



**Bulletin HY14-2705-M3/US
Service and Parts Bulletin**

Model V20

Effective: August 1, 2002
Supersedes: Cat. No. GSD-1102 dated 2/92



**Sectional Body
Directional Control Valve**

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SECTION I INTRODUCTION

This manual contains pertinent step-by-step maintenance instructions plus parts ordering information and a complete part and service kit listing for the Model V20 Directional Control Valve.

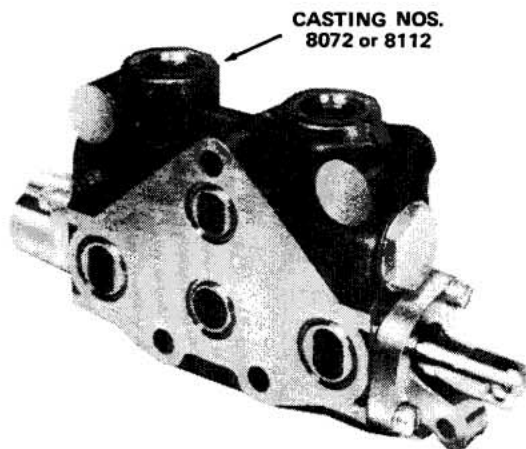
If further assistance is required, contact:

Your Gresen Distributor or Representative.

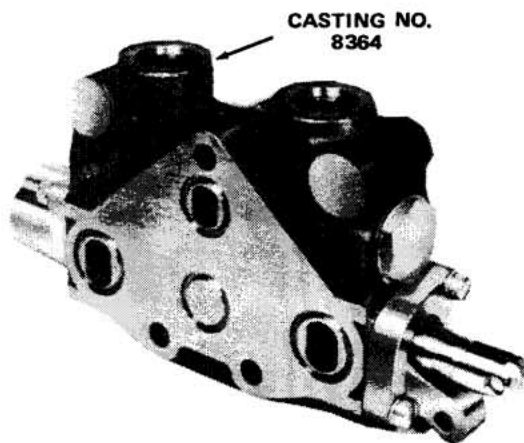
WARNING

There is a visual similarity between Gresen's Model V20 Directional Control Valve covered in this manual and Gresen's V20C Closed Center Directional Control Valve.

Work sections for these two valve assemblies should *NEVER* be *intermixed* or *interchanged* without prior consultation with the factory. Intermixing a V20C closed center work section with a V20P or V20T work section will convert the complete valve bank to closed center operation and in some cases, could render the valve assembly inoperable and cause damage to components in the hydraulic circuit.



Model V20P or V20T
Work Section.



Model V20C
Work Section.

SECTION II DESCRIPTION

Gresen Model V20 Directional Control Valves may be purchased with five different valve sections, plus various options, to meet the desired job specification.

The following paragraphs describe the five sections and any options with reference to the parts illustrations in Section IV in this manual.

Gresen's Models CP, CT, V20P and V20T work sections are interchangeable and may be intermixed within a complete directional control valve assembly. When Models CP or CT work sections are used, maximum pressure is limited to 2500 PSI.

Table 2-1. Casting Part Numbers

| Description | Model CP/CT | Model V20 |
|----------------------------|-------------|-----------|
| Parallel Center Section | 7697- | 8072- |
| Tandem Center Section | 7698- | 8112- |
| Series Center Section | — | 11483- |
| V20R Center Section | — | 10954- |
| V20R Tandem Center Section | — | 10762- |
| LO Center Section | 6732- | 11571- |
| Mid-Inlet Section | 6825- | 6825- |
| Inlet Cover (Standard) | 1815- | 8398- |
| Inlet Cover (Top Ports) | 1862- | 8398- |
| Inlet Cover w/Flow Control | 7736- | 7736- |
| Outlet Cover (End Outlet) | 6770- | 6770- |
| Outlet Cover (Top Outlet) | 8644- | 8644- |

Numbers shown for sections and covers are base casting numbers, not ordering numbers. Refer to Parts Ordering Information, Section III, for ordering information.

MODEL V20P

4-WAY, 3-POSITION VALVE SECTION

This section provides control of double-acting cylinders without the floating action plus hydraulic motor start, stop and reverse control where free-wheeling is NOT required. Cylinder ports are blocked in neutral position.

MODEL V20P

3-WAY, 3-POSITION VALVE SECTION

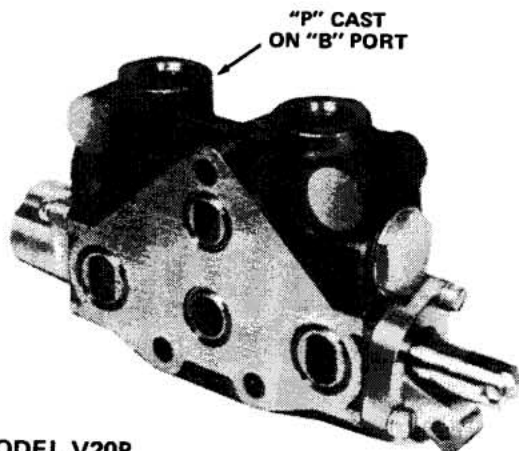
This section provides control of single acting cylinders or start and stop of non-reversible hydraulic motors where free-wheeling of motor is not required. The cylinder port is blocked in neutral position.

MODEL V20P

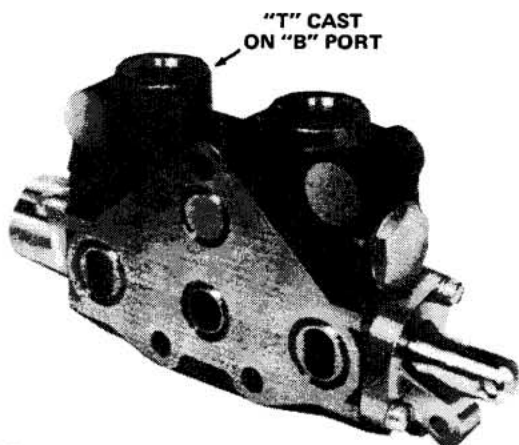
4-WAY, 3-POSITION VALVE SECTION WITH PRESSURE DETENT RELEASE

This section provides automatic return to neutral position as soon as work cycle is completed.

The spool is held in either power position by a detent assembly until released. When pressure in the power circuit reaches a predetermined setting, the detent assembly releases and the centering spring returns the spool to neutral.



MODEL V20P



MODEL V20T

Figure 2-1. Model V20P (Parallel Circuit) and Model V20T (Tandem Circuit) Work Sections.

MODEL V20P

4-WAY, 4-POSITION, FLOAT VALVE SECTION

This section provides control of double-acting cylinders requiring a floating action such as: loaders, dozers, snow plows, etc.

Incorporated into the valve section is a 4-position float positioner. Three positions are standard double-acting with spring return to neutral. The fourth position is detented to hold control in float (both cylinder ports open to tank).

MODEL V20-T

TANDEM (PRIORITY) SECTION, 3-WAY, 4-WAY, OR 4-WAY FLOAT

This section allows any upstream valve sections to have priority. Only when the upstream sections are in neutral or metering position will oil be available to this section.

SPOOL ACTION OPTIONS:

A. SPRING RETURN TO NEUTRAL, (Standard).

Spool will return to neutral position from A or B power position when handle is released.

B. "R" OPTION, Detent with Spring Return to Neutral

Can be used on either 3-way, 4-way or free flow spool. Has detent position for either spool "in", spool "out" or 2-position detent for both spool "in" and spool "out" positions, with spring return to neutral position.

Recommended for hydraulic motors where the motor operates continuously in one direction (detent position) with only intermittent operation in the opposite direction.

C. "D" Option, 3-Position Detent

Used when manual placement (NO spring return to neutral) is desired in any of three positions—spool in, spool out, and neutral. An optional detent stop (part no. 1889-001) may be used to convert spool action to "neutral" and "spool out" positions only or for "neutral" and "spool in" position only, thus giving a two-position spool action.

D. "A" OPTION, Spring Extended Spool

This feature eliminates spring return to neutral. The spring returns to the spool "out" position only, usually used for cam operation of spool.

Customer must supply cam follower mechanism.

HANDLE ASSEMBLIES

Provides choice of either horizontal or vertical handle assemblies.

INLET and OUTLET COVERS (Refer to Section III, Parts Ordering Information)

CYLINDER PORT CHECK and RELIEF VALVE OPTION (Refer to Figures 4-30 through 4-42)

SECTION III MAINTENANCE

REPLACING, ADDING OR REMOVING SECTION ASSEMBLIES

NOTE

For clarification, we shall call the inlet cover containing the main relief the left side of the valve assembly. Refer to Figure 3-1.

1. Before disassembly, it is suggested that each valve section be marked numerically to avoid incorrect reassembly.
2. Remove three assembly stud nuts (Item 32, Figure 4-1) from the left end section using a 9/16" thin wall socket.
3. Remove valve sections by sliding from assembly studs (Item 1, Figure 4-1).

4. If valve sections are to be added or removed, use the proper length assembly studs from the chart below.

| No. of Sections | Assembly Stud Kit No.* |
|-----------------|------------------------|
| 1 | K-6104-D |
| 2 | K-6105-D |
| 3 | K-6106-D |
| 4 | K-6107-D |
| 5 | K-6108-C |
| 6 | K-6109-C |
| 7 | K-6110-C |
| 8 | K-6111-C |
| 9 | K-6112-C |

*Each Kit contains 3 assembly studs and 3 9310-006 hex nuts.

NOTE: When using 8644 Right End Cover, add one section to assure proper stud length.

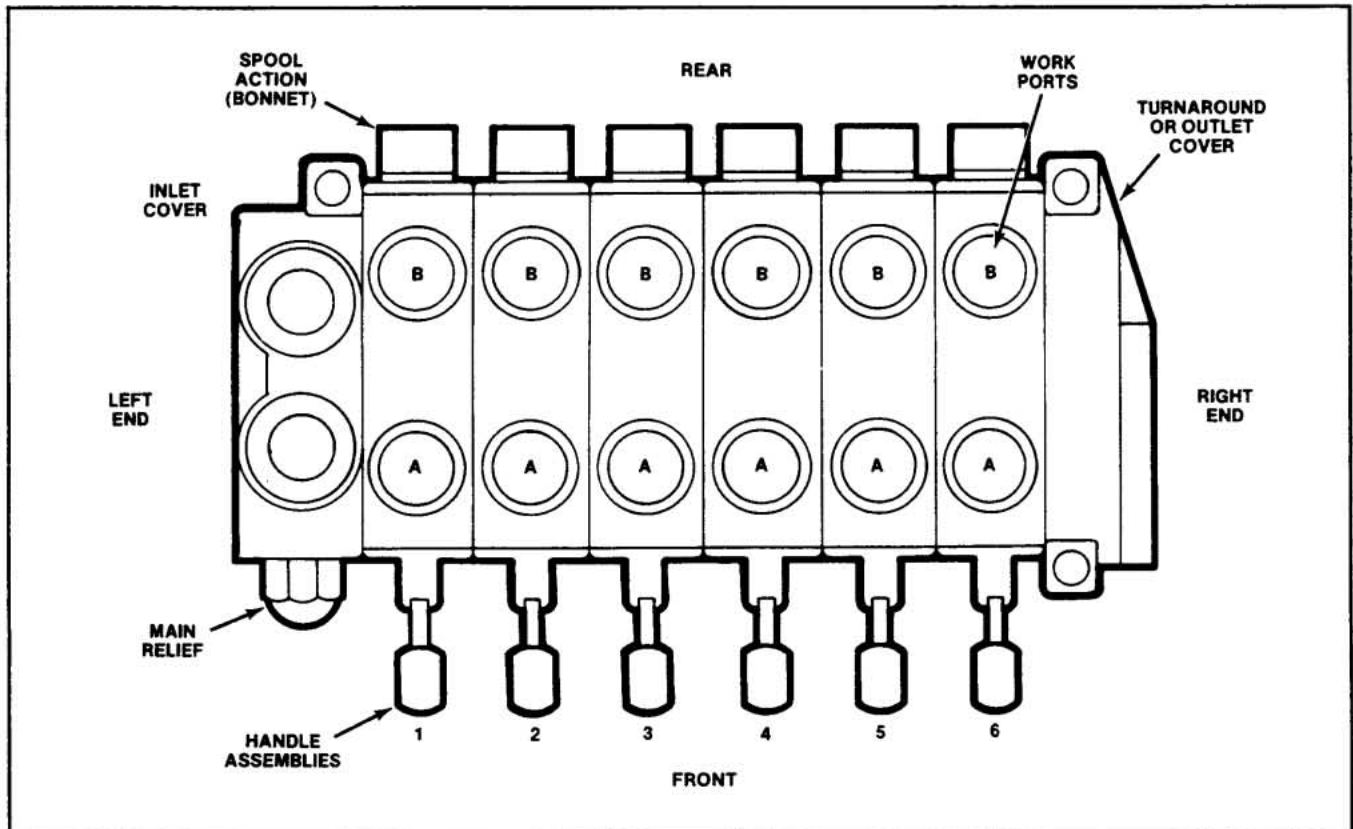


Figure 3-1. Schematic-View of Typical Control Valve Assembly.

NOTE

Use assembly nuts (part no.9310-006), 3 required, with all assembly studs. **NO LOCK WASHERS!** All studs are stress-proof material and should be replaced only with original equipment replacement parts.

5. Thoroughly clean O-ring counterbores and ground surfaces of each section.
6. Replace the four O-rings. For closed center sections use two 21733-001 (new) and two 21857-001 seals per section. For open center, use three 21733-001 and one 21857-001. For closed center, load sensing, sections use two 21857-001, two 21733-001 and one 21866-001. Buna-N seals are standard. For optional viton seals, see cross-reference chart on pg. 4-37. See chart on pg. 3-2 for old seal numbers.
7. Replace valve sections on assembly studs in the same order in which they were removed. O-ring counterbores should be to the left when facing "A" port-end of valve.

NOTE

Use care in replacing valve sections to avoid dislodging O-rings from counterbores.

8. When all valve sections are positioned on assembly studs, replace stud nuts and tighten evenly to 32 ft. lbs. [43 Nm] torque.

CAUTION

If stud nuts are not tightened to the proper torque, valve spools may bind or stick, or cause section seals to extrude.

REPLACING SPOOL SEALS

Valve sections and covers are identified by numbers cast into the body. Refer to Table 2-1, page 2-0.

Figure 3-2 shows spool assembly—less the complete handle assembly. When handle bracket is furnished, retainer plates and screws (items 1 and 4, Figure 3-2) are omitted. Seal assembly is retained by the handle bracket which will also retain the optional wiper seal.

1. Remove bonnet assembly parts from back of valves and keep in order of disassembly.

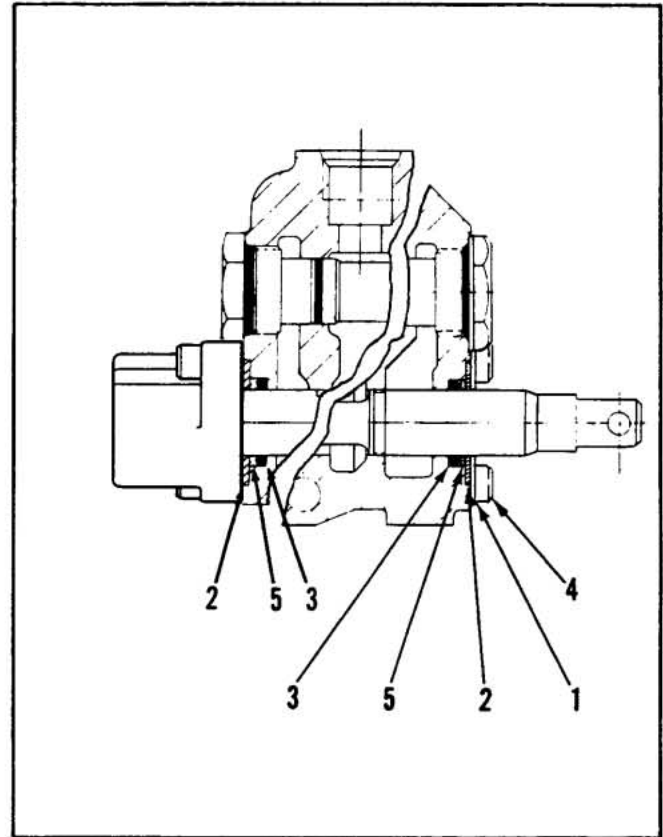


Figure 3-2. Spool Seal Assembly

2. Remove all parts connected to the spool on the front of the valve, either the complete handle bracket assembly, or the seal retainer assembly if a handle bracket is not furnished.

NOTE

DO NOT REMOVE the spool as the seals can be replaced externally. Prevent spool from turning or moving by inserting a screw driver through clevis slot, or running a rod through the pin hole and using as a handle. **DO NOT** hold the spool with a wrench. This will destroy the finish.

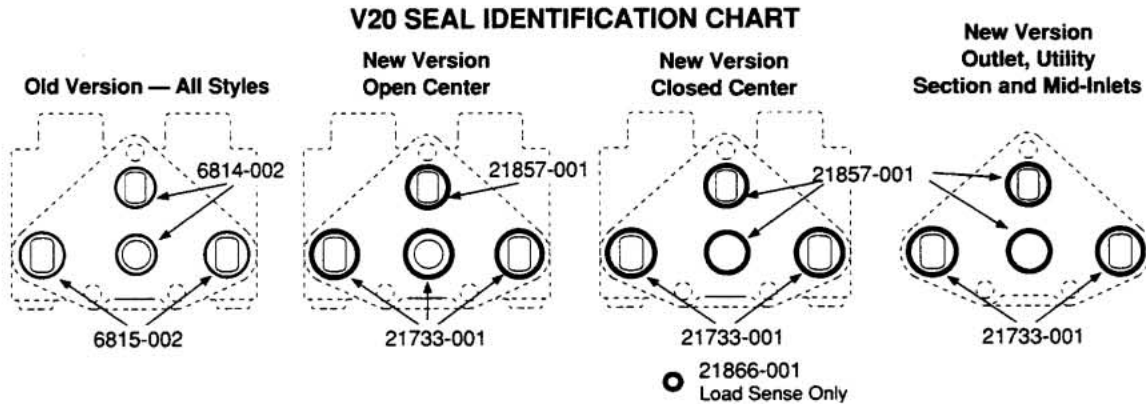
3. Remove retainer plate (Item 1, Figure 3-2), retainer plate washers (Item 2), back-up washers (Item 5), and spool seals (Item 3).
4. Thoroughly clean counterbore.
5. Lightly oil new seals. Slide over valve spool and insert in seal counterbore.

PARTS ORDERING INFORMATION

As of April 1, 1991, the section seals for the V20 changed. The new versions have larger cross section (old was .070, new is .103) and different configurations for open center and closed center sections. The old design utilized the same seals for all versions (two .801 I.D. and two .926 I.D.). The new design uses one configuration for open center- (three .924 I.D. and one

.799 I.D.) and another configuration for closed center, load sensing and all outlet covers (two .924 I.D. and two .799 I.D., with one .237 I.D. for load sensing).

The following chart is provided to aid in selection of the proper seals. It is important to note that the seal kits include all O-rings (new and old), therefore there will be some left unused.



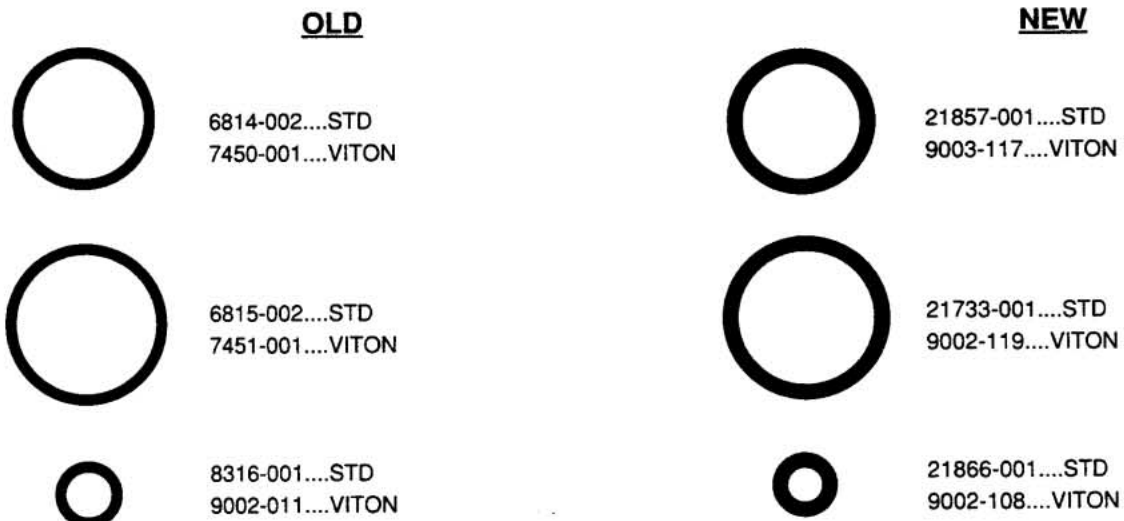
The following section seals are included in the Kits:

| Standard Kits | | Viton Kits | |
|--------------------------------------|--------------|-------------|-------------|
| Old | New | Old | New |
| (2)6814-002 | (2)21857-001 | (2)7450-001 | (2)9003-117 |
| (2)6815-002 | (3)21733-001 | (2)7451-001 | (3)9002-119 |
| Load sensing kits (additional seals) | | | |
| (1)8316-001 | (1)21866-001 | (1)9002-011 | (1)9002-108 |

Seal kit changes.

- K-6121 Section Seal Kit, One Section
- K-6027 Complete Seal Kit, 3 or 4 Way Section
- K-6028 Complete Seal Kit, 4 Way Float Section
- K-6209 Complete Seal Kit, Series 3 or 4 Way Section
- K-6210 Complete Seal Kit, Series 4 Way Float Section
- K-6154 Complete Seal Kit, Load Sensing 4 Way Float
- K-6155 Complete Seal Kit, Load Sensing 3 or 4 Way Section
- K-6156 Section Seal Kit, Load Sensing-One Section
- K-6160 Viton Section Seal Kit, One Section

* Complete Seal Kits include spool seals and O-rings for check plugs.



THESE SEALS ARE NOT INTERCHANGEABLE. OLD AND NEW STYLE SECTIONS MAY BE USED IN THE SAME ASSEMBLY PROVIDED THE CORRECT SEALS ARE USED FOR EACH SECTION.

INLET COVERS — Two Inlet Covers are available. All inlet covers are machined to accept the Model WH differential poppet relief cartridge or Model RP51 pilot-operated relief cartridge. If an outlet port is not used in the inlet cover, the outlet port in the right end cover of the valve must be used for tank return line. The inlet cover may be machined

with several different combinations of port sizes and locations. NPT and SAE threads cannot be intermixed in the same casting.

Use the following porting charts to arrive at the desired machining modification number.

Inlet Cover, Part No. 8398

| Port Location | NPT* | | | | | | SAE | | | | | |
|-------------------------------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | End Inlet | 1/2 | 3/4 | 1/2 | — | 3/4 | — | 12 | 12 | — | 10 | 10 |
| Top Inlet** | 1/2 | 3/4 | 1/2 | 1/2 | 3/4 | 3/4 | 12 | 12 | 12 | 10 | 10 | 10 |
| Top Outlet** | 1/2 | 3/4 | 1/2 | 1/2 | 3/4 | 3/4 | 12 | 12 | 12 | 10 | 10 | 10 |
| End Outlet | 1/2 | 3/4 | — | — | — | — | 12 | — | — | 10 | — | — |
| SAE 4 Gage Port | — | — | — | — | — | — | No | Yes | Yes | No | Yes | No |
| 1/4" Gage Port | No | No | No | Yes | Yes | No | — | — | — | — | — | — |
| Machining Modification Number | 018 | 014 | 019 | 012 | 023 | 016 | 008 | 025 | 013 | 024 | 021 | 002 |

* Pipe ports not recommended for pressures over 2000 PSI [138 bar].

** Top ports are cored and will be plugged if end inlet and outlet are specified.

Inlet Cover, Part No. 7736 With Flow Control

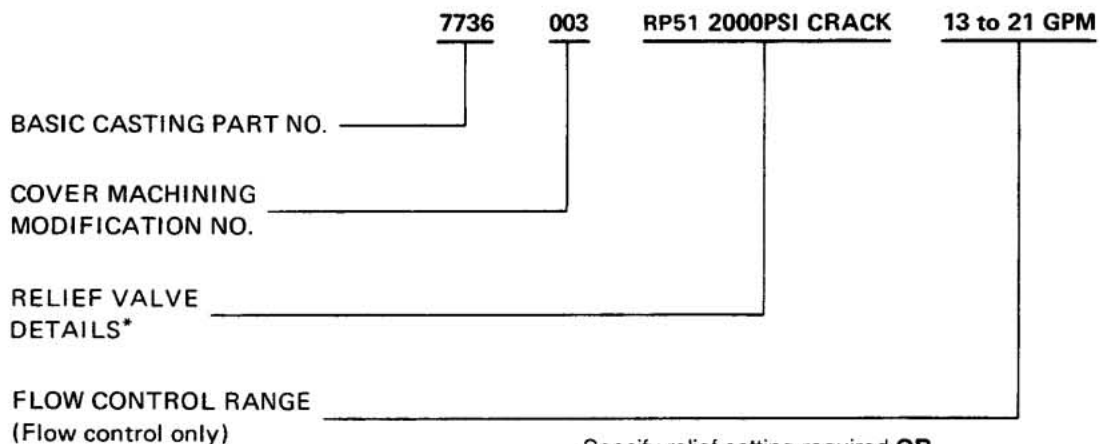
Inlet cover, part number 7736, is equipped with an adjustable flow control assembly. Refer to Figure 4-42 for complete parts breakdown.

A Power Beyond option in this cover will allow excess flow to be used downstream only when upstream valve is activated and controlled flow is being used. When upstream valve is in neutral position, all flow is directed through the open center.

| Port Location | | NPT* | SAE | | |
|-------------------------------|----------------------|------|-----|-----|-----|
| End In | | 3/4 | 10 | 12 | 10 |
| Top In | | 3/4 | 10 | 12 | 10 |
| End Out | | 3/4 | 10 | 12 | 12 |
| Machining Modification Number | Without Power Beyond | 011 | 016 | 009 | — |
| | With Power Beyond | 013 | — | 012 | 017 |

* Pipe ports not recommended for pressures over 2000 PSI [138 bar].

ORDERING EXAMPLE FOR INLET COVERS WITH FLOW CONTROL



Flow Control Ranges

(For inlet cover with flow control only)

- 3 to 16 GPM [11 to 60 litres/min]
- 8 to 25 GPM [30 to 95 litres/min]
- 13 to 21 GPM [49 to 79 litres/min]

Specify relief setting required **OR**
 Specify "NR" (no relief) plug installed **OR**
 Specify plastic shipping plug, installed in relief cavity.

Example: If a left inlet cover with a SAE 10 inlet, a SAE 12 outlet, with RP51 relief set at 2000 PSI [138 bar] crack and flow control range of 13-21 GPM [49-79 litres/min] is required, order 7736-003-RP51 2000 PSI [138 bar] crack — 13-21 GPM [49-79 litres/min].

*Specify model number of relief valve to be installed; either WH or RP51.

OUTLET COVERS — Two Outlet Covers are available.

Outlet covers may be machined with several different combinations of port sizes and locations. NPT and SAE threads cannot be intermixed in the same casting. If an outlet port is not used in the outlet cover, the outlet port in the left end cover must be used for tank return line.

