Service Manual

WLS 432ZX

Service Manual - WLS 432ZX

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Section 2 - Care and Safety

Section 3 - Routine Maintenance

Section B - Body and Framework

Section C - Electrics

Section E - Hydraulics

Section F - Transmission

Section G - Brakes

Section H - Steering

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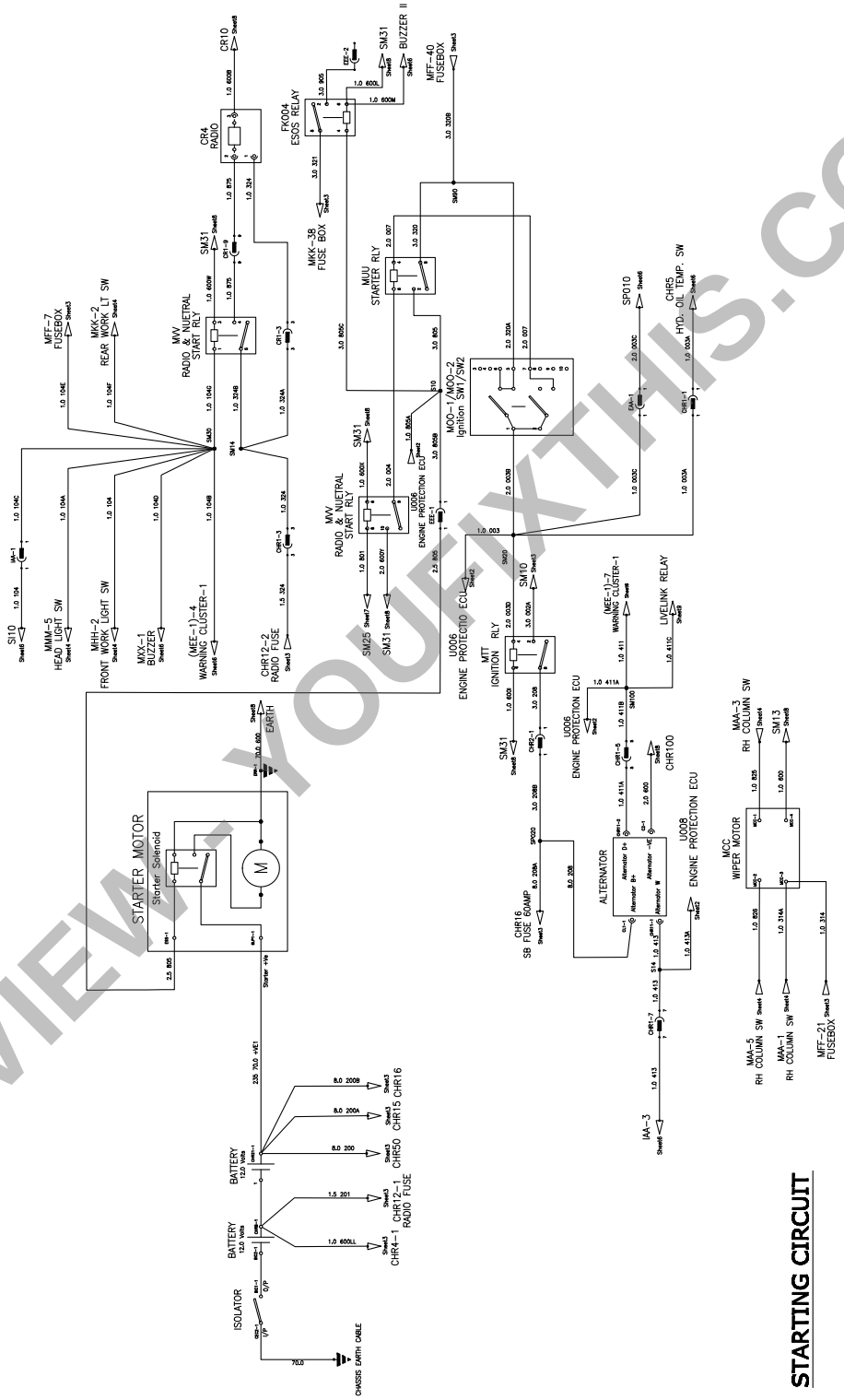


Fig 40. 334/L5209 Sheet (1 of 9)

