- (g) Diaphragm seals shall be stainless steel body c/w flushing ports. Provide manufacture interface fluid suitable for exposure to -40°C without damage.
- (h) Provide gauges suitable for the operating ambient and fluid temperature conditions.

INSTRUMENTATION FOR PROCESS SYSTEMS

- (i) Provide gauges with 1% accuracy full scale or better.
- (j) Gauge unit displays shall be in kPa and PSIG. Span shall be:
 - (A) Pump discharge gauges: 0 to 1500 kPag.
 - (B) Raw water from intake pump station: 0 to 200 kPag.
- (k) Gauges shall be rated:
 - (A) Pump discharge gauges: 2000 kPag.
 - (B) Raw water from intake pump station: 1035 kPag.

2.9 Pressure Transmitter (Pump Discharge Header):

- Material to be supplied by electrical contractor, mechanical contractor to install

2.9.1 Acceptable Manufacturer / Qualifications

- a) Endress and Hauser Cerabar PMC71 Digital transmitter with capacitive sensor and ceramic membrane.
- b) Other acceptable manufacturers include Rosemount, ABB or

2.9.2 Design Criteria

- a) Sensor housing threaded: G1/2...G2, R1/2, MNPT1/2...MNPT2.
- b) Instrument capable of reading up to 1400 kPag, with smallest calibratable span of 0.075psi. Reference accuracy of 0.05% of span.
- c) Provide block and bleed valve on inlet of pressure transmitter, one each for maintenance and calibration.
- d) Provide mounting accessories for cable support.

2.9.3 Electrical and Controls

- a) Power Source: 24VDC. See electrical for wiring, conduit and junction layout.
- b) Transmitter to be rated for dry, indoor installation on interior wall face. See Electrical Drawings for location. Pipe-mount LCD display to be provided.
- (c) Transmitter assembly to be rated for Class 1, Zone 2 Group D.
- c) Instrument output signal 4-20 mA and HART.
- (d) Pressure transmitter shall be CSA certified.

INSTRUMENTATION FOR PROCESS SYSTEMS

2.10 Temperature Transmitter (Room):

- Material to be supplied by electrical contractor, mechanical contractor to install

2.10.1 Acceptable Manufacturer / Qualifications

- a) Sensors to be Endress Hauser TMT142R
- b) Other acceptable manufacturers include Rosemount, ABB or

2.10.2 Design Criteria

- a) Sensor housing threaded: G1/2...G2, R1/2, MNPT1/2...MNPT2.
- b) Instrument capable of reading -50 to 200 Celsius .
- c) Stainless steel and aluminium construction
- d) Provide mounting accessories for cable support.

2.10.3 Electrical and Controls

- a) Power Source: 24VDC. See electrical for wiring, conduit and junction layout.
- (e) Transmitter assembly to be rated for Class 1, Zone 2 Group D.
- b) Instrument output signal 4-20 mA and HART.
- (f) Shall be CSA certified.

2.11 Turbidity, pH & Temperature Analysers (Reagentless Type):

2.11.1 Acceptable Manufacturer / Qualifications

- a) Halogen Systems with controller, or approved equal

2.11.2 Analyzer shall be wall panel mounted, complete with sensors, sensor holders and flow indicator; pre-plumbed / valved and pre-wired.

2.11.3 Analyzer and tubing shall be NSF 61 compliant and certified for potable water applications.

2.11.4 Measurement range shall be 0.001 – 4000 NTU turbidity, 0 to 14 pH, and 0 °C to 40 °C.

2.11.5 The analyzer shall not require a chemical reagent.

2.11.6 The monitor shall provide: backlit LCD display, high and low alarm, 4-20 mA output for recording.

INSTRUMENTATION FOR PROCESS SYSTEMS

- 2.11.7 The sensor shall work on amperometric principle, with membrane covered 2-electrode cell.
- 2.11.8 Provide sample line complete with pressure reducing and isolation valves as shown on the *Contract Drawings*.
- 2.11.9 Route drain line directly to wet well with a sealed connection to prevent outside contamination, as shown on the *Contract Drawings*.
- 2.11.10 Power: 120 VAC, Single Phase, 60 Hz.

3.0 EXECUTION

3.1 Delivery, Storage and Handling

- 3.1.1 Provide and securely attach the tag number and instructions for proper field handling and installation to each instrument prior to packaging.
- 3.1.2 Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.
- 3.1.3 Include a shipping label which contains the following information:
 - 3.1.4 Tag number and description.
 - 3.1.5 Instructions for unloading, transporting, storing and handling at the site.

3.2 Installation

- 3.2.1 Install the instrumentation components as per manufacturer's instructions and provided drawings.
- 3.2.2 If equipment fails to meet the any of the above requirements immediately make the necessary repairs, replacements, modifications and adjustments to ensure equipment functions as intended at no additional cost to Owner.
- 3.2.3 Adjust and calibration instrumentation as necessary ensure components function as intended.

3.3 Calibration

- 3.3.1 Calibrate instrument spans to the required values as Specified in Drawings.

3.4 Functional Testing

- 3.4.1 Testing of all units shall be completed to demonstrate accuracy, functionality and transmittance of data to receiving unit under the supervision of equipment representative and the Engineer.

INSTRUMENTATION FOR PROCESS SYSTEMS

- 3.4.2 The *Contractor* shall allow for services of a qualified equipment representative to carry out setup and testing of all instruments if required.
-

END SECTION 40 70 00

INSTRUMENTATION FOR PROCESS SYSTEMS

1.0 GENERAL

1.1 Description:

1.1.1 Section 40 70 00 refers to those portions of the work that are unique to the installation of process system instrumentation not defined in Division 26 or elsewhere. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.1.2 All details not specifically covered in this Section to comply with respective AWWA, ASTM, or CSA standards and/or manuals of practice as specified in Contract Documents.

1.2 Reference Sections:

1.2.1 Division 26: Electrical

1.2.2 Division 40: Process Interconnections

1.2.3 Division 43: Process Gas and Liquid Handling Equipment

1.2.4 Division 46: Water and Wastewater Process Equipment

1.3 Reference Standards:

1.3.1 Instrument Systems and Automation Society, ISA-S50.1, current edition, Compatibility of Analog Signals for Electronic Industrial Process Instruments.

1.3.2 ISA Standard S20: Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

1.3.3 ISA Standard S20: Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves.

1.3.4 Underwriter Laboratories, UL508, Standards for Industrial Control Equipment.

1.3.5 National Electrical Manufacturers Association (NEMA), Pub. No. ICS-6, enclosures for industrial controls and systems.

1.3.6 Canadian Standards Association (CSA).

1.3.7 Canadian Electrical Code (CEC)

1.3.8 International Electrotechnical Commission Standardized, International (or Ingress) Protection Code (IP Code).

1.4 Shop Drawings

1.4.1 Submit shop drawings indicating:

INSTRUMENTATION FOR PROCESS SYSTEMS

- a) Complete part number and nomenclature
- b) Dimensional information, dimensional drawing, process and conduit connections.
- c) Options selected and factory ordering codes.
- d) Instrument performance specifications and factory setpoints.
- e) Operation and maintenance manuals.
- f) Electrical, control and wiring information, including area class rating
- g) Installation and maintenance requirements.
- h) Enclosure ratings, voltage, amperage, wattage. Provide proof of CSA certification.
- i) Instrument factor cable lengths, control panel size and design.

