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DEBEERS SNAP LAKE
S/N 6920
02/09/07

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1. INTRODUCTION /GENERAL INFORMATION

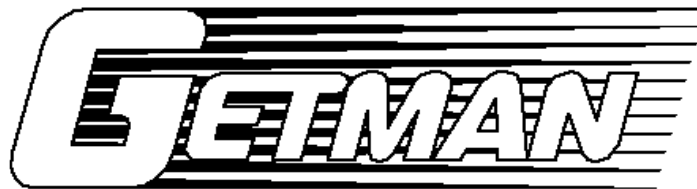
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TO AVOID DELAYS AND ASSURE THE MOST EFFICIENT HANDLING, PLEASE SPECIFY THE FOLLOWING ON ALL ORDERS.

- MODEL TYPE AND FACTORY SERIAL NUMBER OF YOUR MACHINE.
- NAME, MODEL NUMBER, AND SERIAL NUMBER OF THE ASSEMBLY (SUCH AS A TRANSMISSION) FOR WHICH THE PART REQUIRED.
- PART NUMBER (REFER TO THE CORRECT REPAIR PART NUMBER).
- GIVE COMPLETE PART DESCRIPTION.
- EXACT QUANTITY OF PART REQUIRED. (DO NOT ORDER BY SET UNLESS SET IS SPECIFICALLY CALLED OUT IN PARTS MANUAL. IN THOSE INSTANCES, SPECIFY ONE (1) SET OF _____ MATCHES PIECES.)
- SHIPPING INSTRUCTIONS (INCLUDE ROUTING WHEN POSSIBLE).
- BILLING INSTRUCTIONS.

PLEASE PLACE ALL ORDERS WITH YOUR LOCAL GETMAN DISTRIBUTOR.



MODEL A-64

TYPE SCISSOR LIFT

SPEC. 3347

SERIAL NO. 6920



Limited Warranty

Getman Corporation warrants each new vehicle manufactured by it to be free from defects in materials and workmanship for one (1) year or two thousand (2,000) hours of operation (whichever occurs first) from the date of delivery to the first user, excepting the vehicle mainframe which is warranted to be free from defects in materials and workmanship for five (5) years or ten thousand (10,000) hours of operation (whichever occurs first).

This warranty is limited to the replacement or repair, at Getman's factory or at a point designated by Getman, of such part which is found by Getman, after inspection, to be defective in materials or workmanship. Repair parts provided under this warranty are warranted for the remainder of the warranty period of the vehicle to the same extent as if such parts were original components thereof.

This warranty does not apply to:

1. Engines, tires, batteries, or other components which are warranted directly to the user by the respective manufacturers thereof;
2. Any vehicle or component which has been repaired or altered in such a way, and in Getman's judgment, as to affect the product adversely;
3. Any vehicle or component which has, in Getman's judgment, been subject to negligence, accident or improper storage or usage;
4. Any vehicle which has not been operated and maintained in accordance with normal practices and within the recommendations of Getman; and
5. Any vehicle or component or accessory manufactured by others and supplied by Getman on special order by the first user.

This warranty does not obligate Getman to bear the costs of labor or transportation charges in connection with the replacement or repair of defective vehicles or parts.

ALL WARRANTIES IN THIS AGREEMENT ARE IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, SAID WARRANTIES BEING EXPRESSLY DISCLAIMED.

GETMAN WILL NOT BE LIABLE FOR ANY LOSS, DAMAGE OR INJURY RESULTING FROM DELAY IN DELIVERY OR INSTALLATION OF THE GOODS OR FOR ANY FAILURE TO PERFORM WHICH IS DUE TO CIRCUMSTANCES BEYOND ITS CONTROL. THE MAXIMUM LIABILITY, IF ANY, OF GETMAN FOR ALL DAMAGES, INCLUDING WITHOUT LIMITATIONS CONTRACT DAMAGES FOR INJURIES TO PERSONS OR PROPERTY, WHETHER ARISING FROM GETMAN'S BREACH OF THIS AGREEMENT, BREACH OF WARRANTY, NEGLIGENCE, STRICT LIABILITY, OR OTHER TORT WITH RESPECT TO THE GOODS, IS LIMITED AS OTHERWISE PROVIDED HEREIN. IN NO EVENT SHALL GETMAN BE LIABLE TO BUYER FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, INCLUDING WITHOUT LIMITATION LOST REVENUES AND PROFITS, EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE RIGHT TO RECOVER DAMAGES WITHIN THE LIMITATION SPECIFIED IS BUYER'S EXCLUSIVE ALTERNATIVE REMEDY IN THE EVENT THAT ANY OTHER CONTRACTUAL REMEDY FAILS OF ITS ESSENTIAL PURPOSE.

Any dispute arising out of or relating to an alleged breach of this warranty shall be submitted for resolution to arbitration. Such arbitration shall be conducted according to the rules of the American Arbitration Association, and any award shall, if deemed necessary by either party, be submitted to the appropriate judicial body for confirmation as a judgment to such judicial body.



Limited Warranty

Scissor Lift Arm Assembly

Getman Corporation warrants each new scissor lift arm assembly manufactured by it to be free from defects in materials and workmanship for five (5) years or ten thousand (10,000) hours (whichever comes first) of operation from the date of delivery to the first user.

The obligation, statutory or otherwise, of this warranty to the replacement or repair, at the Manufacturer's factory or at a point designated by the Manufacturer, of such part which is found by the Manufacturer, upon inspection at such point, to be defective in materials or workmanship.

Included in this warranty are the structural assemblies and weldments and exclude normal wear components (i.e. bushings, bearings, and rollers). Purchased components (including, but not limited to, hydraulic cylinders, hoses, and fittings) are warranted for six months or 1,000 hours (whichever comes first).

This warranty does not apply to:

- 1.) Any scissor lift arm assembly which has been repaired or altered in such a way, in the Manufacturer's judgment, as to affect the product adversely.
- 2.) Any scissor lift arm assembly which has, in the Manufacturer's judgment, been subject to negligence, accident, or improper storage.
- 3.) Any scissor lift arm assembly which has not been operated and maintained in accordance with normal practice and with the recommendations of the Manufacturer.

This warranty does not obligate the Manufacturer to bear the costs of labor or transportation charges in connection with the replacement or repair of defective vehicles or parts.

This warranty is exclusive and is in lieu of all other warranties, expressed or implied, and there is no implied warranty of merchantability or fitness for a particular purpose.

Getman Corporation's liability for losses, damages, or expenses of any kind arising from its manufacture or sale of the scissor lift arm assembly or parts covered by this warranty, whether based on contract, tort or otherwise, including liability arising from a breach of this warranty, is limited, unless otherwise prohibited by law, to an amount not exceeding the cost of performing the obligations contained in this warranty according to its terms.

Getman Corporation disclaims all liability for loss, damage or expense attributable to a loss of use of the scissor lift arm assembly, a loss or damage to property other than the scissor lift arm assembly, a loss of profits or other commercial loss, or any special or consequential damages (except liability for consequential damages which by law may not be disclaimed).

Before consideration can be given to requests for warranty claims, the user shall request, fill out, and return a Warranty Claim Form which will require the following information:

Owner's name and address
Person to contact
Scissor lift arm assembly serial
and model numbers
Alleged defective material

Description of problem
Date of occurrence
Date scissor lift arm assembly
was placed in service
Accumulated hours of service



COMPONENT LIST

2-0101
Page 1 of 1

Model: SCISSOR LIFT Type: A-64

Shop No.: 3347 Serial No.: 6920 Truck No.: N/A

Customer: DEBEERS SNAP LAKE

COMPONENT	MANUFACTURER	MODEL	SPECIFICATION	SERIAL NUMBER
ENGINE	DETROIT DIESEL	OM904LA	465198	904.947-00-610718
TRANSMISSION	CLARK	32000	465157	HBEA258889
CRADLE AXLE	NEW HOLLAND	D-65	464891	86559438 6L09
RIGID AXLE	NEW HOLLAND	D-65	464891	86559438 6K19
MAIN HYD PUMP	COMMERCIAL	P-31	494029	N1106-2561
FAN/ALT BELT	DDEC	N/A	146015	GETMAN
OPTIONS:				
INNER SCISSOR ARM				07-4I-64
OUTER SCISSOR ARM				07-4O-64
CENTER PIVOT PINS				A27-05
MAIN PIVOT PINS				C26-08
UPPER HOIST PINS				B26-04
LOWER HOIST PINS				D26-00

*WHEN ORDERING PARTS, ALWAYS GIVE MODEL AND SERIAL NUMBER OF UNIT.

Updated:
02/21/07



SERVICE REPORT FORM

16636
Page 1 of 1

MAKE COMMENTS ON FAULTS FOUND – FACT OF YOUR OPINION:

FAULTS FOUND IF ANY:

ACTION TAKEN IF ANY:

PARTS USED:

NOTE: SAFETY FIRST

MAINTENANCE
PERSON'S SIGNATURE: _____ DATE: _____

SUPERVISOR'S
SIGNATURE: _____ DATE: _____



SHIFT CHANGE CHECK LIST

OK								
	1	CHECK FUEL OIL LEVEL						
	2	CHECK ENGINE OIL LEVEL						
	3	CHECK V-BELT CONDITION						
	4	CHECK HYDRAULIC OIL LEVEL						
	5	CHECK COMPRESSOR OIL LEVEL						
	6	CHECK CYLINDER PINS AND KEEPERS						
	7	CHECK ALL HYDRAULIC HOSES FOR LEAKS OR WEAR						
	8	CHECK HORN AND LIGHTS						
	9	SECURE BIN DOOR						
	10	CHECK WHEEL LUG NUTS						
	11	CHECK FOR MISSING OR LOOSE NUTS, BOLTS OR SCREWS						
	12	TEST PARKING BRAKE						



The following storage instructions are intended to help ensure optimum performance from Getman equipment that will not be utilized for a period of three months to one year.

It is important that these instructions be followed as described in order to keep your warranty valid.

ENGINE

Change oil using an oil with corrosion preventing properties of at least a HD- S1 oil. Listed are some of the oils that have been approved: Esso MZ20X20V7N; Texaco EKM 162; Shell V6828.

Change oil and fuel filters.

Fill fuel tank completely with a mixture of diesel fuel and 10% corrosion inhibiting motor oil.

Run engine for at least 10 minutes to fill fuel lines and filters, injection pump and nozzles with preservative mixture.

If engine is to be stored over six months, seal intake and exhaust system to keep moisture out.

TRANSMISSION & HYDRAULICS

No special care is required except exposed cylinder rods should be covered with grease.

AXLE

Axle housings should be filled completely to eliminate the chance of moisture condensation.

BRAKE SYSTEM

Drain all air reservoirs of moisture.

BATTERY

Remove battery; clean off top; fill with water, charge, and store in a well-ventilated battery storage area. Do not store on concrete or metal.

EQUIPMENT STORAGE FOR LESS THAN THREE MONTHS

When storing equipment for less than three months, vehicle(s) should be started and driven for a minimum of 10 minutes every two weeks.



LUBRICANT CROSS REFERENCE

ENGINE & AIR CLEANER (OIL BATH) (Engine Manufacturers Specifications.)

Shell	Rotella
BP	Vanellus C-Extra
Citgo	C-500 Motor Oil
Conoco	HD Fleet
Gulf	Super Duty
Mobil	Delvac 1300
Sunoco	Super-C
Texaco	Ursa Super Premium
Exxon	XD-3

POWERSHIFT TRANSMISSION OIL CLARK (TYPE C-3, TO -4)

Shell	Donax T
BP	Autran C-4/TO-4
Citgo	Transgard Torque Converter 250
Conoco	Powerdrive Fluid
Gulf	HT C-3 Fluid
Mobil	Trans HD
Sunoco	TO-4 Transmission
Texaco	Texamatic 4291

Torque converter/transmission lubricant must be qualified by one of the following specifications.

ORDER OF PREFERENCE PER SPICER OFF HIGHWAY:

1. Caterpillar	TO-4
2. John Deere	J20 C, D
3. Military	MIL-PRF-2104G
4. Allison	C-4
5. Dexron II Equivalent	unless using Graphite

LUBRICANTS NOT RECOMMENDED:
DEXRON III, ENGINE OIL, ANY GL-5 OILS

AXLES - FORD, JOHN DEERE

Shell	Donax TD
Citgo	Transgard Tractor Hydraulic Fluid
Conoco	Power Trans. 11 Fluid
Gulf	Universal Tractor Fluid
Mobil	Mobil Fluid 424
Sunoco	TH Tractor Fluid
Texaco	Super Universal Tractor Oil
Exxon	Hydraul 560

HYDRAULIC OIL

Shell	Tellus 68
BP	AW 68
Citgo	AW 68 Hydraulic Oil
Conoco	Hydroclear AW 68
Gulf	Harmony 68 AW
Mobil	DTE 26
Sunoco	Sunvis 800
Texaco	Rando HD 68
Exxon	Nuto H68

CHASSIS GREASE

Shell	Super Duty Lithium MDS
BP	Energrease LC
Citgo	Overdrive HD
Conoco	Super Lube
Gulf	Crown LC3
Mobil	Mobilegrease Special
Sunoco	Ultra Prestige
Texaco	Multifak All-Purpose EP-2
Exxon	Ronex Extra Duty Moly 2



GETMAN CORPORATION

OPERATING AND MAINTENANCE

MANUAL

FOR

MODEL A-64 CHASSIS

**Read thoroughly before
operating vehicle**

INTRODUCTION

This manual is a guide to proper, safe operation, lubrication and minor adjustment of the Getman A-64 Chassis. Each operator assigned to this vehicle should study this manual carefully before starting or operating the vehicle in order to become familiar with all the controls and procedures. This manual should be kept in a protected place on the vehicle for the operators reference.

Getman A-64 Chassis are purchased with the expectation that it will provide long and faithful service. In its construction, we have taken every precaution to see that you receive an efficient, long-lived, satisfactory vehicle. However, to realize the full measure of value and utility that Getman has designed into this unit, a small amount of time and expense must be invested in the performance of regular inspections and service as recommended in this manual. This small investment will pay off in low operating costs, minimal service expenses and, most importantly, in personnel safety.

RELATED MANUALS

Engine operation manuals are included with the Parts and Service Manuals supplied with this vehicle. You should become familiar with these manuals.

Getman has increased the frequency of many recommended maintenance procedures due to the vehicles demanding application. These changes are noted at each maintenance section end.

A complete parts listing of engine drive train components, applicable Electric/Air/Hydraulic systems, and mounted equipment is included in the Parts and Service Manual. This manual also contains service and repair information useful to maintenance department personnel.

If you have any questions about operating or servicing this unit, contact your local Getman dealer or Getman Corporation direct, immediately.

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CAUTION STATEMENT

Use this equipment under the following conditions only.

1. GENERAL SAFETY

This diesel-powered vehicle is only for use in non-coal mines. Such mine are those in which material being mined is incombustible or contains at least 65% by weight of incombustible material, and in which underground atmosphere in any open workings contains less than 0.25% by volume of flammable gas. Tunneling operations in which underground conditions conform with the foregoing are in the same category as non-coal mines.

Make frequent inspections to see all engine intake and exhaust parts, all electrical components, including wiring and all other equipment, are in safe operating condition. There must be no openings in any part of the engine exhaust system except one exhaust outlet originally provided.

All circuit breakers or fuses for overload protection in electrical circuits must be kept in good condition.

2. FASTENERS

Keep all bolts, nuts, screws and other fasteners for electrical enclosures in place. Properly tighten and secure them. Similarly, keep fasteners for the engine cylinder head, intake and exhaust systems in place, properly tightened and secured.

3. REPAIRS AND RENEWALS

Take special care when making repairs and renewals. Use new parts exactly like those furnished by original manufacturer. Use gaskets from the manufacturer only. Have all mating surfaces clean and in proper condition.

4. BATTERY AND CABLES

Before working on or around batteries, turn the battery disconnect switch off.

5. VENTILATION

The amount of fresh moving air for ventilation at any place underground where the vehicle is working must meet the engine manufacturer's minimum requirements (refer to section 4 Engine and Accessories of Parts and Service Manual). This ventilation must be supplied in addition to that required for other diesel powered vehicles and other requirements. Shut off the engine whenever underground ventilation stops for any reason. It is recommended the engine be shut off any time the vehicle is not in use. Do not idle engine for excessively long periods.

6. ENGINE

Replace any faulty fuel injection part with manufacturers parts. Check fuel pump adjustment and governor seals.

7. INTAKE SYSTEM

Air must flow freely into intake system. Maximum pressure (vacuum) through intake system at full throttle, no load, 2300 RPM should not exceed twenty (20) inches of water. Inspect the intake air cleaner at regular intervals and clean or replace as necessary.

8. EXHAUST SYSTEM

Keep exhaust piping tight at all times. Do not allow piping to become blocked. The minimum back pressure (positive) in exhaust system at full throttle, no load, 2300 RPM must not exceed the engine manufacturer's recommended value.

9. EXHAUST PURIFIER

Purifier can lose efficiency when used on engines producing excessive amounts of blue and/or black smoke. Other engine malfunctions such as stuck or leaking injectors will also cause loss of efficiency. Compression loss will lead to lower exhaust temperature and loss of purifier efficiency.

10. PURIFIER SERVICE

Check back pressure and carbon monoxide periodically (for example, each 250 hours of engine service). Measure back pressure with a manometer having a range of) to 50 inches of water. Record actual vehicle back pressure at time of delivery. Take back pressure reading at N.P.T. fitting located on the purifier inlet cone. When purifier back pressure is three inches higher than the initial clean reading, it may be blocked with diesel soot. Remove and clean purifier as specified.

11. PURIFIER MAINTENANCE

Visually examine inside the purifier. There are parallel channels where it should be possible to see through. Using compressed air in a well ventilated area, blow out the channels to remove blockage. Following the air cleaning, finish catalyst cleaning by soaking the purifier in a cleaning solution. Do not use solvents containing chlorine, sulfur or metals. (do not use leaded gasoline). After soaking for 15 minutes to 2 hours, shake purifier to remove fluid and flush body out with compressed air to remove cleaner.

12. FUEL

Use only diesel fuel recommended by the engine manufacturer for satisfactory engine operation. The flash point must not be less than 140°F or sulfur content greater than 0.5% by weight. When filling fuel tanks underground, transport fuel in secure metal containers. Store fuel containers in closed, incombustible compartments while awaiting transfer to the fuel tank of the diesel vehicle. *Keep fuel in ventilated area.*

13. FIRE EXTINGUISHERS

Each diesel vehicle must carry at least one CO2 type (5-pound size) or dry type, pressurized (2-pound size) fire extinguisher at all times.

14. VEHICLE OUT OF SERVICE

Each out of service vehicle must have an "out of service" tag displayed.

CAUTION STATEMENT continued...



SAFETY ALERT SYMBOL

This symbol will appear at various points throughout the manual in conjunction with warning statements. Its appearance means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

The following messages are also used:

NOTICE: Message is used for special information or instructions, relating to procedures, equipment, tools and other special data.

IMPORTANT: This message is used when special precautions should be taken to ensure correct action or to avoid damage to or malfunction of equipment.

CAUTION: This message is used as a reminder of safety hazards which can result in personal injury if proper precautions are not taken.

WARNING: This message is used when a hazard exists which can result in injury or death if proper precautions are not taken.

DANGER: This message is used when an extreme hazard exists which will result in death or serious injury if proper precautions are not taken.

GENERAL SAFETY PRECAUTIONS

SAFETY NOTICE

Safety depends on well maintained, properly operated equipment. Following service and maintenance recommendations set forth in this manual will result in a reliable vehicle. Observing operating procedures can help you avoid accidents. Listed below are some basic safety precautions which should be read, understood and practiced. It is however, impossible to cover every condition. Always be alert, think **safety** at all times, and use common sense.

DO

- Do read this manual thoroughly before operating vehicle.
- Do learn to recognize and avoid potential hazard areas, such as the articulation joint.
- Do perform all recommended checks.
- Do report all defects.
- Do check the area around vehicle before entering operators compartment.
- Do fasten seat belt.
- Do sound horn before starting engine.
- Do operate vehicle with caution.
- Do park vehicle on a level surface, if possible. Block wheels.
- Do use parking brake.
- Do place direction lever in neutral (N) position when not in use.
- Do enter and exit operator's compartment carefully.
- Do use proper tools for service.

DO NOT

- Do not operate vehicle while under the influence of alcohol or drugs.
- Do not allow pedestrians near vehicle when engine is in operation.
- Do not arc weld on vehicle without first turning master switch to off position.
- Do not allow riders. Passengers must be seated in proper seats with seat belts fastened.
- Do not enter or exit a vehicle when in motion.
- Do not pump the brake pedal.
- Do not drive the vehicle over electrical cables.
- Do not operate a vehicle with a defective exhaust system.
- Do not re-fuel vehicle with engine running.

FUEL SHUT OFF

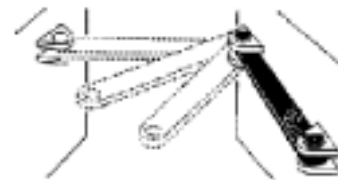
Close fuel line valves at tank ports.

SERVICE POSITION

Throughout this manual, you will be requested to place the vehicle in "Service Position". Do this by:

1. Position the vehicle on a clear, level parking area.
2. Apply the parking brake.
3. Lock frame joint by connecting safety bar (articulating vehicle only)
4. Shut off engine.
5. Block wheels.

Complete all the above procedures before servicing vehicle.

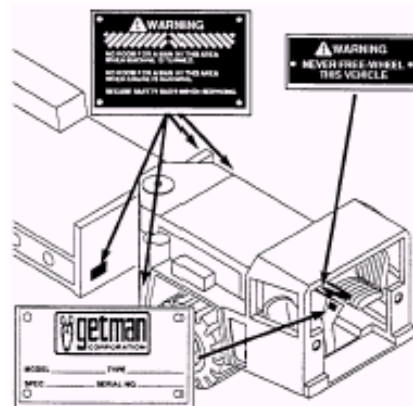


PARKING PROCEDURE

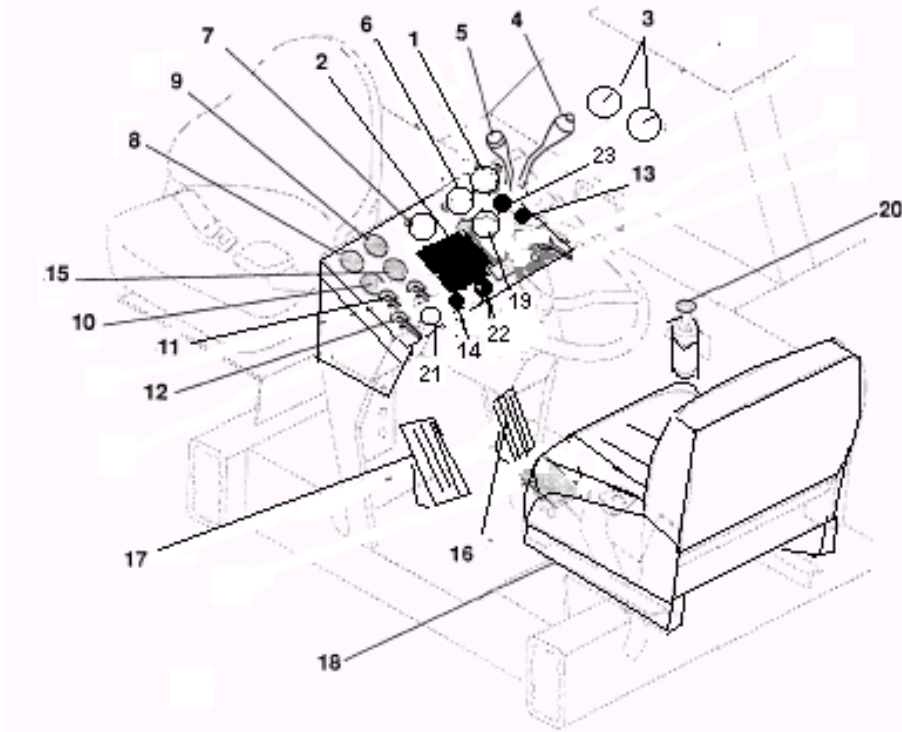
1. Park vehicle away from traffic area, and turn vehicle toward rib.
2. Apply parking brake, and place transmission in neutral (N) position.
3. If vehicle has been operating in a working environment just prior to parking, allow engine to cool. Park and allow engine to run at idle for 1 - 2 minutes.
4. Turn off engine and block wheels.

NAME, WARNING & CAUTION PLATES

Locate and understand all name plates and decals, including the GETMAN Model/Serial Number plate, two types of Warning plates and Caution plate.



INSTRUMENTS AND OPERATING CONTROLS



GENERAL DESCRIPTION

Getman Model A-64 Chassis is a four wheel drive, articulating frame steering vehicle powered by a diesel engine. The power of the engine is transmitted through the torque converter to a three speed, full reversing, powershift transmission. From the transmission, drive shafts with universal slip type joints transmit the power to the deep reduction, inboard planetary drive axles.



