MODELS

FIAT-HITACHI

COMPACT LINE

FB90.2 FB100.2 FB110.2 FB200.2 4WS

WORKSHOP MANUAL

Print 604.13.028 edition 09/2000

SECTION 82 – LOADER REMOVAL

CHAPTER 1 – OVERHAUL (2 and 4 Wheel Drive Only)

CHAPTER 2 – OVERHAUL (4 Wheel Steer Only)

SECTION 84 – BACKHOE REMOVAL

CHAPTER 1 – OVERHAUL

Description **Page**

SECTION 90 – CAB PARTS

CHAPTER 1 –

Description **Page**

'O' RING FLAT FACE SEAL FITTING TORQUE VALUES

Nominal O.D (in.)	Tube (mm)	Dash Size	Thread Size In.	Swivel Nut Torque lbf. Ft	Nm
0.250	6.35	-4	9/16-18	12	16
0.375	9.52	-6	11/16-16	18	24
0.500	12.70	-8	13/16-16	37	50
0.625	15.88	-10	1-14	51	69
0.750	19.05	-12	1 3/16-12	75	102
0.875	22.22	-14	1 3/16-12	75	102
1.000	25.40	-16	1 7/16-12	105	142
1.250	31.75	-20	1 11/16-12	140	190
1.500	38.10	-24	2-12	160	217

SEALER SPECIFICATIONS

The following sealers should be used as directed in the manual:

SEALERS	PART NUMBER	TRADE DESCRIPTION
Anaerobic sealer	82995770/1	LOCTITE GASKET ELIMINATOR 518
RTV silicone sealer	82995775/6	LOCTITE SUPERFLEX 593, 595 or 596 LOCTITE ULTRA BLUE 587 DOW CORNING SILASTIC 732 GENERAL ELECTRIC RTV 103 OR 108
Pipe sealant	82995768	PST 592 PIPE SEALANT WITH TEFLON
Thread-locking compound	82995773	LOCTITE 271 THREADLOCKER/SEALANT (red)

HARDWARE TORQUE VALUES

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the Backhoe Loader.

IMPORTANT: *DO NOT use the values listed in the charts if a different torque value or tightening procedure is specified in this manual for a specific application. Torque values listed are for general use only.*

Make sure fastener threads are clean and not damaged.

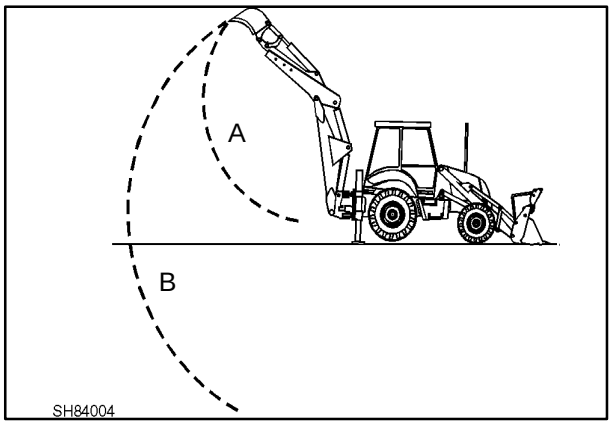
NOTE: *A torque wrench is necessary to properly torque hardware.*

LIFTING CAPACITIES DURING NORMAL OPERATION – SAE RATED kgs (lbs)

The following tables reflect the lifting capacities of the Backhoe Dipper (A) and Boom (B) on a typical 4WD Centre Pivot machine.

NOTE: *Capacities shown may vary slightly between machines dependant upon options fitted, pressure settings and market requirements.*

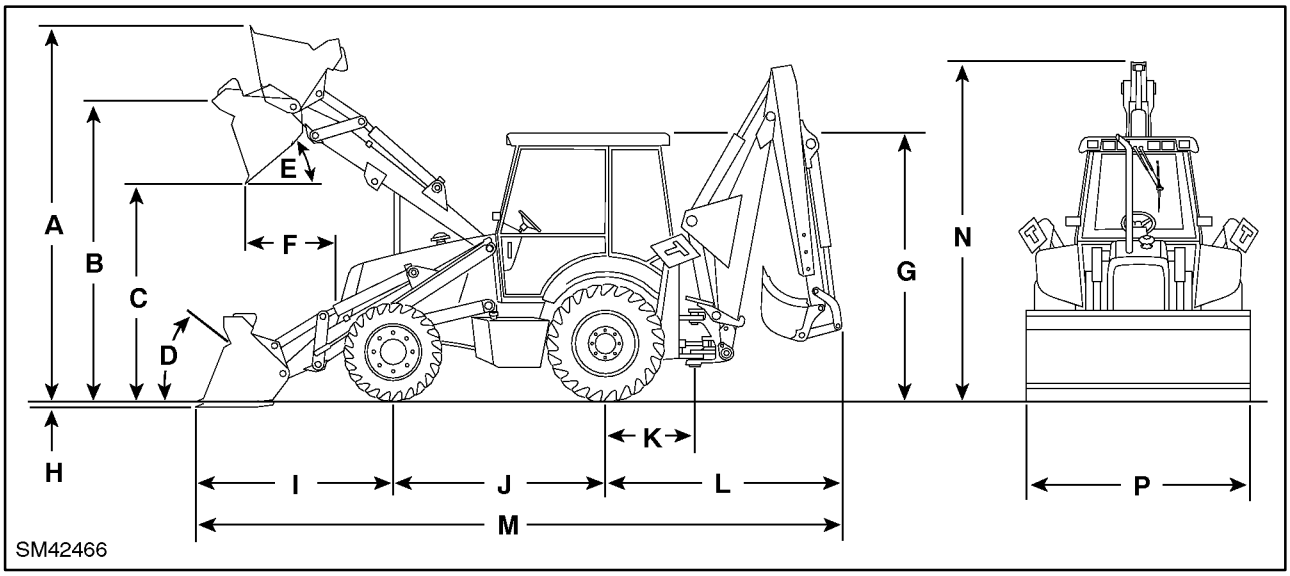
Lifting capacities – kgs (lbs) are shown with Standard Dipper, Extendible Dipper (HED) in retracted position and Extendible dipper in full extended position.



12

Standard		HED (Retracted)		HED (Extended)		Height/ Depth: m (ft)
Dipper – A	Boom – B	Dipper – A	Boom – B	Dipper – A	Boom – B	
					580 (1275)	+5.4 (18)
	1225 (2700)		1030 (2270)		810 (1785)	+4.9 (16
	1495 (3295)		1330 (2930)	1680 (3710)	955 (2110)	+4.3 (14)
2700 (5955)	1655 (3655)	2435 (5370)	1440 (3175)	1585 (3500)	1020 (2250)	+3.6 (12)
2575 (5680)	1675 (3700)	2325 (5125)	1450 (3195)	1555 (3435)	1045 (2310)	+3.0 (10)
2660 (5870)	1655 (3655)	2380 (5245)	1425 (3145)	1590 (3505)	1055 (2330)	+ 2.4 (8)
3070 (6770)	1615 (3565)	2650 (5850)	1390 (3070)	1690 (3730)	1055 (2330)	+ 1.8 (6)
5365 (11830)	1575 (3475)	3745 (8265)	1355 (2990)	1915 (4225)	1045 (2310)	+ 1.2 (4)
	1535 (3390)	5405 (11920)	1315 (2905)	2475 (5460)	1035 (2290)	+ 0.6 (2)
	1500 (3310)		1280 (2830)	4960 (10935)	1030 (2270)	0 Ground
	1470 (3240)		1250 (2760)		1020 (2250)	– 0.6 (2)
	1445 (3190)		1230 (2710)		1015 (2240)	– 1.2 (4)
	1435 (3170)		1215 (2680)		1015 (2240)	– 1.8 (6)
	1455 (3205)		1220 (2695)		1025 (2265)	– 2.4 (8)
	1545 (3410)		1275 (2875)		1055 (2330)	– 3.0 (10)
	1690 (3725)		1460 (3220)		1120 (2470)	– 3.6 (12)
					1325 (2925)	– 4.2 (14)
					1670 (3680)	– 4.8 (16)

CENTRE PIVOT LOADER DIMENSIONS AND PERFORMANCE



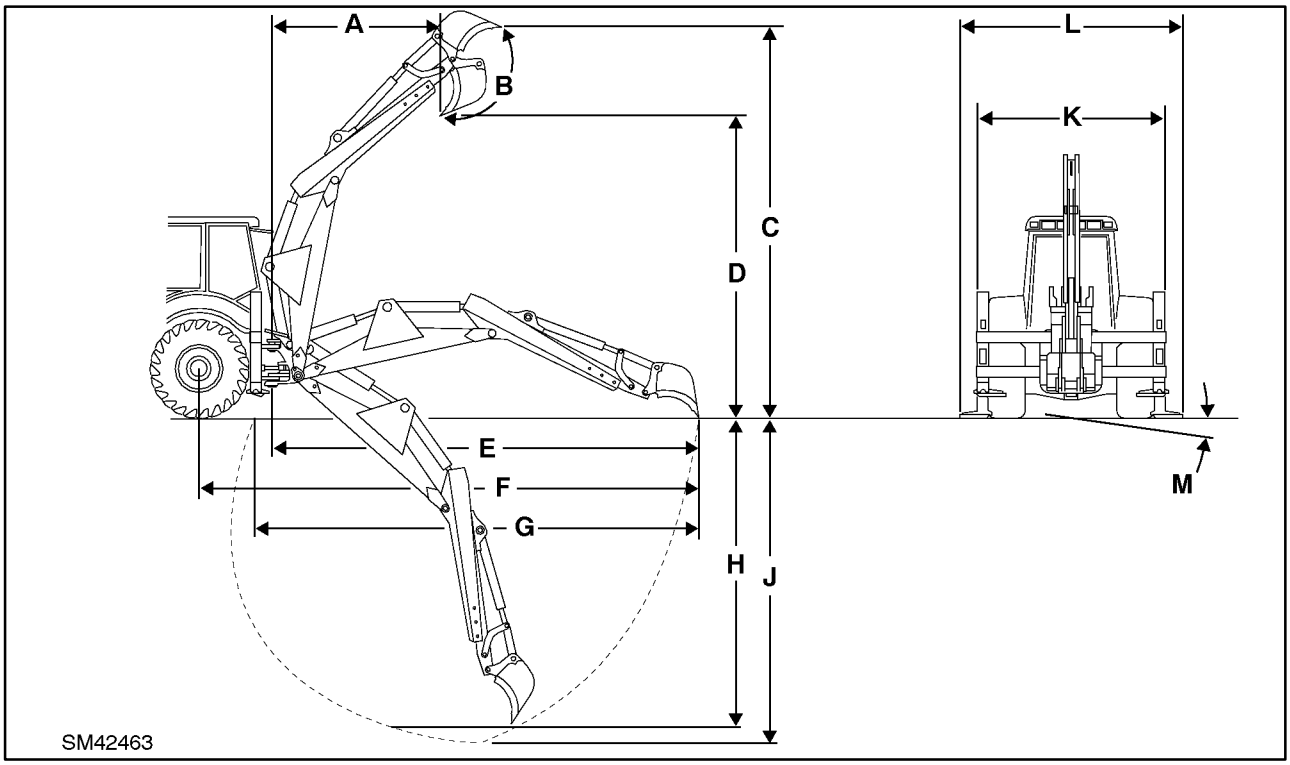
16

(PER SAE J 732 C) WITH TYRES **2WD FRONT = 11L–16SLF3 REAR = 19.5–24 R4**
4WD FRONT = 12–16.5 REAR = 19.5L–24 R4

With Four Wheel Drive (Bucket 1.0m^3)

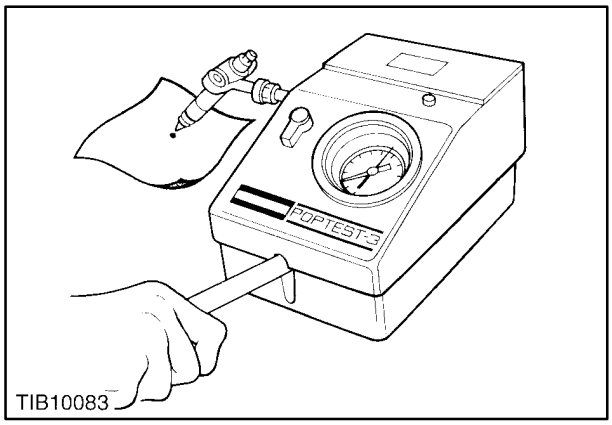
A. Overall Operating height	2WD 4270mm (14ft 0in) – 4WD 4284mm (13ft 9in)
Lift Capacity at Maximum Height	3530 kg (7780 lbs)
Breakout Force	6324 kg (13938 lbs)
B. Height to Hinge Pin Full Raise	2WD 3442mm (11ft 3in) – 4WD 3456mm (11ft 2in)
C. Dump Height	2WD 2694mm (8ft 6in) – 4WD 2710mm (8ft 8in)
D. Maximum Roll back at ground level	40°
E. Dump Angle	45°
F. Reach fully raised	2WD 800mm (2ft 6in) – 4WD 795mm (2ft 6in)
G. Height to Top Of Cab	2885mm (9ft 4in)
H. Digging Depth	2WD 146mm (6.0in) – 4WD 130mm (5.1in)
I. Centre line of axle to Bucket Lip at ground level	2WD 2007mm (6ft 5in) – 4WD 1997mm (6ft 5in)
J. Wheelbase	2175mm (7ft 1in)
K. Centre Line of rear axle to Centre line of swing post	1120mm (3ft 6in)
L. Centre Line of rear axle to edge of backhoe bucket	2934mm (9ft 5in)
M. Overall Length	2WD 7040mm (23ft 1in) – 4WD 7040mm (23ft 1in)
N. Overall Height Lip of Bucket to top of Boom	3973mm (12ft 9in)
P– Overall Width With Bucket	2250mm (7ft 3in)
P– Overall Width Less Bucket	2170mm (7ft 1in)
– Weight of machine Loader/Backhoe*	
*example (4WD, 6 in 1 Bucket, Counterweights)	7800 kg (17191 lbs)

SIDESHIFT BACKHOE – DIMENSIONS AND PERFORMANCE



(Per SAE J 49) WITH TYRES FRONT AND REAR = 440/80R28			
Backhoe		**Standard Dipper**	**HED Extended**
A.	Loading Reach	1877mm (6ft .1in)	2818mm (9ft 2in)
B.	Bucket Rotation	204°	204°
C.	Operating Height, Fully Raised	5717mm (18ft 6in)	6374mm (20ft 7in)
D.	Loading Height Maximum	3905mm (12ft 7in)	4593mm (14ft 9in)
E.	Reach from Swing Post Pivot	5867mm (19ft 1in)	6952mm (22ft 6in)
F.	Reach from Rear Axle C/L	7193mm (23ft 4in)	8278mm (26ft 9in)
G.	Max Length Surface Excavation	6492mm (21ft 1in)	7500mm (25ft 0in)
H.	Maximum Digging Depth To Achieve a 0.6m Flat Bottom Trench To Achieve a 2.4m Flat Bottom Trench	 4598mm (15ft 1in) 4255mm (14ft 0in)	 5771mm (18ft 9in) 5505mm (18ft 1in)
J.	Maximum Digging Depth	4302mm (14ft 1)	5527mm (18ft 1in)
K.	Stabilizer Spread – Transport	2280mm (7ft 5in)	2280mm (7ft 5in)
L.	Stabilizer Spread (pads reversed)	2790mm (9ft 2in)	2790mm (9ft 2in)
M.	Stabiliser Pad Levelling Angle	14°	14°
–	Swing Arc	180°	180°
–	Max digging force (general purpose bucket) crowd cylinder (ICED) bucket cylinder (ICED)	 3621 kg (7983 lbs) 5630 kg (12412 lbs)	 2592 (5714 lbs) 5630 kg (12412 lbs)
–	Lift capacity through dipper arc –	2350 kg (5190 lbs)	1625 kg (3585 lbs)
–	Lift capacity, dipper 3.66m above ground	2425 kg (5945 lbs)	1625 kg (2409 lbs)
–	Lift capacity at 4.2m (14ft) above ground	1500 kg (3305 lbs)	995 kg (2195 lbs)
–	Extendible dipper extension length–		1.2m (3.9 ft)

4. Pressure Tester Fuel Injectors



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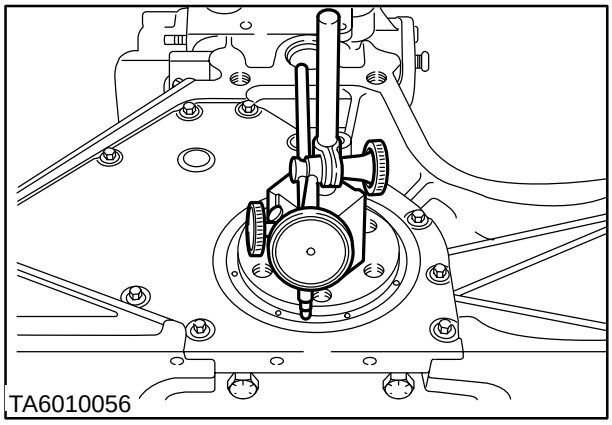
5. Dial Indicator for checking Concentricity, End Floats, Crankshaft Seal seating.



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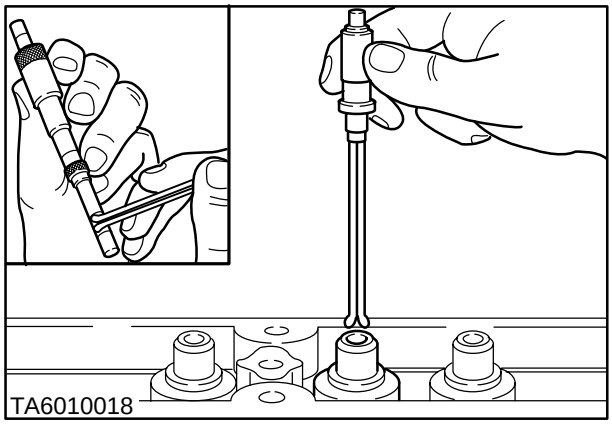
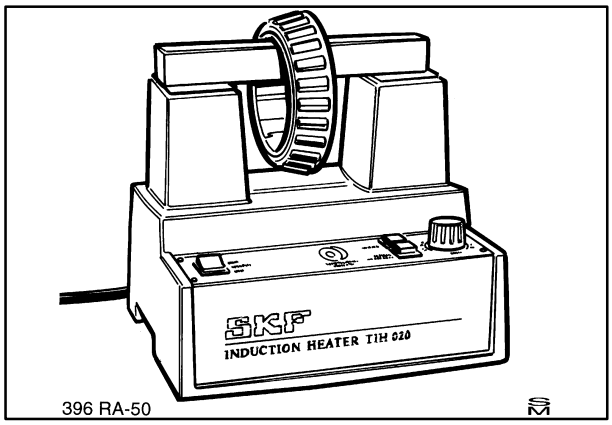
6. Internal Bore Gauge for Valve Guides and general measurement



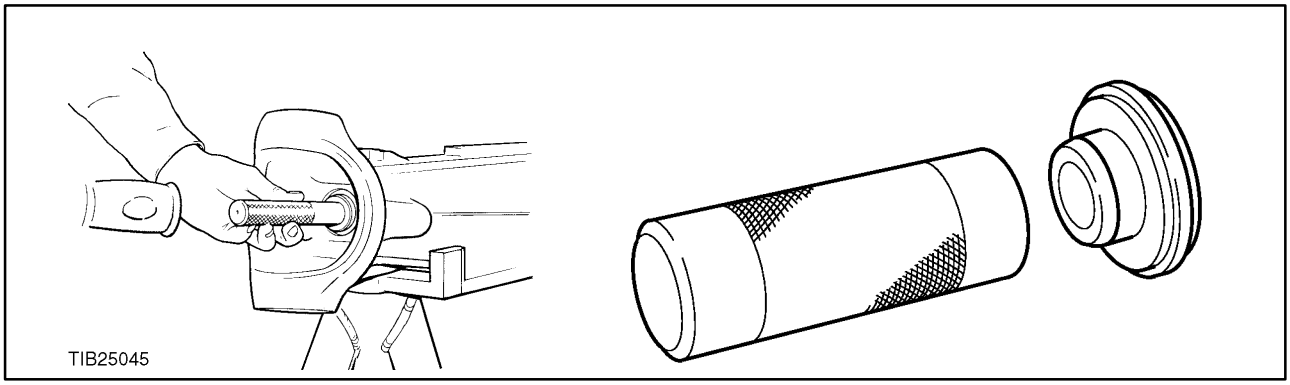
6

7. Bearing Heater



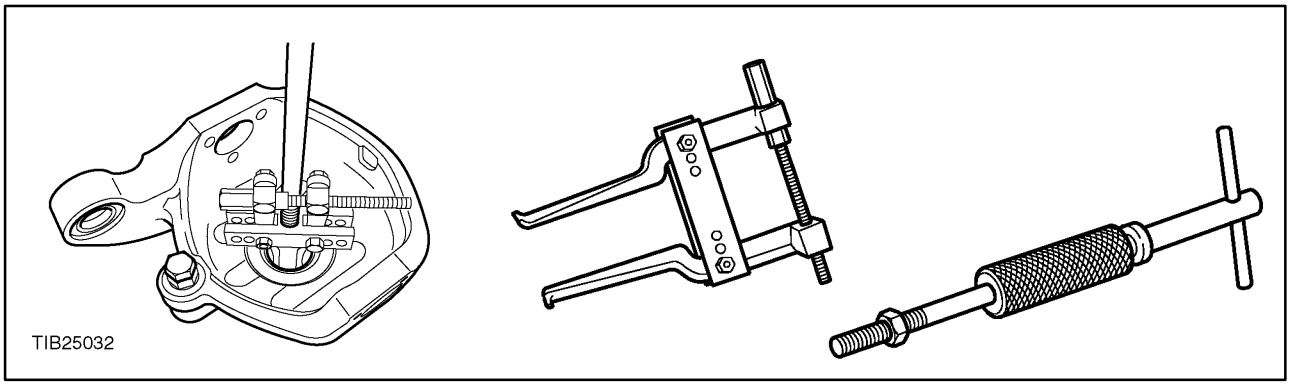
7

44. **FRONT AXLE –** Seal Insertion Tool #297103



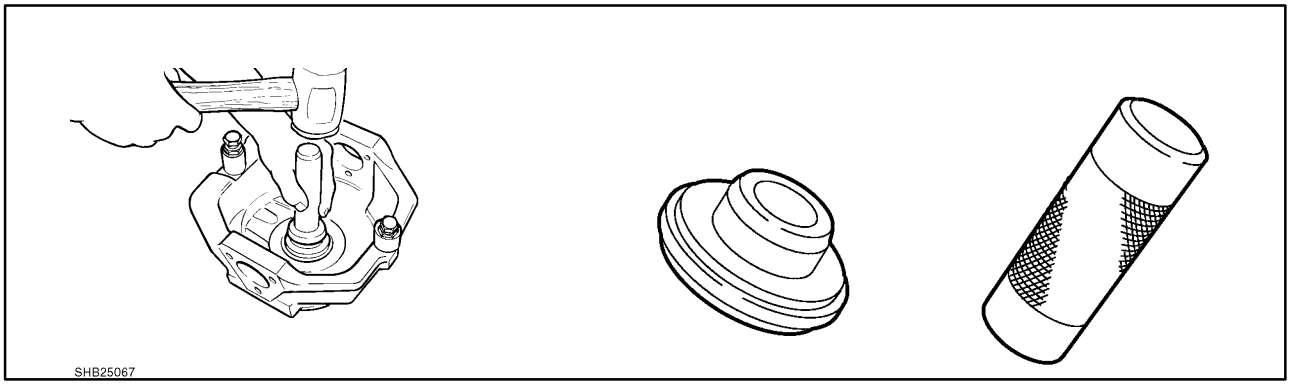
29

45. Seal Removal Tool Hub #297101, #297504



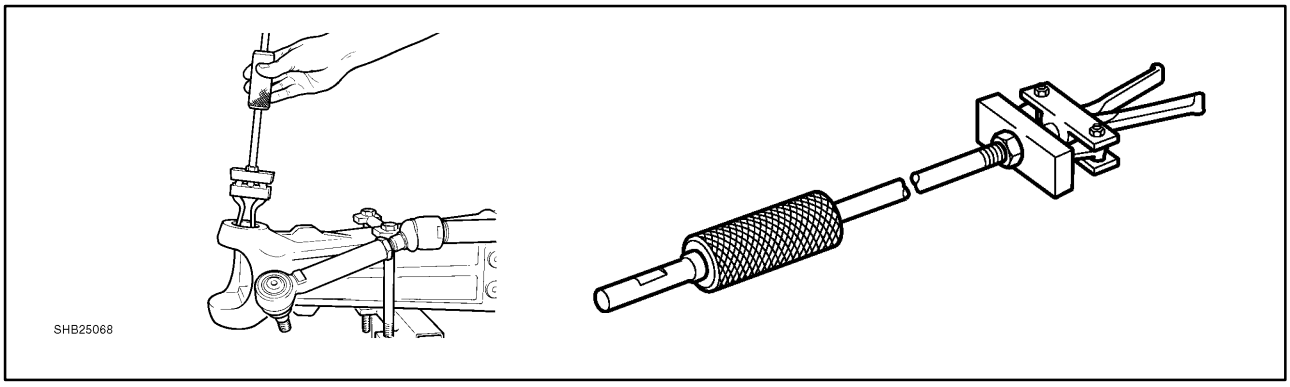
30

46. Seal Insertion Tool Hub #297103



31

47. Bush Removal Tool Axle #297111

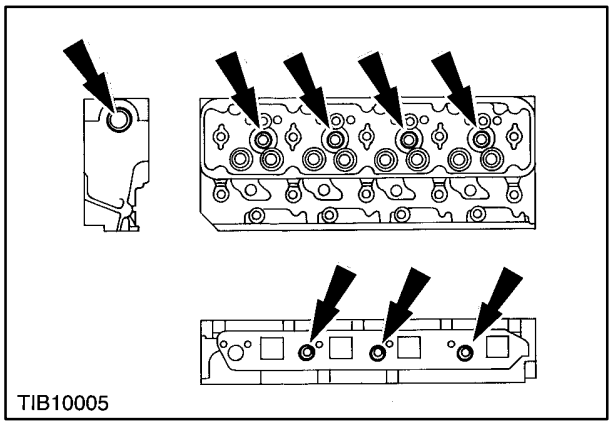


32

ROCKER ARM SHAFT	
Shaft Diameter	25.40–25.43mm (1.000–1.001 in)
Shaft Support Internal Diameter	25.45–25.20mm (1.002–1.004 in)
ROCKER ARM	
Inside Diameter	25.48–25.50mm (1.003–1.004 in)
TAPPETS	
Clearance to Bore	0.015–0.053mm (0.0006–0.0021 in)
Tappet Diameter	25.118–25.130mm (0.9889–0.9894 in)
Tappet Bore Diameter	25.15–25.17mm (0.9900–0.9910 in)
CAMSHAFT	
Bearing Journal Diameter	60.693–60.719mm (2.3895–2.3905 in)
Bearing Clearance	0.025–0.076mm (0.0010–0.0030 in)
End Play	0.051–0.18mm (0.0020–0.0070 in)
CONNECTING RODS	
Small End Bushing (Internal Diameter)	
Normally Aspirated	38.113–38.120mm (1.5005–1.5008 in)
Turbocharged	41.288–41.295mm (1.6255–1.6270 in)
Clearance Bushing to Piston Pin	0.013–0.025mm (0.0005–0.0010 in)
Side Float	0.13–0.33mm (0.0050–0.0130 in)
Maximum Twist	0.30mm (0.0120 in)
Maximum Bend	0.10mm (0.0040 in)
PISTON PIN	
Outside Diameter	
Normally Aspirated Engine	38.095–38.100mm (1.4998–1.5000 in)
Turbocharged Engine	41.270–41.275mm (1.6248–1.6250 in)
PISTONS	
Skirt to Cylinder Clearance	
Naturally Aspirated	0.140–0.171mm (0.0055–0.0067 in)
– *New, unrun engine*s	
	0.140–0.28mm (0.0055–0.011 in) – *Run engines*
Skirt to Cylinder Clearance	
Turbocharged	0.165–0.196mm (0.0064–0.0077 in)
– *New, unrun engine*s	
	0.165–0.28mm (0.0064–0.011 in) – *Run engines*
Piston Pin Clearance	0.0030–0.0140mm (0.00012–0.00055 in) at 21°C (70°F)
Piston Crown to Block Face,	
Naturally Aspirated	0.28–0.58mm (0.011–0.023 in)
Turbocharged	0.0–0.3mm (0.0–0.012 in)

PROBLEM	POSSIBLE CAUSES	REMEDY
Low oil pressure	1. Engine oil level low	1. Top up, as necessary
	2. Wrong grade of oil	2. Drain and refill with correct grade of oil
	3. Blocked oil pump sump screen	3. Clean pump screen
	4. Oil pressure relief valve faulty	4. Fit new relief valve
	5. Oil pump worn	5. Renew Oil Pump
	6. Excessive oil pump rotor and shaft assembly clearance	6. Overhaul pump
	7. Excessive main or connecting rod bearing clearance	7. Install new bearings inserts and / or re–grind crankshaft
Excessive oil consumption	1. Engine oil level too high	1. Reduce oil level
	2. External oil leaks	2. Renew gaskets and seals, where necessary. Check mating surfaces for damage or distortion
	3. Worn valves, valve guides or bores	3. Renew
	4. Cylinder head gasket leaking	4. Renew gasket. Check head for damage or distortion
	5. Oil loss past the pistons and rings	5. Renew rings and/or rebore/ re–sleeve block as necessary
	6. Oil cooler leak	6. Repair/renew oil cooler assembly
	7. Rocker cover oil filter blocked	7. Change filter
Engine tends to keep firing after fuel is shut off	1. Air cleaner dirty or restricted	1. Clean or renew element
	2. Oil leak on compressor side of turbocharger where fitted	2. Overhaul turbocharger

1. Clean the cylinder head, and remove carbon deposits from around the valve heads.
2. Cylinder head core plugs if discoloured (rusty), or leaking will require changing. Before fitting new plugs remove all old sealer from the cylinder head. Apply sealant (82995772), refer to 'Specifications', to the new plug mating faces, and drive the new plugs into location, .



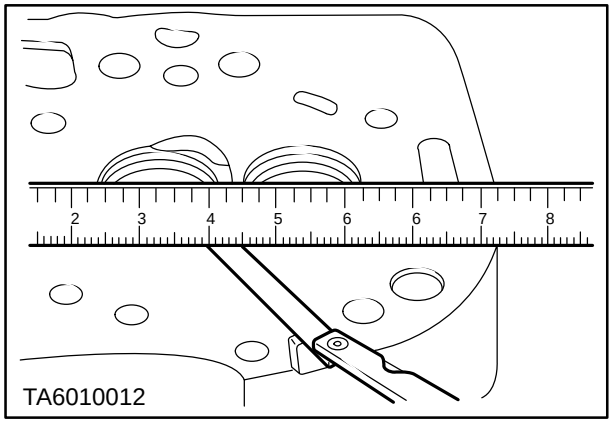
21

Core plugs required in the Cylinder Head:–

4 off, In the top of the cylinder head
1 off, in the rear of the cylinder head.
3 off, are mounted in the intake face.

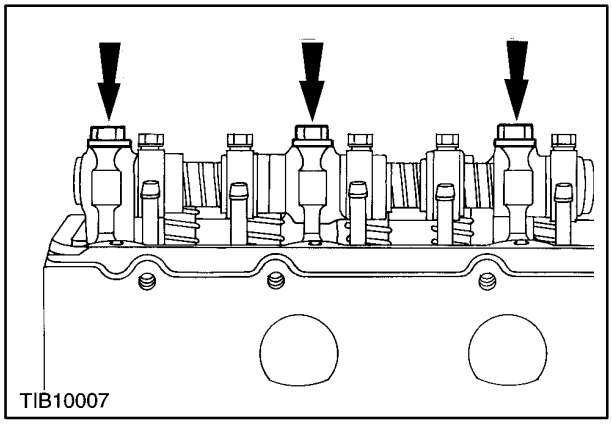
3. Scrape all gasket surfaces clean and wash cylinder head in a suitable solvent, also cleaning valve guide bores.
4. Inspect cylinder head for nicks and burrs on mating face, Remove using a suitable abrasive and ensure faces are clean after repair.

5. Using a straight edge, and feeler gauge, check flatness of cylinder head in all directions does not exceed,
   0.03mm (0.001 in) in any 25.4mm (1 in), or 0.127mm (0.005 in), overall limit.
6. If the cylinder head has been resurfaced, determine all head bolt faces will seat. By placing the cylinder head less gasket, on the cylinder block and installing bolts hand tight.



22

7. Ensure rocker shaft supports are fitted with long bolts (1). Using a feeler gauge (2), check clearance between underside of bolt heads and cylinder head or rocker shaft support.
8. If a 0.25mm (0.010 in) feeler gauge can be inserted under the bolt head the bolt has bottomed. Therefore the cylinder block thread must be increased using a 9/16–13 UNC–2A Thread tap. Identify the bolt heads and ensure they are reinstalled in the bolt holes they were checked in.



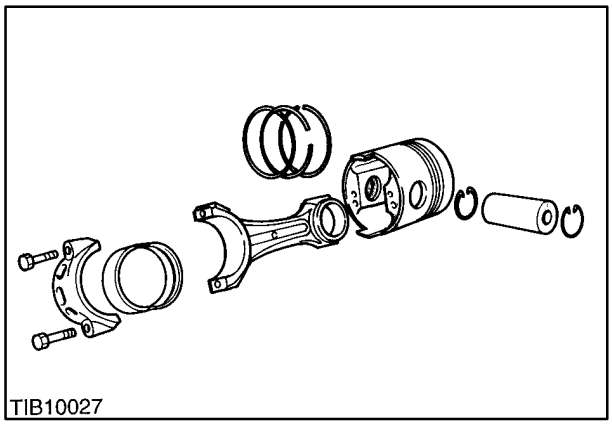
23

Inspection and Repair

1. Clean the piston, and connecting rod assembly, in a suitable solvent and inspect for damage to ring lands, skirts, or pin bosses.
2. Check connecting rod components for damage, and place in an alignment fixture to check for distortion, and ensure that any distortion, is within specification as follows.

Maximum Twist ‘A’ 0.30mm (0.012 in).

Maximum Bend ‘B’ 0.10mm (0.004 in).



49

3. Check piston pin bushing for damage or wear in the following manner.

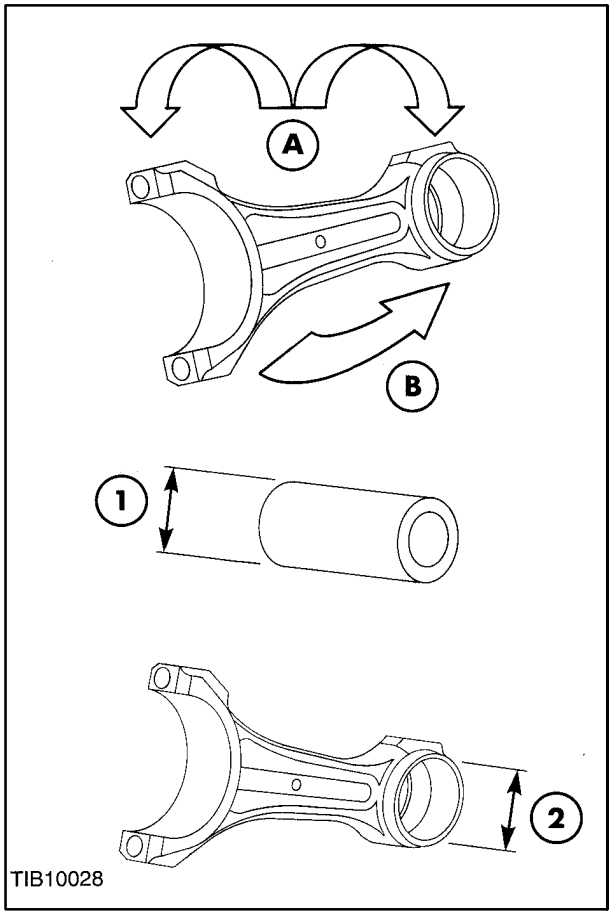
Measure the outside diameter of the piston pin, and inside diameter of the connecting rod bushing, to the following,

Piston Pin Outside Diameter

Naturally Aspirated,
38.095–38.100mm (1.4998–1.500 in).
Turbocharged,
41.270–41.275mm (1.6248–1.625 in).

Connecting Rod Bush Internal Diameter

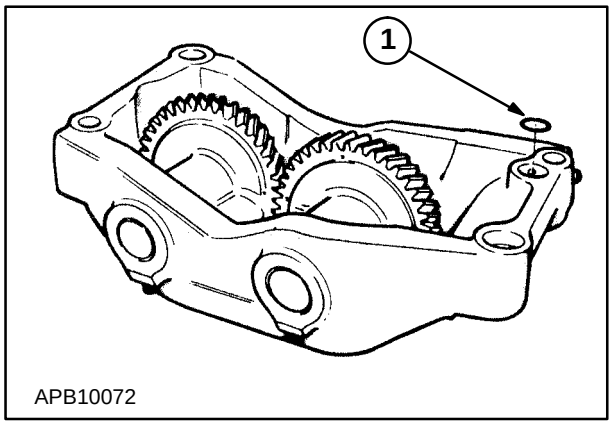
Naturally Aspirated,
38.113–38.120mm (1.5005–1.5008 in).
Turbocharged,
41.288–41.295mm (1.6255–1.6258 in)



50

Installation

1. Clean all the mating surfaces, and install a new seal around the lubrication passage.
2. Rotate crankshaft until timing mark on crankshaft gear aligns with timing mark on balancer drive gear, position balancer on dowels install the bolts and torque to 108–120 Nm (80–90 lbf ft)
3. Recheck the gear backlash between crankshaft and balancer gear, as previously described and replace the oil pan.



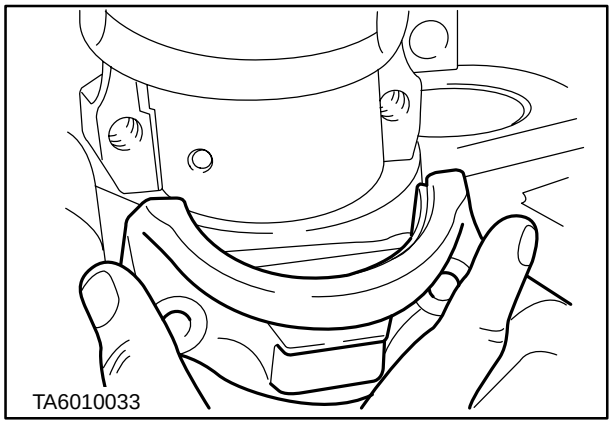
74

MAIN BEARING REMOVAL

1. Remove oil pan, and balancer, to gain access to the crankshaft. Remove the main bearing caps, and install one set at a time.

