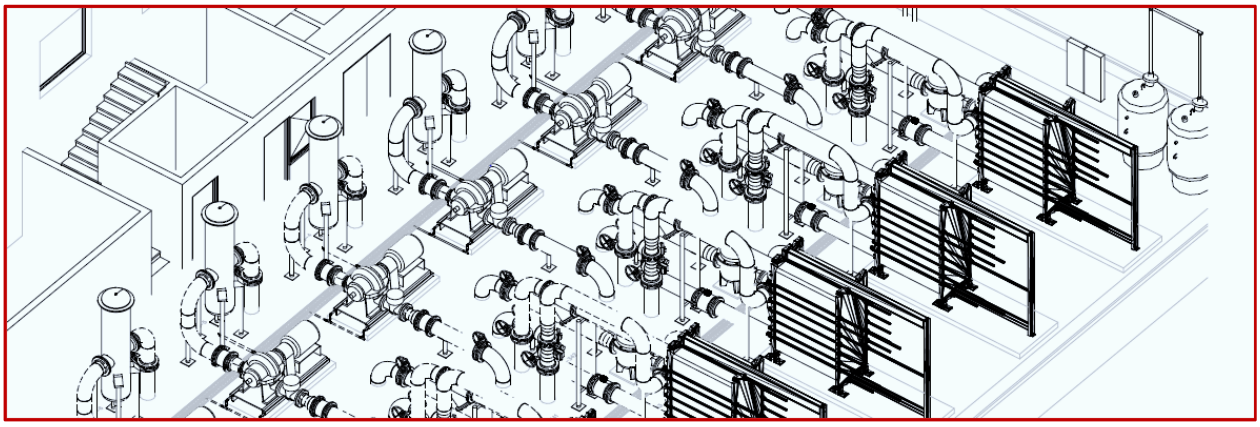
University of Nebraska - Lincoln
Nebraska Innovation Campus

Central Renewable Energy System (CRES) Customer Installation and Operational Guidelines

Version 2.0



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1 Introduction

This document details the necessary components required for customer connections to the Campus Renewable Energy System (CRES) at Nebraska Innovation Campus (NIC). In addition, the responsibility for the installation and operation of all components are discussed.

2 CRES Service Installation Guidelines

A complete CRES customer installation consists of the following components (refer to Detail 03 in the Appendix):

- Connections to CRES supply and return mains.
- Exterior underground building supply and return piping.
- One or more plate-and-frame heat exchangers.
- Interior piping, valves and miscellaneous components within the facility.
- Energy metering components.

The requirements and responsibilities for the ***installation*** of these components are discussed in this section.

2.1 Connection to CRES Supply and Return Mains

UNL will provide and install the tapping sleeve, isolation valve and reducer at the CRES mains. The cost for these will be the responsibility of the customer as part of the CRES connection fee.

2.2 Exterior Underground Building Supply and Return Piping

The installation of all underground piping from the isolation valve / reducer at the CRES mains to a point within a mechanical room located at the exterior of the facility is the responsibility of the customer. Piping shall be installed and pressure tested using the materials and methods as outlined in the most recent City of Lincoln (COL) Standard Specifications – Chapter 23, Water Mains.

Sizing and routing of all exterior underground building piping to be coordinated with UNL FPC Engineering. Provide properly engineered thrust blocks at vertical direction change as shown on Detail 03 in the Appendix. Pipe trenching and bedding to be as shown in Detail 04.

Care should be taken during installation to minimize the intrusion of dirt and debris. However, no flushing, disinfection of piping or water chemical treatment of underground piping is required.

2.3 Plate and Frame Heat Exchanger(s)

One or more plate-and-frame type heat exchangers are required in order to isolate the customer's hydronic systems from the main CRES distribution loop. Multiple heat exchangers may be required on larger facilities. The number and performance attributes of all heat exchangers shall be coordinated with UNL FPC Engineering. The installation of all heat exchangers is the responsibility of the customer.

