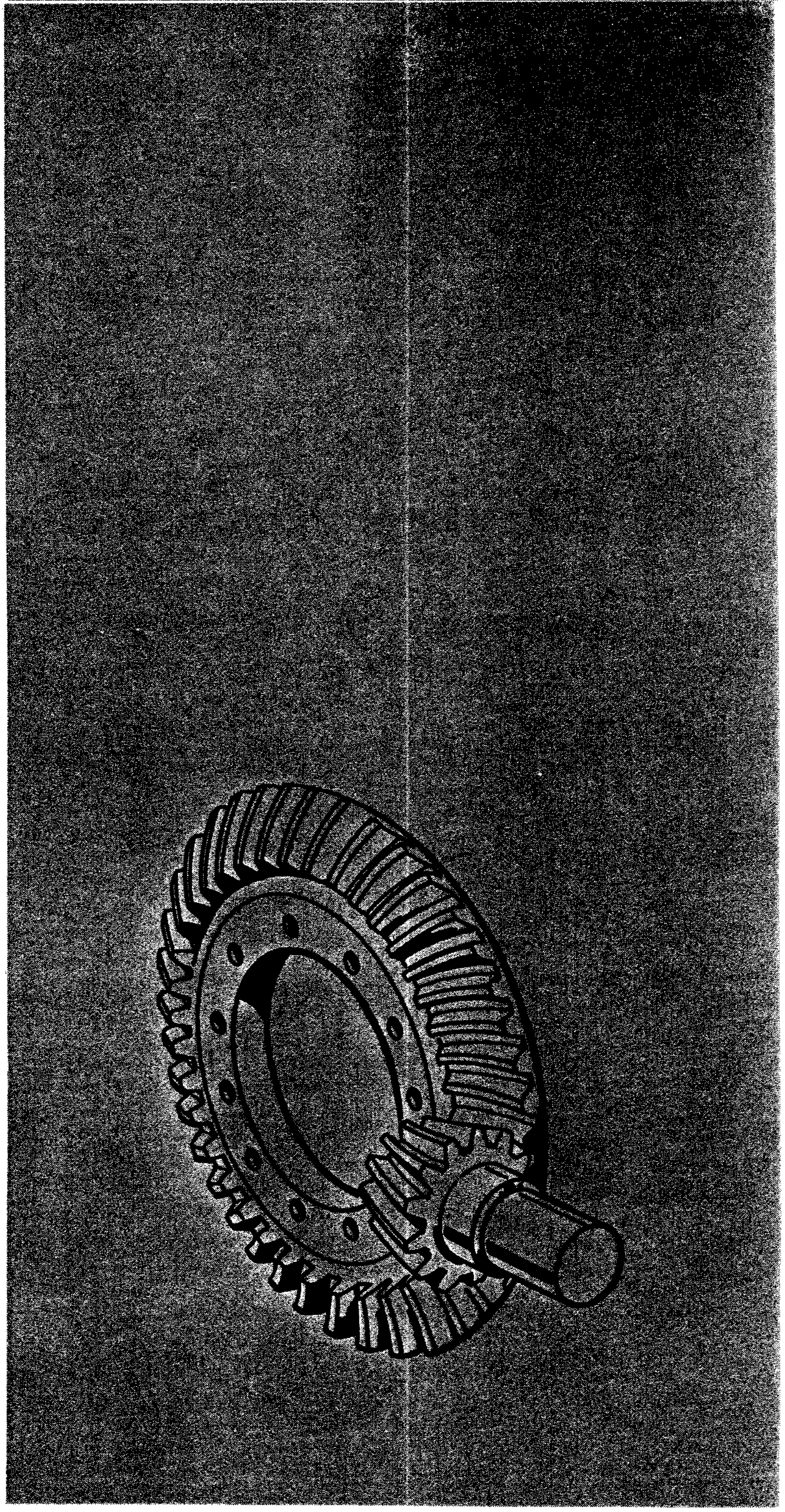

SERVICE MANUAL

950
POWER TRAIN

INTRODUCTION

This publication has instructions and procedures for the subject on the front cover. The information, specifications, and illustrations in this publication are on the basis of information that was current at the time this issue was written.

Correct operation, maintenance, test and repair procedures will give this product a long service life. Before starting a test, repair or rebuild job, the serviceman must read the respective sections of the Service Manual, and know all the components he will work on.

Your safety, and the safety of others, is at all times very important. When you see this symbol in the manual, you must know that caution is needed for the procedure next to it. This symbol is a warning. To work safely, you must understand the job you do. Read all instructions to know what is safe and what is not safe.

It is very important to know the weight of parts. Do not lift heavy parts by hand. Use a hoist. Make sure heavy parts have a good stability on the ground. A sudden fall can cause an accident. When lifting part of a machine, make sure the machine has blocks at front and rear. Never let the machine hang on a hoist, put blocks or stands under the weight.

When using a hoist, follow the recommendation in the manual. Use correct lift tools as shown in illustrations to get the correct balance of the component you lift. This makes your work safe at all times.

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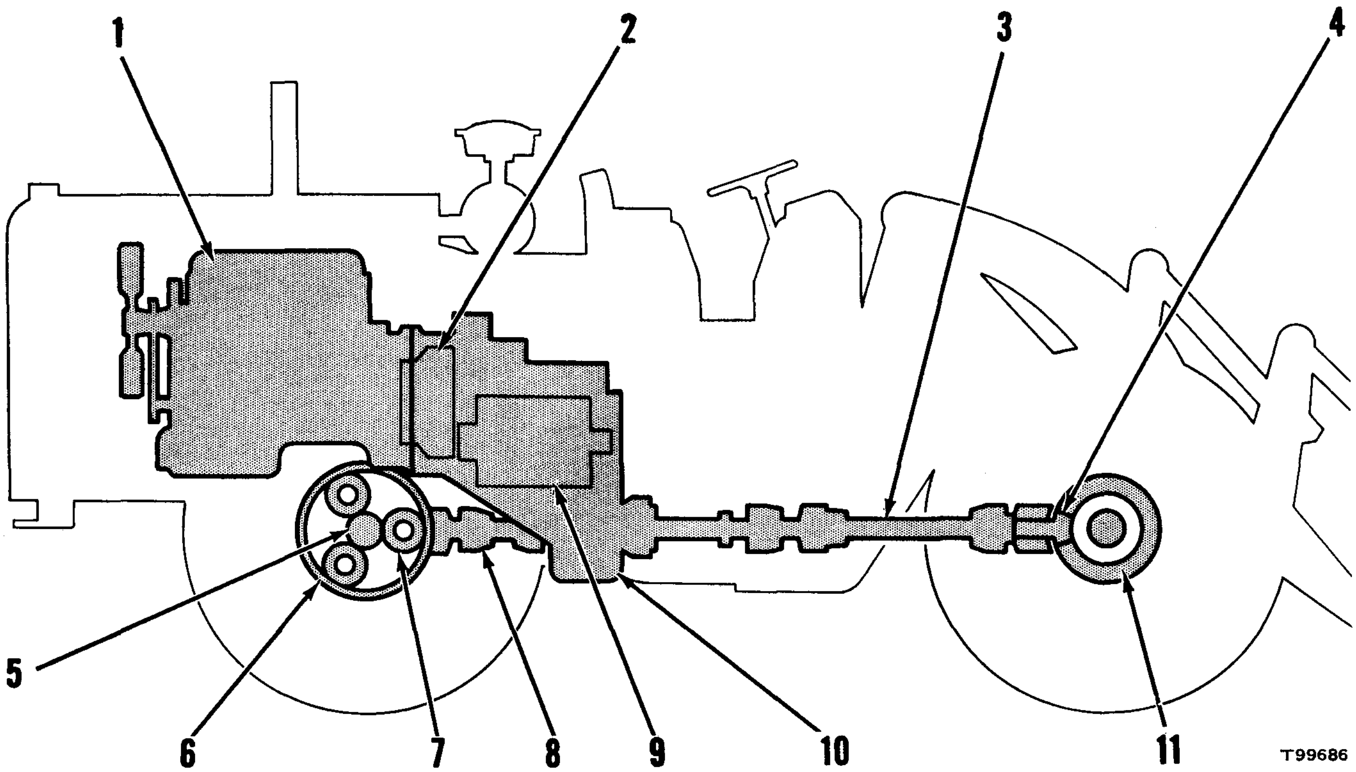
SYSTEMS OPERATION

SPECIFICATIONS

TESTING AND ADJUSTING

GENERAL INFORMATION



POWER TRAIN COMPONENTS

1. Diesel engine. 2. Torque converter. 3. Front drive shaft and universal joints. 4. Bevel gear and bevel pinion. 5. Sun gear. 6. Ring gear. 7. Planet gear. 8. Rear universal joint. 9. Range transmission. 10. Transfer drive. 11. Carrier.

Power from the diesel engine is transmitted directly from the engine flywheel to the torque converter. The converter output shaft gear transmits the power to the range transmission input shaft gear. Six hydraulically actuated clutches, five stationary, and one rotating and four planetary systems are combined in the range transmission to provide four forward and four reverse ranges which are manually selected.

The range transmission output shaft gear transmits power to the transfer drive output gear. A universal joint and drive shaft connects the transfer drive output flanges to the front and rear differentials. The bevel gear and bevel pinion of each differential transmits power through the differential to the free floating axles. The planetary final drive sun gears are splined to the axles.

As the axles rotate, planet gears, mounted in the carrier, are forced to walk around the stationary ring gear, imparting rotation to the differential carrier and the wheel to which it is fastened.

A gear-type oil pump provides oil for charging the torque converter, controlling the range transmission, and lubricating the transmission and converter. The pump is driven by a splined shaft which is driven by a gear bolted to the torque converter impeller.

The transmission oil sump is located in the bottom of the transmission case. Oil, picked up by the transmission oil pump, flows through an external line to the magnetic strainer. The magnetic strainer separates foreign material from the pump inlet oil. The oil flows to the pump through internal passages in the transmission case and torque converter housing. From the pump, the oil goes through a full flow filter into the transmission hydraulic control package. Should the filter element become restricted or the oil extremely viscous, a bypass valve in the filter opens. This allows the oil to bypass the filter element.

Valves in the hydraulic control package direct the oil flow to the transmission speed and directional clutches and to the torque converter. Oil not required to fill the clutches is routed to the torque converter. From the converter the oil flows through a water-to-oil cooler to the lubrication relief valve. The relief valve limits the lubricating oil pressure in the planetary transmission.

TORQUE CONVERTER AND TRANSMISSION

The transmission consists of a torque converter and a 4-speed forward, 4-speed reverse planetary gear transmission. The six clutches in the planetary group are hydraulically controlled with the No.6 clutch being a rotating clutch. Each speed is manually selected.

The single stage torque converter is located at the input end of the transmission. The converter housing is bolted directly to the flywheel housing. Output torque from the converter enters the planetary transmission through either the No.1 or No.2 sun gear. Which gear receives the output is dependent upon the directional clutch engaged.

The clutches of the planetary group are divided into two sections and are identified according to their function. No.1 and No.2 clutches comprise the directional clutch section. The No.3, No.4, No.5, and No.6 clutches comprise the speed clutch section. It is necessary for one clutch in each section to be engaged for each speed. The No.6 clutch coupling in the planetary group serves as the output member and is bolted directly to the transmission output gear.

Clutch Designation:

CLUTCH NO.	FUNCTION
No.1	Reverse Directional
No.2	Forward Directional
No.3	Fourth Speed
No.4	Third Speed
No.5	Second Speed
No.6	First Speed

The transmission output gear is splined to the transfer gear. The transfer gear is splined to the transfer output shaft which connects through universal joints to the drive shafts.

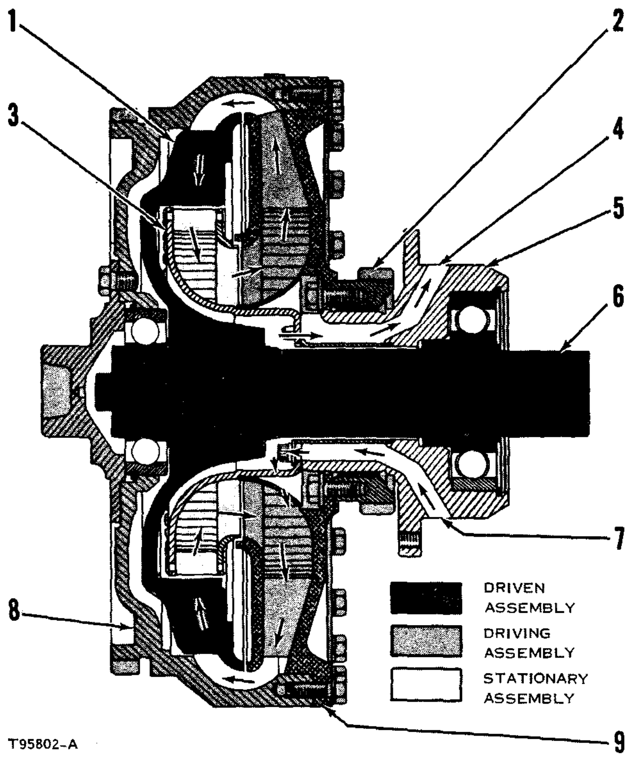
TORQUE CONVERTER

Oil for the operation of the converter is supplied by the transmission oil pump. The converter inlet oil pressure is controlled by the inlet relief valve. The valve is located in the selector valve group in the transmission hydraulic controls.

The outlet oil pressure is determined by an orifice located in the converter outlet oil passage at the entrance to the torque converter oil cooler.

The input flange, rotating housing, impeller, impeller hub, and the oil pump drive gear rotate as a unit at engine speed.

Oil from the transmission hydraulic controls enters the torque converter through an inlet port in



TORQUE CONVERTER

1. Turbine. 2. Oil pump drive gear. 3. Stator. 4. Outlet port. 5. Stator carrier. 6. Output shaft. 7. Inlet port. 8. Rotating housing. 9. Impeller.

the stator carrier. Oil is directed to the carrier by a passage in the converter housing.

The impeller acts as a pump. As the impeller rotates, it directs oil to the rotating turbine. The turbine is splined to the output shaft. The turbine directs the oil to the stator which is bolted to the converter housing.

