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# Installation, Operating and Maintenance Instructions

## For Jerguson 1600# B Boiler Water Gage

Section: J500  
Bulletin: J500.1600B  
Date: 09/10/03  
Approved By: JSC

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## I DESCRIPTION OF GAGE ASSEMBLY

The gage assembly consists of a chamber and glass assembly, shut-off valves (with expansion loop), flange connected to the gage on top and bottom, and a drain valve connected to the bottom shut-off valve.

### A. CHAMBER ASSEMBLY

The chamber is machined from bar stock material. Cover sections are tightly locked over the liquid chamber by heat-treated alloy steel studs and bolts. A specially processed tempered borosilicate glass is used for the glass inserts. To protect the glass inserts from corrosion by the alkaline boiler water, mica shields are provided between the glass inserts and the gaskets.

### B. VALVES

The shut-off drain and vent valve bodies are machined from forgings and are fitted with either flange or welding connections. Expansion loops are provided as necessary to allow free thermal expansion of the gage assembly. The bottom shut-off valve has a vertical rising ball check located in bottom gage connection between the shut-off valve seat and the gage.

Where specifications and codes permit, the top shut-off valve may be furnished with a horizontal ball check located in a fitting body between the shut-off valve seat and the gage. The ball check seat is notched to allow sufficient steam flow, when the ball check is seated, to facilitate blow down of the gage and also prevent a false level from being locked in the gage. For operating pressures up to 900 PSIG, the shut-off valve may be fitted with handwheels or chain wheels and plain-closing stems or with levers and quick-closing stems. All valves for operating pressure above 900 PSIG are fitted with handwheels or chain wheels and plain-closing stems.

## II INSTALLATION INSTRUCTIONS

Installation consists of mounting the unit, making the piping connections, adjusting and testing the assembly.

### A. MOUNTING

The gage assembly should be mounted to the boiler or water column with careful attention given to proper fitting and alignment of parts to prevent un-necessary strains from being applied to the valves and gage.

Where severe shock and vibration conditions are involved, the gage assembly should be mounted by means of support brackets which meet the requirements of MIL-S-901 (NAVY) and MIL-STD-167. The support brackets should in no way restrict the free thermal expansion of the gage assembly.

## B. PIPING CONNECTIONS

Install the gage as close to the boiler as possible, preferably on the boiler nozzles. The connection piping and boiler nozzles should have an inside diameter of not less than one inch. Do not make any connections to the gage piping for any other equipment.

Whenever the gage cannot be connected directly to the boiler nozzle, both the top and bottom connections should be insulated. The top connection should be pitched down from the boiler toward the shut-off valve; be careful not to form any pockets where condensate can collect and block the steam passage. When the top shut-off valve is fitted with a horizontal ball check, the connection should be pitched down from the shut-off valve toward the boiler. The bottom connection should be pitched down from the shut-off valve toward the boiler to prevent formation of a cold-water pocket. Strict compliance with the proceeding requirements will eliminate gage errors due to excessive pressure drop from the boiler to the gage, and excessive water temperature drop at the gage glass. The highest point of the visible portion of the glass insert must be lower than the steam connection of the drum. The lowest point of the visible portion of the glass insert must be higher than the water connection on the drum. When welding of the gage connections to the boiler is required, steps must be taken to prevent excessive heat from reaching the valve seat and packing. The valve stem should be lifted from the seat to prevent damage to the seating surfaces during welding.

## C. ADJUSTMENTS

After installation, and prior to testing, check all flange connections to insure that all have been properly tightened.

## D. TESTS

The gage assembly has undergone hydrostatic tests at the factory, but due to handling and the lapse of time between manufacture and installation, it is recommended for best operation that these tests be repeated after installation and in conjunction with the boiler hydrostatic test. Complete hydrostatic testing of the gage assembly requires three (3) steps, which are as follows:

1. Test the valve seat and valve seat threads by applying the hydrostatic pressure with the shut-off valves tightly closed. If leakage is detected, check that the valves seat is tightly seated in the valve body; check the seat and valve stem faces for damage.

Test the gage, gage connections and valve stem packing by opening the shutoff valves slowly to prevent seating of the ball checks. Check for leakage around the gage connections, the valve stem and the glass inserts. No leakage can be tolerated around the glasses. (See Paragraph B – CORRECTIVE MAINTENANCE-GAGE – under IV – MAINTENANCE). Tightening down on the packing gland will usually remedy any leakage at the valve stem. (See Paragraph C – CORRECTIVE MAINTENANCE-VAVES – under IV – MAINTENANCE).

2. Test the bottom ball check by bringing the pressure suddenly onto the gage. The top ball check, when furnished, is provided with a notched seat and therefore need not be tested. With both shut-off valves closed and the drain valve open, close the drain valve and open the bottom shut-off valve rapidly and fully. The design leakage for the ball check is 100 cc per minute. Excessive leakage may be overcome by lapping the ball in its seat until a tight seal is obtained. If this fails to remedy the leakage, replacement of the ball and/or seat may be required.

### III OPERATION INSTRUCTIONS

The water level gage is ruggedly constructed to a well proven design and is equipped with the necessary safety devices to protect the operator. However, as with any pressure containing vessel, it should be treated with care and respect.

