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Service and Parts Bulletin

Models
SP, SPK, and SSK

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Monoblock
Directional Control Valves





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SECTION I

INTRODUCTION

This manual contains pertinent step-by-step maintenance instructions plus parts ordering information and a complete parts and service kit listing for the Models SP, SPK and SSK Monoblock Directional Control Valves.

If further assistance is required, contact: your Gresen Distributor or Representative

WARNING

Maximum Pressure Rating for SP, SPK and SSK Directional Control Valves is 2000 PSI [138 bar].

See catalog No. PC-1000 for ordering information.

SECTION II DESCRIPTION

The Models SP, SPK and SSK Monoblock Directional Control Valves may be purchased with many combinations of spools, spool positioners and relief options to meet the desired job specifications or applications.

The following paragraphs describe the 3 valve models and their respective options with references to the parts illustrations in Section IV in this manual. In some cases, identification of a specific part or component may only be made by comparison with these parts illustrations.

MODEL SP DIRECTIONAL CONTROL VALVE (Refer to Figure 4-1)

The Model SP 1-, 2-, or 3-spool Valve can be identified by the number 2701, 2702 or 2703 stamped on the housing.

This is a parallel circuit valve. The open center passage is closed off when the spool is fully shifted and hydraulic oil will flow directly to the power core passage, making oil available to all work ports. If two or more spools are fully shifted at the same time, the oil will follow the path of least resistance, and the hydraulic cylinder or the hydraulic motor with the lightest load will begin to function first.

The hydraulic oil can be divided so that it will flow to two or more functions by metering the spools.

The parallel circuit is the most commonly used circuit in mobile equipment because more than one function can be operated at the same time at random in the valve bank assembly.

Six spool variations are available for the Model SP Valve. They are:

- 3-way, 3-position standard spool
- 3-way, 3-position free flow motor spool
- 3-way, 3-position metering spool
- 4-way, 3-position standard spool
- 4-way, 3-position free flow motor spool
- 4-way, 3-position metering spool

Seven relief options are available. They are:

- Standard, adjustable (Model J)
- Standard, non-adjustable (Model J-NJ)
- High pressure, adjustable (Model J-HP)
- High pressure, non-adjustable (Model J-NJ-HP)
- Differential poppet-type, adjustable (Model WSA)
- Differential poppet-type, non-adjustable (Model WS)
- Plug, "NR" no relief

The machining required for the Model J Relief Valves is not the same as that required for the Model WS Relief Valves and therefore these reliefs are not interchangeable.

Seven spool positioner or "bonnet" options are available. They are:

- Spring return to neutral (standard)
- 1-position detent with spring return to neutral (spool "in" only)*
- 3-position detent
- Spring extended
- Spool travel limiter
- Rotary detent*
- Manual

*Cannot be changed in the field. Requires special machining.

MODEL SPK DIRECTIONAL CONTROL VALVE (Refer to Figure 4-2)

The Model SPK 1-, 2-, or 3-spool Valve can be identified by the number 2711, 2712 or 2713 stamped on the housing.

This is a parallel circuit valve. The open center passage is closed off when the spool is fully shifted and hydraulic oil will flow directly to the power core passage, making oil available to all work ports. If two or more spools are fully shifted at the same time, the oil will follow the path of least resistance, and the hydraulic cylinder or the hydraulic motor with the lightest load will begin to function first.

The hydraulic oil can be divided so that it will flow to two or more functions by metering the spools.

The parallel circuit is the most commonly used circuit in mobile equipment because more than one function can be operated at the same time at random in the valve bank assembly.

Only one spool variation and one spool positioner assembly (bonnet) is available for the No. 1 spool — the 4-way, 4-position float. There are no other options for this spool.

Six spool variations are available for the No. 2 and No. 3 spools of the Model SPK Valves. They are:

- 3-way, 3-position standard spool
- 3-way, 3-position free flow motor spool
- 3-way, 3-position metering spool
- 4-way, 3-position standard spool
- 4-way, 3-position free flow motor spool
- 4-way, 3-position metering spool

Seven relief options are available. They are:

- Standard, adjustable (Model J)
- Standard, non-adjustable (Model J-NJ)
- High pressure, adjustable (Model J-HP)
- High pressure, non-adjustable (Model J-NJ-HP)
- Differential poppet-type, adjustable (Model WKA)
- Differential poppet-type, non-adjustable (Model WK)
- Plug, "NR" no relief

The machining required for the Model J Relief Valves is not the same as that required for the Model WK Relief Valves and therefore these reliefs are not interchangeable.

Seven spool positioner assembly (bonnet) options are available for 2- and 3-spool Model SPK Valves only. They are:

- Spring return to neutral (standard)
- 1-position detent with spring return to neutral (spool "in" only)*
- 3-position detent
- Spring extended
- Spool travel limiter
- Rotary detent*
- Manual

*Cannot be changed in the field. Requires special machining.

MODEL SSK DIRECTIONAL CONTROL VALVE (Refer to Figure 4-3)

The Model SSK Valve cannot be used in a "closed center" hydraulic circuit.

The Model SSK Valve has only 2 spools and can be identified by the number 2822 stamped on the housing.

This is a series circuit valve. The entire flow of hydraulic oil is available to each work section in sequence from inlet to outlet port through the open center passage. As oil is directed from the inlet port to the work port of the first spool which is shifted, the returning oil to that section is directed back to the open center passage and not to the tank port as in a parallel valve circuit. The returning oil is then available for any downstream section.

In a series circuit, pressure is additive. That is, the sum of all pressures required by all sections cannot exceed the main relief setting or pump pressure capability.

Only one spool variation and one spool positioner assembly (bonnet) is available for the No. 1 spool — 4-way, 4-position float. There are no other options for this spool.

Three spool variations are available for the Model SSK Valve, No. 2 spool only. They are:

- 3-way, 3-position standard spool
- 3-way, 3-position free flow motor spool
- 4-way, 3-position standard spool

Seven spool positioner assembly (bonnet) options are available for the No. 2 spool. They are:

- Spring return to neutral (standard)
- 1-position detent with spring return to neutral*
- 3-position detent
- Spring extended
- Spool travel limiter
- Rotary detent*
- Manual

*Cannot be changed in the field. Requires special machining.

Seven relief options are available. They are:

- Standard, adjustable (Model J)
- Standard, non-adjustable (Model J-NJ)
- High pressure, adjustable (Model J-HP)
- High pressure, non-adjustable (Model J-NJ-HP)
- Differential poppet-type, adjustable (Model WKA)
- Differential poppet-type, non-adjustable (Model WK)
- Plug, "NR" no relief

Machining required for the Model J relief valve is not the same as for the Model WK relief valve. They cannot be interchanged.

SECTION III

MAINTENANCE

REPLACING SPOOLS or HOUSING

Gresen Monoblock Valves and spools are matched parts and cannot be sold, repaired or replaced separately. In many instances an oversized spool may be installed by an authorized Gresen Service Center. In some cases the valve may be rebuilt to give additional years of service.

REPLACING SPOOL SEALS

NOTE

For clarification, the control handle side of the valve is considered the front.

Seal Removal

1. At the BACK of the valve, remove all spool positioner or "bonnet" assembly parts which are connected to the spool, and keep in the order of disassembly.
2. At the FRONT of the valve, remove all parts connected to the spool (Handle, etc.).
3. Push spool into housing from the FRONT of the valve until front seal is exposed, then remove front seal. Pull spool out of housing from FRONT end, being very careful that neither spool nor bore is scratched or damaged in any way.
4. Remove back seal.
5. Thoroughly clean both seal grooves.

Seal Installation, No. 2902 BUNA-N Quad Ring Seals

1. If the quad seal is replacing a U-Cup Seal, it is necessary to grind off the sharp edge on the leading and trailing edges of the spool. This allows the spool to pass the quad ring without cutting it. If the quad ring seal is replacing a quad ring, then the sharp edges have already been removed at the factory.
2. Replace the spool through the front of the housing being sure that the end having the bolt hole enters the housing first. Push the spool into the valve exposing the FRONT seal groove. Insert a new quad ring seal in the FRONT groove. It will be helpful to pinch one side of the seal causing the seal to shape slightly smaller than the seal groove in the valve. When the seal has been properly placed in the seal groove, straighten the seal by running a smooth rod around the exposed surface of the seal until you have a perfect fit. To check this, run your finger around the exposed edge of the seal. You should have a smooth, perfect ridge with no kinks or twists.
3. Pull the spool out toward the FRONT of the valve until the spool handle end is exposed. Insert a metal rod about 3 to 4 inches [76 to 102 mm] long, and up to 1/4 inch [6 mm] diameter through the spool handle pin hole for use as a handle. Pull the spool slowly past the seal with a twisting motion to assist the movement.
4. Continue to pull the spool until the BACK seal groove is exposed. DO NOT pull the spool too far, as this will allow the seal in the FRONT seal groove to enter a spool groove and cut the seal when the spool is pushed back.
5. Install the new BACK seal in the same manner as the FRONT seal taking care that the seal is not twisted or cut.
6. Push the spool into the housing past the seal with a twisting motion until 1/4 inch [6 mm] of the polished surface of the spool remains exposed at the FRONT of the valve.

7. Reassemble all parts disassembled in Step No. 2, Seal Removal.
8. Reassemble (in reverse order) all parts disassembled in Step No. 1, Seal Removal.

NOTE

When tightening assembly screw, part No. 0510 or screw, part No. 2673, use 8 ft. lbs. [11 Nm] torque. Refer to Figure 4-11, 4-12 and 4-16.

When tightening detent adapter bolt, part No. 3491, use 9 ft. lbs. [12 Nm] torque. Refer to Figures 4-13 and 4-15.

PARTS ORDERING INFORMATION

HOUSING AND SPOOLS

Housing and spools for the Model SP, SPK and SSK Valves are matched parts and are not sold separately. Basic part numbers for these items are shown in Section IV, Parts Listing to assist in production identification and also in ordering replacement assemblies.

Cast iron valve housings usually are not repairable. It is not economically feasible to install old spools and other parts in a new housing. Housings are, therefore, not available as a service part. A complete replacement valve assembly must be ordered.

At times an authorized Gresen Service Center may install an oversize spool and rebuild the valve housing to provide additional years of service. But, this work must be done by a Gresen Service Center. They have the proper honing and repair equipment. Because it is a specialized job, valve spools are not available as a service part.

Refer to the Monoblock Valve product catalog, No. PC-1000, for details and instructions on ordering a complete replacement valve assembly.

SERVICE KITS

Service kits are available for servicing the Model SP, SPK and SSK Directional Control Valves. Use kit numbers shown in the following table. Refer to Section IV, Parts Listing, for complete breakdown of service kit part numbers.

Service Kit Ordering Table

Description	Model SP	Model SPK	Model SSK
Seal Kits			
Seal Kit, 1-Spool with Adjustable Relief	K-2001A	K-2001A	—
Seal Kit, 2-Spool with Adjustable Relief	K-2002B	K-2002B	K-2002B
Seal Kit, 3-Spool with Adjustable Relief	K-2003A	K-2003A	—
Seal Kit, 1-Spool with WS Relief	K-2009A	—	—
Seal Kit, 2-Spool with WS Relief	K-2010A	—	—
Seal Kit, 3-Spool with WS Relief	K-2011A	—	—
Seal Kit, 1-Spool with WK Relief	—	K-2012A	—
Seal Kit, 2-Spool with WK Relief	—	K-2013A	K-2013A
Seal Kit, 3-Spool with WK Relief	—	K-2014A	—
Check Plug	K-2028B	K-2028B	K-2028B
Spool Action Option Kits			
Float Detent, Spool No. 1 (old style, round cap)	—	K-2006B	—
Float Detent, Spool No. 1 (new style, hex cap)	—	—	K-2007
Rotary Detent Assembly "W" (valve housing must be machined to accept "W" Detent Assembly)	K-2016C	K-2016C	K-2016C
3-Position Detent (After early 1974)	K-2034C	K-2034C	K-2034C
Spring Extended Spool	K-2018	K-2018	K-2018
Standard Spring Return to Neutral	K-2019A	K-2019A	K-2019A
Detent Assembly "R" (valve housing must be machined to accept "R" Detent Assembly)	K-2005A	K-2005A	K-2005A
Spool Travel Limiter Assembly	K-2020	K-2020	K-2020
Main Relief Service Kits			
Standard Relief (J)	K-2029A	K-2031A	K-2031A
High Pressure Relief (J-HP)	K-2030A	K-2032B	K-2032B
NR Plug	K-2033A	K-2033A	K-2033A
Outlet Option Kits			
Power Beyond Sleeve, 3/4" NPTF	K-2021C	K-2021C	K-2021C
Power Beyond Sleeve, SAE No. 8	K-2022C	K-2022C	K-2022C
Power Beyond Sleeve, SAE No. 10	K-2023C	K-2023C	K-2023C
Power Beyond Sleeve, SAE No. 12	K-2024C	K-2024C	K-2024C
Power Beyond Sleeve, SAE No. 14	K-2025C	K-2025C	K-2025C
Conversion Plug	K-2026B	K-2026B	K-2026B
Closed Center Plug	K-2027C	K-2027C	—
Handle Assembly Kit			
Complete Handle Assembly (Standard)	K-2004-A	K-2004-A	K-2004-A
Complete Handle Assembly (Offset to left)	K-2035C	K-2035C	K-2035C
Complete Handle Assembly (Offset to right)	K-2036C	K-2036C	K-2036C
Complete Handle Assembly (Short)	K-2037C	K-2037C	K-2037C
Link and Pin Assembly	K-2059C	K-2059C	K-2059C