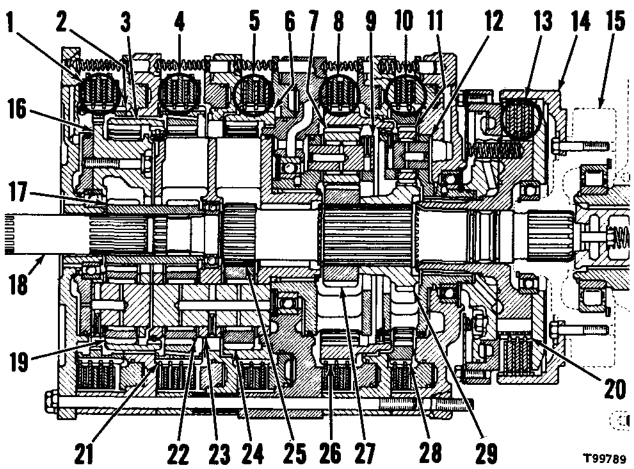
Oil leaves the converter through an outlet port in the carrier. The oil flows through an oil cooler and then to the transmission lubrication system.

The energy imparted to the oil by the impeller transmits torque to the turbine and the output shaft. Under normal operating conditions, the oil passes through the converter easily and quickly striking each blade at a very slight angle. When a load is encountered, the speed of the turbine is reduced, and the oil strikes the turbine blades at a sharper angle. This multiples the torque delivered to the output shaft of the torque converter.

The output shaft gear of the torque converter meshes with the input shaft gear of the transmission which in turn transmits power into the transmission.

PLANETARY TRANSMISSION

The directional clutch section consists of the No.1 and No.2 clutches and the No.1 and No.2 planetary carrier. The No.1 clutch is the reverse directional clutch. The No.2 clutch is the forward directional clutch. The No.1 clutch ring gear and No.1 carrier are splined together and rotate as a unit. The No.1 and No.2 carrier ring gear, No.2 and No.3 carrier, and No.4 carrier are splined together and rotate as a unit. The No.1 and No.2 sun gears are integral and turn as a unit. The speed clutch section consists of the No.3 (4th speed), No.4 (3rd speed), No.5 (2nd speed), and No.6 (1st speed) clutches and No.3, No.4, and No.5 planetary carriers. The No.4 clutch ring gear is splined to the No.5 carrier. The No.3 sun gear is integral with the output shaft and the No.4 and No.5 sun gears are splined to the output shaft. The No.6 clutch is a rotating. clutch. The No.6 clutch is internally splined to the No.5 carrier and rotates as a unit.



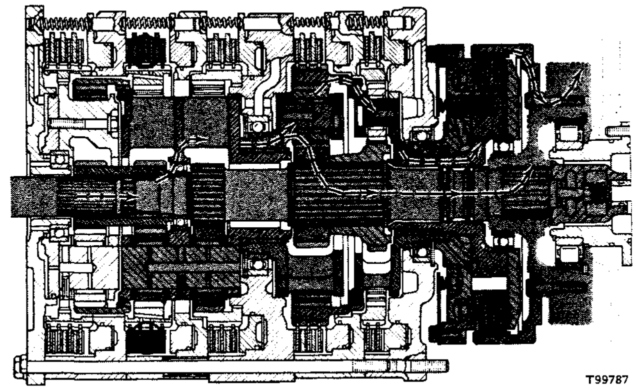
TRANSMISSION

1. No.1 clutch.
2. No.1 clutch ring gear.
3. No.1 and No.2 carrier ring gear.
4. No.2 clutch.
5. No.3 clutch.
6. No.3 clutch ring gear.
7. No.4 planet gear.
8. No.4 clutch.
9. No.4 carrier.
10. No.5 clutch.
11. No.5 planet gear.
12. No.5 carrier.
13. No.6 clutch.
14. No.6 clutch and output gear coupling.
15. Output gear.
16. No.1 carrier.
17. No.1 and No.2 sun gears.
18. Input shaft.
19. No.1 planet gear.
20. No.6 clutch hub.
21. No.2 clutch ring gear.
22. No.2 planet gear.
23. No.2 and No.3 carrier.
24. No.3 planet gear.
25. No.3 sun gear and output shaft.
26. No.4 clutch ring gear.
27. No.4 sun gear.
28. No.5 clutch ring gear.
29. No.5 sun gear.

In the following illustrations, circle denotes engaged clutches. Components which are involved with the transmitting of power have been shaded.

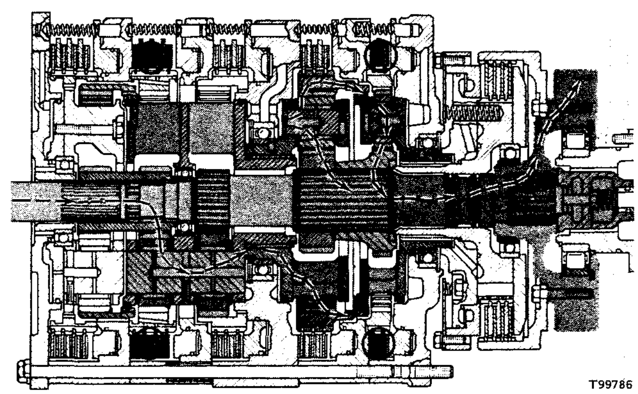
First Speed Forward

The No.2 clutch ring gear is held stationary causing the No.2 and No.3 carrier and No.4 carrier to rotate. A torque split occurs at this point between the No.4 sun gear and No.4 ring gear. Torque from the No.4 ring gear transfers through a spline to the No.5 carrier and through another spline to the No.6 clutch hub and No.6 clutch coupling. The output gear receives torque from the No.4 sun gear and the No.6 clutch coupling. The No.6 clutch coupling is bolted directly to the output gear.



FIRST SPEED FORWARD
(No.2 and No.6 clutches engaged.)

Second Speed Forward

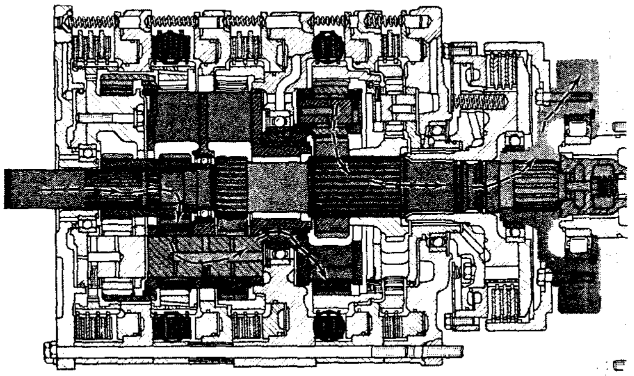


SECOND SPEED FORWARD
(No.2 and No.5 clutches engaged)

The No.2 clutch ring gear is held stationary. This causes the No.2 and No.3 carrier and No.4 carrier to rotate. The No.4 clutch ring gear is splined to the No.5 carrier. The No.5 clutch ring gear is held stationary by the No.5 clutch. No.5 planet gears walk around the inside of the No.5 clutch ring gear and output shaft. The interlocking of No.4 clutch ring gear and No.5 carrier also transmits torque to the output shaft through the No.4 sun gear.

Third Speed Forward

The No.2 clutch ring gear is held stationary causing the No.2 and No.3 carrier and No.4 carrier to rotate. The No.4 clutch ring gear is held stationary by the No.4 clutch. The No.4 planet gears walk around the inside of the No.4 clutch ring gear driving the No.4 sun gear and output shaft.



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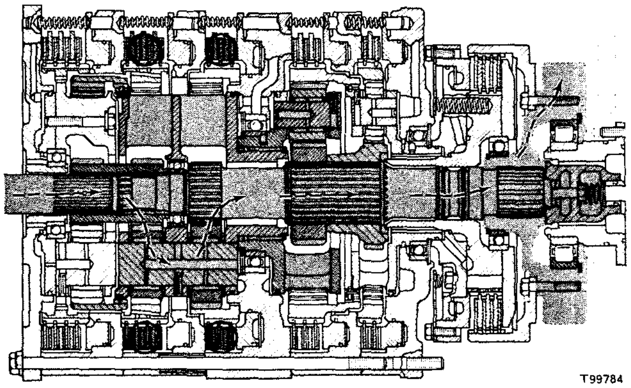
THIRD SPEED FORWARD
(No.2 and No.4 clutches engaged.)

Fourth Speed Forward



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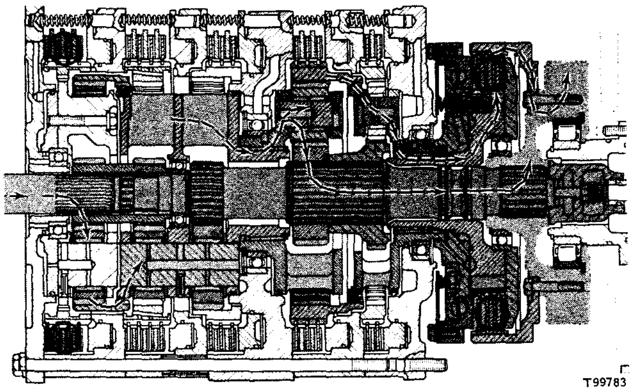
FOURTH SPEED FORWARD
(No.2 and No.3 clutches engaged.)

The No.2 clutch ring gear is held stationary by the No.2 clutch. The No.3 clutch ring gear is held stationary by the No.3 clutch. The No.2 sun gear drives the No.2 planet gears which walk around the inside of the No.2 clutch ring gear to rotate the carrier. The No.3 planet gears are driven around the inside of the stationary No.3 clutch ring gear and drive the No.3 sun gear and output shaft.

First Speed Reverse



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FIRST SPEED REVERSE
(No.1 and No.6 clutches engaged.)

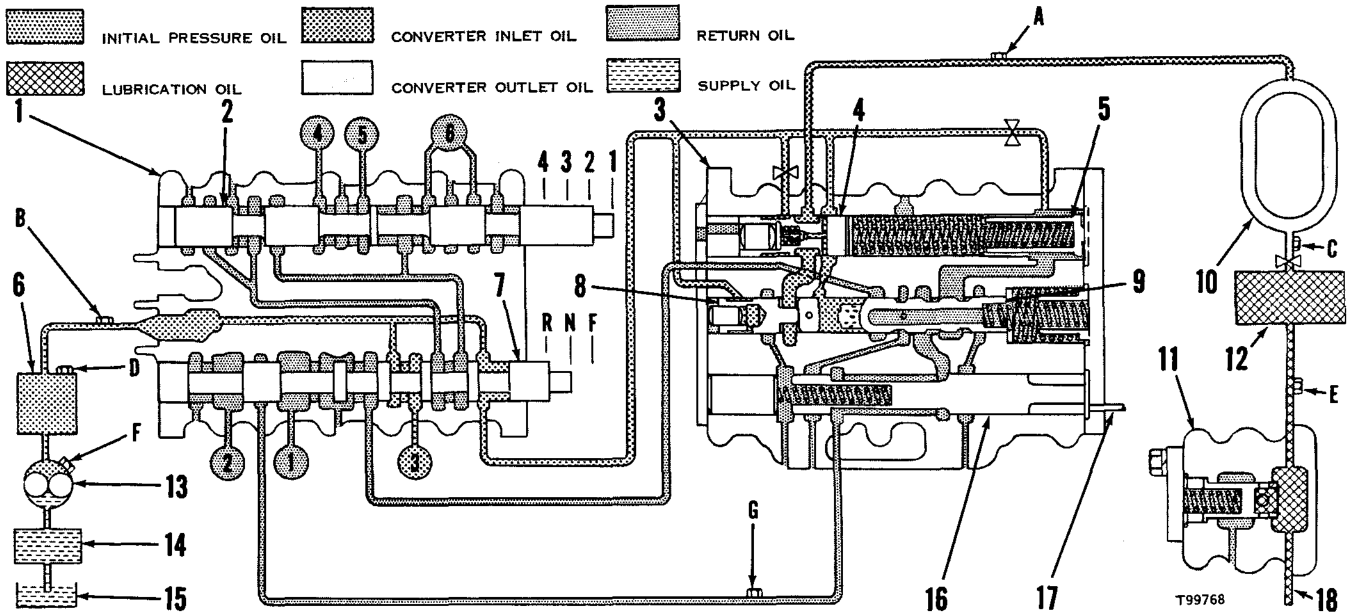
The No.1 ring gear and No.1 carrier are held stationary by the No.1 clutch. The No.1 sun gear drives the No.1 and No.2 carrier ring gear through the No.1 planet gears. This causes the No.2 and No.3 carrier and No.4 carrier to rotate in the opposite direction. The torque divides in the No.4 carrier. The No.4 clutch ring gear is splined to the No.5 carrier which is in turn splined to the No.6 clutch hub and No.6 clutch coupling. The output gear receives torque from the No.4 sun gear and the No.6 clutch coupling. The No.6 clutch coupling is bolted directly to the output gear.

In second speed reverse, the No.1 and No.5 clutches are engaged. The power flow through the directional clutch section of the transmission is identical to first speed reverse. The power flow through the speed clutch section of the transmission is the same as for second speed forward.

In third speed reverse the No.1 and No.4 clutches are engaged. The power flow through the directional clutch section of the transmission is the same as first speed reverse. Power flow through the speed clutch section is the same as for third speed forward.

In fourth speed reverse the No.1 and No.3 clutches are engaged. Power flow through the directional clutch section is the same as for first speed reverse. Power flow through the speed clutch section is the same as for fourth speed forward.

TRANSMISSION HYDRAULIC CONTROLS



HYDRAULIC CONTROLS (SCHEMATIC)
(Speed selector valve in FIRST SPEED position. Directional selector valve in NEUTRAL position)

1. Selector valve body.
2. Speed selector valve spool.
3. Pressure control valve body.
4. Modulating relief valve spool.
5. Load piston.
6. Transmission oil filter.
7. Directional selector valve spool.
8. Converter ratio spool.
9. Differential and safety valve spool.
10. Torque converter.
11. Transmission lubrication relief valve.
12. Oil cooler.
13. Oil pump.
14. Magnetic strainer.
15. Oil sump.
16. Neutralizer valve spool.
17. Neutralizer air line from brake system.
18. Lubrication oil line to transmission.
A. Torque converter inlet oil pressure tap (P3).
B. Speed clutch oil pressure tap (P1).
C. Torque converter outlet oil pressure tap.
D. Transmission oil pump pressure tap.
E. Transmission lubrication oil pressure tap.
F. Transmission oil pump pressure tap.
G. Directional clutch oil pressure tap (P2).

