

Mini-Pack™

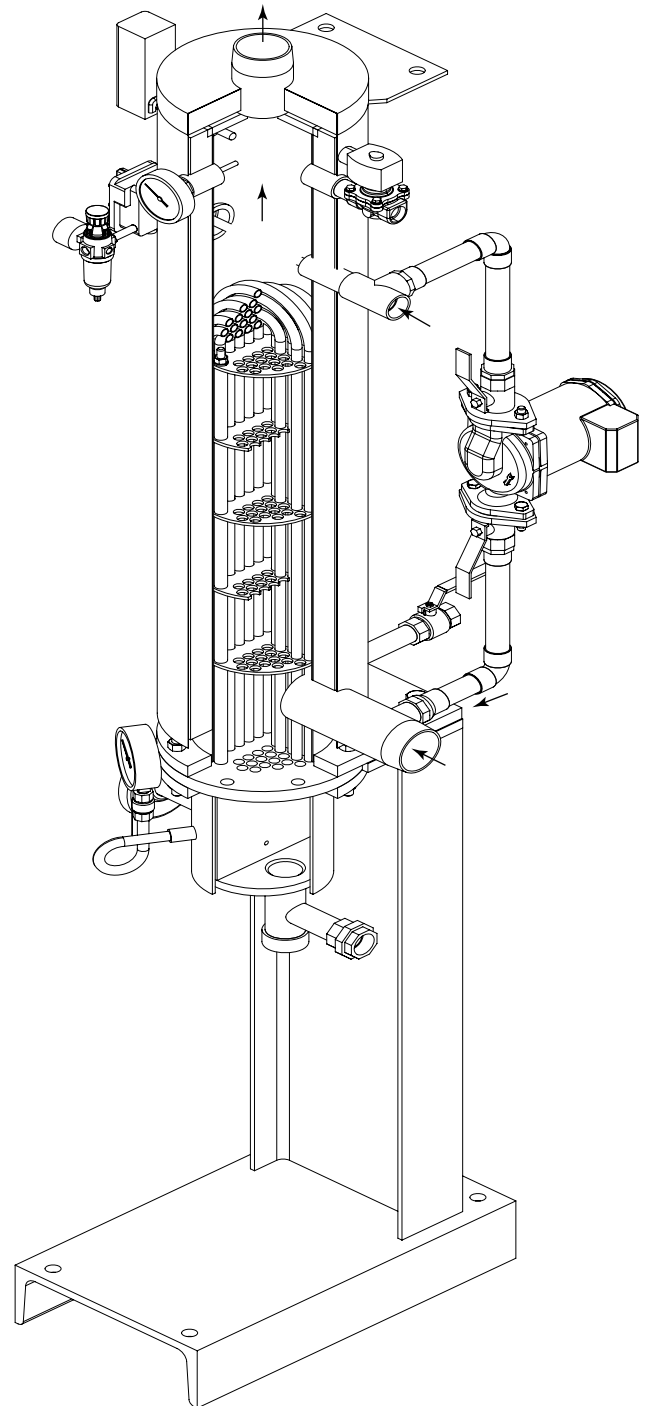
Semi-Instantaneous Water Heaters

The Ace Series Mini-Pack™ is designed as a high quality, low maintenance, domestic water heating package and is available in both vertical and horizontal configurations. It features guaranteed sub-cooled condensate, single or double-wall tube bundles, and very tight temperature control. Simple installation and easy servicing make the Mini-Pack™ well-suited for the following applications:

- Hospitals
- Colleges & Universities
- Hotels & Motels
- Correctional Institutions

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Instantaneous vs. Semi-Instantaneous Steam-Fired Domestic Water Heaters

	SEMI-INSTANTANEOUS (U-Tube)	INSTANTANEOUS (Shell & Tube)	INSTANTANEOUS (Helical Coil)
Safer Design	X		
Water to Steam Ratio - 5:1	X		
Steam to Water Imbalance - 5:1		X	X
High Efficiency	X		
Low Efficiency		X	X
Teflon Baffles	X		
Limited Scale Formation	X		
316 Stainless Steel Construction	X		
Built to A.S.M.E. Standards	X		
Sub-Cooled Condensate / No Trap / No Flash	X		
Easy and Inexpensive to Rebuild	X		
10 Year Non-Prorated Warranty	X		
No Mixing Valves Required	X		
Does Not Overheat Water	X		
Low Maintenance	X		

ASHRAE Definitions

ASHRAE (American Society of Heating & Refrigeration Engineers) & ASPE (American Society of Plumbing Engineers) both define instantaneous water heaters as those having the primary media (steam) in the shell and the secondary media (service water) in the tubes. The instantaneous heat exchanger has been around for many years and was primarily designed as a building converter for converting steam to hot water for hydronic heating loops. Instantaneous heaters were also often used as booster heaters for dishwashers or 'industrial-point-of-use' heat exchangers. This type of heat exchanger is better suited for closed loop systems where no raw water can introduce foreign particles, mineral, scale, oxygen or corrosion into the system.

ASHRAE & ASPE also define semi-instantaneous water heaters as those with the primary media (steam) in the tubes and the secondary media (service water) in the shell. This design is more than 50 years old and was developed to improve the performance, safety, longevity and overall customer satisfaction of indirect heat exchangers in domestic raw water systems.

All indirect type water heaters belong in one of the three following categories:

- Storage
- Instantaneous or storage-less
- Semi-instantaneous or limited storage

On Demand

Both instantaneous and semi-instantaneous heaters are considered 'on-demand' type exchangers with the ability to heat very large quantities of hot water, instantly, without the need for large volumes of stored water. The storage-type hot water generator is often used where a boiler or the steam distribution system is not large enough to meet the potentially higher steam volume required to satisfy peak demands of typical domestic hot water systems. A volume of stored water serves to lower peak demand requirements on an undersized boiler or distribution system.

Construction and Design

Construction and design features differ greatly between instantaneous & semi-instantaneous type heat exchangers. These differences have a major impact on first cost as well as

Instantaneous vs. Semi-Instantaneous Steam-Fired Domestic Water Heaters

life-cycle costs. Design features and benefits must be explored in conjunction with cost to properly evaluate which design is best suited for your system.

Instantaneous heat exchangers are typically shell & tube type construction with a 2, 4, or 6-pass copper 'U'-tube heat exchanger. High thermal stresses and scale formation are the two primary reasons for premature failure of this design when used for heating domestic water. Thermal stress and scale are not typically a concern when instantaneous designs are used for building hot water converters, due to the absence of scale, foreign deposits and oxygen. Thermal stresses are also lower due to the load profile of stable flow and slower responding temperature changes characteristic of a steam-to-water hydronic system.

Some designs attempt to alleviate thermal stresses by re-designing the heat exchanger. Helically wound copper coils allow for stress-free expansion and contraction as the temperature control valve cycles. However, when these coil types are used in an instantaneous type exchanger it can facilitate early failures due to loosening of scale formation and lodging it in the temperature control and/or mixing valve.

Scale formation has always been an issue for any design of direct or indirect type domestic water heater. Whenever fresh water is introduced to a heated surface, mineral deposits, in the form of scale, will develop. Scale formation, along with the amount of thermal stress on a heat exchanger is directly proportional to the surface temperature of the heat exchanger tubes. Therefore, lowering the surface temperature of the heat exchanger tubes lowers the amount of scale formation as well as the thermal stress on those tubes.

Instantaneous Designs Overheat Service Water

In a domestic, potable water system, depending on domestic water quality, large quantities of scale formation may occur due to the fact the water is unnecessarily 'overheated' to 250°F (if using saturated steam @15 psi). This is a direct result of the very short duration time the service water travels through the exchanger tubes. The volume of the water in the tubes is small versus the steam volume in the shell (approximately a ratio of 1:5). This ratio imbalance of steam to water results in high exchanger tube temperatures and an inefficient exchange of BTU's, causing very high water temperatures to leave the heat exchanger. This 'overheated water' creates the need for

temperature blending valves (code requirement) to protect from delivering potentially dangerous scalding water temperatures to the system.

Semi-Instantaneous Designs DO NOT Overheat Service Water

In the semi-instantaneous exchanger design, the ratio imbalance of the service water to steam is now reversed, with five parts/volume of water (shell) to one part/volume of steam (tubes). This imbalance is now in favor of the heated service water resulting in more stable and efficient heat transfer of BTUs virtually eliminating any overheating. As the water velocity (in the shell) is lower, and the water volume is higher, the service water is heated to the required outlet or 'use temperature' and no higher (within $\pm 4^\circ\text{F}$). Now the temperature control system has more time to react, preventing the inefficient exchange of BTUs as seen in the instantaneous design. Overall, this design results in minimal scale formation and reduced thermal stress. More importantly, scalding water temperatures are not present and water mixing valves (if installed) are not clogged with scale.

Conclusion

Instantaneous water heaters are often misapplied in domestic, potable, hot water systems. Standardizing on the design features of Semi-Instantaneous water heaters will greatly improve efficiency, longevity, and safety of a hot water system.

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Semi-Instantaneous Water Heaters

Ajax Boiler, Inc. designs and manufactures a comprehensive line of boiler and commercial water heating products. With over eight decades of experience, the company offers high quality, heavy duty products with a reputation for reliability, serviceability, and cost effective operation. The company currently offers three distinct product lines; the Ajax Series for the commercial boiler market, the Ace Series for the water heating market, and the Atlas Series for the high-efficiency, condensing boiler and water heater markets. Product lines are distributed by more than 70 sales representatives located throughout the United States and Canada.

Ace Series

- Mini-Pack semi-instantaneous, indirect water heaters
- Gas-fired conical copper fin water heaters
- Indirect storage water heaters
- Tanks (Storage)

Critical Design Features in High Quality Water Heaters

- High efficiency
- Longevity
- Safety
- Low Cost Operation

The Mini-Pack™ Advantage

The Ace Series Mini-Pack offers all four critical design features as a standard. Sub-cooled condensate improves efficiency. 0.49" wall seamless copper heat exchanger tubes improves longevity. Double-solenoid, over-temperature safety system ensures safety.

Condensing Design... Sub-Cooled Condensate

Sub-cooling condensate maximizes the heat transfer efficiency of a heat exchanger. By using a condensing design, the Mini-Pack condenses steam in the tubes and cools condensate well below its flash temperature. This is achieved by simultaneously flowing entering cold water across the tubes carrying exiting condensate while using an orifice to restrict condensate drainage. Depending on the load, exiting condensate temperatures are typically 10 - 15 degrees higher than the exiting domestic hot water temperature which negates the need for a steam trap or flash tank.

Several benefits are realized from sub-cooling condensate:

- Sub-cooling can increase efficiency by as much as 25% which results in less steam required to heat the same GPM.
- No steam trap means no possibility for steam trap failure.
- Heat typically lost to flash heats the domestic water instead

of being lost in the condensate receiver or flash tank.

- Mechanical spaces are much cooler.
- Pumping cooler condensate greatly extends the life of pumps.

Heavy Wall Heat Exchanger Tubes

The Ace Series Mini-Pack uses heavy duty, .049" wall copper heat exchanger tubes... twice the wall thickness as tubes used by other leading water heater manufacturers. Thicker tube walls increase the longevity of the heat exchanger and provide improved efficiency. Thin wall tube bundles cost less, but can result in premature failure and high replacement cost. .049" tubing can last up to 25 to 30 years. .049" wall seamless SB75 copper tubing is standard on Ace Series Mini-Pack™ packages.

Double Solenoid High Temperature Safety Systems

The double solenoid system adds safety and guards against scalding. At a pre-determined high temperature setpoint, the system provides annunciation to the EMS system before a dangerous condition develops or the domestic hot water loop cools down. The system discharges at a lower temperature before the relief valve discharges (at 210F!). This safety system is optional on Ace Series Mini-Pack and storage water heater packages.

Extended Non-Prorated Warranty

The Ace Series Mini-Pack offers a factory extended, 10-year, non-prorated warranty that includes all wetted components (shell, heat exchanger tube sheet, etc).

Construction

All semi-instantaneous water heaters must have non-ferrous shell construction to accommodate rust-free domestic, potable water. The Mini-Pack's shell construction is unlined 316L stainless steel. Other leading manufacturers use a carbon steel shell with a thin copper lining on the water side. Liners are problematic because they can separate or split. Such failure exposes domestic water to carbon steel and can result in rusty, discolored, and contaminated water. Conversely, unlined shells are trouble-free. The Ace Series unlined 316L stainless steel shell construction is unequalled in the industry and far superior to a copper-lined, carbon steel shell.

Design Versatility

The Ace Series Mini-Pack is ideal for small mechanical spaces. The Mini-Pack unit is available in a variety of configurations including vertical and horizontal, and single or double wall tubes.

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Semi-Instantaneous Water Heaters

Horizontal units are preferred where headroom is a constraint. In the horizontal configuration, dual units can be stacked to minimize required floor space and reduce installation cost. If the condensate line is too high, the horizontal unit will enable gravity discharge of condensate and eliminate the need for a condensate receiver and pumpset. The vertical configuration has an extremely small footprint and does not require significant headroom clearance for servicing.

Temperature Control

There are two basic types of temperature controls used on semi-instantaneous water heaters: *active systems* (with a pump) and *passive systems* (without a pump). Both designs are characterized as 'anticipatory feed-forward' type temperature control systems and will control +/- 4°F at 'normal load variations'. The Mini-Pack uses an active system which uses a 1/6 HP, all bronze circulator to maintain constant flow over the temperature sensing element. This ensures fast response and tight temperature control at all load profiles. Passive systems rely on the differential pressure of the water flowing over the heat exchange surface and can save the cost of operating the small circulator. However, they cannot control temperature as well as pumped systems can at low flow conditions. With a pumped system, temperature control is very tight at all load profiles. The Mini-Pack's temperature control system is simple, fast and accurate.

Serviceability

Servicing the Mini-Pack is fast, easy, and inexpensive. Parts are reasonably priced and readily available. The O & M manual outlines respective part numbers for each accessory manufacturer. All of the Mini-Pack's accessories are readily available from local plumbing supply houses. In addition, the Mini-Pack is designed to be completely serviced in place without an overhead clearance requirement or the need to lay the unit horizontally. On single-wall vertical units, enough clearance exists under the stand to completely remove the heat exchanger.

