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Technical Manual

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TEREX | REEDRILL

MK7-2 DRILL JUMBO OPERATOR'S MANUAL

Number:	OM-MK7-S4
Revision:	Original
Revision Date:	03-MAR-2005
By:	DJJ
Topic:	Fire Prevention Safety

FIRE PREVENTION SAFETY

Fires can create severe emergencies where both human life and property may be lost. Even when confined, a fire may cause very expensive damage to your equipment. Fire can strike at any time, not only when the equipment is used, but also when left unattended between work shifts and nobody is around to fight it.

When working in a confined environment, it is impossible to prevent combustive dust from collecting in tight corners of the machine. This dust, in itself, may not cause a fire; however, when mixed with fuel, oil or grease in a hot and confined place, it can become a fire hazard. To reduce the chances of a fire occurring, follow the preventative instructions listed below:

- Inspect the machine daily for potential fire hazards and make any necessary repairs immediately.
- Always ensure that excess grease and oil accumulation, including spillage, are cleaned up immediately.
- Set up, and follow a wash schedule. Use only nonflammable cleaning agents for cleaning the machine or machine components.
- Discard oily rags and other combustible materials in the proper designated location; do not store them on the Drill Jumbo.
- Before performing repair work such as welding, the area surrounding the repair location should be cleaned and a fire extinguisher positioned close by.
- Ensure that you are familiar with the location of the machine's fire suppression system actuators and KNOW HOW TO USE THEM.
- Maintain a charged fire extinguisher on or near the Drill Jumbo at all times and KNOW HOW TO USE IT.

TEREX | REEDRILL

MK7-2 DRILL JUMBO OPERATOR'S MANUAL

Number:	OM-MK7-V1
Revision:	Original

Figure 2 – Carrier Hydraulic Components in Powerframe Assembly Area

Main Hydraulic Pump – the hydraulic pump for the carrier hydraulic system is a variable displacement piston pump with a pressure/flow (load sense) controller. The pump is mounted directly to the upper right pump drive on the transmission. When the Drill Jumbo is in "Drive" mode the pump operates under load sense conditions. When the Drill Jumbo is in "Auxiliary" mode the pump operates under pressure compensated (full pressure) conditions.

Pressure Filter – this component provides downstream filtration directly from the hydraulic pump before the hydraulic fluid reaches any hydraulic valving. There is a visual "pop-out" indicator that signals when the filter needs to be replaced.

Hydraulic Control Manifold – this manifold contains several cartridge valves and provides the ability to switch the hydraulic flow between the "Drive" and "Auxiliary" mode functions. It also controls whether the pump operates under load sense or pressure compensated conditions. For more detailed information on this manifold please refer to maintenance bulletin MB-HYD1394.

AIR SYSTEM

The air system uses components that are located throughout the Drill Jumbo.

The air compressor installation is located in the rear deck assembly and is shown in Figure 11.

Figure 11 – Air Compressor Located in Rear Deck Assembly

Air Intake Filter – this filter removes any contamination entering the compressor.

Air Pressure Filter – this filter removes any contamination leaving the air compressor.

Air Pressure Gauge – this gauge displays the discharge pressure of the compressor.

Air Temperature Gauge/Switch – this combination gauge and switch displays the discharge temperature of the air and shuts down the compressor if the temperature exceeds 115°C. A red alarm indicator in the operator's control console comes on at 100°C to allow the operator time to shut down the compressor prior to an automatic shut down. The temperature must be allowed to cool back down sufficiently before the compressor can be turned back on.

The carrier junction box is located in the powerframe assembly area of the Drill Jumbo and is mounted to the front of the hydraulic tank. This junction box does not contain any switches or controls. Figure 5 shows the location of the carrier junction box.

Figure 5 – Carrier Junction Box Location

INTERLOCKS

The Drill Jumbo has several interlocks. These interlocks are designed to help protect the operator and the equipment.

Automatic Brake Application Interlock – the vehicle's braking system is designed such that the unit's emergency/park brakes will apply in the event of low accumulator pressure, low transmission clutch pressure, if there is a loss of electrical power, or if the cable reel last wind interlock is activated. In the event that the machine is switched from Drive to Auxiliary Mode, the Automatic Brake application system will apply the brakes regardless of the position of the emergency/park brake button.

Cable Reel Last Wind Interlock – this interlock is designed to prevent the Drill Jumbo from driving away from the electrical sub-station any further than what the electrical cable will allow. It warns the operator when the electrical trailing cable is getting close to being completely spooled out and it automatically applies the brakes when the cable is completely spooled out. The interlock will illuminate the amber indicator light located in the driver's instrument panel when three (3) or less spools of trailing cable are left on the cable reel. The interlock will illuminate the red indicator light and will apply the emergency/park brakes when one (1) spool of trailing cable is left on the cable reel. At this point the operator will have to use the cable reel last wind override switch in order to release the brakes and drive towards the cable and reel in the trailing cable. The operator should drive slowly and ensure that the cable is not run over.

Rock Drill Lube Pump Interlock – this interlock is designed to prevent drilling if there is insufficient lubrication that may damage the rock drill. The interlock uses the air pressure switch and oil level sensor to allow the drill impact, feed, and rotation lock functions from operating. If either air pressure or rock drill oil level becomes insufficient the lube pump will stop operating and the drill functions will not operate.

Hydraulic Tank Pressure Interlock – when equipped, this interlock is designed to protect the AC electric powerpacks from starting unless there is sufficient air pressure in the hydraulic tank. The air compressor must be started first and the tank air pressure switch must sense sufficient air pressure before the powerpacks can be started.

Hydraulic Tank Level/Temperature Interlock – this interlock is designed to prevent the operation of the AC electric powerpacks if the level of the hydraulic fluid is too low (leading to possible cavitation of the pumps) or if the temperature is too high (leading to insufficient lubrication of the pumps). There are two (2) amber warning indicators in the operator's control console that will illuminate when these shutdown conditions are being approached.

FEED CONTROLS

The same joystick controls that operate the boom functions can be used to operate the feed functions by changing the control console from Boom mode to Feed mode. Either depressing the green Feed mode switch/indicator or either of the bottom two buttons on the joystick can do this. When the control console is in Feed mode the green indicator light will illuminate.

Feed Dump – this function is proportionally controlled using the Y-axis of the joystick. Moving the joystick forward will cause the feed to dump downward and pulling back will cause the feed to dump upward. The further the joystick is displaced in either direction the faster the function will move.

Feed Swing – this function is proportionally controlled using the X-axis of the joystick. Moving the joystick to the left will cause the feed to swing to the left and moving the joystick to the right will cause the feed to swing to the right. The further the joystick is displaced in either direction the faster the function will move.

Feed Rollover – this function is proportionally controlled using the Z-axis of the joystick. Rotating the joystick to the left will cause the feed to rollover to the left and rotating the joystick to the right will cause the feed to rollover to the right. The further the joystick is displaced in either direction the faster the function will move.

Feed Extend – this function is discretely controlled using the two top buttons on the joystick. Depressing and holding the left button will cause the feed to extend outward. Depressing and holding the right button will cause the feed to extend inward. This function moves at a constant speed.

Feed Extend Lock – this function is discretely controlled using the toggle switch below the drill joystick. Moving this switch up will cause the feed to extend continuously until the switch is moved back down. This feature is typically used during drilling where a constant sting force is required.

Feed Table Dump – this function is discretely controlled using the toggle switch below the joystick. Moving the switch up will cause the feed table to dump upward and moving the switch down will cause the feed table to dump downward. Releasing the switch will allow it to automatically return to the neutral position.

14. AC panel inspection and testing emergency stop switches.

Inspect the AC panel's general condition. All instrument gauges, indicator lights, and switches should be free of damage. The panel should be fastened closed.

Ensure the Drill Jumbo is connected to the mine's power supply. The main disconnect switches for the carrier and AC panel should both be in the "ON" position. Connect AC power to the Drill Jumbo by pressing the main power reset switch.

Start both of the AC electric powerpacks. Test both of the emergency stop buttons (AC panel, operator's control console) to ensure that both shut down the electric powerpacks and they cannot be re-started unless the emergency stop button is pulled out and the main power is reset.

With the AC electric powerpacks off, start the diesel engine. Test both of the emergency stop buttons again to ensure that both shut down the engine and prevent it from being re-started unless the emergency stop button is pulled out.

15. Compressor inspection.

Check the oil level in the compressor using the sight gauge found in the side of the oil compressor unit. There is a maximum and minimum level indicator on the sight gauge.

Start the compressor and confirm that it builds normal pressure (approx 115 psi). There will typically be some foaming of the oil. Also check that the air intake filter indicator is within the acceptable range.

The remote mounted air pressure filter has a small valve in the bottom of the housing to allow any collected moisture to be drained away. Open this valve with the compressor running to purge any water and then close.

16. Test all boom, feed, and drilling functions.

With the AC electric powerpacks, water pump, and air compressor running operate each of the boom, feed and drilling functions to ensure all are working properly. Rock drill lubricator will need to be filled in order for the drill rotation to be operational.

Monitor the operation of the boom and feeds for any signs of excessive play indicating maintenance is required.

Maclean Canada - MAINTENANCE BULLETIN

Description:	**Transmission, 32000 Dana-Spicer Service Manual**
Number:	**MB-TRA1329**
Revision:	Original
Revision Date:	May 8, 2003
By:	IFL
Part Number(s) Affected:	1051660
Machine Model(s) Affected:	All Equipped

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See the following attached document:

SPICER

DANA

SPICER OFF-HIGHWAY COMPONENTS

Service Manual

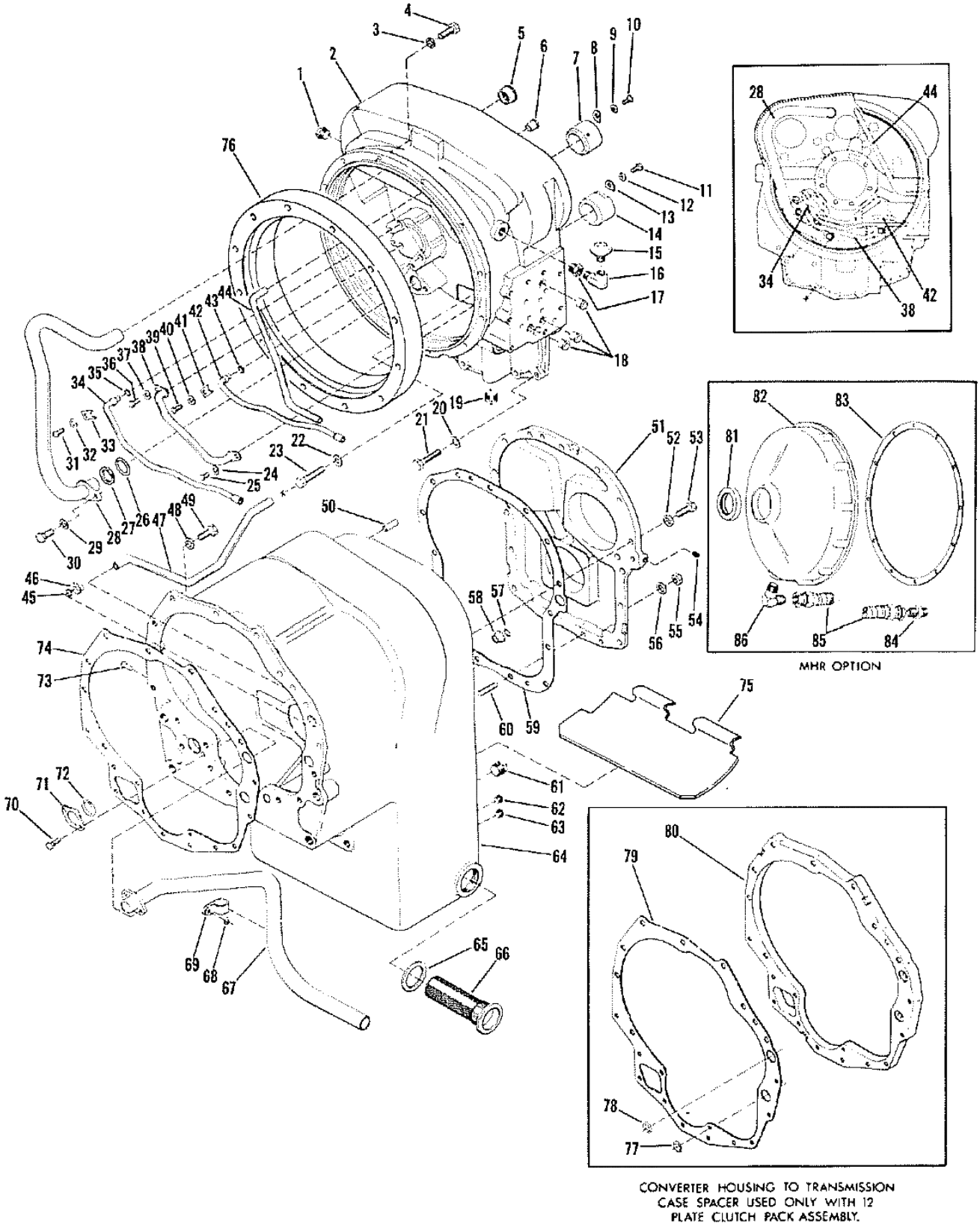

MHR OPTION
CONVERTER HOUSING TO TRANSMISSION CASE SPACER USED ONLY WITH 12 PLATE CLUTCH PACK ASSEMBLY.

Figure C

AXLE DISCONNECT

ITEM	DESCRIPTION	QTY
1	Disconnect Housing Capscrew	4
2	Disconnect Housing Capscrew Lockwasher	4
3	Disconnect Housing	1
4	Disconnect Housing Plug	1
5	Shift Hub	1
6	Shift Fork	1
7	Shift Fork Lockscrew	1
8	Disconnect Shaft	1
9	Detent Ball	1
10	Detent Spring	1
11	Shift Rail	1
12	Shift Rail Oil Seal	1
13	Bearing Retainer Ring	1
14	Bearing	1
15	Bearing Retainer Ring	1

PARKING BRAKE GROUP
10 X 3 BRAKE

ITEM	DESCRIPTION	QTY
1	Lock Nut	1
2	Washer	1
3	Operating Lever	1
4	Backing Plate	1
5	Cam Shaft	1
6	Strut Assembly	1
7	Return Spring	1
8	Brake Shoe, Lining & Rivet	1
9	Brake Flange	1
10	Brake Drum	1
11	Brake Drum Screw Lockwasher	6
12	Brake Drum Screw	6
13	Brake Lining	1
14	Rivet Kit	24
15	Backing Plate Screw	4
16	Backing Plate Screw Lockwasher	4

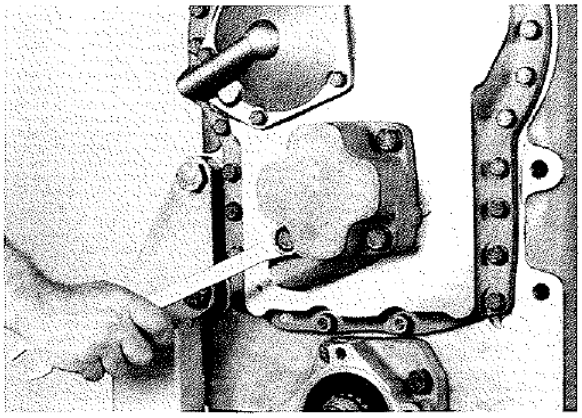


Figure 41
Remove idler shaft rear bearing cap bolts and washers.

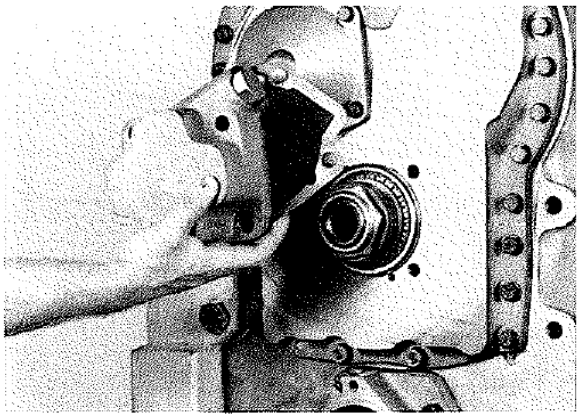


Figure 42
Remove bearing cap and gasket.

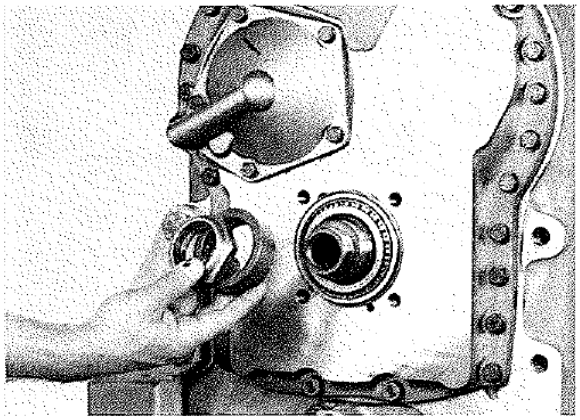


Figure 43
Remove idler shaft rear bearing retainer nut and spacer.

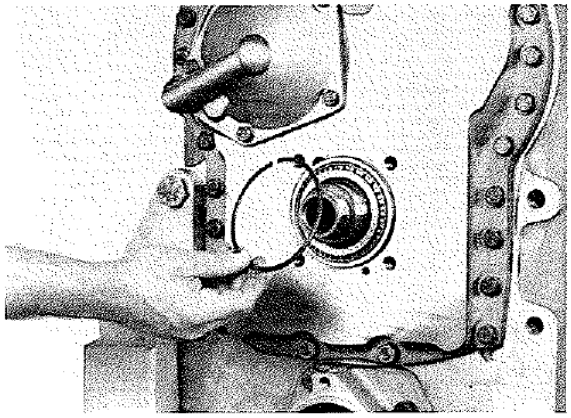


Figure 44
Remove rear bearing locating ring.

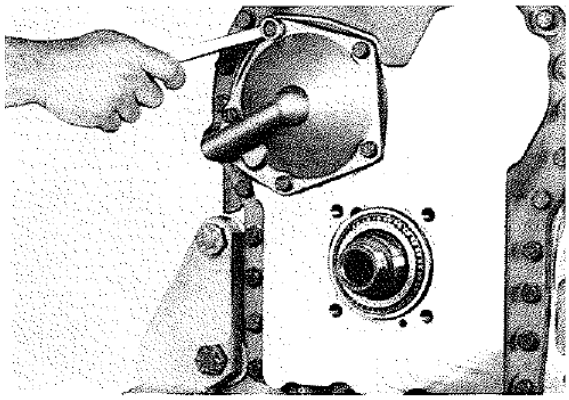


Figure 45
Remove 1st speed clutch (low) rear bearing cap bolts and washers.

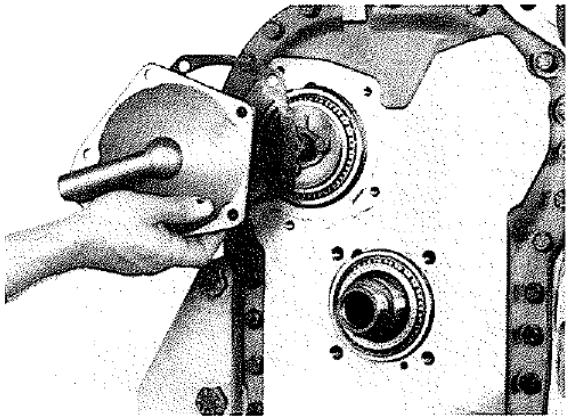


Figure 46
Remove bearing cap and gasket.

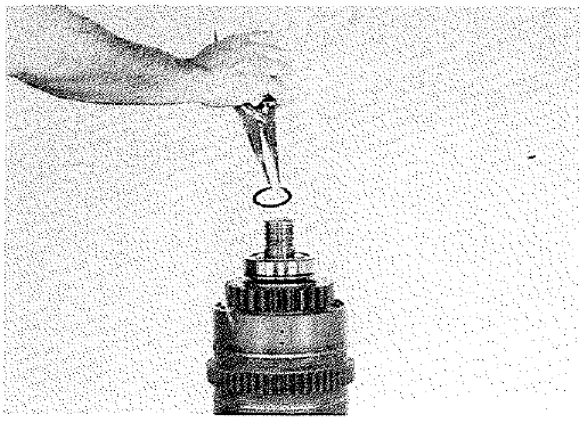


Figure 104
Remove front bearing retainer ring.

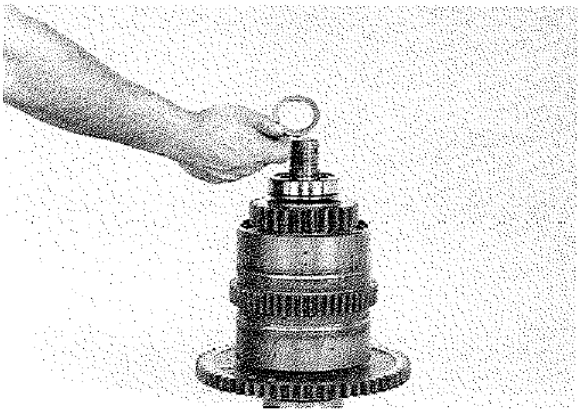


Figure 105
Remove front bearing end plate.

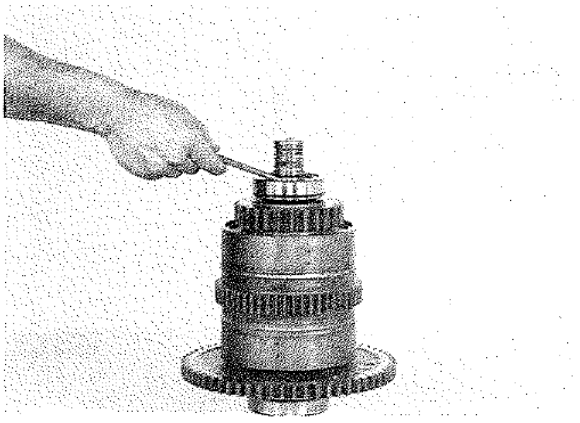


Figure 106
Remove end plate lock ball.

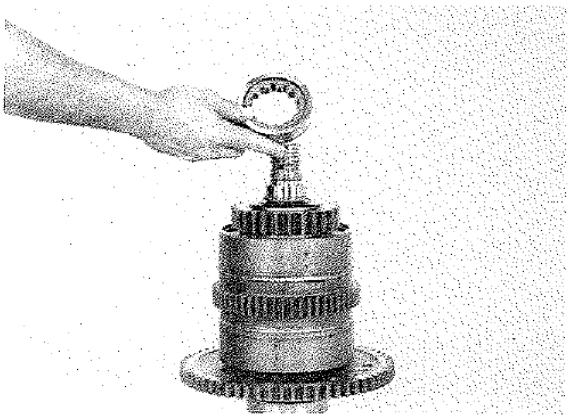


Figure 107
Remove front bearing.

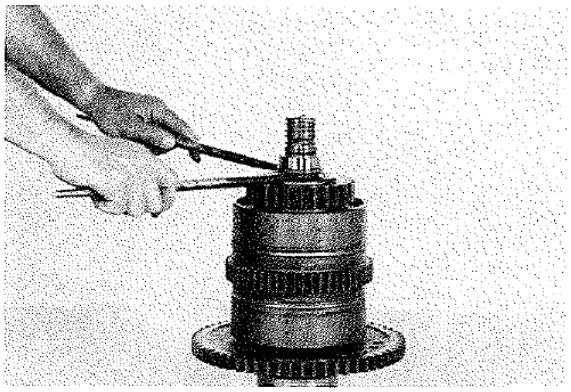


Figure 108
Pry front bearing inner race up far enough to use a bearing puller.

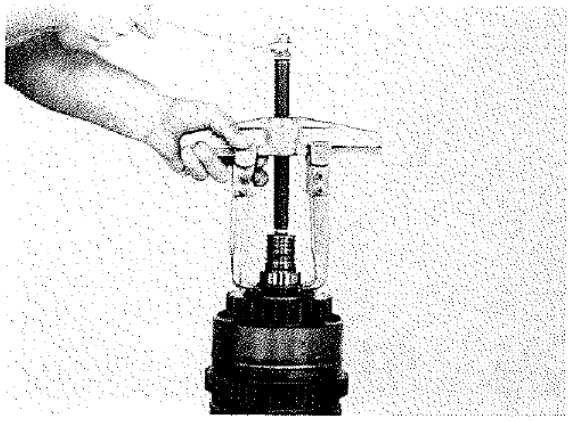


Figure 109
Remove bearing inner race.

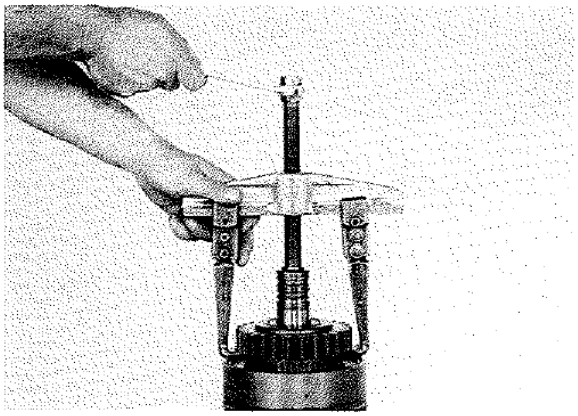


Figure 170
Remove clutch gear and outer bearing.

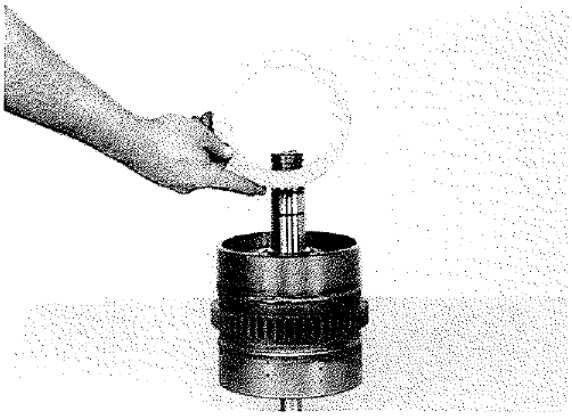


Figure 173
Remove end plate.

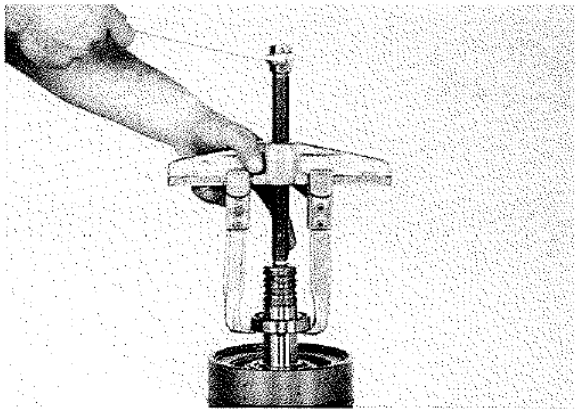


Figure 171
Remove inner bearing.

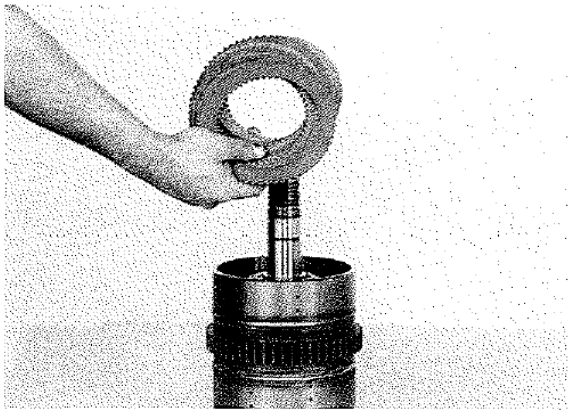


Figure 174
Remove inner and outer clutch discs.

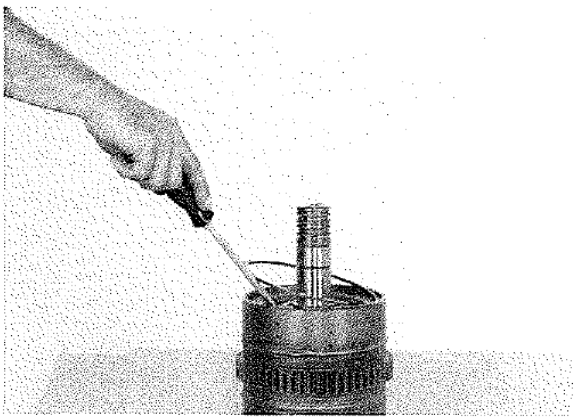


Figure 172
Remove clutch disc end plate retainer ring.

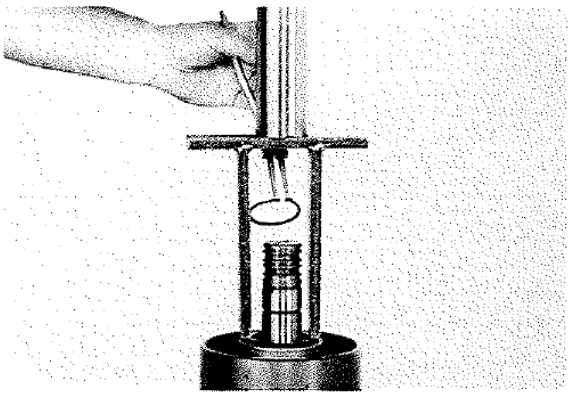


Figure 175
Compress piston return spring. Remove return spring retainer ring.

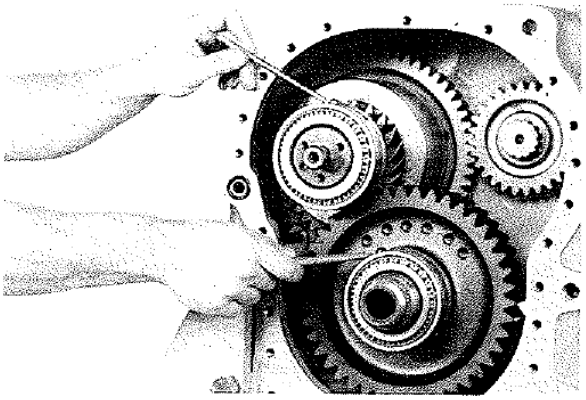


Figure 235
Use caution as not to lose low (1st) and idler bearing lock balls. A light coat of grease will hold lock balls in place.

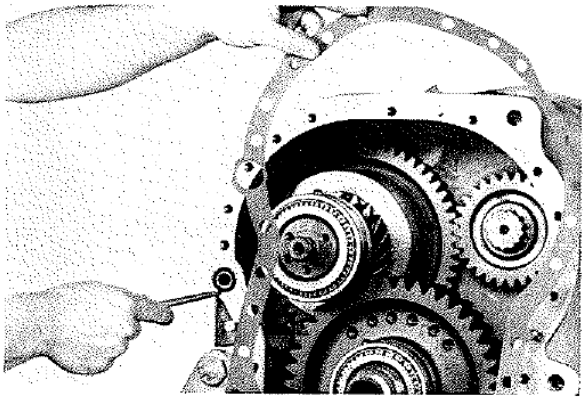


Figure 236
The use of aligning studs will facilitate rear cover installation. Position a new gasket and "O" ring on rear of case. A light coat of grease will hold gasket in place.