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Typical Ram

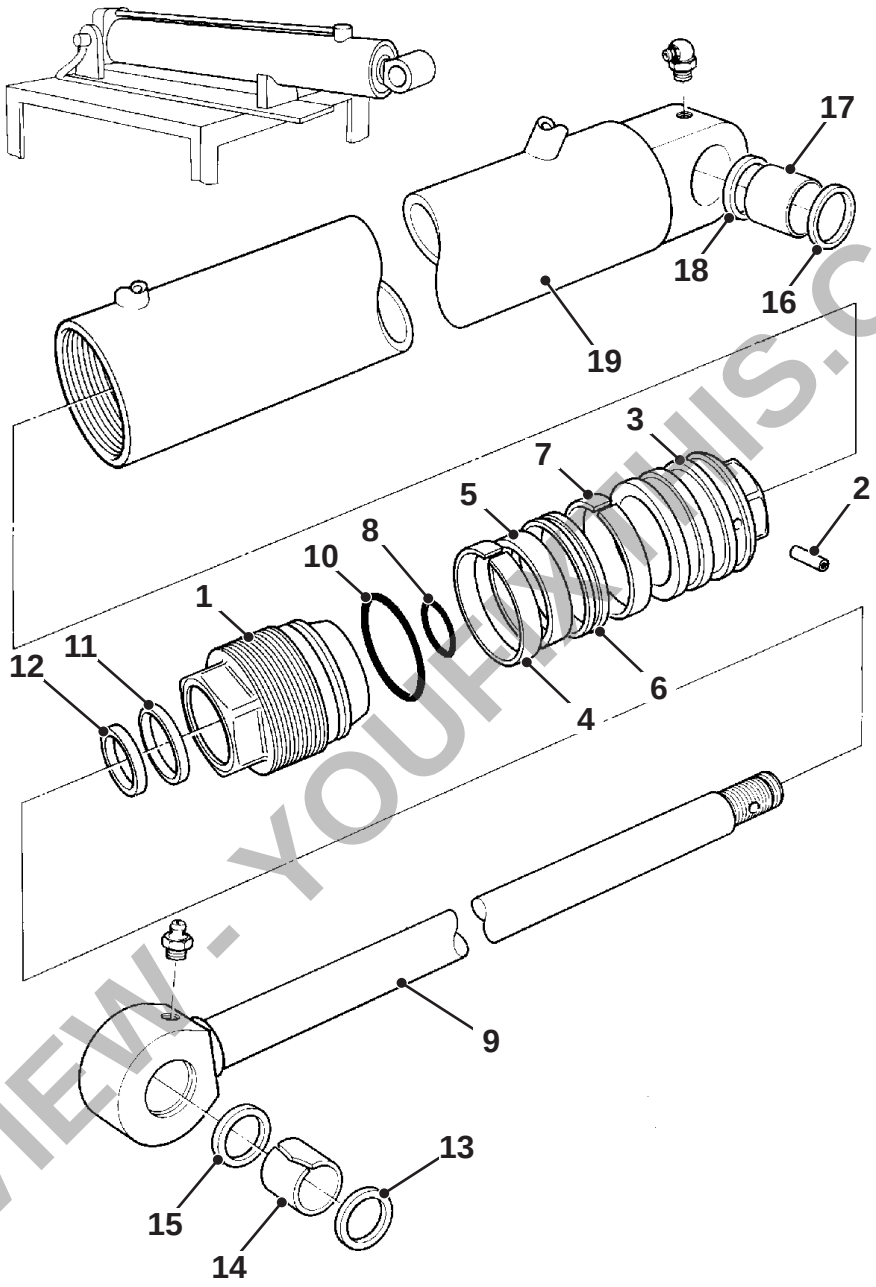


Fig 96.

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Zinc Plated Fasteners and Dacromet Fasteners

Table 2. Torque Settings - UNF Grade 'S' Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
in.	mm	in.	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
1/4	6.3	7/16	11.2	1.1	8.3	10.0	1.0	7.4
5/16	7.9	1/2	22.3	2.3	16.4	20.0	2.0	14.7
3/8	9.5	9/16	40.0	4.1	29.5	36.0	3.7	26.5
7/16	11.1	5/8	64.0	6.5	47.2	57.0	5.8	42.0
1/2	12.7	3/4	98.00	10.0	72.3	88.0	9.0	64.9
9/16	14.3	13/16	140.0	14.3	103.2	126.0	12.8	92.9
5/8	15.9	15/16	196.0	20.0	144.6	177.0	18.0	130.5
3/4	19.0	1 1/8	343.0	35.0	253.0	309.0	31.5	227.9
7/8	22.2	1 15/16	547.0	55.8	403.4	492.0	50.2	362.9
1	25.4	1 1/2	814.0	83.0	600.4	732.0	74.6	539.9
1 1/8	31.7	1 7/8	1181.0	120.4	871.1	1063.0	108.4	784.0
1 1/4	38.1	2 1/4	1646.0	167.8	1214.0	1481.0	151.0	1092.3

Table 3. Torque Settings - Metric Grade 8.8 Fasteners

Bolt Size		Hexagon (A/F)	Condition 1			Condition 2		
ISO Metric Thread	mm	mm	Nm	kgf m	lbf ft	Nm	kgf m	lbf ft
M5	5	8	5.8	0.6	4.3	5.2	0.5	3.8
M6	6	10	9.9	1.0	7.3	9.0	0.9	6.6
M8	8	13	24.0	2.4	17.7	22.0	2.2	16.2
M10	10	17	47.0	4.8	34.7	43.0	4.4	31.7
M12	12	19	83.0	8.5	61.2	74.0	7.5	54.6
M16	16	24	205.0	20.9	151.2	184.0	18.8	135.7
M20	20	30	400.0	40.8	295.0	360.0	36.7	265.5
M24	24	36	690.0	70.4	508.9	621.0	63.3	458.0
M30	30	46	1372.0	139.9	1011.9	1235.0	125.9	910.9
M36	36	55	2399.0	244.6	1769.4	2159.0	220.0	1592.4

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ZF Error Codes

The Electronic Monitoring System will display an error code in the event of a fault developing in the transmission system.

The code will be displayed on the top line of the EMS display panel in the format: **ZFCB ERROR?**

Further details of the EMS system can be found in ***Section C - Electrics***.

FC	Fault Code (Hex)	SPN	Serial Parameter Number	FMI	Failure Mode Indicator
IC	Internal Code (Dec)	TCU	Transmission Control Unit	SC	Short Circuit
OC	Open Circuit	EMS	Electronic Monitoring System	CS	Customer Specific

Table 2. ZF Error Codes

FC	SPN	FMI	IC	Description of the Fault Code	Reaction of the TCU	Repair Procedures
11	5000	12	48	A Logical Error for the Selected Gear Range		
				The TCU senses an incorrect signal combination for the selected gear range: -A cable from the shift lever to the TCU is broken -A cable is defective, it has a SC to the battery or earth -The shift lever is defective	TCU shifts the transmission to neutral OP-Mode: transmission shutdown	Check the cables from the TCU to the shift lever Check the signal combinations at the shift lever positions for the gear range Note: A failure can not be detected in a system with a DW2/DW3 shift lever Note: The fault is reset if the TCU senses the correct signal for that shift lever position
12	5010	12	46	A Logical Error for the Selected Direction		
				The TCU senses an incorrect signal combination for the selected direction: -A cable from the shift lever to the TCU is broken -A cable is defective, it has a SC to the battery or earth -The shift lever is defective	TCU shifts the transmission to neutral OP-Mode: transmission shutdown	Check the cables from the TCU to the shift lever Check the signal combinations at the shift lever positions F-N-R Note: The fault is reset if the TCU senses the correct signal for that direction at the shift lever
13	5020	12	95	A Logical Error at the Engine Derating Device		
				The TCU does not sense a reaction from the engine when the derating device is active	After neutral is selected the TCU changes to, OP-Mode: limp home	Check the engine derating device Note: The fault is reset after the power-up of the TCU

