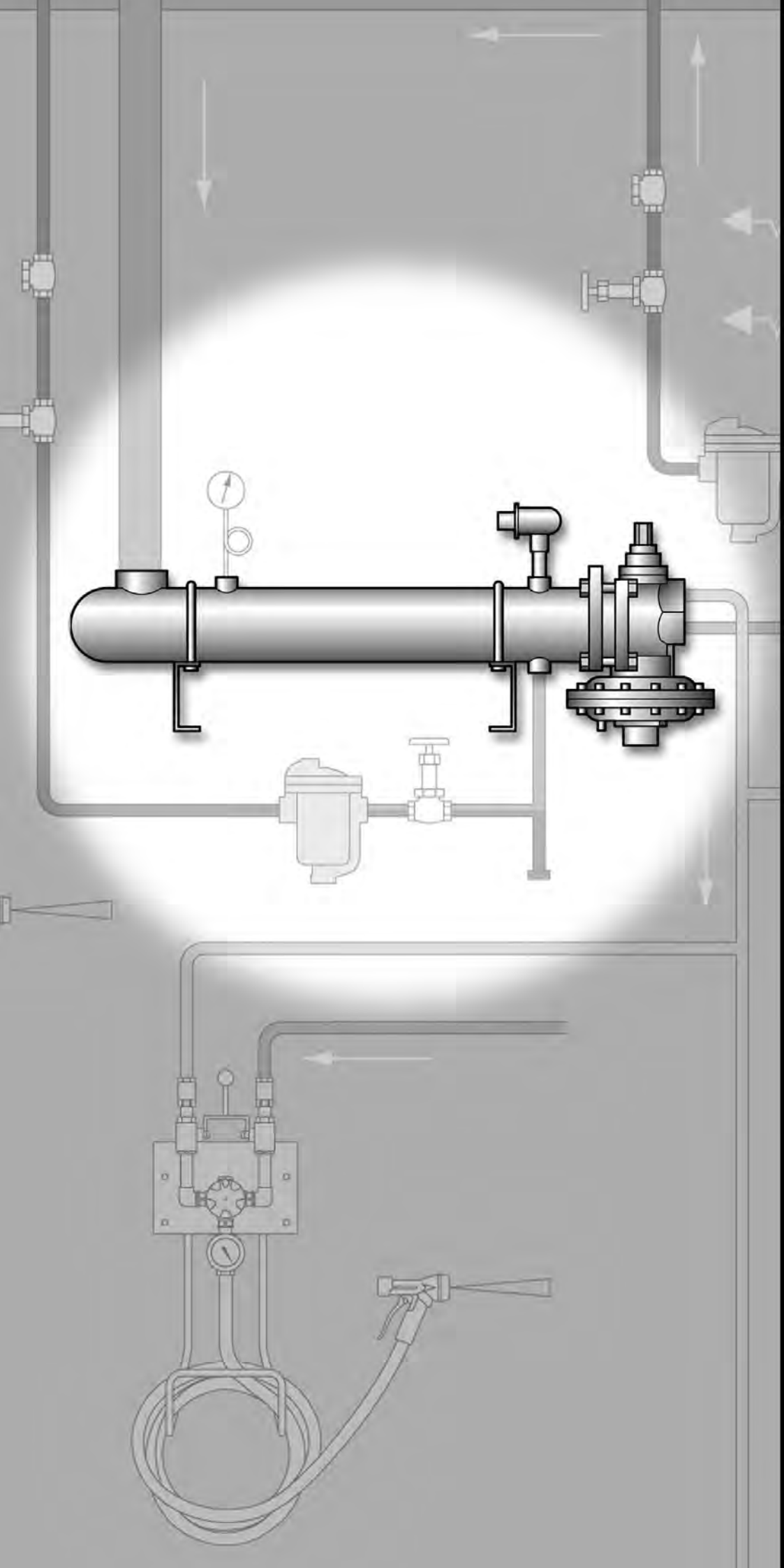
Water Heating



Armstrong

Armstrong®
Intelligent System Solutions™
STEAM • AIR • HOT WATER

Water Heating and Water Temperature Control Solutions

Steam/Water Heaters

Steam/water heaters are typically classified as instantaneous, semi-instantaneous and tank-type. Temperature control can be defined as either feed-forward or feedback.

Feedback systems are error-driven and rely upon an outlet or downstream thermostatic temperature-sensing device to detect a temperature change requirement and then modulate the steam to effect the heat exchange in an attempt to recover the heater set-point. Feedback systems are reactive, and a significant concern is their speed of response to system and application temperature control requirements.

Tank-Type Steam/Water Heaters (feedback)

Tank-type steam/water heaters typically include a temperature sensing element or coil immersed in a storage vessel with a separate, remote steam control valve. As a function of their integral and often significant storage capability, the poor response times often associated with the relationship of temperature-sensing device and steam control valve are less of an issue.

Tank-Type Steam/Water Heaters are a less attractive option because:

- They consume a large amount of valuable mechanical-room real estate.
- They have been identified as amplification and colonization points for Legionella bacteria.
- They have significant leak potential over time.
- Tank repair is difficult, and tank replacement often requires mechanical room/building structural modifications.
- They consume energy to heat and maintain what is effectively a reserve hot water supply.
- They require separate steam control valves, which require ongoing maintenance.
- They require thermostatic element/sensors,which have shown a tendency to wear and eventually rupture under a heavy cycle load.
- They are slow to recover and may run out of hot water during peak load periods.

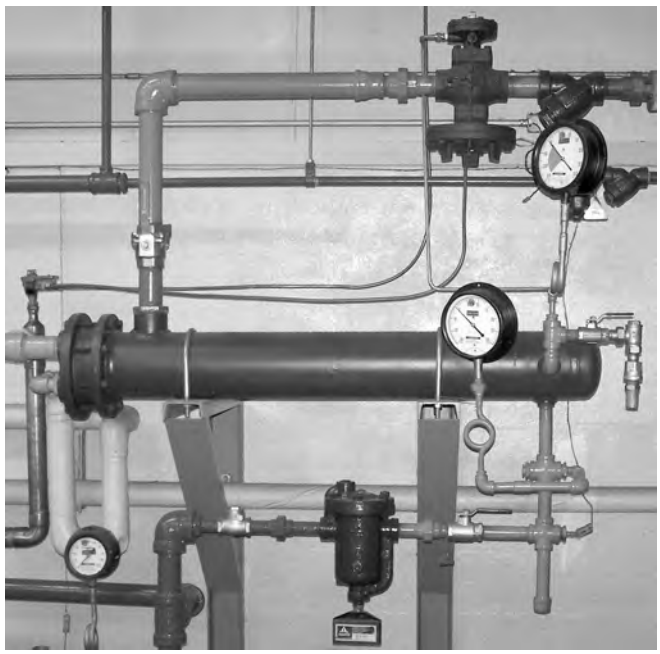
Tankless Instantaneous Steam/Water Heaters (feedback)

Tankless instantaneous steam/water heaters, often referred to as shell and tube heat exchangers, do not include hot water storage capacity. These models will rely upon either an outlet or downstream temperature-sensing element with a separate steam control valve.

Tankless Instantaneous Steam/Water Heaters are a less attractive option because:

- Lag time from message (thermostat) to action (control valve) creates thermal lag and a resulting temperature swing.
- Modulating steam supply can cause condensate evacuation issues, resulting in damage from water hammer and tube bundle corrosion.
- A cycling phenomenon during low- or no-demand periods will cause premature wear to the thermostatic element. Thermostats typically fail in an open position, making overheated, scald-temperature water available to the system.

High-maintenance feedback systems with bulky tank units like this one often leak, corrode or rupture a thermostatic control.



Feedback instantaneous systems suffer from lag time, tube bundle corrosion and problems with thermostatic element deterioration.

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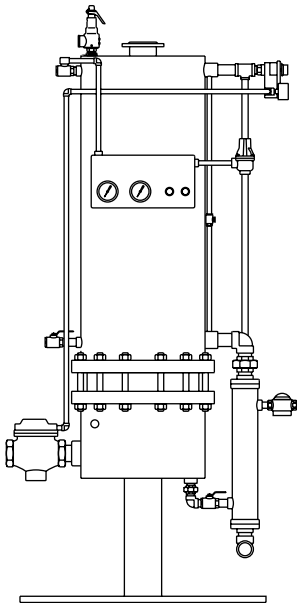
Semi-Instantaneous Steam/Water Heaters (feedback)

Semi-instantaneous steam/water heaters typically include lower-capacity storage, with an integral steam control valve to deliver the heat exchange through an internally positioned element or coil.

Semi-Instantaneous Steam/Water Heaters are a less attractive option because:

- Poor low-flow temperature control creates an accumulation tank requirement.
- Accumulation tank creates recovery-time issues at peak demand.
- Heating element/coil in generation/accumulation tank is susceptible to failure and cross contamination.
- Accumulation tanks have been identified as amplification and colonization points for Legionella bacteria.
- Although a lower-cost option, semi-instantaneous steam/water heaters are a higher-maintenance selection.
- Semi-instantaneous steam/water heaters have a shorter service life before replacement than other choices.



Semi-instantaneous water heaters are subject to poor recovery time at peak demand, inadequate low-flow temperature control and shorter service life.

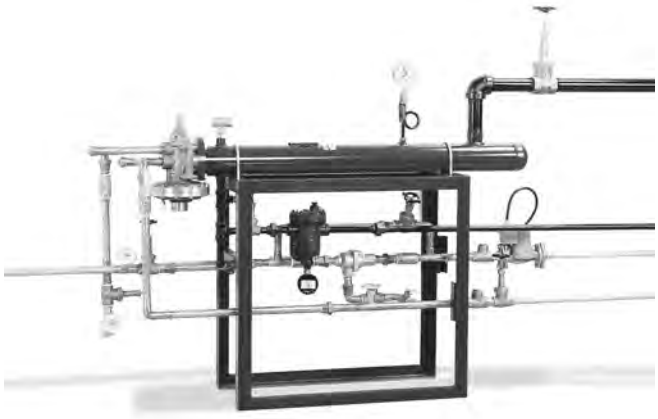
Flo-Rite-Temp™ Feed-Forward Instantaneous Steam/Water Heaters

Flo-Rite-Temp feed-forward instantaneous steam/water heaters offer a simple yet time-proven alternative to traditional feedback instantaneous, semi-instantaneous and tank-type steam-heating methods.

By eliminating the temperature sensing feedback element and relying upon the actual hot water system demand requirement within the system or application, feed-forward systems respond rapidly and are extremely accurate.

Flo-Rite-Temp Feed-Forward Instantaneous Steam/Water Heater is a more attractive option because:

- The constant, non-modulating steam pressure within the shell eliminates cycling damage.
- The system demand or flow feed-forward activation eliminates the requirement for either steam control valve or thermostatic control device.
- It delivers a consistent outlet temperature (+/-2°C of set-point) with no thermal lag and resulting temperature swing.
- It is extremely safe because the mixing unit will position to cold water flow upon failure of the primary operating component.



The Armstrong Flo-Rite-Temp can easily do the work of a storage tank unit many times its size-at lower installed cost and with minimum maintenance. Even the largest capacity Flo-Rite-Temp requires only 0.63 m² of floor space.

The Armstrong Flo-Rite-Temp can easily do the work of a storage tank unit many times its size - at lower installed cost and with minimum maintenance. Even the largest capacity Flo-Rite-Temp requires only 0,63 m² of floor space.

Why the Armstrong Feed Forward Design Gives You a Head Start in Performance, Maintenance and Savings

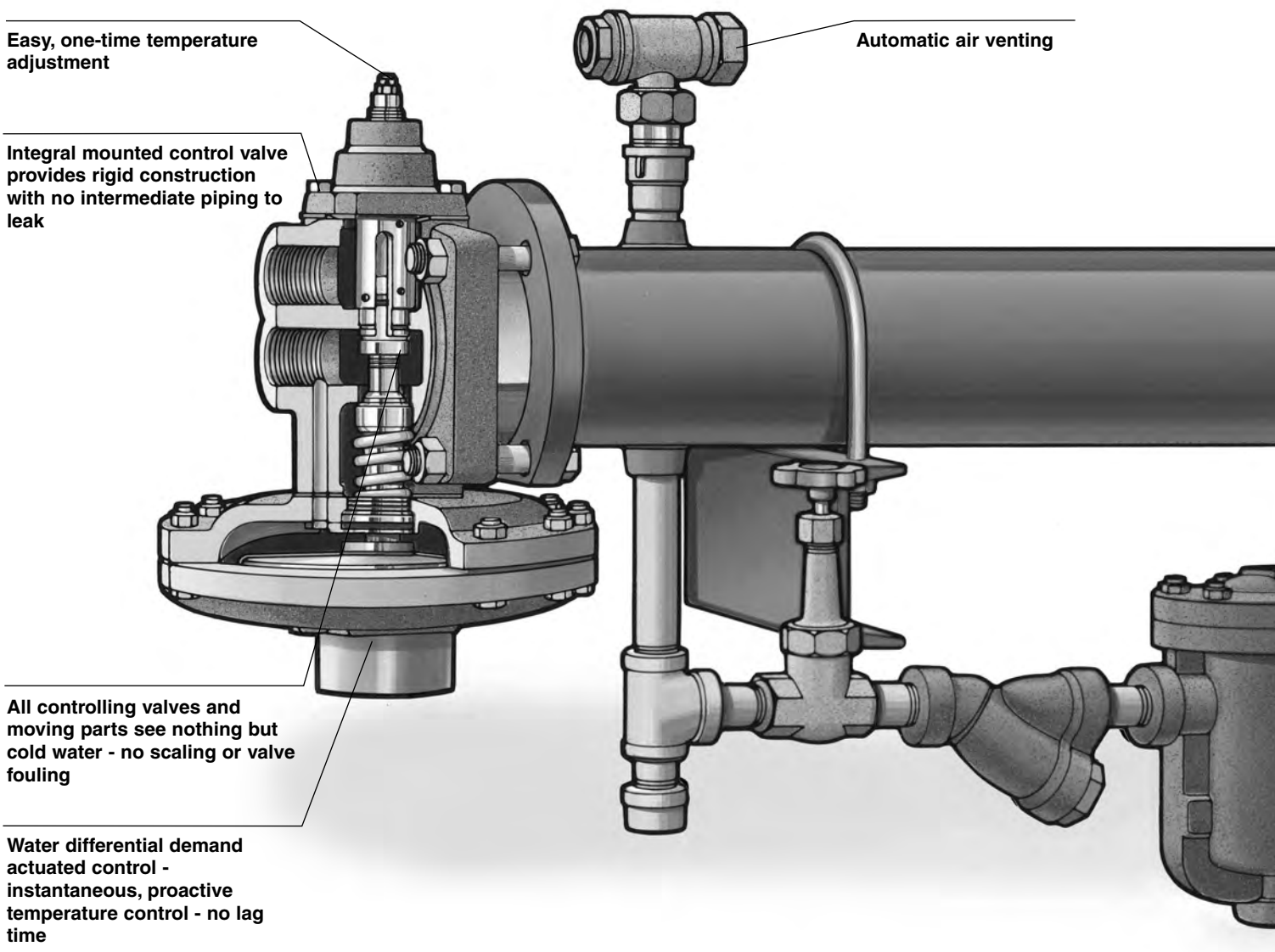
The Armstrong feed forward design eliminates the troublesome temperature regulator and uses a differential pressure diaphragm valve to regulate flow and control temperature. The valve teams up with a shell and tube heat exchanger to complete the system.