The basic components of the transmission hydraulic control oil system are: oil sump (15), magnetic strainer (14), oil filter (6), oil pump (13), transmission hydraulic control, torque converter (10), and oil cooler (12). The only external lines are those to and from the transmission oil cooler (12), and the oil pump suction tube from the transmission oil sump (15) to the magnetic strainer (14).

The hydraulic controls, consisting of a selector valve group (1), pressure control group (3), and a manifold, are mounted on the center clutch housing. The controls are completely enclosed by the transmission case. Four forward and four reverse speeds are provided by the transmission and the hydraulic controls. The valve spools in the selector valve direct oil to pressurize the proper clutches for the speed and direction selected. Pressures in the hydraulic system are regulated by the pressure control valve.

When the machine is started and the selector is in NEUTRAL, oil from the pump enters the controls and is directed to the modulating relief valve (4). The oil flows around the small diameter portion of the valve spool and enters the slug cavity end of the spool behind the poppet valve. Since the load piston (5) cavity is open to drain by the position of the differential and safety valve spool (9), system pressure is held to initial pressure or approximately 75 psi (5,3 kg/cm^2).

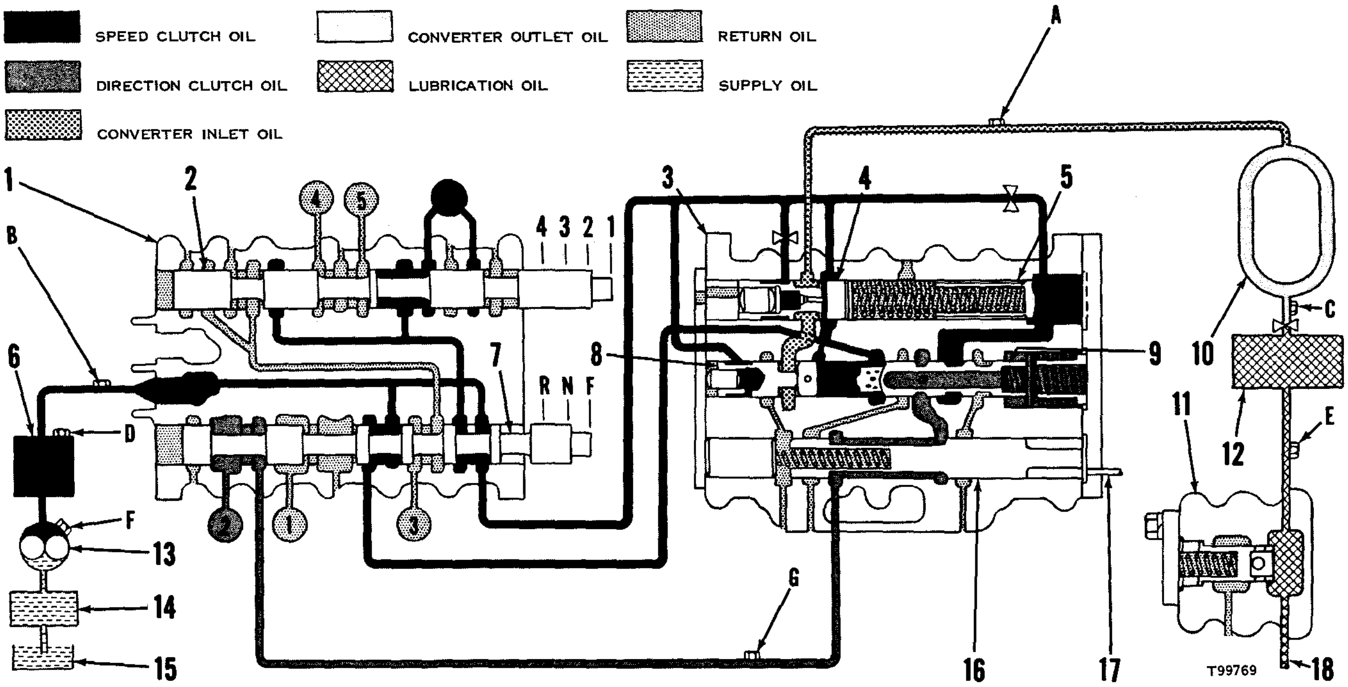
When a shift is made and a transmission clutch is open for fill, the system pressure drops and spring pressure moves the modulating relief valve (4) to the left, closing off the oil supply to the torque converter (10). As the clutches fill, the system pressure increases to overcome the spring force and reopens oil flow to the torque converter (10). Further increase in system pressure causes the load piston (5) to move to the left and increases the spring force against the modulating relief valve (4). This gradual increase of clutch pressure, time versus psi, is called modulation. When full clutch pressure is reached, the speed clutch pressure is approximately 360 psi (25,3 kg/cm^2) and directional clutch pressure is approximately 50 psi (3,5 kg/cm^2) less than speed clutch pressure. The pressure difference is maintained by the differential and safety valve spool (9). Since the pressure is always higher in the speed clutches, they engage first and the load is picked up by the directional clutches which have the lower pressure and therefore engage last.

If the engine is started when the selector lever is in any position but NEUTRAL, oil flows to both ends of the differential and safety valve spool (9). The spring force holds the valve spool to the left. In this position, the oil flow to the directional clutches is blocked and the machine will not move. When the selector lever is moved to the NEUTRAL position, the oil at the end of the differential and safety valve (9) is opened to drain. The oil pressure then overcomes the spring force, the spool moves to the right and the controls are ready for a clutch fill and modulation cycle as soon as the selector lever is moved to a SPEED position.

The torque converter inlet relief valve (8) limits the maximum pressure to the torque converter (10) to approximately 119 psi (8,4 kg/cm^2).

Torque converter outlet oil pressure is controlled by an orifice at the entrance to the oil cooler.

Transmission lubrication oil pressure is limited to approximately 8 psi (0,6 kg/cm^2) by the transmission lubrication relief valve (11).

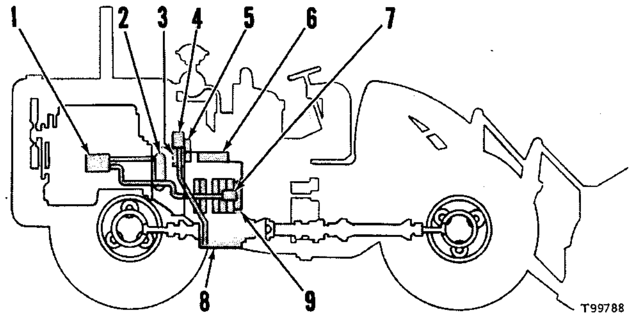


TRANSMISSION HYDRAULIC SYSTEM (FIRST SPEED FORWARD)

1. Selector valve body.
2. Speed selector valve spool.
3. Pressure control valve body.
4. Modulating relief valve spool.
5. Load piston.
6. Transmission oil filter.
7. Directional selector valve spool.
8. Converter ratio spool.
9. Differential and safety valve spool.
10. Torque converter.
11. Transmission lubrication relief valve.
12. Oil cooler.
13. Oil pump.
14. Magnetic strainer.
15. Oil sump.
16. Neutralizer valve spool.
17. Neutralizer air line from brake system.
18. Lubrication oil line to transmission.

A. Torque converter inlet oil pressure tap (P3)..
B. Speed clutch oil pressure tap (P1).
C. Torque converter outlet oil pressure tap.
D. Transmission oil pump pressure tap.
E. Transmission lubrication oil pressure tap.
F. Transmission oil pump pressure tap.
G. Directional clutch oil pressure tap (P2).

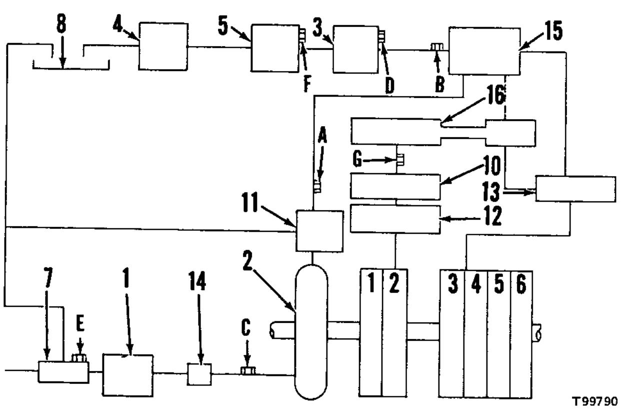
TRANSMISSION LUBRICATION SYSTEM



LUBRICATION SYSTEM

1. Oil cooler. 2. Torque converter. 3. Oil filter. 4. Magnetic strainer. 5. Oil pump. 6. Hydraulic control group. 7. Lubrication relief valve. 8. Oil sump. 9. Planetary range transmission.

A gear-type oil pump (5) provides oil for controlling the range transmission (9), charging the torque converter (2) and lubricating the transmission and converter. The pump is driven by a gear meshed with a drive gear bolted to the torque converter impeller.



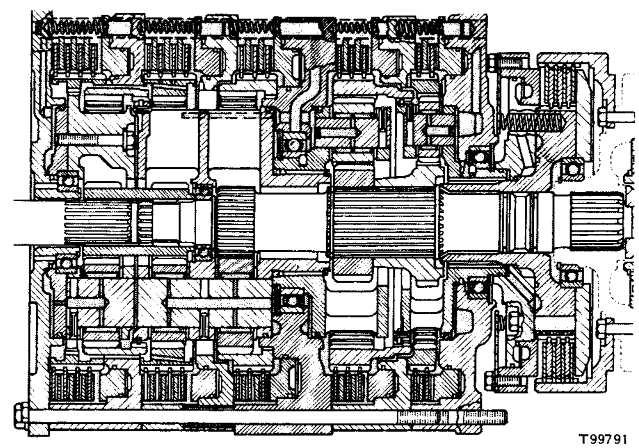
OIL FLOW

1. Oil cooler. 2. Torque converter. 3. Oil filter. 4. Magnetic strainer. 5. Oil pump. 7. Lubrication relief valve. 8. Oil sump. 10. Directional clutch valve. 11. Torque converter inlet relief valve. 12. Neutralizer valve. 13. Speed clutch valve. 14. Orifice. 15. Modulating relief valve. 16. Differential and safety valve. A. Torque converter inlet oil pressure tap (P3). B. Speed clutch oil pressure tap (P1). C. Torque converter outlet oil pressure tap. D. Transmission oil pump pressure tap. E. Transmission lubrication oil pressure tap. F. Transmission oil pump pressure tap. G. Directional clutch oil pressure tap (P2).

The transmission oil sump (8) is located in the bottom of the transmission case. Oil, picked up by the transmission oil pump (5), flows to the magnetic strainer (4) through an external tube. The magnetic strainer (4) separates foreign material from the pump inlet oil. The oil flows to the pump through internal passages in the transmission case and torque converter housing. From the pump, the oil flows through the filter (3) and into the transmission hydraulic controls (6). Should the filter element become restricted or the oil extremely viscous, a bypass valve in the filter opens. This allows the oil to bypass the filter element.

Valves in the hydraulic controls (6) direct oil flow to the transmission clutches and torque converter (2). Oil not required to fill the clutches is routed into the converter. From the converter, the oil flows through a water-to-oil cooler (1) to the lubrication relief valve (7). The relief valve limits the lubricating oil pressure in the planetary transmission.

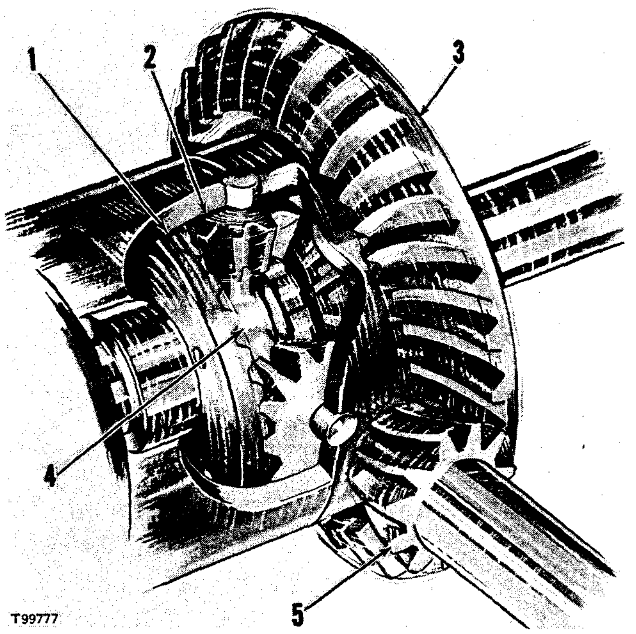
A passage, common to the No.1, No.2, No.3, No.4, and No.5 clutch housings, directs lubricating oil on all five stationary clutches, and provides pressure oil for the lubrication of the planet gears, clutch discs and plates, and bearings in the No.1, No.2, No.3, No.4, and No.5 carriers. Oil for No.6 clutch lubrication is supplied through passages in the No.6 clutch housing and the No.6 clutch hub.



TRANSMISSION LUBRICATION

DIFFERENTIAL AND FINAL DRIVE

DIFFERENTIAL



DIFFERENTIAL

1. Side gear. 2. Pinions (four). 3. Bevel ring gear. 4. Spider. 5. Bevel pinion.

The differential equalizes the driving torque delivered to both wheels. When one wheel is turning slower than the other, as in a turn, the differential allows the inside wheel to stop or slow in relation to the outside wheel.

