



Technical Manual

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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 combustible 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.



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Revision:	B

Return Filter – The Return Filters are mounted on top of the hydraulic tank. They filter the hydraulic oil as it returns from system components. If the filter element is dirty or if the backpressure through the element exceeds 50 psi the return filter is designed to allow the returning fluid to bypass the filter element (indicating that the element needs to be changed). A dial-type visual indicator on the return filter is used to indicate when it has reached bypass mode (red zone on indicator). The indicator will only display a reading when there is hydraulic flow through the system.

Return Filter Bypass Indicator – The Return Filter Bypass indicator will display this backpressure only while functions are operating. If the needle is found in the red zone, it indicates that the filter is in bypass and the element should be changed.

Breather – The breather allows air to enter and leave the tank depending on whether the hydraulic fluid level is dropping or rising. The breather filters the air to avoid contaminating the hydraulic system and must be properly maintained.

Thermometer – The thermometer provides a visual indication of the temperature of the hydraulic fluid inside the tank. The maximum allowable temperature depends on the hydraulic fluid being used.

Sight Gauges – The sight gauges provide a visual indication of the hydraulic fluid level in the tank. These gauges use a cork ball that floats in the hydraulic fluid. The sight gauges from top to bottom indicate the maximum, middle, and minimum fluid levels.

Level/Temperature Switch – The level/temperature switch is included in the tank to provide an electrical signal to indicate warning and shutdown conditions for the hydraulic fluid (e.g. high temperature or low level).

Suction Ball Valves (not shown) – Each hydraulic pump has its own suction line ball valve that can be closed to allow component maintenance without having to drain the hydraulic tank.

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NOTE

If the anti-jam kick-out valve is adjusted too far CCW then the anti-jam system may not activate properly

AIR SYSTEM

The air system uses components that are located throughout the Drill Jumbo. Compressed air is supplied by connecting to the mine's compressed air lines via a connector on the rear deck assembly as shown in Figure 11.



Figure 11 – Typical Mine Air Inlet Located in Rear Deck Assembly

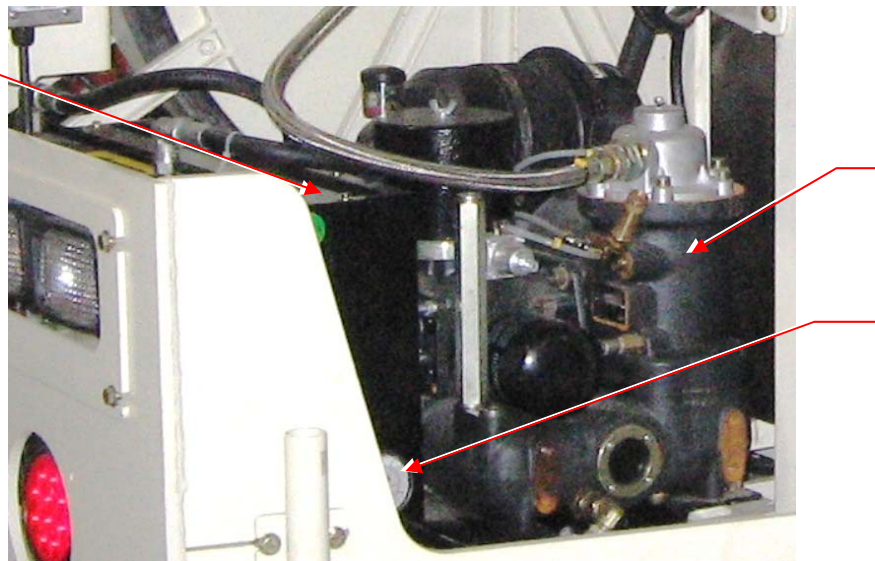


Figure 12 – Air Compressor (If Equipped) Located in Rear Deck Assembly

The air compressor assembly (if equipped) is located in the rear deck assembly and is shown in Figure 12. A brief description of some of the components follows.

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AC CONTROL SYSTEM

The AC control system is used once the Drill Jumbo has been driven to the working face and is ready to commence drilling operations.

Figure 6 shows the AC panel in the rear deck assembly area of the Drill Jumbo and identifies its features.

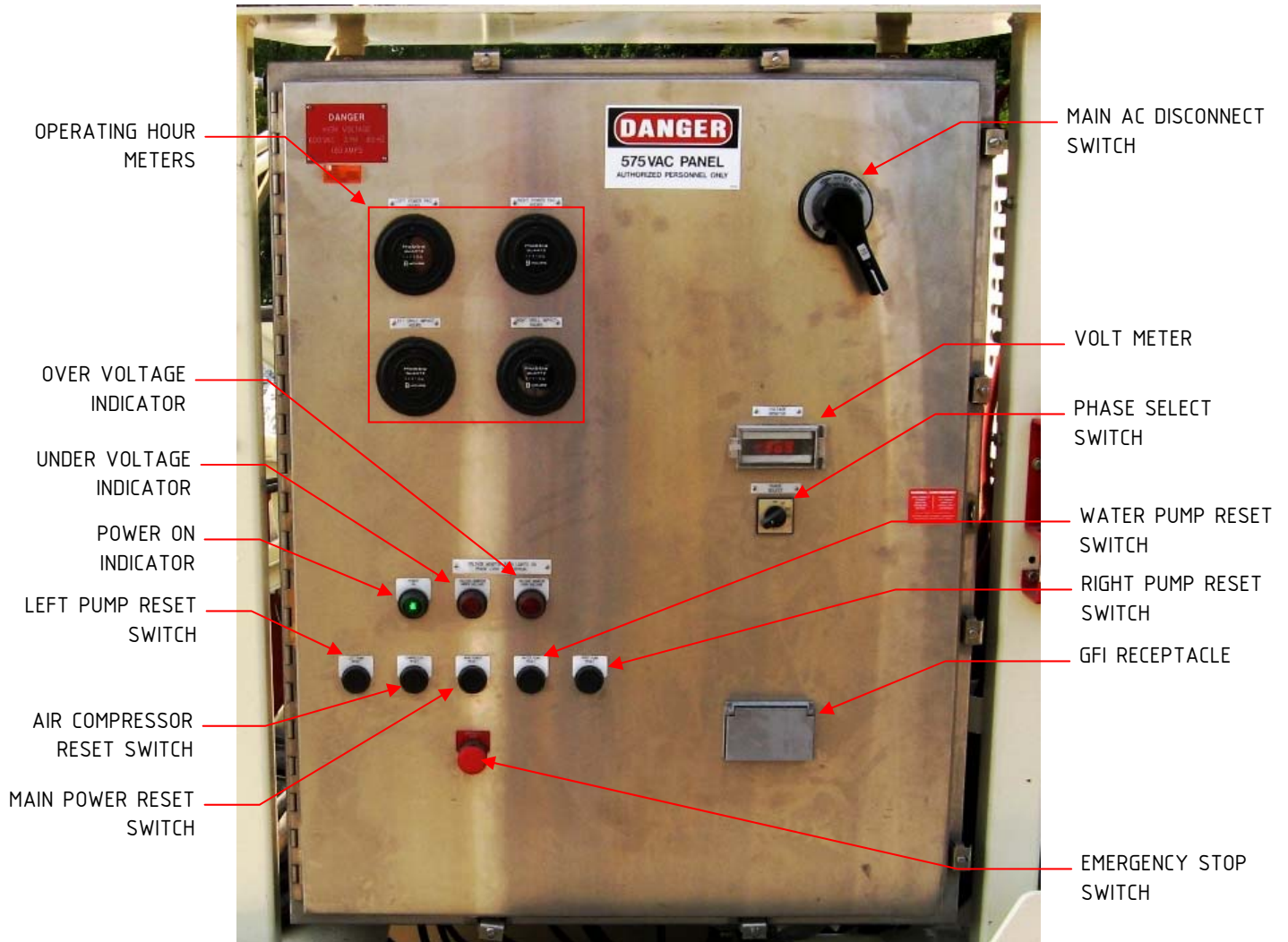


Figure 6 – AC Panel Located in Rear Deck Assembly



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Revision:	A

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 trailing 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.

Reedrill has asked us to remove the lubricator interlock. The low lube /air warning indicator in the console is still there.

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.



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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. 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. 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. 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 located 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 located 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.



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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.



TEREX | REEDRILL - SERIAL NUMBER LIST

Machine Serial Number: **MK7-2-005**
 Customer Unit Number:
 Revision: Original
 Revision Date: 10-OCT-2007
 By: DLU

COMPONENT	SERIAL NUMBER	MANUFACTURER
Engine Serial #:	904-946-00-671241	Mercedes
Engine ECM Serial #:	A042-447-1840	Mercedes
Engine ADM Module Serial #:	NR 260524	Mercedes
Transmission Serial #:	1750607	Spicer
Carrier Piston Hyd Pump Serial #:	49232857	Rexroth
LH AC Piston Hyd Pump #1 Serial #:	49227121	Rexroth
LH AC Piston Hyd Pump #2 Serial #:	49247103	Rexroth
RH AC Piston Hyd Pump #1 Serial #:	40117480	Rexroth
RH AC Piston Hyd Pump #2 Serial #:	49232091	Rexroth
LH Rock Drill Serial #:	N/A	
RH Rock Drill Serial #:	N/A	
ROPS / FOPS Serial #:	170-1063915	MacLean
Brake Accumulator #1 Serial #:	521647-01	Parker
Brake Accumulator #2 Serial #:	517143-01	Parker
LH Valve Controller Serial #:	0609-3516	Hawe
RH Valve Controller Serial #:	M4006-665	Hawe
Controller Software (Filename & Rev.):	MK7-2	Hawe
LH Feed Rollover Serial #:	368606	Helac
RH Feed Rollover Serial #:	368605	Helac
Engine Axle Serial #:	7D25	New Holland
Deck Axle Serial #:	7D05	New Holland

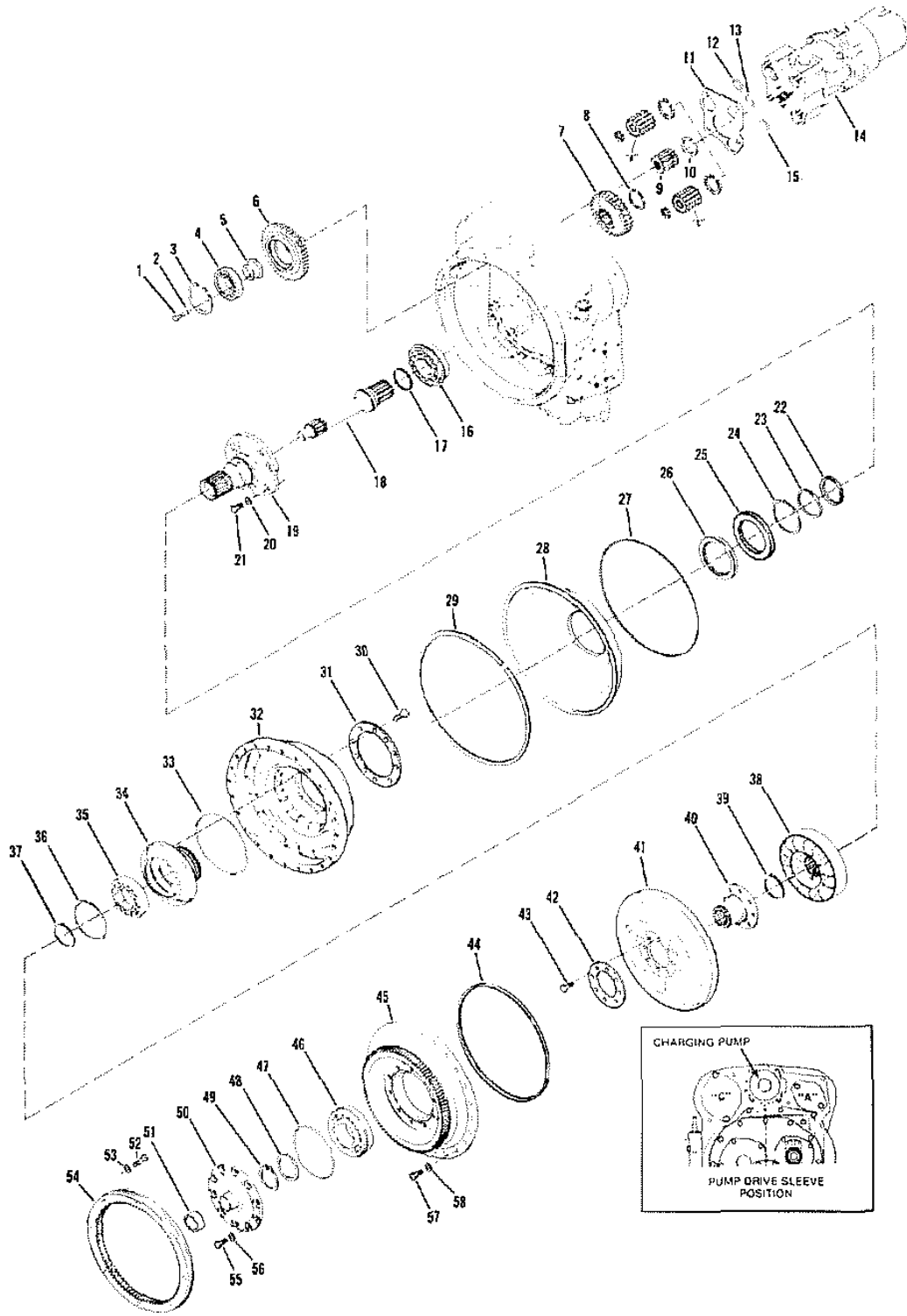


Figure B

CONTROL VALVE ASSEMBLY

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Oil Seal	1	22	Overshift Spacer (Not on all models). . . .	1
2	Oil Seal Retainer Ring	1	23	Oil Seal Retainer Washer	1
3	Oil Seal Retainer Washer	1	24	Oil Seal Retainer Ring	1
4	Forward & Reverse Valve Spool	1	25	Oil Seal	1
5	Control Valve Gasket	1	26	Piston Housing Assembly	1
6	Detent Spring	1	27	Stop Plug	1
7	Detent Spring	1	28	Plug "O" Ring	1
8	Detent Ball	3	29	Piston "O" Ring	1
9	Neutral Switch	1	30	Glyd Ring	1
10	Detent Ball	1	31	Piston	1
11	Valve Housing Plug	1	32	Piston Housing	1
12	Valve Housing Plug "O" Ring	1	33	Oil Seal	1
13	Overshift Spacer (Not on all models). . . .	1	34	Band Seal	1
14	Control Valve Housing	1	35	"O" Ring	1
15	Detent Spring Plug	1	Figures A-B-C & D are various declutch options.		
16	Detent Spring Plug Washer	1	44	Adaptor Screw	4
17	Detent Spring	1	45	Adaptor Screw Lockwasher	4
18	Valve to Adaptor Housing Screw	9	46	Valve Adaptor	1
19	Valve to Adaptor Housing Screw Lockwasher	9	47	Valve Adaptor Gasket	1
20	Speed Selector Spool Plug	1	48	Adaptor Screw	5
21	Speed Selector Spool	1	49	Adaptor to Plate Gasket	1
			50	Valve Adaptor Plate	1

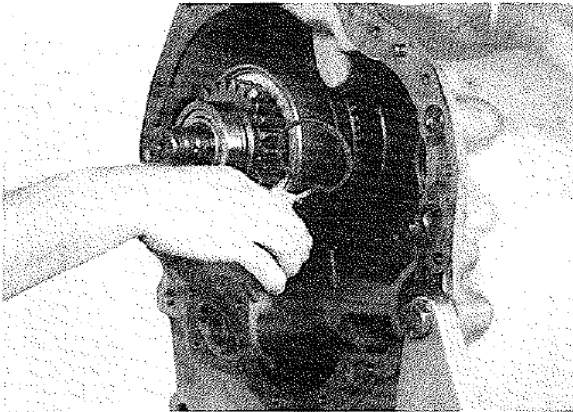


Figure 29
Remove 2nd clutch disc hub retainer ring retainer.

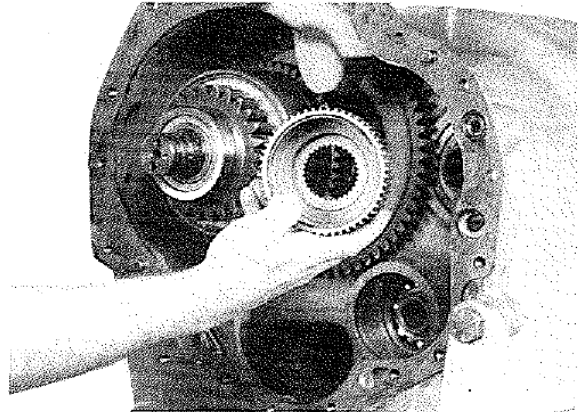


Figure 32
Remove disc hub.

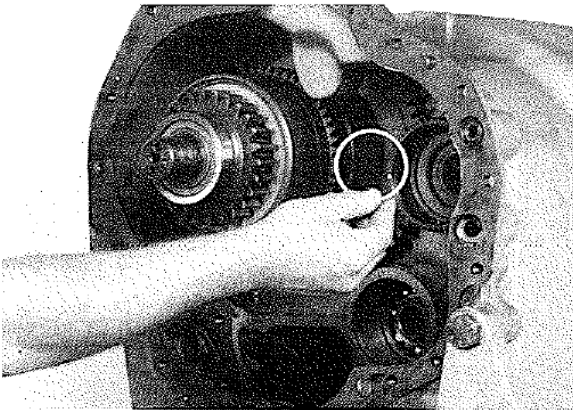


Figure 30
Remove disc hub ring retainer.

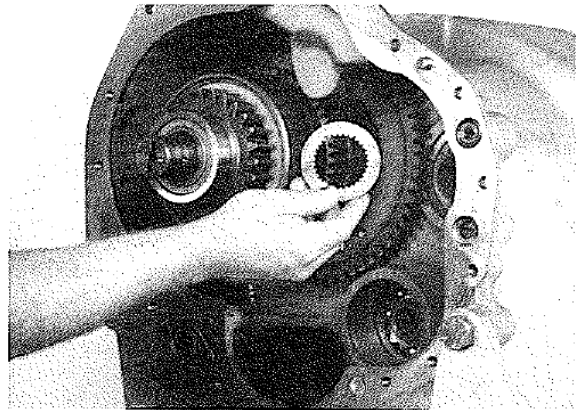


Figure 33
Remove bearing end plate.

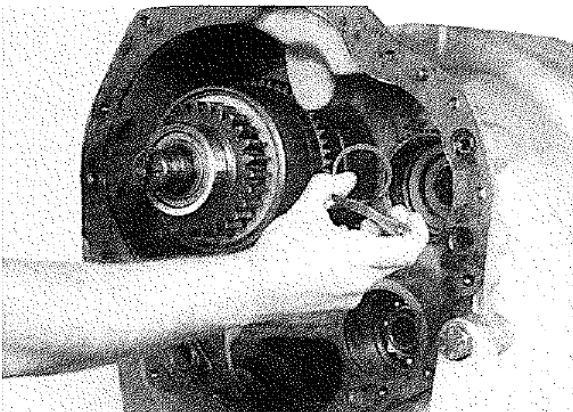


Figure 31
Remove disc hub retainer ring.

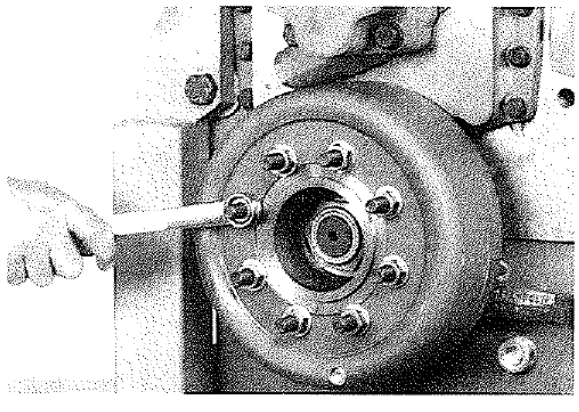


Figure 34
Remove brake drum stud nuts (used only to hold drum in place after drive shaft was removed).

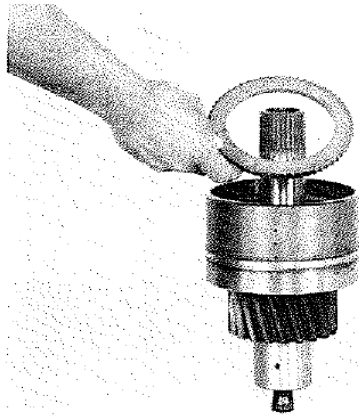


Figure 93
Install clutch disc end plate.

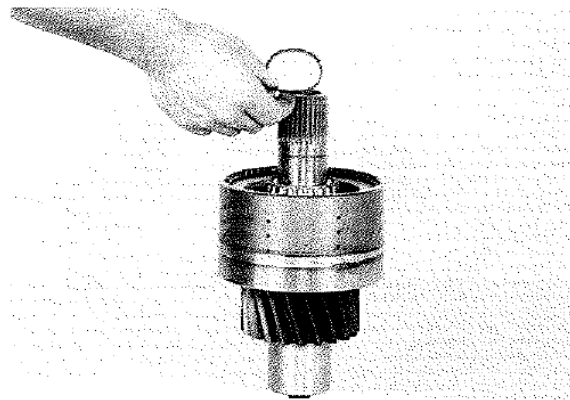


Figure 96
Position taper bearing spacer on shaft.

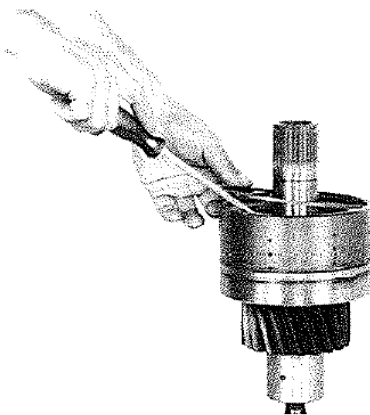


Figure 94
Install end plate retainer ring.

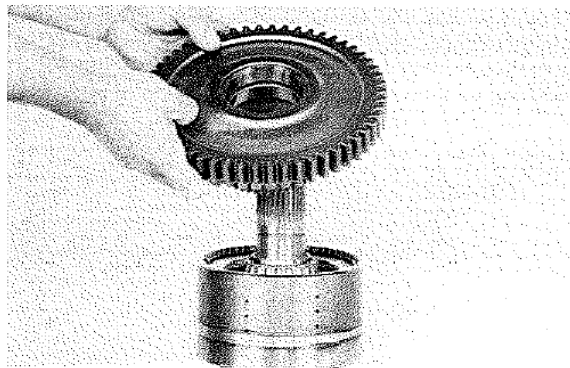


Figure 97
Install 1st gear into clutch drum. Align splines on 1st gear with internal teeth of friction discs. Tap gear into position. Do not force this operation. Gear splines must be in full position with internal teeth of all friction discs.

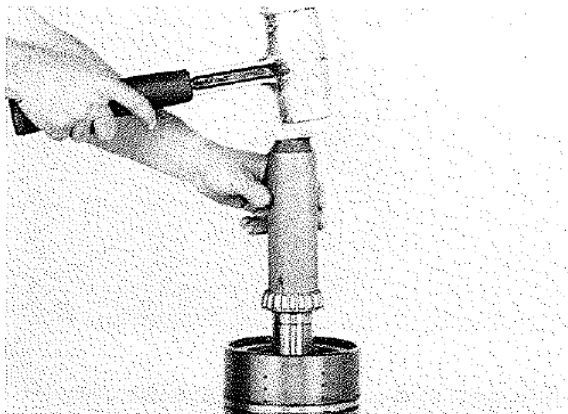


Figure 95
Install inner clutch gear taper bearing.

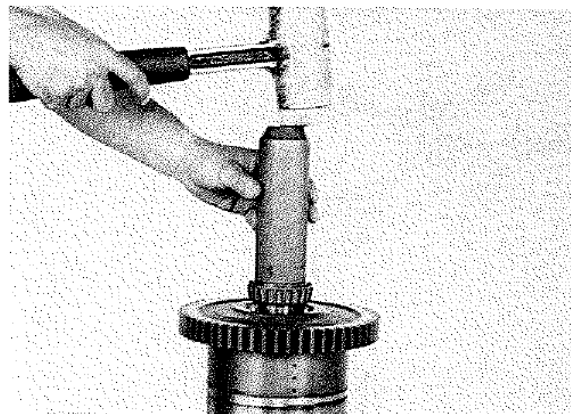


Figure 98
Install outer taper bearing.

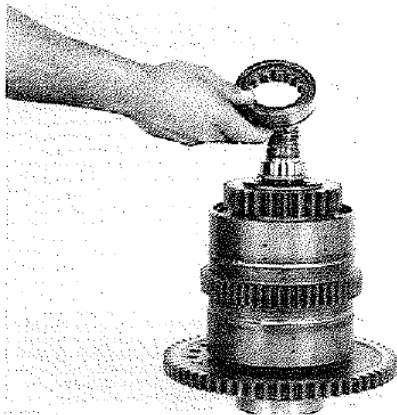


Figure 158
Position front bearing over bearing race.

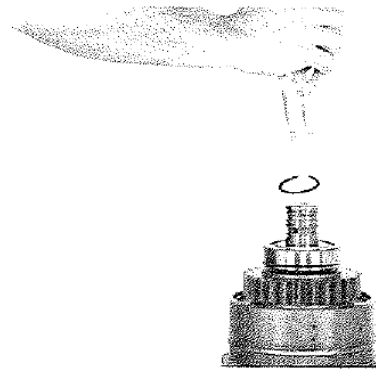


Figure 161
Install bearing retainer ring.

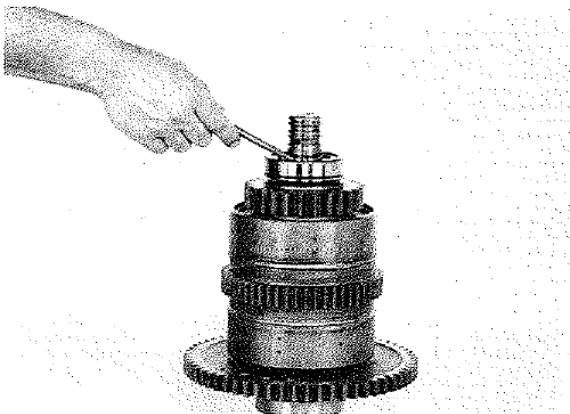


Figure 159
Position end plate lock ball in clutch shaft.

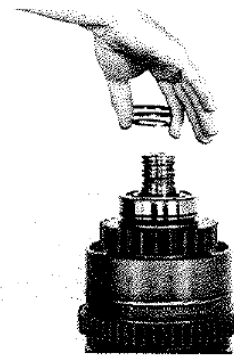


Figure 162
Install clutch shaft piston rings. See note in Figure 103.

**DISASSEMBLY AND REASSEMBLY
OF THE FORWARD AND 2ND CLUTCH**

(Forward being disassembled)

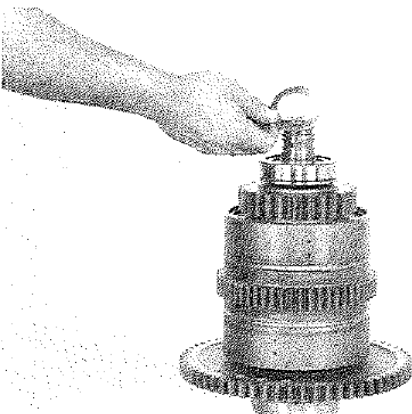


Figure 160
Install bearing end plate, aligning notch in plate with lock ball.

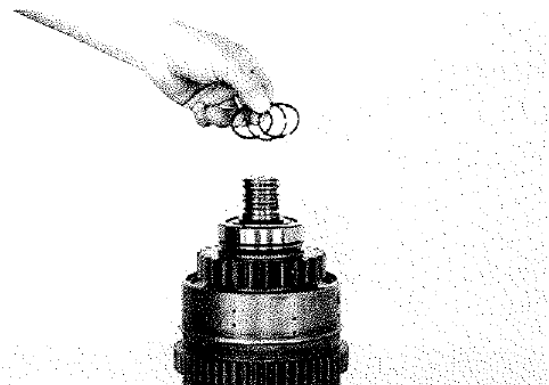


Figure 163
Remove clutch shaft piston rings. (See note in Figure 103.)

