CITY OF DULUTH & DULUTH ENERGY SYSTEMS – REQUEST FOR PROPOSALS for MECHANICAL ENGINEERING DESIGN AND PLANNING

Table of Contents

Request for Proposal

1. Project Overview

Duluth Energy Systems (DES) in Duluth, MN, is leading its conversion from a steam-based district energy distribution network to a hot water-based district energy network. The current once-through steam distribution network under Superior Street in downtown will be replaced with hot water supply and return piping. The future distribution system will provide hot water to DES customers in place of the steam service they receive today. DES is seeking a consultant to develop plans for the conversion of individual DES customer buildings' mechanical systems to receive the future hot water service. The City of Duluth and DES request proposals for mechanical engineering design and planning for the conversion of the customer buildings from the existing steam connection to the future hot water connection.

1.1. Preliminary Schedule

It is anticipated that the selected proposal will be accepted by **Wednesday, December 6th, 2017**. A Notice of Award is expected to be issued shortly thereafter. The company selected shall consider a signed and accepted Notice of Award as permission to begin work designing the aspects of the customer mechanical room conversions described in this RFP. Building mechanical room walk-throughs should begin immediately following signed contract arrangements. The company awarded the contract shall provide construction documents for all buildings (as described in Section 2) by January 25th, 2018.

A pre-proposal meeting will be held on Wednesday, November 8, 2017 at 10:00 AM local time in City Hall Room 106A, 411 West 1st Street, Duluth, MN. All interested proposers are encouraged to attend. For the process of preparing the proposal, DES project representatives will walk through some representative mechanical rooms to be converted. This walkthrough will be scheduled after the pre-proposal meeting. Companies are encouraged to send a representative to get a more complete sense of the required design work. A preliminary schedule is as follows:

	Phase 1	Phase 2
Pre-Proposal Meeting	November 8, 2017	
Pre-Proposal Site Walkthroughs	TBD	
Proposals Due	November 16, 2017	
Notice to Proceed (anticipated)	December 7th, 2017	
Design Documents Complete	January 25th, 2018	December 2018

1.2. Rejection of Proposals. The City reserves the right, in its sole and complete discretion, to reject any and all proposals or cancel the request for proposals, at any time prior to the time a contract is fully executed, when it is in its best interests. The City is not liable for any costs the Proposer incurs in preparation and submission of its proposal, in participating in the RFP process or in anticipation of award of the contract.

1.3. Questions & Answers. Any questions regarding this RFP must be submitted by e-mail to the Purchasing Office at purchasing@duluthmn.gov no later than the date indicated on the Calendar of Events. Answers to the questions will be posted as an Addendum to the RFP.

1.4. Addenda to the RFP. If the City deems it necessary to revise any part of this RFP before the proposal response date, the City will post an addendum to its website http://www.duluthmn.gov/purchasing/bids-request-for-proposals/ . Although an e-mail notification will be sent, it is the Proposer's responsibility to periodically check the website for any new information

1.5. Proposals. To be considered, hard copies of proposals must arrive at the City on or before the time and date specified in the RFP Calendar of Events. The City will not accept proposals via email or facsimile transmission. The City reserves the right to reject or to deduct evaluation points for late proposals.

Proposals must be signed by an official authorized to bind the Proposer to its provisions. If the official signs the Proposal Cover Sheet attached as Attachment D, this requirement will be met. Proposals must remain valid for 60 days or until a contract is fully executed.

Please submit one (1) paper copy of the Technical Submittal and one (1) paper copy of the Cost Submittal. In addition, Proposers shall submit one copy of the entire proposal (Technical and Cost submittals, along with all requested documents) on CD-ROM or Flash drive in Microsoft Office-compatible or pdf format.

All materials submitted in response to this RFP will become property of the City and will become public record after the evaluation process is completed and an award decision made.

1.6. Term of Contract. The term of the contract will begin once the contract is fully executed and is anticipated to end by December 31, 2018. The selected Proposer shall not start the performance of any work nor shall the City be liable to pay the selected Proposer for any service or work performed or expenses incurred before the contract is executed.

1.7. Mandatory Disclosures. By submitting a proposal, each Proposer understands, represents, and acknowledges that:

A. Their proposal has been developed by the Proposer independently and has been submitted without collusion with and without agreement, understanding, or planned common course of action with any other vendor or suppliers of materials, supplies, equipment, or services described in the Request for Proposals, designed to limit independent bidding orcompetition, and that the contents of the proposal have not been communicated by the Proposer or its employees or agents to any person not an employee or agent of the Proposer.

B. There is no conflict of interest. A conflict of interest exists if a Proposer has any interest that would actually conflict, or has the appearance of conflicting, in any manner or degree with the performance of work on the project. If there are potential conflicts, identify the municipalities, developers, and other public or private entities with whom your company is currently, or have been, employed and which may be affected.

C. It is not currently under suspension or debarment by the State of Minnesota, any other state or the federal government.

D. The company is either organized under Minnesota law or has a Certificate of Authority from the Minnesota Secretary of State to do business in Minnesota, in accordance with the requirements in M.S. 303.03.

1.8. Notification of Selection. The selected Proposer will be expected to execute a City of Duluth standard Professional Engineering Services Agreement.

Proposers whose proposals are not selected will be notified in writing when contract negotiations have been successfully completed and the City has received the final contract signed by the selected Proposer.

2. Project Description and Scope of Services

DES is requesting services of a contractor/consultant to perform design for the customer building mechanical conversions as described above. It is anticipated that each of the conversions will be unique, so a specific design for each building is required. The scope of services includes:

- Preparation of the design elements of the customer building mechanical system conversions, including the locations, necessary piping, appurtenant items, controls, valves, etc. for the construction of the items listed in Section 3.0.
- Preparation of construction plans for the construction of the components designed, signed by a Professional Engineer, Licensed in the State of Minnesota.
- Preparation of specifications related to the conversions, signed by a Professional Engineer, Licensed in the State of Minnesota.
- Preparation of an itemized Engineer's Estimate for the construction of the components to be installed.
- Prepare and participate in meetings with DES as requested by its Project Manager. (3 meetings maximum)

The conversion of the existing customer buildings from steam to hot water will require the completion of engineering documents to identify the steps required to allow the building to utilize the hot water district energy system. The selected consultant shall perform the mechanical design and generate documents required to convert each customer building from steam to hot water. This package will be supplied to contractors for bidding and construction.

Preliminary process and instrumentation diagrams for the hot water service entrance and energy transfer stations are shown in **Attachment A: Preliminary Hot Water Connection Diagrams**. The preliminary energy transfer station schedule is shown in **Attachment B: ETS Schedule**. The Preliminary energy transfer station specification control document is shown in **Attachment C: ETS Specification Control Document**.

For each customer building identified in the ETS Schedule, the work shall include, but not be limited to:

- Generate the necessary design documents to concisely detail and specify the connection of the customer building to the district energy system (primary side). This shall include the location of the service entrance, the shutoff valves, the shunt assembly, appurtenances (drains, vents, etc), btu meter, and the location of the energy transfer station. All equipment shall include necessary operating and maintenance clearances. The design shall include, where possible, a modular/pre-fabricated hot water energy transfer station. Identify any required demolition.

- Generate the necessary design documents to concisely detail and specify the conversion process for the building (secondary side). The design shall include any additional radiation, terminal units, heat transfer equipment, vents, drains, pumps, equipment relocation, or other work required to convert the building and serve the customer load. Identify any required demolition.
- Generate cost estimates for installation of building service, the fabrication and installation of the energy transfer station, and building side conversion.

It is expected that the contractor/consultant will perform in person site walkthroughs in each of the customer building mechanical rooms to accurately design and detail the conversion work necessary in each of the buildings. Site walkthroughs should be coordinated through DES (218-723-3601) to obtain access to the buildings.

3. Specific Project Information

Description of the project approach you would typically take in organizing and completing a project of this type, description shall include:

- Identification of work to be completed by your firm as it relates to this Request for Proposal.
- Outline the steps that will be taken to perform the mechanical system conversion designs.
- Listing of the types of services or assistance you would require from DES
- Project schedule
- Completion of the DEED Jobs Report and Worksheet for State Funded Projects. Form will be provided by DES.

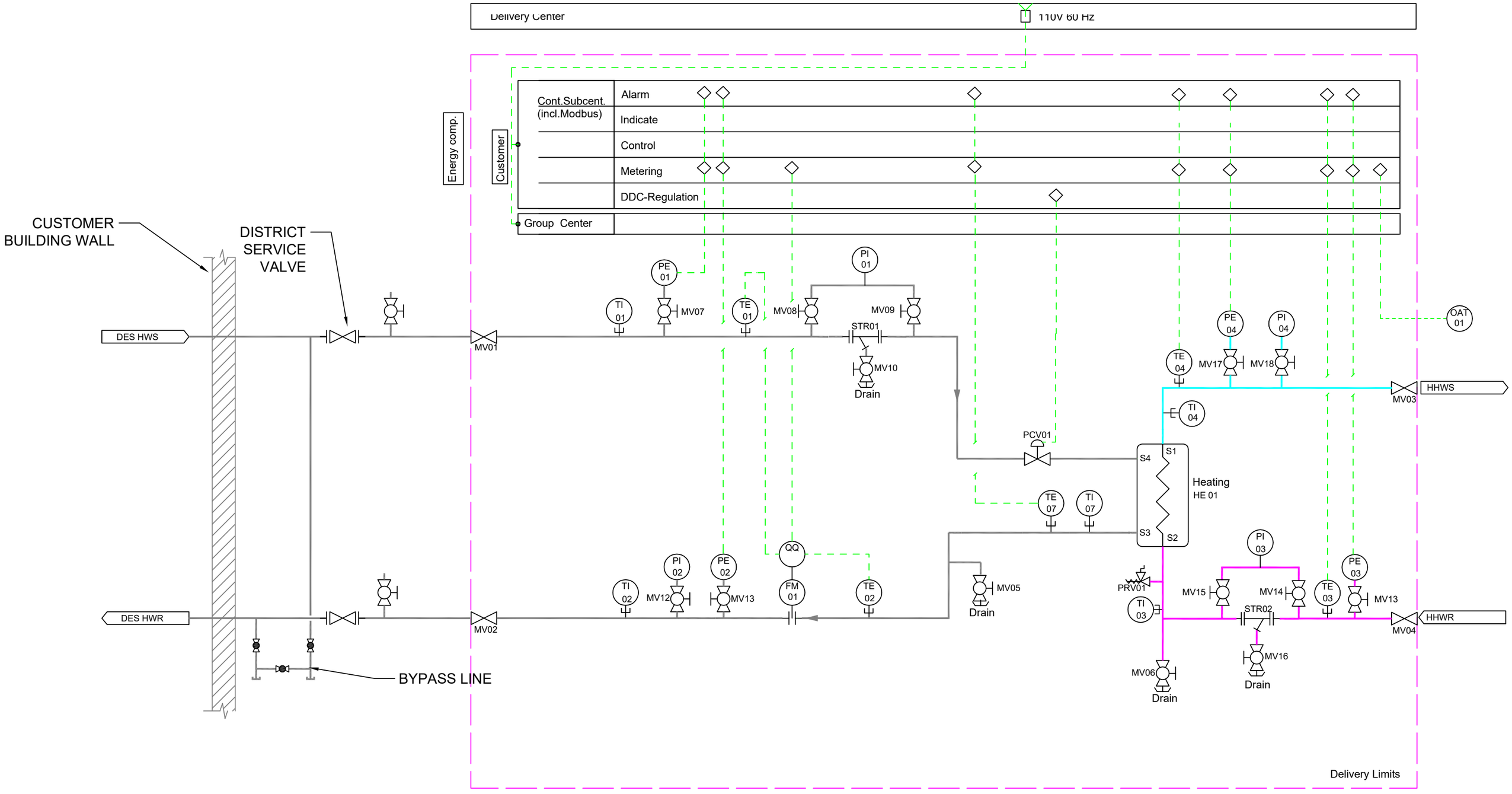
4. Evaluation Criteria and Contract Award

