LESLIE CONTROLS, INC.
A subsidiary of CIRCOR International, Inc.
12501 Telecom Drive • Tampa, FL 33637-0906

CONSTANTEMP®
STEAM POTABLE WATER HEATERS
Models EN-320 and EN-620

TABLE OF CONTENTS

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION I — GENERAL INFORMATION

1.1 Description

The Leslie-Constantemp concept of steam-water heating is a completely engineered system designed to provide accurately controlled temperatures for hot water applications.

The Leslie-Constantemp fill all the needs for hot water required in showers, wash basins, deep sinks, cafeteria uses, etc. The concept is based on a feed-forward principle rather than the traditional, temperature sensing feedback method of control.

Hot water is generated only on demand — to exact and predetermined temperatures, adjustable form 110°F to 185°F.

The heart of the system is a unique blending device that automatically proportions hot and cold water to produce the desired outlet temperature. The blending valve control mechanism is actuated by the demand for or flow of hot water. The heat exchanger, blending valve and intermediate piping act to produce an engineered pressure drop so that each increment in flow represents a specific water pressure differential.

A diaphragm is used to measure the pressure differential between the incoming cold water at the blending valve inlet and the final blended hot water at the blending valve outlet. The diaphragm is spring loaded and positions the blending valve stem according to the water flow. Stem movement adjusts both the hot and cold water flow through characterized ports in a cylindrical hollow sliding plug which are designed to maintain a predetermined final temperature versus water flow relationship throughout the full operating range.

Temperature settings are established by rotating the characterized sliding plug within the body to establish a desired ratio of hot and cold water blending. The rotary setting is locked and the plug is free to move vertically within the body to respond to water demands.

In addition to proportioning both hot and cold water, the blending valve stem, through mechanical linkage, also adjusts a simple automatic water pressure loader which in turn, adjusts the pressure setting of a regulating valve in the steam supply line to the exchanger. There is a specific relationship in the regulated steam pressure delivered to the exchanger and the water flow. The system provides a defined change in steam pressure for each change in water flow. Since water pressure to the heater is used to load the diaphragm of the steam valve, steam pressure to the heater can never equal or exceed the saturated temperature of the water in the heater.

Since flow demand causes the temperature to be controlled, none of the vulnerable temperature sensing devices used with closed loop, feedback type of control systems on storage or instantaneous heaters are needed — Leslie—Constantemp automatically controls temperatures to within ±4°F of set point.

The characterized ports in the blending valve are designed to produce accurate stable control over the full flow range for which the heater is rated and in combination with specific other components of the complete heater package.

A Thermal expansion relief system is incorporated in the loading valve section (lower of the blend valve. The adjusting screw is factory adjusted to relieve at approximately 160 psig.

A safety feature comprised of a thermal switch and solenoid valve, will automatically shut-off steam supply when the blended water temperature exceeds a pre-set value. These shut-off temperatures are 185°F on heater set for 180°F maximum blended water temperature; 145°F on heaters set for 140°F blended water temperature.

If the blended water temperature exceeds the steam shut-off temperature the thermal switch de-energizes the solenoid valve, closing it. This causes the steam regulating valve to tightly shut-off by venting cold water loading pressure from above the regulator's diaphragm. At the same time a red warning lamp will light up on the solenoid valve.

The safety device will also react to loss of electrical power, closing the steam regulating valve.

When the blended water temperature drops to a level below the set temperature, the thermal switch will energize the solenoid valve (opening it), restoring steam supply. The red warning lamp will go out at this point.

Steam Potable Water Heaters
Models EN-320 and EN-620

Table I

Heater Model	Inlet Steam Press. (psig)	Valve Size (In.)	Max. Elev. Steam Valve Above Heater	Max. Elev. Cond. Disch. Above Heater	Max. Elev. Steam Valve Below Heater	Nominal Pipe Dia. After Steam Valve
EN-320	50-75 psig	1 1/2	30 ft.	15 ft.	8 ft.	2 in.
EN-320	40-50 psig	2	30 ft.	15 ft.	8 ft.	3 in.
EN-320	20-40 psig	2 1/2	30 ft.	15 ft.	8 ft.	3 in.
EN-620	40-75 psig	2 1/2	20 ft.	15 ft.	6 ft.	3 in.
EN-620	30-40 psig	3	20 ft.	15 ft.	8 ft.	3 in.

Table II

Maximum elevation (Ft.) Trap Discharge Line Above Heater	1'	2'	3'	4'	5'	6'	8'	10'	12'	15'
Set Steam Pressure (psig) to Heater with Zero WAter Flow at:	1.0	1.5	2.0	2.5	2.7	3.0	4.5	5.5	6.5	8.0

SECTION II—INSTALLATION (See Illustration Fig. 1 or Fig. 10 for Installation)

2.1 Constantemp Heater and Steam Control Valve

1. Select accessible location for heater and allow clearance above heat exchanger and below blend valve as shown on Fig. 1 and Fig. 6, for maintenance and parts replacement.
2. The unit is supplied assembled to a shock type bracket with drilled foundation bolt holes for assembly to a customer furnished support.
3. Locate steam control valve (Class GPBCN) on the same level as the heater, if possible. Protect steam control valve with a self-cleaning strainer as shown on fig. 1.

WARNING: When connecting heater to other than copper pipe use dielectric unions, (isolators) to prevent possible galvanic action.

If necessary, steam control valve may be located above or below heater (see Table 1 and Fig. 6).

WARNING: To prevent water hammer damage, provide adequate condensate drainage leg and trap at low point in steam line to Steam Control Valve.

A small sized trap is required for installation in the steam line from the Control Valve to the Heat Exchanger to keep the line free of condensate during standby periods.

When water is used as the operating force, the steam control valve must not be installed at distances (above or below heater) in excess of maximum allowable elevations shown in Table 1. Drain pipe form loading valve (lower end of blend valve) must be protected from freezing.

2.2. Steam Trap Discharge

1. Connect steam trap discharge line to an atmospheric or sub-atmospheric return system.
2. Where condensate lift is necessary DO NOT discharge condensate against a lift elevation greater than figures shown in Table II.
3. When both the steam valve and the condensate discharge line are mounted above the heater the maximum elevation of the steam valve above the heater must be reduced by the elevation of the condensate discharge above the heater.

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION II—INSTALLATION (Con't)

2.3 Thermometer and Steam Gauge

1. Install a thermometer in outlet water line and install

   a zero to 100 lb. steam gauge in steam supply line between steam control valve and heater exchanger as shown on Fig. 1.

2.4 Installation and Operating Instructions for Three-Way Thermostatic Valve

Your three-way thermostatic valve is fitted with a fully enclosed pre-set temperature element and is NOT ADJUSTABLE. The valve has three (3) ports identified with the letters "A", "B" and "C" imprinted on body casting. A rise in controlled fluid temperature at 10° to 12°F ABOVE nominal temperature rating of element will completely stroke valve, closing PORT "B" preventing any flow of recirculating water to heat exchanger thus protecting system from overtemperature. Element operation may be impaired if subjected to temperatures in excess of 25° F above nominal temperature rating of element for extended periods of time.

NOTE: For proper operation and tight shut-off of valve, pressure drop across ports should not exceed 75 psig. Maximum rated valve pressure 150 psi.

Installation of Three-Way Thermostatic Valve

1. PORT "A" — connect recirculating pump discharge (hot water return from system) to port "A"
2. PORT "B"—connect port "B" to cold water inlet pipe supplying cold water to heater.
3. PORT "C"—must be connected to hot water supply piping to system.

For START-UP PROCEDURES see Instruction paragraph 3.1 and 3.2, page 4.

If Recirculation Pump used is a high capacity pressure type which can produce excessive flow through system, it may be necessary to throttle in on hot water return stop valve at Port "A" to prevent off and on action of Three-Way Valve.

2.5 Installation and Operating Instructions for Thermal Switch and Solenoid Valve

A 120 volt (A.C.) 60 Hz electrical power supply is required. Field wiring should be rated for 90° C (194° F) or greater.

Nominal power consumption is 10.5 watts.

Switch and solenoid valve wiring is per diagram on page 4.

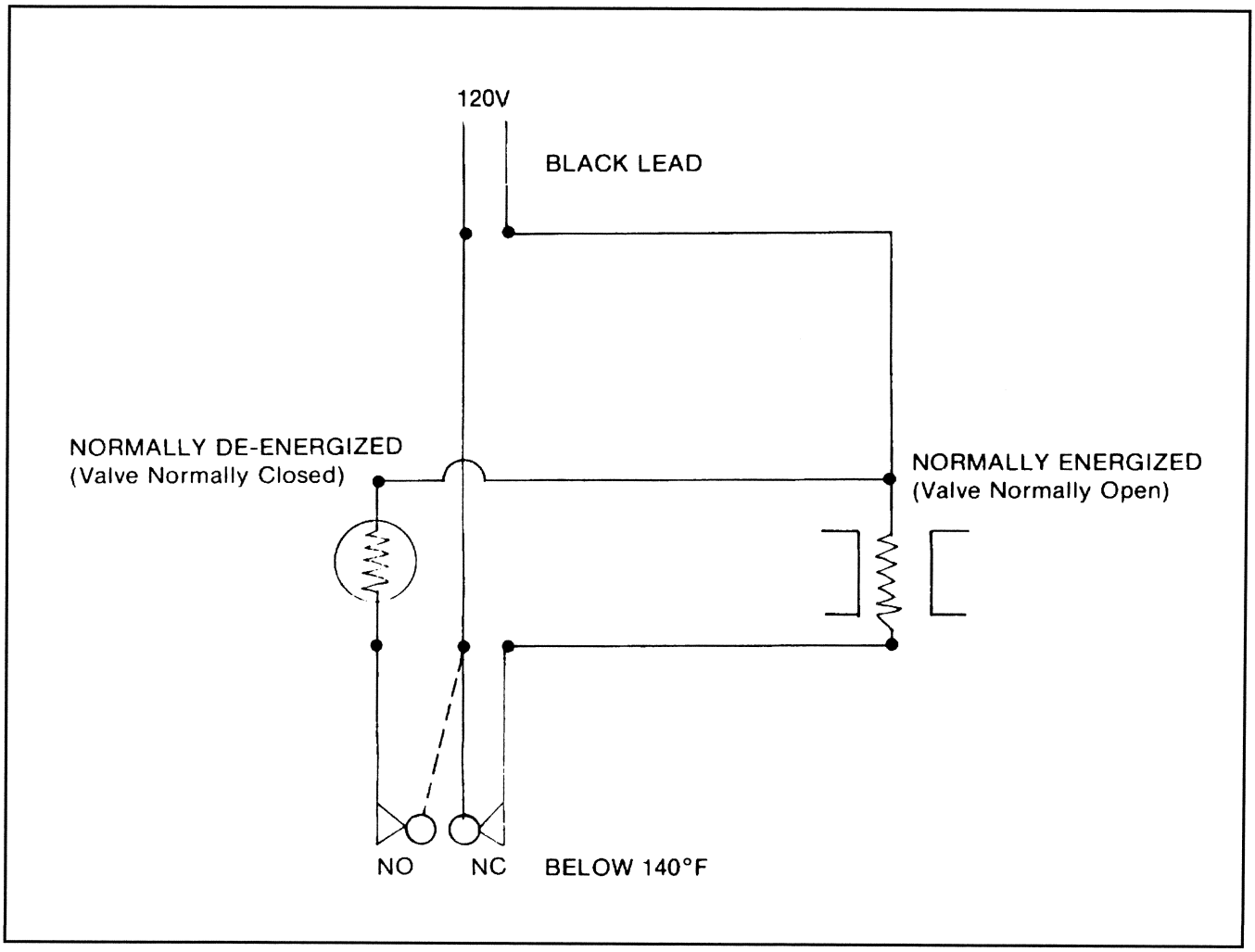
The solenoid valve should be placed in the cold water loading line of the steam regulating valve as shown in the following diagram:

2.6 Preparation for Reshipment

1. Shut off and disconnect all steam and water lines to Constantemp Heater.
2. Remove all bolts and nuts supporting the heater shock bracket to ships support and foundation .
3. Place heater complete with shock bracket on a heavy weight pallet preferably made of 2 x 4 lumber.
4. Using shock bracket as drilling template, drill 3 or 4 holes through pallet on each side where bracket rests and apply bolts holding bracketed heater to same.
5. After fastening bolts, frame up balance of unit. Cover top of blend valve with lumber for protection .

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION II—INSTALLATION (Con't)



SECTION III—OPERATION

3.1 Safety Precautions

Due to simplicity of unit, all operational functions are performed locally. Manual controls are not required as there is no means to bypass the Constantemp Heater to obtain hot water.

Sequence of operation: To shut down heater the steam should be secured first, followed by securing the water. To start-up heater, the water should be turned on first followed by the steam.