Health Issues (i.e. Legionellae)

The three conditions that must be present to promote the growth of the Legionellae organism are:

- Host (usually in the form of scale)
- Low velocity
- Water temperatures between 68°F - 122°F.

The Ace Series Mini-Pack is designed to keep the shell side domestic water in constant circulation via the 1/6 HP circulator.

This keeps the entire volume of water in the shell at set-point temperature and eliminates temperature stratification common in the designs of our leading competitors. Most importantly, the Mini-Pack design eliminates the proliferation of Legionellae bacterium by maintaining safe water temperatures and higher water velocities and minimizing scale formation.

Conclusion

The Ace Series Mini-Pack water heater has been tested and used for more than two decades in demanding, high volume water heating applications. It is a proven design that is simple, efficient, and trouble-free and offers building owners and maintenance personnel numerous end-user features and benefits. Specifying the Ace Series Mini-Pack water heater combines the highest levels of quality, efficiency, and safety with a long lasting, cost-effective design that is inexpensive to operate and easy to service.

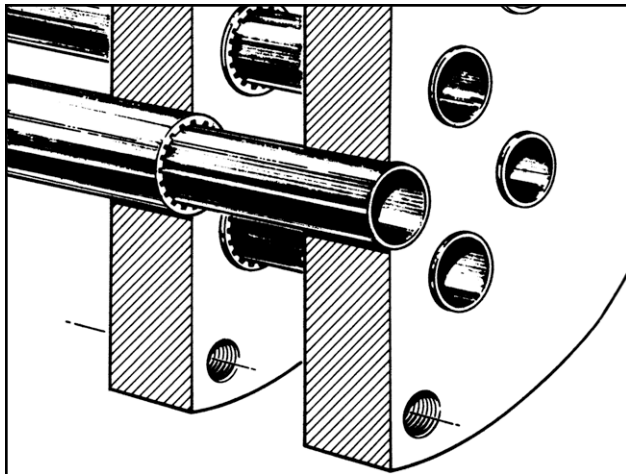
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Semi-Instantaneous Water Heaters

The Mini-Pack™ semi-instantaneous water heater is dependable, quiet, and provides commercial and institutional buildings with potable hot water. Close temperature control, outstanding thermal efficiency, high quality ASME coded construction, and minimum floor space requirements make the Mini-Pack™ one of our best products.

Features

- Close temperature control with $\pm 4^{\circ}\text{F}$ at heater hot water outlet under normal operating conditions, even on deadend hot water systems without recirculation.
- Solid rust-free stainless steel construction on the entire domestic water side and standard stainless steel jacket.
- Compact footprint requiring minimum space for installation, with vertical or horizontal heater choice.
- Tube bundle is readily accessible without moving, shell or foundation for single-wall models; recommended horizontal mounting of double-wall due to coil length.
- Standard sizes cover hot water output up to 650 GPM simplifying size selection, layout and decreasing the potential for heater duplication on multiple heater projects.
- Quality components for longevity.



Double-Wall Tube Bundles with Vent Path

- Easy Inspection
- Low Maintenance

Double-wall tube bundles are available in all semi-instantaneous water heaters with copper or cupro-nickel tubes and stainless steel tube sheets.

Standard Equipment

Shell & Tube Bundle

- ASME Section VIII Div I vessel.
- National Board registered.
- 150 psig design working pressure.
- Vertical or horizontal model with solid 316L stainless steel construction and 304L stainless steel fittings.
- SB-75 seamless copper U-tube.
- Single wall tubing.
- 304 stainless steel tube sheet.

Controls

- Pilot operated control valve for steam or pneumatic control valve for water.
- Condensate orifice trap and steam strainer for steam models.
- 150 psig ASME pressure relief valve.
- High limit aquastat.
- Safety solenoid valve.
- NEMA 1 control panel.
- Temperature gauge.
- 1/6 HP recirculator pump.

Support

- Steel support stand.

Optional Equipment

Shell & Tube Bundle

- Horizontal model available.
- 250 psig shell & tube design pressure or working pressure.
- 400 psig tube design pressure or working pressure, for HTW
- 316L stainless steel tube sheet.
- Double wall copper or cupro-nickel (90/10) tubing.
- Single wall cupro-nickel (90/10) or 316L stainless steel tubing.

Controls

- Pneumatic or electric valve.
- Mounted compressor.
- Double safety solenoid dump valve.
- Dual valves setup: 1/2 and 2/3 control.
- All 316 stainless steel components and piping on shell side.

Support

- Single steel horizontal rack for 2 Mini-Pack units.

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Semi-Instantaneous Water Heaters

Mini-Pack™ Features

1. Compact Design

Minimum floor space requirement for vertical configurations. Also available in a single or dual-unit, rack-mounted horizontal configuration.

2. Removable Tube Bundle

Tube bundle is easily accessible without moving heater unit, shell, or foundation. Double-wall tube bundles are most easily serviced in the horizontal configuration.

3. Pressure Gauge

4. Insulation & Jacketing

1 1/2" fiber glass insulation wrapped with a 24 gauge, mirror finish, stainless steel jacket.

5. High Quality Vessel Construction

Solid, rust-free construction on the domestic water side. ASME Section VIII Division I vessel.

6. NEMA 1 Control Box

Equipped with Normal and Over Temp indicator lights.

7. Air Filter/Regulator (Pneumatic Only)

8. Temperature Gauge

9. High Temperature Limit Sensor (Aquastat)

10. Safety Solenoid Dump Valve (Optional)

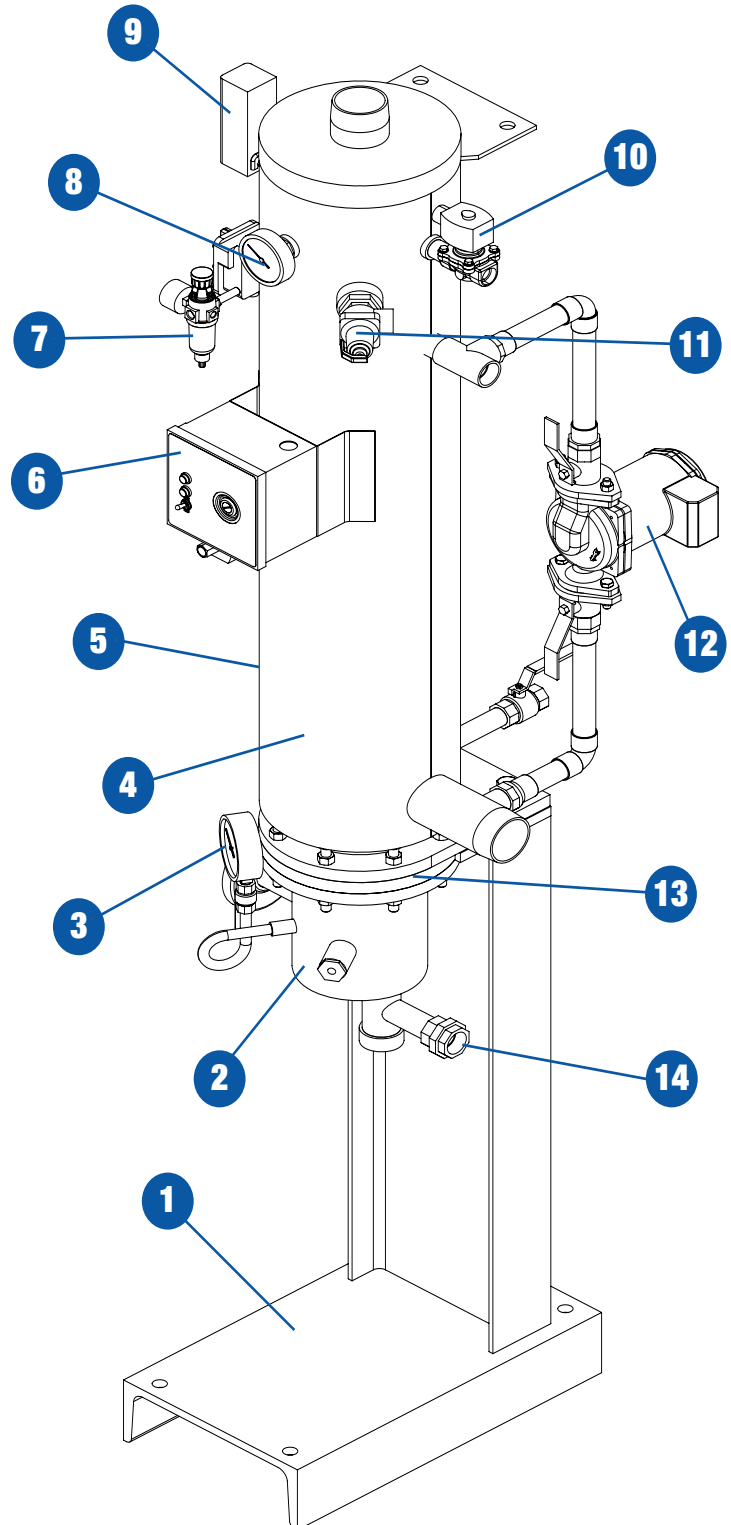
11. ASME Rated Pressure Relief Valve

12. Integral Circulator

1/6 HP pump constantly circulates a portion of the heater water to the cold water inlet. This eliminates temperature stratification in the shell and guarantees tight temperature control for all flow conditions.

13. Single or Double-Wall Tube Bundles

14. Condensate Outlet



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Semi-Instantaneous Water Heaters

Accurate temperature control under widely fluctuating demand:

1. Temperature Sensing

This is a basic feature of all heaters and is usually achieved via a sensing bulb in the hot water outlet. It is considered a “feedback control” because the monitored media is measured after it has already left the heater.

2. Integral Internal Recirculation

In conjunction with a minimum of a 5:1 ratio of storage to steam volume in the heater, integral internal recirculation allows the temperature sensing bulb to be located internally in a constant flow path of the water leaving the heating surface and to recirculate a portion of the heated water to the cold water inlet. The result is that the entire heater becomes a blending chamber while the water is still controllable inside the water heater. The internal recirculation precludes temperature stratification or dead spots within the heater even during periods of no demand. Any potential for initial scalding upon demand resumption is eliminated.

3. Pressure Limiting

During sudden calls for high demand, the conventional temperature control sends line pressure steam to the coil. Conversely, when there is a rapid drop in demand, the valve slams closed. These extremes result in a “Shark’s Tooth” profile of undershooting and/or overshooting the the sensed water temperature and has become the accepted norm associated with instantaneous water heaters. The Mini-Pack’s pressure limiting feature restricts the steam in the coil to no more than the preset pressure setting. Limiting the coil pressure also lowers the tube film temperature and subsequently reduces fouling potential.

4. Anticipating Control

Since the Mini-Pack™ self-contained combination temperature and pressure control valve is first a pressure controller, it has a downstream pressure sensing line which “sees” all steam pressure changes in the coil. Any change in demand, whether sudden or gradual, results in a pressure change in the coil. This very small pressure variation is “seen” as a pressure offset and results in the pressure pilot of the valve to immediately react in the correct direction... while the water is still in the heater. This feature, when combined with recirculation, provides for *anticipatory control*.

5. Fail-Safe Operation

Since the self-contained combination temperature and pressure control valve is simply a pressure regulator with temperature trimming, it is normally closed (i.e. “Fail-Safe” or non-scalding). Conventional temperature regulators fail in the open position.

6. Narrow Deadband Control

A self-contained combination temperature and pressure control valve, a parabolic plug (optional), and internal recirculation provides stable operation when the valve is very close to its seat during time of low demand, or when the system is near its setpoint temperature. The combination of internal recirculation, pressure limiting, anticipation, and an optional parabolic plug result in a much narrower deadband than possible with conventional heaters. Close narrow deadband control, under widely fluctuating demand, *is* the definition of good control.

7. Condensing Design... Condensate Subcooling

To eliminate the possibility of downstream flashing (i.e. scalding), condensate should not exceed 190°F. This condition must be maintained regardless of the range of demand and at all flows from near zero to full rating. A guarantee to subcool at rating only, does not assure the same protection at lower flows. A unit will not operate at 100% of rating at all times. Subcooling is just as important immediately after swinging from high to very low demand.