SECTION IV PARTS LISTING

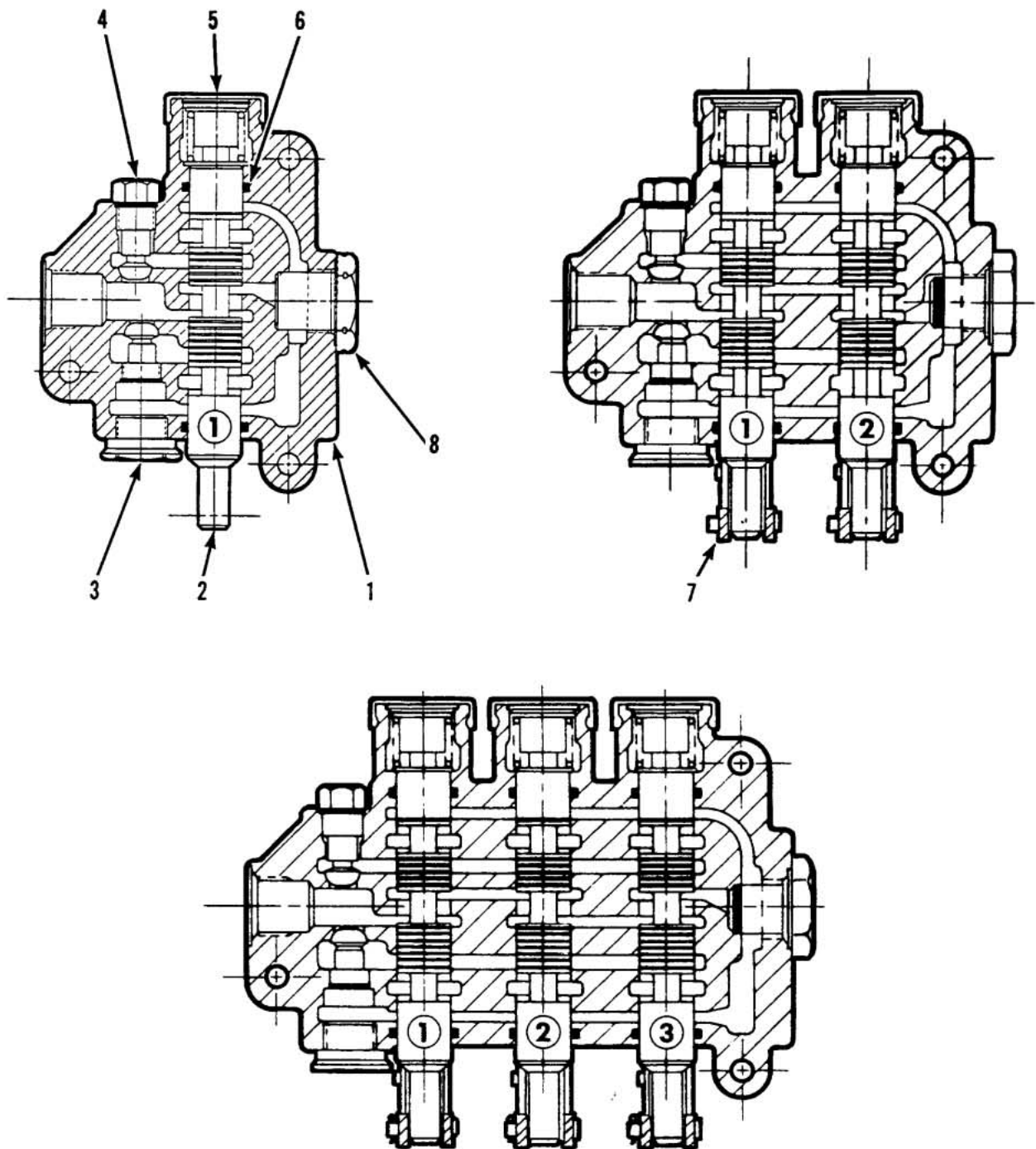


Figure 4-1. Models SP 1-, 2- and 3-Spool Directional Control Valves.

MODELS SP 1-, 2- and 3-SPOOL DIRECTIONAL CONTROL VALVES

Item No.	Part No.	Description
1	2701-	HOUSING, SP 1-Spool
	2702-	HOUSING, SP 2-Spool
	2703-	HOUSING, SP 3-Spool
2	0904-001	SPOOL, 4-Way, 3-Position
	0903-001	SPOOL, 3-Way, 3-Position
	0906-001	SPOOL, 4-Way, Free Flow
	2891-001	SPOOL, Metering
3		RELIEF, Adjustable, J (Standard) (See Figure 4-4)
		RELIEF, High Pressure, Adjustable, J-HP (See Figure 4-5)
		RELIEF, Non-Adjustable, J-NJ (See Figure 4-6)
		RELIEF, High Pressure, Non-Adjustable, J-NJ-HP (See Figure 4-7)
		RELIEF, Differential Poppet Type, Non-Adjustable, WS (See Figure 4-8)
		RELIEF, Differential Poppet Type, Adjustable, WSA (See Figure 4-8)
		PLUG, No Relief, NR (See Figure 4-9)
4	K-2028	LOAD CHECK (See Figure 4-10)
5		POSITIONER, Spring Return to Neutral (See Figure 4-11)
		POSITIONER, Manual (See Figure 4-12)
		POSITIONER, 3-Position Detent (After early 1974) (See Figure 4-14)
		POSITIONER, 1-Position With Spring Return (See Figure 4-15)
		POSITIONER, Rotary Detent (See Figure 4-16)
		POSITIONER, Spring Extended Spool (See Figure 4-17)
		LIMITER, Spool Travel (See Figure 4-18)
6	2902-001	SEAL, BUNA-N Quad Ring (2 req'd for each Spool)
7	0902-001	HANDLE ASSEMBLY, Short (See Figure 4-22)
	2580-001	HANDLE ASSEMBLY, Standard (See Figure 4-23)
	3461-001	HANDLE ASSEMBLY, Offset to Right (See Figure 4-24)
	3462-001	HANDLE ASSEMBLY, Offset to Left (See Figure 4-25)
8		PLUG, Closed Center (See Figure 4-19)
		PLUG, Conversion (See Figure 4-21)
		SLEEVE, Power Beyond (See Figure 4-20)

Notes:

1. These are matched parts and are not sold separately. A complete valve assembly must be ordered. Refer to Monoblock product catalog, No PC-1000, for complete details and ordering instructions.
2. Refer to page 7 for all service kits.

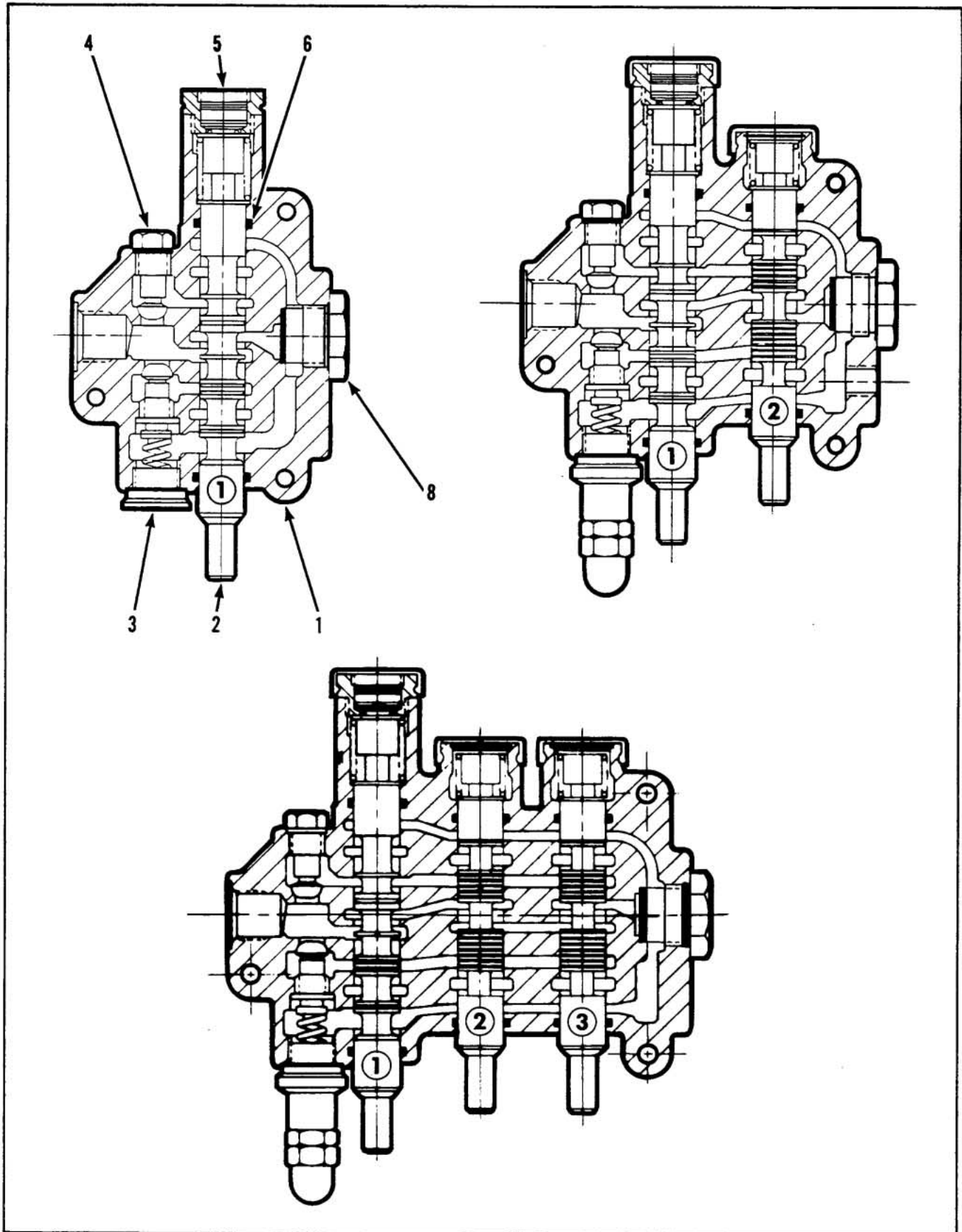


Figure 4-2. Models SPK 1-, 2- and 3-Spool Directional Control Valves.

MODELS SPK 1-, 2- and 3-SPOOL DIRECTIONAL CONTROL VALVES

Item No.	Part No.	Description	
1	2711-	HOUSING, SPK, 1-Spool	} See Note 1
	2712-	HOUSING, SPK, 2-Spool	
	2753-	HOUSING, SPK, 3-Spool	
2	1204-001	SPOOL, 4-Way, 4-Position Float (Spool No. 1 only)	
	0904-001	SPOOL, 4-Way, 3-Position (Spools No. 2 and 3 only)	
	0903-001	SPOOL, 3-Way, 3-Position (Spools No. 2 and 3 only)	} See Note 3
	0906-001	SPOOL, Free Flow (Spools No. 2 and 3 only)	
	2891-001	SPOOL, Metering (Spools No. 2 and 3 only)	
3		RELIEF, Adjustable J (Standard) (See Figure 4-4)	
		RELIEF, High Pressure, Adjustable, J-HP (See Figure 4-5)	
		RELIEF, Non-Adjustable, J-NJ (See Figure 4-6)	} See Note 2
		RELIEF, High Pressure, Non-Adjustable, J-NJ-HP (See Figure 4-7)	
		RELIEF, Differential Poppet Type, Non-Adjustable, WK (See Figure 4-8)	
		RELIEF, Differential Poppet Type, Adjustable, WKA (See Figure 4-8)	
		PLUG, No Relief, NR (See Figure 4-9)	
4	K-2028	LOAD CHECK (See Figure 4-10)	} See Note 3
5		POSITIONER, 4-Position Float (See Figure 4-13)	
		POSITIONER, Spring Return to Neutral (See Figure 4-11)	
		POSITIONER, Manual (See Figure 4-12)	
		POSITIONER, 3-Position Detent (After early 1974) (See Figure 4-14)	
		POSITIONER, 1-Position With Spring Return (See Figure 4-15)	} See Note 3
		POSITIONER, Rotary Detent (See Figure 4-16)	
		POSITIONER, Spring Extended Spool (See Figure 4-17)	
		LIMITER, Spool Travel (See Figure 4-18)	
6	2902-001	SEAL, BUNA-N Quad Ring (2 req'd for each Spool)	
7	0902-001	HANDLE ASSEMBLY, Short (See Figure 4-22)	}
	2580-001	HANDLE ASSEMBLY, Standard (See Figure 4-23)	
	3461-001	HANDLE ASSEMBLY, Offset to Right (See Figure 4-24)	
	3462-001	HANDLE ASSEMBLY, Offset to Left (See Figure 4-25)	}
8		PLUG, Closed Center (See Figure 4-19)	
		PLUG, Conversion (See Figure 4-21)	
		SLEEVE, Power Beyond (See Figure 4-20)	

Notes:

1. These are matched parts and are not sold separately. A complete valve assembly must be ordered. Refer to Monoblock product catalog, No. PC-1000, for complete details and ordering instructions.
2. For spool No. 1 only.
3. For spools No. 2 and 3 only.
4. Refer to page 7 for all service kits.

