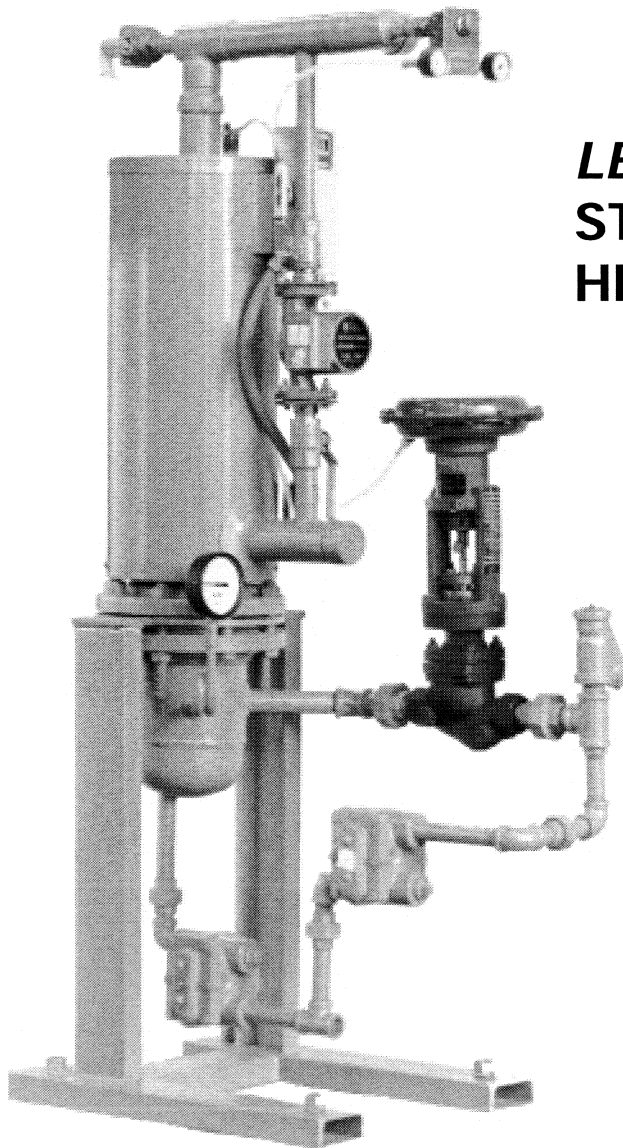


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**INSTALLATION, OPERATING,
AND MAINTENANCE INSTRUCTIONS**



**LESLIE PACKAGED
STEAM-FIRED WATER
HEATER**

 **LESLIE
CONTROLS, INC.**

A subsidiary of CIRCOR International, Inc.
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INTRODUCTION

DESCRIPTION

Congratulations on purchasing a LES Series Packaged Water Heater. The unit purchased will offer years of superior dependable service.

LES Series Packaged Water Heaters, employing the copper "U-Bend" heat exchanger coil, are the most economical method of furnishing domestic hot water when steam, boiler water, or high temperature water are used as the energy source. All LES Series Water Heaters are "Packaged" and ready for installation. All components are sized, mounted, and piped prior to shipment. Each unit is built to exact customer design specifications and requires only connection to energy, water, and power sources to be ready for operation.

The "Packaging" concept provides a compact size that is ideal for new installations, or for use as replacement of existing water heaters. The compact size requires less space for installation, and makes moving the unit through doorways, work areas, etc., less of a problem.

Each water heater is accompanied by this Installation, Operation, and Maintenance Manual, a detailed Submittal sheet and CAD drawing, as well as all documentation supplied by the manufacturer of each major component. If any of these documents are missing, contact either Leslie Controls or your authorized sales representative.

All LES Series Packaged Water Heaters are constructed from superior materials and utilize only the highest quality components. Each water heater meets or exceeds all applicable American Society of Mechanical Engineers (A.S.M.E.) Code regulations.

Each LES Series Packaged Water Heater is equipped with an A.S.M.E. approved relief valve and an external drain, providing a means to remove accumulated sediment.

The water heater jackets used for all LES Series Packaged Water Heaters are constructed of twenty (20) gauge metal and professionally painted with a superior quality enamel paint. This

procedure increases corrosion resistance and provides an attractive, easy to maintain surface.

A nameplate, mounted to the jacket, bears the model and serial numbers of the unit. These numbers should be included in all correspondence regarding the unit.

All LES Series Packaged Water Heaters contain a 2 inch (5.1 cm) layer of insulation between the tank and jacket. Depending on the Series, the insulation consists of either fiberglass or foam that conforms to the latest American Society of Heating, Refrigeration, and Air Conditioning Engineers (A.S.H.R.A.E.) Standards for commercial water heaters.

The "U-Bend" heat exchanger coils are manufactured from copper-lined steel or stainless tubesheet, with a cast iron or steel fabricated head. In units equipped with a circulating pump, the heat exchanger coil is designed with a copper wrapper surrounding the coil, providing the most efficient means of heat transfer from the coil to the water.

All other components included in LES Series Packaged Water Heaters have been specifically selected to meet the individual design specifications of each unit. Each component is judged to be of highest quality to provide long life and superior performance.

All LES Series tanks are manufactured with stainless steel threaded openings. All component piping and joints are manufactured from non-corroding (copper, brass, or stainless) piping to insure that water never contacts steel, which is subject to corrosion.

All LES Series Packaged Water Heaters can be configured and manufactured to use one (1) of three (3) possible energy sources for heating water:

- Steam
- Boiler water
- High temperature water

NOTE: Most LES Series Packaged Water Heaters use steam as the energy source for heating water.

Therefore, procedures detailed in this manual will be geared towards the installation, operation, and maintenance of steam powered units. When procedures differ substantially for the installation, operation, and maintenance of units powered by either boiler water or high temperature water, notes will be included giving specific instructions for those units.

Energy Source	Minimum Pressure (PSI)	Maximum Pressure (PSI)
Steam	0	150
Boiler Water	0	150
High Temp. Water	N/A	400

The table above lists the range of acceptable pressures at the inlet for each energy source.

