



OPERATING AND MAINTENANCE MANUAL

SIGNATURE SH & H

6/13/24



-IMPORTANT-

Always reference the full model number and serial number when calling the factory.

HUBBELL ELECTRIC HEATER COMPANY
45 SEYMOUR STREET
STRATFORD, CT 06615

PHONE: (203) 378-2659
FAX: (203) 378-3593
Hubbellheaters.com

WARNING / CAUTION

1. Tank is to be completely filled with water and all air is to be vented before energizing.
2. Due to the rigors of transportation, all connections should be checked for tightness before the heater is placed in operation.
3. Safety relief valve must be installed in tapping provided.
4. The refractory material used in heating elements may absorb some moisture during transit, periods of storage, or when subjected to a humid environment. This moisture absorption results in a cold insulation resistance of less than one (1) megohms. If this heater has been subjected to the above condition, each heating element must be checked for insulation resistance before energizing. A low megohm condition can be corrected by removing the terminal hardware and baking the element in an oven at 300°F -500°F for several hours or until the proper megohm reading is obtained.
5. KEEP AWAY FROM LIVE ELECTRICAL CIRCUITS. Do not perform any maintenance, make any adjustments, or replace any components inside the control panel with the high voltage power supply turned on. Under certain circumstances, dangerous potentials may exist even when the power supply is off. To avoid casualties, always turn the power supply safety switch to off, turn the charge or ground the circuit before performing any maintenance or adjustment procedure.
6. Generalized instructions and procedures cannot anticipate all situations. For this reason, only qualified installers should perform the installations. A qualified installer is a person who has licensed training and a working knowledge of the applicable codes, regulations, tools, equipment, and methods necessary for safe installation of an electric resistance water heater. If questions regarding installation arise, check your local plumbing and electrical inspectors for proper procedures and codes. If you cannot obtain the required information, contact the company.

Table of Contents

SECTION I – OUTLINE DIMENSIONS 4

SECTION II – RECOVERY RATINGS AND AMPERAGE AT SELECTED kW 6

SECTION III – GENERAL DESCRIPTION AND CONSTRUCTION 7

 GENERAL DESCRIPTION 7

 CONSTRUCTION..... 7

 Standard Tank Construction: 7

 Optional Tank Linings: 7

 Optional Working Pressures: 7

 TANK CONNECTIONS 8

 OUTER SHELL, INSULATION, AND SUPPORTS 8

 HEATING ELEMENT..... 8

 ELECTRICAL ENCLOSURE 8

 CONTROL THERMOSTAT..... 9

 TEMPERATURE HIGH LIMIT SWITCH..... 10

 MAGNETIC CONTACTOR..... 10

 FUSED LOW VOLTAGE TRANSFORMER..... 10

 INDIVIDUALLY FUSED ELEMENTS 11

 OPTIONS..... 11

 Low Water Cut-Off 12

 Audible Alarm..... 12

 Building Management System (BMS) 13

 Status Indicating Lamp(s) 13

 Silicon Control Rectifier 13

 Circulating Pump Package 13

 Dial Temperature and Pressure Gauge..... 13

 Vacuum Relief Valve..... 13

SECTION IV – INSTALLATION 14

 WATER HEATER PLACEMENT 14

 PIPING INSTALLATION 14

 FILLING THE HEATER 15

 ELECTRICAL INSTALLATION..... 15

 FINAL CHECKS..... 15

SECTION V – TROUBLESHOOTING 16

SECTION VI – SCHEDULED MAINTENANCE AND OPERATION 18

 MAINTENANCE AND OPERATION 18

FREEZING..... 18

QUARTERLY INSPECTION 18

ANNUAL INSPECTION 19

SECTION VII – SERVICING AND REPLACEMENT OF PARTS..... 20

 MAGNETIC CONTACTOR..... 20

 IMMERSION TEMPERATURE CONTROLLER..... 21

 HEATING ELEMENT – STYLE A 22

 HEATING ELEMENT – STYLE B..... 24

 RELIEF VALVE..... 25

SECTION VII – MISCELLANEOUS CHARTS AND FORMULAS 26

 NEMA ENCLOSURES 26

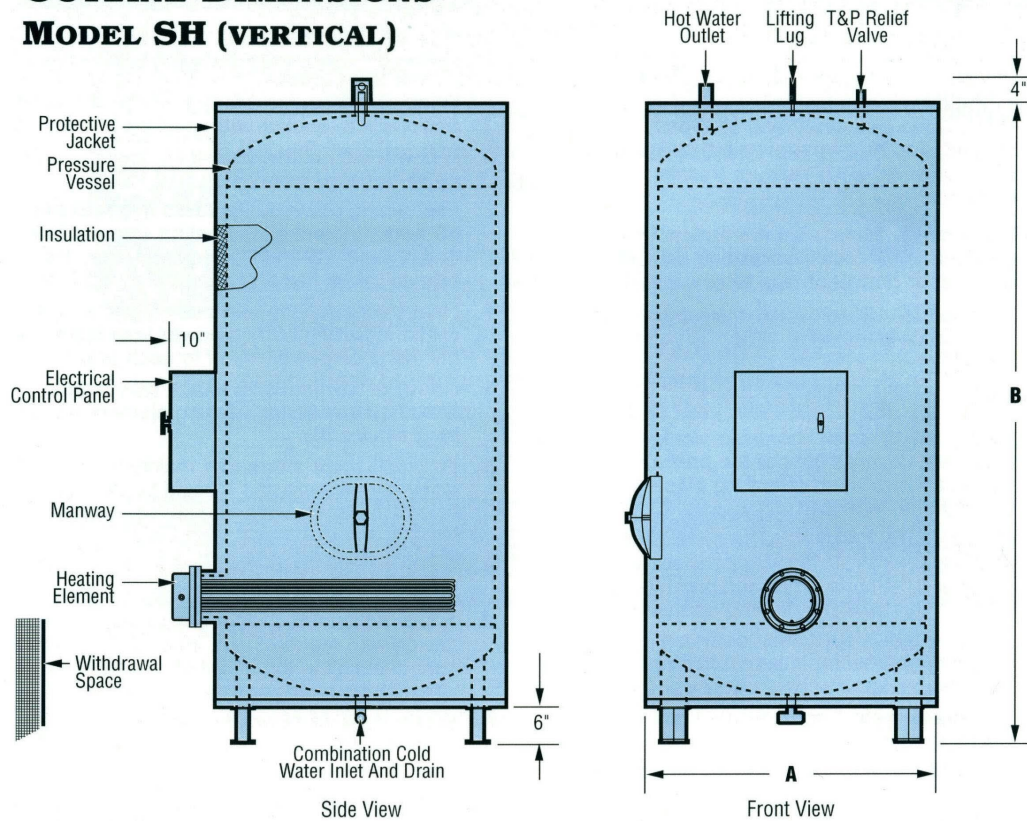
 ELECTRICAL DATA..... 27

 FORMULAS 28

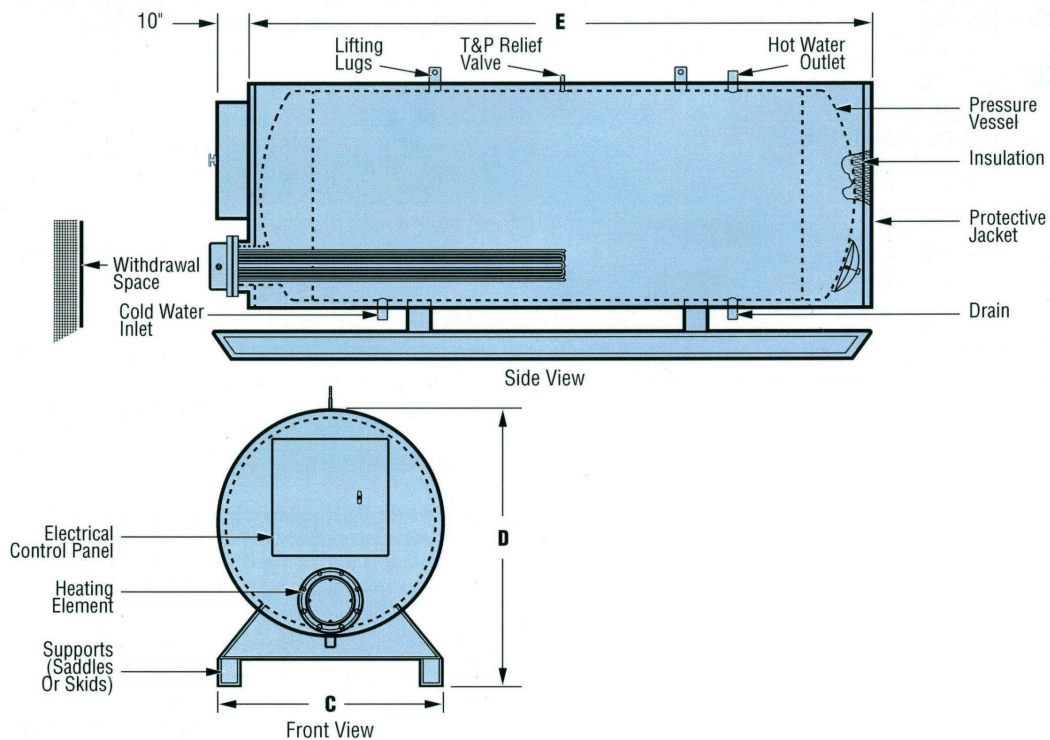
 TORQUE VALUES 29

SECTION I – OUTLINE DIMENSIONS

OUTLINE DIMENSIONS MODEL SH (VERTICAL)



MODEL H (HORIZONTAL)



