Section **3**

Transmission and Drive Train

ENGINE DRIVE COUPLING

GENERAL DESCRIPTION

The machine is fitted with a direct drive coupling from the output of the engine via a drive shaft to the input of the torque converter on the transmission, allowing the engine to sit lower in the frame. The flywheel on the engine is coupled to the engine drive coupling via a flexible coupling. The output of the drive coupling is coupled to the transmission by an end yoke drive line coupling.

The engine drive coupling is directly coupled to the engine flywheel so whenever the engine is running the drive coupling output and input drive line to the torque converter is rotating. Isolate the engine if access to the engine drive coupling or drive lines is required.

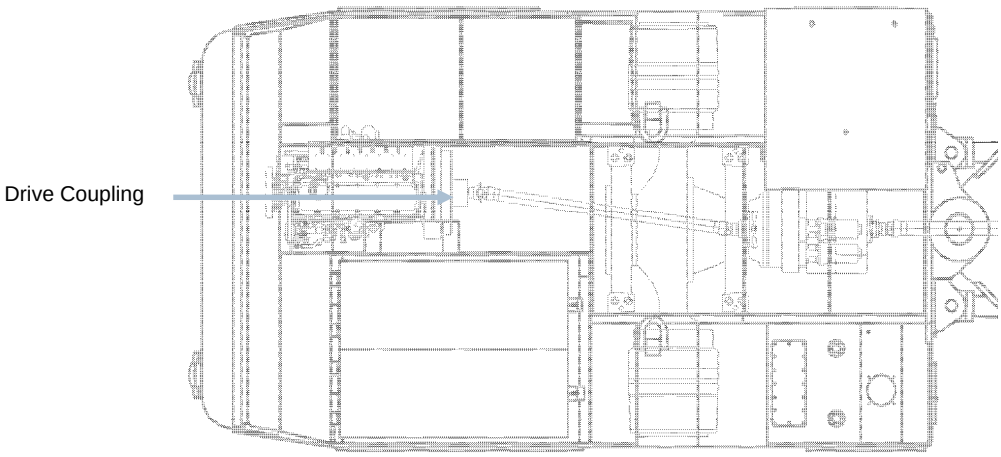
SAFETY PRECAUTIONS

The following safety precautions are not intended to be exhaustive. Safe Work Practices should be used when servicing or operating heavy machinery.

ALWAYS give the engine an opportunity to cool down before performing any servicing.

ALWAYS wear personal protective equipment including safety glasses, gloves and suitable clothing.

ALWAYS be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys and drive lines) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.



CHECKING AND GREASING OF DRIVE COUPLING

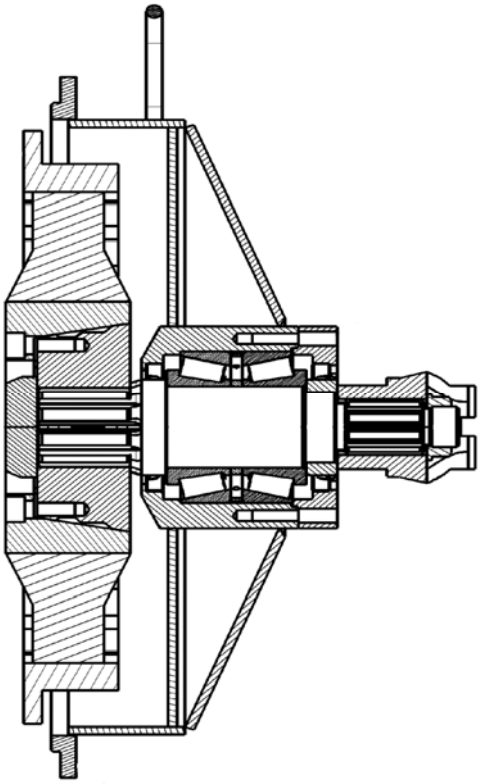
Care and Maintenance

Check the drive coupling as follows:

1. Park the machine on flat, level ground.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Check for excessive free play in bearings.
4. Locate the remote grease point to the side of the air cleaner assembly.
5. Greasing of the coupling bearings should be carried out at 250 hour service intervals.

ONLY Shell Stamina RL2 grease should be used for drive coupling bearing lubrication.

DO NOT over grease drive coupling assembly. The greasing of the assembly is to replenish the lubricant not to replace it.



Drive Coupling Assembly

Round Head Grease Nipple

Greasing Port and Relief Port

Engine Drive Coupling

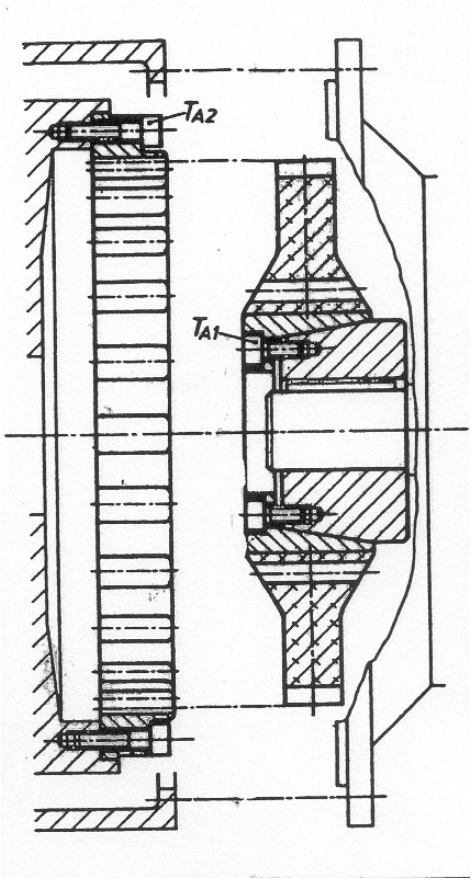
REMOVAL AND INSTALLATION DRIVE COUPLING

Removal

1. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
2. Remove output drive line.
3. Remove bolts from drive coupling housing and sling housing for lifting.
4. Take weight of drive hosing and slide back towards front of machine until rubber drive clears the engine fly wheel housing.
5. Remove the outer ring bolted to the flywheel by removing the bolts shown as TA2.
6. The rubber disc is removed by removing the bolts shown as TA1 and withdrawing it off the taper.

Installation

1. Fit the new ring to the flywheel.
2. Tighten the bolts in a cross sequence to pull the ring up squarely to the flywheel face.
3. Torque the bolts (Reference TA2) to 110 Nm.
4. Ensure ring is fully bedded against the flywheel face.
5. The driven hub is fitted onto the driven shaft.
6. The rubber disc with the vulcanised ring is then assembled to the driven hub with bolts (Reference TA1) which must be tightened to the correct torque of 85 Nm.
7. After these are fitted slide the drive coupling assembly back and line up the rubber coupling teeth with the corresponding teeth on the ring bolted to the flywheel.
8. Fit the bolts and bolt drive assembly to the engine flywheel housing.
9. Fit the output drive line and replace all covers.
10. Grease coupling as per instructions in page 4.



TRANSMISSION/TORQUE CONVERTER

GENERAL DESCRIPTION

The transmission used on the MH-40 has four forward and reverse speeds with forward and reverse modulation.

When the engine is running the converter charging pump draws oil from the transmission sump through the removable oil suction screen and directs it through the pressure regulating valve and the oil filter. The pressure regulating valve maintains pressure to the transmission control cover for actuating the direction and speed clutches. This requires a small portion of the total volume of oil used in the system. The remaining volume of oil is directed through the torque converter circuit to the oil cooler and returns to the transmission for positive lubrication. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is spring loaded to hold the valve in the closed position. When a specific pressure is achieved, the valve spool works against the spring until a port is exposed along the side of the bore. This sequence of events provides the proper system pressure.

After entering the converter housing the oil is directed through the stator support to the converter blade cavity and exits in the passage between the turbine shaft and converter support. The oil then flows out of the converter to the oil cooler. After leaving the cooler, the oil is directed to a fitting on the transmission. Then through a series of tubes and passages which lubricates the transmission bearings and clutches. The oil then gravity drains to the transmission sump.

