SECTION 10 – ENGINE

BOOK 1 – 87393596

Chapter 2 – Cooling System (Three-Cylinder)

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PISTON DATA	mm (in)
Pistons	light alloy with three compression rings, including two seal rings and one scraper ring
Standard piston diameter, measured at 57 mm (2.244 in) from skirt base and perpendicularly to the wrist pin axis	103.812 to 103.826 (4.0870 to 4.0876)
Piston clearance in cylinders	0.174 to 0.212 (0.0068 to 0.0083)
Maximum permitted wear clearance	0.30 (0.0118)
Piston oversizes	0.4 – 0.8 (0.0157 – 0.0314)
Piston protrusion at TDC from cylinder block face	0.355 to 0.761 (0.0139 to 0.0299)
Wrist pin diameter	37.983 to 37.990 (1.4953 to 1.4956)
Diameter of wrist pin seat in piston	37.993 to 38.000 (1.4957 to 1.4960)
Wrist pin to seat clearance	0.003 to 0.017 (0.0001 to 0.0006)
Wrist pin to small end bearing clearance	0.014 to 0.031 (0.0005 to 0.0012)
Maximum permitted wear clearance	0.06 (0.0023)
Maximum weight difference between pistons in same engine	20 grams (0.044 lb)
Piston ring groove clearance (measured vertically):	
– 1st ring	0.090 to 0.122 (0.0035 to 0.0048)
– 2nd ring	0.060 to 0.092 (0.0023 to 0.0036)
– 3rd ring	0.040 to 0.075 (0.0015 to 0.0029)
Maximum permitted wear clearance:	
– 1st ring	0.50 (0.0019)
– 2nd and 3rd ring	0.20 (0.0078)
Assembly clearance between piston ring ends in cylinder sleeves:	
– 1st ring	0.40 to 0.65 (0.0015 to 0.0025)
– 2nd ring	0.30 to 0.55 (0.0011 to 0.0021)
– 3rd ring	0.30 to 0.60 (0.0011 to 0.0023)
Maximum permissible gap (wear limit)	1.20 (0.0472)

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Op. 10 254 44

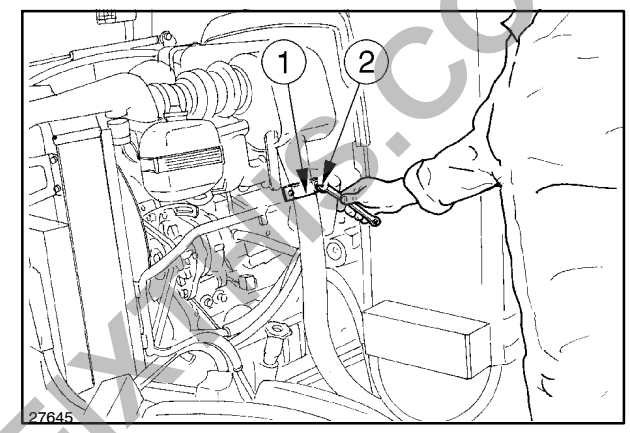
EXHAUST PIPE

Removal

⚠ WARNING ⚠

Handle all parts carefully. Do not put your hands or fingers between parts. Wear suitable safety clothing - safety goggles, gloves and shoes.

1. Remove the two retaining bolts (2), and the exhaust pipe bracket (1).



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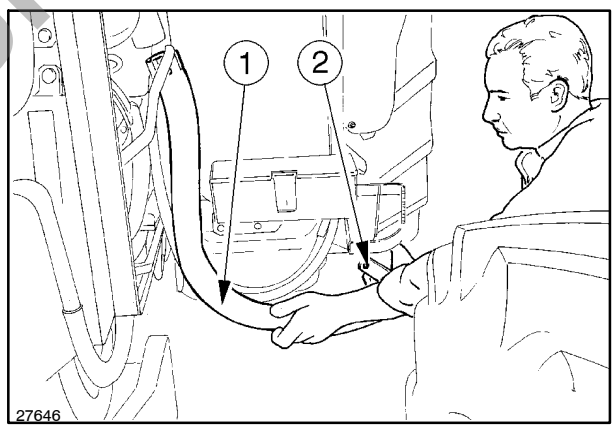
2. Remove the retaining bolt (2), washer and exhaust pipe (1).

Installation

⚠ WARNING ⚠

Always use suitable tools to align holes in parts. NEVER USE YOUR FINGERS OR HANDS.

1. Install the exhaust pipe, washer and retaining bolt.
2. Install the exhaust pipe bracket and the two retaining bolts.



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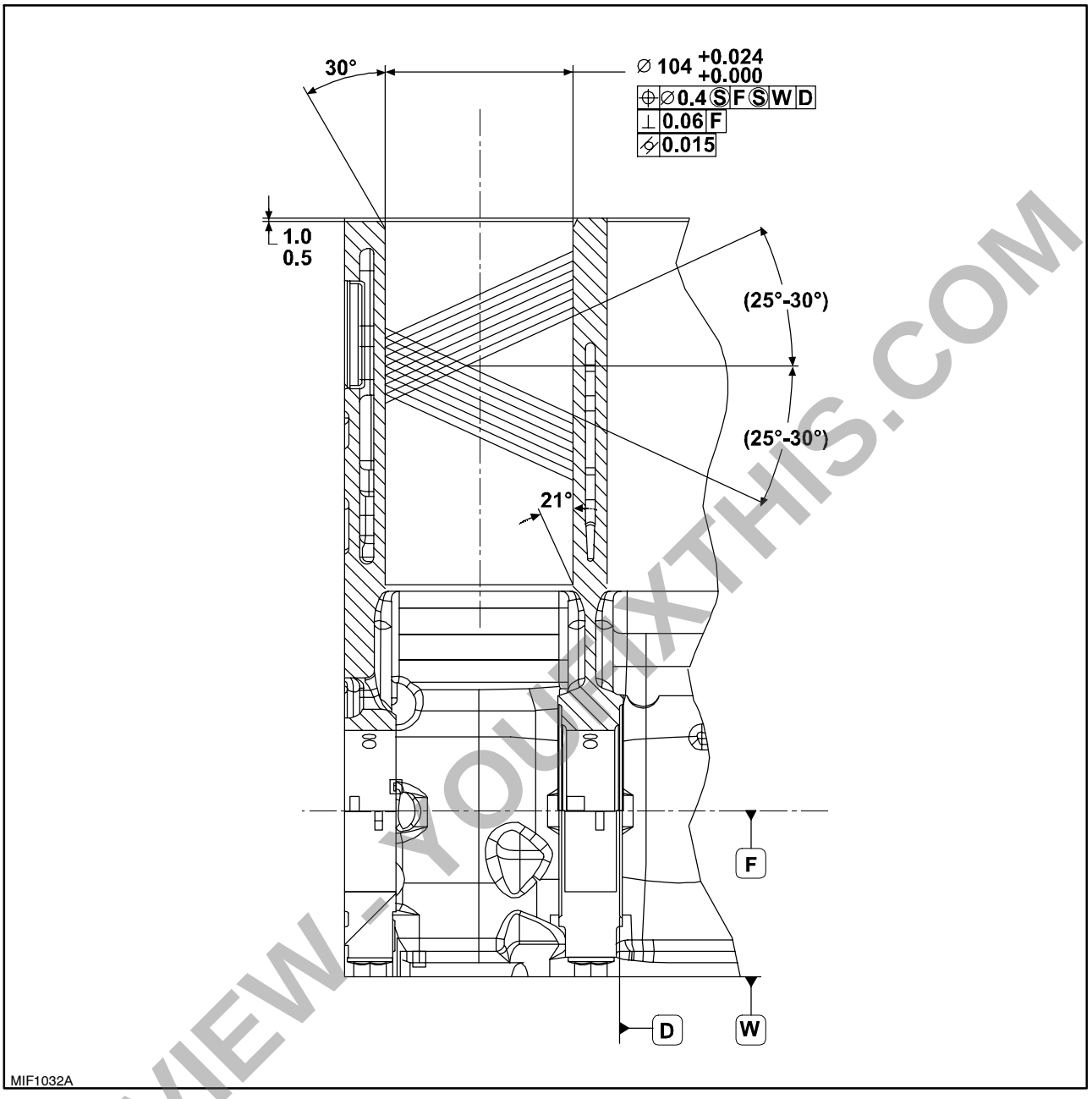
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TORQUE SETTINGS WITH ANGLES