NOTE: Consult the design specifications for each unit, as well as the nameplate attached to the exterior of the tank and individual specification tags on pressure related components and controls, for design and maximum pressure for the unit.

LES Series Packaged Water Heaters can be equipped with a circulating pump to assist in the even heating of the water, and electrically activated controls to regulate pressure and temperature. Pumps and electric controls used, depending on individual design specifications, can range in power requirements from 120 volt single phase to 480 volt three phase. Consult the individual design specifications for the unit and identification plates attached to the pump and controls for the exact requirements.

This manual is intended to cover installation, operation, and maintenance procedures for Les Series Packaged Water Heaters. Since each unit is built to meet customer specifications, instructions may seem general in nature at times. Where procedures differ substantially between the four (4) series; or between steam, boiler water, or high temperature water as the energy source for water heating; specific notes will be given.

If questions are not answered by this manual, or if specific installation, operation, and / or maintenance procedures are not clearly understood, contact Leslie Controls for clarification before proceeding.

All installation, operation, and maintenance procedures should be performed by experienced, trained, and certified personnel only. Personnel should be trained in correct plumbing and electrical procedures and methods, and should be experienced in working with steam and boiler water / high temperature water systems.

LES Series Packaged Water Heaters are designed for indoor use only, unless otherwise required by design specifications. Each unit requires at least 2 feet (0.62 m) of clearance around and above the unit. It should be located on a level surface (no more than one-half degree of slope), capable of supporting the total weight of the unit when filled to capacity.

The unit should be mounted to the floor following applicable architectural and local code requirements for the specific installation site.

In areas prone to seismic activity, it is recommended that the unit be mounted to the floor according to recommended procedures for the site / location to make the units less susceptible to seismic damage.

The high quality enamel paint, applied to the jacket of the unit, will provide years of protection against corrosion. If it is necessary to clean the outside of the unit, a mild cleaning agent should be used that will not damage the paint.

Inspection procedures, troubleshooting, and periodic maintenance, as well as suggested intervals, are detailed on pages 12 to 24 of this manual.

LES Series Packaged Water Heaters are available in a wide range of operating pressures and temperatures. For the specific ranges for your unit, refer to the design specifications and accompanying literature supplied with the unit.

If the unit is damaged during installation, operation, or maintenance, follow the following steps.

1. Turn off the power to the unit.

2. Turn off the inlet steam / boiler water / high temperature water inlet valve(s).
3. Turn off the condensate outlet valves or boiler water / high temperature return valves.
4. Turn off cold water inlet valves and hot water outlet valves.
5. Contact in-house maintenance personnel or Leslie Controls, Inc. for instructions.

For all piping connections, the use and / or type of joint compound or sealer on the joints should be determined by referring to local codes, accepted standards, and / or the requirements of the installing contractor.

WARRANTY INFORMATION

Stainless Steel tanks are warranted for five (5) years from date of purchase. All other components used in LES Series Packaged Water Heaters are warranted for one (1) year from startup or eighteen (18) months from date of purchase, whichever comes first.

WARNING

As with any piece of equipment that utilizes steam, boiler water, or high temperature water under pressure, as well as electricity, the potential exists for severe personal injury if proper installation, operation, and maintenance procedures are not followed. Listed below are specific warnings pertaining to LES Series Packaged Water Heaters. In addition, throughout this manual, warnings are restated when procedures are described pertaining to areas of potential danger. All warnings should be carefully read and understood. All precautions contained in the warnings should be carefully followed to reduce the chance of injury.

CAUTION

All documentation for each major component has been included with the unit. It is strongly recommended that each document be reviewed before attempting any installation, operation, or maintenance procedures.

The documentation for each major component may also contain warnings and cautions. These warnings and cautions may be specific for the particular component, and therefore not covered in this general Installation, Operation, and Maintenance Manual. They should also be carefully reviewed before attempting installation, operation, or maintenance procedures.

WARNING

Areas of potential danger:

1. All steam / boiler water / high temperature water lines, joints, valves, and pressure regulators;
2. All hot water outlet lines, joints, valves, and pressure regulators; and
3. All power connections and cables.

WARNING

Before attempting any installation, operation, or maintenance procedures pertaining to the unit:

1. Assure that the incoming steam (or boiler water / high temperature water) has been turned off at the manual shutoff valve;
2. If the unit has been in operation, allow the water in the heater and all components and surfaces (incoming steam line, hot water outlet line, etc.) to cool before starting the procedure;
3. Assure that all power has been shut off / disconnected before attempting any procedures; and
4. Assure that all incoming and outgoing water lines have been turned off at the manual shutoff valves.

WARNING

Steam, boiler water, or high temperature water present situations that can be very dangerous due to the fact they are under pressure and at very high temperatures. To avoid possible injury or death, use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures.

WARNING

The combination of electricity and water can pose a very dangerous situation. Assure that all power has been shut off / disconnected before attempting any installation or maintenance procedures.

I. INSTALLATION

A. TRANSPORTING AND UNPACKING THE UNIT

Each LES Series Packaged Water Heater is crated, as necessary, at the factory. The crating is designed to provide protection for the unit during transportation, and to provide a safe means by which to lift and move the unit with a fork lift or hand truck. On horizontal units, lifting lugs are attached inside the jacket to provide a safe lifting position.

CAUTION

The unit should only be lifted at the areas indicated on the crate, or by the lifting lugs provided. Improper lifting of the unit may result in damage to the unit.

B. FAMILIARIZATION WITH THE UNIT AND COMPONENTS

LES Series Packaged Water Heaters are designed to make installation a relatively simple procedure. Because the unit is "Packaged," after placing and mounting the unit, installation involves:

1. Connecting the cold water source to the water inlet;
2. Connecting the hot water outlet to the hot water feed line;
3. Connecting the condensate / water return line and piping it to the recycling system;
4. Piping the pressure relief valve to an acceptable drain;
5. Connecting the energy source (steam, boiler water, or high temperature water) to the unit; and
6. Wiring the applicable source of electricity (if the unit is packaged with a circulating pump or electrically activated pressure or temperature controls).

