DAEWOO
DAEWOO HEAVY INDUSTRIES & MACHINERY LTD.

SB2097E00
Aug. 1996

Specifications
Systems Operation
Testing & Adjusting
Disassembly & Assembly

New Hydraulic Systems
D20/25-2
D20/25/30S-2
G20/25/30S-2
G20/25/30S-2

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "WARNING" as shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows :

Attention! Become Alert! Your Safety is Involved.

The Message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

DAEWOO cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by DAEWOO is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or repair procedures you choose.

The information, specifications, and illustrations in this publication are on the basis of information available at the time it was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product.
Obtain the complete and most current information before starting any job. DAEWOO dealers have the most current information available.

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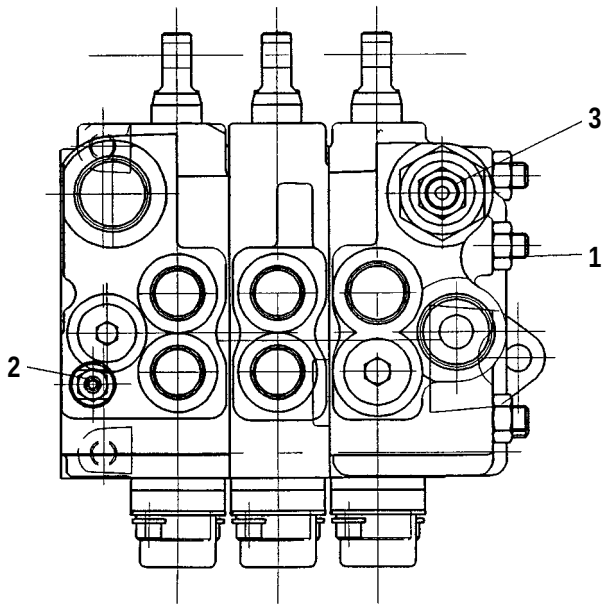
Specifications

Hydraulic Control valve

CONTROL VALVE			
Model	Mast	Main Relief Valve Pressure ± 500 kPa (± 75 psi)	TILT, Auxiliary Relief Valve Pressure ± 350 kPa (± 50 psi)
D(G)20(S) GC20(S)	Std FFL FFTL	18,100 (2625)	15,500 (2250)
D(G)25(S) GC25(S)	Std FFL FFTL	19,500 (2825)	15,500 (2250)
D(G)30S GC30S	Std FFL FFTL	21,550 (3125)	15,500 (2250)



IDCS001B

(1) Torque for bolts that hold control valve sections together ····· 40.5 ± 2 N•m (360 ± 18 lb•in)

(2) Adjust TILT and sideshift relief valve pressure as shown above. See Relief Valve Pressure Check in Testing And Adjusting.

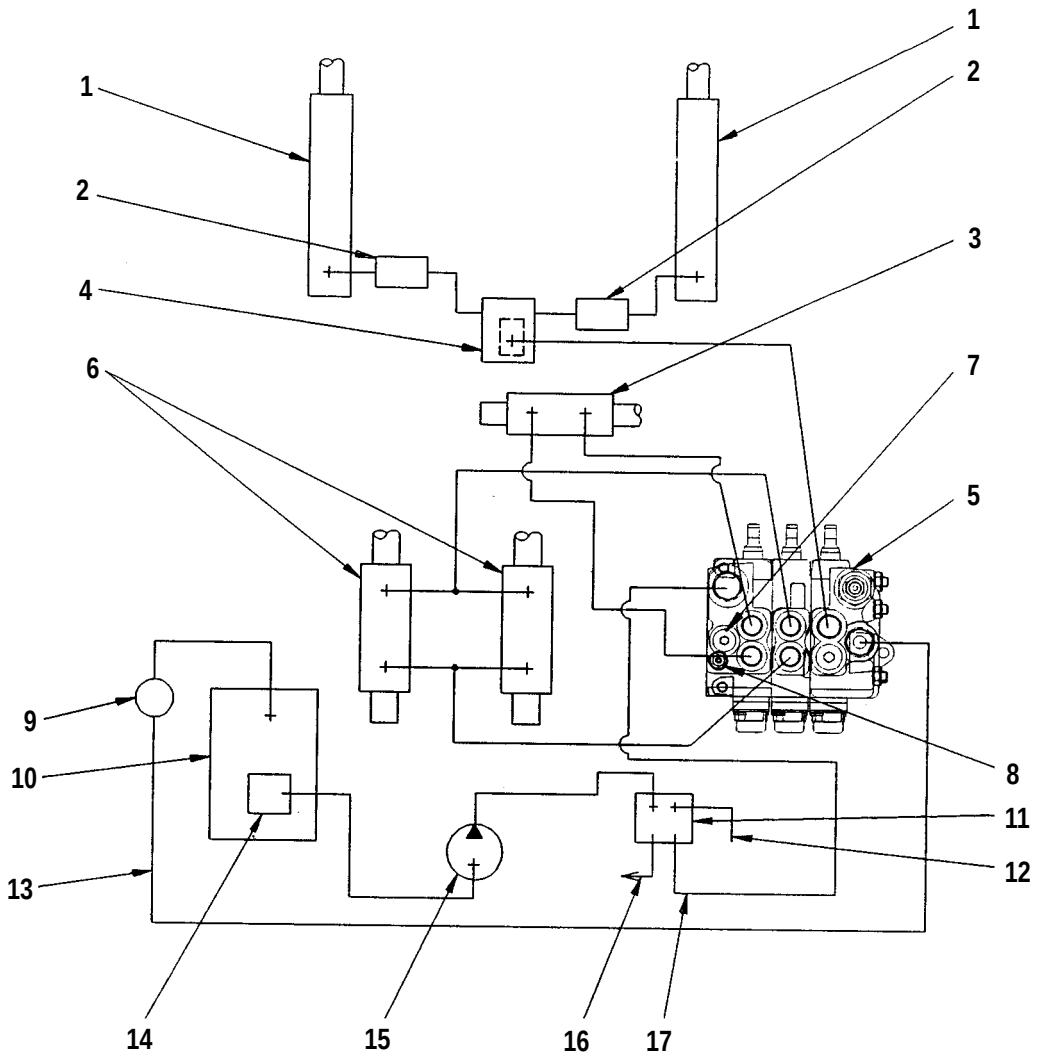
(3) Torque for nipple assembly ····· 36.5 ± 0.5 N•m (320 ± 4 lb•in)

See Folw Control Valve Adjstment in Testing And Adjusting.

(4) Torque for screws·····12 ± 1.5 N•m (105 ± 13 lb•in)

Systems Operation

Hydraulic System (D20/25/30S-2, G20/25/30S-2, GC20/25/30S-2 Model)