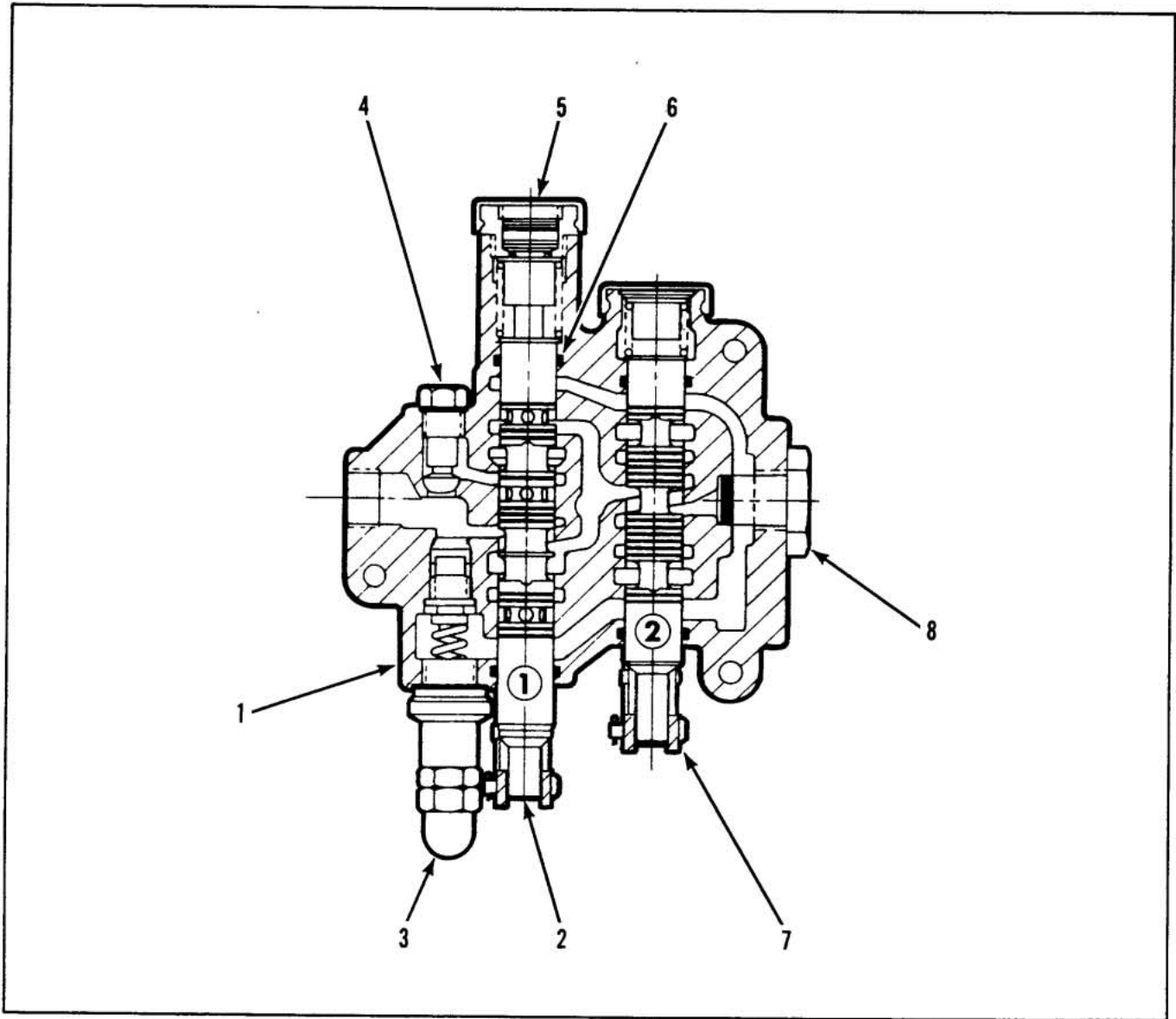


Figure 4-3. Model SSK 2-Spool Directional Control Valve.

MODEL SSK 2-SPOOL DIRECTIONAL CONTROL VALVE

Item No.	Part No.	Description	
1	2822-	HOUSING, SSK	} See Note 1
2	7131-001	SPOOL, 4-Way, 4-Position Float (Spool No. 1 only)	
	2824-001	SPOOL, 4-Way, 3-Position (Spool No. 2 only)	
3		RELIEF, Adjustable, J (Standard) (See Figure 4-4)	} See Note 3
		RELIEF, High Pressure, Adjustable, J-HP (See Figure 4-5)	
		RELIEF, Non-Adjustable, J-NJ (See Figure 4-6)	
		RELIEF, High Pressure, Non-Adjustable, J-NJ-HP (See Figure 4-7)	
		RELIEF, Differential Poppet Type, Non-Adjustable, WK (See Figure 4-8)	
		RELIEF, Differential Poppet Type, Adjustable, WKA (See Figure 4-8)	
		PLUG, No Relief, NR (See Figure 4-9)	
4	K-2028	LOAD CHECK (See Figure 4-10)	
5		POSITIONER, 4-Position Float (See Figure 4-13) See Note 2	
		POSITIONER, Spring Return to Neutral (See Figure 4-11)	
		POSITIONER, Manual (See Figure 4-12)	
		POSITIONER, 3-Position Detent (After early 1974) (See Figure 4-14)	
		POSITIONER, 1-Position With Spring Return (See Figure 4-15)	
		POSITIONER, Spring Extended Spool (See Figure 4-17)	
		LIMITER, Spool Travel (See Figure 4-18)	
6	2902-001	SEAL, BUNA-N Quad Ring (2 req'd for each Spool)	
7	0902-001	HANDLE ASSEMBLY, Short (See Figure 4-22)	
	2580-001	HANDLE ASSEMBLY, Standard (See Figure 4-23)	
	3461-001	HANDLE ASSEMBLY, Offset to Right (See Figure 4-24)	
	3462-001	HANDLE ASSEMBLY, Offset to Left (See Figure 4-25)	
8		PLUG, Closed Center (See Figure 4-19)	
		PLUG, Conversion (See Figure 4-21)	
		SLEEVE, Power Beyond (See Figure 4-20)	

Notes:

1. These are matched parts and are not sold separately. A complete valve assembly must be ordered. Refer to Monoblock product catalog No. PC-1000, for complete details and ordering instructions.
2. For spool No. 1 only.
3. For spool No. 2 only.
4. Refer to page 7 for all service kits.

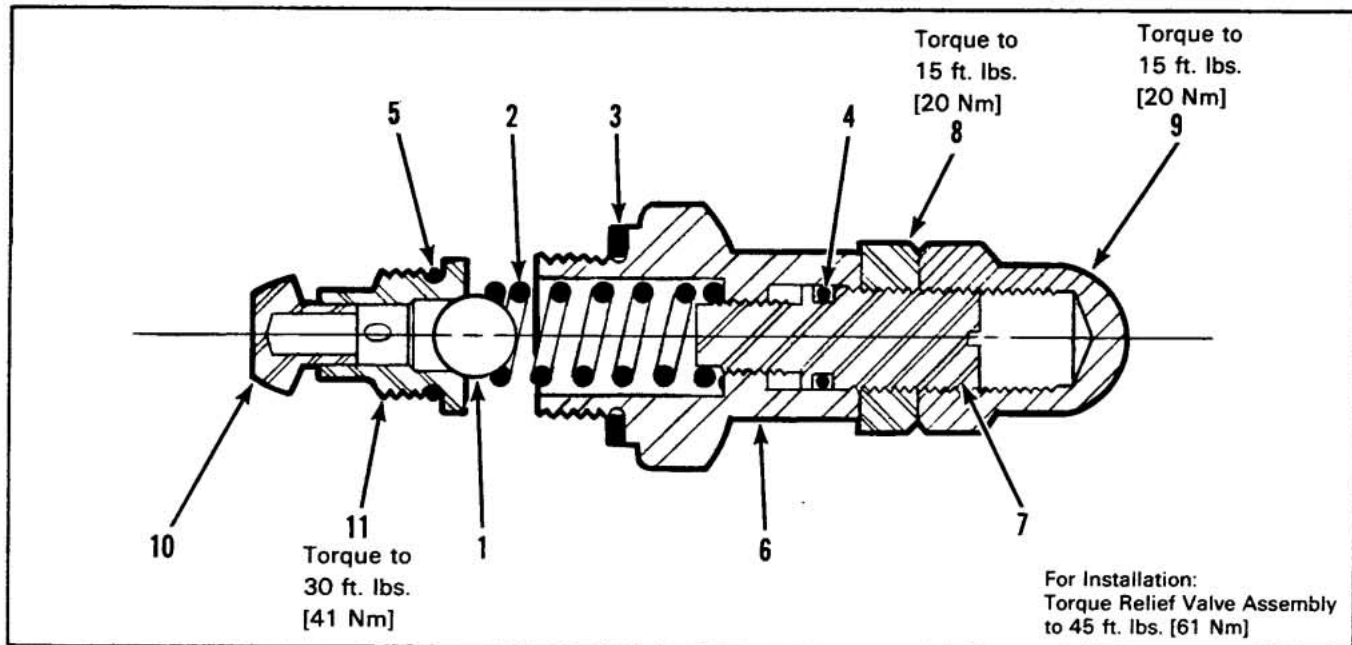


Figure 4-4. Model J Standard Relief. 500-1500 PSI [34-103 bar]

MODEL J STANDARD RELIEF

Item No.	Part No.	Description	Quantity
	K-2029A	SERVICE KIT (Model SP only) (Contains items 1 thru 11 listed below)	
	K-2031A	SERVICE KIT (Models SPK and SSK only) (Contains all items listed below)	
	K-20003	SEAL KIT (Contains items 3, 4 and 5 listed below)	
1	0014-001	BALL	1
2	0922-001	SPRING (Model SP only)	1
	1212-001	SPRING (Models SPK and SSK only)	1
3	0923-001	GASKET, Relief Body	1
4	0926-001	O-RING, Adjusting Screw	1
5	2706-001	O-RING, Valve Seat	1
6	0924-001	BODY	1
7	0925-001	SCREW, Adjusting	1
8	0973-001	NUT, Jam	1
9	0974-001	NUT, Acorn Cap	1
10	2781-001	POPPET, Check	1
11	2784-001	SEAT, Valve	1
	0994-001	GUIDE, Spring (Models SPK and SSK only) (not shown)	1
	1213-001	WASHER, Spacer (Models SPK and SSK only) (not shown)	1

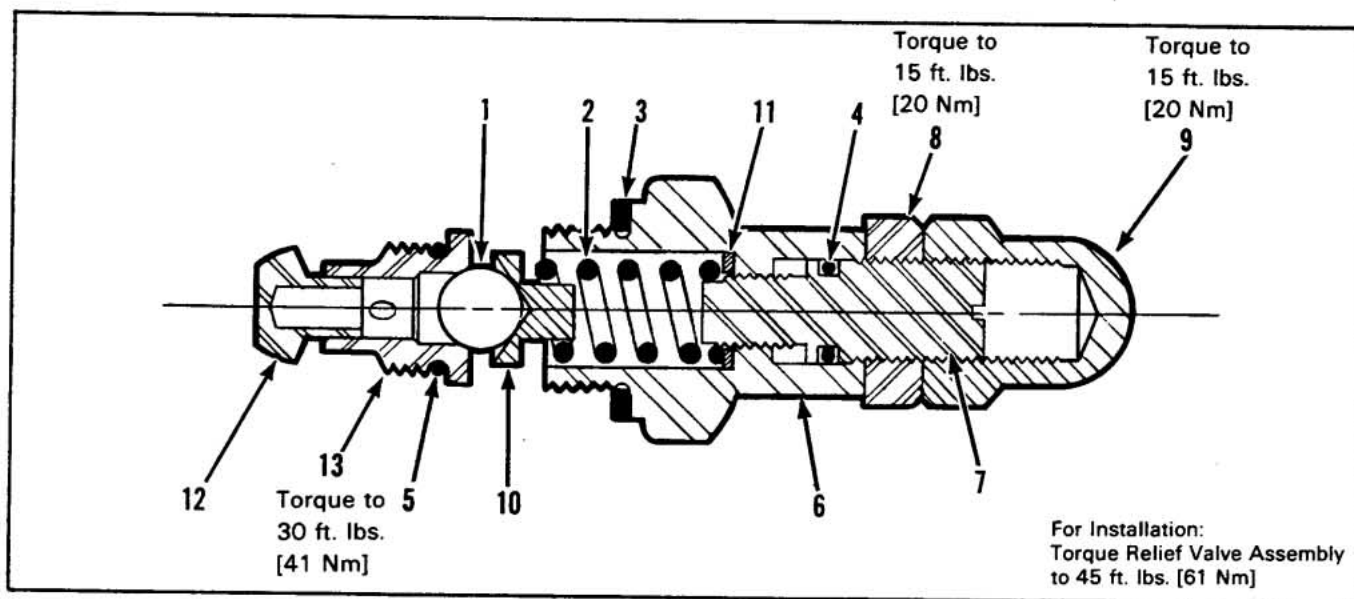


Figure 4-5. Model J-HP High Pressure Relief. 1500-2000 PSI [103-138 bar]