C. INSTALLATION POSITION AND CLEARANCES

LES Series Packaged Water Heaters are designed for indoor use only and require at least 2 feet (0.6 m) of clearance around and above the unit, unless otherwise required by the design specifications. The unit should be located on a level surface (no more than one-half degree of slope), capable of supporting the total weight of the unit when filled to capacity.

Once the unit has been set in place, the crating should be carefully removed.

D. EXAMINING THE UNIT

After the unit has been set in place and uncrated, it should be carefully examined to assure that neither the main unit nor components have been damaged during shipping. If any evidence of damage is detected that could affect the safe operation of the unit, contact Leslie Controls, Inc., or your authorized sales representative, to report the damage and to receive instructions on how to proceed.

After the unit and all components have been inspected for damage, it is suggested that all pressure and temperature control components be checked to assure that they meet or exceed design specifications. This can be done by reviewing the design specifications (included with

the unit) and the specification tags / plates attached to each component. If any discrepancy is found, contact Leslie Controls, or your authorized sales representative, before proceeding with the installation.

E. MOUNTING THE UNIT

The unit should be mounted to the floor, following applicable architectural / local code requirements, or accepted standards for the specific installation site and for the Series purchased.

In areas prone to seismic activity, it is recommended that the unit be mounted to the floor, according to recommended procedures for the site, to make the units less susceptible to seismic damage.

Connecting the Cold Water Source and Hot Water Outlet

NOTE: Before making any connections of water inlet or outlet to the unit, assure that all piping is clean and free of foreign material or scale. This can usually be accomplished by "blowing out" the pipe. Any foreign material or scale entering the unit can adversely affect operation and performance.

Cold Water Source

The first step in the installation process is to connect the cold water source to the water inlet port. The exact location of this port for the specific unit, as well as inlet pipe diameter and thread size, can be determined from the CAD drawing supplied with the Submittal sheet.

A manual shutoff valve should be installed upstream on the cold water source as an isolation device. The shutoff valve should be in the closed position and remain so until the installation is complete.

NOTE: For all piping connections, the use and or type of joint compound or sealer on the joint should be determined by referring to local codes, accepted practices or the requirements of the installing contractor.

If the cold water source is equipped with an in-line check valve or back flow preventer, a suitable expansion tank must be installed in the hot water outlet side of the system. See the supplied Submittal sheet and CAD drawing, or contact Leslie Controls for expansion tank specifications.

Hot Water Outlet

The next step in the installation process is to connect the hot water system piping to the hot water outlet port. The exact location of this port for the specific unit, as well as outlet pipe diameter and thread size, can be determined from the CAD drawing supplied with the Submittal sheet.

A manual shutoff valve should be installed downstream on the hot water outlet line as an isolation device in case the unit must be disconnected from the system. The shutoff valve should be in the closed position and remain so until the installation is complete.

Connecting the Energy Source (Steam, Boiler Water, or High Temperature Water)

WARNING

Steam, boiler water, or high temperature water present situations that can be very dangerous because of the high temperatures and pressures. Use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures to avoid possible injury or death.

Assure that a manual shutoff valve is installed upstream in the steam, boiler water, or high temperature water line (energy source), and that it is functioning properly. If any doubt exists concerning the integrity of the shutoff valve, replace the valve before attempting installation. All energy source valves should be closed and remain closed throughout the installation process.

Connect the energy source to the line(s) leading to the temperature control valve. The exact location of the temperature control valve for the specific

unit, as well as energy source pipe diameter and thread size, can be determined from the CAD drawing supplied with the Submittal sheet.

NOTE: For all energy source piping connections, the use and / or type of joint compound or sealer on the joint should be determined by referring to local codes, accepted practices, or the requirements of the installing contractor.

Connecting the Steam Condensate Line or the Boiler Water / High Temperature Water Return Lines Steam Condensate Return Line.

As the heat is extracted from the steam and transferred to the water heating system, condensate will form. This condensate must have a means by which it can drain from the unit and return to the steam system. The condensate return line serves this purpose.

The condensate return line should be connected to the unit at the condensate return port. The condensate port is normally located downstream from the main and auxiliary traps. The exact location of this port for the specific unit, as well as the condensate return pipe diameter and thread size, can be determined from the CAD drawing supplied with the Submittal sheet. The condensate line should be piped back into the site's steam system for recycling.

A manual shutoff valve should be installed downstream in the condensate return line to allow the unit to be isolated from the system. The condensate shutoff valve will prevent back flow of steam if the line is disconnected.

Boiler Water and High Temperature Water Return Line

After the boiler water or high temperature water has passed through the heat exchanger coil, and the heat has been extracted and transferred to the domestic water system, the water must return to the system. The water return line serves this purpose.

The water return line should be connected to the unit at the return port. Unlike the steam condensate return line, the return lines for boiler and high temperature water do not have in-line condensate traps. The return port is normally located downstream from the heat exchanger coil. The exact location of this port for the specific unit, as well as the water return pipe diameter and thread size, can be determined from the CAD drawing supplied with the Submittal sheet.

A manual shutoff valve should be installed downstream in the water return line to allow the unit to be isolated from the system. The water return shutoff valve will prevent back flow of boiler water or high temperature water if the line is disconnected.

Piping the Relief Valve To Drain

All LES Series Packaged Water Heaters are equipped with pressure relief valves for both the tank and steam (or boiler water and high temperature water) system. Both should be piped to a vent line leading to a suitable drain. Piping the pressure relief valves to suitable drains will prevent both water and heat damage to the unit, as well as reduce the risk of injury from released steam or water. The pipe must be of adequate size to properly handle the capacity of the relief valve and vent line. Check local codes to assure compliance.