The hydraulic torque converter consist basically of three elements and related parts to multiply engine torque. The engine power is transmitted from the engine flywheel to the impeller element through the impeller cover. This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components for torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its centre and discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the output shaft of the torque converter. This element receives fluid at its outer edge and discharges at its centre. Fluid directed by the impeller out into the blading in the turbine and reaction member. This is the means by which the hydraulic torque converter multiplies torque.

The reaction member of the torque converter is located between and at the centre of inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

The torque converter will multiply engine torque to its designed maximum multiplication ratio when the output shaft is at zero RPM. Therefore, we can say that when the output shaft is decreasing in speed the torque multiplication is increasing.

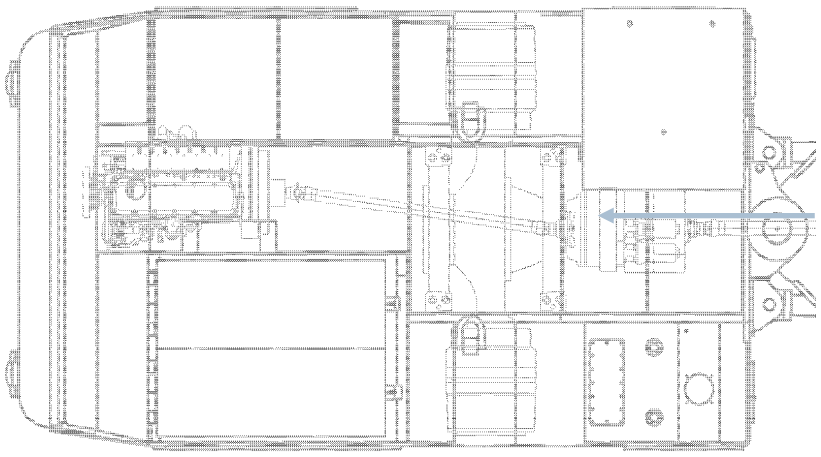
The shift control valve assembly consists of a valve body with selector valve spools. A detent ball and spring in the selector spool provides one position for each speed range. A detent ball and spring in the direction of the spool provides three positions, one each for forward, neutral and reverse.

With the engine running and the directional control lever in the neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction clutch as desired. When either directional clutch is selected the opposite clutch is relieved of pressure and vents back through the direction selector spool. The same procedure is used in the speed selector.

The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is oil tight by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved. A heavy backup plate is then inserted and secured with a snap ring. A hub with outside diameter splines is inserted into the splines of the discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control valve, through a tube, to the chosen clutch shaft. This shaft has a drilled passage way for oil under pressure to enter the shaft. Oil pressure sealing rings are located on the clutch shaft. These rings direct oil under pressure to a desired clutch. Pressure of the oil forces the piston and discs against the heavy backup plate. The disc, with teeth on the outer diameter, clamping against the disc with teeth on the inner diameter, enables the hub and clutch shaft to be locked together and allows them to drive as a unit.

There are bleed balls in the clutch piston which allow quick escape of oil when the pressure to the piston is released.



SAFETY PRECAUTIONS

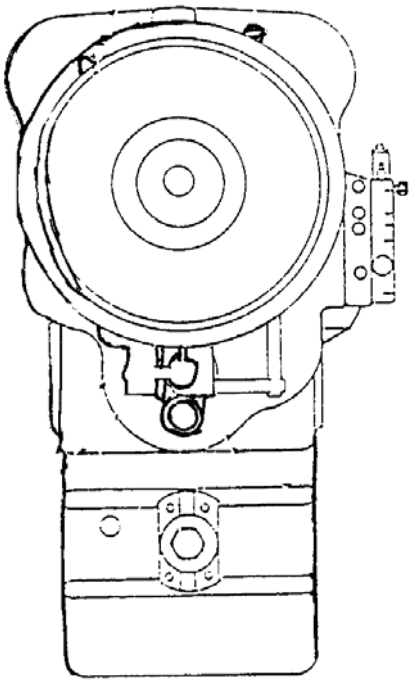
The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

ALWAYS give the transmission an opportunity to cool down before servicing.

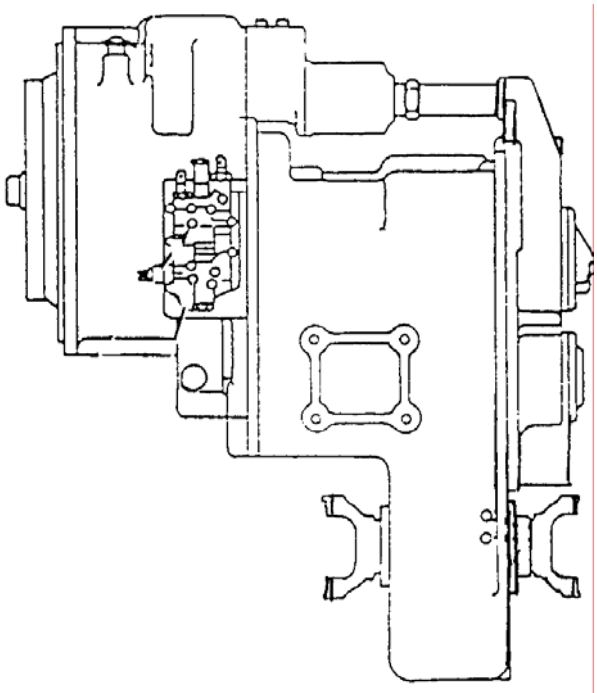
ALWAYS wear personal protective equipment including safety glasses, gloves and suitable clothing

ALWAYS clean up any spilled oil immediately to remove the potential for slip, trip or fall injuries.

ALWAYS be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys and drive lines) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.



FRONT VIEW



SIDE VIEW

CHECKING/FILLING THE TRANSMISSION OIL

Care and Maintenance

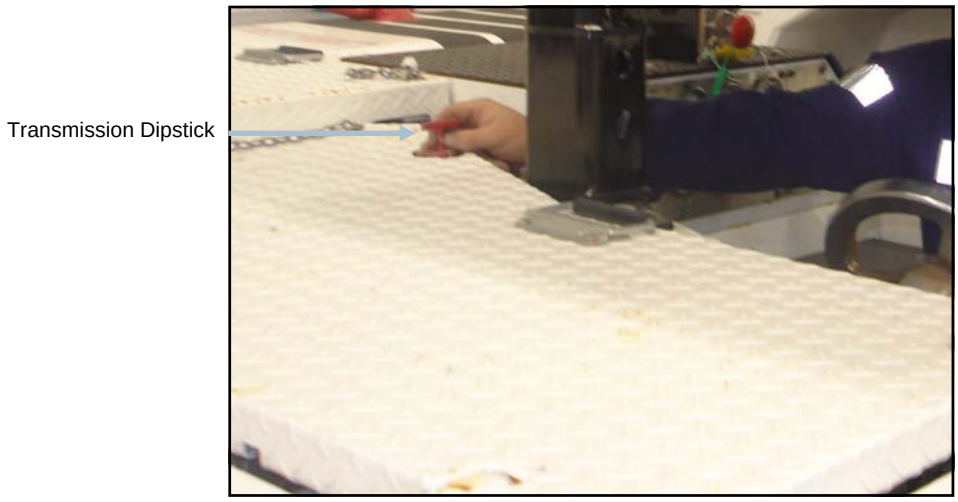
Check the transmission oil level daily and fill as required.

To check and fill the transmission oil level:

The oil temperature must be between 82.2°C and 93.3°C. This can be read from the transmission temperature gauge in the operator's compartment. *Do not check the level of the transmission with cold oil*. To raise the transmission oil temperature to its operating level it is necessary to work the machine or to *stall* out the torque converter. To stall out the machine apply the brakes and engage the transmission control levers in the forward and high speed positions. Release the park brake and accelerate the engine to ½ throttle. Hold the engine at stall until the desired transmission oil temperature is reached.

Excessive transmission stall will overheat and damage the torque converter.