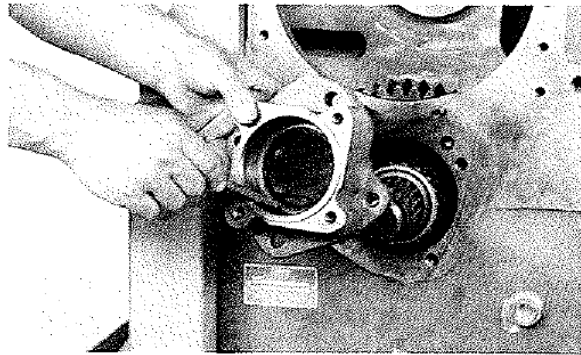


Figure 223

Coat outer diameter of oil seal with Permatex No. 2 and press seal in bearing cap with lip of seal in. See assembly instruction sheet for seal depth. Using new "O" rings install rear output bearing cap, oil seal and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case.

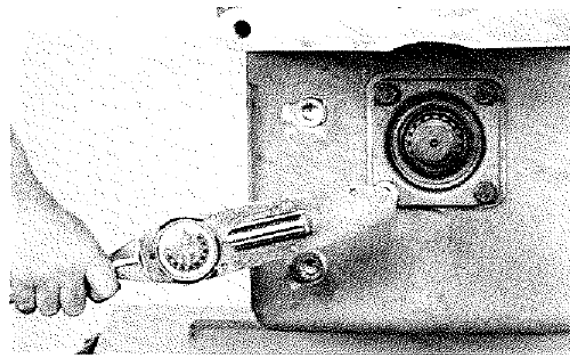


Figure 226

Install front bearing cap and shims. Tighten bolts to specified torque. Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts.

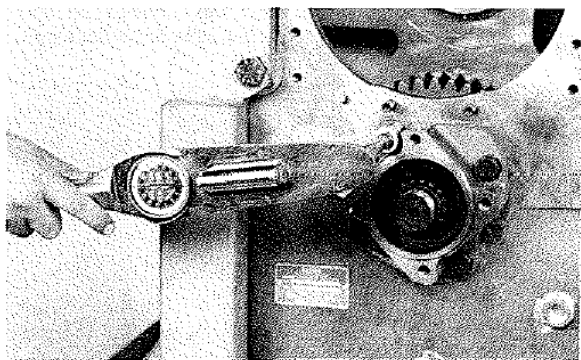


Figure 224

Tighten bearing cap bolts to specified torque. (See torque chart.)

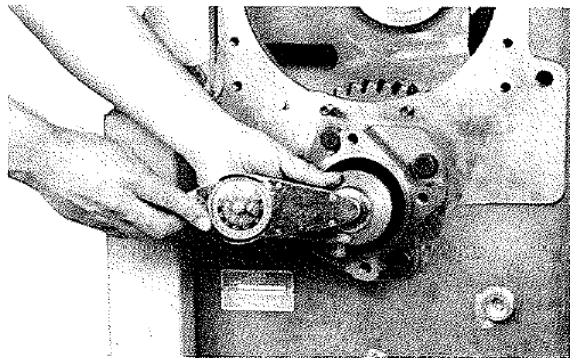


Figure 227

Using a inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 6 to 8 inch lbs. (0,7-0,09 N.m) more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.

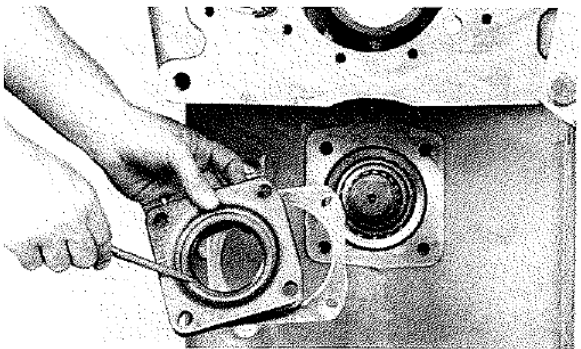


Figure 225

Coat outer diameter of front output oil seal with Permatex No. 2. Install seal in bearing cap with lip of seal in.

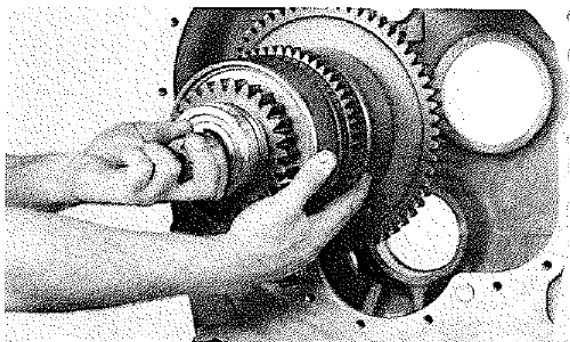


Figure 228

Position reverse and 3rd clutch in transmission housing.

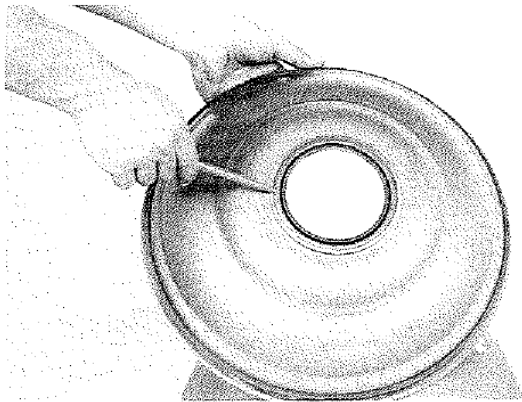


Figure 288

Apply a light coat of Permatex No. 2 on the outer diameter of the oil baffle seal. Press seal in oil baffle with lip of seal down.



Figure 291

Install pump drive gear retainer ring.

DISASSEMBLY AND REASSEMBLY OF TURBINE AND IMPELLER COVER

DISASSEMBLY

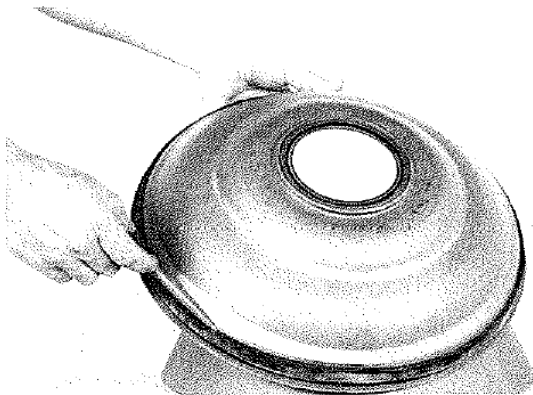


Figure 289

Install new oil baffle seal ring. Position oil baffle on impeller and hub assembly.

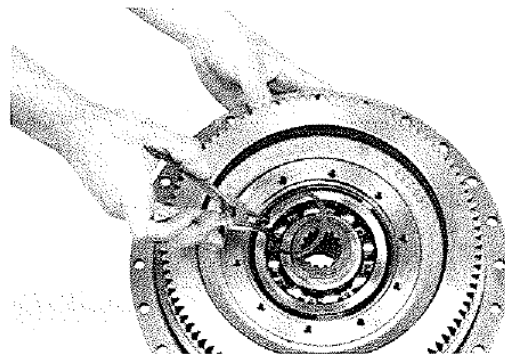


Figure 292

Remove turbine hub to impeller cover bearing retainer ring.

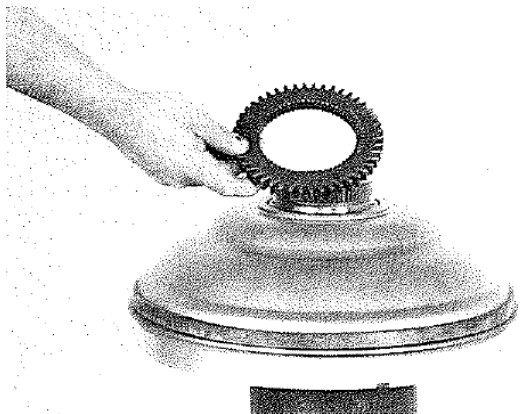


Figure 290

Install pump drive gear on impeller hub.

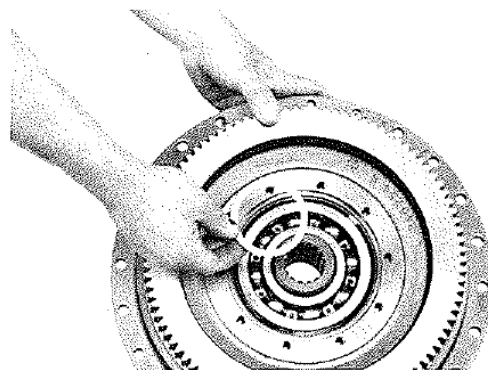


Figure 293

Remove retainer ring to bearing washer.

**16 SCREW RING GEAR INSTALLATION PROCEDURE
(Non-Asbestos Ring Gear)**

1. Remove all burrs from flywheel mounting face and pilot bores. Clean the torque converter ring gear flywheel mounting surface and the ring gear screw tapped holes with solvent. Dry thoroughly, being certain ring gear screw holes are dry and clean.
2. Check engine flywheel and housing or housing adaptor for conformance to standard S.A.E. No. 3 -- SAE J927 and J1033 tolerance specifications for pilot bores size, pilot bores eccentricities and mounting face deviations. Measure and record engine crankshaft end play.
3. Install torque converter ring gear as shown.

NOTE: Assembly of the ring gear must be completed within a fifteen minute period from start of screw installation. The screws are prepared with an epoxy coating which begins to harden after installation in the flywheel mounting holes. If not tightened to proper torque within the fifteen minute period insufficient screw clamping tension will result.

4. Install backing ring and sixteen (16) special screws to approximately .06 inch [1.5 mm] of seated position. It is permissible to use a power wrench for this installation phase. With a calibrated torque wrench tighten screws 30 to 33 pounds feet of torque [40,7 - 44,7 N.m].

To obtain maximum effectiveness of the special screw's locking feature, a minimum time period after screw installation of twelve (12) hours is suggested before engine start-up.

The special screw is to be used for **ONE** installation only. If the screw is removed for any reason it **MUST BE REPLACED**. It is recommended that the epoxy left in the flywheel hole be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a **NEW** screw for re-installation.

5. Assemble torque converter to engine flywheel by sliding converter into position by hand before fastening housing attachment screws. This may require more than one trial to match the drive gear teeth. Pulling the converter into position with housing attachment bolts is not recommended.
6. Measure engine crankshaft end play after assembly of torque converter. This value must be within one thousandth (.001) of an inch [0,0254mm] of end play recorded (in Paragraph #2) before assembly of torque converter.

802553 -- 1.5 INCH [38,1] 16 SCREW RING GEAR KIT			802554 1.5 INCH [38,1] 16 SCREW RING GEAR KIT		
1	249341	Torque Converter Ring Gear	1	249341	Torque Converter Ring Gear
16	236288	Ring Gear Screw 1.5 Inch [38,1]	16	236288	Ring Gear Screw 1.5 Inch [38,1]
1	802555	Installation Instruction Sheet	1	243767	Backing Ring
			1	802555	Installation Instruction Sheet

243767 Backing Ring not included in 802553 Ring Gear Kit. Must be Ordered Separately.

Dimensions are in inches Dimensions in [] are mm.

**SEE PAGE 60 FOR INSTALLATION ILLUSTRATIONS
SEE PAGE 69 FOR 32 BOLT INSTALLATION**

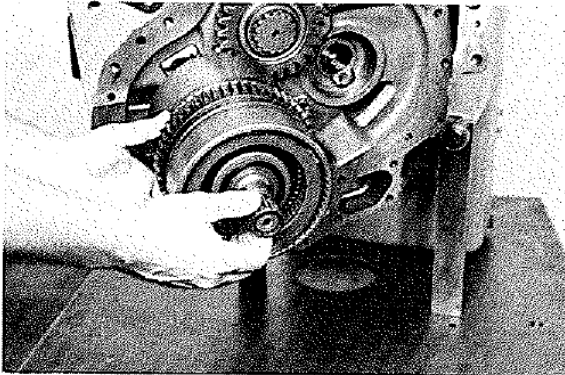


Figure 11
Install 2nd speed clutch pilot bearing.

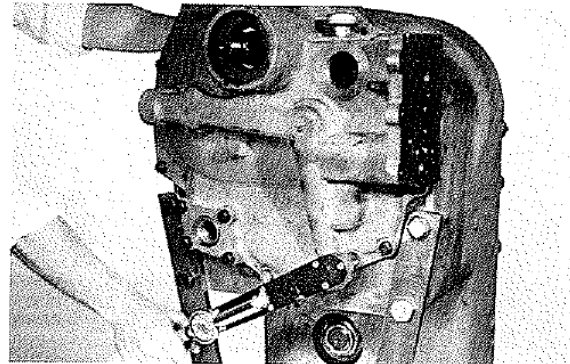


Figure 14
Support front cover with a chain fall. Install alignment studs in transmission case. Position front cover assembly on aligning studs. Turn output flange to align clutch disc hub in clutch. Do not force this operation. With front cover in position against the transmission case install cover to case bolts. Tighten to specified torque.

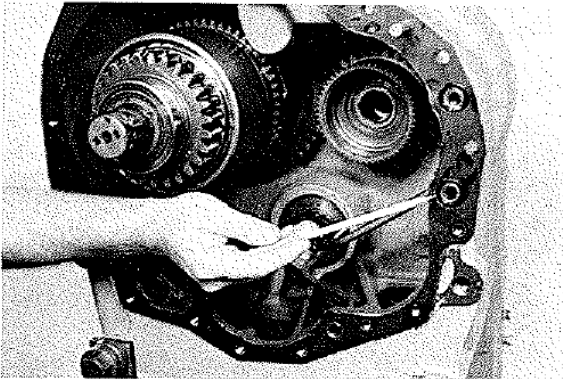


Figure 12
Install transmission case gasket and "O" ring seals.

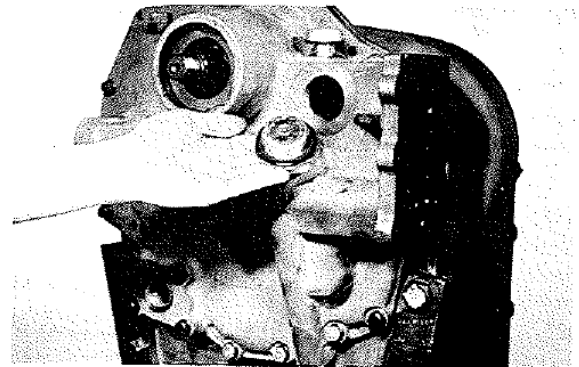


Figure 15
Install front cover plug.

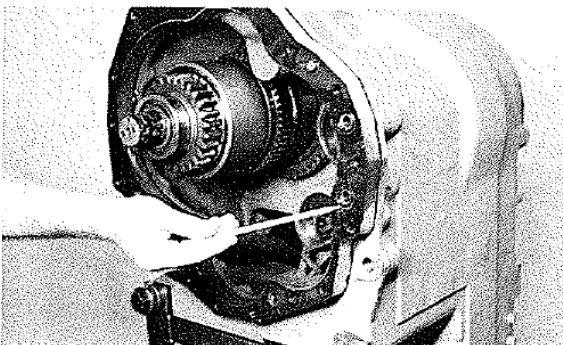


Figure 13
Install housing spacer, gasket and "O" ring seals. **NOTE:** Housing spacer is used with 12 plate clutch modulation only.

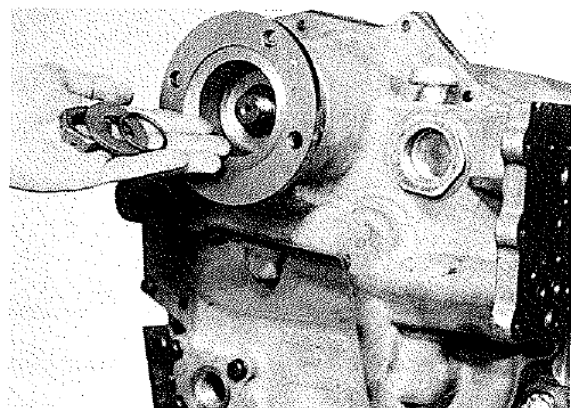


Figure 16
Install companion flange, flange "O" ring, washer and nut. Torque nut to specified torque. (See elastic stop nut torque chart).

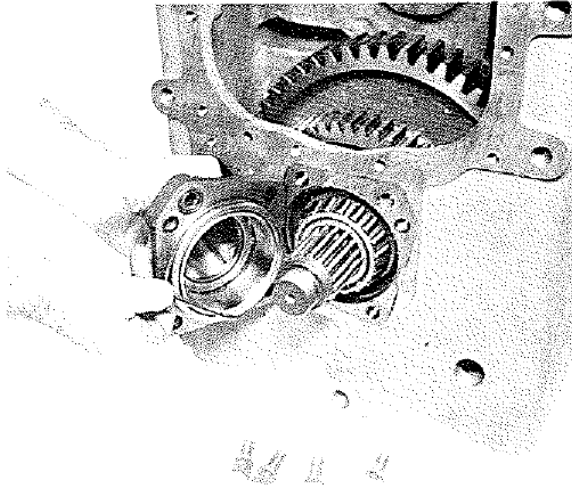


Figure 9

Using new "O" rings install rear output bearing cap and taper bearing cup on transmission case. Lube opening in bearing cap must be aligned with lube opening in case. Tighten bearing cap bolts to specified torque. (See torque chart.)

Install front bearing cap and shims. Tighten bolts to specified torque. Tap output shaft front and rear to seat taper bearings. Loosen front bearing cap bolts.

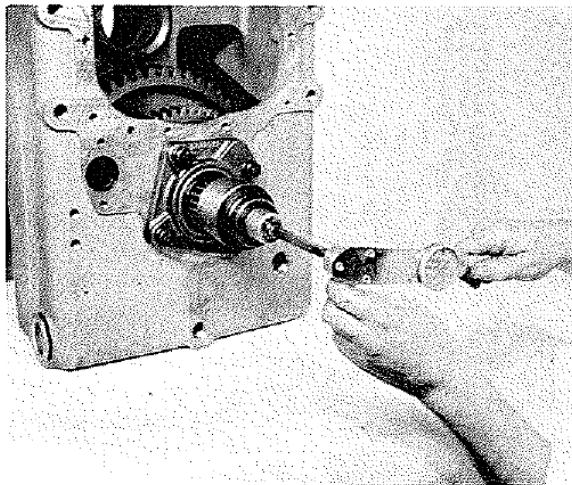


Figure 10

Using a inch lb. torque wrench, determine the rolling torque of the output shaft and record. Tighten front bearing cap bolts to specified torque. Check rolling torque with bolts tight. Torque must be 6 to 8 inch lbs. (0.68 - 0.90 N·m) more than when bearing cap bolts were loose. Add or omit shims on the front bearing cap to achieve the proper preload.

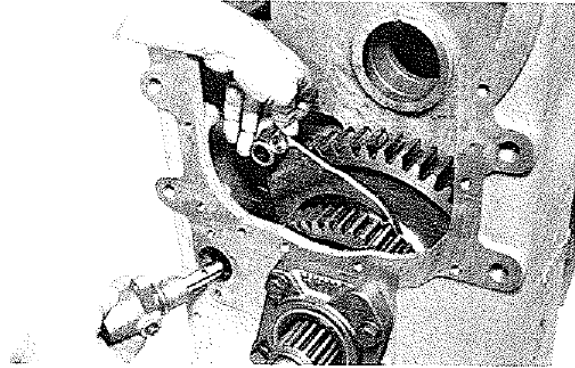


Figure 11

Locate high-low range shift fork in shift hub with offset of fork toward gear. Insert rail support and rail into bore in transmission housing and into shift fork.

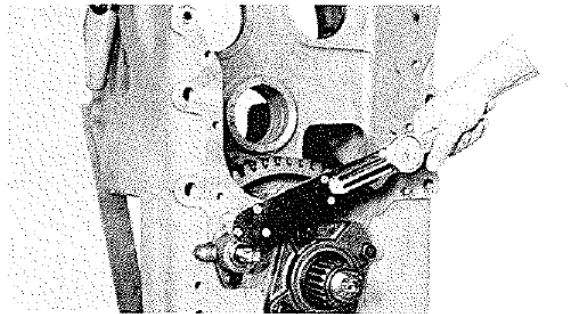


Figure 12

Tighten support bolts to specified torque. (See torque chart.)

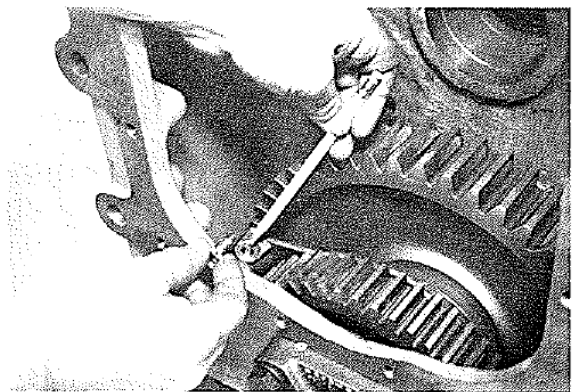


Figure 13

Locate lock screw hole in shift rail with hole in shift fork. Install lock screw, tighten securely and lockwire to prevent loosening.

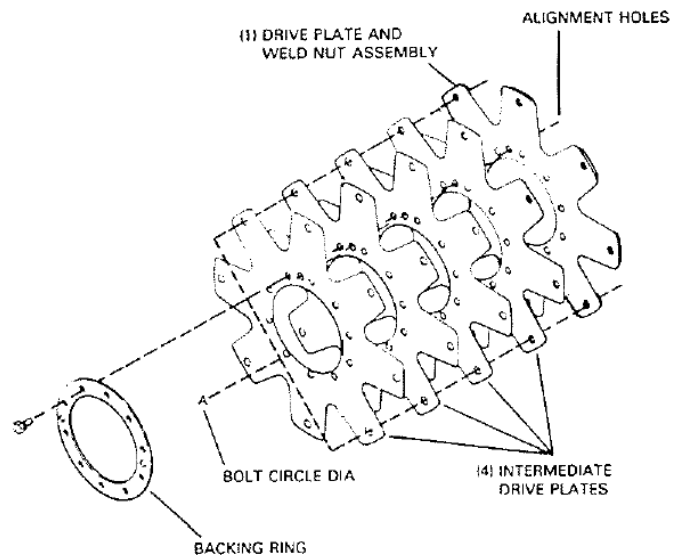
Proceed with Figure 228 in the R & HR 32000 3-Speed Section.

DRIVE PLATE INSTALLATION

SUBJECT: 28000/32000 Series Transmission and C-270/C-320 Series Converter Drive Plate Kits.

REASON FOR BULLETIN: Proper Identification by Bolt Circle Diameter.

Measure the "A" dimension (Bolt Circle diameter) and order Drive Plate Kit listed below.



"A" Dimension (Bolt Circle Diameter)

13.125" [333,375 mm] Diameter
Kit No. 802335

13.50" [342,900 mm] Diameter
Kit No. 802333

17.00" [431,800 mm] Diameter
Kit No. 802454

Each kit will include the following parts:

- 4 Intermediate Drive Plates
- 1 Drive Plate and Weld Nut Assembly.
- 1 Backing Ring.
- 10 Screw and Lockwasher Assembly.
- 1 Instruction Sheet.

TO FACILITATE ASSEMBLY, ALIGN SMALL HOLES IN DRIVE PLATES -- SEE ILLUSTRATION ABOVE.

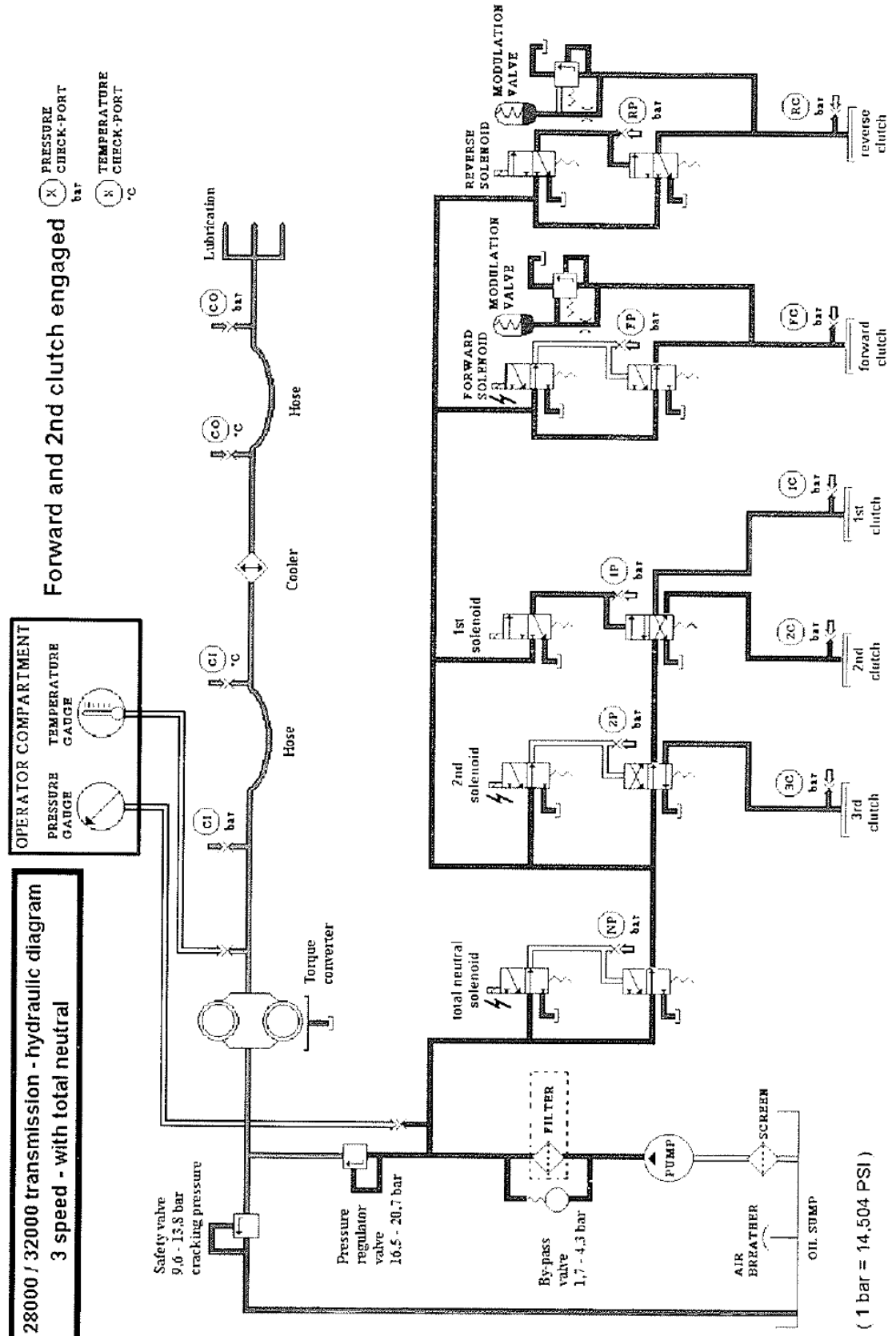
Position drive plate and weld nut assembly on impeller cover with weld nuts toward cover. Align intermediate drive plate and backing ring with holes in impeller cover. **NOTE:** Two dimples 180° apart in backing ring must be out (toward engine flywheel). Install capscrews and washers. Tighten 23 to 25 ft. lbs. torque [31,2 - 33,8 N.m].