The following parameters should be used when sizing the plate-and-frame heat exchanger(s):

- Design summer Entering Water Temperature (EWT): 80 Deg F
- Design winter Entering Water Temperature (EWT): 52 Deg F
- Heat exchanger temperature rise / drop (i.e., DeltaT shall be no less than 12 Deg at design conditions and no less than 10 Deg at part load conditions.
- See Section 2.4 for pressure drop requirements.

2.4 Interior Piping, Valves and Miscellaneous Components

Detail 03 in the Appendix illustrates all required piping, valves and miscellaneous components required within a customer's mechanical room. The installation of these components is the customer's responsibility.

- A duplex basket strainer is required before the inlet of any heat exchangers.
- A ***pressure independent*** type control valve is required to throttle CRES flow to the heat exchanger. The control valve actuator must be designed to close off against 50 psig pressure differential. Based on the size of the heat exchanger and building load turndown requirements, consideration should be given to a 1/3-2/3 valve capacity arrangement.
- The building CRES supply/return water system shall be designed to operate on no more than 15 psig pressure differential. This includes building supply/return mains, piping within the building, heat exchanger, strainers, valves, etc.

All piping between the heat exchangers and the CRES system building shut-off valves shall be pressure tested to 150 psig and flushed.

2.5 Energy Metering Components

The energy metering equipment and components shown in the Appendix will be *furnished* by UNL as part of the CRES connection fee. Installation of these components using the materials and methods detailed is the responsibility of the customer. Coordinate installation of all energy meter equipment with UNL Utilities.

The initial meter calibration and setup will be performed by UNL.

3 CRES Service Operational Guidelines

The following section outlines the ***operational*** requirements and responsibilities for the CRES customer installation components.

3.1 Connection to CRES Supply and Return Mains

UNL will be responsible for any maintenance or repair of the tapping sleeve and building isolation valve.

3.2 Exterior Underground Building Supply and Return Piping

Maintenance and repair of the underground building supply/return mains shall be the responsibility of the customer.

3.3 Plate and Frame Heat Exchanger(s)

The maintenance and repair of all heat exchangers is the responsibility of the customer.

3.4 Interior Piping, Valves and Miscellaneous Components

The pressure independent control valve at the CRES side of the heat exchanger shall be controlled by the customer's Building Automation System (BAS). Valve control logic shall be based on building load requirements as well as achieving an acceptable temperature difference between the CRES supply and return water flows (deltaT). The maintenance and repair of all interior piping and components is the responsibility of the customer.

3.5 Energy Metering Components

The maintenance, repair and calibration of energy metering equipment are the responsibility of UNL. The customer shall grant access to UNL personnel for such activities.

3.6 Low DeltaT Penalty

DeltaT is defined as the difference between the customer's CRES return and supply water temperature. For the same net heat energy transfer, a deltaT value that is lower than the preferred range requires that the CRES plant pump more water, thereby increasing the electrical consumption of the CRES plant. The preferred deltaT range is between 10 and 12 Deg F (see section 2.3).

The *CRES Customer Services Agreement* contract includes an economic incentive for high deltaT as averaged over a monthly billing period as well as a penalty for low deltaT. The following schedule defines these incentives and penalties. See the *CRES Customer Services Agreement* for more details.

Schedule 1: CRES Efficiency Incentive and Penalty Schedule									
Average Monthly DeltaT (Deg F)	>13.5	12.5 – 13.49	7.5 – 12.49	6.5 – 7.49	5.5 – 6.49	4.5 – 5.49	3.5 – 4.49	2.5 – 3.49	< 2.49
Penalty / Incentive per MMBtu	($0.09)	($0.07)	$0.00	$0.13	$0.21	$0.31	$0.47	$0.73	$1.25

Note: Amounts in parenthesis are incentives paid to the customer, amounts without parenthesis are penalties paid by the customer.

