

# Flo-Rite-Temp<sup>®</sup> Installation and Operation Manual

IOM-780-N



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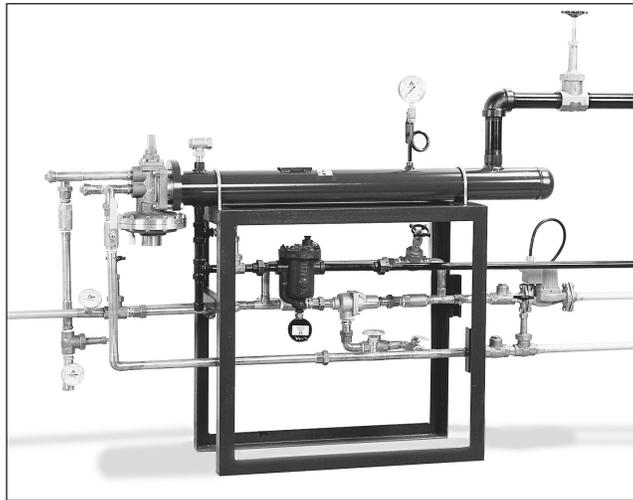
# Flo-Rite-Temp® Feed-Forward Instantaneous Steam/Water Heaters

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 temperatures 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 (+/-4°F 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 7 square feet (0.63 m<sup>2</sup>) of floor space.*

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 ensures condensate drainage and nixes potential water hammer and corrosion.

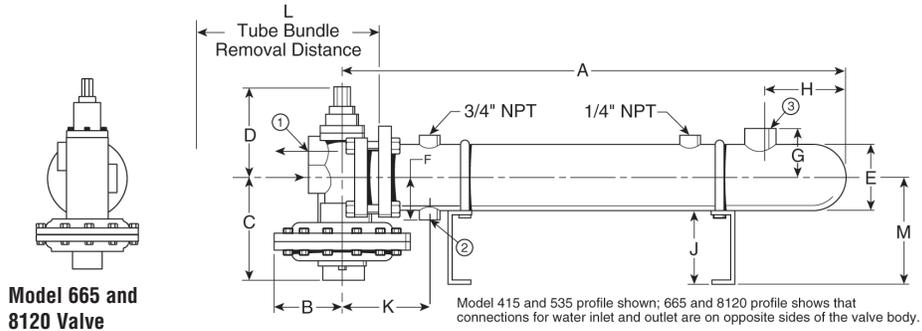
**Pushes you out front in savings.** When it comes to replacing a bulky storage tank system, the choice is clear. The Flo-Rite-Temp consumes dramatically less floor space, and you don't have to tear out walls to install it. In fact, it slips through a standard doorway. Payoff? Lower installed cost. Another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

**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 technical assistance in selecting and installing, contact your Armstrong Representative today.

<b>Table 4-1. How Flo-Rite-Temp Scores on Key Benefits</b>			
	Flo-Rite-Temp Feed Forward	Storage Tank Feedback	Tankless Instantaneous Feedback
Saves space	Yes	No	Yes
Saves energy	Yes	No	Yes
Eliminates temp. swings	Yes	Yes	No
Eliminates thermal lag	Yes	Yes	No
Ensures accurate control	Yes	Yes	No
Designed with straight tubes for easy cleaning	Yes	No	No
Eliminates potential health hazard for standing water	Yes	No	Yes
Fails cold for safety	Yes	No	No
Eliminates thermostatic control	Yes	No	No

# Flo-Rite-Temp® Single Wall Instantaneous Water Heater

**Figure 5-1.**  
Note: Double wall units available.



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.

**Table 5-1. Dimensions**

Model	A		B		C		D		E		F		G		H		J		K		L		M	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
415	54	1372	4-1/2	114	7-1/2	190	7	178	4-1/2	114	3-5/16	84	3	76	7	178	6	152	6-1/4	159	50	1270	7-1/2	190
535	67-1/2	1715	5-1/4	133	8-5/8	219	9	229	5-9/16	141	4	102	3-11/16	94	7-7/8	200	7	178	7-1/2	191	62	1575	9	229
665	82	2083	5-3/4	146	10-3/8	264	10-3/8	264	6-5/8	168	4-5/8	117	4-9/16	116	9-1/4	235	8	203	8-3/4	222	74	1880	11	280
8120	85	2159	5-3/4	146	11-3/4	299	12	305	8-5/8	219	6	152	8-7/8	225	9-1/2	241	8	203	9-1/2	241	74	1880	12-3/8	314

**Table 5-2. Connections and Weights**

Model	Connections			Weight	
	1	2	3	lb	kg
	in (mm)	in (mm)	in (mm)		
415	1" (25) NPT	3/4" (20) NPT	2" (50) NPT	133	60
535	1-1/2" (40) NPT	1" (25) NPT	2-1/2" (65) NPT	235	107
665	2" (50) NPT*	1-1/4" (32) NPT	3" (80) NPT	358	162
8120	3" (80) NPT*	2" (50) NPT	4" (100) 150#ANSI	585	265

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

**Table 5-3. Specifications**

Application	Steam Supply Pressure	Water Supply Pressure	Maximum Water Pressure Drop
Steam to Water	2 - 15 psig (0.14 to 1.0 bar)	20 - 150 psig (1.4 - 10.3 bar)	10 psig (0.7 bar)

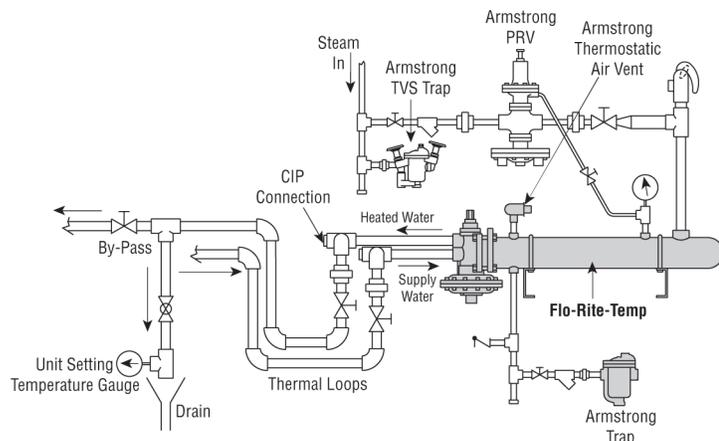
NOTE: Reusable insulation wraps available.

**Table 5-4. Materials**

Model	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 ASTM "U" Stamped	5/8" 16 BWG Admiralty Brass	Brass	Brass
	(535/665/8120) Brass	(665/8120) Brass					

## Heater Installation

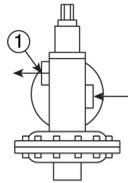
NOTE: Flo-Rite-Temp is provided with one Armstrong Steam Trap and Thermostatic Air Vent (shaded). All other items shown not included. Removable/reusable insulation covers for the heat exchangers are available. Contact Armstrong or your local representative for more information.



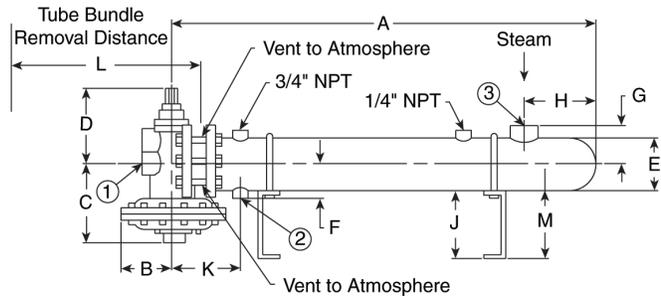
# Flo-Rite-Temp® Double Wall Instantaneous Water Heater

Model 415DW and 535DW profile shown below. 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 sizing table on page HWS-10.



**Model 665DW and 8120 DW Valve**



**Model 415DW and 535DW Profile**

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.

**Table 6-1. Dimensions**

Model	A		B		C		D		E		F		G		H		J		K		L		M	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
415DW	76-1/8	1934	4-1/2	114	7-1/2	190	7	178	4-1/2	114	3-3/8	86	3-3/4	95	10-1/2	267	6	152	6-7/8	175	50	1270	7-1/2	190
535DW	77-3/8	1965	5-1/4	133	8-5/8	219	9	229	5-9/16	141	4	102	4-1/4	108	11-1/2	292	7	178	8-1/8	206	62	1575	9	229
665DW	90-5/8	2302	5-3/4	146	10-3/8	264	10-3/8	264	6-5/8	168	4-3/4	121	5	127	11-3/4	298	8	203	9-3/4	248	74	1880	11	280
8120DW	79-7/8	2029	5-3/4	146	11-3/4	299	12	305	8-5/8	219	6	152	8-3/4	222	12-5/8	321	8	203	11-5/8	295	74	1880	12-3/8	314

**Table 6-2. Connections and Weights**

Model	Connections			Tube Bundle Removable in (mm)	Weight	
	1	2	3		lb	kg
	in (mm)	in (mm)	in (mm)			
415DW	1" (25) NPT	3/4" (20) NPT	2" (50) NPT	75" (1905)	199	90
535DW	1-1/2" (40) NPT	1" (25) NPT	2-1/2" (65) NPT	75" (1905)	270	122
665DW	2" (50) NPT*	1-1/4" (32) NPT	3" (80) NPT	87" (2210)	444	201
8120DW	3" (80) NPT*	2" (50) NPT	4" (100) 150#ANSI	75" (1905)	665	302

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

**Table 6-3. Specifications**

Application	Steam Supply Pressure	Water Supply Pressure	Maximum Water Pressure Drop
Steam to Water	2 - 15 psig (0.14 to 1.0 bar)	20 - 150 psig (1.4 - 10.3 bar)	10 psig (0.7 bar)

**Table 6-4. Materials**

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

\*Units are ASME "UM" stamped - ASME "U" stamped available on request.