OVERALL DIMENSIONS, MODELS SH AND H

| Storage Capacity (Gallons) | Overall Dimensions (Inches) | | | | | Storage Tank Diameter x Length | Inlet Outlet Sizing (NPT) | Approx. Shipping Weight (Lbs.) |
|-------------------------------|-----------------------------|---------------|--------------|---------------|---------------|--|------------------------------------|---|
| | Vertical | | Horizontal | | | | | |
| | Diameter "A" | Height "B" | Width "C" | Height "D" | Length "E" | | | |
| 80 | 28 | 56 | 28 | 34 | 50 | 24 x 46 | 1.5 | 1000 |
| 120 | 28 | 75 | 28 | 34 | 69 | 24 x 65 | 1.5 | 1150 |
| 150 | 34 | 65 | 34 | 40 | 59 | 30 x 55 | 1.5 | 1300 |
| 175 | 34 | 73 | 34 | 40 | 67 | 30 x 63 | 1.5 | 1500 |
| 200 | 34 | 82 | 34 | 40 | 76 | 30 x 72 | 1.5 | 1700 |
| 225 | 34 | 89 | 34 | 40 | 83 | 30 x 79 | 1.5 | 1750 |
| 250 | 40 | 74 | 40 | 46 | 68 | 36 x 64 | 1.5 | 1850 |
| 275 | 40 | 80 | 40 | 46 | 74 | 36 x 70 | 1.5 | 2000 |
| 300 | 40 | 88 | 40 | 46 | 82 | 36 x 78 | 1.5 | 2180 |
| 325 | 40 | 92 | 40 | 46 | 86 | 36 x 82 | 1.5 | 2300 |
| 350 | 40 | 94 | 40 | 46 | 88 | 36 x 84 | 1.5 | 2500 |
| 375 | 46 | 81 | 46 | 52 | 75 | 42 x 71 | 1.5 | 2600 |
| 400 | 46 | 85 | 46 | 52 | 79 | 42 x 75 | 1.5 | 2700 |
| 425 | 46 | 88 | 46 | 52 | 82 | 42 x 78 | 1.5 | 2900 |
| 450 | 46 | 93 | 46 | 52 | 87 | 42 x 83 | 1.5 | 3000 |
| 475 | 52 | 79 | 52 | 58 | 73 | 48 x 69 | 2 | 3100 |
| 500 | 52 | 82 | 52 | 58 | 76 | 48 x 72 | 2 | 3225 |
| 525 | 52 | 85 | 52 | 58 | 79 | 48 x 75 | 2 | 3350 |
| 550 | 52 | 89 | 52 | 58 | 83 | 48 x 79 | 2 | 3400 |
| 575 | 52 | 93 | 52 | 58 | 87 | 48 x 83 | 2 | 3500 |
| 600 | 52 | 95 | 52 | 58 | 89 | 48 x 85 | 2 | 3650 |
| 700 | 52 | 107 | 52 | 58 | 101 | 48 x 97 | 2 | 4000 |
| 800 | 52 | 119 | 52 | 58 | 113 | 48 x 109 | 2 | 4300 |
| 900 | 52 | 132 | 52 | 58 | 126 | 48 x 122 | 2 | 4800 |
| 1000 | 52 | 145 | 52 | 58 | 139 | 48 x 135 | 2 | 5200 |
| 1250 | 58 | 149 | 58 | 64 | 143 | 54 x 139 | 2 | 5600 |
| 1500 | 58 | 174 | 58 | 64 | 168 | 54 x 164 | 2 | 6000 |
| 1750 | 64 | 168 | 64 | 70 | 162 | 60 x 158 | 3 | 7400 |
| 2000 | 64 | 185 | 64 | 70 | 179 | 60 x 175 | 3 | 8100 |
| 2500 | 76 | 169 | 76 | 82 | 163 | 72 x 159 | 3 | 8200 |
| 3000 | 76 | 197 | 76 | 82 | 191 | 72 x 187 | 3 | 8300 |
| 3500 | 88 | 174 | 88 | 94 | 168 | 84 x 164 | 6 FLG. | 8900 |
| 4000 | 88 | 195 | 88 | 94 | 189 | 84 x 185 | 6 FLG. | 9800 |
| 4500 | N/A | N/A | 94 | 100 | 178 | 90 x 174 | 6 FLG. | 10700 |
| 5000 | N/A | N/A | 94 | 100 | 100 | 90 x 196 | 6 FLG. | 11600 |
| | | | | | | | | |
| | | | | | | | | |

SECTION II – RECOVERY RATINGS AND AMPERAGE AT SELECTED KW

RECOVERY RATINGS AND AMPERAGE AT SELECTED KW

| KW INPUT | BTU/HR RATING | Gallons Per Hour (GPH) Heated At Various Temperature Rises | | | | | Amperage Rating At Various Voltages | | | | |
|----------|---------------|--|--------|---------|---------|---------|-------------------------------------|---------|---------|---------|---------|
| | | 60°F Δ | 80°F Δ | 100°F Δ | 120°F Δ | 140°F Δ | 208V 3Φ | 240V 3Φ | 380V 3Φ | 415V 3Φ | 480V 3Φ |
| 15 | 51,195 | 103 | 77 | 62 | 51 | 44 | 42 | 36 | 23 | 21 | 18 |
| 20 | 68,260 | 137 | 103 | 82 | 68 | 59 | 56 | 48 | 30 | 28 | 24 |
| 25 | 85,325 | 171 | 128 | 103 | 85 | 73 | 69 | 60 | 38 | 35 | 30 |
| 30 | 102,390 | 205 | 154 | 123 | 103 | 88 | 83 | 72 | 46 | 42 | 36 |
| 35 | 119,455 | 239 | 179 | 144 | 120 | 103 | 97 | 84 | 53 | 49 | 42 |
| 40 | 136,520 | 273 | 205 | 164 | 137 | 117 | 111 | 96 | 61 | 56 | 48 |
| 45 | 153,585 | 308 | 231 | 185 | 154 | 132 | 125 | 108 | 68 | 63 | 54 |
| 50 | 170,650 | 342 | 256 | 205 | 171 | 146 | 139 | 120 | 76 | 70 | 60 |
| 55 | 187,715 | 376 | 282 | 226 | 188 | 161 | 153 | 132 | 84 | 77 | 66 |
| 60 | 204,780 | 410 | 308 | 246 | 205 | 176 | 167 | 145 | 91 | 84 | 72 |
| 65 | 221,845 | 444 | 333 | 267 | 222 | 190 | 181 | 157 | 99 | 91 | 78 |
| 70 | 238,910 | 478 | 359 | 287 | 239 | 205 | 195 | 169 | 106 | 97 | 84 |
| 75 | 255,975 | 513 | 384 | 308 | 256 | 220 | 208 | 181 | 114 | 104 | 90 |
| 80 | 273,040 | 547 | 410 | 328 | 273 | 234 | 222 | 193 | 122 | 111 | 96 |
| 85 | 290,105 | 581 | 436 | 349 | 290 | 249 | 236 | 205 | 129 | 118 | 102 |
| 90 | 307,170 | 615 | 461 | 369 | 308 | 264 | 250 | 217 | 137 | 125 | 108 |
| 95 | 324,235 | 649 | 487 | 390 | 325 | 278 | 264 | 229 | 145 | 132 | 114 |
| 100 | 341,300 | 683 | 513 | 410 | 342 | 293 | 278 | 241 | 152 | 139 | 120 |
| 110 | 375,430 | 752 | 564 | 451 | 376 | 322 | 306 | 265 | 167 | 153 | 132 |
| 120 | 409,560 | 820 | 615 | 492 | 410 | 351 | 333 | 289 | 183 | 167 | 145 |
| 125 | 426,625 | 854 | 641 | 513 | 427 | 366 | 347 | 301 | 190 | 174 | 151 |
| 150 | 511,950 | 1025 | 769 | 615 | 513 | 439 | 417 | 361 | 228 | 209 | 181 |
| 175 | 597,275 | 1196 | 897 | 718 | 598 | 513 | 486 | 421 | 266 | 244 | 211 |
| 200 | 682,600 | 1367 | 1025 | 820 | 683 | 586 | 556 | 482 | 304 | 279 | 241 |
| 225 | 767,925 | 1538 | 1153 | 923 | 769 | 659 | 625 | 542 | 342 | 313 | 271 |
| 250 | 853,250 | 1708 | 1281 | 1025 | 854 | 732 | 695 | 602 | 380 | 348 | 301 |
| 275 | 938,575 | 1879 | 1409 | 1128 | 940 | 805 | 764 | 662 | 418 | 383 | 331 |
| 300 | 1,023,900 | 2050 | 1538 | 1230 | 1025 | 879 | 834 | 723 | 456 | 418 | 361 |
| 325 | 1,109,225 | 2221 | 1666 | 1333 | 1110 | 952 | 903 | 783 | 494 | 453 | 391 |
| 350 | 1,194,550 | 2392 | 1794 | 1435 | 1196 | 1025 | 973 | 843 | 532 | 487 | 421 |
| 375 | 1,279,875 | 2563 | 1922 | 1538 | 1281 | 1098 | 1042 | 903 | 570 | 522 | 452 |
| 400 | 1,365,200 | 2733 | 2050 | 1640 | 1367 | 1171 | 1112 | 963 | 608 | 557 | 482 |
| 450 | 1,535,850 | 3075 | 2306 | 1845 | 1538 | 1318 | 1251 | 1084 | 685 | 627 | 542 |
| 500 | 1,706,500 | 3417 | 2563 | 2050 | 1708 | 1464 | 1390 | 1204 | 761 | 696 | 602 |
| 1000 | 3,412,000 | 6833 | 5125 | 4100 | 3417 | 2929 | 2779 | 2408 | 1521 | 1393 | 1204 |
| 1200 | 4094400 | 8200 | 6150 | 4920 | 4100 | 3514 | 3335 | 2890 | 1825 | 1671 | 1445 |
| 1400 | 4776800 | 9567 | 7175 | 5740 | 4783 | 4100 | 3891 | 3372 | 2130 | 1950 | 1686 |
| 1600 | 5459200 | 10933 | 8200 | 6560 | 5467 | 4686 | 4446 | 3854 | 2434 | 2229 | 1927 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Notes:

1. The KW selections above are shown for convenience. A full selection of KW ratings from 1 to 1600 KW is available by entering the desired KW into the model number.

