

SECTION 15130 (23 05 19)

METERS AND GAGES

PART 1 – DESIGN DIRECTIVE

1.1 QUALITY ASSURANCE

- A. Comply with applicable UL standards pertaining to meters and gages and with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

1.2 DESIGN CRITERIA

- A. The designer shall indicate on the drawing details and flow schematics the locations of all gauges.
- B. At hydronic pumps, a single pressure gauge shall be installed with isolated taps before the strainer, between the strainer and the pump inlet, and after the pump discharge. This is not required at domestic hot water recirculation pumps.
- C. Temperature and pressure gauges shall be installed in hydronic systems as required to facilitate troubleshooting. This shall include locations such as building service entrances, supply and return piping mains prior to leaving the mechanical room, and wherever an electronic temperature or pressure sensor is installed for reporting to the Building Management System.
- D. Provide temperature and pressure gauges on both the inlet and discharge piping connections of all equipment whose function is to add or remove heat from the fluid, or to change its pressure.
- E. Provide a low pressure drop flow measuring device as specified herein on the return piping main of all hydronic systems.

PART 2 – PRODUCTS

2.1 THERMOMETERS, GENERAL

- A. Accuracy shall be 1% of range span, grade A.
- B. Temperature ranges for services listed as follows (center of range shall be the scheduled fluid temperature):
 - 1. Domestic Hot Water: 0° to 200°F with 2° scale divisions.
 - 2. Domestic Cold Water: 30° to 130°F with 2° scale divisions.
 - 3. Hot Water: 0° to 250°F with 2° scale divisions.
 - 4. Condenser Water: 0° to 200°F with 2° scale divisions.
 - 5. Chilled Water: 30° to 130°F with 2° scale divisions.
 - 6. Steam and Condensate: 50° to 300°F with 2° scale divisions.

2.2 BIMETAL DIAL THERMOMETERS

- A. Direct mounted, bimetal type with adjustable angle feature for 360° rotation and 180° angle adjustment. Hermetically sealed, 5" diameter case of welded stainless steel

construction with external adjustment. Thermometer shall have a bimetal coil, plastic window, white dial with black markings. Stem Length of 6", or adjust length to be minimum 3" from insulation, 1/2" NPT stem connection.

- B. Manufacturers:
1. Ashcroft, Dresser Industries, Instrument Div. #50EL60E series.
 2. Trerice #B85600 series

2.3 THERMOMETER WELLS

- A. Brass threaded thermometer wells for all piping systems, pressure rated to match piping system design pressure; with 2" extension for insulated piping and threaded cap nut with chain permanently (material to match well material) fastened to well and cap.

2.4 PRESSURE GAGES

- A. General use, ASME B40.1, Grade 2A, phosphor bronze bourdon tube type, bottom connection. Phenolic case, 4-1/2" diameter, with 1/2" NPS brass connector. White coated aluminum background, with permanently etched black markings. Accuracy shall be $\pm 1/2\%$ of range span. The scale range for all gages shall be 2 times the operating pressure. All gages in liquid systems shall be vibration resistant (Plus performance or silicone filled).

- B. Manufacturers:
1. Ashcroft, Dresser Industries, Instrument Div.
 - a. Steam systems: #45-1279-04L
 - b. Liquid systems: #45-1279-04L-XLL
 2. Trerice
 - a. Steam systems: #450B45TRL500PSI series
 - b. Liquid systems: #450BG45TRL500PSI series

2.5 TEST PLUGS

- A. Test Plugs shall be nickel plated brass body, with 1/4" or 1/2" NPS fitting and two self sealing valve type core inserts, suitable for inserting a probe assembly from a dial type thermometer or pressure gage. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

- B. Core Material: Conform to the following for fluid and temperature range:
1. -30°F to 275°F: EPDM.

- C. Manufacturers:
1. MG Piping Products Co.
 2. Peterson Equipment Co., Inc.
 3. Sisco, A Spedco, Inc. Co.
 4. Trerice (H.O.) Co.
 5. Watts Regulator Co.

2.6 PRESSURE GAGE ACCESSORIES

- A. Connectors:
1. Steam systems: Provide 1/2" NPS iron pig tail siphons.
 2. Water systems: 1/2" NPS steel (for steel pipe) or brass (for copper pipe) nipple, length to allow minimum 3" beyond insulation cover.

- B. Snubber
 1. 1/2" stainless steel, Ashcroft #112S (for steel piping systems), or 1/2" brass, Ashcroft #112B (for copper piping systems).
 2. Provide a 1/2" ball or needle valve, carbon steel for steel piping systems or bronze for copper piping systems.