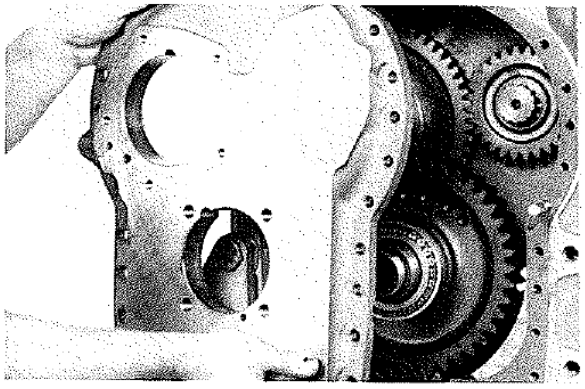


Figure 237
Align lock balls in bearing with notches in rear cover.

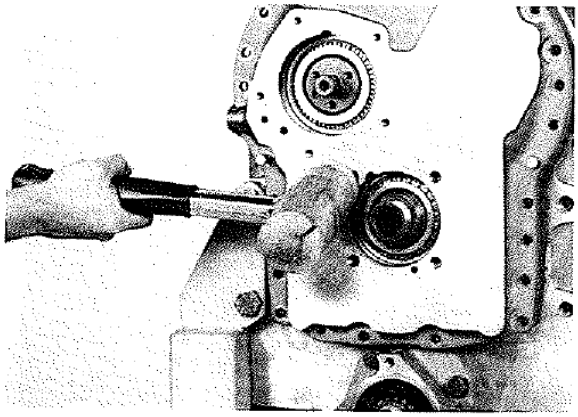


Figure 238
Tap cover in place.

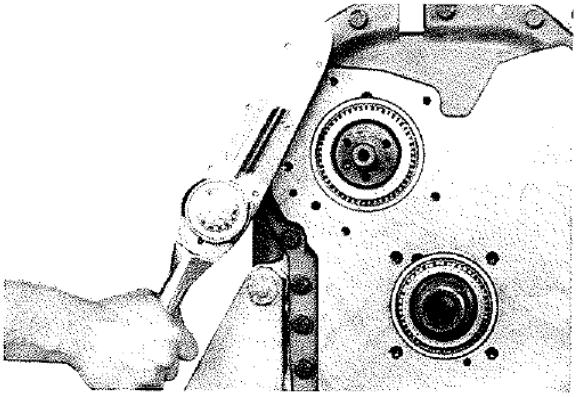


Figure 239
Install rear cover bolts and washers, tighten to specified torque. (See torque chart).

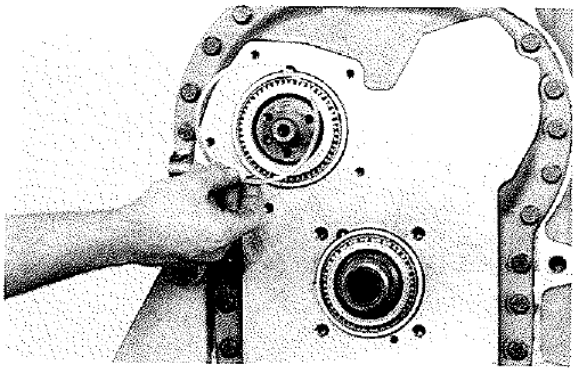


Figure 240
From the front, tap the low (1st) clutch and idler shaft to the rear to expose the rear bearing locating ring groove. Install locating ring.

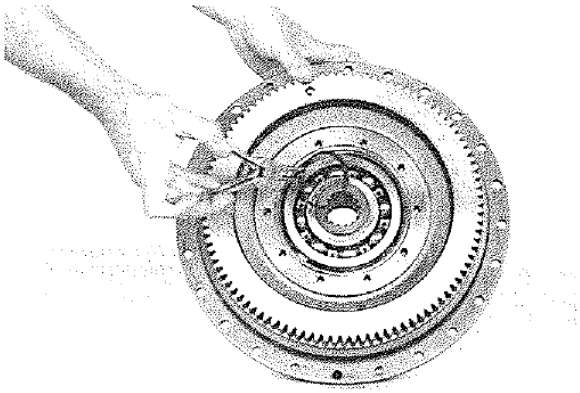


Figure 299
Install turbine hub to impeller cover retainer ring.

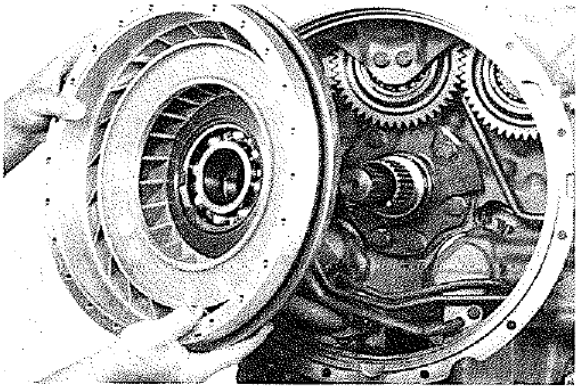


Figure 300
Grease stator support piston ring, oil baffle oil seal and seal ring to facilitate reassembly. Install impeller and oil baffle assembly in converter housing.

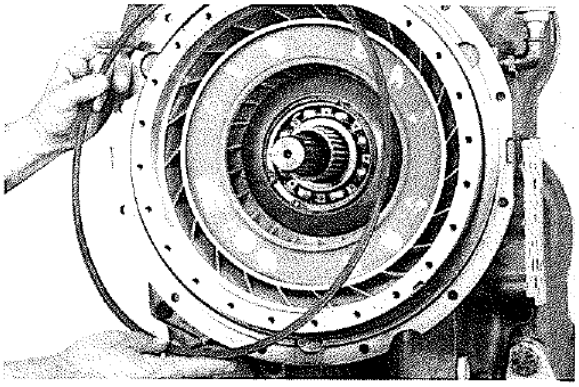


Figure 301
Position oil baffle in housing. Secure with oil baffle retainer ring, being sure ring is in full position in ring groove.

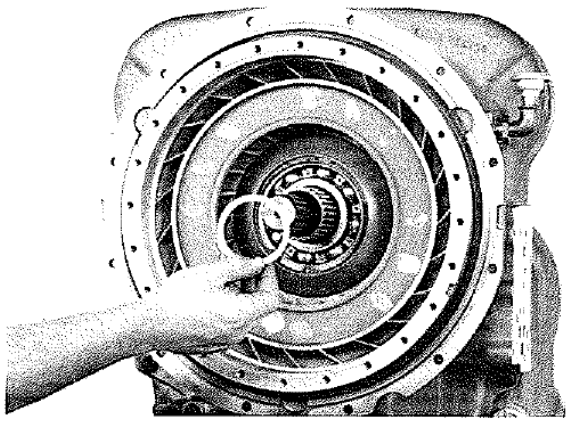


Figure 302
Install reaction member spacer with tang facing out.

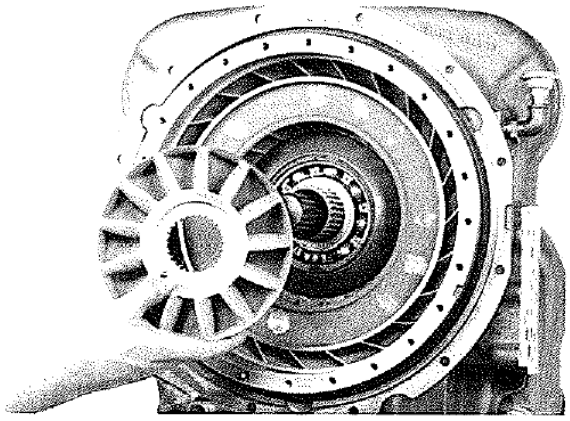


Figure 303
Install reaction member with thick part of blades out.

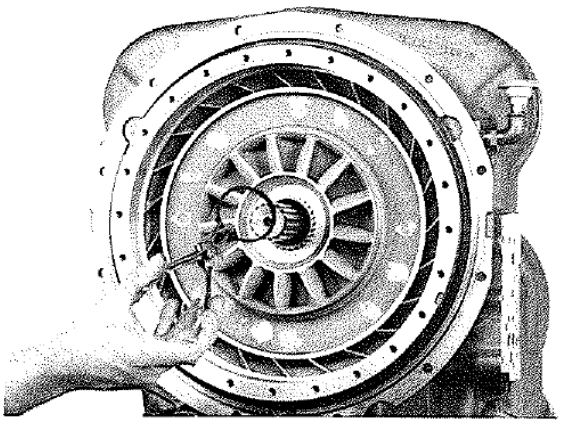
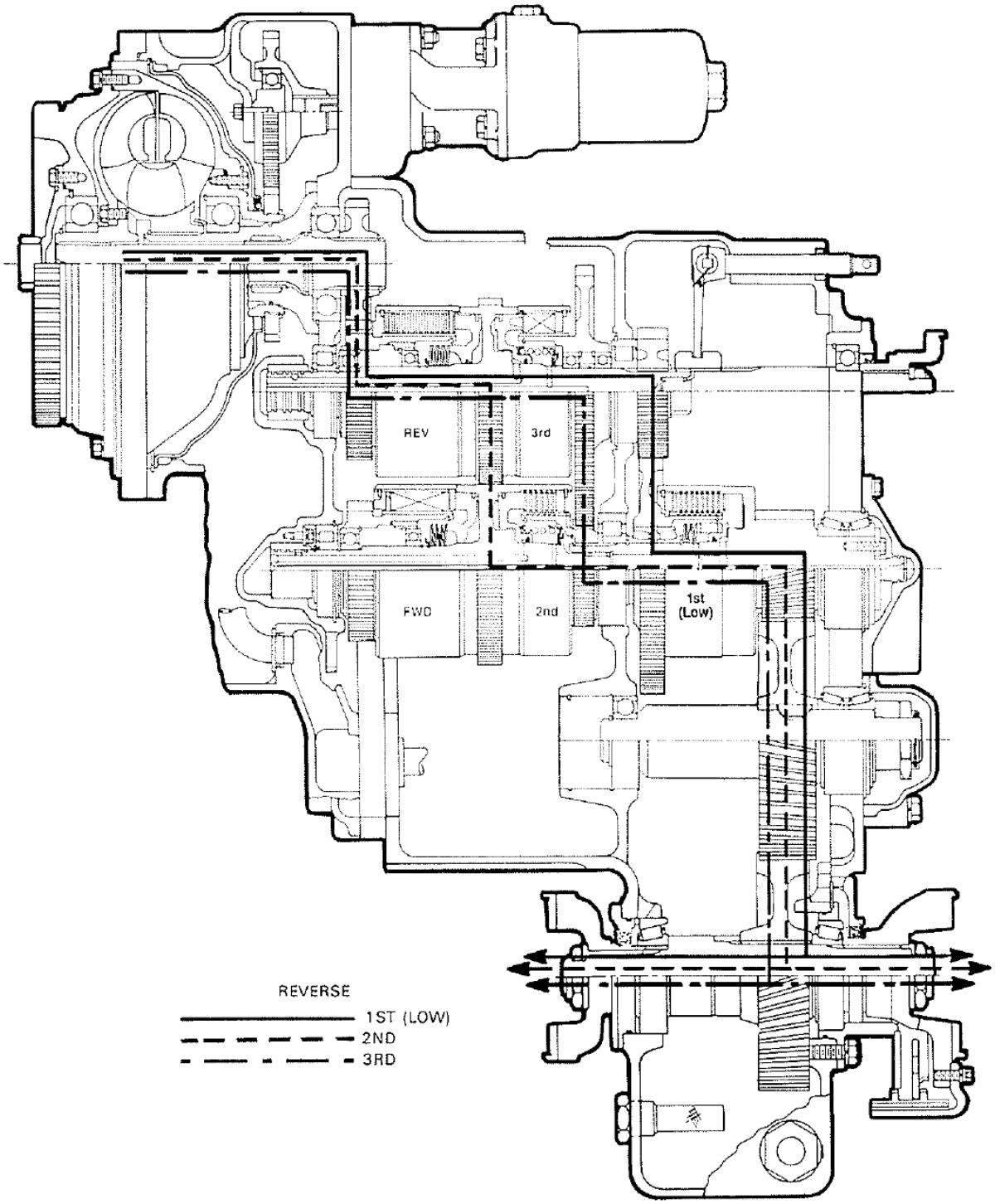
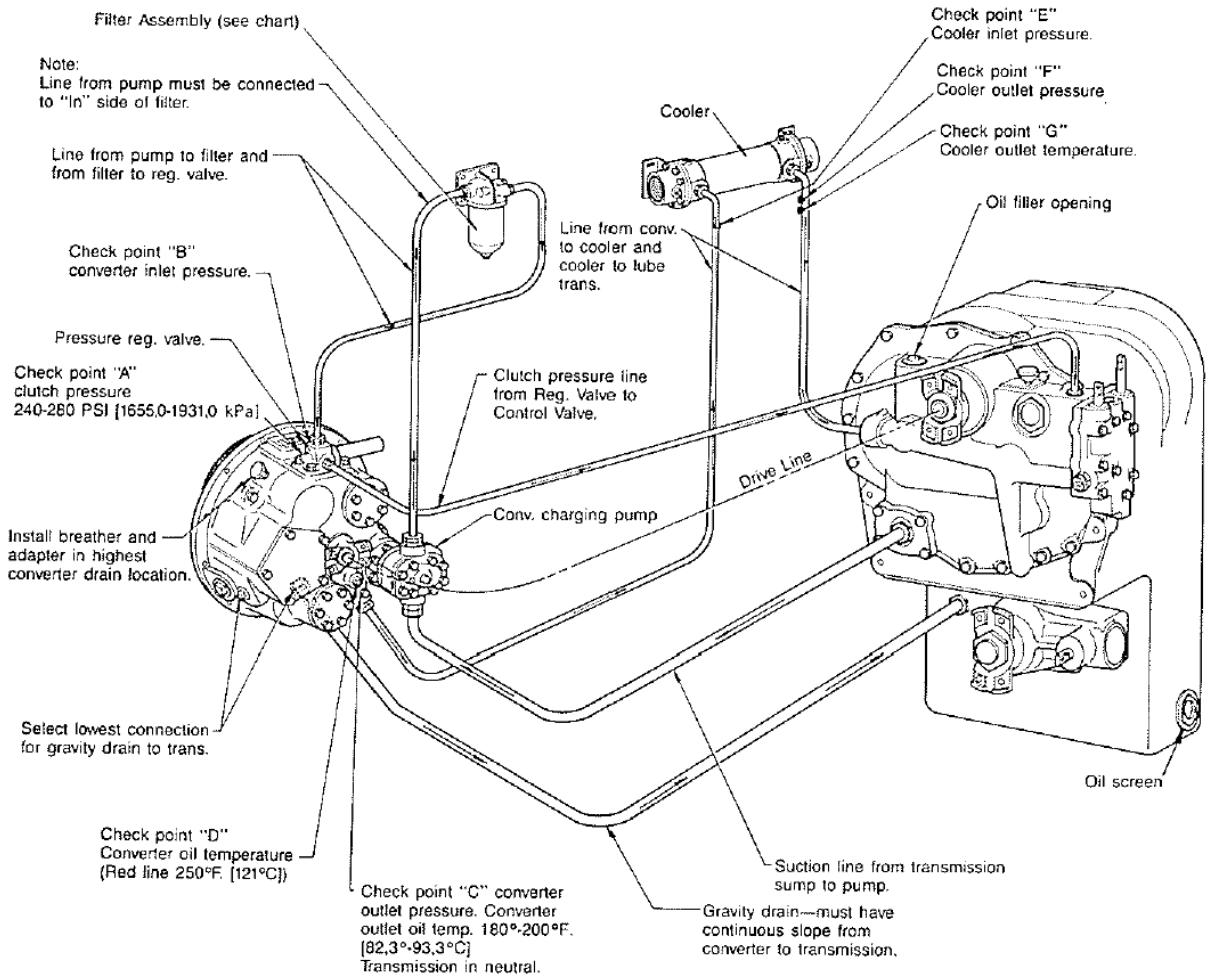


Figure 304
Install reaction member retainer ring.


REV
3rd
FWD
2nd
1st
(Low)
REVERSE
1ST (LOW)
2ND
3RD

R32000 - C270/C320 EXTERNAL PLUMBING DIAGRAM



Metric dimensions shown in brackets [ ].

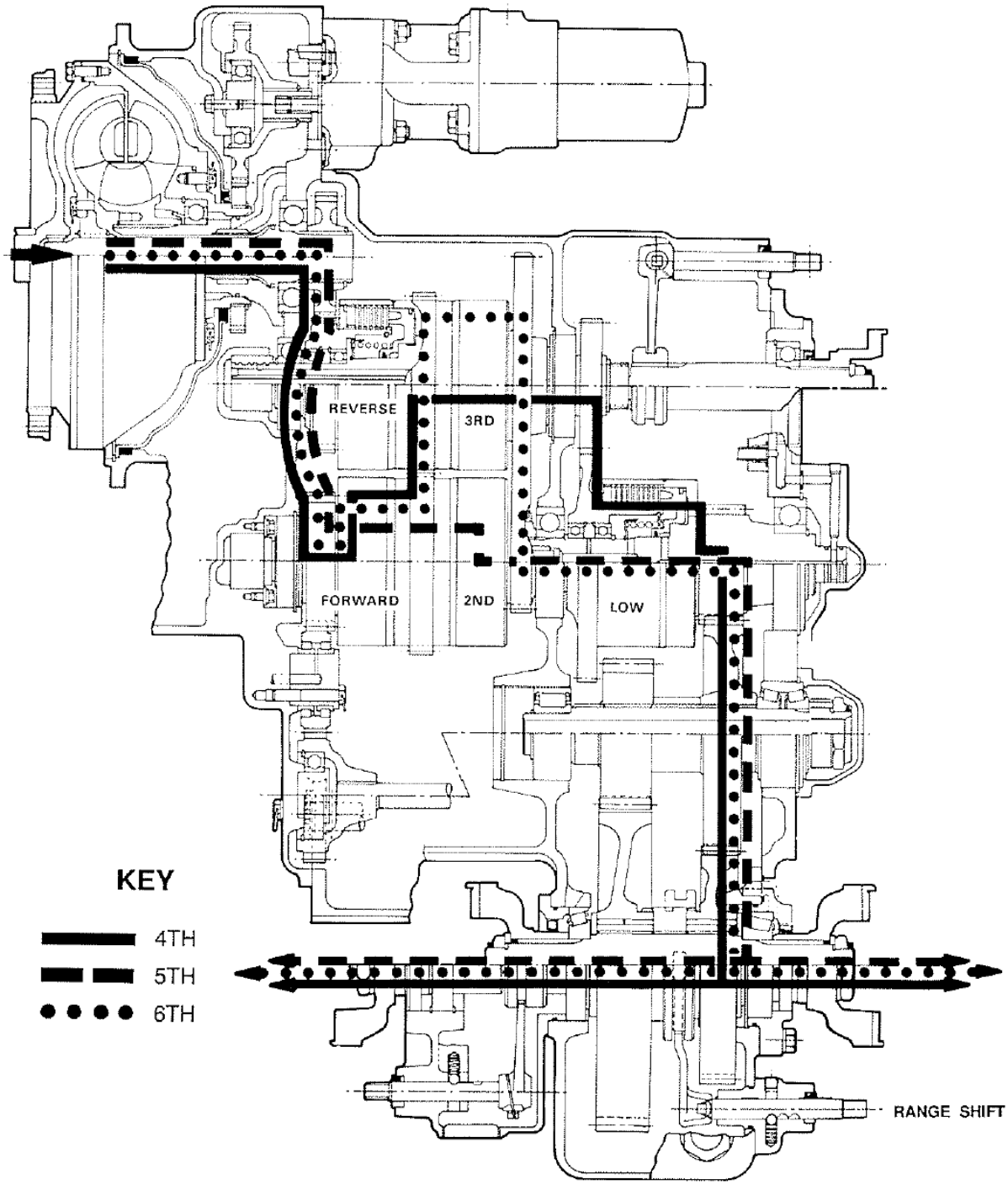
Note: Do not deviate any line size.

FILTER ASSEMBLY CHART

Filter Type	Assembly No.	Cartridge No.	Spin-on Type	
			Assembly No.	Element
A	1533614 Single Can	215502	247055 Single Element	247052
B	234777 Dual Can	215502	246787 Dual Element	243622

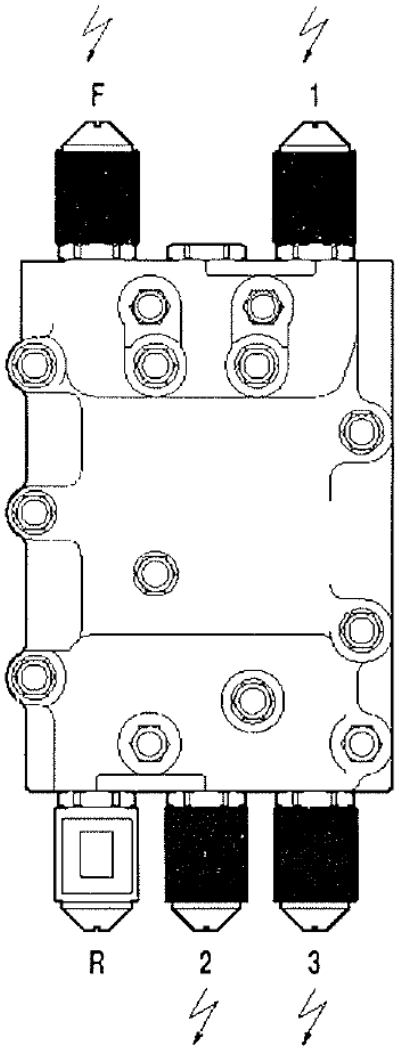
Notes:
Hose line operating requirements.

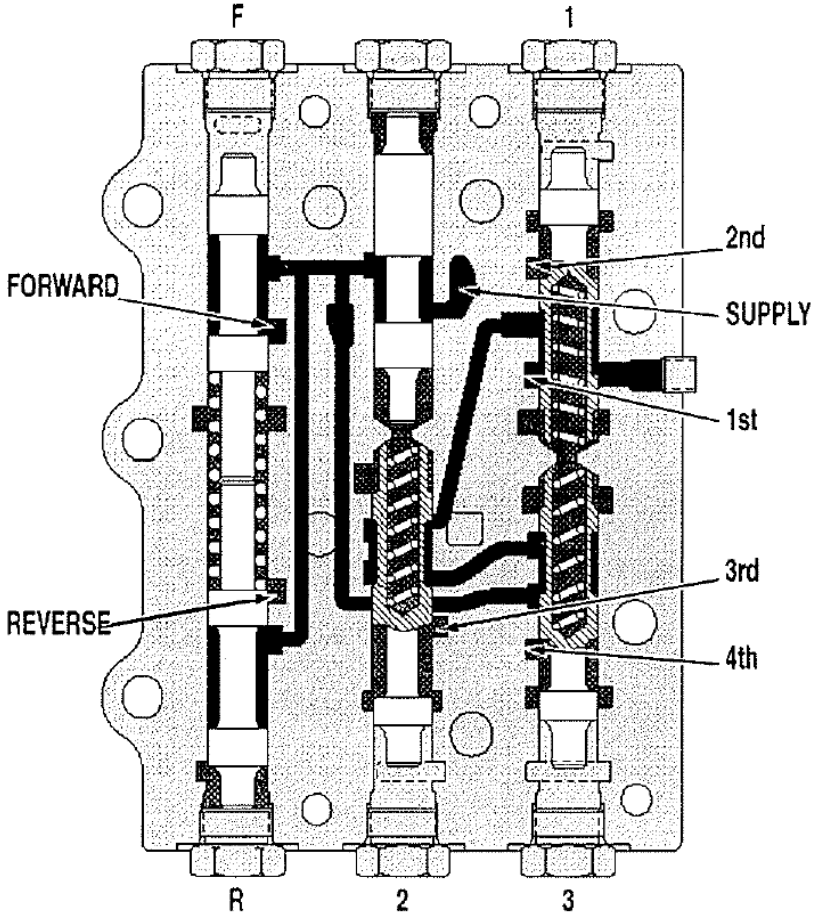
1. **Pressure Lines**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Must withstand 300 PSI [2068 kPa] continuous pressure with 600 PSI [4137 kPa] intermittent surges. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
2. **Suction Line**—To be protected from collapse by interwoven steel wire. Ref. S.A.E. Spec. No. J517,100R4 Hydraulic Hose Specification. Suitable for operation from ambient to 250°F. [121,1°C]. Continuous operating temperature.
3. **Gravity Drain Line**—Suitable for operation from ambient to 250°F. [121,1°C] continuous operating temperature. Ref. S.A.E. Spec. No. J517,100R1 Hydraulic Hose Specification.
4. **All Hose Lines** used must conform to S.A.E. Spec. No. J1019 Test Procedure for High Temp. Transmission Oil Hose.
5. See Lubrication Specifications.

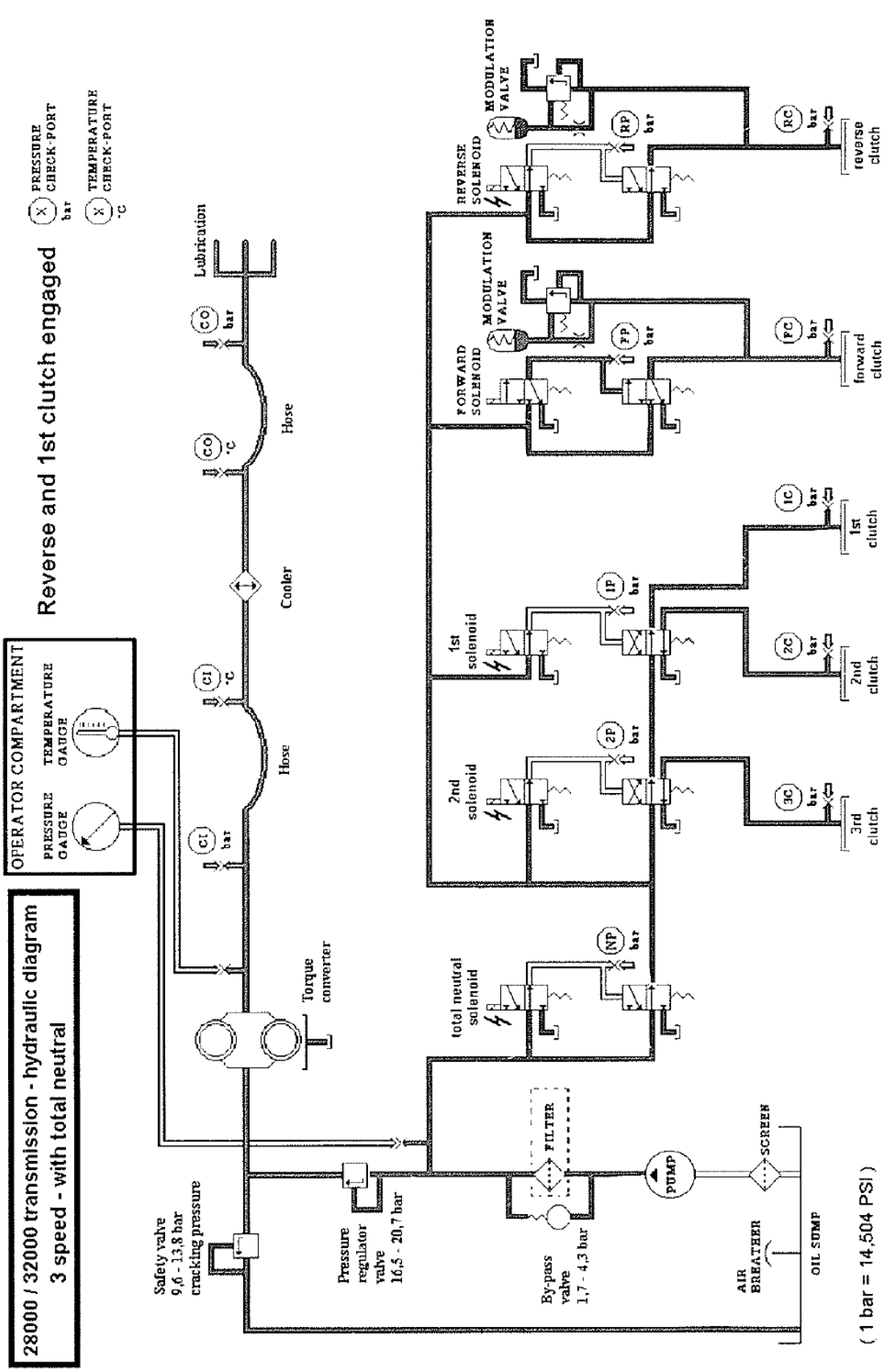


6 SPEED TRANSMISSION HI RANGE

Control valve function of 28000 / 32000 - 4 speed : forward 1st





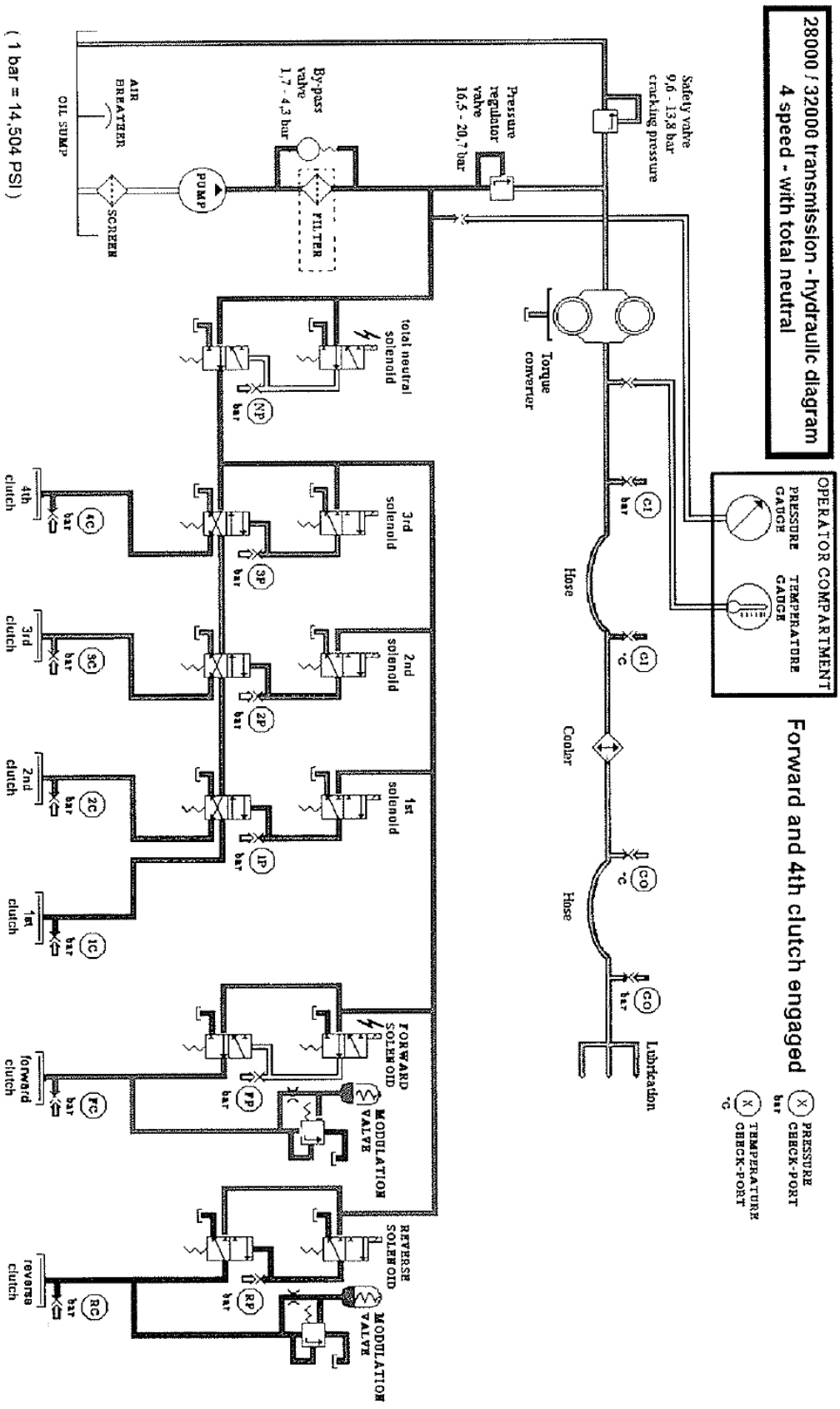


DANA

OFF-HIGHWAY COMPONENTS

DANA

OFF-HIGHWAY COMPONENTS



Maclean Canada - MAINTENANCE BULLETIN

Description:	**Transmission, 32000 Dana-Spicer, Parts Manual**
Number:	**MB-TRA1313**
Revision:	Original
Revision Date:	February 19, 2003
By:	IFL
Part Number(s) Affected:	1051660
Machine Model(s) Affected:	All Equipped

