Flow

94K HYPERPRESSURE™ INTENSIFIER

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94K HyperPressure™ Intensifier

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CHAPTER 1

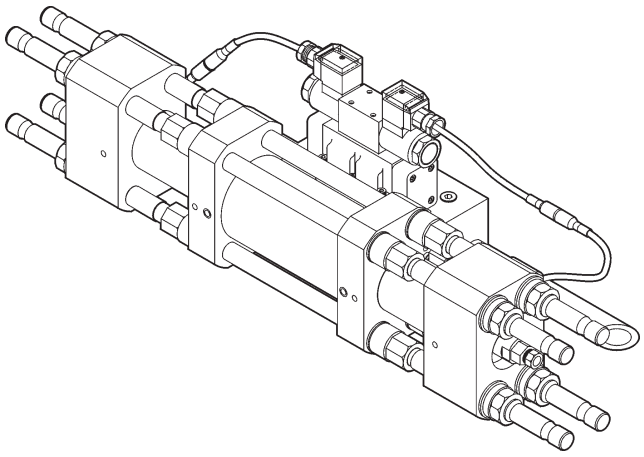
Intensifier Description

This manual will help you become familiar with your new Flow International (Flow) equipment. Information was compiled from the most current information available at the time of publication.

Physical specifications

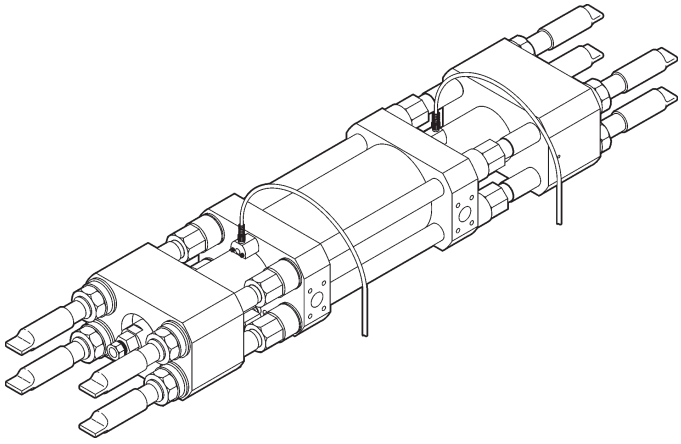
014623-1 or -3 Long-block intensifier (Pressure Vessel Application)

Width . . . . . 11.5 x 12 in. (292 x 304 mm)
Length. . . . . 40.5 in. (1028.7 mm)
Weight
  Intensifier . . . . . 265 lb (120 kg)
  Manifold . . . . . 51 lb (23 kg)



020070-1 Short-block intensifier (HyperPressure)

Width . . . . . 9 x 6 in. (229 x 152 mm)
Length. . . . . 42 in. (1067 mm)
Weight
  Intensifier . . . . . 272 lb (124 kg)



Functional specifications

Type of shift . . . . . electric
Output pressure. . . . . 94,000 psi (6483 bar)
Intensification ratio 31.4:1

Operating principles

The intensifier pump consists of a hydraulic system, a high-pressure water delivery system, and a control system. Details of the control, hydraulic oil and high-pressure water systems can be found in the intensifier pump manual.

The water is pressurized by using the fluid pressure intensification principle. Hydraulic oil pressure acting on the piston results in a force on the plunger, which pressurizes the water in the small chamber. Force equilibrium is achieved when the water pressure equals the hydraulic oil pressure times the effective area of the piston divided by the area of the plunger, assuming no friction losses. The ratio of the effective piston area to plunger area is defined as the pressure intensification ratio.

CHAPTER 2

Safety

This chapter contains a comprehensive list of safety precautions that must be followed to ensure safe operation of the equipment. These precautions must be read and understood by everyone operating and maintaining the equipment—before they start working with the equipment. Note that OSHA and state safety agency rules must be complied with in addition to those given in this chapter and elsewhere in this manual. Applicable plant general safety precautions must also be followed.

Safety precautions

Flow designed your high-pressure waterjet cutting system and related equipment with safety in mind. Throughout the manual, safety precautions and warnings for specific operations are highlighted. Safety precautions are also posted on the equipment. The operator and service personnel shall pay particular attention to these precautions at all times.

Operators of a high-pressure waterjet cutting system must treat the system as they would treat any high-speed cutting tool. Although the waterjet may appear harmless, it is a high-energy cutting tool capable of cutting many non-metallic materials such as composites, plastics, and wood products. Misuse of this equipment or carelessness in its application can be extremely hazardous to operating personnel. Always treat the waterjet cutting system with respect.

Warnings, cautions, and notes

Service procedures in the waterjet manuals include safety warnings, cautions, and notes that must be read, understood, and adhered to. These are specific categories of safety notices, and are defined as follows:

WARNING
Highlights an operating condition or service procedure that can result in death or serious injury to personnel.

CAUTION
Highlights an operating condition or service procedure that can lead to impaired system operation or equipment damage.

Note: Highlights an operating condition or service procedure that is considered essential for efficient operation and service.

Replacement labels

- Part # 006317-1
  3.75 x 6 in.
- Part # 009837-1
  1.8 x 3 in.

Safety tips

- Do not allow the waterjet stream to touch any part of your body—it will cause serious injury.
- Do not point the waterjet at anyone.
- During equipment maintenance, take the system out of service. The controls must be properly locked and marked with a warning sign.
- All personnel required to perform any system operating or service function must pay particular attention to all warning signs and notices posted in the plant and on the equipment.
- All protective guards, shields, and covers must be in place on the equipment at all times.
- First aid facilities must be provided in convenient locations throughout the plant. These locations must be known by all personnel.
- Always keep the work area around the equipment clean and free of debris. Oil spillage results in slippery floors and must be cleaned up immediately.
- Any unfavorable conditions that may result in injuries must be reported to the plant supervisor without delay.
- As a general practice, it is recommended that safety shoes, glasses, and hearing protection be worn by all personnel working around the equipment. Do not wear rings, watches, or necklaces when working around any equipment that has moving parts.

Mechanical system

- Don't start the system unless you know how to stop it.
- Never maintain, service, or clean around the equipment while it is operating.
- Use only the correct tools—wrong tools can cause injury or costly damage to equipment.
- Never climb on or around the equipment on makeshift devices. Use only approved catwalks, ladders, or platforms.
- Do not exceed specified pressure setting limits for pneumatic or hydraulic components. Exceeding these limits may result in serious injury to personnel or damage to the equipment.
- Shield and bundle equipment hoses and cables so they do not obstruct the operator's freedom of movement.
- Be alert at all times when working around the equipment.
- Clear all tools, parts, and rags from moving parts after servicing the equipment.

Electrical system

- Only properly trained personnel shall perform electrical and/or electronic troubleshooting and servicing of electrical devices.
- Always assume that power is ON in all electrical systems. Always check and lock out the main power switches before servicing the equipment. Post a sign, "Maintenance in Progress —Do Not Energize."
- Be aware that live electrical circuits are present in the control console whenever the master disconnect is on, regardless of whether the E-Stop is engaged.
- Disconnect circuit breakers and lock them in the OFF position before servicing the electrical system. If this isn't possible, have someone stand by to prevent someone from powering up the system.
- Take extra precautions when servicing the power system in a damp environment.
- Never alter or bypass protective interlocks or devices unless specifically instructed to do so, and only if all precautions are followed.
- You must give capacitors sufficient time for discharge. If this is not possible, discharging should be done manually and with care.
- Do not use jumper wires across fuses, fuse holders, or breakers.
- Make sure all tools are properly insulated for the job.
- Use only proper test apparatus; check regularly to make sure it is working correctly.
- Use caution when connecting a test probe to test points.
- All replacement wires must conform to the manufacturer's specifications, including color coding, wire numbers, and size.
- Close the control panel doors or junction box covers after servicing.

Waterjet system

- High-pressure water can remain in the system for an extended time after shutting down the water source. Always bleed-down system pressure before servicing any part of the system.
- Do not touch weep holes with your bare hands or try to stop water by plugging the holes.
- Remember that the waterjet stream is a knife. Do not introduce anything into its path that you do not intend to cut.
- Wear a face shield when required by operating instructions.
- Do not remove protective shields from high-pressure tubing. If shields are removed for servicing, they must be replaced before starting the system.
- Torque all fittings to the manufacturer's torque specifications.
- Stepping or leaning on high-pressure tubing can break connections, causing leakage.
- Use only high-pressure fittings, valves, and tubing certified for 94,000 psi (6483 bar) when making alterations or additions to the high-pressure water system.
- Do not alter or eliminate stress relief tubing coils.
- Follow the tubing manufacturer's recommendations for high-pressure tube bending radii.
- Do not exceed specified operating pressures for high-pressure water system components.
- Do not over-torque fittings or bend swivels excessively.
- Follow the manufacturer's recommendations for servicing the equipment, and use only original manufacturer replacement parts.
- Follow the manufacturer's system startup procedure to ensure safe operation.
- Use care when lifting equipment covers during operation.

Protective clothing

Personnel operating hand-held, high-pressure water cutting or cleaning equipment and those working nearby should wear the protective clothing and safety devices described in this chapter.

Flow recommends that work-site safety personnel approve all safety equipment and clothing for everyone working around waterjet equipment.

Eye protection

- At a minimum, operators must wear safety glasses with side shields and a visor (or goggles and a visor) to guard against spray and flying debris.
- All eye protection shall meet appropriate ANSI requirements for that type of eye protection.
- Some states and countries have their own eye protection rules that must be followed.

Head protection

- Helmets must be worn at all times by all personnel within the work area.
- Helmet material must withstand mechanical shock to 10 G in 8 ms without fracturing.

Hand protection

- The operator must wear gloves at all times. Leather gloves are preferred.

Foot protection

- Safety footwear with steel toe-caps 0.02 in. (5 mm) thick (minimum) must be worn. The toe cap must cover at least 30% of the footwear length.
- For some applications, footwear must be equipped with metatarsal guards to provide instep protection.

Hearing protection

- Operators and other personnel exposed to noise levels of more than 90 dBa for more than 1 hour must wear suitable ear protection. Ear plugs and muffs are usually adequate.

Body protection

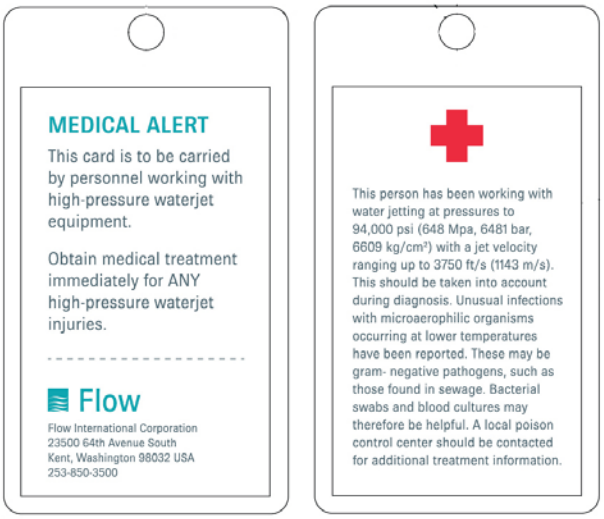
- Waterproof garments only protect the operator from spray and flying debris. They DO NOT provide any protection from direct jet impact.

WARNING
NEVER point a waterjet cutting or cleaning tool at yourself or at any person. Do not aim any waterjet tool at anything you do not want to cut.

Emergency medical information

Anyone who receives equipment-related injuries while operating high-pressure water equipment should be given immediate hospital attention. Because it is vital that medical personnel have information about this type of injury, all waterjet operating personnel should carry a waterproof emergency medical tag such as the one illustrated below. This card describes the work and the nature of injuries inherent in using waterjet cutting devices. The card illustrated below can be purchased from Flow (P/N A-8466).

The tag or card should contain the following standard information:



CHAPTER 3

Maintenance Procedures

Periodic maintenance

Daily inspections and periodic maintenance will help you get the maximum life, safety, and efficiency from your Flow equipment. Periodic maintenance is regularly scheduled preventive maintenance and includes replacing worn parts that have reached the end of their service life. It will help minimize unscheduled down time, maximize equipment use, and eliminate unsafe operating conditions.

Flow recommends that you use a maintenance and service log to record all service work.

Maintenance tips

- Stock enough spare parts to minimize down time and help avoid rush part orders.
- Practice good housekeeping.
- Assign a complete set of service tools to the work station.

Maintenance precautions

- Protect all machined and lapped mating surfaces from damage.
- Carefully clean and blow out all parts being reassembled. Do not use paper towels.
- Large components such as end bells, end caps, low-pressure cylinders, and tie rods should be washed in solvent and dried prior to reassembly.
- Do not use any substitutes for the fluids, sealants, and lubricants recommended by Flow.

Replacement parts

The view of the intensifier shown on Page 16 identifies components that need regular replacement. Maintenance schedules for these components are identified by item number and description in the following table.

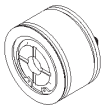
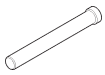
Item	*Part/component*		*Qty**	*Maintenance*			*Replacement*		
				Hours	*Procedure*	*Parts/kits Needed*	*Hours*	*Procedure*	*Parts/kits needed for each intensifier*
1*	High-pressure cylinder 020592-1		2	–	–	–	AR	A,C	02592-1 *2 per intensifier*
2*	Seal carrier cartridge 052190-1 or 040015-1		2	–	–	–	AR	A,B	052190-1 or 040015-1 *2 per intensifier*
3**	Low-pressure piston 011304-1 or 020080-1		1	–	–	–	AR	A,F	Low-pressure piston 011304-1 Low-pressure seal kit 013157-1 or 020080-1
4	Low-pressure seal kit 013157-1	no graphic	1	–	–	–	AR	A,F	Low-pressure seal kit 013157-1
5*	High-pressure plunger assembly 010253-1		2	–	–	–	AR	A,F	High-pressure plunger assembly 010253-1 Low-pressure seal kit 013157-1
6*	Retaining screw 004380-1		2	–	–	–	AR	A, D2	Check valve inlet replacement kit 014884-1
7*	Inlet check valve support 010564-1		2	–	–	–	AR	A, D2	
8*	Inlet poppet 015384-1		2	–	–	–	AR	A, D2	

Table references

** Flow recommends changing components on both sides of the intensifier at the same time.*

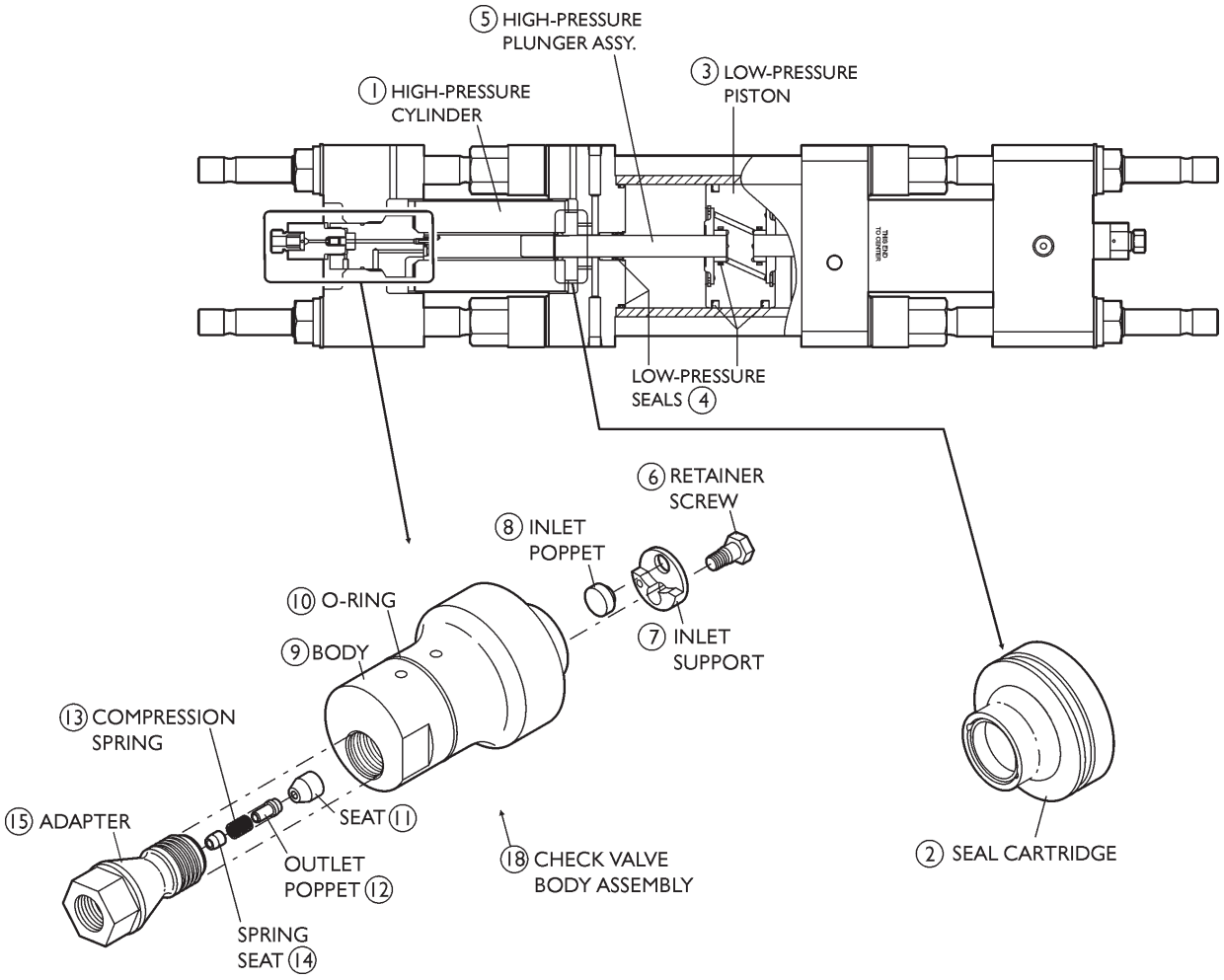
***Use low-pressure piston 011304-1 on the long-block intensifier (052919-10); use low-pressure piston 020080-1 on the short-block intensifier (020070).*

AR = as required

Replacement parts (continued)

Item	*Part/Component*		*Qty*	*Maintenance*			*Replacement*		
				Hours	*Procedure*	*Parts/Kits Needed*	*Hours*	*Procedure*	*Parts/Kits Needed*
9*	Check valve body 020077-1		2	AR	A, D2	B-1813-3	AR	–	–
10*	O-ring A-0275-131		2	–	–	–	AR	–	–
11*	Check valve seat 014388-1		2	–	–	–	AR	A, E	Check valve outlet replacement kit 014885-1
12*	Outlet poppet 011309-1		2	–	–	–			
13*	Compression spring A-1606		2	–	–	–			
14*	Outlet spring seat 042102-1		2	–	–	–	AR	–	–
15*	Outlet adapter 042101-1		2	–	–	–	AR	–	–
16*	Check valve assembly 020071-1		2	–	–	–	AR	–	
	Note: Items 9–15 are the components parts of Item 16, Check valve assembly								

Replacement parts



Intensifier service notes

The following list was compiled from Flow customers and Field Service Engineers. Following these suggestions could help lower repair costs, shorten repair time, and increase service life.

- Everyone working with the equipment must read and understand all applicable maintenance/service procedures before starting any work on the intensifier pump, then carefully follow the instructions as they work through each procedure.
- Carefully check the amount of water seepage from the end bell weep hole. If leakage is less than 2 teaspoons (0.8 oz/23ml) per stroke and has not suddenly appeared or drastically increased, you do not need to immediately stop the pump and change seals. However, you should schedule maintenance as soon as possible.
- Seals should be replaced when you are not able to maintain correct pressure.
- Except for a complete overhaul or repairs that involve the hydraulic oil cylinder, it is usually easier and quicker to do repair work on the intensifier while the intensifier remains on the pump frame. However, this is not recommended in environments where there is excessive dust or contamination.
- Repair all cracked parts and leakage from the check valve immediately.
- Clean all parts with a clean, non-residue type solvent such as Citra-safe or isopropyl alcohol. Use a dedicated solvent tank if possible.
- All threaded high-pressure connections *require* a fresh, even coating of Blue Lubricant. Clean parts thoroughly, then apply new lube. Do not substitute another product.
- All parts that contain high-pressure water (cylinder, check valve body, tubing) are susceptible to stress fatigue accelerated by stress risers. Stress risers result when scratches, nicks, or other surface disruptions are present. Do not attempt to rework damage. You must replace the component.
- High-pressure seal life and the service life of several other parts is related to the stress put on the parts—a function of stroke rate and water pressure. Exceeding the pump rating can lead to increased cost and downtime.
- Keep all intensifier tools supplied with the pump in a separate, locked cabinet. Substituting tools for those supplied by or available from Flow is not recommended.
- Use the intensifier assembly fixture when reassembling the low-pressure cylinder. Problems with the manifold and leaking o-rings are significantly reduced when the fixture is used.
- Keep the work area clean. When reassembling any intensifier, clean hands, shop coat, rags, parts, tools, air, solvent and lubricants all contribute to lower maintenance costs and reduced down time.

Torque specifications

Refer to the following table when specific torque requirements are not listed in a service procedure. Mounting bolts and machine screws shall not be torqued beyond the manufacturer's recommended limits.