If a check valve has been installed on the inlet water line, thermal expansion may take place causing build up of excessive pressure when the water is being heated. This expansion will cause the relief valve to releasing hot water to the vent line.

WARNING

Do not install a valve between the water heater relief valve and the vent. Doing so could cause serious injury or death if the pressure relief valve released and the manual valve was closed. This would cause excessive buildup of pressure in the water heater which could result in an explosion.

Connecting The Circulation Pump and Electrically Activated Controls

LES Series Packaged Water Heaters can be equipped with a circulation pump and / or electrically activated pressure and temperature control valves.

If the unit being installed is so equipped, the correct power source(s) must be connected.

WARNING

The combination of electricity and water can pose a very dangerous situation. Assure that all electric power has been turned off before attempting any installation or maintenance procedures.

Reference the wiring CAD drawing that is included with the Submittal sheet, or the installation instructions contained in the Installation Manual for the component, for specific wiring instructions.

NOTE: All power connection should be performed by trained, certified electricians.

F. COMPLETING INSTALLATION

Installation of the LES Series Packaged Water Heater is now complete. All documentation supplied with the unit should be passed along to maintenance personnel for future reference.

II. OPERATION

After all installation procedures have been completed, and all water, energy source joints, and power connections have been double checked, the unit is ready for operation. As a precaution, it is strongly suggested that the following startup and shutdown procedures be followed.

A. STARTUP PROCEDURES

1. Assure that all manual shutoff valves on water and energy source lines are closed.
2. Slowly open the manual shutoff valve on the cold water inlet line, checking to assure that there are no leaks at the valve or any joints. Allow the tank to fill with water. As the tank is

filling, hold the pressure relief valve open to allow air to bleed out of the tank. This will speed the filling process.

3. Adjust the operating temperature control to the desired operating temperature. See the Submittal sheet and the operating temperature control component manual, included with the unit, for the exact location of the control and detailed adjusting procedures.
4. Set the high temperature limit thermostat at 10 to 15°F degrees (-12 to -9°C) above the desired operating temperature. See the Submittal sheet and the high temperature control manual, included with the unit, for the exact location and detailed adjusting procedures.
5. If the unit is so equipped, turn on the internal circulating pump. The circulating pump will operate constantly as long as power is supplied to the pump. On some units, shutoff valves are located on the inlet and / or outlet side of the circulating pump line. These valves should be opened before the pump is turned on. After the power to the pump is turned on, verify that the pump is working. If the pump is an oil lubricated unit, verify proper oiling.
6. Open the valve on the condensate drain line, or boiler water / high temperature water return line.
7. Slowly open the manual shutoff valves on the steam inlet and outlet lines, and create a load / demand situation of approximately ten to twenty-five percent (10% to 25%) of the system design conditions. As the valves are being opened, check for leaks at the valves and all steam joints.

NOTE: This procedure is similar for both boiler water or high temperature water energy sources.

WARNING

Steam, boiler water, or high temperature water present situations that can be very dangerous because of the high temperatures and pressures. Use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures to avoid possible injury or death.

8. Turn on the power to the rest of the electrically controlled components of the unit.
9. As the unit is initially heating the water, carefully reinspect all joints for cold water inlet, hot water outlet, steam inlet (or boiler water / high temperature water inlet), and condensate return (or boiler water / high temperature water return line) joints for signs of leakage.
10. As unit approaches the desired operating temperature, adjust the temperature control valve. See the submittal sheet and the temperature control valve component manual, included with the unit, for the exact location of the valve and detailed adjusting procedures.
11. After the unit has reached operating temperature, reinspect all joints for signs of leakage. In addition, check all gauges and controls to verify that the water temperature and pressure, as well as energy source pressure, are within design specifications.
12. The unit is now ready for normal operation.

III. MAINTENANCE

The information contained in this section will detail service and maintenance procedures for the inspection and replacement of the components of the LES Series Packaged Water Heater. If there are any questions concerning maintenance procedures that are not clearly explained in this manual, contact Leslie Controls. Be sure to have the model and serial numbers of the unit and heat exchanger coil available before making contact.

NOTE: Many of the maintenance procedures detailed in this section will require the unit to be taken off-line before the procedure is performed; and put back on-line after the procedure is completed. It is recommended that the maintenance personnel performing these procedures review the startup and shutdown procedures, detailed on pages 10 and 11 of this manual, before attempting any maintenance procedure.

Any component(s) directly connected or linked to the component being replaced should carefully be examined before maintenance procedures are started. If any of the related components show signs of wear or proper operation, they should be considered for replacement at the same time.

A. SHUTDOWN PROCEDURE

1. Turn off all power to the circulating pump and / or electric controls, if so equipped.
2. Close all valves in the steam inlet line (or boiler water / high temperature water line).
3. Relieve the pressure from the energy source line (steam, boiler water, or high temperature water), where possible.
4. Close all remaining valves in the system in this order:
 - a. The hot water outlet line
 - b. the cold water inlet line
 - c. the condensate return line (or boiler / high temperature water return line).
5. After the system has cooled, drain the unit by opening the tank drain valve and holding the pressure relief valve in the open position. This will prevent the formation of a vacuum and to the increase the drainage flow.
6. Proceed with the required maintenance or repairs.
7. After performing the required maintenance or repairs, return the unit to operation by following the startup procedure detailed on pages 9 and 10.

Reconfigure the condensate / water return piping and check valve to allow for proper drainage. Check to assure that there is no restriction in the condensate / water drain line. Replace the check valve if it is leaking or has failed. Also, check to assure that there is no restriction in the condensate / water drain line.

B. INSPECTION

The following table summarizes the recommended time intervals for inspections of the water heater, components, inlet and outlet water and energy source lines (steam, boiler water, or high temperature water), and power connections.

