Continuous Blowdown Heat Recovery Systems

For Boilers Rated 35 to 250 PSIG

Installation, Operating &Maintenance Instructions

INSTALLATION INSTRUCTIONS

Install any separately packed piping manifolds, pressure gauges and the thermometer according to the diagrams. The blowdown System can be mounted any place convenient to the cold water make-up line, usually near the feed water heater or receiver. Place the Blowdown System so that (a) the internal expansion tube assembly can be withdrawn from the handwheel end of the Proportional Control Valve without breaking the make-up piping and (b) so that the tube bundle of the exchanger can be removed. Be sure the handwheel and thermometer are conveniently placed.

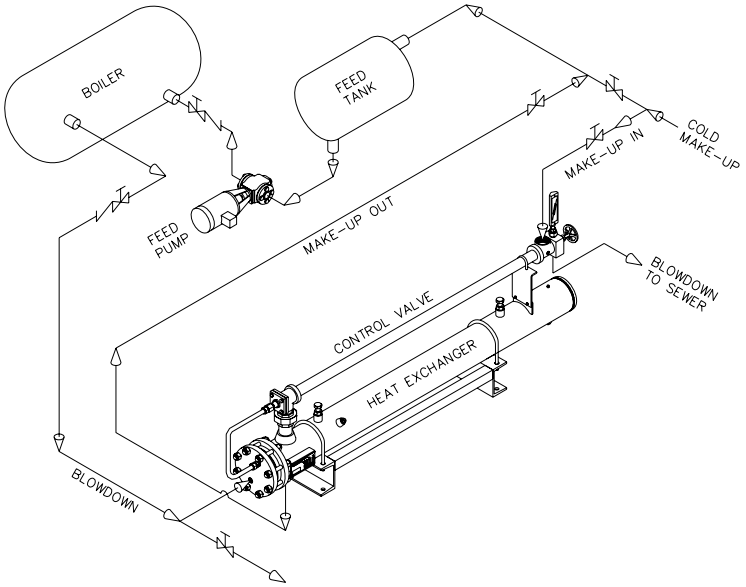
Make-up Piping. Break into the make-up line and install two tees with a valve between them. From these two tees, install two shut-off valves and then pipe the water to the top connection on the handwheel end and from the bottom connection on the other end back to the make-up line. The make-up connections can be bushed down, but not smaller than the main make-up piping.

Blowdown Piping. Use extra heavy pipe one size larger than the Blowdown System. Connect to continuous blowdown connection on boiler to the connection as indicated on the diagrams. Connect the Blowdown outlet connection to an open sewer connection so that the blowdown may be observed. Do not place any valves in this line to the sewer.*

*Note: Do not install any flow regulating valves in Blowdown line between the boiler and Blowdown System installtion of isolation valves is acceptable.

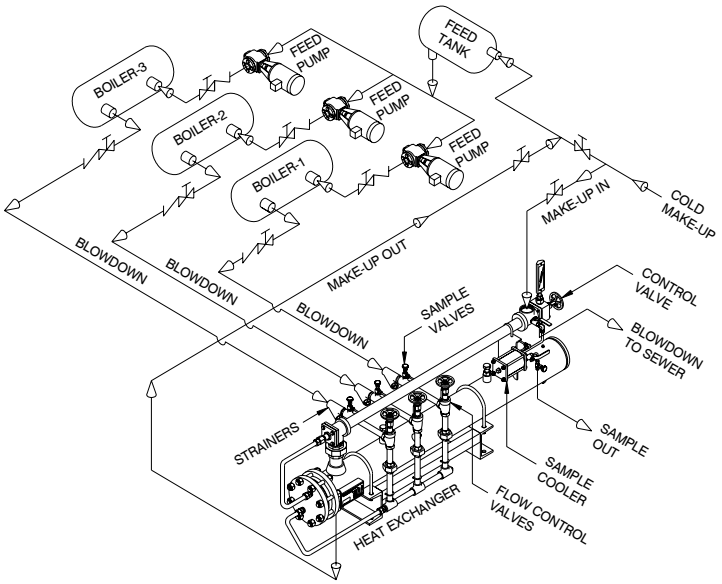
No Continuous Blowdown Connection on Boiler. Install an extra heavy coupling or use any existing connection so that it is on the opposite side or well toward the end compared to the feed water inlet. The best elevation is 4" below the low water level. If in doubt ask the boiler manufacturer about the best location.