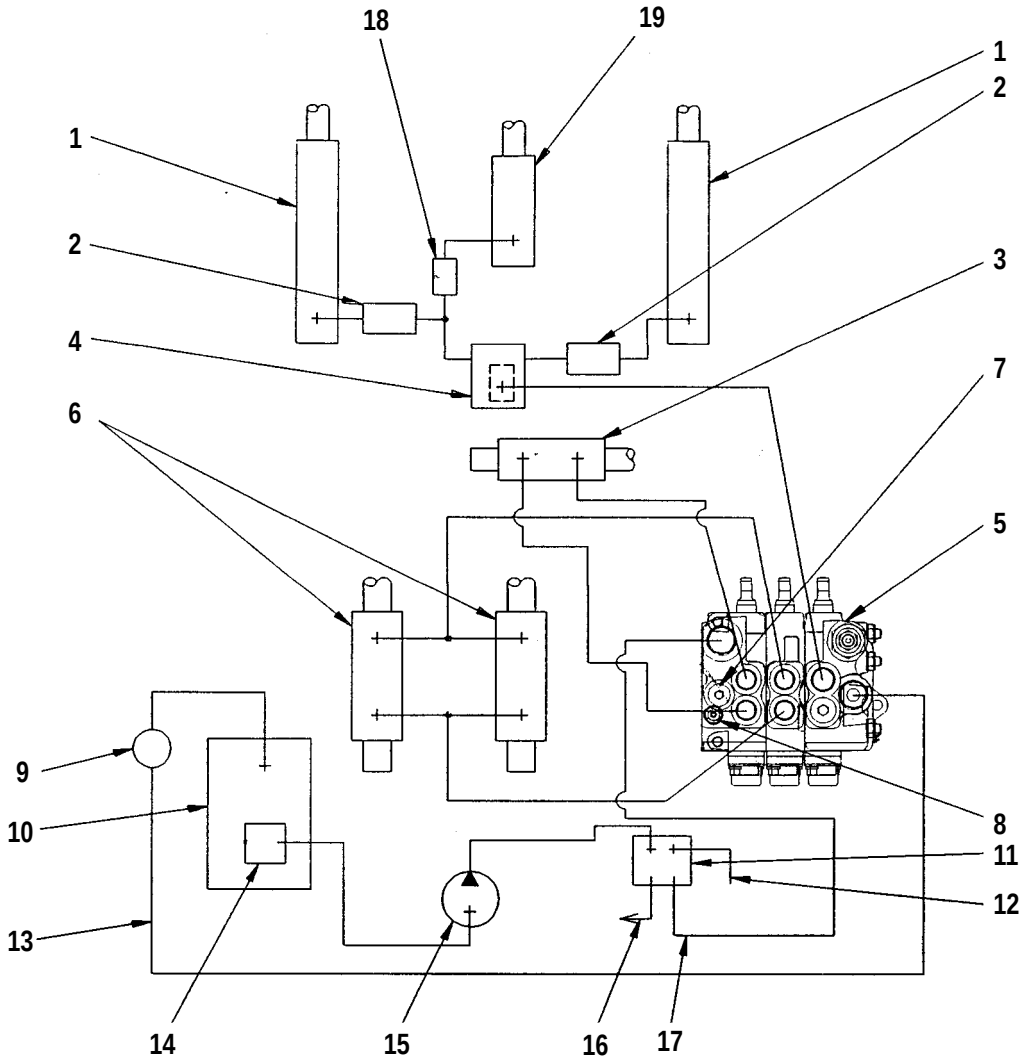
IDCS002B

Basic Hydrauic Schematic With Standard Lift
(1) Lift cylinders. (2) Excess flow protectors. (3) Sideshift cylinder(s)(if equipped). (4) Lowering flow control valve. (5) Hydraulic control valve. (6) Tilt cylinders (7) Relief valve(lift). (8) Relief valve(tilt and sideshift). (9) Hydraulic oil filter. (10) Hydraulic oil tank. (11) Priority valve. (12) Oil line(trucks with power brakes only). (13) Oil line. (14) Hydraulic strainer. (15) Hydraulic pump. (16) Oil line to steering gear. (17) Oil line.

The hydraulic system has hydraulic oil tank (10) which holds the oil for gear type hydraulic pump (15). Hydraulic pump (15) sends pressure oil to the power brakes (if equipped), hydraulic and steering systems. Pump oil flows from pump (15) to priority valve (11) where the oil folw divides to the power brakes brake valve (if equipped)(not shown) through line (12) and to the steering gear through line (16).

The control valve levers move the valve spools in control valve (5) to let the pump oil in the control valve go to lift cylinders (1) and/or (19), tilt cylinders (6) or sideshift cylinder(s) (3).

The return hydraulic oil from the cylinders flows through hydraulic control valve (4), line (13), into filter (9) and hydraulic tank (10). Relief valve (7) in the control valve body will make the flow control valve release extra pressure to the hydraulic tank when the pressure in the lift or tilt circuits goes higher than relief valve pressure shown in the Control Valve section of Specifications. Relief valve (8) does the same thing for the sideshift circuit when it goes higher than the auxiliary relief valve pressure shown in the Control Valve section of Specifications.



IDCS003B

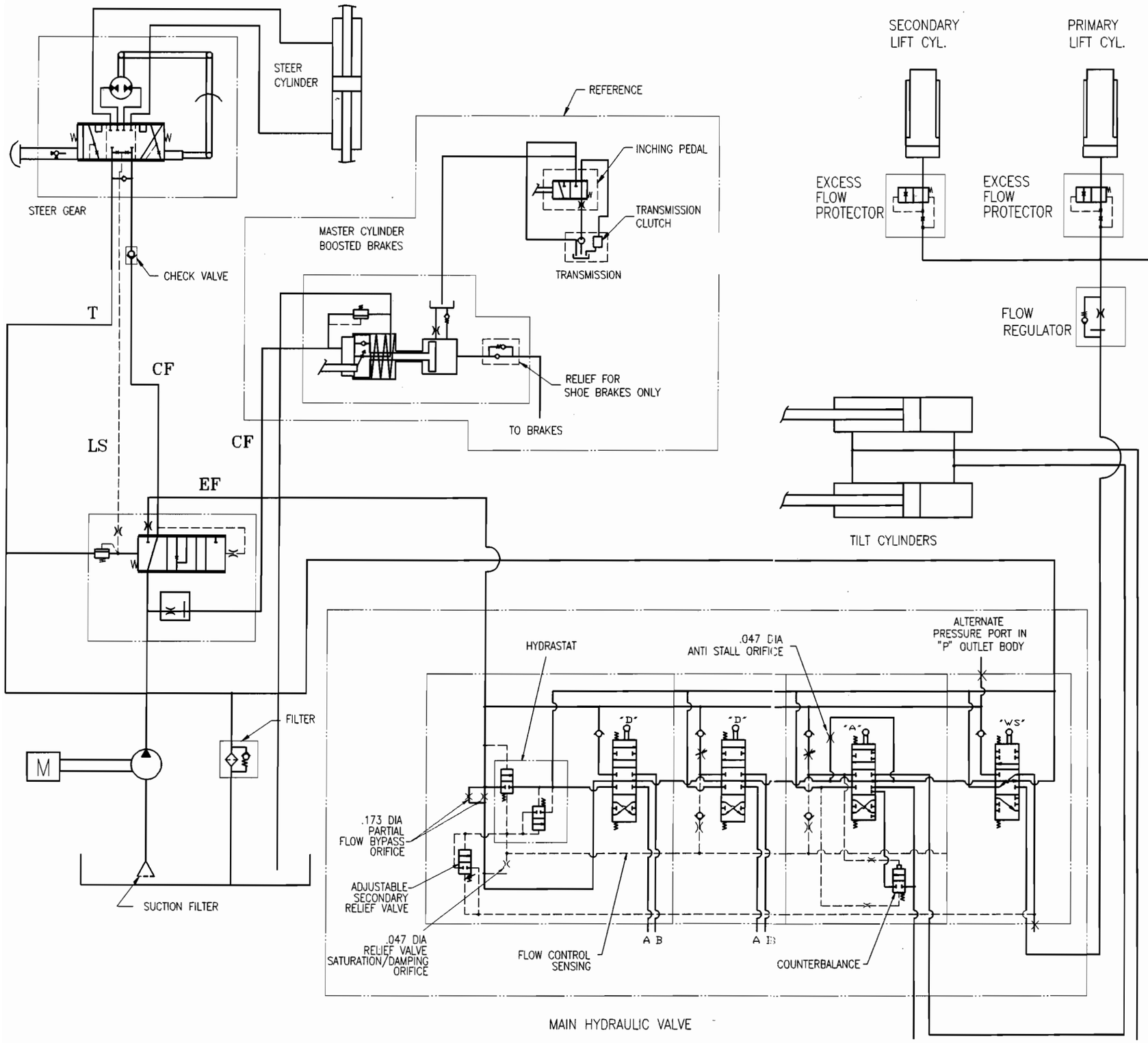
Basic Hydraulic Schematic With Standard Lift
(1) Lift cylinders. (2) Excess flow protectors. (3) Sideshift cylinder(s)(if equipped). (4) Lowering folw control valve. (5) Hydraulic control valve. (6) Tilt cylinders. (7) Relief valve(lift). (8) Relief valve(tilt and sideshift). (9)Hydraulic oil filter. (10) Hydraulic oil tank. (11) Priority valve. (12) Oil line(trucks with power brakes only). (13) Oil line. (14) Hydraulic strainer. (15) Hydraulic pump. (16) Oil line to steering gear. (17) Oil line. (18) Excess folw protector. (19) Lift cylinder(primary).

The maximum speed at which the lift cylinder(s) are lowered is controlled by lowering flow control valve (4).

