



UniCarriers Americas Corporation

SERVICE MANUAL - CHASSIS

MODELS 1F1/1F2

Platinum II Series Cushion & Pneumatic Tire
Engine Powered/LPG, Gasoline, Dual Fuel, Diesel & Carburetor
3,000-8,000 lb. Capacities



SERVICE

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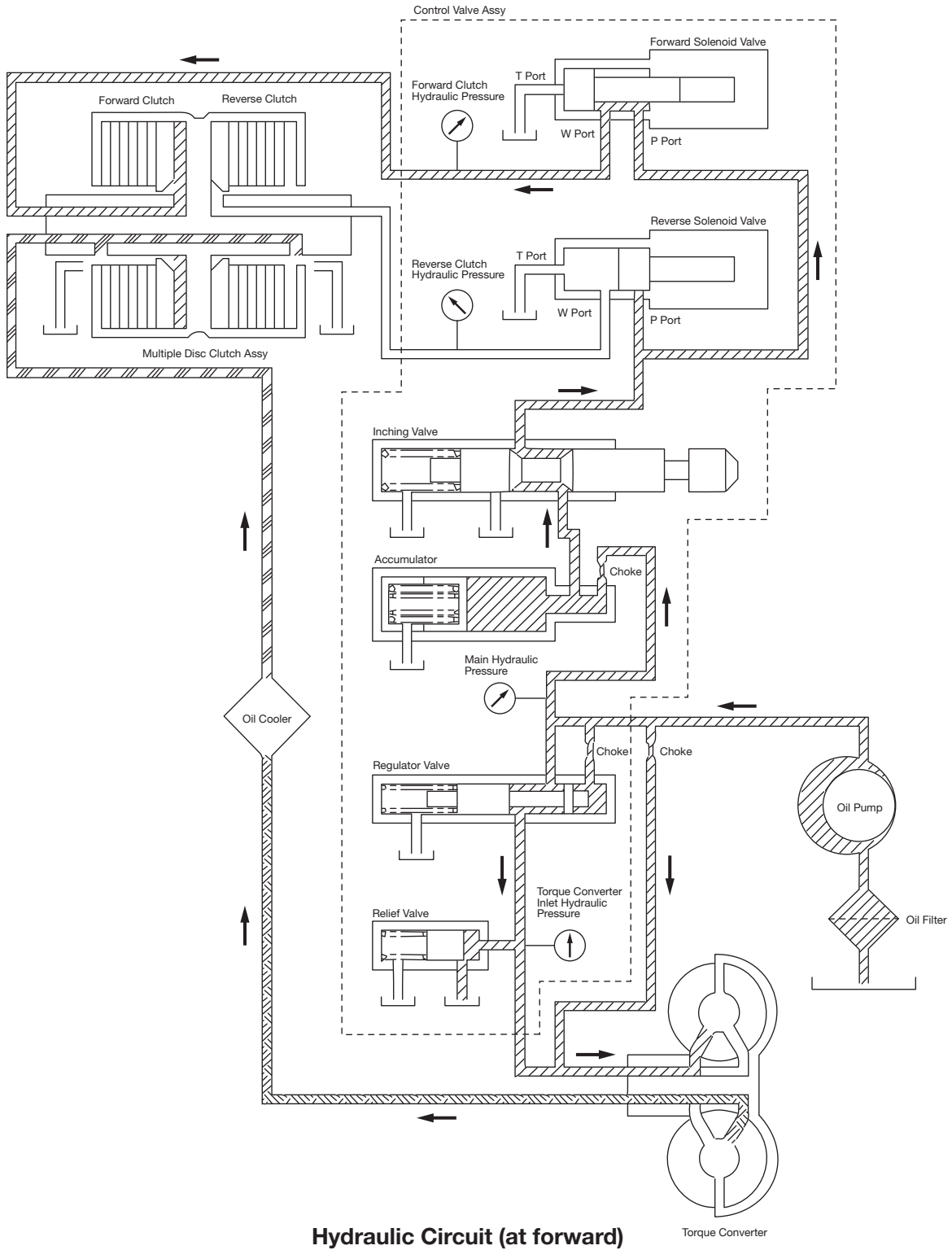
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CONSTRUCTION



DISASSEMBLY AND REMOVAL



Disassembly of the Clutch Drum Assembly (Cont'd)

10. Remove the Spring.

11. Remove the Piston from the Clutch Drum. If the Piston is stuck and cannot be removed, introduce air into one of the Shaft Holes to assist in removal of the Piston.

Shaft Hole <1> is forward.

Shaft Hole <2> is reverse.

Remove and discard the O-Rings.

NOTE: Never reuse O-Rings.

12. Remove and discard the Seal Ring.

NOTE: When re-assembling, DO NOT open the Ring any more than is necessary. It's made of resin and can easily break.

NOTE: Never reuse a Seal Ring after it has been removed.



AUTOMATIC TRANSMISSION CUSHION TWO SPEED

SECTION **ATC2**

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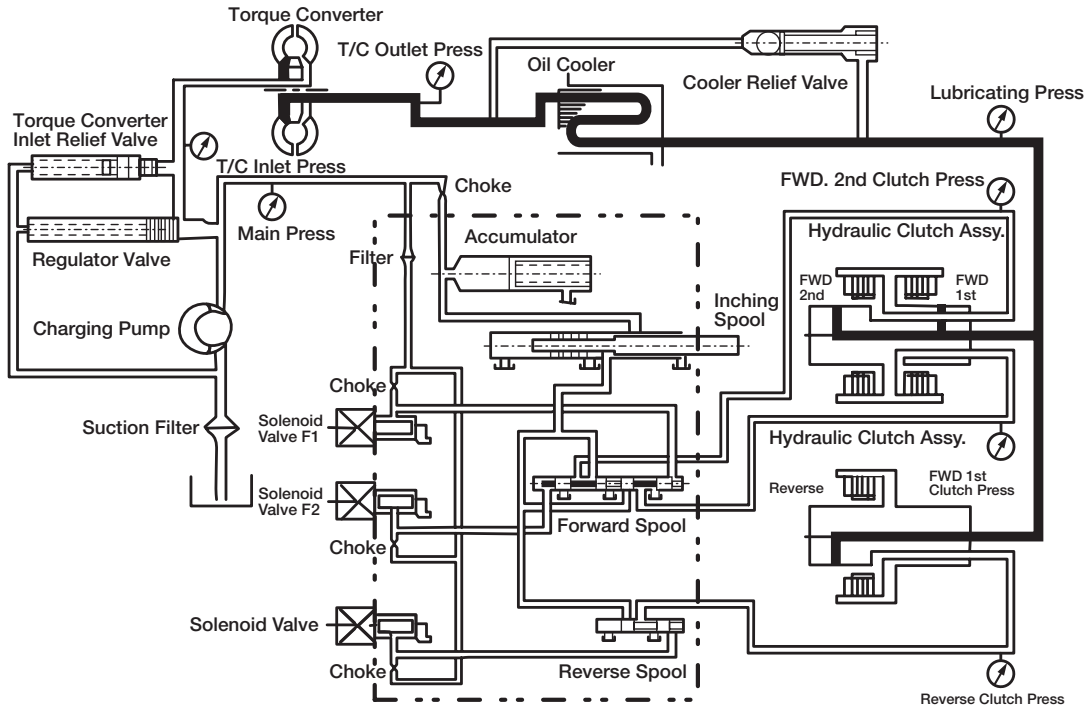
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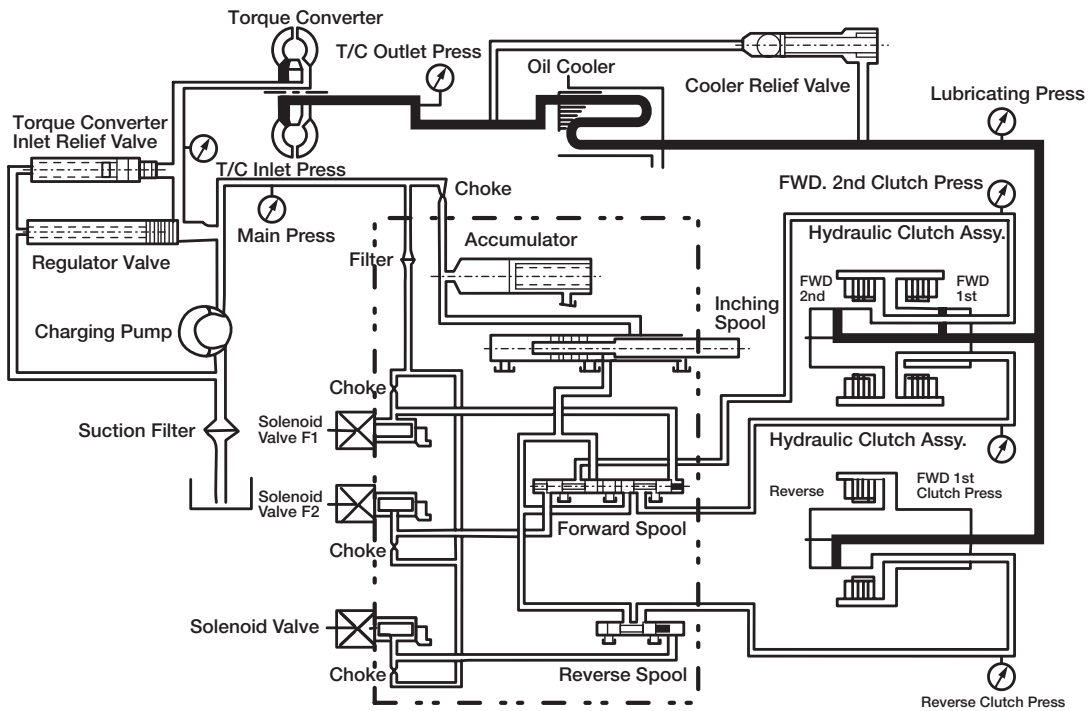
This section contains information and specifications for both carbureted general overseas market (GOM) models, as well as, electronic control models (manufactured in USA.) Therefore, prior to taking any action, ensure the specifications and/or procedures are for the proper fuel delivery system; carbureted or electronic controlled.

MAINTENANCE

Hydraulic Diagrams (Cont'd)



Hydraulic Circuit (at Forward 2nd)



Hydraulic Circuit (at Reverse)

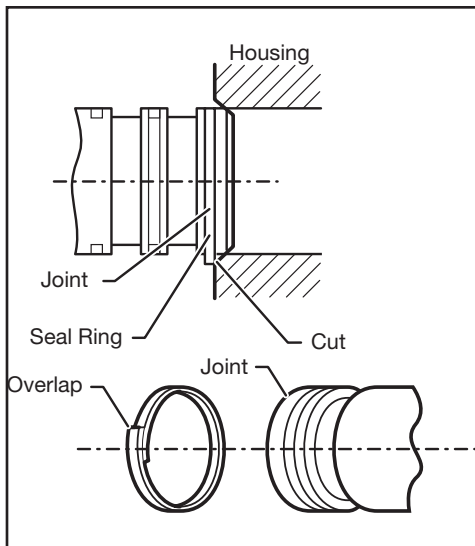
DISASSEMBLY AND ASSEMBLY

Assemble the Torque Converter and Transmission

To re-assemble the Torque Converter and Transmission, reverse each disassembly steps in reverse order.

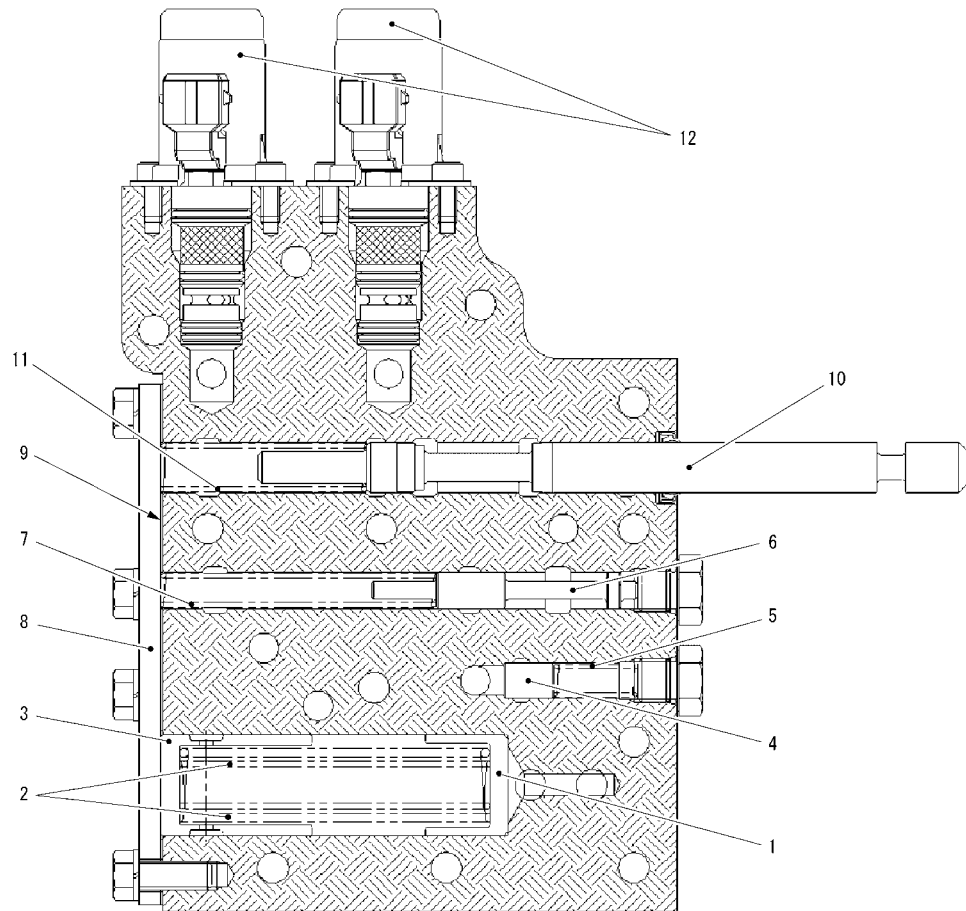
Note the following prior to re-assembly:

1. Clean the parts disassembled using clean oil to remove all the foreign items.
2. Clean all oil grooves and oil circuits completely.
3. Remove and replace all the Oil Seals, O-Rings, Gaskets and Disks.
4. Refer to the inspection notices of Section 5 (Maintenance Standard) to avoid any errors on the reassembling.
5. Clean and apply proper oil to the Pistons, Control Valve Pistons and Spools contained in the Housing before assembling.
6. When assembling oil seals, fill in lithium grease (Shell Albania No.2 or equivalent) for 1/3 to 1/2 of lip can. Apply semi-dry liquid gasket (loctite #271 or equivalent) before assembling. However, be careful not to attach liquid gasket on the lip nor on the sliding surfaces.
7. To avoid damage or cracking while inserting, apply thin layer of lithium grease on the surface of O-Rings before inserting.
8. When installing the resin type Seal Ring of the Hydraulic Clutch, bend the Seal Ring ends slightly to achieve a small overlap of the Seal Ring ends. Insert the Seal Ring into the groove.
HINT: Apply a small amount of grease into the groove prior to installing the Seal Ring. The grease will help keep the Seal Ring in the groove.
9. Refer to the tightening torque for Bolts and threads as given in Section 6 (Bolt and Plug Tightening Torque).
10. Upon the completion of assembly of each unit, Confirm the unit assembly slides are smooth and free of any binding.
11. When inserting the Torque Converter, keep the Torque Converter side of the housing raised so the Torque Converter can be installed horizontally. Be careful not to damage the Oil Seals and Bushings of the Gear Pump when installing the Torque Converter.



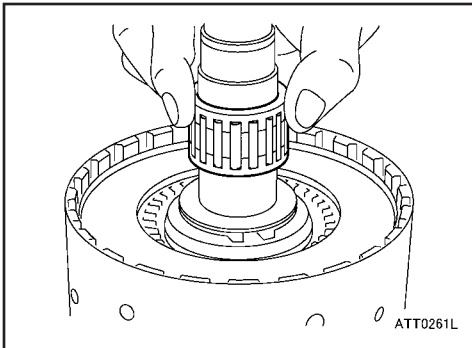
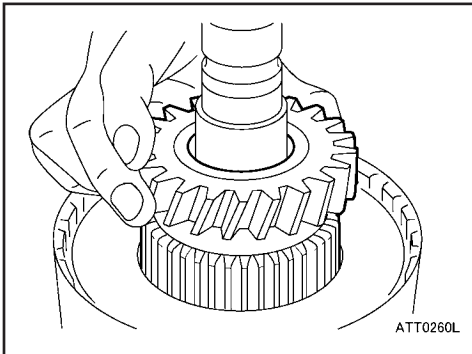
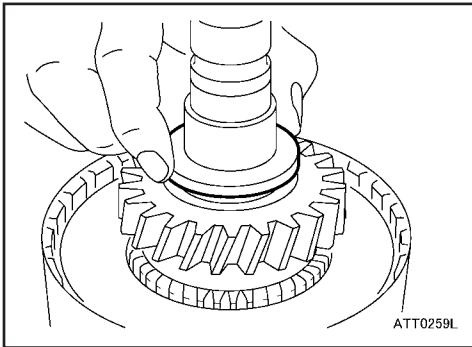
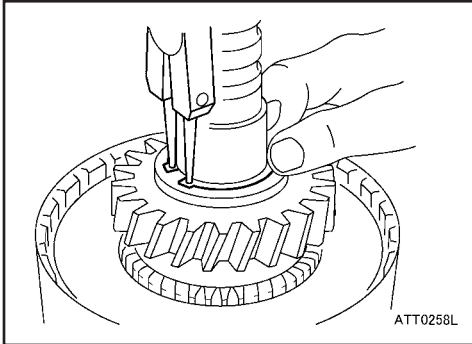
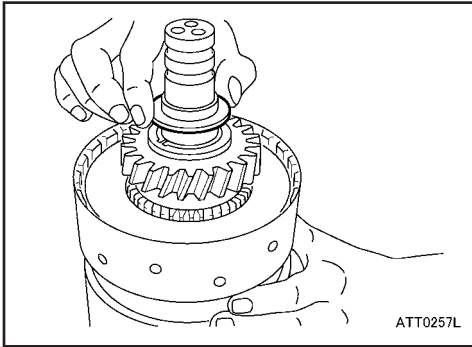
CONSTRUCTION

Control Valve



1. Accumulator Piston
2. Accumulator Piston Spring
3. Accumulator Piston Stopper
4. Converter Relief Valve
5. Converter Relief Valve Spring
6. Regulator Valve
7. Regulator Valve Spring
8. Side Plate
9. Side Plate Gasket
10. Inching Valve
11. Inching Valve Spring
12. Solenoid Valve

DISASSEMBLY AND ASSEMBLY



Disassembly of Clutch Drum Assembly

Disassemble the forward and reverse side with the same procedure.

1. Pull out the Gear Spacer.

2. Remove the Snap Ring from the groove.



CAUTION

- **Never reuse the Snap Ring.**

3. Remove the Thrust Washer.

4. Remove the Forward Gear.

5. Remove the Needle Bearing.

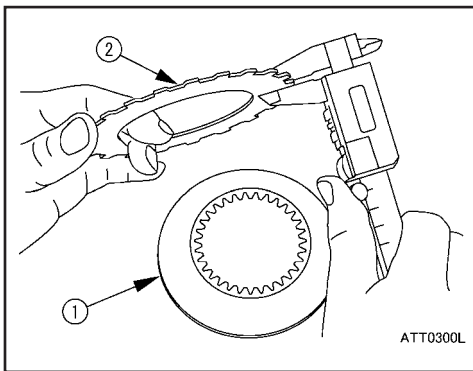
INSPECTION OF THE CONSTRUCTION PARTS

Control Valve

Inspect for damage or seizing of the Spool; wear or fatigue of the Valve Spring. Replace parts as needed referencing the table below. If the Control Valve Body is damaged, replace the entire Control Valve.

Unit: mm (in)

Item Spring names	Wire diameter	Average coil diameter	Effective number of turns	Free length	Installation length	
					Specified length	Specified load N (kg, lb)
Accumulator (inside)	1.8 (0.071)	11.7 (0.461)	26.5	102 (4.02)	86.1 (3.390)	40.2 (4.1, 9.0)
Accumulator (outside)	2.6 (0.102)	17.9 (0.705)	18	110 (4.33)	86.1 (3.390)	106.9 (10.9, 24.0)
Regulator	1.6 (0.063)	7.8 (0.307)	33	87.2 (3.433)	75.8 (2.984)	49.0 (5.0, 11.0)
Torque converter relief	1.2 (0.047)	7.8 (0.307)	10	27.9 (1.098)	23 (0.91)	22.1 (2.25, 4.96)
Inching	1.4 (0.055)	12 (0.47)	17.5	81 (3.19)	56.5 (2.224)	32.0 (3.26, 7.19)



Clutch Drum

- If the Drive (1) or Driven Plate (2) is worn out or damaged, replace it.

Drive Plate

Standard: 2.5 - 2.65 mm (0.0984 - 0.1043 in)

Repair limit: 2.2 mm (0.087 in)

Driven Plate

Standard: 1.53 - 1.67 mm (0.0602 - 0.0657 in)

Repair limit: 1.4 mm (0.055 in)

- If the Spring is worn out or damaged, or the Spring Retainer is deformed, replace them.
- When the piston slide surface is damaged, replace the piston.
- Measure the width of the Mainshaft Seal Ring groove. If the result is outside the repair limit, replace the Clutch Drum.

Seal Ring groove

Standard: 2.26 - 2.29 mm (0.0890 - 0.0902 in)

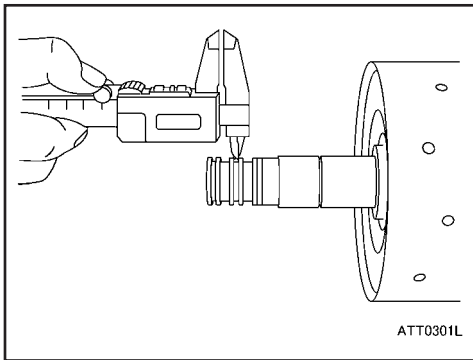
Repair limit: 2.4 mm (0.094 in)

- Measure the Seal Ring width. If the result is outside the repair limit, replace the Clutch Drum.

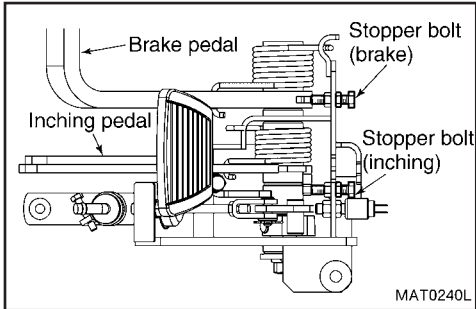
Seal Ring width

Standard: 2.05 - 2.15 mm (0.0807 - 0.0846 in)

Repair limit: 2.01 mm (0.0791 in)



INSPECTION AND ADJUSTMENT



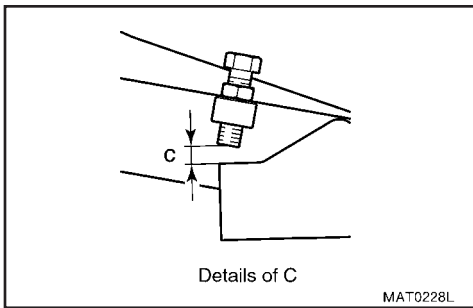
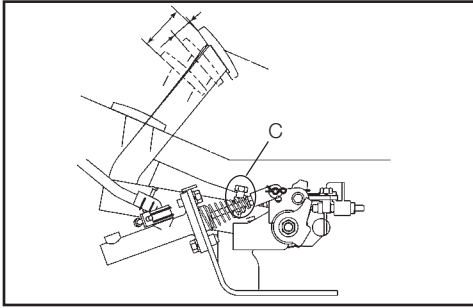
Adjustment of Inching Brake Pedal

1. Adjust and tighten the Stopper Bolt (inching) so the height (A) from the top surface of the floor plate to the center of the Inching Pedal meets the below standard:

Standard (mm, in): 140, 5.5

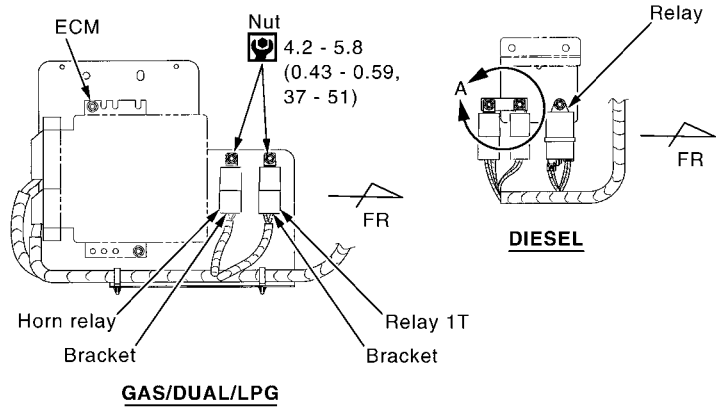
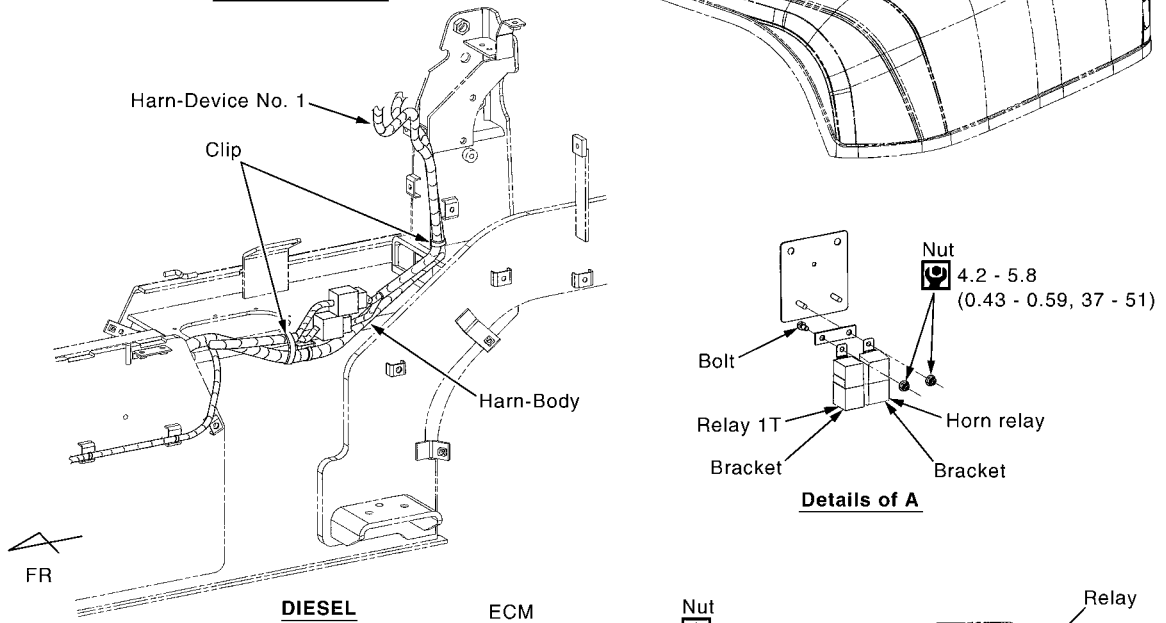
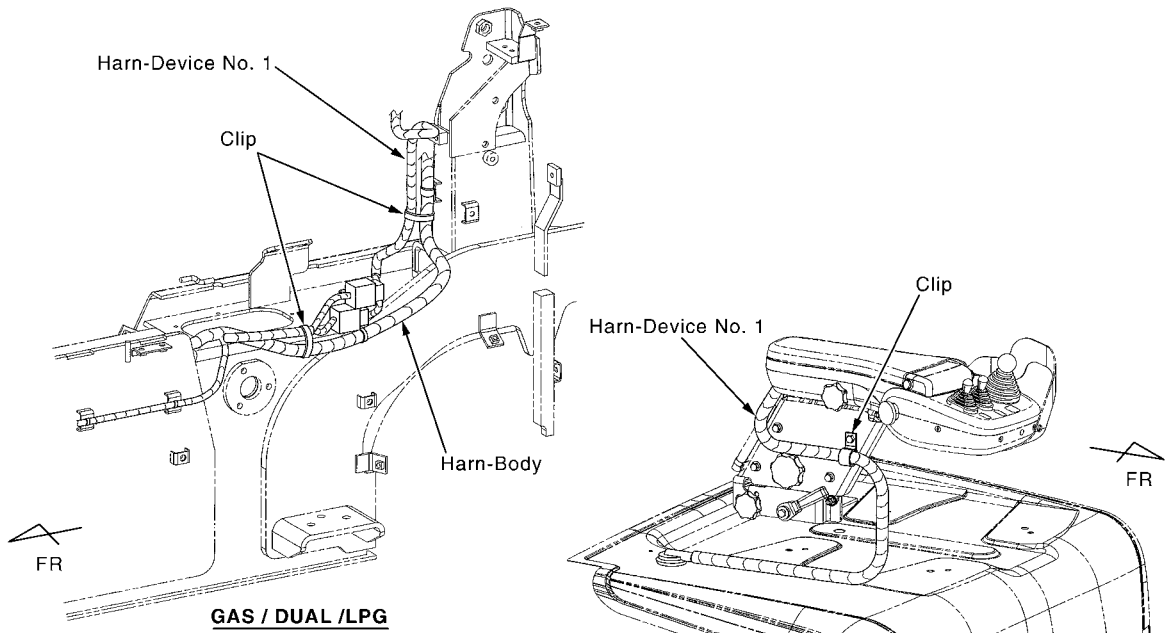
2. Adjust the clearance (c) of the part C Bolt and linkage to the standard indicated below. Securely tighten with the Nut.