BHR-S for Single Boilers. Note that all of the make-up is diverted through the shell of the blowdown unit. Be sure that the piping is large enough to handle the make-up water required. Place the discharge blowdown connection to the sewer so that it is easy to take a sample and easy to measure the rate of flow. This blowdown is cool. The unit is controlled by adjusting the handwheel and observing the thermometer, so see that they are conveniently placed.



MODEL NO. BHR-25 THROUGH BHR-125

BHR-M for Multiple Boilers. These BHR-M are the same as the BHR-S Systems, except they are provided with a flow control valve manifold and a sample cooler. Each BHR-M should be associated with only one feed tank and its make-up line and all of the boilers connected to that feed tank. All of the boilers must operate at approximately the same pressure. Consult the factory for possible exceptions. From each boiler connect a separate blowdown line to each strainer and flow control valve. Note the blowdown must enter the side of the flow control valve and discharge at the bottom. These flow control valves are intentionally installed backward for longer service.



MODEL NO. BHR2M THROUGH BHR-22M

OPERATING INSTRUCTIONS

Models BHR-2S through BHR-22S - For Single Boilers Only. The level of dissolved solids or specific conductance should be adjusted to prevent foaming, priming, scaling, etc. Information can be obtained from water treatment firms on the required level to maintain and the testing method to verify that level. If you do not have the proper equipment to make these tests to determine the condition of your boiler water, we suggest that you purchase a portable conductivity meter to determine how much you should blow down. If your boiler tests too high, blowdown more and if it tests to low you need not blowdown quite as much.

To adjust the amount of blowdown, open or close the handwheel on the thermometer end of the blow-down unit. Turning the handle slightly counter clockwise will increase blowdown as the valve opens; turning the handwheel clockwise will reduce the amount of blowdown. The thermometer in the control unit gives an indication as to the relative flows of the make-up and blowdown. It will aid you in adjusting the handwheel. If you need more blowdown, open the valve enough so the thermometer reads, say 5° higher in steady operation and vice-versa.

The step by step instructions for starting the blowdown unit are:

1. Open two valves in the make-up line to allow the make-up to go to and from the heat exchanger shell; close the by-pass valve in the make-up to force all of the make-up water through the shell.

2. Open or close the handwheel as required to hold a leaving blowdown temperature of approximately 45°F (7°C) above the make-up water for BHR-1 unit, 27°F (-3°C) for BHR-2 units, 21°F (-6°C) for BHR-9 units, when the unit is in steady operation. Check the concentration of the boiler water every few hours until a trend is noted upward or downward. If the trend is toward too high a concentration, open the hand-wheel slightly, 1/8 to 1/4 of a turn. You will note that the blowdown from the unit may flow heavily at times or not at all at other times. This is normal as this is the way the make-up flow is occurring. After several weeks of operation you will find a control point to maintain your boiler concentration and a simple daily check from then on should assure you of a properly blown down boiler.

Models BHR-2M through BHR-22M for Multiple Boilers. The BHR-M will be operated exactly as the BHR-S above, but in addition require the balancing of the flow control valves for the load being carried by each of the boilers.