1. Once the correct transmission oil temperature has been reached park the machine on flat, level ground and leave it running.
2. Place the transmission in *neutral*, apply the park brake.
3. The transmission dipstick is located on the top of the transmission directly in front of the operator and is accessible through a hole in the transmission guard.
4. The engine should be idling at 650 RPM.
5. Remove the dipstick by pulling it upwards and wipe it with a clean, lint free cloth.
6. Reinsert the dipstick into the spout and push it all the way home.
7. Withdraw the dipstick and check the oil level. The level is to be maintained at the *full* mark.
8. If necessary top up the oil level via the fill point with the correct transmission lubricant specified in Section 1.



CHANGING THE TRANSMISSION OIL FILTER ELEMENT

The filter elements should be changed at 100 service hours on new, rebuilt or repaired units and then 250 service hours from there on. The machine is fitted with a single element filter assembly fitted to the charge pump on top of the transmission.

To change the transmission oil filter:

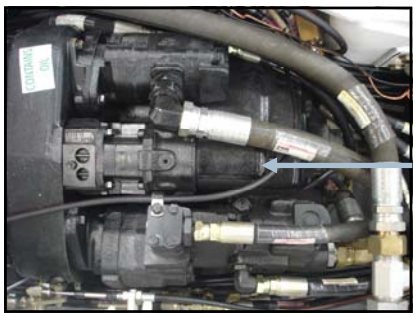
1. Park the machine on flat, level ground. If possible in a low dust environment.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Lift the transmission cover.
4. Locate the filter element housing on the top of the transmission between hydraulic pumps.
5. Ensure the transmission oil has had sufficient time to cool. Check by feeling the surface temperature of the oil filter element housing.
6. If necessary clean down the area around the oil filter element housing with a hose and dry the area to minimise the possibility of any contaminants getting into the system.
7. Place a suitable container beneath the oil filter element housing.
8. Remove the filter element housing using a socket on the nut provided.

There is a spring positioned inside the filter housing between the filter element and the end of the housing.

9. Dispose of the oil filter element and the housing o-ring in a responsible manner.
10. Clean the filter adaptor with a clean lint free cloth.
11. Lightly coat the new filter element housing o-ring with clean transmission oil.
12. Install the spring and new oil filter element into the oil filter element housing. Hand tighten (*do not over tighten)*.

Over tightening the oil filter element housing may distort or crack the filter housing resulting in an oil leak.

13. Add oil as required to bring the oil level to the *low* mark on the dipstick.
14. Start and run the engine idle at 650 RPM to prime the converter and lines. Check for any leaks around the filters.
15. Recheck the level with the engine running at 650 RPM and add oil till the level is at the *low* mark.
16. When oil temperature is hot between 82.2°C and 93.3°C on the transmission temperature gauge in the operator's compartment) check the level of the oil again and bring it up to the *full* mark on the dipstick.



CHANGING THE TRANSMISSION OIL

The transmission oil is to be changed every 1000 service hours. When the transmission oil is changed the oil filter elements should be replaced and the charge pump suction strainer should be cleaned.

Servicing

To change the transmission oil:

1. Park the machine on flat, level ground. If possible in a low dust environment.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. The transmission drain plug is located at the bottom of the front side of the main transmission case. If necessary clean down the area around the drain plug to minimise the possibility of any contaminants getting into the system.
4. Place a suitable container beneath the transmission drain point. *NOTE:* the approximate volume of the transmission and torque converter is 40 litres).
5. Remove the drain plug and allow the transmission to drain.
6. Check the condition of the o-ring on the drain plug and replace if necessary.
7. Refit the drain plug.
8. Replace the transmission oil filter elements.

Over tightening the oil filter element housing may distort or crack the it resulting in an oil leak.

9. Add oil via the dipstick orifice as required to bring the oil level to the *low* mark on the dipstick.
10. Start and run the engine and run at 650 RPM to prime the converter and lines. Check for any leaks around the filters.
11. Recheck the oil level with the engine running at 650 RPM and add oil till the level is at the *low* mark.
12. Stall the torque converter as previously described and when the oil temperature is between 82.2°C and 93°C check the level of the oil again and bring it up to the *full* mark on the dipstick.
13. Recheck all drain plugs, lines, filters, etc for leaks and tighten where necessary.

Transmission Dipstick

TROUBLESHOOTING GUIDE

The following information has been provided to aid in identifying the cause of a problem when examining a malfunctioning transmission. It is necessary to consider the torque converter charging pump, transmission, oil cooler and all connecting lines as a complete unit when determining the source of the problem since the condition and proper operation of all of these components effects the performance. By referring to how the unit operates together with this information service personnel should be able to correct any malfunction that may occur with the transmission.

The troubleshooting procedure consists of two classifications: Mechanical and Hydraulic.

Mechanical Checks

Before examining the transmission from a hydraulic point of view, the following mechanical checks should be made:

1. Check all control linkages are properly connected and adjusted at all connecting points.
2. Check all transmission control levers and cables for bindings and restrictions in travel that would prevent full engagement. Shift the transmission control levers by hand at the control valve, if full engagement cannot be obtained the cause may be in the control cover and valve assembly.
3. Check the input shaft is rotating when the engine is running.

Hydraulic Checks

Before checking the torque converter, transmission or associated hydraulic system for pressures and rate of oil flow, it is essential that the transmission oil level is *checked* first.

Cause	Remedy
1. Low oil level	1. Fill to correct level
2. Clutch pressure regulating valve stuck open	2. Clean valve spool and housing or replace
3. Faulty charging pump	3, Replace pump
4. Broken or worn clutch shaft or piston sealing rings	4. Replace sealing rings
5. Clutch piston bleed valve stuck open	5. Remove piston and clean bleed valves

Low Converter Charging Pump Output

Cause	Remedy
1. Low Oil level	1. Fill to correct level
2. Suction screen blocked	2. Clean suction screen
3. Defective oil pump	3. Replace pump

Overheating

Cause	Remedy
1. Worn oil sealing rings	1. Remove, Disassemble and rebuild converter assembly
2. Defective oil pump	2. Replace pump
3. Low oil level	3. Fill to correct level
4. Excessive load	4. Ensure machines are not overloaded

Noisy Converter

Cause	Remedy
1. Worn coupling gears	1. Replace
2. Worn oil pump	2. Replace pump
3. Worn or damaged bearings	3. Remove, disassemble and rebuild converter

Lack of Power

Cause	Remedy
1. Low engine RPM at converter stall	1. Check engine governor and injectors
2. High engine RPM at converter stall	2. Check clutch pressure and pump output
3. See ‘Overheating’ and make the same checks	3. Remove, disassemble and rebuild converter

SERVICE DATA

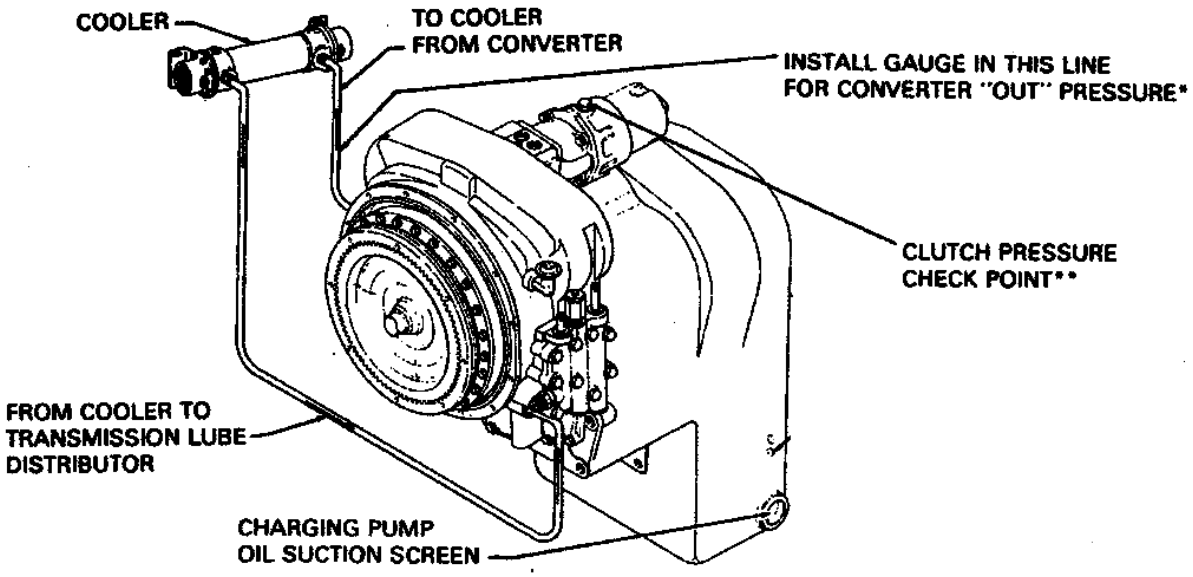
Converter Outlet Pressure

To test the converter outlet pressure perform the following steps:

1. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
2. Remove the cover over the top of the transmission. This panel is located in front of the operator's compartment.
3. Attach a 0-500 kPa pressure gauge to the port adjacent to the converter outlet temperature pick up.
4. Start the machine and bring the transmission oil temperature to between 82.2°C and 93.3°C. This can be read from the transmission temperature gauge in the operator's compartment. To bring the temperature to this level it is necessary to work the machine or to *stall* out the converter. To stall out the machine apply the brakes and engage the transmission control levers in the forward and high gear positions. Accelerate the engine to ½ to ¾ throttle. Hold the engine at stall until the desired outlet temperature is reached.

Excessive transmission stall will overheat and damage the torque converter.

5. Once the correct transmission oil temperature has been reached park the machine on flat, level ground and leave it running.
6. Place the transmission in neutral and apply the park brake.
7. The minimum converter outlet pressure is 172.4 kPa (25 psi) when the engine speed is 2000 RPM.
8. The maximum converter outlet pressure is 482.6 kPa (70 psi) when the engine is at no load governed speed (2250 RPM).
9. Shutdown the machine, allow sufficient time for the transmission to cool, remove the pressure gauge and replace the test port plug.

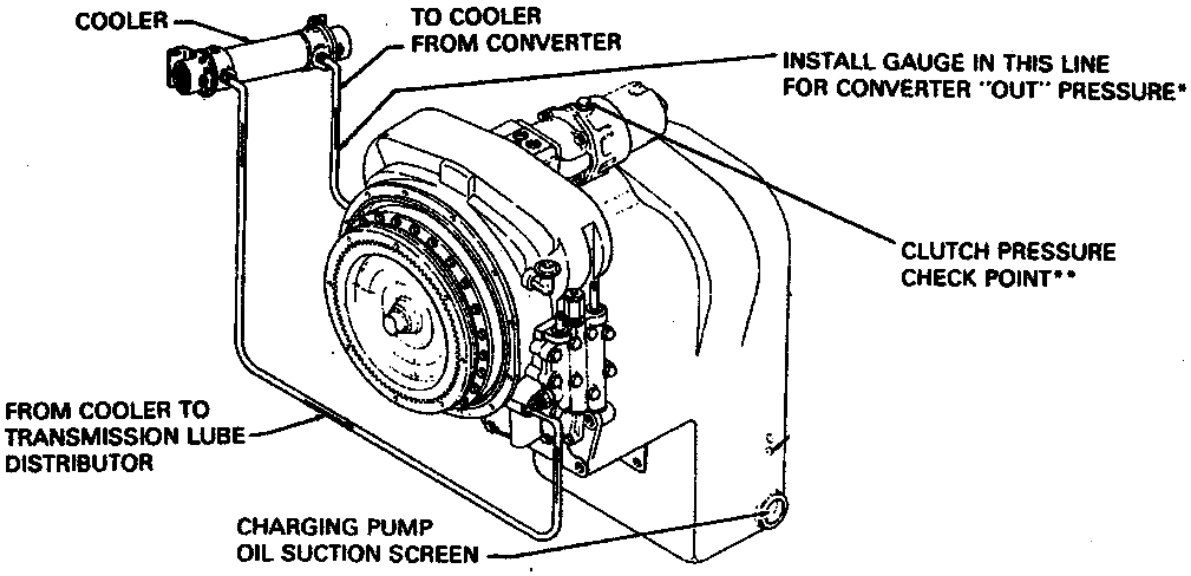


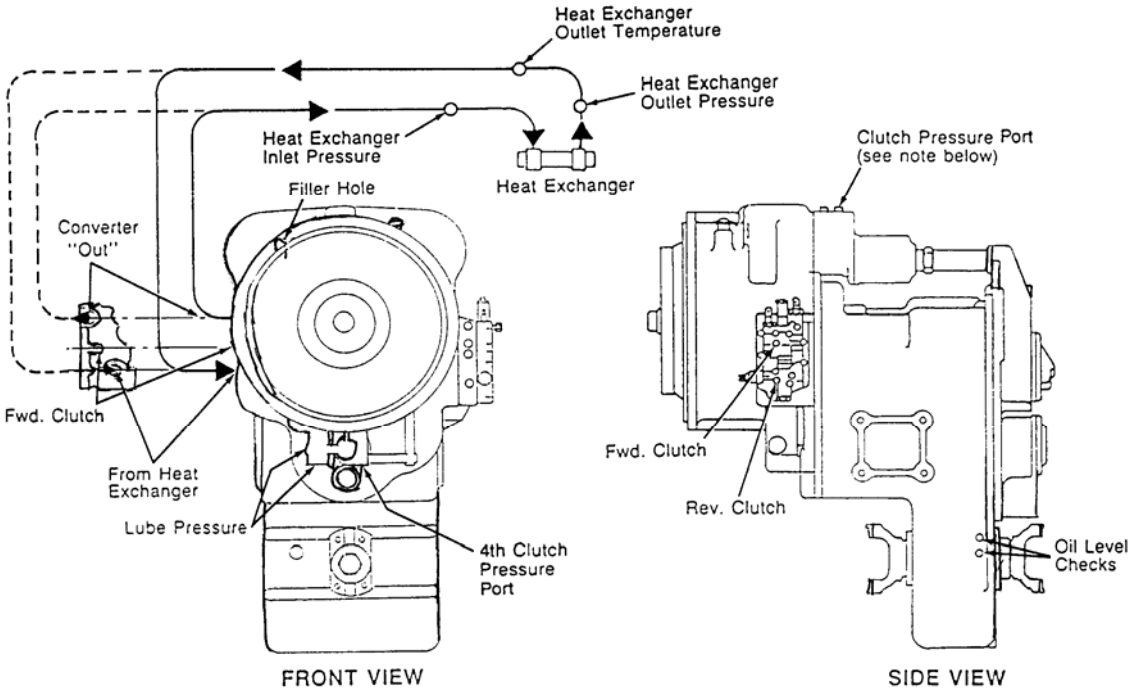
Clutch Pressure

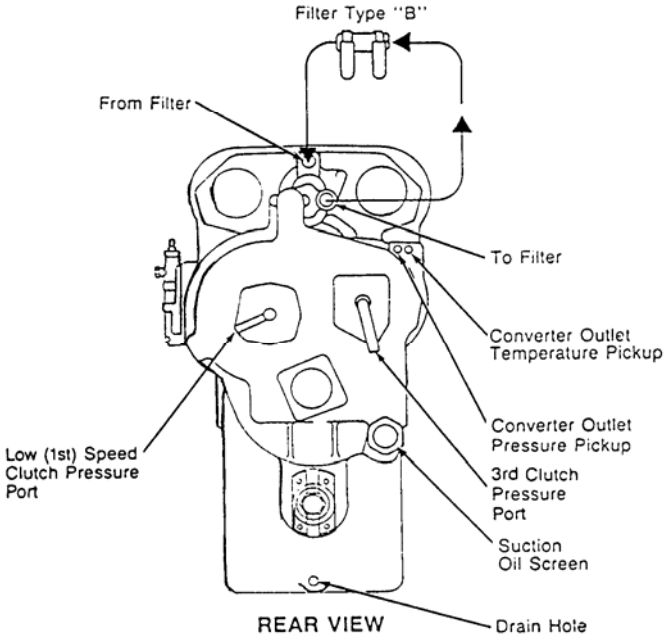
The clutch pressure is measured from the clutch pressure port on the top of the transmission. The normal clutch pressure operating range is 1680 kPa to 1930 kPa (240 psi to 280 psi).