#### A. SETTING GAGE IN OPERATION

(Bringing boiler and gage to pressure and temperature simultaneously)

A gage must increase uniformly in temperature as the pressure increases, but when left to itself, it will not do this. The gage is a bypass circuit and is heated only by steam in a very small channel. The water level is frequently high during the starting-up period so the steam space in the gage is correspondingly small; the result is that the gage temperature lags considerably behind the drum steam pressure. To avoid this temperature lag; keep the bottom shut-off valve open slightly and the top shut-off valve wide open. Then slowly open the drain valve to lower the water level until just visible. The drain valve should be shut occasionally to allow the water level to rise for examination. The object is to keep the gage full of steam so that its temperature will stay close to the drum temperature.

#### B. SETTING GAGE IN OPERATION

(Boiler under operating conditions with gage cold)

With all valves closed, crack open the bottom shut-off valve and let water rise slowly in the gage (approximately six inches per minute). When the gage is completely full, close the bottom shut-off valve. After two or three minutes, open the drain valve and drain the gage slowly (at same rate as filled). When the gage is empty, close the drain valve and repeat this procedure at least five times. (The time element will vary from thirty minutes for an 18-INCH gage to an hour and forty minutes for a 60-INCH gage.) When the glass has been filled for the last time, open the bottom shut-off valve wide and crack open the top shut-off valve, letting the water level drop slowly until the level in the gage stabilizes. Open the top shut-off valve fully.

#### C. SETTING GAGE IN OPERATION

(Boiler under operating conditions with gage hot)

The following procedure is to be used only when the gage has been removed from service for repairs of short duration. With all the valves closed, crack open the bottom shut-off valve and let the water rise slowly in the gage (approximately six inches per minute). When the gage is completely full, close the bottom shut-off valve. After two or three minutes, open the drain valve and drain the gage slowly (at same rate as filled). When the gage is empty, close the drain valve and crack open the bottom shut-off valve, letting the water level rise slowly as described above. When the gage is completely full, open the bottom shut-off valve wide and crack open the top shut-off valve, letting the water level drop slowly until the level in the gage stabilizes. Open the top shut-off valve slowly until the full open position is reached.

#### D. BLOWING DOWN GAGE GLASS

Modern water condition practice makes it unnecessary to blow-down gages with a wide open valve. An orifice of 3/32 INCH diameter is ample blow-down area for gages above 900 PSIG. When blow-down of the gage appreciably lowers the gage glass pressure, it is likely to cause rapid deterioration of the mica. If small holes or cracks in the mica pack have permitted water to penetrate, suddenly lowered pressure permits this water to expand into steam and burst the mica, causing poor visibility. The rush of steam which occurs when blowing down through full drain areas may tear the mica. Even with an orifice in the drain line, it is not advisable to blow the gage frequently. It should be blown down when necessary to clear out dirty water. During blow-down, the gage should be watched to see if the water level is lively as the blow starts and stops. This indicates that the gage passages are clear. A gage blow-down procedure insuring maintenance of clear gage connections is as follows:

##### 1. BLOW-DOWN THROUGH THE TOP CONNECTION

With the top and bottom shut-off valves open and the drain valve closed, close the bottom shut-off valve and open the drain valve. This will confine all flow to the top connection and insure a clear passage. Close the drain valve and open the bottom shut-off valve.

##### 2. BLOW-DOWN THROUGH THE BOTTOM CONNECTION

With the top and bottom shut-off valves open and the drain valve closed, close the top shut-off valve and open the drain valve. This will confine all flow to the bottom connection and insure a clear passage. Close the drain valve and open the top shut-off valve.

NOTE: The shut-off valves should always be opened slowly and carefully whenever the gage assembly is under pressure.

It should be noted that the required frequency and duration of blow-down is dependent upon cleanliness of the boiler water, therefore the blow-down schedule and duration of the blow-down should be established by operating personnel through experience on the particular installation.

#### IV MAINTENANCE

##### A. PREVENTIVE MAINTENANCE – GAGE

Check the gage assembly for signs of leakage. Even minor seepage, if allowed to continue, may result in cutting of seating surfaces necessitating remachining of the piece. If leakage is detected, the gasket loading should be checked as follows:

With torque wrench set at 80 FT-LB, go over nuts following sequence shown in Figure 2. ***The pressure in the gage should be relieved before any retightening is attempted.*** If leakage continues after retightening, the section should be disassembled and the parts examined to determine a reason other than washer loading for the continued leakage. Carefully examine the seating surface for steam cuts. Examine the impression in the gasket to determine that the glass was properly centered and evenly loaded. After correcting the difficulty reassemble the section using new gasket, new cushion, new mica, and new glass.

The water level gage should be isolated from the vessel and repaired whenever:

- 1) The mica becomes too fouled for observing level,
- 2) The glass becomes cloudy indicating mica failure and glass deterioration  
Or
- 3) Leakage around the glass inserts is observed which cannot be corrected by checking gasket loading as described above.