Proceed with the start up of this unit exactly in the same manner as the single boiler units above with the Tasco Flo Control Valves set in the half open position. The Tasco Flo Control Valve openings must be set in accordance with the approximate load that each boiler is taking. This balancing should be done, however, so that the average valve openings are always one-half. If there are two valves and one is set at a ¼ opening, the other should be set at ¾ opening. If there are three valves and one is set ½ open and another ¾ open, the third one should be about ¼ open. After several days of operation you should be able to balance the boilers so that they all reach approximately the same test. Under known conditions, however, you will want to anticipate variations. For example, if a boiler is to be shut down for several days or months because it is not required, you can turn off the flow control valve from that boiler. Remember the automatic control should be adjusted to hold the average settings of the boilers in question and the hand flow control valve should balance according to the loads that the various boilers carry.

NOTE: BHR-M System will maintain consistent solids control for a boiler system having a make-up valve which closes and opens slowly as the level rises and falls. A snap action valve should be avoided if possible – to avoid the possibility of having to frequently readjust the Proportional Control Valve.

CAUTION
AVOID VIBRATION, EROSION AND CORROSION WHICH ARE THE TYPICAL CAUSES OF TYPE BHR-S FAILURES

Avoid Flash Steam In The Blowdown Water

This destroys the heat exchangers, valves and piping. Even a small amount of FLASH STEAM in the blowdown lines between the boiler and the BHR-S will result in excessive water-steam velocities (example: an 11 psi pressure loss in water @ 138 psig (9.5 bar) and 360°F (182°C) will generate only 0.73% of flash steam – but this small amount of steam will increase the velocity in the blowdown lines by 230%).

Excessive velocity destroys heat exchanger, valves and piping by causing:

a. Erosion failure
b. Vibration which fatigues and ultimately fractures exchanger bundles.
c. Vibration which results in stress corrosion cracking of the exchanger bundles.

PREVENT FLASH STEAM in blowdown line between boiler and BHR-S System by:

a. Using only wide-open gate or plug isolation valves between boilers and BHR-S.
b. Using extra heavy blowdown piping one size larger than the BHR-S inlet connection.
c. Setting Flo Control Valves (for the multiple boiler BHR-S System) so that the average valve openings are always one-half (see page two of SD 1730). Flo Control Valves set in this manner will not generate flash steam.

d. Not insulating the blowdown piping. A small amount of blowdown cooling is necessary to compensate for the line friction loss – so as to avoid flash steam.

Avoid Excessive Tubeside And Shellside Water Velocities

To prevent damaging vibration and erosion. DO NOT EXCEED FOLLOWING GPM VALUES:

Model	Max BD GPM	Max Gross MU GPM
BHR-1S	1.0 GPM (4.5 l pm)	15 GPM (68.2 l pm)
BHR-2S	2 GPM (9.1 l pm)	48 GPM (218.2 l pm)
BHR-4S	4 GPM (18.2 l pm)	48 GPM (218.2 l pm)
BHR-9S	9 GPM (40.9 l pm)	130 GPM (591 l pm)
BHR-14S	14 GPM (63.6 l pm)	130 GPM (591 l pm)
BHR-22S	22 GPM (100 l pm)	180GPM (818.3 l pm)

Do Not Allow Makeup Water To Be Heated Above 140°F to avoid

a. Severe Shellside scaling of the BHR-S Heat Exchanger

b. Liberated dissolved gases which corrode and erode the exchanger, valves, piping and deaerator inlet.

Maintain and adjust the Proportional Control Valve so it will properly proportion makeup to blowdown – to stop overheating of makeup. Replace damaged rubber diaphragms (of the Proportional Control Valve) because undamaged diaphragms are essential for the proper operation of the Proportional Control Valves.

Avoid Contaminating The Makeup With Chloride Ions From Water Treatment Systems

This can cause stress corrosion of stainless steel tubes in the BHR-S Heat Exchanger.

Water treatment systems *(Zeolite softeners and demineralizers) are regenerated with sodium chloride and hydrochloric acid. If not adequately back-washed before returned to service, these systems will heavily contaminate the makeup water with chloride ions. Chloride ions, together with the low pH water from the treatment systems may cause stress corrosion of the stainless steel tubing of the BHR-S heat exchanger and rapid failure.

Operator of water treatment system should measure output water (using conductivity meters, cells, etc.) to verify that a regenerated system is adequately backwashed before returning the water treatment system to service.