1.5 Requirements

- 1.5.1 To provide all components, hardware, software, labour and necessary services to provide fully functional instrumentation systems. Supply all items and accessories specified by the drawings or the specifications in the quality and quantity required.
- 1.5.2 The Contractor shall be ultimately responsible and shall provide for the supply, installation, certification, adjustment, calibration, tuning and commissioning of complete, functional instrumentation components and instrumentation communication systems.
 - a) Where noted below, material shall be supplied by electrical contractor and shall be installed into the process by mechanical contractor

1.6 Quality Assurance

- 1.6.1 Provide instrumentation of rugged construction designed for the site conditions. Provide only new, standard, first-grade materials throughout, conforming to standards established by Underwriter's Laboratories (cUL), Inc., CSA approved and so marked or labelled, together with manufacturer's brand or trademark.
- 1.6.2 Provide material and equipment in accordance with applicable codes and standards, except as modified by the specifications.
- 1.6.3 Use single source manufacturer for each instrument type. Use the same manufacturer for different instrument types whenever possible.

INSTRUMENTATION FOR PROCESS SYSTEMS

- 1.6.4 Coordinate instrumentation to assure proper interface and system integration. Provide signal processing equipment, to include, but not be limited to, process sensing and measurement, transducers, signal converters, conditioners, transmitters, receivers and power supplies.
- 1.7 Delivery, Storage and Handling
 - 1.7.1 Provide and securely attach the tag number and instructions for proper field handling and installation to each instrument prior to packaging.
 - 1.7.2 Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.
 - 1.7.3 Include a shipping label which contains the following information:
 - a) Tag number and description.
 - b) Instructions for unloading, transporting, storing and handling at the site.
- 1.8 Warranty and Guarantees:
 - 1.8.1 The Contractor shall be responsible for providing and honouring issues that fall within the manufacturer equipment warranty and performance, as specified herein.
 - 1.8.2 Supply, install, commission, and provide a two-year warranty for all instrumentation, equipment, component subsystems and appurtenances specified in this and other sections of the specifications.
 - 1.8.3 Providing the proposed equipment is installed in accordance with the instructions contained in the Manufacturer's installation manual, the Contractor shall replace or repair all components that fail or become defective. The Contractor shall be liable for the direct labour and material cost of such repair or replacement issues that fall under the warranty.
 - 1.8.4 All instruments to have a manufacturer warranty as defined in Division 01.

2.0 PRODUCTS

- 2.1 General
 - 2.1.1 Design Criteria
 - a) Provide instruments with conformably coated printed circuit boards if available from the listed manufacturers in order to prevent damage by dust, moisture, fungus and airborne contaminants.

INSTRUMENTATION FOR PROCESS SYSTEMS

- b) Provide instruments complete with mounting hardware, supports, anchors, and wall brackets as required by the manufacturer.
- c) Provide instrument enclosures NEMA/EEMAC or IP rated for the environment. In hazardous areas, meet the Area and zone rating as shown or specified. In areas subject to flooding, provide submergence rated enclosures.
- d) Provide each instrument with a stainless-steel tag with easy to read lettering identifying the individual tag number as identified on the Drawings.

2.2 Flow Meter & Transmitter (Pump Discharge Header – Magnetic)

2.2.1 Acceptable Manufacturer

- a) Use Endress and Hauser Promag W400 or approved equal

2.2.2 Design Criteria

- a) Flow Meter Type: Electromagnetic
- b) Ensure flow meter sizing is within manufacturer velocity guidelines for optimal accuracy. Meter shall provide optimal flow measurement accuracy with velocities down to the 0.20 to 0.30m/sec range.
- c) FE-1005 shall be type of Option C – Fixed flange, constricted measuring tube, 0xDN inlet/outlet runs.

Other meters shall be type of Option I – Fixed flange, 0xDN inlet/outlet runs.
- d) Commodity Details:
 - (i) Type: Raw Water
 - (ii) Temperature Range: 1 to 40°C
 - (iii) Conductivity: 100 to 8000 µS/cm
 - (iv) pH Range: 7.0 to 8.5
- e) Operating Flow Rate:

Flow Meter	FE-1005	FE-1015	FE-1025	FE-1035
Minimum flow rate:	11 L/s	8 L/s	30 L/s	8 L/s
Normal flow rate:	100 L/s	15 L/s	60 L/s	15 L/s
Maximum flow rate:	231 L/s	30 L/s	100 L/s	30 L/s
Meter size:	300mm	150mm	300mm	150mm
Operating Pressure:	60kPag	60kPag	60kPag	60kPag
Design Pressure:	1035kPag	1035kPag	1035kPag	1035kPag

INSTRUMENTATION FOR PROCESS SYSTEMS

- f) Flow Range Factory Calibration: 0 (4mA) to 150 L/sec (20mA)
- g) Units of Measurement: L/sec and m³/sec
- h) Units of Totalization: L and m³
- i) Accuracy: $\pm 0.5\%$
- j) Flanges: ANSI/ASME Class 150
- k) Electrode Type: Stainless Steel
- l) Liner Material: Polyurethane
- m) Tag: Provide factory supplied SS tag
- n) Provide flanged 10S stainless steel spool for meter run (including upstream and downstream obstruction-free distances) to be installed in the event the meter needs to be removed from service.

2.2.3 Electrical and Controls

- a) System to include factory supplied grounding rings.
- b) Transmitter system to include operator interface HMI c/w LCD display.
- c) Output: Analog 4 to 20mA.
- d) Secondary Communication: HART
- e) Power source: 24VDC. See electrical for wiring, conduit and junction layout.
- f) Enclosure shall be rated to IP68 for temporary submergence.
- g) Rated for Class 1 Zone 2 Group D
- h) Flow meter shall be CSA certified.

2.3 Pressure Indicator

- 2.3.1 Provide inline pressure indicators as per the drawings, suitable for municipal raw water service.
- 2.3.2 All gauges shall be installed with an isolation ball valve and flushable diaphragm seals.
- 2.3.3 Acceptable Manufacturer / Qualifications
 - (a) Ashcroft, Wika, or approved equal.
- 2.3.4 Design Criteria

INSTRUMENTATION FOR PROCESS SYSTEMS

- (b) Gauge shall be Bourdon Tube design. Sensor case, internal components and process connection to be 316 stainless steel. Used 13mm diameter process connection. Gauge window shall be manufactured from safety glass. Gauge face shall have a minimum diameter of 63mm or larger.
- (c) Diaphragm seals shall be stainless steel body c/w flushing ports. Provide manufacture interface fluid suitable for exposure to -40°C without damage.
- (d) Provide gauges suitable for the operating ambient and fluid temperature conditions.
- (e) Provide gauges with 1% accuracy full scale or better.
- (f) Gauge unit displays shall be in kPa and PSIG. Span shall be 0 to 200 kPag.
- (g) Gauges shall be rated: for a minimum of 1035 kPag pressure.