Recommended Inspections

To Be Inspected	Time Interval						
	Per Manu. Specs.	Weekly	Monthly	Quarterly	Annually	Semi-Annually	Bi-Annually
Circulating Pump							
Control Valves - Temperature & Pressure							
Gauges - Pressure & Temperature							
Heat Exchanger Coil & Gasket							
Lines - Inlet, Outlet, & Return							
Power Connections							
Pressure Relief Valve							
Shutoff Valves - Manual							
Single Solenoid Safety System							
Strainers							
Temperatures - Water & Operating							
Thermometer							
Traps - Main & Auxiliary							

If any problems are detected during inspections, refer to either the Troubleshooting (page 12) or Maintenance (page 10) section of this manual for specific actions and instructions.

Troubleshooting

The following table summarizes problems that may be encountered over the life of a Les Series Packaged Water Heater, and the procedures to remedy those problems. The left-hand column lists the symptoms. The columns to the right are suggested procedures or "remedies", and are identified by the black areas.

Symptom	Probable Cause and Remedy #									
	1	2	3	4	5	6	7	8	9	10
Water heater does not maintain the required temperature at the rated capacity										
Outlet temperature is too high.										
Outlet temperature fluctuates widely.										
Excess or insufficient condensate (boiler/high temp. water) being returned from the unit.										
Steam being discharged into the condensate drain.										
Pressure relief valve "pops".										
Water heater shuts down at or too close to (above or below) the design steam outlet temperature.										
A loud banging in the water heater, primary piping, or condensate/water return piping (not to be confused with a normal clicking noise made during operation).										

Probable Cause and Remedy

1. The thermometer is not correctly sensing the water temperature.

Check the water temperature with a temperature gauge that is known to be correct. Replace the thermometer if it is found to be incorrectly sensing the water temperature. (Reference thermometer replacement procedure on page 23)

2. Inlet energy source pressure is too low.

Check the primary energy source pressure gauge. If the reading is low, adjust the inlet pressure to meet the design requirements. If there is a restriction in the primary energy source line, the gauge reading will drop excessively when the generator calls for full energy, even though the pressure seems to be normal during light demand. If the primary pressure is correct, its pressure gauge reading should reach design pressure for energy source in the coil as the temperature of the water in the tank heater approaches shutoff.

3. The condensate / water return piping has not been installed properly, allowing the condensate / water to drain freely (by gravity); the condensate / water drain line is restricted; or the condensate / water check valve is leaking or has failed.

Reconfigure the condensate / water return piping and check valve to allow for proper drainage. Check to assure that there is no restriction in the condensate / water drain line. Replace the check valve if it is leaking or has failed. Also, check to assure that there is no restriction in the condensate / water drain line.

4. Primary / inlet steam line is not properly trapped (steam as energy source only).

Reconfigure the primary / inlet steam line to allow main and auxiliary (drip) traps to function properly.

5. The primary / inlet temperature control valve is not closing properly.

See the adjustment and testing instructions contained in the supplied Installation / Operations Manual for the specific temperature control valve installed on the unit. Replace the valve if necessary. (Reference replacement procedure on page 22)

6. The primary / inlet temperature control valve is not opening properly.

See the adjustment and testing instructions contained in the supplied Installation / Operations Manual for the specific temperature control valve installed on the unit. Replace the valve if necessary. (Reference replacement procedure on page 22)

7. The secondary / outlet energy source pressure control system is not operating properly.

See the adjustment and testing instructions contained in the supplied Installation / Operations Manual for the specific temperature / pressure control system installed on the unit. Replace the valve if necessary. (Reference replacement procedure on page 22)

8. The over-temperature limit system is out of adjustment, or some component of the system has failed.

Check the individual components of the system and repair or replace the failed component(s) as necessary.

9. There is a leak in the heat exchanger coil or the condensate / water return line causing water to leak from the tank or energy source system.

To verify the existence of a leak, shut off the primary energy source to the unit and carefully break a connection in the condensate / water return line.

CAUTION

The system still contains the primary energy source, possibly under pressure, and could present a serious potential for injury. Use extreme caution when breaking any connection in the system.

Condensate (boiler or high temperature water) will drain from the coil initially, but the flow should stop after a short period of time. If the flow continues, water is leaking from the tank into the coil. Disassemble, inspect, repair (if possible), or replace the heat exchanger coil and reassemble the unit. (Reference heat exchanger coil replacement procedure on page 16-17)

10. The heat exchanger coil is heavily scaled or damaged.

Call Leslie Controls, or an authorized sales agent, for instructions on repair or replacement. Refer to the nameplate for the model and serial numbers of the unit and heat exchanger coil. Include these numbers in all correspondence.

Circulating Pump - Inspection and Replacement

LES Series Packaged Water Heaters can be equipped with a circulating pump to assist in the even heating of the water. If the unit is equipped with a circulating pump, the following procedure should be followed to replace the pump.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to service the circulating pump.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedure.

2. Refer to the manufacturer's documentation supplied with the unit pertaining to testing the pump. If found to be defective or questionable, replace the pump by continuing with the steps that follow.
3. After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.
4. Close the manual shutoff valves located near the inlet and outlet ports of the pump.
5. Break the joints between the pump and the inlet and outlet piping. Remove the pump.
6. Reconnect the pump to the inlet and outlet piping. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.

7. Open the manual shutoff valves located on the inlet and outlet sides of the pump and check for any leakage at the joints.
8. Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).
9. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Circulating Pump Shutoff Valves - Replacement

If the LES Series Packaged Water Heater is equipped with a circulating pump to assist in the even heating of the water, manual shutoff valves will be located on both the inlet and outlet side piping. To replace the valves, follow the procedures detailed below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to service the circulating pump shutoff valves.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

2. After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.
3. Break the joints between the pump and the inlet and outlet piping. Remove the pump.
4. Remove the shutoff valves.
5. Install the new valves. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
6. Reconnect the pump to the inlet and outlet piping. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to

the use and / or type of joint compound or sealer at the connections.

7. Open the manual shutoff valves located on the inlet and outlet sides of the pump.
8. Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).
9. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all joints for any sign of leakage.

Power Connections - Rewiring

If any of the power connections must be rewired at the circulating pump or electrically activated controls, follow the steps listed below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedure.