CAUTION

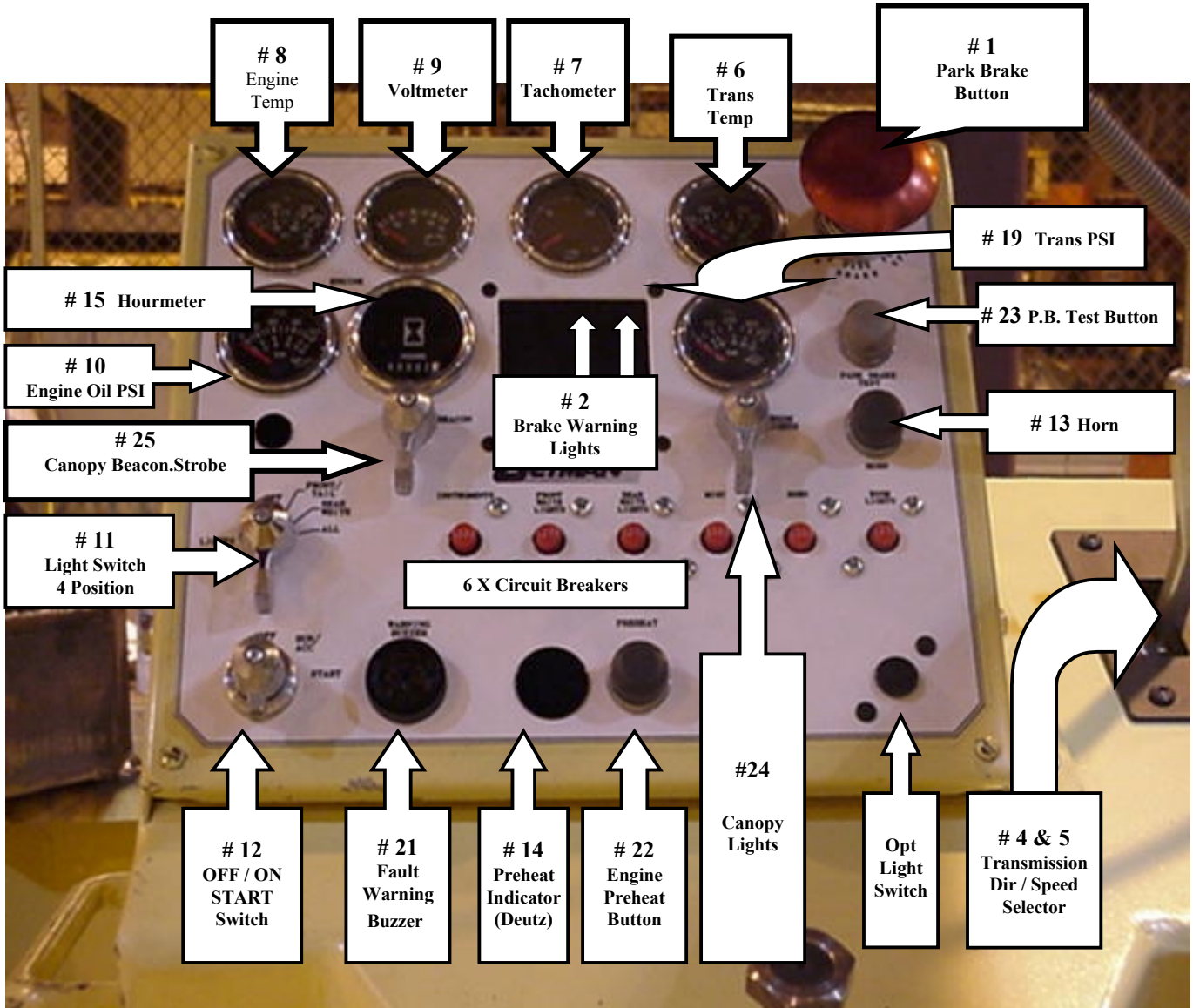
Steering is not functional when engine is not running.

Steering is full hydraulic power type, utilizing a flange mounted, direct drive hydraulic gear pump which provides hydraulic fluid to an orbitrol valve operated by the steering wheel. This operates the two steer cylinders located in the articulation joint.

Every effort has been made to ensure that you can stop this vehicle. The service brakes (axle brakes) are fully enclosed wet disk type, with a dual system, permitting separate circuitry for front and rear brakes. Should a failure occur in either circuit, the other circuit remains functional. The spring set, hydraulically released, drive line disk brake serves as a parking brake, manually set and released by utilizing the dash mounted push/pull control button. This drive line disk brake is also used as a secondary brake which automatically applies in the event of loss of hydraulic or transmission pressure. This brake can also be manually applied in the event of complete hydraulic system failure or mechanical failure of the internal wet disk service brakes or mechanisms.

This vehicle is equipped with two red Brake Warning lights located in the instrument panel. These are for each the front and rear brake circuits. These warning lights will illuminate if hydraulic pressure in either brake circuit drops below the preset 1100 PSI (76 BAR) level. The drive line disk brake will automatically apply if the hydraulic pressure in the brake circuit drops below 700 PSI (48 bar). All the instruments required to operate the vehicle are located in the operator's area. Become familiar with the position and function of each.

Getman Instrument Panel



#3 Brake PSI Gauges

INSTRUMENTS AND CONTROLS

1. Parking/Secondary Brake Button. - Push to apply, pull to release.

2. Brake Warning Lights. - Light will illuminate when the hydraulic brake circuit pressure in either circuit drops below 1100 PSI (76 bar).

3. Brake Pressure Gauges. - These two gauges (front & rear) indicate the specific hydraulic pressure of the front and rear brake circuits.

4. Direction Selector Lever. - Move selector lever to “F” for forward. Move selector lever to “R” for reverse direction. “N” is for neutral.

5. Gear Selector Lever. - Move lever to position “1” for low gear, position “2” for second and position “3” for third gear.



WARNING

Never free wheel vehicle. Free wheeling will cause serious injury and damage vehicle.

6. Converter Oil Temperature Gauge. - Normal transmission/Converter operating temperature 160° - 220° F (71°-104° C). If gauge indicates higher temperature, stop vehicle, shift transmission into neutral, apply parking brake and run engine at 1000-1200 RPM until oil temperature returns to normal.

7. Tachometer. - Indicates engine speed. 2,300 engine RPM normal under no load.

8. Engine Oil Temperature Gauge. - Will indicate when engine is overheating. Refer to manual for specific engine temperature ranges.

9. Voltmeter. - Indicates battery charging or discharging.

10. Engine Oil Pressure Gauge. - Pressure should read 20-35 PSI (1.37 - 2.4 BAR) at idle with engine warm. Full load condition, pressure should be approximately 50-80 PSI (3.4 - 5.4 BAR). If gauge fails to indicate oil pressure upon start up, stop engine immediately and find cause.

11. Light Switch - four position switch turn as follows:
Position 1. Off
Position 2. Front lights and rear red.
Position 3. Rear lights and rear red.
Position 4. All lights on.

12. Start Switch - Turn switch to position 1 for pre-heat, and turn to momentary position 2 for starting engine.

13. Horn Button - Push to sound horn.

14. Pre-heat Indicator Light - (Deutz only) light will glow indicating engine is ready to start. When engine is warm, it is not necessary to utilize pre-heat.

15. Hour meter - This gauge indicates the actual engine running hours.

16. Accelerator Pedal - Push to increase engine RPM.

17. Brake Pedal - Push to activate service brakes.

18. Seat Adjustment - Adjust for operator comfort.

19. Transmission Pressure Gauge - Refer to specific page for normal operating range.

20. Fire Suppression Button - (optional) Pull pin and depress red button to activate fire suppression system.

21. Warning Buzzer - Depending on engine and chassis configuration, the warning buzzer will sound for the following events:

1. low engine oil pressure
2. low transmission oil pressure
3. high engine temperature

22. Pre-heat Button - (Deutz Only) Pressing and holding button will energize glow plugs. Not necessary when engine is warm.

23. Park Brake Test Button - For vehicles equipped with a “Park BrakeTest” button, depressing and holding this button allows the operator to isolate the parking brake from the service brake for testing purposes.

Follow the instruction tag as follows:

1. Apply parking brake.
2. Place transmission in 3rd gear F.
3. Increase engine RPM to maximum.
4. Vehicle should not move.

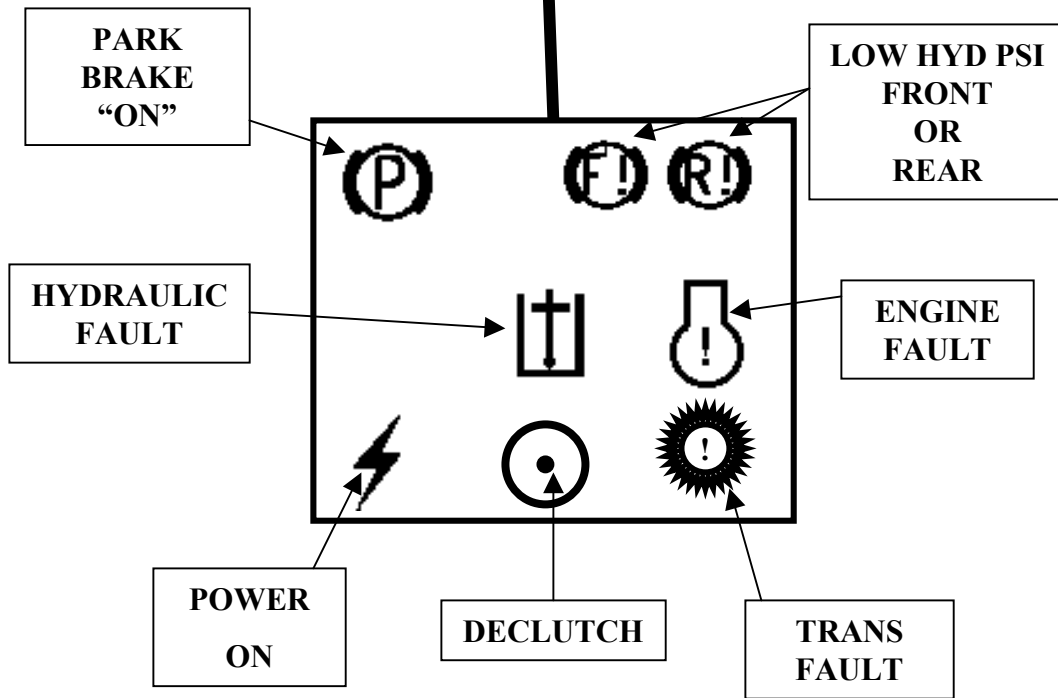
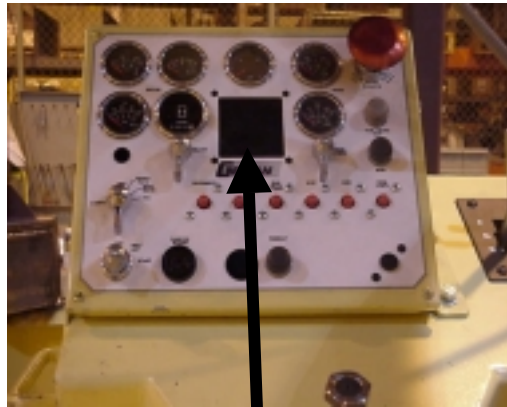
If vehicle moves, park vehicle in safe area, apply wheel chocks and notify maintenance for brake inspection and/or adjustment. If vehicle is equipped with Ford /New Holland axles, the service brakes act as the parking brake and are tested with this procedure.

24. Service Brake Test. For vehicles equipped with John Deere axles, test the service brakes by fully depressing the service brake pedal, Placing the transmission in forward, 2nd gear, release the parking brake and increase engine RPM to maximum for 3-5 seconds. Vehicle should not move. If vehicle moves, park, apply wheel chocks and contact maintenance.

25. Canopy Lights - Turn to on position to operate canopy lights.

26. Beacon/Strobe (Optional) Turn to on position to operate Beacon or strobe light.

Instrument Panel Warning Display



INSTRUMENT PANEL WARNING DISPLAY CONTINUED....



Rear Brakes and Front Brakes.

- Two individual lights are in the display to provide the operator with information regarding possible auto brake application. These lights are an indication that less than 1100 PSI exists in either the forward or rear brake circuit. Auto brake application occurs when brake system pressure falls below 700 PSI.



Park Brake “On or Off”.

This light illuminates when the drive line parking brake is engaged. When the parking brake is released to set the vehicle in motion, this light will not be illuminated.



Low Hyd. Oil Level - High Hyd. Oil Temp - Hyd. Filter Restriction. (Optional)

- This warning light advises the operator or maintenance personnel that the hydraulic circuit is experiencing problems with “Low Hyd Oil Level”, “High Hyd Oil Temp” or excessive “Hyd Oil Filter Restriction”. In addition to the warning light, any of the above listed faults will also activate relay #R5 which will remove voltage supply from the operators Boom/Tool joysticks disabling the operation of the vehicles until corrections are made.



Power Light.

- The power light is an indication that the ignition switch has been turned to the “ON” position. It will remain illuminated until the ignition is turned off.

INSTRUMENT PANEL WARNING DISPLAY CONTINUED....



Declutch. (Optional)

- The Declutch light indicates that the transmission of this vehicle is in declutch mode. This means the transmission direction selector is disabled. Depending on options chosen, the following can activate the declutch option.

1. Parking Brake is “ON”.
2. Diverter valve is in Accessories mode.
3. Stabilizer jacks are not fully retracted.
4. Man basket is not stowed level on deck.
5. Scissor deck is in elevated position.



Engine Fault.

- The engine fault warning light will illuminate in the event of low engine oil pressure or high engine temperature.



Transmission Fault. (Optional)

- The transmission fault light will illuminate in the event of low hydraulic oil pressure or high transmission temperature.

Getman A-64

INSTRUMENTS AND OPERATING CONTROLS

GENERAL DESCRIPTION

Getman Model A-64 Chassis is a four wheel drive, articulating frame steering vehicle powered by a diesel engine. The power from the engine is transmitted through the torque converter to a three speed, full reversing, powershift transmission. From the transmission, driveshafts with universal slip type joints transmit the power to the deep reduction, inboard planetary drive axles.



CAUTION

Steering is not functional when engine is not running.

Steering is full hydraulic type, utilizing a flange mounted, direct drive hydraulic pump which provides hydraulic fluid to an orbitrol valve operated by the steering hand wheel.. This activates two steering cylinders located at the articulating joint.

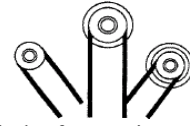
Braking Circuits.

Every effort has been made to ensure that you can stop this vehicle. The service brakes (axle brakes) are a wet disk type with a dual system, permitting separate circuitry for front and rear brakes. Should failure occur in either circuit, the opposing circuit remains operational. The spring set, hydraulic released, driveline disk brake serves as a parking brake, manually set by utilizing the dash-mounted parking brake control, and as a secondary brake which automatically applies in the event of loss of hydraulic pressure of the front or rear brake circuits, loss of transmission pressure or power failure. This brake may also be manually applied in the event of complete hydraulic circuit failure or mechanical failure of the internal wet disk service brake mechanisms.

This vehicle is equipped with two Brake Warning Lights (located in the warning display pad in the center of the instrument panel). One for each the front and rear brake circuits. A warning light will illuminate when hydraulic pressure in a specific brake circuit falls below the specific setting (1100 PSI/ 76 BAR) to provide adequate braking. Should brake system pressure continue to drop, the auto brake circuitry will apply the parking brake when the pressure drops below 700 PSI.

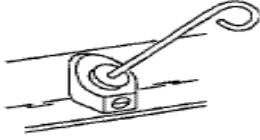
The instruments and controls required to monitor and operate this vehicle are located in the operators area. Become familiar with position and/or operation of each.

CHECKS BEFORE START UP

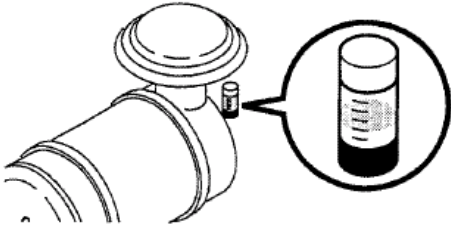


Check all the engine belts for tension and condition. Worn or gouged belts should be replaced immediately. (see belt adjustment procedure in Parts and Service Manual.)

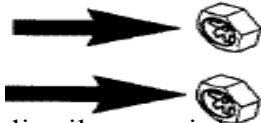
Check area around vehicle for obstacles that might be damaged by, or cause damage to, vehicle when it is driven.



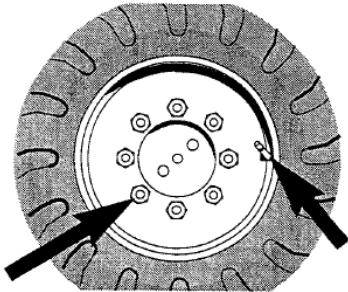
Check engine oil level. Fill as required with recommended lubricant.



Check air cleaner sight gauge. If indicator is in the red zone, clean or replace filter element/s. Visually inspect rubber connectors and clamps.



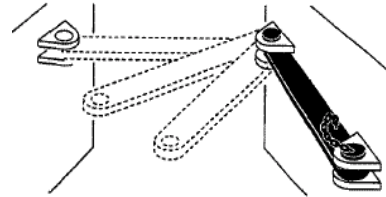
Check hydraulic oil reservoir level with engine shut off. Oil level should not be above the top sight gauge or below the lower sight gauge. Fill as required.



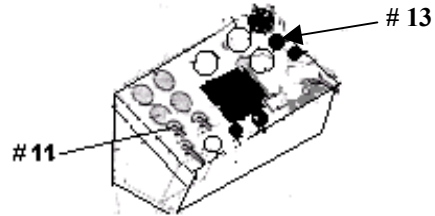
Check tire pressure, 95 PSI (6.55 BAR) is recommended. Check wheel nuts. Do not operate with loose or missing wheel nuts.



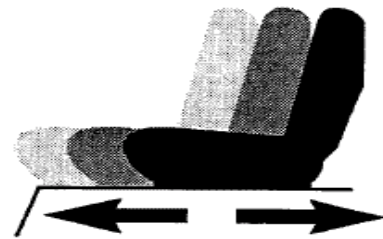
Check Fire Extinguisher and replace as needed.



Make sure frame joint safety bar is **not** connected.

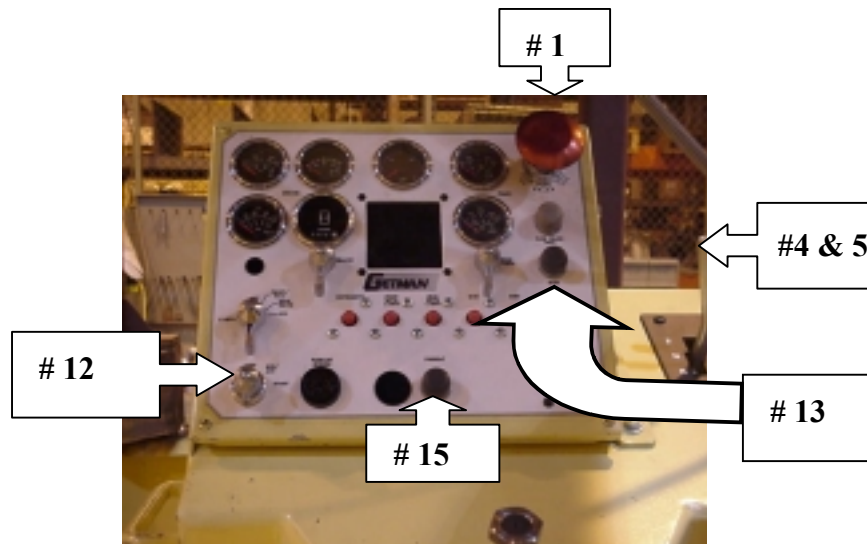


Check lights and horn to ensure all are operational.



Check seat belt to make certain fastener works and belt is not worn or cut. Adjust operators seat to a comfortable operating position. Some seats have height adjustments. See information for seat adjustments.

STARTING PROCEDURE



IMPORTANT

All personnel must be a safe distance from vehicle before you enter operator's compartment!

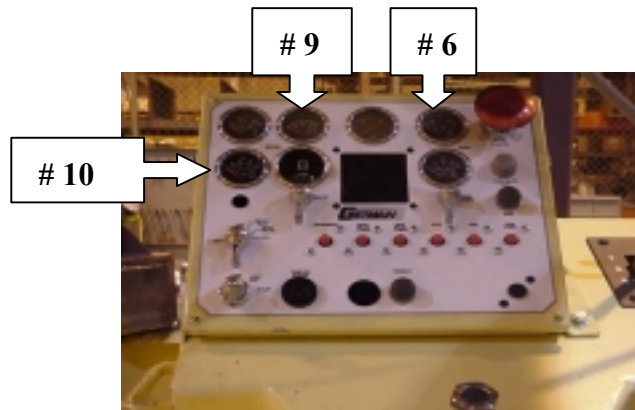


IMPORTANT

Frame safety bar must not be connected!

- Transmission selector #4 must be in the neutral position (N).
- Parking Brake button #1 must be pushed in, (Parking Brake Applied)
- Push button #13 to sound horn.
- Turn off/on/start switch, # 12 to “on” position and depress and hold button #15 to preheat engine if necessary. (Deutz engine only)
- Turn start switch #12 to “start” position and hold until engine has started. If engine does not start within 15 seconds, again depress glow plug button # 15 until indicator glows and try starting again.
- Once engine is operating, allow to run at idle for two minutes. Check to ensure engine oil pressure and all other gauges are functional.

AFTER ENGINE STARTS



Engine oil pressure gauge # 10 – pressure should read 15-35 PSI (1 – 2.4 BAR) at idle with engine warm. At full engine load, pressure should read between 60-80 PSI (4.9 – 5.4 BAR). If gauge fails to show pressure after engine start up, stop engine immediately and find cause.

Voltmeter # 9 – with engine running, this should read 12-16 volts for 12 volt vehicles and 24 – 30 volts for vehicles equipped for 24 volts.

Transmission/Converter Oil Temperature # 6 – normal operating temperature is 160° to 220°F (71° -104° C) If the gauge indicates temperature higher than 220°F, bring vehicle to a stop, place transmission in neutral (N), apply parking brake and run engine at 1000-1200 RPM until oil temperature returns to normal.

Brake Pressure Gauges – there are two brake accumulator pressure gauges located on the engine panel on the right hand side of the operators seat. These display the individual hydraulic pressures existing in the front and rear brake accumulators. Normal operating pressure in these gauges is between 1500 and 2200 PSI(103.5-151.5 BAR).



CAUTION Stop engine immediately if any gauge is not in its set range.

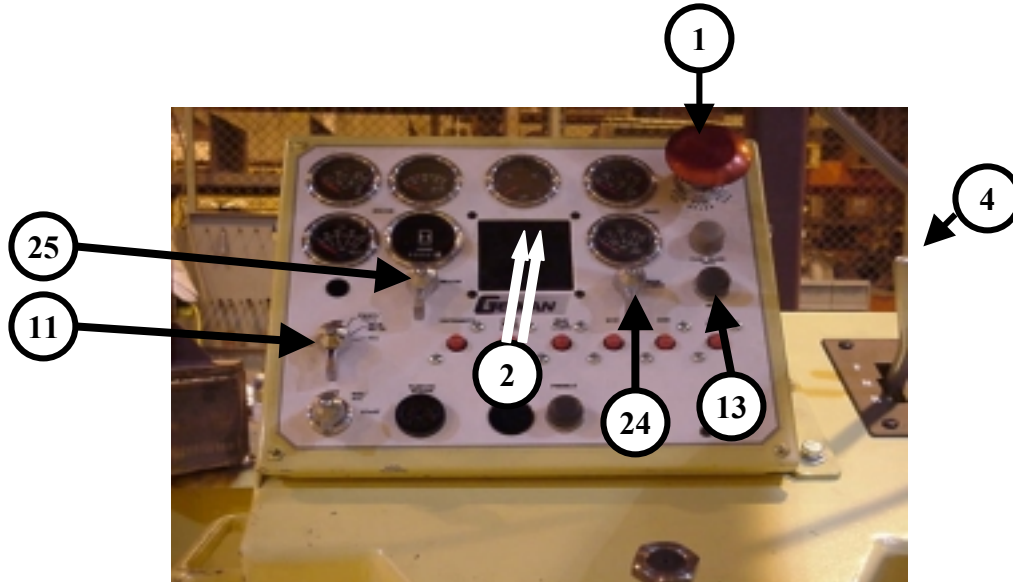
Test Parking/Secondary Brake - this system is designed to hold a fully loaded vehicle on a 35% grade. If vehicle is equipped with a Deutz F6L 912 or a CAT 3304 PCNA engine, apply parking/secondary brake, place vehicle in forward, 2nd gear and apply full power. Vehicle should not move. Vehicles equipped with other engines should be tested in 3rd gear. If vehicle is equipped with a park brake test button, this button should be depressed during test to isolate the parking brake.



WARNING

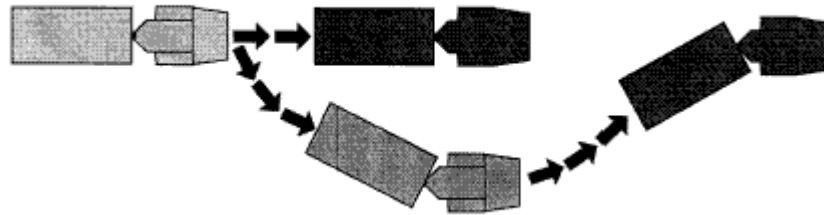
Do not operate any vehicle with a faulty parking/secondary brake system. Serious personal injury or damage to vehicle may result.

OPERATING VEHICLE



- Once all gauges have been checked and are within normal operating ranges, vehicle is ready to operate.
- Turn all Light Switches (#11, #24 & 25) to the ON position.
- Depress Service Brake Pedal (# 17) and hold.
- Check Brake Accumulator Pressure Gauges and check Instrument Panel Warning Display for Low Pressure Warning Lights (# 2).
- Ensure all hydraulic stabilizers are in the up position (if applicable)
- Check to be sure area is clear of all personnel and obstacles. Select forward by pushing the gear selector lever (#4) forward and select 1st gear by pulling gear selector lever (#5) to the lower position.
- Pull Park Brake Button (#1) to release the drive line disk brake.
- Depress horn button (#13) on instrument panel to sound horn.
- Release Foot Brake Pedal, test steering for proper operation and move vehicle slowly by gently depressing Accelerator Pedal (#16) with foot.

OPERATING VEHICLE (CONT'D)



Acquaint yourself with the “FEEL” of the steering by driving the pattern shown above. Do this several times until you become familiar with vehicle steering and feel you would be comfortable driving the vehicle in traffic areas. To familiarize yourself with vehicle response to an automatic application of the drive line brake, drive straight, remove foot from accelerator pedal and push Park Brake Button (#1) while still rolling.

Park brake should set and vehicle should come to a stop. If this does not occur, have brake circuit and adjustment checked by authorized personnel.

When satisfied that you can safely and comfortably operate the vehicle, find a long straight open stretch of roadway and accelerate. Start in 1st gear, shift to 2nd gear, and then to 3rd. (if conditions permit) Make certain area chosen is free of obstacles and/or other personnel. At higher speeds slight turns should be tried as long as there is no danger of hooking the rib or another vehicle. Stop vehicle and return transmission gear selector to neutral (N). Apply Park Brake(#1). Check all gauges again to be certain they are within normal operating range.

NOTE: When travelling up a grade, select lower gear if torque converter oil temperature approaches 200°F (93 °C).



CAUTION!

When proceeding down grades, use 1st gear. Use of 2nd or 3rd gear could cause engine over speeds and possible safety hazards to operator.

LUBRICATION AND MAINTENANCE



IMPORTANT

Whenever performing service on this vehicle, make certain it has first been placed in service position.

