



ES 24A Electric Steam Generator

Installation, Operation and Maintenance Manual

Model No. _____ Power Circuit Voltage _____
Boiler Serial No. _____ Control Circuit Voltage _____
National Board No _____ Amps _____ Phase _____ Cy _____

IMPORTANT: This data file contains the National Board Registration Certificate approving your generator. It must be kept near the generator at all times.

Products Covered by this Manual

Model	KW Range	Steam Rate	BHP	Design Pressure	Max. Work Pressure*
24A	24	73 lbs./hr	2.44	100 PSIG	90 PSIG

*Line water pressure must be a minimum of 10 PSIG higher than generator operating pressure or you will require high pressure water feed w/motor and pump.

Installation

CAUTION Refer to National and all applicable Local Codes for specific installation requirements.

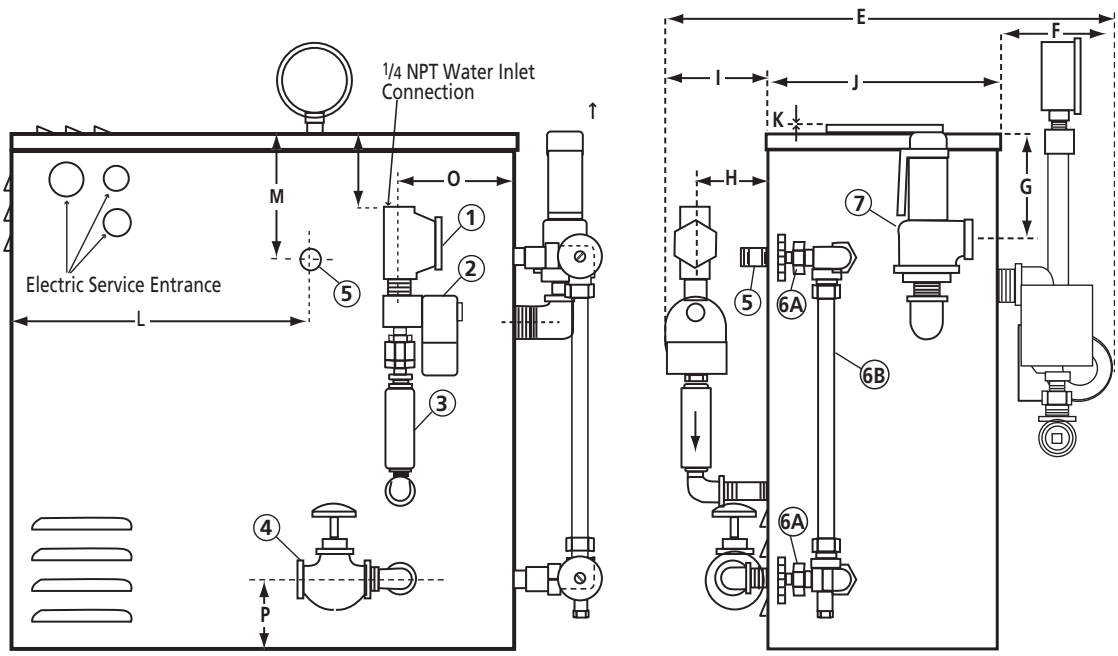
NOTE: Reference heating element clearance requirements for particular boiler to allow for removal of elements. Standard minimum suggested clearance is 21 inches.

1. The boiler should be mounted on a solid level foundation.
2. All piping should be installed by a licensed plumber.
3. When any type water feed other than a pump feed is used, the existing water supply pressure must be 10 PSIG greater than boiler operating pressure to assure water supply maintains proper water level in boiler. Lack of water can result in improper boiler operation. Keep feed water valves open at all times during normal operation.
4. Connect steam line with customer supplied outlet valve to boiler steam outlet.
5. During normal operation, keep drain valve closed.
6. If pump and boiler are plumbed within 30 ft (pipe length), a minimum of two check valves are required on boiler to avoid damage to pump.