The heat exchanger casing and the blending valve diaphragm chamber must be vented to remove any entrained air after each shut down period BEFORE putting heater into operation. Heat exchanger has vent plugs to remove. On blend valve loosen elbow (4) hex nut until chamber is free of air.

3.2 Start-Up Procedures — Initial Start-Up (See Illustration Fig. 2 for part numbers)

1. Turn on cold water supply.
2. Loosen the hex nut of elbow (4) in upper diaphragm case of hot water control valve and permit water to flow through opening until all air is vented from case. Re-tighten the elbow nut.
3. With no water flow through heater, turn on steam supply to steam control valve (Fig. 4). NOTE: Make sure that condensate is being properly drained from steam line ahead of the steam control valve.
4. Vent air from steam side of heater (Fig. 3) by loosening vent plugs in top of heater casing. After venting air, re-tighten vent plugs.
5. Remove clamp complete (42) from AWR loading valve. Using an adjusting pin, move AWR spring seat (44) downward to load diaphragm of steam control valve (Fig. 3) until the steam pressure to the heater is 1/2 psig (or, when condensate lift exists, pressures as shown in Table II). Replace clamp and rubber seal so that both windows are sealed.
6. Start water flow through heater. Adjust water temperature by lock nut (21). Move adjusting handle (25) to the left to increase water temperature or right to decrease water temperature. See HOT and COLD direction plate in yoke above adjusting handle. For best results temperature should be adjusted with an approximate water flow of 15 GPM for EN-320 and 20 GPM flow through heater for EN-620.

When desired water temperature is obtained relock lock nut (21) to prevent adjusting handle (25) from moving.

3.3 Normal Operating Procedure after Initial Start-up

1. Heater is now adjusted and operating. No further adjustments are necessary. To shut down close water and steam valves. To restart open valves.

3.4 To Drain Unit for Prolonged Shut-Down (Where Drainage is Necessary)

1. Turn off water supply. Release water pressure from steam control valve diaphragm by breaking copper tubing fitting.
2. Turn off steam supply.
3. Open a vent line in high point of system.
4. Open drain connections in steam and condensate lines.
5. Drain all water out of system.
6. When restarting system, tighten all connections and close all vents.

3.5 Operator's Maintenance

Leslie Constantemp Water Heaters and associated control equipment do not require periodic inspection, servicing, lubrication or cleaning with the exception of cleaning the strainers and traps. Replacement of steam control valve or blending valve diaphragm or equipment malfunctions are noted in Section V (Trouble Shooting) and the maintenance is covered in Section IV.

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION IV—MAINTENANCE

4.1 Dismantling—Blend Valve Assembly (See Illustration Fig. 2 for part numbers)

1. Close steam, water and outlet line stop valves. Disconnect all tubing from upper diaphragm case and valve body. Remove Victaulic couplings from cold and hot water inlet connections and from hot water outlet connection .
2. Disconnect tubing from AWR loading valve assembly at lower end of blend valve and valve body (33). Remove the two screws on shock frame holding bar to bottom cap (65) and remove bar. Remove the four bolts (14A) with nuts (5) holding blend valve to shock frame and lift. Remove the blend valve from the shock frame.
3. Remove the assembled AWR loading valve assembly from lower end of blend valve by dismantling the V-retaining coupling (41) and carefully lowering unit from outlet manifold (37). The lower end of spring loader complete (38) will separate from the spring adjustor (43) as the AWR unit is lowered.

For dismantling and reassembly of the AWR unit follow steps 1 through 12 of 4.5 on Page 7.

4. Disconnect Victaulic coupling (36) from outlet manifold and remove manifold by lowering part below spring loader complete. The spring loader complete (38) is removed by tilting 20 to 30° until pin of the spring loader leaves the 1/4" drilled hole for the upper stem (18).
5. Remove upper diaphragm case (1) by removing bolts (14) and nuts (5).
6. With a wrench on flats of upper stem (18) to prevent turning and possible diaphragm damage, apply a wrench to jam nut (10) and loosen and remove same.
7. Remove shoulder washer (12), diaphragm (2), diaphragm plate (15), spring guide washer (13),control valve spring (16) and for EN-320 size only the spacer (3).
8. Remove capscrews (8), diaphragm case lower (6). and stem support (12) with O-rings (9), (22) and (23).
9. Loosen lock nut (21) and with a wrench on flats of adjusting handle (25) remove the handle.
10. Remove valve plug adjusting collar (24) with lower O-ring (23).
11. Slide upper stem (18) with lower assembled parts including valve plug complete (31) though bottom of valve body (33).
12. If necessary to disassemble this unit because of damage or wear, apply hand pressure to spring seat (30), compressing yielding spring (29) sufficiently to remove pin (32). The spring seat (30), yielding spring (29), special washer (28), temperature adjusting disc (27) and valve plug complete (31) will then separate from upper stem (18).

4.2 Cleaning—Blend Valve Assembly

WARNING — Cleaning solvent is flammable and toxic. Use in well ventilated area. Avoid breathing of vapors and contact.

Clean all parts with an approved solvent and wipe off with a clean cloth. Do Not use coarse abrasives on any guiding surfaces such as outside diameter of valve plug (31), finished outside diameter of stem support (17) or bores of valve body (33). Check all O-ring grooves and the serrated surface of shouldered washer (12) for nicks or other damage. Replace any worn or damaged part.

4.3 Reassembly—Blend Valve Assembly (See illustration Fig. 2 for part numbers)

CAUTION: Coat all "O" Rings with SILICON GREASE before installation.

1. Reassemble the valve plug complete (31) with upper stem (18) if previously disassembled by inserting upper stem (18), thread end up, into valve plug (31) until snap ring (26) shoulders on valve plug. (Note: Extended groove pin must be located on hot water inlet side of valve body.)
2. Insert temperature adjusting disc over outside diameter of upper stem with one of the pin cut outs over diameter of drive pin. Add the washer (28), yielding spring (29) and spring seat (30), and by compressing the spring slightly place pin (32) through hole in upper stem (18).

SECTION IV—MAINTENANCE (Cont.)

3. plug adjusting collar (24) and place in body, "O" ring side down with valve plug groove pin in drilled hole and thread facing temperature adjusting opening of valve body (33).
4. Insert thread end of adjusting handle (25) into thread of valve plug adjusting collar (24) and tighten with a wrench on the flats of handle. Loosely assemble lock nut (21) to handle. Check that temperature indicator plate (20) is attached to body.
5. Apply greased "O" rings (22) and (23) to grooves of stem support (17) and place stem support over upper stem (18) and into body guide.
6. Add greased "O" ring (9), diaphragm case lower (6) and tighten to valve body with capscrews (8). Move adjusting handle (25) from right to left with light pressure to assure freedom of movement.
7. Place spacer (3) over upper stem (18) for EN-320 model only.Add control valve spring (16), spring guide washer (13), diaphragm plate (15) and diaphragm (2).
8. Insert greased "O" ring (11) into groove of shouldered washer (12) and place over upper stem (18) with groove facing downward with raised face through hole of diaphragm (2). Apply jam nut (10) and tighten holding upper stem from turning with a wrench on flats.
9. Add diaphragm case upper (1), bolts (14) and tighten with nuts (5). Tighten 4 nuts 90° apart before tightening others. Bolts (14A) to be added later when assembling unit in shock frame.
10. Install tubing (7) from valve body cold water inlet elbow (4) to elbow (4) in diaphragm case upper.
11. Assemble spring loader complete (38) to upper stem with a tilting motion until pin of loader enters drilled hole of stem.
12. Assemble outlet manifold (37) to valve body (33) and fasten with Victaulic coupling (36).
13. After lubricating teflon coated end of spring loader (38), lift AWR loading valve guiding the spring loader thru the spring case and into the opening of the spring adjustor (43). Continue to lift AWR valve into bore of manifold and clamp with the v-retaining coupling (41).

4.4 Reassembly—Control Valve Assembly

Assemble tubing (60) and tighten shock bar to bottom cap (65). Tighten bar to shock plate with two screws .

Assemble blend valve to shock bracket fasten bolts (14A) and assemble all manifolds and couplings.

To adjust heater steam preload and temperature, follow instructions under Section 3.1, Start-up procedure before installing AWR clamp (42) and rubber seal.

4.5 Dismantling and Reassembly of AWR Loading Valve

NOTE: AWR loading valve consists of all Pcs. 39-59 and 61-66 Illustration Fig. 2.

CAUTION: Do not disturb adjustment or remove any parts from bottom cap (65) assembly unless disassembly is necessary for cleaning or parts replacement etc. If unit is disassembled the thermal relief pressure must be readjusted as described in Step 4.5.12.

1. Shut off water supply and disconnect tubing from AWR. Remove AWR from outlet manifold (37).
2. Remove clamp (42) from spring case (57).
3. Hold AWR in a protected jaw vise and remove spring case (57) by unscrewing it from body.
4. Remove spring seat (44), spring seat washer (45) and spring (46). Carefully lift out diaphragm washer (59) and diaphragm nozzle assembly.
5. Unscrew bottom cap (65) and remove spring (53). Remove yoke assembly yoke (51), main valve (52) and disc (63) by sliding it toward outlet side of body and tilting upper end toward inlet side at same time.
6. Clean all parts in an approved solvent and wipe dry. Replace any worn or damaged parts.

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION IV—MAINTENANCE (Cont.)

7. **To Replace Diaphragm**

Disassemble parts 47, 48, 49, 50, 58 and 61.

Replace diaphragm and reassemble in reverse order as shown on drawing.

8. **To Replace Valve Disc**

Clamp yoke in cover. Loosen and remove main valve (52). Remove disc (63) and replace with new one. Reassemble in reverse order.

9. **To Replace Spring Adjustor Seal**

If packing (39) is damaged remove from spring case (57) by pushing out packing with a thin wire. Replace with new packing and reassemble as shown on drawing. Lubricate "O" ring (40).

10. Reassemble unit and tighten spring case to body.

11. Readjust AWR as shown in instructions Section 3.1 Start-up Procedure. After adjusting replace clamp (42) and rubber seal.

12. **To Reset Thermal Relief Pressure**

Remove tubing from inlet and outlet of AWR loading valve. Using water, air or nitrogen provide inlet supply pressure to AWR that can be adjusted from 150 to 170 psig. Loosen nut (55) and turn adjusting screw (55) until AWR just starts to relieve with inlet pressure between 160 to 170 psig. After making adjustment hold adjusting screw (54) and tighten nut (55). Recheck to make sure valve will relieve with inlet pressure between 160 and 170 psig.

4.6 Maintenance Heat Exchanger
(See Illustration Fig. 3 for part numbers)

Check tightness of all casing bolts and nuts after unit has been in operation for a few hours and again in twenty-four hours.

4.6.1 Disassembly

1. Disconnect all piping.
2. Remove all nuts around casings.
3. Remove casing from base plate. Be careful not to damage gasket (3D).
4. Remove manifold nuts and lock rings. Coil manifold and manifold gaskets (3E) may not be removed.

4.6.2 Assembly

1. Clean all parts and replace any damaged gaskets or parts.
2. Install manifold gaskets between manifold and base plate. Insert coil manifold into base plate.
3. Place lock rings over manifold ends with locks fitted into slots. Install manifold nuts and tighten securely. (A light coating of thread lubricant should be used on manifold threads before assembly of nuts.)
4. Place casing gasket on base plate and follow with casing.
5. Install nuts and bolts and tighten evenly to assure a tight leak proof seal.
6. Reinstall piping.
7. Vent steam side of heater as described under Section 3-1, Start-up procedure safety precaution .

4.7 Maintenance Class GPBCN
Steam Control Valve
(See Illustration Fig. 4 for part numbers)

4.7.1 Dismantling

1. Shut off loading pressure. Disconnect loading line to release pressure from diaphragm area.
2. Close stop valve on inlet and outlet sides on control valve and open strainer blowdown valve to vent trapped fluid.
3. Remove nuts (20), bolt (19), bottom cap (13).Gasket (12), main valve spring (11), main valve (9) will follow.
4. Do not remove seat ring (10) unless remachining or replacement is necessary.
5. To examine diaphragm (two leaves) (3 and 4), main valve guide (8) or to clean diaphragm area remove diaphragm cover bolts (1), nuts (7), diaphragm (3 and 4) and diaphragm disc.

SECTION IV—MAINTENANCE (Cont.)