The idea is simple: Overheat water in the heat exchanger and then blend it (as needed) with proportional amounts of cold water to achieve the correct outlet temperature for a wide range of flows. There's no storage tank or potential health hazard posed by standing water.

Gives you a jump on peak demand periods. The differential pressure diaphragm acts immediately upon a change of demand so there's no lag time. You get all the hot water you need - up to the unit's capacity - instantly. What's more, if the diaphragm fails, a spring returns the valve to a closed position (cold), so there's no danger of scalding by accident.

Makes maintenance a straight, easy shot. Virtually everything about the design and operation of the Flo-Rite-Temp reduces maintenance. (See below.) For starters, the tubes inside the carbon steel shell are straight for easy mechanical cleaning. And steam pressure in the heat exchanger is not modulated but constant, which assures condensate drainage and nixes potential water hammer and corrosion.

Pushes you out front in savings. When it comes to replacing a bulky storage tank system, the choice is clear. The Flo-Rite-Temp consumes dramatically less floor space, and you don't have to tear out walls to install it. In fact, it slips through a standard doorway. Payoff? Lower installed cost. Another advantage: An energy-efficient Armstrong Flo-Rite-Temp won't waste energy by constantly reheating stored water. You can even insulate the heat exchanger shell for greater savings.



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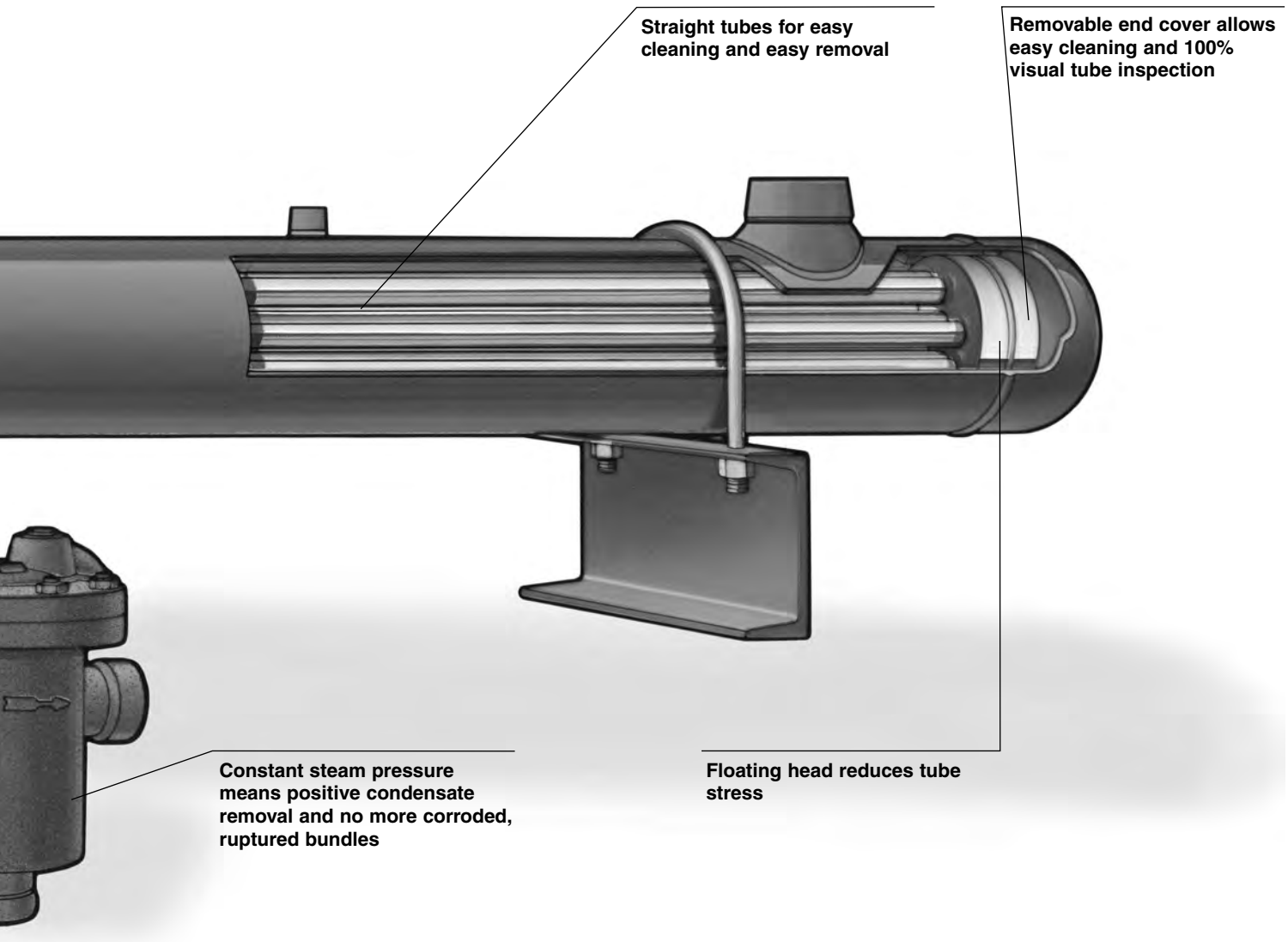
Heat it as you need it. Match your capacity needs with one of the four models of Armstrong's Flo-Rite-Temp instantaneous water heaters. For an application overview or tech assistance in selecting and installing, contact your Armstrong Representative today.

Table WH-293-1. How Flo-Rite-Temp Scores on Key Benefits

	Flo-Rite-Temp Feed Forward	Storage Tank Feedback	Tankless Instantaneous Feedback
Saves Space	Yes	No	Yes
Save Energy	Yes	No	Yes
Eliminates Temperature Swings	Yes	Yes	No
Eliminates Thermal Lag	Yes	Yes	No
Assures Accurate Control	Yes	Yes	No
Designed with Straight Tubes for Easy Cleaning	Yes	No	No
Eliminates Potential Health Hazard of Standing Water	Yes	No	Yes
Fails Cold for Safety	Yes	No	No
Eliminates Thermostatic Control	Yes	No	No



Control is based on Pressure Difference

The Controlling Valve Operating Principle

The controlling valve operates on a differential pressure principle. The cold water enters the valve body at line pressure (P1), which is sensed through the cored body passage on top of the valve diaphragm. The outlet pressure (P2) is sensed under the diaphragm and is transmitted to the bottom of the diaphragm through the hollow central main shaft that is ported to the outlet side of the valve.

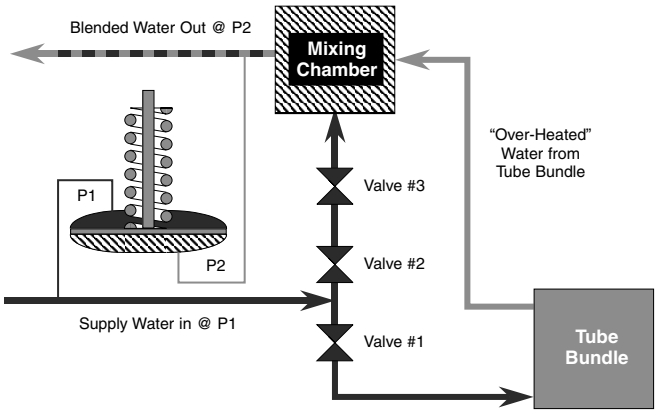
Essentially, there are three valves operating in unison. Valve 1 controls the flow of the water going through the heat exchanger. It has a spring return so that the valve stays closed in the event of a diaphragm failure. The valve begins to stroke at a pressure differential of 0,02 bar and is stroked completely open at 0,4 bar pressure differential.

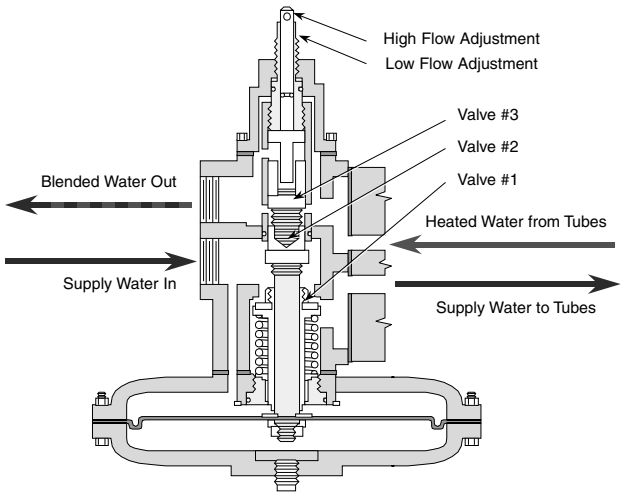
At low flow, Valve 2 controls the amount of bypassed cold water that passes from the inlet to the outlet mixing chamber, where it is mixed with the overheated water coming from the heat exchanger.

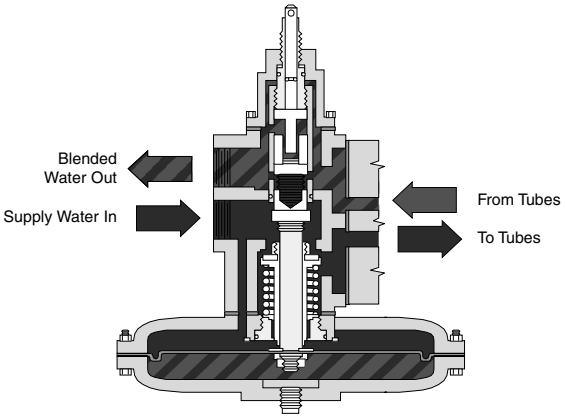
Valve 3 works in series with Valve 2, remaining wide open at lower demand and throttling proportionally at higher flows. When it comes into operation, it restricts the flow of cold water that mixes with overheated water coming from the heat exchanger. This takes into account the higher demand and flow rate through the heat exchanger and subsequently does not heat up as fast as a low-demand water flow. The water is not in the heat exchanger as long and therefore needs less cold water added to maintain a constant temperature.

Both Valves 2 and 3 have external adjustments. The adjustment for Valve 2 is set during low-load flow conditions and controls during the low flow ranges of the unit. Adjustment of Valve 3 is made during high flows and controls throughout the unit's high-flow ranges.

All three valves are integral to the same hollow shaft that is connected to the differential pressure diaphragm. When there is hot water demand, the diaphragm strokes proportionally based on the demand. When it strokes, due to a change in outlet pressure, all three valves stroke downward equally, positioning all three valves to perform their instantaneous mixing function without delay.







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Eliminates Legionella

The Legionella Disease

The Legionella disease officially appeared in 1976, when more than 200 people became sick, 20 of which died, from a mysterious disease at a fateful American Legion convention in Philadelphia. A year later, the cause of the disease was discovered - a bacteria that was called Legionella pneumophilia. Water is its primary medium for growth and the legionella organism is found naturally in streams, ponds, lakes and mud. Since then, much has been about the bacteria, how it grows, how it affects people, what are the likely symptoms and what precautions should be taken to prevent the disease.

The right conditions

First, the legionella organism must find its way into an ideal place to grow and amplify. Then the water harboring the bacteria is aerosolized into a mist, the legionella organisms – now airborne – can be transmitted into a susceptible host. The bacteria can be introduced into airstreams by showers, faucets, whirlpool baths, respiratory therapy equipment, decorative fountains and even misters sometimes used in the produce departments of grocery stores.

When the organisms are inhaled, they will likely migrate to the deepest part of the lungs where they will continue to multiply. It is also here where the infection will occur producing pneumonia-like symptoms.

The official number of Legionella cases in Europe is shown on the enclosed graph. However, the exact number of cases is unclear because the symptoms for legionellosis and pneumonia are similar. Furthermore, one known subgroup of the bacteria can cause Pontiac fever with flu-like symptoms.

Attack the amplifiers

The logical place to take control of the problem is to eliminate places where the bacteria will amplify or multiply rapidly. These harbors for bacterial growth are often referred to as amplifiers. It stands to reason then, remove the amplifiers and you minimize the bacterial growth.

We know that the bacteria require water, warm temperatures and a food source. While the bacteria will grow between 15°C and 50°C, the optimal temperature range for the growth of legionella is between 35°C and 45°C. The legionella bacteria cannot survive in water above 55°C and a sustained temperature in excess of 60°C is necessary to destroy the organism. With these parameters in mind, the number one man-made amplifying source for the bacteria is hot water storage tanks. Cooling towers and evaporative condensers have tended to receive more attention due to many publicized outbreaks, but large hot water storage tanks are at the top of the amplifier list.

Storage tanks must go

Water systems in hotels, hospitals, nursing homes and industrial plants have been linked to outbreaks of Legionnaire disease. Typically, steam is used to heat water for these large institutional buildings and then that heated water is stored in large bulky holding tanks. In these tanks, conditions are ideal for bacteria amplification. Often, the water temperature in storage tanks is maintained in the range of 43°C to 49°C, which is ideal for bacteria growth. To help maintain a uniform temperature and to minimize water temperature stratification in the tank, a recirculating pump is used. Furthermore, scale and other buildup materials in the large storage tanks and piping furnish the bacteria with a food source and provide protection from the high temperatures and/or chemical disinfection. In order to diminish the legionella disease, the bacteria amplifiers must be eliminated.

Feedback instantaneous hot water systems - Not hot enough to kill

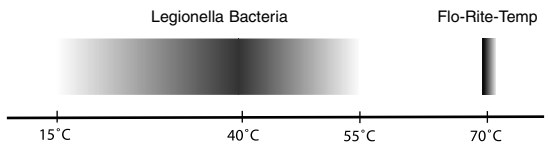
There is a hot water alternative to bacteria-amplifying storage tanks – the tankless instantaneous hot water system.

The classical feedback instantaneous hot water systems are reactive with respect to response time. That is to say, there is a slight delay between the time the system senses a need for more hot water and the time the system responds with more steam to heat the water. Because there is no storage tank with the feedback instantaneous system, the temperature-sensing bulb is inserted into the outlet water piping. The sensor transmits a temperature signal through a capillary tube to a temperature regulating valve that modulates the steam pressure entering the heat exchanger in order to control the outlet water temperature.