High-pressure gland nuts	U.S. ft-lb	SI N-m
¼-in.	15-25	20-34
⅜-in.	35-45	47-60
9⁄16-in.	60-75	80-100

***Note**: Lubricate threads for all high-pressure tubing connections with Blue Lubricant before assembly.*

Notes

Maintenance Procedure A

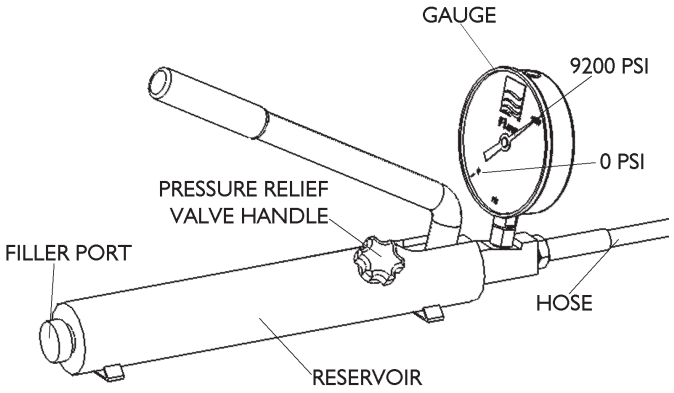
Using the Pressure Loading Tool to Assemble and Disassemble the Intensifier

Tools required

Pressure loading tool kit (042512-3)
½ in. drive torque wrench
½ in. drive ratchet
1⅝ in. crow's foot wrench (½ in. drive)
1⅝ in. socket (½ in. drive)
1½ in. socket (½ in. drive)
1 in. open-end wrench
⅞ in. open-end wrench
$^{13}/_{16}$ in. open-end wrench
Food grade grease (A-4689)
Blue Lubricant (A-2185)
Anti-seize (A-10039)

The pressure loading tool

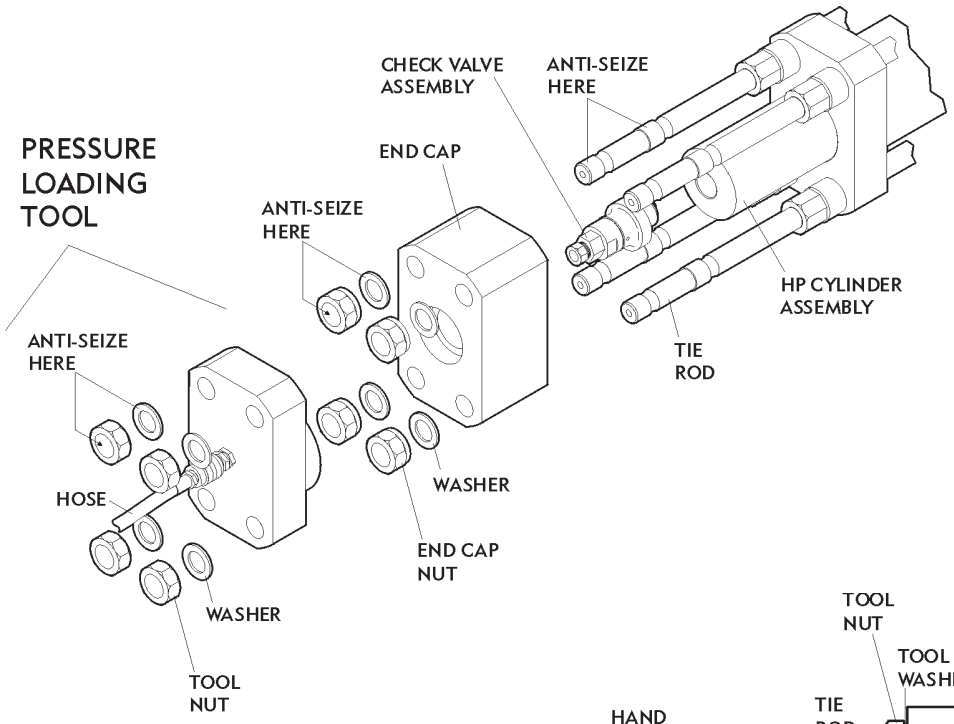
The following procedures use a special tool created especially for the 94K HyperPressure intensifier. You must read and understand these usage notes before attempting any maintenance procedure that requires the use of this tool. Failure to do so could damage the tool and/or the component being serviced. Such damage is not covered by warranty.

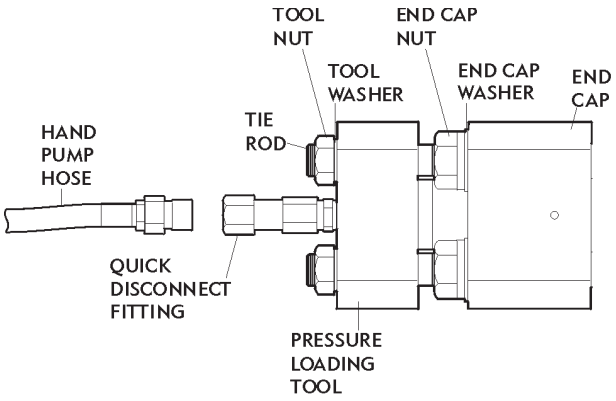


Usage and service notes

- The pressure loading tool is a delicate instrument and must be handled with care.
- Use only approved hydraulic oil in the hand pump.
- It is critical that service technicians be trained in the assembly and disassembly procedures of the intensifier before they use the pressure loading tool.
- Do not use the pressure loading tool for anything other than the assembly and disassembly of the intensifier.
- It is important to collapse the tool (push the piston fully into its cylinder) before each use as described in this section, to prevent accidental separation of the tool.
- Inspect the tool piston stop for damage. Replace if it is not flat. DO NOT grind to remove damage.
- For ease of use and to prevent damage, Flow recommends that you mount the hand pump permanently to a rigid cart. When not in use, cover the cart with a dust cover and store in a clean location.
- When storing the pressure hose, do not kink or bend it.
- Always keep dust caps in place on the quick disconnect fittings when the tool is not in use.
- Once a year, the pressure gauge of the tool should be calibrated by a qualified laboratory.

Assembling the intensifier



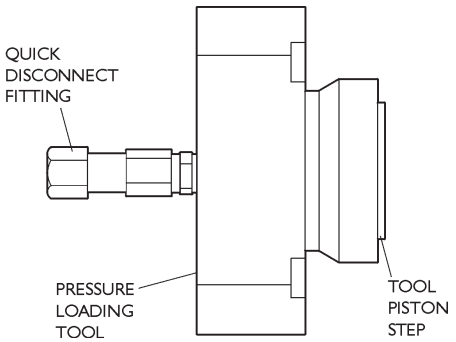


The illustrations on this page identify the parts used in this procedure, and provide a visual description of how the tool assembles to the tie rods of the intensifier.

1. Apply anti-seize (A-10039) to all exposed threads of each tie rod. Apply anti-seize to the threads of the end cap nuts and tool nuts and the contacting faces of the nuts and their washers.
2. With the high-pressure seal assembly, high-pressure cylinder, filler tube, check valve assembly, and end cap in place, install the end cap washers and nuts on the tie rods and run up hand tight to the end cap.
3. Install the tool on the tie rods and locate the tool piston step in the end cap counterbore.

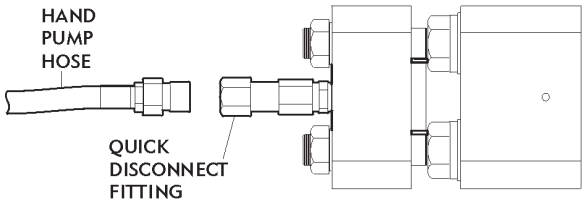
CAUTION
Make sure the tool piston step is fully engaged in the counterbore before continuing. Failure to do so can damage the end cap or the pressure loading tool.

4. Install the tool washers and nuts on the tie rod ends and run up hand tight to the tool.



5. Connect the hand pump hose to the tool at the quick-disconnect fitting (see below).

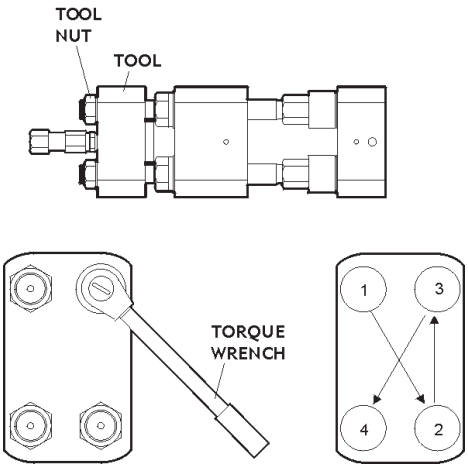
   Note: On some tool models the hand pump hose does not have a quick-disconnect fitting. If this is the case, leave the hose attached to the tool at all times to prevent leaking.



6. Open the pressure-release valve on the hand pump by turning the valve handle counter-clockwise one turn.
7. Collapse the pressure loading tool using a ratchet and socket on the tool nuts. In the pattern shown below, torque the tool nuts to 20 ft-lb (27 N-m), then to 50 ft-lb (67.8 N-m).

   Note: Oil from the tool will flow back to the hand pump reservoir.

8. Close the hand pump pressure-release valve by turning the valve handle clockwise until tight.



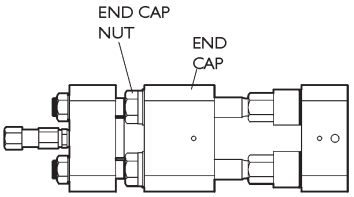
9. Pump the tool to 9200 psi (634 bar).

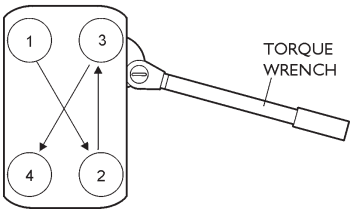
   Wait 10 seconds, then recheck the gauge. If the needle falls off the mark, re-tighten the pump pressure relief valve and bring the pressure back up to the 9200 psi (634 bar) mark.

10. Run up the end cap nuts by hand. Using a torque wrench with a crow's foot end, torque in the pattern indicated (see illustration below) to 50 ft-lb (67.8 N-m).

    Note: The pressure reading will drop as the nuts are torqued. This is normal; do not adjust pressure.

CAUTION
Do NOT repump the tool after starting the end cap nut torquing. Repumping the tool can cause misalignment and break parts.

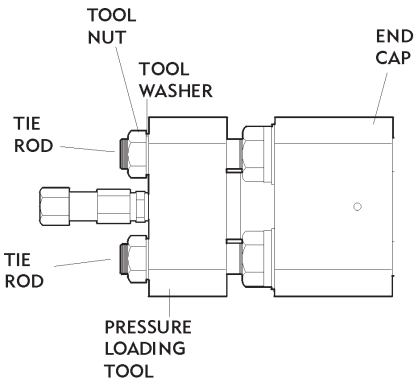




11. Bleed off the remaining tool pressure by opening the pump pressure-release valve.
12. Remove the hand pump hose from the tool at the quick-disconnect fitting.

    Note: On some tool models the hand pump hose does not have a quick-disconnect fitting. In this case, the hose should be left attached to the tool at all times to prevent leaking.

13. Remove the pressure loading tool nuts and washers. Remove the tool.



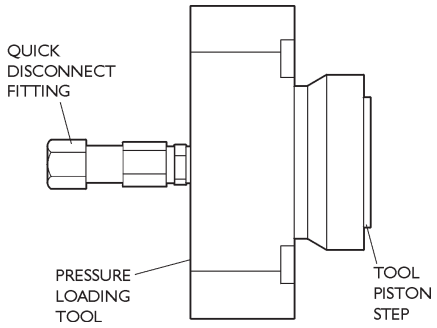
Disassembling the intensifier

1. Shut down the system.

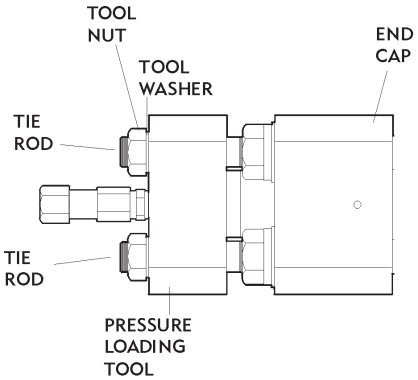
WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Disconnect the high-pressure tubing from the intensifier outlet adapter and move it out of the way.
3. Disconnect the supply water hose from the end cap.
4. Install the pressure loading tool on the tie rods, being careful to correctly locate the tool piston step in the end cap counterbore.

CAUTION
Make sure the tool piston step is fully engaged in the counterbore before continuing. Failure to do so can damage the end cap or the pressure loading tool.

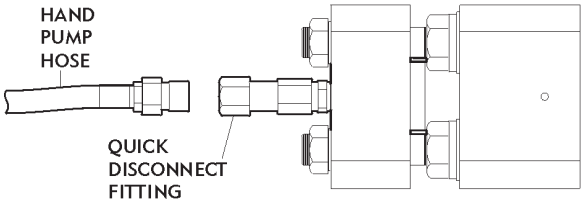


5. Thoroughly clean the tie rods to ensure no old anti-seize lubricant remains. Apply fresh anti-seize to the threads at the end of the tie rods, and on both sides of the tool washers.
6. Install the tool washers and nuts on the tie rod ends and run up hand tight to the tool.



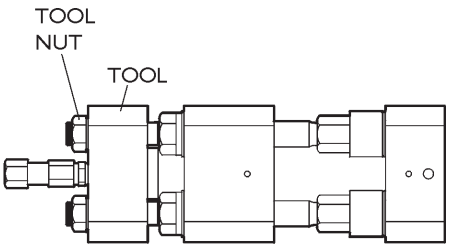
7. Connect the hand pump hose to the tool at the quick-disconnect fitting.

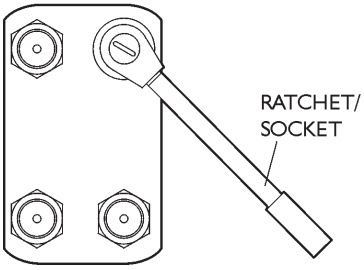
   Note: On some tool models the hand pump hose does not have a quick-disconnect fitting. If this is the case, leave the hose attached to the tool at all times to prevent leaking.



8. Open the pressure-release valve on the hand pump by turning the valve handle counterclockwise one turn.
9. Collapse the pressure loading tool using a ratchet and socket on the tool nuts, tightening all of the nuts until they are snug against the tool.

   Note: Oil from the tool will flow back to the hand pump reservoir.





10. Using the ratchet and socket, back off the tool nuts **exactly one** full turn.

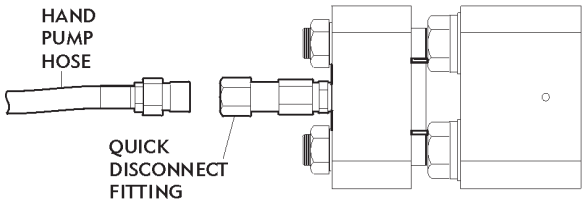
CAUTION
Failure to properly back off the tool nuts will make it impossible to remove the tool from the tie rod, and could damage the intensifier.

11. Close the hand pump pressure-release valve by turning the valve handle clockwise until tight.
12. Pump the tool to the 9200 psi (634 bar) mark on the pressure gauge.

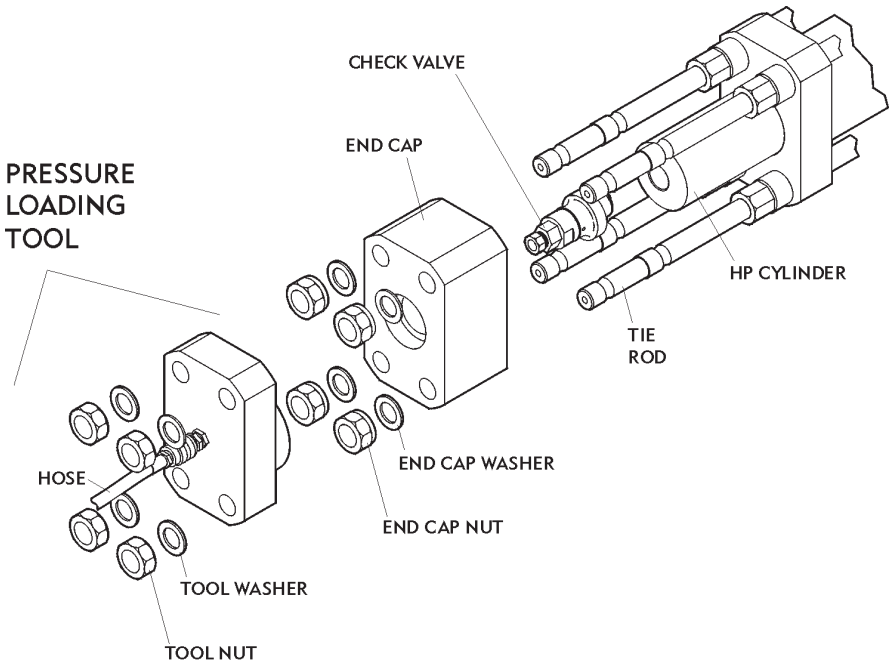
    Note: It will take 60–70 pumps before pressure will begin to build.

13. Wait 10 seconds, then recheck the gauge. If the needle falls off the mark, retighten the pump pressure relief valve and bring pressure back up to the 9200 psi (634 bar) mark.
14. Loosen the four end cap nuts and back off **two** full turns.
15. Bleed off the tool pressure by opening the pump pressure-release valve.
16. Remove the hand pump hose from the tool at the quick-disconnect fitting.

    Note: On some tool models the hand pump hose does not have a quick-disconnect fitting. If this is the case, leave the hose attached to the tool at all times to prevent leaking.



17. Remove the pressure loading tool nuts and washers, then remove the tool.
18. Remove the end cap nuts and washers.



Maintenance Procedure B

Replacing the Intensifier High-Pressure Seal

Service notes

Flow recommends that all high-pressure seals on the intensifier be serviced at the same time. This will help prevent unnecessary downtime.

Tools required

1 in. open-end wrench

⅞ in. open-end wrench

13⁄16 in. open-end wrench

Flat-head screwdriver

Service steps

1. Shut down the system.

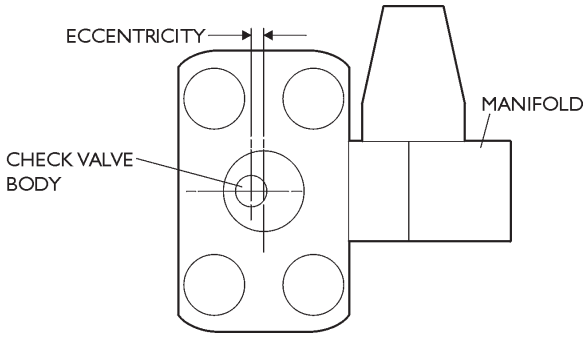
WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Unload the intensifier tie rods.
   - See *Maintenance Procedure A,* Disassembling the Intensifier
5. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier. This is important when reinstalling the check valve body—correct orientation is critical to ensure the correct fit of high-pressure tubing, which is affected by the eccentricity of the outlet body.

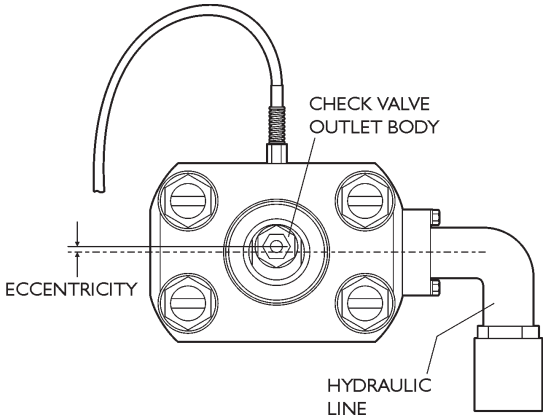
   Note: The check valve body is usually positioned with the outlet body away from the intensifier manifold block, but this may vary on some intensifiers.

   Check valve orientation of both the long-block and short-block intensifiers is shown on the next page.

014623-1 or -3 Long-block intensifier (StoneCrafter)

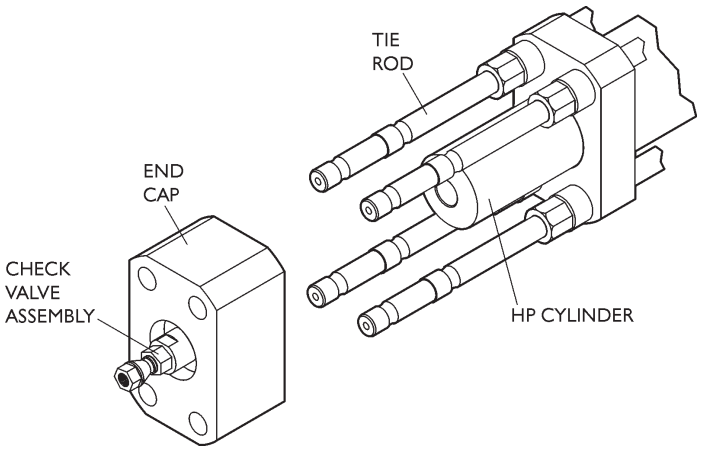


020070-1 Short-block intensifier (HyperPressure)



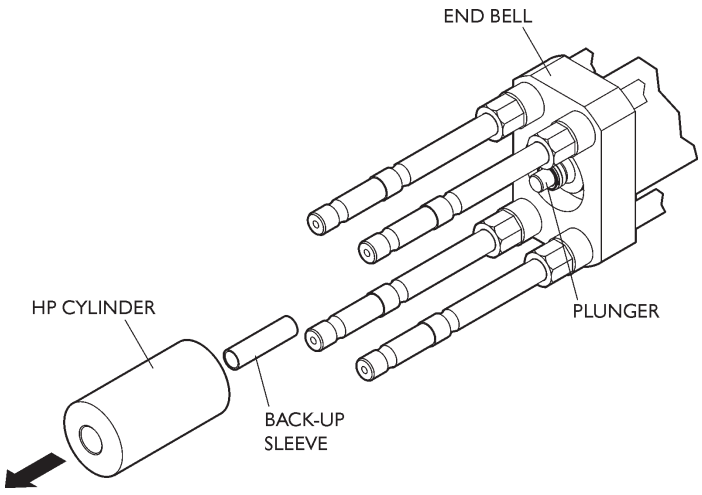
6. Remove the end cap from the tie rods. Note that the check valve assembly will stay inside the end cap because of compression of the o-ring on the check valve body.