The City of Duluth and DES will evaluate and validate all qualifying proposals. The proposal evaluation process will permit DES to identify the proposal that best meets the needs of DES. Estimated project fees will be the primary criterion considered, but each proposal will be evaluated and scored as follows:

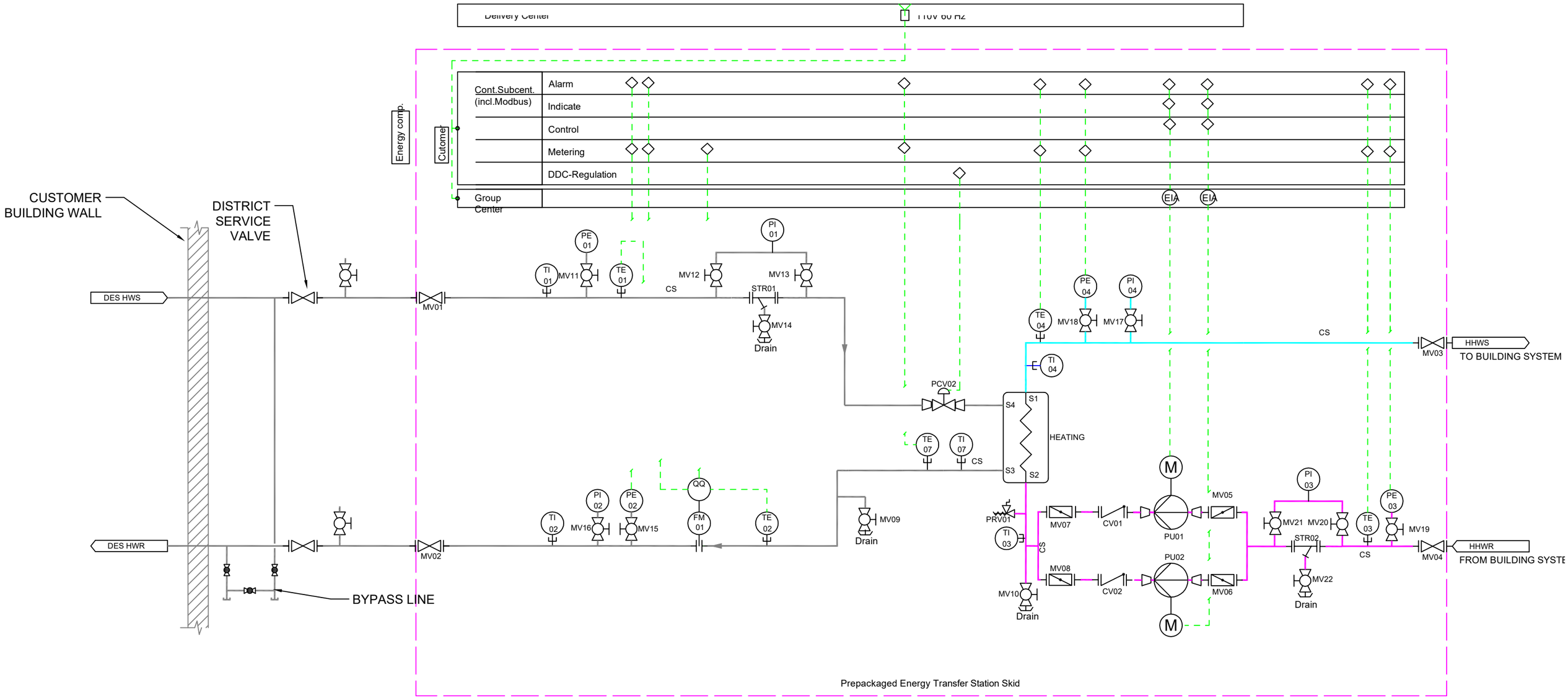
Selection Criteria	Scoring (Pts)
Estimated project fees.	45
Understanding of the requirements of this project.	20
Background experience of the firm and the project team as it directly relates to this project.	20
Qualifications and experience of key personnel assigned to this project.	10
Clarity, conciseness, and organization of the proposal.	5

The award of contract will be made utilizing the above criteria.

