Massey Ferguson®

1660
Compact Tractor

WORKSHOP SERVICE MANUAL
4283388M1

CONTENTS

Part Number 4283388M1 (English)

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May 2009

GENERAL DIMENSIONS

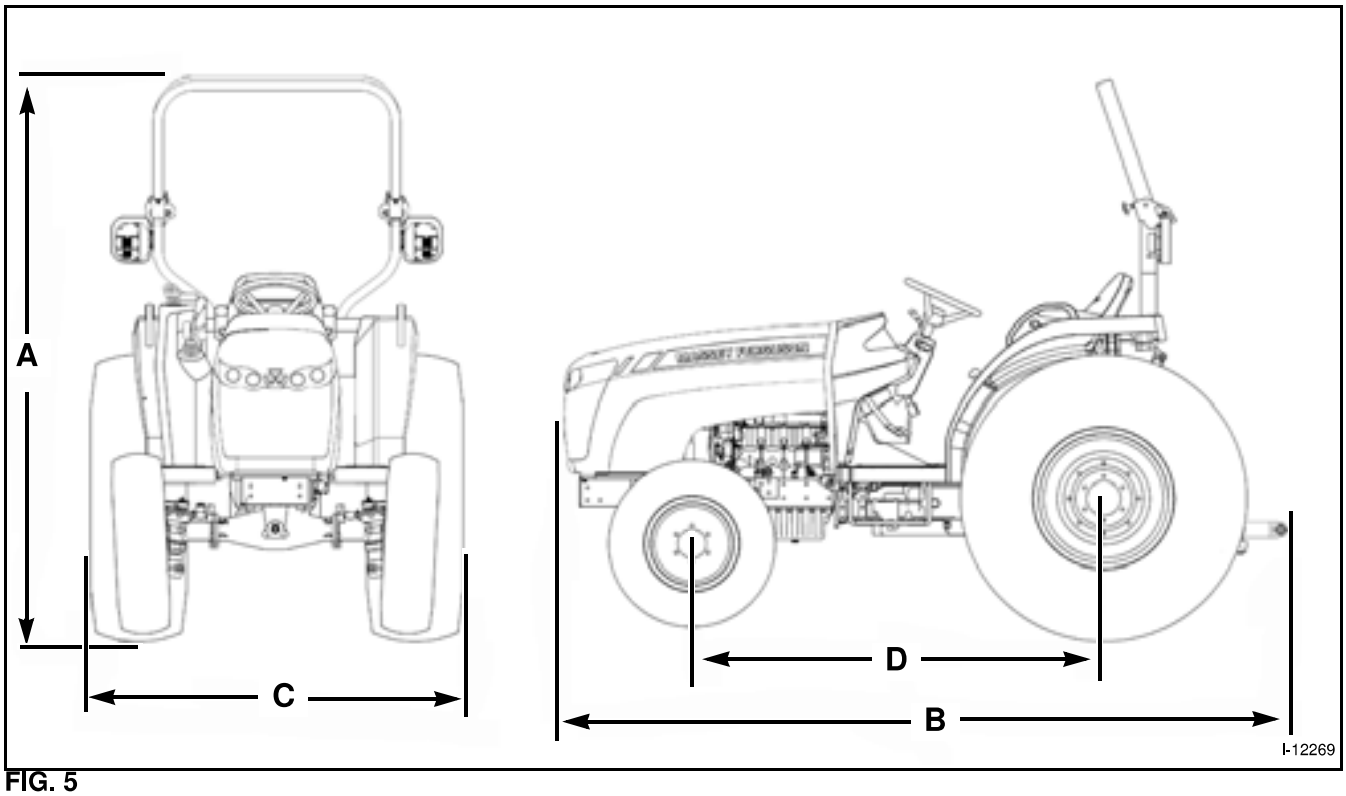

FIG. 5

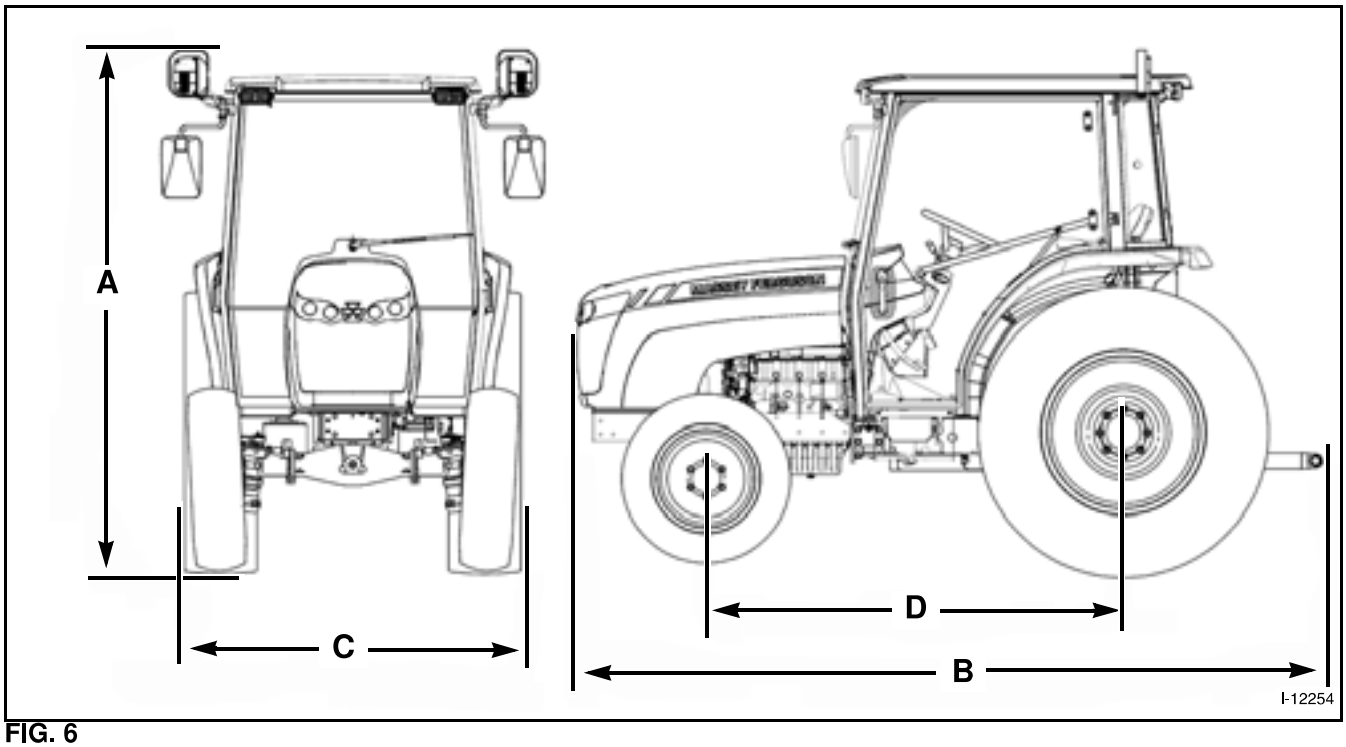

FIG. 6

Tightening Torque Chart

NOTE: Above torques are for "rigid" joints, or joints meeting the following conditions:

1. Damage will not occur to joined members of an assembly.

2. It is desirable to use a higher clamping force.

3. Fastener threads are NOT lubricated prior to assembly.

Fan Belt

FIG. 3: Correct fan belt tension helps to insure adequate coolant flow through cylinder block and radiator. Belt is correctly tensioned when belt deflection is approximately 12 mm (0.50 in) as shown at (1) when thumb pressure is exerted at center of belt span.

CAUTION: Due to muffler position, allow to cool before checking or adjusting fan belt tension.

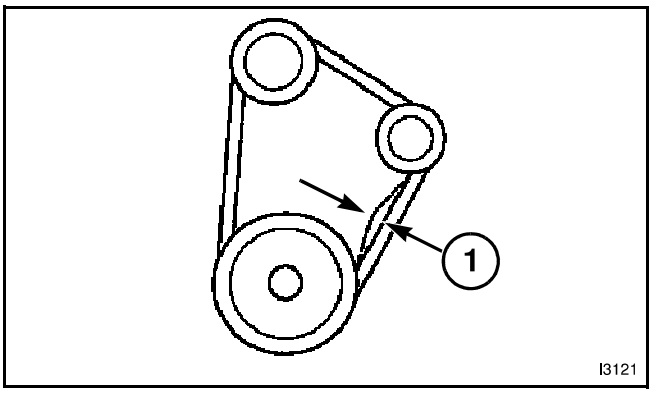

FIG. 3

FIG. 4: To adjust belt tension, loosen alternator pivot bolt and nut (1) and tensioning bracket bolt (2). Pull outward on top of alternator to correctly tension belt and tighten bolt first and then tighten pivot bolt.

IMPORTANT: Do not pry against alternator housing or pulley. Carefully pry against alternator mounting flange to prevent damage.

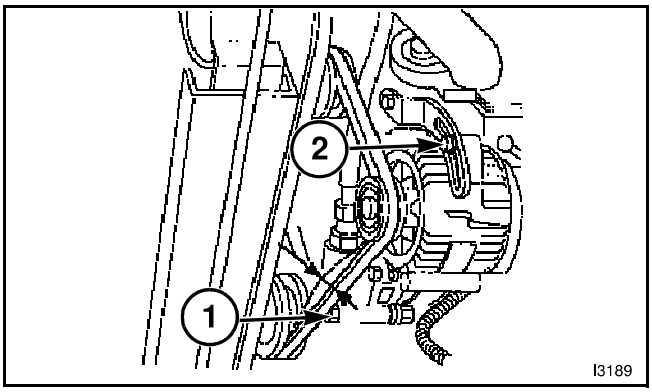

FIG. 4

Thermostat

FIG. 5: The thermostat is rated at 75 to 78 degrees C (167 to 172 degrees F).

(1) Water Outlet Pipe

(2) Thermostat

(3) Housing Gasket

(4) O-ring

(5) Thermostat Housing

(6) Flange Bolt

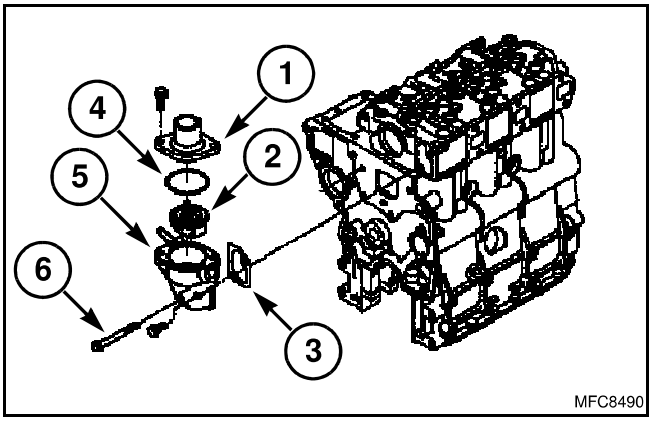

FIG. 5

NOTES

Excessive Fuel Consumption			
Problem	**Inspection**	**Causes**	**Countermeasures**
Check for fuel leaking.	Inspect seals and fasteners.	loose or worn	Replace and tighten parts as necessary.
Nozzles	Check the nozzles performance.	Bad nozzles	Correct or replace
Injection timing	Check injection timing	Defective injection timing	Correct

Insufficient Oil Pressure			
Problem	**Inspection**	**Causes**	**Countermeasures**
Oil level	Check oil level	Low oil level	Fill oil level
Coolant temperature	Check coolant temperature	Low coolant level	High coolant temperature refer to overheating
Oil in crankcase	Check the oil in the crankcase	Improper viscosity	Replace with the right viscosity of oil
	Check relief valve	Defective valve	Replace

Over discharged battery			
Problem	**Inspection**	**Causes**	**Countermeasures**
Battery	Check electrolyte level	Low, cracked casing	Replace battery
	Check for over charging	Cracked casing	Replace battery
	Check specific gravity	Low Supplemental charging, impossible charging	A specialist must be seen then.
Wiring	Check terminals for deformation, corrosion	Poor contact	Correct or replace
	Check for open circuits	Has open circuits	Repair or replace
Regulator and alternator	Check belt	Slipping or damaged	Correct or replace
	Check for charging	Battery fault or defective wiring are possible causes.	Consult a specialist.

Engine Does Not Start			
Problem	**Inspection**	**Causes**	**Countermeasures**
Starter does not work	Check battery for charge		Charge battery or replace
	Check wiring	Loose connector or open wiring.	Run starter independently and tighten and re wire.
	Check starter switch	Wore out switch	Replace
	Check magnetic switch		Defective: replace
	Check starter brushes	Poor contact	Repair or replace
Starter works but engine does not start.	Check Engine body if the engine body can be turned by hand.	If not the engine is seized.	Replace or over haul engine.
	Check compression	Low compression, defective valves, springs, gaskets.	Overhaul engine

Fan Belt Tension

FIG. 25: Depress the belt midway, 1, with a finger, it should deflect about 8 mm (3/8 in). A cracked or exfoliated belt should be replaced with a new one.

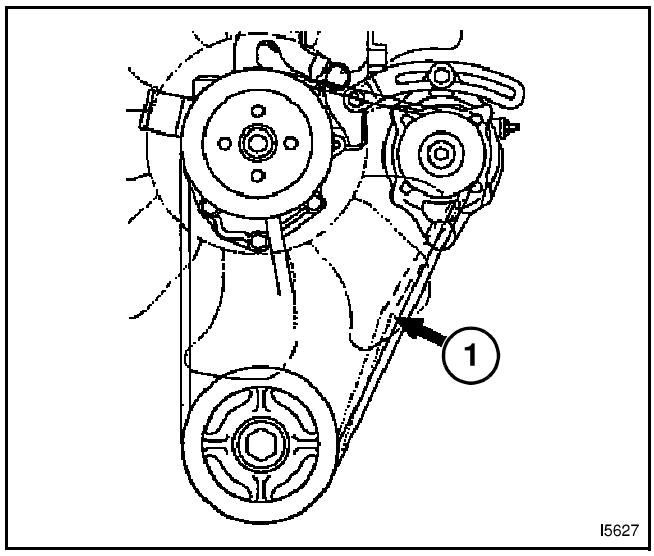

FIG. 25

Fuel

Fuel quality will greatly influence the performance of the engine, so be sure to use good quality diesel fuel.

Fuel to be used: Diesel fuel

NOTE: Fuel should be replenished before the fuel tank is emptied. Before replenishing with fuel, stop the engine and use a strainer to prevent debris from entering the fuel tank.

Coolant

Before operation, be sure to check for the coolant level in the reserve tank. When the level is lower than specified, replenish with the coolant specified by the manufacturer.

Engine Starting

When starting the engine, pay attention to the following items:

- One cranking duration should be limited within 10 seconds. When cranking fails, wait 5 to 10 seconds before the next attempt.
- As soon as the engine starts, release the engine key. Continued cranking after the engine starts may cause engine trouble.

FIG. 39: Wear of Cylinder in Diameter: Measure the bore of the cylinder with a cylinder gauge in two directions parallel (A) and vertical (B) to the crankshaft and in three levels a, b and c. When this shows the worn out is more than 0.2 mm (.008 in), correct the cylinder bore on a boring machine. Boring and honing operation should be done at a workshop where authorized mechanics and required equipment are available. Boring and honing should be done to fit an oversize piston.

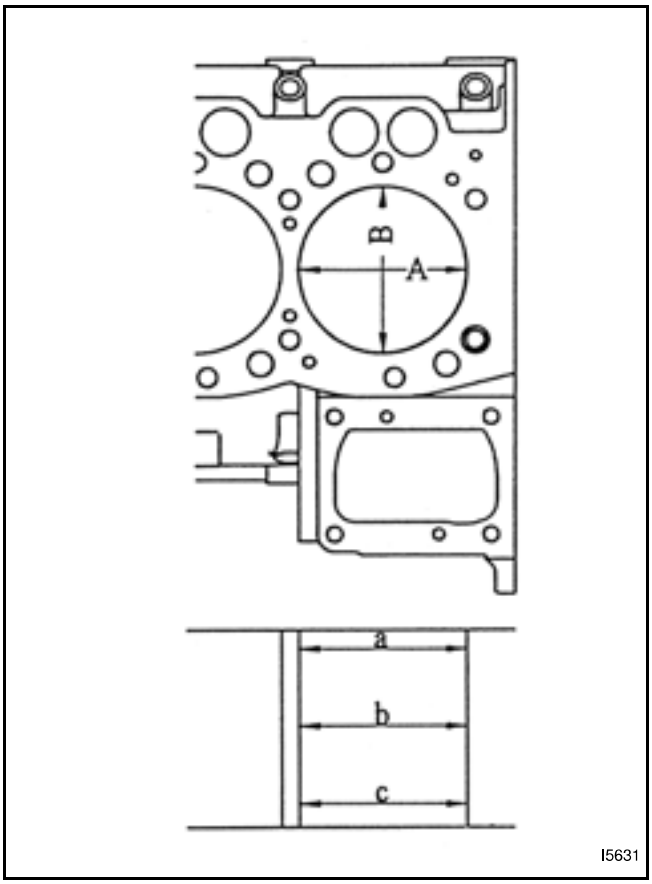

FIG. 39

FIG. 40: Accuracy after Boring Operation: The difference between the values measured in A, B, a, b, and c should be less than 0.02 mm (.0008 in).

Oversize Piston	0.5 - 1.0 mm (.020 to .040 in)

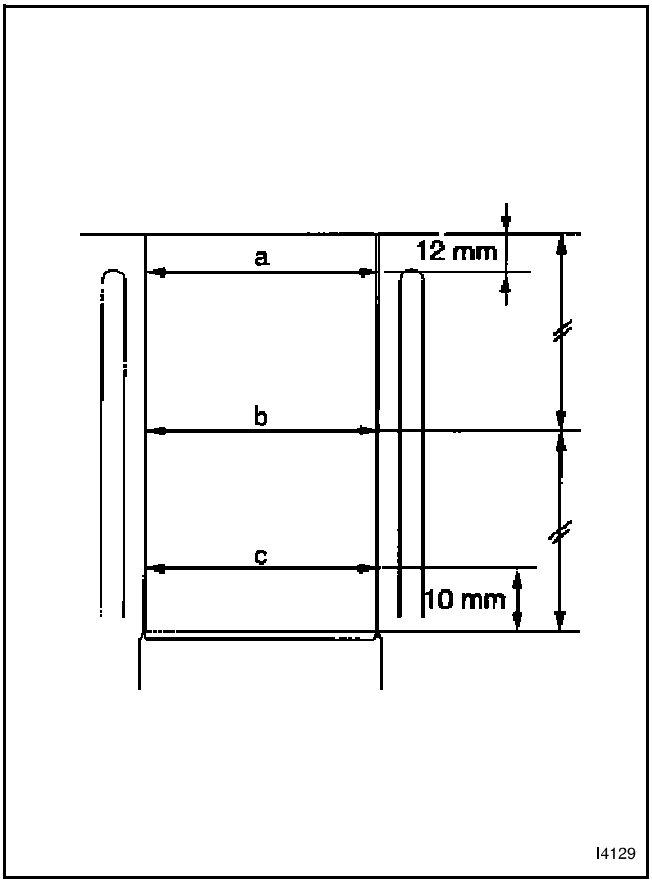

FIG. 40

FIG. 60: Thrust play: Install the cam bearing and thrust plate temporarily on the cam shaft. Press the thrust plate against the journal and measure the clearance between the thrust plate and gear using a feeler gauge.

Thrust Play	Standard Value	0.05 to 0.174 mm (.002 to .007 in)
	Usable Limit	0.20 mm (.008 in)

Tappets: Measure the outside diameter of the tappet.

Outside Diameter of Tappet	Standard Value	25 mm (.984 in)
	Usable Limit	24.95 mm (.983 in)

Distortion of push rod: Place the push rod on flat a surface and measure the distortion with a feeler gauge. When the distortion exceeds 0.3 mm (0.012 in), replace the push rod with a new one.

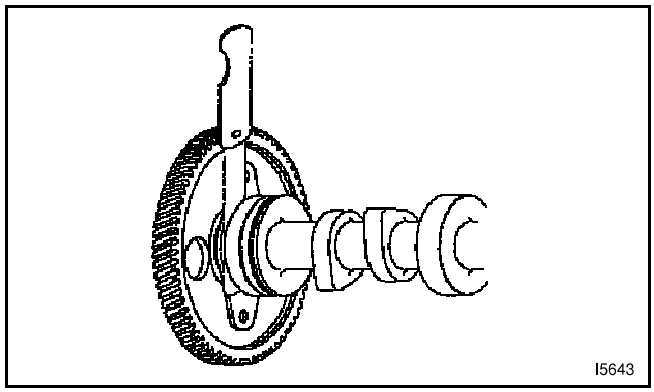

FIG. 60

ASSEMBLY

Installation of Crankshaft

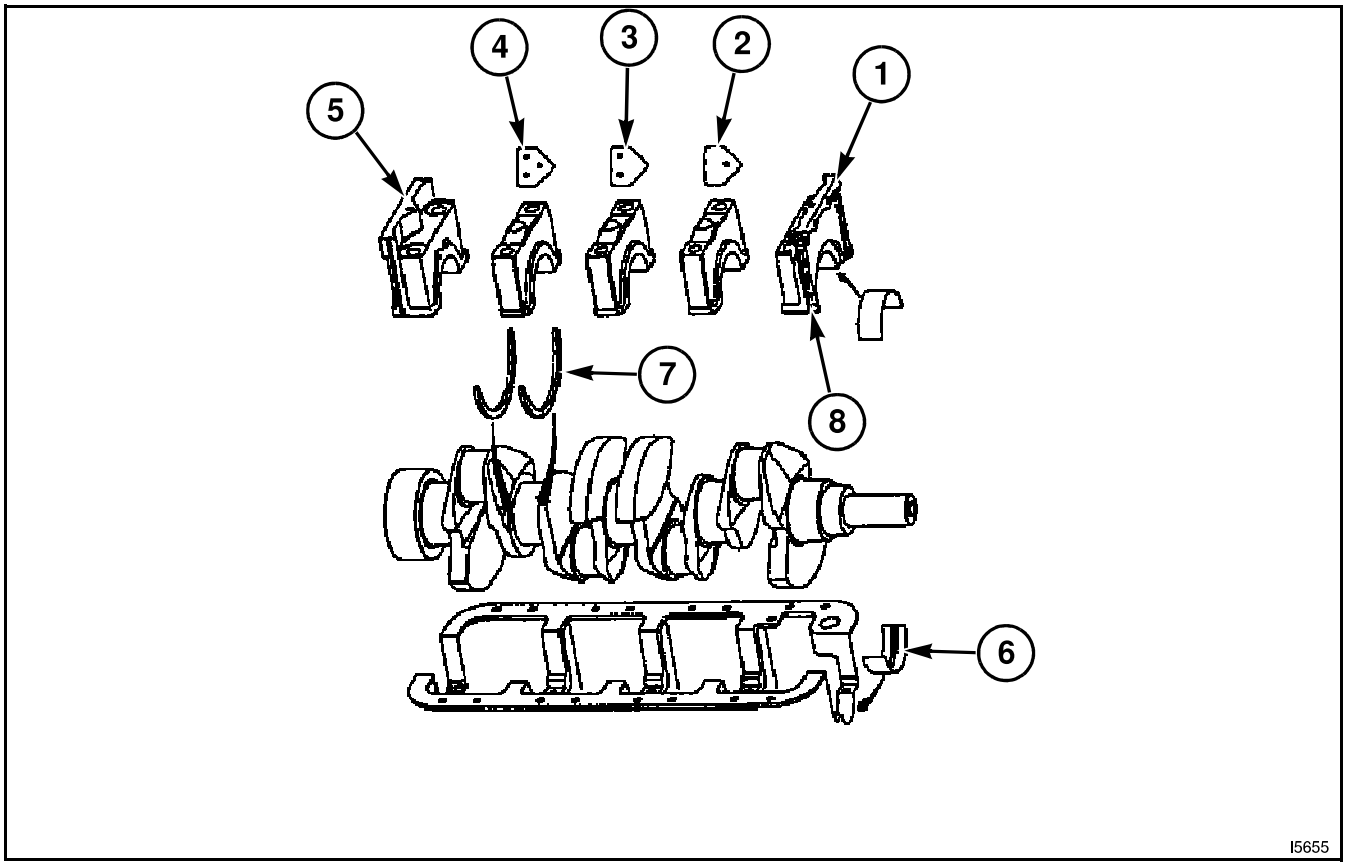

FIG. 84

FIG. 84: Install the bearings with the oil groove or oil hole in the cylinder block journals.

Install the crankshaft.

Apply oil to the journals. Install the thrust bearings.

Apply oil and install the bearing with the oil grooved side turned towards the contacting surface of the crankshaft as illustrated.

Install the thrust bearings to the No. 4 journal. Install the bearings to the bearing caps.

(1) Front Journal

(2) #2 Journal

(3) #3 Journal

(4) #4 Journal

(5) Rear Journal

(6) Bearing with Oil Groove

(7) Thrust washer with oil groove turned outward

(8) Apply Adhesive to both ends

Installation of Crankshaft Pulley and Water Pump

FIG. 110: Install the crankshaft pulley (1).

Apply adhesive to the contact surface between the washer and pulley to prevent leaks.

Tightening Torque	185 Nm (136.7 lbf ft)

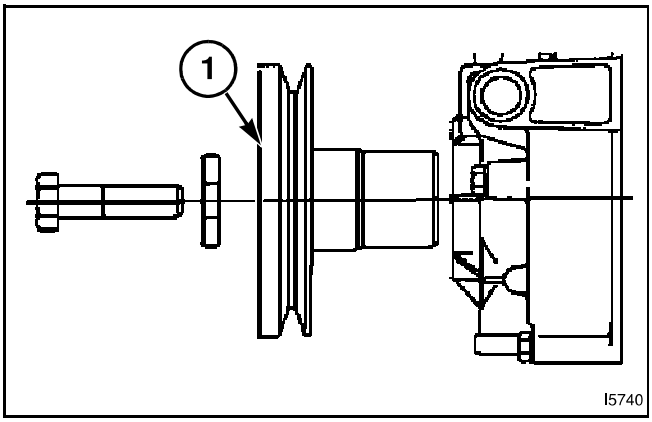

FIG. 110

FIG. 111: Secure the ring gear.

Align the marks on the crankshaft end and crankshaft pulley when installing the pulley. Install O-rings on both sides of the water pump spacer.

Apply grease to the O-ring ahead of time to prevent them from failing.

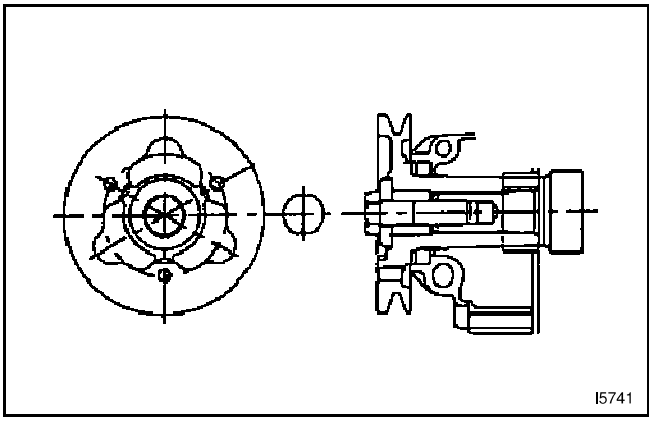

FIG. 111

FIG. 112: Install the spacer (1) and water pump .