MODEL J-HP HIGH PRESSURE RELIEF

Item No.	Part No.	Description	Quantity
	K-2030A	SERVICE KIT (Model SP only) (Contains all items listed below)	
	K-2032B	SERVICE KIT (Model SPK and SSK only) (Contains all items listed below)	
	K-20003	SEAL KIT (Contains items 3, 4 and 5 listed below)	
1	0071-001	BALL	1
2	0922-001	SPRING, Relief (Model SP only)	1
	1212-001	SPRING, Relief (Models SPK and SSK only)	1
3	0923-001	GASKET, Relief Body	Not Sold Separately Order K-20003
4	0926-001	O-RING, Adjusting Screw	
5	2706-001	O-RING, Valve Seat	
6	0924-001	BODY	1
7	0925-001	SCREW, Adjusting	1
8	0973-001	NUT, Jam, Adjusting Screw	1
9	0974-001	NUT, Acorn Cap	1
10	0994-001	GUIDE, Spring	1
11	1213-001	WASHER, Spacer (SP)	1
		WASHER, Spacer (SPK)	2
12	2781-001	POPPET, Check	1
13	2785-001	SEAT, Valve	1

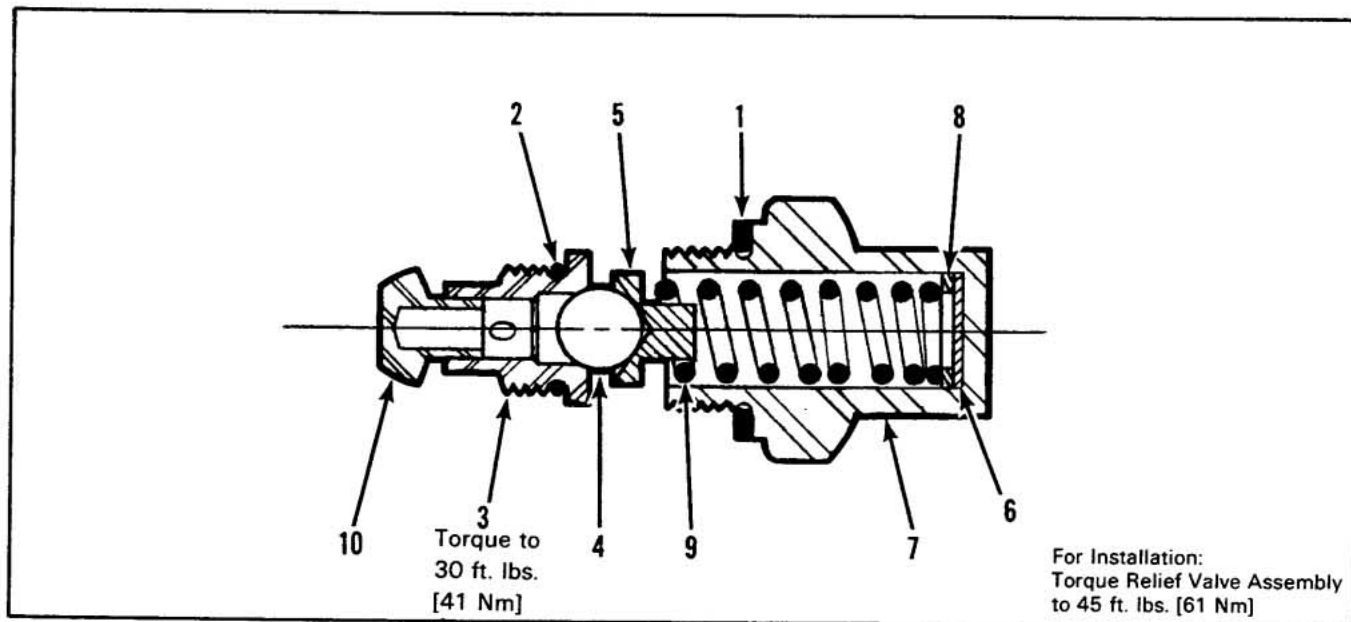


Figure 4-6. Model J-NJ Non-Adjustable Relief. (Standard) 500-1500 PSI [34-103 bar]

MODEL J-NJ NON-ADJUSTABLE RELIEF (STANDARD)

Item No.	Part No.	Description	Quantity	
	K-20003	SEAL KIT (Contains items 1 and 2 listed below)		
1	0923-001	GASKET, Relief Body	Not Sold Separately Order K-20003	1
2	2706-001	O-RING, Relief Valve Seat		1
3	2784-001	SEAT, Relief Valve (to 1500 PSI)		1
4	0014-001	BALL, Relief Valve		1
5	2770-001	GUIDE, Spring (Models SPK and SSK only)		1
	0994-001	SPACER, Spring (Model SP only)		1
6	0949-001	SHIM		A/R
7	2587-001	BODY, Relief		1
8	1213-001	WASHER, Spacer		A/R
9	2583-001	SPRING, Relief Valve (Models SPK and SSK only)		1
	1212-001	SPRING, Relief Valve (Model SP only)		
10	2781-001	POPPET, Check (Models SP and SPK only)		1

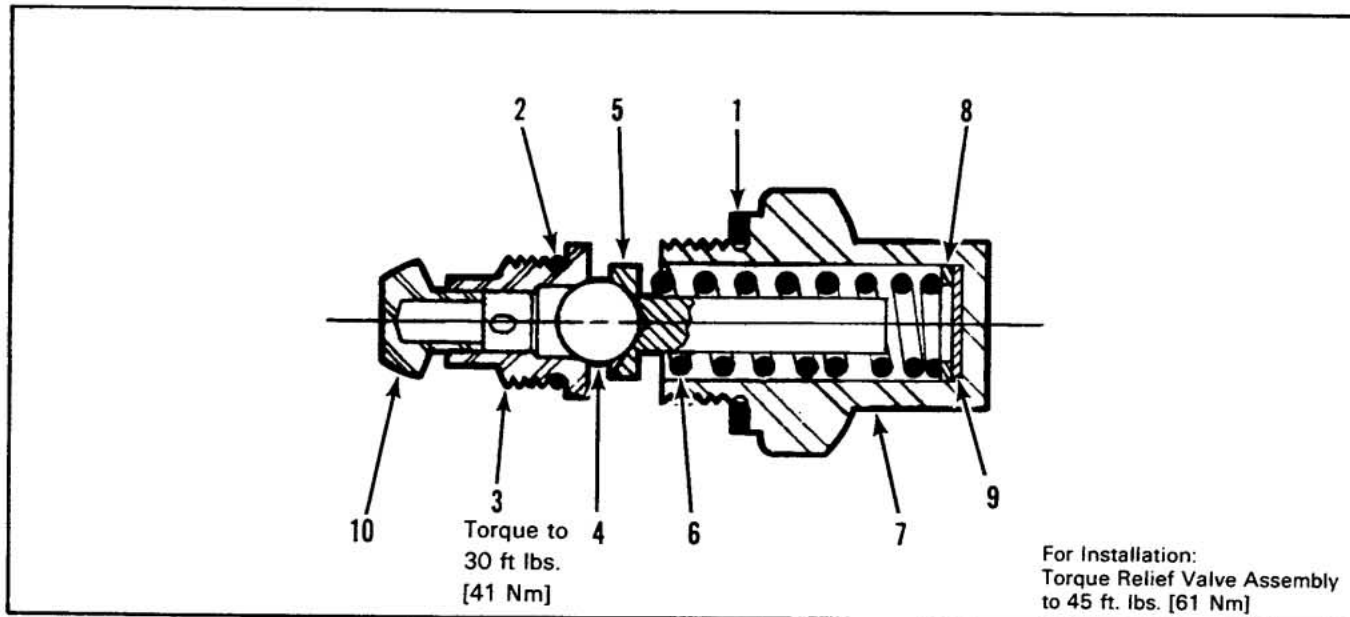


Figure 4-7. Model J-NJ-HP Non-Adjustable High Pressure Relief. 1500-2000 PSI [103-138 bar]

MODEL J-NJ-HP NON-ADJUSTABLE HIGH PRESSURE RELIEF

Item No.	Part No.	Description	Quantity	
	K-20003	SEAL KIT (Contains items 1 and 2 listed below)		
1	0923-001	GASKET, Relief Body	Not Sold Separately Order K-20003	1
2	2706-001	O-RING, Relief Valve Seat		1
3	2785-001	SEAT, Relief (HP)		1
4	0071-001	BALL, Relief		1
5	2770-001	GUIDE, Spring		1
6	2583-001	SPRING, Relief (Models SP and SSK only)		1
	2741-001	SPRING, Relief (Model SPK only)		1
7	2587-001	BODY, Relief		1
8	1213-001	WASHER, Spacer		A/R
9	0949-001	SHIM		A/R
10	2781-001	POPPET, Check (Models SP and SPK only)		1

For Installation: Torque Relief Valve Assemblies to 20 ft. lbs. [27 Nm]

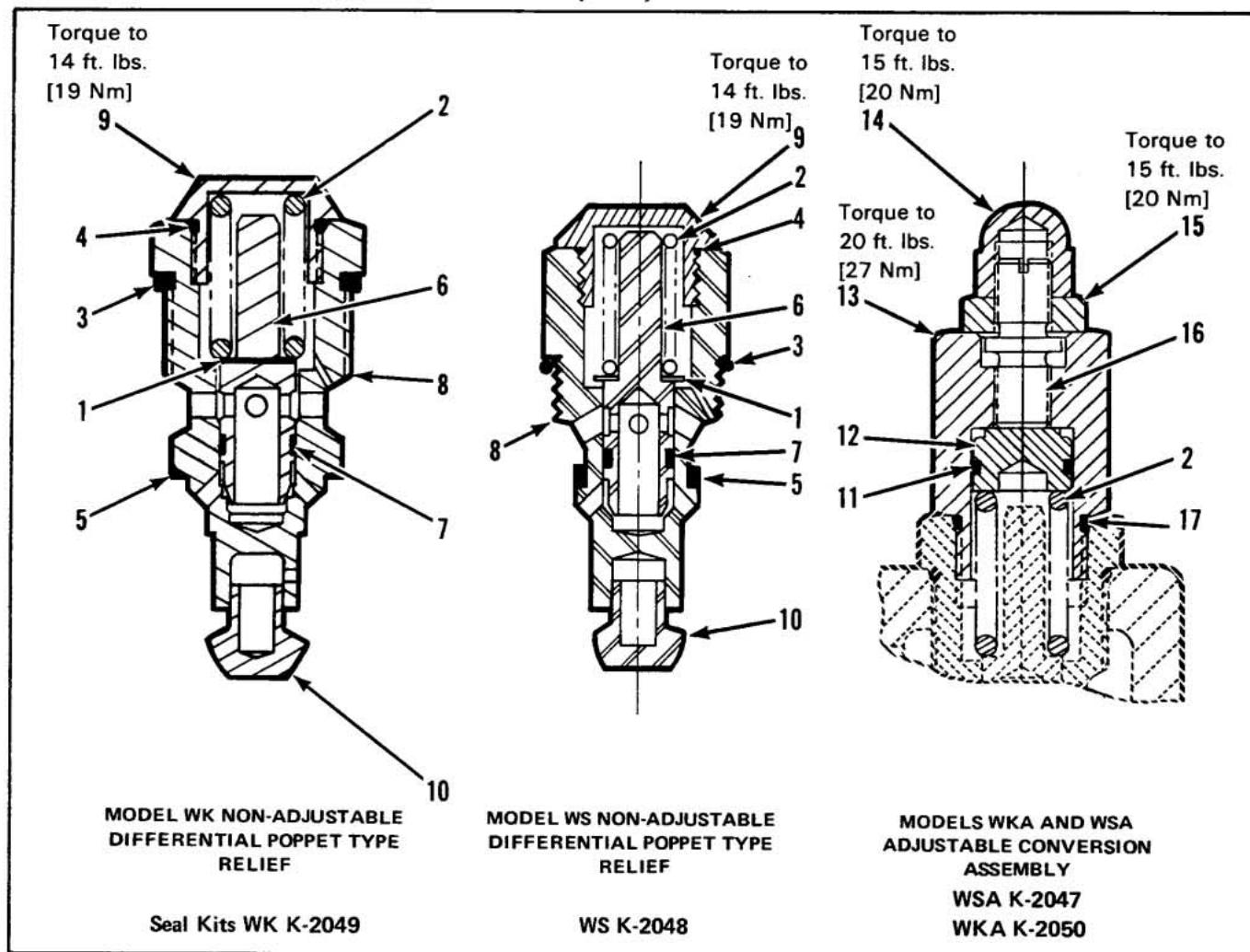


Figure 4-8. Models WK and WS Non-Adjustable; WKA and WSA Adjustable Differential Poppet Type Relief.