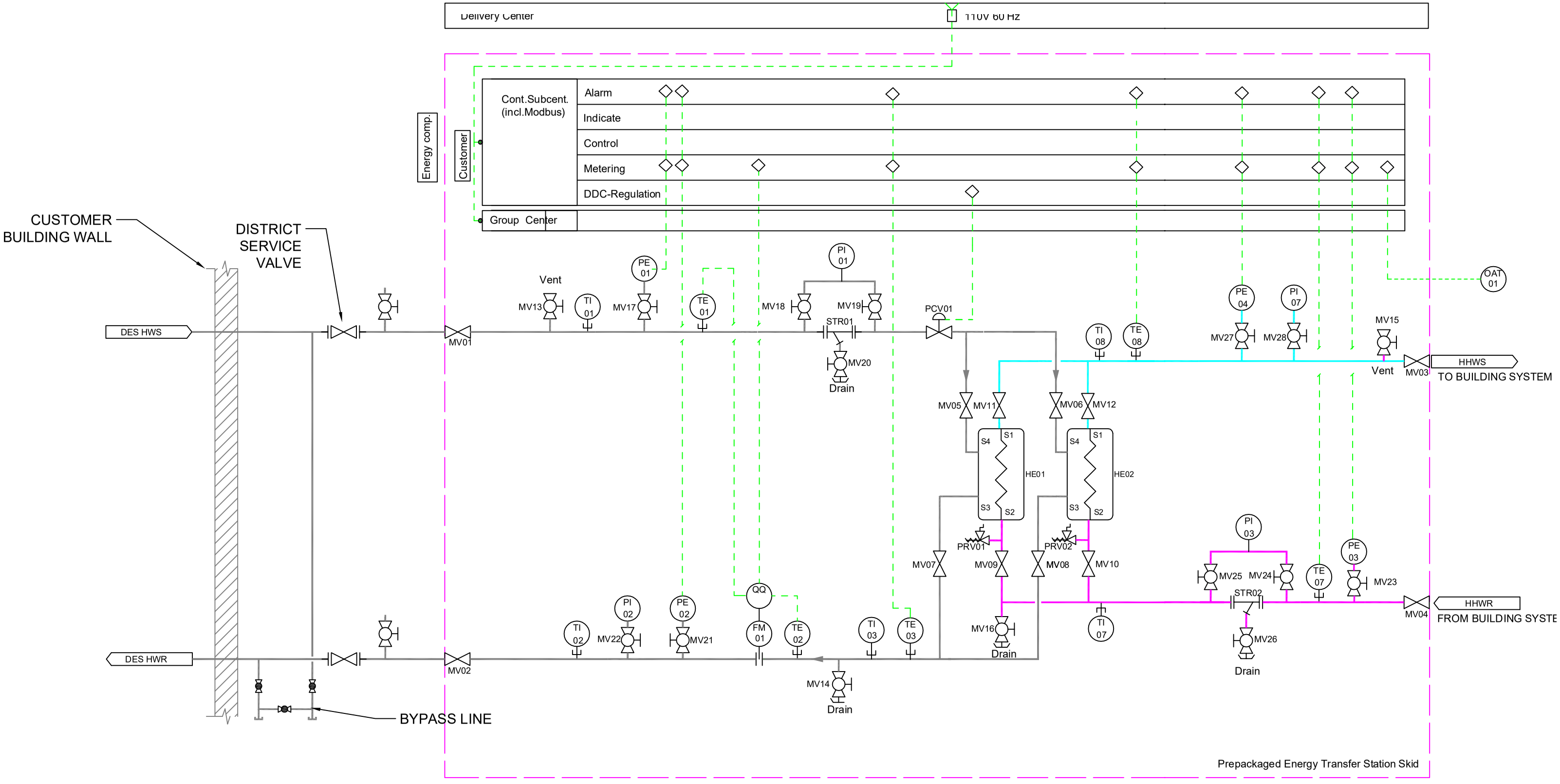
Space Heating without Secondary Pumps



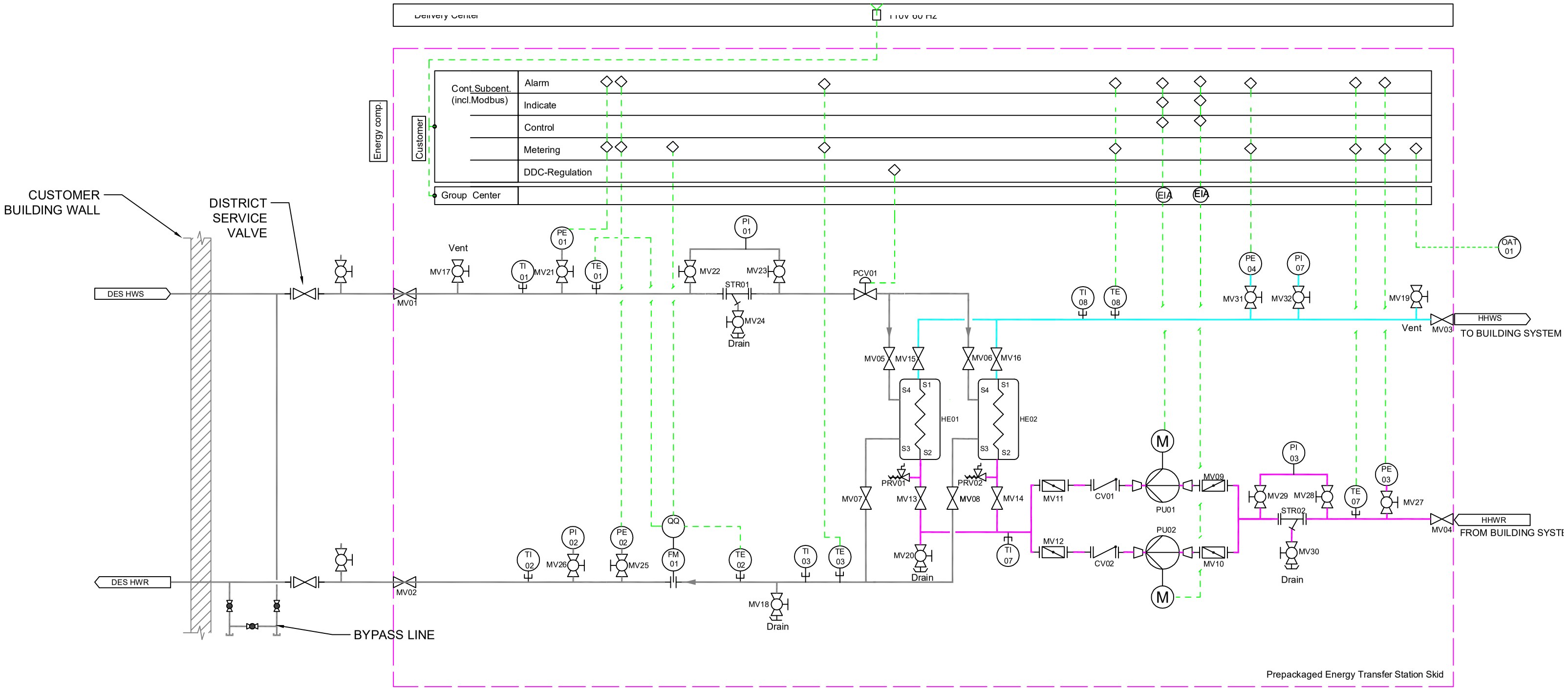
Space Heating with Secondary Pumps



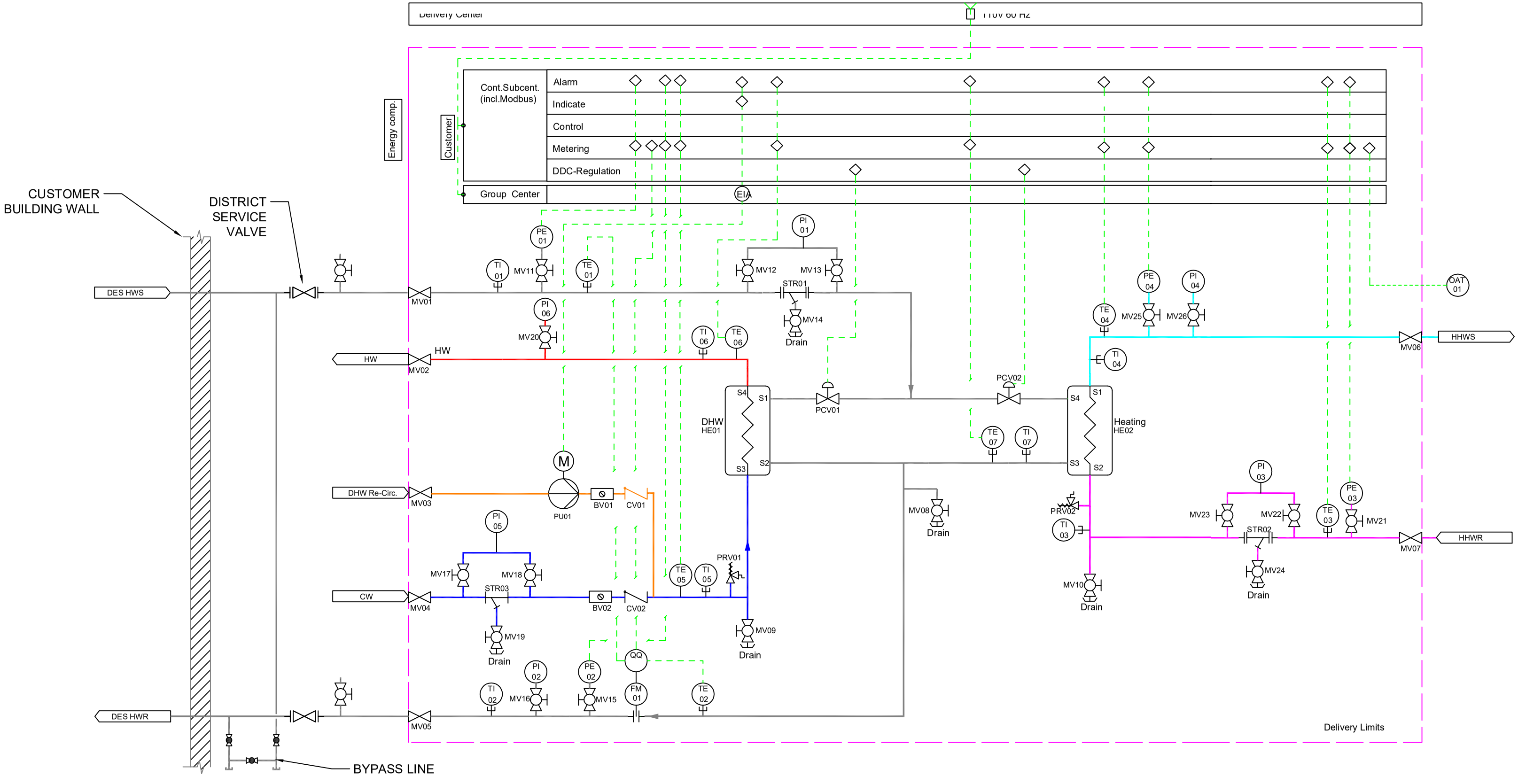
Space Heating without Secondary Pumps
Redundant Heat Exchangers



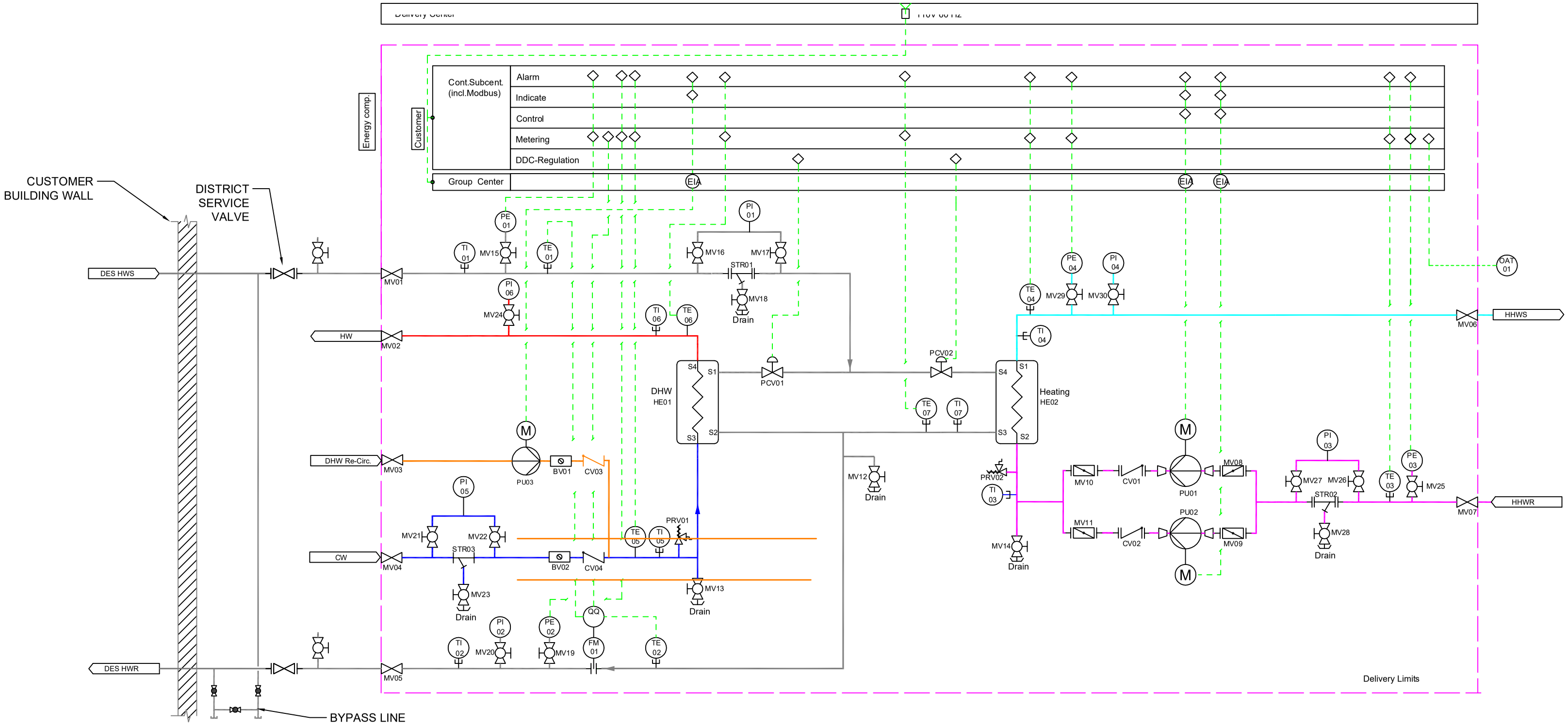
Space Heating with Secondary Pumps
Redundant Heat Exchangers