   Note: Unless check valve maintenance is necessary (Maintenance Procedure D) you do not need to remove the check valve assembly from the end cap.



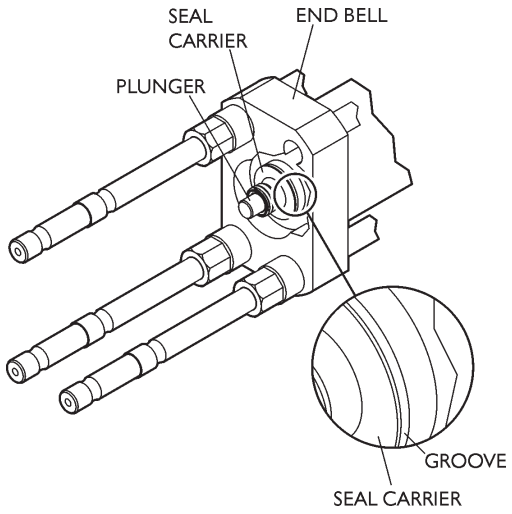
7. Remove the high-pressure cylinder and filler tube from the intensifier end bell. Rocking the cylinder gently while pulling will help separate the cylinder from the end bell.

CAUTION
When the cylinder is clear of the end bell, pull it straight out to avoid contact with the plunger. Otherwise, you could damage the ceramic plunger.

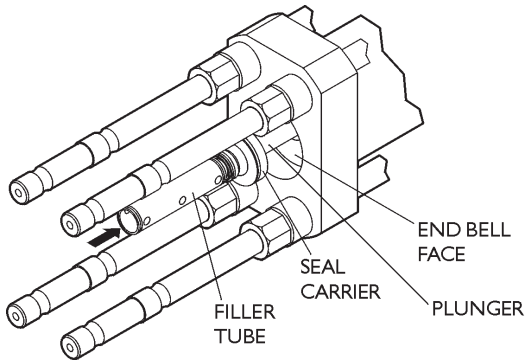


8. Pry the seal carrier away from the end bell using a small pry bar in the groove provided, as shown.

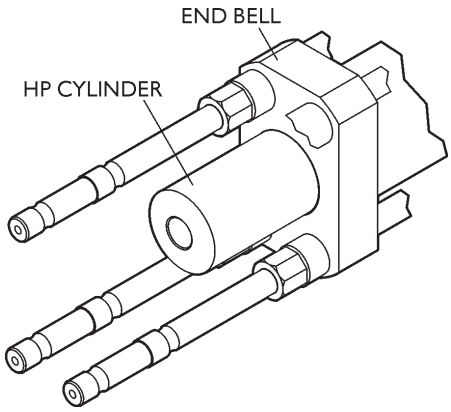
   Once the seal carrier is away from the end bell, slide it off the ceramic plunger by hand.



9. Clean and inspect the high-pressure cylinder, filler tube, and plunger.
10. Place the new seal carrier assembly onto the plunger. Using the filler tube as a tool, push the assembly along the plunger until it butts against the end bell face.

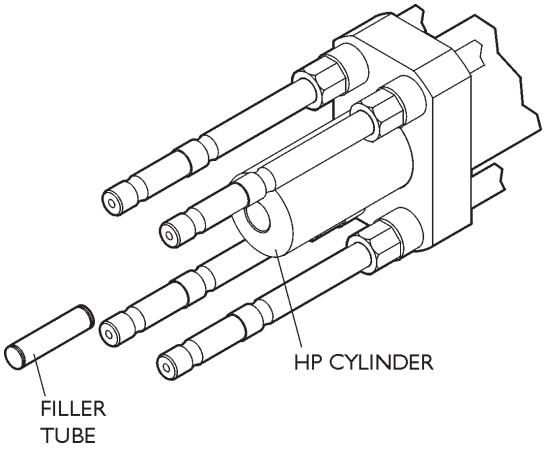


11. Slide the high-pressure cylinder over the ceramic plunger and into the end bell bushing. A slight rocking motion will help ease the cylinder into position.

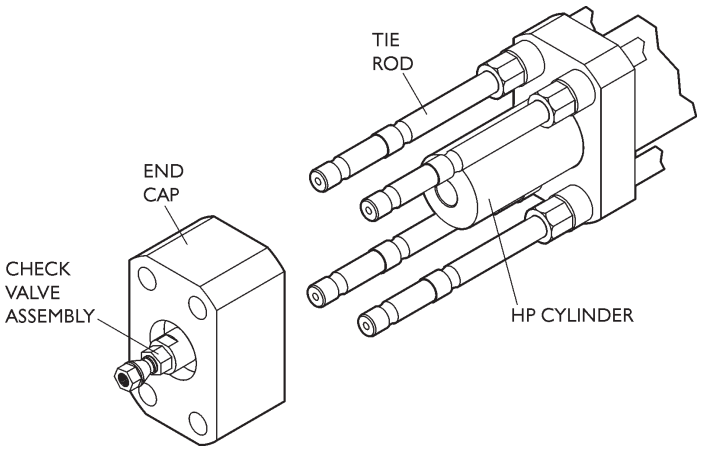


12. Install the filler tube in the high-pressure cylinder.

CAUTION
Make sure the filler tube is oriented correctly. There is a wall inside the tube that must be at the outermost end of the tube when it is inserted. Failure to orient the tube correctly will damage the intensifier assembly.



13. Reinstall the check valve assembly and end cap together by sliding the end cap along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap. Take care to align the check valve assembly with the correct orientation as previously noted in Step 5.



14. Reload the intensifier tie rods.
    - See *Maintenance Procedure A,* Assembling the Intensifier

15. Reconnect the high-pressure tubing and the inlet water hose.

Maintenance Procedure C

Replacing the Intensifier High-Pressure Cylinder

Service notes

- Flow recommends that you service both of the high-pressure cylinders on the intensifier at the same time. This will prevent unnecessary downtime.
- Cylinder failures that occur at the conical sealing surfaces of the cylinder can cause failures of the check valve body (014420-1) or seal carrier (052190-1). While the intensifier is open, it is a good idea to inspect the sealing surfaces of these components.

Tools required

1 in. open-end wrench

⅞ in. open-end wrench

13⁄16 in. open-end wrench

Service steps

1. Shut down the system.

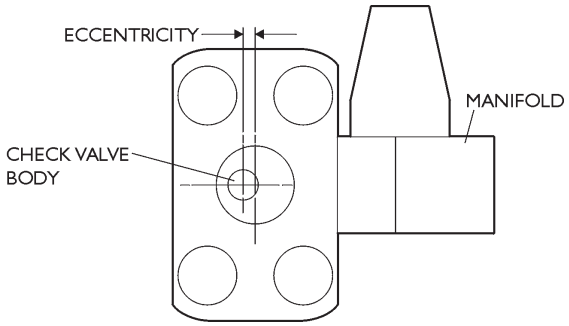
WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Unload the intensifier tie rods.
   - See *Maintenance Procedure* A, Disassembling the Intensifier
5. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier. This is important when reinstalling the check valve body—correct orientation is critical to ensure the correct fit of high-pressure tubing, which is affected by the eccentricity of the outlet body.

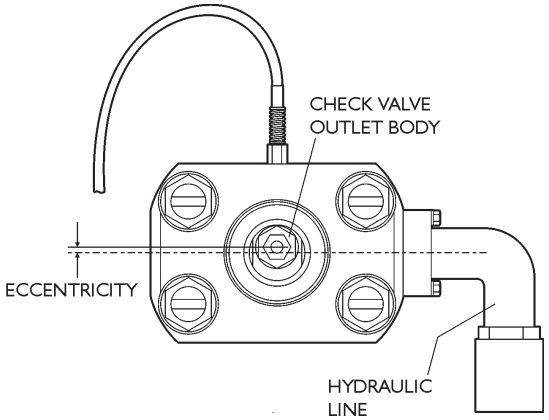
   Note: The check valve body is usually positioned so with the outlet body away from the intensifier manifold block, but this may vary on some intensifiers.

   Check valve orientation of both the long-block and short-block intensifiers is shown on the next page.

014623-1or -3 Long-block intensifier (StoneCrafter)

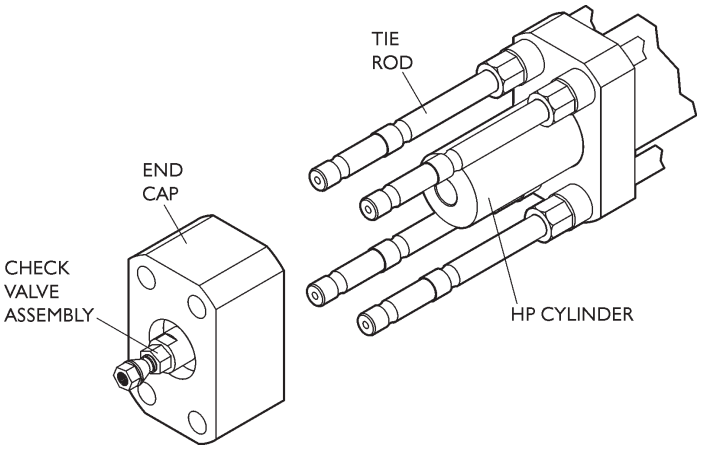


020070-1 Short-block intensifier (HyperPressure)



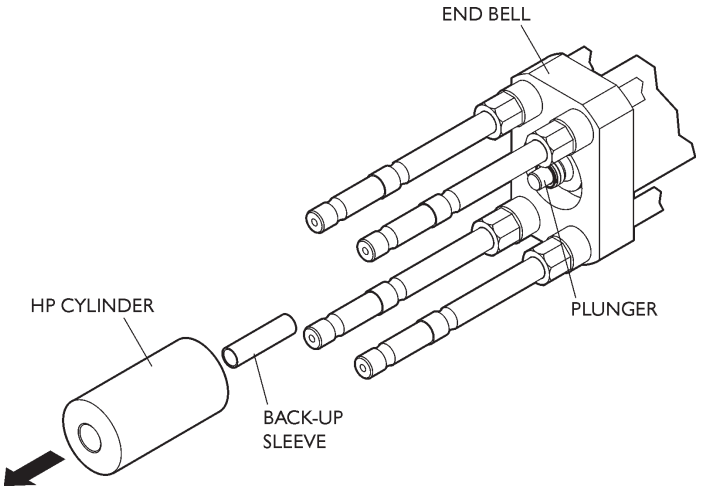
6. Remove the end cap from the tie rods. The check valve assembly will remain inside the end cap due to compression of the o-ring on the check valve body.

   Note: Unless check valve maintenance is necessary (Maintenance Procedure D), you do not need to remove the check valve assembly from the end cap.

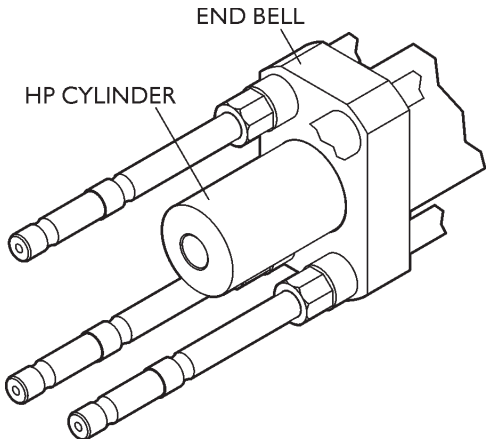


7. Remove the high-pressure cylinder and filler tube from the intensifier end bell. Rocking the cylinder gently while pulling will help separate the cylinder from the end bell.

CAUTION
When the cylinder is clear of the end bell, pull it straight out to avoid contact with the ceramic plunger. Otherwise, you could damage the plunger.

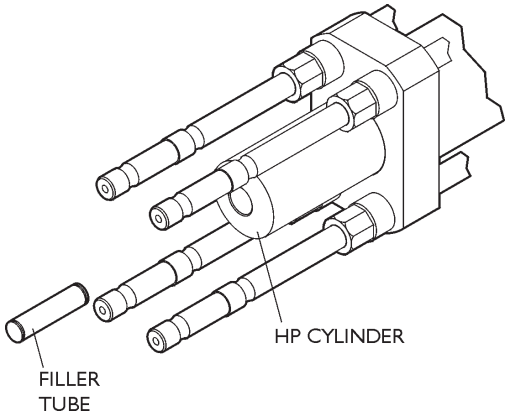


8. Clean and inspect the filler tube and plunger for damage. Replace if necessary.
9. Slide the high-pressure cylinder over the ceramic plunger and into the end bell bushing. A slight rocking motion will help ease the cylinder into position.

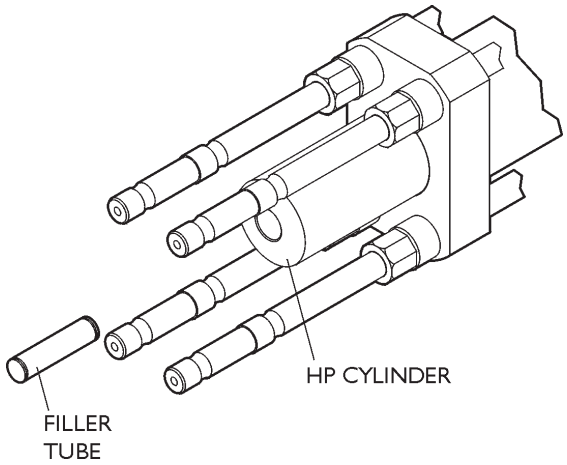


10. Reinstall the filler tube in the new high-pressure cylinder.

CAUTION
Make sure the filler tube is oriented correctly. There is a wall inside the tube that must be at the outermost end of the tube when it is inserted. Failure to orient the tube correctly will damage the intensifier assembly.



11. Thoroughly clean the tie rods, nuts, and washers to remove the old anti-seize lubricant.
12. Reinstall the check valve assembly and end cap together by sliding the end cap along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap. Take care to align the check valve assembly with the correct orientation as previously noted in Step 5.



13. Reload the intensifier tie rods.
    - See *Maintenance Procedure A,* Assembling the Intensifier
14. Reconnect the high-pressure tubing and the inlet water hose.

Notes

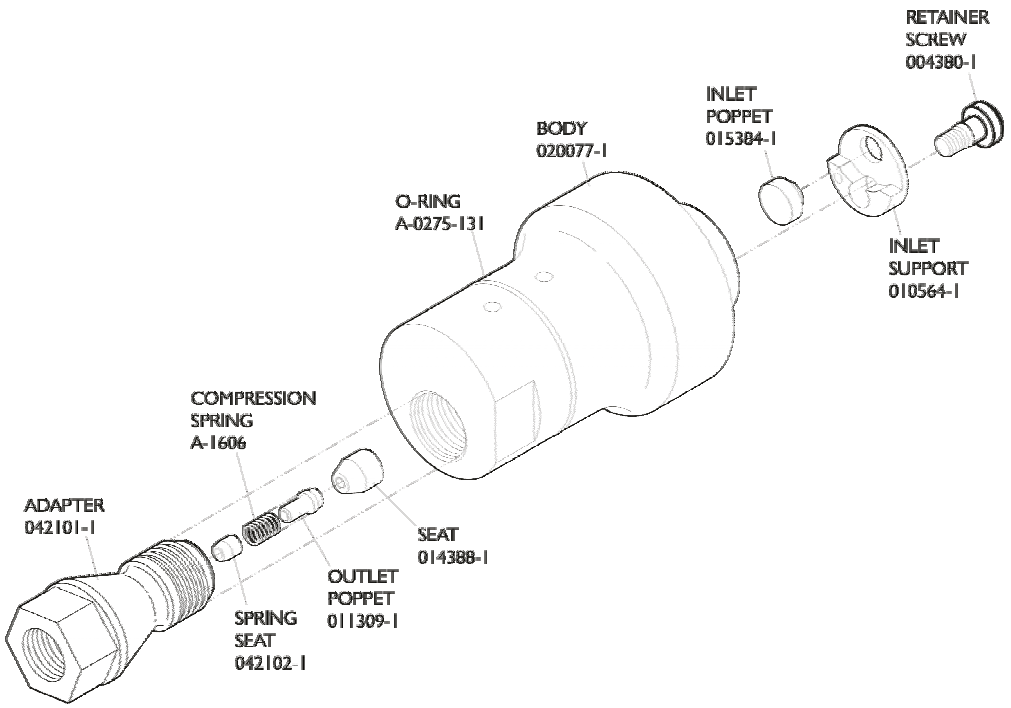
Maintenance Procedure D

Replacing the Check Valve Body Assembly
Servicing the Inlet Components of the Check Valve Body Assembly

Service notes

There are two ways to service the high-pressure inlet check valve:

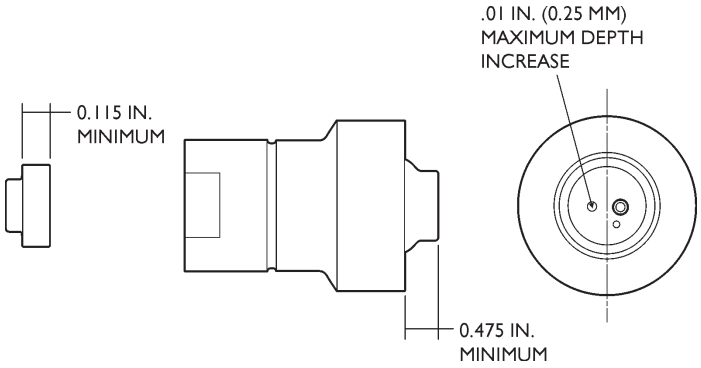
- D-1: Replacing the check valve body assembly
- D-2: Lapping the check valve body face and installing the inlet replacement kit



Lapping notes

When lapping any component, if the sealing surface cannot easily be restored by the lapping techniques described in this section, you can machine it flat before lapping as long as you machine *only* the sealing surface, maintain the perpendicularity of the face to the component axis, and maintain these minimum dimensions:

- Shoulder of the check valve body: minimum height of 0.475 in. (12.06 mm)
- Check valve inlet poppet: minimum thickness of the large diameter portion 0.115 in. (2.921 mm)
- If the check valve body retaining screw does not seat correctly, the part is at the end of its service life and must be replaced.



Maintenance Procedure D1
Replacing the check valve body assembly

Service notes

Before performing this procedure, review *Using the Pressure Loading Tool to Assemble and Disassemble the Intensifier.*

Tools required

1 in. open-end wrench

⅞ in. open-end wrench

$^{13}/_{16}$ in. open-end wrench

1¼ in. socket (½ in. drive) and handle

Food grade grease (A-4689)

Service steps

1. Shut down the system.

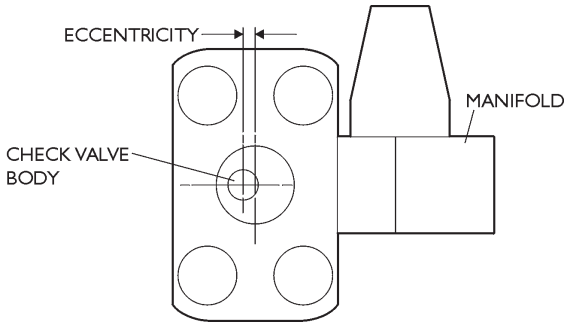
WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Using a 1¼ in. socket, loosen the outlet adapter from the check valve body (do not remove it at this point).
5. Unload the intensifier tie rods
   - See *Maintenance Procedure A*, Disassembling the Intensifier
6. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier. This is important when reinstalling the check valve body—correct orientation is critical to ensure the correct fit of high-pressure tubing, which is affected by the eccentricity of the outlet body.

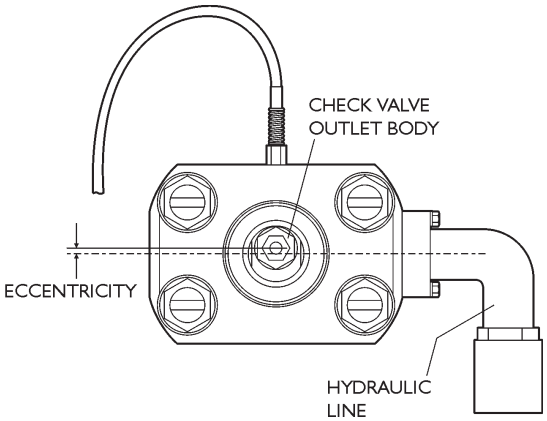
   Note: The check valve body is usually positioned with the outlet body away from the intensifier manifold block, but this may vary on some intensifiers.

   Check valve orientation of both the long-block and short-block intensifiers is shown on the next page.

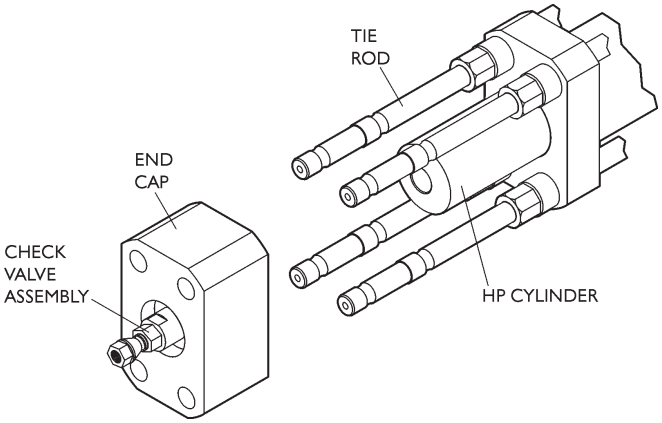
014623-1or -3 Long-block intensifier (StoneCrafter)



020070-1 Short-block intensifier (HyperPressure)

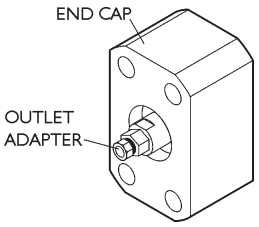


7. Remove the end cap from the tie rods. Note that compression of the o-ring on the check valve body will keep the check valve assembly in the end cap.