NOTE:THE SAFETY VALVE SHALL NOT BE PLUMBED WITH A DRAIN LINE SIZED LESS THAN THE OUTLET SIZE OF THE SAFETY VALVE.



Component Identification Dimensional Information



Dimensional Table	
Item	Models 24A
A	25 ³ / ₁₆
B	22 ¹ / ₈ (REF)
C	17 ¹³ / ₁₆ (REF)
D	1 ³ / ₄
E	16 ¹¹ / ₁₆
F	4 ¹ / ₁₆
G	2 ¹⁵ / ₁₆
H	2 ¹ / ₂
I	3 ¹ / ₂
J	9 ¹ / ₈
K	2 ¹ / ₄
L	10 ⁵ / ₁₆
M	4 ⁵ / ₁₆
N	2 ⁵ / ₈
O	8 ³ / ₄
P	2 ¹ / ₂

Dimensional Table Model 24A		
Item	Description	
1	¼ NPT Strainer	93806
2	¼ NPT 120V 60HZ Solenoid, ¼ OBIF.	99042
3	¾ NPT Check Valve	99162
4	½ NPT Drain Valve	99178B
5	½ NPT Steam Outlet Nipple	100380
6A	Gauge Glass Valve Set	99173C
6B	Gauge Glass Tube	99074-1
7	½ NPT 100PSIG S.Valve	99136

Dimensional Table Model 24A		
Item	Description	
8	¼ NPT Pressure Gauge	99197
9	Hi-Limit Pressure Control	99066
10	operating Pressur Control	99966
11	Access Panel	-----
12	Main On-Off Switch	92830
13	Probe Isolator	100378
14	Probe Spark Plug	90229
15	Probe 5 inch	99807F

Wiring

CAUTION Ground boiler according to National Electric Code requirements to avoid shock. Use proper sized wire. Power wiring to boiler should be in accordance with Local and N.E.C. requirements following wiring diagram supplied. Wire size specified adjacent to field wiring terminal block(s). Use 90° C copper wire only.

Purchaser should use a disconnect switch employing circuit breakers or fuses between the main power source and the boiler.

CAUTION Boilers are susceptible to lightning damage because of plumbing water lines. Industrial type lightning/surge protectors should be installed according to the manufacturer's recommendation at your service entrance. Consult your contractor or electrical dealer.

1. The unit is pre-wired and tested. Connect control circuit voltage at the control circuit terminal block.
2. With the main power off, make sure that all wiring terminations are tight to avoid arcing, carbonizing and/or overheating of contacts.

WARNING Substitution of components or modification of wiring systems voids the warranty and may lead to dangerous operating conditions.

3. Instructions for water feed control system (i.e. motor and pump or solenoid feed).
 - a. Check the voltage of the motor or solenoid before making electrical connection.

WARNING b. The water feed circuit should be wired to the junction box provided.

