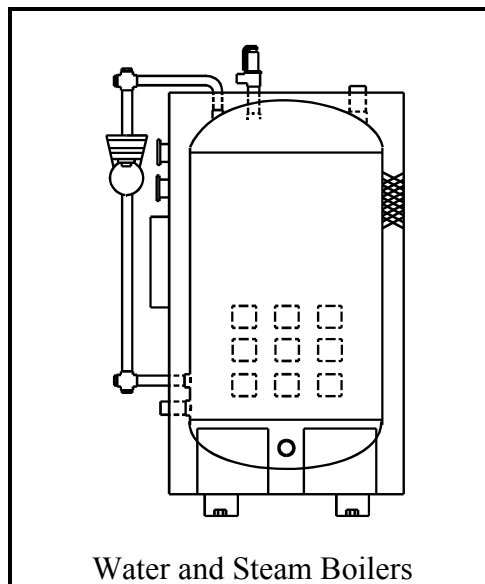
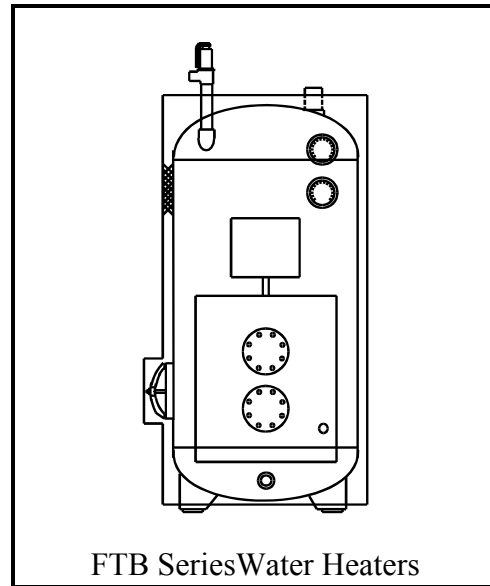
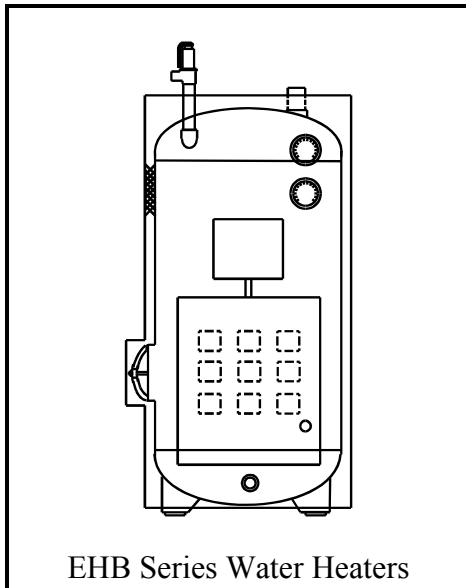

Installation, Operation, and Maintenance Manual

CEMLINE CORPORATION®

Electric Water Heaters (Series EHB & FTB) and Electric Water & Steam Boilers



CEMLINE CORPORATION

P. O. Box 55, Cheswick, PA, 15024

Phone: (724) 274-5430 • FAX (724) 274-5448

www.cemline.com

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Disclaimers

This Installation, Operation, and Maintenance Manual is intended to be as complete and up to date as possible. It covers the installation, operation, and maintenance procedures for CEMLINE CORPORATION's Electric Water Heaters (FTB & EHB Series) and Electric Water and Steam Boilers. CEMLINE reserves the right to update this manual and other product information concerning installation, operation, and / or maintenance, at any time and without obligation to notify product owners of such changes.

CEMLINE is not responsible for inaccuracies in specifications, procedures, and / or the content of other product literature, supplied by the manufacturers of components used in CEMLINE Electric Water Heaters and Boilers (i.e.: valves, controls, gauges, components, etc.). CEMLINE strives to use only the highest quality components in building Electric Water Heaters and Boilers. However, CEMLINE has no direct control over their manufacture, or their consistent quality.

CEMLINE is not responsible for injury to personnel or product damage due to the improper installation, operation, and / or maintenance of CEMLINE Electric Water Heaters and Boilers. All installation, operation, and maintenance procedures should only be performed by trained / certified personnel. All personnel performing these procedures should completely and carefully read and understand all supplied materials before attempting the procedures. All personnel should pay strict attention to all Notes, Cautions, and Warnings that appear within the procedures detailed in this manual.

CEMLINE welcomes user input as to suggestions for product or manual improvement.

General Information

This Installation, Operation, and Maintenance Manual is designed as a procedural guide for all CEMLINE CORPORATION Electric Water Heaters and Boilers. Covered in this manual are:

- ❖ EHB Series Vertical and Horizontal Electric Water Heaters;
- ❖ FTB Series Vertical and Horizontal Electric Water Heaters; and
- ❖ Vertical and Horizontal Electric Water and Steam Boilers.

Power Requirements

For Heating Water

CEMLINE Electric Water Heaters and Boilers, depending on the specific unit, can be configured to require 208, 240, 415, or 480 volts for heating water. The following table lists the voltage and phase configurations available.

| Type of Unit | Available Voltages | Phase Requirements |
|--------------------------|--------------------|--------------------|
| EHB Series Water Heaters | 208 | 3 Phase |
| | 240 | 3 Phase |
| | 415 | 3 Phase |
| | 480 | 3 Phase |
| FTB Series Water Heaters | 208 | 3 Phase |
| | 240 | 3 Phase |
| | 415 | 3 Phase |
| | 480 | 3 Phase |
| Boilers | 208 | 3 Phase |
| | 240 | 1 or 3 Phase |
| | 415 | 3 Phase |
| | 480 | 3 Phase |

Note: Consult the design specifications for the unit, as well as the supplied Submittal Sheet and Wiring Diagrams, for the specific power requirements for the unit.

For Controls

All CEMLINE Electric Water Heaters and Boilers use 120 volts for control operation. Whether 208, 240, 415, or 480 volts are utilized to heat water, the application line voltage is connected to an isolation transformer that provides constant 120 volt control power.

Construction

All CEMLINE Electric Water Heaters and Boilers are constructed from superior materials and incorporate only the highest quality components. Each meets or exceeds all applicable American Society of Mechanical Engineers (A.S.M.E.) Code regulations.

Tanks and Linings

Electric Water Heaters

CEMLINE Electric Water Heaters are equipped with STONESTEEL® tanks. Each tank is designed and constructed in strict accordance with the latest A.S.M.E. Code regulations, stamped in accordance with the applicable section of the A.S.M.E. Code, and accompanied by the applicable Certificates. Each tank is manufactured using pressure vessel quality plate and welded by certified welders. All tanks are registered with the National Board of Boiler and Pressure Vessel Inspectors.

STONESTEEL® tanks are lined with hydraulic cement, using the exclusive CEMLINE patented process. This time proven process prevents rust and corrosion, common to metal tanks, and helps guarantee exceptionally long life.

Electric Boilers

CEMLINE Electric Boilers are equipped with Carbon (Black) tanks. Each tank is designed and constructed in strict accordance with the latest A.S.M.E. Code regulations, stamped in accordance with the applicable section of the A.S.M.E. Code, and accompanied by the applicable Certificates. Each tank is manufactured using pressure vessel quality plate and welded by certified welders. All tanks are registered with the National Board of Boiler and Pressure Vessel Inspectors.

Each CEMLINE Electric Water Heater is equipped with an A.S.M.E. approved pressure / temperature relief valve, providing a means to vent excess pressure and remove accumulated sediment.

Each boiler is equipped with an A.S.M.E. approved pressure relief valve, providing a means to vent excess pressure; and a drain for removal of accumulated sediment. Each unit is also equipped with a drain to remove accumulated sediment.

Electric Water Heater and Boiler Jackets

The jackets used for all CEMLINE Electric Water Heaters and Boilers are equipped with steel jackets that are professionally coated 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 identification numbers should be included in all correspondence regarding the unit.*

Insulation

All CEMLINE Electric Water Heaters and Boilers contain a two inch (2") layer of fiberglass insulation between the tank and jacket that reduces energy loss. For some models, thicker insulation (up to four inches [4"]) is available as an option.

Heating Elements

Electric Water Heaters

The heating elements used in CEMLINE Electric Water Heaters consist of one or more copper or incoloy sheathed removable immersion rods mounted in standard A.N.S.I. (FTB Series) or nonferrous (EHB Series) flanges. These rods are grouped together as three (3) phase deltas to achieve the required total kilowatt.

Each rod contains resistance wire surrounded by an ample thickness of compressed magnesium oxide. Individual rods are removable and replaceable with ordinary hand tools, for in the field replacement, that insures worry free maintenance of the unit.

Electric Boilers

The heating elements used in CEMLINE Electric Boilers consist of one or more incoloy sheathed removable immersion rods. These rods are grouped together as three (3) phase deltas to achieve the required total kilowatt.

Each rod contains resistance wire surrounded by an ample thickness of compressed magnesium oxide. Individual rods are removable and replaceable with ordinary hand tools for in the field replacement that insures worry free maintenance of the unit.

Other Components

All other components, included in **CEMLINE** Electric Water Heaters and Boilers, have been specifically selected to meet the individual design specifications of the unit. Each component is judged to be of the highest quality to provide long life and superior performance.

Advantages and Benefits of CEMLINE Electric Water Heaters and Boilers

- ❖ STONESTEEL® tanks offer years of reliable, trouble free service.
- ❖ Highest quality design, construction, and components.
- ❖ Built and "Packaged" to meet exact customer design specifications.
- ❖ CEMLINE "Packaging" helps keep installation time to a minimum.
- ❖ Offers a wide range of configurations and capacities.
- ❖ Configured to utilize 208, 240, 415, or 480 volts for heating water.

Warranty Information

STONESTEEL® tanks are warranted for ten (10) years from date of purchase (first 5 years non-pro-rated; second 5 years pro-rated).

All other components used in CEMLINE Electric Water Heaters and Boilers are warranted for one (1) year from startup, or eighteen (18) months from date of purchase, whichever comes first. In some cases, extended warranties are available on an individual basis, at extra cost.

Contact Information

For information concerning warranties, or for questions pertaining to the installation, operation, or maintenance of CEMLINE Electric Water Heaters and Boilers, contact:

CEMLINE CORPORATION
P. O. Box 55
Cheswick, PA 15024

www.cemline.com

USA Phone: (724) 274-5430
USA Fax: (724) 274-5448

To order replacement parts, contact CEMLINE CORPORATION at the address listed above, or call toll free:

USA Phone: (800) 245-6268

Note: Please include the model and serial number of the unit for which the parts are being ordered. If ordering by phone, please have this information readily available.

General Notes and Warnings

Notes

- ❖ This manual is intended to cover installation, operation, and maintenance procedures for CEMLINE CORPORATION Electric Water Heaters and Boilers. Since each unit is built to meet customer specifications, instructions may, at times, seem general in nature. Where procedures differ substantially between Series EHB and FTB Water Heater, or Electric Water and Steam Boilers, 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 CEMLINE CORPORATION for clarification before proceeding.