Inspection and Repair

1. Thoroughly clean bearing liners, journals, caps, and inspect for wear, scores, or damage replace as required**.**



75

Installation

2. Coat all parts in new engine oil prior to assembly. Position bearing cap with locking tang, towards camshaft side of engine and fit the bolts, 190–203Nm (140–150 lbf ft) 19.3–20.1 kgm
3. If fitting a new thrust bearing liner it must be aligned as in the following crankshaft chapter.

FLYWHEEL REMOVAL

NOTE: *To remove the flywheel, the engine requires to be split from the transmission housing refer to "Separating the Unit"****.***

1. To gain access to the flywheel separate the engine to transmission.

NOTE: *Prior to removal and using a dial indicator, rotate the flywheel and measure to specification 0.127mm (0.005 in) Total Indicator Reading. If not to specification check crankshaft to flywheel seating.*

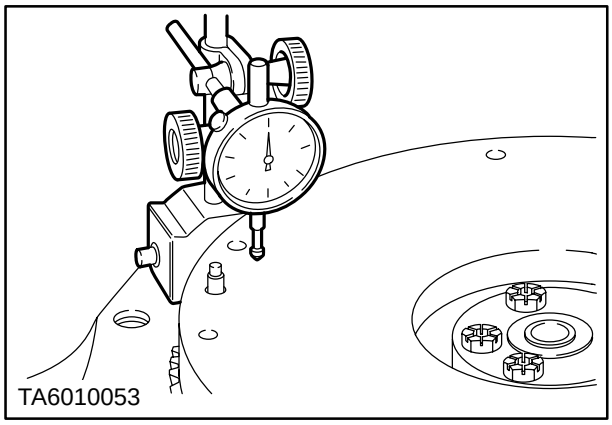
Inspection and Repair

Ring Gear

1. Inspect the flywheel ring gear, and if damaged renew in the following manner,

Cut old ring gear free from the flywheel.

Clean the mating surfaces of the new ring gear, and flywheel.

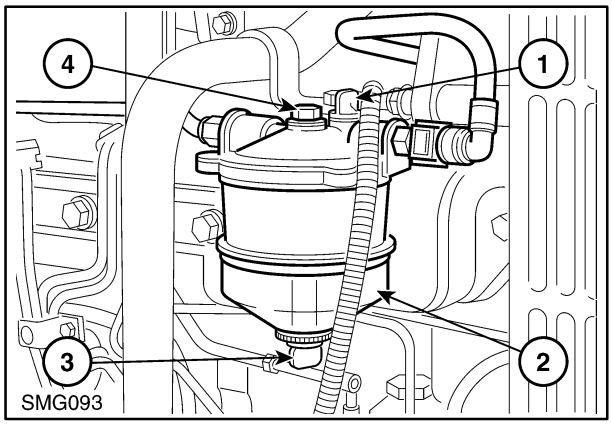


76

TORQUE VALUES

DESCRIPTION	N·m	ft. lbs.	kgf/m
Throttle Cable Locknuts	50	37	5.1
Throttle Lever Stop Bolt Locknut	10	7	1.0
Fuel Tank Strap Retaining Nut	2.5	1.8	0.25
Fuel Tank Strap Locknut	25	18	2.5
Fuel Tank Shutoff Valve	14	10	1.4
Fuel Tank Leak-Off Elbow	14	10	1.4
Leak-Off Pipe to Elbow	24	18	2.4
Thermostart Plug	37	27	3.8
Thermostart Pipe Union	10	7	1.0
Leak-Off Pipe to Injector Line	24	18	2.4
Fuel Tank Sender Retaining Screws	2.5	1.8	0.25
Fuel Filter Element Retaining Bolt	10	7	1.0
Fuel Filter Retaining Bolts	30	22	3.1
Exhaust Muffler Retaining Clamp	35	26	3.6
Air Cleaner Retaining Bolts	55	40	5.6
Air Cleaner Hose Clamps	2.5	1.8	0.25
Air Cleaner Restriction Indicator Switch	12	9	1.2

FUEL FILTER/SEDIMENT SEPARATOR (OP NO 10 206)



16

Removal

1. Drain the filter and sediment separator of fuel, by removing the bowl drain screw (3).
2. Disconnect and remove the fuel lines from the head of the filter/sediment separator assembly and plug the exposed openings to prevent contamination.
3. Remove the retaining bolts, then remove the assembly from the tractor.

Disassembly

1. Remove the center retaining bolts and separate the filter components.
2. Using clean fuel, wash out the filter bowl and the glass bowl on the sediment separator.

Reassembly

Reassembly of the fuel filter/sediment separator follows the disassembly procedure in reverse. On reassembly, observe the following requirements:

3. Install a new filter element and sealing rings, be sure the sealing rings are correctly positioned.
4. Tighten the center retaining bolts.

Installation

Installation of the fuel filter/sediment separator assembly follows the removal procedure in reverse. On installation, observe the following requirements:

5. Tighten the retaining bolts.
6. Assemble the fuel pipes to the connectors in the head and tighten the nuts until the stop is reached (metal to metal contact).
7. Bleed the fuel system as previously described.

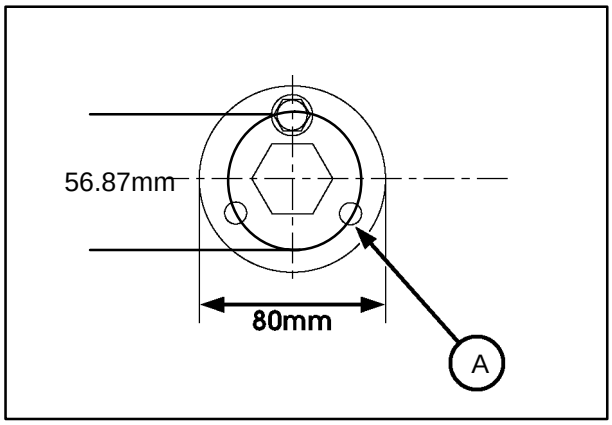
NOTES

TOOLS

Fuel Injection Pump Drive Gear Puller

If the pump drive gear is tight It may be necessary to manufacture a gear puller, this can be achieved by following the guidlines as shown:

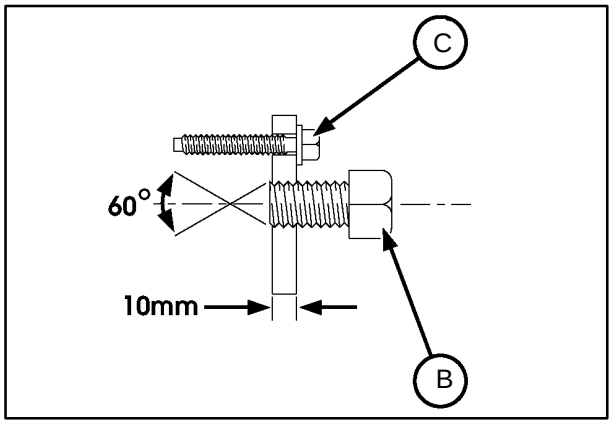
1. Use a plate of (HRLC P&O Steel material) with a Diameter 80mm (3.15in) and a thickness of 10mm (0.394 in).
   Drill x3 Holes (A) 9.5mm (0.375 in) equally spaced with a diameter 56.87mm (2.2 in) on the plate.



44

2. Drill and tap a thread into the centre of the plate 3/4 x 16 – UNC (B) and attach a bolt 51mm (2 in) in length.
3. Attach 3 bolts 5/16 – UNF x 2 in (51mm) with washers (C) through the plate and into the pump face.

Apply a gradual torque to the centre bolt (B) and remove the pump gear.



45

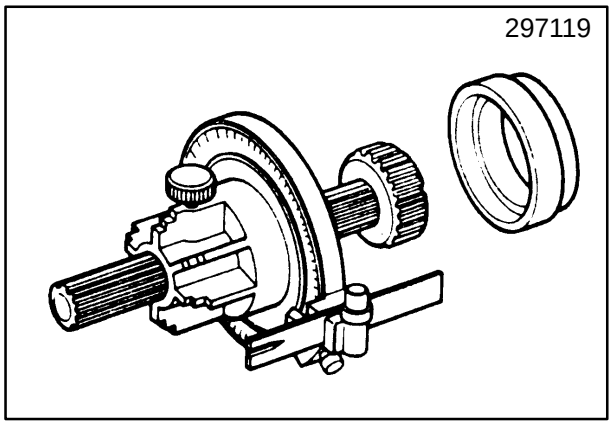
DP200 fuel injection pump timing TOOLS

V.L. Churchill Ltd tools are available and recommended, to check the fuel injection pump timing of all Lucas CAV D.P.S. type fuel injection pumps. These tools are used for:

- Engine front plate timing marks in relation to flywheel timing marks.
- Fuel injection pump internal timing.

IMPORTANT: *Whenever a replacement fuel injection pump is being installed or poor engine performance is evident, the use of the following timing tool is recommended.*

1. Timing gauge, splined shaft and slotted arm
   Tool #**297119**



46

The increased volume and density of the air delivered to the engine cylinders permit a corresponding increase in the volume of fuel that can be introduced into the cylinders while maintaining the air/fuel ratio required for proper combustion. Since engine power output is a function of the volume of fuel burned, the increase in the volume of fuel introduced as a result of turbocharger operation results in an increase in engine power output.

To allow the turbocharger and exhaust manifold to cool down and present any possible distortion of components, idle the engine at 1000 RPM for approximately one minute before stopping the engine.

IMPORTANT: *To ensure adequate lubrication of the turbocharger, allow the engine to idle at 1000 RPM for approximately one minute after starting the engine.*

TURBOCHARGER FAULT FINDING

It is important when troubleshooting a suspected turbocharger malfunction to keep in mind that a turbocharger cannot compensate for incorrect engine operating procedures; deficiencies of the engine air intake, fuel, or exhaust systems; or for damaged engine components such as valves, pistons, rings, liners, etc. Replacing a good turbocharger with another will not correct engine deficiencies.

Consequently, systematic troubleshooting of a suspected turbocharger failure is essential for two very important reasons. First, it must be determined what, if anything, is wrong with the turbocharger so that it can be repaired. Second, it must be determined what action will prevent a recurrence of the failure.

In many cases, the evidence required to determine the cause of a malfunction is destroyed in the process of removing the turbocharger from the engine. For example, if a turbocharger failed as the result of a faulty installation (such as loose duct connections that permitted ingestion of dirt by the compressor), this fact would not be evident once the turbocharger was removed from the engine.

Furthermore, failure to take appropriate steps to ensure correct installation, such as repairing or replacing defective clamps or ducting, could cause the replacement unit to fail in a similar manner.

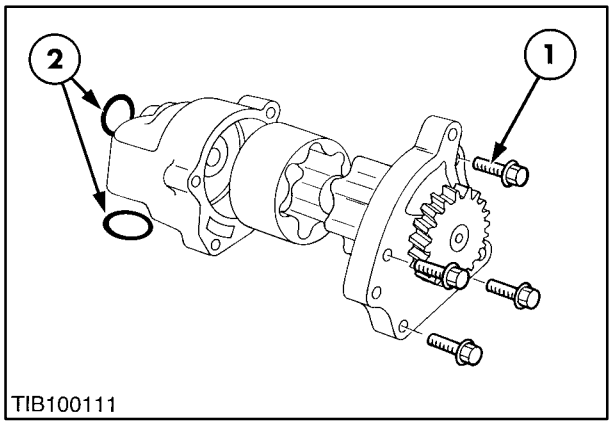
The follow chart contains information pertaining to probable failure modes of turbocharged engines, possible causes for such failures, and the maintenance action required to remedy each possible cause. It is not represented that this information is all-inclusive. On the contrary, this information should be considered primarily as representative of the methods or techniques that should be employed in troubleshooting a turbocharged engine malfunction.

In general, those troubleshooting procedures that can be performed with the least effort and in the least amount of time should be performed first. No removal or disassembly procedures should be performed until all visual inspections and sensory tests (sight and feel) that can be accomplished with the turbocharger installed have been performed. The possible causes and procedure are generally arranged in the order of ease of accomplishment.

NOTES PAGE

Disassembly

1. Loosen and remove the pump face plate to body bolts (1). Disassemble the pump and discard the O–rings (2).



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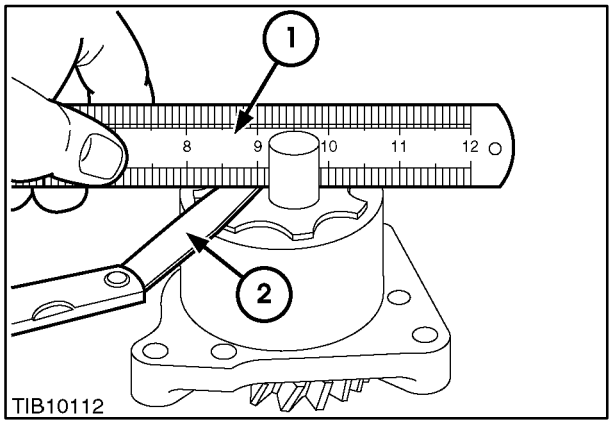
Inspection and Repair

1. Wash all parts in a suitable solvent and inspect inside of pump plate, and body, for excessive wear or damage. If visually okay check in the following manner.
2. Invert pump plate/rotor assembly, and place outer rotor over inner rotor. Placing a ruler (1) across top of both, slide a feeler gauge (2), between ruler and inner rotor, to 0.025–0.089mm (0.001–0.0035 in).

NOTE: *If not to specification replace the oil pump, as reduced pump pressure through wear could result in reduced engine life.*



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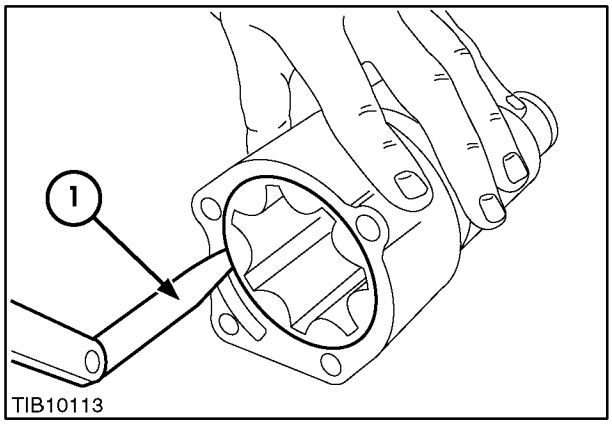
3. Place outer rotor in pump body and check clearance, by inserting a feeler gauge (1) between the rotor and body. Check to a max of 0.55mm (0.022 in). If exceeded a new pump is required.



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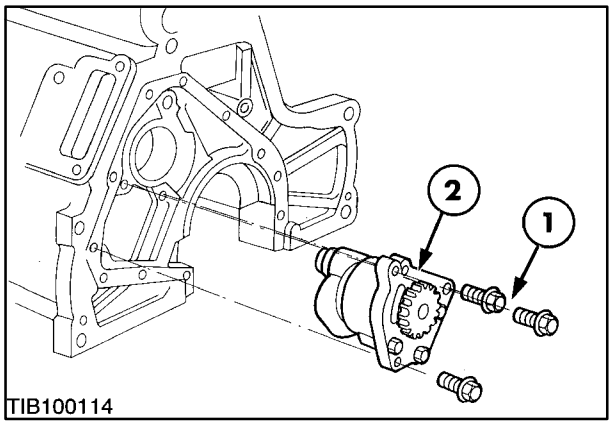
Installation

1. Clean and coat parts in new engine oil. Place outer rotor in pump body, and ensure free rotation. Insert inner rotor, and pump plate assembly, into the body and ensure that shaft is fully seated into bushing.
2. Assemble the front plate to the body bolts,and torque to, 23.0–28.4Nm (17–21 lbf ft) 2.3–2.9kgf m.

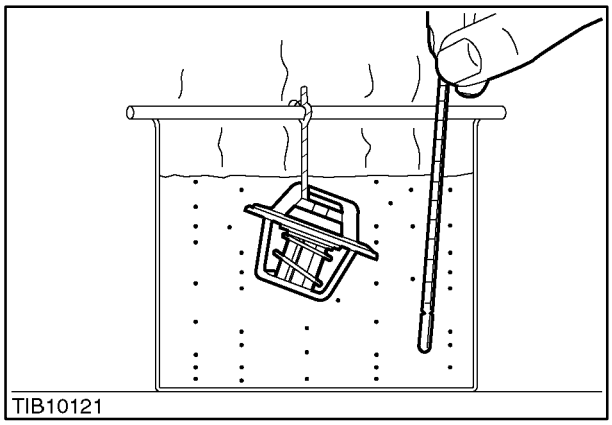
IMPORTANT: *After tightening ensure the drive gear rotates freely by hand, at least 5 revolutions, if not "disassemble" and repeat the exercise.*



7

Inspection and Repair

1. Place the thermostat in a container of water, and raise the temperature to 100°C (212°F). If the thermostat fails to open when hot, or close properly when cooled, it must be replaced.



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Installation

Installation of the thermostat is the reverse of the removal procedure but observing the following:

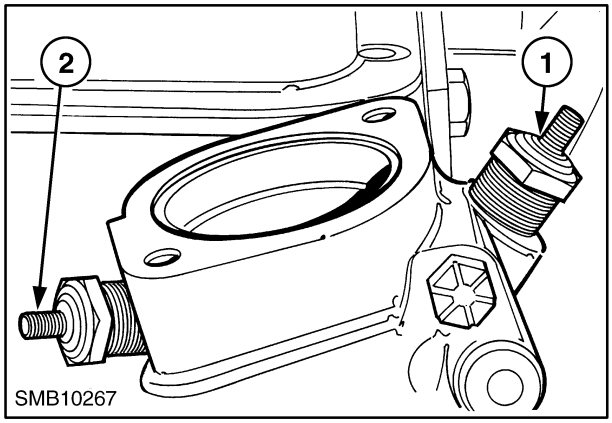
1. Prior to re–assembly ensure the thermostat housing faces are clean and free of old sealer or gasket material. Clean the faces with a small stone or fine grit paper.
2. Coat a new gasket with sealer 82995774 and position in the recess on the thermostat housing, prior to installing the thermostat.
3. Coat the edge of the thermostat with grease and install, with the heat element located in the cylinder head.
4. Refit the thermostat housing and torque the two bolts to 20–28Nm (15–21 lbs ft).
5. Ensure the correct grade, and quantity of anti-freeze, is added to the coolant. Recommended content mixture is Water 50%, with 50% Anti-freeze to WSN–M97B18–D specification.

TEMPERATURE WARNING SENDER

1. The engine temperature sender for the gauge (1), and the temperature warning light (2), (where fitted), are located on the thermostat housing.

Installation

1. If a fault occurs fit a new sender and apply sealant to the threaded portion of the sender body and torque to, 16–24Nm (12–18 lbf ft).



10

4. Ensure the brakes are firmly locked so the unit will not move, gradually depress the foot accelerator and note the maximum engine speed obtained. Move the power reversing lever to the neutral position. The stall speed should be:

STALL SPEED:

Power Shuttle Transmission Models 90.2 (Outside of N/America) . . . 1980 revs/min
Power Shuttle Transmission Models 100.2 (Outside of N/America) . . . 2082 revs/min

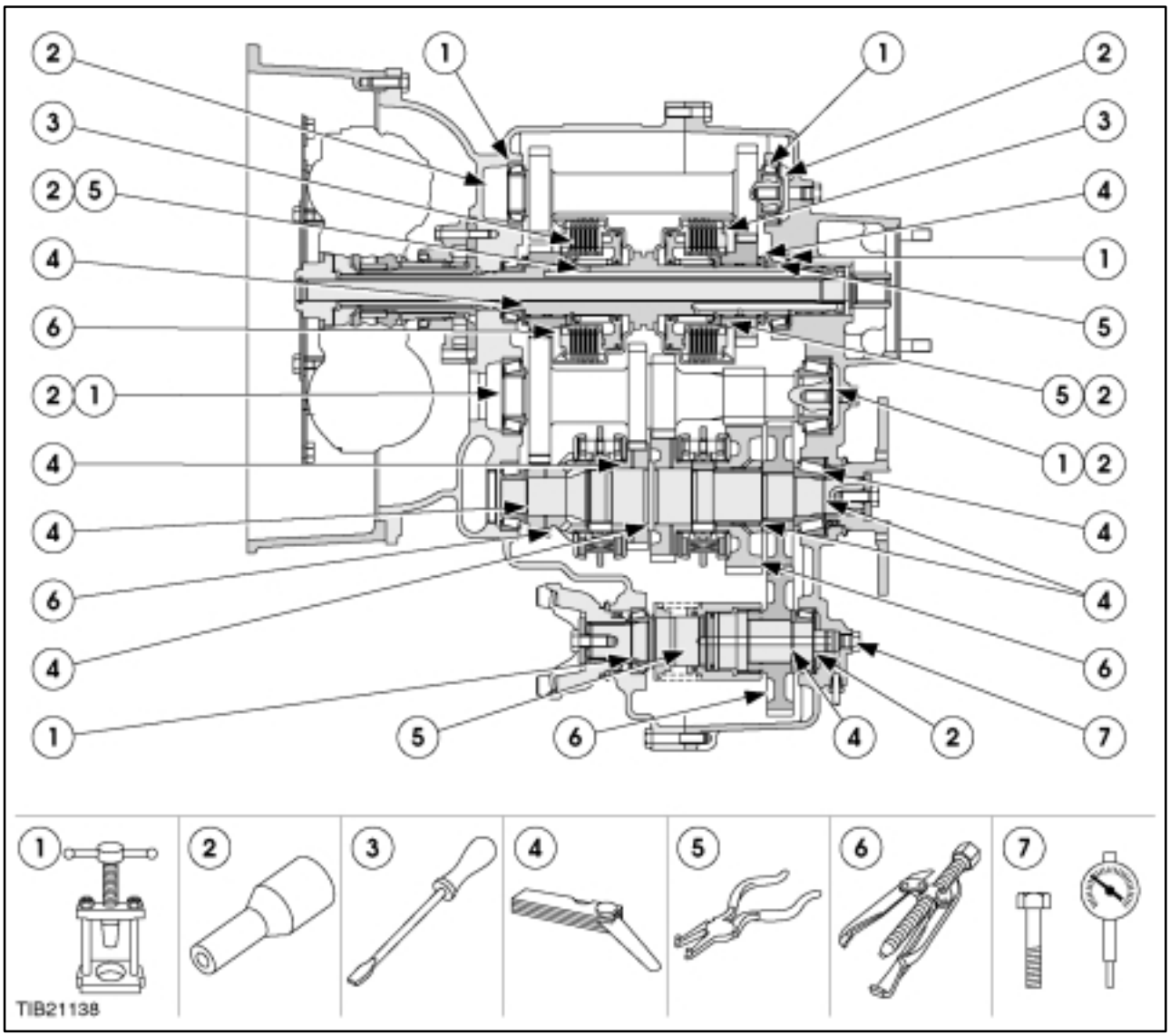
IMPORTANT: *To prevent the transmission from overheating, do not allow the engine to operate at wide open throttle for more than fifteen seconds.*

5. Allow the transmission oil to cool to 29°-35° C (85°-95° F). Check the rear hydraulic clutch by repeating Steps 3 and 4, but with the power reversing lever in the rearward position. Again, cool the transmission oil by allowing the engine to run at approximately 1000 revs/min for one minute.
6. The engine speed noted in Step 4 (stall speed) for both the front and rear clutch assemblies should be within 150 revs/min of each other. If the stall speed is not within these limits, refer to the diagnosis guide for possible causes.
7. With the gearshift lever and power reversing lever in neutral, set the engine speed at 600-800 revs/min, then shift into any gear ratio. If the gears clash, either the front or rear hydraulic clutch assembly is transmitting power, even though the power reversing lever is in neutral.

NOTE: *If the unit creeps forward and the gears clash, the front clutch is at fault. The rear clutch is at fault if the unit creeps backward. If the unit does not creep and the gears still clash, use the stabilizers to raise the rear wheels off the ground, move the power reversing lever to neutral and shift into first gear. Check the rear wheels for rotational direction - if the wheel rotate rearward, then the rear clutch is at fault.*

SPECIAL TOOLS

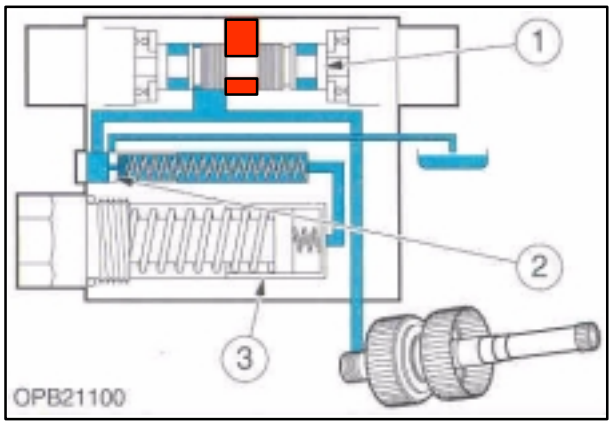
DESCRIPTION	APPLICATION
Bearing Cone Drift 40mm	Counter Shaft, Rear Main Shaft and 4WD Bearing
Bearing Cone Drift 35mm	Reverse Idler and Front Main Shaft Bearing
Bearing Cone Drift 40mm	Front Input Shaft Bearing
Bearing Cone Drift 50mm	Rear Input Shaft Bearing
Slide Hammer	Bearing cone removal
Bush Insertion Tool 22mm	Pump rod Insertion Tool
Welch Plug Drift	Shim Adjustment Cover
Oil Seal Drift	Pump Seal
*Spring Compressor	Main Clutches Tool no 297394
Spring Compressor	Detent Ball Spring
Circlip Pliers .	Where applicable
Feeler Gauges	Where applicable
*Dial Indicator Bolt	Shaft end float Tool no 297395



2

OIL FLOW SOLENOID CONTROL VALVE OPERATION (FORWARD DRIVE ONLY SHOWN)

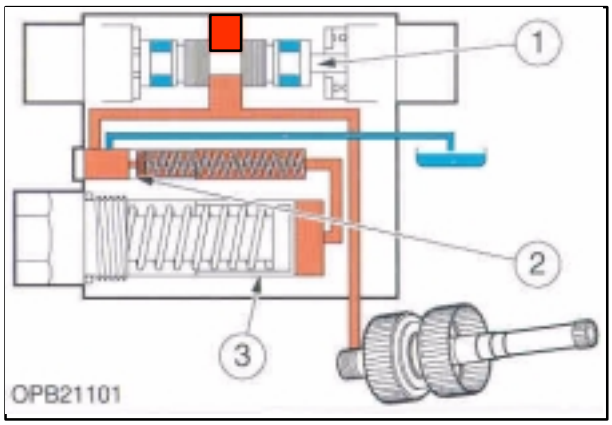
The solenoid valve when in neutral position dead heads the oil flow at the spool (1) from the supply port and no oil is allowed to pass through the valve. Therefore the oil in the galleries beyond the spool at the fill time metering valve (2) remains static.



23

Selection of the forward / reverse shuttle lever in the cab directs a current flow to the forward or reverse solenoid and the spool (1) will move in the direction selected, reverse shown. The oil then flows past the spool to the clutch pack and applies pressure to the fill time metering valve (2), a small bore allows oil to flow into the clutch feathering valve.

When valve (2) moves it partially uncovers a port to the reservoir and also opens the control orifice within the valve. Therefore a precisely metered flow of oil is fed to the pressure regulating (feathering) piston (3). As this piston is pushed back against its spring the pressure at the clutch builds up gradually to give a smooth jerk free clutch engagement.



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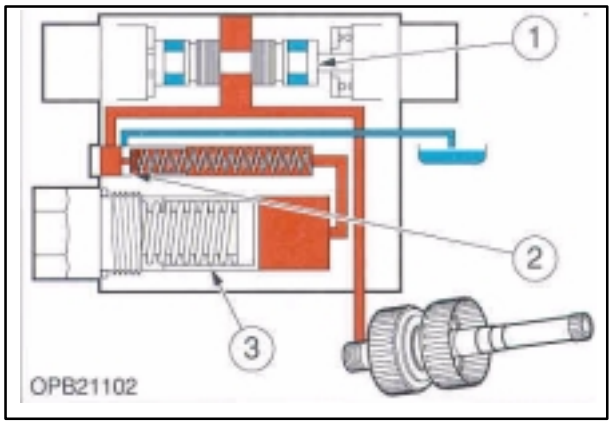
When the piston reaches the end of its travel, clutch pressure quickly builds up to full system pressure either side of valve (2) so the the light spring pushes the valve covering the port to the reservoir.

The oil is dead headed at system pressure at the clutch so ensuring full torque can be transmitted by the clutch.



25

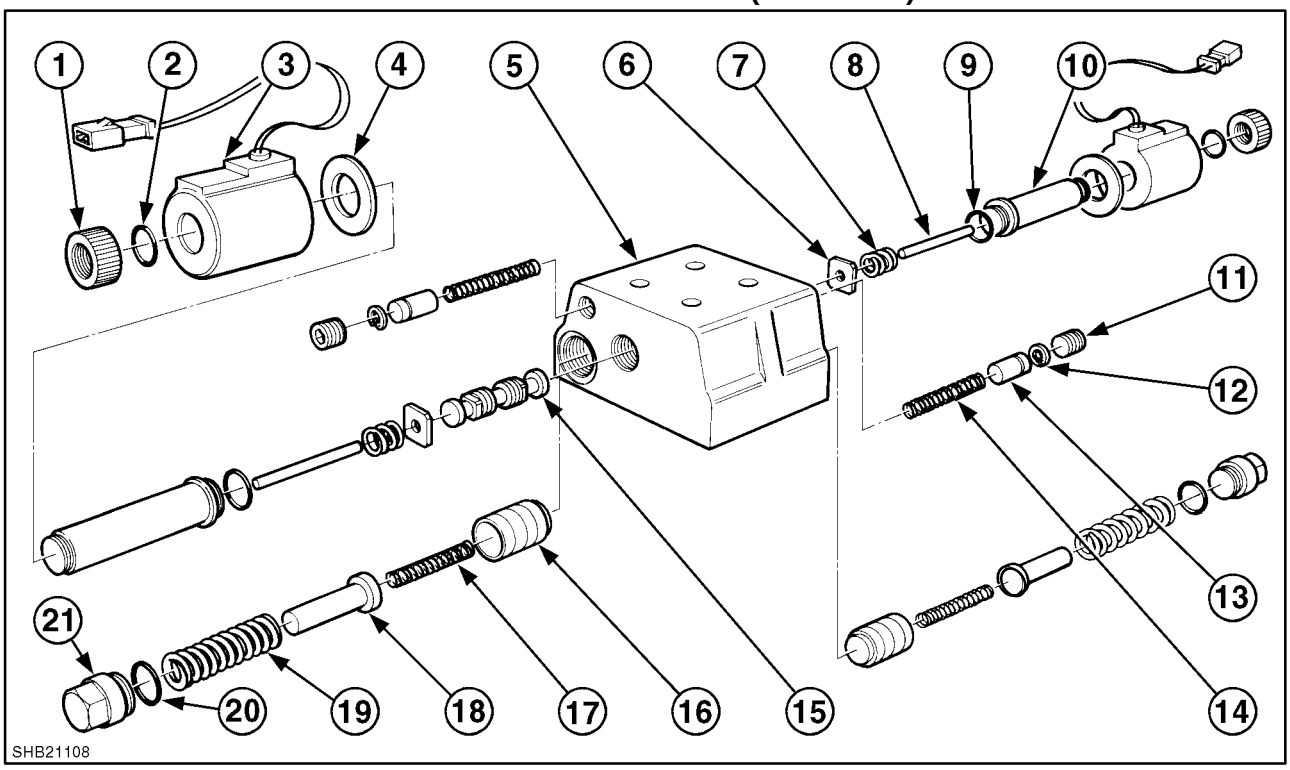
NOTE: *The control valve also includes a pressure regulating (feathering) valve and a fill time metering valve for the reverse clutch pack.*

= Regulated Pressure Oil

= Return Oil

= Pressure Oil

FORWARD / REVERSE CONTROL SOLENOID VALVE (OP. 21 136)



32

Shuttle Valve Disassembled

1. Solenoid Retainer
2. Dirt Seal
3. Solenoid
4. Washer
5. Solenoid Body
6. Guide
7. Spring
8. Solenoid Pin
9. Seal
10. Support Body Solenoid
11. End Cap *
12. Circlip *
13. Clutch fill metering valve *
14. Spring *
15. Spool
16. Piston Clutch fill
17. Spring
18. Retainer
19. Spring
20. Seal
21. End Plug

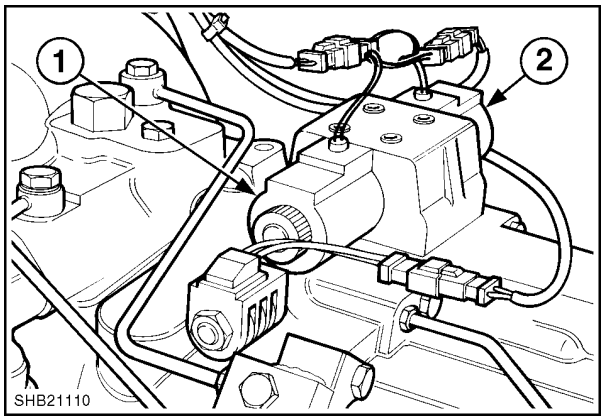
NOTE: **These items are not serviceable other than for cleaning*

SOLENOID VALVE – DISASSEMBLY

Mounted on the top of the transmission is the shuttle solenoid valve of which is controlled by the forward (2) and reverse (1) solenoids. Remove the 4 attaching bolts and remove from the transmission.

Removal of the retaining ring and ‘O’ ring on the end of each of the coil blocks allows removal of the coils from the solenoid assembly.

Anti clockwise rotation of the solenoid sleeve disassembles the sleeve from the body and allows removal of the plungers, springs, spool supports and spool. Clean and inspect parts for wear or scoring on the friction areas, replace if in doubt. Fit new ‘O’ rings before re–assembly.

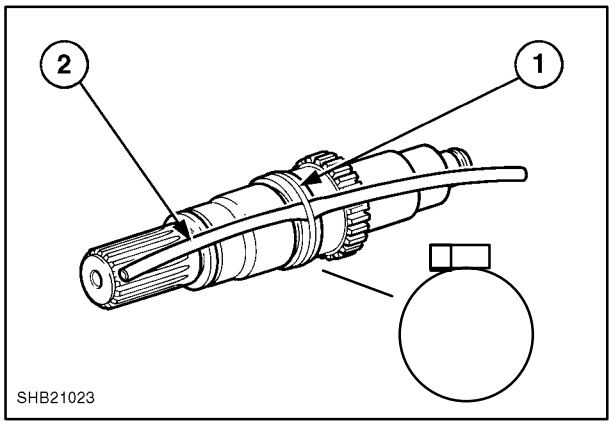


33

RE–ASSEMBLY OF SHAFT

IMPORTANT: *Where new parts are fitted ensure a coating of new transmission oil is liberally applied to all mating surfaces before re–assembly.*

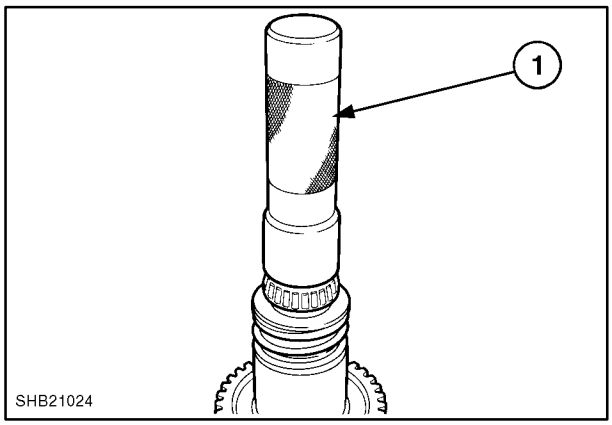
1. Prior to re–assembly ensure a new clutch seal is fitted onto the shaft. Place the seal (1) in warm water prior to fitting, when pliable carefully seat the seal in the groove on one side of the shaft and pull the seal onto the shaft around the circumference. Use a pliable PVC tube (2) or similar material that will not damage the seal.



59

   To size the seal in position place a band of tape over the seal, a jubilee clip can then be placed over the tape to compress the seal fully into the groove prior to fitting the FWD piston.

2. Re–assemble the clutch housing along with spring, washer and apply pressure as in, Figure 15, and refit the circlip. Using a 40mm bearing tool (1) refit the bearing onto the shaft.



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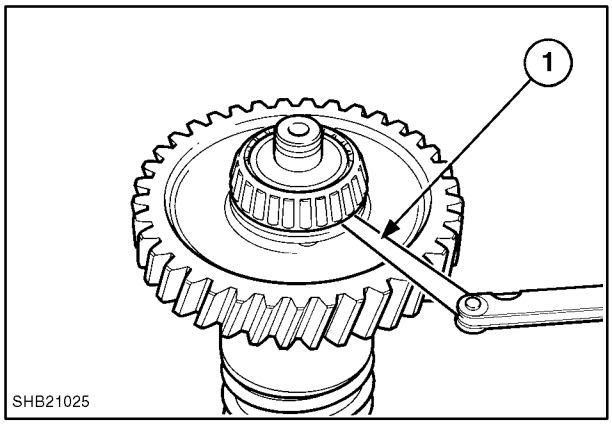
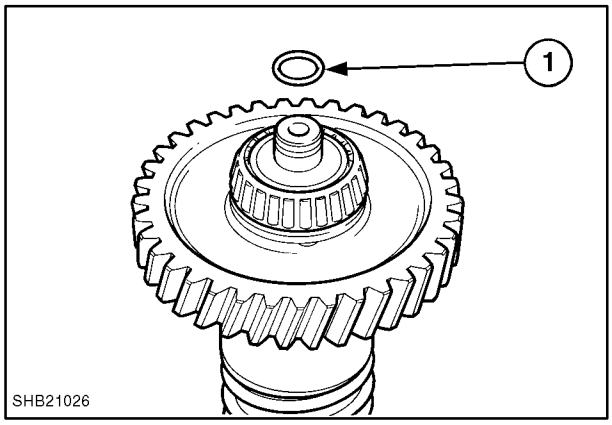
3. Ensure when the bearing is seated an end float of gear to washer 0.05–0.28mm (0.002– 0.011 in) is maintained between the thrust washer and gear (1).