PARTS TO BE TIGHTENED	Thread	Tightening torque		Angle
		Nm	lb.-ft.	
Main bearing cap bolts				
phase 1	M 12 x 1.5	49 – 56	36 – 41	–
phase 2	M 12 x 1.5	74 – 86	55 – 64	–
phase 3	M 12 x 1.5	–	–	90° ± 5°
Big end cap bolts				
phase 1	M 10 x 1.25	25 – 35	18 – 26	–
phase 2	M 10 x 1.25	45 – 55	33 – 41	–
phase 3	M 10 x 1.25	–	–	60° ± 5°
Cylinder head bolts	M 12 x 1.75 x 70	45 – 55	33 – 41	90°
	M 12 x 1.75 x 140	35 – 45	26 – 33	180°
	M 12 x 1.75 x 180	65 – 75	48 – 55	180°
Bolts fastening pulley on crankshaft	M 12 x 1.25	45 – 55	33 – 41	90° ± 5°
Engine flywheel retaining bolts	M 12 x 1.25	25 – 35	18 – 26	60° ± 5°

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TOLERANCES	CHARACTERISTIC SUBJECT OF TOLERANCE	GRAPHIC SYMBOL
SHAPE	Cilindricity	/○/
ORIENTATION	Perpendicularity	⊥
POSITION	Location	⌖

NOTE: *If regrinding, all the cylinders must have the same oversize 0.5 mm (0.0196 in.).*

Check the main bearing seats, proceeding as follows:

- Install the main bearing caps on the supports without bearings;
- Tighten the retaining bolts to the prescribed torque;
- Using an appropriate dial gauge for interiors, check that the diameter of the seats is as prescribed in the “specifications.”

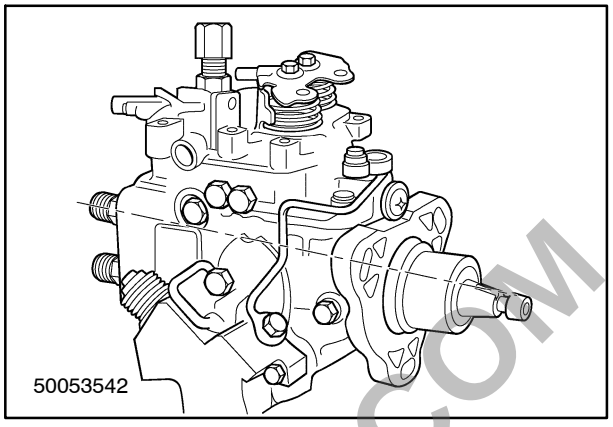
If the measurement is any greater, change the crankcase.

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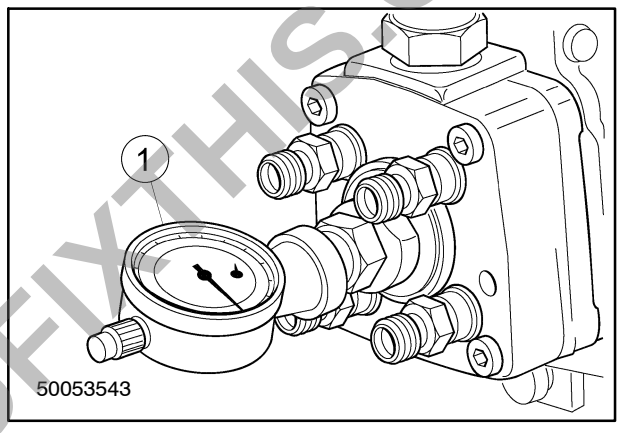
LOCK TIMING THE FUEL INJECTION PUMP ON A WORKBENCH

1. Verify the groove on the pump shaft is in line with the first piston outlet port. See figure.



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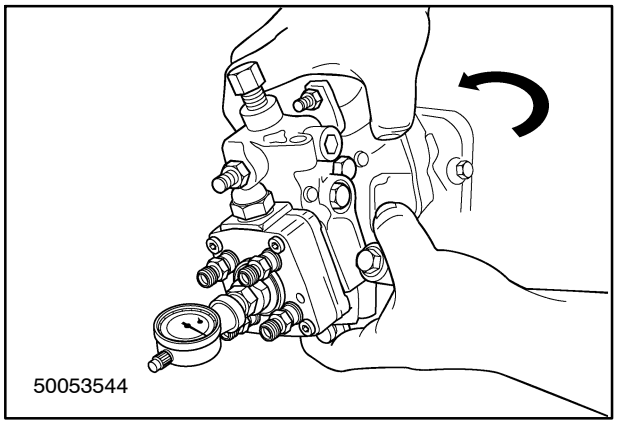
2. Insert Tool 380001601 and dial gauge 380000228. Preload the rod approximately 2.52 mm (0.0984 in).



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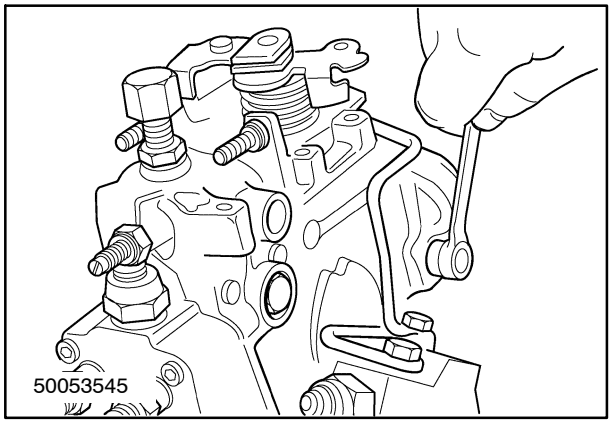
3. Lock the pump shaft in a vise.
4. Set the dial gauge to zero. Rotate the pump to 1.35 mm (0.0531 in) for Naturally Aspirated engines, and 1.0 mm (0.0393 in) for Turbocharged engines.

NOTE: *Rotate the pump in the direction of the arrow in the figure, which is counterclockwise from the pump side.*



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5. Screw down the pump shaft locking bolt.

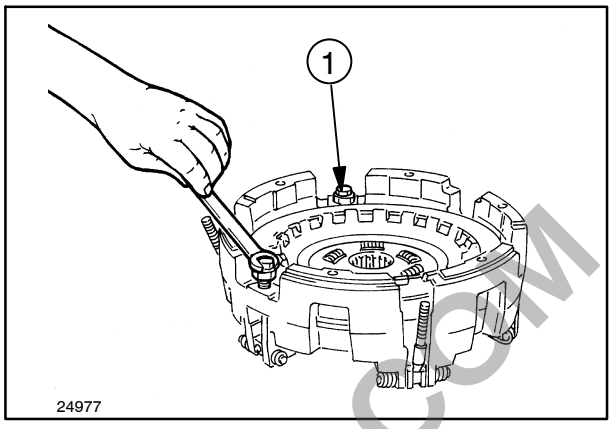


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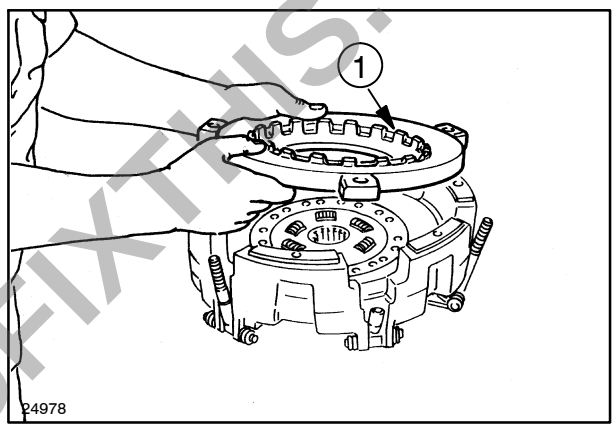
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7. Remove the three main clutch lever adjustment screws (1).



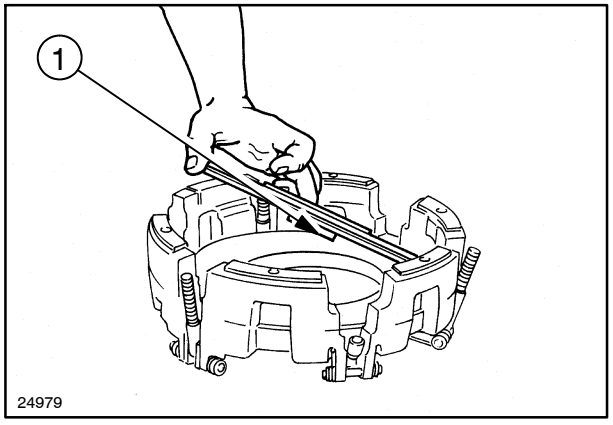
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8. Extract the main clutch pressure plate (1).



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9. Extract the main clutch disk (1).