Use the following porting charts to arrive at the desired machining modification number.

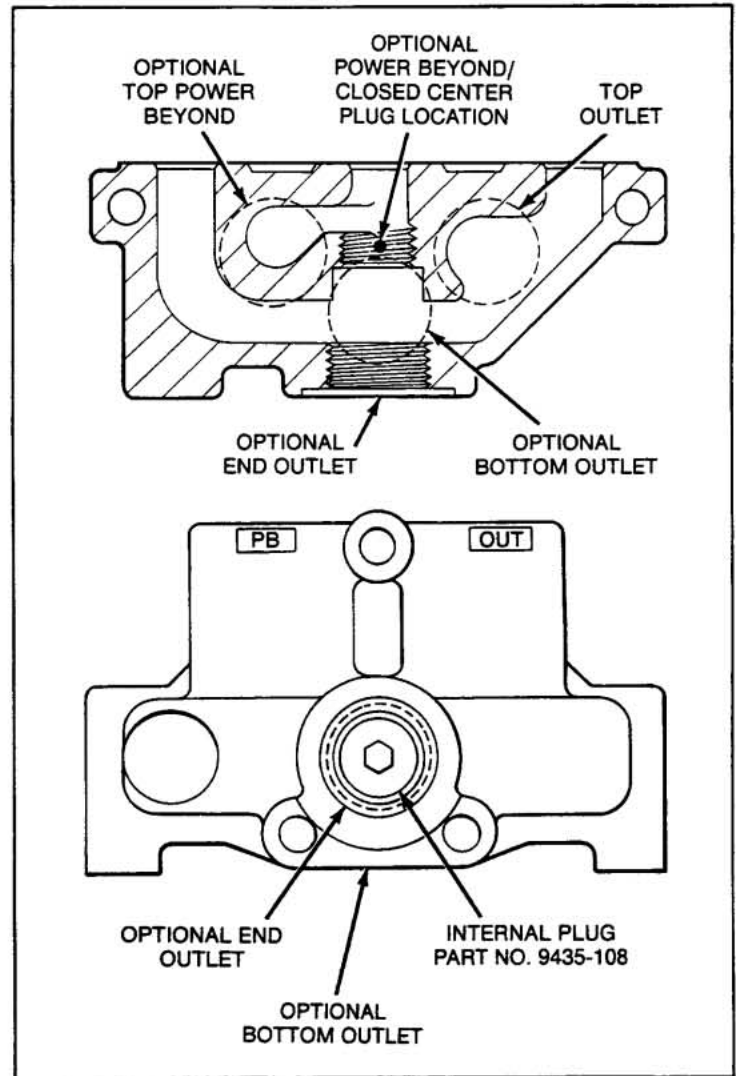


Figure 3-3. Outlet Cover Part No. 8644

Outlet Cover, Part No. 8644

Standard machining provides an outlet port (top, end or bottom) for open center applications. Closed center or top power beyond options are available. For power beyond, the top power beyond port is machined, and the core between the open center and exhaust passages is tapped and plugged. Plugging the power beyond port (and the internal core) converts the cover to closed center.

| Port Location | NPT | | | SAE | | | | |
|-------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| | 3/4 | 3/4 | 3/4 | 12 | 12 | 12 | 12 | 12 |
| Top Outlet* | 3/4 | 3/4 | 3/4 | 12 | 12 | 12 | 12 | 12 |
| End Outlet | — | — | 3/4 | — | — | 12 | 12 | 12 |
| Bottom Outlet | — | 3/4 | — | — | 12 | — | — | 12 |
| Top Power Beyond | — | — | 3/4 | — | — | 10 | 12 | 12 |
| Machining Modification Number | 008 | 005 | 006 | 007 | 010 | 012 | 004 | 013 |

*Top outlet is cored and will be plugged if end or bottom outlet is specified.

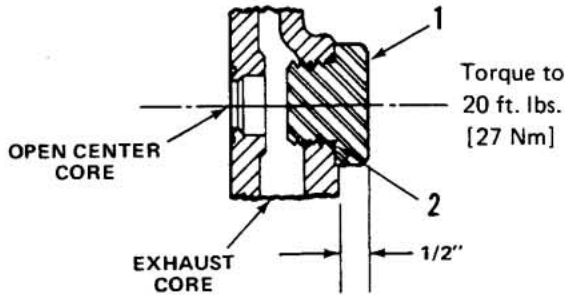
Outlet Cover, Part No. 6770.

| Port Size Available | End Outlet Port Only | Machined for Power Beyond Sleeve, Closed Center Plug or Conversion Plug. | |
|------------------------|----------------------|--|---------------|
| | | With End Outlet | No End Outlet |
| 1/2-14 NPT | 6770-004 | 6770-009 | 6770-007 |
| 3/4-14 NPT | 6770-001 | 6770-005 | |
| SAE 10 (7/8-14 UNF) | 6770-002 | 6770-006 | |
| SAE 12 (1-1/16 12 UNF) | 6770-003 | 6770-013 | |

6770 OUTLET COVER OPTIONS

No. 1727 Conversion Plug

Provides for conversion from "Power Beyond" or "Closed-Center" usage to "Open-Center" or vice-versa.



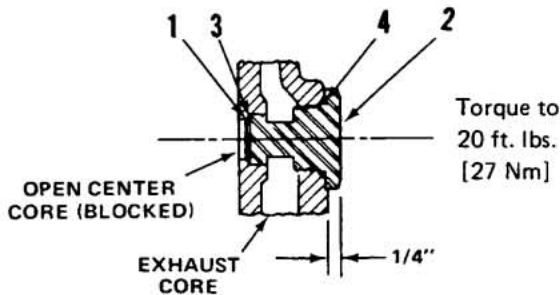
SERVICE KIT K-6016

(Contains 1 Each of Items 1 and 2)

| Item No. | Part No. | Description | No. Required |
|----------|-----------|-----------------|--------------|
| 1 | 1727-001 | Conversion Plug | 1 |
| 2 | 2709-001* | O-Ring Seal | 1 |

No. 1830 Closed-Center Plug Option.

Provides a "Closed-Center" System by plugging the open-center flow passage. It is normally used with a variable displacement pump.



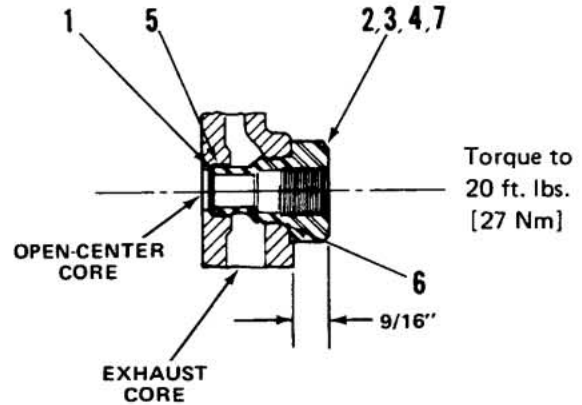
SERVICE KIT K-6015

(Contains 1 Each of Items 1, 2, 3 and 4)

| Item No. | Part No. | Description | No. Required |
|----------|-----------|--------------------|--------------|
| 1 | 1721-001* | Seal | 1 |
| 2 | 1830-001 | Closed-Center Plug | 1 |
| 3 | 9020-017 | Back-Up Washer | 1 |
| 4 | 2709-001* | O-Ring Seal | 1 |

No. 1833, 1835 or 1836 Power Beyond Sleeve Options.

Provides for proper hook-up of an additional valve "downstream". The Power Beyond Sleeve prevents subjecting the exhaust core of the valve to back pressure.



SERVICE KITS

K-6017-B* (1/2 NPT – Contains 1 Each of Items 1, 2, 5, 6)

K-6018-B* (SAE 8 – Contains 1 Each of Items 1, 3, 5, 6)

K-6019-B* (SAE 10 – Contains 1 Each of Items 1, 4, 5, 6)

K-6060-B (SAE 16 – Contains 1 Each of Items 1, 5, 6, 7)

| Item No. | Part No. | Description | No. Required |
|----------|-----------|--|--------------|
| 1 | 1721-001* | Seal | 1 |
| 2 | 1833-001 | P.B. Sleeve (1/2-14 NPT) | 1 |
| 3 | 1835-001 | P.B. Sleeve SAE 8 (3/4-16 UNF) | 1 |
| 4 | 1836-001 | P.B. Sleeve SAE 10 (7/8-14 UNF) | 1 |
| 5 | 9020-017 | Back-Up Washer | 1 |
| 6 | 2709-001* | O-Ring Seal | 1 |
| 7 | 7706-001 | P.B. Sleeve SAE 16 (1" Tube) Male Fitting | 1 |

NOTE

To convert from Power Beyond usage to "Open-Center" usage, NEVER ATTEMPT TO PLUG THE POWER BEYOND SLEEVE, as this would convert to "Closed-Center" Valve.

ORDERING EXAMPLE
FOR RIGHT COVER PLATE:

BASIC CASTING

COVER MACHINING
MODIFICATION

OPTION DETAILS

6770

006

Cover with SAE 8 Power
Beyond Sleeve Installed

Example: If a right cover with a SAE 10 outlet and a SAE 8 power beyond sleeve was required, then order: per the above description.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on Page 4-37.

**V20P, V20T and V20S VALVE
CENTER SECTIONS**

The following information is necessary for proper specification for each V20P, V20T or V20S Valve Center Section:

1. Function of Section
2. Options
3. Work port sizes

4. Work port "A" Options
5. Work port "B" Options
6. Handle end Options

The chart shown below will help in identifying the Options available and the information needed for proper ordering. Refer to product catalog No. PC-1106 for complete information on options available.

| | | |
|------------------------------|--|--|
| CIRCUIT | <p>PARALLEL - V20P <input type="checkbox"/> Casting No. 8072 (See Page 2-0)</p> <p>TANDEM - V20T <input type="checkbox"/> Casting No. 8112 (See Page 2-0)</p> <p>SERIES - V20S <input type="checkbox"/> Casting No. 11483 (See Page 2-0)</p> | |
| FUNCTION OF SECTION | <p>FUNCTION OF SECTION (Check one for each section)</p> <ul style="list-style-type: none"> • 3-Way (Work port on handle end will be plugged) <input type="checkbox"/> • 4-Way <input type="checkbox"/> • 4-Way Float (K) <input type="checkbox"/> • _____ <input type="checkbox"/> | |
| OPTIONAL FEATURES | <p>ADDITIONAL OPTIONS</p> <ul style="list-style-type: none"> • Free Flow (F) <input type="checkbox"/> • 3-Position Detent (D) <input type="checkbox"/> • _____ <input type="checkbox"/> • _____ <input type="checkbox"/> | |
| WORK PORT SIZES | <p>"A" and "B" WORK PORT SIZES 3/8, 1/2 NPT; SAE 8, 10</p> | |
| WORK PORT "A" OPTIONS | <p>OPTIONS AVAILABLE (Specify)</p> <ul style="list-style-type: none"> • Relief (RC or RCA*) _____ • Anti-Cavitation (A-C) _____ • Combination Relief and Anti-Cavitation (CRA) _____ <p>Specify Relief Setting, Crack or Full Flow *RCA cannot be used with valve handle or bracket.</p> | |
| WORK PORT "B" OPTIONS | <p>OPTIONS AVAILABLE (Specify)</p> <ul style="list-style-type: none"> • Relief (RC or RCA*) _____ • Anti-Cavitation (A-C) _____ • Combination Relief and Anti-Cavitation (CRA) _____ <p>Specify Relief Setting, Crack or Full Flow *RCA cannot be used with valve handle or bracket.</p> | |
| HANDLE-END OPTIONS | <p><u>Location:</u> "A" Work Port End <input type="checkbox"/> "B" Work Port End <input type="checkbox"/></p> <p><u>Handle Type:</u> No. 1802, Vert. <input type="checkbox"/> No. 3249, Horiz. <input type="checkbox"/></p> <p style="padding-left: 40px;">Less Complete Handle Assy (LCHA) <input type="checkbox"/></p> <p style="padding-left: 40px;">Less Handle Only (LHO) <input type="checkbox"/></p> <p style="padding-left: 40px;">Handle Bracket Only (HBO) <input type="checkbox"/></p> <p><u>Bracket:</u> No. 1801 <input type="checkbox"/> No. 7355 <input type="checkbox"/></p> <p style="padding-left: 40px;">Rotate 180° From Standard <input type="checkbox"/></p> <p><u>Float Section:</u> Pull Handle to Float <input type="checkbox"/></p> <p style="padding-left: 40px;">Push Handle to Float <input type="checkbox"/></p> <p>Heavy Duty Retainer <input type="checkbox"/> Spool Protector Boot <input type="checkbox"/></p> <p>Spool Wiper <input type="checkbox"/></p> | |

SECTION IV PARTS LISTING

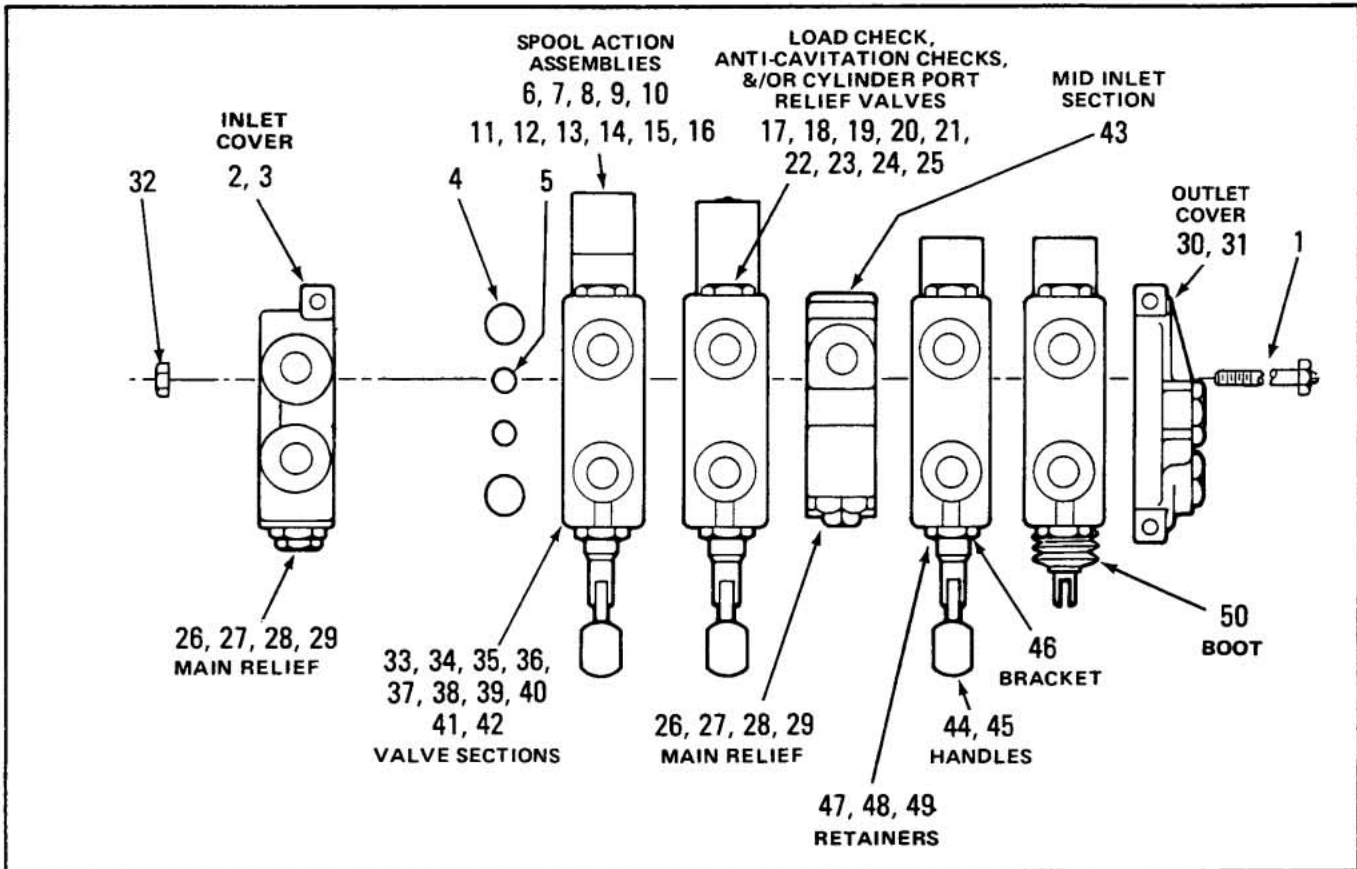


Figure 4-1. Model V20 Directional Control Valve, Typical Main Assembly.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Assembly |
|----------|------------|--|-----------------------|
| 1 | K-6104-D | STUD KIT, 1-Section | 1 |
| | K-6105-D | STUD KIT, 2-Section | |
| | K-6106-D | STUD KIT, 3-Section | |
| | K-6107-D | STUD KIT, 4-Section | |
| | K-6108-C | STUD KIT, 5-Section | |
| | K-6109-C | STUD KIT, 6-Section | |
| | K-6110-C | STUD KIT, 7-Section | |
| | K-6111-C | STUD KIT, 8-Section | |
| | K-6112-C | STUD KIT, 9-Section | |
| | | Each Stud Kit Contains 3 Assembly Studs and 3 Stud Nuts | |
| | | Note: Torque Stud Nuts to 32 ft. lbs. [43.5 Nm] | |
| 2 | 8398- | COVER, Left (Refer to Page 3-3) | 1 |
| 3 | 7736- | COVER, Left, with flow control (Refer to Page 3-3 and Figure 4-43) | 1 |
| 4 | 21733-001* | O-RING, Exhaust, Large (new) | ** |
| | 6815-002* | O-RING, Exhaust, Large (old) | ** |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

**All old versions include two exhaust and two small O-rings. All new open center versions include three large and one small O-ring. Other new versions including outlet, utility section and mid-inlets contain two of each.

MODEL V20 DIRECTIONAL CONTROL VALVE, TYPICAL MAIN ASSEMBLY (Continued)

| Item Part No. No. | Description | Quantity Per Assembly | |
|----------------------|-------------|---|-----|
| 5 | 21857-001* | O-RING, Pressure, Small (new) | ** |
| | 6814-002* | O-RING, Pressure, Small (old) | ** |
| | 21866-001* | O-RING, Load Sensing (new) | ** |
| | 8316-001* | O-RING, Load Sensing (old) | ** |
| 6 | | POSITIONER, Standard Spool (See Figure 4-12) | A/R |
| 7 | | POSITIONER, Manual Spool (See Figure 4-13) | A/R |
| 8 | | POSITIONER, Float Detent, 4-Way, 4-Position (See Figure 4-14) | A/R |
| 9 | | DETENT, Option "R", With Spring Return To Neutral (See Figure 4-15) | A/R |
| 10 | | DETENT, Option "D", 3-Position (See Figure 4-16) | A/R |
| 11 | | SPRING EXTENDED SPOOL, Option "A" (See Figure 4-17) | A/R |
| 12 | | ELECTRO-MAGNETIC SPOOL RELEASE (See Figure 4-18) | A/R |
| 13 | | POSITIONER, Pressure Detent Release (See Figure 4-19) | A/R |
| 14 | | POSITIONER, Rotary, Option "W" (See Figure 4-20) | A/R |
| 15 | | POSITIONER, Standard Spool, V20S or V20R (See Figure 4-21) | A/R |
| 16 | | POSITIONER, Float Detent, 4-Way, 4-Position, V20S (See Figure 4-22) | A/R |
| 17 | | CHECK, Lockout (See Figure 4-29) | A/R |
| 18 | | CHECK, Anti-Cavitation (See Figure 4-30) | A/R |
| 19 | | CHECK, Anti-Cavitation, V20S (See Figure 4-31) | A/R |
| 20 | | PLUG, Load Check, (See Figure 4-32) | A/R |
| 21 | | PLUG, Load Check, V20S (See Figure 4-33) | A/R |
| 22 | | RELIEF, Work Port, Model RC (See Figure 4-34) | A/R |
| 23 | | RELIEF, Work Port, Model RCA (See Figure 4-35) | A/R |
| 24 | | RELIEF/ANTI-CAVITATION CHECK, Work Port, Model CRA (See Figure 4-37) | A/R |
| 25 | | RELIEF, Work Port, Model RCS (See Figure 4-38) | A/R |
| 26 | | RELIEF, Main, Model WH (See Figure 4-39) | A/R |
| 27 | | RELIEF, Main, Model WHA (See Figure 4-40) | A/R |
| 28 | | RELIEF, Main, Model RP51 (See Figure 4-41) | A/R |
| 29 | | PLUG, No Main Relief (NR) (See Figure 4-43) | A/R |
| 30 | 6770- | COVER, Right (See pages 3-3 & 3-4) | 1 |
| 31 | 8644- | COVER, Right (See page 3-3) | 1 |
| 32 | 9310-006 | NUT, Stud (Not sold separately. See Item No. 1) | |
| 33 | 8072- | VALVE SECTION, 4-Way, 4-Position, Float (See Figure 4-2) | A/R |
| 34 | 8072- | VALVE SECTION, 4-Way, 3-Position (See Figure 4-3) | A/R |
| 35 | 8072- | VALVE SECTION, 3-Way, 3-Position (See Figure 4-4) | A/R |
| 36 | 8072- | VALVE SECTION, 4-Way, 3-Position, With Pressure Detent Release (See Figure 4-5) | A/R |
| 37 | 11571- | VALVE SECTION, 4-Way, 3-Position, With Pilot Operated Checks (See Figure 4-6) | A/R |
| 38 | 8112- | VALVE SECTION, Tandem (See Figure 4-7) | A/R |
| 39 | 10954- | VALVE SECTION, Low Pressure Drop (See Figure 4-8) | A/R |
| 40 | 10762- | VALVE SECTION, Tandem, Low Pressure Drop (See Figure 4-9) | A/R |
| 41 | 11483- | VALVE SECTION, Series (See Figure 4-10) | A/R |
| 42 | 11483- | VALVE SECTION, Series, 4-Way, 4-Position, Float (See Figure 4-11) | A/R |
| 43 | 6825-001 | MID-INLET SECTION, Split Flow, Top Inlet 3/4—14 NPT | A/R |
| | 6825-004 | MID-INLET SECTION, Split Flow, Top Inlet 1/2—14 NPT | A/R |
| | 6825-007 | MID-INLET SECTION, Split Flow, Top Inlet SAE 12 (1-1/16—12 UNF) | A/R |
| | 6825-011 | MID-INLET SECTION, Split Flow, Top Inlet SAE 10 (7/8—14 UNF) | A/R |
| | 6825-005 | MID-INLET SECTION, Combined Flow, Top Inlet 3/4—14 NPT | A/R |
| | 6825-008 | MID-INLET SECTION, Combined Flow, Top Inlet 1/2—14 NPT | A/R |
| | 6825-013 | MID-INLET SECTION, Combined Flow, Top Inlet SAE 10 (7/8—14 UNF) | A/R |
| | 6825-016 | MID-INLET SECTION, Combined Flow, Top Inlet SAE 12 (1-1/16—12 UNF) | A/R |
| | 6825-002 | MID-INLET SECTION, Top Cored Hole Plugged with 3/8—18 NPT Plug | A/R |
| 44 | | HANDLE ASSEMBLY, Vertical (See Figure 4-26) | A/R |
| 45 | | HANDLE ASSEMBLY, Horizontal (See Figure 4-27) | A/R |
| 46 | | BRACKET, Standard Handle (See Figure 4-25) | A/R |
| 47 | K-6033-B | RETAINER, Seal, Standard (See Figure 4-23) | A/R |
| 48 | K-6029-B | RETAINER, Seal, Heavy Duty (See Figure 4-24) | A/R |
| 50 | K-6056-B | BOOT ASSEMBLY, Spool Protective (See Figure 4-28) | A/R |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

**All old versions include two exhaust and two small O-rings. All new open center versions include three large and one small O-ring. Other new versions including outlet, utility section and mid-inlets contain two of each.

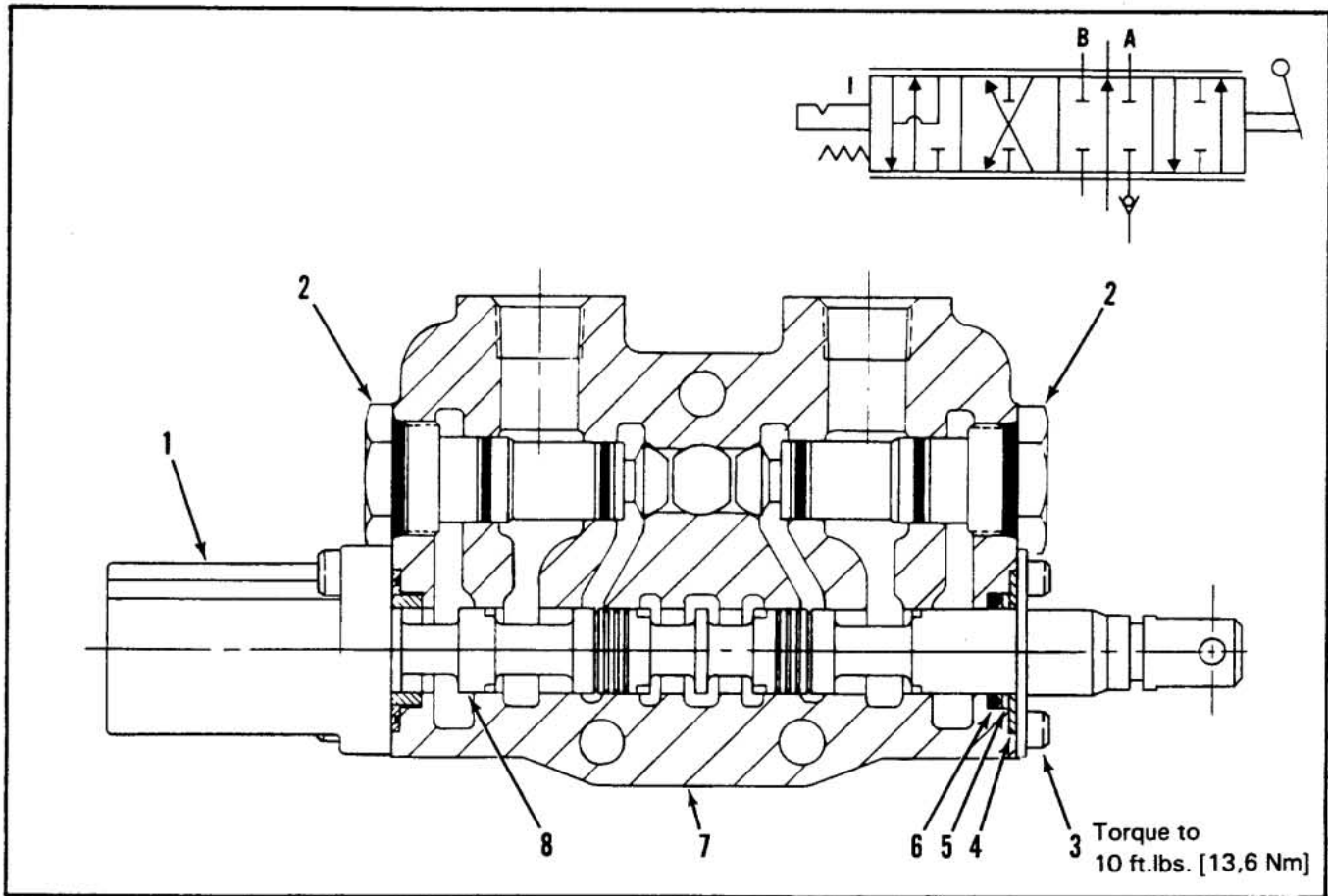


Figure 4-2. 4-Way, 4-Position Float Valve Section.