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See the following attached document:

DANA

SPICER OFF-HIGHWAY PRODUCTS DIVISION

Parts Manuals

Form No. GRP-000 (Rev.01/01)

SPICER OFF-HIGHWAY PRODUCTS DIVISION

TRANSMISSION CASE ASSEMBLY

Rev: Feb. 15 2002
July 1, 2001
MODEL: 269744 (GRP

ITEM	QTY	PART NO	%	DESCRIPTION
37	1	76K-216	B	Suction Tube "O"Ring
38	1	249894		Suction Tube Clip Rivet
39 Thru 59				**Not Used On This Model**
60	2	249894		Rivet
61	1	247884		Oil Baffle
62	1	247885		Oil Baffle
63	2	249894		Rivet
64	1	40K4		Plug Case Lock-Up Port **N.I.**
65	2	10F16		Plug- Pipe **N.I.**
66	1	10F16		Plug- Dipstick Hole **N.I.**
67	1	251380		Plug- Range Shift Bore **N.I.**
68	1	16F2		Plug- Pipe **N.I.**
69	1	248166		Bushing-Speed Sensor
70	AR	248167		Washer-Shim **N.I.**
71	1	1KM18		Plug-Speed Sensor Bushing **N.I.**
72	1	76K114	B	"O"Ring -Bushing Plug **N.I.**

%- Part Stock Recommendation

GRP-2 Rev. 3-93

SPICER OFF-HIGHWAY PRODUCTS DIVISION

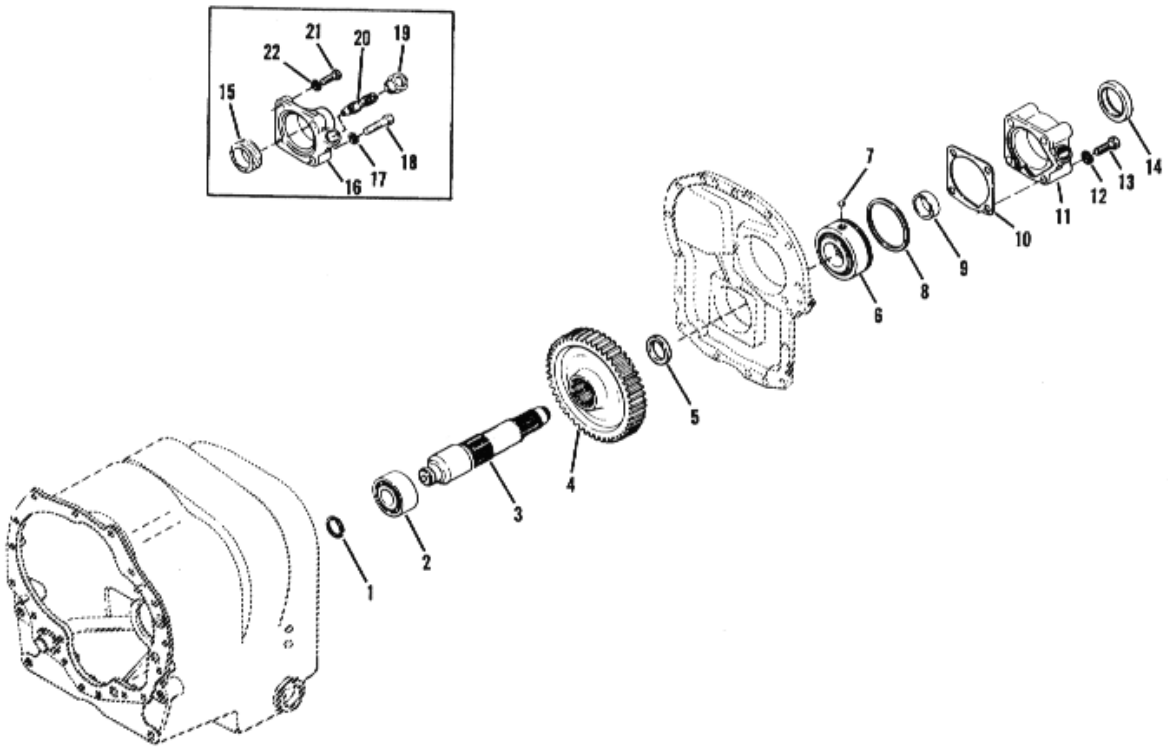
32000
REVERSE & HIGH SHAFT GROUP (SSP)
3 & 4 SPEED W/ 7 INNER & OUTER DISC
3RD CLUTCH, MELDIN PISTON RINGS
W/ PISTON METERING SEAL

Rev: May 24, 2002
July 1, 2001
MODEL: 269729 GRP

ITEM	QTY	PART NO	%	DESCRIPTION
1	3	249779	B	Reverse & 3rd Clutch Shaft Piston Ring
2	1	247949	D	Front Bearing Retainer Ring
3	1	239947		Reverse & 3rd Shaft Front Brg. End Plate
4	1	10 J-4		Reverse & 3rd Shaft Brg. End Plate Ball
5	1	239946	C	Reverse & 3rd Shaft Brg. Front Bearing
6	1	247949		Front Bearing Retainer Ring
7	1	233389	C	Clutch Driven Gear Bearing- **Shield In**
8	1	223877	D	Clutch Driven Gear Bearing Snap Ring
9	1	243997		Clutch Hub Oil Baffle Ring
10	1	215190	E	End Plate Retainer Ring
11	1	245205	D	End Plate- **3rd Clutch**
12	7	224772	C	Clutch Outer Drive- **3rd Clutch**
13	7	236989	C	Clutch Inner Disc- **3rd Clutch**
14	1	251306	D	Clutch Piston Assy- **3rd Clutch**
14A	1	249680	B	Clutch Piston Metering Seal **Not Shown**
15	1	224771	B	Clutch Piston **Outer Seal**
16	1	230857	B	Clutch Piston **Inner Seal**
17	1	251404	E	Reverse & 3rd Clutch Drum & Plug Assy
18	1	230857		Clutch Piston **Inner Seal**
19	1	224771		Clutch Piston **Outer Seal**
20	1	249717		Clutch Piston Assembly- **Reverse Clutch**
20A	1	249680	B	Clutch Piston Metering Seal **Not Shown**
21	6	236989		Clutch Inner Disc- **Reverse Clutch**
22	6	224772		Clutch Outer Disc- **Reverse Clutch**
23	1	224774		End Plate- **Reverse Clutch**
24	1	215190		End Plate Retainer Ring
25	1	232088		Sping Retainer
26	1	230822	D	Piston Return Spring
27	1	232089		Spring Retainer

SPICER OFF-HIGHWAY PRODUCTS DIVISION

32000 OUTPUT SHAFT GROUP SHORT DROP



GRP-32-81 4-85

SPICER OFF-HIGHWAY PRODUCTS, DANA CORPORATION
1293 GLENWAY DRIVE STATESVILLE, NC 28625 TEL: (704) 878-5608

WWW.DANA.COM

2.8 Using a shop press, remove the bearing cones from shaft, as shown in Figure 7.

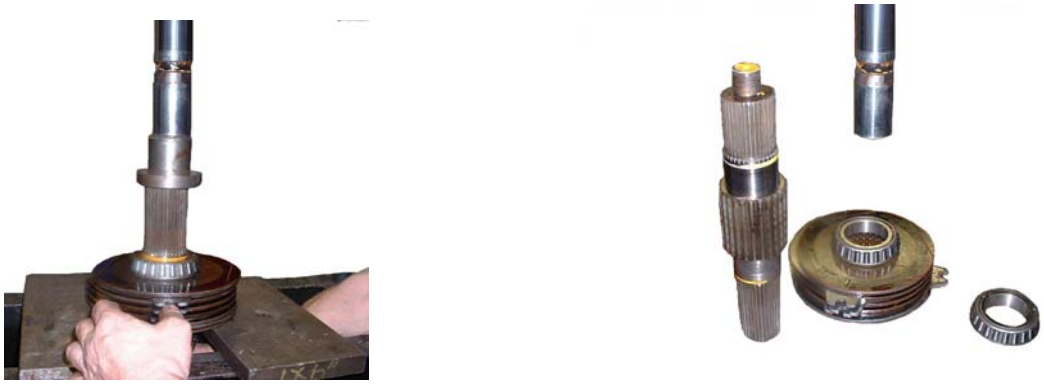


Figure 7 - Removal of Bearings With Press

WARNING!
Use caution when using compressed air to remove piston. Before removing piston from power plate take preventive measures to ensure that piston is being removed safely.

NOTE **ALL INTERNAL PARTS (I.E. SPRINGS & PLATES) SHOULD ALREADY BE REMOVED FROM BRAKE BODY.**

2.9 To remove piston follow these steps:

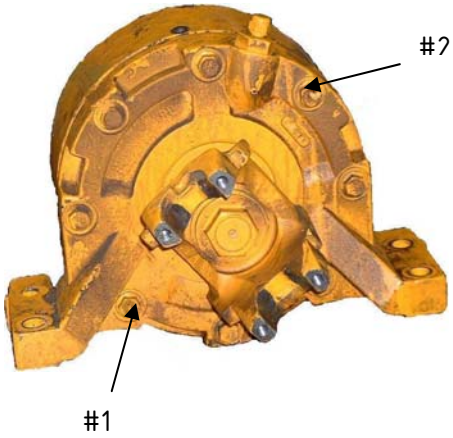


Figure 8 - Bolt Locations

1. Replace Stationary plate, and bolts in positions #1 and #2 with M12x1.75x70 bolts, as shown in Figure 8.
2. Add air pressure regulator to hydraulic inlet, and slowly introduce 15 psi of compressed air. Allow the piston to separate from the power plate.
3. First the compressed air must be turned off, and then remove the air pressure regulator from the hydraulic inlet.
4. Remove the bolts, and the stationary plate. The piston should be loose from the power plate, and can be removed.
5. Remove the o-ring from O.D. and I.D. of the piston groove, as shown in Figure 9.

Maclean Canada - MAINTENANCE BULLETIN

Description:	**Inspection and Lubrication, Universal Joints and Driveshafts**
Number:	**MB-MEC1256**
Revision:	Level A
Revision Date:	May 9, 2003
By:	IFL
Part Number(s) Affected:	Numerous
Machine Model(s) Affected:	All Driveline Assemblies equipped with Spicer

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See the following attached document:

SPICER®

DANA

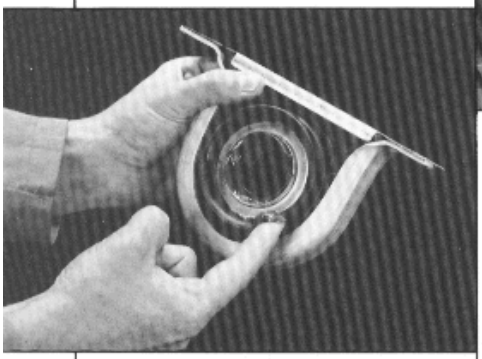
Service Manual – Spicer® Universal Joints and Driveshafts

Form No. #3264-1 3/90

SERVICING THE DRIVESHAFT

SHAFT SUPPORT BEARING ASSEMBLIES

Bearing manufacturers do the initial lubrication and all Spicer shaft support (center) bearings are lubed for life. When replacing a shaft support bearing assembly, be sure to fill the entire cavity around the bearing with waterproof grease to shield the bearing from water and contaminants. Enough grease must be put in to fill the cavity to the extreme edge of the slinger surrounding the bearing. Lubricants must be waterproof. Consult your grease supplier for recommendations.



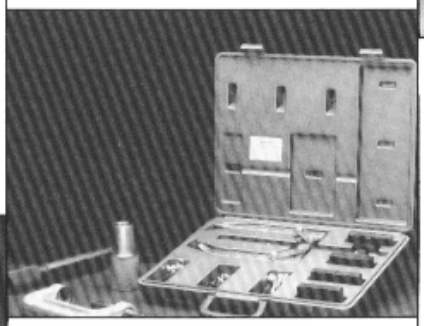
NOTE: There are numerous instances where special lubrication is required by vehicle specification or customer request. The lubrication recommendations listed in this manual are what Spicer U-Joint engineers suggest. Any alternate lubricants, or lubrication procedures, are the responsibility of the user.

SERVICING THE DRIVESHAFT

HEAVY DUTY APPLICATION

Cross and Bearing Kit Replacement Bearing Plate Design

Full Round and Quick Disconnect End Yoke Designs



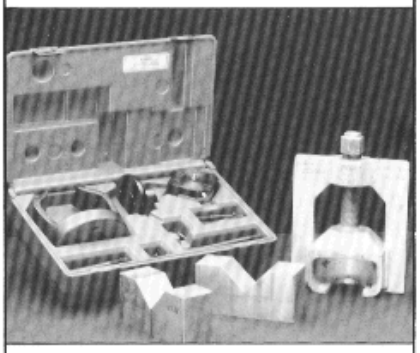
SPECIAL TOOLS:

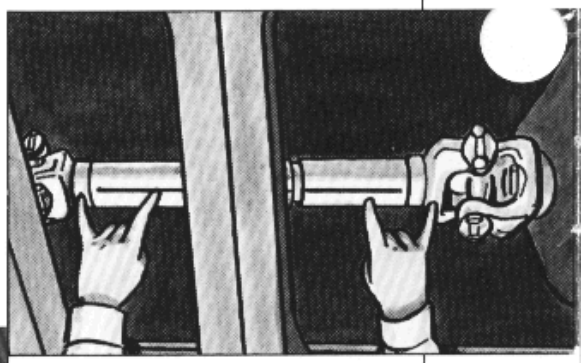
Torque wrench (125 lb./ft.)
Journal locator
U-joint press
V-block
*Alignment bar/no go wear gauge
Common hand tools

One of the following is recommended:

Owatonna tool kit (#7057)
(Two-jaw puller)
Tiger tool kit
JJAG tool kit
J & J tool kit

*Available only from Dana Corporation Spicer Service Representatives.





NOTE: Before removal of the driveshaft set the brakes, block the wheels, mark the slip yoke assembly and tube shaft with a marking stick or paint to assure proper alignment when reassembled. This is known as keeping the driveshaft yoke "In Phase."

CAUTION: Never heat components or use sledge hammers and floor jacks to disassemble driveshafts. This can result in damaged, weakened or bent components.

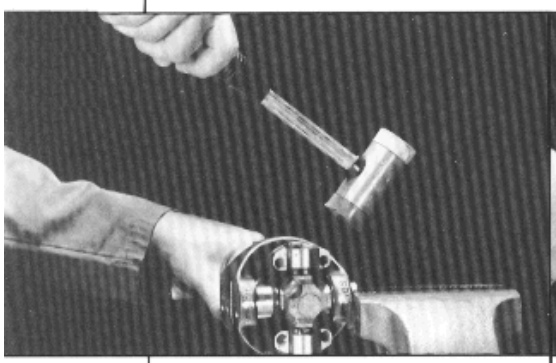
WARNING: Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Do not work on a shaft (with or without a guard) when the engine is running.

REMOVAL (Full Round End Yoke Style)

1. The method of driveshaft removal should be one that assures safety and ease of removal to the mechanic without damage to the driveshaft, transmission or axle components. Suggested method is use of a u-joint puller: Owatonna tool kit #7057, Tiger tool kit, or JJAG tool kit.

SERVICING THE DRIVESHAFT

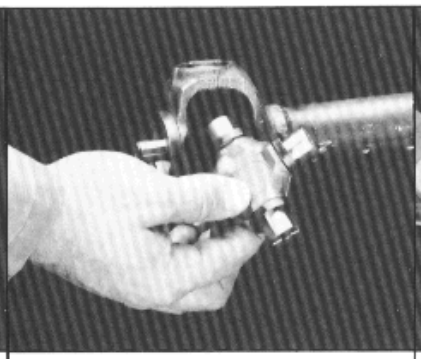


4. Grasp the protruding bearing assembly by vise jaws. Tap the tube yoke with a mallet and drift to dislodge the bearing assembly from the yoke hole.

5. Flip the assembly and repeat steps 3 and 4 for removing the opposite side bearing assembly. This will then allow removal of the cross centering kit assembly and spring.

6. Press the remaining bearing assemblies out on the other cross as described above to complete disassembly.

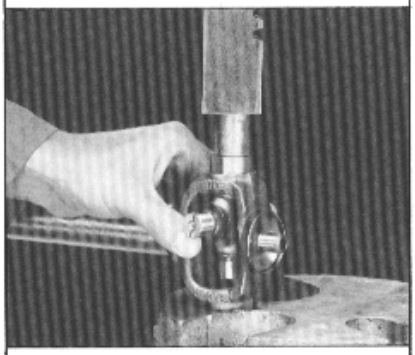
CAUTION: Tap in the center of the "H" yoke. Never strike the yokes at the bearing assembly holes because the snap ring grooves may collapse and make reassembly impossible.



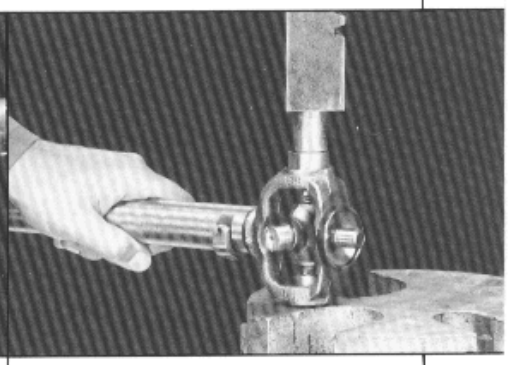
REASSEMBLY

1. Fit a cross into the tube yoke.
2. Place a bearing assembly in a tube yoke hole and over a trunnion. Keep the needle rollers upright in the bearing assembly. A needle roller lying at the bottom of the bearing assembly will prevent proper assembly.

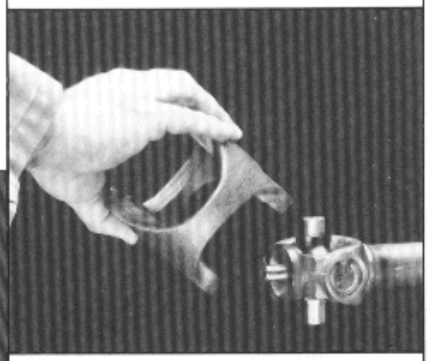
NOTE: Be sure to remove the lube fitting if it interferes with bearing assembly press-up.



3. Press the bearing assembly in place and install a snap ring.



4. Flip the tube yoke and repeat bearing assembly installation on the opposite trunnion. Install a snap ring.



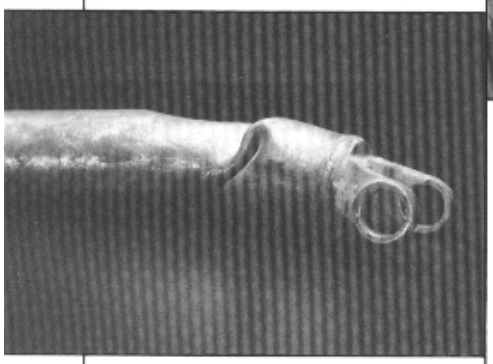
5. Fit the center yoke on the remaining two trunnions and press bearing assemblies in place, both sides. Install snap rings.

TROUBLESHOOTING / GLOSSARY

Complaints

SHAFT AND/OR TUBE

Shaft support bearing wear or fracture
Shaft support rubber insulator wear or fracture
Tube circle weld fracture

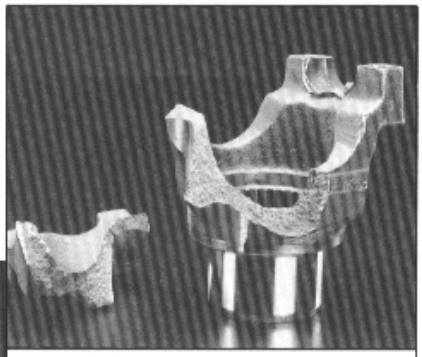


Causes

Balance weight located in apex of weld yoke lug area
Balance weight too close to circle weld
Improper circle weld
Bending fatigue due to secondary couple loads
Driveshaft too long for operating speeds
Worn or damaged parts
Excessive torque load (shock loading) for u-joint and driveshaft size
Improper lubrication of bearings
Shaft support bearing misaligned —interferes with slinger

Corrections

Reduce u-joint continuous running angle
Replace with higher capacity u-joint and driveshaft
Install two piece driveshaft with shaft support bearing
Use larger diameter tube
Normal bearing wear—replace
Realign mounting bracket to frame cross member to eliminate interference with slinger



Complaints

YOKE FRACTURE

Yoke broken in hub
Yoke broken at ear tip

Causes

Mating yoke lug interference at full jounce and rebound
Excessive torque load for u-joint and driveshaft size
Improper shaft length and slip
Bending fatigue due to secondary couple loads

Corrections

Reduce u-joint continuous running angles
Replace with higher capacity u-joint and driveshaft
Replace yoke—check design for application
Use wide angle yokes
Check installed lengths and adjust driveshaft length to provide proper slip conditions

WARNING: Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Refer to safety precaution section on inside front cover.

GLOSSARY

ALIGNMENT BAR—a device (gauge) used to check yoke cross hole alignment.

BEARING ASSEMBLY—a hollow cup containing the needle roller bearings that ride on the cross trunnion.

BRINELLING—grooves from needle rollers marking and burning into trunnion. Usually caused by improper angles, lack of lubrication or too much load.

CARDAN-TYPE U-JOINT—a non-constant velocity u-joint which consists of two yokes connected by a cross through four bearings.

COMPOUND ANGLE—a driveline angle that is offset both vertically and horizontally.

CONSTANT VELOCITY (CV) U-JOINT—a u-joint which uniformly transmits motion at an angle without speed changes in the driven shaft.

CONTINUOUS OPERATING TORQUE—represents the constant torque load that a respective driveshaft or joint series will transmit over long periods of time, such as a direct drive installation.

COUPLING SHAFTS—are essentially extension members to the total drivetrain. In automotive applications these units are inserted ahead of the two joint assemblies and lead out of the power source, usually supported by a shaft support bearing. Used where one piece shafts would be too long.

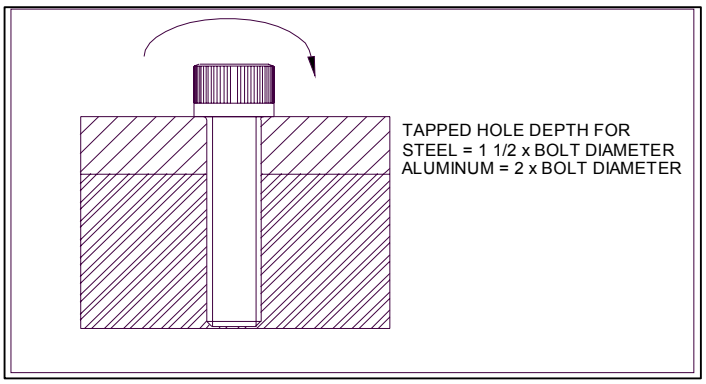


Chart #4: Grade 12.9 Metric SHCS Torquing the Head

	Fastener Torque (Ft-lbs)		
Bolt Diameter	**Antiseize**	**Red Loctite or Dry**	**Blue Loctite**
Millimeter			
M10	60	75	70
M12	100	130	125
M14	165	205	195
M16	255	320	305
M18	370	460	435
M20	500	625 (155)	595
M22	680 (170)	850 (210)	810 (200)
M24	865 (215)	1080 (270)	1025 (255)
M27	1265 (315)	1585 (395)	1505 (375)
M30	1720 (430)	2150 (535)	2045 (510)

Values in () represent input torque to a 4:1 torque multiplier

Maclean Canada - MAINTENANCE BULLETIN

Title: Hose List, MK7-2-004
Number: **MB-HYD1596**
Revision: Original

Hose No.	Size	Length	Fitting	Fitting	Circuit	Description
DF03L	8C	150	1	1	BOOM	FROM LH BULKHEAD TO LH JOINER
DF03R	8C	150	1	1	BOOM	FROM RH BULKHEAD TO RH JOINER
DF04L	8C	132	1	1	BOOM FRAME	FROM LH JOINER TO LH DRILL BULKHEAD
DF04L	8C	132	1	1	BOOM	FROM LH JOINER TO LH DRILL BULKHEAD
DF04R	8C	132	1	1	BOOM	FROM RH JOINER TO RH DRILL BULKHEAD
DF11L	8C	85	1	1	BOOM FRAME	FROM LH DRILL VALVE TO LH ANTI-JAM
DF11R	8C	58	1	1	BOOM FRAME	FROM RH DRILL VALVE TO RH ANTI-JAM
DF12L	8C	109	1	L	BOOM FRAME	FROM LH ANTI-JAM TO LH BULKHEAD
DF12R	8C	109	1	L	BOOM FRAME	FROM RH ANTI-JAM TO RH BULKHEAD
DF13L	8C	150	1	1	BOOM FRAME	FROM LH BULKHEAD TO LH JOINER
DF13L	8C	150	1	1	BOOM	FROM LH BULKHEAD TO LH JOINER
DF13R	8C	150	1	1	BOOM	FROM RH BULKHEAD TO RH JOINER
DF14L	8C	132	1	1	BOOM FRAME	FROM RH JOINER TO RH DRILL BULKHEAD
DF14L	8C	132	1	1	BOOM	FROM LH JOINER TO LH DRILL BULKHEAD
DF14R	8C	132	1	1	BOOM	FROM RH JOINER TO RH DRILL BULKHEAD
DLB01	6B	36	1	1	STEER/BRAKE	FROM BRAKE MANIFOLD TO DRIVE LINE BRAKE
DR01L	8C	163	1	1	BOOM FRAME	FROM LH DRILL VALVE TO LH BULKHEAD
DR01R	8C	163	1	1	BOOM FRAME	FROM RH DRILL VALVE TO RH BULKHEAD
DR02L	8C	150	1	1	BOOM FRAME	FROM LH BULKHEAD TO LH JOINER
DR02L	8C	150	1	1	BOOM	FROM LH BULKHEAD TO LH JOINER
DR02R	8C	150	1	1	BOOM	FROM RH BULKHEAD TO RH JOINER
DR03L	8C	132	1	1	BOOM FRAME	FROM LH JOINER TO LH DRILL BULKHEAD
DR03L	8C	132	1	1	BOOM	FROM LH JOINER TO LH DRILL BULKHEAD
DR03R	8C	132	1	1	BOOM	FROM RH JOINER TO RH DRILL BULKHEAD
DR11L	8C	163	1	1	BOOM FRAME	FROM LH DRILL VALVE TO LH BULKHEAD
DR11R	8C	163	1	1	BOOM FRAME	FROM RH DRILL VALVE TO RH BULKHEAD
DR12L	8C	150	1	1	BOOM FRAME	FROM LH BULKHEAD TO LH JOINER
DR12L	8C	150	1	1	BOOM	FROM LH BULKHEAD TO LH JOINER
DR12R	8C	150	1	1	BOOM	FROM RH BULKHEAD TO RH JOINER
DR13L	8C	132	1	1	BOOM FRAME	FROM LH JOINER TO LH DRILL BULKHEAD
DR13L	8C	132	1	1	BOOM	FROM LH JOINER TO LH DRILL BULKHEAD
DR13R	8C	132	1	1	BOOM	FROM RH JOINER TO RH DRILL BULKHEAD
EB02	6B	80	1	L	STEER/BRAKE	
EB04	6B	23	1	L	STEER/BRAKE	
EB06	6B	23	1	L	STEER/BRAKE	
EB14	6B	56	1	L	STEER/BRAKE	

3. Making Adjustments

Oil level Switch adjustment: The oil level switch is a factory set reed style switch that includes predetermined heights. If the rock drill lube level drops below the lower predetermined height the switch will close the contacts between 1 and 2 and the machine specific drill interlocks will be activated which will prevent the operator from drilling and the drill lubrication pump will be de-energized. See Figure B that has the level switch shown in the low level condition.

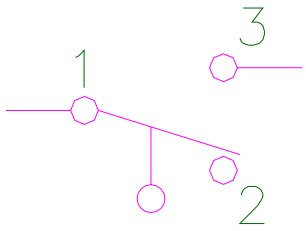


Figure B – Drill Lube Pump Level Switch Schematic

Air Pressure Regulator: In general, the maximum pressure recommended for the lube air to the fronthead of a rock drill is 35 to 40 PSI. Turning the knob on the pressure regulator adjusts the air pressure for the lube system. If the pressure is ever adjusted below 25 PSI, there will not be enough pressure to satisfy the pressure switch, the pump will not rotate and the machine specific drill interlocks will be activated which will prevent the operator from drilling.

The air pressure switch is a factory-preset style of switch that cannot be adjusted.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Pump, Grundfos Installation & Operations
Number:	**MB-HYD1563**
Revision:	Original

GRUNDFOS **INSTRUCTIONS**
Installation and Operation

CR, CRI, CRX, CRN, CRT

Vertical Multistage Centrifugal Pumps

Please leave these instructions with the pump for future reference

BE›THINK›INNOVATE›

GRUNDFOS

Maclean Canada - MAINTENANCE BULLETIN

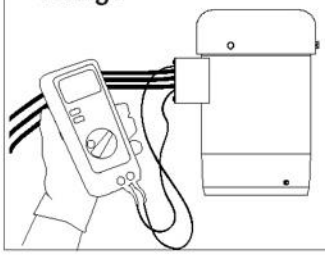
Title:	Pump, Grundfos Installation & Operations
Number:	**MB-HYD1563**
Revision:	Original

WARNING:

WHEN WORKING WITH ELECTRICAL CIRCUITS, USE CAUTION TO AVOID ELECTRICAL SHOCK. IT IS RECOMMENDED THAT RUBBER GLOVES AND BOOTS BE WORN, AND METAL TERMINAL BOXES AND MOTORS ARE GROUNDED BEFORE ANY WORK IS DONE. FOR YOUR PROTECTION, ALWAYS DISCONNECT THE PUMP FROM ITS POWER BEFORE HANDLING.