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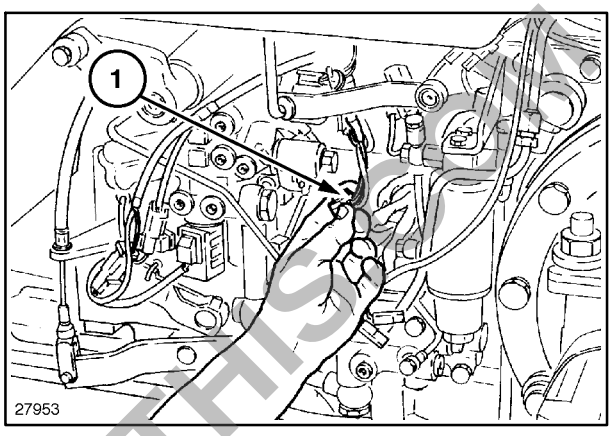
Op. 21 134 70
A + B CLUTCH VALVE SOLENOIDS
Removal - Installation

⚠ WARNING ⚠

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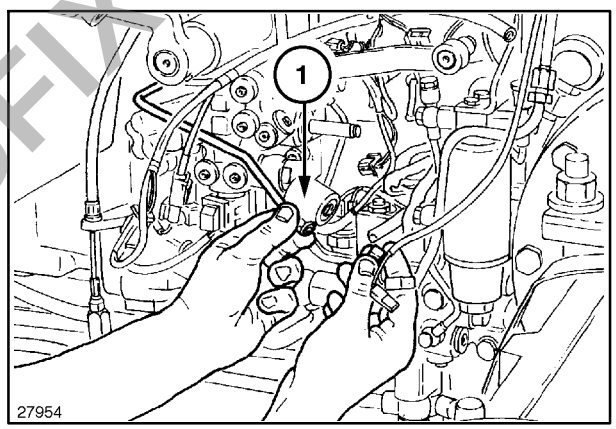
Proceed as follows.

1. Carry out operation **10 216 10** fuel tank removal (see Section 10).
2. Disconnect the solenoid valve connection (1).



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3. Loosen the nut and remove the solenoid valve (1).

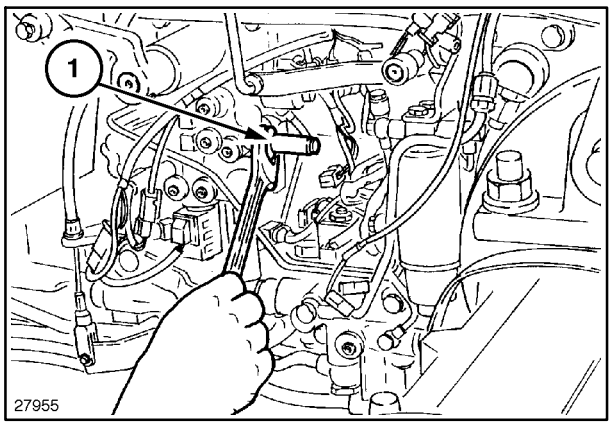


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4. Unscrew the solenoid valve pin (1).
5. To install the control valve solenoid, proceed as follows.

⚠ WARNING ⚠

Always use appropriate tools to align fixing holes. NEVER USE YOUR FINGERS OR HANDS.



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- Screw the pin on the solenoid valve.
- Install and secure the solenoid valve.
- Connect the electrical connection.
- Carry out operation **10 216 10** fuel tank installation (see Section 10).

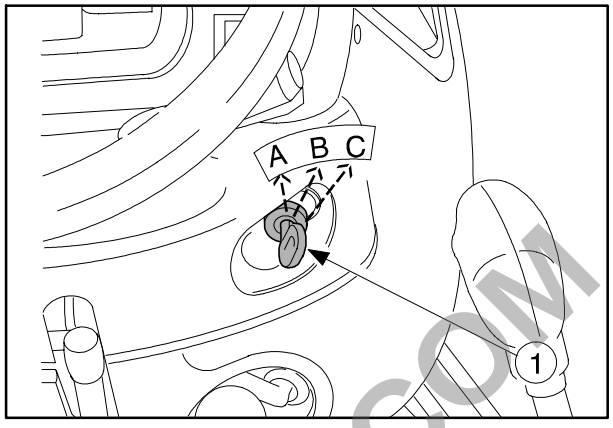
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ECM - FIRST START-UP (Self Configuration)

The ECM will require configuration when any one of the following circumstances has occurred.

- At the end of the production line.
- Following ECM replacement.
- Following erasure of the Non-Volatile memory (NVM) (see H8 MENU).
- Following manual configuration **NONE** (see H3 MENU).

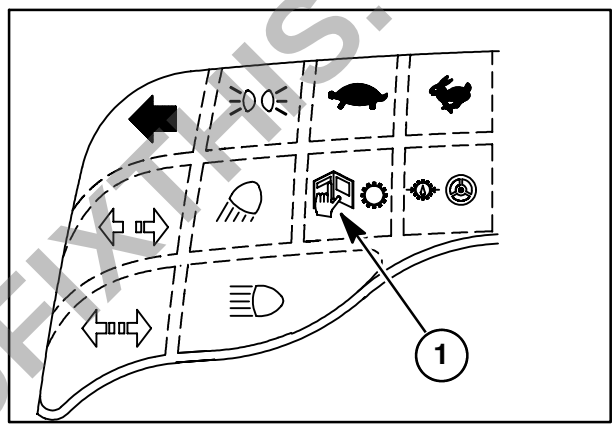


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Turn switch (1) to B (ON) without switching on the engine.

Indicator (1) (fig. 76) will be illuminated (non-flashing), after a while the indicator will flash to repeat the recognised configuration code - i.e.: rapid flashing, followed by 1 flash.

- Turn the key (1, fig. 75) to OFF for a few seconds: the configuration is now saved in the Non-Volatile memory (NVM).



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FAULT CODE 13 – HI AND LO BUTTONS PRESSED SIMULTANEOUSLY.

(NOT USED ON TNDA OR TNSA MODELS)

NOTE: *Error Code is not triggered during clutch pack calibration, H1. Error is only shown on 32x16 transmissions.*

NOTE: *On a 32 x 16 the Transmission Status Lamp is the Hi(Rabbit) and Lo(Turtle) lamps. They will flash in a alternating manner.*

Conditions:

- While driving or stationary, both Hi and Lo buttons pressed simultaneously longer than 0.5 seconds.

Causes:

- Operator pressed Hi and Lo Buttons at the same time.
- Hi or Lo Button Switch is stuck closed while the other button is pressed, (broken switch).
- Faulty wiring; circuit is shorted to 12 volts between Hi or Lo Button Switch and ECM connector 2, pin 3 or 22, when the opposition button is pressed.

Tests:

- H5, doesn't display transition between d0 and d24 for Lo(Turtle) or d25 for Hi(Rabbit).

Effects:

- The Transmission Status Lamp is flashing.
- Speed shift will not take place.
- Transmission operates normally but not when Hi or Lo speed shift is conducted.

Recovery:

- Error will self-clear when Condition or Causes stop, but will be stored in HF.
- Cause must be resolved and cleared using the CDU or EST, HF Menu.

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FAULT CODE 33 – DUMP SOLENOID COIL SHORT CIRCUIT.

NOTE: *On all Transmissions the Status Lamp (Gear with a Slash) will flash in a alternating manner.*

Conditions:

1. While the tractor is being driven in forward or reverse the Dump Solenoid has a short circuit.
2. While the tractor is in neutral the Dump Solenoid has a short circuit.

Causes:

- Faulty wiring; circuit is shorted between ECM connector 1, pin 18 and ECM connector 1, pin 2 wires, or across the two coil terminals.
- Faulty Dump Solenoid Coil.
- Faulty ECM.

Tests:

- No H Menu for diagnostic check.

Effects of Condition 1:

- The Transmission Status Lamp is flashing.
- Transmission is disabled, but can be re-enabled by cycling the Power Shuttle FNR Lever or Clutch Pedal.

Effects of Condition 2:

- Transmission is limited; Dump Solenoid stays energized, meaning the output signal from ECM, CN1-18 sends voltage to the input signal ECM, CN1-2 without going through the solenoid coil. The Clutch Packs (A or B) can not be hydraulically de-pressurised. Transmission will still operate by using other Clutch Pack solenoids to bleed off hydraulic pressure when shuttle or speed shift is conducted.