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Troubleshooting

Fault	Cause	Remedy
Oil leakage from final drive carrier	Incorrect screws torque, O-ring damaged	Check the torque. Replace O-ring
Oil leakage from seals	Incorrect installation, Seals damaged	Replace seals
Oil leakage from breather	High oil level	Check oil level
Lubricant with excessive foam	Incorrect lubricant	Replace the oil
Oil leakage from brake caliper parking	Seals damaged	Replace seals Kit
Final drive noise	Incorrect lubricant	Replace the oil
	Low oil level	Check oil level
	Incorrect bearing adjustment	Verify and adjust the bearing setting
	Bearing damaged	Verify and change the bearing
	Gears damaged	Verify and replace the gears
Differential assembly noise	Incorrect lubricant	Replace the oil
	Incorrect backlash	Verify and adjust
	Incorrect bearing preload	Verify and adjust
	Incorrect bevel pinion position	Verify the pinion position
	Side gears thrust washer damaged	Verify and replace

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Pre-start Cold Checks, Service Points and Fluid Levels

Table 1. Engine

	Operation	10	50	250	500	750	1000	1250	1500	1750	2000
Engine Oil Level	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Engine Oil and Filter	- Change			☐	☐	☐	☐	☐	☐	☐	☐
Coolant	- Change										☐
Coolant Level	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coolant Strength and Condition	- Check			☐	☐	☐	☐	☐	☐	☐	☐
Air Cleaner Dust Valve	- Clean			☐	☐	☐	☐	☐	☐	☐	☐
Air Cleaner Outer Element(1)	- Change						☐				☐
Air Cleaner Inner Element	- Change										☐
Fuel System for Leaks and Contamination	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Filter with Water Separator(2)	- Drain	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fuel Filter with Water Separator	- Change			☐	☐	☐	☐	☐	☐	☐	☐
Fuel Filter 3 micron	- Change			☐	☐	☐	☐	☐	☐	☐	☐
Fuel Strainer Replacement(3)(4)	- Change				☐		☐		☐		☐
Drive Belt Condition(5)	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
External Oil Leaks	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Radiator	- Clean				☐	☐	☐	☐	☐	☐	☐
All Hoses for Condition and Security	- Check	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rocker Cover and Injector Seals(6)	- Check										☐
High Pressure Fuel Lines(7)	- Check										

(1) Change the outer element more frequently in dusty operating enviroments.
(2) Standard schedule for drain is every 50 hours however for coastal/cold climate regions, drain it on daily basis.
(3) Do not clean the fuel strainer, replace it every 500 hours. In case of arduous conditions, replace it every 250 hours.
(4) While replacing the fuel strainer, ensure that the new strainer is installed correctly i.e. in the direction of fuel flow only.
(5) Change if necessary.
(6) Change the injectors and leak-off rails every 6000 hours.
(7) Check every 6000 hours.

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Assembly and Disassembly Procedures

Cylinder Disassembly

1 Remove the cylinder from the equipment

2 Drain the oil from the cylinder

Note: *Do not open the cylinder or pull the piston rod out unless the oil is drained.*

3 Put the cylinder on a wooden V-block

4 Clean the cylinder with clean cotton cloth

5 Clamp the cap end using rod and de-torque the hexagonal bolts. See ⇨ *Fig 108. (E-76)*



D065400

Fig 108.

6 Tap the head end cover out using nylon mallet as shown in ⇨ *Fig 109. (E-76)*

Note: *Do not hit the cylinder with hammer.*

Note: *Do not heat the cylinder using welding flames for opening the head end cover.*

Note: *Do not chisel the head end cover*



D065410

Fig 109.

Disassembly of Piston Rod

1 Put the piston rod on a V block support

2 Ensure direction of cushioning bush during assembly as shown in ⇨ *Fig 110. (E-76)*



D065420

Fig 110.

3 Remove grub screw and locking ball. See ⇨ *Fig 111. (E-77)*

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Specifications

Table 1.

Model	6BTAA 5.9 150C
Type – 432ZX	Water-cooled, 4 stroke, 6 cylinder in-line direct injection, Turbo -Charged diesel engine.
Net Power	150HP@2200 Rev/min
Air filtration	Dry element with secondary safety element and cab warning indicator
Cooling	Water-cooled via large capacity radiator
Batteries	2 x 12 volt heavy duty
Alternator	24V, 45Amps

Note: *For further details, see Cummins Engine Service Manual, Publication No. 9806/4050*

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Additives

The additives listed below are advertised as being suitable for bringing the lubricity levels of kerosene/low sulphur fuels up to those of diesel fuels. They must be used as specified by your fuel supplier who will understand the concentration level necessary.

Important: *The lubricity wear scar diameter must not be more than 460 microns, as tested on a high frequency reciprocating rig at 60°C (140°F).*

- Elf 2S 1750. Dosage 1000-1500 ppm (0.1 - 0.15%), specifically for Indian Superior Kerosene (SKO) but may be applicable to other fuels.
- Lubrizol 539N. Dosage (on Swedish low sulphur fuel) 250 ppm.
- Paradyne 7505 (from Infineum). Dosage 500 ppm (0.05%).