**SEE PAGE 99 FOR TRANSMISSION TO ENGINE
INSTALLATION PROCEDURE**

Instruction Sheet 802334
TSB-79 Rev. 11-93

**28000 / 32000 transmission - hydraulic diagram
3 speed - with total neutral**

Forward and 2nd clutch engaged

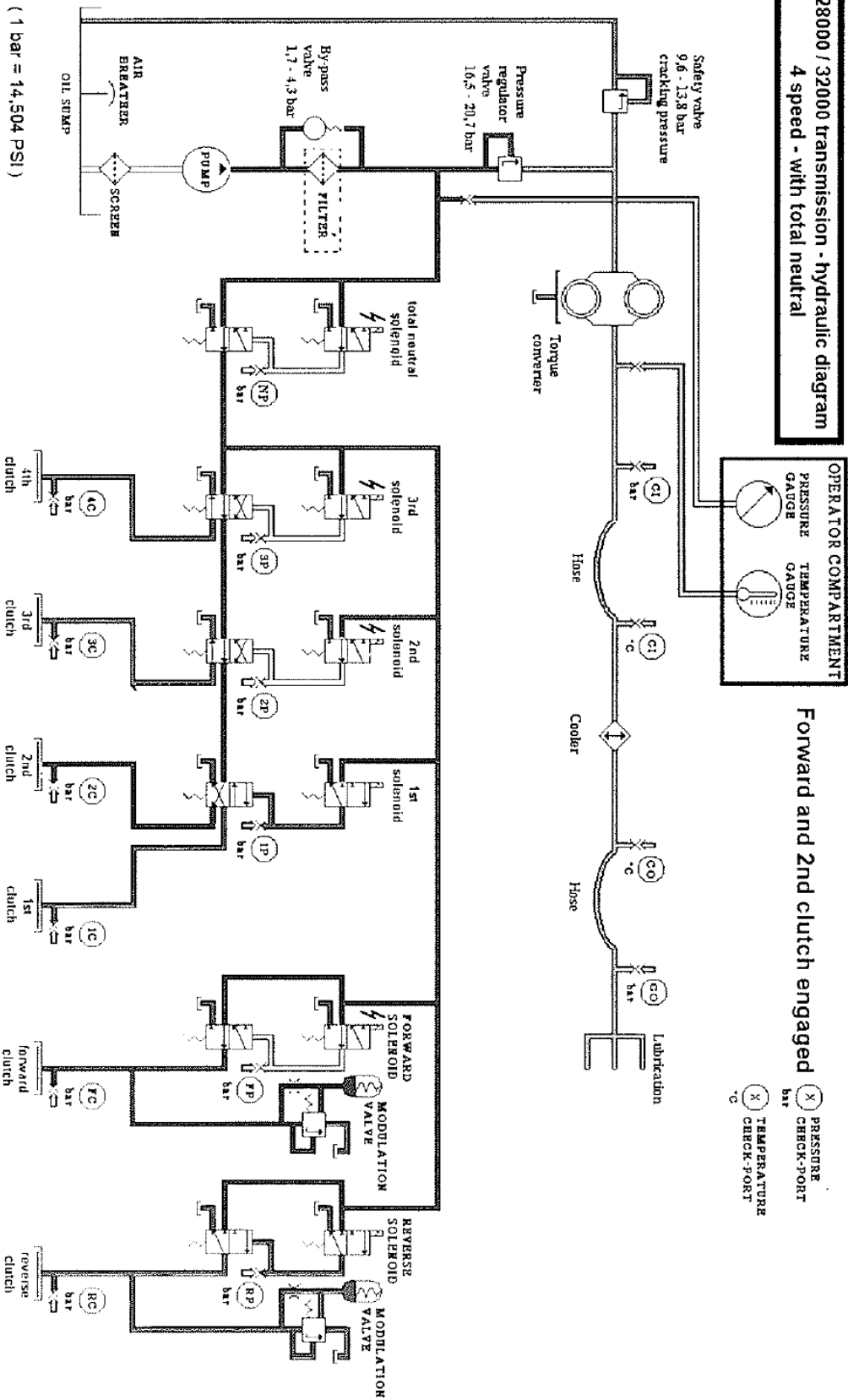


(1 bar = 14,504 PSI)

DANA OFF-HIGHWAY COMPONENTS

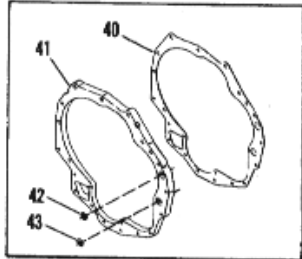
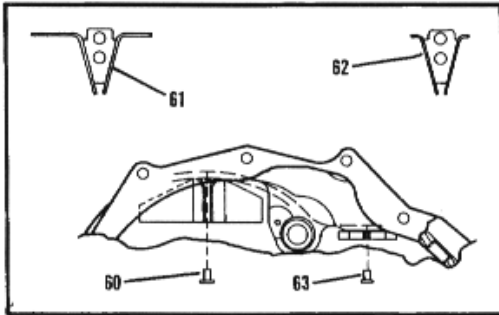


OFF-HIGHWAY COMPONENTS

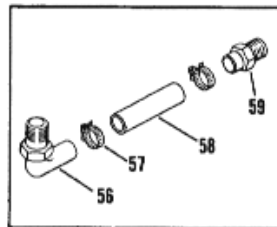
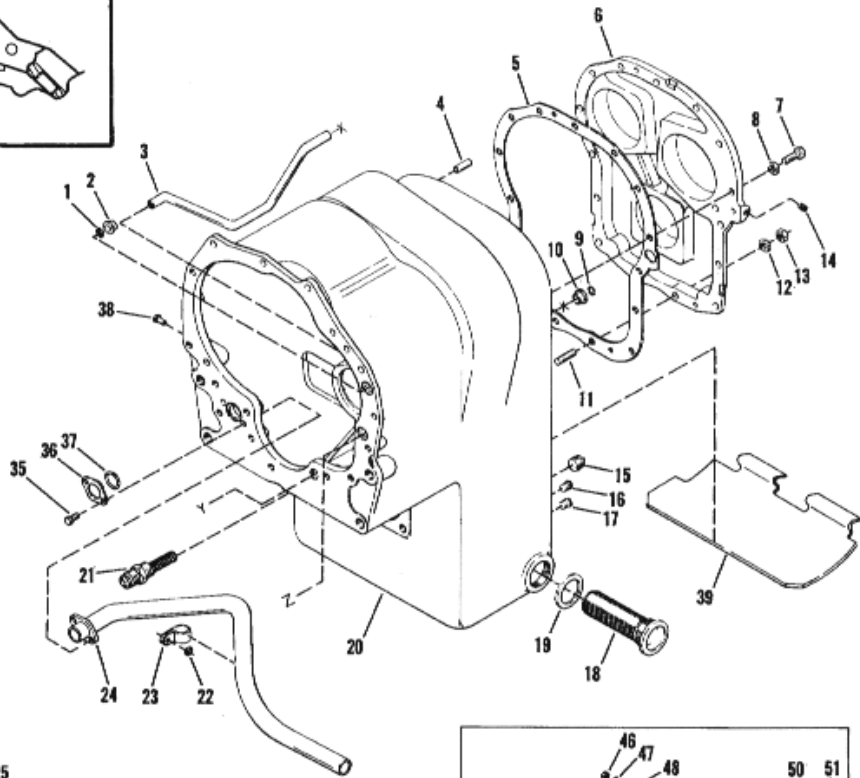
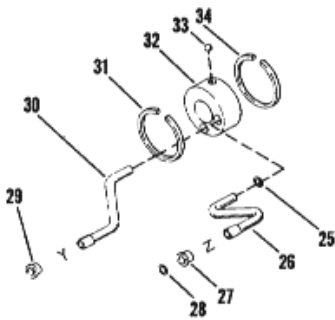


CLARK-HURTH

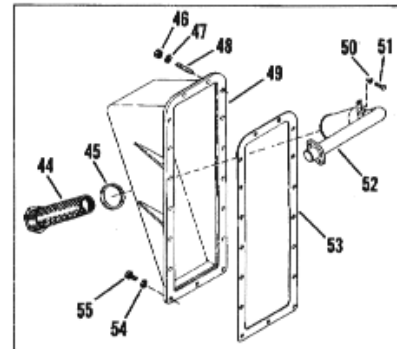
COMPONENTS



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



DRAIN BACK HOSE OPTION



SPECIAL SUMP

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GRP-2 (REV. 3-93)



SPICER OFF-HIGHWAY PRODUCTS DIVISION

REV: 13 Jan 83 *

MODEL: 237241 GRP

PUMP DRIVE GROUP

ITEM	QTY	PART NO	%	DESCRIPTION
1	6	2C-720		Bearing Support Screw
2	6	4E-07		Bearing Support Screw Lockwasher
3	3	223925		Drive Gear Snap Ring
4	3	237798		Pump Drive Gear Bearing
5	3	230811		Pump Drive Bearing Support
6	3	230812	D	Pump Drive Gear 47T

%- Part Stock Recommendation

GRP-31 3-82



SPICER OFF-HIGHWAY PRODUCTS DIVISION

32000 LOW 4 SPEED**SHAFT GROUP****May 24, 2002****MODEL: 269761 GRP**

<u>ITEM</u>	<u>QTY</u>	<u>PART NO</u>	<u>%</u>	<u>DESCRIPTION</u>
24	1	243257	C	Low Shaft Rear Bearing Cone
25	1	243259	C	Low Shaft Rear Bearing Cup
26	1	250215	B	Low Shaft Pressure Piston Ring
27	1	76K241	B	Rear Bearing Cap "O"ring
28	1	251434	E	Rear Bearing Cap
29	5	4E-06		Rear Bearing Cap Lockwasher
30	5	1C-618		Rear Bearing Cap Capscrew
31	1	239244		Rear Bearing Cap Plug
32	1	76K112	B	O-ring-Pressure Tube
33	AR	251442	D	Bearing Cap Shim -.004
33A	AR	251443	D	Bearing Cap Shim -.007
33B	AR	251444	D	Bearing Cap Shim -.010
33C	AR	251445	D	Bearing Cap Shim -.020

N.I- Not Illustrated

AR- As Required

% - Part Stock Recommendation

GRP - 32-164 5-02

Page 2



SPICER OFF-HIGHWAY PRODUCTS DIVISION

ELECTRIC CONTROL VALVE GROUP

3-Nov-00

REV 9-Nov-00

MODEL: 251165 GRP

ITEM	QTY	PART NO	%	DESCRIPTION
1	1	249695	E	Reverse & 2nd Solenoid Cover
1A	1	250627	E	Forward & 1st Solenoid Cover- N.I
2	4	1 C516		Solenoid Cover Screw
3	3	4 E-5		Solenoid Cover Screw Lockwasher
4				Not Used on this Model
5	2	249696		Reverse & 2nd Solenoid Wire Retainer-N.I
5A	2	250629		Forward & 1st Solenoid Wire Retainer-N.I
6	4	248838		Wire Retainer Spacer
7	1	250624	B	Control Valve Assembly to Converter Housing Gasket
8	1	47K-7		Modulator Pressure Regulator Bore Plug
9 thru 16				Not Used on this Model
17	1	251006	D	Control Valve Housing Assembly- Inc Item 8 thru 16 & Items 28,29,41
18	5	76K-014	B	Cartridge "O"Ring
19	5	76K-015	B	Cartridge "O"Ring
20	5	76K-016	B	Cartridge "O"Ring
21	5	78K-10	B	Cartridge "O"Ring
22	4	248871	D	Valve Cartridge- 4 way- includes items 18 thru 21
23	4	76K122	E	Solenoid Coil to Cartridge "O"Ring
24	4	250445	D	Solenoid Coil - 12 Volt
25	4	76K-121	B	Solenoid Nut to Coil "O"Ring
26	4	248875	E	Solenoid Coil Nut
27				Not Used on this Model
28	4	250444	D	Spool Type Solenoid Cartridge Assy Includes Items 18 thru 26

Page 1

Title:	Procedure, Drive-Line Brake Repair
Number:	MB-MEC1450
Revision:	A

**WARNING:**

Stored energy from the springs can cause power plate assembly to pop off housing. To control this, remove assembly bolts #1 & #2 (see Figure 3) and replace with (2 x M12 X 1.75 X 70).

Remove all other assembly bolts alternately keeping power plate parallel to the housing to prevent damage to bearings. Loosen remaining bolts in an alternate pattern until all bolts are removed.

- 2.5** Replace bolts at location #1 & #2 with 2 x M12 X1.75 x 70mm Bolts. Remove all other assembly bolts alternately keeping power plate parallel to the housing to prevent damage to bearings. Loosen remaining bolts in an alternate pattern until all bolts are removed. As shown in Figure 4. Remove bolts from location #1 & #2, and then remove power plate sub-assembly from brake. As shown in Figure 4.

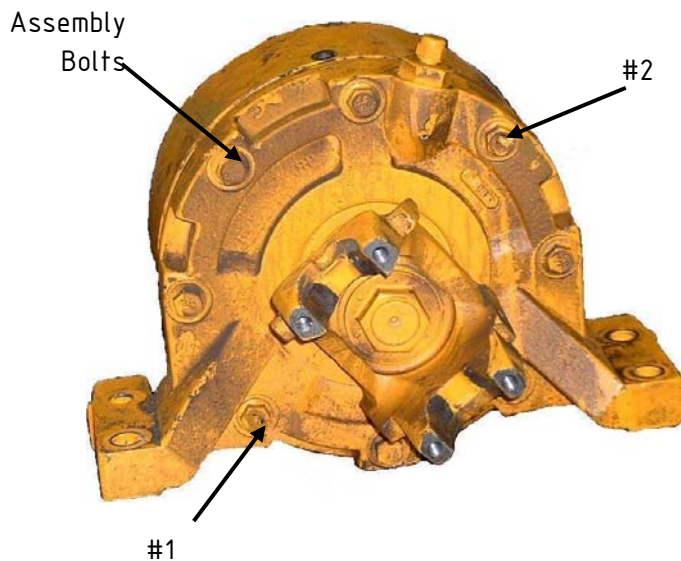


Figure 3- Installing of Longer Bolts.



Figure 4- Removal of Power Plate.

Title:	Procedure, Drive-Line Brake Repair
Number:	MB-MEC1450
Revision:	A

**CAUTION NOTES:**

BEFORE RE-COMMISSIONING UNIT COMPLETE UNIT BRAKE TESTING PROCEDURES TO CONFIRM ALL BRAKING SYSTEMS ARE FUNCTIONING PROPERLY.

INSPECTING AND LUBRICATING

LUBRICATION

Among the most common causes of joint and slip problems is lack of proper lubrication. Properly sized Spicer U-joints that are adequately relubricated at recommended intervals will normally meet or exceed vehicle operation requirements. Relubrication flushes the joints thus removing abrasive contaminants from the bearings.

LUBRICANTS FOR UNIVERSAL JOINTS

For a normal application, use a good quality lithium soap base extreme pressure (E.P.) grease meeting the *N.L.G.I. Grade 2 specifications. Grades 3 and 4 are not recommended because of their greater thickness.

For a severe application, use a good quality lithium soap base or equivalent E.P. grease having an operating temperature range of +325 to -10 degrees Fahrenheit. In addition, the grease should meet the N.L.G.I. grade 2 specifications.

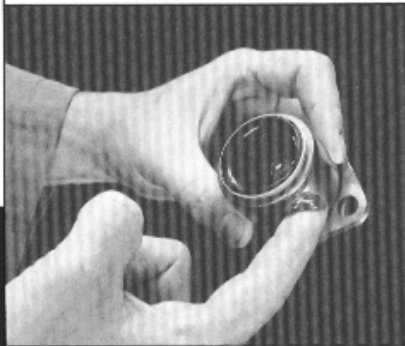
Consult your local lubricant source for greases that meet these specifications.

N.L.G.I.*E.P. Grade 2 Lubricating Grease

*National Lubricating Grease Institute

INITIAL LUBRICATION AND RELUBE CYCLES

Spicer replacement universal joint kits contain only enough grease to provide needle roller bearing protection during storage. It is therefore necessary to completely lubricate each replacement kit prior to assembly into the yokes. Each cross lube reservoir should be fully packed with a recommended grease and each bearing assembly should also be wiped with the same grease; filling all the cavities between the needle rollers and applying a liberal grease coating on the bottom of each bearing assembly. Too much grease may cause hydraulic "lock-up," making installation difficult. After the kits are installed into the yokes and prior to placing into service, they should be relubed, through the lube fitting, using the same grease.



Relubrication cycles vary depending on the service requirements and operating conditions of the vehicle. A recommended relube cycle for various types of service is shown below.

NOTE: On-highway is defined as all applications requiring less than 10% of operating time on gravel, dirt or unimproved roads. If longer than 10% operating time off-highway, use off-highway recommendations.

For line haul tractors using "10" series (1610, 1710, 1760 and 1810) u-joints and Glidecote slip splines, the relubrication cycle may be extended up to 50,000 miles. Consult Dana Corporation, Spicer Universal Joint Division, for lubricant recommendations and evaluation of specific operating conditions that may require this extended relubrication cycle.

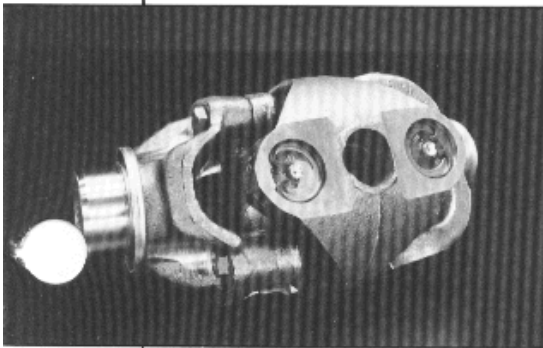
Type of Service	Miles	or	Time
City	5000/8000		3 months
On Highway	10,000/ 15,000		1 month
On/Off Highway	5000/8000		3 months
Extended (Line Haul) (Series 1610 thru 1880)	50,000		3 months
Severe Usage Off Highway (4 x 4)	2000/3000		1 month

SERVICING THE DRIVESHAFT

TORQUE SPECS FOR LIGHT AND MEDIUM DUTY

POSITION	BOLT SIZE	TORQUE (Lb./Ft.)
U-Bolts	(5/16) .312-24	14-17
	(3/8) .375-24	20-24
	(7/16) .438-20	32-37
Bearing Strap	(1/4) .250-28	13-18
	(5/16) .312-24	25-30
	(3/8) .375-24	45-60
Flange Bolts	(5/16) .312-24	22-26
	(3/8) .375-24	40-48
	(7/16) .438-20	63-75
	(1/2) .500-20	97-116

DOUBLE-CARDAN CONSTANT VELOCITY TYPE JOINT (Light Duty)



The double-cardan constant velocity (CV) type u-joint is a special design to accommodate necessary installation angles not compatible with single-cardan u-joints. The CV joint also requires special attention. Neglect is its main enemy.

The CV joints need lubrication to live and some flush-type fittings require special lube gun of the older assemblies creates problems. Some flush-type fittings require special lube gun fittings, such as a needle nose attachment. The crosses may or may not have lube fittings.

The centering socket and ball is critical to proper function of the CV joint and smooth operation. Without lubrication it will wear out, causing vibration and serious damage. Rebuilding the CV joint will be necessary.

LUBRICATION

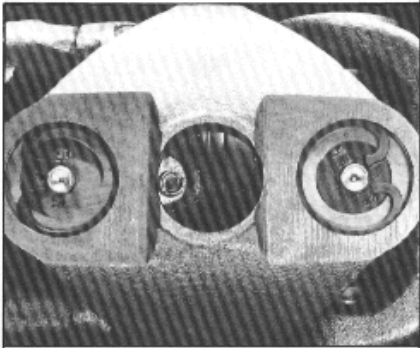
The lube fitting for the centering socket in the CV joint can be difficult to reach and requires a special lube technique. It is necessary to rotate the driveshaft to a position with the flush type lube fitting in the centering socket up toward the floor board. The yokes spread or open in this position to allow access with the needle nose tip. It is still an awkward and blind procedure. That explains why neglect is so common.



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.

A more positive, less frustrating approach is to disconnect the driveshaft. The lube fitting will come into view but it may be necessary to jack one front wheel and rotate the driveshaft. This can be done to all 4WD vehicles with the double-cardan u-joint.



Lubrication access hole in late-design Spicer Double Cardan Joints.

The later-design Spicer CV joints simplify lubrication by making easy access to the lube fittings. Service replacement kits have been modified with a lube fitting in one or more bearing assemblies to aid in lubrication access. Also, an access hole has been provided in the center yoke for easy lubrication of the centering ball. This new design eliminates the need to disconnect the shaft and puts the fittings in plain view.

Look for signs of u-joint trouble when lubricating u-joints:

- ✓ Lube spray from a leaky seal indicates need for u-joint replacement.
- ✓ Any looseness or noticeable "slop" at a u-joint in the driveshaft calls for immediate replacement of the u-joint, assuming the snap rings or bolts are already in place or torqued down.

FIELD PROBLEM ANALYSIS

be related to angularity problems. Both of these problems can be caused by lack of lubrication.

Problems which are not a result of lubrication are associated with the installation, angles and speed of the driveshaft. Fractured parts caused by torque, fatigue and bending are associated with overload, excessively high u-joint angles and driveshaft lengths exceeding critical speed limitations.

greater the unbalance force acting on the shaft.

The force produced by this out-of-balance condition tends to bend the supporting members. As the supporting members have a natural frequency of vibration similar to a swinging pendulum, a violent vibration may exist at certain periods when the speed of rotation and the natural frequency of supports coincide.

Each end of the shaft must be balanced individually as each support is responsive to an out-of-balance condition in the portion of the shaft it supports. Out-of-balance affects operating conditions only when rotating.

Transverse vibration caused by a driveshaft out-of-balance will usually emit sound waves that you can hear and mechanical shaking that you can feel. The force from out-of-balance increases with speed, not torque load. The driveshaft speed is determined by vehicle speed and the vibration is demonstrated best by road testing the vehicle to operating speed, disengaging engine, and checking vibration while coasting with engine noises eliminated.

The energy to produce torsional vibration can occur from the power impulses of the engine or from improper u-joint angles.

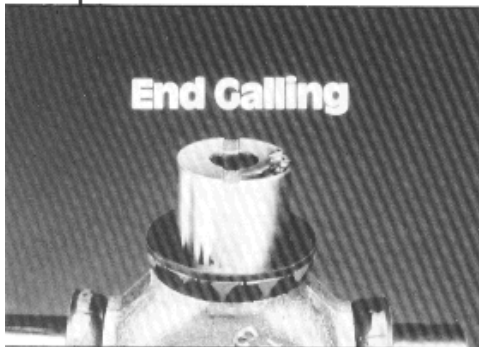
This type of vibration is difficult to identify in road testing but certain characteristics do exist. It causes a noticeable sound disturbance and can occasionally transmit mechanical shaking.

Torsional vibrations can exist at one or more periods any place in the operating range and tend to be more severe at lower speeds. Changes in torque load (part-to-full throttle) usually effect the vibration. The nonuniform velocity obtained when a u-joint operates at an angle produces torsional vibration. In a driveline having two or more joints in series, it is desirable to have the individual joint angles arranged such that the net result minimizes nonuniform velocity characteristics over the system.

It is practically impossible to maintain the desired joint angles throughout the operating range. Therefore, it is necessary to determine some maximum limit of torsional excitation which can be considered as generally acceptable.

The amount of torsional excitation which can be accepted without causing excessive disturbance depends upon operating speed and characteristics of supporting structures and other units in the driveline and drivetrain system.

Other vibrational problems in a driveshaft could be caused by worn or damaged u-joints. These joints must be constantly maintained according to manufacturer's lubrication specifications.

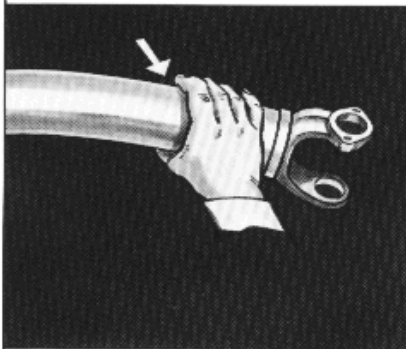


End Galling

End Galling

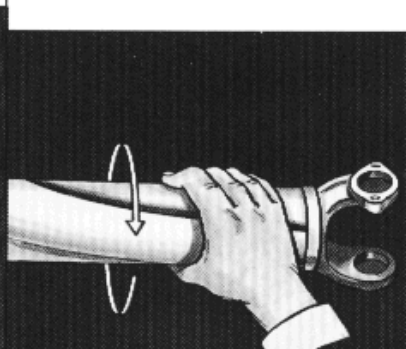
VIBRATION-RELATED PROBLEMS

Vibration is a driveshaft problem that can be either transverse or torsional.



Transverse Vibration

Transverse vibration is the result of unbalance acting on the supporting shafts as the driveshaft rotates. When a part having an out-of-balance, or heavy side, is rotated an unbalanced force is created that increases with the square of the speed. The faster the shaft turns, the



Torsional Vibration

Torsional vibration, although similar in effect to transverse vibration, is an entirely different motion. The transverse vibration is a bending movement whereas torsional vibration is a twisting motion.

Number: **MB-MEC1170**
 Revision: **Level A**

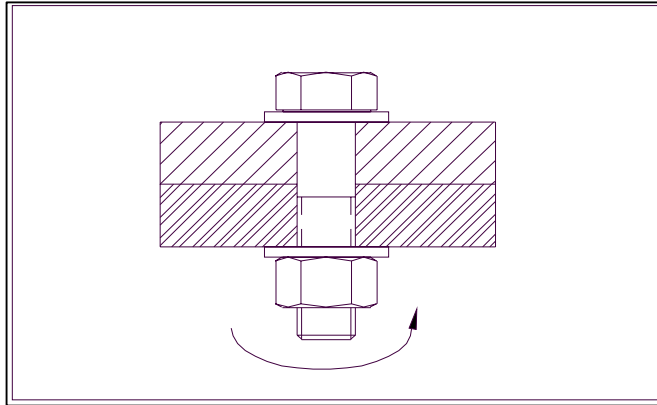


Chart #2: Grade 8 Imperial HHCS Torquing the Nut

Bolt Diameter	Fastener Torque (Ft-lbs)		
	Hex Nut with Antiseize		Lock Nut
	UNC	UNF	
3/8	25	30	20
7/16	40	50	35
1/2	65	70	50
9/16	95	100	75
5/8	125	145	100
3/4	225	250	180
7/8	365	405	290
1	545	610 (155)	430
1-1/8	775 (195)	870 (220)	615 (155)
1-1/4	1090 (275)	1210 (305)	860 (215)
1-3/8	1430 (360)	1625 (405)	1145 (285)
1-1/2	1895 (475)	2135 (535)	1510 (380)

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

Title: Hose List, MK7-2-005
Number: MB-HYD1604
Revision: Original

The following is the machine specific hose list for 2-Boom Jumbo MK7-2-005.

Hose No.	Size	Length	Fitting	Fitting	Circuit	Description
A01	8C	42	1	1	AIR/WATER	FROM AIR COMPRESSOR TO FILTER
A02	8C	195	1	1	AIR/WATER	FROM FILTER TO T FITTING
A03	8C		1	1	AIR/WATER	FROM T FITTING TO JOINER
A04	8C	155	1	1	AIR/WATER	FROM JOINER TO LUBE PUMP ASSY
A12	8C	49	1	L	AIR/WATER	FROM FILTER TO COALESCING FILTER
A14	4A	49	1	1	AIR/WATER	FROM VALVE ASSY TO TANK
A14A	4A	49	1	0	AIR/WATER	FROM VALVE ASSY TO GROUND
A1R	6B	28	1	L	STEER/BRAKE	FROM PRESS RED MANIFOLD TO BRAKE MANIFOLD
A2R	6B	24	1	L	STEER/BRAKE	FROM PRESS RED MANIFOLD TO BRAKE MANIFOLD
AB02	6C	9	1	1	STEER/BRAKE	
AB12	6B	8	1	1	POWER FRAME	FROM FRONT AXLE TO FRONT AXLE
AB12	6C	9	1	1	STEER/BRAKE	
ACC01	6B	9	1	L	STEER/BRAKE	FROM PRESS RED MANIFOLD TO CHARGE VALVE
ACC02	6B	48	1	1	STEER/BRAKE	FROM PRESS RED MANIFOLD TO ACCUMULATOR
ACC03	6B	7	1	L	STEER/BRAKE	FROM ACCUMULATOR TO BRAKE VALVE
ACC11	6B	11	1	L	STEER/BRAKE	FROM PRESS RED MANIFOLD TO CHARGE VALVE
ACC12	6B	50	1	1	STEER/BRAKE	FROM PRESS RED MANIFOLD TO ACCUMULATOR
ACC13	6B	8	1	L	STEER/BRAKE	FROM ACCUMULATOR TO BRAKE VALVE
ACCSW	6B	16	1	L	STEER/BRAKE	FROM CHARGE VALVE TO BRAKE MANIFOLD
AF01	16E	228	1	1	AIR/WATER	
AF01	16E	246	1	1	AIR/WATER	MINE AIR IN
AF02	16E	60	1	1	STEER/BRAKE	
AF03	8C	26	1	L	AIR/WATER	
AF13	8C	26	1	L	AIR/WATER	
ARPS01L	4A	24	1	L	AIR/WATER	
ARPS01L	4A	171	1	L	BOOM FRAME	FROM LH BULKHEAD TO LH FEED AUTO-REV P-SWITCH
ARPS01LA	4A	22	1	1	BOOM FRAME	
ARPS01R	4A	24	1	L	AIR/WATER	
ARPS01R	4A	171	1	1	BOOM FRAME	FROM RH BULKHEAD TO RH FEED AUTO-REV P-SWITCH
ARPS01RA	4A	22	1	1	BOOM FRAME	
ARPS02L	4A	150	1	1	BOOM	FROM LH BULKHEAD TO LH JOINER
ARPS02R	4A	150	1	1	BOOM	FROM RH BULKHEAD TO RH JOINER
ARPS03L	4A		1	1	BOOM	FROM LH JOINER TO LH AUTO RETRACT VALVE
ARPS03R	4A	147	1	1	BOOM	FROM RH JOINER TO RH AUTO RETRACT VALVE

MB

Title: Drill Lubrication System
Number: MB-HYD1570
Part Number(s) Affected: 1065720, 1075750, 1074867
Machine Model(s) Affected: All Equipped
Parts Manual Section: Drills and Feeds
Revision: Original

Creation Date: 14-SEP-2006
Written By: Donna Umlah
Checked By: Chad Pink
Approved By: Darren Bowins

Revision Date:
Revised By:
Checked By:
Approved By:

1. Scope:

The drill lubrication system supplies atomized oil to the fronthead of the rock drill. The system also provides a means of pressurizing the fronthead of the drill with air pressure to restrict drill cuttings and water from entering the fronthead.