To check the transmission clutch pressure:

1. Release the park brake as the transmission is fitted with a park brake actuated declutch valve in the forward and reverse directions and pressures will not be a true reading.
2. Allow the transmission oil to warm up to 82.2°C to 93.3°C (180°F to 200°F). See page 8.
3. With the brake applied and the engine at idle speed (650 RPM) shift through the directional and gear clutches taking note of the pressures indicated at each shift.
4. All clutch pressures must be within 35 kPa (5 psi) of each other. If pressure varies outside the 35 kPa tolerance then clutch repair is required.







Converter Outlet Temperature
Port is to be used for converter outlet temperature pickup. Gauge is to be located in the operators compartment.

Converter Outlet Pressure
Test Conditions:
Converter outlet oil temp. 180°-200° [82,3°-93,3° C]
Transmission in "Neutral".
25 PSI [172,4 kPa] Minimum pressure at 2000 RPM Engine speed and a maximum 70 PSI [482,6 kPa] outlet pressure with engine at no load governed speed.

Clutch Pressure
Recommend that the clutch pressure be monitored by a gauge having an indicator dial range of 0-400 [0-2758 kPa]. Gauge is to be located in the operators compartment. Clutch pressure range 240-280 PSI [1655-1931 kPa].

FRONT AND REAR AXLES

GENERAL DESCRIPTION

The only difference between the front and rear axles is the mounting arrangement. The front axle is rigidly mounted to the front frame and the rear axle is mounted via a bolster to allow an 8° side to side pivot.

The axle assembly consists of a spiral bevel type ring gear and pinion in the centre section with further reduction via a planetary gear set within each wheel hub. Both of the differentials are limited slip. These differentials contain a set of discs that are mounted between the differential side gears and differential case. These discs limit the amount of *differential* according to the amount of torque transmitted through the differential assembly. As the discs wear through normal use, the side gears move further outward however the differential is self-adjusting or self-compensating. It is extremely important that the oil level is kept at the level plug because if the level becomes too low the discs will not receive sufficient lubrication premature wear will result.

Both differential centres are described as Posi-Torque with springs. The differentials are both limited slip. Posi-Torque performs in a range dependent upon the size and design variation of the differential. The inclusion of springs creates pressure on the clutch plates that can increase the tractive effort to the high traction wheel to as much as five times over the wheel with the poor traction. As operating conditions improve and the torque level in the axle increases, the effect of the springs diminishes and the bias ratio declines.

The wheel ends are also fitted with multi-disc liquid cooled brakes. The brakes are fitted with a lining wear indicator to measure the wear of the disc and inform service personnel when it is necessary to replace them.

SAFETY PRECAUTIONS

The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

ALWAYS allow the differential and wheel ends an opportunity to cool down before servicing.

ALWAYS wear personal protective equipment including safety glasses, gloves and suitable clothing

ALWAYS clean up any spilled oil immediately to remove the potential for slip or fall injuries.

ALWAYS be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys and drive lines) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.

ALWAYS carry out the correct lifting and/or chocking procedure if access underneath a supported machine is required.

NEVER access underneath the machine unless it has been isolated and tagged as appropriate and the wheels have been chocked.

CHECKING/FILLING THE PLANETARY WHEEL END OIL LEVEL

Care and Maintenance

The planetary wheel end oil levels should be checked and topped up if required every 250 service hours.

To check the oil level of the planetary wheel ends:

1. Run the machine for approximately five minutes to heat the oil.
2. Park the machine on flat, level ground. The wheel end should be orientated as per the label on its outside face.
3. Allow it to stand for a minimum of five minutes. Doing this will allow the oil to drain back to its normal level.

NOTICE

The machine will have to be driven forward or backward to achieve the correct orientation for each wheel end.

4. Isolate and tag out as described in Section 1.
5. Locate the planetary wheel end filler plugs on the outside face of the planet carriers. If necessary clean the areas to minimise the possibility of any contaminants getting into the system. When the level is measured in the wheel ends the oil fill plugs should be in the 3 o'clock position. Move the machine either forward or reverse to achieve this.
6. Allow five minutes settling time then remove the oil filler plug.
7. The oil levels should be to the bottom of the filler hole. If not, fill up with the lubricant specified in Section 1.
8. Allow a few minutes for the lubricant to attain its level as it flows through the various internal compartments and recheck the levels on each wheel end. Add lubricant if necessary.
9. Reinstall the filler plug, ensure o-ring is in good condition (replace as necessary).

NOTICE

The self-contained liquid cooled brake system uses the same lube as the axle centre section and wheel ends. There are no seals between the spindles and wheel hubs. Oil that lubricates the differential and planetary wheel ends also lubricates and cools the brake assembly. The oil level is the same height as the planet and axle centre and the brake may be filled and the oil level checked at the planet carrier assembly or planet carrier cover.

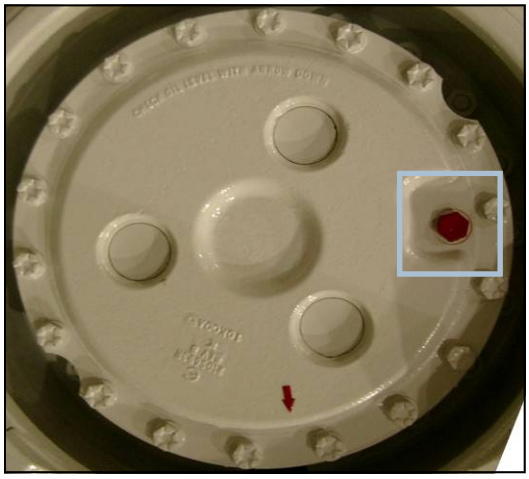
CHECKING/FILLING THE AXLE CENTRE OIL LEVEL

Care and Maintenance

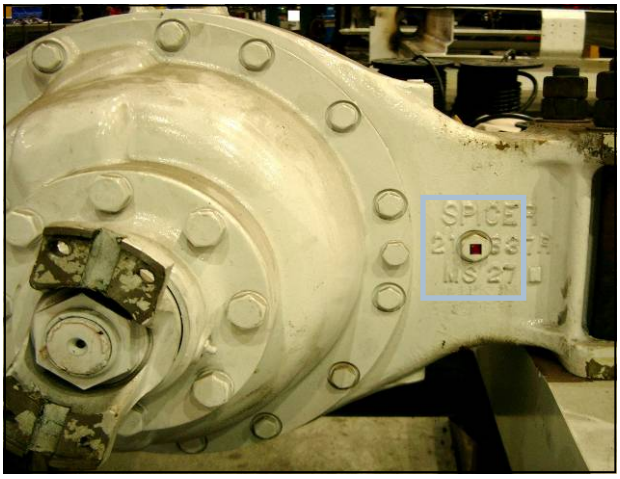
The oil level at the front and rear axle centres should be checked and topped up if required every 250 service hours.

To check the oil level of the axle centres and planetary wheel ends:

1. Run the machine for approximately five minutes to heat the oil.
2. Park the machine on flat, level ground. The wheel end should be orientated as per the label on its outside face. Allow it to stand for a minimum of five minutes. Doing this will allow the oil to drain back to its normal level.
3. Isolate and tag out as described in Section 1.
4. Locate the axle centre filler plug adjacent to the differential and carrier assembly. If necessary clean the areas to minimise the possibility of any contaminants getting into the system.
5. Allow five minutes settling time then remove the oil filler plug.
6. The oil levels should be to the bottom of the filler hole. If not, fill up with the lubricant specified in Section 1.
7. Allow a few minutes for the lubricant to attain its level as it flows through the various internal compartments and recheck the levels on each wheel end. Add lubricant if necessary.
8. Reinstall the filler plug, ensure o-ring is in good condition (replace as necessary).