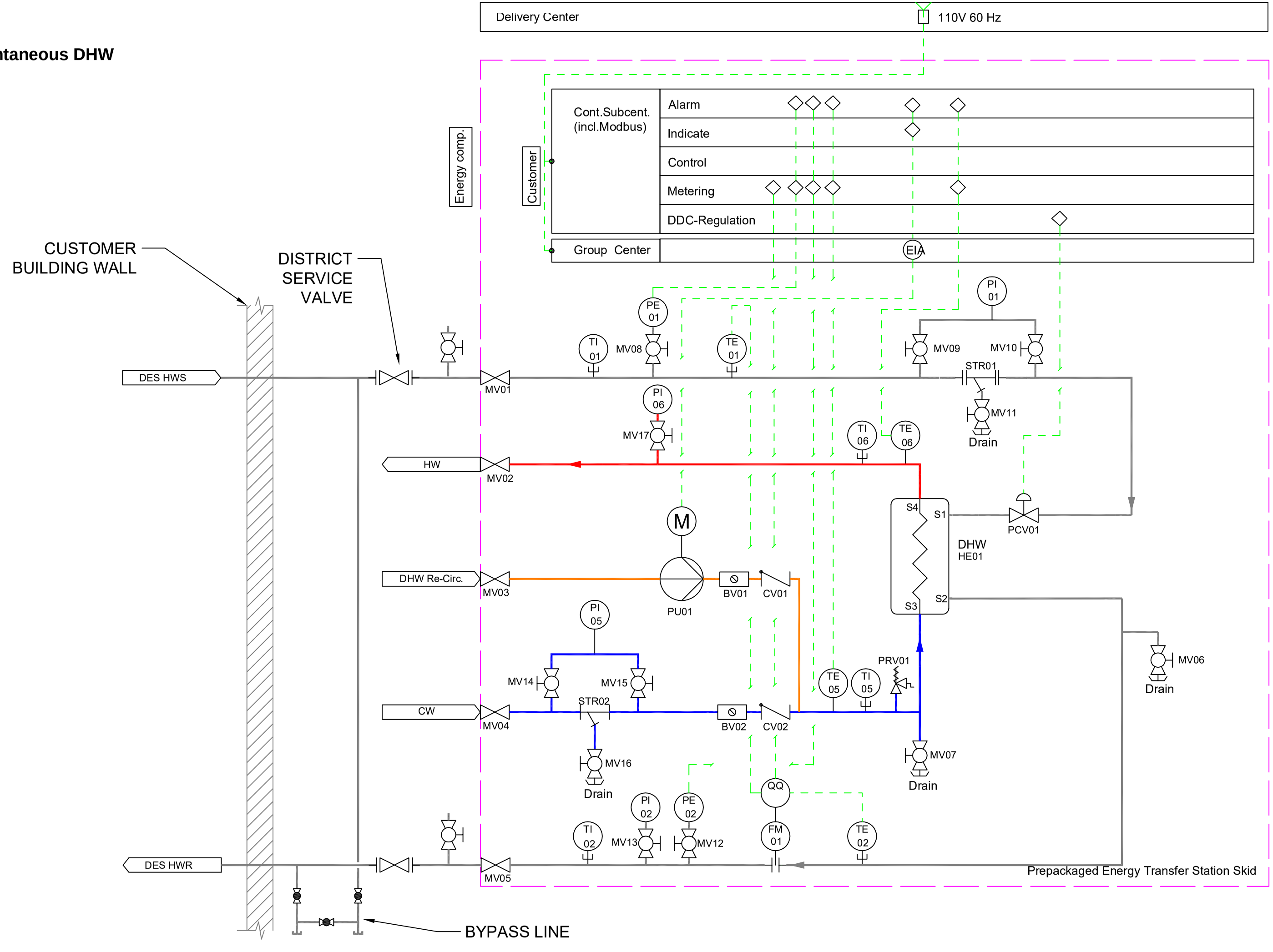
Space Heating without Secondary Pumps
Instantaneous DHW



Space Heating with Secondary Pumps
Instantaneous DHW



Instantaneous DHW



ETS Schedule

Project Duluth Hot Water - Energy Transfer Stations Phase 1

ETS #	Bldg #	HX Capacity [MBH]	Service Type	District-Side Flow [gpm]	Bldg-Side Flow [gpm]	District-Side EWT [ºF]	District-Side LWT [ºF]	Bldg-Side EWT [ºF]	Bldg-Side LWT [ºF]	District-Side Max HX DP [psid]	Bldg-Side Max HX DP [psid]	New Pump Req'd?	Prelim-inary Pump Flow [gpm]	Prelim-inary Pump Head [ft]	Campus-Side Range of Potential DP at Peak [psid]	Voltage available in Mech room
1	1500	1954	HHW	65	130	215	155	150	180	5	5	Y	130	95.0		120
1	1500	1462	HHW	49	97	215	155	150	180	5	5	Y	97	8.5		120
1	1500	1200	DHW	25	27	215	120	35	125	5	5	Y	27	25		120
2	1480	1954	HHW	65	130	215	155	150	180	5	5	N	0	65		240
2	1480	500	DHW	11	11	215	120	35	125	5	5	N	0	40		240
3	1470	1954	HHW	65	130	215	155	150	180	5	5	Y	130	100		120
4	1490	3228	HHW	108	215	215	155	150	180	5	5	N	0			240
4	1490	977	HHW	33	65	215	155	150	180	5	5	N	0			240
4	1490	1909	DHW	40	42	215	120	35	125	5	5	Y	42			240
4	1490	745	POOL	20	149	215	140	90	100	5	5	Y	149			240
5	2425	5082	HHW	169	339	215	155	150	180	5	5	N	0			240
6	680	341	HHW	11	34	215	155	130	150	5	5	Y	34	19		120
7	1390	434	HHW	14	29	215	155	150	180	5	5	Y	29	36		120
8	675	721	HHW	24	48	215	155	150	180	5	5	Y	48	45		120
9	1410	1005	HHW	33	67	215	155	150	180	5	5	Y	67	40		120
10	1310	734	HHW	24	73	215	155	130	150	5	5	N	0			240
10	1310	189	DHW	4	4	215	120	35	125	5	5	N	0			240
11	1350	690	HHW	23	69	215	155	130	150	5	5	Y	69	65		240
12	1380	526	HHW	18	35	215	155	150	180	5	5	Y	35	60		120
13	1680	174	HHW	6	12	215	155	150	180	5	5	Y	12	47		120
14	1640	50	HHW	2	3	215	155	150	180	5	5	Y	3	35		120
15	1220	1000	HHW	33	67	215	155	150	180	5	5	Y	67			
16	1250	830	HHW	28	55	215	155	150	180	5	5	Y	55			
17	1251	430	HHW	14	29	215	155	150	180	5	5	Y	29			
18	1280	410	HHW	14	27	215	155	150	180	5	5	Y	27			

ETS Schedule

Project Duluth Hot Water - Energy Transfer Stations Phase 2

ETS #	Bldg #	HX Capacity [MBH]	Service Type	District-Side Flow [gpm]	Bldg-Side Flow [gpm]	District-Side EWT [ºF]	District-Side LWT [ºF]	Bldg-Side EWT [ºF]	Bldg-Side LWT [ºF]	District-Side Max HX DP [psid]	Bldg-Side Max HX DP [psid]	New Pump Req'd?	Prelim-inary Pump Flow [gpm]	Prelim-inary Pump Head [ft]	Campus-Side Range of Potential DP at Peak [psid]	Voltage available in Mech room
19	4260	9474	HHW	316	632	215	155	150	180	5	5	Y	632			120
19	4260	1263	DHW	27	28	215	120	35	125	5	5	Y	17	20		120
20	180	318	HHW	11	21	215	155	150	180	5	5	Y	21			
21	260	1547	HHW	52	103	215	155	150	180	5	5	Y	103			240
21	260	1229	DHW	26	27	215	120	35	125	5	5	Y	27			240
22	2910	802	HHW	27	53	215	155	150	180	5	5	Y	74	27		120
23	2700	659	HHW	22	44	215	155	150	180	5	5	Y	44			120
23	2700	292	DHW	6	6	215	120	35	125	5	5	Y	6			120
24	3260	275	HHW	9	18	215	155	150	180	5	5	Y				120
24	3260	46	DHW	1	1	215	120	35	125	5	5	Y	22	15		120
25	2790	186	HHW	6	12	215	155	150	180	5	5	Y	32	25		120
25	2790	16	DHW	0	0	215	120	35	125	5	5	Y	22	15		120
26	200	778	HHW	26	52	215	155	150	180	5	5	Y	70	20		240
26	200	512	DHW	11	11	215	120	35	125	5	5	Y	20	15		240

PACKAGED DISTRICT HEATING SUBSTATIONS SPECIFICATION CONTROL DOCUMENT

October 20, 2017

DISCLAIMER

The design information and equipment selections presented herein are preliminary. This Specification Control Document is not approved until signed and approved by Owner. The Supplier shall be responsible for the detailed design, specification, and final selection of all equipment, systems, and components subject to qualification and approval by Owner and/or their designated engineering representative.

TABLE OF CONTENTS

1 GENERAL REQUIREMENTS

1.1 SUMMARY

This Specification Control Document (SCD) provides for the design and procurement of packaged district heating substations that are designed to transfer thermal energy from the Medium Temperature Hot Water (MTHW) district heating system to customer buildings.

1.2 DEFINITIONS

Design Pressure — The design pressure is the maximum allowable working pressure as defined in ASME B31.1 Power Piping Code.

Heat Exchanger (HX) — A device that permits heat to be extracted from one system for use in another without mixing fluids.

Interconnecting Pipe — Piping that runs from the isolation valves within the building wall to the substation.

Medium Temperature Hot Water (LTHW) – A description used with district heating systems that distribute water at a supply temperature between 190°F and 250°F.

Operating Pressure — The operating pressure is the pressure at which the system normally operates.

Owner — The entity that will own and operate the packaged substations.

Owner's Representative — Hired by the Owner to provide continuity of design as well as oversee and review the work by the Supplier and/or the Owner's contractor.

Service Line — Piping that runs from the main lines of an underground district heating distribution system to the customer interior wall terminating (normally) at the isolation valves where the service lines penetrate the building wall.

Substation –- An integrated energy transfer station that is packaged on a skid and designed to be installed at the interface between a district heating distribution system and customer buildings.

Supplier — The vendor supplying packaged district heating substations described herein.

1.3 REFERENCE STANDARDS

1.3.1 This section is applicable only to district heating substations procured as packaged units.

1.3.2 The latest published edition of a reference shall be applicable unless identified by a specific edition date.

1.3.3 All reference amendments adopted prior to the effective date of a contract with a Supplier shall be applicable.

1.3.4 The design and construction of the district heating substation shall be in accordance with applicable laws and regulations.