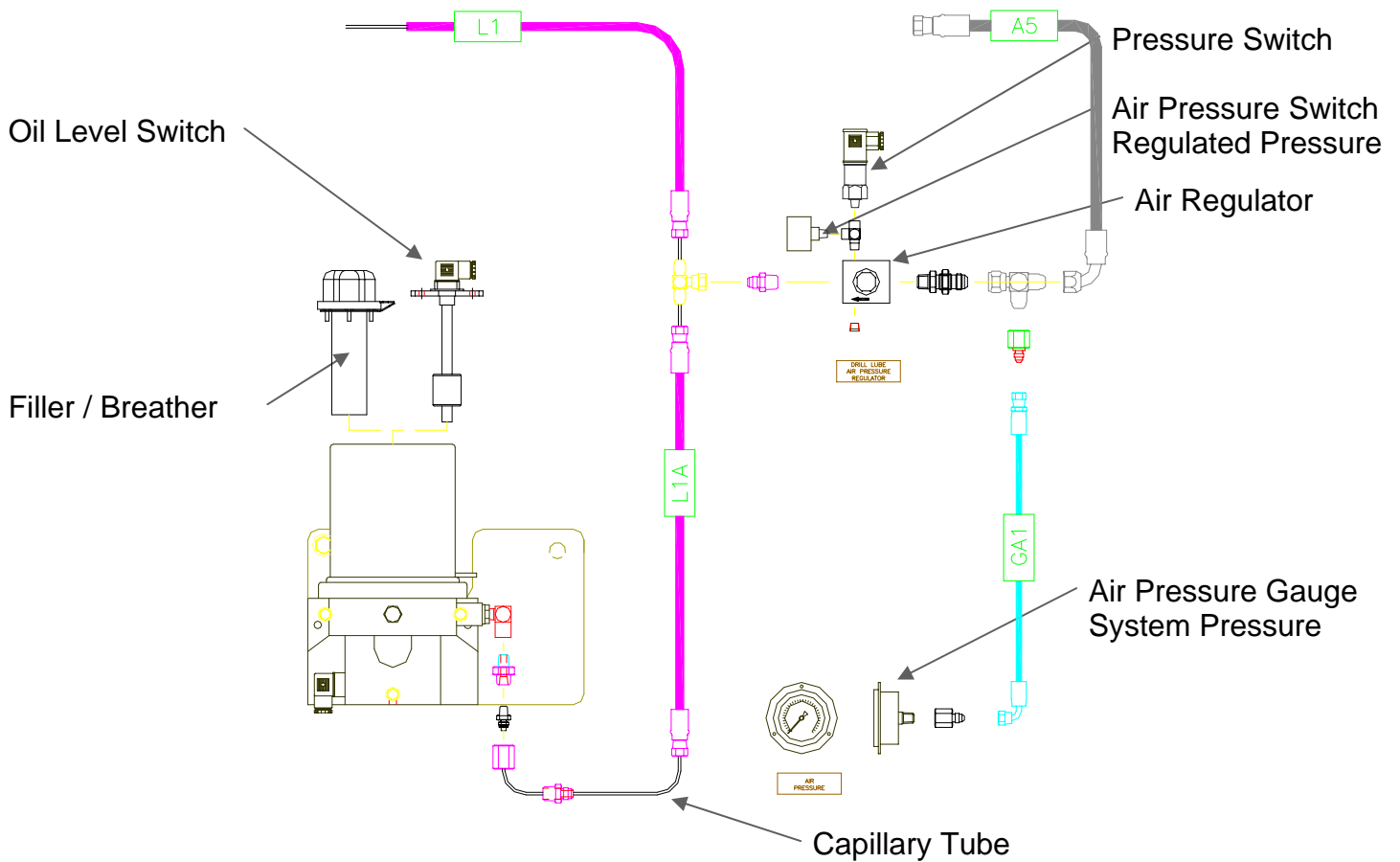


Figure A - Drill Lube Pump System

Title:	Drill Lubrication System
Number:	MB-HYD1570
Revision:	Original

6. Notes:

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

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

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

Preventative Maintenance

At regular intervals depending on the conditions and time of operation, the following checks should be made:

1. Pump meets required performance and is operating smoothly and quietly.
2. There are no leaks, particularly at the shaft seal.
3. The motor is not overheating.
4. Remove and clean all strainers or filters in the system.
5. Verify the tripping of the motor overload protection.
6. Check the operation of all controls. Check unit control cycling twice and adjust, if necessary.
7. If the pump is not operated for unusually long periods, the unit should be maintained in accordance with these instructions. In addition, if the pump is not drained, the pump shaft should be manually rotated or run for short periods of time at monthly intervals.
8. To extend the pump life in severe duty applications, consider performing one of the following actions:
 - Drain the pump after each use.
 - Flush the pump, through system, with water or other fluid that is compatible with the pump materials and process liquid.
 - Disassemble the pump liquid components and thoroughly rinse or wash them with water or other fluid that is compatible with the pump materials and process liquid.

If the pump fails to operate or there is a loss of performance, refer to the Troubleshooting Section on pages 13-14.

Motor Replacement

If the motor is damaged due to bearing failure, burning or electrical failure, the following instructions detail how to remove the motor for replacement. It must be emphasized that motors used on CR pumps are specifically selected to our rigid specifications. Replacement motors must be of the same frame size, should be equipped with the same or better bearings and have the same service factor. Failure to follow these recommendations may result in premature motor failure.

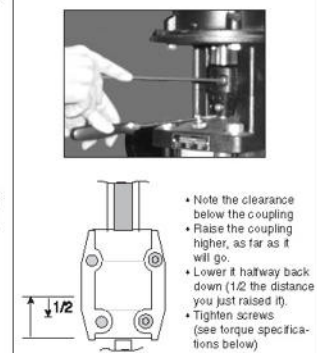
Disassembly

1. Turn off and lock out power supply. The power supply wiring can not be safely disconnected from the motor wires.
2. Remove the coupling guards.
3. Using the proper metric Allen wrench, loosen the four cap screws in the coupling. Completely remove coupling halves. On CR1s-CR20, the shaft pin can be left in the pump shaft. CR(N)32, 45, 64 and 90 do not have a shaft pin.
CR 1s, 1, 3, 5, 10, 15, and 20: do not loosen the three shaft seal securing allen screws.
4. With the correct size wrench, loosen and remove the four bolts which hold the motor to the pump end.
5. Lift the motor straight up until the shaft has cleared the motor stool.

Assembly

1. Remove key from motor shaft, if present, and discard.
2. Thoroughly clean the surfaces of the motor and pump end mounting flange. The motor and shaft must be clean of all oil/grease and other contaminants where the coupling attaches. Set the motor on the pump end.
3. Place the terminal box in the desired position by rotating the motor.
4. Insert the mounting bolts, then diagonally and evenly tighten. For 3/8" bolts, torque to 17 ft.-lbs., for 1/2" bolts torque to 30 ft.-lbs., and for 5/8" bolts torque to 59 ft.-lbs.
5. CR 1s, 1, 3, and 5:
Insert shaft pin into shaft hole. Reinstall the coupling halves onto shaft and shaft pin. Reinstall the coupling screws and leave loose. Check that the gaps on either side of the coupling are even, and that the motor shaft keyway is centered in the coupling half, as shown in Figure 6a, page 11. Tighten the screws to the correct torque.
CR 10, 15 and 20:
Insert shaft pin into shaft hole. Insert plastic shaft seal spacer beneath shaft seal collar. Reinstall the coupling halves onto shaft and shaft pin. Reinstall the coupling screws and leave loose. Check that the gaps on either side of the coupling are even and that the motor shaft keyway is centered in the coupling half, as shown in Figure 6a, page 11. Tighten the screws to the correct torque. Remove plastic shaft seal spacer and hang it on inside of coupling guard.
CR 2, 4, 8 and 16:
Reinstall coupling halves. Make sure the shaft pin is located in the pump shaft. Put the cap screws loosely back into the coupling halves. Using a large screwdriver, raise the pump shaft by placing the tip of the screwdriver under the coupling and carefully elevating the coupling to its highest point (see Figure 6). Note: the shaft can only be raised approximately 0.20 inches (5mm). Now lower the shaft halfway back down the distance you just raised it and tighten the coupling screws (finger tight) while keeping the coupling separation equal on both sides. When the screws are tight enough to keep the couplings in place, then torque the screws evenly in a criss-cross pattern.

Figure 6
CR(X)(N)(T) 8, 16 & CRT 2, 4



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

2. Torques and lubricants

This section shows the screws and nuts that must be tightened to a certain torque and the lubricants to be used.

Pos.	Description	Number	Dim.	Torque [Nm]	Lubricant
7.a	Screw	4	M4	2	
9	Hexagon socket head screw	4	M6	13	Thread-Eze
			M8	31	
			M10	62	
18	Air vent screw (spindle)	1	½" (M8)	35 (3)	Soapy water
23	Plug	1	½"	35	
25	Priming valve (spindle)	1	½" (M10)	35 (5)	
26	Staybolt	4	M12		Thread-Eze
28	Hexagon head screw	4	M6	10	Thread-Eze
			M8	12	
			M12	40	
35	Hexagon head screw	4	M10	23	Thread-Eze
36	Nut	4	M12	50	Thread-Eze
37	O-ring	2	ø137.5 x 3.3		Rocol 22
47.a	Bearing ring	See section 5. Order of assembly for chambers and impellers			Rocol 22
67	Lock nut	1	M8	18	Gardolube L 6034
105	Shaft seal	1	M28	35	
113	Hexagon socket set screw	3	M5	2.5	

Thread-Eze, part no. SV9997 (0.5 l).

Gardolube L 6034, part no. SV9995 (1 l).

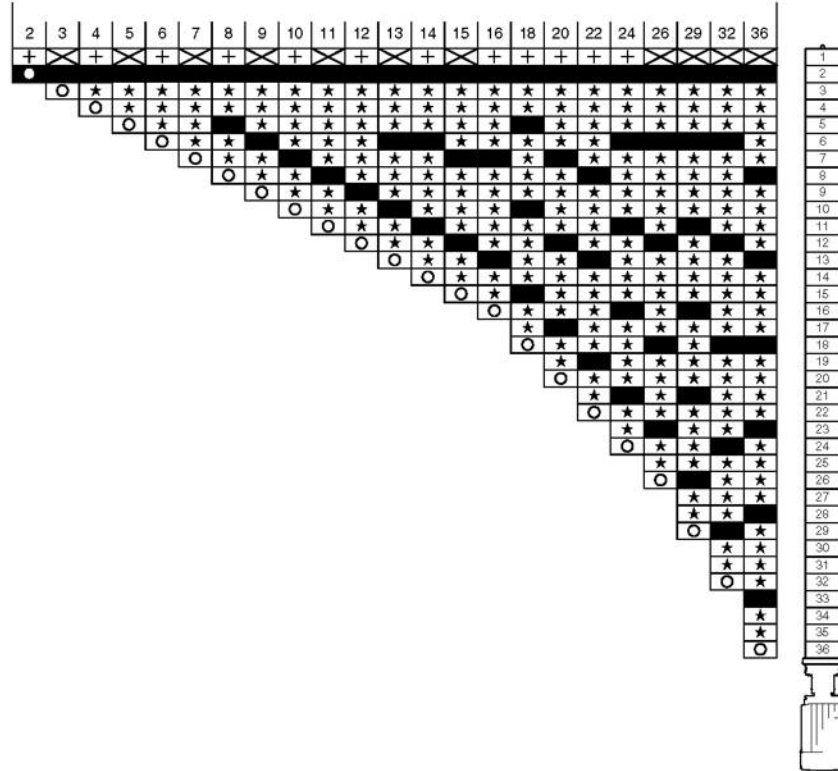
Rocol 22, part no. RM2924 (1 kg).

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

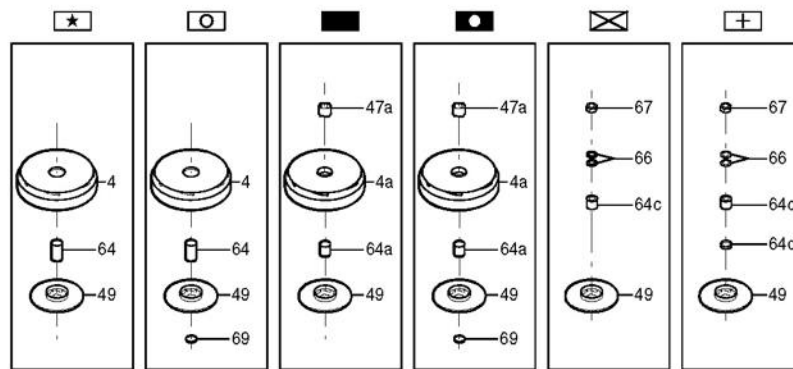
5.2 CR 5

Stage survey

CR / CRI / CRN 5 -



Symbol survey



TM02 0444 4600

Title:	Brake Manifold for Mercedes Powered Vehicles
Number:	MB-HYD1528
Revision:	Original

4. **Driveline Brake Pressure Reducing Valve “PRV” (if equipped)** – this valve is required to ensure that no more than 500 psi pressure is sent to the driveline brake because it is only rated for 750 psi maximum pressure. The valve is preset and non-adjustable.
5. **Automatic Brake Application (ABA) Impending Pressure Switch “PS1”** – this pressure switch is required to monitor the stored energy in the lowest brake accumulator. When the stored energy drops to 1700 psi the switch closes and illuminates an amber warning light in the driver’s instrument panel.
6. **Automatic Brake Application (ABA) Release Pressure Switch “PS2”** – this pressure switch is required to monitor the stored energy in the lowest brake accumulator. When the stored energy drops to 1350 psi the switch opens and de-energizes all of the solenoid valves in the brake manifold, when this happens the axle and driveline brakes apply to stop the unit.
7. **Brake On Light Pressure Switch “PS3”** – this pressure switch is required to identify when the brakes are applied. When hydraulic pressure drops below 150 psi the switch closes and illuminates a red light in the driver’s instrument panel.

The brake manifold also contains five different test points for measuring the pressure in various parts of the brake manifold:

1. **Brake Accumulator #1 Test Point “TEST A1”** – this test point measures the pressure in brake accumulator #1 for the engine end axle brake. It is common with the pressure gauge located in the operator’s compartment.
2. **Brake Accumulator #2 Test Point “TEST A2”** - this test point measures the pressure in brake accumulator #2 for the deck/boom end axle brake. It is common with the pressure gauge located in the operator’s compartment.
3. **Driveline Brake Test Point “TEST DLB”(if equipped)** – this test point measures the pressure that is applied to the driveline brake. It will range from 0 psi (“SV3” de-energized) to 500 psi (“SV3” energized). It is common with the gauge in the operator’s compartment.
4. **Engine Axle Brake Test Point “TEST ENG EB”** – this test point measures the pressure that is applied to the engine end axle secondary brakes. It will range from 0 psi (“SV1” de-energized) to the pressure in the corresponding accumulator (“SV1” energized). It is common with the gauge in the operator’s compartment.
5. **Deck Axle Brake Test Point “TEST DECK EB”** – this test point measures the pressure that is applied to the deck/boom end axle secondary brakes. It will range from 0 psi (“SV2” de-energized) to the pressure in the corresponding accumulator (“SV2” energized). (It is common with the gauge in the operator’s compartment).

MB

Title:	MK7-2 Hydraulic Setup Guide
Number:	MB-HYD1461
Part Number(s) Affected:	Numerous
Machine Model(s) Affected:	MK7
Parts Manual Section:	Hydraulics
Revision:	Original

Creation Date:	04-APR-2005
Written By:	Arlen Yao
Checked By:	Adam Howse
Approved By:	David Jacques

Revision Date:	
Revised By:	
Checked By:	
Approved By:	

1.0 Scope:

This Maintenance Bulletin includes the setup instructions for various hydraulic components on the MK7 equipment.

Notes:

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

Phone: 1-866-856-3626

Email: service@macleanengineering.com

Title:	Setup Guide, Hydraulic
Number:	MB-HYD1461
Revision:	Original

5. Using the appropriate drill control joystick, activate the drill feed forward function and adjust the feed pressure to 1000 psi using the feed pressure regulator.
6. Engage the drill impact/feed/rotation lock. The drill impact should be operating at low pressure.
7. Turn the sequence valve adjustment CCW until the drill impact changes from low to “hi” pressure.
8. Lock the adjustment using the jam nut.
9. Re-connect the drill impact and drill feed forward hoses.

The “anti-jam sequence valve” determines the minimum drill rotation pressure that will engage the anti-jam system. This valve can be adjusted using the following procedure:

1. Disconnect the CCW drill rotation hose at a convenient location (at the drill, at a bulkhead) and plug the hose.
2. Loosen the jam nut on the sequence valve.
3. Turn the sequence valve adjustment fully CCW so that it is at its minimum setting.
4. Install a pressure gauge onto test point “TEST2” on the pump unload manifold. This measures the pump pressure from the 45cc pump.
7. Remove the cap from the maximum pressure adjustment on the 45cc pump controller and loosen the jam nut.
8. Start the appropriate AC powerpack and observe the pressure on the gauge.
9. Turn the maximum pressure adjustment CCW until the gauge reads 1300 psi.
10. Turn the anti-jam kick in valve adjustment fully CCW so that it is at its minimum setting.
11. Enable the anti-jam system using the toggle switch on the boom control console.
12. Using the appropriate drill control joystick engage the drill impact/feed/rotation lock. Due to the anti-jam sequence valve being at its minimum setting the drill feed should reverse.
13. Turn the sequence valve adjustment CW until the drill feed automatically begins to move forward.
14. Lock the adjustment using the jam nut.
15. Re-set the 45cc pump pressure to 2500 psi. (See section 2.2.1).
16. Re-connect the CCW drill rotation hose.

Title:	Drilling Control System
Number:	MB-HYD1460
Revision:	Original

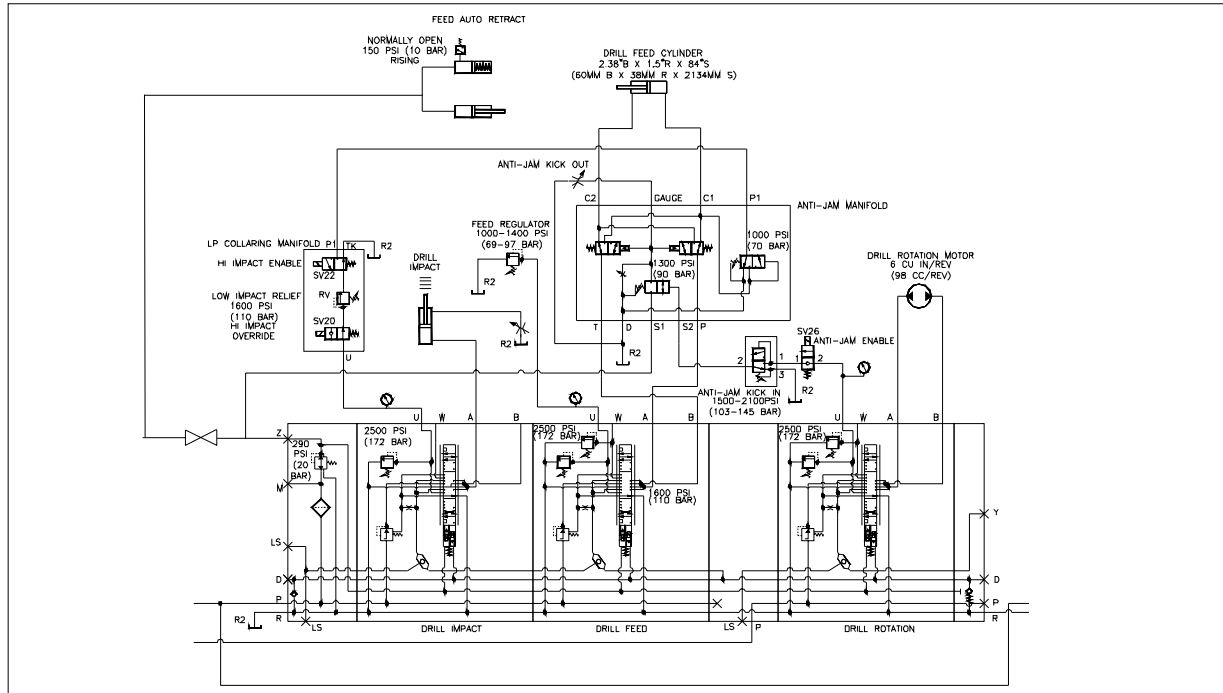


Figure 4: Drilling Control System Schematic

The drill control system has five primary roles:

1. Anti-jam protection
2. Low pressure collaring
3. Feed pressure adjustment (manual)
4. Feed auto retract
5. Drill impact back pressure
6. Maximum pressure control for drill impact, feed, and rotation functions

The drilling control system is composed of the following valves and manifolds:

1. **Anti-jam Enable Valve** – this valve is a 2P2W (2 position, 2 way) on/off valve that is schematically located between port “U” of the drill rotation valve section and the anti-jam kick in valve. When de-energized, this valve blocks the drill rotation pressure signal to the anti-jam kick in valve to prevent the anti-jam system from operating. When energized, this valve allows the drill rotation pressure signal to reach the anti-jam kick in valve to enable the anti-jam system to operate (if rotation pressure exceeds the setting of the anti-jam kick in valve).

Title:	Drilling Control System
Number:	MB-HYD1460
Revision:	Original

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

Title: Low Pressure Collaring Manifold
Number: MB-HYD1454
Revision: Original

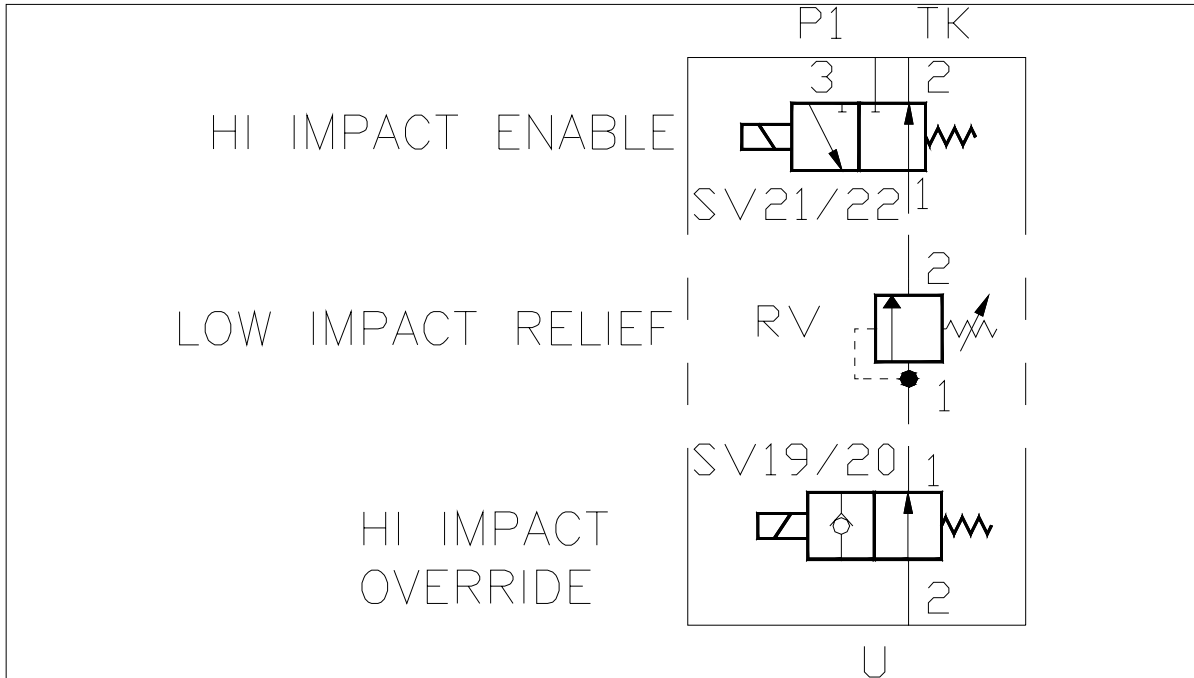


Figure 2: Low Pressure Collaring Manifold Schematic

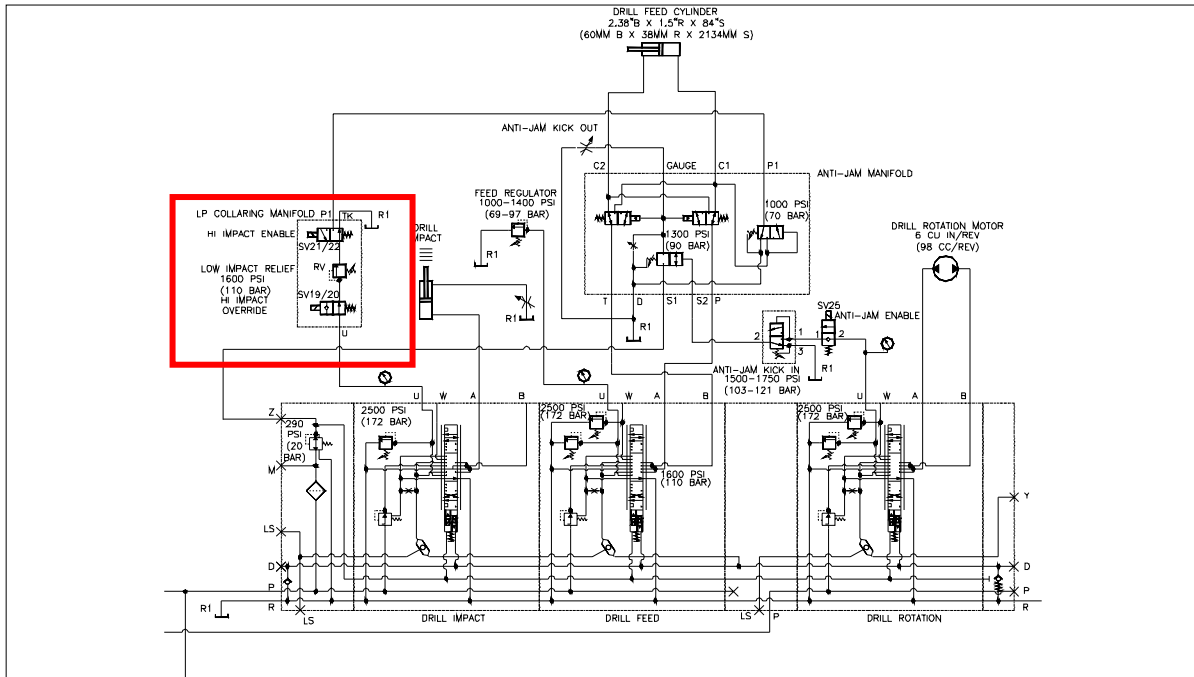


Figure 3: Low Pressure Collaring Circuit

Title:	Pump Unload Manifold
Number:	MB-HYD1453
Revision:	Original

3.0 Troubleshooting:

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

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
The hydraulic pumps will not develop any hydraulic pressure.	A. The pump unload solenoid valve SV23/24 is being energized even when the electric motors have started.	In this condition the hydraulic control signal to the pumps is dumped to tank so the pumps will not produce any pressure.	Verify if the pump unload solenoid valve is being energized at all times. If so, review the electrical schematic for proper electrical control.
	B. The pump unload solenoid valve is stuck in the energized position.	Contamination or an over-tightened cartridge or coil nut may cause the valve to malfunction.	Remove the cartridge and inspect/clean as required. Apply electrical power to solenoid and verify that the spool is moving. 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.