The water temperature of all feedback type systems does not get hot enough to eliminate the bacteria instantly. This must be done at a minimum temperature of 60°C or hotter. The outlet water temperature is usually within the range of where the bacteria will survive.

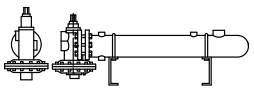
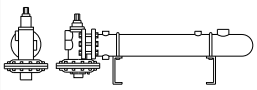
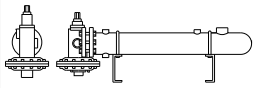
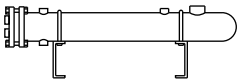
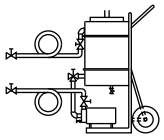
Armstrong Flo-Rite-Temp

Armstrong Flo-Rite-Temp is different. It essentially blends extremely hot water (>70°C) with cold water to deliver water in the required range. Furthermore, the storage tank amplifier has been eliminated with a feed-forward type system.



Water Heating and Mixing ID Charts

Table WH-296-1. Armstrong Water Heaters

Illustration	Type	Fluid	Connection Type	Maximum Allowable Pressure	TMA °C	Body Material	Model	Max. Oper. Pressure	Connection Size	Located on Page
	**Flo-Rite-Temp** Steam to Water Instantaneous Water Heater (Single-Walled Exchanger)	Steam and Water	NPT	Steam: 9 bar Water: 15 bar	149	Bronze (Valve) Carbon Steel Shell with Admiralty Brass Tube Bundle (Heat Exchanger)	**415**	8,5 bar	1" Water	WH-299
								1,0 bar	2" Steam	
			NPT	Steam: 4 bar Water: 15 bar			**535**	8,5 bar	1 1/2" Water	
								1,0 bar	2 1/2" Steam	
			NPT	Steam: 2 bar Water: 15 bar			**665**	8,5 bar	2" Water	
								1,0 bar	3" Steam	
			NPT (Water) ANSI 150 (Steam)	Steam: 10 bar Water: 15 bar			**8120**	8,5 bar	3" Water	
								1,0 bar	4" Steam	
	**Flo-Rite-Temp** Steam to Water Instantaneous Water Heater (Double-Walled Exchanger)	Steam and Water	NPT	Steam: 9 bar Water: 15 bar	149	Bronze (Valve) Carbon Steel Shell with Copper Tube Bundle (Heat Exchanger)	**415 DW**	8,5 bar	1" Water	WH-305
								1,0 bar	2" Steam	
			NPT	Steam: 4 bar Water: 15 bar			**535 DW**	8,5 bar	1 1/2" Water	
								1,0 bar	2 1/2" Steam	
			NPT	Steam: 2 bar Water: 15 bar			**665 DW**	8,5 bar	2" Water	
								1,0 bar	3" Steam	
			NPT (Water) ANSI 150 (Steam)	Steam: 10 bar Water: 15 bar			**8120 DW**	8,5 bar	3" Water	
								1,0 bar	4" Steam	
	**Flo-Rite-Temp** Steam to Water Instantaneous Water Heater (Single-Walled, All Stainless Steel Wetted Parts)	Steam and Water	NPT	Steam: 2 bar Water: 15 bar	149	316 Stainless Steel (Valve) Carbon Steel Shell with 316L Stainless Steel Tube Bundle (Heat Exchanger)	**665 SS**	8,5 bar	2" Water	WH-306
								1,0 bar	3" Steam	
			NPT (Water) ANSI 150 (Steam)	Steam: 10 bar Water: 15 bar			**8120 SS**	8,5 bar	2" Water	
								1,0 bar	4" Steam	
	**Flo-Rite-Temp** Shell and Tube Steam to Water Instantaneous Heat Exchanger	Steam and Water	NPT	Steam: 6,6 bar Water: 15 bar	191	Cast Iron (Stainless Optional) (Head) Carbon Steel Shell with Admiralty Brass Tube Bundle (Stainless Optional) (Heat Exchanger)	**442 ST**	15,5 bar	1 1/4" Water	WH-308
								6,6 bar	2" Steam	
			NPT	Steam: 3,3 bar Water: 15 bar			**552 ST**	15,5 bar	1 1/2" Water	
								3,3 bar	2 1/2" Steam	
			NPT	Steam: 1,9 bar Water: 15 bar			**662 ST**	15,5 bar	2" Water	
								1,9 bar	3" Steam	
			NPT (Water) ANSI 150 (Steam)	Steam: 1,1 bar Water: 15 bar			**862 ST**	15,5 bar	3" Water	
								1,1 bar	4" Steam	
	**Clean-In-Place** Scale Removal System	Rite-Qwik Scale Solvent	NPT	Atmospheric	60	Teflon Coated Cast Iron (Pump) Polypropylene (Tank) PVC (Pipe & Hose)	**CIP**	Atmo-spheric	1"	WH-311

All steam equipment comply with the Pressure Equipment Directive PED 97/23/EC. For details, see specific product page or Armstrong PED Certificate.

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Table WH-297-1. Armstrong Water Heaters

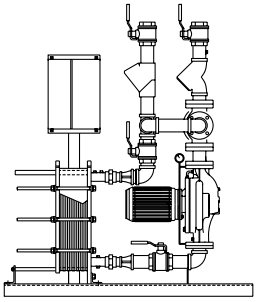
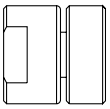
Illustration	Type	Fluid	Connection Type	Maximum Allowable Pressure	TMA °C	Body Material	Model	Max. Oper. Pressure	Connection Size	Located on Page
	**Flo-H_2O™** Water to Water Instantaneous Water Heater (Single-Walled Plate and Frame Exchanger)	Boiler Water and Domestic Water	For more information consult Armstrong International or you local representative							WH-313
	Flo-H_2O™ Water to Water Instantaneous Water Heater (Double-Walled Plate and Frame Exchanger)	Boiler Water and Domestic Water	For more information consult Armstrong International or you local representative							WH-313
	**MS-6 Noiseless Heater**	Steam	NPT	7 bar	90	304 Stainless	**MS-6**	7 bar	1/2", 3/4", 1", 1-1/4", 1-1/2", 2"	WH-314

Table WH-297-2. Flo-Direct

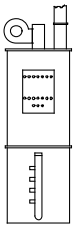
Illustration	Type	Fluid	Conn. Type		Body Material	Model	Gas Conn.	Water Conn.	Located on Page
			Gas	Water					
	**Flo-Direct** Direct Fire Water Heater	Natural Gas and Water	NPT	NPT	Stainless Steel	1000	1"	1"	WH-315
						1500	1"	1"	
						3000	1-1/2"	1-1/2"	
						5000	2"	2-1/2"	
						7000	2"	3"	
						9000	2-1/2"	3"	
				ANSI 150# Flanged		11000	3"	4"	
						15000	3"	4"	
						18000	3"	4"	
			Buttweld			25000	4"	6"	

Table WH-297-4. Balancing Valves

Illustration	Type	Body Pattern	Conn. Type	Max. Allow. Press. Bar	TMA C°	Body Material	Model	Max. Oper. Press. bar	Connection Size						Located on Page
									1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	
	**ABV-VS** Balancing Valve	Straight	Sweat	17	121	Bronze	ABV-VS	17	●	●	●	●	●	●	WH-318
	ABV-VT Balancing Valve	Straight	Threaded	17	121	Bronze	ABV-VT	17	●	●	●	●	●	●	

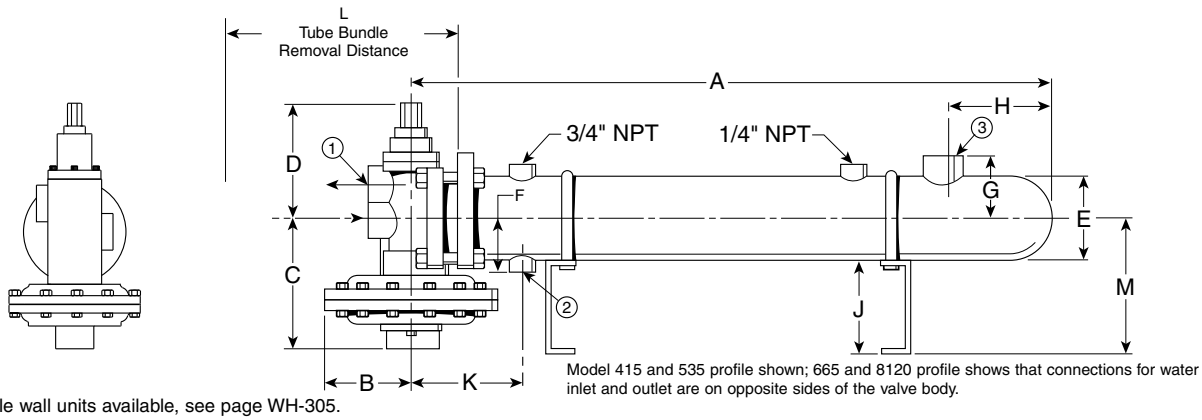
Table WH-297-4. Balancing Valves

Illustration	Type	Body Pattern	Conn. Type	Max. Allow. Press. Bar	TMA C°	Body Material	Model	Max. Oper. Press. bar	Connection Size								Located on Page
									2-1/2"	3"	4"	5"	6"	8"	10"	12"	
	**ABV-G** Balancing Valve	Straight	Grooved	26	110	Ductile Iron	ABV-G	26	●	●	●	●	●	●	●	●	WH-318
			AINSI 125	17				17	●	●	●	●	●	●	●	●	
			AINSI 250	26				26	●	●	●	●	●	●	●	●	
	ABV-A Balancing Valve	Angle	Grooved	26	110	Ductile Iron	ABV-A	26	●	●	●	●	●	●	●	●	
			AINSI 125	17				17	●	●	●	●	●	●	●	●	
			AINSI 250	26				26	●	●	●	●	●	●	●	●	

All steam equipment above comply with the Pressure Equipment Directive PED 97/23/EC. For details, see specific product page or Armstrong PED Certificate.

Notes

Model 665 and 8120 Valve



Model 415 and 535 profile shown; 665 and 8120 profile shows that connections for water inlet and outlet are on opposite sides of the valve body.

Note: Double wall units available, see page WH-305.

Table WH-299-1. Dimensions

Model	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	K mm	L mm	M mm
415	1 372	114	190	178	114	89	89	178	127	159	1 270	190
535	1 715	133	219	229	141	102	114	200	152	191	1 575	229
665	2 083	146	264	264	168	121	140	235	190	222	1 880	280
8120	2 159	146	299	305	219	156	225	241	203	241	1 880	314

Shade indicates products that are CE Marked according to the PED (97/23/EC). All the other models comply with the Article 3.3 of the same directive.

Table WH-299-2. Connections and Weights

Model	Connections			Weights Kg
	1	2	3	
415	1" NPT	3/4" NPT	2" NPT	60
535	1 1/2" NPT	1" NPT	2 1/2" NPT	107
665	2" NPT*	1 1/4" NPT	3" NPT	162
8120	3" NPT*	2" NPT	4" 150#ANSI	265

Table WH-299-3. Specifications

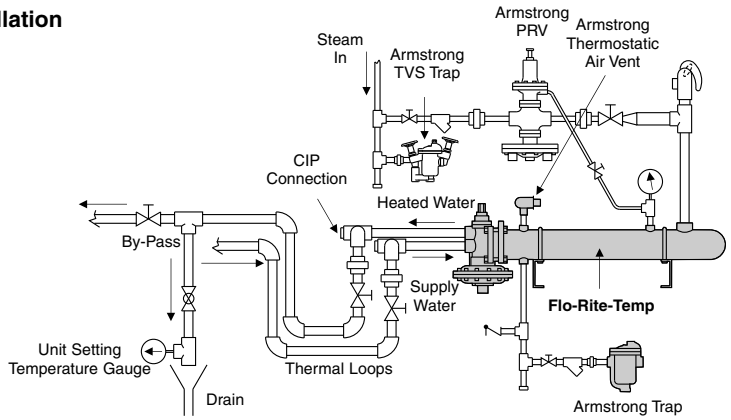
Application	Steam Supply Pressure	Water Supply Pressure	Maximum Water Pressure Drop
Steam to Water	0,14 - 1 bar	1,4 - 8,5 bar	0,7 bar

* 665 and 8120 connections for water inlet and outlet are on opposite sides of the valve body

Table WH-299-4. Materials

Body	Valve	Valve Seats	Diaphragm	Heat Exchanger Shell	Heat Exchanger Tubes	Tube Sheets	Tube Bundle End Cap
Bronze	**415** 303 Stainless Steel w/Teflon Inserts	**415/535** 303 Stainless Steel	Viton® GF Reinforced w/Nomex® Fiber	Carbon Steel ASME "U" Stamped	5/8" 16 BWG Admiralty Brass	Brass	Brass
	535/665/8120 Brass	**665/8120** Brass					

Heater Installation



Notes: Flo-Rite-Temp is provided with one Armstrong Steam Trap and Thermostatic Air Vent (shaded). All other items shown not included. Removable/reusable insulation covers for the heat exchangers are available. Contact Armstrong or your local representative for more information.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Selecting the Proper Flo-Rite-Temp™ Model

Table WH-300-1. Water and Steam Capacities (Note: Capacities for Single-Wall and Double Wall Units are identical)