Tightening Torque	18.6 Nm (13.7 lbf ft)

Take care not to allow the O-rings to dislodge from the groove.

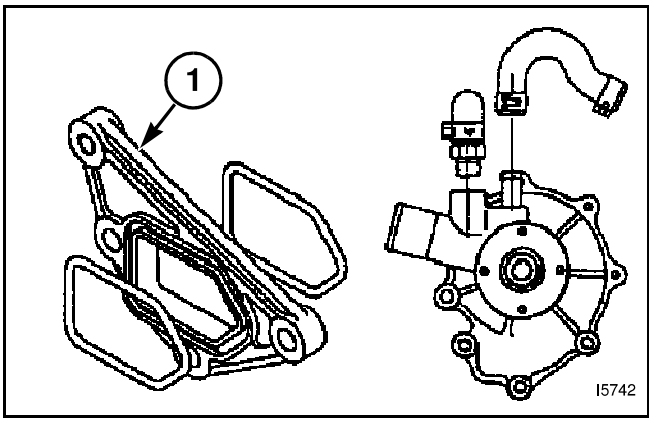

FIG. 112

NOTES

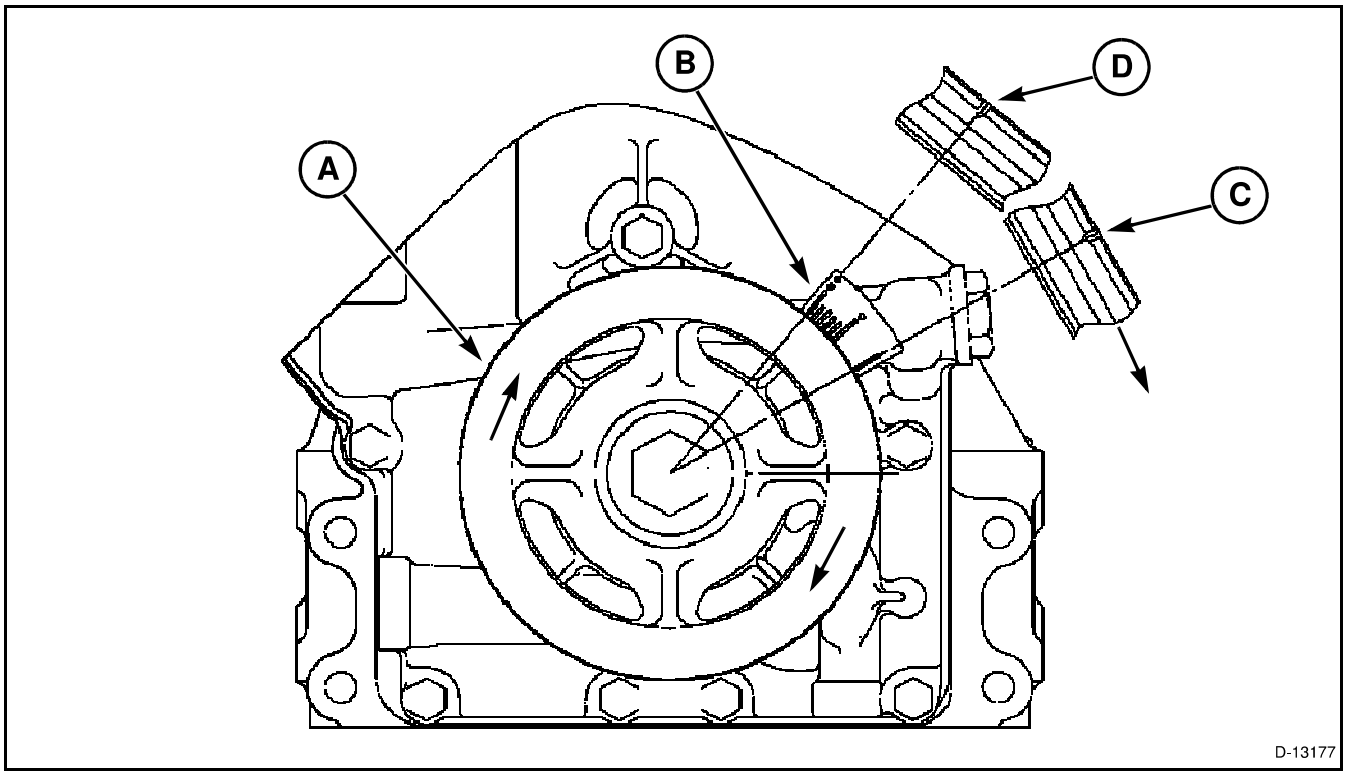

FIG. 141

FIG. 141: The crankshaft pulley, A, has one timing mark. The TDC mark and injection pump timing marks are on a scale, B, located on the timing cover. The TDC mark, C, is by itself on the scale. The correct injection timing mark, D, for the E4CG engine is identified with two dots on the scale. Turn the engine by hand and bring the piston on the Number 1 cylinder to TDC on compression stroke by aligning the marking on the crankshaft pulley with the TDC mark on the timing cover.

NOTE: The crankshaft must be rotated clockwise when establishing proper fuel injection timing. If the crankshaft is rotated counter clockwise, the measurement will be inaccurate.

NOTE: 1 degrees of crankshaft angle is approximetly 1 mm on the outer circumference of the crankshaft pulley and about 2.5 mm on the flywheel.

FIG. 142: After checking the fuel injection timing, remove the delivery valve holder, (1) and install the delivery valve spring (2) and stopper, (3) and re tighten the delivery holder.

Connect the injection pipe. Tightening torque:
14.6 to 24.4 Nm (10.8 to 18 lbf ft)

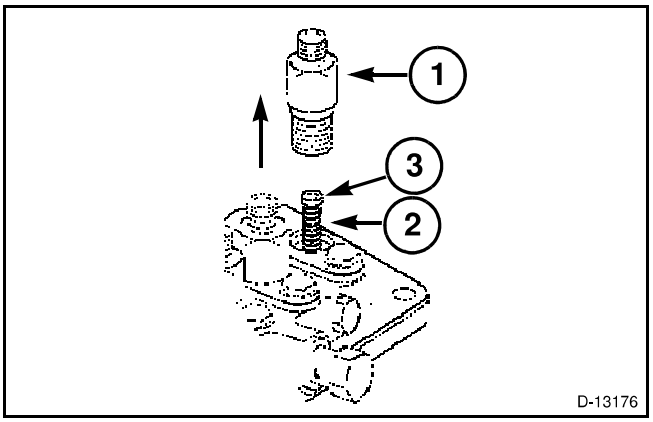

FIG. 142

Adjustment Of Injection Volume And Adjustment Conditions

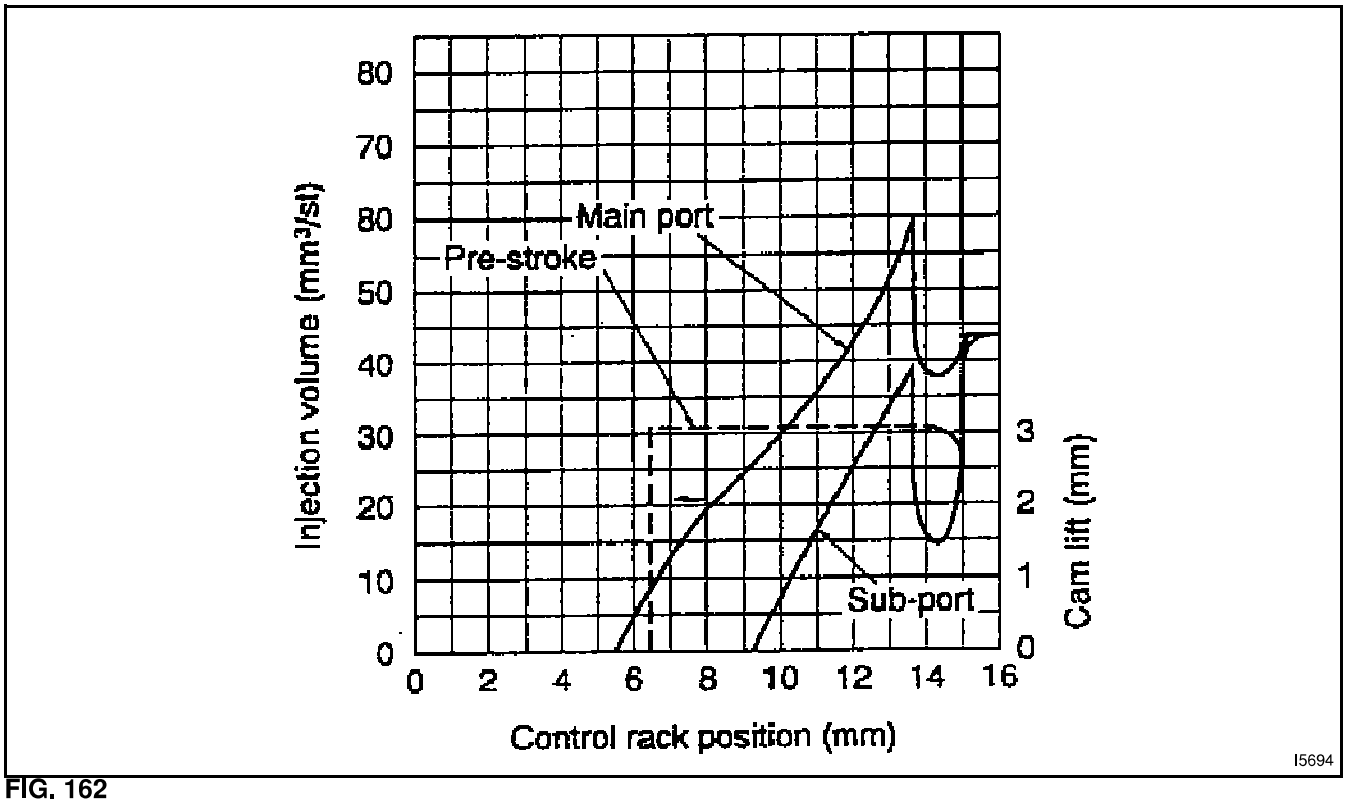

FIG. 162

FIG. 162: Injection volume

Applicable engine model	E4CG and E4DE
Injection volume for adjustment (Reference)	31 mm³/stroke
Pump speed	Np=1400 rpm (0.0036 cu in/stroke)
Rack position	10 mm (0.37 in)

NOTES

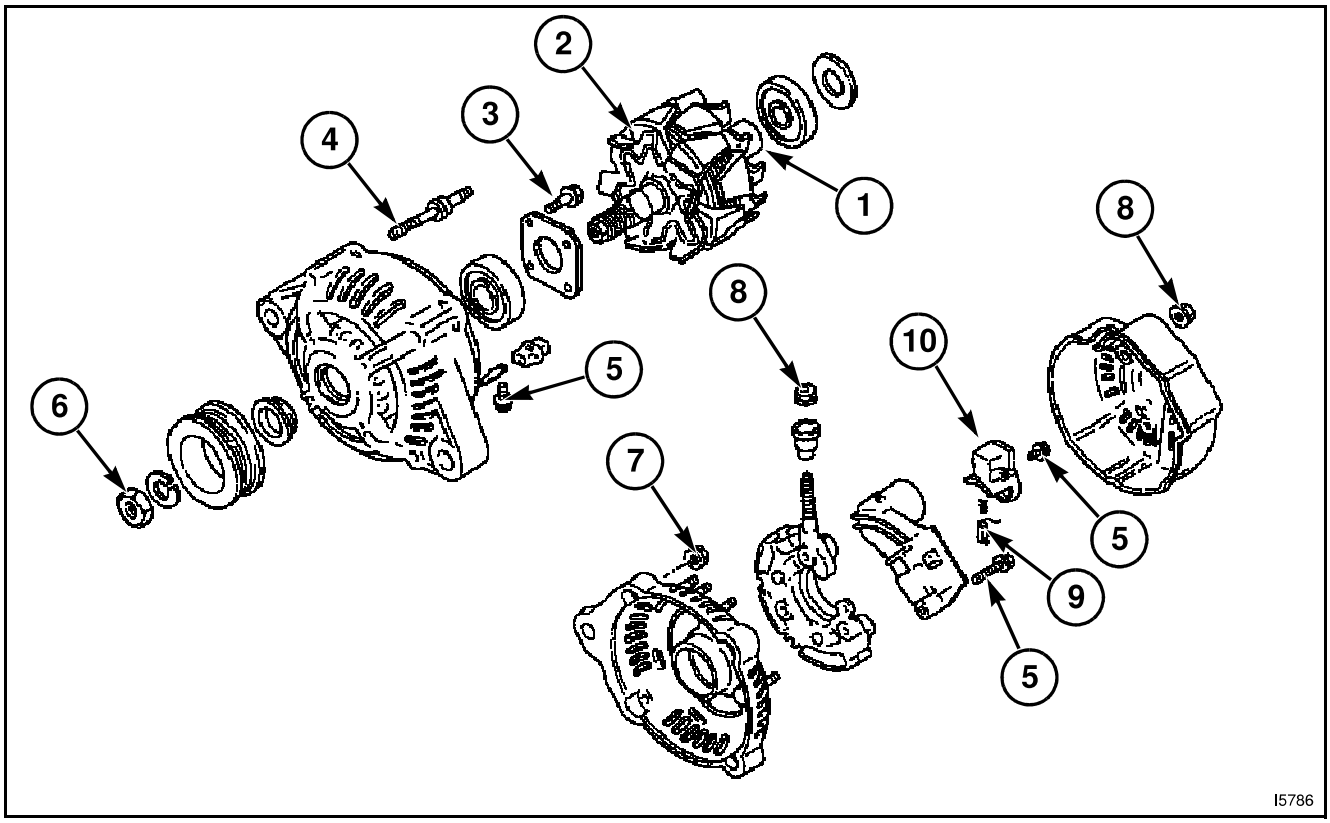

FIG. 198

FIG. 198: Service standards

NOTE: When assembling parts, do not allow any foreign matter to be trapped between parts.

(1) Slip Ring Diameter

Standard Value ..... 14.4 mm (0.567 in)

Usable Limit ..... 14.0 mm (0.552 in)

(2) Rotor Coil Resistance ..... ~2.9 ohm

(3) Tightening Torque ..... 2.03 to 2.60 Nm (18 to 23 lbf in)

(4) Tightening Torque ..... 10.8 to 14.2 Nm (8 to 10.5 lbf ft)

(5) Tightening Torque ..... 1.50 to 2.10 Nm (14 to 19 lbf in)

(6) Tightening Torque ..... 49.5 to 68.0 Nm (36.5 to 50 lbf ft)

(7) Tightening Torque ..... 4.0 to 6.80 Nm (35 to 52 lbf in)

(8) Tightening Torque ..... 3.50 to 5.60 Nm (31 to 43 lbf in)

(9) Protruding Brush Length

Standard Value ..... 10.5 mm (0.413 in)

Usable Limit ..... 4.5 mm (0.177 in)

(10) Soldering Thickness..... Less than 1mm (0.040 in)

FIG. 211: Inspection of the commutator.

Inspect the commutator surfaces for dirt, burning, damage, etc. Minor damage can be corrected with sandpaper of #400 or higher.

Inspect the commutator for run out with a dial gauge on a V block.

Commutator Run-Out	Standard Value	0.02 mm (.0008 in)
	Usable Limit	0.05 mm (.002 in)

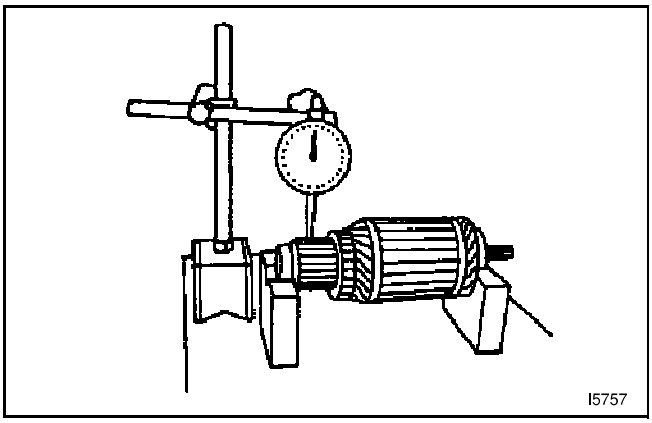

FIG. 211

FIG. 212: Measure the commutator diameter with vernier calipers.

Commutator Diameter	Standard Value	35 mm (1.38 in)
	Usable Limit	34 mm (1.34 in)

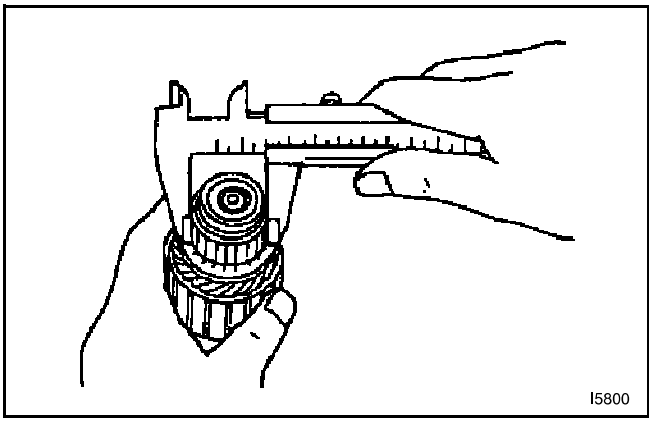

FIG. 212

FIG. 213: Measure mica depth against segment top.

Mica Depth	Standard Value	0.7 to 0.9 mm (.028 to .035 in)
	Usable Limit	0.2 mm (.008 in)

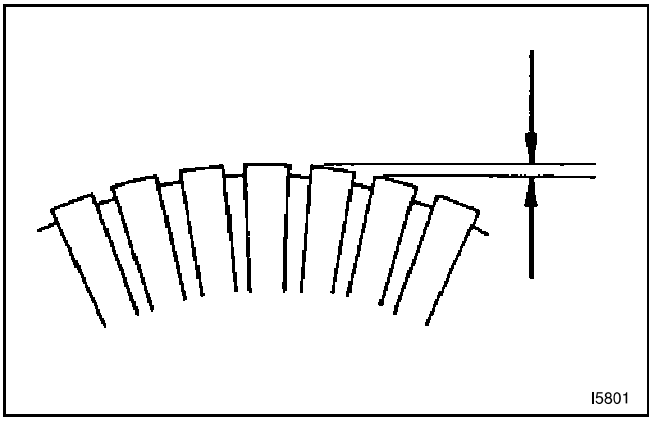

FIG. 213

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NOTES

FIG. 38: Drain oil from transmission.

Remove the hydraulic suction lines and filter head assembly (1).

FIG. 38

FIG. 39: Remove the line from the joystick manifold to the front of the lift cover.

FIG. 39

FIG. 40: disconnect the linkage at the 4wd shift arm (1). Seperate the left hand and right hand brake rods at the turnbuckle (2).

FIG. 40

FIG. 41: Remove the 4wd shift housing (1).

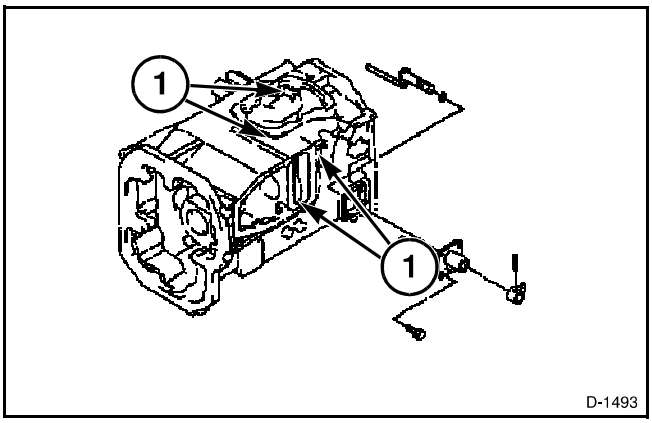


FIG. 41

FIG. 63: Remove the sway bar and the lower 3 point arms.

FIG. 63

FIG. 64: Cab only - Remove the appropriate axle bracket (1) from the axle housing.

NOTE: If both axles are being removed at the same time, insert lifting straps at the rear upper corners of the cab and support the rear of the cab with a suitable overhead hoist.

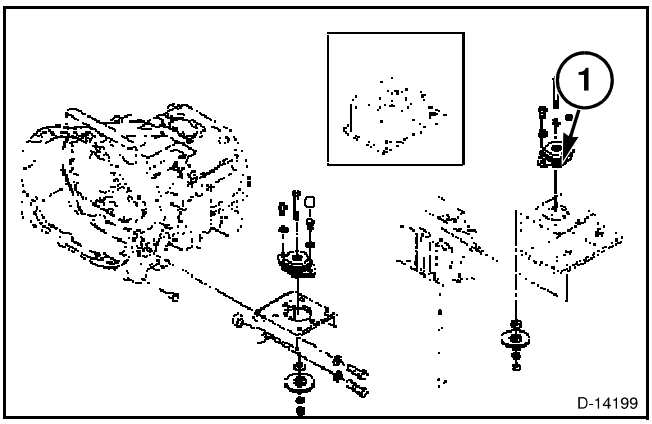


FIG. 64

FIG. 65: Platform only - Insert lifting straps thru the handle on the fenders. Support the rear of the platform with a suitable overhead hoist and remove the ROPS structure from the rear axle housing.

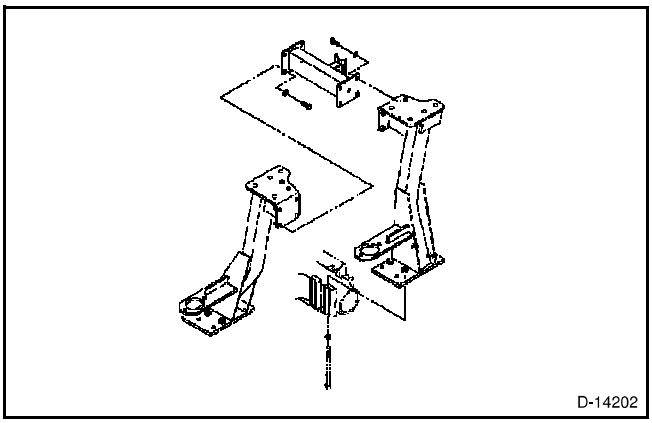


FIG. 65

FIG. 66: Remove the bolts securing the outer axle housing to the inner axle housing. Remove the outer axle housing and rear axle as an assembly.

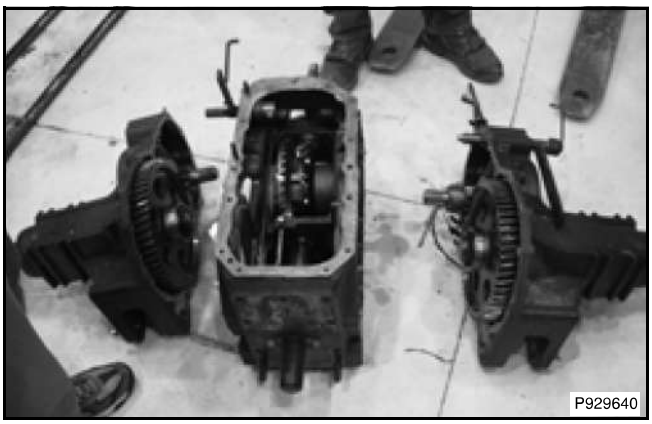


FIG. 66

FIG. 89: Remove the bolts (1) from the hood support.

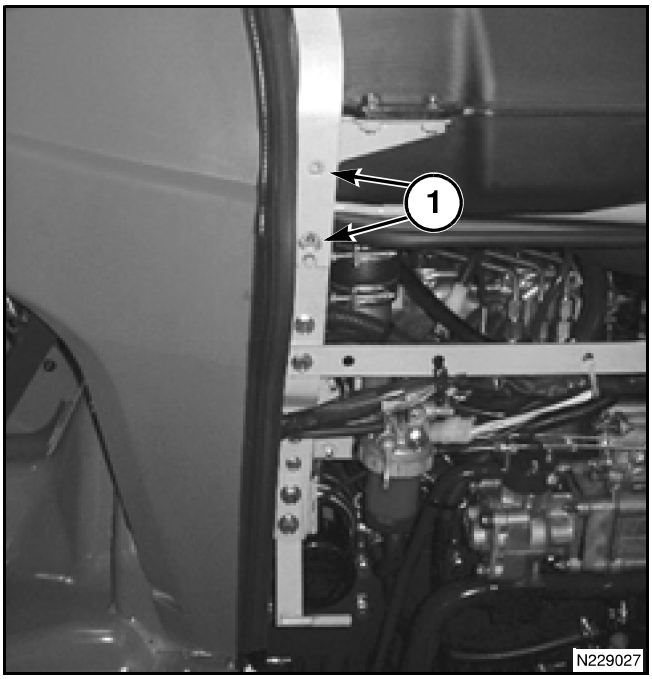


FIG. 89

FIG. 90: Remove the bolts (1) from the hood support.

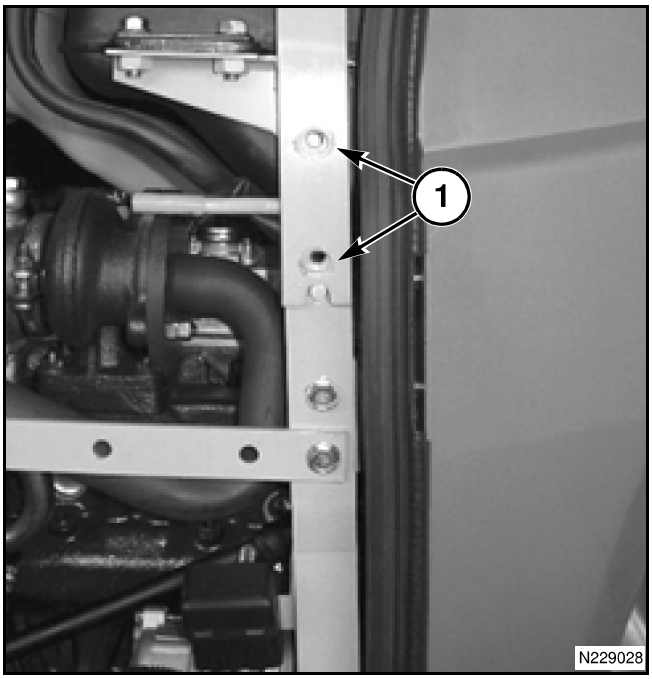


FIG. 90

FIG. 119: Unbolt the fuel filter bracket (1) from the hood support and lay the filter assembly to one side. Remove the rear hood frame (2) with out removing the fuel tank.

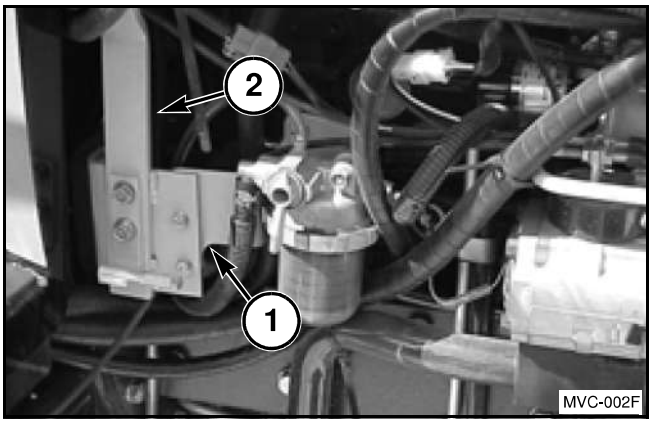


FIG. 119

FIG. 120: Jack up the rear of the tractor and support the rear of the tractor with suitable jack stands. Remove both rear tires.