Standard (mm, in): 5, 0.228



WIRE HARNESS

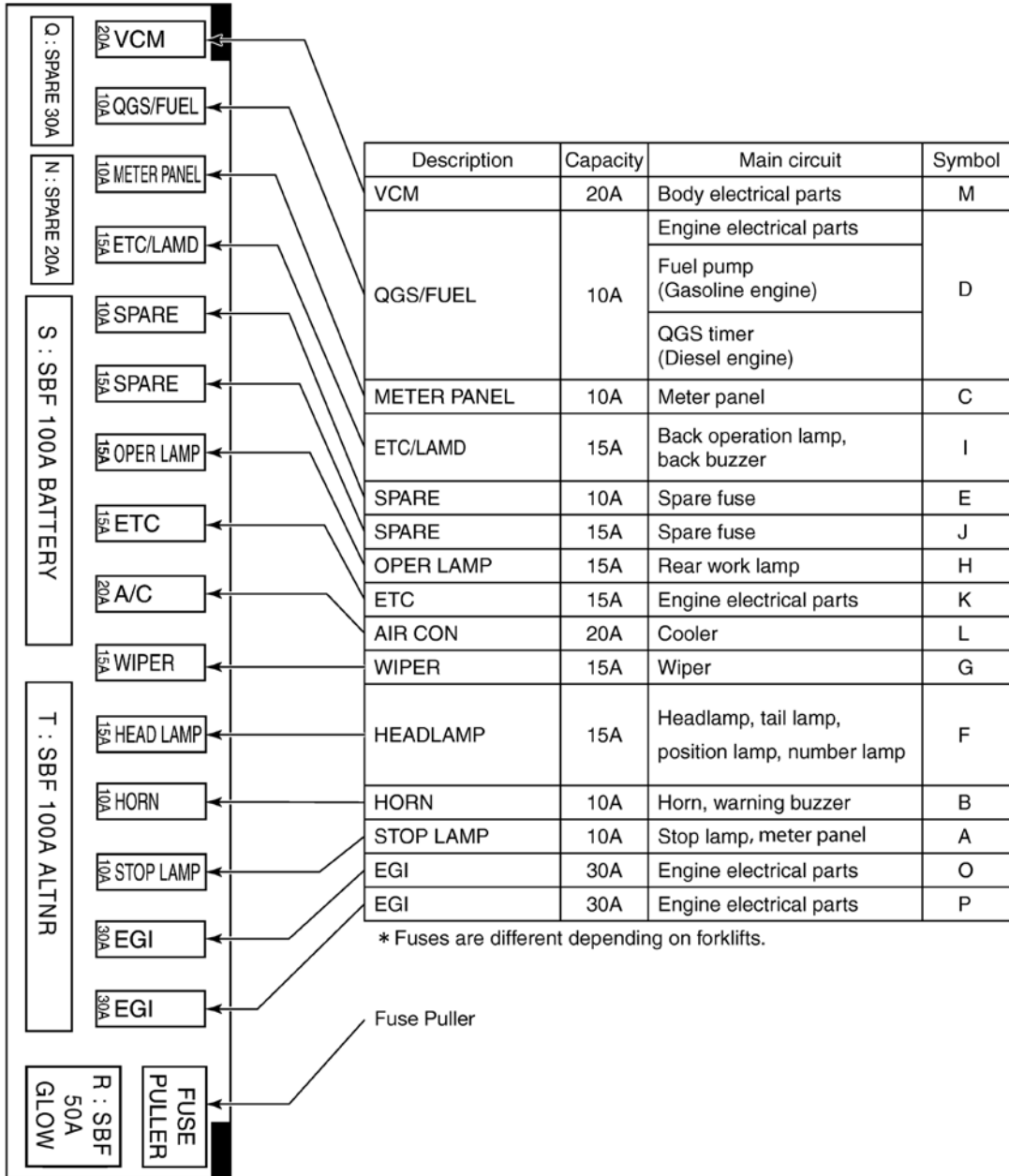
Joystick Control System



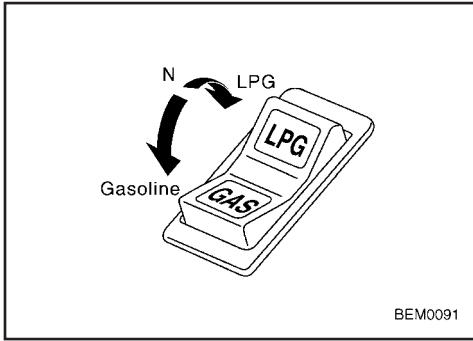
: N•m (kg-m, in-lb)

FUSE BOX

Fuse Arrangement



SWITCHES



Fuel Switch (Gasoline/LPG Dual-Fuel Models Only)

- This Switch is used to switch the working fuel from LPG to gasoline, or from gasoline to LPG.
- LPG: Position at which to use LPG fuel.
- (N): Neutral position (OFF position) No working fuel type is selected. In Neutral position, the truck will not run.
- GAS: Position at which to use gasoline.
- The switch's display light illuminates on the side of the fuel currently being used.

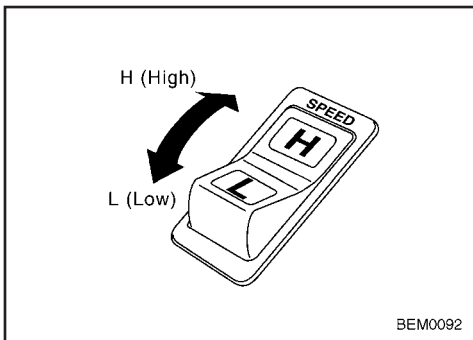


CAUTION

- **Do not operate the Charging Bulb (green or gray color). LP gas will blow out.**
- **While the Engine is running, the fuel will not change even if the Fuel Switch is pressed.**

NOTE:

- When switching the fuel, wait until the Engine warm-up is completed. Then follow the correct switching procedure.
- To prevent gasoline deterioration, drive several kilometers with gasoline about once every two weeks.
- The Engine will not start when the switch is in the neutral position. Before starting the Engine, press the switch to the desired fuel.

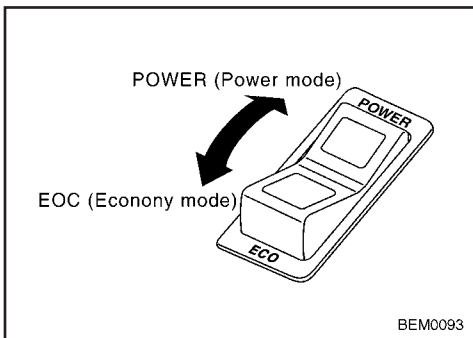


Maximum Speed Switch (Option)

This Switch is used to switch the maximum speed to High (H) or Low (L). If it is not necessary to restrict the maximum speed, select the H setting. If restricting the maximum speed is desired, select the (L) setting.

The Switch will illuminate the selected speed option.

Throttle Sensitivity Adjustment Switch (Option)



- This Switch is used to switch the acceleration to Power (Power mode) or ECO (Economy mode).
- When normal acceleration is required, press the Power option. When gentle acceleration is desired, press the Eco option.
- The Switch will illuminate the selected acceleration option. Settings can be changed in the conditions shown below.

○: OK X: NG

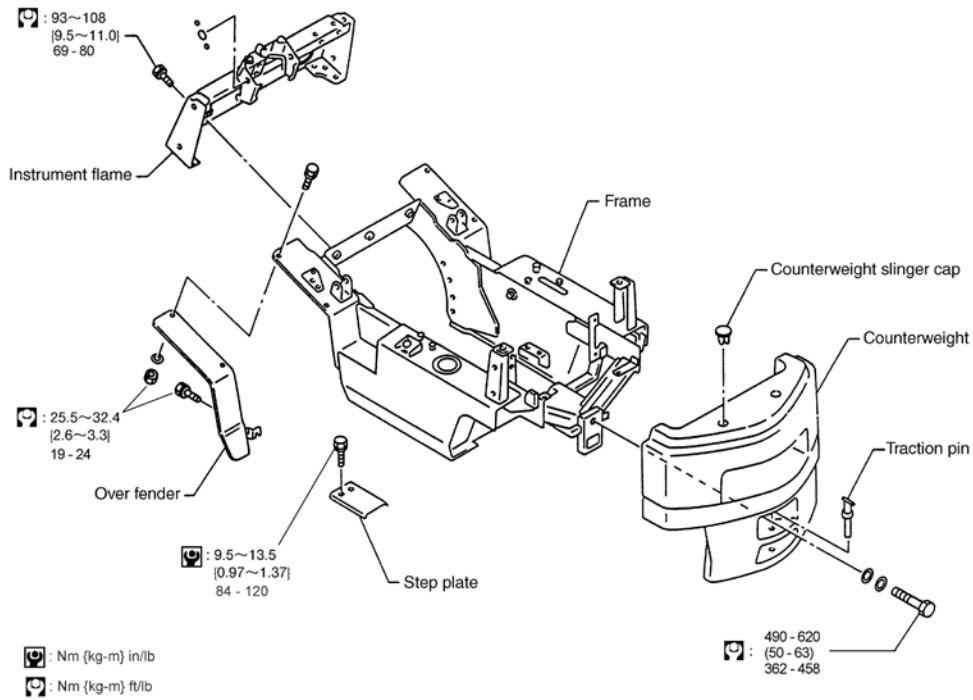
Switching Operation	Driving	Stopping
From power mode to Economy mode	X	○
From Economy mode to power mode	X	○

NOTE:

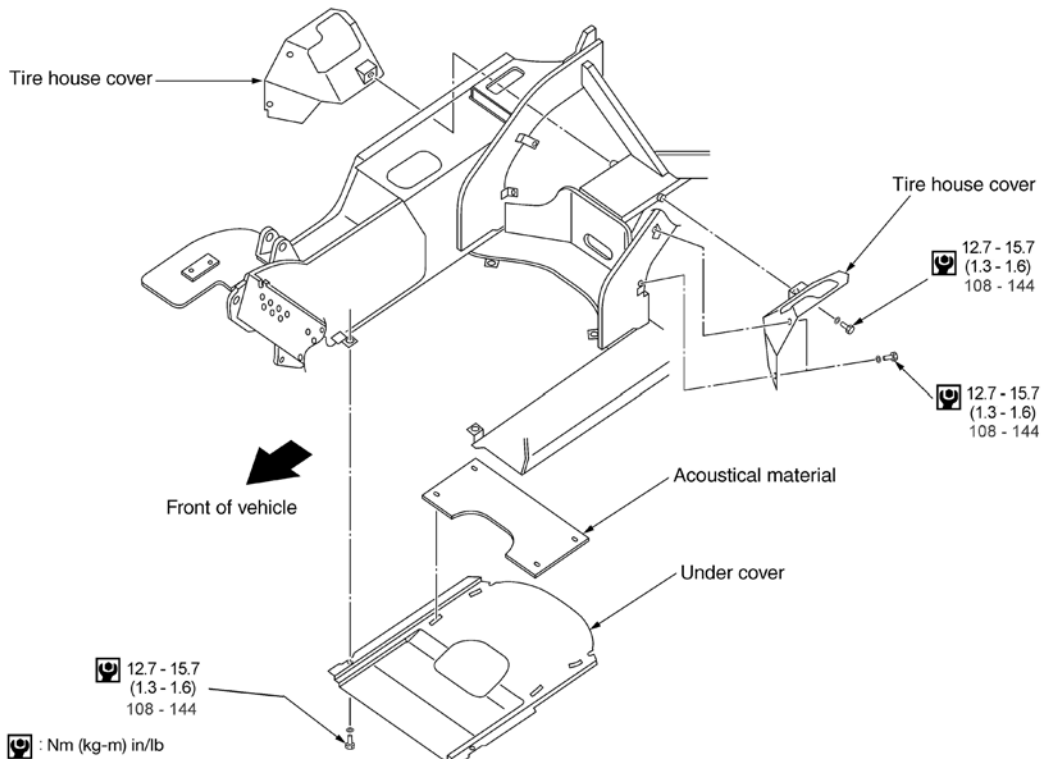
Switching from the ECO mode to the POWER mode can be made only when the accelerator is released.

COUNTERWEIGHT, FRAME, INSTRUMENT FRAME / UNDER COVER

Counterweight, Frame, Instrument Frame

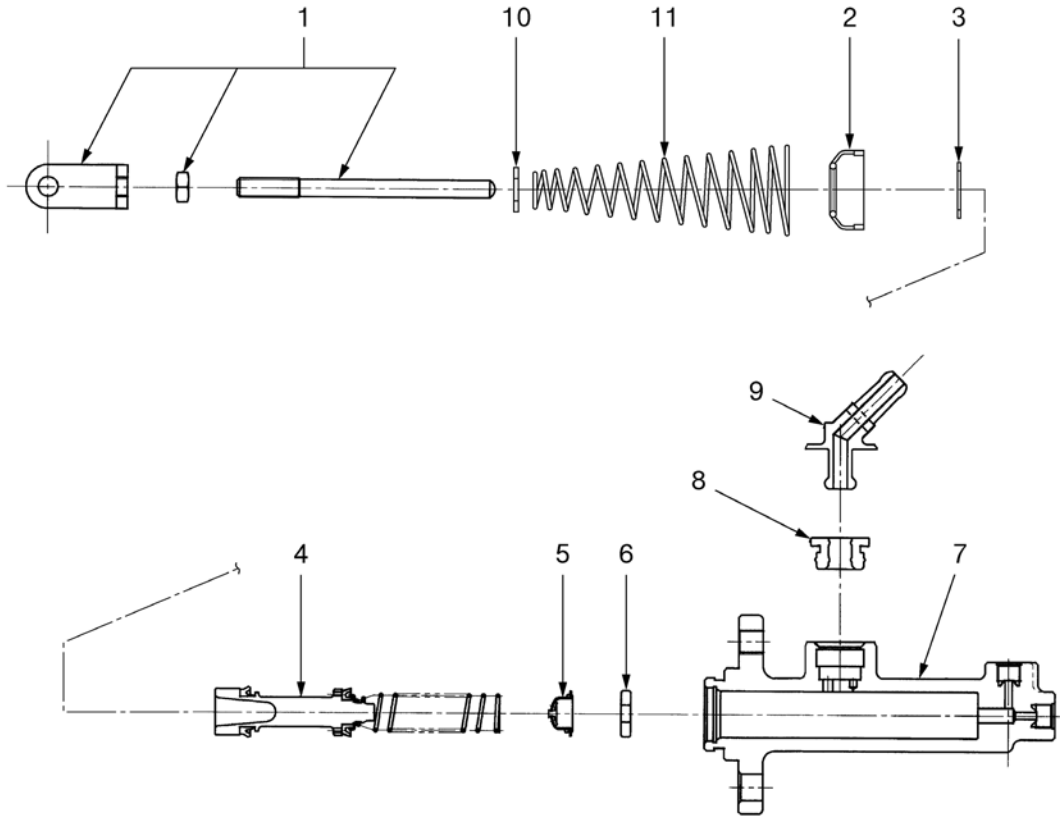


Under Cover (Option)



DISASSEMBLY AND ASSEMBLY

Master Cylinder Disassembly

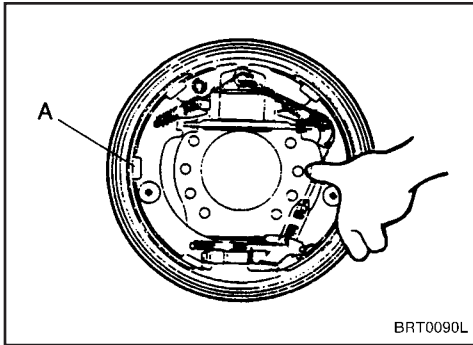


Order of assembly

- 1) Clevis, Nut, Push Rod
- 2) Boot
- 3) Snap Ring
- 4) Piston Assembly
- 5) Valve Assembly
- 6) Valve Seat
- 7) Cylinder Body
- 8) Filler Union Bushing
- 9) Filler Union
- 10) Flat Washer
- 11) Spring

INSPECTION AND ADJUSTMENT

Performance Test for Automatic Adjuster



1. Pull the Fitting Cable outward with fingers. The clearance (A) between the Lining and Drum is normal if the lever returns to its original position after one tooth of the screw passes.

- Clearance (A) between Lining and Drum

Standard (mm, in):

1F1 (0.25 - 0.5, 0.010 - 0.020)

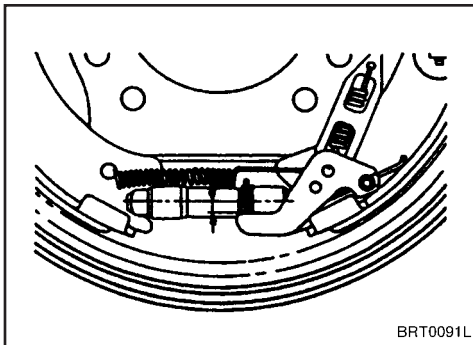
1F2 (0.1 - 0.35, 0.004 - 0.014)

2. If the Lever action is slow, check the position of the Lever under the Adjusting Screw.

- The Lever is designed to make contact with the Adjusting Screw about 7 to 9 mm below the Screw centerline. If this position is improper, the Lever will not engage correctly with the Screw's teeth, and the Screw will not rotate correctly, even if the Lever operates.

3. If the automatic adjuster does not operate correctly, take the following actions:

- Make sure that the Adjusting Spring is correctly attached to the prescribed hole of the Primary Shoe.
- Replace the Adjusting Cable.
- Replace the Adjusting Lever.
- Replace the Adjuster.

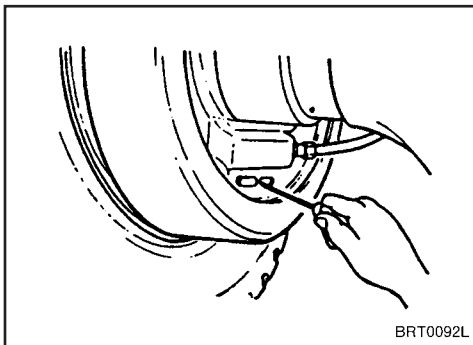


Manual Adjustment Procedure

Insert a screwdriver into the adjusting hole on the back of the Backing Plate. Turn the Adjusting Screw to adjust the clearance between the Drum and Lining.

NOTE:

Turning the Screw by one tooth makes an adjustment of 0.03 mm (diameter).



PARKING BRAKE

Removal

- Remove the Lever Mounting Bolts (2).
- Remove the Lock Nuts from the Cable Clamp and Holder and remove the Stick and Cable Assembly.



CAUTION

- **Disconnect the cable from the Brake Assembly ahead of time.**

Inspection

- If the Cable is broken or elongated, preventing adjustment: Replace the Cable.
- If the Grip is damaged: Replace the Grip.
- If connections are damaged and deformed, causing catching: Replace appropriate parts.

Installation

Note the following, and install in the reverse order of removal.

- Prevent cables from interfering with other moving parts, and do not install them in an unreasonable manner.
- After installation, adjust the Parking Brake.
- Lever Mounting Bolt

Tightening torque [Nm (kg-m) ft/lb]:

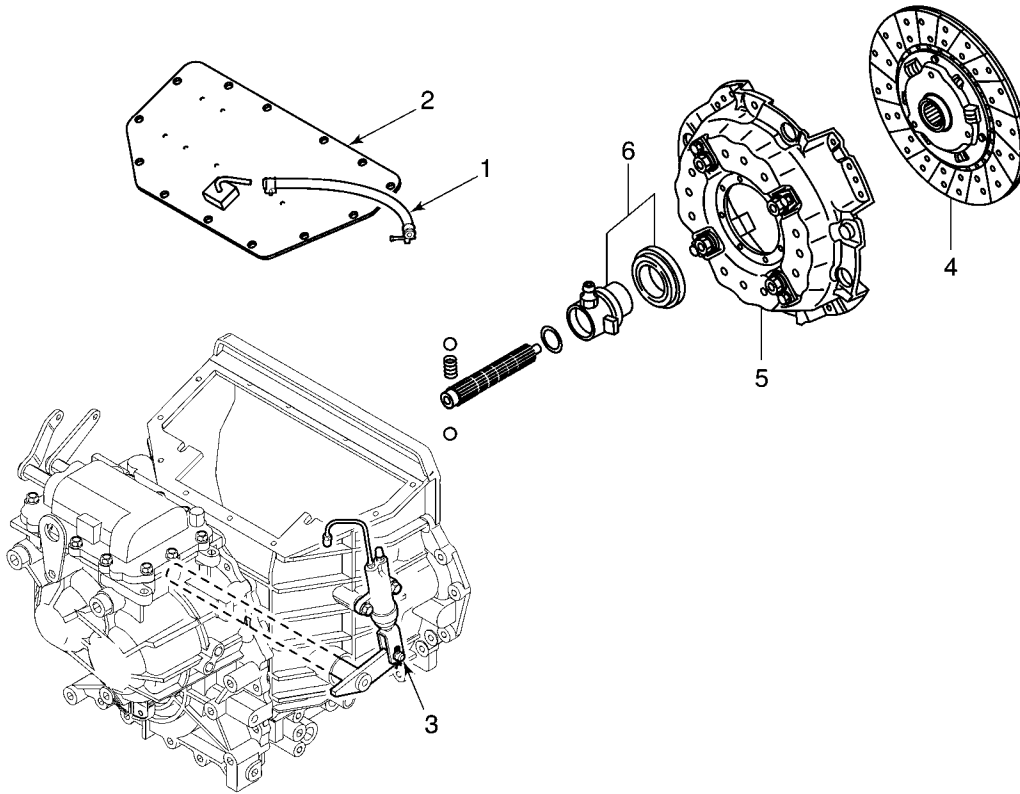
32.4 - 38.2 (3.3 - 3.9) 23.9 - 28.2

Troubleshooting

	Condition	Possible Cause	Corrective Action
Parking Brake	Operating stroke of Parking Brake is small	<ul style="list-style-type: none"> • Insufficient clearance between brake lining and drum 	Standard gap adjustment
	Unusual noise is emitted from Parking Brake	<ul style="list-style-type: none"> • Insufficient clearance between brake lining and drum • Brake Drum is badly deformed 	Standard gap adjustment Repair or replace Brake Drum according to repair standard
	Parking Brake does not work	<ul style="list-style-type: none"> • Parking cable is longer than specified length • Brake lining is worn beyond usable limit • Clearance between brake lining and drum is too large • Parking Brake pulling force is small 	After adjusting brake lining and drum clearance, when brake is still not effective, inspect parking cable length Replace shoe and lining assembly with new ones Adjust clearance between brake lining and drum Adjust to 245 - 295 N (25 - 30 kg) 55 - 66 Ft/lbs.

CLUTCH UNIT

Component Parts Location



Order of disassembly

- 1) Hose (Wet Type Only)
- 2) Clutch Cover
- 3) Clutch Operating Cylinder Pin
- 4) Clutch Disc Assembly
- 5) Clutch Cover Assembly
- 6) Release Bearing, Hub

The Manual Transmission Input Shaft is a type that can be split with the Input Gear. Because of this structure, components such as the Clutch Cover, Clutch Disc, and Release Bearing can be removed and installed while the Transmission Assembly is installed to the chassis.

To remove the forks and Clutch Shaft, however, the Engine and Transmission Assembly must be removed from the chassis.