2.7 ENERGY METERS

- A. GENERAL – Meters shall be installed at all buildings to monitor, measure, and track consumption of energy, typically in the form of electricity, steam condensate (heating), hot water (heating), and chilled water (cooling). The guidelines of this section define requirements for metering the usage of steam condensate, hot water and chilled water. Refer to the Electrical division of these Guidelines for requirements related to metering of electrical usage.

- B. FLOW METERS – INLINE MAGNETIC

1. Full-port body with Teflon liner, 250°F minimum temperature rating. Electronics/display can be integral or remote.
2. ACCURACY: +/- 0.25% or better, achieved with 1.5 diameters or less up and downstream straight run of piping.
3. RANGEABILITY: 300:1 turndown or better.
4. 4-20 mAdc outputs.
5. Furnished with matched RTD temperature sensors with thermowells and BTU meter.
6. Factory calibrated and furnished with NIST calibration certificate.
7. Factory Mutual Approved.
8. Applications: Gravity or pumped steam condensate, hot water, chilled water.
9. Product: Magnetic, In-Line Flow Meter shall be Cadillac CMAG Series as manufactured by Central Station Steam Co., Tigard, OR.

- C. FLOW METERS – INLINE TURBINE

1. Brass or epoxy coated cast-iron housing with internal measuring chamber and impeller, 250° F minimum temperature rating.
2. ACCURACY: +/- 1.0% of flow.
3. REPEATABILITY: +/- 0.25% of flow.
4. RANGEABILITY: 30:1 turndown.
5. Self-powered, sealed, mechanical totalizing register.
6. Provide optional electronic transmitter with register option: Magnetically coupled activated reed switch contact closure, 3 Watts, 0.2 A, 30VDC max.
7. Applications: Pumped steam condensate.
8. Product: Niagara series MTX, model 421, with model 840 reed switch output, or equivalent from ISTECH.

- D. FLOW METERS – ULTRASONIC

1. Clamp-on transducers with automatic transducer spacing utilizing a mounting track (ruler scales not acceptable), precluding the requirement of penetrating into the pipe. 250°F minimum temperature rating.
2. Transit-time and Doppler flow measurement design. Flow meter shall be capable of measuring all liquids in full sonically conductive pipes, including steel pipes up to schedule 80. Flow meters that simply offer standalone transit-time or Doppler measurement modes are not acceptable.
3. ACCURACY: +/-1% of flow over a +/-40 fps flow range with 10 diameters upstream and 5 diameters downstream straight run of piping.
4. REPEATABILITY: Repeatability shall be 0.1% of flow with a flow sensitivity of 0.001 fps at any flow rate including no flow conditions.

5. RANGEABILITY: 300:1 turndown or better.
6. 4-20 mAdc outputs.
7. Furnished with matched RTD temperature sensors with thermowells and BTU meter.
8. Applications: Hot water, chilled water.
9. Product: GE Measurement & Control, Panametrics Liquid Ultrasonic Flowmeter.

E. FLOW-ENERGY (BTU) METERS

1. Flow-energy meters shall be dual channel, with electronics housed in a NEMA 4X enclosure, 120VAC, 60Hz. One isolated 4 to 20 mA DC and one 0 to 5000 Hz pulse output proportional to flow shall be provided for each channel or the average of both paths.
2. Flow-energy meters shall employ an open communications protocol such as Lon Works, Modbus TCP, or BACnet (BACnet is preferred).
3. The unit shall provide one 0 to 10 volt or 4-20mA output and four alarm relays assignable to flow velocity, liquid sonic velocity, signal strength or liquid aeration. An internal data-logger shall be provided to allow storage of all measured and calculated variables and alarms.
4. Flow-energy meter shall be completely microprocessor based, able to calculate and display hot water use in BTUs and chilled water use in ton-hours. Energy calculation shall be integral to the meter and shall utilize the feed temperature for mass calculation. The flow-energy meter shall have the ability to indicate flow and energy rate, flow velocity, total energy, T1, T2 and delta T, and signal strength for both channels. The flow-energy meter shall be equipped with an integral front panel keypad and multifunction display with the ability of displaying both channels and paths simultaneously. In addition, the flow-energy meter shall provide self and application diagnostics to isolate any fault conditions to either equipment failure or abnormal process conditions. The flow-energy meter shall have full HELP menu routines corresponding to all levels of programming and operation
5. Supply and return temperature measurement shall be via platinum matched RTD'S mounted in a thermowell.
6. Applications: Hot water and chilled water.
7. Product: For in-line, magnetic flow meter applications, furnish Cadillac HEATX-2, wall-mount, dual channel meter. For clamp-on, ultrasonic applications, furnish GE Measurement & Control, DigitalFlow DF868.