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

# Sizing and Single and Double Wall Flo-Rite-Temp<sup>®</sup>

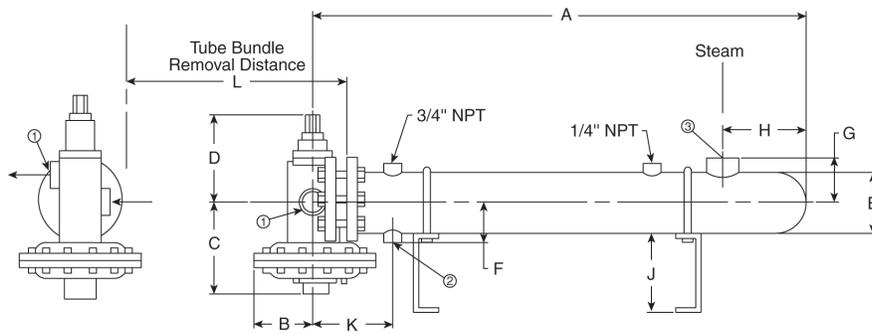
**Table 7-1. Water and Steam Capacities (Note: Capacities for single-wall and double-wall units are identical.)**

Inlet Temp.	Set Temp.	Standard								Inlet Temp.	Set Temp.	Metric								Model
		Hot Water Capacities*				Steam Capacities						Hot Water Capacities*				Steam Capacities				
		Steam Pressure				Steam Pressure						Steam Pressure				Steam Pressure				
		psig	psig	psig	psig	psig	psig	psig	psig			bar	bar	bar	bar	bar	bar	bar	bar	
40	120	2	5	10	15	2	5	10	15	0.14	0.35	0.7	1	0.14	0.35	0.7	1	415		
		gpm	gpm	gpm	gpm	lbs/hr	lbs/hr	lbs/hr	lbs/hr	m <sup>3</sup> /h	m <sup>3</sup> /h	m <sup>3</sup> /h	m <sup>3</sup> /h	kg/h	kg/h	kg/h	kg/h			
		17	18	20	20	714	767	839	901	3.8	4.1	4.5	4.5	323	347	379	407			
		37	40	43	45	1,543	1,657	1,814	1,946	8.4	9.1	9.8	10.2	697	749	820	880			
		69	74	80	80	2,855	3,067	3,356	3,601	15.7	16.8	18.2	18.2	1,290	1,386	1,517	1,628			
		142	145	145	145	5,680	6,160	6,760	7,160	32.2	32.9	32.9	32.9	2,576	2,794	3,066	3,248			
		15	16	17	18	681	734	807	868	3.4	3.6	3.8	4.1	308	332	365	392			
		32	34	37	39	1,472	1,587	1,743	1,876	7.3	7.7	8.4	8.8	665	717	788	848			
		58	63	68	73	2,723	2,936	3,226	3,472	13.2	14.3	15.4	16.6	1,230	1,327	1,458	1,569			
		112	122	136	145	5,040	5,490	6,120	6,705	25.4	27.7	30.9	32.9	2,286	2,490	2,776	3,041			
		12	13	15	16	646	700	773	835	2.7	3.0	3.4	3.6	292	316	349	377			
		27	29	32	34	1,397	1,513	1,671	1,804	6.1	6.6	7.3	7.7	631	684	755	815			
	50	54	59	63	2,585	2,799	3,091	3,338	11.3	12.2	13.3	14.3	1,168	1,265	1,397	1,509				
	88	97	109	120	4,400	4,850	5,450	6,000	20.0	22.0	24.7	27.2	1,996	2,200	2,472	2,722				
	9	10	11	12	572	627	702	765	2.0	2.3	2.5	2.7	259	283	317	346				
	20	22	24	26	1,235	1,355	1,517	1,652	4.5	5.0	5.5	5.9	558	612	686	747				
	37	40	45	48	2,286	2,508	2,806	3,057	8.4	9.1	10.2	10.9	1,033	1,134	1,268	1,382				
	69	83	89	95	4,140	4,980	5,340	5,700	15.6	18.8	20.2	21.6	1,878	2,259	2,422	2,585				
	5	5	6	7	344	386	441	487	1.1	1.1	1.4	1.6	156	175	200	221				
	12	13	15	16	861	966	1,104	1,219	2.7	3.0	3.4	3.6	390	438	501	553				
	23	26	39	32	1,663	1,866	2,134	2,355	5.2	5.9	6.6	7.3	754	846	968	1,068				
	43	47	52	59	3,010	3,290	3,640	4,130	9.7	10.7	11.8	13.4	1,365	1,492	1,651	1,873				
	19	20	20	20	692	745	816	877	4.3	4.5	4.5	4.5	313	337	369	396				
	41	44	45	45	1,495	1,609	1,764	1,896	9.3	10.0	10.2	10.2	676	727	797	857				
76	80	80	80	2,767	2,977	3,264	3,508	17.3	18.2	18.2	18.2	1,251	1,346	1,475	1,586					
145	145	145	145	5,740	6,090	6,580	7,035	32.2	32.2	32.2	32.2	2,603	2,762	2,985	3,191					
16	17	19	20	660	712	785	846	3.6	3.8	4.3	4.5	298	322	355	382					
34	37	40	45	1,425	1,539	1,695	1,827	7.7	8.4	9.1	9.8	644	696	766	826					
64	68	75	80	2,637	2,848	3,137	3,381	14.5	15.4	17.0	18.2	1,192	1,287	1,418	1,528					
127	138	145	145	5,080	5,520	6,120	6,760	28.8	31.3	32.2	32.2	2,304	2,504	2,776	3,066					
13	14	16	17	626	679	752	813	2.9	3.2	3.6	3.8	283	307	340	367					
29	31	34	37	1,352	1,467	1,624	1,756	6.6	7.0	7.7	8.4	611	663	734	794					
54	58	64	68	2,502	2,715	3,005	3,250	12.2	13.2	14.5	15.4	1,131	1,227	1,358	1,474					
99	108	121	134	4,455	4,860	5,445	6,030	22.5	24.5	27.5	30.4	2,021	2,204	2,470	2,735					
10	11	12	13	553	608	682	744	2.3	2.5	2.7	3.0	250	275	308	336					
21	23	25	28	1,194	1,313	1,473	1,607	4.7	5.2	5.7	6.4	540	593	665	726					
39	42	47	51	2,210	2,429	2,725	2,974	8.9	9.5	10.7	11.6	999	1,098	1,232	1,344					
76	90	95	102	4,180	4,950	5,225	5,610	17.2	20.4	21.6	23.1	1,896	2,245	2,370	2,545					
5	6	6	7	332	373	428	473	1.1	1.4	1.4	1.6	151	169	194	214					
12	14	16	17	831	934	1,071	1,185	2.7	3.2	3.6	3.9	377	424	486	537					
24	27	30	33	1,605	1,805	2,069	2,289	5.4	6.1	6.8	7.5	728	819	938	1,037					
49	55	63	72	3,185	3,575	4,095	4,680	11.1	12.5	14.3	16.3	1,445	1,622	1,857	2,123					
18	19	20	20	638	690	762	822	4.1	4.3	4.5	4.5	288	312	344	372					
38	41	45	45	1,378	1,491	1,646	1,777	8.7	9.3	10.2	10.2	623	674	744	803					
70	76	80	80	2,550	2,760	3,046	3,288	15.9	17.3	18.2	18.2	1,152	1,247	1,377	1,486					
145	145	145	145	5,110	5,565	6,090	6,510	32.2	32.2	32.2	32.2	2,318	2,524	2,762	2,953					
15	16	17	19	605	658	729	790	3.4	3.6	3.8	4.3	273	297	330	357					
32	34	38	40	1,307	1,421	1,576	1,708	7.3	7.7	8.6	9.1	591	642	712	772					
58	63	69	75	2,418	2,629	2,917	3,160	13.2	14.3	15.7	17.0	1,093	1,188	1,318	1,428					
111	123	137	145	4,440	4,920	5,480	6,080	25.2	27.9	31.1	32.2	2,014	2,232	2,486	2,758					
10	11	13	14	533	588	661	723	2.3	2.5	2.9	3.2	241	266	299	327					
22	24	27	30	1,152	1,270	1,428	1,561	5.0	5.5	6.1	6.8	521	574	645	706					
41	45	50	55	2,132	2,349	2,642	2,889	9.3	10.2	11.3	12.5	964	1,062	1,194	1,306					
85	99	104	115	4,250	4,950	5,200	5,750	19.3	22.5	23.6	26.1	1,928	2,245	2,359	2,608					
5	6	7	7	320	360	414	459	1.1	1.4	1.6	1.6	145	163	188	208					
13	14	16	18	800	902	1,037	1,150	3.0	3.2	3.6	4.1	363	409	470	522					
25	28	32	35	1,546	1,743	2,004	2,221	5.7	6.4	7.3	7.9	701	791	909	1,007					
59	67	80	90	3,540	4,020	4,800	5,400	13.4	15.2	18.1	20.4	1,606	1,823	2,177	2,449					

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

**NOTES:** Minimum water temperature increase is 60°F (33°C). Consult factory if less than 60°F (33°C) increase is required or a set temperature below 120°F (49°C) is required. See page PTC-37 for proper pressure reducing valve selection.

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



Model 665 SS and 8120 SS Valve

**Note:** 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.

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 electric equipment, pharmaceuticals and food.