MODELS WK and WS NON-ADJUSTABLE; WKA and WSA ADJUSTABLE DIFFERENTIAL POPPET TYPE RELIEFS

Models WK and WS Non-Adjustable Differential Poppet Type Reliefs can be converted to adjustable type. Simply remove cap (Item 9) and install Conversion Assembly (Items 11 thru 17).

Item No.	Part No.	Description	Quantity
	K-19002	SERVICE KIT (Contains items 6 and 7 listed below)	
	K-2010A	SEAL KIT For Model WS (Contains items 3, 4 and 5 listed below)	
	K-2012A	SEAL KIT For Model WK (Contains items 3, 4 and 5 listed below)	
1	0458-001	SHIM, .040 inch [1,02 mm] thick	A/R
	0459-001	SHIM, .020 inch [0,51 mm] thick	A/R
	0462-001	SHIM, .010 inch [0,25 mm] thick	A/R
2	1869-001	SPRING, S.S., 500-1000 PSI [34-70 bar]	1
	7638-001	SPRING, S.S., 1000-1500 PSI [70-103 bar]	1
	7078-001	SPRING, S.S., 1500-2000 PSI [103-138 bar]	1
3	1615-001	SEAL, O-Ring	1
4	2707-001	CAP, O-Ring Relief	1
5	1718-001	SEAL (Model WK only)	1
	3158-001	SEAL (Model WS only)	1
6	1881-001	POPPET, Relief	1
7	1883-001	RING, Piston	1
8	3139-001	BODY, Relief (Model WK only)	1
	3137-001	BODY, Relief (Model WS only)	1
9	1880-001	CAP, Relief	1
10	2781-001	POPPET, Check	1
(Items 11 thru 17, following, are for Adjustable Conversion Assembly.)			
11	1818-001	SEAL, O-Ring	1
12	11481-001	PISTON	1
13	3498-001	CAP, Adjustable Relief	1
14	3497-001	NUT, Acorn	1
15	3500-001	NUT, Jam	1
16	3496-001	STEM, Adjustable	1
17	2707-001	SEAL, O-Ring	1

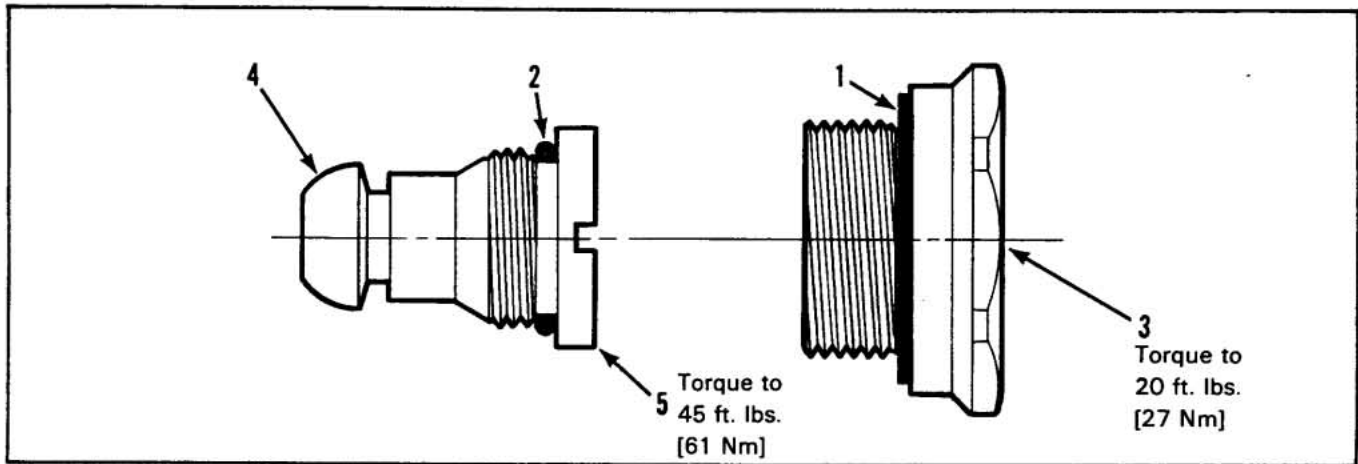


Figure 4-9. Plug "NR" (No Relief).

PLUG "NR" (NO RELIEF)

Item No.	Part No.	Description	Quantity
	K-2033A	SERVICE KIT (Contains items listed below)	
	K-20004	SEAL KIT (Contains items 1 and 2 listed below)	
1	0923-001	GASKET	1
2	2706-001	O-RING	
3	0983-001	CAP, Plug	1
4	2781-001	POPPET	1
5	2787-001	GUIDE, Poppet	1

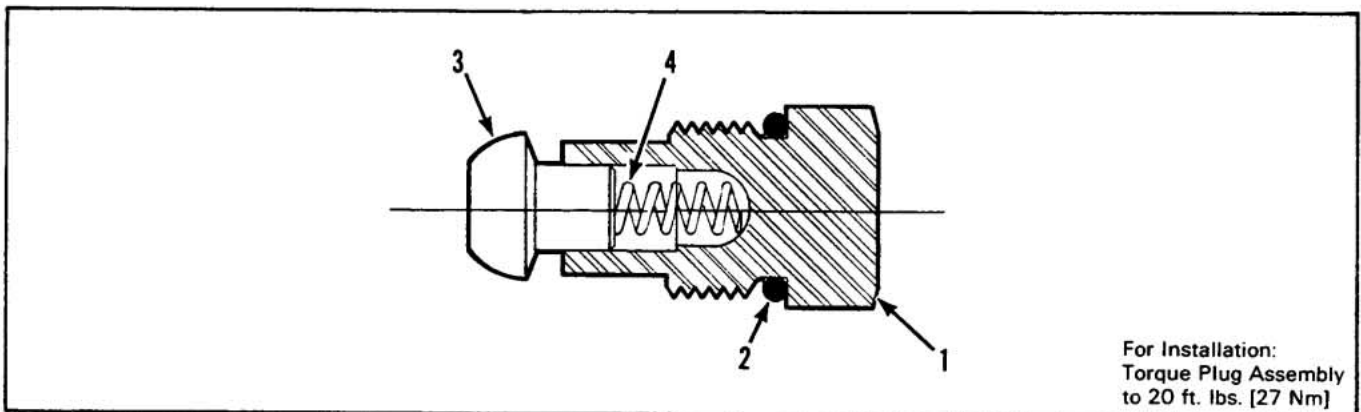


Figure 4-10. Load Check.

LOAD CHECK

Item No.	Part No.	Description	Quantity
	K-2028B	SERVICE KIT (Contains items listed below)	
1	2783-001	PLUG, Check	1
2	1141-001	SEAL, O-Ring	1
3	2781-001	POPPET, Check	1
4	2796-001	SPRING (Optional)	1

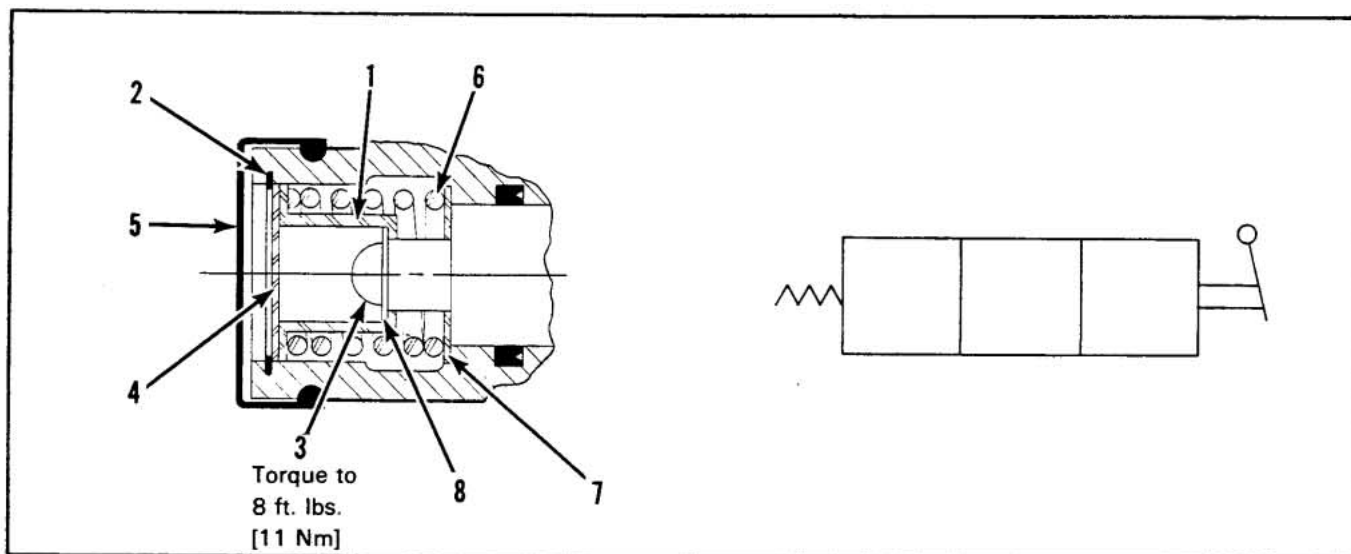


Figure 4-11. Spring Return To Neutral Positioner.

SPRING RETURN TO NEUTRAL POSITIONER

Item No.	Part No.	Description	Quantity
	K-2019A	SERVICE KIT (Contains all items listed below)	
1	0911-001	COLLAR, Stop	1
2	0914-001	RING, Retaining	1
3	0510-001	SCREW, Hex-Socket, Button Head Cap	1
4	0912-001	DISC, Stop	1
5	0967-001	BONNET, Rubber	1
6	0913-001	SPRING, Centering, Standard	1
	0986-001	SPRING, Centering, Heavy (Optional)	1
	0988-001	SPRING, Centering, Light (Optional)	1
7	1202-001	WASHER, Stop	1
8	2529-001	LOCKWASHER	1

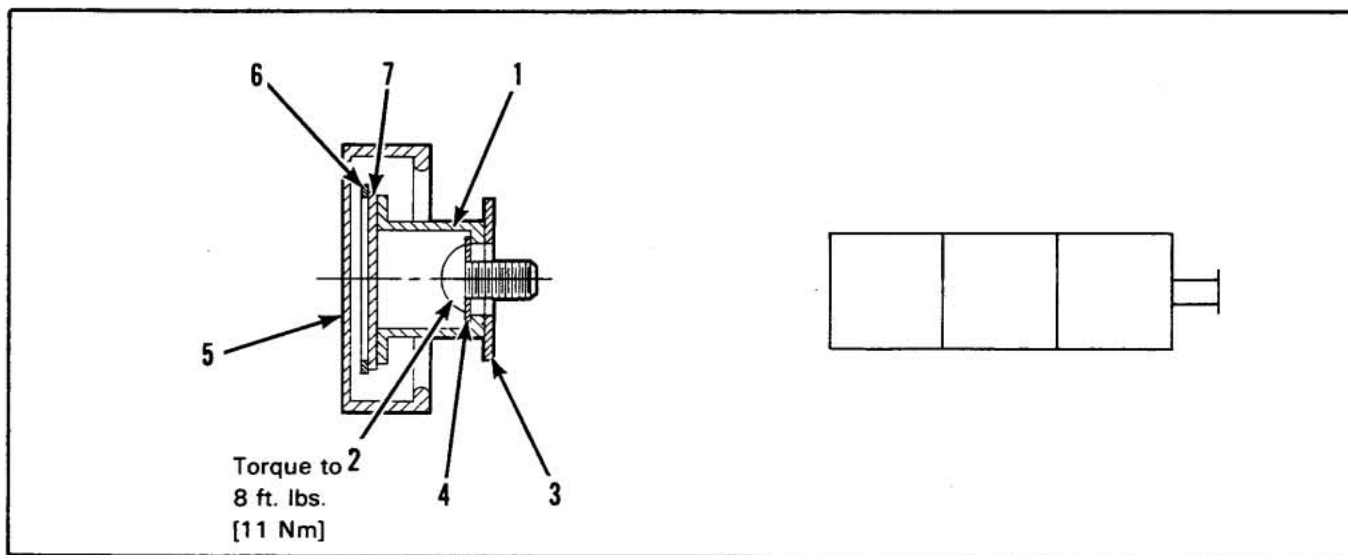


Figure 4-12. Manual Positioner.

