



## Basic Models 200B and 300B Barstock Design

Powreactor Dome Regulator

### OPERATION AND MAINTENANCE

#### Contents

Scope .....	1	Adjustment .....	2
General Description .....	1	Maintenance .....	3
Installation .....	1	Appendix .....	6

<b>NOTE:</b> The following drawings form a part of this Instruction:		
<b>Assembly Drawing:</b>	W-201B-A01,	or as applicable
<b>Parts List:</b>	W-201B-A01-1,	or as applicable
<b>Mounting Dimension Drawing:</b>	W-202B-B03,	or as applicable
<b>Special Tools:</b>	As shown in Table 1	
<b>Accessories for external dome loading:</b>	As applicable	

#### Scope

These instructions give procedures for installing, adjusting, and servicing the following basic models of RedQ Powreactor Air Dome Regulator, barstock design:

BASIC MODEL / SIZE		DOME LOADING		VALVE TYPE	
200	300	External	Internal	Standard	Balanced
201B	301B	*		*	
211B	311B	*			*
202B	302B	*	*	*	
212B	312B	*	*		*

Each basic model is available with various end connection types and sizes, valve orifice sizes, and materials, to suit service requirements. ASA flanged end connections are integral with body; other types of end connections may also be integral, or they may be removable bushing-type port fittings with o-ring seals. Standard design variations are identified by a basic figure number followed by code letters.

#### General Description

(Refer to Assembly Drawing)

The RedQ Powreactor Pressure Reducing Regulator is designed to maintain a constant reduced or delivered

fluid pressure in a line or closed vessel where inlet pressure or flow volume may vary.

It is a balanced pressure type of regulator which is actuated by static gas pressure in a sealed dome. There is a flexible diaphragm between the sealed dome and the outlet line fluid. When outlet line pressure drops below dome pressure, the diaphragm moves out slightly, and pushes the main valve open. This allows inlet line fluid to flow through the valve until outlet line pressure builds up enough to balance the dome pressure. Then the diaphragm moves back to throttle or close the main valve so that dome and outlet pressures always remain in balance.

Any change in dome pressure causes a corresponding change in outlet line pressure. When the dome is completely vented, the main valve shuts off bubble tight.

RedQ Powreactors may be used in either gas or liquid systems, but the dome must be loaded with air or other gas.

Powreactors with standard valves will show a slight variation in delivered fluid pressure if the inlet pressure varies over a wide range after the dome is set. Small changes of inlet pressure have no appreciable effect. Balanced valves are optional, to minimize this variation.

#### Installation

(Refer to installation diagrams, figures 1. and 2.)

##### A. SENSING CONNECTION

Regulator is normally shipped with plugs or probes arranged for internal sensing of downstream pressure. If external sensing is desired, prepare regulator as follows:

1. All 200 size regulators, and 300 size with flanged integral end connections use sensing plugs:
  - a. Remove dome and diaphragm as directed in Maintenance.-D.-5.
  - b. Insert plug in body internal sensing port and reassemble dome parts
  - c. Remove plug from body external sensing port
  - d. Connect external sensing line from this port to the downstream line at the point where pressure response is desired, using the correct connection type and size.
2. 300 size regulators with removable port fittings use a sensing probe for internal sensing which is replaced by a connection fitting for external sensing. These fittings are accessible from outside the regulator body. Refer to assembly drawing.
  - a. Remove internal sensing probe (20) from body using wrench per Table I.
  - b. Assemble o-rings (101) and (38) on external sensing fitting (37).
  - c. Insert fitting in body and tighten using wrench and torque per Table I.
  - d. Connect external sensing line from sensing fitting to the downstream line at the point where pressure response is desired, using the correct connection type and size.

**NOTE:** After regulator is installed in line, sensing hook-up may be changed without shutting off inlet pressure. Vent dome as directed in Section V.-D.-3. and vent downstream line. Wrench and torque for internal sensing probe are same as for external sensing fitting. Be sure o-ring (101) is in place before assembling.

#### B. REGULATOR MOUNTING

1. Note that downstream pressure gage should be readable from dome loading controls. Installation of the RedQ Powreactor in a horizontal section of line with dome up is recommended.
2. Before mounting regulator be sure to eliminate any loose dirt particles from supply line.
3. Replacement of trim parts requires removal of body plug. Sufficient clearance should be provided to permit this.