## Features

- Feed-forward control provides accurate temperature control on demand even when demand fluctuates abruptly.
- Feed-forward operation ensures 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

Table 8-1. Dimensions

Model	Dimensions												Connections			Weights	
	A	B	C	D	E	F	G	H	J	K	L	1	2	3			
665 SS	in	82-3/4	5-3/4	10-3/8	10-3/8	6-5/8	4-3/4	5-1/2	9-1/4	8	8-3/4	74	2 NPT	1-1/4 NPT	3 NPT	lb	335
	mm	2102	146	264	264	168	121	140	235	191	222	1880	50	32	80	kg	152
8120 SS	in	90	5-3/4	10-3/8	10-3/8	8-5/8	6-1/8	8-7/8	9-1/2	8	14-1/2	74	2 NPT	2 NPT	4 150# ANSI	lb	670
	mm	2286	146	264	264	219	156	225	241	203	368	1880	50	50	100	kg	298

Table 8-2. Materials

Body	Valve	Valve Seats	Diaphragm	Heat Exchanger Shell	Heat Exchanger Tubes	Heat Exchanger Tube Sheets
T-316 Stainless Steel			Viton® GF Reinforced w/Nomex® Fiber	Carbon Steel (Stand.) T-316 Stainless Steel (Opt.)	T-316L Stainless Steel	T-316L Stainless Steel

Table 8-3. Specifications

Application	Steam Supply Pressure	Water Supply Pressure	Maximum Water Pressure Drop
Steam to Water	2 - 15 psig (0.14 to 1.0 bar)	20 - 150 psig (1.4 - 10.3 bar)	10 psig (0.7 bar)

# Flo-Rite-Temp® SS Sizing

Table 9-1. Water and Steam Capacities (Note: Capacities for single-wall and double-wall units are identical.)																						
Inlet Temp. °F	Set Temp. °F	Standard								Inlet Temp. °C	Set Temp. °C	Metric								Model		
		Hot Water				Steam Capacities						Hot Water Capacities*				Steam Capacities						
		Steam Pressure				Steam Pressure						Steam Pressure				Steam Pressure						
		psig				psig						bar				bar						
		2	5	10	15	2	5	10	15			0.14	0.35	0.7	1	0.14	0.35	0.7	1			
		gpm				lbs/hr						m <sup>3</sup> /h				kg/h						
40	120	41	44	47	51	1,695	1,821	1,993	2,138	4	49	9.3	10.0	10.7	11.6	769	826	904	970	665 SS		
		84	89	97	103	3,351	3,720	4,100	4,368			19.1	20.2	22.0	23.4	1,520	1,687	1,860	1,981	8120 SS		
	130	35	37	41	43	1,617	1,743	1,915	2,061		54	7.9	8.4	9.3	9.8	733	791	869	935	665 SS		
		66	72	80	86	2,974	3,239	3,611	3,956			15.0	16.4	18.2	19.5	1,349	1,469	1,638	1,974	8120 SS		
	140	30	32	35	37	1,535	1,662	1,836	1,982		60	6.8	7.6	7.9	8.4	696	754	833	899	665 SS		
		52	57	64	71	2,596	2,862	3,216	3,540			11.8	12.9	14.5	16.1	1,178	1,298	1,459	1,606	8120 SS		
	160	17	18	19	21	1,011	1,110	1,242	1,353		71	3.9	4.1	4.3	4.0	459	503	563	614	665 SS		
		44	48	53	57	2,726	2,990	3,346	3,646			10.0	10.9	12.0	12.9	1,237	1,356	1,518	1,654	8120 SS		
	180	12	13	15	17	860	964	1,103	1,217		82	2.7	3.0	3.4	3.9	390	437	500	552	665 SS		
		32	35	40	44	2,316	2,598	2,971	3,280			7.3	7.9	9.1	10.0	1,051	1,178	1,348	1,488	8120 SS		
	50	120	45	48	53	56	1,643	1,768	1,938		2,083	10	49	10.2	10.9	12.0	12.7	745	802	879	945	665 SS
			91	97	105	113	3,300	3,550	3,892		4,183			20.7	22.0	23.8	25.7	1,497	1,610	1,765	1,897	8120 SS
130		38	41	44	47	1,566	1,691	1,862	2,007	54	8.6		9.3	10.0	10.7	710	767	845	910	665 SS		
		75	81	89	95	2,997	3,257	3,740	4,031		17.0		18.4	20.2	21.6	1,359	1,477	1,696	1,828	8120 SS		
140		32	34	38	41	1,486	1,612	1,784	1,930	60	7.3		7.7	8.6	9.3	674	731	809	875	665 SS		
		58	64	71	79	2,628	2,867	3,212	3,558		13.2		14.5	16.1	17.9	1,192	1,300	1,457	1,614	8120 SS		
160		17	19	21	23	978	1,075	1,206	1,316	71	3.9		4.3	4.8	5.2	444	488	547	597	665 SS		
		46	51	56	61	2,635	2,896	3,249	3,545		10.4		11.6	12.7	13.9	1,195	1,314	1,474	1,608	8120 SS		
180		12	14	16	18	830	933	1,070	1,183	82	2.7		3.2	3.6	4.1	376	423	485	537	665 SS		
		33	37	42	47	2,235	2,513	2,882	3,188		7.5		8.4	9.5	10.7	1,014	1,140	1,307	1,446	8120 SS		
60		120	51	55	60	64	1,590	1,713	1,883	2,027	16		49	11.6	12.5	13.6	14.5	721	777	854	919	665 SS
			71	104	122	130	3,247	3,500	3,846	4,139				16.1	23.6	27.7	29.5	1,473	1,588	1,745	1,877	8120 SS
	130	42	45	49	53	1,514	1,639	1,808	1,952	54		9.5	10.2	11.1	12.0	687	743	820	885	665 SS		
		86	92	100	108	3,093	3,347	3,694	3,988			19.5	20.9	22.7	24.5	1,403	1,518	1,676	1,809	8120 SS		
	140	35	37	41	44	1,436	1,561	1,732	1,876	60		7.9	8.4	9.3	10.0	651	708	786	851	665 SS		
		66	73	81	87	2,620	2,903	3,233	3,703			15.0	16.6	18.4	19.8	1,188	1,317	1,466	1,680	8120 SS		
	160	18	20	22	24	943	1,040	1,170	1,279	71		4.1	4.5	5.0	5.5	428	472	531	580	665 SS		
		49	54	60	65	2,543	2,801	3,151	3,445			11.1	12.3	13.6	14.8	1,154	1,271	1,429	1,563	8120 SS		
	180	13	14	17	19	799	901	1,035	1,148	82		3.0	3.2	3.9	4.3	362	409	469	521	665 SS		
		35	39	44	49	2,152	2,427	2,791	3,093			7.9	8.9	10.0	11.1	976	4,401	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 60°F (33°F). Consult factory if less than 60°F (33°F) increase is required or a set temperature of below 120°F (49°C) is required.

# Steam Piping Installation of a Single Unit

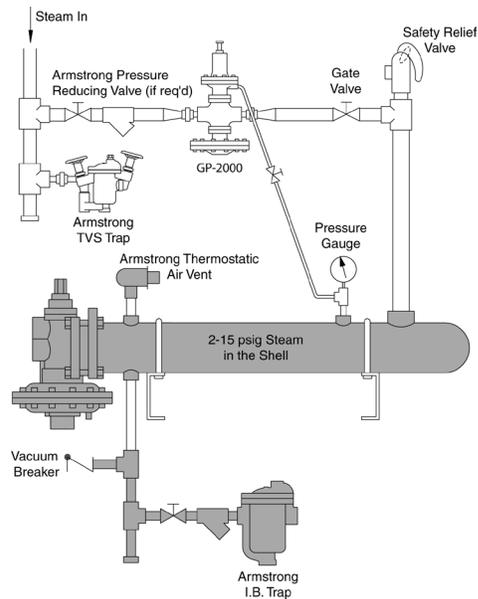
## NOTICE:

No water heater will work satisfactorily if improperly installed and operated. These instructions contain important information for the installation and adjustment of the Flo-Rite-Temp® Water Heaters. Read these instructions carefully before installing this unit. **FAILURE TO ADHERE TO THESE INSTRUCTIONS COULD RESULT IN SERIOUS BODILY INJURY OR PROPERTY DAMAGE.**

## Single and Double Wall

**NOTE:** FLO-RITE-TEMP is provided with (1) one Armstrong Steam Trap and Thermostatic Air Vent (shaded). All other items shown not included.

**NOTE:** Units may be piped in parallel for larger capacity requirements. See Fig. 17-1 for an example of parallel unit installation.



The unit includes the mixing valve mounted to the heat exchanger, channel iron and U-bolts mounted, thermostatic air vent installed on the heat exchanger, a water pressure pop off valve integral to the unit control valve and a separate Armstrong Inverted Bucket Steam Trap.

# Steam Piping Installation

Refer to Figure 2-1.

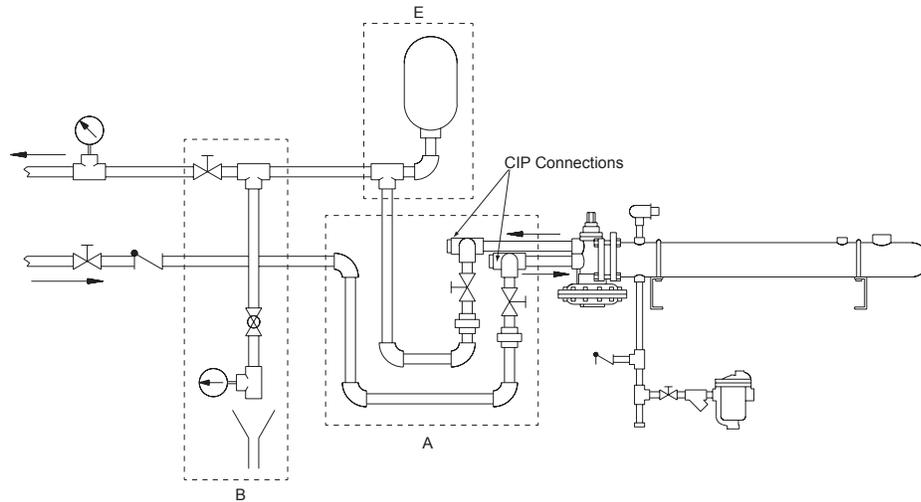
1. Install the Flo-Rite-Temp® with adequate room to allow for tube bundle removal when cleaning is required. See Table 12-1 for specific dimensions.
2. If 2-15 psig of steam is available a pressure reducing valve is NOT required. If a pressure reducing valve is required, an Armstrong Inverted Bucket Steam Trap is recommended to drain condensate at the inlet of the pressure reducing valve.
3. An Armstrong Y-strainer should be installed before the pressure reducing valve to reduce the chance of dirt fouling.
4. If an externally piloted pressure reducing valve is used, the control pipe should be pitched away from the PRV and installed at the pressure gauge on the shell of the heat exchanger.
5. A steam safety relief valve should be used prior to the heat exchanger if either or both of the following conditions exist. (1) If the maximum steam pressure could exceed the minimum water pressure in the tubes, or (2) The maximum steam pressure could exceed 150 psig (the maximum steam pressure rating of the shell).