Remove the inner fender panels.

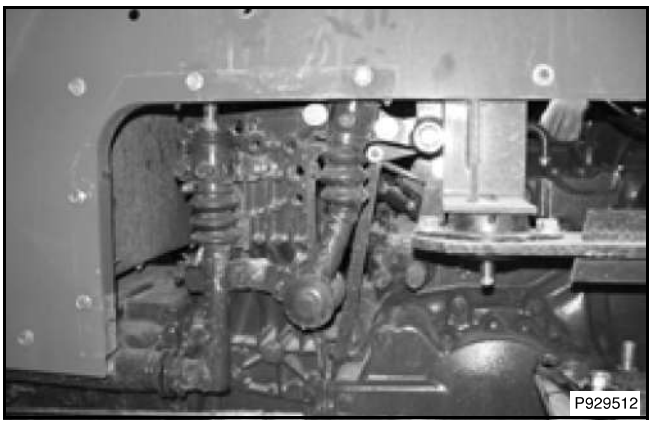


FIG. 120

FIG. 121: Remove for the diff lock pedal (1). Remove the 3 point slow return knob and shaft (2). Remove the locking bolt on the tube and tube to remove shaft.

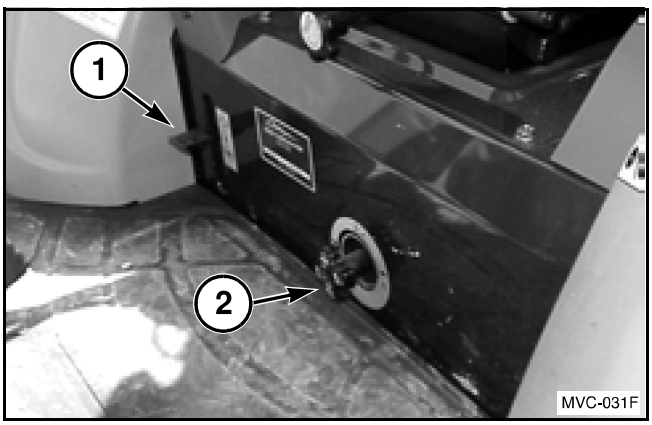


FIG. 121

FIG. 122: Remove for the diff lock pedal. Remove the 3 point slow return knob and shaft. Remove the locking bolt on the tube and tube to remove shaft.

FIG. 122

NOTES

ROPS

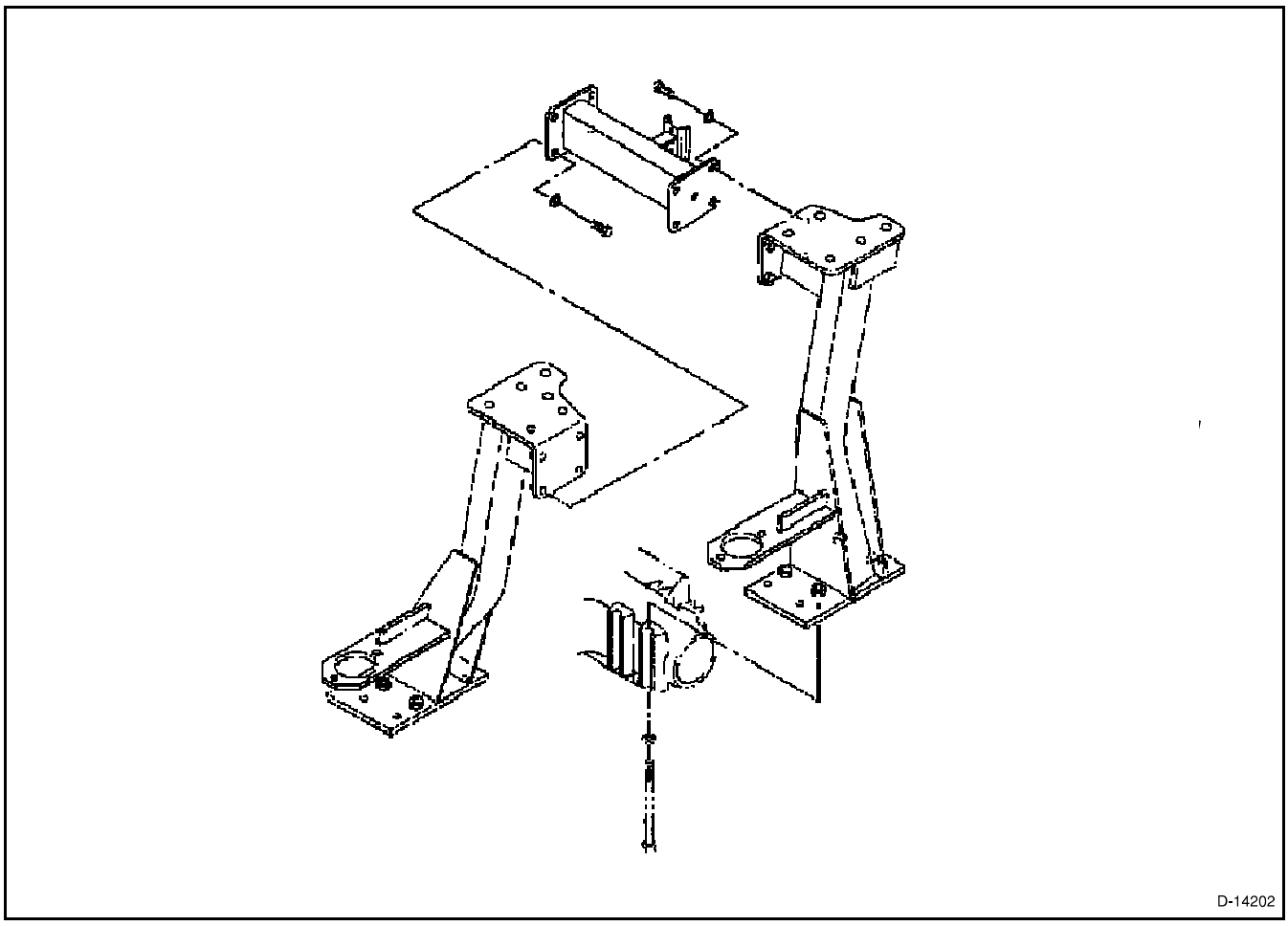


FIG. 171

FIG. 171: Remove hardware as required to assemble the ROPS structure. Assemble in reverse order. Torque value for the M14 bolts is 250 Nm (185 lbf ft). Adjust the pivot bolt (1) to reduce vibration when the ROPS is in the upright position.

FIG. 172: Remove hardware as required to assemble the ROPS structure. Assemble in reverse order. Torque value for the M14 bolts is 250 Nm (185 lbf ft). Adjust the pivot bolt (1) to reduce vibration when the ROPS is in the upright position.

WARNING: Never weld on or drill into any portion of the ROPS structure. This will compromise the integrity of the ROPS.

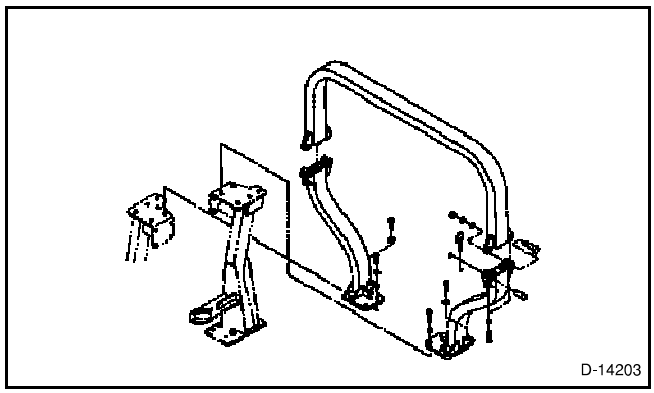


FIG. 172

NOTES

ADJUSTMENT OF CLUTCH PEDAL

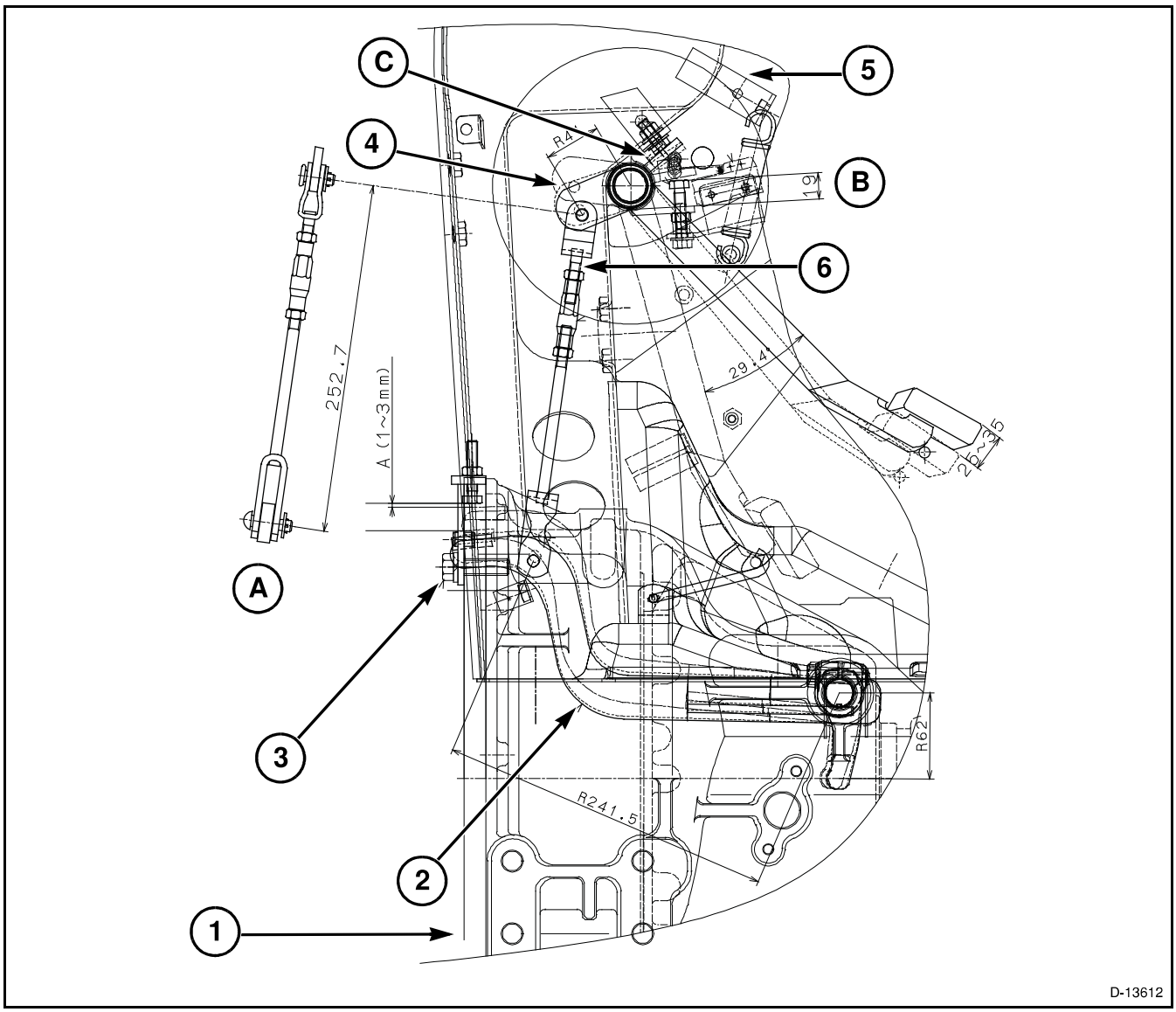


FIG. 8

FIG. 8: Clutch Pedal

(A) Adjust the stopper bolt when the bar comp is held by hand. The length should be 21 to 23 mm (0.83 to 0.91 in).

(B) Pedal free play should be 25 to 35 mm (0.98 to 1.38 in).

(C) Adjust the stopper bolt when clutch pedal is stepped fully, the length should be 1 to 3 mm (0.039 to 0.118 in).

(1) Engine Rear Plate

(2) Bar COMP

(3) Tighten with rear plate and transmission case.

(4) The limit switch should be off when the pedal backs 25 to 35 mm (0.98 to 1.38 in) from being fully depressed,

(5) Limit Switch

NOTE: The IQ model does not have a limit switch.

NOTES

Precautions for Assembly

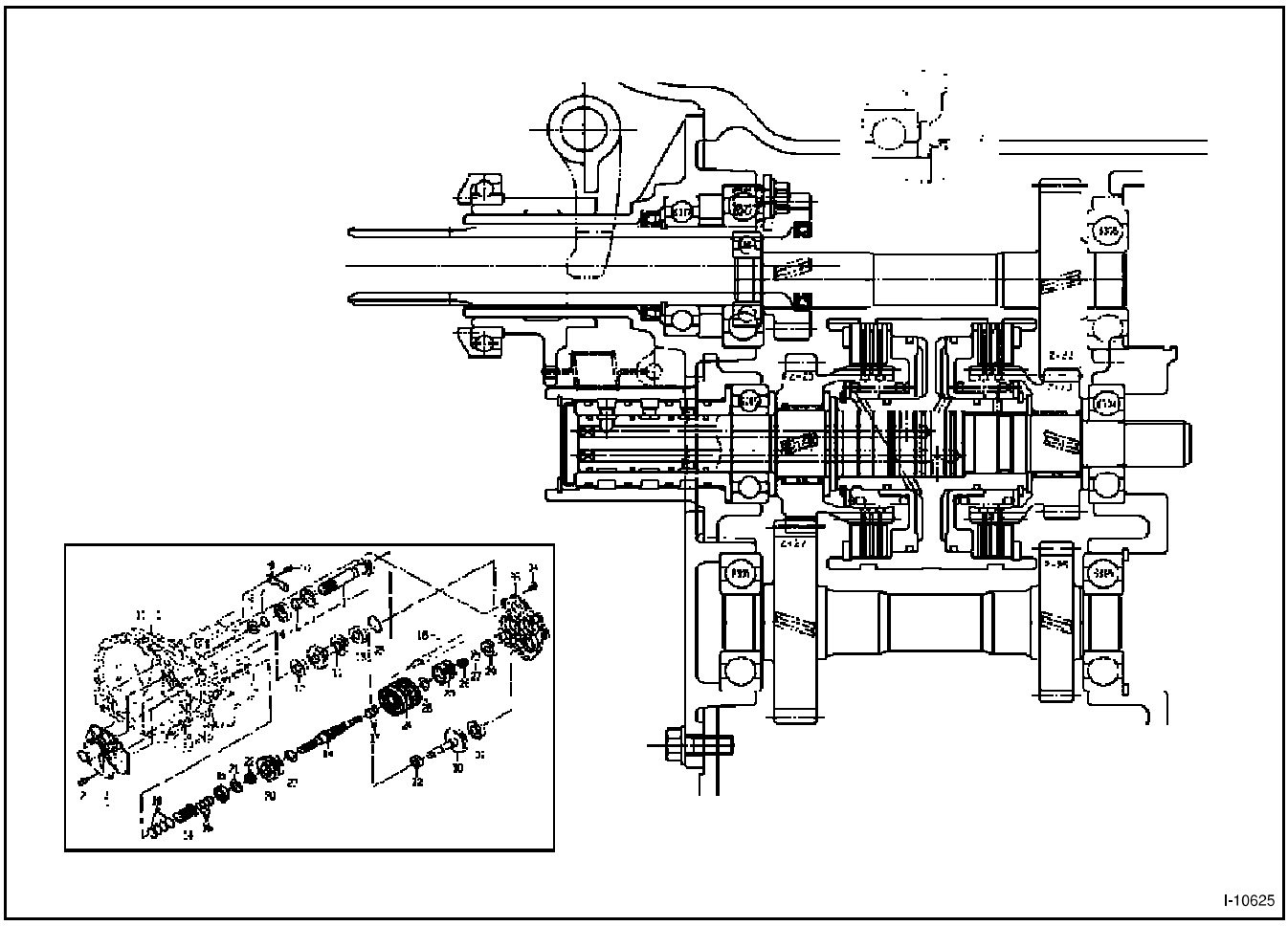


FIG. 6

FIG. 6: Power Shift and Power Shuttle Assembly Precautions

Seal Ring check for any unlinked parts and damages. Apply grease.

O-ring check for any unlinked parts and damages. Apply grease.

Attention: Direction of washer

The clutch case is made of die-cast aluminum. Handle the clutch case with care and do not to damage or deform it.

FIG. 25: Install the main change gear clusters and rear support as an assembly.

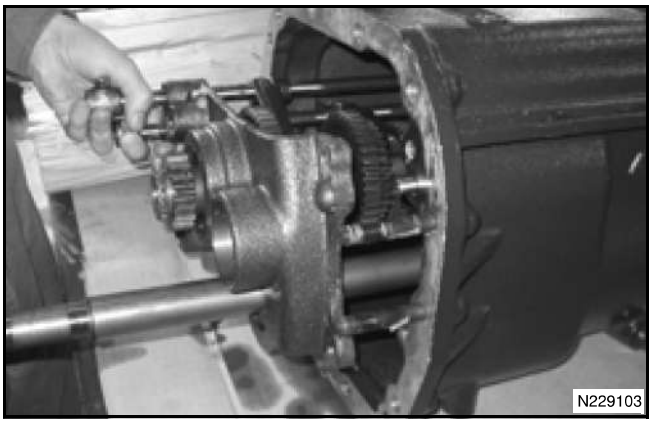


FIG. 25

Input Housing

FIG. 26: Separate transmission between the engine and the front housing.

Remove the wire (1).

Thread a bolt into the pin (2) and attach a slide hammer to the bolt.

Remove the pin.

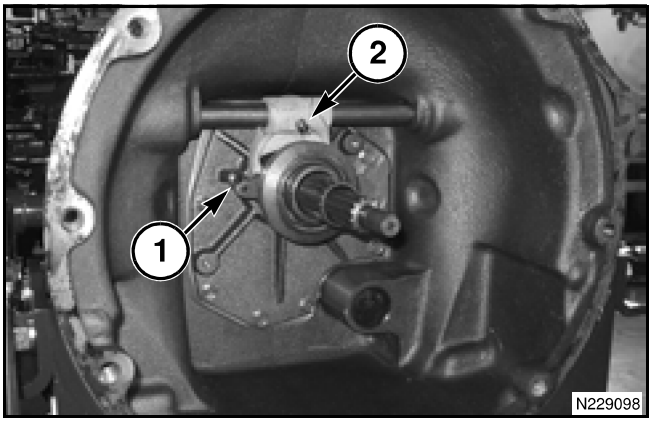


FIG. 26

FIG. 27: Thread two bolts into the input cover and remove the input cover.

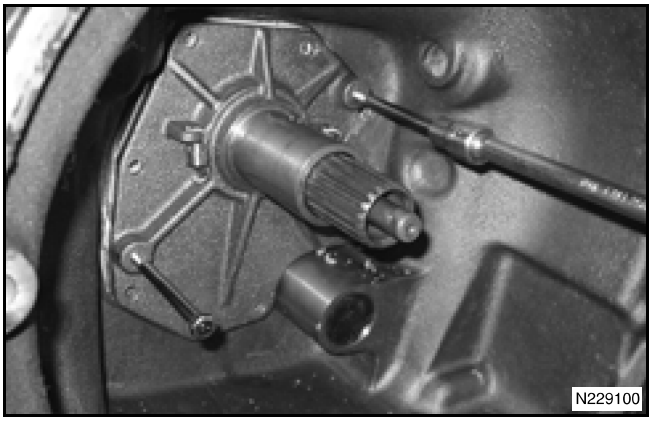


FIG. 27

NOTES

Left-Hand Side

Power Shuttle Valve

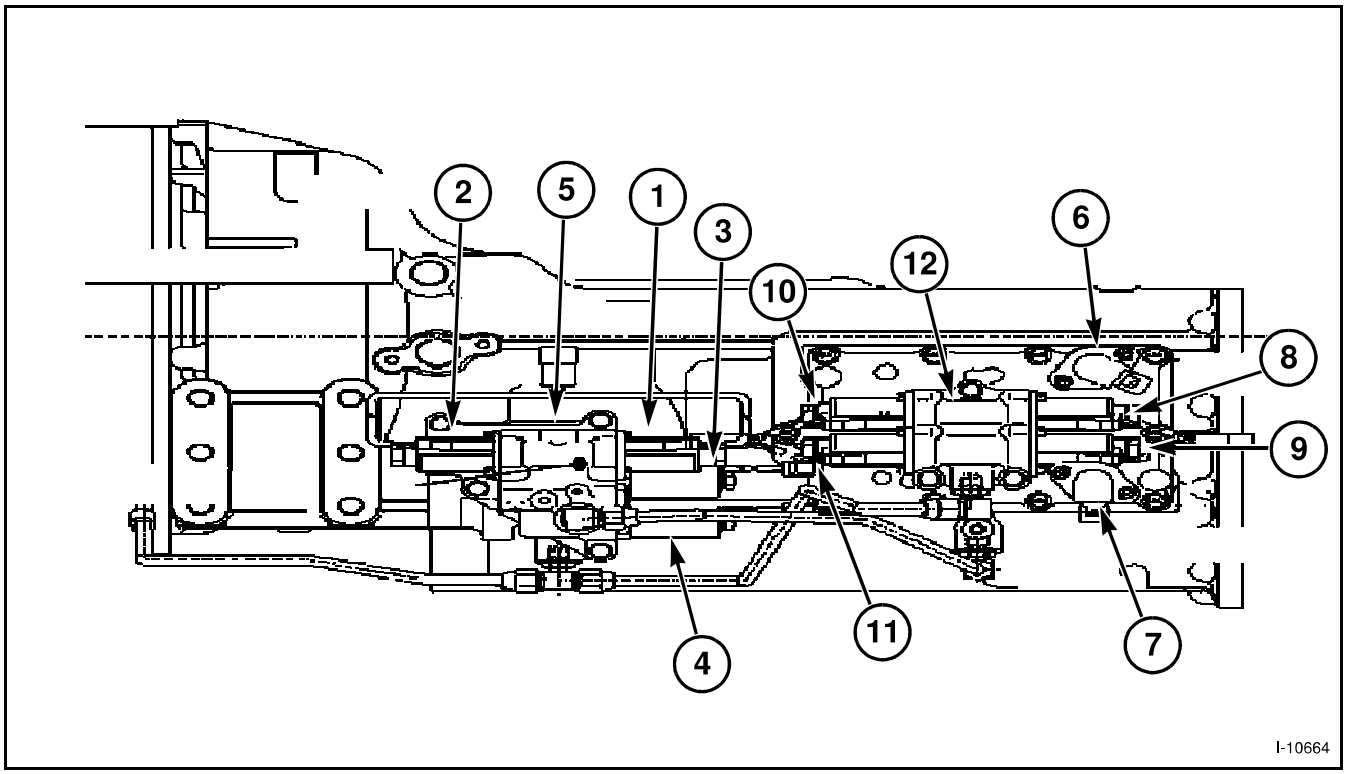


FIG. 42

FIG. 42: Parts located on the left-hand transmission case.

	Part	Function
1	Power Shuttle Forward Solenoid	Supplies oil to the forward clutch.
2	Power Shuttle Reverse Solenoid	Supplies oil to the reverse clutch.
3	Power Shuttle Control Solenoid	Controls pressure to the forward and reverse clutches.
4	PTO Shuttle Control Solenoid	Controls pressure to the PTO clutch.
5	Power Shuttle Valve	Directed by the ECU to control forward and reverse clutch pressure. The power shuttle contains PTO proportional valve control PTO clutch pressure.
6	Shift Position - 1st and 2nd Gear	Potentiometer which detects position of shifter.
7	Shift Position Sensor - 3rd and 4th Gear	Potentiometer which detects position of shifter.
8	1st Gear Shift Solenoid	Shifts transmission gear into 1st gear position.
9	2nd Gear Shift Solenoid	Shifts transmission gear into 2nd gear position.
10	3rd Gear Solenoid	Shifts transmission gear into 3rd gear position.
11	4th Gear Shift Solenoid	Shifts transmission gear into 4th gear position.
12	Gear Shift Change Valve	Changes gears to selected speed by sending oil to the appropriate gear shift change pistons.

Adjustment operation of the main shift sensor

FIG. 60:

1. Remove the check fuse (1) (lower right side) in the fuse box. Fuse box is located above break pedals.
2. Start the engine of the tractor, while pushing simultaneously the shiftbuttons (+) and (-) on the grip part of the sub-gear shift.
3. When the engine starts, release hand from the shift buttons (+) and (-).

When the hand is lifted, transmission enters automatic adjustment mode, a buzzer will sound once and automatic adjustment will start.

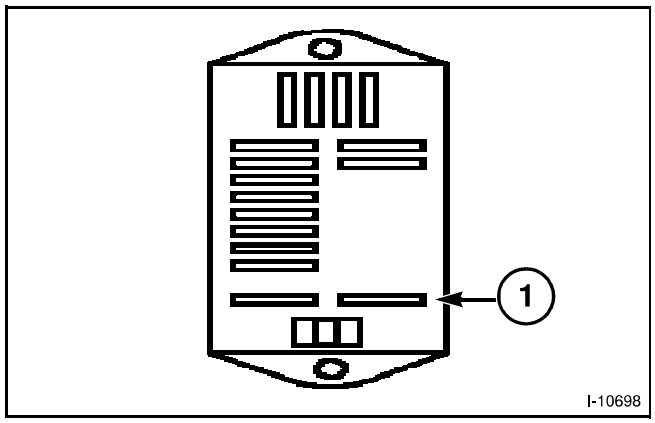


FIG. 60

Automatic adjustment operation

The automatic adjustment operation shall be performed as follows:

Carrie out every second in order of 1st 2nd neutral of [1st 2nd] 3rd [3rd 4th], and repeat this operation 3(three) times.

FIG. 61: The tractor will check the valve of gear sensors 1 to 4 and repeat this operation three times.

At this time, the gear shift position which the solenoid outputs is displayed on the screenof the digital panel.

When the automatic adjustment operation is completed, a buzzer output will be performed and adjustment operation will be completed. (Time required for automatic adjustment is about 20 seconds.)

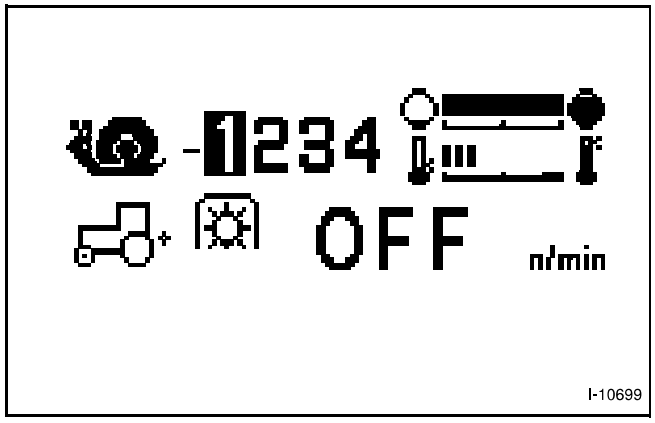


FIG. 61

*A buzzer output sounds twice with beep.

This shows that adjustment was completed normally.

* A buzzer output sounds for 5 seconds with prolonged sound beep.