SECTION III – GENERAL DESCRIPTION AND CONSTRUCTION

GENERAL DESCRIPTION

This book describes a packaged electric water heater that is a stationary, self-contained unit. The complete assembly consists of the storage tank, immersion electric heating element(s), thermostat, safety relief valve, safety high temperature cut out, magnetic contactor(s), power circuit fusing, fused low voltage control circuit transformer, and any other required electrical operating control. Optional equipment may be supplied with your unit. Please consult the product drawing for details specific to your assembly. The unit is factory assembled, insulated, jacketed, wired, tested, and ready for electrical and plumbing service connections.

CONSTRUCTION

TANK

Standard Tank Construction:

The standard storage tank is constructed of all welded carbon steel, designed and built in accordance with ASME Section IV and stamped, certified, and registered with the National Board of Boiler and Pressure Vessel Inspectors. It is internally lined with specially formulated HydraStone cement to a 5/8- inch minimum thickness for superior protection and tank longevity.

Optional Tank Linings:

1. Phenolic – An epoxy coating applied in two coats to a total thickness of 10-12 mils. Typically used in process applications using low conductivity deionized (DI), distilled, or food grade water.
2. Copper – A 3lb./sq. ft. copper sheet approximately 0.0646-inches thick covers all interior surfaces. All copper sheet seams are factory tested to ensure long lasting protection of the steel vessel.
3. Flame-Spray Copper – Molten copper is sprayed on the interior surfaces to a thickness of 5-6 mils. The copper bonds to the steel, and an additional overcoat of Phenolic lining is applied on the copper to seal all pores.
4. Galvanizing – The steel pressure vessel is pickled and hot dipped in molten zinc to create a barrier which internally and externally protects the steel vessel for cold and hot water storage.

Optional Non-Ferrous Tank Materials:

1. Copper-Silicon – A copper-silicon alloy offers tremendous tank longevity due to its ability to withstand the cycling effects induced from changes in water temperature and pressure. This material is suitable for storage of hot potable water in a variety of commercial and industrial applications.
2. 90/10 Copper-Nickel – A 90% copper and 10% nickel alloy similar to copper-silicon, but with added strength and corrosion resistance. Typically used in applications with corrosive environments (salt water) or critical applications.
3. Stainless Steel – Stainless steel (type 304, 316, or 316L) is well suited for high purity applications requiring a corrosion resistant tank with minimal leaching of impurities into the water. Well suited for process, RO, and DI water systems in the pharmaceutical, food, and electronic industries.

Optional Working Pressures:

The tank may be supplied with optional working pressures (standard working pressure is 125 psi). See the drawing for details.

TANK CONNECTIONS

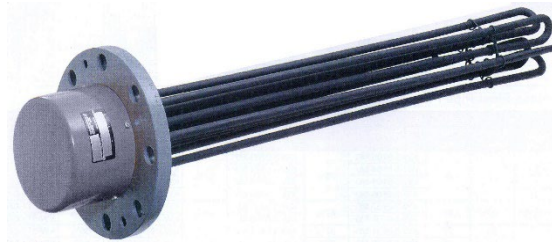
The heater is supplied with separate cold water and hot water connections. A FNPT connection is provided for mounting a combination safety temperature and pressure relief valve. An overflow line should be utilized from the relief valve outlet to a floor drain. See the drawing for locations and sizes.

OUTER SHELL, INSULATION, AND SUPPORTS

The tank is encapsulated in 2-inches of high-density fiberglass insulation. The protective shell is constructed of galvalume and is coated with a durable gray hammertone finish. The entire vessel is supported on heavy-duty integrally welded steel supports for sturdy floor mounting.

HEATING ELEMENT

The water heater is supplied with a flanged electric immersion heating element assembly, composed of copper, incoloy, or stainless-steel sheathed elements. Each assembly is fastened to a corresponding tank flange using a gasket and hex head steel bolts and nuts. Specialized heating element construction may be included. These options include special watt density ratings, passivation, electropolishing, or special materials. See drawing for voltage, power ratings, and special options.



ELECTRICAL ENCLOSURE

A louvered control panel available in various sizes and with assorted types of handles is supplied. The standard cabinet is rated NEMA 1, but other NEMA rated enclosures are available, consult drawing for further information. A list of NEMA ratings are available in Section VI.

CONTROL THERMOSTAT

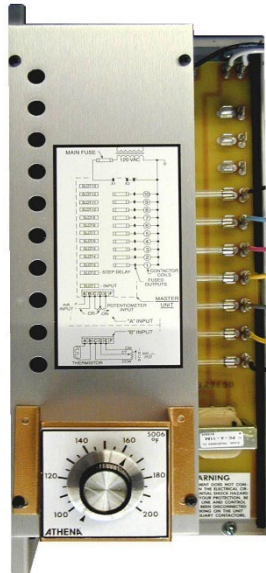
The control panel is supplied standard with a single-stage immersion thermostatic switch. As an optional any of the following may be supplied; a four-stage immersion thermostatic switch, a solid-state staging controller with thermistor, or a digital 1/16 DIN temperature controller with thermocouple. See the drawing for specific details. The single-stage immersion thermostat can be adjusted through a range of 100° - 190° F. A low range, (30° - 110° F), operating thermostat is also available in the single-stage version. The four-stage immersion thermostat can be adjusted through a range of 100° - 250° F and is capable of switching four stages. The solid-state staging controller has a range of 100° - 200° F and provides control of up to ten stages. This thermostat automatically brings on-line the required number of heating steps in order to meet the hot water demand and will also operate each circuit in a circular mode to allow for equal usage of all heating circuits. A 1/16 DIN electronic temperature control package may be installed. A separate manufacturer's operating manual will be supplied with all units except the single-stage immersion thermostat.



Single-Stage Immersion Thermostat



Four-Stage Immersion Thermostat



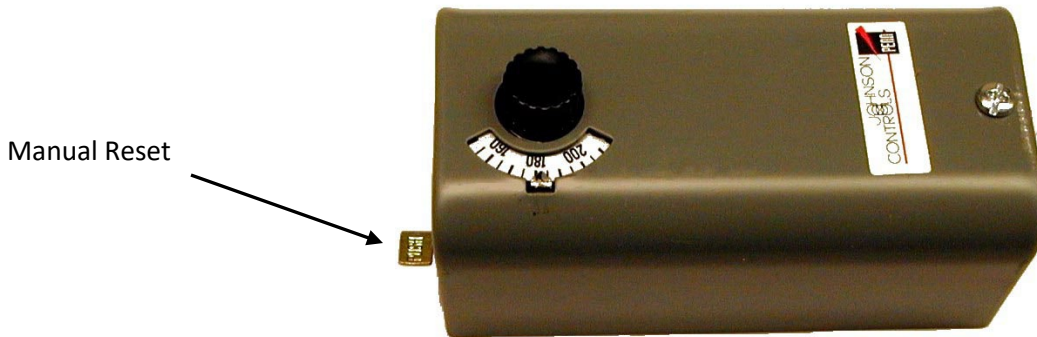
Solid State Staging Controller



1/16 DIN Digital Display

TEMPERATURE HIGH LIMIT SWITCH

As a safety device, an immersion high temperature cut-off switch with manual reset, adjustable through a range of 100° - 240° F, is provided. The high limit must be manually reset in order to engage the control circuit thereafter to restart the heater. Optionally a 1/16 DIN digital controller may be used as a high limit. A separate manufacturers operating manual will be supplied for this option.



MAGNETIC CONTACTOR

The magnetic contactor(s) is a heavy-duty resistive load type rated for 100,000 cycles. The contactor supplies power to the heating element(s) based on the resistive load (non-inductive) of the heater only when the thermostatic switch is engaged, thereby pulling in the contacts until the desired temperature is reached. At this point, the contacts will drop out, which in turn disconnects power from the elements.



FUSED LOW VOLTAGE TRANSFORMER

A fused low voltage transformer may be supplied. This option is used to step down higher voltages to 120-volt for safety when working with control circuits.



INDIVIDUALLY FUSED ELEMENTS

To prevent the possibility of damage to circuits and elements in case of electrical overloads, fuses may be supplied for each circuit. Two types of fuses may be used: a type NON for voltages less than 250- volt or type JJS for voltages less than 600-volt.



OPTIONS

The following optional features may be included in your water heater. Reference included drawing specific to your heater for further details.

Stainless Steel Jacket

An optional stainless steel outer jacket may replace the standard galvalume covering. This optional jacket may be painted.

Skid Mounting

Optionally, the unit may be mounted on heavy-duty all welded I-beams.

On / Off Switch

A built-in non-fused On/Off disconnect switch may be supplied with the control panel to disconnect power to the control panel.

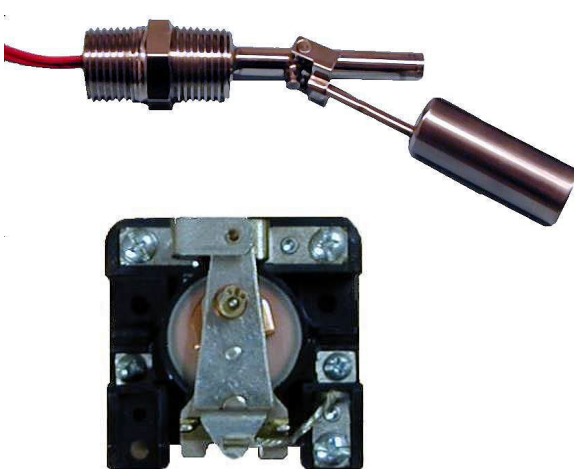
Built-In Circuit Breaker

A built-in circuit breaker may be provided with or without shunt trip protection for protection from circuit overload.