4 Appendix

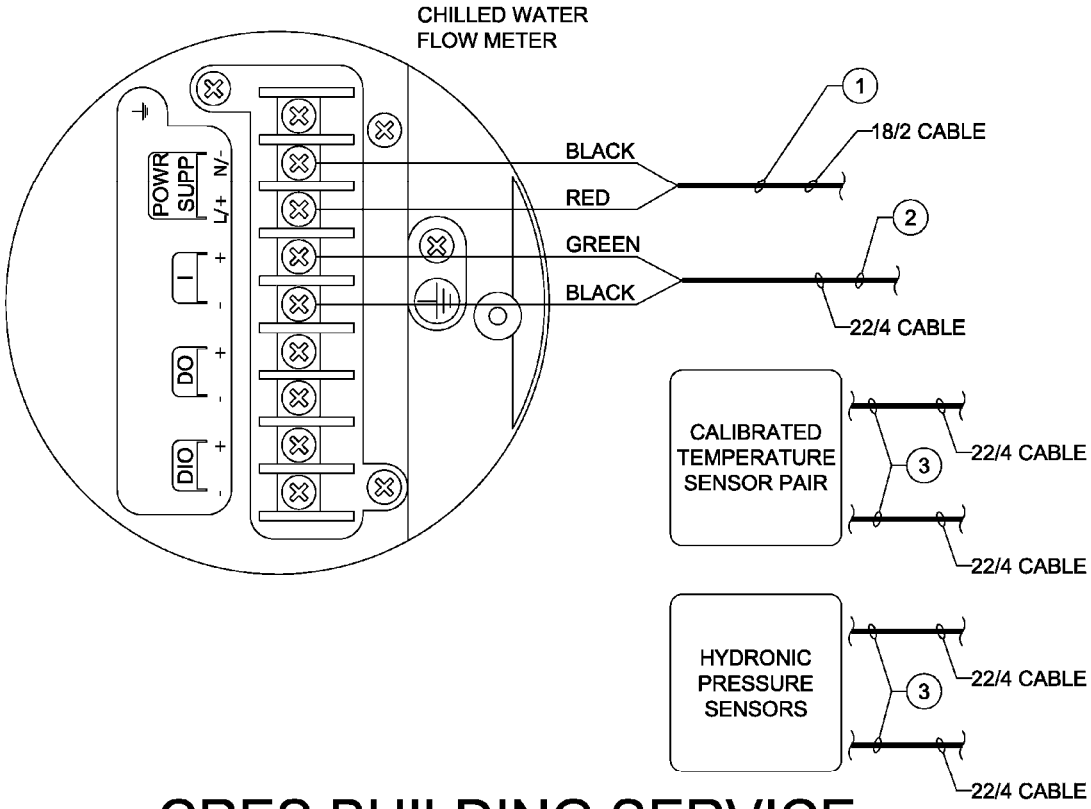
Detail Number	Title
01	CRES Building Service Meter Wiring Detail
02	CRES Building Service Energy Metering Cabinet Detail
03	CRES Building Service Piping Schematic
04	CRES Building Service Pipe Trench Detail

GENERAL NOTES

1. ALL CABLE RUNS BACK TO METERING CABINET GUTTER SHALL HAVE TEN (10) FT EXTRA LENGTH IN GUTTER FOR FINAL TERMINATIONS.
2. FINAL TERMINATIONS AT METERING PANELS, METERS, SENSORS TO BE PERFORMED BY UNL STAFF.