LUBRICATION

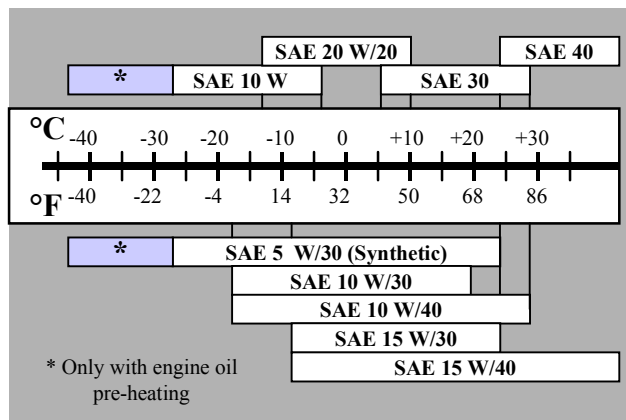
This section requires you to “add lubrication” at designated intervals. For proper lubricant, see Fluid Specifications.

REGULAR MAINTENANCE REQUIRED

Basic service and maintenance procedures are illustrated in the maintenance manuals. These are to be performed at regular intervals based on hours of operation.

For further details on service and necessary major component adjustments (i.e. engine, transmission, axles etc.) see respective sections in service manual. Read and become familiar with them.

ENGINE OIL VISCOSITY RECOMMENDATIONS



The viscosity of the oil being greatly influenced by the ambient temperature, **the choice of SAE-grade should be governed by the ambient temperature of the engine site** (see diagram). If temperatures temporarily fall below the limit of the SAE grade selected, engine will not be damaged. However, starting performance will be affected. **During winter operation viscosity grade should be governed by ambient temperature when starting engine.**

FLUID SPECIFICATIONS

COMPONENT	SYMBOL	FLUID
Transmission & Torque Converter	TF	Hydraulic Transmission Fluid, Type C-2 or C-3, MIL-L-2104C Examples: Shell Donax T-5, Texaco Torque Fluid 47
Hydraulic system (Steering and Optional cylinders)	HO	Use only an “MS” API (MS-DG) oil, MIL-L244459. Examples: Shell Tellus 68, Texaco RO 68
Drive Axle Differential (Front and Rear)		Mineral Base Oil. Examples: Ford Oil No. M2C53-B, MBO Shell Donax TD, Texaco 303 TDH Oil, Amoco 303, Arco Tractor Fluid, Exxon Torque Fluid 66
All Grease Fittings including Upper & Lower Hinge Pins, Bearings & Oscillating Trunnion	EPG	Grade 2 Lithium Base Extreme Pressure Grease, MIL-G-10924A Examples: Shell Super Duty Lithium, MDS, Texaco Marfok Multi-Purpose
All Linkage	EO	Hand Oil As Required
Fuel System	D2	#2 Diesel Fuel, Centane 40 Minimum.
Battery	H2O	Distilled Water Only



IMPORTANT

The lubrication and maintenance schedule was developed to protect vehicle when operated in severe underground mining conditions, these conditions may vary, and service intervals should be adjusted to meet your requirements.

MAINTENANCE SCHEDULE AS REQUIRED

Place vehicle in service position.

NOTE:

Depending on dust conditions, air cleaner may require daily service.

This vehicle will be equipped with one of the following air filtration options. Determine which system your vehicle is equipped with and refer to the proper section for service instructions.

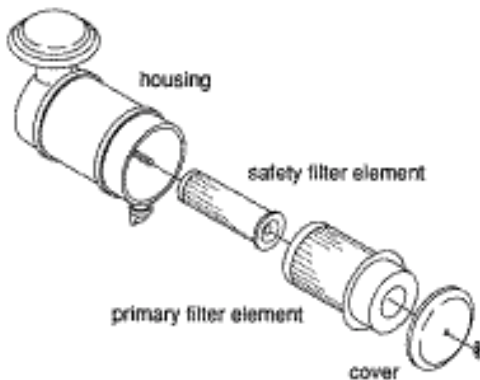
AIR CLEANER SERVICE PROCEDURE

NOTE: Lack of engine power and/or excessive exhaust smoke are signs that the air filter elements may require service.

DONALDSON DRY TYPE AIR CLEANER



Check service indicator. Clear dust collector discharge slot daily. Service air cleaner *ONLY* when indicator locks in red position. Proceed as follows:

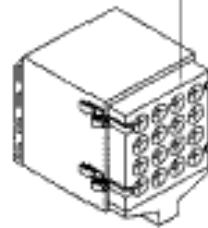


Loosen thumbscrew holding cover and remove cover. Remove and discard primary filter element. Clean inside housing. Install new element.

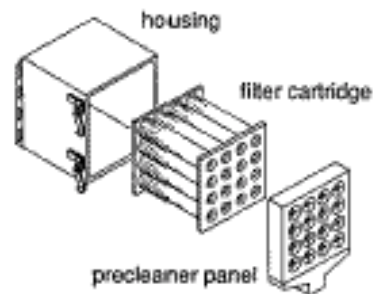
Check cover gasket to ensure a good seal. Reposition cover and thumbscrew. Reset service indicator.

Replace safety filter element every 5th primary filter change. Safety filter element is replaced in same manner as primary element change.

FARR DRY TYPE AIR CLEANER



Check service indicator. Clear dust collector discharge slot daily. Service air cleaner *ONLY* when indicator locks in red position. Proceed as follows:

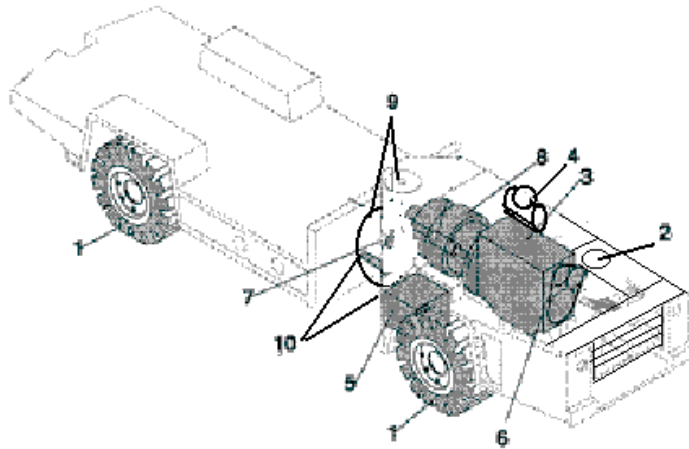


Loosen nuts on air cleaner housing and remove precleaner panel. Remove and discard dirty filter cartridge. Clean inside filter housing and install new filter cartridge.

Clean precleaner panel. Replace panel and tighten nuts. Reset service indicator.

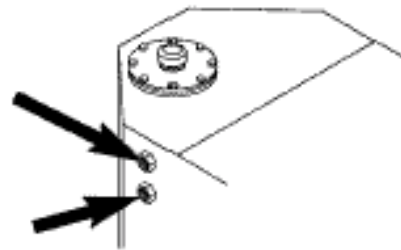
MAINTENANCE SCHEDULE DAILY OR EVERY SHIFT CHANGE

Place vehicle in service position.

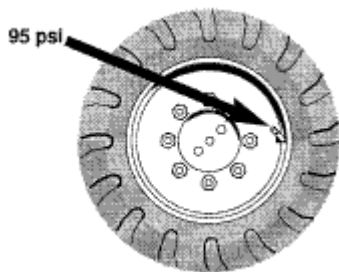


Component	Fluid*
1. Tires.....	----
2. Hydraulic System.....	HO
3. Engine.....	EO
4. Air Precleaner.....	----
5. Fuel System.....	D2
6. Belts.....	----
7. Oscillating Axle Trunnions.....	EPG
8. Transmission and Torque Converter.....	TF
9. Upper and Lower Pivot Pin Bearings.....	EPG
10. Steering Cylinder Bushings.....	EPG

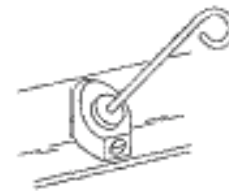
* Perform maintenance schedule as required
* See Fluid Specifications.



Check hydraulic reservoir sight gauges and fill as required. Fluid level should not be above top sight gauge or below bottom sight gauge.

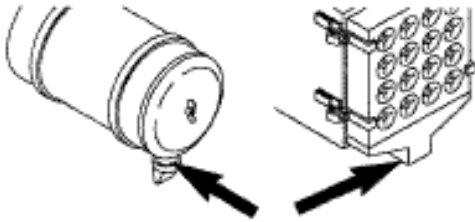


Check tire condition and pressure. Do not operate vehicle with low tire pressure. Do not operate vehicle with badly worn and/or gouged tires.

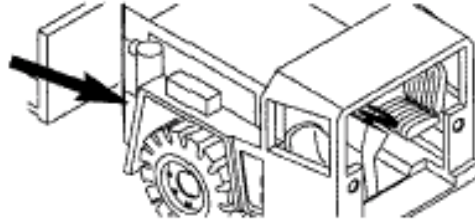


Check engine oil level. Fill as required.

DAILY MAINTENANCE OR EVERY SHIFT CHANGE (CONT'D)

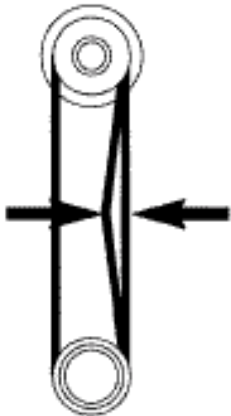


Empty and clean precleaner dust bowl.

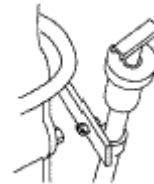


Check fuel level. Fill as required.

Check all engine belts for tension and condition. Worn or gouged belts should be replaced immediately. Check belt tension as follows:



1. Engine must be shut off.
2. Push the belt at center between pulleys with finger.
3. Belt movement should be 3/8" to 5/8" (10 - 15 mm.)



Check transmission fluid level. Fluid should be checked at normal operating temperature with engine running at idle and transmission in neutral. Fill as required.



Avoid any moving belts, components, or high temperature areas. Serious personal injury can result from carelessness.

Visually inspect machine:

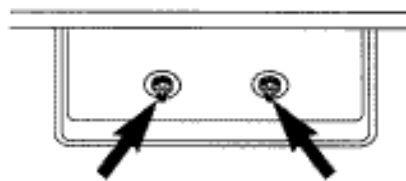
With Engine Running Check:

1. Hydraulic system for leaks.
2. Fuel system for leaks.
3. Instruments for proper function.

With Engine Off Check:

1. All controls for free movement.
2. Mounting bolts.

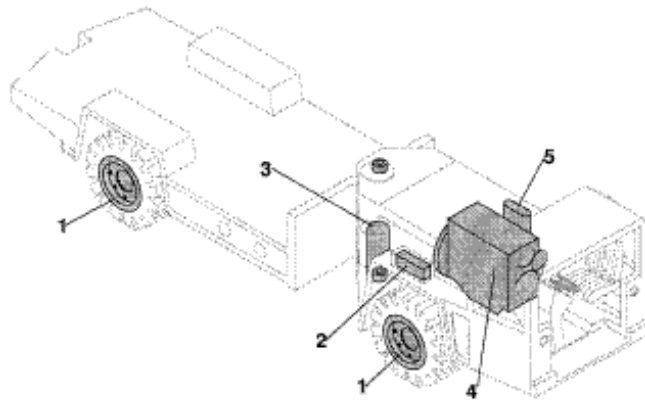
NOTE: Perform engine maintenance as indicated in Deutz instruction manual.



Grease axle trunnions.

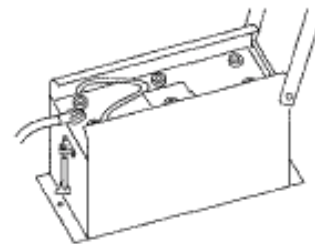
MAINTENANCE SCHEDULE EVERY 50 OPERATING HOURS

Place vehicle in service position.



Component	Fluid*
1. Wheels.....	-----
2. Battery.....	H2O
3. Air Cleaner.....	EO
4. Air Cooling System.....	-----
5. Catalytic Exhaust Purifiers.....	-----

- * Perform Maintenance Schedule As Required.
- * Perform Maintenance Schedule Daily Or Every Shift.
- * See Fluid Specifications.



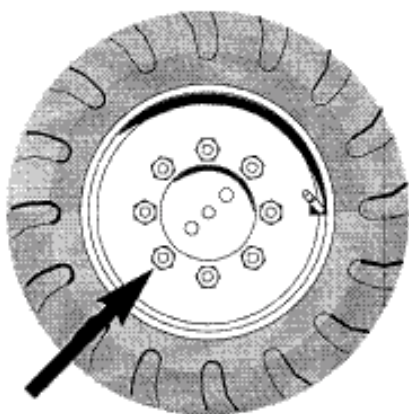
Release and lift battery access plate. Clean battery off. Check fluid level in battery. Add distilled water as required.



Be aware of hydrogen gas build up under battery access plate. Keep open flame and sparks away from battery.

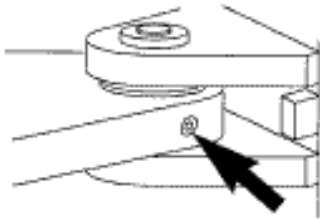


Do not get battery acid on skin. Keep all open flame out of area.

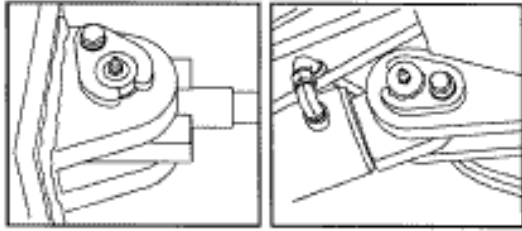


Check wheel nuts. Nuts should be tightened to 360 ft./lbs. (49.8 kg/m).

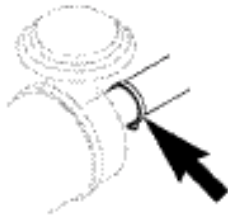
50 HOUR MAINTENANCE (CONT'D.)



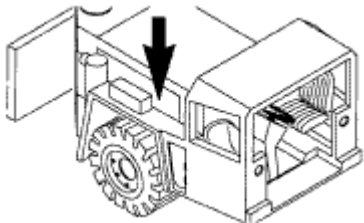
Add grease to both upper and lower pivot pin bearings.
(See specifications)



Add grease to both steering cylinder ends.



Check *ALL* air intake connections. Tighten as required



Remove air cowl on injector side of engine by releasing retainer snaps. Clean cooling fins, oil cooler, transmission cooler, and radiator if applicable with compressed air.

Vehicles equipped with ECS catalytic air purifier:

1. If vehicle is operated under heavy load with high engine rpm at least 70% of operating time, a minimum amount of maintenance will be required. If engine does not work hard and is allowed to idle for excessive periods of time, the catalyst may become "carboned up" and exhaust will start to smoke after a few hours, indicating regeneration is necessary.

DO NOT allow engine to idle more than five (5) minutes at a time, or purifier will loose efficiency.

2. Before vehicle is put into service, and during every 50 hour check, check exhaust back pressure at full throttle by connecting a back pressure or water gauge to the 1/8" NPT test port between purifier and exhaust manifold. If back pressure exceeds 29" (737 mm) H₂O or has risen 5" (127 mm) or more since last regeneration, purifier must be regenerated.

ECS REGENERATION

Required Equipment:

1. Nylon, hard-bristle parts cleaning brush.
2. Solvent-air, parts cleaning gun.
3. Super concentrate degreasing solution.
4. Stoddard solvent or high grade kerosene (sulphur free) -- 5 parts Stoddard to 1 part S.C.
5. High pressure air source. (30 psi)
6. Wrench.



WARNING

Flammable Solution. Use in accordance with manufacturers recommendations. Use in a properly ventilated area. Failure to follow these instructions could result in serious injury.

Cleaning Procedure:

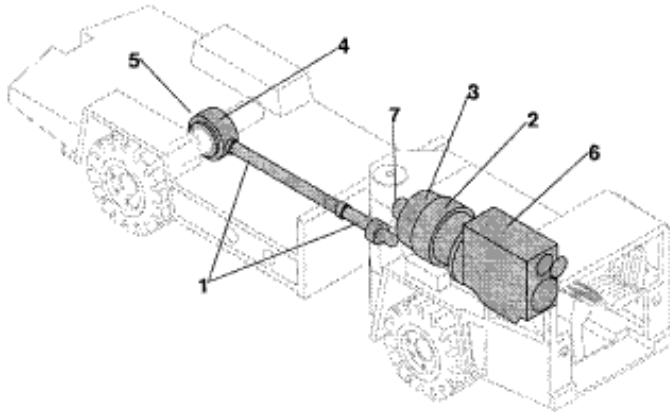
1. Remove center section of purifier.
2. Dry brush inlet face of catalyst.
3. Air clean through outlet face of catalyst.
4. Continue steps 1 and 2 until inlet face is clean.
5. Completely soak catalyst in Stoddard, S.C. solution for one hour.
6. Solvent-air clean through outlet face of catalyst for 10 minutes.
7. Air clean through outlet face.
8. Repeat steps 4, 5, and 6 until purifier is clean.
9. High pressure water wash purifier through outlet face and air dry.
10. Replace purifier.
11. Record back pressure at full throttle, remove gauge and tighten test plug.

NOTE: If high pressure steam is available, it may be substituted for solvent solution. Steam clean through outlet face, keeping nozzle 2" (51 mm) away from catalyst face.

NOTE: If purifier has been regenerated but engine continues to smoke, engine must be serviced to maintain safe exhaust conditions. Refer to engine instruction in Parts Service Manual.

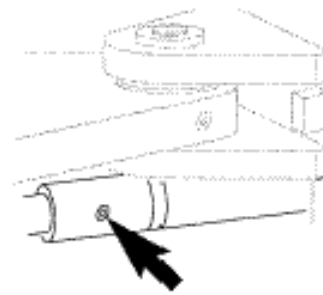
MAINTENANCE SCHEDULE EVERY 250 OPERATING HOURS

Place vehicle in service position.

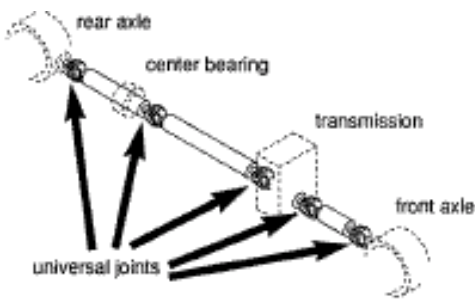


Component	Fluid
1. Drive Line; Universal Joints, Slip Joints.....	EPG
2. Transmission.....	TF
3. Hydraulic System.....	HO
4. Axle Differential Housing.....	MBO
5. Axle Breather.....	-----
6. Engine.....	-----
7. Parking Brake.....	-----

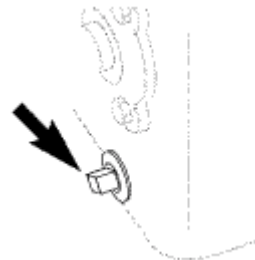
- * Perform Maintenance Schedule as Required
- * Perform Maintenance Schedule Daily or Every Shift
- * Perform 50 Hour Maintenance
- * See Fluid Specifications.



Add grease to driveline slip yokes, one fitting each.

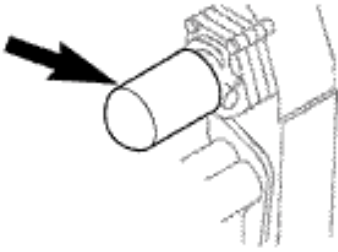


Add grease to the five driveline universal joints, and center bearing.



Drain transmission oil by removing the drain plug. Clean plug in solvent, dry, and replace in transmission.

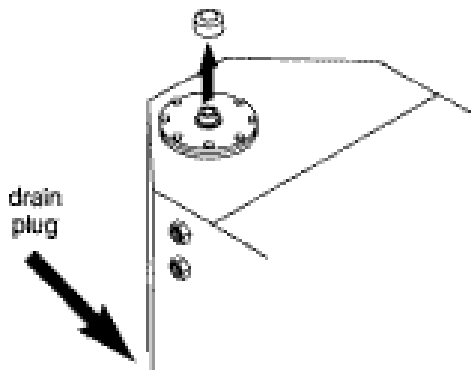
250 HOUR MAINTENANCE (CONT'D)



Remove transmission filter. Replace with new filter. Before installing filter, coat gasket with light film of oil. Torque filter to 20 - 25 ft/lbs. (27 - 34 N.m)

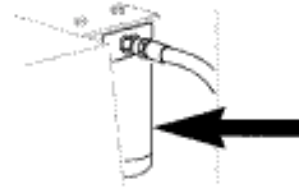
Fill and check transmission as follows:

1. Fill transmission to low mark on dipstick.
2. Run engine at idle 500-600 rpm to prime converter and hydraulic hoses.
3. Re-check oil level with engine at idle and transmission in neutral. Bring oil level to low mark on dipstick. When oil reached normal operating temperature of 180° to 200° F (82° to 93°C.) make a final oil level check and bring to the full mark of the dipstick.
4. Check for oil leaks.

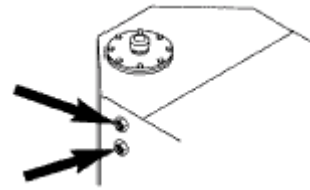


Remove reservoir fill cap and empty main hydraulic reservoir by removing drain plug.

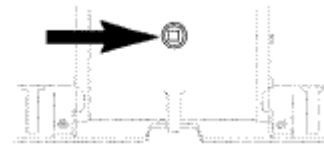
NOTE: To avoid contamination, clean reservoir top before servicing.



Remove return line filter. Replace filter element and install return line filter. Install drain plug. Fill hydraulic reservoir with fluid.



Check hydraulic reservoir sight gauges. Add fluid as required. Fluid level should not be above top sight gauge or below lower sight gauge.



Check lubricant level in both differential housings. Remove fill plug. Gear oil should be level with full plug bottom. Add lubricant as required. Replace fill plug. Refer to specification page for proper fluid.



Remove axle breather, clean in solvent and dry with compressed air. Re-install in axle. Do for both axles.

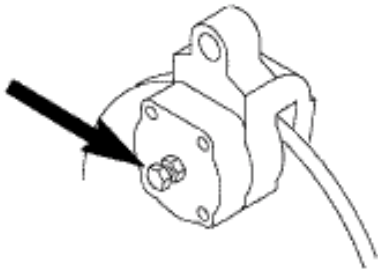
250 HOUR MAINTENANCE (CONT'D)

BRAKES -- INSPECTION AND ADJUSTMENT

Service Brakes

Drive axle brakes (service brakes) are self adjusting and do not require regular inspection. Inspection of internal wet disk axle brakes should be performed during axle overhaul. Overhaul procedure can be found in the Getman Service Manual.

Parking Brake Spring Set Hydraulic Released



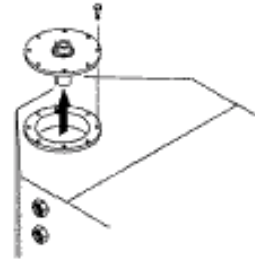
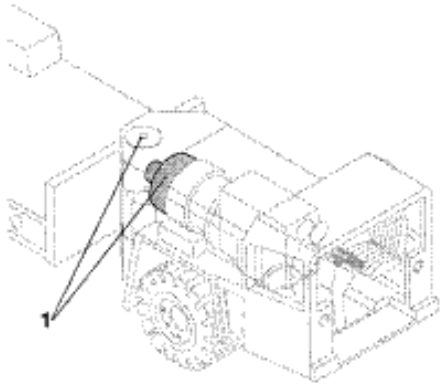
Ensure vehicle is parked on level area away from traffic. Place vehicle in the "Service Position". Parking brake must be disengaged for adjustment so wheels must be securely blocked to prevent vehicle movement.

- Loosen locking nut.
- Turn adjusting bolt clockwise until tight.
- Then loosen, by turning counter clockwise 1/2 turn.
- Tighten lock-nut and test.

NOTE: Use parking/secondary brake test procedure (page 15)

MAINTENANCE SCHEDULE EVERY 500 OPERATING HOURS

Place vehicle in service position.



Remove hydraulic reservoir access plate. Disconnect sump strainer located inside reservoir.

NOTE: Strainer suction port must be closed off with an 1 1/2" NPT cap to prevent circuit contamination and possible damage to hydraulic components.

Clean reservoirs inside with steam or solvent.

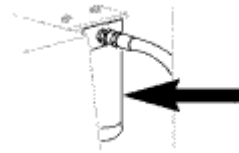
Clean or replace sump strainer and re-install inside reservoir.

Component	Fluid
------------------	--------------

1. Hydraulic System.....	HO
--------------------------	----

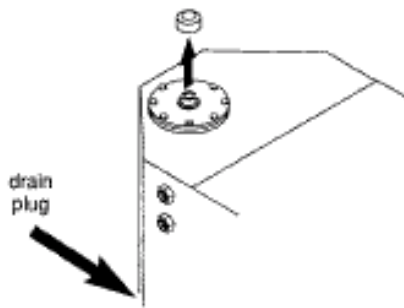
- Perform Maintenance Schedule as required.
- Perform Maintenance Schedule Daily or Every Shift.
- Perform 50 Hour Maintenance.
- Perform 250 Hour Maintenance.

*See Fluid Specifications.



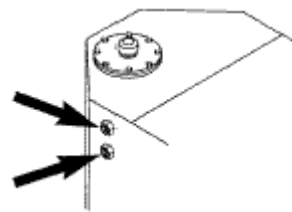
Remove return line filter. Replace filter element. Install return line filter.

Install reservoir access plate, install drain plug, and fill hydraulic reservoir with fluid. Check specifications.



Remove reservoir fill cap. Empty main hydraulic reservoir by removing drain plug.

NOTE: To avoid contamination, replace cap and clean reservoir top before proceeding.