MAINTENANCE INSTRUCTIONS

CAUTION

Properly maintain and adjust the Proportional Control Valve so it will proportion makeup to blowdown –to stop overheating of make-up. Overheated make-up results in (a) severe shell-side scaling of the Heat Exchanger and Proportional Control Valve and (b) liberated dissolved gasses which corrode and erode the exchanger, valves, piping and deaerator inlet.

A proper preventative maintenance program includes yearly overhauling and cleaning of the Exchanger and Proportional Control Valve. Failure to do so can result in scaling equipment beyond salvaging. Replacement of the diaphragm every two years or sooner as needed is recommended.

Disassembly And Reassembly

Close blowdown and makeup water valves before disassembly.

Proportional Control Valve

- Remove handwheel block bolts.
- Remove block assembly by separating it at the diaphragm.
- Remove valve plunger.
- Loosen diaphragm from the shell flange.
- Unscrew the valve seat from the expansion tube.
- Remove diaphragm.
- Break unions in blowdown inlet line and move piping out of the way.
- Unscrew pipe nut.
- Protect the threaded end (blowdown inlet) of the expansion tube with a wooden block.
- Loosen tube with light hammer blows.
- Remove tube toward the handwheel end of the the valve.
- After overhaul, reassemble in opposite manner.
- Properly align gaskets and diaphragm during reassembly.

Except for replacement of the diaphragm, the above procedure is not routine maintenance.

Heat Exchanger. Shellside scaling is typically the cause of any required maintenance. Descaling may be chemical and in-place – by circulating inhibited acid through the shellside. Operator should contact water treating chemical for appropriate descaling procedures, agents and apparatus.

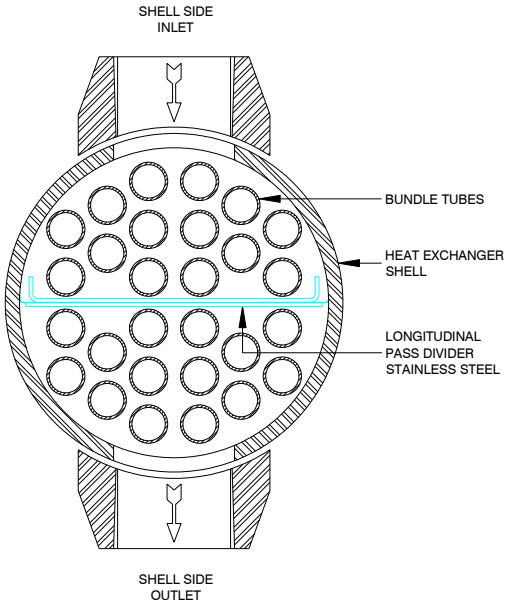
- Disassemble the exchanger
  a. Disconnect blowdown piping.
  b. Remove head bolts, head, pass divider and their gaskets.
  c. Back off the bundle antivibration hold down bolts on the shell.
  Pull out the tube bundle. Use a straight pull when removing the bundle – to avoid damaging the longitudinal pass dividers.

If the shellside is severely scaled:

1. Loosen the bundle free by prying with several bars inserted between tube sheet and shell flange.
2. Use a block and tackle to pull bundle.
3. Pre-soak the shellside with inhibited acid.

• Reassemble in opposite fashion.

a. As the tube bundle is reinserted, position the seals (of the longitudinal pass divider) in the upward direction (toward shellside inlet) per diagram below.



b. Typically, new gaskets are required for reassembly.
c. Torque bolts hand tight in star fashion.
d. Insure alignment of head, pass divider and shell flange and all gaskets.
e. Tighten again in star fashion.
f. Tighten head bolts first, then tighten bundle hold-down bolts ¼ turn past snug.