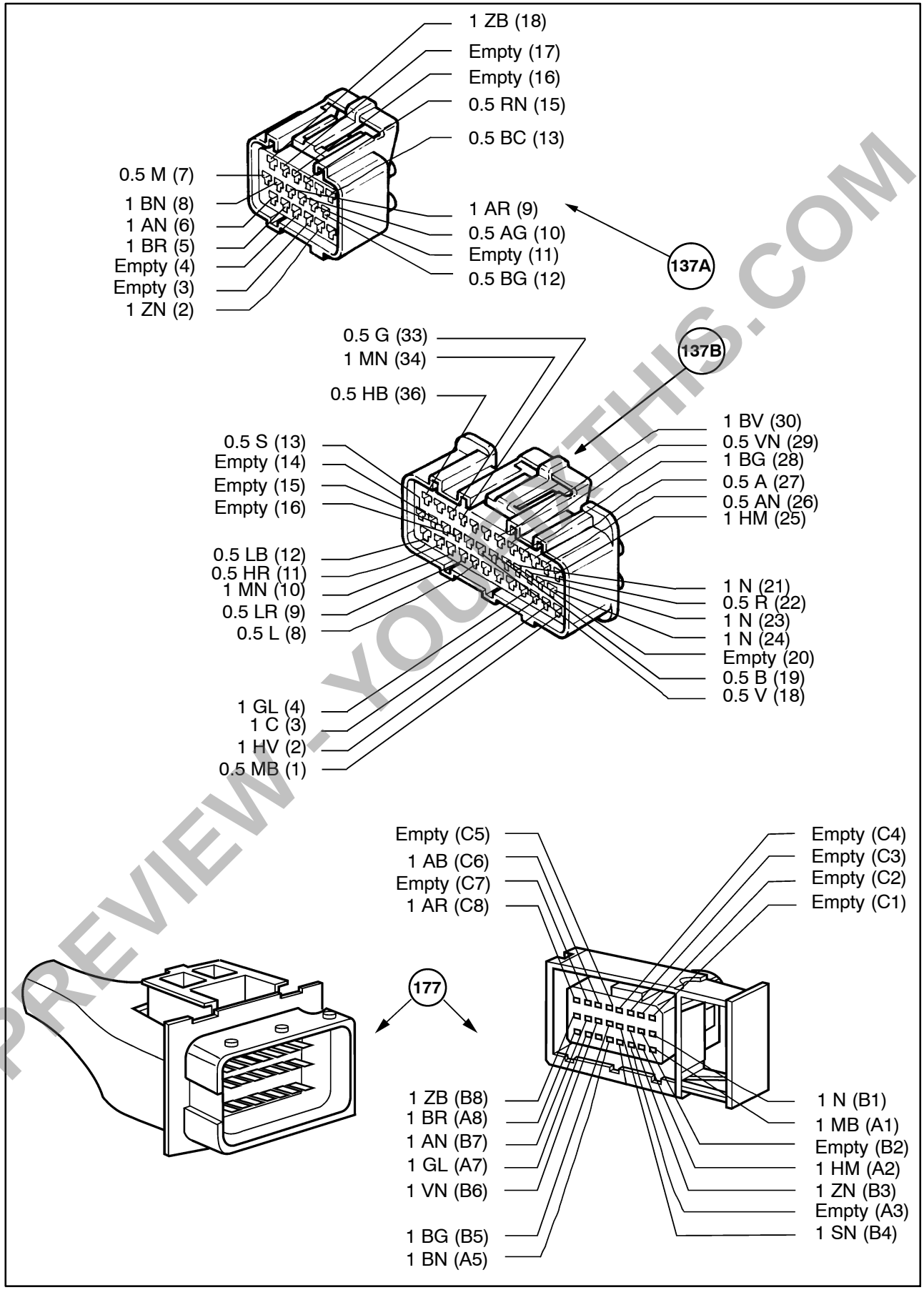
Recovery:

- Cause must be resolved and error must be cleared using the CDU or EST, HF Menu.

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FAULT CODE 52



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FAULT CODE 73 – ECM (2) SUPPLY VOLTAGE (12VF) IS TOO HIGH.

Conditions:

- When tractor is on, ECM detects that the voltage at ECM connector 2, pin 34 or ECM connector 2, pin 10 is above 18 volts for longer that 0.3 seconds.

Causes:

- Faulty Battery.
- Overcharged Battery.
- Faulty Alternator.

Tests:

- H9, channel 3, is above 762.

Effects:

- Transmission is critically disabled, but can be re-enabled by cycling the Ignition Switch, (shutting off the tractor). Dump solenoid stays energized. Indicator lights will not illuminate when key switch is in the “ON” or “Start” position. ECM stops sending diagnostic pulses to the sensors, switches, or solenoids. This error will automatically clear when voltage dropped below 16 volts

Recovery:

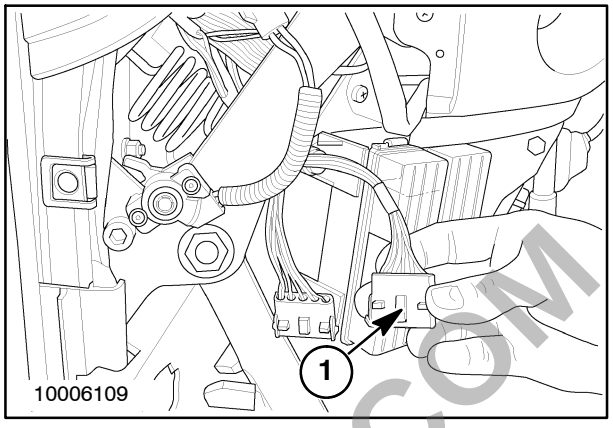
- Cause must be resolved and error must be cleared using the CDU or EST, HF Menu.

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HH MENU ACCESS

1. Turn switch (1, fig. 37) to A (OFF) and connect the EST to the diagnosis socket (red connector) under the right hand console panel (1).



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2. Pressing down the H MENU button (1, fig. 33) on the EST cable and turn switch (1) to C to start the engine.
3. After a brief pause, the display (1, fig. 34) shows:

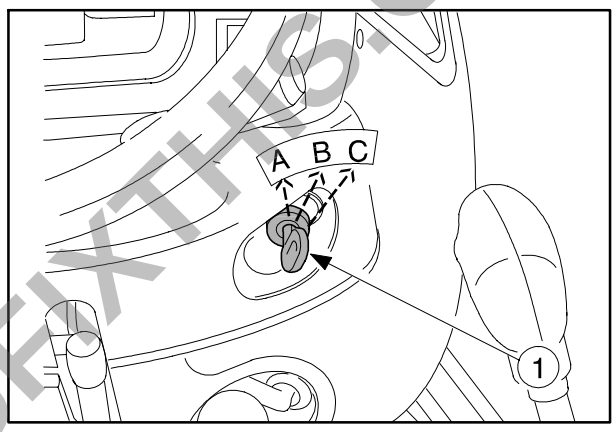
   HH MENU
4. Release the H MENU button (1, fig. 33) on the EST cable.
5. Select the required H menu by pressing the H MENU button the correct number of times to display the relative code on the display e.g.: once to access H1, five times to access H5, etc. Each time the button is pressed, the display shows the H code obtained, i.e.: H1, H2 etc.

   Remember that after the HF MENU, the count restarts from HH.

   After a brief pause (2 seconds) the ECM enters the procedure of the selected menu.

   If the operator presses the button on the EST cable while an H Menu is in use, the menu is abandoned and the display returns to the HH selection phase.

   If the H code does not correspond with an active H Menu, the display returns to HH.



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FAULT CODE 28

Turn the starter key to the OFF position.
Disconnect the Four-wheel drive switch.
Using a digital tester, check the efficiency of the switch.
Does it work?

NO → Replace the switch.

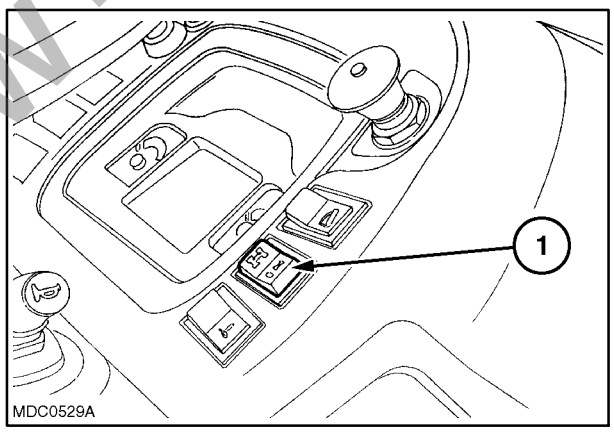
YES

Remove the control panel and the ECM connection (138).
Are pins CN2 (CN) and CN27 (CL) on connection (138) (wiring side) in short circuit?

NO → Replace the ECM.

YES

Check the wiring between connection (140) on the switch and the ECM.
Eliminate the cause of the short circuit.