Inlet Temperature °C	Set Temperature °C	Hot Water Capacities* Steam Pressure (barg)				Steam Capacities Steam Pressure (barg)				Model
		0,14	0,35	0,7	1	0,14	0,35	0,7	1	
		m^3/h				kg/h				
4	49	3,8	4,1	4,5	4,5	323	347	379	407	**415**
		8,4	9,1	9,8	10,2	697	749	820	880	**535**
		15,7	16,8	18,2	18,2	1 290	1 386	1 517	1 628	**665**
		32,2	32,9	32,9	32,9	2 576	2 794	3 066	3 248	**8120**
	54	3,4	3,6	3,8	4,1	308	332	365	392	**415**
		7,3	7,7	8,4	8,8	665	717	788	848	**535**
		13,2	14,3	15,4	16,6	1 230	1 327	1 458	1 569	**665**
		25,4	27,7	30,9	32,9	2 286	2 490	2 776	3 041	**8120**
	60	2,7	3,0	3,4	3,6	292	316	349	377	**415**
		6,1	6,6	7,3	7,7	631	684	755	815	**535**
		11,3	12,2	13,3	14,3	1 168	1 265	1 397	1 509	**665**
		20,0	22,0	24,7	27,2	1 996	2 200	2 472	2 722	**8120**
	71	2,0	2,3	2,5	2,7	259	283	317	346	**415**
		4,5	5,0	5,5	5,9	558	612	686	747	**535**
		8,4	9,1	10,2	10,9	1 033	1 134	1 268	1 382	**665**
		15,6	18,8	20,2	21,6	1 878	2 259	2 422	2 585	**8120**
	82	1,1	1,1	1,4	1,6	156	175	200	221	**415**
		2,7	3,0	3,4	3,6	390	438	501	553	**535**
		5,2	5,9	6,6	7,3	754	846	968	1 068	**665**
		9,7	10,7	11,8	13,4	1 365	1 492	1 651	1 873	**8120**
10	49	4,3	4,5	4,5	4,5	313	337	369	396	**415**
		9,3	10,0	10,0	10,2	676	727	797	857	**535**
		17,3	18,2	18,2	18,2	1 251	1 346	1 475	1 586	**665**
		32,2	32,2	32,2	32,2	2 603	2 762	2 985	3 191	**8120**
	54	3,6	3,8	4,3	4,5	298	322	355	382	**415**
		7,7	8,4	9,1	9,8	644	696	766	826	**535**
		14,5	15,4	17,0	18,2	1 192	1 287	1 418	1 528	**665**
		28,8	31,3	32,2	32,2	2 304	2 504	2 776	3 066	**8120**
	60	2,9	3,2	3,6	3,8	283	307	340	367	**415**
		6,6	7,0	7,7	8,4	611	663	734	794	**535**
		12,2	13,2	14,5	15,4	1 131	1 227	1 358	1 474	**665**
		22,5	24,5	27,5	30,4	2 021	2 204	2 470	2 735	**8120**
	71	2,3	2,5	2,7	3,0	250	275	308	336	**415**
		4,7	5,2	5,7	6,4	540	593	665	726	**535**
		8,9	9,5	10,7	11,6	999	1 098	1 232	1 344	**665**
		17,2	20,4	21,6	23,1	1 896	2 245	2 370	2 545	**8120**
	82	1,1	1,4	1,4	1,6	151	169	194	214	**415**
		2,7	3,2	3,6	3,9	377	424	486	537	**535**
		5,4	6,1	6,8	7,5	728	819	938	1 037	**665**
		11,1	12,5	14,3	16,3	1 445	1 622	1 857	2 123	**8120**
16	54	4,1	4,3	4,5	4,5	288	312	344	372	**415**
		8,7	9,3	10,2	10,2	623	674	744	803	**535**
		15,9	17,3	18,2	18,2	1 152	1 247	1 377	1 486	**665**
		32,2	32,2	32,2	32,2	2 318	2 524	2 762	2 953	**8120**
	60	3,4	3,6	3,8	4,3	273	297	330	357	**415**
		7,3	7,7	8,6	9,1	591	642	712	772	**535**
		13,2	14,3	15,7	17,0	1 093	1 188	1 318	1 428	**665**
		25,2	27,9	31,1	32,2	2 014	2 232	2 486	2 758	**8120**
	71	2,3	2,5	2,9	3,2	241	266	299	327	**415**
		5,0	5,5	6,1	6,8	521	574	645	706	**535**
		9,3	10,2	11,3	12,5	964	1 062	1 194	1 306	**665**
		19,3	22,5	23,6	26,1	1 928	2245	2 359	2 758	**8120**
	82	1,1	1,4	1,6	1,6	145	163	188	208	**415**
		3,0	3,2	3,6	4,1	363	409	470	522	**535**
		5,7	6,4	6,4	7,9	701	791	909	1 007	**665**
		13,4	15,2	18,1	20,4	1 606	1 823	2 177	2 449	**8120**

* Units may be piped in parallel when desired capacities exceed that of a single unit.

Notes: Minimum water temperature increase is 33°C. Consult factory if less than 33°C increase is required or a set temperature of below 49°C is required. See pages PTC-267 and PTC-272 for proper pressure reducing valve selection.

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Flo-Rite-Temp™ Instantaneous Water Heater Sizing Instructions

Chart WH-301-1

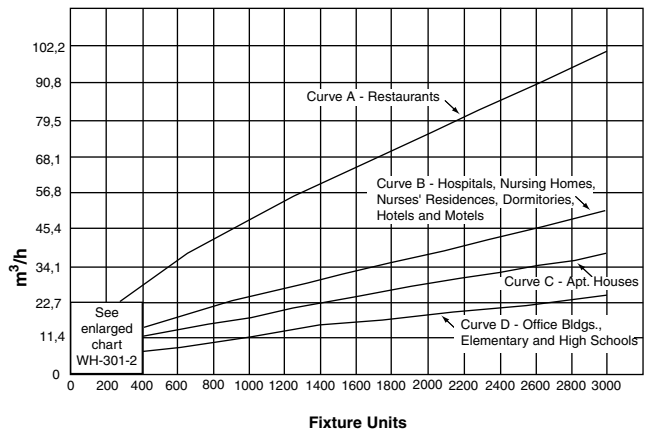
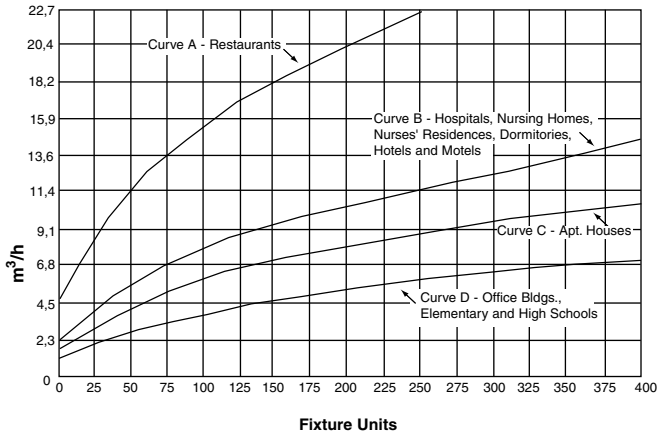


Chart WH-301-2. Enlarged Section



Reprinted from the 1987 ASHRAE Handbook – HVAC with permission from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Hunter curves should be used for intermittent, insignificant fixtures only.

Step 1
Determine the total fixture unit load for all the fixtures serviced by your water heater application using the Fixture Units Table on page WH-302. See example below.

Step 2
Using the total fixture units for your application, enter the Hunter Curves (Chart WH-301-1) from the bottom on the total fixture units line for your application. Read up to the curve that best fits the application. Then read to the left for the corresponding m³/h requirement.

Step 3
Select the proper Armstrong Flo-Rite-Temp Instantaneous Water Heater from Pages WH-300 through WH-307.

Table WH-301-1. Example: College Dormitory

No. Fixtures	Type of Fixture	Fix. unit	Demand Fix. Unit
150	Private Lavatory	0,75	113
120	Private Shower	1,5	180
20	Slop Basin	2,5	50
8	Clothes Washer	2,0	16
Total Fixture Units			**359**

Refer to the modified Hunter Curves in Chart WH-301-2. Curve B represents dormitories. Enter the graph from the bottom at 359 fixture units and go up to curve B. Then move to the left horizontally to read approximately 13,6 m³/h of hot water capacity required.
Note: Remember to add any constant flow capacities, as determined under "Important Note" below, to this 13,6 m³/h.

Important Note
Special consideration should be given to applications involving periodic use of gang showers, process equipment, laundry machines, etc., as may occur in field houses, gymnasiums, factories, hospitals, etc. Because these applications could have all equipment on at the same time, their total hot water capacity should be determined and then added to the maximum hot water demand as read from the modified Hunter Curves. Use the following formula to determine total hot water capacity needed for these applications when final water temperatures are lower than that of the water heater.

$$\frac{(B - C)}{(H - C)} \times \left(\begin{array}{c} \text{Total water flow from all} \\ \text{gang shower heads in m³/h} \end{array} \right) = \text{Hot water needed (m³/h)}$$

Where:
B = Blended water temperature out of the fixture
H = Hot water temperature to the fixture
C = Cold water temperature to the fixture

Flo-Rite-Temp™ Instantaneous Water Heater Sizing Instructions

Table WH-302-1. Fixture Units Table - 60°C Temperature From Heater

Hospital	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
Semi-Private Lavatory	1,2
†Private Shower	1,5
†Ward Shower	2,5
†Semi-Private Shower	1,5
Private Bath	1,5
Ward Bath	2,0
Sink - Flushing Rim	2,0
Sink - Scrub-Up	1,5
Sink - Laboratory	1,5
Sink - General Purpose	1,0
Bath - Leg	6,0
Bath - Arm	4,0
Bath - Sitz	3,0
Bath - Foot	3,0
Bath - Emergency	2,0
Hydrotherapeutic Showers	
#1 Shower Head	8,0
#2 Spray	12,0
Continuous Flow Bath	
Continuous Flow Fill	2,0
Continuous Flow Operate	1,5
Hubbard	4,0
Autopsy Table	2,0
Autopsy Sink and Table	2,5

Club	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Public Shower	1,7
†Tub and Shower	1,5
Sink - Slop	2.5
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5
1 350 mm Half Bradley	1,5
1 250 mm Full Bradley	2,0

Gymnasium	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
Private Shower	1,5
Public Shower	3,0
Sink - Slop	1,5
Basin - Foot	1,2
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5
1 350 mm Half Bradley	1,5
1 350 mm Full Bradley	2,0

Association Buildings	
Type of Fixture	**FIx. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Tub and Shower	1,7
Sink - Slop	2,5
Janitor Drop	2,0

Restaurant**	
Type of Fixture	**Fix. Units**
Private Lavatory	0,70
Public Lavatory	2,0
†Private Shower	1,5
†Public Shower	1,7
Sink - Kitchen	3,0
Sink - Pantry	2,5
Sink - Slop	2,0
Sink - Pot (Single)	2,5
Sink - Pot (Double)	3,5
Sink - Pot (Triple)	5,5
Sink - Vegetable	2,0
Sink - Bar	2,5
Washer - Silver	2,0*
Washer - Glass	2,0*
Washer - Can	3,0
Coffee Urn	1,2
Bain Marie	1,0
Pot and Pan Washer	2,0*
Dish Pre-Rinse	2,5
Pre-Scraper	2,0
Pre-Scraper Conveyor	2,5
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5

*Dishwashers (use booster to heat tram 60° to 82°C)	
Type of Fixture	**Fix. Units**
Single Tank - Stationary Rack	
16 x 16 Rack	2,5
18 x 18 Rack	3,9
20 x 20 Rack	4,2
Multiple Tank Conveyor Type	
Dishes - Inclined	2,0
Dishes - Flat	2,5
Single Tank Conveyor Type	2,3

Hotel - Motel	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Tub and Shower	1,5
Basin - Barber	2,0
Sink - Slop	2,5
Basin - Beauty Parlor	2,5

Office Building	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
Private Shower	1,5
Sink - Slop	2,5
Janitor Drop	2,5
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5

Factory	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Public Shower	3,0
Sink - Slop	2,5
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5
1 350 mm Half Bradley	1,5
1 350 mm Full Bradley	2,0

Correctional or Mental Institutions	
Type of Fixture	**Fix. Units**
Private Lavatory	0,70
Public Lavatory	1,0
†Private Shower	1,5
†Public Shower	3,0
†Tub and Shower	1,5
Sink - Slop	2,0
Janitor Drop	2,0
900 mm Half Bradley	1,0
900 mm Full Bradley	1,5
1 350 mm Half Bradley	1,5
1 350 mm Full Bradley	2,0

Apartment	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Public Shower	1,5
†Tub and Shower	1,5
Sink - Kitchen	0,75
Sink - Slop	1,5
Sink - Pantry	1,5
Domestic Clothes Washer	1,2
Domestic Dishwasher	1,5
Laundry Tray	1,5

Private - Public School	
Type of Fixture	**Fix. Units**
Private Lavatory	0,75
Public Lavatory	1,0
†Private Shower	1,5
†Tub and Shower	1,7
Sink - Slop	2,5
Janitor Drop	1,5
Domestic Clothes Washer	2,0
Domestic Dishwasher	2,0

Institution - Home	
Type of Fixture	**Fix. Units**
Private Lavatory	0,70
Public Lavatory	1,0
†Private Shower	1,5
†Tub and Shower	1,5
Sink - Slop	2,0
Janitor Drop	2,0

* These items require 82°C hot water. The consumption figures are based on supplying 60°C water with a booster heater used to obtain 82°C water.

** Add 20% to all figures when not used in combination with other building services from same heater.

† The fixture units listed for shower heads are based on a flow rate of 0,68 m³/h. These units should be corrected for other flow rates. Multiply the fixture units by Correction Factor "C" from the formula: C = G : 0,68 where C = Correction Factor and G = flow in m³/h of shower head being used. Example: Shower head 1 m³/h = C = 1 : 0,68 or 1,47. From Fixture Units Table, Hotel-Motel (shower) which shows 1,5 fixture units, multiply 1,5 x 1,47 = 2,21 fixture units per shower head using 1 m³/h.

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Flo-Rite-Temp™ Packaged Instantaneous Water Heater

As costs climb and manpower availability decreases, simple equipment installation is more important than ever. And with preassembled instantaneous water heater packages from Armstrong, installation has never been easier.

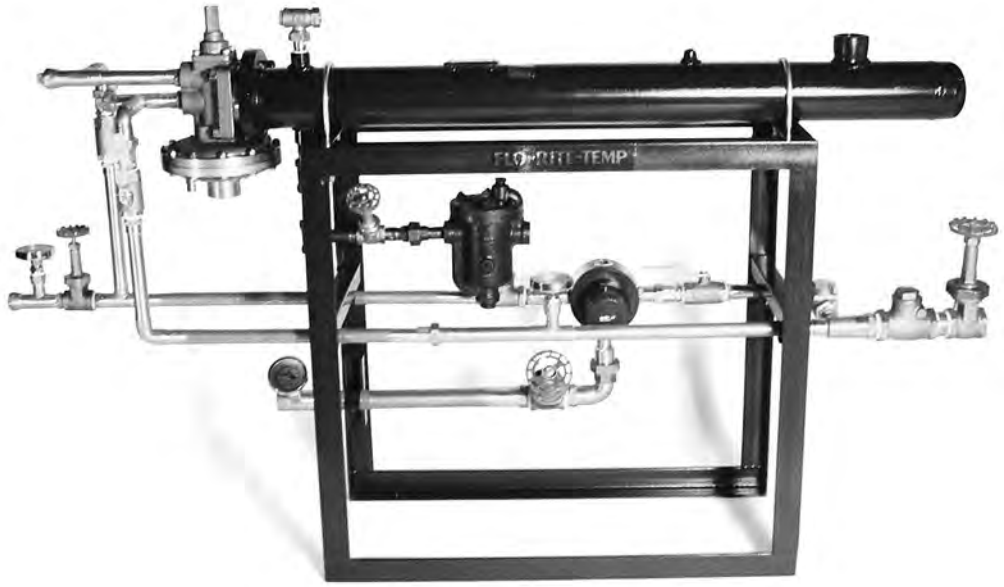
Armstrong Flo-Rite-Temp Packaged Water Heaters eliminate all the guesswork and preparation time involved in installation. Make four connections, and you're ready to produce up to 96,6 m^3/h of hot water. Instantly, easily and accurately.