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Semi-Instantaneous Water Heaters

Fixture Units Capacity Tables

	Hospital	Dormitory	Restaurant	Apartment	Correctional	Office Building	Factory	School	Hotel
Basin - Barber									2.0
Basin - Beauty Salon									2.5
Janitor Drop						2.5		1.5	
Laundry Tray				1.5				2.0	
Lavatory - Private	.75	.75	.75	.75	.75	.75	.75	.75	.75
Lavatory - Public	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0
Shower & Tub		1.5		1.5	1.5			1.7	1.5
Shower - Private	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Shower - Public		1.5	1.7	1.5	3.0		3.0		
Sink - General Purpose	1.0						2.5		
Sink - Kitchen	3.0	1.5		.75		1.5		.75	1.5
Sink - Laboratory	1.5							1.5	
Sink - Pantry	2.5		2.5	1.5				2.5	
Sink - Slop	2.5	2.5	2.0	1.5	2.0	2.5	2.5	1.5	2.5
Wash Fountain - 36" Half			1.0		1.0	1.0	1.5		
Wash Fountain - 36" Full			1.5		2.0	1.5	3.0		
Wash Fountain - 54" Half					1.5		2.0		
Wash Fountain - 54" Full					2.5		4.0		
Washer - Clothes (Domestic)		2.0		1.2				2.0	1.2
Washer - Dish (Domestic)		2.0		1.5				2.0	

Hospital-Specific Fixtures

Autopsy - Sink & Table	2.5
Autopsy - Table	2.0
Bath - Arm	4.0
Bath - Continuous Flow Fill	2.0
Bath - Continuous Flow Operate	1.5
Bath - Emergency	2.0
Bath - Foot	3.0
Bath - Leg	6.0
Bath - Private	1.5
Bath - Sitz	3.0
Bath - Ward	2.0
Hubbard Tank	4.0
Hydrotherapeutic Shower #1 Head	8.0
Hydrotherapeutic Shower #2 Spray	12.0
Shower Ward	2.5
Sink - Flushing Rim	2.0
Sink - Scrub-up	1.5

Restaurant-Specific Fixtures

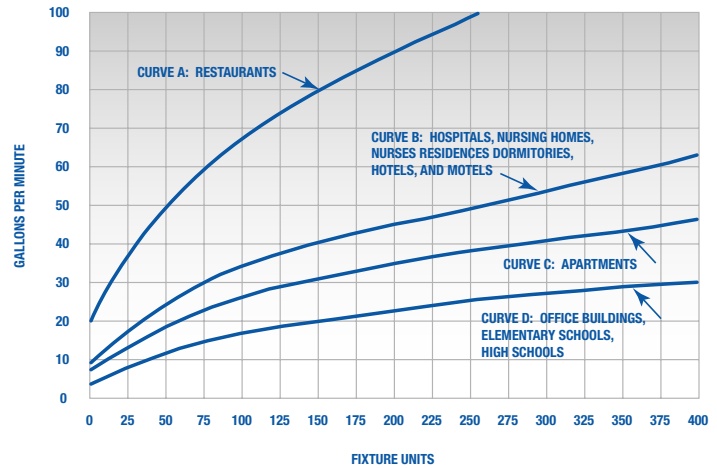
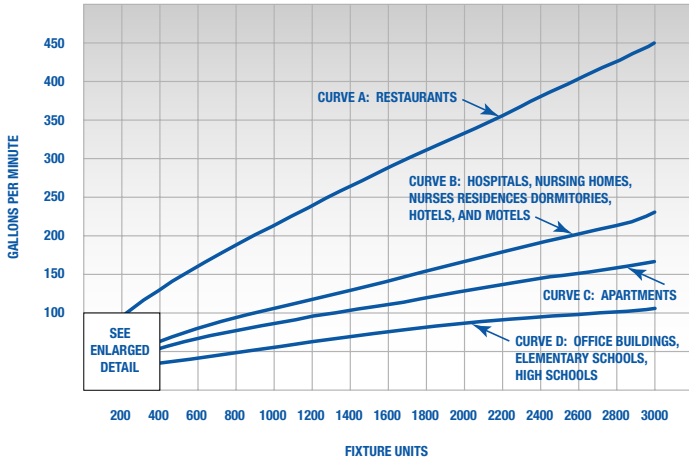
Baine Marie	1.0
Coffee Urn	1.2
Sink - Bar	2.5
Sink - Kitchen	3.0
Sink - Pot (Single)	2.5
Sink - Pot (Double)	3.5
Sink - Pot (Triple)	6.5
Sink - Vegetable	2.0
Washer - Can	3.0
Washer - Dish (Pre-Rinse)	2.5
Washer - Glass	2.0
Washer - Pots & Pans	2.0
Washer - Pre-Scraper	2.0
Washer - Pre-Sprayer Conveyor	2.5
Washer - Silver	2.0

These tables are reprinted from the A.S.H.R.A.E. handbook (latest Systems Guide).

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Semi-Instantaneous Water Heaters

Hot Water Demand Curves



Mini-Pack™ Sizing Instructions

1. Fixture Unit Count

Determine the total fixture unit count by using the Fixture Capacity Table on the previous page.

2. Demand GPM

Determine the demand GPM requirements by referencing the modified demand curves above.

3. Heater Selection

Select the appropriate size Ace Series Mini-Pack™ by referencing the Sizing Tables on pages 11 through 12.

Correction Factor for Water Temperature Variations

The Fixture Unit Capacity Table is based on the consumption of 140°F hot water using 40°F cold water to obtain 100°F water at the fixture. Variations of these standard temperatures will affect hot water consumption.

Use the following procedure to determine how water temperature variations will impact your Mini-Pack™ size selection:

1. Determine appropriate heater size (see instructions above).
2. Multiply the GPM rating by the correction factor:

$$\frac{M - C}{H - C} \div \frac{M - 40}{100} = \text{Correction Factor}$$

M = Mixed temperature at fixture

C = Cold water temperature

H = Hot water temperature

Correction Example:

A heater with a rating of 75 GPM from 40°F to 140°F and actual cold water temperature of 50°F:

$$\frac{100^\circ\text{F} - 50^\circ\text{F}}{140^\circ\text{F} - 50^\circ\text{F}} \div \frac{100^\circ\text{F} - 40^\circ\text{F}}{100^\circ\text{F}} = .926$$

Correction Factors for Cold Water Temperatures:

Cold Water Supply	Correction Factor*
40°F	1.000
50°F	0.926
60°F	0.833
70°F	0.714
80°F	0.556
90°F	0.333

* Based on 140°F water from the heater and 100°F mixed at the fixture

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Semi-Instantaneous Water Heaters

Sizing Table: Steam-to-Water / Single-Wall / 40°F - 140° F

160°F Sub-Cooled Condensate • Bundle Pressure = 50% of Valve Inlet Pressure • 0.0010 Fouling Factor • GPM

MODEL	VALVE INLET PRESSURE (PSIG)							
	5	10	15	25	40	50	75	100
4" SW	12	13	14	15	16	17	19	20
5" SW	19	21	22	24	26	27	30	32
6" SW	35	37	39	42	46	48	52	56
8" SW	55	58	61	66	71	74	81	86
8" SW-L	69	73	76	82	89	93	101	107
10" SW	97	102	107	115	124	129	140	149
10" SW-L	119	125	131	140	152	159	172	182
12" SW	146	154	161	172	187	194	210	223
12" SW-L	203	214	224	239	259	270	287	287
14" SW	249	262	273	293	316	330	356	378
16" SW	411	433	451	483	522	543	587	622

Please reference the online Ace STAR System sizing application for the most updated sizing data.

Sizing Table: Steam-to-Water / Double-Wall / 40°F - 140° F

160°F Sub-Cooled Condensate • Bundle Pressure = 50% of Valve Inlet Pressure • 0.0010 Fouling Factor • GPM

MODEL	VALVE INLET PRESSURE (PSIG)							
	5	10	15	25	40	50	75	100
5" DW	18	19	21	22	25	26	28	30
6" DW	28	29	31	34	37	38	42	45
8" DW	55	58	61	66	72	75	81	86
10" DW	92	97	101	109	118	123	134	141
12" DW	143	151	159	169	183	190	206	218
14" DW	209	220	230	246	266	277	300	317
16" DW	291	307	320	342	370	385	417	441

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Semi-Instantaneous Water Heaters

Sizing Table: Water-to-Water / Single-Wall / 40°F - 140° F

200°F Boiler Supply Temperature • 0.0015 Fouling Factor • Flow Rates in GPM

MODEL	BOILER RETURN TEMPERATURE			
	180°F		160°F	
	DOMESTIC WATER	BOILER WATER	DOMESTIC WATER	BOILER WATER
4" SW	6	29	4	11
5" SW	9	48	7	19
6" SW	18	89	14	36
8" SW	28	143	23	59
8" SW-L	35	181	29	75
10" SW	50	257	42	108
10" SW-L	62	316	53	134
12" SW	77	394	65	166
12" SW-L	90	459	92	234
14" SW	120	614	113	288
16" SW	150	769	188	480

Please reference the online Ace STAR System sizing application for the most updated sizing data.

Sizing Table: Water-to-Water / Double-Wall / 40°F - 140° F

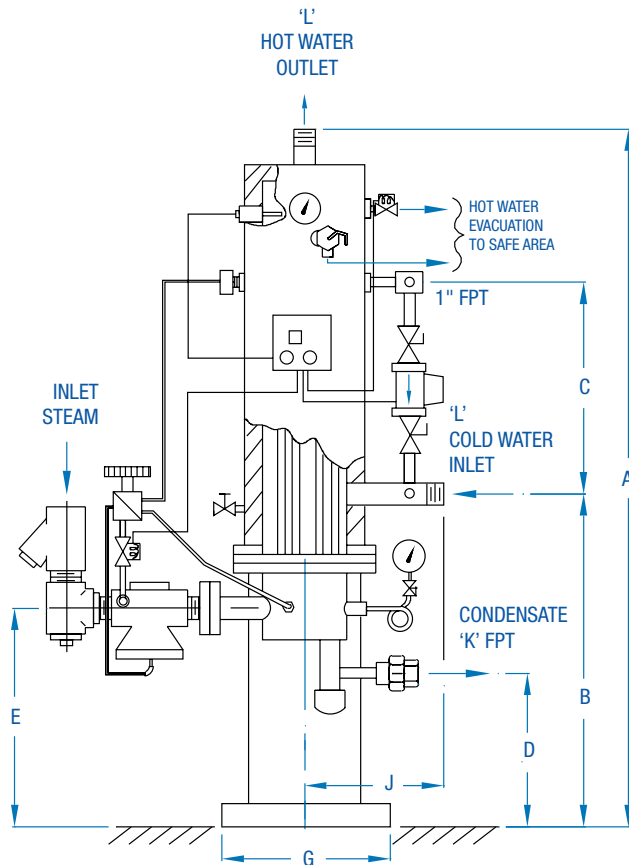
200°F Boiler Supply Temperature • 0.0015 Fouling Factor • Flow Rates in GPM

MODEL	BOILER RETURN TEMPERATURE			
	180°F		160°F	
	DOMESTIC WATER	BOILER WATER	DOMESTIC WATER	BOILER WATER
5" DW	9	48	6	15
6" DW	14	70	11	28
8" DW	27	139	24	60
10" DW	44	227	40	103
12" DW	67	343	64	164
14" DW	85	436	95	242
16" DW	112	570	134	341

Please reference the online Ace STAR System sizing application for the most updated sizing data.

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Semi-Instantaneous Water Heaters



VERTICAL • SINGLE-WALL • STEAM TO WATER

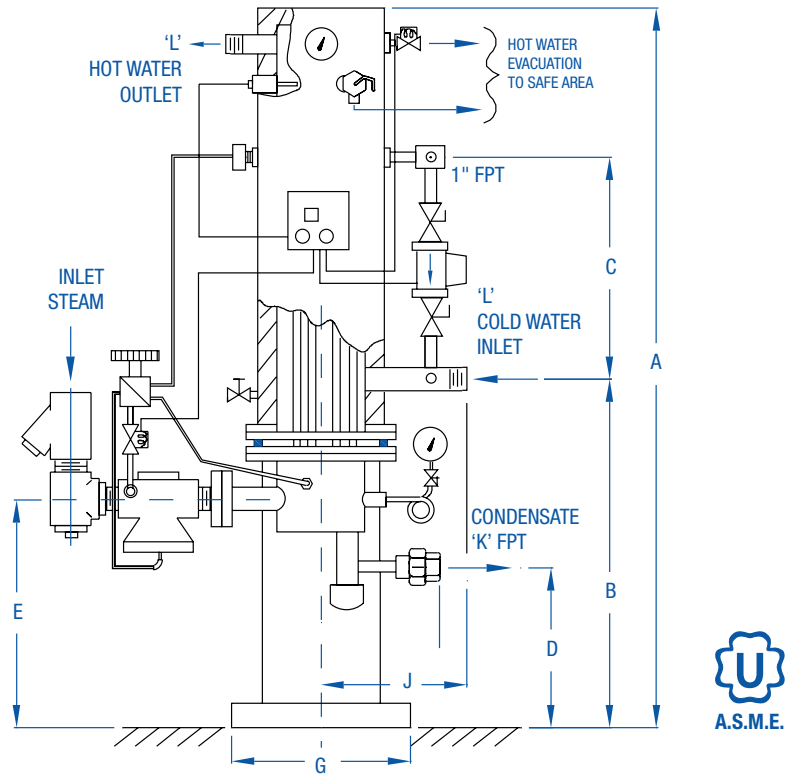
Dimensions

MODEL	A	B	C	D	E	G	J	K	L ¹	SHIPPING WEIGHT (LBS.)
SI-V-4-SW-SP	83	40	30	25 ¹ / ₄	30 ¹ / ₄	12	9	3 ⁴ / ₄	2	350
SI-V-5-SW-SP	69 ³ / ₄	33 ³ / ₄	23	19	24	12	10	1	2 ¹ / ₂	400
SI-V-6-SW-SP	86	42	31 ³ / ₄	26 ¹ / ₂	31 ¹ / ₂	12	10 ¹ / ₂	1	2 ¹ / ₂	500
SI-V-8-SW-SP	75 ¹ / ₂	36 ¹ / ₂	24 ³ / ₄	19 ¹ / ₂	25 ¹ / ₄	12	11 ¹ / ₂	1 ¹ / ₂	3	600
SI-V-8L-SW-SP	88 ¹ / ₂	43 ¹ / ₂	30 ³ / ₄	26 ¹ / ₂	32 ¹ / ₄	12	13 ¹ / ₂	2	3	650
SI-V-10-SW-SP	79 ¹ / ₂	38 ³ / ₄	25	20	26	18	13 ¹ / ₂	2	4 F	900
SI-V-10L-SW-SP	92 ¹ / ₂	45 ³ / ₄	31	27	33	18	13 ¹ / ₂	2	4 F	950
SI-V-12-SW-SP	83 ¹ / ₂	41 ³ / ₄	24 ¹ / ₂	15 ³ / ₄	25 ³ / ₄	18	14 ¹ / ₂	2 ¹ / ₂	4 F	1,125
SI-V-12L-SW-SP	107 ¹ / ₂	53 ³ / ₄	36 ¹ / ₂	27 ³ / ₄	37 ³ / ₄	18	14 ¹ / ₂	2 ¹ / ₂	4 F	1,175
SI-V-14-SW-SP	98 ¹ / ₂	48 ³ / ₄	30 ¹ / ₂	18 ¹ / ₂	30 ¹ / ₂	18	16 ¹ / ₄	3	5 F	1,700
SI-V-16-SW-SP	122	60 ³ / ₄	40 ¹ / ₂	26 ¹ / ₂	40	18	18	3	6 F	2,200

All dimensions in inches. Dimensions are subject to change.
¹ Connections 4" IPS and above 150# ANSI FLG