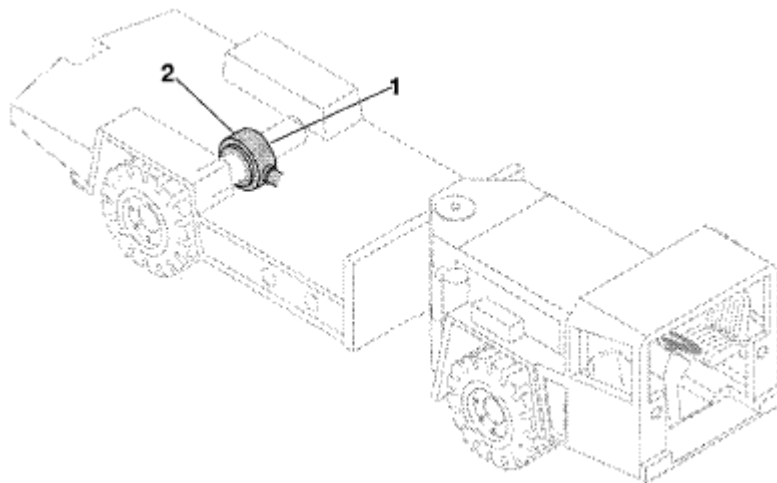


Check hydraulic reservoir sight gauges. Add fluid as required. Level should not be above upper sight gauge or below lower sight gauge.

MAINTENANCE SCHEDULE

EVERY 1000 OPERATING HOURS

Place vehicle in service position



Component	Fluid
1. Axle Differential Housing.....	MBO
2. Axle Breather.....	-----

- Perform Maintenance Schedule as required.
 - Perform Maintenance Schedule Daily or Every Shift.
 - Perform 50 Hour Maintenance.
 - Perform 250 Hour Maintenance.
 - Perform 500 Hour Maintenance.
- *See Fluid Specifications.



Remove front and rear axle differential drain plugs. When axle are empty of all fluid, clean and re-install drain plugs.



Remove differential fill plugs (one per axle). Add specified lubricant until fluid level reaches bottom of oil fill plug port. Clean and re-install differential fill plugs.

SPECIFICATIONS

FUEL

Use No. 2 Diesel Fuel, Cetane 40 Minimum.

Use a dependable brand of diesel fuel with a sulfur content of less than 0.5%. Use care when re-fuelling to avoid fuel system contamination. Use a winter grade fuel when operating vehicle in low temperatures. **NOTE:** To avoid drawing air into the fuel system, do not allow vehicle to run out of fuel.

TIRES

SIZE	PLY RATING	TYPE	PSI	BAR
9.00 X 20	12	LCM	90	6.1
10.00 X 20	14	LCM	95	6.5
12.00 X 20	16	SMC	95	6.5

NOTE: This chart indicates tire pressure specifications *ONLY*. Tire sizes are not interchangeable. Always replace with tires of same size, type, and ply rating originally supplied with vehicle

PRESSURES

TYPE	PSI	BAR
Engine Oil Pressure at 1000 RPM	60-80	4.1-5.5
Steering Hydraulic System at low idle with vehicle turned and held against stops. NOTE: Checks made at 150°F (65°C) oil temperature.	1500-2000	103-138
Transmission Clutches - run engine at approx. 2000 RPM, engage each clutch forward and reverse. (see manual for details) NOTE: Trans pressure check should be performed at 180° - 200°F (80°-93°C) oil temperature.	180-220	12.4 - 15
Hydraulic brake charging pressure.		
John Deere Axles	1650-2200	114 - 151
Ford / New Holland D45	1650-2200	114 - 151
Pressure from brake treadle valve		
John Deere Axles	1000	69.0
Ford / New Holland D45	1500	103.5



LUBRICANTS CROSS REFERENCE

ENGINE AND AIR CLEANER OIL (Engine Manufacturers Specifications)

Shell.....	Rotella
Amoco.....	300 Motor Oil
Arco.....	Acrofleet Plus S - 3
Citgo.....	C-500 Motor Oil
Conoco.....	Diesel Oil S-3 Fleet
Gulf.....	Super Duty
Mobile.....	Delvac 1300
Sun.....	Sunfleet S-3
Texaco.....	Ursa Oil Super 3
Exxon.....	XD-3

POWERSHIFT TRANSMISSION OIL FUNK / CLARK / BORG WARNER (TYPE C - 3)

Shell.....	Donax T-5
Amoco.....	C - 3
Arco.....	C - 3
Citgo.....	Torque Converter 250
Conoco.....	Hydraulic Trans. C - 3
Gulf.....	HT C3 Fluid
Mobile.....	Power Fluid C - 3
Sun.....	C - 3 Transmission
Texaco.....	Torque Fluid 47

AXLES - CLARK & ROCKWELL TRANSFER CASE AND MANUAL TRANSMISSION (85W/140 Gear Lube)

Shell.....	Spirax HD
Amoco.....	MP Multi-Purpose
Arco.....	HD Gear Oil
Citgo.....	MP Premium
Conoco.....	Universal Gear
Gulf.....	Transgear EP
Mobile.....	Lubrite
Sun.....	Sunfleet XL
Texaco.....	Multigear EP
Exxon.....	GX Gear Oil

AXLES - FORD NEW HOLLAND / JOHN DEERE CLARK HURTH

Shell.....	Donax TD
Amoco.....	303Fluid
Arco.....	Tractor Fluid
Citgo.....	Tractor Hydraulic Fluid
Conoco.....	Power Trans 11 Fluid
Gulf.....	Universal Tractor Fluid
Mobile.....	Mobilefluid 424
Sun.....	Altran J20A
Texaco.....	303 TDH Oil
Exxon.....	Torque Fluid 56

HYDRAULIC OIL

Shell.....	Tellus 68
Amoco.....	Amovis AW 68
Arco.....	Duro AW 315
Citgo.....	AW 68 Hydraulic Oil
Conoco.....	CPS 37
Gulf.....	Harmony 68AW
Mobile.....	DTE 26
Sun.....	Sunfleet 300
Texaco.....	RO 68
Exxon.....	Nuto H68

CHASSIS GREASE

Shell.....	Super Duty Lithium MDS
Amoco.....	Molyolith
Arco.....	EP Moly
Citgo.....	Extra Range
Conoco.....	Super Lube M
Gulf.....	Gulflex Moly
Mobile.....	Mobilegrease Special
Sun.....	Prestige Moly
Texaco.....	Marfok Multi-purpose
Exxon.....	Beacon Q-2



Getman Equipment

STORAGE PROCEDURES

The following storage instructions are intended to help ensure optimum performance from Getman equipment that will not be utilized for a period of three months to one year.

It is important that these instructions be followed as described in order to keep your warranty valid.

ENGINE

Change oil using an oil with corrosion preventing properties of at least a HD-S1 oil. Listed are some of the oils that have been approved: ESSO MZ20W20V7N; TEXACO EKM 162 SHELL V6828.

Change oil and fuel filters.

Fill tank completely with a mixture of diesel fuel and 10% corrosion inhibiting motor oil.

Run engine for at least 10 minutes to adequately fill fuel lines and filters, injection pump and nozzles with preservative mixture.

If engine is to be stored for over six (6) months, seal intake and exhaust system to keep out moisture.

TRANSMISSION & HYDRAULICS

No special care is required except exposed cylinder rods should be covered with grease.

AXLES

Axle housings should be completely filled to eliminate the chance of moisture condensation.

BRAKE SYSTEM

If applicable, drain all air reservoir of moisture.

BATTERY

Remove battery/batteries, clean off top, fill with distilled water, charge and store in a well ventilated area. Do not store on concrete or metal.

EQUIPMENT STORAGE FOR LESS THAN 3 MONTHS

When storing equipment for less than three (3) months, vehicle(s) should be started and driven for a minimum of ten (10) minutes every two (2) weeks.

**GETMAN
CORPORATION**

**OPERATING AND
MAINTENANCE
MANUAL
FOR
A-64 SCISSOR TRUCK**

**Read thoroughly before
operating vehicle**

INTRODUCTION

Operators must study all manuals carefully! You must become familiar with all controls and procedures. Getman's A-64 Series Scissor Truck manual is a guide to safe, proper operation and maintenance. Keep manual on vehicle always.

Getman A-64 Series Scissor Truck is bought with expectations it will give long and faithful service. In its construction, we have taken every precaution to see that you get an efficient, long-lived vehicle. To realize the value and utility that Getman has designed into this unit, a small amount of time and expense must be invested in doing regular inspections and service as recommended in this manual. This small investment will pay off in low operating costs, minimal service expenses and most importantly, in personnel safety.

If you have any questions about operating or servicing this unit, contact your local Getman dealer or Getman Corporation direct, immediately.

RELATED MANUALS

This manual covers operation and maintenance schedule of scissor platform when mounted on Getman A-64 Chassis. An operators manual for A-64 Getman Prime Mover is included in Parts and Service Manuals supplied with vehicle. You must become familiar with all manuals supplied.

Getman has increased the frequency of many recommended maintenance procedures because of the vehicles demanding application. Changes are noted at each maintenance section end.

A complete parts listing of engine drive train components, applicable Electric/Air/Hydraulic systems, and mounted equipment is included in Parts and Service Manual. Manual also has service and repair information useful to maintenance department.

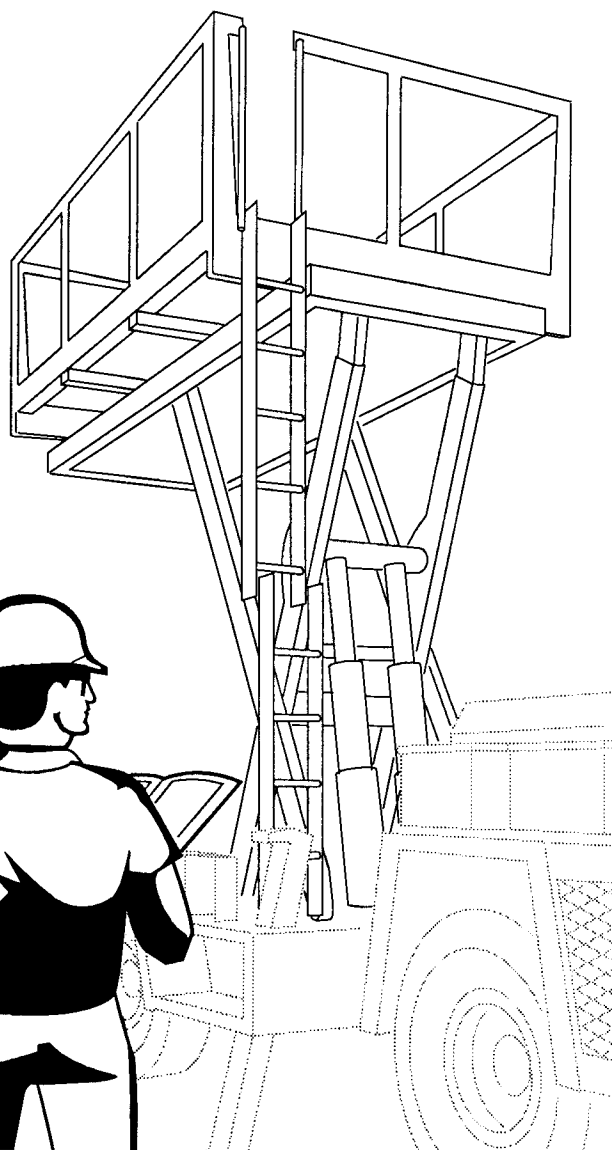


TABLE OF CONTENTS.....PAGE

Introduction	2
Related Manuals	2
Safety Instruction	3
Description and Operating Controls.....	5
Checks before Operating.....	6
Operating Scissor Platform.....	7
Maintenance	9
Lubrication	10

We reserve the right to introduce, without notice, changes in data, equipment, instructions for maintenance and other service jobs.

SAFETY INSTRUCTIONS

This equipment is to be used only under the following conditions:

• GENERAL SAFETY

Frequent inspections must be made to see that all electrical components, including wiring connectors and other equipment, are in safe operating condition. All fuses for overload protection in electrical circuits must be maintained in approved condition.

• FASTENERS

All bolts, nuts, screws and other fasteners for electrical enclosures must be kept in place. Properly tighten and secure them.

• REPAIRS AND RENEWALS

Special care must be taken in making repairs and renewals. Use new parts exactly like the originals. Use gaskets from the O.E.M. only. Mating surfaces must be clean and in proper condition.

• VEHICLE OUT OF SERVICE

Each out of service vehicle must have an "out of service" tag displayed.



SAFETY ALERT SYMBOL

This symbol will appear at various points throughout the manual with warning statements. Its appearance means **ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!**

SAFETY NOTICE

Safety depends on well maintained, properly operated equipment. Following service and maintenance procedures in this manual will lead to reliable equipment. Good operating procedures can help you avoid accidents. Listed below are some basic safety precautions read, understand and practice them. It is, however, impossible to cover every condition. Be alert, think safety, and use common sense.

DO

- Do read this manual thoroughly before operating equipment.
- Do learn to recognize and avoid potential hazard areas, such as scissor arm pivot joint.
- Do perform all recommended checks.
- Do report all defects.
- Do check the area around equipment before operating.
- Do operate equipment with caution.
- Do park vehicle on a level surface, if possible. Block wheels.
- Do use parking brake.
- Do use proper tools for service.

DO NOT

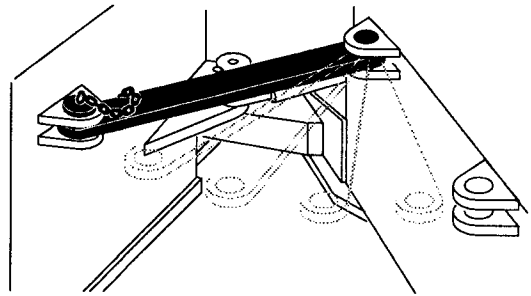
- Do not operate equipment while under influence of alcohol or drugs.
- Do not allow pedestrians near equipment when equipment is in use.
- Do not arc weld on equipment without first disconnecting vehicle alternator.

SERVICE POSITION

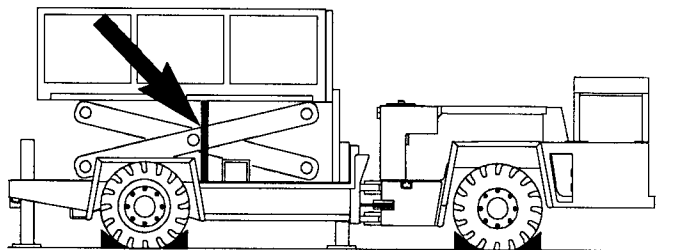
Throughout this manual, you will be told to place the equipment in the service position.

Do this by:

1. Applying parking brake.
2. Locking frame joint by connecting safety bar (articulating vehicles only).



3. Blocking wheels.
4. Lower stabilizers.
5. Raise scissor platform and put safety post in place. Lower platform onto safety post. Be sure safety post is in pocket.



6. Stopping engine.

Complete procedure before servicing vehicle.

SAFETY INSTRUCTIONS



SAFETY ALERT SYMBOL

This symbol will appear at various point throughout the manual with warning statements. Its appearance means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!



WARNING

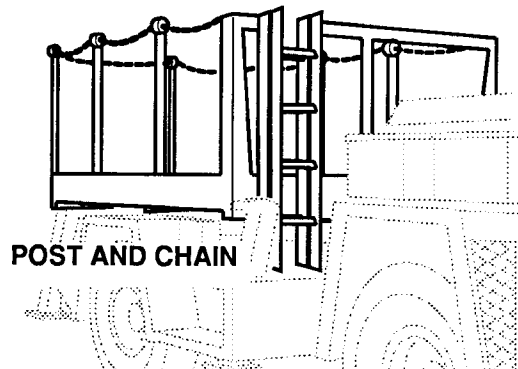
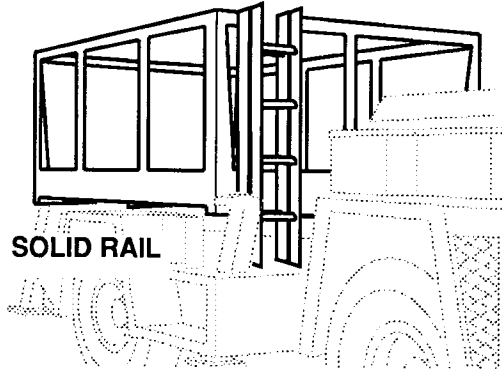
Do not raise scissor platform under or near any overhead electric cables or wires. Failure to follow this warning could lead to injury or death.

- You must have a basic operation and safety knowledge before operating scissor platform.
- Always place vehicle in a straight position as possible. Parking the vehicle in an articulated position when raising scissor platform can cause instability.
- Always apply vehicle park brake. Place wheel chocks under wheels before operating scissor.
- Always lower outriggers prior to placing scissor deck in operation. Try and place vehicle on as level a position as possible.
- Never operate outriggers when scissor platform is in raised position.
- Keep working area clear of all pedestrians when operating scissor platform.
- Never exceed maximum capacity stated on scissor platform capacity plate.
- Never walk, stand, or perform work below a raised scissor platform..
- Never place vehicle in motion with scissor platform raised.
- After completing scissor operations, disengage PTO using diverter in operators compartment.
- Do not weld on scissor arm structure without permission from approved service shop.
- When the vehicle is placed out of service, an “OUT OF SERVICE” tag must be displayed.

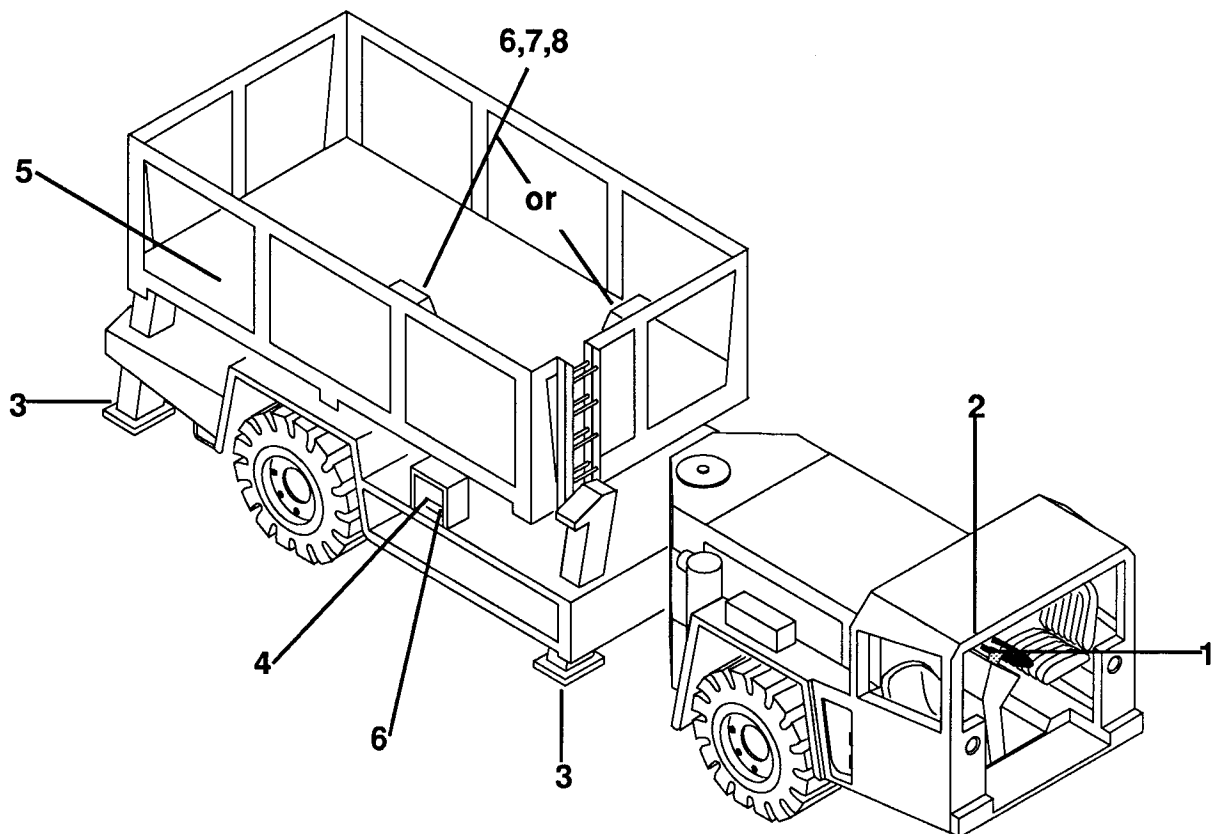
DESCRIPTION AND OPERATING CONTROLS

GENERAL DESCRIPTION

Getman Scissor Platform is a railed work area that can be raised to 14 feet. Rail will be welded in place or post and chain. Post and chain rail can be removed for low overhead clearance. However, it must be in place when platform is in use. Audible alarm will sound while platform is lowering.



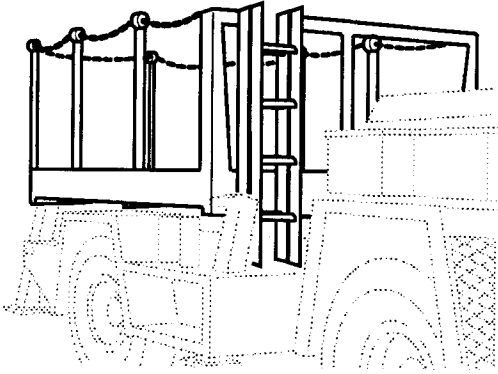
CONTROLS



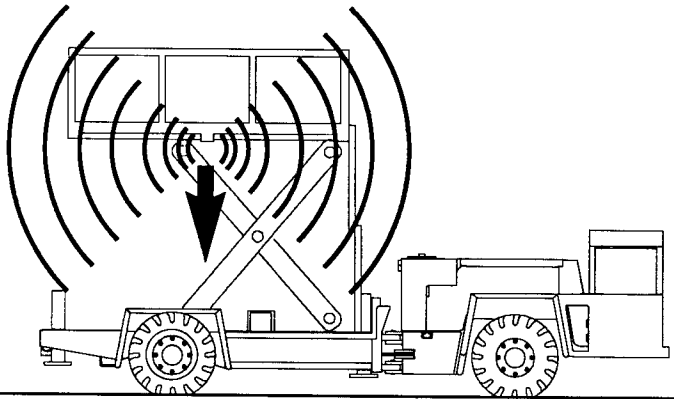
1. Parking brake control. Push to apply, pull to release.
2. Accessory control. Pull to activate, push to deactivate. Hydraulic power to raise platform is diverted from power steering circuit. When the scissor platform is in use power steering becomes inactive.
3. Stabilizers.
4. Stabilizer controls.
5. Scissor platform.
6. Scissor platform controls
7. Engine shut down switch (optional). Engine start from platform (optional).
8. Light switch (optional).

CHECK'S BEFORE OPERATING

Before using scissor platform check the area around and above for obstacles that might be damaged by, or cause damage to, scissor platform.



Post and chain rail must be in place. (if so equipped)

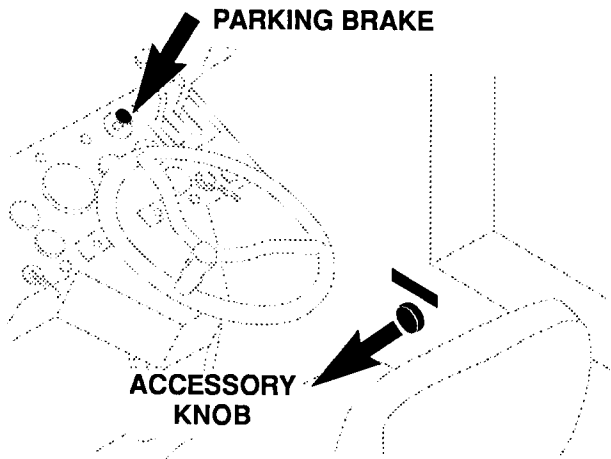


Check audible alarm. It must sound as platform is being lowered.

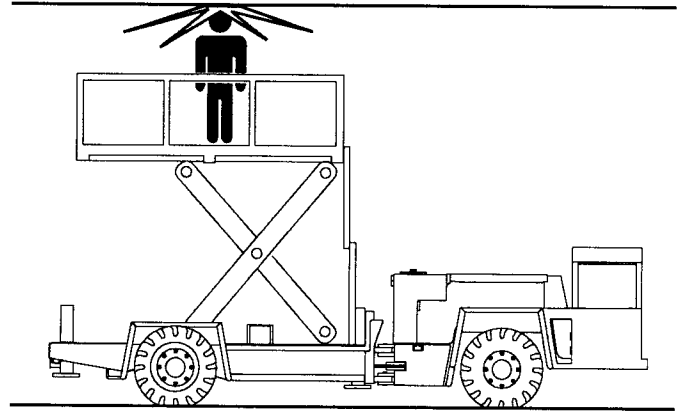
Check control levers. They must work freely and automatically return to neutral.

OPERATING SCISSOR TABLE

Park scissor truck on flat, level surface.



Apply parking brake. Pull accessory knob to activate scissor platform hydraulic circuit (power steering is inactive).

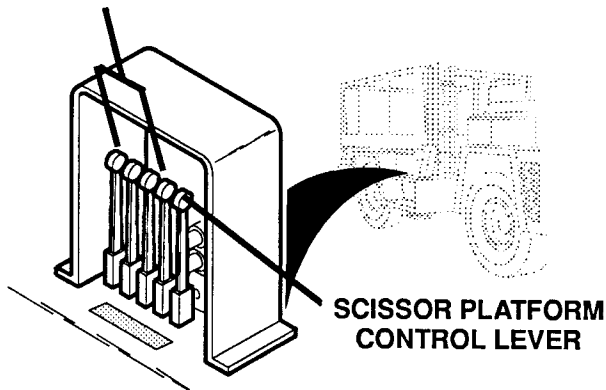


! WARNING

Overhead obstructions

Be sure you have enough overhead clearance. Failure to follow this rule could cause serious injury.

STABILIZER CONTROLS



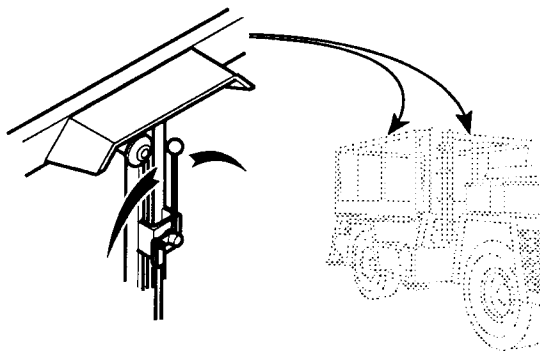
Use stabilizers to level truck. Do not use stabilizers to gain extra platform height. To raise and lower platform from ground, use truck mounted control.