Just add water. That may be oversimplifying things a bit. But not much. All single and parallel units fit through a standard doorway. So you don't have to rebuild your facility before you retrofit your equipment. Steam, cold water, hot water and condensate are the only four connections to make. Our packaged units install quickly and easily because Armstrong experts have planned, designed, manufactured and assembled the packages to eliminate trial-and-error guesswork.

Performance on demand. The Flo-Rite-Temp's feed-forward control provides accurate temperature control on demand. You can also get twice the capacity with no increase in floor space, thanks to optional parallel/redundant systems. For you, that means the peace of mind of complete capacity backup.

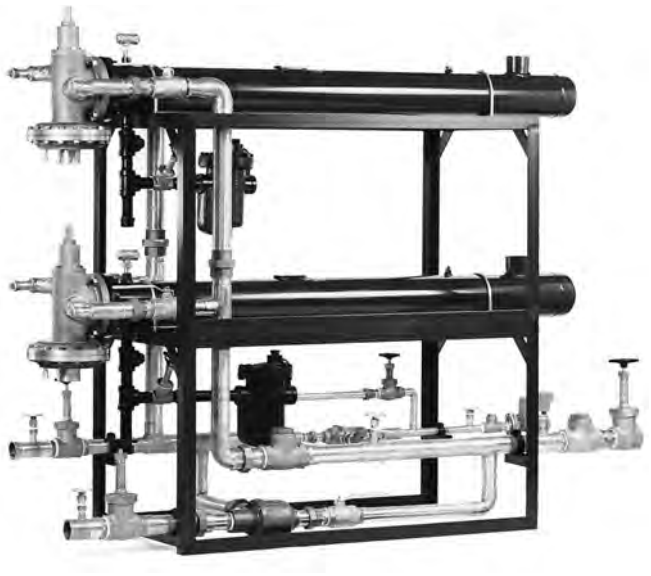
Flo-Rite-Temp is ideal for a wide variety of applications, including domestic hot water, wash downs, safety showers, closed loop heating and process hot water.

*Includes three Model 8120 units on a single frame.



Flo-Rite-Temp™ Model 665 Parallel

A parallel system offers complete capacity backup - twice the capacity without increasing the floor space requirement.



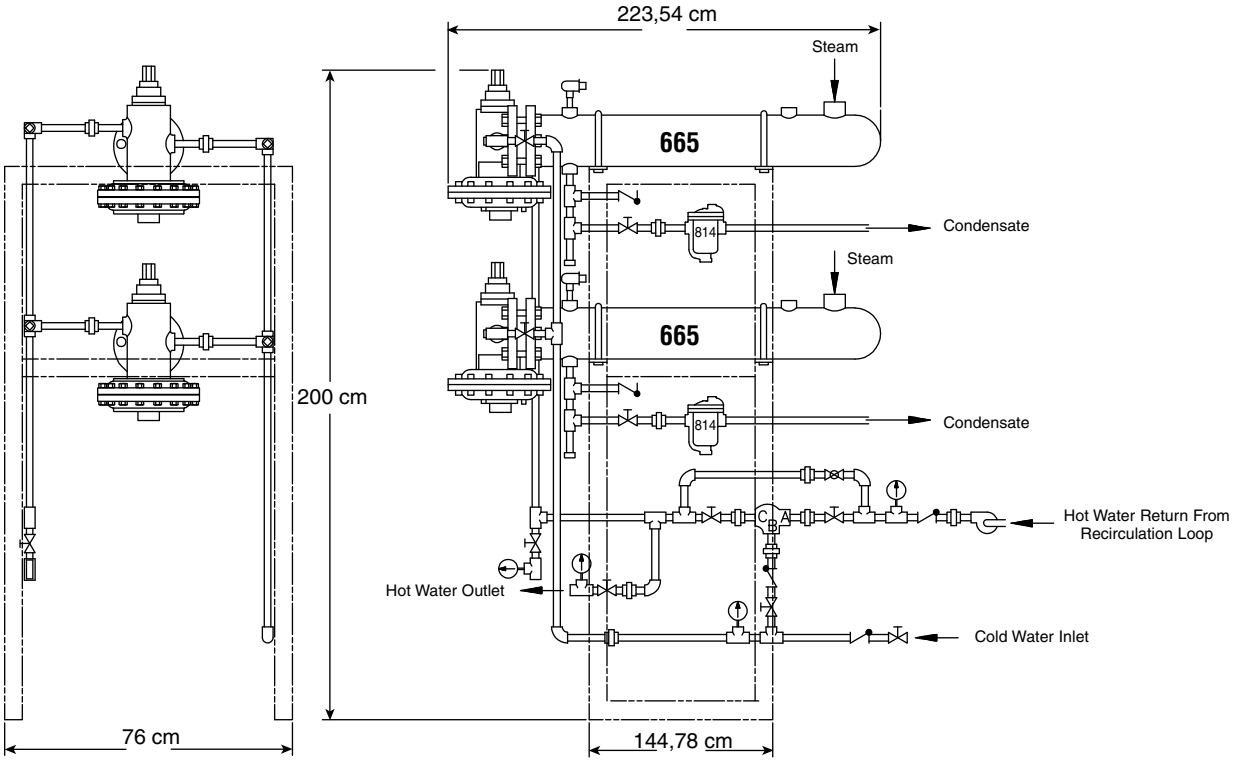
Flo-Rite-Temp Standard Package

- Flo-Rite-Temp
- Steam trap
- Air vent
- Thermometers
- Water side piping, valves and fittings
- Mounting frame
- Clean-in-place isolation valves and connections
- Two-year warranty

Flo-Rite-Temp Optional Equipment

- Recirculation pump
- Recirculation package
- Pressure reducing station
- Pressure powered condensate pump
- Self diagnostic steam trap(s)
- Safety shutdown systems

Model 665 Flo-Rite-Temp Parallel With Recirculation



Dimensions will vary by package model; however, all Model 665 parallel packages will fit through a standard 800 mm doorway, and the Model 8120 parallel packaged units will fit through a standard 900 mm doorway.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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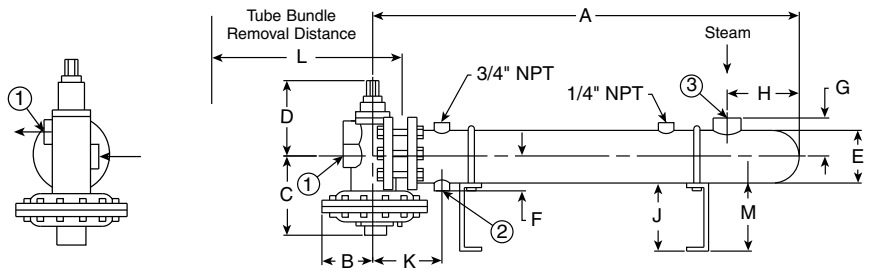
Flo-Rite-Temp™ Double Wall Instantaneous Water Heater

Model 665DW and 8120DW Valve **Model 415DW and 535DW Profile**



Model 415DW and 535DW profile shown. 665DW and 8120DW profile would show that connections for water inlet and outlet are on opposite sides of the valve body.
Note: For capacities, see Capacities and Steam Loads table on page WH-300.

The DW (double wall) version of the Armstrong Flo-Rite-Temp instantaneous water heater uses a double-walled tube to provide positive separation of the steam and water in the heat exchanger. The area between the walls of the tubes vents to atmosphere so you can detect tube failure without cross-contaminating either the steam or water. The Flo-Rite-Temp DW is well suited for all hot water applications where steam is available and plumbing codes or safety requirements prevent the heating medium and the potable water supply from being cross-contaminated.

Installs quickly and easily. The Flo-Rite-Temp DW fits through a standard doorway and requires no external power source.

Requiring only 0,63 m³ of floor area, the unit mounts easily on the floor or wall or hangs from the ceiling.

Performs dependably. Simple reliability is the heart of the Flo-Rite-Temp. Its controlling valves encounter only cold water, so hot water scaling doesn't foul valve operation. The control valve is also mounted integral to the heat exchanger to eliminate intermediate piping leaks and minimize maintenance.

Constant - not modulating - steam pressure on the heat exchanger assures condensate removal. So there's no subcooled condensate to water hammer or corrode the heat exchanger tubes. Another advantage: You can easily remove the tube bundle horizontally, which requires no vertical clearance.

Table WH-305-1. Specifications

Application	Steam Supply Pressure	Water Supply Pressure	Maximum Water Pressure Drop
Steam to Water	0,14 - 1 bar	1,4 - 8,5 bar	0,7 bar

Table WH-305-2. Connections and Weights

Model	Connections			"L" Tube Bundle Removal	Weight (kg)
	1	2	3		
415 DW	1" NPT	1 1/4" NPT	2 1/2" NPT	1 930	96
535 DW	1 1/2" NPT	1" NPT	2 1/2" NPT	1 651	152
665 DW	2" NPT*	1" NPT	3" NPT	2 260	216
8120 DW	3" NPT*	1 1/4" NPT	4" 150 RF	1 930	322

Shade indicates products that are CE Marked according to the PED (97/23/EC). All the other models comply with the Article 3.3 of the same directive.
* 665 and 8120 connections for water inlet and outlet are on opposite sides of the valve body.

Table WH-305-3. Materials

Body	Valve	Valve Seats	Diaphragm	Heat Exchanger Shell	Heat Exchanger Tubes	Tubes Sheets*
Bronze	**415 DW** 303 Stainless Steel w/Teflon Inserts	**415 DW/535 DW** 303 Stainless Steel	Viton® GF Reinforced w/Nomex® GF	Carbon Steel ASTM SA-53B	5/8" Copper Inner Tube 3/4" ID Grooved Copper Outer Tube	Steam Side:Steel Water Side: Brass
	535 DW/665 DW/8120 DW Brass	**665 DW/8120 DW** Brass				

* There is an open vent to atmosphere between the tube sheets to detect tube failure.

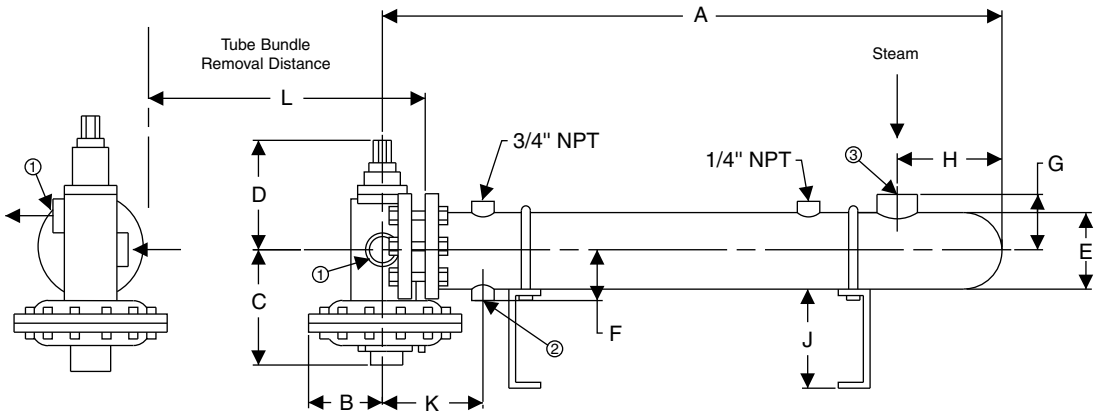
Table WH-305-4. Dimensions

Model	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm
415 DW	2 032	114	190	178	114	95	89	127	286
535 DW	1 797	133	219	229	168	121	111	146	356
665 DW	2 451	146	264	264	168	127	111	146	394
8120 DW	2 159	146	299	305	219	222	146	146	464

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Flo-Rite-Temp™ SS
316 Stainless Steel Steam Instantaneous Water Heater

Model 665 SS and 8120 SS Valve



The Flo-Rite-Temp SS is a compact, steam to water, instantaneous water heater with all wetted metal parts of type 316 stainless steel. Because of its construction materials, this heater is well-suited for heating most corrosive liquids, such as demineralized, deionized or reverse osmosis water commonly used by manufacturers of electronic equipment, pharmaceuticals and food.

Features

- Feed forward control provides accurate temperature control on demand even when demand fluctuates abruptly.
- Feed forward operation assures that the heater will fail safely in the closed (cold) position to prevent overheating.
- Straight, non-U-bend tube bundle with removable end cover provides for easy tube cleaning along with the capability to visually inspect all tubes.
- Constant steam pressure on heat exchanger at all times means positive condensate evacuation, avoiding damage to the exchanger due to water hammer.
- Heavy duty 5/8" tubes of 16 gauge 316L stainless steel ensure long life and maintainability backed up by a 10-year tube bundle warranty against workmanship and material defects.
- Control valve is mounted integral to the heat exchanger, thus eliminating intermediate piping leaks.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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Flo-Rite-Temp™ SS
316 Stainless Steel Steam Instantaneous Water Heater

Table WH-307-1. Specifications

Application	Steam Supply Pressure	Water Supply pressure	Maximum Water Pressure Drop
Steam to Water	0,14 - 1 bar	1,4 - 8,5 bar	0,7 bar

Table WH-307-2. Materials

Body	Valve	Seats	Diaphragm	Heat Exchanger Shell	Heat Exchanger Tubes	Heat Exchanger tube Sheets
T-316 Stainless Steel			Viton® GF Reinforced with Nomex® Fiber	Carbon Steel (Standard) T-316 Stainless Steel (Optional)	T-316 Stainless Steel	T-316 Stainless Steel

Table WH-307-3. Dimensions and Weights

Model	Dimensions (mm)											Connections			Weight (kg)
	A	B	C	D	E	F	G	H	J	K	L	1	2	3	
665 SS	2 102	146	264	264	168	121	140	235	191	222	1 880	2" NPT	1 1/4" NPT	3" NPT	152
8120 SS	2 286	146	264	264	219	156	225	241	203	368	1 880	2" NPT	2" NPT	4" 150 RF	298

Shade indicates products that are CE Marked according to the PED (97/23/EC). All the other models comply with the Article 3.3 of the same directive.