Title:	Pressure Control Manifold
Number:	MB-HYD1396
Revision:	Level B

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
When the accumulator dump valve "ADV" is operated the accumulators do not lose any pressure or only one accumulator loses pressure.	a. The accumulator dump valve is damaged.	Internally the cartridge might be damaged so that it cannot be operated.	Turn off the unit and manually bleed off the accumulators by pumping the service brake pedal until the accumulator gauges read zero pressure. Remove the accumulator dump valve and inspect for proper operation. Replace cartridge if necessary.
	b. The shuttle valve "SHUT" may be malfunctioning.	If the shuttle ball inside the cartridge is stuck to one side it might not allow one of the accumulators to be dumped.	Turn off the unit and manually bleed off the accumulators by pumping the service brake pedal until the accumulator gauges read zero pressure. Remove the shuttle valve and inspect for proper operation. Replace cartridge if necessary.
	c. The check valve "CV" may be stuck	If this cartridge becomes stuck it will not allow the hydraulic fluid to reach the "TK" port.	Turn off the unit and manually bleed off the accumulators by pumping the service brake pedal until the accumulator gauges read zero pressure. Remove the check valve and inspect for proper operation. Replace cartridge if necessary.
	d. The manifold may have an internal blockage.	If one of the passages in the manifold is blocked it could prevent the hydraulic fluid from being dumped.	Turn off the unit and manually bleed off the accumulators by pumping the service brake pedal until the accumulator gauges read zero pressure. Remove and disassemble the pressure control manifold. Clean and inspect as required.
			If none of these suggestions have resolved the problem contact MacLean Engineering Technical Service Department.

Title: Hydraulic Control Manifold
Number: MB-HYD1394
Revision: Level A

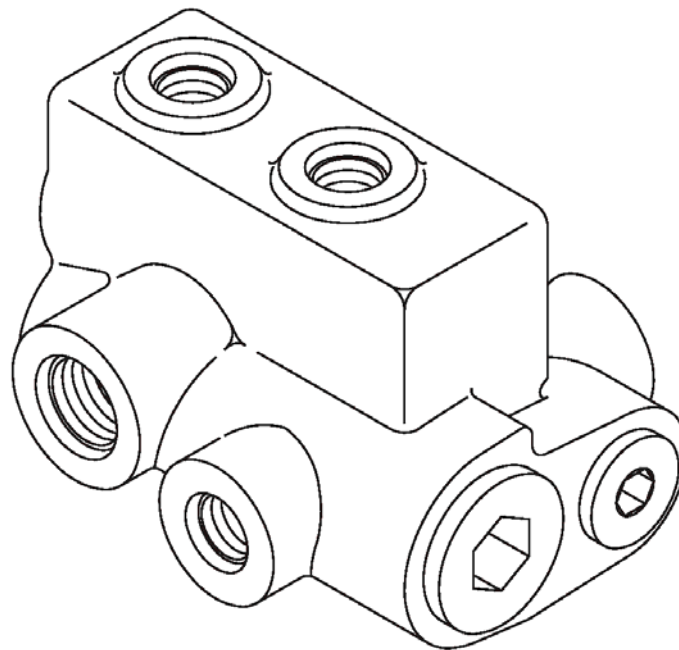
PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
The hydraulic pump will not go to maximum pressure when the LS/PC solenoid valve "SV4" is energized.			See the previous problem for the Drive/Aux solenoid valve "SV5". Test for electrical power to the solenoid, coil magnetic field, and contamination. If none of these suggestions resolves the problem contact MacLean Engineering Technical Service Department.

PROBLEM	CAUSE	EXPLANATION	CORRECTIVE ACTION
The engine labours when starting.	a. The pump unload solenoid valve "SV6" is not energizing.	If this valve is not energized it will not unload the pump and this will draw power from the engine causing it to work too hard.	The LED on the DIN connector should be illuminated when pushing the engine start button. If it is not illuminated test for power at the appropriate terminal block inside the driver's instrument panel.
	b. The pump unload solenoid valve "SV6" 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 while trying 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 the coil is working properly. If there is no magnetic field then the coil should be replaced.
	c. The pump unload solenoid valve "SV6" 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.

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

**463 Series
 Single & Dual Load Sensing
 ACCUMULATOR
 CHARGING VALVES**

SERVICE INSTRUCTIONS



MICO could not possibly know of and give advice with respect to all conceivable applications in which this product may be used and the possible hazards and/or results of each application. MICO has not undertaken any such wide evaluation. Therefore, anyone who uses an application which is not recommended by the manufacturer, first must completely satisfy himself that a danger will not be created by the application selected, or by the particular model of our product that is selected for the application.

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

5.0 Removal and Replacement:

If a counterbalance valve or counterbalance valve cartridge is found to be faulty there is a specific removal and replacement procedure:



Warning: Do not remove a counterbalance valve or cartridge unless the mechanical load can be safely secured. Failure to do so may result in serious injury.

1. Turn off the machines electric and diesel power sources so that there is no hydraulic power source available.
2. If the counterbalance valve or cartridge that is to be removed is supporting the weight of a mechanical component (e.g. boom rollover, tilt actuator, crowd cylinder) ensure the weight of that component is secured.
3. Bleed any residual pressure that may still exist between the counterbalance valve and the actuator using the following procedure:
 - a) Turn each of the counterbalance valve cartridges to their minimum setting (fully CW) to decrease the residual pressure as much as possible
 - b) For a counterbalance valve that is remote mounted gradually loosen the hydraulic hoses from the C1 and C2 ports while covering the hose end with a rag to prevent any hydraulic spray
 - c) For a counterbalance valve that is directly mounted to the actuator there is no C1 or C2 port available. Slowly remove the cartridge or the valve while using a rag to protect against oil spray
4. Install the new counterbalance valve or cartridge.
5. Adjust the counterbalance valve cartridge according to the hydraulic schematic setting. See Section 6.0 Making Adjustments.
6. Re-connect the hydraulic hosing as required.
7. Slowly re-apply the weight back onto the actuator and verify that the counterbalance valve is holding.
8. If the counterbalance valve is not holding increase the setting of the cartridge slightly.

Title: Pumps, Rexroth Hydraulic
Number: MB-HYD1025
Revision: LEVEL B

The following flows are considered acceptable at 1750 RPM. Instances where a Montabert drill is being used in conjunction with a 71cc pump, the flows must be in the upper range of what is shown below in order for the drill to operate properly.

Pump Size	Acceptable Pump Flows
45 cc	17.5 to 20 GPM (66.2 – 75.7 l/min)
60 cc	23.5 to 27 GPM (88.9 – 102.2 l/min)
71 cc	27.5 to 31 GPM (104 – 117.3 l/min)
100 cc	39 to 44 GPM (147.6 – 166.5 l/min)

2.

- The approximate condition of the pump can also be determined by the flow produced from the case drain. No more than 10 to 12 percent of the pump output should be coming from the case drain. This means that at an electric motor speed of 1750 RPM, the following case drain flows should apply:

Pump Size	Maximum Reasonable Case Drain Flow
45 cc	2 to 2.5 GPM (7.5 to 9.5 l/min)
60 cc	2.5 to 3.5 GPM (9.5 to 13.2 l/min)
71 cc	3 to 4 GPM (11.3 – 15.1 l/min)
100 cc	4.5 to 5.5 GPM (17 – 20.8 l/min)

NOTE for testing case drain leakage: It is recommended that the case drain leakage “not” be tested with a flow meter. Since piston pumps are very sensitive to case pressure and most flow meters create a backpressure through them, the act of testing the case leakage could damage the pump. Therefore it is recommended the case drain hose be directed into a pail of known volume and the flowed timed and calculated.

Title: Brake, MICO Pedal Assembly
Number: MB-HYD1019
Revision: Level B

Models: 03-464-200 06-464-216
 03-464-202 06-464-218
 06-464-210 06-464-222

DISASSEMBLY

(Refer to Figures 1 & 3)

NOTE

Spool(9)/sleeve(8) and spool(12)/sleeve (11) are matched sets and should not be intermixed with other parts.

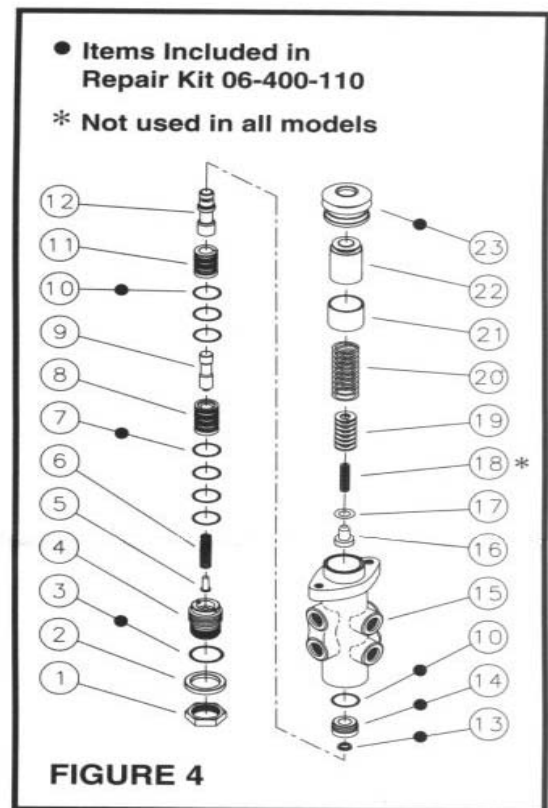
1. Remove boot (23) from piston (22).
2. Remove piston (22), springs (18, 19 & 20) and shim(s) (17) from housing bore. **NOTE: Not all models use spring (18). Some models also use a 6.35 mm (.25") spacer with shims. Note number of shim(s) being removed from housing.**
3. Bearing (21) should not be removed from housing bore. **NOTE: Excessive wear in both bearing (21) and piston (22) may require replacement.**
4. Remove retainer assembly (16) from housing bore. **NOTE: Ball is pressed into retainer.**
5. Loosen nut (1) and remove end plug (4) from housing. Remove spring (6), retainer (5), nut (1), washer (2), and o-ring (3) from end plug (4).
6. Remove spacer (14), sleeves (8 & 11) and spools (9 & 12) assembly from housing bore. This assembly must be taken out by way of end plug (4) end of housing. **NOTE: Care must be taken so as not to scratch housing bore. A wooden dowel will help in this procedure.**
7. Separate spacer (14) and spools (9 & 12) from sleeves (8 & 11). **NOTE: Excessive wear on either spools (9 & 12) or sleeves (8 & 11) may require replacement.**
8. Remove o-ring (10) from retainer (14) and cup (13) from spool (12). Remove other o-rings (10) from sleeve (11) and o-rings (7) from sleeve (8). **NOTE: Care must be taken so as not to damage cup and o-ring grooves or bores.**

ASSEMBLY

(Refer to Figures 1 & 3)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT, SPOOLS (9 & 12), AND SLEEVES (8 & 11) WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install one new o-ring (10) on spacer (14) and new cup (13) on spool (12). Note direction of cup.
3. Install other new o-rings (10) on sleeve (11) and new o-rings (7) on sleeve (8).
4. Carefully insert spool (12) into sleeve (11). Note direction of spool and cup.
5. Carefully insert spacer (14) into housing bore through end plug (4) end. Note direction of spacer.
6. Carefully insert sleeve (11) and spool (12) assembly into housing bore using a wooden dowel. Note direction of assembly.
7. Carefully insert sleeve (8) into housing until it rests against sleeve (11). Gently insert spool (9) into sleeve (8). Note direction of spools and sleeves.
8. Install spring (6) and retainer (5) into housing bore.
9. Install end plug (4) and torque to 10.85 - 20.34 Nm (96 - 180 inch-lbs) to seat sleeves. Then turn back end plug 1/4 turn and torque to 1.13 - 6.78 Nm (10 - 60 inch-lbs). Install new o-ring (3), washer (2) and nut (1). Hold end plug and torque nut 67.80 - 81.36 Nm (50 - 60 ft-lbs).
10. Install retainer assembly (16) in housing. **NOTE: Depress retainer (16) until it bottoms on spacer (14). Spools (9 & 12) and retainer (16) should return when released. If the spools and retainer do not return when released, the bore of sleeves (8 & 11) were possibly damaged when installed.**
11. Install shim(s) (17), springs (18, 19 & 20) and piston (22) in housing bore. **NOTE: Not all models use spring (18). Some models also use a 6.35 mm (.25") spacer with shims. For proper brake pressure setting, install the same number of shims and spacer that were removed during disassembly. If spools (9 & 12), sleeves (8 & 11), or spring (20) were replaced, shim adjustment may be required. (Refer to brake pressure settings TABLE 1).**
12. Install new boot (23) on housing (15).



MB

Title:	Mobile Equipment Wash Down Procedure
Number:	MB-GEN1274
Part Number(s) Affected:	Various
Machine Model(s) Affected:	All
Parts Manual Section:	Assemblies
Revision:	Original

Creation Date:	09/27/04
Written By:	Case Roest
Checked By:	Rene Dubois
Approved By:	Steve Czerny

Revision Date:	
Revised By:	
Checked By:	
Approved By:	

1.0 Scope:

This Maintenance Bulletin describes procedures and precautions that should be followed when high-pressure washing MacLean Engineering mobile equipment.

2.0 Pre-wash Inspections and Precautions:

1. Before washing any MacLean Engineering mobile equipment, ensure that all sources of power (electric/diesel) are shut off or disconnected. Electric power must be turned off using the master battery disconnect switch. If the machine has an AC main panel, the panel main breaker must be turned off, and the trailing cable must be disconnected from the power source. Follow mine site lock out/tag out procedures.
2. Ensure that the wheel chocks, articulation lock bar, scissor lock, and outriggers are utilized to prevent accidental machine movement according to mine site procedures.
3. 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 before proceeding with the wash down of the machine to prevent overspray from entering the enclosure and causing damage.
4. Before washing any portion of any MacLean mobile equipment, ensure that all electrical enclosures are closed and all cover latches are fully tightened to prevent overspray from entering the enclosures and causing damage.
5. Ensure that all electrical connectors (i.e. multi-pin connectors, DIN connectors, engine connectors, cord sets, etc.) at enclosures, distribution boxes, and devices are tightened down/connected before proceeding with the machine wash down.
6. Check that all tank (fuel, hydraulic, lubricants, coolant etc) openings are sealed to prevent water ingress.

INSTALLATION (Continued)

- 10. Check the bursting disc.
 - The flat side of the disc should face the tank; the washer side should face out.
 - The disc should be free from wrinkles, dents, or other deformities.
 - Replace the disc if there is any visual evidence of damage.
 - Place the tank(s) in the bracket(s) and secure locking clamp arm(s).

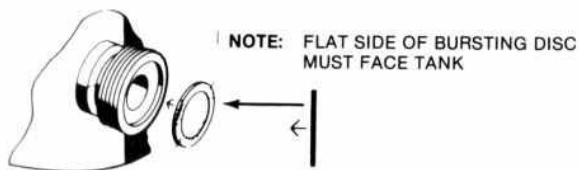


FIGURE 4

NOZZLE BRACKETS (HOLDERS)

- 11. Gather the nozzles, nozzle brackets, blow-off caps and 1/2" pipe elbows or nipples that are required.
- 12. Install (weld) the nozzle brackets, positioned so that the nozzles may be properly aimed.

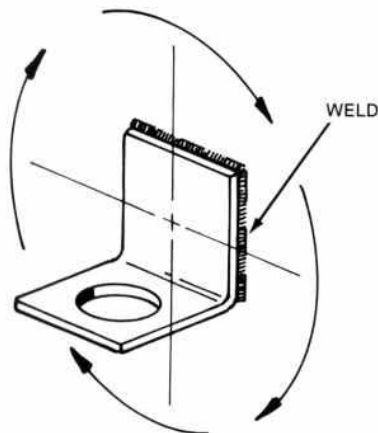


FIGURE 5

DISTRIBUTION, REDUCING AND TRIPLE TEES

- 13. Note the proposed tee mounting location(s), considering the following requirements:
 - Tee locations must not cause the hose length limitations to be exceeded from tank to tee or tee to nozzles.
 - Tee locations must not cause hoses to be exposed to extreme heat or physical abuse.
 - One reducing tee (1/2" x 1/2" x 3/4") per tank, supplying two nozzles.
 - One triple tee per tank, supplying four nozzles.

- One distribution tee and three 1/2" tees per tank, supplying six nozzles.
- 14. Mount the tee(s) firmly, as shown.
- Make sure the end tees on the triple tee are not twisted from their original position.

Reducing Tee, 1/2" x 1/2" x 3/4"

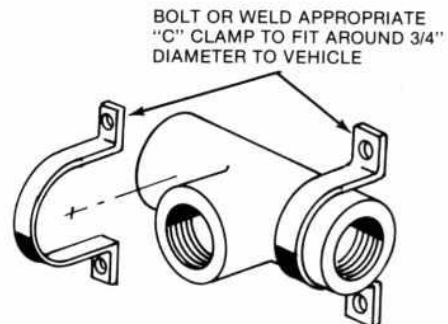


FIGURE 6

Triple Tee

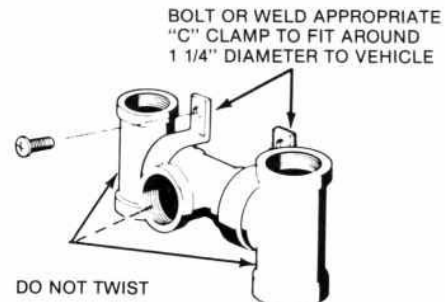


FIGURE 7

Distribution Tee

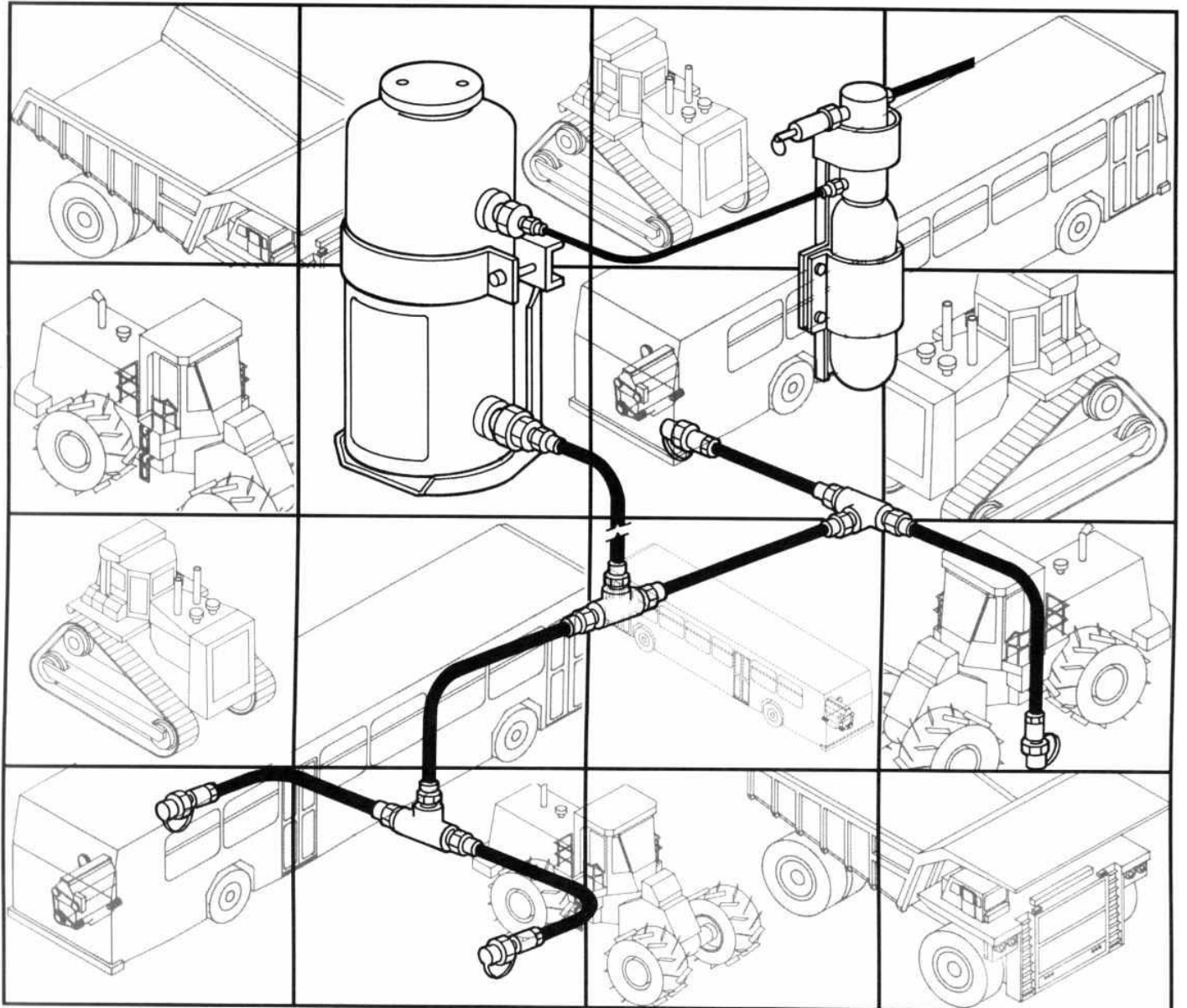


FIGURE 8

ANSUL®

**INSTALLATION,
RECHARGE,
INSPECTION, AND
MAINTENANCE
MANUAL**

**A-101 VEHICLE
FIRE
SUPPRESSION
SYSTEMS**



SECTION III – SYSTEM COMPONENTS

5-15-96 Page 3-2

DRY CHEMICAL

FORAY is a monoammonium phosphate based dry chemical which is effective on Class A,B, C related fires. FORAY agent is color coded yellow for easy identification. FORAY dry chemical is shipped in 45 lb. pails, Part No. 53080. See Figure 3.



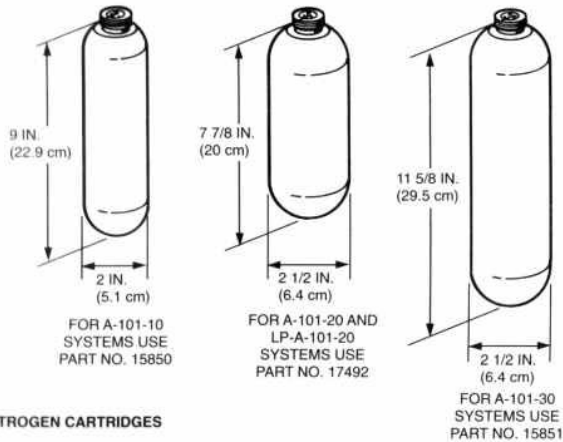
FIGURE 3

CARTRIDGE – EXPELLANT GAS

The expellant gas cartridges used on the A-101 system contain either carbon dioxide or nitrogen as their expellant gas. The cartridge is a sealed pressure vessel containing gas under pressure. When the cartridge seal is punctured by the pneumatic actuator pin, the gas flows into the dry chemical tank, fluidizes the dry chemical, and carries it through the distribution piping network and out the nozzles.

The expellant gas cartridges meet the requirements of DOT 3A-2100 or 3AA-1800. See Figure 4.

CARBON DIOXIDE CARTRIDGES



NITROGEN CARTRIDGES

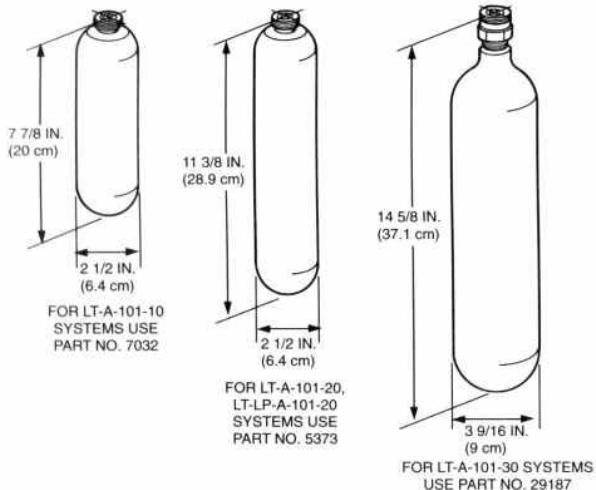
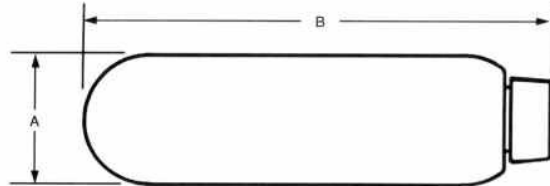


FIGURE 4

CARTRIDGE – ACTUATION GAS

The actuation gas cartridge used on the A-101 system contains nitrogen as the actuation gas. The cartridge is a sealed pressure vessel containing gas under pressure. When the cartridge seal is punctured by the pin in the remote manual or pneumatic actuator, the gas flows to the actuator on the expellant gas cartridge, causing that actuator to puncture the seal in the expellant gas cartridge. The actuation gas cartridges meet the requirements of DOT 3E-1800. See Figure 5.



	A	B	RIGHT-HAND THREAD	LEFT-HAND THREAD
LT-5	2 IN. (5.1 cm)	6 IN. (15.2 cm)	6979	7013
LT-10	2 IN. (5.1 cm)	6 13/16 IN. (17.3 cm)	13193	13177

FIGURE 5

CARTRIDGE BRACKET

The cartridge brackets for the expellant gas cartridges are constructed of heavy gauge steel and formed to protect and secure the cartridge. The cartridge brackets are painted with red, air dry enamel paint. See Figure 6.

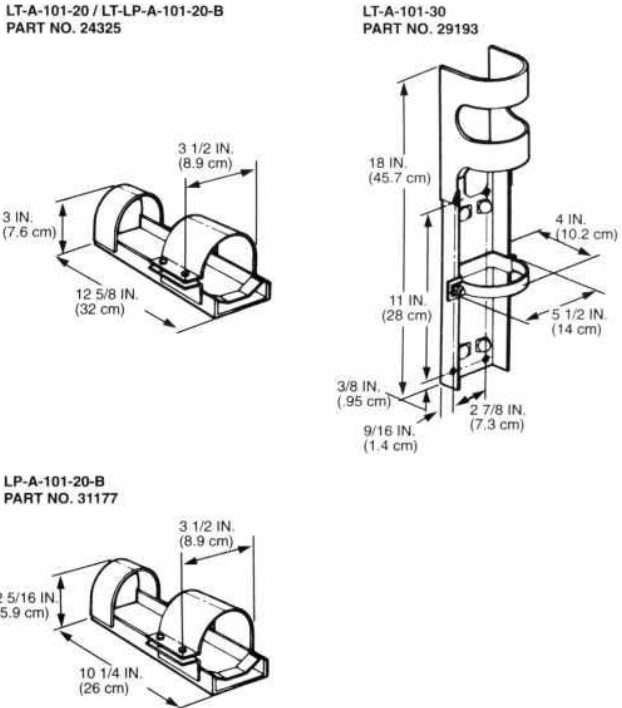


FIGURE 6

Supply and Branch Line Requirements (Continued)

20, 30 lb. 2 Nozzle Balanced System With Reducing Tee
See Figure 11 and 11A.

- Maximum supply line length from extinguisher to reducing 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. Two (2) nozzles maximum.
- Maximum unbalanced allowed on the total system is 10% difference in length from reducing tee to nozzle on one line compared to the same distance between the same 1/2 in. tee to nozzle on the other line.

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

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

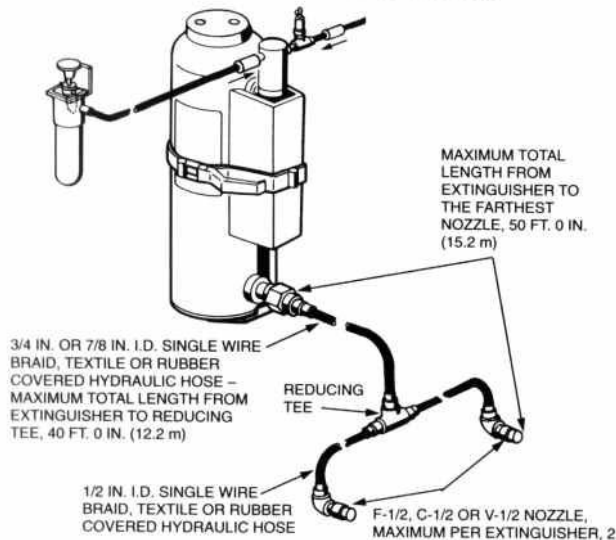


FIGURE 11

EXAMPLES OF TYPICAL SYSTEMS

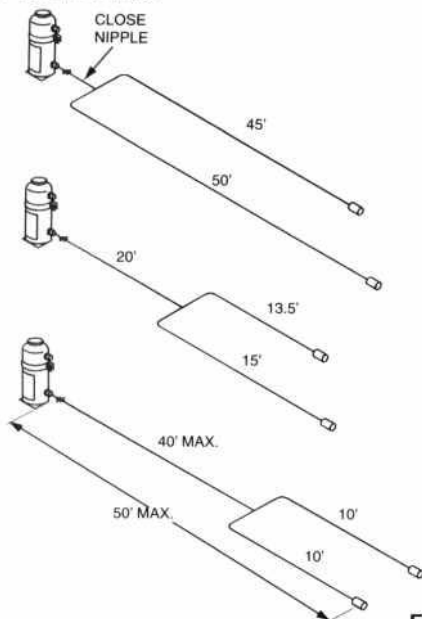


FIGURE 11A

20, 30 lb. 4 Nozzle Balanced System With Triple Tee
See Figure 12 and 12A.