1. Follow Steps 1 through 4 of the shutdown procedure (page 11) to take the unit off-line before attempting any electrical service.
2. After assuring the power has been turned off, disconnect and rewire the electrical connections in question.
3. Turn the power on and check that the component that has been rewired is functioning properly.
4. Slowly open the shutoff valves on the condensate (or boiler water / high temperature water return) line, cold water inlet line, and hot water outlet line.
5. Slowly open the shutoff valves on the energy source inlet line.

Heat Exchanger Coil and Gaskets - Inspection and Replacement

The "U-Bend" heat exchanger coil is the heart of LES Series Packaged Water Heaters. It should be removed and inspected every two (2) years. There

are two (2) gaskets, one (1) between the tube face of the coil and the flange welded to the tank, and one (1) gasket with a divider to fit between the head and the tubesheet.

WARNING

Steam, boiler water, or high temperature water present situations that can be very dangerous because of the high temperatures and pressures. To avoid possible injury or death, use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to remove and inspect the heat exchanger coil.
2. Assure that the energy source, condensate / water return line, cold water inlet, and hot water outlet have been shut off; that the tank has been completely drained; that the pressure has been bled from both the water and energy source systems; and that the water, all components' and surfaces have cooled.
3. Carefully break the joint between the heat exchanger coil head and the small line leading to the energy source pressure gauge.
4. Carefully break the connections between the heat exchanger coil head and the energy source inlet and outlet lines.

NOTE: It may be necessary to break the lines at a second location, and for the lines to be rotated to allow clearance for the heat exchanger coil to be removed from the tank. If it is necessary, care should be taken to insure that in-line components are not damaged.

5. Break the bolts loose that secure the heat exchanger coil head to the tank. After all bolts have been broken loose, remove them from the unit.
6. Carefully separate the heat exchanger coil head from the mounting flange and remove the coil assembly from the tank.

WARNING

There may still be residual steam condensate (or boiler / high temperature water) in the coil that can run out during removal of the coil from the tank. If sufficient time has not been allowed for cooling, this residual condensate / water could present a danger of injury.

7. Examine the heat exchanger coil for scale buildup and signs of leakage. If no leakage is detected, carefully clean the excess scale from the coils and prepare the heat exchanger coil for installation. If leakage is detected between the coils and water in the tank, either repair the leaking coil(s) or replace the heat exchanger coil.
8. Remove the old gaskets and completely clean the mating surfaces. Install the two (2) new gaskets: one (1) between the tube face of the coil and the flange welded to the tank, and one (1) gasket with a divider to fit between the head and the tubesheet.
9. Carefully insert the heat exchanger coil into the tank. The coil should be installed so that the divider in the head lines up with the coil, and that the divider is parallel to the horizon.
10. After assuring that the heat exchanger unit is correctly aligned, clamp the flanges together and proceed with the torque procedure detailed below.

NOTE: Bolts used to secure the heat exchanger unit in LES Series Packaged Water Heaters are rated as either Grade A or Grade 5. Grade A bolts have no marking on the head. Grade 5 bolts are designated by three (3) slash marks on the head (///).

- a. Lubricate the bolt threads and the nut faces with a suitable lubricant.

- b. Insert the bolts through the flanges, then start and finger tighten the nuts.
- c. Number all bolts so that torquing requirements can be followed.

NOTE: Appendix A contains drawings depicting the typical flange configurations (number of bolts, location, tightening sequence, etc.) for Les Series Packaged Water Heaters. Reference the applicable drawing for the unit being serviced.

- d. Apply torque in twenty percent (20% [1/5]) steps of required final torque, loading all bolts at each step before proceeding to the next step. The following tables list ANSI approved target torques for both Grade A and Grade 5 bolts. The correct target torque can be determined by the nominal pipe size, number and grade of bolts used to secure the flange, and the size of the bolt used.

CAUTION

Be sure of the bolt grade used in the unit. Do not tighten a Grade 5 bolt to the torque specification of a Grade A bolt, or vice versa. When replacing bolts, be sure to use the same type of bolt and corresponding nuts. Grade 5 bolts can be used in all cases. Grade A bolts can only be used to replace Grade A bolts.

- e. Tighten bolts in the applicable sequential order (0 - 180°, 90° - 270°, 45° - 225°, 135° - 315°, etc.) at each step until final target torque is reached (see applicable diagram contained in Appendix A).
- f. Use rotational tightening until all bolts are stable at final torque level. Two (2) complete times around is usually required.

11. Reconnect the energy source inlet and outlet lines to the heat exchanger coil. If these lines were broken at an additional location to allow for removal of the coil, be sure to also tighten those connections. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as

**Garlock Bolt Torque Values
Grade 5 Bolts**

.062" Ring Gaskets

ANSI - 150# Flanges

Nominal Pipe Size (IN)	Number of Bolts	Size of Bolts (IN)	Grade A Target Torque (FT - LBS)
2"	4	5/8"	96
2 1/2"	4	5/8"	96
3"	4	5/8"	96
3 1/2"	8	5/8"	96
4"	8	5/8"	96
5"	8	5/8"	160
6"	8	3/4"	160
8"	8	3/4"	160
10"	12	7/8"	184
12"	12	7/8"	184
14"	12	1"	250
16"	16	1"	250

**Garlock Bolt Torque Values
Grade 5 Bolts**

.062" Ring Gaskets

ANSI - 300# Flanges

Nominal Pipe Size (IN)	Number of Bolts	Size of Bolts (IN)	Grade A Target Torque (FT - LBS)
2"	8	5/8"	86
2 1/2"	8	5/8"	113
3"	8	5/8"	160
3 1/2"	8	5/8"	160
4"	8	5/8"	160
5"	8	3/4"	160
6"	12	3/4"	160
8"	12	7/8"	256
10"	16	7/8"	392
12"	16	1 1/8"	568
14"	20	1 1/8"	521
16"	20	1 1/8"	730

to the use and / or type of joint compound or sealer at the connections.