4.7.2 Cleaning, Replacing, or Repairing Parts

Clean all parts with kerosene or other approved solvent and check as follows:

1. Examine main valve, seat ring and main valve guide. Remove any encrusted material with crocus cloth.
2. If main valve or seat ring seating surfaces are cut or scored, relap with very fine compound. Remove all traces of lapping compound before reassembling. When relapping main valves in sizes 2-1/2" and larger take off diaphragm cover and remove diaphragm so that their spring action will not interfere with lapping operation.
3. Removing and installing seat ring (10), position slots in seat ring wrench on lugs of seat ring and position a bar through hole of tubing. Holding wrench tight against seat ring, tap end of bar with a hammer to loosen seat ring and remove.
4. Carefully clean threads and joint contact surface of seat ring and body making sure neither are damaged.
5. Screw seat ring into valve body threads, pull up tight with wrench and lock in place with a hammer tap on the rod handle of wrench.
6. Lap in main valve (9) and seat ring (10) carefully. Use very fine lapping compound.

NOTE: If main valve, seat ring or both must be remachined due to damage to seating surfaces, in order to maintain correct diaphragm disc to diaphragm seat dimension it will be necessary to shorten the main valve. To do this remove from the top of the main valve stem (diaphragm disc end) an amount of metal equal to the amount (dimensional thickness) removed from the main valve and/or the seat ring.

4.7.3 Reassembly

1. Do not use graphite or compound on joints.
2. Place main valve, main valve spring and gasket on bottom cap and assemble bottom cap into main body. Tighten just enough to hold in place.
3. Place diaphragm disc on main valve.
4. Put diaphragm leaves together, matching convolutions as closely as possible and position them carefully in main body above diaphragm disc.

IMPORTANT — Place diaphragm containing drain hole on underside toward diaphragm disc.

5. Assemble diaphragm cover and bolts/nuts to main body. Snug up bolts alternating and evenly across diaphragm cover. Then tighten firmly. Tighten bottom cap. Reconnect loading line.

4.8 Preventive Maintenance

CAUTION: Water and steam pressures should not exceed Max. pressure shown in Tables I and II.

1. Check strainer screen periodically and clean when necessary.
2. Traps should be checked for proper leakage and renew when necessary.
3. Check Victaulic coupling for gasket leakage and renew when necessary.
4. Drain piping of AWR loading valve (at bottom of blend valve) should be checked periodically for dirt or foreign matter. This is accomplished by disconnecting the piping and blowing it out with air.

SECTION V—TROUBLE SHOOTING

IMPORTANT

FIRST READ INSTRUCTIONS FOR INSTALLATION, START-UP OPERATION AND MAINTENANCE. Study installation drawing and CAREFULLY read the details concerning the installation of the HEATER AND TRAPPING SYSTEM. Following these recommendations will insure maximum efficiency from the CONSTANTEMP HEATER.

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION V—TROUBLE SHOOTING

(Con't)

5.1a Problem

Excessive rise in water temperature occurring during or after prolonged periods when no water is being used from heater and a recirculating system is provided.

NOTE: This problem can also be indicated if the safety solenoid valve shuts off the steam supply and the red warning lamp is lit.

5.1b Probable Cause

Too much water being recirculated through heater.

5.1c Remedy

Reduce water flow through heater by throttling in on recirculating stop valve allowing enough time for water in piping system to cool and assume new temperature setting. If piping system is extensive and contains a large volume of water, readjustment of temperature can be speeded up by closing steam supply stop valve to heat exchanger and opening faucets etc. preferably at end of loop, until water temperature drops a few degrees below the heater adjusted water temperature. Close off recirculating stop valve and open steam supply valve to heater. With recirculating pump in operation open recirculating stop valve in small increments while allowing adequate time for water to be recirculated throughout piping before proceeding to next increment of adjustment. Continue until the desired recirculating water temperature is achieved .

5.2a Problem

Excessive drop in water temperature occurring during or after prolonged periods when water is not being used from heater and a recirculating system is provided.

5.2b Probable Cause

Incorrect adjustment of steam pressure to heat exchanger for Heater NO FLOW condition .

5.2c Remedy

See Start-Up procedure paragraph 3.1 and 3.2 page 4 and readjust according to instruction.

5.3a Problem

Drop in controlled heater temperature occurring before rated capacity (GPM) of your heater is obtained.

5.3b Probable Cause

Incorrect inlet steam or water pressure to heater before and during any operational tests.

5.3c Remedy

1. Check water pressure. Minimum water pressure is 40 psig with steam valve installed below heater and 50 psig with the steam valve above heater. Maximum water pressure to heater is 150 psig.
2. Check to be sure steam strainers are clean and that all traps are functioning efficiently. A flooded or partly flooded heat exchanger will cause a reduction in heat transfer. Excessive back pressure in trap discharge piping system or partly plugged or dirty piping can restrict condensate flow from heater and cause a reduction in heat transfer. Dirty or partly plugged strainer screens can also cause this condition. ABOVE SYSTEMS MUST BE OPERATING SATISFACTORILY BEFORE ANY CHECK FOR FOULED COILS CAN BE MADE.
3. Checking for fouled coils: Temperature of water from Heat Exchanger outlet piping should be approximately 200 to 215°F when Heater is being operated within its RATED CAPACITY. Steam pressure to Heater will increase as water flow increases and pressure should NOT BE LESS than 30 psig when flow reaches the rated capacity of heater.

EXAMPLE: With all traps-functioning efficiently and with 60% rated flow from heater the heat exchanger outlet water temperature drops below 200°F and continues to drop off as flow is increased to the

SECTION V—TROUBLE SHOOTING

(Cont.)

heater rated capacity in GPM although steam to the heater exchanger increases to 30 or 35 psig. This indicates that coils are fouled and should be cleaned or replaced. A coil cleaning ADAPTOR KIT is available through your Leslie representative. If quality of water being used for heater is poor, coils may foul rapidly indicating that corrective water treatment may be necessary.

5.4a Problem

Insufficient Steam Pressure to Heat Exchanger.

5.4b Probable Cause

Same as Steps 5.3b.

5.4c Remedy

1. Same as Steps 5.3c 1.
2. Same as Steps 5.3c 2.
3. Shut off steam and water supply to Heater. Remove tubing connecting AWR loading valve to steam control valve diaphragm cover. Blow out tubing. Check for broken diaphragms and be sure diaphragm cover loading orifice is not plugged. See "Maintenance of Class GPBCN steam control valve" in Section 4.7.
4. Check operation of AWR loading Valve and Blending Valve by shutting water supply to heater. Remove tubing and fitting from outlet connection of AWR loading valve and install a 60 psig gauge in connection. Remove pipe plugs from blending valve base and cover and install a pressure gauge in each connection. Turn on water supply to heater making sure inlet water pressure is correct for operating conditions and that it does not exceed 150 psig. Check gauges to be sure they indicate the same pressure reading at zero flow. Open hot water supply valve and slowly increase flow through heater until there is a 7 psig differential between, gauge readings. At this differential the gauge in outlet connection of AWR loading valve should read a MINIMUM pressure of30to35psig. If a 7 psig differential or the rated travel of blending valve cannot be obtained, check the blending valve against maintenance instructions steps 4.1, 4.2, 4.3 and 4.4.

If AWR loading valve outlet pressure is less than 30 psig the loader should be disassembled and checked in accordance with Step 4.5 or maintenance instructions.

5.5a Problem

Excessive steam pressure to heat exchanger.

5.5b Probable Cause

AWR loading valve drain piping plugged or frozen or valve parts may be dirty.

5.5c Remedy

AWR unit drain pipe must be protected from freezing temperatures. Regulator has a slight constant LEAK-OFF and if unit is not properly drained it will pressurize diaphragm of steam control valve causing a rise in steam pressure to heat exchanger by opening main valve of control valve although there may be no demand for hot water. Be sure there is no back-pressure in piping to which drain pipe is connected. Correct condition by cleaning and blowing out drain pipe and fittings. Check AWR main valve disc and main body seat for dirt or damage. Check for dirt.or foreign material between main valve and seat or on guide of steam control valve as this condition can also cause the above problem. BE SURE STEAM CONTROL VALVE DIAPHRAGM COVER LOADING ORIFICE IS NOT PLUGGED. For disassembly of either of the above units, see appropriate steps of maintenance instructions, Section 4.

5.6a Problem

Excessive rise in water temperature above heater setpoint occurring at low flows.

5.6b Probable Cause

This may occur if Heater is overset due to one of the following causes: (1) fouled coils, (2) drop in inlet water supply pressure, or (3) adjustment of water temperature while exceeding heater rated capacity in GPM.

Steam Potable Water Heaters
Models EN-320 and EN-620

SECTION V—TROUBLE SHOOTING

(Cont.)

5.6c Remedy

Same as steps 5.3c 1 and 5.3c 3.

5.7a Problem

Excessive drop-in water temperature below heater setpoint occurring during low flows.

5.7b Probable Cause

Same as paragraph 5.2b.

5.7c Remedy

Check for inefficient trap operation or increase in trap discharge drain piping back-pressure.

If and when parts are needed be sure to use only genuine Leslie Parts.

5.8a Problem

Low water temperature. Due to improper closing of steam regulating valve by the safety device. This would be indicated by de-energized solenoid and no red warning lamp.

5.8b Probable Cause

Electrical wiring is broken or disconnected; defective coil or lamp.

5.8c Remedy

Check all wiring, connections and warning lamp. See separately provided instructions for the coil.

5.9a Problem

1. Excessive temperature of recirculating water.

5.9b Possible Causes and Remedies

1. 3-Way Valve installed incorrectly. Correct per Para. 2.4 above.
2. Incorrect element range. Replace element with range suitable for system requirements.
3. Seats worn or pitted. "O" ring seals leaking. Disassemble and replace defective parts.
4. Carbonates, scale or other solids build-up on element. Clean with a suitable solution of OAKITE or mild acid. Hard scale may require wire brush buffing.
5. Foreign matter between slide valve and seat. Disassemble and clean.
6. Defective element. Replace element.

TO CHECK FOR A FAULTY ELEMENT—immerse complete unit in an agitated bath of hot water. (Do not use oil as "O" rings may be damaged.) Raise temperature of water 10° to 12°F above rated operating range of element. Port "B" should be closed. If port "B" does not close the element and gaskets should be replaced.

5.10a Problem

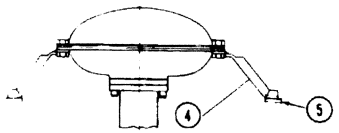
1. Recirculating water too cold.

5.10b Possible Causes and Remedies

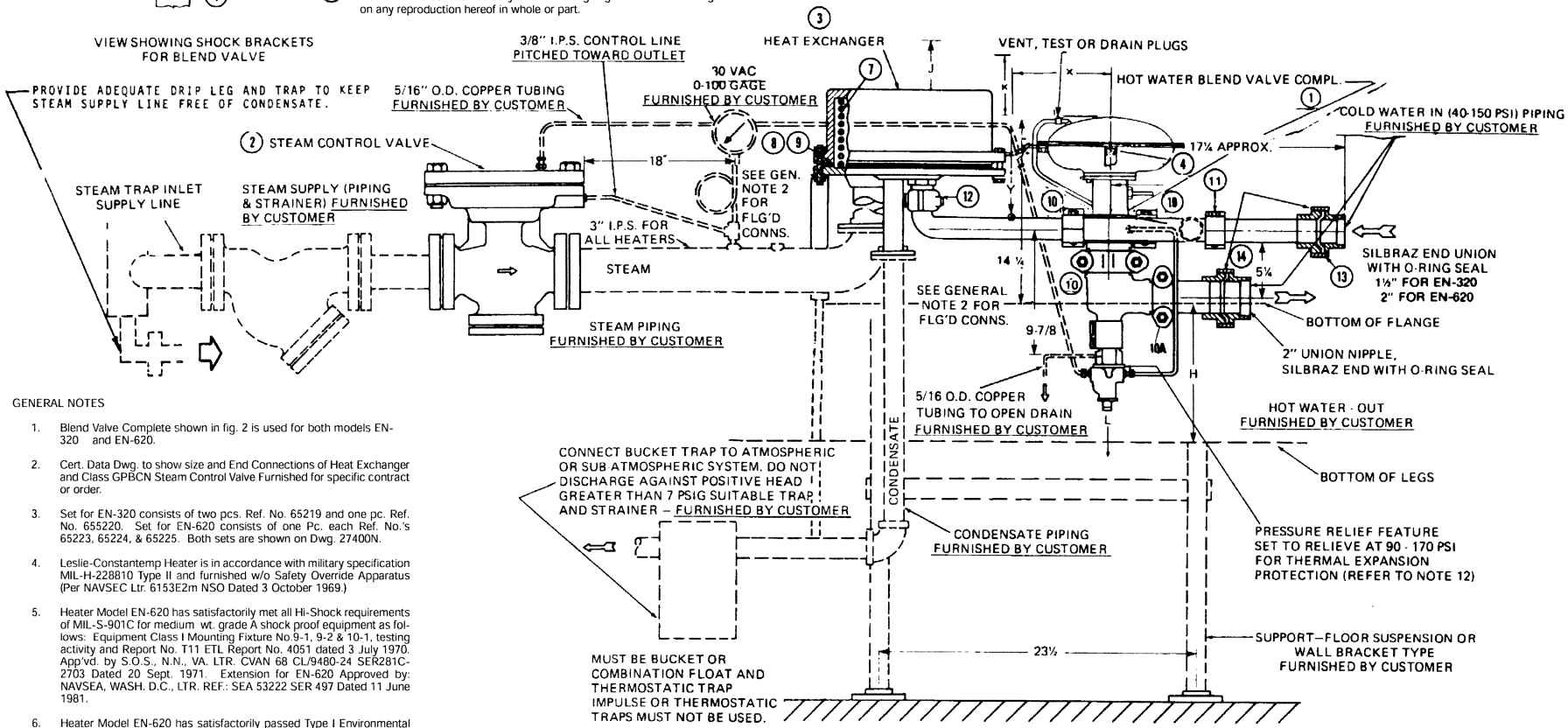
1. 3-Way Valve installed incorrectly. Correct per drawing supplied with kit.
2. Steam preload adjustment incorrect. Readjust in accordance with Paragraph 3.1 and 3.2 page 5.
3. Worn or leaking "O" ring seal. Replace "O" ring.
4. Foreign matter between slide valve and seat. Disassemble and clean.
5. Excessive pressure drop across ports. Check and correct.
6. Hot water return stop valve to Port "A" closed. Open stop valve.