2.8 LOW PRESSURE DROP FLOW MEASUREMENT DEVICES

- A. Very low pressure drop, wafer-type, orifice flow meter or calibrated manual balancing valve; flow proportional to measured differential pressure. Furnish with appropriate flow vs. differential pressure charts.
 1. Orifice Flow Meters: Bell & Gossett Circuit Sensor or approved equal.
 2. Manual Balancing Valves: (Refer to Section 15100, "Valves"). Manual balancing valves, if used, shall be used for flow verification only during testing and balancing operations. The valve shall be set in the 100% open position under normal operating conditions.
- B. Very low pressure drop, pitot tube type flow meter, sensing upstream total pressure and downstream static pressure. Furnish with appropriate flow charts.
 1. Taco Sentinel or approved equal.

PART 3 – EXECUTION

3.1 THERMOMETERS INSTALLATION

- A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.
- B. Install thermometer wells in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.2 INSTALLATION OF PRESSURE GAGES

- A. Install pressure gages in piping tee with pressure gage valve, located on pipe at most readable position.
- B. Install snubbers in liquid piping systems, siphons in steam piping systems.

3.3 CONNECTIONS

- A. Install meters and gages piping adjacent to machine to allow servicing and maintaining of machine.
- B. Install test plugs in stems of all thermometers and pressure gages.

3.4 LOW PRESSURE DROP FLOW MEASUREMENT DEVICES

- A. Comply with manufacturer's written recommendations for unrestricted pipe upstream and downstream of the flow device.