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32. Using wrench **380000252** (1) turn the adjustment ring nut and check using torque wrench **380001633** (2), that the rolling resistance torque of the differential, as measured in the same conditions used to check only the pinion, is:

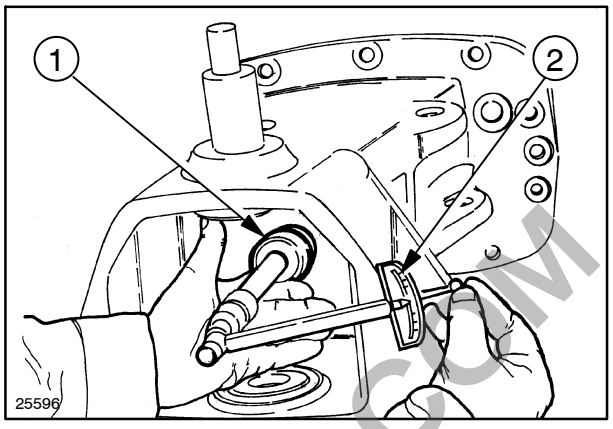
    $A_2 = A_1$ + 1 to 1.5 Nm (8.8 to 13 in. lb.)

    where:

    A_2 = pinion-differential rolling resistance torque;

    A_1 = rolling resistance torque of pinion only as previously measured;

    0.1 to 1.5 Nm (8.8 to 13 in. lb.) = rolling resistance torque of differential only measured at the end of the pinion, using wrench **380001623** (1) and torque wrench **380001633** (2).

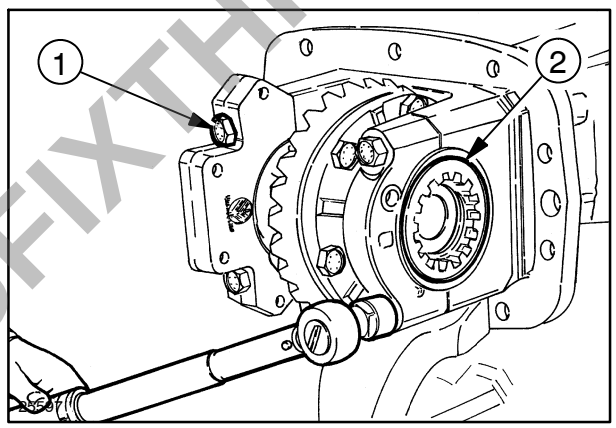


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33. Tighten the cap bolts (1) to a torque value of 119 to 144 Nm (87 to 106 ft. lbs.).

34. Install the safety plate, screwing the adjustment ring nut in or out, to reach the nearest notch.

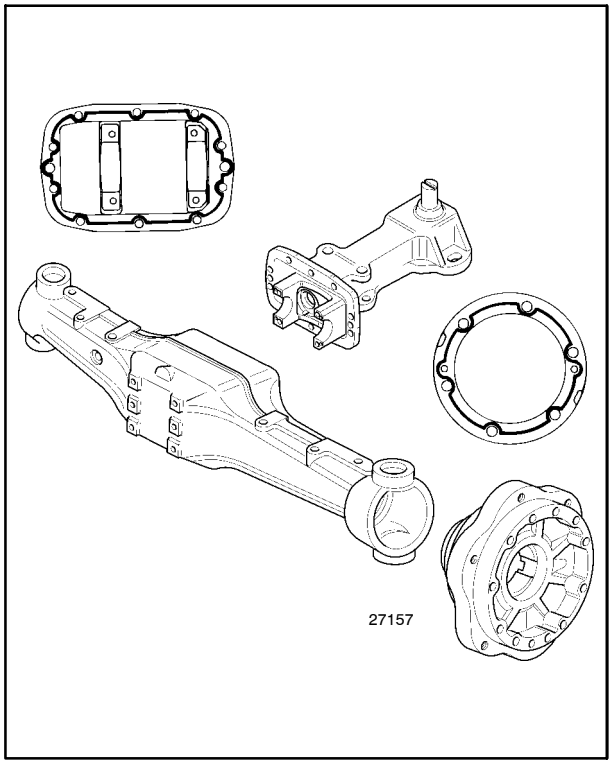
35. Attach the bevel drive-differential to the axle casing after having carefully cleaned and degreased the mating surfaces and apply sealing compound [approx. 2 mm (.078 ins.)] along the marked line shown in the figure below.



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Mastic application diagram for assembly of bevel drive unit and epicyclic final drive unit.

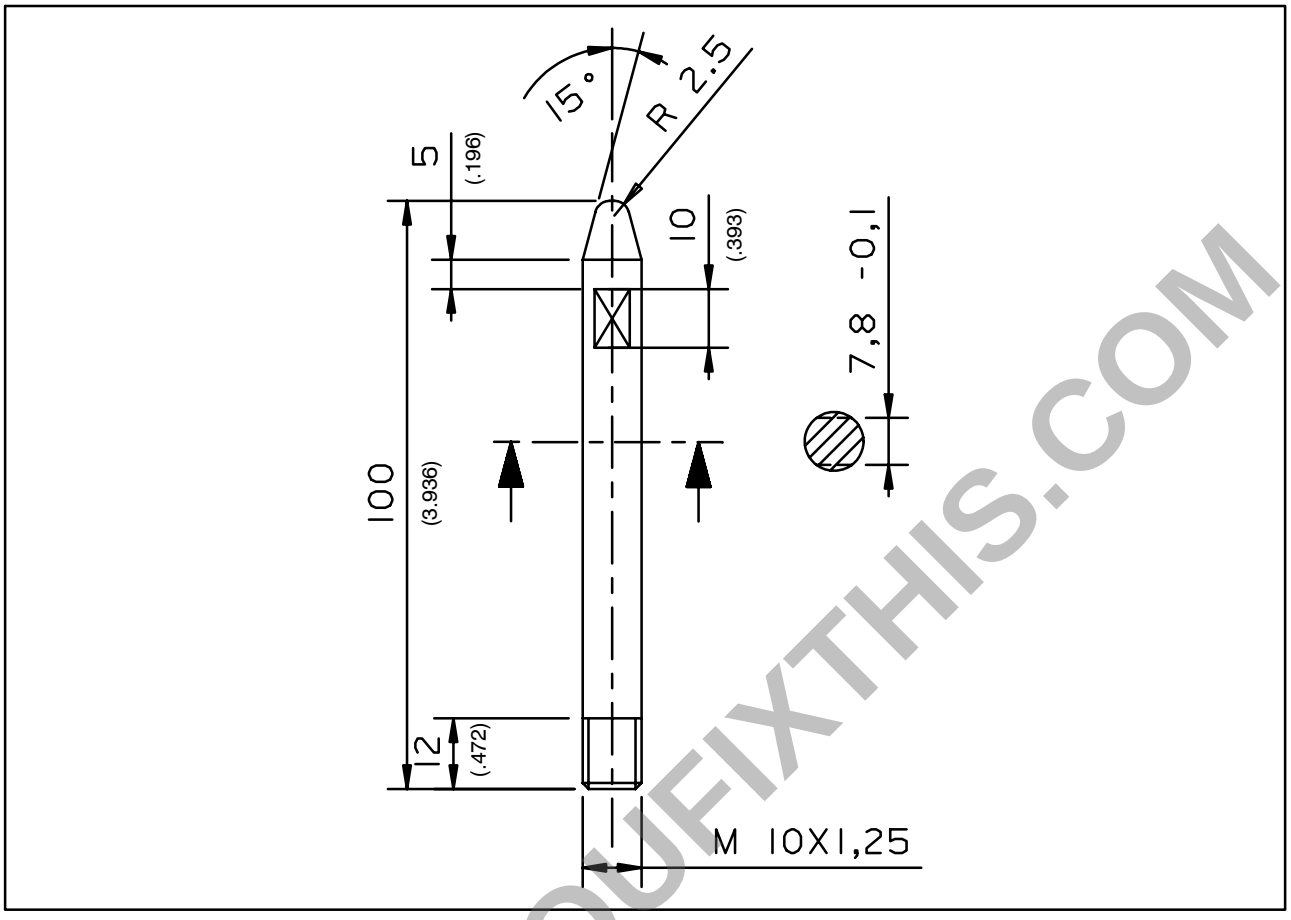
The types of mastic to use are listed in Section 00.



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Series of guide pins (no. 2) to be constructed for differential support removing-refitting.
[Stamp number 50164 on the pins - Measurement in mm (in.)]

Construct in C40 material

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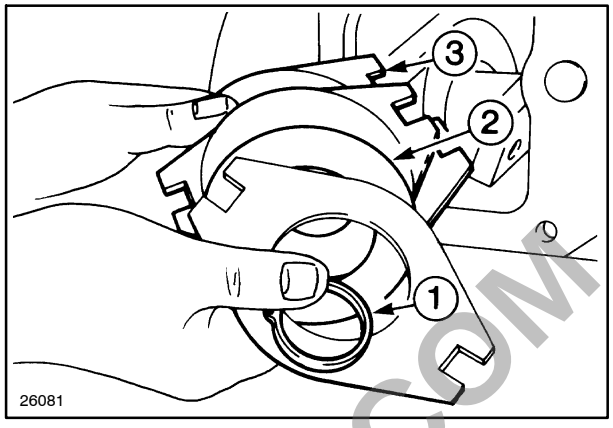
4. Recover the retaining ring (1), the brake disks (2) and the friction disks (3).