4. If end connections are the removable port fitting type, use wrench to hold them against turning when end connections are tightened.

#### **CAUTION:**

**Do not clamp on body plug when installing end connections**

#### C. DOME CONNECTION

1. If regulator is to be externally loaded, remove plug from dome. Connect dome to a source of gas at a pressure higher than the desired regulator downstream pressure, through a suitable dome loading control device.

**NOTE:** Since the dome is sealed after loading, a change in temperature will cause a slight change in dome pressure, with a corresponding shift in outlet line pressure. This outlet pressure shift amounts to about 1% for each five Fahrenheit degrees. When a compensating device such as the RedQ Hand Loader is used to load the dome, dome pressure is maintained constant regardless of ambient temperature changes.

2. If regulator is to be internally loaded, use dome loading needle valves contained in the regulator. Gas from the inlet line is used to load the dome.

**NOTE:** The internal loading feature can be used only in gas service.

#### Adjustment

To put the RedQ Powreactor Regulator into operation after it has been installed, load the dome with a gas pressure which will result in the desired outlet pressure.

**NOTE:** Actual pressure inside the air dome will be slightly higher than the controlled outlet pressure.

#### A. ADJUSTMENT, DOME INTERNALLY LOADED (Models 202B, 212B, 302B, 312B)

1. Using loading wrench per Table I, close SUPPLY needle valve. Vent dome by opening DOME needle valve
2. Close DOME needle valve.
3. Open inlet line stop valve, admitting pressure to inlet side of regulator. If feasible, adjust outlet line stop valve to allow a small flow.
4. Open SUPPLY needle valve about one-half turn. This opens loading duct to inlet line. (Needle valves

are not sealed, so there will be some blow-by during dome loading operation.)

5. Insert loading wrench in DOME needle valve and open slowly, watching outlet pressure gage as it indicates pressure building up in the outlet line.
6. When desired outlet pressure is reached in the line, as shown on outlet pressure gage, close DOME needle valve.
7. Close SUPPLY needle valve.
8. Check to see that DOME and SUPPLY needle valves are securely closed, but do not exceed 30 inch-lb torque. Excessive torque on needle valves may cause deformation or galling and leaks.
9. Slowly open outlet stop valve to wide open position. Internally loaded Powreactor is now in operation.
10. If outlet system is not sealed, outlet pressure may be reduced by opening DOME needle valve to vent dome. When outlet falls to desired level, close DOME valve.

#### B. ADJUSTEMENT, DOME EXTERNALLY LOADED (All 200B and 300B Models)

Adjustment of externally loaded Powreactor depends on the particular loading device used, such as RedQ Hand Loader or other device or system preferred by the user.

#### **CAUTION:**

**If internally loaded regulators are to be loaded externally, DO NOT USE internal loading needle valves in regulator. Be sure both are securely closed.**

1. Adjustment procedure using RedQ Hand Loader:
  - a. Turn Loader handwheel counterclockwise to its limit. This vents Powreactor dome.
  - b. Admit line pressure to inlet port of Powreactor. If feasible, adjust outlet stop valve to allow a small flow.
  - c. Slowly turn loader handwheel clockwise until outlet pressure gage shows desired pressure in outlet line.
  - d. Slowly open outlet stop valve to wide open position.
2. Adjustment procedure using loading manifold or other device preferred by the user:
  - a. Close dome loading line, and vent dome.
  - b. Admit line pressure to inlet port of Powreactor. If feasible, adjust outlet stop valve to allow small flow to outlet line.
  - c. Admit gas pressure to dome loading line.
  - d. Slowly open dome loading line, watching outlet pressure gage as it indicates pressure building up in outlet line.
  - e. When desired outlet pressure is reached as shown on outlet pressure gage, close dome loading line.
  - f. Slowly open outlet stop valve to wide open position.

Externally loaded Powreactor is now in operation.

#### **Maintenance**

(Refer to Assembly Drawing to identify parts.)