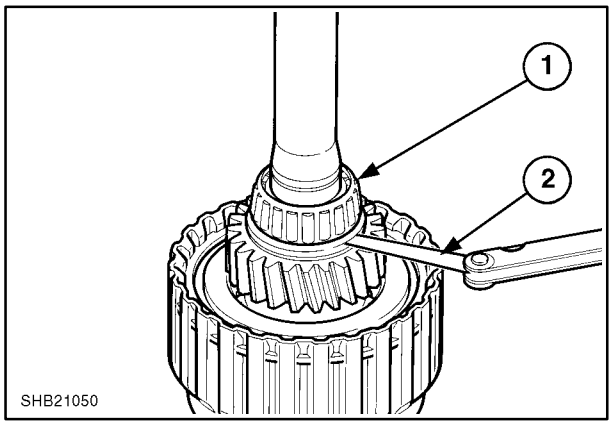
61

4. Fit a new oil seal (1) to the end of the shaft, gear end.



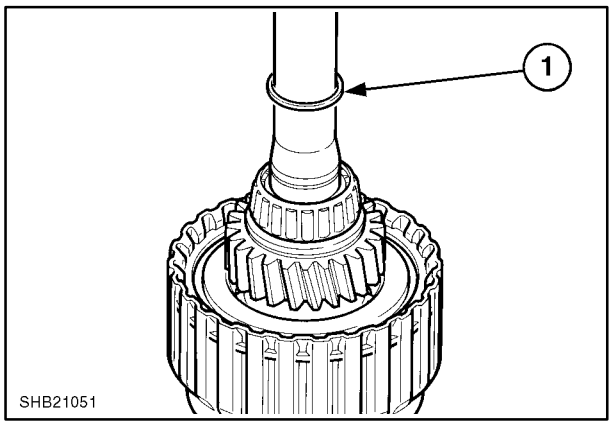
62

11. With the bearing (1) fully seated ensure a free-play of at least 0.0508–0.40mm (0.002–0.016in) exists between the thrust washer and gear (2).



93

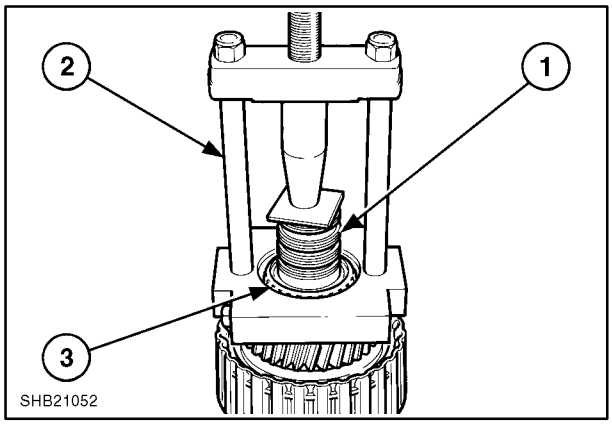
12. Fit a new sealing ring onto the shaft above the bearing (1).



94

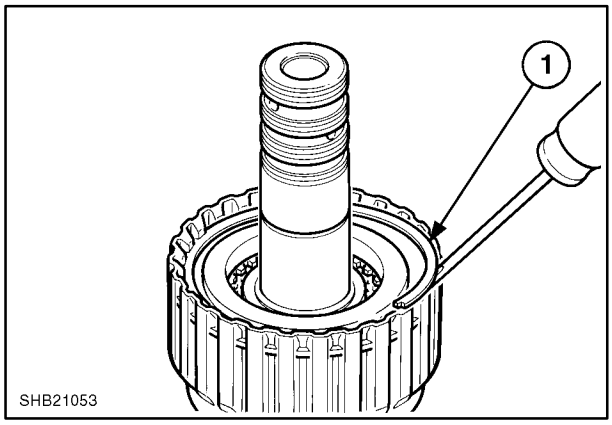
INPUT SHAFT DISASSEMBLY (REAR SUPPORT END)

13. Support the shaft vertically (front support end) in a soft jawed vice and remove the sealing rings (1). Attach puller (2) to the underside of the bearing (3) and remove. Remove the circlip which allows the removal of the thrust washer, thrust bearing, gear/hub, needle bearings with spacer.

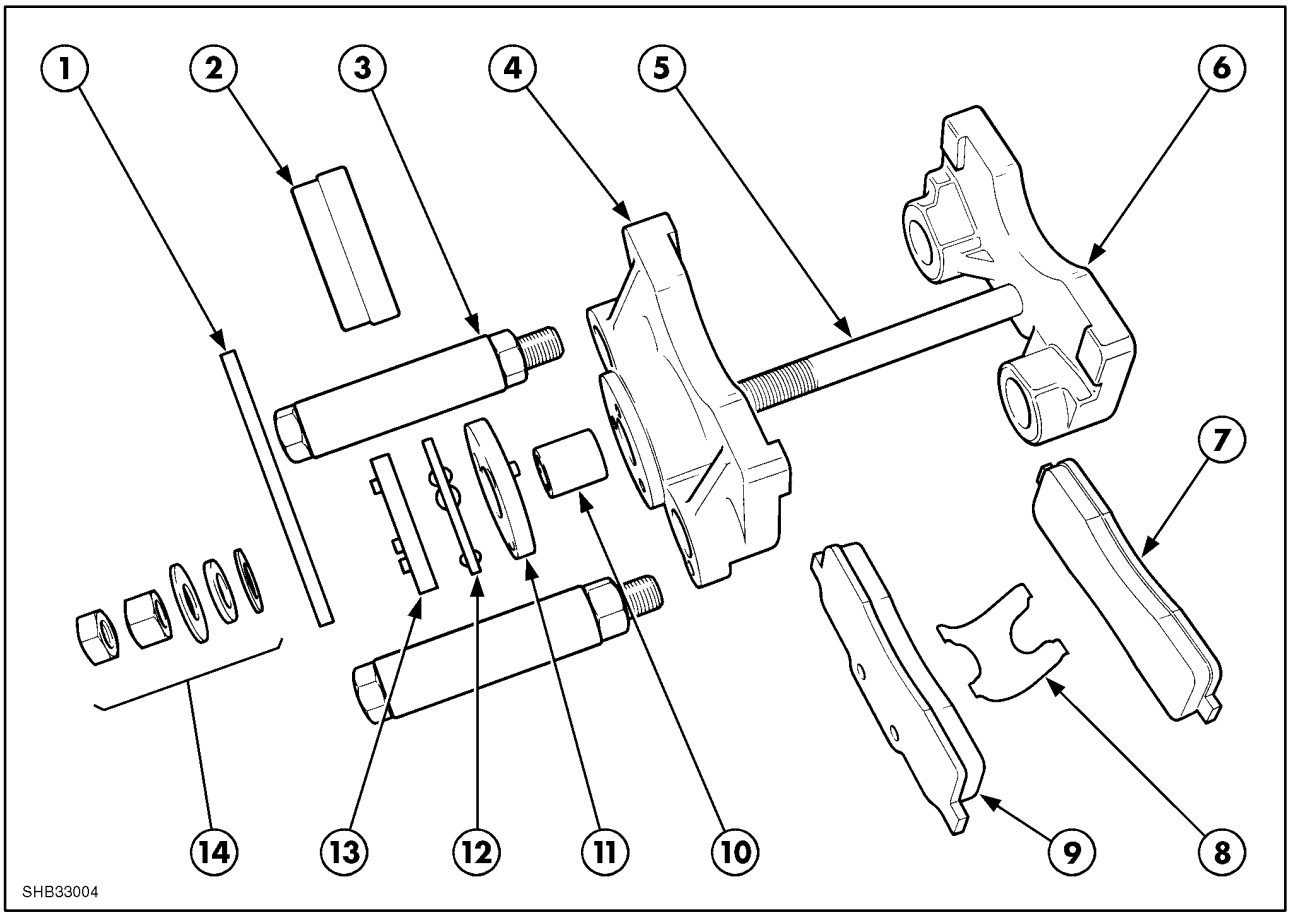


95

14. Release the snap ring (1) retaining the clutch pack drive discs and remove from the clutch housing.



96



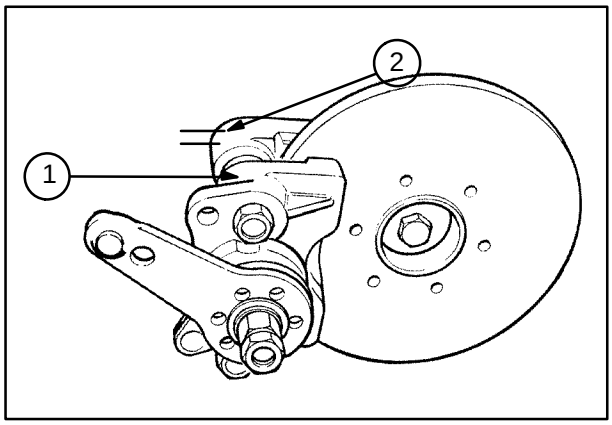
129

Brake Disc and Caliper Assembly

1. Lever
2. Cover
3. Fixing Bolt
4. Outer Caliper
5. Bolt
6. Inner Caliper
7. Inner Friction Pad
8. Fixing Spring
9. Outer Friction Pad
10. Spacer
11. Actuator Plate
12. Balls and Retainer Plate
13. Actuator Plate
14. Adjusting Nuts and washers

The transmission parking brake is fitted to all models and incorporates two free floating friction pads.

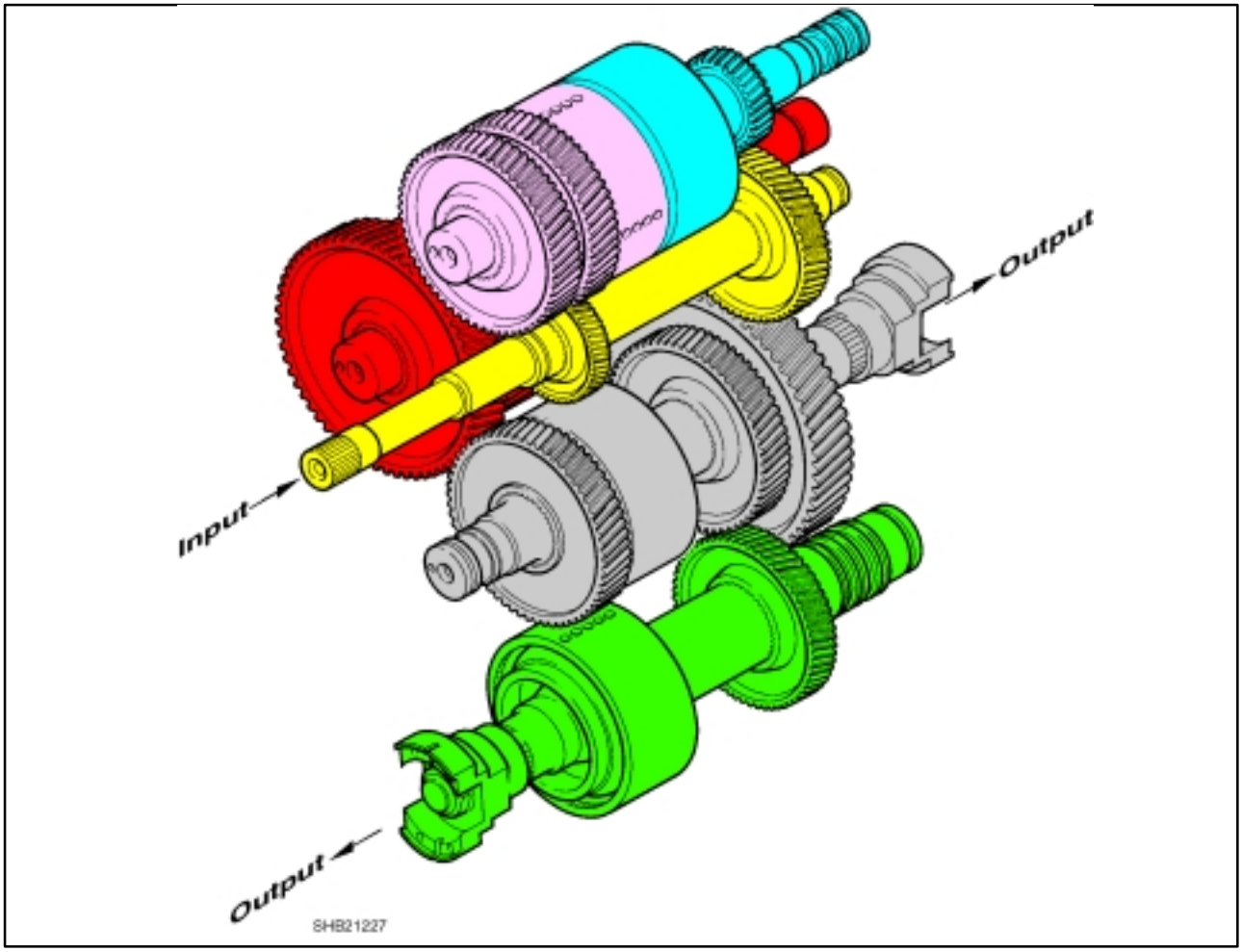
If the brake assembly is fully dismantled upon re–assembly the caliper fixing bolt spacer (1) must maintain a gap of 0.76mm (0.030in) to the transmission body (2).



130

Transmission gear	Activated solenoids	Activated clutches
Forward 4	Forward	Forward high, 2nd
Forward 3	Forward, 2nd/1st	Forward high, 1st
Forward 2	Forward, Forward Hi/Low	Forward low, 2nd
Forward 1	Forward, Forward Hi/Low 1st/2nd	Forward low, 1st
Reverse 1	Reverse, 2nd/1st	Reverse, 1st
Reverse 2	Reverse	Reverse, 2nd
Four wheel drive off	Four wheel drive	None
Four wheel drive on	None	Four wheel drive

GEAR AND CLUTCH LAY-OUT



12

Forward Low

Forward High

Reverse and 1st

Input

2nd

Disconnect

CONTROL FORWARD THIRD GEAR FOUR WHEEL DRIVE DISENGAGED.

System pressure is reduced to 5.5 bar (80 psi) by the pressure reducer this oil then supplies the 6 solenoids and electronic modulation valve.

When the powershift lever is moved forward and twisted anti clock wise an electrical signal is sent to:–

1. The range modulation solenoid sending pilot pressure to the spool.
2. The 1st 2nd solenoid sending pilot pressure to the spool.
3. Once the 3rd gear has been engaged the range modulation solenoid will be de–energised
4. The high/low solenoid prevents pilot oil to flow to the shift spool.
5. The neutral forward solenoid allowing pilot oil to flow to the shift spool.
6. The powershift electronics will then reduce the current to the modulation valve which gives an out put pressure curve from 0 – 5.5 bar (0 to 80 psi) to the pressure booster valve.
7. The modulation pressure curve is multiplied by 4 in the pressure booster so that a curve of 0 – 20 bar (0 – 292 psi) is available for the directional clutch.

   Between the modulation valve and the booster is accumulator to dampen any hydraulic vibration.
8. The four wheel drive solenoid supplies pilot oil to the shift spool

PRESSURE TESTING TORQUE CONVERTER AND COOLER CIRCUIT.

All pressure and flow testing should be measured with an oil temperature of 82–93 degrees Celsius (180 – 200 F). For operating speed refer to each test.

Port 1 System pressure.

– Engine set to 750 revs/min minimum pressure15 bar (218 psi).

– Engine set to 2200 revs/min 19.6 – 23.1 bar (290 – 333 psi).

Port 2 Torque converter in.

– Engine set to 2200 revs/min oil pressure range 5 – 11 bar (73 – 159 psi).

Port 3 Torque converter out.

– Engine speed 2000 revs/min minimum pressure 2 bar (29 psi).

– Engine speed 2200 revs/min maximum pressure 5 bar (73 psi).

Port 4 Oil temperature converter out.

– Normal operating temperature 80 – 90 degrees Celsius. Maximum temperature 120 degrees Celsius (284 F).

Port 5 Oil temperature cooler out.

– T.B.A

Port 6 Lubrication pressure

– Engine speed 2000 revs/min pressure range 0.8 – 2.0 bar (11.6 – 29 psi).

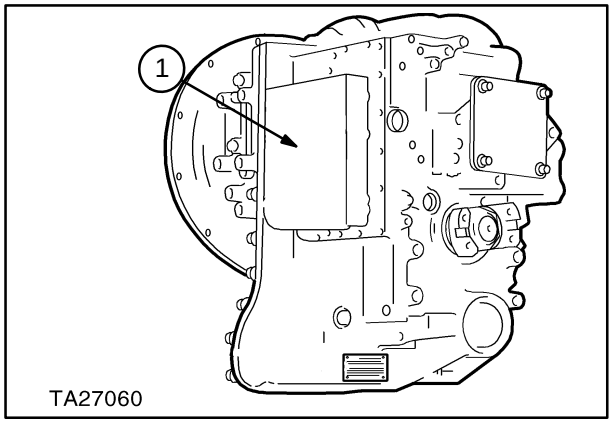
NOTES

Operating Valves and Sensors

The signals sent out from the microprocessor control the speed and gear shifts by operation of valves and sensors which are situated in the valve chest to the left of the transmission.

Enclosed within the valve chest which requires removal from the transmission if repairs are necessary are:

Forward Solenoid
Reverse Solenoid
1/2 Solenoid
Lo/Hi solenoid
4WD/2WD Solenoid
Direction Modulator
Range Modulator
Speed / Temperature Sensor



20

FAULT CODE – F4

BATTERY OVERVOLTAGE – 17 VOLTS PLUS

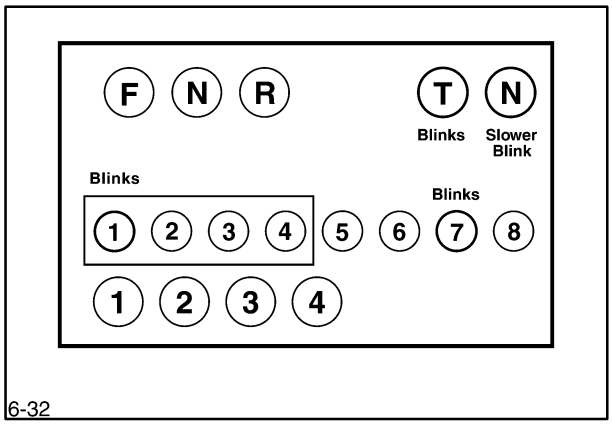
Overvoltage

Even power supply levels up to 30V will not damage circuit components.

Above a power supply of 17 Vdc:

Group Fault 1 – Fault code 7

NOTE: *The speed sensor circuit will not operate when an overvoltage is present*



34

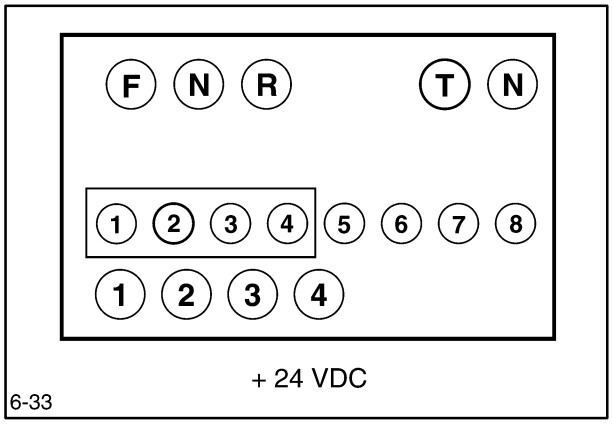
Above a power supply of 24 Vdc:

the analogue signals are not reliable to convert anymore

Overvoltage: When the voltage exceeds 17 Vdc

Action of the Microprocessor:

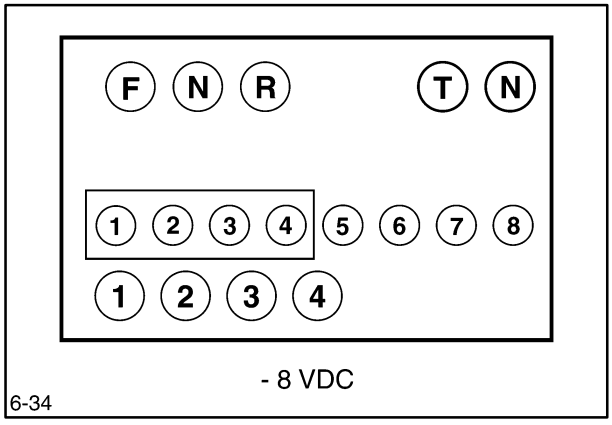
- no upshifts above 2nd gear
- direction change while in Forward 3 or Forward 4: the actual reversal is preceded by a downshift sequence until 2nd gear is obtained



35

- Brake switch activation always engages four Wheel Drive

NOTE: *Voltages below 8 volts D.C the microprocessor enters the reset mode*



36

Intermittent power loss

After power is restored, the Microprocessor goes through the reset mode.

FAULT CODE – F11

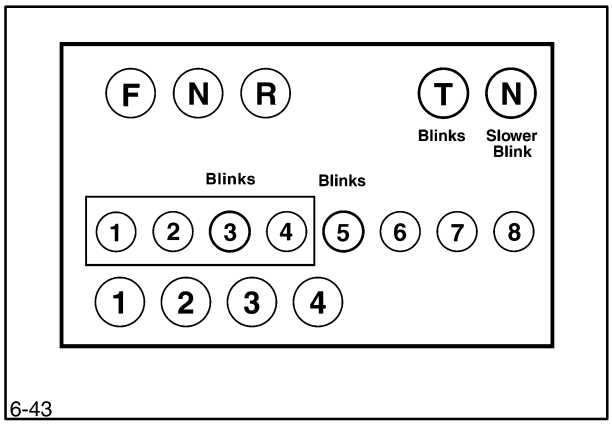
START UP FAULT LIMP HOME SELECTED

Internal faults

At power up a series of integrity checks is done.

If a fault is detected:

- and the fault prevent operation as a transmission controller : the Microprocessor **locks itself in a reset state**.
- and controlling the transmission is still possible : the Microprocessor **reverts to limp home mode**.



50

Limp Home mode

Defaulted to if an internal problem is detected **at power up.**

This mode is automatically selected at power up if the integrity tests show that **EPROM parameters are corrupt,** but the microprocessor can still function as a transmission controller (other component's integrity are intact).

In this mode the user can operate the transmission in either direction in 1st. and 2nd. There are **no protections**; all shifts are **unmodulated**.

FAULT FINDING

Refer to the following troubleshooting guide for the diagnosis of typical transmission troubles.

LOW CLUTCH PRESSURE

CAUSE	REMEDY
1. Low oil level	1.Fill to proper level
2. Clutch pressure regulating valve stuck open	2.Clean valve spool and housing
3. Faulty charging pump	3.Replace pump
4. Broken/worn clutch shaft/piston sealing rings	4.Replace sealing rings

LOW CHARGING PUMP OUTPUT

CAUSE	REMEDY
1. Low oil level	1.Fill to proper level
2. Suction screen plugged	2.Clean section pump
3. Defective charging pump	3.Replace pump

OVERHEATING

CAUSE	REMEDY
1. Worn oil sealing rings	1.Remove, disassemble, and rebuild converter
2. Worn charging pump	2.Replace
3. Low oil level	3.Fill to proper level
4. Dirty oil cooler	4.Clean cooler
5. Restriction in cooler lines	5.Change cooler lines

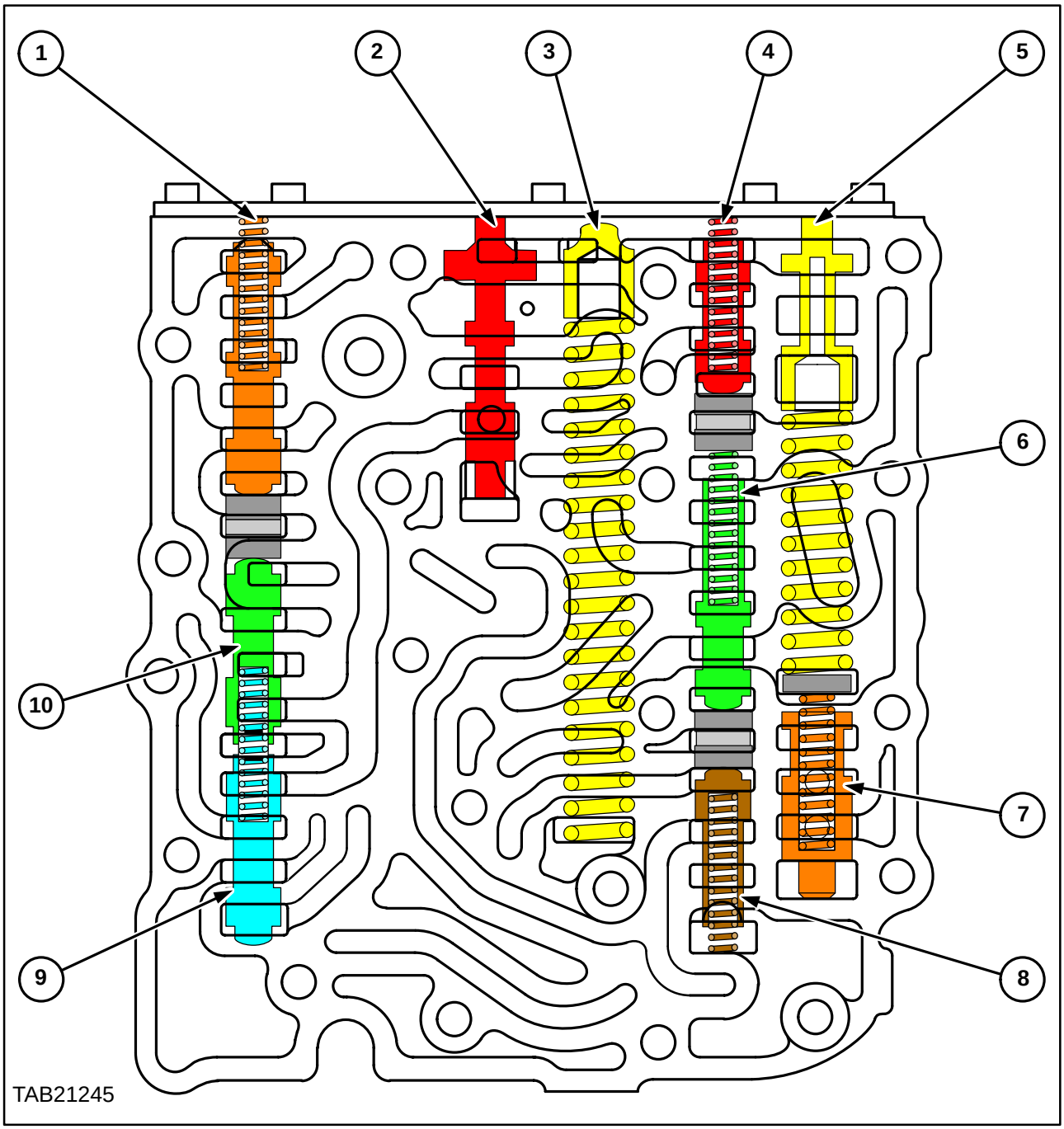
NOISY CONVERTER

CAUSE	REMEDY
1. Worn charging pump	1.Replace
2. Worn or damaged bearings	2.A complete disassembly will be necessary to determine what bearing is faulty

LACK OF POWER

CAUSE	REMEDY
1. Low engine R.P.M. at converter stall	1.Tune engine check governor
2. See ”Overheating” and make same checks	2.Make corrections as explained in ”Overheating”

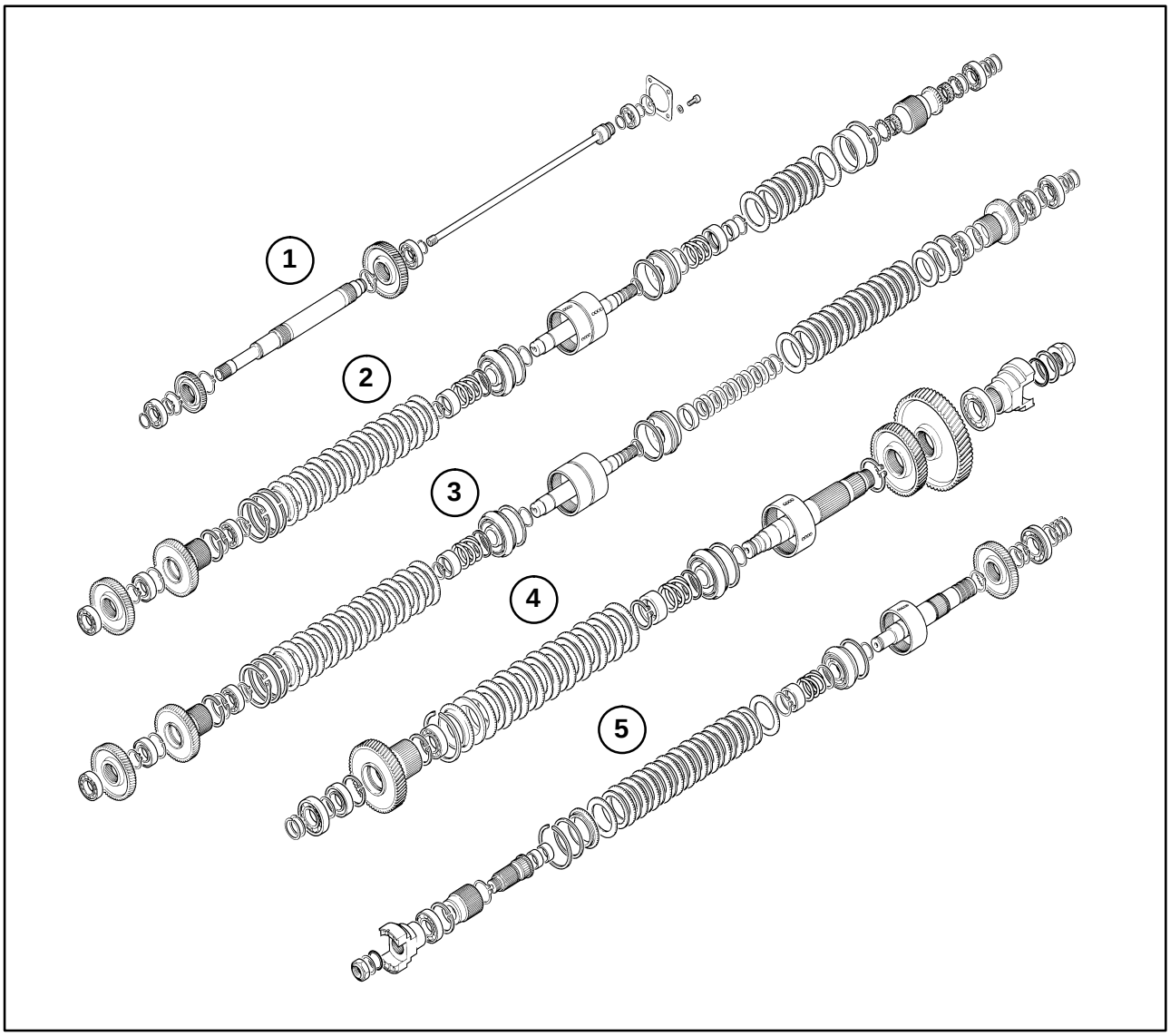
SPOOLS



16

Transmission Control Valve Chest as shown (mating face to transmission body)

1. Forward high Low Valve Spool
2. Pressure Booster Spool
3. Accumulator Spool
4. Range Modulation Spool
5. System Pressure Regulating Spool
6. 2nd and 1st Clutch Spool
7. Pressure Reducer Spool
8. Four Wheel drive Spool
9. Reverse Spool
10. Forward Spool



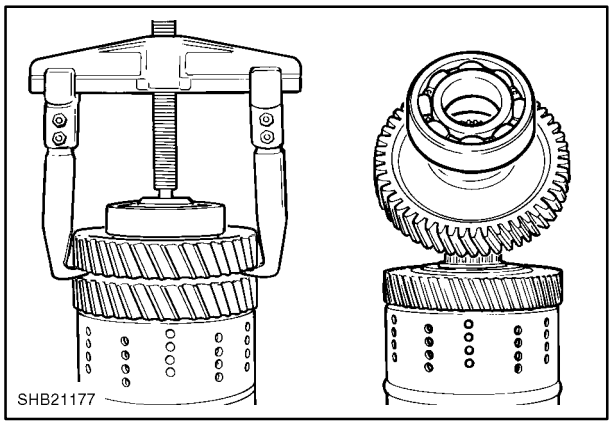
41

Powershift Transmission Operating Shafts

Disassembly of the above shafts can be found the following pages as listed.

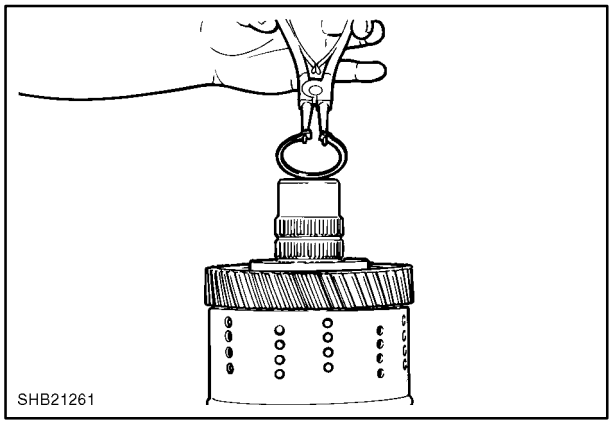
Disassembly forward low clutch

Use bearing puller remove front bearing and gear.



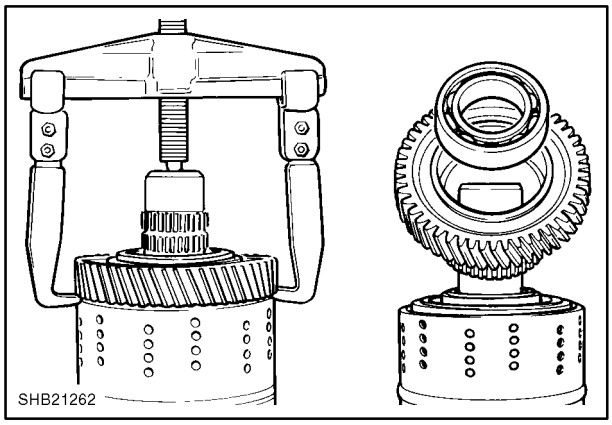
65

Remove gear retainer ring.



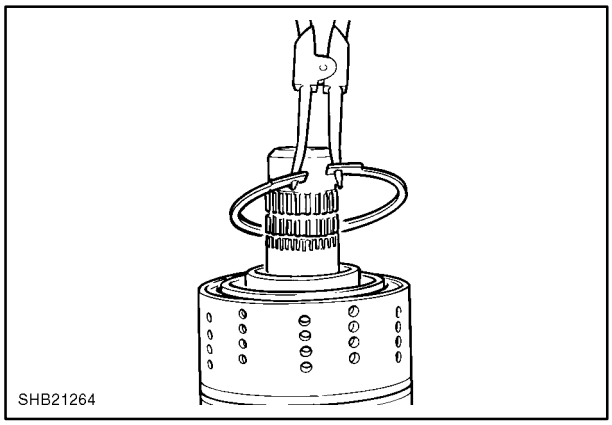
66

Use a bearing puller and slice to remove clutch gear and bearing.



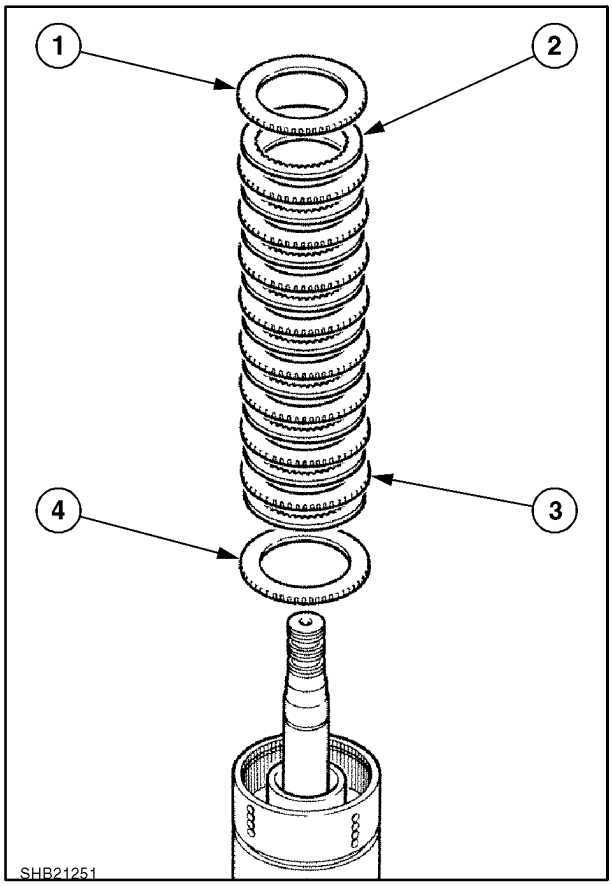
67

Remove circlip and spacer.



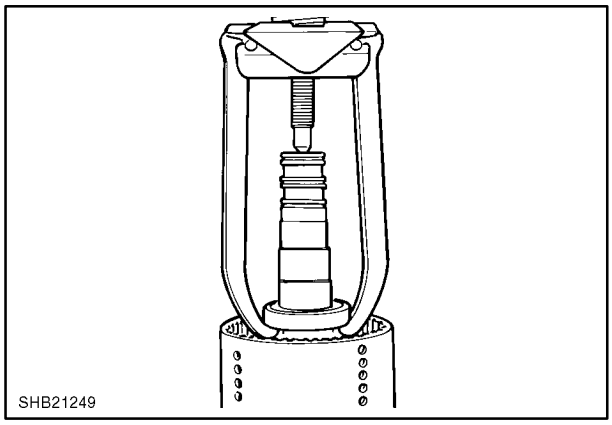
68

Remove 1x friction half disc (1).
9x – Steel Discs (2).
8x – Friction Discs (3)
1x – Friction Half Disc (4)



92

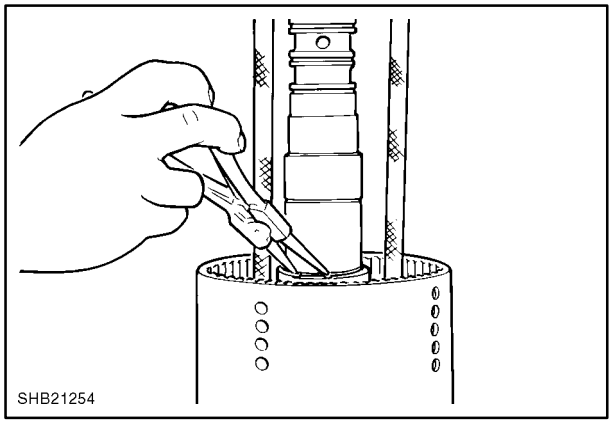
Use bearing puller to remove clutch gear steel bearing.