MANUAL POSITIONER

Item No.	Part No.	Description	Quantity
1	0911-001	COLLAR, Stop	1
2	0510-001	SCREW, Hex-Socket, Button Head Cap	1
3	1202-001	WASHER, Stop	1
4	2529-001	WASHER, Lock	1
5	0967-001	BONNET, Rubber	1
6	0914-001	RING, Retaining	1
7	0912-001	DISC, Stop	1

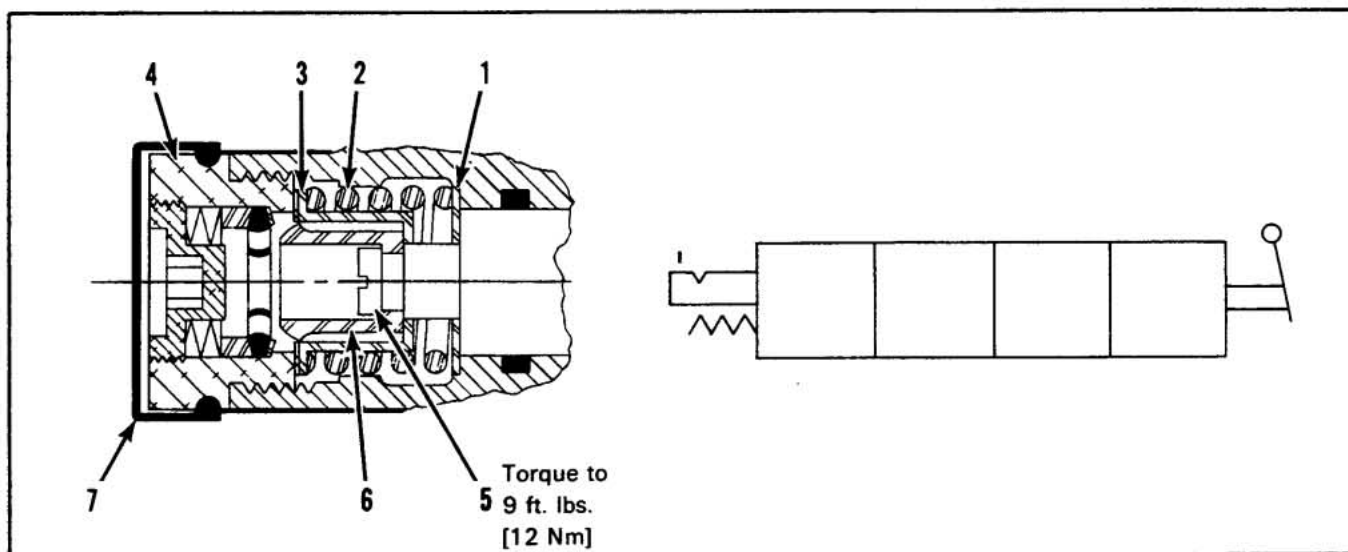


Figure 4-13. 4-Position Float Positioner.

4-POSITION FLOAT POSITIONER

Item No.	Part No.	Description	Quantity
	K-2006B	SERVICE KIT (Model SPK only, contains items 4, 5 and 6 listed below)	
	K-2007	SERVICE KIT (Model SSK only, contains items 4, 5, 6 and 8 listed below)	
1	1202-001	WASHER, Stop	1
2	2581-001	SPRING, Centering	1
3	1205-001	COLLAR, Spring	1
4	3504-001	DETENT, Sub Assembly	1
5	3491-001	BOLT, Shoulder	1
6	3490-001	PLUNGER, Detent	1
7	0967-001	BONNET, Rubber	1
8	3556-001	SHIM (Model SSK only, not shown) See Note	1

Note:

Model SSK Detent uses same parts as Model SPK — plus one shim, Part No. 3556-001. Shim is installed between item No. 3 and item No. 6. Shim is not shown in drawing.

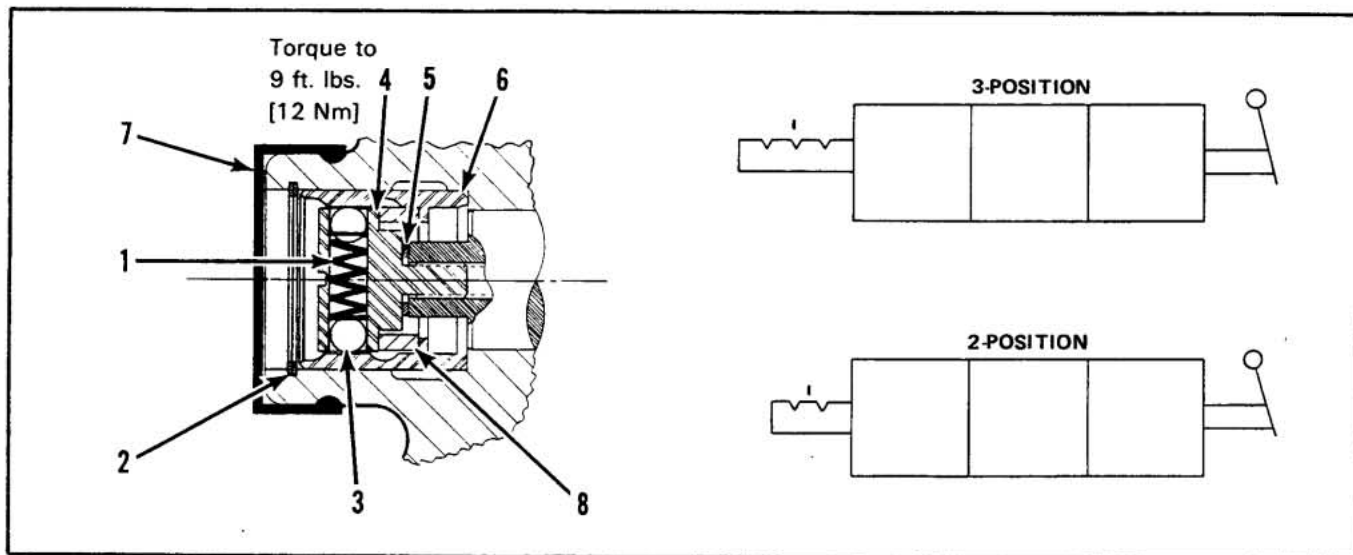


Figure 4-14. 2-Position or 3-Position "D" Detent Positioner (After early 1974).

2-POSITION OR 3-POSITION "D" DETENT POSITIONER

Item No.	Part No.	Description	Quantity
	K-2034C	SERVICE KIT (Contains all items listed below except part No. 6796-002)	
1	1838-001	SPRING, Detent	1
2	7776-001	RING, Retaining	1
3	0023-001	BALL, Detent	2
4	6795-001	HOLDER, Detent Ball	1
5	1861-001	WASHER, Lock	1
6	6796-001	SLEEVE, Detent (3-Position, Spool "in", Spool "out", Neutral)	1
	6796-002	SLEEVE, Detent (2-Position, Spool "in", Spool "out", not shown) (Optional)	1
7	0967-001	BONNET, Rubber	1
8	7551-001	COLLAR, Stop (Optional) See Note 2	1

Note:

1. This detent will replace standard spring centering without additional machining.
2. Part No. 7551-001 Detent Stop Collar is available to block out one detent position. It can be used to block either Spool "in" or Spool "out".

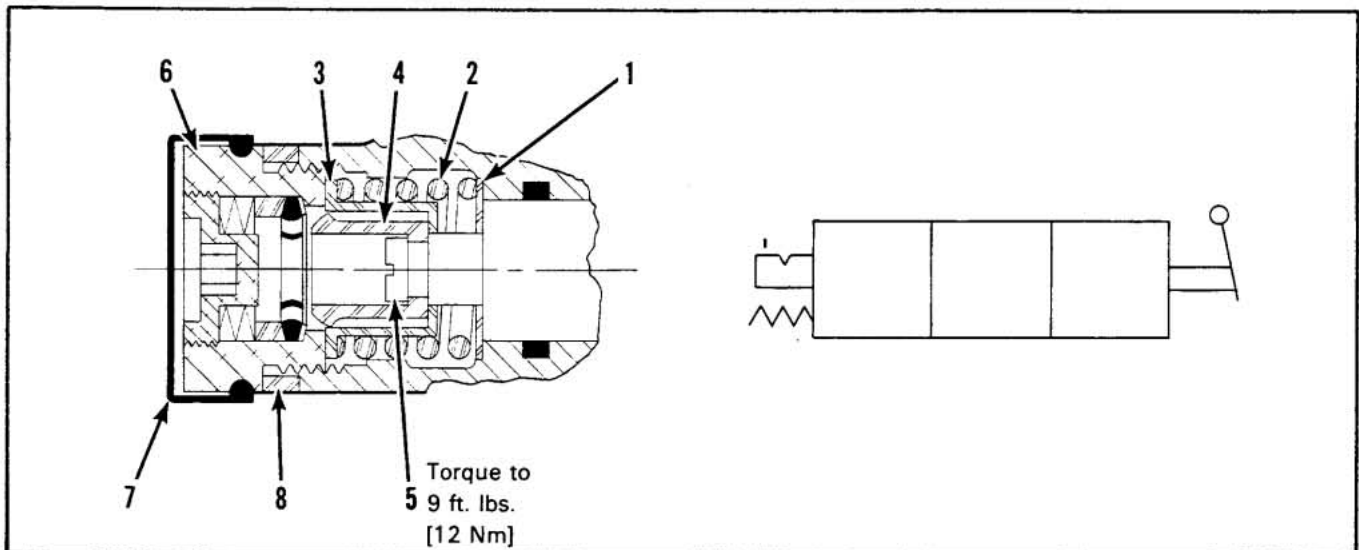


Figure 4-15. 1-Position "R" Detent with Spring Return to Neutral.

1-POSITION "R" DETENT WITH SPRING RETURN TO NEUTRAL

Item No.	Part No.	Description	Quantity
	K-2005A	SERVICE KIT (Contains items 4, 5, 6 and 8 below)	
1	1202-001	WASHER, Stop	1
2	0913-001	SPRING, Centering	1
3	0911-001	COLLAR, Stop	1
4	3492-001	PLUNGER, Detent	1
5	3491-001	BOLT, Shoulder	1
6	3504-001	DETENT, Subassembly	1
7	0967-001	BONNET, Rubber	1
8	3224-001	WASHER, Spacer	1

Note:

"R" Detent Spool part 2590-001 is tapped with 5/16-18UNC threads and is not interchangeable with standard spool.

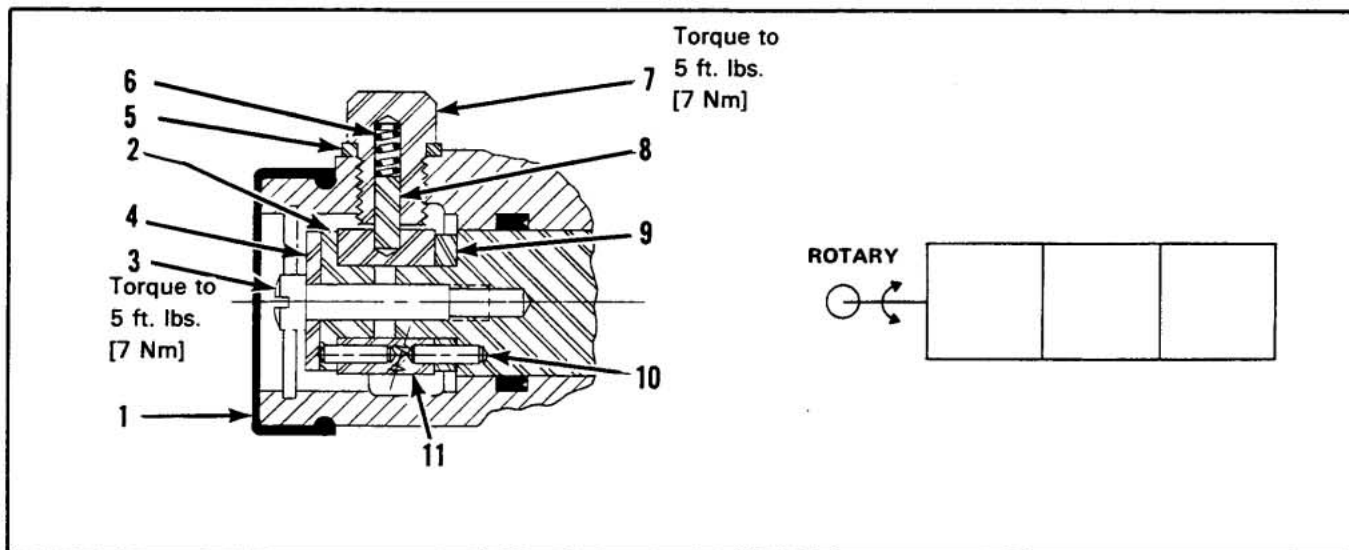


Figure 4-16. Rotary "W" Detent Positioner.