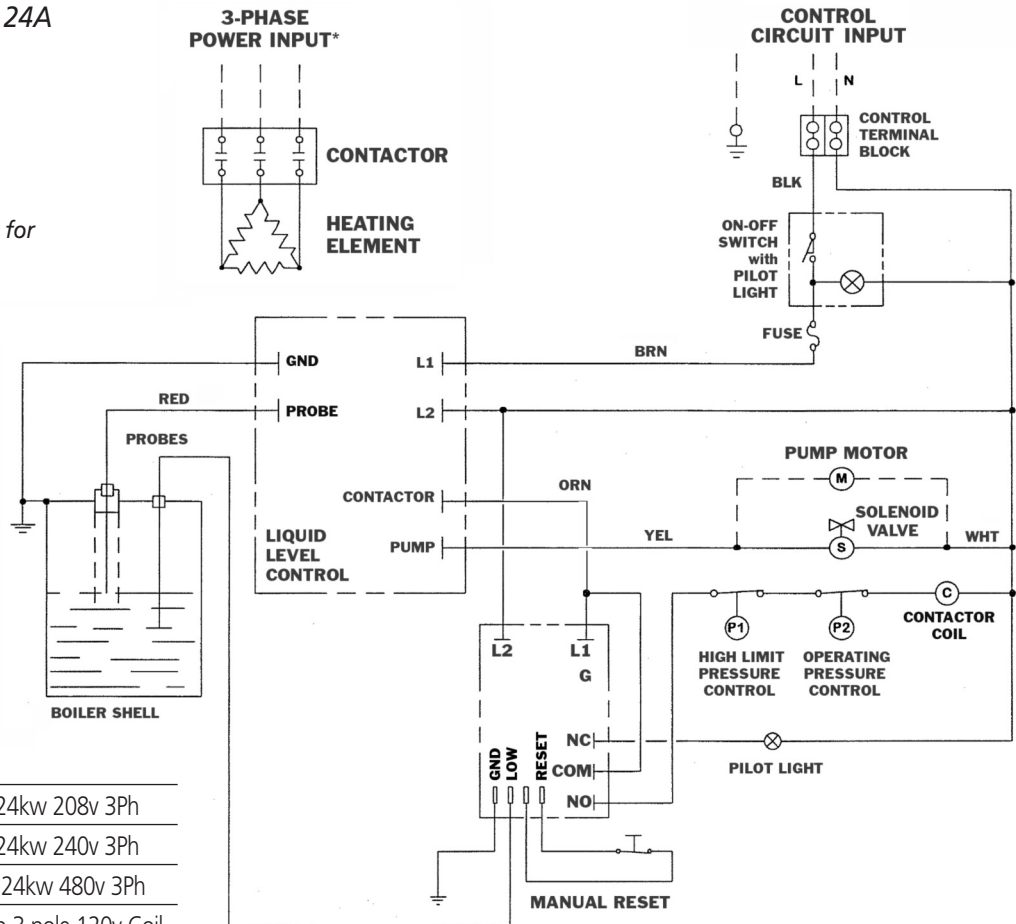
- c. Motors rated greater than 1/3HP or are not 120VAC single phase require the use of suitable motor starter.
- d. Amperage/Wire Size – For correct sizing refer to the label on the boiler located next to the field wiring terminals. This label states the wire size (AWG or MCM), minimum temperature rating (90°C) and conductor material (copper only). Deviation from this information may result in improper or unsafe boiler operation.

Wiring Diagram Control Circuit ES-24A–PRI Electric Boilers

Typical Wiring Diagram 24A

Factory Wiring _____
Field Wiring - - - - -

Note: *See Boiler Nameplate for Input requirements



Electrical Parts List

39243B	Heating Element 24kw 208v 3Ph
39243C	Heating Element 24kw 240v 3Ph
39243F	Heating Element 24kw 480v 3Ph
102206-1	Contactor 75 amp 3 pole 120v Coil
100412A	Liquid Level Control Board 120v
90241MRT	Auxiliary LWCO Board 120v

Pre-Operation Check - All Boilers

LWCO/PUMP CONTROL, OPERATION AND TESTING

1. All valves for incoming water supply are to be fully opened. Main disconnect switch to be in "ON" position. Boiler switch to be in "ON" position. Since boiler will be empty, pump (or solenoid) will be energized allowing boiler to fill with water. Control will allow for automatic reaching of proper water level. Contactors will be energized, applying voltage to heating elements.
2. Pump Switch Operation – At this point, water should be visible approximately halfway up sight glass. Slowly open drain valve located at bottom of boiler. Water level will fall, allowing low water cutoff/pump control to energize feed water system. Close drain valve for proper operation.
3. Low Water Cut-Out Switch Performance. Open drain valve completely. Maintain this condition until water level falls within gauge glass enough to cause low water cut-out switch to de-energize heating elements. Contactor will be in the de-energized state at this time. Close the drain valve. For automatic resetting type low water cut-out switches, feed system will return water level to normal. Boiler is now qualified for proper low water cut-out and normal liquid-level operating conditions.

PRESSURE CONTROLS OPERATION AND TESTING

NOTE: ALL ES STEAM BOILERS ARE PROVIDED WITH ONE HI-LIMIT PRESSURE CONTROL AND ONE OPERATING PRESSURE CONTROL.