! WARNING

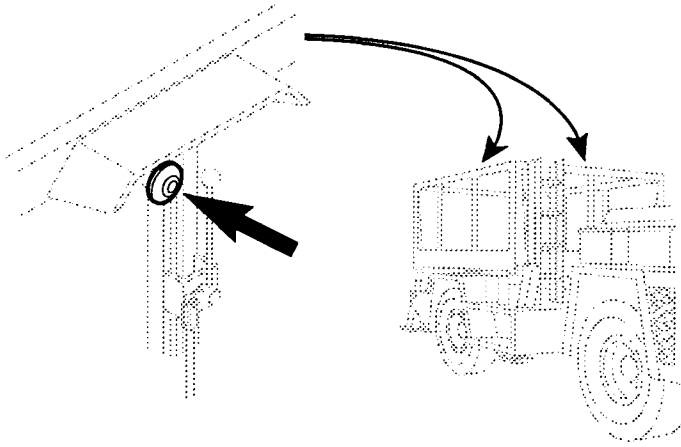
Slide by Ladder

Keep away from ladder when scissor platform is moving up or down. Failure to follow this rule could cause serious injury.



To operate from platform, use rail mounted control.

OPERATING SCISSOR TABLE (CONT'D)

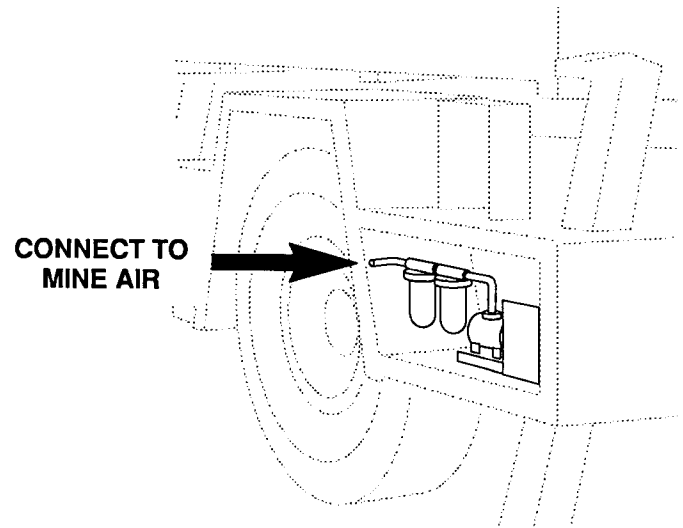


When you have reached working height stop engine by pushing engine stop control. Engine start from platform. (optional.)

Keep platform clear of rocks and debris. Keep supplies and tools orderly and out of your way. Do not reach out beyond rail. Do not stand or sit on rail, or allow others to.

When work is complete lower platform, an audible alarm will sound.

Raise stabilizers, push accessory control, and release parking brake. Truck is ready to travel.

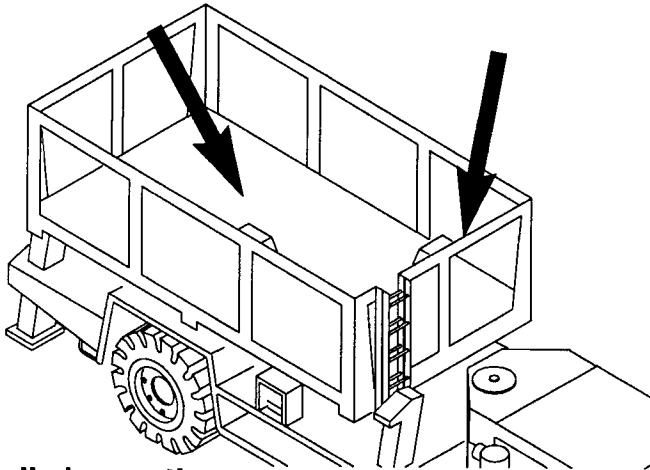


Optional

The scissor platform hydraulic system can be driven with compressed air, supplied by the mine.

IMPORTANT

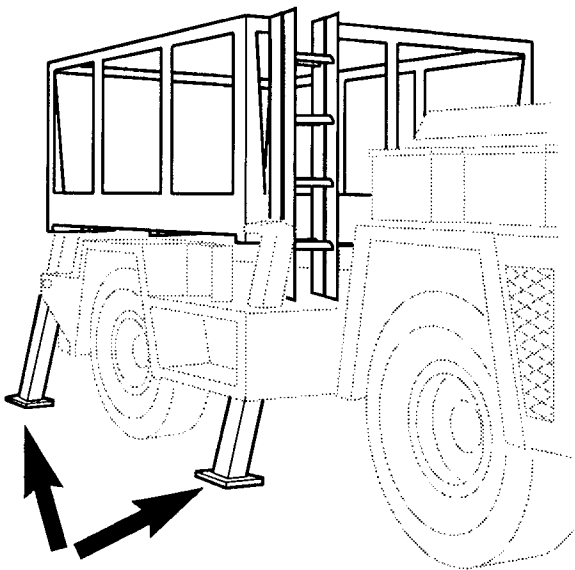
When working on scissor platform, make sure it is in service position.



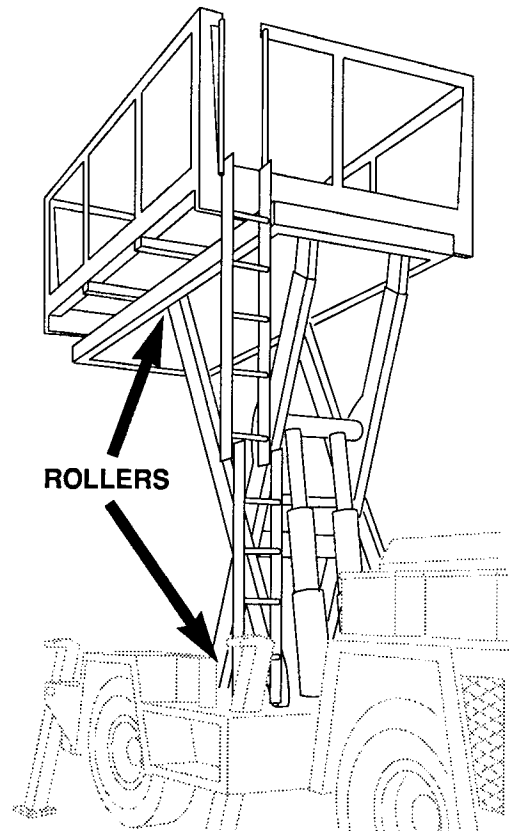
Daily inspection

Check platform floor; it must be clear of debris and in good repair.

Check rail, it must be in place and in good repair.



Lower stabilizers, they should work smoothly. Be sure each one has a foot plate.



From the ground, raise platform to full height then lower it. Audible alarm must sound while lowering. Watch for jerking or sticky movement.

Watch hoses and cables fold and unfold, their path must be clear and free from debris. Hoses and cables must be free from kinks and sharp bends.

Watch rollers they should roll freely, be sure their pathway is clean.

Put truck in service position.

Check hoses and fittings for leaks.

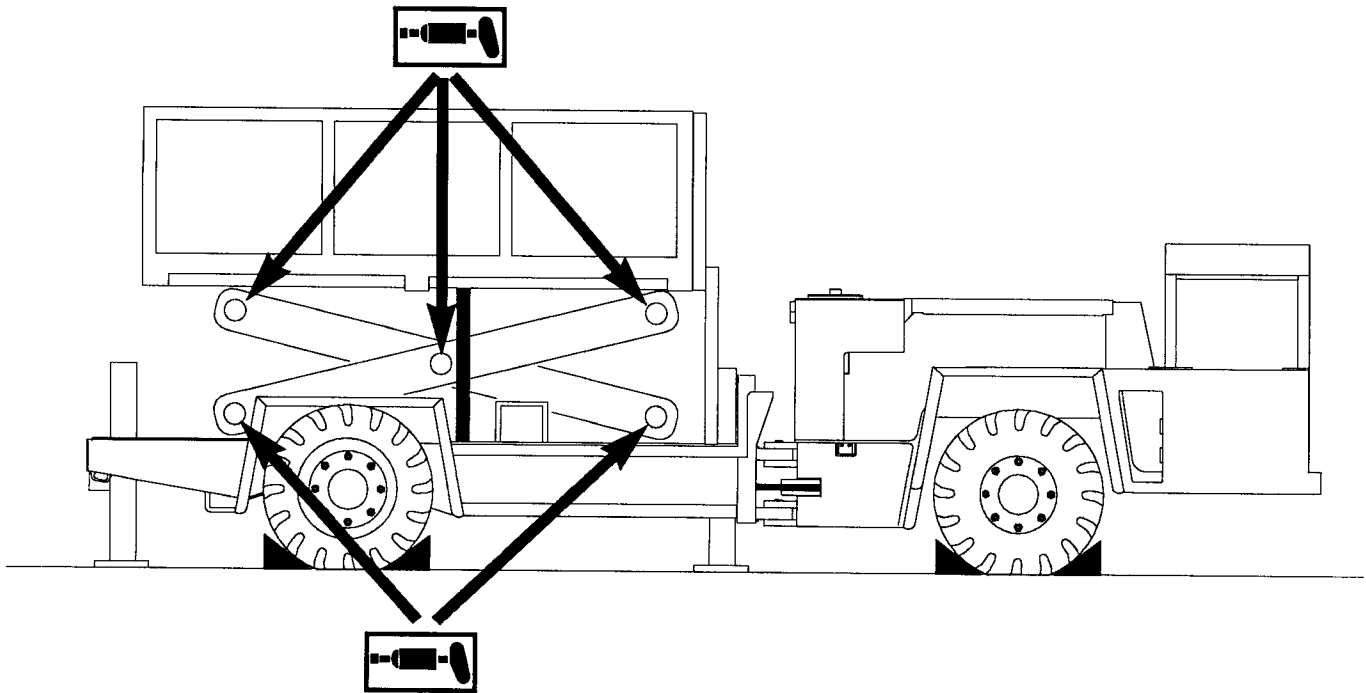
Check cables and connections they must be in good repair and tight.

Check hose and cable pathways for signs of rubbing and wear.

Report any unusual or suspected conditions, and put an "out of service" tag on the truck.

LUBRICATION - EVERY 250 HOURS

Put truck in service position and lubricate all grease fittings with Grade 2 Lithium Base Extreme Pressure Grease, MIL-G-10924A, such as: Shell Super Duty Lithium, MDS, Texaco Marfok Muilt-Purpose.



NOTE:

MAINTENANCE AND LUBRICATION INTERVALS WERE DEVELOPED TO PROTECT EQUIPMENT WHEN USED IN SEVERE UNDERGROUND MINING CONDITIONS, THESE CONDITIONS MAY VARY, AND SERVICE INTERVALS SHOULD BE ADJUSTED TO MEET YOUR REQUIREMENTS.



Installation and Operations Manual MURPHY

Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. It is your responsibility to have a qualified person install this unit.

GENERAL INFORMATION

WARNING

BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.

Description

The PowerView is a powerful new display in a line of components manufactured by FWMurphy as part of its J1939 MurphyLink™ † Family. The J1939 MurphyLink™ Family of products have been developed to meet the needs for instrumentation and control on electronically controlled engines communicating using the SAE J1939 Controller Area Network (CAN).

The PowerView System is comprised of the PowerView and the Mlink™ PowerView Gages. The PowerView is a multifunction tool that enables equipment operators to view many different engine or transmission parameters and service codes. The system provides a window into modern electronic engines and transmissions. The PowerView includes a graphical backlit LCD screen. It has excellent contrast and viewing from all angles. Back lighting can be controlled via menu or external dimmer potentiometer. The display can show either a single parameter or a quadrant display showing four parameters simultaneously. Diagnostic capabilities include fault codes with text translation for the most common fault conditions.

The PowerView has four buttons using self-calibrating charge transfer activation technology, which eliminates the concern for pushbutton wear and failure. In addition, operators can navigate the display with ease.

The enhanced alarm indication has ultra bright alarm and shutdown LEDs (amber & red). It has a wide operating temperature range of -40 to +85° C (-40 to 185° F), display viewing -40 to +75° C (-40 to 167° F), and increased environmental sealing to +/- 5 PSI (± 34kPa). It also features Deutsch DT style connectors molded into the case and fits quickly and easily into existing 2-1/16 in. (52 mm) gage opening with little effort.

Other components in the system are microprocessor-based Mlink™ PowerView Gages for displaying critical engine data broadcast by an electronic engine or transmission's Engine Control Unit (ECU): engine RPM, oil pressure, coolant temperature, system voltage, etc. and a combination audible alarm and relay unit for warning and shutdown annunciation. Up to 32 components may be linked to the PowerView using a simple daisy chain wire connection scheme using RS485. The PowerView and all connected components can be powered by 12- or 24-volt systems.

Warranty

A limited warranty on materials and workmanship is given with this FWMurphy product. A copy of the warranty may be viewed or printed by going to www.fwmurphy.com/warranty.html

† MurphyLink™ is a registered trademark of FWMurphy. All other trademarks and service marks used in this document are the property of their respective owners.

Display Parameters

The following are some of the engine and transmission parameters displayed by the PowerView in English or Metric units as well as in Spanish, French, or German (when applicable, consult engine or transmission manufacturer for SAE J1939 supported parameters):

- ◆ Engine RPM
- ◆ Engine Hours
- ◆ Machine Hours
- ◆ System Voltage
- ◆ % Engine Load at the current RPM
- ◆ Coolant Temperature
- ◆ Oil Pressure
- ◆ Fuel Economy
- ◆ Throttle Position
- ◆ Engine Manifold Air Temperature
- ◆ Current Fuel Consumption
- ◆ Transmission Oil Pressure
- ◆ Transmission Oil Temperature
- ◆ Transmission Gear Position
- ◆ Active Service Codes
- ◆ Stored Service Codes (when supported)
- ◆ Set Units for display (English or Metric)
- ◆ Engine Configuration Parameters

Specifications

Display: 1.3 x 2.6 in. (33 x 66 mm), 64 x 128 pixels.

Operating Voltage: 8 VDC minimum to 32 VDC max.

Reversed Polarity: Withstands reversed battery terminal polarity indefinitely within operating temperatures.

Operating Temperature: -40 to +85°C (-40 to 185°F).

Display Viewing Temperature: -40 to +75°C (-40 to 167°F).

Storage Temperature: -40 to +85°C (-40 to 185°F).

Environmental Sealing: IP68, +/- 5 PSI (+/- 34.4 kPa).

Power Supply Operating Current: (@ 14 VDC)=
52 mA minimum; 268 mA maximum (LCD heater on).

CAN BUS: SAE J1939 Compliant.

Case: Polycarbonate / Polyester.

Clamp: Polyester (PBT).

Connectors: 6-Pin Deutsch DTO6 Series.

Maximum Panel Thickness: 3/8 in. (9.6 mm).

Mounting Hole: 2.062 inch (52 mm) in diameter.

Auxiliary Communications: Either:

Gages: One (1) RS485 port, MODBUS RTU master.

MODBUS: One (1) RS485 port, MODBUS RTU slave, selectable baud rate; 9600; 19.2K; 38.4K.

Potentiometer (External Dimmer)Input: 1K ohm, 1/4 W

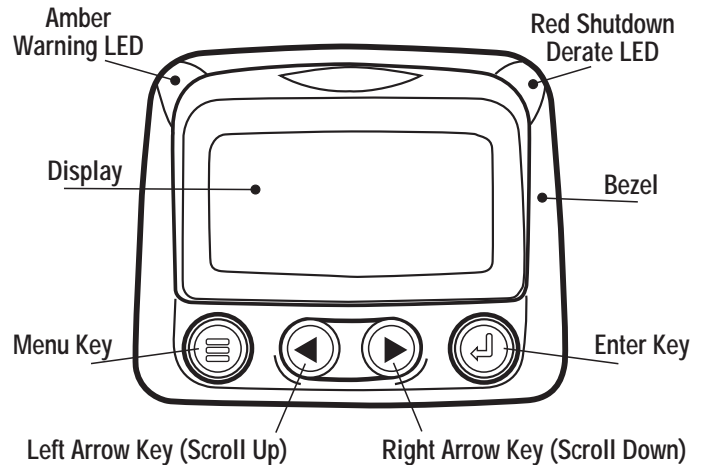
Shipping Weights (all models): 1/2 lb. (225 g.)

Shipping Dimensions (all models): 6 x 6 x 6 in. (152 x 152 x 152 mm).

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Faceplate Features

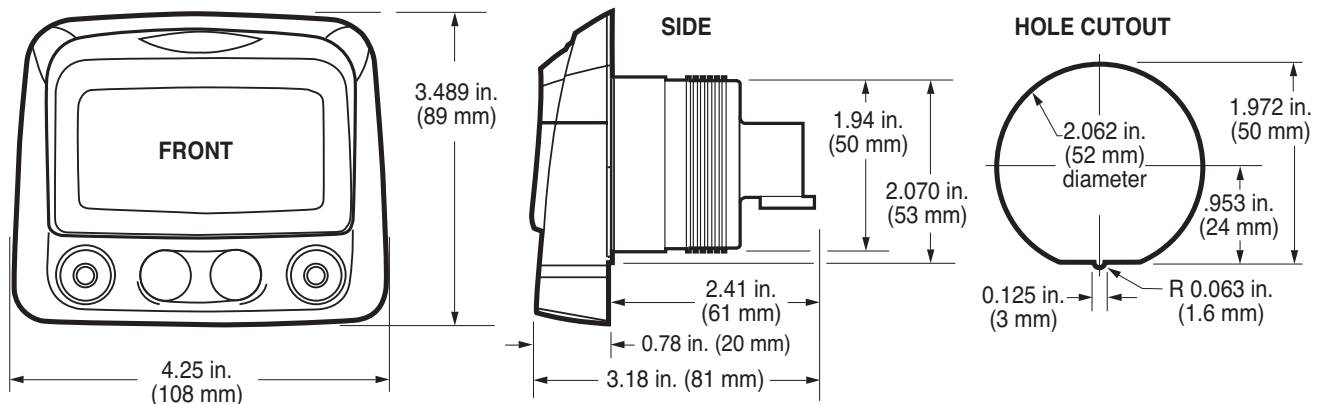


Keypad Functions

The keypad on the PowerView is a capacitive touch sensing system. There are no mechanical switches to wear or stick, and the technology has been time proven in many applications. It operates in extreme temperatures, with gloves, through ice, snow, mud, grease, etc., and it allows complete sealing of the front of the PowerView. The 'key is touched' feedback is provided by flashing the screen. The keys on the keypad perform the following functions:

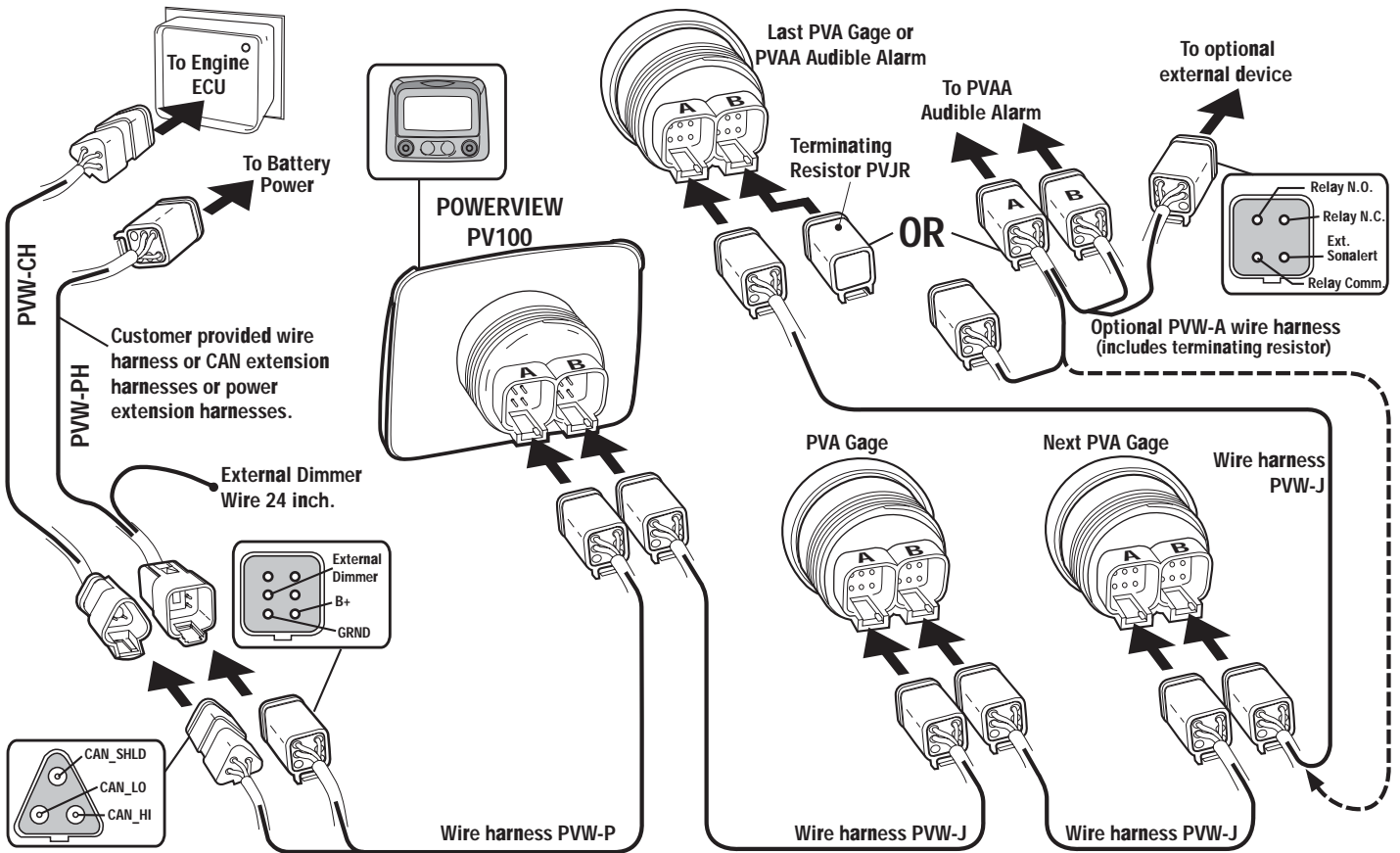
- 
– *Menu Key* - The Menu Key is touched to either enter or exit the menu screens.
- 
– *Left Arrow* - The Left Arrow Key is touched to scroll through the screen either moving the parameter selection toward the left or upward.
- 
– *Right Arrow* - The Right Arrow Key is touched to scroll through the screen either moving the parameter selection toward the right or downward.
- 
– *Enter Key* - The Enter Key (also known as Enter Button) is touched to select the parameter that is highlighted on the screen.

Typical Mounting Dimensions



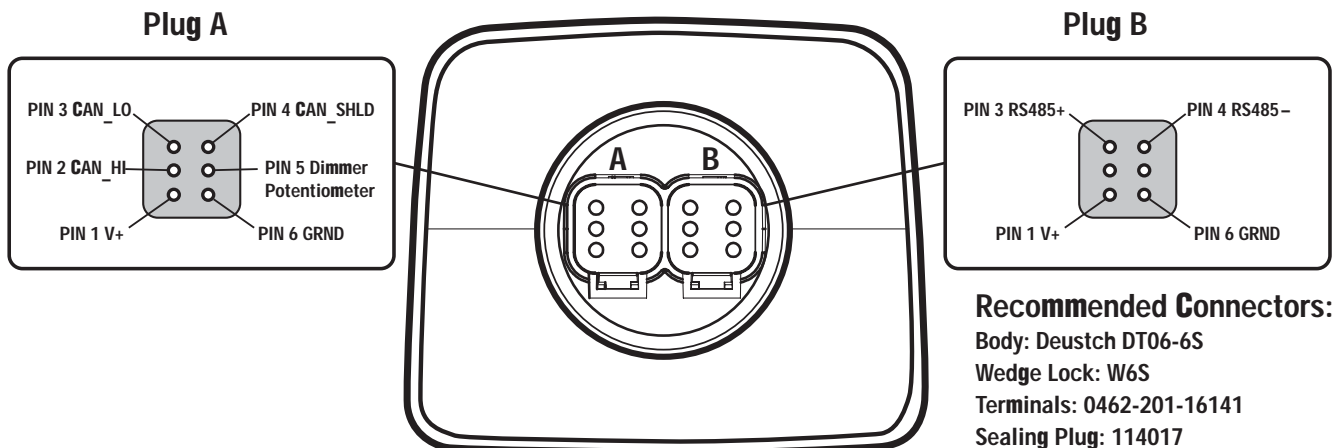
MECHANICAL INSTALLATION

Typical Quick-Connect Diagram



ELECTRICAL INSTALLATION

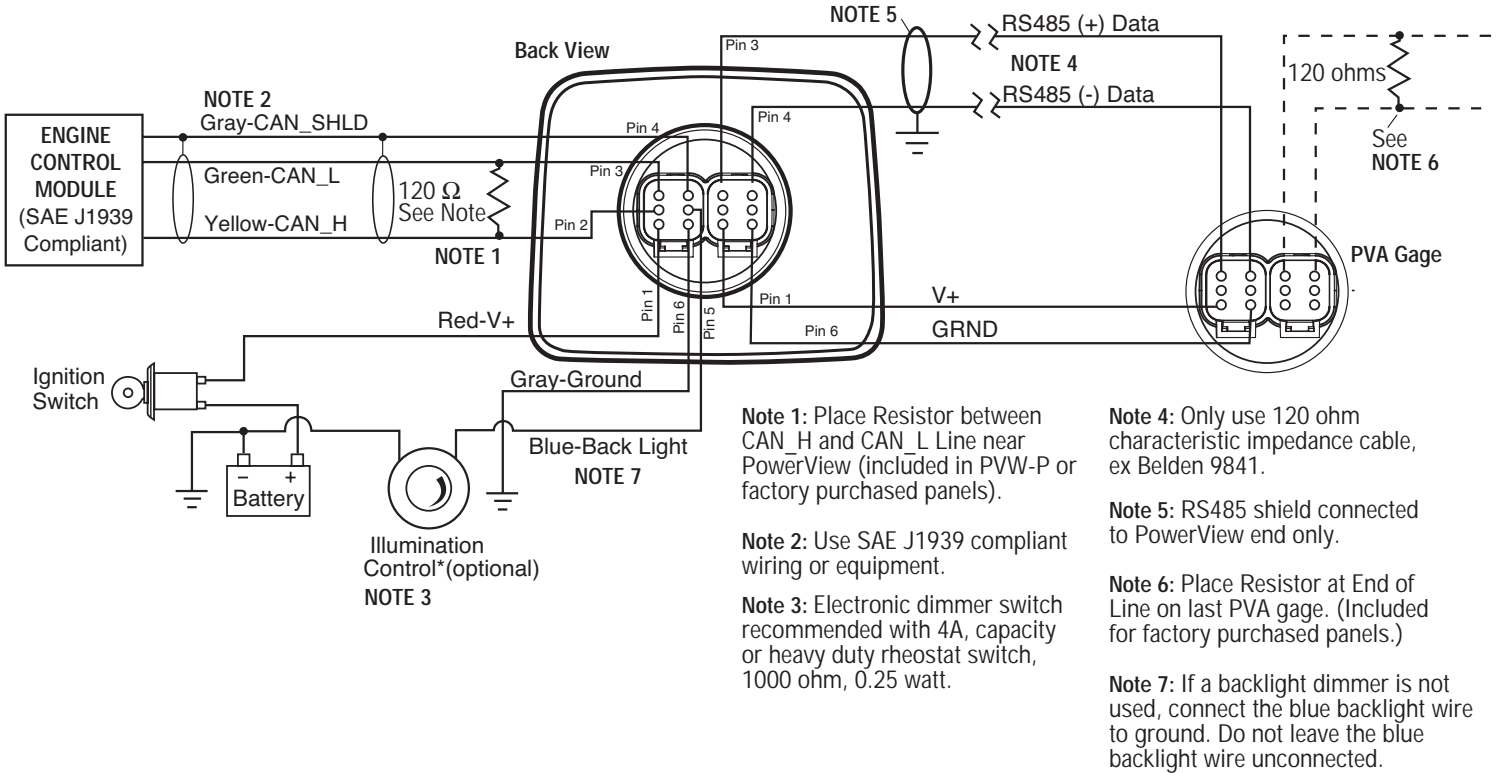
PowerView Unit Back View Deutsch DT06-6S Style Connections