This shows that adjustments are abnormal (not adjusted correctly).

Judgment values - Judging if the adjustment valve is normal or abnormal.

When a sensor is adjusted, the judgment on a normality of the adjustment value is performed based on the range from which the sensor changed.

*The judgment of the adjustment value for 1st gear shift: (The adjustment value for 1st gear shift – the value in neutral position of (1st - 2nd) gear shift)>140

*The judgment of the adjustment value for 2nd gear shift: (the value in neutral position of (1st - 2nd) gear shift - the adjustment value for 2nd gear shift)>158

*The judgment of the adjustment value for 3rd gear shift: (The adjustment value for 3rd gear shift - the value in neutral position of (3rd - 4th) gear shift)>147

*The judgment of the adjustment value for 2nd gear shift: (The value in neutral position of (3rd - 4th) gear shift - the adjustment value for 4th gear shift)>169

INSTALLATION OF RANGE GEAR SHIFT

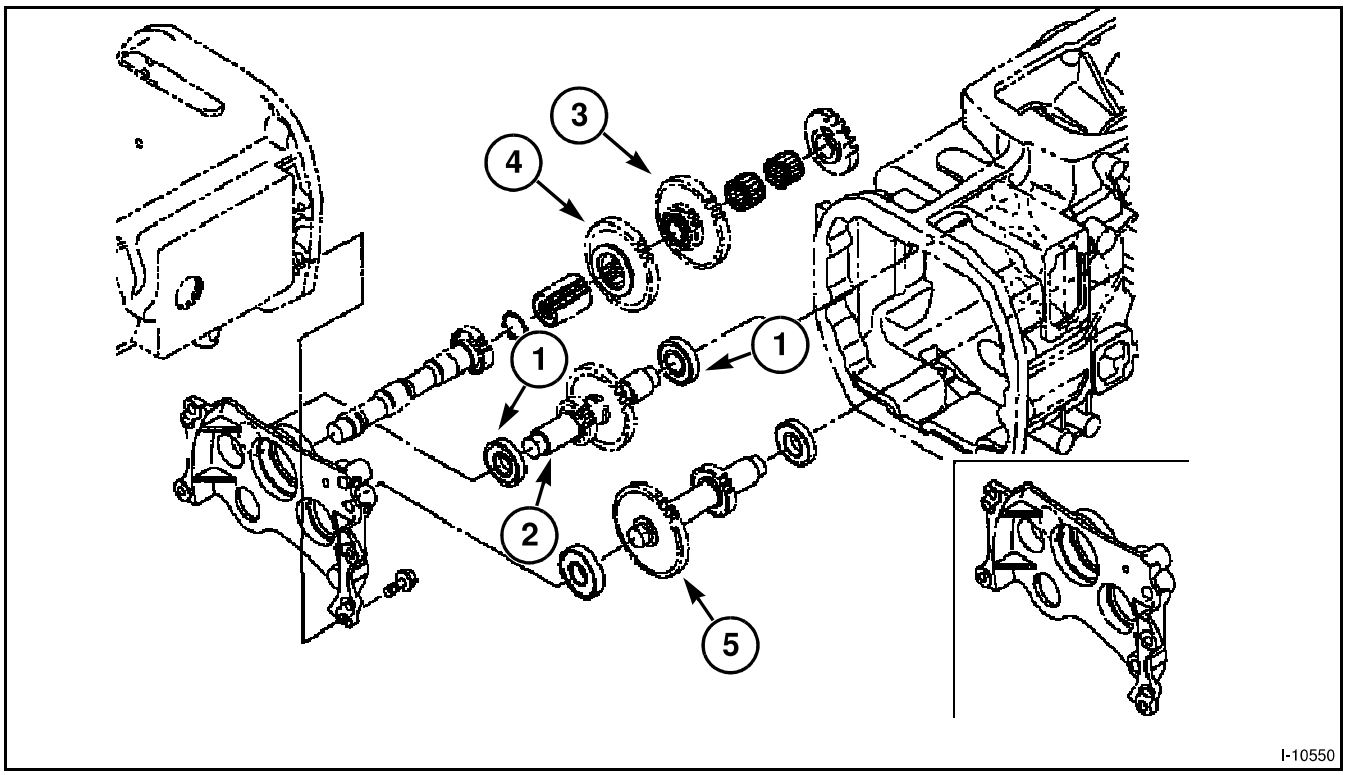


FIG. 69

FIG. 69: Power Shift and Power Shuttle Assembly

Install the bearing (1) to Counter Gear (2). Assemble gear (3). The assemble Counter Gear (2) with bearing (1).

Assemble change gear (4) so that groove of shifter faces to front side.

Assemble the shift fork and shift rail. Then assemble the counter gear (5).

IMPORTANT: Make sure not to disengage the PTO clutch brake tab from the groove in the housing.

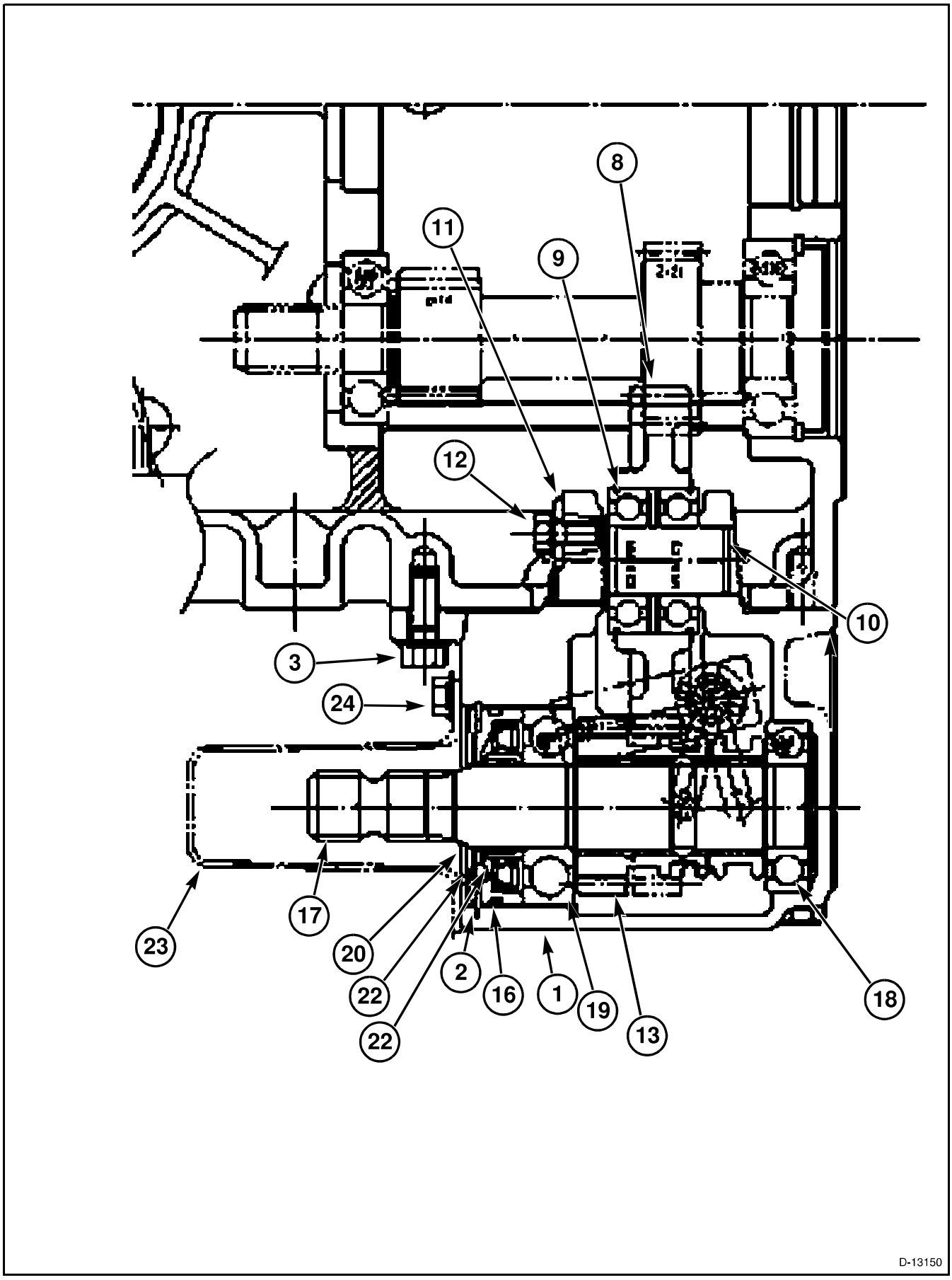


FIG. 80

NOTES

Overhaul

Remove ring gear and pinion.

FIG. 17: Use a small chisel in keyway to remove locking crimps (2) on pinion nut, and remove nut (1).

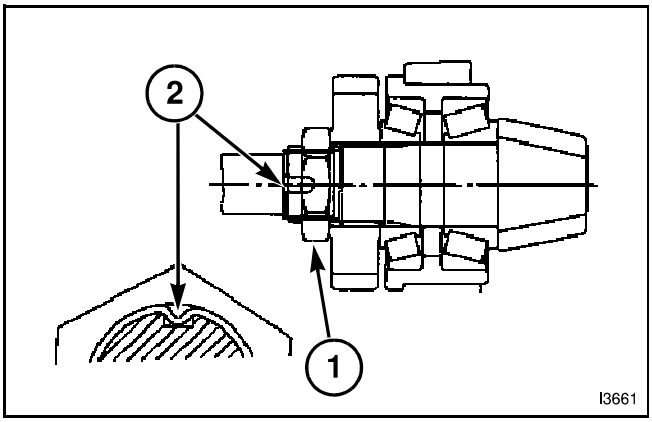


FIG. 17

FIG. 18: Push drive pinion (1) out of bearing retainer using a press.

Use a special tool to remove bearing.

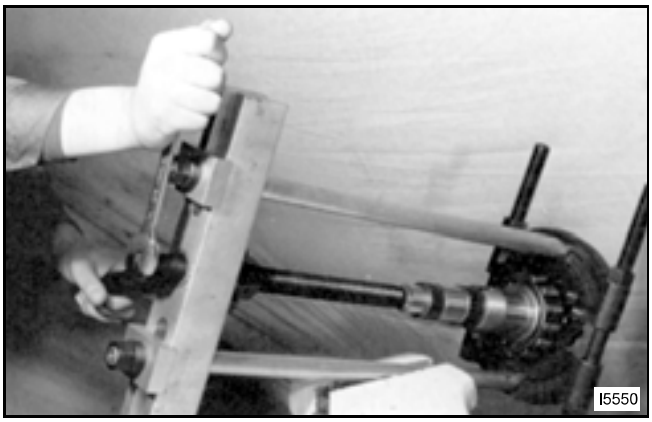


FIG. 18

Disassembly, Inspection, and Adjustment

Disassembly

FIG. 37: Remove the rear axle housing from the rear transmission case.

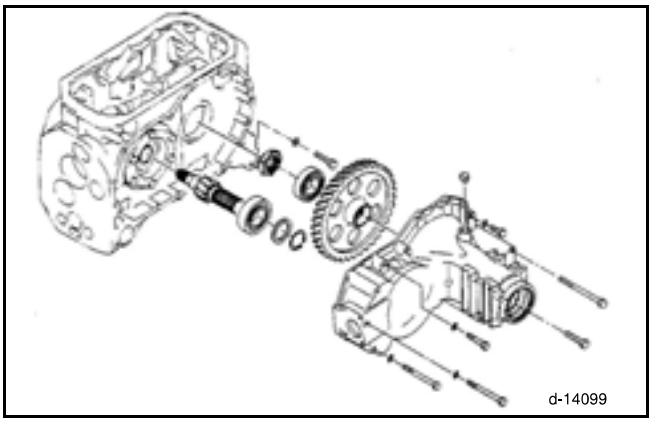


FIG. 37

FIG. 38: Remove the brake discs, the separator plates and the brake actuator from the rear axle housing.

NOTE: When replacing the brake discs, make sure to immerse the new disc in oil.

When installing the brake discs into the transmission case, be sure to check the steel ball.

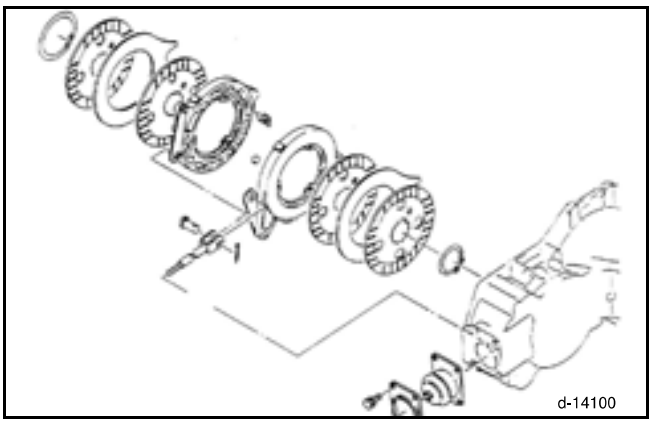


FIG. 38

Inspection

Check the brake disc for damage such as abnormal wear, cracks, etc., and replace if necessary.

NOTES

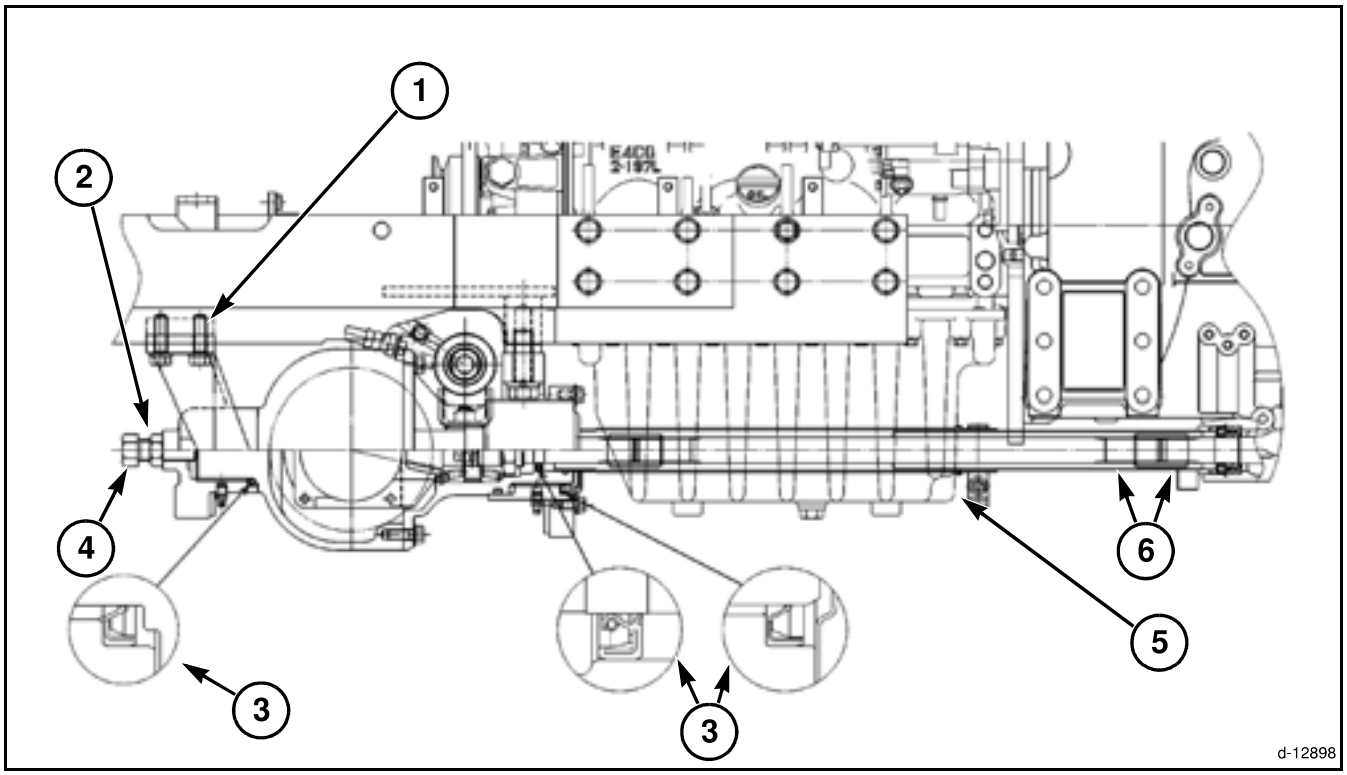


FIG. 12

FIG. 12: Front Axle: Precautions for assembly.

(1) Use loctite®

(2) Tightening Torque 118 to 137 Nm (87 to 101 lbf ft)

(3) Note The Installed Direction Of The Seal

(4) Set End Play to 0.2 mm (0.008 in)

(5) Grease

(6) Apply grease to coupler

WHEEL SHAFT SEAL OR COVER

Removal and Installation

FIG. 29: Block front axle up on side where cover will be removed.

Remove wheel and tire.

Position an oil pan under housing and remove drain plug to drain oil.

Remove cover bolts (1) and remove cover with axle hub (2) gear (3) and bearing (4).

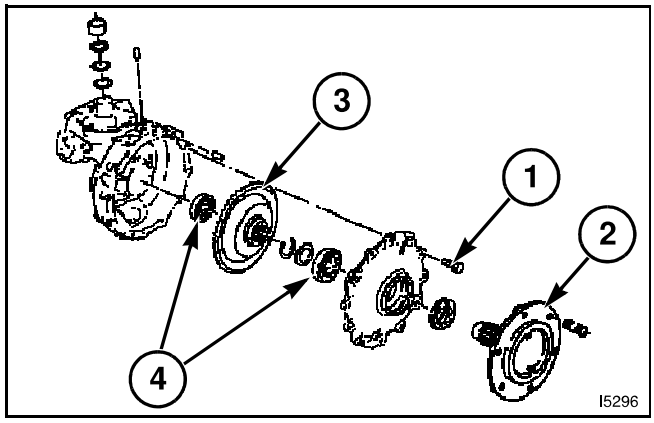


FIG. 29

FIG. 30: Use a suitable puller to remove gear (2) with bearing (1).

Remove split ring (3) washer (4) bearing (5) cover (6) and seal (7).

NOTE: Round one piece split ring is difficult to remove. Use snap ring pliers to spread it out until one end can be pried up out of groove. The ring can then be spiraled out with a pry bar.

This round one-piece split ring must be discarded and a new one installed on reassembly.

The two piece split ring will replace the round, one-piece split ring (3).

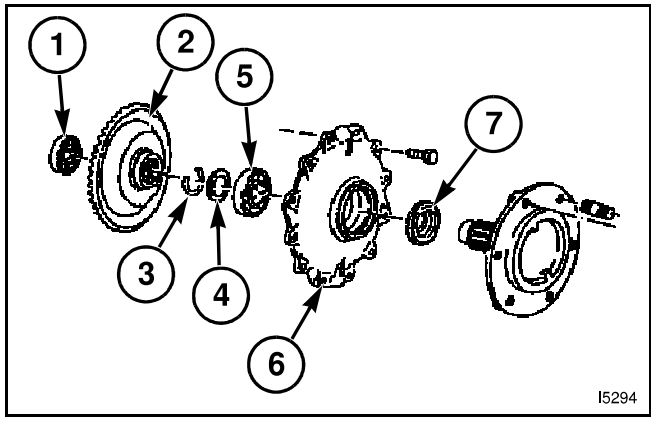


FIG. 30

FIG. 31: Check bearings and replace if they have excessive play or are rough.

Install a suitable sealant on outside of seal housing and install seal (1).

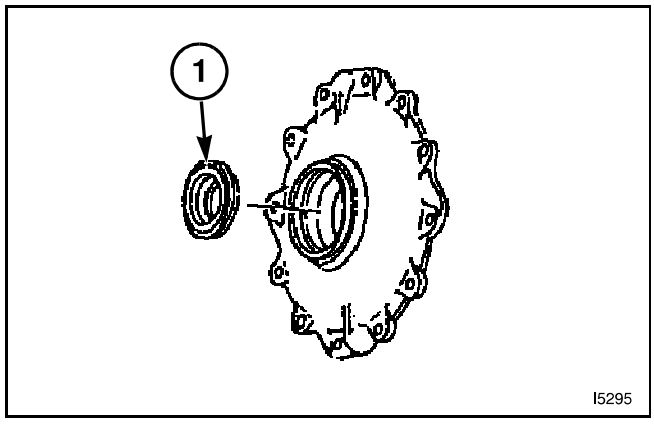


FIG. 31

STEERING FREE-PLAY

FIG. 50: Steering should be checked for excessive looseness, as indicated by steering wheel free-play. Maximum free-play (1) is approximately 30 mm (1.25 in) when measured at outside of steering wheel rim.

Excessive free-play can be caused by:

- Loose or worn ball joints.
- Worn or damaged steering column shaft/universal joints.
- Air in steering system.
- Worn or damaged power steering unit.

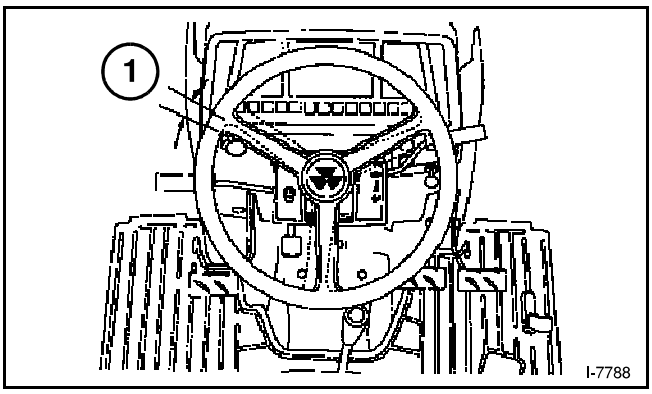


FIG. 50

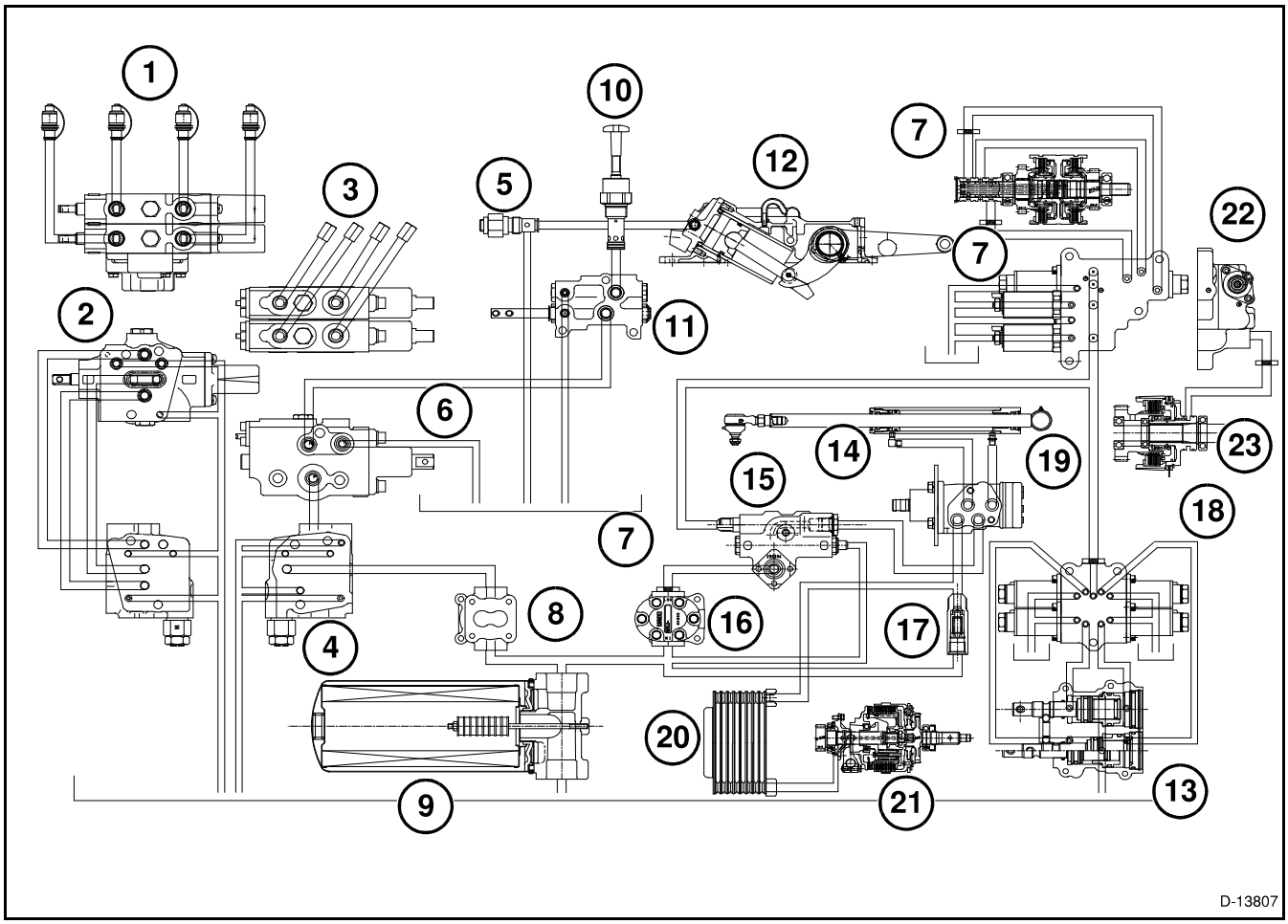


FIG. 4

FIG. 4: Hydraulic Diagram Q - Type

(1) To Front Loader Cylinder
(2) Joystick Valve
(3) To External Auxiliary Cylinder
(4) Main Relief Valve
(5) Safety Valve
(6) Auxiliary Hydraulics Control Valve
(7) L / C Filter
(8) Main Pump
(9) Suction Filter
(10) Slow Return Valve
(11) Main Control Valve
(12) Main Cylinder
(13) Push - Pull Cylinder for Shifting Gear
(14) Power Steering Cylinder
(15) Reduce Valve
(16) Sub Pump
(17) Relief Valve
(18) Valve for Gear Shift
(19) Orbit Roll
(20) Oil Cooler
(21) Main Clutch
(22) Valve for Power Shuttle and PTO
(23) PTO Clutch