(#) KEY NOTES

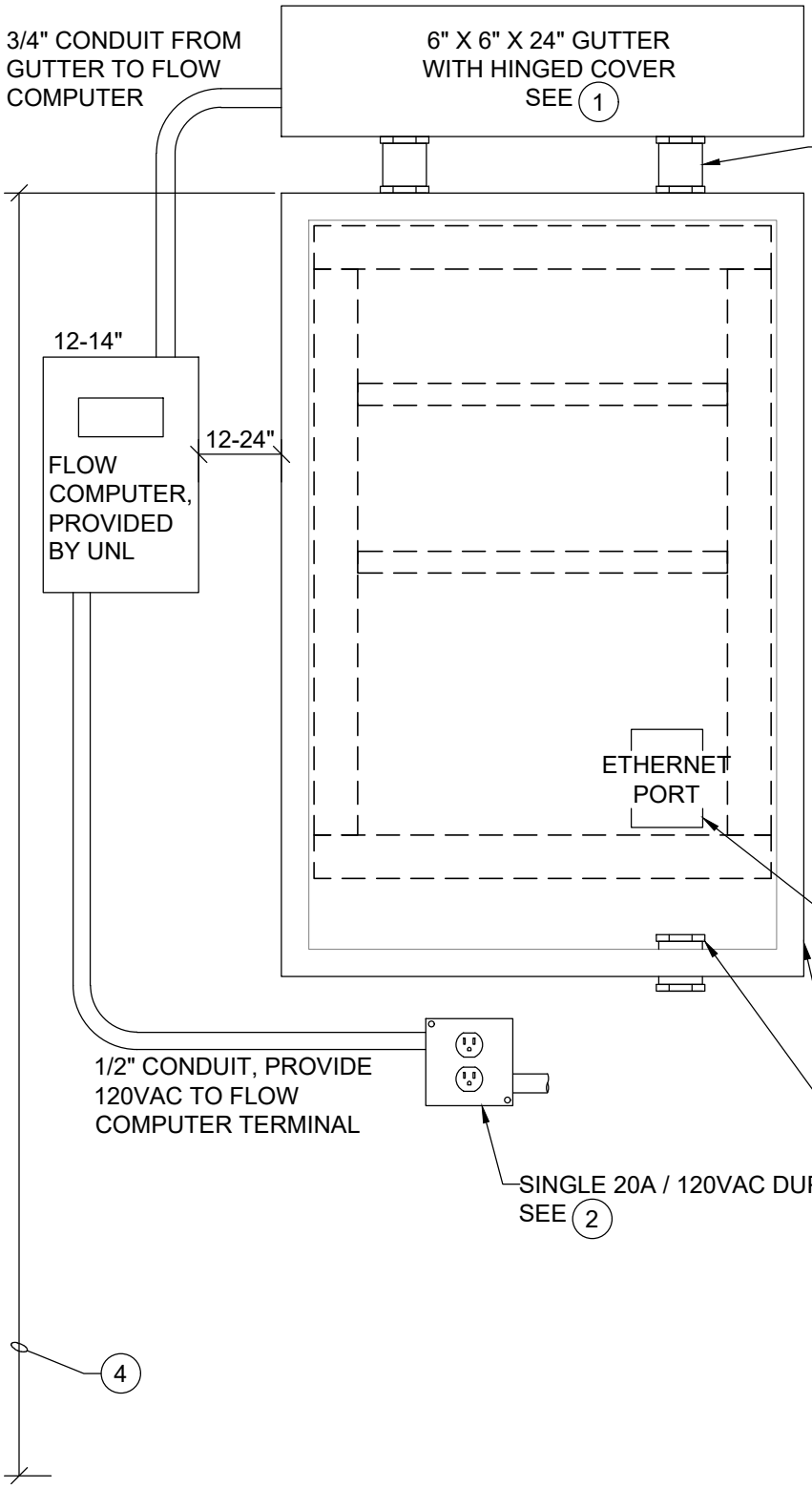
1. PROVIDE CONDUIT AND CABLING FROM METER BACK TO METERING CONTROL CABINET WIRE GUTTER. CABLE SHALL BE: 18 AWG / 2 CONDUCTOR COLEMAN CABLE 71902. SEE METERING CABINET DETAIL.
2. PROVIDE CONDUIT AND CABLING FROM METER BACK TO METERING CONTROL CABINET WIRE GUTTER. CABLE SHALL BE: 22 AWG / 4 CONDUCTOR COLEMAN CABLE 72304. SEE METERING CABINET DETAIL.
3. PROVIDE CONDUIT AND CABLING FROM SENSORS BACK TO METERING CONTROL CABINET WIRE GUTTER. CABLE SHALL BE: 22 AWG / 4 CONDUCTOR COLEMAN CABLE 72304. SEE METERING CABINET DETAIL.