#### B. CORRECTIVE MAINTENANCE – GAGE

It is best to dismantle the gage while hot as gasket sticking is reduced to a minimum. To dismantle the gage, the nuts and spring washers at the ends of the cover should be removed first. The remaining nuts and washers are then removed following the sequence shown in Figure 1. Before removing the cover plate, carefully mark its position on the chamber so that it can be replaced in its original position at reassembly. Remove the cover plate, glass and mica. Remove the gasket being careful not to damage the chamber-seating surface. If tools must be used to overcome sticking, a broad, flat brass scraper should be used. Carefully clean all gasket material from the gasket seat. Remove the cushion from the cover plate, taking the same precautions as observed in removing the gasket. New gaskets and cushions should always be used in reassembly of the gage since a glass not seated in the identical depressions left previously would create a condition of point loading under which the glass would readily fail. New mica should always be used. Even if the old mica can be thoroughly cleaned and looks satisfactory, cracks may develop during cleaning, which will allow water to penetrate to the glass. Although a used glass may look perfect, it may have lost some of its original temper. Therefore, the glass must also be replaced when dismantling and reassembling a gage.

Assemble the gage as follows:

Centralize the glass insert so that it uniformly clears the sides of the recess (See Figure 3). A piece of 1/64 INCH gasket material, 1-1/2 INCH long by 3/8 INCH wide should be placed as a spacer at each end of the glass to prevent contact with the chamber and to assist in centralizing the glass in its seat. Use new parts for glass insert, mica protector, gasket (1/32 INCH thick), cushion for cover plate (1/32 INCH thick), washer set and old cover plate and nuts. Four (4) spring washers (P/N: V-15697-J1) are to be stacked under each nut on the bolts as shown in Figure 2B and two (2) spring washers are to be stacked under each nut on the studs as shown in Figure 2A.

NOTE:

In order to obtain the correct results, the washer orientation must be exactly as shown in Figures 2A and 2B.

Be sure the cover is firmly seated. Turn all nuts finger tight, following the sequence shown on Figure 2, repeating this procedure twice. Do not go over the nuts more than twice. **NOTE: IT IS IMPORTANT THAT THE COVER BE DRAWN DOWN EVENLY.** Using a torque wrench set for 20 FT-LB, tighten nut No. 1, then work outward following the sequence shown in Figure 2 until all bolt nuts are tightened. Repeat this procedure, increasing torque by 10 FT-LB increments until a uniform torque of 80 FT-LB is reached.

Reset torque wrench to 20 FT-LB and repeat the above procedure on the stud nuts – first, tighten stud nuts on one end and then the other; both front and rear of gage to 20 FT-LB. Proceed as with the bolts, tightening the stud nuts in 10 FT-LB increments until all nuts are torque to 80 FT-LB.

**NOTE: ALL THREADED SURFACES SHOULD BE PROPERLY LUBRICATED TO ENSURE PROPER GASKET LOADING.**

**WARNING:**

The foregoing instructions are based on the use of grafoil gaskets, (P/N: V-13488-7) and Garlock IFG5500 cushions (inorganic fiber gasket), (P/N: V-19087-7). The washers are springs and will compensate for bolt elongation, due to thermal expansion and for gasket set, so that further tightening should not be necessary. If these instructions are carefully followed, all nuts should draw up evenly on the last adjustment because of uniform loading. Gross differences should be investigated.

**C. PREVENTATIVE MAINTENANCE – VALVES**

A periodic check of all valve joints should be made and all leakage corrected immediately. Discovery of leaks at an early stage will considerably prolong valve life. Proper maintenance of packing and corrected adjustment of packing glands are essential to satisfactory valve stem life and good valve performance. New packing lubricates the stem; after this lubricant disappears, friction between stem and packing increases. If the packing cap screws must be tightened to a point where it is difficult to turn the stem, the packing has become dry and hard or it is unsuitable for service. In either case it should be discarded as it imposes an additional burden that will rapidly shorten stem thread life. If a packing joint leaks too much, tighten each cap screw only one turn and then wait for about ten minutes to allow packing to adjust itself and reduce excessive leakage. Repeat this procedure until leakage is eliminated. Stem packing that has been subjected to high temperature steam and then allowed to cool often leaks a small amount when the valve goes back into operation. It does not necessarily call for adjustment of packing gland; as soon as the valve becomes hot it will in most cases stop leaking.

**D. CORRECTIVE MAINTENANCE – VALVES**

Be sure to relieve internal valve pressure before performing maintenance on valves (See Figure 4).

**E. REPACKING THE VALVES**

Remove packing gland cap screws and slide packing gland back on the stem. Remove old packing, being careful not to damage stuffing box or stem with the packing tool. Be sure all old packing has been removed and that the stuffing box is clean. New packing should be installed by seating each ring individually. If seating of the complete pack of rings is done simultaneously by the gland, the rings nearest the gland will be overloaded and the bottom rings may do no sealing whatsoever. Packing ring joints should be staggered 90 degrees apart. Replace the packing gland and cap screws in position, tighten firmly and evenly with a wrench and then back off and adjust to finger tight.