Preliminary tests

Supply voltage



How to measure

Use a voltmeter, (set to the proper scale) measure the voltage at the pump terminal box or starter.

On single-phase units, measure between power leads L1 and L2 (or L1 and N for 115 volt units). On three-phase units, measure between:

- Power leads L1 and L2
- Power leads L2 and L3
- Power leads L3 and L1

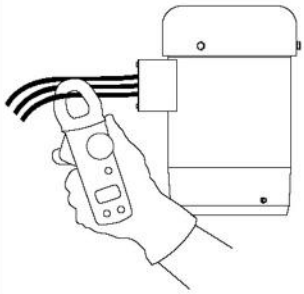
What it means

When the motor is under load, the voltage should be within ±10% of the nameplate voltage. Larger voltage variation may cause winding damage.

Large variations in the voltage indicate a poor electrical supply and the pump should not be operated until these variations have been corrected.

If the voltage constantly remains high or low, the motor should be changed to the correct supply voltage.

Current measurement



How to Measure

Use an ammeter, (set on the proper scale) to measure the current on each power lead at the terminal box or starter. See the motor nameplate for amp draw information.

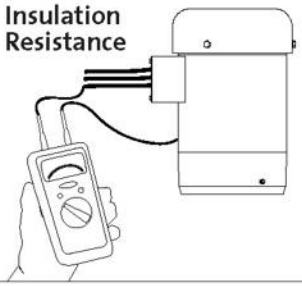
Current should be measured when the pump is operating at constant discharge pressure.

What it Means

If the amp draw exceeds the listed service factor amps (SFA) or if the current imbalance is greater than 5% between each leg on three-phase units, check the following:

1. Burned contacts on motor starter.
2. Loose terminals in starter or terminal box or possible wire defect.
3. Too high or too low supply voltage.
4. Motor windings are shorted or grounded. Check winding and insulation resistances.
5. Pump is damaged causing a motor overload.

Insulation Resistance



How to Measure

Turn off power and disconnect the supply power leads in the pump terminal box. Using an ohm or mega ohm meter, set the scale selector to Rx 100K and zero adjust the meter.

Measure and record the resistance between each of the terminals and ground.

What it Means

Motors of all HP, voltage, phase and cycle duties have the same value of insulation resistance. Resistance values for new motors must exceed 1,000,000 ohms. If they do not, motor should be repaired or replaced.

3.2 Standard tools

Pos.	Description	Bit no.	For pos.	Suppl. information		Part no.
H	Bit holder		I-J		1/4"	SV2011
I	Bits kit	PZ2	7.a		1/4"	SV2010
		5	9-H	M6 - 5 mm	1/4"	
		6		M8 - 6 mm	1/4"	
		8		M10 - 8 mm	1/4"	
J	Hexagon bit		113-H-M	M5 - 2,5 mm	1/4"	SV2012
K	Ring/open-end spanner		28	M6 - 10 mm		SV0083
			28-67	M8 - 13 mm		SV0055
			35	M10 - 17 mm		SV0056
			28-36	M12 - 19 mm		SV0054
			18-23-25	M16 - 24 mm		SV0122

3.3 Torque tools

Pos.	Description	For pos.	Suppl. information		Part no.
L	Torque wrench	N-O	4-20 Nm	9 x 12	SV0292
			20-100 Nm	9 x 12	SV0269
			40-200 Nm	14 x 18	SV0400
M	Torque screwdriver	J	1-6 Nm	1/4"	SV0438
N	Ratchet insert tool	L-O-P	9 x 12 -> 1/2"		SV0295
O	Ring spanner	28-L	M6 - 10 mm	9 x 12	SV0310
		28-L	M8 - 13 mm	9 x 12	SV0294
		28-L	M10 - 17 mm	9 x 12	SV0270
		36-L	M12 - 19 mm	9 x 12	SV0271
		18-23-25-L	M16 - 24 mm	9 x 12	SV0524
P	Socket spanner for hexagon socket head screws	9-N	M6 - 5 mm	½" x ½"	SV0296
			M8 - 6 mm	½" x ½"	SV0297
			M10 - 8 mm	½" x ½"	SV0298
Q	Socket spanner, purpose-ground	67-L	M8 - 13 mm	9 x 12	SV2013

Maclean Canada - MAINTENANCE BULLETIN

Title:	Pump, Grundfos Installation & Operations
Number:	**MB-HYD1563**
Revision:	Original

Model A valid from 1.10.2000 (0039)

	Pos	Description	Annotation	Classification Data	Partno	Qty.	Unit
-		Base complete				1	PC
	6	Base			96442012	1	PC
-	25	Drain plug with bypass valve			96440608	1	PC
	38	O-ring		Diameter: 16,3 Material type: EPDM Thickness: 2,4	00ID1288	1	PC
	37	O-ring		Diameter: 137,5 Material type: EPDM Thickness: 3,3	96438743	1	PC
-		Pump head complete				1	PC
	2	Pump head			96436502	1	PC
	7	Coupling guard			96438138	2	PC
	7.a	Screw		Length: 8 Thread: M4		4	PC
-	8	Coupling complete		Dimension: 28,5/12	00415315	1	PC
	9	Hexagon socket head screw		Designation: DIN 912 Length: 25 Thread: M8	00ID7900	4	PC
	10	Shaft pin		Diameter: 5 Length: 26		1	PC
	10.a	Coupling half				2	PC
	18	Air vent screw		Thread: RG 1/2	00405150	1	PC
	23	Pipe plug		Thread: G 1/2	91120659	1	PC
	23.c	Plug			00ID7216	1	PC
	28	Hexagon head screw		Length: 25 Thread: UNC 1/2"	00ID1840	4	PC
	36	Nut		Thread: M12		4	PC
	37	O-ring		Diameter: 137,5 Material type: EPDM Thickness: 3,3	96438743	1	PC
	60	Corrugated spring		Outside diameter: 128 Thickness: 3,5	96439662	1	PC
	66.a	Washer		Designation: DIN 125 A Inside diameter: 13 Outside diameter: 24 Thickness: 2,5		4	PC
	100	O-ring		Diameter: 16,3 Material type: EPDM Thickness: 2,4	00ID1288	2	PC
	26	Staybolt		Length: 454 Thread: M12	96442764	4	PC
	55	Outer sleeve		Outside diameter: 138 Length: 422,6	96440005	1	PC
	76	Nameplate			96468064	1	PC
	76.a	Rivet				2	PC
-	80	Chamber stack		Bearing type: SILICON CARBIDE	96453589	1	PC
-	4	Chamber complete			96437517	12	PC
		Chamber				1	PC
	45	Neck ring			96436720	1	PC
	65	Neck ring retainer			96436721	1	PC
-	4.a	Chamber with bearing ring		Material type: SILICON CARBIDE	96437636	3	PC
		Chamber				1	PC
	45	Neck ring			96436720	1	PC
	65	Neck ring retainer			96436721	1	PC
-	5.a	Chamber, bottom			96437737	1	PC
		Chamber				1	PC
	45	Neck ring			96436720	1	PC
	65	Neck ring retainer			96436721	1	PC
	47.a	Bearing ring			96437488	3	PC
	49	Impeller		Inside diameter: 35 Outside diameter: 73 Height: 13,2	96437414	16	PC
	50.a	Top guide vanes			96439170	1	PC
	51	Pump shaft		Diameter: 12,0 Length: 540,1	96440404	1	PC
	64	Spacing pipe		Inside diameter: 13 Outside diameter: 15 Length: 26,03	00410143	12	PC
	64.a	Spacing pipe		Inside diameter: 12,7 Outside diameter: 15 Length: 13	96443611	3	PC

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1/3

This towing procedure is to release all secondary (spring applied) brakes. This nameplate should be located somewhere near the brake manifold. Figure 4 illustrates a typical towing instructions name plate.

Figure 4 – Brake Release Instructions Name Plate

2.1.2 Diesel Driven Pump Control

The diesel driven pump is a variable displacement pump and has both a maximum pressure and differential (standby) pressure adjustment as shown in Figure 2.

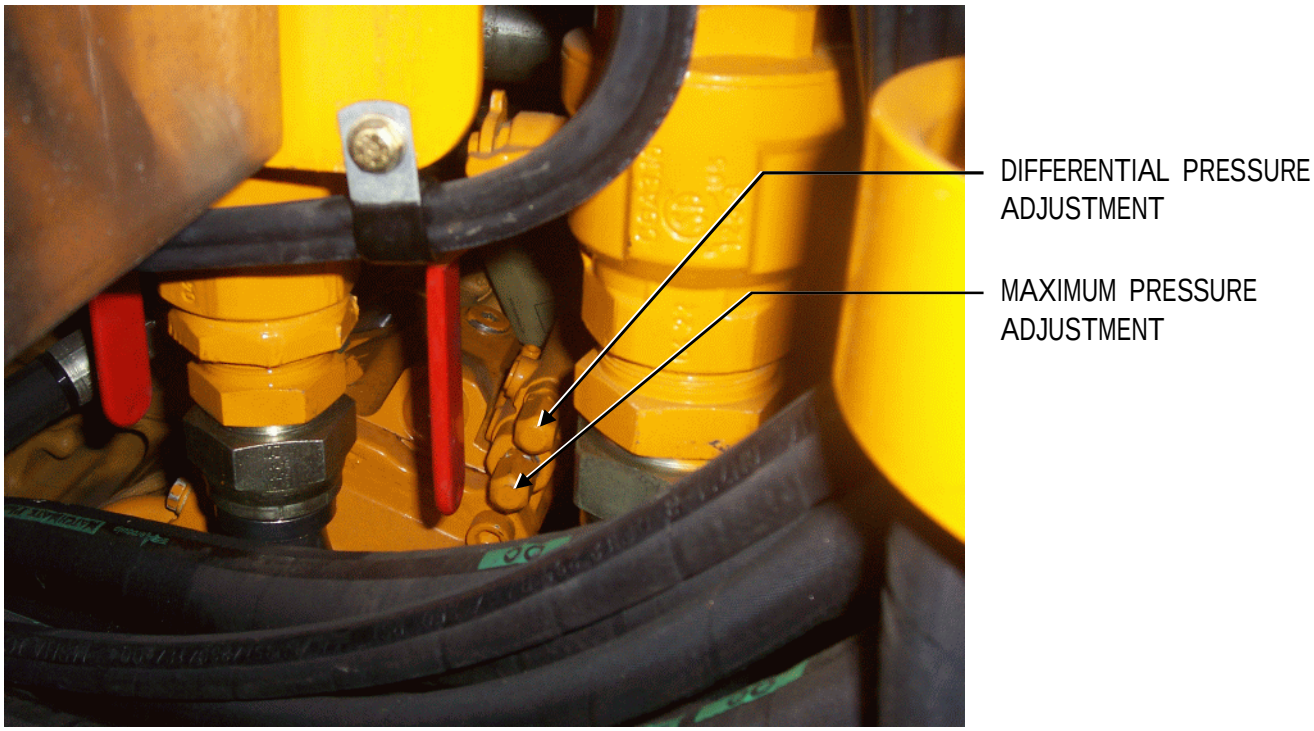

Figure 2 – Diesel Driven Pump Controls

The maximum pump pressure can be adjusted using the following procedure:

1. Remove the cap from the maximum pressure adjustment on the pump controller and loosen the jam nut.
2. Install articulation lock bar to prevent accidental steering of the unit. Start the diesel engine and place the unit into “Drive” mode.
3. Install a pressure gauge to the test point “TEST1” on the hydraulic control manifold.
4. Switch Carrier to “Aux” mode. This will cause the pump to switch to full pressure (rather than load sense in “Drive” mode).
5. Turn the maximum pressure adjustment CW to increase and CCW to decrease until the pressure gauge reads 3000 psi.
6. Lock the adjustment with the jam nut and re-install the cap.

The respective pressure limiters can be adjusted using the following procedure:

Drill Impact Valve (single pressure limiter)

1. Disconnect the drill impact hose at a convenient location (at the drill, at a bulkhead) and plug the hose.
2. Start the appropriate AC powerpack and switch to “Aux” mode.
3. Using the appropriate drill control joystick press and hold the “hi impact override” button. The drill impact should be operating at high pressure and this can be observed on the gauge in front of the boom control console. If the gauge reads 2500 psi no adjustment is required.
4. Remove the cap from the “A” pressure limiter adjustment and loosen the jam nut.
5. Turn the pressure limiter adjustment CW to increase and CCW to decrease until the gauge reads 2500 psi.
6. Lock the adjustment using the jam nut and re-install the cap.
7. Reconnect the hoses.

Drill Feed Valve (dual pressure limiters)

1. Turn the adjustment of feed regulator fully CW.
2. Start the appropriate AC powerpack or diesel engine and switch to “Aux” mode.
3. Using the appropriate drill control joystick move and hold the feed fully forward and observe the feed pressure on the gauge in front of the boom control console. If the gauge reads 1600 psi no adjustment is required.
4. Remove the cap from the “A” pressure limiter adjustment and loosen the jam nut.
5. Turn the pressure limiter adjustment CW to increase and CCW to decrease until the gauge reads 1600 psi.
6. Lock the adjustment using the jam nut and re-install the cap.
7. Repeat steps 3 through 9 for the “B” pressure limiter by holding the feed in the fully reversed position. A pressure gauge must be connected to the “W” port of the drill feed valve section. Set the pressure limiter to 2500 psi.

Drill Rotation Valve

1. Turn off the anti-jam system using the anti-jam enable toggle switch on the boom control console.
2. Disconnect both of the drill rotation hoses at a convenient location (at the drill, at a bulkhead) and plug the hoses.
3. Start the appropriate AC powerpack and switch to “Aux” mode.

8. **Drill Impact Back Pressure Valve** – this valve is a pressure relief valve used to adjust the drill impact back pressure to optimize the drilling performance. It is installed in the drill impact return line. Turning the adjustment CW increases the backpressure and CCW decreases the backpressure. Typically this valve is set to 125psi.

The following four steps describe how the drilling control system typically works:

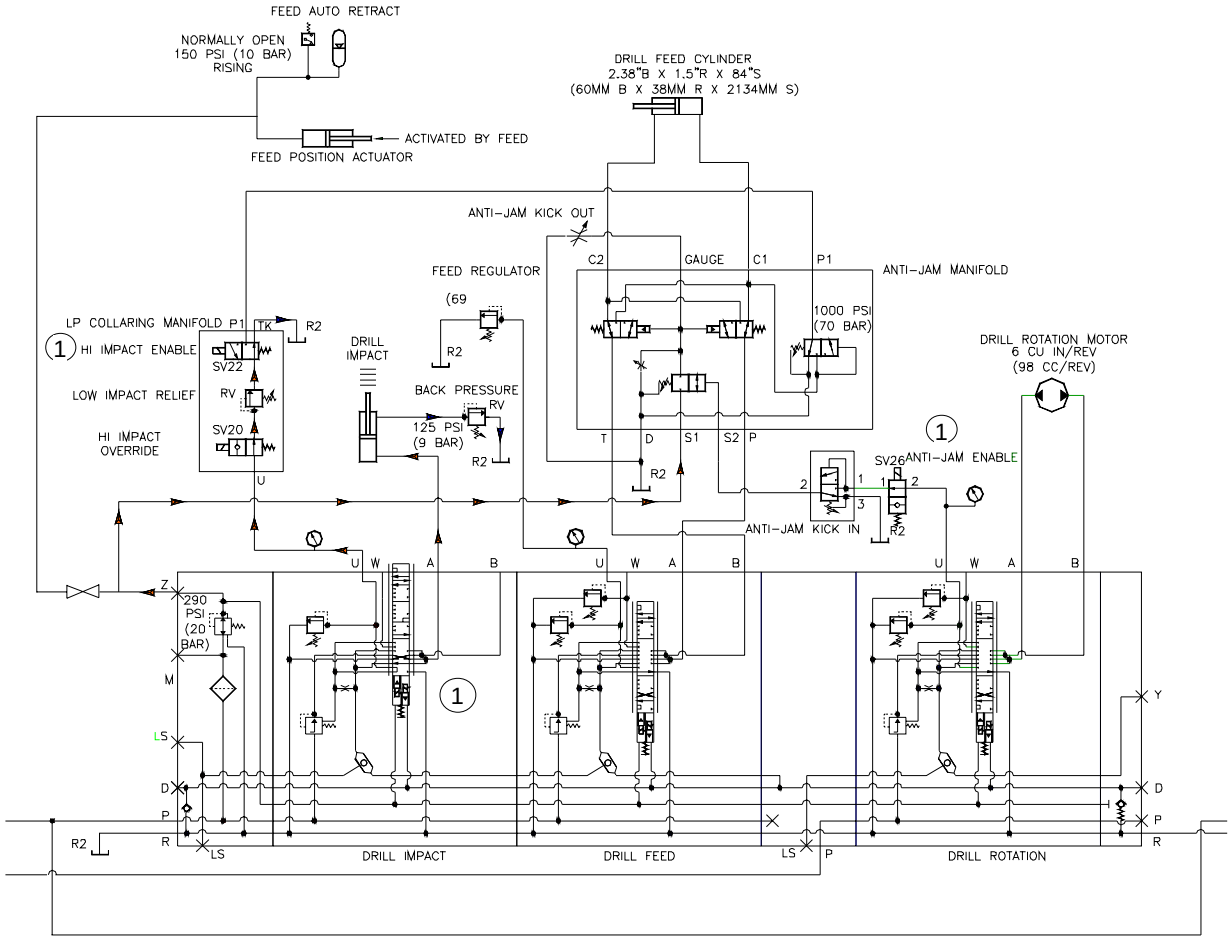

Figure 5: Step 1 – Drill Impact Operation

1. The drill impact valve is energized and Anti-jam is enabled. The impact operates at Lo pressure, since the Hi Impact Enable Valve and Hi Impact Override Valve are de-energized.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Anti-jam Manifold
Number:	**MB-HYD1455**
Revision:	Original

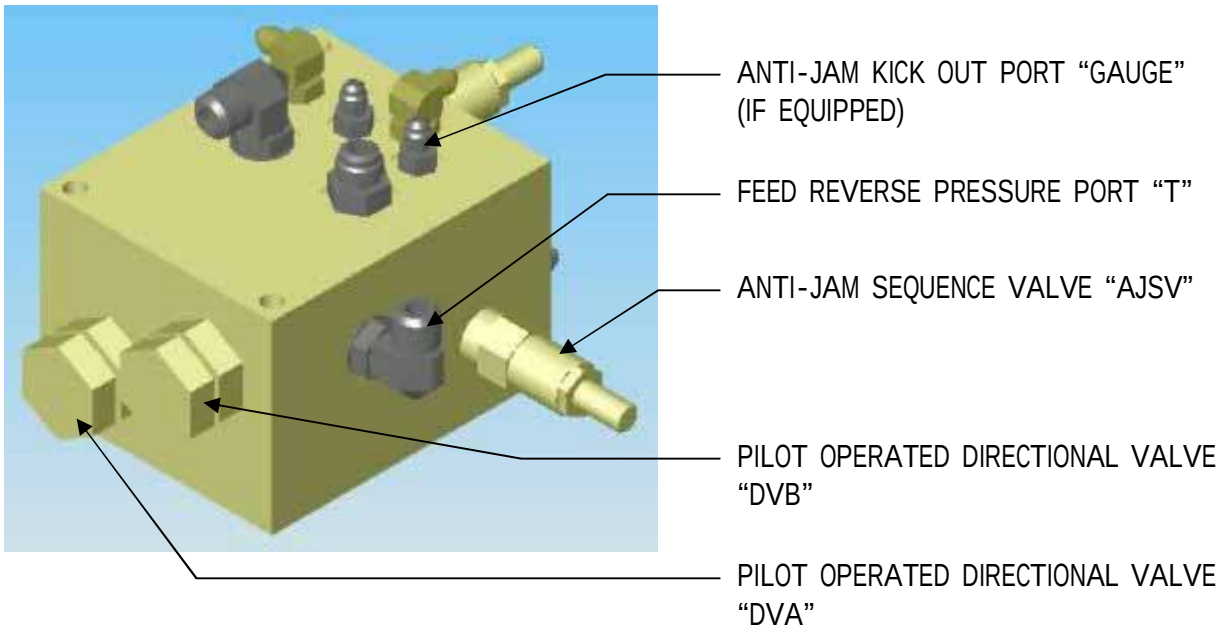

Figure 2: Anti-jam Manifold

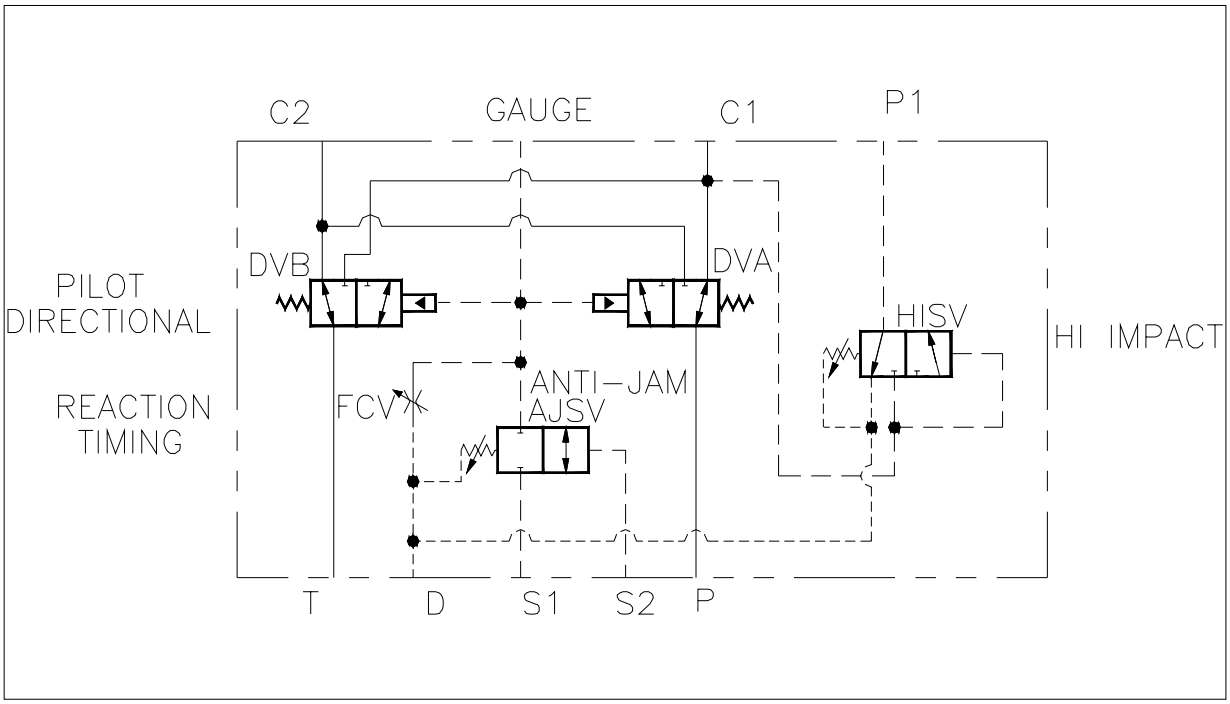

Figure 3: Anti-jam Manifold Schematic

3.0 Troubleshooting:

When problems in the hydraulic system arise it could be due to the low pressure-collaring manifold. The following troubleshooting guide provides some suggestions for typical hydraulic issues.

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
Drill does not come off Low Pressure Collaring when bit is against rock and full feed pressure is being applied.	A. The Hi impact enable solenoid valve "SV21/22" is not receiving an electrical signal.	If this valve is not energized the downstream pressure of the relief valve will be released to tank.	The LED on the DIN connector should be illuminated when Hi Impact enabled. If it is not illuminated test for power at the appropriate terminal block inside the electrical panel.
	B. The Hi impact enable solenoid valve "SV21/22" coil is burned out.	The electrical signal is being sent to the valve but with a burned out coil it cannot create the magnetic field to shift the valve.	Remove the cap from the top of the Hi impact enable solenoid valve and make sure the Hi Impact Enable is on. Try to pull the coil off the valve to test if the magnetic field is being created that shifts the valve. If there is a magnetic field then the coil is working properly. If there is no magnetic field then the coil should be replaced.
	C. The Hi impact enable solenoid valve "SV21/22" has a stuck spool	Contamination or an over-tightened cartridge or coil nut may be causing the valve to malfunction.	Remove the cartridge from the manifold and inspect/clean as required. Energize the valve while it is removed and observe if the spool is shifting. If spool will not shift replace the cartridge. Be sure to not over-tighten the cartridge coil nut when re-installing.
			If none of these suggestions have resolved the problem contact MacLean Engineering Technical Service Department.

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
The electrical motor labours when starting.	A. The pump unload solenoid valve “SV23/24” is not energizing.	If this valve is not energized it will not unload the pump and this will draw power from the electrical motor causing it to work too hard.	The LED on the DIN connector should be illuminated when pushing the electrical motor start button. If it is not illuminated, test for power at the appropriate electrical panel.
	B. The pump unload solenoid valve “SV23/24” coil is burned out.	The electrical signal is being sent to the valve but with a burned out coil it cannot create the magnetic field to shift the valve.	Remove the cap from the top of the solenoid valve and push the start button. Try to pull the coil off the valve to determine if the magnetic field is being created that shifts the valve. If there is a magnetic field then the coil is working properly. If there is no magnetic field the coil should be replaced.
	C. The pump unload solenoid valve “SV23/24” has a stuck spool	Contamination or an over-tightened cartridge may be causing the spool to stick.	Remove the cartridge from the manifold and inspect/clean as required. Energize the valve while it is removed and observe if the spool is shifting. If spool will not shift replace the cartridge. Re-install the cartridge into the manifold taking care not to over-tighten.
			If none of these suggestions have resolved the problem contact MacLean Engineering Technical Service Department.

4.0 Maintenance:

Routine inspections of the manifold should be done to ensure that all cartridge valves are in good condition and that all hoses connected to the manifold are not damaged.

5.0 Removal and Replacement:

Before doing any servicing of the pressure control manifold ensure that the engine is turned off and brake accumulators have been fully discharged. Follow all mine lock out and tagging procedures. Failure to do so may result in an oil spray that might lead to injury or death.

When removing and replacing cartridges or coils from the manifold please note the following:

a) Check the cartridge to verify that there is no external contamination.
b) Check to be sure the o-rings and back-up rings are in good condition and in the correct orientation.
c) Dip the cartridge in clean oil to the top of the threads to lubricate the o-rings.
d) Take care not to cross-thread a cartridge valve or fitting when installing them into the manifold. If it will not turn in a number of turns by hand there may be a problem with the threads of the manifold or the cartridge.
e) After the cartridge has been installed by hand use a wrench to seat the cartridge on the manifold. Do not torque the cartridge more than 35 ft-lbs as this can cause the spool to become stuck leading to system malfunctions.
f) Do not torque the nut that holds down the coil more than 5 ft-lbs as this can cause the core tube to stretch and not allow the valve to shift properly.

6.0 Making Adjustments:

There are no adjustable cartridges within the pressure control manifold. The pressure reducing valves “PRV1” and “PRV2” are factory set and cannot be adjusted (if equipped).

6.0 Making Adjustments:

The only component in the hydraulic control manifold that may require adjustment is the spike relief valve. This valve is adjusted clockwise (CW) to increase the setting and counter-clockwise (CCW) to decrease the setting. Please see the hydraulic schematic for the proper setting for this valve.

NOTE For every turn of this valve the setting changes by approximately 750 psi. Always lock the jam nut after completing any adjustments.

7.0 Notes:

If any questions or problems arise, please contact MacLean Engineering Technical Service for assistance.

Phone: 1-866-856-3626
Email: service@macleanengineering.com

Maclean Canada - MAINTENANCE BULLETIN

Title:	Valve, MICO Accumulator Charging
Number:	**MB-HYD1151**
Revision:	A

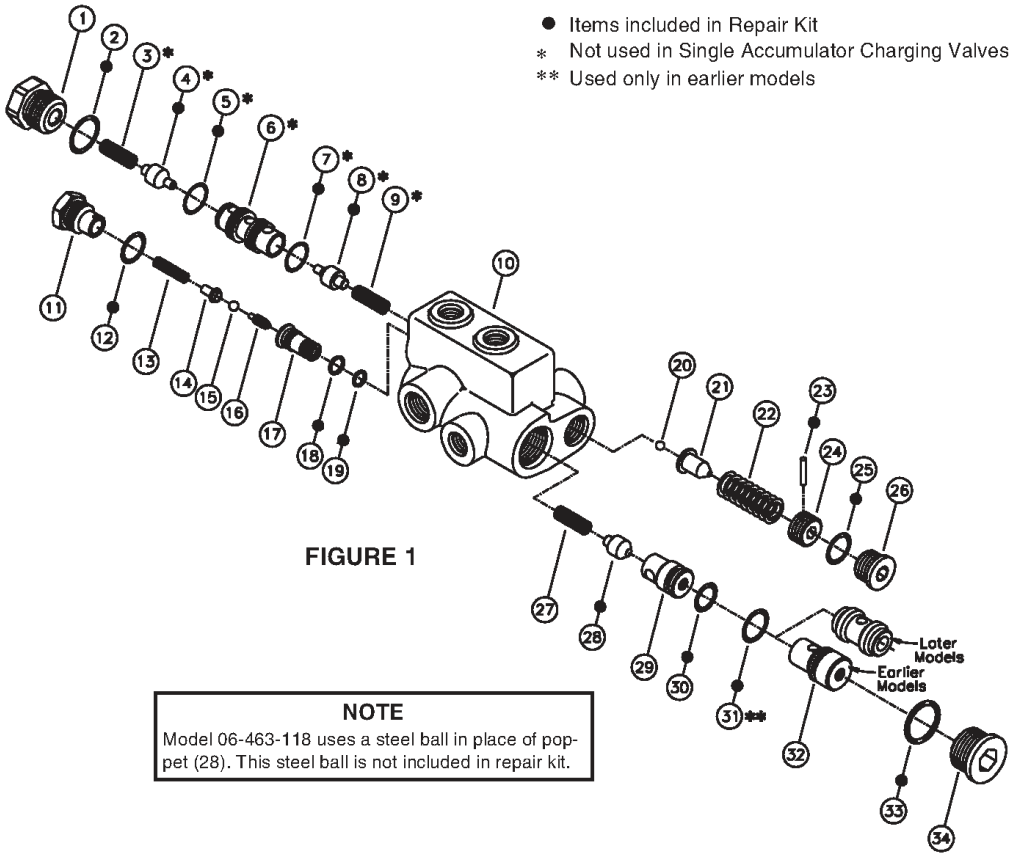

FIGURE 1

NOTE
Model 06-463-118 uses a steel ball in place of poppet (28). This steel ball is not included in repair kit.