4-WAY, 4-POSITION FLOAT VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6127-A | POSITIONER, Float (See Figure 4-14) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 4-24 through 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 1 |
| 5 | 3265-001 | WASHER, Back-Up | 1 |
| 6 | 7700-001* | SEAL, O-Ring | 1 |
| 7 | 8072- | HOUSING, V20 Valve | 1 |
| 8 | 8085-001 | SPOOL, Float | 1 |

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.
2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

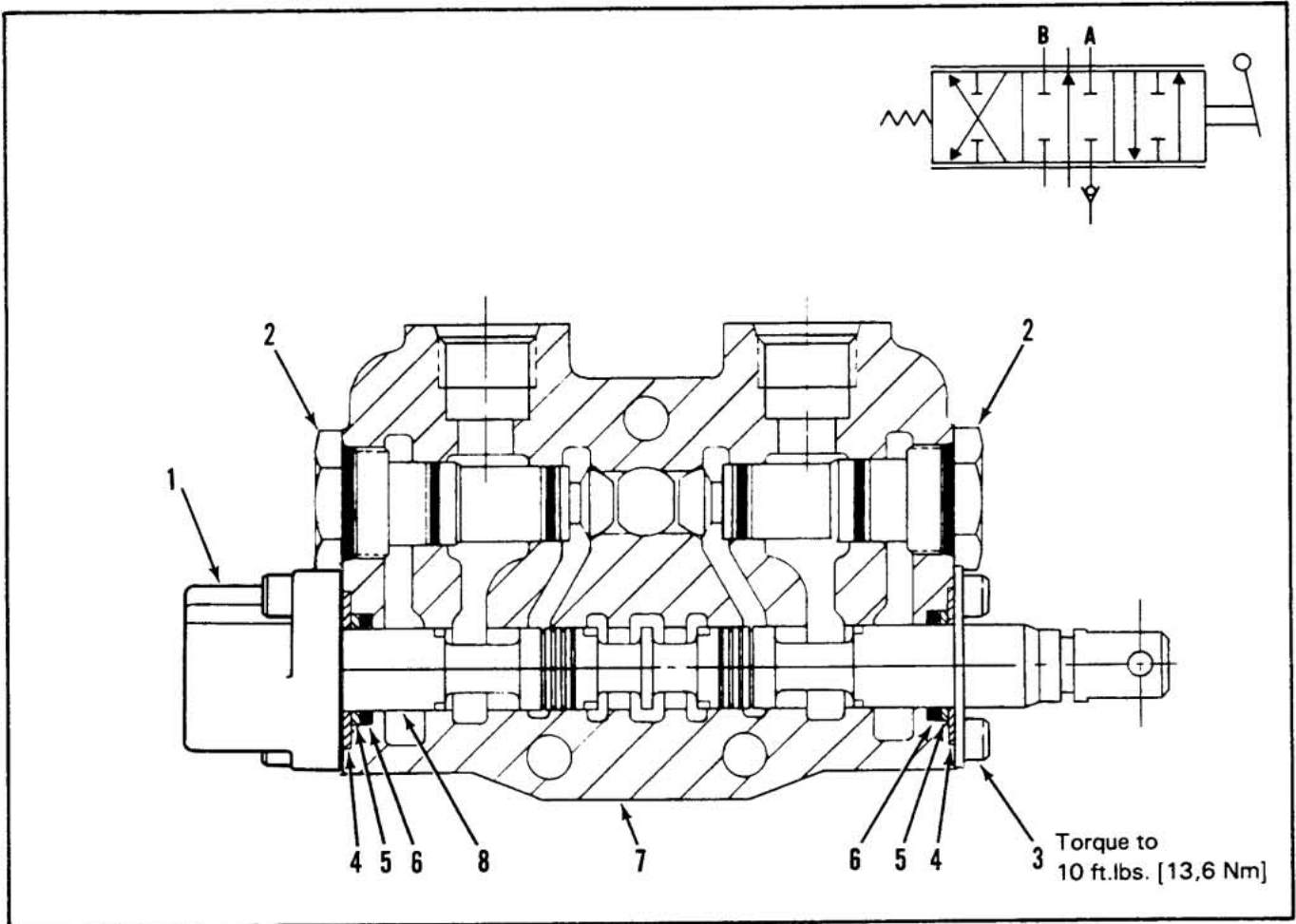


Figure 4-3. 4-Way, 3-Position Valve Section.

4-WAY, 3-POSITION VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6125-B | POSITIONER, Spool, Standard (See Figure 4-12) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 2 |
| 5 | 3265-001 | WASHER, Back-Up | 2 |
| 6 | 7700-001* | SEAL, O-Ring | 2 |
| 7 | 8072- | HOUSING, Standard | 1 |
| 8 | 8084-001 | SPOOL, 4-Way | 1 |

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

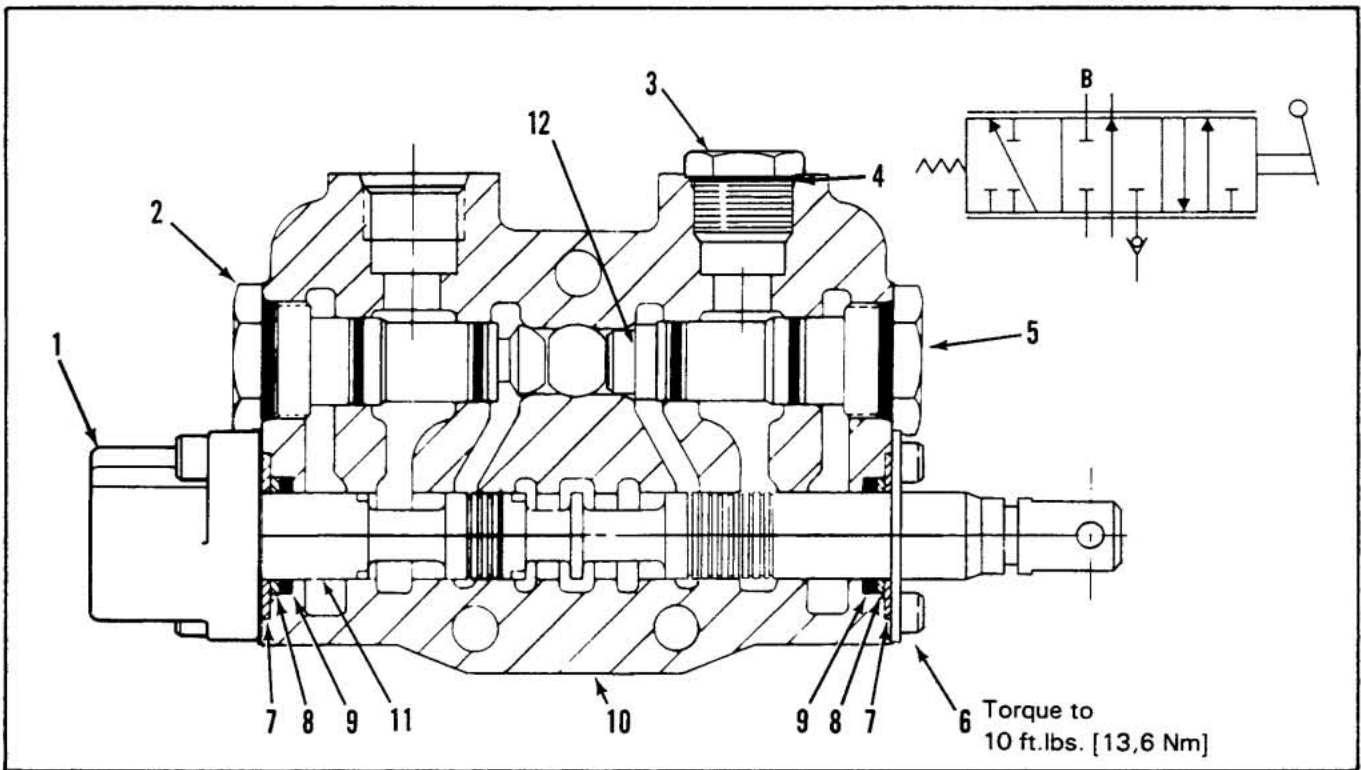


Figure 4-4. 3-Way, 3-Position Valve Section.

3-WAY, 3-POSITION VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Assembly |
|----------|-----------|--|--------------------------|
| 1 | K-6125-B | POSITIONER, Spool, Standard (See Figure 4-12) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 1 |
| 3 | 2684-001 | PLUG, 3-Way Conversion, SAE 8 (3/4"–16 UNF) | A/R |
| | 1458-001 | PLUG, 3-Way Conversion, SAE 10(7/8"–14 UNF) | A/R |
| | 0073-001 | PLUG, 3-Way Conversion, 3/8"–18 NPT | A/R |
| | 0947-001 | PLUG, 3-Way Conversion, 1/2"–14 NPT | A/R |
| | 4 | 2706-001 | SEAL, O-Ring, SAE 8 Plug |
| | 2707-001 | SEAL, O-Ring, SAE 10 Plug | A/R |
| 5 | K-6030-C | PLUG, Check (Load Check and Spring are not used) | 1 |
| 6 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 24 thru 4-28 for optional assemblies) | 1 |
| 7 | 6752-001 | RETAINER, Plate Washer | 2 |
| 8 | 3265-001 | WASHER, Back-Up | 2 |
| 9 | 7700-001* | SEAL, O-Ring | 2 |
| 10 | 8072- | HOUSING | 1 |
| 11 | 8083-001 | SPOOL, 3-Way | 1 |
| 12 | 6754-001 | PLUG, 3-Way | 1 |

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

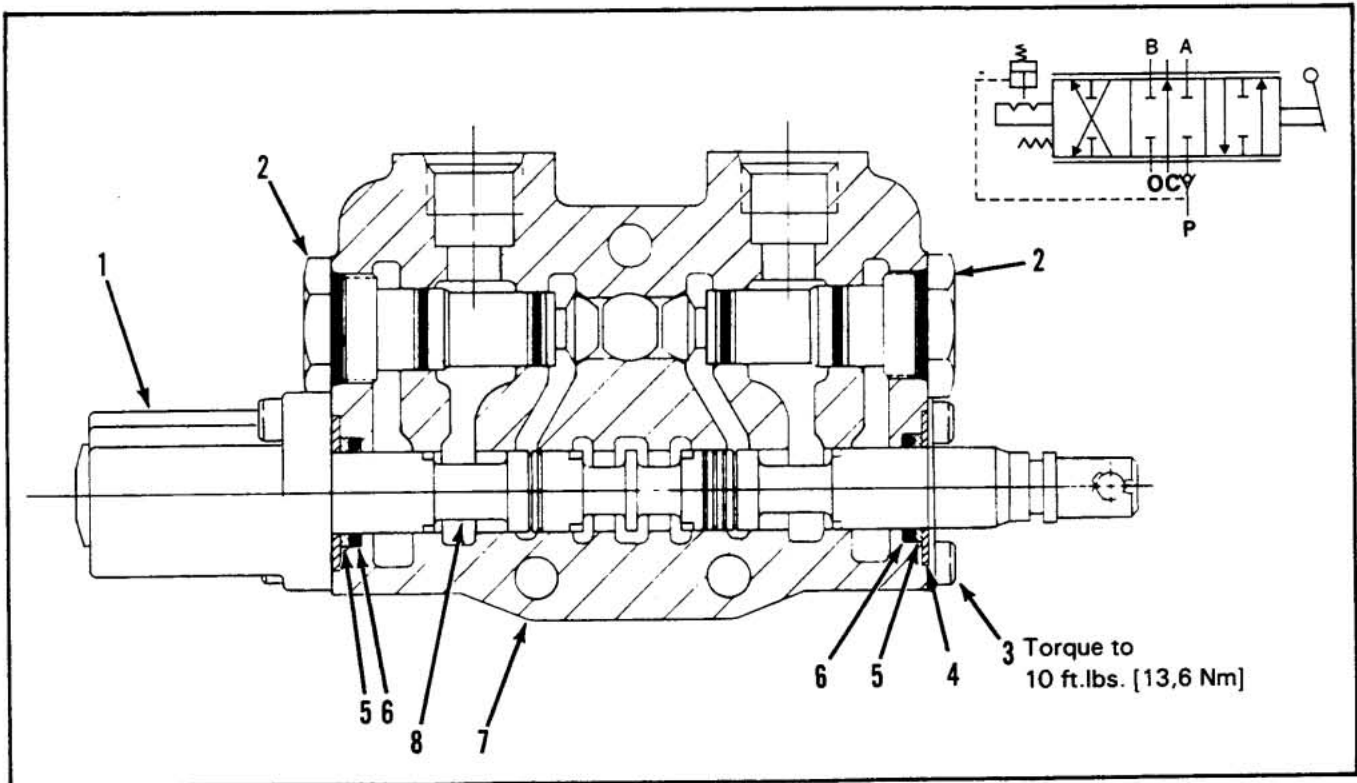


Figure 4-5. 4-Way, 3-Position Valve Section with Pressure Detent Release.

4-WAY, 3-POSITION VALVE SECTION WITH PRESSURE DETENT RELEASE (KO)

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | | POSITIONER, Pressure Detent Release (See Figure 4-19) | 1 |
| 2 | K-6030-A | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes Screws, (See Figure 4-23. See Figures 4-24 thru 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 1 |
| 5 | 3765-001 | WASHER, Back-Up | 2 |
| 6 | 7700-001* | SEAL, O-Ring | 2 |
| 7 | 8072- | HOUSING | 1 |
| 8 | 8534-001 | SPOOL, 4-Way | 1 |

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

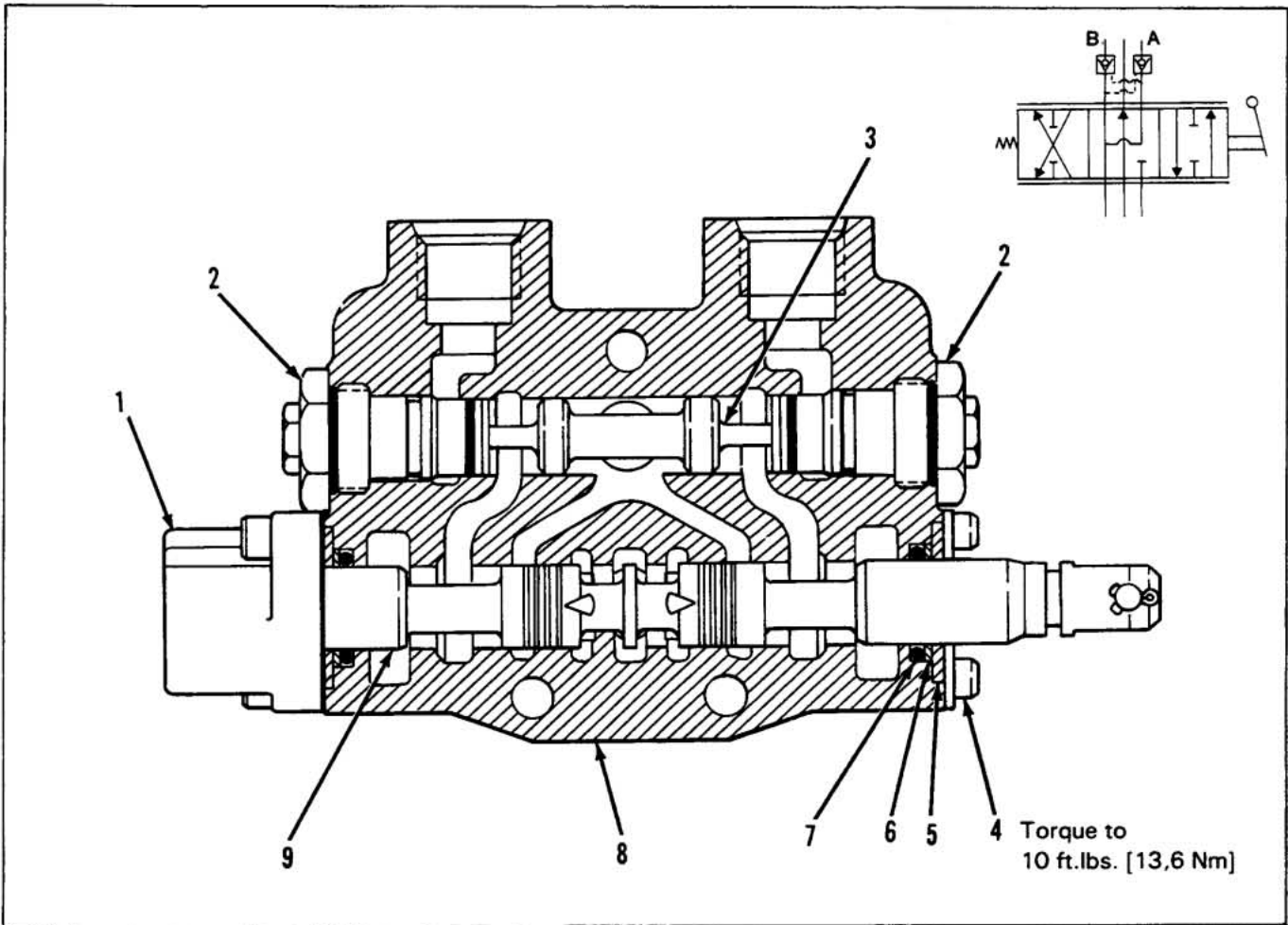


Figure 4-6. 4-Way, 3-Position Lockout Valve Section.

4-WAY, 3-POSITION LOCKOUT VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6125-B | POSITIONER, Spool, Standard (See Figure 4-12) | 1 |
| 2 | K-6024-D | CHECK, Lockout (See Figure 4-29) | 2 |
| 3 | 8648-001 | PISTON, Unlocking | 1 |
| 4 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 5 | 6752-001 | RETAINER, Plate Washer | 2 |
| 6 | 3265-001 | WASHER, Back-Up | 2 |
| 7 | 7700-001* | SEAL, O-Ring | 2 |
| 8 | 11571- | HOUSING, V20 Lockout | 1 |
| 9 | 8397-001 | SPOOL, Modified 4-Way Free Flow | 1 |

} Not sold separately. Order K-6035-A

} See Note

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

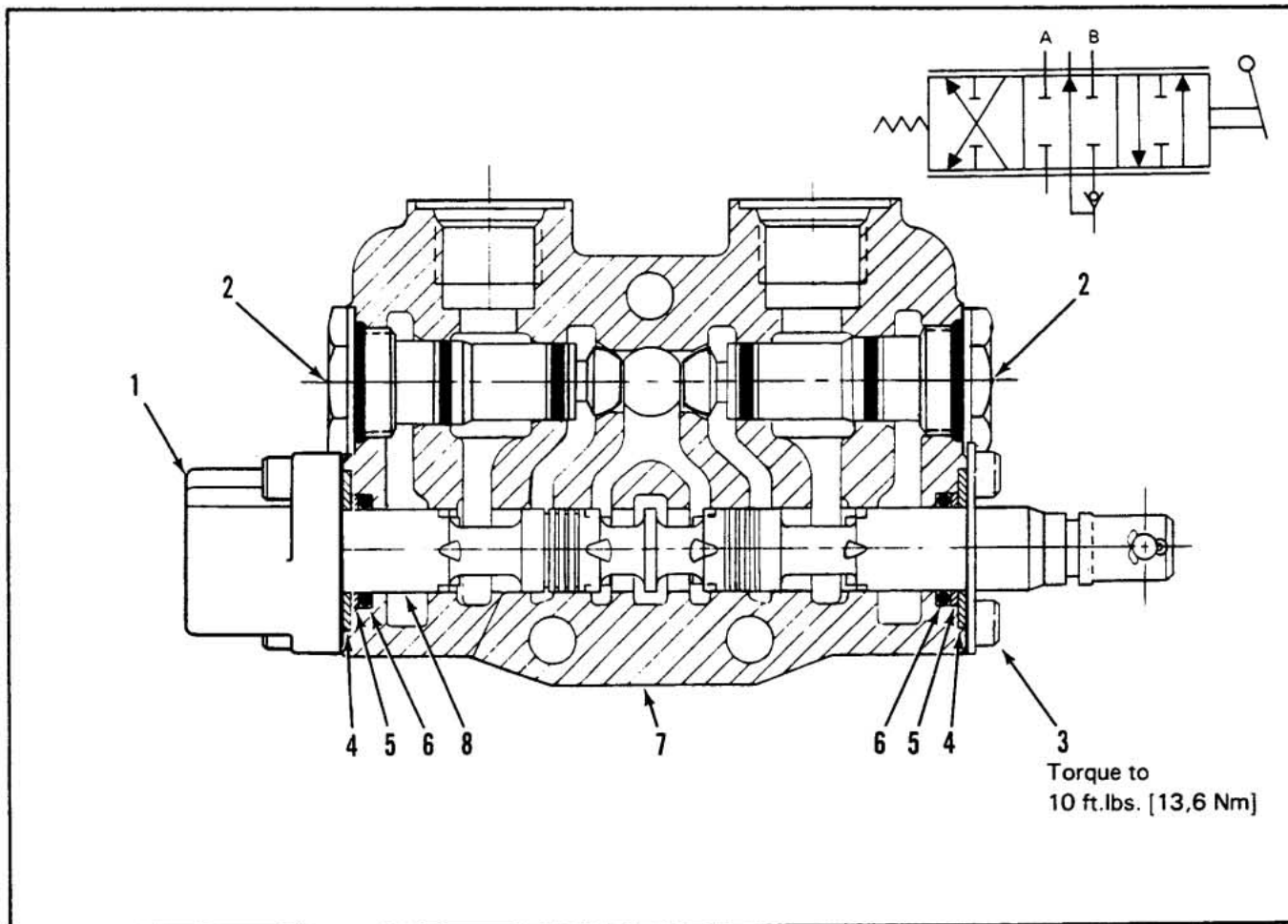


Figure 4-7. 4-Way, 3-Position Tandem Valve Section (shown with 4-way spool).

4-WAY, 3-POSITION TANDEM VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|---|----------------------|
| 1 | K-6125-B | POSITIONER, Spool, Standard (See Figure 4-12) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes Screws (See Figure 4-23. See Figures 4-24 thru 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 2 |
| 5 | 3265-001 | WASHER, Back-Up | 2 |
| 6 | 7700-001* | SEAL, O-Ring | 2 |
| 7 | 8112- | HOUSING | 1 |
| 8 | 8084-001 | SPOOL, 4-Way | 1 |

Notes:

1. Seal and washer not sold separately. Order Seal Kit No. K-6035-A.

2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

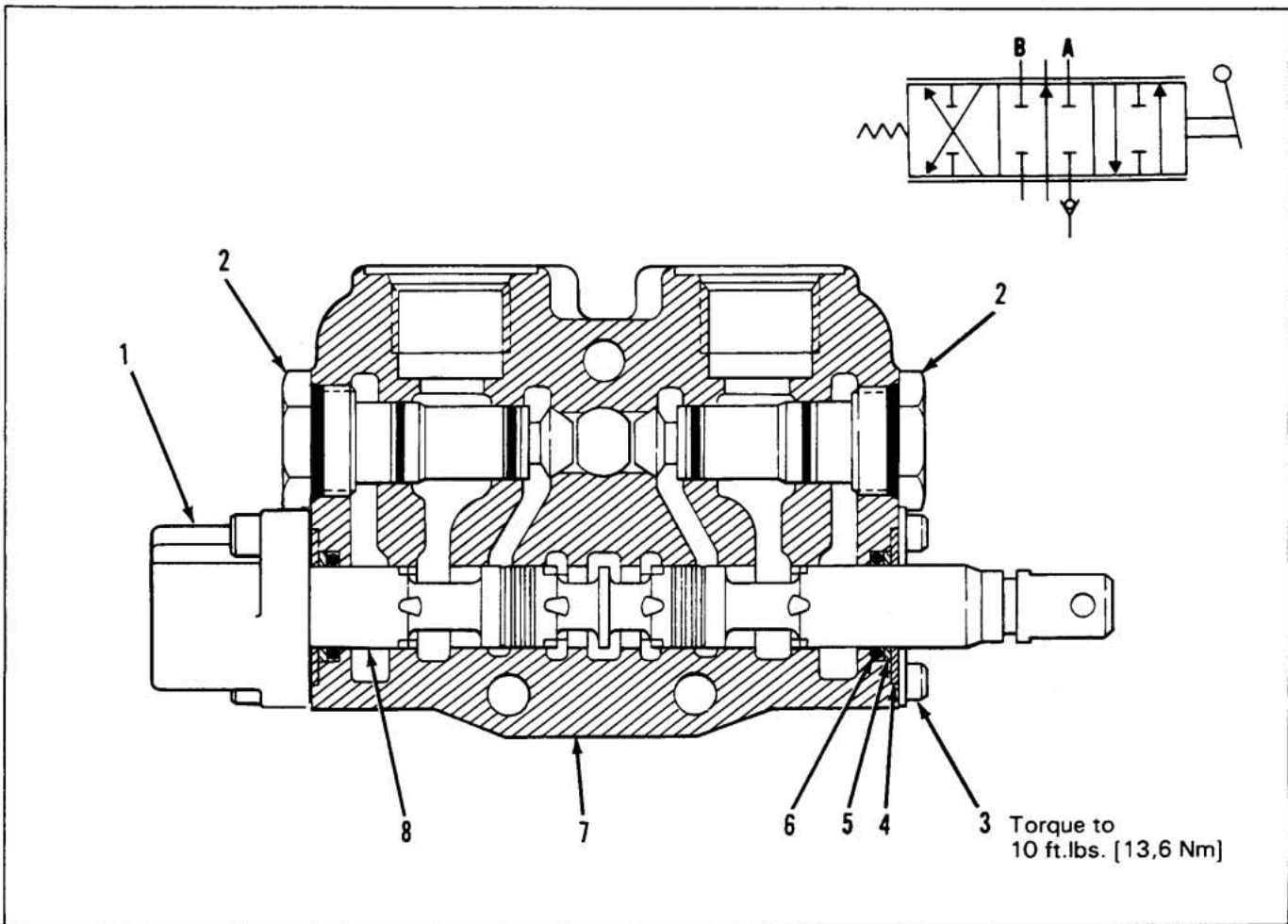


Figure 4-8. 4-Way, 3-Position, Low Pressure Drop Valve Section.