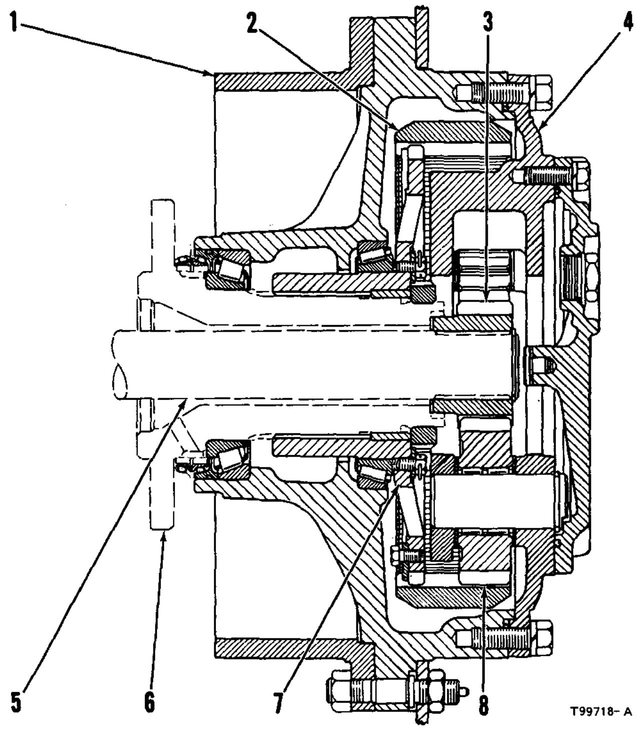
The transmission output shaft gear meshes with the transfer output shaft gear which transmits power through universal joints to the drive shafts. The drive shafts are splined to the bevel pinion (5) in each differential. The bevel pinion drives ring gear (3) which is bolted to the differential carrier. The carrier contains four pinions (2), mounted on a spider (4), and two side gears (1). The four pinions mesh at right angles with the two side gears. The side gears are splined to the inner ends of the axles.

When the machine is moving straight ahead with equal traction under each drive wheel, equal torque on each axle locks the pinions (2) so they will not rotate on the spider (4). This gives the same effect as both drive wheels locked on the same driving axle. When unequal loads are put on the drive wheels, as in a turn, unequal forces are placed on the opposite sides of the differential causing the pinions (2) to rotate. This rotation of the pinions slows or stops the inside wheel and speeds up the rotation of the outside wheel, thereby driving the machine with full power in a turn.

The differential carrier hubs are mounted on tapered roller bearings. The pinions rotate on hardened steel bearings. Both the pinions and side gears rotate against thrust washers which take the end thrust against the differential carrier.

The differential is splash lubricated. Milled flats on the spider allow passage of lubricant to the pinion bearings and thrust washers.

FINAL DRIVE

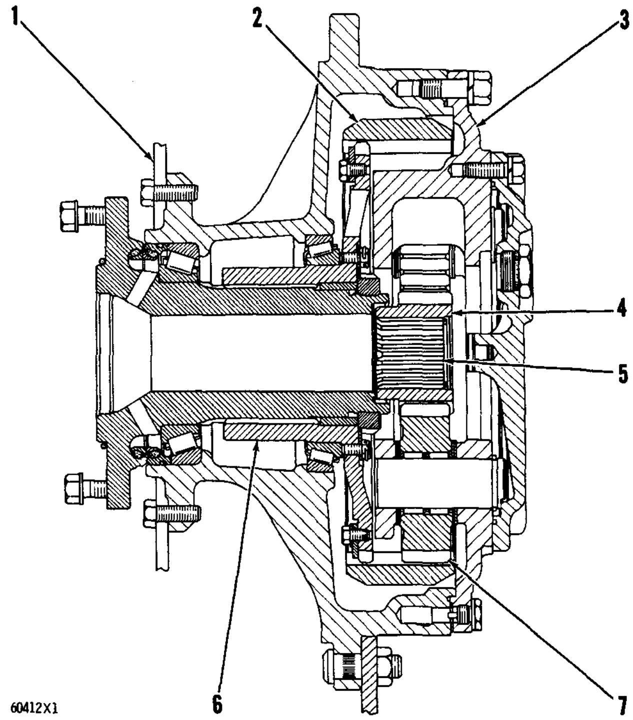


FINAL DRIVE (Earlier Machines)

1. Brake drum. 2. Ring gear. 3. Sun gear. 4. Planet carrier. 5. Axle shaft. 6. Axle housing. 7. Final drive hub. 8. Planet gear.

The final drive consists of a planetary gear system. The ring gear is mounted on the final drive hub which is splined to the axle housing. The ring gear remains in a fixed position. The planet gears are held by a planet carrier which is bolted to the wheel. The sun gear is splined to the axle shaft which is driven by the differential. As the sun gear rotates it causes the planet gears and carrier to walk around the sun gear in the same direction, but at a reduced speed. The planet carrier drives the wheel assembly.

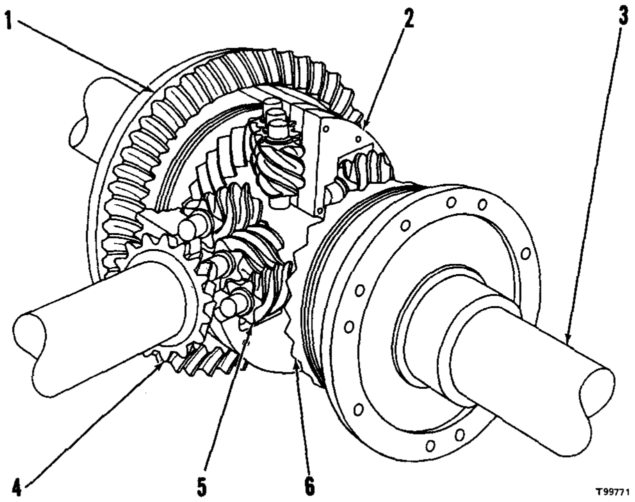
NOTE: The final drive (earlier machines) has shoe-type brake. The final drive (later machines) has disc brakes.



FINAL DRIVE (Later Machines)

1. Brake disc. 2. Ring gear. 3. Planet carrier. 4. Sun gear.
5. Axle shaft. 6. Final drive hub. 7. Planet gear.

TORQUE PROPORTIONING DIFFERENTIAL



TORQUE PROPORTIONING DIFFERENTIAL

1. Ring gear. 2. Carrier. 3. Axles (two). 4. Bevel pinion. 5. Pinion gears (twelve). 6. Side gears (two).

The torque proportioning differential divides torque to the wheels according to conditions at the wheels. When one wheel is turning slower than the other, as in a turn, the differential allows the inside wheel to stop or slow in relation to the outside wheel.

The transmission output shaft gear meshes with the transfer output shaft gear which transmits power through universal joints to the differentials.

The differential pinion (4) drives the differential ring gear (1) which is bolted to the differential carrier (2). The carrier contains twelve helical cut pinions (5) and two side gears (6). The pinions are arranged in four groups of three pinions, one group in each quadrant. Two of the pinion gears (5) in each group mesh with the side gears (6) while the remaining pinion in each group serves as an idler gear. The side gears (6) are splined to the inner ends of the axles (3).

When the machine is moving in a straight line and when both wheels encounter the same tractive conditions, the torque from the bevel gear (1), drives the carrier (2), and the four sets of pinion gears (5). The pinion gears (5) cause both side gears (6) to rotate in the same direction at bevel gear speed.

When traction decreases at one wheel the axle shaft torque required to turn that wheel decreases. In order for a wheel to spin, one side gear (6) must rotate faster than the other side gear. When this occurs the pinions must have relative rotation and walk around the other side gear.

The torque proportioning differential restricts this rotation. A frictional resistance must be overcome to allow the pinion to rotate. The frictional resistance results from the contact between the helically cut pinions (5) and side gears (6) and the preload spring force on the side gears. To allow one side gear to speed up, an input torque to the carrier is required to overcome the frictional resistance. This causes the pinions to rotate about the slower moving side gear. A reaction torque is created at the slower moving side gear and in turn, torque is transmitted to the wheel with the best traction.

The differential carrier hubs are mounted on tapered roller bearings. The pinion gears rotate on shafts which are fixed in the carrier housing.

PROBLEM SOLVING

This is intended as a reference for locating and correcting problems that may occur in the power train. In the event further investigation is necessary, use of the 7S8875 or 8M2736 Hydraulic Test Box will be helpful. Pressure tap locations and testing and adjusting procedures are defined in topic TORQUE CONVERTER, TRANSMISSION AND HYDRAULIC CONTROLS.

In all instances, visual checks of the machine should be made first and then operational checks before proceeding to instrumentation tests.

VISUAL CHECKS

1. Check the oil level in the transmission.
2. Examine all external oil lines, hoses and connections for leaks and damage. Look on the ground beneath the machine for evidence of leaks and locate their source.
3. Move the range control lever to REVERSE position and all FORWARD positions. The detents should be felt in each position.
4. Drain the transmission lubrication oil filter housing, remove and check the filter element for foreign material. Also, check the magnetic strainer.
   a. Bronze-colored particles would indicate a clutch failure.
   b. Bright steel particles in the filter indicate a pump failure.
   c. Aluminum particles indicate a torque converter failure.
   d. Rubber particles indicate a blown seal or ruptured hose.

If metal or rubber particles are found, clean all components in the hydraulic systems and recondition the damaged components.

OPERATIONAL CHECKS

With the engine running, move the transmission speed selector lever to all positions. The detents should be felt in each position.

Operate the machine in each direction and at all speeds. Listen for unusual noises and determine their source. If improper operation is observed, refer to the OPERATIONAL CHECK LIST for "problems" and "probable causes."

OPERATIONAL CHECK LIST

Transmission

PROBLEM: Does not operate in any speed or slips in all speeds.

PROBABLE CAUSE:

1. Low oil pressure due to:
   a. Low oil level.
   b. Control linkage broken loose or incorrectly adjusted.
   c. Oil pump or oil pump drive failure.
   d. Air leaks on inlet side of pump.
   e. Leakage within transmission.
   f. Pressure modulating relief valve spool incorrectly adjusted or stuck open.
   g. Load piston or differential and safety valve spool stuck.
2. Mechanical failure in transmission.
3. Torque converter failure.
4. Bevel pinion and/or bevel gear failure.

PROBLEM: Operates in reverse speeds only or in forward speeds only.

PROBABLE CAUSE:

1. Control linkage broken, loose or incorrectly adjusted.
2. Worn discs and plates and/or broken parts in directional clutch.
3. Excessive leakage in connections and/or clutch piston seals of directional clutch.

PROBLEM: Transmission does not shift.

PROBABLE CAUSE:

1. Low oil level.
2. Low clutch pressures.
3. Incorrect linkage adjustment or worn or broken parts.

PROBLEM: Sluggish shifting.

PROBABLE CAUSE:

1. Low oil pressure.
2. Incorrectly adjusted internal and external control system linkages.
3. Air leaks on inlet side of pump.
4. Load piston or differential and safety valve sticking in pressure control valve.

PROBLEM: Rough shifting.

PROBABLE CAUSE:

1. Incorrectly adjusted control system linkage.
2. Incorrect initial setting of relief valve.
3. Sticking load piston and/or differential and safety valve spool.
4. Weak or broken valve springs.

PROBLEM: Does not operate in one speed (forward or reverse) or operates in one speed only.

PROBABLE CAUSE:

1. Control linkage broken, loose or incorrectly adjusted.
2. Worn discs and plates and/or broken components of the clutch in question.
3. Excessive leakage in connections and/or clutch piston seals of the clutch in question.
4. Clutch plates broken, binding ring gear of the clutch in question. (Torque converter will stall in all other speeds.)

PROBLEM: Transmission remains in gear when selector lever is in NEUTRAL.

PROBABLE CAUSE:

1. Control linkage broken, loose or incorrectly adjusted.
2. Directional clutches not releasing.

PROBLEM: Transmission engages, torque converter stalls and engine under load condition. Machine does not move.

PROBABLE CAUSE:

1. Locked transmission.
   a. Broken parts.
   b. One or more clutches incorrectly engaged.
2. Broken teeth on bevel pinion or bevel gear.
3. Broken teeth on pinion and/or gears in final drives.

PROBLEM: Overheating of the transmission.

PROBABLE CAUSE:

1. Low oil level.
2. Oil cooler core partially plugged.
3. Excessive clutch drag.
4. Low oil flow as a result of a worn oil pump or extreme leakage in the hydraulic system.

PROBLEM: Unusually noisy pump.

PROBABLE CAUSE:

1. An intermittent loud popping sound which gives the impression that foreign materials are passing through the pump is caused by pump cavitation.
2. A constant loud milling or gritting noise is an indication of pump failure.

Torque Converter

PROBLEM: Torque converter overheating.

PROBABLE CAUSE:

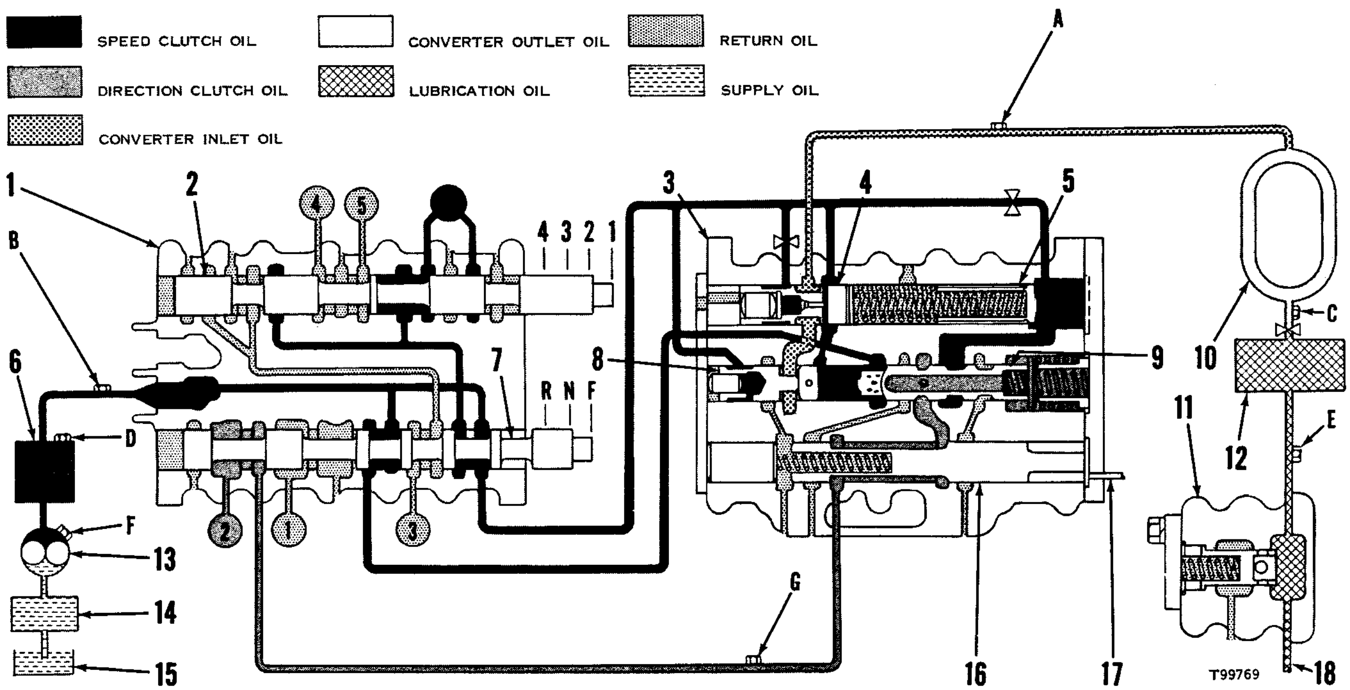
1. Incorrect operation of machine. Constant overloading.
2. Faulty temperature gauge.
3. Cooling system of machine faulty.
4. Mechanical failure of torque converter.
5. Excessive oil build-up in the torque converter housing around converter due to excessive leakage through torque converter.
6. Insufficient oil supply to the converter caused by:
   a. Excessive leakage in the transmission.
   b. Faulty pump.
   c. Clogged oil cooler or lines.