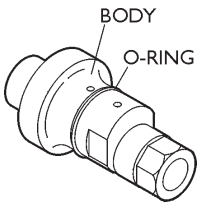


8. Remove the old check valve assembly from the end cap by pushing on the outlet adapter (see illustration below).

   Set the old check valve assembly aside.



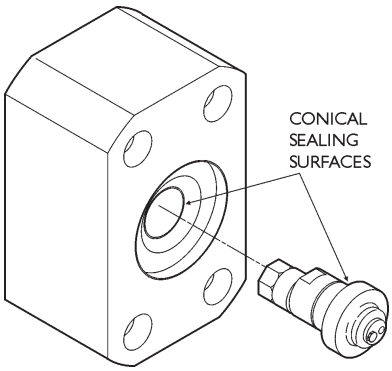
9. Clean and inspect the end cap. Replace if necessary.
10. Remove the o-ring from the new check valve body. Lubricate the o-ring with food grade grease (A-4689) and reinstall it.



11. Make sure the conical sealing surfaces of the check valve assembly and the end cap are clean and free of debris.

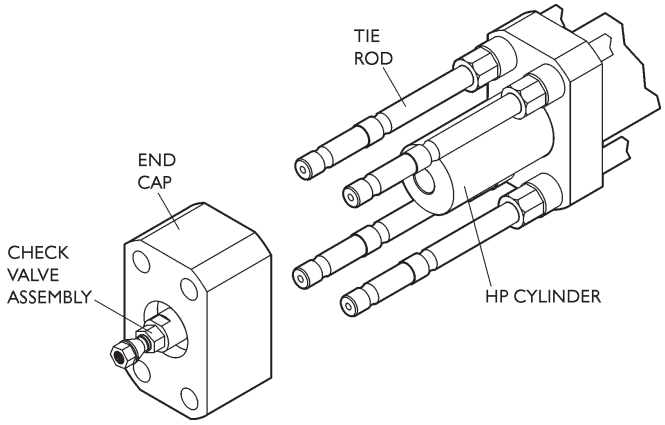
    Note: Do NOT apply grease or lubricant to the conical sealing surfaces. This can cause an inlet water leak.

    Install the new check valve assembly by pushing it into the end cap as indicated. Take care to align the check valve assembly with the correct orientation as explained in Step 5.



12. Remove the old anti-seize from the tie rods, nuts, and washers.

13. Reinstall the end cap (complete with check valve body assembly) by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap.



14. Reload the intensifier tie rods.
    - See *Maintenance Procedure A*, Assembling the Intensifier

15. Reconnect the high-pressure tubing and the inlet water hose.

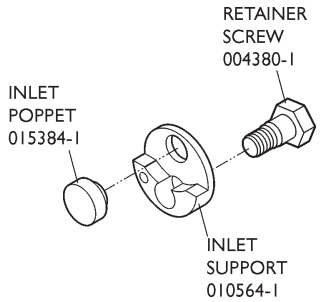
Notes

Maintenance Procedure D2 Lapping the check valve body face and installing the inlet replacement kit

Tools required

½ in. drive torque wrench
¼ in. drive torque wrench
1¼ in. socket (½ in. drive) and handle
5/16 in. socket (¼ in. drive)
1 in. open-end wrench
⅞ in. open-end wrench
13/16 in. open-end wrench
5/16 in. open-end wrench
Lapping kit (B-1813-3)
Check valve inlet replacement kit (014884-1)
Food grade grease (A-4689)
Blue Lubricant (A-2185)
Loctite #242 (A-3202)

Check valve inlet replacement kit



Service steps

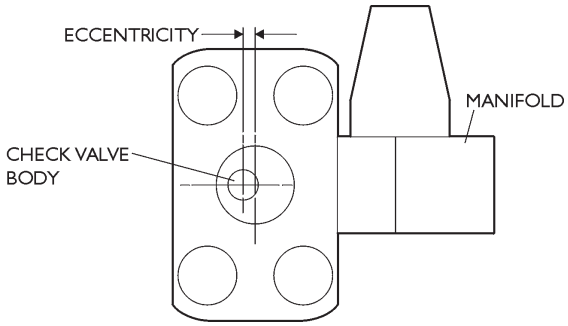
1. Shut down the system.

WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

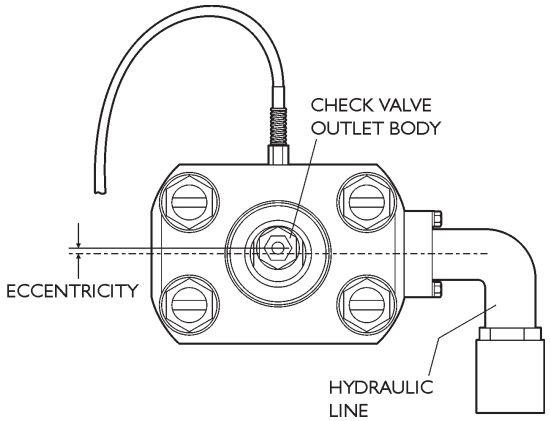
2. Disconnect the inlet water hose from the end cap.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
4. Using a 1¼ in. socket, loosen the outlet adapter from the check valve body (do not remove it at this point).
5. Unload the intensifier tie rods.
   - See *Maintenance Procedure A*, Disassembling the Intensifier
6. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier. This is important when reinstalling the check valve body—correct orientation is critical to ensure the correct fit of high-pressure tubing, which is affected by the eccentricity of the outlet body.

   Check valve orientation of both the long-block and short-block intensifiers is shown on the next page.

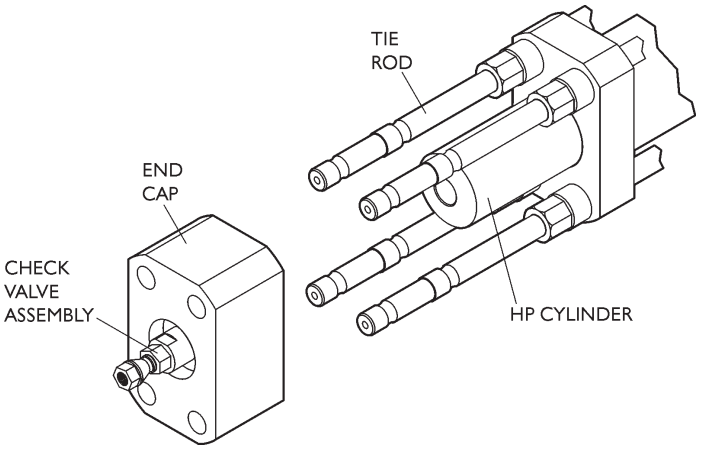
014623-1or -3 Long-block intensifier (StoneCrafter)



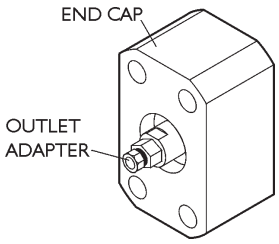
020070-1 Short-block intensifier (HyperPressure)



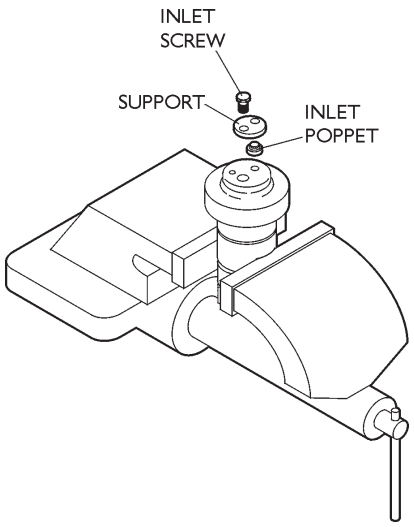
7. Remove the end cap from the tie rods. Note that compression of the o-ring on the check valve body will hold the check valve assembly inside the end cap.



8. Remove the check valve assembly from the end cap by pushing on the outlet adapter (see illustration at right). Set the end cap aside.

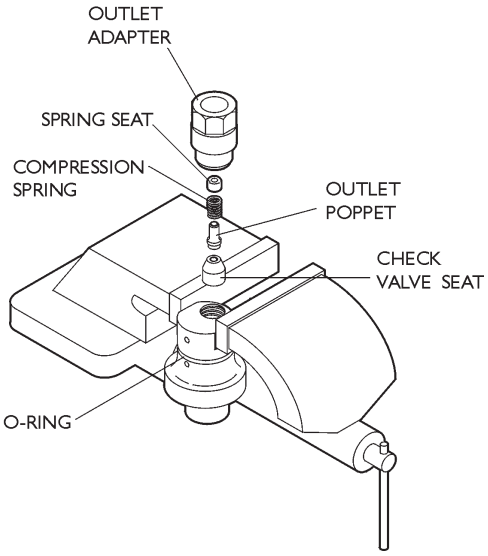


9. In a soft-jawed vise, clamp the check valve assembly on the flats machined into the body.



10. Using a 5/16 in. open-end wrench, remove the inlet screw from the face of the check valve body. Remove the inlet check valve support and the inlet poppet.
11. Clamp the check valve assembly in the soft-jawed vise, holding the assembly on the flats of the check valve body.

    Remove the outlet adapter (loosened in an earlier step) from the check valve body. Remove the outlet check valve poppet, compression spring, check valve seat, and outlet spring seat and set aside. Also remove the large o-ring from the check valve body and set it aside.



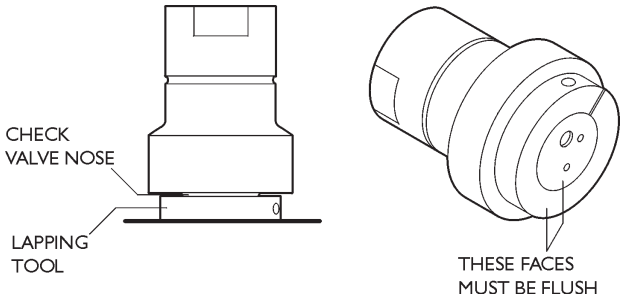
12. Clean and inspect the check valve body and outlet adapter.

Lapping the check valve body

Lapping notes

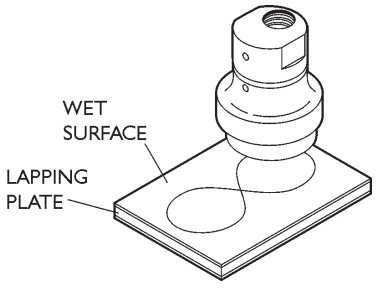
- The dimensions for the check valve body listed at the beginning of Maintenance Procedure D are the *minimum* allowed. You can re-use the check valve body down to these dimensions, but you must discard the check valve body if it becomes smaller.
- Hand lapping, machining, machine grinding, polishing, or a combination thereof are usually all acceptable ways to remove surface imperfections from components before final lapping.

13. Install the check valve body lapping tool (014853-1) around the check valve nose. Place the assembly, end face down, on a flat surface. Slide the tool down as far as it will go, until the check valve body and tool end faces are flush. Tighten the lapping tool onto the check valve body.

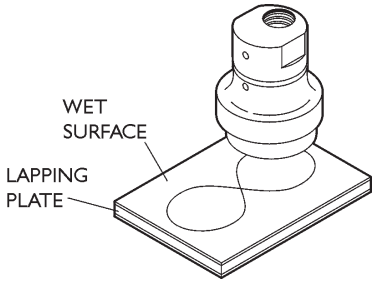


14. Attach a 320 grit abrasive strip to one side of the glass plate, and a 600 grit strip to the other side.

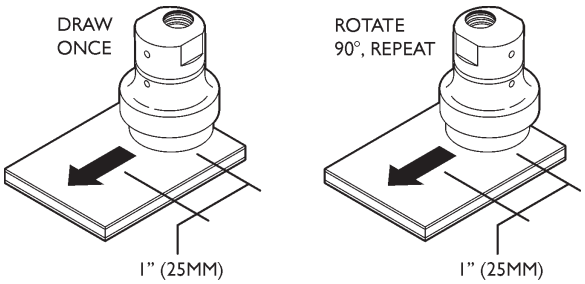
    Place a few drops of water on the 320 grit side of the lapping plate. Lap the check valve body in a figure-8 pattern until all surface imperfections have been removed.



15. Turn the lapping plate over and place a few drops of water on the 600 grit side of the plate. Lap the check valve body in a figure-8 pattern until the body is evenly polished.



16. To avoid poppet sticking problems, turn the lapping plate back to the 320 grit side and draw the check valve body for 1 in. (25 mm) in a straight line along the abrasive strip once, then rotate the body 90° and repeat the 1 in. (25 mm) score.



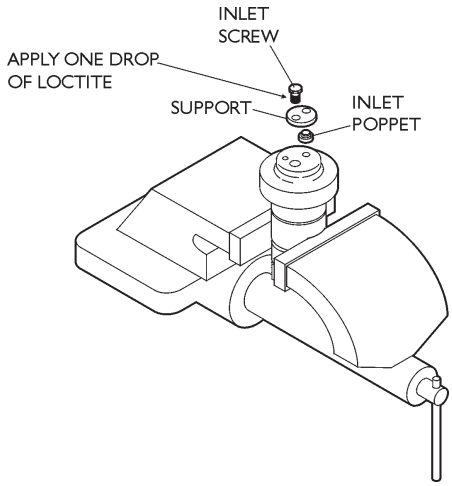
17. Carefully clean the newly-lapped check valve body with clean solvent such as isopropyl alcohol. Dry and re-inspect the part.

CAUTION
Lapping debris remaining after incomplete cleaning will result in reduced component life.

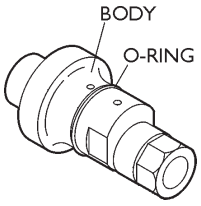
Installing the check valve inlet replacement kit

18. Set out and inspect the components of the check valve inlet replacement kit (014884-1).
19. Apply one drop of Loctite #242 to the threads of the new retainer screw. Position the new inlet check valve support and new poppet on the main body, with the pin of the inlet check valve support in its locating hole.

    Insert the retainer screw and tighten to 40 in-lb, (4.52 N-m).

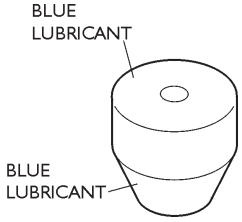


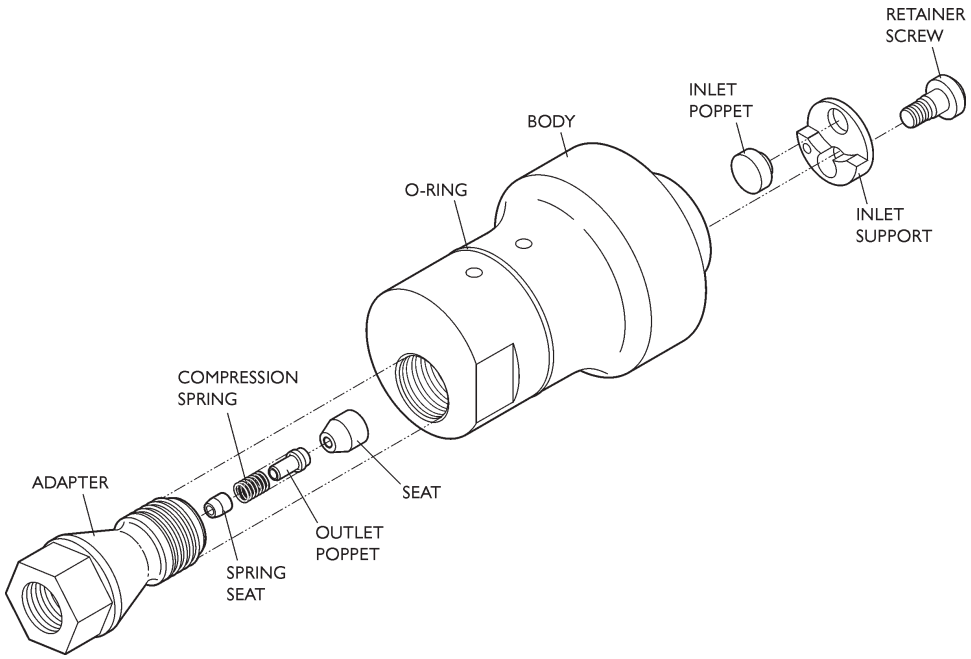
20. Lubricate the o-ring (removed from the check valve body in Step 10) with food grade grease (A-4689). Replace the o-ring on the check valve body.



21. Clean and inspect the outlet check valve seat, outlet poppet, compression spring, outlet spring seat and the threads and bore of the outlet adapter with solvent. See parts identified on the next page.

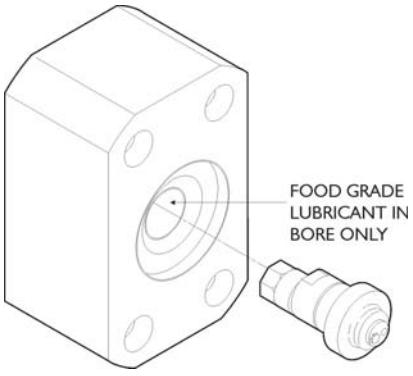
    Apply a small amount of Blue Lubricant to the outlet adapter threads and the conical surfaces of the outlet check valve seat.





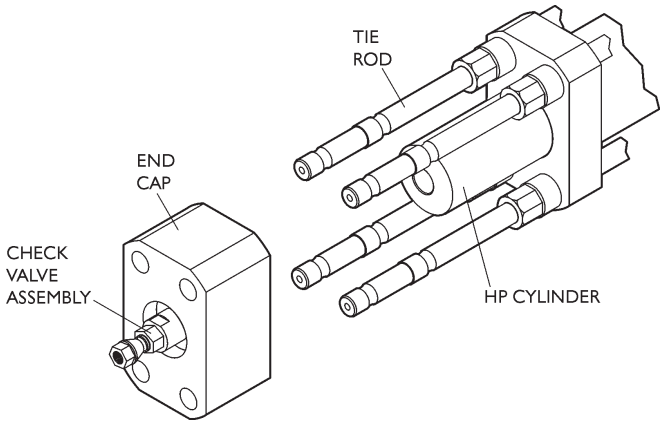
22. Assemble the outlet components of the check valve body. Thread the outlet adapter into the check valve body. Secure hand tight.
23. Clean and inspect all surfaces in the end cap. Lubricate the bore of the end cap with food grade lubricant as shown.

CAUTION
Do NOT apply grease or lubricant to the conical sealing surfaces. This can cause an inlet water leak.



Install the new check valve assembly by pushing it into the end cap. Take care to align the check valve assembly with the correct orientation as previously noted in Step 6.

24. Remove the old anti-seize from the tie rods, nuts, and washers.
25. Reinstall the end cap (complete with check valve body assembly) by sliding the body along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap.



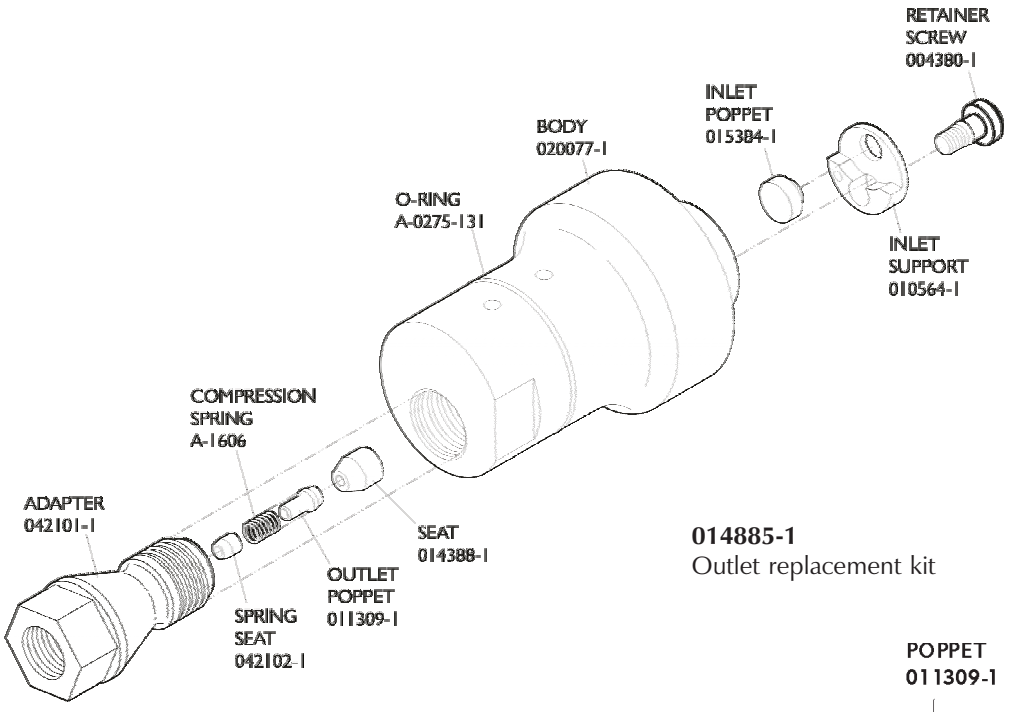
26. Reload the intensifier tie rods.
    - See *Maintenance Procedure A,* Assembling the Intensifier

27. Torque the outlet adapter to 200 ft-lb (271.2 N-m).

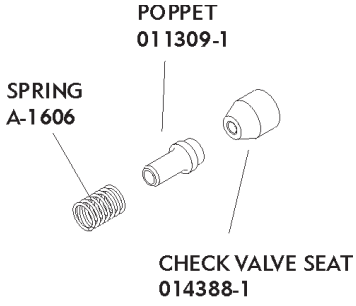
    Note: The outlet adapter should be torqued on the workbench, not when installed. Torquing when installed can disturb the sealing surface, and could cause galling.