ROTARY "W" DETENT POSITIONER

Item No.	Part No.	Description	Quantity
	K-2016C	SERVICE KIT (Contains all items listed below)	
1	0967-001	BONNET, Rubber	1
2	8308-001	BUSHING, Locking	1
3	2673-001	SCREW, Fillister Head	1
4	2670-001	WASHER	1
5	0970-001	WASHER, Detent Cap	1
6	8808-001	SPRING, Compression	1
7	2675-001	CAP, Detent	1
8	2676-001	PIN, Rotary Cam	1
9	2669-001	WASHER, Flat	1
10	0888-001	PIN, Lock	2
11	2672-001	ADAPTOR	1

Note:

Valve housing and spool require special machining.

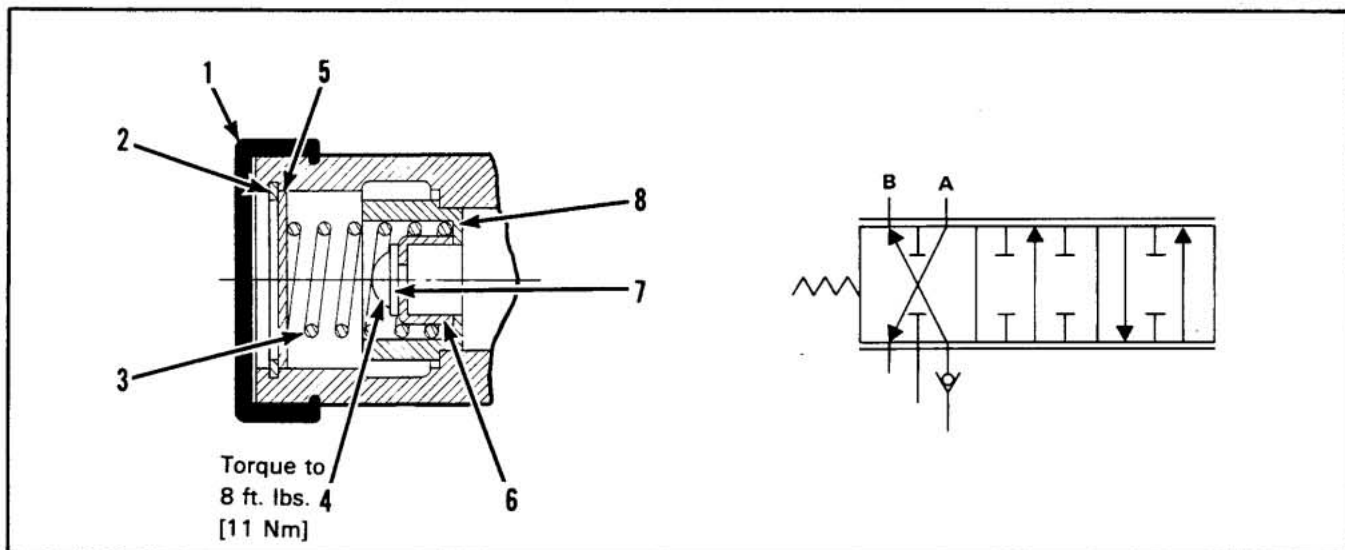


Figure 4-17. Spring Extended "A" Spool Positioner.

SPRING EXTENDED "A" SPOOL POSITIONER

Item No.	Part No.	Description	Quantity
	K-2018	SERVICE KIT (Contains all items listed below)	
1	0967-001	BONNET, Rubber	1
2	0914-001	RING, Retaining	1
3	0566-001	SPRING, Cam and Foot	1
4	0510-001	SCREW, Hex-Socket, Button Head Cap	1
5	0912-001	DISC, Stop	1
6	2682-001	SLEEVE, Lock	1
7	2529-001	LOCKWASHER	1
8	2681-001	COLLAR, Stop	1

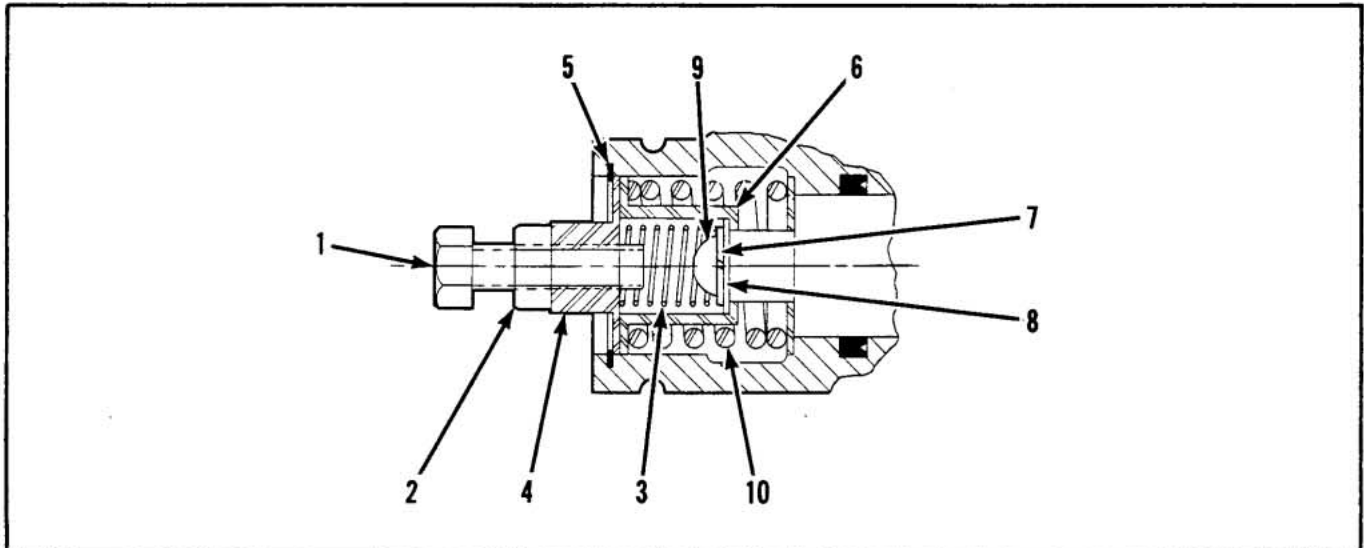


Figure 4-18. Spool Travel "L" Limiter.

SPOOL TRAVEL "L" LIMITER

Item No.	Part No.	Description	Quantity
	K-2020	SERVICE KIT (Contains items 1 thru 5 listed below) See Note	
1	2532-001	SCREW, Adjusting	1
2	0589-001	NUT, Lock	1
3	0976-001	SPRING, Compression	1
4	2508-001	CAP, Retainer	1
5	0914-001	RING, Retaining	1
6	0911-001	COLLAR, Stop	1
7	2529-001	LOCKWASHER	1
8	1202-001	WASHER, Stop	1
9	0510-001	SCREW, Hex-Socket, Button Head Cap	1
10	0913-001	SPRING, Compression	1

Note:

K-2020 Service Kit may also be used for conversion from standard spring return to neutral or spring extended spool positioners.

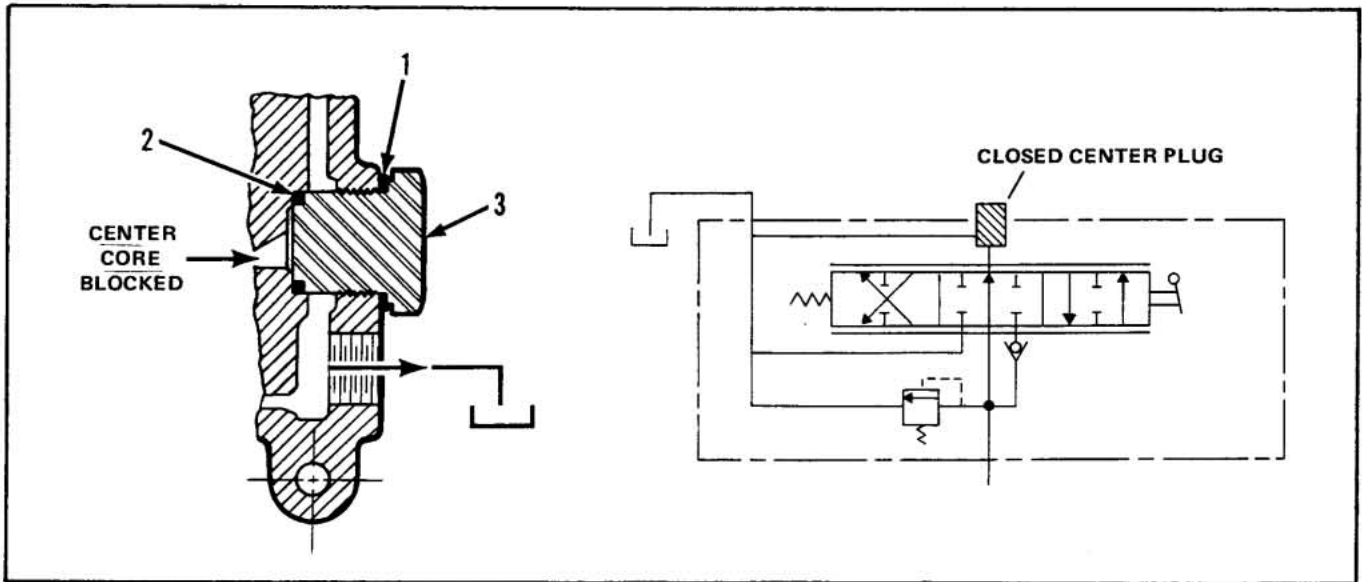


Figure 4-19. Closed Center Plug Kit.

CLOSED CENTER PLUG KIT

Item No.	Part No.	Description	Quantity
	K-2027C	SERVICE KIT (Contains items 1 thru 3 listed below)	
1	3096-001	SEAL	1
2	8005-001	SEAL, Quad	1
3	3154-001	PLUG, Closed Center	1

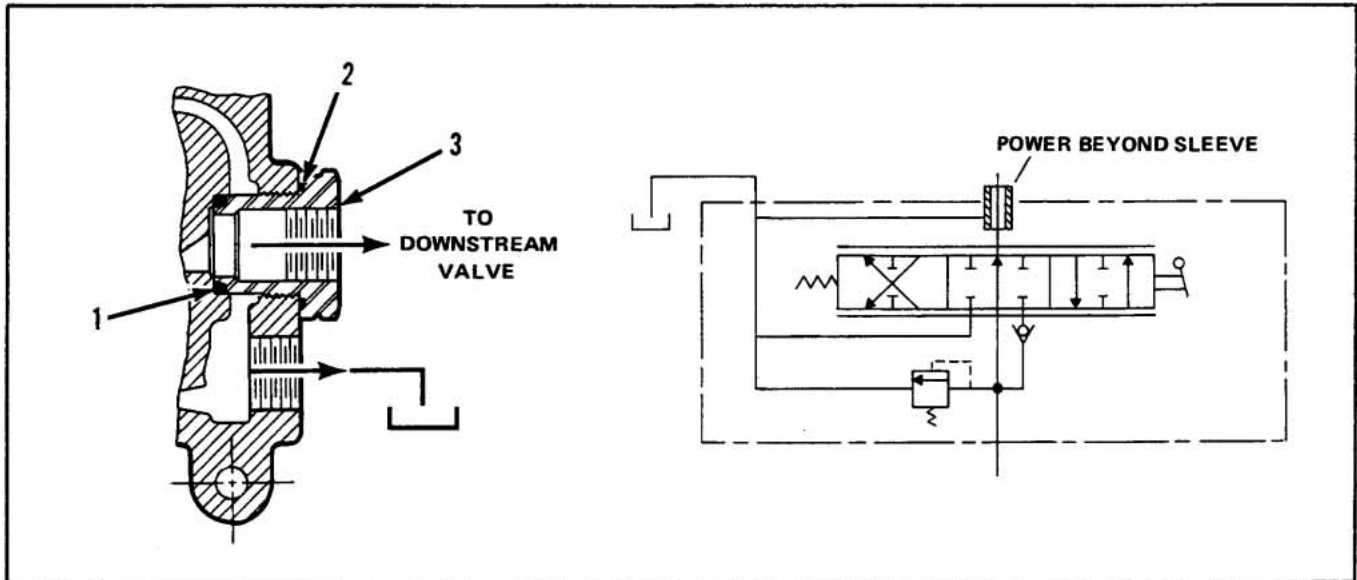


Figure 4-20. Power Beyond Kit.