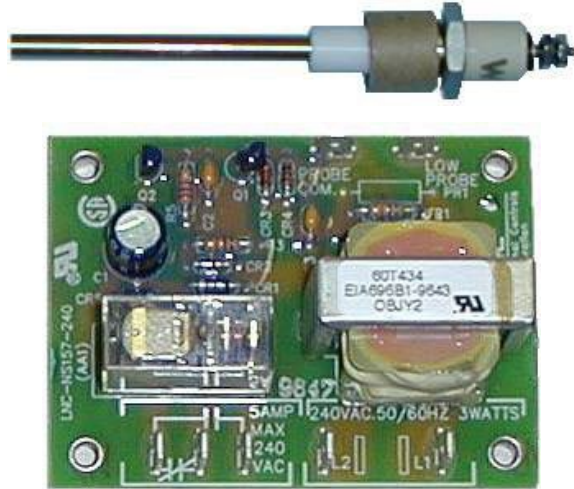


Low Water Cut-Off

Used as a safety device, the electronic low water cut-off is used to detect a low water situation and disengage the operating coils in the magnetic contactor(s). Once the condition is remedied, the low water cut-off switch is automatically reset. Two types of low water cut-offs are available; the float type and the conductive style.



Float Type Low Water Cut-Off
Probe and Relay



Conductive Type Low Water Cut-Off
Probe and Relay

Audible Alarm

An audible alarm may be installed on the outside of the control panel to give warning of a fault condition.



Building Management System (BMS)

A Building Management System control package may be supplied for remote operation and alarm capabilities.

Status Indicating Lamp(s)

Optional status indicating lamps may be installed to show when the unit is on, when the heating element is energized, or if there is an alarm condition.

Silicon Control Rectifier

A silicon control rectifier (SCR) “zero fired” power controller for 0-100% proportional control of heaters may be supplied.

Circulating Pump Package

An intra-tank circulation pump package with On/Off switch to continuously circulate water within the tank and thereby reduce stratification may be installed. An all-bronze circulator pump, rated 1/25 HP, 120V, 1Ph, is used.

Dial Temperature and Pressure Gauge

A combination temperature (70° - 250° F) and pressure (0 – 200 psi) gauge with 2½-inch dial may be supplied for in-line installation (shipped loose) or factory installed in the tank.



Vacuum Relief Valve

A vacuum relief valve may be provided with the unit to reduce the risk of back siphonage and back pressure of the system. The valve will be shipped loose for in-line installation. Instructions for installation are provided with the valve.



Special Customized Features

Please reference the drawing for details.

SECTION IV – INSTALLATION

WARNING / CAUTION

DO NOT TURN ON THE ELECTRIC POWER SUPPLY to this equipment until the heater is completely filled with water and all air has been released. *If the heater is NOT filled with water when the power is turned on, the heating elements will burn out.*

For protection against excessive pressures and temperatures, local codes require the installation of a temperature-and-pressure (T&P) relief valve certified by a nationally recognized laboratory that maintains periodic inspection of production of listed equipment of materials, as meeting the requirements for Relief Valves and Automatic Gas Shutoff for Hot Water Supply Systems. ANSI Z21.22-1971. THE CUSTOMER IS RESPONSIBLE TO PROTECT PROPERTY AND PERSONNEL FROM HARM WHEN THE VALVE FUNCTIONS.

All water heaters have a risk of leakage at some unpredictable time. IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE A CATCH PAN OR OTHER ADEQUATE MEANS, SO THAT THE RESULTANT FLOW OF WATER WILL NOT DAMAGE FURNISHINGS OR PROPERTY.

WATER HEATER PLACEMENT

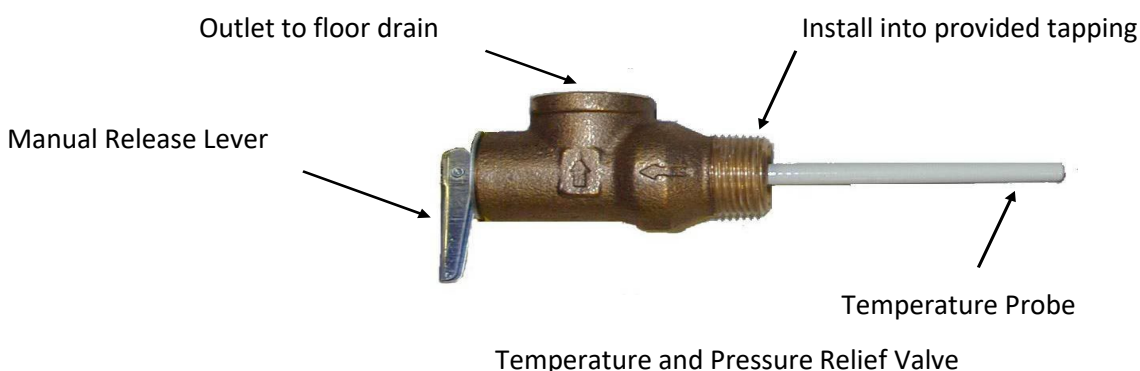
1. Place the heater on a solid foundation in a clean, dry location nearest to the point of most frequent hot water use.
2. The water heater should be protected from freezing and waterlines insulated to reduce energy and water waste.
3. Leave sufficient clearance for element withdrawal, if necessary.
4. Do not install in an area where flammable liquids or combustible vapors are present.

PIPING INSTALLATION

NOTE: The most effective means for preventing deterioration from accelerated corrosion due to galvanic and stray current is the installation of dielectric fittings/unions. The installation of these fittings is the responsibility of the installing contractor.

1. Connect the cold-water inlet and hot water outlet to the appropriate connections as shown; refer to the drawing for location and sizes.
2. Install an in-line vacuum breaker and in-line pressure and temperature gauge, if supplied.
3. Install the combination temperature and pressure safety relief valve in the tapping provided.

*Note that this is required by law for safety considerations.



4. Install a relief valve overflow pipe to a nearby floor drain. CAUTION: No valve of any type should be installed between the relief valve and tank or in the drain line.

FILLING THE HEATER

1. Completely close the drain valve and open the highest hot water valve to allow all air to escape from piping.
2. Open the valve to the cold-water inlet and allow the heater and piping system to completely fill, as indicated by a steady flow of water from the open faucet.

ELECTRICAL INSTALLATION

1. Enter electric enclosure with properly sized feeder leads (use 60° C copper wire for water heaters rated less than 100 amps; otherwise use 75°C copper wire). Be sure to properly ground the water heater.
2. Install these power leads into the box lugs on the terminal block or magnetic contactor.
3. Torque screws per torque chart included in Section VI.
4. 4. All other electrical connections are made at the factory; therefore, no other electrical connections are necessary.

FINAL CHECKS

1. Check all connections for tightness.
2. Ensure that all the above steps are completed.
3. After the water is heated for the first time, monitor the water temperature as described in Section VI, Quarterly Inspection.

SECTION V – TROUBLESHOOTING

| Symptom | Probable Cause | Corrective Action / Remedy |
|--------------|---|--|
| No hot water | Circuit breaker tripped at source. | Reset circuit breaker. |
| | On/Off switch in 'OFF' position, if installed. | Turn switch to 'ON' position. |
| | Circuit breaker at control cabinet tripped, if installed. | Reset circuit breaker. |
| | Blown fuse in element fuse block, if installed. | Replace fuse. |
| | Blown fuse in transformer, if installed. | Replace fuse. |
| | High limit switch tripped. | Reset high limit switch. |
| | Loose wires. | Tighten wires. Torque screws per torque chart on Page 29. |
| | Heating element inoperable. | Check heating element operation by clamping an Amprobe around each wire to the element. The ampere reading should agree with the nameplate 'AMP' figure. |
| | Low line voltage. | Have source electrical system checked by an electrician. |
| | Faulty thermostat. | Move thermostat dial through full range. A definite 'click' should be heard. If not, replace thermostat. |
| | Faulty low water cut-off, if installed. | Check to see if the tank is full of water. If not, fill the tank. If the problem continues and the tank is full, check for continuity between the common and normally open contact of the relay board. If continuity is not observed, replace low water cut-off. |
| | Magnetic contactor does not energize. | Replace complete magnetic contactor. Because of the design of this particular contactor, it is more desirable to replace complete control rather than rebuilding coil, contacts and springs, etc. |

| | | |
|---|---|--|
| Water temperature below settings at all times | Faulty thermostat. | Check thermostat adjustment. Monitor thermostat as described in Section VI, Quarterly Inspection. Replace if necessary. |
| | Blown fuse in the element fuse block, if installed. | Replace fuse. |
| | Heating element not working on all phases | Check to see that heating element is working on all phases, by checking the resistance (ohms) value for each element and comparing with the chart included in Section VII. |
| | Heater improperly sized | Verify heater is properly sized for the flow rate and temperature rise of your system. See formulas included in Section VII. Replace elements with proper size as necessary. |
| Relief valve discharges continuously | Excessive temperature or pressure in tank | Temperature and pressure relief valves are made to operate if the water temperature exceeds 210°F or water pressure exceeds the pressure rating of the safety relief valve. If trouble is excessive temperature, then thermostat is not shutting off at the right setting and thermostat must be replaced. |

SECTION VI – SCHEDULED MAINTENANCE AND OPERATION

WARNING / CAUTION

Before performing any maintenance procedure, make certain power supply is **OFF** and cannot accidentally be turned on.

MAINTENANCE AND OPERATION

The water heater is automatic in its operation. It will maintain a full tank of water at the temperature setting of the thermostat. The water heater should not be turned on without first making sure that the tank is full of water and all air has been released.

FREEZING

The tank should be fully drained in the event the electricity has been turned off and if there is danger of freezing.

QUARTERLY INSPECTION

1. Monitor thermostat
 - a. Let the water heater completely heat to a designated thermostat setting.
 - b. After thermostat satisfies (that is, when the thermostat actually clicks off), draw water from heater.
 - c. Compare water temperature of drawn water to the temperature setting of the thermostat when it satisfies. Normal variation between the two points is approximately + 5°F.
 - d. If these two readings do not coincide within acceptable tolerances and verification has been made of the accuracy of the temperature-reading gauge, replace thermostat.
2. Lift test lever on relief valve and let water run through valve for a period of approximately 10 seconds. This will help flush away any sediment that might build up in water passageways.
3. Inspect element flange for leakage as follows:
 - a. Shut off Power Supply.
 - b. Remove element housing cover.
 - c. Visually inspect heating element gasket for evidence of leaks.
 - d. Rub finger around gasket that is between the heating element and tank flange for any evidence of moisture. If moisture is present or a water drip is observed, follow procedure outlined in Section V.
4. Check for loose electrical connections. Tighten as necessary.