Mini-Pack™

Semi-Instantaneous Water Heaters



VERTICAL • DOUBLE-WALL • STEAM TO WATER

Dimensions

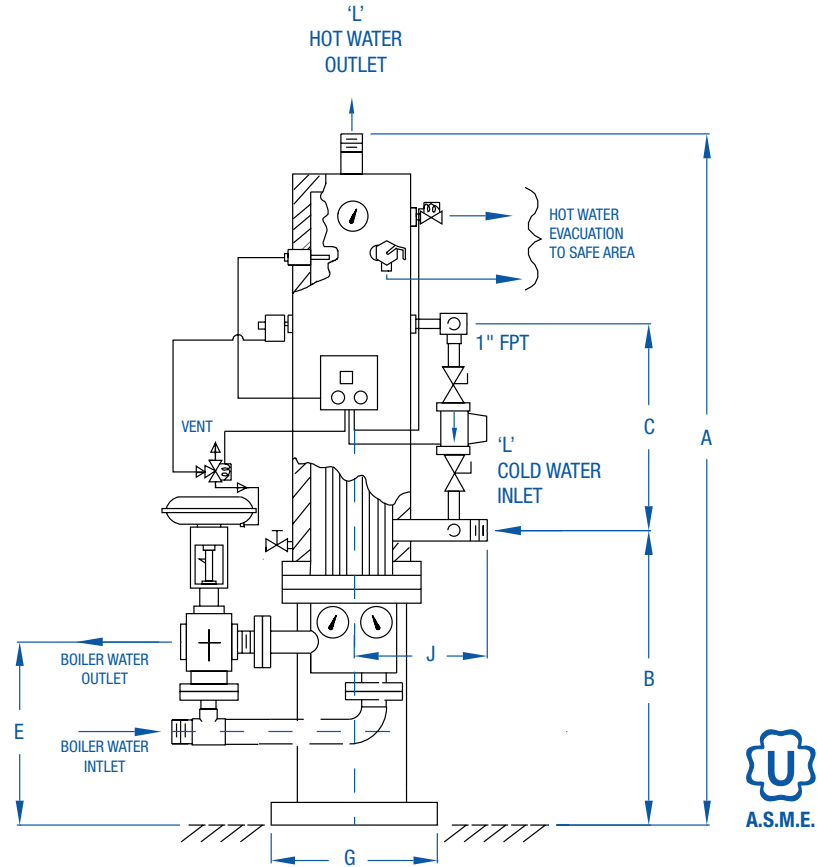
MODEL	A	B	C	D	E	G	J	K	L ¹	SHIPPING WEIGHT (LBS.)
SI-V-5-DW-SP	98 ¹ / ₄	27 ¹ / ₂	55	12	16 ³ / ₄	12	10	1	2 ¹ / ₂	400
SI-V-6-DW-SP	102	30 ³ / ₄	54 ¹ / ₂	14	19 ¹ / ₄	12	10 ¹ / ₂	1	2 ¹ / ₂	500
SI-V-8-DW-SP	98 ³ / ₄	31 ¹ / ₂	55 ¹ / ₄	13 ¹ / ₄	19	12	11 ¹ / ₂	1 ¹ / ₂	3	600
SI-V-10-DW-SP	105 ¹ / ₂	35 ³ / ₄	56 ¹ / ₂	15 ¹ / ₂	21 ³ / ₄	18	13 ¹ / ₂	2	4 F	1,000
SI-V-12-DW-SP	110 ¹ / ₂	39 ¹ / ₄	55	11 ³ / ₄	21 ³ / ₄	18	14 ¹ / ₂	2 ¹ / ₂	4 F	1,300
SI-V-14-DW-SP	122	41 ³ / ₄	63	9 ³ / ₄	21 ³ / ₄	18	16 ¹ / ₄	3	5 F	1,900
SI-V-16-DW-SP	128 ¹ / ₂	44	66 ³ / ₄	8 ³ / ₄	22 ¹ / ₄	18	18	3	6 F	2,450

All dimensions in inches. Dimensions are subject to change.

¹ Connections 4" IPS and above 150# ANSI FLG

Mini-Pack™

Semi-Instantaneous Water Heaters



VERTICAL • SINGLE-WALL • WATER TO WATER

Dimensions

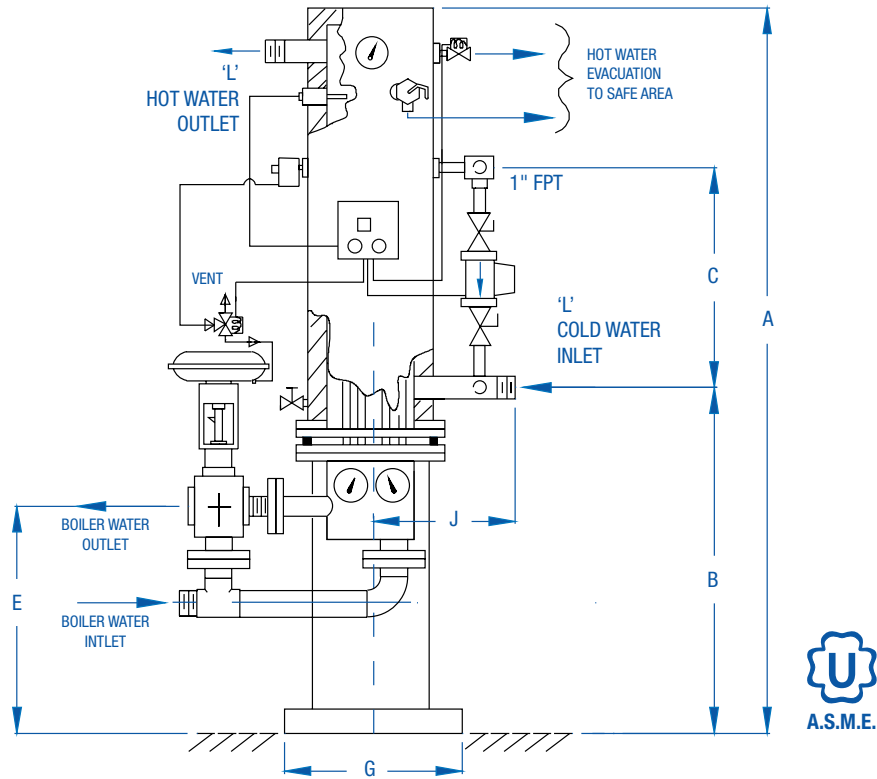
MODEL	A	B	C	E	G	J	L ¹	SHIPPING WEIGHT (LBS.)
SI-V-4-SW-WA	83	40	30	30 ¹ / ₄	12	9 ¹ / ₄	2	300
SI-V-5-SW-WA	69 ³ / ₄	33 ³ / ₄	23	24	12	10	2 ¹ / ₂	350
SI-V-6-SW-WA	86	42	31 ³ / ₄	31 ¹ / ₂	12	10 ¹ / ₂	2 ¹ / ₂	400
SI-V-8-SW-WA	75 ¹ / ₂	36 ¹ / ₂	24 ³ / ₄	25 ¹ / ₄	12	11 ¹ / ₂	3	500
SI-V-8L-SW-WA	114 ¹ / ₂	56 ¹ / ₂	43 ³ / ₄	32 ¹ / ₄	12	11 ¹ / ₂	3	550
SI-V-10-SW-WA	79 ¹ / ₂	38 ³ / ₄	25	27 ¹ / ₂	18	13 ¹ / ₂	4 F	850
SI-V-10L-SW-WA	92 ¹ / ₂	45 ³ / ₄	31	34 ¹ / ₂	18	13 ¹ / ₂	4 F	900
SI-V-12-SW-WA	83 ¹ / ₂	41 ³ / ₄	24 ¹ / ₂	28 ³ / ₄	18	14 ¹ / ₂	4 F	1,075
SI-V-12L-SW-WA	107 ¹ / ₂	53 ³ / ₄	36 ¹ / ₂	40 ³ / ₄	18	14 ¹ / ₂	4 F	1,200
SI-V-14-SW-WA	90	48 ³ / ₄	30 ¹ / ₂	34	18	16 ¹ / ₄	5 F	1,550
SI-V-16-SW-WA	122	60 ³ / ₄	40 ¹ / ₂	29 ¹ / ₂	18	16 ¹ / ₄	6 F	2,125

All dimensions in inches. Dimensions are subject to change.

¹ Connections 4" IPS and above 150# ANSI FLG

Mini-Pack™

Semi-Instantaneous Water Heaters



VERTICAL • DOUBLE-WALL • WATER TO WATER

Dimensions

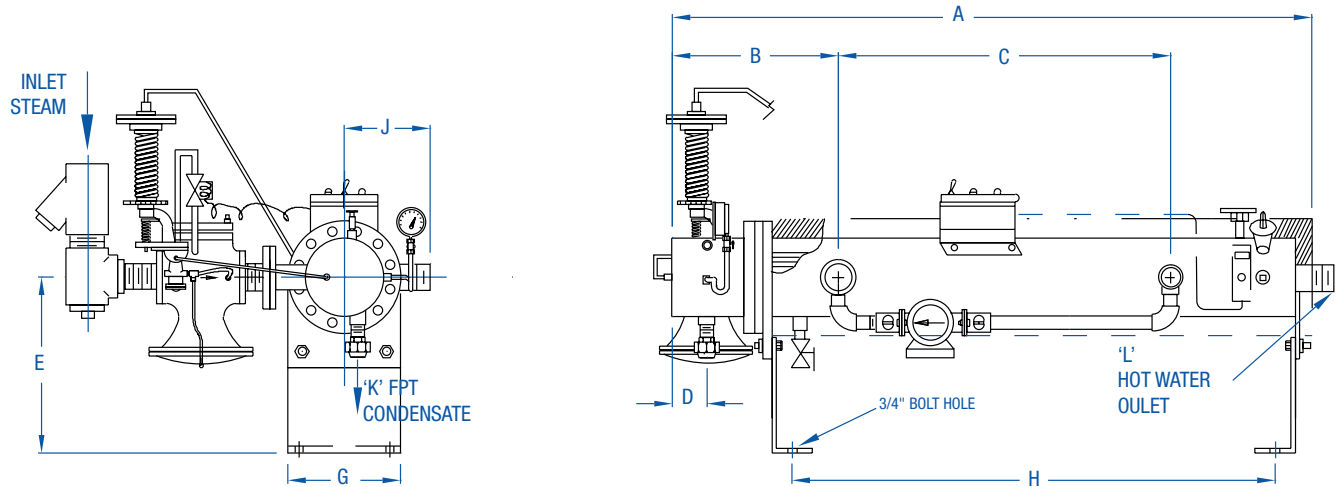
MODEL	A	B	C	E	G	J	L'	SHIPPING WEIGHT (LBS.)
SI-V-5-DW-WA	98 1/2	27 1/2	55	16 3/4	12	10	2 1/2	425
SI-V-6-DW-WA	102	30 3/4	54 1/2	19 1/4	12	10 1/2	2 1/2	500
SI-V-8-DW-WA	98 3/4	31 1/2	55 1/4	19	12	11 1/2	3	700
SI-V-10-DW-WA	105 1/2	35 3/4	56 1/2	23 1/4	18	13 1/2	4 F	1,100
SI-V-12-DW-WA	110 1/2	39 1/4	55	24 3/4	18	14 1/2	4 F	1,425
SI-V-14-DW-WA	122	41 3/4	63	25 1/4	18	16 1/4	5 F	1,975
SI-V-16-DW-WA	128 1/2	44	66 3/4	29 3/4	8	18	6 F	2,475

All dimensions in inches. Dimensions are subject to change.

¹ Connections 4" IPS and above 150# ANSI FLG

Mini-Pack™

Semi-Instantaneous Water Heaters



HORIZONTAL • SINGLE-WALL • STEAM TO WATER

Dimensions

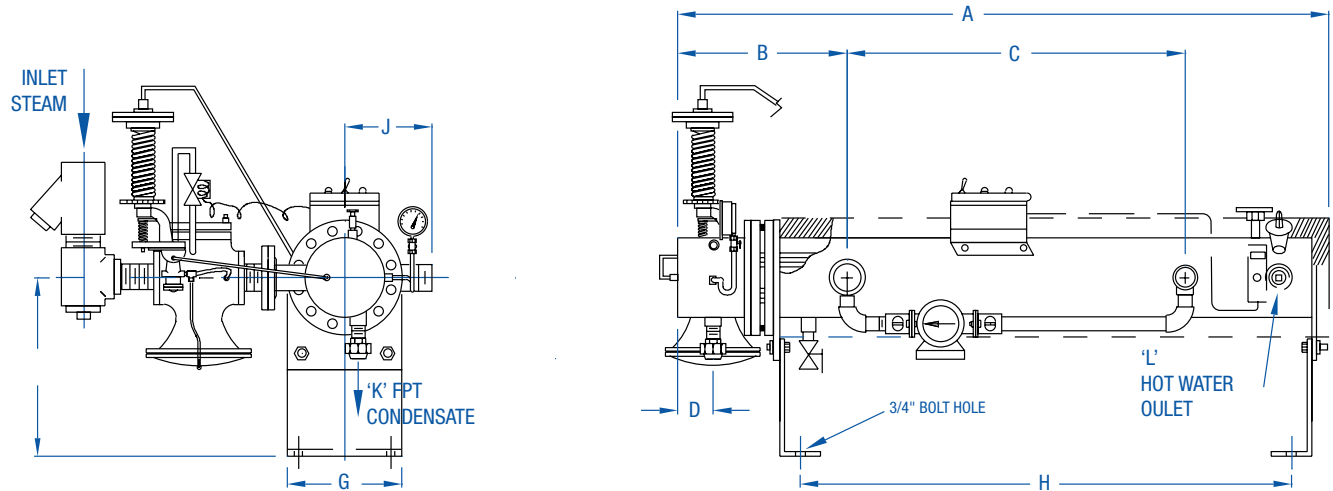
MODEL	A	B	C	D	E	G	H	J	K	L'	SHIPPING WEIGHT (LBS.)
SI-H-4-SW-SP	56 1/4	13 1/4	30	3 1/2	13 1/2	7 1/2	40 1/2	9 1/4	3/4	2	300
SI-H-5-SW-SP	49 1/4	13 1/4	23	3 1/2	14 3/4	8 3/4	33 1/2	10	1	2 1/2	350
SI-H-6-SW-SP	57 3/4	13 3/4	31 3/4	3 1/2	15 1/4	9 3/4	41 3/4	10 1/2	1	2 1/2	450
SI-H-8-SW-SP	54 1/4	15 1/4	24 3/4	4	18 1/4	11 3/4	36 3/4	11 1/2	1 1/2	3	550
SI-H-8L-SW-SP	60 1/4	15 1/4	30 3/4	4	18 1/4	11 3/4	42 3/4	11 1/2	1 1/2	3	600
SI-H-10-SW-SP	57 1/2	16 3/4	25	4 1/4	22	14 1/2	37 1/2	13 1/2	2	4 F	850
SI-H-10L-SW-SP	63 1/2	16 3/4	31	4 1/2	22	14 1/2	43 1/2	13 1/2	2	4 F	900
SI-H-12-SW-SP	64 1/2	23	24 1/2	7	26 1/2	16 1/2	38 3/4	14 1/2	2 1/2	4 F	1,075
SI-H-12L-SW-SP	76 1/2	23	36 1/2	7	26 1/2	16 1/2	50 3/4	14 1/2	2 1/2	4 F	1,125
SI-H-14-SW-SP	76 1/4	26 3/4	30 1/2	8 1/2	26	18 1/2	46 1/4	15 1/2	3	5 F	1,650
SI-H-16-SW-SP	91 3/4	30 3/4	40 1/2	10	27	20	58 3/4	16 1/4	3	6 F	2,150

All dimensions in inches. Dimensions are subject to change.