4-WAY, 3-POSITION, LOW PRESSURE DROP VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6207-A | POSITIONER, Spool, Standard (See Figure 4-21) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 2 |
| 5 | 3265-001 | WASHER, Back Up | 2 |
| 6 | 7700-001* | SEAL, O-Ring | 2 |
| 7 | 10954- | HOUSING, V20 Low Pressure Drop | 1 |
| 8 | 8084-001 | SPOOL, 4-Way | 1 |

} Not Sold separately. Order K-6035-A

} See Note

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

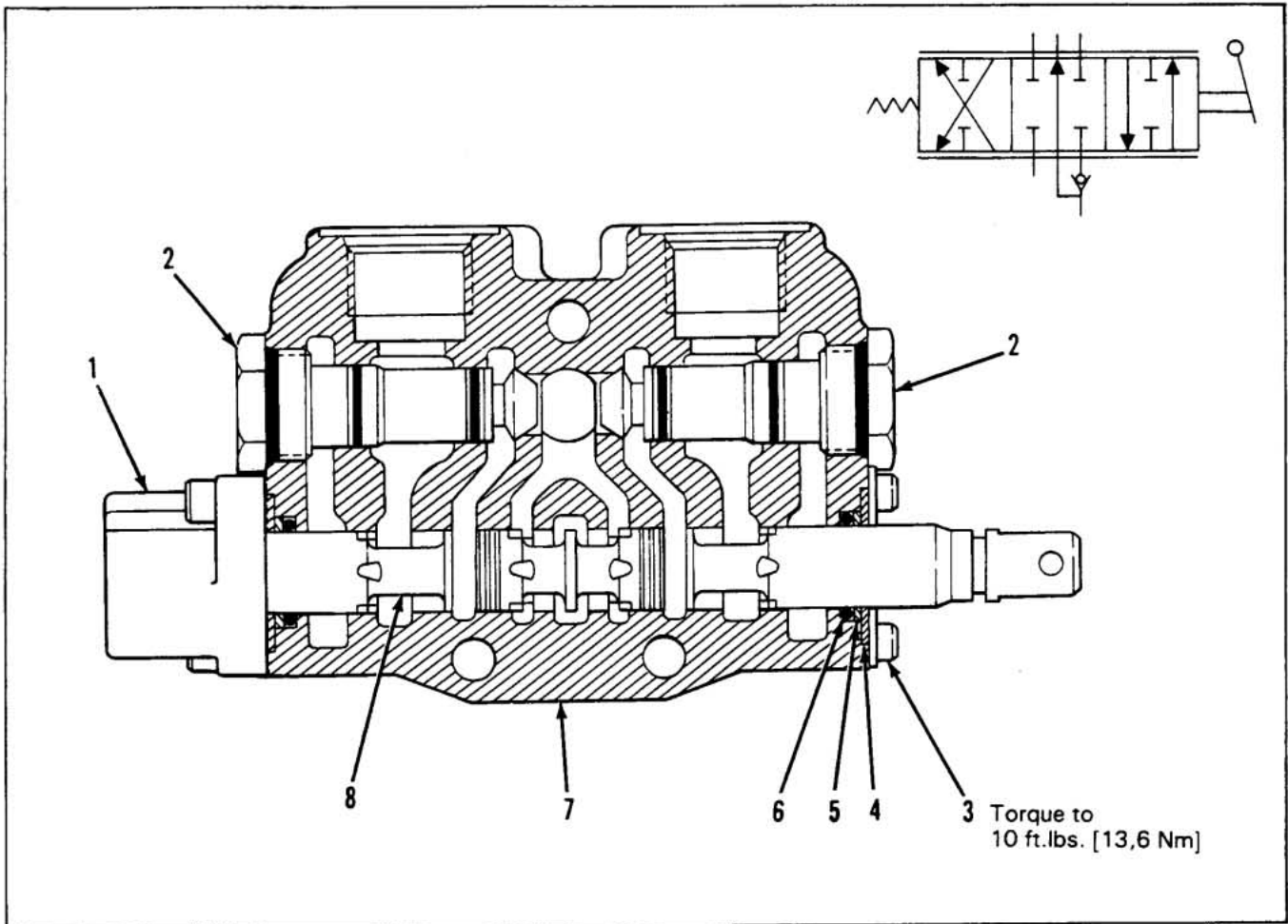


Figure 4-9. 4-Way, 3-Position, Tandem, Low Pressure Drop Valve Section.

4-WAY, 3-POSITION, TANDEM, LOW PRESSURE DROP VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6207-A | POSITIONER, Spool, Standard (See Figure 4-21) | 1 |
| 2 | K-6030-C | CHECK, Load (See Figure 4-32) | 2 |
| 3 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 4 | 6752-001 | RETAINER, Plate Washer | 2 |
| 5 | 3265-001 | WASHER, Back-Up | 2 |
| 6 | 7700-001* | SEAL, O-Ring | 2 |
| 7 | 10762- | HOUSING, Tandem, Low Pressure Drop | 1 |
| 8 | 8084-001 | SPOOL, 4-Way | 1 |

} Not Sold separately. Order K-6035-A

} See Note

Note: These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

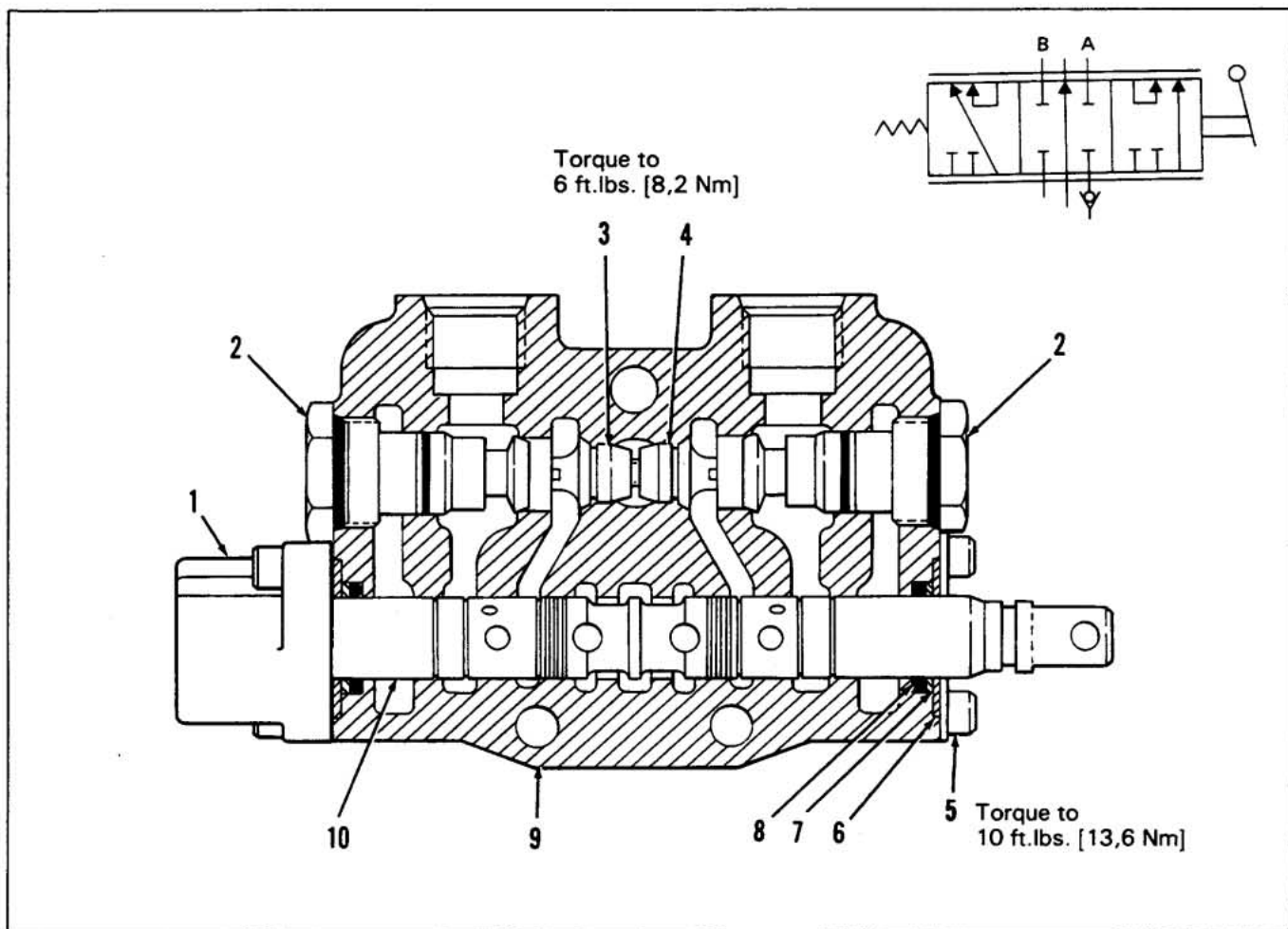


Figure 4-10. 4-Way, 3-Position, Series Valve Section.

4-WAY, 3-POSITION, SERIES VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|----------|-----------|--|----------------------|
| 1 | K-6207-A | POSITIONER, Spool, Standard (See Figure 4-21) | 1 |
| 2 | K-6203 | CHECK, Load (See Figure 4-33) | 2 |
| 3 | 11246-001 | PLUG, Power Core | 1 |
| 4 | 11716-001 | PLUG, Power Core | 1 |
| 5 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 6 | 6752-001 | RETAINER, Plate Washer | 2 |
| 7 | 3265-001 | WASHER, Back-Up | 2 |
| 8 | 7700-001* | Seal, O-Ring | 2 |
| 9 | 11483- | HOUSING, V20 Series | 1 |
| 10 | 11245-001 | SPOOL, Series, 4-Way | 1 |

Notes:

1. Parts not sold separately. Order K-6200-A. Power core plug assembly is only used in Series housings manufactured prior to May 1, 1985 (Series housing #8072).
2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-6 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

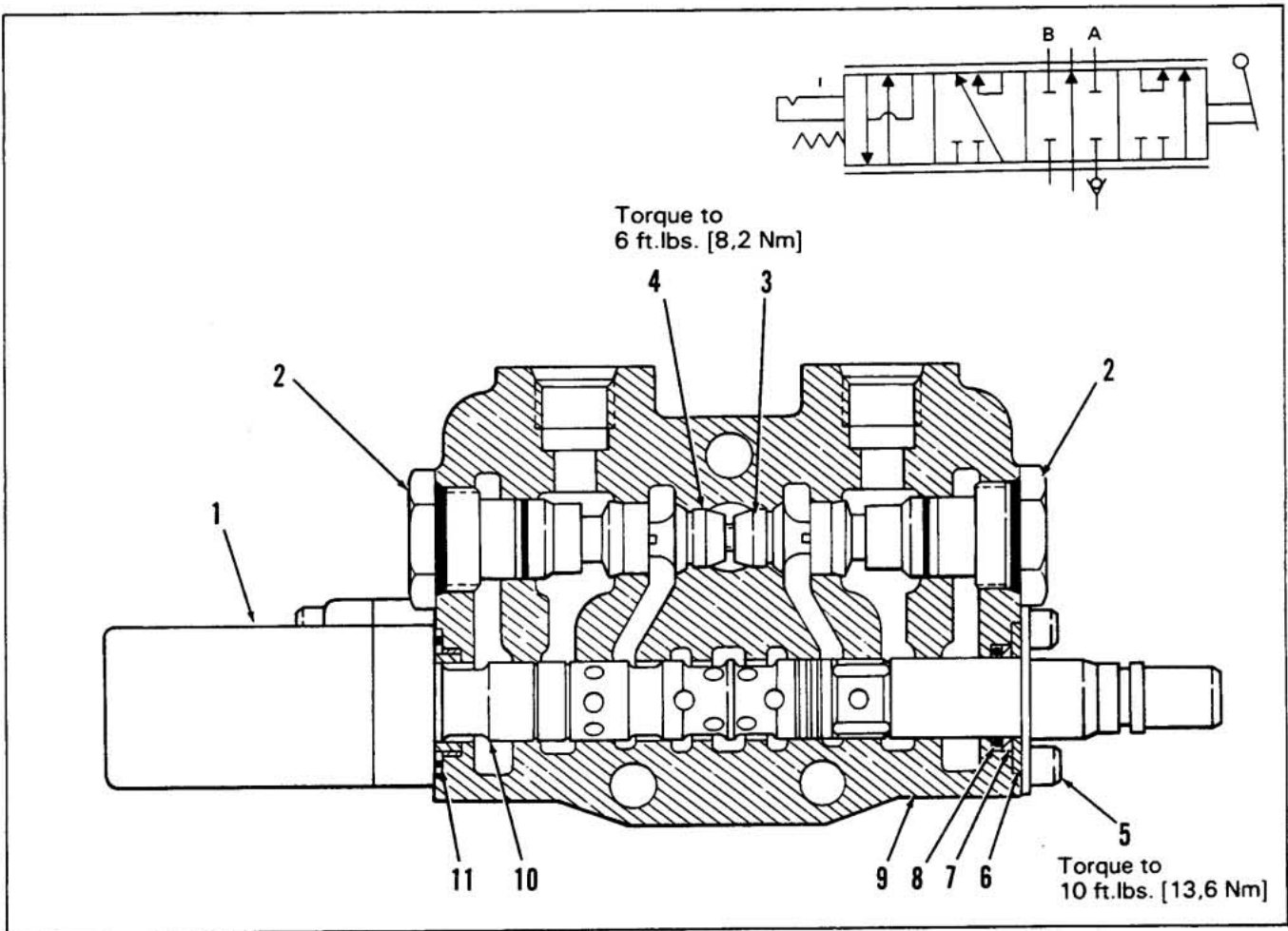


Figure 4-11. 4-Way, 4-Position Float, Series Valve Section.

4-WAY, 4-POSITION FLOAT, SERIES VALVE SECTION

| Item No. | Part No. | Description | Quantity Per Section |
|---------------------------------------|-----------|--|----------------------|
| 1 | K-6208 | POSITIONER, Float Out (See Figure 4-22) | 1 |
| 2 | K-6203 | CHECK, Load (See Figure 4-33) | 2 |
| 3 | 11246-001 | PLUG, Power Core | 1 |
| 4 | 11716-001 | PLUG, Power Core | 1 |
| } See Note 1 | | | |
| 5 | K-6033-B | RETAINER ASSEMBLY, Standard, Includes screws (See Figure 4-23. See Figure 4-24 thru 4-28 for optional assemblies.) | 1 |
| 6 | 6752-001 | RETAINER, Plate Washer | 1 |
| 7 | 3265-001 | WASHER, Back-Up | 1 |
| 8 | 7700-001* | SEAL, O-Ring | 1 |
| } Not sold separately. Order K-6035-A | | | |
| 9 | 11483- | HOUSING, V20 Series | 1 |
| 10 | 11377-001 | SPOOL, Series, Float | 1 |
| } See Note 2 | | | |
| 11 | | SPOOL SEAL ASSEMBLY (See Figure 4-22) | 1 |

Notes:

1. Parts not sold separately. Order K-6200-A. Power core plug assembly is only used in Series housings manufactured prior to May 1, 1985 (series housing #8072).
2. These are matched parts and are not sold separately. Refer to Ordering Instructions, page 3-2 for complete section.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

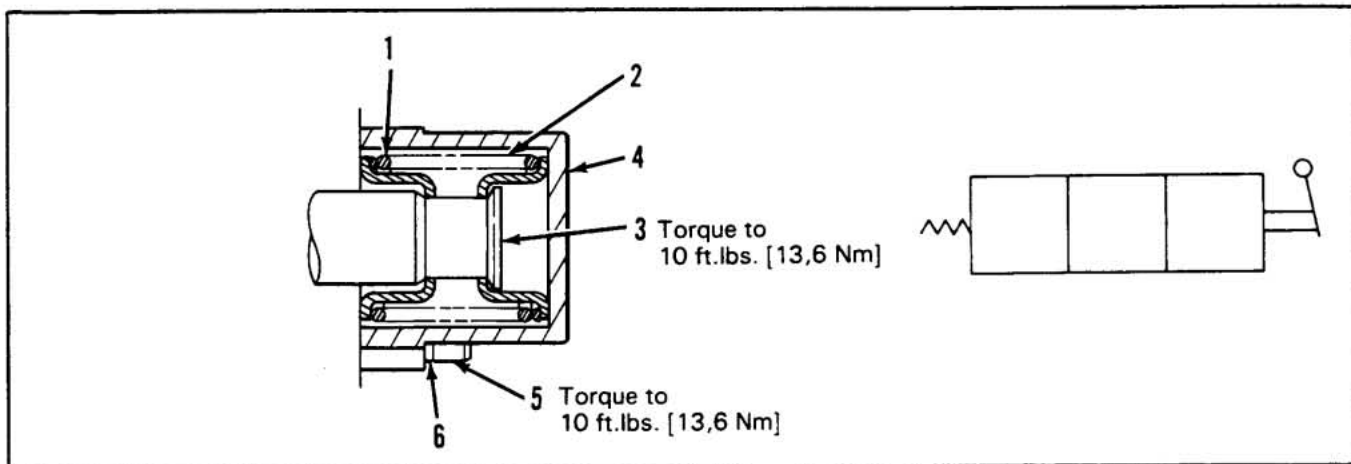


Figure 4-12. Standard Spool Positioner.

STANDARD SPOOL POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|-----------|---|----------|
| | K-6125-B | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 7433-001 | Spring, Return | 1 |
| 2 | 1809-001 | COLLAR, Spring | 2 |
| 3 | 10892-001 | COLLAR, Spool | 1 |
| 4 | 1811-001 | BONNET | 1 |
| 5 | 3731-101 | SCREW, HSHC, 1/4-20 x 7/8 inch long | 2 |
| 6 | 0563-001 | WASHER, Lock | 2 |

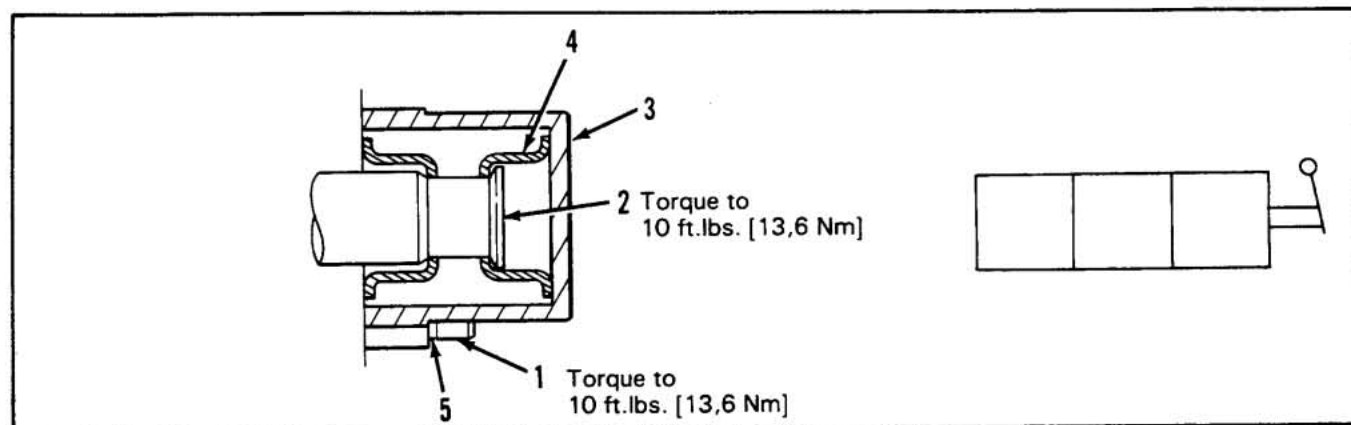


Figure 4-13. Manual Spool Positioner.

MANUAL SPOOL POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|-----------|-------------------------------------|----------|
| 1 | 3731-101 | SCREW, HSHC, 1/4-20 x 7/8 inch long | 2 |
| 2 | 10892-001 | COLLAR, Spool | 1 |
| 3 | 1811-001 | BONNET | 1 |
| 4 | 1809-001 | COLLAR, Stop | 2 |
| 5 | 0563-001 | WASHER, Lock | 2 |

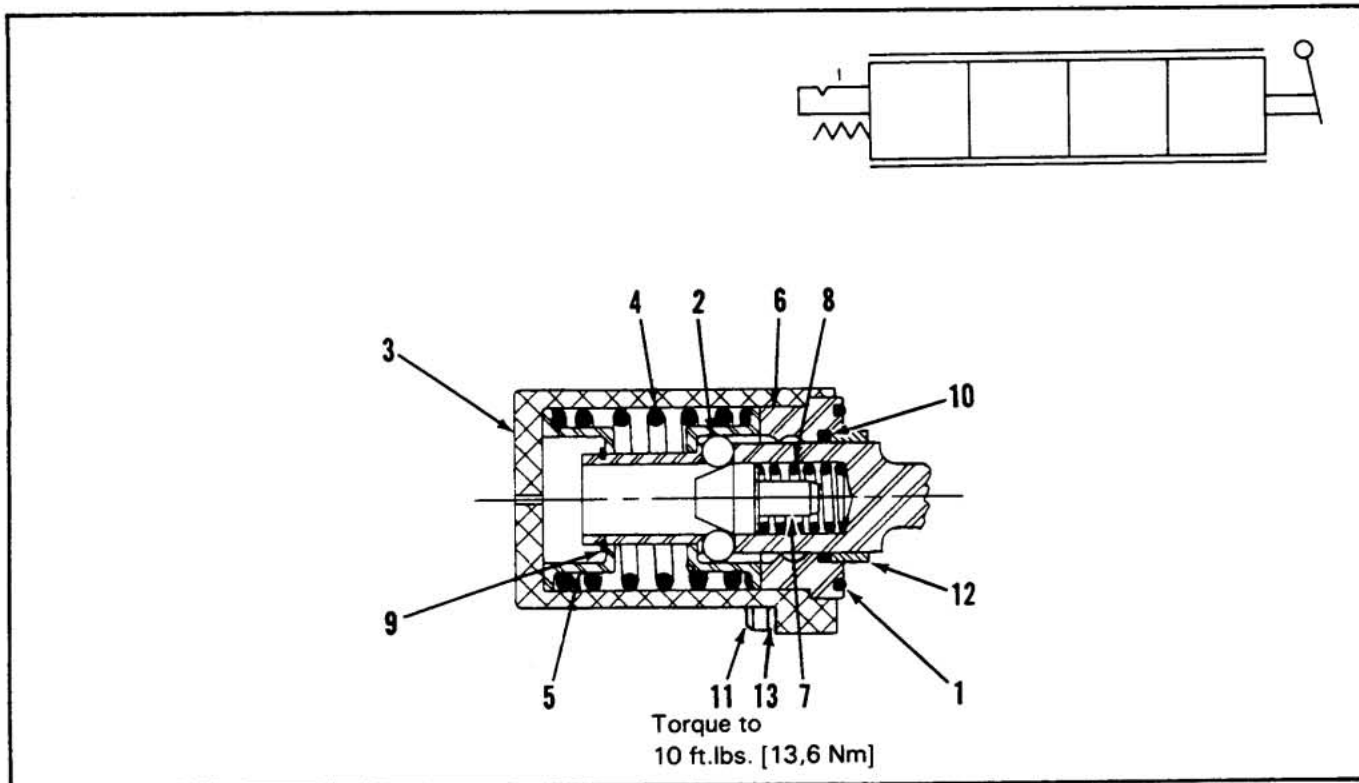


Figure 4-14. 4-Way, 4-Position Float Detent Positioner.

4-WAY, 4-POSITION FLOAT DETENT POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|------------|---|----------|
| | K-6127-B | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 21047-001* | O-RING, Seal | 1 |
| 2 | 1700-001 | BALL, Detent | 4 |
| 3 | 8082-001 | BONNET, Float | 1 |
| 4 | 8099-001 | SPRING, Centering (See Note) | 1 |
| 5 | 1826-001 | COLLAR, Stop | 2 |
| 6 | 8077-001 | SLEEVE, Detent | 1 |
| 7 | 1828-001 | FOLLOWER, Detent Ball | 1 |
| 8 | 8098-001 | SPRING, Detent (See Note) | 1 |
| 9 | 1852-001 | RING, Retaining | 1 |
| 10 | 1853-001* | SEAL, Spool | 1 |
| 11 | 3731-101 | SCREW, HSHC, 1/4-20 x 7/8 inch long | 2 |
| 12 | 8079-001 | SLEEVE, Retainer | 1 |
| 13 | 0563-001 | WASHER, Lock | 2 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

Note:
 Springs shown are standard. Heavy duty springs are available:
 Order No. 3091-001 Heavy Duty Centering Spring.
 Order No. 1829-001 Heavy Duty Detent Spring.

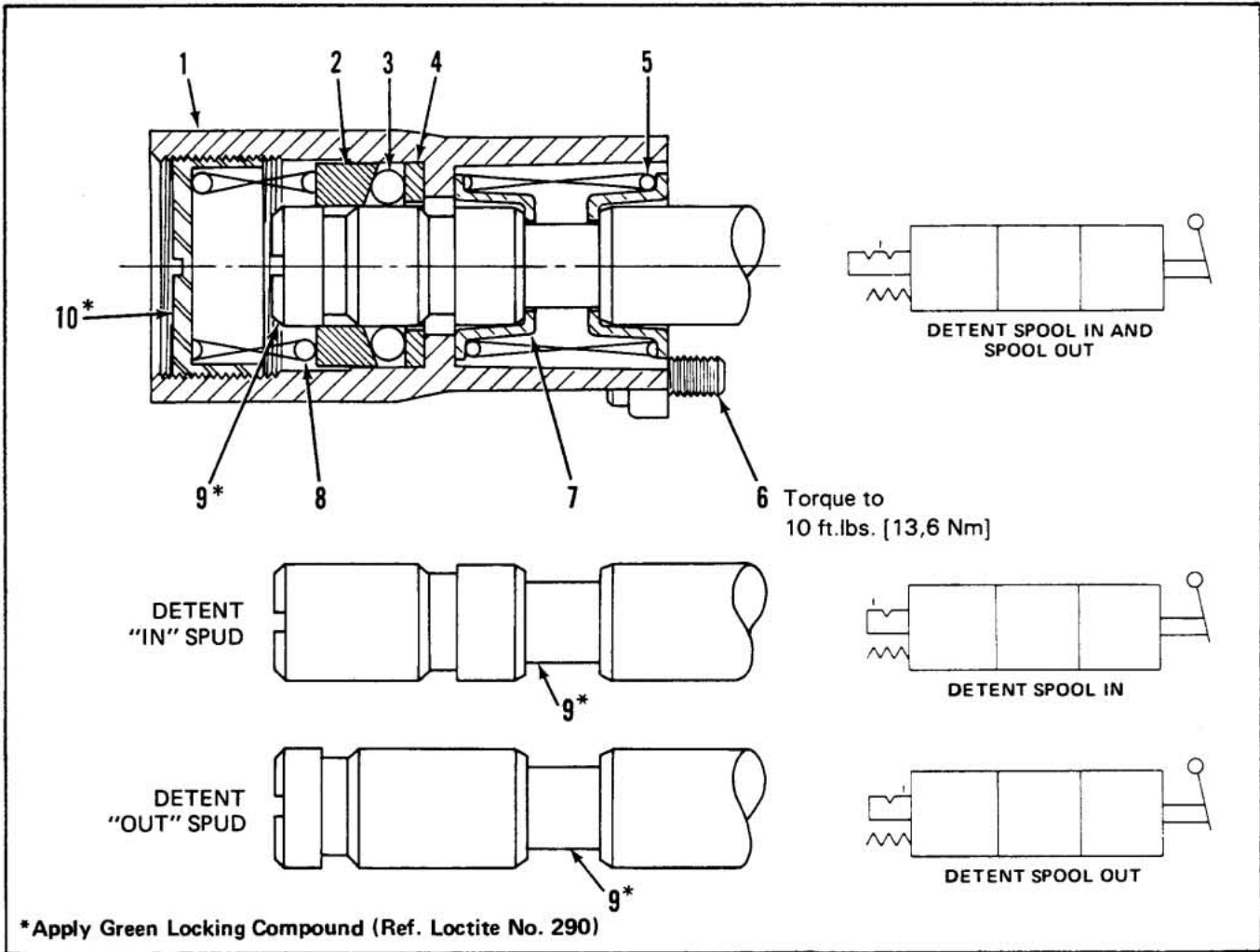


Figure 4-15. Option "R" Detent with Spring Return to Neutral.