If outlet pressure deviates from original setting, check as follows:

#### A. RISE IN OUTLET PRESSURE

1. Check to see whether inlet pressure has fallen below the level it was when dome was set. Outlet will return to original setting when inlet rises to original level. If inlet is expected to remain at the lower level, re-set dome pressure per Adjustment.
2. Check temperature. A rise in temperature will cause a rise in outlet pressure (unless RedQ Hand Loader is used to load dome externally). Outlet will return to original setting when temperature returns to original level. (See Installation-C-1).
3. Check for dirt in valve and regulating mechanism:
  - a. Slowly open outlet line so as to increase flow through regulator.
  - b. Slowly return to normal flow.
  - c. Outlet gage should show return to original setting.
4. If regulator is externally loaded, check loading mechanism for malfunction.
5. If outlet continues to rise, close inlet stop valve and inspect Powreactor main valve parts for damage. Follow directions for disassembly, Maintenance -C and Maintenance -D-4.

## B. DROP IN OUTLET PRESSURE

1. Check to see whether inlet has risen above the level it was when dome was set. Outlet will return to original setting when inlet falls to original level. If inlet is expected to remain at the higher level, re-set dome pressure per Adjustment.
  2. Check temperature. A drop in temperature will cause a drop in outlet pressure (unless RedQ Hand Loader is used to load dome externally). Outlet will return to original setting when temperature returns to original level. (See Installation-C-1.)
  3. Check for external leaks in dome or dome venting system:
    - a. On internally loaded models, use bubble fluid around DOME needle valve. Also check dome sealing plug (external loading connection).
    - b. On externally loaded models, use bubble fluid on vent valve and connections of loading device.
    - c. On all models use bubble fluid around interfaces between dome, dome plate, and body.
    - d. On models with removable port fittings, use bubble fluid around outlet port fitting connection.
  4. If leaks appear around DOME needle valve or dome sealing plug, vent dome, inspect needle valve and/or plug, and replace if necessary. Re-set dome pressure per Maintenance.
  5. If leaks appear around interfaces between dome and dome plate or body, close inlet stop valve and inspect dome seals for damage. Follow directions for disassembly, Sections B.-C. and Maintenance.-D.-5.
  6. If leaks appear around outlet port fitting, close inlet stop valve and inspect port fitting seal for damage. Follow directions, for disassembly, Maintenance-C and Maintenance-D-6.
  7. If no external dome leaks are found, and outlet continues to fall off, close inlet stop valve and check Powreactor diaphragm for damage. Follow directions for disassembly, Maintenance-C and Maintenance-D-5.
- ## C. REPLACEMENT OF PARTS, GENERAL INSTRUCTIONS
1. Order spares and replacement parts by part number and name, as shown on the applicable Assembly Drawing and Parts List; or give serial number of the regulator involved and names of parts required.

2. To replace damaged parts other than port fittings, Powreactor Regulator need not be removed from line, but inlet and outlet stop valves must be closed securely, and pressure released from dome and line.
3. Disassembly procedure is similar for all Powreactor regulators, but wrench sizes, special tools, and assembly torques may vary. Refer to Table I to find the information which applies. Refer to Assembly Drawing for identification of parts.

### CAUTION:

**If non-metal parts are to be re-used, handle with extreme care. Cuts, scratches, or over-stretching will cause leaks.**

4. Clean all parts before inspection
  - a. Clean metal parts with suitable solvent. Wipe, flush, or vapor degrease as necessary to get desired level of cleanliness.
  - b. Clean non-metal parts by dry wipe with soft paper or cloth, or use ethyl or isopropyl alcohol, or wash in mild alkaline solution followed by thorough rinse in clean water. Any other solvents may cause damage to parts.
5. Inspect all seating and sliding metal surfaces and all soft sealing parts for damage that might cause leaks or faulty operation. Replace any defective items.
6. Lubricate as required before reassembly, using hydrocarbons for best performance, other types as required for compatibility with service conditions. Acceptable lubricants are as follows:

ITEM	HYDROCARBON	FLUOROCARBON
Metal Surfaces	Aero Lubriplate Molykote Type G	Kel-F 90 grease Fluorolube LG-160 Grease, FS-5 oil
Non-metal Parts	Texaco Marfak #3	Same as above