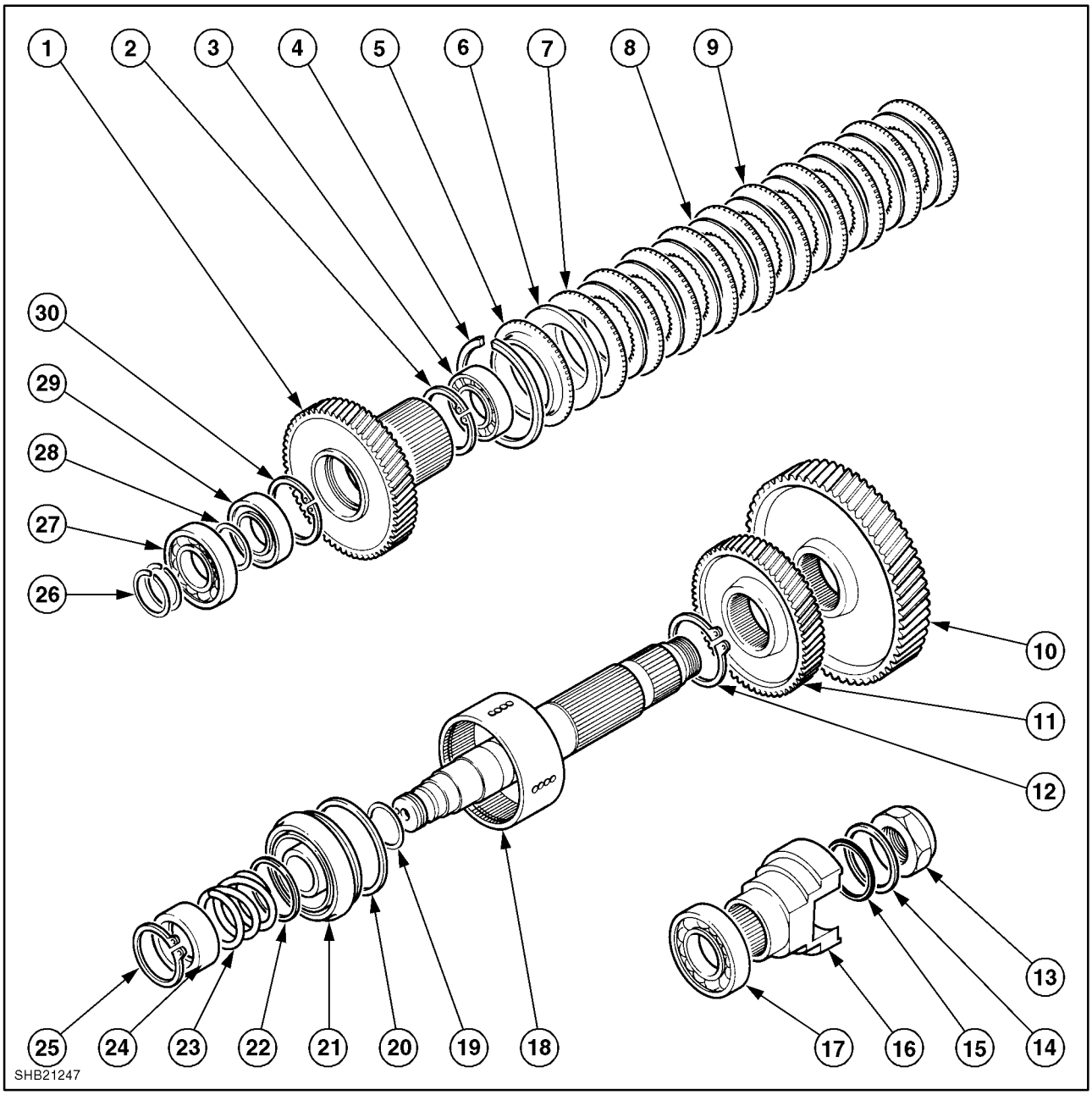
93

Compress clutch piston Belleville washer spring using tool no **297401**. Remove spring snap ring.

NOTE: *Force of disc spring is 3.280N !*



94



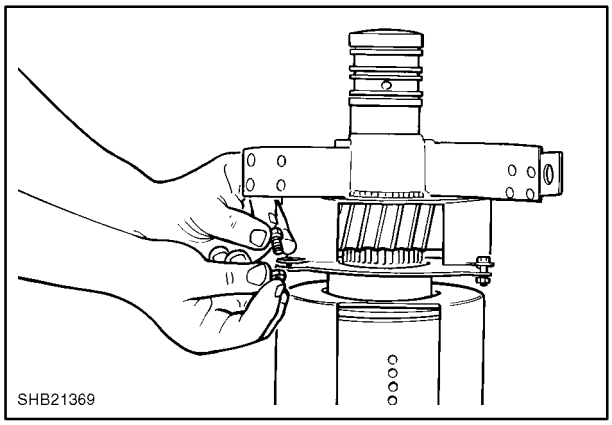
126

2nd Clutch Drum Output Shaft

1. Gear 2nd Clutch
2. Circlip
3. Bearing
4. Snap Ring
5. Outer Half Disc
6. Modulation Spring
7. Steel Disc
8. Steel Disc
9. Friction Disc
10. Gear Upper Output
11. Gear Lower Output Drive
12. Circlip
13. Retaining nut Output Yoke
14. Washer
15. Sealing Ring
16. Output Yoke
17. Bearing
18. 2nd Shaft / Drum Assembly
19. Piston Seal Inner
20. Piston Seal Outer
21. Piston
22. Spring Wear Ring
23. Spring
24. Spacer
25. Circlip
26. Piston Rings
27. Bearing
28. Washer Bearing Support
29. Bearing
30. Circlip

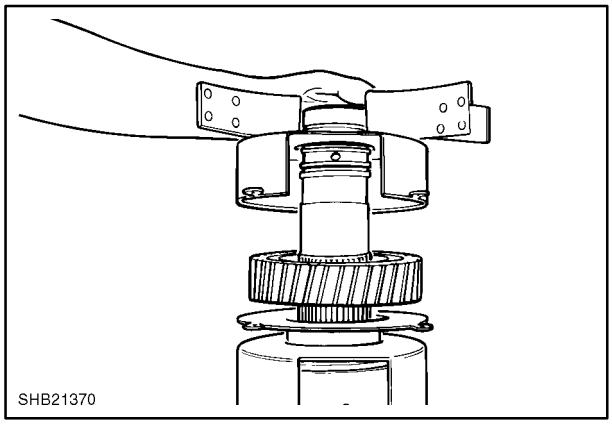
Disassembly output shaft

Remove oil baffle screws and nuts.



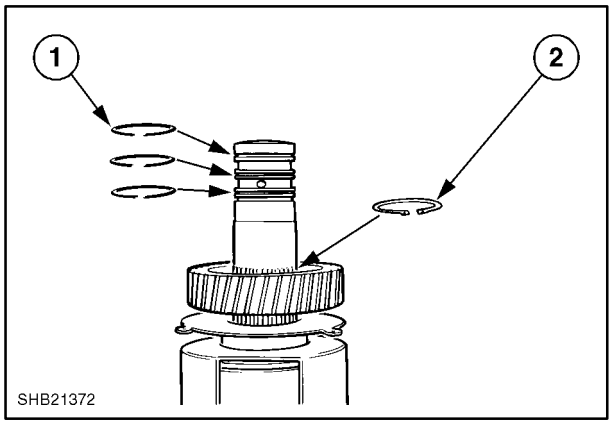
151

Remove oil baffle.



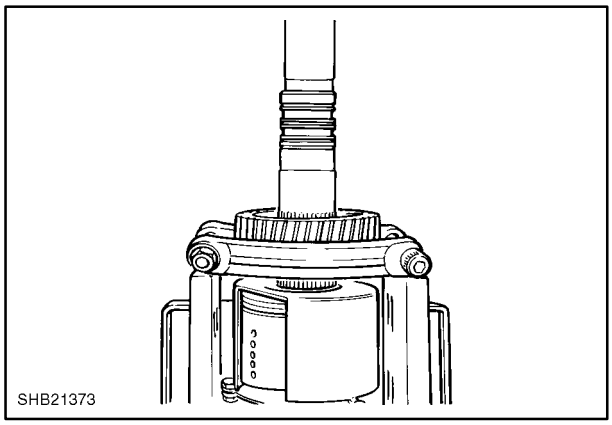
152

Remove output shaft sealing rings (1) and output shaft gear circlip (2).



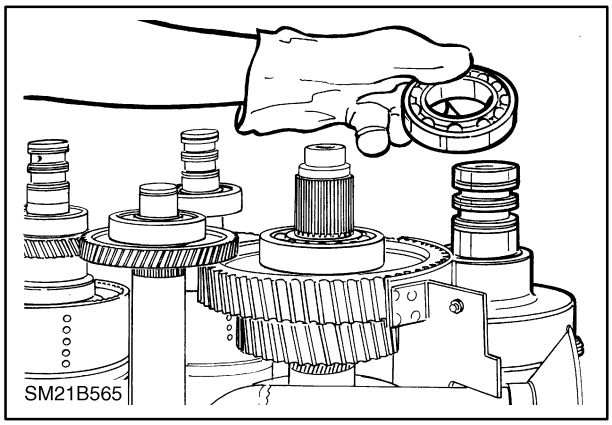
153

Press output gear from shaft



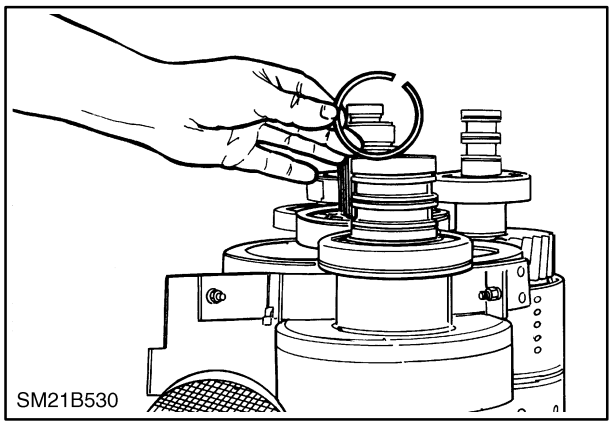
154

Warm FWD shaft rear bearing to 120° C (248 F), install bearing.



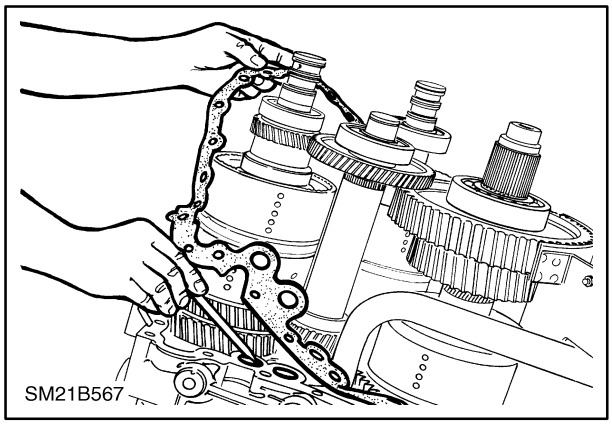
188

Install output shaft rear sealing rings.



189

Install gasket and 'O' rings into 'O' ring grooves.

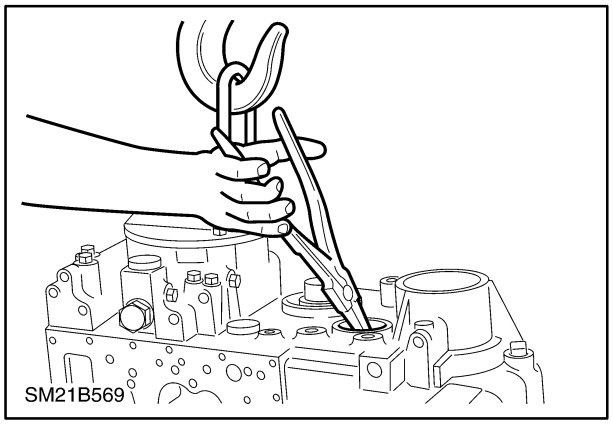


190

Reassembly Powershift transmission

Remove lower output bore plug. Position transmission case on converter housing (using lifting bracket).

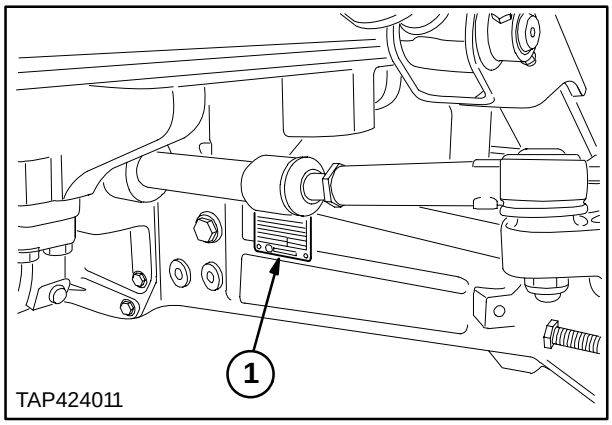
Using spreading type snap ring pliers, spread ears on FWD shaft rear bearing circlip. Holding snap ring open. Tap transmission case into place.



191

The data plate details the axle type, serial number, total gear ratio, reference number, oil capacity, type and grease type.

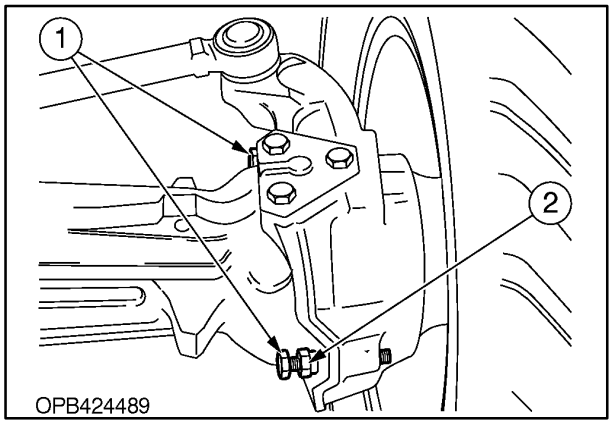
NOTE: *When ordering parts, always quote the type, reference and serial numbers. Refer to later sections for oil and grease specifications.*



7

Steering stops (1) are incorporated on the axle at each end.

The stops are adjustable to prevent the tyres contacting any part of the loader when on full left or right lock and held by the lock nut (2).

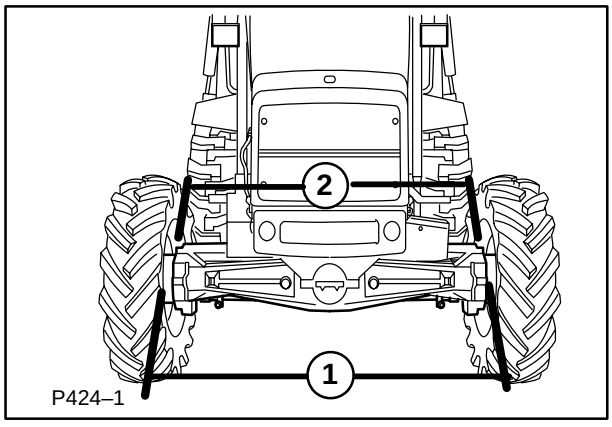


8

When checking the toe in of the front wheels the measurements should be through the centre of the hub.

Measuring the front inner wheel rim to rim (1) and then measuring the rear inner wheel rim to rim (2). The variance between (1) and (2) should be:

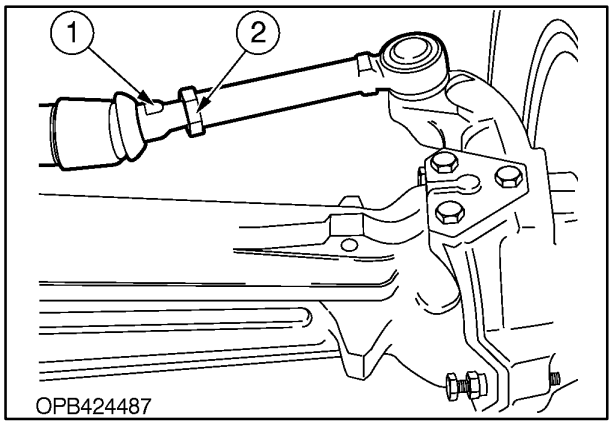
Toe-in should measure: 0 – 2 mm (0 – 0.08 ins)



9

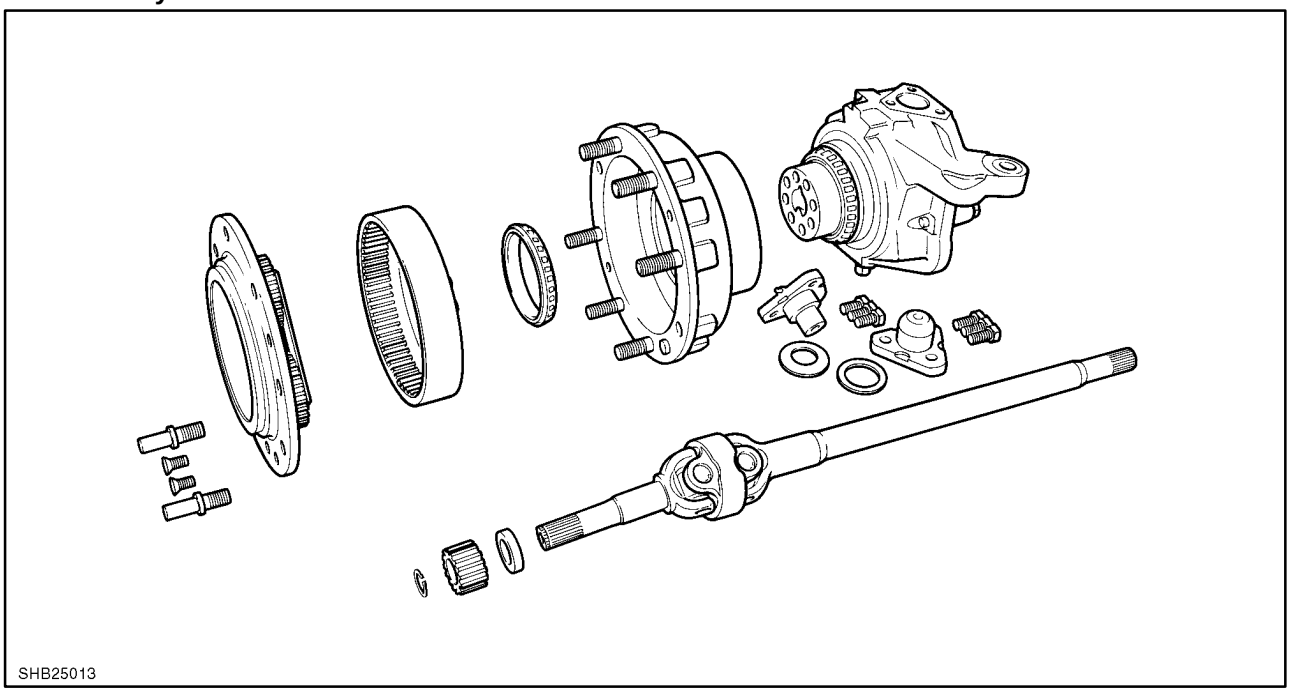
To adjust front wheel toe-in slacken both lock nuts and turn rams equally to correct toe-in measurement. Re-tighten both lock nuts.

1. Clamp Bolt
2. Track Rod End
3. Adjuster



10

Reduction Hub, Swivel Housing and Axle Shaft Re-assembly

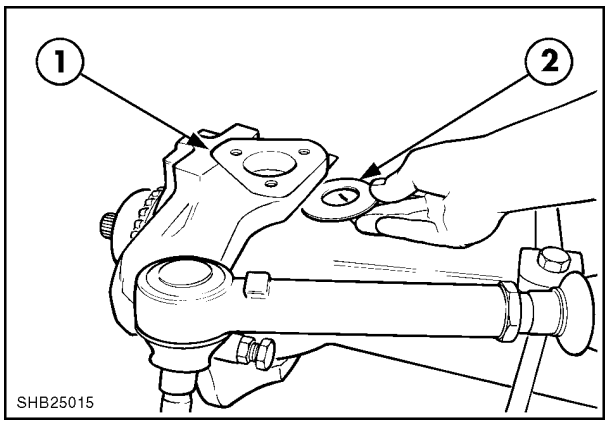


40

Reduction Hub, Swivel Housing and Axle Shaft Assembly

- Re-assembly is in the reverse sequence to the dis-assembly illustrated.
- It is important to locate the axle shaft inner end splines into the differential side gear before fitting the swivel casings.
- Wrap protective tape over the axle shaft outer end spline to protect the hub drive shaft oil seal, before location of swivel casing assembly.
- There are no swivel pin freeplay adjustments. Two Belleville washers are now installed to automatically preset swivel free play. The small washer is installed at the top of the swivel hub and the larger washer installed on the bottom of the swivel hub assembly.

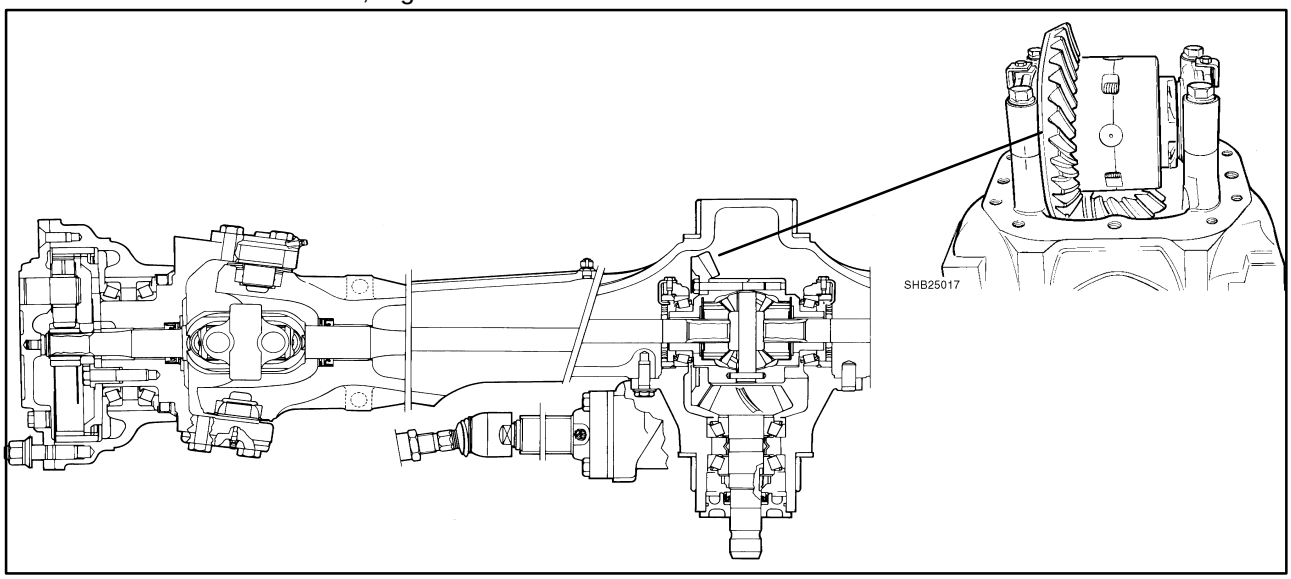
1. Swivel Housing
2. Belleville Washer



41

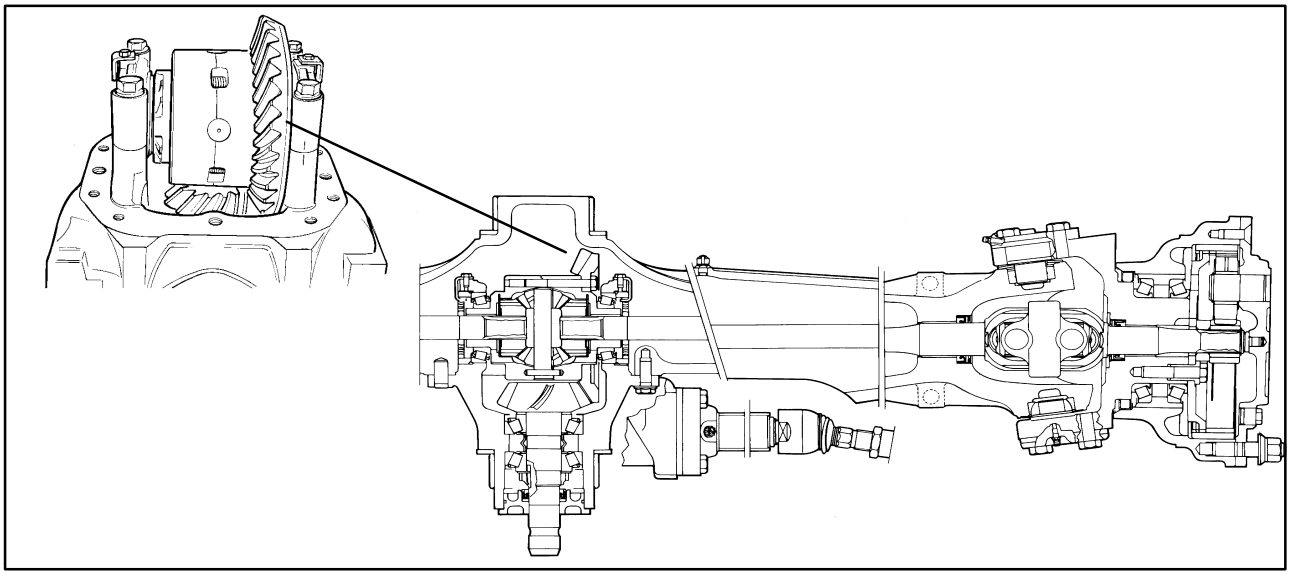
Differential Disassembly

Whilst all dimensions and teardown operations remain the same for both front axles, it must be remembered that on the the Powershuttle Front Axle the differential is mounted to left of the front axle:
– POWERSHUTTLE SHOWN, Figure 67.



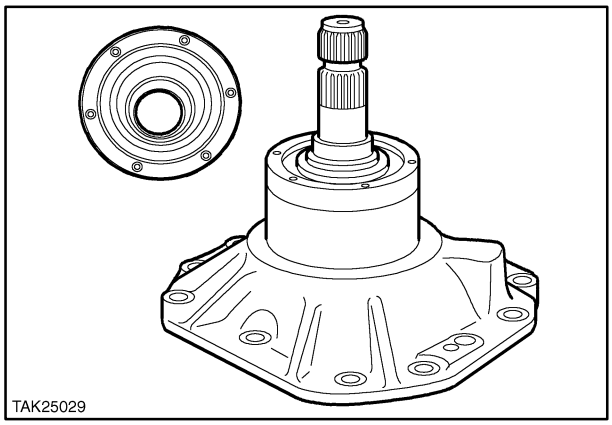
67

On Powershift Front Axles the differential is mounted to the right of the front axle:
– POWERSHIFT SHOWN, Figure 68.



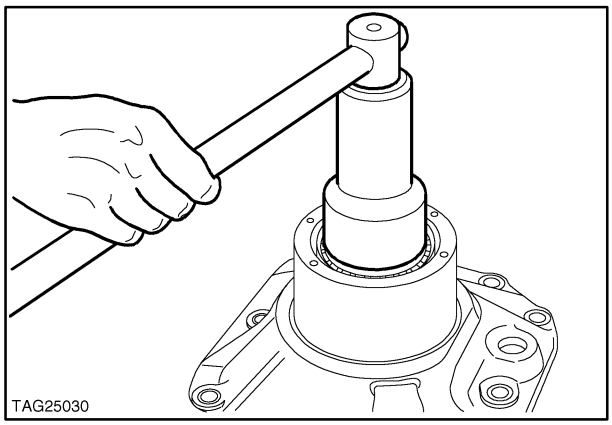
68

29. **Differential disassembly and set up.**
Undo the seal housing fixing bolts and remove the housing.



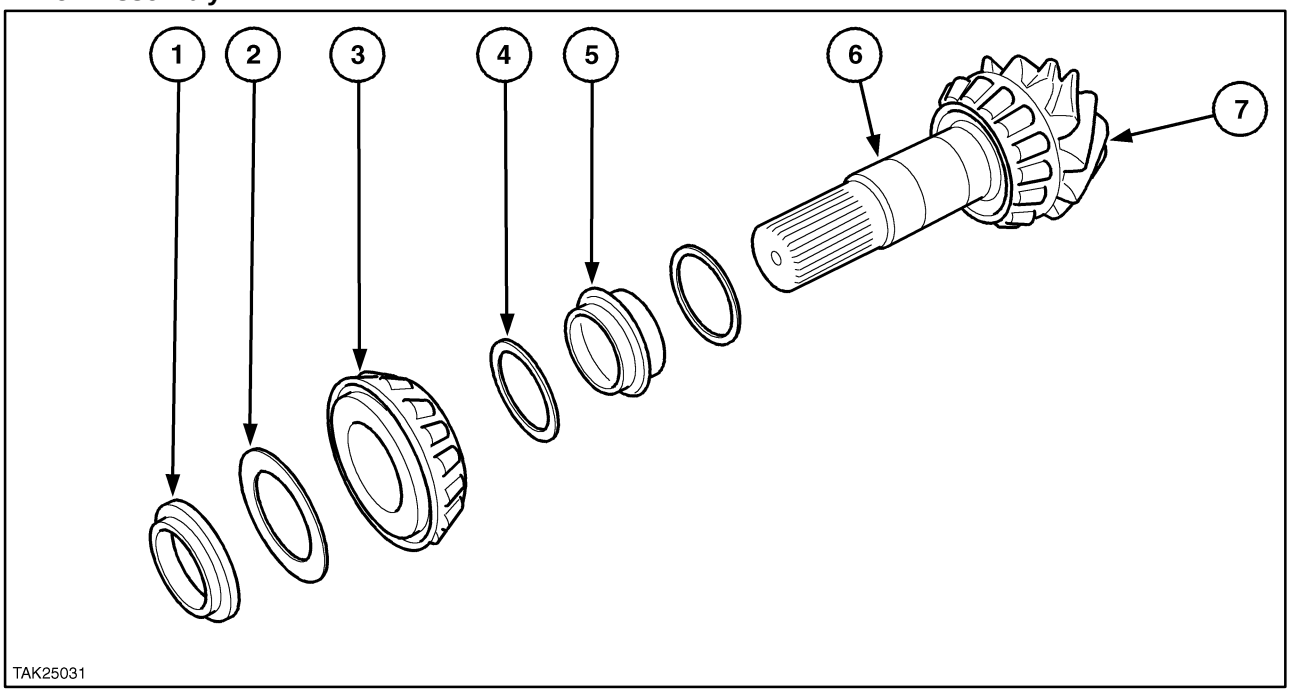
30

30. Lock the differential and bend back the locking tabs on the pinion nut. Then using tool number **297511** and a $^{3}/_{4}$“ drive socket, undo the pinion nut.



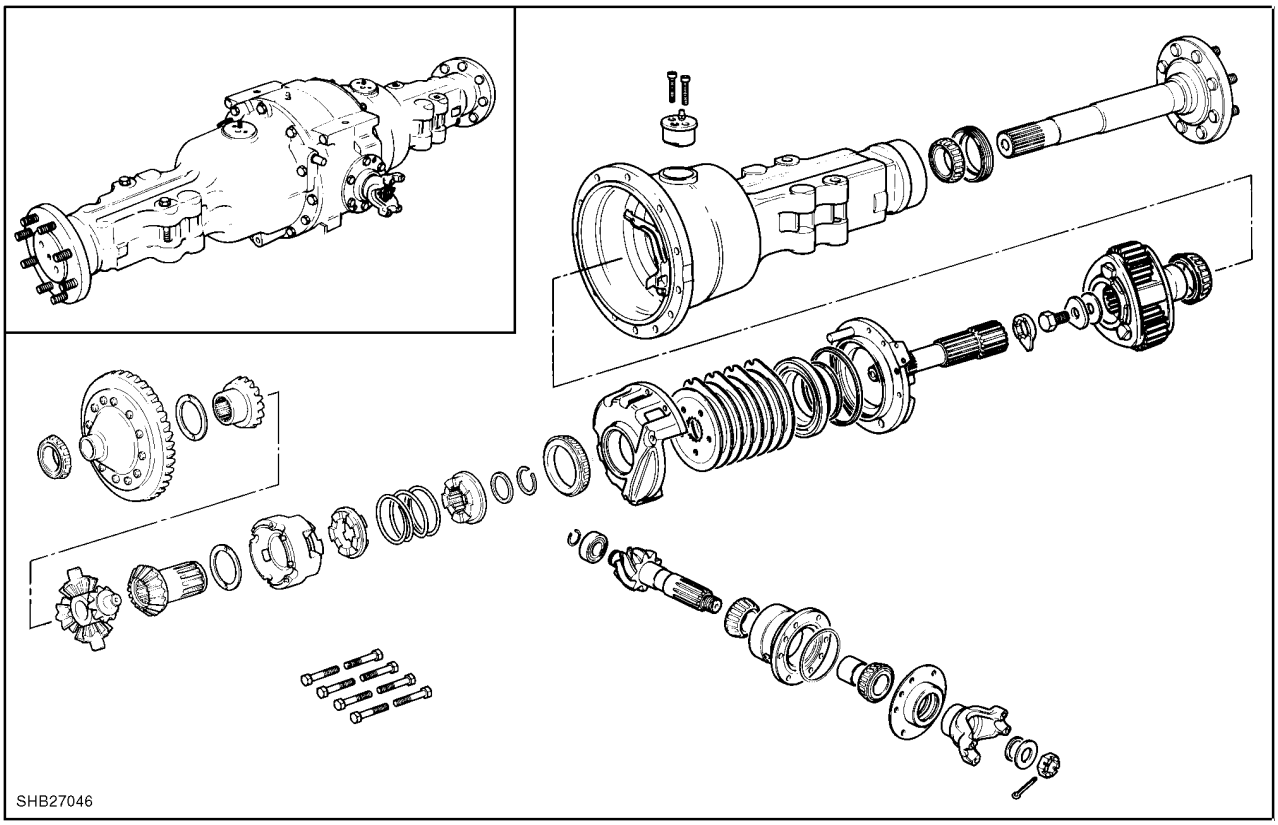
31

Pinion Assembly



32

1. Pinion Nut
2. Washer
3. Bearing
4. Washer
5. Collapsable Bush
6. Pinion
7. Bearing



7

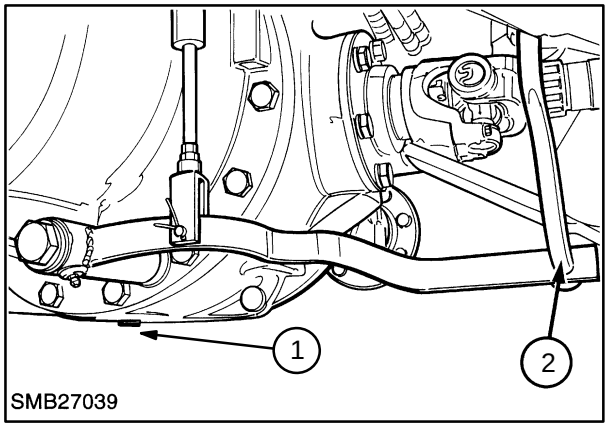
OVERHAUL

Rear Axle Removal

For servicing of any rear axle component the axle must be removed.

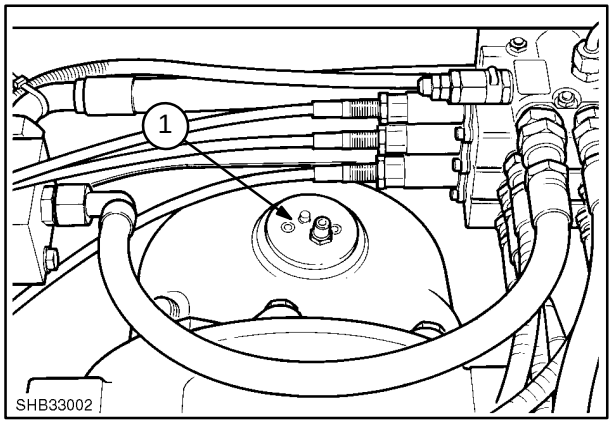
Prior to removal of the axle place a suitable clean container under the axle, capable of holding 26 litres (6.86 US. gals) and drain the oil from the plug at the base of the axle (1).

Disconnect the differential Lock lever(2)



8

Accessed from the top of the rear axle disconnect and drain the residual brake oil into a suitable clean container. Remove the pipes from both sides of the axle half shafts. Plug the brake pipes to prevent any dirt or contamination entering the brake system.



9

ADJUSTMENTS

Drive pinion preload

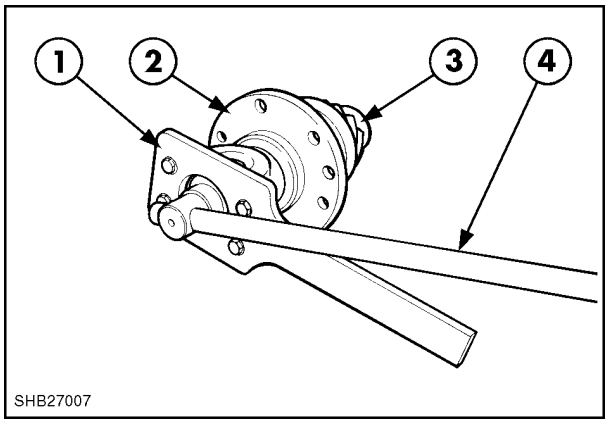
Axle shaft bearing preload

Differential bearing preload

NOTE: *Crown wheel to pinion backlash is preset by manufacturing tolerances in production.*

The pinion bearing preload is set by selecting the correct shim (spacer) which is placed between the bearings.

Re–assemble the pinion assembly, attach the fabricated spanner (1) to the assembly (2) and torque to 271–813 Nm (200–600 lbf ft) with spanner (4) to the locknut.



38

Shims Available:

- 31.852/31.864
- 31.902/31.915
- 31.953/31.966
- 32.004/32.017
- 32.055/32.068
- 32.106/32.32.118
- 32.156/32.169
- 32.207/32.220
- 32.258/32.271
- 32.309/32.322
- 32.360/32.372
- 32.410/32.423
- 32.461/32.474
- 32.512/32.525
- 32.563/32.576

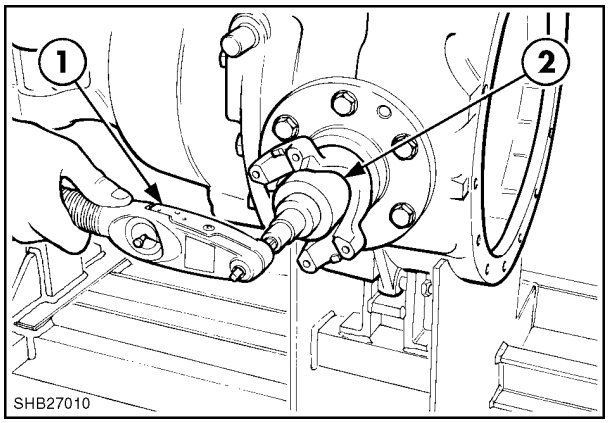
Use a torque meter (1) to check rolling resistance when the assembly is fitted back into the axle.
The rolling resistance should be: 1.3 Nm (10–40 lb in)

Leave pinion retainer bolts loose for this check.