TABLE 1 (Specifications)

Model Number	Description	Repair Kit	Accumulator High Limit		Accumulator Low Limit	
			bar	(psi)	bar	(psi)
06-463-100	Dual	06-400-107	77.6 ± 1.7	(1125 ± 25)	55.2 ± 3.5	(800 ± 50)
06-463-102	Single	06-400-107	106.9 ± 3.5	(1550 ± 50)	74.1 ± 3.5	(1075 ± 50)
06-463-104	Dual	06-400-107	144.8 ± 3.5	(2100 ± 50)	118.9 ± 3.5	(1725 ± 50)
06-463-106	Single	06-400-107	129.3 ± 1.7	(1875 ± 25)	104.2 ± 2.6	(1512 ± 38)
06-463-108	Single	06-400-107	158.6 ± 3.5	(2300 ± 50)	117.2 ± 3.5	(1700 ± 50)
06-463-110	Single	06-400-107	141.3 ± 3.5	(2050 ± 50)	115.5 ± 3.5	(1675 ± 50)
06-463-112	Single	06-400-107	158.6 ± 3.5	(2300 ± 50)	117.2 ± 3.5	(1700 ± 50)
06-463-114	Single	06-400-107	113.8 ± 3.5	(1650 ± 50)	93.1 ± 3.5	(1350 ± 50)
06-463-116	Single	06-400-107	103.4 ± 3.5	(1500 ± 50)	82.7 ± 3.5	(1200 ± 50)
06-463-118	Dual	06-400-107	158.6 ± 3.5	(2300 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-120	Single	06-400-107	186.2 ± 3.5	(2700 ± 50)	141.3 ± 3.5	(2050 ± 50)
06-463-122	Dual	06-400-192	144.8 ± 3.5	(2100 ± 50)	118.9 ± 3.5	(1725 ± 50)
06-463-126	Dual	06-400-107	113.8 ± 3.5	(1650 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-128	Dual	06-400-107	189.6 ± 3.5	(2750 ± 50)	155.1 ± 3.5	(2250 ± 50)
06-463-136	Single	06-400-107	165.5 ± 3.5	(2400 ± 50)	127.6 ± 3.5	(1850 ± 50)
06-463-144	Dual	06-400-107	200.0 ± 3.5	(2900 ± 50)	165.5 ± 3.5	(2400 ± 50)
06-463-148	Dual	06-400-107	113.8 ± 3.5	(1650 ± 50)	86.2 ± 3.5	(1250 ± 50)
06-463-154	Dual	06-400-107	200.0 ± 3.5	(2900 ± 50)	165.5 ± 3.5	(2400 ± 50)
06-463-156	Dual	06-400-107	158.6 ± 3.5	(2300 ± 50)	127.6 ± 3.5	(1850 ± 50)

NOTE: If your product number is not listed, please call MICO, Incorporated for information.

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Maclean Canada - MAINTENANCE BULLETIN

Title:	**Valve, Counterbalance and Motion Control**
Number:	**MB-HYD1028**
Revision:	E

When a counterbalance valve requires adjustment please use the following procedure to ensure a proper setting is achieved:

1. Refer to the hydraulic schematic for the setting of the counterbalance valve cartridge that is being adjusted.
2. Make certain that any mechanical components that are held in position by the counterbalance valve cartridge are properly secured before making any adjustments.
3. Loosen the jam nut on the cartridge and screw the adjustment until it is at its maximum setting (all the way CCW for SUN, all the way CW for VICKERS or COMMAND CONTROLS).
4. For critical applications, Table 2 provides the required setting and # of turns required to achieve that setting.
5. For other applications, use Table 3 to determine the # of complete turns required to achieve the required setting.
6. Turn the adjustment screw the required # of turns. Use the Allen key to make sure the adjustment screw does not turn while locking the jam nut.
7. After testing the new installation, minor adjustments to the counterbalance valve cartridge may be required. Recall that for increasing the valve setting the adjustment must be screwed CCW for SUN and CW for VICKERS or COMMAND CONTROLS.

Application	Counterbalance Valve Cartridge MacLean#	Valve Brand	Required Setting (psi/Bar)	# Of Turns From Maximum Setting
928/946 Boom Rollover	1029610	Sun	3500 psi/240 Bar	1 ½
928/946 Boom Rollover	1024986	Command	3500 psi/240 Bar	2
928/946 Scissor Cylinder	1009204	Sun	3500 psi/240 Bar	½
928/946 Scissor Cylinder	1003007	Vickers	3500 psi/240 Bar	
928/946 Tilt Actuator	1009204	Sun	4000 psi/280 Bar	None
928/946 Engine End Outrigger	1009204	Sun	3500 psi/240 Bar	½
928/946 Deck End Outrigger	1009204	Sun	4000 psi/280 Bar	None
993MR Boom Rollover	1029610	Sun	3250 psi/225 Bar	1 ¾
993MR Boom Lift	1029771	Sun	2800 psi/190 Bar	2
993MR Boom Swing	1009204	Sun	3500 psi/240 Bar	½
993MR Boom Extend	1051537	Sun	1300 psi/90 Bar	4 ½
993MR Feed Rollover	1009204	Sun	2000 psi/140 Bar	2
993 Robust Boom Rollover	1029610	Sun	3500 psi/240 Bar	1 ½
993 Robust Boom Lift	1009204	Sun	3500 psi/240 Bar	½
993 Robust Boom Swing	1009240	Sun	3500 psi/240 Bar	½
993 Robust Feed Rollover	1009204	Sun	2000 psi/140 Bar	2

Table 2 – Critical Counterbalance Valve Cartridge Settings

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
Pump is noisy	Pump is cavitating/ aerating	A piston pump that is being starved of oil or has air entrapment in the oil (aeration) will be noisy.	Shut the system down. a) Make certain inlet ball valve is open. b) Make certain there are no kinks or twists or obstructions in the suction line. c) Make sure the suction strainer in the tank is clean. (only older MacLean Engineering rigs have suction strainers – any rigs built after 1997 do not have suction strainers. Generally, piston pump manufacturers are no longer recommending suction strainers.)

2.0 Notes:

Revision B – Added the paragraph on the first page explaining the change by Mico from the 464 series to the 466 series brake valve. Updated Mico document 81-464-010 to the latest available revision dated 9/27/01.

If any questions or problems arise, please contact Maclean Engineering Technical Service for assistance.

Phone: 1-866-856-3626
Email: service@macleanengineering.com

7. Avoid direct spraying onto any electrical panel faces that have indicating lights, switches, gauges, etc on them. Avoid direct spraying at electrical enclosure doors and cover seals.

8. Avoid direct spraying at exposed electrical connections, and at multi-pin, DIN, weather pack or engine connectors. Generally avoid spraying at any electrical component.

9. Avoid direct spraying at cable reel slip ring compartment cover seals. If water ingress is noted or suspected, remove cover, inspect and dry out before energizing.

10. Do not direct water at, or attempt to wash battery chargers because of their open cooling vents and fan intakes. If accidentally washed, dry out the box and components before turning on the power.

11. Avoid direct spraying at electric motor bearings and connection boxes. Avoid direct spray at bell hosing cover seals.

12. Do not direct spraying at the operator's seat. If equipped with an enclosed cab, close operator's cab door while washing the machine.

13. Avoid direct spraying at the fire suppression nozzles (to prevent removal of the pink non-curing silicone lubricant on F type nozzles) and the dry chemical canister seals.

14. Disconnect and remove batteries before washing inside battery boxes.

15. Dispose of dirty wash water and removed debris/grease as per mine site procedures.

4.0 Post Wash Inspection

1. After washing, inspect electrical enclosures for water ingress. If any dampness is noted, dry out the box and components, and replace the moisture absorbing desiccant packs before energizing the box.

2. Inspect F type fire suppression nozzles to ascertain presence of pink silicone lubricant. If washed away replace with new silicone lubricant (Dow Corning 33/ MACLEAN #1060182).

INSTALLATION (Continued)

HOSE

25. connect the 3/4 or 7/8 inch wire braid hose between the tank and the distribution, reducing or triple tee and make these checks:

☐ Proper hose and fittings in use.

☐ Hose length within limitations.

☐ Hose not exposed to extremely high temperatures or physical abuse.

☐ 26. Tighten bursting disc union.

NOTE: When tightening the connection to the bursting disc union, use a wrench, but avoid overtightening. The bursting disc can be damaged by over-tightening.

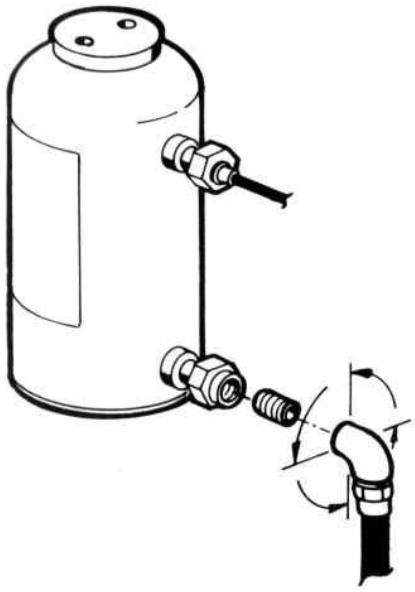


FIGURE 13

NOTE: Use of nipple and elbow at bursting disc union permits directional position option of 360° leading from tank outlet to triple tee.

☐ 27. Clamp the hose securely at least every five feet.

28. Connect the 1/2 inch wire braid hose between the distribution, reducing or triple tee and the nozzles, and make these checks:

☐ Proper hose and fittings in use.

☐ Hose lengths approximately equal or (unbalanced system) within limitations.

☐ Total hose lengths (tank to nozzle) within the established limits.

☐ Hose not exposed to high temperature extremes or physical abuse.

☐ 29. Clamp hose securely, at least every five feet.

☐ 30. While connecting a 1/4 inch wire braid hose between the expellant gas assembly and the dry chemical tank, make these checks:

☐ Proper hose and fittings in use.

☐ Maximum hose length of 20 feet adhered to between expellant gas cartridge and tank.

☐ Hose not exposed to physical abuse.

☐ Hose not exposed to high temperature extremes (exhaust manifolds, etc.).

☐ 31. Clamp the hose securely, at least every five feet.

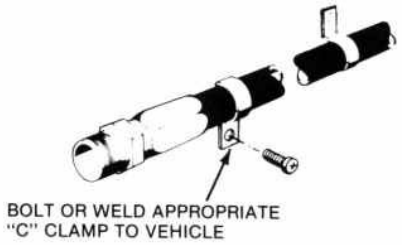


FIGURE 14

NOTE: One "C" clamp required for every 5'-0" of hose.

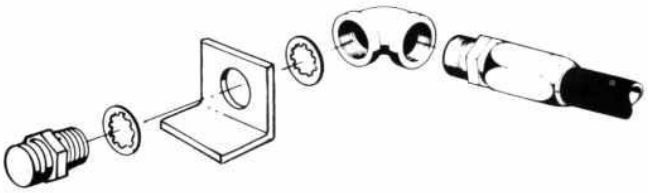


FIGURE 15

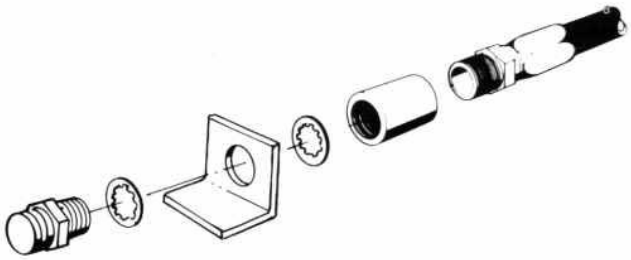


FIGURE 16

32. Connect the 3/4 or 7/8 inch wire braid hose between the tank and the distribution, reducing or triple tee and make these checks:

☐ Proper hose and fittings in use.

☐ Hose length within limitations (75' maximum).

☐ Hose not exposed to high temperature extremes (exhaust manifold, etc.) or physical abuse.

DO NOT INSTALL CARTRIDGES IN ACTUATOR(S) AT THIS TIME.

This manual is intended for use with the Ansul A-101 Vehicle Fire Suppression Systems.

Those who install, operate, recharge, inspect, or maintain these fire suppression systems should read this entire manual. Specific sections will be of particular interest depending upon one's responsibilities.

As with all mechanical equipment, the A-101 systems need periodic care to provide maximum assurance that they will operate effectively and safely. Inspection frequency should be based on 250 vehicle operating hours or monthly, whichever comes first. Maintenance should be conducted at 1000 vehicle operating hours or every six monthly, whichever comes first. Maintenance should be conducted in accordance with this manual and NFPA 17 ("National Fire Protection Association's Standard for Dry Chemical Extinguisher Systems") by a qualified, trained service person.

Additional service and maintenance information can be obtained in other applicable NFPA Standards.

This Ansul systems manual is limited to uses herein described. For other applications, contact your local Ansul distributor or Ansul Incorporated, Pre-Engineered Systems Application Department, Marinette, Wisconsin 54143-2542.

ANSUL is a registered trademark and CHECKFIRE is a trademark.

TRIPLE TEE

When four nozzles are to fed from a single dry chemical tank, a triple tee, Part No. 16424, can be used to properly distribute the dry chemical from the supply line to two branch lines. See Figure 11.

TRIPLE TEE, 1/2 IN. X 1/2 IN. X 1/2 IN. X 3/4 IN. – PART NO. 16424

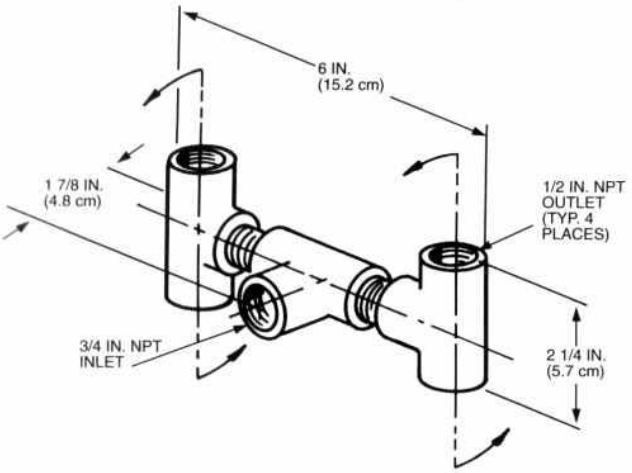


FIGURE 11

SAFETY RELIEF VALVE

A spring-loaded pressure relief valve, Part No. 15677, is used to prevent excessive pressure from building up in the actuation line. The valve is set to relieve at 265 psi (18.3 bar). After system discharge, all pressure in the actuation line can be relieved by pulling the ring on the safety relief valve. See Figure 12.

SAFETY RELIEF VALVE PART NO. 15677

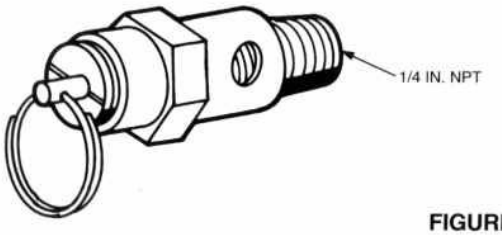


FIGURE 12

AIR CYLINDER (OPTIONAL)

The air cylinder, Part No. 15733, is a system accessory whose function is to shut off the fuel supply to the engine when the fire suppression system is actuated. It is a piston operated by gas pressure from the actuation line. See Figure 13.

AIRCYLINDER PART NO. 15733

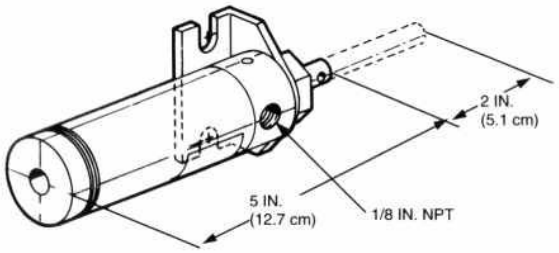


FIGURE 13

PRESSURE SWITCH – WEATHERPROOF

The pressure switch, Part No. 46250, is a DPST (Double-Pole, Single Throw) pneumatically operated, resettable switch used to open or close electrical circuits to either shut down equipment or turn on lights or alarms. The pressure switch is constructed of malleable iron, painted red. A 1/4 in. NPT pressure inlet is used to connect the 1/4 in. hose from the actuation line. The switch rating is 2 HP-240 VAC/480 VAC, 2 HP-250 VDC, 30A-250 VAC/DC, 5A-480 VAC/DC. See Figure 14.

PRESSURE SWITCH PART NO. 46250

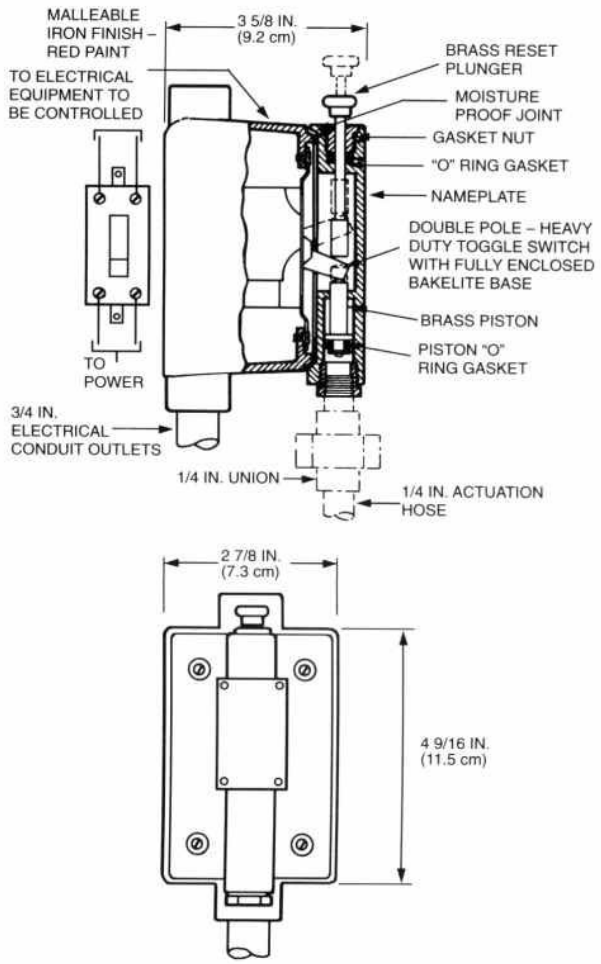


FIGURE 14

Supply and Branch Line Requirements (Continued)

20, 30 lb. 4 Nozzle Balanced System With Reducing Tee See Figure 14 and 14A.

- Maximum supply line length from extinguisher to triple tee is 40 ft. 0 in. (12.2 m).
- Maximum total length from extinguisher to farthest nozzle is 50 ft. 0 in. (15.2 m).
- Any combination of F-1/2, C-1/2, or V-1/2 nozzles are acceptable. Four (4) nozzles maximum.
- Linear length of the primary branch line on one side of the primary tee to the secondary tee must be within 10% of the linear length of the other primary branch line from the primary tee to the secondary tee.

  Also, the linear length of the secondary branch line on one side of the secondary tee must be within 10% of the linear length of the other secondary branch line sharing the same tee.

NOTE: See Page 6-5 for fitting and bend limitations.

4 NOZZLE BALANCED WITH REDUCING TEE – 20 LB.-30 LB. SYSTEMS

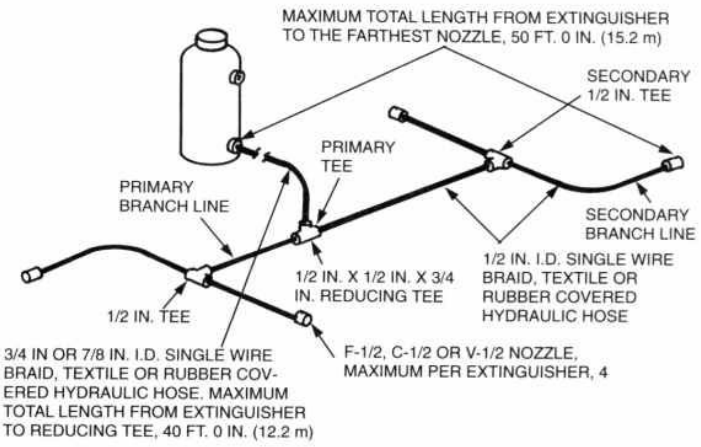
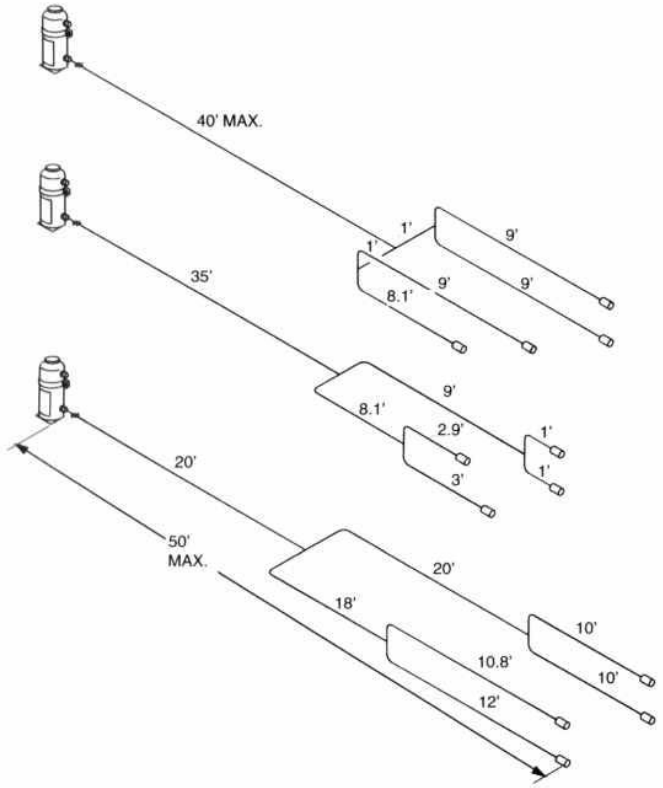


FIGURE 14

EXAMPLES OF TYPICAL SYSTEMS



EXAMPLES OF TYPICAL SYSTEMS

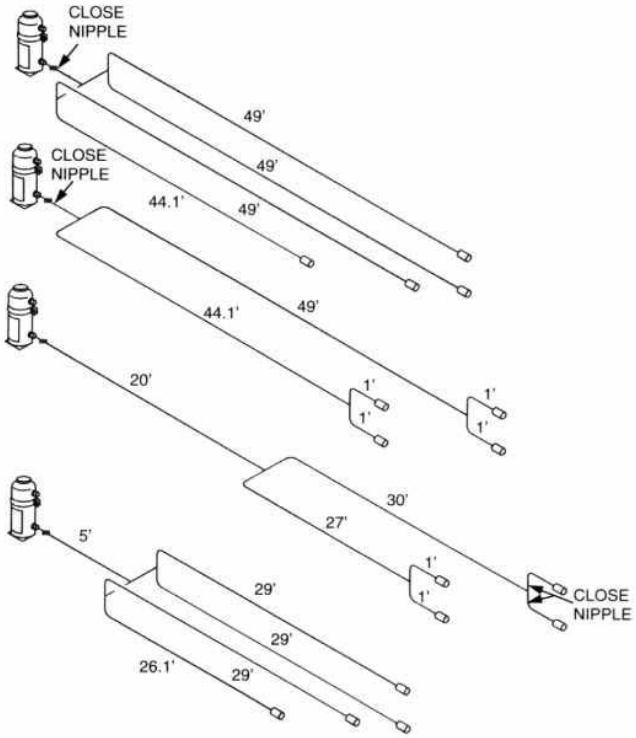


FIGURE 14A

Cartridge Bracket

When installing low temperature or low profile type systems, it is necessary to mount the remote cartridge bracket also. The location of this bracket must be such that the length of 1/4 in. hose between the bracket and the pneumatic inlet on the agent tank does not exceed 20 ft. (6.1 m) and the 1/4 in. hose from each remote actuator does not exceed 75 ft. (22.86 m) for LT-5 cartridges and 125 ft. (38.10 m) for LT-10 cartridges.

1. Remove the cartridge from the bracket. Locate a rigid, protected surface and weld or bolt the cartridge bracket securely. When bolting the bracket, use 5/16 in. fasteners. Make certain mounting location allows for easy removal of the cartridge when required.

NOTE: The cartridge must be located in an area that will not exceed temperature limitations or be subject to fire or damage.

Remote Actuator Bracket

A remote manual actuator must be located in the drivers compartment within reach of the operator, and a remote manual actuator should be located at a point on the vehicle accessible from ground level. When mounting any actuator, make certain the length of hose between the actuator and the tank or remote expellant gas cartridge does not exceed 75 ft. (22.9 m) for LT-5 cartridges and 125 ft. (38.10 m) for LT-10 cartridges). Also, make certain there is enough room for cartridge removal.

NOTE: The actuator must be located in an area that will not exceed temperature limitations or be subject to fire or damage. Try to avoid mounting actuator near engine compartment.

1. Choose a suitable mounting location and weld or bolt each actuator bracket in place. If bolting the bracket(s), use 3/8 in. fasteners. If welding, to avoid corrosion, paint welded surface. See Figure 4.
2. If mounting the remote manual actuator in the dashboard of a vehicle, the actuator can be mounted by drilling a 1 5/16 in. (33.3 mm) diameter hole as shown in Figure 4. Make certain there is enough room for the actuator body, cartridge and 1/4 in. actuation line connection under the dash.

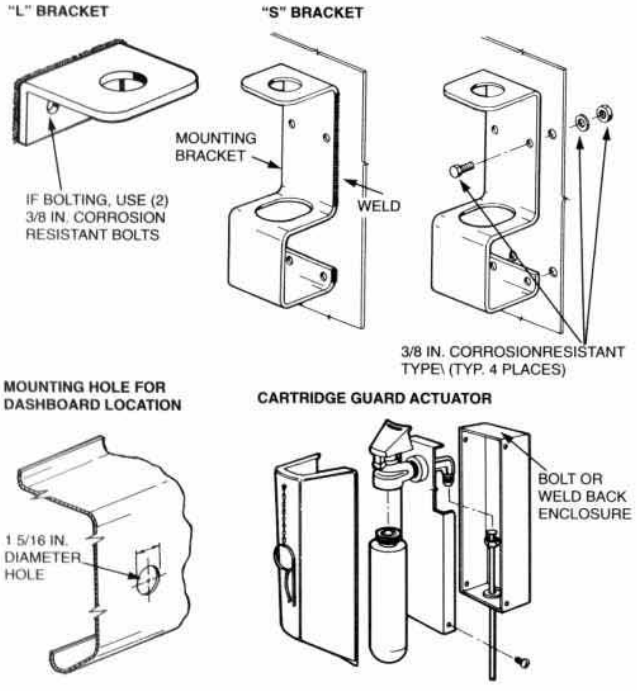


FIGURE 4

MOUNTING THE DISTRIBUTION, REDUCING, AND TRIPLE TEES

Based on the sketch done in the Design Section, locate each tee at a point which will not cause the supply line and branch line lengths to be exceeded.

1. All distribution network fittings must be welded or clamped to the mounting surface. See Figure 5. All welds must be made before any hose has been installed to avoid damage to the hose due to high welding temperatures.
2. When locating tees, make certain the locations do not cause the hose to be exposed to extreme heat or physical abuse.
3. Make certain the end tees on the triple tee are not twisted from their original position. See Figure 5.

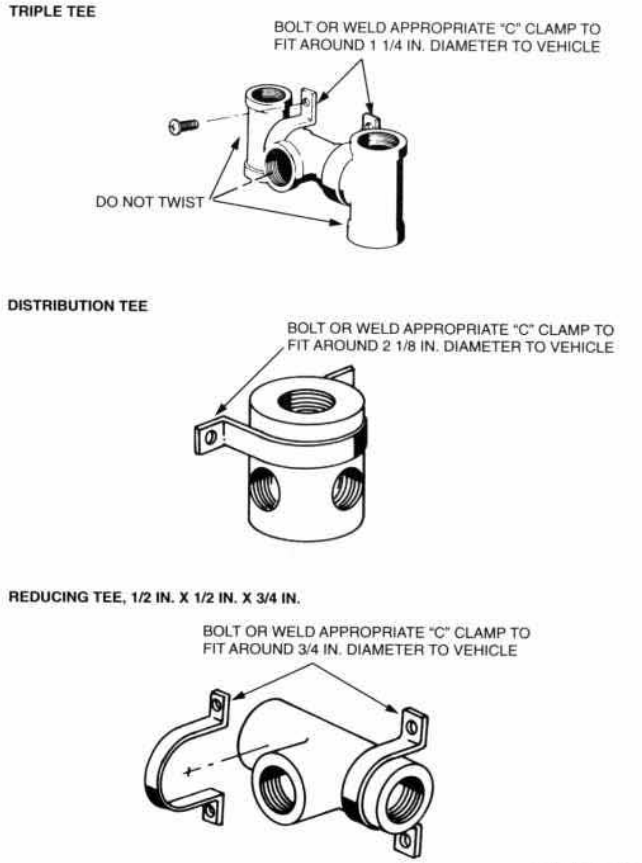


FIGURE 5

In order to help understand the design process, the following example hazards are covered in this section. There may be different design approaches that can be taken for each hazard, but the example are only intended to show the typical areas requiring protection and the number of nozzles and tanks required. They will give the designer an idea of what to look for on these type vehicles. Also, refer to approprate CHECKFIRE Design, Installation manual for detailed information concerning detection system requirements.

NOTICE

These are conceptual drawings. They were prepared from information provided through vendor's sales literature to assist field installations. The fire suppression system illustrated constitutes nominal hardware requirements. The detection system has not been shown for the purpose of clarity. The final system design must consider other potential ignition and fuel source areas not in the vendor's literature, meaning a pre-installation in depth analysis of all likely areas of probable fire incident.

FRONT END LOADER

Nozzle No. 1 and 2 – Located toward the lower rear of the engine compartment and are aimed forward and toward the center. They are positioned to provide complete coverage of the entire pan area.

Nozzle No. 3 and 4 – Located to provide protection for the sides of the engine. Each is mounted on the side of the engine compartment in front and aimed toward the rear and center to completely cover the engine sides.

Nozzle No. 5 and 6 – Located at the top of the engine compartment toward each side. Each is positioned to discharge toward the rear and center of the engine and the turbocharger.

Nozzle No. 7 – Located under the operator's compartment toward one side and aimed to discharge across the pan area. In addition to the pan, its discharge will protect the parking brake disc.

Nozzle No. 8 – Located under the operator's compartment but is positioned to discharge dry chemical on the hydraulic lines in the compartment. It is oriented so a portion of its discharge will pass through the front bulkhead to protect the hydraulic lines leading to the front bucket.