2.4 Turbidity, pH & Temperature Analysers (Reagentless Type):

2.4.1 Acceptable Manufacturer / Qualifications

- a) Halogen Systems with controller, or approved equal

2.4.2 Analyzer shall be wall panel mounted, complete with sensors, sensor holders and flow indicator; pre-plumbed / valved and pre-wired.

2.4.3 Analyzer and tubing shall be NSF 61 compliant and certified for potable water applications.

2.4.4 Measurement range shall be 0.001 – 4000 NTU turbidity, 0 to 14 pH, and 0 °C to 40 °C.

2.4.5 The analyzer shall not require a chemical reagent.

2.4.6 The monitor shall provide: backlit LCD display, high and low alarm, 4-20 mA output for recording.

2.4.7 The sensor shall work on amperometric principle, with membrane covered 2-electrode cell.

2.4.8 Provide sample line complete with pressure reducing and isolation valves as shown on the *Contract Drawings*.

2.4.9 Route drain line directly to sump, as shown on the *Contract Drawings*.

2.4.10 Power: 120 VAC, Single Phase, 60 Hz.

INSTRUMENTATION FOR PROCESS SYSTEMS

3.0 EXECUTION

3.1 Delivery, Storage and Handling

- 3.1.1 Provide and securely attach the tag number and instructions for proper field handling and installation to each instrument prior to packaging.
- 3.1.2 Package instrumentation to provide protection against shipping damage, dust, moisture and atmospheric contaminants.
- 3.1.3 Include a shipping label which contains the following information:
- 3.1.4 Tag number and description.
- 3.1.5 Instructions for unloading, transporting, storing and handling at the site.

3.2 Installation

- 3.2.1 Install the instrumentation components as per manufacturer's instructions and provided drawings.
- 3.2.2 If equipment fails to meet the any of the above requirements immediately make the necessary repairs, replacements, modifications and adjustments to ensure equipment functions as intended at no additional cost to Owner.
- 3.2.3 Adjust and calibration instrumentation as necessary ensure components function as intended.

3.3 Calibration

- 3.3.1 Calibrate instrument spans to the required values as Specified in Drawings.

3.4 Functional Testing

- 3.4.1 Testing of all units shall be completed to demonstrate accuracy, functionality and transmittance of data to receiving unit under the supervision of equipment representative and the Engineer.
- 3.4.2 The *Contractor* shall allow for services of a qualified equipment representative to carry out setup and testing of all instruments if required.

END SECTION 40 70 00

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

1. GENERAL

1.1 RELATED SECTIONS

- .1 Basic Electrical Requirements: Section 26 05 00.

1.2 ABBREVIATIONS

- | | | |
|----|----------|---|
| .1 | ETL | Electronic Testing Laboratories |
| .2 | IDC | Insulation Displacement Connectors |
| .3 | UTP | Unshielded Twisted Pair |
| .4 | NEXT | Near End Crosstalk |
| .5 | ELFEXT | Equal Level Far End Crosstalk |
| .6 | PSNEXT | Power Sum Near End Crosstalk |
| .7 | PSELFEXT | Power Sum Equal Level Far End Crosstalk |

1.3 INSTALLER QUALIFICATIONS

- .1 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project.

1.4 SCOPE

- .1 System to be complete with all data and voice outlets, patch panels, patch cords, wire and cable required to from a complete system.
- .2 Install cable in raceway in all locations.

1.5 STANDARDS

- .1 Comply with the following standards:
- | | |
|----|---------------------------------|
| .1 | TIA/EIA 568-B1, B2 and B3 |
| .2 | TIA/EIA TSB-67, 72 and 75 |
| .3 | ANSI/TIA/EIA 568a-1, 2, 3, 4, 5 |
| .4 | TIA/EIA/IS 729 |
| .5 | BICSI |

1.6 SYSTEM DESCRIPTION

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fibre cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
- | | |
|----|---|
| .1 | Horizontal cables link work areas to telecommunications room located on same floor. |
| .2 | Telecommunications rooms linked to main terminal/equipment room (MT/ER) by backbone cables. |
| .3 | MT/ER also linked to Entrance Room by backbone cables. |

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

1.7 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00.
- .2 As-built Records and Drawings:
 - .1 Provide database reflecting cable installation and cross-connections.
 - .2 Provide as-built markups of drawings depicting all construction.

2. PRODUCTS

2.1 SHORT HAUL OR HORIZONTAL CABLING

- .1 UTP: to CAN/CSA T529-M95 and TIA/EIA 568 - B1, B2, B3, Category 6.
 - .1 Physical Characteristics:
 - .1 Conductors: four-pair, 24 AWG, thermoplastic insulated, solid copper wire.
 - .2 Twists: pairs variably twisted relative to one another. Minimum 29 twists/m per pair.
 - .3 Cable Size: maximum OD 6.4 mm.
 - .4 Breaking strength: 40.8 kg at temperature of -20°C ±1°C without jacket or insulation cracking.
 - .5 Colour coding of pairs: tracer coloured white paired with each of blue, orange, green and brown.
 - .6 Fire Rating: plenum-rated overall jacket, CSA FT-4 compliant.
 - .2 Transmission Characteristics: to EIA/TIA TSB 36-1991.
 - .1 DC resistance: less than 94 ohms/km, with an unbalance between conductors in a pair of 5% maximum.
 - .2 Mutual Capacitance of any one pair: maximum of 17 nF/305 m @ 1 MHz.
 - .3 Characteristic Impedance 1-100 MHz: 100 ohms ±15%.
 - .4 Maximum values for attenuation, loss and crosstalk, worst pair at 20°C:

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

Frequency (MHz)	AttenuationdB/100 0ft	NEXT Loss Pr-pr dB	PS NEXT Loss dB	ELFEXT pr-pr dB	PSELFEXT dB
1	2.5	76.0	53.0	57.4	54.4
4	4.5	53.6	50.6	45.3	42.2
8	6.3	50.0	45.6	39.3	36.3
10	7.0	47.0	44.0	37.4	34.4
16	9.2	43.6	40.6	33.3	30.3
20	10.3	42.0	39.0	31.4	27.4
25	11.4	40.4	37.4	29.4	26.4
31.25	12.8	38.7	35.5	27.5	24.5
62.5	18.5	33.6	30.6	21.5	18.5
100	24.0	30.1	27.1	17.4	14.4

2.2 LONG HAUL OR RISER CABLING

.1 Fiber Optic Cable Riser:

.1 Fiber Optic Cable: to CAN/CSA T529-M95.

.1 Physical Description:

- .1 Conductors: As shown on drawings.
- .2 Continuous operating temperature: -20°C to +80°C.
- .3 Strength member: Aramid.
- .4 Minimum bend radius for installation:
 dual strand – 130 mm
 12 strand – 305 mm
 Minimum bend radius for long term:
 dual strand – 80 mm
 12 strand - 178 mm
- .5 Fire Rating: plenum-rated overall jacket, CSA FT-4 compliant.

.2 Transmission Characteristics:

- .1 Minimum bandwidth: 160 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.
- .2 Maximum attenuation:
 - .1 3.5 dB/km @ 850 nm.
 - .2 1.5 dB/km @ 1300 nm.
 - .3 1.0 dB/km @ 1550 nm.