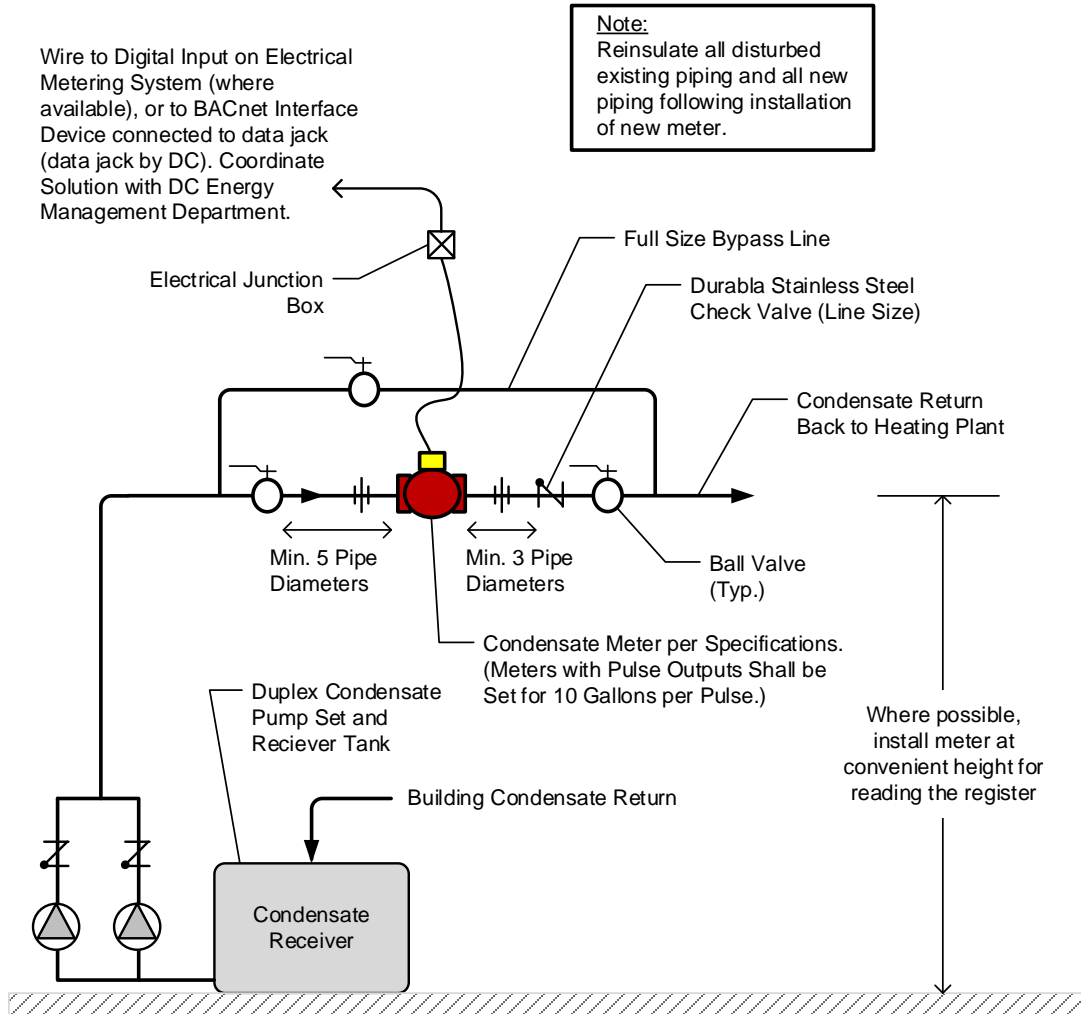
3.5 ENERGY METERS

- A. All meters must be able to be read directly without the use of a ladder. Where meters are not readable from the floor provide a floor level remote display.
- B. To facilitate meter removal without shutting down the system, all condensate meters and in-line, magnetic flow meters shall have a full sized bypass line piped around the meter. Furnish bypass line with full-port isolation valve with locking handle.
- C. Condensate meters shall be piped so that there is a column of liquid present in the meter at all times.
- D. Install all meters in conformance with manufacturer's written instructions, with particular attention paid to pipe configuration and minimum straight runs of pipe.

E. Typical Meter Installation Details:

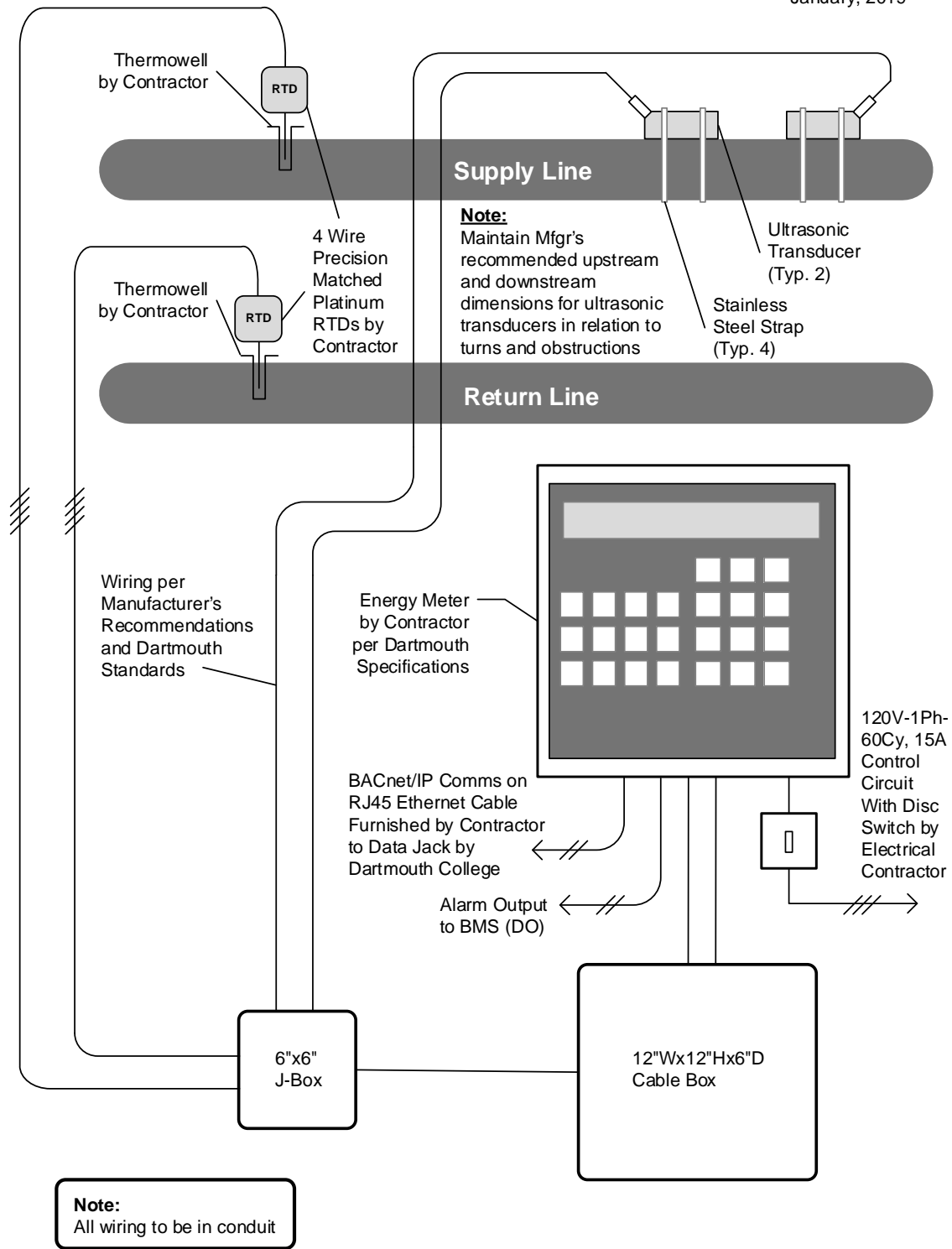
Dartmouth College – Typical Condensate Meter Installation Detail