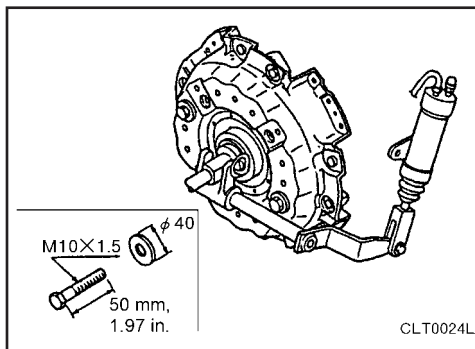


CAUTION

- **When the Engine and Transmission Assembly are installed to the chassis, there is insufficient space to remove the Clutch Shaft.**

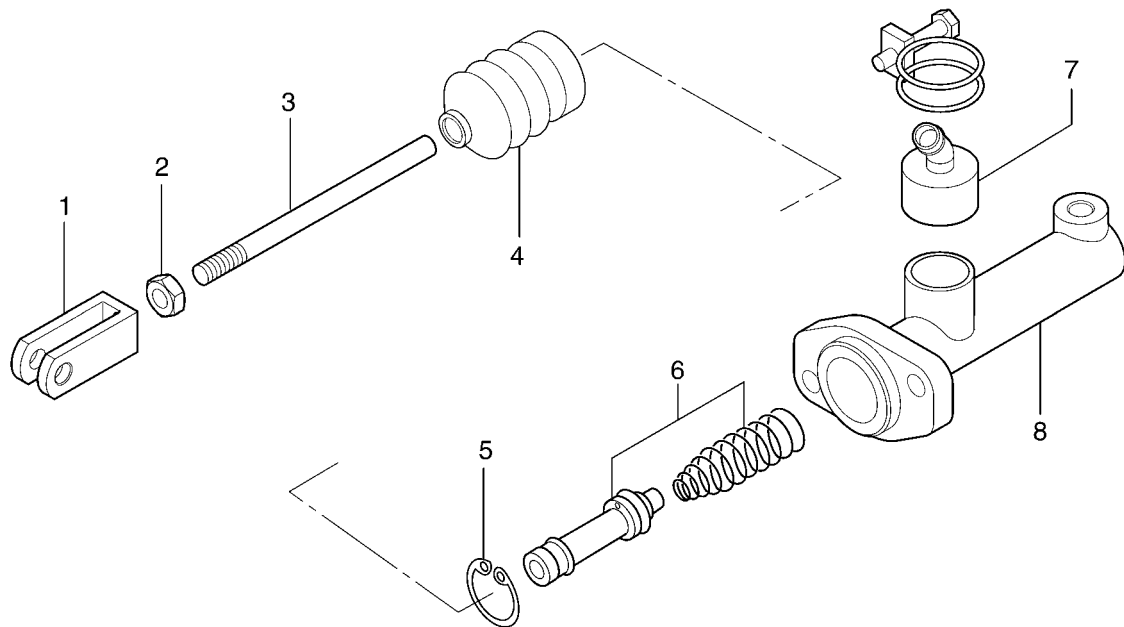
Disassembly

1. Press down on the Clutch Pedal and tighten the two Bolts (NFF1145-10050, for removing and installing Pressure Plate) with Washer (NF92301-02700) to put the Pressure Spring in a compressed state.



CLUTCH MASTER CYLINDER (FOR DRY CLUTCH)

Disassembly



Order of disassembly

- 1) Clevis
- 2) Lock Nut
- 3) Push Rod
- 4) Boot
- 5) Snap Ring
- 6) Piston Assembly
- 7) Filler Union
- 8) Cylinder Body



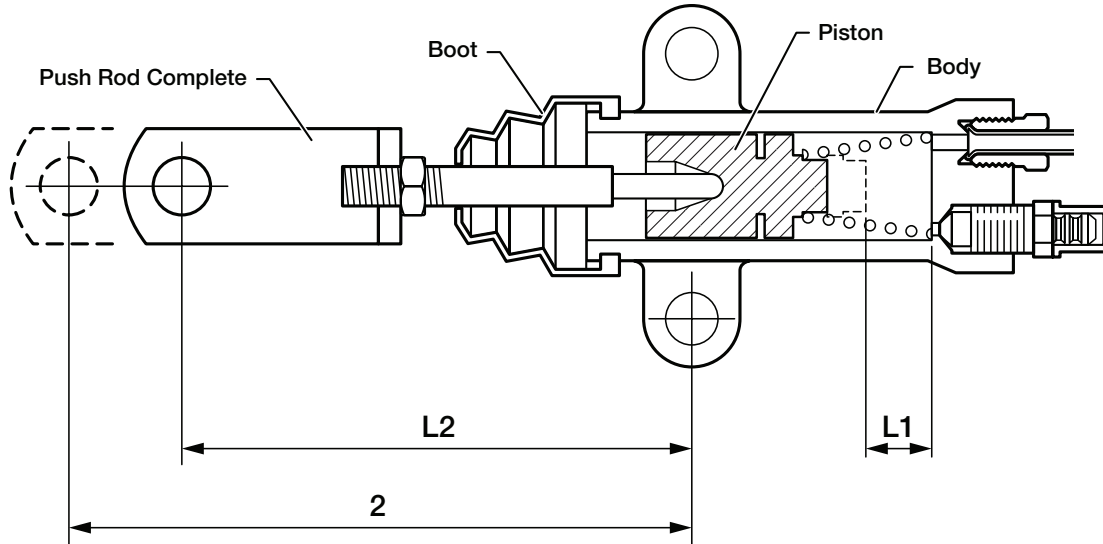
CAUTION

- **Replace Boot, Snap Ring and Piston Assembly using a repair kit.**
- **Replace the Lock Nut and Push Rod as a set.**
- **Do not damage the Cylinder, Piston, Cup, etc.**
- **Do not disassemble the Piston Assembly.**
- **Do not press on the exterior wall of the Cylinder body with a vise.**

ADJUSTMENT

Clutch Disc Wear Limit Inspection

The Clutch Operating Cylinder absorbs the positional change that occurs in the Pressure Plate Release Lever as a result of Clutch Disc wear. Measuring the amount of Clutch Disc wear as shown below makes it possible to determine the replacement period.



2: Length of the Release Cylinder unit when assembled (mm)

L1: Length when attached to the Clutch Shifter Shaft (when the clutch disc is new)

L2: Length from center of the body mounting bolt hole to center of the mounting pin hole when attached to the Clutch Shifter Shaft

L1 (Reference)			
Dry Clutch	(mm, in)	Standard	22, 0.87
Wet Clutch	(mm, in)	Standard	17, 0.67
Dimension L2			
Dry Clutch	(mm, in)	Standard	105.4 - 106.4, 4.15 - 4.19
		Repair limit	89.4 - 90.4, 3.52 - 3.56
Wet Clutch	(mm, in)	Standard	100.4 - 101.4, 3.95 - 3.99
		Repair limit	84.4 - 85.4, 3.32 - 3.36

- After installing the Clutch Release Cylinder in accordance with the aforementioned Clutch Pedal adjustment procedure, measure and record dimension L2.

CAUTION

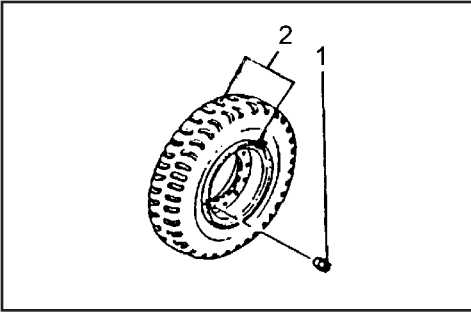
- **Because of factors such as measurement errors and play in the locations where parts are installed, dimension L2 may not meet the standard value.**
- When the Clutch Disc wears, the Piston gradually becomes pressed in and dimension L2 shortens. During monthly inspections, measure dimension L2. If the dimension reaches the usable limit, replace the Clutch Disc with a new one.

REMOVAL AND INSTALLATION

Drive Tire

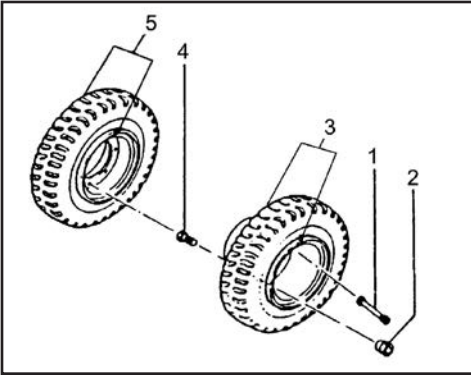
Removal of Single Tire

1. Wheel Nut
2. Drive Wheel



Removal of Double Tire

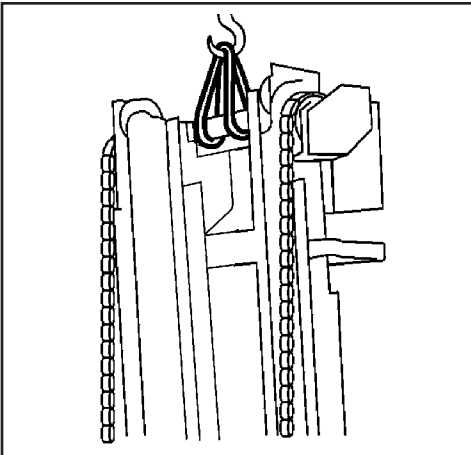
1. Extension Valve
2. Outer Wheel Nut
3. Drive Tire (outside)
4. Inner Wheel Nut
5. Drive Tire (inside)



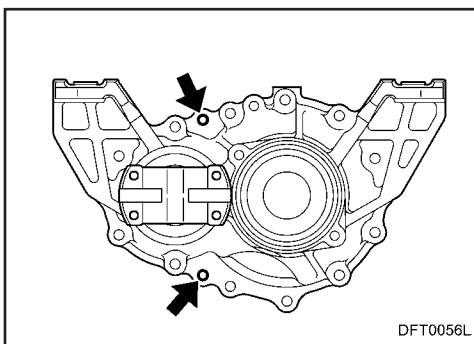
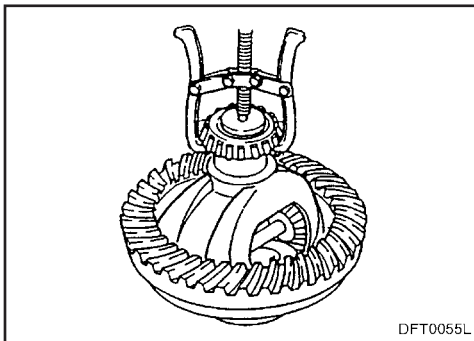
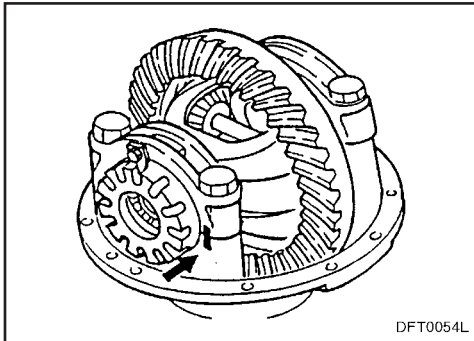
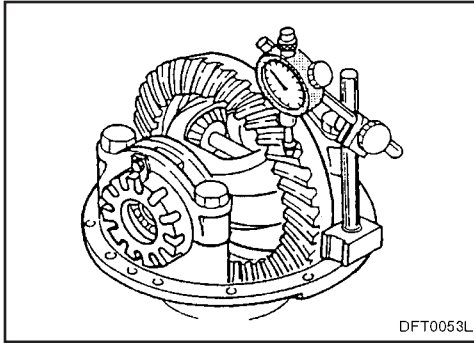
Preparation Work

1. Pull the Hand Brake and attach a Wheel Stopper to the Steered Tires.
2. Turn the Wheel Nut about two rotations to loosen it.
3. Using a crane or hydraulic device, lift the vehicle.

Attach a Wire Rope and Nylon String to the left and right eyelets of the outer Mast's upper beam. Lift and support the Mast's upper beam with a crane.



DIFFERENTIAL CARRIER



Disassembly



- **Except when replacing the Ring Gear Set, measure the Drive Gear Backlash before disassembling and use it for reference during assembly.**

Measure the backlash of Ring Gear and Drive Pinion.

Backlash:

0.20 - 0.28 mm, 0.008 - 0.011 in (1F1, 1F2 series)

0.25 - 0.33 mm, 0.009 - 0.013 in (J1F1, G1F2 series)

Place alignment marks on the Side Bearing Cap, Adjusting Nut, and Carrier to serve as guides during assembly.

Removal of Bearing

Using a Bearing Puller, remove the Side Bearing Inner Race.

Removal of Shim

After removing the Lock Nut and taking out the Shim, check the Shim full thickness. Tie the Lock Nut with string to keep from losing it.

Removal of Tapered Roller Bearing

Check the tapered roller bearing (inner) that was pressed into the drive pinion. If it is normal, it does not have to be removed.

Removal of Carrier Cover

Install the Guide Bolts in the two Guide Bolt holes. While tapping near the Knock Pins (2) with a plastic hammer, remove the Carrier Cover.

Guide Bolt: Size M10 x 1.25

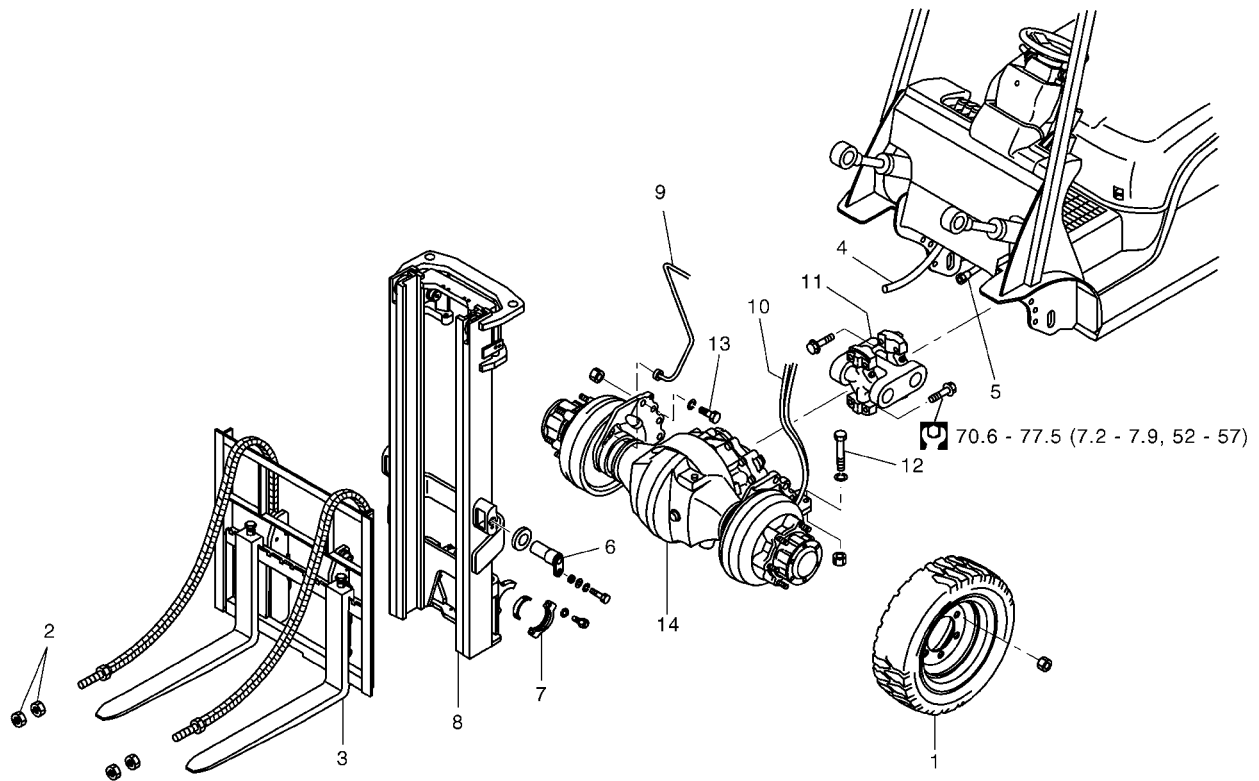
Under-head length 20 mm, 0.79 in. or more


Check Oil Seal

Check the oil seal tapped into the Carrier Cover. If the oil seal is normal, it does not need to be removed.

DIFFERENTIAL CARRIER

Component Parts Location Removal



 : N•m (kg-m, ft-lb)

Order of assembly

1. Drive Tire
2. Nut
3. Fork, Carriage Bracket Assembly
4. Low-Pressure Hose For Mast Cylinder (3.5-Ton Models Only)
5. High-Pressure Hose For Mast Cylinder
6. Pivot Pin
7. Mast Support Cap
8. Mast
9. Brake Pipe
10. Parking Brake Cable
11. Universal Joint
12. Bolt, Nut
13. Bolt, Nut
14. Drive Axle And Differential Carrier

NOTE:

- Refer to LM section for removal of Mast-related items 2 to 8.
- Before removing the Drive Axle and Differential Carrier, remove the Drive Axle Drain Plug and drain Gear oil.

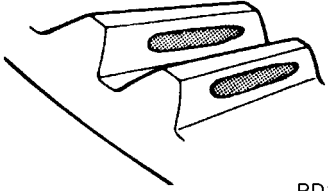
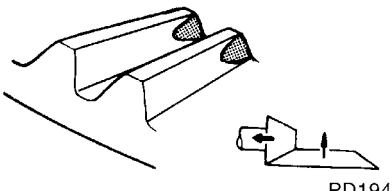
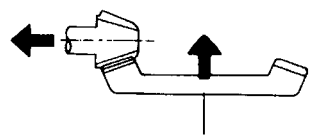
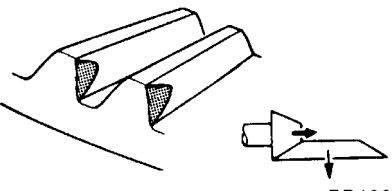
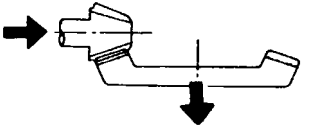
DIFFERENTIAL CARRIER

Adjustment

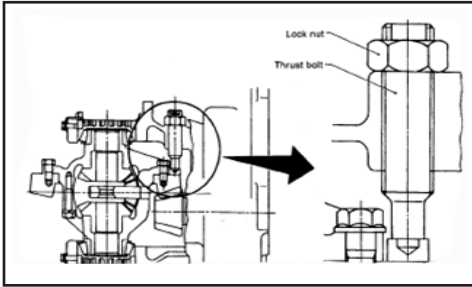
Hypoid Gear

Tooth Contact

- Apply a thin coat of a Powdered Ferric Oxide and Oil mixture to three or four teeth of the Drive Gear. Turn the Drive Gear a few turns to check tooth contact pattern.
- If tooth contact is correct, wipe the Powdered Ferric Oxide and Oil mixture from the Gear teeth.
- If tooth contact is incorrect, make adjustment by changing the thickness of Pinion Height Adjusting Spacer or by turning the Side Bearing Adjusting Nut. Turn the Drive Gear a few turns to re-check tooth contact pattern. If tooth contact is correct, wipe the Powdered Ferric Oxide and Oil mixture from the Gear teeth.

Tooth Contact	Phenomenon	Adjustment
<ul style="list-style-type: none"> • Correct tooth contact <p>Tooth contact extends about 50 to 60% of tooth toward toe end in unloaded state. (When loaded, tooth contact appears toward heel end of tooth.)</p>	 <p style="text-align: right;">PD197</p>	
<ul style="list-style-type: none"> • Short contact at toe end 	 <p style="text-align: right;">PD194</p> <p>Contacting face is too small. Break on toe end may result.</p>	 <p style="text-align: right;">PD160</p> <p>Increase thickness of drive pinion adjusting spacer to move drive pinion away from ring gear.</p>
<ul style="list-style-type: none"> • Short contact at heel end 	 <p style="text-align: right;">PD193</p> <p>Contacting face is too small. Break on heel end may result.</p>	 <p style="text-align: right;">PD159</p> <p>Reduce thickness of drive pinion adjusting spacer to move drive pinion toward ring gear.</p>

DIFFERENTIAL CARRIER - CUSHION

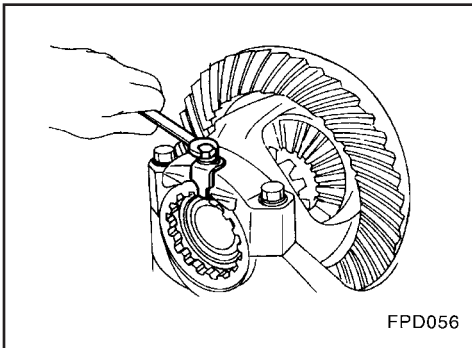


Disassembly

Pre-Disassembly Inspection

Before disassembly, thoroughly inspect the following items:

- Backlash between the Ring Gear and Drive Pinion.
- Tooth contact.
- Ring Gear and Differential Gear for smooth rotation
- Correctly diagnose the cause of malfunction.



Differential Case

1. Loosen the Lock Nut and remove the Thrust Bolt and Spacer. (2.0 and 2.5 ton models only)
2. Remove the Side Bearing Adjusting Nut Lock Plate.
3. Loosen the Side Bearing Cap Bolts and remove the Adjusting Nut.
4. Remove the Side Bearing Caps.

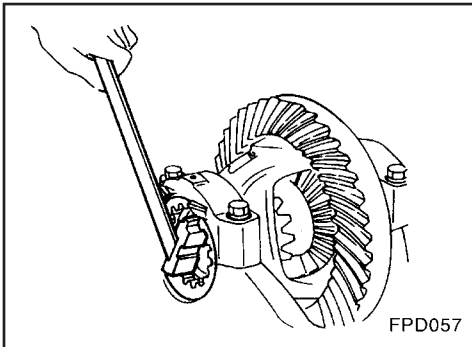
NOTE:

Mark the Cap on one side so it can be easily replaced in the correct position.

5. Remove the Differential Case Assembly with Side Bearing Outer Races.

NOTE:

Do not confuse the RH side with LH side Bearing Outer Races.



DIFFERENTIAL CARRIER - CUSHION

Assembly (Cont'd)

Drive Pinion (Cont'd)

4-Pinion for 2.8 thru 3.6 ton Models (Cont'd)

6. Install Adjusting Shims and the Rear Inner Bearing to the Drive Pinion.
7. Install the Lock Washer and Drive Pinion Nut to the Drive Pinion.
8. Install Adjusting Shims and the Drive Pinion Sleeve to the Differential Carrier Assembly.

Unit: mm (in)

	Thickness
Available Adjusting Shims	0.05 (0.0020), 0.07 (0.0027), 0.10 (0.0039)
	0.30 (0.0118), 0.50 (0.0197)

Tighten Fixing Bolts to specified torque.

Tightening torque:

77 - 98 Nm (7.8 - 10 kg-m, 57 - 72 ft/lb)



CAUTION

- **Before tightening Fixing Bolts, apply a coat of screw lock agent (Herm seal 902B (Nihon Hermetic) or equivalent) to Bolt threads.**
9. Tighten the Drive Pinion Nut to specified torque.

Tightening torque:

275 - 343 Nm (28 - 35 kg-m, 203 - 252 ft/lb)

10. Measure the preload without the Ring Gear.

Specified preload:

1.76 - 3.46 Nm (0.18 - 0.35 kg-m, 15.6 - 30.6 in/lb)

If preload is out of specification, remove the Drive Pinion Nut, Lock Washer, Inner Bearing and Adjusting Shims. Select and install other Shims using the same procedure Steps 6 to 10.

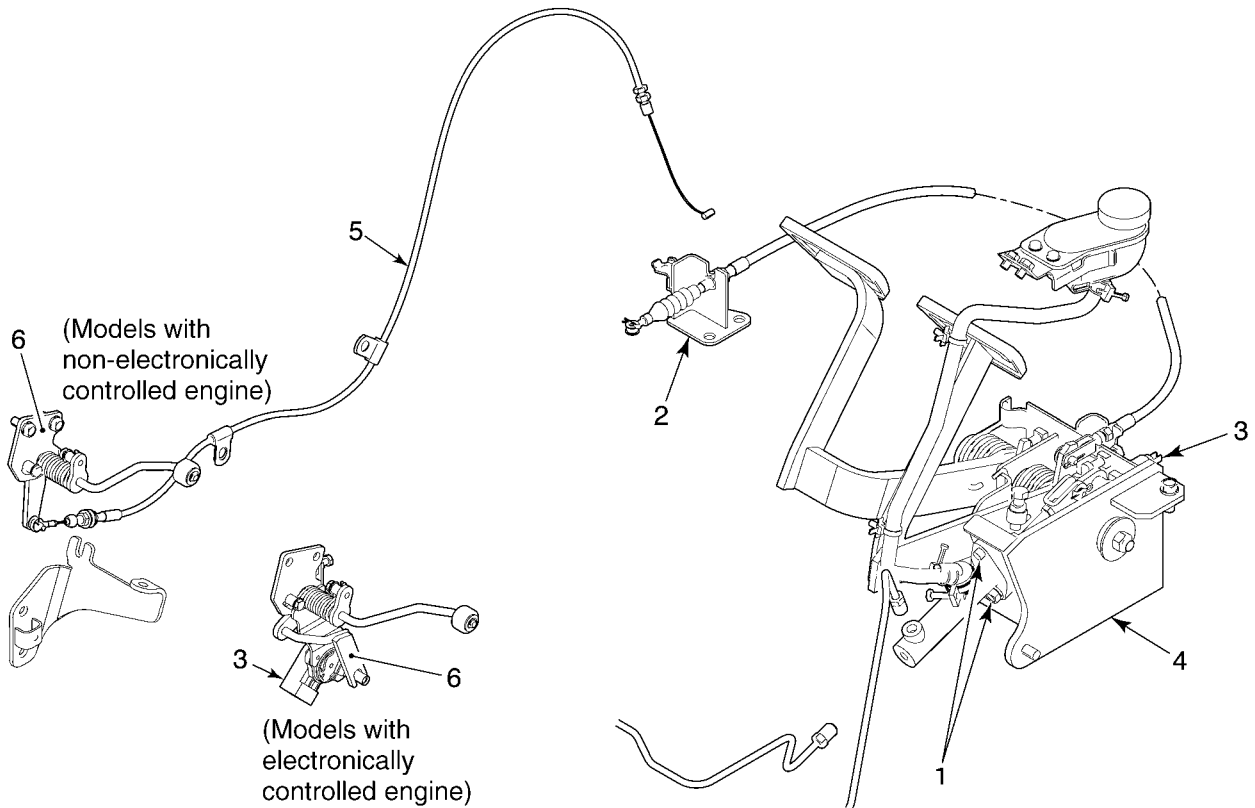
Unit: mm (in)

	Thickness
Available adjusting shims	0.15 (0.0059), 0.18 (0.0071), 0.20 (0.0079)
	0.25 (0.0098), 0.30 (0.0118), 0.50 (0.0197)

11. Press fit the Lock Washer and Drive Pinion Nut using a hammer.
12. Install the Pilot Bearing and Snap Ring on the Drive Pinion Front End.

REMOVAL AND INSTALLATION

Control System (Models with Torque Converter)



ERT0026L

Order of removal

- 1) Brake Master Cylinder Mounting Bolt
- 2) Inching Cable, Clevis Pin, Washer, Snap Pin
- 3) Connector (Throttle)/Connector Brake Switch (Models With Electronically Controlled Engine)
- 4) Pedal Assembly
- 5) Throttle Cable (Models With Non-Electronically Controlled Engine)
- 6) Accelerator Bracket

Removal

- Disconnect the Inching Cable from both the Inching Pedal side and Transmission side.
- Disconnect the Throttle Cable from the engine side.

Installation

Install in the reverse order of removal.