.2 Quantity: install fibre optic cables as shown on drawings.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

2.3 COMMUNICATIONS OUTLET ASSEMBLIES

- .1 Communications Outlet - Boxes:
 - .1 Double wide box recessed or surface mount box, 63 mm minimum depth.
- .2 Communications Outlet - Housings:
 - .1 Formed Outlet Plate.
 - .2 Accepts minimum of four snap-in or slide-in outlet inserts.
 - .3 Mounts to standard two device opening or mounting ring.
 - .4 Constructed of high-impact fire-retardant thermoplastic.
 - .5 Unused ports to be filled with blank inserts.
- .3 Communication Outlet - Jacks:
 - .1 Copper-Based Inserts: to TIA/EIA 568-B1, B2, B3, Category 6 standards, worst pair:
 - .1 Termination via fixed or removable IDC, AT&T 110, Krone LSA-Plus, or NT BIX IDC's with hinged or separate stuffer cap.
 - .2 If removable IDC type is used, they must meet the following physical specifications:
 - .1 Connection of removable IDC's via 8-position edge connectors plated with minimum 40 microns of nickel. Capable of minimum 250 insertion and withdrawal cycles.
 - .2 Connection of removable IDC's via 8-pin header connector. Maximum 8.9 N engagement force and minimum 2.25 N disengagement force. Pins minimum 1.4 mm square.
 - .2 Modular Outlet - UTP:
 - .1 8-position unkeyed jack for voice and data compatible with 4-pair 100 ohm unshielded twisted pair.
 - .2 Capable of minimum of 200 insertion and withdrawal cycles.
 - .3 Copper-based contacts with 50 to 100 microns of nickel overlay uniformly coated with minimum 50 microns of gold overlay.
 - .4 Minimum contact force 1.1 N per contact. Minimum plug retention force 76 N.
 - .5 Conductors separated and aligned internally by comb structure.
 - .6 Electrical Specification:
 - .1 Contacts:
 - .1 Dielectric strength: 1000 V rms @ 60 Hz.
 - .2 Insulation resistance: 10 megohms, minimum.
 - .3 Contact resistance: 0.02 ohms, maximum.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .4 Current rating: 1.5 amps, maximum.
- .2 Insulation Displacement Connectors:
 - .1 Voltage Rating: 250 VAC.
 - .2 Current Rating: 5 amps.
 - .3 Resistance: 0.02 ohms maximum.
 - .4 Dielectric Withstanding: 2000 VAC for 60 sec.
 - .5 Insulation Resistance: 500 megohms minimum.
- .7 Rated for data transmission up to 100 MHz.
- .8 Wire configuration to T568A pair assignment.

2.4 HARDWARE

- .1 Provide all components of a particular type of the same manufacture. (for example: all rack components shall be of common manufacture).
- .2 Rack: Free-standing cabinet rack:
 - .1 Body fabricated of 2.5 mm minimum metal,
 - .2 Equipment mounting rails minimum 2.0 mm metal
 - .3 Designed to accept EIA standard 483 mm wide panels. Drilled and tapped for No 10 screws for vertical panel of 2134 mm in increments of 44.5 mm
 - .4 Grounding provision.
 - .5 Full height vertical wire management on both sides minimum 152mm x 152mm.
 - .6 Colour ASA 61 grey.
- .3 Wall Mounting:
 - .1 Backboard for Equipment:
 - .1 Backboard: If backboard does not already exist in equipment room use Poplar plywood, G1S, 1200mm x 1200mm x 19mm thick. Painted gray on front and all edges, prime coat back.
 - .2 Components indicated for wall mounting shall be low profile and mounted so as to minimize any protrusion into the equipment room.
- .4 UTP Patch Panels: supply all hardware from the same manufacturer.
 - .1 Ports: same type as corresponding outlets Ports/Panel: maximum quantity 48.
 - .2 Physical, Electrical, Transmission Properties: not less than specified for outlets, Category 5 enhanced, worst pair.
 - .3 Horizontal cable management minimum 90 mm high.
 - .4 Grounding lug hardware kit.
 - .5 Panel:

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .1 Width 483 mm.
 - .2 Multiple of EIA standard module height of 44.45 mm.
 - .3 EIA mounting hole spacing.
 - .4 Rack mountable
- .6 Panel Height: 178 mm maximum
- .7 Material: metal of the following minimum thickness:
 - .1 3 mm flat anodized aluminum.
 - .2 1.65 mm formed aluminum.
 - .3 1.9 mm flat steel.
 - .4 1.5 mm formed steel.
- .5 Fibre Optic Cable Patch Panels
 - .1 Fibre interconnect center wall or rack mounted, low profile, modular design. Rack mount to be used in central equipment room, Wall mount to be used in remote equipment rooms.
 - .2 Ports: as required.
 - .3 Connectors: feed through type SC.
 - .4 Cable management and slack storage designed to accommodate fibre optic cable bend radius.
 - .5 Lockable doors or covers for cable termination and patch compartments.
 - .6 Anchor points for strain relief of fiber cable entry.
 - .7 Grounding provisions.

2.5 PATCH CABLES

- .1 UTP Type:
 - .1 Patch Cables to match installed cable's transmission and electrical specifications.
 - .2 Fire Rating: plenum rated overall jacket, CSA FT-4 compliant.
 - .3 Modular Connectors:
 - .1 Matching types and minimum specifications as for outlet components.
 - .2 Long body type.
 - .3 Suitable for solid or stranded conductor and wire gauge used.
 - .4 Tool-stuffed or plier-stuffed with IDC contacts and plier-latched cap.
 - .5 Factory manufactured
 - .4 Quantity: Provide one 1 m and one 3 m UTP patch cord for each new cable outlet.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .2 Optical fiber patch cords:
 - .1 Fiber Core and Cladding: identical to installed cable.
 - .2 Transmission Properties: match installed cable's transmission and electrical specifications.
 - .3 Configuration:
 - .1 Dual fiber, single jacket, with breakout assemblies separate SC connectors each end.
 - .2 Single fiber dual cable, separate SC connectors each end.
 - .4 Factory manufactured
 - .5 Quantity: As required plus 10% or 2 (whichever is greater) spares of each length used.
 - .6 Lengths: Use minimum standard length necessary for each location.

2.6 WIREWAYS AND SURFACE RACEWAYS

- .1 Provide slotted PVC raceway on rack sides or on backboard as applicable in equipment rooms.

2.7 IDENTIFICATION MATERIALS

- .1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
 - .1 Size 1: 12 mm high with 5 mm high letters.
- .2 Wire Identification Materials:
 - .1 Machine-printed heat shrink sleeves.