Note: *These products are given as examples only. The information is derived from the manufacturers data. The products are not recommended or endorsed by JCB.*

Service Requirements for use of B5 Biodiesel

- The engine oil must be a grade CI4+ as minimum specification.
- Do not leave unused B5 biodiesel in the fuel tank for extended periods (top up each day).
- Make sure that 1 in 5 fuel tank fills use standard diesel to EN590 specification, this will help to prevent 'gumming'.
- Make sure regular oil sampling is completed (look for excessive unburnt fuel content, water or wear particles.
- Change the engine oil and filter more frequently (as a minimum half the recommended intervals), or as indicated by oil sampling.
- Change the fuel filters more frequently (as a minimum half the recommended intervals), or if there are engine performance related issues.
- Make sure the fuel is stored correctly, care must be taken to make sure no water enters the machine fuel tank (or the storage tank). Water will encourage micro-bacterial growth.
- Make sure that the fuel pre-filter is drained daily.
- Only Tier 3 engines (factory filled with CH4 oil) - this is not approved with other manufacturers.
- Use heater kits in low ambient temperature territories.
- The biodiesel must meet the following standards: ASTM D6751, DIN 51606, ISO 14214

Note: *If necessary use a test kit to confirm the fuel specification. Testing kits are available (not from JCB currently), use the internet as a source for the kits.*

Note: *If performance related issues are to be reported to JCB Service, and the engine has been run on biodiesel, then the fuel system must be filled with standard diesel (at least 2 x tank fills) to EN590 specification and relevant stall speeds recorded prior to making the report.*

Warranty

JCB have shown a commitment to support the environment by approving the use of biodiesel blended fuels.

Using a B5 blend of biodiesel requires caution and additional servicing of the engine is required. ⇒ ***Service Requirements for use of B5 Biodiesel (16)***.

Failure to follow the additional recommended service requirements may lead to a warranty claim being declined.

Failures resulting by the incorrect use of biodiesels or other fuel additives are not defects of the engine workmanship and therefore will not be supported by JCB Warranty.

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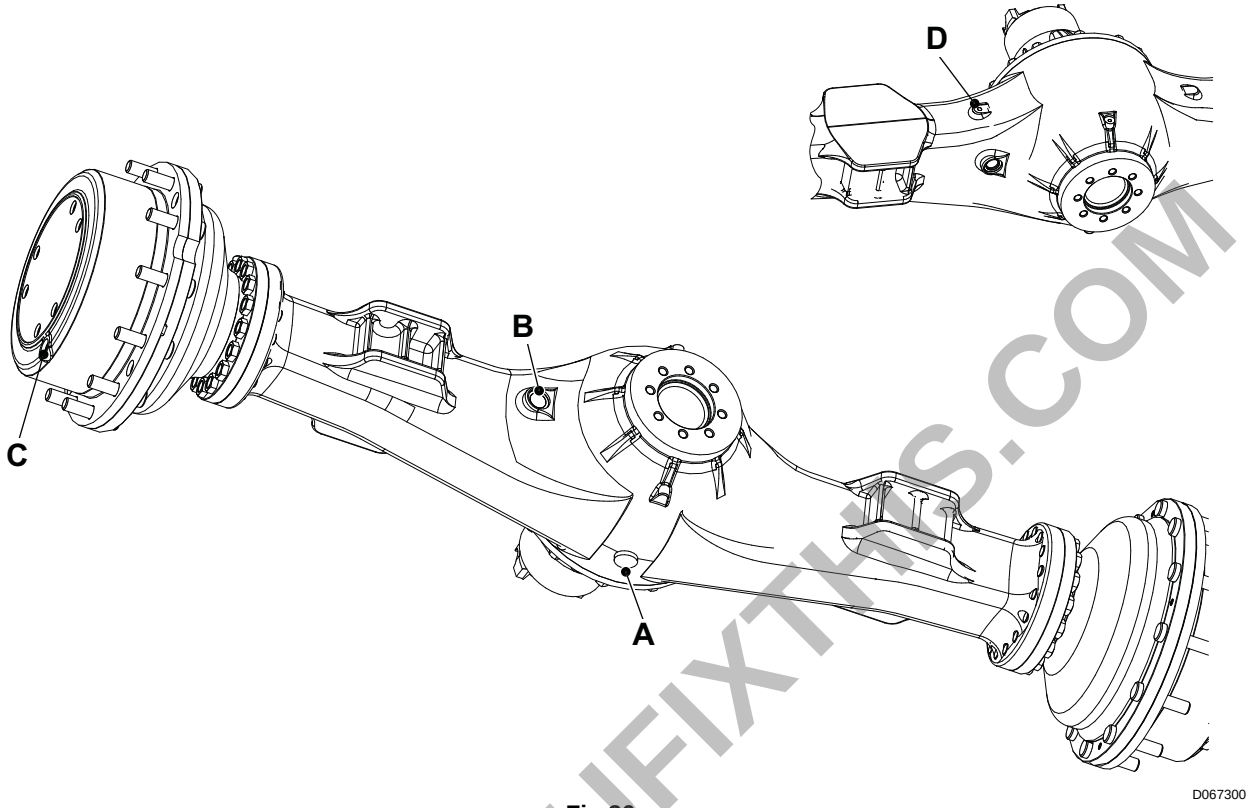


Fig 36.

Table 17.

A	Oil drain plug
B	Oil level check plug
C	Oil fill and drain plug
D	Breather

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8 Disconnect the electrical multi plugs between the AC unit and the machine harness, then carefully remove the AC unit from the cab.

9 Put the AC unit onto a solid surface or work bench.

Note: *Check the recirculating air filter when the AC unit is removed from the machine. Wash the filters in warm soapy water or replaced as necessary.*

Installation

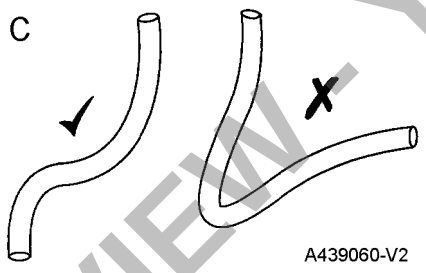
The installation procedure is the reverse of the removal procedure, take note of the following.

1 When the AC unit is installed, care must be taken to allow the condensation drain hoses to run downwards. ⇨ ***Fig 34. (B-30)***.

Do not cable tie the drain hoses so there is a uphill run. Condensation could become trapped at this point and cause a build up of stagnant water.

2 When refilling the cooling system use the correct mixture of water and anti freeze. A 50% mixture should be used even if frost protection is not needed. Refer to ***Coolant Mixtures, Section 3***.