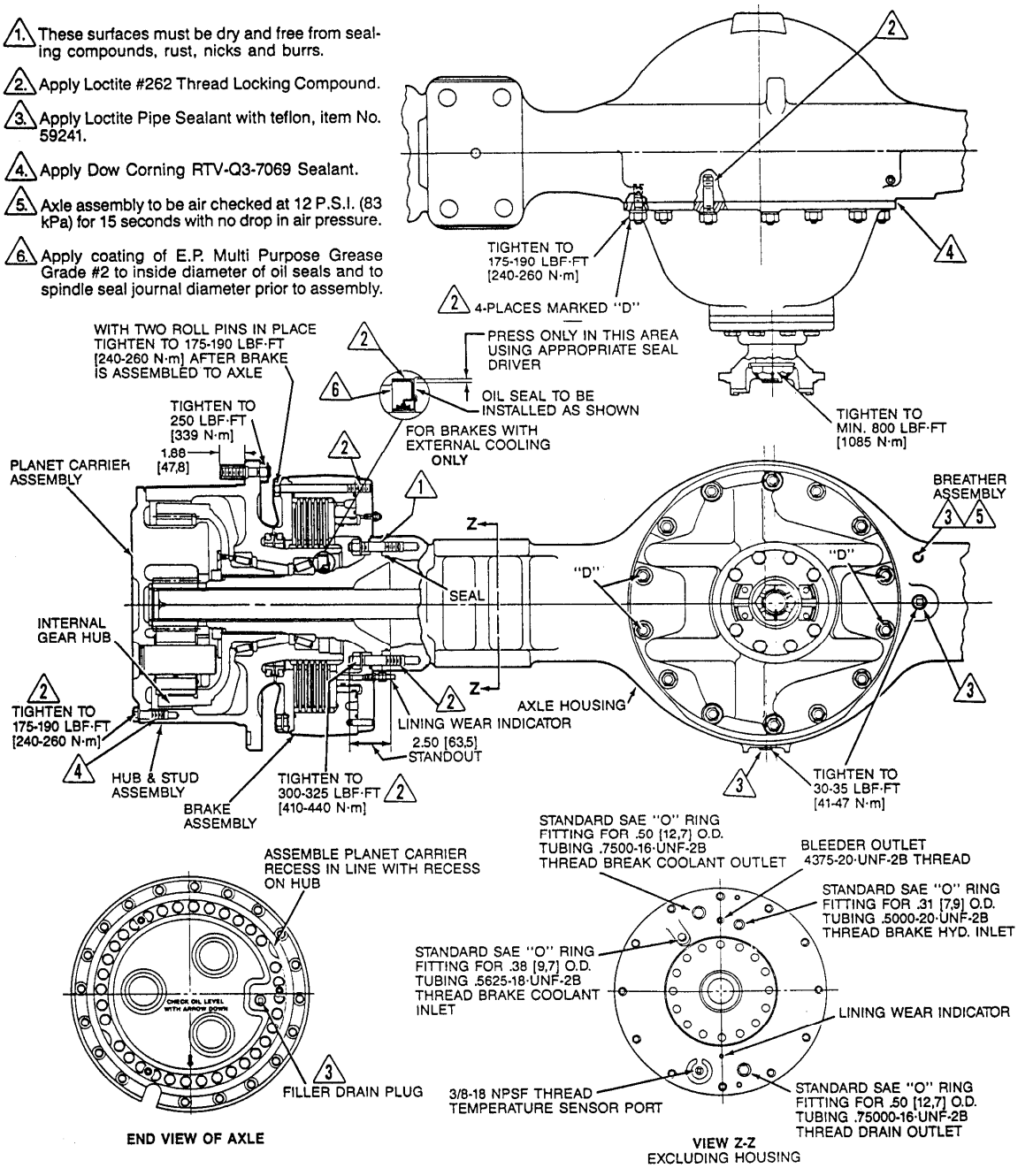


Planetary Level Check Point



Differential Level Check Point

AXLE ASSEMBLY INSTRUCTION ILLUSTRATION (WITH LIQUID COOLED BRAKES)



CHANGING OIL IN AXLE CENTRES, WHEEL ENDS AND LIQUID COOLED BRAKES

Servicing

The oil in the axle centres, wheel ends, and liquid cooled brakes is to be changed every 1000 service hours.

To change the oil perform the following:

1. Run the machine for approximately five minutes to heat the oil.
2. Park the machine on flat, level ground. The wheel end should be orientated as per the label on its outside face. Allow it to stand for a minimum of five minutes. Doing this will allow the oil to drain back to its normal level.
3. Isolate and tag out as described in Section 1.
4. Drain each wheel end: rotate each wheel end until the filler hole is at the lowest point on the housing. If necessary clean around the filler hole to minimise the possibility of contaminants entering the system. Place a suitably sized container beneath the filler hole (the volume in each wheel end is approximately 4.7 litres). Remove the filler plug. Allow sufficient time for the wheel end to drain completely.
5. Drain the brake housings: if necessary clean around the drain plug beneath the bottom of the brake housing and inlet plug beneath the bleeder screw to minimise the possibility of contaminants from entering the system. Place a suitably sized container beneath the drain plug (the volume in brake housing is approximately 4.7 litres). Remove the drain plug and the inlet plug from the brake housing. Allow sufficient time for the housing to drain completely. Replace the drain plug.
6. Drain the axle housing: If necessary clean around the drain plug on the bottom of the housing and oil filler plug adjacent to the differential and carrier assembly to minimise the possibility of contaminants from entering the system. Place a suitable size container beneath the drain plug (the volume of the differential centre is approximately 34.5 litres). Remove the drain plug and allow sufficient time for the housing to drain completely. Inspect the magnetic drain plug. If there is a considerable increase in the amount of metal particles found on the magnetic drain plug this indicates the necessity to replace the disc inside the limited slip differential centre. Replace the drain plug with Loctite Pipe Sealant with Teflon. Tighten to 41-47 Nm.
7. Refill the wheel ends: the wheel ends should be orientated as per the label on its outside face. Fill the wheel ends to the bottom of the filler holes with the lubricant specified in Section 1.
8. Refill the axle housing: fill the axle housing to the bottom of the filler hole with the lubricant specified in Section 1.

After filling has been completed wait a few minutes for the lubricant to attain its actual level. Recheck the oil level and add lubricant if necessary.

9. Reinstall the fill plugs with Loctite Pipe Sealant with Teflon if they have a tapered thread and apply o-ring grease to UN o-ring type plugs. Torque to 41-47 Nm.

CHECKING WEAR OF THE POSI STOP BRAKE ASSEMBLIES

Care and Maintenance

The wear indicator on the brakes should be inspected every 250 service hours.

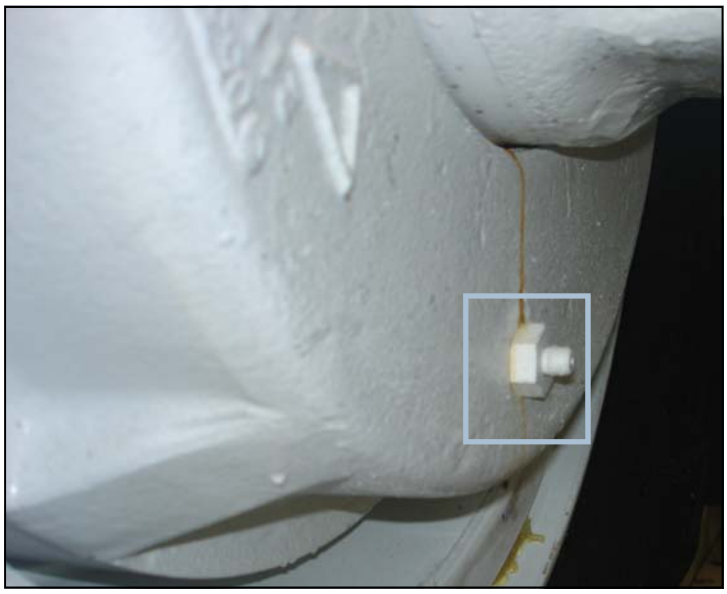
Each Posi-Stop brake housing assembly is fitted with its own brake lining wear indicator. The lining wear indicator is located on the inside of the brake housing beneath where the axle centre is attached on to the brake housing.