3. EXECUTION

3.1 INSTALLATION

- .1 Cable Installation:
 - .1 Generally install FT4 rated data cable and voice cable using raceway.
 - .2 Install data and voice cable in conduit.
 - .3 Support cable runs independently of ceiling suspension system.
 - .4 Swab raceway system before installing wiring.
 - .5 Do not exceed manufacturer's maximum pulling force.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .6 Maintain not less than minimum bending radius for fiber and copper conductors.
- .7 Install cable along or at right angles to building lines unless impractical to do so. Verify specific cases of deviation in advance.
- .8 Maintain open copper-conductor cable at maximum practical distance from fluorescent ballasts and other EMF - or discharge-generating equipment.
- .9 Ensure that cable is not flattened, squeezed, or crimped at any point along entire run. No splices or intermediate terminations in cable runs except by special permission in advance, with documentation detailing locations and nature of splices.
- .10 Install cables in PVC raceway in telecom room and fan individual cables to applicable patch panels in neat, logical fashion.
- .11 Tie wrap cables neatly into logical bundles.
- .12 Minimum 1 m of slack cable per run.
- .2 Connectors:
 - .1 Use tooling specific to connector types in use.
 - .2 Use connectors suitable for nature of conductor in cable, eg. stranded vs solid copper.
 - .3 Ensure that connectors' strain relief provisions are used. Strip jackets only amount required.
 - .4 Maintain pair twists within 13 mm of termination.
 - .5 UTP Connection Configuration in accordance with EIA/TIA 568A-1991 or CAN/CSA-T529-M95.

Pair	Colour	RJ-45 Pins
1	Blue	4
	White/Blue	5
2	White/Orange	3
	Orange	6
3	White/Green	1
	Green	2
4	White/Brown	7
	Brown	8

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .3 Outlets, Boxes and Fittings:
 - .1 Communications outlet assemblies to be used for work station locations in office areas. For other devices an appropriate plug is to be installed directly on the wire for direct connection to the device.
 - .2 Ensure in advance that outlet box/data outlet installation methods yield vertically-mounted data outlets.
 - .3 Install all outlets flush with finished surfaces unless indicated otherwise on the drawings.
- .4 Cabinets, Enclosures, Racks, Backboards:
 - .1 Install at locations and heights indicated on drawings.
 - .2 Use green insulated 6 AWG ground conductors for grounding racks. Use grounding bushing, solderless lug, clamp, or cup washer and screw.
 - .3 Protect ground conductors from mechanical injury.
 - .4 Install ground conductors such that neither ground conductors nor data cables interfere with one another in regards to future servicing of patch panel rear connections.
- .5 Patch Panels
 - .1 Mount patch panels in order shown on drawings.
 - .2 Ground as required by system.
 - .3 Attach horizontal wiring in an ordered fashion according to the numbers as indicated on the drawings.
 - .4 Mount panels to racks with as many screws as there are mounting holes or slots in panels.
 - .5 Provide and install necessary strain reliefs and cable support brackets, plus trays for cable loop behind panel and install cables utilizing such devices.

3.2 COMMUNICATIONS CABLE AND EQUIPMENT LABELING

- .1 Label communication outlets, panels and ports with size 1 Device Identification Materials.
- .2 Label each of cables with other end's address using Wire Identification Materials.
- .3 Label outlets with labels vertically aligned in each row.
- .4 Position panel labels in the same position on each panel.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .5 Use the naming convention as indicated on the drawings when labeling communications cabling components.

3.3 TESTING

- .1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to Owner. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.
- .2 Copper Media:
 - .1 Test for the following:
 - .1 Continuity.
 - .2 Pair placement and polarity.
 - .3 DC resistance.
 - .4 Characteristics at highest contemplated frequency for data and voice cables:
 - .1 Attenuation.
 - .2 Mutual Capacitance.
 - .3 NEXT, PS NEXT, ELFEXT and PS ELFEXT.
 - .5 Run length.
 - .2 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:
 - .1 Resistance and capacitance readings more than 10% above or below predicted values.
 - .2 NEXT, PS NEXT, ELFEXT or PS ELFEXT values 3dB higher than predicted values.
 - .3 Attenuation values 2dB higher than predicted values.
 - .3 Reconnect or re-install and retest as necessary to correct excessive variations.
- .3 Fiber Optic Media:
 - .1 Ensure that test instrument is temperature-stabilized or is temperature-independent or temperature-compensated before commencing test.
 - .2 Test for following:
 - .1 Run attenuation at 850 nm and 1300 nm wavelengths.
 - .2 Run length.
 - .3 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:
 - .1 Attenuation values greater than 6.0 dB/km @ 850 nm and 4.0 dB/km @ 1300 nm.
 - .4 Reconnect or re-install and retest as necessary to correct excessive variations.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

3.4 REPORT

- .1 Record results in tabular form.
- .2 Segregate horizontal runs, inter-room runs, and risers by category or run and by type of cable.
- .3 Present horizontals' results in ascending order, following grid numbering.
- .4 Report Submission:
 - .1 Submit three reports printed on 215 mm x 280 mm white paper. Leave copies unbound for insertion into O&M manuals.
 - .2 Submit report prepared in electronic form using Microsoft Excel on a USB memory stick.

END OF SECTION

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

1. GENERAL

1.1 RELATED SECTIONS

- .1 Basic Electrical Requirements: Section 26 05 00.

1.2 ABBREVIATIONS

- | | | |
|----|----------|---|
| .1 | ETL | Electronic Testing Laboratories |
| .2 | IDC | Insulation Displacement Connectors |
| .3 | UTP | Unshielded Twisted Pair |
| .4 | NEXT | Near End Crosstalk |
| .5 | ELFEXT | Equal Level Far End Crosstalk |
| .6 | PSNEXT | Power Sum Near End Crosstalk |
| .7 | PSELFEXT | Power Sum Equal Level Far End Crosstalk |

1.3 INSTALLER QUALIFICATIONS

- .1 Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project.

1.4 SCOPE

- .1 System to be complete with all data and voice outlets, patch panels, patch cords, wire and cable required to from a complete system.
- .2 Install cable in raceway in all locations.

1.5 STANDARDS

- .1 Comply with the following standards:
- | | |
|----|---------------------------------|
| .1 | TIA/EIA 568-B1, B2 and B3 |
| .2 | TIA/EIA TSB-67, 72 and 75 |
| .3 | ANSI/TIA/EIA 568a-1, 2, 3, 4, 5 |
| .4 | TIA/EIA/IS 729 |
| .5 | BICSI |

1.6 SYSTEM DESCRIPTION

- .1 Structured telecommunications wiring system consist of unshielded-twisted-pair and optical fibre cables, terminations, connectors, cross-connection hardware and related equipment installed inside building for occupant's telecommunications systems, including voice (telephone), data, and image.
- .2 Installed in physical star configuration with separate horizontal and backbone sub-systems.
- | | |
|----|---|
| .1 | Horizontal cables link work areas to telecommunications room located on same floor. |
| .2 | Telecommunications rooms linked to main terminal/equipment room (MT/ER) by backbone cables. |
| .3 | MT/ER also linked to Entrance Room by backbone cables. |

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

1.7 SUBMITTALS

- .1 Provide submittals in accordance with Section 26 05 00.
- .2 As-built Records and Drawings:
 - .1 Provide database reflecting cable installation and cross-connections.
 - .2 Provide as-built markups of drawings depicting all construction.