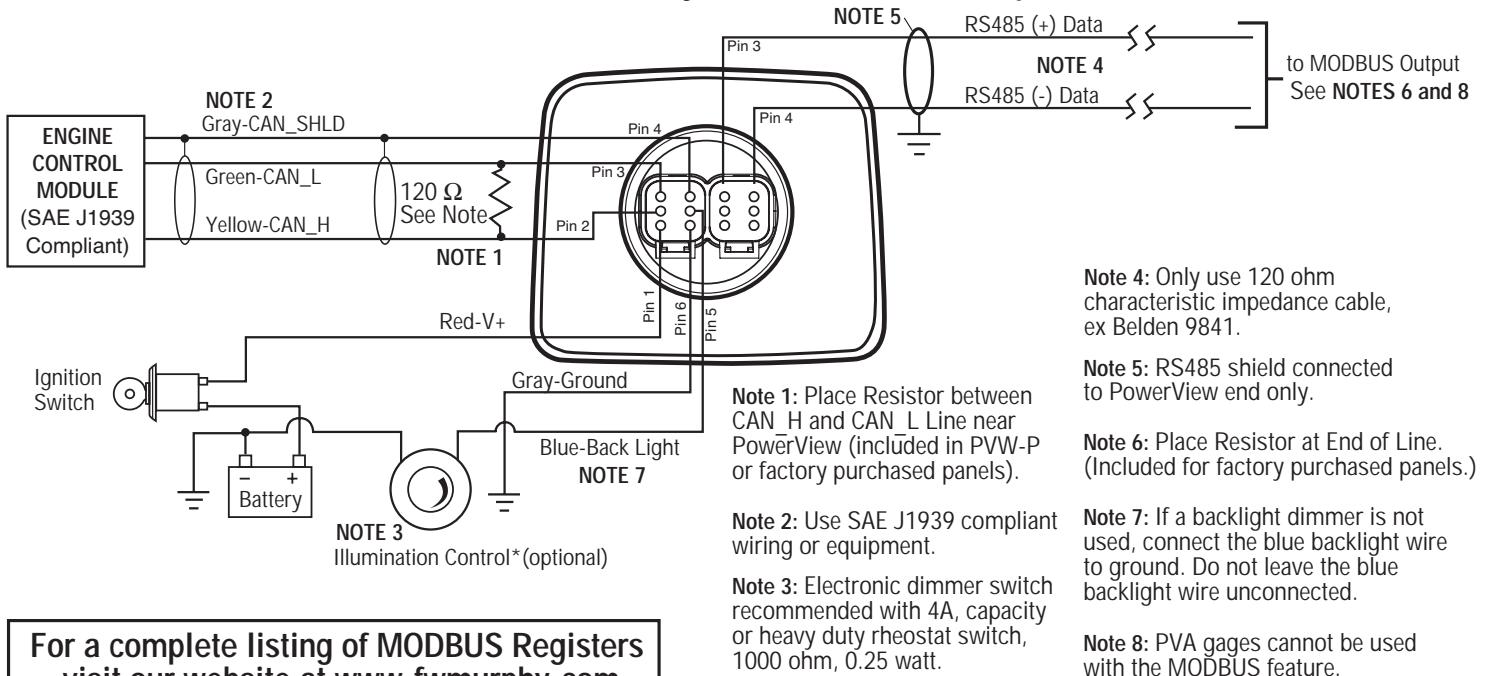
TYPICAL WIRING DIAGRAMS

IMPORTANT: To eliminate external interference: RS485(+) and RS485(-) should be twisted pair cable or twist wires together, one twist per inch minimum. CAN_L, CAN_H and CAN Shield should be approved J1939 CAN bus cable (CAN wire for example: RADOX plug and play cable, from Champlain cable). (RS485 wire for example: BELDEN 9841 or 3105A).

PowerView Deutsch DT06-6S Style Unit to PVA Gage



PowerView Deutsch DT06-6S Style Unit to MODBUS Output

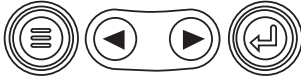


For a complete listing of MODBUS Registers visit our website at www.fwmurphy.com

POWerview OPERATION

PowerView Menus (First Time Start Up)

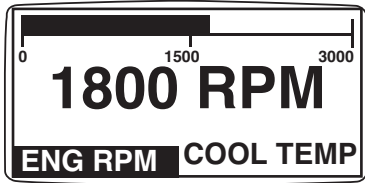
1. When power is first applied to the PowerView, the "Logo" is displayed.



2. The "Wait to Start" message will be displayed for engines with a pre-startup sequence. Once the "Wait to Start" message is no longer displayed the operator may start the engine. Note: Displays only when SAE J1939 message is supported by engine manufacturer.

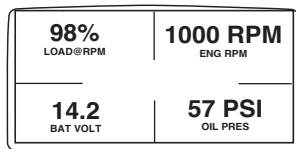
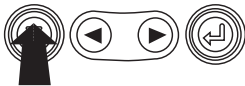
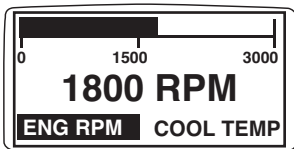


3. Once the engine has started the single engine parameter is displayed.

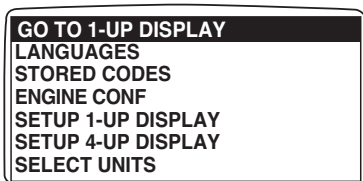


Main Menu Navigation

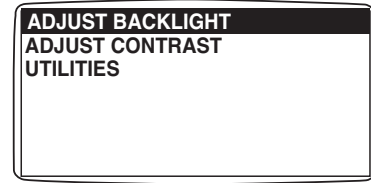
1. Starting at the single or four engine parameter display, touch "Menu".



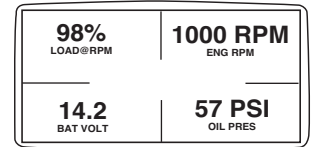
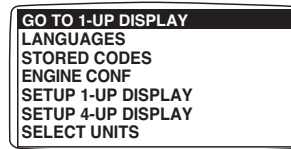
2. The first seven items of the "Main Menu" will be displayed. Touching the "Arrow Buttons" will scroll through the menu selection.



3. Touching the right arrow button will scroll down to reveal the last items of "Main Menu" screen highlighting the next item down.

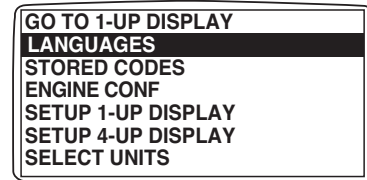


4. Touch the "Arrows" to scroll to the desired menu item or touch "Menu" to exit the Main menu and return to the engine parameter display.

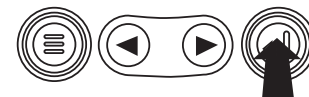
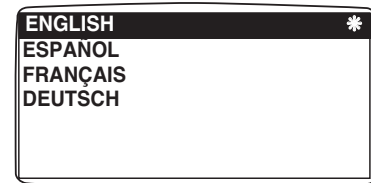


Selecting a Language

1. Starting at the main menu display use the "Arrows" to scroll to the "Language" menu and once highlighted touch the "Enter" button.



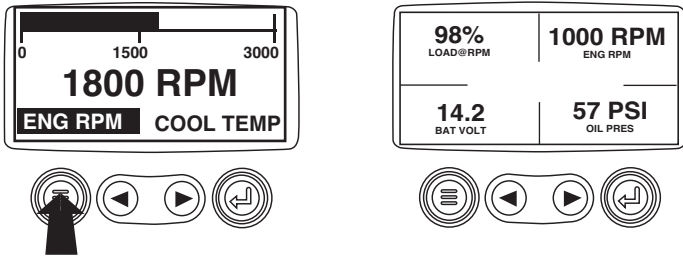
2. The language choices will be displayed. Use the "Arrow" buttons to scroll through the selections and touch "Enter" to make a selection.



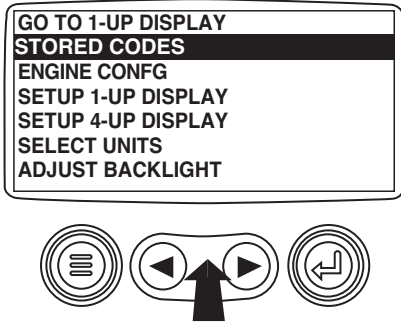
3. Now that you have selected the language, touch the "Menu" button to return to the main menu display.

Stored Fault Codes

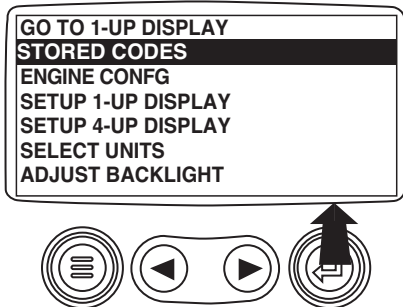
1. Starting at the single or the four engine parameter display touch the "Menu button".



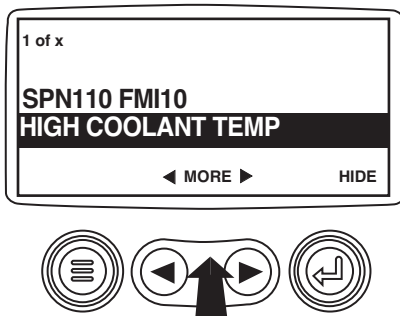
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the Stored Fault Codes is highlighted.



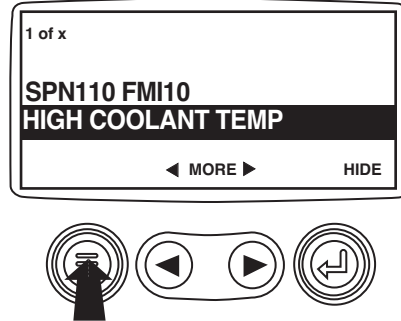
3. Once the "Stored Fault Codes" menu item has been highlighted touch the "Enter Button" to view the "Stored Fault Codes" (when applicable, consult engine or transmission manufacturer for SAE J1939 supported parameters).



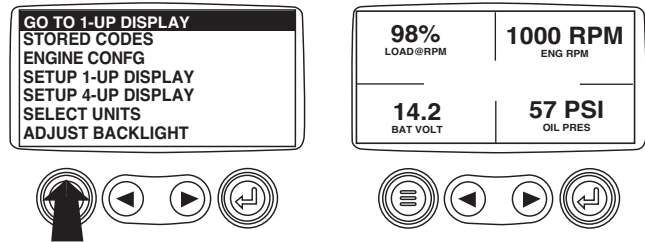
4. If the word "MORE" appears above the "Arrow Buttons" there are more stored fault codes that may be viewed. Use the "Arrow Buttons" to scroll to the next Stored Diagnostic Code.



5. Touch the "Menu Button" to return to the main menu.

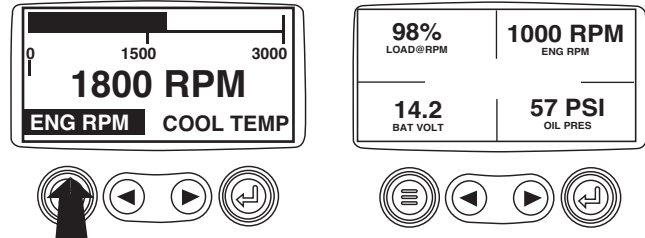


6. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.

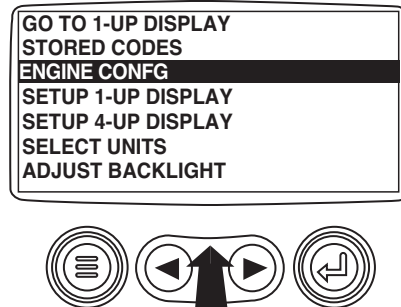


Engine Configuration Data

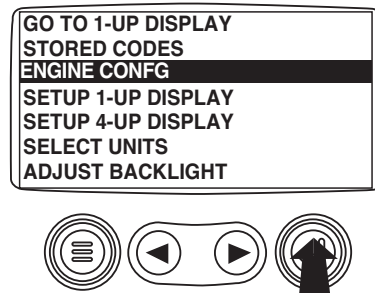
1. Starting at the single or four engine parameter display touch the "Menu Button".



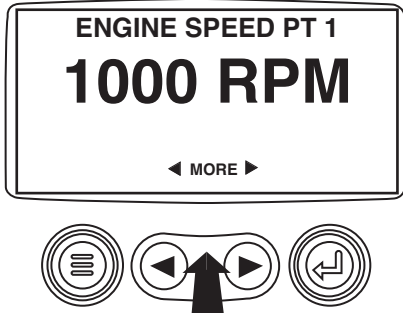
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Engine Configuration" is highlighted.



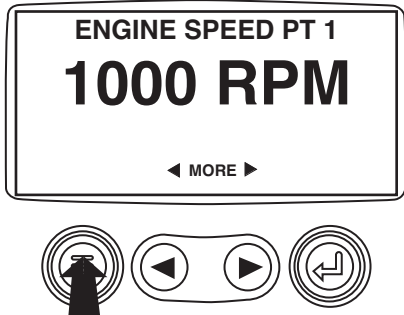
3. Once the "Engine Configuration" menu item has been highlighted touch the "Enter Button" to view the engine configuration data.



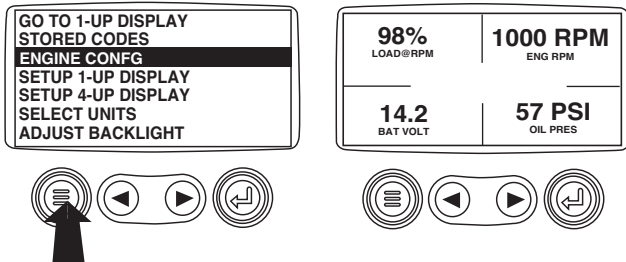
4. Use the "Arrow Buttons" to scroll through the engine configuration data.



5. Touch the "Menu Button" to return to the main menu.



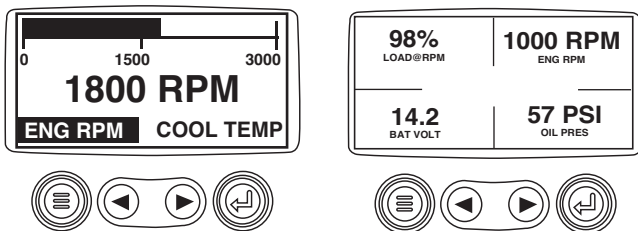
6. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.



Faults and Warnings

Auxiliary Gage Fault

1. During normal operation the single or four parameter screen will be displayed.



2. The PVA Series of auxiliary gages can be attached to the PowerView. These auxiliary gages communicate with the Modbus master PowerView via a daisy-chained RS-485 port. If at any time during system initialization

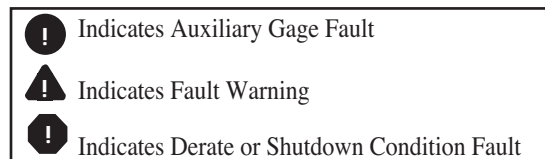
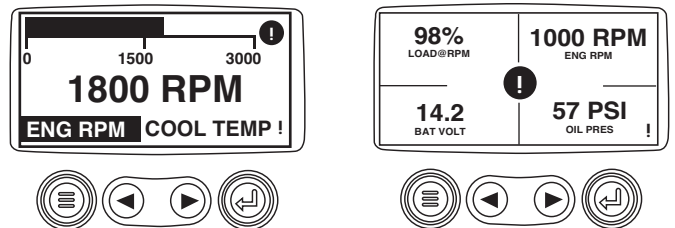
or normal operation an auxiliary gage should fail, the single or four parameter screen will be replaced with the "MLink Gage Fault" message.



3. To acknowledge and "Hide" the fault and return to the single or four parameter display, touch the "Enter Button".



4. The display will return to the single or four parameter screen.

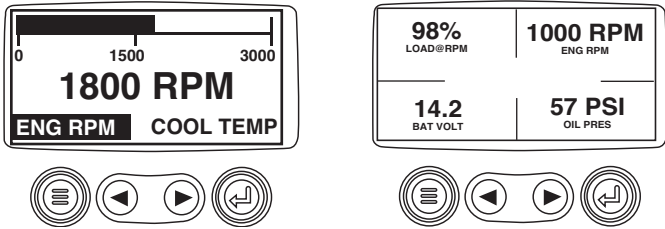


5. Touching the "Enter Button" will redisplay the hidden fault. Touching the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display. NOTE: The fault can only be cleared by correcting the cause of the fault condition.

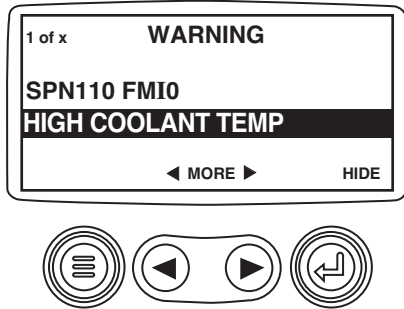


Active Fault Codes

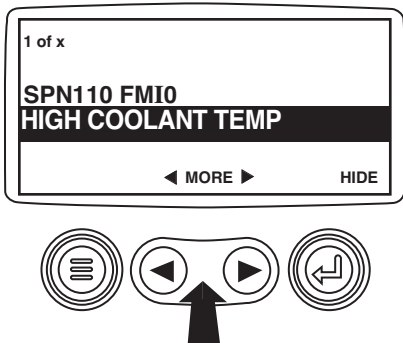
1. During normal operation the single or four parameter screen will be displayed.



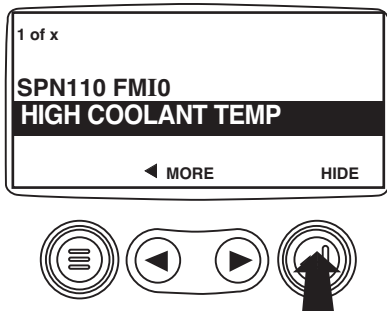
2. When the PowerView receives a fault code from an engine control unit the single or four parameter screen will be replaced with the "Active Fault Codes" message.



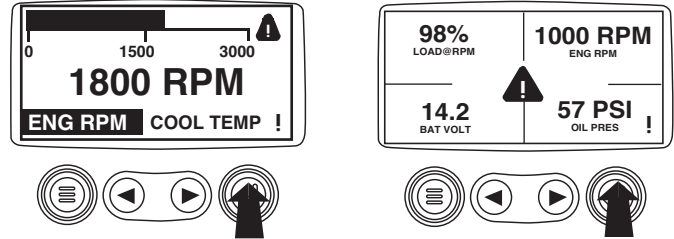
3. If the word "MORE" appears above the "Arrow Buttons" there are more active fault codes that may be viewed. Use the "Arrow Buttons" to scroll to the next "Active Fault Code"



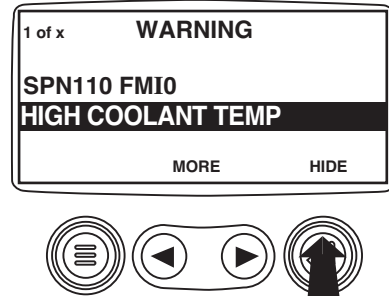
4. To acknowledge and "Hide" the fault and return to the single or four parameter display touch the "Enter Button".



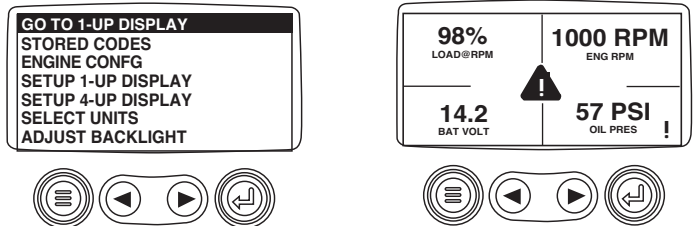
5. The display will return to the single or four parameter display, but the display will contain the "Active Fault" warning icon. Touching the "Enter Button" will redisplay the hidden fault.



6. Touching the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display.

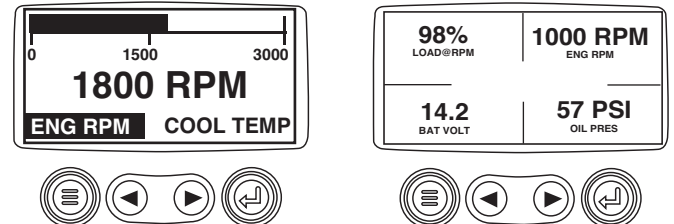


7. The Single or Four parameter screen will display the fault icon until the fault condition is corrected. NOTE: Ignoring active fault codes could result in severe engine damage.

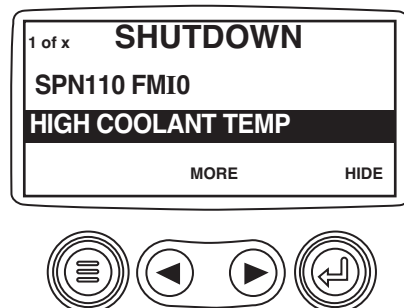


Shutdown Codes

1. During normal operation the single or four parameter screen will be displayed.

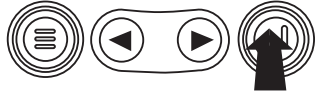
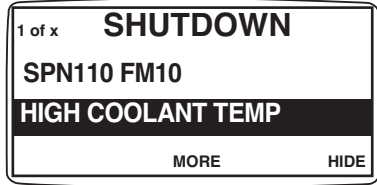


2. When the PowerView receives a severe fault code from an engine control unit the single or four parameter screen will be replaced with the "Shutdown!" message.



POWerview OPERATION *continued*

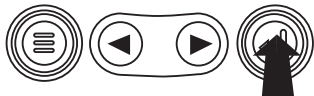
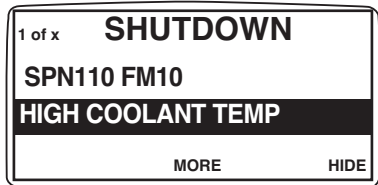
3. To acknowledge and "Hide" the fault and return to the single or four parameter display touch the "Enter Button".



4. The display will return to the single or four parameter display, but the display will contain the "Shut Down" icon. Touching the "Enter Button" will redisplay the hidden fault.



5. Touching the "Enter Button" once again will hide the fault and return the screen to the single or four parameter display.

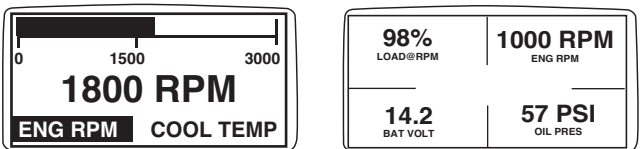


6. The Single or Four parameter screen will display the fault icon until the fault condition is corrected. NOTE: Ignoring active fault codes could result in severe engine damage.

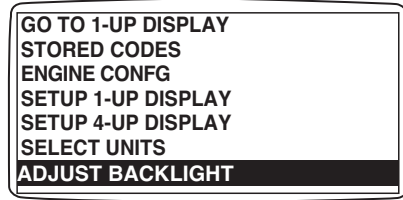


Back Light Adjustment

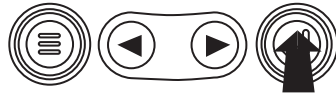
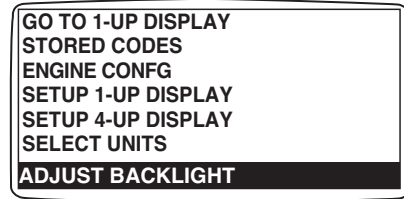
1. Starting at the single or four engine parameter display touch the "Menu Button".



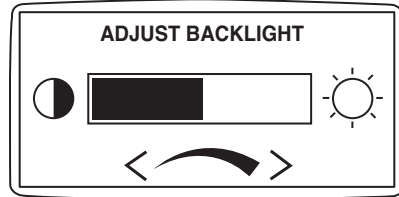
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Adjust Backlight" is highlighted.



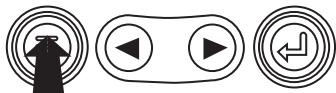
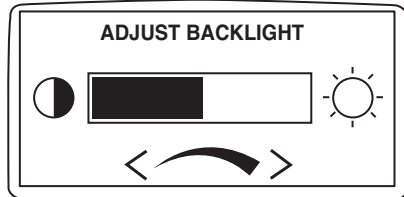
3. Once the "Adjust Backlight" menu item has been highlighted touch the "Enter Button" to activate the "Adjust Backlight" function.



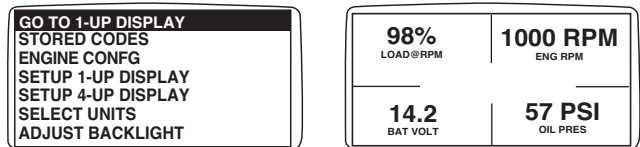
4. Use the "Arrow Buttons" to select the desired backlight intensity.