1.3.5 All materials, construction, and workmanship shall comply with the latest editions of the applicable codes and standards from the following:

- American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
- American Society of Mechanical Engineers (ASME)
- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- American Water Works Association (AWWA)
- Instrument Society of America (ISA)
- Underwriters Laboratories (UL)
- National Electrical Manufacturer's Association (NEMA)
- National Fire Protection Association (NFPA)
- American Standards Association (ASA)

1.3.6 The supplier may submit a request to the Engineer for acceptance of an alternate standard. In the request, the supplier must provide sufficient documentation demonstrating that the requested standard meets or exceeds ANSI/ASME/ASTM standards and has been approved by the local mechanical inspector.

1.4 QUALITY ASSURANCE

1.4.1 Equipment and piping components shall be made in the United States, Canada or Europe to ANSI/ASME/EN standards.

1.4.2 Welding shall be in accordance with ANSI/ASME B31.1 and the following quality assurance requirements:

A. Welders employed by the Supplier shall have passed a qualification test in accordance with ANSI/ASME B31.1 and Section IX, ASME Boiler and pressure vessel code.
B. All welds shall be examined by a Certified Welding Inspector and in accordance with inspection and examination requirements of ANSI/ASME B31.1.

1.4.3 The Supplier shall undertake performance tests and acceptance tests of packaged district heating substations in accordance with Section 3 of this specification.

1.5 SUBMITTALS

1.5.1 The Supplier shall provide the following information for qualification and approval. Part numbers are required for all substation components. All units must be US customary units but metric may be included for reference:

A. Substation Schematic Drawings
B. Component Submittals
C. Assembly/Installation Drawings (including interfaces, dimensions, and weights)
D. Process and Instrumentation Diagrams
E. Control Equipment Description
   - Functional description
   - Sequence of operation
F. Programs for Performance Testing, Commissioning and On-site O&M Training (including proposed personnel)
G. Operation and Maintenance Manual
H. Qualification Test Procedure Report
I. Weld Procedure Specifications (WPS), Procedure Qualification Records (PQR), and Welder Performance Qualifications (WPQ)
J. Acceptance Test Procedure
K. Substation Datasheet Template
L. Requested Deviations

1.5.2 For each packaged substation furnished by the Supplier the following information shall be provided:

A. Factory Acceptance Test Report
B. Substation Datasheet – including description of the nameplate, all major components (including part numbers and serial numbers), and revision levels of controlling drawings and documents
C. Declaration of Conformity - with a certificate that the unit has been inspected during manufacture in accordance with requirements of applicable pressure vessels directives and confirming that the district heating substation is suitable for use with design pressures and temperatures as per this specification.

1.6 DELIVERY, STORAGE AND HANDLING

1.6.1 Supplier shall be required to provide 2-D CAD files of models with proposal. The engineer of record shall verify the equipment can fit into given location of where the energy transfer stations are to be installed. If equipment does not fit, then installation contractor is responsible for providing feedback to Supplier for redesign efforts. Engineer of record shall have responsibility to confirm that packaged substation skids are designed to fit within available space and that there is adequate egress for delivery to installation location. The Supplier is to design the substation to be broken down into sections if required.

1.6.2 Products shall be delivered in original, unbroken packages, containers, or bundles bearing the name of the manufacturer.

1.6.3 Supplier shall be responsible for shipping of all materials, and delivery of substations to site in accordance with Owner's delivery schedule.

1.7 COMMISSIONING

1.7.1 The Supplier shall provide support during substation commissioning for all phases of substation deployment and mutually sign off on all completed commissioning activities and checklists together with the commissioning agent.

1.7.2 Customer shall provide suppler a minimum of 3 weeks advanced notice for start-up if start up is required.

1.7.3 Commissioning and start-up support services shall include support by a representative from the entity responsible for control system integration for the packaged substation skids. Support services representative shall have a minimum of 1 year experience with low temperature hot water district energy substation control systems.

1.8 ON-SITE O&M TRAINING

1.8.1 Supplier shall provide one (1) day on-site operational and maintenance training sessions to Building Owner's operating staff as part of this contract.

1.9 WARRANTY

1.9.1 A manufacturer's warranty shall be provided for a period of not less than twenty four (24) months from the date of substation start-up or thirty six (36) months after delivery. Under which the Supplier agrees to repair or replace systems, products, or components that fail, or do not perform in accordance with Owner's requirements, due to defects in materials or workmanship at no cost provided that defects occurred under normal and proper use.

1.9.2 The manufacturer's warranty shall cover all elements and components of the substation, including controls and control system.

2 DESIGN AND CONFIGURATION REQUIREMENTS

2.1 GENERAL

2.1.1 Design, sizing and configuration requirements for each packaged substation are specified in this section and defined in Appendix A. The Supplier must request a deviation for approval for any design/configuration requirement that cannot be met.

2.1.2 Each packaged substation shall be equipped with the following at a minimum:

- Heat exchanger(s) for space heating
- Heat exchanger(s) for domestic hot water (if applicable)
- Control valve(s) for heating
- Control valves for domestic hot water (if applicable)
- Pumps and VFDs (if selected for supply with the integrated package)
- Revenue grade energy meter
- Control system with local panel and HMI and network interface
- Temperature and pressure sensors and gauges
- Thermal insulation (removable) for heat exchangers (PHE exempt)
- Isolation, filling, check, safety, drain and vent valves
- Strainers for primary/heating and domestic hot water

2.1.3 Flow on both sides of the district heating substation is designed to vary.

A. The substation must be capable of delivering the range of supply temperatures for heating water and domestic hot water on the building side.

B. The substation must also be capable of achieving the low return water temperature expected on the district side of the heat exchangers, provided the building heating hot water systems perform as intended.

2.1.4 No district side water flow should pass through the substation unit when there is no load. For this purpose, an unloaded unit is one which is not being called on to supply space heating, domestic hot water or domestic hot water circulation.

2.2 SUBSTATION CONFIGURATION

2.2.1 Achieving hot water return temperatures at or below 160°F from customer buildings is critical to successful district heating system performance. This results in lower district return water temperature which reduces the flow rate necessary to serve the heating loads and preserves available capacity.

2.2.2 For hydraulically remote (hydraulically critical) customer buildings in the district heating system a minimum differential pressure of 20 psid (110 kPa) will be allocated. This includes 4 psid (28 kPa) for the interconnecting piping and 16 psid (83 kPa) for the packaged substation on the district side. For those hydraulically remote substations with both space heating and DHW HX the Supplier shall work to configure the space heating and DHW HX in series, but may consider a parallel HX configuration if required due to differential pressure limitations.

2.2.3 The piping and control valve configuration for series connection of heating HX and DHW HX illustrated in the substation schematics found in Appendix A is a suggested configuration. Alternative vendor configurations may be acceptable, pending Owner approval, but they must meet the following functional requirements:

A. When district supply water supplementing is required to maintain building side domestic hot water temperature requirements, configuration and control must be designed for minimal use of district supply water peaking, versus designed for full space heating HX return flow through the DHW HX in conjunction with district supply water peaking.
B. Configuration and control must allow for instantaneous DHW load to be served by district supply water when space heating HX is not in use in buildings without DHW or IHW storage tanks

2.2.4 Substation schematics identifying general requirements and Supplier scope of work are included in Appendix A.

2.3 TEMPERATURE AND PRESSURE REQUIREMENTS

2.3.1 The following table shall be considered the design temperatures and pressure for the district heating system and connected buildings:

Design Pressures and Temperatures		
	District	Building
Design Pressure	150 psig	150 psig*
Design Temperature	215 °F	180 °F*

*Design temperature and pressure on building side must be verified for each individual building.

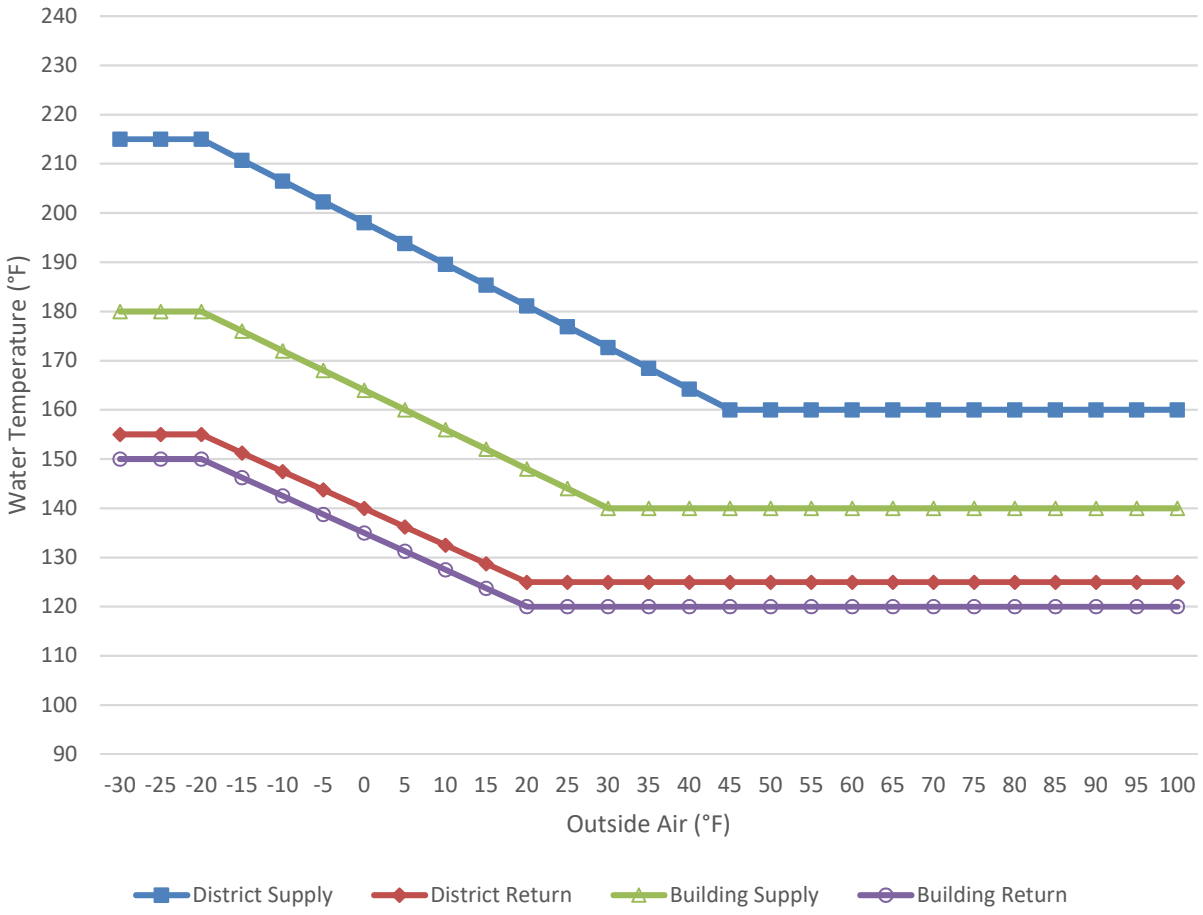
All components and equipment shall be either PN16 rated (232 psi at 200°F) or ANSI Class 150 rated (260 psi at 200°F) or higher.