**IMPORTANT -Steam supply pipe size coming to the heat exchanger should NOT be smaller than the steam connection supplied on the heater, otherwise steam flow could be restricted. If a pressure reducing valve is used, installation should be as close as possible to the Flo-Rite-Temp. Downstream piping from the Pressure Reducing Valve should be expanded immediately after the PRV to accommodate the expanded volume of steam.**

6. To vent start-up air, an Armstrong Thermostatic Air Vent is included and installed on the top connection, opposite the trap drain connection of the heat exchanger. This discharge can be piped to drain or the floor if preferred.
7. Install a vacuum breaker in the piping between the heat exchanger drain connection and the steam trap. This will prevent improper draining of the heat exchanger caused by a possible vacuum forming when the steam is shut off.
8. Install a suitable steam pressure gauge in the 1/4" coupler located in the top mid section of the heat exchanger shell. This gauge will help diagnose pressure problems should they occur. This port may also be used for a PRV external control pipe if a PRV is required.

# Water Piping Installation

Figure 12-1



1. The hot and cold pipe should drop a minimum of 18" immediately out of water heater (See Fig. 3-1A). These loops will act as a thermal check valve or heat trap to prevent the conduction of heat through the water from the unit during inactive times.
2. Isolation valves and hose connections added to both the inlet and outlet water supplies will allow for Clean-In-Place equipment to be utilized.
3. Use pipe unions on both the water inlet and outlet to allow ease of water heater mixing valve removal for maintenance and removal of the tube bundle for cleaning (See Fig. 3-1A).
4. For adjusting the unit, an isolation valve and hot water by-pass to drain should be installed close to the unit down stream from the thermal loops and prior to the recirculation loop (if one is used), See Fig. 3-1B. This allows for quick and easy setting of the Flo-Rite-Temp® by one person. By isolating the unit from the hot water system, flow can be controlled to drain through the globe valve while monitoring outlet water temperature during low and high flow adjustments on the water heaters mixing valve.

**Minimum line sizes to drain should be as follows: model 415 = 3/4", model 535 = 1", model 665 = 1-1/4", model 8120 = 2".** Line sizes smaller than these will not allow sufficient flow for making high flow settings on the mixing valve.

6. A water temperature gauge should be installed directly after the by-pass drain valve. This thermometer is only used for initial temperature adjustments of the Flo-Rite-Temp® or troubleshooting the unit.

**NOTE:** Expansion tanks should be used in on/off demand applications where there is a short duration of time from high flow to no flow of water, i.e., a shut off time of 10 seconds or less.

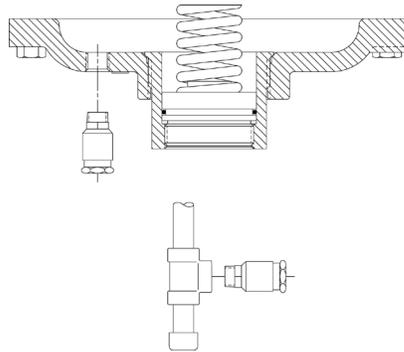
# Pop-Off Valve Installation

1. Thread relief valve into the 1/4" NPT port located on the lower diaphragm half near the spring chamber. See drawing 4-1.
2. Tighten with a 3/4" wrench. Warning: Do Not Over Tighten. Distortion can result causing the relief valve not to seat.

**Note:** The discharge of the relief valve is 1/4" FPT and can be piped over to a drain to prevent the relief valve discharge from going onto the floor underneath the Flo-Rite-Temp®.

**Note:** The function of this pressure relief valve is to relieve any excess pressure on the water side of the Flo-Rite-Temp® resulting from system water hammer or water expansion pressure due to water heating. If the problem is severe, water hammer arrestors should be placed on all equipment with fast closing water valves. Expansion tanks should be used for all expansion pressure problems. The relief set point of this valve is 165 psig.

Figure 13-1

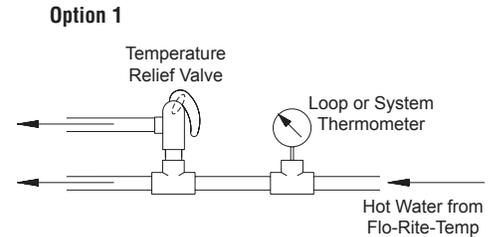


**Note:** For hard water applications, pipe pop-off valve into dirt leg.

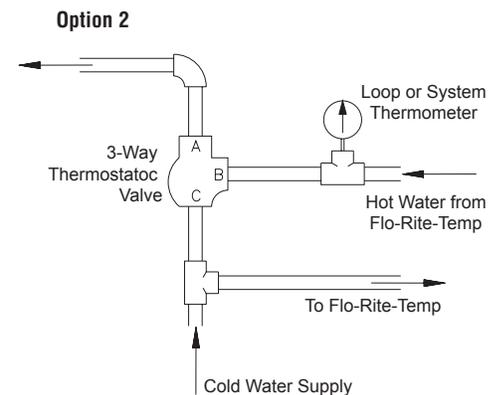
# Optional Thermostatic Controllers and Safety Equipment

See Fig. 3-1E for location of each option within the system. All options would be installed downstream of the water heater in the outgoing recirculation loop, if one is present, or downstream of the hot water thermal loop if recirculation is not used but always before the first hot water take off from the system.

**Option #1** A temperature relief valve set at roughly 15-30 degrees above that of the Flo-Rite-Temp® will help prevent any chance of overheated water reaching the faucets. (NOTE: Normally unit will fail closed and either no water or only cold water will flow from the unit.)

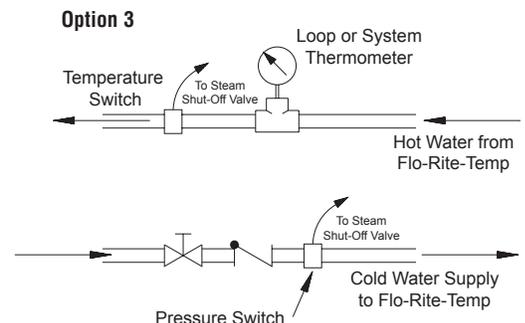


**Option #2** A 3-way blending valve with a set point 10-30 degrees above that of the Flo-Rite-Temp® will help prevent the chance of overheated water reaching the faucets in the event of unit failure. Under normal operating conditions the hot water flows straight through the blending valve from Port B to Port A. But in the event of an overheated situation, the blending valve will open Port C to add sufficient cold water to maintain a constant temperature. (NOTE: The blending valve should be sized to handle the maximum flow of the system).



**Note:** The Armstrong Flo-Rite-Temp® comes supplied with a 1/4" NPT water pressure relief valve. The standard valve has a cracking pressure of 165 psig. Installation instructions (See AY-700) are supplied with each heater. The valve is a self relieving and self seating valve which will open due to thermal expansion or hydrolic shock continuous or intermittent discharge of this valve while heater is in service could indicate a system pressure problem. See note for (Fig. 31F) on previous page for possible solution.

**Option #3** A temperature switch installed well downstream of the Flo-Rite-Temp® outlet on a non-recirculated system or just into the outgoing recirculated system loop on a recirculated system, with a set point 15-30 degrees above that of the Flo-Rite-Temp® will help prevent the chance of overheated water reaching the faucets in the event of system problems. This switch can be used to turn off the steam supply to the heater in the event of overheating. The most economical way to accomplish this is with a solenoid on the PRV. A full ported motorized valve on the steam supply line may also be used. Option 3B. Along these same lines, a pressure switch installed in the inlet water line would shut down the supply steam on the heat exchanger in the event of water pressure loss, preventing thermal shock and water hammer to the unit.



# Start-Up and Adjusting Procedure

## **IMPORTANT: UNIT START-UP AND SHUTDOWN PROCEDURES**

Its important to remember that water pressure must ALWAYS be greater than steam pressure on the unit to avoid boiling the water in the tubes of the heat exchanger. When starting up a Flo-Rite-Temp® it is very important that the water supply is turned on to the unit before any steam is turned on. Once the unit is up and running, the inlet water valve should never be closed unless the steam is turned off first. When shutting down a unit you should always first shut off the steam and then allow water to run through the unit until it has cooled and completely condensed all remaining steam in the heat exchanger before closing off the supply water to the unit.

## **Adjusting Procedures**

All models of Flo-Rite-Temp®s have two settings which need to be made on initial start-up. One setting must be made at low flow while the other is made at high flows.

**IMPORTANT: Once the low and high flow adjustments have been made, the unit generally need not be adjusted again unless your operating conditions change or a different set point is desired. A significant drop in temperature output or capacity is an indication of a bad diaphragm or that the tube bundle needs to be cleaned. Do not readjust the valve unless isolation of the unit from the system and running water to drain produces poor temperature control. If capacity is minimal, check the diaphragm or clean the bundle but do not readjust the control valve.**

## **Start-Up and Adjusting Procedure for Model 415**

1. Before turning on the steam to the Flo-Rite-Temp®, begin by opening the water supply valve to the unit and checking for water leaks at the unit or any of the associated piping.
2. If the unit is connected to a system which has a recirculation loop and pump, be sure the pump is turned off and the isolation valve on the leg of piping going from the diverting valve back to the inlet of the Flo-Rite-Temp® is closed (this is the isolation valve downstream of port "B" of the thermostatic diverting valve).
3. Close the isolation valve on the hot water outlet of the unit and open full and close several times the throttling bypass valve to drain to purge all the air from the Flo-Rite-Temp®. (See Fig. 3-1B). This process also primes the units lower diaphragm area with water. Failure to do this prior to initial adjustment can result in inaccurate settings and poor results.
4. Throttle the bypass valve to drain so that a constant 3 gpm of flow may pass to drain.
5. Slowly open steam valve or adjust the pressure reducing valve to allow 2 - 15 psig of steam pressure on the unit.

(CAUTION: always make sure there is water pressure on the unit before adding steam. Failure to do this will cause severe hammering of the unit and possible damage).

6. Make sure that the steam trap draining the unit is functioning properly and allow the entire unit to come up to temperature for at least three to five minutes while passing the 3 gpm of water flow to drain before beginning the adjustment of the unit.
7. Locate the low and high flow adjustments on top of the mixing valve hidden under the hex bonnet (see Fig. 7-1). Before beginning adjustments, check to make sure the high flow adjustment is fully open. To do this start by pressing down on the high flow adjustment when water pressure is present on the unit and there is no water flow through the unit. This should only depress about 1/8". If it pushes in further, turn the adjustment stem counter clockwise to open. Check every turn until there is only 1/8" travel to the high flow stem when pushed down.