7. Apply lubricant sparingly to threads and sliding contact surfaces. Apply freely to o-rings to facilitate reassembly.

## D. DISASSEMBLY PROCEDURES

1. Close inlet stop valve. This traps pressure on inlet side of regulator.
2. Release trapped inlet pressure:

- a. If regulator is internally loaded, open SUPPLY needle valve in regulator body, using loading wrench per Table I.
  - b. Open outlet line to atmosphere, if feasible.
3. Vent dome as follows:
    - a. If internally loaded, open DOME needle valve, using loading wrench per Table I.
    - b. If externally loaded using RedQ Hand Loader, turn handwheel counterclockwise to its limit and remove dome connection line.
    - c. If externally loaded using other loading devices, release gas pressure from device, open dome VENT valve, and then remove loading device from dome port.
  4. On 300 size regulators with removable port fittings, sensing hook-up is converted internal/external by changing sensing fitting only, as directed in Installation-A.-2.
  5. Disassemble main valve as follows:
    - a. With all pressure vented from regulator, remove body plug unit, using hex wrench per Table I. This allows valve parts to drop clear, including pushrod, valve seat, and gasket.
    - b. If valve seat does not fall out freely, use a wood or brass rod to work it loose.
    - c. Disassemble soft seal valve seat unit for inspection. Parts may be pried apart with a thin blade, but be careful not to damage parts.
    - d. If valve is standard construction, valve and spring will fall freely out of body plug. Remove body plug o-ring for cleaning and inspection.
    - e. If valve is balanced type, disassemble body plug unit as follows:
      - i. Pull valve out of body plug. Spring is now free.
      - ii. Remove seal retainer, seal o-ring, and slip per seal, using care not to damage parts.
      - iii. Remove body plug o-ring for cleaning and inspection.
    - f. Clean, inspect, and lubricate valve parts per Section C.
    - g. Replace o-ring on outside shoulder of body plug.
    - h. If valve is of standard construction, place valve spring and valve in body plug.
    - i. If valve is balanced, reassemble body plug as follows:
      - i. Slide valve into slipper seal retainer. (Check orientation of parts on assembly drawing.)
      - ii. Fit o-ring around seal and carefully slip over lower end of valve. Use lubricant on o-ring such as Marfak #3 or Kel-F 90 grease.
      - iii. Insert assembly (i) + (ii) into body plug and seat the seal and o-ring securely in body plug counterbore.
      - iv. Hold down seal retainer and pull out valve.
      - v. Insert valve spring in valve and replace in body plug.
    - j. Reassemble soft seal valve seat unit. Position gasket on outside shoulder of seat.
    - k. Insert valve seat and gasket in regulator body.
    - l. Position valve seat bushing over valve seat.
    - m. Position pushrod on top of valve, in recess if any.
    - n. Screw body plug and valve assembly up into body.
- IMPORTANT:** Be sure that pushrod fits through hole in body plate, and valve seats evenly into seat unit. Hand tighten body plug until parts are seated properly.
- o. Tighten body plug with hex wrench, using size and torque given in Table I.

**CAUTION:**

**Excessive torque may cause buckling of valve seat bushing.**

6. Disassemble Powreactor diaphragm parts and/or convert internal/external sensing as follows:
  - a. Be sure dome and line are vented as directed in Maintenance-D-3. Disconnect dome loading accessories, if any.
  - b. Remove dome nuts or capscrews, using wrench per Table I.
  - c. Lift dome off plate and remove o-ring.
  - d. Lift dome plate off diaphragm. If Powreactor is internally loaded, remove grommet from dome plate loading duct.
  - e. Remove diaphragm, diaphragm plate, and spring if used. (Spring is a snap fit in plate.)

- f. Except on 300 size regulators with removable port fittings, sensing port in body is now exposed, for insertion or removal of internal sensing plug. See Installation-A.
  - g. Body plate should not normally be removed. If necessary to do so, use special wrench per Table I to unscrew from body.
  - h. Clean, inspect, and lubricate dome parts per Section C.
  - i. Replace spring, if any, in diaphragm plate; grommet, if any in dome plate; o-ring in dome, and reassemble dome parts over Powreactor body.
  - j. Tighten dome nuts or capscrews evenly all around, using wrench and torque shown in Table I.
7. To replace port fittings, Powreactor must be removed from line. Pad vise jaws to avoid damage to body plug or dome bolting while working on fittings.
- a. Clamp Powreactor securely across top and bottom of unit.
  - b. Remove port fittings, using wrench per Table I.
  - c. Remove o-rings from port fittings carefully, to avoid cutting them on metal threads.
  - d. Clean, inspect, and lubricate per section C.

- e. Replace o-rings on port fittings, using extra lubricant to avoid cutting them on metal threads.
- f. Replace port fittings in body, using wrench and torque per Table I.
- g. Replace Powreactor in line. Use wrench to hold port fittings against turning when end connections are tightened. Do not clamp on body plug.