2. PRODUCTS

2.1 SHORT HAUL OR HORIZONTAL CABLING

- .1 UTP: to CAN/CSA T529-M95 and TIA/EIA 568 - B1, B2, B3, Category 6.
 - .1 Physical Characteristics:
 - .1 Conductors: four-pair, 24 AWG, thermoplastic insulated, solid copper wire.
 - .2 Twists: pairs variably twisted relative to one another. Minimum 29 twists/m per pair.
 - .3 Cable Size: maximum OD 6.4 mm.
 - .4 Breaking strength: 40.8 kg at temperature of -20°C ±1°C without jacket or insulation cracking.
 - .5 Colour coding of pairs: tracer coloured white paired with each of blue, orange, green and brown.
 - .6 Fire Rating: plenum-rated overall jacket, CSA FT-4 compliant.
 - .2 Transmission Characteristics: to EIA/TIA TSB 36-1991.
 - .1 DC resistance: less than 94 ohms/km, with an unbalance between conductors in a pair of 5% maximum.
 - .2 Mutual Capacitance of any one pair: maximum of 17 nF/305 m @ 1 MHz.
 - .3 Characteristic Impedance 1-100 MHz: 100 ohms ±15%.
 - .4 Maximum values for attenuation, loss and crosstalk, worst pair at 20°C:

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

Frequency (MHz)	AttenuationdB/100 0ft	NEXT Loss Pr-pr dB	PS NEXT Loss dB	ELFEXT pr-pr dB	PSELFEXT dB
1	2.5	76.0	53.0	57.4	54.4
4	4.5	53.6	50.6	45.3	42.2
8	6.3	50.0	45.6	39.3	36.3
10	7.0	47.0	44.0	37.4	34.4
16	9.2	43.6	40.6	33.3	30.3
20	10.3	42.0	39.0	31.4	27.4
25	11.4	40.4	37.4	29.4	26.4
31.25	12.8	38.7	35.5	27.5	24.5
62.5	18.5	33.6	30.6	21.5	18.5
100	24.0	30.1	27.1	17.4	14.4

2.2 LONG HAUL OR RISER CABLING

.1 Fiber Optic Cable Riser:

.1 Fiber Optic Cable: to CAN/CSA T529-M95.

.1 Physical Description:

- .1 Conductors: As shown on drawings.
- .2 Continuous operating temperature: -20°C to +80°C.
- .3 Strength member: Aramid.
- .4 Minimum bend radius for installation:
 dual strand – 130 mm
 12 strand – 305 mm
 Minimum bend radius for long term:
 dual strand – 80 mm
 12 strand - 178 mm
- .5 Fire Rating: plenum-rated overall jacket, CSA FT-4 compliant.

.2 Transmission Characteristics:

- .1 Minimum bandwidth: 160 MHz-km @ 850 nm and 500 MHz-km @ 1300 nm.
- .2 Maximum attenuation:
 - .1 3.5 dB/km @ 850 nm.
 - .2 1.5 dB/km @ 1300 nm.
 - .3 1.0 dB/km @ 1550 nm.

.2 Quantity: install fibre optic cables as shown on drawings.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

2.3 COMMUNICATIONS OUTLET ASSEMBLIES

- .1 Communications Outlet - Boxes:
 - .1 Double wide box recessed or surface mount box, 63 mm minimum depth.
- .2 Communications Outlet - Housings:
 - .1 Formed Outlet Plate.
 - .2 Accepts minimum of four snap-in or slide-in outlet inserts.
 - .3 Mounts to standard two device opening or mounting ring.
 - .4 Constructed of high-impact fire-retardant thermoplastic.
 - .5 Unused ports to be filled with blank inserts.
- .3 Communication Outlet - Jacks:
 - .1 Copper-Based Inserts: to TIA/EIA 568-B1, B2, B3, Category 6 standards, worst pair:
 - .1 Termination via fixed or removable IDC, AT&T 110, Krone LSA-Plus, or NT BIX IDC's with hinged or separate stuffer cap.
 - .2 If removable IDC type is used, they must meet the following physical specifications:
 - .1 Connection of removable IDC's via 8-position edge connectors plated with minimum 40 microns of nickel. Capable of minimum 250 insertion and withdrawal cycles.
 - .2 Connection of removable IDC's via 8-pin header connector. Maximum 8.9 N engagement force and minimum 2.25 N disengagement force. Pins minimum 1.4 mm square.
 - .2 Modular Outlet - UTP:
 - .1 8-position unkeyed jack for voice and data compatible with 4-pair 100 ohm unshielded twisted pair.
 - .2 Capable of minimum of 200 insertion and withdrawal cycles.
 - .3 Copper-based contacts with 50 to 100 microns of nickel overlay uniformly coated with minimum 50 microns of gold overlay.
 - .4 Minimum contact force 1.1 N per contact. Minimum plug retention force 76 N.
 - .5 Conductors separated and aligned internally by comb structure.
 - .6 Electrical Specification:
 - .1 Contacts:
 - .1 Dielectric strength: 1000 V rms @ 60 Hz.
 - .2 Insulation resistance: 10 megohms, minimum.
 - .3 Contact resistance: 0.02 ohms, maximum.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .4 Current rating: 1.5 amps, maximum.
- .2 Insulation Displacement Connectors:
 - .1 Voltage Rating: 250 VAC.
 - .2 Current Rating: 5 amps.
 - .3 Resistance: 0.02 ohms maximum.
 - .4 Dielectric Withstanding: 2000 VAC for 60 sec.
 - .5 Insulation Resistance: 500 megohms minimum.
- .7 Rated for data transmission up to 100 MHz.
- .8 Wire configuration to T568A pair assignment.

2.4 HARDWARE

- .1 Provide all components of a particular type of the same manufacture. (for example: all rack components shall be of common manufacture).
- .2 Rack: Free-standing cabinet rack:
 - .1 Body fabricated of 2.5 mm minimum metal,
 - .2 Equipment mounting rails minimum 2.0 mm metal
 - .3 Designed to accept EIA standard 483 mm wide panels. Drilled and tapped for No 10 screws for vertical panel of 2134 mm in increments of 44.5 mm
 - .4 Grounding provision.
 - .5 Full height vertical wire management on both sides minimum 152mm x 152mm.
 - .6 Colour ASA 61 grey.
- .3 Wall Mounting:
 - .1 Backboard for Equipment:
 - .1 Backboard: If backboard does not already exist in equipment room use Poplar plywood, G1S, 1200mm x 1200mm x 19mm thick. Painted gray on front and all edges, prime coat back.
 - .2 Components indicated for wall mounting shall be low profile and mounted so as to minimize any protrusion into the equipment room.
- .4 UTP Patch Panels: supply all hardware from the same manufacturer.
 - .1 Ports: same type as corresponding outlets Ports/Panel: maximum quantity 48.
 - .2 Physical, Electrical, Transmission Properties: not less than specified for outlets, Category 5 enhanced, worst pair.
 - .3 Horizontal cable management minimum 90 mm high.
 - .4 Grounding lug hardware kit.
 - .5 Panel:

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .1 Width 483 mm.
 - .2 Multiple of EIA standard module height of 44.45 mm.
 - .3 EIA mounting hole spacing.
 - .4 Rack mountable
- .6 Panel Height: 178 mm maximum
- .7 Material: metal of the following minimum thickness:
 - .1 3 mm flat anodized aluminum.
 - .2 1.65 mm formed aluminum.
 - .3 1.9 mm flat steel.
 - .4 1.5 mm formed steel.
- .5 Fibre Optic Cable Patch Panels
 - .1 Fibre interconnect center wall or rack mounted, low profile, modular design. Rack mount to be used in central equipment room, Wall mount to be used in remote equipment rooms.
 - .2 Ports: as required.
 - .3 Connectors: feed through type SC.
 - .4 Cable management and slack storage designed to accommodate fibre optic cable bend radius.
 - .5 Lockable doors or covers for cable termination and patch compartments.
 - .6 Anchor points for strain relief of fiber cable entry.
 - .7 Grounding provisions.