Substation hydronic piping and equipment shall be hydrostatic pressure tested to a pressure of 1½ times the design pressure for a period of minimum 30 minutes with no drop in pressure.

2.3.2 District heating substations must meet the design and operating conditions and strategies of the district heating distribution system:

A. Allowable differential pressure in building(s) for each substation are to be provided by Owner's Representative to Supplier.

B. Supply temperature varies from 160-220°F over the year with the outside air temperature between. The outside air temperature reset schedule is as follows:



2.3.3 Heat exchangers shall be selected based on the capacity, temperature and pressure information provided by the Owner.

Maximum allowable pressure drop (ΔP) across the heat exchangers is 5 psi.

Space Heating Heat Exchanger Selection Criteria					
District Side Conditions			Building Side Conditions		
Supply Temp	Return Temp	Max. ΔP	Return Temp	Supply Temp	Max. ΔP
215°F	155°F	5 psi	150°F	180°F	5 psi

Domestic Hot Water Heat Exchanger Selection Criteria					
District Side Conditions			Building Side Conditions		
Supply Temp	Return Temp	Max. ΔP	Inlet Temp	Supply Temp	Max. ΔP
215-160°F	120-95°F	5 psi	50°F	130-140°F	5 psi (14 kPa)

2.4 INSTALLATION AND IDENTIFICATION OF PIPES AND EQUIPMENT

2.4.1 Substation shall be configured such that equipment and components can conveniently and safely be serviced and/or replaced.

2.4.2 Equipment intended for operation, supervision, indication or inspection shall be clearly visible, easy to read and reach.

2.4.3 Components that may need to be operated during usage shall be positioned such that contact with hot surfaces is avoided.

2.4.4 Electronic equipment shall not be subjected to higher temperatures than that for which it is intended.

2.4.5 The design of connections and sealing surfaces shall be appropriate to the type of material used in the connected pipes, and to the substation's design data.

2.4.6 Welded connections are preferred but whenever flanges and/or threaded connections must be used for equipment, connection type should be to ANSI/ASME standards unless a deviation is approved by the Owner's Representative.

2.4.7 Provide nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters.

2.4.8 Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.5 HEAT EXCHANGERS – GENERAL

ACCEPTABLE MANUFACTURERS:

1. Alfa Laval
2. Sondex
3. Swep

FRAME COMPONENTS

2.5.1 The Plate Heat Exchanger manufacturer shall not subcontract or purchase for resale the plates. They shall press their own plates.

2.5.2 The Plate Heat Exchanger Manufacturer shall have an established and on-going QA/QC program including manuals available for inspection at plant.

2.5.3 The Plate and Frame heat exchanger manufacturer shall have extensive background and experience in the design and fabrication of plate and frame heat exchangers. The manufacturer shall have fabricated plate heat exchangers for a minimum of twenty (20) years.

2.5.4 Heat exchangers for space heating shall be sized for design load capacity defined in designer's specification and equipment schedule. Heat exchangers for space heating shall be brazed plate type. If brazed plate type heat exchangers are not available for the capacity defined in designer's specification then AHRI-certified gasketed plate and frame type heat exchangers shall be acceptable. When gasketed plate and frame type heat exchangers must be used they shall be selected with frames that allow for future

expansion of at least 20% additional plates.

2.5.5 Plate heat exchangers shall be certified according to ARI Standard 400 and listed on the ARI.org site **http://www.ahridirectory.org/ahridirectory/pages/llhe/defaultSearch.aspx**. If heat exchanger is not ARI certified, then the manufacturer shall provide an independent third party field performance test using the mapped ratings, limits and tolerances of ARI Standard 400 to verify performance to specification. Any and all cost associated with correcting a non-performing heat exchanger to meet the performance requirements shall be the responsibility of the supplier. Any cost associated with the field performance test shall be included in the price of the heat exchanger.

2.5.6 Plate heat exchangers shall be designed, constructed, and tested in accordance with Section VIII, Division I of the ASME Pressure Vessel Code.

2.5.7 Preference will be given to single pass designs with all connections on the fixed cover.

2.5.8 The fixed and movable covers shall be of sufficient thickness for the design pressure and code requirements and shall have no welded reinforcements or stiffeners.

2.5.9 The movable cover shall be provided with a steel or nylon roller bearing for units greater than 50" in height (from bottom of feet). This allows the movable cover to be moved without additional rigging or handling equipment.

2.5.10 The carrying and guide bars shall be designed to allow for expansion of at least 20%.

2.5.11 The carrying and guide bars guiding system shall be precision manufactured of stainless steel to prohibit corrosion and facilitate movement of the plates. A stainless steel sleeve for the carrying bar is acceptable on connections 4” and above. Painted or surfaces are not permitted.

2.5.12 The entire frame shall be bolted together to allow unit to be field assembled to permit rigging into place. Welding of the frame components is not permitted.

2.5.13 Plate and carrying bar design shall permit the removal or access to any plate in the plate pack without the need to remove any other plates.

2.5.14 Provide lifting lugs designed to allow lifting of the entire unit’s flooded weight.

2.5.15 All steel surfaces shall be thoroughly cleaned and prepared for painting per SSPC-SP1063T, painting over mill scale is not acceptable. All steel components shall be primed using a high grade epoxy primer and finish painted using a high solids urethane or polyurethane coating.

CONNECTIONS

2.5.16 Connections equal to or less than 2" shall be stainless steel NPT type.

2.5.17 To avoid leakage on port area, studded port design should be provided on heat exchangers with connections greater than 2". Flanged nozzle connections are not acceptable.

COMPRESSION BOLTS

2.5.18 Compression bolts shall not require special tools and shall be equipped with lock

washers at the movable cover to facilitate opening and closing of the unit from the fixed cover.

2.5.19 Compression bolts shall be equipped with captive nuts at the fixed cover and threaded nuts at the movable cover. Welding of the nut to the closure bolt is prohibited.

2.5.20 Bolts shall be provided with rolled threads to reduce galling and a minimum of 1.5 times width hex nuts to adequately distribute the load, plus ball bearing box washers at all critical closing bolts on all units greater than 50" in height.

2.5.21 Bolts shall be liberally coated with LUBRIPLATE FML-2 for lubrication and rust prevention, and covered with a plastic protective sleeving for protection from the environment and to prevent bodily injury. Alternatively, zinc plating of rods is acceptable.

2.5.22 The bolting system shall be designed so that only (4) compression bolts are required opening and closing of the unit.

PLATES

2.5.23 The plate and frame heat exchanger shall consist of pressed type ALLOY 316 to provide the required heat transfer area to meet the operating conditions specified.

2.5.24 Individual plates shall be pressed from a homogeneous single metal sheet in one step. No multi-stage pressing of one sheet is allowed.

2.5.25 Each heat transfer plate to be with herringbone corrugations to optimize heat transfer with nominal pressure loses. Corrugations to be designed to provide support to adjacent plates at evenly distributed support points to allow pressurization of each circuit to a full differential of 1.3 times the design pressure for one hour without buckling or deformation of the heat transfer plates.

2.5.26 All plates and gaskets shall be permanently marked to identify quality and material.

2.5.27 Each heat transfer plate shall have a built-in self-aligning system to accurately locate the plates in the frame assembly and prevent lateral plate movement and maintain maximum gasket contact under pressure.

2.5.28 Plates shall be reinforced on the upper and lower mounting slots to avoid bending hangers on the plates.

2.5.29 The plate and frame heat exchanger shall be designed to perform the capacities and pressure drops as shown on the schedule. Plates to be alloy 316 with 2B finish and tapered gasket grooves.

2.5.30 The plate pack shall be covered with an aluminum shroud in accordance with OSHA.

GASKETS

2.5.31 Gaskets shall have relieving grooves to prevent intermixing of fluids and cause leak to flow to outside of unit.

2.5.32 One piece molded GLUED EPDM gaskets are required and shall fit around both the heat transfer area and the port holes.

2.5.33 EPDM or NBR and shall be rated for at least 10 year working life under design temperature and pressure conditions.

2.5.34 Preference shall be given to non-glued gasketing systems.

2.5.35 If an adhesive is necessary, it shall be compatible with the gasket material and the fluids. The adhesive shall be a 2 component epoxy glue and heat cured.

2.5.36 The Supplier shall decide on the optimum number of heat exchangers required to fulfill space heating and domestic hot water load requirements to minimize cost and footprint of each substation without compromising the ability to perform scheduled maintenance and cleaning.

2.5.37 Heat exchangers shall be supplied with removable insulation kits and supports (stands, brackets etc.), see thermal insulation requirements.

2.6 HEAT EXCHANGERS FOR SPACE HEATING

2.6.1 BRAZED PLATE HEAT EXCHANGERS (FOR SPACE HEATING)

A. Heat exchanger(s) shall consist of thin corrugated Type 316L stainless steel plates stacked on top of each other and brazed together. Brazing material shall be copper. Every second plate shall be inverted so that a number of contact points are created between the plates. The plate patterns are to create two separate channels designed for counter flow. Plate thickness shall be of a minimum of 1/64".
B. The plate pack shall be covered by Type 316 stainless steel cover plates. Nozzle connections shall be threaded, flanged or studded port.