ENGINE CONTROL, FUEL & EXHAUST

SECTION FE

CONTENTS

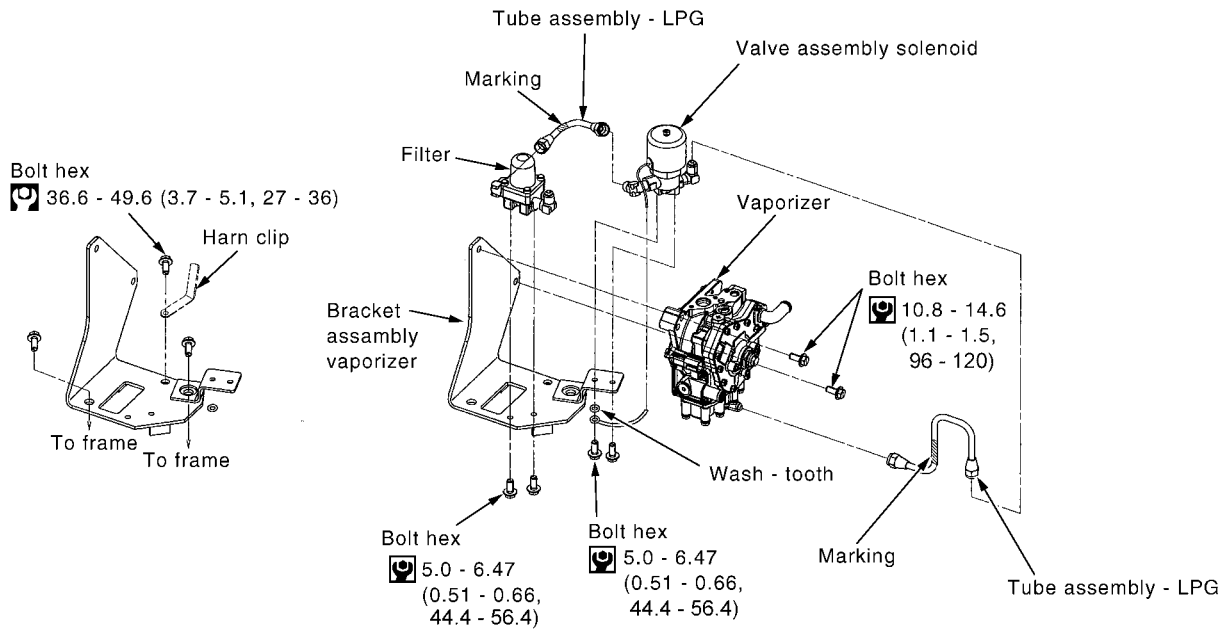
ENGINE CONTROL SYSTEM	FE-2
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(DIESEL ENGINE MODEL)	FE-4
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NOTE:

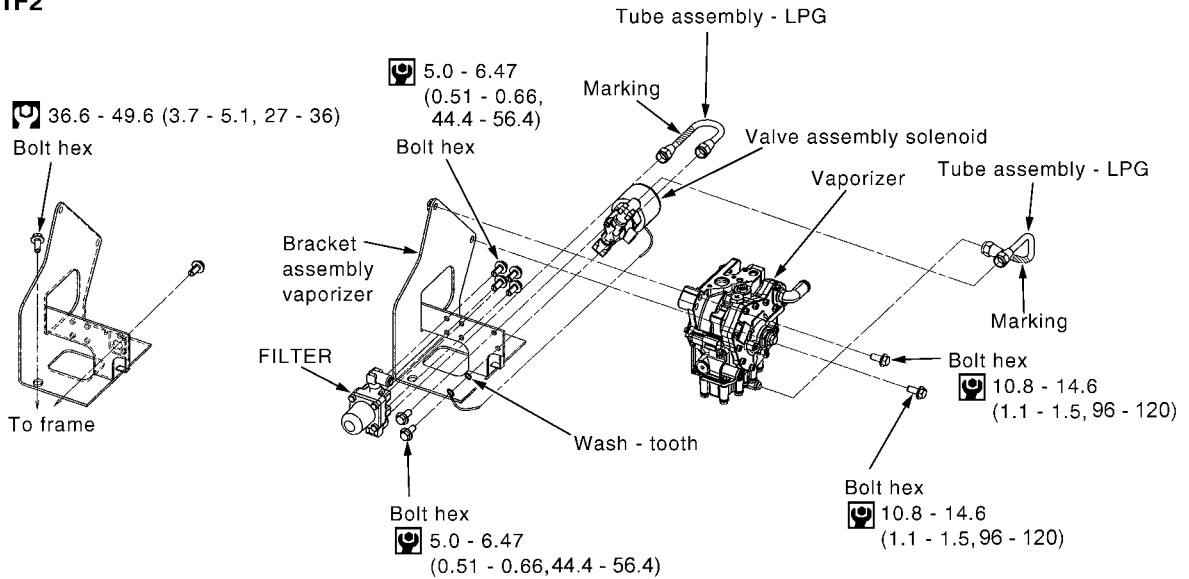
This section contains information and specifications for both carbureted general overseas market (GOM) models, as well as, electronic control models (manufactured in USA.) Therefore, prior to taking any action, ensure the specifications and/or procedures are for the proper fuel delivery system; carbureted or electronic controlled.

LPG SYSTEM (MODELS FOR AUSTRALIA)

(A/C) 1F1



(A/C) 1F2



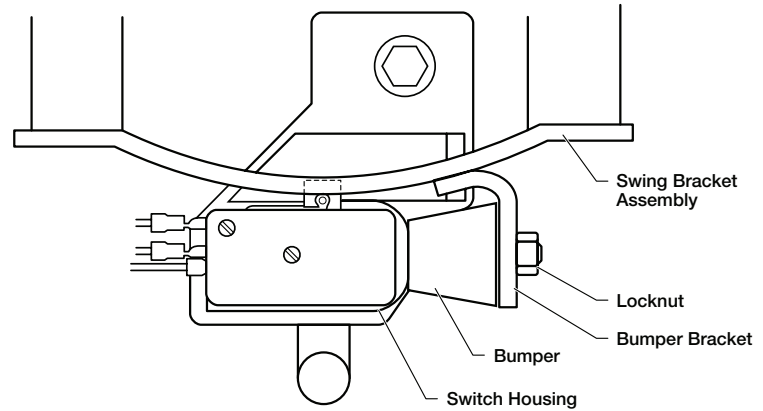
: Nm (kg-m, in/lb)

: Nm (kg-m, ft/lb)

LPG SWING BRACKET ADJUSTMENT

Purpose and Operation

The Bumper is a “STOP” to limit forward movement of the Swing Bracket Assembly past the lock position. The Bumper compresses when the Swing Bracket Assembly is closed to eliminate looseness in the LOCKED position.

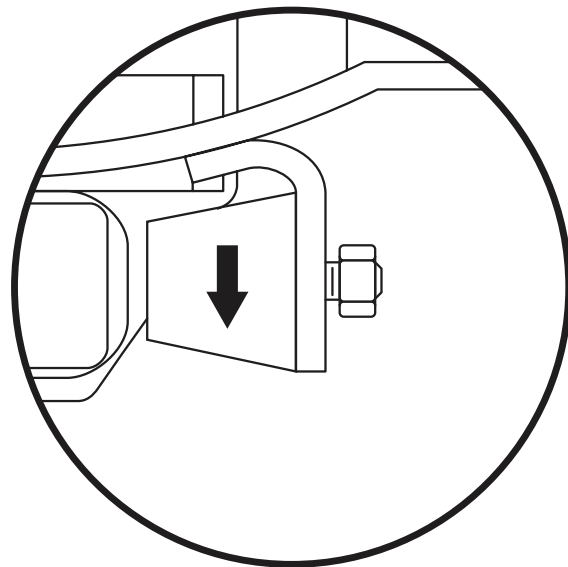


Adjustment

NOTE:

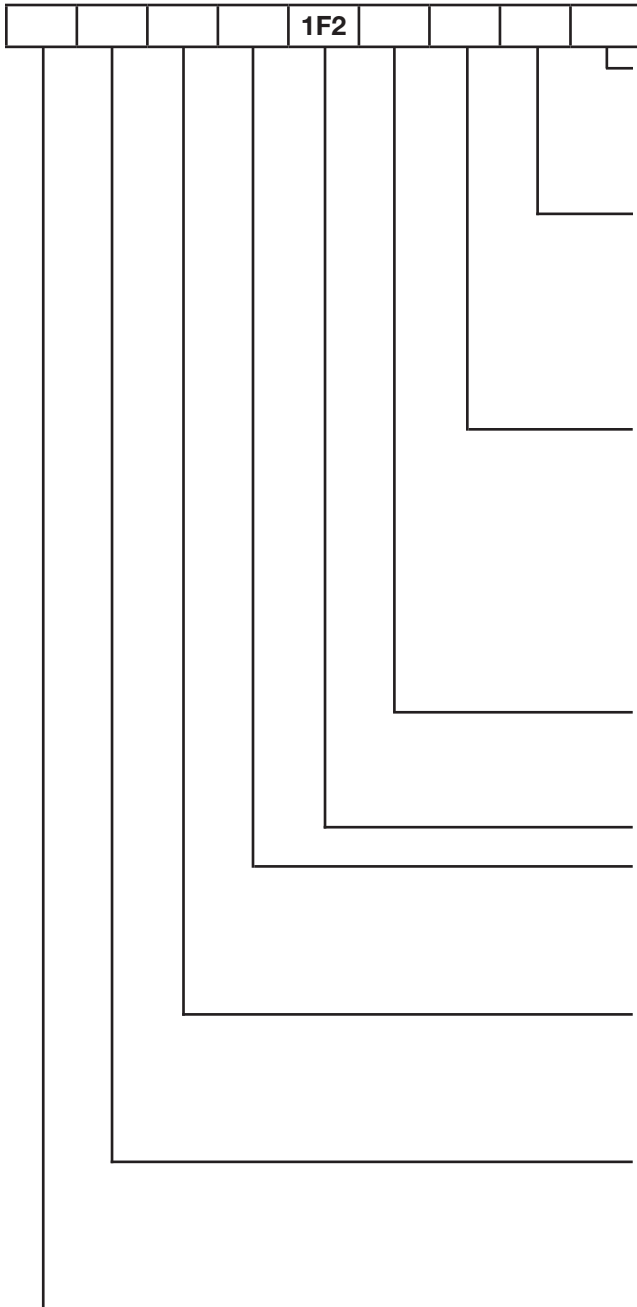
This Bumper adjustment is not required unless the factory bumper adjustment is disturbed.

1. Move the Swing Bracket Assembly to the UNLOCKED position and loosen the Bumper Locknut.
2. Rotate the Bumper clockwise against the Bumper Bracket.



IDENTIFICATION INFORMATION

Model Variation (Long Model Code) Breakdown - 1F2 Series



DESTINATION

U : Europe & General Overseas Areas (GOM)
 V : North America UL G, LP, G/LP & D Type
 S : UL North America UL LPS Type

FUEL

: Diesel Engine / Carburetor Gasoline
 W : Carburetor Dual Fuel (LPG/Gasoline)
 J : EFI Gasoline
 L : EFI LPG
 D : EFI Dual Fuel (LPG/Gasoline)

LOAD CAPACITY / LOAD CENTER

20 : 2.0 ton / 600 mm, 4,000 lb / 24 in
 25 : 2.5 ton / 600 mm, 5,000 lb / 24 in
 28 : 2.8 ton / 600 mm, 5,500 lb / 24 in
 30 : 3.0 ton / 600 mm, 6,000 lb / 24 in
 33 : 3.3 ton / 600 mm, 6,500 lb / 24 in
 35 : 3.5 ton / 600 mm, 7,000 lb / 24 in
 36 : 3.6 ton / 600 mm, 8,000 lb / 24 in

TRANSMISSION

A : 1 Speed Automatic
 F : 2 Speed Automatic

BASIC MODEL

WHEELBASE

: Standard
 G : Long
 J : Intermediate

ENGINE

P : K21 Gasoline
 U : K25 Gasoline
 Y : QD32 Diesel

TIRE TYPE

: Pneumatic
 C : Cushion
 A : Compact Pneumatic

M : Manufactured in Marengo, IL USA

Serial Number Designation

Short Model Code	Starting S/N
P1F1	9G20001
CP1F1	9N20001
AP1F1	9T20001
CP1F2	9W20001
CU1F2	9Q20001
CUG1F2	9R20001
P1F2	9H20001
U1F2	9J20001
Y1F2	9K20001
UG1F2	9L20001
YG1F2	9M20001
AP1F2	9U20001
UJ1F2	9V20001

SPECIFICATIONS

Main truck - 1F2 (pneumatic) based on 2W330 mast, 1070mm forks and minimum battery specifications

Item		Model code	1F2								
			MP1F2A20JV/ LV/DV	MU1F2A20JV/ LV/DV	MY1F2A20V/ U	MP1F2A20U/ WU	MU1F2A20U/ WU				
Rated Load Capacity		lb (kg)	Refer to Truck Data Plate								
Load center		in (mm)	24 (600)								
Overall Length (to face of forks)		in (mm)	96.9 (2460)								
Overall Width (standard tires)		in (mm)	45.3 (1150)								
Wheelbase		in (mm)	63.0 (1600)								
Front Overhang		in (mm)	17.5 (445)								
Rear Overhang		in (mm)	16.3 (415)								
Tread - Center of Tire (standard tires)		Front	37.8 (960)								
		Rear	38.4 (975)								
Minimum Turning Radius		Outside	83.5 (2120)								
Minimum Right Angle Stack		Add load length & clearance	101.0 (2565)								
Fork Length (standard)		in (mm)	42.0 (1070)								
Fork Width x Thickness		in (mm)	1.5 x 4 (40 x 100)								
Ground Clearance		Under Mast	4.5 (115)								
		Under Power Unit	5.3 (135)								
		Under Frame, center of wheelbase	6.1 (155)								
Gradeability Maximum		Full Load	%	31.0	39.0	36.0	26.0	34.0			
		Empty	%	28.0			Not Available				
Grade Clearance		Approach Angle	%	32.0							
		Ramp Breakover Angle	%	44.0							
		Departure Angle	%	45.0							
Lifting Speed		2W	Full Load	fpm (mm/sec)	118.1 (600)	129.9 (660)	127.9 (650)	104.3 (530)	108.3 (550)		
			Empty	fpm (mm/sec)	127.9 (650)	137.8 (700)		135.8 (690)	127.9 (650)		
		2F	Full Load	fpm (mm/sec)	110.2 (560)	122.0 (620)	120.0 (610)	106.3 (540)	112.2 (570)		
			Empty	fpm (mm/sec)	122.0 (620)	131.9 (670)	129.9 (660)	120.0 (610)	129.9 (660)		
		3F	Full Load	fpm (mm/sec)	110.2 (560)	120.0 (610)	118.1 (600)	104.3 (530)	110.2 (560)		
			Empty	fpm (mm/sec)	126.0 (640)	136.4 (695)		118.1 (600)	127.9 (650)		
		3V	Full Load	fpm (mm/sec)	110.2 (560)	120.0 (610)	118.1 (600)	98.4 (500)	104.3 (530)		
			Empty	fpm (mm/sec)	120.0 (610)	129.9 (660)		110.2 (560)	122.0 (620)		
		Lowering Speed		2W	Full Load	fpm (mm/sec)	98.4 (500)				
					Empty	fpm (mm/sec)	98.4 (500)				
				2F	Full Load	fpm (mm/sec)	94.5 (480)			74.8 (380)	
					Empty	fpm (mm/sec)	59.0 (300)			92.5 (470)	
3F	Full Load			fpm (mm/sec)	94.5 (480)						
	Empty			fpm (mm/sec)	68.1 (345)			80.7 (410)			
3V	Full Load			fpm (mm/sec)	94.5 (480)			55.1 (280)			
	Empty			fpm (mm/sec)	64.9 (330)						

SPECIFICATIONS

Main truck - 1F2 (cushion) based on 2H330 mast, 1070mm forks and minimum battery specifications (cont'd)

Item			Model code		1F2			
			MCP1F2A28JV/ LV/DV	MCU1F2A28LV/ DV	MCU1F2A30LV/ DV	MCUG1F2F30LV/ DV		
Maximum Travel Speed	Forward	mph (km/h)	10.6 (17)				1ST: 6.2 (10) 2ND: 11.5 (18.5)	
	Reverse	mph (km/h)	10.6 (17)				9.9 (16)	
Drawbar Pull Maximum	Full Load	lb (kg / N)	3638 (1650 / 16180)	4189 (1900 / 18635)			3009 (1365 / 13385)	
Truck Weight		lb (kg)	Refer to Truck Data Plate					
Engine	Model		K21		K25			
	Classification		EFI					
	Rated Output - SAE Gross	hp (kW) @ rpm	55 (41) @ 2700		62.9 (46.9) @ 2700			
	Rated Torque - SAE Gross	ft-lb (Nm) @ rpm	111.4 (151) @ 2000		138.7 (188) @ 1600			
	Displacement	cu in (cm ³)	126 (2065)		151.8 (2488)			
Transmission	Type		Automatic					
	Number Speeds - fwd/rev		1/1				2/1	

Item			Model code		1F2			
			MCU1F2A33LV/ DV	MCUG1F2F35LV/ DV	MCUG1F2F36LV/ DV	MCUG1F2F36LV/ DV Boxcar		
Rated Load Capacity		lb (kg)	Refer to Truck Data Plate					
Load center		in (mm)	24 (600)					
Overall Length (to face of forks)		in (mm)	96.3 (2445)	98.2 (2495)	100.0 (2540)	94.4 (2400)		
Overall Width (standard tires)		in (mm)	43.9 (1115)	45.9 (1165)				
Wheelbase		in (mm)	55.1 (1400)	59.1 (1500)				
Front Overhang		in (mm)	17.7 (450)	17.9 (455)				
Rear Overhang		in (mm)	23.4 (595)	21.3 (540)	23.0 (585)	17.5 (445)		
Tread - Center of Tire (standard tires)	Front	in (mm)	35.8 (910)	37.0 (940)				
	Rear	in (mm)	35.0 (890)	36.6 (930)				
Minimum Turning Radius	Outside	in (mm)	81.5 (2070)	82.5 (2095)	83.9 (2130)	79.9 (2030)		
Minimum Right Angle Stack	Add load length & clearance	in (mm)	99.2 (2520)	100.4 (2550)	101.8 (2585)	97.8 (2485)		
Fork Length (standard)		in (mm)	42.0 (1070)					
Fork Width x Thickness		in (mm)	2 x 5 (50 x 125)					
Ground Clearance	Under Mast	in (mm)	2.8 (70)	3.1 (80)				
	Under Power Unit	in (mm)	3.5 (90)	3.7 (95)				
	Under Frame, center of wheelbase	in (mm)	5.5 (140)	5.7 (145)				
Gradeability Maximum	Full Load	%	24.0	38.0	34.0			
	Empty	%	16.0	18.0	15.0			

SPECIFICATIONS

Mast - 1F2 2.0 - 2.5 ton (Cushion)

Mast Name	Maximum Fork Height; in (mm)	Free Lift without Backrest in (mm)	Tilt Angle Forward/ Backward	Overall Height				
				Lowered Mast Position in (mm)		Extended Mast Position in (mm)		
				Top of OHG	Mast (OHL)	With Backrest	Without Backrest	
TWO STAGE (Wide View 2W)	2W203T	80 (2030)	4.0 (100)	10/5	82.1 (2085)	62.1 (1580)	Not Available	
	2W270	106 (2700)	4.2 (105)	5/5	82.1 (2085)	71.3 (1815)	155.7 (3955)	130.0 (3303)
	2W300	118 (3000)	4.2 (105)	5/5	82.1 (2085)	77.2 (1965)	167.5 (4255)	141.8 (3603)
	2W330	130 (3300)	4.2 (105)	5/10	82.1 (2085)	83.1 (2115)	179.3 (4555)	153.6 (3903)
	2W350	138 (3500)	4.2 (105)	5/10	82.1 (2085)	88.4 (2250)	187.2 (4755)	161.5 (4103)
	2W370	146 (3700)	4.2 (105)	5/5	82.1 (2085)	93.3 (2370)	195.1 (4955)	169.4 (4303)
	2W400	157 (4000)	4.2 (105)	5/10	82.1 (2085)	100.8 (2565)	206.9 (5255)	181.2 (4603)
	2W450	177 (4500)	4.2 (105)	5/5	82.1 (2085)	110.6 (2810)	226.6 (5755)	200.9 (5103)
	2W500	197 (5000)	4.2 (105)	5/5	82.1 (2085)	120.5 (3065)	246.3 (6255)	220.6 (5603)
TWO STAGE (Full Free 2F)	2F270	105.5 (2700)	47.4 (1200)	5/10	82.1 (2085)	72.0 (1830)	Not Available	
	2F300	117.5 (3000)	53.4 (1355)	5/10	82.1 (2085)	78.0 (1985)	Not Available	
	2F330	129.5 (3300)	59.4 (1505)	5/10	82.1 (2085)	84.0 (2135)	Not Available	
	2F350	137.5 (3500)	63.4 (1610)	5/10	82.1 (2085)	88.0 (2235)	Not Available	
	2F370	145.5 (3700)	67.4 (1710)	5/10	82.1 (2085)	92.0 (2340)	Not Available	
	2F400	157.5 (4000)	73.4 (1860)	5/10	82.1 (2085)	98.0 (2490)	Not Available	
THREE STAGE (Full Free 3F)	3F385	152 (3850)	46.9 (1190)	5/5	82.1 (2085)	71.3 (1815)	Not Available	
	3F430	169 (4300)	52.8 (1340)	5/5	82.1 (2085)	77.2 (1965)	Not Available	
	3F475	187 (4750)	58.7 (1490)	5/5	82.1 (2085)	83.1 (2115)	Not Available	
	3F515	203 (5150)	64.0 (1625)	5/5	82.1 (2085)	88.4 (2250)	Not Available	
	3F550	217 (5500)	68.9 (1750)	5/5	82.1 (2085)	93.3 (2370)	Not Available	
	3F600	236 (6000)	76.4 (1940)	5/5	82.1 (2085)	100.8 (2565)	Not Available	
	3F650	256 (6500)	86.2 (2185)	5/5	82.1 (2085)	110.6 (2810)	Not Available	
	3F700	276 (7000)	96.1 (2440)	5/5	82.1 (2085)	120.5 (3065)	Not Available	
THREE STAGE (OptiView 3V)	3V360	142 (3600)	47.8 (1210)	5/5	82.1 (2085)	71.3 (1815)	Not Available	
	3V405	159 (4050)	53.7 (1360)	5/5	82.1 (2085)	77.2 (1965)	Not Available	
	3V450	177 (4500)	59.6 (1510)	5/5	82.1 (2085)	83.1 (2115)	Not Available	
	3V490	193 (4900)	64.9 (1645)	5/5	82.1 (2085)	88.4 (2250)	Not Available	
	3V525	207 (5250)	69.8 (1770)	5/5	82.1 (2085)	93.3 (2370)	Not Available	
	3V575	226 (5750)	77.3 (1960)	5/5	82.1 (2085)	100.8 (2565)	Not Available	
	3V633	249 (6330)	87.2 (2210)	5/5	82.1 (2085)	110.6 (2810)	Not Available	
	3V688	271 (6880)	97.0 (2460)	5/5	82.1 (2085)	120.5 (3065)	Not Available	

HYDRAULIC SYSTEM

SECTION **HD**

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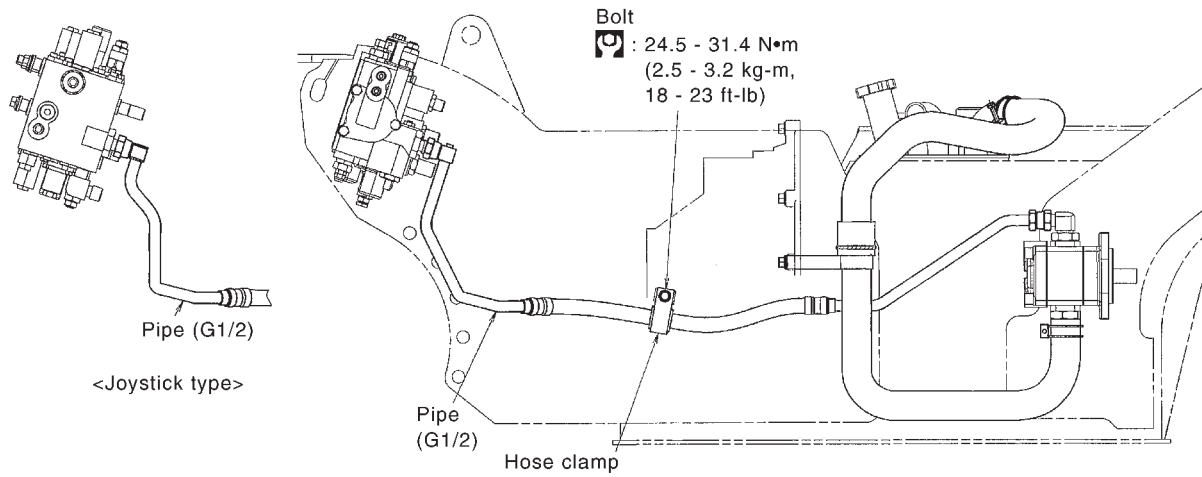
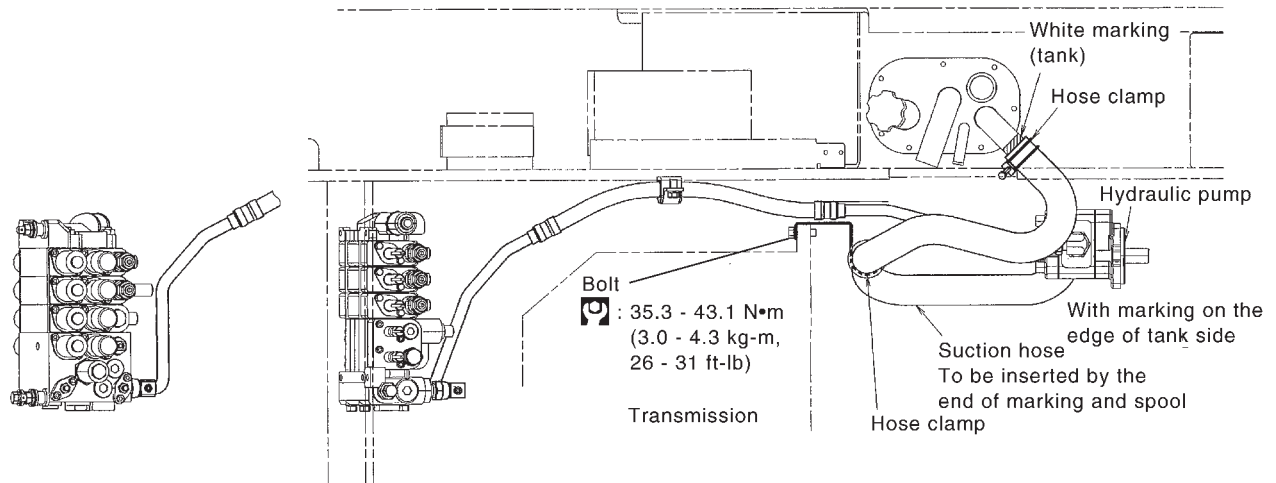
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NOTE:

This section contains information and specifications for both carbureted general overseas market (GOM) models, as well as, electronic control models (manufactured in USA.) Therefore, prior to taking any action, ensure the specifications and/or procedures are for the proper fuel delivery system; carbureted or electronic controlled.