SECTION VI—REPAIR PARTS

When ordering parts for heaters, valves and accessories refer to Figures 1 through 4 for the list of materials. For size and end connections of class GPBCN steam control valve refer to Figures 5,6, or 7. Refer to the ship's "Allowance Parts List" and NAVSEA forms 4786 and 4786A for a listing of onboard repair parts. Include the nameplate data, piece number, service part number and federal stock number (as available) in each order to the manufacturer.



VIEW SHOWING SHOCK BRACKETS FOR BLEND VALVE



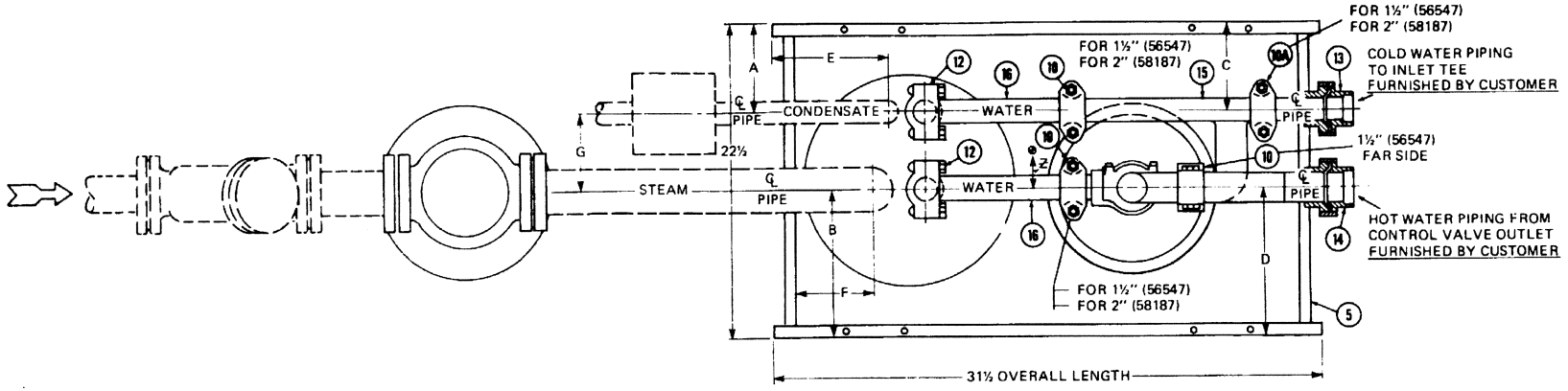
GENERAL NOTES

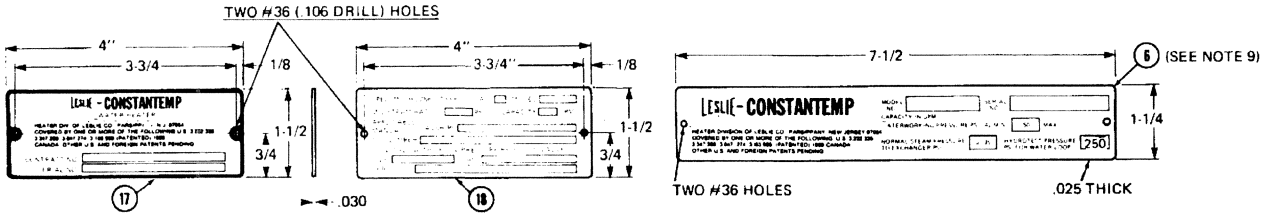
1. Blend Valve Complete shown in fig. 2 is used for both models EN-320 and EN-620.
2. Cert. Data Dwg. to show size and End Connections of Heat Exchanger and Class GPBCN Steam Control Valve Furnished for specific contract or order.
3. Set for EN-320 consists of two pcs. Ref. No. 65219 and one pc. Ref. No. 655220. Set for EN-620 consists of one Pc. each Ref. No.'s 65223, 65224, & 65225. Both sets are shown on Dwg. 27400N.
4. Leslie-Constantemp Heater is in accordance with military specification MIL-H-228810 Type II and furnished w/o Safety Override Apparatus (Per NAVSEC Ltr. 6153E2m NSO Dated 3 October 1969.)
5. Heater Model EN-620 has satisfactorily met all Hi-Shock requirements of MIL-S-901C for medium wt. grade A shock proof equipment as follows: Equipment Class I Mounting Fixture No.9-1, 9-2 & 10-1, testing activity and Report No. T11 ETL Report No. 4051 dated 3 July 1970. App'vd. by S.O.S., N.N., VA. LTR. CVAN 68 CL/9480-24 SER281C-2703 Dated 20 Sept. 1971. Extension for EN-620 Approved by: NAVSEA, WASH. D.C., LTR. REF.: SEA 53222 SER 497 Dated 11 June 1981.
6. Heater Model EN-620 has satisfactorily passed Type I Environmental Vibration Testing up to 25 CPS in accordance with the requirements of MIL-STD-167. Testing activity and Report No. TIL ETL Test Report No. 4041. Dated 30 June 1970. Appv'd by S.O.S. N.N. Va., LTR. CVAN68 CL/9480-24 SER. 281C-2703 dated 20 Sept. 1971. Extension for EN-620 approved by: NAVSEA WASH. D.C., LTR. REF.: SEA 53222 SER. 497 dated 11 June 1981.
7. All dimensions show are nominal and are indicated for information only.
8. Net weight of assembled blend valve with Heat Exchanger excluding Class GPBCN Reducing Valve, steam trap etc. for EN-320 is 325 lbs. and EN-620 is 410 lbs.
9. Data Plate Pc.6 in accordance with Par 3.4.10 of Spec. MIL-H-22881 B. furnished per certification data drawing and Pc. No's 17 & 18 in accordance with MIL-H-2288D furnished per certification data drawing where applicable.
10. Fabrication by welding and brazing in accordance with MIL-STD-278. All Welders qualified in conformance to MIL-STD-248.
11. Heater Model EN-320 is similar in design, construction and intended service to that equipment depicted on Leslie Company Dwg. 220504N (Model EN-620 which has been accepted as meeting all the Hi-Shock requirements in accordance with MIL-S901 for medium with, Grade hhh

A shockproof equipment as follows: Equipment Class - Class I, Mounting Fixture - 9-1 & 9-2 & 10-1. Testing Activity & Test Report: TII ETL Report No. 4051 Dated 3 July 1970. And Vibration Test Type I per Test Report TII ETL No. 4041 Dated 30 July 1970. Naval Approval of Extension: S.O.S. N.N. VA. LTR., CVAN 68CL/9480-24, SER 281c-2703 dated 20 Sept. 1971. Extension for EN-320 approved by: NAVSEA, WASH, D.C., LTR: SEA 53222 SER. 497 dated 11 June 1981.

12. For pressure relief feature setting refer to Certification Data Dwg.
13. Gaskets Pc. 19 listed for parts orders only. Vitaulic Couplings Pc. 10. 10A, 11 & 12 are furnished compl. with gaskets.

DIMENSIONS IN INCHES									CALCULATED C. OF G. FOR BLEND VALVE + HEAT EXCHANGE MTD ON FRAME			MIN. CLEARANCE REQUIRED FOR MAINTENANCE/PARTS REPLACEMENT		
SIZE	A	B	C	D	E	F	G	H	X	Y	Z	J	K	L
EN-320	6-5/8	11-1/4	5-7/8	11-1/4	6-13/16	5-5/8	4-5/8	9-11/16	7-1/4	8-1/2	2-1/4	6	3	6
EN-620	7-5/8	10	5-5/8	10	7-1/16	6-1/16	5-1/8	9-11/16	8	7-1/4	2-1/4	10	3	6





SERVICE PART NO.					LIST OF MATERIAL QUANTITIES FOR ONE UNIT			
PC. NO.	MODEL EN-320	MODEL EN-620	NAME	QTY.	MATERIAL	MATERIAL SPEC.	REMARKS NOTES	MATERIAL CONTROL
1	NOTE 1	NOTE 1	BLEND VAL COMPL.	1	CAST BRONZE	(SEE DWG)	1	(SEE DWG)
2	NOTE 2	NOTE 2	STM CONTR. VAL., CL GPBCM	1	CAST BRONZE	(SEE DWG)	2	(SEE DWG)
3	58811-20	58812-20	HEAT EXCHANGER	1	CAST STEEL SHELL, COPPER COIL, BRONZE MANIFOLD	(SEE DWG)	2	(SEE DWG)
4	NOTE 3	NOTE 3	BRACKET SET COMPL.	1	CARBON STEEL	ASTM - A 283 GR.D	3	
5	67460	58787	FRAME COMPLETE	1	ANGLE STEEL HOT ROLL	COMM'L		
6	55545	55545	DATA PLATE	1	ALUMINUM	COMM'L	9	
7	58223	58224	COIL, HEAT EXCHANGER	1	COPPER COILS BRONZE MANIFOLD	ASTM B 75		
8	56685	56686	GASKET, CASING	1	ARMSTRONG AN 890	COMM'L		
9	56683	56684	GASKET, MANIFOLD	2	ARMSTRONG AN 890	COMM'L		
10	56547	56547	1-1/2" VICTAULIC COUPLING	1	MALLEABLE IRON	COMM'L		
10A	58187	58187	2" VICTAULIC COUPLING	3				
11	- -	58187	2" VICTAULIC COUPLING	1				
11	56547	- -	1-1/2" VICTAULIC COUPLING	1				
12	55568	- -	1-1/4" VICTAULIC COUPLING	2				
12	- -	58187	2" VICTAULIC COUPLING	2	MALLEABLE IRON	COMM'L		
13	60513	- -	1-1/2" UNION NIPPLE, COMPL.	1	(NIPPLE) BRASS) (SCH. 40 PIPE)	ASTM - B 43		
13	- -	60514	2" UNION NIPPLE, COMPL.	1	(UNION) VALVE BRONZE	ASTM - B 61		
14	60514	60514	2" UNION NIPPLE, COMPL.	1	(NIPPLE) BRASS (SCH. 40 PIPE) (UNION) VALVE BRONZE	ASTM - B 43 ASTM - B 61		
15	58172	58170	INLET MANIFOLD	1	BRONZE	ASTM - B 62		
16	64906	58169	EXCHANGER MANIFOLD	2	BRONZE	ASTM - B 61/62		
17	59373	59373	NAME PLACE	1	ALUMINUM	COMM'L	9	
18	59374	59374	DATA PLACE	1	ALUMINUM	COMM'L	9	
19	56236	- -	GASKET,1-1/4" VIT. COUPLING	NOTE 13	COMM'L	COMM'L		
	56548	56548	GASKET, 1-1/2" VIT COUPLING					
	58188	58188	GASKET, 2" VIT. COUPLING					

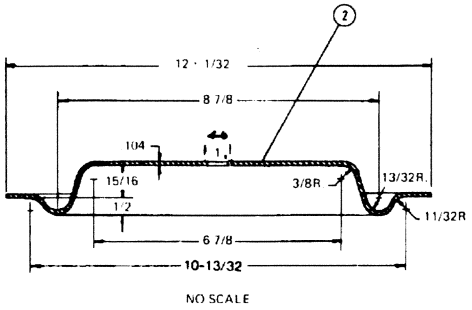
Figure 1
LESLIE-CONSTANTEMP HEATER
MODEL EN-320 and MODEL EN-620
INSTALLATION and LIST OF MATERIALS

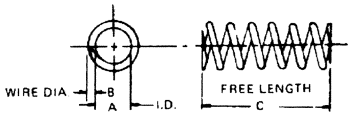
GENERAL NOTES:

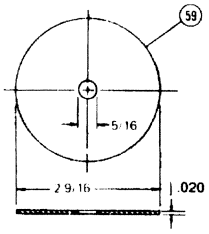
1. All detail dimensions are for reference purposes only.