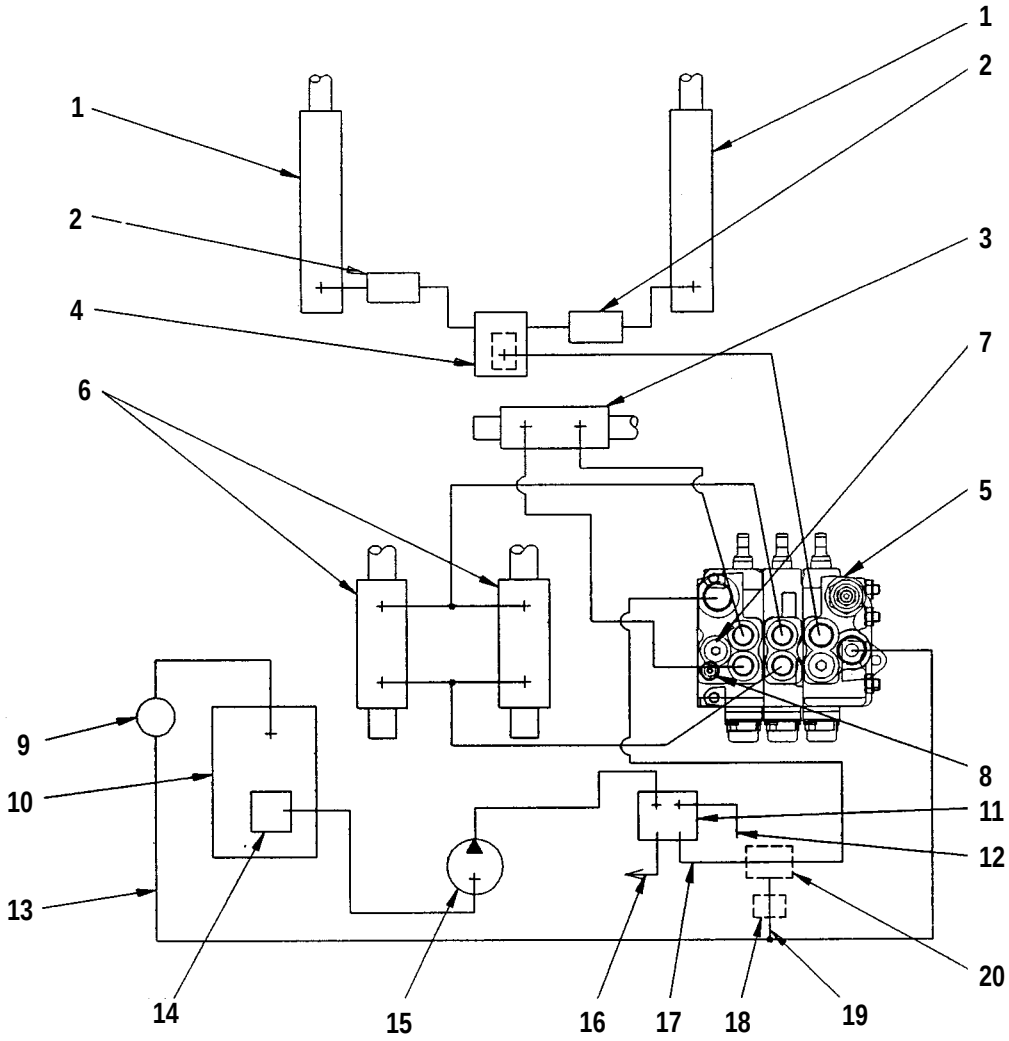
Excess flow protectors (2) and (18) will act as flow control valve if an oil line between them and flow control valve (4) is broken when the mast is raised or lowered. This prevents a sudden fall of the mast or carriage if an oil line is broken.

The tilt forward, tilt back and sideshift speeds are controlled by flow control valves in hydraulic control valve (5). There is an anti-cavitation valve inside the tilt spool to prevent cavitation (development of air pockets) in tilt cylinders (6).

REFERENCE : For the Hydraulic Systems Schematics.



Hydraulic System (D20/25-2 Model Only)



IDCS004B

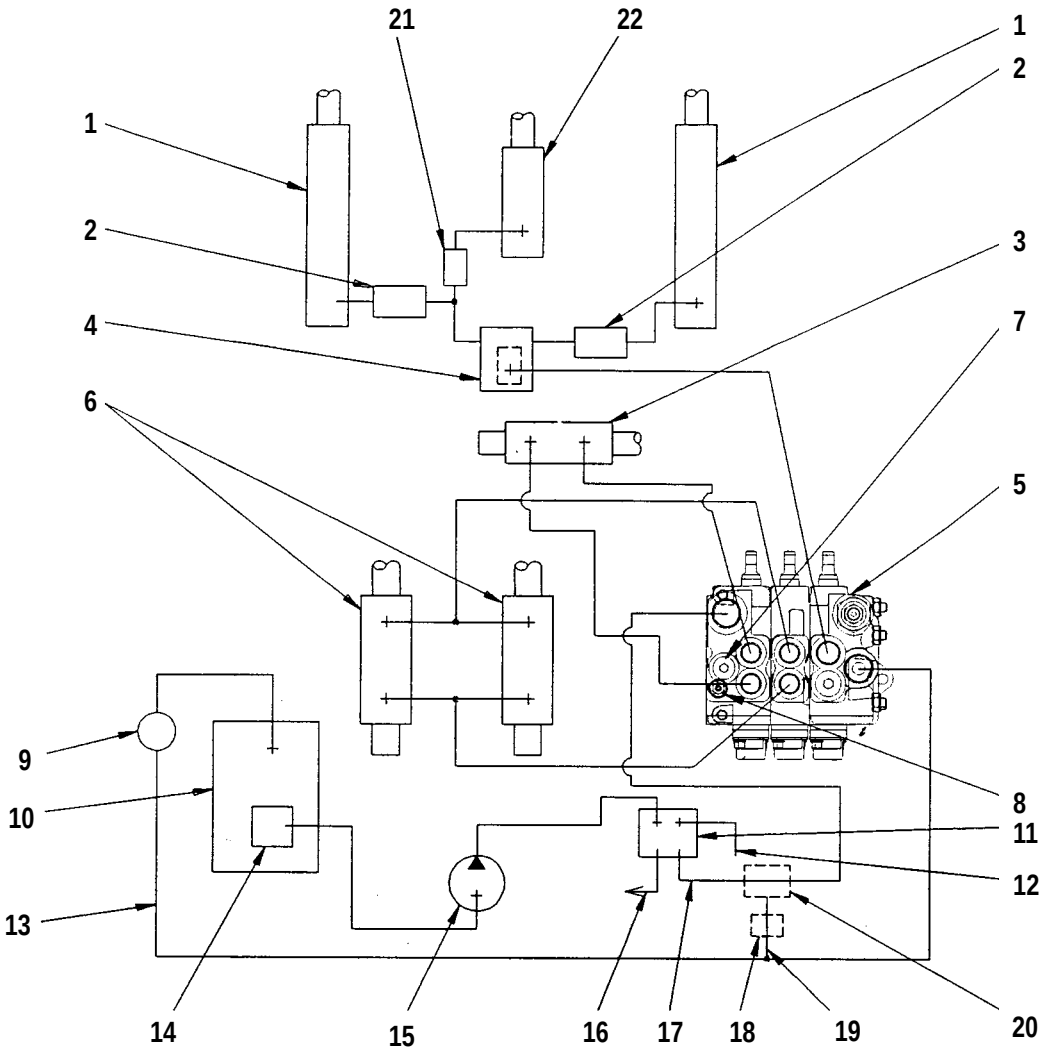
Basic Hydraulic Schematic With Standard Lift
(1) Lift cylinders. (2) Excess flow protectors. (3) Sideshift cylinder(s)(if equipped). (4) Lowering folw control valve. (5) Hydraulic control valve. (6) Tilt cylinders. (7) Relief valve(lift). (8) Relief valve(tilt and sideshift). (9) Hydraulic oil filter. (10) Hydraulic oil tank. (11) Priority valve. (12) Oil line(trucks with power brakes only). (13) Oil line. (14) Hydraulic strainer. (15) Hydraulic pump. (16) Oil line to steering gear. (17) Oil line. (18) Remote relief valve. (19) Oil line(trucks with anti-stall valve only). (20) Anti-stall valve(if equipped).

The hydraulic system has hydraulic oil tank (10) which holds the oil for gear type hydraulic pump (15). Hydraulic pump (15) sends pressure oil the power brakes (if equipped), hydraulic and steering systems. Pump oil flows from pump (15) to priority valve (11) where the oil folw divides to the power brakes brake valve (if equipped)(not shown) through line (12) and to the steering gear through line (16). Oil also flows through anti-stall valve (20), to hydraulic control valve (5) and back to hydraulic tank (10).