ANNUAL INSPECTION

1. Flush tank as follows:
 - a. Shut off the power supply.
 - b. Close valve on hot water outlet piping.
 - c. Open valve on drain piping.
 - d. Cold water inlet line pressure will be strong enough to flush sediment from the bottom of the tank out through the drain. Let the water run for 3-4 minutes.
 - e. Close drain valve.
 - f. Open hot water valve.
 - g. Turn the power supply ON.

NOTE:

Cement lining is a durable lining that will provide many years of service protecting your steel pressure vessel from corrosion. The process of cement lining includes an inspection to ensure that the lining is applied to the correct thickness, covers all appropriate surfaces, and is free from defects or cracks greater than 3 mm (1/8") in width. Any deficiencies are repaired at the factory prior to shipment. However, it is characteristic to find hairline cracks in the cement lining prior to initial installation. After the vessel is first filled, the water will work its way into these cracks and begin the corrosion process. At the same time the cement lining undergoes a "wet curing" process whereby the cement absorbs water and expands. The water that is absorbed into the lining becomes trapped between the cement lining and the steel tank and once the cement is fully absorbed with water, the water in contact with the steel tank becomes deoxygenated which serves to protect the steel vessel. In addition, the cement leaches minerals and various impurities from the water which fills and "heals" the cracks. This "healing" together with the "wet curing" and expansion of the cement prevents any ongoing corrosion. In the unlikely event a crack greater than 3 mm (1/8") develops, the cement lining can be easily repaired in the field. For repair procedures please contact Hubbell.

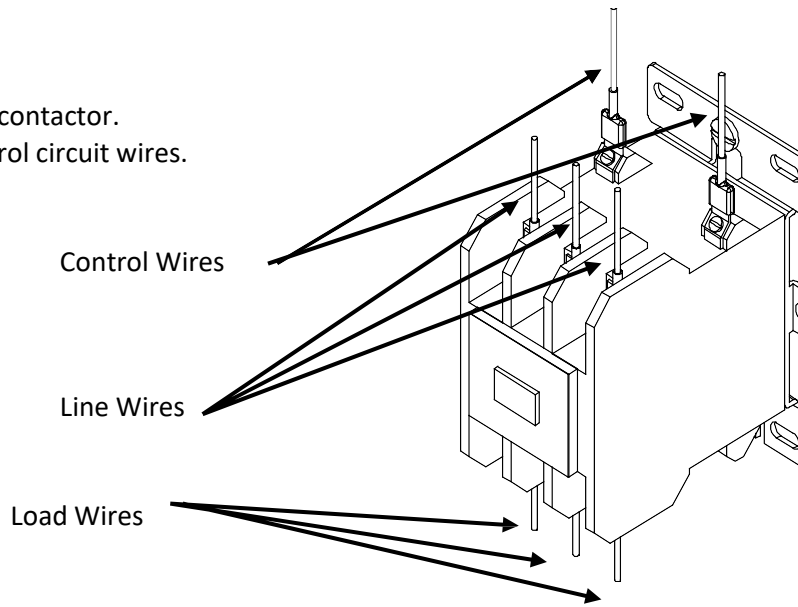
SECTION VII – SERVICING AND REPLACEMENT OF PARTS

WARNING / CAUTION

Before servicing or replacing any part make sure to turn the power supply switch to the OFF position.

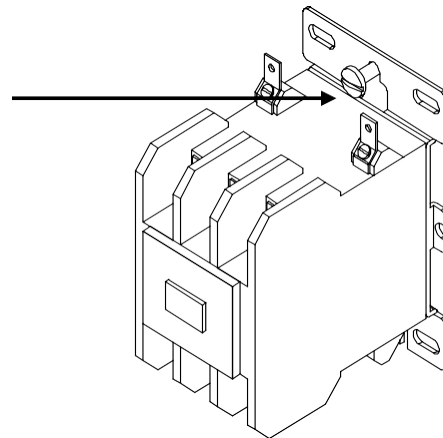
MAGNETIC CONTACTOR

1. Disconnect power from unit.
2. Disconnect line and load wires to contactor.
3. Disconnect two (2) 14-gauge control circuit wires.



4. Loosen two (2) holding screws and remove contactor.

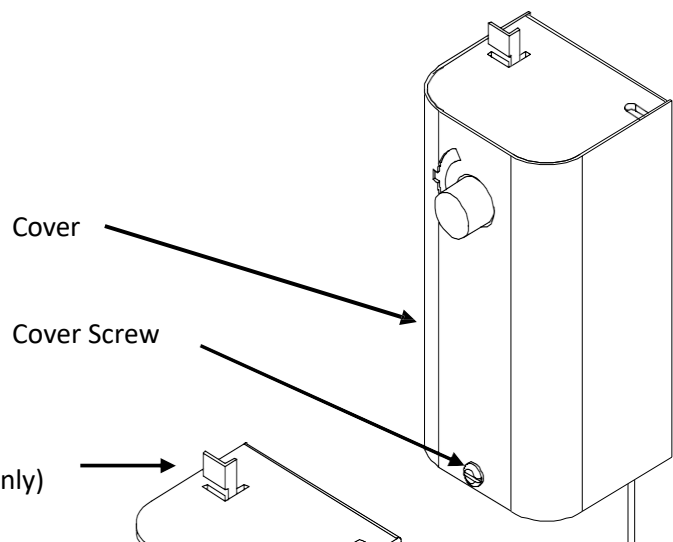
Mounting Screws
(Bottom screw not shown)



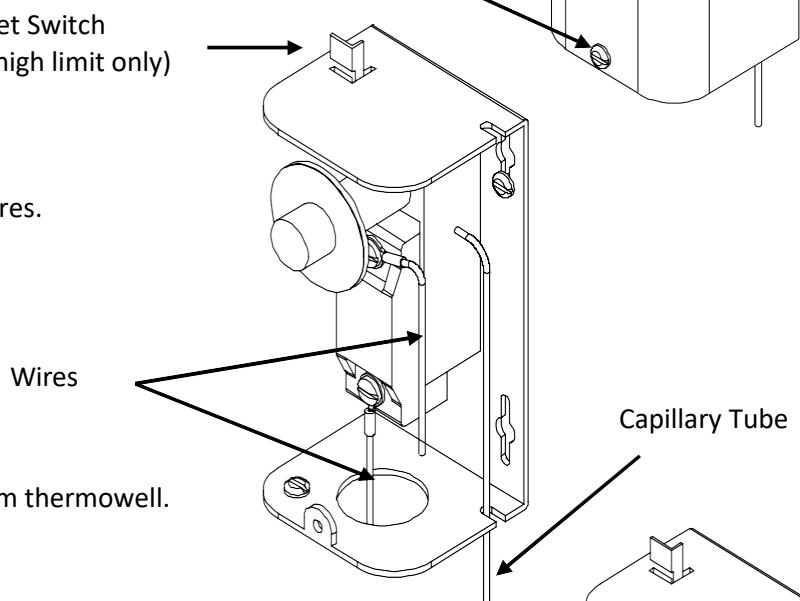
5. Replace with new contactor using reverse procedure.

IMMERSION TEMPERATURE CONTROLLER

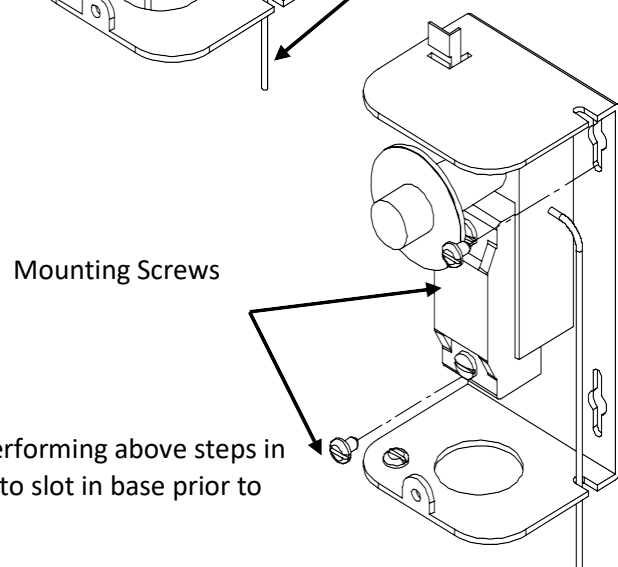
1. Disconnect power from the unit.
2. Remove access cover.
3. Remove high limit cover screw and cover.