*Note: with water pressure on the unit the stem should pop back up after depressing it. If the high flow adjustment stem will not depress at all the valve is opened too far and you must turn the adjustment clockwise until there is 1/8" travel downward to the stem.*

8. With the unit now isolated from the hot water system and all flow of water being directed to drain at 3 gpm, let the temperature stabilize.

9. Monitor the outlet temperature on the gauge located in the bypass to drain (see Fig. 3-1B). Place an adjustable wrench on the flats of the low flow adjustment (see Fig. 7-1). Turning clockwise raises the discharge temperature and counter-clockwise lowers the discharge temperature. Make the appropriate adjustment to achieve the desired set point. For example if a set point of 140°F is desired and the temperature reading is 155°F, you must turn the low flow adjustment counter-clockwise to lower the set point temperature from 155°F down to 140°F.

**IMPORTANT - When making the low flow adjustment the high flow adjustment shaft SHOULD rotate with the low flow adjustment. If it does not do so, you will have to turn it by hand while making the low flow adjustment. Allow the unit to stabilize to be sure that the unit will remain at the desired set point. The low flow is now adjusted and should not be readjusted.**

10. To make the high flow adjustment, SLOWLY increase the flow of water through the unit to drain while monitoring the outlet thermometer. When the outlet temperature has dropped by approximately 10 °F below set point for a Model 415E, make your high flow adjustment while maintaining that flow.
11. Place a small screw driver or center punch through the hole in the high flow adjustment stem (see Fig. 7-1) and turn it in a clockwise direction. This will start to close the valve restricting the cooling water and cause the outlet water temperature of the unit to rise. Continue until the outlet temperature is back up to your required set point.

**IMPORTANT - When making the high flow adjustment the low flow adjustment SHOULD NOT rotate with the high flow adjustment. If it does, you will have to hold it stationary while making your high flow adjustment.**

12. The unit is now adjusted.

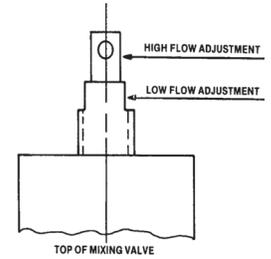
**IMPORTANT - If for any reason you must readjust the unit, you will first have to return the high flow adjustment back to its full up position as stated in point # 7.**

# Start-Up and Adjusting Procedure for Model 535EP, 665SEP, and 812Pop-Off Valve

Follow all the steps 1-6 as stated in the adjustment procedures of the model 415.

7. Locate the low flow temperature adjustment (LFT) and the high flow temperature adjustment (HFT) on top of the mixing valve hidden under the hex bonnet (See Fig. 7-1). Before beginning adjustments, check to make sure the LFT is fully closed. To do this, turn the LFT clockwise until it stops. Also make sure the HFT is fully open. To do this start by pressing down on the HFT when water pressure is present on the unit and there is no water flow through the unit. The HFT should only depress about 1/8". If it pushes in further, turn the HFT stem counter clockwise to open. Check every turn until there is only 1/8" travel to the HFT when pushed down (Note: with water pressure on the unit the stem should pop back up after depressing it). If the HFT stem will not depress at all the valve is opened too far and you must turn the adjustment clockwise until there is 1/8" travel downward to the stem.
8. With the unit now isolated from the hot water system and all flow of water being directed to drain, slowly increase the water demand to approximately 3/4 of the maximum capacity according to the capacity chart on page 13. When starting a cold system, you should take at least 2 to 3 minutes to slowly increase to this demand. This will allow time for the steam piping feeding the unit to come up to temperature, pressure and purge itself of excess condensate.
9. Place a small screwdriver or center punch through the hole in the HFT adjustment and slowly turn the HFT to change the temperature to the desired set point. Close (clockwise) the HFT to raise the outlet water temperature. Allow adequate time for the water temperature to stabilize. This could take several minutes if the piping is cold and the measurement point is far from the unit.

Figure 17-1.



**IMPORTANT: When making the HFT adjustment, the LFT adjustment SHOULD NOT rotate with the HFT adjustment. If it does, you will have to hold it stationary while making your HFT adjustment.**

10. Lower the water flow rate to 3 gpm. The LFT adjustment is currently fully closed (see step 8). Slowly open (counterclockwise) the LFT to lower the outlet water temperature to the desired set point. Allow adequate time for the temperature to stabilize. This will take longer since the flow rate is so small.

**IMPORTANT: When making the LFT adjustment, the HFT adjustment shaft SHOULD rotate with the LFT adjustment. If it does not do so, you will have to turn it by hand while making the LFT adjustment.**

11. Recheck the outlet water temperature at 3/4 of the maximum demand it will see. Adjust if necessary. Opening the HFT (counterclockwise) will lower the temperature and closing the HFT (clockwise) will raise the temperature. Note: You may want to fine tune the HFT adjustments during normal operation of the unit at heavy demand. If outlet temperature is slightly low, turn HFT clockwise to raise it. This should only be done during the initial service of the unit or when the unit has been cleaned. Never attempt to re-adjust the unit with a dirty tube bundle - always clean tube bundle first. The unit is now adjusted.

**IMPORTANT: If, for any reason, you must readjust the unit, you will first have to return the LFT adjustment to the fully closed position as stated in step 8).**

**CAUTION: When putting a heavy load on the heat exchanger, watch the steam pressure gauge. This pressure should not be permitted to fall below 2 psig. If it does and severe water hammer develops, reduce the load by closing some of the faucets or shut the system down. When steam pressure drops under heavy load and hammering occurs, not enough steam is getting to the unit. This can be a result of an undersized reducing valve, lack of boiler capacity or restrictive steam lines. Hammering can also be caused by a loss of water pressure where the water pressure in the unit falls below the pressure of steam. This condition is usually caused by improper shutdown of the unit or someone closing the inlet water valve with the steam pressure still on the unit.**

# Flo-Rite-Temp® Recirculation System Piping and Operation

Because of its relatively small size and compactness, the Flo-Rite-Temp® can easily be installed close to the point of water use eliminating the need for a recirculation system.

In applications where water heaters are located in basements or utility rooms and feed an entire building or wing a recirculation system or loop must be utilized to assure instantaneous hot water to all usage points.

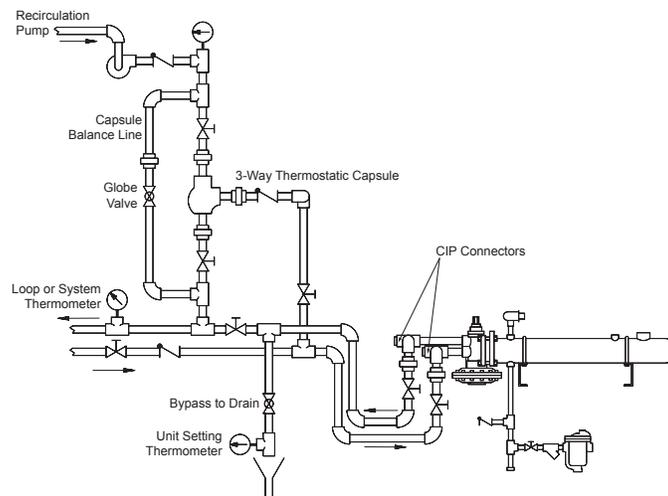
The recirculation system is made up of several different components designed to work together to maintain the temperature of the water in the loop at times of low or no flow.

**Recirculation pump** - This is a constant GPM pump that runs continuously regardless of the hot water demand from the loop. Its function is to continually recirculate the water in the loop in order to maintain the temperature during low or no flow conditions. As a rule of thumb, the capacity of the pump should be approximately 10 to 15 percent of the maximum capacity of the Flo-Rite-Temp® and be able to overcome any head found in the loop. The recirculation pump however, may be larger than 15 percent. But when a larger pump is used, a full line size bypass with a globe valve must be piped to divert most of the flow around the thermostatic capsule.

**Three-way Thermostatic Capsule** - This device has a set point roughly 20 degrees below the set point of the Flo-Rite-Temp® and will maintain the temperature in the loop between the set point of the capsule and the set point of the Flo-Rite-Temp®. The capsule senses the temperature of the recirculated water and compares it with its pre-set temperature. If the temperature in the loop drops below the capsule's set point because of radiation loss from the piping and no hot water demand from the loop, then the capsule begins to divert some of the loop's flow to the inlet of the Flo-Rite-Temp® (ports A to B) for reheating. This diversion will bring the temperature of the loop back up to its required temperature. Once the temperature in the loop is over the capsule's set point all flow from the recirculation pump now goes straight through the capsule (ports A to C) and the return water is fed back to the hot water supply line. To regulate flow to the capsule, a balancing/bypass line with globe valve is required.

This diverting recirculating system eliminates the need for aquastats and any electrical wiring. It is a self contained, self regulating system that controls the temperature of the water in the loop during low or no hot water demand situations. When there is a demand for hot water the temperature of the water introduced into the system is instantly controlled by the Flo-Rite-Temp® feed forward mode of operation.

Figure 18-1.



# Flo-Rite-Temp® Accumulation System

For peak load conditions or to avoid large intermittent steam demands

The Flo-Rite-Temp® water heater accumulation system is designed to provide a specified volume of accumulated hot water for short duration peak loads or when steam is in short supply and a recovery time can be tolerated. During periods of low or no demand, the water in the accumulator tank is heated to the set point temperature by the Flo-Rite-Temp® water heater.

An accumulator or large storage tank is installed in series with the Flo-Rite-Temp® water heater. Cold water is piped to the inlet of the water heater and into the bottom of the accumulator tank. Hot water flows from the Flo-Rite-Temp® directly to the accumulator tank through a pump that is controlled by an aquastat. When the pump is off the flow goes to the accumulator via a bypass around the pump. This would occur when there is hot water demand and the temperature in the tank is at set point.

When the system is started the water in the accumulator tank is cold which causes the aquastat to turn the pump on. Water flows out of the bottom of the tank to the inlet of the Flo-Rite-Temp®. The water continues this cycle until the aquastat in the tank senses the appropriate temperature. At that time the pump shuts off and the water is ready for use. The globe valve on the bottom of the accumulator tank should be adjusted at full system demand so that a pressure differential of approximately 8 psi is read across the Flo-Rite-Temp®.