When the lift truck is at idle speed the hydraulic pump delivers a low oil flow. If the lift, tilt or auxiliaries are used the pressure in line (17) will increase and remote relief valve (18) will dump oil to hydraulic tank (10). As engine speed is increased, oil flow increases, anti-stall valve (20) now closes the passage to remote relief valve (18). With remote relief valve (18) blocked, normal hydraulic relief pressures are available.

The control valve levers move the valve spools in control valve (5) to let the pump oil in the control valve go to lift cylinders (1) and/or (22), tilt cylinders (6) or sideshift cylinder(s) (3).

The return hydraulic oil from the cylinders flows through hydraulic control valve (4), line (13), into filter (9) and hydraulic tank (10). Relief valve (7) in the control valve body will make the flow control valve release extra pressure to the hydraulic tank when the pressure in the lift or tilt circuits goes higher than relief valve pressure shown in the Control Valve section of Specifications. Relief valve (8) does the same thing for the sideshift circuit when it goes higher than the auxiliary relief valve pressure shown in the Control Valve section of Specifications.



IDCS005B

Basic Hydraulic Schematic With Standard Lift
(1) Lift cylinders. (2) Excess flow protectors. (3) Sideshift cylinder(s)(if equipped). (4) Lowering folw control valve. (5) Hydraulic control valve. (6) Tilt cylinders. (7) Relief valve(lift). (8) Relief valve(tilt and sideshift). (9) Hydraulic oil filter. (10) Hydraulic oil tank. (11) Priority valve. (12) Oil line(trucks with power brakes only). (13) Oil line. (14) Hydraulic strainer. (15) Hydraulic pump. (16) Oil line to steering gear. (17) Oil line. (18) Remote relief valve. (19) Oil line(trucks with anti-stall valve only). (20) Anti-stall valve. (21) Excess flow protector. (22) Lift cylinder(primary).

The maximum speed at which the lift cylinder(s) are lowered is controlled by lowering flow control valve (4).

Excess flow protectors (2) and (21) will act as flow control valve if an oil line between them and flow control valve (4) is broken when the mast is raised or lowered. This prevents a sudden fall of the mast or carriage if an oil line is broken.

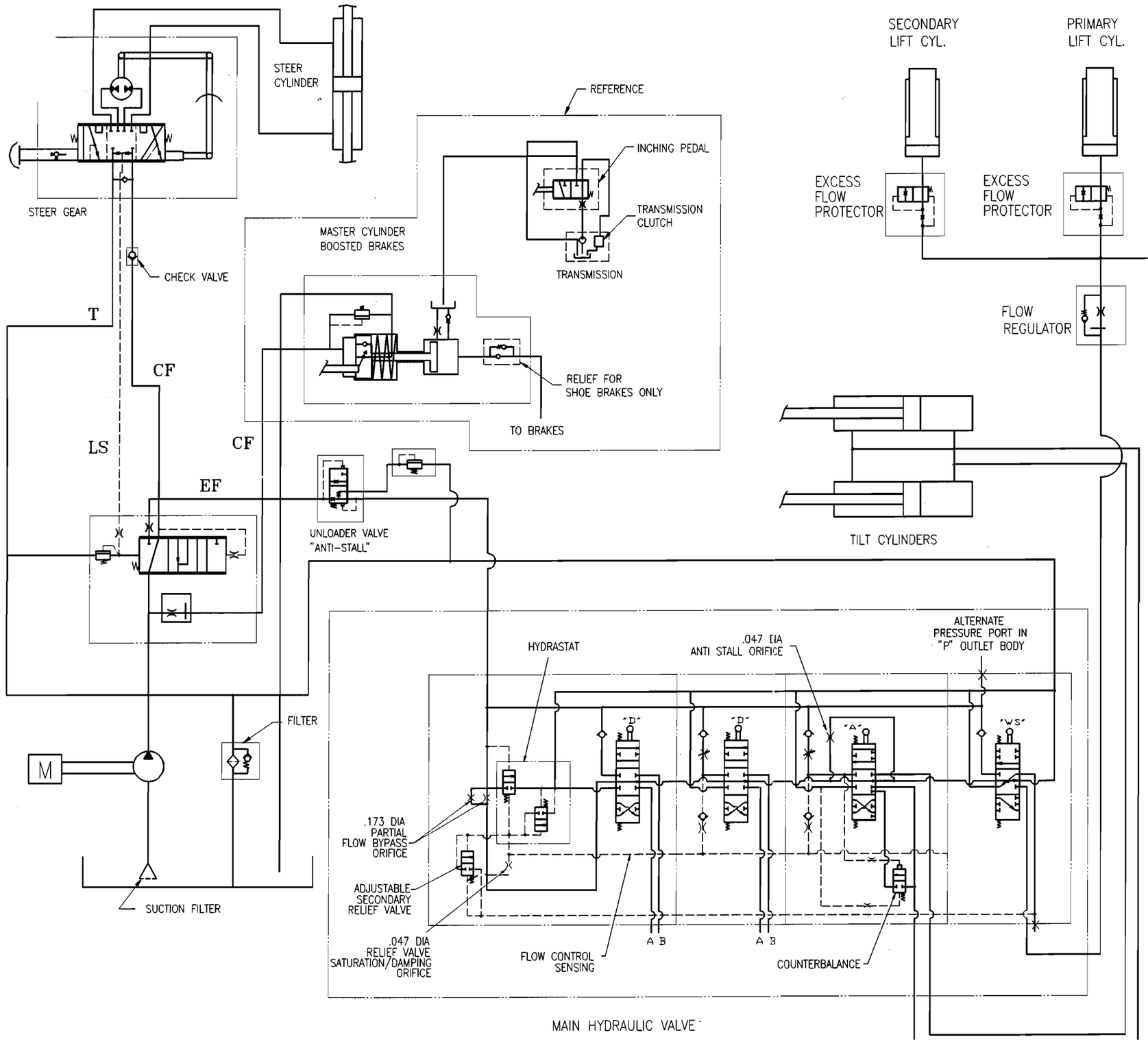
The tilt forward, tilt back and sideshift speeds are controlled by flow control valves in hydraulic control valve (5). There is an anti-cavitation valve inside the tilt spool to prevent cavitation (development of air pockets) in tilt cylinders (6).

REFERENCE : For the Hydraulic Systems Schematics.