#### F. REGRINDING THE SEAT

Backseat stem by fully opening valve. Disengage bushing nut. Remove packing gland cap screws and slide packing gland back on the stem. Remove packing, position stem in yoke to permit rotating of the bushing. Rotate bushing until it rests against the unrelieved portion of the stem. Mark position of yoke on valve body. Remove the yoke holding cap screws, remove yoke assembly from the valve, remove and discard spiroallic gasket.

Apply grinding compound to the back seating surface of the stem. Pull stem back against the yoke and grind back seat by rotating the handwheel. Apply additional grinding compound as required to complete the regrinding. Apply grinding compound to the seating surface of the stem and assemble yoke to valve body being careful to replace yoke in its original position as marked. Only two (2) cap screws need to be used to tighten yoke in position for grinding. Push stem down on valve seat and regrind by rotating the handwheel.

When grinding has been completed, remove the yoke assembly from the valve and clean all compound from the stem and seat. Swab the area with a clean, lintless cloth, saturated with a volatile solvent (acetone) and clean with demineralized or distilled water before the solvent dries. As an aid to assembly, and to future disassembly, Neolube or an equivalent lubricant may be applied to the threaded parts. (Neolube is a suspension of colloidal electric furnace graphite in isobutyl alcohol.) One coat of Neolube should be applied with a soft brush and allowed to dry for five minutes before assembly. It should be used only where deemed necessary and then only on surface which make actual metal-to-metal contact.

Reassemble the valve using a new spiroallic gasket and repack following the instructions under Paragraph E (REPACKING THE VALVE). Perform a hydrostatic test if possible to check the seating surfaces for leakage (See Paragraph D – TESTS – under II – INSTALLATION INSTRUCTIONS).

#### G. RENEWING THE SEAT

Remove the yoke assembly and spiroallic gasket from the valve. Discard the spiroallic gasket. Using a standard 3/8" allen wrench, remove the seat and remove the seat gasket. Apply Neolube to the new seat threads following the instructions in Paragraph F (REGRINDING THE SEAT), and replace the seat and new gasket in the valve body. Tighten well to prevent leakage around the seat threads. Reassemble the valve as instructed in Paragraph F (REGRINDING THE SEAT).

### V REMACHINING PROCEDURE FOR REPAIR OF GASKET SEATS

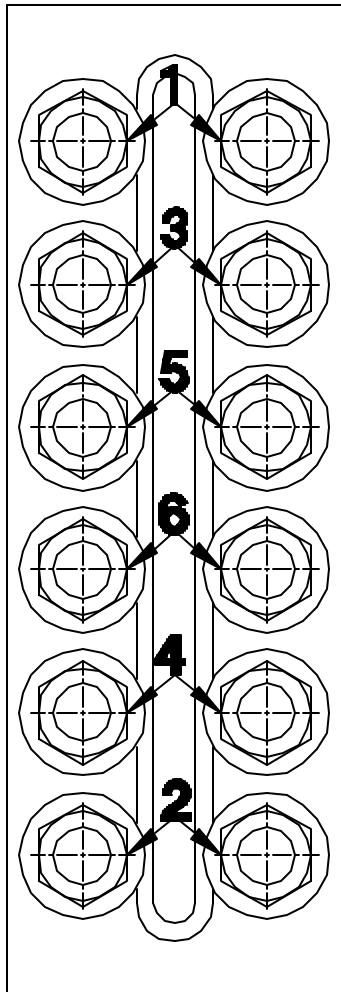
#### A. GENERAL

Remachining of defects in the gasket seats of gage chamber should be performed only if emergency conditions necessitate that it be done to keep the gage serviceable. Gasket seat defects are caused by steam cuts due to steam leaks not detected during routine preventative maintenance checks or gouges caused by careless removal of gaskets or subsequent handling of gasket seats during the maintenance of gage chamber.



## B. PROCEDURE

1. Disassemble and remove old gaskets following the instructions under (See Paragraph B – CORRECTIVE MAINTENANCE-GAGE under IV – MAINTENANCE.
2. Remove stud tack weld by grinding or machining as required taking care not to damage chamber threads and seating surfaces. Remove all studs from chamber.
3. A milling machine using a 1-3/8 INCH diameter cutter as shown in Figure 5, is required to remachine the gasket seating surfaces.
4. The maximum allowable depth for remachining the gasket seat in chamber is as shown in Figure 6. Do not remove any more material than necessary to eliminate defect.
5. After remachining gasket seat, clean and deburr chamber.
6. Install and tack weld new studs in chamber as shown in Figure 7.
7. Reassemble gage following the instructions under (See Paragraph B – CORRECTIVE MAINTENANCE-GAGE under IV – MAINTENANCE.