2.5 PATCH CABLES

- .1 UTP Type:
 - .1 Patch Cables to match installed cable's transmission and electrical specifications.
 - .2 Fire Rating: plenum rated overall jacket, CSA FT-4 compliant.
 - .3 Modular Connectors:
 - .1 Matching types and minimum specifications as for outlet components.
 - .2 Long body type.
 - .3 Suitable for solid or stranded conductor and wire gauge used.
 - .4 Tool-stuffed or plier-stuffed with IDC contacts and plier-latched cap.
 - .5 Factory manufactured
 - .4 Quantity: Provide one 1 m and one 3 m UTP patch cord for each new cable outlet.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .2 Optical fiber patch cords:
 - .1 Fiber Core and Cladding: identical to installed cable.
 - .2 Transmission Properties: match installed cable's transmission and electrical specifications.
 - .3 Configuration:
 - .1 Dual fiber, single jacket, with breakout assemblies separate SC connectors each end.
 - .2 Single fiber dual cable, separate SC connectors each end.
 - .4 Factory manufactured
 - .5 Quantity: As required plus 10% or 2 (whichever is greater) spares of each length used.
 - .6 Lengths: Use minimum standard length necessary for each location.

2.6 WIREWAYS AND SURFACE RACEWAYS

- .1 Provide slotted PVC raceway on rack sides or on backboard as applicable in equipment rooms.

2.7 IDENTIFICATION MATERIALS

- .1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
 - .1 Size 1: 12 mm high with 5 mm high letters.
- .2 Wire Identification Materials:
 - .1 Machine-printed heat shrink sleeves.

3. EXECUTION

3.1 INSTALLATION

- .1 Cable Installation:
 - .1 Generally install FT4 rated data cable and voice cable using raceway.
 - .2 Install data and voice cable in conduit.
 - .3 Support cable runs independently of ceiling suspension system.
 - .4 Swab raceway system before installing wiring.
 - .5 Do not exceed manufacturer's maximum pulling force.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .6 Maintain not less than minimum bending radius for fiber and copper conductors.
- .7 Install cable along or at right angles to building lines unless impractical to do so. Verify specific cases of deviation in advance.
- .8 Maintain open copper-conductor cable at maximum practical distance from fluorescent ballasts and other EMF - or discharge-generating equipment.
- .9 Ensure that cable is not flattened, squeezed, or crimped at any point along entire run. No splices or intermediate terminations in cable runs except by special permission in advance, with documentation detailing locations and nature of splices.
- .10 Install cables in PVC raceway in telecom room and fan individual cables to applicable patch panels in neat, logical fashion.
- .11 Tie wrap cables neatly into logical bundles.
- .12 Minimum 1 m of slack cable per run.
- .2 Connectors:
 - .1 Use tooling specific to connector types in use.
 - .2 Use connectors suitable for nature of conductor in cable, eg. stranded vs solid copper.
 - .3 Ensure that connectors' strain relief provisions are used. Strip jackets only amount required.
 - .4 Maintain pair twists within 13 mm of termination.
 - .5 UTP Connection Configuration in accordance with EIA/TIA 568A-1991 or CAN/CSA-T529-M95.

Pair	Colour	RJ-45 Pins
1	Blue	4
	White/Blue	5
2	White/Orange	3
	Orange	6
3	White/Green	1
	Green	2
4	White/Brown	7
	Brown	8

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .3 Outlets, Boxes and Fittings:
 - .1 Communications outlet assemblies to be used for work station locations in office areas. For other devices an appropriate plug is to be installed directly on the wire for direct connection to the device.
 - .2 Ensure in advance that outlet box/data outlet installation methods yield vertically-mounted data outlets.
 - .3 Install all outlets flush with finished surfaces unless indicated otherwise on the drawings.
- .4 Cabinets, Enclosures, Racks, Backboards:
 - .1 Install at locations and heights indicated on drawings.
 - .2 Use green insulated 6 AWG ground conductors for grounding racks. Use grounding bushing, solderless lug, clamp, or cup washer and screw.
 - .3 Protect ground conductors from mechanical injury.
 - .4 Install ground conductors such that neither ground conductors nor data cables interfere with one another in regards to future servicing of patch panel rear connections.
- .5 Patch Panels
 - .1 Mount patch panels in order shown on drawings.
 - .2 Ground as required by system.
 - .3 Attach horizontal wiring in an ordered fashion according to the numbers as indicated on the drawings.
 - .4 Mount panels to racks with as many screws as there are mounting holes or slots in panels.
 - .5 Provide and install necessary strain reliefs and cable support brackets, plus trays for cable loop behind panel and install cables utilizing such devices.

3.2 COMMUNICATIONS CABLE AND EQUIPMENT LABELING

- .1 Label communication outlets, panels and ports with size 1 Device Identification Materials.
- .2 Label each of cables with other end's address using Wire Identification Materials.
- .3 Label outlets with labels vertically aligned in each row.
- .4 Position panel labels in the same position on each panel.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

- .5 Use the naming convention as indicated on the drawings when labeling communications cabling components.

3.3 TESTING

- .1 Test all runs upon completion of permanent terminations, using instrumentation acceptable to Owner. Before commencing testing, submit sample test data sheets and information with respect to test instrumentation to be used.

- .2 Copper Media:

- .1 Test for the following:

- .1 Continuity.
 - .2 Pair placement and polarity.
 - .3 DC resistance.
 - .4 Characteristics at highest contemplated frequency for data and voice cables:

- .1 Attenuation.
 - .2 Mutual Capacitance.
 - .3 NEXT, PS NEXT, ELFEXT and PS ELFEXT.

- .5 Run length.

- .2 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:

- .1 Resistance and capacitance readings more than 10% above or below predicted values.
 - .2 NEXT, PS NEXT, ELFEXT or PS ELFEXT values 3dB higher than predicted values.
 - .3 Attenuation values 2dB higher than predicted values.

- .3 Reconnect or re-install and retest as necessary to correct excessive variations.

- .3 Fiber Optic Media:

- .1 Ensure that test instrument is temperature-stabilized or is temperature-independent or temperature-compensated before commencing test.

- .2 Test for following:

- .1 Run attenuation at 850 nm and 1300 nm wavelengths.
 - .2 Run length.

- .3 Before recording results, compare readings to predicted values based on cable specification and run length, using connector and patch cord losses as part of predicted value. Retest runs with:

- .1 Attenuation values greater than 6.0 dB/km @ 850 nm and 4.0 dB/km @ 1300 nm.

- .4 Reconnect or re-install and retest as necessary to correct excessive variations.

STRUCTURED CABLING FOR COMMUNICATIONS SYSTEMS

3.4 REPORT

- .1 Record results in tabular form.
- .2 Segregate horizontal runs, inter-room runs, and risers by category or run and by type of cable.
- .3 Present horizontals' results in ascending order, following grid numbering.
- .4 Report Submission:
 - .1 Submit three reports printed on 215 mm x 280 mm white paper. Leave copies unbound for insertion into O&M manuals.
 - .2 Submit report prepared in electronic form using Microsoft Excel on a USB memory stick.