1. All pressure controls are equipped with a screw allowing for setting of the desired operational and hi-limit pressures. To reduce pressure setting, rotate screw in direction which allows indicator to point to a lower pressure setting.

NOTE: IT IS RECOMMENDED THAT THE HI-LIMIT CONTROL BE SET 10 PSIG ABOVE DESIRED NORMAL OPERATION PRESSURE.

2. A differential pressure can be obtained on all automatic re-setting operating pressure controls in the same manner as operating pressure control is set. Differential indicated pressure below the main operating maximum pressure the pressure control will reset.
3. Pressure Control Operating Check – Close steam outlet valve (by customer) and adjust operating pressure control to a low pressure setting. Set hi-limit control at 10 PSIG above that setting. Switch boiler on to allow for steam pressure build-up. Pressure gauge reading will build and the operating pressure control will shut off boiler at its pressure setting. Re-setting of operating pressure control is accomplished by bleeding off pressure through steam outlet valve (by customer) and allowing pressure to drop below set point.
4. Hi-limit Pressure Control Check – See item 3 above but, in doing so, **assure for this test purpose only**, that the operating control is set above the pressure setting of the hi-limit control. The hi-limit trip will de-energize the contactors. Resetting of the hi-limit occurs after bleeding steam to reduce pressure inside the boiler.



CAUTION

TO AVOID IMPROPER OR UNSAFE CONDITIONS, INSURE OPERATING PRESSURE CONTROL IS RESET TO PROPER DESIRED BOILER OPERATING PRESSURE.

Operation



CAUTION

ONLY WITH MAIN DISCONNECT "OFF", TIGHTEN ALL ELECTRICAL CONNECTIONS BEFORE ENERGIZING BOILER TO PREVENT ARCING, CARBONIZING OF CONTACTS AND/OR OVERHEATING.

1. Turn on water supply. Turn main switch on. Turn boiler switch to ON position. When water appears approximately halfway up the gauge glass, the pump or solenoid feed will automatically shut off and the contactors will switch on.
2. Operation of Low Water Cut-Off – The boiler is equipped with a probe type liquid level control which is coupled to an electronic controller (pc board).
3. The automatic reset operating pressure control has a visual pressure adjustment. The top screw of the control adjusts the scale in the large indicator window. By turning the screw, the pressure setting can be adjusted. Selection of desirable pressure is very easily made. Some pressure controls have an additional screw for adjustment of pressure differential (OFF/ON pressure operating range) which is factory set at the maximum allowable rating.
4. Close steam outlet valve. Boiler will build up to desired pressure and shut off automatically.
5. High Pressure Control – This control will de-energize the boiler should pressure within the boiler exceed the set pressure.
6. Slowly open steam outlet valve and use steam as needed.
7. Boiler should be blowdown daily (see blowdown instructions on page 6).

Blowdown

Blowdown is an essential part of boiler operation. It is one of the best preventative maintenance steps you can take. Make sure a blowdown schedule is established and followed regularly.

In hard water areas, blowdown is necessary at least once a day. In soft water areas, once a week. If there is a particular problem which applies to your own local water condition other than mineral content, take this into consideration in determining which schedule is to be followed.

1. At the end of the working day, while boiler is still operating, turn switch to the OFF position and close water supply valve. De-energize wall mounted safety switch.
2. It is preferable to connect the blowdown valve directly into a drainage system when allowed by local codes. If this is done, the boiler can be discharged at operating pressure. Consult local plumbing codes before doing so.
3. If blowing-down into a receptacle, allow pressure to decrease to 15-20 PSIG before opening blow-down valve.
4. When discharge is complete and boiler is drained:
 1. Close the blowdown valve
 2. Open water supply valve;
 3. Put boiler switch in the ON position
 4. Close wall mounted safety switch.
5. When refilling is complete, turn off the boiler switch unless further operation is desirable.
6. If you have been supplied with a Manual Reset Low Water Control as required in some states, the reset button on the control must be pushed before boiler will begin developing pressure. (Do not push reset until boiler has filled with water.)