CRES BUILDING SERVICE FLOW METER WIRING DETAIL

1 / A1.01 SCALE: NO SCALE

Detail Title:	Detail No.: 01		
CRES Building Meter Wiring Detail	Scale: N.T.S.	Facilities Planning & Construction Standard Detail	University of Nebraska Lincoln
	Date: NOVEMBER 2013		



KEY NOTES

1. METERING CABINET AND WIRING GUTTER TO BE PROVIDED BY UNL, INSTALLED BY THE CONTRACTOR IN WALL LOCATION TO BE COORDINATED WITH UNL REPRESENTATIVE. TOP OF CABINET TO BE 6'-0" AFF. PROVIDE A MINIMUM 12" DISTANCE BETWEEN CABINET AND ANY ADJACENT WALL MOUNTED EQUIPMENT. AREA BELOW CABINET TO BE LEFT CLEAR TO ALLOW FOR UNL PROVIDED UPS UNIT.
2. PROVIDE DEDICATED 20 AMP / 120 VOLT DUPLEX OUTLET WITHIN 12" OF METERING CABINET. OUTLET TO BE SERVED FROM EMERGENCY POWER CIRCUIT.
3. PROVIDE ETHERNET NETWORK PORT IN METERING CABINET. COORDINATE LOCATION OF PORT WITH UNL REPRESENTATIVE. PORT TO BE FULLY OPERATIONAL BEFORE METERING CONTROLS ARE INSTALLED.
4. TOP OF CABINET TO BE 6'-0" A.F.F.