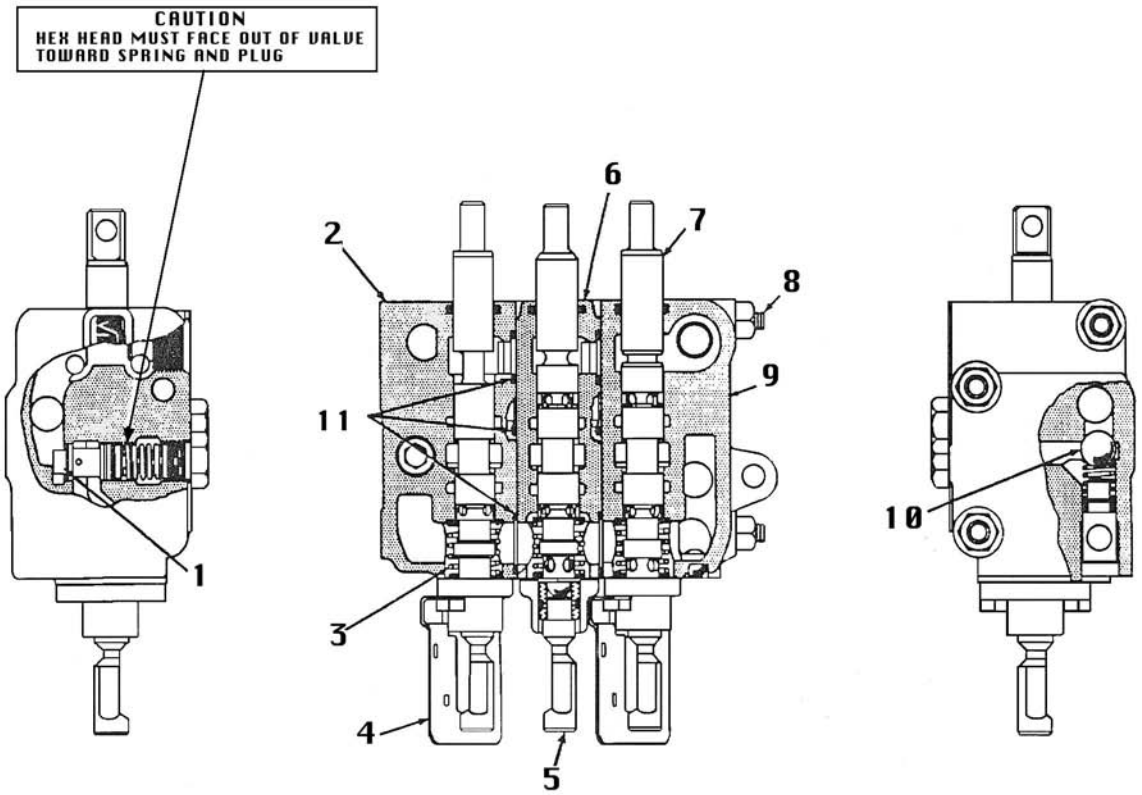
Anti-Stall And Remote Relief Valve

The anti-stall valve in combination with the remote relief valve prevent hydraulic overloads at engine idle, which could cause excessive vibration and engine stalling. At engine idle, the anti-stall valve opens ports to the hydraulic control valve and the remote relief valve. If the hydraulic control valve is used, the pressure in the oil line from the priority valve to the anti-stall valve will increase. This pressure increase will be limited by the remote relief valve to 8250 kPa (1200 psi) (6R7072 Relief Valve). This relatively low system pressure allows for a smoother engine idle because the engine is not overloaded by the hydraulic pump with an engine speed of 700 rpm minimum.

As engine speed increases the hydraulic system oil flow increases. The anti-stall valve senses this flow increase and closes the output port to the remote relief valve. Flow is now directed to the main control valve only and full system pressure can be achieved.



Hydraulic Control Valve



IDCS006B

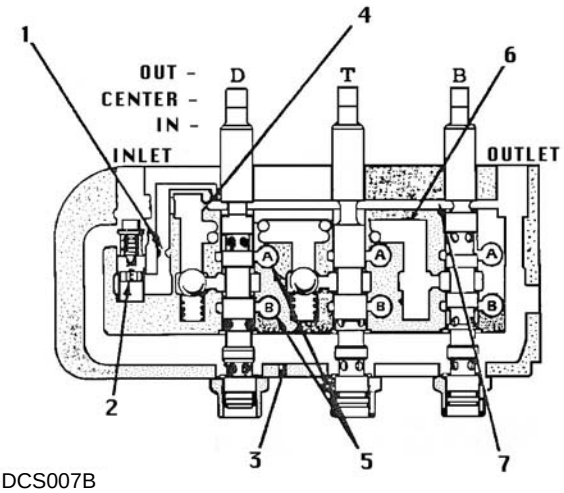
(1) Relief Valve.
(2) Inlet Body.
(3) Center Spring.
(4) Switch Bracket.
(5) Cam.
(6) Center Body.
(7) Spool.
(8) Tie Stud.
(9) Outlet Body.
(10) Check Valve.
(11) Seal Rings.

Assembly And Construction

Above figure is a cross-section view showing construction and assembly of a three-section valve. The inlet section also contain a relief valve assembly.

Passages between the bodies connect each section to the common inlet and tank ports.
Seal rings between the sections seal the connecting passages, Sections are held together by studs and nuts.

Valve Operation



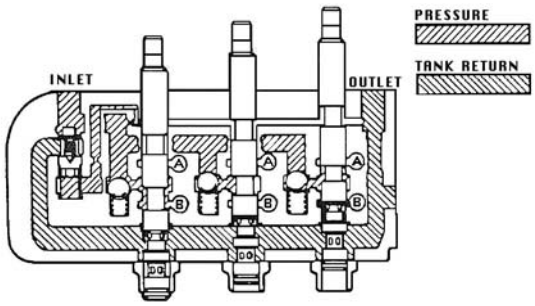
IDCS007B

(1) Control Valve Sensing Orifice.
(2) Flow Control And Relief Valve.
(3) Tank Passage.
(4) By-pass Flow Control Orifice.
(5) Cylinder Ports.
(6) Pressure Passage. (7) By-pass Passage.

Figure IDCS007B is a schematic illustration of a three section valve, showing the inlet and outlet ports and the by-pass, pressure and tank passages. The pressure passage is used to carry fluid to the cylinder ports when the spools are shifted. The by-pass passage permits flow directly to the outlet when the spools are not being operated. The tank passage also carries fluid to the outlet; either return flow from the cylinder ports or fluid diverted past the flow control and relief valve,

The spools are shown in the centered or neutral position, Under these conditions, fluid in the pressure passage is blocked from the cylinder ports by the spool lands. Flow through the valve is through the by-pass and tank passages to the outlet.

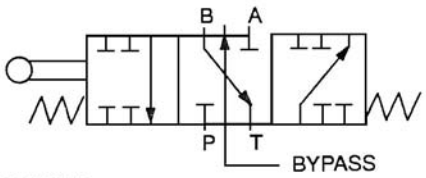
Lift Spool



IN	Pressure to “B” “A” to tank By-pass blocked
CENTER	“A” and “B” blocked By-pass open
OUT	“B” to tank “A” blocked By-pass open

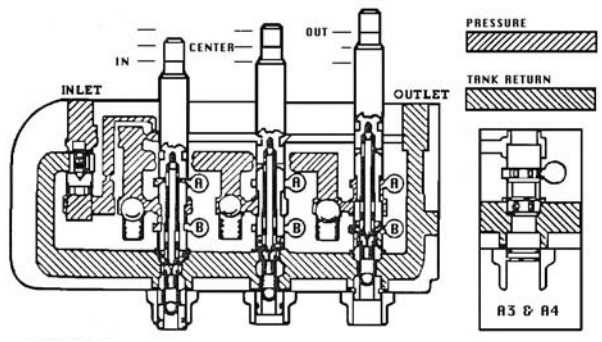
IDCS008B

Lift spool - used for control of single acting cylinder applications. It directs flow to only one end of a cylinder, as in the lift mechanism of a lift truck. Return flow is from the same end of the cylinder and relies on gravity or mechanical means to retract.



IDCS009B

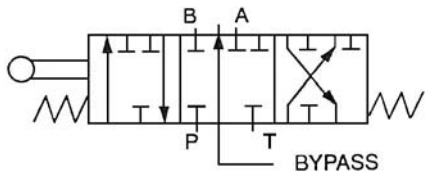
Tilt Spool



IN	Pressure to “B” “A” to tank By-pass blocked
CENTER	“A” and “B” blocked By-pass open
OUT	Pressure to “A” “B” to tank By-pass blocked

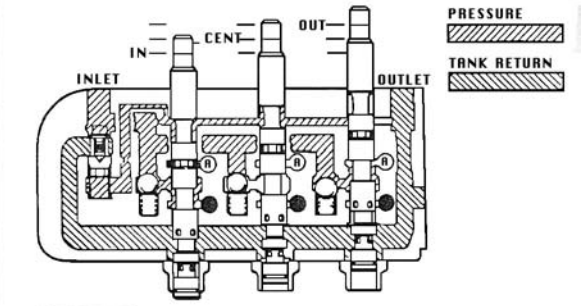
IDCS010B

Tilt spool - a counterbalance spool normally used to control the tilt function of a lift truck.
The counterbalance feature prevents the forks from tilting forward faster than the pump can supply oil, preventing tilt.



IDCS011B

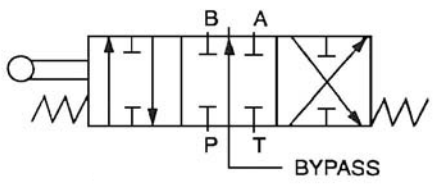
Auxiliary Spool



IN	“A” to tank “B” blocked By-pass open
CENTER	“A” and “B” blocked By-pass open
OUT	Pressure to “A” “B” blocked By-pass blocked

IDCS012B

Auxiliary spool - directs flow to either end of a double acting cylinder. Flow from the end that is not under pressure is returned to tank via internal coring of the valve section.



IDCS013B

Flow Control And Relief Valve

Earlier design valves were equipped with simple relief valves in the inlet sections.
The partial flow by-pass system in the LT valve makes use of a compound type flow control and relief valve arrangement.