RANGE TRANSMISSION SELECTION	CLUTCHES ENGAGED IN RANGE TRANSMISSION
First Range Forward	2-6
Second Range Forward	2-5
Third Range Forward	2-4
Fourth Range Forward	2-3
First Range Reverse	1-6
Second Range Reverse	1-5
Third Range Reverse	1-4
Fourth Range Reverse	1-3

Clutch designation:

CLUTCH NO.	FUNCTION
No.1	Reverse Directional
No.2	Forward Directional
No.3	Fourth Speed
No.4	Third Speed
No.5	Second Speed
No.6	First Speed

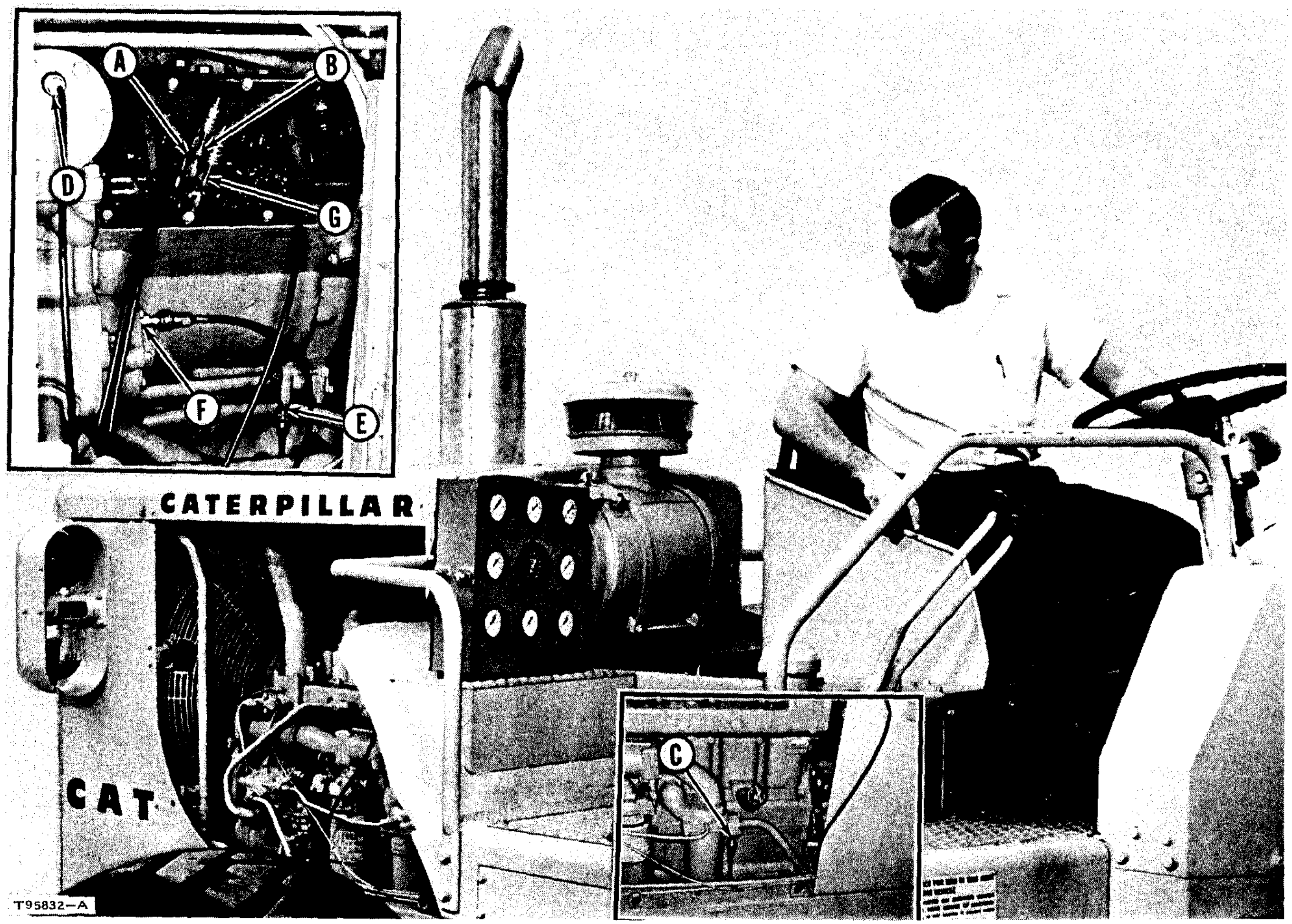
TORQUE CONVERTER, TRANSMISSION AND HYDRAULIC CONTROLS



TRANSMISSION HYDRAULIC SYSTEM (FIRST SPEED FORWARD)

1. Selector valve body.
2. Speed selector valve spool.
3. Pressure control valve body.
4. Modulating relief valve spool.
5. Load piston.
6. Transmission oil filter.
7. Directional selector valve spool.
8. Converter ratio spool.
9. Differential and safety valve spool.
10. Torque converter.
11. Transmission lubrication relief valve.
12. Oil cooler.
13. Oil pump.
14. Magnetic strainer.
15. Oil sump.
16. Neutralizer valve spool.
17. Neutralizer air line from brake system.
18. Lubrication oil line to transmission.

A. Torque converter inlet oil pressure tap (P3).
B. Speed clutch oil pressure tap (P1).
C. Torque converter outlet oil pressure tap.
D. Transmission oil pump pressure tap.
E. Transmission lubrication oil pressure tap.
F. Transmission oil pump pressure tap.
G. Direction clutch oil pressure tap (P2).

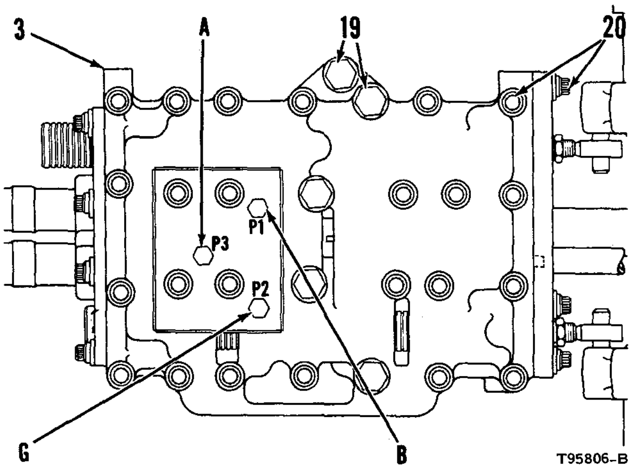


ON MACHINE PRESSURE TAP LOCATIONS

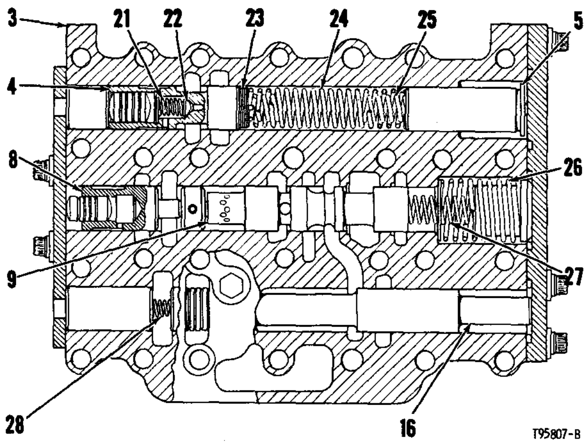
A. Torque converter inlet oil pressure tap (P3). B. Speed clutch oil pressure tap. C. Torque converter outlet oil pressure tap. D. Transmission oil pump pressure tap. E. Transmission lubrication oil pressure tap. F. Transmission oil pump pressure tap. G. Directional clutch oil pressure tap (P2).

PRESSURE	PRESSURE TAP LOCATION	VALUE		ADJUSTMENT
		LOW IDLE	HIGH IDLE	
PUMP	(D) On Oil Filter (F) On Pump	325 psi (22,9 kg/cm²) Minimum Any speed except NEUTRAL.	360 ± 15 psi (25,31 ± 1,1 kg/cm²) Any speed except NEUTRAL.	Change by setting primary pressure at modulating relief valve.
SPEED CLUTCH (primary pressure)	(B) On Pressure Control Valve	75 ± 5 psi (5,3 ± 0,4 kg/cm²) Selector lever in NEUTRAL.		Add or remove spacer (23) behind modulating relief valve (4).
SPEED CLUTCH	(B) On Pressure Control Valve	325 psi (22,9 kg/cm²) Minimum Any speed except NEUTRAL.	360 ± 15 psi (25,31 ± 1,1 kg/cm²) Any speed except NEUTRAL.	Change by setting modulating relief valve.
DIRECTION CLUTCH	(G) On Pressure Control Valve	50 ± 8 psi (3,5 ± 0,6 kg/cm²) less than pressure in speed clutch in any speed except NEUTRAL.	50 ± 8 psi (3,5 ± 0,6 kg/cm²) less than pressure in speed clutch in any speed except NEUTRAL.	None.
LUBRICATION OIL	(E) On Lubrication Relief Valve	1 psi (0,07 kg/cm²) Minimum.	8 ± 3 psi (0,6 ± 0,14 kg/cm²)	None.
CONVERTER INLET	(A) On Pressure Control Valve		119 psi (8,4 kg/cm²) Maximum The converter stalled.	None.
CONVERTER OUTLET	(C) Pressure tap on converter housing on outlet line near inlet to oil cooler.	1 psi (0,07 kg/cm²) Minimum with brakes locked, selector lever in THIRD SPEED and the converter stalled.	40 ± 10 psi (2,8 ± 0,7 kg/cm²) with brakes locked, selector lever in THIRD SPEED and the converter stalled.	None.

PRESSURE CHANGE TO MODULATING RELIEF VALVE (4) BY REMOVAL OR ADDITION OF ONE SPACER		
SPACER NO.	THICKNESS	CHANGE IN psi
5M3492 (23)	.010 in. (0,25 mm)	2.2 psi (0,15 kg/cm²)
7M1397 (23)	.036 in. (0,91 mm)	8.2 psi (0,58 kg/cm²)
7M1396 (23)	.062 in. (1,57 mm)	14.1 psi (0,98 kg/cm²)



PRESSURE TAP LOCATIONS



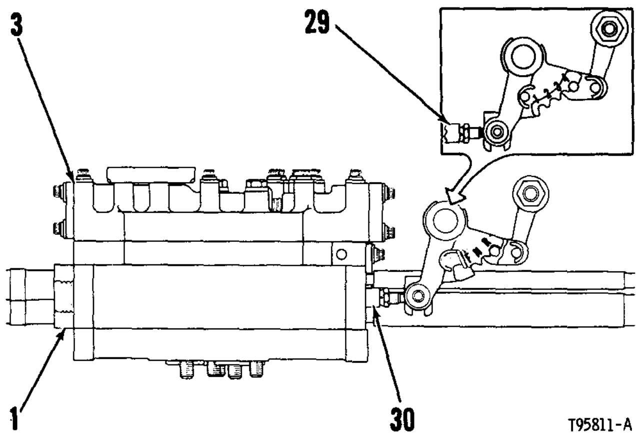
5S1003 PRESSURE CONTROL VALVE

3. Pressure control valve body. 4. Modulating relief valve spool. 5. Load piston. 8. Converter ratio spool. 9. Differential and safety valve spool. 16. Neutralizer valve spool. 19. Six point head bolts (six). 20. Twelve point head bolts (thirty-four). 21. Plunger spring. 22. Plunger. 23. Spacer. 24. Load piston relief valve outer spring. 25. Load piston and relief valve inner spring. 26. Differential and safety valve spool outer spring. 27. Differential and safety valve spool inner spring. 28. Neutralizer valve spring. A. Torque converter inlet oil pressure tap (P3). B. Speed clutch oil pressure tap (P1). G. Directional clutch oil pressure tap (P2).

TRANSMISSION OIL PUMP BENCH TEST SPECIFICATIONS	
Type	Gear
Number of sections	One
Rotation	Counterclockwise
Output [using SAE No. 10W oil at 120° F (49° C)]	18.1 U.S. gpm (68,5 lit/min.)
Based on speed of	1894 rpm
When developing pressure of	230 psi (16,2 kg/cm²)

CONTROL VALVES AND LINKAGE ADJUSTMENT (EARLIER MACHINES)

1. Adjust directional spool (30) so adjustment end of spool is flush with front face of body (1) when spool and detent is in REVERSE position.
2. Adjust speed selector spool (29) so adjustment end of spool is flush with front face of body (1) when spool and detent is in FOURTH speed position.

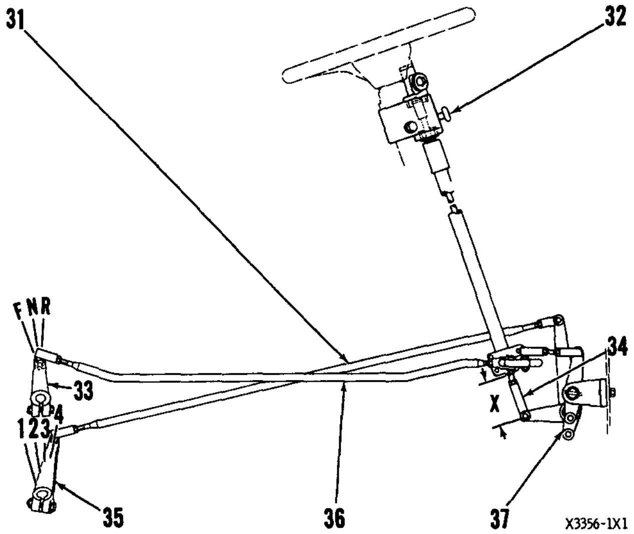


SELECTOR VALVE SPOOL ADJUSTMENTS

1. Selector valve body. 3. Pressure control valve body. 29. Speed selector valve spool. 30. Directional selector valve spool.