Overhaul And Repair/General Cleaning

Normal cleaning includes removal of scale and rust from the Proportional Control Valves and the Exchangers. The tubesides (blowdown water side) typically do not collect scale or foreign matter. A fouled tubeside may be cleaned chemically (inhibited acid) or mechanically with manual or rotary bristle brushes (take care not to damage U bends), and with water flushing.

Shellside fouling may be removed chemically (inhibitied acid) or mechanically (scraping, wire brush ing, light sandblasting, etc.).

Do Not Descale With Muriatic Acid (Hydrochloric Acid)

This can cause stress corrosion of stainless shell tubes in the BHR-S heat exchanger. Use an inhibited Sulfamic Acid solution (such as Water Services Division UOP "ALL-MET") in accordance with the manufacturer's recommended procedures.

Proportional Control Valves
- Replace worn or damaged rubber diaphragms (Undamaged diaphragms are essential for proper operation of Proportional Control Valves).
- Reseat the valve as necessary by lapping with a coarse valve grinding compound and a clockwise – counterclockwise rotary motion.
- Replace worn or damaged flange gaskets.

Heat Exchangers

• Make visual examination for suspected leaks in an assembled exchanger as follows:

a. Install a temporary ring flange in place of the head – so that tube ends are exposed

b. Pressurizing the shellside (max. 250 psig [17.3 bar] water or max. 50 psi [3.5 bar] air). If pressurizing with air, use a bubble leak detector solution to detect leaks.

c. Repair minor leaks by one or more of the following actions:

1. Rerolling leaking tube-to-tubesheet joints.
2. Welding holes in tubes and U bends with stainless steel filler rod.

Extensive damage may require returning the exchanger to the factory for repair.

Other Valves – V-Port Flow Control, etc.

• Contact valve manufacturer for instructions regarding cleaning, reseating and repair parts.

Note: Flow control valves are intentionally installed backwards. This arrangement provides greater valve life and does not affect performance.