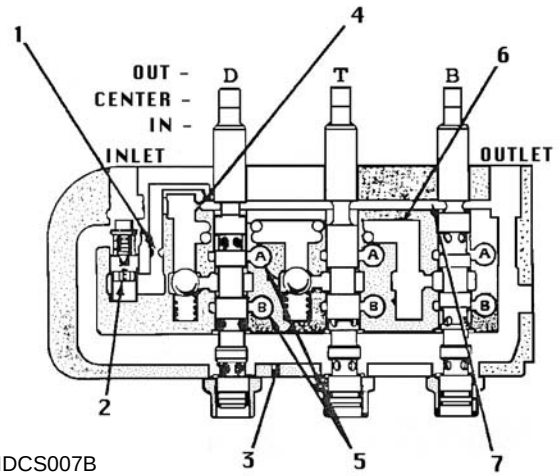
Sensing the pressure drop across an orifice at the entrance to the by-pass, the valve acting as a control to limit flow through the by-pass to approximately seven gallons per minute. The balance of the pump delivery is diverted through the reservoir passage. This arrangement greatly reduces pressure drop through the valve in the neutral position.

When a spool is shifted to operate a portion of a machine, the flow control is inoperative and full pump volume is available to the system. The control valve then functions as an overload relief valve. System pressure is limited to a prescribed maximum by the action of this valve. Inlet body type F is not equipped with a relief valve. Full pump volume is available to the system at all times.

Use of the optional secondary relief valve allows the use of lower pressure for tilt and accessory function while higher pressure is provided for the lift function.

NOTE : The secondary relief valve must be set at a lower relief setting than the system relief.

Flow Control



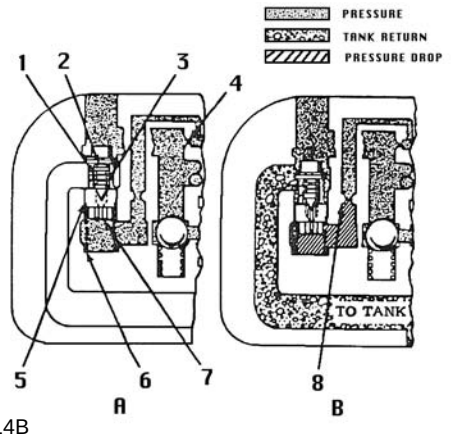
IDCS007B

(1) Control Valve Sensing Orifice.
(2) Flow Control And Relief Valve.
(3) Tank Passage.
(4) By-pass Flow Control Orifice.
(5) Cylinder Ports. (6) Pressure Passage.
(7) By-pass Passage.

Figure IDCS007B shows the valve operation in neutral with flow in excess of seven USgpm. Flow across the by-pass orifice result in a pressure drop. Decreased pressure is sensed at the spring end of the valve sub-assembly through a sensing orifice. The slightly higher pressure at the other end of the valve permits it to shift down, diverting excess flow to the reservoir passage. With flow at less than seven USgpm there would be negligible pressure drop across the by-pass orifice. Then the control valve would be held closed by the large spring and all flow would be through the by-pass passage.

Optional flow control valves are available for all operating sections. These valves can be set from 1 - 15 US gpm.

Relief Valve



IDCS014B

(1) Spring. (2) Spool. (3) Poppet.
(4) By-pass Flow Control Orifice.
(5) Flow Control And Relief Valve.
(6) Spring. (7) Sensing Orifice.
(8) Control Valve Sensing Orifice.

Operation of the relief valve feature is shown in above figure. When an operating spool is shifted, fluid is ported into the system and the by-pass is blocked.

Above figure A shows operation at less than the relief valve setting. There is no flow over the by-pass orifice, so full system pressure is sensed at the spring end of the control valve, as well as the opposite end. The valve is thus hydraulically balanced and the large spring holds the relief spool closed.

Maximum pressure is determined by the setting of the small spring inside the control valve assembly. When system pressure is sufficient to overcome this heavy spring, the poppet is forced off its seat (see above figure B).
Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the control valve is no longer hydraulically balanced.

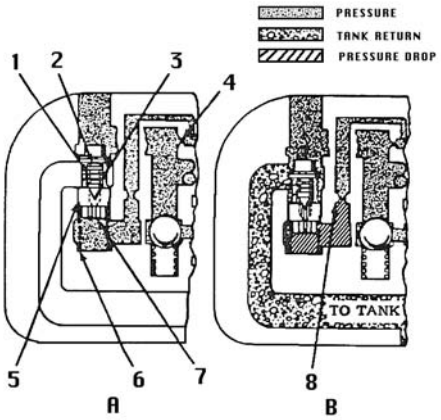
When pressure drop across the sensing orifice is great enough to overcome the force of the large spring, the valve spool shifts, permitting flow to the tank passage.

Relief valve sub-assemblies in the inlet section are pre-set and tested by Vickers for given pressure settings. Selection of the relief valves setting is based on the work requirements of the system.

If a different relief valve setting is required, the valve sub-assembly should be replaced,

Model	Part Number	Setting Pressure
D20-2, D20S-2, G20S-2, GC20S-2	D144363	2625 psi (18,100 kPa)
D25-2, D25S-2 G25S-2, GC25S-2	D144364	2825 psi (19,478kPa
D30S-2, G30S-2 GC30S-2	D144365	3125 psi (21,546 kPa)

Check Valve



IDCS014B

(1) Spring. (2) Spool. (3) Poppet.
(4) By-pass Flow Control Orifice.
(5) Flow Control And Relief Valve.
(6) Spring. (7) Sensing Orifice.
(8) Control Valve Sensing Orifice.

Timing of the spools is such that one cylinder port opens to pressure and the other port opens to reservoir before the by- pass passage is completelyblocked.

To prevent return flow from passing into the pressure passage and escaping through the partially closed by-pass, check valves are provided in each operating section except sections with “B” spool.
The check valves prevent the load from dropping.

Testing And Adjusting

Troubleshooting

Below table lists the difficulties which may be experienced with the unit and the hydraulic system. It indicates the cause and remedy for each of the trouble listed. It should always be remembered that pressure and delivery are factors which are usually dependent upon each other. Adequate pressure gauge equippment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnose improper conditions.

Trouble :
Oil leaks at either end of spools.

Probable Cause	Remedy
Defective O-rings in valve body	Replace O-rings

Trouble :
Spring-centered spools do not return to neutral.

Probable Cause	Remedy
Broken springs	Replace springs
Bent spool	Replace with new section of same size and type
Foreign particles	Clean system and valve
Misalignment of operating linkage	Check linkage for binding condition
Valve bank improperly torqued	Retorque nuts to specified ratings

Trouble :
Detent type spools will not stay in detent position

Probable Cause	Remedy
Worn detent barrel	Replace detent barrel
Weak or broken detent spring	Replace detent spring

Trouble :
No motion, slow or jerky action of hydraulic system

Probable Cause	Remedy
Relief valve not properly set, or stuck in base and/or worn	Repair, clean and readjust
Dirt or foreign particles lodged between relief valve control poppet and seat	Disassemble, clean and reassemble
Valve body cracked inside	Replace valve section
Spool not moved to full stroke	Check travel

Trouble :
No relief valve action (high pressure)

Probable Cause	Remedy
Small particle of dirt plugging orifice in relief valve sub-assembly	Remove relief valve and check hole. If blocked, clear hole
Relief valve sub-assembly installed backward	Install properly

Trouble :
Load will not hold

Probable Cause	Remedy
Oil by passing between spool and body	Replace valve
Oil by passing piston in cylinder	Repair or replace cylinder
Cylinder not centered	Refer to above spool remedies

Trouble :
Load drops when spool is moved from neutral to a power position

Probable Cause	Remedy
Dirt or foreign particles lodged between check valve ball and seat	Disassemble, clean and reassemble
Scoreed or sticking check valve	Replace poppet

Hydraulic System

Relief Valve Pressure Check

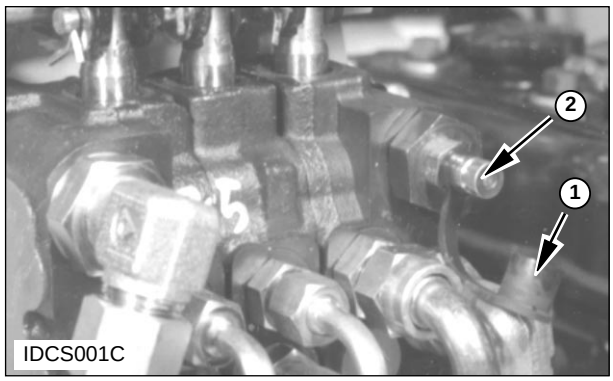
Tools Needed
Fittings Group

CONTROL VALVE			
Model	Mast	Main Relief Valve Pressure °æ 500 kPa (°æ 75 psi)	Tilt, Auxiliary Relief Valve Pressure °æ 350 kPa (°æ 50 psi)
D(G)20(S) GC20(S)	Std FFL FFTL	18,100 (2625)	15,500 (2250)
D(G)25(S) GC25(S)	Std FFL FFTL	19,500 (2825)	15,500 (2250)
D(G)30S GC30S	Std FFL FFTL	21,550 (3125)	15,500 (2250)

Use the Fittings Group to check the relief valve pressure.