- ❖ All installation, operation, and maintenance procedures should be performed only by experienced, trained, and certified personnel. Personnel should be trained in and familiar with correct piping and electrical procedures and methods, and should be experienced in working with hot / boiler water systems.
- ❖ CEMLINE Electric Water Heaters and Boilers are designed for indoor use only, unless otherwise required by design specifications. Each unit requires at least two feet (2') of clearance around and above the unit. It should be located on a level surface (no more than one-half degree [$\frac{1}{2}$] 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 and codes for the site / location, to make the unit 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 24 to 59 of this manual.
- ❖ If the unit is damaged during installation, operation, or maintenance, complete the following steps.

1. Turn off and lock out the electric power supply to the unit in an approved manner.
 2. Turn off the cold water inlet and hot water outlet valves.
 3. Contact in-house maintenance personnel or CEMLINE CORPORATION for instructions.
- ❖ For all piping connections, the use and / or type of joint compound or sealer on each joint should be determined by referring to local codes, accepted standards, and / or the requirements of the installing contractor.

Warnings

As with any piece of equipment that utilizes hot / boiler water and electricity, *the potential exists for severe personal injury* if proper installation, operation, and maintenance procedures are not followed. Listed on the following pages are specific warnings pertaining to CEMLINE Electric Water Heaters and Boilers. 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.

Note: *Throughout this manual, warnings will be denoted by the symbol ▼.*

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 identified by the manufacturer of each component. 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.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an appropriate manner, before attempting any installation or maintenance procedures.

▼ Areas of potential danger:

1. all electric power leads and connections;
2. all hot / boiler water lines, joints, valves, and relief valves; and

3. all joints between low water cut off control, gauges, valves, etc.

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

1. assure that the electric power supply has been turned off and locked out in an approved manner;
2. if the unit has been in operation, allow the water in the tank, as well as all components and surfaces (heating elements, hot water outlet lines, etc.) to cool before starting the procedure;
3. assure that all incoming and outgoing water lines have been turned off at the manual shutoff valves; and
4. completely drain the tank, after allowing the water time to cool.

▼ Hot / boiler water presents a situation that can be *very dangerous* due to the fact it is 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.

Product Features and Specifications

Congratulations on purchasing a **CEMLINE CORPORATION** Electric Water Heater or Boiler. The unit purchased will offer years of superior dependable service.

CEMLINE Electric Water Heaters and Boilers are one of the most economical methods of furnishing hot water or boiler water because of the superior design of the tanks and heating elements. All **CEMLINE** Electric Water Heaters and Boilers are "Packaged" and ready for installation. All components are sized, wired, mounted, piped, and tested prior to shipment. Each unit is built to exact customer design specifications and requires only connection to water and a power source to be ready for operation.

Each Electric Water Heater employs a **STONESTEEL**[®] tank, and each Electric Boiler employs a Carbon (Black) tank, providing years of trouble free service. All components used in the unit are of highest quality and meet or exceed all customer design specifications and A.S.M.E. Code regulations.

Each Electric Water Heater and Boiler is accompanied by this Installation, Operation, and Maintenance Manual, a Submittal Sheet, C.A.D. Drawing, and detailed Wiring Diagram(s), as well as all documentation supplied by the manufacturer of each major component. If any of these documents are missing, contact either **CEMLINE CORPORATION** or your authorized sales representative before attempting installation, operation, or maintenance procedures.

Installation

Transporting and Unpacking the Unit

Most CEMLINE CORPORATION Electric Water Heaters and Boilers Generators are 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. Larger horizontal units are shipped uncrated, but fitted with lifting lugs attached to the tank to provide a safe means for lifting and moving the unit.

- ▼ 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.

Location Requirements

CEMLINE Electric Water Heaters and Boilers are designed for indoor use only, and require at least two feet (2') 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 [$1/2^\circ$] of slope), capable of supporting the total weight of the unit when filled to capacity.

If crated when shipped, once the unit has been set in place, the crating should be carefully removed.

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 any of the components have been damaged during shipping. If any evidence of damage is detected that could affect the safe operation of the unit, contact CEMLINE CORPORATION, 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 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 (that is below design specifications), contact CEMLINE CORPORATION or your authorized sales representative, before proceeding with the installation.

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 unit 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.

Familiarization with the Unit and Components

CEMLINE Electric Water Heaters and Boilers 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 cold water inlet;
2. connecting the hot water or boiler water outlet to the hot water system;
3. connecting the electric power source to the unit;
4. piping the pressure / temperature relief valve to an acceptable vent or drain system;

Each unit is supplied with a Submittal Sheet, C.A.D. Drawings, and Wiring Diagrams that indicate the location and specifications for each connection that must be made. In addition, the drawings will enable the installer(s) to determine the flow direction of the water.

Connecting the Cold Water Source and Hot / Boiler Water Outlet

Note: Before making any connections of cold water inlet or hot / boiler water 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 cold 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 C.A.D. Drawings supplied with the Submittal Sheet.

A manual shutoff valve should be installed upstream on the cold water source as an isolation device.

Note: *Some Electric Steam Boilers are equipped with water feeder or pump. If so, the shutoff valve must be installed upstream from the water feeder or pump.*

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.*

Hot / Boiler Water Outlet

The next step in the installation process is to connect the hot / boiler water system piping to the hot / boiler water outlet port. The exact location of this port for the specific unit, as well as outlet pipe diameter or flange size, can be determined from the C.A.D. Drawing supplied with the Submittal Sheet.

A manual shutoff valve and automatic check valve should be installed downstream on the hot / boiler water line as isolation devices 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.

Note: *Refer to local codes and specifications for site specific shutoff and check valve requirements. 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.*

Connecting the Electric Power Source

- ▼ All installation procedures involving electric power connection should only be performed by trained, certified electricians.
- ▼ Hot / boiler water presents a situation 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**. Assure that all power has been **shut off / disconnected and locked out** in an approved manner, before attempting any installation or maintenance procedures.

The CEMLINE Electric Water Heaters and Boilers have been completely wired during assembly. Connecting the electric power supply to the unit consists simply of connecting the correct voltage, phase, and amperage power leads to the terminal strip or circuit breaker. The exact voltage, phase, and amperage requirements for the unit can be determined from the rating plate affixed to the jacket of the unit, or from the Submittal Sheet and Wiring Diagrams supplied with the unit.

Note: *All CEMLINE Electric Water Heaters and Boilers require power and ground wire suitable for 90 degrees (90°), Cu only.*

Assure that the cold water inlet and hot / boiler water outlet valves are closed. All water valves should be closed and remain closed throughout the installation process. Assure that the power supply to the intended power source has been turned off.

Unlock and open the electronic control cabinet attached to the jacket of the unit. Locate the terminal strip or circuit breaker within the cabinet and connect the power leads by means of the solderless connectors. The exact location for the connection of the power leads can be determined from the detailed Wiring Diagrams supplied with the unit. Typical Wiring Diagrams are contained in Appendix A of this manual. If in doubt of the exact location for the connections, contact CEMLINE CORPORATION for assistance.

Connect the proper size ground wire to the unit by means of the pressure connector supplied with the unit. Before turning on the power supply, it is strongly suggested that all wiring connections be checked to assure tightness. Close and lock the door of the electronic control cabinet.

▼ **Do not turn on the power supply until the tank is filled with water.** The heating elements in the unit will "burn out" if not completely covered with water when power is supplied.

Piping the Relief Valve to Vent or Drain

▼ **Do not** install a shutoff valve between the relief valve and the vent or drain. Doing so could cause serious injury or death if the pressure is released and the valve is closed. This would cause excessive buildup of pressure in the tank which could result in an explosion.

Electric Hot Water Heaters and Water Boilers

All CEMLINE Electric Water Heaters and Water Boilers are equipped with a pressure or pressure and temperature activated relief valve for the tank. For most units used to heat water, the relief valve should be piped to a suitable drain.

Electric Steam Boilers

For Electric Steam Boilers, the relief valve should be vented to atmosphere (generally through the roof). The piping used in the vent system **must be of adequate size to handle the capacity of the pressure relief valve and vent.** The vent piping system should incorporate a "drip pan elbow" to allow for condensate drainage. The drip pan elbow should be piped to a suitable drain.

Piping the relief valve to a suitable vent or drain will prevent both water and heat damage to the unit, as well as reduce the risk of injury from released steam. All pressure relief venting and piping should comply with local codes. It is the responsibility of the purchaser / installing contractor to assure this compliance.

Completing Installation

Installation of the CEMLINE Electric Water Heaters or Boiler is now complete. All documentation supplied with the unit should be passed along to maintenance personnel for future reference.

Operation

After all installation procedures have been completed, all power connections and cold water, hot water, and relief piping joints 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.

Startup Procedures

1. Assure that all manual shutoff valves on cold water and hot water lines are closed.



The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. Unlock and open the electric control cabinet door.

Electric Water Heaters - On units equipped with EHB type heating elements, the individual thermostats, auxiliary high temperature thermostat, and high limit thermostat should be checked to assure they are set to the desired operating temperature. The temperature for all of the individual thermostats is set by turning the black dials to the desired temperature. This temperature is normally set in the range of 130 to 140 degrees (130° to 140°). The unit is equipped with one (1) individual thermostat for each set of three (3) heating elements.

Note: All individual thermostats should be set to the same temperature.

The auxiliary thermostat should be set ten degrees (10°) above the temperature at which the individual thermostats are set. Each unit is equipped with one auxiliary high temperature thermostat that is recognizable by the red dial.

The high limit thermostat is factory preset at 205 degrees (205°) and is not user adjustable.

After checking the thermostat settings, close the door to the electric control cabinet.

Electric Water and Steam Boilers - A solid state step controller controls water heating. The desired temperature for the unit should be set by means of this thermostat. This temperature is normally set in the range of 80 to 200 degrees (80° to 200°).

The auxiliary thermostat should be set ten degrees (10°) above the temperature at which the individual thermostats are set. Each unit is equipped with one auxiliary high temperature thermostat that is recognizable by the red dial.

The high limit thermostat is factory preset at 205 degrees (205°) and is not user adjustable.

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

During initial filling, the **power source must remain off until water completely covers the heating elements to prevent "burn out"**. Therefore, if so equipped, the low water cut off and water feeder or pump controller will be inactive, making the process completely manual. The tank should be filled until the cold water begins to flow from the open relief valve.

As the tank is filling, inspect the mating areas between the tank and each heating element for leakage. These can be viewed within the electric control cabinet. If a leak is detected, shut off the cold water inlet valve and check the tightness of the bolts used to mount the heating element flange(s) to the tank. If, after tightening any loose bolts, water continues to leak, contact **CEMLINE CORPORATION** for assistance.

If the unit has filled to the correct level, and no leaks are detected, close and lock the door to the electric control cabinet, and proceed to the next step.