5. To install the parking brake disks, proceed as follows.

⚠ WARNING ⚠

Always use appropriate tools to align fixing holes. NEVER USE YOUR FINGERS OR HANDS.

- Insert the brake disks and friction disks in their respective seats.
- Install the safety ring.
- Install the access cover on the transmission casing and secure with the four bolts.
- Tighten the cap on the rear transmission casing and fill up with oil (for products and quantities see Section 00).



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OP. 35 110 42

ARM SHAFT AND LIFT CYLINDER DISASSEMBLY-ASSEMBLY

(With the lift removed)

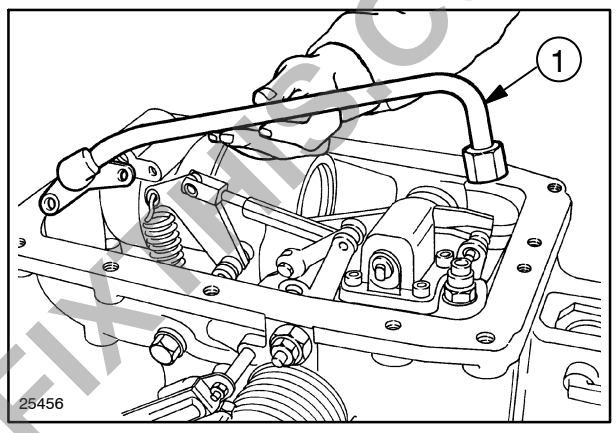
Disassembly

⚠ DANGER ⚠

Handle all parts carefully.
Do not put your hands or fingers between parts. Wear suitable safety clothing - safety goggles, gloves and shoes.

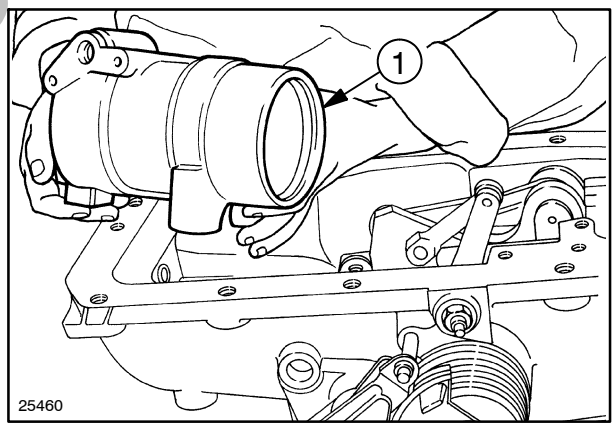
Proceed as follows.

1. Remove the front bolts, the rear union and the oil delivery pipe (1) to the lift cylinder.



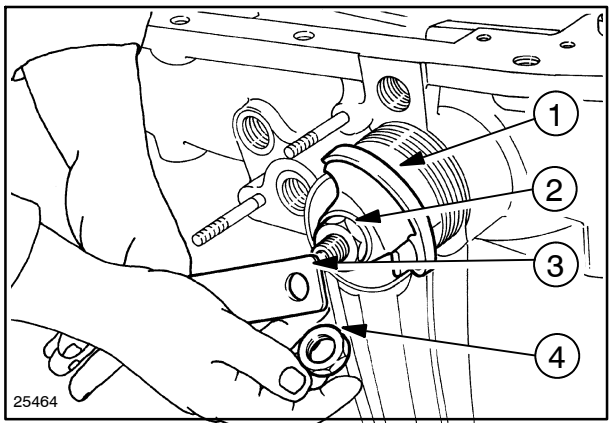
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2. Remove the three lift cylinder retaining bolts.
3. Remove the lift cylinder (1).



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4. Loosen the nut (4) and remove the locking lever (3) on the lifting stroke limit cam (1). Unscrew the nut (2) and remove the cam (1).



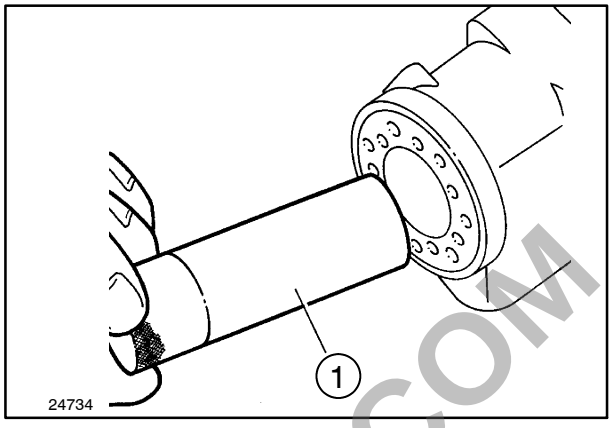
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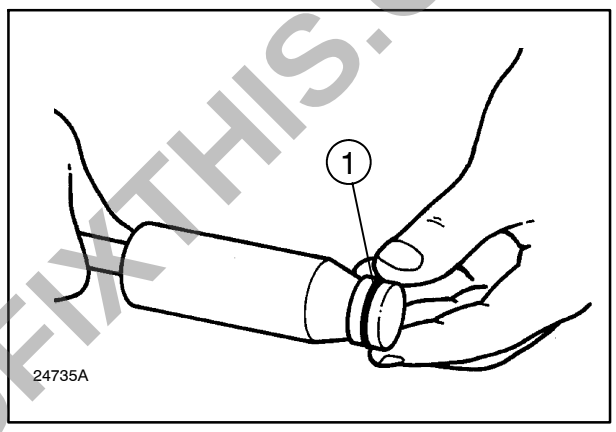
34. Position the control valve body so that the housing seat on the rotating valve sleeve is positioned horizontally.

35. For the ROTOGLYD seal (OGNIBENE hydrostatic steering) insert the guide bushing (1) of tool **380000281** in the rotary valve seat.



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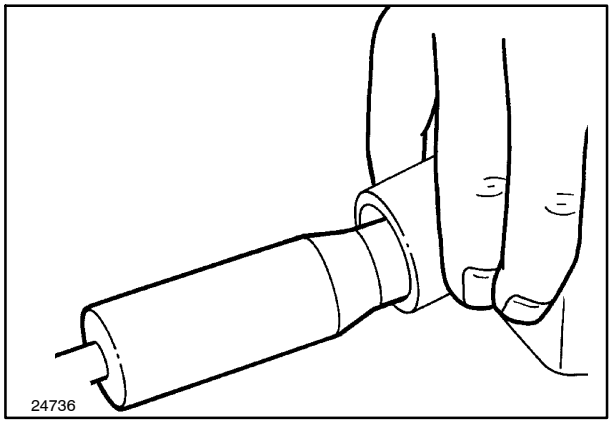
36. Lubricate the ROTOGLYD seal (1) with hydraulic fluid and position it on the head of tool **380000281** with the flat portion of the ring facing in front of the tool.



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37. Insert tool **380000281** in the guide bushing positioned beforehand.
38. While holding the external bushing with the hands, press down and simultaneously rotate the tool **380000281** in order to facilitate the entry of the ROTOGLYD seal in the control valve body seat.
39. Extract the parts on tool **380000281** (external bushing and punch).

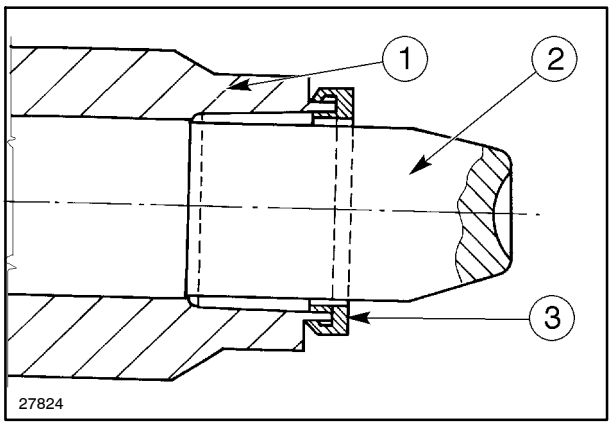
NOTE: *The support and seal ring support head remains on the control valve body.*



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40. Position the control valve body so that the housing seat on the rotating valve sleeve is horizontal.

41. Lubricate the VARISEL seal (3) with grease and install on the outer edge of the guide bushing (1) of tool **380000836**.