¹ Connections 4" IPS and above 150# ANSI FLG

Mini-Pack™

Semi-Instantaneous Water Heaters



HORIZONTAL • DOUBLE-WALL • STEAM TO WATER

Dimensions

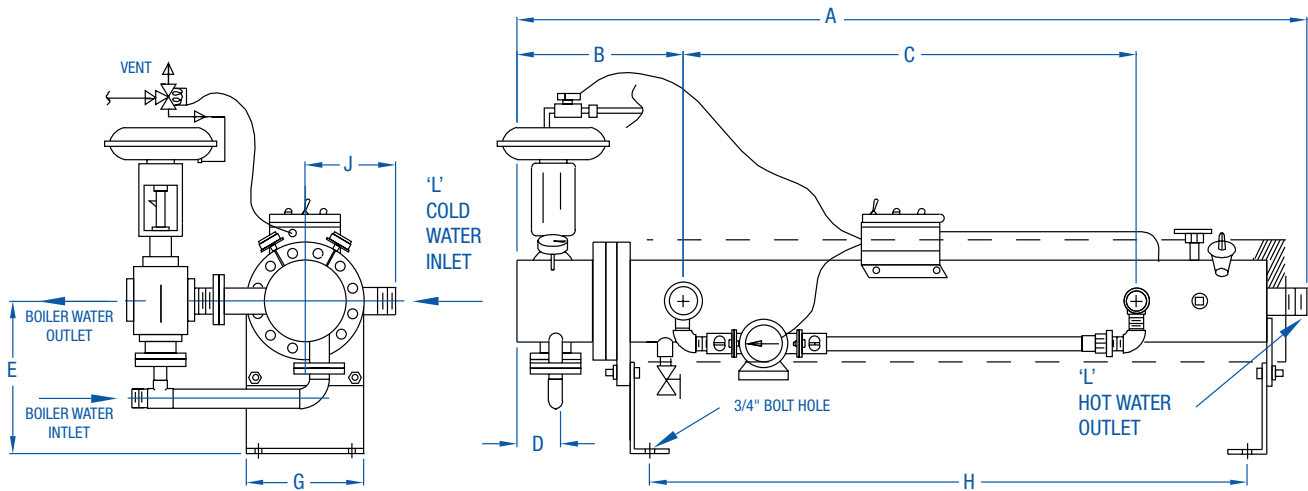
MODELS	A	B	C	D	E	G	H	J	K	L'	SHIPPING WEIGHT (LBS.)
SI-H-5-DW-SP	85	14 1/4	55	3 1/2	14 3/4	8 3/4	66	10	1	2 1/2	435
SI-H-6-DW-SP	86 1/4	15	54 1/2	3 1/2	15 1/4	9 3/4	67	10 1/2	1	2 1/2	535
SI-H-8-DW-SP	83 3/4	16 1/2	55 1/4	4	18 1/4	11 3/4	68	11 1/2	1 1/2	3	635
SI-H-10-DW-SP	88	18 1/4	56 1/2	4 1/8	22	14 1/2	69 1/2	13 1/2	2	4 F	950
SI-H-12-DW-SP	95 3/4	24 1/2	55	7	26 1/2	16 1/2	70 3/4	14 1/2	2	4 F	1,200
SI-H-14-DW-SP	109	28 1/2	63	8 1/2	25 1/4	18 1/2	79 1/2	15 1/2	2	5 F	1,750
SI-H-16-DW-SP	116 1/2	32 1/2	66	10	27	20	83 1/2	16 1/4	2	6 F	2,250

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Mini-Pack™

Semi-Instantaneous Water Heaters



HORIZONTAL • SINGLE-WALL • WATER TO WATER

Dimensions

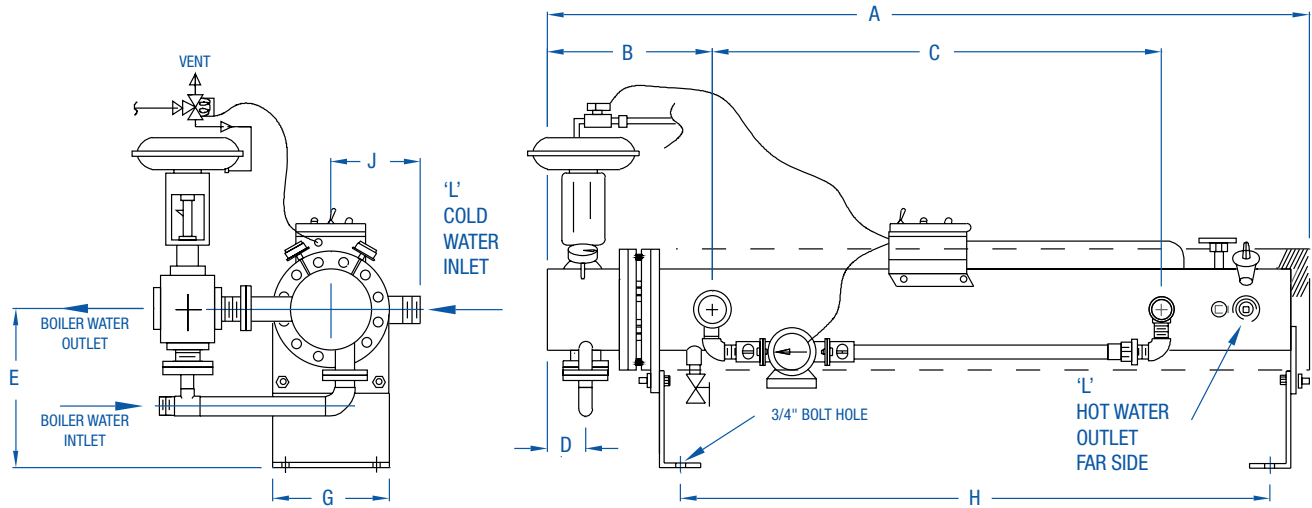
MODEL	A	B	C	D	E	G	H	J	L'	SHIPPING WEIGHT (LBS.)
SI-H-4-SW-WA	56 ¹ / ₄	13 ¹ / ₄	30	3 ¹ / ₂	13 ¹ / ₂	7 ¹ / ₂	40 ¹ / ₂	9 ¹ / ₄	2	275
SI-H-5-SW-WA	49 ¹ / ₄	13 ¹ / ₄	23	3 ¹ / ₂	14 ³ / ₄	8 ³ / ₄	33 ¹ / ₂	10	2 ¹ / ₂	300
SI-H-6-SW-WA	57 ³ / ₄	13 ³ / ₄	31 ³ / ₄	3 ¹ / ₂	15 ¹ / ₄	9 ³ / ₄	41 ³ / ₄	10 ¹ / ₂	2 ¹ / ₂	350
SI-H-8-SW-WA	54 ¹ / ₄	15 ¹ / ₄	24 ³ / ₄	4	18 ¹ / ₄	11 ³ / ₄	36 ³ / ₄	11 ¹ / ₂	3	450
SI-H-8L-SW-WA	60 ¹ / ₄	15 ¹ / ₄	30 ³ / ₄	4	18 ¹ / ₄	11 ³ / ₄	42 ³ / ₄	11 ¹ / ₂	3	500
SI-H-10-SW-WA	55 ³ / ₄	15 ¹ / ₄	25	4	22	14 ¹ / ₂	37 ¹ / ₂	13 ¹ / ₂	4 F	800
SI-H-10L-SW-WA	61 ³ / ₄	15 ¹ / ₄	31	4	22	14 ¹ / ₂	43 ¹ / ₂	13 ¹ / ₂	4 F	850
SI-H-12-SW-WA	58 ¹ / ₂	17	24 ¹ / ₂	4	26 ¹ / ₂	16 ¹ / ₂	38 ³ / ₄	14 ¹ / ₂	4 F	1,025
SI-H-12L-SW-WA	70 ¹ / ₂	17	36 ¹ / ₂	4	26 ¹ / ₂	16 ¹ / ₂	50 ³ / ₄	14 ¹ / ₂	4 F	1,150
SI-H-14-SW-WA	70 ³ / ₄	21	30 ¹ / ₂	6 ¹ / ₂	25 ¹ / ₄	18 ¹ / ₂	46 ¹ / ₄	15 ¹ / ₂	5 F	1,500
SI-H-16-SW-WA	84 ¹ / ₄	23	40 ¹ / ₂	6 ³ / ₄	27	20	58 ³ / ₄	16 ¹ / ₄	6 F	2,075

All dimensions in inches. Dimensions are subject to change.

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Mini-Pack™

Semi-Instantaneous Water Heaters



HORIZONTAL • DOUBLE-WALL • WATER TO WATER

Dimensions

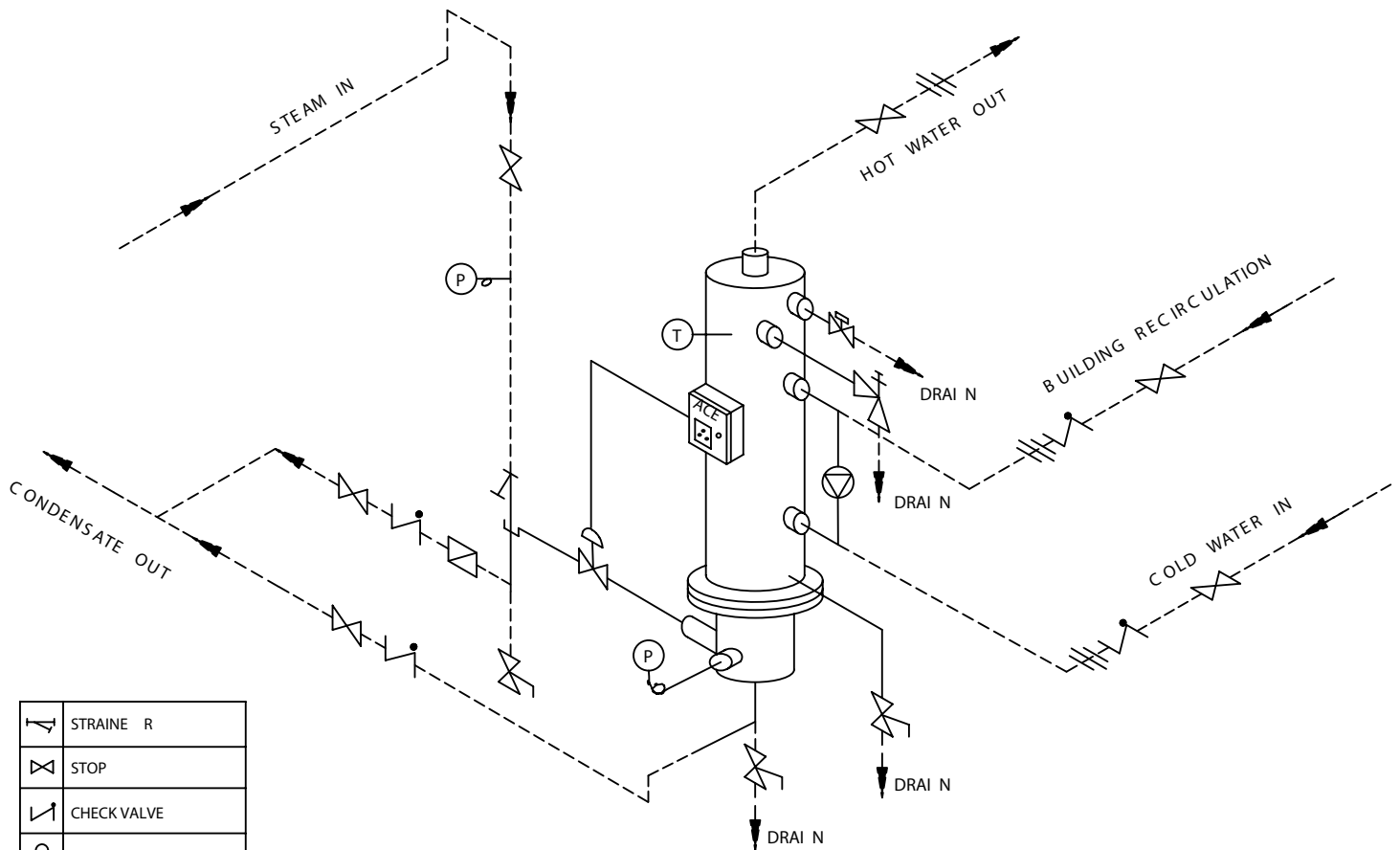
MODEL	A	B	C	D	E	G	H	J	L'	SHIPPING WEIGHT (LBS.)
SI-H-5-DW-WA	85	14 1/4	55	3 1/2	14 3/4	8 3/4	66	10	2 1/2	375
SI-H-6-DW-WA	86 1/4	15	54 1/2	3 1/2	15 1/4	9 3/4	67	10 1/2	2 1/2	450
SI-H-8-DW-WA	83 3/4	16 1/2	55 1/4	4	18 1/4	11 3/4	68	11 1/2	3	650
SI-H-10-DW-WA	86 1/4	16 1/2	56 1/2	4	22	14 1/2	69 1/2	13 1/2	4 F	1,050
SI-H-12-DW-WA	89 3/4	18 1/2	55	4	26 1/2	16 1/2	70 3/4	14 1/2	4 F	1,375
SI-H-14-DW-WA	103 3/4	23 1/2	63	6 1/2	25 1/4	18 1/2	79 1/2	15 1/2	5 F	1,925
SI-H-16-DW-WA	109 1/2	25 1/2	66 3/4	6 3/4	27	20	83 1/2	16 1/4	6 F	2,425

All dimensions in inches. Dimensions are subject to change.