If under specification, fit a smaller shim

If over specification, fit a larger shim

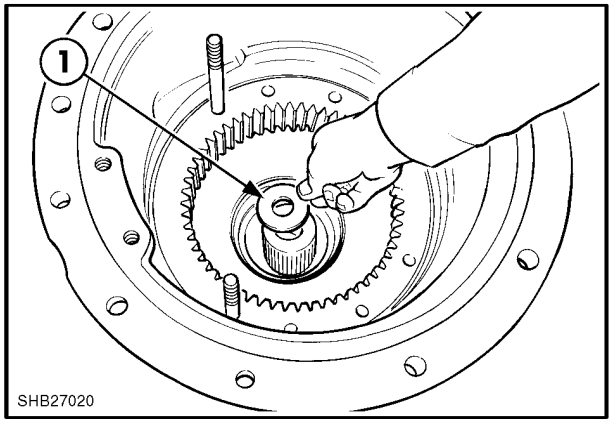
NOTE: *Make sure both bearings are well lubricated and, once preload is set, lock nut to pinion.*



39

Axle shaft bearing preload

Adjustable shims (1) are located between the inner end of the axle shaft and carrier retainer.



40

Hydraulically operated oil immersed foot brakes fitted with four disc brakes

three planetary reduction carrier

Operation

Power from the transmission output shaft is transmitted to the rear axle through (1) the brake disc (2) and onto the half shaft (3).

The spiral bevel pinion is located in preloaded taper roller bearings.

The differential is located on two taper roller bearings, the right hand bearing supported by an internal web of the axle centre housing.

The crown wheel is rivetted to the differential housing. Drive from the housing is transmitted through a conventional four pinion differential to sun gear shafts which are splined into the differential side gears.

The differential lock sliding coupling is located on the splines of the left hand differential side gear. The coupling has dog teeth which engage with the dog teeth on the differential housing lock adaptor.

If the dog teeth are not aligned, the spring engagement link will be preloaded, ensuring rapid and full tooth engagement when the dog teeth align.

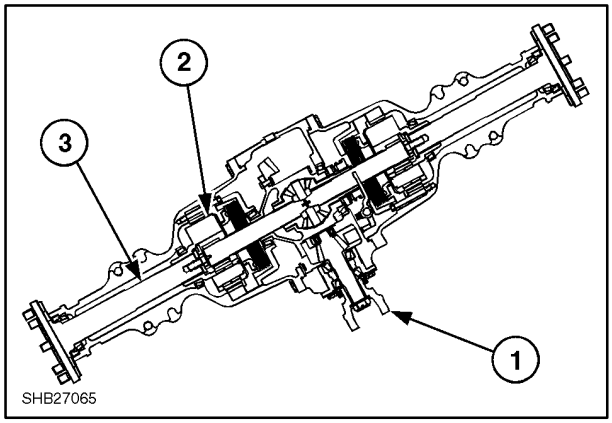
The differential lock will remain engaged due to dog tooth side loading as long as the rear wheels have unequal traction.

The return spring disengages the lock when both wheels have equal traction or drive is disengaged.

The brakes are mounted on the final reduction sun gears. These brakes are wet disc type with hydraulic piston actuator operated by foot pedals, independently for turning assistance, or together for transport.

The planetary gears (1) are mounted in a carrier and are positioned around the sun gear and within the planetary ring gear (2). The rear axle shafts (3) locate into the internal splines in the carriers.

As the sun gear is driven by the differential, the reduction planet gears revolve inside the stationary planetary ring gear and drive the carrier and axle shaft at reduced speed.



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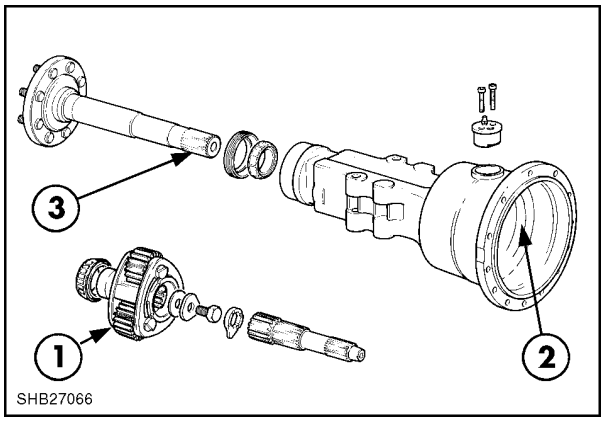

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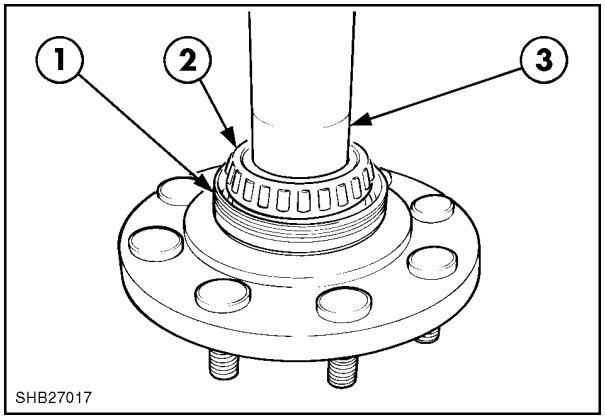
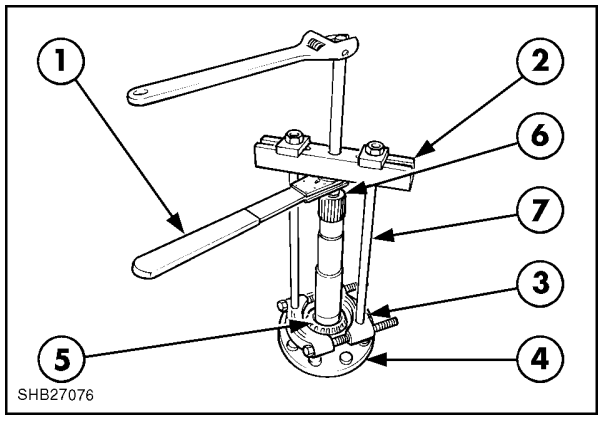
The half shaft axle seal (1) is retained in position by the axle bearing (2). To remove the seal it is necessary to remove the bearing.



36

To remove the bearing, stand the half axle (4) upright and attach the bearing removal tool as shown.

1. Ratchet Tool No 297457
2. Puller Tool No 297390
3. Pulling Attachment Tool No 297391
4. Axle Shaft
5. Bearing
6. Shaft Protector
7. Legs



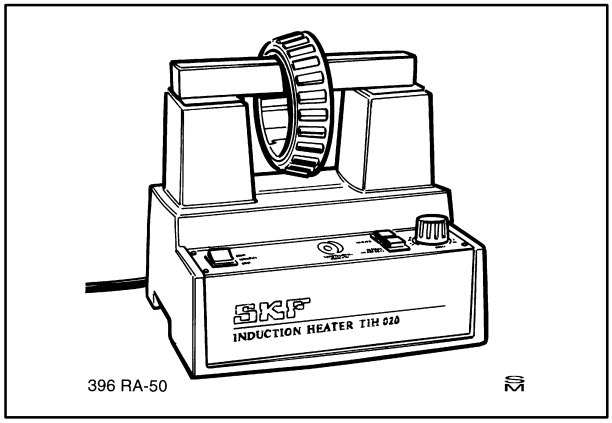
37

Applying gradual pressure to the puller tool the bearing will separate from the half axle.

Inspect the bearing for wear, scoring or damage and replace if in any doubt.

IMPORTANT: *Always fit a new axle seal if the axle bearing is removed for any reason.*

Re–assembly of the seal and bearing is the reverse procedure. Locate the seal and using an induction heater, heat the bearing sufficiently to expand it enough to allow it to easily seat onto the half shaft.



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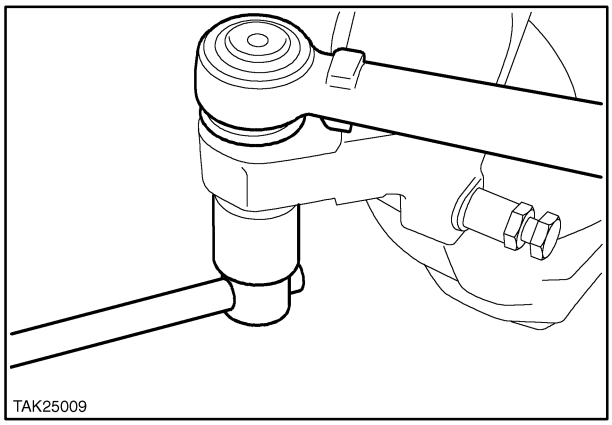
9. Undo the nut which holds the steering rod to the hub.



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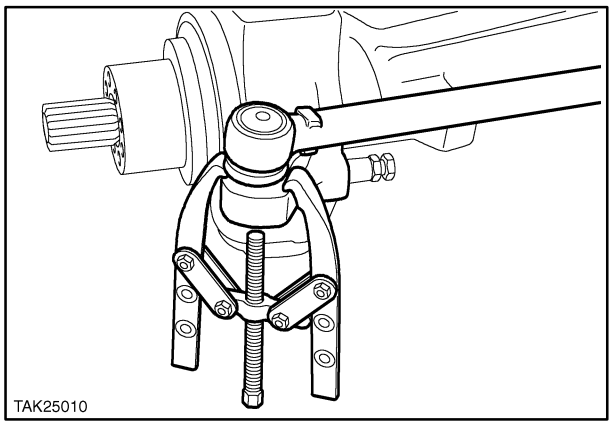
10. Use a set of bearing pullers to press the tapered shaft from the hub assembly



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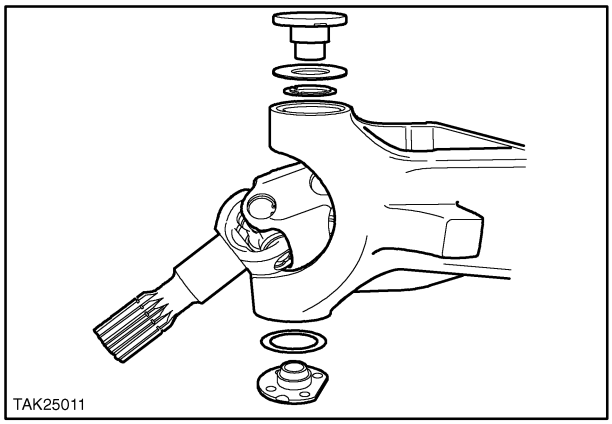
11. Undo the bolts holding the top and bottom pivot pins. Then remove the pivot pins and also the belleville washers and spacers.



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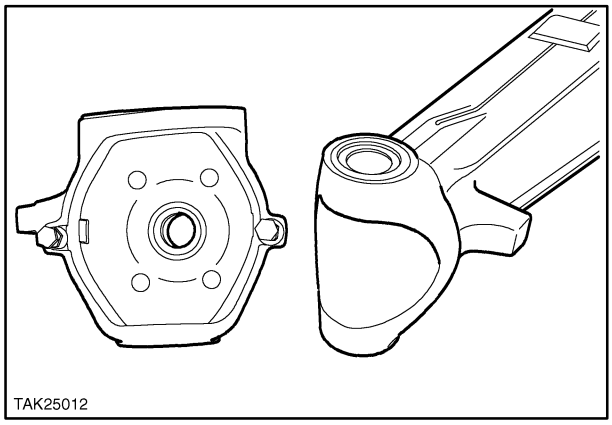
12. Remove the remainder of the hub assembly.



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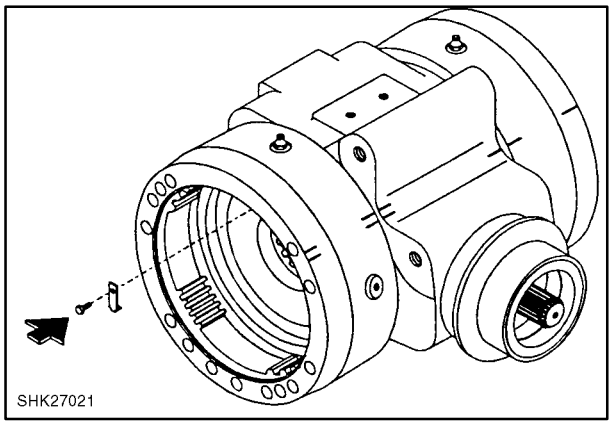
Fit the adjusting ring locks when all backlashes and rolling resistances are correct.



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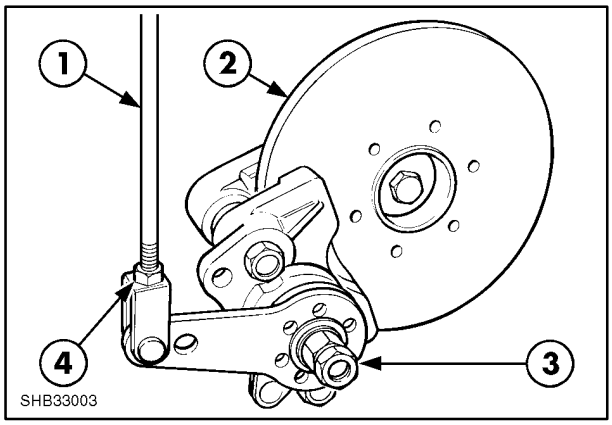
TRANSMISSION HAND BRAKE

The transmission hand brake is fitted to all models and incorporates two free floating friction pads. When operated the eccentric cam forces the friction pads against the disc, effecting a braking action on the output shaft from the transmission, locking the drive shaft to the rear and front axle.



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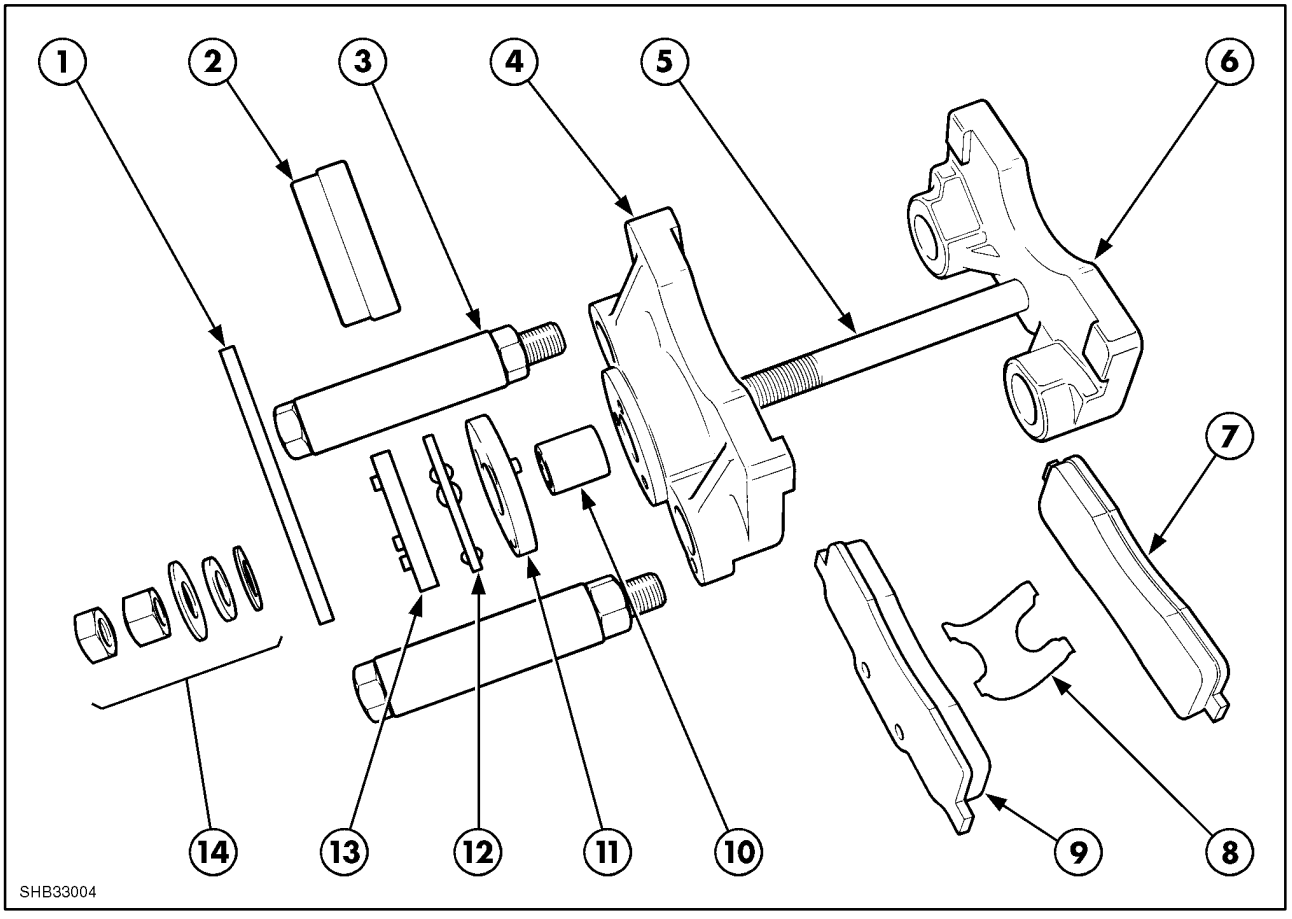


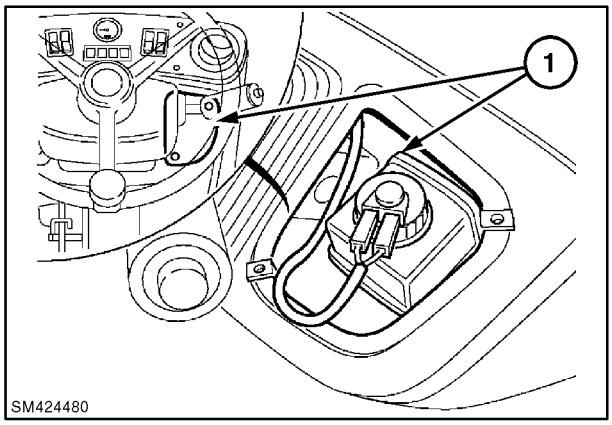
17

Component Layout

1. Lever
2. Cover
3. Fixing Bolts
4. Outer Caliper
5. Bolt
6. Inner Caliper
7. Inner Friction Pad
8. Fixing Spring
9. Outer Friction Pad
10. Spacer
11. Actuator Plate
12. Balls and Retainer Plate
13. Actuator Plate
14. Adjusting Nuts

Brake Bleeding Procedure

10. Ensure the reservoir is full (1).



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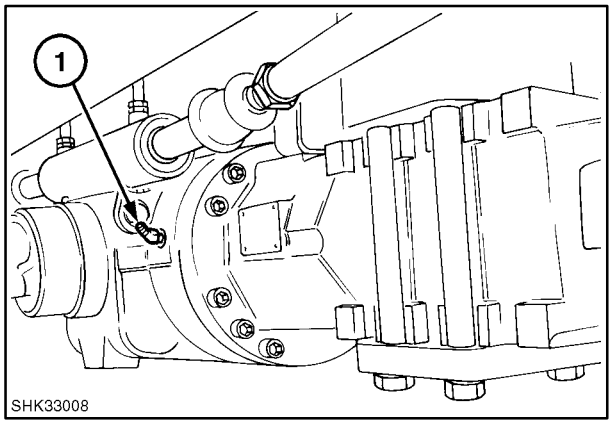
11. Open the left hand brake bleed valve (2).



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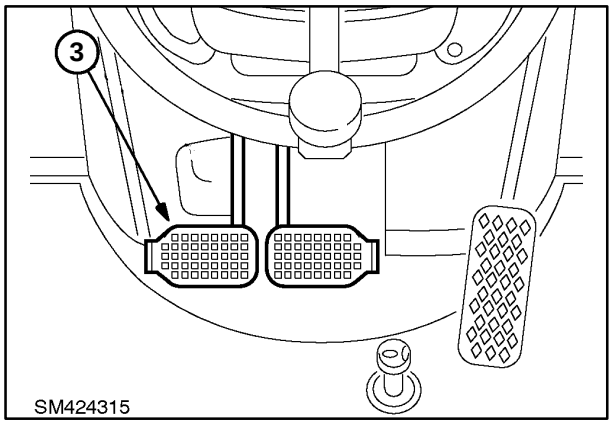
12. Pump both brakes to purge the system (3), ensuring the reservoir is kept topped up.

13. When the bubbles cease coming from the bleed screw hold both pedals down and lock the screw.



14

14. Release the pedals and repeat procedure items 1 to 4 for the right hand brake bleed valve.

15. Test the brakes and repeat if necessary.

HYDRAULIC CIRCUIT

The hydraulic circuit is a load sensing flow sharing system working in conjunction with a fixed displacement gear type hydraulic pump. This system has the advantage that at any time the distribution of flow to the services being operated is in proportion to the openings of the control valve spools.

The flow distribution to the backhoe and loader control valves is load independent and it is therefore possible to satisfactorily operate two or more spools at the same time.

The principal components of the load sensing flow sharing system are the pressure compensator valves in each control valve section, refer to Figure 15, together with the load sense line which connects all the spool sections in both the loader and backhoe control valve assemblies.

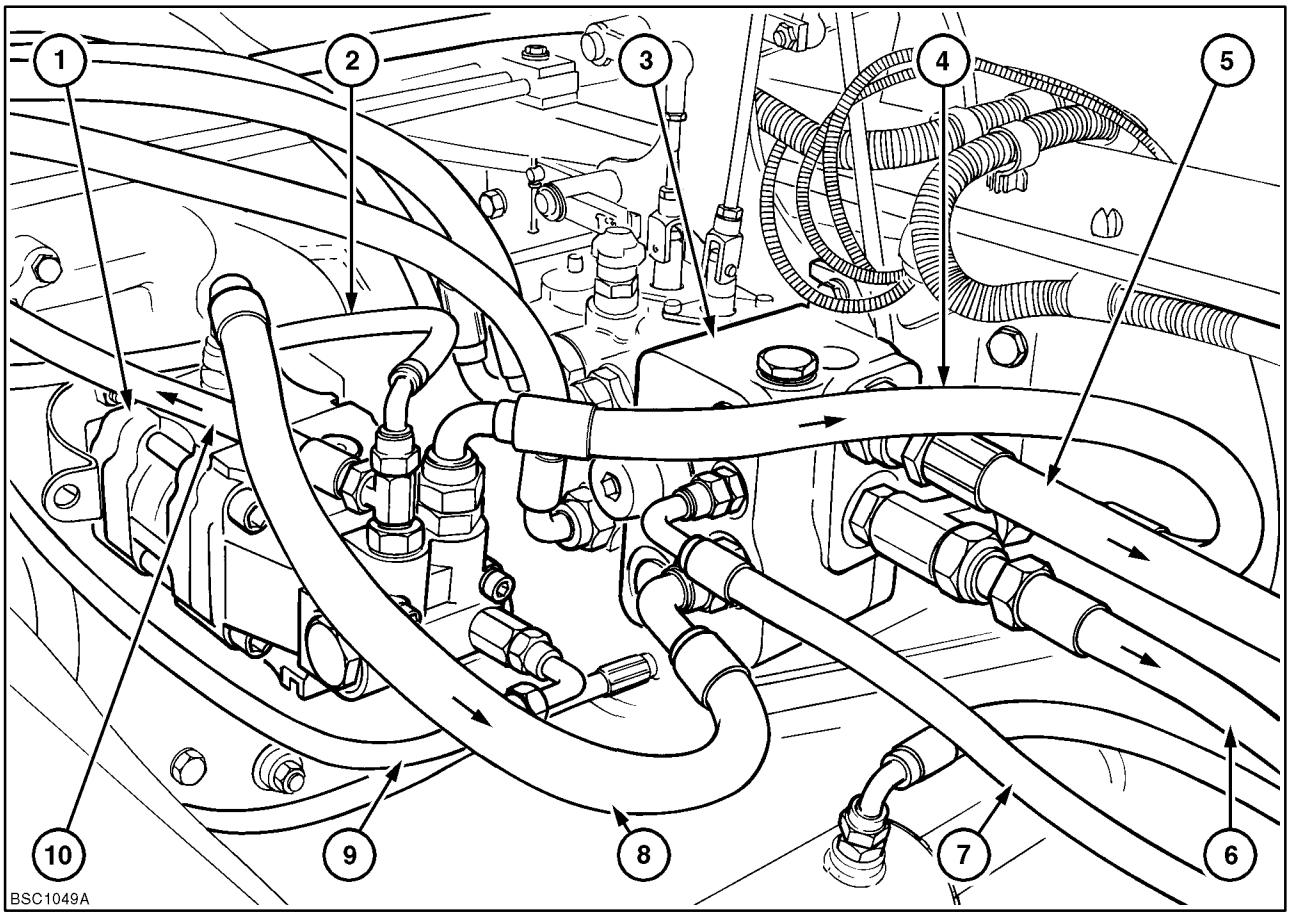
Because the hydraulic pump is a fixed displacement gear type pump it should be noted that the load sense line only connects the loader and backhoe control valve assemblies and does not have any connection to the hydraulic pump.

The hydraulic pump draws oil from the reservoir and flow from the front pump is directed to the centre galleries of the loader and backhoe control valves assemblies.

Flow from the rear section of the pump passes through the load sensing flow divider valve mounted on the pump and gives priority flow to the steering circuit with remaining flow directed to supplement the flow from the front pump for the loader and backhoe circuits.

The centre gallery of both the loader and backhoe control valves are blocked by the end plate. Pressure in the supply circuit is controlled by the pump flow balancer valve in accordance with the pressure in the load sense line. Consequently the higher the load sense pressure the less flow is returned to reservoir with corresponding increase in flow/pressure to the hydraulic circuits.

Maximum system pressure is limited by the load sense pressure relief valve which relieves pressure in the load sense line when it reaches 210 bar. Because the pump flow balancer valve is influenced by load sense pressure the valve diverts sufficient flow back to reservoir to maintain the maximum system pressure of 210 bar.

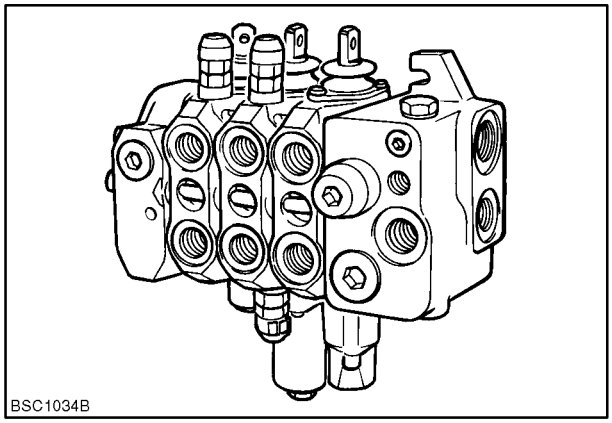


25

Hydraulic Pump and Loader Control Valve Installation

1. Hydraulic Pump
2. To Steering Test Port
3. Loader Control Valve
4. Rear Pump Supply to Hydraulic Circuit
5. Return to Reservoir
6. Supply to Backhoe Control Valve
7. Load Sense Line to Backhoe Control Valve
8. Front Pump Supply to Hydraulic Circuit
9. Steering Load Sense Line
10. To Steering Motor

4. Identify and disconnect hydraulic connections and linkage to control valve.
5. Remove valve assembly from machine.
6. For disassembly of control valve refer to Page 34.



26

7. Installation is removal procedure in reverse.

FAULT FINDING - HYDRAULIC PUMP

PROBLEM	POSSIBLE CAUSES	CORRECTION
System noisy.	Worn or damaged pump gears or pressure plates.	Hydraulic pump performance test.
	Aeration: Air entering the systems at: suction tube, pump shaft, fittings, or cylinder glands.	Hydraulic pump performance test.
	Cavitation: Restrictions in the system at the suction line or at the suction screen in the reservoir.	Visual and/or hydraulic pump performance test.
	Water in the system.	Visual.
	Tubing vibration.	Visual.
	Cold hydraulic oil.	Check hydraulic oil operating temperature.
	Wrong type oil being used.	Investigate/drain and refill.
Hydraulic oil exhausts from breather at the reservoir.	Reservoir overfilled.	Check hydraulic oil level.
	Aeration: Air entering the system at: suction tube, pump shaft, fittings, or cylinder glands.	Hydraulic pump performance test.
	Cavitation: Restriction in the system at the suction screen in the reservoir.	Visual and/or hydraulic pump performance test.
Oil heating.	Oil supply low.	Fill reservoir.
	Contaminated oil.	Drain reservoir and refill with clean oil.
	Setting of relief valve too high or too low.	Drain reservoir and refill with clean oil. Test relief valves.
	Oil in system too light.	Drain reservoir and refill with correct viscosity oil.
	Oil cooler fins blocked.	Clean oil cooler.
Shaft seal oil leakage.	Worn shaft seal.	Replace shaft seal and inspect pump.
Foaming oil.	Low oil level.	Fill reservoir.
	Air drawn into suction line.	Check/tighten suction line.
	Wrong oil grade.	Drain and refill with correct oil.

Hydraulic Oil Flow through Swing System

Hydraulic feed to the swing cylinders is controlled by the swing section of the backhoe control valve which contains pilot operated relief valves with anti cavitation feature to protect the circuit and cylinders should an overload condition occur.

Figure 156 illustrates operation of the swing circuit when retracting the right hand cylinder (4) and extending the left hand cylinder (5) in order to swing the backhoe to the right.

When swinging the backhoe to the left the oil flows are reversed and exactly the same principal of operation applies.

Oil flow for a right hand swing is as follows:–

When the swing control is operated the control valve directs oil flow to the rod end of the right hand cylinder. The flow of oil at pump pressure lifts the one way restrictor (2) of its seat allowing the flow to continue unrestricted to the inlet port of the piston end of the left hand cylinder.

System pressure increases causing the right hand cylinder to retract and the left hand cylinder to extend.

As the cylinders move, displaced oil on the piston side of the left hand cylinder flows towards the one way restrictor (7) in the inlet port on the rod end of the right hand cylinder.

The oil flow moves the restrictor to the restrict position which limits the flow of oil and creates a back pressure (1st stage restricted return oil) in the right hand cylinder.

The restricted flow of oil passes through restrictor (7) into the rod end of the left hand cylinder before returning to the control valve and back to reservoir.

The spool in the swing control valve assembly (1) is designed such that during operation oil can flow freely through the port directing oil flow to the swing cylinders but restricts the flow returning oil back to reservoir.

This restriction is achieved using metering lands machined into the lands of the spool and creates a secondary back pressure (2nd Stage Restricted Return Oil) in the rod end of the cylinder.

By allowing oil to flow unrestricted to the power side of the cylinder and be restricted on the exhaust side a smooth controlled swing of the backhoe at optimum speed is achieved.

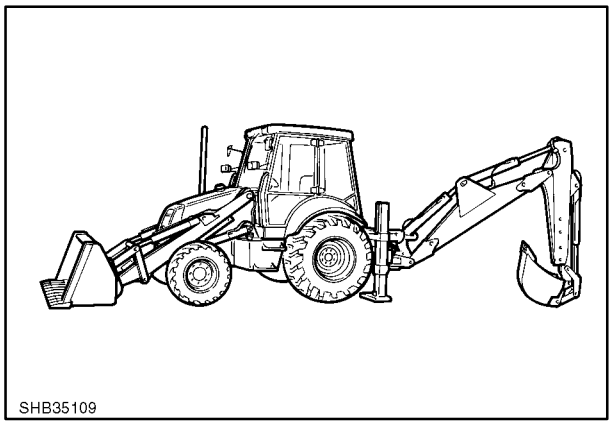
When the swing system reaches the last 20–25° of travel the sliding restrictor in the end of the piston rod touches the outlet port in the cylinder barrel. This further restricts the flow of oil exhausted from the cylinder and as the piston moves towards the end of its stroke the sliding restrictor is gently pushed down the centre of the cylinder rod allowing a progressive and controlled halt to the swing cycle.

If the swing control valve is suddenly returned to neutral mid–way through a full power swing the supply and exhaust ports in the main control valve are totally blocked.

The momentum of the swinging backhoe assembly if not controlled will make the machine extremely unstable. To prevent this from occurring the circuit relief valves operate and dumps oil to exhaust until the excess pressure is relieved. When the relief valve operates the cylinder rod will move and a void will be created in the low pressure side of the cylinder. The anti–cavitation feature in the relief valves prevent the void from occurring by transferring exhaust oil from the excess pressure side of the circuit to the low pressure side. For further details on the operation of the anti–cavitation circuit relief valves refer to Circuit Relief Valves Principle of Operation in Chapter 1.

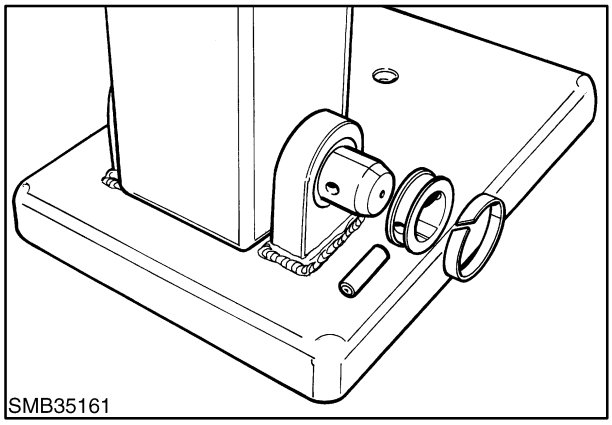
Stabiliser Cylinder - Side Shift
(Op No 35 703)

1. Position the unit on a hard level surface and rest the digging elements on the ground in a safe position.



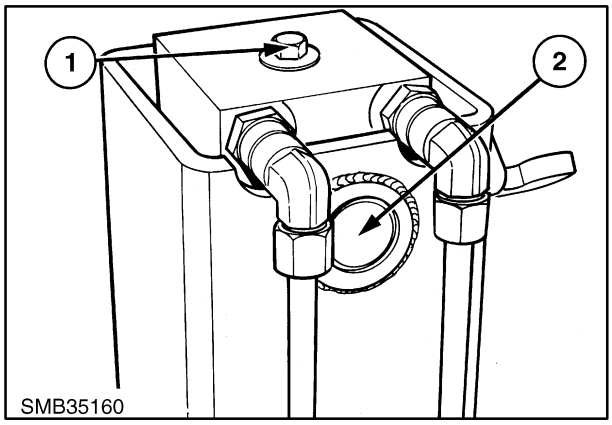
31

2. Remove the stabiliser pad. Lower the stabiliser to the ground and with the engine stopped, relieve residual pressures.
3. Disconnect the hydraulic feed tubes at the top of the stabiliser leg



32

4. Remove the cylinder pin locking bolt (1).
5. Fit a $^1/_2$ inch–13 x 1.50 threaded eye bolt and shackle in the threaded hole on the top of the cylinder. Ensure that the threaded portion of the eye bolt does not screw into the waisted section of the locating pin (2)



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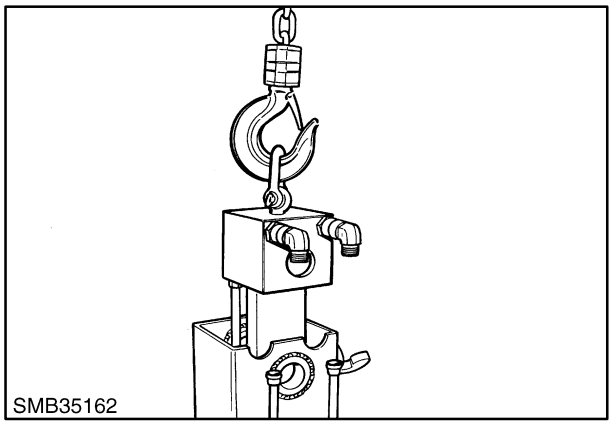
6. Drive out the locating pin and lift the cylinder from the casing.
7. Installation follows removal procedure in reverse. Tighten locking bolt to a torque of 108–130 Nm (80–96 lbf ft).



34

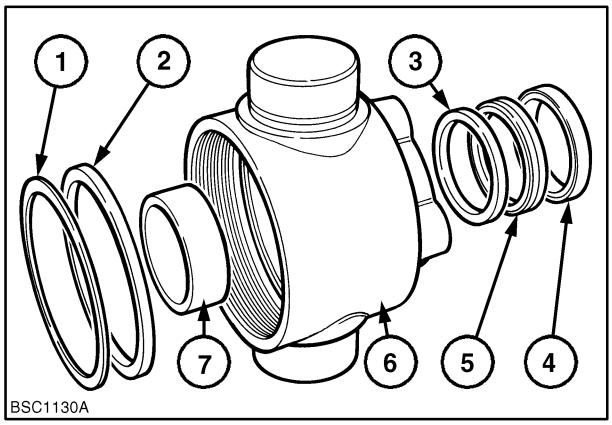
7. Remove seals from headstock

Swing Cylinder Gland Assembly

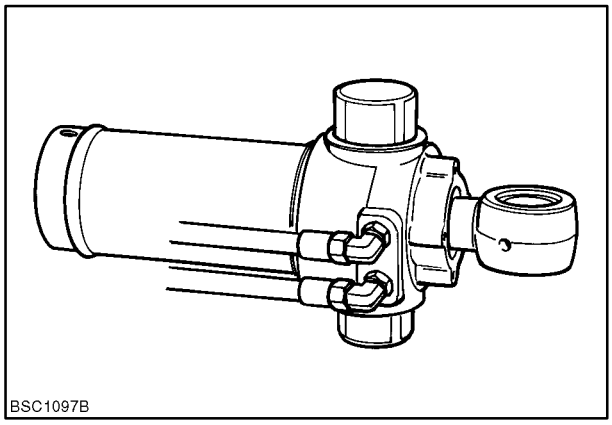
1. Back up ring
2. 'O' ring seal
3. Buffer seal
4. Wiper seal
5. Rod seal
6. Trunnion
7. Wear ring

When installing new seals ensure the groove moulded in the face of the buffer seal is positioned towards the cylinder barrel.

8. Examine piston and if damaged or worn replace the piston assembly.
9. Examine trunnion bushes and grease retaining seals on headstock and mating bushes in the swing cylinder retaining plate and carriage.