COMPONENT LOCATION

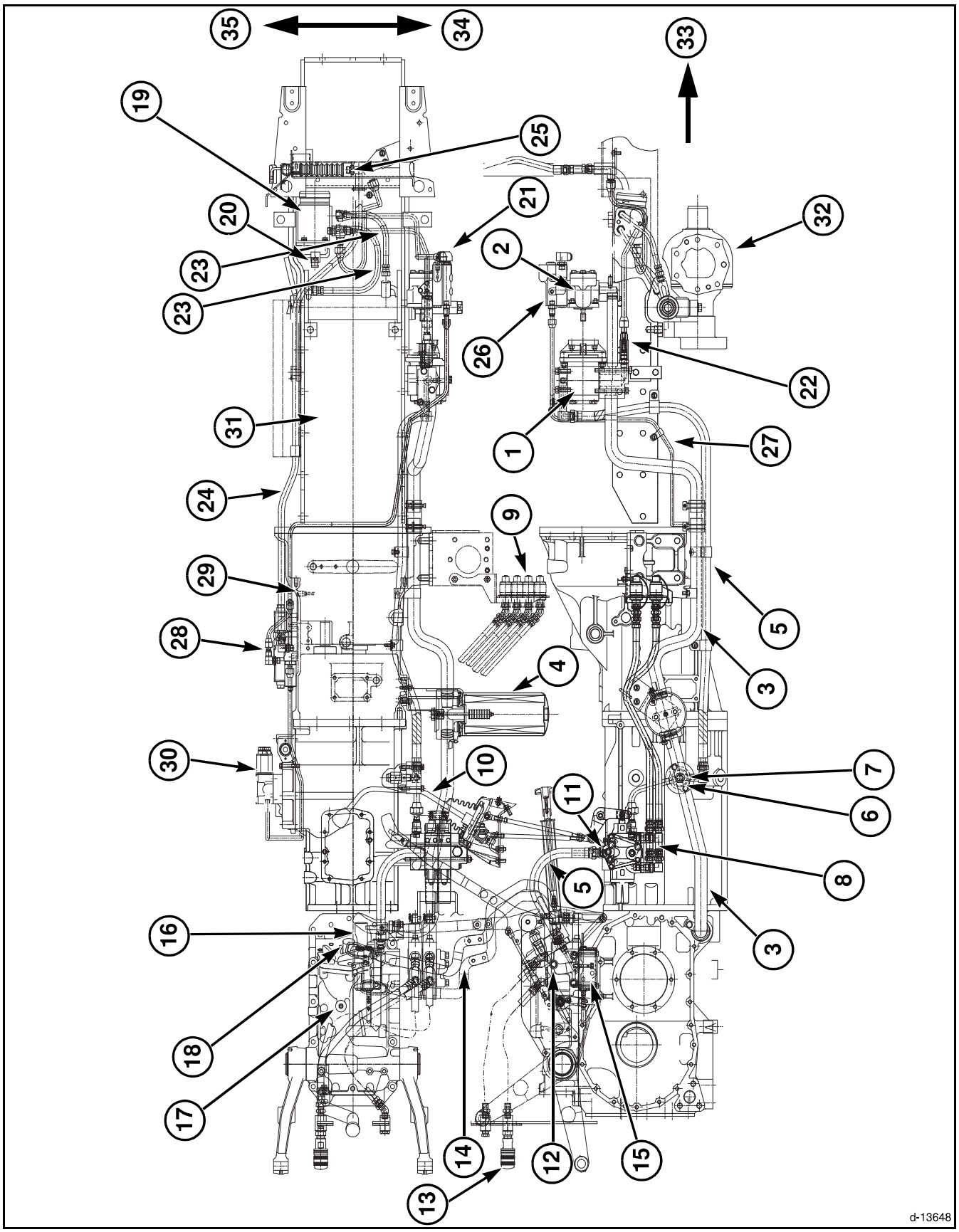


FIG. 10

MAIN CYLINDER

Parts and Hydraulic Diagram

FIG. 26: Main Cylinder

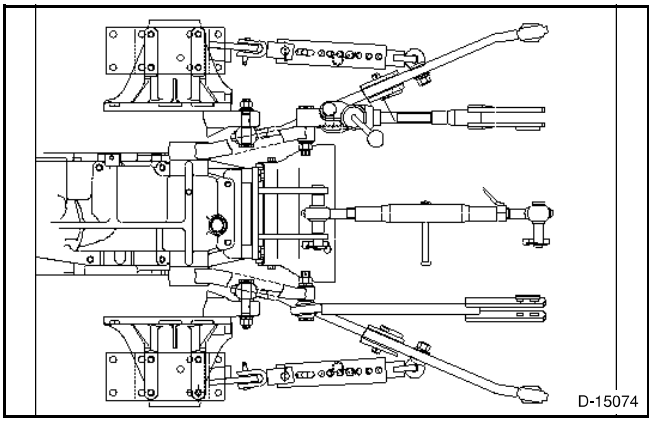


FIG. 26

FIG. 27: Cylinder Case Assembly (Backside)

(1) Main Control Valve

(2) Link

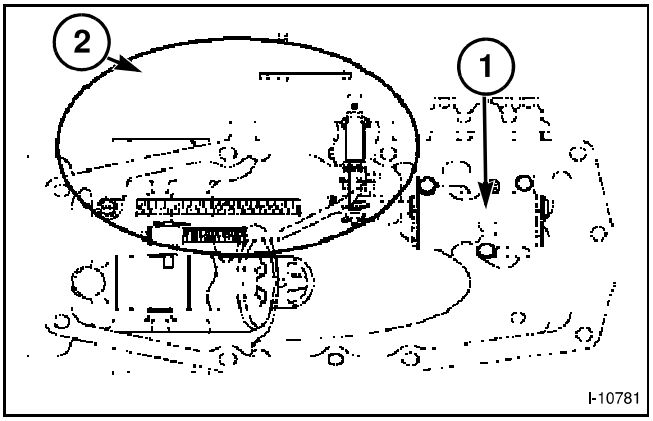


FIG. 27

FIG. 28: Main Cylinder Circuit

(1) Safety Valve

(2) 3P Linkage (Lift crank etc.)

(3) Main Cylinder

(4) Slow Return Valve

(5) Main Control Valve

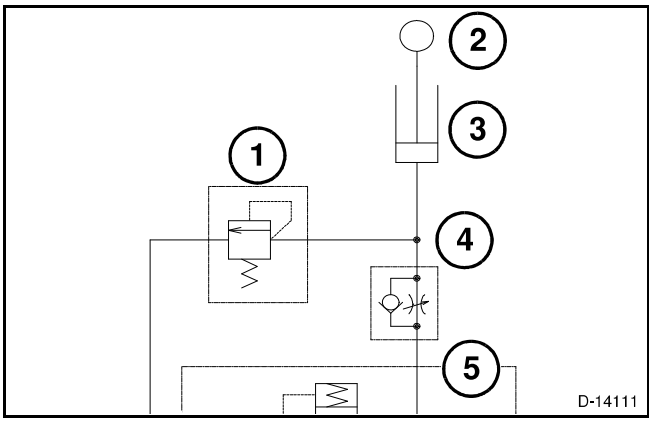


FIG. 28

Operation Mechanism

Fluid from reduce valve goes to pressure proportional valve through orifice.

Fluid from orifice is controlled by pressure proportional valve and goes to PTO clutch. There is a L/C filter in hydraulic circuit of PTO clutch. L/C filter prevents dust from coming into valve.

When pressure proportional valve is OFF, fluid goes to tank from PTO clutch.

CONTROL VALVE

Parts and Hydraulic Diagram

FIG. 46: Control Valve

(1) Power Shuttle and PTO Control Valve
(2) Pressure Proportional Valve Of Power Shuttle
(3) Pressure Proportional Valve Of PTO
(4) To PTO Clutch
(5) Adapter With L/C Filter (Dyna QPS)
(6) Adapter With L/C Filter (Power Shuttle)
(7) From Reduce Valve
(8) Valve Dyna QPS

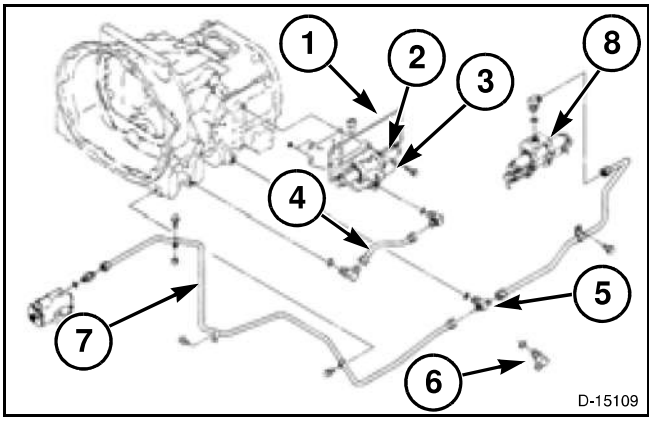


FIG. 46

FIG. 47: Power Shuttle Control Valve Circuit

(1) Hydraulic Clutch for Power Shuttle
(2) L/C Filter
(3) Pressure Proportional Valve of Power Shuttle
(4) L/C Filter
(5) F/R Power Shuttle Valve
(6) Relief Valve
(7) Lubricating Circuit of Power Shuttle
(8) Pressure Proportional Valve of PTO

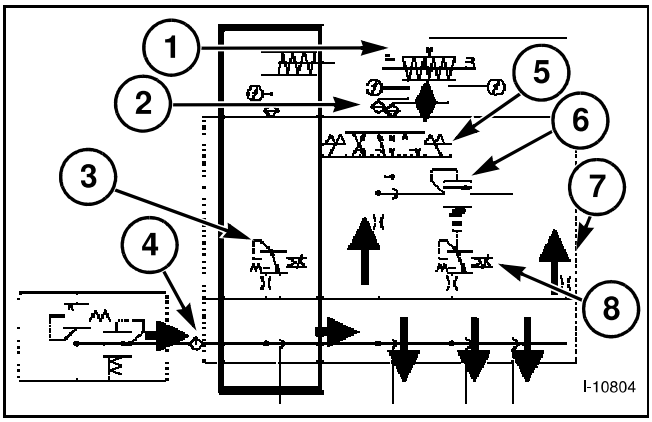


FIG. 47

FIG. 63: Bucket Valve

(1) Detent (Without Lock)

(2) D

(3) C

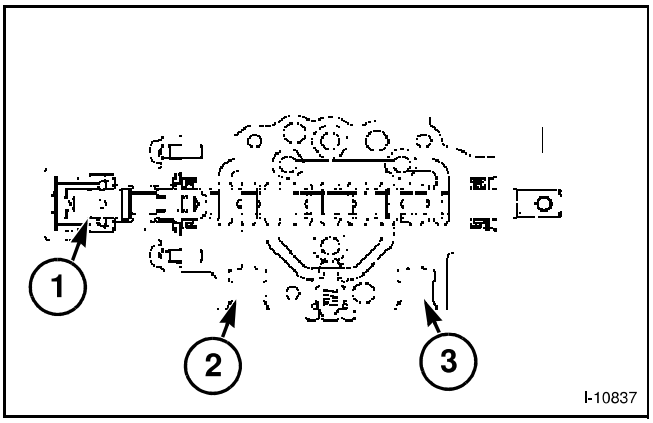


FIG. 63

FIG. 64: Identification Mark Of Spool

(1) Identification mark of boom spool (bucket spool does not have a mark)

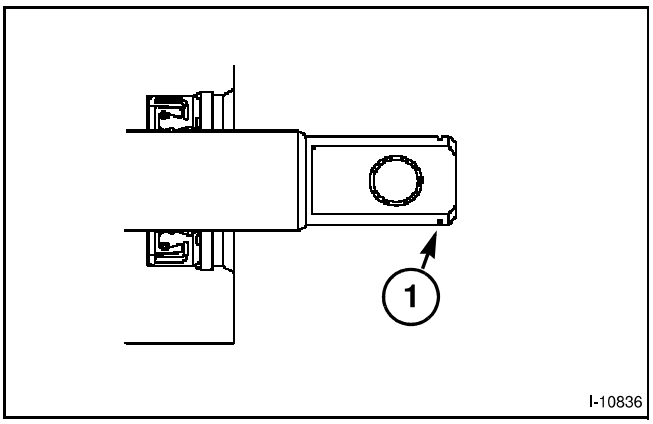


FIG. 64

FIG. 65: Boom Valve Detent

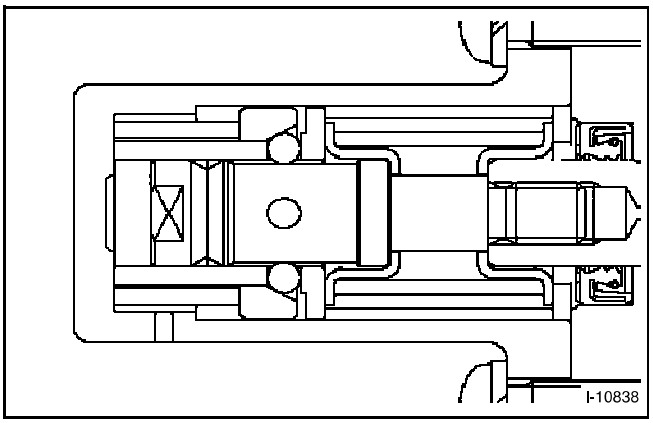


FIG. 65

FIG. 66: Bucket Valve Detent

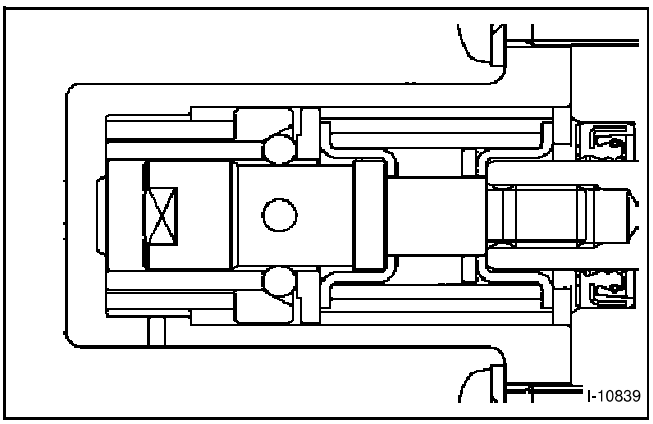


FIG. 66

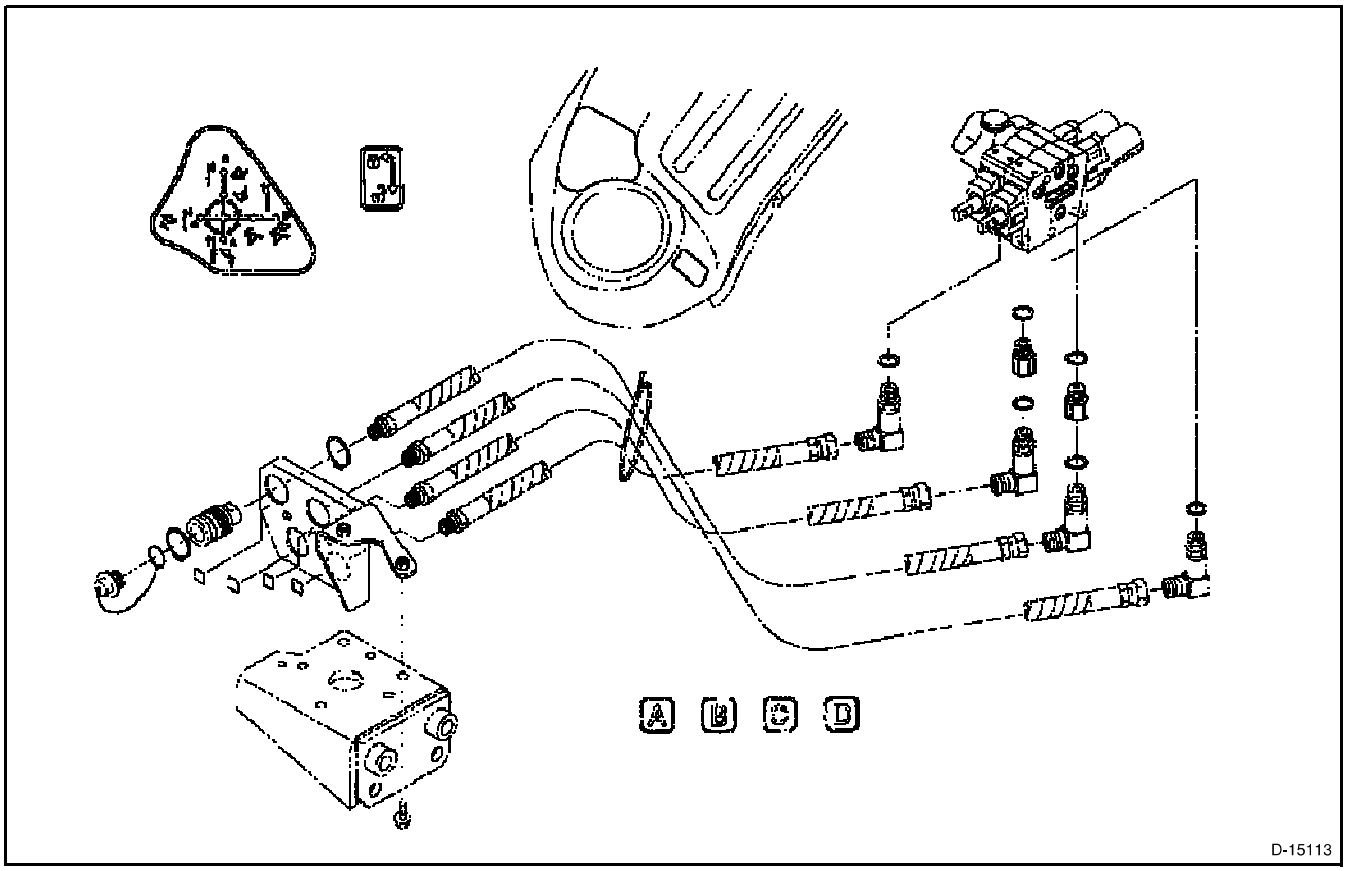


FIG. 88

FIG. 88: Remote Control Valves

Remote control valves are available in single valve sections for the tractors.

Provisions for one or two valves has been designed into the tractors allowing use of loaders, or remote cylinders on other applications.

The valves can be used with either single or double acting hydraulic cylinders by setting an adjustment screw on the valve, when adjusting screw is turned out, single acting cylinders can be raised or lowered from the A port.

When adjusting screw is turned in fully, double acting cylinders can be raised and lowered from the A and B ports on each valve bank.

Type	Convertible to Single or Double Acting Cylinders
Pressure	15.691 MPa (2276 psi)
Flow	28.2 l/min (7.7 gal/min)

POSITION CONTROL LINK AND LEVER

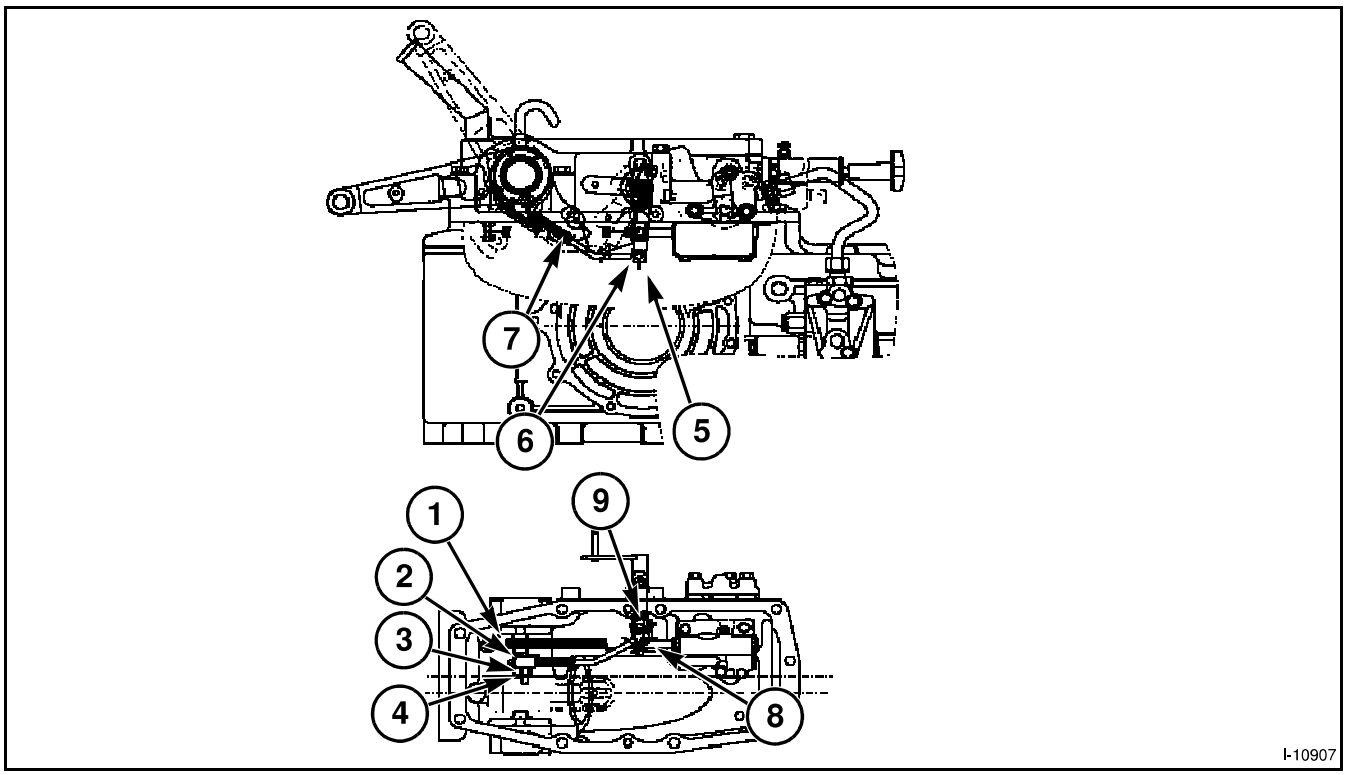


FIG. 104

FIG. 104: Parts to the position control link

(1) Wire

(2) Pin/Spring

(3) Pin 12 x 45

(4) Washer Lock

(5) Cotter Pin

(6) Washer

(7) Spring/ HC101

(8) Washer

(9) Pin/Spring

FIG. 105: Linkage

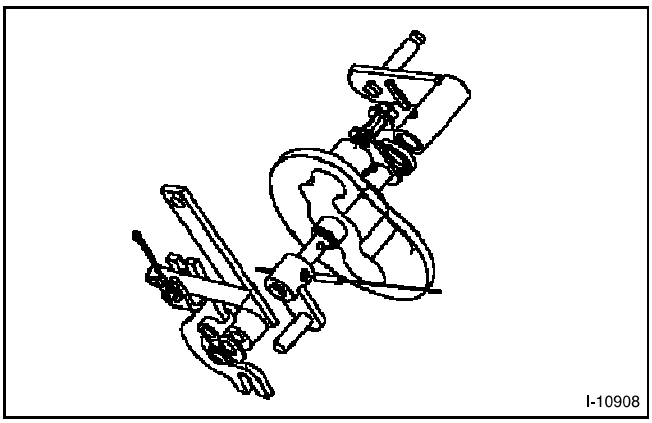


FIG. 105

NOTES

NOTES

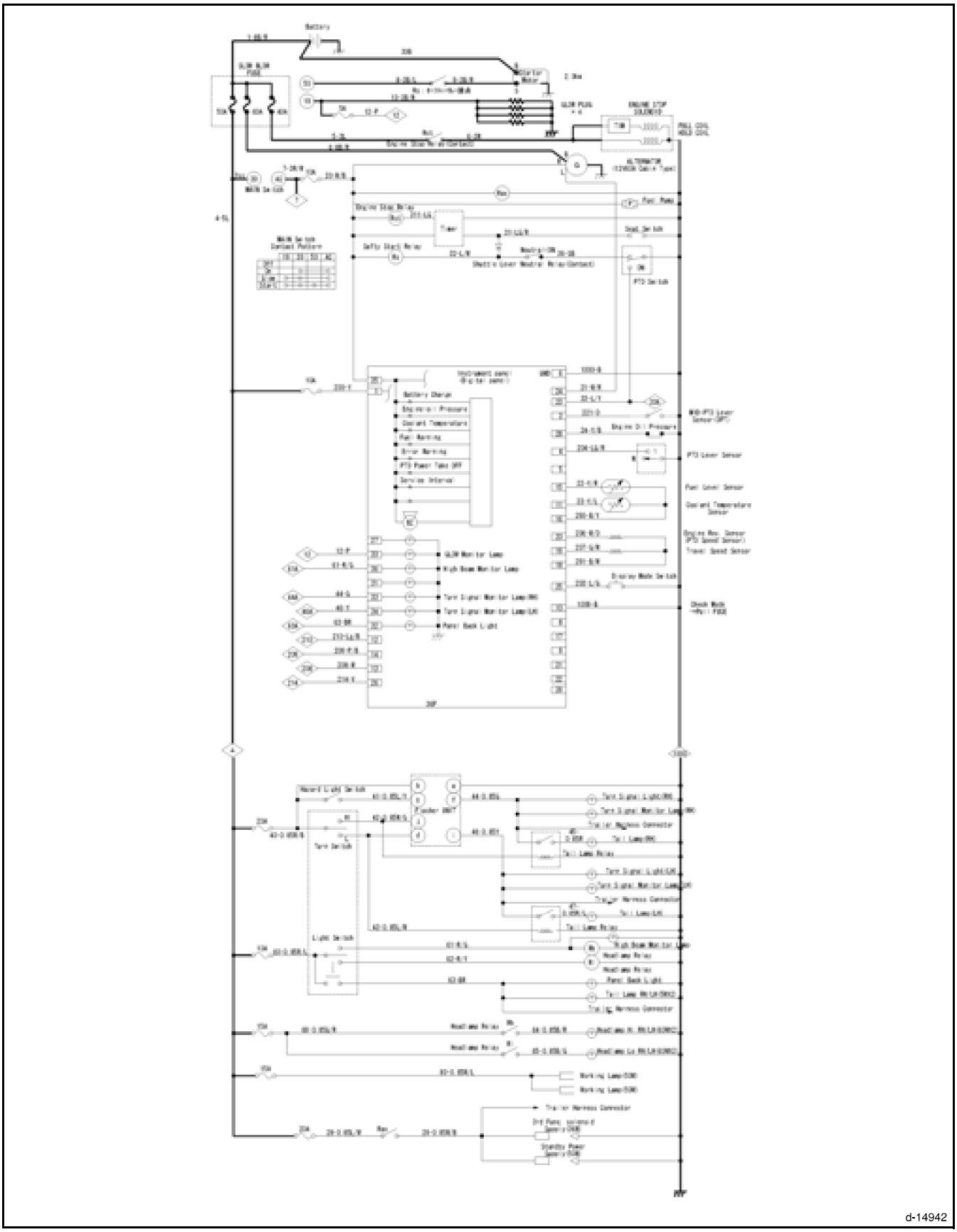


FIG. 3

FIG. 3: Dyna QPS

NOTES

FIG. 34: Shift 1 solenoid

(Solenoid Side)

Check the coil of the solenoid valve.

Disengage coupler from the harness and check the resistance between 1+ and 1

Normal	9.6 ohm at 20 degrees C (68 degrees F)

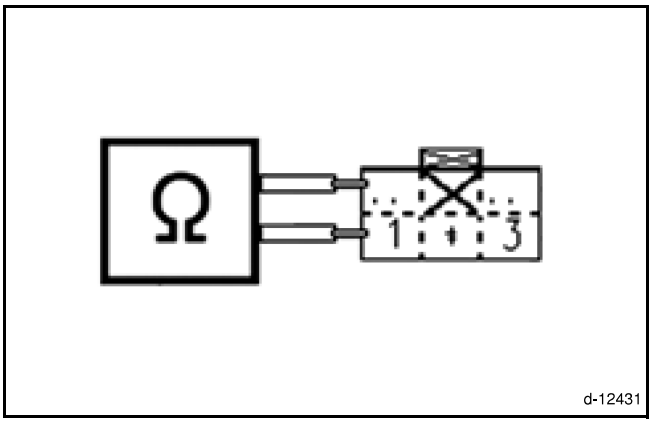


FIG. 34

FIG. 35: Check the insulation of the solenoid valve. Disengage coupler from the harness and check the resistance between 1+ and GND. (or 1 and GND).