Checking Brake Wear

1. The machine must be parked on a level surface with lift arms lowered to the ground or all attachments removed.
2. Isolate and tag as described in Section 1.
3. Using minimal force and a suitable drift and hammer, the indicator should be tapped in until it comes to a stop, the amount of indicator that remains protruding is the amount of brake wear that is still present in the brake pack.

As the discs wear the indicator pin retracts and when it is flush with the mounting nut the discs should be replaced.

The wear indicator pin can become *gummed up* when the brakes are operated in dusty environments and therefore the pin will not show the true condition of the discs. Remove the indicator and free up the pin. Because of this brake performance should be monitored with testing. If the performance is deteriorating and the pin is protruding then suspect the pin has gummed up and service the brakes.



Brake Wear Indicator

DRIVE LINES

GENERAL DESCRIPTION

There are four drive shafts used on the machine.

Upper Drive Line

The upper drive line transmits power from the output of the engine drive coupling via a drive line to the input of the converter which is an integral part of the transmission.

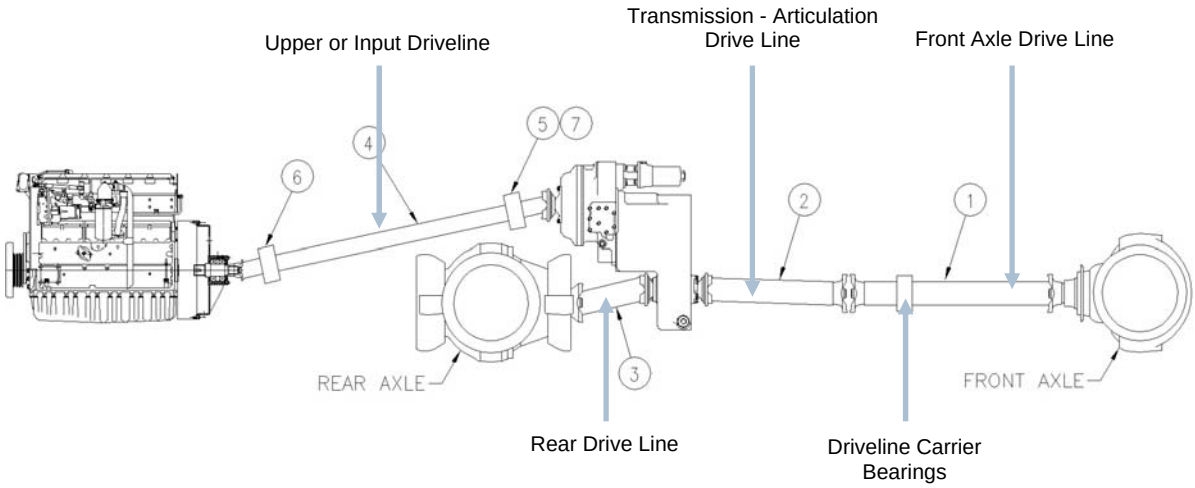
The upper drive line consists of a tube assembly, slip joint assembly and two universal joints. The drive line also has two safety brackets either side of the slip joint assembly to retain the assembly should a universal joint fail.

Rear Drive Line

The rear drive line transmits power from the transmission to the rear axle. It consist of a tube assembly, slip joint assembly and two universal joints.

Articulation and Front Drive Lines

The front drive line transmits power from the transmission to the front axle. The front drive line consists of two drive shafts that allow for the machine to articulate. The first drive shaft is attached to the output at the front of the transmission and consists of a tube assembly, slip joint assembly, bearing carrier assembly and two universal joints. The second drive shaft attaches between the first drive shaft and bolts to the front axle and consists of a tube assembly, slip joint assembly, a carrier bearing and two universal joints.



NOTICE

Later model machine drive lines are fitted with grease for life Uni-joints.

SAFETY PRECAUTIONS

The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

ALWAYS chock all wheels before removing any of the drive lines.

ALWAYS be careful of hot surfaces when accessing the drive lines.

ALWAYS wear personal protective equipment including safety glasses, gloves and suitable clothing

ALWAYS clean up any spilled grease immediately to remove the potential for slip or fall injuries.

ALWAYS fit the articulation lock before commencing work on the drive lines.

ALWAYS be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.

GREASING AND INSPECTING DRIVE LINES

Care and Maintenance

The drive lines are to be lubricated at every weekly service. Failure to maintain proper lubrication is one of the most frequent causes of drive line failure. Lubrication of the drive line points is important due to the large loads that the needle bearings in the universal joints transmit.

Lubricant should be applied with either a hand operated grease gun or a pressure gun. The specification of the lubricant can be found in Section 1.

To lubricate and inspect the drive lines perform the following:

1. Park the machine on flat, level ground. Ensure the machine is in a straight line.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Lubricate each universal joint until grease is visible at the journal cross bearing caps. This will ensure the grease will fully lubricate the universal joint and purge the old lubricant.
4. Using a small pinch or wrecking bar check the flanges on the transmission and differential flanges for tightness. If either is loose drop that end of the drive shaft. Twist the flange to check any backlash between the splines and the flange. Replace any flange that is not a snug fit. If there is play in any of the universal joints replace it. Inspect the splines at the slip joints and replace that drive shaft if there is excessive wear. If the front drive line is removed, take off the carrier bearing and inspect it for wear.
5. Inspect the tightness of the bolts in the universal joints and if necessary re-tighten to the correct torque (see Section 1).
6. Check the condition of the rubber boots over the slip joints and ensure they are properly secured.
7. Grease the slip joints.
8. Grease the carrier bearing on the front drive shaft.

REMOVING AND INSTALLING THE REAR DRIVE LINE

Removing the Rear Drive Line

To remove the rear drive shaft:

1. Park the machine on flat, level ground. Ensure the machine is in a straight line.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Support the drive shaft.
4. Remove the bolts from the universal joints at the transmission and rear differential.
5. Compress the drive shaft at the slip joint using a small pinch or wrecking bar.
6. Lower the drive shaft out of position.

Installing the Rear Drive Line

To install the rear drive shaft perform the following:

All drive shafts are to be installed so that the solid shaft end of the slip joint is attached to the power output and the tube end attaches to the input.

1. Make sure that the yokes are aligned in the same direction. If they are not aligned they will be out of phase and cause excessive vibration.
2. Raise each end into position and bolt together.
3. Tighten the bolts to the appropriate torque (see Section 1).

REMOVING AND INSTALLING THE FRONT DRIVE LINES

Removing the Front Drive Lines

To remove the front drive shafts perform the following:

1. Park the machine on flat, level ground. Ensure the machine is in a straight line.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Remove the intermediate drive line by removing the bolts on the universals.
4. Compress the drive shaft at the slip joint using a small pinch or wrecking bar.
5. Remove the intermediate drive shaft from the machine through the articulation point.
6. Remove the universal bolts on the transmission-intermediate drive shaft attached to the transmission yoke. Then support the drive line and remove the carrier bearing support bolts.
7. Lift the drive shaft out of position.
8. Remove the bolts connecting the front drive line to the front universal. Then support the drive line and remove the carrier bearing support bolts.
9. Lift the drive shaft out of position through the articulation joint.

Installing the Front Drive Lines

To install the front drive shafts perform the following:

1. Lift the front drive line into position and install the universal bolts to the yoke on the differential. *Tighten the bolts to the appropriate torque (see Section 1).* Then support the drive line and install the carrier bearing support bolts.
2. Install the universal bolts on the transmission-intermediate drive shaft attached to the transmission yoke. *Tighten the bolts to the appropriate torque (see Section 1).* Then support the drive line and install the carrier bearing support bolts.
3. Install the intermediate drive line by installing the bolts on the universals. *Tighten the bolts to the appropriate torque (see Section 1).*

All drive shafts are to be installed so that the solid shaft end of the slip joint is attached to the power output and the tube end attaches to the input. Make sure all the yokes are aligned in the same direction. If they are not aligned they will be out of phase and cause excessive vibration.