⚠ WARNING

Hydraulic oil, under pressure can remain in the hydraulic system after the engine and pump have been stopped. Personal injury can be caused if this pressure is not released before any work is done on the hydraulic system. To prevent possible injury, lower the carriage to the ground, turn the engine off and move the control levers to make sure all hydraulic pressure is released before any fitting, plug, hose or component is loosened, tightened, removed or adjusted. Always move the lift truck to a clean and level location away from the travel of other machines. Be sure that other personnel are not near the machine when the engine is running and tests or adjustments are made.

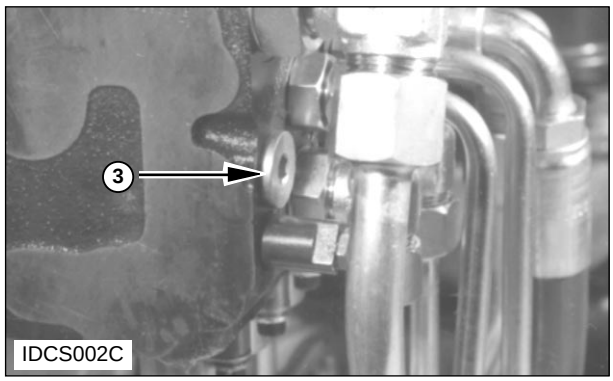


Pressure Tap Location
(1) Cap. (2) Nipple assembly.

With the engine off, remove cap (1) from nipple assembly (2) and connect the **28,000 kPa (4000 psi)** gauge to the nipple assembly.

Lift Relief Valve Check and Adjustment

1. Start the engine and activate the hydraulics until the hydraulic oil is at the normal operating temperature. Tilt the mast back to the end of its travel.
2. With the engine at high idle, hold the tilt control lever in the tilt back position and watch the gauge. The gauge indication is the pressure that opens the relief valve.
3. The correct pressure setting is shown in the chart.



Relief Valve Adjustment.
(3) Plug.

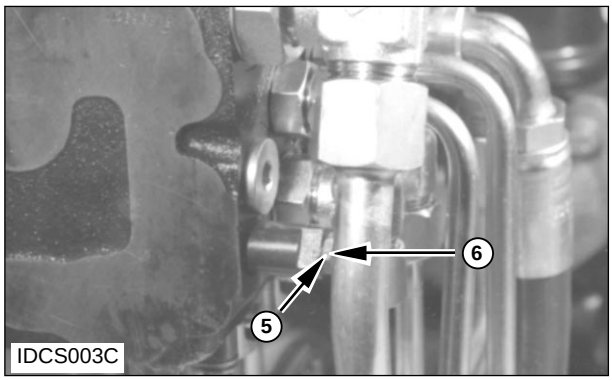
Tilt and Sideshift Relief Valve Check and Adjustment

1. Start the engine and activate the hydraulics until the hydraulic oil is at the normal operating temperature. Put the carriage in the full sideshift position.

2. With the enigne at high idle, hold the sideshift control lever in the full sideshift position and watch the gauge. The gauge indication is the pressure that opens the relief valve.

3. The correct pressure setting is shown in the chart.

4. If an adjustment to the relief valve setting is necessary, loosen nut (5).



Relief Valve Adjustment
(5) Nut. (6) Setscrew.

5. Turn setscrew (6) clockwise to increase or counterclockwise to decrease the pressure setting of the relief valve.

6. Tighten the locknut and check the pressure setting again for correct adjustment.

Flow Control Valve Adjustment

The tilt and first attachment speeds can be adjusted at the control valves. They can be adjusted by turning plug the in the hydraulic control valve body. The lift speed can not be adjusted. Do the procedure that follows to change the flow control assembly.

⚠ WARNING

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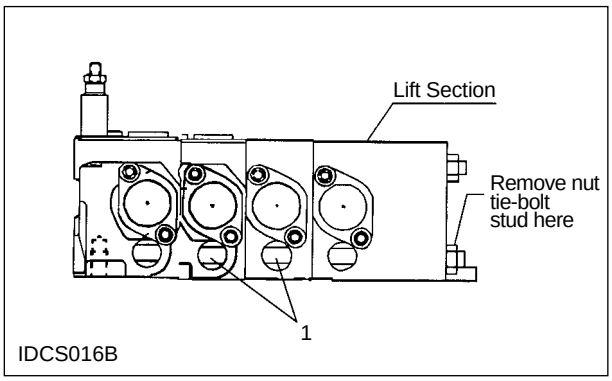


1. Remove the nut from the main hydraulic valve tie-bolt stud.

2. Remove the stud from the valve.

3. Use Hex Wrench (6mm), turn the flow control adjuster clockwise to increase the flow or counterclockwise to decrease the flow.

4. Assemble the tie bolt stud in the valve. Torque the stud to **38.5 - 42.5 N•m (342 - 378 lb•in)**

5. Reinstall the nut on the tie bolt and torue **38.5 - 42.5 N•m (342 - 378 lb•in).**

Disassembly And Assembly

General

During disassembly, particular attention should be given to identification of parts for reassembly. Spools are selectively fitted to valve bodies and must be returned to the same bodies from which they were removed,

Valve sections must be reassembled in the same order. Figure IDCS015B is an exploded view showing the proper relationship for reassembly. Reference is made to these figures in the procedures which follow.

⚠ WARNING

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure. Plug all removed units and cap all lines to prevent the entry of dirt into the system

Unit Removal

1. Thoroughly clean the exterior of the valve and the area around the valve to prevent contamination of the system during removal.
2. Loosen mounting bolts that hold valve to mounting surface. Be ready to catch fluid retained inside lines and valve.
3. Remove valve from mounting surface and set it on a clean work bench.

Unit Disassembly

NOTE : All parts within the unit must be kept clean during the overhaul process. Handle each part with great care. The close tolerance of the parts makes this requirement very important. Clean all parts that are removed from the unit with a commercial cleaning solvent that is compatible with the system fluid. Compressd air may be used in the cleaning process, however, it must be filtered to remove water and other contamination. Be sure the unit is not subjected to pressure. Disconnect and cap all lines and disconnect linkage to the spool.

Attaching Parts

1. Remove the four nuts (1) and four tie studs (2).
2. Separate the valve sections, being careful not to destroy or lose spacers.
3. Remove retainer (3), seals (4) and O-rings(5).

Flow Control Checks

1. Remove flow control check springs (6) and ball(s) (7).

End Caps

1. Unscrew two screws (8) holding dust cover (9), retainer (10) and sleeve (11).
2. Remove the O-ring (12) from the sleeve.

Operating Spool

1. Slide the spool (13) out of its bore.
2. Remove the quad seals (14) from the valve body around the spool bore.
3. Remove the wiper seal (15).

NOTE : Do not remove the centering spring (16) or the retainers (17) unless it is necessary to replace them.

Check Valve

1. Remove the retainer ring (18) and screw out plug stop adjuster (19) from the valve body.
2. Remove the back-up ring (20) and O-ring (21).
3. Remove the spring (22) and ball (23) from the valve body.

Adjustable Flow Control Valve

1. Remove the retainer ring (18) and screw out plug stop adjuster (19) from the valve body.

2. Unscrew the adjustable relief seat (24) from the plug stop adjuster (19).

3. Remove the back-up ring (20) and O-ring (21).

4. Remove the spring (22) and poppet (25) from the valve body.

Relief Valve Subassembly

1. Screw out the plug (26) which retains the relief valve and remove the O-ring (27) from the plug.

2. Remove the spring (28) and the relief valve sub-assembly (29).

Secondary Adjustable Relief Valve

1. Screw out relief plug (30) and remove O-ring (31) from valve body.

2. Remove setscrew (32) and nut (33) from relief plug.

3. Remove O-ring (34) and spring (35) from relief plug.

4. Pull piston (36) and poppet (37) from the plug.

Valve Body

1. Remove the plug (38) and O-ring (39) from cylinder °∞b°± work port.

2. Remove the plug (40) and O-ring (41) on models with a single acting spool. If the alternate discharge port is plugged, it is not necessary to remove the plug unless the body is to be replaced. On bodies equipped with the quick disconnect option, remove the dust cap (42) and the coupling (43).