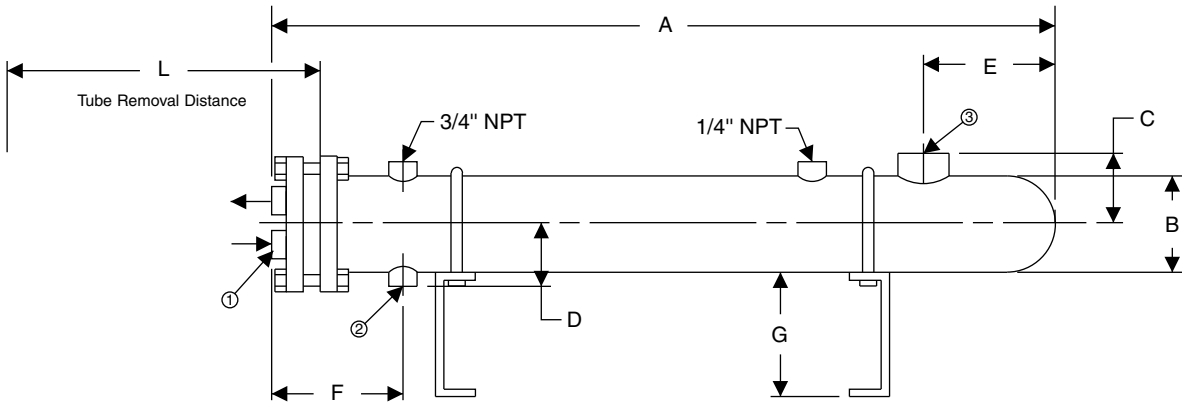
Table WH-307-4. Capacities and Steam Loads

Water Temperature		Hot Water Capacities* Steam Pressure (barg)				Steam Capacities Steam Pressure (barg)				Model
		0,14	0,35	0,7	1,0	0,14	0,35	0,7	1,0	
Inlet °C	Outlet °C	m^3/h				kg/h				
4	49	9,3	10,0	10,7	11,6	769	826	904	970	665 SS
		19,1	20,2	22,0	23,4	1 520	1 687	1 860	1 981	8120 SS
	54	7,9	8,4	9,3	9,8	733	791	869	935	665 SS
		15,0	16,4	18,2	19,5	1 349	1 469	1 638	1 794	8120 SS
	60	6,8	7,3	7,9	8,4	696	754	833	899	665 SS
		11,8	12,9	14,5	16,1	1 178	1 298	1 459	1 606	8120 SS
	71	3,9	4,1	4,3	4,8	459	503	563	614	665 SS
		10,0	10,9	12,0	12,9	1 237	1 356	1 518	1 654	8120 SS
	82	2,7	3,0	3,4	3,9	390	437	500	552	665 SS
		7,3	7,9	9,1	10,0	1 051	1 178	1 348	1 488	8120 SS
10	49	10,2	10,9	12,0	12,7	745	802	879	945	665 SS
		20,7	22,0	23,8	25,7	1 497	1 610	1 765	1 897	8120 SS
	54	8,6	9,3	10,0	10,7	710	767	845	910	665 SS
		17,0	18,4	20,2	21,6	1 359	1 447	1 696	1 828	8120 SS
	60	7,3	7,7	8,6	9,3	674	731	809	875	665 SS
		13,2	14,5	16,1	17,9	1 192	1 300	1 457	1 614	8120 SS
	71	3,9	4,3	4,8	5,2	444	488	547	597	665 SS
		10,4	11,6	12,7	13,9	1 195	1 314	1 474	1 608	8120 SS
	82	2,7	3,2	3,6	4,1	376	423	485	537	665 SS
		7,5	8,4	9,5	10,7	1 014	1 140	1 307	1 446	8120 SS
16	49	11,6	12,5	13,6	14,5	721	777	854	919	665 SS
		16,1	23,6	27,7	29,5	1 473	1 588	1 745	1 877	8120 SS
	54	9,5	10,2	11,1	12,0	687	743	820	885	665 SS
		19,5	20,9	22,7	24,5	1 403	1 518	1 676	1 809	8120 SS
	60	7,9	8,4	9,3	10,0	651	708	786	851	665 SS
		15,0	16,6	18,4	19,8	1 188	1 317	1 466	1 680	8120 SS
	71	4,1	4,5	5,0	5,5	428	472	531	580	665 SS
		11,1	12,3	13,6	14,8	1 154	1 271	1 429	1 563	8120 SS
	82	3,0	3,2	3,9	4,3	362	409	469	521	665 SS
		7,9	8,9	10,0	11,1	976	1 101	1 266	1 403	8120 SS

* Units may be piped in parallel when desired capacities exceed that of a single unit.
Notes: Minimum water temperature increase is 33°C. Consult factory if less than 33°C increase is required or a set temperature of below 49°C is required.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Armstrong Flo-Rite-Temp™ ST
Shell and Tube Steam Heat Exchanger



The Flo-Rite-Temp is a compact heavy duty industrial steam shell and tube type instantaneous heat exchanger. Its heavy duty construction and easy-to-clean tube bundle make it ideal for those difficult applications where minimum downtime is a concern.

Features

- Straight tube bundle with a free floating end designed for easy bundle removal.
- A non U-bend tube bundle design with a removable end cover allows for easy and assured tube cleaning when required.
- Heavy duty 5/8" tubes of 16 gauge admiralty brass assure long life and maintainability - 10 year tube bundle warranty against workmanship or material defects.
- The removable tube bundle end cover allows for 100% visual inspection of all tubes both inside and out.

To select the correct size shell and tube heat exchanger, the following data must be known:

1. Water flow (m³/h in tubes)
2. Inlet water temperature (°C in tubes)
3. Outlet water temperature (°C in tubes)
4. Steam pressure available at exchanger (barg in shell)

Step No. 1
From the table WH-310-1 on page WH-310, determine the clean tube temperature value by using inlet water temperature and outlet water temperature along with the available saturated steam pressure bar(a) at the exchanger. Where necessary interpolate.

Step No. 2
The clean tube temperature values are calculated with no fouling allowance. If a fouling allowance is specified or must be considered, refer to the table WH-310-2 on page WH-310. Based on the fouling factor and tube velocity, obtain multiplication factor. The clean tube temperature value from Step 1 must now be corrected by multiplying its value by the fouling factor. The fouling factor will give you the value that the exchanger will be reduced to when fouling is considered.

Table WH-308-1. Specifications

Tube Side Max. Working Pressure	Shell Side Max. Working Pressure	Shell Side Fluid	Maximum Working Temperature
442 ST: 6,6 bar - **552 ST**: 3,3 bar - **662 ST**: 1,9 bar - **862 ST**: 1,1 bar		Steam	191°C

Table WH-308-2. Materials

Head	Heat Exchanger Shell	Heat Exchanger Tubes	Tube Sheets	Tube Bundle End Cap
Cast Iron ASTM A278	Carbon Steel ASTM-SA-53B	Brass ASTM B-111 Alloy C44300 5/8" - 16 BWG	Brass ASTM B-16	Brass ASTM B-16

Note: All stainless steel available on request.

Table WH-308-3. Dimensions and Weights

Model	Dimensions (mm)								Connections			Weight (kg)
	A	B	C	D	E	F	G	L	1	2	3	
442 ST	1 384	114	89	89	178	165	127	1,27	1 1/4" NPT	3/4" NPT	2" NPT	43
552 ST	1 708	141	114	102	200	171	152	1,58	1 1/2" NPT	1" NPT	2 1/2" NPT	77
662 ST	2 038	168	140	121	235	175	191	1,88	2" NPT	1 1/4" NPT	3" NPT	108
862 ST	2 121	219	225	156	241	200	203	1,88	3" NPT	2" NPT	4" NPT	200

All models comply with the article 3.3 of the PED (97/23/EC).

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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Armstrong Flo-Rite-Temp™ ST
Shell and Tube Steam Heat Exchanger

Step No. 3
From the capacity table below and the known flow (in m³/h), move down the appropriate flow column and select a temperature value equal to or greater than the required value from Step 1 with no fouling allowance or from Step 2 with a fouling allowance considered.

Example:
Select a unit for 9 m³/h from 5°C to 49°C with 1 barg steam pressure available. From the table WH-310-1 on page WH-310, the clean tube temperature value is 45. Go to capacity table below with a flow of 9 m³/h. Select a temperature value of 45 or greater. A Model 552ST would be the shell and tube heat exchanger required with a temperature value of 48 and a tube velocity of 1,6 m/sec.

Example:
Same as above but with a specified fouling factor of 0,001 from the Fouling Correction Factor table below, the clean tube temperature value remains at 45. Multiply 45 by the fouling factor multiplier of 1,58 at 1,52 m/sec (round velocity from the capacity table to nearest even number on the Fouling Correction Factor table) consult capacity table below. The new clean tube temperature value for this heat exchanger is now 71,1. The capacity has been reduced from 9 m³/h to about 6,3 m³/h at this fouling factor. You also have the option to jump up to a 662ST and achieve approximately 11,4 m³/h at this fouling factor using a 71,1 temperature value.

Ethylene glycol Correction Factor
Ethylene glycol (50% and 50% water) correction factor. Use the same steps as for water except multiply the clean tube temperature value from Step 1 or Step 2 by using the correction factors shown in the table below.

Table WH-309-1. Flo-Rite-Temp ST Capacities

Model		m³/h heated in tubes															
		1,1	2,3	3,4	4,6	5,7	6,8	9,1	11,4	13,7	16,0	18,2	20,5	22,8	225,1	27,4	31,9
442 ST	Clean Tube Temperature Value	105	89	60	50	45											
	Average Tube Velocity, m/sec	0,5	0,7	1,1	1,5	1,8											
552 ST	Clean Tube Temperature Value				85	80	59	**48**	38	29							
	Average Tube Velocity, m/sec				0,9	1,1	1,3	**1,6**	1,8	2,0							
662 ST	Clean Tube Temperature Value						112	86	70	63	50	46	39				
	Average Tube Velocity, m/sec						0,7	0,9	1,1	1,3	1,6	1,8	2,0				
862 ST	Clean Tube Temperature Value							120	118	116	104	91	85	66	62	58	46
	Average Tube Velocity, m/sec							0,5	0,6	0,7	0,9	1,0	1,1	1,2	1,3	1,5	1,7

Table WH-309-2. Fouling Correction Factor

Tube Velocity (m/sec)	Fouling Correction Factor		
	0,0005	0,0010	0,0015
0,30	1,12	1,26	1,26
0,61	1,19	1,37	1,37
0,91	1,25	1,37	1,37
1,22	1,25	1,53	1,53
1,52	1,30	1,58	1,58
1,83	1,32	1,65	1,65
1,98	1,35	1,67	1,67

Table WH-309-3. 50% Glycol - 50% Water Correction Factor

Average Solution Temperature (°C)	Clean Tube Temperature Value Correction Factor
16	1,44
27	1,40
38	1,36
60	1,28
82	1,18
93	1,12

Armstrong Flo-Rite-Temp™ ST
Shell and Tube Steam Instantaneous Heat Exchanger

Table WH-310-1. Clean Tube Temperature Values

Water Temp. (°C)		Saturated Steam Pressure in bar(a)											
Inlet	**Outlet**	**0**	**0,1**	**0,3**	**0,7**	**1,0**	**1,4**	**2,0**	**2,7**	**3,5**	**5,0**	**7,0**	**8,0**
5	16	13	13	12	12	11	10	10	10	9	8	8	7
	27	27	25	24	22	21	20	18	18	16	16	15	14
	38	42	40	38	35	33	31	28	26	24	22	21	20
	49	59	54	52	49	45	43	39	37	35	31	29	28
	60	78	72	69	63	59	55	50	47	44	40	38	35
	71	104	96	89	80	74	70	62	58	54	48	45	42
	82	143	131	118	103	94	88	76	71	67	60	54	50
10	21	13	13	13	12	11	11	10	10	9	9	8	7
	32	28	26	25	23	22	21	19	18	17	16	15	14
	43	43	41	39	36	34	31	29	27	26	28	21	20
	54	61	58	54	50	46	44	39	37	35	32	29	28
	65	84	79	72	65	60	57	51	48	45	40	38	35
	77	114	106	96	85	78	72	62	60	56	50	46	43
	88	168	149	130	111	100	92	80	76	70	64	56	52
16	27	14	13	12	12	11	11	10	10	10	9	8	7
	38	29	26	25	24	23	21	20	18	17	16	15	14
	49	45	43	40	38	35	32	30	28	26	24	22	20
	60	65	60	57	52	48	45	40	38	36	32	30	28
	71	91	85	78	69	64	60	52	50	46	41	38	36
	82	130	117	106	90	84	79	67	63	59	52	48	44
	93	208	178	149	128	112	100	86	78	74	64	58	52
27	38	15	14	13	13	12	11	10	10	10	9	9	7
	49	31	30	27	25	24	22	20	19	18	16	16	14
	60	51	47	45	40	27	34	31	29	27	25	23	21
	71	78	72	66	58	53	50	43	40	38	34	31	29
	82	116	105	93	80	73	68	59	54	50	44	40	38
	93	193	163	136	112	98	90	77	70	65	56	51	46
38	49	17	16	15	14	12	12	11	10	10	9	9	7
	54	24	22	20	19	18	16	14	13	12	11	10	10
	60	37	35	32	28	26	24	21	20	18	16	16	15
	71	63	57	53	46	42	39	34	32	30	26	24	22
	82	101	92	80	69	62	57	49	45	42	36	33	30
	93	176	148	122	98	86	79	67	60	56	47	43	39
43	49	8	8	7	7	6	5	5	5	4	4	4	3
	54	19	18	16	15	13	13	11	11	10	9	9	7
	60	30	26	24	22	20	18	17	15	14	13	12	11
	65	43	38	36	30	28	26	25	21	19	18	16	15
	71	56	52	46	40	36	34	30	26	25	23	20	18
	77	70	60	57	51	45	42	36	34	30	28	25	23
	82	95	86	76	64	56	51	46	42	39	34	30	27
	88	124	106	90	72	66	60	52	46	44	38	34	31
	93	170	142	115	92	82	73	62	55	51	43	40	38
49	54	10	9	8	8	7	7	6	5	5	4	4	4
	60	20	18	17	16	14	13	12	11	10	9	9	7
	65	31	30	27	26	22	20	17	16	15	13	12	11
	71	46	42	38	32	28	27	24	22	21	18	17	15
	77	63	56	50	44	39	36	30	29	26	24	21	19
	82	83	74	65	55	49	45	38	35	32	28	26	23