28. Reconnect the high-pressure tubing and the inlet water hose.

Servicing and Replacing the Outlet Check Valve Components (Outlet Poppet and Check Valve Seat)



014885-1
Outlet replacement kit



Tools required

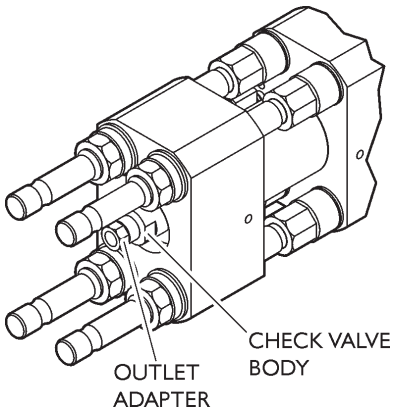
1¼ in. socket (½ in. drive) and handle
1 in. open-end wrench
⅞ in. open-end wrench
$^{13}/_{16}$ in. open-end wrench
Check valve outlet replacement kit (014885-1)
Blue Lubricant (A-2185)

Service steps

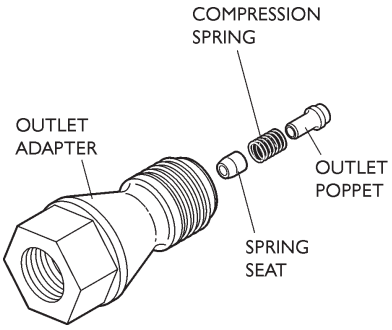
1. Shut down the system.

WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet adapter. Loosen the other end of the tubing and move it out of the way.
3. Using a 1¼ in. socket and handle, unscrew the outlet adapter from the check valve body.

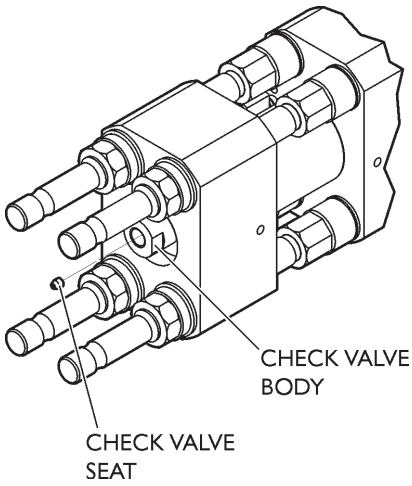


4. Remove the outlet poppet, compression spring, and outlet spring seat from the outlet adapter. Discard the poppet and spring, but set the spring seat aside.



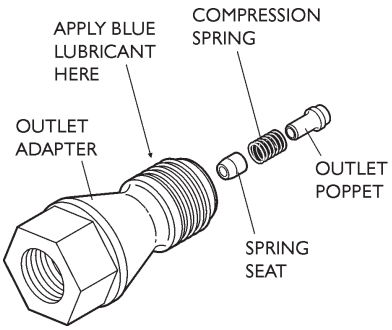
5. Remove the check valve seat from the check valve body.

   Note: The check valve seat can be difficult to remove. If necessary, insert the sharpened end of a small dowel or a sharp pencil into the check valve seat. Push until the check valve seat is fixed to the dowel, then pull it out.

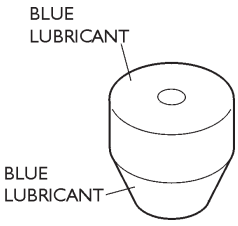


6. Using fresh solvent, clean the threads and bore of the outlet adapter and check valve body.

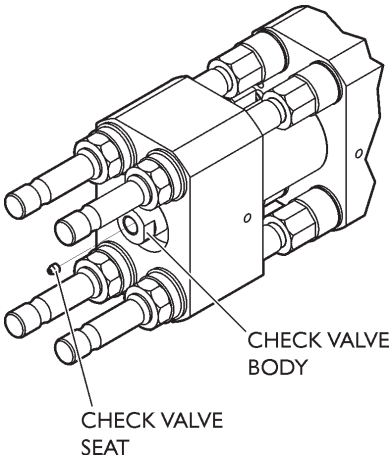
7. Lay out and inspect all components of the outlet check valve replacement kit.
8. Apply a small amount of Blue Lubricant to the threads of the outlet adapter and insert the old spring seat, new compression spring, and new outlet poppet into the bore in the order shown.



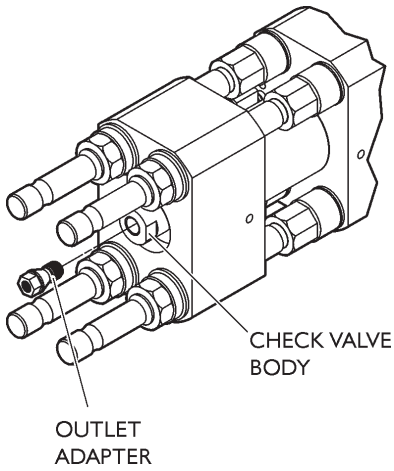
9. Apply Blue Lubricant to the surfaces of the new outlet check valve seat as shown and insert it into the bore of the check valve body.



Make sure the coned end is pointing out once installed, and that there is no Blue Lubricant on the sealing face of the outlet check valve seat.



10. Thread the outlet adapter into the check valve body. Torque to 200 ft-lb (271.2 N-m).



11. Reconnect the high-pressure tubing and the inlet water hose.

Notes

Maintenance Procedure F

Servicing the Low-Pressure Components

Tools required

Low-pressure assembly fixture plate (014030-1)
Torque multiplier
1½ in. socket (½ in. drive) and handle
1⅝ in. socket (½ in. drive)
½ in. drive torque wrench
½ in. drive ratchet
1 in. open-end wrench
⅞ in. open-end wrench
$^{13}/_{16}$ in. open-end wrench
Slotted screwdriver
Check valve outlet replacement kit (014885-1)
Shift pin tool assembly (002228-2)
Rubber mallet
4 x ⅜-16 UNC threaded screws
Blue Lubricant (A-2185)
Food-grade grease (A-4689)
Anti-seize (A-10039)
Parker Super O-ring Lube (200006)

Service steps

1. Shut down the system.

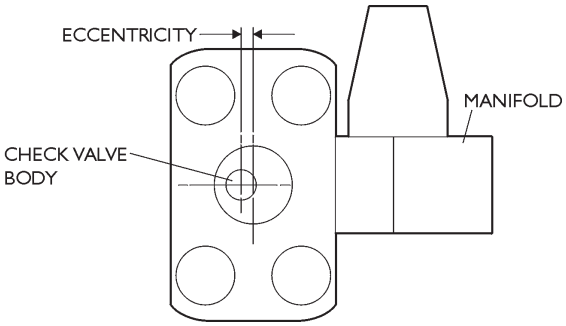
WARNING
Place the main electrical disconnect in the OFF position and bleed down the high-pressure lines. Place an "Out of Service" tag on the main electrical disconnect and lock it out. Failure to do so can cause equipment damage or injury to personnel.

2. Disconnect the inlet water hoses from the end caps.
3. Using two wrenches, disconnect the high-pressure tubing from the check valve outlet bodies. Loosen the other ends and move the tubing out of the way.
4. Unload the intensifier high-pressure tie rods at both ends of the intensifier.
   - See *Maintenance Procedure A*, Disassembling the Intensifier
5. Note the orientation of the check valve body by observing the position of the eccentrically positioned outlet body relative to the intensifier. This is important when reinstalling the check valve body—correct orientation is critical to ensure the correct fit of high-pressure tubing, which is affected by the eccentricity of the outlet body.

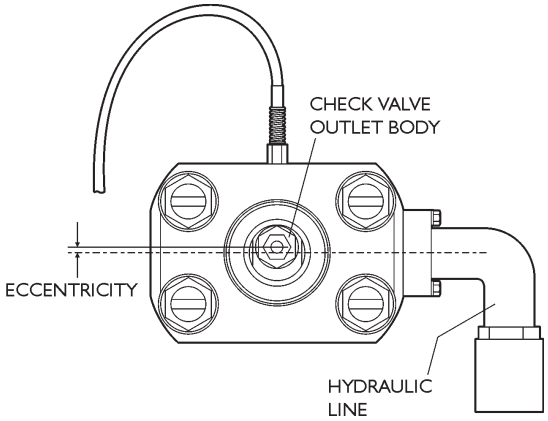
   Note: The check valve body is usually positioned with the outlet body away from the intensifier manifold block, but this may vary on some intensifiers.

   Check valve orientation of both the long-block and short-block intensifiers is shown on the next page.

014623-1 or -3 Long-block intensifier (StoneCrafter)

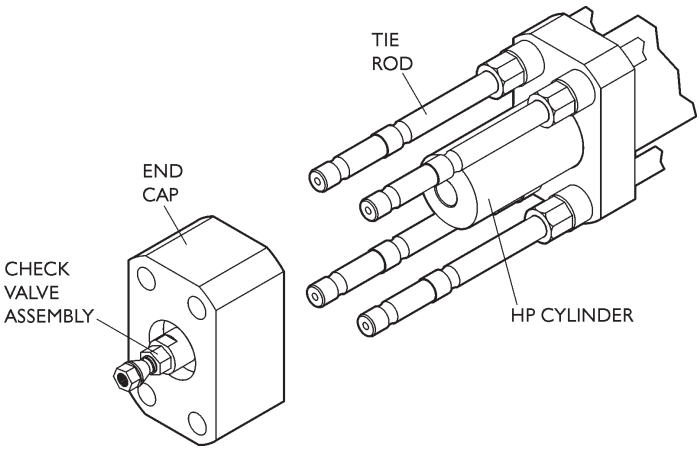


020070-1 Short-block intensifier (HyperPressure)

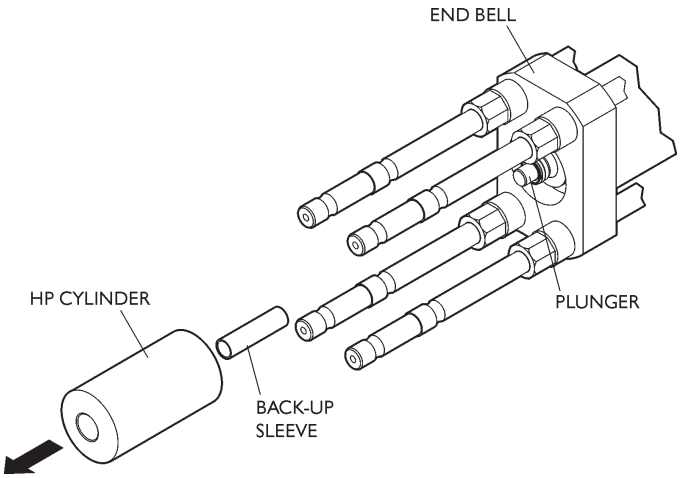


6. At one end of the intensifier, remove the end cap from the tie rods. The check valve assembly will remain in the end cap due to the compression of the o-ring on the check valve body.

   Note: Unless check valve maintenance is necessary (Maintenance Procedure D) it is not necessary to remove the check valve assembly from the end cap.



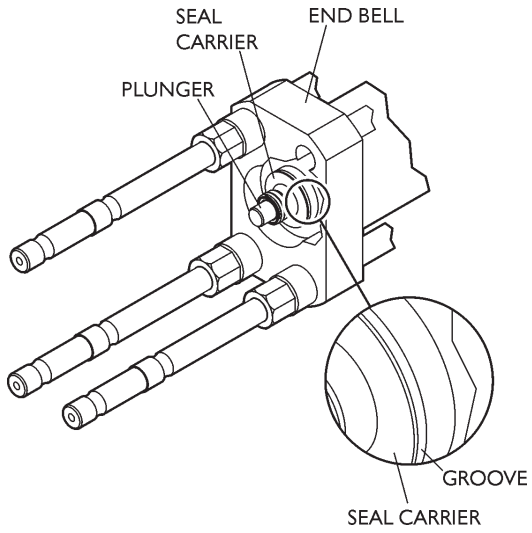
7. Remove the high-pressure cylinder and filler tube from the intensifier end bell. Rocking the cylinder gently while pulling outward is helpful in separating the cylinder from the end bell. When the cylinder is clear of the end bell pull it straight out to avoid the ceramic plunger.



8. Pry the seal carrier away from the end bell using a small pry bar in the groove provided, as shown.

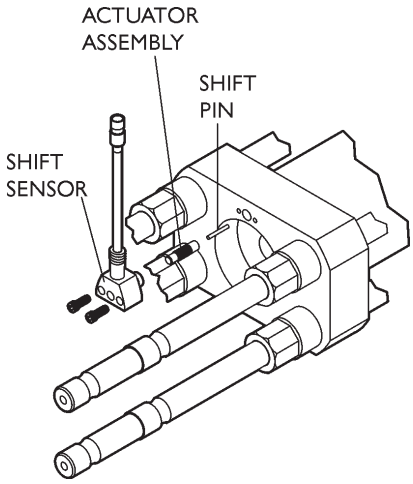
   Once the seal carrier is away from the end bell, remove it by hand by sliding it along the ceramic plunger.

   Discard the used seal carrier, o-ring, and high-pressure seal.



9. Repeat Steps 6–8 on the other end of the intensifier.

10. Remove the shift sensors. Use the shift pin tool to remove the shift pins. Refer to your pump manual for detailed instructions.



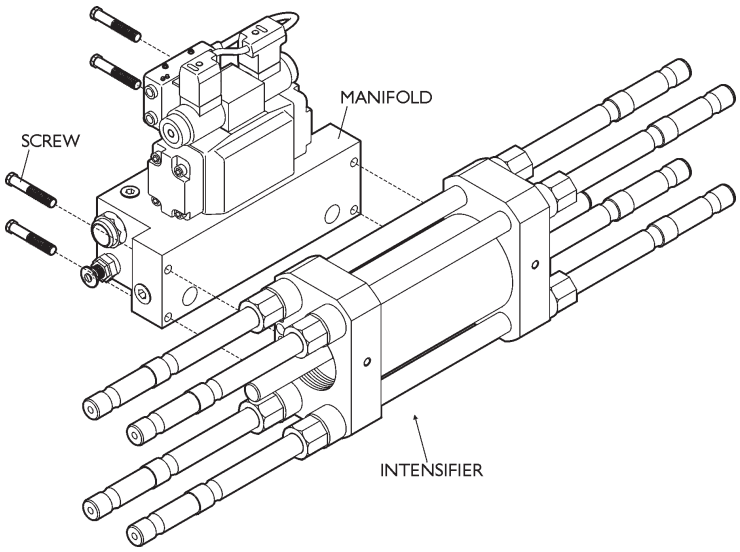
11. Loosen the screws that hold the manifold to the intensifier, then separate the two assemblies. Drain oil from the intensifier ports.

    If the intensifier is not connected to a hydraulic manifold, simply disconnect the hydraulic hose fittings from each end bell.

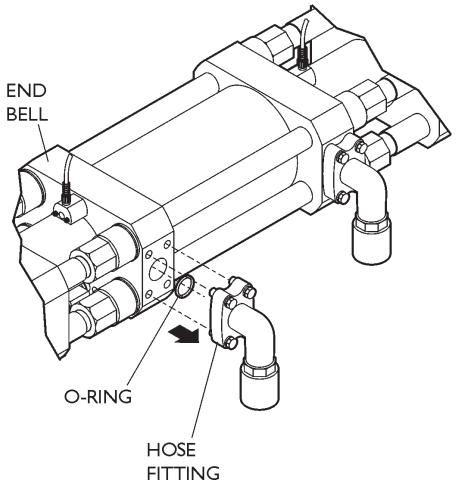
Short-block (HyperPressure) intensifier only

After Step 11, remove the bolts from the bottom of the intensifier so it will come off the pump. The best approach is to remove the two bolts on the top to remove the plate, which makes it easier to access the two bolts on the bottom.

014623-1 or -3 Long-block intensifier (StoneCrafter)



020070-1 Short-block intensifier (HyperPressure)

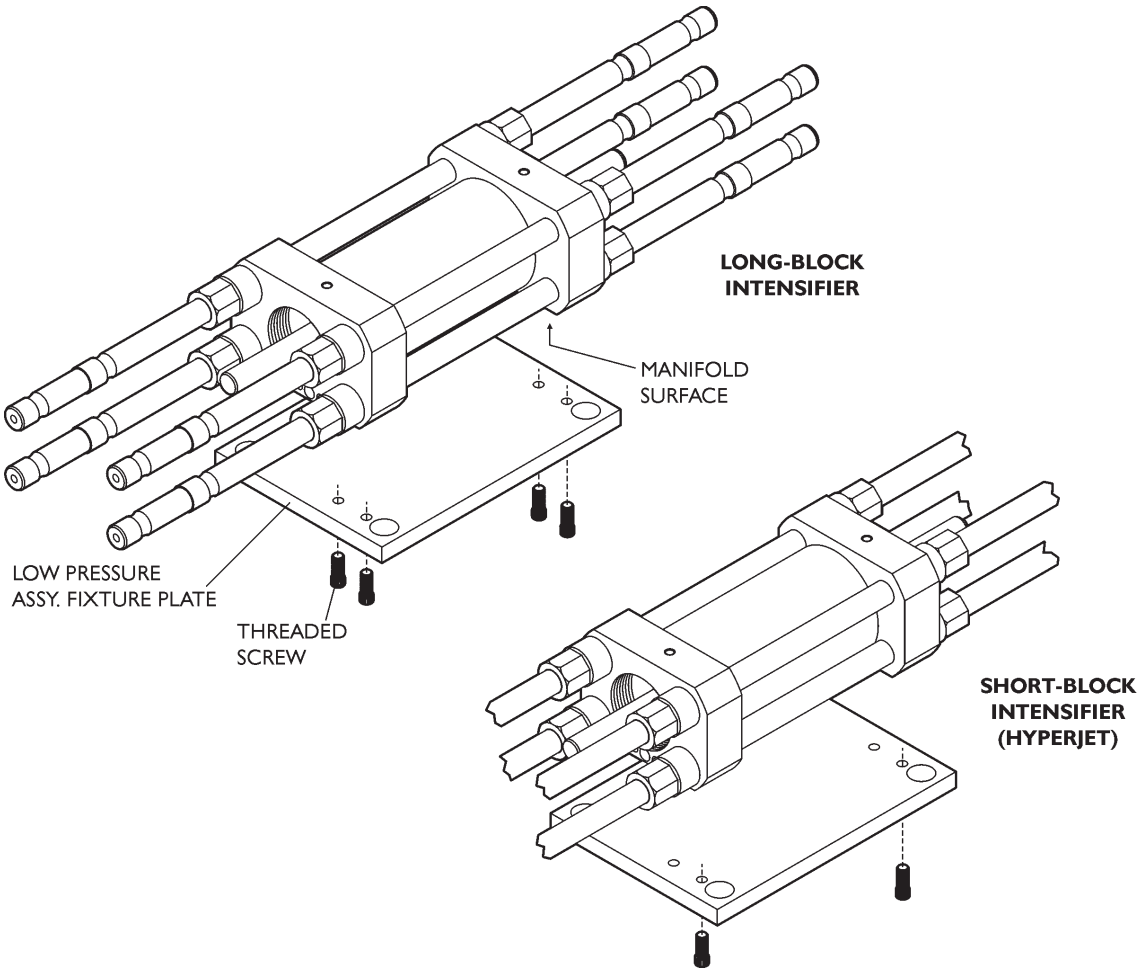


12. Securely bolt the fixture plate (014030-1) to a sturdy workbench.

> **WARNING**
> **Failure to properly mount the intensifier assembly fixture or secure the intensifier to the intensifier fixture could allow the parts to unexpectedly tip and fall, causing serious bodily injury.**

Place the intensifier on the low-pressure assembly fixture plate with the manifold surface facing down. Secure the intensifier to the fixture from below:

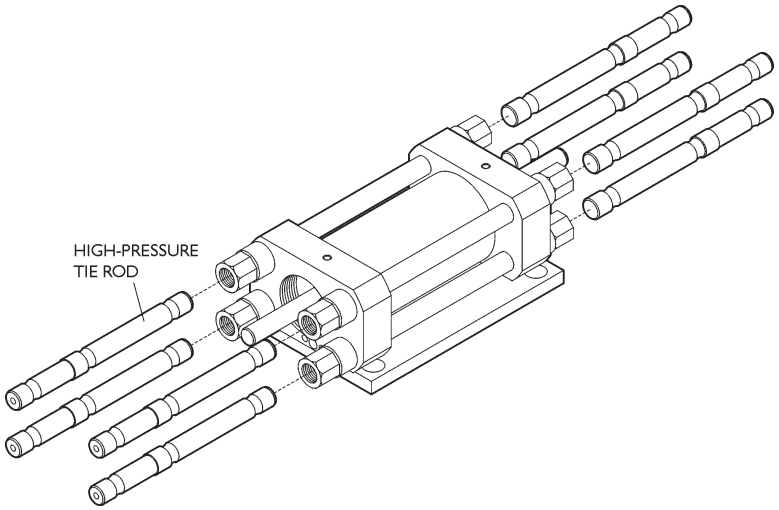
- For the long-block intensifier (StoneCrafter), use four ⅜-16 UNC threaded screws.
- For the short-block intensifier (HyperPressure), use two 5/8-18 UNF bolts



13. Remove the high-pressure tie rods.

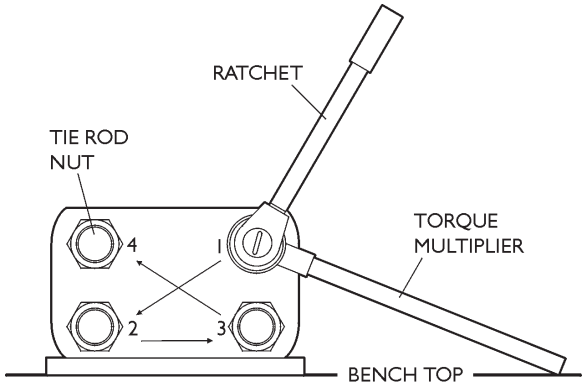
    If a tie rod is tight, use two nuts tightened back-to- back on the thread of the tie rod and loosen with an open-ended wrench.