OPTION "R" DETENT with SPRING RETURN TO NEUTRAL

| Item No. | Part No. | Description | Quantity |
|----------|-----------|--|----------|
| | K-6152-A | REPLACEMENT KIT, Detent Spool "IN" position only | |
| | K-6151-A | REPLACEMENT KIT, Detent Spool "OUT" position only | |
| | K-6153-A | REPLACEMENT KIT, Detent Spool "IN" and "OUT" positions (Replacement Kits contain all of the items listed below with the correct spud (item 9) for each kit) | |
| 1 | 8325-001 | BONNET, R Detent | 1 |
| 2 | 8571-001 | RACE, Ball | 1 |
| 3 | 1700-001 | BALL, Steel | 12 |
| 4 | 7994-001 | PLATE, Thrust | 1 |
| 5 | 3250-001 | SPRING, Centering | 1 |
| 6 | 3731-099 | SCREW, HSHC, 1/4-20 by 5/8 inch long | 2 |
| 7 | 1809-001 | COLLAR, Spring | 2 |
| 8 | 3252-001 | SPRING | 1 |
| 9 | 8573-001 | SPUD, R Detent "IN" | 1 |
| | 8572-001 | SPUD, R Detent "OUT" | 1 |
| | 8574-001 | SPUD, R Detent "IN" and "OUT" | 1 |
| 10 | 20443-001 | CAP, Adjusting | 1 |

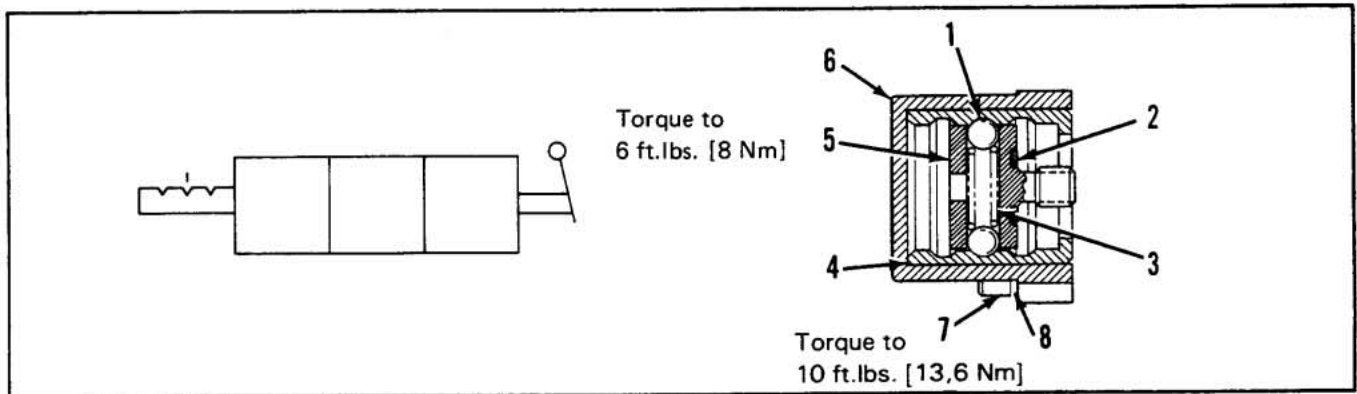


Figure 4-16. Option "D" 3-Position Detent Spool.

OPTION "D" 3-POSITION DETENT SPOOL

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6012-E | REPLACEMENT KIT (Contains all items listed below except item 8) | |
| 1 | 0023-001 | BALL, Detent | 2 |
| 2 | 1837-001 | WASHER, Lock | 1 |
| 3 | 1838-001 | SPRING, Detent | 1 |
| 4 | 6812-001 | SLEEVE, Detent, 3-position | 1 |
| 5 | 1840-001 | HOLDER, Detent | 1 |
| 6 | 1811-001 | BONNET | 1 |
| 7 | 3731-101 | SCREW, HSHC, 1/4-20 x 7/8 inch long | 2 |
| 8 | 0563-001 | WASHER, Lock | 2 |
| 9 | 1889-001 | STOP, Detent, optional (not shown) | 1 |

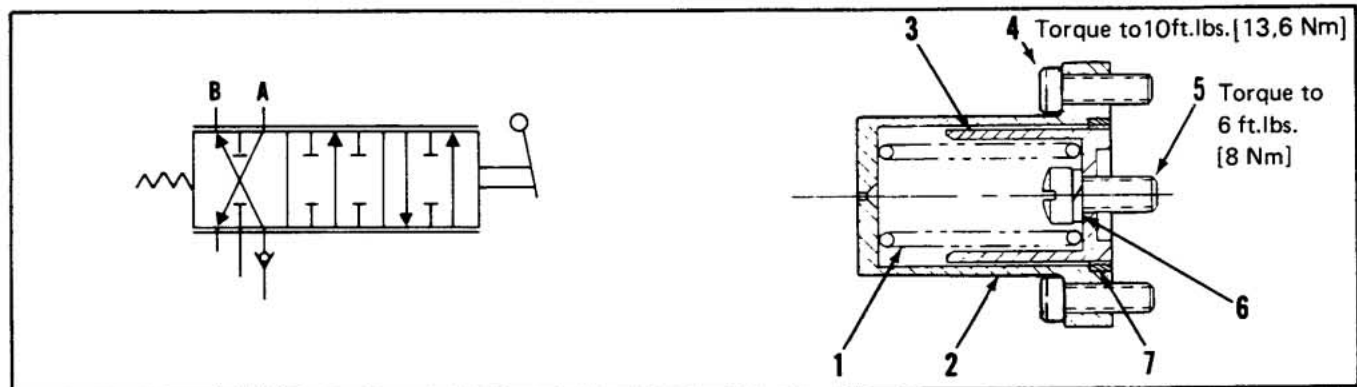


Figure 4-17. Option "A" Spring, Extended Spool.

OPTION "A" SPRING, EXTENDED SPOOL

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6150-A | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 8666-001 | SPRING, Return | 1 |
| 2 | 1824-001 | BONNET | 1 |
| 3 | 1860-001 | COLLAR, Stop | 1 |
| 4 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 5 | 1812-001 | SCREW, Cap | 1 |
| 6 | 1813-001 | WASHER, Lock | 1 |
| 7 | 6756-001 | SLEEVE, Bonnet | 1 |

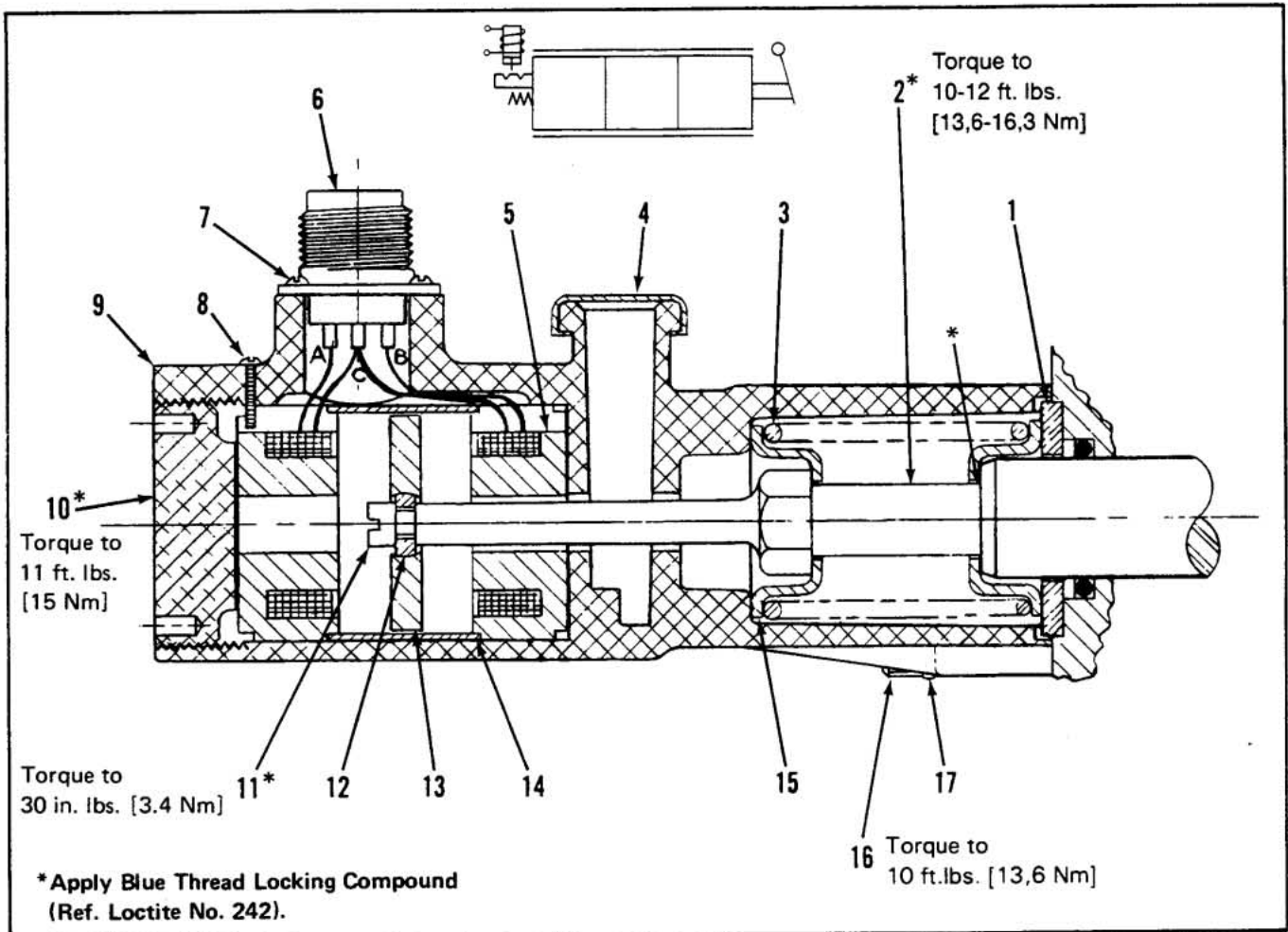


Figure 4-18. Electro-Magnetic Spool Release Positioner.

ELECTRO-MAGNETIC SPOOL RELEASE POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6064-A | REPLACEMENT KIT (Contains Items 2, 5, 11, 12, 13) | |
| 1 | 7572-001 | RETAINER, Spool Seal | 1 |
| 2 | 7954-001 | SPUD, Positioner | 1 |
| 3 | 3250-001 | SPRING, 1.114 OD x 0.095 WD | 1 |
| 4 | 7589-001 | CAP, Seal | 1 |
| 5 | 7752-001 | ELECTRO-MAGNET | 2 |
| 6 | 7955-001 | CONNECTOR, Electrical | 1 |
| 7 | 7593-001 | SCREW, Thread-Cutting | 4 |
| 8 | 7956-001 | SCREW, Thread-Cutting | 1 |
| 9 | 7583-004 | BONNET, Electric Detent | 1 |
| 10 | 7957-001 | PLUG, Bonnet | 1 |
| 11 | 7756-001 | SCREW, Shoulder, .188 x 0.156 inch long | 1 |
| 12 | 7755-001 | WASHER, Alignment | 1 |
| 13 | 8555-001 | ARMATURE | 1 |
| 14 | 7958-001 | SPACER | 1 |
| 15 | 7573-001 | COLLAR, Spring | 2 |
| 16 | 3731-103 | SCREW, Housing, .250 x 1.25 inches long | 2 |
| 17 | 0563-001 | WASHER, Lock, 0.250 ID | 2 |

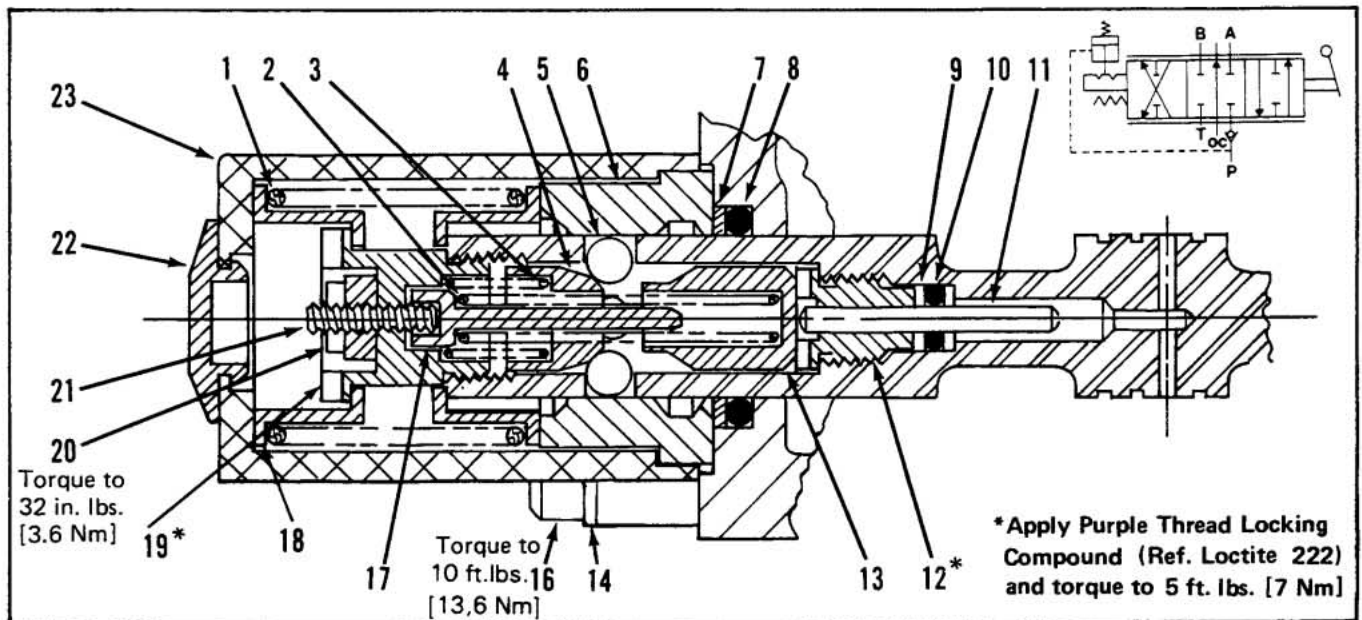


Figure 4-19. Optional Pressure Detent Release (KO) Positioner.

OPTIONAL PRESSURE DETENT RELEASE (KO) POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|-----------|---|--|
| | K-6061-B | SEAL KIT (Contains items 7, 8, 9 and 10 listed below) | |
| 1 | 7433-001 | SPRING, Centering | 1 |
| 2 | 8047-001 | SPRING, Standard (500-1600 PSI [35-110 bar] Crack) | 1 |
| | 8010-001 | SPRING, Optional (1601-2400 PSI [111-165 bar] Crack) | 1 |
| | 8538-001 | SPRING, Optional (2401-3000 PSI [166-207 bar] Crack) | 1 |
| | 8537-001 | SPRING, Optional (3001-3500 PSI [166-207 bar] Crack) | 1 |
| 3 | 7898-001 | SPRING, 0.385 O.D.x.054 W.D. | 1 |
| 4 | 7897-001 | FOLLOWER, Ball | 1 |
| 5 | 1700-001 | BALL, Steel | 4 |
| 6 | 8007-001 | SLEEVE, Detent | 1 |
| 7 | 3265-001 | RING, Back-Up | } Not Sold Separately Order K-6061-B |
| 8 | 7700-001* | SEAL, O-Ring | |
| 9 | 7907-001 | RING, Back-Up | |
| 10 | 3328-001 | SEAL, O-Ring | 1 |
| 11 | 7908-001 | ROLLER, Needle | 1 |
| 12 | 7906-001 | GUIDE, Piston | 1 |
| 13 | 7896-001 | PLUNGER, Knockout | 1 |
| 14 | 7904-001 | PLATE, Bearing | 2 |
| 16 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 17 | 7899-001 | GUIDE, Spring | 1 |
| 18 | 8536-001 | COLLAR, Spring | 2 |
| 19 | 8535-001 | COLLAR, Spool | 1 |
| 20 | 6229-001 | LOCKNUT | 1 |
| 21 | 8014-001 | SCREW, Hex Set, No. 10-24x0.62 | 1 |
| 22 | 7902-001 | PLUG, Button, Flush Head | 1 |
| 23 | 1824-002 | BONNET | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

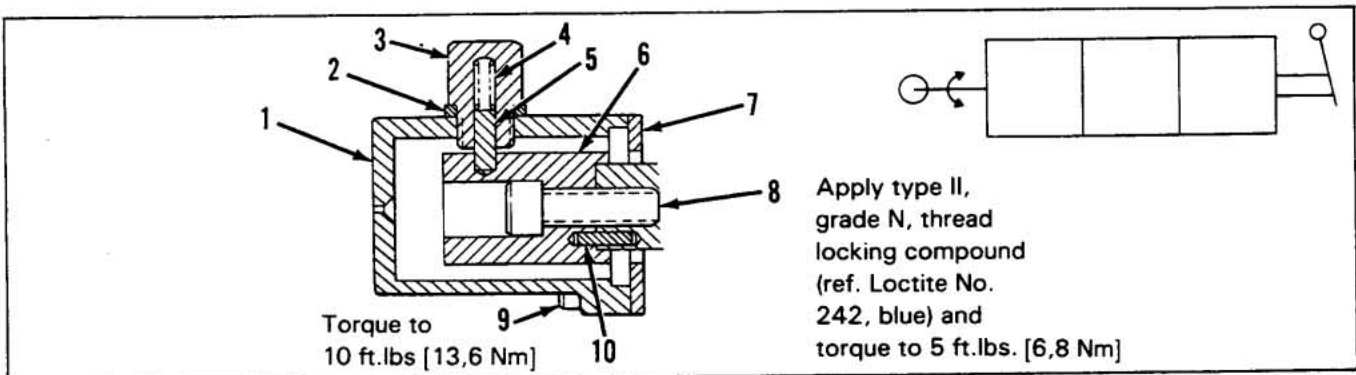


Figure 4-20. Option "W" Rotary Spool Positioner.

OPTION "W" ROTARY SPOOL POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6141-C | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 1824-006 | BONNET, Rotary | 1 |
| 2 | 8743-001 | WASHER, Detent Cap | 1 |
| 3 | 8744-001 | CAP, Rotary Detent | 1 |
| 4 | 8808-001 | SPRING, Detent | 1 |
| 5 | 2676-001 | PIN, Detent | 1 |
| 6 | 8746-001 | BODY, Rotary Cam | 1 |
| 7 | 6552-001 | PLATE, Seal Retainer | 1 |
| 8 | 3731-150 | SCREW, HSHC, 5/16-18 by 1 inch long | 1 |
| 9 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 10 | 0888-001 | PIN, Dowel | 1 |

NOTE: Apply heavy duty, general purpose grease to the helical groove of Cam Body (Item 6) and Pin (Item 5). For standard assembly, hole in spool clevis must be horizontal with valve spool in neutral.

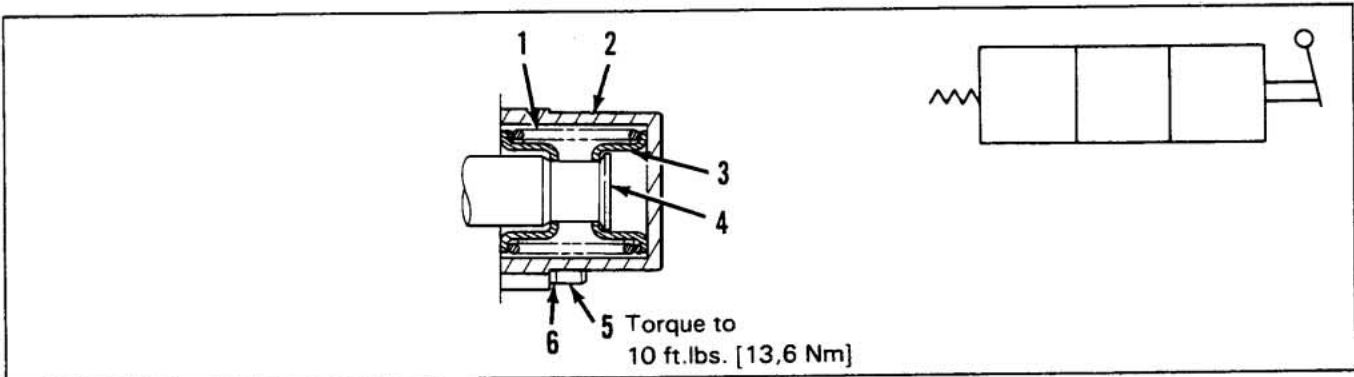


Figure 4-21. Series or Low Pressure Drop, Standard Spool Positioner.

SERIES OR LOW PRESSURE DROP, STANDARD SPOOL POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|-----------|---|----------|
| | K-6207-A | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 10956-001 | SPRING, Return | 1 |
| 2 | 1811-001 | BONNET | 1 |
| 3 | 1809-001 | COLLAR, Spring | 2 |
| 4 | 10892-001 | COLLAR, Spool | 1 |
| 5 | 3731-101 | SCREW, HSHC, 1/4-20 x 7/8 inch long | 2 |
| 6 | 0563-001 | WASHER, Lock | 2 |

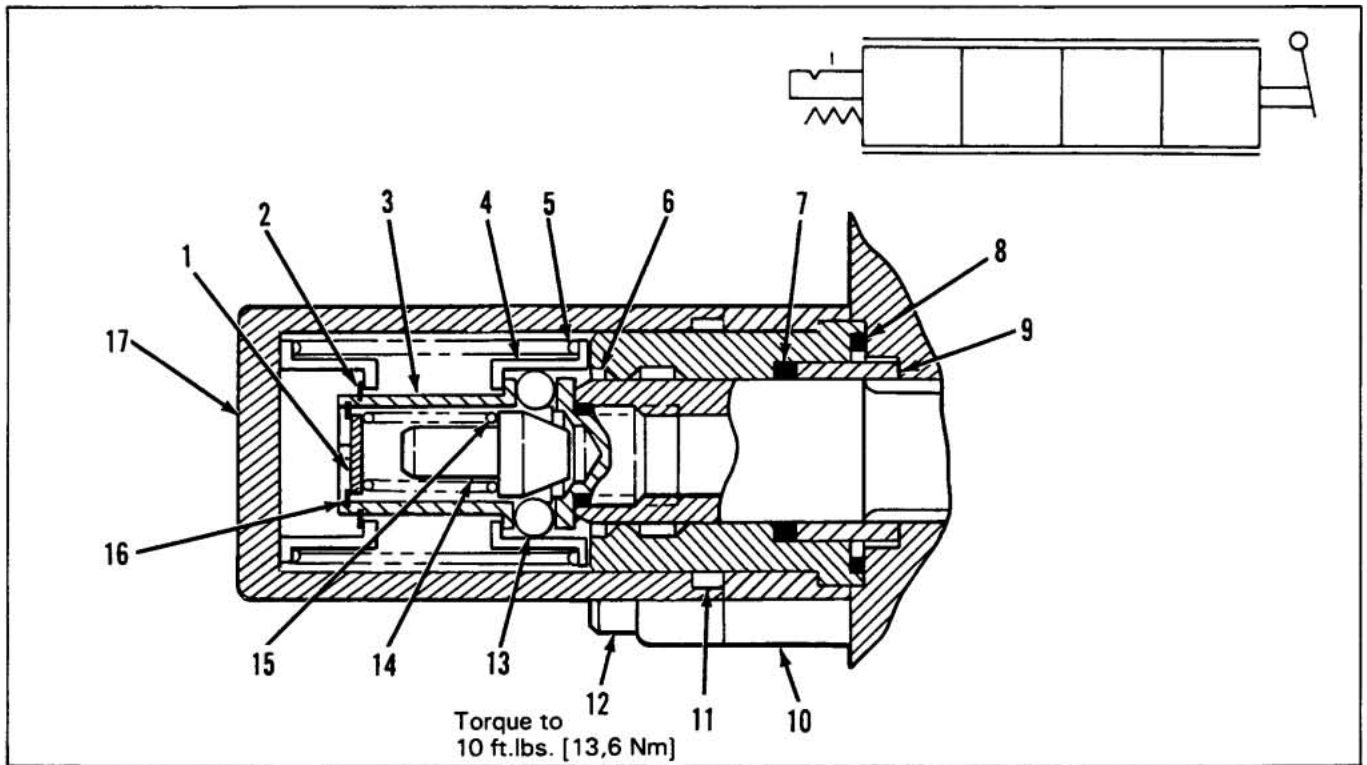


Figure 4-22. V20S 4-Way, 4-Position Float (out) Detent Positioner.

V20S 4-WAY, 4-POSITION FLOAT (OUT) DETENT POSITIONER

| Item No. | Part No. | Description | Quantity |
|----------|------------|---|----------|
| | K-6208 | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 11371-001 | SHIM | 1 |
| 2 | 1852-001 | RING, Retaining | 1 |
| 3 | 11373-001 | COLLAR, Spool | 1 |
| 4 | 1826-001 | COLLAR, Spring | 2 |
| 5 | 1807-001 | SPRING, Centering | 1 |
| 6 | 0449-001* | SEAL, O-Ring | 1 |
| 7 | 1853-001* | SEAL, Four Lobed | 1 |
| 8 | 21047-001* | SEAL, O-Ring | 1 |
| 9 | 8079-001 | SLEEVE, Retainer | 1 |
| 10 | 7905-001 | SPACER, Bonnet | 1 |
| 11 | 11372-001 | SLEEVE, Detent | 1 |
| 12 | 9161-412 | SCREW, HSHC, 1/4-20 by 1 1/2 inch long | 2 |
| 13 | 1700-001 | BALL, Detent | 4 |
| 14 | 1828-001 | FOLLOWER, Ball | 1 |
| 15 | 1829-001 | SPRING, Detent | 1 |
| 16 | 9320-016 | RING, Retaining | 1 |
| 17 | 8082-001 | BONNET | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

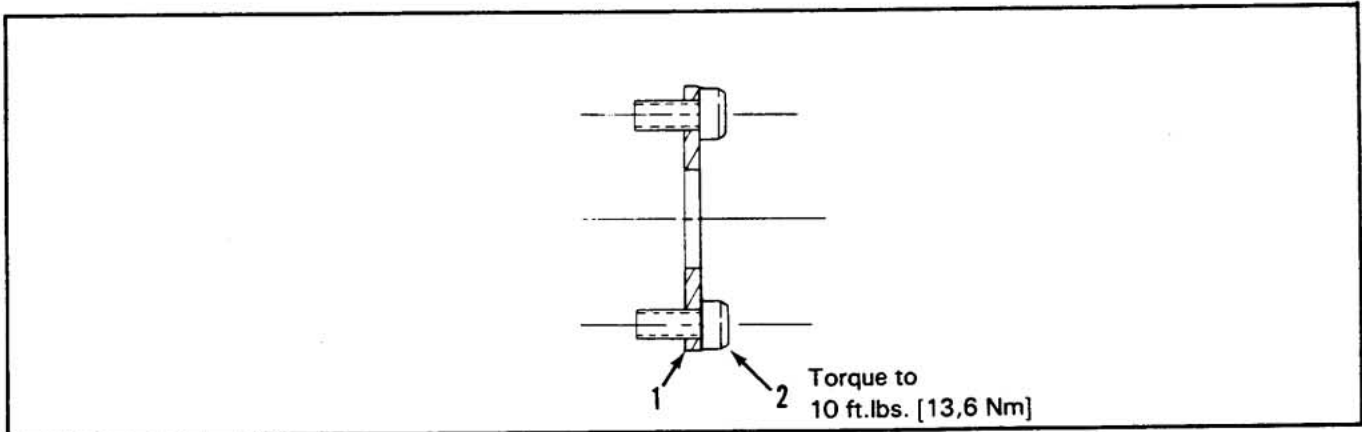


Figure 4-23. Standard Seal Retainer.