3 If the system is being refilled, it is important not to exceed the recommended fill rate of 10 litres per minute.



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Fig 34.

Filters

Removal, installation and cleaning, refer to ***Section 3 Maintenance, Air Conditioning***.

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Specific Gravity Testing

The specific gravity of the electrolyte gives an idea of the state of charge of the battery. A reading should be taken when the electrolyte temperature is 15°C (60°F) with a quality hydrometer that is regularly cleaned.

If the battery has recently been on charge, wait approximately one hour (or slightly discharge the battery) to dissipate the surface charge before testing.

The readings should be as tabulated and should not vary between cells by more than 0.04. A greater variation indicates an internal fault on that particular cell.

If the electrolyte temperature is other than 15°C (60°F) a 'correction factor' must be applied to the reading obtained.

Add 0.07 per 10°C (18°F) if the temperature is higher than 15°C (60°F) and subtract the same if the temperature is lower.

TEMPERATURE COMPENSATED BATTERY STATE-OF-CHARGE (SoC) TABLE

Electrolyte Temperature		Wet 'Maintenance Free' (Ca/Ca) Battery									
		Specific Gravity Reading					Open Circuit Voltage Reading				
Degrees Fahrenheit	Degrees Celsius	100% SoC	75% SoC	50% SoC	25% SoC	0% SoC	100% SoC	75% SoC	50% SoC	25% SoC	0% SoC
100	37.8	1.257	1.217	1.182	1.147	1.112	12.808	12.608	12.408	12.008	11.808
80	26.7	1.265	1.225	1.190	1.155	1.120	12.800	12.600	12.400	12.000	11.800
50	10.0	1.277	1.237	1.202	1.167	1.132	12.772	12.572	12.372	11.972	11.772
30	-1.1	1.285	1.245	1.210	1.175	1.140	12.738	12.538	12.338	11.938	11.738
0	-17.8	1.297	1.257	1.222	1.187	1.152	12.666	12.466	12.266	11.866	11.666

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Notes:

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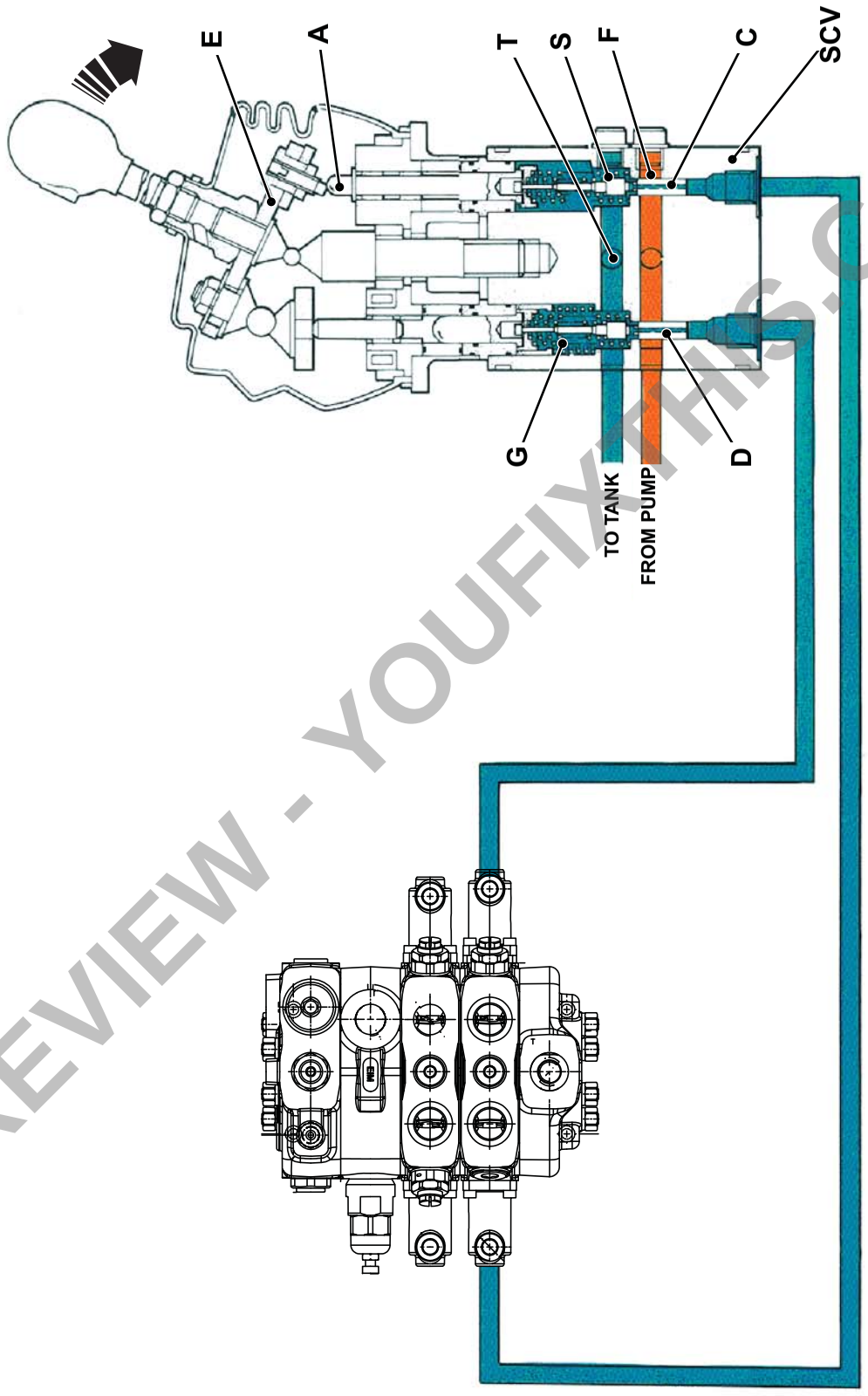


Fig 21.