Between 1+ and GND

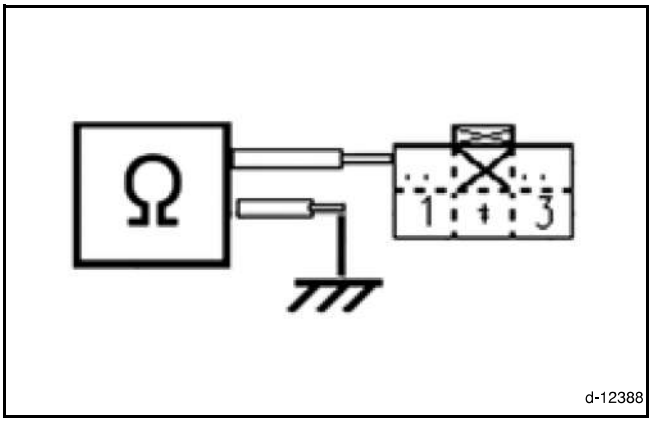


FIG. 35

FIG. 36: Between 1 and GND

Normal	- ohm

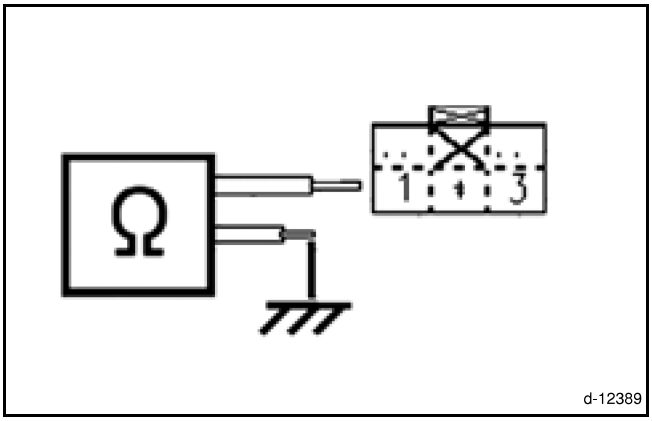


FIG. 36

FIG. 60: Check insulation of the solenoid valve. Disengage coupler from the harness and check the resistance between PTO+ and GND. (or PTO and GND).

(Between PTO+ and GND)

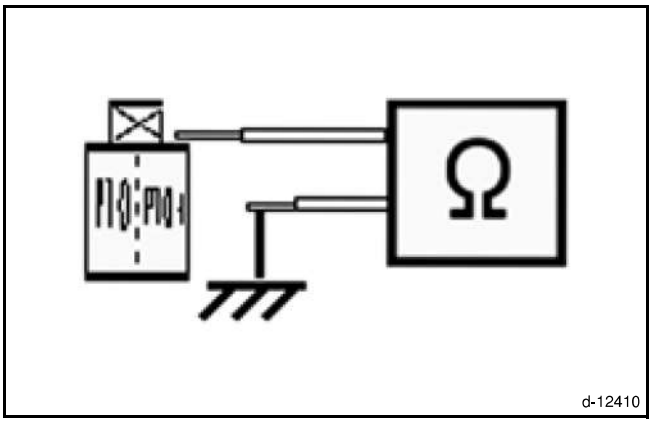


FIG. 60

FIG. 61: (Between PTO and GND)

Normal	- ohm (non-conductance)

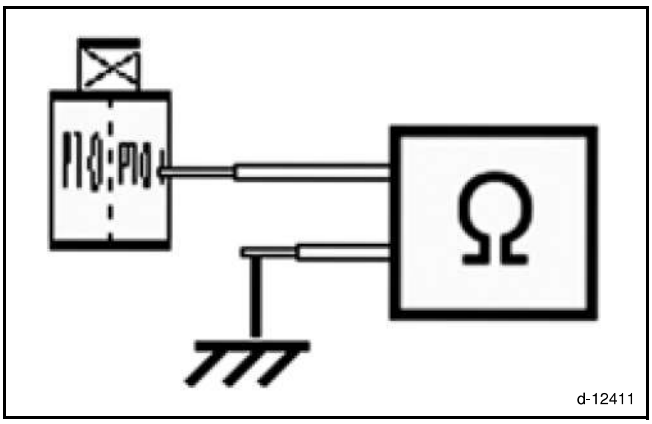


FIG. 61

FIG. 62: (Harness - Side)

Check wiring harness between Q-ECU and solenoid (coupler: Green) Disengage coupler from the harness and check resistance between the power shift and the solenoid (302-302).

Normal	About 0 ohm

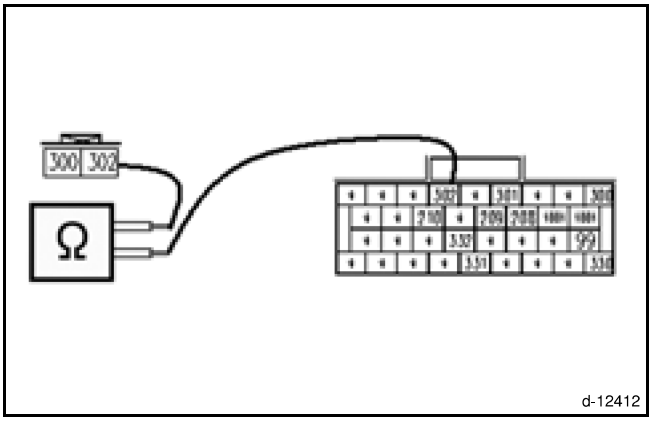


FIG. 62

FIG. 85: Check power supply from the wiring harness. Disengage coupler from solenoid valve and turn main switch ON. Check voltage between coupler and GND. (between 30 and GND).

Normal	DC11 - 12V

When starting the engine, expect approximately 14V.

NOTE: Coupler of power shuttle clutch (control) solenoid is the same shape as the coupler of PTO clutch control solenoid.

NOTE: When connecting coupler, make sure color of coupler and wire are the appropriate color.

NOTE: Power shuttle clutch (control) solenoid - tube of solenoid: blue, coupler of wire: blue

NOTE: PTO clutch control solenoid - tube of solenoid: black, coupler of wire: green

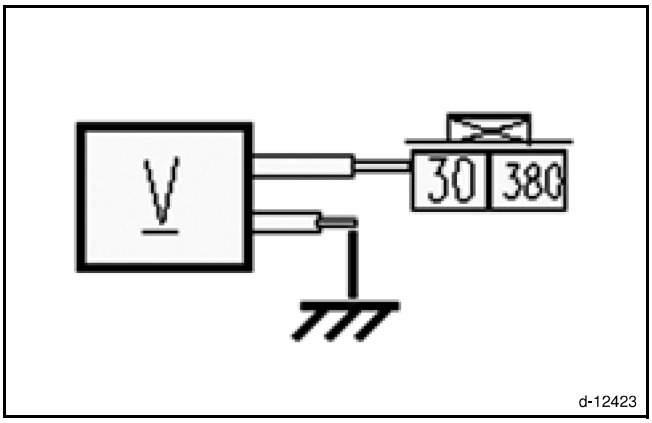


FIG. 85

Coolant Temperature

FIG. 105: An alarm will sound when the engine coolant temperature is too high.

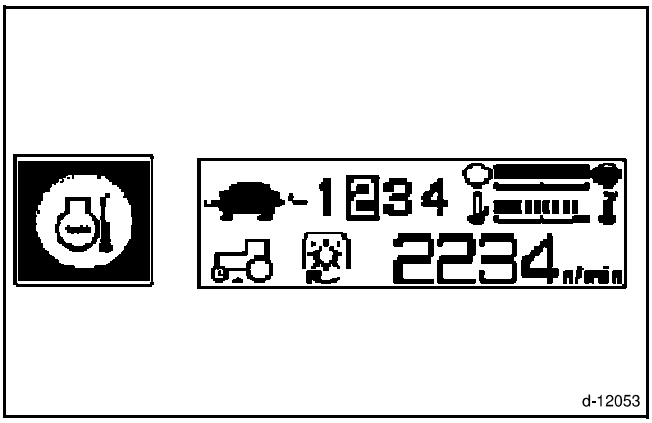


FIG. 105

FIG. 106: If all the coolant temperature gages are full, the engine is overheated. An alarm will sound and a warning will appear, as shown, on the monitor

Stop working immediately, if overheating occurs and keep engine idling.

After this alarm has been indicated, overheat has occurred is recorded in the ECU. Make sure that the engine has overheated or not.

When the alarm is indicated in [Error Memory] of Check Mode, occurring of overheat is proved.

Make sure the tension on the cooling fan belt is tight and the water pump is operating normally. Also make sure there is an adequate quantity of coolant. make sure the radiator screen is free of dust and debris.

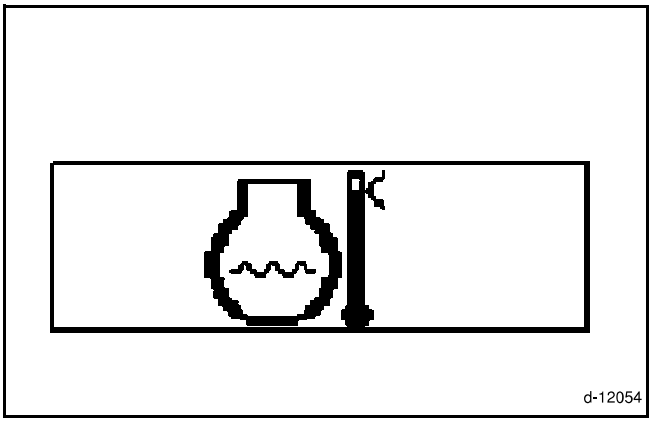


FIG. 106

FIG. 107: The indicator, as shown, will appear if there is a problem with the lubricant system.

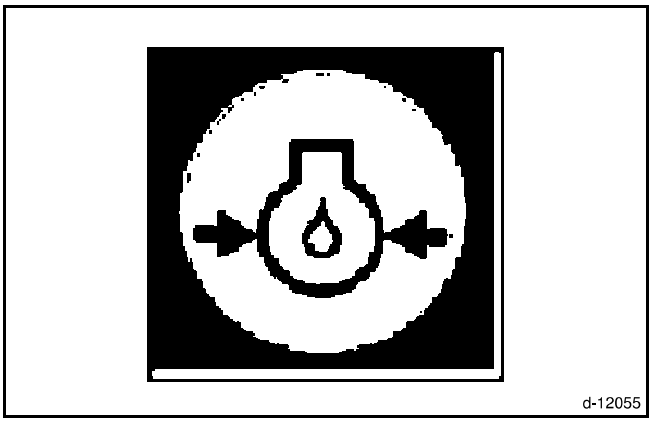


FIG. 107

DIGITAL PANEL SWITCHES AND SENSORS

FIG. 129:

Switches On Instrument Panel

(1) Combination Switch

(2) Hazard Switch

(3) PTO Selectable Switch

(4) PTO Switch

(5) Display Mode switch

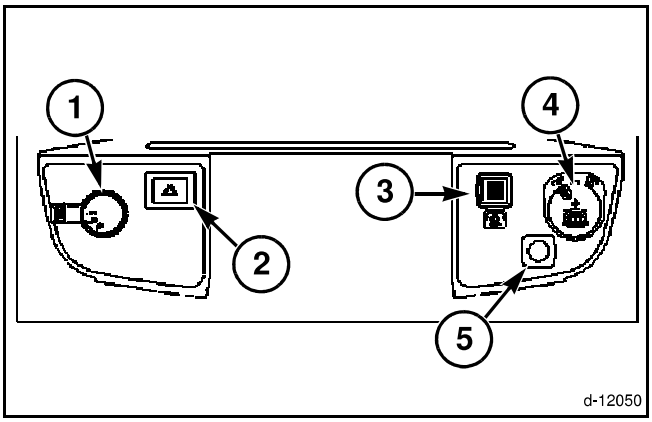


FIG. 129

Abbreviation	Description
Q ECU	Q Electronic Control Unit
Check Mode Pull FUSE	Check Mode Pull Fuse
Range Shift Lever Sensor	Range Shift Lever Sensor
HST Model selection	Hydrostatic Model Selection
Range shift Lever Neutral Relay	Range shift Lever Neutral Relay

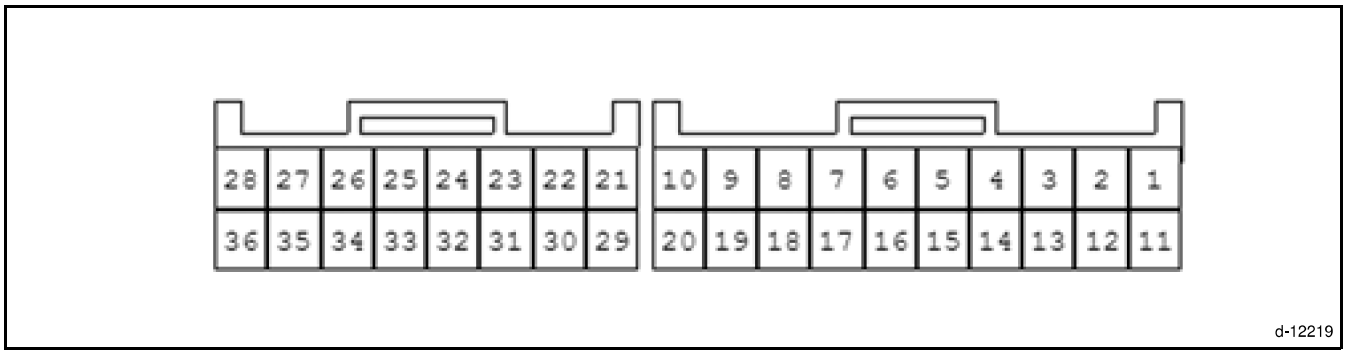


FIG. 138

FIG. 138: Meter Panel Coupler (Wire Harness)

No.	Description		Wire Color
	Power Shift Type	HST Type	
1	Power Supply 12V (Battery)		Y
2			
3	MID-PTO Lever Senor (OPT)		O
4	Rear PTO Lever Sensor		LG/R
5			
6	GND		B
7			
8		Range Shift Lever Sensor	LG/R
9		Range Shift Lever Sensor	L
10	GND Level (Wire color:B)	Check Mode(Pull Fuse Check Mode)	Y/B
11	Coolant Temperature Sensor		Y/L
12	DATA Communication SCK in		LG/B
13	DATA Communication TxD (Q-ECU:TxD)		W
14	DATA Communication RxD(Q-ECU:RxD)		P/B
15	Fuel Level Sensor		Y/R
16	Sensor GND		B/Y
17		Range Shift Lever Sensor	G/Y
18	Sensor GND		B/W
19	Travel Speed Sensor		G/W
20	Engine Rev. Sensor PTO Speed Sensor)		W/O

Check Mode Function

NO	Item	Note	M model	
			Power Shift	HST
1)	Check on Sensor	Check sensor of power shift and meter panel such as a circuit tester.	X	X
2)	Check on Adjustment of Sensor	Check adjustment of sensor of IQ-shift.	X	N/A
3)	Selection of Unit of Traveling Speed	Choose unit of traveling speed, mph and km/h.	X	X
4)	Selection of Language	Choose language on meter panel among English, Dutch, German, French.	X	X
5)	Selection of Tractor Model	Enter your tractor model to digital meter panel when exchanging meter panel or ECU of power Shift.	X	X
6)	Selection of Tire Size	Enter tire size to digital meter panel.	X	X
7)	Check the Error History	Check error history on the tractor	X	X

FIG. 168: Indication will be changed by pushing selectable switch within two seconds.

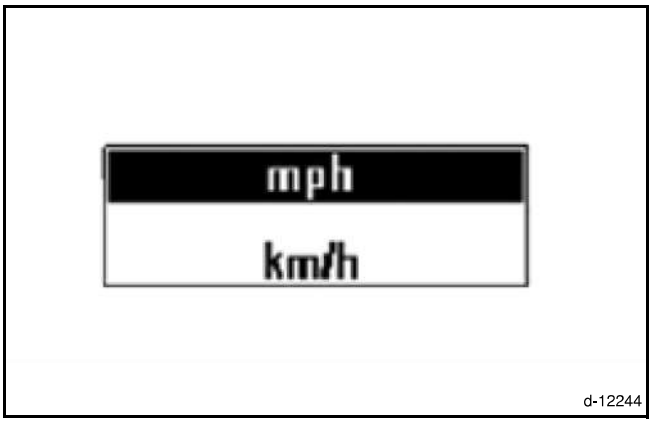


FIG. 168

FIG. 169: Indication will be changed by pushing selectable switch more than two seconds.

An alarm will sound when the image is changed.

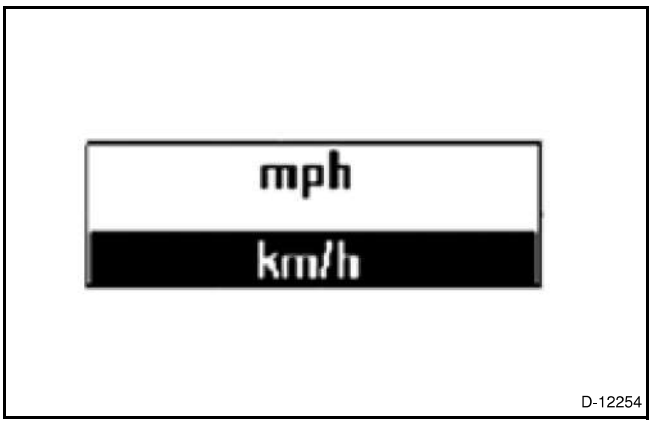


FIG. 169

FIG. 170: To cancel the process of changing the unit of traveling speed from mph to km/h push the selectable switch for within two seconds to choose not okay.

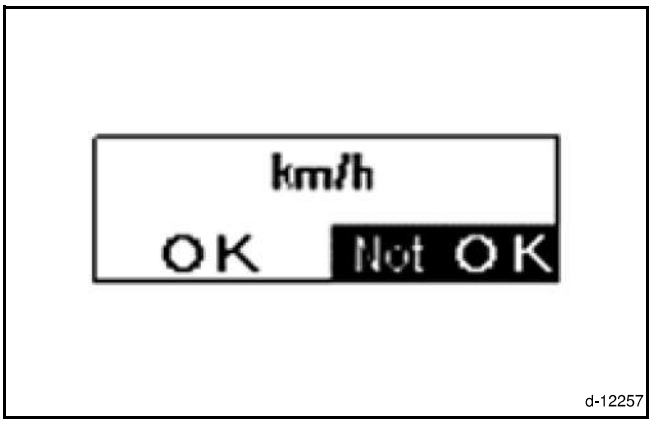


FIG. 170

FIG. 171: In order to keep the traveling unit in km/h push the selectable switch for more than two seconds and the next image will appear.

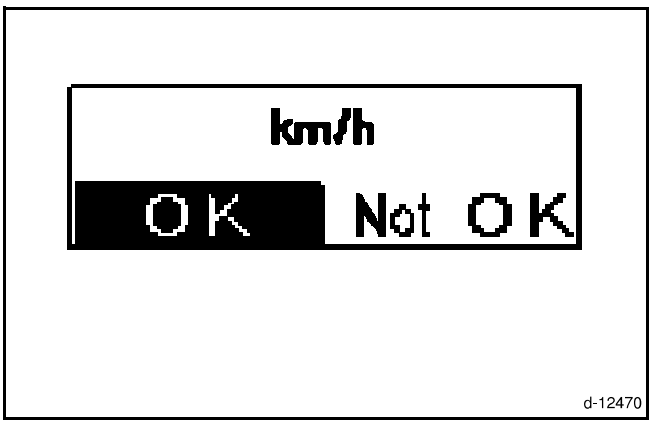


FIG. 171

Check Error History

Clear error history after checking error history.

If the digital meter panel is not cleared, it would remain in digital meter.

Check the error history in case of an occurring error in the past. Remove the Check Fuse from the fuse box.

FIG. 204: Indication will be changed automatically after two seconds.

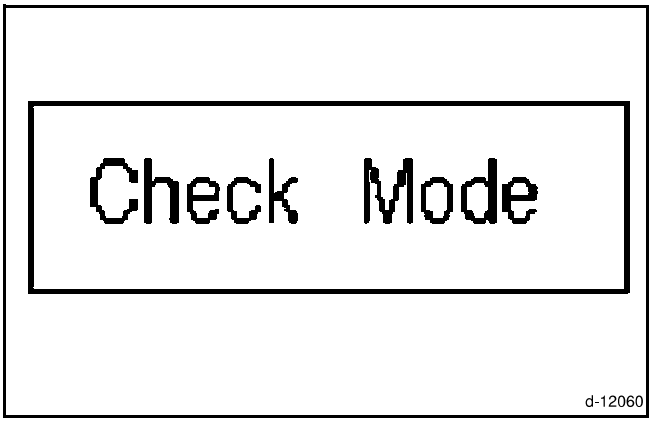


FIG. 204

FIG. 205: Indication will be changed by pushing selectable switch within two seconds.

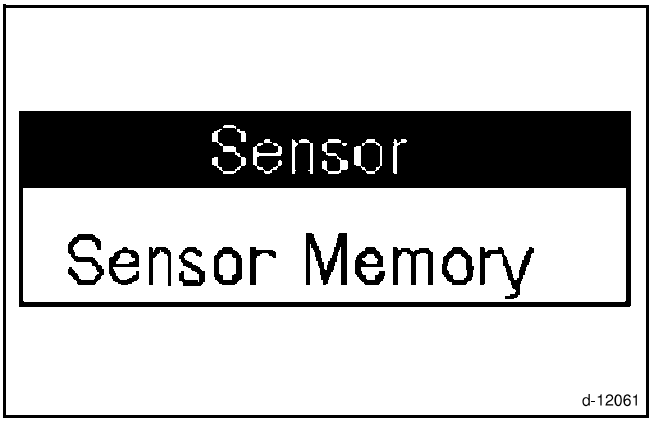


FIG. 205

FIG. 206: Indication will be changed by pushing selectable switch within two seconds.

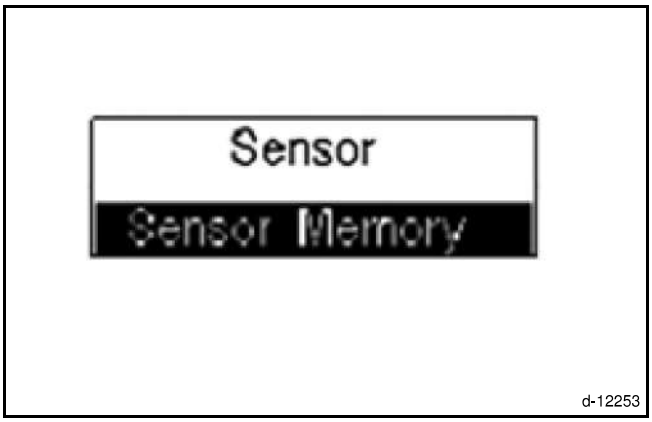


FIG. 206

FIG. 237: End view of Controller Q

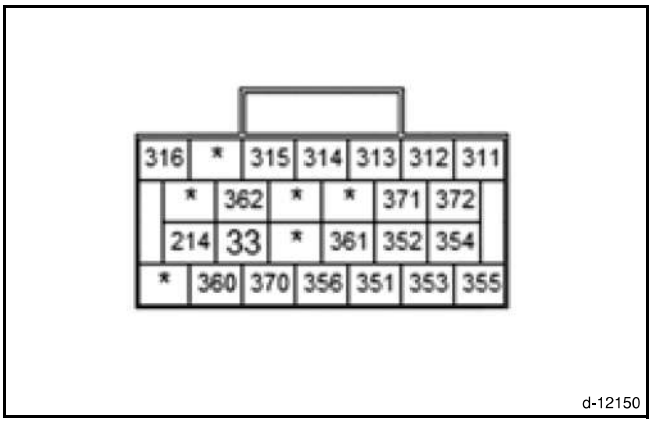


FIG. 237

FIG. 238: Intensified Pressure PTO

FIG. 238

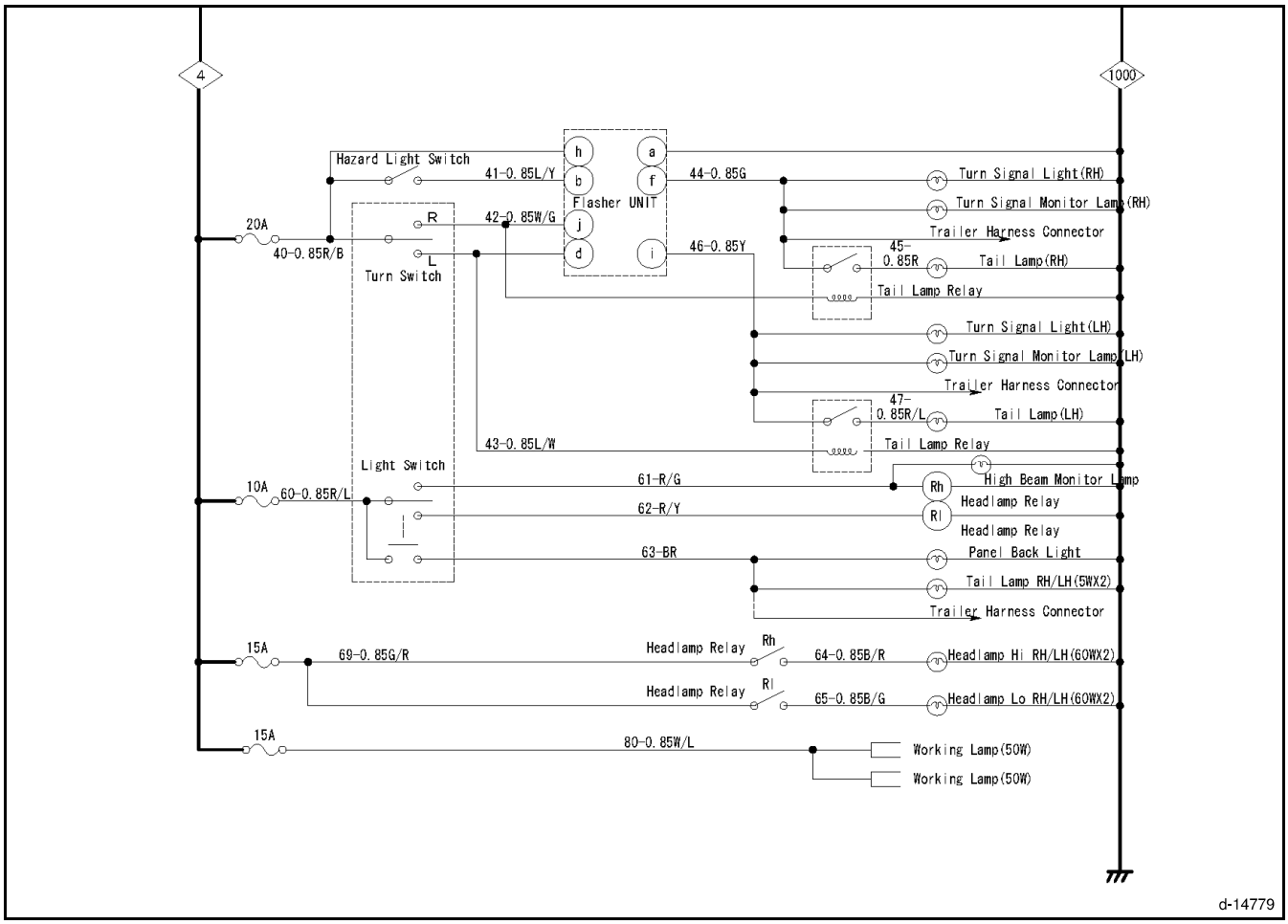


FIG. 248

FIG. 248: Light circuit schematic

Abbreviation	Description
Battery	Battery
SLOW BLOW FUSE	Slow Blow Fuse
Hazard Light Switch	Hazard Light Switch
Turn Switch	Turn Switch
Flasher UNIT	Flasher Unit
Turn Signal Light (RH)	Turn Signal Light (right-hand)
Turn Signal Monitor Lamp (RH)	Turn Signal Monitor Lamp (right-hand)
Tail Lamp (RH)	Tail lamp (right-hand)
Tail Lamp Relay	Tail Lamp Relay
Turn Signal Light (LH)	Turn Signal Light (left-hand)
Turn Signal Monitor Lamp (lh)	Turn Signal Monitor Lamp (left-hand)
Tail Lamp (LH)	Tail lamp (left-hand)
High Beam Monitor lamp	High Beam Monitor Lamp
Headlamp Relay	Head Lamp Relay

Position		Normal range	Lever Position		Important
Arm	Terminal	Resistance	Q Type	H Type	
R	R-B	Approx. 0 Ohm	Hare	Hare	When the lever is in each position, do not disconnect the contact point of the sensor by the excess play in the lever.
L	L-B	Approx. 0 Ohm	Snail	tortoise	
Y	Y-B	Approx. 0 Ohm	Tortoise	Snail	
Excerpt R,L and Y	R-B	Infinity Ohm	Neutral	Neutral	When the lever is in the neutral position, do not connect the contact point of the sensor
	L-B	Infinity Ohm			
	Y-B	Infinity Ohm			

NOTE: When the above adjustment is incorrect, there is a possiblility that a malfunction will occur in the Q Type.