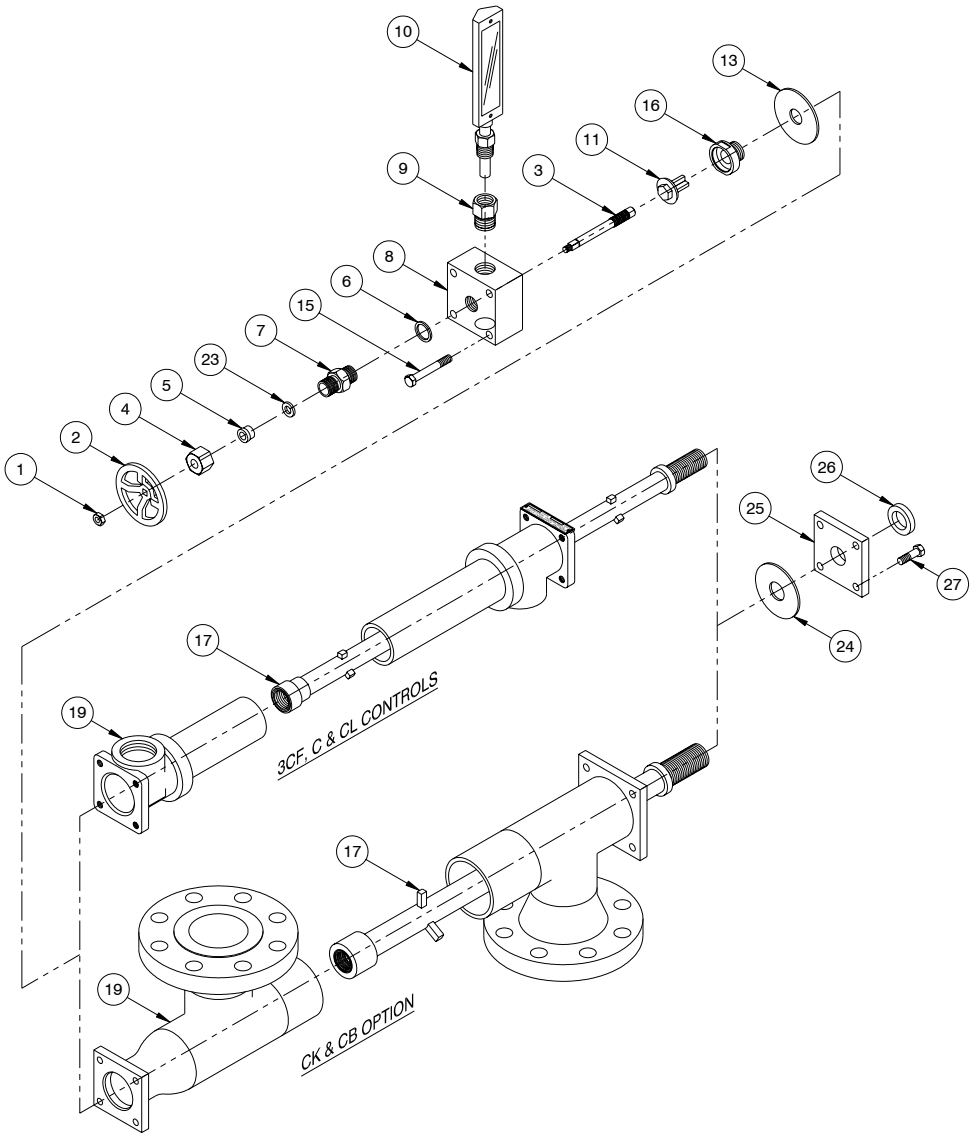
PARTS LIST

COMMON PARTS FOR C, CL CK, AND CB CONTROLS		
ITEM NO.	**DESCRIPTION**	**PART NO.**
1	HandwheelJam nut	797-938
2	Handwheel	797-939
3	Stem	797-940
4	Packing Nut	797-941
5	Packing Gland	797-942
6*	Gasket, Front	797-943
7	Bonnet	797-944
9	Bushing - Thermometer	797-945
10	Thermometer	797-946
23	Packing: 1/8" Square Teflon Impregnated	797-947

SPECIFIC PARTS FOR C, CL, CK AND CB CONTROLS			
ITEM NO.	**MODEL**	**DESCRIPTION**	**PART NO.**
8	C, CL CK	Control Block Body Control Block Body	797-948 797-949
11	C, CL, CK	Valve Plunger	797-950
13*	C, CL, CK	Diaphragm	797-951
15 27	C, CL, CK, CB	Bolts, Standard Hardware Purchase Locally	
16	C, CL, CK	Valve Seat	797-952
17	ANY	Expansion Tube Assembly – Provide Model and Serial Number from Nameplate	
19	ANY	Shell Assembly – Provide Model and Serial Number from Nameplate	

SPECIFIC PARTS FOR C, CL, CK AND CB CONTROLS CONTINUED			
ITEM NO.	MODEL	DESCRIPTION	PART NO.
24*	C, CL	Gasket, Rear	2-00612A
	CK	Gasket, Rear	2-00364A
	CB	Gasket, Rear	2-00657A
25	C, CL	Flange Plate	2-00410A
	CK	Flange Plate	2-00419A
	CB	Flange Plate	2-00412A
26	C, CL	Tube Lock Nut	4-01270A
	CK	Tube Lock Nut	2-00384A
	CB	Tube Lock Nut	2-00383A