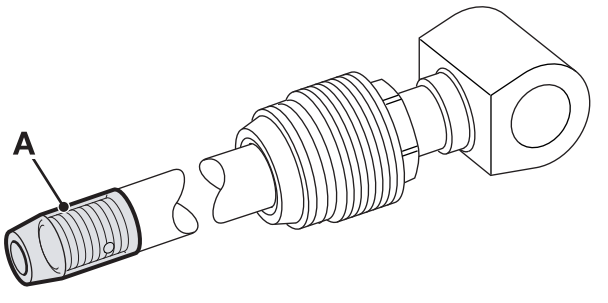
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Typical Ram

Note: *Some rod wipers, i.e. power track rod, may use a metal encased seal which is pressed into the housing. Care must be taken to ensure the seal is square before it is pressed in.*

f Sleeve **105-A** must be used to protect the rod seals from damage when fitting end cap onto the piston rod. There are various sizes of sleeve, see ***Service Tools, Section 1***. Make sure the hexagon on the end cap is towards the eye end of the rod.

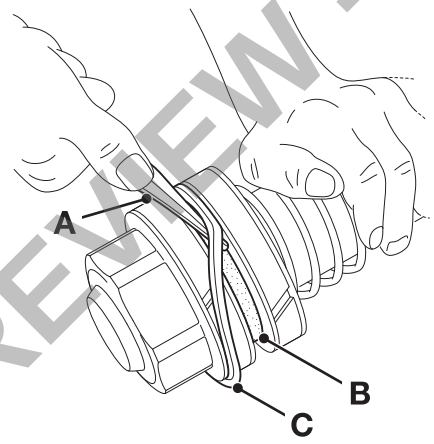


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Fig 105.

2 Fit new head piston seals.

a Use a blunt instrument **106-A** (Part no. 892/01027) to lever the inner seal **106-B** into the piston head seal groove. Do not let the seal twist. There are identification marks on the outer diameter of the seal, make sure the marks are visible and the seal is free to rotate, if not remove the seal and refit.



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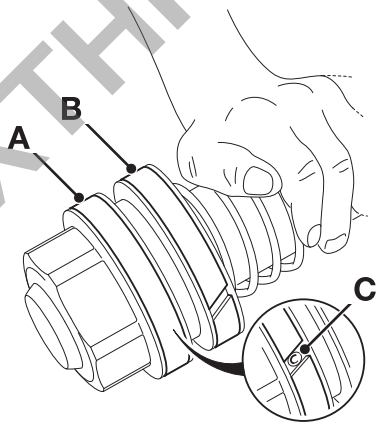
Fig 106.

b Fit outer seal **106-C** using the same procedure as stated for seal **106-B**. Check the external grooves are visible.

c Ensure the O-ring is fitted into the internal seal groove on the piston head. Screw the piston head onto the thread of the piston rod, refer to the relevant section for torque figure and completion of ram assembly.

d Fit the piston head retaining dowel, refer to the relevant section for torque figure and completion of ram assembly.

e Fit wear rings **107-A** and **107-B**. Rotate the wear rings so that the piston retention dowel is covered by the wear ring, Not as shown at **107-C**.



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Fig 107.

3 Fit the piston rod and head assembly into the cylinder.

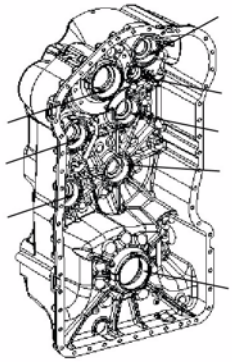
a Insert the piston/rod assembly into the cylinder. Align the rod and head assembly until parallel with the cylinder then push the assembly into the cylinder.

b Fit the end cap, refer to the relevant section for torque figure and completion of ram assembly.

c

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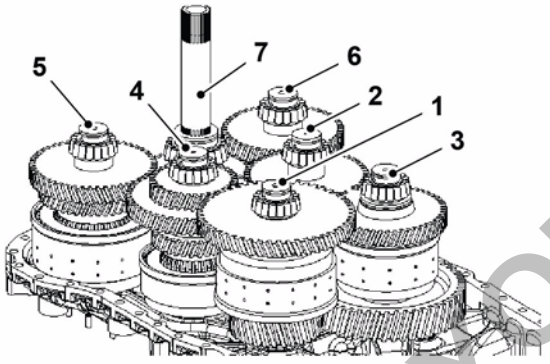
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Fig 62.

10 Lift the clutches out of the housing in numerical order as described in ⇒ *Fig 63. (F-20)*



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Fig 63.

1 K1 clutch
2 K2 clutch
3 K3 clutch
4 K4 clutch
5 KR clutch
6 KV clutch
7 Input shaft

11 Remove bearing outer rings (arrows) from the housing rear part.

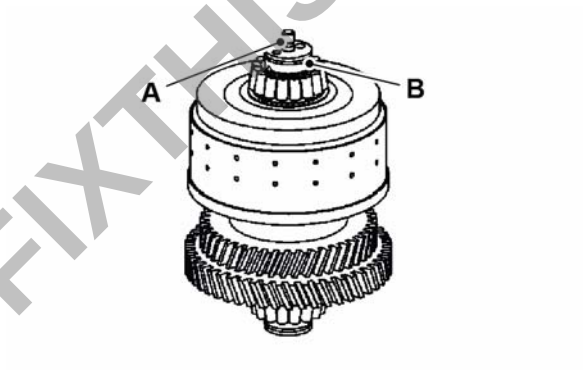
Note: *If, contrary to the ZF recommendation, the tapered roller bearings of clutches, input and output are not replaced, it is imperative to ensure the previous pairing (bearing outer ring/ bearing inner ring). Bearing outer ring and bearing inner ring must be marked.*

Note: *The lubrication lines are highly difficult to remove. In case of damage, use of the appropriate ZF special tool is imperative for fitting or replacing these components.*

Disassembly of Clutches KV/KR/K1/K2/K3/K4 Input and Output Shaft

Disassembly of KV Clutch

1 Remove stud bolt **A** and snap out piston ring **B**.

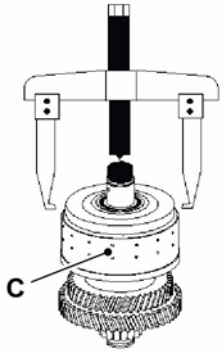


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Fig 64.