POWER BEYOND KIT

Item No.	Part No.	Description	Quantity
	K-2021C	SERVICE KIT 3/4" NPTF (Contains items 1 thru 3 listed below)	
	K-2022C	SERVICE KIT SAE No. 8 (Contains items 1 thru 3 listed below)	
	K-2023C	SERVICE KIT SAE No. 10 (Contains items 1 thru 3 listed below)	
	K-2024C	SERVICE KIT SAE No. 12 (Contains items 1 thru 3 listed below)	
	K-2025C	SERVICE KIT SAE No. 14 (Contains items 1 thru 3 listed below)	
1	8005-001	SEAL, Nose	1
2	3096-001	SEAL, Sleeve	1
3	3147-001	SLEEVE, 3/4 NPTF	1
	3148-001	SLEEVE, SAE 8	1
	3149-001	SLEEVE, SAE 10	1
	3150-001	SLEEVE, SAE 12	1
	3152-001	SLEEVE, SAE 14	1

Not Sold Separately
Order Applicable
Kit

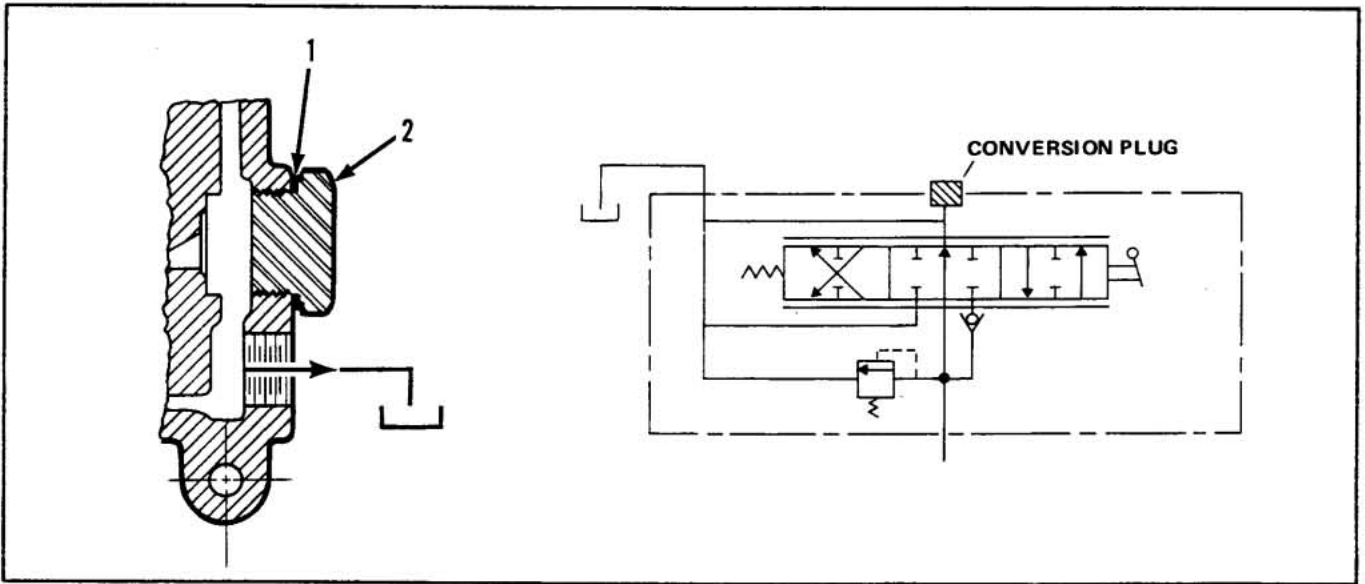


Figure 4-21. Conversion Plug Kit.

CONVERSION PLUG KIT

Item No.	Part No.	Description	Quantity
	K-2026B	SERVICE KIT (Contains items 1 and 2 listed below)	
1	3096-001	SEAL	1
2	3153-001	PLUG	1

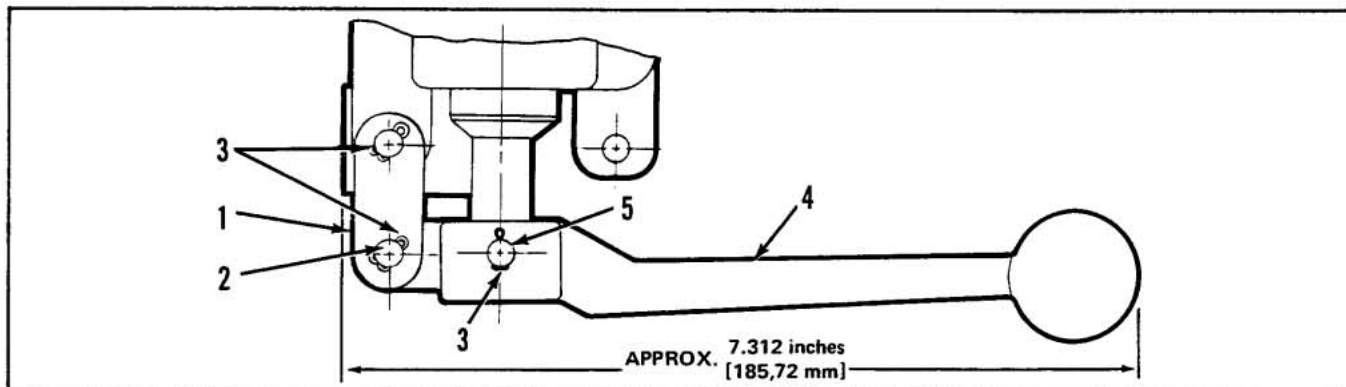


Figure 4-22. Handle Assembly, Short .

HANDLE ASSEMBLY, SHORT

Item No.	Part No.	Description	Quantity
	K-2037	SERVICE KIT (Contains 0902-001, Black Plastic Coated Handle)	Includes All Items Listed Below
	K-2054	SERVICE KIT (Contains 0902-003, Plain Handle)	
1	11392-001	SIDE PLATE, Link	Note Sold Separately. Order 928-001.
2	11393-001	PIN, Link	
3	0086-001	PIN, Cotter	3
4	0902-001	HANDLE, Black Plastic Coating (Standard)	
	0902-003	HANDLE, Plain (Optional)	1
5	0553-001	PIN	1

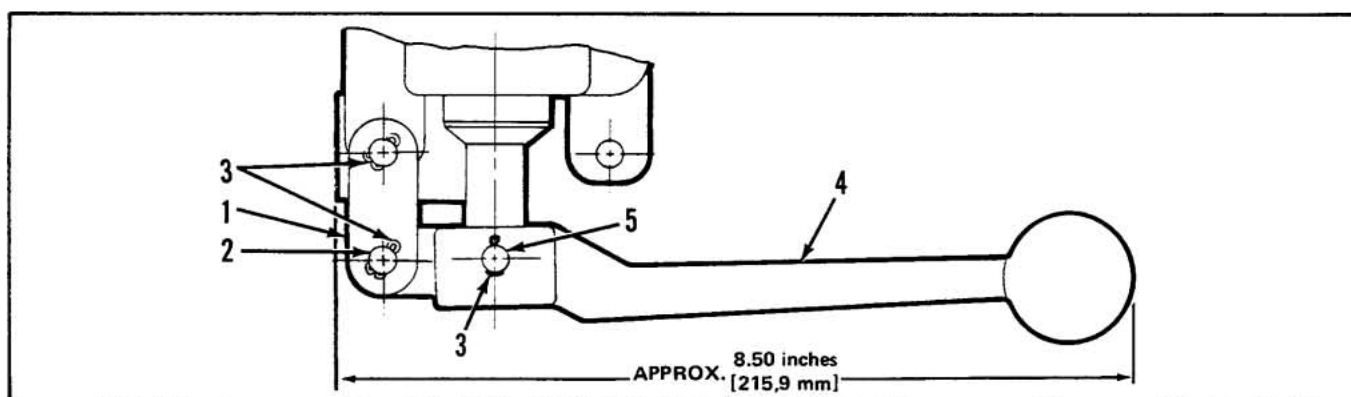


Figure 4-23. Handle Assembly, Standard .

HANDLE ASSEMBLY, STANDARD

Item No.	Part No.	Description	Quantity
	K-2004	SERVICE KIT (Contains 2580-001, Black Plastic Coated Handle)	Includes All Items Listed Below
	K-2052	SERVICE KIT (Contains 2580-006, Plain Handle)	
1	11392-001	SIDE PLATE, Link	Note Sold Separately. Order 928-001.
2	11393-001	PIN, Link	
3	0086-001	PIN, Cotter	3
4	2580-001	HANDLE, Black Plastic Coated (Standard)	
	2580-006	HANDLE, Plain (Optional)	1
5	0553-001	PIN	1

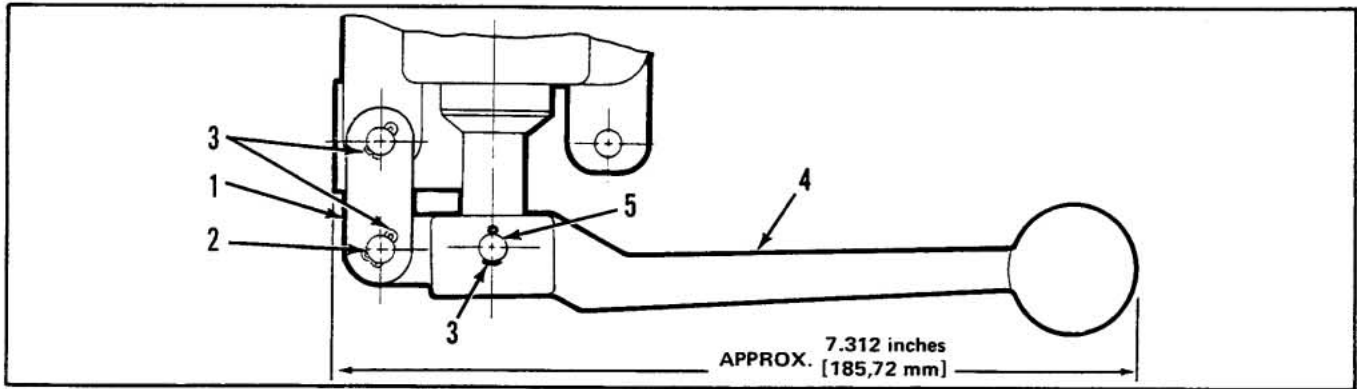


Figure 4-24. Handle Assembly, Offset to Right.

HANDLE ASSEMBLY, OFFSET TO RIGHT

Item No.	Part No.	Description	Quantity
	K-2036	SERVICE KIT (Contains 3461-001, Black Plastic Coated Handle)	Includes All Items Listed Below
	K-2056	SERVICE KIT (Contains 3461-003, Plain Handle)	
1	11392-001	SIDE PLATE, Link	Note Sold Separately. Order 928-001.
2	11393-001	PIN, Link	
3	0086-001	PIN, Cotter	3
4	3461-001	HANDLE, Black Plastic Coated (Standard)	1
	3461-003	HANDLE, Plain (Optional)	
5	0563-001	PIN	1

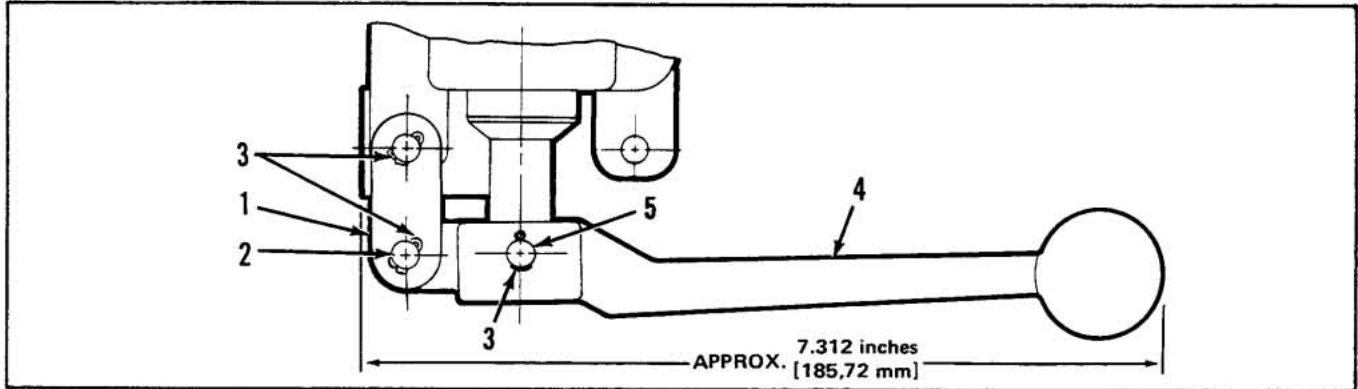


Figure 4-25. Handle Assembly, Offset to Left.

HANDLE ASSEMBLY, OFFSET TO LEFT

Item No.	Part No.	Description	Quantity
	K-2035	SERVICE KIT (Contains 3462-001, Black Plastic Coated Handle)	Includes All Items Listed Below
	K-2058	SERVICE KIT (Contains 3462-003, Plain Handle)	
1	11392-001	SIDE PLATE, Link	Not Sold Separately. Order 928-001.
2	11393-001	PIN, Link	
3	0086-001	PIN, Cotter	3
4	3462-001	HANDLE, Black Plastic Coated (Standard)	1
	3462-003	HANDLE, Plain (Optional)	
	0553-001	PIN	1



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