2.6.2 GASKETED PLATE AND FRAME HEAT EXCHANGERS (FOR SPACE HEATING)

A. Frame shall be epoxy painted carbon steel and the carrying and guide bar surface in contact with the plates and roller shall be made of, or cladded with a, corrosion resistant material such as stainless steel.
B. Nozzle connections shall be threaded, flanged or studded port.
C. The plates shall be corrugated Type 316 stainless steel. The plates should have no supporting strips and should be pressed in one step. The part of the plate in contact with the carrying and guiding bars shall be reinforced to prevent bending and twisting during the handling of the plates. The plates shall be fully supported and fully steered by the carrying bar and guided by the guide bar to prevent misalignment in both vertical and horizontal directions. Plate design shall permit the removal of any plate in the pack without the need to remove all of the other plates ahead of it.
D. Gaskets shall be clip-on or snap-on (glue-free) EPDM or NBR and shall be rated for at least 10 year working life under design temperature and pressure conditions. The gaskets shall be in one piece, as well as one piece molded, in a groove around the heat transfer area and around the portholes of the plates. The gasket groove shall allow for thermal expansion of the gaskets. The gaskets shall have a continuous support along both its inner and outer edges and to prevent over-compression of the gaskets.

2.7 DOUBLE WALL PLATE AND FRAME HEAT EXCHANGER (FOR DHW)

2.7.1 Frame shall be epoxy painted carbon steel and the carrying and guide bar surface in contact with the plates and roller shall be made of, or cladded with a, corrosion resistant material such as stainless steel.

2.7.2 Nozzle connections shall be threaded, flanged or studded port.

2.7.3 The double wall plate elements shall be comprised of two plates pressed together simultaneously and laser welded at the port. Failure of one plate or weld shall result in an external detection without inter-leakage. The plates shall be corrugated Type 316L stainless steel. Metal to metal contact shall exist between adjacent plates. The plates should have no supporting strips and should be pressed in one step. The part of the plate in contact with the carrying and guiding bars shall be reinforced to prevent bending and twisting during the handling of the plates. The plates shall be fully supported and fully steered by the carrying bar and guided by the guide bar to prevent misalignment in both vertical and horizontal directions. Plate design shall permit the removal of any plate in the pack without the need to remove all of the other plates ahead of it. Plate thickness shall be a minimum of 1/64".

2.7.4 Gaskets shall be clip-on or snap-on (glue-free) EPDM or NBR and shall be rated for at least 10 year working life under design temperature and pressure conditions. The gaskets shall be in one piece, as well as one piece molded, in a groove around the heat transfer area and around the portholes of the plates. The gasket groove shall allow for thermal expansion of the gaskets. The gaskets shall have a continuous support along both its inner and outer edges and to prevent over-compression of the gaskets.

2.8 CONTROL VALVES AND ACTUATORS

2.8.1 Control valves shall be high performance industrial grade and must be rated and selected to accommodate the design temperatures and pressures noted herein.

2.8.2 All modulating control valves shall be selected to ensure proper sizing in the hydraulic gradient, to allow for expansion and growth and changes in the district heating system's load profile, to provide temperature stability in the presence of real time pressure fluctuations, and to deliver the lowest possible return water temperature included local control system.
Flow rates on MTHWS to control valve in excess of 125 GPM shall use 1/3, 2/3 control valve configuration. Control valve rangeability shall be a minimum of 100:1 and control valve actuator resolution shall be no greater than 1% to ensure 100:1 turndown in the location in the hydraulic gradient where the substation is installed.

If the Supplier seeks to use conventional (pressure-dependent) control valves then the supplier shall provide a control valve sizing and selection method statement for approval by the Owner's Representative. Control valves shall be sized by engineers experienced in control valve sizing and based on differential pressure figures provided by Owner's Representative and associated with the expected differential pressure in the hydraulic gradient in the location where it is applied. Two control valves i.e. 1/3–2/3 split range shall be considered for large turn down. Control valve sizing calculations for each substation shall be submitted to the Owner's Representative for approval.

2.8.3 Control valve position must have a nameplate that indicates position that is visible at all times.

2.8.4 Actuators must be capable of producing the torque necessary to shutoff the valve at the

rated shutoff pressure of pumps in the district heating system or 90 psid, whichever is greater.

2.8.5 District side control valves serving instantaneous DHW HX shall be provided with short positioning time actuators, such as magnetic actuators, to ensure adequate building-side DHW supply temperature response. The Supplier shall consider and mitigate potential surge effects from application of fast acting valves in this application.

2.8.6 Actuator running time from open to closed position of all valves (control and isolation) shall be adjusted to valve design, size and piping system structure so that harmful pressure waves (water hammer) does not occur.

2.8.7 Valves and actuators for space HX applications shall be configured as Normally Closed (signal to open) / Fail Closed so that there is full shutoff with a loss of actuator power and reposition automatically without intervention.

2.8.8 Valves and actuators for DHW HX applications shall be fail safe and configured as Normally Closed (signal to open) / Fail Closed so that there is full shutoff with a loss of actuator power and reposition automatically without intervention.

2.8.9 Control valve actuator shall have manual override capability at local or substation control system level.

2.9 PUMPS AND VARIABLE FREQUENCY DRIVES

2.9.1 GENERAL

A. Pumps shall be designed with at least the same pressure and temperature class as the system where it is installed.
B. Pumps equipped with integral VFD shall have a high pressure protection in the supply line and low pressure protection in the suction line.
C. Pump connection type shall be flanged.
D. Each pump shall be designed for 100% capacity.
E. Each pump shall have a power disconnect at the pump whether or not there is a panel in the room. Disconnect shall be placed to allow the service technician to disconnect the power to the pumps while working on the pumps.
F. Each pump shall have manual override at local or substation control system level.
G. Each pump shall have sufficiently low noise levels so that no noise is transferred into the occupied space of the building.

2.9.2 DOMESTIC HOT WATER PUMPS

A. The packaged substation shall be equipped with a domestic hot water charging pump when semi-instantaneous system is used. The purpose of the charging pump is to fill the storage tank with desired water temperature.
B. The packaged substation shall be equipped with a domestic hot water circulation system with an in-line pump. The purpose of the circulation of warm water is to keep the system active and the temperature on such a level that both comfort and health requirements are satisfied for the customer. It shall be sized for 30% of peak demand flow and have enough head pressure to circulate through substation,

storage tank and building network.

C. The wet part of the pump shall be made of water-resistant materials with high oxygen content and suitable for actual water hardness.

2.9.3 SPACE HEATING DISTRIBUTION PUMPS

A. Each pump supplied shall have an integral VFD each.
B. Unless otherwise indicated, distribution pumps shall be configured in pairs with each pump/VFD having 100% capacity and automatic switchover should a single pump fail in service.

2.10 ENERGY METER

2.10.1 Energy meters will allow the Owner to accurately track and/or invoice each customer for thermal energy. The meter is also useful for the surveillance of operations in district heating networks and for monitoring of temperatures and flows needed for system troubleshooting and optimization.

2.10.2 The energy meter shall consist of an ultrasonic or magnetic type flow meter, two matched pair of temperature sensors, and energy calculator/integrator. Energy meter installation shall comply with manufacturer's technical requirements and advice with respect to necessary lengths of straight pipes and positions of temperature sensors.

2.10.3 Energy Meter shall conform to Environmental Class C, in accordance with EN 1434.

2.10.4 FLOW METER

A. The flow meter shall be of ultrasonic or magnetic type and tested in accordance with EN 1434-4 and EN 1434-5.
B. Dimensions shall be in accordance with EN 1434-2 for compatibility and ease of replacement.
C. Flow meter shall be in compliance with Accuracy Class 2 in accordance with EN 1434.
D. Manufacturer's recommendations for installation shall be followed.

2.10.5 TEMPERATURE SENSORS

A. The temperature sensor pairs shall be tested in accordance with EN 1434-4 and EN 1434-5 and the types and dimensions shall be in accordance with EN 1434-2 for compatibility and ease of replacement.
B. Since the temperature information will be used for performance checking, the maximum permissible error in the temperature shall be within limits of EN 1434.
C. Resistance Temperature Detectors (RTDs) shall be paired PT100 or PT500 type sensors with maximum thermal response time to accommodate the fastest expected time rate of change for the application.

2.10.6 ENERGY CALCULATOR

A. The calculator shall be tested in accordance with EN 1434-4 and EN 1434-5, factory calibrated and supplied with verification certificate.
B. The time interval between calculations and measurements of temperatures and

flows shall accommodate the fastest expected time rate of change for the application.

C. The local display shall have at least the following information easily accessible:
   - accumulated energy (MMBtu or kBtu)
   - accumulated water volume (gallons)
   - supply and return temperature (°F)

D. Minimum remote communication output (e.g. M-Bus) module for the following data:
   - accumulated energy (MMBtu or kBtu)
   - accumulated water volume (gallons)
   - supply and return temperatures (°F)
   - instantaneous heat load (MBH or kBtu/hr)
   - instantaneous flow (gpm)
   - peak value of heat load with timestamp (MBH or kBtu/hr)
   - peak flow rate with timestamp (gpm)

   All the above information (inclusive of set points, error codes, addresses, etc.) shall also be available on the local display after some additional display button operations.

E. The calculator shall be able to store, in an extended memory, at least:
   - peak values of heat load and flow with timestamp
   - mean value of flow under a number of periods of about 15 minutes
   - error codes with time stamp

F. Local display in metric units shall be acceptable only if energy calculator data is available at controller touch panel interface in US customary units.

2.11 TEMPERATURE AND PRESSURE TRANSMITTERS AND GAUGES

2.11.1 The following temperature and pressure transmitters shall be included in the substation (over and above transmitters required for Energy Metering).If these transmitters do not include a local display, temperature and pressure gauges shall also be installed for local display. Measured value shall be presented in US customary units (i.e. °F and psi)

A. To be provided for control/alarm:

- One TT to measure DHW HX entering cold temperature
- One TT to measure DHW HX leaving warm temperature
- One TT to measure space heat HX building supply temperature
- One TT to measure space heat HX building return temperature
- One TT to measure space heat HX district return temperature

B. To be provided for monitoring/alarm:

- One PT to measure district side supply pressure
- One PT to measure district side return pressure
- One PT to measure space heat building side supply pressure
- One PT to measure space heat building side return pressure

2.11.2 Temperature and pressure transmitters/gauges installed on the district side shall be of industrial grade, as well as building side transmitters used for control purposes.

2.11.3 Temperature and pressure transmitters/gauges and/or installed on the building side may be of commercial grade, except for transmitters used for control purposes.