62

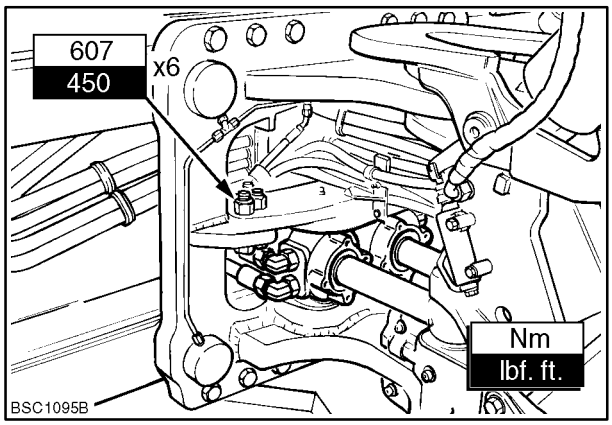


63

Re–assembly and Installation

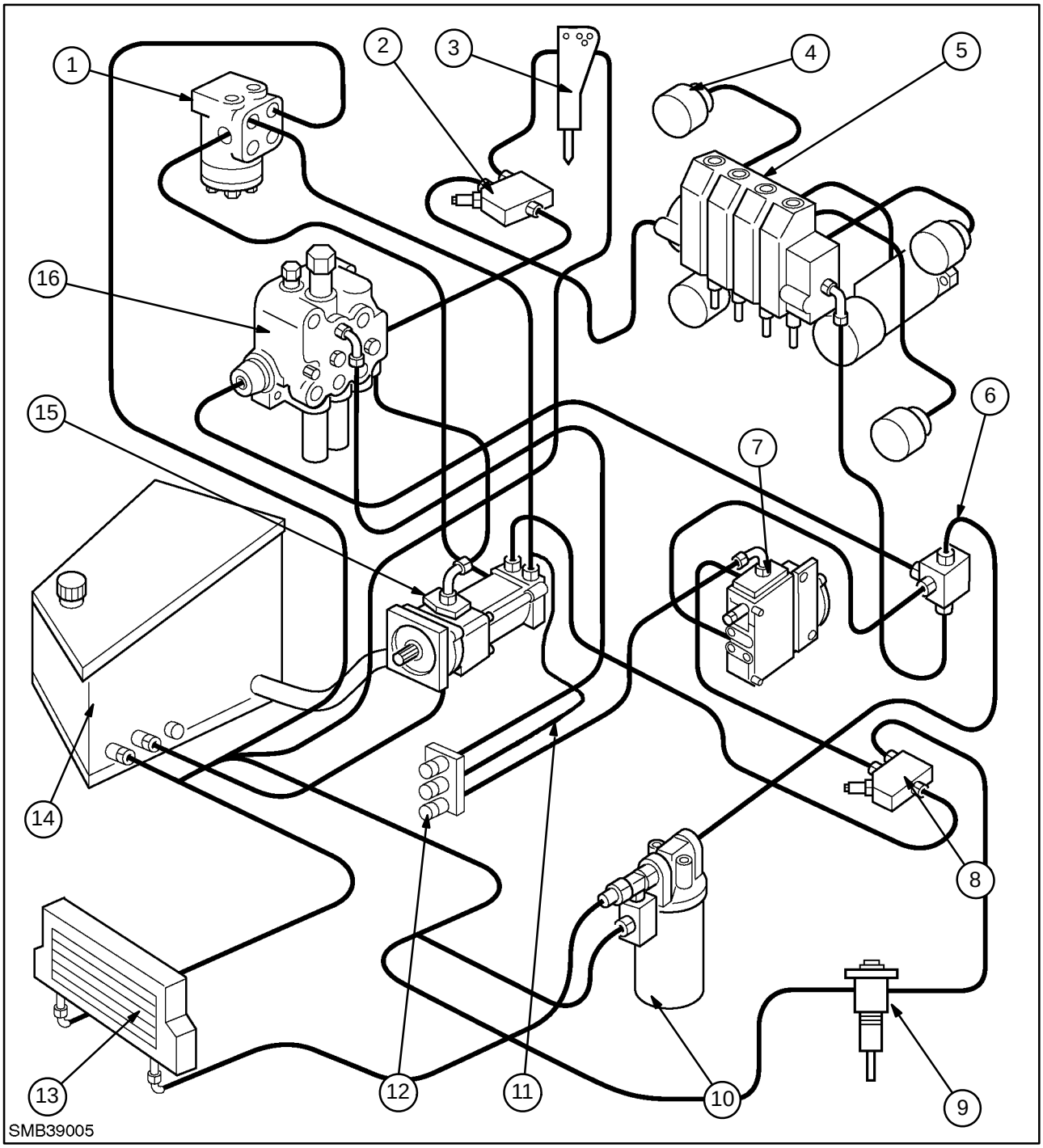
Re–assembly follows the disassembly procedure in reverse while observing the following.

1. Tighten the piston retaining bolt to a torque of 1470–1570 Nm (1084–1157 lbf ft.)
2. Apply 6 drops of thread sealant New Holland Part No 82995773 to the gland threads and tighten to a torque of 670–830 Nm (494–612 lbf ft).
3. Bend locking tab into groove in the gland.
4. Tighten swing cylinder plate retaining bolts to a torque of 607 Nm .



64

35 000 Hydraulics



Hydraulic Components attached within the chassis 6

Contained within the chassis are the hydraulic valve slices, steering motor connections all of which are interconnected by pipes and tubing to the pump and reservoir for the operation of:

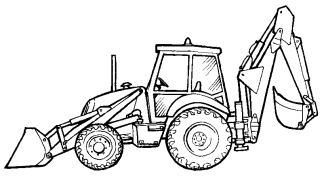
Loader, Backhoe and related components, Stabilisers, Backhoe Hammer, Hand Hammer and Steering Motor

IMPORTANT: *Before disconnecting any hoses relieve all pressure in the hydraulic system and have ready suitable clean containers to drain the oil into. Ensure all ports and hoses are plugged or capped to prevent dirt ingress during overhaul.*

In general the hydraulic components can easily be removed from the machine. However to gain access for the removal of several items at the same time it may be beneficial to consider removal of the cab.

90 000 Chassis / Cab

COMPONENTS	TORQUES
CAB	
Cab support	450 Nm (332 lbf ft)
Front cab retaining bolts	214 Nm (158 lbf ft)
Rear cab retaining bolts	180 Nm (133 lbf ft)
SHEET METAL	
Bonnet Front casting to frame	214 Nm (158 lbf ft)
Upper and front bonnet retaining bolts	80 Nm (59 lbf ft)
Front bonnet to frame	170 Nm (125 lbf ft)



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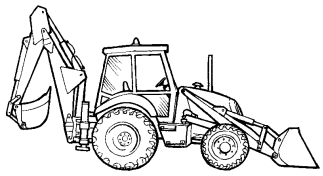
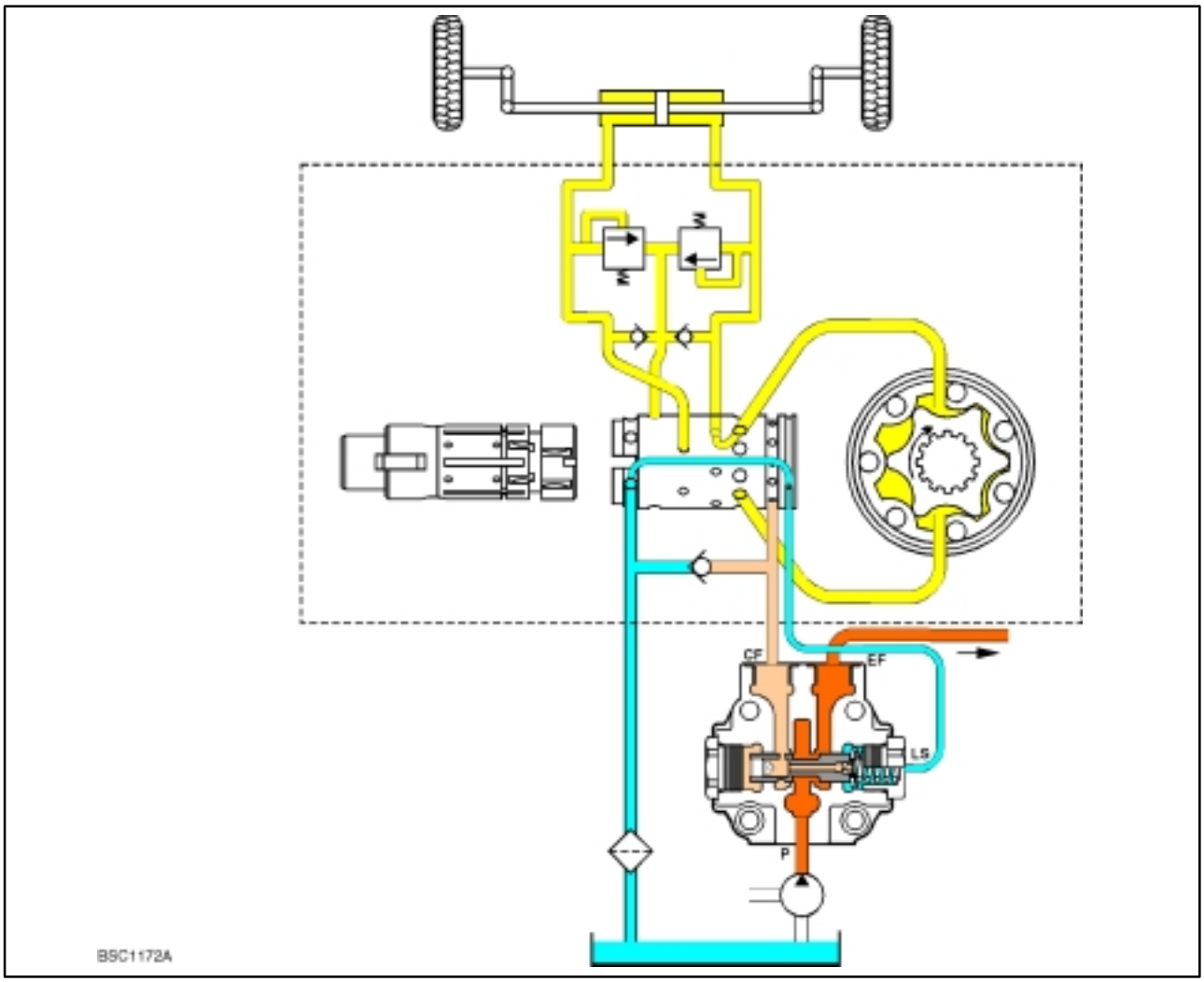




9

Steering Motor – Neutral

Pump Pressure

Standby Pressure

Trapped Oil

Return to Reservoir

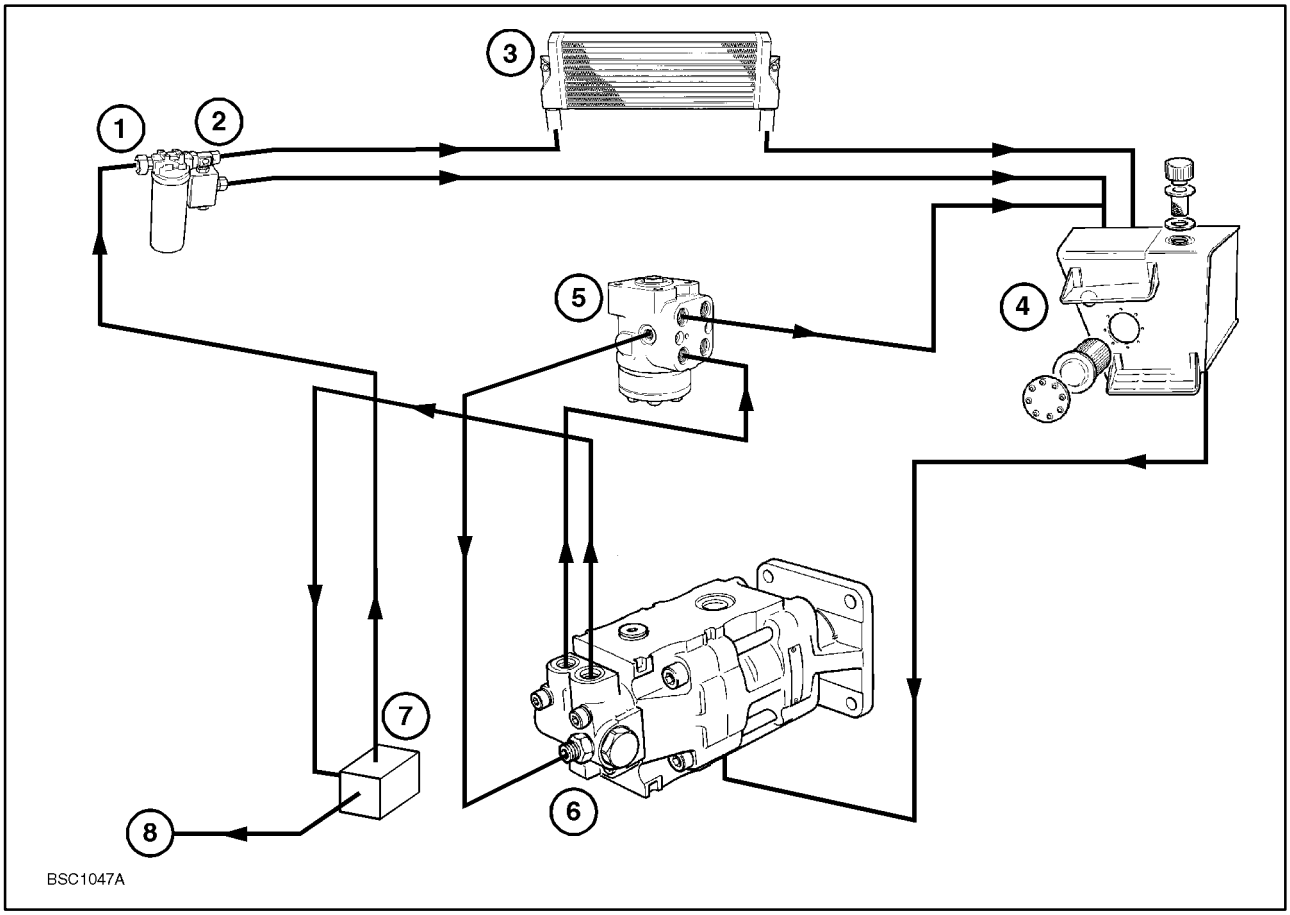
When the steering wheel is held still, the leaf springs return and hold the spool and sleeve in the neutral position.

This ensures no more oil is supplied to the steering cylinder. The sleeve also traps the oil in the steering cylinder and allows oil in the sensing lines to return to tank therefore allowing the priority flow divider to move to the left.

SPECIAL TOOLS

Pressure Test Quick Release Coupler 291924

DESCRIPTION AND OPERATION



1

Steering System

1. Hydraulic System Reservoir
2. Steering Pump
3. Steering Motor
4. Hydraulic System Filter
5. Flow Divider
6. Hydraulic Oil Cooler

The hydrostatic steering features

- Double acting balanced steering cylinders on both the front and rear axles.
- Common hydraulic reservoir with the main hydraulic reservoir.
- Steering pump located on the rear of the transmission.
- Oil is cooled and filtered during every cycle.
- Oil flow from the steering motor to axles is electronically controlled using a 4 wheel steer valve which diverts oil in various directions depending on the choice selected by the operator.

The three modes of steering are as follows:

- Front wheel only steering 
- Front and rear wheel steer 
- Front and rear wheel crab 

The solenoids energised are shown in the table opposite. These are also the pins which need to be pressed when changing steering mode manually in an emergency.

X = Energised

O = Not Energised

		3a	3b	2a	2b
2WS		O	O	O	O
4WS		X	O	O	O
4WS TO 2WS		O	X	O	O
CRAB		X	O	X	O
CRAB TO 2WS		O	X	O	X

13

DESCRIPTION AND OPERATION

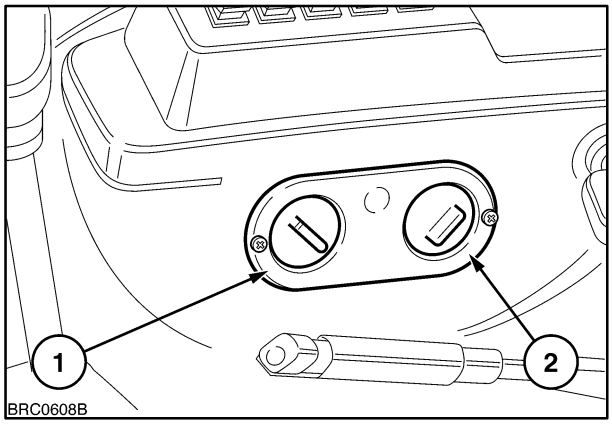
Cab Heating

The cab is heated by a radiator mounted below the cab seat, which is supplied hot water from the engine coolant system. A blower motor mounted behind the cab radiator is used to transfer the heat into the cab.

Heater Blower Control, Figure 1

The three speed blower is controlled by switch (1) mounted in the instrument console to the right of the cab seat. Turn the switch clockwise to the first position for slow speed. Further rotation of the switch in a clockwise direction selects medium and fast speeds.

The blower draws outside air from beneath the cab floor and through a filter medium into the cab.



1

Heater Temperature Control, Figure 1

The temperature of the air from the radiator is adjusted by rotation of the control knob (2) which opens or closes the radiator valve increasing or decreasing the water flow as required. Turn the control clockwise to increase the temperature of air from the heater and counter clockwise to reduce the temperature.

⚠ WARNING ⚠

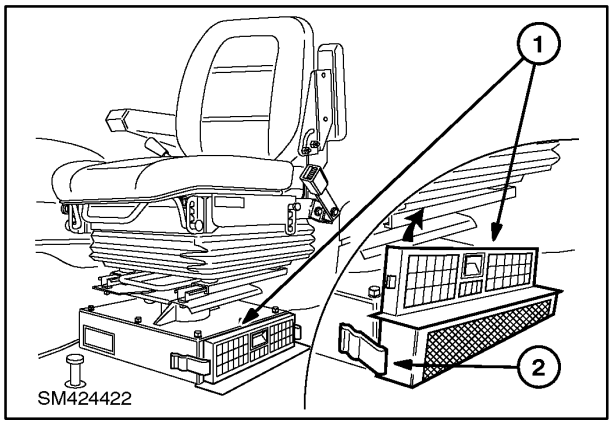
The cab air filters are designed to remove dust from the air but may not exclude chemical vapour. When working in an enclosed area ensure there is adequate ventilation as exhaust fumes can suffocate you.

Cab Air Filter

Before servicing the air filter situated under the drivers seat, switch off the blower and close all windows and one door. Forcibly close the other door. The resulting back pressure will dislodge loose dirt from the underside of the filters.

To remove the filter (1) release the retaining straps (2) and remove the filter element. Ensure the element, and sealing faces are not damaged on removal.

IMPORTANT: *In humid conditions, such as occur on most early mornings, do not switch on the blower prior to servicing the filters. Damp particles drawn into the filter may solidify and prove difficult to remove without washing.*



2

The filter elements are made of specially treated paper with a sealing strip bonded to the outer face.

Clean all of the elements by blowing with compressed air from the clean side through to the dirty side. The compressed air should not exceed 2 bar (30 psi) and the air line nozzle should be at least 300 mm (12 in) from the element.

SAFETY PRECAUTIONS

⚠ WARNING ⚠

Before overhauling an air conditioning system read and observe the following Safety Precautions If a repair or replacement becomes necessary, ensure that only certified Air Conditioning technicians are employed, using approved equipment to effect repairs. Do not attempt to disassemble the air conditioning system, It is possible to be severely frostbitten or injured by escaping refrigerant.

IMPORTANT: *Do* ***not*** *allow refrigerant to escape into the atmosphere.*

Refrigerant must be handled with care in order to AVOID HAZARDS.

Undue direct contact with liquid refrigerant can produce freezing of skin and eyes.

Keep the refrigerant container and air conditioning system away from flame or heat sources, the resulting pressure increase can cause the container or system to explode.

If in direct contact with open flames or heated metal surfaces, the refrigerant will decompose and produce products that are toxic and acidic.

Make sure to comply with the following indications and simple precautions to avoid any risk of injury:

- Never discharge refrigerant into the atmosphere. When servicing air conditioning units a certified refrigerant recovery unit operated by a certified technician must be used.

- When discharging the refrigerant in the system make sure you are operating in well–ventilated premises with good air circulation and far away from open flames.

- When charging and discharging the system always wear goggles and take suitable precautions to protect the face in general and the eyes in particular, from accidental spillage of the refrigerant fluid.

- The oil and refrigerant mixture inside the air conditioning system is pressurized.
  Consequently, never loosen fittings or tamper with lines unless the system has been properly discharged.

- Before loosening any connection, cover the fitting in question with a cloth and wear gloves and goggles in order to prevent refrigerant from reaching the skin or eyes.

- In the event of an accident, proceed as follows:–

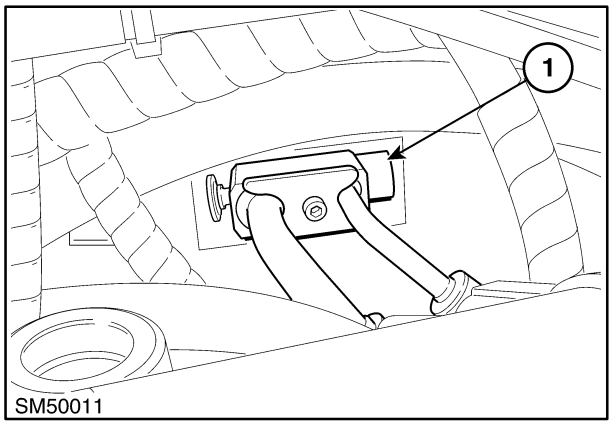
  If the refrigerant has reached the eyes, wash them immediately with copious amounts of sterilised water or mains pressure tap water and transfer to hospital for immediate medical help.

  If the refrigerant has touched the skin, wash with cold water and transfer to hospital for immediate medical help.

Expansion Valve

The expansion valve is located underneath the evaporator in the pressure line leading from the receiver/ dryer and performs the following functions:

1. METERING ACTION -
   A metered orifice changes the liquid refrigerant from a high pressure low temperature liquid to a low pressure, lower temperature atomized liquid.
2. MODULATING ACTION -
   A thermostatically controlled valve within the expansion valve body controls the volume of liquid refrigerant passing through the orifice and makes sure the refrigerant is fully vaporized within the evaporator. Liquid refrigerant would damage the compressor reed valves or freeze the pistons.
3. CONTROLLING ACTION -
   The valve responds to changes in the cooling requirements. When increased cooling is required, the valve opens to increase the refrigerant flow and when less cooling is required the valve closes and decreases the refrigerant flow.



17

Expansion Valve - Operation

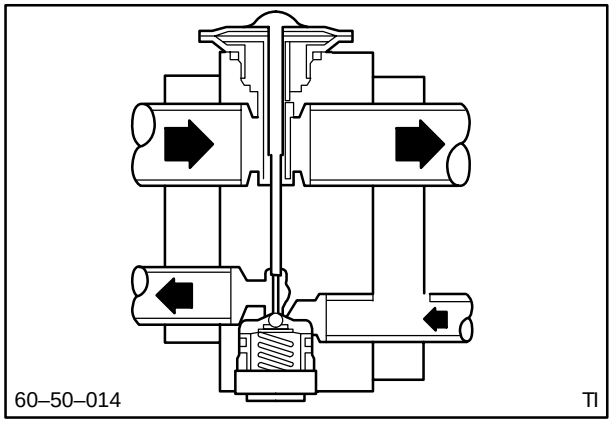
All of the needed temperature sensing and pressure sensing functions are consolidated into this basic unit and no external tubes are required for these purposes.

The refrigerant from the condenser and receiver dryer enters the thermostatic expansion valve as a high pressure warm liquid. Upon passing through the ball and spring controlled metering orifice, the pressure and temperature of the refrigerant is reduced and the refrigerant leaves the thermostatic expansion valve as a low pressure, lower temperature atomized liquid.

The atomized liquid now passes through the evaporator where it absorbs heat before returning via the expansion valve to the compressor as a warm low pressure vapour.

There are two refrigerant passages in the valve. One passage is in the refrigerant line from the condenser to the evaporator and contains the ball and spring type orifice valve. The other passage is in the refrigerant line from the evaporator to the compressor and contains the valve's temperature sensing element.
Liquid refrigerant flow from the condenser and receiver dryer is controlled by a push-rod forcing the orifice valve ball off its seat and the spring exerting pressure on the ball to keep it on its seat.

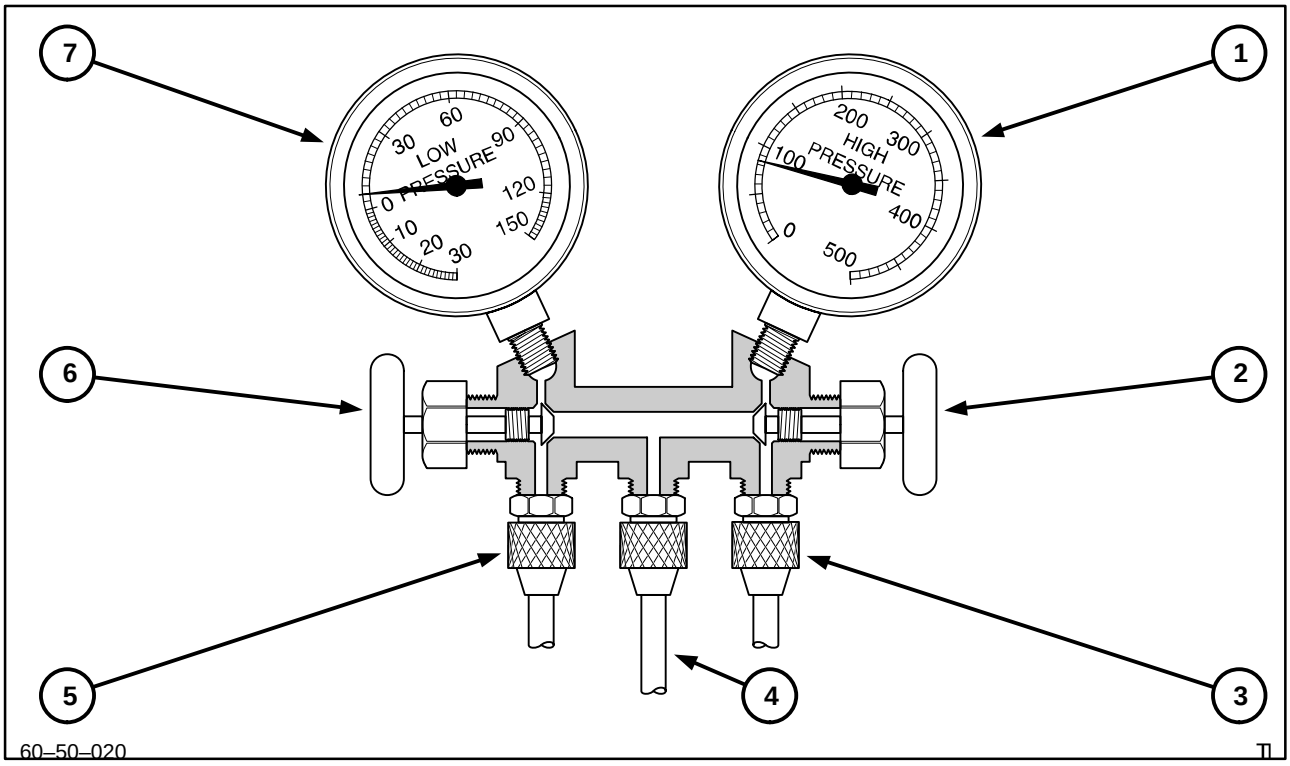
During stabilized (vehicle shutdown) conditions, the pressure on the bottom of the expansion valve diaphragm rises above the pressure on the top of the diaphragm allowing the valve spring to close the orifice.



18

NOTE: * *Test procedure based upon ambient temperature of 35°C (95°F). For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*

PERFORMANCE TEST EXAMPLE 2



25

Performance Test Example 2

1. High Side Low
2. High Side Hand Valve Closed
3. High Side Hose Connected to High Side Service Connector
4. Not Used
5. Low Side Hose Connected to Low Side Service Connector
6. Low Side Hand Valve Closed
7. Low Side Normal

PROBLEM:

Insufficient cooling.

CAUSE:

Refrigerant excessively low.

CONDITIONS*

Low side pressure very low.
Gauge should read 1–2 bar (15-30 psi)

High side pressure too low.
Gauge should read 13.3–14.8 bar (194–215 psi).

Evaporator air warm.

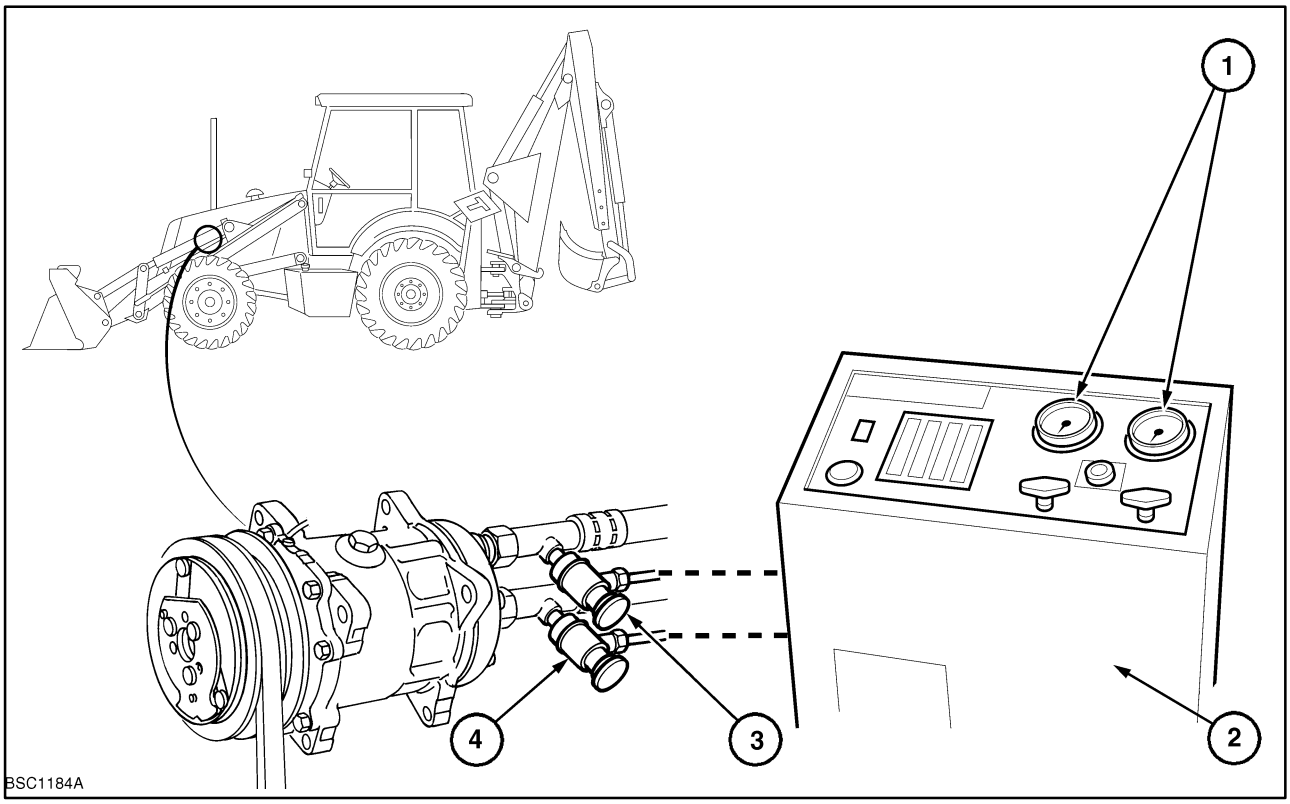
Low pressure switch cutting out

CORRECTIVE PROCEDURES

1. Leak test the system.
2. Discharge and recover the refrigerant from the system.
3. Repair leaks.
4. Check compressor oil to ensure no loss.
5. Evacuate the system.
6. Charge the system.
7. Performance test the system.

DIAGNOSIS: *System refrigerant is extremely low. A serious leak is indicated.*

NOTE: * *Test procedure based upon ambient temperature of 95°F. For proper high side gauge reading for other ambient temperatures, refer to the pressure temperature chart.*



36

Connecting Recovery Evacuation and Recycling/Charging Station to the Tractor

1. Built In Manifold Gauge Set
2. Recovery/Recharging Unit
3. Low Side (Suction) Service Valve (Blue Hose)
4. High Side (Discharge) Service Valve (Red Hose)

Other recovery systems are available where the manifold gauges are not an integral part of the machine. When this type of equipment is used a separate manifold gauge set must be used.

The following is a summary of the steps for discharging the system using a recovery/recycling unit

⚠ WARNING ⚠

***Never** discharge refrigerant gas into the atmosphere. Always wear safety goggles and gloves when working with refrigerant. Only use authorised refrigerant tanks.*

***IMPORTANT:** Always follow the manufactures instructions when operating recovery equipment.*

1. Run the vehicle's air conditioning system for a few minutes.
2. Set up the recovery unit following manufacturer's instructions. Ensure that the units red (high side) hose is connected to the high side (discharge) fitting and the blue (low side) hose to the low side (suction) fitting.

***NOTE:** If a unit requiring the manifold gauge set is being used, the low and high sides of the manifold set are connected to the low and high sides of the tractor air conditioning system. The hose from the recovery unit is then connected to the manifold centre port. .*

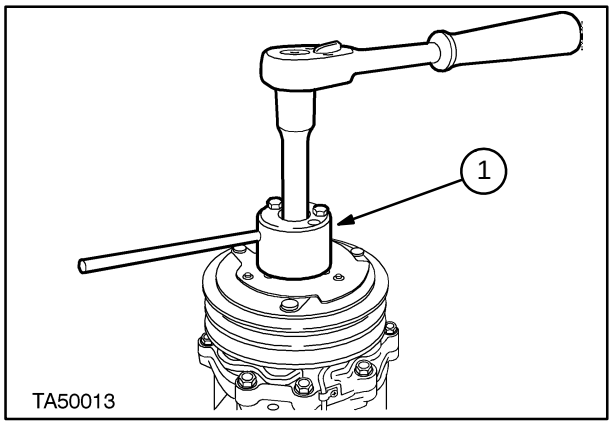
3. To recover refrigerant, open both high and low side valves on the control panel or the valves on the manifold gauge set if being used.
4. Open the valves labelled "gas" and "liquid" on the recovery unit refrigerant tank.
5. Plug in the unit's power cord
6. Operate the recovery system in accordance with the manufacturers instructions.

The compressor will shut off automatically when the recovery is complete.

Clutch Disassembly – Removal

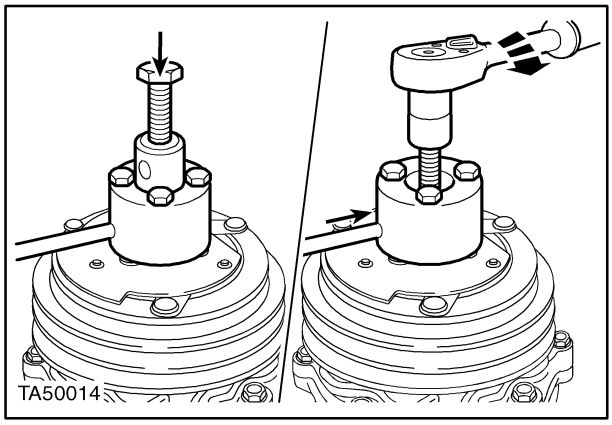
All clutch servicing should be done with the compressor removed from the vehicle:

1. Support the compressor. If using a vice, do not hold on to the housing.
2. Attach tool (1) number**297423** to the cover on the front of the clutch plate and placing a socket and ratchet through the tool remove the the cover attaching nut.



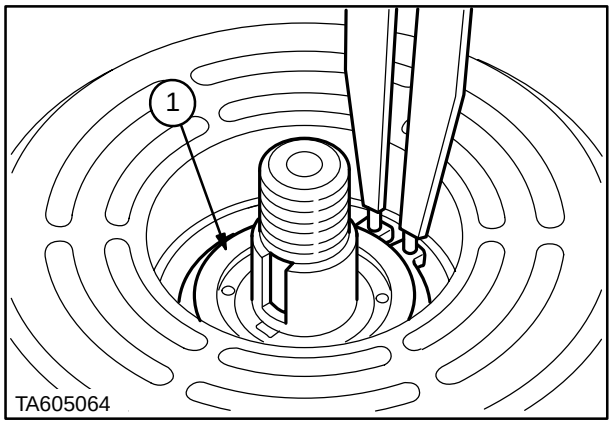
53

3. Using the front plate tool, insert tool number JD166/3 into 297423 and place a tommy bar through both hold the clutch plate stationary.
4. Place the bolt into the tool JD166/3 and by tightening the bolt onto the end of the shaft the front plate will be extracted from the shaft.



54

5. Remove the pulley bearing external snap ring (1) and lift the pulley assembly from the compressor.



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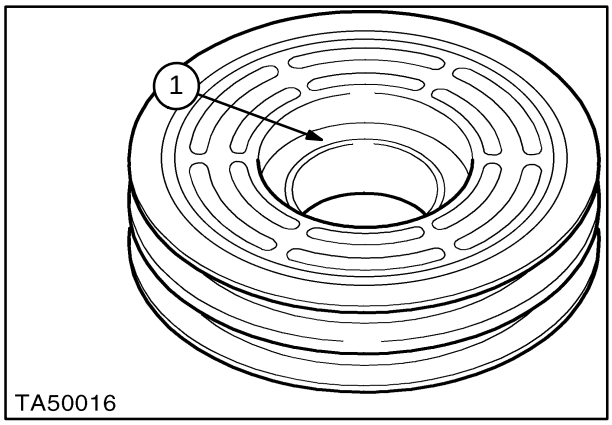
6. Inspect the pulley bearing assembly for wear and replace the assembly as necessary.