Maintenance



CAUTION

HAZARD OF ELECTRICAL SHOCK. DISCONNECT ALL POWER BEFORE WORKING ON BOILER.

Sussman Electric Steam boilers are designed for years of trouble-free performance. To establish a good preventative maintenance program, we suggest that the building maintenance person or engineer familiarize themselves with these simple rules.

1. The sight glass should be checked daily to ensure that boiler has adequate water.
2. A monthly inspection should be made of the internal wiring. All electrical connections should be checked for tightness. A check for water leaks should also be made and any loose fittings immediately tightened.
3. Every four months, the low water cut-off and pump control should be checked to insure that it is functioning properly.
4. Every four months, the probe and isolator should be checked for deposits and cleaned, if necessary. This is accomplished by removing the inspection plate, removing the probe (with a standard socket wrench) cleaning and replacing.
5. Every four months, the heating elements should be removed. If scale has begun to form, the element should be cleaned and the boiler should be drained and flushed.

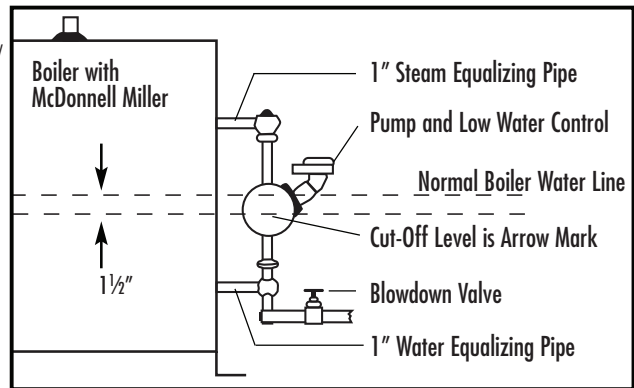
NOTE: NEW BOLTS AND GASKET SHOULD BE USED WHEN RE-INSTALLING THE ELEMENT TO ASSURE PROPER SEALING.

Element Replacement

READ INSTRUCTIONS COMPLETELY BEFORE STARTING WORK

CAUTION Before installing your new elements be sure the McDonnell Miller low water cut-off and aux. low water cutoff (if supplied) is operating properly. The float chamber and lower equalizer column of the MM control must be completely clear of sludge or other foreign matter. Failure to do this may cause the immediate burn-out of the new elements. If the unit is probe equipped, check condition of the probes and isolator. All elements are thoroughly checked before shipment. The manufacturer cannot be responsible for burn-outs caused by a faulty low water cut-off.

The lower equalizer column can best be examined by breaking the unions on either side and then visually and manually examining the piping with your finger or probes to see if it is clear and clean.



1. Disconnect boiler from electric power supply at main safety switch or fuse panel. Then turn boiler switch to "OFF" position.
2. Close water supply valve on incoming water supply line. Drain boiler completely of water.
3. Open boiler door to access heating element.
4. Disconnect wire (electric) leads connecting element to main power system of boiler. Again, note wire connections to facilitate re-assembly. Proceed to remove and discard (6) bolts from flange.

IMPORTANT: Note the wire connections to facilitate re-assembly (see wiring schematic). Remove and discard six (5/16" -18) bolts from flange. Do not reuse these bolts.

5. Thoroughly clean boiler flange of all foreign material. Be certain no part of old gasket remains on flange.
6. Apply "Slic-Tite" Gasket Compound (or equal) to both surfaces of new gasket supplied with replacement element. Proceed to install element flange assembly with gasket between boiler flange and element flange. In doing this, be careful to align flange holes so element wire connection terminals on element assembly are in line with previously disconnected wire leads to facilitate easy connections.