- 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.
- Maximum unbalanced allowed on the total system is 10% different in length from 1/2 in. tee to nozzle on one line compared to the same distance between the same 1/2 in. tee to nozzle on the other line.

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

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

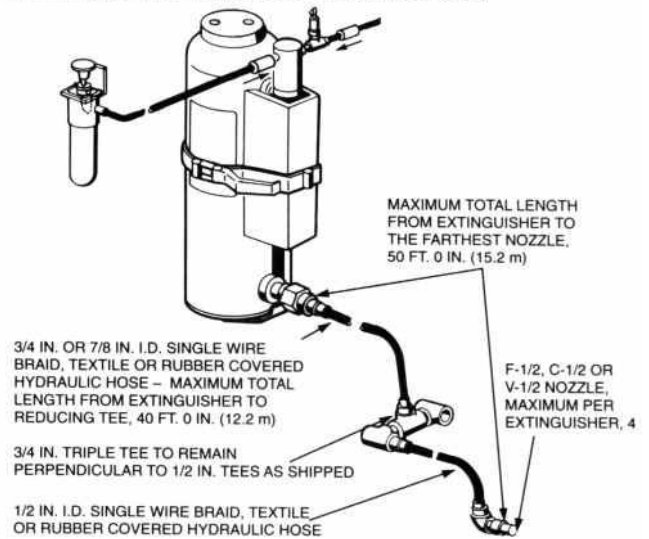


FIGURE 12

EXAMPLES OF TYPICAL SYSTEMS

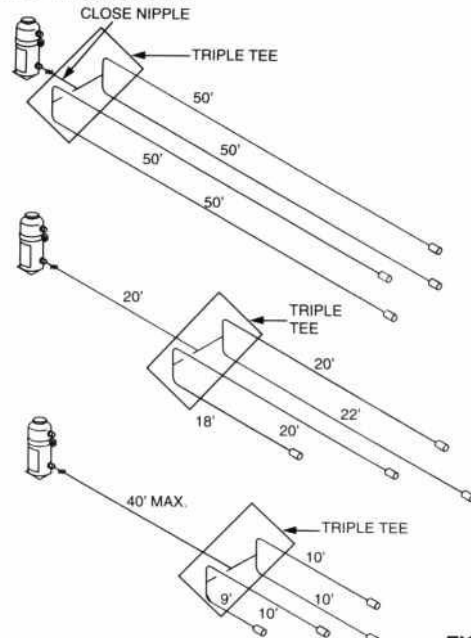


FIGURE 12A

SECTION V – SYSTEM DESIGN – INDUSTRIAL

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Nozzle Coverage (Continued)

A-101-30 FIRE SUPPRESSION SYSTEM – TOTAL FLOODING APPLICATION

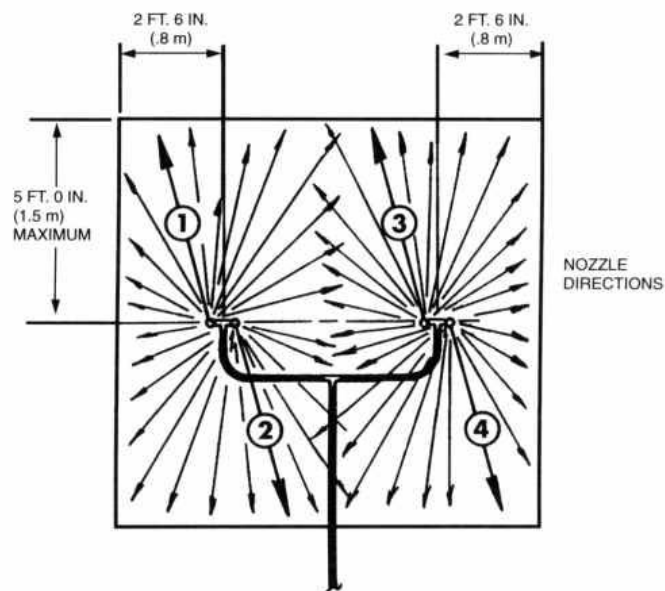
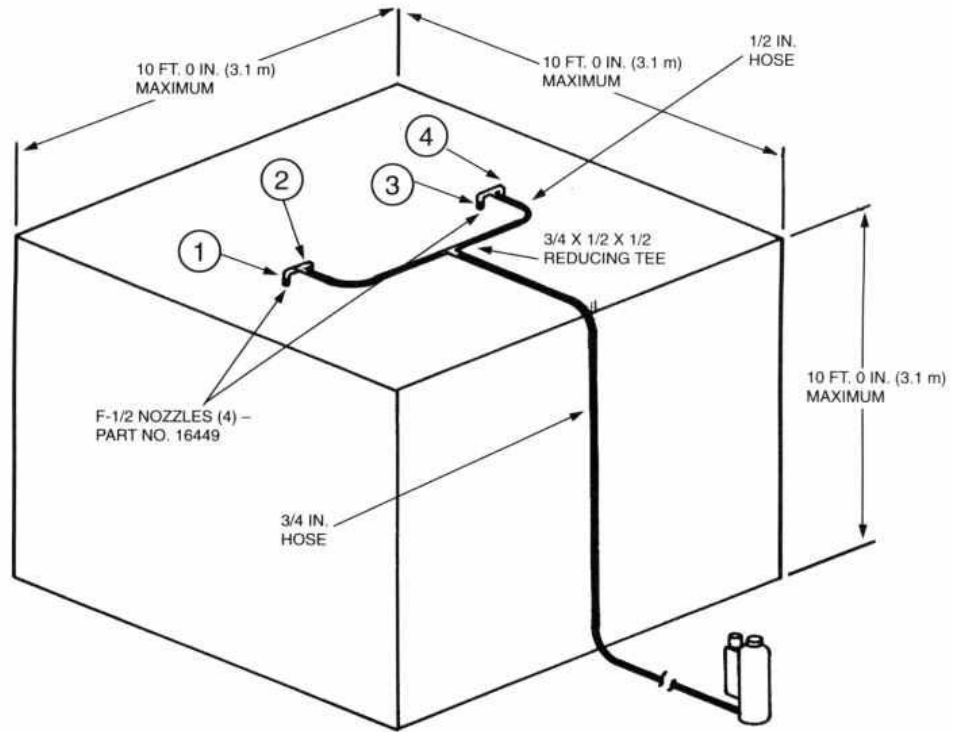


FIGURE 3

SECTION IX – RECHARGE

5-15-96 Page 9-1

The first concern in Recharge is to determine the cause of the system discharge and to have the problem corrected before re-arming the fire suppression system.

In the event of system discharge, the vehicle must not be returned to service until the system has been recharged.

The system must be recharged immediately after use. A fire condition could cause damage to the hose and nozzles and possibly support members. Check all hose supports, hose, and all fitting connections. Take the nozzles off, inspect for damage, corrosion, or obstructions, clean and re-install, making certain they are aimed correctly. Blow-off caps must also be replaced.

See Figure 1 when following the recharge steps.

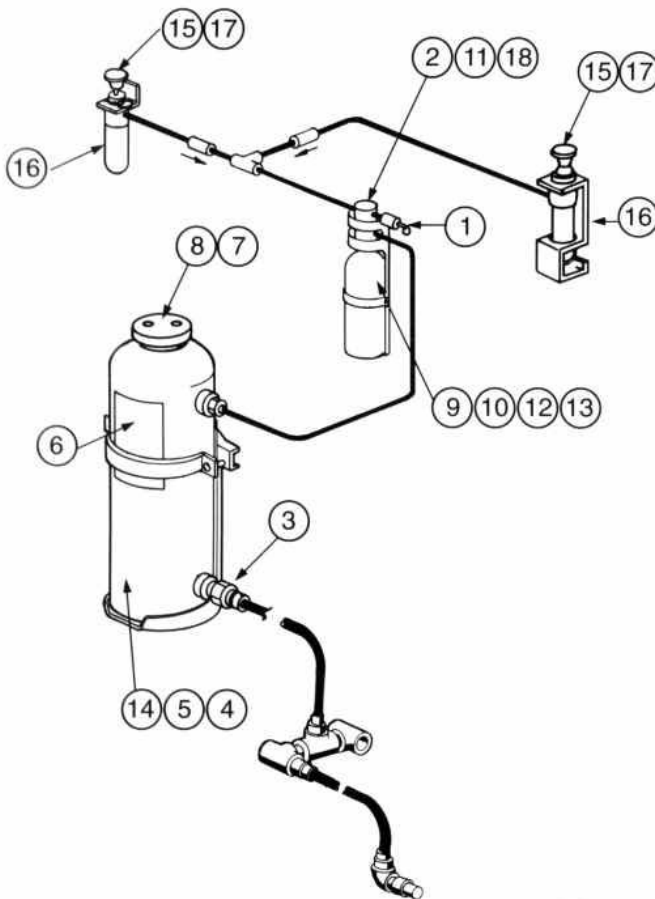


FIGURE 1

1. Pull ring on safety relief valve to relieve actuation pressure.
2. Disconnect actuation system hose at cartridge receiver/actuation assembly.
3. Open bursting disc union assembly.
4. Remove dry chemical tank from its bracket.
5. Replace ruptured bursting disc with a new disc, Part No. 26400. Make certain the seating area for the disc is clean of dry chemical. Make certain the disc is installed with the transparent washer facing away from the tank.

NOTICE

Before filling tank, hand tighten a spare ring and tail piece to the portion of the burst disc union which is attached to the tank outlet. This will keep the burst disc from becoming loose or falling out when the tank is being filled.

6. Remove the tank fill cap, discard any remaining dry chemical, and fill each tank to its rated capacity with Ansul FORAY dry chemical as specified on the nameplate.
7. Before securing the fill cap, brush the dry chemical from the threads on the fill cap and tank, and clean the gasket seating surface on the tank opening. Coat the gasket lightly with a good grade of extreme temperature silicone grease, such as Dow Corning No. 4 or equal.
8. Secure the fill cap, hand tighten.
9. Loosen the bolts on the expellant gas cartridge bracket or remove the cartridge guard on the tank.
10. Unscrew and remove the empty expellant gas cartridge.
11. Make certain that the puncture pin on the pneumatic actuator/cartridge receiver is fully retracted.
12. Install new cartridge per the following chart. Before installing, weigh cartridge to determine it is within specifications stamped on the cartridge. Weight cartridge with shipping cap removed.

Type of System	Cartridge Part No.
A-101-10	15850
LT-A-101-10	7032
A-101-20	17492
LT-A-101-20	5373
LT-LP-A-101-20	5373
A-101-30	15851
LT-A-101-30	29187

13. Re-install cartridge guard or retaining bolts on cartridge bracket.
14. Return tank(s) to its bracket and tighten securely.
15. Depending on the type, either pull up the red button or pull up the puncture lever.
16. Remove spent cartridge. Weigh fully charged one, and install. For actuation lines up to 75 ft. (22.9 m), install either an LT-5-R (Part No. 6979) or an LT-5-L (Part No. 7013). For actuation lines up to 125 ft. (38.1 m), install either an LT-10-R (Part No. 13193) or an LT-10-L (Part No. 13177).

NOTICE

If automatic detection system was used, refer to appropriate Installation, Recharge Manual for detailed recharge instructions.

17. Insert ring pin in actuator stem and seal with visual seal, Part No. 197.
18. Reconnect actuation and, if necessary, expellant gas hose. Wrench tighten.
19. Notify operating personnel that the suppression system is back in service and record date of recharge.

SECTION XI – APPENDIX

5-15-96 Page 11-4

LARGE EXCAVATORS

Large excavators are defined as those machines with more than 150 gallons of hydraulic fluid in hydraulic hoses.

Hazards and Protection

The following are generally considered to be fire hazard areas. Hazard areas exist when an ignition source can come in contact with a fuel source. This may be due to the close proximity of the ignition source to the fuel source or due to the configuration of the machine that may allow running or spraying fuel to come in contact with an ignition source. A hazard analysis of the excavator should determine which of the following components will require protection. A hazard analysis should also determine any other areas not listed below that potentially could be considered hazard areas requiring protection.

1. Engine. The engine consists of various components that contain or transfer fuels, components involved with lubrication, and electrical contacts and controls as well as components that generate heat. Protection should include but not be limited to the following components:
 - Manifolds
 - Turbochargers
 - Heat exchangers
 - Fuel lines
 - Engine block
 - Electrical equipment, such as starters, generators, alternators, etc.
 - Exhaust systems
 - Bottom of engine, belly pan or floor area
2. Hydraulic pump(s) and control valve banks/manifolds.
3. Hydraulic hoses and fuel lines, including those under operator's compartment.
4. Transmissions/gear reduction boxes.
5. Brakes and brake valves. Note: Brakes located in the track mechanism are not required to be protected.
6. Drive train bearings.
7. Swing gear motors and travel clutches.
8. Ring Gear area.
9. Lubrication systems.
10. Hydraulic oil tank and fuel tank fill and outlet connections.
11. Batteries.
12. Large electrical generators and motors.

Design Parameters

1. **Extended Discharge System** (Not FMRC Approved) – Fire suppression on large excavators will require an extended agent discharge time to allow for operator egress from the machine. In order to extend the time of agent discharge from A-101 system nozzles, the number of tanks determined by hazard analysis must be doubled. (Refer to drawings for revised actuation and discharge hose connection parameters and system operation.)
 - 3/4 in. Extended Discharge Supply Hose Line Connection. See Figure 1. (**NOTE:** Maximum of 24 in. from each adjacent tank to the common "Y" fitting.)
 - 1/4 in. Actuation Hose Detail. See Figure 2.
 - CHECKFIRE SC Wiring Diagrams. See Figures 3 and 4.
2. Each four nozzle agent distribution network will be connected to two adjacent tanks using a "Y" fitting. See Figure 1. **Six nozzles systems are not allowed.**

3. An automatic detection and actuation system will be required, using the CHECKFIRE SC Detection and Actuation system.
4. The fire suppression system must automatically perform the following functions:
 - Engine shutdown.
 - Pressurized hydraulic tank and fuel tank venting.
 - Fuel shutoff.
 - Electrical disconnect (Optional).

If mine personnel refuse to allow any of the above items to be performed, it should be **documented** and kept in the job file.
5. The system must also include a Remote High Level Alarm Horn, Part No. 79559 and should also include a remote visual alarm.
6. As part of the total fire suppression system package, training for mine personnel and the machine operator(s) must be conducted and documented. Training should include but not be limited to:
 - A-101 and CHECKFIRE SC system description.
 - System operation.
 - System limitations and primary intent.
 - What to do in case of fire.
 - Vehicle maintenance and fire suppression system maintenance.
7. An A-101/CHECKFIRE SC Maintenance Contract allowing periodic service and maintenance at scheduled intervals should also be included.

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Number: MB-ENG1480
Revision: Original

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English

Maintenance intervals

Maintenance by operating hours

Applications such as engines in mobile work units.

2

Maintenance service ¹	Maintenance category A			Maintenance category B			Maintenance category C		
	Oil grade			Oil grade			Oil grade		
	228.5 ²	228.2/3 ²	228.0/1 ²	228.5 ²	228.2/3 ²	228.0/1 ²	228.5 ²	228.2/3 ²	228.0/1 ²
1 W	1,400	1,100	800	900	700	500	500	400	300
2 W	2,800	2,200	1,600	1,800	1,400	1,000	1,000	800	600
3 W	4,200	3,300	2,400	2,700	2,100	1,500	1,500	1,200	900
4 W	5,600	4,400	3,200	3,600	2,800	2,000	2,000	1,600	1,200
5 W	7,000	5,500	4,000	4,500	3,500	2,500	2,500	2,000	1,500
6 W	8,400	6,600	4,800	5,400	4,200	3,000	3,000	2,400	1,800
7 W	9,800	7,700	5,600	6,300	4,900	3,500	3,500	2,800	2,100
8 W	11,200	8,800	6,400	7,200	5,600	4,000	4,000	3,200	2,400
9 W	12,600	9,900	7,200	8,100	6,300	4,500	4,500	3,600	2,700
10 W	14,000	11,000	8,000	9,000	7,000	5,000	5,000	4,000	3,000

...

¹ Maintenance intervals for additional work from (▷ page 62)

² Sheet number of the Mercedes-Benz Specifications for Service Products

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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.

Title: Mercedes-Benz Maintenance Instructions
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English

Confirmations of maintenance work

6th 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

Engine

Additional work

Valve gear


Every third maintenance service

Fuel system

Engine brake

2

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

English

Confirmations of maintenance work

17th 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

80

 **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.

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

English

Service products


Engine oils

Engine oils are specially tested for their suitability for use in our engines. A list of engine oils which are tested and approved in accordance with **Mercedes-Benz Specifications for Service Products** can be obtained from any Mercedes-Benz Service Centre.

The use of engine oil brands which have not been approved may limit your warranty entitlement. They may lead to increased wear or engine damage. Do not use any fuel additives.

Only engine oils of the same grade and SAE class should be used when topping up. If an engine oil with a lower grade is used for topping up, this grade must be set in the driver information system, Settings menu – Service Products submenu, see Operating Instructions.

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

Introduction

Symbols

▼ Symbols

1 You will find the following symbols used in these Operating Instructions:

- * This asterisk indicates special equipment. Since not all models have the same standard equipment, the layout of your engine may differ from certain descriptions and illustrations.

Warning



A warning draws your attention to possible risks of accident and injury to yourself and others.

You should therefore always read and observe all warning notices.

Environmental note



An environmental note gives you tips on the protection of the environment.



This note draws your attention to possible hazards to your engine.



This tip contains advice or further information you may find useful.

- ▶ This symbol means that you have to do something.
- ▶ A number of these symbols one after the other indicates a sequence of actions.
- ▷ page This symbol indicates the page on which you will find further information on the subject.
- ▷▷ This continuation symbol indicates an interrupted sequence of actions that will be continued on the next page.
- > This symbol in the glossary of technical terms means that the term following the arrow is also explained.

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

At a glance

OM 906 LA/OM 926 LA

- ① Fan
- ② Poly-V-belt tensioning pulley
- ③ Coolant pump
- ④ Heating forward line* coolant line
- ⑤ Charge pressure pipe from intercooler
- ⑥ Oil filter
- ⑦ Charge pressure pipe to intercooler
- ⑧ Oil filler neck
- ⑨ Charge-air housing
- ⑩ Cylinder head cover
- ⑪ Fuel filter
- ⑫ Fuel prefilter
- ⑬ Engine control unit
- ⑭ Air compressor*
- ⑮ Dipstick
- ⑯ Power-steering pump

2

17

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

Before commissioning

General

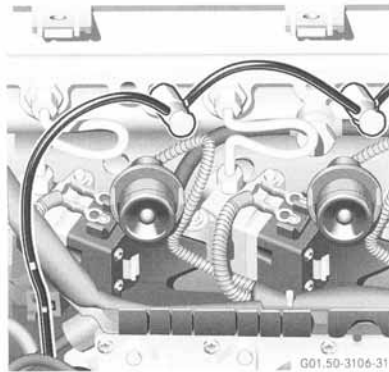
Exhaust brake / constantly-open throttle valve*

To increase braking power, the engine can be equipped with an engine brake valve on the exhaust gas turbocharger in conjunction with constantly-open throttle valves on the cylinders.

3

While the exhaust gas back pressure from the engine brake valve is used to increase the braking power, the constantly-open throttle valves cause a pressure reduction in the working cycle (3rd cycle), while compression (2nd cycle) is practically unaffected.

The constantly-open throttle valves are small valves in the cylinder head and located on the side opposite the exhaust valve. When open, they form a connection from the combustion chamber to the exhaust port.



Constantly-open throttle valves on a 4-cylinder engine

When the engine brake* is applied, the constantly-open throttle valves are pneumatically pressurised on the 4-cylinder engine and hydraulically pressurised on the 6-cylinder engine. This opens the valves. At the same time, the engine brake valve on the exhaust gas turbocharger is closed.

The constantly-open throttle valves are not controlled at lower engine speeds (900 / 1,300 rpm) or at temperatures below 40 °C. When the power unit is being used, these limitations must be taken into account under braking conditions.

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

Safety

Safety/emergency running programs

▼ Safety/emergency running programs

The engine is equipped with an electronic control system which monitors both the engine and itself (self-diagnostic system).

As soon as the electronic control system has detected and assessed a malfunction, one of the following measures is automatically implemented:

- When the engine is in operation, the electronic system warning lamp lights up, indicating a malfunction.
- The fault codes may be shown on a display which is part of the Telligent[®] engine system (vehicle diagnostic system).
- The engine switches to the appropriate back-up function for continued (but restricted) operation (e.g. constant emergency running speed).

Risk of accident



Incorrectly performed maintenance and repair work on the engine can impair both its correct operation and safety, leading to accidents and personal injury as a consequence.

Always have work on or modifications to the engine carried out at a qualified specialist workshop which has the necessary specialist knowledge and tools to carry out the work required.

Mercedes-Benz recommends that you use a Mercedes-Benz Service Centre for this purpose.



The fault codes can be read from the DaimlerChrysler diagnostic testers (STAR DIAGNOSIS or Minidiag 2 tester), connected to the 14-pin diagnostic socket (equipment-resident).



N54.30-8279-31

4

Electronic system warning lamp

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

Operation

Monitoring engine operation

Telligent® engine system

The electronic system warning lamp must go out after the engine has been started.



5

Electronic system warning lamp

If the warning lamp does not go out or lights up while the engine is running, there is a fault in the Telligent® engine system.

Each fault is stored in the system with a special fault code. Even temporary faults are stored.

The fault codes may be shown on a display which is part of the Telligent® engine system (vehicle diagnostic system).

Fault codes can be read using DaimlerChrysler diagnostic equipment (STAR DIAGNOSIS or Minidiag 2-Tester), (▷ see page 31). If the electronic system warning lamp lights up while the engine is running, read or determine the fault code.

Flame-start system*



Flame-start system indicator lamp

There is a fault in the flame-start system, if:

- the flame-start system indicator lamp lights up when the engine is running
- the flame-start system indicator lamp does not go out after more than approximately 20 seconds when the engine is started

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

Operation

Service products

If summer diesel fuel or winter diesel fuel with less resistance to low temperatures is used, only add a specific quantity of flow improver or kerosene, depending on the outside temperatures.

Risk of fire and explosion



Adding petrol reduces the flash point for the diesel fuel and increases the risk of fire and explosion.

- Therefore, never add petrol to diesel fuel.
- For this reason, you must avoid fire, naked flames and sparks and refrain from smoking when handling these service products.
- Observe the relevant safety regulations.



If petrol is added, there is a risk of serious engine damage.

Therefore, never add petrol to diesel fuel.

Add the flow-improver additive to the diesel fuel in good time, before paraffin separation affects the diesel's flow properties. Malfunctions caused by paraffin separation can only be remedied by warming up the entire fuel system.

Do not add additives to especially cold-resistant winter diesel fuels, as the fuel's cold-flow properties could deteriorate.

Flow improvers

The effectiveness of flow improvers cannot be guaranteed with all fuels. Comply with the manufacturer's recommendations. Information about approved flow improvers is available from any Mercedes-Benz Service Centre.

Kerosene

Add as little as possible, depending on outside temperatures. The addition of 5% by volume of kerosene improves the cold-resistance of diesel fuel by approximately 1 °C. Do not exceed the maximum mixing ratio of 50% kerosene.

5

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

Maintenance

Work plans

- ▷▷ ▶ Start the engine with the setpoint value sensor in the idling position. Monitor the oil pressure gauge.



Keep the engine running at idling speed until an oil pressure reading is displayed. If no oil pressure is displayed after approximately 10 seconds, switch off the engine and establish the cause.

- ▶ Check the filter and drain plug for leaks.
- ▶ Stop the engine. Check the oil level after approximately 5 minutes. Top up oil to the maximum mark on the dipstick if necessary.

6**72**

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

Maintenance

Work plans

Poly-V-belt: Checking the condition

Risk of injury



Faulty poly-V-belts may tear and parts or all of the belt may be thrown off, thereby causing injury to persons.

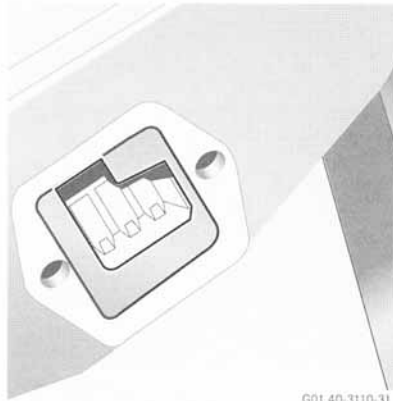
- Always observe the specified maintenance intervals for poly-V-belts.
- If damage is detected, replace the poly-V-belt concerned immediately.

Special tools

Rotation device: 904 589 04 63 00

- ▶ Fit the rotation device to the flywheel housing inspection hole.
- ▶ Make a chalk mark on the poly-V-belt.

Check the poly-V-belt for damage in sections; rotate the engine and poly-V-belt a little at a time



G01.40-3110-31

Flywheel housing inspection hole

- ▶ rotate further using the rotation device until the chalk mark is reached again.



Replace the poly-V-belt if one of the damage patterns shown on the next page is detected. For information on installing and removing the poly-V-belt (▷ see page 86).

- ▶ Remove the rotation device.

6

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

Maintenance

Work plans

Renewing coolant

Risk of scalding

The cooling system is pressurised. Hot coolant can spray out when the cooling system is opened and scald your skin and eyes.

- Only open the cooling system at coolant temperatures below 90 °C.
- Unscrew the sealing cap slowly and release any excess pressure completely before opening the cap fully.
- Wear suitable protective gloves, protective clothing and safety goggles when handling coolant.

6

Risk of poisoning

There is a risk of poisoning if coolant is swallowed.

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

Only use antifreeze / corrosion inhibitor approved by Mercedes-Benz (▷ see page 59).

Before renewing the coolant, check the cooling and heating system for leaks and condition. Have the coolant renewal confirmed in the Maintenance Booklet.

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

Practical advice
Malfunctions, causes and solutions

Malfunction	Cause	Solution
Exhaust fumes are white	Cylinder head or cylinder head gasket leaking; coolant entering the combustion chamber	▶ Locate damaged cylinder using pressure loss test; consult a qualified specialist workshop
Engine "knocks"	Combustion malfunction	▶ Consult a qualified specialist workshop
Knocking noise from the bearings	Damage to bearings	▶ Consult a qualified specialist workshop
Abnormal noises	Leakage in intake pipe and exhaust pipe causes whistling noise	▶ Remedy leakage; replace seals if necessary
	Turbine or compressor wheel scrapes on the housing; foreign object in the compressor or turbine; seized bearing in rotating parts	▶ Have the exhaust gas turbocharger replaced at a qualified specialist workshop

7
105

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

Technical terms

Minidiag 2

DaimlerChrysler AG electronic diagnostic tool for reading faults and parameters on commercial vehicles.

MR

(Engine control) control unit. Engine control is a monitored electronic system which forms part of the Telligent[®] engine system. It controls the engine functions, such as the engine idling speed and exchanges data with the drive control.

OM

Engine name, abbreviation for oil engine = diesel engine.

Sensor

Electronic component which converts certain parameters (e.g. oil temperature, engine speed and others) into electrical values for use in the engine control unit.

9

STAR DIAGNOSIS

DaimlerChrysler AG electronic diagnostic system

116

TDC

Top dead centre; term for the upper position of the piston in the cylinder.

Telligent[®] engine system

Mercedes-Benz electronic engine control. Controls fuel injection period and quantity depending on the current operating conditions and driver's requests.