FIG. 260: Harness Side

(1) Q Type

(2) H Type

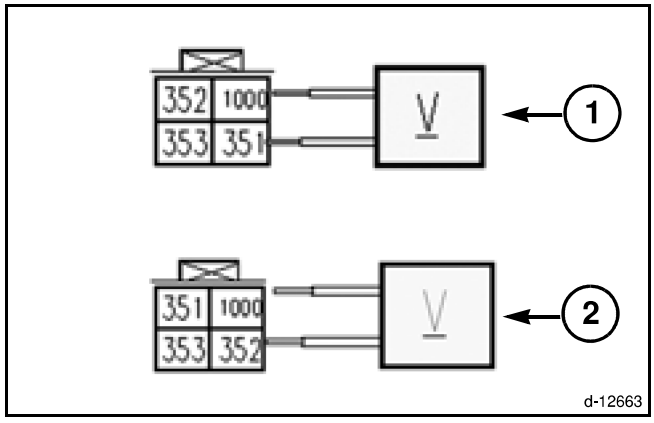


FIG. 260

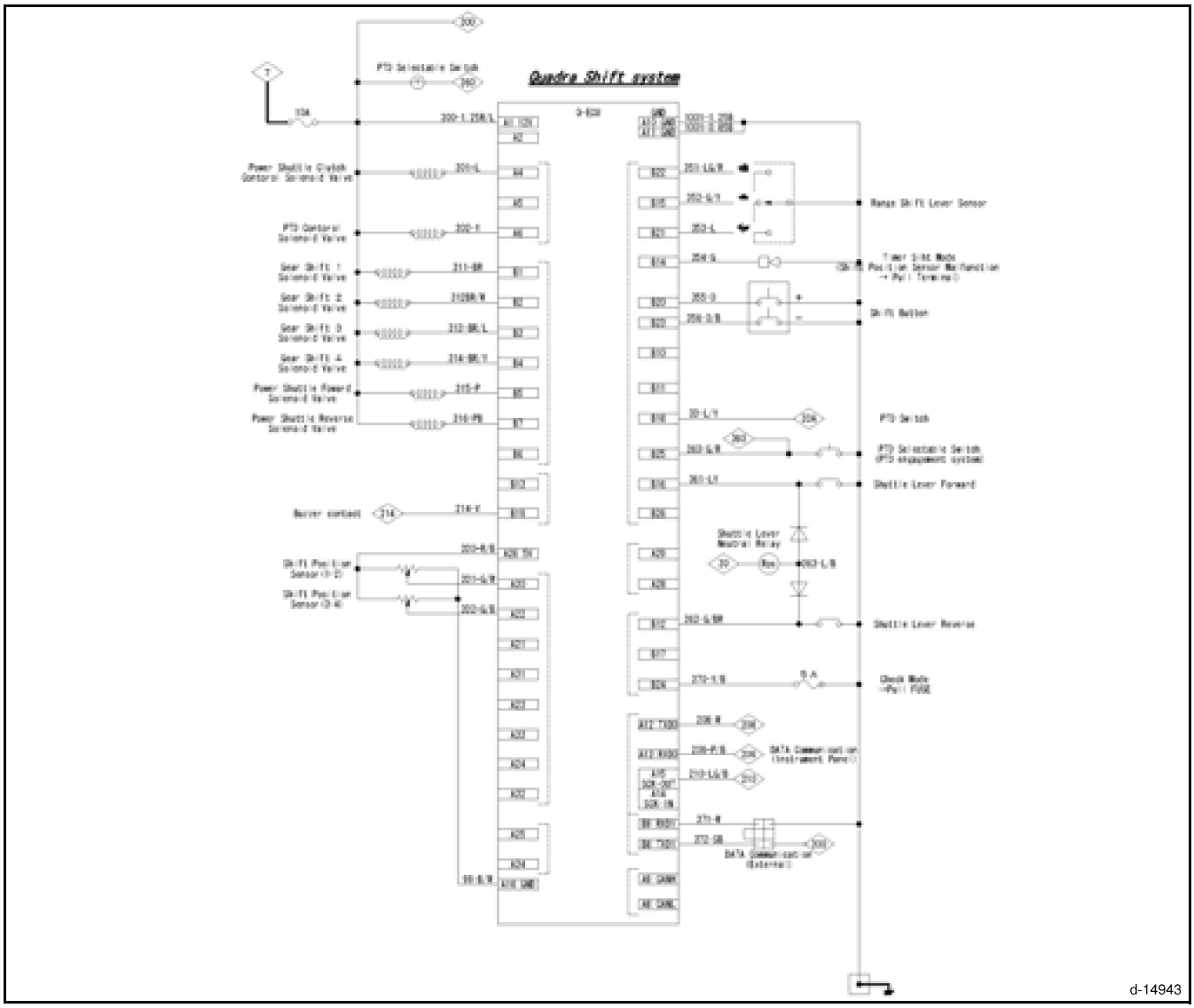


FIG. 272

FIG. 272: Q Type Schematic

Abbreviation	Description
Q-ECU	Electronic-Electronic Control Unit
12V	12 Vaults
Shuttle Lever Forward	Shuttle Lever Forward
MAIN Switch	Main Switch
Shuttle Lever Neutral Relay	Shuttle Lever Neutral Relay
Shuttle Lever Reverse	Shuttle Lever Reverse
L/Y	Blue/Yellow
L/B	Blue/Black
F	Forward
R	Reverse
G/BR	Green/Brown

FIG. 287: Engine Reverse Sensor

Abbreviation	Description
Digital Panel	Digital Panel
Engine Rev. Sensor	Engine Revolution Sensor
PTO Speed Sensor	Power Take Off Speed Sensor
Travel Speed Sensor	Travel Speed Sensor
W/O	White/Orange
G/W	Green/White
B/W	Black/White

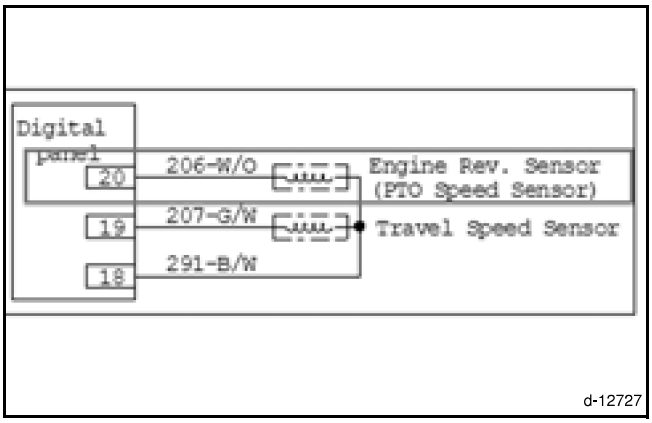


FIG. 287

FIG. 288: Harness of Digital Panel Side

(1) Travel Speed Sensor Side Coupler

Terminal		Normal Range
Panel Side	Sensor Side	Resistance
291	291	Approximately 0 ohms
206	206	Approximately 0 ohms

NOTE: The engine revolution sensor for the digital panel is used for display of the engine revolution and PTO revolution. PTO revolution is calculated by the engine sensor and PTO lever sensor.

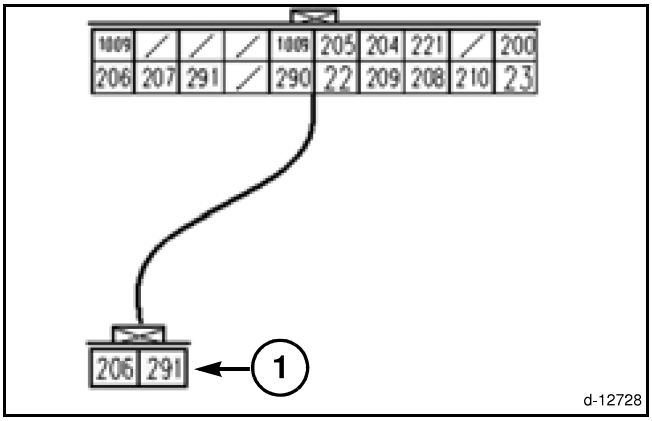


FIG. 288

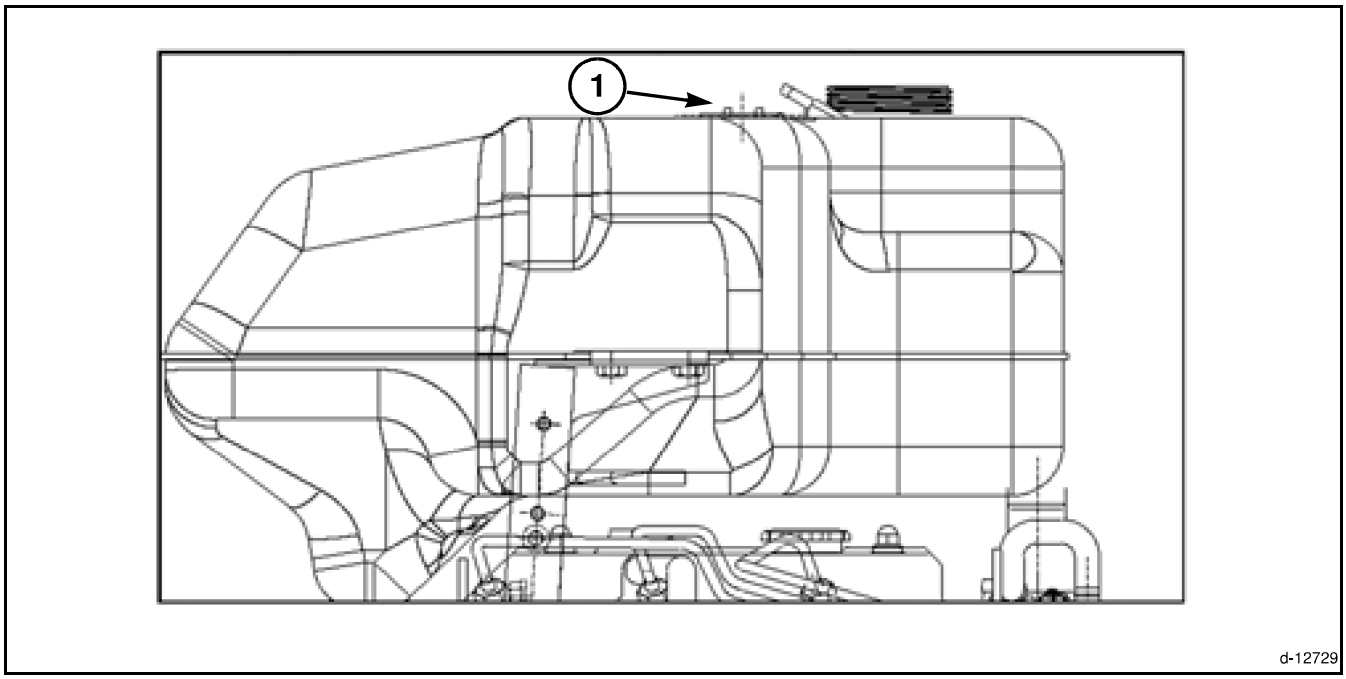


FIG. 289

FIG. 289: Fuel Level Sensor

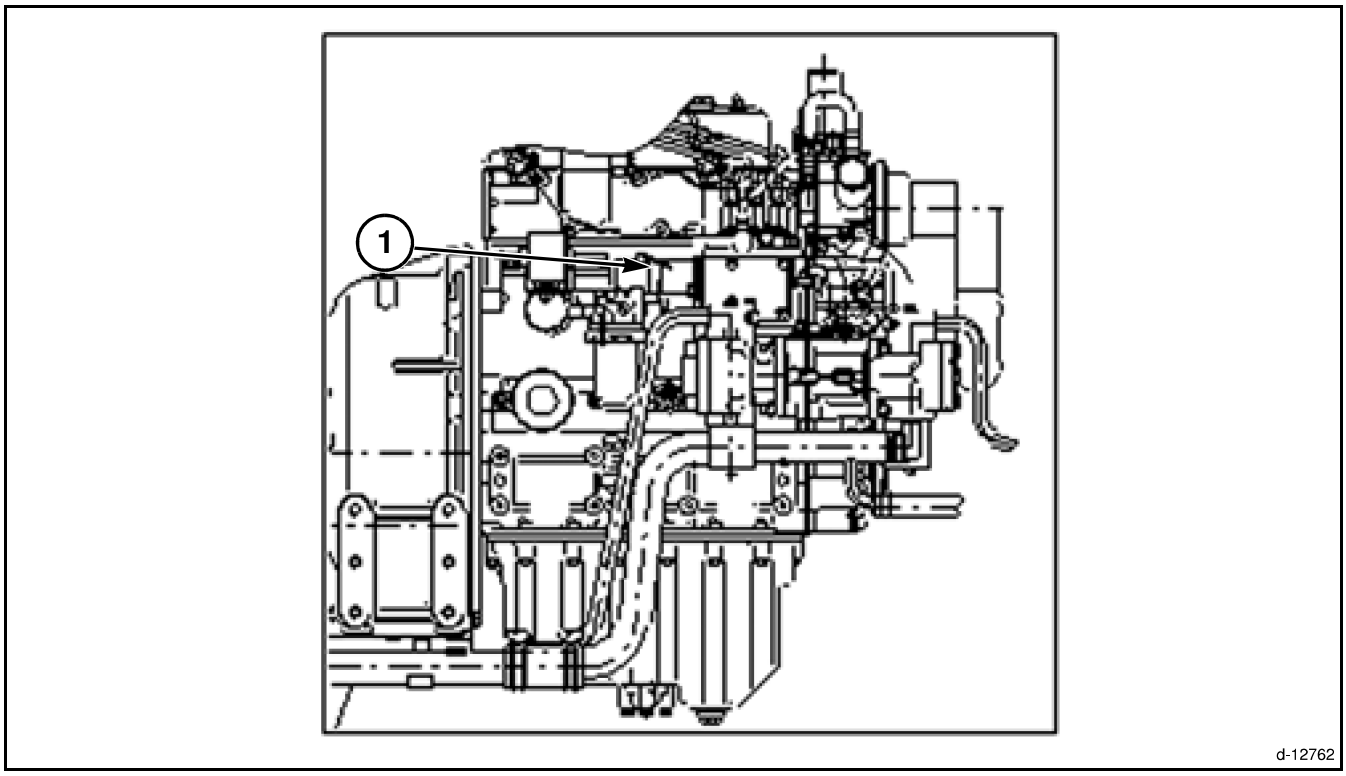


FIG. 306

FIG. 306: Engine Stop Solenoid

(1) Engine Stop Solenoid

FIG. 307: Solenoid with White, Red, Black, wire color for coupler

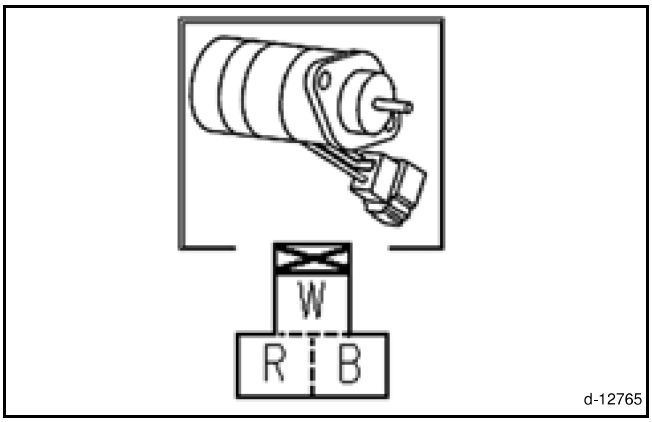


FIG. 307

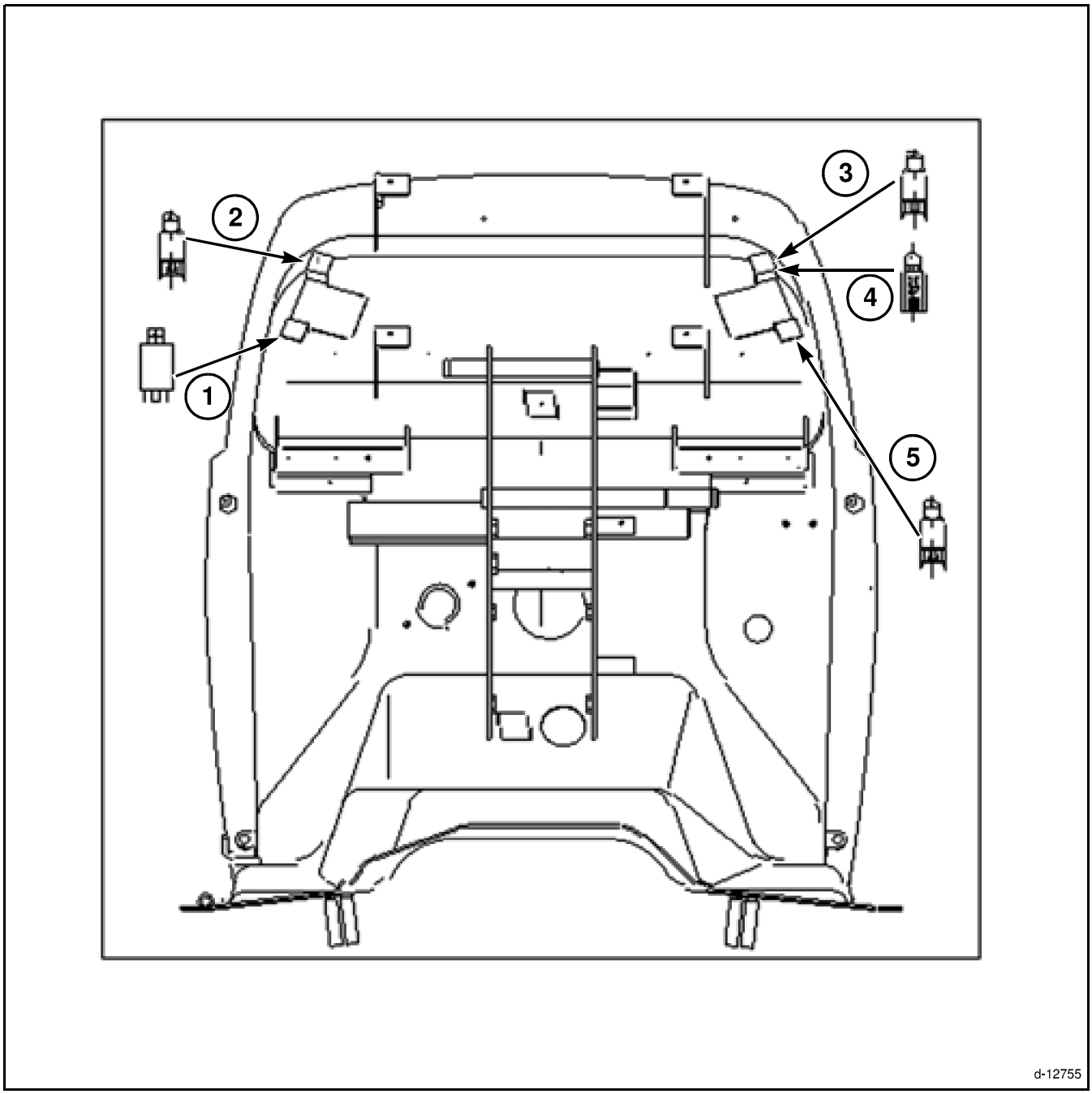


FIG. 325

FIG. 325: Location of Relays (E3,E6)

(1) Flasher UNIT

(2) Tail Lamp Relay

(3) Safety Start Relay (Black)

(4) Shift Lever Neutral Relay (Blue)

(5) Head Lamp Relay (Black) x 2

FIG. 350: Key Stop Relay

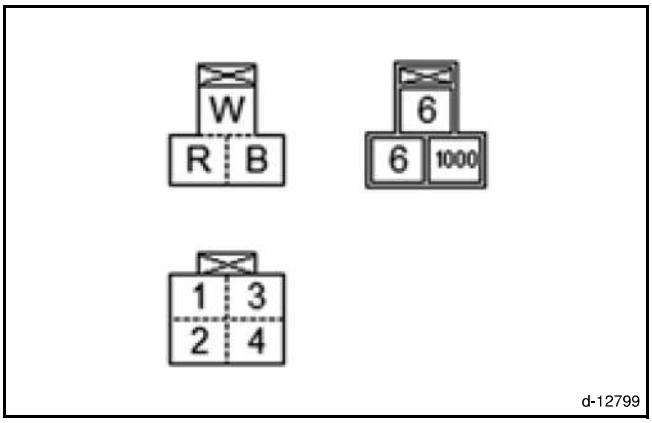


FIG. 350

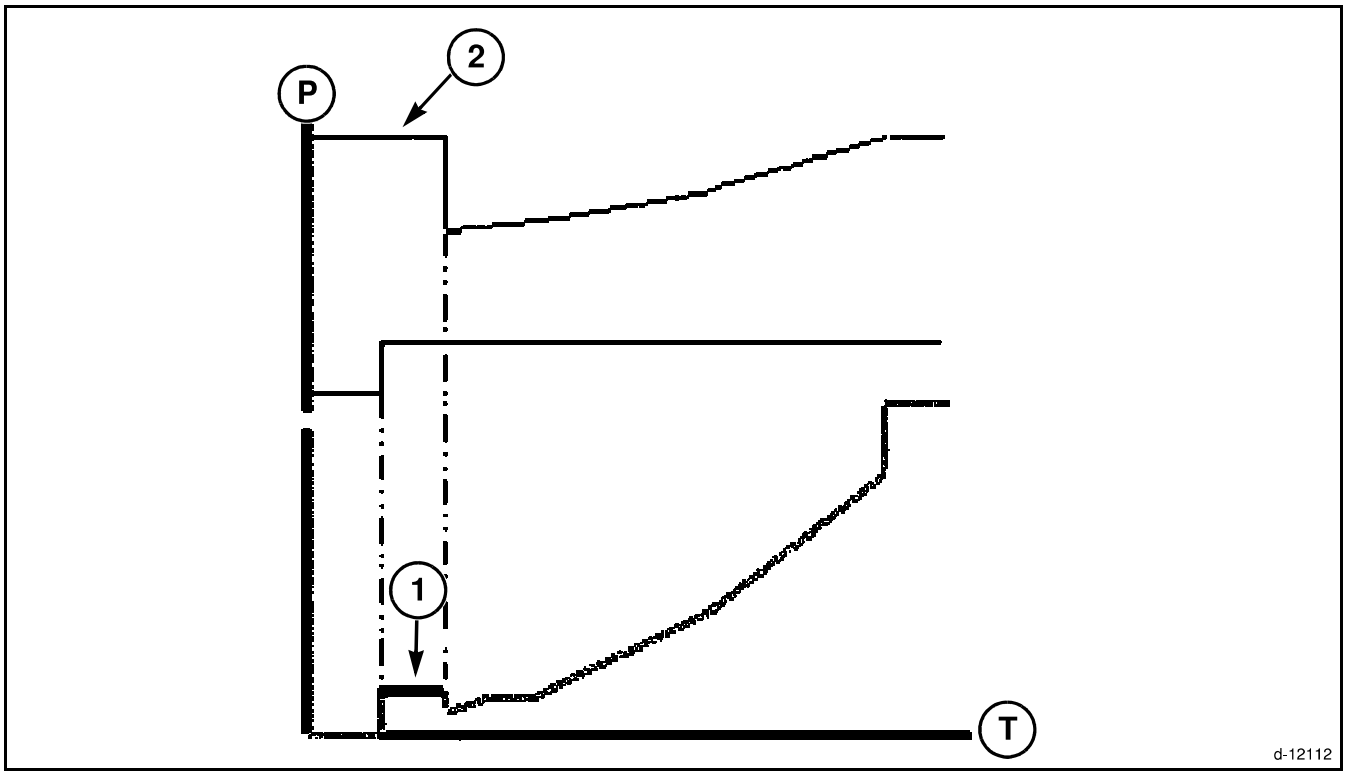


FIG. 361

FIG. 361: Detailed explanation of the Valve Operation

(1) Immediately After Forward Gear Change

(2) Pressure Control Valve Control Current 1.6 A

(T) Time

(P) Pressure

PTO Controls

The following information refers to Fig. 375:

Abbreviations	Description
PTO Selectable Switch	Power Take Off Selectable Switch
Power Shuttle Clutch Control Solenoid Valve	Power Shuttle Clutch Control Solenoid Valve
PTO Control Solenoid Valve	Power Take Off Control Solenoid Valve
Gear Shift 1 Solenoid Valve	Gear Shift 1 Solenoid Valve
Gear Shift 2 Solenoid Valve	Gear Shift 2 Solenoid Valve
Gear Shift 3 Solenoid Valve	Gear Shift 3 Solenoid Valve
Gear Shift 4 Solenoid Valve	Gear Shift 4 Solenoid Valve
Power Shuttle Forward Solenoid Valve	Power Shuttle Forward Solenoid Valve
Power Shuttle Reverse Solenoid valve	Power Shuttle Reverse Solenoid valve
Buzzer Contact	Buzzer Contact
Shift Position Sensor (1-2)	Shift Position Sensor (1-2)
Shift Position Sensor (3-4)	Shift Position Sensor (3-4)
Range Shift Lever Sensor	Range Shift Lever Sensor
Timer Shift Mode (Shift Position Sensor malfunction Pull Terminal)	Timer Shift Mode (Shift Position Sensor malfunction Pull Terminal)
Shift Butten	Shift Button
PTO Switch	Power Take Off Switch
PTO Selectable Switch (PTO equivalent system)	Power Take Off Selectable Switch (Power Take Off Equivalent System)
Shuttle Lever Forward	Shuttle Lever Forward
Check Mode (Pull Fuse)	Check Mode (Pull Fuse)
DATA Communication (External)	Data Communication (External)
Shuttle Lever Neutral Relay	Shuttle Lever Neutral Relay
MAIN Switch	Main Switch
AC	Air Conditioner
Buzzer Contact (Instrument Panel)	Buzzer Contact (Instrument Panel)
Shuttle Lever Neutral Relay	Shuttle Lever Neutral Relay

STARTING PROGRAM

Connecting to the Tractor

FIG. 389: Download the CT DIAGNOSTICS program software on to the laptop computer.