Water Temp. (°C)		Saturated Steam Pressure in bar(a)											
Inlet	**Outlet**	**0**	**0,1**	**0,3**	**0,7**	**1,0**	**1,4**	**2,0**	**2,7**	**3,5**	**5,0**	**7,0**	**8,0**
49	88	112	103	84	68	62	55	46	43	38	35	30	27
	93	158	132	107	85	74	66	56	50	46	39	35	32
54	60	11	10	9	8	7	7	7	5	5	5	4	4
	65	22	21	19	17	15	14	12	11	10	9	9	7
	71	37	34	30	28	24	22	19	17	16	14	13	12
	77	54	48	42	37	32	30	26	23	22	19	17	16
	82	78	68	58	52	42	40	33	30	27	25	22	20
	88	106	90	76	64	55	50	42	38	34	30	26	24
	93	150	136	104	80	70	60	50	46	42	37	32	29
60	65	12	11	10	8	8	7	7	6	5	5	4	4
	71	25	24	21	18	16	14	13	12	10	9	9	7
	77	42	38	33	29	25	23	20	18	16	14	13	12
	82	63	55	48	40	34	32	27	24	22	19	17	16
	88	92	78	65	60	46	42	35	31	28	26	22	20
	93	137	113	90	72	61	54	44	40	36	30	27	25
	99	-	172	124	94	78	65	56	48	45	39	33	30
	105	-	-	191	120	105	84	66	59	53	44	39	36
65	71	14	13	12	10	8	8	7	6	6	5	5	4
	77	30	26	22	20	16	15	13	12	11	10	10	8
	82	50	45	38	31	28	24	22	18	18	14	13	12
	88	80	66	56	45	38	34	30	26	23	21	18	16
	93	104	102	78	60	53	46	37	34	32	26	24	21
	99	-	160	116	82	70	60	48	44	39	34	29	27
	105	-	-	-	116	85	78	62	54	47	42	35	32
71	77	16	14	13	12	9	8	8	6	6	5	5	4
	82	37	32	27	22	19	17	15	13	12	10	10	8
	88	65	55	45	39	31	27	23	20	19	16	14	13
	93	113	88	69	52	44	39	32	28	26	22	19	17
	99	-	146	102	75	62	53	44	38	35	29	25	23
	105	-	-	168	106	84	62	56	48	44	37	31	27
77	82	20	18	16	12	11	10	8	7	6	6	6	4
	88	48	40	31	25	22	20	16	14	13	11	10	9
	93	94	73	56	42	35	30	26	22	21	17	16	14
	99	-	132	87	62	51	43	35	30	28	23	20	18
	105	-	-	154	93	76	62	50	43	37	32	27	24
82	88	28	23	18	14	12	12	9	7	7	6	6	5
	93	73	56	41	30	25	22	18	16	14	12	11	9
	99	204	115	75	50	42	35	28	24	22	18	16	15
	105	-	-	140	83	64	55	42	36	31	26	22	19
88	93	45	32	23	17	14	12	10	9	7	6	6	5
	99	175	91	56	37	30	25	19	17	16	13	12	10
	105	-	-	120	66	50	40	31	26	23	19	16	15
	110	-	-	-	122	68	62	46	38	33	27	23	21
93	99	130	52	33	21	16	14	10	9	8	7	6	5
	105	-	-	97	50	36	30	22	18	16	13	12	10
	110	-	-	-	98	65	51	36	30	26	20	18	16
	115	-	-	-	-	124	84	52	46	42	31	25	22

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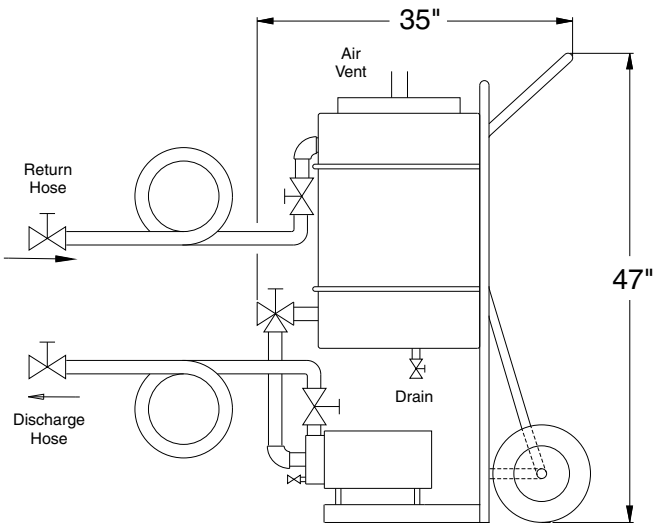
Clean-In-Place Scale Removal System

Clean-In-Place



The Clean-In-Place scale removal system from Armstrong is surefire defense against lime scale, rust and mud. When mechanical cleaning is ineffective or just not feasible for water-wetted process equipment, just wheel in this portable dynamo and say goodbye to crud-encrusted surfaces.

Use Clean-In-Place to remove scale from all types of water-wetted equipment: instantaneous water heaters, heat exchangers of all types (up to 38 liters of internal volume), booster heaters, pumps, evaporative condensers, vacuum pumps, small water-cooled air compressors, stills and sterilizers, and vessel jackets.

Benefits

- Removes scale quickly and effectively
- Requires only two 1-inch connections
- Equipped with easy-to-fill 57 liters tank (or can draw from a larger stand-by reservoir)
- Goes where you need it on a heavy-duty hand truck: compact and portable
- Adapts to multiple applications
- Operates easily

Note: Make certain that scale solvents used in the Clean-In-Place are compatible with all wetted parts of the heater. Check with your local Armstrong Representative for recommended scale solvents.

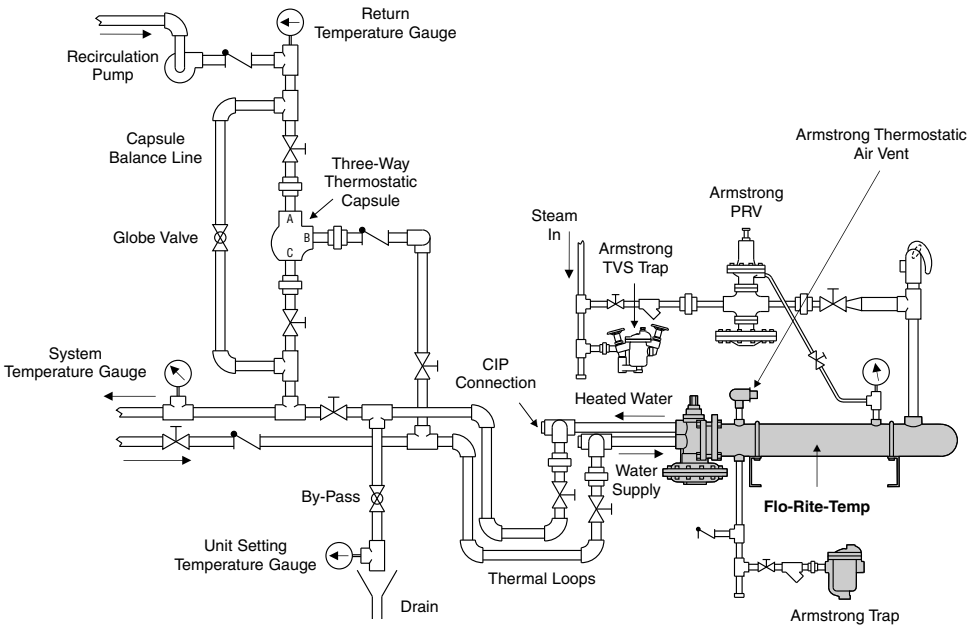
Table WH-311-1. Materials

Name of Part	Materials
Pump	Teflon Coated Cast Iron Body and Barform Impeller Rotary Graphite Seal with Ceramic Seat
Pump Motor	1/2 H.P. 3 450 RPM, 115/230V, 60 Cycle AC
Tank	57 liters - Polypropylene - DOT Hose
Hoses	Clear, Reinforced PVC Hose
All Piping	PVC Sch. 80
Valves	PVC
Hand Truck	Steel Frame with 200 mm Rubber Wheels

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

Flo-Rite-Temp™

Recirculation System



Note: Flo-Rite-Temp is provided with one Armstrong Steam Trap and Thermostatic Air Vent (shaded). All other items shown not included.

Recirculation System

Since the Flo-Rite-Temp is small and compact, you can usually install it close to the point of use, eliminating the need for a recirculation system. However, in some applications, re-circulation is necessary to assure instantaneous hot water to all points of use. Such a system is made up of several components designed to work together.

Recirculation pump. The job of this pump is to continually recirculate water in the loop to maintain the temperature during low or no system demand. Its capacity is usually 10% to 15% of the water heater's maximum capacity. For pumps with a larger capacity, use a full line by-pass with a globe valve or balancing valve to divert and balance the flow around and to the thermostatic capsule.

Three-way thermostatic capsule. Sensing the temperature of the recirculated water, the capsule compares it to its own preset temperature (about 8°C lower than that of the Flo-Rite-Temp). If water temperature is too low due to radiation loss from the piping and no demand from the loop, the capsule diverts some of the loop's flow to the inlet of the water heater (ports A to B) for reheating. Once the temperature in the loop exceeds the capsule set point, flow is directed straight through the capsule (ports A to C). To regulate flow to the capsule, use a by-pass with a globe valve or balancing valve.

Accumulation System

The Flo-Rite-Temp accumulation system will also increase capacity by providing a specified volume of accumulated hot water. It is designed for short duration peak loads or when steam is in short supply and a recovery time can be tolerated. For more information, contact your local Armstrong Representative.

Parallel Installation

Parallel installations can meet larger capacity demands not possible with a single unit. In addition, they can provide partial or total backup during maintenance or in the event of unit failure.

Warranty

The instantaneous water heater shall have a one-year guarantee against defective material or faulty workmanship in accordance with Armstrong's standard limited warranty and remedy terms.

In addition the tube bundle shall have a 10-year guarantee against failure caused by materials or workmanship but not against gasket failure or damage caused by corrosion, water hammer or lack of proper cleaning.

For more information, contact Armstrong or your local Armstrong Representative.

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.

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Flo-H2O™ Boiler Water-to-Water Instantaneous Water Heater

The Flo-H2O™ is a pre-engineered pre-packaged boiler water-to-water instantaneous water heater designed for domestic hot water generation. The Flo-H2O package system ships completely assembled on a compact common base-plate that will fit through a standard door.

The Basic System

- Plate and frame heat exchanger
- Boiler side recirculating pump to supply the heat exchanger
- PID temperature controller using fuzzy adaptable tuning (FAT)
- Three-way motorized control valve
- High temperature safety shut-off
- Six temperature sensors

Installation is easy with only one connection to hot and cold ports for both domestic and boiler side, domestic recirculation and electrical.

The Flo-H_2O package system provides more precise temperature control through the full range of flow through the heat exchanger over contemporary shell and tube exchangers. Temperature control will be maintained +/- 4°F from low flow to high flow. Additional benefits and features include:

- Night-time temperature set back for energy savings
- Optional double-wall plates-no cross contamination of domestic water
- Control panel UL and CSA approved
- Compatibility with building automation systems

Optional Feature

Armstrong Water Temperature Controls are available as customized packaged heating and mixing solutions.

Note: For detailed material specifications, options, approximate dimensions and weights, consult Armstrong or your local Representative.

Armstrong MS-6 Noiseless Heater

The use of hot water is indispensable in food processing, cleaning, and plating operations. Although the simplest and most efficient way to provide the water is by direct steam sparging, such a format often results in vibration and noise caused by steam blowing into the water tank. These problems can be greatly reduced by mounting an MS-6 noiseless heater at the end of the pipe.

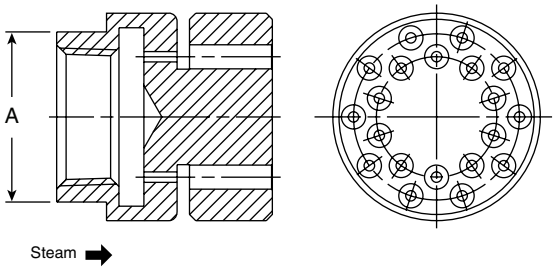
Features

- Stainless steel construction for greater durability
- Mounting is simple and economical
- Maintenance free

Formula for Calculating Steam Load to Heat Water in Tank

$$kg/hr = \frac{Lit \times \Delta T \times 4{,}186}{Lat \times T}$$

Lit = Liters of water to be heated
ΔT = Temperature rise °C
Lat = Latent heat of steam (kJ/Kg)
T = Time in hours



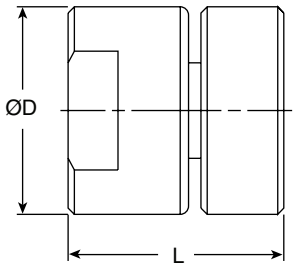


Table WH-314-1. Specifications

Fluid	Steam
Pressure Range	0,5 - 7 bar
Silencing Limit Temperature	90°C
Material	304 Stainless Steel
Connection	NPT

Table WH-314-2. Dimensions and Weights

Connections Size (mm)	15	20	25	32	40	50
"L"	49	49	52	55	59	65
"D"	35	45	50	60	70	105
"A"	30	35	41	50	60	90
Weights (kg)	0,25	0,40	0,52	0,77	1,15	2,99

Table WH-314-3. Capacities–Steam (kg/hr)

Inlet (bar)	**Connections Size**					
	15	**20**	**25**	**32**	**40**	**50**
0,50	25	58	71	86	132	164
0,70	30	67	81	101	147	187
1,00	38	80	97	125	171	226
1,38	46	94	113	150	195	264
2,00	63	122	146	199	243	341
2,76	80	149	178	248	292	418
3,45	97	177	210	297	340	494
4,14	114	205	242	346	388	571
4,83	131	232	275	395	437	648
5,52	148	260	307	445	485	725
6,20	165	288	339	494	533	801
6,90	181	315	371	543	582	878

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Flo-Direct® Direct Contact Gas-Fired Water Heater

Armstrong's Flo-Direct direct contact gas-fired water heaters are high efficiency, compact, all-stainless steel units that are simple in design and operation, and suitable for a wide variety of hot-water applications. With capacities from 1 million to as high as 25 million kJ per hour, these units can offer fuel savings of 15% to 40% over conventional means of heating water. Features include small footprint for space savings, 99.7% or greater heat transfer efficiencies, simple installation and operation, ease of maintenance, and the ability to operate well with poor water quality. Typical applications include laundries, batch food processes, washdown, parts washers, dyeing operations, gang showers, concrete plants and boiler makeup water.

"Low Nox" option available

High-efficiency burner/blower for low carbon monoxide and nitrous oxide emissions. Able to meet stringent emission standards.