January, 2019



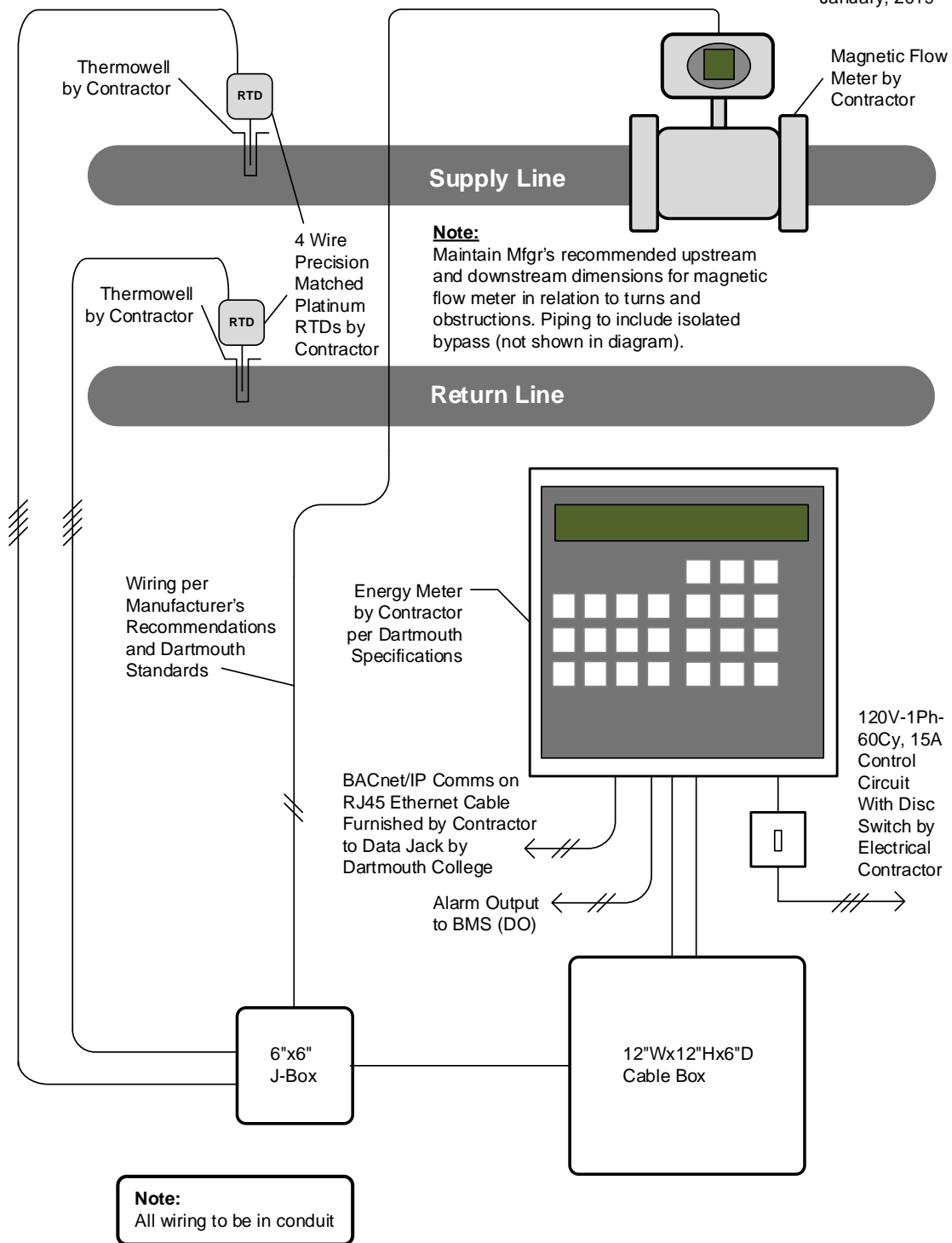
Dartmouth College – Ultrasonic Energy Meter Installation Detail

January, 2019



Dartmouth College – In-Line Magnetic Energy Meter Installation Detail

January, 2019



END OF SECTION 15130 (23 05 19)