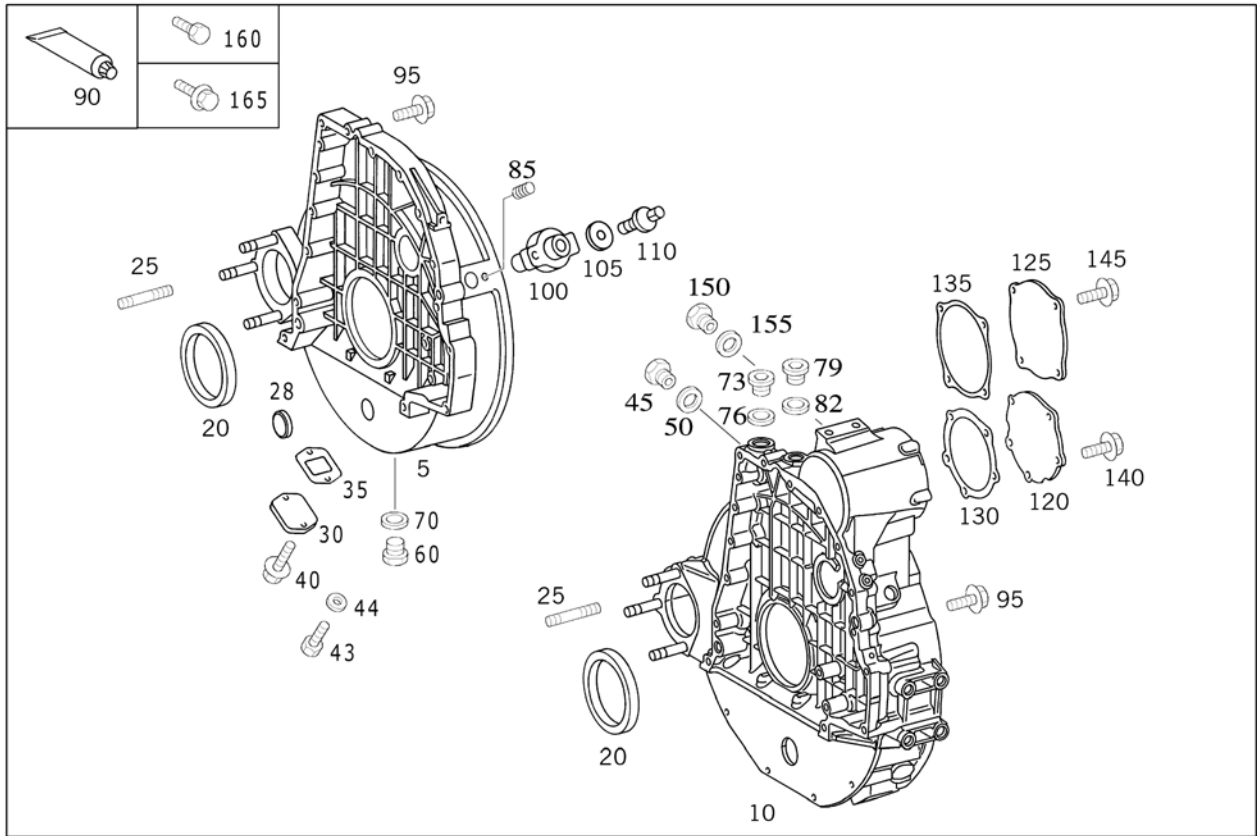
Tightening torque (Nm)

Product of force and lever arm length with which bolted connections, e.g. cylinder head bolts, are tightened. (Nm = Newton metres)

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

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

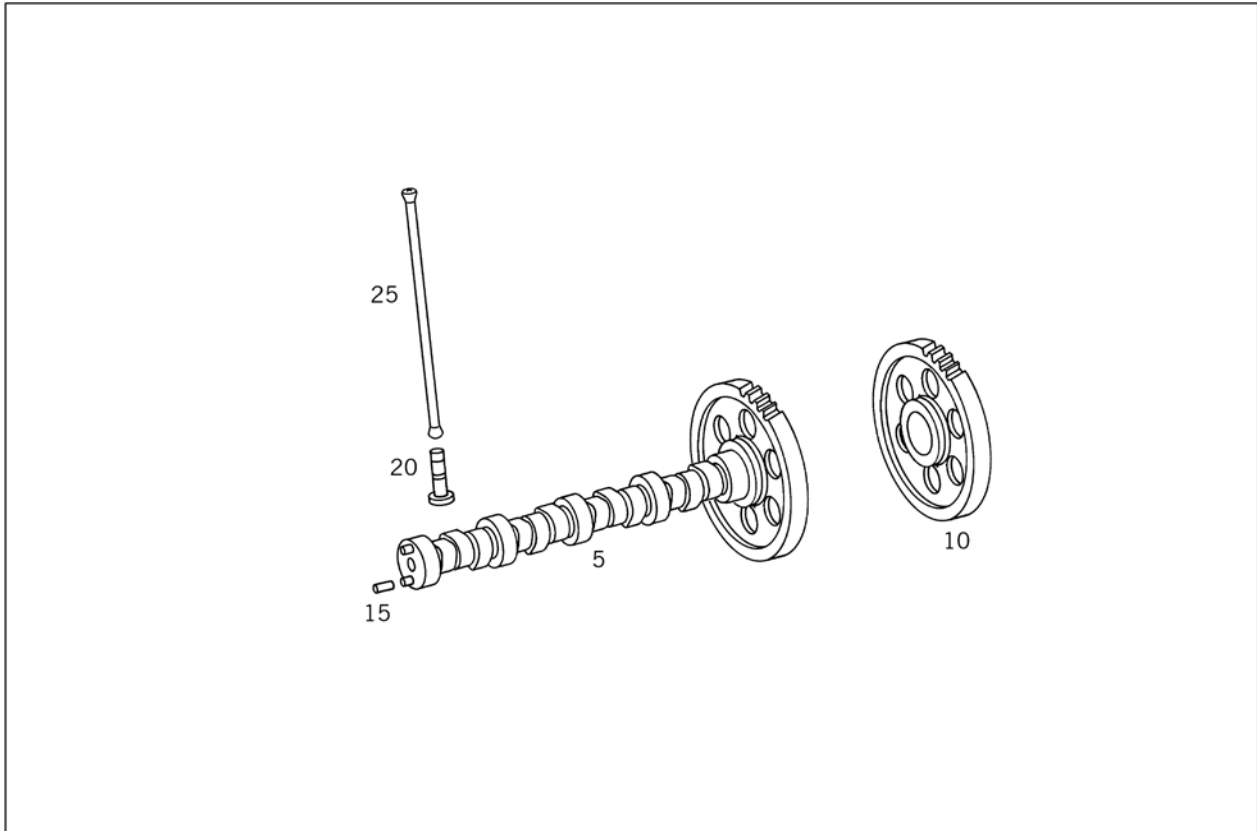
Gruppe | Grupo 01 045 00206
 Group | Grupo
 Groupe | группа
 Gruppo | المجموعة



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

Steuerung | Distribuição
 Timing | Distribución
 Distribution | рулевое управление
 Distribuzione | أتوجيه

Gruppe | Grupo
 Group | Grupo
 Groupe | группа
 Gruppo | المجموعة 05 015 00146

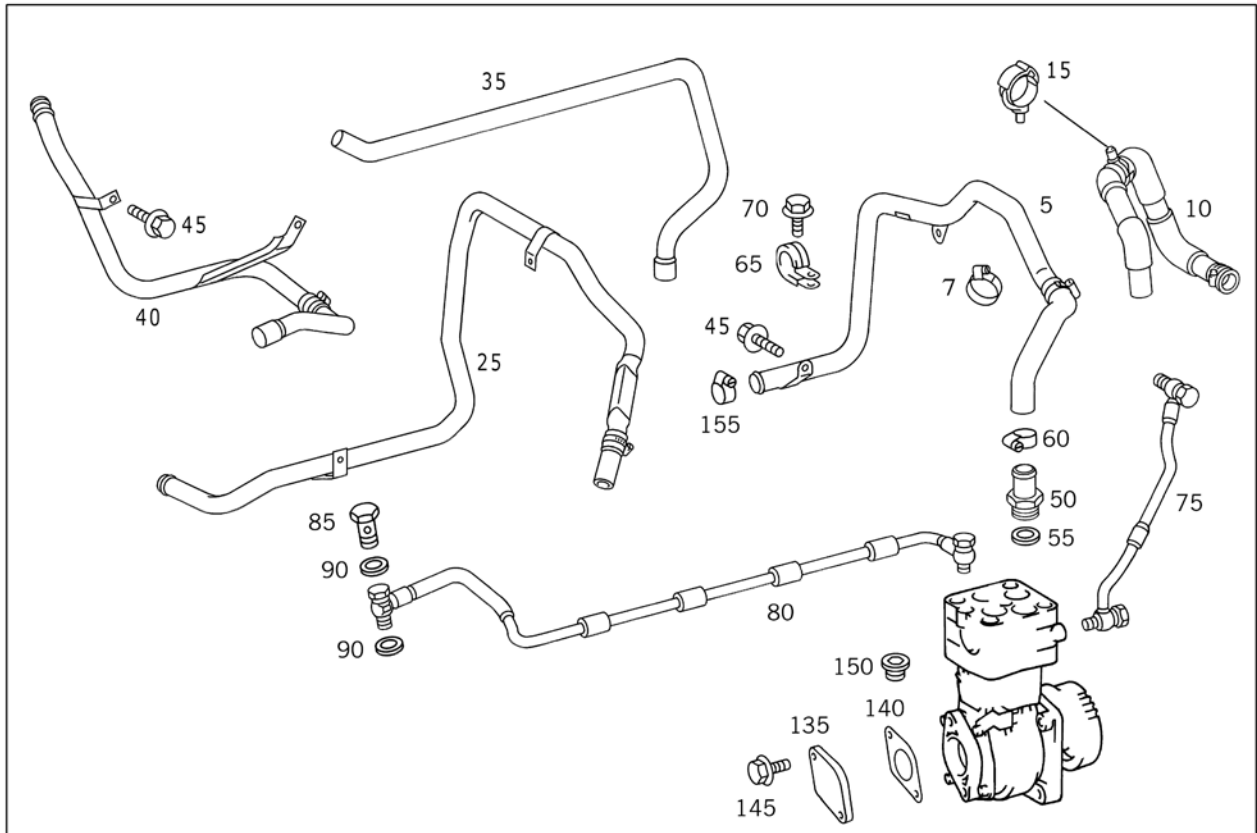


Title: Mercedes-Benz Parts Catalog
Number: MB-ENG1463
Revision: Original

Luftpresse | Compressor de ar
 Air Compressor | Compresor de aire
 Compresseur d'air | воздушный компрессор
 Compressore aria | ضاغط الهواء

Gruppe | Grupo
 Group | Grupo
 Groupe | группа
 Gruppo | مجموعة

13 075 00126

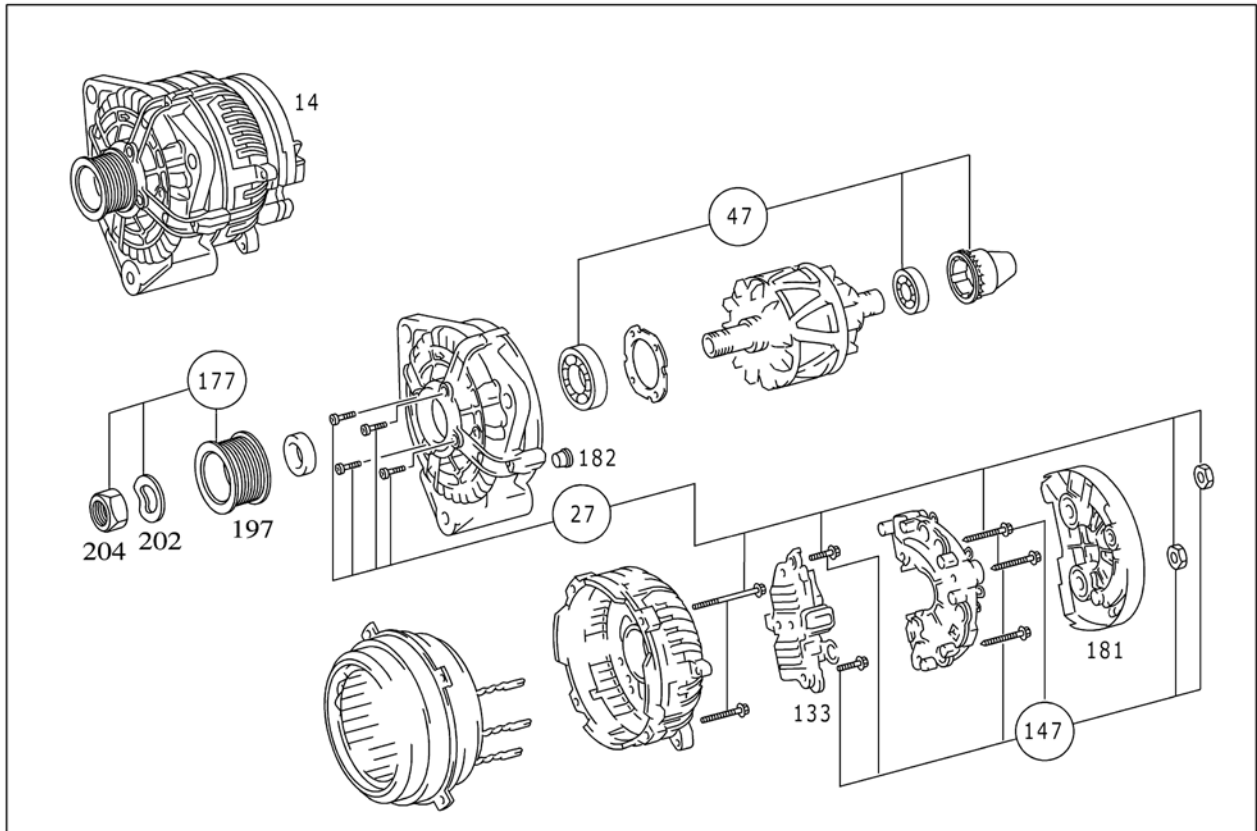


Title: Mercedes-Benz Parts Catalog
Number: MB-ENG1463
Revision: Original

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

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

15 030 00257



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

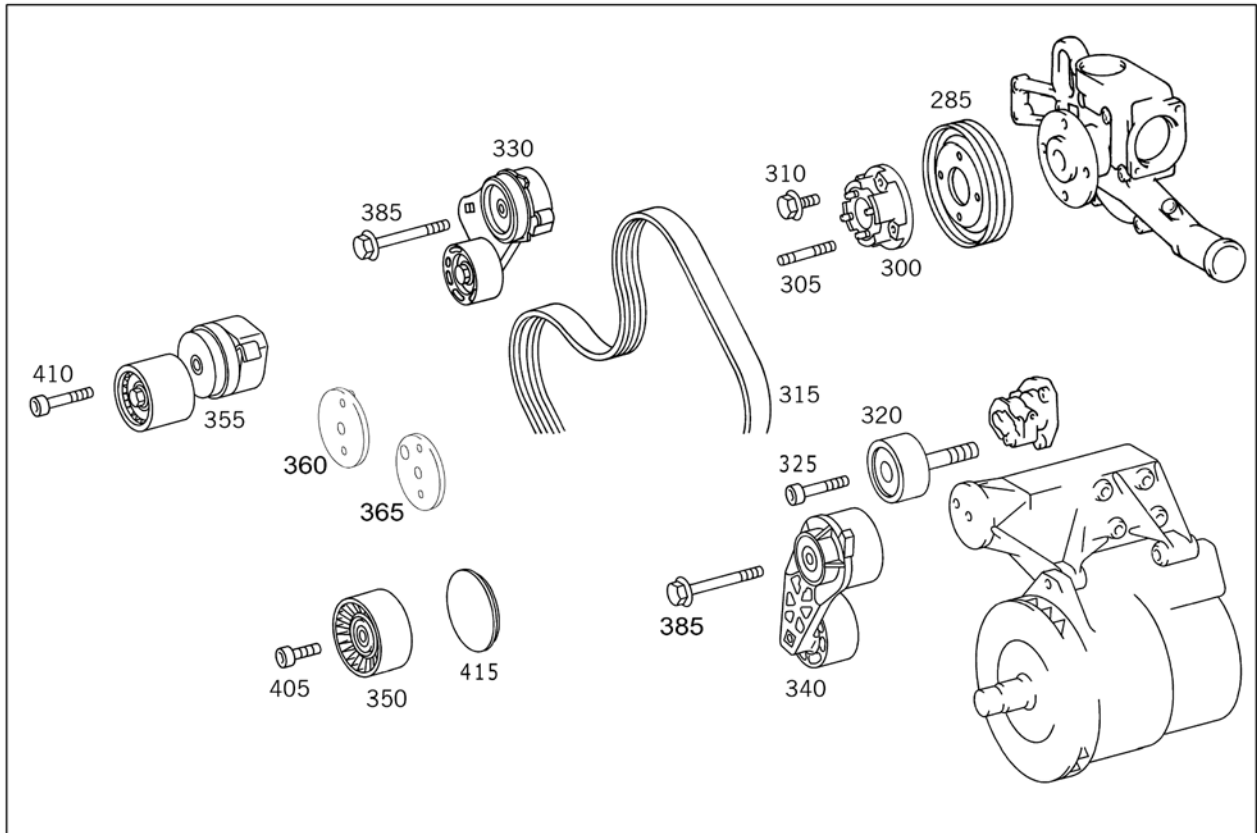
Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeración do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

20 015 00366

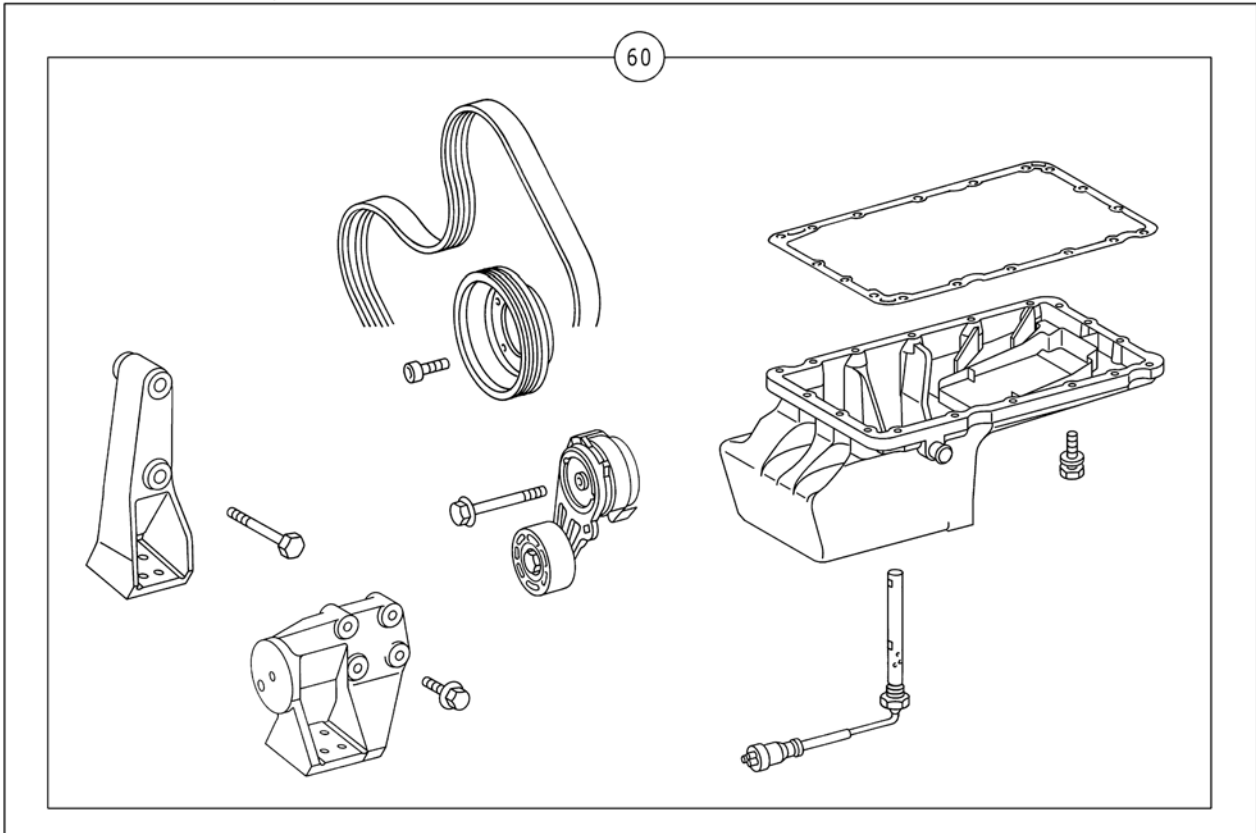


Title: Mercedes-Benz Parts Catalog
Number: MB-ENG1463
Revision: Original

Kältekompressor
 Refrigerant Compressor
 Compresseur pour installation d'air
 conditionné
 Compressore impianto refrigeratore

Compressor do produto refrigerante
 Compressor de refrigeración
 охладитель
 كباس أو مشحن التبريد

Gruppe | Grupo
 Group | Grupo
 Groupe | rpyrma
 Gruppo | المجموعة
 23 075 00018



Title: Radiator, Mesabi
Number: MB-ENG1393
Revision: Original

We solve big heat transfer problems around the world.



Parts shipped within 48 hours from four plants around the world.

MESABI® Flexible Core Heat Exchangers are marketed on a factory-direct basis from four L&M Radiator plants around the world.

L&M Radiator is able to give exceptional service to users and OEMs because all service is controlled at the manufacturer level. In emergencies, we can ship complete radiator cores or parts within 48 hours.

On site technical and engineering assistance is available nearly anywhere in the world within a few days notice.

L&M Radiator is proud to provide both old and new customers around the world with products known for quality and dependability since 1957.

L&M Radiator manufacturing facilities and parts depots are located in the following countries:

MESABI
Flexible Core Heat Exchangers

Manufacturing Facilities

UNITED STATES

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1414 East 37th Street
Hibbing, Minnesota 55746 U.S.A.
Telephone: (218) 263-8993
FAX: (218) 263-8234
Email: cool@mesabi.com



L&M Radiator, Inc.

6966 Market Street
El Paso, Texas 79915 U.S.A.
Telephone: (915) 779-3866
FAX: (915) 779-3195
Email: cool@mesabi.com



Toll Free: 1-800-346-3500
(U.S.A. and Canada)

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Calle De La Plata y Los Nogales
Parque Industrial
Apartado Postal 763
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Telephone: 011-52-662-251-0480
FAX: 011-52-662-251-0638
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Email: lmrad@q-net.net.au



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www.mesabi.com

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Printed in U.S.A.
VV 2M 6-03

Title:	Radiator, Mesabi
Number:	MB-ENG1393
Revision:	Original

MESABI WARRANTY CLAIM PROCEDURE

1. L & M Radiator reserves the right to rule on all warranty claims. It is not a warranty until L & M Radiator determines that it is.
2. The customer must not proceed with possible warranty claims or repairs before consulting with the L & M factory or sales and service representatives. Any repairs done prior to determination may void a potential warranty claim.
3. The customer must provide the L & M serial number, along with a complete description of the problem, including: application, make, model, machine serial number, and other information requested by L & M at the time of the reported warranty claim.

NOTE: On **MESABI** cores, the serial number is located on a brass tag, soldered to the bottom header plate. On **MESABI** radiators and oil coolers, it will be located on a steel tag, welded on the top tank.

4. L & M may wish to send a representative to the work site to investigate.
5. L & M may ask that damaged parts be returned for evaluation. (At the customer's expense, and if warranty is allowed, then the customer will be reimbursed).
6. In all cases, if repair parts are sent to the customer prior to determination of warranty, these parts will be invoiced to the customer at full price. If L & M decides that warranty is allowed, cost for these parts and any freight charges incurred by the customer will be reimbursed.
7. In all cases, L & M reserves the right to recall any defective parts. Warranty claims will not be credited until the receipt of these parts is confirmed.
8. L & M also reserves the right to determine whether or not warranty claim charges are reasonable and fair, and to what extent L & M Radiator is liable.
9. Genuine **MESABI** parts must be used in repairs or future warranty claims will be void.

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

GENERAL WARNINGS AND SAFETY PRECAUTIONS

The cable reel movement is remotely controlled by the crane or the machine on which it is installed. Thus if the machine starts moving the cable reel will start rotating.

People should not stay in the proximity of the cable reel during normal operation. Maintenance people should be informed and understand the risks before working on the cable reel.

The area around the cable reel should be closed for any other people.

All persons working with the cable reel must be informed where the nearest emergency stop button is located.

Before removing the cover of the collector be sure the power (medium or low voltage) has been shut off.

For this reason check again with your specialised personnel that there is no power on line and there is no possibility to switch on the power while you have access to the power rings of the collector.

Check always **before touching the collector's ring**, with an appropriate tool, that there is no power on.

The warning panels (on the medium voltage collectors) are placed in view to warn you about the danger: "**HIGH VOLTAGE**".

Inside the medium voltage collector, once you remove the cover, there is another protection in order to do not touch the rings: a metallic net with the warning "**HIGH VOLTAGE**".

The padlock keys supplied for the interlock of the protection net inside the medium voltage collector has to be welded or fixed to the central main circuit breaker's key, in a manner that is **not possible** to have **access** to the collector's power rings if the **power is on**.

Whenever must be open a medium voltage collector, after switching off the power, connect each phase ring to the ground with an earthing cable.

If heaters or travel limit switches are delivered in the collector enclosure these can still have tension on the terminals even if the main power is switched off.

Stay away from all moving parts, such as drums, motors, cable guides, cables.

Specimas will not be held responsible for the lack or misuse of above systems

ENGINEERING WARNING FOR THE CABLE REEL INSTALLATION!

Walkways suggested at least along one drum side in order to allow an easy access to the cable reel for the maintenance and torque set-up operations.

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

Horizontal retrieval:

The most difficult working mode is reeling in and accelerating with drum nearly full. In this working mode check that the cable leaves the cable guide with a slight slack; the cable should hardly touch the last roller in the cable guide. In this way the torque is correct and the reel is not pulling too hard on the cable.

Vertical retrieval:

The most difficult working mode is reeling up and accelerating, cable amount on drum is normally of less importance as this is compensated by the layering diameter on the drum which changes with the amount of cable on the drum.

Position hook near ground level, hoist with full speed. During the acceleration phase the cable should show a slight relaxation or even a slight slack.

This indicates that the torque is correct and not too high.

If the cable is always fully tight it is impossible to see how much the reel is pulling and the extra pull on the cable will only go to a destructive force on the cable itself.

It is recommended to fix the cable to the hook with an elastic element spring or similar as this movement is then easy to see in the spring movement.

The spring will also dampen dynamic forces from sway etc. on the cable.

- I. After a few weeks to a month of operation it is normal that the torque must be re-adjusted.

This as the initial wear in of the clutch plates has occurred. After this re-adjustment might be needed every 12 months depending on working load and intensity.

At the same time check screws, bolts, and electric connection.

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

Catalogue HY11-2500/UK

Heavy-duty aluminium pumps and motors
 Series PGP, PGM 500

Characteristics**PGP/PGM 500 Series**

PGP 500 series pumps offer superior performance, high efficiency and low noise operation at high operating pressures. They are produced in four frame sizes (PGP 503, PGP 505, PGP 511, PGP 517) with displacements ranging from 0.8 to 70 cm³/rev. A wide variety of standard options is available to meet specific application requirements.

Advantages

- **Up to 275 bar continuous operation**
High strength materials and large journal diameters provide low bearing loads for high pressure operation.
- **Low noise**
PGP 503 - 9 tooth gear profile, PGP 505 and 517 - 13 tooth gear profile, PGP 511 - 12 tooth gear profile and optimized flow metering provide reduced pressure pulsation and exceptionally quiet operation.
- **High efficiency**
Pressure balanced bearing blocks assure maximum efficiency under all operating conditions.



PGP 500

1

- **Application flexibility**
International mounts and connections, integrated valve capabilities and common inlet multiple pump configurations provide unmatched design and application versatility.

For a full overview of all gear products available please order Catalogue 3252/UK from your Parker partner.

Characteristics

Pump type	Heavy-duty, aluminium, external gear
Mounting	SAE, rectangular, thru-bolt standard specials on request
Ports	SAE and metric Split flanges and others
Shaft style	SAE splined, keyed, tapered, cylindrical tang drive, specials on request.
Speed	500 - 4000 rpm, see tables
Theor. displacem.	see tables
Drive	Drive direct with flexible coupling is recommended.
Axial / Radial load	Units subject to axial or radial loads must be specified with an outboard bearing.
Inlet pressure	Operating range 0.8 to 2 bar abs. Min. inlet pressure 0.5 bar abs. Short time without load. Consultation is recommended.
Outlet pressure	see tables
Hydraulic fluids	Hydraulic oil H-LP, DIN 51525
Fluid temperature	Range of operating temperature -15 to +80°C. Max. permissible operating pressure dependent on fluid temperature. Temperature for cold start -20 to -15°C at speed ≤ 1500 rpm. Max. permissible operating pressure dependent on fluid temperature.

Fluid viscosity	Range of operating viscosity 8 to 1000 mm ² /s. Max. Permissible operating pressure dependent on viscosity. Viscosity range for cold start 1000 to 2000 mm ² /s at operating pressure p≤10 bar and speed n ≤1500 rpm.
Range of ambient temperature	-40°C - +70°C
Filtration	According to ISO 4406 Cl. 16/13
Direction of rotation	Clockwise, counter-clockwise or double. (looking at the drive shaft) Attention! Drive pump only in indicated direction of rotation.
Multiple pump assemblies	- Available in two, three or four section configurations. - Max. shaft loading must conform to the limitations shown in the shaft loading rating table in this catalogue. - Max. load is determined by adding the torque values for each pumping section that will be simultaneously loaded.
Separate or common inlet capability	Separate inlet configuration: - Each gear housing has individual inlet and outlet ports. Common inlet configuration: - Two gear sets share a common inlet.