Refer to section on Installing/Uninstalling Software for additional information.

Connect signal converter to (4) an adaptor harness. Connect the adaptor harness to the white 6 pin test connector on the tractor.

The test port connector is a (1) white 6 pin plug located on the right-hand side of the steering column above the fuse box.

Connect properly configured (2) serial cable (obtained locally) to the laptop computer.

Specification of serial cable is located in ANNEX section of user guide. The cable must be equipped with a cross connection or Null Modem.

Connect serial cable from (3) laptop computer with WINDOWS XP or WINDOWS 2000 to the signal converter.

Turn on the laptop.

Turn the tractor ignition key to the ON position.

Run the CT Diagnostics program on the laptop computer.

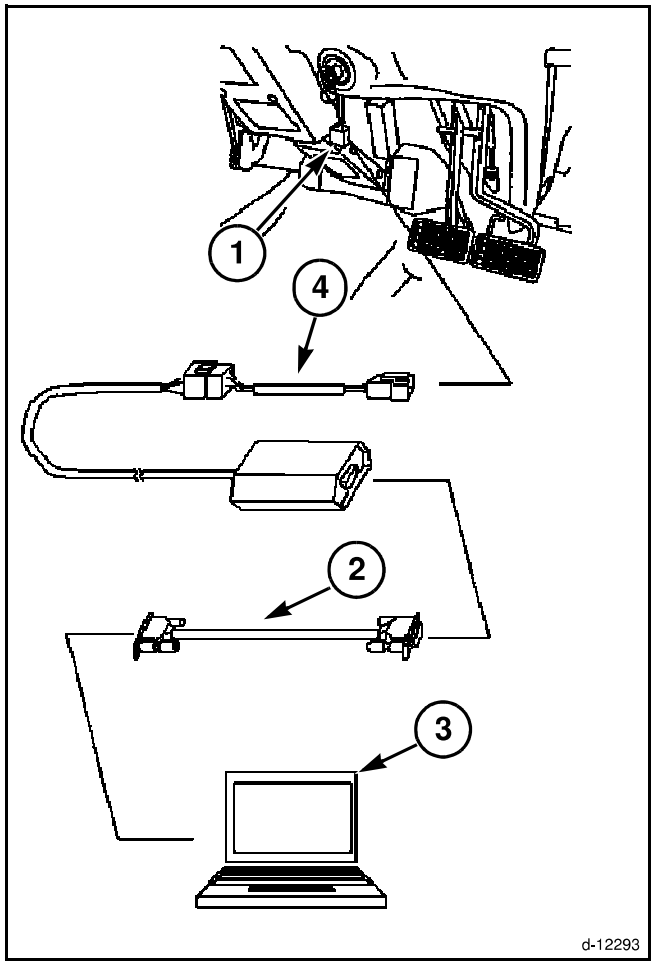


FIG. 389

FIG. 390: Click the Connecting button.

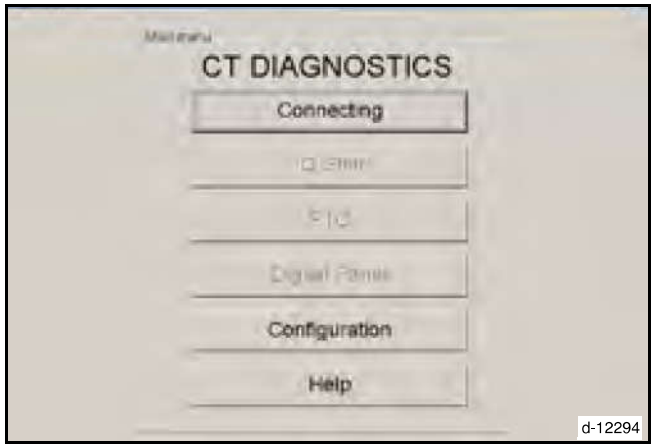


FIG. 390

Position value of Gear Shift 1 of 6

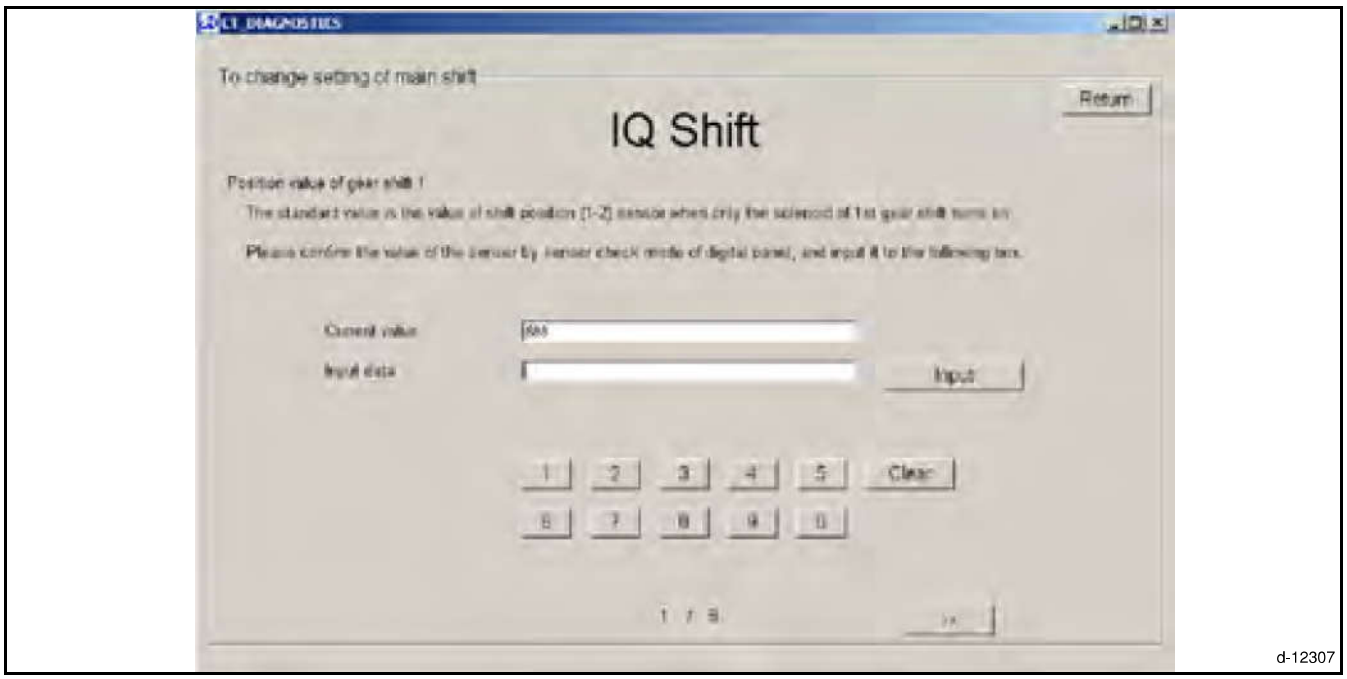


FIG. 403

FIG. 403: When the solenoid for Gear Shift 1 is energized, either by or clicking the Output button for Gear Shift 1 in the Check output data window, the controller memorizes the value depressing the push pin on the 1st gear shift solenoid of the Gear Shift Position Sensor (1-2) as the standard value for 1st gear.

Initial Time (Forward) - Screen 2 of 8

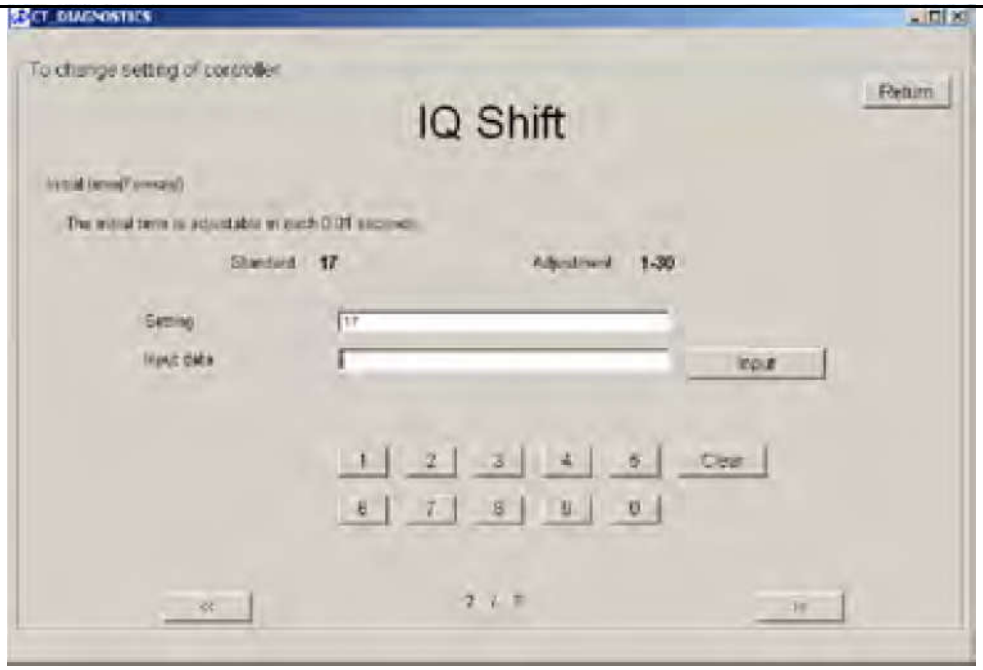


FIG. 414

FIG. 414: The time required for the power shuttle clutch solenoid to respond when placing the shuttle lever in the Forward position can be adjusted. Adjusting the initial time value by 1 will change the time of the shuttle valve response by 10 milliseconds.

Standard: 17 (4 cylinder tractor)

12 (3 cylinder tractor)

Adjustable range 1 to 30

To Change Setting of Controller (PTO)

From the PTO menu window, click on To change setting of controller. From this window, the PTO controller settings can be viewed or changed.

The controller setting can be modified from the factory setting to:

- Adjust the amount of (fill) time required for oil to reach operating pressure in the PTO clutch.
- Adjust the amount of (fill) time required for oil to reach operating pressure in the PTO clutch when the Selectable
- Adjust the initial oil pressure available when the Selectable PTO feature is used.

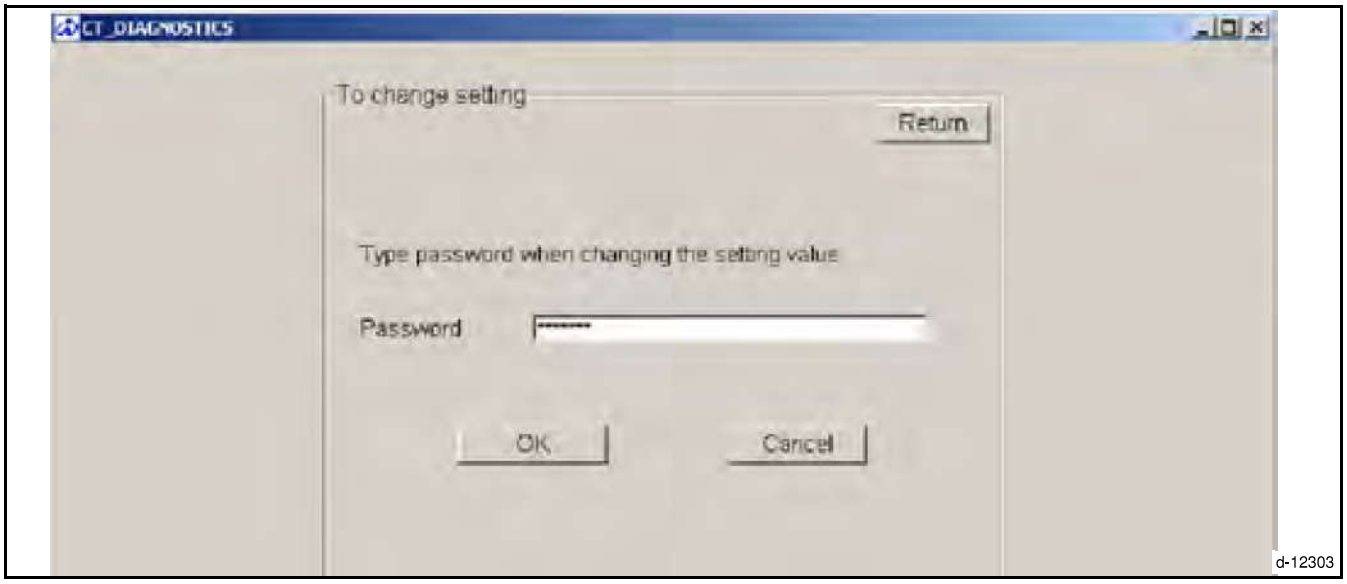


FIG. 426

FIG. 426: A password is required to change the controller settings. The default password is tractor. The password can be changed as outlined in the SETTINGS section of this User Guide. Click OK after typing in the password.

FIG. 427: If the password is entered, an error message will appear. To simply view the current settings, click on the Cancel button.

FIG. 427

TROUBLESHOOTING

Software Does Not Recognize the Tractor

FIG. 445: If the software and tractor fail to communicate when connecting the laptop to the computer, the following message will appear on the Connecting screen.

FIG. 445

1. Make sure the tractor key is in the ON position before attempting to make the connection.
2. Check all connections from tractor laptop computer.
3. Verify that the serial cable properly configured. It requires a cross connection or null modem adaptor (see annex).
4. Make sure the proper COM port has been selected.

Lost Password

Go to the START menu in MS Windows. Go to SETTINGS. Go to CONTROL PANEL. Go to ADD/REMOVE Programs. Locate CT Diagnostics and delete the software. Also delete the CT Diagnostics folder from PROGRAM files. Reinstall the CT Diagnostics software. Reinstalling the software will initialize all the settings back to the default values. The default password is tractor.

Key Turned Off

If the tractor key has been turned to the OFF position while running the program, it will be necessary to close and restart the program.

Replace the Tractor Controller and the Tractor Will Not Shift

The digital dash panel must be programmed prior to using the CT diagnostics software. Programming the digital dash panel identifies the tractor. See tractor service manual.

FIG. 3: Component listing:

(1) Bolts (6)
(2) Retainer Bolt Assembly
(3) Retainer Bolt
(4) Spring Pin
(5) Ball
(6) End Cap
(7) Gyrator
(8) Spacer Plate
(9) Drive
(10) Control Valve Assembly
(11) Housing
(12) Sleeve
(13) Spool
(14) Pin
(15) Centering Springs (4)
(16) Flat Springs (2)
(17) Adjust Plug
(18) O-ring
(19) Spring
(20) Poppet
(21) Collar
(22) Bearing Races (2)
(23) Thrust Needle Bearing
(24) Seal
(25) Oil Seal
(26) Dust Seal
(27) Retaining Ring
(28) Seal Bushing
(29) O-rings
(30) Seal
(31) O-ring

NOTES

Adjustment of Opening Angles of the Door

The angles will be adjusted by shifting the position of the door damper on the cabin frame. The unused holes are capped.

FIG. 8: When shipped, the door is set to 1m in opening width.

Damper setting position rear (1).

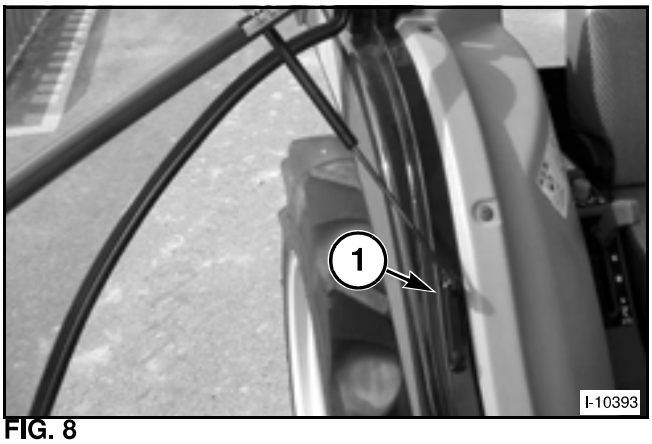


FIG. 8

FIG. 9: After adjustment, the door opens about 65 cm in width.

Damper setting position front (1).

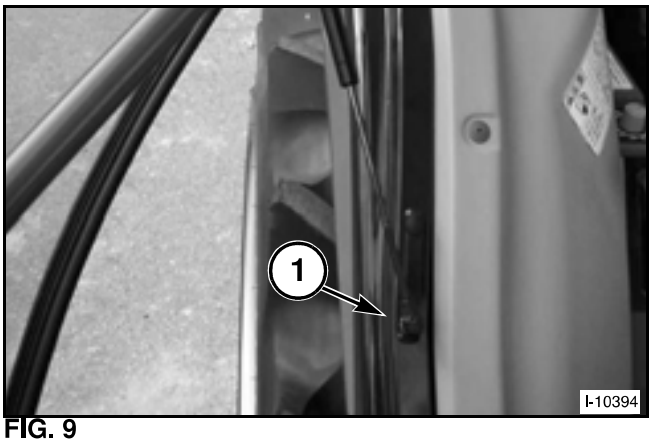


FIG. 9

Magnetic Clutch

FIG. 24: The magnetic clutch (1) transmits or shuts off the engine power to the compressor while the engine is running while the air conditioner switch is on. It stops the compressor when the indoor temperature has reached to the specified level set by the control lever and restarts the compressor when the temperature exceeds the specified level.

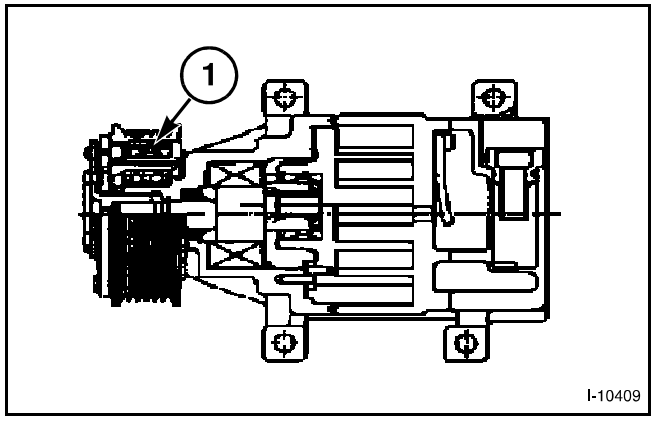


FIG. 24

Safety Relief Valve

The safety relief valve opens when pressure on a high-pressure side of the refrigerating cycle rises abnormally, and a part of the refrigerant is discharged.

Opening pressure: 3.43 to 4.17 MPa (497.50 to 604.80 psi)

Closing pressure: 2.75 MPa (398.85 psi) or lower

Condenser

FIG. 25: The condenser plays the role to return liquid the refrigerant gas of high pressure and high temperature. Therefore, when the air-cooling efficiency of the condenser is poor, it deteriorates performance of the air conditioner.

(1) Intake Side

(2) Delivery Side

IMPORTANT: When the condenser cores are stopped up, the air conditioner doesn't get cold at all and the refrigerant gas is pressurized excessively, which may lead to compressor seizure or belt slippage. Advise users to check it everyday and keep it clean.

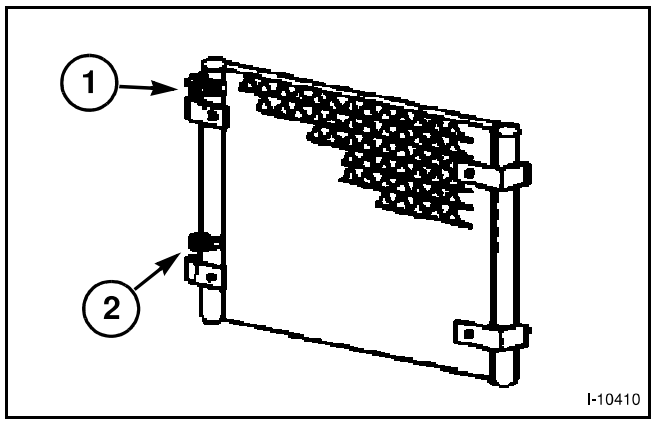


FIG. 25

Air Conditioner Filter

The air conditioner filter should be inspected and made clean every month or so, which may depend on use conditions.

When cleaning is neglected, deteriorated airflow rate and trouble of the air conditioner unit will result.

Exterior

FIG. 35: Remove four screws, and open the filter cover.

(1) Air Conditioner Filter

(2) Air Filter

(3) Four Screws

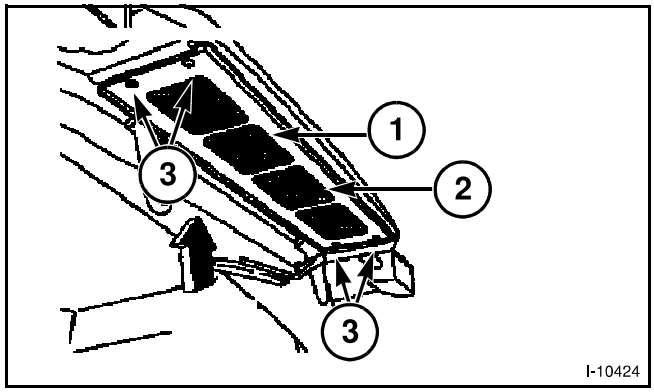


FIG. 35

FIG. 36: Take out the air conditioner filter.

(1) Air Conditioner Filter

(2) Filter Cover

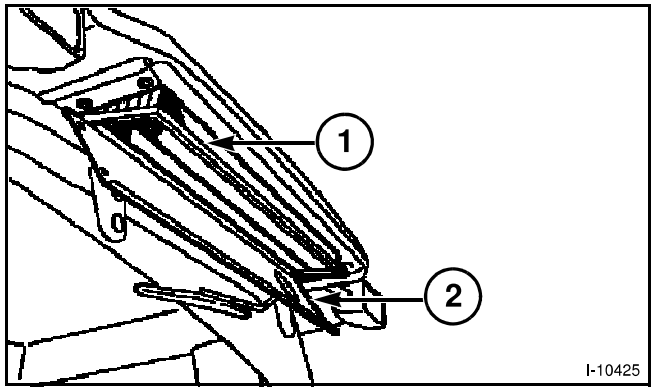


FIG. 36

FIG. 37: Blow the filter with compressed air from the opposite side, that is, the opposite direction of the wind, which normally passes in the air conditioning operation through the filter.

Install the filter.

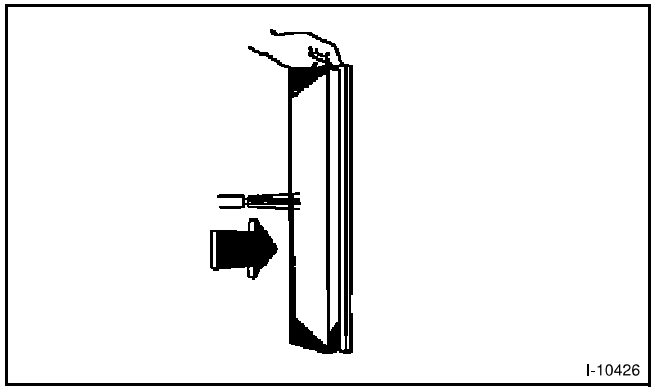
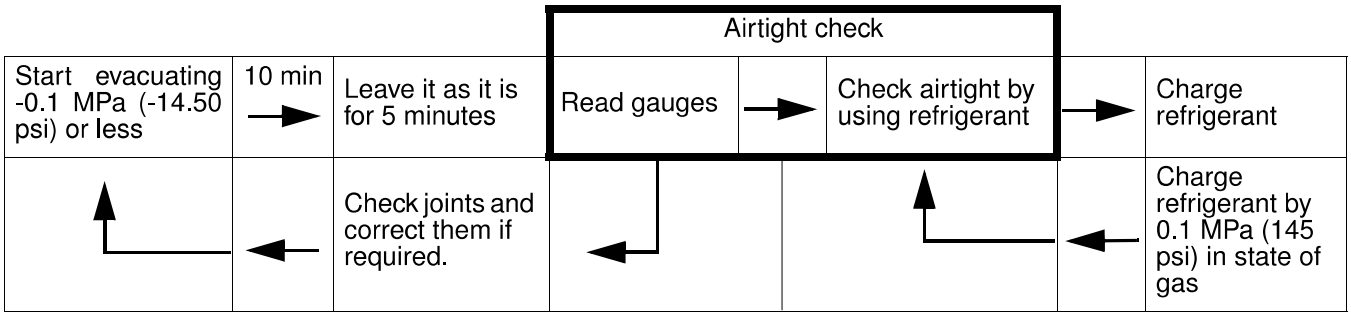


FIG. 37

Air Evacuation



Connection of Service Gauge Manifold

FIG. 60: Connect the charging hoses of high and low pressure with the service gauge manifold.

(1) Red hose … High-pressure side (H mark)

(2) Blue hose … Low-pressure side (L mark)

Connect the charging hose (green) (3) at the center of the service gauge manifold with the vacuum pump.

NOTE: Be sure to connect the high-pressure and low-pressure side correctly without fail.

The service valve might be provided on the compressor according to a vehicle type.

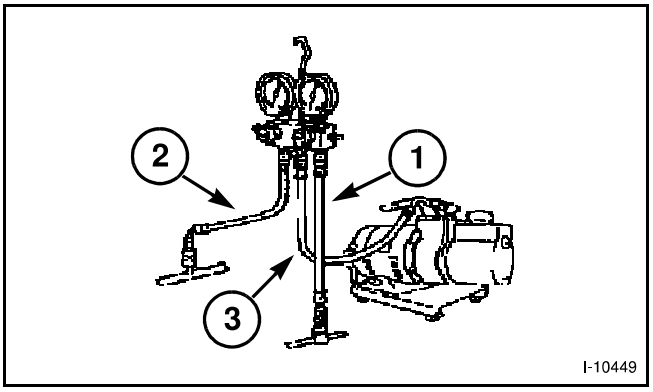


FIG. 60

Evacuation

FIG. 61: Open the high-pressure valve (Hi) (1) and low-pressure valve (Lo) (2) of the gauge manifold respectively.

Switch on the vacuum pump to evacuate the system. (Ten minutes)

When the scale of the low-pressure gauge exceeds -0.1 mPa (-14.50 psi), close the high-pressure valve and the low-pressure valve of the gauge manifold and turn off the vacuum pump (3).

Point:

The air will enter the system when the vacuum pump is stopped before the valves of the gauge manifold are closed.

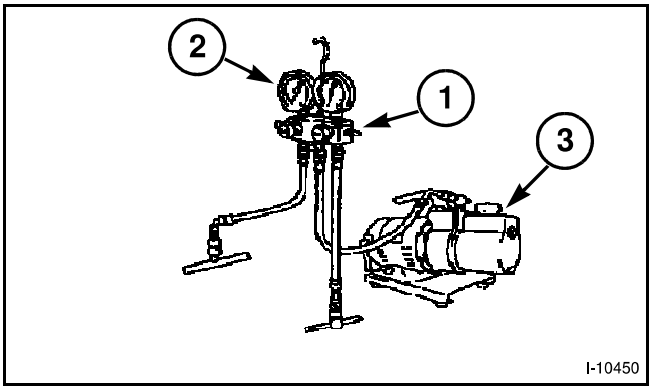


FIG. 61