56

ROPS – POWER SHUTTLE, 92 – 108 hp (Worldwide)

Fuse No.	Rating	Colour	Circuit
F1/A			
F1/B	7.5A	Brown	Fuel Shut Off, Anti – Theft, Fuel Pump, Thermostart
F1/C	10A	Red	Brake Stop Switch
F2/A	15A	Blue	Instruments, Switches, Brake Oil, Pneumatic Seat
F2/B			
F2/C	20A	Yellow	Engine Glow Plug
F3/A	3A	Violet	Rear right / Front Left side Instrument
F3/B	3A	Violet	Rear left / Front right side, licence plate light
F3/C	10A	Red	Rapid connect, Glide Ride, Hand Hammer, Cold Start
F4/A	5A	Orange	Shuttle Lever, Reverse Buzzer, Speed switch
F4/B	10A	Red	Backhoe Hammer Valve, Loader Self Levelling, Transmission Disconnect
F4/C	10A	Red	Sideshift Lock, Boom Lock
F5/A	15A	Blue	Front Working lamps Internal
F5/B	10A	Red	Dip Beam (not N/America)
F5/C	15A	Blue	Main Beam (not N/America)
F6/A	7.5A	Brown	Rotating Beacon
F6/B	7.5A	Brown	Flashers
F6/C	7.5A	Brown	Hand Hammer Valve, 4WD
F7/A	10A	Red	+ 30 Warning and Horn Fuse
F7/B			
F7/C			
F8/A	15A	Blue	Rear Work Lamps External
F8/B	15A	Blue	Front Work Lamps External
F8/C	15A	Blue	Rear Work Lamps Internal

* Special Bi Metal, re–setting Fuse

RELAYS

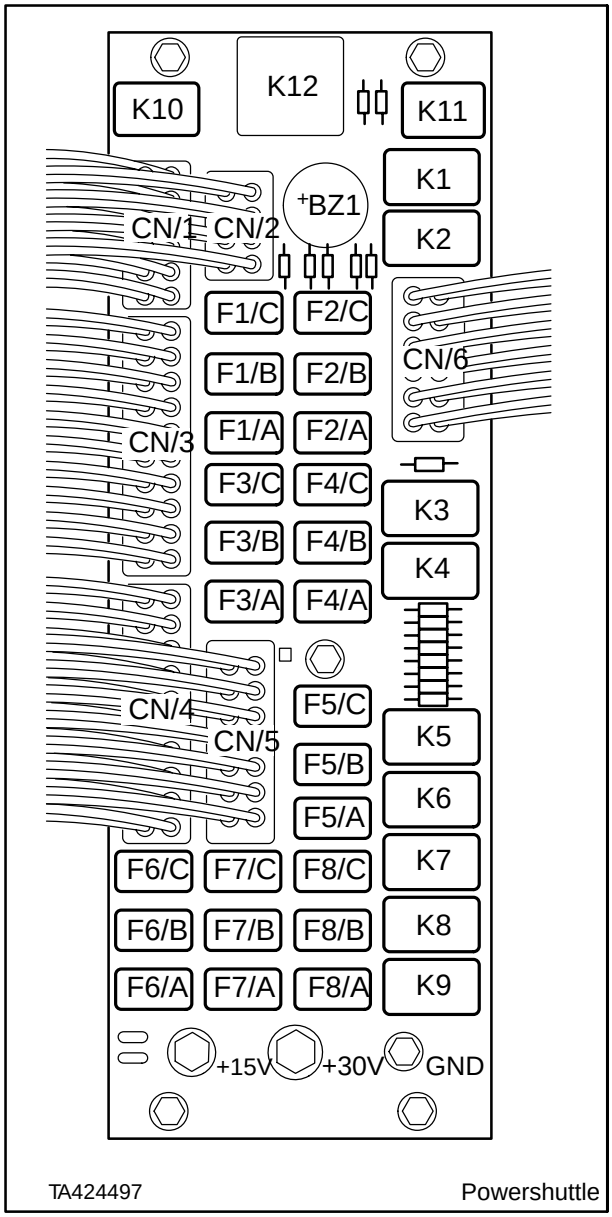
K1	Transmission Forward / Reverse
K2	Handbrake on Alarm / Speed Alarm
K3	Starting Relay
K4	Loader Self Levelling
K5	Headlamp Main Beam (not N/America)
K6	Front Work Lights 2 off – Internal
K7	Rear Work Lamps 2 off – Internal
K8	Front Work Lights 4 off – External
K9	Rear Work Lamps 4 off– External
K10	Shuttle Control Reverse
K11	Shuttle Control Forward
K12	Flashers

BUZZER

BZ1	Audible Warning Buzzer

CONNECTORS

CN	Main Harness Connections into Fuse Board



TA424497 Powershuttle

10

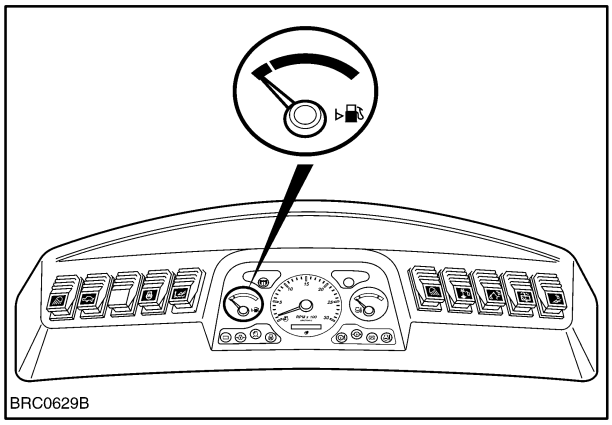
SIDE MOUNTED PANEL INSTRUMENTS AND WARNING LIGHTS

NOTE: *The machine gauge's and switches mounted in the Instrument panel, are all illuminated internally when the machine lights are switched 'on'.*

Fuel Level Gauge

This gauge indicates the level of fuel in the tank on a continuous basis but is only operative with the key–start/stop switch in the ''ON'' position.

NOTE: *When the key–start/stop switch is turned off the gauge needle may assume a random position.*

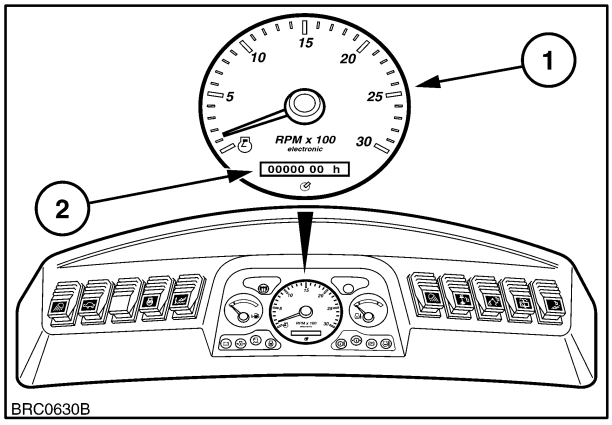


19

Tachometer and Hour Meter

The Tachometer (1) graduated to 3000 rev/min is driven from the alternator and reflects true engine speed.

The hourmeter (2) situated in the lower half of the tachometer reflects hours of engine operation and is driven from the alternator when running.



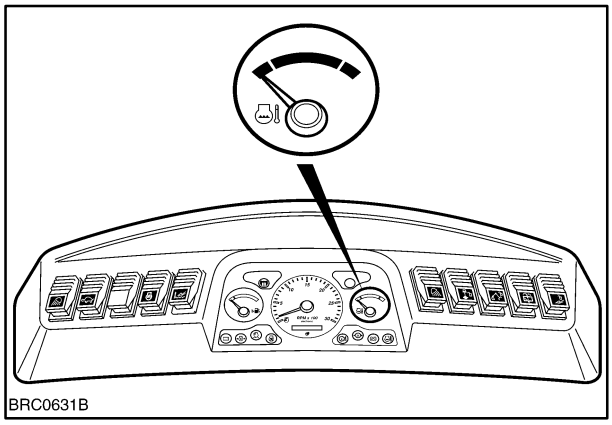
20

Engine Coolant Temperature Warning Gauge with Warning alarm

The engine coolant temperature indicator responds to a sensor fitted in the engine. During normal operations the indicator will tend to rise from the low point of the green segment to the centre of the gauge. When operating under heavy load conditions the indicator may continue to rise to just below the red segment and return to a lower position when normal machine operation is resumed.

Should the indicator rise into the red segment a warning alarm will sound. Stop the engine immediately and investigate the cause. Normal operations can be resumed once the engine has cooled sufficiently or the cause corrected.

NOTE: *When the key–start/stop switch is turned off the gauge needle assumes a random position.*



21

55 000 ELECTRICAL SYSTEM – GENERAL FAULT FINDING

PROBLEM	POSSIBLE CAUSE	CORRECTION
Electrical system is inoperative	Loose or corroded battery connections	Clean and tighten connections
	Sulphated batteries	Check battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity.
	Battery Isolator switch turned 'off'	Re–instate isolator switch
	Main machine fuse link blown	Establish reason of failure and replace fuse link
Starter speed low and engine cranks slowly	Loose or corroded connections	Clean and tighten loose connections
	Low battery output	Check battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity.
	Incorrect viscosity engine oil	Use correct viscosity oil for temperature conditions
Starter inoperative	Transmission shift lever in gear	Place shift lever in neutral
	Loose or corroded connections	Clean and tighten loose connections
	Dead batteries	Charge or replace batteries.
Charge indicator lamp stays on with engine running	Low engine idle speed	Increase idle speed
	Loose belt	Check belt tension
	Malfunctioning battery	Check battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity.
	Malfunctioning alternator	Check alternator
Batteries will not charge	Loose or corroded terminal connections	Clean and tighten connections
	sulphated batteries	Check battery open circuit voltage for 12.6 volts minimum. Check electrolyte level and specific gravity.
	Loose or worn belt	Check automatic belt tensioner. Replace belt if required.
Charge indicator flashing indicating excessive charging voltage	Malfunctioning alternator	Check alternator

SOLENOID VALVES

Serial number from 031026803

Components and their (Connectors)

EV2 – Hand Hammer Solenoid Valve (Optional)
. . . . . X35 = 2 Pin
EV6 – Grab Level Solenoid Valve
. . . . . X29 = 2 Pin
EV8 – 4WD Solenoid Valve (Optional)
. . . . . X8 = 2 Pin
EV9 – Reverse Solenoid Valve (Optional)
. . . . . X7 =2 Pin
EV10 – Forward Solenoid Valve (Optional)
. . . . . X6 = 2 Pin
HA1 – Reverse Buzzer
. . . . . X19 = 2 Pin
K1 – . Transmission Forward/Reverse
K2 – . Handbrake On Alarm/Speed Alarm
K4 – . Loader Self Levelling
K10 – Shuttle Control Reverse
K11 – Shuttle Control Forward
KC – Fuse & Relay Board
. . . . . XC1 = 11 Pin
. . . . . XC3 = 21 Pin
. . . . . XC4 = 21 Pin
. . . . . XC6 = 13 Pin
S2 – 4WD Switch (Optional)
S3 – Hand Hammer Switch (Optional)
S26 – Clutch Shut Off Button
. . . . . X28 = 2 Pin
S27 – Clutch Shut Off Button
. . . . . X23 = 2 Pin
S28 – Grab Sender
. . . . . X26 = 3 Pin
S29 – Horn Button
. . . . . X27 = 2 Pin
S40 – Gear Shift
. . . . . X62 = 6 Pin
X1 = . Engine Harness Connector 18 Pin
X9 = Front Dashboard Connector 9 Pin
X10 = Solenoid Valves Connector 24 Pin

WIRE COLOURS:
A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

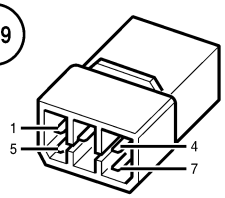
Example of mixed colours

G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)

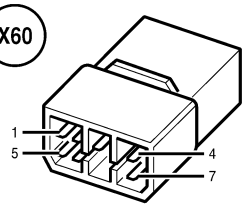
X59

1: CM:N:1
2: CM:A:1
3: CM:G-N:1
4: CM:H:1
5: CM:V:1



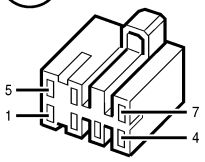
X60

1: CM:N:1
2: CM:L:1
3: CM:G:1
4: CM:H:1(X2)
5: CM:V:1
6: CM:C:1
7: CM:H/R:1



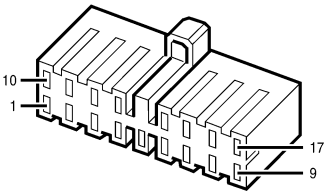
XC2

1: CM:A:2
2:
3: CM:A-B:1
4: CM:A-B:1
5: CM:V:1
7: CM:V:1



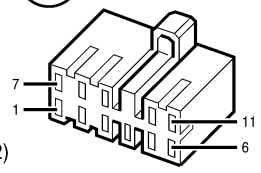
XC5

1: CM:A/N:2(X2)
2:
3: CM:A/B:1
4: CM:R/N:1
5:
6: CM:G:2(X2)
7: CM:L:1(X2)
8: CM:G-N:1
9: CM:A:1(X2)
10: CM:R-N:1.5
CM:B/R:1.5
11: CM:H-N:1(X2)
12: CM:H:1(X2)
13: CM:V-N:1(X2)
14: CM:V:1(X2)
15:
16: CM:A-G:1
17: CM:R-N:1(X2)



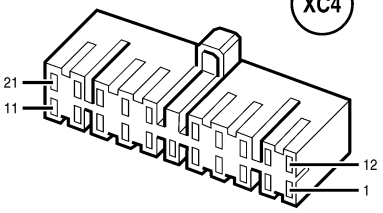
XC1

1: CM:C:1
2:
3:
4: CM:R/N:1
5: CM:B-R:1
6:
7: CM:R-N:1
8: CM:C-R:1(X2)
9:
10: CM:R-V:1
11:



XC4

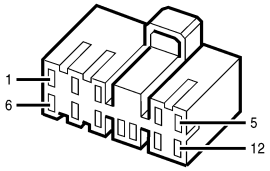
1: CM:A-G:1
2: CM:R:1.5
3: CM:H-R:1
4: CM:R:2.5
5: CM:H-N:1.5
6: CM:G:1
7: CM:M/B:1
8: CM:V-N:1
9: CM:L/R:1
10: CM:H-L:1
11: CM:H-N:1



12: CM:G:1.5
13: CM:H/R:1
14: CM:A:1
15: CM:G-N:1
16:
17: CM:H:1(X2)
18: CM:G-N:1.5
19: CM:A/B:1.5
20:
21: CM:G:1.5

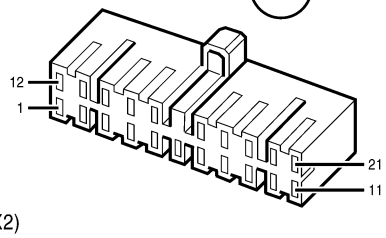
X70

1: CM:R/N:1
2: CM:N:1
3: CM:A-B:1
4: CM:V:1
5: CM-G-N:1
6: CM:G:1
7:
8:
9:
10:
11: CM:R-V:1
12: CM:G-R:1



XC3

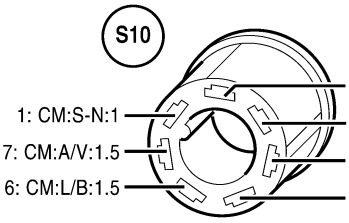
1: CM:H-N:1
2: CM:L:1
3: CM:G-V:1
4: CM:G-S:1
5:
6:
7: CM:C/N:1.5
8: CM:H-R:1
9:
10: CM:A-B:1
11: CM:C-N:1(X2)



12: CM:A:1
13: CM:G-N:1(X2)
14: CM:A-V:1
15: CM:V-N:1
16: CM:R-V:1(X2)
17: CM:A/N:1.5
18: CM:C/B:1.5
19: CM:A-G:1
20: CM:G:1
21: CM:R-N:1

S10

1: CM:S-N:1
7: CM:A/V:1.5
6: CM:L/B:1.5
2: CM:H-R:1
3: CM:A-G:1
4: CM:H-R:1
5: CM:L/R:1.5



BRC0784B

MISCELLANEOUS ITEMS

Serial number from 031026803

Components and their (Connectors)

H15 – Beacon Lamp
. . . . . X80 = 2 Pin

H16 – Beacon Lamp
. . . . . X81 = 2 Pin

KC – Fuse and Relay Board
. . . . . XC2 = 7 Pin
. . . . . XC3 = 21 Pin
. . . . . XC4 = 21 Pin
. . . . . XC5 = 17 Pin

S15 – Beacon Lamp Switch

S41 – Lights Switch
. . . . . X61 = 12 Pin

X10 = Solenoid Valves Connector 24 Pin

X16 = Side Dashboard Connector 21 Pin

WIRE COLOURS:

A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours

G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)

NOTES

SOLENOID VALVES

Serial number from 031026803

Components and their (Connectors)

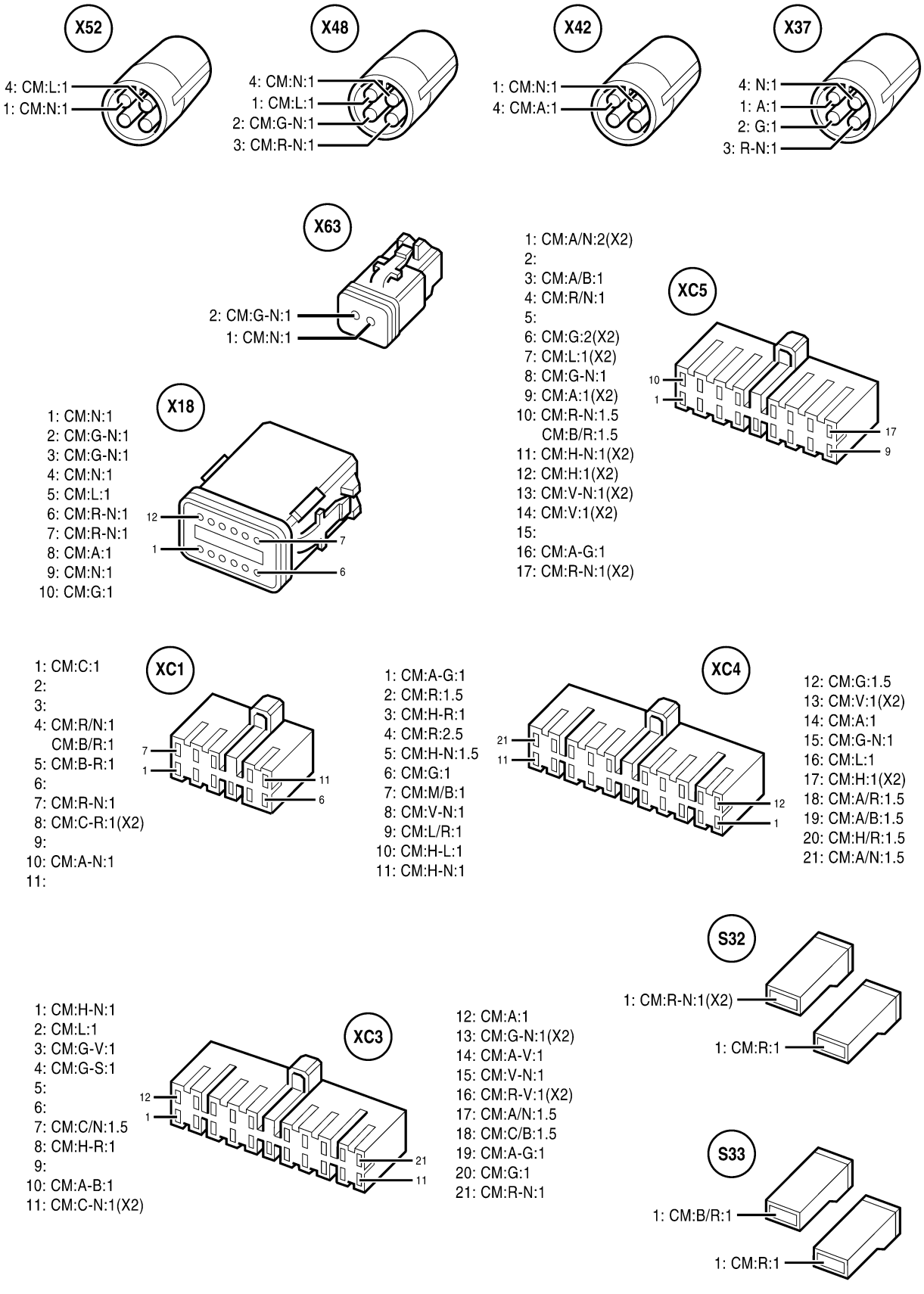
EV1 – Double Delivery Solenoid Valve (Optional)
. . . . . X30 = 2 Pin
EV3 – Rear Hammer Solenoid Valve (Optional)
. . . . . X32 = 2 Pin
EV4 – Rear Translation Solenoid Valve
. . . . . X24 = 2 Pin
EV5 – Excavator Rear Lock Solenoid Valve
. . . . . (Optional)
. . . . . X25 = 2 Pin
EV11 – Ride Control Solenoid Valve (Optional)
. . . . . X34 = 2 Pin
EV12 – Tools Rapid Connection Solenoid Valve
. . . . . (Optional)
. . . . . X31 = 2 Pin
H1 – Excavator Rear Lock Warning Light
. . . . . (Optional)
S4 – Double Delivery Switch (Optional)
S5 – Ride Control Switch (Optional)
S6 – Tools Rapid Connection Switch (Optional)
S7 – Rear Translation Lock Switch
S8 – Excavator Rear Lock Switch (Optional)
S30 – Rear Hammer Button
. . . . . X36 = 2 Pin
X10 = Solenoid Valves Connector 24 Pin
X14 = Side Dashboard Connector 9 Pin
X15 = Side Dashboard Connector 7 Pin
X16 = Side Dashboard Connector 21 Pin

WIRE COLOURS:
A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours

G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)


X52
4: CM:L:1
1: CM:N:1
X48
4: CM:N:1
1: CM:L:1
2: CM:G-N:1
3: CM:R-N:1
X42
1: CM:N:1
4: CM:A:1
X37
4: N:1
1: A:1
2: G:1
3: R-N:1
X63
2: CM:G-N:1
1: CM:N:1
X18
1: CM:N:1
2: CM:G-N:1
3: CM:G-N:1
4: CM:N:1
5: CM:L:1
6: CM:R-N:1
7: CM:R-N:1
8: CM:A:1
9: CM:N:1
10: CM:G:1
12
1
7
6
1: CM:A/N:2(X2)
2:
3: CM:A/B:1
4: CM:R/N:1
5:
6: CM:G:2(X2)
7: CM:L:1(X2)
8: CM:G-N:1
9: CM:A:1(X2)
10: CM:R-N:1.5
CM:B/R:1.5
11: CM:H-N:1(X2)
12: CM:H:1(X2)
13: CM:V-N:1(X2)
14: CM:V:1(X2)
15:
16: CM:A-G:1
17: CM:R-N:1(X2)
XC5
10
1
17
9
1: CM:C:1
2:
3:
4: CM:R/N:1
CM:B/R:1
5: CM:B-R:1
6:
7: CM:R-N:1
8: CM:C-R:1(X2)
9:
10: CM:A-N:1
11:
XC1
7
1
11
6
1: CM:A-G:1
2: CM:R:1.5
3: CM:H-R:1
4: CM:R:2.5
5: CM:H-N:1.5
6: CM:G:1
7: CM:M/B:1
8: CM:V-N:1
9: CM:L/R:1
10: CM:H-L:1
11: CM:H-N:1
XC4
21
11
12
1
12: CM:G:1.5
13: CM:V:1(X2)
14: CM:A:1
15: CM:G-N:1
16: CM:L:1
17: CM:H:1(X2)
18: CM:A/R:1.5
19: CM:A/B:1.5
20: CM:H/R:1.5
21: CM:A/N:1.5
S32
1: CM:R-N:1(X2)
1: CM:R:1
1: CM:H-N:1
2: CM:L:1
3: CM:G-V:1
4: CM:G-S:1
5:
6:
7: CM:C/N:1.5
8: CM:H-R:1
9:
10: CM:A-B:1
11: CM:C-N:1(X2)
XC3
12
1
21
11
12: CM:A:1
13: CM:G-N:1(X2)
14: CM:A-V:1
15: CM:V-N:1
16: CM:R-V:1(X2)
17: CM:A/N:1.5
18: CM:C/B:1.5
19: CM:A-G:1
20: CM:G:1
21: CM:R-N:1
S33
1: CM:B/R:1
1: CM:R:1
BRC0756B

CAB RADIO, HEATER BLOWER,

Serial number from 031026803

Components and their (Connectors)

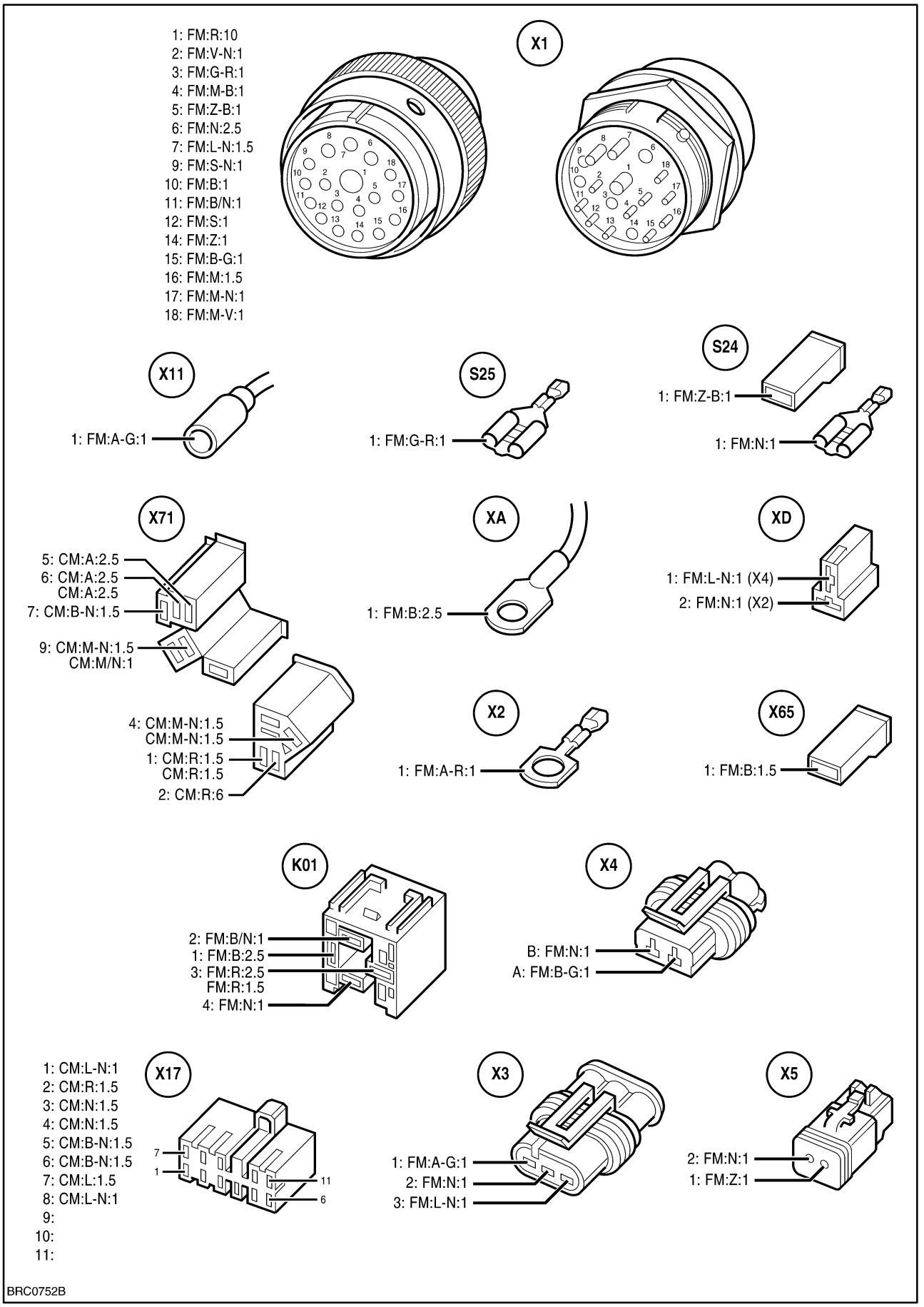
BS1 – Right Speaker (Optional)
BS2 – Left Speaker (Optional)
H17 – Current Intake Illumination
H18 – Cabin Lamp
KC – Fuse & Relay Board
. . . . . XC5 = 17 Pin
. . . . . XC6 = 13 Pin
M8 – Blower Motor
. . . . . X13 = 4 Pin
S34 – Roof Lamp Left Switch
S35 – Roof Lamp Right Switch
S43 – Radio (Optional)
. . . . . X53 = 8 Pin
. . . . . X54 = 8 Pin
S44 – Seat (Optional)
. . . . . X21 = 4 Pin
S45 – Conditioner & Blower Motor Switch
. . . . . X20 = 2 Pin
S46 – Current Intake
. . . . . X55 = 2 Pin
X1 = Engine Cable Connector 18 Pin
X14 = Side Dashboard Connector 9 Pin
X77 = Blower Motor Third Speed Connector 1 Pin

WIRE COLOURS:
A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours

G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)


X1
1: FM:R:10
2: FM:V-N:1
3: FM:G-R:1
4: FM:M-B:1
5: FM:Z-B:1
6: FM:N:2.5
7: FM:L-N:1.5
9: FM:S-N:1
10: FM:B:1
11: FM:B/N:1
12: FM:S:1
14: FM:Z:1
15: FM:B-G:1
16: FM:M:1.5
17: FM:M-N:1
18: FM:M-V:1
X11
1: FM:A-G:1
S25
1: FM:G-R:1
S24
1: FM:Z-B:1
1: FM:N:1
X71
5: CM:A:2.5
6: CM:A:2.5
CM:A:2.5
7: CM:B-N:1.5
9: CM:M-N:1.5
CM:M/N:1
4: CM:M-N:1.5
CM:M-N:1.5
1: CM:R:1.5
CM:R:1.5
2: CM:R:6
XA
1: FM:B:2.5
XD
1: FM:L-N:1 (X4)
2: FM:N:1 (X2)
X2
1: FM:A-R:1
X65
1: FM:B:1.5
K01
2: FM:B/N:1
1: FM:B:2.5
3: FM:R:2.5
FM:R:1.5
4: FM:N:1
X4
B: FM:N:1
A: FM:B-G:1
1: CM:L-N:1
2: CM:R:1.5
3: CM:N:1.5
4: CM:N:1.5
5: CM:B-N:1.5
6: CM:B-N:1.5
7: CM:L:1.5
8: CM:L-N:1
9:
10:
11:
X17
7
1
11
6
X3
1: FM:A-G:1
2: FM:N:1
3: FM:L-N:1
X5
2: FM:N:1
1: FM:Z:1
BRC0752B

FRONT LIGHTS

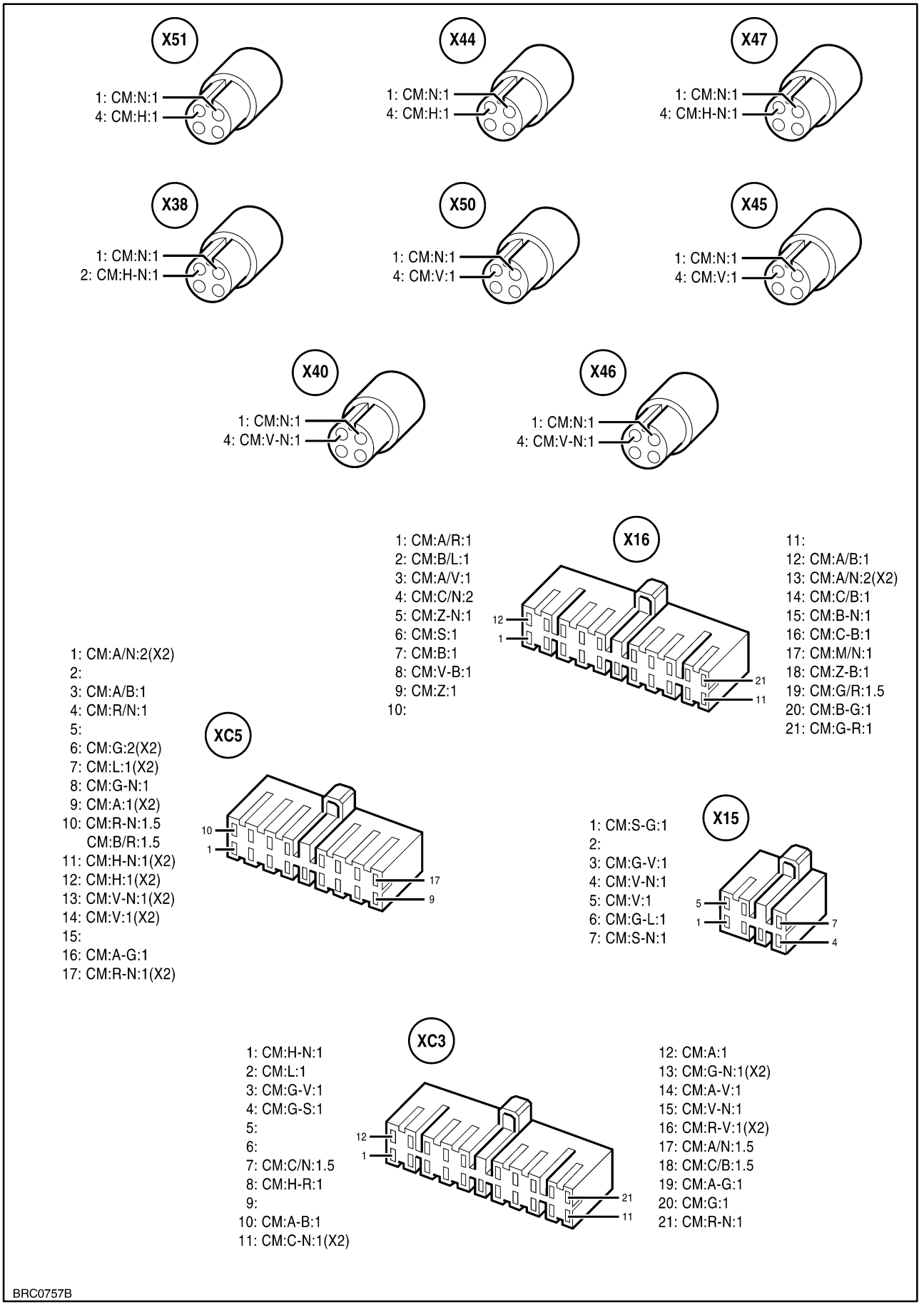
Serial number from 031026803

Components and their (Connectors)

BZ1 – Audible Warning Buzzer
H2 – Front Left Light
H3 – Front Right Light
HA2 – Horn
K5 – . Headlamp Main Beam
K12 – Flashers
KC – Fuse and Relay Board
. . . . . XC1 = 11 Pin
. . . . . XC2 = 7 Pin
. . . . . XC3 = 21 Pin
. . . . . XC4 = 21 Pin
. . . . . XC5 = 17 Pin
S9 – Lights Switch
S10 – Hazard Switch
S31 – Brake Oil Level Sender
ST2 – Front Panel
. . . . . X70 = 12 Pin
X58 = Flasher Unit Connector 13 Pin
X59 = Right Lights Connector 5 Pin
X60 = Horn & Left Lights Connector 7 Pin

WIRE COLOURS:
A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours
G/V = Yellow/Green (Transverse colours)
G–V = Yellow–Green (Longitudinal Colours)


X51
1: CM:N:1
4: CM:H:1
X44
1: CM:N:1
4: CM:H:1
X47
1: CM:N:1
4: CM:H-N:1
X38
1: CM:N:1
2: CM:H-N:1
X50
1: CM:N:1
4: CM:V:1
X45
1: CM:N:1
4: CM:V:1
X40
1: CM:N:1
4: CM:V-N:1
X46
1: CM:N:1
4: CM:V-N:1
X16
1: CM:A/R:1
2: CM:B/L:1
3: CM:A/V:1
4: CM:C/N:2
5: CM:Z-N:1
6: CM:S:1
7: CM:B:1
8: CM:V-B:1
9: CM:Z:1
10:
11:
12: CM:A/B:1
13: CM:A/N:2(X2)
14: CM:C/B:1
15: CM:B-N:1
16: CM:C-B:1
17: CM:M/N:1
18: CM:Z-B:1
19: CM:G/R:1.5
20: CM:B-G:1
21: CM:G-R:1
12
1
21
11
1: CM:A/N:2(X2)
2:
3: CM:A/B:1
4: CM:R/N:1
5:
6: CM:G:2(X2)
7: CM:L:1(X2)
8: CM:G-N:1
9: CM:A:1(X2)
10: CM:R-N:1.5
CM:B/R:1.5
11: CM:H-N:1(X2)
12: CM:H:1(X2)
13: CM:V-N:1(X2)
14: CM:V:1(X2)
15:
16: CM:A-G:1
17: CM:R-N:1(X2)
XC5
10
1
17
9
1: CM:S-G:1
2:
3: CM:G-V:1
4: CM:V-N:1
5: CM:V:1
6: CM:G-L:1
7: CM:S-N:1
X15
5
1
7
4
1: CM:H-N:1
2: CM:L:1
3: CM:G-V:1
4: CM:G-S:1
5:
6:
7: CM:C/N:1.5
8: CM:H-R:1
9:
10: CM:A-B:1
11: CM:C-N:1(X2)
XC3
12
1
21
11
12: CM:A:1
13: CM:G-N:1(X2)
14: CM:A-V:1
15: CM:V-N:1
16: CM:R-V:1(X2)
17: CM:A/N:1.5
18: CM:C/B:1.5
19: CM:A-G:1
20: CM:G:1
21: CM:R-N:1
BRC0757B

INSTRUMENT PANELS

Serial number from 031026803

SIDE INSTRUMENT PANEL

Pos	Pin	Function	Signal
L3	1	Air Cleaner Lamp	–
L2	2	Engine Oil Pressure Lamp	–
L1	3	Generator Lamp	–
S4	4	Water Temperature Gauge	ohm
S1	5	Fuel Level Gauge	ohm
S2	6	Tachometer	Hz
+ILL	6	Instrument Lighting	+Lights
Gnd	8	Negative	
+15	9	Positive	
	10	NC	
L10		Service Lamp	Int.
	11	NC	
+30	12	Permanent Supply Voltage	
L7	13	Handbrake Lamp	
	14	NC	
B	15	External Buzzer Driving	
L8	16	Neutral Red Lamp	+/–
L8	17	Neutral Red Lamp	+/–
L6	18	Transmission Oil Pressure Lamp	–
L5	19	Transm. Oil Temp. Lamp	–
L4	20	Engine Preheating Lamp	+
L12		High Water Temp. Lamp	Int.