2 Pull tapered roller bearing (inner ring) off the shaft.

Pull clutch **C** off the shaft. ⇒ *Fig 65. (F-20)*



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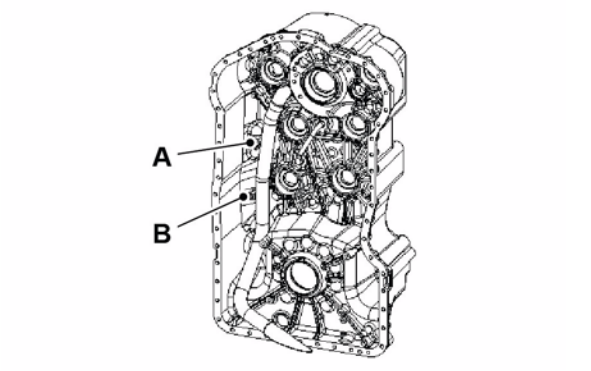
Fig 65.

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Installation of Input Shaft, Output Shaft and Clutches

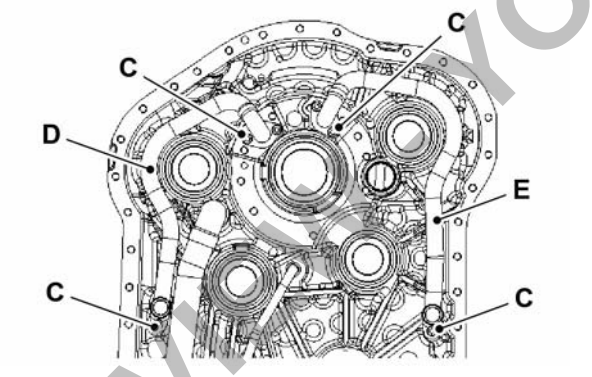
1 If the suction tube **B** in the housing front part is to be replaced, it is imperative to use the ZF special tool (rolling tool) for assembly. Then fix the tube with cylindrical screw **A**. ⇒ *Fig 221. (F-59)*



D067780

Fig 221.

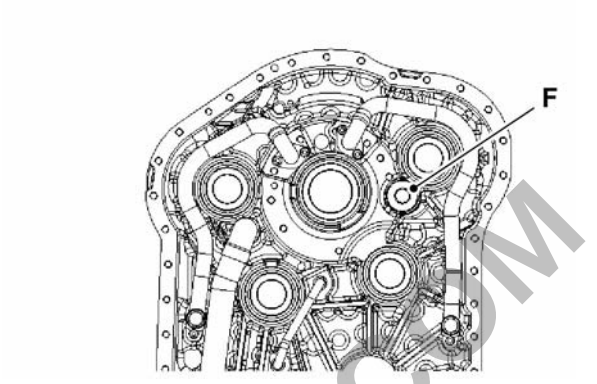
2 Mount O-rings 22x3 into the annular groove of the oil tubes **D, E** and oil them. Then insert tubes into the housing front part and fix them by means of cylindrical screws **C**. ⇒ *Fig 222. (F-59)*



D067780-1

Fig 222.

3 Mount screw plug **F** with new O-ring. ⇒ *Fig 223. (F-59)*

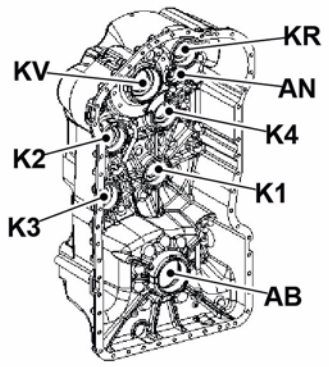


D067780-2

Fig 223.

4 Insert all bearing outer rings into the bearing holes of both housing parts. ⇒ *Fig 224. (F-59)*

AN	Input
AB	Output
KV	Forward Clutch
KR	Reverse Clutch
K1	1st Gear Clutch
K2	2nd Gear Clutch
K3	3rd Gear Clutch
K4	4th Gear Clutch



D067780-3

Fig 224.

Note: *Place bearing outer rings into the bearing holes using assembly grease.*

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FC	SPN	FMI	IC	Description of the Fault Code	Reaction of the TCU	Repair Procedures
37	5160	3	40	A Short Circuit to the Battery or an Open Circuit at the Internal Speed Input		
				The TCU measures a voltage higher than 7V at the speed input pin: -A cable is defective, it has a SC to the battery -A cable is not connected to the TCU -The speed sensor has an internal defect -A connector pin has a SC to the battery or has an OC	OP-Mode: substitute clutch control	Check the cable and the connectors from the TCU to the sensor Check the speed sensor
38	5160	4	36	A Short Circuit to Earth at the Internal Speed Input		
				The TCU measures a voltage less than 0.45V at the speed input pin: -A cable/connector is defective, it has a SC to earth -The speed sensor has an internal defect	OP-Mode: substitute clutch control	Check the cable and the connectors from the TCU to the sensor Check the speed sensor
39	5160	12	44	A Logical Error at the Internal Speed Input		
				The TCU measures a internal speed over the threshold and immediately the measured speed becomes zero: -A cable/connector is defective, it has bad contacts -The speed sensor has an internal defect -The sensor gap is incorrect	OP-Mode: substitute clutch control	Check the cable and the connectors from the TCU to the sensor Check the speed sensor Check the sensor gap Note: The fault is reset after the power-up of the TCU

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FC	SPN	FMI	IC	Description of the Fault Code	Reaction of the TCU	Repair Procedures
WE				Warning high engine speed		Changes between actual gear/direction while driving, in neutral only displayed if no fault is detected (spanner)
WV				Warning high output speed (velocity)		Changes between actual gear/direction while driving, in neutral only displayed if no fault is detected (spanner)
WL				W arning high transmission input torque (load)		Changes between actual gear/direction while driving, in neutral only displayed if no fault is detected (spanner)
WO				Warning high transmission output torque (load)		Changes between actual gear/direction while driving, in neutral only displayed if no fault is detected (spanner)
PN				Direction F or R selected while parking brake engaged		transmission in neutral until parking brake is released. CAUTION: vehicle starts to move after release of parking brake
EE flashing				No communication with display		checked wiring from TCU to display

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D015050

Fig 440.