TO DISASSEMBLE  
FIGURE 1

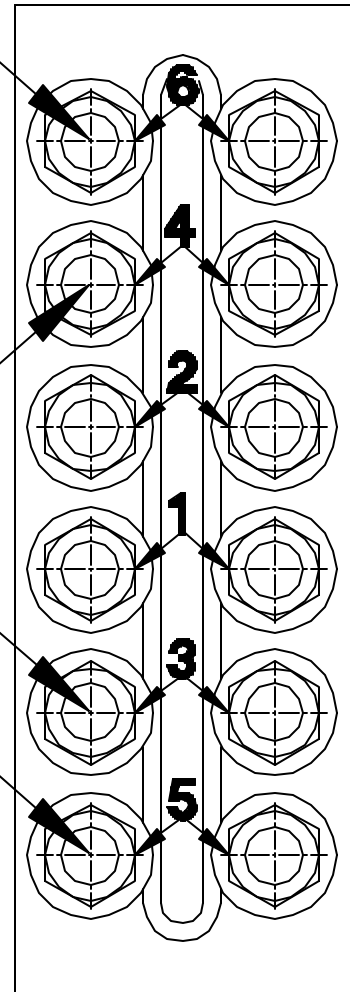
END STUDS (SEE FIG. 2A)

TIGHTEN THESE NUTS  
 FRONT AND BACK ON  
 BOTH ENDS, 80 FT-LBS  
 IN SEVEN STEPS, AFTER  
 TIGHTENING BOLT NUTS.  
 (SEE TEXT)

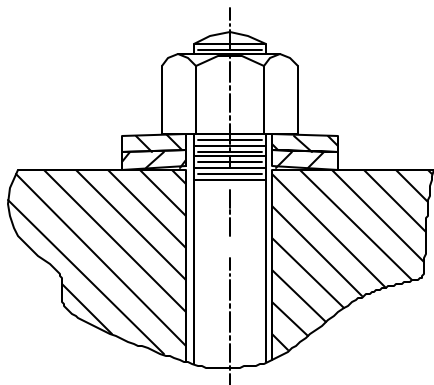
BOLTS (SEE FIG. 2B)

TIGHTEN NUTS TO  
 80 FT-LBS IN SEVEN  
 STEPS.  
 (SEE TEXT)

END STUDS (SEE FIG. 2A)