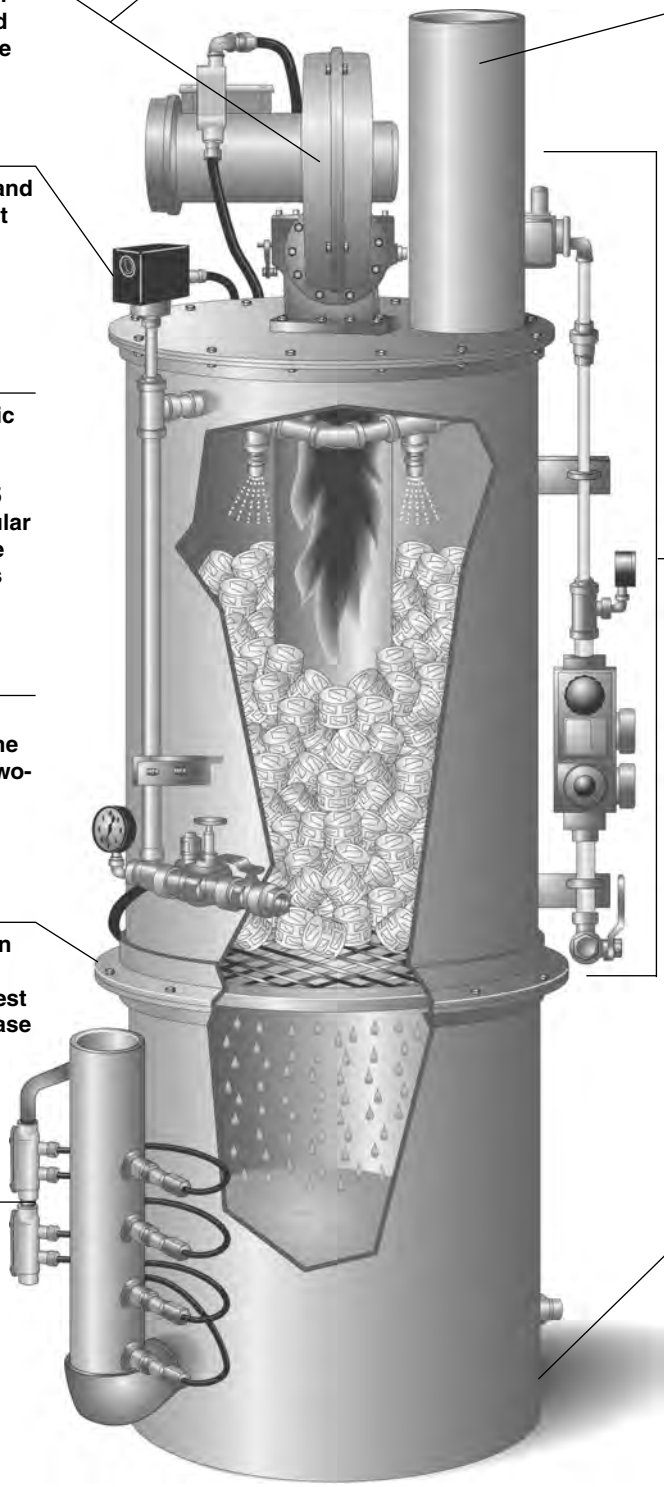
Water pressure limit switch and high temperature switch shut down the unit for safety if water pressure fails or is accidentally shut off.

Electrical programmable logic controller (PLC) for building automation system compatibility. NEMA 4 - IP 65 (watertight) enclosure; modular components for easy service or replacement. Status lights for easy troubleshooting.

Stainless steel construction with a 10-year warranty on the structure and its internals. Two-year warranty on external components.

Indexability of the top portion to the bottom allows for flexibility in rotating for easiest utility hookups. Allows for ease of internal inspection.

Level controls automatically control the transfer pump (included) which delivers heated water to application.



Exhaust temperatures within a few degrees of the incoming water allow for inexpensive CPVC or single-walled stainless for ducting materials.

Modular fuel train using slideout components for ease of maintenance or replacement. CE approved according to the PED (97/23/EC)

Small footprint because the burner is installed on top of the unit and not on the side. No side clearance required.

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Flo-Direct® Direct Contact Gas-Fired Water Heater

How the Flo-Direct Gives You Top Performance and Efficiency in a Direct Fired Water Heater.
Water is introduced into the top of the unit through a series of calibrated dispersion nozzles. Cold water travels down through a bed of multifaceted stainless steel packing rings that break the water into smaller and smaller droplets.

A burner is mounted on top of the unit, firing downward through a centrally located flame tube. The flame tube is cooled by incoming cold water, and all of the fuel gasses are consumed within this flame tube. The design allows all combustion to take place within a dry and cool environment, and produces very low levels of nitrous oxide (NO) and carbon dioxide (CO2). Heat from the flame enters the lower chamber from the bottom of the flame tube, and travels slowly upward through the packing rings. The descending water comes in contact with the bed of packing rings, where heat transfer takes place.

This "rain" of hot water then falls into the lower chamber and is pumped out to a storage tank. Water temperatures up to 85°C are available within a minimum of 30 seconds after the unit starts. Outlet water temperature is set with a valve controlling the incoming water flow. More incoming water results in cooler outlet water temperatures, and less incoming water produces hotter outlet water temperatures.

The products of combustion are exhausted out of the top of the unit, and are normally within a few degrees of incoming water temperature.

The Result
The unit produces potable hot water instantaneously. There is no fuel consumed for warm-up or idle time. No energy is lost through steam conversion or within a heat exchanger. Virtually all of the fuel energy is transferred to the water.

Features

- No internal moving parts
- Low-temperature exhaust
- Water temperature differential from 6°C to 77°C
- 99.7% or greater efficiency
- Water treatment not required
- Stainless steel construction
- Takes up minimal floor space
- Ten year warranty on structure/two years on all other components

Sizing Formulas

$$\frac{\text{lpm}}{4,2} \times \Delta T = \text{AFD Model}$$

$$\frac{\text{AFD Model} \times 4,2}{\Delta T} = \text{lpm}$$

$$\frac{\text{AFD Model} \times 4,2}{\text{lpm}} = \Delta T$$

Formulas Keys

lpm = Liters per minute
ΔT = Temperature rise °C
AFD = Armstrong Flo-Direct (e.g., 1000, 5000)

NOTE: Use the Flo-Direct sizing tool at www.armstronginternational.eu/flo-direct

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Flo-Direct® Direct Contact Gas-Fired Water Heater

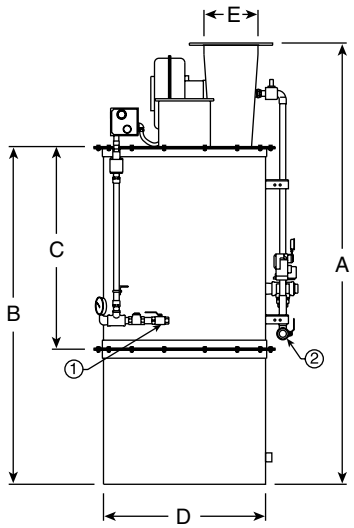


Table WH-317-1. Specifications	
Gas Supply Pressure*	Water Supply Pressure*
0,14 - 0,41 bar	2,0 - 6,8 bar

*For other pressures, consult factory.

Table WH-317-2. Materials	
Tank	304 SS
Gas Piping	Malleable Iron
Water Piping	Copper (304 SS optional)
Spray Ring	304 SS
Tank Gasket	Warco White
Flame Tube	304 SS
Pall Rings	304 SS

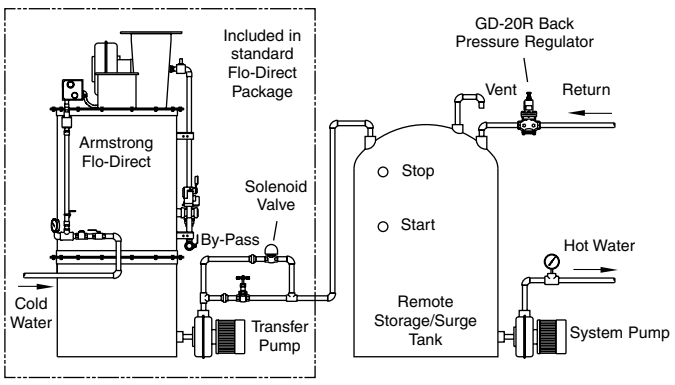
Table WH-317-3. Materials

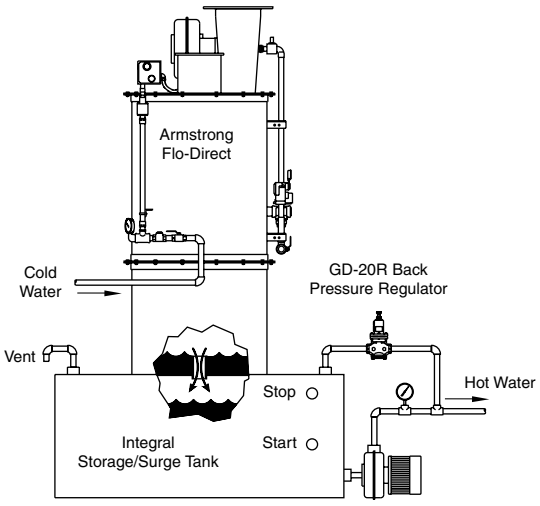
Model	Connections*		Dimensions					Weight*	kJ/hr
	1	2	A	B	C	D	E		
	mm	mm	mm	mm	mm	mm	mm	kg	
1000	25	25	2 413	1 803	991	610	203	375	1 000 000
1500	25	25	2,464	1 854	1 041	660	203	386	1 500 000
2000	40	40	2 540	1 930	1 118	762	273	680	2 000 000
3000	40	40	2 540	1 930	1 118	914	305	725	3 000 000
5000	65	50	3 226	2 464	1 651	1 118	356	1 136	5 000 000
7000	80	50	3 531	2 718	1 956	1 270	457	1 455	7 000 000
9000	80	65	4 293	3 531	2 718	1 524	508	2 273	9 000 000
11000	100	80	4 597	3 835	3 023	1 549	559	2 495	11 000 000
15000	100	80	4 877	4 089	3 277	1 778	610	3 175	15 000 000
18000	100	80	5 537	4 750	3 937	1 930	660	3 636	18 000 000
25000	150	100	6 706	5 156	4 191	2 489	813	6 818	25 000 000

*The weights and connections can vary due to options.
For additional sizes between Model 1000 and Model 25000, consult factory.

Example Installations of the Flo-Direct Direct Fired Water Heater

The unit can be used in both open-circuit and closed-circuit systems. Additionally, the unit may have either an integral or remote storage tank. See the following examples.





NOTE: The small immersion heater on closed-circuit system only makes up for losses from the circulation of unused water (pipe losses).

Balancing Valve Models ABV-VS & ABV-VT

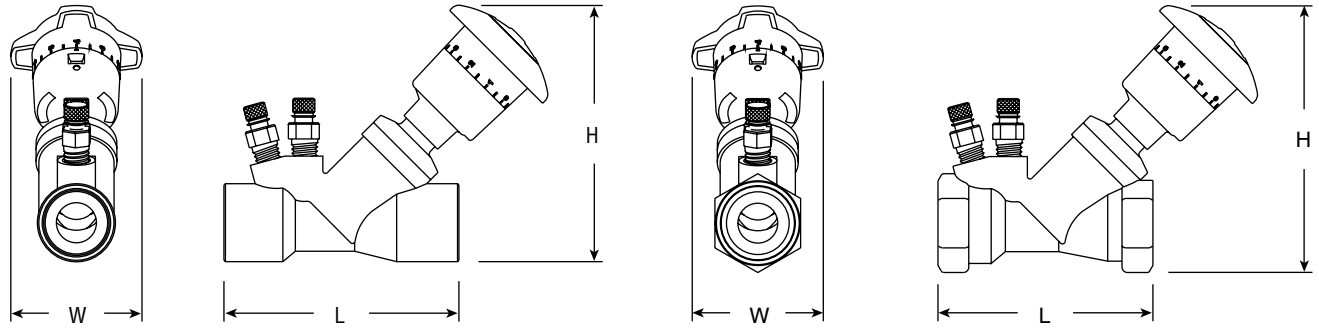
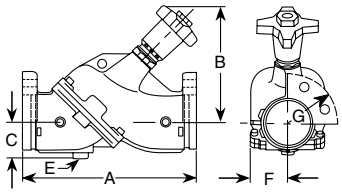


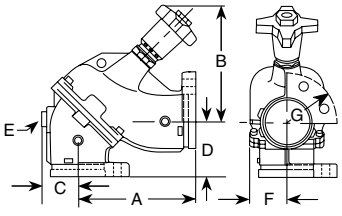
Table WH-318-1. Physical Data Specifications 15 - 50 mm			
Design Information		**ABV-VS**	**ABV-VT**
Handwheel - No. of 360° Turns		Five	
Maximum Working Pressure		20 bar	
Maximum Working Temperature		150°C	
Materials of Construction	Body, Bonnet	Brass Alloy CW617	
	Stem and disc	Brass Alloy B16	
	Elastomers	EPDM	
	Handwheel	Reinforced Nylon; ABS	
Insulation*		Optional	
Pressure Metering Ports 1/4" (2)		NPT Brass Body with EPDM** Check and Gasketed Cap	
Connection Type		Solder	Threaded NPT
No. of Drain Trappings (1/4")		Two	

*Optional pre-formed insulation is available to meet ASTM D1784/Class 14253-C, MEA #7-87, ASTM E84 and ASTM E136 with a flame spread rating of 25 or less and a smoke development rating of 50 or less.
**EPDM is not suitable for oil service.

Balancing Valve Models ABV-G & ABV-A



ABV-G



ABV-A

Armstrong Flange Adapter

Armstrong 2-1/2" through 12" (65 mm - 300 mm) ABVs are furnished with industry standard grooved ends.

The combination of the Armstrong flange adapter and ABV body, equipped with the unique anti-rotation lugs, ensures a rigid flanged valve installation.

For fully detailed certified drawing, refer to list below.

ABV-VT CDY #1065 **ABV-G CDY #1068**
ABV-VS CDY #1066 **ABV-A CDY #1069**

Design Information		**ABV-G (Straight) / ABV-A (Angle)**
Maximum Working Pressure		26 bar
Maximum Working Temperature		110°C
Materials of Construction	Body	Ductile Iron ASTM A536 Gr. 65-45-12
	Disc	Bronze ASTM B584 C-84400
	Seat	Ultra High Strength Engineered Resin
	Trim	Brass C-37700
	"O" Ring	Buna
Insulation		Optional*
Pressure Metering Ports 1/4" (2 mm)		NPT Brass Body with EPDM** Check and Gasketed Cap

Connection Type (Flanged or Grooved Ends)	**Grooved Ends**	**Adapter Flange Design Class 125/150**	**Adapter Flange Design Class 250/300**
Maximum Working Pressure	26 bar	17 bar	26 bar
Maximum Working Temperature	110 °C		
Flange Material	–	Duxtile Iron	
Flange Gasket	–	EPDM	

*Optional pre-formed insulation is available to meet ASTM D1784/Class 14253-C, MEA #7-87, ASTM E84 and ASTM E136 with a flame spread rating of 25 or less and a smoke development rating of 50 or less.
**EPDM is not suitable for oil service.

Table WH-318-2. Armstrong Flange Adapter		
Flange Adapter	**Maximum Working Pressure**	**Temperature**
Design Class 125	17 bar	110°C
Design Class 250	26 bar	

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Notes