HYDRAULIC PIPING

1F2 Vehicle Type



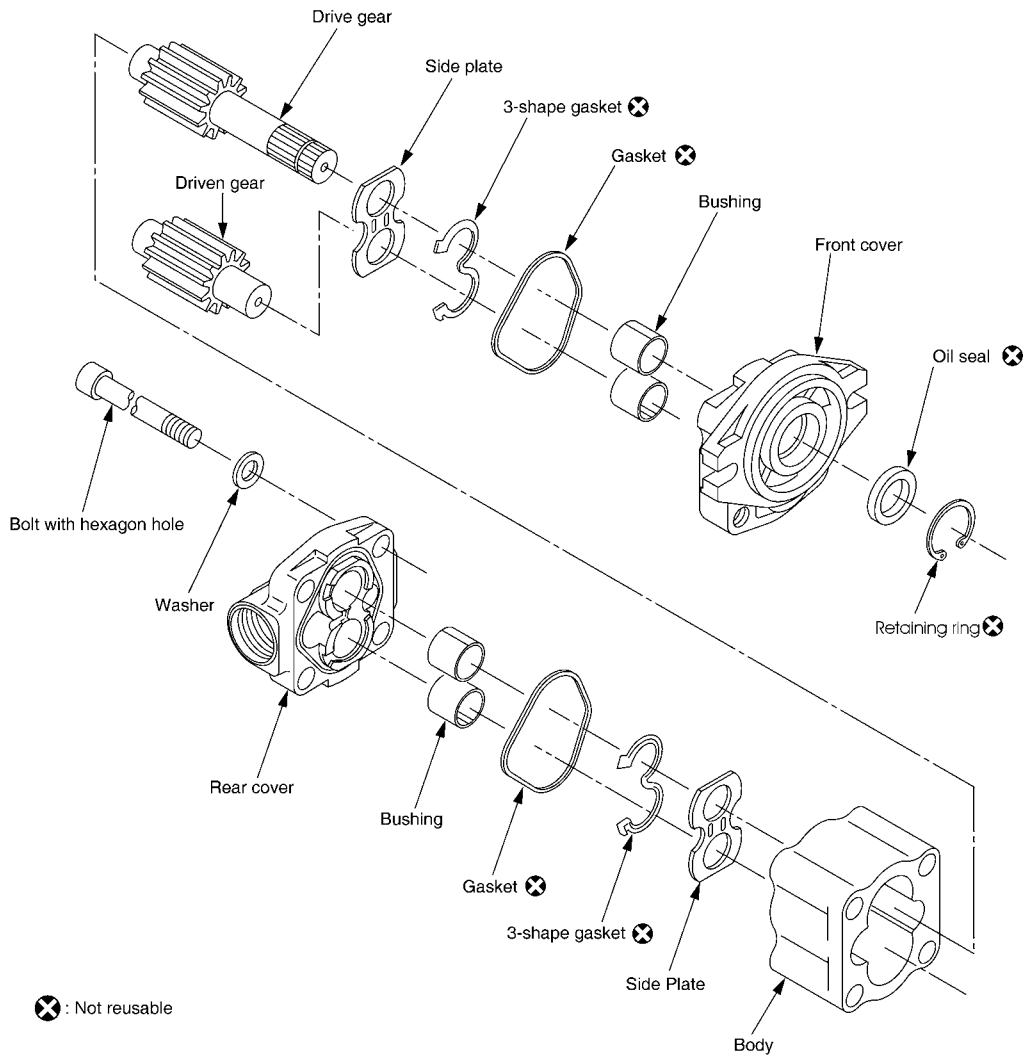
Screw tightening torque:

G1/2 58.9 - 98.0 Nm (6 - 10 kg-m, 44 - 72 ft/lb)

The PS Flow Dividing Valve is built into the Control Valve. This allow for a single hydraulic supply line to the Control Valve. In addition, the Steering Box is also supplied via the Control Valve.

HYDRAULIC PUMP

Component Parts Location



Removal (e.g. Vehicles with Gasoline Engines)

- Remove the Air Cleaner.

Disconnect the Intake Hose, Suction Tube and the Hydraulic Pump connection.

CAUTION

- **Prior to removal, extracting a small amount of oil from the Tank using an oil pan is recommended. Otherwise, some oil will inevitably overflow from the Tank when the Suction Hose is disconnected.**
- Loosen the two Mounting Bolts and remove the Hydraulic Pump.

CONTROL VALVE

Inspection

Clean disassembled parts with solvents. Blow parts with air and confirm foreign materials are removed completely.

If deformation, cracks, damage and unusual wear are found on any parts, replace them.

O-Ring, Wiper Ring

Discard used O-Rings and Wiper Ring. Use only new O-Rings and Wiper Ring when re-assembling the Control Valve.

Valve Housing and Plunger

Measure the inner and outer diameters of the Plunger. If the gap between the Plunger and the Housing exceeds the specified limit, replace the Housing and Plunger as an assembly.

**Tolerance limit of gap between plunger and housing
(mm, in): 0.02, 0.0008**

Assembly

Install in the reverse order of removal, follow the instructions below.

- The housing pieces must be assembled in the correct order.
- Ensure no foreign materials get into the Control Valve.
- Apply hydraulic oil or grease to the O-Rings, O-Ring attaching faces, Wiper Rings and Plunger.
- Tie Rod Nut

Tightening torque [Nm (kg-m, ft/lb)] :

24.5 - 29.4 (2.5 - 2.9, 23.7 - 28.4) (M10 size x 3)

24.5 - 29.4 (2.5 - 2.9, 23.7 - 28.4) (M8 size x 2)

- Main Relief Valve Assembly

Tightening torque [Nm (kg-m, ft/lb)]:

49 (5.0, 47.3)

Installation

Install in the reverse order of removal, follow the instructions below.

- Ensure no foreign materials get into the Piping and Control Valve.
- Control Valve Assembly Nuts

Tightening torque [Nm(kg-m, ft/lb)]:

20 - 29 (2.0 - 3.0, 15 - 21.0)

- After connecting the Piping, apply relief pressure and make sure that no fluid leakage is present.



CAUTION

- **After installation, operate lift and tilt, perform tilt relief for 3 seconds at high idle and bleed the Valve.**

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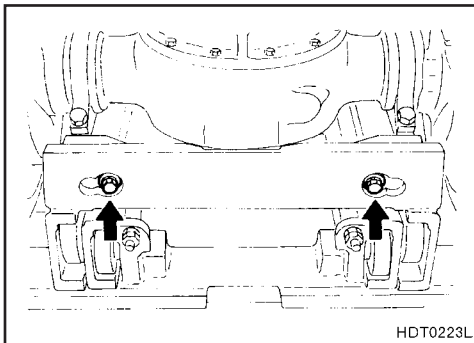
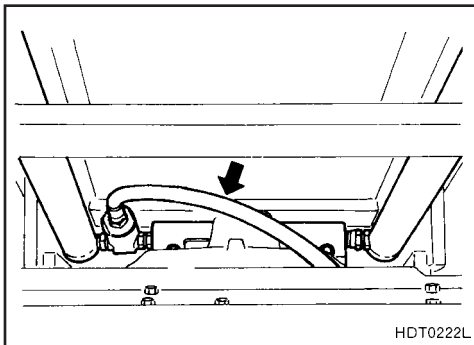
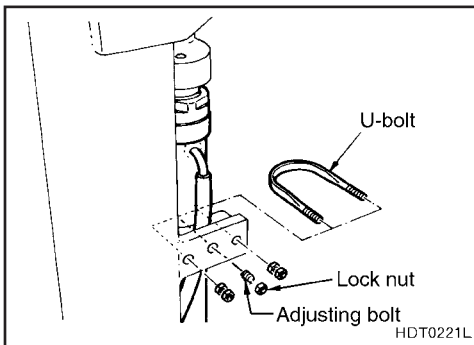
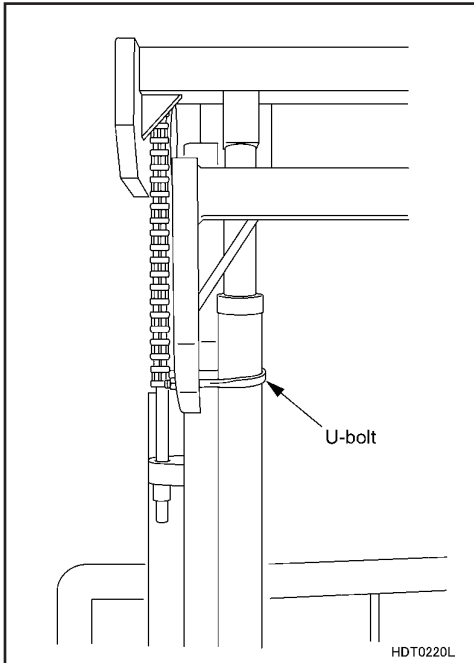
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LIFT (MAST) CYLINDER



Removal

CAUTION

- Use extreme caution when removing the Lift (Mast) Cylinder. Risk of injury to hands and legs exists throughout the procedure.

Preparation for Lift (Mast) Cylinder Removal

1. Remove the Carriage Assembly together with the Fork.
(Refer to the LM section.)
2. Jack up the vehicle front so approximately 120 mm ground clearance is created under the outer Mast bottom end. (Refer to the GI section.)
3. Operate a Control Lever, a mast fully backward and descend to the bottom dead end. Then, a mast neutrality, a key switch is turned OFF, and engine is suspended.

CAUTION

- Always lower the Lift (Mast) Cylinder to the bottom stroke end to release any residual pressure from the Piping.

2W Lift Cylinder, 2F Mast Cylinder

1. Remove the Upper Retaining Nut (2W mast) of the Lift (Mast) Cylinder or Bolt (2F mast).
2. Suspend the Inner Mast with a Nylon Sling or Wire.
3. Remove the Lift (Mast) Hose, Return Hose (2W mast) and Lift Pipe (2F mast) from the Lift (Mast) Cylinder.

CAUTION

- Plug the Hose openings to prevent hydraulic fluid leakage.
4. Remove the Lower Retaining Bolt from the Lift (Mast) Cylinder.

HYDRAULICS

Joystick System Option

- For Tilt Piping, place the fork horizontal (tipped slightly forward) and turn the Key Switch off. Loosen the Piping and wait while the remaining pressure escapes.
- For Lift Piping, place the Fork at the lowest position. Turn the Key Switch off. Loosen the Shut-Off Valve and let the remaining pressure escape.
- For Attachment Piping (3rd and 4th)
 - a. Union Connector

Place the attachment in neutral. Turn the Key Switch off. Loosen the Piping and wait while the remaining pressure escapes.
 - b. Coupling

Installing and removing the Cup may be difficult if the remaining pressure inside the Piping is high. If this is the case, turn the Key Switch ON and, while idling, tip the lever (3rd and 4th) backwards or forwards, and one of the cups will come off. Then tip the Lever in the other direction and remove the other Cup.



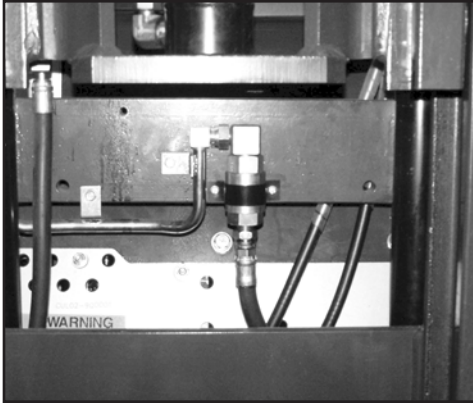
CAUTION

- **Before removing hydraulic lines or piping, be sure the oil pressure remaining in hydraulic lines is completely bled off.**
- **To prevent foreign matter from entering, always maintain a clean workplace. Never allow foreign matter to enter pipes when connecting.**
- **When disconnecting pipes, cover the surrounding area with a rag and ensure oil does not contaminate other parts.**
- **Put disassembled parts on clean paper or rag and use care not to contaminate, scratch or dent them.**
- **Always assign lifting operations to qualified operators trained in slinging or hoisting procedures.**
- **When handling heavy parts, two people should perform the work.**

NOTE:

- For the removal of the Instrument Inner Cover, Floor Mat and Floor Panel, refer to BF section.
- For removal and installation of Mast, refer to LM section.

HYDRAULIC DOWN FLOW REGULATOR VALVE



Hydraulic Down Flow Regulator Valve (FRV) Kits

Starting in September 2004 the hydraulic Down Flow Regulator Valve mounted on the Mast was moved and became an internal component of the Hydraulic Valve Assembly.

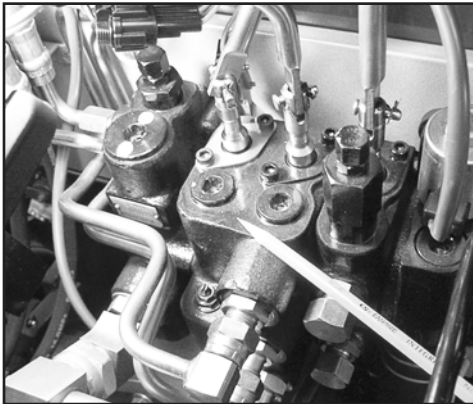
It will be necessary to determine which FRV is being used as piping to the Main Hydraulic Valve on the mast is different depending on FRV. UCA has made kits available to assist in changing Masts between units that now have Flow Regulator Valve (FRV) in the Main Hydraulic Valve position.

The following pages show all the kit numbers for the different masts, excluding Cascade and Lifttec Masts.

Refer to page LM-6 for 2 Stage Mast

Refer to page LM-7 for 3F Mast

Refer to page LM-8 for 3V Mast



WITHOUT FRV

If you are not sure whether the unit has a Flow Control Valve built into the Hydraulic Control Valve, lift the Floor Plate and check the Main Hydraulic Valve as shown at left.



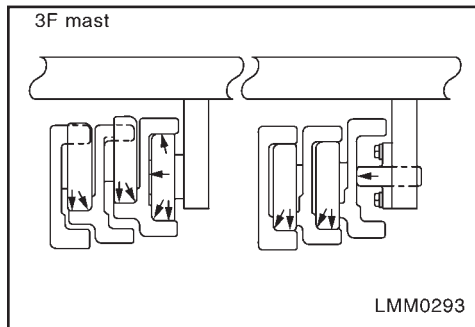
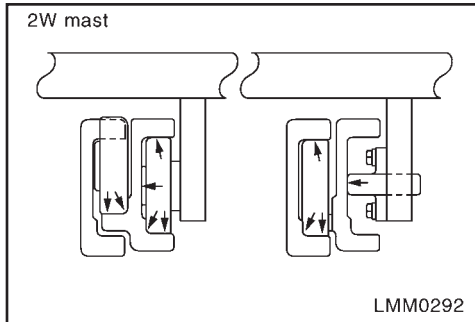
CAUTION

- **A Mast change could effect capacity and performance of the unit which could cause injury or damage. A new Capacity Plate must be requested before the unit is placed into operation with the new Mast. Use UCA's Capacity Plate request process.**



WITH FRV

CARRIAGE ASSEMBLY



Adjustment (Cont'd)

- After adjustment, always check the carriage assembly operation for smoothness.

CAUTION

- Apply grease to the rolling face of the roller and the thrust metal contact face.

Installation

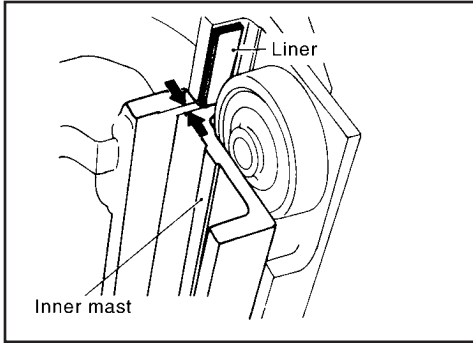
Install in the reverse order of removal, following the instructions below.

CAUTION

- Replace cotter pins with new ones.

MAST

Assembly (Cont'd)



3. Adjust the Liner with the following procedure.

- Measure the clearance between the Mast Roller and the Inner Mast on the inside of the Inner Mast and Middle Mast (3F mast) using a Feeler Gauge.
- When the measured value is out of the standard, perform the Shim adjustment to the right and left evenly.

Standard:

0.1 - 0.6 mm (0.004 - 0.024 in)

Shim:

0.5, 1.0 mm (0.020, 0.039 in)



CAUTION

- **When installing the Liner after making Shim adjustments, apply a coat of bearing grease to the sliding surface of the Liners and Mast.**

NOTE:

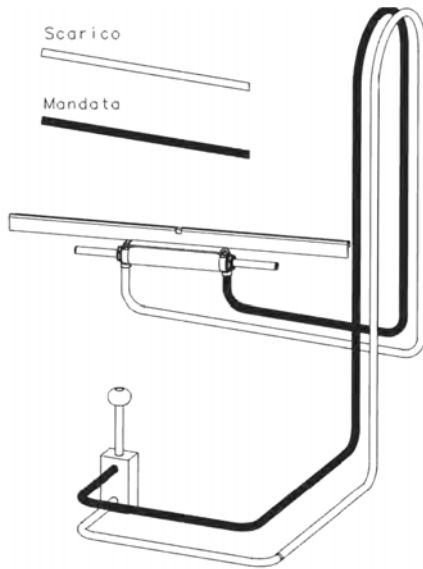
The Liners are push-in type for easy positioning in the Mast.

ADJUSTMENT OF MAST INSTALLED TO VEHICLE

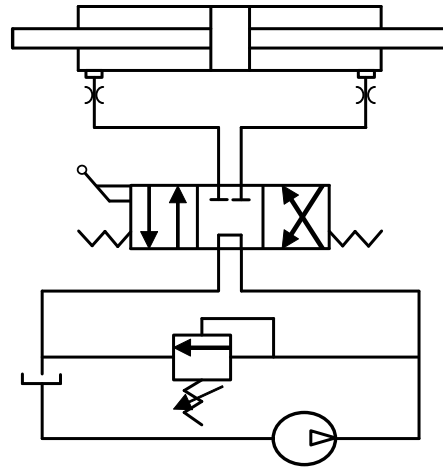
3F/3V Mast

- Hang the Mast using a Wire, etc., and remove the Carriage Assembly. Refer to "Carriage Assembly".
- Remove the Mast Chain.
- Remove the Master Cylinder. Refer to HD section.
- Lower the Inner Mast by approximately 120 mm (4.72 in), replace the Liner of the Middle Mast side and then perform the Shim adjustment.
- Lower the Inner Mast and Middle Mast simultaneously for approximately 120 mm (4.72 in). Replace the Liner of the Outer Mast side and then perform the Shim adjustment.

LOADING MECHANISM



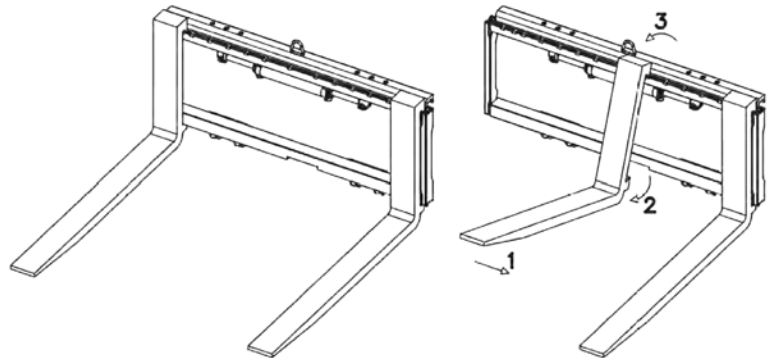
Hydraulic Circuit



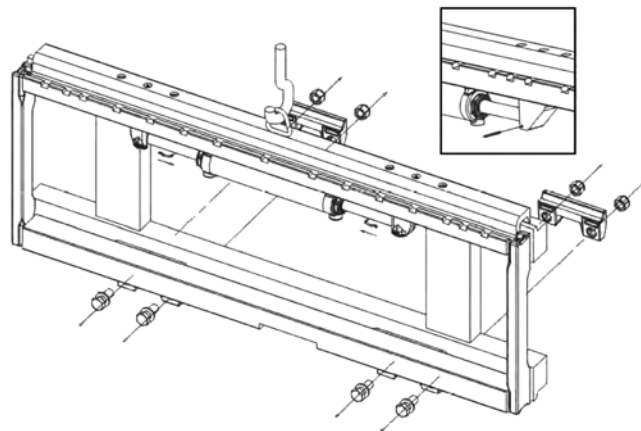
Repair Procedures

1. Sideshifter Removal

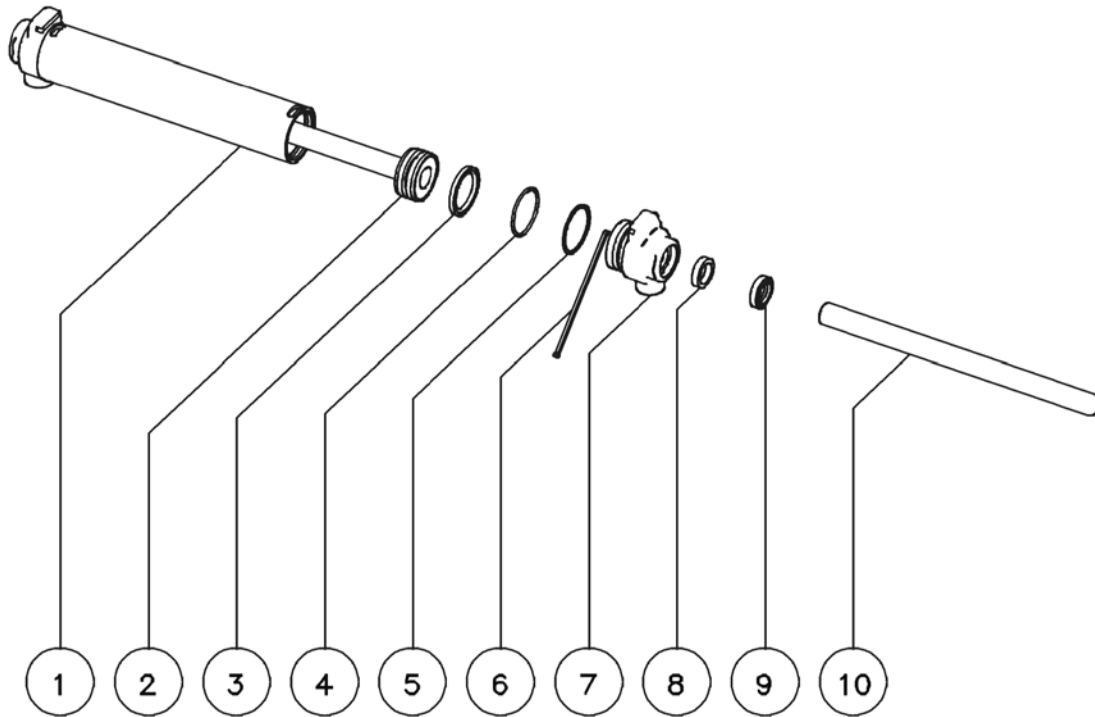
A. Remove the forks



B. Remove the lower Hooks. On the Class II Sideshifter, remove the Spring Clips locking the Cylinder on the Mobile Frame as shown in the drawing below. For the Class III Cylinder, remove the Split Pins locking the Cylinder to the Mobile Frame as shown in the detail drawing.



LOADING MECHANISM



Position	Part Number	Quantity	Description
	141050312C	1	Cylinder Capacity 4900Kg/10000Lbs Jic Version
1	101050007C	1	Cylinder Body
2	101050003C	1	Piston
3	41041269	1	Seal
4	41040538	2	Seal
5	41040238	2	Seal
6	101050008C	2	Cap-Body Fixing
7	101050296C	2	Cap Jic Version
8	41041299	2	Seal
9	41041300	2	Scraper
10	101050004C	2	Rod
11	111050009C	1	Seal Kit (Includes Pos 3, 4, 5, 8, 9)

MAINTENANCE SCHEDULE

Periodic Maintenance and Lubrication Schedule for Emission Control System (Cont'd)

Inspection Items			Interval														How to check	
			Months	1	2	3	4	5	6	7	8	9	10	11	12	.		18
			100s of hours	2	4	6	8	10	12	14	16	18	20	22	24	.		36
K21/K25 Engine	Engine Compartment Maintenance (Except LPG Fuel System)	Intake & exhaust valve clearance (operating temp)		A		A			A			A			A	.	A	Test/Adjust
		Drive belt tension		I	I	I	I	I	I	I	I	I	I	I	I	.	I	Visual
		Engine oil		R		R		R			R		R		R	.	R	Replace
		Oil filter		R		R		R			R		R		R	.	R	Replace
		Engine Coolant (LLC)												R	.		Replace	
		Air cleaner element		I	I	I	I	I	I	I	I	I	I	I	R	.	R	Visual/Replace
		Spark plugs		I	I	I	I	I	I	I	I	I	I	I	I	.	R	Visual
		PCV Valve				I			I			I			I	.	I	Visual
	Engine Compartment Maintenance (Except LPG Fuel System)	Piping or pipe connector portion for gas leakage and damage		I	I	I	I	I	I	I	I	I	I	I	I	.	I	Visual
		Tar in vaporizer		D	D	D	D	D	D	D	D	D	D	D	D	.	D	Drain
		LPG Fuel Filters				C			C			C			R	.	C	Visual/Replace
		Injection screen				C			C			C			C	.	C	Visual
		Check LPG cylinder holder for looseness or damage		I	I	I	I	I	I	I	I	I	I	I	I	.	I	Visual

NOTE:

- When the LPG Cylinder is replaced, inspect pipe connectors for gas leakage with soapy water.
- UCA recommends a complete tear down, inspection and resealing of the vaporizer before 6,000 hours or 30 months of operation, whichever comes first. This maintenance is necessary for all units even if the recommended HD5 grade is being used. The conditions in your area and the quality of the LPG may dictate a more stringent maintenance schedule.

Inspection Items			Interval														How to check	
			Months	1	2	3	4	5	6	7	8	9	10	11	12	.		18
			100s of hours	2	4	6	8	10	12	14	16	18	20	22	24	.		36
QD32 Engine	Engine Compartment Maintenance	Intake & exhaust valve clearance (operating temp)		A		A			A			A			A	.	A	Adjust
		Drive belt tension		I	I	I	I	I	I	I	I	I	I	I	I	.	I	Visual
		Engine oil		R	R	R	R	R	R	R	R	R	R	R	R	.	R	Replace
		Oil filter		R	R	R	R	R	R	R	R	R	R	R	R	.	R	Replace
		Engine coolant (LLC)													R	.		Replace
		Air cleaner element		I	I	R	I	I	R	I	I	R	I	I	R	.	R	Visual/Replace
		Water separator		D		D			D			D			R	.	D	Drain
		Engine idle rpm		A	A	A	A	A	A	A	A	A	A	A	A	.	A	Adjust
		Nozzle							I						I	.	I	Visual

NOTE:

- If Engine power decreases, black exhaust smoke is emitted or Engine noise increases before the maintenance period expires, check and, if necessary, adjust the fuel injection nozzle starting pressure and the fuel spray pattern.

Abbreviations: **I:** Inspect (correct or replace if necessary), **D:** Drain, **R:** Replacement, **A:** Adjustment, **C:** Clean, **T:** Retighten, **L:** Lubricate/Grease

ENGINE MAINTENANCE

Cooling System Bleeding Instructions (Cont'd)

9. Add coolant to the reservoir tank up to the "MAX" line.
10. With the Radiator Cap removed, start the Engine and accelerate above idle RPM to purge air out of the LP Vaporizer. Continue to operate the Engine until the thermostat opens and you can visually see the coolant moving in the Radiator.
11. Top off the coolant (approximately 25 mm (1 in) from the top of the radiator) in the Radiator after all the air has been purged.
12. Securely attach the Radiator Cap.
13. Turn off the Engine.
14. Close the Engine Hood and install the Radiator Cover.
15. Start the Engine. Check for leaks and ensure the Engine temperature stays within the operating range. If the unit starts to overheat, there is air in the cooling system. Repeat Steps 5 through 15 until the Engine temperature stays within the operating range.