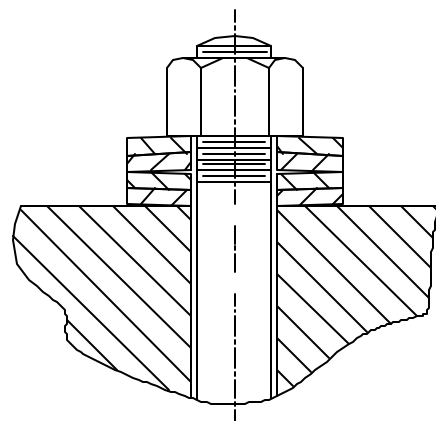


TO ASSEMBLE  
FIGURE 2



SPRING WASHER STACK  
 UNDER EACH STUD NUT

FIGURE 2A



SPRING WASHER STACK  
 UNDER EACH BOLT NUT

FIGURE 2B

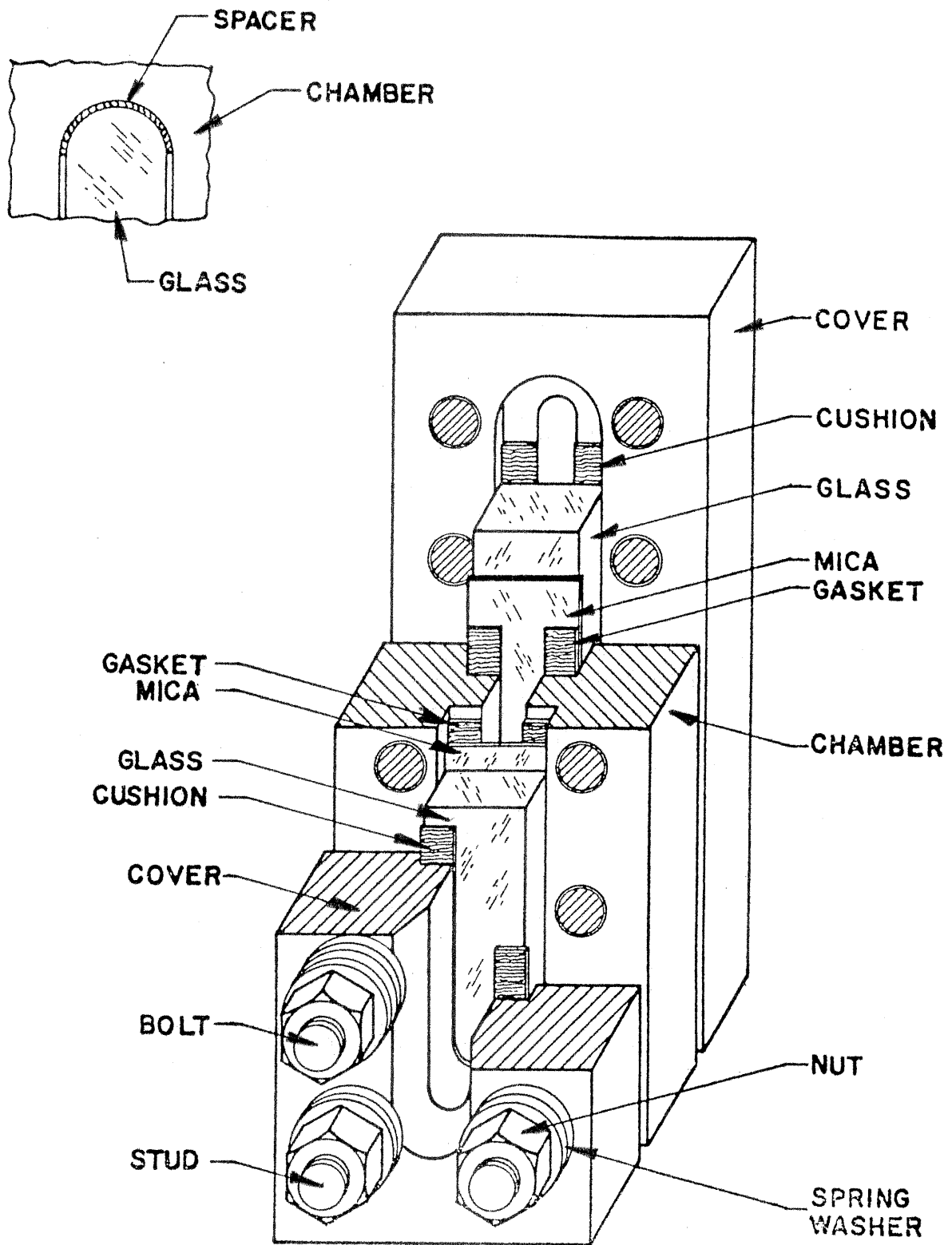


FIGURE 3

**AN OBLIQUE SECTIONAL  
VIEW OF A TYPICAL BOILER  
WATER GAGE SECTION**

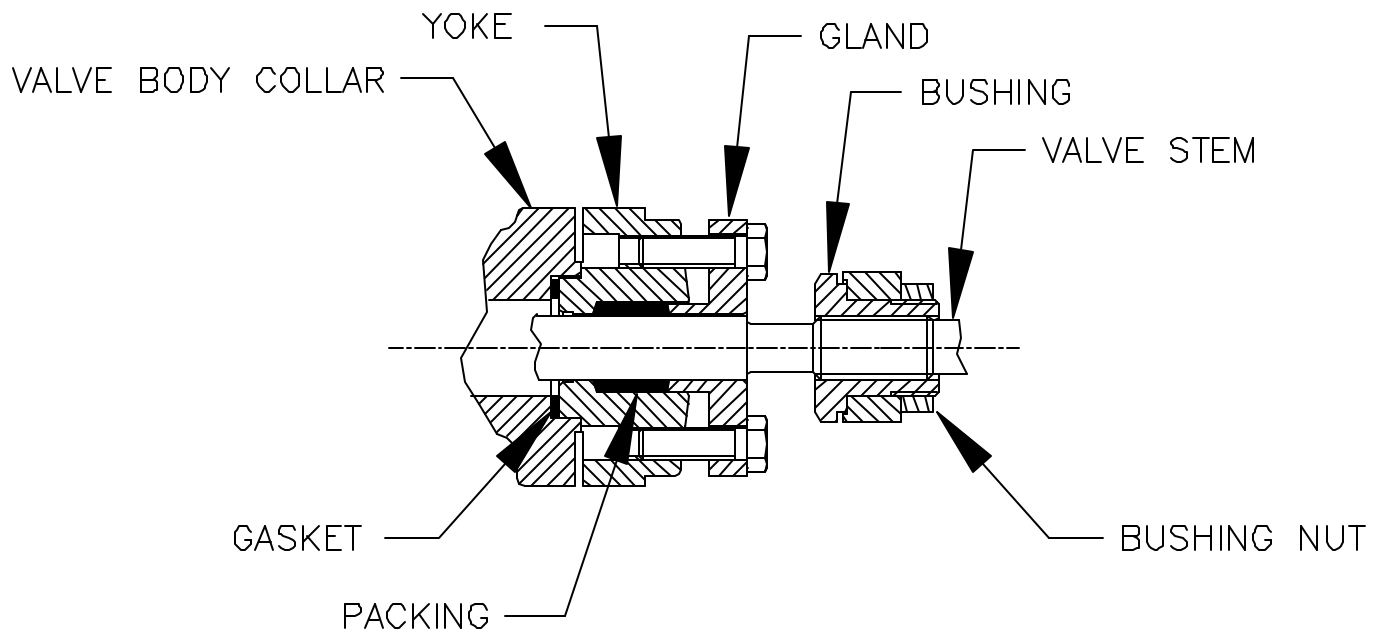
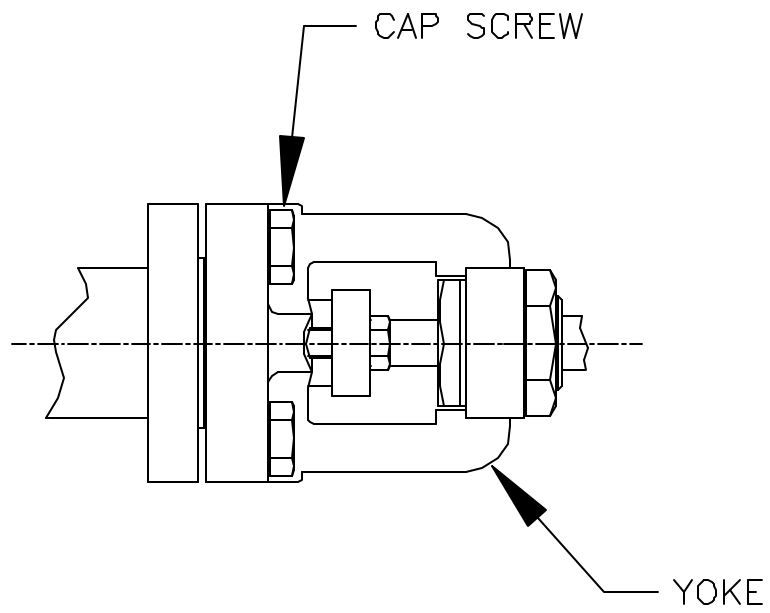