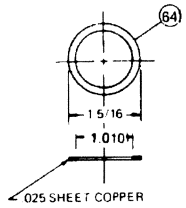
LIMITED RIGHTS LEGEND

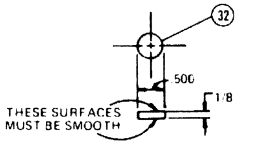
This drawing and related details shall not be either released outside the government, or used, duplicated, or disclosed in whole or in part for manufacture or procurement, without the written permission of Leslie Co., except for: (a) Emergency repair or overhaul work by or for the government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work; or (b) Release to a foreign government, as the interest of the United States may require; provided that in either case the release, use, duplication or disclosure hereof shall be subject to the foregoing limitations. This legend shall be marked on any reproduction hereof in whole or part.

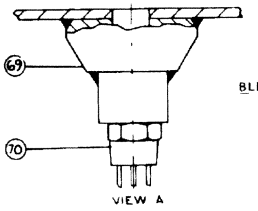


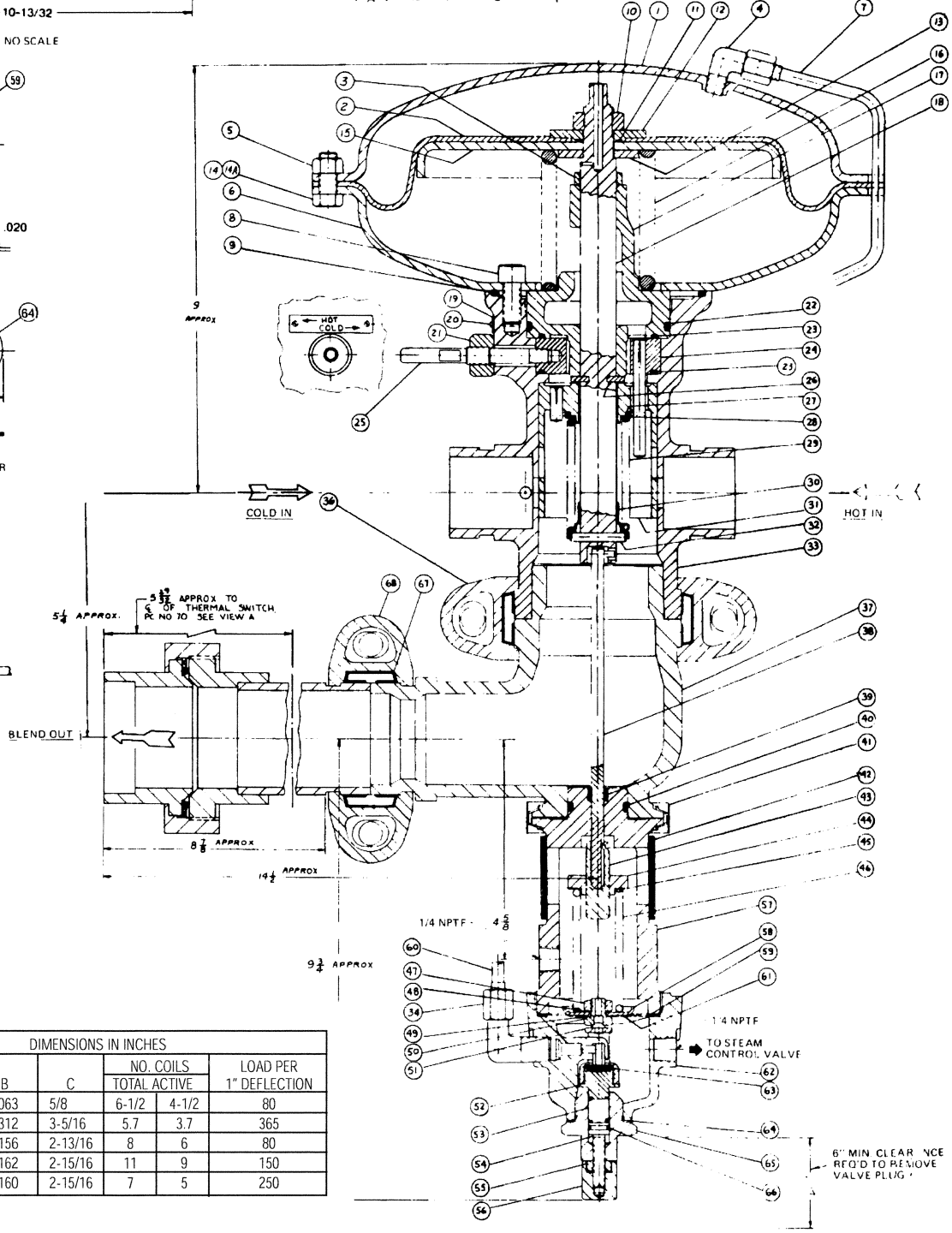












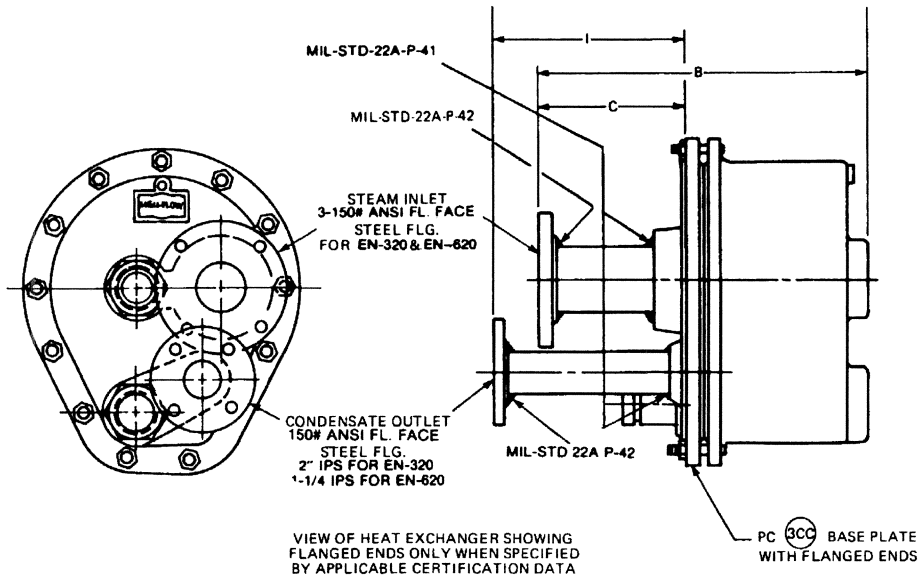
	DIMENSIONS IN INCHES						
	PC NO.	A	B	C	NO. COILS TOTAL	NO. COILS ACTIVE	LOAD PER 1" DEFLECTION
	53	281	.063	5/8	6-1/2	4-1/2	80
	16	1-3/4	.312	3-5/16	5.7	3.7	365
	29	1	.156	2-13/16	8	6	80
EN-620	46	23/32	.162	2-15/16	11	9	150
EN-320	46	23/32	.160	2-15/16	7	5	250

LIST OF MATERIAL QUANTITIES FOR ONE UNIT

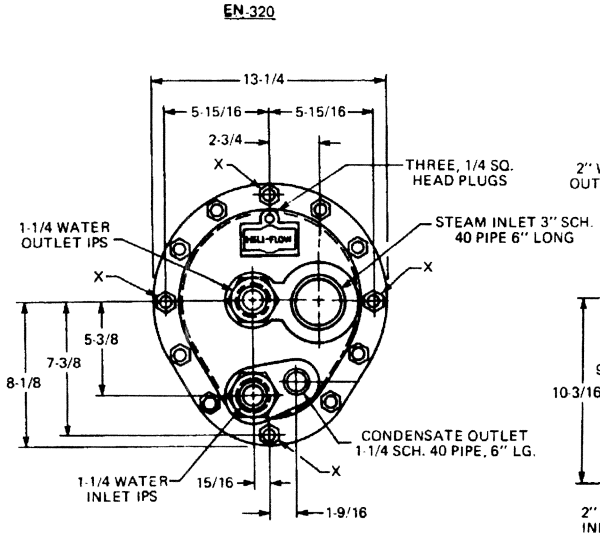
PC. NO.	TYPE EN-320 QTY. PER UNIT	TYPE EN-320 REF. NO.	TYPE EN-620 QTY. PER UNIT	TYPE EN-620 REF. NO.	NAME	MATERIAL	MAT' L SPEC.	REMARKS NOTES	MATERIAL CONTR. CODE
1	1	64442	1	64442	DIAPHRAGM CASE, UPPER	CRES	AISI TYPE 304		
2	1	37809	1	37809	DIAPHRAGM	SYNTHETIC RUBBER	BUNA-N		
3	1	64646	-	- -	SPACER	CRES	AISI TYPE 304		
4	1	64829	1	64829	MALE ELBOW FLARED	BRASS	COMMERCIAL		
5	14	26585	14	26585	NUT	STEEL	COMMERCIAL		
6	1	64443	1	64443	DIAPHRAGM CASE LOWER	CRES	AISI TYPE 304		
7	1	64768	1	64768	FORMED TUBING	CRES	AISI TYPE 304		
8	6	39655	6	39655	SOCKET HEAD CAP SCREW	CRES	AISI TYPE 18-8		
9	1	64769	1	64769	O-RING	BUNA-N	COMMERCIAL		
10	1	50547	1	50547	JAM NUT	BRASS	COMMERCIAL		
11	1	49746	1	49746	O-RING	BUNA-N	COMMERCIAL		
12	1	64645	1	64645	SHOULDERED WASHER	CRES	AISI TYPE 302/304		
13	1	64632	1	24632	SPRING GUIDE WASHER	CRES	AISI TYPE 304		
14	10	37797	10	37797	BOLT	STEEL	COMMERCIAL		
14A	5	67872	10	67872	BOLT	STEEL	ASTM A-193 GR B7		
15	1	64641	1	64641	DIAPHRAGM PLATE	CRES, ANNEALED	AISI TYPE 304		
16	1	64747	1	64747	CONT. VALVE SPRING	CRES.	AISI TYPE 302		
17	1	64620	1	64620	STEM SUPPORT	CAST BRONZE	ASTM B-61		
18	1	64644	1	64644	UPPER STEM	CRES	AISI TYPE 316		
19	1	64639	1	64639	TEMPERATURE IND. PLATE	BRASS	ASTM B-16		
20	2	21400	2	21400	DRIVE SCREW	CRES	AISI TYPE 18-8		
21	1	64640	1	64640	LOCKNUT	BRASS	ASTM B-16		
22	1	63899	1	63899	O-RING	BUNA-N	COMMERCIAL		
23	2	64236	2	64236	O-RING	BUNA-N	COMMERCIAL		
24	1	64739	1	64739	V PLUG ADJ. COLLAR	CRESS	AISI TYPE 304		
25	1	64633	1	64633	ADJUSTING HANDLE	BRASS	COMMERCIAL		
26	1	64622	1	64622	SNAP RING	CRES	AISI TYPE 302/304		
27	1	64657	1	64657	TEMP ADJ. DISC	CRES	AISI TYPE 302		
28	1	64647	1	64647	SPECIAL WASHER	CRES	AISI TYPE 302/304		
29	1	64746	1	64746	YIELDING SPRING	CRES	AISI TYPE 302		
30	1	64643	1	64643	SPRING SEAT	CRES, ANNEALED	AISI TYPE 302		
31	1	64741	1	64741	VALVE PLUG, COMPLETE	MONEL	ASTM A-744 GR. M35-1		
32	1	64661	1	64661	PIN	CRES	AISI TYPE 300 SERIES		
33	1	64603	1	64603	VALVE BODY	CAST BRONZE	ASTM B-61		
34	3	64770	3	64770	FITTING (MALE ELBOW, FLARED)	BRASS	COMMERCIAL		
35	2	65018	2	65018	BRACKET	STEEL	AISI 1029 HR		
36	1	55569	1	55569	3" COUPLING	MALLEABLE IRON	COMMERCIAL		
37	1	65005	1	65005	OUTLET MANIFOLD	CAST BRONZE	ASTM B-61		
38	1	65089	1	65089	SPRING LOADER, COMPL.	CRES, P.H.	ASTM A564 TYPE 630		
39	1	19800	1	19800	PACKING	SILICONE	COMMERCIAL		
40	1	27251	1	27251	O-RING	SYNTH. RUBBER	COMMERCIAL		
41	1	65025	1	65025	V-RETAINING COUPLING	CRES	AISI TYPE 316		
42	1	59109	1	59109	CLAMP	GALVANIZED ST.	ASTM A-93		
43	1	65091	1	65091	SPRING ADJUSTOR	CRES	AISI TYPE 303		
44	1	59010	1	59010	AWR SPRING SEAT	BRASS	ASTM B-16		
45	1	59013	1	59013	AWR SPG SEAT WASHER	CRES	AISI TYPE 302/304		
46	1	59016	1	59029	AWR ADJ. SPRING	CRES	AISI TYPE 302		
47	1	20586	1	20586	DIAPHRAGM NUT	BRASS	ASTM B-16		
48	1	20587	1	20487	LOCKWASHER	BRONZE	COMMERCIAL		
49	1	26052	1	26052	NOZZLE WASHER	BRASS	COMMERCIAL		
50	1	63154	1	63154	NOZZLE	CRES	AISI TYPE 303		
51	1	60862	1	60862	YOKE, AWR	COPPER ALLOY	ASTM B-283 ALLOY #377		
52	1	20576	1	20576	MAIN VALVE AWR	BRASS	ASTM B-16		
53	1	9852	1	9852	MAIN VALVE SPRING	PHOSPHOR BRZ.	ASTM B-139		
54	1	59480	1	59480	RELIEF ADJ. SCREW	BRASS	ASTM B-16		
55	1	11243	1	11243	NUT	BRASS	COMMERCIAL		
56	1	59706	1	59706	LOCK CAP	BRASS	ASTM B-16		
57	1	65006	2	65006	AWR SPRING CASE	C. BRONZE	ASTM B-61		
58	1	20572	1	20572	DIAPHRAGM DISC. AWR	BRASS	COMMERCIAL		
59	1	20575	1	20575	DIAPHRAGM WASHER	BRASS	COMMERCIAL		
60	1	65015	1	65015	TUBING	CRES	AISI TYPE 304		
61	1	63346	1	63346	DIAPHRAGM	DUPONT VITON	COMMERCIAL		
62	1	60863	1	60863	MAIN BODY	COPPER ALLOY	ASTM B-283 ALLOY #377		
63	1	11178	1	11178	DISC AWR	HYCAR PLATE	COMMERCIAL		
64	1	20579	1	20579	BOTTOM CAP GASKET	COPPER ANNEALED	COMMERCIAL		
65	1	59479	1	59479	BOTTOM CAP	BRASS	ASTM B-16		
66	1	28421	1	28421	O-RING	SYNTH. RUBBER	COMMERCIAL		
67	1	58188	1	58188	GASKET	HIGH TEMP. SYN RUBBER	COMMERCIAL		
68	1	58187	1	58187	VICTAULIC COUPLING 2"	MALLEABLE IRON	ASTM A47 GR 32510		
						BRASS (NIPPLE ADAPTER)	ASTM B-43 & ASTM B-16		
69	1	68002	1	68002	2" UNION NIPPLE COMPL.	COPPER (THD O' LET)	ASTM B-505 ALLOY C93200		
						SYN. RUBBER (O-RING)	VITON		
70	1	67999	1	67999	THERMAL SWITCH (190 + 5°F)	SEE REMARKS NOTE 1	COMMERCIAL		
70A	1	68062	1	68062	THERMAL SWITCH (150 + 5°F)	SEE REMARKS NOTE 1	COMMERCIAL		