3. Place parking brake lever in the ENGAGED position.
4. Place transmission directional control lever (33) in the NEUTRAL position, adjust and connect rod (36).
5. Rotate speed control handle (32) counterclockwise as far as possible (to FOURTH speed position). Adjust rod end (34) to obtain dimension (X).
6. Place transmission speed control lever (35) in FOURTH speed position, adjust and connect rod (31).

7. Adjust indicator collar on speed control handle (32) shaft to FOURTH speed and tighten setscrew.

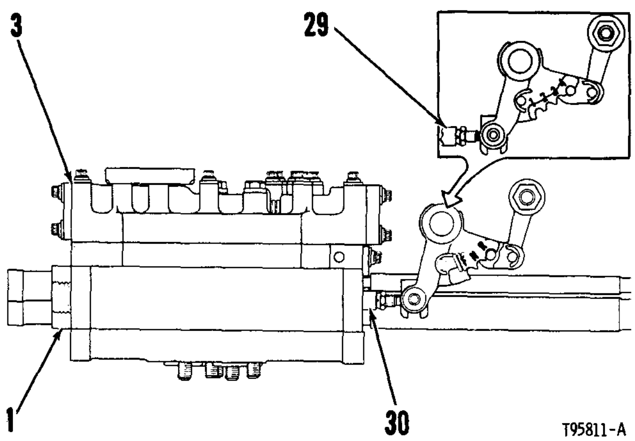


CONTROL LINKAGE ADJUSTMENT

31. Rod. 32. Speed control handle. 33. Directional control lever. 34. Rod end. 35. Speed control lever. 36. Rod. 37. Bellcrank. X. 3.19 in. (81,03 mm) dimension.

CONTROL VALVES AND LINKAGE ADJUSTMENT (LATER MACHINES)

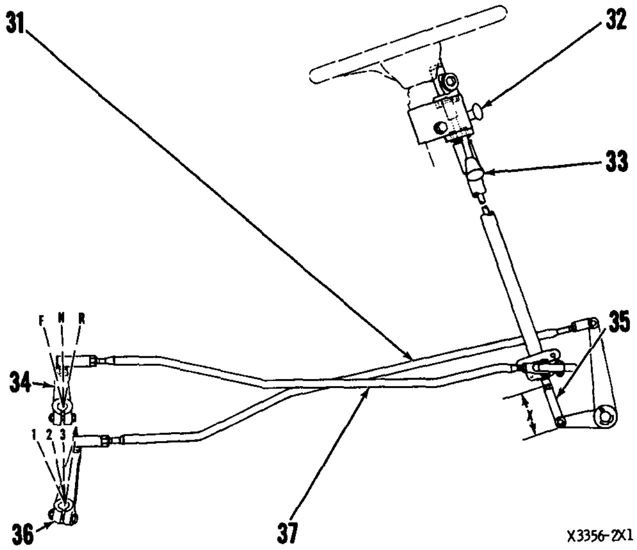
1. Make an adjustment to direction spool (30) so the adjustment end of the spool is even with the front face of body (1) when the spool and detent are in REVERSE position.
2. Make an adjustment to speed spool (29) so the adjustment end of the spool is even with the front face of body (1) when the spool and detent are in FOURTH.



ADJUSTMENT TO THE VALVE SPOOL

1. Body of the selector valve. 3. Body of the pressure control valve. 29. Valve for speed selection. 30. Valve for direction selection.

3. Put lever for neutral lock (33) in the hold position.
4. Put lever for direction control (34) in NEUTRAL position, make an adjustment to rod (37) and make the connection to the lever (34).

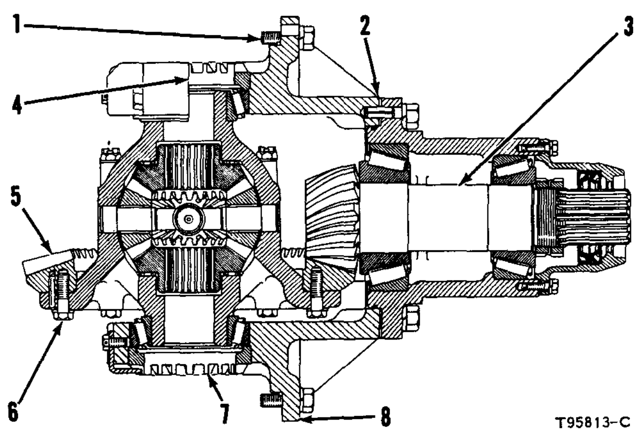


CONTROL LINKAGE ADJUSTMENT

31. Rod. 32. Handle for speed control. 33. Lever for the neutral lock. 34. Lever for direction control. 35. Rod end. 36. Lever for speed control. 37. Rod. X. 3.19 in. (81,03 mm) dimension.

5. Turn handle for speed control (32) counterclockwise until the top of the rack is even with the top of the housing. Make an adjustment to rod end (35) to get dimension (X).
6. Put handle for speed control (32) in FOURTH speed position make the adjustment and connection of rod (31) to lever (36).
7. Make an adjustment to the indicator collar on handle for speed control (32) to FOURTH speed position and tighten the set screw.

DIFFERENTIAL AND BEVEL GEAR



DIFFERENTIAL AND BEVEL GEAR

1. Differential carrier retaining bolts. 2. Shims. 3. Bevel pinion shaft. 4. Bevel gear shaft bearing adjusting nut. 5. Bevel gear. 6. Bevel gear retaining bolt. 7. Bevel gear shaft bearing adjusting nut. 8. Differential carrier housing.

Adjustment Procedure:

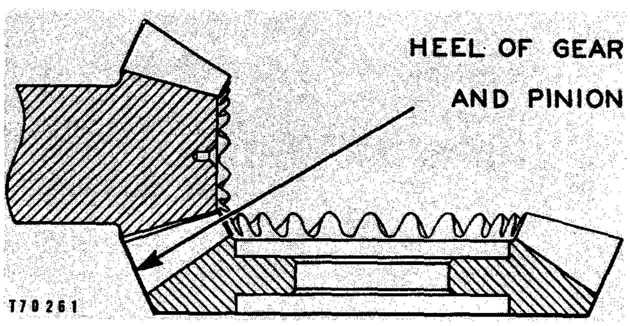
1. Adjust bevel pinion shaft (3) bearing preload so torque required to rotate pinion is 8 ± 2 lb. in. (9,2 ± 2,3 cm.kg).
2. Install bevel pinion assembly temporarily into differential housing (8).
3. Install differential carrier assembly with bevel gear (5), leaving a reasonable amount of backlash between bevel gear (5) and bevel pinion (3).
4. Remove bevel pinion assembly (3) and adjust carrier assembly bearing preload by turning nut (4) until torque required to rotate differential assembly is 30 ± 5 lb. in. (34,5 ± 5,8 cm.kg).
5. Install bevel pinion assembly (3) using the amount of shims (2) necessary to align heels of gears.
6. Turn nut (4) and (7) the same amount without changing bearing preload to provide a backlash between bevel gear and bevel pinion of .007 to .014 in. (0,18 to 0,36 mm).

NOTE: Turning nuts (4 and 7) the same amount does not change bearing preload.

7. Check the tooth contact and do Steps 5 and 6 again to make corrections, if necessary. See the topic BEVEL PINION LOCATION for correct tooth contact pattern.

BEVEL PINION LOCATION

If the same pinion shaft is reinstalled, use the same shims that were removed. The pinion can be located by observing the tooth contact pattern made by the pinion gear teeth on the bevel gear teeth. This can be done in the following manner.

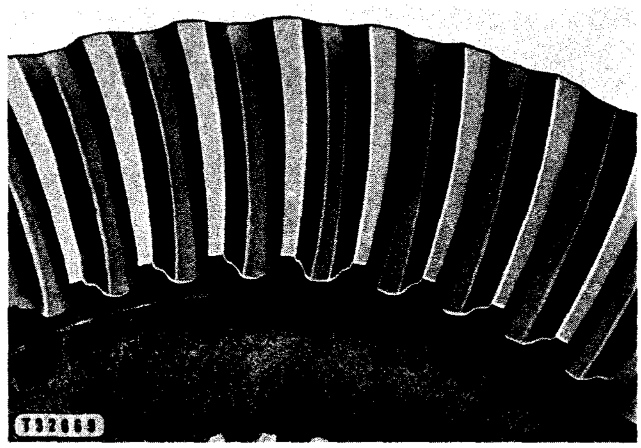


ALIGNING THE BEVEL GEAR AND PINION

Use sufficient shims to align the heel ends of the bevel gear and pinion gear teeth. This will place the pinion in nearly the correct relationship with the bevel gear.

Adjust the bevel gear backlash as described in the topic, DIFFERENTIAL AND BEVEL GEAR. This should give a very close adjustment.

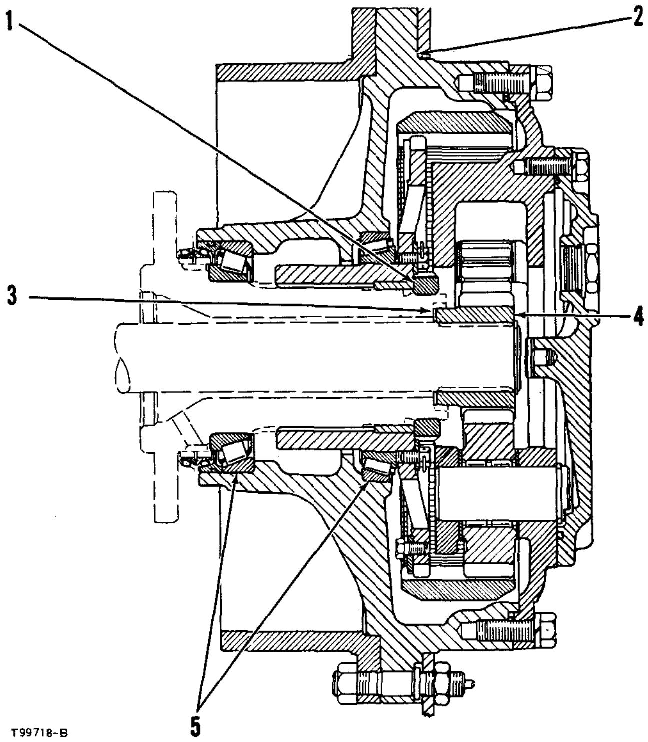
To further check the adjustment, chalk the bevel gear teeth (discolor). Rotate the pinion and bevel gear to produce a tooth contact pattern on the bevel gear teeth. Correct tooth contact starts near the toe and extends approximately 30 percent of the length of a bevel gear tooth.


CORRECT TOOTH CONTACT

If tooth contact is more on one side of a tooth or is near the heel of a tooth, the location of the pinion shaft must be readjusted. Add or remove shims to locate the pinion shaft. Readjust the bevel gear backlash. Produce another tooth contact pattern. It may be necessary to make several pinion and bevel gear adjustments to obtain both correct tooth contact and backlash.

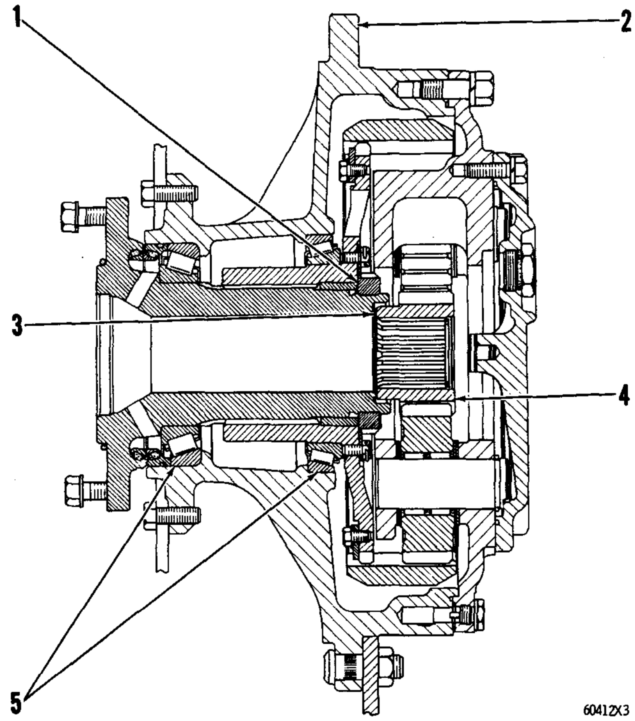
FINAL DRIVE AND WHEEL BEARING ADJUSTMENT

1. Tighten nut (1) slowly while turning wheel (2) to put the bearings (5) into place.
2. Tighten nut (1) to 500 to 600 lb. ft. (69,2 to 83,0 mkg) to put preload on the bearings.
3. Install washer (3) with the steel side next to sun gear (4).
4. Tighten nut (1) an additional amount so the lock can be put into position.
5. Last torque must be 500 to 800 lb. ft. (69,2 to 110,6 mkg).



FINAL DRIVE AND WHEELS (Early Machines)

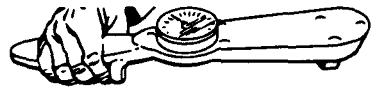
1. Retaining nut. 2. Wheel. 3. Washer. 4. Sun gear. 5. Bearings.



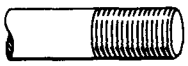
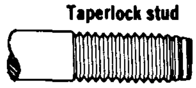
FINAL DRIVE AND WHEELS (Later Machines)

1. Retaining nut. 2. Wheel. 3. Washer. 4. Sun gear. 5. Bearings.

GENERAL TIGHTENING TORQUE FOR BOLTS, NUTS AND TAPERLOCK STUDS



The following charts give the standard torque values for bolts, nuts and taperlock studs of SAE Grade 5 or better quality. Exceptions are given in the Specifications.