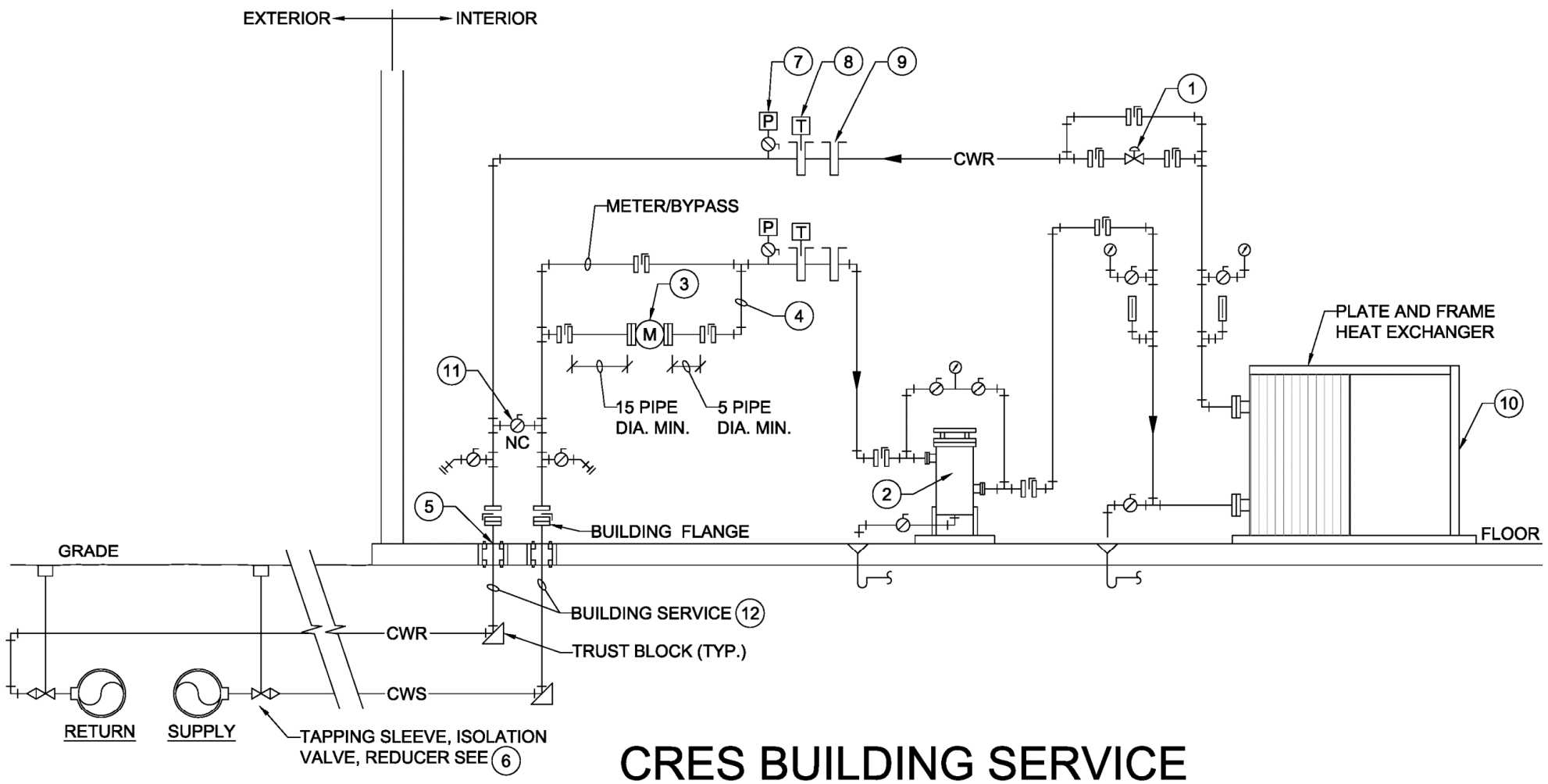
CRES BUILDING SERVICE ENERGY METERING CABINET DETAIL

1 / A1.01 SCALE: NO SCALE

Detail Title:	Detail No.: 02		
CRES Building Metering Cabinet Detail	Scale: N.T.S.	Facilities Planning & Construction Standard Detail	University of Nebraska Lincoln
	Date: APRIL 2020		

GENERAL NOTES

1. UNLESS OTHERWISE NOTED, ALL EQUIPMENT, PIPING, VALVES, ETC. SHALL BE PROVIDED, INSTALLED AND MAINTAINED BY THE BUILDING TENANT.
2. ONLY THE CRES SUPPLY / RETURN WATER SYSTEM IS SHOWN. PIPING LAYOUT AND DEVICES ON THE BUILDING SIDE OF THE HEAT EXCHANGER ARE NOT SHOWN. A MANUAL PRESSURE GAGE AND THERMOMETER ARE REQUIRED ON THE BUILDING SUPPLY AND RETURN LINES.