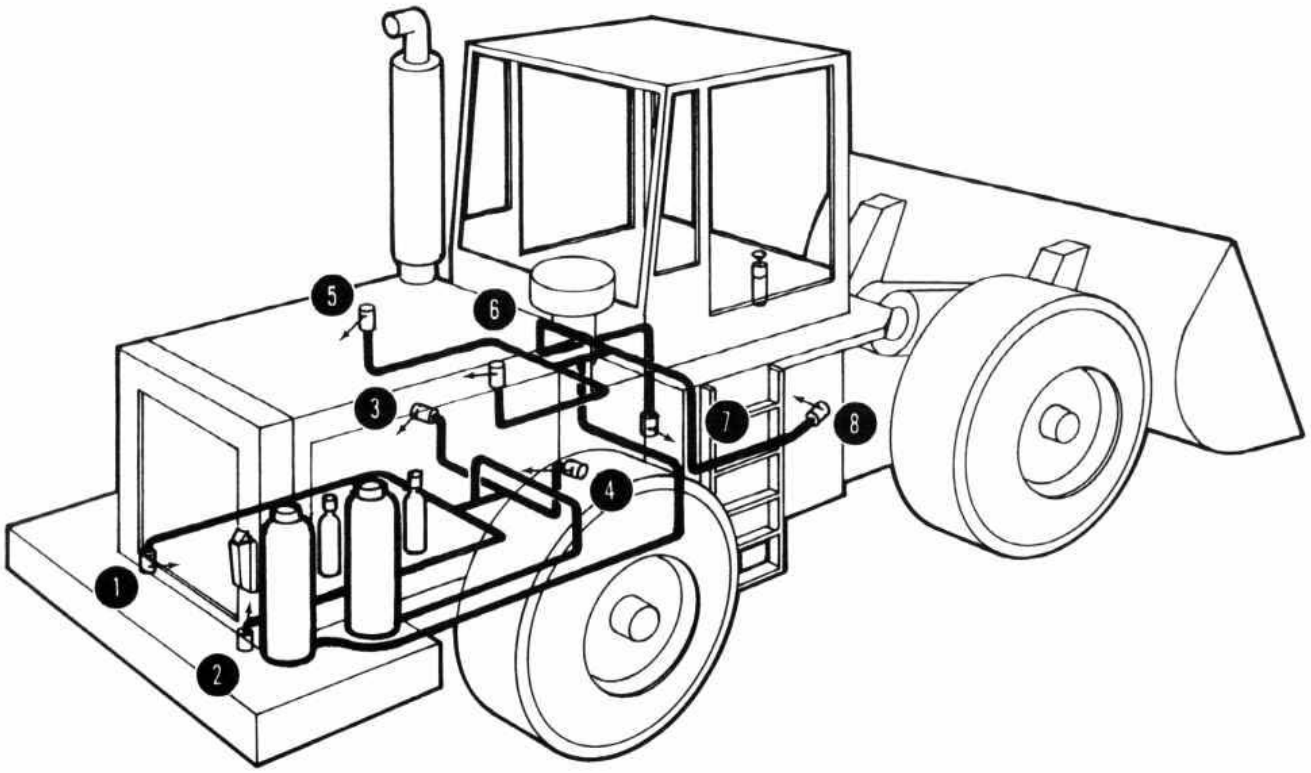
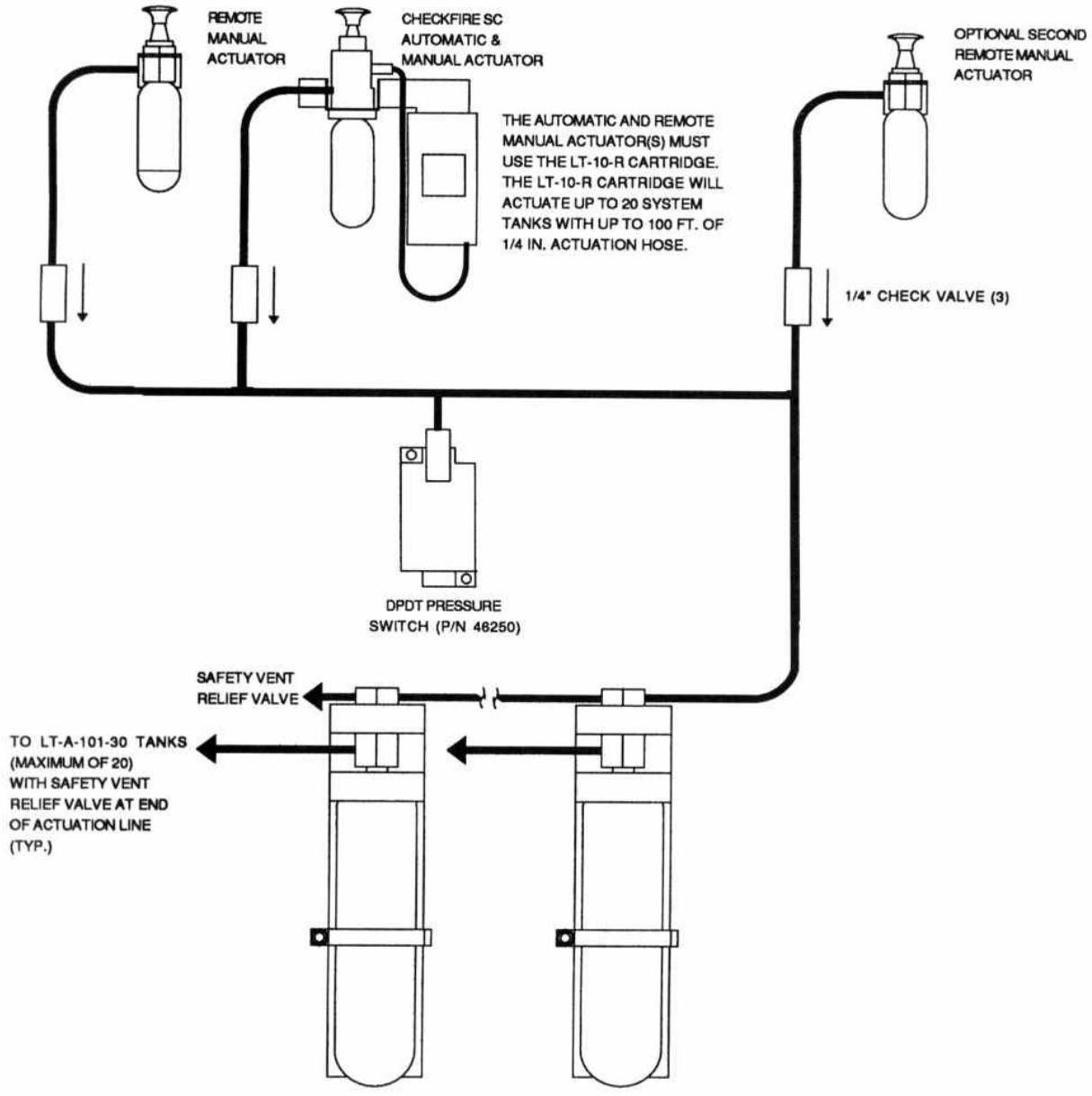


FIGURE 1

LARGE EXCAVATORS (Continued)

Design Parameters (Continued)



1/4" ACTUATION HOSE DETAIL FOR A-101 EXTENDED DISCHARGE SYSTEM

FIGURE 2

Environmental note

DaimlerChrysler's declared policy is one of integrated environmental protection. This policy starts at the root causes and encompasses in its management decisions all the consequences for the environment which could arise from production processes or the products themselves.

The objectives are for the natural resources which form the basis of our existence on this planet to be used sparingly and in a manner which takes the requirements of both nature and humanity into account.

You too can help protect the environment by operating the engine in an environmentally-responsible manner.

Fuel consumption and engine wear depend on the operating conditions.

Therefore:

- Do not warm the engine up when the vehicle is stationary.
- Monitor fuel consumption.
- Switch off the engine in stationary traffic.
- Always have service and maintenance work carried out at a qualified specialist workshop. We recommend your Mercedes-Benz Service Centre for this purpose. It has the necessary specialist knowledge and tools to carry out the work required.

Risk of injury

Before having maintenance or repair work carried out, please make sure that you read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information. You could otherwise fail to recognise dangers, which could result in injury to yourself or others.

English

Maintenance work

Engine oil renewed and oil filter replaced at least once a year.

	Engine–oil service	
2	0101[1]	Engine: oil renewed and filter replaced.

[1] Mercedes-Benz Workshop Information System (WIS) work item number

	General maintenance work
1351	Belt drive: poly-V-belt checked for wear and damage.

If more fluid has been lost than can be accounted for by normal consumption, cause traced and rectified.

	Fluid level
2010	Engine cooling system: fluid level and corrosion inhibitor / antifreeze concentration checked and corrected.

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⚠ **Risk of injury**

Before having maintenance or repair work carried out, please make sure that you read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information. You could otherwise fail to recognise dangers, which could result in injury to yourself or others.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz Maintenance Instructions
Number:	**MB-ENG1480**
Revision:	Original

English

Confirmations of maintenance work

8th Maintenance service

Due at:

▶ Maintenance by operating hours (h)*

▶ Maintenance by distance driven (km)*

* Enter as appropriate

▶ Engine oil brand / viscosity

▶ MB Specifications for Service Products Sheet

▶ Carried out at (h / km*)

▶ Repair order number

▶ Date

▶ Signature

☐ **General maintenance work**

☐ **Fluid level**

Oil change 2

☐ **Engine**

Additional work

☐ **Valve gear**

Every third maintenance service

☐ **Fuel system**

☐ **Engine brake**

Stamp of the qualified specialist workshop

⚠ **Risk of injury**

Before having maintenance or repair work carried out, please make sure that you read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information. You could otherwise fail to recognise dangers, which could result in injury to yourself or others.

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English

Confirmations of maintenance work

19th Maintenance service

Due at:

2

▶ Maintenance by operating hours (h)*

▶ Maintenance by distance driven (km)*

* Enter as appropriate

▶ Engine oil brand / viscosity

▶ MB Specifications for Service Products Sheet

▶ Carried out at (h / km*)

▶ Repair order number

▶ Date

▶ Signature

☐ **General maintenance work**

☐ **Fluid level**

Oil change

☐ **Engine**

Additional work

☐ **Valve gear**

Every third maintenance service

☐ **Fuel system**

☐ **Engine brake**

Stamp of the qualified specialist workshop

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⚠ **Risk of injury**

Before having maintenance or repair work carried out, please make sure that you read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information. You could otherwise fail to recognise dangers, which could result in injury to yourself or others.

English

Engine data card

The data card contains all the principal engine data.

This information is essential when ordering genuine Mercedes-Benz spare parts or in the event of technical enquiries.

Affix engine data card at end of booklet.

2

⚠ **Risk of injury**

Before having maintenance or repair work carried out, please make sure that you read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information. You could otherwise fail to recognise dangers, which could result in injury to yourself or others.

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Introduction

Operating safety

▼ Operating safety

1 The operating safety of an engine firstly depends on its proper installation into the complete system (e.g. vehicle, machine, etc.). Secondly, as operator or service personnel, you also have a direct influence on the safe operation of the engine.

Some of the requirements for operating the engine safely can be achieved by adhering to the specified maintenance intervals and ensuring that the required maintenance work is carried out correctly.

However, safe engine operation also depends on correct servicing, such as checking the engine oil level at regular intervals.

Risk of accident ⚠

Improper operation of the engine, e.g. exceeding the permitted maximum engine speed in overrun mode or operating the engine with too little oil, can cause engine damage. Engine damage can lead to an increase in the risk of accident.

Therefore, observe the notes on operating the engine in these Operating Instructions.

Risk of accident ⚠

Faulty maintenance work or failure to carry out maintenance work, e.g. not changing the oil filter or not observing the correct maintenance interval, can cause engine damage. Engine damage can lead to an increase in the risk of accident.

Therefore, observe the notes on engine maintenance in these Operating Instructions.

8

1 Starter motor
2 Flywheel housing
3 Exhaust gas turbocharger
4 Exhaust manifold
5 Charge-air housing
6 Cylinder head cover
7 Oil filler neck
8 Charge pressure pipe to intercooler
9 Charge pressure pipe from intercooler
10 Crankcase ventilation system
11 Alternator

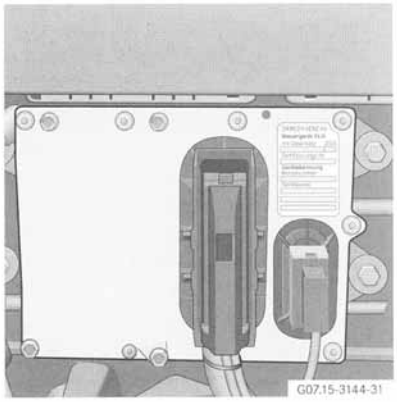
Before commissioning

General

3

Engine control unit (engine-resident)

The engine control unit is located on the left-hand side of the engine.



Engine control unit

The engine control unit processes data coming from the drive control unit or the ADM, such as the position of the setpoint value sensor (accelerator pedal), the engine brake* or engine start / stop, etc.

This data is evaluated along with data from the sensors on the engine, such as those for:

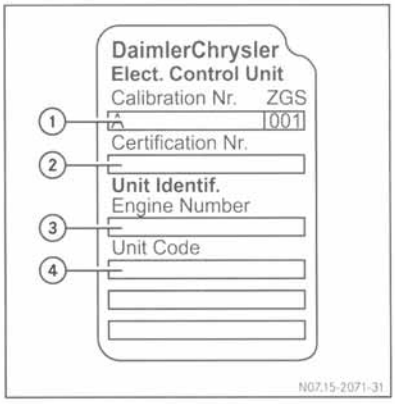
- charge-air pressure and temperature
- coolant temperature
- fuel temperature
- oil pressure

These parameters are compared with the characteristic maps and graphs stored in the engine control unit.

Start, duration and amount of injection are calculated from the graphs and the unit pumps are controlled accordingly via the solenoid valves.

All the information on the control unit type plate is required to obtain a replacement engine control unit.

The type plate is located on the engine control unit in the upper right-hand corner.



Control unit type plate

① Data record
② Certification no.
③ Engine plate
④ Equipment code

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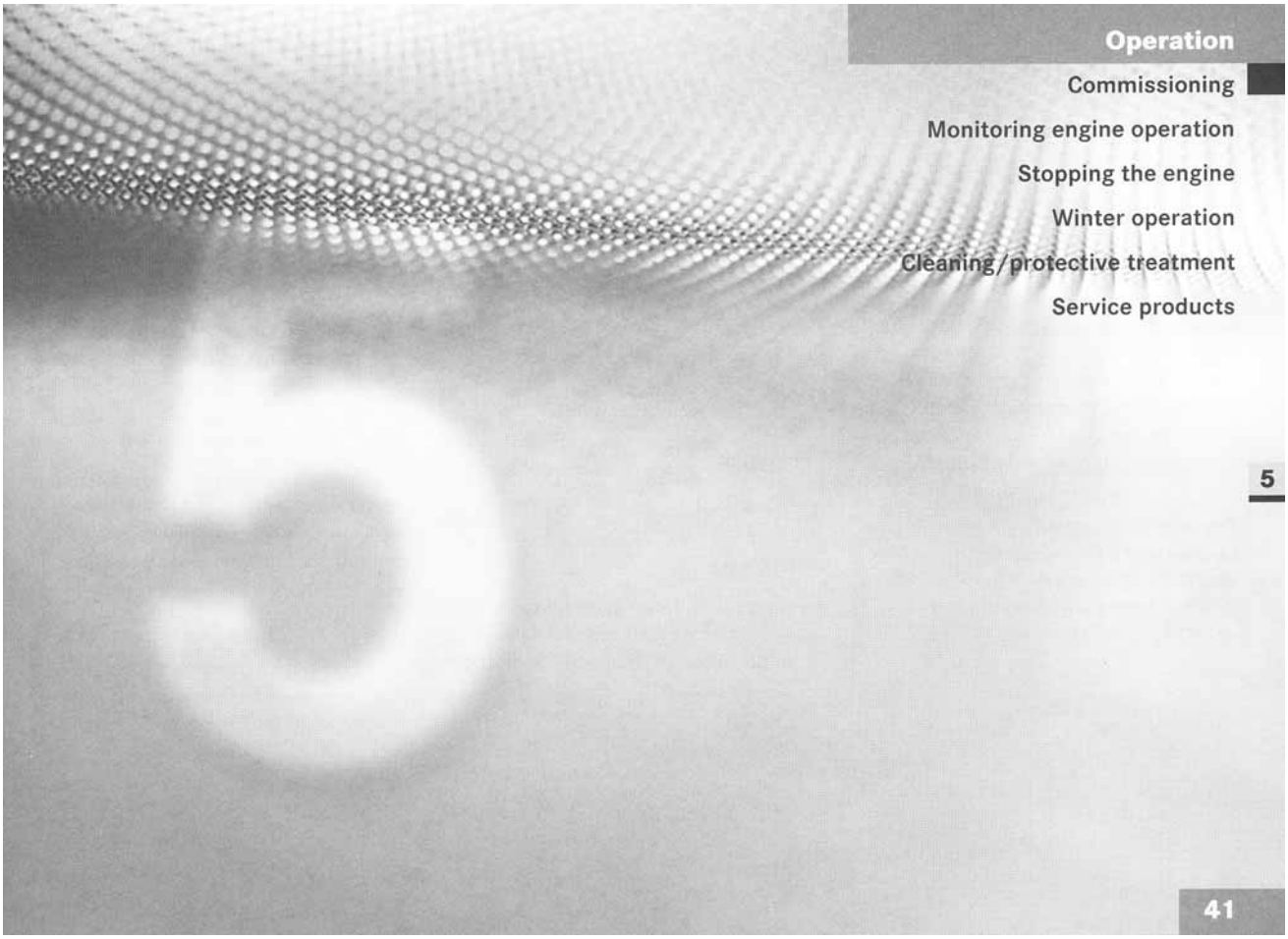
Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz
Number:	**MB-ENG1479**
Revision:	Original

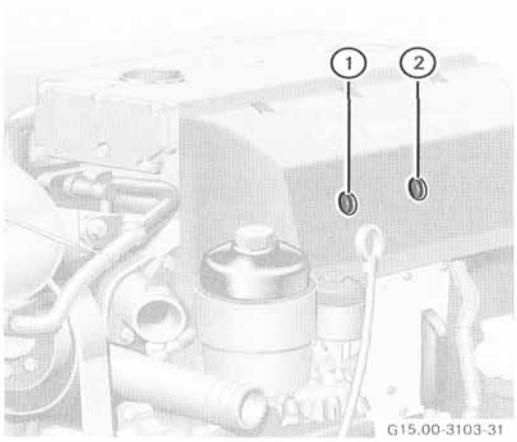


Operation

Stopping the engine

▼ Stopping the engine

► After driving at full power output or at a high coolant temperature, allow the engine to idle without load for one or two minutes.



Start-Stop buttons

① Stop button
② Start button

► Press Stop button ① on the engine or on the equipment-resident stopping facility.

Stop the engine immediately if you observe any of the following signs:

- oil pressure drops or fluctuates considerably
- power and speed drop while the position sensor (accelerator pedal position sensor) stays in the same position
- large amounts of exhaust smoke are emitted from the exhaust
- coolant and oil temperature increase very quickly
- unusual noises suddenly occur in the engine or exhaust gas turbocharger

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If engine oils of a different grade are used, the oil change intervals will alter. Information is available from any Mercedes-Benz Service Centre. Select the SAE class of engine oil in accordance with the outside temperatures.

After maintenance work, the engine oil change is entered in the Maintenance Booklet along with the engine oil brand, grade and SAE class.

Only use engine oils of the same grade and SAE class when topping up.

If engine oil of a lower grade is used to top up, the properties of the engine oil are impaired and the engine oil and filter changes must therefore be carried out at shorter intervals.

Coolant

Risk of poisoning

There is a risk of poisoning if coolant is swallowed.

- Never swallow coolant.
- Never put coolant into container normally used for beverages.
- Store coolant out of the reach of children.

The coolant is a mixture of water and antifreeze/corrosion inhibitor. The coolant must remain in the cooling system all year round to ensure anti-corrosion protection and to increase the boiling point.

Renew the coolant every three years, since the level of corrosion protection gradually decreases.

Water

Water without additives is not permitted as a coolant, even if antifreeze properties are not necessary.

The coolant water must satisfy certain requirements which are not always fulfilled by drinking water.

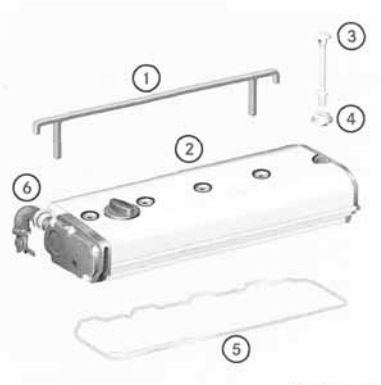
If the water is not of sufficient quality, it must be treated.

Information is available from any Mercedes-Benz Service Centre.

Maintenance

Work plans

Removing and fitting the cylinder head cover



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6

① Charge-air manifold
② Cylinder head cover
③ Allen bolt
④ Sealing washer
⑤ Cover seal
⑥ Engine breather hose

Removing:

- ▶ Remove engine breather hose ⑥ from the cylinder head cover.
- ▶ Unscrew Allen bolt ③ from the cylinder head cover together with sealing washers ④.
- ▶ Remove cylinder head cover ②.

Fitting:

- ▶ Clean the cylinder head and the cylinder head cover sealing surfaces.
- ▶ Check the gasket between the cylinder head cover and charge-air manifold ① and replace if necessary.
- ▶ Always replace the gasket between the cylinder head cover and the cylinder head.
- ▶ Position the cylinder head cover.
- ▶ Fit Allen bolts ③ with new sealing washers ④ and tighten
  Tightening torque: 30 Nm.

G01.40-3110-31

Flywheel housing inspection hole

- ▶ Fit rotation device (904 589 04 63 00) on the flywheel housing inspection hole.

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Damage patterns

① Condition as new (as reference: trapezoidal ribs)
② One-sided wear: wedge-shaped ribs
③ Cord visible in the base of the ribs
④ Ribs split
⑤ Transverse cracks in several ribs
⑥ Rubber lumps in the base of the belt
⑦ Deposits of dirt or stones
⑧ Rib detached from the base of the belt
⑨ Cord torn out to the side
⑩ Outer cord frayed
⑪ Transverse cracks on the back of the belt
⑫ Transverse cracks in several ribs

Environmental note

Dispose of used coolant in accordance with prevailing local regulations
(▷ see page 64).

- ▶ Clear blocked drain openings from deposits.
- ▶ Retighten the coolant drain plug on the engine.
- ▶ Pull off the drain hose.
- ▶ Fit additional drain plugs (without hose connections) with new seals and screw tight.

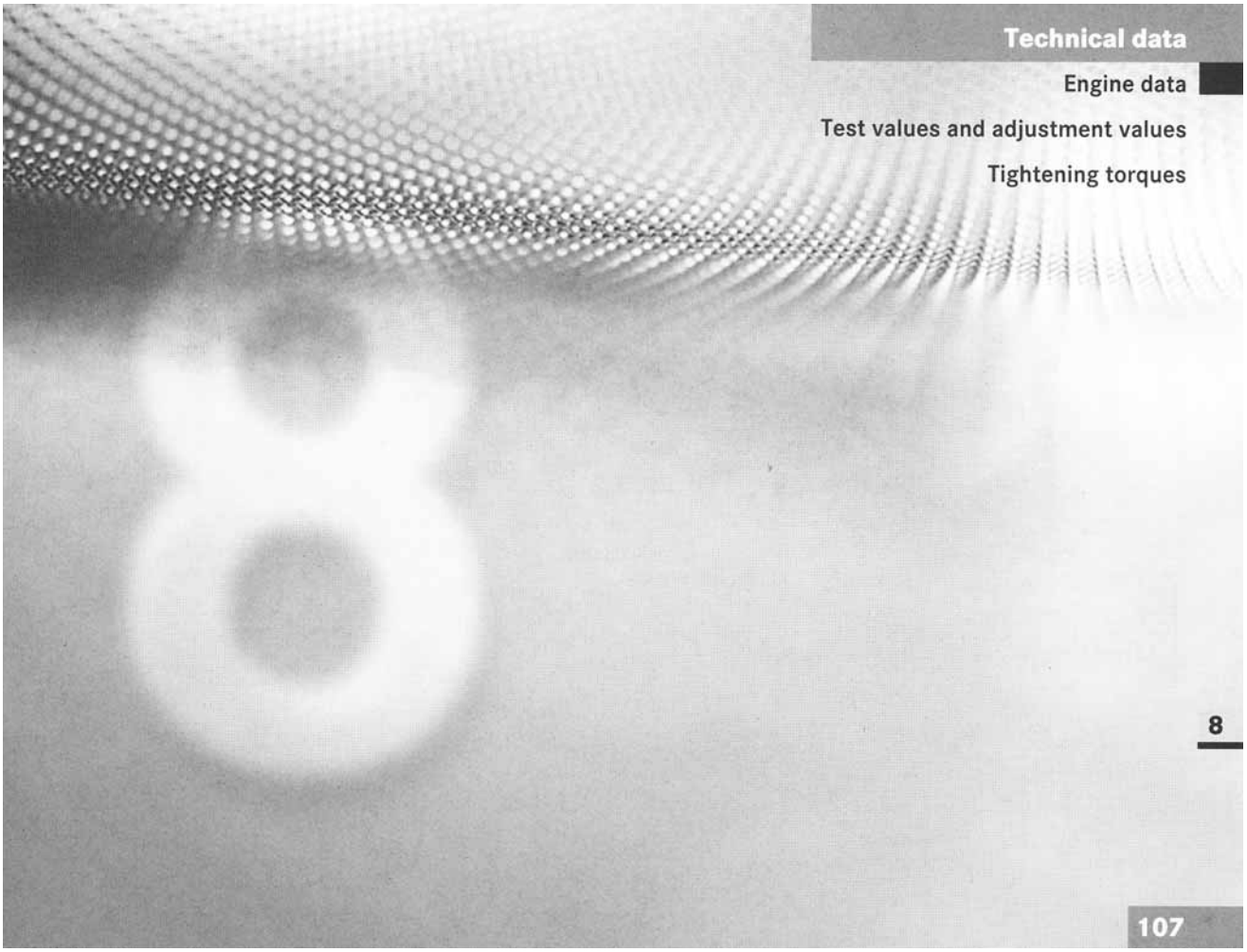
6

Adding coolant

- ▶ Start the engine and allow it to run at different speeds for approximately 1 minute.
- ▶ Add coolant in the specified ratio until it reaches the lower edge of the filler neck.
- ▶ Switch off the engine and close the cooling system again.

For further information, see the vehicle manufacturer's operating instructions.

Title:	Mercedes-Benz
Number:	**MB-ENG1479**
Revision:	Original



Index

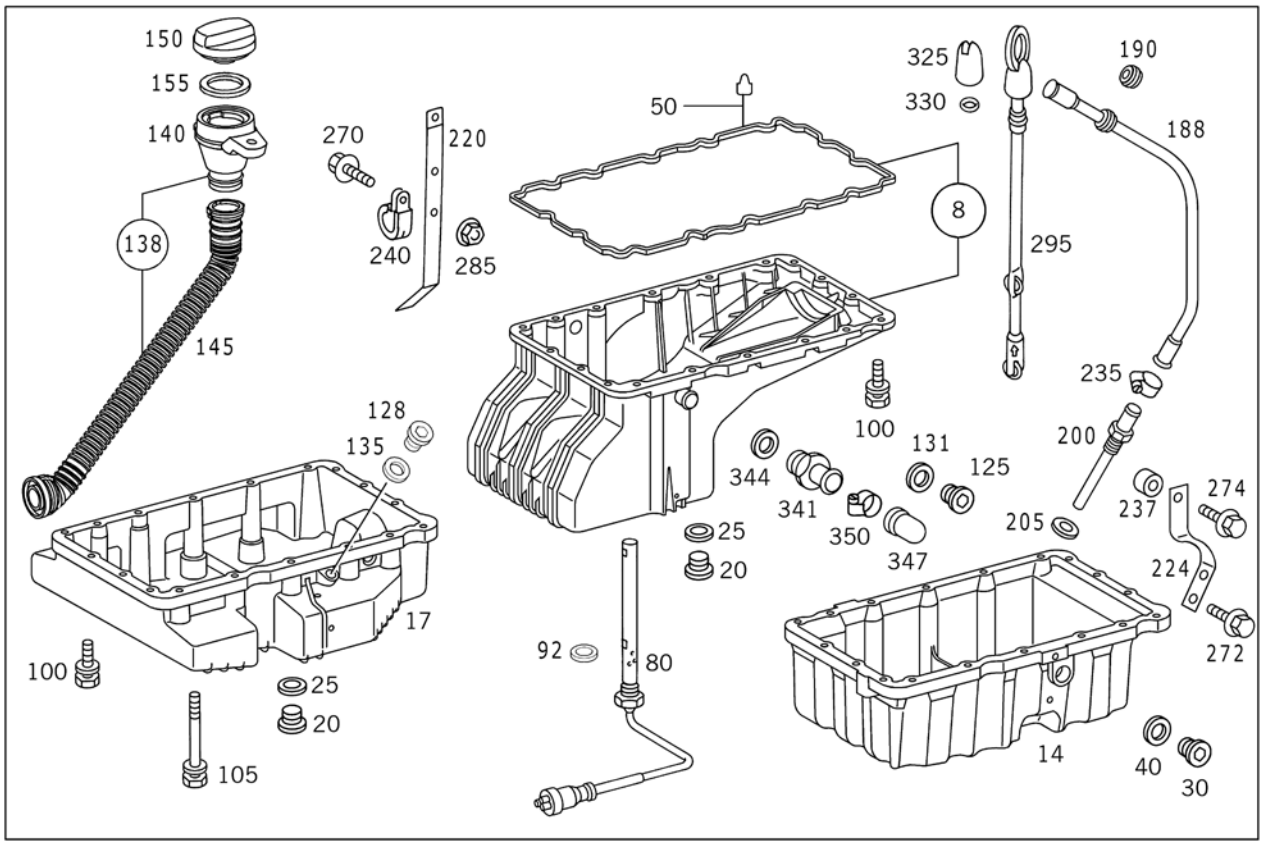
Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz Parts Catalog
Number:	**MB-ENG1463**
Revision:	Original

Motorgehäuse | Carter do motor
Engine Housing | Cárter del motor
Carter du moteur | картер двигателя
Basamento motore | هيكل الموتور

Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة

01 060 00178



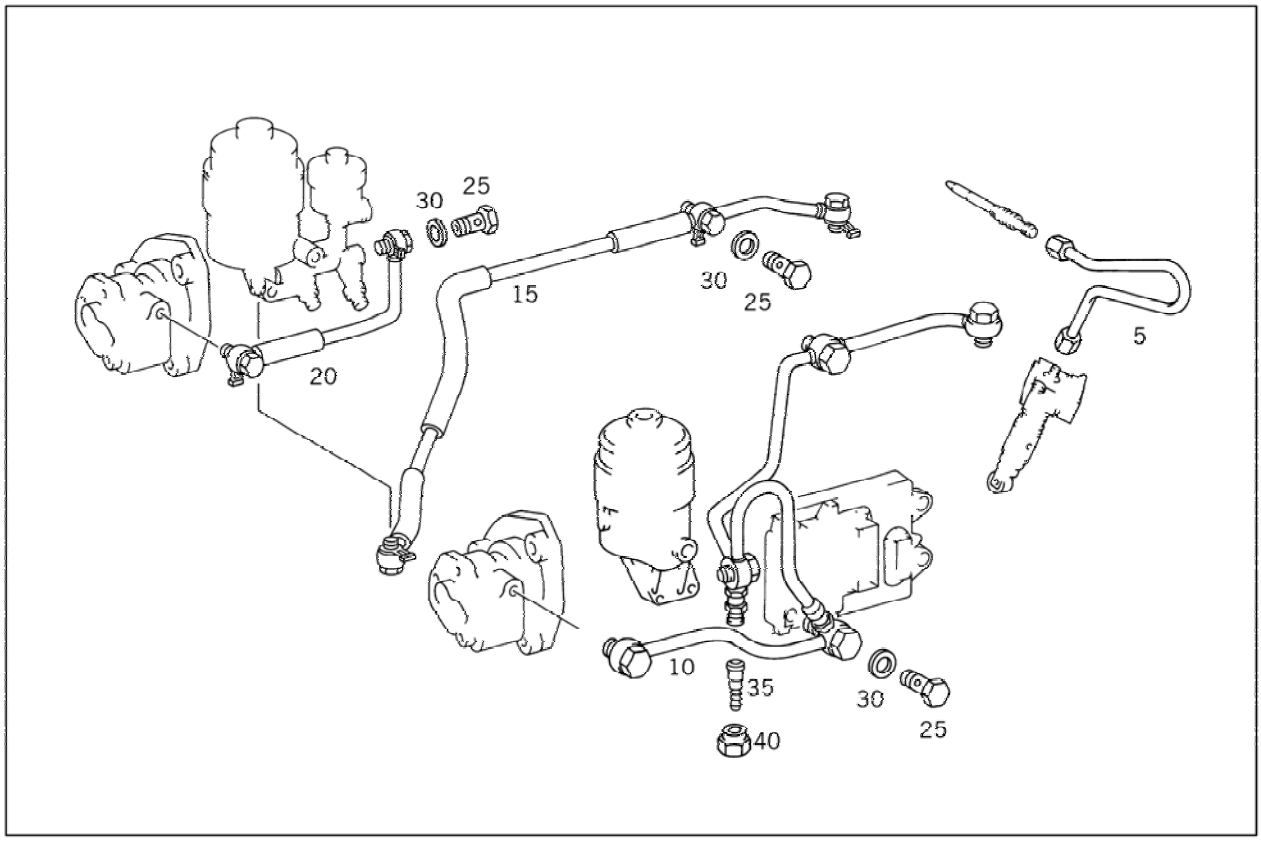
Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz Parts Catalog
Number:	**MB-ENG1463**
Revision:	Original

Kraftstoffpumpe | Bomba de combustível
Fuel Pump | Bomba de combustible
Pompe d' alimentation | топливный насос
Pompa combustibile | مضخة الوقود

Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة

07 090 00144



Maclean Canada - MAINTENANCE BULLETIN

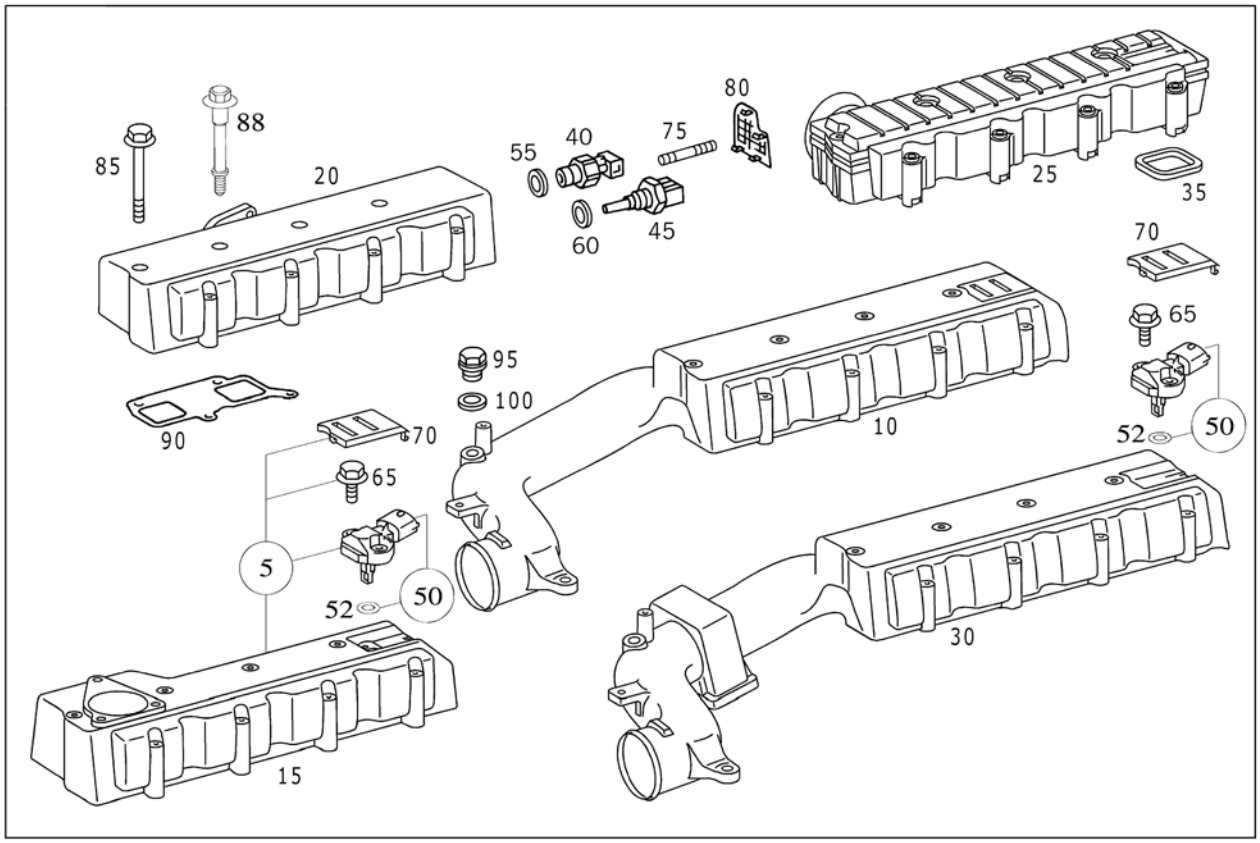
Title:	Mercedes-Benz Parts Catalog
Number:	**MB-ENG1463**
Revision:	Original

Saugrohr und Auspuffkrümmer
Intake and Exhaust Manifolds
Collecteurs d'admission et d'échappement
Condotto aspirazione e collettore scarico

Tubo de admissão e colector de escape
Tubo de admisión y colector de escape
впускная труба и колено выпускного трубопровода
أنبـوب أمتصـاص والعادم المشعـب

Gruppe / Group / Groupe / Gruppo
Grupo / Grupo / группа / المجمـوعـة

14 015 00194



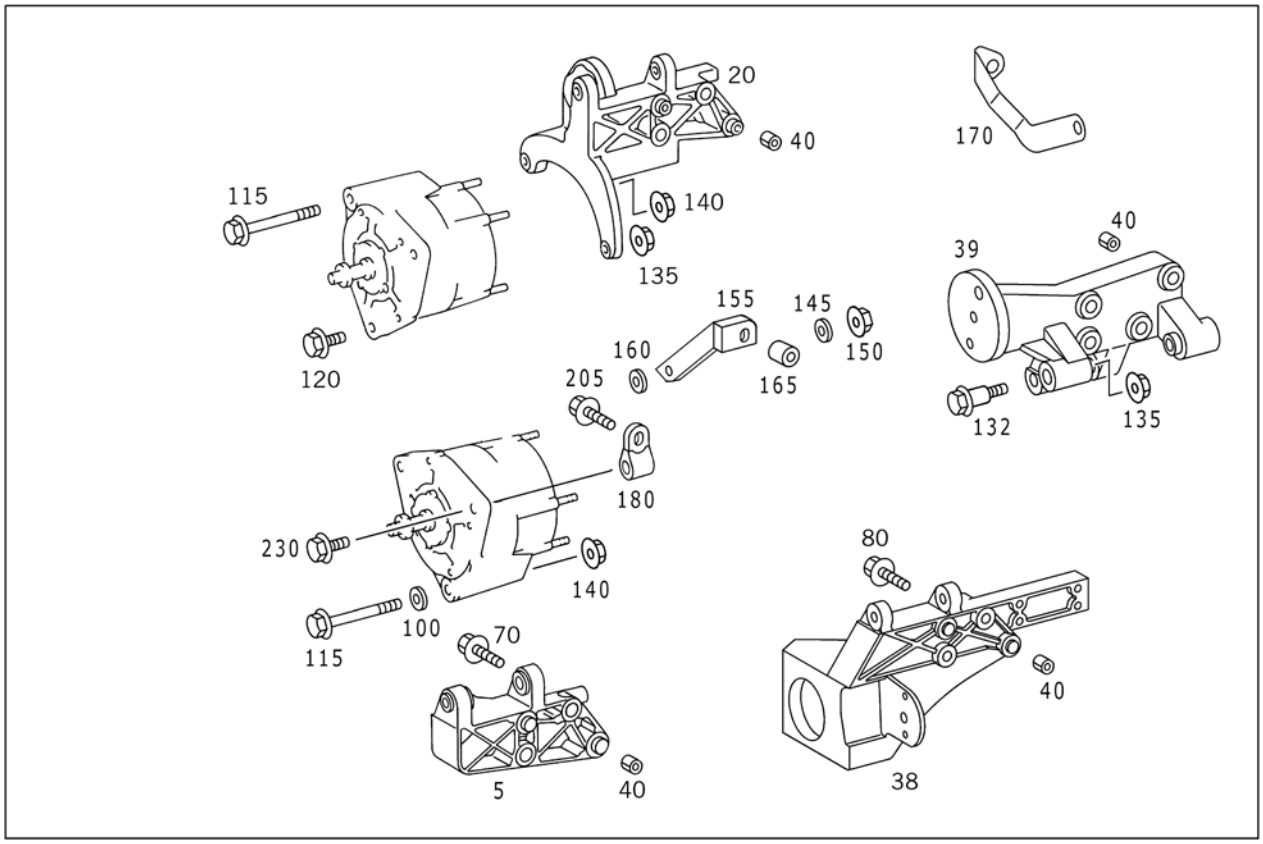
Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz Parts Catalog
Number:	**MB-ENG1463**
Revision:	Original

Elektrische Ausrüstung | Equipamento eléctrico
Electrical Equipment | Equipo eléctrico
Equipement électrique | электрооборудование
Impianto elettrico | التجهيزات الكهربائية

Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة

15 045 00172

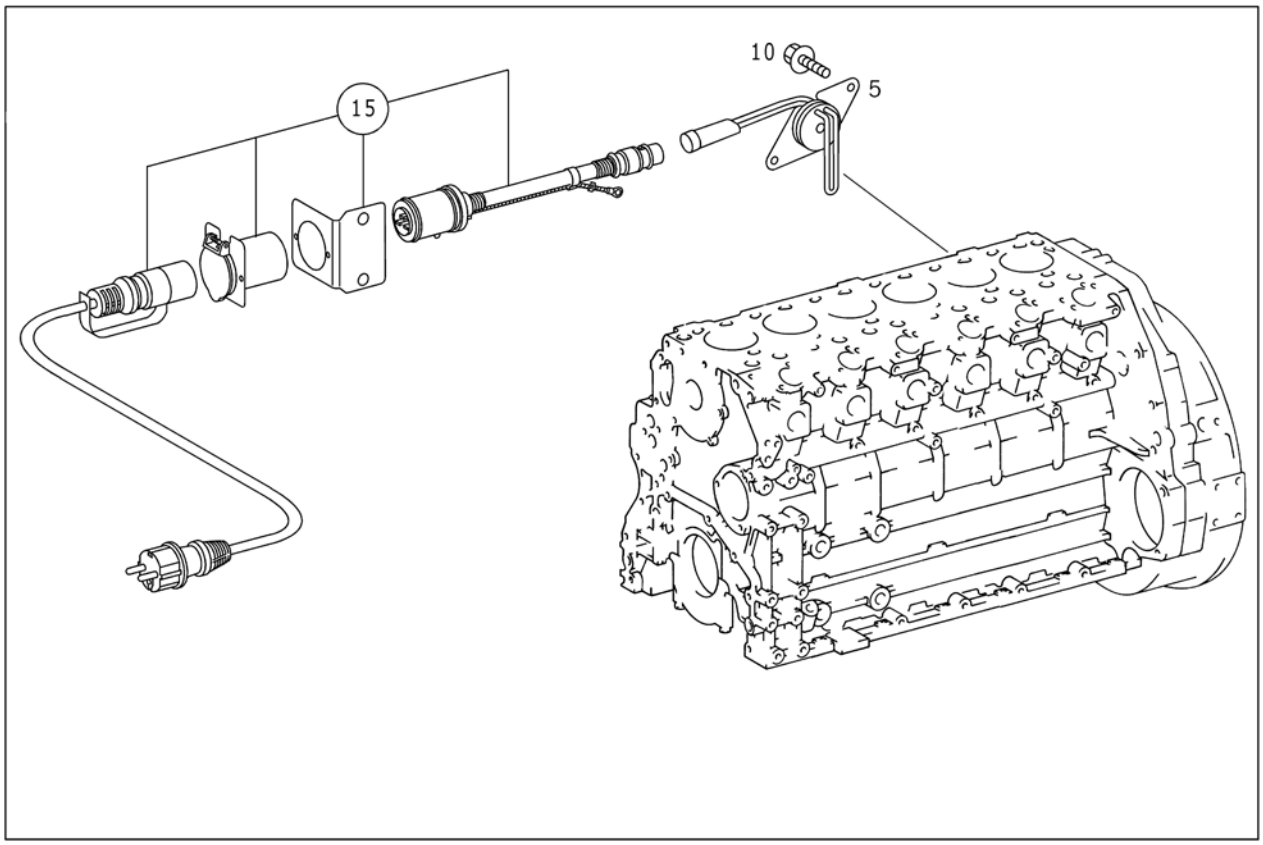


Maclean Canada - MAINTENANCE BULLETIN

Title:	Mercedes-Benz Parts Catalog
Number:	**MB-ENG1463**
Revision:	Original

Motorkühlung
Engine Cooling System
Refroidissement du moteur
Raffreddamento motore
Refrigeração do motor
Refrigeración del motor
охлаждение двигателя
تبريد الموتور

Gruppe
Group
Groupe
Gruppo
Grupo
Grupo
группа
المجموعة
20 100 00007



2.0 Notes:

If any questions or problems arise, please contact Maclean Engineering Technical Service for assistance.

Phone: 1-866-856-3626
Email: service@macleanengineering.com

2

FEBRUARY 2004

CONTENTS

MESABI® Radiator Cores

This Service Manual is Available TO PRINT Online at WWW.Mesabi.com. A Service Video IS Also Available for viewing online, or request a copy from L&M Radiator.

DO NOT VOID WARRANTY. CONTACT L&M's CUSTOMER SERVICE DEPARTMENT PRIOR TO REPAIRS WHERE WARRANTY IS A POSSIBILITY.

MESABI® RADIATOR AND CORE 48-MONTH WARRANTY

L&M Radiator warrants the MESABI® Core and framework manufactured by L&M for a period of 18 months from date of invoice. Under this warranty, our obligation is limited to the repair or replacement (at our option) of products or parts manufactured by L&M that are proven to be defective in workmanship or material. L&M further warrants the MESABI® Core against seal leakage during normal use for 48 months from date of invoice on new cores with MESABI® fluorocarbon seals installed. Damage or leakage due to accidents, misuse, or corrosion is not warranted.

Warranty on components not manufactured by L&M Radiator shall be that of the individual manufacturers. Individual manufacturers operational and maintenance requirements must be met and their policies regarding shipment and inspection of claimed defective parts will apply.

L&M is not liable for consequential or incidental damages or costs. Consult factory before proceeding with warranty claims. This warranty supersedes all previously published warranties.

MESABI® is a registered trademark of L&M Radiator, Inc. ITS™ is a trademark of L&M Radiator, Inc.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Cavotec, Cable Reel Instruction Manual
Number:	**MB-ELE1632**
Revision:	Original

8.	TURNOVER ANCHOR	optional (central feeding point made by others)
9.	CABLE TRENCH	not delivered by Specimas Trench profiles delivered in conjunction with the Panzerbelt ® System.
10.	CABLE PROTECTION SYSTEM	Panzerbelt ® system delivered by Specimas on request.
11.	JUNCTION BOX	optional (or fixed junction)
12.	CABLE GRIP	optional for fixing cable on drum and in center feeding point.
13.	CABLE TERMINATION KITS	optional

THE BASIC FEATURES OF THE SYSTEM

- Maximum compactness of torque unit, motor and collector when assembled together.
- Possibility to adjust the output torque according to the work or load requirement.
- Automatic braking which allows the cable to be unreeled in case of power failure.
- Few components, easily interchangeable.
- Can be powered by conventional squirrel cage, flange mounted motors.

1. MOTOR

Any type of motor is suitable, providing it can be fed by the power available on the machine on which the cable reel is fitted.
The most widely used are squirrel cage electric motors, but hydraulic and pneumatic motors are also frequently used, for instance, in most mining applications.
Optional motor heater or motor heat sensors can be installed (clixon, PTC, PT100).

2. TORQUE UNIT

This is the basic component of the Specimas system. It incorporates an irreversible worm reduction which is automatically braking and totally immersed in oil. The irreversible worm reduction gives these three functions in one compact unit:

– reduction of motor speed to needed drum speed
– self braking (always with constant torque)
– adjustable torque output clutch.

The output torque can be easily adjusted according to the requirement of the application.
This operation is carried out during the initial setting up of the cable reel, and few further adjustments are generally required.
The torque unit is explained in detail in chapter 2.
Optional low and high temperature sensors can be mounted.

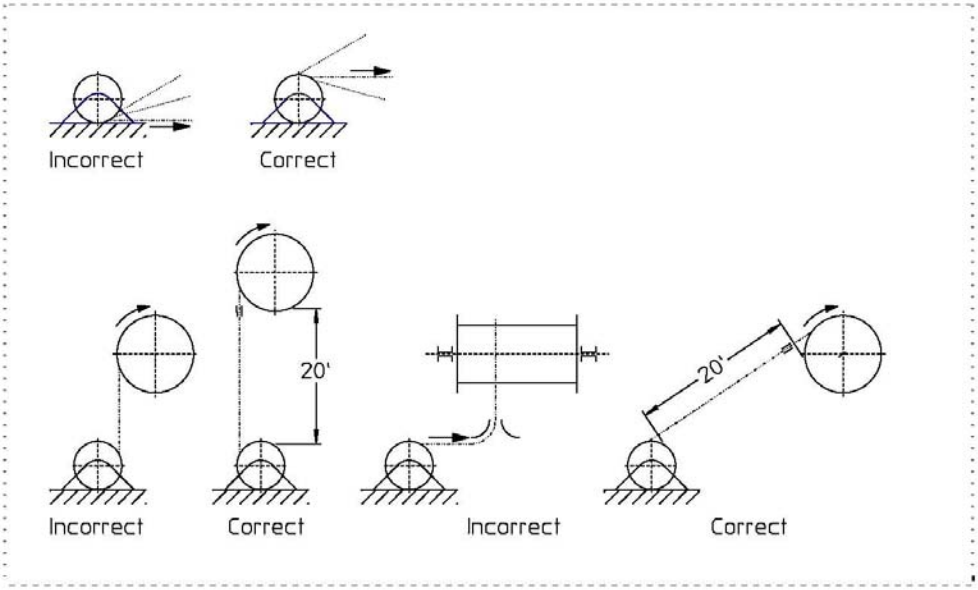
3. DRUM

Specimas drums are module designed, using standard stock components, offering a wide range of selections.
Drums are manufactured from steel tubing and surface treated to withstand tropical and marine corrosive conditions (hot dip galvanized).

CABLE INSTALLATION ON REEL

CABLE INSTALLATION

Generally when cable is installed onto a forced guidance system i.e. reeler system, the transport reel should be jacked up above ground level. Avoid introducing "S" bends. Advice for specific types of guidance system follows the notes on twist removal.



CABLE INSTALLATION ON REEL

A. Power cable is normally manufactured with a left hand conductor lay. This conductor lay has the natural effect of making the cable roll to the left. Therefore important that the first turn of cable be wound on the drum against the reel's left hand flange and angled correctly. This allows the cable to layer on the drum correctly. (see fig.1)

B. Control cables, standard with their right hand lay, should be installed in the opposing direction. (see fig.2)

On site cable installation consists to jack up the transport reel and unwind the cable onto the cable run along the entire length of the crane route. If the marking or jacket imprinting on the cable shows a slight spiraling around the cable along its length, do not attempt to straighten the cable. The spiraling is a natural effect of the manufacturing process which is sometimes evident over long cable lengths.

This method is recommended when the reel location and/or cable runway are not accessible. Avoid introducing "S" bends between the transport reel and the reel during this procedure. Whenever possible, the cable should be transferred directly from the transport reel onto the reel without passing over any guide rollers or changes of direction.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Cavotec, Cable Reel Instruction Manual
Number:	**MB-ELE1632**
Revision:	Original

Motor Drain Option[3]	Drain Position [3]	Section Connection	511	Unit	Displacement	Shaft Seal	Side Suction Port	Side Pressure Port	Rear Suction Port [2]	Rear Pressure Port [2]	4)

1

Code	Section Connection
S	Separate inlets
C	Common inlets

Code	Drain Position
2	Drain on bottom
3	Drain on top
4	Rear drain
5	Drain right view on drive shaft
6	Drain left view on drive shaft

Code	Motor Drain Option
B1	no drain
G	1/4 BSP thread
N	M10x1 metric thread

Code	Flange
D3	71.4x96.0 - Ø36.47 rectangular
D4	72.0x100.0 - Ø80 rectangular
H2	106.4 - Ø82.55 SAE "A" 2bolt flange
Q1	60.0x60.0 - Ø52.0 w/o seal ,O' thrubolt flange
Q2	60.0x60.0 - Ø50.0 w. seal ,O' thrubolt flange
Q3	60.0x60.0 - Ø52.0 w/o seal ,O' thrubolt flange
Q4	60.0x60.0 - Ø50.0 w. seal O' ,thrubolt flange

Code	Port Options	Code	Port Options
B1	No ports	L1*	13mm-Ø30mm-M6 diamond
E2	3/8 - 19 BSP thread	L2*	19mm-Ø40mm-M8 diamond
E3	1/2 - 12 BSP thread	P2*	19.0mm - M10 Metric Split Flange
E4*	5/8 - 14 BSP thread	P3*	25.4mm - M10 Metric Split Flange
E5*	3/4 - 14 BSP thread	P4*	31.8mm - M10 Metric Split Flange
E6*	1 - 11 BSP thread		
E7*	1 1/4 - 11 BSP thread		
G1	M14x1.5 thread		
G3	M18x1.5 thread		
G4	M22x1.5 thread		
G5*	M26x1.5 thread		
G7*	M30x1.5 thread		
J3*	8mm - Ø30mm - M6 square		
J4*	12mm - Ø30mm - M6 square		
J5*	15mm - Ø35mm - M6 square		
J6*	15mm - Ø40mm - M8 square		
J7*	20mm - Ø40mm - M6 square		
J8*	18mm - Ø55mm - M8 square		
J9*	26mm - Ø55mm - M8 square		

* Not usable for rear ports.

4) For further "B" triple unit repeat
displacement,
shaft seal between sections,
side suction port,
side pressure port,
rear suction port,
rear pressure port.

Maclean Canada - MAINTENANCE BULLETIN

Title:	Cavotec, Cable Reel Instruction Manual
Number:	**MB-ELE1632**
Revision:	Original

Lista Pezzi/Parts List

1

Codice/Part No: S22-00450-115
Lista/List Rev: 2
Data/Date: 10-nov-04
Descrizione: Frutto collettore K450/1 1 kV prep FC Ravasi interno
Description: Frutto collettore K450/1 1 kV prep FC Ravasi interno
Disegno/Drawing No: AC-162
Disegno/Drawing Rev: C
Peso/Weight (kg): 11 kg

Rev	*Data*	*Nome*	*Descrizione*
0			Pubblicato per produzione
1	24-ago-04	AAF	Aggiunto collegamento di terra
2	10-nov-04	AAF	Revisionato
3			
4			
5			
6			

Pos.	Codice/Part No.	Descrizione	Description	Qty	Peso (kg)	Disegno/Dwg No.	Rev	Comment
1	S87-10201-000	Supporto SBPF 201		1				
2	SR2-05982-000	Flangia supporto Koyo K450	Support flange Koyo K450	1		PS-5982		
3	S40-73906-016	Vite TE M6 x 16	Hexagon screw M6 x 16	5				
4	S48-8842X-006	Rosetta dent. M6	Lock washer M6 s.s.	3				
5	S49-5588G-006	Dado galvanizzato M6	Nut M6 galvanizzed	5				
6	SR2-03834-000	Squadretta		1		PS-3834		
7	S47-6592G-008	Rosetta piana M8	Washer M8 plain	4				
8	S40-73908-016	Vite TE M8 x 16	Hexagonal screw M8	2				
9	SR2-03833-000	Triangolo di chiusura porta anelli		1		PS-3833	C	
10	S40-73912-055	Vite TE M12 x 55	Hexagonal screw M8	1				
11	S49-5589G-012	Dado galvanizzato M12 basso	Nut M12 galvanizzed low profile	1				
12	SR2-05649-000	Pignone conico a denti dritti M12		1		PS-5649		
13	S49-5589G-010	Dado galvanizzato M10 basso	Nut M10 galvanizzed low profile	15				
14	S47-6592G-010	Rosetta piana M10		13				
15	S92-1522W-012	Tubo WT Ø22x15x12	Fibreglass tube Ø22x15x12	3				
16	S45-1000G-320	Tirante M10 x 320 galvanizzato	Tierod M10 x 320 galvanized	3				
17	SR2-01368-000	Anello collettore Ø170 Sp 30 No 5 cave		4		PS-1368	C	
18	S92-1522W-060	Tubo WT Ø22x15x60	Fibreglass tube Ø22x15x60	9				
19	SR2-03832-000	Anello Ø170	Ring Ø170	2		PS-3832		
20	S92-1522W-035	Tubo WT Ø22x15x35	Fibreglass tube Ø22x15x35	3				
21	S92-1014P-282	Tubo PVC Ø15x1x282	PVC tube Ø15x1x282	3				
22	SR2-05947-002	Flangia porta anelli Øe160 x Øi64 x 6		1		PS-5947		
23	SR2-05432-000	Basetta anelli Øi70 in alluminio		1		PS-5432	E	
24	S42-93308-025	Vite TSPEI M8 x 25	Screw TSPEI M8 x 25	3				
25	S92-1522W-030	Tubo WT Ø22x15x30	Fibreglass tube Ø22x15x30	3				
26	SR2-05650-000	Pignone conico a denti dritti		1		PS-5650		
27	SR2-05651-000	Bussola di riduzione per F. C.		1		PS-5951		
28	SR2-05646-000	Squadretta di supporto FC Ravasi MF2C		1		PS-5646		
29	S40-73904-020	Vite TE M4 x 20	Hexagon screw M4 x 20	2				
30	S47-6592G-006	Rosetta piana M6	Washer plain M6	2				
31	S49-5588G-004	Dado galvanizzato M4	Nut M4 galvanizzed	2				
32	SR2-05948-000	Supporto di sostegno		1		PS-5948	B	
33	S47-6593G-004	Rosetta piana extra larga M4	Washer plain extra large M4	2				
34	S47-6592G-004	Rosetta piana M4	Washer plain M4	2				
35	SR2-01804-000	Supporto di base	Base plate	1		PS-1804	C	
36	S45-1000G-380	Tirante M10 x 380 galvanizzato	Tierod M10 x 380 galvanized	2				

Distinta AC-162c - S22-00450-115.xls Page 1 of 2 Printed 13/07/2006

Control Unit	J1939 SPN	J1587 PID	J1587 SID	FMI	Description of Code
ECU	98	98	-	5	Engine Oil Level Sensor Open Circuit
ECU	98	98	-	2	Engine Oil Level Too High or Too Low
VCU	100	100	-	1	Engine Oil Pressure Low
ECU	100	100	-	3	Engine Oil Pressure Sensor Open Circuit
ECU	100	100	-	2	Engine Oil Pressure Sensor Data Erratic
ECU	100	100	-	4	Engine Oil Pressure Sensor Short to Ground
VCU	100	100	-	14	Engine Oil Pressure Too Low
ECU	102	102	-	0	Boost Pressure High
ECU	102	102	-	1	Boost Pressure Low
ECU	102	102	-	2	Boost Pressure Sensor Data Erratic
ECU	102	102	-	3	Boost Pressure Sensor Open Circuit
ECU	102	102	-	4	Boost Pressure Sensor Short to Ground
ECU	102	102	-	14	Boost Pressure Out of Range
ECU	103	103	-	7	Turbo Charger 1 No Rev
ECU	103	103	-	14	Turbo Charger 2 No Rev
ECU	105	105	-	3	Intake Manifold Temperature Sensor Open Circuit
ECU	105	105	-	4	Intake Manifold Temperature Sensor Short to Ground
ECU	105	105	-	0	Intake Manifold Temperature High
VCU	107	107	-	0	Air Filter Restriction High
VCU	107	107	-	3	Air Filter Sensor Open Circuit
VCU	107	107	-	4	Air Filter Sensor Short to Ground
VCU	110	110	-	14	Engine Coolant Temperature Very High
VCU	110	110	-	0	Engine Coolant Temperature High
ECU	110	110	-	4	Engine Coolant Temperature Sensor Short to Ground
ECU	110	110	-	3	Engine Coolant Temperature Sensor Open Circuit
VCU	111	111	-	1	Coolant Level Low
VCU	111	111	-	3	Coolant Level Sensor Open Circuit
VCU	111	111	-	4	Coolant Level Sensor Short to Ground
VCU	111	111	-	14	Coolant Level Very Low
VCU		123	-	7	OI Loop Fault
VCU	158	158	-	0	Switched Battery Voltage High
VCU	158	158	-	1	Switched Battery Voltage Low
ECU	158	158	-	2	Switched Battery Voltage Does Not Match ECU and VCU
ECU	168	168	-	3	Battery Voltage High
ECU	168	168	-	4	Battery Voltage Low

In order to reconfigure the digital outputs to produce the pulse width modulated signal with a minimum starting current, the “Ratio 1” parameter has to be changed from 100% to 30% for most of the digital outputs. For channels 8, 9, 10, 11, 14 and 15 the “Ratio 1” parameter has to be changed to 25%. Also, the “Ratio 2” parameter has to be changed from 100% to 85% for all of the digital outputs.

The number of digital outputs to be adjusted will be from output number 00 to output number 15. Use the “UP” and “DOWN” tabs to scroll from one parameter to the next or type in the equivalent letter displayed with each one (example: <b> for Ratio 1) to select the desired parameter to be changed. The selected parameter will be highlighted when selected. Please note that when selecting the parameter using it’s designated letter, the software is case sensitive so the selection must be made using lower case letters.

Use the “VALUE +”, “VALUE ++”, “VALUE –“, and “VALUE --“ tabs to change the value of the selected parameters. In the case of the “Ratio 1” parameter, the “Value +” and “Value –“ tabs will increase or decrease the value by a factor of 5 respectfully. The “Value ++” and “Value --“ tabs will increase or decrease the value by a factor of 50 respectfully. In the case of the “Output-Number” parameter, the “Value +” and “Value –“ tabs will increase or decrease the value by a factor of 1 respectfully. The “Value ++” and “Value --“ tabs will increase or decrease the value by a factor of 10 respectfully.