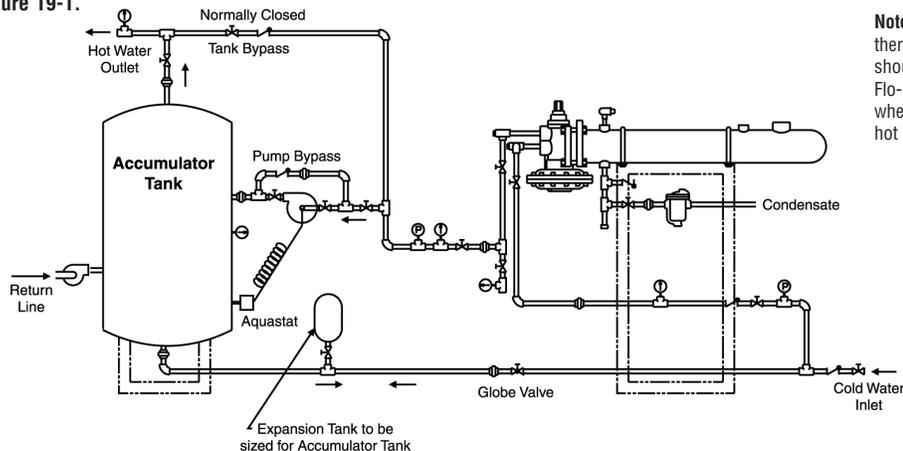
In operation, hot water is drawn off the top of the tank at the same time as cold water enters from the bottom and hot water from the Flo-Rite-Temp® enters the tank from the side. When the peak load stops and the aquastat senses the cooler water in the tank, the pump starts and the heating process begins another cycle.

A bypass line from the heater to the hot water demand is shown and is normally kept closed. When the accumulator tank requires maintenance this bypass allows the tank to be isolated, with hot water being supplied by the Flo-Rite-Temp® only.

## Advantages of the accumulation system are:

- Accumulation tank temperatures are restored over a period of time avoiding large intermittent steam demands.
- Providing the Flo-Rite-Temp®'s safety features to the entire system.
- Providing accurate hot water temperature control.
- Providing a back up alternative during tank maintenance.
- To allow accumulator tanks to be relatively small in size because hot water demand is supplemented by the Flo-Rite-Temp®.

Figure 19-1.



**Note:** Position of system thermometer. Thermometers should not be placed between Flo-Rite-Temp and "T" fitting where 3-Way valve ties back into hot water outlet.

# Flo-Rite-Temp® Tempered Water Systems

## For Safety Shower/Eye Wash Stations

The problem which faces many companies today is how to safely warm water to be used effectively in a drench shower or safety shower situation.

Storage tank units can run out of warm water causing people to go into possible shock due to cold water exposure or to end the shower before proper flushing has taken place. Also, because the water in the tank is only heated to a temperature range of 65 to 95 degrees F. there is the potential and risk of legionella bacteria forming inside of the tank. Lastly, tank systems are feedback systems which can cause severe overheating of the water when thermostatic elements fail causing personal injury.

The solution is to use the Armstrong Flo-Rite-Temp tankless instantaneous feedforward water heater in series with a self-contained fail safe thermostatic mixing valve.

### How the System Works

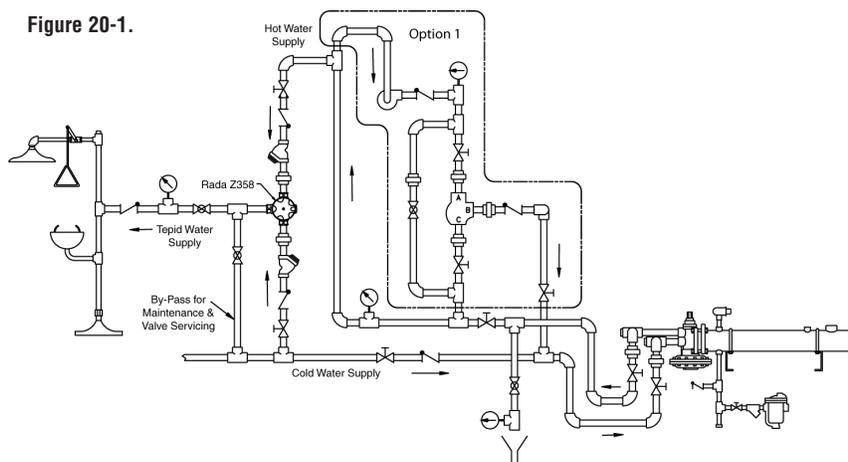
The system, when piped as shown in the drawing, will provide a safe, continuous and dependable source of accurately controlled warm water.

Incoming cold water is heated between 120 to 130 degrees F by the Flo-Rite-Temp. (The unit is set to provide a constant supply of hot water at an adjusted set point within this temperature range, usually the lowest set point of 120 degrees is used). The 120°F water can be piped to the Rada Z358 thermostatic mixing valve which will blend cold water with the 120°F water to make the tepid water for the safety shower/eye wash station. The Rada Z358 valve is equipped to allow cold water to the showerhead in the event of hot water failure.

The Rada Z358 Mixing Valve (see Bulletin ALIB-Z358-20) properly proportions the hot and cold incoming water to obtain a preset delivery temperature to the drench shower head. Demand induced changes are sensed and automatically compensated for by the valve so that shower output temperature remains constant. A recirculation system may also be incorporated in this system and is especially recommended in applications where shower lines are exposed to the cold air or shower heads are a distance from the heater.

Feedforward control in the water heater eliminates the danger of thermostatic element failure and overheating typical in storage tank feedback systems. Because there is no storage tank, there is no danger of legionella forming in the stored warm water. All water is heated instantaneously on the spot, there is no shortage of heated water or shower time limits.

**Option 1:** Water recirculation when heater is servicing a long run to the shower head, more than one shower head, or piping is exposed to cold ambient temperatures.



# Flo-Rite-Temp® Pre-Piped Water Heater Package

This Flo-Rite-Temp® pre-piped water heater package has been engineered for a specific application based upon information provided to the Armstrong Hot Water Group at the time the order was placed.

All Armstrong Flo-Rite-Temp water heaters are individually tested and can be factory temperature set if ordered as such. If the temperature for the application is different that what was ordered, please contact your local Armstrong representative or call (269) 279-3600.

Pre-piped water heater packages come equipped with thermal loops, thermometers, check valves, isolation valves and gauges. Therefore, connections should only be made to the package. All connection points should be clearly tagged with the appropriate utility connection (see drawings on back). A bypass to drain should be labeled for each water heater. This connection is used to either set the temperature or troubleshoot the unit while isolation from the building system. This is its only purpose and is a normally closed valve.

Parallel units are piped with common inlet and outlet pipes so the units can run separately or together. Isolation valves on the inlet pipe should remain open. If you have a stand-by unit, only the outlet water, steam and condensate should be turned off. This will prevent water in the bundle from boiling, should the steam valve leak, by keeping pressure on the water side.

Clean-In-Place (CIP) connections are labeled below. There are used for chemically cleaning the tube bundle and the control valve without water heater disassembly. Temperature probes and/or indicators should never be placed in these ports.

A Recirculation Pump is optional and may be included with this package.

Figure 21-1. P-PR

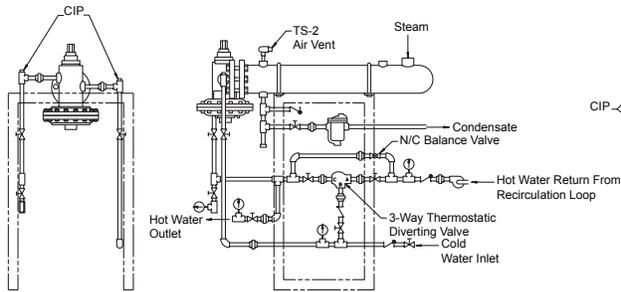


Figure 21-2. PP-PR

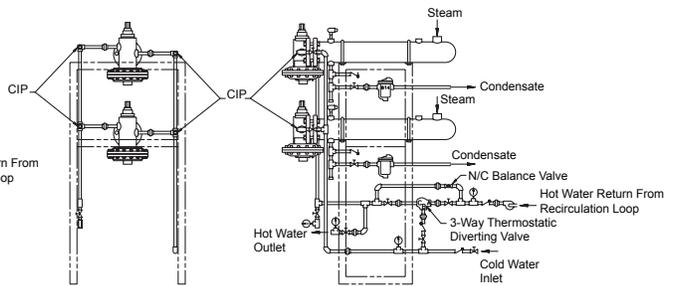


Figure 21-3. P-PTW

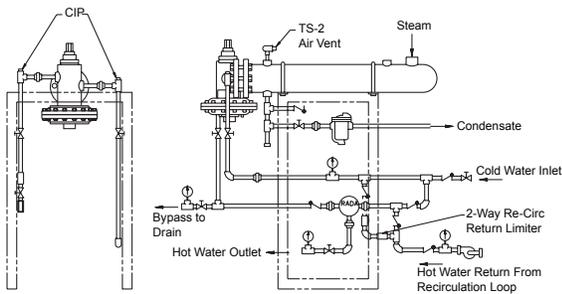
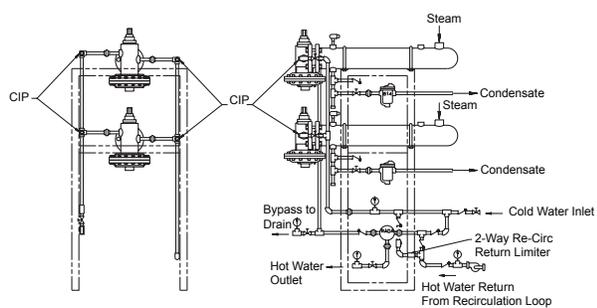