12. Reconnect the small line leading to the energy source pressure gauge. If the unit is equipped with a circulating pump, the pump relay must be interlocked with the temperature control valve so that the energy source will shut off if the pump is not operational. Failure to do so could create a very dangerous situation if the pump were to fail.
13. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Inlet, Outlet, and Condensate / Water Return Line and Manual Shutoff Valves - Replacement

If any of the inlet, outlet, return lines, or shutoff valves are damaged and must be replaced, follow the steps outlined below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 10) to take the unit off-line before attempting to replace damaged lines or shutoff valves.

While it might seem feasible to replace inlet, outlet, condensate / water return lines, and shutoff valves without shutting down the entire unit, it is not advised. Unless the unit is completely shutdown, and water and the energy source are isolated from the system, failure of a manual shutoff valve during the replacement process could result in serious injury.

2. Assure that the energy source, condensate / water return line, cold water inlet, and hot water outlet have been shut off; that the tank

has been completely drained; that the pressure has been bled from both the water and energy source systems; and that all components and surfaces have cooled.

3. Carefully break the joint between the unit and the line or valve to be replaced.
4. Remove the section of line or valve to be replaced.
5. Replace the damaged section of line or valve.
6. Reconnect the line or valve to the unit. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
7. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Pressure Gauge (Energy Source) - Replacement

If the pressure gauge for the energy source does not function correctly and must be replaced, follow the procedures outlined below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedure.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the energy source pressure gauge.
2. Carefully disconnect the small line connecting the pressure gauge with the heat exchanger coil head from both the head and gauge.

3. Remove the gauge from its mounting.
4. Mount the new gauge.
5. Reconnect the small line to both the heat exchanger coil head and the gauge. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
6. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Pressure Gauge (Water) - Replacement

If the pressure gauge for the water tank is not functioning correctly and must be replaced, follow the procedures outlined below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the water pressure gauge.
2. Carefully disconnect the small line connecting the pressure gauge with the tank. This line should only be disconnected at the gauge.
3. Remove the gauge from its mounting.
4. Mount the new gauge.
5. Reconnect the small line to the gauge. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
6. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Pressure Relief Valve (Tank) - Replacement

If the water pressure relief valve mounted on the tank is not functioning correctly and must be replaced, follow the procedures outlined below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedure.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the water pressure relief valve.
2. Disconnect the vent line leading from the water pressure release valve to the drain.
3. Carefully unscrew the water pressure relief valve from the port in the tank.
4. Install the new valve by screwing it into the pressure relief valve port in the tank. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use of joint compound or sealer at the connections.
5. Reconnect the vent line leading from the water pressure relief valve to the drain.
6. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Single Solenoid Safety System - Inspection and Replacement

The single solenoid safety system closes the steam (or boiler water / high temperature water) control valve in an over-temperature condition. The system should be checked semi-annually. (See manufacturer's documentation for the solenoid safety system provided with the unit for specific inspection intervals and test routine). If the system is found to be malfunctioning and must be replaced, follow the procedure outlined below.

NOTE: The exact location and configuration of the single solenoid safety system can vary between Series and units. See the CAD drawing supplied with the submittal sheet and design specifications supplied with the unit for the exact placement and configuration.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedure.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the single solenoid safety system.
2. Carefully disconnect the small line connecting the single solenoid safety system to the energy source control valve. This line should only be disconnected at the safety system.
3. Carefully disconnect the small line connecting the single solenoid safety system to the tank or hot water outlet line. This line should only be disconnected at the safety system.
4. If the system is electrically activated, turn off the power and disconnect the electric leads from the safety system.
5. Remove the safety system from its mounting.
6. Mount the new safety system.
7. Reconnect the small line from the tank or hot water outlet line to the safety system. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
8. Reconnect the small line from the energy source control valve to the safety system.
9. Reference the manufacturer's documentation for the safety system that was supplied with your unit for additional installation / setup instructions.
10. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Strainers - Inspection and Replacement

The strainers are installed upstream of the energy source shutoff valve for both the coil and the main traps. These strainers must be blown down periodically (approximately every three (3) to six (6) months) to prevent the build up of any sediment.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the energy source pressure gauge.
2. The exact location of the strainers can differ between Series and units. Reference the CAD drawing supplied with the Submittal sheet for the unit to identify the location of the strainers on the unit.
3. Carefully break the line connections on the inlet side of both strainers.
4. Carefully break the line connection on the outlet side of the strainers.
5. Remove and examine the strainers.
6. Remove any sediment that is present in the strainers. If they can not be satisfactorily cleaned, replace with new strainers.
7. Place the strainers back in-line in the system.
8. Reconnect the inlet and outlet lines to each strainer. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
9. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Temperature Control Valve - Inspection and Replacement

The temperature control valve is installed upstream of the heat exchanger coil and must be interlocked with the high temperature cut off solenoid. The manufacturer documentation included with the unit gives specifics for operation and maintenance of the control valve. The submittal sheet and CAD drawing included with the unit will give the exact location, as well as interlocks with other components. This information should be reviewed before removal / replacement of the temperature control valve.

WARNING

Steam, boiler water, or high temperature water present situations that can be very dangerous because of the high temperatures and pressures. Use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures to avoid possible injury or death.

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to remove and inspect the temperature control valve.
2. Assure that the energy source, condensate / water return line, cold water inlet, and hot water outlet have been shut off; that the tank has been completely drained; that the pressure has been bled from both the water and energy source systems; and that all components and surfaces have cooled.
3. If the temperature control valve is electrically activated, turn off the power and disconnect the leads to the valve.
4. Carefully break the joints between the temperature control valve and pump relay, single solenoid safety unit, and the auxiliary trap line.

5. Carefully break the connections between the energy source inlet line and the heat exchanger coil.

NOTE: It may be necessary to break the lines at a second location, and for the lines to be rotated to allow clearance for the temperature control valve to be removed from the system. If it is necessary, care should be taken to insure that in-line components are not damaged.