FIGURE 4

NOTE:  
1-3/8 INCH O.D. END MILL MUST  
BE PERPENDICULAR TO GASKET  
SEATING SURFACE TO BE MACHINED.

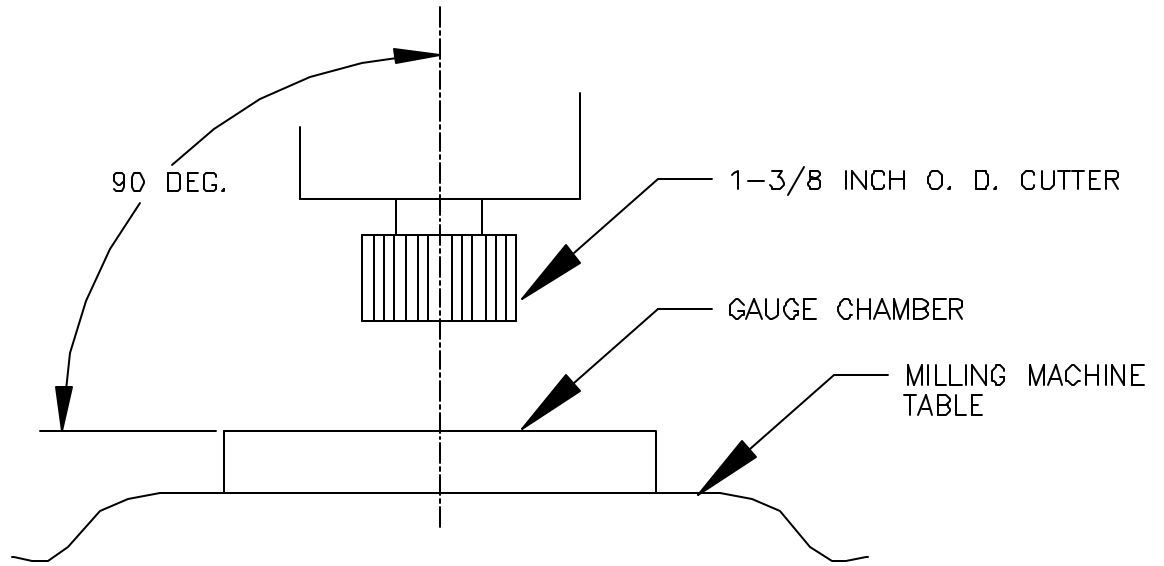


FIGURE 5

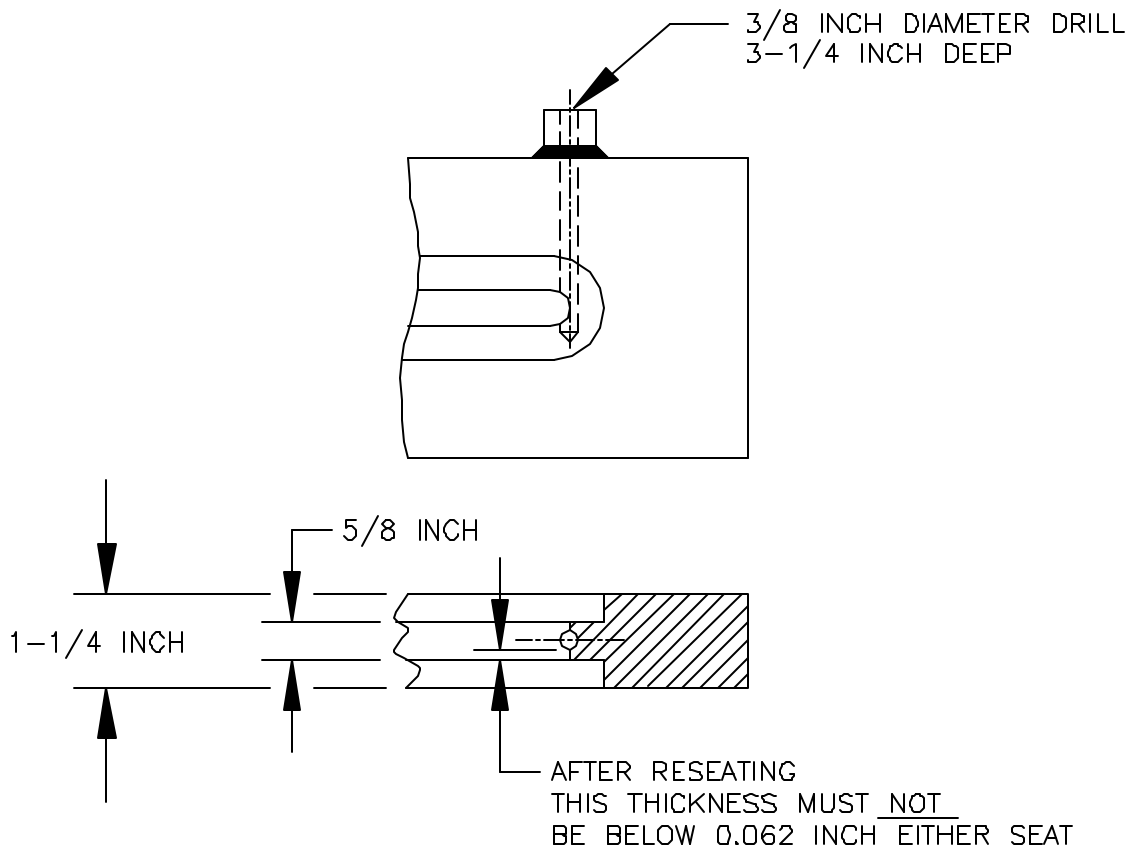


FIGURE 6