CAUTION
Do not use a pipe wrench—it will mark the tie rod and cause premature tie rod failure.

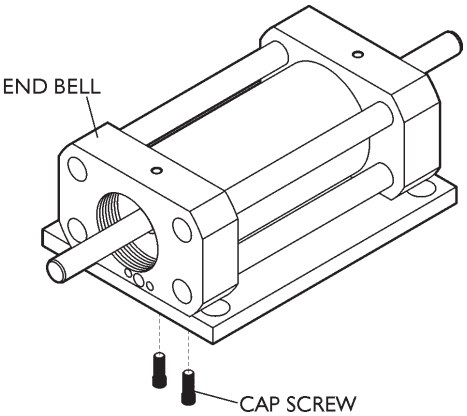


14. Use the ratchet handle and torque multiplier (as shown here) to loosen the tie rod nuts at **one** end of the low-pressure cylinder assembly.

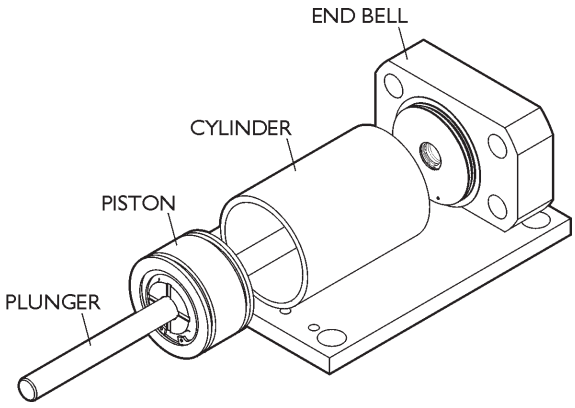
    Loosen the nuts in the figure-8 pattern shown below, turning each nut no more than ¼ turn at a time, repeating the sequence until nuts are loose. This will avoid overloading of the tie rods or nuts. Remove the tie rods, nuts, and washers and set aside.



15. Remove the cap screw(s) that hold one end bell to the intensifier assembly fixture. Using a mallet, tap the end bell free of the cylinder. Remove the end bell and set it aside.



16. Remove the cylinder from the other end bell. The piston and plungers can stay with the cylinder. Do not use a screwdriver to pry the cylinder from the end bell.



Remove the cap screw(s) holding the remaining end bell to the assembly fixture and set aside.

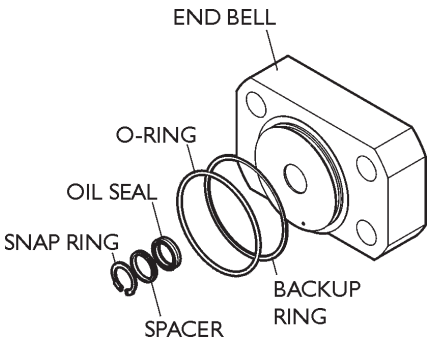
17. Use a dead blow hammer to drive the piston and plungers from the cylinder. Set the parts aside.

End bells

18. Remove the snap ring, spacer and oil seal from one end bell bore. Remove the large diameter o-ring and back-up ring from the end bell. Remove the large o-ring from the high-pressure cylinder side of the end bell.

CAUTION
Do not use a sharp tool to remove these parts—it will damage the parts.

Repeat this step for the other end bell.



19. Clean the hydraulic cylinder, end bells, oil seal spacers and snap rings. All service must be completed in a clean, well-lit area.

Inspect the parts for the following:

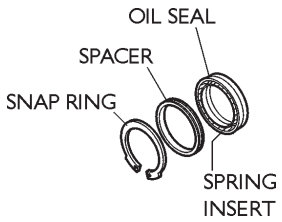
- Make sure the oil seal spacers are not warped or nicked.
- Make sure the snap rings are not bent and that they still have the appropriate tension.
- Check the end bells for damage to the sealing surfaces and grooves, and a damaged or out-of-round shift pin hole.
- Clean all surfaces of the low-pressure cylinder and inspect for any signs of damage or fatigue. Inspect the inner surface by looking through the cylinder angled toward a brightly lit white surface. If there is any damage to this surface that can be felt with a fingernail, discard the cylinder.

CAUTION
Do not reassemble the intensifier with a cylinder that has a damaged inner surface.

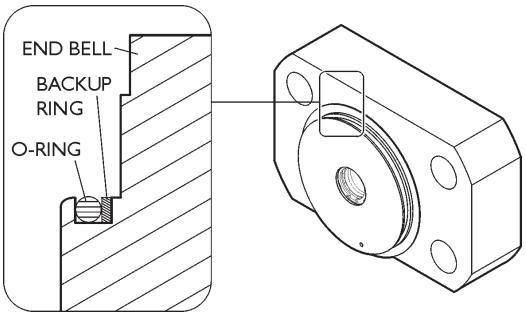
Sharp burrs on the beveled edge of the cylinder ID can damage the end bell o-ring and backup ring when the parts are assembled. Such damage can lead to immediate seal failure and excessive hydraulic oil loss.

20. Apply clean hydraulic oil or Parker Super O-ring Lube to a new oil seal and install it in an end bell with the spring insert visible. (See orientation in illustration below, and in Step 18.)

Take care not to collapse the oil seal spring insert when installing. Place the spacer on top of the seal and install the snap ring.



21. Apply clean hydraulic oil or Parker Super O-ring Lube to the new backup ring. Locate the molding marks, and install the backup ring so the molding marks face the end bell. Lubricate the new o-ring and place it in the groove on top of the backup ring. The o-ring must be outside of the backup ring, facing the low-pressure cylinder.



Reinstall the o-ring removed in Step 18 from the high-pressure cylinder side of the end bell.

22. Repeat Steps 20–21 for the other end bell, then set both end bells aside and cover with a lint-free cloth.

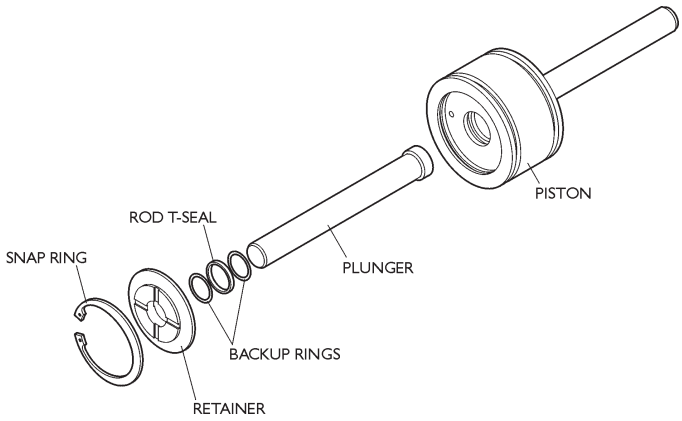
Piston and plungers

Disassemble the piston and plungers for any of these reasons:

- One or both of the plungers need to be replaced.
- The piston needs to be replaced.
- A plunger has excessive lateral movement relative to the piston biscuit. (Excessive lateral movement is anything over ⅛ in. off center line at the plunger tip.)

If any of the above apply, continue with Step 23. Otherwise, skip to Step 29.

23. Remove the snap ring and retainer (blow air down between the plunger and the retainer bore to loosen the retainer). Remove the plunger by hand.
    - Repeat for the other plunger. Set plungers aside.

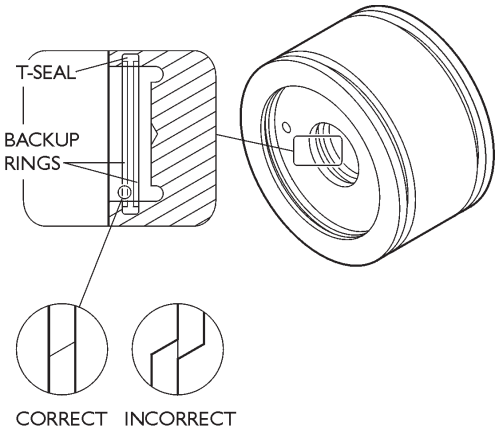


24. Remove the T-seals from the piston. Do not scratch the piston sealing surfaces.
25. Clean all parts of the piston assembly. Make sure oil, dirt, and burrs are removed from all surfaces.

    Notes:

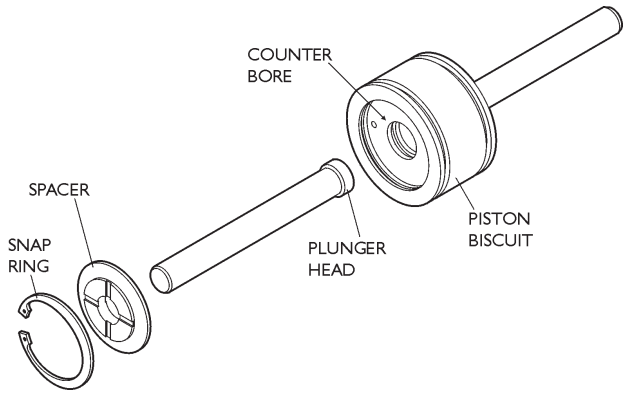
    - Inspect the plungers carefully. Nicks, scratches, or pits will cause premature failure of high-pressure seals.
    - Plungers cannot be reworked in the field. Contact Flow Technical Service for information on factory rework of plungers.
    - Inspect the piston for cracks; replace as needed.

26. Lubricate the new T-seals and backup rings with Parker O-Ring Lube (200006). Place two backup rings and one T-seal in each piston groove. The must be in the middle of the two backup rings.



27. Apply clean hydraulic oil or Parker Super O-Ring Lube to the head of the plunger. Insert the plunger into the counter bore in the piston, using a soft mallet if needed. Make sure the T-seals do not get nicked or rolled.

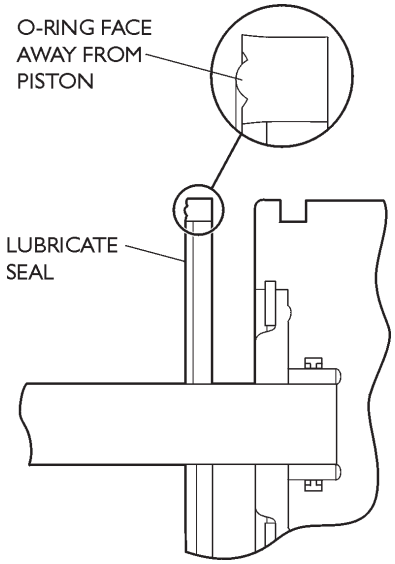
    Slide the spacer over the plunger with the large end facing in. Install the snap ring into the groove.



28. Repeat Steps 23–27 for the other plunger.

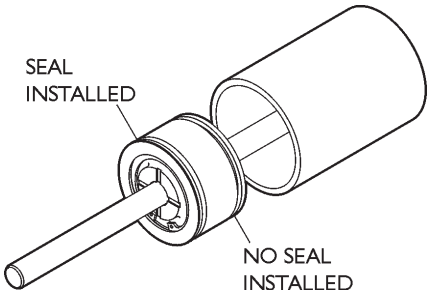
Low-pressure cylinder

29. Apply clean hydraulic oil or Parker Super O-Ring Lube to one new seal and the inside of the low-pressure cylinder. Install the seal onto the piston with the flared (o-ring) face toward the outside of the piston.



30. Slide the piston and plunger assembly containing one seal into the cylinder so that the empty groove enters the cylinder first. Use a soft-faced mallet where necessary.

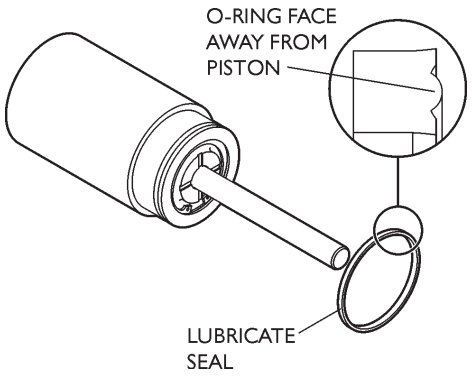
CAUTION
Take care when the seal enters the cylinder. It is compressed at this point and can easily be damaged by rough handling.



31. Continue sliding the piston into the cylinder until the *empty* seal groove on the piston exits the other end of the cylinder.

CAUTION
If the seal starts to come out of the end of the cylinder, do not force it back against the flare. Instead, push the whole piston assembly through and start again, this time stopping before the seal appears.

32. Apply clean hydraulic oil or Parker Super O-Ring to the seal and install it in the groove on the piston, making sure the flared o-ring face is toward the outside of the piston.



33. Slide the piston and plunger back into the cylinder. Take care when the seal is being compressed as it enters the cylinder—the seal can easily be damaged by rough handling at this point.

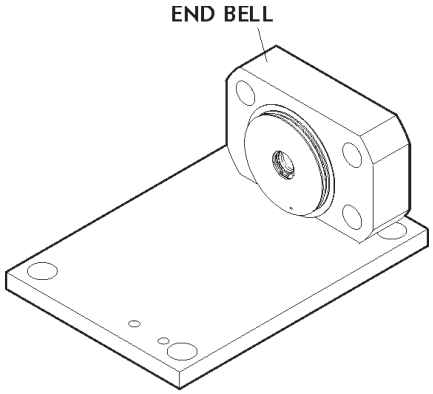
    Note: Centering the piston will make intensifier re-assembly easier.

Set the cylinder containing the piston and plunger assembly aside.

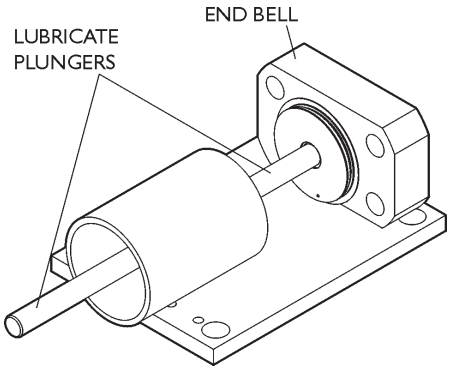
34. Mount an end bell to the assembly fixture. Insert the fixture plate screw(s) and fasten finger tight.

    Notes:

    - The short-block intensifier has one fixture plate screw; the long-block intensifier has two screws.
    - The backup ring and o-ring were lubricated and installed in Step 21.

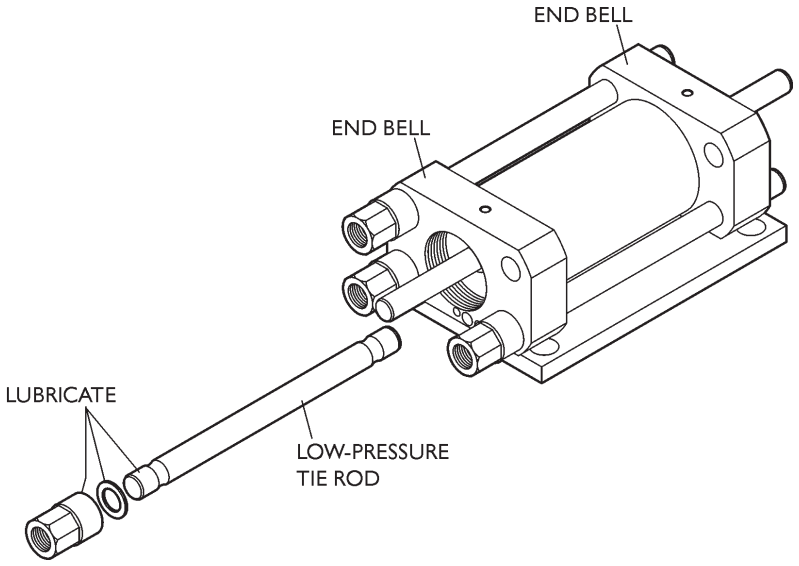


35. Apply clean hydraulic oil or Parker Super O-Ring Lube to both plungers. Install the cylinder by inserting the plunger into the end bell.

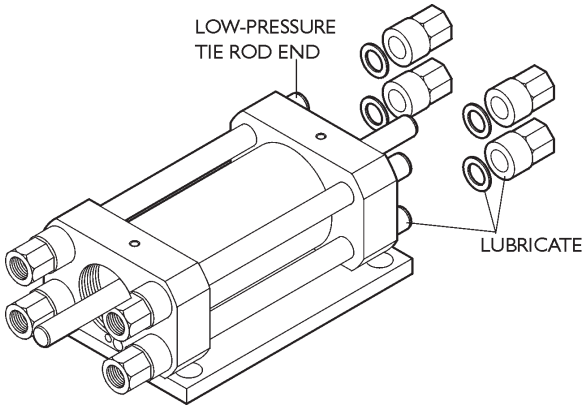


36. Slide the remaining end bell over the other plunger and seat it on the assembly fixture.

37. Thoroughly clean the tie rods to ensure no old anti-seize lubricant remains (it can interfere with proper torque up). Then apply fresh anti-seize lubricant (A-10039) to one end of the low-pressure tie rods and to the faces of the washers and nuts. Run the nuts onto the tie rods until they bottom out, then slide the tie rods through the two end bells.

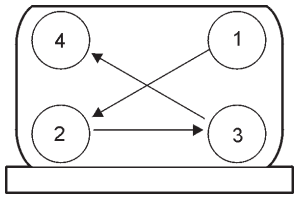


38. Apply anti-seize lubricant to the exposed threads of the tie rods and the faces of the washers and nuts. Install the nuts onto the tie rods hand tight.



39. Draw the low-pressure cylinder carefully onto the end bells by tightening the nuts evenly in a figure-8 pattern, as shown below. Be careful not to nick the seals and back-up rings. There must be no seal or back-up ring debris visible at the cylinder/end bell interface. Be sure to check for any problems before continuing.

    Following the figure-8 pattern shown below, torque all nuts evenly to 20 ft-lb (27 N-m) to seat all parts.

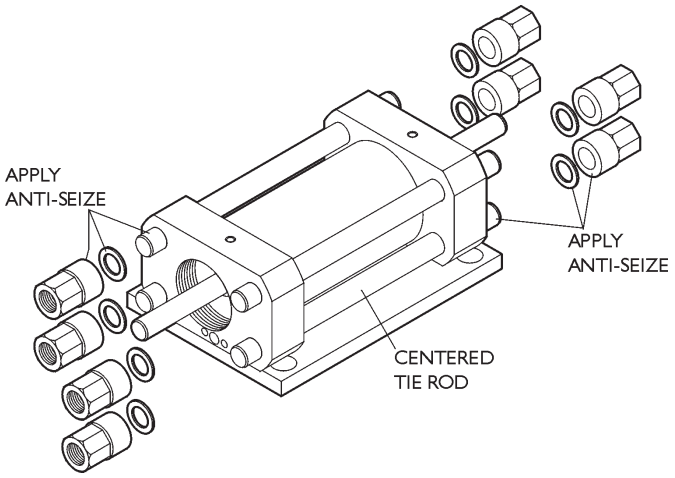


40. Loosen and remove nuts and washers from **both** ends of the tie rods.
41. Visually center the tie rods between the end bells, leaving the same number of tie rod threads exposed on both sides of the assembly. Apply anti-seize lubricant to the faces of all mating components.

Center and hold the tie rods in place while installing the washers and nuts onto the tie rods. Secure the nuts hand tight.

42. Insert the second fixture plate screw (the long-block intensifier has a pair) into the second end bell. Tighten both sets of fixture plate screws to 30 ft-lb (41 N-m). The screws must hold the end bells tight against the fixture to prevent any misalignment.

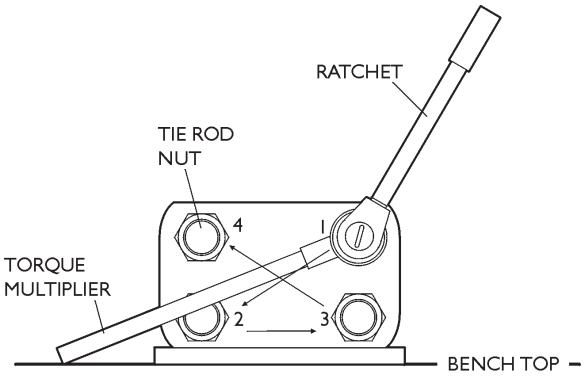
    Retighten the tie rod nuts to 20 ft-lb (27 N-m) to keep the end bells seated.



43. Tighten the tie rod nuts at one end of the tie rods only, while restraining the nuts on the other end using a suitable wrench, moving from one nut to the next in a figure-8 pattern (shown on this page).

    Note: You *must* follow this torque pattern (1-2-3-4). Correctly moving from nut 2 to nut 3 crosses the LONG dimension of the rectangular end bell. DO NOT substitute with the pattern 1-2-4-3.

    Using the torque wrench (and the torque multiplier when necessary), tighten the nuts not more than ¼ turn at a time, following the figure-8 sequence.



Notes for using a torque multiplier

- When using a torque multiplier, the torque wrench setting must be calculated as follows:

  TORQUE WRENCH SETTING =
  REQUIRED NUT TORQUE ÷ ACTUAL MULTIPLIER RATIO

  The actual multiplier ratio must be obtained from the multiplier tool instructions. Beware that a tool may be named with an implied multiplication ratio that is not the actual ratio (for instance, a tool named X4 that has an actual multiplication ratio of 3.86 to 1).