Inspection of Radiator

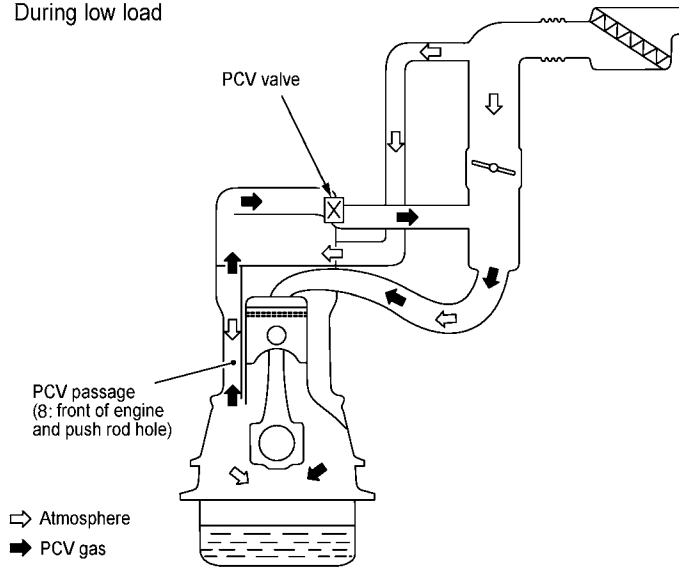
Check the Radiator core for any coolant leakage and plugged Radiator meshes. If any coolant leakage is observed, replace the Radiator core. For plugging, clean the core by applying compressed air.

Inspect Radiator hoses for any coolant leakage from connections or due to hose deterioration. Tighten any loose connections and replace any deteriorated parts.

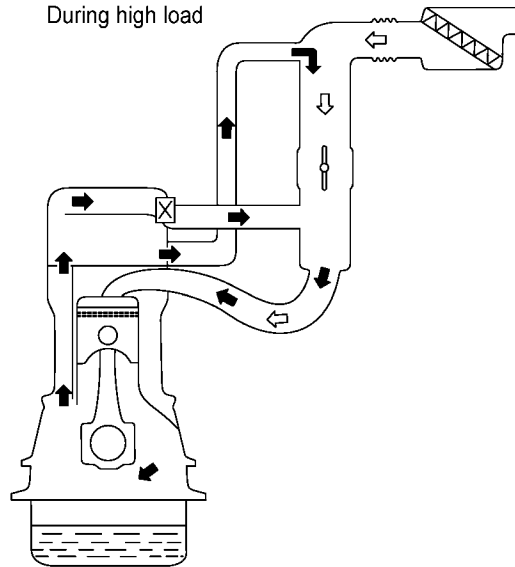
PCV GAS RECIRCULATION DEVICE

System Diagram

During low load



During high load



ECM0498

Component Parts Inspection

PCV valve

Running Test

1. At idle, with the hose remaining connected to the PCV valve, detach the PCV Valve from the Rocker Cover.
2. Listen for a hissing sound from the PCV Valve. Hissing indicates a normal operating PCV Valve. If hissing not heard, replace the PCV Valve.

Manual Test

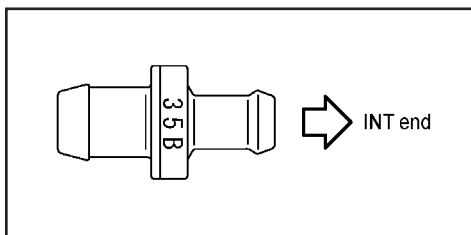
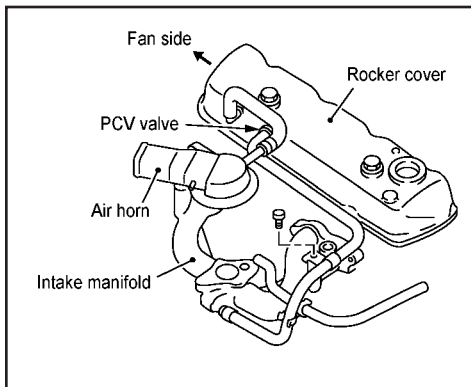
1. Remove the PCV Valve. Check air flow through the Valve by passing air to and from the INT end of the Valve.

Appropriate results:

Blowing air: No air flow

Sucking air: Air flow exists

Replace the Valve if the results are not as listed above.



BRAKE SYSTEM

Brake Burnishing Procedure

Burnish contact surface between brake drum and brake shoes according to the following procedure after refinishing or replacing Brake Drums, or after replacing Brake Shoes.

CAUTION

- **Be careful of travel speeds because the brakes do not provide full effectiveness until the Shoes and Brake Drum are fully burnished.**

Only perform this procedure under safe operating conditions. Use extreme caution.

1. Drive the truck on straight, flat surface with a load secured to the forks (approximately 1/2 truck rated capacity).
2. Accelerate forward up to normal travel speed and apply the brakes to make a moderate stop.
3. Perform the same procedure in reverse.
4. Repeat steps 1 to 3 until shoes and drums are burnished. (Approximately 20 to 25 complete cycles of forward/reverse stops).
5. Drive without depressing the brakes for a few minutes to cool the brakes.

Discontinue burnishing process if truck is not stopping properly (pulling to one side or grabbing) and investigate / correct the problem before continuing.

After letting brakes cool, check operation of parking brake and adjust if necessary.

Inspection/Adjustment of Parking Brake Operation Effort

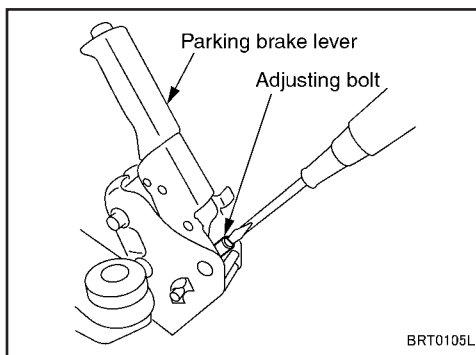
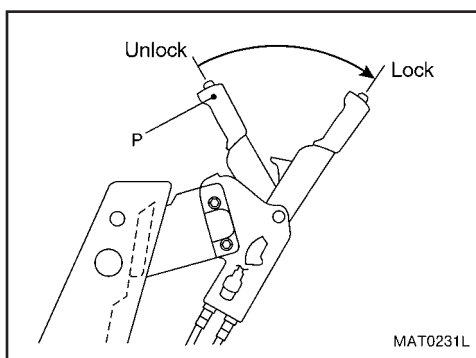
CAUTION

- **Preliminarily adjust the Brake Shoe clearance.**
1. Measure the operation force required to move the Parking Brake lever to the lock position by applying force to point P shown in the figure.

Standard [N (kg) lbs]:

116 - 160 (12 - 16) 26 - 36

2. If the measured operation force is not within the specified range, perform the following adjustment.
 - Unlock Parking Brake lever.
 - Adjust Adjusting Bolt using a screwdriver so that the operation force required to move the lever to the lock position is within the standard.



LOADING MECHANISM

Fork Maintenance and Inspection (Cont'd)

Fork Use Guidelines

Use your forks correctly:

1. Inspect forks regularly.
2. Make sure the fork capacity meets or exceeds truck capacity rating and load weight center.
3. Obtain written approval from fork manufacturer prior to making any fork modifications/repairs.
4. Determine wear cycle and replacement schedule for your operation. Use of larger forks in demanding applications will extend fork life.
5. All positioning locks must be in place at all times. Forks must be properly seated on the Carriage and the positioning locks fully located in the slot before use.

What not to do:

1. DO NOT overload the fork beyond its rated capacity.
2. DO NOT change fork from one lift truck to another without knowing capacities of each truck and fork.
3. DO NOT use a fork in an application for which it is not designed.
4. DO NOT add a fork extension longer than 150% of the supporting fork's length.
5. DO NOT try to repair or modify forks in the field, especially by welding. Improper welding destroys heat treat properties and makes the forks brittle.
6. DO NOT carry full or partial loads on one fork.
7. DO NOT apply sideways pressure to forks, commonly called "side loading". Forks are designed for vertical loading only.

(This reprint courtesy of Cascade Corporation)

MAST LOWERING

Manual Mast Lowering Shut-Off Valve (Hydraulic)

NOTE:

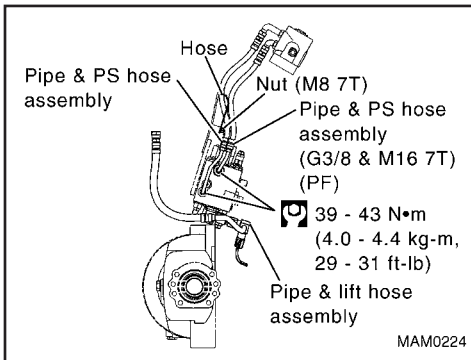
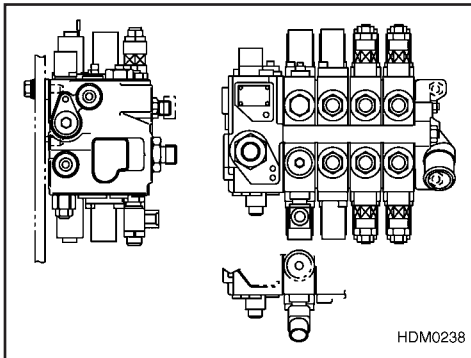
When the Forks and Masts cannot be lowered with/without load, initially verify the following:

For Joystick Valve:

1. Check and verify the C1 Solenoid and Solenoid for Lift operate normally. Refer to the VC section.
2. Operate the Control Valve Lever toward the Mast lowered side, and then make sure that the Pump operates (turns). If not, repair the vehicle by referring to the VC section.

If the above steps are OK, the Forks and Masts can be lowered with the following procedure.

1. Turn key switch to OFF, disconnect the Battery connection.
2. Remove the Floor Mat and Floor Board.
3. Disconnect the PS Piping (PF).
4. Loosen Lock Nut of Shut-off Valve on the lower side of Control Valve.
5. Loosen the screw counterclockwise until it stops.



CAUTION

- **The Mast will begin to lower when Screw is first turned.**

Return:

1. Tighten the Screw until it stops.
2. Tighten the Lock Nut.
3. Reconnect the PS Piping (PF), install the Floor Board and Floor Mat and re-connect the Battery.

CAUTION

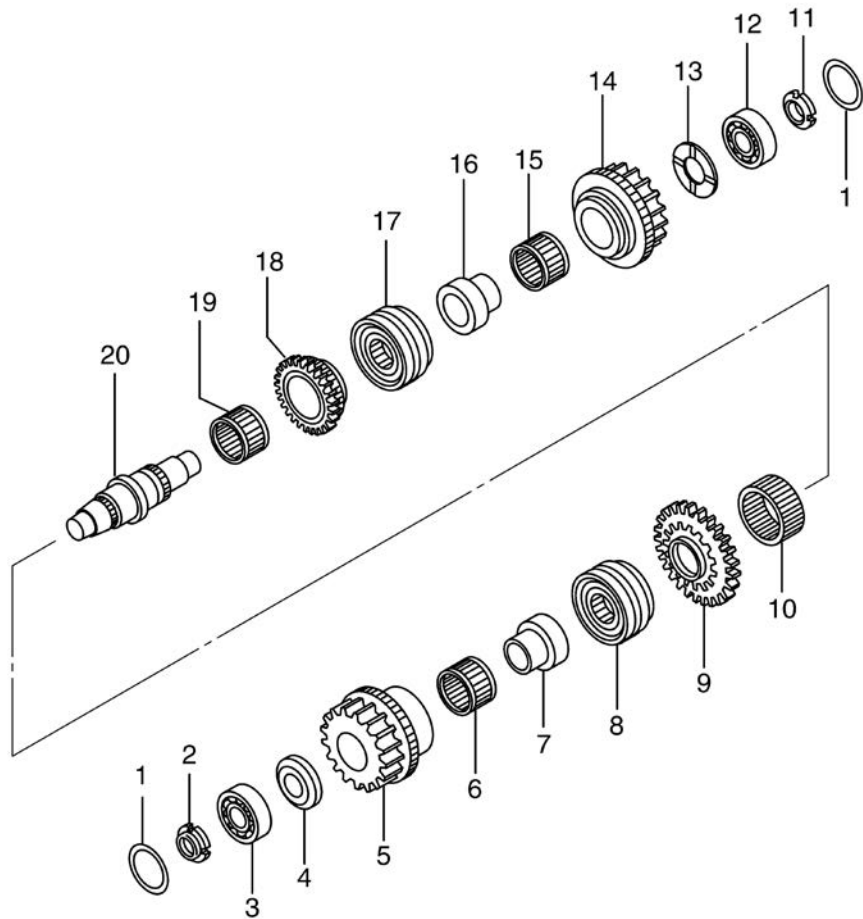
- **Always return to the Lift Lock function after repair.**

DISASSEMBLY

Disassembly of Mainshaft Assembly

Order of disassembly

1. Shim
2. Nut
3. Roller Bearing
4. Thrust Washer
5. High Gear
6. Needle Bearing
7. Synchronizer Sleeve
8. Synchromesh Assembly (H&L)
9. Low Gear
10. Roller Bearing
11. Nut
12. Roller Bearing
13. Thrust Washer
14. Forward Gear
15. Needle Bearing
16. Synchronizer Sleeve
17. Synchromesh Assembly (F&R)
18. Reverse Gear
19. Needle Bearing
20. Mainshaft

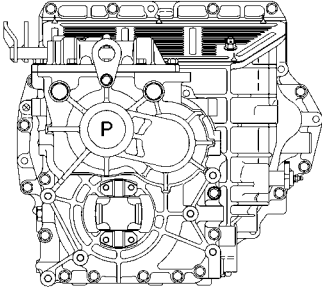


ASSEMBLY

Attach the parts 10 - 20 listed in the "Order of assembly" to the Control Cover. Then install in the Transmission Housing.

Confirmation of Gear Rotation

1. After assembling the Transmission, place the Gear in forward-high and carefully feel by hand to make sure that the Output Flange rotates.
2. If the Output Flange will not rotate by hand, the engagement of the Roller Bearing's outer race may be unsatisfactory. In such case, tap the Transmission Case's Roller Bearing (P) several times with a plastic hammer and check again.
3. If the Output Flange still will not rotate by hand, the Shim adjustment may be unsatisfactory. In such a case, disassemble and readjust.



MAINTENANCE AND INSPECTION FOR U.S.

Wheel and Tire (Cont'd)



WARNING

- If any of these warnings are not adhered to, it could result in death or serious injury.
- Tires used on forklifts manufactured in Japan and the U.S. are different. Do not mix different sizes or tire types. Mixing could affect stability.
- If tire pressure is not correct it can affect the stability of the forklift, potentially resulting in tip over. It can also cause rupturing, premature tire wear or explosive separation of the multi-piece rim set.
- Tire pressure is very high. When checking the tire pressure, do not face the tire side to avoid a danger of personal injury.

Cushion Models Standard Tire Sizes

Vehicle (tons)	Type	Tire Size	Tire Load Capacity
1F1 (Cushion)	Drive	18-6-12.12	Standard
	Steer	14-5-10	HiLoad*
1F2 2.0-2.5 Ton (Cushion)	Drive	21-7-15	Standard
	Steer	16.25-6-11.25	Standard
1F2 2.8-3.3 Ton (Cushion)	Drive	28x9-15	Standard
	Steer	16.25-6-11.25	HiLoad*
G1F2 3.0 Ton (Cushion)	Drive	22-8-16	Standard
	Steer	18-6-12.12	HiLoad*
G1F2 3.5-3.6 Ton (Cushion)	Drive	22-9-16	Standard
	Steer	18-6-12.12	HiLoad*



WARNING

- *Use only the OEM recommended HiLoad Steer Tire as listed in the parts catalog. This will reduce the possibility of premature wear to the Tire, Wheel Hub and/or Steer Linkage. Using parts other than those recommended may affect overall stability while traveling and during load handling. Instability could cause a tip over or loss of load condition creating an unsafe condition.

REMOVAL AND INSTALLATION

Installation

Install in the reverse order of removal.



- Tighten Wheel Nuts to the specified torque evenly.

- Wheel

Tightening torque [Nm (kg-m, ft/lb)]:

P1F1 (1.0t - 2.0t) : 167 - 226 (17 - 23, 123 - 167)

P1F2 (2.0t - 3.0t) : 167 - 226 (17 - 23, 123 - 167)

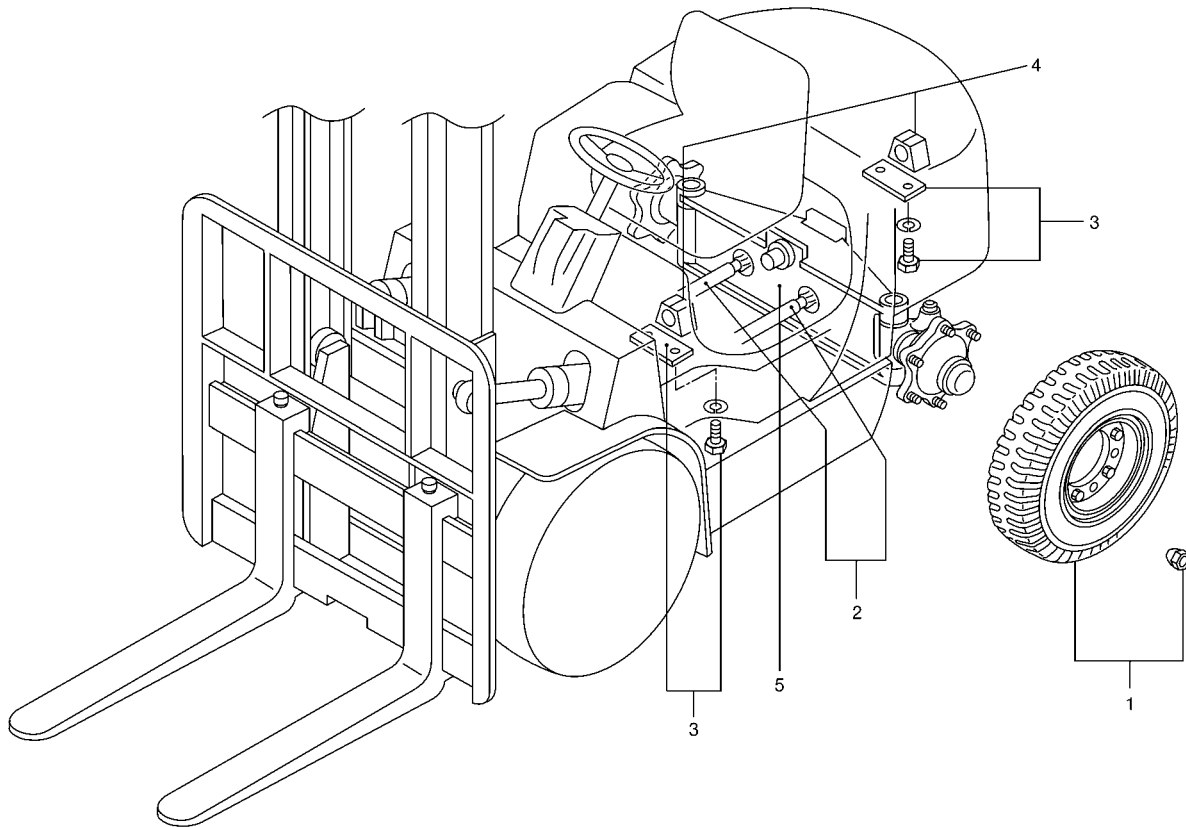
P1F2 (3.5t) : 210 - 257 (21 - 26, 155 - 190)

A1F1 (1.5t - 1.75t) : 167 - 226 (17 - 23, 123 - 167)

A1F2 (2.5t) : 135 - 155 (13.7 - 15.8, 100 - 114)

Steering Axle

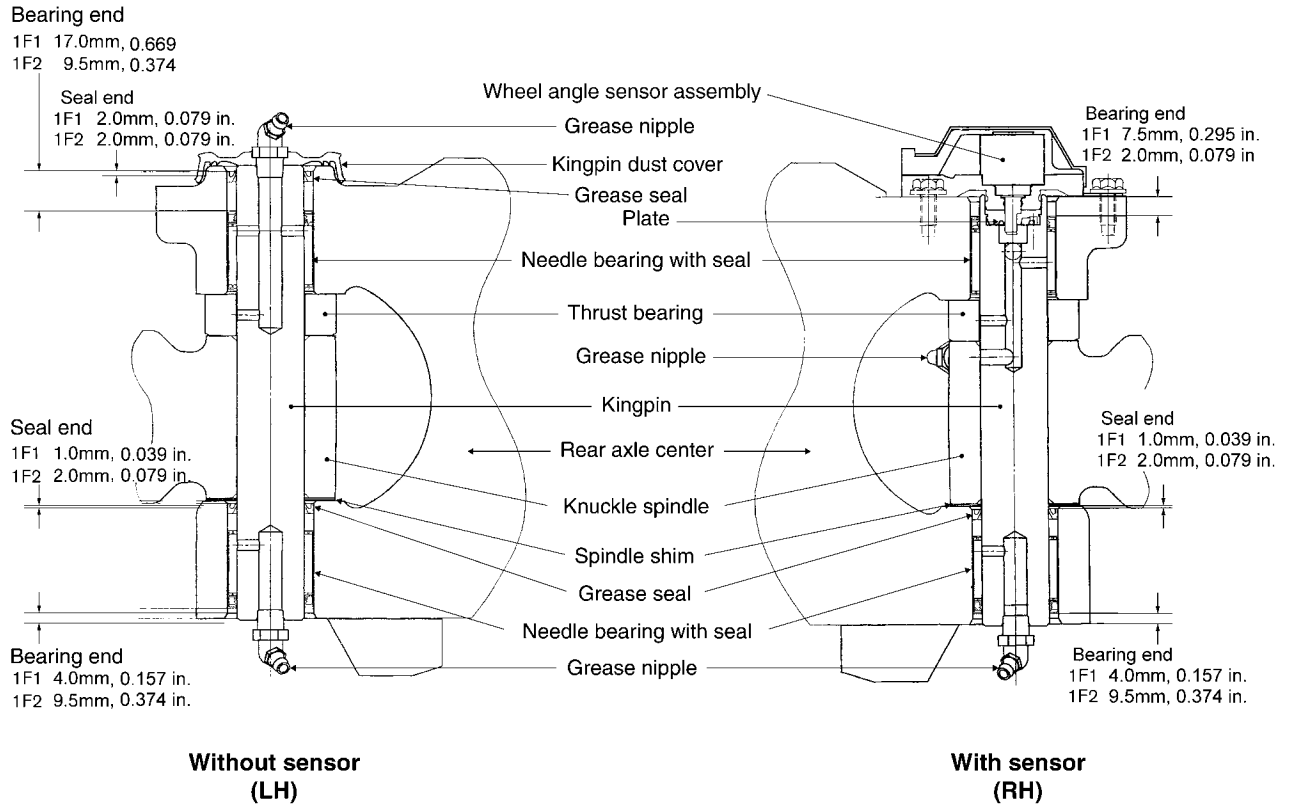
Removal



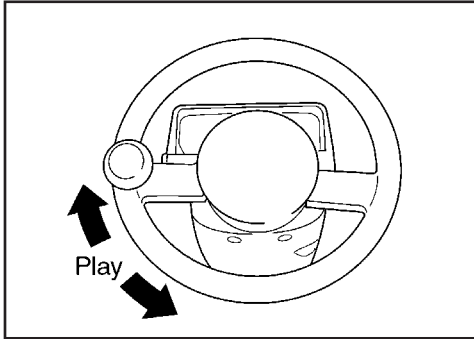
Order of removal

1. Steering Tire, Wheel Nut
2. Ps Piping
3. Axle Mounting Cap, Bolt
4. Axle Mounting Bushing
5. Steering Axle Assembly

SPINDLE DETAILS



STEERING WHEEL



CAUTION

- Neutral knob position must be redetected after removing, installing or replacing the Steering Wheel Angle Sensor of the Steering Axle.
- Refer to “3. Selection of Vehicle Specification (3)” in VC section.

Inspection After Installation

Inspection of Steering Wheel for Play

- With the Engine stopped, make sure the Steering Wheel play is within the standard on the circumference.

Play: 30 mm, 1.18 in, or less

Inspection of Steering Force

- Apply the Parking Brake and warm up Engine.
- Fully warm up the Engine and run it at 1,000 rpm.
- Install a Spring Scale to the Steering Wheel Knob. Pull the Spring Scale (in a tangential direction). Read the Scale when the Wheel just starts to move.

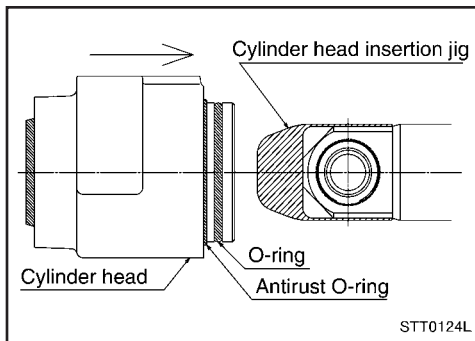
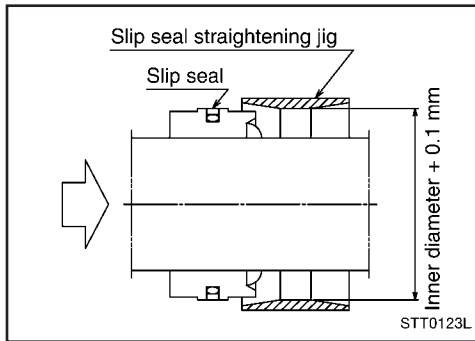
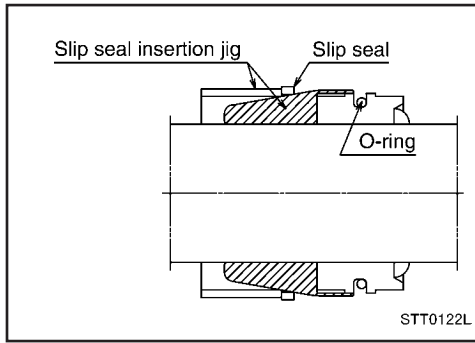
Steering force: 1.3 kg, 2.87 lb, or less

PS VALVE

Trouble Diagnosis and Corrections

Condition	Possible Cause	Corrective Action
High-effort steering	1. Hydraulic system <ul style="list-style-type: none"> • High backpressure • Set Steering Relief Valve pressure too low 	<ul style="list-style-type: none"> • Lower backpressure to under allowable level. • Reset pressure.
	2. PS Valve <ul style="list-style-type: none"> • No centering to column • Seizure due to foreign objects between Spool and Sleeve or Sleeve and Housing • Excessive tightening torque of End Cap Screw • Missing ball in Emergency Steering Check Valve 	<ul style="list-style-type: none"> • Repair. (If the steering effort is reduced when the PS valve retaining bolts are loosened, the cause is incorrect centering.) • Replace. • Evenly tighten to correct torque. • Install ball.
	3. Direct Valve or other attached Control Valves <ul style="list-style-type: none"> • Excessive tightening torque of port connector • Excessive tightening torque of Retaining Bolts • Foreign object in relief valve • Foreign object between Housing and Spool • Malfunction (inappropriate operation) • Clogged orifice • Incorrect assembly of Control Spring 	<ul style="list-style-type: none"> • Tighten to the specified torque. • Tighten to the specified torque. • Disassemble, clean, reassemble, adjust set pressure or replace Valve Assembly. • Replace Valve Assembly. • Replace Valve Assembly. • Disassemble, clean, reassemble. • Replace with optimum Spring.
	4. Pump <ul style="list-style-type: none"> • Not operating • Worn, malfunctioning • Reverse rotation 	<ul style="list-style-type: none"> • Activate. • Replace. • Repair.
	5. Vehicle <ul style="list-style-type: none"> • Excessive wear of mechanical parts 	<ul style="list-style-type: none"> • Lubricate or replace Bearing Joint.
Steering wheel will not return to neutral position after it is released, or steering wheel turns spontaneously (except load reaction type).	1. Hydraulic system <ul style="list-style-type: none"> • High backpressure 	<ul style="list-style-type: none"> • Lower pressure to under allowable level.
	2. PS valve <ul style="list-style-type: none"> • Seizure due to foreign objects between Spool and Sleeve • No centering to column • Damaged centering spring 	<ul style="list-style-type: none"> • Replace. • Repair. • Replace spring.
Cylinder does not follow steering wheel at all or only unsatisfactorily, wheel slip is too large.	1. Hydraulic system <ul style="list-style-type: none"> • Air inclusion 	<ul style="list-style-type: none"> • Bleed the air.
	2. PS valve <ul style="list-style-type: none"> • Worn internal parts • Insufficient tightening torque of End Cap Screw • Missing drive or spacer 	<ul style="list-style-type: none"> • Replace, clean, reassemble, and adjust set pressure. • Evenly tighten to correct torque. • Assemble correctly.
Cylinder does not follow steering wheel at all or only unsatisfactorily, wheel slip is too large.	3. Direct Valve or other attached Control Valves <ul style="list-style-type: none"> • Foreign objects in overload Relief Valve and anti-cavitation check valve • Damaged O-Ring 	<ul style="list-style-type: none"> • Disassemble, clean, reassemble, and adjust set pressure or replace Valve Assembly. • Replace.
	4. Pump <ul style="list-style-type: none"> • Insufficient volume efficiency 	<ul style="list-style-type: none"> • Replace.
	5. Cylinder <ul style="list-style-type: none"> • Damaged Piston Seal 	<ul style="list-style-type: none"> • Replace.
Steering wheel is pulled back or wheel kick symptom occurs.	1. Hydraulic system <ul style="list-style-type: none"> • Incorrect piping to 4 ports 	<ul style="list-style-type: none"> • Repair.
	2. PS valve <ul style="list-style-type: none"> • Incorrect Valve Timing Assembly 	<ul style="list-style-type: none"> • Assemble correctly.