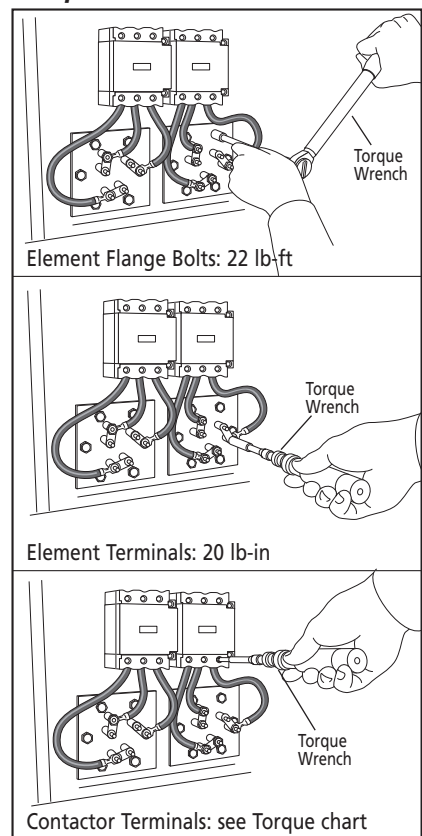
NOTE: Observe markings on element flange. Install element marking "TOP" on top.

7. Use only new element flange bolts. Tighten all (6) element flange bolts to a torque value of 22 lb-ft each (see illustration).

8. Connect all wires to the terminals. Tighten all element terminals to a torque value of 20 lb-in each (see illustration). Make sure all wires are clean and bright to assure good electrical contact.
9. Check that the wires are correctly connected to the contactor terminals and are tightened to a torque value of 45 lb-in. (see illustration). Make sure all wires are clean and bright to assure good electrical contact.
10. Open water valve to allow water supply to reach boiler feed mechanism.
11. As boiler automatically refills, observe the new flange assembly for possible leaks. If water is noticed, the bolts must be re-tightened. Before doing this, turn the boiler off at the main fuse safety switch.
12. When boiler reaches working pressure, check flange assembly again for leaks.

CAUTION Follow maintenance instructions provided with the boiler.

Torque Values:



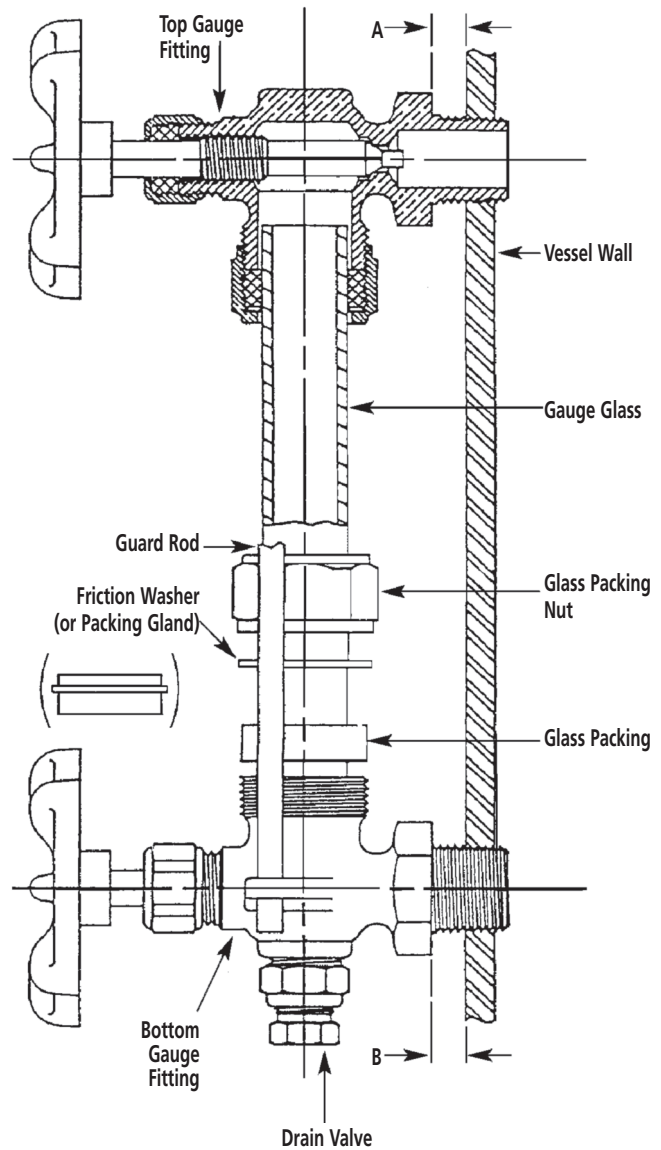
*For Illustrative Purposes Only.
Power wiring shown in approximate factory-installed location*