THREAD DIAMETER		STANDARD TORQUE	
inches	**millimeters**	**lb. ft.**	**mkg**
Standard thread 		Use these torques for bolts and nuts with standard threads.	
1/4	6,35	9±3	1,24±0,4
5/16	7,94	18±5	2,5±0,7
3/8	9,53	32±5	4,4±0,7
7/16	11,11	50±10	6,9±1,4
1/2	12,70	75±10	10,4±1,4
9/16	14,29	110±15	15,2±2,0
5/8	15,88	150±20	20,7±2,8
3/4	19,05	265±35	36,6±4,8
7/8	22,23	420±60	58,1±8,3
1	25,40	640±80	88,5±11,1
1 1/8	28,58	800±100	110,6±13,8
1 1/4	31,75	1000±120	138±16,6
1 3/8	34,93	1200±150	166±20,7
1 1/2	38,10	1500±200	207±27,7
		Use these torques for bolts and nuts on hydraulic valve bodies.	
5/16	7,94	13±2	1,8±0,3
3/8	9,53	24±2	3,3±0,3
7/16	11,11	39±2	5,4±0,3
1/2	12,70	60±3	8,3±0,4
5/8	15,88	118±4	16,3±0,5
Taperlock stud 		Use these torques for studs with Taperlock threads.	
1/4	6,35	5±2	0,69±0,3
5/16	7,94	10±3	1,4±0,4
3/8	9,53	20±3	2,8±0,4
7/16	11,11	30±5	4,1±0,7
1/2	12,70	40±5	5,5±0,7
9/16	14,29	60±10	8,3±1,4
5/8	15,88	75±10	10,4±1,4
3/4	19,05	110±15	15,2±2,0
7/8	22,23	170±20	23,5±2,8
1	25,40	260±30	35,9±4,1
1 1/8	28,58	320±30	44,2±4,1
1 1/4	31,75	400±40	55±5,5
1 3/8	34,93	480±40	66±5,5
1 1/2	38,10	550±50	76±7

T95416–4

TORQUE CONVERTER
(1T725)

Size of the converter is . . . . 13 in. (330 mm)

(1) Torque for the bolts that hold the impeller to the rotating housing . . . . 20 ± 1 lb. ft. (2,8 ± 0,1 mkg)

(2) Clearance between the turbine and the rotating housing:

Across the diameter . . . . .020 to .040 in. (0,51 to 1,02 mm)

Running . . . . .010 to .020 in. (0,25 to 0,51 mm)

Maximum permissible clearance:

Across the diameter . . . . .045 in. (1,14 mm)

Running . . . . .0225 in. (0,572 mm)

(3) Torque for the bolts that hold the pilot to the rotating housing . . . . 36 ± 2 lb. ft. (5,0 ± 0,3 mkg)

(4) Torque for the bolts that hold the drive gear for the oil pump to the impeller . . . . 20 ± 1 lb. ft. (2,8 ± 0,1 mkg)

(5) Torque for bolt . . . . 81 ± 4 lb. ft. (11,2 ± 0,55 mkg)

(6) Gap for the seal ring . . . . .005 to .015 in. (0,13 to 0,38 mm)

(7) Torque for the bolts that hold the stator to the carrier . . . . 20 ± 1 lb. ft. (2,8 ± 0,1 mkg)

(8) Clearance between the stator and the turbine:

Across the diameter . . . . .012 to .018 in. (0,30 to 0,46 mm)

Running . . . . .006 to .009 in. (0,15 to 0,23 mm)

Maximum permissible clearance:

Across the diameter . . . . .030 in. (0,76 mm)

Running . . . . .015 in. (0,38 mm)

(9) Clearance between the stator and the impeller:

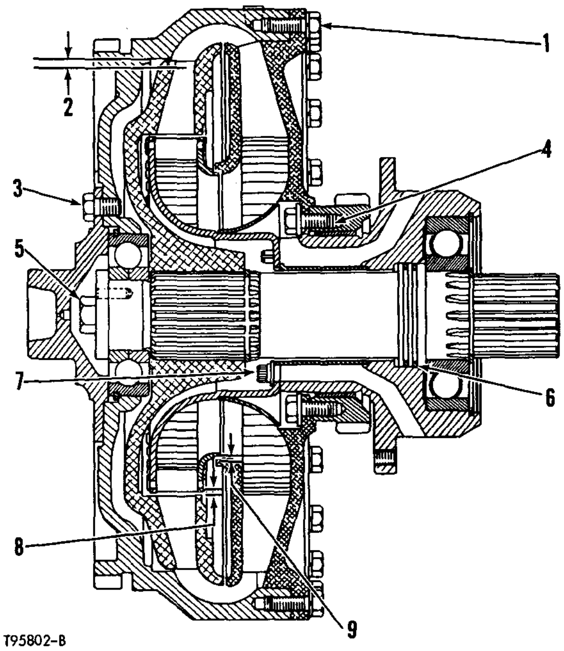
Across the diameter . . . . .009 to .015 in. (0,23 to 0,38 mm)

Running . . . . .0045 to .0075 in. (0,114 to 0,191 mm)

Maximum permissible clearance:

Across the diameter . . . . .024 in. (0,61 mm)

Running . . . . .012 in. (0,30 mm)



T95802-B

OIL FILTER FOR THE TRANSMISSION
(2S6457)

(1) Torque for the plug . . . . 35 ± 5 lb. ft. (4,8 ± 0,7 mkg)

(2) Torque for the plug . . . . 35 ± 5 lb. ft. (4,8 ± 0,7 mkg)

(3) 4M7945 Spring:

Length under test force . . . . 2.12 in. (53,8 mm)

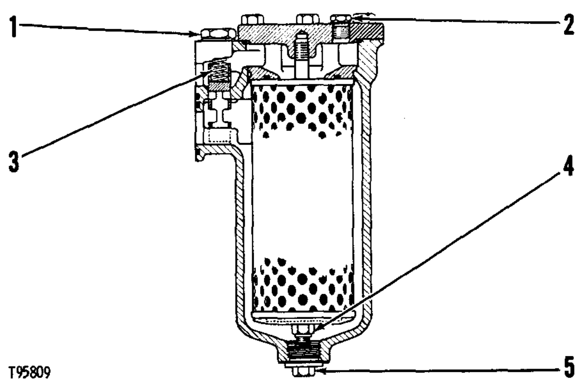
Test force . . . . 3.41 ± .27 lb. (1,6 ± 0,12 kg)

Free length after test . . . . 2.56 in. (65,02 mm)

Outside diameter . . . . .68 in. (17,3 mm)

(4) Torque for the nut that holds the filter element in place . . . . 10 ± 2 lb. ft. (1,4 ± 0,3 mkg)

(5) Torque for the plug . . . . 35 ± 5 lb. ft. (4,8 ± 0,7 mkg)



T95809

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

TRANSMISSION

(1) Thickness of four new discs and three new plates for the No.6 clutch .... 1.089 to 1.131 in. (27,66 to 28,73 mm)

Thickness of one new disc .. .192 to .198 in. (4,88 to 5,03 mm)

Thickness of one new plate . .107 to .113 in. (2,72 to 2,87 mm)

(2) Diameter of the shaft for the planet gears for the No.5 clutch ..... 1.0407 to 1.0411 in. (26,434 to 26,444 mm)

(3) Thickness of two new discs and one new plate for the No.5 clutch .... .631 to .649 in. (16,03 to 16,48 mm)

Thickness of one new disc .. .192 to .198 in. (4,88 to 5,03 mm)

Thickness of one new plate . .247 to .253 in. (6,27 to 6,43 mm)

(4) Thickness of three new discs and two new plates for the No.4 clutch .... 1.070 to 1.100 in. (27,18 to 27,94 mm)

Thickness of one new disc .. .192 to .198 in. (4,88 to 5,03 mm)

Thickness of one new plate . .247 to .253 in. (6,27 to 6,43 mm)

(5) Diameter of the shaft for the planet gears of the No.4 clutch ..... 1.0407 to 1.0411 in. (26,434 to 26,444 mm)

(6) Thickness of three new discs and two new plates for the No.3 clutch .... 1.070 to 1.100 in. (27,18 to 27,94 mm)

Thickness of one new disc .. .192 to .198 in. (4,88 to 5,03 mm)

Thickness of one new plate . .247 to .253 in. (6,27 to 6,43 mm)

(7) Diameter of the shaft for the planet gears for the No.2 and No.3 clutches 1.6688 to 1.6694 in. (42,388 to 42,403 mm)

(8) Thickness of four new discs and three new plates for the No.1 and No.2 clutches .... 1.509 to 1.551 in. (38,33 to 39,40 mm)

Thickness of one new disc .. .192 to .198 in. (4,88 to 5,03 mm)

Thickness of one new plate . .247 to .253 in. (6,27 to 6,43 mm)

(9) Torque for the eight bolts holding clutch housings to transmission case .... 85 ± 5 lb. ft. (11,8 ± 0,7 mkg)

(10) Diameter of the shaft for the planet gears for the No.1 clutch ..... 1.6688 to 1.6694 in. (42,388 to 42,403 mm)

(11) 9H5537 Spring (30 springs) for the No.1, No.2 and No.6 clutches:

Length under test force .... 1.84 in. (46,7 mm)

Test force .... 28.70 ± 2.30 lb. (13,0 ± 1,0 kg)

Free length after test .... 2.47 in. (62,7 mm)

Outside diameter .... .562 in. (14,27 mm)

(12) 4M9592 Spring (30 springs) for the No.3, No.4 and No.5 clutches:

Length under test force .... 1.375 in. (34,93 mm)

Test force .... 26.2 ± 1.3 lb. (11,9 ± 0,6 kg)

Free length after test .... 1.760 in. (44,70 mm)

Outside diameter .... .562 in. (14,27 mm)

(13) 3K2510 Reaction Pin (five) for the No.3, No.4, and No.5 clutches:

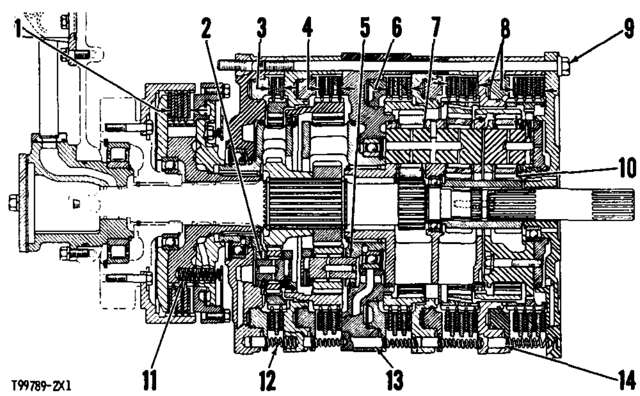
Length .... 8.25 in. (209,6 mm)

Outside diameter ..... .4975 ± .0005 in. (12,637 ± 0,013 mm)

(14) 9H5546 Reaction Pin (five) for the No.1 and No.2 clutches:

Length .... 6.59 in. (167,4 mm)

Outside diameter ..... .4975 ± .0005 in. (12,637 ± 0,013 mm)



HYDRAULIC CONTROLS FOR THE TRANSMISSION

(1) Torque for the bolts (6 point heads) . . . . . 35 ± 3 lb. ft. (4,8 ± 0,4 mkg)

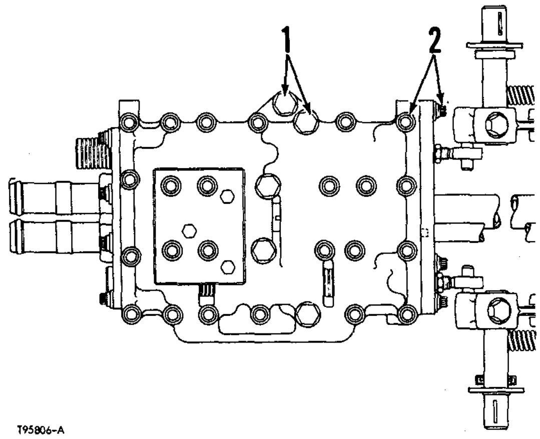
(2) Torque for the bolts (12 point head) . . . . . 22 ± 3 lb. ft. (3,0 ± 0,4 mkg)

(3) 4M2381 Spring for the poppet valve:

Length under test force . . . . . .48 in. (12,2 mm)
Test force . . . . . .517 ± .041 lb. (0,23 ± 0,02 kg)
Free length after test . . . . . .89 in. (22,6 mm)
Outside diameter . . . . . .30 in. (7,6 mm)

(4) 7S4596 Spring for the load piston and relief valve (outer):

FIRST TEST:
Length under test force . . . . . 3.19 in. (81,0 mm)
Test force . . . . . 8.50 ± .60 lb. (3,9 ± 0,3 kg)
SECOND TEST:
Length under test force . . . . . 1.94 in. (49,3 mm)
Test force . . . . . 47.0 ± 1.75 lb. (21,3 ± 0,8 kg)
Free length after test . . . . . 3.45 in. (87,6 mm)
Outside diameter . . . . . .830 in. (21,08 mm)



T95806-A

(5) 7S4595 Spring for the load piston and relief valve (inner):

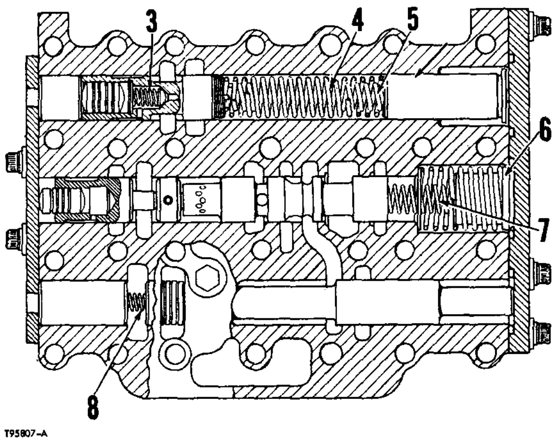
FIRST TEST:
Length under test force . . . . . 5.36 in. (136,1 mm)
Test force . . . . . 10.70 ± .76 lb. (4,9 ± 0,3 kg)
SECOND TEST:
Length under test force . . . . . 4.11 in. (104,4 mm)
Test force . . . . . 54.10 ± 2.06 lb. (24,5 ± 0,9 kg)
Free length after test . . . . . 5.65 in. (143,5 mm)
Outside diameter . . . . . .580 in. (14,73 mm)