Once all of the outputs have been reconfigured, click the “Save to EEprom” tab to update the controller and save all of the changes. The software will automatically switch to the logged in screen once the changes have been saved.

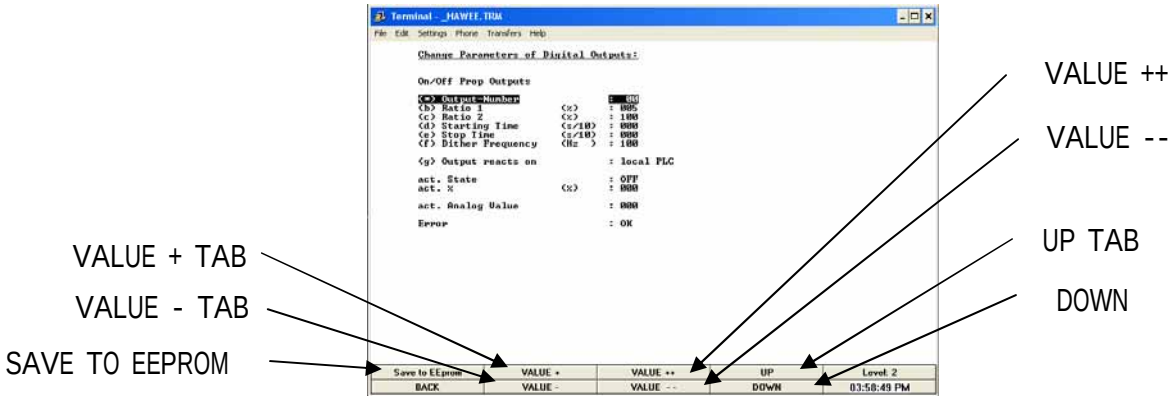


Figure 7 – Digital Outputs Parameter Screen

Maclean Canada - MAINTENANCE BULLETIN

Title:	Inspection, Control System Functionality
Number:	MB-ELE1445
Revision:	Original

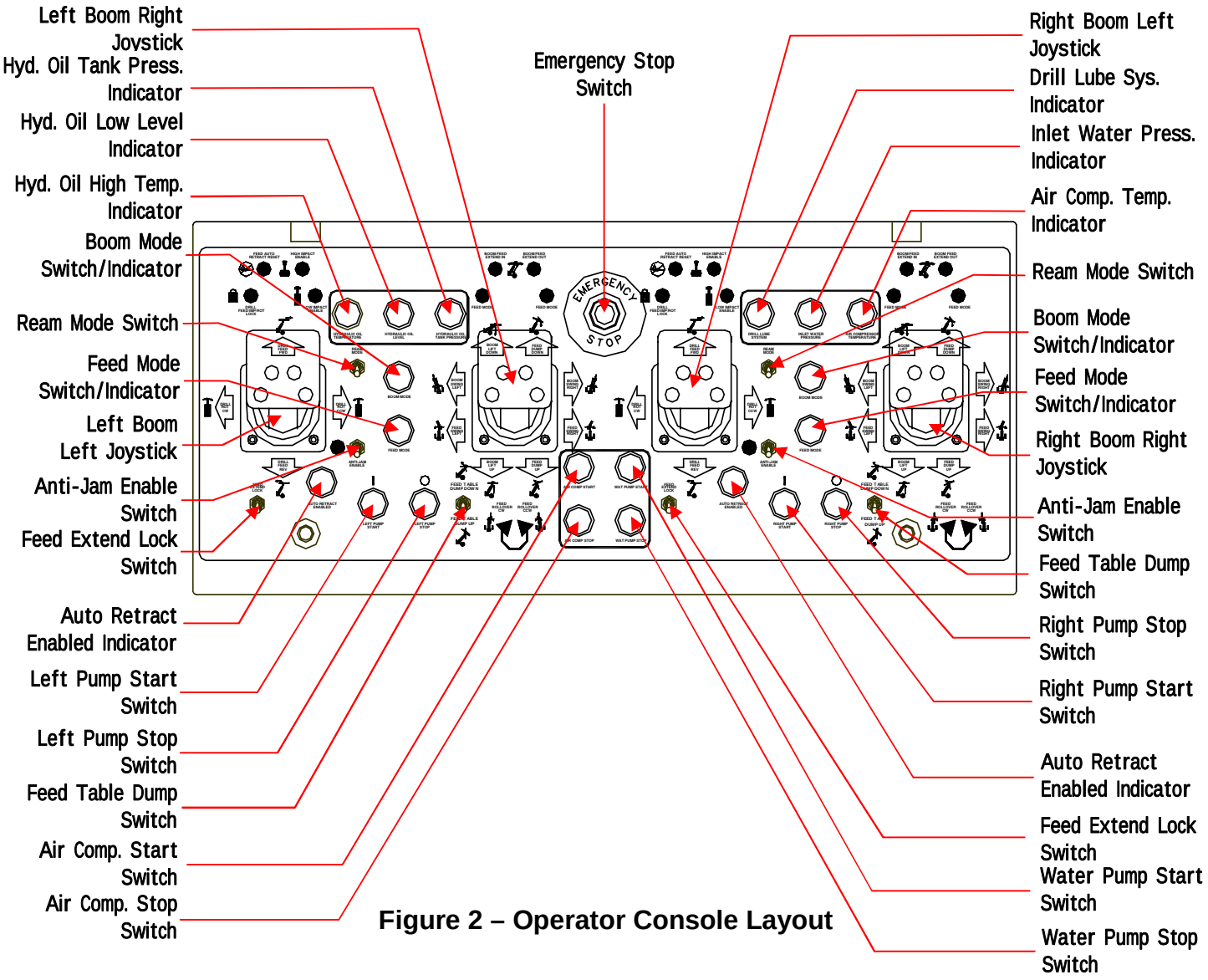


Figure 2 – Operator Console Layout

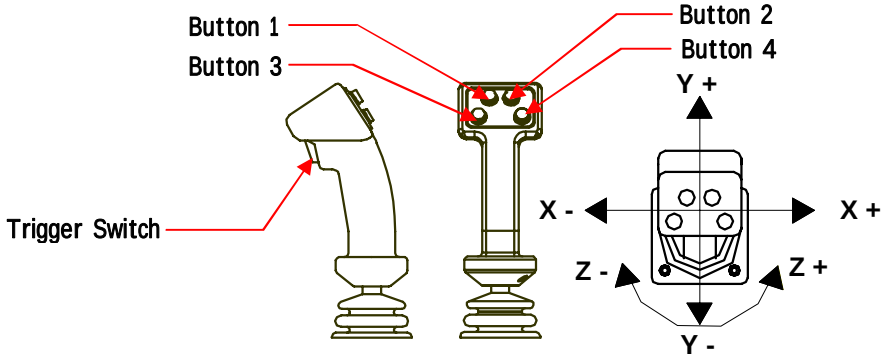


Figure 3 – Typical Joystick Layout

3.0 Panel Preventive Maintenance:

1. Open each enclosure and inspect for moisture in the panel. If moisture is found, dry out the panel and its components. Inspect enclosures for watermarks or other evidence of water ingress at switches, lights, gauges, enclosure lid, cable entry points, etc. Inspect the condition of all gaskets and seals, and replace or repair as necessary to prevent water from entering. Check that enclosure lid latching devices are in good condition and are capable of holding the lid sealed shut against moisture and/or contamination ingress. Replace or repair as necessary.

2. Vacuum inside each enclosure to remove any build up of dirt or other foreign objects.

3. Wipe down enclosures with rags and glass cleaner to remove any built-up dirt.

4. Inspect all electrical enclosures for missing, broken, or loose devices. (i.e. indicating lights, switches, meters, strain reliefs, etc.) Replace, repair and tighten these devices to prevent moisture or dirt from entering the enclosure and causing damage. Non-conducting, non-corrosive silicone sealant (MEMCO # 1008812) can be used to help seal devices at openings. Ensure that any unused holes resulting from removed cables or devices are sealed with a proper plug or gasketed cover plate.

5. Examine for missing or damaged decals or labels. Replace as necessary.

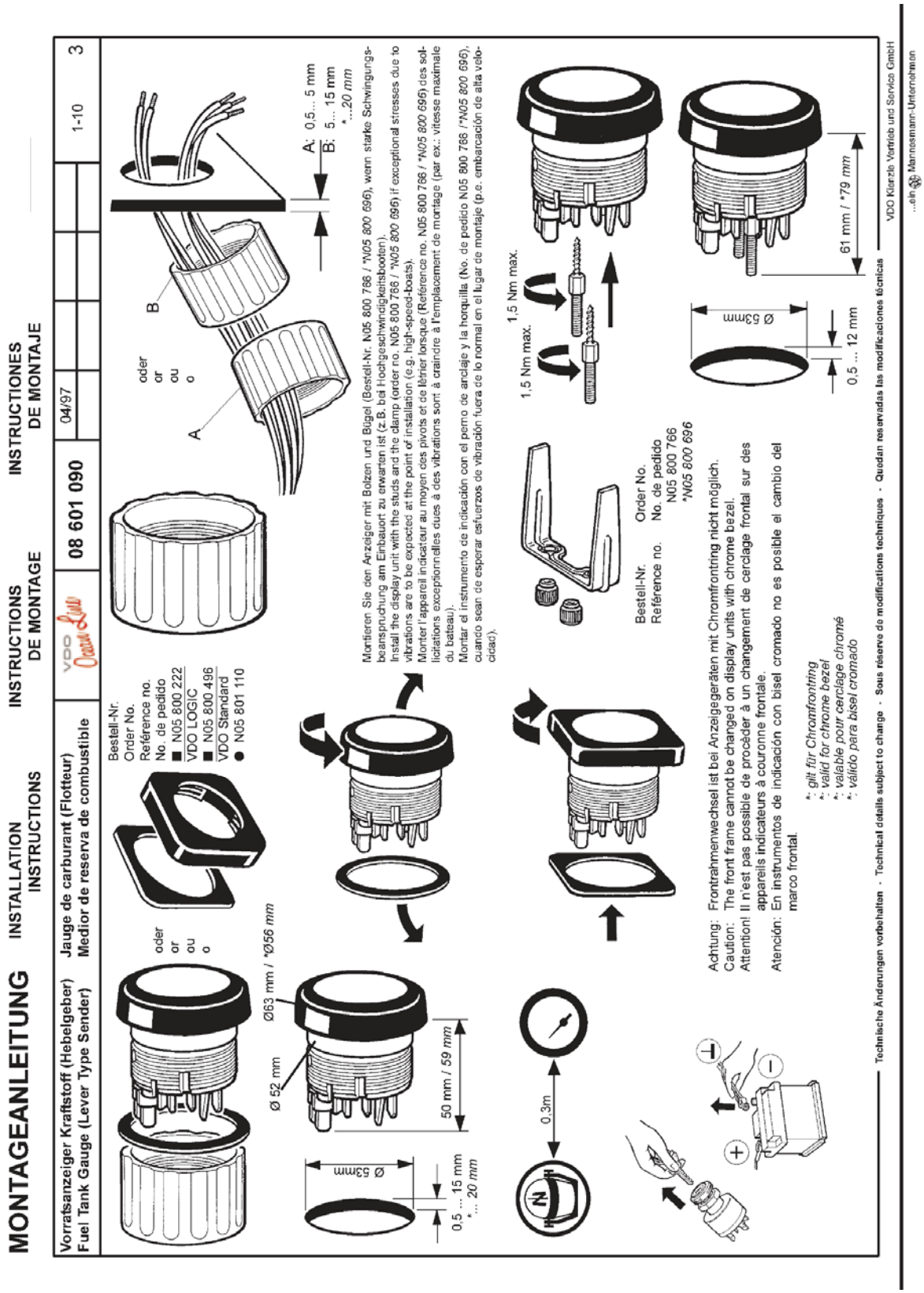
6. Check that all indicating lights have working bulbs in them. Replace any missing or burnt out ones (consider upgrading to LED bulbs for longer life and lower current draw). Inspect for broken or dirty lenses. Clean, repair and replace as necessary. Tighten all indicating light connections.

7. Inspect all switches for damage, corroded terminals, missing or torn protective boots, missing actuators, etc. Check the switch action to ensure proper movement. Repair or replace as necessary. Tighten all switch connections.

8. Inspect all relays for damage, moisture or corrosion. Replace as necessary. Ensure that all relays are fully pushed into their bases with the hold down clips or latches applied. Tighten all relay connections. Replace any missing identifying labels.

Maclean Canada - MAINTENANCE BULLETIN

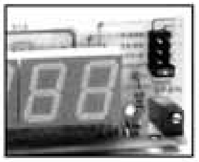
Title:	Installation Instruction, Fuel Level Sender
Number:	**MB-ELE1386**
Revision:	Original



Maclean Canada - MAINTENANCE BULLETIN

Title:	**Digital Voltmeter, Main AC Panel**
Number:	**MB-ELE1354**
Revision:	Original

Decimal Point Selection



Decimal selection is made on the front of the display board by moving the jumper to the indicated position on the header for the decimal required.

Rear Selection of Decimal Points

An optional output board is available that provides access to all decimal points via a rear PCB edge connector.

Opening Back Panel

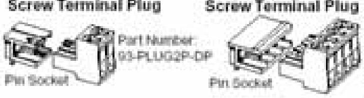
To open back panel, insert a flat screw-driver or similar instrument in both slots on the top of the case and pry open. The DU-Series meters slide out from the rear of the case as a complete assembly.

Selecting Power Supply Voltage

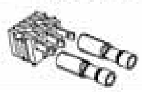
This unique voltage selector PCB displays the operating voltage selected. To change the voltage, disconnect power to the meter. Remove the selector, reverse the selector and fully re-insert it in the socket.This selector is not required for optional power supplies.

DU-Series Connector Options

Plug-in Screw Terminal Connectors are Provided



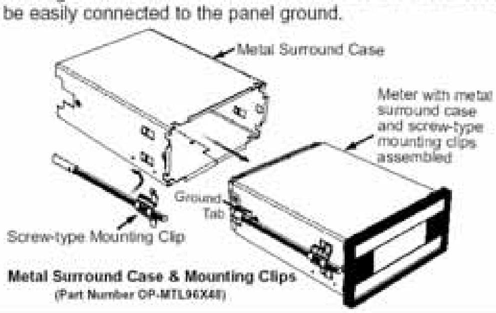
Spade Lug pinouts and insulated quick disconnects may still be ordered as an option. P/N.:CN-SPADE.



Metal Surround Case Option

The meter's plastic case is made from fire retardant polycarbonate. A metal surround case can be ordered to enhance the meter's fire retardant capabilities and also provide shielding against electromagnetic interference (EMI). The metal case slides over the polycarbonate case and is held firmly in place by spring-type non-return clips. The Metal Surround Case must be factory installed on the polycarbonate case and once installed, it cannot be removed in the field.

With the metal case in place, the meter's standard ratchet-type mounting clips can not be used. Instead a pair of screw-type DIN standard mounting clips are provided, which clip into holes on the side of the metal case and tighten against the rear of the panel. A ground tab on the metal case enables the metal case to be easily connected to the panel ground.



Metal Surround Case & Mounting Clips
(Part Number OP-MTL96X48)

Face Plate Descriptors

AC	Ω	kV	kVAR	m³/hr	Hz	RPM
V	mV	min	PF	°F	°C	CosØ
DC	r/min	μA	PSIG	mS	kg/cm²	psi
kW	W	kWH	pH	%	K	kPa
A	mbar	mA	MW	kA	RPS	MWH
mWs	μm	kW/s	l	l/sec	ml	cm
ORP	mm/s	1/min	mm	kg/sec	lbs	kg/hr
FT	bars	min'	m/min	l/hours	μV	dB

To customize the face plate, each DU-meter is supplied with a white printed clear adhesive label containing various popular descriptors. Choose the descriptor desired, peel off the adhesive backing and align the descriptor in the center right of the faceplate.

Custom Face Plates

Texmate Produces Thousands of Custom OEM Face Plates

Have Texmate Design and Build a Custom Face Plate to Suit your Next project!

- Custom face plates have a non-recurring artwork charge. A serial number is then assigned to each artwork, to facilitate re-ordering.
- Small Run or One-Off custom face plates incur an installation charge, and are generally printed on a special plastic film, which is then laminated to custom faceplate blanks as required.
- Large Run (250 pieces min): custom face plates are production silk screened, issued a part number, and held in stock for free installation as required by customer orders.
- OEMs may also order Custom Meter Labels, Box Labels Custom Data Sheets and Instruction Manuals.

Optional Display Styles

DU Series Above-Center Display Option

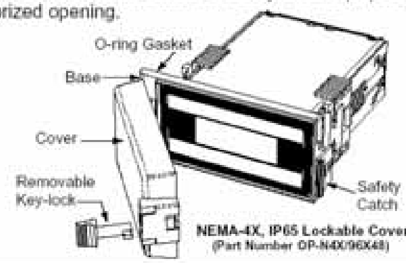
0.8" LED Options available in Lynx Family

To match all display styles, DU-Meters have an optional display and faceplate with the digits positioned above center. (see Display Options)

For 0.8" LEDs in 1/8 DIN cases order Lynx family DX-35 and DX-40 w/ LR or LG displays and input modules that match DU-Series inputs.

Clear Lockable Water-proof Cover

The clear lockable cover is designed to be dust and water proof to NEMA-4X, IP65 standards. The assembly consists of a base and cover with a cam hinge and key-lock fastening mechanism. An O-ring, or neoprene gasket forms a seal between the base and the panel. The cam hinge prevents the cover from closing when opened until pushed closed. The cover has a tapered recess that, when closed, forms a seal with a tapered spigot on the base. A key-lock employs a cam locking device to force the spigot into the recess, ensuring seal integrity. A safety catch keeps the cover closed even when the key is removed, and the keyhole can be used to attach a safety seal clip, preventing unauthorized opening.



NEMA-4X, IP65 Lockable Cover
(Part Number OP-N4X/96X48)

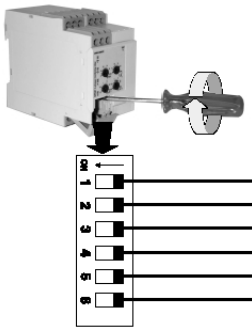
CARLO GAVAZZI

Function/Range/Level/Time Setting

Adjust the input range setting the DIP-switches 3 and 4. Select the desired function setting the DIP-switches 5 and 6 as shown on the left. To access the DIP-switches open the plastic cover using a screwdriver as shown below.

Centre knobs:
Setting of upper and lower level or setting of asymmetry and tolerance on relative scale.

Lower knobs:
Setting of delay on alarm time on absolute scale: 0.1 to 30 s.



Power-ON delay
ON: 6 s ± 0.5 s
OFF: 1 s ± 0.5 s

Monitoring
ON: Phase-Neutral voltages
OFF: Phase-Phase voltages

Measuring range

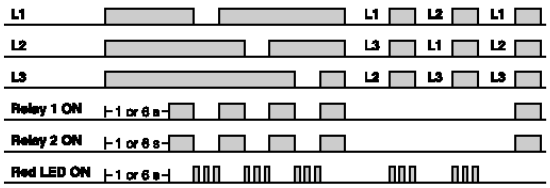
SW3	ON	ON	OFF	OFF
SW4	ON	OFF	ON	OFF
M23 Ph-Ph Voltage	208 VAC	220 VAC	230 VAC	240 VAC
M48 Ph-Ph Voltage	380 VAC	400 VAC	415 VAC	480 VAC DPC01 only
M48 Ph-N Voltage	220 VAC	230 VAC	240 VAC	277 VAC DPC01 only
DPC01DM69 Ph-Ph Volt.	600 VAC	600 VAC	690 VAC	690 VAC
DPC01DM69 Ph-N Volt.	347 VAC	347 VAC	400 VAC	400 VAC

Output
ON: 2 x SPDT relays
OFF: 1 x DPDT relay

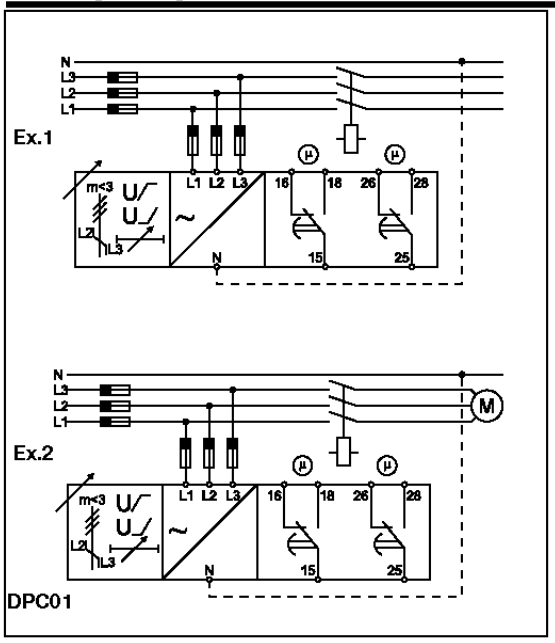
Function
ON: Asymmetry and tolerance monitoring
OFF: Over and undervoltage monitoring

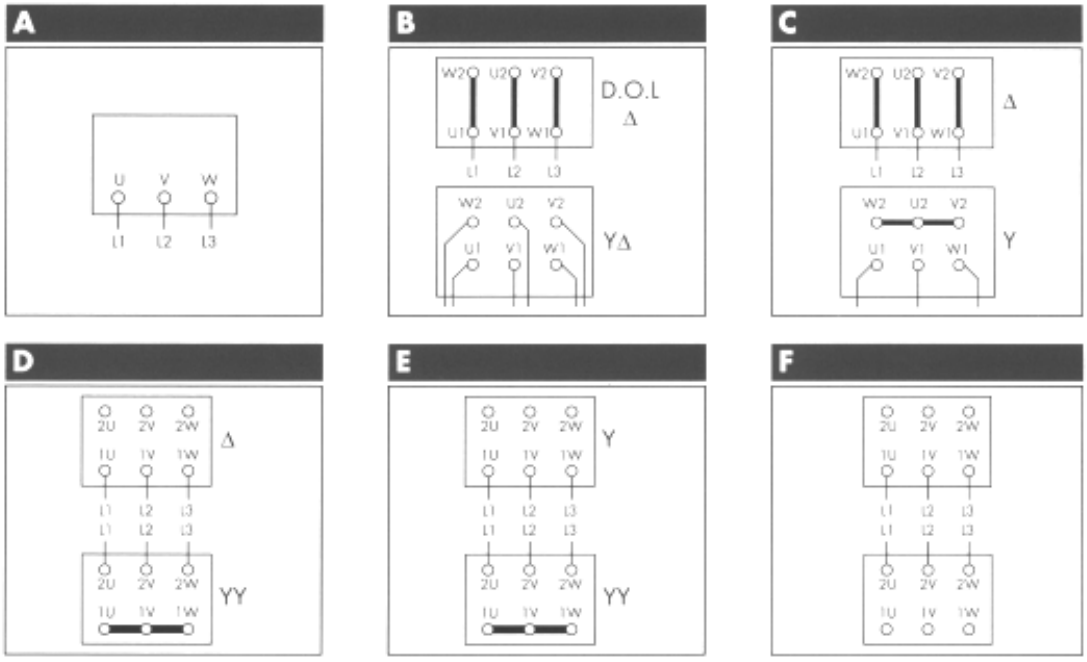
Operation Diagrams

Phase sequence, total phase loss



Wiring Diagrams





A: Direct-on-line	Direct-on-line	Conexión directa	**直接接线**
Direct en ligne	Direkt start	Directa em linha	Прямой оперативный режим
Direktes Anlassen	Diretto in linea	ダイレクト・オンライン	مباشر على الخط
B: Star Delta	Sterdriehoek	Estrella triángulo	**星形三角形结线**
Etoile-triangle	Y/D-start	Estrela triângulo	Звезда - треугольник
Sterndreieck-Anlassen	Star Delta	スター・デルタ	توصيل نجمي مثلثي (ستار - دلتا)
C: Dual Voltage (Δ/ Y)	Dubbele spanning	Bitensión	**双电压**
Bitension	Dubbelspänning	Tensão dupla	двойное напряжение
Doppelspannung	Doppio tensione	デュアル電圧	فولطية مزدوجة
D: Two Speed Pole Change (Δ/ YY)	Tweetoerige poolomschakeling	Dos velocidades con cambio del número de polos	**双速换极**
Inversion de pôles deux vitesses	Polomkoppling med två hastigheter	Mudança de pólo de duas velocidades	Переключение полюсов две скорости
Zweifach polumschaltbar	Cambiamento di poli a due velocità	二速極数切り換え	تغيير القطب بسرعتين
E: Two Speed Pole Change (Y/YY)	Tweetoerige poolomschakeling	Dos velocidades con cambio del número de polos	**双速换极**
Inversion de pôles deux vitesses	Polomkoppling med två hastigheter	Mudança de pólo de duas velocidades	Переключение полюсов две скорости
Zweifach polumschaltbar	Cambiamento di poli a due velocità	二速極数切り換え	تغيير القطب بسرعتين
F: Two Speed Dual Wound (Y/Y)	Tweetoerig dubbelgewikkeld	Dos velocidades con dos bobinados	**双速复绕**
Double enroulement deux vitesses	Dubbel burlindning med två hastigheter	Enrolamento duplo de duas velocidades	Двой-ная обмотка две скорости
zweifach drehzahlumschaltbar, Doppelwicklung	Avvolgimento a due velocità	二速デュアル巻き	ملف مزدوج بسرعتين

VULCAN ELECTRIC
CO. LIMITED
6310 LAWRENCE AVENUE EAST, SCARBOROUGH, ONTARIO M1C 4A7
PHONE (416) 281-1550 FAX (416) 281-3416

OPERATING INSTRUCTIONS

SCR Controlled Automatic Constant Voltage Charger

This Model is automatic S.C.R. controlled with current limiting. Designed for use on 120 volt, 60 Hertz, single phase supply. Equipped with A.C. and D.C. breaker protection.

INSTALLATION

Connect the A.C. 120 volt supply to terminals designated as LINE-COM. Now connect the battery to terminals designated as positive and negative. Always be sure the charger and battery voltage correspond. The potentiometers for current limit, float charge and equalize charge are all factory preset on each charger and should not require any field adjustment.

In operation, L.E.D. lamps which are mounted on the control board or by remote harness to the instrument panel will indicate the charging position.

Red - current limit
Red and green - current limit and float mode
Green only - Float mode battery at float voltage setting

Amber - equalize mode
Red - current limit
Red and amber - current limit & equalize mode.
Amber and green - Equalize mode battery at equalize voltage setting

OPERATION

Place Norm-Equalize switch in NORM position, now place main switch to ON position as indicated by the AC on pilot lamp. The charger is now in automatic float charge mode with the ammeter indicating the rate of charge. This will continue until the battery reaches 2.17 V.P.C. at which time the ammeter will reduce to zero.

Switch in Equalize Position

The charger is now in automatic equalize charge mode with the ammeter indicating the rate of charge. This will continue until the battery reaches 2.33 V.P.C. at which time the ammeter will reduce to zero.

CAUTION

Switch must be returned to Norm Position (Float Mode) or excess electrolyte dissipation will be the result thus reducing battery life.

NOTE: To obtain best results, this charger should be installed in a position free from vibration, also avoid damp locations, moisture and acids.
The lack of ventillation and misuse are the enemies of all electrical equipment.
NOTE: Please refer to nameplate on the unit purchased for ratings.

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BATTERY CHARGING AND TESTING EQUIPMENT
PRODUCTS OF QUALITY FOR OVER 50 YEARS

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Revision:	B

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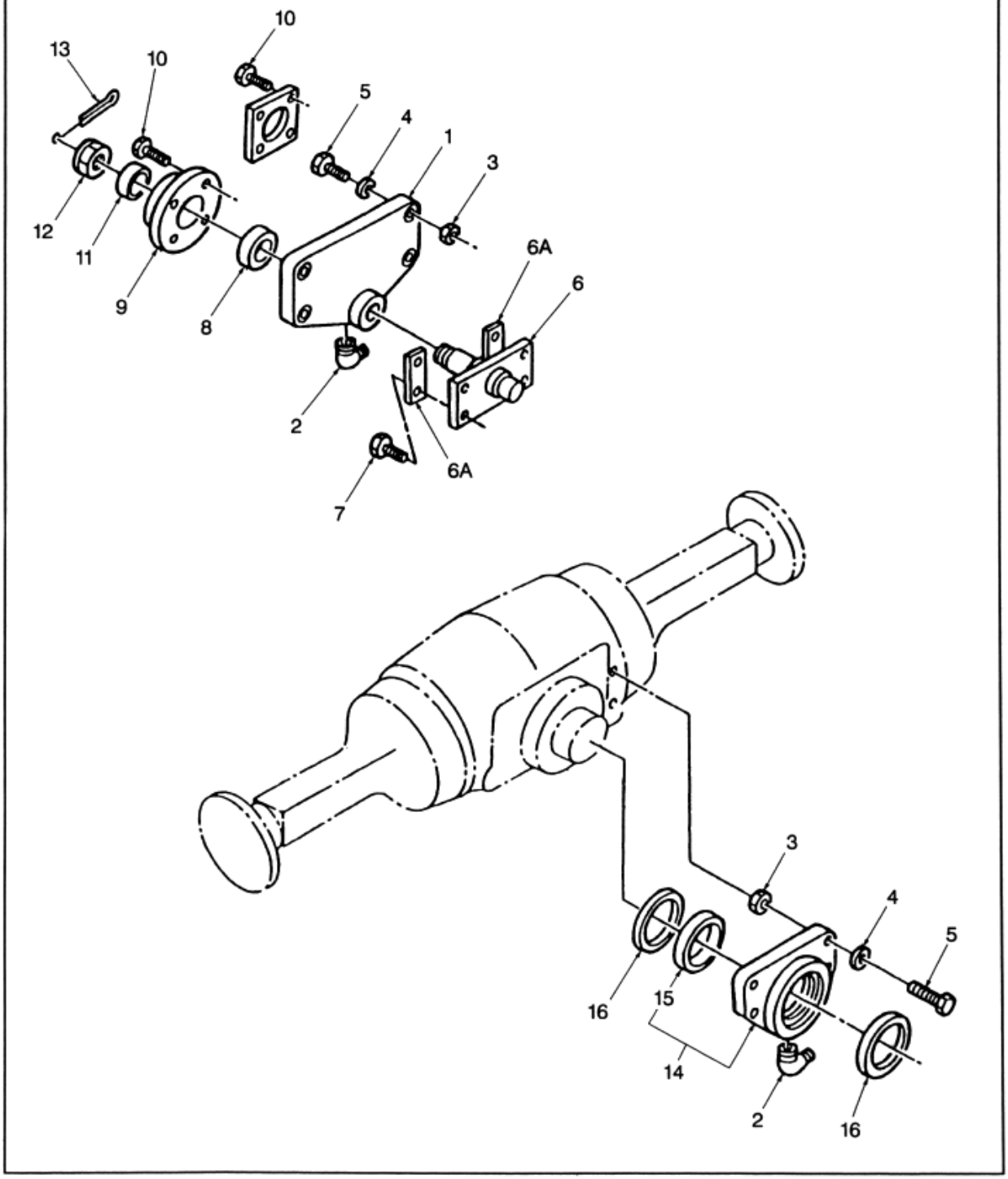
OSCILLATION AXLE MOUNTING



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