STANDARD SEAL RETAINER

Used when handle bracket is not furnished and tank line pressures are below 200 PSI [14 bar].

| Item No. | Part No. | Description | Quantity |
|----------|----------|--|----------|
| | K-6033-B | REPLACEMENT KIT (Contains items 1 and 2) | |
| 1 | 6552-001 | PLATE | 1 |
| 2 | 3731-098 | SCREW, HSHC, 1/4-20 by 1/2 inch long | 2 |

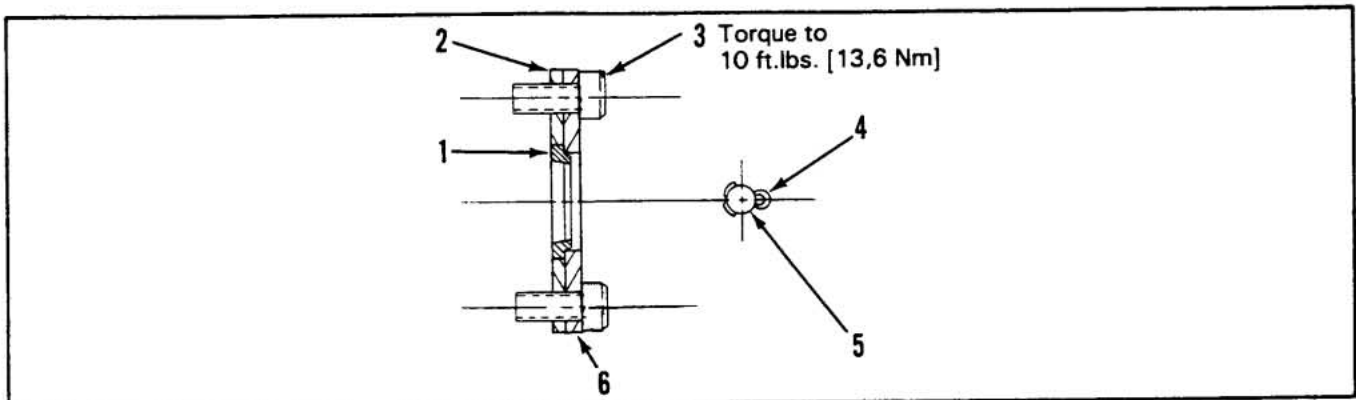


Figure 4-24. Optional Heavy Duty Seal Retainer.

OPTIONAL HEAVY DUTY SEAL RETAINER WITH OPTIONAL SPOOL WIPER

Used when handle bracket is not furnished and tank line pressure is below 1000 PSI [69 bar], and when wiper seal is desired.

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6029-B | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 1800-001 | WIPER, Spool (Optional) | 1 |
| 2 | 6802-001 | PLATE, Seal | 1 |
| 3 | 3731-098 | SCREW, HSHC, 1/4-20 by 1/2 inch long | 2 |
| 4 | 0086-001 | PIN, Cotter | 1 |
| 5 | 1857-001 | PIN | 1 |
| 6 | 6552-001 | PLATE | 1 |

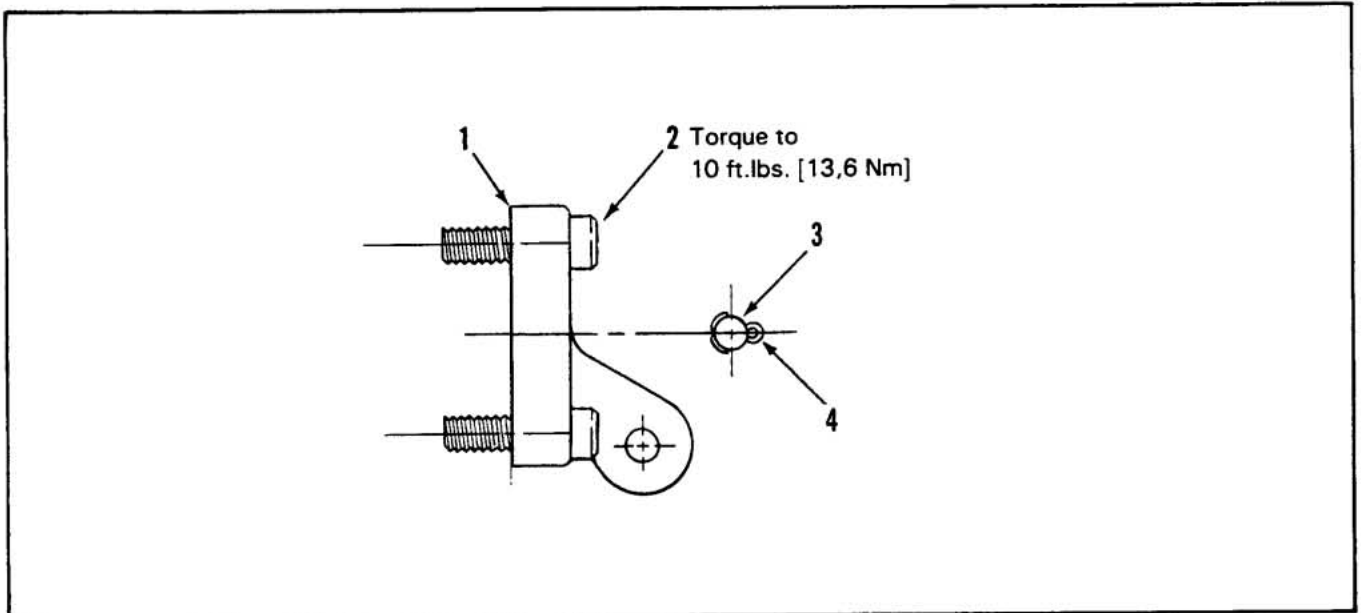


Figure 4-25. Handle Bracket Assembly.

HANDLE BRACKET ASSEMBLY

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6031-A | REPLACEMENT KIT, Standard, (Contains items 1, 2, 3 and 4) | |
| | K-6037-A | SERVICE KIT, Heavy Duty, (Contains items 1 and 2) | |
| 1 | 1801-001 | BRACKET, Die Cast (Standard) | 1 |
| | 1801-002 | BRACKET, Die Cast (Optional, for use with CRA Relief) | 1 |
| | 7355-001 | BRACKET, Cast Iron (Optional, Heavy Duty) | 1 |
| 2 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 3 | 1857-001 | PIN | 1 |
| 4 | 0086-001 | PIN, Cotter | 1 |
| 5 | 1800-001 | SEAL, Wiper, optional (not shown) | 1 |

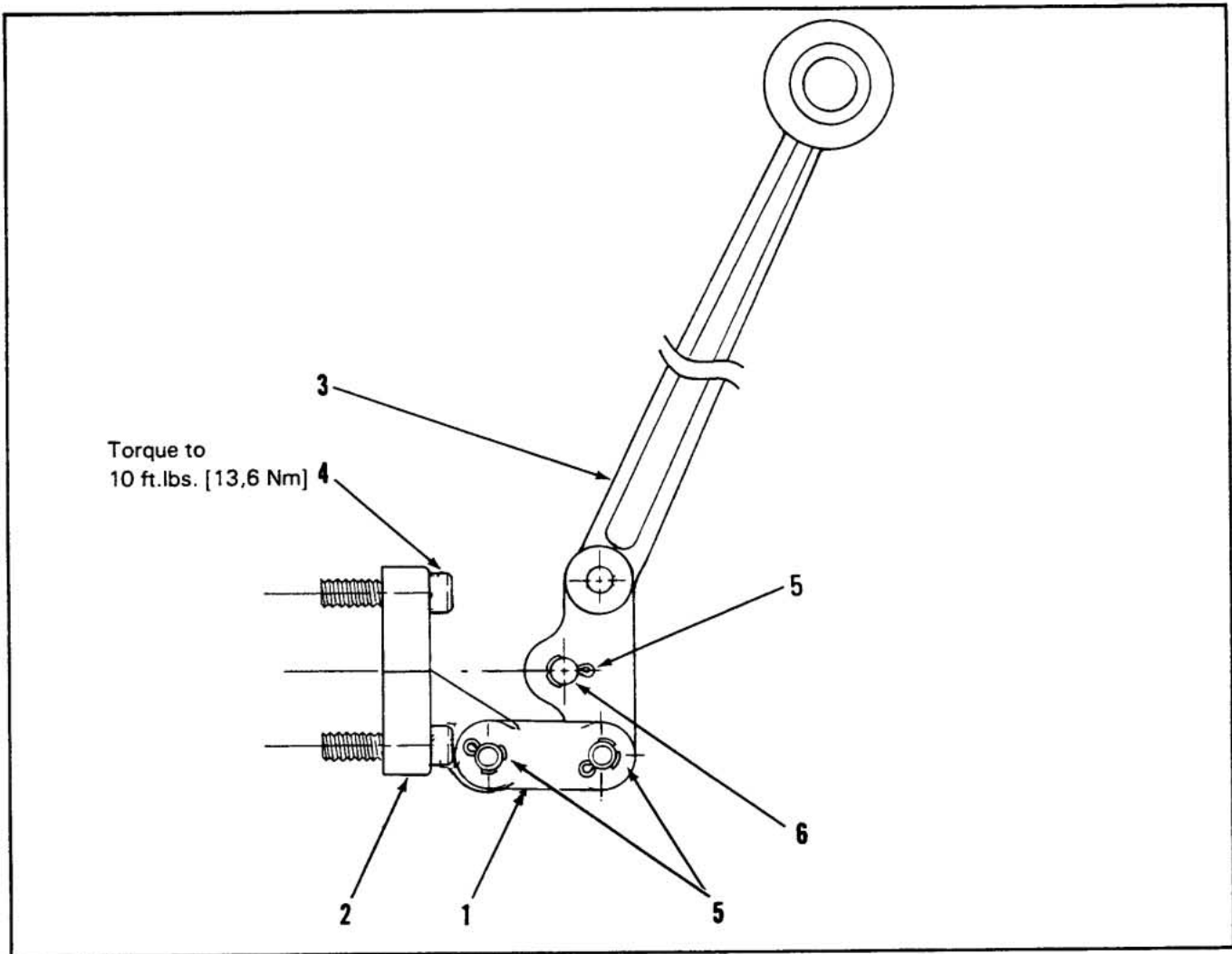


Figure 4-26. Optional Vertical Handle and Bracket Assembly.

OPTIONAL VERTICAL HANDLE and BRACKET ASSEMBLY

| Item No. | Part No. | Description | Quantity |
|----------|-----------|--|----------|
| | K-6004-B | REPLACEMENT KIT, Standard (Black plastic coated handle) | |
| | K-6137-A | REPLACEMENT KIT, Optional (Plain handle) | |
| | | All Replacement Kits contain all items listed below except No. 7355-001, Bracket | |
| 1 | 11393-001 | LINK | 1 |
| | 11392-001 | PLATE, Link | 1 |
| 2 | 1801-001 | BRACKET, Die Cast (Standard) | 1 |
| | 7355-001 | BRACKET, Cast Iron (Optional, Heavy Duty) | 1 |
| 3 | 1802-001 | HANDLE, Standard Vertical, Black plastic coated | 1 |
| | 1802-003 | HANDLE, Optional Vertical, Plain | 1 |
| 4 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 5 | 0086-001 | PIN, Cotter | 3 |
| 6 | 1857-001 | PIN | 1 |
| 7 | 1800-001 | SEAL, Wiper, optional (not shown) | 1 |

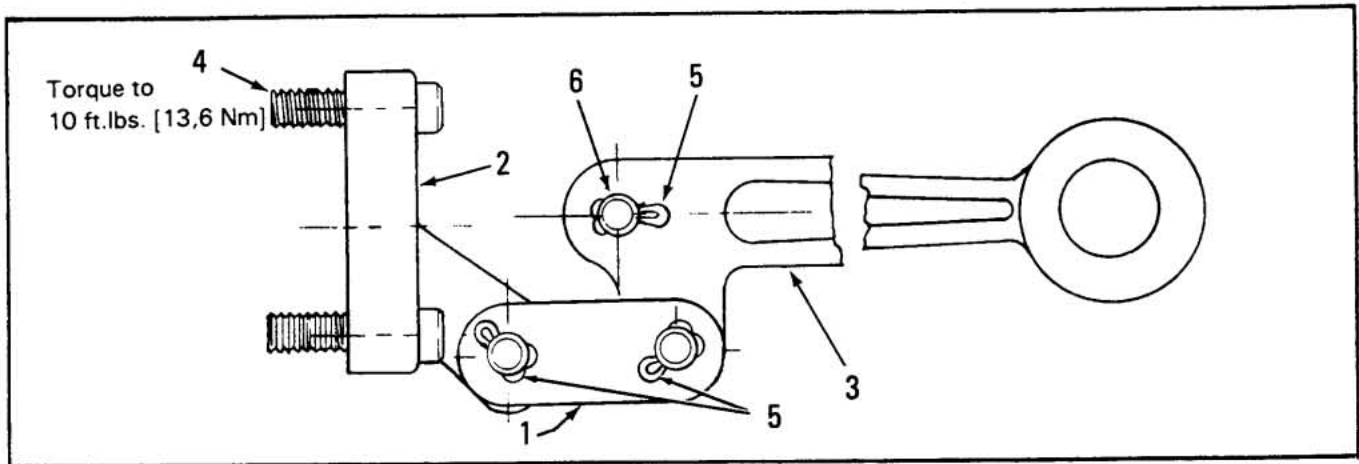


Figure 4-27. Optional Horizontal Handle and Bracket Assembly.

OPTIONAL HORIZONTAL HANDLE and BRACKET ASSEMBLY

| Item No. | Part No. | Description | Quantity |
|----------|-----------|--|----------|
| | K-6007-B | REPLACEMENT KIT, Standard (Black plastic coated handle) | |
| | K-6139-A | REPLACEMENT KIT, Optional (Plain handle) | |
| | | All Replacement Kits contain all items listed below except No. 7355-001, Bracket | |
| 1 | 11393-001 | LINK | 1 |
| | 11392-001 | PLATE, Link | 1 |
| 2 | 1801-001 | BRACKET, Die Cast (Standard) | 1 |
| | 7355-001 | BRACKET, Cast Iron (Optional Heavy Duty) | 1 |
| 3 | 3249-001 | HANDLE, Standard Horizontal, Black plastic coated | 1 |
| | 3249-003 | HANDLE, Optional Horizontal, Plain | 1 |
| 4 | 9161-407 | SCREW, HSHC, 1/4-20 by 7/8 inch long | 2 |
| 5 | 086-001 | PIN, Cotter | 3 |
| 6 | 1857-001 | PIN | 1 |
| 7 | 1800-001 | SEAL, Wiper, optional (not shown) | 1 |

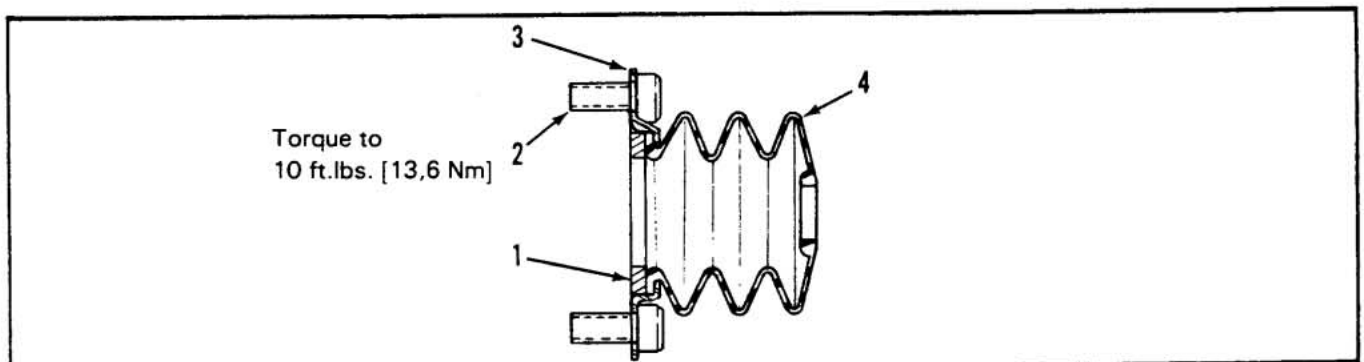


Figure 4-28. Spool Protective Boot Assembly.

SPOOL PROTECTIVE BOOT ASSEMBLY

| Item No. | Part No. | Description | Quantity |
|----------|----------|---|----------|
| | K-6056-B | REPLACEMENT KIT (Contains all items listed below) | |
| 1 | 7624-001 | WASHER, Breather | 1 |
| 2 | 3731-098 | SCREW, HSHC, 1/4-20 by 1/2 inch long | 2 |
| 3 | 7623-001 | RETAINER, Boot | 1 |
| 4 | 7622-001 | BOOT | 1 |

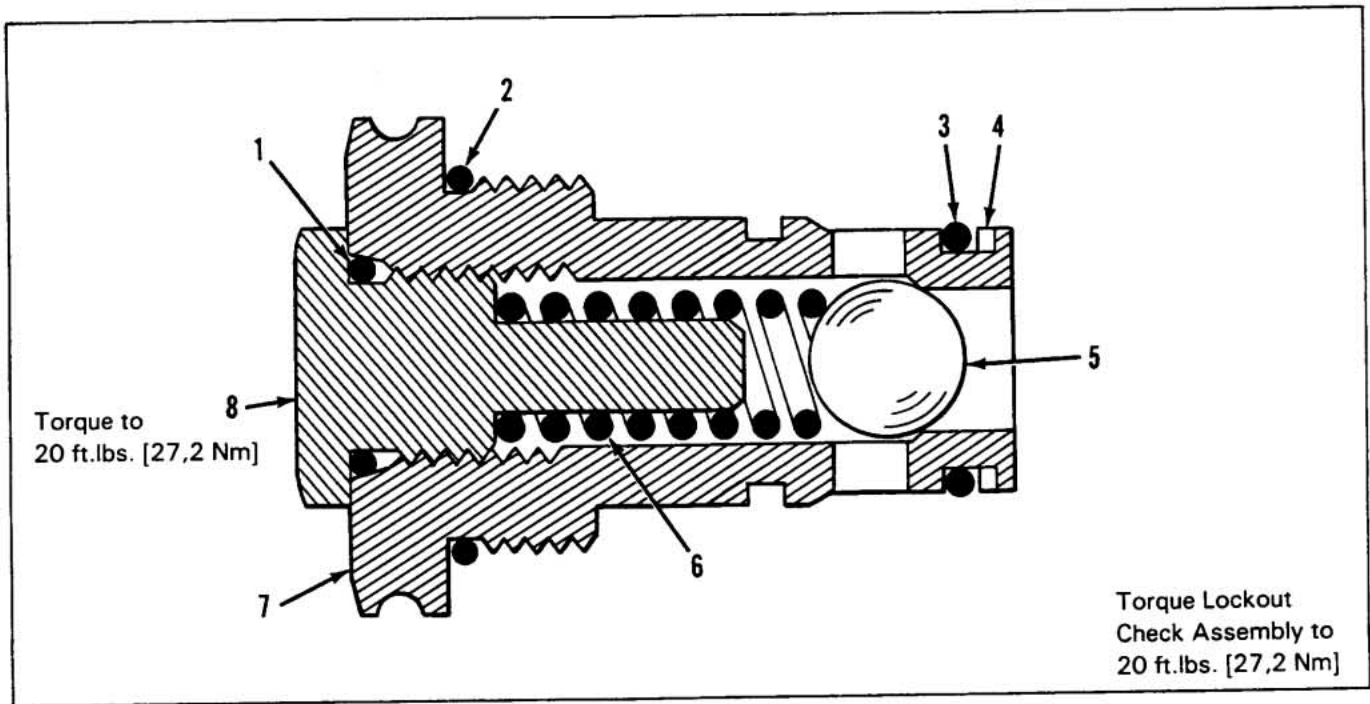


Figure 4-29. Lockout Check Assembly.

LOCKOUT CHECK ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Check |
|----------|-----------|---|--------------------|
| | K-6024-D* | REPLACEMENT KIT (Contains all items listed below) | |
| | K-6039* | SEAL KIT (Contains items 1 thru 4) | |
| 1 | 0449-001* | SEAL, O-Ring | 1 |
| 2 | 2707-001* | SEAL, O-Ring | 1 |
| 3 | 1818-001* | SEAL, O-Ring | 1 |
| 4 | 3092-001 | RING, Back-Up, Cut | 1 |
| 5 | 0071-001 | BALL, Steel | 1 |
| 6 | 1571-001 | SPRING | 1 |
| 7 | 11466-001 | BODY, Check | 1 |
| 8 | 0216-001 | CAP, Check | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

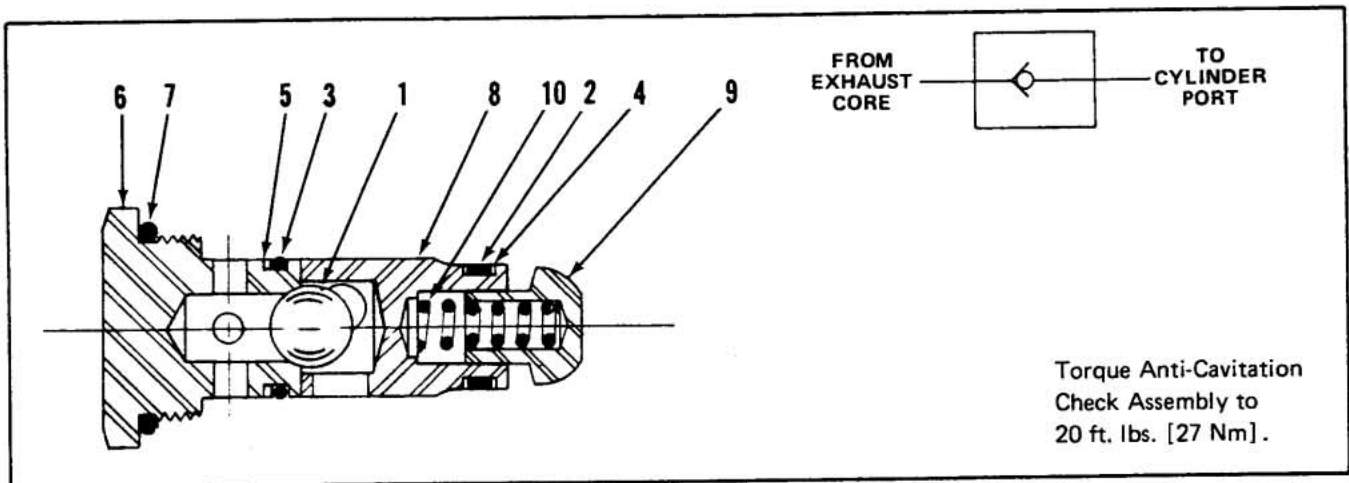


Figure 4-30. Optional Anti-Cavitation Check Assembly.

OPTIONAL ANTI-CAVITATION CHECK ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Check |
|----------|-----------|--|---------------------------------------|
| | K-6021-A* | REPLACEMENT ANTI-CAVITATION ASSEMBLY (Contains all items listed below) | |
| | K-6032* | SEAL KIT (Contains items 2, 3, 4, 5 and 7 listed below) | |
| 1 | 0071-001 | BALL, Steel, 7/16 inch | 1 |
| 2 | 1818-001* | SEAL, O-Ring | 1 |
| 3 | 1819-001* | SEAL, O-Ring | 1 |
| 4 | 1820-001 | WASHER, Back-Up, inner, Check Plug | } Not Sold Separately Order K-6032 |
| 5 | 1821-001 | WASHER, Back-Up, Outer, Check Plug | |
| 6 | 1822-001 | BODY, Check, Anti-Cavitation | 1 |
| 7 | 2707-001* | SEAL, O-Ring | 1 |
| 8 | 1823-001 | RETAINER, Ball, Check | 1 |
| 9 | 2781-001 | CHECK, Steel | 1 |
| 10 | 1868-001 | SPRING, Check | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

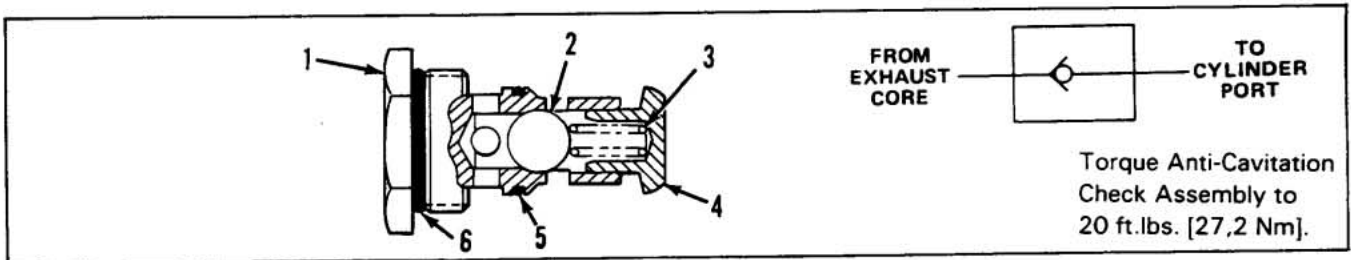


Figure 4-31. Optional, V20S Anti-Cavitation Check Assembly.

OPTIONAL, V20S ANTI-CAVITATION CHECK ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Check |
|----------|-----------|---|--|
| | K-6205* | REPLACEMENT KIT (Contains all items listed below) | |
| | K-6206* | SEAL KIT (Contains items 5 and 6) | |
| 1 | 11340-001 | BODY, Check | 1 |
| 2 | 0071-001 | BALL, Steel, 7/16 inch | 1 |
| 3 | 11343-001 | SPRING, Check | 1 |
| 4 | 7791-002 | POPPET, Check | 1 |
| 5 | 1819-001* | SEAL, O-Ring | } Not sold separately. Order K-6206 |
| 6 | 2707-001* | SEAL, O-Ring | |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

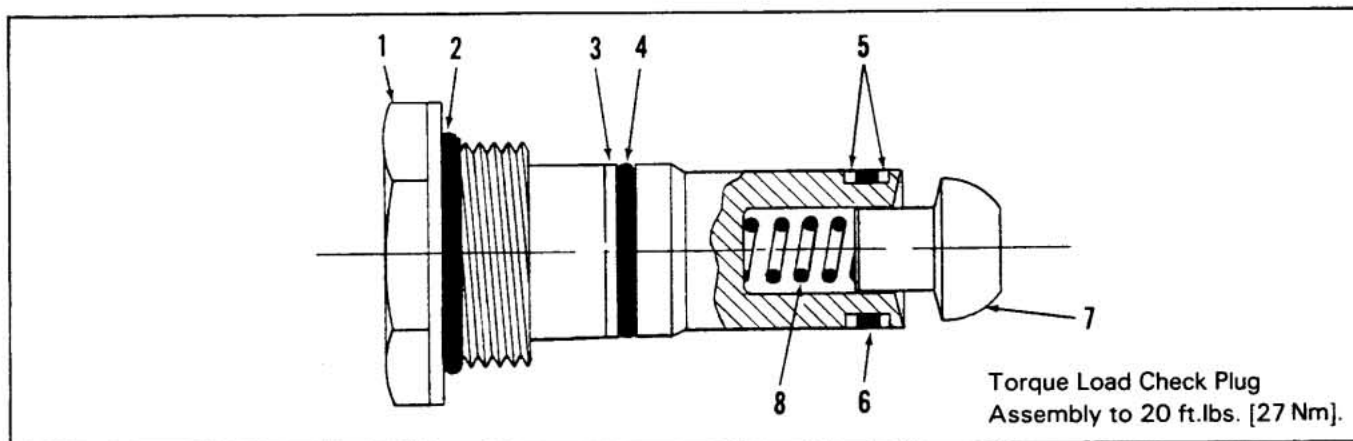


Figure 4-32. Load Check Plug Assembly.