5. Touch the "Menu Button" to return to the main menu.

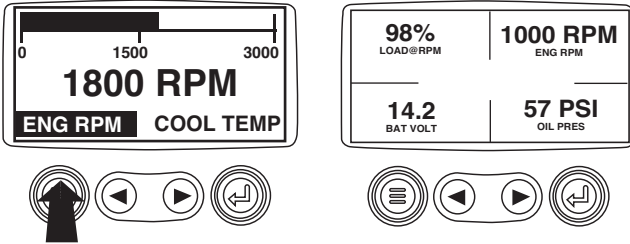


6. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.

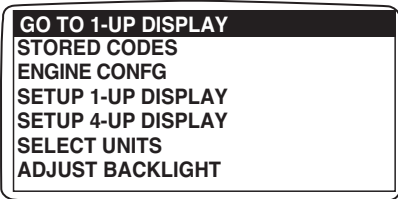


Contrast Adjustment

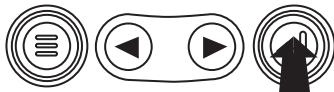
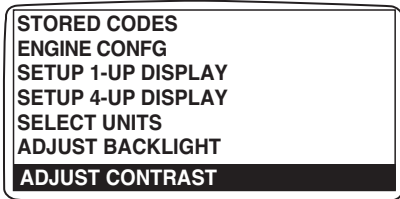
1. Starting at the single or four engine parameter display, touch the "Menu Button".



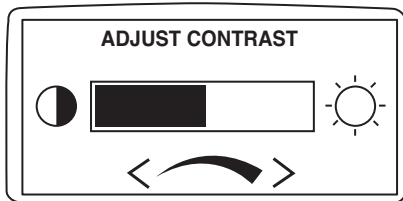
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until "Adjust Contrast" is highlighted.



3. Once the "Adjust Contrast" menu item has been highlighted touch the "Enter Button" to activate the "Adjust Contrast" function.



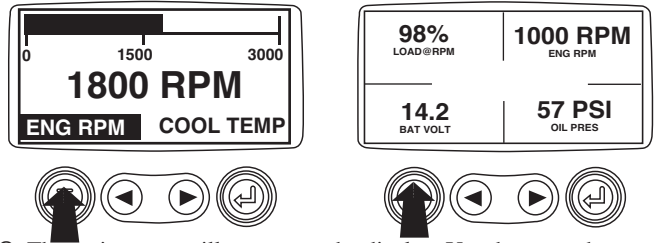
4. Use the "Arrow Buttons" to select the desired contrast intensity.



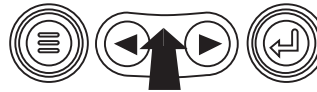
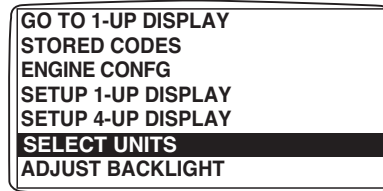
5. Touching the "Menu Button" will take you back through the menus.

Select Units

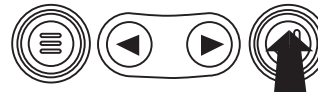
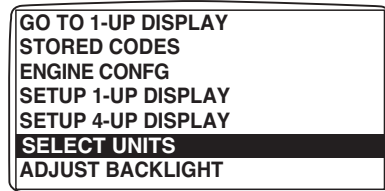
1. Starting at the single or four engine parameter display touch the "Menu Button".



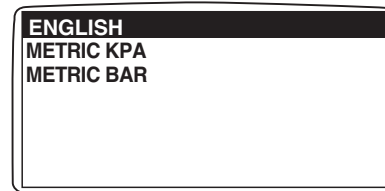
2. The main menu will pop up on the display. Use the arrow buttons to scroll through the menu until the "Select Units" is highlighted.



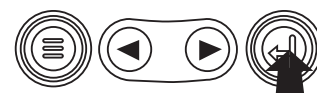
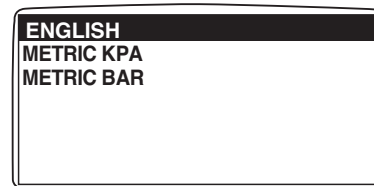
3. Once the "Select Units" menu item has been highlighted touch the "Enter Button" to access the "Select Units" function.



4. Use the arrows to highlight the desired units. "English" for Imperial units i.e. PSI, °F or Metric kPa, Metric Bar for IS units i.e. kPa, Bar, °C.



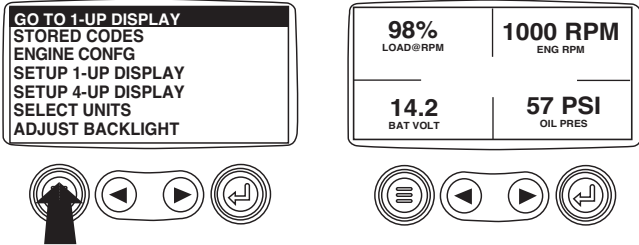
5. Touch the "Enter Button" to select the highlighted units.



6. Touch the "Menu Button" to return to the "Main Menu".

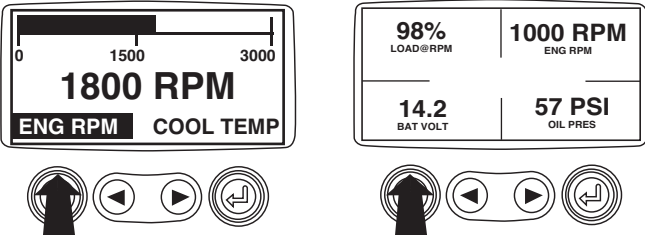


7. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.

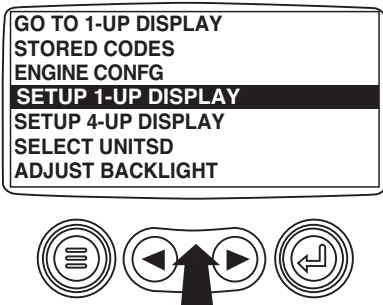


Setup 1-Up Display

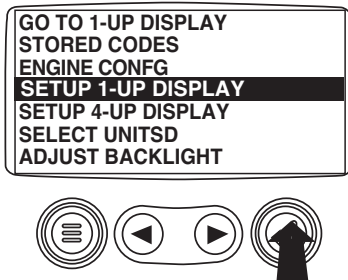
1. Starting at the single engine parameter display, touch the "Menu Button".



2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Setup 1-up Display" is highlighted.

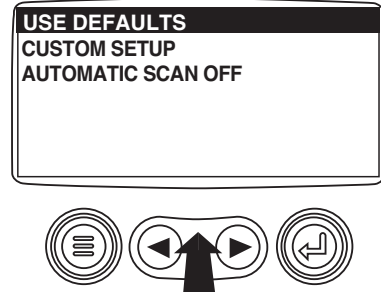


3. Once the "Setup 1-up Display" menu item has been highlighted touch the "Enter Button" to access the "Setup 1-up Display" function.

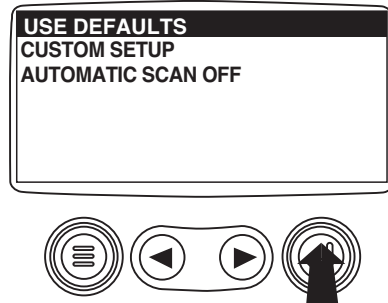


- 4. Three options are available for modification of the 1-Up display.
 - a). Use Defaults – This option contains a set of engine parameters: Engine Hours, Engine RPM, System Voltage, Battery Voltage, % Engine Load at Current RPM, Coolant Temperature, Oil Pressure.
 - b). Custom Setup – This option allows for the modification of what parameter, the number of parameters, and the order in which the parameters are being displayed.
 - c). Automatic Scan – Selecting the scan function will cause the 1-Up Display to scroll through the selected set of parameters one at a time, momentarily pausing at each.

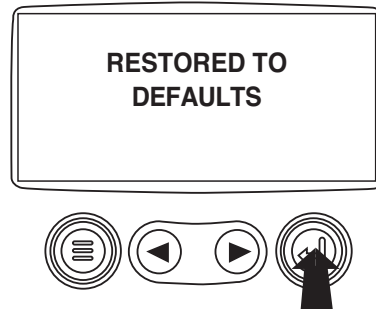
5. Use Defaults - To select "Use Defaults" use the arrow buttons to scroll to and highlight "Use Defaults" in the menu display.



6. Touch the "Enter Button" to activate the "Use Defaults" function.

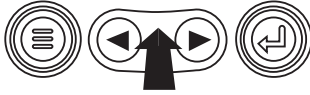
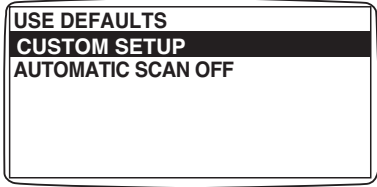


7. A message indicating the "Single Engine" parameter display parameters are reset to the factory defaults will be displayed, then the display will return to the "Custom Setup" menu.

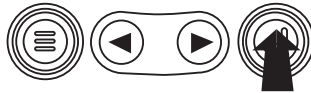
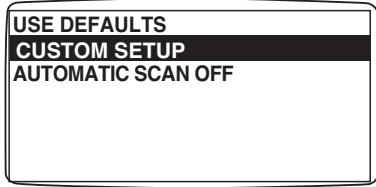


POWerview OPERATION *continued*

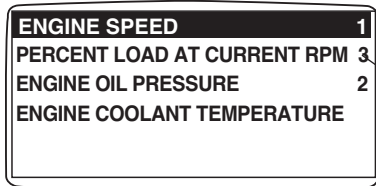
8. Custom Setup - To perform a custom setup of the 1-Up Display, use the arrow buttons to scroll to and highlight "Custom Setup" on the display.



9. Touching the "Enter Button" will display a list of engine parameters.



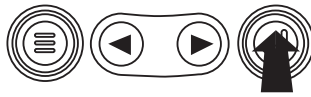
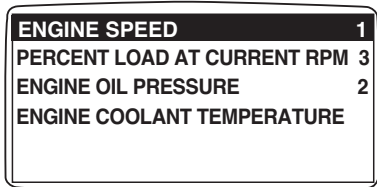
10. Use the "Arrow Buttons" to scroll to and highlight a selected parameter (parameter with a # symbol to right of it).



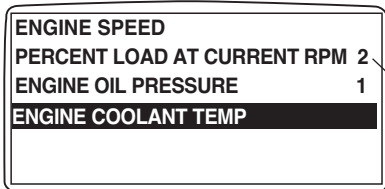
This number indicates the order of display for the parameters and that the parameter is selected for display.



11. Touch the "Enter Button" to deselect the selected parameter removing it from the list of parameters being displayed on the 1-up display.



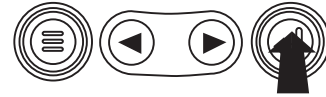
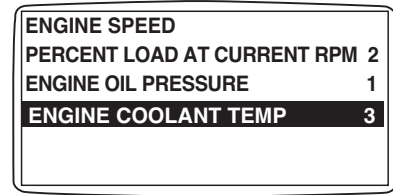
12. Use the "Arrow Buttons" to scroll and highlight the desired parameter that has not been selected for display.



Note that the numbers now indicate the new order of display for the parameters.

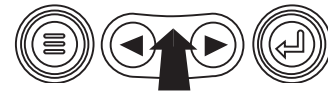
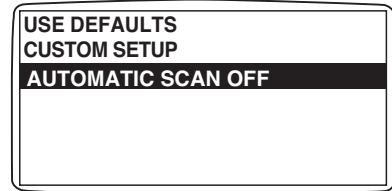


13. Touch the "Enter button" to select the highlighted parameter for inclusion in the Single Engine Parameter Display.

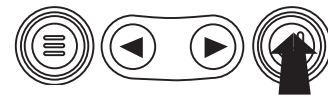
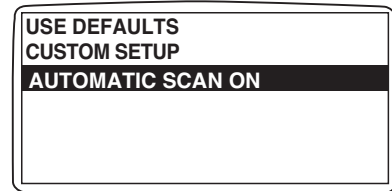


14. Continue to scroll and select additional parameters for the custom 1-Up Display. Touch the "Menu button" at any time to return to the "Custom Setup" menu.

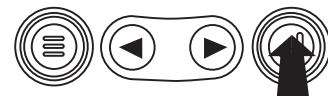
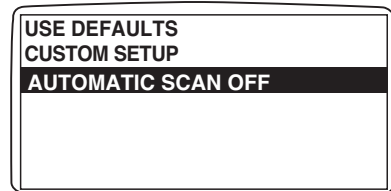
15. Automatic Scan - Selecting the scan function will cause the 1-Up Display to scroll through the selected set of parameters one at a time. Use the "Arrow Buttons" to scroll to the "Automatic Scan" function.



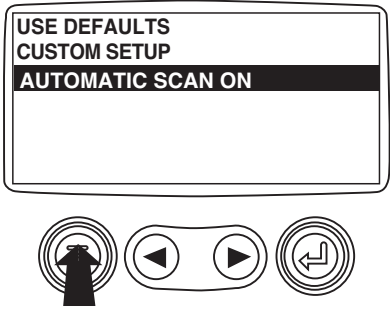
16. Touching the "Enter Button" toggles the "Automatic Scan" function on.



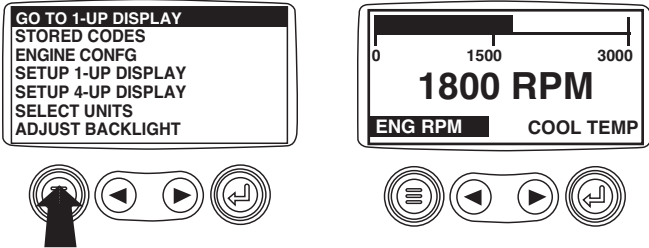
17. Touching the "Enter Button" again toggles the "Automatic Scan" function off.



18. Once the "Use Defaults", "Custom Setup" and "Automatic Scan" functions have been set touch the "Menu Button" to return to the main menu.

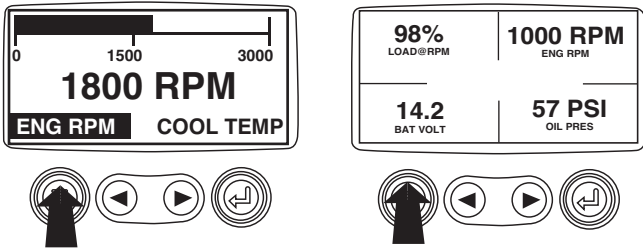


19. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.

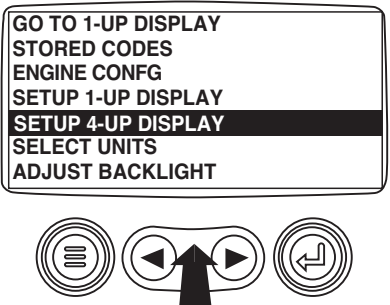


Setup 4-Up Display

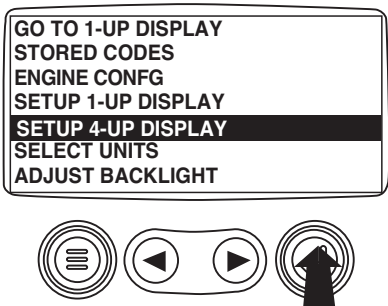
1. From the single or four engine parameter display touch the "Menu Button".



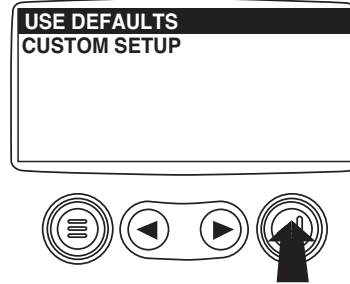
2. The main menu will pop up on the display. Use the "Arrow Buttons" to scroll through the menu until the "Setup 4-Up Display" is highlighted.



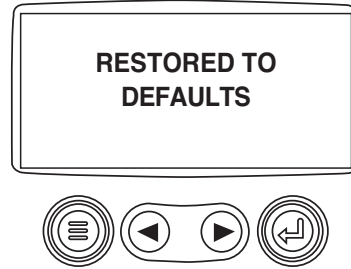
3. Once the "Setup 4-Up Display" menu item has been highlighted touch the "Enter Button" to activate the "Setup 4-Up Display" menu.



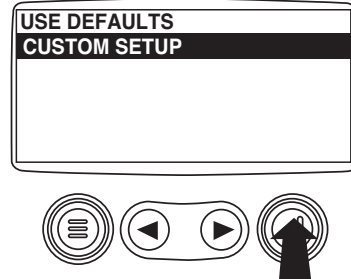
4. Touch the "Enter Button" to activate the "Use Defaults" function. This action will reset the unit to the factory default.



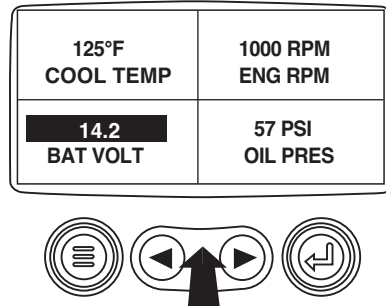
5. The "Use Defaults" screen will be displayed during the resetting period then will automatically return to the "Setup 4-Up Display" menu.



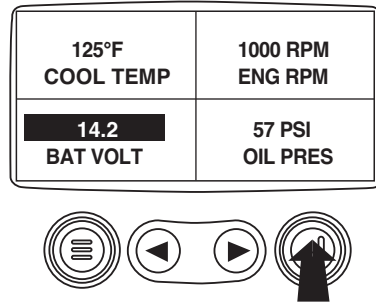
6. Select the "4-Up Custom Setup" from the "4-Up Setup" menu.



7. The quadrant with the backlit parameter value is the current selected parameter. Use the "Arrow Buttons" to highlight the parameter value in the quadrant you wish to place a new parameter.



8. Touch the "Enter Button" and a list of parameters will appear.

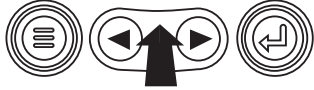


POWerview OPERATION *continued*

9. The parameter that is highlighted is the selected parameter for the screen. Use the "Arrow Buttons" to highlight the new parameter to be placed in the quadrant selected in the previous screen.

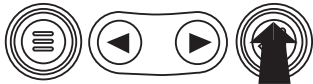
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

The number to the right of the parameter indicates the quadrant in which it is displayed.
 1. = Upper Left Quadrant
 2. = Lower Left Quadrant
 3. = Upper Right Quadrant
 4. = Lower Right Quadrant



10. Touch the "Enter Button" to change the selected parameter in the quadrant to the new parameter.

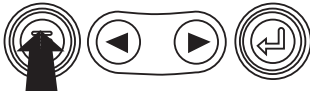
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	2
ENGINE OIL TEMPERATURE	
ENGINE OIL PRESSURE	4



11. Use the "Menu Button" to return to the "4-UP Custom Setup" screen.

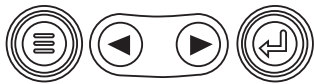
ENGINE SPEED	3
ENGINE HOURS	
ENGINE COOLANT TEMPERATURE	1
BATTERY POTENTIAL	
ENGINE OIL TEMPERATURE	2
ENGINE OIL PRESSURE	4

Note the number to the right of the selected parameter indicating that the parameter is now assigned to that display location.



12. The parameter in the selected quadrant has changed to the parameter selected in the previous screen.

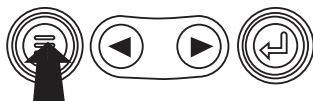
125°F COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



13. Repeat the parameter selection process until all spaces are filled.

14. Touch the "Menu Button" to return to the main menu.

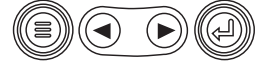
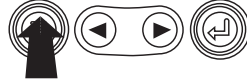
125°F COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



15. Touch the "Menu Button" to exit the Main menu and return to the engine parameter display.

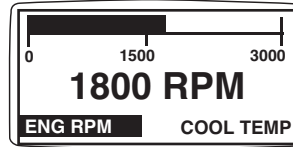
GO TO 1-UP DISPLAY
STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT

125% COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES

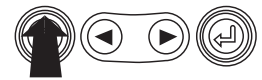
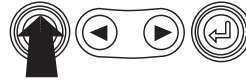


Utilities (Information and troubleshooting)

1. Starting at the single or four engine parameter display, touch the "Menu button"



125% COOL TEMP	1000 RPM ENG RPM
143°F OIL TEMP	57 PSI OIL PRES



2. The main menu will be displayed. Use the "Arrow buttons" to scroll through the menu until the "Utilities" is highlighted.

STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT
UTILITIES



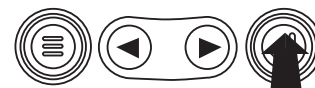
3. Once the "Utilities" menu item has been highlighted, touch the "Enter Button" to activate the "Utilities" functions.

STORED CODES
ENGINE CONFG
SETUP 1-UP DISPLAY
SETUP 4-UP DISPLAY
SELECT UNITS
ADJUST BACKLIGHT
UTILITIES

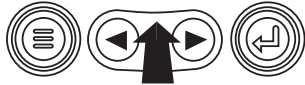
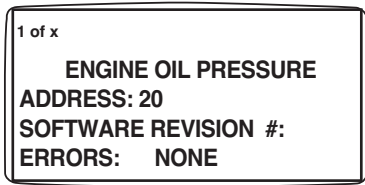


4. Touch "Select" to enter the "Gage Data" display. When "Gage Data" is selected the PowerView will communicate with the analog gages at a fixed rate of 38.4 k Baud, 8 data bits, no parity check, 1 stop bits, half duplex.

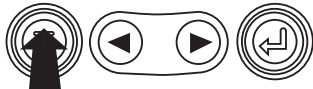
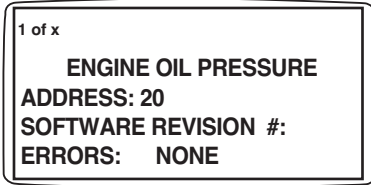
GAGE DATA
REMOVE ALL GAGES
SOFTWARE VERSION
MODBUS SETUP
FAULT CONVERSION
DEMO MODE ON



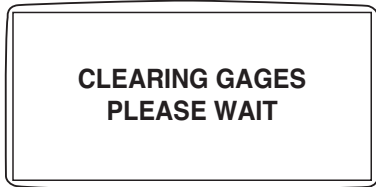
5. Use the “Arrow buttons” to scroll through the items or touch “Menu” to return to the “Utilities” menu.



6. Touch “Menu Button” to return to the “Utilities” menu.



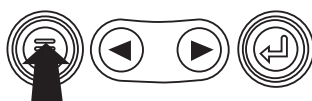
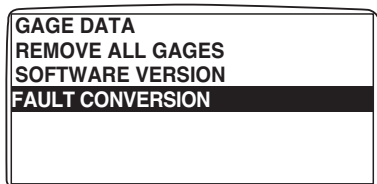
7. Use the “Arrows” to highlight “Remove All Gages”. Touch “Select” to clear gage data from memory. It takes a moment to clear all gages.



8. When the gage data has cleared, the display automatically returns to the “Utilities” menu. Scroll to “Software Version”. Touch “Select” to view the software version currently in the PowerView.



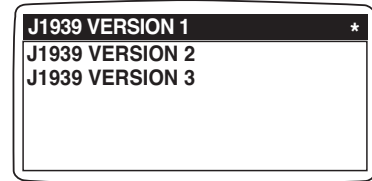
9. Touch “Menu” to return to “Utilities”. Highlight “Fault Conversion” using the “Arrows”. Touch “Select” to enter the Fault conversion menu.



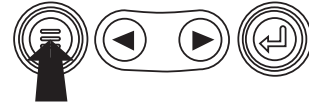
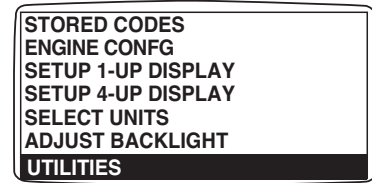
10. Use the “Arrows” to scroll to and highlight the desired version then touch “Select”. An asterisk denotes which version is currently selected.

NOTE: There are four (4) different methods for converting fault codes. The PowerView always looks for J1939 Version 4 and can be set to read the code as one of three (3) other J1939 versions if Version 4 is not being used. Most engine ECU’s use Version 4, therefore in most cases adjustment of this menu option will not be required.

Upon receiving an unrecognizable fault, change to a different J1939 Version. If the fault SPN does not change when the version is changed, the ECU generating the fault is using Fault Conversion method 4. If the SPN number does change but is still unrecognizable, try changing to another J1939 Version not yet used and continue to check the SPN number.

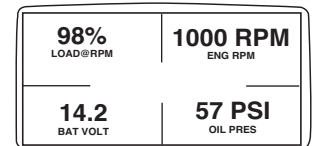
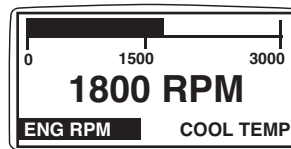


11. Touch the “Menu” button to return to “Utilities” menu. Touch the “Menu” button again to return to the “Main” menu.

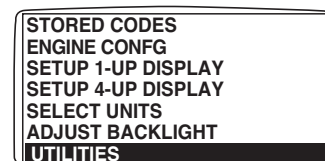


MODBUS Setup

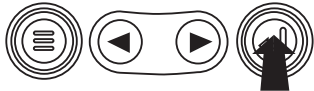
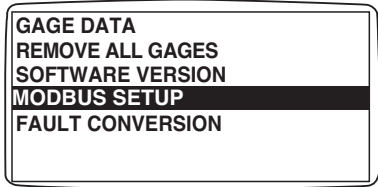
1. Starting at the single or four engine parameter display, touch the “Menu” button:



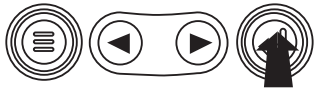
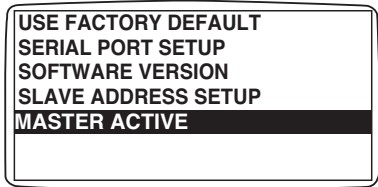
2. The main menu will be displayed. Use the “Arrow buttons” to scroll through the menu until the “Utilities” is highlighted, then touch “Enter”.