3. Remove O-ring (44) from coupling.

4. Unscrew the plug (45) and remove O-ring (46).

Cleaning, Inspection And Repair

1. Check that all internal passages are clean and free from obstruction. Examine all mating surfaces for nicks and burrs. Minor nicks and burrs can be removed with a crocus cloth or an India stone.

2. Discard all old seals and O-rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

NOTE : Obtain new seal kits. Refer to the appropriate part drawing as shown on figure IDCS015B for the seal kit part number. Apply a light film of clean hydraulic fluid to the new seals. This will make assembly easier and also provide initial lubrication of moving parts.

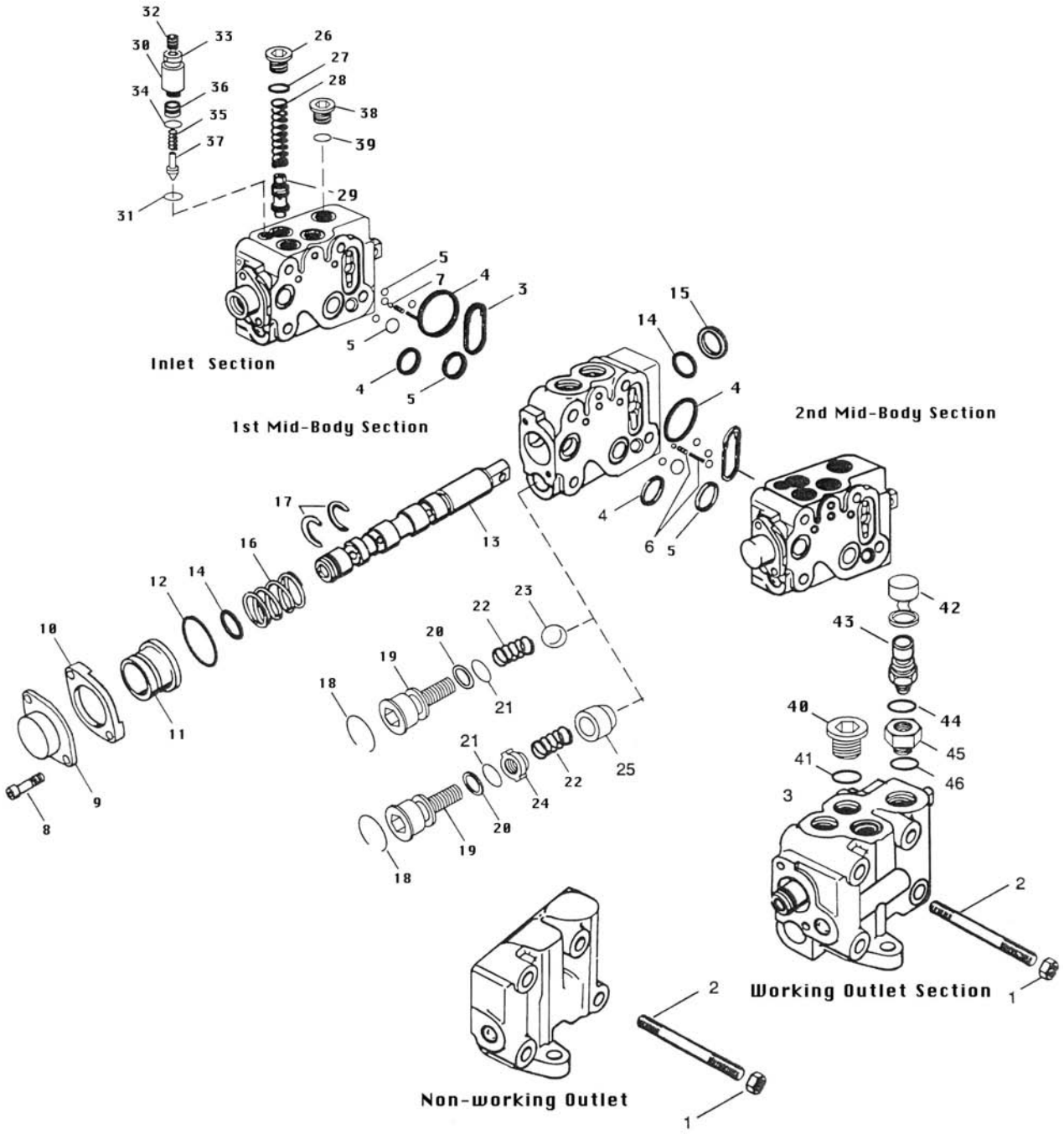
3. Inspect the valve spools and bores for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive, the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

CAUTION : DO NOT stone the edges of spool sealing lands. Remove minor burrs with #500 grit paper. Use paper very lightly on the outer diameter of each spool.

4. Check the relief valve for smooth movement in its bore. The valve should move from its own weight.

5. Inspect all screws for evidence of damaged threads. If threads are damaged, replace the screws.

6. Inspect all springs for distortion or wear. The ends of the springs shall be square and parallel to each other. Replace springs that are damaged or distorted.



IDCS015B

Assembly

Assembly is generally performed in reverse order of disassembly. Refer to figure IDCS015B during the following assembly procedure.

NOTE : Coat all parts with clean hydraulic oil to facilitate assembly and provide initial lubrication. Petroleum jelly can be used to hold seal rings in place on assembly.

Valve Body

1. Install new O-ring (39) on plug (38) and install in cylinder “b” work port. On models with a single acting spool, install new O-ring (41) on the port plug (40) and plug the appropriate cylinder port.

2. Tighten the plug (40) securely but DO NOT over tighten.

3. On bodies with the quick disconnect option, install new O-ring (46) on plug (45) and screw into bore.

4. Tighten the plug (45) to a torque of **97 - 106 N•m (71 - 78 lb•ft).**

5. Install new O-ring (44) on quick disconnect coupling (43) and insert coupling into plug.

6. Tighten the coupling (43) to a torque of **29 - 31 N•m (21 - 23 lb•ft).**

7. Install dust cap (42).

Secondaty Adjustable Relief Valve

1. Replace O-ring (34), piston (36) and spring (35) in relief plug (30).

2. Insert poppet (37) in plug.

3. Install the O-ring (31) on the relief plug. Tighten the plug securely in valve body. DO NOT over tighten.

CAUTION : Hex head of relief valve must be face outside of unit.

Relief Valve

1. Install a new O-ring (27) on the relief valve plug (26).

2. Place the relief valve assembly (29) in its bore, **HEX NUT END UP.**

3. Install the spring (28) and plug. Tighten the plug securely, but do not Over Tighten.

Optional Adjustable Flow Control Valve

1. Install a new back-up ring (20) and O-ring (21) on the plug stop adjuster (19) with the O-ring toward the spring (22) and seat (24).

2. Place the poppet (25) and spring in the body and install the plug stop adjuster. Be sure the hole in the plug lines up with the stud hole in the body.

3. Replace retaining ring (18).

Check Valve

1. Install a new back-up ring (20) and O-ring (21) on the plug stop adjuster (19) with the O-ring toward the spring (22) and ball (23).

2. Place the ball and spring in the body and install the plug stop adjuster (19). Be sure the hole in the plug lines up with the stud hole in the body.

3. Replace retaining ring (18).

Operating Spool

1. If the centering spring was removed, install spring (16) and retainers (17) on the spool (13).

2. Slide the spool into the bore.

End Cap

1. Install new O-ring (12) on the sleeve(11).

2. Insert sleeve (11) into retainer (10).

3. Assemble dust cover (9) and retainer and sleeve with attaching screws (8).

4. Tighten the screws (8) to a torque of **11 - 15 N•m (8 - 11 lb•ft).**

Flow Control Checks

1. Insert small check spring (6) into larger spring.

2. Install flow control sensor ball(s)(7) and springs in proper bores of inlet and mid-body sections.

Attaching Parts

CAUTION : Make sure all mating surfaces of valve bodies are clean and free of burrs.

1. Install seals (4), O-ring (5) and the retainer (3) in the grooves in the body of each inlet and mid-body section.

2. Carefully place the sections together in the same order in which they were removed.

3. Coat the stud threads with Loctite or a similar sealant and install the studs.

4. Tighten the nuts to **38 - 44 N•m (28 - 32 lb•ft)** torque.