4. Slowly open the manual shutoff valve on the hot water outlet line. Again check for any signs of leaks at all joints and valves.
5. After assuring that the tank is completely filled and that no leaks are detected at any joints, valves, or heating element flanges, turn on the electric power.
6. As the unit is heating, check the contactors for "buzzing" or "chattering". If any noise is detected, turn off the power and disassemble the contactor. Check for and remove any dust or foreign particles that are detected. Reassemble the contactor and turn on the power.
7. Each boiler is equipped with a series of pilot lights that make verifying proper operation an easy matter. Typically, the unit will be fitted with pilot lights for:

- power on;
- high limit control; and
- low water cut off.

If all pilot lights are illuminated, the system has adequate water and is functioning within the high temperature limit.

8. After approximately thirty (30) minutes of operation, shut off and lock out the power and feel each wire connection and fuse clip for excessive temperature. If any connection or clip is found to be excessively hot, check to assure the integrity of the connection. **All connections must be tight for proper operation.**
9. Close and lock the door to the electric control cabinet.
10. Turn on the power supply.
11. After the unit has reached operating temperature, reinspect all joints for signs of leakage. In addition, check the pressure and temperature gauges to verify that the water temperature and pressure are within design specifications.
12. The unit is now ready for normal operation.

Shutdown Procedures

1. Turn off the electric power supply at the unit and at its source, and lock out the power supply in an approved manner before proceeding.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an appropriate manner, before attempting any installation or maintenance procedures.
2. Turn off the cold water inlet and hot / boiler water outlet shutoff valves.
3. Relieve the pressure within the unit by means of the relief valve and vent / drain system.
4. 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 help to increase the drainage flow.
5. Proceed with the required maintenance or repairs.
6. After performing the required maintenance or repairs, return the unit to operation by following the startup procedures detailed on page 17.

Daily Operation - Electric Water Heaters and Water Boilers

Daily operation of CEMLINE Electric Water Heaters and Boilers is totally automated. However, it is recommended that approximately twice a day the unit is checked to assure

that all pilot lights are illuminated. If any pilot light is not illuminated, it means that a problem exists that should be investigated.

Daily Operation - Electric Steam Boilers

CEMLINE Electric Steam Boilers are equipped with a gauge glass and water feeder or pump to insure proper water level within the unit. The water level within the unit should be checked, via the gauge glass, at least twice a day.

Parts List

Replaceable Parts List

The following is a list of parts that are generally replaceable, by trained / certified personnel, on CEMLINE CORPORATION Electric Water Heaters and Boilers. The replaceable parts may vary, depending on the unit and the particular design specifications to which the unit was constructed. If there are questions concerning the replaceable parts for the unit, refer to the original design specifications, or contact CEMLINE CORPORATION.

Note: Please have the unit's model and serial number available when contacting CEMLINE CORPORATION.

Note: Replaceable Parts may vary depending on design specifications of the unit.

Replaceable Parts CEMLINE Electric Water Heaters and Boilers - Vertical and Horizontal

Operating Thermostats
High Temperature Limit Thermostat (Manual Reset)
Auxiliary High Temperature Limit Thermostat
(Automatic Reset)
Contactors
Fuses - Power Circuit
Fuses - Transformer
Heating Element - EHB Type (Complete)
Heating Element - FTB Type (Complete)
Heating Element - FTB Type (Rod Only)
Gasket - Heating Element
Isolation Transformer - 120 Volt
Low Water Cut Off Control
Relief Valve - Pressure and Temperature
Pressure Gauge
Temperature Gauge
On / Off Switch (Some Models)
Pilot Light (Some Models)
Circuit Breaker (Some Models)
Terminal Box (Some Models)

CEMLINE Electric Boilers Only

Contactors Coils
Gauge Glass
High Pressure Cut Off (Automatic Reset - Steam Only)
High Pressure Cut Off (Manual Reset - Steam Only)
High Temperature Limit Thermostat (Manual Reset)
Adjustable High Temperature Limit Thermostat
(Automatic Reset)
Pump Controller (Some Steam Boilers Only)
Step Controller - Solid State
 Mother Board
 Black Card
 White Card(s)
 Green Card
 Yellow Card
Potentiometer
Step Controller Thermistor
Water Feeder (Some Steam Boilers Only)

Suggested Spare Parts

For One (1) Year of Duty

Because of the built-in quality and long life of CEMLINE Electric Water Heaters and Boilers, there are no spare parts suggested for stock during the first year of service.

For Five (5) Years of Duty

It is recommended that the user stock a replacement heating element(s) and gasket(s) for possible replacement during the first five (5) years of duty. If suggested maintenance procedures are performed, the heating element(s) should not need to be replaced during the first five (5) years of duty.

For the replacement heating element model number, voltage, and wattage, refer to the Submittal Sheet. The voltage and wattage are also listed on the flange of each heating element.

Ordering Information

All replacement parts for CEMLINE Electric Water Heaters and Boilers can be ordered directly from:

CEMLINE CORPORATION
P. O. Box 55
Cheswick, PA 15024

Phone: (800) 245-6268
Fax: (724) 274-5448

Note: Replacement parts can also be ordered through your authorized sales agent.

Please include the model and serial number of the unit for which the parts are being ordered. If ordering by phone, please have this information readily available.

Inspection

The following table summarizes the recommended time intervals for inspections of the Electric Water Heaters and Boilers, components, and electrical system.

Recommended Inspections Electric Water Heaters and Boilers

Time Interval

| To Be Inspected | Per Manu. Specs. | Daily | Weekly | Monthly | Quarterly | Semi- Annually | Annually |
|---|------------------------|--------------|--------|---------|-----------|-------------------|----------|
| Contactors | | | | | | ✓ | |
| Fuses - Power Circuits | | ✓ | | | | | |
| Fuses - Transformer | | | ✓ | | | | |
| Gauges - Pressure and Temperature | | ✓ | | | | | |
| Heating Element(s) and Gasket(s) | | | | | | | ✓ |
| Lines - Inlet and Outlet | | | | | ✓ | | |
| Low Water Cut Off Control | ✓ | | | | | | |
| Pilot Light(s) | | ✓ | | | | | |
| Power Connections and Leads | | | | ✓ | | | |
| Relief Valve - Pressure and Temperature | ✓ | | | | | | |
| Shutoff Valves - Manual | | | ✓ | | | | |
| Thermostat - Auxiliary High Temperature Limit | ✓ | | | | | | |
| Thermostat - High Temperature Limit | ✓ | | | | | | |
| Thermostats - Operating | ✓ | | | | | | |
| Water Level | | ✓ minimum | | | | | |

Recommended Inspections Electric Boilers Only

Time Interval

| To Be Inspected | Per Manu. Specs. | Daily | Weekly | Monthly | Quarterly | Semi- Annually | Annually |
|--|------------------------|--------------|--------|---------|-----------|-------------------|----------|
| Contactors Coils | | | | | | | ✓ |
| Gauge Glass (Steam Boilers Only) | | ✓ minimum | | | | | |
| High Pressure Cut Off | ✓ | | | | | | |
| Potentiometer | ✓ | | | | | | |
| Pump (Steam Boilers Only - Some Models) | | ✓ minimum | | | | | |
| Step Controller | ✓ | | | | | | |
| Step Controller Thermistor | ✓ | | | | | | |
| Water Feeder (Steam Boilers Only - Some Models) | | ✓ minimum | | | | | |

If any problems are detected during inspections, refer to either the Troubleshooting (page 26) or Maintenance (page 29) sections of this manual for specific actions and instructions.

Troubleshooting

The following table summarizes problems that may be encountered over the life of CEMLINE CORPORATION Electric Water Heaters and Boilers, and the procedures to remedy those problems. The left-hand column lists the symptoms. The remaining columns are suggested procedures or "remedies" that should be followed to identify and correct the problem. If a "✓" appears in a remedy column, the corresponding procedure(s) should be followed to identify and correct the problem.

Electric Water Heaters and Boilers

| Symptom | Probable Cause and Remedy # | | | | | | | | | | |
|---|-----------------------------|---|---|---|---|---|---|---|---|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| The unit does not maintain the required temperature at the rated capacity. | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | |
| Outlet temperature is too high. | ✓ | ✓ | | | | | | | | | |
| Pressure / temperature relief valve "pops". | | | | | | ✓ | ✓ | | | | |
| The unit does not maintain the design pressure. | | | | | | ✓ | | ✓ | | | |
| A loud banging in the unit or primary piping (not to be confused with a normal clicking noise made during operation). | | | | | | | | | ✓ | | |

Electric Boilers Only

| Symptom | Probable Cause and Remedy # | | | | | | | | | | |
|--|-----------------------------|---|---|---|---|---|---|---|---|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Feed water level incorrect or inconsistent. | | | | | | | | | | ✓ | |
| The unit does not maintain the required temperature at the rated capacity. | | | | | | | | | | | ✓ |

Probable Cause and Remedy

1. The operating or auxiliary high temperature limit thermostat(s) are incorrectly set.
 - Check to assure that the thermostats are set for the desired temperatures. Usually the operating thermostats will be set from 130 to 140 degrees (130° to 140°) Fahrenheit. The auxiliary high limit thermostat should be set at ten degrees (10°) above the temperature selected on the operating thermostats. (Reference thermostat setting procedure page 17.)

2. The thermostat(s) are not correctly sensing the water temperature.
 - Check the water temperature with a temperature gauge that is known to be correct. Check and replace any thermostats that are found to be incorrectly sensing the water temperature. (Reference thermostat replacement procedure on page 30.)
3. A fuse(s) has "blown".
 - Check for "blown" circuit fuses (fuses normally blow when a heating element has gone bad). Replace the fuse and / or the heating element. (Reference heating element and fuse replacement procedure on page 34.)
4. Electric power supply has been disrupted.
 - Check the leads and circuit into which the unit has been wired for damage or malfunction.
5. A heating element has shorted and is no longer functioning.
 - Replace the heating element. (Reference heating element replacement procedure on page 34.)
6. The pressure / temperature relief valve is malfunctioning.
 - Replace the pressure / temperature relief valve. (Reference pressure / temperature relief valve replacement procedure on page 45.)
7. Water pressure supplied to the unit is too high.
 - Reduce the water pressure entering the unit.
8. A leak exists in the inlet or outlet lines, or at one of the joints.
 - Check all lines and joints for signs of leakage. Repair any leaks that are found.
9. The inlet, outlet, or pressure / temperature relief lines are not properly piped.
 - Reconfigure and redo the piping in question.
10. The water feeder or pump (which is supplied with the unit) is malfunctioning.

- Check and replace the water feeder or pump controller if found to be defective. (Reference the water feeder and pump controller replacement procedure on page 58)
11. The solid state step controller or thermistor (probe) is malfunctioning.
- Check and replace the step controller (or internal boards) and thermistor if found to be defective. (Reference the step controller and board replacement procedure on page 53; reference the step controller thermistor replacement procedure on page 56.)