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Mini-Pack™

Semi-Instantaneous Water Heaters



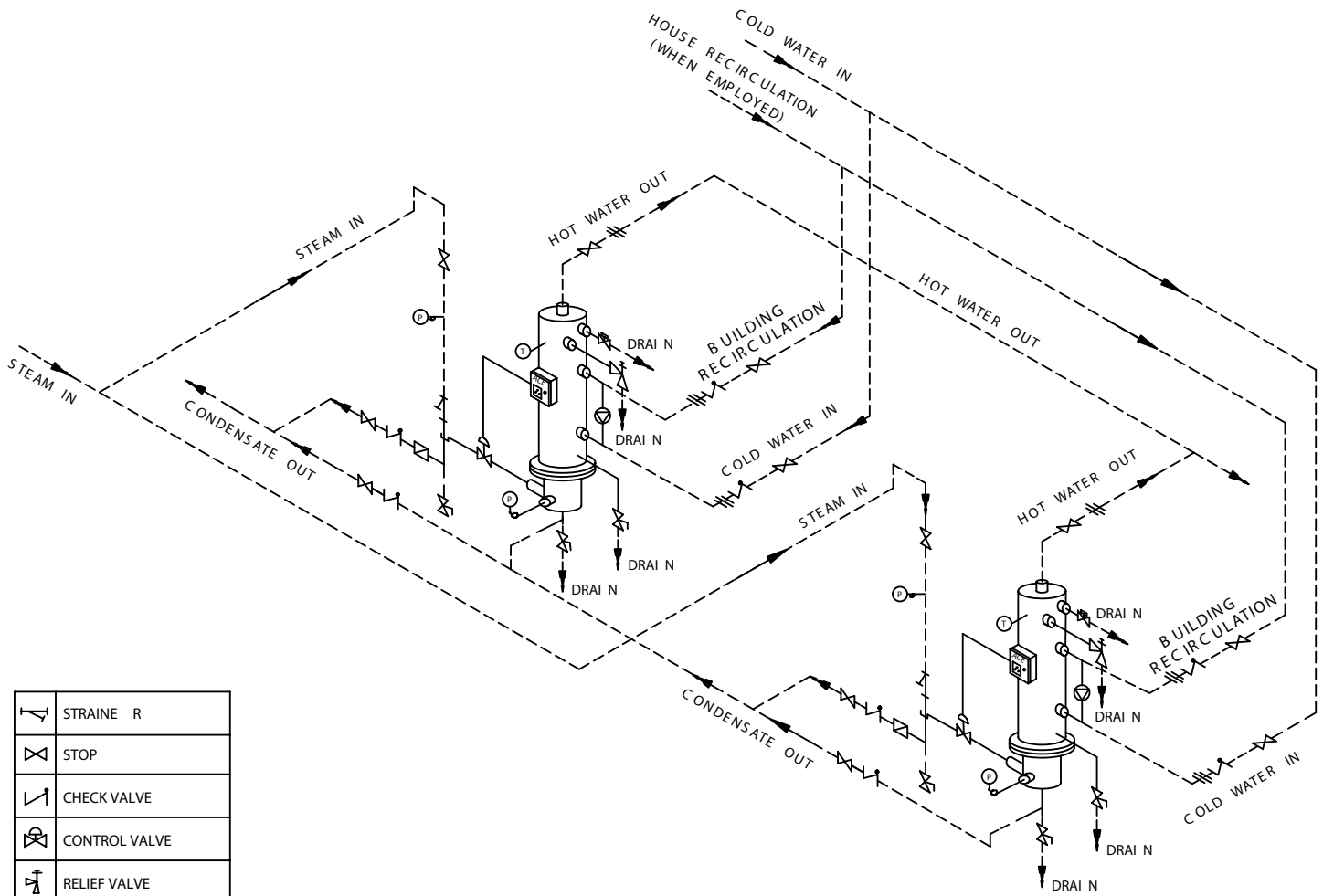
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	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

----- FIELD PIPING
 BY OTHERS

Single-Wall / Steam-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



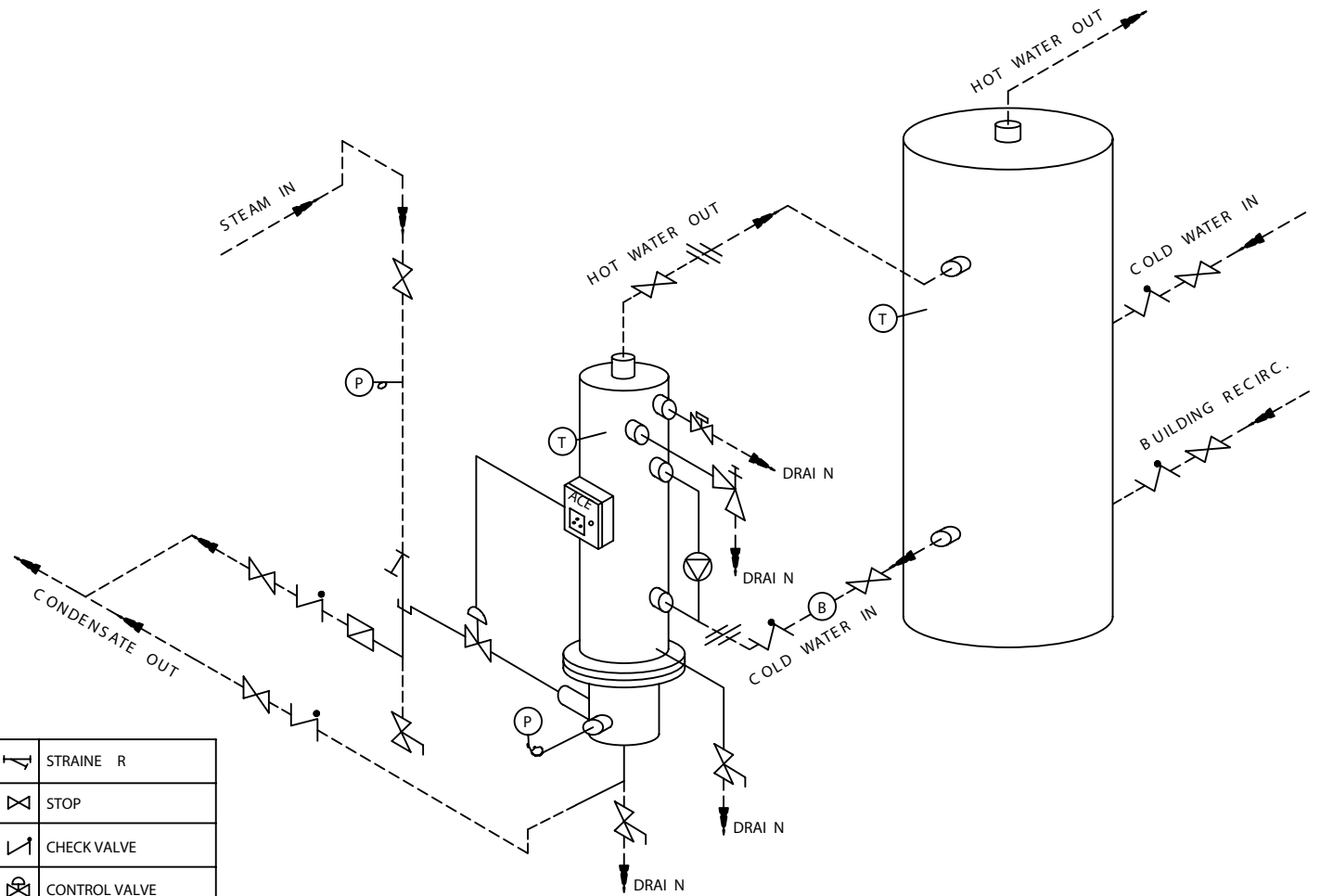
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	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

----- FIELD PIPING
 BY OTHER

Single-Wall / Parallel Steam-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



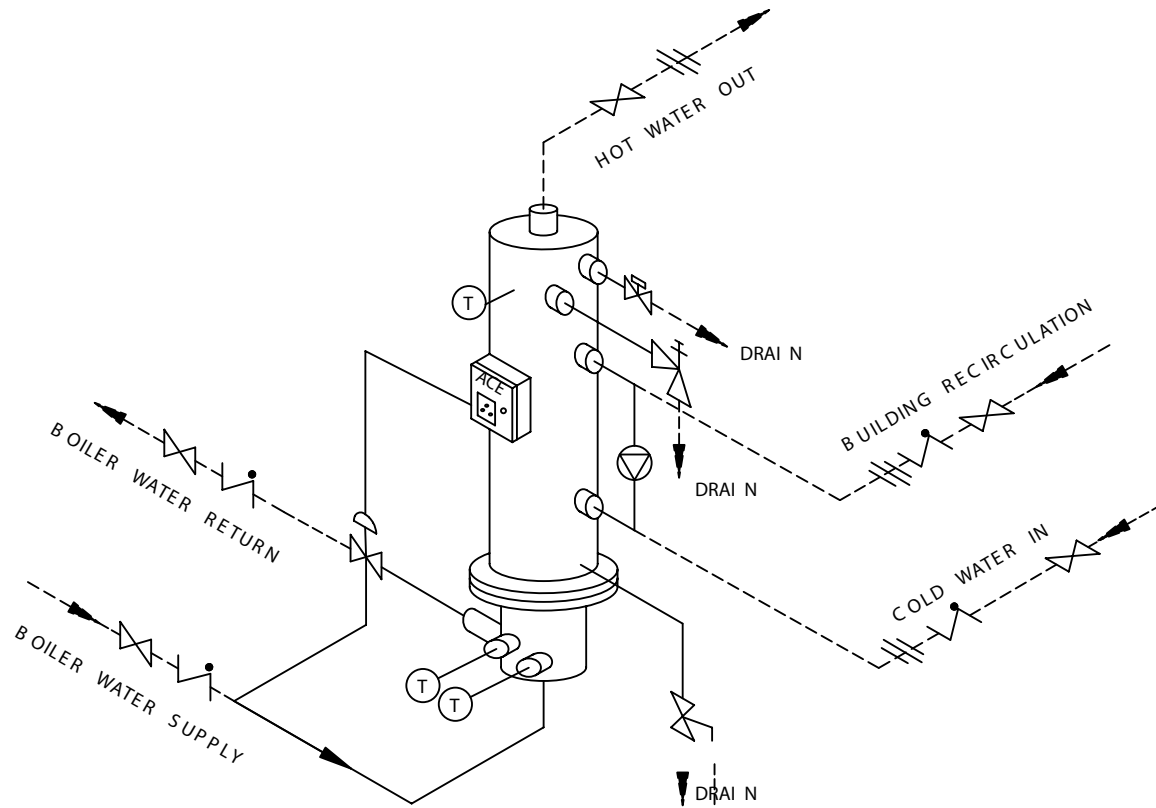
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	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUX. TRAP OPTION
	TANK RECIRCULATOR

--- FIELD PIPING
 --- BY OTHERS

Single-Wall / Steam-to-Water with Tank

Mini-Pack™

Semi-Instantaneous Water Heaters



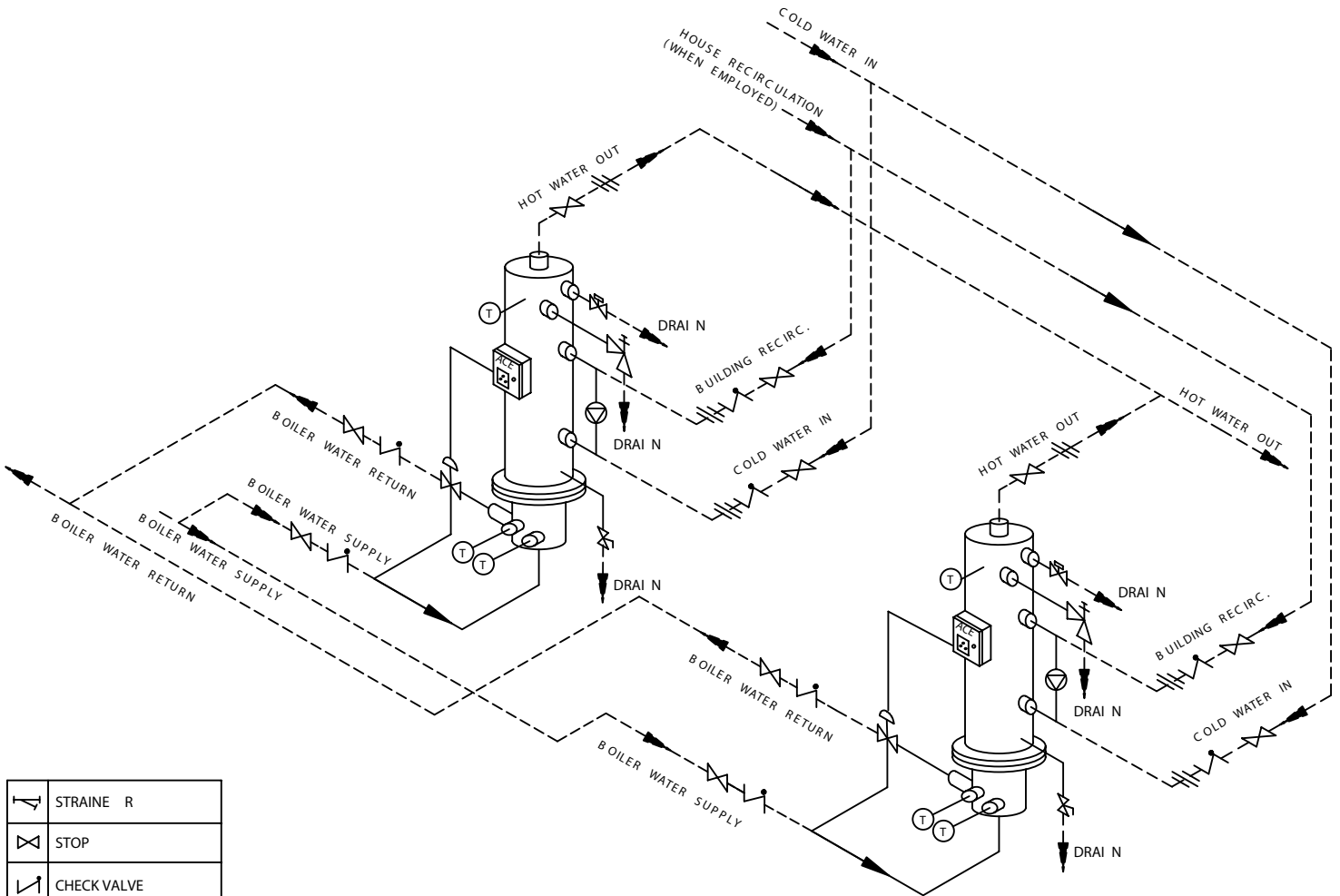
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	INTERNAL RECIRCULATOR
	OVER-TEMP SOLENOID OPTION
	AUX. TRAP OPTION