*** Recommended Spare Part**



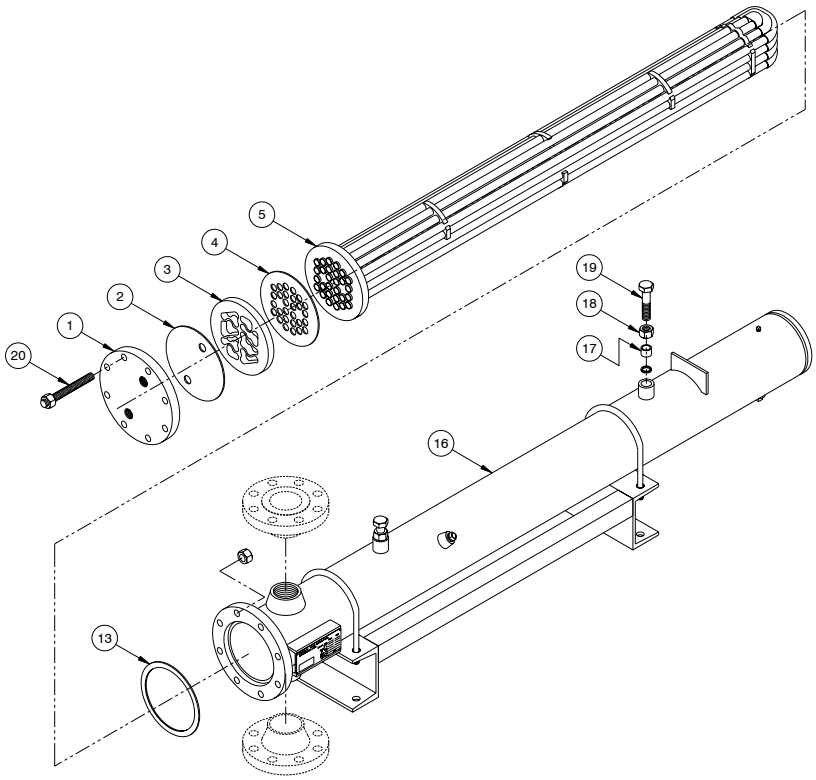
C, CL, CK AND CB CONTROLS

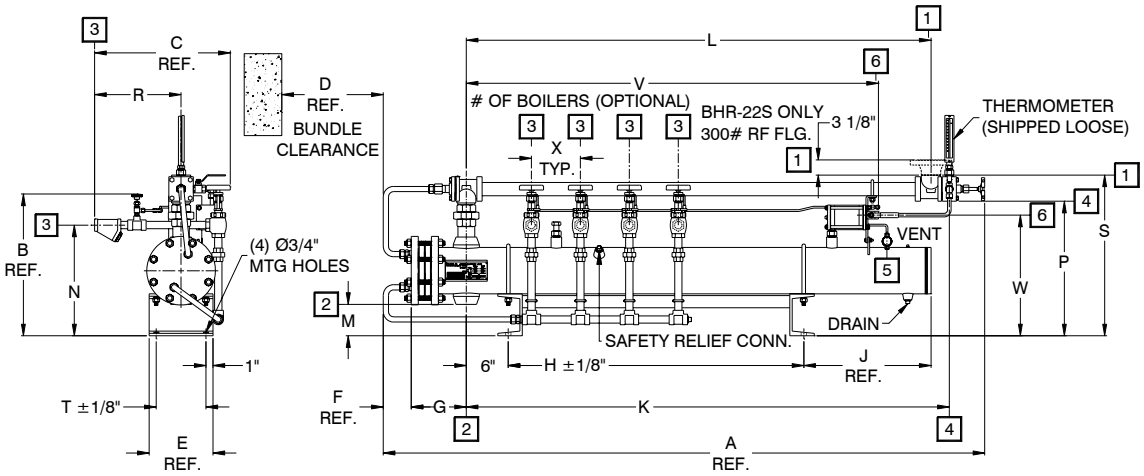
Parts List – Type X (250 PSIG)

HEAT EXCHANGER PARTS				
MODEL NUMBERS		BHR-2 BHR-4	BHR-9 BHR-14	BHR-22
DIAMETER		4”	6”	8”
Item No.	Description	Part No.	Part No.	Part No.
1	Head	797-961	797-962	797-963
2*	Head Gasket	797-964	797-965	797-966
3	Pass Divider for Tube Side	797-967	797-968	797-969
4*	Tube SheetGasket	797-970	797-971	797-972
13*	FlangeGasket	797-973	797-974	797-975
17	Packing Gland	797-976	797-976	797-976
18	Jam Nut	797-977	797-977	797-977
19	Hold down/anchor bolt	797-978	797-978	797-978
20	Bolting SA193B 7 or SA194 Gr. 7 type hardware or equivalent must be used. Purchase locally.			