Figure 21-4. PP-PTW



# Troubleshooting Guide

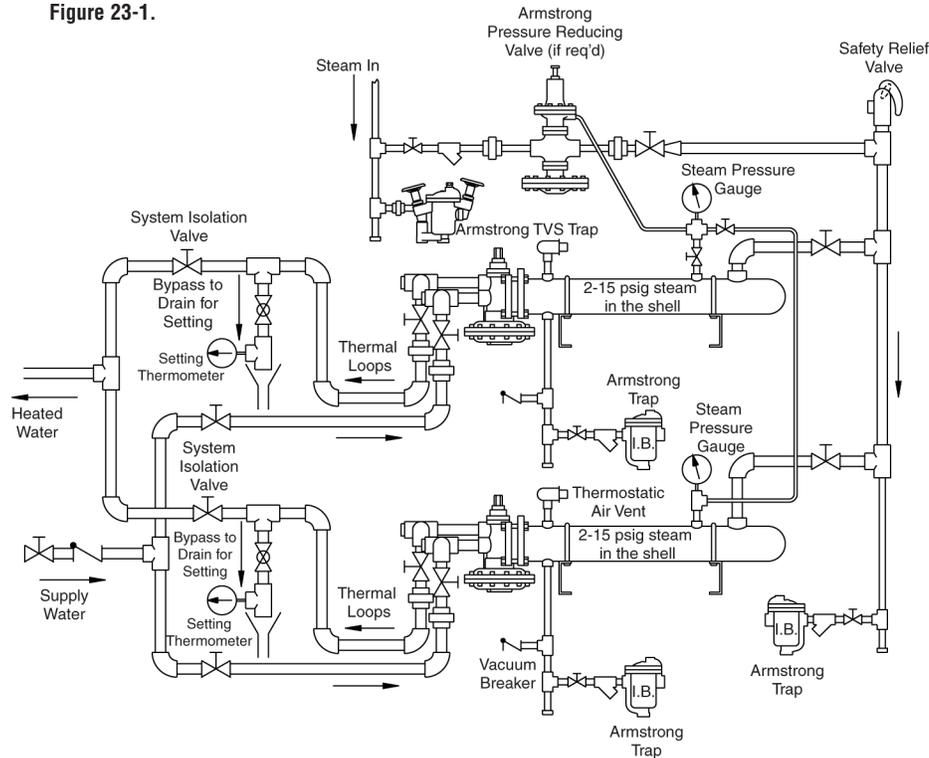
Problem	Causes	Solutions
Only cold water comes out of the unit.	The steam is not turned on to the unit.	Open steam valve to the unit.
	The water tubes in the heat exchanger are plugged.	See Clean-In-Place operating instructions or remove tube bundle and clean.
	The differential pressure sensing diaphragm is ruptured.	Replace the diaphragm.
	The mixing valve is not properly adjusted.	Adjust the unit according to instructions.
Only warm water comes out of the unit.	The steam pressure is low.	Increase steam pressure (2-15 psig).
	Air has accumulated in the shell of the heat exchanger.	Install a thermostatic air vent of the shell.
	The flow is above the rated capacity of the unit.	Make sure unit is sized properly.
	The tubes in the heat exchanger are sealed.	See Clean-In-Place operating instructions or remove tube bundle and clean.
	The mixing valve is not properly adjusted.	Adjust the unit according to instructions.
Extreme hot water comes out of the unit.	The steam pressure is too high.	Decrease steam pressure (2-15 psig).
	Recirculated water is continually diverting through the Flo-Rite-Temp.	Check diverting valve for a stuck or failed thermal capsule.
	The steam is superheated.	Pipe to saturated steam.
	The mixing valve is not properly adjusted.	Adjust the unit according to instructions.
No water comes out of the unit.	The inlet valve on the water supply is closed.	Open valve.
	There is no demand for hot water.	Wait till demand is present then re-check.
The unit hammers and bangs during operation.	The shell of the heat exchanger is not properly drained.	Make sure steam trap is working and properly installed. Make sure shell is level to floor. Do not elevate condensate if pressure is low.
	The steam pressure has dropped or a vacuum has formed.	Increase pressure and install vacuum breaker at shell drain (Figure 1-1).
	The water pressure had dropped below that of the steam pressure and steam is forming inside of the water tubes.	Install a pressure switch on water inlet to shut off steam on a drop in water pressure.

## Disassembly

**Control Valve** - All maintenance on the valve should be done by a factory trained product specialist with the exception of replacing the pressure sensing diaphragm. To replace the diaphragm remove all nuts and bolts from the bottom cover. After removing the bottom cover, remove the lock nuts from the bottom of the valve shaft. You will need to hold the platter to prevent the assembly from spinning, or hold the stem with large a slotted screw driver in the slot at the bottom of the stem. After removing the nuts, slide the platter off, then the old diaphragm, being careful not to lose the brass washer above the diaphragm. To reassemble follow the reverse order. Make sure when tightening the cover bolts that you use a criss-cross pattern.

**Single Wall Heat Exchanger** - To remove the tube bundle for cleaning. Simply unbolt the mixing valve from the shell and move it out of the way. The tube bundle can be pulled out from the valve end (see Table 12-1 for clearance dimensions). Once the tube bundle is out of the shell, unbolt the end cap on the floating head end and remove to provide straight through cleaning. Reassemble in the reverse order (On the Model 665 dual stem unit when reassembling the tube bundle, make sure that the "TOP" indicator stamped on the cover and both ends of the tube bundle line up and bundle is reinstalled in the shell with both "TOP" indicators facing up). New gaskets will be required for this procedure. (Order heat exchanger gasket kit for model number.)

Figure 23-1.



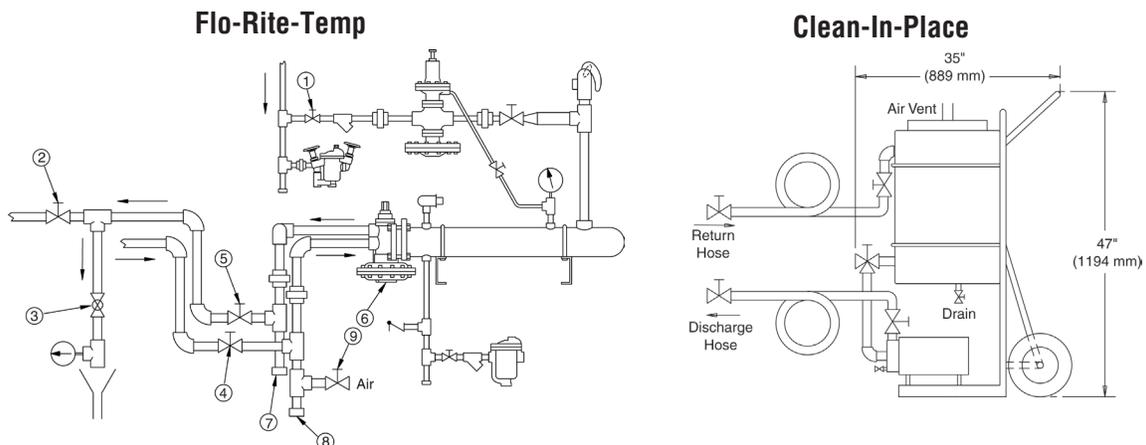
**NOTE:** Depending on capacity requirements a parallel water heater installation may also require (2) two PRV's in parallel. Single wall installation shown - Double wall would be similar. See your Armstrong Representative for proper reducing valve application.

# Clean-In-Place Operating Instructions

When there is a noticeable drop in the Flo-Rite-Temp's — hot water capacity, temperature, or an increased water pressure drop across the unit — tube bundle scale removal should be considered using the commercially available product called RITE-Qwik\*.

Tube bundle scale removal can be accomplished as follows:

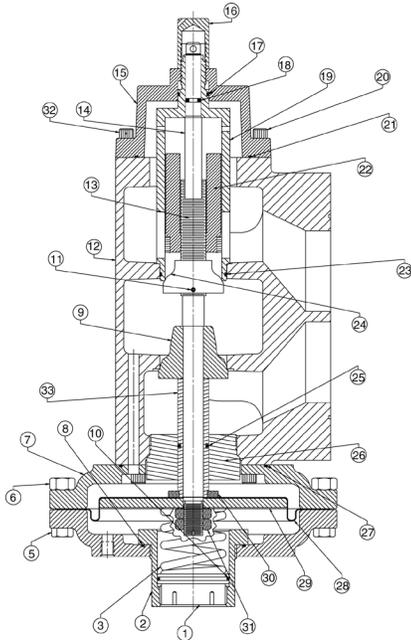
- Step 1** Shut off steam supply valve #1 to the Flo-Rite-Temp.
- Step 2** While the water pressure is still ON and the steam is OFF, run the Flo-Rite-Temp for (10) ten minutes or until the outside of the unit is cool to the touch.
- Step 3** Shut the water inlet valve #4 OFF and water outlet valve #5 OFF; open cleaning connection outlet #7. Connect air hose with regulator to valve #9. Turn air on slowly to approximately 5 psi. Increase to maximum of 25 psi. Leave air pressure on until water stops coming out of connection #7. Turn air (valve #9) off. Open cleaning connection inlet #8 and remove the pop-off valve or inlet pipe plug #6 from the lower diaphragm cover of the control valve. Let the remaining water drain by gravity from the Flo-Rite-Temp.
- Step 4** After all the water has been drained, reinstall the pop-off valve or pipe plug #6 into the lower diaphragm cover of the control valve.
- Step 5** With hose valve closed connect return hose A of the Clean-in-Place to the outlet cleaning connection #7 of the Flo-Rite-Temp.
- Step 6** With hose valve closed connect discharge hose B of the Clean-in-Place to the inlet cleaning connection #8 of the Flo-Rite-Temp.
- Step 7** Start pump. Open ball valve of discharge hose B of the Clean-in-Place.
- Step 8** Slowly open the ball valve on return hose A and watch for foaming in the tank.
- Step 9** Clean-in-Place is now circulating cleaning solution through the Flo-Rite-Temp. Periodically check the solution to see if it has changed color or quit fizzing. If the cleaning solution has stopped fizzing and has not changed color, the Flo-Rite-Temp is clean. You may save the remaining unspent solution for your next job. If the solution quits fizzing and the color has changed, add new cleaning solution. Continue circulating in the same manner as above. Do not exceed a maximum circulation time of (3) three hours.
- Step 10** Shut-off pump. Close discharge hose valve B on Clean-in-Place. Open air (valve #9). Turn air on slowly to approximately 5 psi. Increase as Clean-in-Place fluid returns to tank. (Maximum air pressure 25 psi.)
- Step 11** Leave air blow for approximately 3-5 minutes. This should return most of the fluid to the tank. Close both hose valves.
- Step 12** Disconnect return hose A from the Flo-Rite-Temp outlet cleaning connection #7 and discharge hose B from the inlet cleaning connection #8. Also remove the pop-off valve or pipe plug #6 from the lower diaphragm cover of the control valve. Let the cleaning solution drain by gravity from the Flo-Rite-Temp.
- Step 13** Close valve #2 going into the system and open valve #3 going to the drain.
- Step 14** Open the water outlet valve #5 then open SLOWLY inlet water valve #4. Let the water run for (1) one minute before installing the pop-off valve or pipe plug #6 into the lower diaphragm cover of the control valve.
- Step 15** After the pop-off valve or pipe plug #6 is installed, run water into the drain for (5) five minutes to flush out all of the cleaning solution. Throttle the outlet valve #3 open and closed to purge the air from under the diaphragm.
- Step 16** After flushing the unit, close valve #3 and open the steam supply valve #1 SLOWLY and let the Flo-Rite-Temp heat up.
- Step 17** Set the Flo-Rite-Temp as needed. (This step may not be necessary).
- Step 18** Open valve #2 to the system and monitor the system until the temperature is back to normal.
- Step 19** After use, flush the pump with water to remove the chemical to prevent seal deterioration.