MATERIAL CONTROL & IDENTIFICATION SCHEDULE				
MATERIAL CONTROL CODE	TYPE OF INSPECTION	INSPECTION STANDARD	DOCUMENTATION (NOTE)	IDENTIFICATION MARKING
J	VISUAL	-----	CERT. OF COMPL	-----

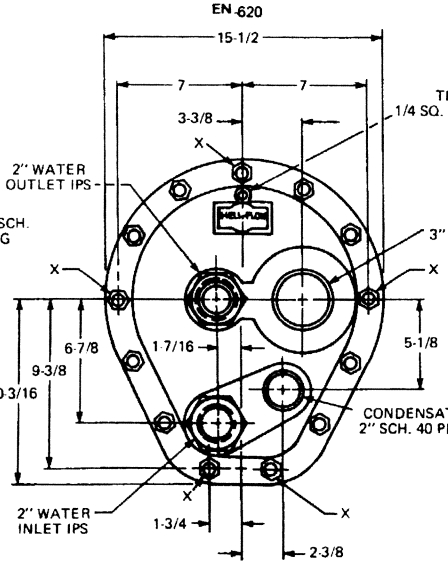
FIGURE 2
LESLIE-CONSTANTEMP HEATER
EN-320 and EN-620
BLEND VALVE COMPLETE



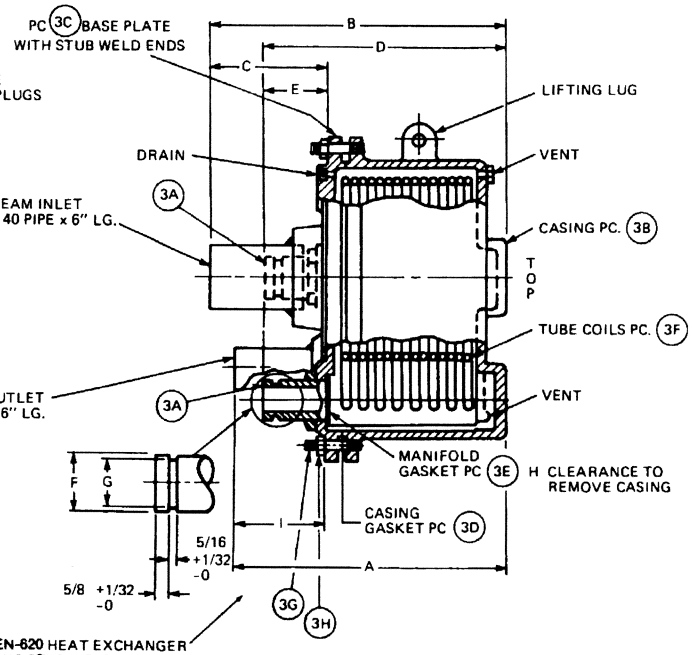
VIEW OF HEAT EXCHANGER SHOWING FLANGED ENDS ONLY WHEN SPECIFIED BY APPLICABLE CERTIFICATION DATA ALL OTHER DIMENSIONS ARE SAME AS SIDE VIEW SHOWING STUB WELD ENDS.



VIEW OF EN-320 HEAT EXCHANGER SHOWING STUB WELD ENDS



NOTE: All studs marked "X" to have 3/8" additional length.



VIEW OF EN-620 HEAT EXCHANGER SHOWING STUB WELD ENDS

GENERAL NOTES

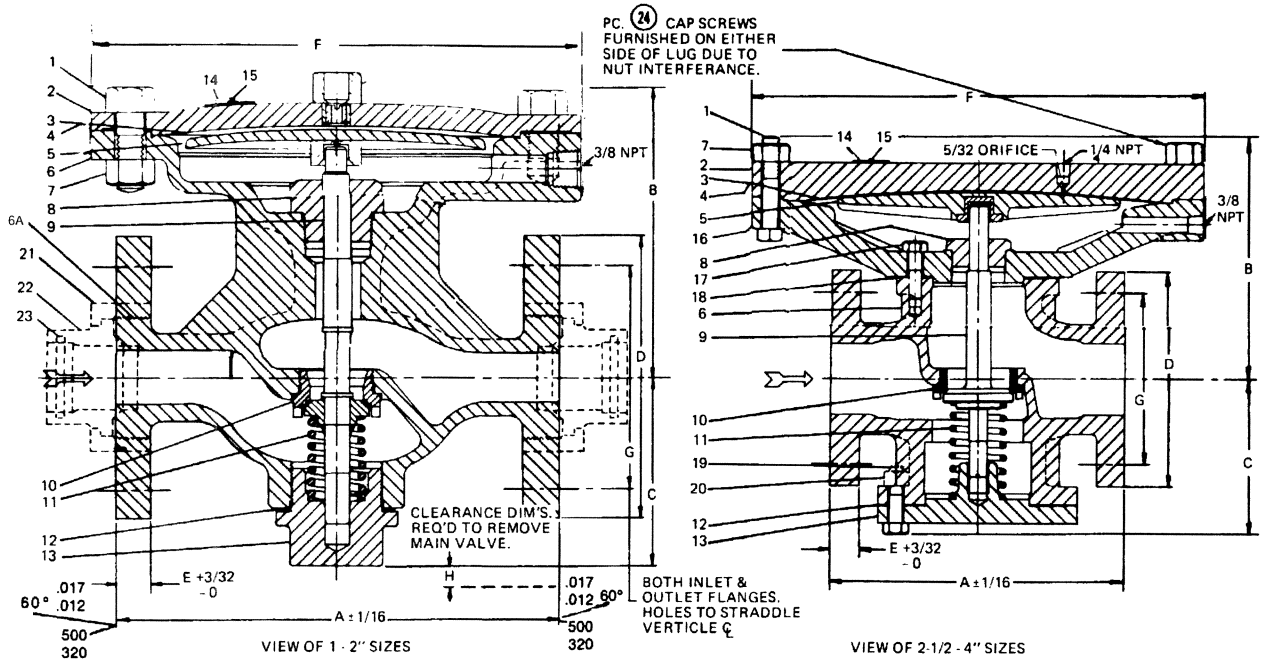
1. For design variation see applicable certification data.
2. All welding in accordance with the requirements of MIL-STD-278, latest revision or as defined on applicable certification data dwg., if required, Class A-3.
3. Weld symbols are in accordance with ASW A2.0-58.
4. All dimensions are for reference purposes only.
5. Equipment is hydrostested at 250.

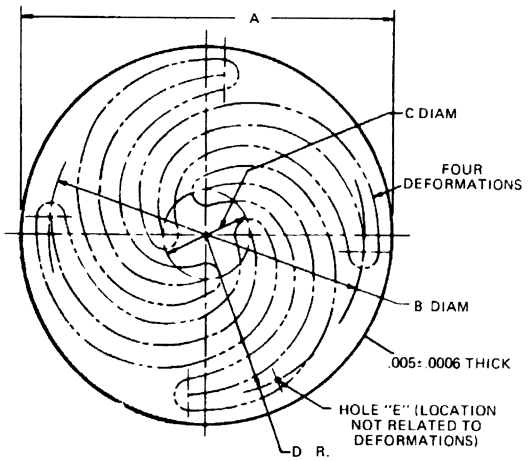
SIZE	INLET & OUTLET CONNECTIONS	DIMENSIONS IN INCHES									
		A	B	C	D	E	F	G +.000 -.015	H	I	J
EN-320	STUB WELD END	13-11/16	15-1/16	8-1/8	9-7/8	2-15/16	1.660	1.535	6	6-5/8	2-3/4
	FLANGED END	20-15/16	14-7/8	7-15/16	9-7/8	2-15/16	1.660	1.535	6	14	2-3/4
EN-620	STUB WELD END	16-7/8	17-7/8	7-3/4	13-3/4	3-1/4	2.375	2.250	10	6-3/4	2-15/16
	FLANGED END	24-1/8	18-3/8	8-1/4	13-3/8	3-1/4	2.375	2.250	10	14	2-15/16

EN-320 & EN-620	DESIGN PRESS	TEST PRESS	DESIGN TEMP.
SHELL SIDE	150 PSIG	250 PSIG	650°F
TUBE SIDE	150 PSIG	250 PSIG	300°F

GROUP NO	1		2		3		4		PC. NO. 3	HEAT EXCHANGER COMPLETE		
CLASS	**EN-320** STUB WELD END 58811-20		**EN-320** FLANGED END 58811-20-99		**EN-620** STUB WELD END 58812-20		**EN-620** FLANGED END 58812-20-99					
SERVICE PT. NO.										CONSISTS OF THE FOLLOWING PARTS		
	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	PC. NO.	NAME	MATERIAL	MATERIAL SPEC.
	2	- -	2	- -	2	- -	2	- -	3A	MANIFOLD	VALVE BRONZE	ASTM-B61
	1	- -	1	- -	1	- -	1	- -	3B	CASING	CAST STEEL	ASTM-A216 WCB
	1	- -	-		1	- -	-		3C	BASE PLATE, STUB END	CARBON STEEL	ASTM-A216 WCB
	-		1	- -	-		1	- -	3CC	BASE PLATE, FLG' D END	CARBON STEEL	ASTM-A216 WCB
	1	57961	1	57961	1	56686	1	56686	3D	GASKET, CASING	ASBESTOS	COMM' L
	2	56683	2	56683	2	56684	2	56684	3E	GASKET, MANIFOLD	ASBESTOS	COMM' L
	1	58223	1	58223	1	58224	1	58224	3F	TUBE COILS	COPPER	ASTM B-88
	12	- -	12	- -	13	- -	13	- -	3G	STUD, 5/8-11 x 3-7/16 LG.	STEEL	ASTM-A193 GR. B7
	12	- -	12	- -	13	- -	13	- -	3H	NUT, 5/8 - 11 AM. STD. HY. HEX.	STEEL	ASTM-A194 GR. 2H