Re-assembly

Before re-assembly, each smooth face have to be lubricated with oil.

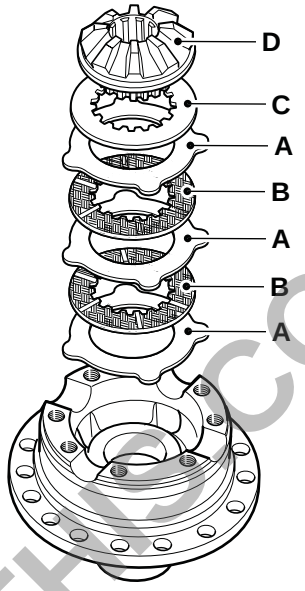
1 Insert a lug disk **A** (with outer lugs) into half case.

2 Insert an intermediate disk **B** (with inner lugs), then another disk **A**, a disk **B**, still lug disk **A**.

Note: *Disks **B** are thin with lining on both faces, disk **C** is thick and lined on one face only.*

3 Insert a disk **C** with unlined face turned upward.

4 Apply oil on the planetary gear **D** and then insert with taking care to mesh shaft spline with inner lugs of clutch disks.



D015060

Fig 441.

5 Re-assemble side gears with relevant bevel thrust washers on spider and position them on the half case.



D015070

Fig 442.

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Steering Valve - Operation 2 (Right Hand Turn)

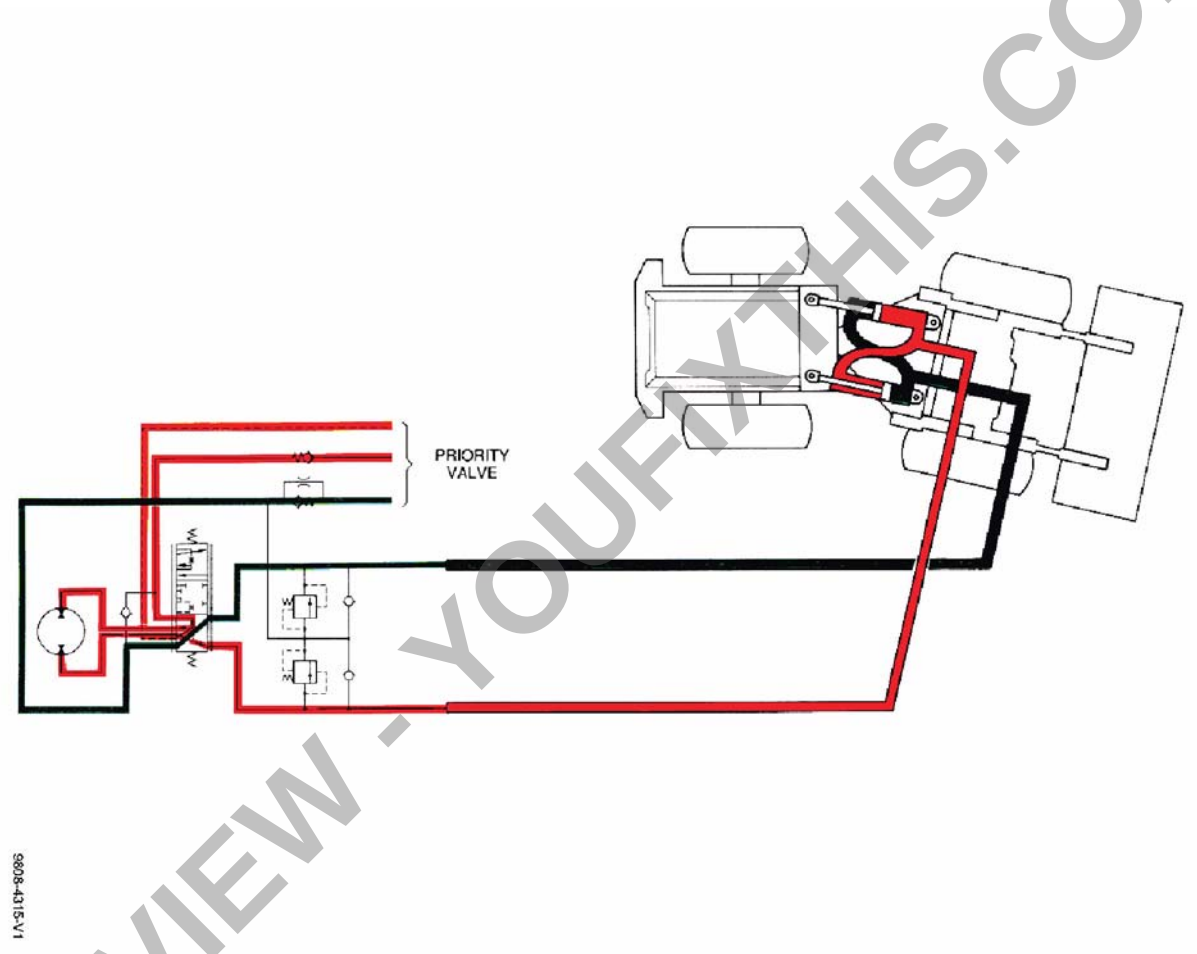
The illustration shows flow through the steering valve **SV** in a right hand turn condition.

The spool has been turned relative to the sleeve and a load sensing signal sent to the priority valve **PV** with a resulting supply of pressure oil.

Oil is directed to the metering unit which pumps it to the rod and piston sides of opposite steering rams.

Simultaneously the opposing piston and rod sides of the rams are connected to exhaust.

When steering action is stopped the spool is spring centred and conditions described in Operation 1 are obtained.



9808-4315-V1

Fig 2.

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