CRES BUILDING SERVICE PIPING SCHEMATIC

1 / A1.01 SCALE: NO SCALE

CWS - CRES WATER SUPPLY
CWR - CRES WATER RETURN

(#) KEY NOTES

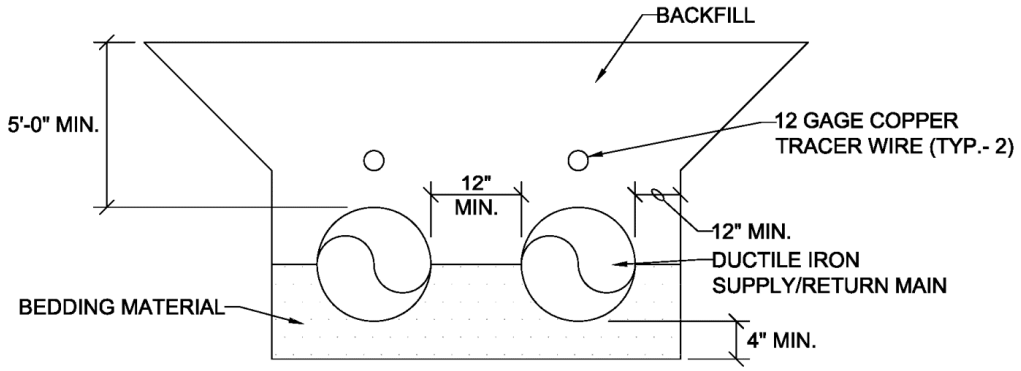
1. HEAT EXCHANGER FLOW CONTROL VALVE PROVIDED AND CONTROLLED BY BUILDING CONTROL VENDOR. FLOW CONTROL SHALL BE PRESSURE INDEPENDENT TYPE WITH MAXIMUM FLOW SET FOR HEAT EXCHANGER DESIGN FLOW. ACCEPTABLE MANUFACTURERS ARE: BELIMO, DANFOSS, AND TOUR ANDERSON.
2. DUPLEX BASKET STRAINER WITH 1/16" SCREEN. TWO SINGLE STRAINERS MAY BE PROVIDED IN LIEU OF DUPLEX UNIT. PIPE BLOWDOWN PIPE TO NEAREST FLOOR DRAIN.
3. FLOW METER PROVIDED CALIBRATED AND MAINTAINED BY UNL, INSTALLED BY CONTRACTOR. CONDUIT AND WIRE BACK TO METERING PANEL CABLE GUTTER BY CONTRACTOR. SEE CRES BUILDING METER WIRING DETAIL. PROVIDE MINIMUM UPSTREAM AND DOWNSTREAM PIPE DIAMETERS AS SHOWN BETWEEN METER AND ANY VALVE / FITTINGS.
4. PROVIDE A MINIMUM OF 15" SPACE BETWEEN METER LEG AND BYPASS LEG.
5. PROVIDE PIPE SLEEVE AND LINK-SEAL WITH SS HARDWARE AT FLOOR PENETRATION. INSTALL SO THAT THREADED NUTS ARE EXPOSED.
6. TAPPING SLEEVES, ISOLATION VALVES AND REDUCERS TO BE PROVIDED AND INSTALLED BY UNL AS PART OF CONNECTION FEE.
7. PRESSURE SENSOR PROVIDED BY UNL, INSTALLED BY CONTRACTOR. CONDUIT AND WIRE BACK TO METERING PANEL CABLE GUTTER BY CONTRACTOR. SEE CRES BUILDING METER WIRING DETAIL.
8. TEMPERATURE SENSOR PROVIDED BY UNL, INSTALLED BY CONTRACTOR. CONDUIT AND WIRE BACK TO METERING PANEL CABLE GUTTER BY CONTRACTOR. SEE CRES BUILDING METER WIRING DETAIL.
9. EXTRA THERMO-WELL FOR SENSOR CALIBRATION PROVIDED BY UNL, INSTALLED BY CONTRACTOR.
10. PLATE AND FRAME HEAT EXCHANGER TO BE INSTALLED IN FIRST FLOOR OR BASEMENT OF TENANT BUILDING.
11. 1" NORMALLY CLOSED BYPASS TO PREVENT ZERO FLOW CONDITIONS FOR EXTENDED OUTAGES.
12. CEMENT LINED, DUCTILE IRON PIPE WITH POLYETHYLENE SLEEVE. ANSI/AWWA C150/A21.5 CLASS 250.

University of Nebraska Lincoln

Facilities Planning & Construction
Standard Detail

Detail No.: 03
Scale: N.T.S.
Date: NOVEMBER 2013

Detail Title:
CRES BUILDING SERVICE
ENTRANCE PIPING SCHEMATIC



CRES BUILDING SERVICE PIPE TRENCH DETAIL

1
A1.01

SCALE: NO SCALE

Detail Title:	Detail No.: 04		
CRES Building Service Pipe Trench Detail	Scale: N.T.S.	Facilities Planning & Construction Standard Detail	University of Nebraska Lincoln
	Date: NOVEMBER 2013		