4. Disconnect the two (2) 14-gauge wires.



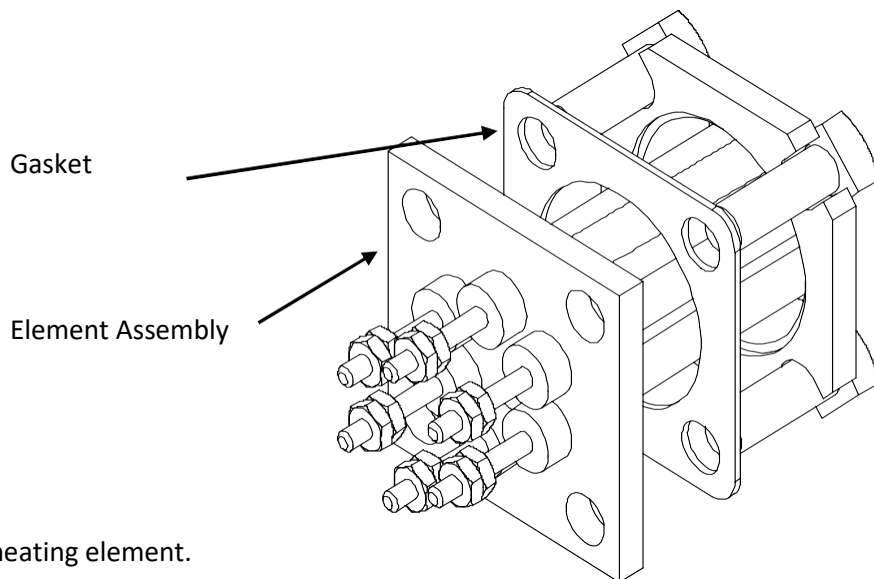
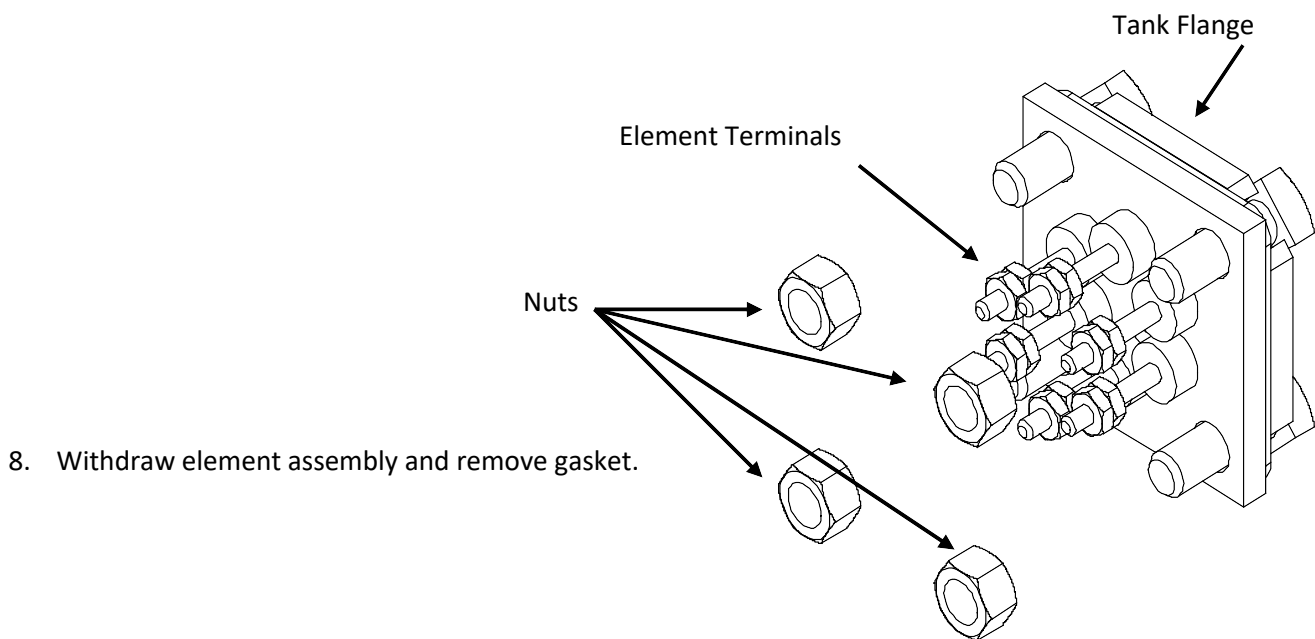
5. Remove capillary tube and bulb from thermowell.
6. Remove two (2) mounting screws.



7. Remove control and install new high limit switch by performing above steps in reverse order. (Note: Be sure to place capillary tube into slot in base prior to installing cover.)

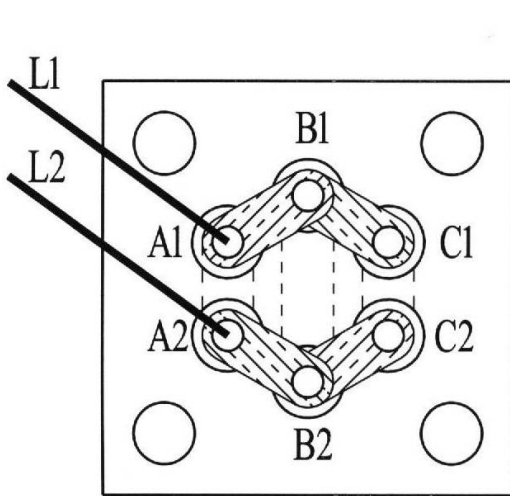
HEATING ELEMENT – STYLE A

1. Disconnect power from unit.
2. Shut off incoming water supply.
3. Attach hose to drain connection.
4. Lift manual release lever on relief valve to let air into system or break union on outgoing water line.
5. Drain water from tank.
6. Disconnect the wires from the heating element terminals.
7. Remove the 3/8-16 nuts.

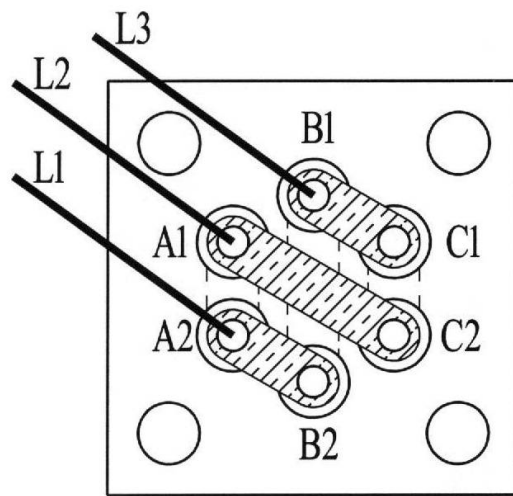


9. Install a new gasket and insert a new heating element.
10. Rewire element according to the voltage and phase rating of the unit as shown below.
11. Fill the tank and check around the gasket for any leaks.