  Example: To obtain the 400 ft-lb nut torque using a multiplier with a multiplication ratio of 3.92 to 1 will require a torque wrench setting of:

  TORQUE WRENCH SETTING =
  400 FT-LB ÷ 3.92 = 102 FT-LB

  Torque all four nuts at one end to 200 ft-lb (271 N-m), then 400 ft-lb (542 N-m), then 535 ft-lb (725 N-m).

44. Remove the intensifier from the assembly fixture and install on the pump frame.
45. Lubricate the manifold o-rings (see illustration on Page 62) with food grade grease and place them in the end bells. Bring the hydraulic manifold and the intensifier together and secure them with the original cap screws. Tighten the cap screws to 35 ft-lb (47 N-m).

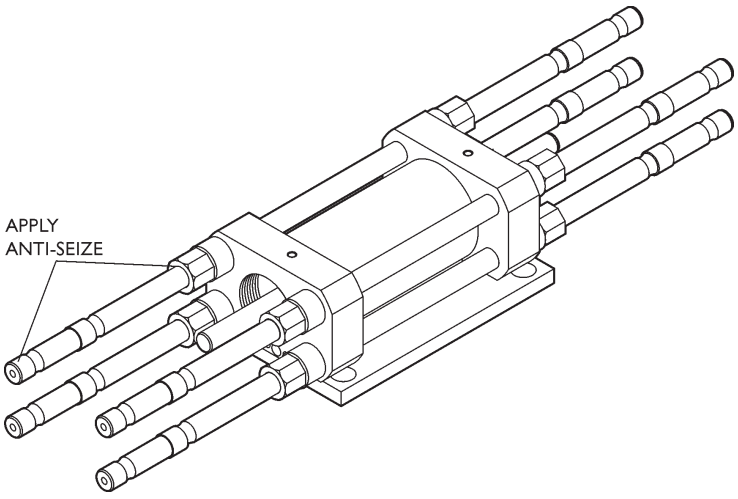
    If your intensifier does not connect directly to the hydraulic manifold, simply replace the hydraulic lines. Take care to ensure proper lubrication and placement of the o-rings.

Short-block (HyperPressure) intensifier ONLY

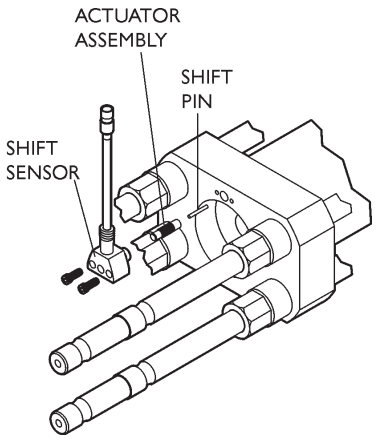
Reattach the intensifier to the plate removed in Step 11.

Procedure continues

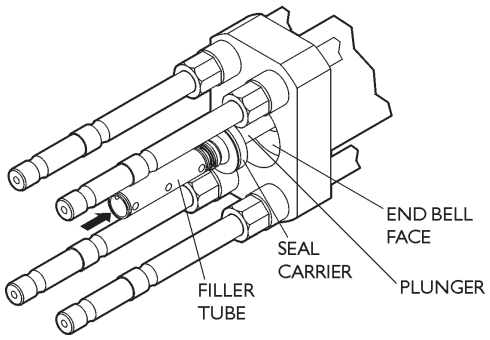
46. Apply anti-seize to all threads of the high-pressure tie rods and thread into the nuts (hand tight).



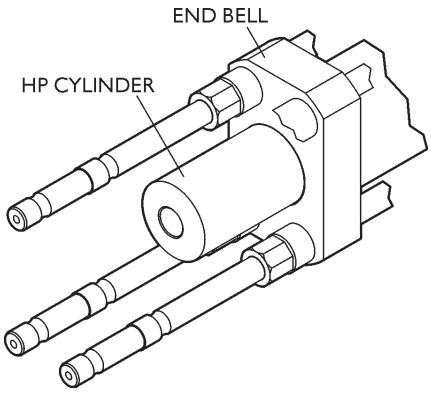
47. Install shift pins and shift sensors. Refer to your pump manual for detailed instructions.



48. Place the seal carrier assembly onto the plunger end, then using the filler tube as a tool, push the assembly along the plunger until it butts against the end bell face.

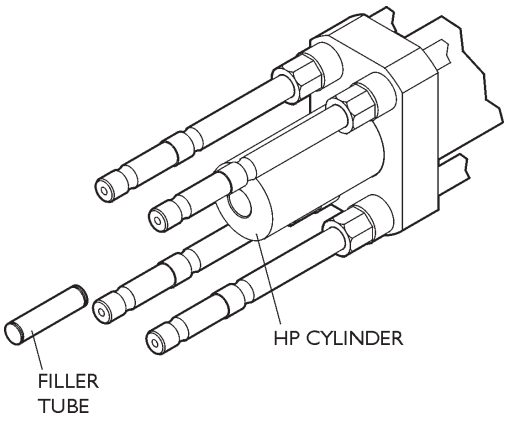


49. Install the high-pressure cylinder by sliding it over the ceramic plunger and into the end bell bushing. A slight rocking motion will help ease the cylinder into position**.**

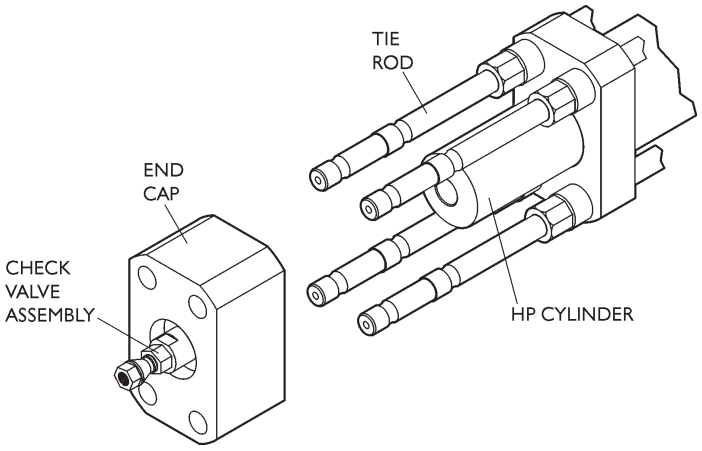


50. Install the filler tube in the high-pressure cylinder.

CAUTION
Make sure the filler tube is oriented correctly. There is a wall inside the tube that must be at the outermost end of the tube when it is inserted. Failure to orient the tube correctly will damage the intensifier assembly.

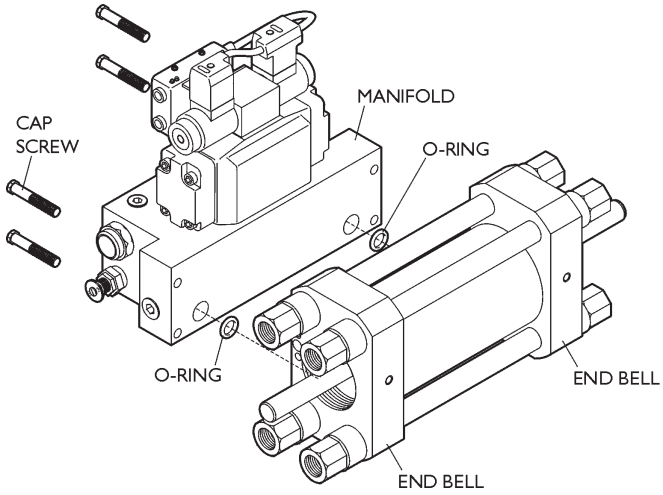


51. Reinstall the check valve assembly and end cap by sliding it along the tie rods and guiding the high-pressure cylinder into the bronze bushing of the end cap. Take care to align the check valve assembly with the correct orientation as previously noted in Step 5.

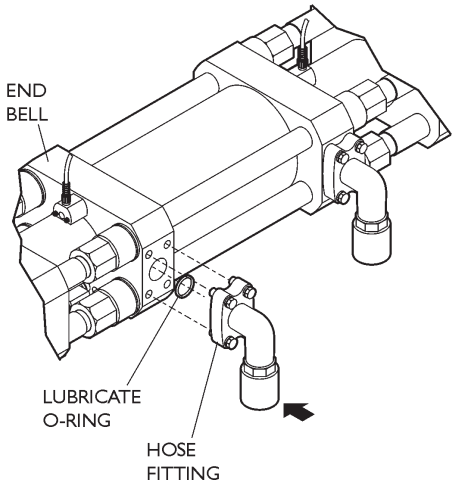


52. Repeat Steps 48–51 at the other end of the intensifier.
53. Reload the intensifier tie rods.
    - See *Maintenance Procedure A*, Assembling the Intensifier
54. Reconnect the high-pressure tubing and the inlet water hoses.

014623-1 or -3 Long-block intensifier (StoneCrafter)



020070-1 Short-block intensifier (HyperPressure)



Notes

CHAPTER 4

Troubleshooting

The troubleshooting guide will help you identify the probable cause of a malfunction and the most effective corrective action.

Leakage from weep holes

Water or oil leaking from weep holes give clues to the condition of intensifier components. Intensifier weep holes and other locations are identified on the illustrations on the following two pages, with the most probable cause of failure noted. If leakage is minimal, no action may be necessary.

The troubleshooting tables in this chapter are keyed to the weep hole graphics by letter. They provide a more detailed description of how to troubleshoot using weep holes, and the necessary corrective actions.

Corrective actions

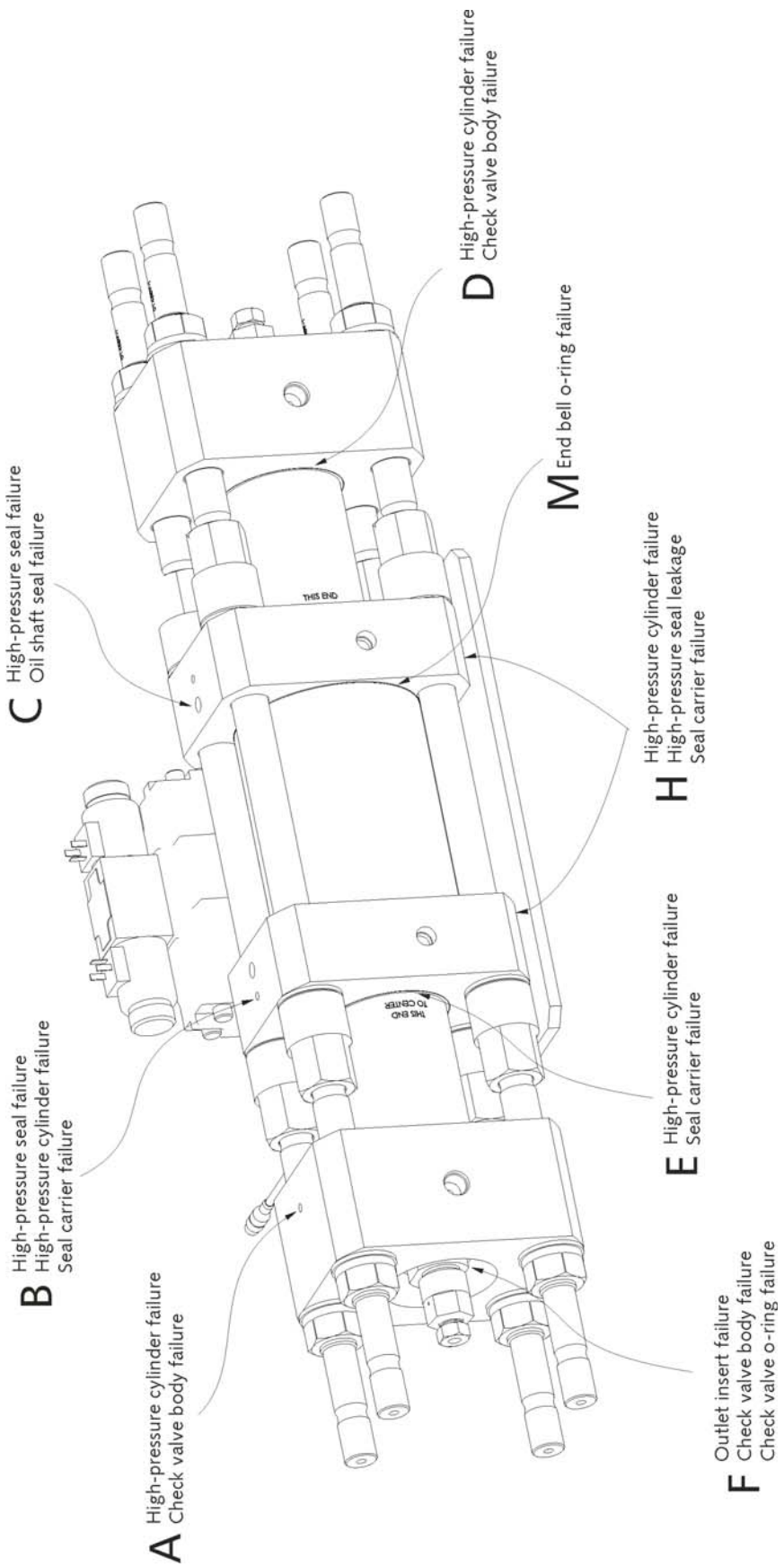
The corrective action listed on a troubleshooting table is a condensed summary of the service required to remedy the problem. When you encounter a malfunction:

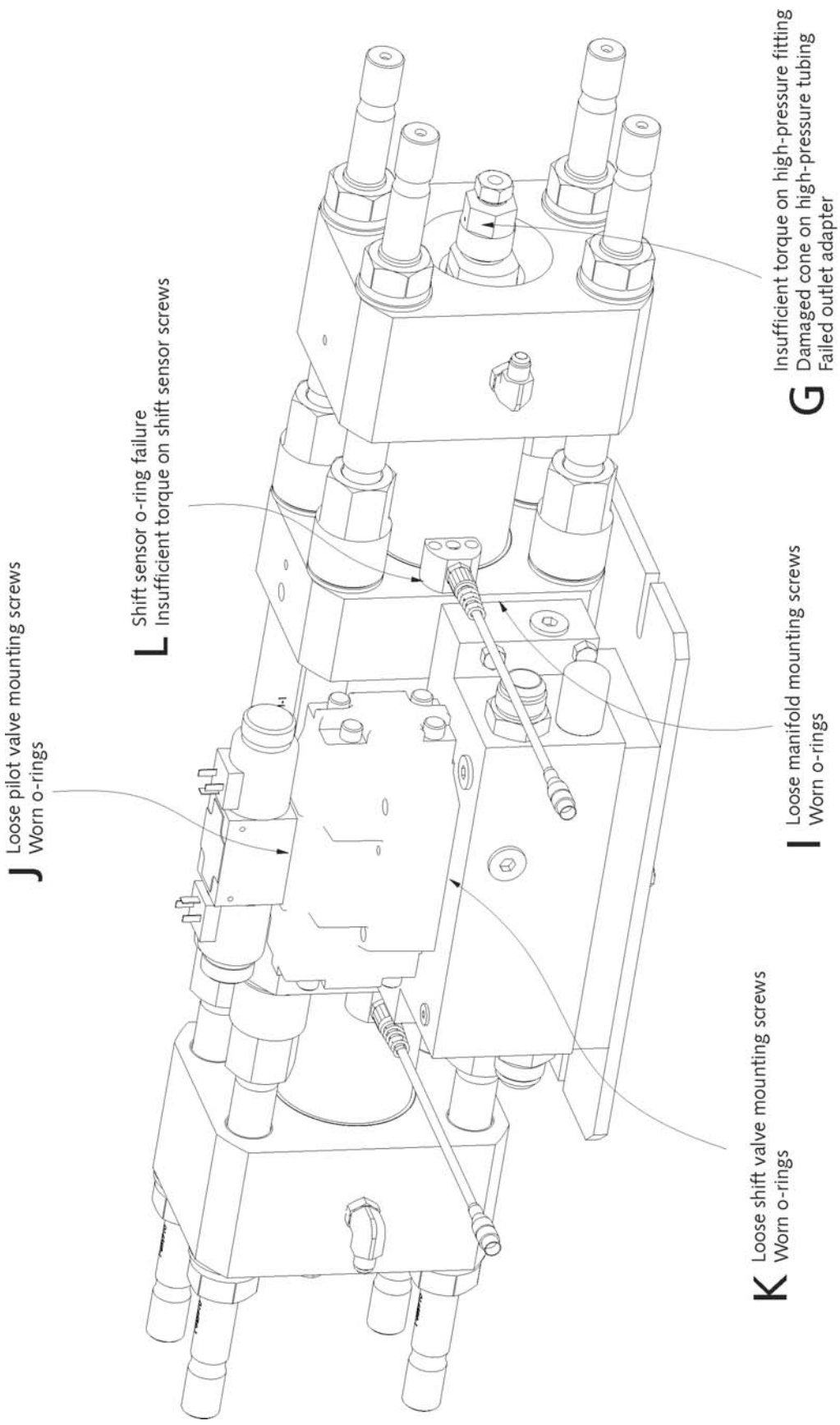
1. Carefully and precisely define the problem.
2. On the troubleshooting table, locate the symptom that most closely resembles your assessment of the problem.
3. Identify the most likely probable cause.
4. Follow the corrective action procedure.

If the symptoms in the chart do not correspond to your malfunction, or if the problem is not resolved or eliminated by the recommended corrective action, contact Flow Technical Service.

Other possible malfunctions

At the end of this chapter is a troubleshooting table that lists intensifier malfunctions that do not exhibit leakage from weep holes. These are listed in order from most likely to least likely to occur.




J Loose pilot valve mounting screws
Worn o-rings
L Shift sensor o-ring failure
Insufficient torque on shift sensor screws
G Insufficient torque on high-pressure fitting
Damaged cone on high-pressure tubing
Failed outlet adapter
I Loose manifold mounting screws
Worn o-rings
K Loose shift valve mounting screws
Worn o-rings

Weep hole A

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Steam with each stroke	Hot/warm	Incorrect loading of intensifier tie rods	Water leakage from C,B,D,E	A	—
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,D	Check valve assembly 020071-1
Large flow with each stroke	Hot/warm	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,D	Check valve assembly 020071-1
Continuous flow or steady drip	Cold	Incorrect loading of intensifier tie rods	Leaks even when pump is stopped and inlet water pressure exists	A	—
		Debris between sealing surfaces	Leaks even when pump is stopped and inlet water pressure exists	A	—

Weep hole B

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		***Likely problem***	***Other possible symptoms***	***Maintenance procedure***	***Kit or parts needed***
Qty.	***Temp.***				
Steam with each stroke	Hot/warm	Incorrect loading of intensifier tie rods	Water leakage from A,C,D,E	A	—
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
Small drip with each stroke	Warm	High-pressure seal leakage	*Note: a small amount of leakage is normal during operation*		
Large flow with each stroke	Warm/hot	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
		High-pressure seal failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)

Weep hole C

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Note: Seal leakage is normal during intensifier operation. This normal leakage can start soon after new seal installation, and does not damage intensifier components. A seal has failed and must be replaced only when the cutting performance becomes unacceptable due to the drop in UHP water pressure caused by the seal leak.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Steam with each stroke	Hot/warm	Incorrect loading of intensifier tie rods	Water leakage from A,B,D,E	A	—
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
Large flow with each stroke OR energetic leakage*	Warm/hot	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
		High-pressure seal failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)

OIL LEAKAGE

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Oil leakage from hydraulic shaft seal	*Note: a small amount of leakage is normal during operation*		
Small periodic flow	Warm	Oil leakage from hydraulic shaft seal	—	A,F	Low-pressure seal kit 013157-1 or 020080-1

Location D

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Steam with each stroke	Hot/warm	Incorrect loading of intensifier tie rods	Water leakage from A,B,C,E	A	—
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,D	Check valve assembly 020071-1
Large flow with each stroke	Hot/warm	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,D	Check valve assembly 020071-1
Continuous flow or steady drip	Cold	Incorrect loading of intensifier tie rods	Leaks even when pump is stopped and inlet water pressure exists	A	—
		Debris between sealing surfaces	Leaks even when pump is stopped and inlet water pressure exists	A	—

Location E

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Steam with each stroke	Hot/warm	Incorrect loading of intensifier tie rods	Water leakage from A,B,C,D	A	—
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
Small drip with each stroke	Warm	High-pressure seal leakage	*Note: a small amount of leakage is normal during operation*		
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
Large flow with each stroke	Hot/warm	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)

Location F

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Small drip with each stroke	Warm	Outlet insert failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Check valve outlet replacement kit 014885-1
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Check valve assembly 020071-1
		Damaged outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Outlet adapter 042101-1
		Insufficient torque between outlet adapter and check valve body	• Pump cannot maintain pressure • Uneven intensifier stroking	Torque adapter to 200 ft-lb as described in E1	—
Large flow with each stroke	Warm/hot	Outlet insert failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Check valve outlet replacement kit 014885-1
		Check valve body failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Check valve assembly 020071-1
		Damaged outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking	A,E	Outlet adapter 042101-1
		Insufficient torque between outlet adapter and check valve body	• Pump cannot maintain pressure • Uneven intensifier stroking	Torque adapter to 200 ft-lb as described in E1	—
Continuous flow or steady drip	Cold	Check valve body o-ring failure	Leaks even when pump is stopped and inlet water pressure exists.	A,E	O-ring A-0275-131

Location G

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Small drip with each stroke	Warm	Insufficient torque between high-pressure gland and outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking	Refer to Small High-Pressure Components manual	
		Damaged cone on high-pressure tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure collar not threaded far enough onto high-pressure tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure tubing not threaded far enough along length of tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure tubing failure or failed outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking		
Large flow with each stroke	Warm/hot	Insufficient torque between high-pressure gland and outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking		
		Damaged cone on high-pressure tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure collar not threaded far enough onto high-pressure tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure tubing not threaded far enough along length of tubing	• Pump cannot maintain pressure • Uneven intensifier stroking		
		High-pressure tubing failure or failed outlet adapter	• Pump cannot maintain pressure • Uneven intensifier stroking		

Location H

WATER LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 64-65.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Small drip with each stroke	Warm	High-pressure seal leakage	*Note: A small amount of leakage is normal during operation*		
		High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
Large flow with each stroke	Warm/hot	High-pressure cylinder failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,C	High-pressure cylinder 020592-1 (2 per intensifier)
		Seal carrier failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)
		High-pressure seal failure	• Pump cannot maintain pressure • Uneven intensifier stroking	A,B	High-pressure seal cartridge 052190-1 or 040015-1 (2 per intensifier)

OIL LEAKAGE

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Oil leakage from hydraulic shaft seal	*Note: a small amount of leakage is normal during operation*		
Small periodic flow	Warm	Oil leakage from hydraulic shaft seal	—	A,F	Low-pressure seal kit 013157-1 or 020080-1

Location I

OIL LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 66–67.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Loose manifold mounting screws	—	Retorque manifold mounting screws as described in your pump manual.	
		Worn or pinched o-rings	—	Service o-rings as described in your pump manual.	
		Misaligned end bells	—	F	—

Location J

OIL LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 66–67.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Loose pilot valve mounting screws	—	Retorque pilot valve mounting screws as described in your pump manual.	
		Worn o-rings	—	Service o-rings as described in your pump manual.	