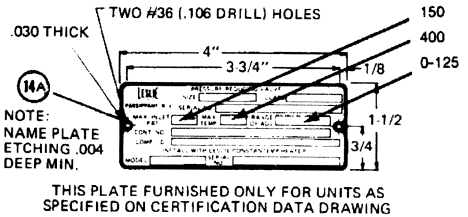
Figure 3
HEAT EXCHANGER
for
EN-320 and EN-620 HEATER
ASSEMBLY DETAILS and LIST OF MATERIALS

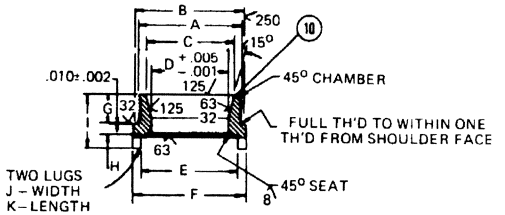


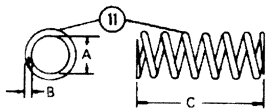


PC. NO.	SERVICE PART NO.	A +000 -010	D DIAM	C DIAM	D RADIUS	E HOLE
3	46729	6.490	5-9/16	1-1/2	NONE	NONE
	45953	8.490	7-7/16	1-11/16	NONE	NONE
	58640	13.740	12-1/4	3	NONE	NONE
4	58510	6.490	5-9/16	1-1/2	2-3/4	1-16
	58511	8.490	7-7/16	1-11/16	3-1/2	1/16
	58645	13.740	12-1/4	3	5-1/2	1/16

DIMENSION IN INCHES 150 # MIL-F-20042C FLANGES											
SIZE	A	B	C	D	E	F	H	DRILLING HOLES			WT. LBS.
								G(BC)	NO.	SIZE	
1	7-1/4	4-19/32	3-1/4	4-1/4	7/16	8-5/8	6-3/8	3-1/8	4	9/16	45
1-1/4	7-5/8	4-23/32	3-15/32	4-1/2	7/16	8-5/8	6-3/4	3-3/8	4	9/16	48
1-1/2	7-13/16	5-7/32	4	5-1/16	7/16	10-1/4	7-3/4	3-15/16	6	9/16	57
2	9-7/8	5-13/32	4-3/8	5-9/16	7/16	10-1/4	7-3/4	4-7/16	6	9/16	60
2-1/2	10-3/4	8-1/4	5-1/2	6-1/8	1/2	16	7-1/8	5	6	9/16	185
3	11-1/2	9	6-1/4	6-5/8	1/2	16	8	5-1/2	8	9/16	208
4	13-3/8	10-1/4	7-7/8	7-11/16	1/2	16	8-1/4	6-9/16	8	9/16	228

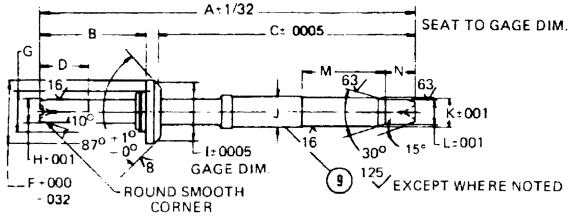






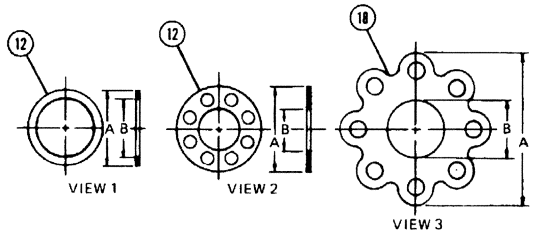
SIZE	S.P. NO.	A	B	C +1/16 -0	COILS		LOAD 1" DEFL. LBS.
					TOTAL	ACTIVE	
1	48035	47/64 ± 1/64	.125 ± .001	1-59/64	8	6	75.-
1-1/4-1-1/2	48036	29/32 ± 1/64	.135 ± .001	1-7/8	6.9	4.9	75.-
2	48037	1-3/32 ± 1-64	.156 ± .0015	2-1/2	7	5	75.-
2-1/2-3	48038	1-5/8 ± 1/32	.235 ± .002	4-13/16	9-3/4	7-3/4	75.-
4	48039	1-13/16 ± 1-32	.262 ± .002	5-13/16	11	9	75.-

DIMENSIONS IN INCHES													
SIZE	S.P.NO.	A THD NS-3	B	C	D	E	F	G	H	I	J	K
1	9445	1-5/16-16	1-462	1-7/64	.9375	1-7/32	1.500	13/32	.180	13/16	5/16	11/64
1-1/4	9544	1-11/16-16	1.840	1-13/32	1.1875	1-17/32	1-7/8	7/16	.180	7/8	5/16	13/64
1-1/2	9446	1-51/64-16	1.957	1-9/16	1.375	1-11/16	2	1/2	.180	15/16	3/8	13/64
2	9447	2-7/32-14	2.374	2	1.750	2-1/16	2.437	9/16	.180	1-1/32	3/8	15/64
2-1/2	9448	2-3/4-14	2.964	2-1/2	2.250	2-11/16	3	9/16	.211	1-1/16	7/16	15/64
3	9569	3-1/4-14	3.467	3	2.625	3	3-5/8	5/8	.243	1-7/32	1/2	19/64
4	11970	4-1/16-14	4.375	3-13/16	3.375	3-13/16	4-7/16	11/16	.274	1-11/32	1/2	21/64



GENERAL NOTES:

1. Bolts and Nuts are 1/2"-13 for 1-2" and 5/8"-11 for 2 1/2" sizes.
2. Bolts and Nuts are 1/2"-13 for 2 1/2" size, 5/8"-11 for 3" sizes and 3/4"-10 for 4" size.
3. Cap screws are 1/2-13 x 1 1/2 for 1 1/2" and 2" size and 5/8"-11 x 2 for 2 1/2 - 4" size.
4. PC. No's 3 and 4 are furnished only as diaphragm sets. Service part No's for sets are: 1/2 - 1 1/4" size 55062, 1 1/2 - 2" size 55063, and 2 1/2 - 4" size 55064.



SIZE	S.P.NO.	A	B	C	D	F	G	H	I	J	K	L	M	N
1	59283	6-37/64	1-7/8	4.478	7/8	1.125	11/16	.430	.9375	.495	.470	.430	1-7/16	1/2
1-1/4	59279	6-29/32	2	4.603	7/8	1.375	13/16	.430	1.1875	.495	.470	.430	1-7/16	1/2
1-1/2	59276	7-13/32	2-1/16	5.072	1-1/8	1.500	13/16	.470	1.375	.495	.470	-	-	-
2	59265	8-7/32	2-7/16	5.510	1-3/16	1.875	1	.610	1.750	3/4	.470	-	-	-
2-1/2	59267	9-23/32	2-27/32	6.469	1-1/2	2-7/16	1-9/16	.610	2.2500	7/8	.678	-	-	-
3	59257	10-11/16	3	7.314	1-9/16	2-13/16	1-9/16	.610	2.625	7/8	.678	-	-	-
4	59274	13-3/8	4-3/16	8.751	1-1/2	3-1/2	1-3/4	.610	3.375	1	.678	-	-	-

PC. NO.	REF. NO.	SIZE	VIEW	NO. OF HOLES	SIZE HOLES	DIA. OF B.C.	DIMENSIONS A	DIMENSIONS B	THK.
12	28138	1/2-1	1	- -	- -	- -	2	1-21/32	3/64
	28139	1-1/4		- -	- -	- -	2-1/2	2	
	28140	1-1/2		- -	- -	- -	2-7/8	2-5/16	
	16511	2		- -	- -	- -	3-5/32	2-43/64	
	49654	2-1/2	2	8	9/16	5-3/4	6-13/16	3-11/16	
	49655	3		8	11/16	6-3/4	8-1/16	4-11/32	
	49656	4		8	13/16	7-15/16	9-7/16	5-9/32	
18	18524	2-1/2	3	8	9/16	4-1/2	5-5/8	3-5/16	1/16
	18525	3		6	11/16	5-1/8	6-1/2	3-3/4	
	18526	4		8	11/16	5-7/8	7-3/16	4-9/16	

MATERIAL CONTROL AND IDENTIFICATION SCHEDULE				
MATERIAL CONTROL CODE	TYPE OF INSPECTION	INSPECTION STANDARD	DOCUMENTATION (NOTE)	IDENTIFICATION MARKING
J	VISUAL	- -	CERT. OF COMPL.	--

1		1-1/4		1-1/2		2		2-1/2		3		4		LIST OF MATERIAL QUANTITIES FOR ONE UNIT						
QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	QTY.	SERVICE PART NO.	PC. NO.	NAME	MATERIAL	MATERIAL SPEC.	REMARKS NOTES	MATERIAL CONTROL
12	65236	12	65235	12	65235	12	65235	16	45812	16	45812	16	45812	1	BOLT, AM STD HY HEX	STEEL	SAE GR. 5	1	J
1	65395	1	65395	1	56625	1	65398	1	56626	1	56626	1	56626	2	DIAPHRAGM COVER	CARBON STEEL	ASTM-A285 GR. C		
1	46729	1	46729	1	45953	1	45953	1	58640	1	58640	1	58640	3	DIAPHRAGM	CRES	AISI TYPE 316	4	
1	58510	1	58510	1	58511	1	58511	1	58645	1	58645	1	58645	4	DIAPHRAGM	CRES	AISI TYPE 316	4	
1	33715	1	33715	1	33663	1	33663	1	42870	1	42870	1	42870	5	DIAPHRAGM DISC / INSERT	SEE NOTE 1			
|	63984	|	63845	|	60174	|	58765	1	43589	1	59541	1		6	BODY, 150# MIL-F-20042C	VALVE BRONZE	ASTM-B-61		
									- -		- -	- -	- -	6A	BODY, SUE				
12	33816	12	33816	12	33816	12	33816	16	36147	16	36147	16	36147	7	NUT, AM STD HEX	STEEL	COMM' L	1	
1	41294	1	41294	1	41294	1	41294	1	36145	1	36145	1	36145	8	MAIN VALVE GUIDE	NAVAL BRASS	ASTM-B124 ALLOY C 46400		
1	59283	1	59279	1	59276	1	59265	1	59267	1	59257	1	59274	9	MAIN VALVE	CRES-HARDENED	ASTM-A 564 TYPE 630		
1	9445	1	9544	1	9446	1	9447	1	9448	1	9569	1	11970	10	SEAT RING	CRES, STELLITE	SEE NOTE 2		
1	48035	1	48036	1	48036	1	48037	1	48038	1	48038	1	48039	11	M.V. SPRING	CRES	AISA TYPE 300 SERIES		
1	28138	1	28139	1	28140	1	16511	1	49654	1	49655	1	49656	12	GASKET, B. CAP	SEE NOTE 3			
1	41397	1	41459	1	41460	1	41461	1	42866	1	42867	1	42868	13	BOTTOM CAP, COMPL.	VALVE BRONZE	ASTM-B-61		
1	59372	1	59372	1	59372	1	59372	1	59372	1	59372	1	59372	14	DATA PLATE	ALUMINUM	COMM' L		
2	21400	2	21400	2	21400	2	21400	2	21400	2	21400	2	21400	15	DRIVE SCREW	CRES	AISA TYPE 300 SERIES		
	- -		- -		- -		- -	1	42871	1	42872	1	42873	16	DIAPHRAGM BASE	VALVE BRONZE	ASTM-B-61		
	- -		- -		- -		- -	8	4021	6	11886	8	11886	17	CAP SCREW	STEEL	ASTM-A 193 GR. B7		
	- -		- -		- -		- -	1	18524	1	18525	1	18526	18	GASKET, D. BASE	SHEET ASBESTOS	ARMSTRONG AN-890		
	- -		- -		- -		- -	8	4488	8	36150	8	19389	19	BOLT, AM STD HY HEX	STEEL	ASTM-A193 GR. B7	2	
	- -		- -		- -		- -	8	3676	8	3677	8	3678	20	NUT, AM STD HY HEX	STEEL	ASTM-A 194 GR. 2H	2	
2	31496	2	31490	2	31492	2	31494		- -		- -		- -	21	UNION NUT	VALVE BRONZE	ASTM-B61		
2	31495	2	31489	2	56789	2	31493		- -		- -		- -	22	TAIL PIECE WITH RING	VALVE BRONZE	ASTM-B61		
2	42893	2	42894	2	42895	2	42896		- -		- -		- -	23	RING	SILBRAZ, ALLOY	MIL-S-15395 GR. III		
	- -		- -	4	9008	4	9008	4	45813	4	45813	4	45813	24	CAP SCREW	NOTE 4			
1	46189	1	46189	1	46189	1	46189	1	46189	1	46189	1	46189	14A	DATE PLATE	BRASS	COMM' L		
1	65394	1	65394	1	65394	1	65394							25	ADAPTER	BRASS	ASTM-B16		J