6. Remove the temperature control valve from the system.
7. Follow the supplied manufacturer instructions for inspecting the valve. If found to be malfunctioning, replace the valve.
8. Carefully replace the temperature control valve into the system by reattaching it to the energy source inlet line and the heat exchanger coil outlet line. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
9. Align the valve as it was situated before removal and tighten the connections. If lines were broken at an additional location to allow for removal of the valve, be sure to also tighten those connections.
10. Reconnect the temperature control valve to the pump or pump relay, single solenoid safety unit, and the auxiliary trap line.

If the unit is equipped with a circulating pump, the pump relay must be interlocked with the temperature control valve so that the energy source will shut off if the pump is not operational. Failure to do so could create a very dangerous situation if the pump were to fail.

11. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Thermometer- Replacement

If the thermometer for the hot water is not functioning correctly and must be replaced, follow the procedures outlined below.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

WARNING

The combination of electricity and water can pose a very dangerous situation. Turn off / disconnect all electric power before attempting any maintenance procedures.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the thermometer.
2. Carefully disconnect the small line connecting the thermometer with the tank. This line should only be disconnected at the gauge.
3. Remove the thermometer from its mounting.
4. Mount the new thermometer.
5. Reconnect the small line to the thermometer. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
6. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

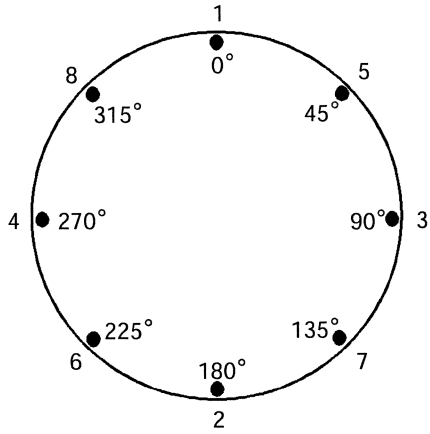
Traps (Main and Auxiliary) - Replacement (Steam Systems Only)

The main and auxiliary traps are installed upstream of the condensate shutoff valve on units that use steam as the energy source. The traps are designed to maintain the flow of condensate with the rise and fall of the float as changes in condensate level occur within the body of the trap. If the traps are not functioning properly and must be replaced, follow the procedures outlined below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 11) to take the unit off-line before attempting to replace the main or auxiliary traps.
2. The exact location of the traps can differ between series and units. Reference the submittal sheet and CAD drawing supplied with the unit to identify the location of the traps on the unit.
3. Carefully break the joint on the inlet side of both traps.
4. Carefully break the joint on the outlet side of the traps.
5. Remove and examine the traps.
6. If the traps are not functioning properly, replace them with new traps.
7. Place the traps back in-line in the system.
8. Reconnect the inlet and outlet lines to each trap. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and / or type of joint compound or sealer at the connections.
9. Follow the startup procedures (pages 10-11) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Appendix A

Bolt Torque Procedure



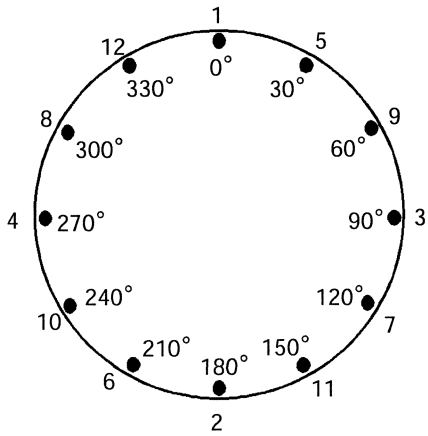
8-BOLTS

SEQUENTIAL ORDER

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8

ROTATIONAL ORDER

- 1
- 5
- 3
- 7
- 2
- 6
- 4
- 8



12-BOLTS

SEQUENTIAL ORDER

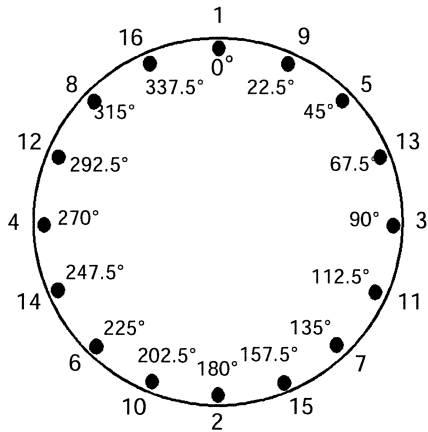
- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12

ROTATIONAL ORDER

- 1
- 5
- 9
- 3
- 7
- 11
- 2
- 6
- 10
- 4
- 8
- 12

Appendix A

Bolt Torque Procedure



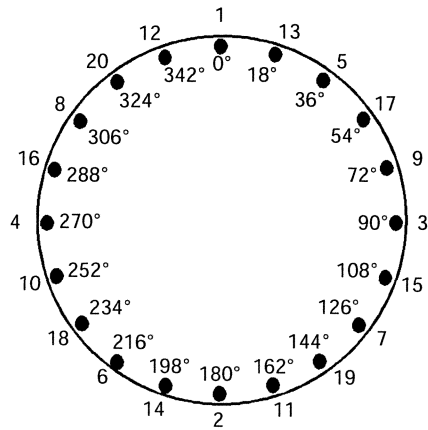
16-BOLTS

SEQUENTIAL ORDER

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 14
- 15 - 16

ROTATIONAL ORDER

- 1
- 9
- 5
- 13
- 3
- 11
- 7
- 15
- 2
- 10
- 6
- 14
- 4
- 12
- 8
- 16



20-BOLTS

SEQUENTIAL ORDER

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10
- 11 - 12
- 13 - 14
- 15 - 16
- 17 - 18
- 19 - 20

ROTATIONAL ORDER

- 1
- 13
- 5
- 17
- 9
- 3
- 15
- 7
- 19
- 11
- 2
- 14
- 6
- 18
- 10
- 4
- 16
- 8
- 20
- 12