Location K

OIL LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 66–67.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Loose shift valve mounting screws	—	Retorque shift valve mounting screws as described in your pump manual.	
		Worn o-rings	—	Service o-rings as described in your pump manual.	

Location L

OIL LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 66–67.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Loose shift sensor mounting screws	—	Retorque shift sensor mounting screws as described in your pump manual.	
		Worn o-rings	—	Service o-rings as described in your pump manual.	

Location M

OIL LEAKAGE

Weep holes and locations are identified on the illustrations on Pages 66–67.

Fluid		*Likely problem*	*Other possible symptoms*	*Maintenance procedure*	*Kit or parts needed*
Qty.	*Temp.*				
Occasional drip	Warm	Worn o-rings	—	A,F	Low-pressure seal kit 013157 or 020080-1

Other possible problems/symptoms for the intensifier

Intensifier does not shift

- High-pressure waterjet on/off valve closed
- Waterjet orifice clogged with debris
- Shift sensor cable is disconnected
- Intensifier disabled at PLC
- Hydraulic pressure setting too low (applies only to intensifier pumps with multiple hydraulic pumps and multiple intensifiers, such as 20XW or 30XQ)
- Faulty shift sensor spring or shift pin
- Faulty shift valve
- Faulty pilot valve
- Faulty integrated shift module

Intensifier shifting loudly (knocking)

- Using a large orifice (this may be a normal mode of operation)

Intensifier does not produce desired pressure

- Waterjet orifice is too large
- Damaged waterjet orifice
- Failed (leaking) high-pressure tubing or on/off valve
- Failed inlet or outlet check valve poppets
- Hydraulic pressure setting is too low
- Failed hydraulic pump
- Failed main system relief valve

Intensifier strokes noticeably faster in one direction than the other

- Failed inlet or outlet check valves
- Faulty shift sensor spring or shift pin
- Failed low-pressure seal
- Faulty shift valve
- Faulty pilot valve

Persistently low seal life

- Poor inlet water quality
- Worn UHP plungers
- Pump running at higher than rated pressure
- Inlet water temperature too high
- Hot hydraulic oil
- Improper loading of the tie rods (see Maintenance Procedure A)

Damaged inlet face of check valve body

- Debris in water
- Inlet check valve support (010564-1) has rotated

Filler tube stuck in UHP cylinder

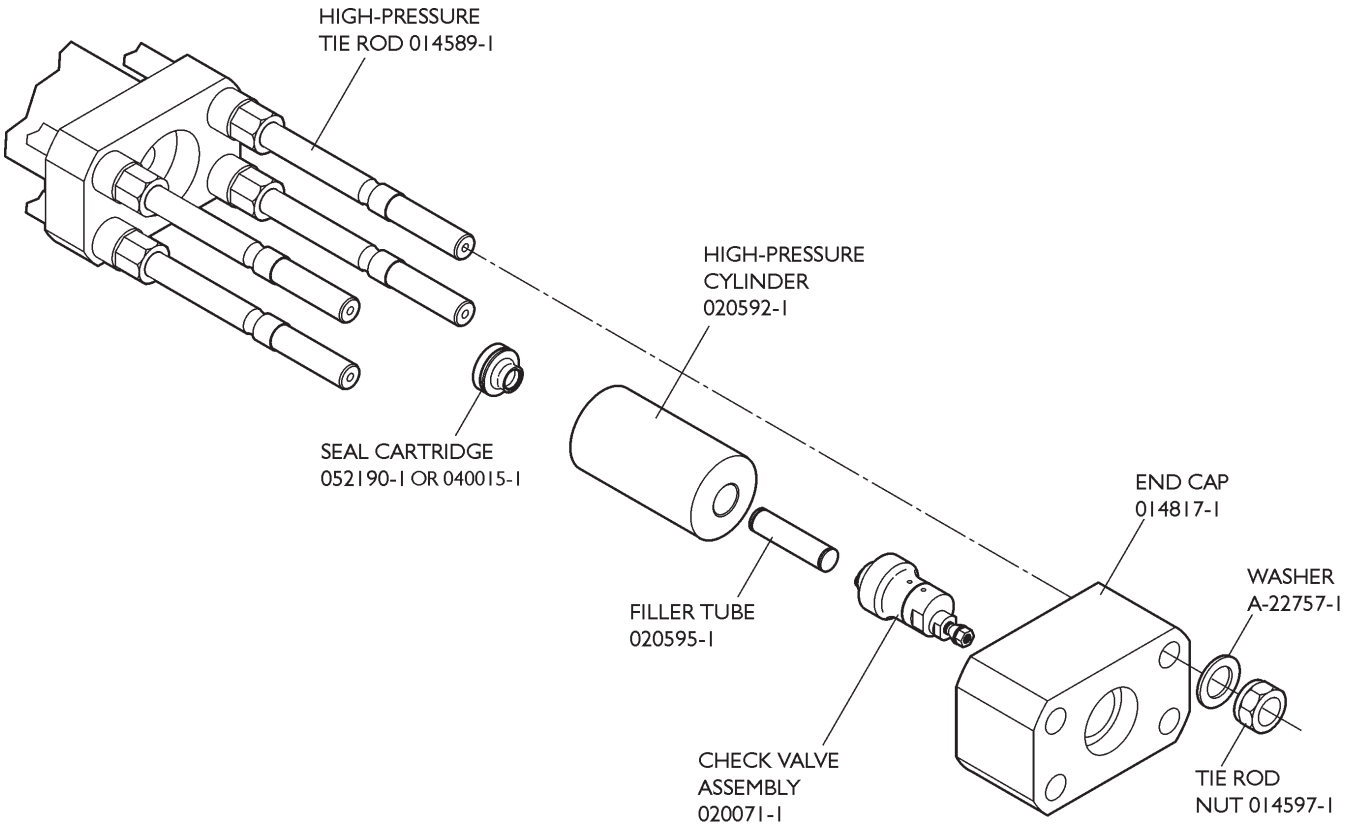
- This can occur occasionally. Remove the filler tube by pulling it from the end of the cylinder.

CHAPTER 5

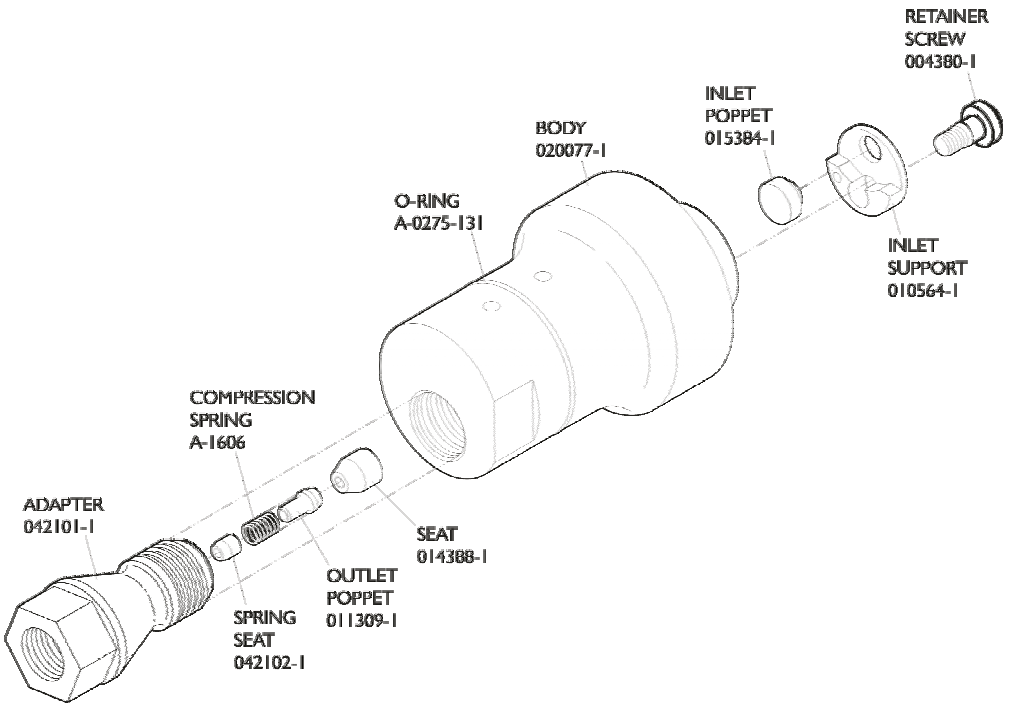
Parts Lists

Intensifier assemblies 014623-1 or -3 and 020070-1

High-pressure end

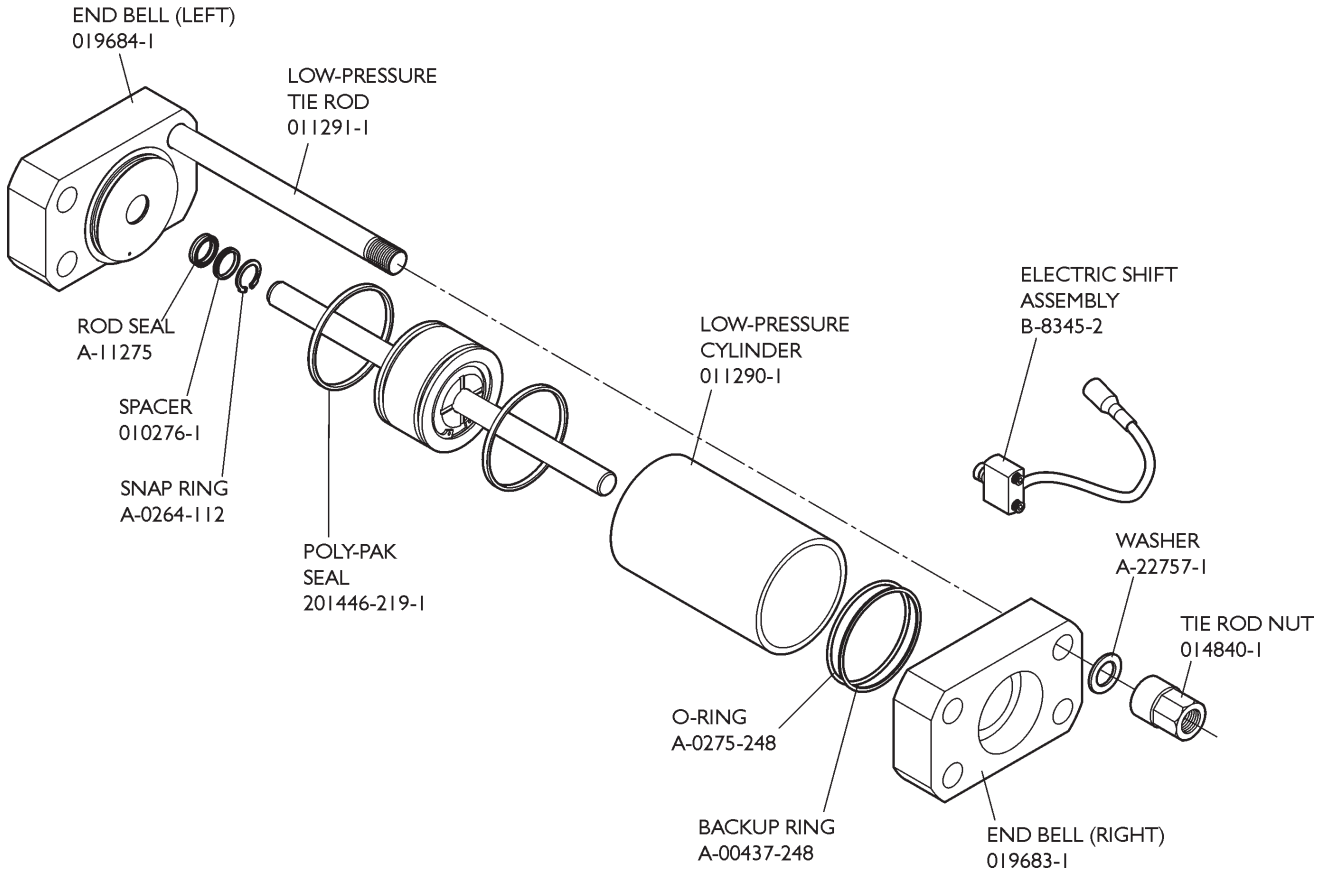


020071, Check valve assembly



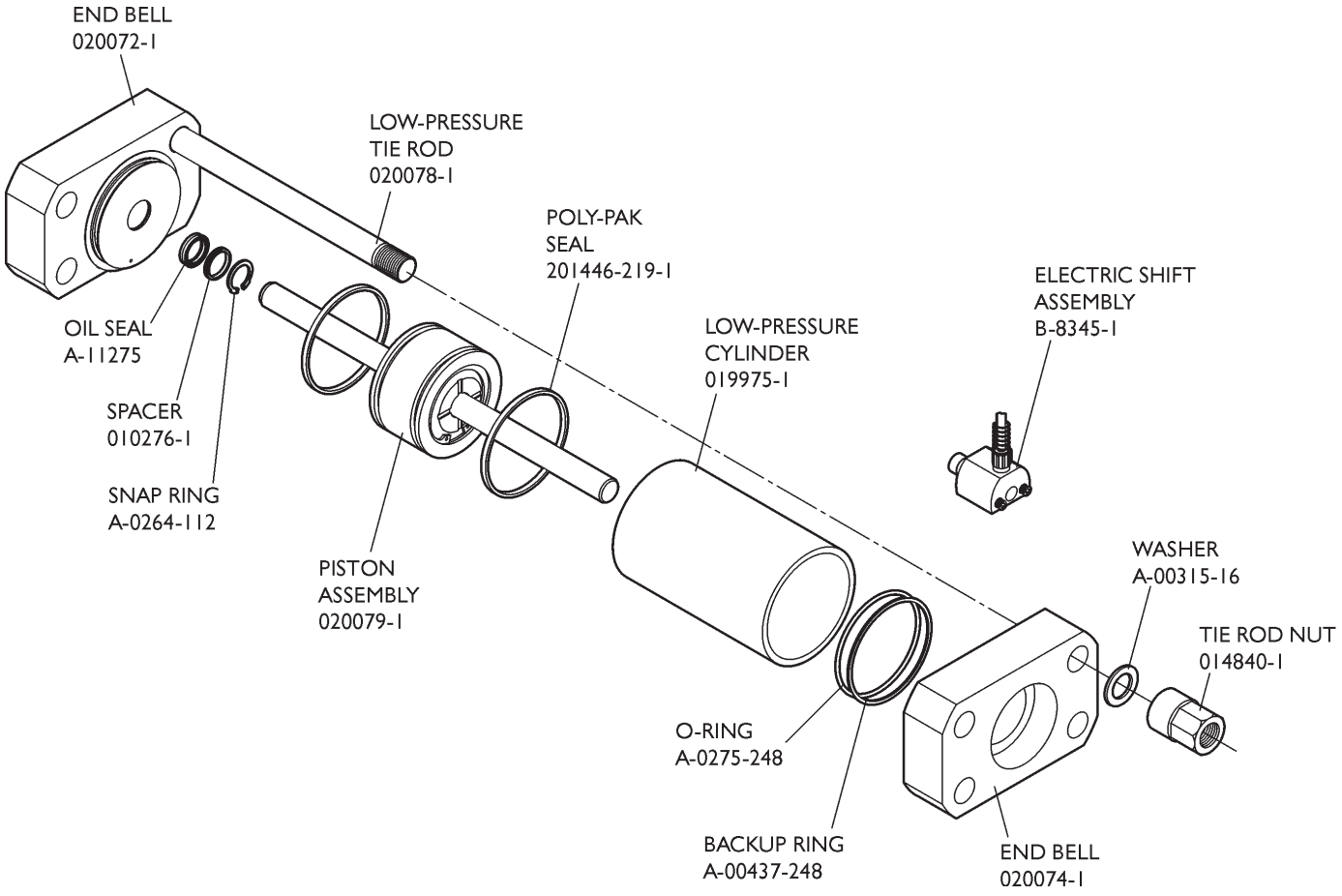
Low-pressure end

For long-block (StoneCrafter) intensifier (014623-1 or -3)



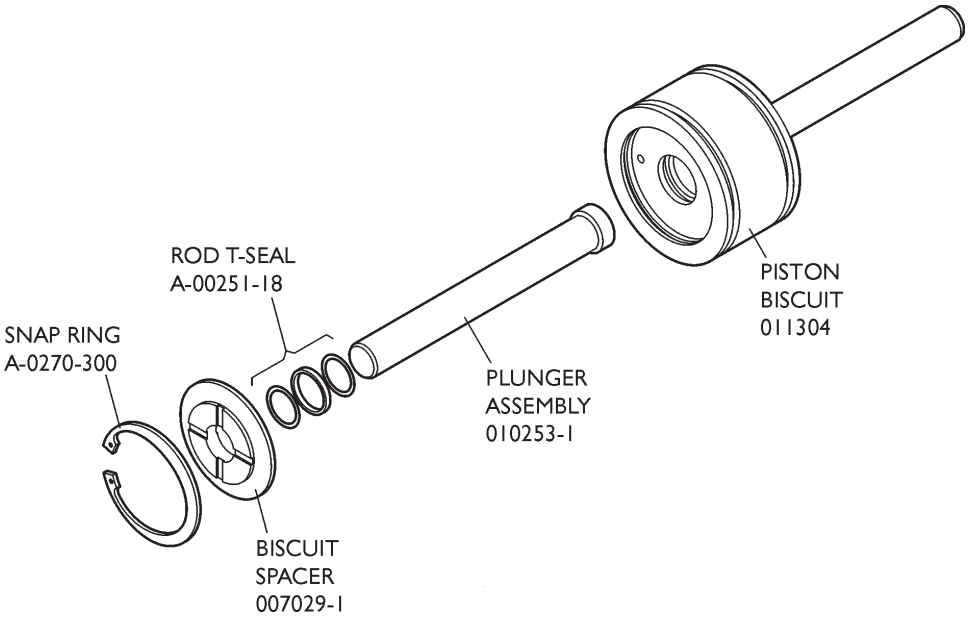
Low-pressure end

For short-block (HyperPressure) intensifier (020070-1)



Piston assembly

011492-1 (for long-block intensifier, 014623)
020079-1 (for short-block intensifier, 020070)



Kits

014884-1
Check valve inlet repair kit

#	Qty	Part #	Description
1	2	004380-1	Retaining screw
2	2	015834-1	Inlet poppet
3	2	010564-1	Inlet check valve support

014885-1
Check valve outlet repair kit

1	2	011309-1	Outlet poppet
2	2	014388-1	Seat
3	2	A-1606	Compression spring

B-1813-3
Check valve lapping kit

#	Qty	Part #	Description
1	1	A-1904	Glass plate
2	3	A-1903	320 grit grinding paper
3	3	A-1902	600 grit grinding paper
4	1	014853-1	Check valve body lapping tool
5	1	014871-1	Check valve seat lapping tool

042512-3
Pressure loading tool kit

#	Qty	Part#	Descriptino
12	1	A-24203-1	Hydraulic hand pump
23	1	019375-1	Cap
24	1	014713-1	Piston
25	4	007100-1	Washer
26	4	040358-1	Nut
27	1	A-0275-157	O-ring
28	1	A-0276-157	Back-up ring
29	1	A-19813-1	Crowfoot
30	1	A-20283-31	Crate
31	1	A-23704-1	Socket wrench
32	1	SB-0195	Service bulletin

013157-1
Low-pressure seal kit

#	Qty	Part #	Description
1	2	A-0275-130	O-ring
2	2	A-00437-248	Back-up ring
3	2	A-0276-012	Back-up ring
4	2	A-0275-013	O-ring
5	2	A-0275-248	O-ring
6	4	A-0275-211	O-ring
7	2	A-11275	Rod seal
9	6	A-0275-012	O-ring
10	2	201446-219-1	Seal
11	2	A-00633-023	O-ring
12	2	A-00251-18	T-seal

Other parts to keep on hand

002228-2	Shift pin assembly tool
A-2185	Blue Lubricant
014030-1	Low-pressure assembly plate
052190-1or 040015-1	Seal cartridge
A-4689	Food-grade grease
A-10039	Anti-sieze
A-3203	Loctite 242