*** Recommended Spare Parts**

Heat Exchanger Model No.	Item 5, Tube Bundle Part No.	Item 16, Shell Part No.
BHR-2	797-979	797-984
BHR-4	797-980	797-985
BHR-9	797-981	797-986
BHR-14	797-982	797-987
BHR-22	797-983	797-988





MODEL	MAX. # OF BOILERS	DIMENSIONS (INCHES) - TOLERANCE IS ±1/4" EXCEPT AS NOTED											
		A	B	C	D	E	F	G	H	J	K	L	M
BHR-2M	4	53"	18.38"	18.5"	28"	7"	4"	7.5"	16.5"	9.31"	35.75"	33"	4.5"
		134.6cm	46.5cm	47cm	71.1cm	17.8cm	10.2cm	19cm	41.9cm	23.6cm	90.8cm	83.8cm	11.4cm
BHR-4M	4	80"	18.38"	18.5"	64"	7"	4"	7.5"	38.5"	23.31"	62.62"	60"	4.5"
		203.2cm	46.7cm	47cm	162.6cm	17.78cm	10.2cm	19.1cm	97.8cm	59cm	159cm	152.4cm	11.4cm
BHR-9M	5	82.5"	20.38"	18.5"	64"	9.12"	4"	8"	38.5"	23.5"	62.62"	60"	4.38"
		209.6cm	51.8cm	47cm	162.6cm	23.2cm	10.2cm	20.3cm	97.8cm	59.7cm	159cm	152.4cm	11.1cm
BHR-14M	5	125.5"	20.38"	18.5"	100"	9.12"	4"	8"	64.5"	33.5"	107.5"	105"	4.38"
		318.8cm	51.8cm	47cm	254cm	23.2cm	10.2cm	20.3cm	163.8cm	85.1cm	273cm	266.7cm	11.1cm
BHR-22M	6	126"	24.38"	18.5"	100"	11.12"	4"	9.5"	64.5"	32.31"	104.5"	96.5"	4"
		320cm	61.9cm	47cm	254cm	28.2cm	10.2cm	24.13cm	163.8cm	82.1cm	265.4cm	245.1cm	10.2cm

MODEL	DIMENSIONS (INCHES/CM) - TOLERANCE IS ±1/4" EXCEPT AS NOTED								CONNECTIONS - FPT				
	N	P	R	S	T	V	W	X	1	2	3	4	6
BHR-2M	13.5"	16.5"	11.5"	20.5"	5"	27.06"	15.5"	5"	1 1/2	1 1/2	3/4	3/4	1/4
	34.3cm	41.9cm	29.2cm	52.1cm	12.7cm	68.7cm	39.4cm	12.7cm					
BHR-4M	13.5"	16.5"	11.5"	20.5"	5"	56.06"	15.5"	7"	1 1/2	1 1/2	3/4	3/4	1/4
	34.3cm	41.9cm	29.2cm	52.1cm	12.7cm	142.4cm	39.4cm	12.7cm					
BHR-9M	15.5"	19.5"	11.5"	23.5"	7.12"	56.25"	18"	7"	2	2	3/4	3/4	1/4
	39.4cm	49.5cm	29.2cm	59.7cm	18.1cm	142.9cm	45.7cm	12.7cm					
BHR-14M	15.5"	19.5"	11.5"	23.5"	7.12"	92.25"	18"	7"	2	2	3/4	3/4	1/4
	39.4cm	49.4cm	29.2cm	59.7cm	18.1cm	234.3cm	45.7cm	12.7cm					
BHR-22M	21"	24.5"	11.5"	29.87"	9.12"	92.06"	22.5	7"	3	3	3/4	1	1/4
	53.3cm	62.2cm	29.2cm	75.9cm	23.2cm	233.8cm	57.1cm	12.7cm					