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AIR CONDITIONING SYSTEM TROUBLESHOOTING *(CONT.)*

INSUFFICIENT COOLING

HIGH DISCHARGE PRESSURE AND/OR HIGH SUCTION PRESSURE

CHECK THE SIGHT GLASS (7, fig. 15)

EXCESS REFRIGERANT IN SYSTEM

Note: bubbles could be visible in the sight glass. Evacuate refrigerant until a large number of bubbles appear in the sight glass, then add refrigerant to the system until the bubbles disappear

CONDENSER

1. The condenser could be clogged or it might not be receiving an adequate air flow. Clean condenser fins.

EXPANSION VALVE

Check the valve, as indicated on page 9.
1. If the valve fails the test, replace it.

DISCHARGE PRESSURE LOW AND/OR SUCTION PRESSURE LOW

CHECK THE SIGHT GLASS (7, fig. 15)

BUBBLES IN SIGHT GLASS

Insufficient refrigerant. Possibly due to small leaks.
1. Check the system for leaks and eliminate them.
2. Add refrigerant until the bubbles disappear and both pressure gauges show normal readings.

DISCHARGE PRESSURE NORMAL AND/OR SUCTION PRESSURE NORMAL

Note: during testing, the low pressure gauge reading could fall to negative values or remain normal.

HUMIDITY IN THE SYSTEM

1. Evacuate the refrigerant from the system.
2. Replace the receiver-dryer.
3. Remove all air from the system then proceed with re-charging.

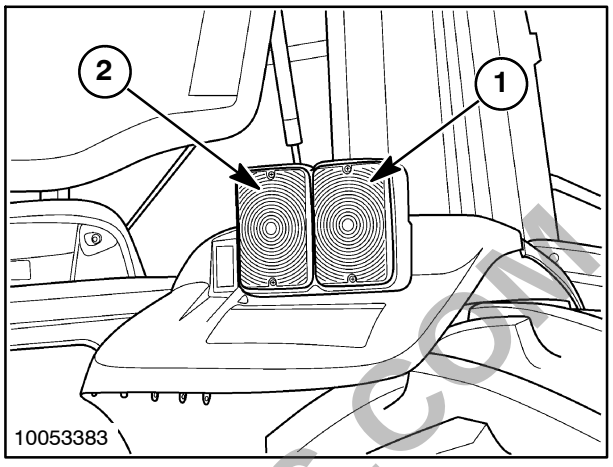
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Rear Direction and Stop Indicator Lamp
The brake stop lamp, 1, is located outward and the direction indicator/ flasher, 2, is located inward on the fender of each wheel.

Remove screws and lift off cover.

Replace bulb with one of same power.

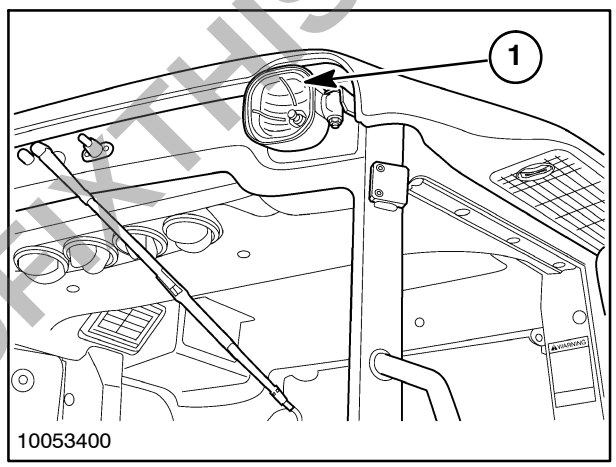


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Cab Front and Rear Work Lights
Swing the light out and remove bulb from back.

Replace bulb with one of same power.

NOTE: *Never touch the new bulbs with your hands, hold the bulb with a cloth or through its wrapping.*



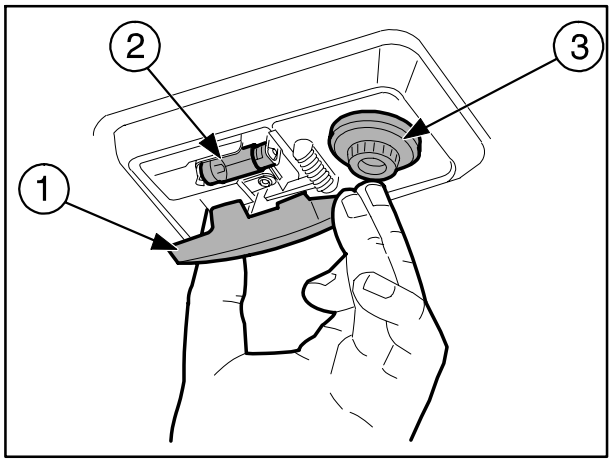
20

Courtesy Light and Adjustable Reading Light
To access the two lamps, proceed as follows:

- Use a screwdriver to prise up the transparent cover, 1, and remove.

Courtesy Light

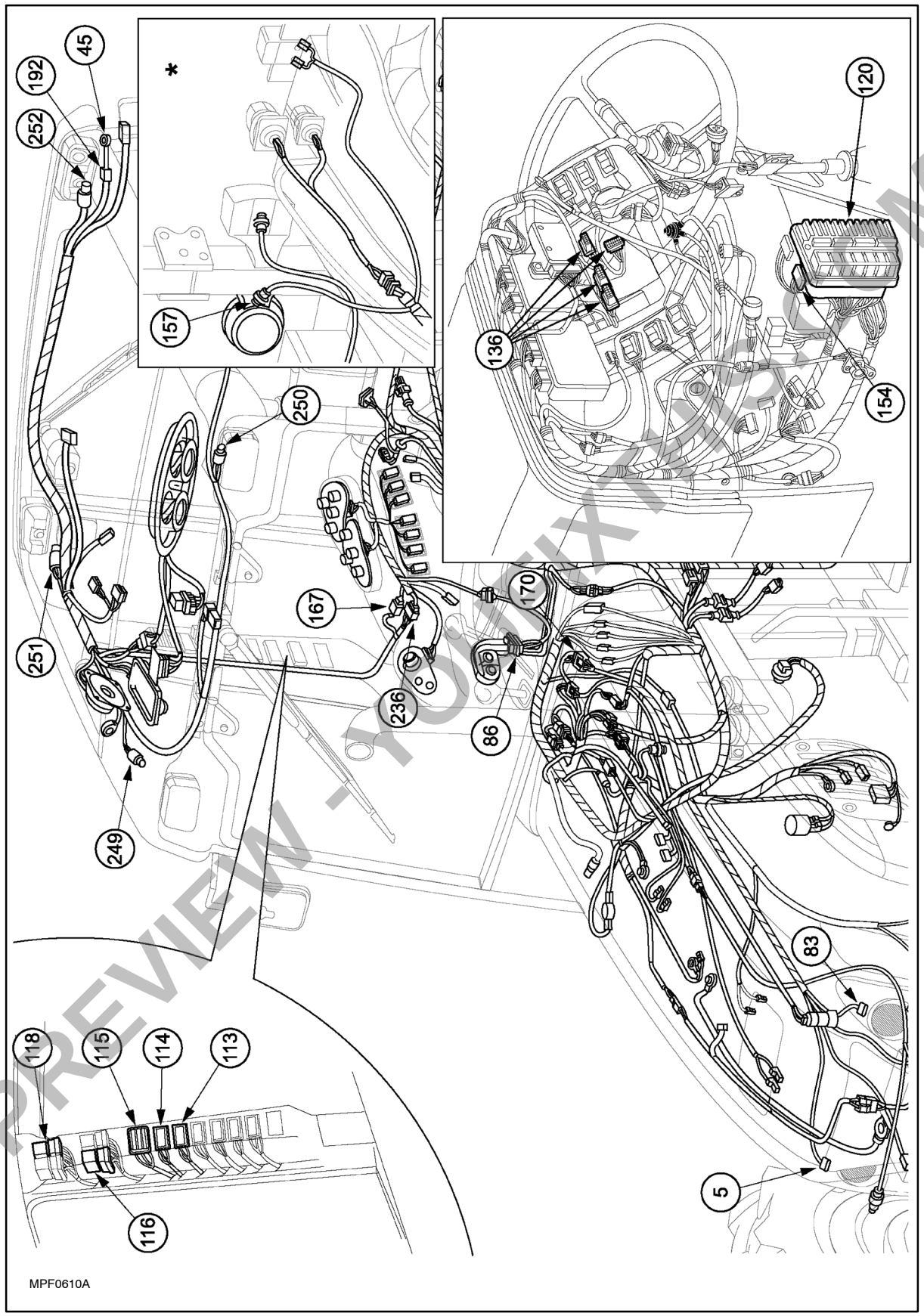
- Pull the lamp, 2, downwards (pressure fitted) and replace it with a new bulb of the same power (10 W).