----- FIELD PIPING
 BY OTHERS

Single-Wall / Water-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



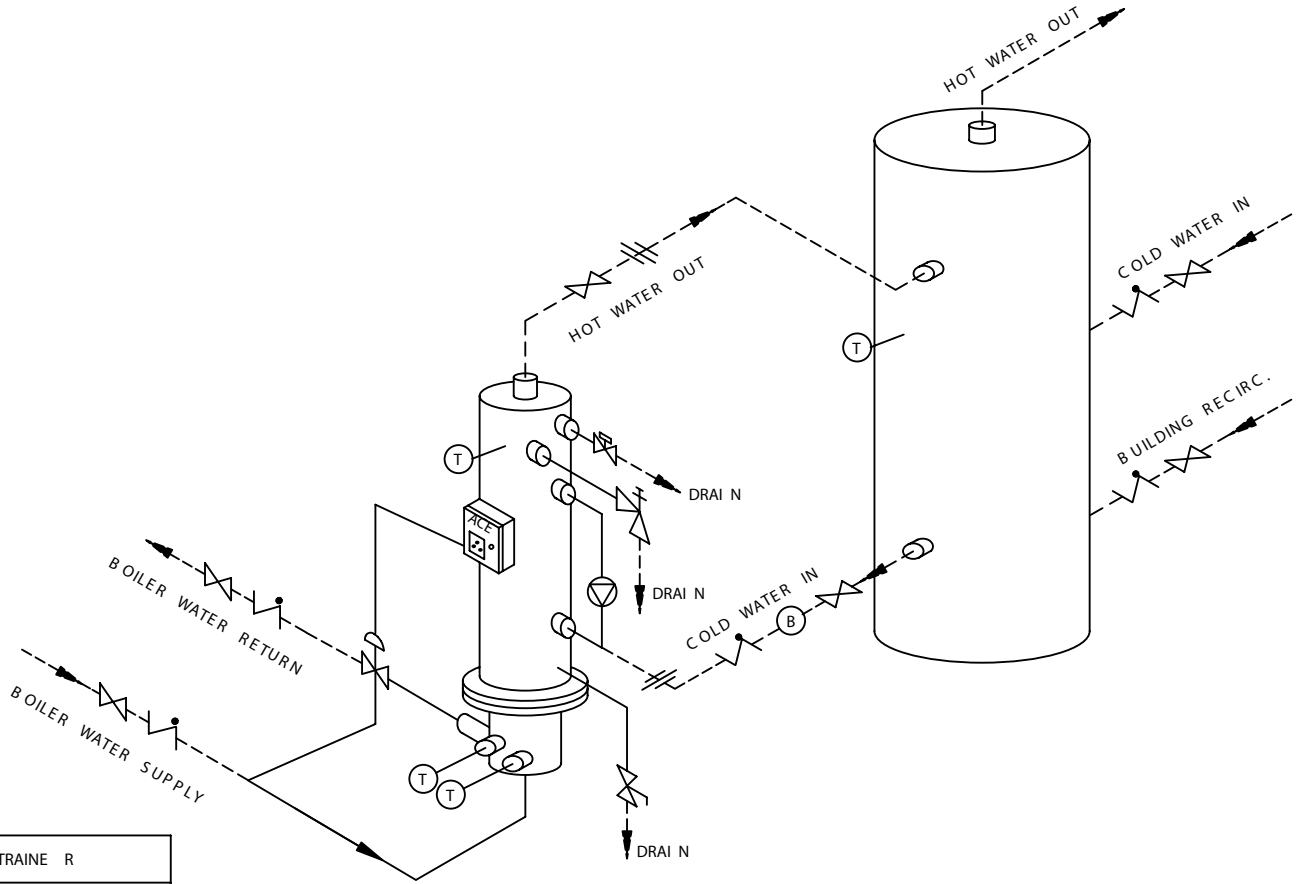
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	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

--- FIELD PIPING
 --- BY OTHER

Single-Wall / Parallel Water-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



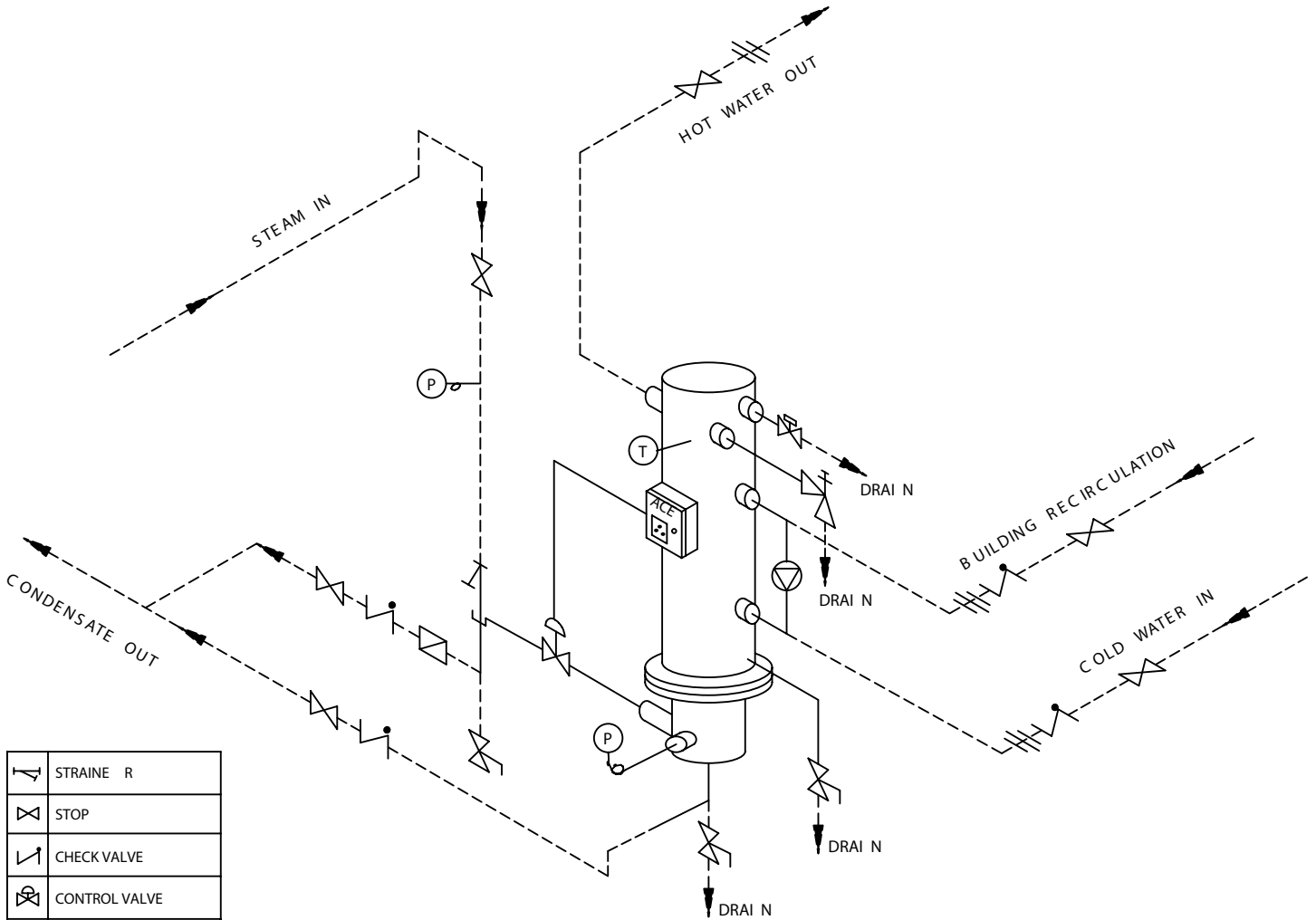
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	OVER-TEMP SOLENOID OPTION
	AUX. TRAP OPTION
	TANK RECIRCULATOR

----- FIELD PIPING
 BY OTHERS

Single-Wall / Water-to-Water with Tank

Mini-Pack™

Semi-Instantaneous Water Heaters



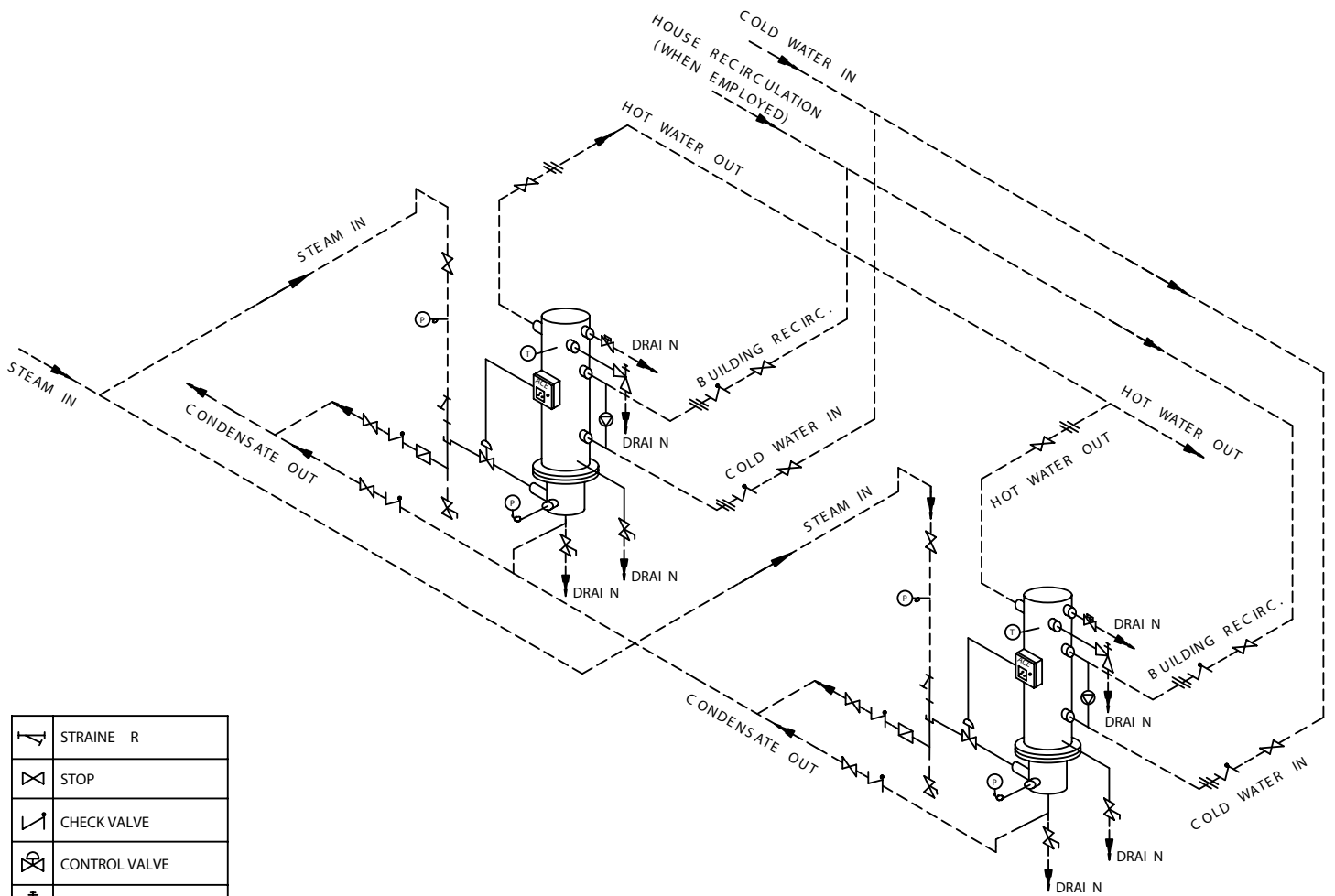
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	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID TRAP (OPTIONAL)
	AUXILIARY TRAP (OPTIONAL)