FRONT INSTRUMENT PANEL

Pos	Pin	Function	Signal
+12	1	Positive (+12V)	
Gnd	2	Negative	
S1	3	Speedometer	Hz
L4	4	Driving Beam Lamp	+
L3	5	Position Lights Lamp	+
+ILL	6	Instrument Lighting	+Lights
L8	7	NC	
L7	8	NC	
L6	9	NC	
L5	10	NC	
L1	11	Direction Lamp	+
L2	12	Brake Oil Level Lamp	+

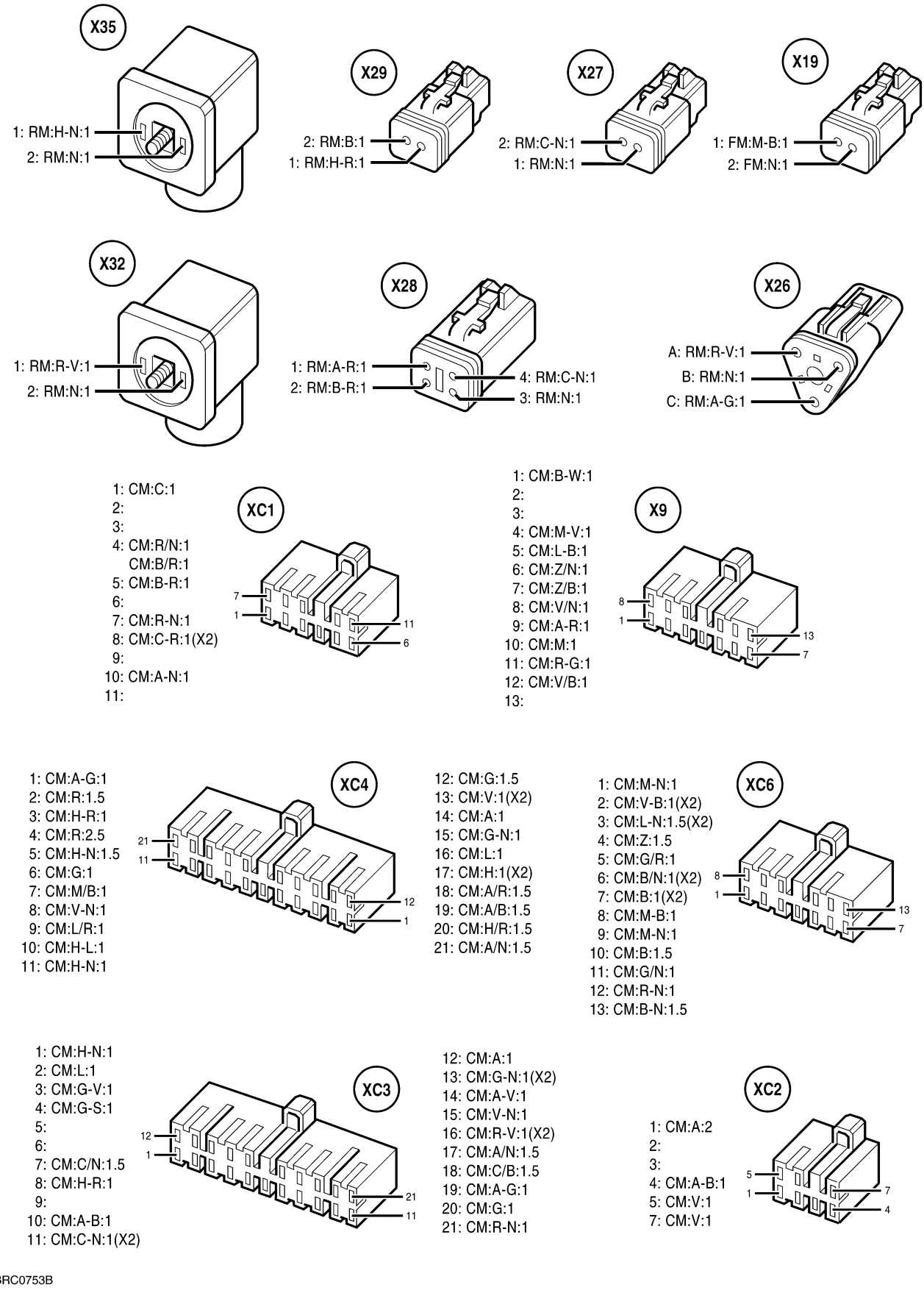
WIRE COLOURS:

A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours

G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)


X35
1: RM:H-N:1
2: RM:N:1
X29
2: RM:B:1
1: RM:H-R:1
X27
2: RM:C-N:1
1: RM:N:1
X19
1: FM:M-B:1
2: FM:N:1
X32
1: RM:R-V:1
2: RM:N:1
X28
1: RM:A-R:1
2: RM:B-R:1
4: RM:C-N:1
3: RM:N:1
X26
A: RM:R-V:1
B: RM:N:1
C: RM:A-G:1
1: CM:C:1
2:
3:
4: CM:R/N:1
CM:B/R:1
5: CM:B-R:1
6:
7: CM:R-N:1
8: CM:C-R:1(X2)
9:
10: CM:A-N:1
11:
XC1
7
1
11
6
1: CM:B-W:1
2:
3:
4: CM:M-V:1
5: CM:L-B:1
6: CM:Z/N:1
7: CM:Z/B:1
8: CM:V/N:1
9: CM:A-R:1
10: CM:M:1
11: CM:R-G:1
12: CM:V/B:1
13:
X9
8
1
13
7
1: CM:A-G:1
2: CM:R:1.5
3: CM:H-R:1
4: CM:R:2.5
5: CM:H-N:1.5
6: CM:G:1
7: CM:M/B:1
8: CM:V-N:1
9: CM:L/R:1
10: CM:H-L:1
11: CM:H-N:1
XC4
21
11
12
1
12: CM:G:1.5
13: CM:V:1(X2)
14: CM:A:1
15: CM:G-N:1
16: CM:L:1
17: CM:H:1(X2)
18: CM:A/R:1.5
19: CM:A/B:1.5
20: CM:H/R:1.5
21: CM:A/N:1.5
1: CM:M-N:1
2: CM:V-B:1(X2)
3: CM:L-N:1.5(X2)
4: CM:Z:1.5
5: CM:G/R:1
6: CM:B/N:1(X2)
7: CM:B:1(X2)
8: CM:M-B:1
9: CM:M-N:1
10: CM:B:1.5
11: CM:G/N:1
12: CM:R-N:1
13: CM:B-N:1.5
XC6
8
1
13
7
1: CM:H-N:1
2: CM:L:1
3: CM:G-V:1
4: CM:G-S:1
5:
6:
7: CM:C/N:1.5
8: CM:H-R:1
9:
10: CM:A-B:1
11: CM:C-N:1(X2)
XC3
12
1
21
11
12: CM:A:1
13: CM:G-N:1(X2)
14: CM:A-V:1
15: CM:V-N:1
16: CM:R-V:1(X2)
17: CM:A/N:1.5
18: CM:C/B:1.5
19: CM:A-G:1
20: CM:G:1
21: CM:R-N:1
1: CM:A:2
2:
3:
4: CM:A-B:1
5: CM:V:1
7: CM:V:1
XC2
5
1
7
4
BRC0753B

REAR LIGHTS

Serial number from 031026803

Components and their (Connectors)

H4 – Rear Left Light
H5 – Number Plate Lamp
. . . . . X63 = 2 Pin
H6 – Rear Right Light
K11 – Not Used
KC – Fuse and Relay Board
. . . . . XC1 = 11 Pin
. . . . . XC3 = 21 Pin
. . . . . XC4 = 21 Pin
. . . . . XC5 = 17 Pin
S32 – Stop Light Switch
S33 – Stop Light Switch
X18 = Rear Lamps Connector 12 Pin
X37 = Rear Right Light Connector 4 Pin (Optional)
X42 = Front Right Indicator Connector 4 Pin
. . . . . (Optional)
X48 = Rear Left Light Connector 4 Pin (Optional)
X52 = Front Left Indicator Connector 4 Pin
. . . . . (Optional)

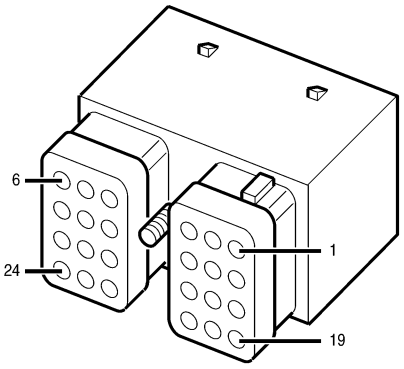
WIRE COLOURS:
A = LIGHT BLUE . . . . . M = BROWN
B = WHITE . . . . . N = BLACK
C= ORANGE . . . . . R = RED
G = YELLOW . . . . . S = PINK
H = GREY . . . . . V = GREEN
L = BLUE . . . . . Z = VIOLET

Example of mixed colours

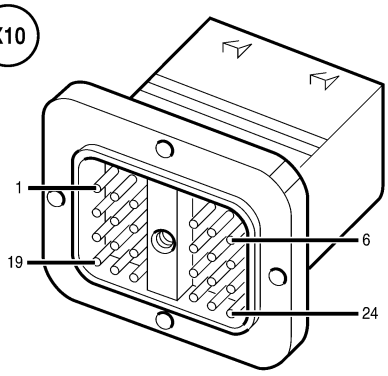
G/V = Yellow/Green (Transverse colours)

G–V = Yellow–Green (Longitudinal Colours)

1: RM:B-N:1
2: RM:M:1.5
3: RM:A-B:1
4: RM:A-R:1
5: RM:
6: RM:
7: RM:
8: RM:C-N:1
9: RM:L-G:1
10: RM:A-R:1
11: RM:V:1
12: RM:R-V:1

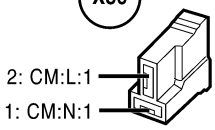


X10

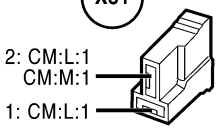


13: RM:A-G:1
14: RM:R-V:1
15: RM:A-N:1
16: RM:
17: RM:B-R:1
18: RM:
19: RM:C-L:1
20: RM:H-N:1
21: RM:C-B:1
22: RM:H-R:1
23: RM:B-R:1
24: RM:C-N:1

X80

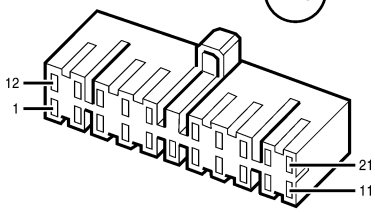


X81



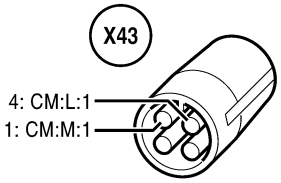
1: CM:A/R:1
2: CM:B/L:1
3: CM:A/V:1
4: CM:C/N:2
5: CM:Z-N:1
6: CM:S:1
7: CM:B:1
8: CM:V-B:1
9: CM:Z:1
10:

X16



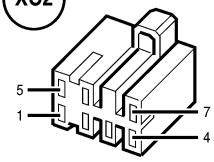
11:
12: CM:A/B:1
13: CM:A/N:2(X2)
14: CM:C/B:1
15: CM:B-N:1
16: CM:C-B:1
17: CM:M/N:1
18: CM:Z-B:1
19: CM:G/R:1.5
20: CM:B-G:1
21: CM:G-R:1

X43



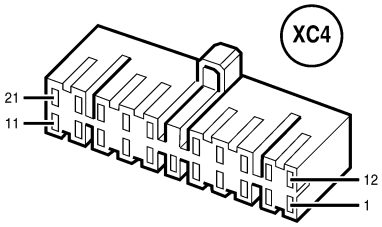
1: CM:A:2
2:
3:
4: CM:A-B:1
5: CM:V:1
7: CM:V:1

XC2



1: CM:A-G:1
2: CM:R:1.5
3: CM:H-R:1
4: CM:R:2.5
5: CM:H-N:1.5
6: CM:G:1
7: CM:M/B:1
8: CM:V-N:1
9: CM:L/R:1
10: CM:H-L:1
11: CM:H-N:1

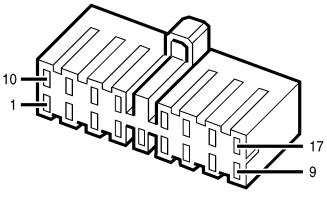
XC4



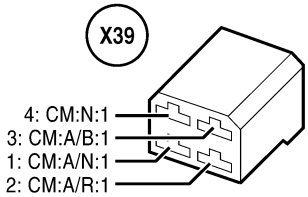
12: CM:G:1.5
13: CM:V:1(X2)
14: CM:A:1
15: CM:G-N:1
16: CM:L:1
17: CM:H:1(X2)
18: CM:A/R:1.5
19: CM:A/B:1.5
20: CM:H/R:1.5
21: CM:A/N:1.5

1: CM:A/N:2(X2)
2:
3: CM:A/B:1
4: CM:R/N:1
5:
6: CM:G:2(X2)
7: CM:L:1(X2)
8: CM:G-N:1
9: CM:A:1(X2)
10: CM:R-N:1.5
CM:B/R:1.5
11: CM:H-N:1(X2)
12: CM:H:1(X2)
13: CM:V-N:1(X2)
14: CM:V:1(X2)
15:
16: CM:A-G:1
17: CM:R-N:1(X2)

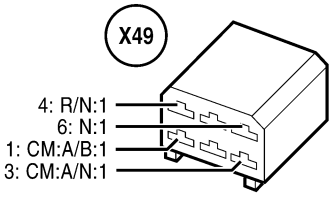
XC5



X39



X49



BRC0758B

OPERATION

The system consists of a key start switch, heavy duty wiring, starter motor, relay and solenoid assembly.

The starting motor is a four pole four brush type with integral solenoid and positive engagement drive assembly.

The integral solenoid incorporates two windings connected in parallel. One winding is the low resistance 'pull–in' coil, grounded through the motor, while the other is the high resistance 'hold–in' coil grounded via the solenoid body.

When the key start switch is operated with the transmission forward/reverse shuttle lever in neutral the solenoid coils are energised and the solenoid plunger is magnetically attracted into the solenoid core.

This movement, transmitted through a pivoted linkage mechanism forces the drive pinion into mesh with the flywheel ring gear. At ring gear to pinion engagement, the solenoid plunger closes a set of contacts to give a direct feed from the battery to all four field coils, providing full power to the starting motor.

At this point one end of the 'pull–in' coil is connected to battery positive through the starter switch while the other end is connected to positive through the solenoid contacts. The 'pull–in' coil is thus by–passed, drawing no current and the 'hold–in' coil alone keeps the solenoid plunger engaged.

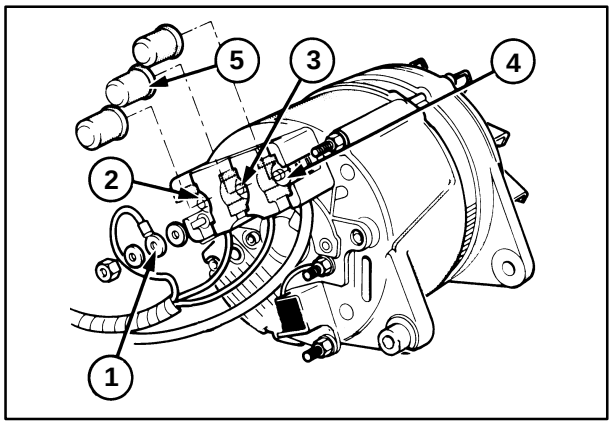
The starter incorporates a single set of contacts and a two piece solenoid plunger which completely closes the contacts even if the pinion and ring gear teeth are misaligned. When this happens, an engagement spring is compressed which forces the pinion into full engagement as soon as the starter begins to turn.

When the key start switch is released, power to the solenoid and motor is removed. The solenoid return spring acting through the pivoted linkage mechanism pulls the drive pinion out of mesh and reopens the solenoid contacts.

Incorporated in the drive pinion assembly is a roller clutch device. This device prevents the armature from rotating excessively if the pinion remains in mesh with the flywheel ring gear after the engine has started.

DESCRIPTION AND OPERATION

The alternator is mounted high at the front of the engine and is driven from a crankshaft pulley via a 'vee' drive belt. The alternator contains integral regulators



1

70 Amp Alternator

1. Earth (Ground) Connection
2. Engine Speed Sensor Connection (W Terminal)
3. Warning Lamp (D+ terminal)
4. Output Connection (B+ Terminal)
5. Protective Terminal Sleeve

Alternator Operation

With reference to Figure 2.

When the key start switch is turned on a small current flows from the battery through the rotor field wiring. The circuit is made via the charge indicator warning lamp, alternator terminal 'D+' the rotor field winding, the alternator regulator and ground.

At this stage the warning light is illuminated and the rotor partially magnetised.

When the engine is started and the partially magnetised rotor revolves within the stator windings a 3–phase alternating current is generated. A constant portion of the generated current is converted to direct current by the three field diodes incorporated in the rectifier pack.

This direct current is fed back to supplement the current flowing through the rotor field winding.

This action results in an ever increasing magnetic influence of the rotor along with an associated rapid rise in generated output current and voltage.

During the rise in generated output voltage (reflected at the 'D+' terminal) the brilliance of the warning lamp is reduced and when the voltage at the 'D+' terminal equates to that at the battery side of the warning light the lamp is extinquished.

The voltage continues to rise until the predetermined regulated voltage level is reached.

In the event of drive belt breakage the voltage will not build up within the alternator and so the charge indicator light will remain on to indicate failure.

Rotor Test

Prior to performing component tests on the rotor the following slip ring inspection should be carried out.

1. Ensure the slip rings are clean and smooth. If necessary the slip rings may be cleaned with a petrol moistened cloth. If the slip rings are burnt and require re–finishing use very fine glass paper (not emery cloth) and wipe clean.

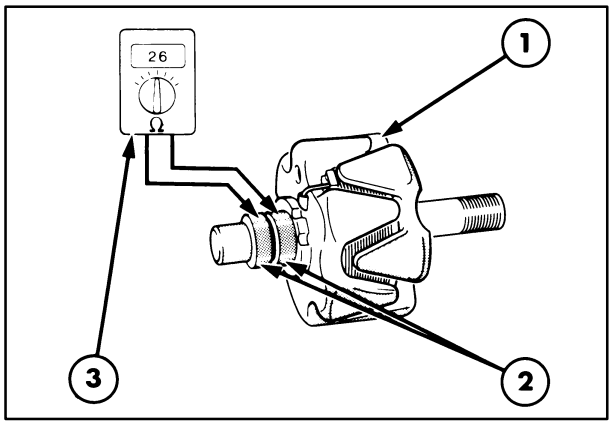
NOTE: *Ensure the re–finishing glass paper is sufficiently fine to produce a highly polished slip ring surface otherwise excessive brush wear will occur.*

2. If the slip rings are excessively worn a new rotor must be installed.

Rotor Field winding Continuity

1. Connect an ohmmeter(3) between the two slip rings(2). The resistance should read 2.6 ohms at 20°C.

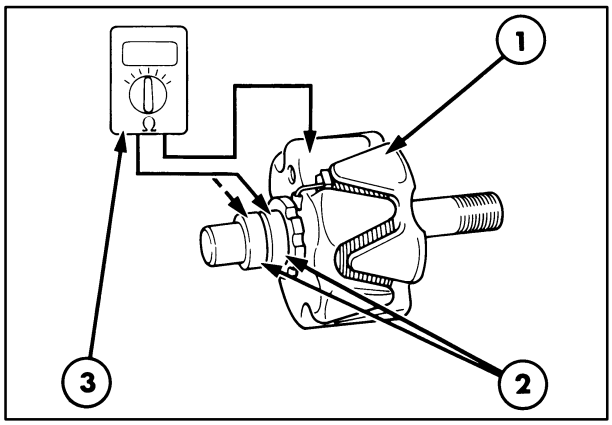
If the resistance is outside of the specification renew the rotor(1).



17

Rotor Field Winding Insulation

1. Using an ohmmeter(3) test between each of the slip rings(2) and the rotor poles(1). An infinity reading should be indicated in each case. If any resistance reading is indicated the rotor assembly must be replaced.

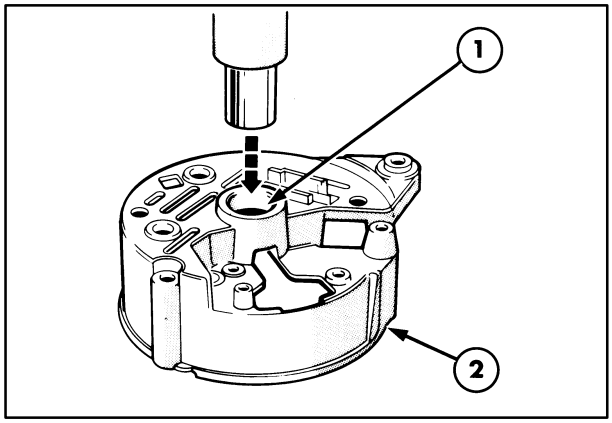


18

INSPECTION AND REPAIR

1. Inspect the rotor poles and stator for signs of rubbing. Areas of rubbing indicates possible worn bearings, misaligned housings or a bent rotor assembly shaft.

NOTE: *Bearings of the 70 Amp alternator are not serviced separately. It will be necessary to either obtain a new rectifier and housing or stator assembly to renew worn bearings.*

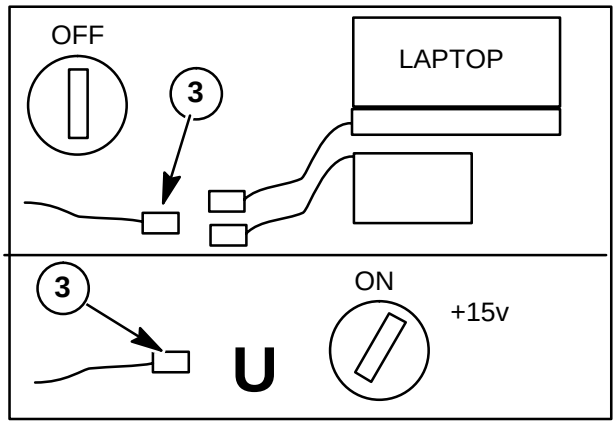


19

NOTE: *When the warning lamps are not turned off ie maintenance not carried out the counting of the next 300 hours always begins again from the time the signalling began.*

The light (2) can only be turned off via a laptop or bridging tool. The reading of the diagnostics programming must be done through the connector on the instrument panel and with the display key in the off position and NOT turned to the on +15 position.

When the connector with U Bolt is used the key must be turned to the ON +15, any lamps and the buzzer are turned off, but the cells recording the times of events cannot be reset to zero



3

ALARMS AND DIAGNOSTIC SIGNALLING

NOTE: *For all machines fitted with diagnostic capability.*

The malfunctioning data for the functions being diagnosed will be memorised on the micro processor and can be displayed by the technician through a serial line accessible through the 5 way 5238 molex connector (3).

The time of the malfunctioning of each individual function will be memorised in four cells in the following way.

The first malfunction will be memorised in the fourth cell and will remain there until the user cancels it by computer.

The next malfunction will be displayed in the first cell and then slip into the second cell when the third malfunction occurs until all 3 cells have been filled.

When the fifth malfunction occurs the data moves down, cancelling the second occurrence and memorising the most recent one in the first cell.

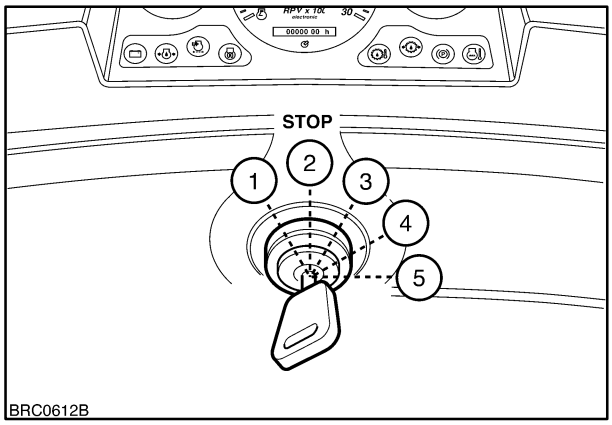
In twos way the very first and last three malfunctions remain in the memory.

Each malfunction is memorised when it appears for the first time at successive Key offs and Key on if the same event occurs it will not be memorised as a new malfunction.

The time will be memorised only if there has been a rework of the service and a later anomaly

NOTE: *The data can only be cancelled while the events are being visualised on the computer. There may be a small variance between times shown on the hour meter and those displayed by the diagnostics programming*

KEY–START AND STOP SWITCH – S17



11

NOTE: *When the key–start/stop switch is turned to the "ON" position the audible alarm will be activated until the engine is started or the key returned to the off position.*

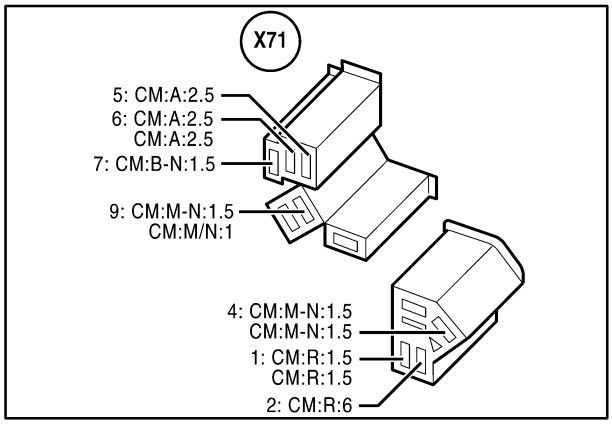
Key Start
1 = Not used
2 = Off
3 = Ignition "ON"
4 = Thermostart (Engine pre–heat)
5 = Engine Start (cranking)

SWITCH – X71

Test Procedure

Voltage:

Pin No.	Key Switch Position			
	OFF	Pos. I	Pos. II	Pos.III
9	0v	0v	12v	12v
7	0v	0v	0v	12v
4	0v	0v	12v	12v
5 & 6	0v	12v	12v	12v
2	12v	12v	12v	12v



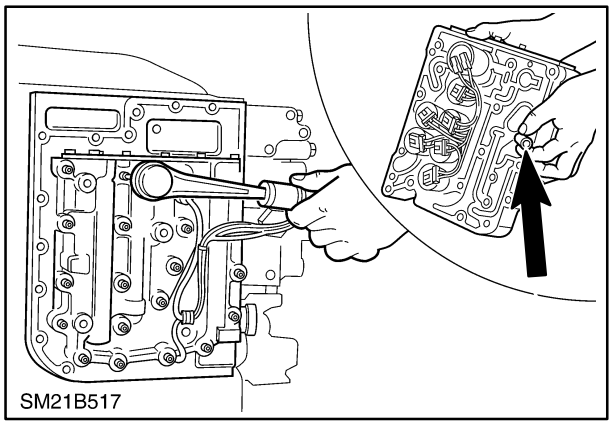
12

Continuity:

Pin No.	Key Switch Position			
	OFF	Pos. I	Pos. II	Pos.III
9			✓	✓
7				✓
4			✓	✓
5 & 6		✓	✓	✓
2		✓	✓	✓

POWERSHIFT SPEED SENSOR TEST

Disconnect from control valve and fit the 12 pin connector from special tool. Connect the power socket into the 12volt power socket . Install the probes from a Multimeter into the tool. Raise the unit off the ground and observe voltage (V1). Turn the rear wheel which inturn rotates the transmission output shaft, observe the second voltage (V2).

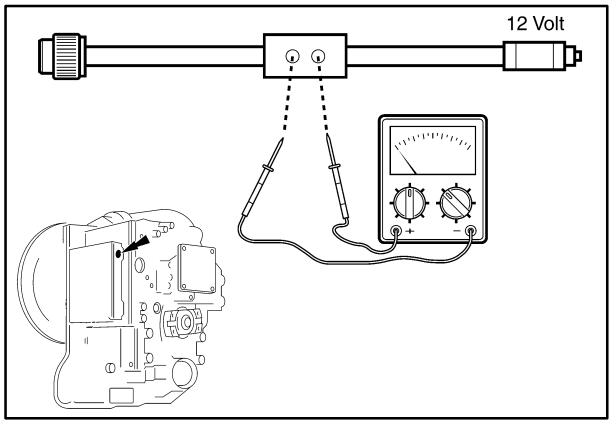


48

Test Procedure

Pin No.	V1	V2
A	0.6–0.8	1.3–1.5

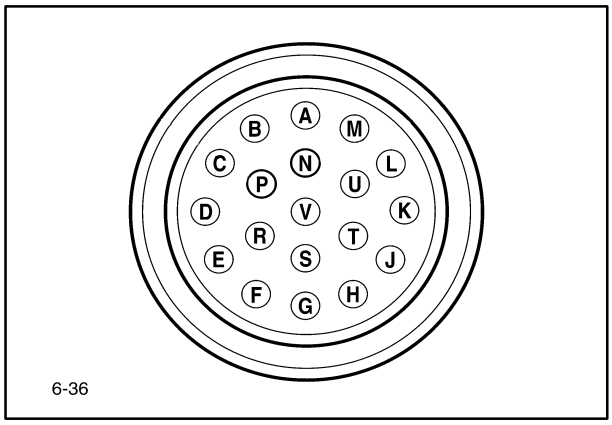
The special tool connects to pin A speed sensor plus out put, and pin J speed sensor / temperature sensor ground.



49

Description

A Speed sensor +
B FWD request
C Disconnect request input
D Speedometer output
E Diagnostic link input
F Analogue Input 1
G Analogue Input 0
H –
J –
K PWM solenoid supply
L Solenoid 3
M PWM 1
N Range solenoid
P Forward solenoid
R Solenoid 2
S Solenoid 1
T VCS
U Ground
V Battery +

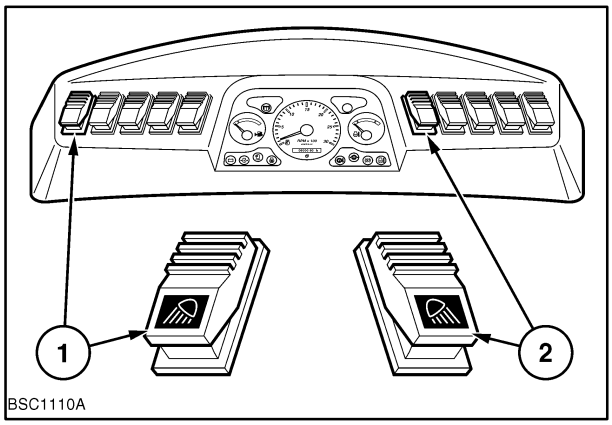


50

FRONT WORK LAMP SWITCH (1)

REAR WORK LAMP SWITCH (2)MAIN LIGHT SWITCH

12 volts should be found at the switch only after main light switch is on and key start activated

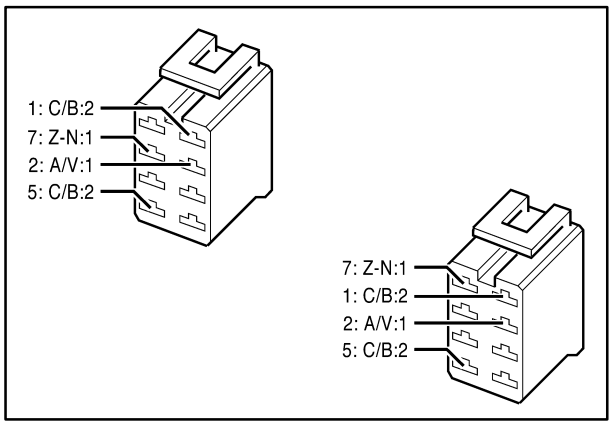


73

Test Procedure

(Switch Off)
Continuity should not be found between any pins

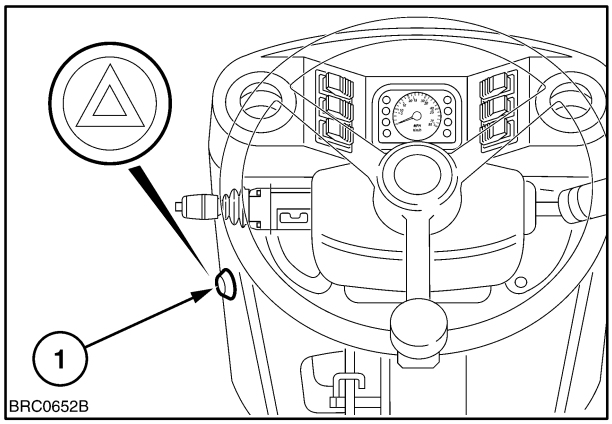
(Switch On)
Continuity should be found between pins 1 and 3 and 2 and 8.



74

HAZARD SWITCH

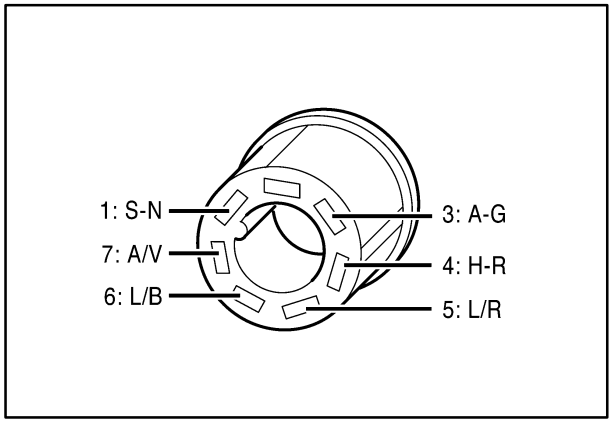
12 volts should be found at this switch at all times regardless of key start position



75

Test Procedure

Pin No.	Switch OFF	Switch ON
1	to Pin 4	——
3	——	to Pins 5/6/7
4	to PIn 1	——
5	——	to Pins 2/3/6/7
6	——	to Pins 2/3/5/7
7	——	to Pins 2/3/5/6



76

GLIDE RIDE CONTROL – S5

Designed to reduce loader bounce when travelling with an unladen bucket

⚠ WARNING ⚠

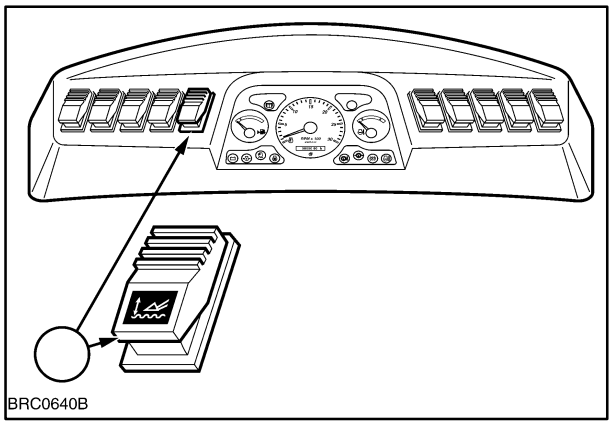
If the machine is raised using the loader bucket do not operate the glide switch ensure it is switched OFF.

If the switch is ON, upon engine start up the vehicle will fall to the ground without any control.

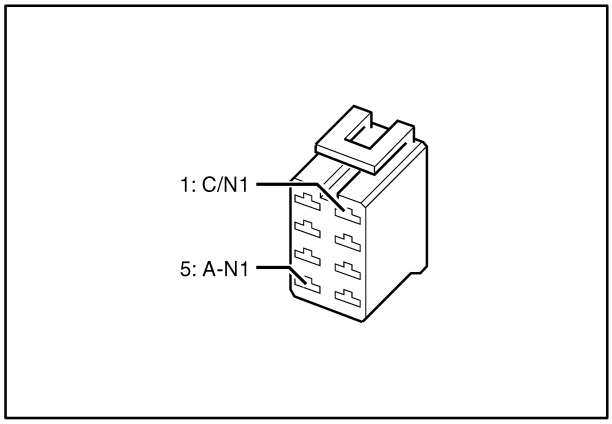
Test Procedure

(Switch Off)
Continuity should not be found between any pins

(Switch On)
Continuity should be found between pins 1 and 5



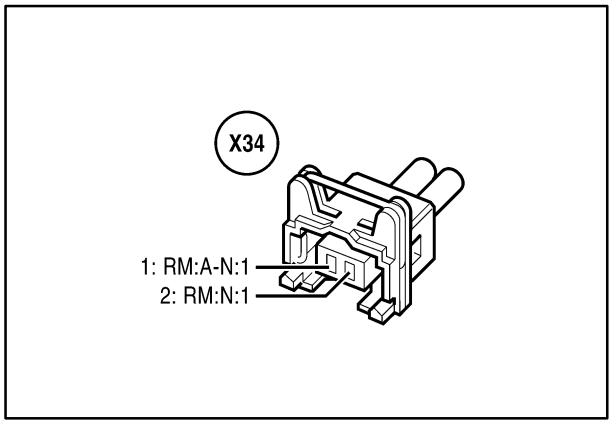
106



107

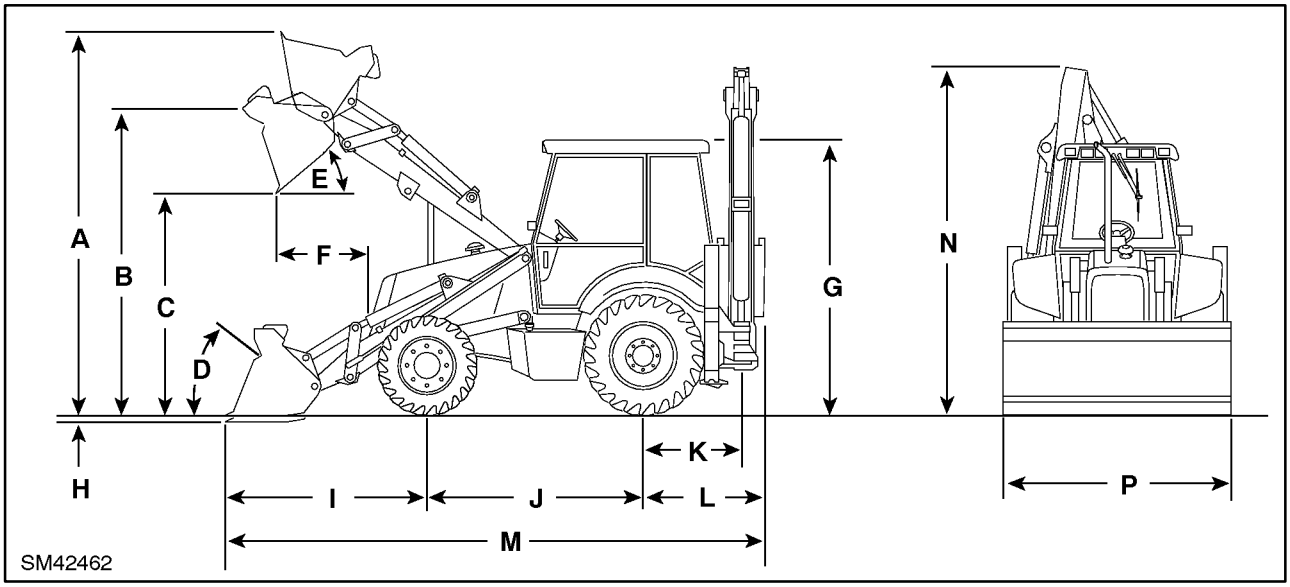
TEST PROCEDURE – EV11

Pin No.	Solenoid	resistance
1	0V	5.0 Ω



108

SIDESHIFT LOADER – DIMENSIONS AND PERFORMANCE – MODELS 85, 90, 90.2



3

(PER SAE J 732 C) WITH TYRES
With Two or Four wheel drive and 1.0m^3 bucket.

2WD FRONT = 11L–16 F REAR = 18.4–26
4WD FRONT = 12.5/80–18 REAR = 18.4–26

A. Overall Operating height	2WD 4240mm (13ft 9in) – 4WD 4359mm (14ft 3in)
Lift Capacity at Maximum Height	2WD 3425 kg (7550 lbs) – 4WD 3553 kg (7833 lbs)
Breakout Force	2WD 6314 kg (13920 lbs) – 4WD 6296 kg (13880 lbs)
B. Height to Hinge Pin	2WD 3411mm (11ft 2in) – 4WD 3530mm (11ft 6in)
C. Dump Height	2WD 2649mm (8ft 7in) – 4WD 2785mm (9ft 1in)
D. Maximum Roll back at ground level	40°
E. Dump Angle	45°
F. Reach fully raised	2WD 830mm (2ft 7in) – 4WD 786mm (2ft 6in)
G. Height to Top Of Cab	2950mm (9ft 7in)
H. Digging Depth	2WD 181mm (7.1in) – 4WD 55mm (2.2in)
I. Centre line of axle to Bucket Lip, at ground level	2WD 2030mm (6.6in) – 4WD 1942mm (6ft 4in)
J. Wheelbase	2WD 2175mm (7ft 1in) – 4WD 2175mm (7ft 1in)
K. Rear axle to Centre of swing post	1325mm (4ft 3in)
L. Rear axle to edge of backhoe bucket	1630mm (5ft 3in)
M. Overall Length with bucket at ground level	2WD 5849mm (19ft 2in) – 4WD 5747mm (18.8in)
N. Lip of Bucket to top of Boom	4000mm (13ft 1in)
P. Width of Bucket	2250mm (7ft 4in)
Maximum Transport Width	2250mm (7ft 4in)
Weight of machine Loader/Backhoe* example (4WD, 4 in 1 bucket, counterweights)	7840 kg (17248 lbs)