TORQUE VALUES	
Element Flange Bolts	22 lb-ft
Element Terminals	20 lb-in
Contactor Terminals	45 lb-in

Gauge Glass Installation

IMPORTANT NOTE: Read all warnings and instructions before performing installation or maintenance. Safety glasses and gloves should be worn at all times when working with or examining water gauge glass and connections. Pressure in generator to be at zero before proceeding. Improper installation or maintenance of gauge glass and connections can cause immediate or delayed breakage resulting in bodily injury and/or property damage.

1. Apply Teflon tape or pipe dope to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).
2. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward. Verify top and bottom fittings are threaded into the tappings the same number of turns (distance A= distance B).
3. Remove glass packing nut, friction washer (or packing gland, depending upon the model), and glass packing from the fittings, and place them, in the same order, on to both ends of the gauge glass. Push both packings about an inch up the gauge glass.
4. Gently insert one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge, then insert glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.
5. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. DO NOT allow the glass to remain in contact with any metal!
6. Carefully slide upper glass packing up as far as possible.
7. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. **DO NOT OVER TIGHTEN!** If any leakage should occur, tighten lightly, a quarter turn at a time, checking for leakage after each turn.



IMPORTANT NOTE: Read all warnings and instructions before performing installation or maintenance.

WARNING Safety glasses and gloves should be worn at all times when working with or examining water gauge glass and connections.

Pressure in generator to be at zero before proceeding.

Improper installation or maintenance of gauge glass and connections can cause immediate or delayed breakage resulting in bodily injury and/or property damage.

Water Quality Information for Carbon Steel Boilers

For optimum results, the feedwater supply should be tested prior to initial start-up. If the mineral content exceeds the following recommended limits, various external treatment processes (water softener, reverse osmosis, etc.) may be used to correct the problem.

NOTE: An analysis of the on-site boiler feedwater must be made by a recognized and reliable water treatment company to ascertain the existing condition and treatment required.

RECOMMENDED FEEDWATER QUALITY

HARDNESS, ppm	8 – 85 (~0.5–5 gpg)
P-ALKALINITY, ppm	85 – 410 (~5–24 gpg)
T-ALKALINITY, ppm	200 – 500 (~7–0 gpg)
pH (strength of alkalinity)	8.0 – 11.4
SPECIFIC RESISTIVITY	~50k Ω cm (50,000 ohm-centimeter)

Blow down the boiler on at least a once-a-day basis. If boiler water or feed-water are outside the above limits, a more frequent blowdown is required.

RECOMMENDED LIMITS WITHIN A BOILER

TOTAL DISSOLVED SOLIDS, ppm	3500
TOTAL ALKALINITY, ppm	850
SUSPENDED SOLIDS, ppm	300
SILICA (SiO ₂), ppm	125
SULFITE (SO ₃), ppm	25–50
PHOSPHATE, ppm	30–60
P-ALKALINITY AS CaCO ₃ , ppm	900
IRON, ppm	2

Water quality can affect efficiency or result in boiler damage if neglected. Boiler feedwater contains impurities in solution and suspension. These impurities concentrate in the boiler since the steam generated is essentially pure. The concentration of these impurities increases as more feedwater is introduced into the boiler and steam is produced. If the suspended solids are allowed to concentrate beyond certain limits, a deposit or "scale" will form on the boiler's internal surfaces. This deposit can interfere with proper boiler operation and cause boiler failure.

The concentration of these impurities is generally controlled by the feedwater quality and by blowdown. Blowdown refers to removing a portion of the boiler water with high solids concentration and replacing it with make-up water of a lower concentration.