END OF SECTION

HARMONIC FILTER

1. GENERAL

1.1 RELATED SECTIONS

.1	Electrical General Requirements:	Section 26 05 00.
.2	Cabinets and Enclosures:	Section 26 27 16.
.3	Electrical Starting And Testing:	Section 26 08 00.

1.2 PRODUCT DATA

- .1 Comply with requirements of Sections 260500.

2. PRODUCTS

2.1 ACTIVE HARMONIC FILTER

- .1 The active filter shall be of shunt connection type.
- .2 The active filter shall be able to work on utility fed networks as well as on local backup generators.
- .3 The active filter shall monitor the current in the phases in real-time and process the measured signals by means of a sufficiently fast digital processing and control system (e.g. Digital Signal Processor based system). It is recommendable that commonly available standard class current transformers with appropriate burden can be used as current sensors for the filter equipment. All three phases are to be monitored.
- .4 The output of the digital control system shall be a pulse width modulated (PWM) signal that controls power modules based on IGBT (Insulated Gate Bipolar Transistor) technology. It is recommendable that the IGBT bridge is controlled at fixed frequency, to allow for optimal attenuation of switching frequency components and to avoid high frequency leakage into the network.
- .5 The control method of the power modules (comprised of the IGBT-inverter and a coupling circuit to the network) shall be such that harmonic currents of exactly the opposite phase of those to be filtered are injected into the network for each harmonic considered.
- .6 The active filter shall be un-overloadable, even when the load harmonics are higher than the rating of the filter. In that case the active filter shall limit its output to safe equipment levels and continue operation without tripping out. It is recommendable that in that case a 'full load' signal is generated by the filter equipment.
- .7 The active filter cooling system shall by preference be based on forced air fan systems. Water cooling is not preferred.
- .8 The active filter shall by preference allow for different filtering modes to be set expressing the priority to be given to the filtering of individual harmonics and if needed also to the possible generation of reactive power and load balancing.
- .9 Active filter rating to meet or exceed rating shown on Single Line Diagram.
- .10 The unit shall have a local interface capable of fully configuring the device.

HARMONIC FILTER

- .11 The unit shall have normal and fault status available as dry contacts.
- .12 The unit shall be capable of an Ethernet data link.
- .13 Shorting block to be included for current transformers.

2.2 ACCEPTABLE MANUFACTURERS

- .1 ABB PQFM, Eaton HCU2, or approved equivalent.

3. EXECUTION

3.1 INSTALLATION

- .1 Location: As shown on drawings
- .2 Make field power and control connections as indicated.

3.2 SITE CONFIGURATION AND TRAINING

- .1 Manufacturer trained representative to provide on site configuration and training.

3.3 PROTECTION OF COMPLETED WORK

- .1 Protect active filter to prevent entry of duct, paint and other foreign matter.

3.4 TESTING

- .1 Comply with requirements of Section 260800.

END OF SECTION

VIDEO MONITORING SYSTEM

1. GENERAL

1.1 RELATED SECTIONS

- | | | |
|----|---|-------------------|
| .1 | Basic Electrical Requirements: | Section 26 05 00. |
| .2 | Structured Cabling for Communication Systems: | Section 27 10 05. |

1.2 DESCRIPTION OF SYSTEM

- .1 Video monitoring system consisting of a network with the following components:
 - .1 Cameras
 - .2 Switch
 - .3 Recorder
 - .4 Video management software (installed on recorder)

1.3 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- .1 Comply with requirements of Division 1 and Section 26 05 00.
- .2 Provide factory data sheets for the following:
 - .1 System devices, indicating:
 - .1 Typical wiring connection.
 - .2 Installation instructions.
 - .3 Component limitations.
- .4 If requested by Engineer, submit samples of following components:
 - .1 Camera.
 - .2 Configuration/Administration Software.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Comply with requirements of Division 1 and Section 26 05 00.

1.5 SUPPLIER QUALIFICATIONS

- .1 System supplier, that is, manufacturer or manufacturer's authorized agent, shall have an office in Alberta established for a minimum of one-year, with full in-house technical service and maintenance capabilities. Suppliers utilizing third party or subcontracted maintenance services are not acceptable.

VIDEO MONITORING SYSTEM

2. PRODUCTS

2.1 CAMERAS

.1 Features:

- .1 Network communications RJ45 connector
- .2 Power: Power Over Ethernet (POE) less than 11 Watts
- .3 Operating Conditions: Outdoor -40C to +50C
- .4 Enclosure Rating: IP66
- .5 Resolution: 4MP (2560 x 1440)
- .6 Lens: Fixed 4 mm, F1.6
- .7 Field of View: H 78° V 41°
- .8 Day and night functionality
- .9 Minimum illumination: Colour: 0.15 lux
- .10 Video Compression: H.265/H.264, Motion JPEG
- .11 IR Distance: Up to 25 meters
- .12 Memory: 512MB RAM
- .13 Analytics: Motion detection, Tampering detection
- .14 Warranty: 3 years from manufacturer
- .15 Optional mounting brackets for wall, corner and ceiling as required

.2 Approved Products:

- .1 Manufacturer: Hanwha Techwin
- .2 Model: QNV 7022R

2.3 NETWORK SWITCH

.1 Features:

- .1 Ports: 16 RJ45 POE @ 100Mbps, 2 RJ45 @ Gigabit
- .2 Power Supply: 120VAC
- .3 Power Over Ethernet (POE): 200 Watts total capacity with up to 30 Watts per port

.2 Included with Recorder.

2.4 RECORDER

.1 Features:

- .1 Type: Server
- .2 Processor: N/A
- .3 RAM: N/A
- .4 Storage: 24TB
- .5 Operating System: Linux Ubuntu 18.04 LTS
- .6 Recording Bandwidth: Up to 150Mbps
- .7 Rack Mount
- .8 Power 120VAC

VIDEO MONITORING SYSTEM

.2 Approved Products:

- .1 Manufacturer: Hanwha
- .2 Model: WRN-1610S

2.5 VIDEO MANAGEMENT SOFTWARE

.1 Features:

- .1 Licenses: 16 camera capability
- .2 Capable of remote viewing and control
- .3 Control of PTZ cameras using mouse
- .4 Motion triggered recording
- .5 Live view interface
- .6 Video Compression: H.264, MPEG-4, Motion JPEG
- .7 Recording frame rate: 30fps per camera
- .8 Security: Multiple user access levels with password protection
- .9 Search capability: based on camera, date and time
- .10 Playback: controllable speed or frame by frame
- .11 Users: Four

.2 Approved Products:

- .1 Manufacturer: Hanwha
- .2 Model: Wisenet WAVE

.3 Included with Recorder.

3. EXECUTION

3.1 INSTALLATION

- .1 All wiring to be installed in conduit or TECK cable.

3.2 TESTING

- .1 Test each camera in the presence of the owner's representative.

3.3 DEMONSTRATION AND INSTRUCTION

- .1 Provide two hours of instruction to the owner's representative on operation and administration of the system.

END OF SECTION