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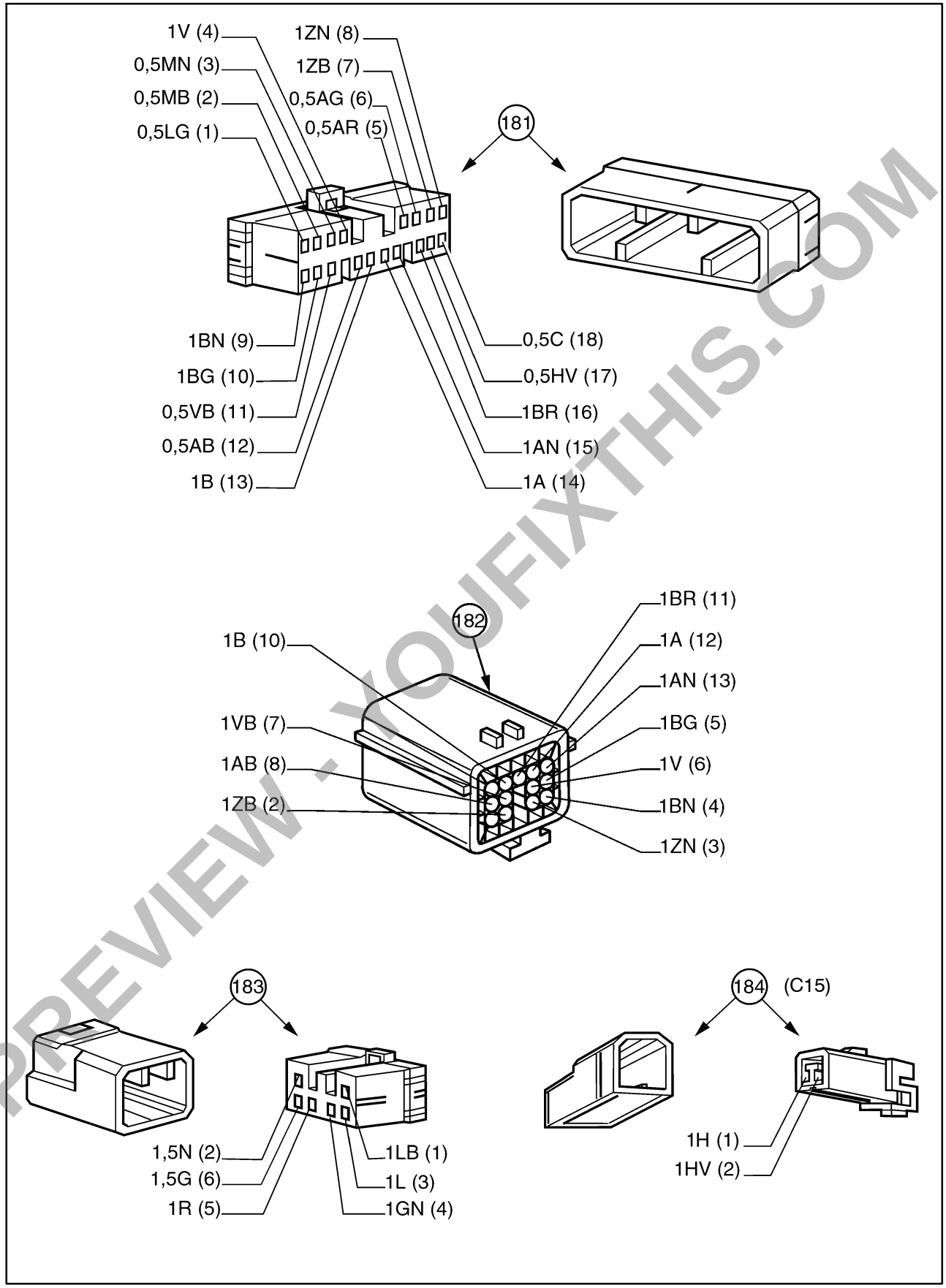
Version without cab *

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(MODELS WITH 3-CYLINDER ENGINE)

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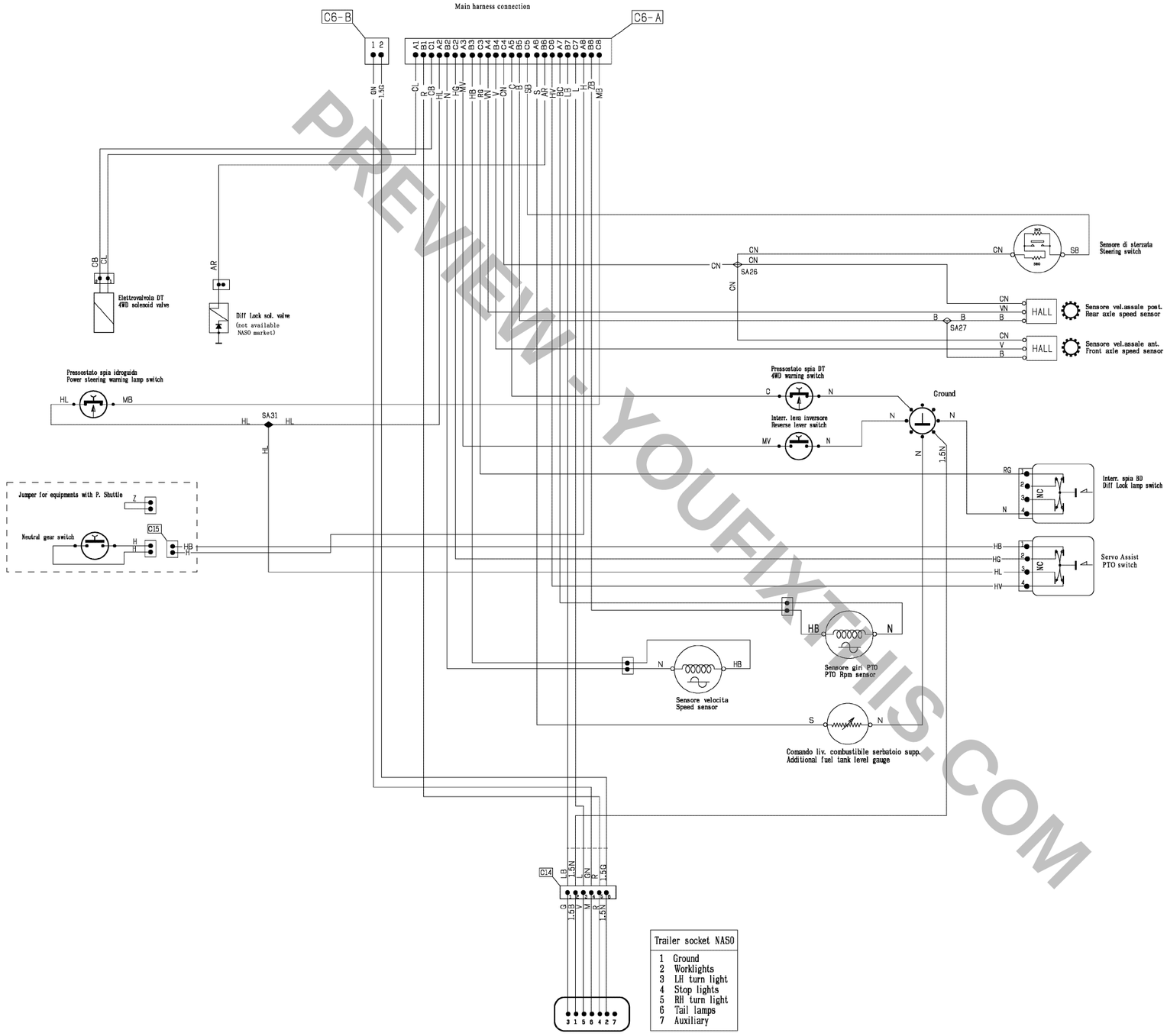
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DIAGRAM F AUTO FWD TRANSMISSION HARNESS



COLORI CAVI	WIRES COLOURS
A Azzurro	Azure
B Bianco	White
C Arancio	Orange
G Giallo	Yellow
H Grigio	Grey
L Blu	Blue
M Marrone	Brown
N Nero	Black
R Rosso	Red
S Rosa	Pink
V Verde	Green
Z Viola	Mauve

Quando sono indicate due lettere la prima identifica il colore base, la seconda le rigature longitudinali

Where two colours are specified first letter indicates base colour, second letter indicates straight stripe

Il simbolo ◆ SA.. indica un nodo di derivazione ottenuto tramite saldatura a ultrasuoni. La posizione è indicata sui cavi relativi.

The symbol ◆ SA.. indicates a shunt by ultrasound welding. About the right location see the relative harnesses.

Le rappresentazione grafica delle connessioni è puramente indicativa. Per una corretta interpretazione fare riferimento ai cavi relativi.

The graphic representation of the connections is aproximate only. About a right interpretation see relative harnesses.

Trailer socket NAS0
1 Ground
2 Worklights
3 LH turn light
4 Stop lights
5 RH turn light
6 Tail lamps
7 Auxiliary

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