Maintenance - Electric Water Heaters and Boilers

The information contained in this section details service and maintenance procedures for the inspection and replacement of the components of CEMLINE Electric Water Heaters and Boilers. Remember, this manual serves all CEMLINE Electric Water Heaters and Boilers. Therefore, the maintenance procedures may be general in some instances.

Where there is a dramatic difference between the procedures pertaining to water heaters and boilers, it will be noted. When a maintenance procedure pertains to only one unit, it will also be noted.

If there are any questions concerning maintenance procedures that are not clearly explained in this manual, contact CEMLINE CORPORATION. Be sure to have the model and serial numbers of the unit 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 17 to 19 of this manual, before attempting any maintenance procedure.*

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

Electric Power Connections - Rewiring and Reconnecting

If any of the power connections must be rewired or reconnected, follow the steps listed below.

▼ The combination of electricity and water can pose a **very dangerous situation**. Assure that all power has been **shut off / disconnected and locked out** in an approved manner, before attempting any installation or maintenance procedures.

1. Follow Steps 1 through 3 of the shutdown procedure (page 19) to take the unit off-line before attempting any electrical service.

Note: *If none of the electrical components are to be removed, there is no need to drain the water from the tank. However, if the water is drained from the tank, be sure the tank is refilled to the point that all heating elements are covered before turning on the power. Failure to do so will cause the heating elements to "burn out".*

2. Unlock and open the door to the electric control cabinet.
3. After assuring the power has been turned off, disconnect and rewire the electrical connections in question.
4. Turn the power on and check that the component(s) that has been rewired is functioning properly.
5. Follow the startup procedure on page 17 of this manual to return the unit to operation.

Thermostats (Operating, Auxiliary High Temperature Limit, and High Temperature Limit) - Resetting and Replacement

Each CEMLINE Electric Water Heater is equipped with three (3) type of thermostats:

- Operating;
- Auxiliary High Temperature Limit (Automatic Reset); and
- High Temperature Limit (Manual Reset).

While each type of thermostat serves a different function within the system, the procedures to replace each is similar.

All thermostats are located in, and are accessible through, the electric control cabinet door. While the operating and auxiliary high temperature limit thermostats are similar in physical appearance, the operating thermostats have a black dial for setting temperature preference, while the auxiliary high temperature limit thermostat has a red dial. There is one (1) operating thermostat for each set of three (3) heating elements. There is only one (1) auxiliary high temperature limit and one (1) high temperature limit thermostat for each unit.

Resetting

If the temperature of the water in the unit surpasses the limit set by the high temperature manual reset thermostat, the thermostat will "trip" and shut down the unit. To reset the high temperature limit thermostat, **after the cause of the overheating problem is identified and corrected**, follow the procedures listed below.

1. Locate the high temperature limit thermostat – the red reset button is located outside the electric control cabinet.
2. Depress and release the button to reset the thermostat.

The auxiliary high temperature limit thermostat will also "trip" when the water temperature surpasses the temperature set on the thermostat. However, the auxiliary high temperature limit thermostat will reset automatically when the water temperature drops below the set temperature.

Replacement

If any of the thermostats are found to be malfunctioning and need to be replaced, follow the procedures detailed below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the thermostat(s).

▼ The combination of electricity and water can pose a ***very dangerous situation***. Assure that all power has been ***shut off / disconnected and locked out*** in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off, the pressure bled from the tank, the water drained, and the unit has cooled, unlock and open the electric control cabinet door.
3. Locate the thermostat to be replaced and tag the wires attached to the thermostat to assure proper reconnection after the new thermostat has been installed.
4. Disconnect the wires from the thermostat terminals.
5. Trace the capillary tube leading from the thermostat to the tank. It may be necessary to move a small portion of the fiberglass insulation to gain access to the location on the tank where the temperature probe is mounted. The capillary tube connects the thermostat body to the temperature probe mounted within the tank.
6. The temperature probe is mounted to the tank via a compression fitting. The body of the compression fitting can be difficult to remove from the tank. To facilitate removal, cut the capillary tube with a pair of diagonals or wire cutters close enough to the compression fitting body to allow a six (6) point socket to be used to remove it from the tank.

Note: Do not remove the compression fitting cap nut. This could allow the temperature probe to become free and possibly fall into the tank.

7. Using the correct size six (6) point socket, remove the body of the compression fitting from the tank. The remainder of the capillary tube, still

in the compression fitting, as well as the temperature probe will come out of the tank with the compression fitting body.

8. Remove the body of the thermostat from its mounting.
9. Verify that the new thermostat is rated the same as the thermostat that is being replaced.
10. Mount the new thermostat, being careful not to damage the capillary tube or temperature probe.
11. Carefully configure (bend) the capillary tube to allow the temperature probe to be inserted into the tank. In addition, to insure proper positioning of the probe, straighten the capillary tube in the area where it meets the temperature probe.
12. Insert the temperature probe into the tank and start the compression fitting body into the threads. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the type and / or use of joint compound or sealer at the connections.
13. Tighten the body of the compression fitting with the correct size **wrench**. A socket can not be used to tighten the fitting because of the attached capillary tube. **Do not tighten the compression fitting cap nut.**
14. Gently withdraw any extra length of the capillary tube from the tank, pulling the temperature probe snug against the inside of the compression fitting body.

Note: If the temperature probe is not correctly positioned in the tank (i.e.: it is allowed to droop), it will not correctly sense the water temperature at the level of the heating elements.

15. Slide the compression ring into place against the compression fitting body and tighten the cap nut.
16. Reconnect the wires to the new thermostat, checking to assure that they are attached in the same position from which they were removed.
17. Set the temperature selector (for operating and auxiliary high temperature limit thermostats only - the high temperature limit thermostat is factory preset and can not be adjusted). For operating thermostats, the temperature should be set the same for all. The auxiliary high temperature

limit thermostat should be set ten degrees (10°) higher than the operating thermostats.

18. Refill the tank with water, examining the tank, compression fitting, and capillary tube for any signs of leakage.
19. If no leakage is detected, reposition any fiberglass insulation that was moved to provide access to the compression fitting.
20. Follow the start up procedures on page 17 to return the unit to operation.

Contactor - Replacement

If a contactor is determined to be defective and must be replaced, follow the procedures outlined below.

1. Turn off the power to the unit.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, unlock and open the electric control cabinet door.
3. Locate the defective contactor and tag the connected wires to assure proper reconnection after the new contactor is installed. Disconnect the wires from the contactor.
4. Remove the contactor from its mounting.
5. Verify that the new contactor is rated the same as the contactor being replaced.
6. Mount the new contactor in the same position as the original contactor.
7. Reconnect the wires to the new contactor, checking to assure that they are attached in the same position from which they were removed.
8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.
9. If no arcing is detected, the unit is ready for operation.

Fuses - Inspection and Replacement

1. Turn off the power to the unit.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, unlock and open the door to the electric control cabinet.

Note: *Fuses in the heating element circuit normally "blow" when the heating element short circuits. If a blown fuse in the heating element circuit is detected, refer to the applicable heating element (EHB or FTB) inspection and replacement section of this manual.*

3. Inspect the suspect fuse, either visually or by means of an Ohm meter.
4. If a blown fuse is found, it can be removed by pulling it out from the receptacle.
5. Insert the new fuse by aligning it with the receptacle and pushing it into place.
6. After assuring that all tools and other foreign matter have been removed from the electric control cabinet, and that all personnel are clear, turn on the power.
7. If the replaced fuse blows again, refer to the appropriate maintenance section for the component which the fuse serves.
8. If the replaced fuse functions correctly, close and lock the electric control cabinet door. The unit is now back on line.

Heating Element(s) and Gasket(s) - Inspection and Replacement

EHB Type Element

1. Follow Steps 1 through 4 of the shutdown procedure (page 19) to take the unit off-line before attempting any heating element service.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power is turned off and locked out, and the tank has been drained and given a chance to cool, unlock and open the door to the electric control cabinet.

Note: *Figure 1 illustrates the typical EHB type heating element and mounting.*

3. Disconnect the electrical connections at the terminals of the heating element to be replaced. It is suggested that the wires be tagged to assure correct reconnection.
4. Using 9/16" socket, remove the four (4) mounting bolts that secure the heating element flange to the tank mounting flange.
5. Remove the electric heating element from the tank by pulling straight out from unit.
6. Thoroughly clean the face of the flange to remove any particles of gasket or sealer that remain. This will help assure a proper seal when the new heating element and gasket are mounted.
7. Each heating element has the rated voltage and wattage listed on the nonferrous face plate. Confirm that the rating of the replacement element matches that of the element being replaced.

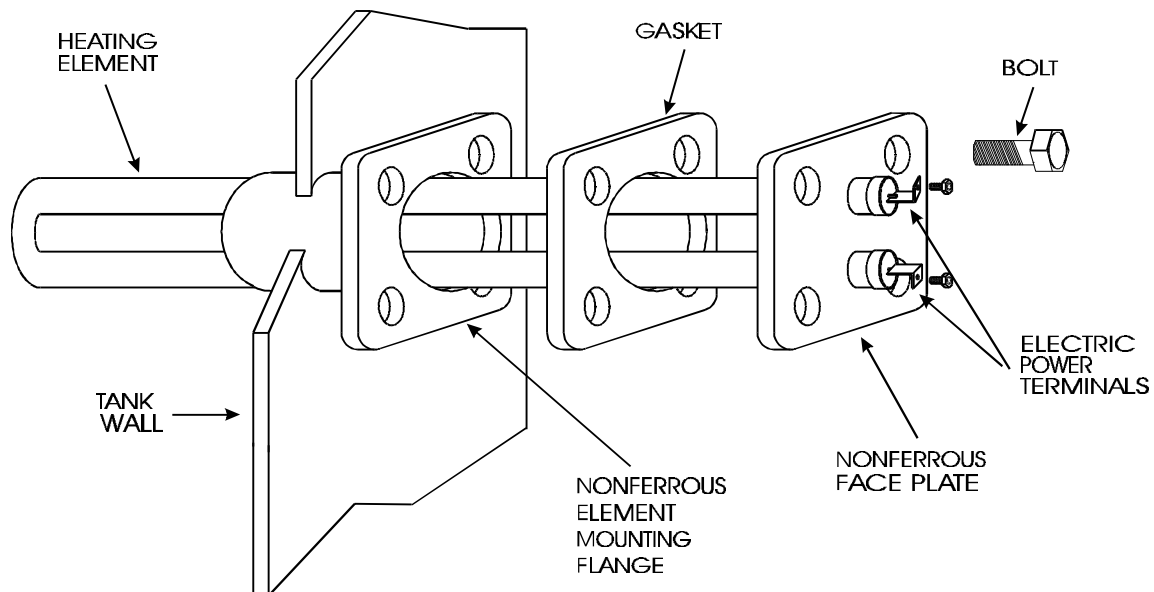


Figure 1: Detailed Drawing of EHB Type Heating Element

8. A new gasket has been supplied with the replacement heating element. Slide the new gasket over the heating element and align it with the face plate. 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 on the gasket and flange surfaces.
9. Insert the element into the tank. Be sure it has been installed with arrows, that appear on the element, pointing in correct directions.
10. Install the mounting bolts and nuts. Tighten to twenty to twenty-five foot-pounds (20-25 ft/lbs).
11. Using an Ohm meter, check from the terminals to ground to assure that no short circuit exists.
12. Reconnect the leads to heating element terminals in same position as they were installed on original elements.
13. The procedure for replacing all elements in the unit are the same as listed above.
14. Refill the tank completely with water, carefully checking each gasket and element for signs of leakage. If leakage is detected, check to assure that the bolts have been tightened to the proper torque. If this does not stop the leakage, replace the gasket or element.
15. Check to make sure all electrical connections are tight.
16. After checking to make sure all tools / foreign matter has been removed from the electric control cabinet, and that all personnel are clear, turn on the power while visually checking for any "arcing" or sparking at the reconnected electric leads.
17. If no evidence of arcing is detected, close and lock the door to the electric control cabinet. The unit is now back in service.