--- FIELD PIPING
BY OTHERS

Double-Wall / Steam-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



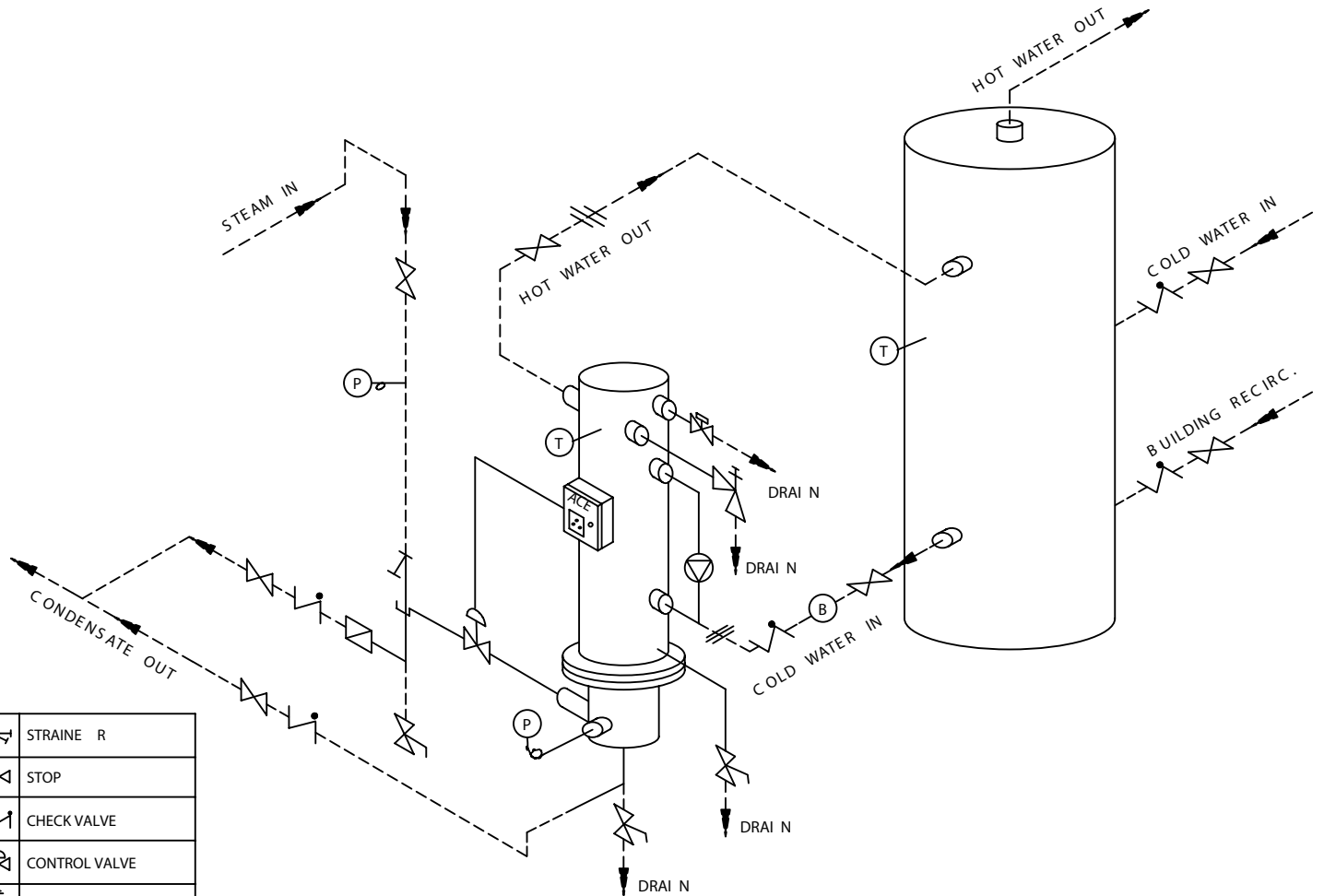
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	TEMP. GAUGE
	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

--- FIELD PIPING
 --- BY OTHERS

Double-Wall / Parallel Steam-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



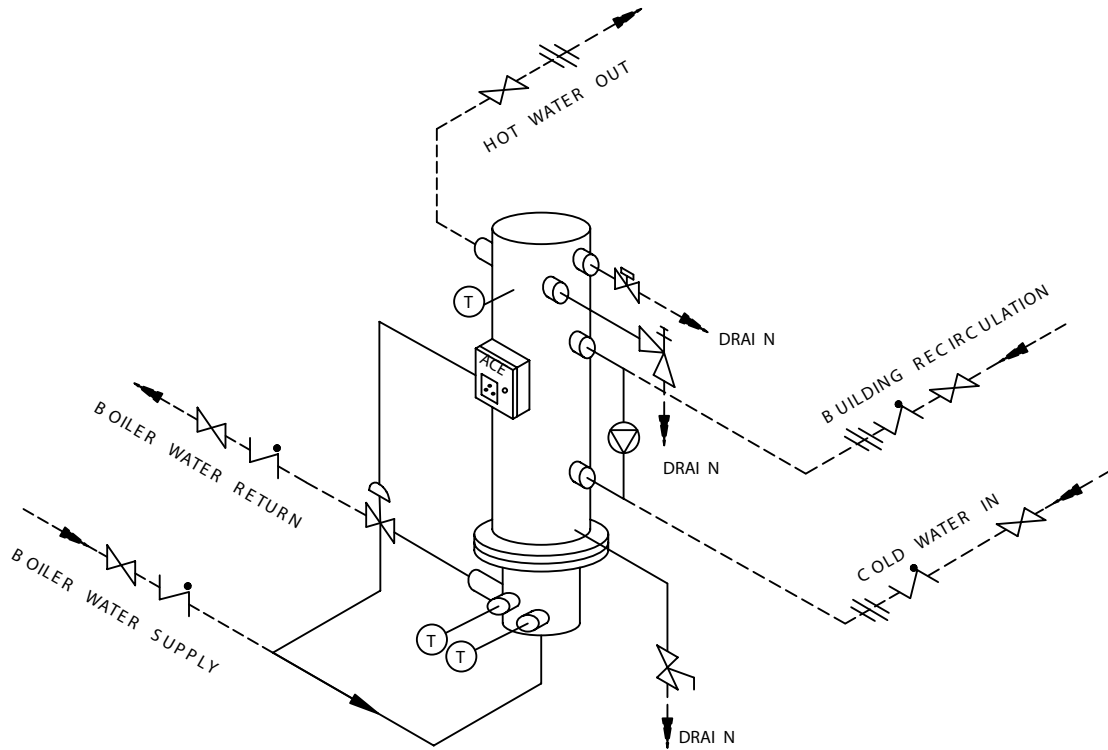
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	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID TRAP OPTION
	AUX. TRAP OPTION
	TANK RECIRCULATOR

----- FIELD PIPING
 BY OTHERS

Double-Wall / Steam-to-Water with Tank

Mini-Pack™

Semi-Instantaneous Water Heaters



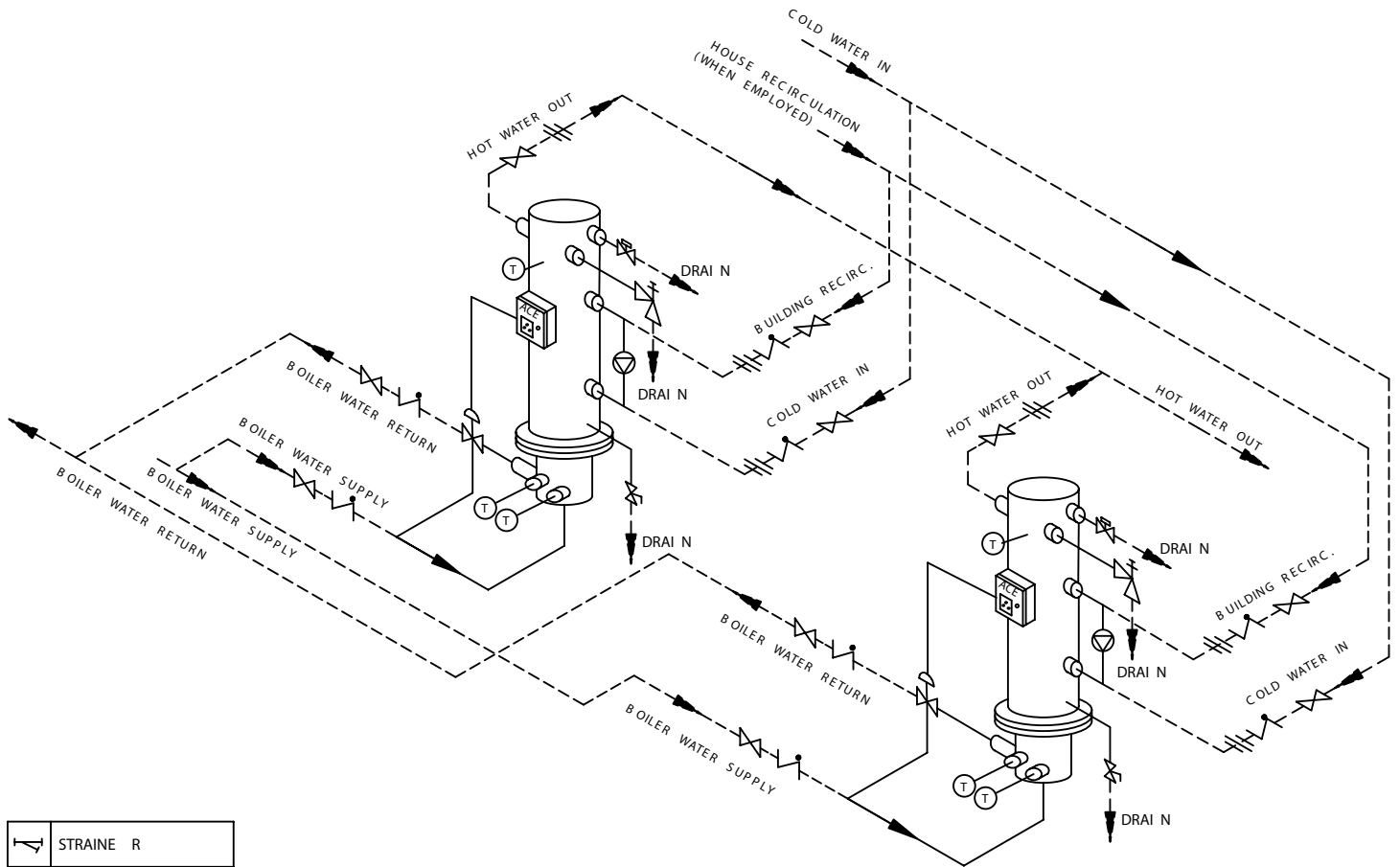
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	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

----- FIELD PIPING
 BY OTHERS

Double-Wall / Water-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



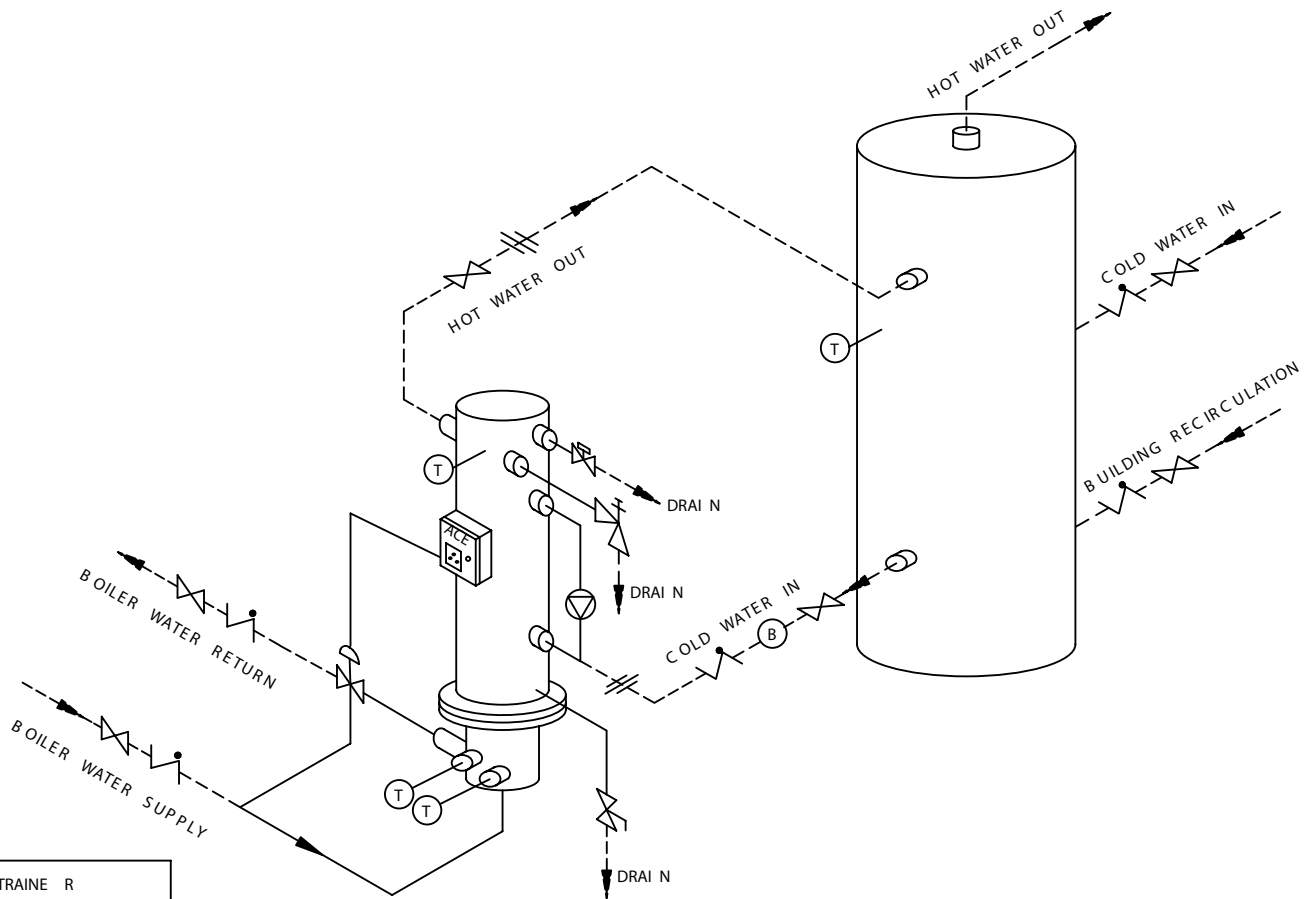
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	UNION
	TEMP. GAUGE
	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUXILIARY TRAP OPTION

----- FIELD PIPING
 _____ BY OTHER

Double-Wall / Parallel Water-to-Water

Mini-Pack™

Semi-Instantaneous Water Heaters



	STRAINER
	STOP
	CHECK VALVE
	CONTROL VALVE
	RELIEF VALVE
	DRAIN VALVE
	UNION
	TEMP. GAUGE
	PRESSURE GAUGE
	INTERNAL RECIRCULATOR
	OVER-TEMPERATURE SOLENOID OPTION
	AUX. TRAP OPTION
	TANK RECIRCULATOR

--- FIELD PIPING
 BY OTHERS

Double-Wall / Water-to-Water with Tank