Note 1. DIAPHRAGM DISC — VALVE BRONZE ASTM B61
DIAPHRAGM INSERT — STEEL OR CRES/COMM' L

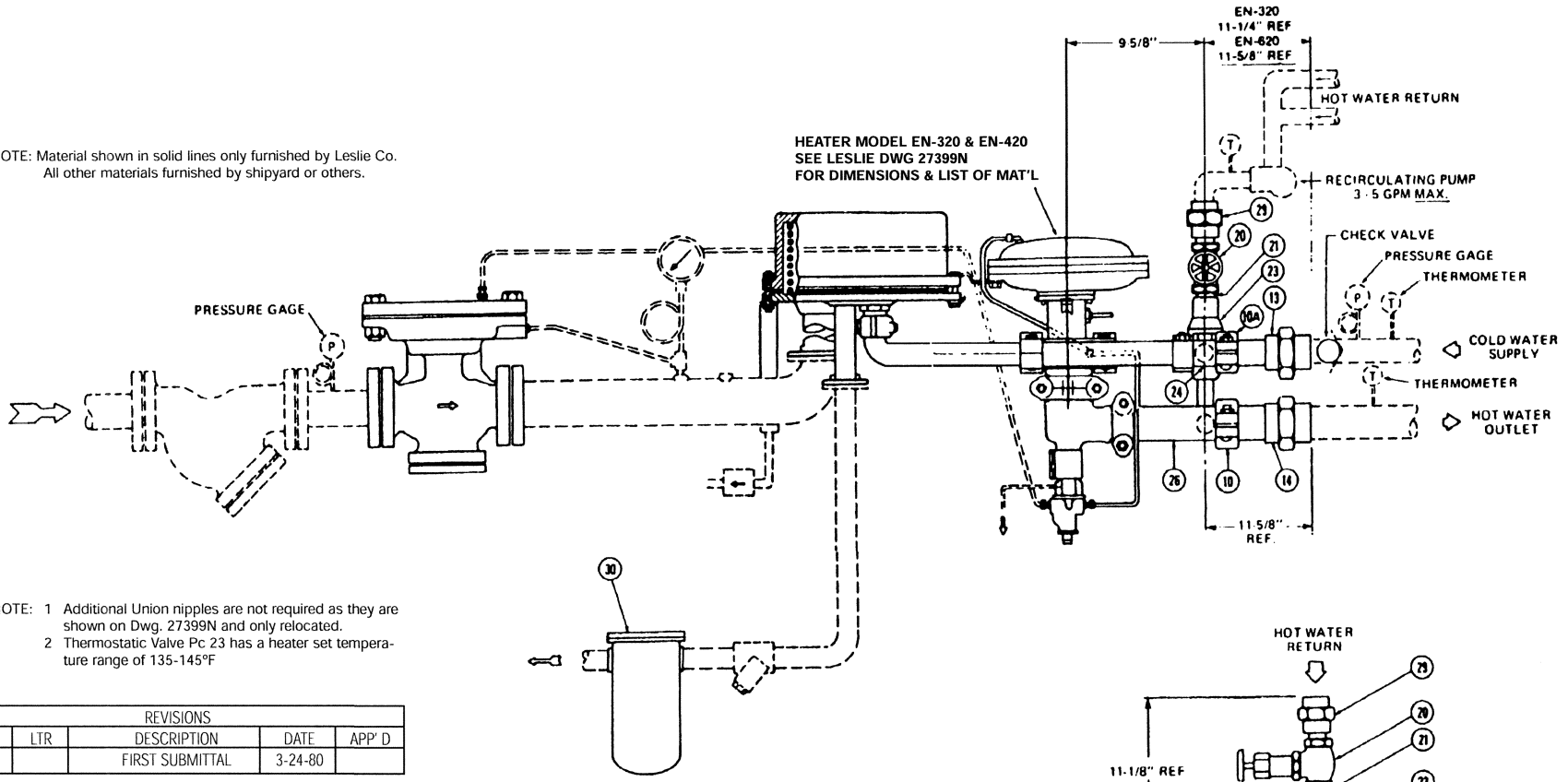
Note 2. AISI TYPE 410, ASTM A564 TYPE 630 (2" ONLY)

Note 3. GASKET, B CAP, 1 - 2"/COPPER ANNEALED/COMM' L
GASKET, B CAP, 2-1/2 - 4"/SHEET ASBESTOS/ARMSTRONG AN-890

Note 4. CAPSCREW, STEEL 1-1/2 - 2"/ASTM A193 GR. B7
CAPSCREW, STEEL 2-1/2 - 4"/SAE GR.3

Figure 4
STEAM CONTROL VALVE 1" - 4" CLASS GPBCN
ASSEMBLY DETAILS and LIST OF MATERIALS

NOTE: Material shown in solid lines only furnished by Leslie Co.
All other materials furnished by shipyard or others.



NOTE: 1 Additional Union nipples are not required as they are shown on Dwg. 27399N and only relocated.
2 Thermostatic Valve Pc 23 has a heater set temperature range of 135-145°F

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APP' D
		FIRST SUBMITTAL	3-24-80	

SERVICE PART NO.			LIST OF MATERIAL		QUANTITIES FOR ONE UNIT		NOTES
PC. NO.	EN-320	EN-620	NAME	QTY.	MATERIAL	MATERIAL SPEC.	REMARKS
10A	56547	- -	1-1/2" VICTAULIC COUPLING				
10A 10	- - 58187	58187 58187	2" VICTAULIC COUPLING 2" VICTAULIC COUPLING	1	MALLEABLE IRON	ASTM A47 GR. 32510	
13 13	60513 - -	-- 60514	1-1/2" UNION NIPPLE COMPL. 2" UNION NIPPLE COMPL.	-	(NIPPLE) COPPER (REG. PIPE) (UNION) VALVE BRONZE	ASTM B-43 ASTM B-61	NOTE 1
14	60514	60514	2" UNION NIPPLE COMPL.	-	(NIPPLE COPPER (SCH 40 PIPE) (UNION) VALVE BRONZE	ASTM B-43 ASTM B-61	
20	60955	60955	1" GLOBE STOP VALVE	1	VALVE BRONZE	LUNKENHEIMER FLG. 2140	
21	60956	61077	1" NPT NIPPLE	1	RED BRASS (SCH 40 PIPE)	ASTM B-43	
22	60946	60946	1" SWING CHECK VALVE	1	VALVE BRONZE	JENKINS #352 W/NO. 119A HI-TEMP DISC	
23	59295	59295	1" BRZ. THERMOSTATIC VALVE	1	VALVE BRONZE	AMOT CONTROLS MOD. NO./CM	NOTE 2
24	60986	60990	COLD WATER INLET TEE	1	HYDRAULIC BRZ.	ASTM B-62	
25	60956	60956	1" NPT. NIPPLE	1	RED BRASS (SCH 40 PIPE)	ASTM B-43	
26	60985	60985	HOT WATER OUTLET TEE	1	HYDRAULIC BRZ.	ASTM B-62	
27	61076	61076	1" NPT. NIPPLE	1	RED BRASS (SCH 40 PIPE)	ASTM B-43	
28	60958	60958	1" 125# CAST BRZ. 90° ELBOW	1	HYDRAULIC BRZ.	ASTM B-62	
29	60995	60995	1" UNION NIPPLE COMPL.	1	(NIPPLE) COPPER (REG PIPE) (UNION) VALVE BRONZE	ASTM B-43 ASTM B-67	
30	60939	60939	1" SWE STEEL TRAP	1	CARBON STEEL	ARMSTRONG #983	

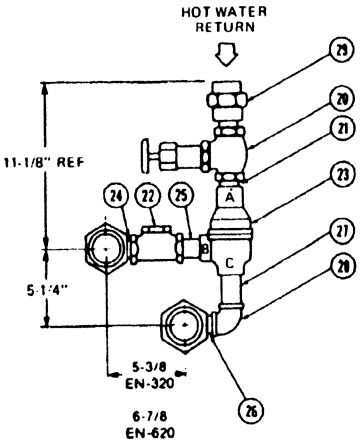


Figure 5
LESLIE-CONSTANTEMP HEATER
MODEL EN-320 and MODEL EN-620
RECIRCULATION SYSTEM

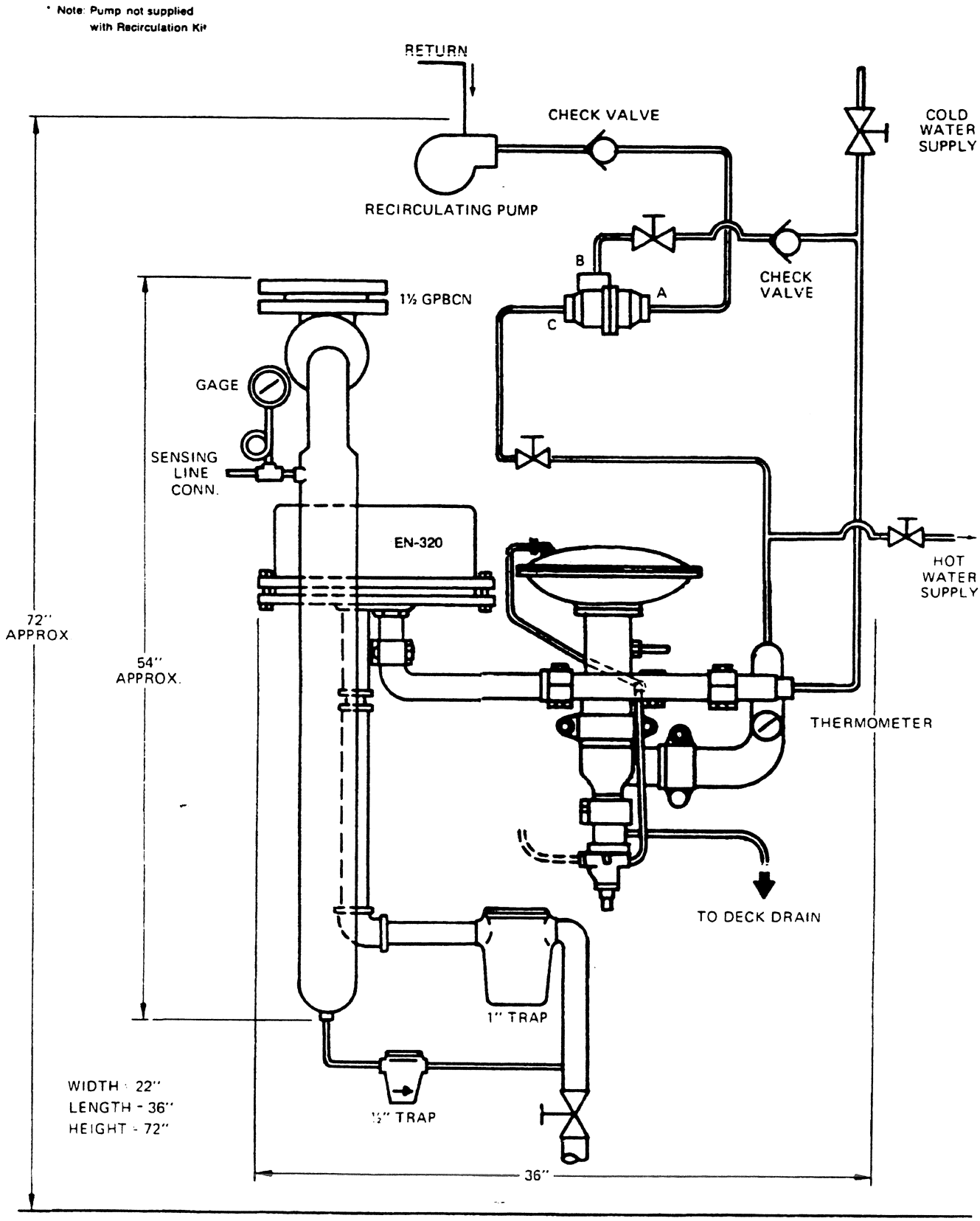


Figure 6
ACCEPTABLE ALTERNATIVE INSTALLATION
LESLIE-CONSTANTEMP HEATERS
(With or Without Recirculation Package)
MIL H-22881 TYPE II