PS CYLINDER



Assembly of Piston Seals

1. Attach the O-Ring into the groove.
 - Ensure the O-Ring is not twisted.
2. Push the Slip Seal onto the Piston while stretching the Seal. The Slip Seal Insertion Jig will help to attach it safely and properly. Heating the Slip Seal to approximately 80°C (176°F) also facilitates the assembly.
3. If the Slip Seal is still stretched when fitted onto the Piston, straighten it with the Straightening Jig.
 - A stretched Slip Seal will prevent subsequent assembly work.

Assembly of Piston Rod, Cylinder Head and Cylinder Tube

1. Hold the Cylinder Tube in a horizontal position.
2. Insert the Piston Rod into the Cylinder Tube.

CAUTION

- **Ensure the Slip Seal is not damaged.**
3. Insert the Piston Rod and Cylinder Tube into the Cylinder Head. When inserting the Rod and Tube, ensure the lips of the Wiper Ring and U-Ring are not damaged by the height gap of the Piston Rod. The Insertion Jig will help to assemble safely.
 4. Insert the Cylinder Head into the Cylinder Tube.

CAUTION

- **Ensure the antirust O-Ring is not caught and damaged by the Tube end face.**

VEHICLE CONTROL SYSTEM

Quick Glow System

NOTE:

- The Glow Timer unit is deleted.
- The Glow Timer's function is controlled within the VCM.

The Glow System for the QD32 Engine is controlled by only the coolant temperature.

But this Quick Glow System is controlled by coolant temperature, Battery voltage and terminal voltage of the Glow Plug. This system is added to the Chopping Control.

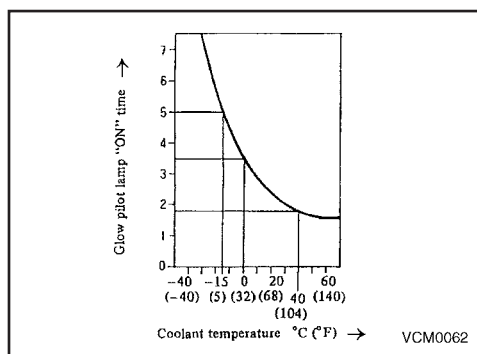
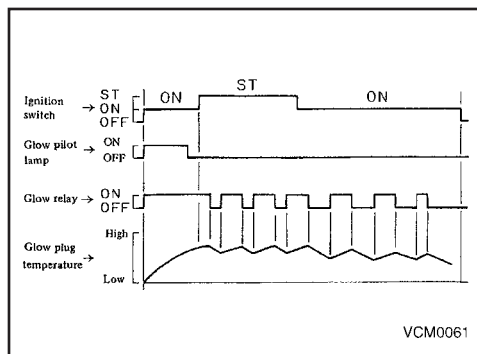
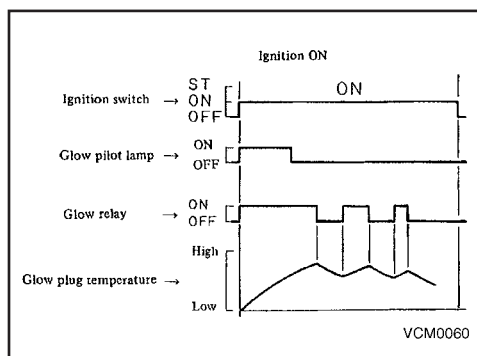
Operation

a) When the coolant temperature is below 50°C (122°F) (temperature detected by Water Temperature Sensor)

1. Operational sequence
2. Ignition Switch "ON"

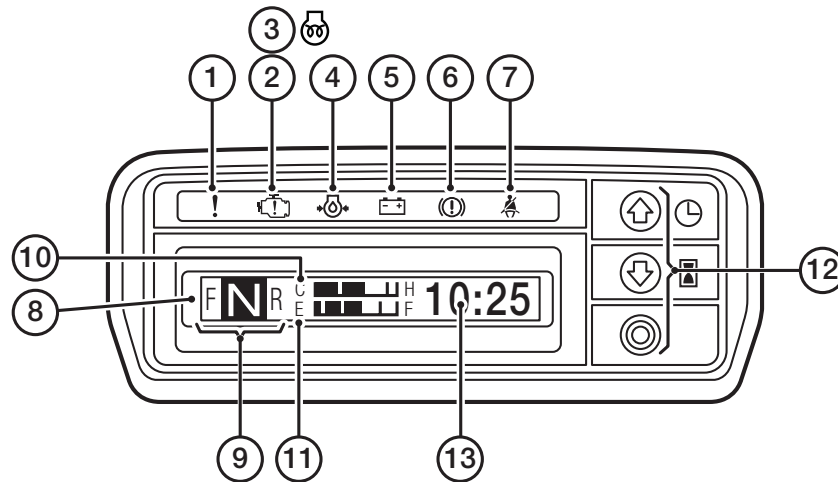
When the Ignition Switch is turned to "ON", the Glow Pilot Lamp comes on and, at the same time, the Glow Relay activates. Current then flows through the Glow Plug in each pre-combustion chamber to provide a quick preheat function.

The duration of time the Glow Pilot Lamp is on (lamp "ON" time duration) is shown in the graph at left. The lamp "ON" time duration differs according to the coolant temperature. For example, when the coolant temperature is 0°C (32°F), the lamp "ON" time duration is approximately 3.5 seconds.



COMBINATION METER

Combination Meter Arrangement



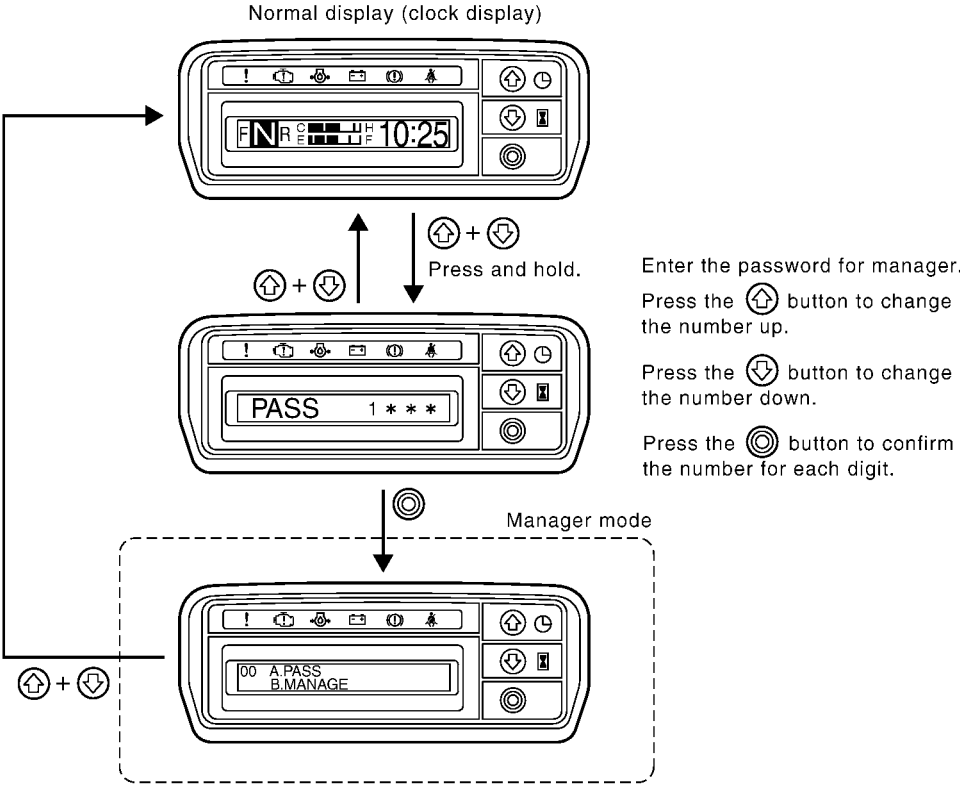
1. Multipurpose Warning Lamp
2. Engine Check Lamp
(Gasoline Engine Forklifts Only)
3. Glow Pilot Lamp
(Diesel Engine Forklifts Only)
4. Oil Pressure Warning Lamp
5. Charge Warning Lamp
6. Parking Brake Warning Lamp
7. Seat Belt Warning Lamp
8. Liquid Crystal Display (LCD)
9. Transmission Position
(Left Side Of LCD)
10. Water Temp. Gauge
(Top Center Of LCD)
11. Fuel Gauge (Bottom Center Of LCD)
12. Operation Buttons
13. Time (Right Side Of LCD)

NOTE:

- In place of TIME(13), the DATE or HOUR meter may be displayed.
- While driving, this display changes to the speedometer when the vehicle speed is approximately 4 km/h (2 MPH) or higher.
- This display also indicates the inspection/service timing, malfunctions and warnings.
- The display time and date will be reset if the Battery cable is disconnected or the Battery is replaced. If the display has been reset, set the time and date again.

COMBINATION METER

Manager Mode



Manager mode can be used by the manager to check and reset operating time for each operator, and to change passwords.

NOTE:

The manager must not disclose to operators the password required to enter manager mode. Default operator and manager passwords are listed on following page.

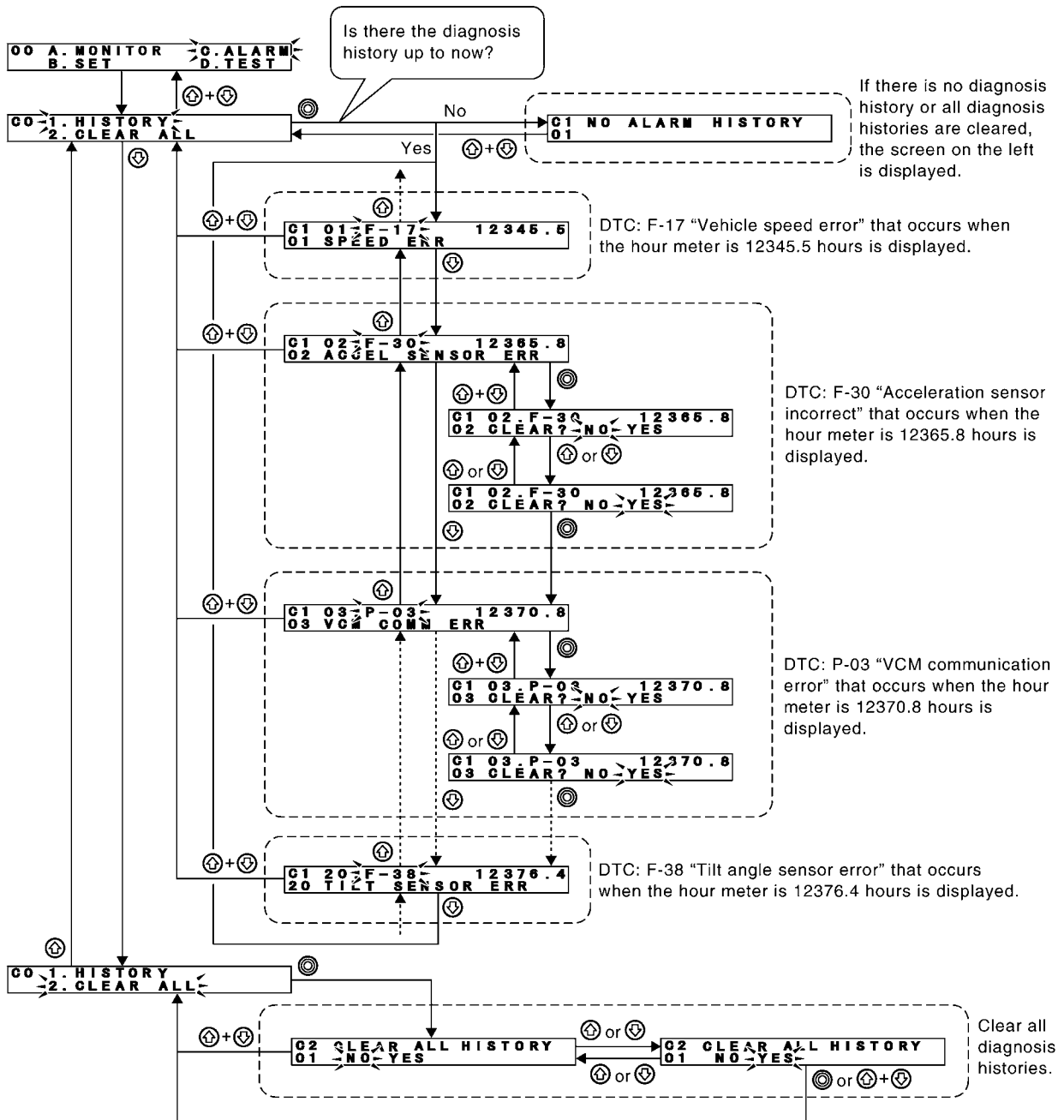
COMBINATION METER

Fault Adjustment Diagnostic Mode (Cont'd)

Item	Display	Item	Remarks
A1-01 (Upper)	**.* km/h	Vehicle Speed Sensor Output	
A1-01 (Lower)	**.* MPa	Hydraulic Oil Pressure Sensor Output	Tilt Leveling OPT
A1-02 (Upper)	**.* V	Tilt Angle Sensor Output	Tilt Leveling OPT
A1-02 (Lower)	**.* V	Wheel Angle Sensor Output	GOM Only
A1-03 (Upper)	**.* %	Acceleration Sensor Opening Angle	
A1-03 (Lower)	ON/OFF	Ignition Start Switch	
A1-04 (Upper)	ON/OFF	Mast Height Switch	OPT
A1-04 (Lower)	ON/OFF	Lift Down Switch	
A1-05 (Upper)	ON/OFF	Tilt Forward Operation Limit Switch	OPT
A1-05 (Lower)	ON/OFF	Speed Limit Switch	OPT
A1-06 (Upper)	ON/OFF	Power/Eco Switch	Power: OFF/Eco: ON
A1-06 (Lower)	ON/OFF	Seat Switch	
A1-07 (Upper)	ON/OFF	Seat Belt Switch	
A1-07 (Lower)	ON/OFF	Accelerator Pedal Switch	GOM Only
A1-08 (Upper)	ON/OFF	Tilt Leveling Switch	OPT
A1-08 (Lower)	ON/OFF	Coolant Low Level Switch	
A1-09 (Upper)	ON/OFF	Air Cleaner Clogging Switch	
A1-09 (Lower)	ON/OFF	T/M Warning Switch	
A1-10 (Upper)	ON/OFF	Inching Switch	GOM Only
A1-10 (Lower)	ON/OFF	Mfc1-4 Change Switch	OPT: FC
A1-11 (Upper)	ON/OFF	Engine Auto Start Switch	GOM Only
A1-11 (Lower)	ON/OFF	Fc Emergency Interception Relay Output	OPT: FC
A1-12 (Upper)	ON/OFF	Auto Light Relay Output	GOM Only
A1-12 (Lower)	ON/OFF	Warning 1 Buzzer Output	
A1-13 (Upper)	ON/OFF	Warning 2 Buzzer Output	
A1-13 (Lower)	ON/OFF	Neutral Signal Output	
A1-14 (Upper)	ON/OFF	Reserve Output 1	Reserve
A1-14 (Lower)	ON/OFF	Starter Drive Relay Output	
A1-15 (Upper)	ON/OFF	Engine Stop Relay Output	
A1-15 (Lower)	ON/OFF	Glow Plug Drive Relay	
A1-16 (Upper)	ON/OFF	T/M Forward Solenoid Operation	
A1-16 (Lower)	ON/OFF	T/M Forward 2Nd Solenoid Operation	2nd speed ATM
A1-17 (Upper)	ON/OFF	T/M Backward Solenoid Operation	
A1-17 (Lower)	**** mA	T/M Solenoid Current	
A1-18 (Upper)	ON/OFF	Power Steering Correction Solenoid Operation	GOM Only
A1-18 (Lower)	**** mA	Power Steering Correction Solenoid Current	GOM Only
A1-19 (Upper)	ON/OFF	Tilt Lock Solenoid Operation	Tilt Leveling OPT
A1-19 (Lower)	**** mA	Tilt Lock Solenoid Current	Tilt Leveling OPT
A1-20 (Upper)	ON/OFF	Lift Lock Solenoid Operation	
A1-20 (Lower)	**** mA	Lift Lock Solenoid Current	

COMBINATION METER

Fault Adjustment Diagnostic Mode (Cont'd) Diagnosis History



CAUTION




- Confirm the diagnosis history with the Ignition Switch ON.

COMBINATION METER

Fault Adjustment Diagnostic Mode (Cont'd)

Item	Setting Value	Name of Item	Remarks
D1-01 (Upper)	ON/OFF	Auto light relay output	GOM Only
D1-01 (Lower)	ON/OFF	Warning buzzer output 1	
D1-02 (Upper)	ON/OFF	Warning buzzer output 2	
D1-02 (Lower)	ON/OFF	Neutral signal output	
D1-03 (Upper)	ON/OFF	Engine stop relay output	
D1-03 (Lower)	ON/OFF	FC emergency interception relay output	OPT: FC
D1-04 (Upper)	ON/OFF	Reserve (Output 1)	
D1-04 (Lower)	ON/OFF	Starter drive relay output	

NOTE:

For ACTIVE TEST of VCM and MP, Change the display OFF -> ON by pressing  or , and then perform ACTIVE TEST by pressing . When completing ACTIVE TEST, the system is changed to the next item.

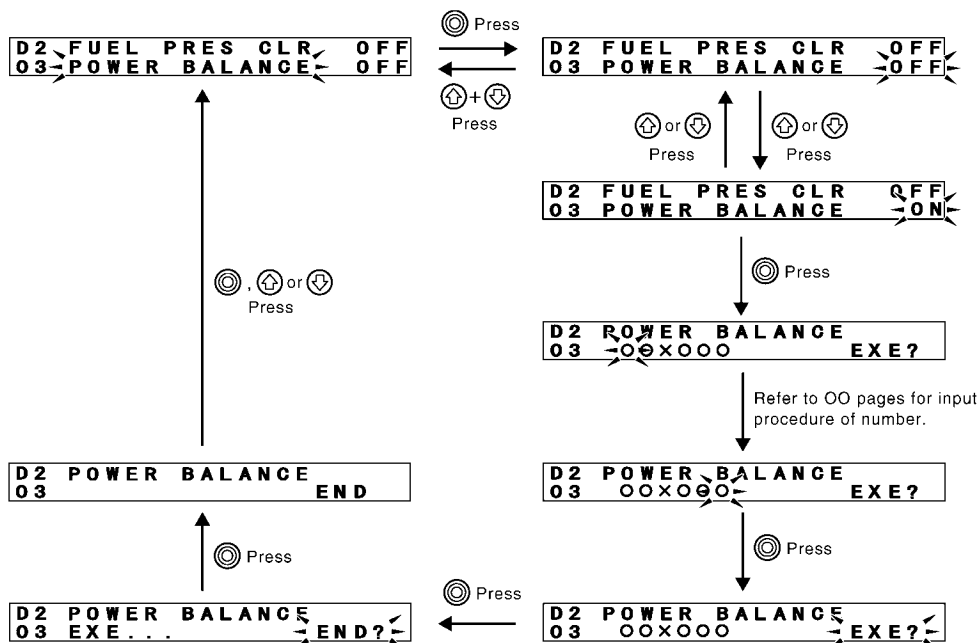
- For Active Test of ECM, refer to page VC-56.
- Always perform ACTIVE TEST under the engine start (operating) status.

COMBINATION METER

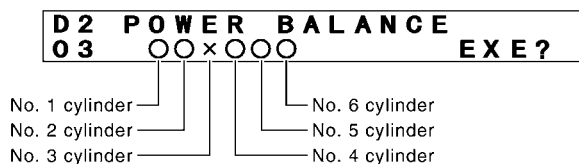
ECM Active Test (Cont'd)

Power Balance:

Stop No. 3 Cylinder in Power Balance.



Power balance



CAUTION

- **LPG model does not have the Power Balance function. Do not perform this adjustment on the LPG model.**
- **If the Power Balance function is performed on the LPG model, the screen will stop. Cancel the function by turning the Ignition Key OFF.**

The Engine Cylinder status is shown by O or X as in the above figure.

These symbols mean No. 1 Cylinder, No. 2 Cylinder, No. 3 Cylinder, No. 4 Cylinder, No. 5 Cylinder And No. 6 Cylinder from the left.

(* Since this vehicle has only 4 Cylinders, No. 5 Cylinder And No. 6 Cylinder are not used for ACTIVE TEST even though these are displayed.)

The Cylinder stops by changing the set values of each Cylinder from O to X and performing the adjustment.

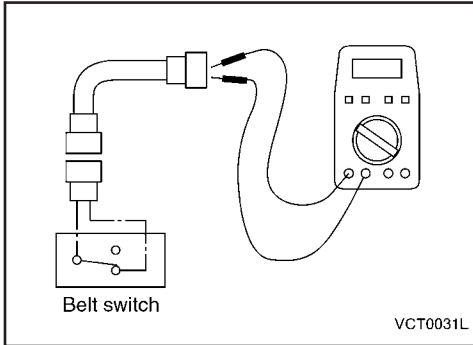
UNIT INSPECTION AND ADJUSTMENT

Inspection (Cont'd)

Seat Belt Switch

Check continuity.

- MC: When buckle is inserted: Continuity should exist.
- When buckle is disconnected: Continuity should not exist.
- FC: When buckle is inserted: Continuity should not exist.
- When buckle is disconnected: Continuity should exist.



Radiator Coolant Level Detection Switch (Option)

Check continuity when it detects that radiator coolant is under the LOW position in reservoir tank.

Air Cleaner Clogging Detection Switch (Option)

Check continuity when applying air pressure.

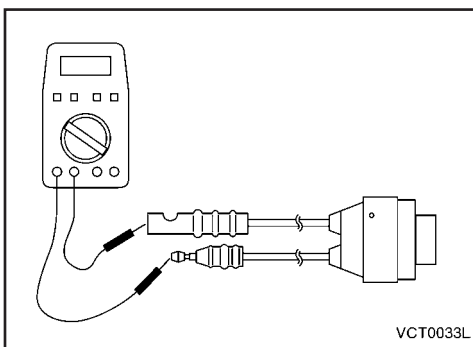
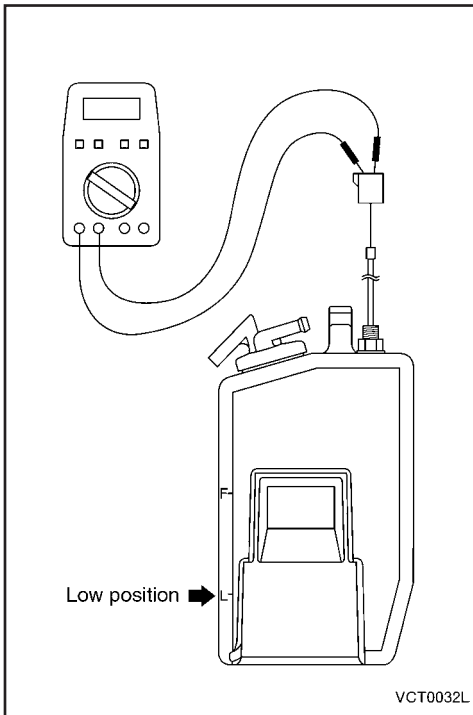
Additional air pressure:

5.7 - 6.7 kPa (0.057 - 0.067 bar, 0.058 - 0.068 kg/cm², 0.83 - 0.97 psi)



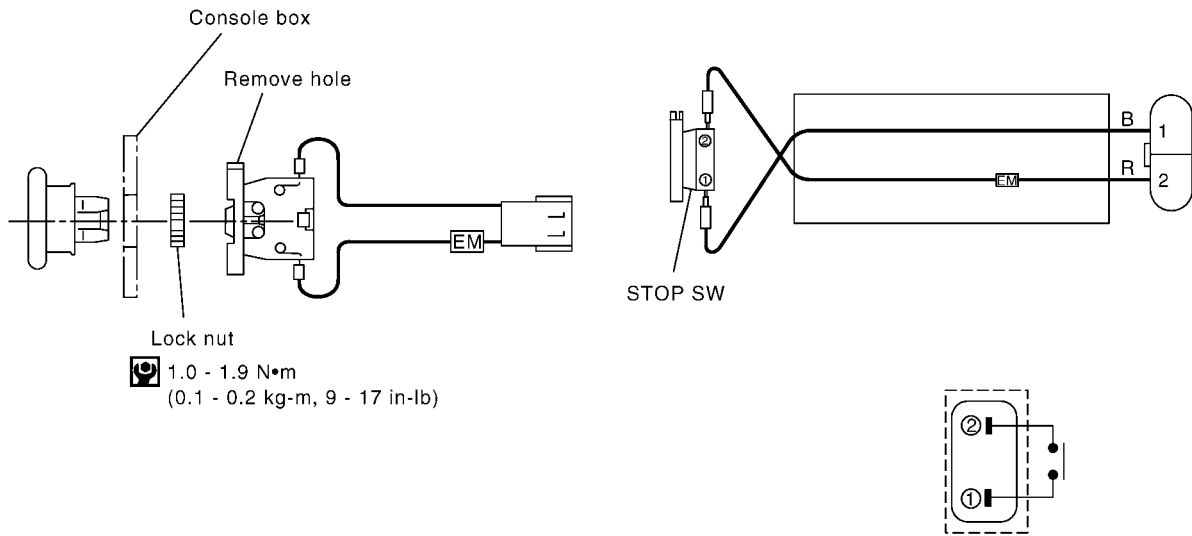
CAUTION

- Replace if continuity exists without air pressure applied.