2.12 OTHER VALVES

2.12.1 ISOLATION VALVES

A. Isolation valves shall be ball valves with Schedule 40 butt weld ends to match pipe, steel body, stainless steel ball and stem, Teflon seat, and reduced bore.
B. Provide a lever actuator for valves up to and including NPS 5" and a gear operated actuator with hand wheel for valves NPS 6" and above.
C. Valves located above 8 feet from floor level shall be equipped with a chain wheel installation.

2.12.2 DRAIN AND VENT VALVES

A. Manual drain and vent valves shall be installed at the high and low points on the district side, DHW and building heating side. These valves should be fitted with a removable plug. The size should not be less than ½" (DN 15). The connection type can be welded or threaded.

2.12.3 Manual drain and vent valves around each heat exchanger shall be ¾" to allow for future connection for chemical injection and periodic flushing of the heat exchanger while the isolation valves are closed.

2.12.4 PRESSURE RELIEF VALVES

A. A pressure relief valve shall be located between the isolation valves on the cold side for each heat exchanger in order to prevent overpressure during shut downs.
B. The valve shall be sized for thermal expansion at design load conditions and the set pressure should be consistent with the pressure class of the heat exchanger. The Supplier shall submit calculations and sizing information to the Owner's Representative for approval.
C. Pressure relief valves shall be ASME rated direct spring loaded type, lever operated, non-adjustable factory set discharge pressure (max design pressure).
D. Each valve shall be drained separately to floor drain.
E. Relief valve capacity shall exceed input rating of protected equipment.

2.12.5 CHECK VALVES

A. Check valves shall be non-slam type and should include an inspection hole in order to check for possible leakages.
B. Maximum pressure drop for check valves shall be 1.3 psi (9 kPa).

2.13 STRAINERS

2.13.1 Strainers are required at both the hot and cold side inlets of all heat exchangers to protect heat exchangers, control valves, and other components for from suspended

particles and debris.

2.13.2 Strainers shall be Y-pattern body, screwed brass or iron for NPS 2" and smaller, flanged steel or iron for NPS 2 ½" and over. Screen area shall be a minimum of three times the area of the inlet pipe.

2.13.3 Stainless steel perforated screen with a mesh size according to requirements for HX and/or control valve, whichever requirement is finer.

2.13.4 Screens shall be accessed by way of flanged cover and equipped with blow off valve suitable to ensure a thorough flushing of the filter.

2.13.5 The strainer shall be positioned in such manner that flushing will not harm other equipment.

2.14 BALANCING VALVES

2.14.1 Balancing valves are required on the cold side inlet of DHW heat exchanger and shall meet lead-free requirement NSF-61, Annex G.

2.14.2 Balancing valve may be solder connection or screwed for NPS 2" and smaller, screwed bronze 2.5" and larger.

2.15 PIPING SYSTEM

2.15.1 All piping shall be in accordance with ASTM A53 Grade B.

- Up to and including NPS 2": Sch. 40, ERW or seamless, plain ends.
- NPS 2 ½" and over: standard weight, ERW or seamless, beveled ends.

2.15.2 Pipe joints shall be butt-welded joints to ANSI/ASME B31.1 latest edition. No other welded joints will be allowed. Backing rings will not be allowed.

2.16 THERMAL INSULATION HEAT EXCHANGERS

2.16.1 Brazed heat exchangers shall be supplied with removable insulation kits and supports (stands, brackets etc.). Plate Frame heat exchangers are exempt.

2.16.2 The insulation shall consist of freon free insulation (polyurethane foam) and jacketed in aluminum or PVC to match adjacent pipes.

2.16.3 Minimum insulation sized to provide personnel safety (anti- scald) to below 105°F (40°C) and/or condensation due to cold domestic water.

2.17 CONTROL SYSTEM - COMMUNICATION

2.17.1 Network

The packaged substation control system shall be able to communicate (bidirectional data transfer) with Building Automation Systems through protocols BACnet, Modbus TCP, Modbus RTU or LON. Each substation control system shall be supplied with communication equipment for one of these protocols, in accordance with Owner

requirements, but shall have the ability to be readily upgraded to include additional protocols in future.

2.17.2 Local User Interface

Local user interface shall be via touch panel of industrial quality. Panel screens shall include, but not limited to:

- Actual and set point values.
- Domestic Hot Water Process actual and set point values.
- Control Loop Parameters
- Alarms with reset capability

2.17.3 Local Connection Interface

The control cabinet shall at a minimum be equipped with a local USB-PC and SD connection facility.

2.18 CONTROL SYSTEM – FUNCTIONS

The substation control system shall include all conventional control functions for District Heating applications and include, but not limited to, functions described in this section.

2.18.1 SPACE HEATING SUPPLY TEMPERATURE CONTROL

- The control system shall have the capability to set the space heating supply water temperature from a reset schedule base on the measured outside air temperature.
- If an outside air temperature (OAT) sensor exists within the building the substation control system shall use this sensor.
- A control loop shall be implemented in the automation system to close the space heat control valve on the district side if the building side distribution pumps are turned off.

2.18.2 DHW SUPPLY TEMPERATURE CONTROL

- The control system shall ensure a stable DHW supply temperature during the whole year.
- The control system shall be able to prioritize flow to DHW HX over the space heating should that be necessary in system operation at a peak condition or during a maintenance procedure.

2.18.3 DOMESTIC HOT WATER PUMP CONTROL

The delivery of domestic hot water within a reasonable time of turning on the tap is a basic comfort requirement.

- DHW circulation pump control shall at all times ensure prescribed water temperature is maintained in the water storage tank (if present) and/or supplied at the furthest tapping point in the building within required time limit. This pump control shall be executed by means of temperature measurement.

- DHW circulation pump control shall at all times ensure that no excess water is circulated for the requirements above.
- Recommended domestic hot water system requirements (adjustable):
  - DHW temperature of 122°F reaches the tap within approximately 10 seconds (this can be ensured through a variable pump capacity, thermostatic valves and balancing valves).
  - DHW HX supply temperature shall be at least 130°F for systems without storage tank.
  - DHW HX supply temperature shall be at least 140°F for systems that includes a storage tank.

2.18.4 DISTRIBUTION PUMP CONTROL

- The VFD for distribution pumps shall be controlled with a differential pressure transmitter located on the secondary supply and return connections of substations.
- The control system shall have the capability to operate with a minimum signal select and two differential pressure transmitters.

2.19 CONTROL SYSTEM - ALARMS

2.19.1 The control system shall allow for alarms and alarm management for all monitored equipment and critical functions.

2.19.2 It shall be possible for the operator to redefine alarm set points as well as time limits compared to default settings.

2.19.3 Control system alarms shall include but not limited to:

- All control system monitored water temperatures and pressures.
- Set point(s) for control have not been obtained for a defined amount of time.
- Control valve(s) fails to move.
- Pumps are stopped
- Control system has been manually bypassed.
- Communication errors

2.20 ELECTRICAL

2.20.1 Provide all required devices for proper system operation, including special electrical switches, transformers, relays, pushbutton stations, etc.

2.20.2 All electrical and control components shall have minimum NEMA-12 or IP54 rating or be protected in a cabinet with NEMA-12 or IP54 enclosure rating and exposed electrical connections covered. Components inside cabinet shall be labeled for ease of identification. Cabinet shall be an integrated component within the substation skid.

2.20.3 All electrical and control equipment shall be designed to operate in the following temperature and humidity ranges without interruption or impairment of continuous service:

- Temperature: 0-104°F (0-40°C)

- Humidity: 0-95%, non-condensing

2.20.4 Provide wiring and conduit required to connect devices furnished as a part of the packaged substation. Install wiring to comply with the National Electrical Code.

2.21 SUBSTATION SKID FRAME

2.21.1 All elements of the packaged substation shall be firmly secured to the substation skid frame.

2.21.2 Substation skid frame shall be constructed of steel and shall be all-welded construction, except where substation must be broken down into sections for egress purposes.

2.21.3 Substation skid shall be painted with corrosion resistant paint.

2.21.4 Substation skid frame shall be fitted with adjustable feet for leveling of skid during installation.

3 PERFORMANCE TESTING

3.1 PURPOSE

3.1.1 The purpose of performance testing is to test and approve/certify each configuration type/model of district heating substation package to be provided by the Supplier.

3.2 GENERAL

3.2.1 The Supplier shall undertake Performance Test per this section on one substation for each configuration type/model of substation and Acceptance Test on all substations.

3.2.2 The Supplier must give to Owner's Representative and/or Independent Certifier not less than ten (10) Business Days' notice of the date or dates on which it intends to carry out performance testing as per this section.

3.3 PERFORMANCE TEST – FOR EACH SUBSTATION CONFIGURATION

3.3.1 GENERAL

The Supplier shall provide a method statement for the following tests to be performed in the test rig in a written Qualification Test Procedure:

A. Inspection of conformity of the substation's primary circuit with the requirements in this document.
B. Static performance tests of the space heating and domestic hot water parts of the unit.
C. Dynamic performance tests of the space heating and domestic hot water parts of the unit.
D. Substation pressure drop test.
E. Operating test of the control system.

3.3.2 INSPECTION OF CONFORMITY

Verify equipment, installation and construction conforms to requirements of this specification.

3.3.3 OPERATING TEST OF THE CONTROL SYSTEM

The Supplier shall develop and submit for approval control system hardware and software acceptance test program. This document shall detail the test procedures to be performed on each control system panel furnished by the Supplier.

3.3.4 PRESENTATION OF RESULTS

The test reports shall be presented in a way that makes it is possible to compare test results between similar substation units. Test reports and product marking shall clearly indicate the system data applicable to the approved unit. It shall be possible to compare both static and dynamic test data.

Record notes, details of any actions taken, and observations during the tests under 'Other Information' in the test report.

Summarize the results of each test as follows: Complies / Does Not Comply with the requirements of the test program.

3.4 ACCEPTANCE TEST – FOR EVERY SUBSTATION

3.4.1 The Supplier shall submit a detailed acceptance test procedure designed to demonstrate compliance for every substation with contract requirements. This procedure shall include factory pretesting of controller software for each substation. This procedure shall be submitted to the Owner or the Owner's Representative for approval prior to the start of the testing.

ATTACHMENT D - PROPOSAL COVER SHEET
CITY OF DULUTH
RFP# 17-0610

Proposer Information:	
Proposer Name	
Mailing Address	
Website	
Contact Person	
Contact Person's Phone Number	
Contact Person's Fax Number	
Contact Person's E-Mail Address	
Federal ID Number	
Authorized Signature	
Title	