This completes replacement of parts on RedQ Powreactors, basic models 200B and 300B, barstock designs. Regulator is ready to put back in operation as directed in Adjustment.

### Appendix

Assembly Drawing: .....	W-201B-A01, or as applicable
Parts List: .....	W-201B-A0-1, or as applicable
Mounting .....	W-202B-B03 or
Dimension Drawing:	W-301B-B03, as applicable
Special Tools: .....	As shown in Table I
Accessories for external Dome loading: .....	As applicable

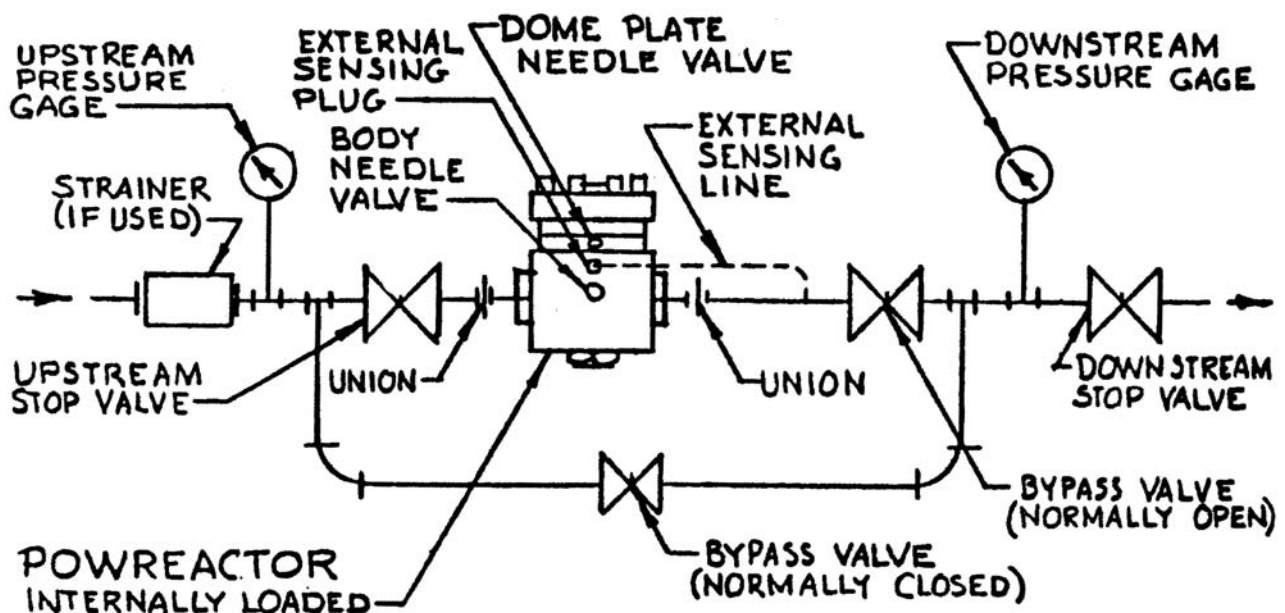


Figure 1 - Suggested Installation for Internally Loaded Powreactors

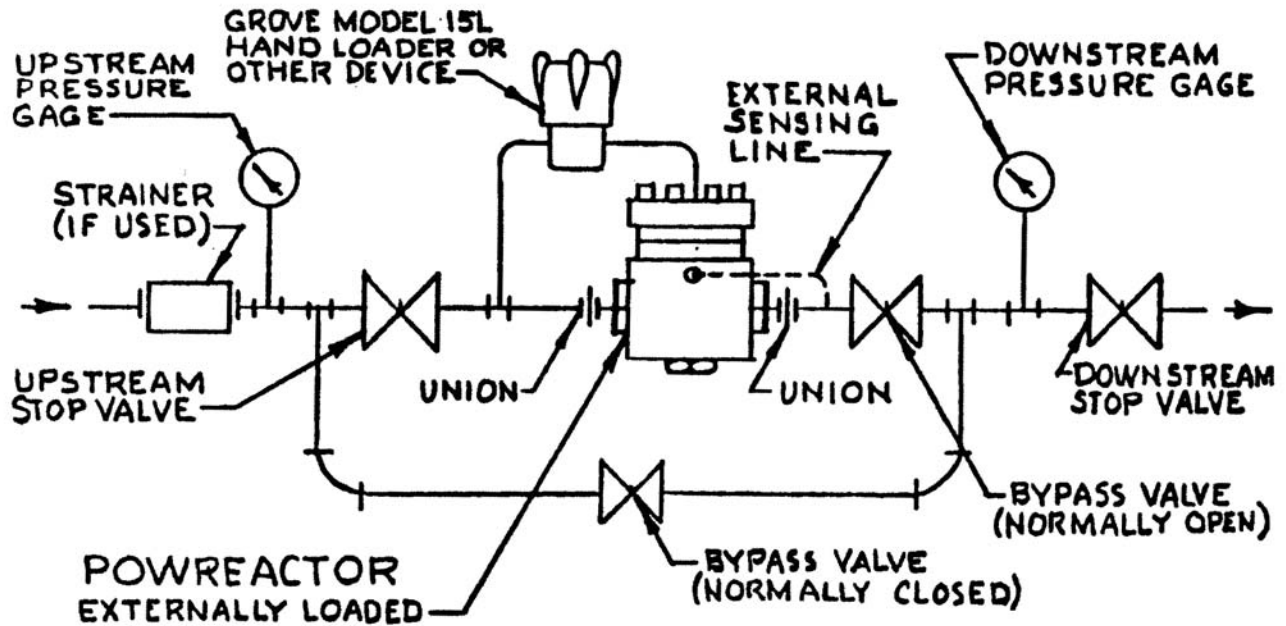


Figure 2 - Suggested Installation for Externally Loaded Powreactors

Table 1 - Wrenches & Torques for Parts Replacement - 200B & 300B Powreactors

ITEM	PART DATA	200B		300B	
		3600 psig Max Inlet	6000 psig Max Inlet	3600 psig Max Inlet	6000 psig Max Inlet
1	Needle Valves Thread Wrench Torque	20519-1 5/16 - 24 5/32 hex key 30 inch-lb max	Same	Same	Same
8	Dome Capscrews Thread Wrench Torque	N46-58345 1/2-20 NF 5/32 hex key 50 ft-lb	Same	Same	Same
15	Dome Nuts Thread Wrench Torque	— — — —	— — — —	12886 5/8 - 18 NF 15/16 hex 150 ft-lb	Same
19	Dome Plug Thread Wrench Torque	035-08065-4 7/16 - 20 11/16 hex (To Seal)	Same	Same	Same