UNIT INSPECTION AND ADJUSTMENT

Fingertip Control System (Option) (Cont'd) Emergency Stop Button



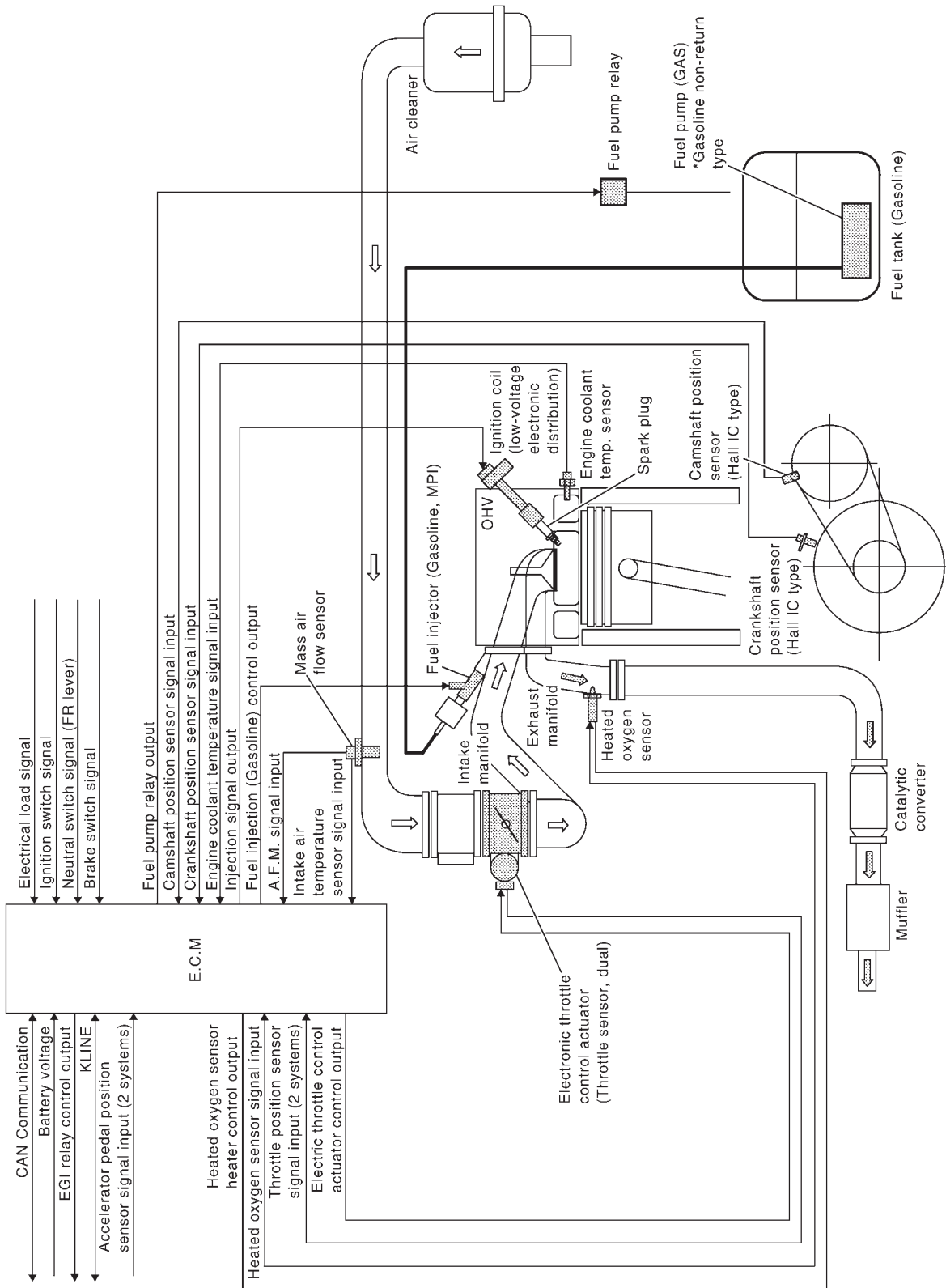
Inspection

Check continuity between terminals using circuit tester (Ω range).

Terminals	Normal Condition	Pushing the Button
1 - 2	Continuity	No continuity

DESCRIPTION

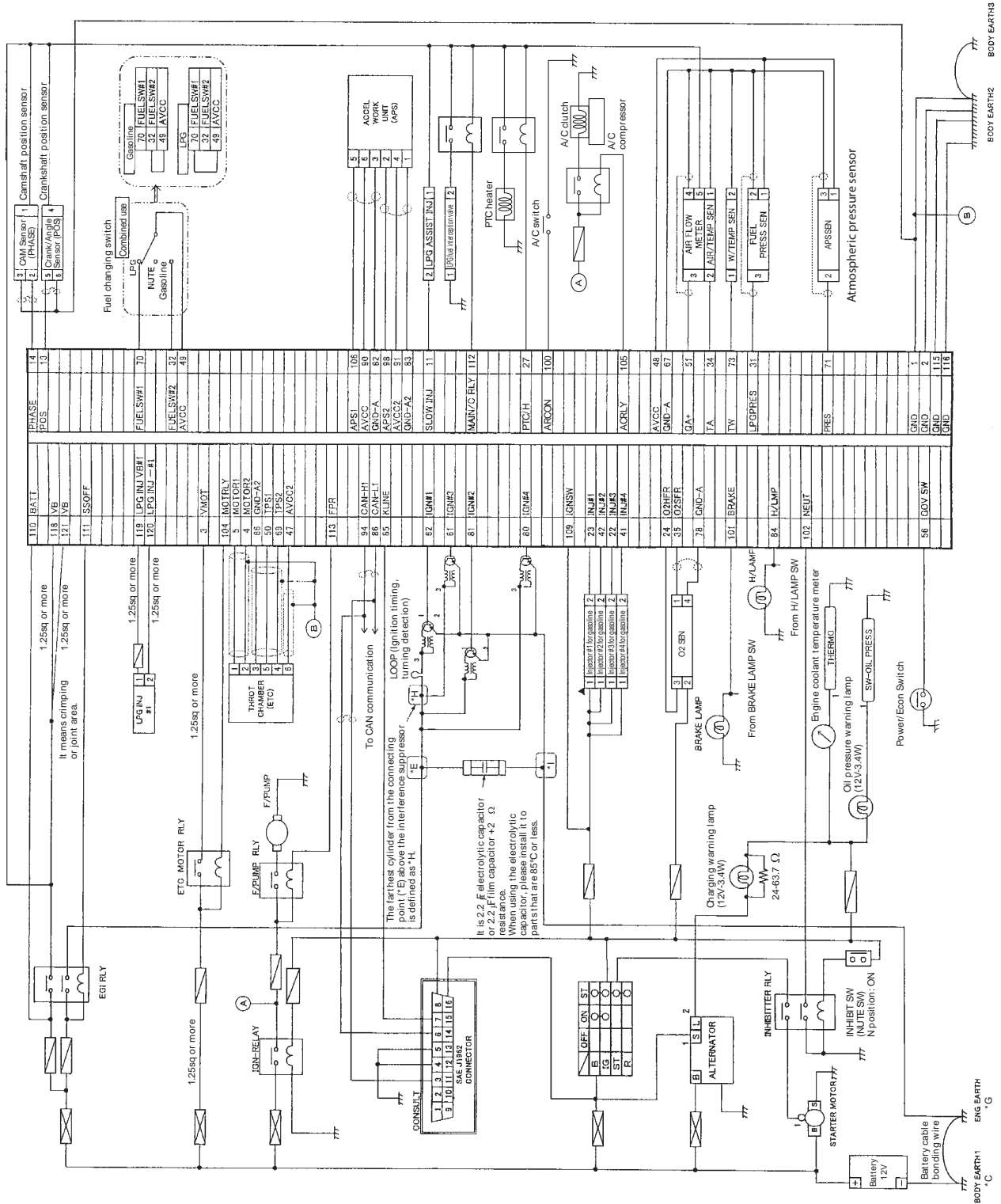
K-Engine Electronic Controlled System Diagram (Gasoline)



TROUBLE DIAGNOSIS

Circuit Diagram

K-Engine Electronic Controlled ECM Circuit Diagram (Combined Gasoline and LPG)




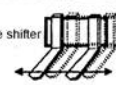

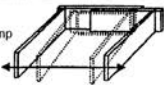
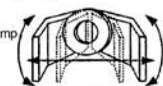


TROUBLE DIAGNOSIS

How to Proceed with Trouble Diagnosis (Cont'd)

Trouble Diagnosis Information Memo

Memo serial No.	
Date	No.

Issue of memo	

Date of occurrence		Weather:		Location:		Operator:						
Vehicle type		Model class	Vehicle ID No.	Model year	Travel time	Engine type	No. stamped on engine					
Vehicle model	Type	(in-house code)			(hr.)							
						Fuel <input type="checkbox"/> Gasoline <input type="checkbox"/> LPG <input type="checkbox"/> Propane <input type="checkbox"/> ratio <input type="checkbox"/> Fuel supplier <input type="checkbox"/> Combined use						
						Transmission <input type="checkbox"/> M/T (gear) <input type="checkbox"/> A/T						
						Heater <input type="checkbox"/> Yes <input type="checkbox"/> No						
						Oil pump capacity (cc) <input type="checkbox"/> Yes <input type="checkbox"/> No						
Trouble diagnosis condition item		Description (Enter a check mark, value, or comment in the dashed or solid-line box for the applicable item.)										
Symptom	1. Poor starting		<input type="checkbox"/> Cranking not possible <input type="checkbox"/> Does not start at all.		<input type="checkbox"/> No initial combustion <input type="checkbox"/> Inconsistent		<input type="checkbox"/> Does not start smoothly. <input type="checkbox"/> Hunting (steady speed fluctuation)		<input type="checkbox"/> Does not start at all.			
	2. Poor idle		<input type="checkbox"/> Occurs without a symptom. <input type="checkbox"/> Occurs after engine stumbles.		<input type="checkbox"/> Stalls but restarts quickly.		<input type="checkbox"/> Occurs when steering.		<input type="checkbox"/> Occurs when loading. <input type="checkbox"/> Occurs after cold start.			
	3. Engine stall		<input type="checkbox"/> Poor hill-climbing ability		<input type="checkbox"/> Insufficient speed		<input type="checkbox"/> Loading not possible		<input type="checkbox"/> Loading slow, difficult to operate			
	4. Poor power output		<input type="checkbox"/> Inappropriate lifting speed during lifting control		<input type="checkbox"/> Governor hunting							
	5. Poor acceleration											
	6. Hesitation											
	7. Surge (vibration in fwd and bwd direction)											
	8. Knocking (pinging sound)											
	9. Backfire (blowback noise)											
	10. After-burn (exhaust detonation)											
	11. Poor fuel economy		<input type="checkbox"/> (LPG hr./tank)		<input type="checkbox"/> Poor oil economy		<input type="checkbox"/> (hr./L)					
	13. Overheat		<input type="checkbox"/> Not overheated, but engine coolant temperature gauge indicates high.		<input type="checkbox"/> Overheated							
	14. Coolant/oil leakage		Location:									
	15. Noise		Location:									
	16. Warning lamp illumination		<input type="checkbox"/> No <input type="checkbox"/> Yes									
	First occurrence		<input type="checkbox"/> With new vehicle <input type="checkbox"/> Recently Approx. date:		<input type="checkbox"/> After brought back for servicing Approx. date:							
Frequency of occurrence		<input type="checkbox"/> At all times <input type="checkbox"/> Under certain conditions <input type="checkbox"/> Sometimes										
Conditions of vehicle	Temperature condition		<input type="checkbox"/> Temperature (°C)		<input type="checkbox"/> Humidity (%)		<input type="checkbox"/> Coolant temp. <input type="checkbox"/> Cold engine <input type="checkbox"/> When engine is warming up		<input type="checkbox"/> High coolant temp.			
	Operating condition, etc.		<input type="checkbox"/> Irrelevant <input type="checkbox"/> At idle <input type="checkbox"/> With engine racing		<input type="checkbox"/> During acceleration <input type="checkbox"/> At constant speed <input type="checkbox"/> During deceleration <input type="checkbox"/> When going up a hill <input type="checkbox"/> When loading							
	<input type="checkbox"/> Unladen <input type="checkbox"/> Laden		Capacity		kg, lbs.		<input type="checkbox"/> Tilting <input type="checkbox"/> Lifting <input type="checkbox"/> Steering					
	<input type="checkbox"/> Other		<input type="checkbox"/> Inching/braking <input type="checkbox"/> Steering <input type="checkbox"/> Other									
	Attachment		<input type="checkbox"/> Standard <input type="checkbox"/> Side shifter <input type="checkbox"/> Hinged fork <input type="checkbox"/> Roll clamp <input type="checkbox"/> Rotating fork <input type="checkbox"/> Stabilizer <input type="checkbox"/> Other		<input type="checkbox"/> Bale clamp							
	   		  									
	Other; Enter comments, etc.											

TROUBLE DIAGNOSIS

Table of DTC (Cont'd)

DTC for GST	Malfunction Return Condition	Diagnosis Outline	Trip
—	—	—	—
U1001	<ul style="list-style-type: none"> • Malfunction occurs in CAN communication transmit/receive data or in VCM, and data transmission/reception cannot be confirmed. • CAN communication data is transmitted/received for predetermined period. 	—	2
		—	2
U1001	<ul style="list-style-type: none"> • Malfunction occurs in CAN communication transmit/receive data or in ECM, and data transmission/reception cannot be confirmed. • CAN communication data is transmitted/received for predetermined period. 	—	2
U1001	<ul style="list-style-type: none"> • Malfunction occurs in CAN communication transmit/receive data or in DCM, and data transmission/reception cannot be confirmed. • CAN communication data is transmitted/received for predetermined period. 	—	2
U1001	<ul style="list-style-type: none"> • Malfunction occurs in CAN communication transmit/receive data or in MP, and data transmission/reception cannot be confirmed. • CAN communication data is transmitted/received for predetermined period. 	—	2
P0102	When the engine is running and the mass air flow sensor output voltage has been 0.5V or less (open or shorted) for a predetermined period.	Detect disconnection and short circuit and make MIL go on.	1
P0103	When the engine is stopped (ignition switch ON) and the mass air flow sensor output voltage has been approx. 4.9V or more (open or shorted) for a predetermined period.		
P0117	Engine coolant temp. sensor output voltage has been less than 0.06V (open or shorted) for a predetermined period.	Detect disconnection and short circuit and make MIL go on.	1
P0118	Engine coolant temp. sensor output voltage has been approx. 4.8V or more (open or shorted) for a predetermined period.		

TROUBLE DIAGNOSIS

Self-Diagnosis Function (Without Service Tool)

Self-Diagnosis Results Clearing Procedure

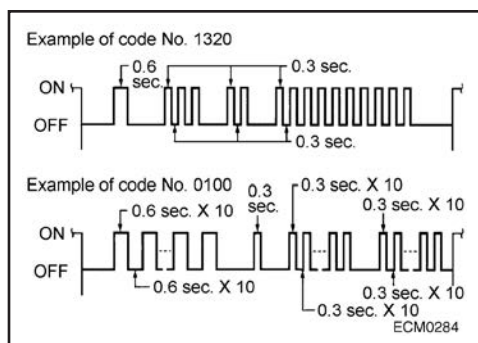
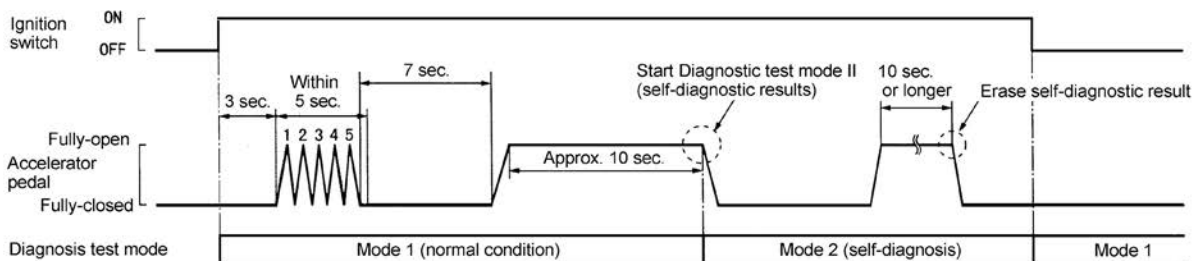
NOTE:

Count Time Accurately With Watch Or Equivalent.

1. Turn ignition switch ON with Accelerator Pedal released.
2. After 3 seconds, fully depress the Accelerator Pedal and release it 5 times quickly.

NOTE: The 5 cycles should be repeated quickly in **less than 5 seconds** ending in the released position.

3. Wait 7 seconds and fully depress the Accelerator Pedal and hold down for approximately 10 seconds.
 4. Release the Accelerator Pedal. The engine check light should start blinking.
 5. If necessary, record all OBD-II diagnostic trouble codes now flashing (see explanation of flash codes below). For flash code system identification, refer to page EC-37, EC-39, EC-41 and EC-43.
 6. Fully depress the Accelerator Pedal for at least 10 seconds. Self-diagnostic results are now erased.
- Release the Accelerator Pedal. *Once existing DTC's are cleared the flash code "0000" will be displayed.
 - Make sure self-diagnostic results are erased.
 - Turn key off. Turn key on and start truck. Verify that there are no warning lamps. The clock should be visible, if there are no diagnosed troubles remaining.



Explanation of Flash Codes

- The engine check light will blink (flash) a repeating four digit code that indicates the OBD-II diagnostic trouble code (DTC).
- The first digit will consist of a long pulse (0.6 sec) for each flash.
- The second, third and fourth digits will consist of short pulses (0.3 sec) for each flash.
- There will be a slight pause between each set of flashes.
- See examples shown.
- Ten flashes (long and short) will be used to indicate the number zero (0).

BASIC INSPECTION

Inspection of Idle Speed and Ignition Timing Service Data and Specifications (SDS)

Fuel pressure gasoline [(kPa, bar, kg/cm ² , psi)]		At idle: 353 kPa (3.53 bar, 3.6 kg/cm ² , 51 psi)
Idle speed (rpm)	A/T model (at N position)	700±50
Ignition timing (°BTDC/rpm)	A/T model (at N position)	0±2/700
Firing order		1-3-4-2
Spark plug	Manufacturer/type/gap mm (in)	NGK/FR2A-D/0.8 - 0.9 (0.0031 - 0.035)
Ignition advance device		Electrically controlled ignition advance
Density of CO at idle speed (%) / Density of HC at idle speed (ppm)		0.1/50 or less

- Turn Ignition Switch ON, and then make sure no malfunction is detected by self-diagnosis.
- Make sure the engine is free of Oil Pressure Pump loads and any electrical loads. Perform the inspection with the Shift Lever in the neutral or 'N' position.
- Warm up the Engine and Transmission to normal operating temperature.

Idle Speed

With ECM Input/Output monitor

NOTE:

The idle speed can be checked in the ECM Input/Output Monitor. (Refer to page EC-48.)



CAUTION

- **Perform "Idle Air Volume Learning" (on page EC-50) when idle speed is outside the standard.**

Without ECM Input/Output monitor:

1. Connect an induction type (current detection type) tachometer to the primary wire of the #1 cylinder to check idle speed.
 - The primary wire for the #1 cylinder is looped and longer than the wires for other cylinders. It is used for detecting idle speed and ignition timing.
2. Make sure the idle speed is 700 ±50 rpm.



CAUTION

- **Perform "Idle Air Volume Learning" (on page EC-50) when idle speed is outside the standard.**

Ignition Timing Inspection

NOTE:

The ignition timing can be checked in the ECM Input/Output monitor. (Refer to page EC-48.)

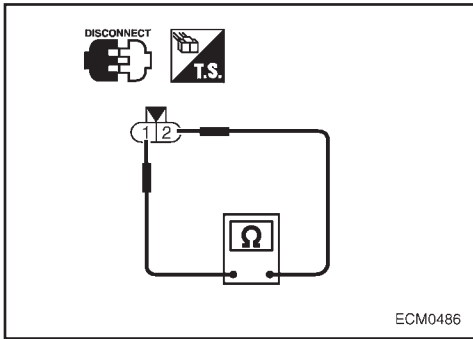
1. Install a timing light to the primary wire for the #1 cylinder.
2. Make sure the ignition timing and idle speed are 0 ±2°BTDC/700 rpm.



CAUTION

- **Perform "Idle Air Volume Learning" (on page EC-50) when ignition timing is outside the standard.**

COMPONENT PARTS INSPECTION



LPG Injector

1. Check resistance between terminals 1 and 2.
Resistance: Approx. 1W (at room temperature)
2. Remove the Fuse Cover and check Fuse for open.



CAUTION

- Do not apply voltage to the LPG injector.

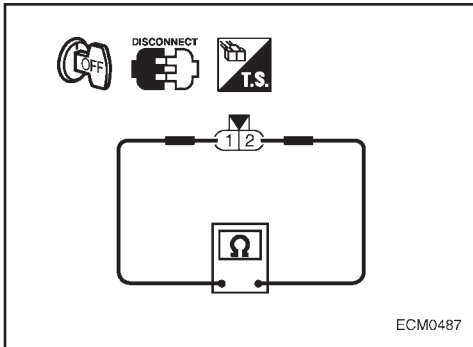
LPG Assistance Injector

Check resistance between terminals 1 and 2.

Resistance: Approx. 27Ω (at room temperature)

**Apply battery voltage directly to terminals 1 and 2.
Check solenoid operation.**

- Apply battery voltage directly between terminals 1 and 2:
Continuity should exist.
- No voltage: Continuity should not exist.



PTC Heater (Integrated with Vaporizer) (GOM Only)

Check the resistance between PTC heater terminal and ground.

Resistance:

1.5 - 2.0Ω (Engine coolant temperature 25°C (77°F))

A/C System

With Service Tool

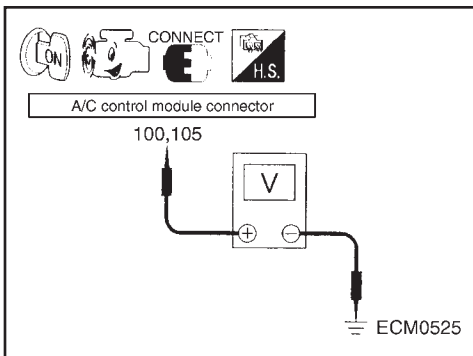
Confirm the service tool monitor.

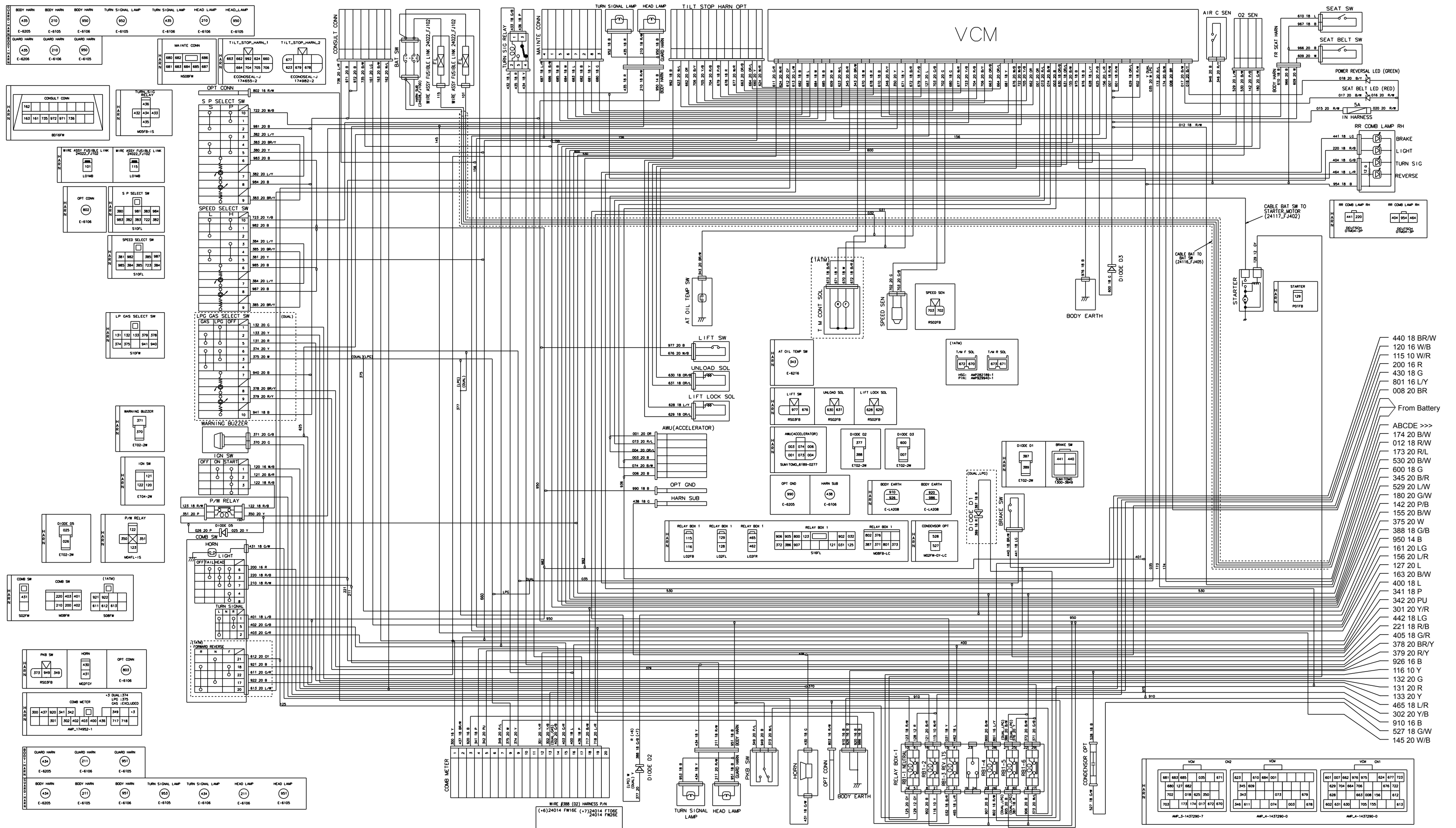
Monitor Item	A/C Switch Off	A/C Switch On
A/C signal	OFF	ON
A/C relay	OFF	ON

With Service Tool

Check voltage between A/C control module terminal 100, 105 and ground.

Terminal	Signal Name	A/C Switch On
100	A/C switch	Approx. 0V
105	A/C relay	Approx. 12V





1F1/1F2 CUSH/PNEU MC 1 ATM EFI SAFETY LP (LPS)
 VCM WIRING SCHEMATIC (24000-FT84A)

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