FTB Type Element

1. Follow Steps 1 through 4 of the shutdown procedure (page 19) to take the unit off-line before attempting any electrical service.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power is turned off and locked out, and the tank has been completely drained and given a chance to cool, unlock and open the door to the electric control cabinet.

3. Remove the cover from the heating element.

Note: *Figures 2 and 3 illustrate the typical FTB type heating element and mounting.*

4. It is strongly suggested that each electric lead be tagged and identified, and a detailed sketch of the terminals, electric leads, and jumper bars be made to assure proper rewiring after replacement of the heating element.

5. Disconnect the electrical connections at the terminals of the heating element.

6. Using the appropriate size socket and ratchet, remove the mounting bolts and nuts that secure the heating element flange to the tank mounting flange.

Note: *Because of the various sizes of FTB heating elements available, the number and size of the mounting bolts will vary.*

7. After removing all mounting bolts and nuts, remove electric heating element from the tank by pulling straight out from unit.

Note: *If the entire heating element assembly is being replaced, proceed to Step 17. It is possible to just replace a defective rod(s) within the element. If this is to be done, continue the procedure with Step 8.*

8. Remove the jumper bar(s) connected to the rod(s) that are to be replaced.

9. The individual rods are held in the heating element flange(s) by compression fittings. Remove the compression fitting cap nuts from the rods you wish to replace and pull off the compression fitting ring.

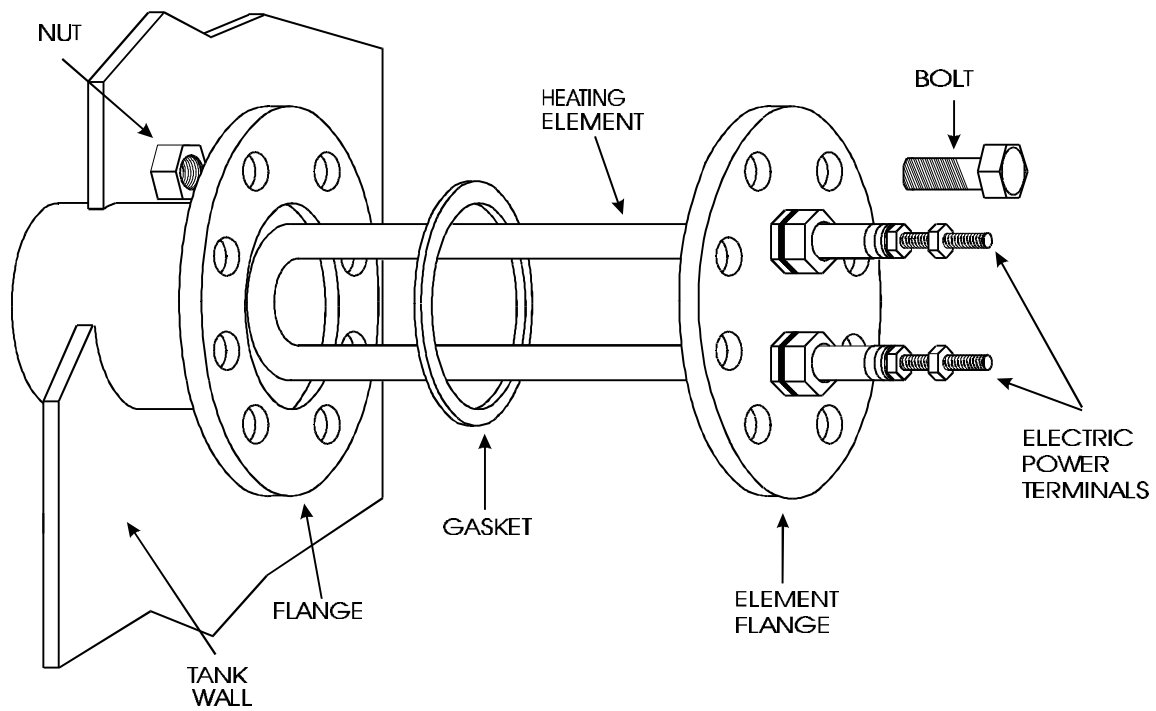


Figure 2: Detailed Drawing of Typical FTB Type Heating Element

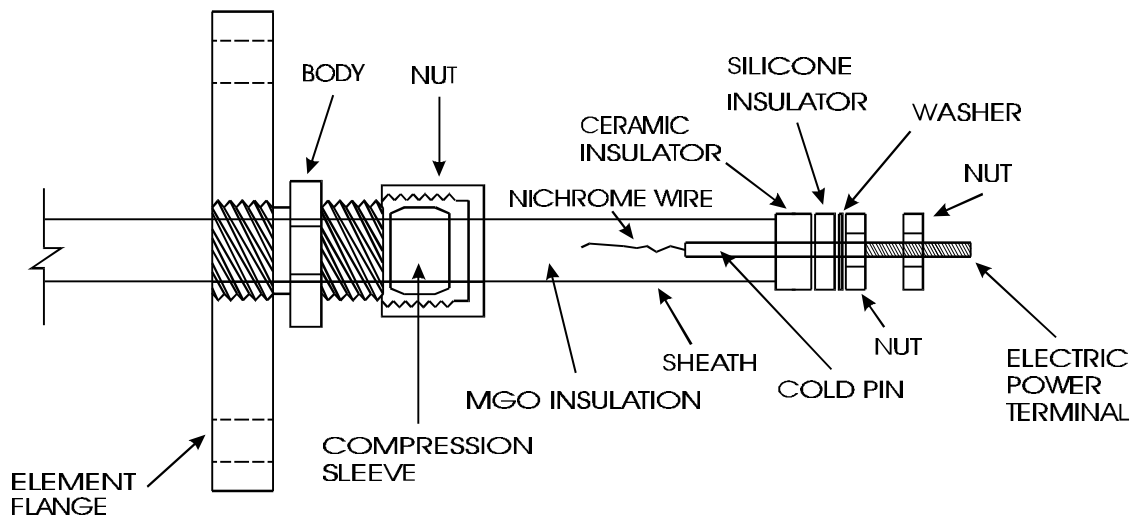


Figure 3: Detailed Drawing of Typical FTB Type Heating Element Mounting

10. Each rod is soldered to the element spacers. Unsolder and pull the rods out of the spacers.
 11. Remove the compression fitting body.
- Note:** *When changing a rod, always replace the body, sleeve, ring, and cap nut of the compression fittings.*
12. Thoroughly clean the flange of the heating element to remove any particles of gasket or sealer that remain. This will help assure a proper seal when the new / repaired heating element and gasket are mounted.
 13. Insert and tighten the new compression fitting body.
 14. Insert the new rod through the element spacers and resolder the rod to the spacer.
 15. Install the compression ring and refit and tighten the compression fitting cap nut.
 16. Referencing the sketch made in Step 4, reinstall the insulators, nuts, and jumper bars to their original element configuration.
 17. If the entire heating element is to be replaced with a new unit, confirm that the rating of the replacement element matches that of the element being replaced. Each heating element has the rated voltage and wattage listed on the face plate.
 18. Thoroughly clean the face of flange on the tank.
 19. Slide the new gasket over the heating element and align it with the face plate. 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 on the gasket and flange surfaces.
 20. Insert the element into the tank. Be sure it has been installed with the arrows, that appear on the element, pointing in correct directions.
 21. After assuring that the heating element is correctly aligned, clamp the flanges together and proceed with the torque procedure detailed as follows.

Note: Bolts used to secure the FTB type heating element assembly in **CEMLINE Electric Water Heaters and Boilers** 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 the nuts.
- c. Number all bolts so that torquing requirements can be followed.

Note: Appendix B contains drawings depicting the typical flange configurations (number of bolts, location, tightening sequence, etc.) for **CEMLINE Electric Water Heaters and Boilers**. 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.

**Garlock Bolt Torque Values
Grade A Bolts**

.062" Ring Gaskets

ANSI - 150# Flanges

| Nominal Pipe Size (IN) | Number of Bolts | Size of Bolts (IN) | Grade A Target Torque (FT - LBS) |
|------------------------|-----------------|--------------------|----------------------------------|
| 3" | 4 | 5/8" | 96 |
| 4" | 8 | 5/8" | 96 |
| 5" | 8 | 3/4" | 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 5 Target Torque (FT - LBS) |
|---------------------------|-----------------|-----------------------|--|
| 3" | 8 | 3/4" | 160 |
| 4" | 8 | 3/4" | 160 |
| 5" | 8 | 3/4" | 160 |
| 6" | 12 | 3/4" | 160 |
| 8" | 12 | 7/8" | 256 |
| 10" | 16 | 1" | 392 |
| 12" | 16 | 1 1/8" | 568 |
| 14" | 20 | 1 1/8" | 521 |
| 16" | 20 | 1 1/4" | 730 |

▼ 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 B).
 - f. Use rotational tightening until all bolts are stable at final torque level. Two (2) complete times around is usually required.
22. Using an Ohm meter, check from the terminals to ground to assure that no short circuit exists.
 23. Reconnect the leads to the heating element terminals in the same location as they were installed on the original element.
 24. Refill the tank completely with water, carefully checking each gasket and element for signs of leakage. If leakage is detected, check to assure that the bolts have been tightened to the proper torque. If this does not stop leakage, replace the gasket or element.
 25. Check to make sure all electrical connections are tight.

26. After checking to make sure all tools / foreign matter has been removed from the electric control cabinet, and that all personnel are clear, turn on the power while visually checking for any "arcing" or sparking at the refitted electric leads.
27. If no evidence of arcing is detected, replace the heating element cover and close and lock the door to the electric control cabinet. The unit is now back in service.

Isolation Transformer - Replacement

If the isolation transformer is determined to be defective and must be replaced, follow the procedures outlined below.