20 (1)	Internal Sense Plug Thread Wrench	055-00201 1/4-28 1/8 hex key	Same	Same	Same

**Table 1 - Wrenches & Torques for Parts Replacement - 200B & 300B Powreactors *continued...***

ITEM	PART DATA	200B		300B	
		3600 psig Max Inlet	6000 psig Max Inlet	3600 psig Max Inlet	6000 psig Max Inlet
20, 37 (2)	Sense Probe & Fitting	—	—	149-00029& 149-00030 3/4-16 UNF 7/8 hex 50 ft-lb	Same
29	Body Plug Unit Standard Balanced Thread Wrench Torque	143-30006 143-30005 1-1/2 - 12 1-5/8 hex 50 ft-lb	Same	140-50007 143-50006 2-1/4 - 12 2-3/8 hex 120 ft-lb	Same
33	Body Plate Thread Wrench Torque	140-30010 1-5/8 - 2 M-13940-100 70 ft-lb	Same	140-50001 3-3/8 - 12 M-13940-99 140 ft-lb	Same
68 (1)	Ext. Sens. plug Thread Wrench Torque	035-12030-4 9/16 -18 UNF 3/16 hex (To Seal)	Same	Same	Same
71, 72	Port Fittings Thread Wrench Torque	Various 1-7/8 - 12 2-1/8 hex 340 ft-lb	Various 1-7/8 - 12 2-1/8 hex 560 ft-lb (3)	Various 2-1/8 - 12 2-3/4 hex 790 ft-lb (3)	Various 2-1/2 - 12 2-3/4 hex 1300 ft-lb (3)

**Notes**

- (1) Used on all except 300 size with removable port fittings.
- (2) Used only on 300 size with removable port fittings.
- (3) Alternate assembly torque: Tighten to 200 ft-lb and strike wrench handle one or two blows with hammer.

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