NOTE:  
STUD MATERIAL IS 4140 STEEL.  
CHAMBER MATERIAL IS CARBON STEEL.  
A WELD ROD COMPATABLE WITH  
ABOVE MATERIALS SHOULD BE  
SELECTED FOR TACK WELDING OPERATION.

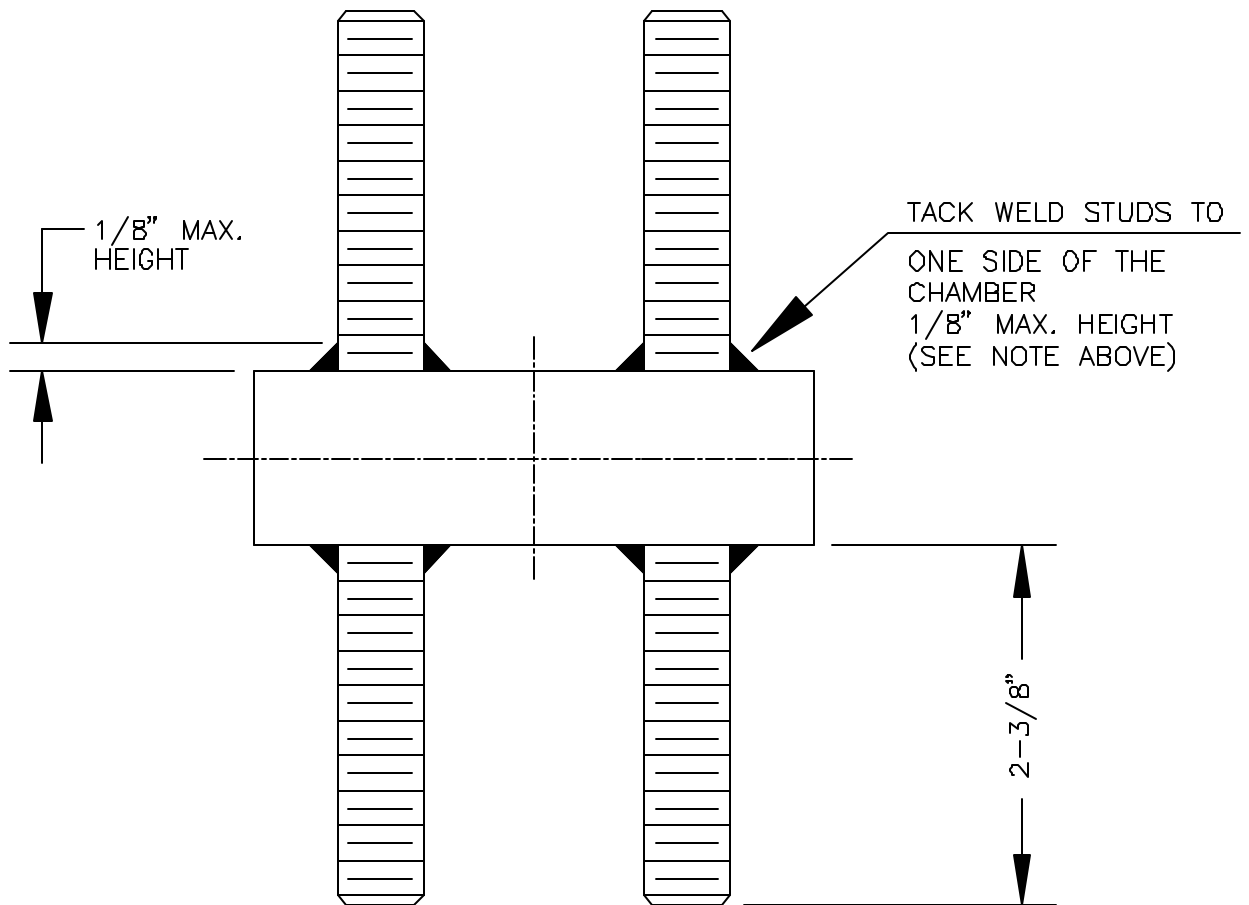


FIGURE 7