1. Turn off the power to the unit and lock out the electric power supply in an approved manner.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, unlock and open the electric control cabinet door.
 3. Tag the wires connected to the isolation transformer to assure proper reconnection after the new transformer is installed. Disconnect the wires from the transformer.
 4. Remove the transformer from its mounting.
 5. Verify that the new transformer is rated the same as the transformer being replaced.
 6. Mount the new transformer in the same position as the original transformer.
 7. Reconnect the wires in the same position from which they were removed from the original transformer.
 8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.
 9. If no arcing is detected, the unit is ready for operation.

Float Type Low Water Cut Off Control - Replacement

The float type low water cut off control assures that if the water level in the tank drops to an unsafe level, power will be cut off so that the heating elements will not "burn out". If the low water cut off is determined to be defective and must be replaced, follow the detailed procedures below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the low water cut off control.



The combination of electricity and water can pose a ***very dangerous situation***. Assure that all power has been ***shut off / disconnected and locked out*** in an approved manner, before attempting any installation or maintenance procedures.

2. Assure that the power has been turned off, the pressure bled from the tank, the water drained from the system, and the unit has had a chance to cool.
3. Unlock and open the door of the electric control cabinet. Make a sketch of how the wires from the low water cut off are connected within the panel. Disconnect the wires leading from the low water cut off. (If necessary, consult the Wiring Diagram(s) supplied with the unit to determine the correct wires to detach.) Feed the wires out of the electric control cabinet housing.
4. Break the joints above and below the low water cut off control.

Note: Depending on the specific unit, it may be necessary to break the joints of other components to allow removal of the low water cut off control. If this is necessary, care should be taken to assure other components are not damaged during these maintenance procedures.

5. Remove the low water cut off.
6. Position the replacement low water cut off control and reconnect to the joints above and below 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. If any other components were loosened or moved to allow for removal of the low water cut off control, reposition and tighten the joints for those components.
8. Feed the wires from the low water cut off control into the electric control cabinet housing. Reconnect the wires in same position from which they were removed.
9. Follow the start up procedures on page 17 to return the unit to service.

10. As the unit is filling and heating, inspect the joints at the low water cut off control (and any joints of other components that were loosened) for signs of leakage.

Probe Type Low Water Cut Off Control - Replacement

The probe type low water cut off control assures that if the water level in the tank drops to an unsafe level, power will be cut off so that the heating elements will not "burn out". If the low water cut off is determined to be defective and must be replaced, follow the detailed procedures below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the low water cut off control.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. Unlock the door of the electric control cabinet. Make a sketch of how the wires from the low water cut control off are connected within the panel.
3. Disconnect the wires leading from the low water cut off control. (See the wiring diagram(s) supplied with the unit to determine the correct wires to detach.)
4. Remove the low water cut off control from its mounting.
5. Verify the new low water cut off control is the same as the component being replaced.
6. Mount the new low water cut off control in the same position as the original low water cut off.
7. Reconnect the wires in the same position from which they were removed from the original low water cut off control.
8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.
9. If no arcing is detected, the unit is ready for operation.

Pressure / Temperature Relief Valve Replacement

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

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the pressure gauge.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off, the pressure bled from the tank, the water drained, and the unit has cooled, disconnect the drain line leading from the relief valve to drain.

Note: For Electric Steam Boilers, disconnect the vent line leading from the relief valve to atmosphere (usually through the roof), and via a drip elbow, to drain.

3. Carefully unscrew the relief valve from the port in the tank.
4. Install the new valve by screwing it into the relief valve port in the tank. 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.
5. Reconnect the drain line leading from the relief valve to drain.

Note: For Electric Steam Boilers, reconnect the vent line leading from the relief valve to atmosphere and, via drip elbow, to drain.

6. Follow the startup procedures (page 17) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Pressure Gauge - Replacement

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

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the pressure gauge.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off and locked out, the pressure has been bled from the tank, the water has been drained, and the unit has cooled, 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 (page 17) to put the unit back on-line. Carefully check all connections for any sign of leakage.

Temperature Gauge - Replacement

If the temperature gauge for the unit is not functioning correctly and must be replaced, follow the procedures outlined below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the pressure gauge.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, the pressure has been bled from the tank, the water has been drained, and the unit has cooled, carefully disconnect the small line connecting the temperature 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 (page 17) to put the unit back on-line. Carefully check all connections for any sign of leakage.

On / Off Switch - Replacement

If the on / off switch is determined to be defective and must be replaced, follow the procedures outlined below.

1. Turn off the power to the unit.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. Depending on the design of the individual unit, the on / off switch will be either mounted to the unit's jacket or located within the electric control cabinet. After assuring that the power has been turned off and locked out, and if the switch is located in the electric control cabinet, unlock and open the electric control cabinet door.
3. Tag the wires connected to the switch to assure proper reconnection after the new switch is installed. Disconnect the wires from the switch.
4. Remove the switch from its mounting.
5. Verify that the new switch is rated the same as the switch being replaced.
6. Mount the new switch in the same position as the original switch.
7. Reconnect the wires in the same position from which they were removed from the original switch.
8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.
9. If no arcing is detected, the unit is ready for operation.

Pilot Light - Replacement

The pilot lights are designed to allow the status of the unit to be easily determined. If a pilot light is not illuminated, it means that either the unit is not functioning properly or that a pilot light has burned out. If, after checking the applicable components of the unit, it is determined that the pilot light has burned out, follow the replacement steps detailed below.

1. Turn off the power to the unit.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, access the rear of the pilot light and tag the connected wires to assure correct reconnection after the new light is installed. Remove the wires.
3. The pilot light is held in the unit by two (2) plastic prongs that extend out of the pilot light body. Squeeze the prongs towards the body and push the light out of the unit.
4. The new light can be seated in the unit by pushing the body into the mounting hole after correct alignment.
5. Reattach the wires in the same position from which they were removed.
6. Turn on the power and check to assure that the pilot light illuminates.

Circuit Breaker - Replacement

If a circuit breaker has been determined to be defective and must be replaced, follow the procedures outlined below.

1. Turn off and lock out the power in an approved manner.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, unlock and open the electric control cabinet door.
3. Tag the wires connected to the defective circuit breaker to assure proper reconnection after the new circuit breaker is installed. Disconnect the wires from the circuit breaker.
4. Remove the circuit breaker from the panel by firmly pulling out on the side opposite the wire terminals.
5. Verify that the new circuit breaker is rated the same as the circuit breaker being replaced.

6. To install the new breaker, insert the side with the wire terminals in the receptacle first, and then push in on the opposite side until completely seated.
7. Reconnect the wires in the same position from which they were removed from the original circuit breaker.
8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected immediately turn off the power, examine the wires, and assure the tightness of all connections.
9. If no arcing is detected, the unit is ready for operation.

Maintenance - Electric Boilers Only

The procedures contained in this section are for components that are **only** supplied with CEMLINE Electric Water and Steam Boilers. Maintenance procedures for components that are not specific to Electric Boilers are contained in the previous section.

Contactor Coils - Replacement

If a contactor coil is determined to be defective and must be replaced, follow the procedures outlined below.

1. Turn off and lock out the power to the unit.
- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.
2. After assuring that the power has been turned off and locked out, unlock and open the electric control cabinet door.
3. Locate the defective contactor coil and tag the connected wires to assure proper reconnection after the new contactor coil is installed. Disconnect the wires from the coil.
4. Remove the contactor coil from its mounting.
5. Verify that the new contactor coil is rated the same as the contactor coil being replaced.
6. Mount the new contactor coil in the same position as the original coil.
7. Replace the wires in the same position from which they were removed from the original contactor coil.
8. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.
9. If no arcing is detected, the unit is ready for operation.

Gauge Glass - Replacement (Electric Steam Boilers Only)

1. Follow Steps 1 through 4 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the gauge glass assembly.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off and locked out, the pressure bled from the tank, the water drained, and the unit has had time to cool, break the joints that secure the gauge glass assembly to the tank.

Note: While designed for heavy duty service, the glass in the assembly is fragile. The assembly should be treated gently to avoid breakage of the glass.

3. Carefully continue to unscrew the fittings from the tank until the gauge glass assembly is free.
4. Install the new gauge glass assembly by screwing the fittings into the tank. 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 (page 17) to put the unit back on-line. Carefully check all connections for any sign of leakage.

High Pressure Cut Off Switches - Replacement (Electric Steam Boilers Only)

Each CEMLINE Electric Steam Boiler is equipped with two (2) types of high pressure cut off switches:

- automatic reset; and
- manual reset.

While each high pressure cut off switch serves a different function within the system, the procedures to replace them are similar.

Both high pressure cut off switches are located on the top of the boiler. While the high pressure cut off switches are relatively similar in physical appearance, the manual reset model is recognizable by the reset button.

Resetting of the High Pressure Cut Off Switch (Manual Reset)

If the pressure in the unit surpasses the limit set by the manual reset high pressure cut off switch, the switch will "trip" and shut down the unit. To reset the high pressure cut off switch, after the cause of the excessive pressure problem is identified and corrected, follow the procedures listed below.

1. Locate the high pressure cut off switch.
2. Depress and release the red button to reset the switch.

The automatic reset high pressure cut off switch will also "trip" when the pressure within the unit surpasses the preset limit. However, it will reset automatically when the pressure within the unit drops below the set pressure.

Replacement

If either of the high pressure cut off switches are found to be malfunctioning and need to be replaced, follow the procedures detailed below.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the switch.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. Assure that the power has been turned off and locked out, the pressure bled from the tank, the water drained, and the unit has cooled.
3. Locate the high pressure cut off switch to be replaced and tag the attached wires to assure correct reconnection after the new switch has been installed.
4. Disconnect the wires from the switch terminals.
5. The switch body can be removed by unscrewing it from the tank with the correct size wrench.
6. Verify that the new high pressure cut off switch is rated the same as the switch that is being replaced.
7. Insert the high pressure cut off switch into the opening and screw it into the port. 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. Tighten the body of the switch with the correct size wrench.
9. Reconnect the wires to the new switch, checking to assure that they are attached in the same position from which they were removed.
10. Refill the tank with water, examining the joint between the switch and tank for any signs of leakage.
11. Follow the start up procedures on page 17 to return the unit to operation.

Step Controller (Including Replacement of Individual Component Boards) - Replacement

The solid state step controller serves to control heating by cycling (controlling the time interval) the activation of the heating elements. Depending on the design of the specific unit, the step controller is comprised of a number of replaceable boards that can be individually replaced. Boards are available directly from **CEMLINE CORPORATION**. Those available are:

- Mother Board;
- Black Board - SC End Board;
- White Boards - SC Heat Stages;
- Yellow Board - Step Delay; and
- Green Board - Input Conditioner.

The following procedures detail both changing individual boards as well as replacing the solid state step controller. If any questions are not clearly addressed, contact **CEMLINE CORPORATION** for assistance.