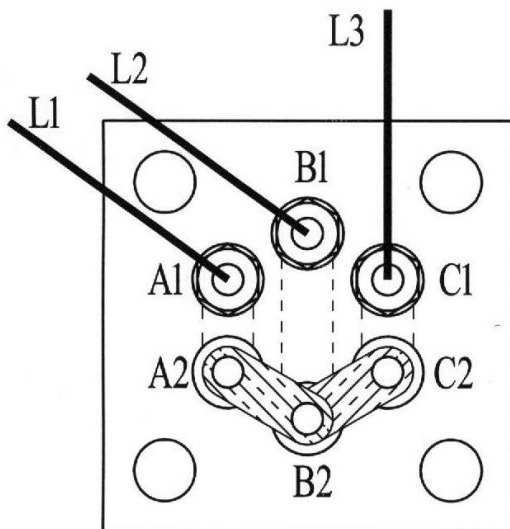
JUMPER CONFIGURATION



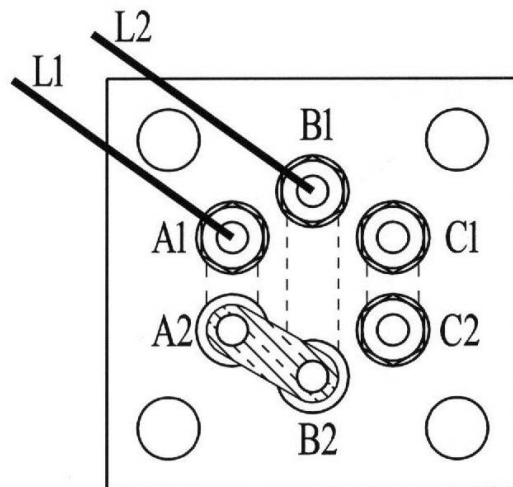
1 PHASE
208 OR 240 VOLT



3 PHASE DELTA
208 OR 240 VOLT



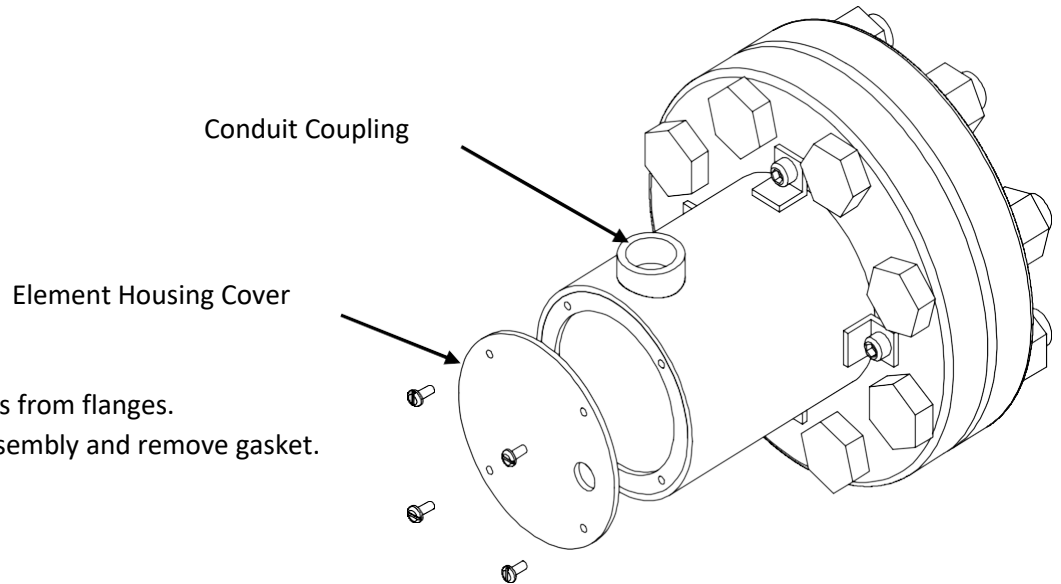
3 PHASE WYE
380 TO 575 VOLT



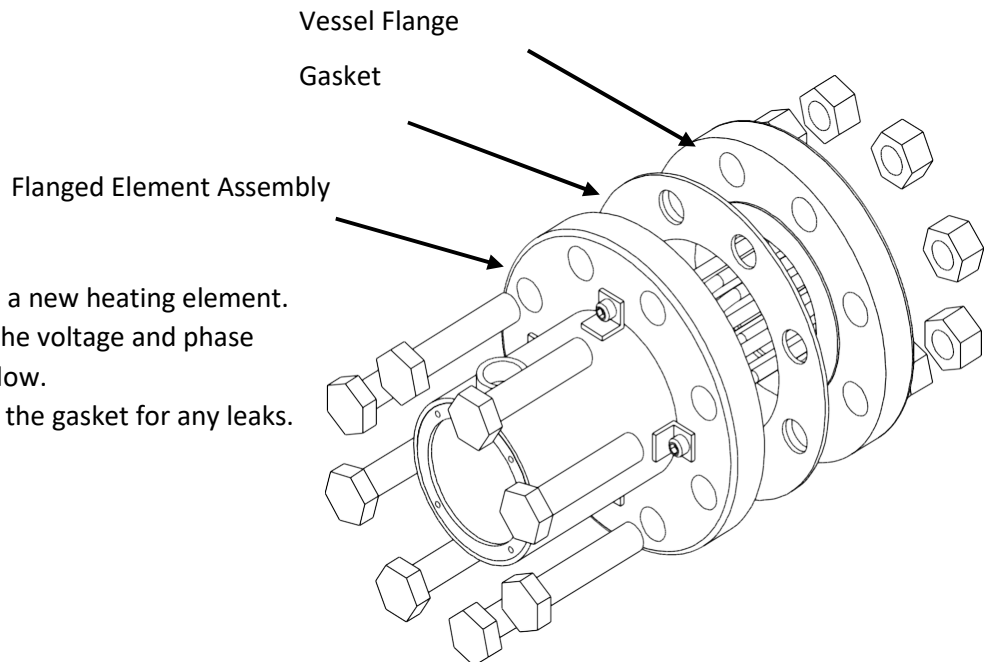
1 PHASE
480 VOLT

HEATING ELEMENT – STYLE B

1. Disconnect power from unit.
2. Shut off incoming water supply.
3. Attach hose to drain connection.
4. Lift manual release lever on relief valve to let air into system or break union on outgoing water line.
5. Drain water from tank.
6. Remove element housing cover.
7. Disconnect the wires from the heating element terminals.
8. Disconnect conduit from coupling.



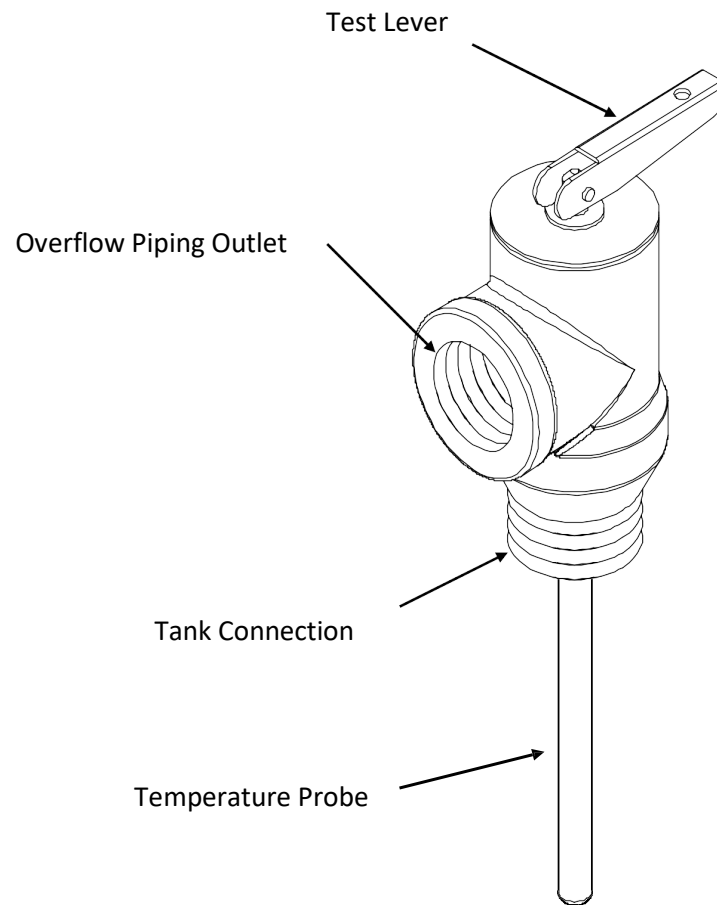
9. Remove nuts and bolts from flanges.
10. Withdraw element assembly and remove gasket.



11. Install a new gasket and insert a new heating element.
12. Rewire element according to the voltage and phase rating of the unit as shown below.
13. Fill the tank and check around the gasket for any leaks.

RELIEF VALVE

1. Disconnect power from unit.
2. Shut off incoming water supply.
3. Lift test lever on relief valve to relieve pressure in tank.
4. Disconnect overflow piping.
5. Unscrew relief valve, remove assembly, and replace with new one.
6. Connect overflow piping.
7. Turn on incoming water supply and check for leaks.
8. Turn the safety switch to ON position.



SECTION VII – MISCELLANEOUS CHARTS AND FORMULAS

NEMA ENCLOSURES

Type Intended Use and Description

- 1 Enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment or locations where unusual service conditions do not exist.
- 2 Enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.
- 3 Enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, and sleet; undamaged by the formation of ice on the enclosure.
- 4 Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against wind-blown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

4X Enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

12 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

13 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and noncorrosive coolant.

The preceding descriptions are not intended to be complete representations of National Electrical Manufacturers Association standards for enclosures.

Table 1. COMPARISON OF SPECIFIC APPLICATIONS OF ENCLOSURES FOR INDOOR NON-HAZARDOUS LOCATIONS

| Provides a Degree of Protection Against the Following Environmental Conditions | 1* | 2* | 4 | 4X | Type of Enclosure | | | | | | |
|--|----|----|---|----|-------------------|---|----|----|----|-----|----|
| | | | | | 5 | 6 | 6P | 11 | 12 | 12K | 13 |
| Incidental contact with the enclosed equipment | X | X | X | X | X | X | X | X | X | X | X |
| Falling dirt | X | X | X | X | X | X | X | X | X | X | X |
| Falling liquids and light splashing | | X | X | X | | X | X | X | X | X | X |
| Dust, lint, fibers, and flyings† | | | X | X | X | X | X | | X | X | X |
| Hosedown and splashing water | | | X | X | | X | X | | | | |
| Oil and coolant seepage | | | | | | | | | X | X | X |
| Oil or coolant spraying and splashing | | | | | | | | | | | X |
| Corrosive agents | | | | X | | | X | X | | | |
| Occasional temporary submersion | | | | | | X | X | | | | |
| Occasional prolonged submersion | | | | | | | X | | | | |

* These enclosures may be ventilated. However, Type 1 may not provide protection against small particles of falling dirt when ventilation is provided in the enclosure top.

† These fibers and flyings are nonhazardous materials and are not considered the Class III type ignitable fibers or combustible flyings. For Class III type ignitable fibers or combustible flyings see the National Electrical Code®, Section 500-6(a).

Table 2. COMPARISON OF SPECIFIC APPLICATIONS OF ENCLOSURES FOR OUTDOOR NON-HAZARDOUS LOCATIONS

| Provides a Degree of Protection Against the Following Environmental Conditions | 3 | 3R** | Type of Enclosure | | | | |
|--|---|------|-------------------|---|----|---|----|
| | | | 3S | 4 | 4X | 6 | 6P |
| Incidental contact with the enclosed equipment | X | X | X | X | X | X | X |
| Rain, snow, and sleet§ | X | X | X | X | X | X | X |
| Sleet†† | | | X | | | | |
| Windblown dust | X | | X | X | X | X | X |
| Hosedown | | | | X | X | X | X |
| Corrosive agents | | | | | X | | X |
| Occasional temporary submersion | | | | | | X | X |
| Occasional prolonged submersion | | | | | | | X |

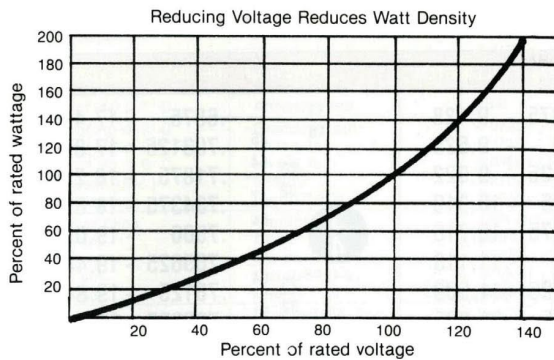
§ External operating mechanisms are not required to be operable when the enclosure is ice covered.

†† External operating mechanisms are operable when the enclosure is ice covered.

** These enclosures may be ventilated.

ELECTRICAL DATA

Wattage Change with Voltage Change



PERCENT RATED WATTS ON REDUCED VOLTAGE

230-volt heater on 208 volts—82%
 240-volt heater on 208 volts—75%
 480-volt heater on 277 volts—33%
 480-volt heater on 440 volts—84%
 480-volt heater on 318 volts—44%
 550-volt heater on 480 volts—76%

$$W_2 = W_1 \times \left(\frac{e_2}{e_1} \right)^2$$

Where:

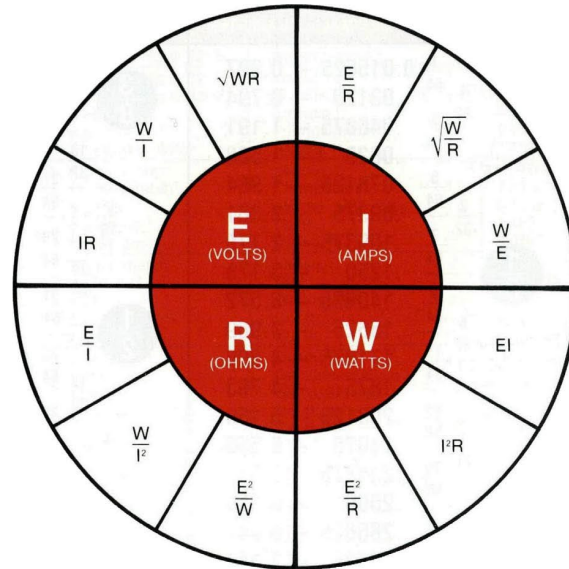
w_2 = New wattage output

w_1 = Rated wattage

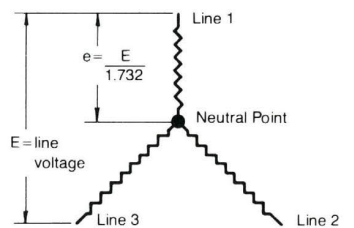
e_2 = Applied voltage

e_1 = Rated voltage

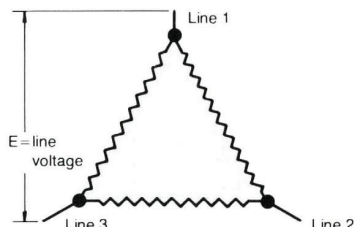
ohms Law



Three Phase Circuits



WYE OR STAR



DELTA

If elements are designed for 3-phase Delta connection, wattage output may be reduced to $\frac{1}{3}$ by reconnecting to 3-phase WYE