\* RITE-QWIK is a non hazardous chemical cleaner which has been proven effective for removing deposits without harming the FLO-RITE-TEMP internally.

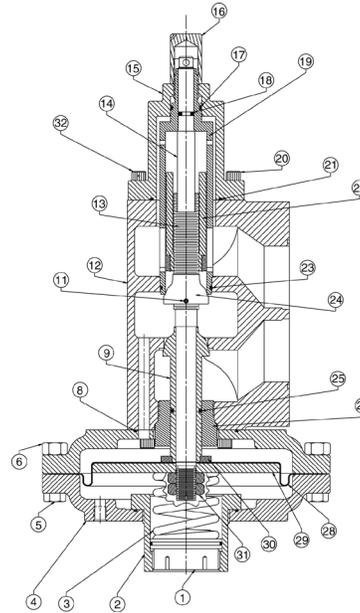
# Control Valve Parts Listing

## 8120 Control Valve



Number	Description
1	Spring Adjustment
2	Spring Housing
3	Spring
4	Lower Diaphragm Cover
5	Diaphragm Bolt (12)
6	Diaphragm Nut (12)
7	Upper Diaphragm Cover
8	O-Ring 2-155
9	Lower Valve
10	O-Ring 2-147
11	Set Screw X2
12	Body
13	Stem
14	HFT Adjuster
15	Top Cap
16	Bonnet
17	O-Ring 2-121
18	O-Ring 2-111
19	Left Adjuster
20	Socket Cap Screw X13
21	O-Ring 2-157
22	Restrictor Assembly
23	O-Ring 2-144
24	Upper Valve Low Temperature
25	Upper Valve High Temperature
26	O-Ring 2-214
27	Stem Guide
28	O-Ring 2-162
29	Diaphragm
30	Diaphragm Supply Disc
31	Jam Nut (2)
32	Socket Cap Scw X1
33	Lower Valve Spacer

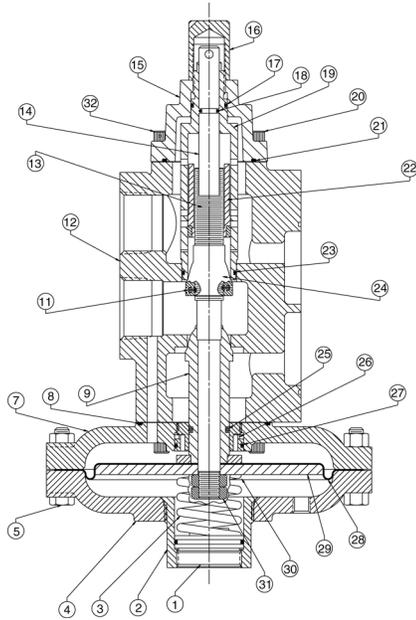
## 665 Control Valve



Number	Description
1	Spring Adjustment
2	Spring Housing
3	Spring
4	Lower Diaphragm Cover
5	Diaphragm Bolt (12)
6	Diaphragm Nut (12)
7	Upper Diaphragm Cover
8	O-Ring 2-155 X2
9	Lower Valve
10	Set Screw X2
11	Body
12	Stem
13	HFT Adjuster
14	Top Cap
15	Bonnet
16	O-Ring 2-121
17	O-Ring 2-111
18	Left Adjuster
19	Socket Cap Screw X11
20	O-Ring 2-157 X2
21	Restrictor Assembly
22	O-Ring 2-134
23	Upper Valve Low Temperature
24	Upper Valve High Temperature
25	O-Ring 2-214
26	Stem Guide
27	Diaphragm
28	Diaphragm Supply Disc
29	Diaphragm Disc
30	Jam Nut (2)
31	Socket Cap Scw X1

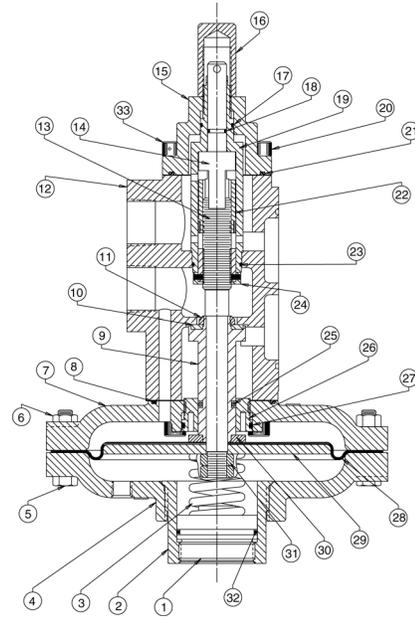
# Control Valve Parts Listing

## 535 Control Valve



Number	Description
1	Spring Adjustment
2	Spring Housing
3	Spring
4	Lower Diaphragm Cover
5	Diaphragm Bolt (12)
6	Diaphragm Nut (12)
7	Upper Diaphragm Cover
8	O-Ring 2-155
9	Lower Valve Low Temperature
9	Lower Valve High Temperature
10	Set Screw X2
11	Body
12	Stem
13	HFT Adjuster
14	Top Cap
15	Bonnet
16	O-Ring 2-119
17	O-Ring 2-111
18	Left Adjuster
19	Socket Cap Screw X11
20	O-Ring 2-147
21	Restrictor Assembly
22	O-Ring 2-128
23	Upper Valve Low Temperature
24	Upper Valve High Temperature
25	O-Ring 2-214
26	Retainer
27	O-Ring 2-135 X2
28	Diaphragm
29	Diaphragm Supply Disc
30	Diaphragm Disc
31	Jam Nut (2)
32	Socket Cap Scev X1

## 415 Control Valve



Number	Description
1	Spring Adjustment
2	Spring Housing
3	Spring
4	Lower Diaphragm Cover
5	Diaphragm Bolt (12)
6	Diaphragm Nut (12)
7	Upper Diaphragm Cover
8	O-Ring 2-153
9	Lower Valve
10	Lower Valve Disc
11	Retainer Nut
12	Body
13	Stem
14	HFT Adjuster
15	Top Cap
16	Bonnet
17	O-Ring 2-118
18	O-Ring 2-112
19	Left Adjuster
20	Socket Cap Screw X7
21	O-Ring 2-138
22	Restrictor Assembly
23	O-Ring 2-025
24	Upper Valve Low Temperature
25	O-Ring 2-210
26	Retainer
27	O-Ring 2-131
28	Diaphragm
29	Diaphragm Supply Disc
30	Diaphragm Disc
31	Jam Nut (2)
32	O-Ring 2-135
33	Socket Cap Scev X1

# Limited Warranty and Remedy

Armstrong-Yoshitake, Inc. ("Armstrong") warrants to the original user of those products supplied by it and used in the service and in the manner for which they are intended, that such products shall be free from defects in material and workmanship for a period of one (1) year from the date of installation, but not longer than 15 months from the date of shipment from the factory [unless a Special Warranty Period applies, as listed below]. This warranty does not extend to any product that has been subject to misuse, neglect, or alteration after shipment from the Armstrong factory. Except as may be expressly provided in a written agreement between Armstrong and the user, which is signed by both parties, Armstrong DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. The sole and exclusive remedy with respect to the above limited warranty or with respect to any other claim relating to the products or to defects or any condition or use of the products supplied by Armstrong, however caused, and whether such claim is based upon warranty, contract, negligence, strict liability, or any other basis or theory, is limited to Armstrong's repair or replacement of the part or product, excluding any labor or any other cost to remove or install said part or product, or, at Armstrong's option, to repayment of the purchase price. As a condition of enforcing any rights or remedies relating to Armstrong products, notice of any warranty or other claim relating to the products must be given in writing to Armstrong: (i) within 30 days of last day of the applicable warranty period, or (ii) within 30 days of the date of the manifestation of the condition or occurrence giving rise to the claim, whichever is earlier. IN NO EVENT SHALL ARMSTRONG BE LIABLE FOR SPECIAL, DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, LOSS OF USE OR PROFITS OR INTERRUPTION OF BUSINESS. The Limited Warranty and Remedy terms herein apply notwithstanding any contrary terms in any purchase order or form submitted or issued by any user, purchaser, or third party and all such contrary terms shall be deemed rejected by Armstrong.

## Special Warranty Periods are as follows:

**Flo-Rite-Temp Instantaneous Water Heater**—The tube bundle shall have a 10-year guarantee against failure caused by materials or workmanship provided by Armstrong but not against gasket failure or damage caused by corrosion, water hammer or lack of proper cleaning.

## **Flo-Rite-Temp Packaged Instantaneous Water Heater**—

Two (2) years from the date of installation, but not longer than 27 months from the date of shipment.

**Flo-Direct Gas Fired Water Heater**—The stainless steel structure and stainless steel internals shall have a 5-year guarantee against failure caused by materials or workmanship provided by Armstrong. Provided only clean potable water is heated.

Installation Date:

Installing Contractor:

Service Dates:



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