LOAD CHECK PLUG ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Plug Assembly |
|----------|-----------|---|---------------------------------------|
| | K-6030-A* | REPLACEMENT LOAD CHECK PLUG ASSEMBLY. | |
| | K-6032* | SEAL KIT, (Contains items 2, 3, 4, 5 and 6) | |
| 1 | 3411-001 | Plug, Lift Check, Steel (Heavy Duty) | 1 |
| 2 | 2707-001* | SEAL, O-Ring | 1 |
| 3 | 1821-001 | WASHER, Back-Up, Outer | } Not Sold Separately Order K-6032 |
| 4 | 1819-001* | SEAL, O-Ring, Outer | |
| 5 | 1820-001 | WASHER, Back-Up, Inner | |
| 6 | 1818-001* | SEAL, O-Ring | 1 |
| 7 | 2781-001 | POPPET, Lift Check | 1 |
| 8 | 1868-001 | SPRING, Lift Check | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

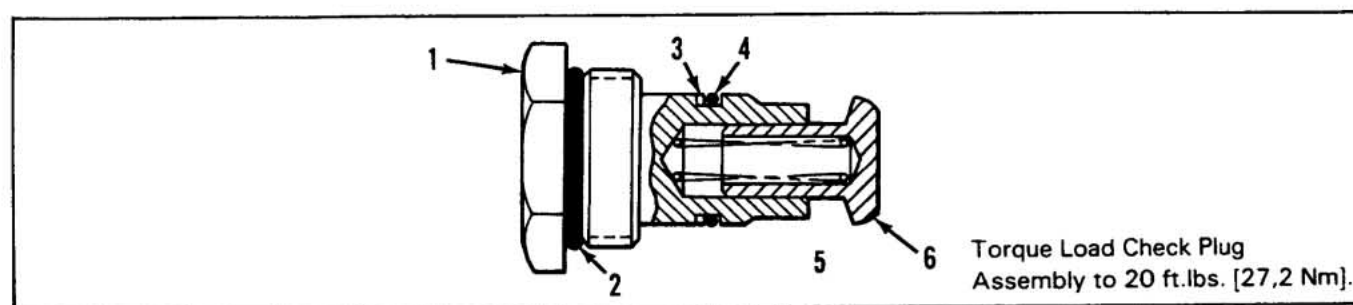


Figure 4-33. V20S Load Check Plug Assembly.

V20S LOAD CHECK PLUG ASSEMBLY

| Item No. | Part No. | Description | Quantity Per Plug Assembly |
|----------|-----------|---|--|
| | K-6203* | REPLACEMENT KIT (Contains all items listed below) | |
| | K-6204* | SEAL KIT (Contains items 2, 3 and 4) | |
| 1 | 11241-001 | PLUG, Load Check | 1 |
| 2 | 2707-001* | SEAL, O-Ring | } Not sold separately. Order K-6204 |
| 3 | 1821-001 | RING, Back-Up | |
| 4 | 1819-001* | SEAL, O-Ring | 1 |
| 5 | 1868-001 | SPRING, Load Check | 1 |
| 6 | 7791-001 | POPPET, Load Check | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

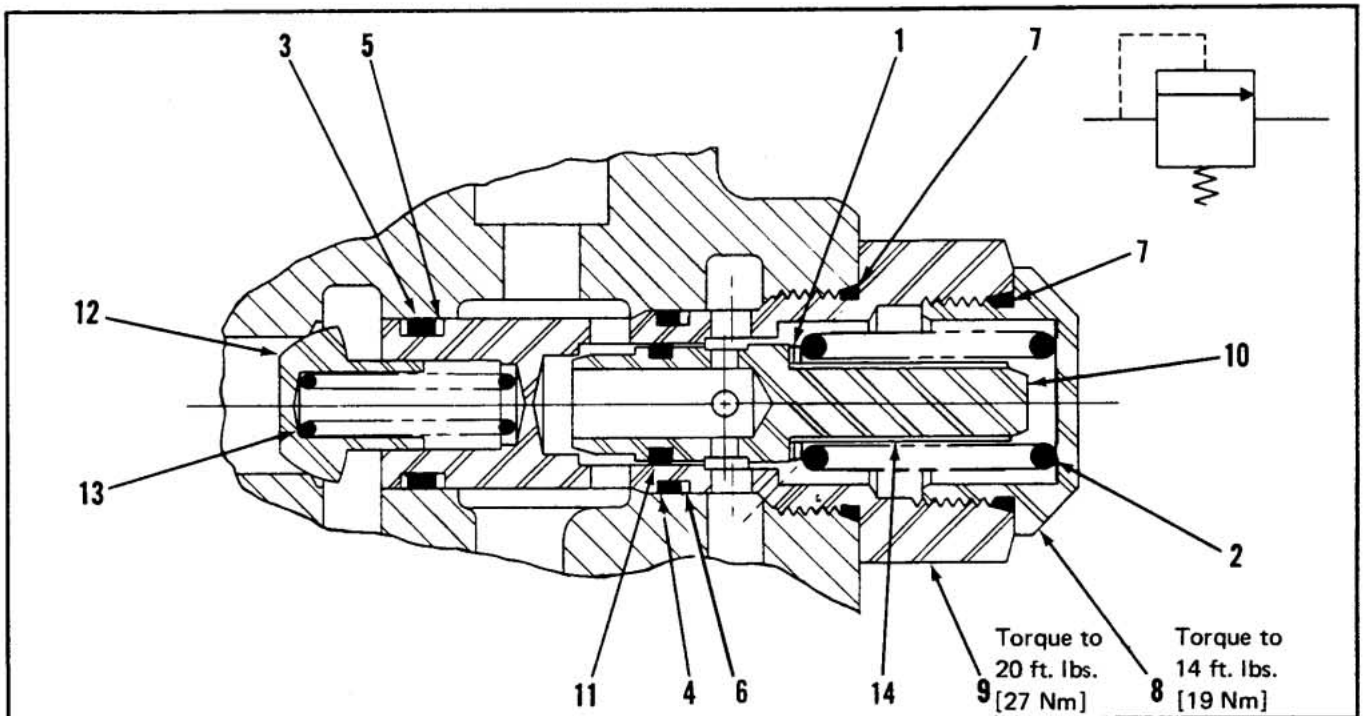


Figure 4-34. Optional Model RC Cylinder Port Relief (non-adjustable type).

OPTIONAL MODEL RC CYLINDER PORT RELIEF (Non-Adjustable Type)

For replacement Model RC Relief Cartridge, specify pressure setting required.

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|-----------|---|---------------------|
| | K-19002 | SERVICE KIT (Contains items 10 and 11) | |
| | K-6005A* | SEAL KIT (Contains all seals - items 3, 4, 5, 6 and 7) | |
| 1 | 0458-001 | SHIM (.040 inch [1,0 mm] thick) | A/R |
| | 0459-001 | SHIM (.020 inch [0,5 mm] thick) | A/R |
| | 0462-001 | SHIM (.010 inch [0,25 mm] thick) | A/R |
| 2 | 1450-001 | SPRING (500-1350 PSI [35-93 bar] Crack) | 1 |
| | 1869-001 | SPRING (500-1249 PSI [34-86 bar] Crack) | 1 |
| | 7638-001 | SPRING (1250-1749 PSI [86-121 bar] Crack) | 1 |
| | 7078-001 | SPRING (1750-1999 PSI [121-138 bar] Crack) | 1 |
| | 1870-001 | SPRING (2000-2599 PSI [138-179 bar] Crack) | 1 |
| 3 | 1818-001* | SEAL, O-Ring | 1 |
| 4 | 1819-001* | SEAL, O-Ring | 1 |
| 5 | 1820-001 | WASHER, Back-Up, Inner, Check Plug | 2 |
| 6 | 1821-001 | WASHER, Back-Up, Outer, Check Plug | 1 |
| 7 | 2707-001* | SEAL, O-Ring | 2 |
| 8 | 1880-001 | CAP, Relief | 1 |
| 9 | 1884-001 | BODY, Relief | 1 |
| 10 | 1881-001 | POPPET, Relief | 1 |
| 11 | 1883-001† | RING, Piston | 1 |
| 12 | 2781-001 | CHECK, Steel | 1 |
| 13 | 1868-001 | SPRING, Check | 1 |
| 14 | 7874-001 | SLEEVE, Dampening (Not to be used with 1450-001 and 1451-001 Springs) | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

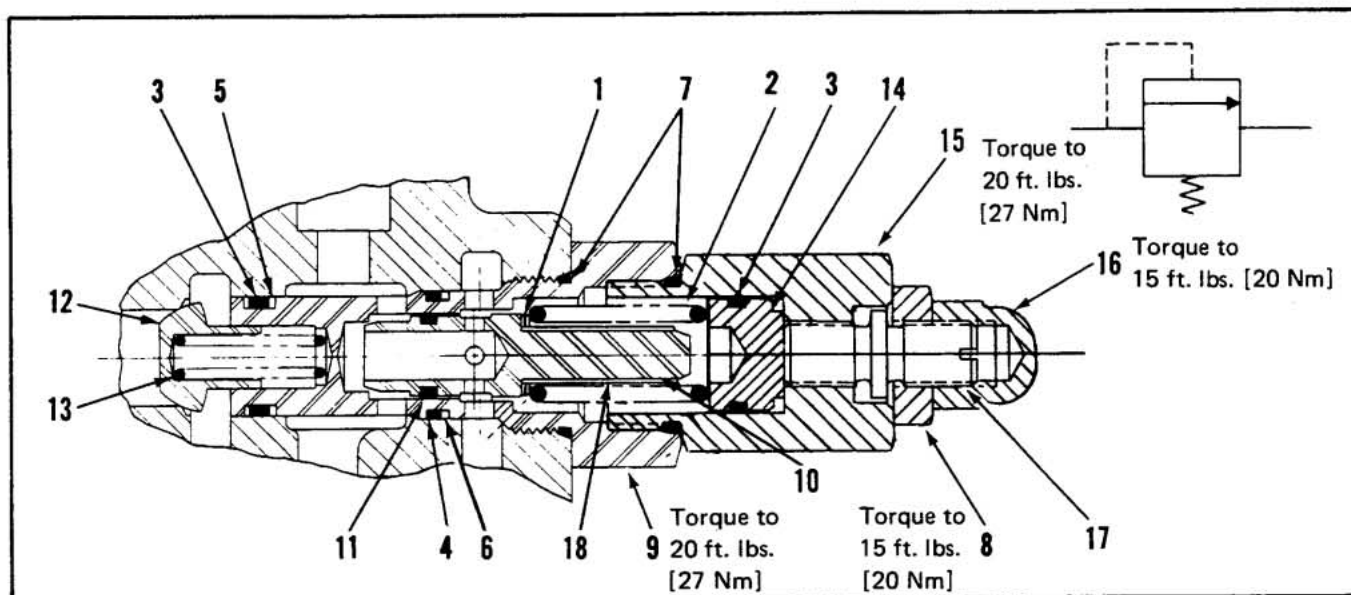


Figure 4-35. Optional RCA Relief Assembly.

OPTIONAL RCA RELIEF ASSEMBLY

All V20 Valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

Model RCA cannot be used on handle end of valve section with No. 1802-001 Vertical Handle due to interference.

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|-----------|--|---------------------|
| | K-19002 | SERVICE KIT (Contains items 10 and 11) | |
| | K-6005A* | SEAL KIT (Contains all seals, items 3, 4, 5, 6 and 7) | |
| 1 | 0458-001 | SHIM (.040 inch [1,0 mm] thick) | A/R |
| | 0459-001 | SHIM (.020 inch [0,5 mm] thick) | A/R |
| | 0462-001 | SHIM (.010 inch [0,25 mm] thick) | A/R |
| 2 | 7638-001 | SPRING, S.S., 750-1500 PSI [52-103 bar] | 1 |
| | 7078-001 | SPRING, S.S., 1250-2000 PSI [86-138 bar] | 1 |
| | 1870-001 | SPRING, S.S., 1500-2500 PSI [103-172 bar] | 1 |
| | 7497-001 | SPRING, S.S., 2000-3000 PSI [138-207 bar] | 1 |
| 3 | 1818-001* | SEAL, O-Ring | 2 |
| 4 | 1819-001* | SEAL, O-Ring | 1 |
| 5 | 1820-001 | WASHER, Back-Up, Inner | 2 |
| 6 | 1821-001 | WASHER, Back-Up, Outer | 1 |
| 7 | 2707-001* | SEAL, O-Ring | 2 |
| 8 | 3500-001 | NUT, Jam | 1 |
| 9 | 1884-001 | BODY, Relief | 1 |
| 10 | 1881-001 | POPPET, Relief | 1 |
| 11 | 1883-001 | RING, Piston | 1 |
| 12 | 2781-001 | CHECK, Steel | 1 |
| 13 | 1868-001 | SPRING, Check | 1 |
| 14 | 11481-001 | PISTON | 1 |
| 15 | 3498-001 | CAP, Adjustable Relief | 1 |
| 16 | 3497-001 | NUT, Acorn | 1 |
| 17 | 3496-001 | STEM, Adjustable | 1 |
| 18 | 7874-001 | SLEEVE, Dampening (Not to be used with 1450-001 or 1451-001 Springs) | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

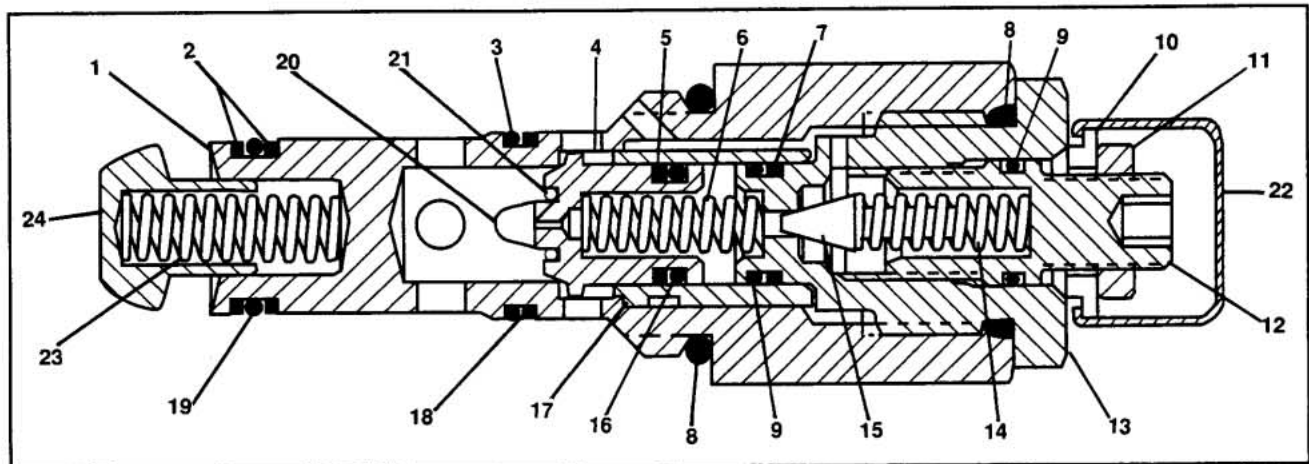


Figure 4-36. Optional RP 20-N Relief Assembly.

OPTIONAL RP 20-N CYLINDER PART RELIEF

All V20 valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|------------|---|---------------------|
| | K-6192 | SEAL KIT (Contains items 2, 3, 5, 7, 8, 9, 16, 18 and 19) | |
| 1 | 20497-001 | BODY, Relief | 1 |
| 2 | 1820-001 | RING, Back-Up | 2 |
| 3 | 01819-001* | SEAL, O-Ring | 1 |
| 4 | 20499-001 | POPPET, Main | 1 |
| 5 | 21581-001 | RING, Back-Up | 1 |
| 6 | 20503-001 | SPRING | 1 |
| 7 | 21582-001 | RING, Back-Up | 1 |
| 8 | 02707-001* | SEAL, O-Ring | 2 |
| 9 | 09001-012* | SEAL, O-Ring | 2 |
| 10 | 10035-001 | WASHER | 1 |
| 11 | 09302-006 | NUT, Hex Jam | 1 |
| 12 | 08956-001 | SCREW, Adjustment | 1 |
| 13 | 20500-001 | BODY, Pilot | 1 |
| 14 | 10059-001 | SPRING | 1 |
| 15 | 08475-001 | POPPET, Relief | 1 |
| 16 | 07830-001* | SEAL, O-Ring | 1 |
| 17 | 20125-001 | SLEEVE, Relief | 1 |
| 18 | 01821-001 | RING, Back-Up | 1 |
| 19 | 01818-001* | SEAL, O-Ring | 1 |
| 20 | 11839-001 | SCREEN, Filter | 1 |
| 21 | 11840-001 | RING, Retaining | 1 |
| 22 | 10034-001 | COVER, Tamper Proof | 1 |
| 23 | 01868-001 | SPRING | 1 |
| 24 | 02781-001 | POPPET | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

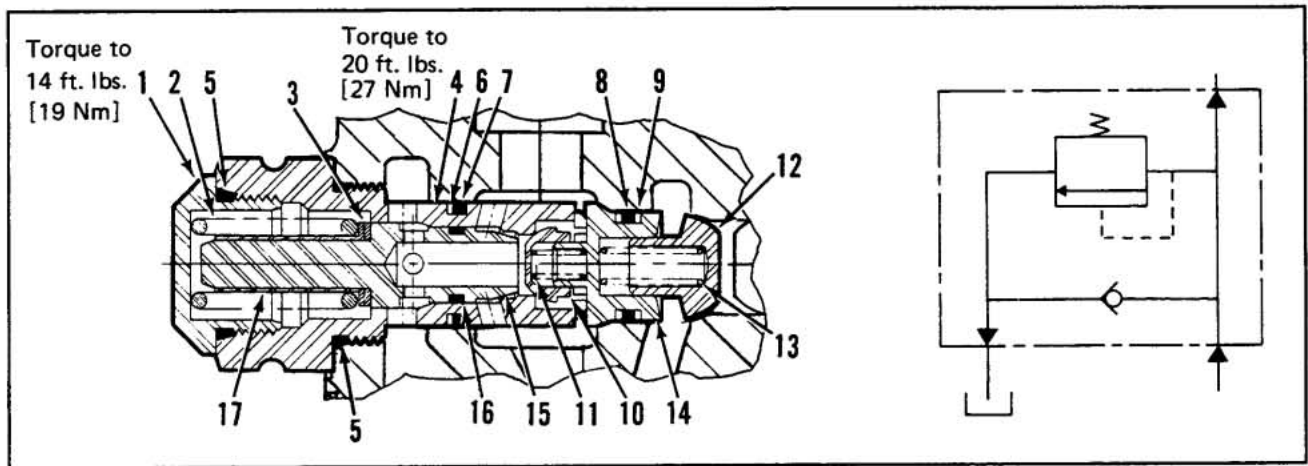


Figure 4-37. Optional Combination Relief and Anti-Cavitation Check Assembly (CRA)

OPTIONAL COMBINATION RELIEF and ANTI-CAVITATION CHECK ASSEMBLY (CRA)

All V20 Valves are machined to accept this assembly without modification. Simply remove load check assembly and install RCA combination.

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|-----------|--|---------------------|
| | K-19002 | SERVICE KIT (Contains items 15 and 16) | |
| | K-6005A* | SEAL KIT (Contains items 5, 6, 7, 8 and 9) | |
| 1 | 1880-001 | CAP, Relief | 1 |
| 2 | 1869-001 | SPRING (500-1249 PSI [34-86 bar] Crack) | 1 |
| | 7638-001 | SPRING (1250-1749 PSI [86-121 bar] Crack) | 1 |
| | 7078-001 | SPRING (1750-1999 PSI [121-138 bar] Crack) | 1 |
| | 1870-001 | SPRING (2000-2599 PSI [138-179 bar] Crack) | 1 |
| 3 | 0458-001 | SHIM (.040 inch [1,0 mm] thick) | A/R |
| | 0459-001 | SHIM (.020 inch [0,5 mm] thick) | A/R |
| | 0462-001 | SHIM (.010 inch [0,25 mm] thick) | A/R |
| 4 | 7741-001 | BODY, Combination | 1 |
| 5 | 2707-001* | SEAL, O-Ring | 2 |
| 6 | 1821-001 | WASHER, Back-Up Outer | 1 |
| 7 | 1819-001* | SEAL, O-Ring | 1 |
| 8 | 1818-001* | SEAL, O-Ring | 1 |
| 9 | 1820-001 | WASHER, Back-Up Inner | 2 |
| 10 | 7743-001 | POPPET, Anti-Cavitation | 1 |
| 11 | 7744-001 | SPRING, Anti-Cavitation | 1 |
| 12 | 6015-001 | POPPET | 1 |
| 13 | 6016-001 | SPRING, Check | 1 |
| 14 | 7742-001 | RETAINER, Poppet | 1 |
| 15 | 1881-001 | POPPET, Relief | 1 |
| 16 | 1883-001 | RING, Piston | 1 |
| 17 | 7874-001 | SLEEVE, Dampening (not to be used with 1450-001 or 1451-001 Springs) | 1 |

Notes:

1. Replacement Model CRA Cartridge includes items 12 and 13. Specify pressure setting.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

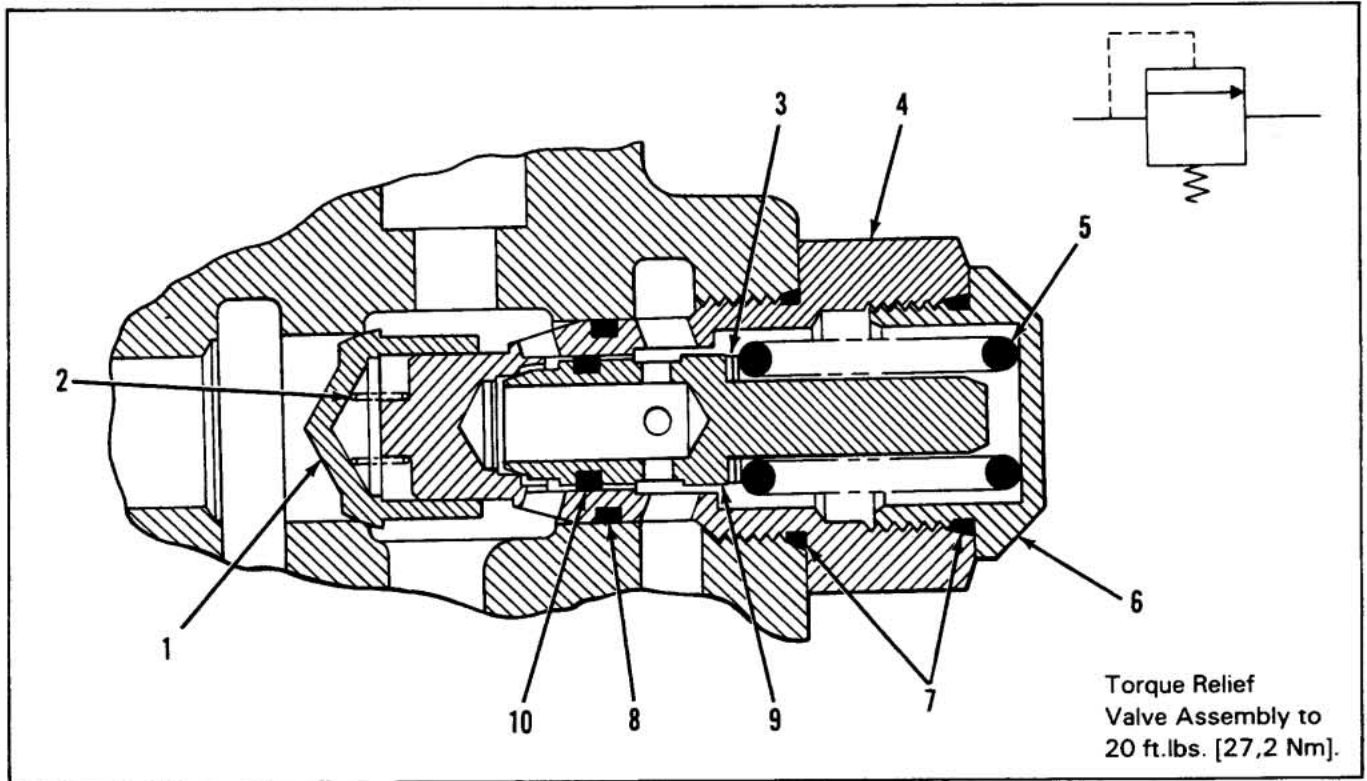


Figure 4-38. Optional V20S Work Port Relief. Model RCS (Non-Adjustable).

OPTIONAL V20S WORK PORT RELIEF, MODEL RCS (Non-Adjustable)

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|-----------|--|---------------------|
| | K-19002 | SERVICE KIT (Contains items 9 and 10) | |
| | K-6206* | SEAL KIT (Contains items 7 and 8) | |
| 1 | 11469-001 | POPPET, Check | 1 |
| 2 | 11470-001 | SPRING, Check | 1 |
| 3 | 0458-001 | SHIM (.040 inch [1,0 mm] thick) | A/R |
| | 0459-001 | SHIM (.020 inch [0,5 mm] thick) | A/R |
| | 0462-001 | SHIM (.010 inch [0,25 mm] thick) | A/R |
| 4 | 11471-001 | BODY, RCS Relief | 1 |
| 5 | 1869-001 | SPRING (500-1249 PSI [35-86 bar] Crack) | 1 |
| | 7638-001 | SPRING (1250-1749 PSI [86-121 bar] Crack) | 1 |
| | 7078-001 | SPRING (1750-1999 PSI [121-138 bar] Crack) | 1 |
| | 1870-001 | SPRING (2000-2599 PSI [138-179 bar] Crack) | 1 |
| 6 | 1880-001 | CAP, Relief | 1 |
| 7 | 2707-001* | SEAL, O-Ring | 1 |
| 8 | 1819-001* | SEAL, O-Ring | 1 |
| 9 | 1881-001 | POPPET, Relief | 1 |
| 10 | 1883-001 | RING, Piston | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

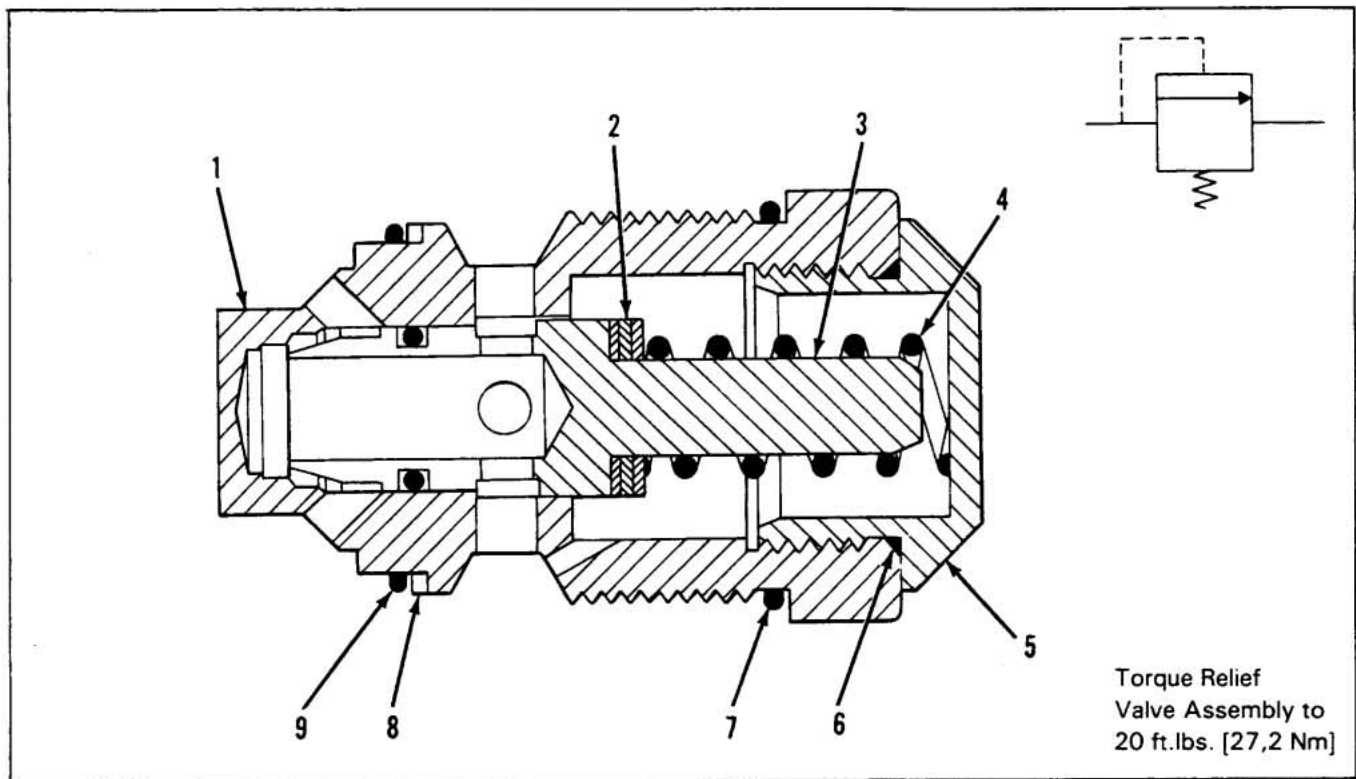


Figure 4-39. Model WH Differential Popper Main Relief Valve (Non-Adjustable).