For current in 3-phase circuits $I = \frac{W}{E \times 1.732}$

For resistance in 3 phase circuit (across any two terminals)

$$R = \frac{E^2}{\frac{1}{2}W}$$

Amperage Conversion Table

| Watts | Volts, Single Phase | | | Volts 3 Phase Balanced Load | | Watts |
|-------|---------------------|------|-------|-----------------------------|-------|-------|
| | 120 | 240 | 480 | 240 | 480 | |
| 100 | .83 | .42 | .21 | .24 | .13 | 100 |
| 150 | 1.25 | .63 | .31 | .36 | .18 | 150 |
| 200 | 1.67 | .83 | .42 | .49 | .25 | 200 |
| 250 | 2.08 | 1.04 | .52 | .61 | .30 | 250 |
| 300 | 2.50 | 1.25 | .63 | .73 | .37 | 300 |
| 350 | 2.92 | 1.46 | .73 | .85 | .43 | 350 |
| 400 | 3.33 | 1.67 | .84 | .97 | .49 | 400 |
| 450 | 3.75 | 1.88 | .93 | 1.10 | .55 | 450 |
| 500 | 4.17 | 2.08 | 1.04 | 1.20 | .60 | 500 |
| 600 | 5.00 | 2.50 | 1.25 | 1.45 | .73 | 600 |
| 700 | 5.83 | 2.92 | 1.46 | 1.70 | .85 | 700 |
| 800 | 6.67 | 3.33 | 1.67 | 1.93 | .97 | 800 |
| 900 | 7.50 | 3.75 | 1.87 | 2.17 | 1.09 | 900 |
| 1000 | 8.33 | 4.17 | 2.10 | 2.41 | 1.21 | 1000 |
| 1100 | 9.17 | 4.58 | 2.30 | 2.65 | 1.33 | 1100 |
| 1200 | 10.0 | 5.00 | 2.51 | 2.90 | 1.45 | 1200 |
| 1250 | 10.4 | 5.21 | 2.61 | 3.10 | 1.55 | 1250 |
| 1300 | 10.8 | 5.42 | 2.71 | 3.13 | 1.57 | 1300 |
| 1400 | 11.7 | 5.83 | 2.91 | 3.38 | 1.69 | 1400 |
| 1500 | 12.5 | 6.25 | 3.12 | 3.62 | 1.82 | 1500 |
| 1600 | 13.3 | 6.67 | 3.34 | 3.86 | 1.93 | 1600 |
| 1700 | 14.2 | 7.08 | 3.54 | 4.10 | 2.05 | 1700 |
| 1800 | 15.0 | 7.50 | 3.75 | 4.34 | 2.17 | 1800 |
| 1900 | 15.8 | 7.92 | 3.96 | 4.58 | 2.29 | 1900 |
| 2000 | 16.7 | 8.33 | 4.17 | 4.82 | 2.41 | 2000 |
| 2200 | 18.3 | 9.17 | 4.59 | 5.30 | 2.65 | 2200 |
| 2500 | 20.8 | 10.4 | 5.21 | 6.10 | 3.05 | 2500 |
| 2750 | 23.0 | 11.5 | 5.73 | 6.63 | 3.32 | 2750 |
| 3000 | 25.0 | 12.5 | 6.25 | 7.23 | 3.62 | 3000 |
| 3500 | 29.2 | 14.6 | 7.30 | 8.45 | 4.23 | 3500 |
| 4000 | 33.3 | 16.7 | 8.33 | 9.64 | 4.82 | 4000 |
| 4500 | 37.5 | 18.8 | 9.38 | 10.84 | 5.42 | 4500 |
| 5000 | 41.7 | 20.8 | 10.42 | 12.1 | 6.1 | 5000 |
| 6000 | 50.0 | 25.0 | 12.50 | 14.50 | 7.25 | 6000 |
| 7000 | 58.3 | 29.2 | 14.59 | 16.9 | 8.5 | 7000 |
| 8000 | 66.7 | 33.3 | 16.67 | 19.3 | 9.65 | 8000 |
| 9000 | 75.0 | 37.5 | 18.75 | 21.7 | 10.85 | 9000 |
| 10000 | 83.3 | 41.7 | 20.85 | 24.1 | 12.1 | 10000 |

FORMULAS

RECOVERY

$$\text{GPH} \times \text{ } ^\circ\text{F } \Delta T \times 0.00244 = \text{KW}$$

$$\text{KW} \times 410 \div \text{GPH} = \text{ } ^\circ\text{F } \Delta T$$

$$\text{KW} \times 410 \div \text{ } ^\circ\text{F } \Delta T = \text{GPH}$$

Note: 1 KW will heat 4.1 GPH at a 100°F ΔT

ELECTRICAL

$$\frac{\text{KW} \times 1000}{\text{Volts}} \div 1.73 = \text{Amps } 3 \Phi$$

$$\frac{\text{KW} \times 1000}{\text{Volts}} = \text{Amps } 1 \Phi$$

METRIC CONVERSION

$$\text{Liters} \times 0.2641 = \text{Gallons}$$

$$\text{Gallons} \times 3.79 = \text{Liters}$$

$$\text{Gallons} \times 0.003785 = \text{m}^3$$

$$\text{m}^3 \times 264.2 = \text{Gallons}$$

$$1^\circ\text{C } \Delta T = 1.8^\circ\text{F } \Delta T$$

$$^\circ\text{F} = (^\circ\text{C} \times 1.8) + 32$$

$$^\circ\text{C} = (^\circ\text{F} - 32) \times 0.556$$

$$\text{psi} \times 0.06896 = \text{Bar}$$

$$\text{Bar} \times 14.5 = \text{psi}$$

$$\text{psi} \times 6.86 = \text{kPa}$$

$$\text{kPa} \times 0.1456 = \text{psi}$$

$$\text{Lbs} \times 0.4536 = \text{Kg}$$

$$\text{Kg} \times 2.2 = \text{Lbs}$$

$$\text{Watts/Sq.Cm.} \times 6.4 = \text{Watts/Sq.In.}$$

$$\text{Watts/Sq.In.} \times 0.155 = \text{Watts/Sq.Cm.}$$

TORQUE VALUES

| Bolt Size | 18-8 S/S IN.-LBS. | BRASS IN.-LBS. | SILICON BRONZE IN.-LBS. | ALUMINUM 2024-T4 IN.-LBS. | 316 S/S IN.-LBS. | MONEL IN.-LBS. |
|-----------|-------------------|----------------|-------------------------|---------------------------|------------------|----------------|
| 4-40 | 5.2 | 4.3 | 4.8 | 2.9 | 5.5 | 5.3 |
| 4-48 | 6.6 | 5.4 | 6.1 | 3.6 | 6.9 | 6.7 |
| 5-40 | 7.7 | 6.3 | 7.1 | 4.2 | 8.1 | 7.8 |
| 5-44 | 9.4 | 7.7 | 8.7 | 5.1 | 9.8 | 9.6 |
| 6-32 | 9.6 | 7.9 | 8.9 | 5.3 | 10.1 | 9.8 |
| 6-40 | 12.1 | 9.9 | 11.2 | 6.6 | 12.7 | 12.3 |
| 8-32 | 19.8 | 16.2 | 18.4 | 10.8 | 20.7 | 20.2 |
| 8-36 | 22.0 | 18.0 | 20.4 | 12.0 | 23.0 | 22.4 |
| 10-24 | 22.8 | 18.6 | 21.2 | 13.8 | 23.8 | 25.9 |
| 10-32 | 31.7 | 25.9 | 29.3 | 19.2 | 33.1 | 34.9 |
| 1/4-20 | 75.2 | 61.5 | 68.8 | 45.6 | 78.8 | 85.3 |
| 1/4-28 | 94.0 | 77.0 | 87.0 | 57.0 | 99.0 | 106.0 |
| 5/16-18 | 132 | 107 | 123 | 80 | 138 | 149 |
| 5/16-24 | 142 | 116 | 131 | 86 | 147 | 160 |
| 3/8-16 | 236 | 192 | 219 | 143 | 247 | 266 |
| 3/8-24 | 259 | 212 | 240 | 157 | 271 | 294 |
| 7/16-14 | 376 | 317 | 349 | 228 | 393 | 427 |
| 7/16-20 | 400 | 327 | 371 | 242 | 418 | 451 |
| 1/2-13 | 517 | 422 | 480 | 313 | 542 | 584 |
| 1/2-20 | 541 | 443 | 502 | 328 | 565 | 613 |
| 9/16-12 | 682 | 558 | 632 | 413 | 713 | 774 |
| 9/16-18 | 752 | 615 | 697 | 456 | 787 | 855 |
| 5/8-11 | 1110 | 907 | 1030 | 715 | 1160 | 1330 |
| 5/8-18 | 1244 | 1016 | 1154 | 798 | 1301 | 1482 |
| 3/4-10 | 1530 | 1249 | 1416 | 980 | 1582 | 1832 |
| 3/4-16 | 1490 | 1220 | 1382 | 958 | 1558 | 1790 |
| 7/8-9 | 2328 | 1905 | 2140 | 1495 | 2430 | 2775 |
| 7/8-14 | 2318 | 1895 | 2130 | 1490 | 2420 | 2755 |
| 1-8 | 3440 | 2815 | 3185 | 2205 | 3595 | 4130 |
| 1-14 | 3110 | 2545 | 2885 | 1995 | 3250 | 3730 |