All rights reserved.

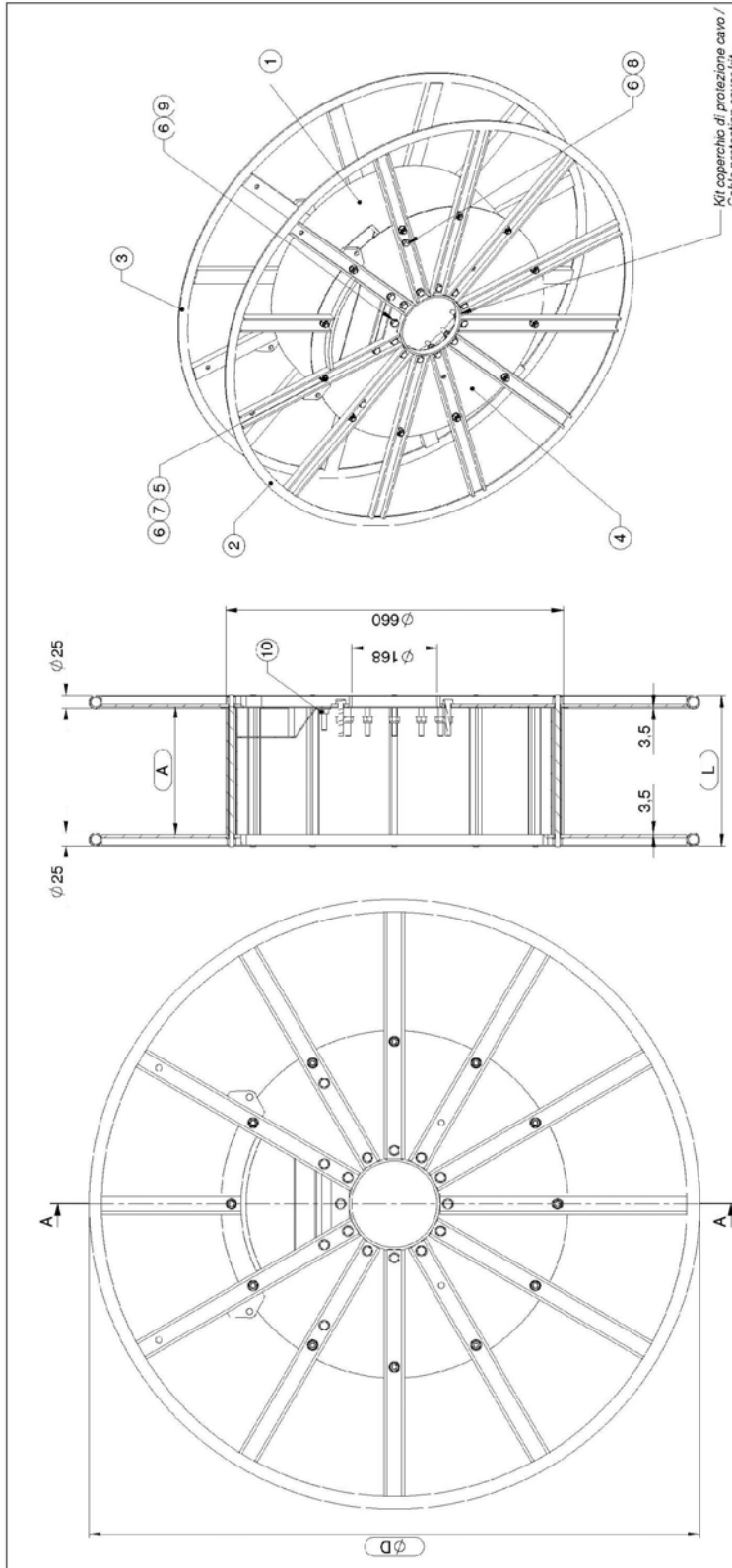
PGP-PGM500_600_GB.PM6.EMM



1-111

Parker Hannifin GmbH
 Hydraulic Controls Division
 Kaarst, Germany

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



SECTION A-A / SEZIONE A-A

Materiale - Material		C		Data della revisione, Modificato codice, Aggiunto formula per L		03.09.04	AAF
S05 - S067		B		Aggiunto S05-C0612-250, Modificate bancarelle, flangia e ruote		04.05.04	AAF
Provisione assemblata - Finish		A		Emesso per produzione		12.01.04	AT
Quantità - Quantity		Ind.		Modifiche			
Oliviera - Oletower		Vedi tabella		 CAVOTEC SPECIMAS S.p.A. MANUFACTURING COMPANY OF THE CAVOTEC GROUP L. SPINALETTA MANAGER S.p.A. S.M. CALABRITA I TEL. 0502 95111 - FAX 0502 11259		Data - Date 12.01.2004 Scale - Scala / Sigla /	
Gruppo - Assembly		Tamburi - Drums RAC		Veddi tabella Peso - Weight (kg)		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0612-201		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0612-310		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0612-250		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0612-301		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0614-201		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	
S05-C0614-300		R6xx-xxx		Gruppo - Quantity Particolari - Parts Tamburo - Drum R6xx-xxx		Veddi tabella No. Progetto - Drawing No. AT-066	

Larghezza max. tamburo, L = A + 43

Codice	Ø D	A	Peso (kg)
S05-C0610-200	995	200	53
S05-C0610-310	995	300	59
S05-C0612-201	1195	200	61
S05-C0612-250	1195	250	65
S05-C0612-301	1195	300	68
S05-C0614-201	1395	200	70
S05-C0614-300	1395	300	77

Title:	Engine Monitoring Display
Number:	MB-ELE1470
Revision:	A

In order for the display to properly communicate with the engine, the SAE J1939 communication bus settings have to be configured accordingly. To access the J1939 communication bus settings, press and hold the Key 5 button in order to display the configuration menu screen. Once the configuration menu screen is displayed, use the arrow keys to select the system screen. Please note that the configuration menu screen will differ depending on what version of software is loaded into the display. Refer to Figures 6 and 7.



Figure 6 – Configuration Menu Screen (Software Version pre 3.00J)

KEY #1
AND #2
BUTTONS
SCROLL
BETWEEN
SELECTION
BUTTONS



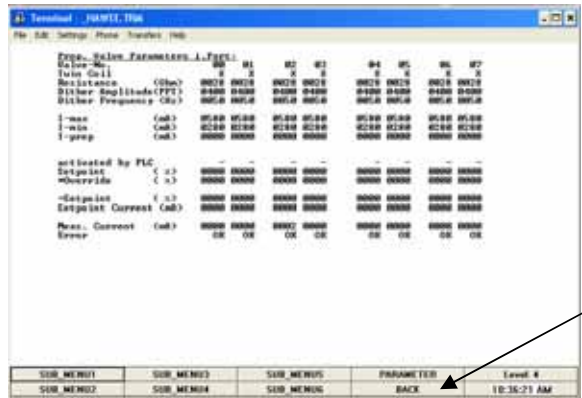
Figure 7– Configuration Menu Screen (Software Version 3.00J and Newer)

Title: Engine Monitoring Display
Number: MB-ELE1470
Revision: A

Control Unit	J1939 SPN	J1587 PID	J1587 SID	FMI	Description of Code
ECU	723	-	64	3	Camshaft Position Sensor Open Circuit
ECU	723	-	64	4	Camshaft Position Sensor Short to Ground
ECU	723	-	64	8	Camshaft Position Sensor Time Out
ECU	723	-	64	14	Camshaft Position Sensor Pins Swapped
VCU	730	-	71	5	Grid Heater Valve Open Circuit
VCU	730	-	71	6	Grid Heater Valve Short to Ground
VCU	730	-	71	0	Grid Heater – No Inc Boost Temperature
VCU	730	-	71	1	Grid Heater Relay Closed
VCU	730	-	71	2	Grid Heater Relay Open
VCU	730	-	71	3	Grid Heater Open Circuit
VCU	730	-	71	4	Grid Heater Short to Ground
VCU	974	-	29	2	Remote Throttle Pedal Supply Out Of Range
VCU	974	-	29	3	Remote Throttle Pedal Supply Open Load
VCU	974	-	29	4	Remote Throttle Pedal Short to Ground
ECU	986	-	159	0	Fan Speed Time Out
VCU	1004	-	56	3	Accessory Bus Shutdown Open Circuit
VCU	1004	-	56	4	Accessory Bus Shutdown Short to Ground
VCU	1005	-	43	3	Gear Output 1 Open Circuit
VCU	1005	-	43	4	Gear Output 1 Short to Ground
VCU	1006	-	44	3	Gear Output 2 Open Circuit
VCU	1006	-	44	4	Gear Output 2 Short to Ground
ECU	2791	-	146	0	EGR Temperature High
ECU	2791	-	146	1	EGR Temperature Low
ECU	2791	-	146	2	EGR Temperature Data Erratic
ECU	2791	-	146	7	EGR Valve Not Responding
ECU	2791	-	146	12	EGR Bad Component

Title: Procedure, HAWE Valve Controller Setup
Number: MB-ELE1451
Revision: Original

To verify that all of the changes have taken effect, from the proportional valves submenu screen (See Figure 9) select the “SUBMENU 1” or “SUBMENU 2” tab. The submenu 1 screen will display the current set values for valve numbers 0 through 7 where the submenu 2 screen displays the set values for valve numbers 8 through 15. Please ensure that all the valves are set the same with the parameters set as stated previously.



BACK TAB

Figure 11 – Proportional Valves Set Values Screen

In order to log out of the terminal software, select the “BACK” tab to return to the login screen. Please see Figure 5. Once the logged in screen is displayed select the “LOGOUT” tab. Once the logged out screen is displayed, the terminal software can be closed.

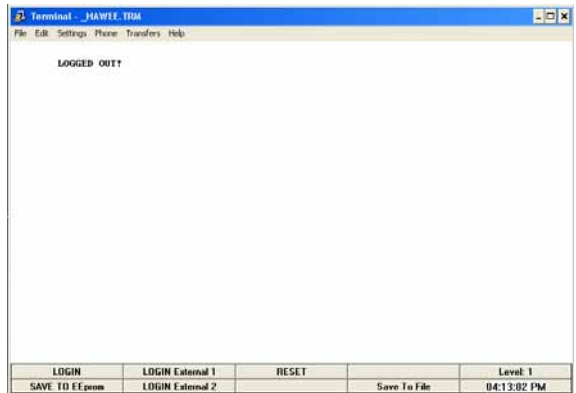


Figure 12 – Logged Out Screen

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

NOTE

When testing the AC Control functions, the Drive / Auxiliary switch must be in Auxiliary Mode.

1. To test the high hydraulic oil temperature warning indicator, jumper wires "AUX" to "A12" in the carrier junction box. The light should turn on.
2. To simulate the high hydraulic oil temperature alarm, remove 1 of the "A14" wires from the terminal block in the carrier junction box.
3. To test the low hydraulic oil level warning indicator, jumper wire "AUX" to "A13" in the carrier junction box.
4. To simulate the low hydraulic oil level alarm, remove 1 of the "A11" wires from the terminal block in the carrier junction box.
5. To simulate the low hydraulic tank pressure alarm, remove the DIN "A" connector from the hydraulic tank air pressure switch.
6. To simulate the low water pressure alarm, remove the DIN "A" connector from the water pump pressure switch.
7. To simulate the high air compressor temperature alarm, jumper wire "AUX" to wires "506 and "507" in the carrier junction box.
8. To simulate the low lube air pressure warning, remove the DIN "A" connector from the lube system air pressure switch.
9. To simulate the low lube level warning, remove 1 of the "A16" wires from the terminal block in the operator's console box.
10. To test the voltage monitor under voltage indicator, turn off dipswitch #3 on the voltage monitor itself so that it is looking for 690VAC instead of 600VAC. Ensure that the Voltage % is set lower than the measured voltage during normal operation. Ensure that the dipswitch is turned back on and that the Voltage % is returned to the normal operation value after the test is complete.
11. To test the voltage monitor over voltage indicator, adjust the Voltage% to lower than the measured voltage during normal operation. Ensure that the Voltage % is returned to the normal operation value after the test is complete.



Maclean Canada - MAINTENANCE BULLETIN

Title: Electrical Panel Preventive Maintenance Procedure
Number: MB-ELE1389
Revision: Original

MACLEAN ELECTRICAL PANEL PM CHECKLIST

Panel Description/Part# _____
 Machine# _____

Power Pack Hour Meter: _____
 Diesel Hour Meter: _____
 Date: _____

Work descriptions	Condition	Repairs	Remarks	Initials
Inspect panel for moisture				
Inspect for signs of water ingress				
Inspect gaskets and seals				
Inspect latches				
Vacuum inside enclosure				
Clean enclosure exterior				
Inspect for missing, broken or loose devices				
Inspect for unplugged, unused holes				
Inspect decals and labels				
Check indicating lights bulbs				
Inspect/clean lenses on lights				
Tighten indicating light connections				
Inspect switches for damage or corrosion				
Check action of switches				
Tighten all switch connections				
Inspect circuit breakers and boots				
Tighten all breaker connections				
Inspect all terminal blocks				
Tighten all terminal block screws				

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

MONTAGEANLEITUNG INSTRUCTIONS DE MONTAGE INSTRUCTIONS DE MONTAJE

Vorratsanzeiger Kraftstoff (Hebelgeber) Fuel Tank Gauge (Lever Type Sender)	VDO Oscor & Co.	08 601 090	04/97	1-10	6
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Emplacement de montage du capteur:
 Installer le capteur sur l'ouverture de montage déjà prévue par le constructeur du réservoir (bride de montage) ou sur une ouverture de montage encore à confectionner dans le réservoir à eau, en un endroit avantageux pour la mesure du contenu du réservoir.
 L'emplacement le plus avantageux pour l'ouverture de montage se trouve au milieu du couvercle du réservoir, dans le cas d'un réservoir à eau rectangulaire. Dans le cas d'autres réservoirs à eau, il se trouve à environ un tiers par rapport à l'endroit le plus profond.
 Lorsque le réservoir à eau possède un grand couvercle d'inspection et que celui-ci est positionné avantageusement, il y a lieu de mettre l'ouverture de montage à cet endroit.
 Afin d'éviter que le moteur n'aspire de l'air lors des mouvements décrits en cas de grosse mer, il y aurait lieu de déduire un quart de la hauteur du réservoir (H) en vue de la détermination de la cote de montage (L). Nous vous prions de monter le capteur de telle manière que le bras de levier soit dirigé dans la direction longitudinale du bateau.
 Veiller à l'espace libre dans la plage de pivotement du bras de levier.

Consignes relatives à la sécurité:
 Lorsqu'il s'avère indispensable de confectionner une ouverture de montage, il sera indispensable de vider intégralement le réservoir au préalable. Déverser le carburant dans un contenant prévu à cet effet. Nous tenons à faire remarquer que des gaz résiduels se trouvant dans le réservoir engendrent un risque d'explosion. Pour cette raison, aérer le réservoir pendant environ 10 minutes au moyen d'une soufflante. Nous vous prions de vous abstenir d'utiliser à cet effet une soufflante comme par exemple un thermovenilateur ou un sèche-cheveux.
 Démontez si possible le réservoir.
 Percez au préalable les ouvertures de montage de petit diamètre. Utilisez une fraise conique, une scie sauteuse pour trous ou une lime pour agrandir le trou et pour le finir. Ebavurer les bords.
 Observer à tout prix les consignes de sécurité du fabricant des outillages portatifs. Nettoyer le réservoir pour le débarrasser des résidus de perçage, de limage et de sciage.
 En cas d'utilisation d'une bride de réservoir pour la fixation par soudage: déconnecter absolument

Lugar de montaje del transmisor:
 Instalar el transmisor en la abertura de montaje (brida de montaje) ya prevista por el fabricante del tanque, o en una abertura de montaje en el tanque a realizar en un lugar favorable para la medición de la reserva.
 El lugar más favorable para la abertura de montaje en un tanque rectangular, está en el centro de la tapa del tanque, en otros tanques de agua a un tercio de la cara del fondo.
 Cuando exista una tapa de inspección grande en el tanque y esta tapa está favorablemente posicionada, colocar la abertura de montaje aquí.
 Para evitar que el motor aspire aire en movimiento con oleaje, se debería restar un cuarto de la altura del tanque (H) para la determinación de la dimensión de montaje (L). Montar el transmisor de tal modo que el brazo de palanca señale en dirección longitudinal del barco.
 Prestar atención al espacio libre en el margen de giro del brazo de palanca.

Indicaciones de Seguridad:
 Si se debe hacer una abertura de montaje, previamente vaciar el tanque por completo. Verter el combustible en un depósito previsto para ello.
 Existe peligro de explosión por los gases residuales dentro del tanque. Por tanto, ventilar el tanque con un soplante durante 10 minutos. Para esto no utilizar soplanes del tipo calentador de aire o similar.
 Cuando sea posible, desmontar el tanque. Taladrar las aberturas de montaje a un diámetro inferior al definitivo. Emplear una fresa cónica, una sierra de perforar, un serrucho de calar o una lima, para ampliar los agujeros y terminarlos. Desbarbar las aristas. Observar obligatoriamente las indicaciones de Seguridad del fabricante de

Sensor installation location:
 Install the sensor in the installation aperture provided by the tank manufacturer (installation flange), or in another installation aperture still to be created in the tank, at a point suitable for measuring the contents.
 The most favourable point for the installation aperture is in the centre of the tank cover in the case of rectangular tank, and at about one third towards the deep side in the case of other tanks. If there is a large inspection cover on the tank, and if it is suitably placed, make the installation aperture there.
 In order to prevent the engine from taking in air through the motion of the sea, one quarter should be subtracted from the tank height (H) to determine the installation measurement (L). Install the sensor in such a way that the lever arm points in the direction of travel of the boat.
 Make sure there is sufficient freedom of movement in the swivel area of the lever arm.

Safety instructions:
 If an installation aperture has to be made, the tank must first be emptied completely. Fill the fuel into a suitable container. There is a danger of explosion through residual fumes in the tank.
 For this reason, the tank should be ventilated with a blower for approx. 10 minutes. Do not use air heaters or hair driers as blowers.
 If possible, remove the tank.
 First drill small holes at the installation apertures. Use tapered drills, compass saws, fretsaws or files to enlarge and complete the hole. Deburr the edges. The safety instructions of the hand tool manufacturer must be observed.
 Clean the tank of residue from drilling, filing and sawing.
 When using a tank flange for weld-mounting: The positive and negative poles must be disconnected from the battery.
 Centre the flange and weld it in position. The welded seam must have no leaks whatsoever. The safety regulations and instructions of the welding equipment manufacturer must be observed.
 When installation is finished, refill the tank with the fuel that was removed. After the welding work is completed, check the compensation of the compass system.

la herramienta manual.
 Cuando se emplee una brida del tanque para unir por soldadura.
 Desmontar obligatoriamente los polos positivo y negativo de la batería.
 Colocar la brida centrada y unir por soldadura. El cordón de soldadura debe ser perfectamente estanco. Observar obligatoriamente los Reglamentos y las indicaciones de Seguridad del fabricante del aparato de soldadura.
 Después de terminado el montaje, verter el combustible extraído otra vez en el tanque.
 Después de finalización de los trabajos de soldadura, comprobar la compensación de la instalación de la brújula.

Technische Änderungen vorbehalten · Technical details subject to change · Sous réserve de modifications techniques · Quodam reservadas las modificaciones técnicas
 VDO Kitzteile Vertrieb und Service GmbH
 ...ein Mannesmann-Unternehmen

Description:	Desiccant Packets
Number:	MB-ELE1319
Revision:	Original
Revision Date:	March 21, 2003
By:	STB
Part Number(s) Affected:	1048721, 1050072
Machine Model(s) Affected:	All Equipped

Table of Contents

SECTION 1:	Description.
SECTION 2:	Usage.
SECTION 3:	Installation & Maintenance.
IMAGE 1:	Desiccant Packets Original Package.
IMAGE 2:	Desiccant Packet, Open Package.
IMAGE 3:	Desiccant Packet in Small Panel.
IMAGE 4:	Desiccant Packet in Large Panel.

Section 1: Description.

Due to the research and testing of newly available products, Maclean Engineering & Marketing Co. Limited now offers two sizes of desiccant packets. Maclean Engineering offers these desiccant packets as a means of protecting sensitive electrical equipment from damage due to moisture.

Moisture, in a sealed electrical enclosure, is generally due to a change in temperature or altitude. These changes result in high relative humidity and/or condensation within the enclosure. The desiccant packets are intended to control moisture levels in sealed enclosures only.



If for any reason an enclosure is not sealed, the moisture levels may exceed the desiccant packet's absorption ability.

Desiccant packets are non-toxic, emit no fumes, and generate no heat during use. No gloves, mask, or special clothing is required to handle the product.

Section 2: Usage.

The 1" X 1" packets are rated to control moisture in sealed electrical enclosures with internal volume less than 1 cu.ft. The 2" X 2" desiccant packet is intended for use in sealed electrical enclosures with internal volumes from 2 cu.ft. to 3 cu.ft. Two or more packets may be required if enclosure's volume exceeds 3 cu.ft. To indicate fullness, each packet will expand to approximately 3 to 4 times its original size. When this occurs the packet requires replacing or rejuvenation.



ISO 9001 : 1987
Certificate Nos:
FS00623 FM1237 FM229



MACHINERY DIRECTIVE
(98/37 EC)

CERTIFICATE OF INCORPORATION

(In accordance with Article 4(2) and
Annex IIB of the above directive)

We,

BROOK HANSEN	BROOK HANSEN	BROOK HANSEN	BROOK HANSEN	ELECTRODRIVES
Small Industrial Motors	Small Industrial Motors	Large Industrial Motors	FSE Tameł S.A.	Cakemore Road
St Thomas' Road	Hope Bank Works	Netherfield Road	Elektryczna Str, 6	Rowley Regis
Huddersfield	Honley	Guisley	33-100 Tarnów	West Midlands
HD1 3LJ	HD7 2QG	Leeds LS20 9NZ	Poland	B65 0QT
England	England	England		England

declare that ac induction machines manufactured by us, having open or totally enclosed construction to all standard IP protection and IC cooling forms, including Ex enclosures, with outputs up to 850kW, must be installed in accordance with our Customer Safety instructions, and must not be put into service until the machinery into which they are incorporated has been declared to be in conformity with the Machinery Directive.

Huddersfield
December 1998

S. Williamson
Technical Director



POWERFUL CONNECTIONS

Brook Hansen incorporates the following brand names:
Brook Crompton, Bull Electric and Brook Crompton Controls.

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MDR 16067

Title:	Battery Charger, Vulcan Type SCA
Number:	MB-ELE1091
Revision:	B



6510 Lawrence Avenue, East, Scarborough, Ontario M1C 4A7
Tel. (416) 281-1550 Fax (416) 281-3416

OPTIONAL FEATURES and ALARM CIRCUITS

LOW BATTERY VOLTAGE ALARM CIRCUIT

Three Terminals designated as LO-VOLT ALARM. Form "C" to interrupt one side of the circuit, to operate a lamp or bell when wired through the above terminals. Factory set to operate at 22.0 volts.

HI-BATTERY VOLTAGE ALARM CIRCUIT

Two terminals designated as HI-VOLT ALARM, "IN-OUT" to interrupt one side of the circuit, to operate a lamp or bell when wired through the above terminals. Factory set to operate at 31.0 volts.

NO-CHARGE ALARM CIRCUIT

Two terminals designated as NO-CHARGE ALARM, "IN-OUT" to interrupt one side of the circuit, to operate a lamp or bell when wired through the above terminals. Alarm operates when charger output fails.

A.C. FAIL ALARM CIRCUIT

Two terminals designated as A.C. FAIL ALARM, "IN-OUT" to interrupt one side of the circuit to operate a lamp or bell when wired through the above terminals. Alarm will operate if A.C. input breaker trips or with any loss of A.C. power from the source.

GROUND DETECTION ALARM CIRCUITS

Two terminals designated as positive and negative Grd Alm, "IN-OUT" and negative alm, "IN-OUT" to interrupt one side of the circuit, to operate a lamp or bell when wired through the above terminals.

30 DAY 6 HOUR EQUALIZE TIMER

NOTE

In some instances the HI-BATTERY VOLTAGE ALARM LAMP or GROUND DETECTION ALARMS may signal during the equalize charge cycle. This would only happen if the battery was above 31 volts.

The maximum rating of charger alarm circuits is 10 amperes, 120 volt A.C. This maximum applies to all alarm lamps or bells connected through the alarm terminals supplied within the battery charger.

These alarms are installed as requested.
Alarms available with extra contacts for external lamps.

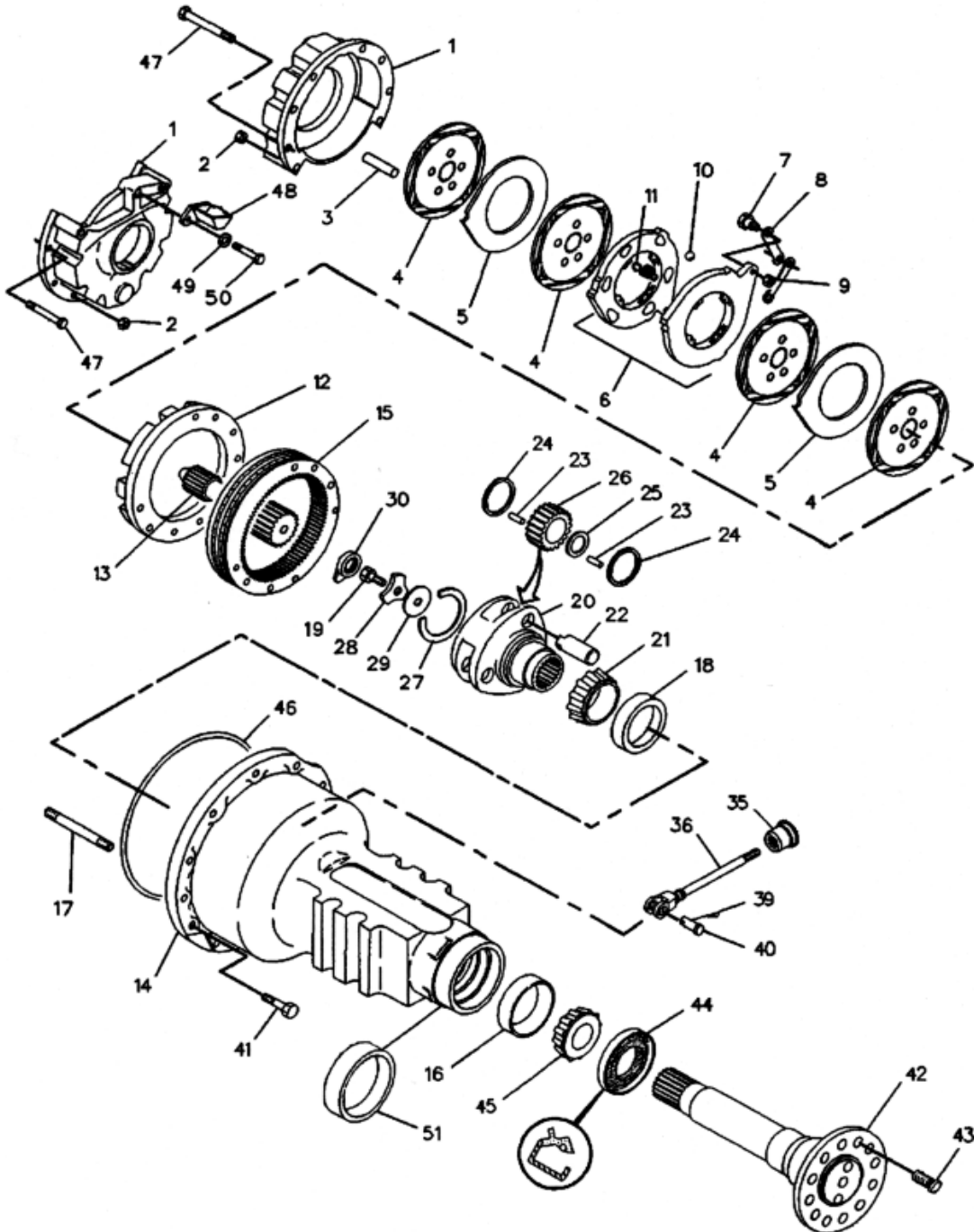
MANUFACTURERS
BATTERY CHARGING AND TESTING EQUIPMENT
PRODUCTS OF QUALITY FOR OVER 90 YEARS

Title: Axle – D65 & D65I Service Manual
Number: MB-AXL1073
Revision: B

001

p2 08/00

TRUMPET HOUSING ASSEMBLY



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