▼ Solid state component boards are very fragile and subject to damage from any type of electrical charge - even static electricity. Before touching any board, assure that the electric power source has been shut off and locked out and all static electricity has been removed from your body by touching a suitable ground (such as the cold water inlet piping).

1. Turn off and lock out the power to the unit.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. Locate the box housing the solid state step controller mounted on the exterior of the boiler. Remove the cover.
3. If a specific board has been determined to be defective, locate the board and remove it from its seat by pulling gently away from the step controller.
4. Each board can be reseated in the appropriate mother board receptacle by simply aligning the board and gently pushing the board into place.
5. If the entire mother board is to be replaced, tag each individual board and note its position. After all individual boards have been removed, carefully remove the screws that secure the mother board in the step controller case and remove the board. Installation of the mother board can be accomplished by reversing the removal steps. Be sure to carefully reinstall each individual board in its original location.
6. If the entire solid state step controller is being replaced, make a detailed sketch of the position of each wire attached to the step controller. After the sketch has been made, remove each wire.
7. After all wires have been removed from the step controller, remove the screws securing the step controller to its housing. Remove the step controller unit.
8. Assure that the new step controller is rated the same as the one being replaced. In addition, check to make sure that the individual boards contained in the new step controller correspond exactly with those contained in the original controller.
9. Position the new step controller in the housing and secure with the original screws.
10. Reconnect all wires to their original location. Consult the sketch made earlier in this process.
11. To adjust the solid state step controller, consult the manufacturer's documentation supplied with the new unit. The new step controller should be set to the same specifications as the original. Those specifications were factory preset for optimum performance of the unit.
12. Replace the cover on the box housing the step controller.
13. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.

14. If no arcing is detected, the unit is ready for operation.

Potentiometer - Replacement

The potentiometer is mounted on the box that houses the solid state step controller and is mounted on the door of the solid state step controller panel. If it is determined to be bad and must be replaced, follow the steps.

- ▼ Solid state component boards are very fragile and subject to damage from any type of electrical charge - even static electricity. Before touching any board, assure that the electric power source has been shut off and locked out all static electricity has been removed from your body by touching a suitable ground (such as the cold water inlet piping).

1. Turn off and lock out the power to the unit.

- ▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. Locate the box, mounted on the exterior of the boiler, housing the solid state step controller and potentiometer. Remove the cover.
3. Tag the wires connected to the potentiometer to assure proper reconnection after the new potentiometer is installed. Disconnect the wires.

Note: *Care should be taken not to damage the solid state step controller or any of its component boards during these procedures.*

4. Remove the potentiometer from its mounting.
5. Verify that the new potentiometer is rated the same as the one being replaced.
6. Mount the new potentiometer in the same position as the original potentiometer.
7. Reconnect the wires in the same position from which they were removed from the original potentiometer.
8. Replace the cover of the box housing the potentiometer and step controller.
9. After assuring that all tools and foreign materials have been removed from the electric control cabinet, and that all personnel are clear of the unit, turn on the power. As the power is turned on, visually inspect for signs of "arcing". If any arcing is detected, immediately turn off the power, examine the wires, and assure the tightness of all connections.

11. If no arcing is detected, the unit is ready for operation.

Solid State Step Controller Thermistor - Replacement

The solid state step controller thermistor is connected by wire to the step controller, and via compression fitting to the tank. It is accessible through the electric control cabinet. If the thermistor is found to be malfunctioning and needs to be replaced, follow the procedures detailed below.

▼ Solid state component boards are very fragile and subject to damage from any type of electrical charge - even static electricity. Before touching any board, assure that the electric power source has been shut off and locked out all static electricity has been removed from your body by touching a suitable ground (such as the cold water inlet piping).

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the pressure gauge.

▼ The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off and locked out, the pressure bled from the tank, the water drained, and the unit has cooled, unlock and open the electric control cabinet door.

3. Open the electric control cabinet and locate the probe.

Note: *Care should be taken not to damage the solid state step controller or any of its component boards during these procedures.*

4. Locate the point at which the thermistor enters the tank. This should be just above the highest heating element. It may be necessary to move some of the fiberglass insulation to allow access.

5. Trace the wires back to the step controller. Tag them for proper replacement after the new thermistor is installed. Disconnect the wires.

6. The body of the compression fitting that mounts the thermistor to the tank can be difficult to remove. To facilitate removal, cut the wires with a pair of diagonals or wire cutters close enough to the compression fitting body to allow a six (6) point socket to be used to remove it from the tank.

Note: Do not remove the compression fitting cap nut. This could allow the thermistor to become free and possibly fall into the tank.

7. Using the correct size six (6) point socket, remove the body of the compression fitting from the tank. The remainder of the wires, still in the compression fitting, as well as the thermistor will come out of the tank with the compression fitting body.
8. Verify that the new thermistor is rated the same as the one that is being replaced.
9. Carefully configure (bend) the wires to allow the thermistor to be inserted into the tank. In addition, to insure proper positioning of the thermistor, straighten the wires in the area where they meet the thermistor.
10. Insert the thermistor into the tank and start the compression fitting body into the threads. 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.
11. Tighten the body of the compression fitting with the correct size **wrench**. A socket can not be used to tighten the fitting because of the wires attached to the thermistor. **Do not tighten the compression fitting cap nut.**
12. Gently withdraw any extra length of the wires from the tank, pulling the thermistor so that 1" of the probe is exposed on the outside of the fitting.

Note: If the thermistor is not correctly positioned in the tank (i.e. it is allowed to droop) it will not correctly sense the water temperature at the level of the heating elements.

13. Slide the compression ring into place against the compression fitting body and tighten the cap nut with the appropriate size wrench.
14. Reconnect the wires to the step controller, checking to assure that they are attached in the same position from which they were removed.
15. Refill the tank with water, examining the compression fitting area for any signs of leakage.
16. If no leakage is detected, reposition any fiberglass insulation that was moved to provide access to the compression fitting.
17. Follow the start up procedures on page 17 to return the unit to operation.

Water Feeder or Pump Controller - Replacement (Electric Steam Boilers Only)

The water feeder or pump controller is integrated into the piping on the side of Electric Steam Boilers. It is located no less than two inches (2") above the highest heating element in the unit. If the water feeder or pump controller is determined to be defective, follow the steps below to replace the component.

1. Follow Steps 1 through 5 of the shutdown procedure (page 19) to take the unit off-line before attempting to replace the water feeder or pump controller.



The combination of electricity and water can pose a *very dangerous situation*. Assure that all power has been *shut off / disconnected and locked out* in an approved manner, before attempting any installation or maintenance procedures.

2. After assuring that the power has been turned off and locked out, the pressure bled from the tank, the water drained, and the unit has had time to cool, tag the wires attached to the component so that they may be replaced in the same position after installation of the new component. Remove the wires after tagging.
3. Break the joints above and below the component.

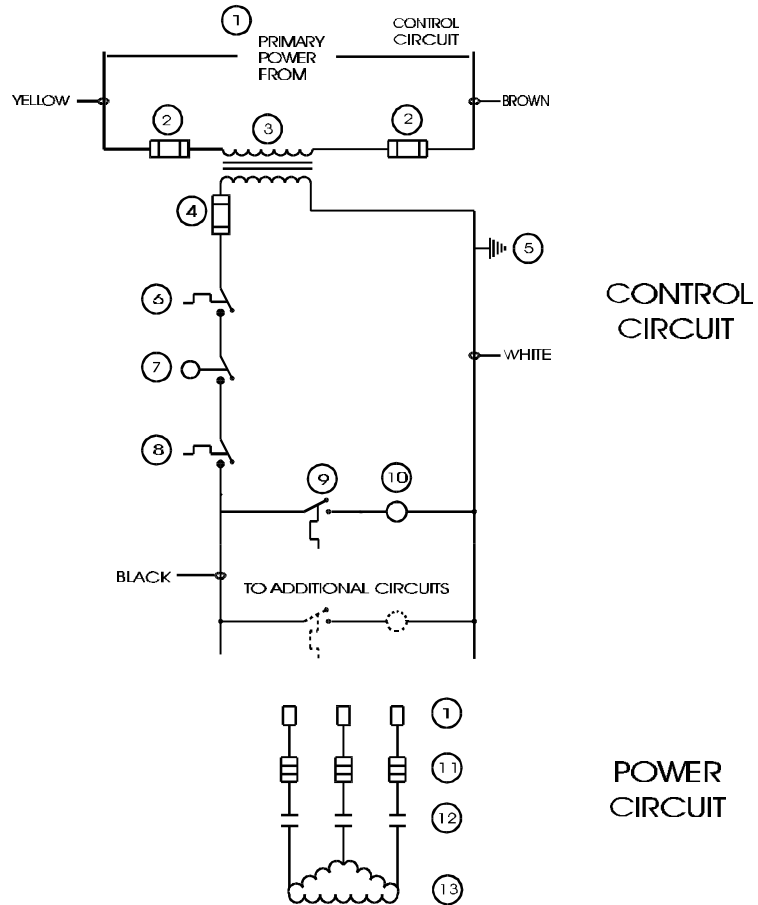
Note: *Depending on the exact design of the unit, it may be necessary to break additional components loose to provide access for removing the water feeder or pump controller from the system. If this is the case, care should be taken to not damage any other components in the system.*

4. Carefully continue to loosen the fittings until the water feeder or pump controller assembly is free.
5. After assuring that the new component is rated the same as the component being replaced, install the new component by aligning with the piping and starting the fittings. 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. Tighten the joints at the water feeder or pump controller, as well as any other joints that were loosened to allow clearance.
7. Reconnect the wires to the unit in the same position
8. Fill the tank to operating level. As the tank is filling, examine all joints and fittings for signs of leakage.