REMOVING AND INSTALLING THE UPPER DRIVES LINES

Removing the Upper Drive Line

To remove the upper drive line then perform the following:

1. Park the machine on flat, level ground. Ensure the machine is in a straight line.
2. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
3. Support each drive shaft at both ends.
4. Remove the bolts from the universal joints at either end of the drive shaft.
5. Unbolt the safety brackets from either end of the drive line.
6. Compress the drive shaft at the slip joint using a small pinch or wrecking bar.
7. Raise the drive shaft out of position.

Installing the Upper Drive Line

To install the upper drive line perform the following:

All drive shafts are to be installed so that the solid shaft end of the slip joint is attached to the power output and the tube end attaches to the input.

1. Make sure all the yokes are aligned in the same direction. If they are not aligned they will be out of phase and cause excessive vibration.
2. Lower the drive shaft into position and fasten the safety brackets into position. This will hold the drive line in position as the universal joints are bolted together.
3. Tighten the universal bolts to the appropriate torque (see Section 1).

WHEEL AND TYRE ASSEMBLIES

SAFETY PRECAUTIONS

The following safety precautions are not intended to be exhaustive. Safe work practices should be used when servicing or operating heavy machinery.

ALWAYS wear personal protective equipment including safety glasses, gloves and suitable clothing

ALWAYS allow sufficient time for the engine, cooling system, and exhaust system sufficient time to cool before commencing work as burns may result with contact with hot surfaces.

ALWAYS fit the articulation lock before removing/installing the tyre/wheel assemblies.

ALWAYS ensure the area around the machine is safe. For example do not change the wheel against a rib to prevent the possibility of being pinned.

ALWAYS be aware of, and isolate, other forms of energy and pinch points (fan, belts, pulleys) when accessing the engine compartment including pneumatic stored pressure, engine coolant pressure and other heat sources such as engine block and exhaust system components.

NEVER access underneath the machine unless the it has been isolated and tagged as appropriate and the wheels have been chocked.

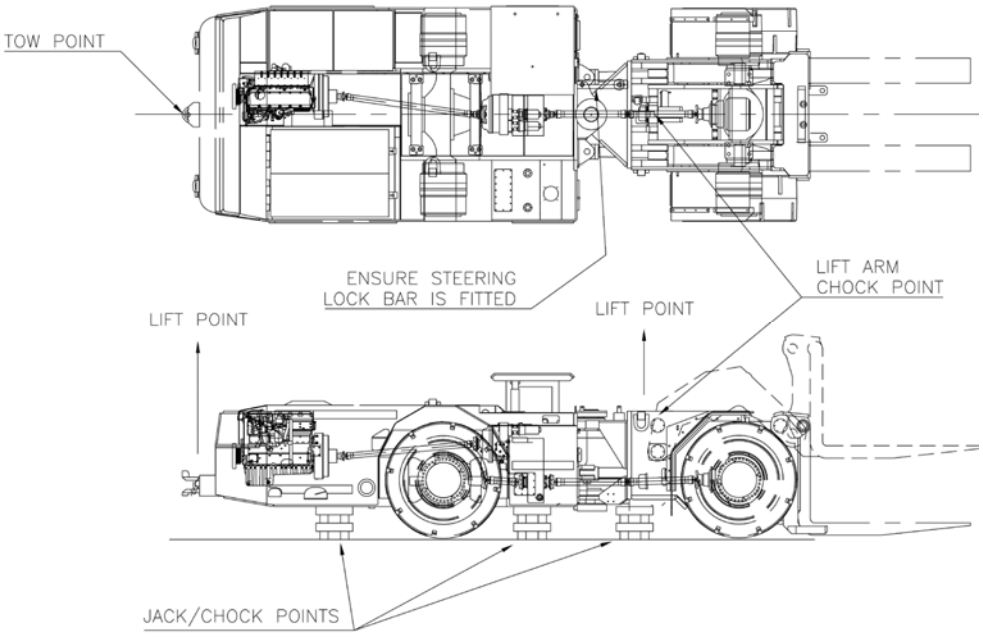
REMOVAL

To remove the wheel and tyre assemblies from the machine perform the following:

1. Lower the lift arms to the ground.
2. Park the machine on flat, level ground. Ensure the machine is in a straight line.
3. Ensure that the engine has had sufficient time to cool and is isolated and tagged as described in Section 1.
4. Check that both the steering and brake pressure gauges in the operator's compartment are reading zero pressure.
5. Raise the wheel to be changed with a suitable rated device (e.g. chain block, hydraulic jack, air bag, etc). See diagram for the suitable lifting and support points for the machine's chassis.
6. Place the machine on suitable stands or blocks that will allow the removal of the wheel.
7. Remove the 19 wheel nuts and remove the wheel assembly from the wheel end.
8. Using suitable lifting equipment, remove the wheel assembly. If the wheel is difficult to remove, insert ¾" UNC jacking bolts into the three threaded holes around the wheel rim. The threaded holes are on the same PCD as the holes for the wheel studs. Evenly screw the bolts in to *jack* the wheel away from the wheel end.

WARNING

DO NOT rely on the lifting equipment alone to support the machine when working beneath it. The machine MUST be supported by stands or similar.



WARNING

The tyres on the machine are of solid rubber construction, extreme care should be taken when removing these wheels because of their mass.

NOTICE

These are recommended jacking, chocking, lifting and tow positions for anything outside this scope contact Bucyrus.

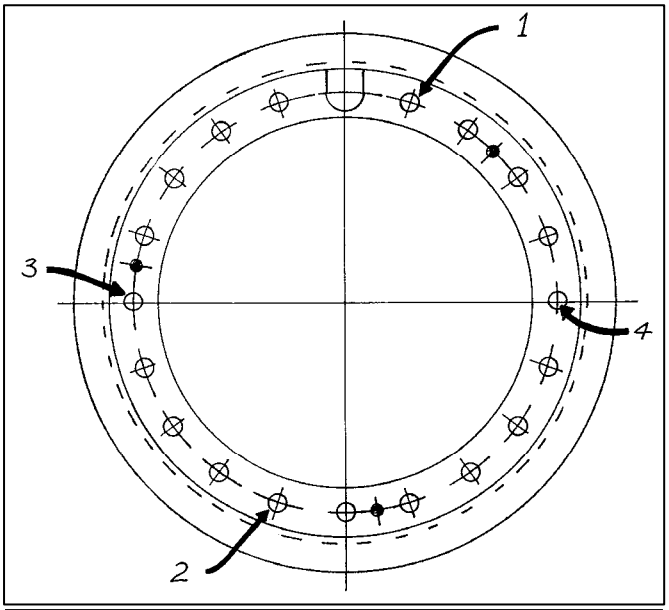
INSTALLATION

To install the wheel and tyre assemblies to the machine perform the following:

1. Check the wheel studs for any damage and replace any damaged or missing wheel studs.
2. Apply anti-seize compound to the wheel studs.
3. Clean all parts and mating surfaces. Remove all sharp edges and burrs. Apply anti-seize compound to all mating surfaces.
4. Raise the wheel assembly over the wheel end and align the tyre valve with the notch in the flange on the wheel end.
5. Fit the 19 wheel nuts and hard washers.
6. Tighten the wheel nuts to a torque of 440 Nm (325 ft lbs) in the sequence shown.

NOTICE

The first 50 hours after installing a new wheel, loosen the wheel nuts and re-tighten them back up to 440Nm.



Wheel Nut Tightening Sequence

Care and Maintenance

1. Daily service: visually inspect each tyre assembly for wear or damaged tread and side wall or rim.
2. Every 250 service hours check tyre pressure using a good quality pneumatic tyre pressure gauge.
3. Every 1000 service hours re torque each wheel nut.

NOTICE

All wheel rims to be crack tested whenever a new tyre is fitted. Damaged or heavily corroded rims and components should not be reused.