MODEL WH DIFFERENTIAL POPPET MAIN RELIEF VALVE (Non-Adjustable)

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|------------|--|---------------------|
| | K-19003-A* | SEAL KIT (Contains items 6 thru 9) | |
| 1 | 6533-001 | BODY, WH Relief | 1 |
| 2 | 0458-001 | SHIM (.040 inch [1,0 mm] thick) | A/R |
| | 0459-001 | SHIM (.020 inch [0,5 mm] thick) | A/R |
| | 0462-001 | SHIM (.010 inch [0,25 mm] thick) | A/R |
| 3 | 3936-001 | POPPET | 1 |
| 4 | 1869-001 | SPRING (500-1249 PSI [35-86 bar] Crack) | 1 |
| | 7638-001 | SPRING (1250-1749 PSI [86-121 bar] Crack) | 1 |
| | 7078-001 | SPRING (1750-1999 PSI [121-138 bar] Crack) | 1 |
| | 1870-001 | SPRING (2000-2599 PSI [138-179 bar] Crack) | 1 |
| 5 | 1880-001 | CAP, Relief | 1 |
| 6 | 2707-001* | SEAL, O-Ring | 1 |
| 7 | 1615-001* | SEAL, O-Ring | 1 |
| 8 | 9020-022 | RING, Back-Up | 1 |
| 9 | 1718-001* | SEAL, O-Ring | 1 |
| | | } Not sold separately. Order K-19003-A | |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

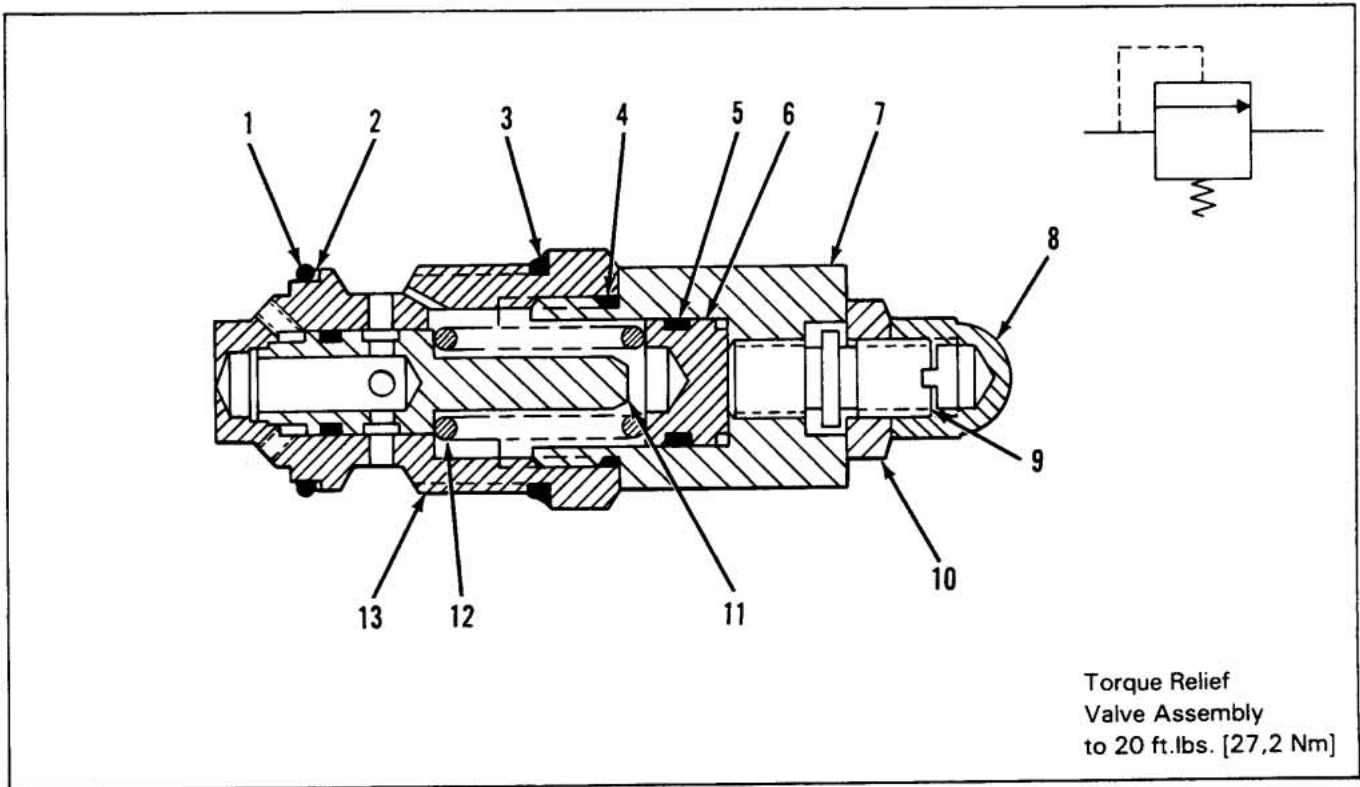


Figure 4-40. Model WHA Differential Poppet Main Relief Valve (Adjustable within the spring range).

MODEL WHA DIFFERENTIAL POPPET MAIN RELIEF VALVE (Adjustable within the spring range)

| Item No. | Part No. | Description | Quantity Per Relief |
|----------|-----------|---|---------------------|
| | K-19012* | SEAL KIT (Contains items 1 thru 5) | |
| 1 | 1718-001* | SEAL, O-Ring | 1 |
| 2 | 9020-022 | RING, Back-Up | 1 |
| 3 | 1615-001* | SEAL, O-Ring | 1 |
| 4 | 2707-001* | SEAL, O-Ring | 1 |
| 5 | 1818-001* | SEAL, O-Ring | 1 |
| 6 | 3495-001 | PISTON | 1 |
| 7 | 3498-001 | CAP | 1 |
| 8 | 3497-001 | NUT, Acorn | 1 |
| 9 | 3496-001 | STEM, Adjusting | 1 |
| 10 | 3500-001 | NUT, Hex Jam | 1 |
| 11 | 3936-001 | POPPET | 1 |
| 12 | 7638-001 | SPRING, S.S., 750-1500 PSI [52-103 bar] Crack | 1 |
| | 7078-001 | SPRING, S.S., 1250-2000 PSI [86-138 bar] Crack | 1 |
| | 1870-001 | SPRING, S.S., 1500-2500 PSI [103-172 bar] Crack | 1 |
| | 7497-001 | SPRING, S.S., 2000-3000 PSI [138-207 bar] Crack | 1 |
| 13 | 6533-001 | BODY, WH Relief | 1 |

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

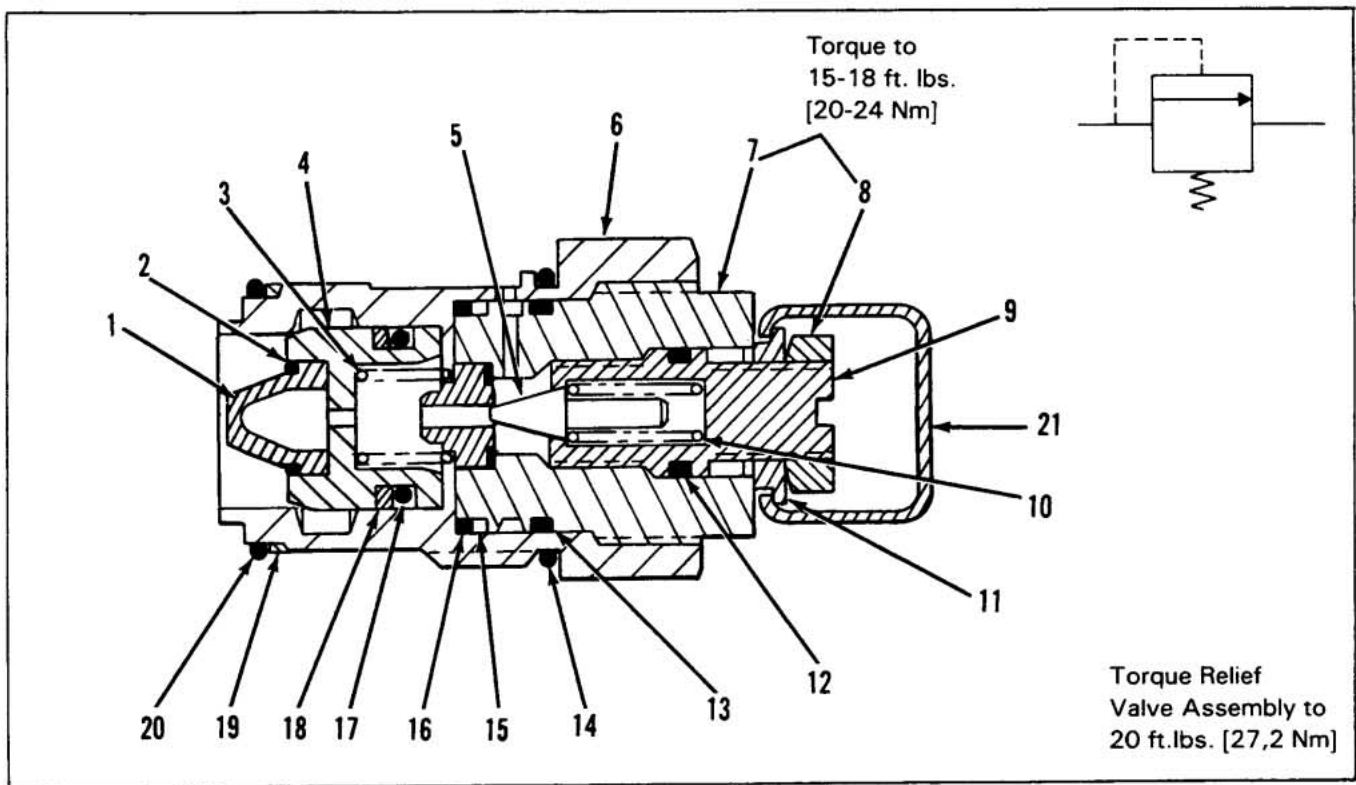


Figure 4-41. Model RP51 Pilot Operated Main Relief Valve.

MODEL RP51 PILOT OPERATED MAIN RELIEF VALVE

| Item No. | Part No. | Description | Quantity |
|----------|-----------|----------------------------------|----------|
| | K-19005* | SEAL KIT (Contains items 12-20) | |
| 1 | 12675-001 | FILTER | 1 |
| 2 | 10298-001 | RING, Retaining | 1 |
| 3 | 20254-001 | SPRING | 1 |
| 4 | 20209-001 | POPPET, Main | 1 |
| 5 | 8475-001 | POPPET, Relief | 1 |
| 6 | 8954-001 | BODY, Relief Valve | 1 |
| 7 | 11059-001 | BODY, Pilot Assembly | 1 |
| 8 | 9302-006 | NUT, Hex Jam | 1 |
| 9 | 8956-001 | SCREW, Adjustment | 1 |
| 10 | 10059-001 | SPRING, Pilot | 1 |
| 11 | 10035-001 | WASHER, RP51-N (Shown) | 1 |
| | 10852-001 | WASHER, ID, RP51-A (Not Shown) | 1 |
| 12 | 6884-001* | SEAL, O-Ring | 1 |
| 13 | 6814-002* | SEAL, O-Ring | 1 |
| 14 | 1615-001* | SEAL, O-Ring | 1 |
| 15 | 9020-019 | RING, Back-Up | 1 |
| 16 | 1660-001* | SEAL, O-Ring | 1 |
| 17 | 9000-113* | SEAL, O-Ring | 1 |
| 18 | 20903-001 | RING, Back-Up | 1 |
| 19 | 9020-022 | RING, Back-Up | 1 |
| 20 | 1718-001* | SEAL, O-Ring | 1 |
| 21 | 10034-001 | COVER, Tamperproof (RP51-N only) | 1 |

Not sold separately.
Order K-19005

NOTE
Due to close tolerances on working parts, Model RP51 is not field serviceable. If service other than seal replacement is required, contact the factory.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

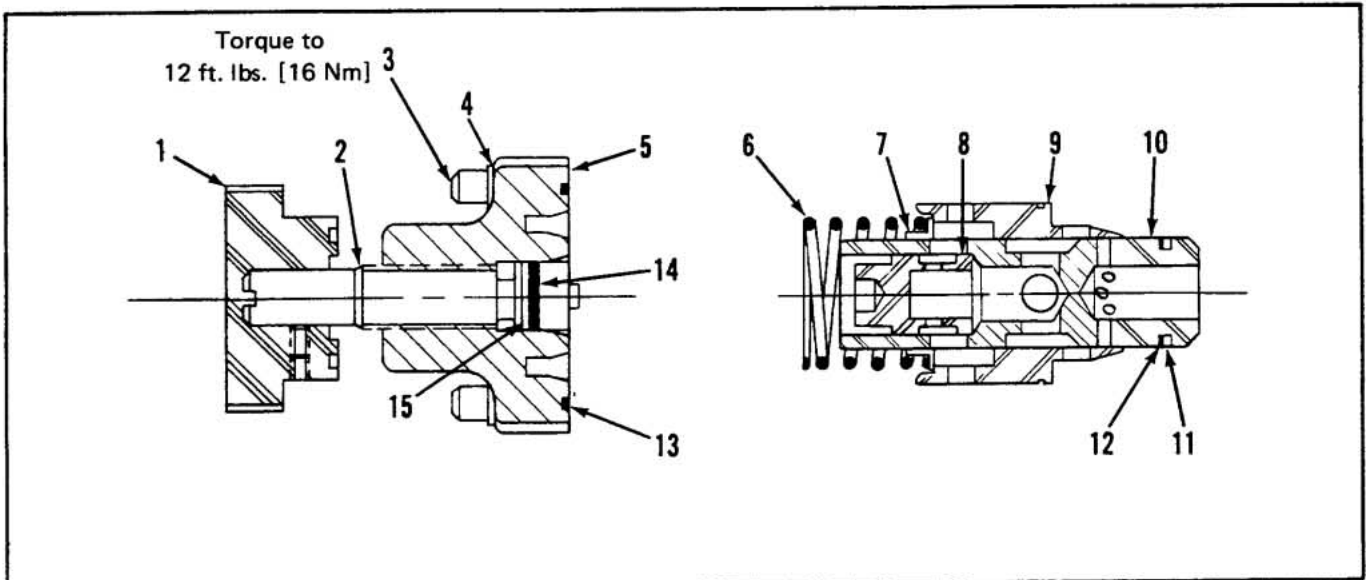


Figure 4-42. Flow Control Assembly, Inlet Cover.

FLOW CONTROL ASSEMBLY, INLET COVER

| Item No. | Part No. | Description | Quantity |
|----------|-----------|--|----------|
| | K-6066-C | REPLACEMENT KIT, Actuator (Contains items 1 thru 5 and 13 thru 15) | |
| | K-6067-A | REPLACEMENT KIT, Flow Control, 3-16 GPM [11-60 litres/min] | |
| | K-6068-A | REPLACEMENT KIT, Flow Control, 8-25 GPM [30-95 litres/min] | |
| | K-6069-A | REPLACEMENT KIT, Flow Control, 13-21 GPM [49-79 litres/min] | |
| | | (Flow Control Replacement Kits contain items 6 thru 12) | |
| | K-6065 | SEAL KIT (Contains items 11 thru 15) | |
| 1 | 3236-001 | KNOB | 1 |
| 2 | 6309-001 | ADJUSTER, Flow (Standard) | 1 |
| | 3902-001 | ADJUSTER, Flow (Optional, 3-inch [76 mm] stem) | 1 |
| 3 | 3731-101 | SCREW, Hex Head | 4 |
| 4 | 0563-001 | WASHER, Lock | 4 |
| 5 | 3906-001 | CAP, Control | 1 |
| | 3906-002 | CAP, Control (For use with optional dust boot) | 1 |
| 6 | 3882-001 | SPRING, Control | 1 |
| 7 | 6665-001 | COLLAR | |
| 8 | 3897-001 | PISTON, Control 3-16 GPM [11-60 litres/min] | 1 |
| | 7740-001 | PISTON, Control, 8-25 GPM [30-95 litres/min] | 1 |
| | 7483-001 | PISTON, Control, 13-21 GPM [49-79 litres/min] | 1 |
| 9 | 3891-001 | SLEEVE, Metering, 3-16 GPM [11-60 litres/min] | 1 |
| | 7484-001 | SLEEVE, Metering, 8-25 and 13-21 GPM [30-95 and 49-79 litres/min] | 1 |
| 10 | 3888-001 | GUIDE, Sleeve, 3-16 GPM [11-60 litres/min] | 1 |
| | 7485-001 | GUIDE, Sleeve, 8-25 and 13-21 GPM [30-95 and 49-79 litres/min] | 1 |
| 11 | 1821-001 | WASHER, Back-Up | 1 |
| 12 | 1819-001* | SEAL, O-Ring | 1 |
| 13 | 3911-001 | SEAL, O-Ring | 1 |
| 14 | 9001-012 | SEAL, O-Ring | 1 |
| 15 | 3908-001 | WASHER, Back-Up | 1 |
| 16 | 10957-001 | BOOT (Not shown, cannot be used with knob) | 1 |

} See Note

} Not sold separately. Order K-6065

Note:

These are matched parts and are not sold separately. Order appropriate Replacement Kit for required GPM flow control.

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

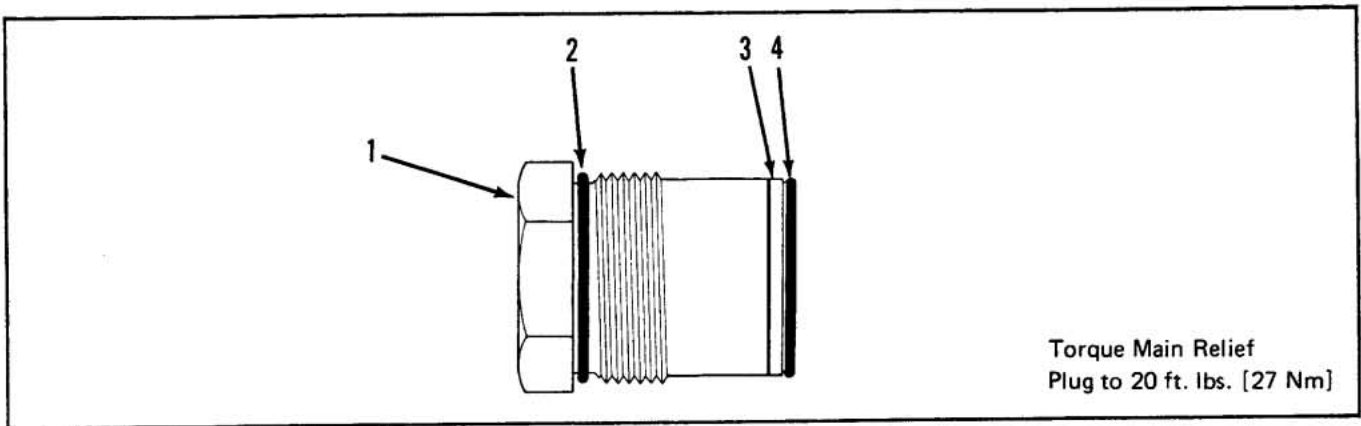


Figure 4-43. Main Relief Plug.

"NR" MAIN RELIEF PLUG

| Item No. | Part No. | Description | Quantity |
|----------|-----------|---|----------|
| | K-6132-A | REPLACEMENT PLUG ASSEMBLY (Contains all items listed below) | |
| | K-28062-A | SEAL KIT (Contains items 2, 3 and 4) | |
| 1 | 6760-001 | PLUG, Relief | 1 |
| 2 | 1615-001* | SEAL, O-Ring | 1 |
| 3 | 9020-022 | WASHER, Back-Up | 1 |
| 4 | 1718-001 | SEAL, O-Ring | 1 |

} Not Sold Separately Order K-28062

*Buna-N seals are standard for all Gresen valve assemblies. Optional Viton seals are available. See Cross Reference Tables on page 4-37.

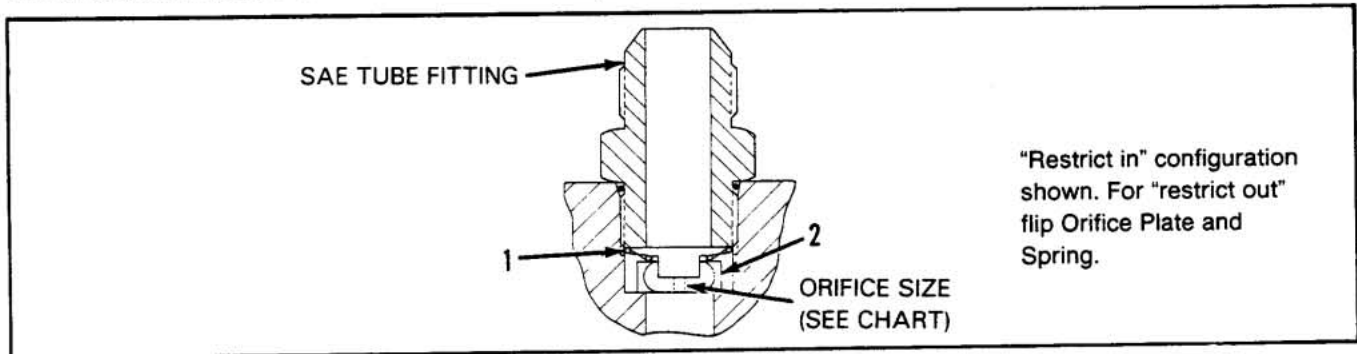


Figure 4-44. Work Port Restrictors.

WORK PORT RESTRICTORS

| Item No. | Port No. | Description | Quantity |
|----------|------------|---|----------|
| | 11031-xxx* | RESTRICTOR ASSEMBLY, SAE 8 Port (Contains items 1 and 2) | |
| | 10098-xxx* | RESTRICTOR ASSEMBLY, SAE 10 Port (Contains items 1 and 2) | |
| 1 | 10821-001 | SPRING, Conical (SAE 8 Port) | 1 |
| | 10064-001 | SPRING, Conical (SAE 10 Port) | 1 |
| 2 | 10817-xxx* | PLATE, Orifice (SAE 8 Port) | 1 |
| | 10063-xxx* | PLATE, Orifice (SAE 10 Port) | 1 |

*The last three digits of the Restrictor Assembly and Orifice Plate part numbers are the same as the orifice hole size. Example: .062 hole is part number XXXXX-062.

ORIFICE HOLE SIZES AVAILABLE

| SAE 8 PORT | SAE 10 PORT |
|--|---|
| 015, 028, 032, 046, 055, 062, 074, 082, 095, 109, 125, 141, 156, 172, 189, 220 | 015, 032, 037, 047, 053, 062, 070, 076, 082, 086, 095, 109, 125, 141, 156, 189, 203, 220, 281 |

Standard Buna-N Seals and O-Rings

All standard Gresen products utilize Buna-N seals which are compatible with petroleum base, water-in-oil emulsions, and water-glycol fluids. Phosphate ester type fire-resistant fluids will cause Buna-N seals to swell. This swelling is not normally detrimental to static seals, but will be a problem for dynamic seals such as valve spool seals. Swelling of these seals can result in binding. The temperature range of Buna-N seals is -40°F to +200°F [-40°C to +93°C].

Table 4-1. Cross Reference For Seals and O-Rings, Buna-N to Viton

| Buna-N Part No. | Viton Part No. | Application |
|-----------------|----------------|----------------------------------|
| 1129-001 | None | |
| 1615-001 | 7447-001 | Section Seal, Exhaust |
| 1718-001 | 7446-001 | WC Relief, NR Plug |
| 1721-001 | 7612-001 | Power Beyond Sleeve, Inner |
| 1800-001 | None | |
| 1818-001 | 7444-001 | Inner Check Plug Seal |
| 1819-001 | 7445-001 | Outer Check Plug Seal |
| 1853-001 | 7613-001 | Quad Seal, Float |
| 2706-001 | None | |
| 2707-001 | 7448-001 | Check Plug Seal |
| 2709-001 | 6277-001 | Power Beyond Sleeve, Outer |
| 6806-001 | None | |
| 21857-001 | 9003-117 | Section Seal, Pressure (new) |
| 6814-002 | 7450-001 | Section Seal, Pressure (old) |
| 21733-001 | 9002-119 | Section Seal, Exhaust (new) |
| 6815-002 | 7451-001 | Section Seal, Exhaust (old) |
| 21866-001 | 9002-108 | Section Seal, Load Sensing (new) |
| 8316-001 | 9002-011 | Section Seal, Load Sensing (old) |

Optional Viton Seals and O-Rings

Viton seals are recommended for most applications that use phosphate-ester type fluids. Viton seals are also recommended for applications that have a continuous operating temperature of +200°F [+93°C] or more.

Table 4-2. Cross Reference For Seal Kits, Buna-N to Viton

| Buna-N Kit No. | Viton Kit No. | Application |
|----------------|---------------|--|
| K-6001-A | None | |
| K-6002-A | None | |
| K-6005-A | K-6041 | RC Relief |
| K-6017-B | K-6053-A | Power Beyond (1/2 NPTF) |
| K-6018-B | K-6054-A | Power Beyond (SAE 8) |
| K-6019-B | K-6055-A | Power Beyond (SAE 10) |
| K-6021-A | K-6043 | Anti-Cavitation Check |
| K-6027-A | K-6046 | Section Seal, 3-Way, 4-Way |
| K-6028-C | K-6049-A | Section Seal, Float |
| K-6030-C | K-6047 | Check Plug |
| K-6032 | K-6041 | Load Check, Anti-Cav. Check, RC Relief |
| K-6034-D | None | |
| K-6035-A | K-6048 | Spool Seal |
| K-6039 | None | |
| K-6040-C | None | |



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