9. If no leaks are found, follow the startup procedures (page 17) to put the unit back on-line.

Appendix A

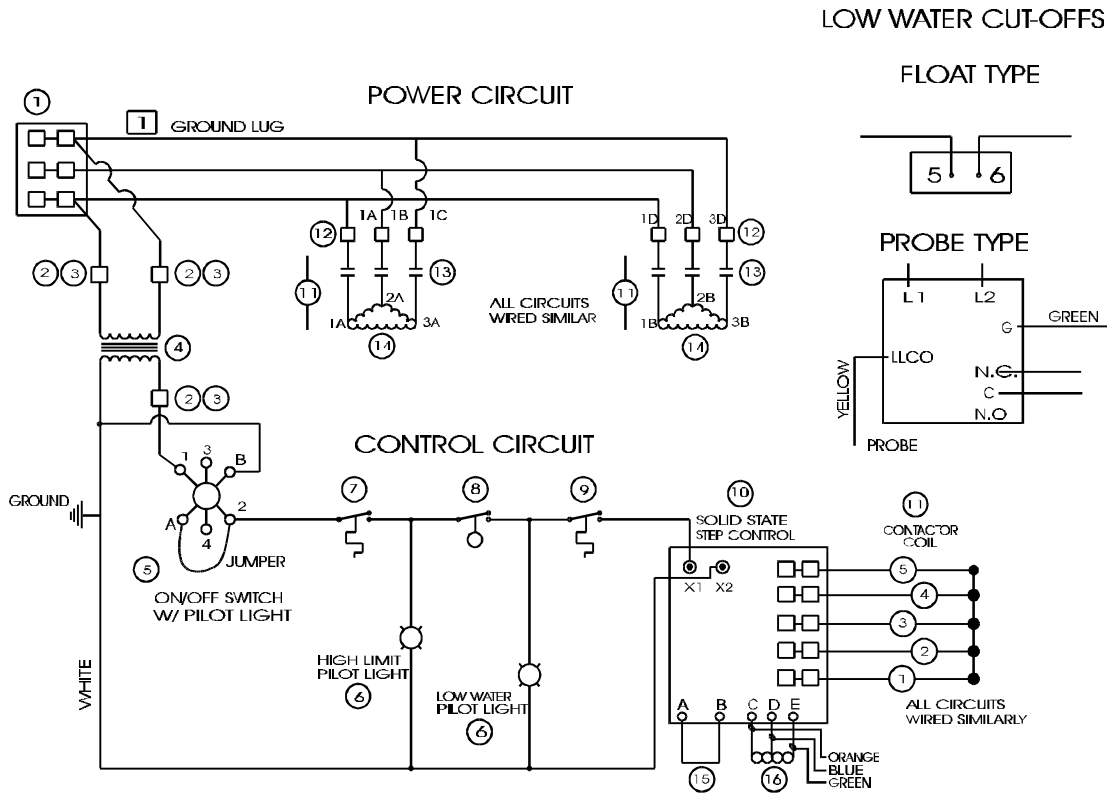
Typical Wiring Diagrams



| | | |
|---|--|------------------------------|
| 1 PRIMARY POWER TERMINAL STRIP | 5 GROUND LUG | 9 OPERATING THERMOSTAT(S) |
| 2 PRIMARY POWER TRANSFORMER FUSES | 6 HIGH TEMPERATURE LIMIT WITH MANUAL RESET | 10 CONTACTOR COIL(S) |
| 3 PRIMARY POWER 120 V ISOLATION TRANSFORMER | 7 LOW WATER CUT-OFF | 11 POWER CIRCUIT FUSES |
| 4 120 V FUSE | 8 AUXILIARY HIGH TEMPERATURE LIMIT WITH AUTO RESET | 12 CONTACTOR(S) |
| | | 13 HEATING ELEMENTS |

Figure A-1: Typical Wiring Diagram For Electric Water Heaters

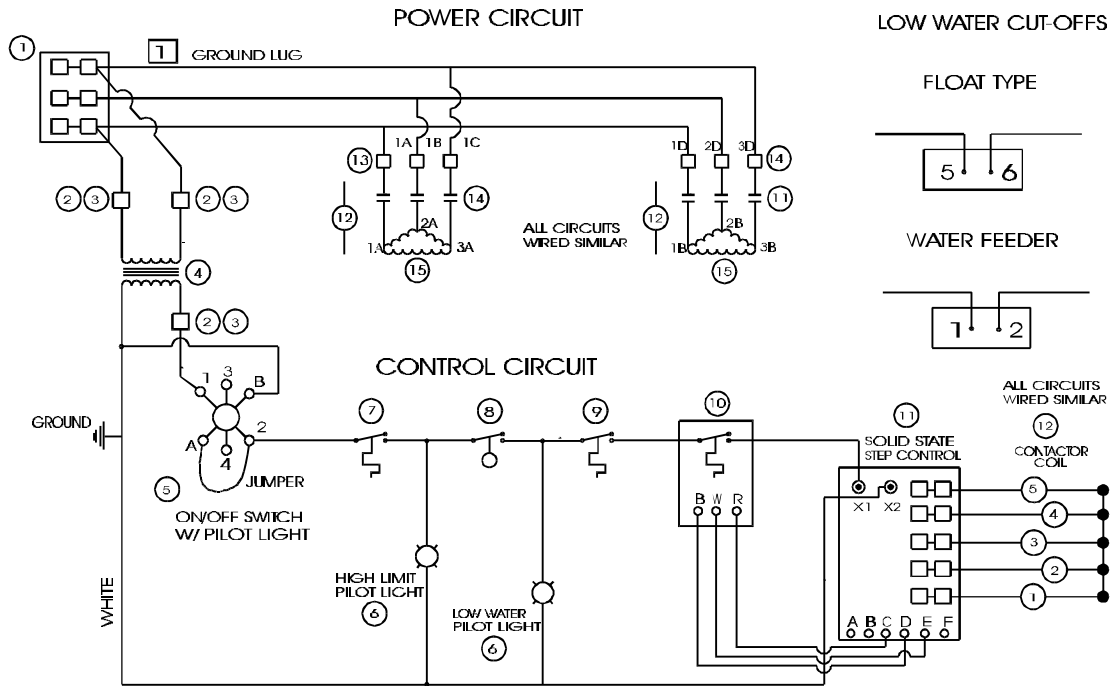
Appendix A (cont'd)



| | | |
|-------------------------------|---|-------------------------------|
| 1 TERMINAL STRIP | 7 HIGH TEMPERATURE CUT-OFF WITH AUTOMATIC RESET | 11 CONTACTOR COIL(S) |
| 2 CONTROL CIRCUIT FUSE HOLDER | 8 LOW WATER CUT-OFF | 12 POWER FUSES |
| 3 CONTROL CIRCUIT FUSE | 9 HIGH TEMPERATURE CUT-OFF WITH MANUAL RESET | 13 CONTACTOR |
| 4 TRANSFORMER | 10 STEP CONTROLLER | 14 HEATING ELEMENTS |
| 5 ON / OFF SWITCH | | 15 STEP CONTROLLER THERMISTER |
| 6 PILOT LIGHTS | | 16 POTENTIOMETER |

Figure A-2: Typical Wiring Diagram For Electric Water Boilers

Appendix A (cont'd)

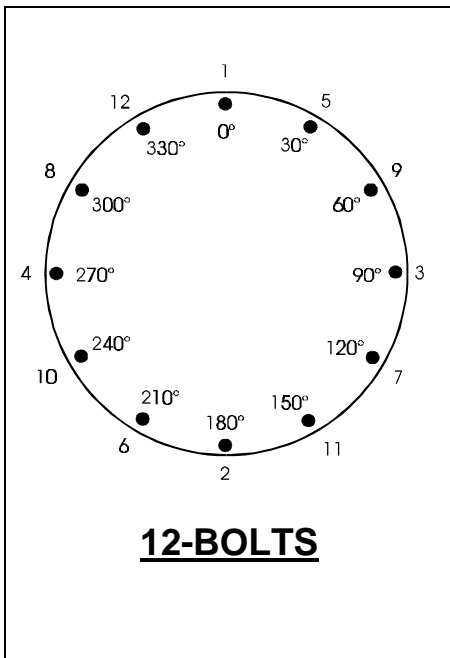
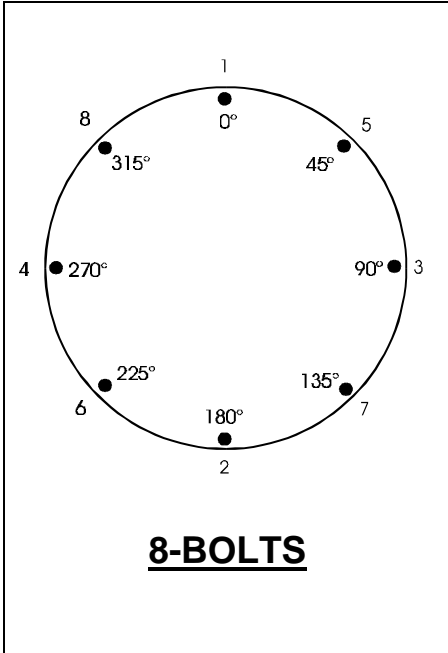


| | | |
|-------------------------------|--|---------------------|
| 1 TERMINAL STRIP | 6 PILOT LIGHTS | 10 PRESSURE CONTROL |
| 2 CONTROL CIRCUIT FUSE HOLDER | 7 HIGH PRESSURE CUT-OFF WITH MANUAL RESET | 11 STEP CONTROLLER |
| 3 CONTROL CIRCUIT FUSE | 8 LOW WATER CUT-OFF | 12 CONTACTOR COIL |
| 4 TRANSFORMER | 9 HIGH PRESSURE CUT-OFF WITH AUTOMATIC RESET | 13 POWER FUSES |
| 5 ON / OFF SWITCH | | 14 CONTACTOR |
| | | 15 HEATING ELEMENTS |

Figure A-3: Typical Wiring Diagram For Electric Steam Boilers

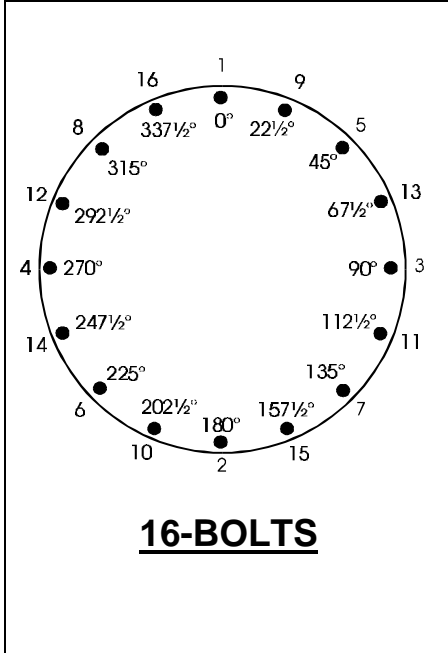
Appendix B

Bolt Torque Procedure



Appendix B (cont'd)

Bolt Torque Procedure

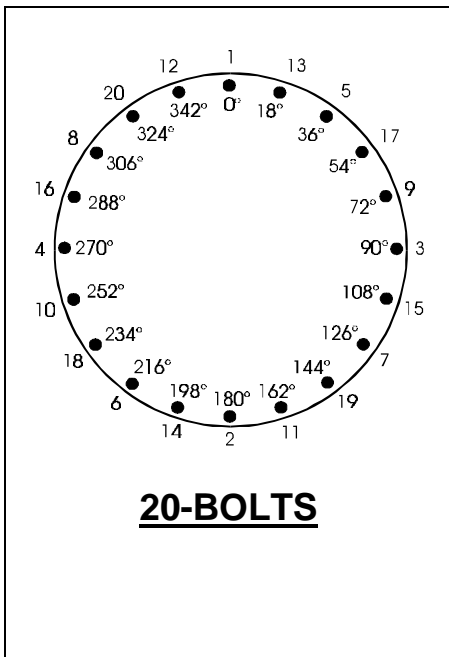


SEQUENTIAL ORDER

- 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



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