(6) 3S9950 Spring (outer) for the differential and safety valve:

Length under test force . . . . . 1.375 in. (34,93 mm)
Test force . . . . . 17.6 ± .7 lb. (8,0 ± 0,3 kg)
Free length after test . . . . . 3.44 in. (87,4 mm)
Outside diameter . . . . . 1.25 in. (31,8 mm)

(7) 3S9949 Spring (inner) for the differential and safety valve:

Length under test force . . . . . 2.28 in. (57,9 mm)
Test force . . . . . 12.5 ± .5 lb. (5,6 ± 0,2 kg)
Free length after test . . . . . 4.50 in. (114,3 mm)
Outside diameter . . . . . .59 in. (15,0 mm)



T95807-A

(8) 7B9411 Spring for the neutralizer valve:

Length under test force . . . . . 2.62 in. (66,5 mm)
Test force . . . . . 19.8 ± 1.6 lb. (9,0 ± 0,7 kg)
Free length after test . . . . . 3.34 in. (84,8 mm)
Outside diameter . . . . . .375 in. (9,53 mm)

(8) 1P9602 Spring for the neutralizer valve:

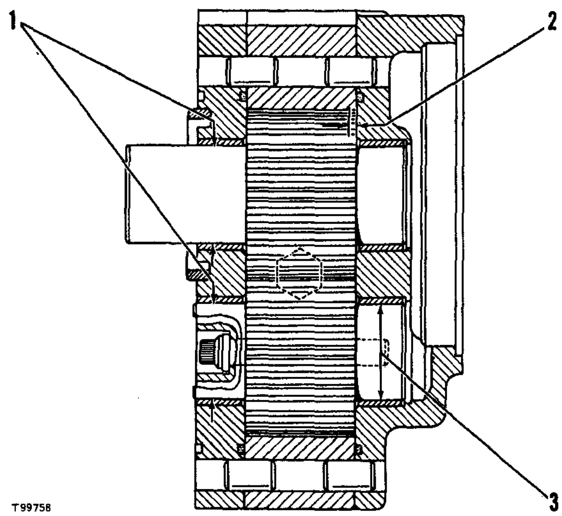
Length under test force . . . . . 2.625 in. (66,68 mm)
Test force . . . . . 19.984 lb. (9,16 kg)
Free length after test . . . . . 3.125 in. (79,38 mm)
Outside diameter . . . . . .375 in. (9,53 mm)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

HYDRAULIC PRESSURES

Transmission pump .... 360 ± 15 psi (25,31 ± 1,1 kg/cm²)
Primary pressure at speed clutch ..... 75 ± 5 psi (5,3 ± 0,4 kg/cm²)
Direction clutch (amount less than in speed clutch) .... 50 ± 8 psi (3,5 ± 0,6 kg/cm²)
Speed clutch .... 360 ± 15 psi (25,31 ± 1,1 kg/cm²)
Converter inlet (bench test) (maximum) .... 119 psi (8,4 kg/cm²)
Converter outlet .... 40 ± 10 psi (2,8 ± 0,7 kg/cm²)
Transmission lubrication (high idle) .... 8 ± 3 psi (0,6 ± 0,2 kg/cm²)

OIL PUMP FOR THE TRANSMISSION
(7S4629)



T99758

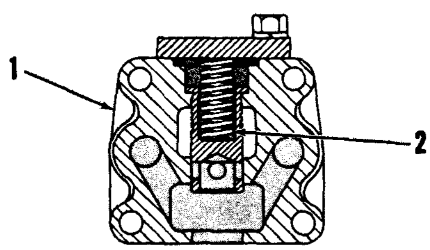
Rotation is counterclockwise when seen from the drive gear.

Bench test using SAE 10W oil at 120° F (49° C)

Output .... 18.1 U.S. gpm (68,5 lit/min)
with pump at .... 1894 rpm
at a pressure of .... 230 psi (16,2 kg/cm²)

(1) Diameter of the shafts .... 1.6231 to 1.6235 in. (41,227 to 41,237 mm)
(2) Clearance between the gears and the cover .... .0019 to .0031 in. (0,048 to 0,079 mm)
(3) Bore of the bearings in the cover and base .... 1.6250 to 1.6256 in. (41,275 to 41,290 mm)

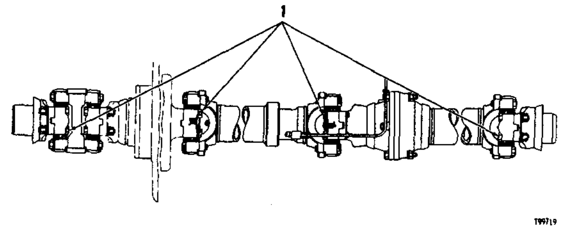
RELIEF VALVE FOR LUBRICATION
(3S6860)



T93556

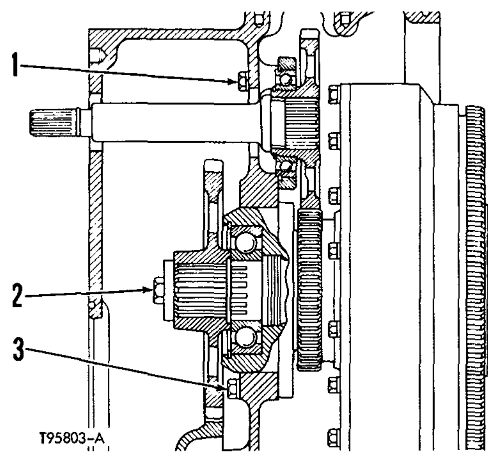
(1) Pressure at which the valve opens .. 9 ± 3 psi (0,6 ± 0,2 kg/cm²)
(2) 8M8597 Spring:
Length under test force .... 1.38 in. (35,1 mm)
Test force .... 3.61 ± .29 lb. (1,6 ± 0,1 kg)
Free length after test .... 2.55 in. (64,8 kg)
Outside diameter .... .594 in. (15,09 kg)

DRIVE SHAFT AND UNIVERSAL JOINTS



(1) Torque for the bolts . . . . 98 ± 10 lb. ft. (13,6 ± 1,4 mkg)

TORQUE CONVERTER, TRANSFER GEARS AND PUMP DRIVE



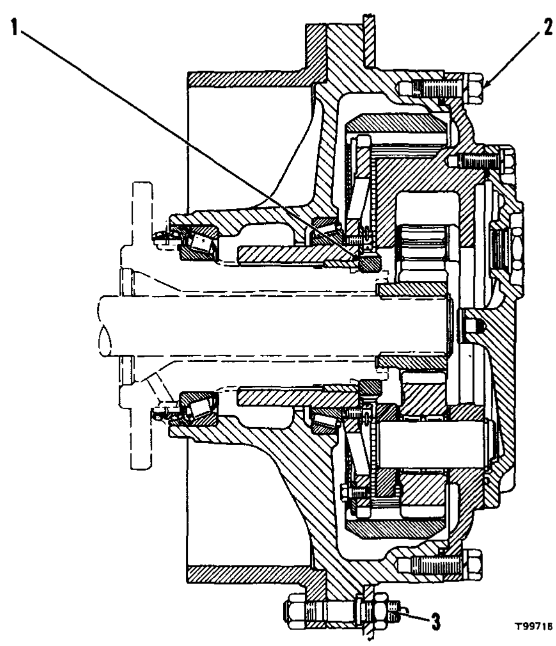
Torque for the bolts that hold the converter housing to the flywheel housing . . . . 36 ± 2 lb. ft. (5,0 ± 0,3 mkg)

(1) Torque for the bolts that hold the drive gear bearing to the converter housing . . . . 36 ± 2 lb. ft. (5,0 ± 0,3 mkg)

(2) Torque for the bolts that hold the bearing retainer for the output shaft . . . . 81 ± 4 lb. ft. (11,2 ± 0,6 mkg)

(3) Torque for the bolts that hold the carrier to the converter housing . . . . 40 ± 5 lb. ft. (5,5 ± 0,7 mkg)

FINAL DRIVE
(EARLIER MACHINES)



(1) Torque for the wheel nut while turning the wheel to put the bearings in the correct place . . 550 ± 50 lb. ft. (76,1 ± 6,9 mkg)

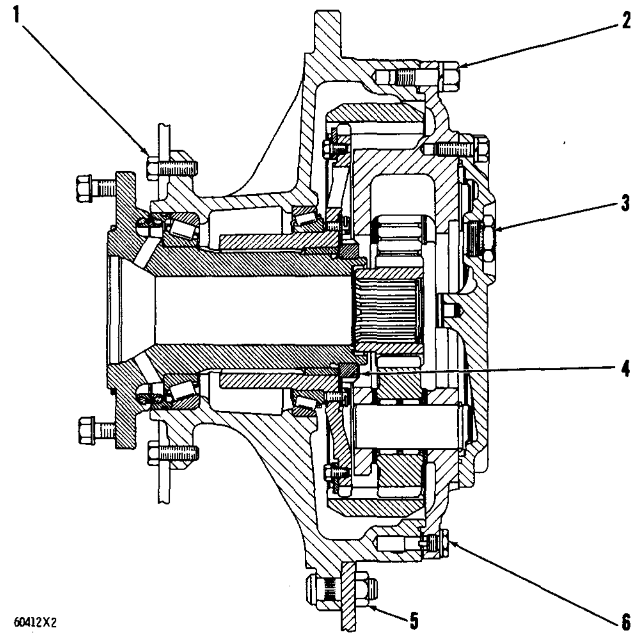
Last torque for wheel nut . . 650 ± 150 lb. ft. (89,9 ± 20,7 mkg)

(2) Torque for the bolts that hold carrier to the wheel . . . . 195 ± 18 lb. ft. (27,0 ± 2,5 mkg)

(3) Torque for the nuts that hold the rim to the wheel . . . . 345 ± 30 lb. ft. (47,7 ± 4,1 mkg)

NOTE: FOR TORQUE VALUES NOT GIVEN, SEE THE FIRST PAGE OF SPECIFICATIONS FOR GENERAL TIGHTENING TORQUES

FINAL DRIVE AND WHEEL
(LATER MACHINES)



(1) Torque for the bolt that holds the brake disc to the wheel .... 165 ± 20 lb. ft. (22,8 ± 2,8 mkg)

(2) Torque for the bolts that hold the carrier to the wheel .... 195 ± 18 lb. ft. (27,0 ± 2,5 mkg)

(3) Torque for the plug .... 75 ± 5 lb. ft. (10,4 ± 0,7 mkg)

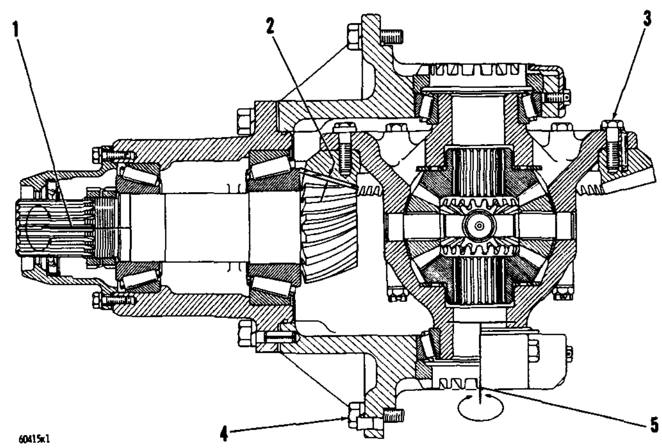
(4) Torque for the nut .... 500 to 600 lb. ft. (69,2 to 83,0 mkg)

Last torque (after alignment of slot) .... 500 to 800 lb. ft. (69,2 to 110,6 mkg)

(5) Torque for the nut that holds the rim to the wheel .... 400 ± 30 lb. ft. (55,3 ± 4,1 mkg)

(6) Torque for the plug .... 15 ± 5 lb. ft. (2,1 ± 0,7 mkg)

DIFFERENTIAL AND BEVEL GEAR



(1) Torque needed to turn the bevel pinion with a preload on the bearings ...... 6 to 10 lb. in. (6,9 to 11,5 cm.kg)

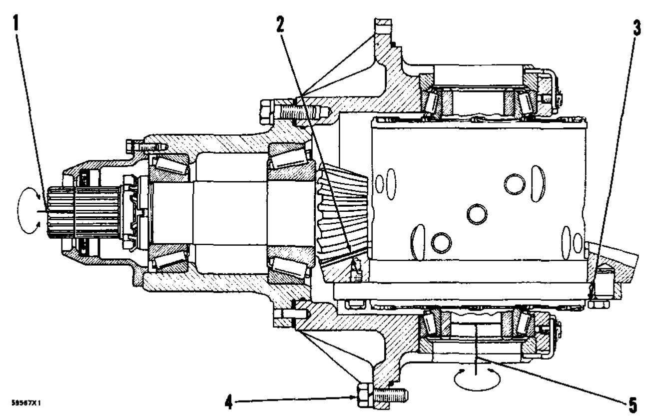
(2) Amount of free motion (backlash) between the bevel gear and the bevel pinion .... .007 to .014 in. (0,18 to 0,36 mm)

(3) Torque for the bolts that hold the bevel gear to the case .... 98 ± 9 lb. ft. (13,6 ± 1,3 mkg)

(4) Torque for the bolts that hold the carrier to the axle housing .... 195 ± 18 lb. ft. (26,97 ± 2,5 mkg)

(5) Torque needed to turn the differential assembly with a preload on the carrier bearings .... 25 to 35 lb. in. (28,8 to 40,4 cm.kg)

TORQUE PROPORTIONAL DIFFERENTIAL



(1) Torque needed to turn the bevel pinion with a preload on the bearings ...... 6 to 10 lb. in. (6,9 to 11,5 cm.kg)

(2) Amount of free motion (backlash) between the bevel pinion and bevel gear .... .007 to .014 in. (0,18 to 0,36 mm)

(3) Torque for the bolts that hold the bevel gear to the case .... 98 ± 9 lb. ft. (13,6 ± 1,3 mkg)

(4) Torque for the bolts that hold the carrier to the axle housing .... 195 ± 18 lb. ft. (26,97 ± 2,5 mkg)

(5) Torque needed to turn the differential assembly with a preload on the carrier bearings .... 25 to 35 lb. in. (28,8 to 40,4 cm.kg)

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