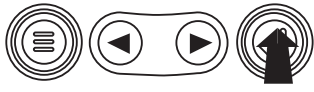
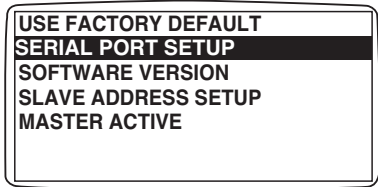
3. Once in the “Utilities” menu use the “Arrows” to scroll through the menu until the “Modbus Setup” menu is highlighted, then touch “Enter”.



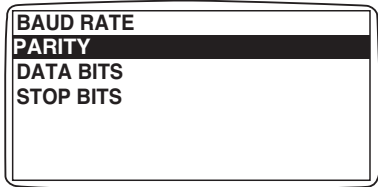
4. Use the “Arrows” to scroll down to and highlight either the “Slave Active or Master Active” modes. Touch the “Enter” button to toggle between master and slave.



5. Use the “Arrows” to scroll to the “Serial Port” menu to highlight it, then touch “Enter”.



6. Use the “Arrow” button to scroll to each selection to configure the MODBUS values for your application.



7. When finished, touch “Menu” to return to the previous screen.

SAE J1939 MurphyLink System Implementation of J1939 Parameters

Source: SAEJ1939-71 Surface Vehicle Recommended Practice

Description	PGN	Parameter	Display Value
Elec Eng Cont #2 - EEC2	61443	Accelerator Pedal Position Percent Load at Current RPM	THROTTLE LOAD@RPM
Elec Eng Cont #1 - EEC1	61444	Actual engine % torque Engine Speed	ENG TORQ ENG RPM
Engine hours, Revolutions	65253	Total Engine Hours	ENG HRS
Fuel Consumption	65257	Trip Fuel Total Fuel Used	TRIP FUEL FUEL USED
Engine Temperature	65262	Engine Coolant Temp Fuel Temperature Engine Oil Temperature Engine Intercooler Temperature	COOL TEMP FUEL TEMP OIL TEMP INTC TEMP
Engine Fluid Level/Pressure	65263	Fuel Delivery Pressure Engine Oil Level Engine Oil Pressure Coolant Pressure Coolant Level	FUEL PRES OIL LVL OIL PRES COOL PRES COOL LVL
Fuel Economy	65266	Fuel Rate Instantaneous Fuel Economy Average Fuel Economy	FUEL RATE FUEL ECON AVG ECON
Ambient Conditions	65269	Barometric Pressure Air Inlet Temperature	BARO PRES AIR IN TP
Inlet/Exhaust Conditions	65270	Boost Pressure Intake Manifold Temp Air Filter Differential Pressure Exhaust Gas Temperature	BST PRES MANI TEMP AIR DIF PR EXH TEMP
Engine Fluid Level/Pressure #2	65243	Injector Metering Rail 1 Pres Injector Metering Rail 2 Pres	INJ PRES1 INJ PRES2
Fan Drive-FD	65213	Estimated Percent Fan Speed	FAN SPD
Diagnostic Messages	65226 65227 65228	DM1 - Active Diagnostic DM2 - Previously Act Diag Codes DM3 - Diagnostic Clear	SRUCODE STORCODE
Machine Hours (PowerView Calculated)	N/A	Machine Hours	MACH HRS
Engine Conf.	65251	Engine Configuration	ENG CONF
Hydraulic Pressure Governor Info-HPG	61448	Hydraulic Oil Pressure	HYD PRES
Electronic Transmission Controller #1	61442	Output Shaft Speed	OUT SFT SP
Electronic Transmission Controller #1	61442	Input Shaft Speed	IN SFT SPD
Electronic Transmission Controller #1	61442	Torque Converter Lockup Engaged	TORQ LOCK
Electronic Transmission Controller #2	61445 61445	Selected Gear Current Gear	SLECT GEAR CURNT GEAR
Transmission Fluids	65272	Transmission Oil Pressure Transmission Oil Temperature	TRAN PRES TRAN TEMP
Transmission Control 1-TC1	256	Requested Gear	REQ GEAR
Auxiliary Pressures & Temperatures	65164	Auxiliary Temperature Auxiliary Pressure	AUX TEMP AUX PRES
Auxiliary Input/Output Status	65241	Auxiliary I/O #1	AUX I0 1
Cruise Control /Vehicle Speed	65265	Wheel Based Vehicle Speed	VEH SPD
Vehicle Electrical Power	65271	Alternator Voltage Electrical Potential (Voltage) Battery Pot. Voltage (Switched)	ALT VOLT SYS VOLT BAT VOLT
Vehicle Distance	65248	Trip Distance Total Vehicle Distance	TRIP DIST VEH DIST
Vehicle Fluids-VF	65128	Hydraulic Oil Temperature	HYD TEMP
Dash Display-DD	65276	Fuel Level	FUEL LEVEL
Rudder	127245	Rudder Angle	RUD ANG
Speed	128259	Water Referenced	H2O REF.SP
Small Craft Status, Port Trim	130576	Port Trim Tab	P TRIM TAB
Small Craft Status, Starboard Trim	130576	Starboard Trim Tab	S TRIM TAB
Support Allison DTCs		Retarded Temperature Above Normal (SPN=120, FMI=15)	RETARDED OIL TEMPERATURE ABOVE NORMAL
		Transmission Oil Temperature Above Normal (SPN=177, FMI=15)	TRANSMISSION OIL TEMPERATURE ABOVE NORMAL
		Unknown General Transmission Fault (SPN=2003, FMI=31)	GENERAL TRANSMISSION FAULT UNKNOWN

GLOSSARY (Troubleshooting information)

CANBUS FAILURE

PowerView has not received any CAN messages for at least 30 seconds.

NO DATA

PowerView has not received the particular message being displayed for at least 5 seconds.

NOT SUPPORTED

PowerView has received a message from the ECU stating the displayed message is not supported.

DATA ERROR

PowerView has received an error message from the ECU for the displayed message.

EMPTY

No parameter selected for this 4-UP quadrant.

WAIT TO START PREHEATING

This is a message from the engine indicating it is in a preheating cycle.
Wait until this message clears before starting the engine.

TIMEOUT ECU NOT RESPONDING

The ECU did not respond to the PowerView request.

NO GAGE DATA

The PowerView has no record of connected gages to the RS485 bus.

Display Not Visible

Press and hold the “Menu” button for approximately 3 seconds.



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TROUBLESHOOTING CHECK LIST

CAUSE

REMEDY

ENGINE WON'T CRANK

- | | |
|-----------------------------------|----------------------|
| 1. SHIFT LEVER IN WRONG POSITION | 1. APPLY TO NEUTRAL |
| 2. PARK BRAKE NOT APPLIED | 2. APPLY PARK BRAKE |
| 3. MAIN FUSE IN BATTERY BOX BLOWN | 3. REPLACE FUSE |
| 4. DEAD BATTERY | 4. CHARGE OR REPLACE |
| 5. LOOSE OR CORRODED CABLES | 5. CLEAN AND TIGHTEN |
| 6. NEUTRAL START SWITCH FAULTY | 6. REPLACE SWITCH |
| 7. START SWITCH FAULTY | 7. REPLACE SWITCH |
| 8. STARTER FAULTY | 8. REPLACE STARTER |

ENGINE CRANKS BUT WON'T START

- | | |
|---------------------------|---|
| 1. OUT OF FUEL | 1. FILL TANK |
| 2. SHUT OFF VALVES CLOSED | 2. OPEN VALVES |
| 3. FUEL FILTER PLUGGED | 3. REPLACE FILTER |
| 4. FUEL LINES LEAKING | 4. TIGHTEN ALL LINES |
| 5. PREHEAT FAILS | 5. TIGHTEN TERMINALS, REPLACE IF NEEDED |

ENGINE OVERHEATS

- | | |
|-------------------------|---|
| 1. BROKEN FAN BELT | 1. REPLACE BELT |
| 2. AIR INLET OBSTRUCTED | 2. REMOVE OBSTRUCTION |
| 3. LOW COOLANT LEVEL | 3. FILL SYSTEM |
| 4. RADIATOR BLOCKED | 4. CLEAN WITH COMPRESSED AIR OR HIGH PRESSURE WATER |

LOW OIL PRESSURE

- | | |
|-------------------------------|------------------------------|
| 1. LOW OIL LEVEL | 1. FILL TO PROPER LEVEL |
| 2. PRESSURE GAUGE FAULTY | 2. REPLACE GAUGE |
| 3. RELIEF VALVE FAULTY | 3. CLEAN OR REPLACE |
| 4. OIL PUMP WORN | 4. REPLACE PUMP |
| 5. EXCESSIVE WEAR IN BEARINGS | 5. REBUILD OR REPLACE ENGINE |

TRANSMISSION NOT FUNCTIONING PROPERLY

SEE "CONVERTER AND TRANSMISSION – SECTION 5" OF SPARE PARTS AND MAINTENANCE MANUAL.



TROUBLESHOOTING CHECK LIST

PARKING BRAKE NOT HOLDING PROPERLY

- | | |
|----------------------------|-----------------|
| 1. BRAKE OUT OF ADJUSTMENT | 1. READJUST |
| 2. BRAKE PADS WORN OUT | 2. REPLACE PADS |

PARKING BRAKE WON'T RELEASE

- | | |
|---------------------------|--|
| 1. HYDRAULIC PRESSURE LOW | 1. CHECK OIL LEVEL, SEE BRAKE COMPONENTS SERVICE MANUALS |
| 2. LOOSE OR BROKEN LINES | 2. TIGHTEN OR REPLACE |

STEERING SYSTEM NOT FUNCTIONING PROPERLY

- | | |
|---|--|
| 1. HYDRAULIC OIL LEVEL TOO LOW | 1. FILL TO PROPER LEVEL |
| 2. RELIEF VALVE IN FLOW DIVIDER TOO LOW | 2. CLEAN OR REPLACE AND CHECK RELIEF SETTING |
| 3. HYDRAULIC PUMP WORN | 3. REPLACE PUMP |
| 4. STEERING VALVE FAULTY | 4. REPLACE VALVE |
| 5. STEER CYLINDER LEAKING | 5. REPAIR OR REPLACE |

HYDRAULIC SYSTEM NOT FUNCTIONING PROPERLY

- | | |
|--------------------------------------|-----------------------------|
| 1. LOW FLUID LEVEL | 1. FILL TO PROPER LEVEL |
| 2. SUCTION STRAINER BLOCKED | 2. CLEAN OR REPLACE |
| 3. HYDRAULIC FILTERS PLUGGED | 3. REPLACE FILTERS |
| 4. LOOSE CONNECTIONS OR DAMAGED HOSE | 4. TIGHTEN OR REPLACE |
| 5. RELIEF VALVE STICKING | 5. CLEAN OR REPLACE |
| 6. RELIEF VALVE SET TOO LOW | 6. ADJUST TO PROPER SETTING |
| 7. WORN PUMP | 7. REPLACE PUMP |



PREVENTIVE MAINTENANCE SCHEDULE FORMS

12630
Page 1 of 5

S/N _____ HOURS _____ DATE _____

SIGNATURE _____

DAILY SERVICES

OK	PARTS ORDERED	UNIT DOWN	PERFORM THE FOLLOWING CHECKS
			Tire pressure and condition
			Hydraulic fluid level
			Engine oil level
			Clean intake precleaner dust bowl
			Fuel level
			Engine belt adjustment and wear
			Grease axle trunnions
			Transmission fluid level
			Grease top and bottom articulation pins
			Grease steer cylinder pins
			Hydraulic system leaks
			Fuel system leaks
			Instrument operation
			All controls for movement and adjustment
			Park brake performance
			Service brake performance



PREVENTIVE MAINTENANCE SCHEDULE FORMS

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Page 3 of 5

S/N _____ HOURS _____ DATE _____

SIGNATURE _____

250 HOUR SERVICE

OK	PARTS ORDERED	UNIT DOWN	PERFORM THE FOLLOWING CHECKS
			Grease driveline and universal joints
			Change transmission fluid
			Change transmission filter
			Change hydraulic fluid
			Change hydraulic filter element
			Check differential fluid levels
			Clean axle breather vents
			Change engine oil
			Change engine oil filter
			Change fuel filter
			Change fuel water separator
			Check park brake adjustment
			50 hour services
			Daily services



PREVENTIVE MAINTENANCE SCHEDULE FORMS

S/N _____ HOURS _____ DATE _____

SIGNATURE _____

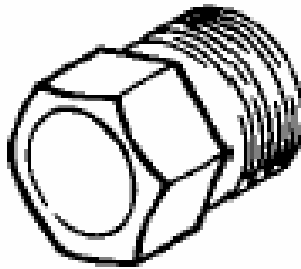
1000 HOUR SERVICES

OK	PARTS ORDERED	UNIT DOWN	PERFORM THE FOLLOWING CHECKS
			Change differential fluid
			500 hour services
			250 hour services
			50 hour services
			Daily services

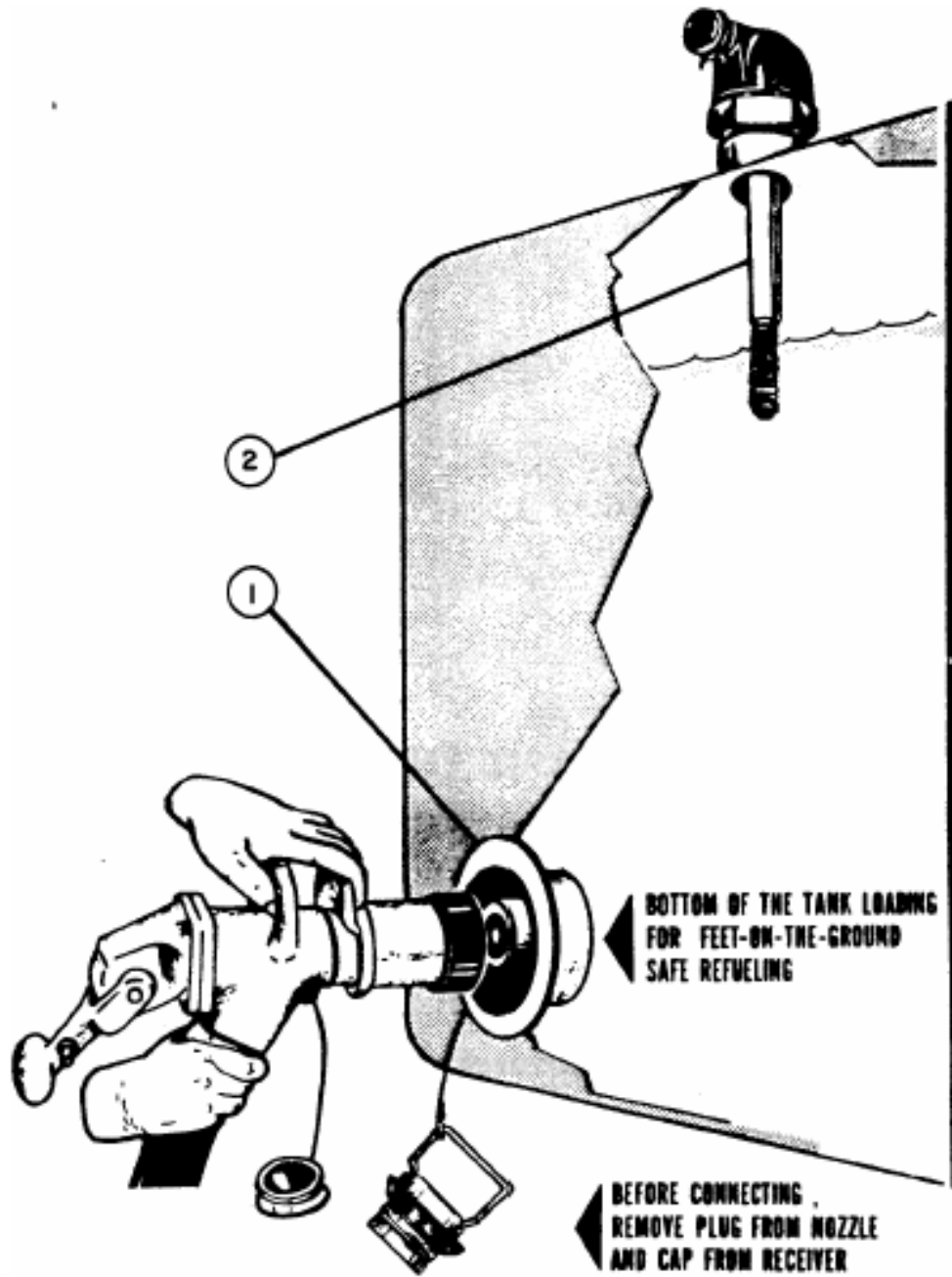
PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

2. CHASSIS

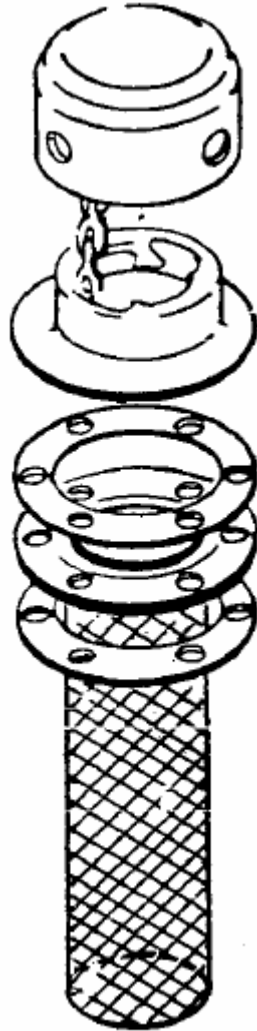
10368	SIGHT GAUGE
11623	AUTO REFUELING SYSTEM
10398	FILL CAP (HYDRAULIC OIL)
15060	HYDRAULIC AUTO FILL
10448	HOLD DOWN FASTENERS
13758	SEAT ASSEMBLY
13942	STEERING (PINS, BEARINGS, BUSHINGS)
12043	ARTICULATION INSTALLATION
13960	ENCLOSED OPERATOR'S COMPARTMENT



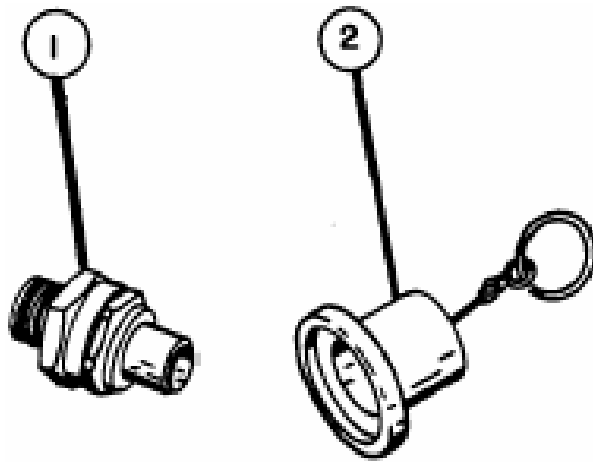
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	53011	WINDOW SIGHT GAUGE	1



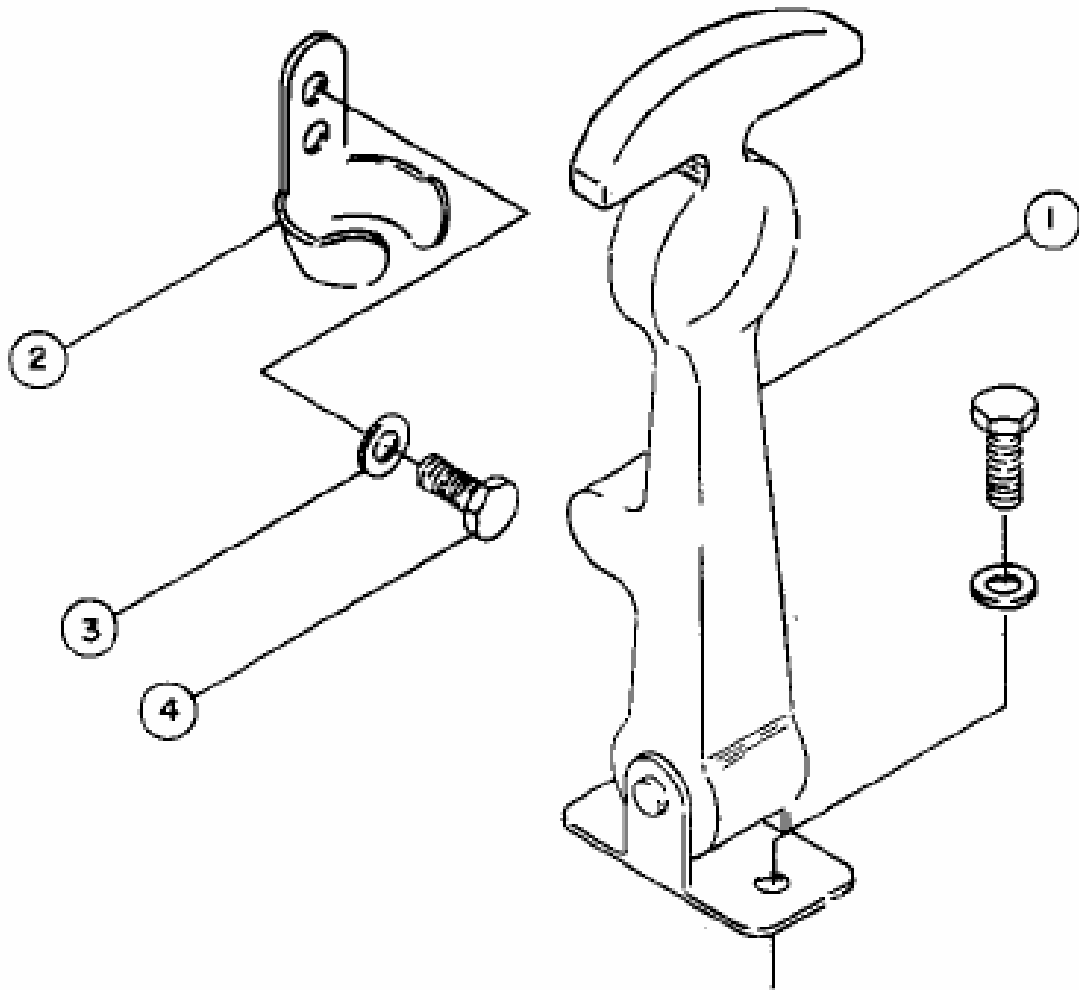
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	394003	RECEIVER AND CAP	1
2	394008	FUELING VENT	1



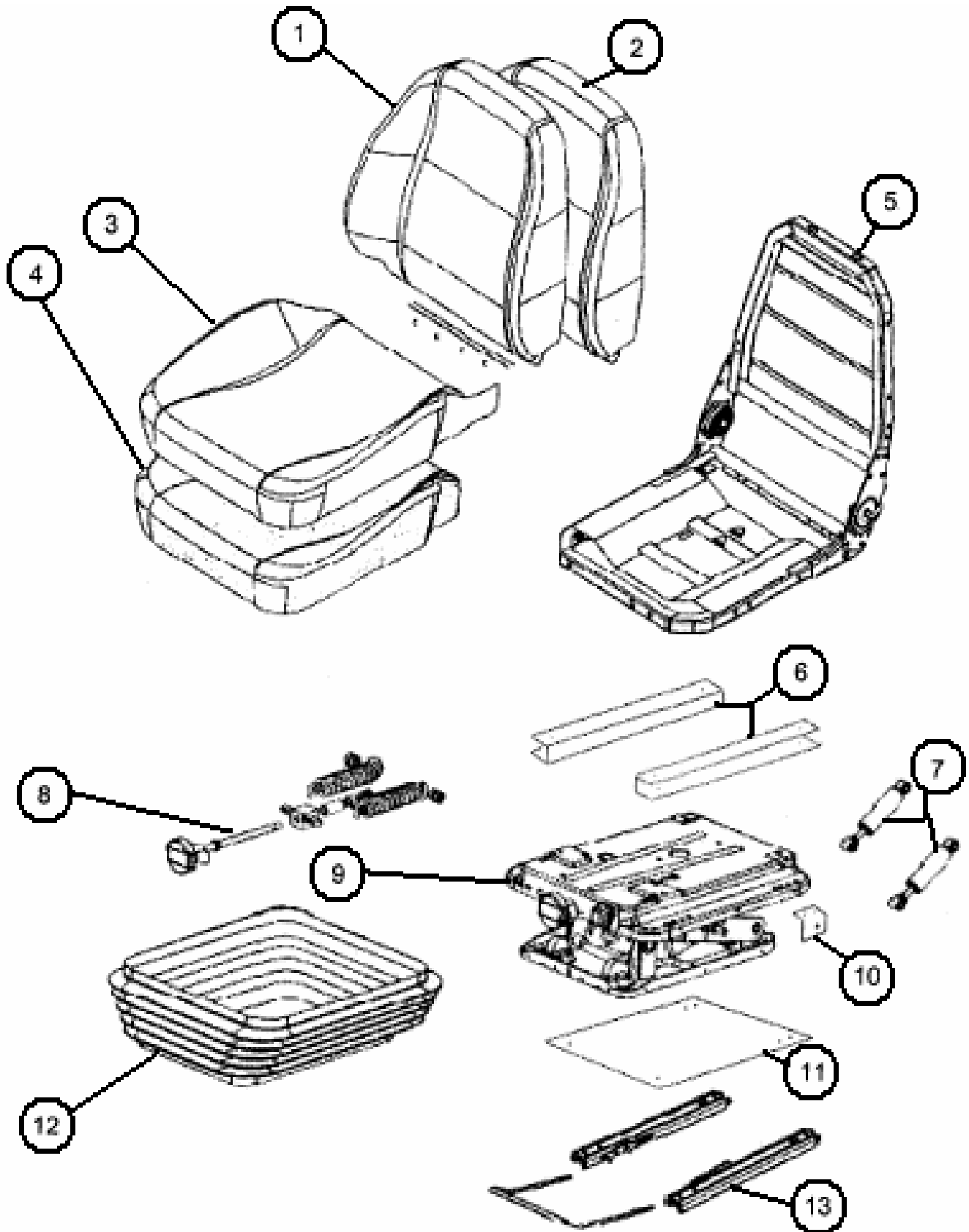
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	52500	CAP & SCREEN ASSEMBLY	1
1	54048	CAP	1
2	54003	SCREEN	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	394004	RECEIVER	1
2	394005	CAP	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	132130	HOLD DOWN ASSEMBLY (INCLUDES ITEMS 5, 6)	1
2	594535	CLIP (USE AS REQUIRED)	1
3	01GE04	WASHER	4
4	01GC04008	BOLT	4
5*	NSS	STRAP	1
6*	NSS	CLIP (90 DEGREE MOUNT)	1

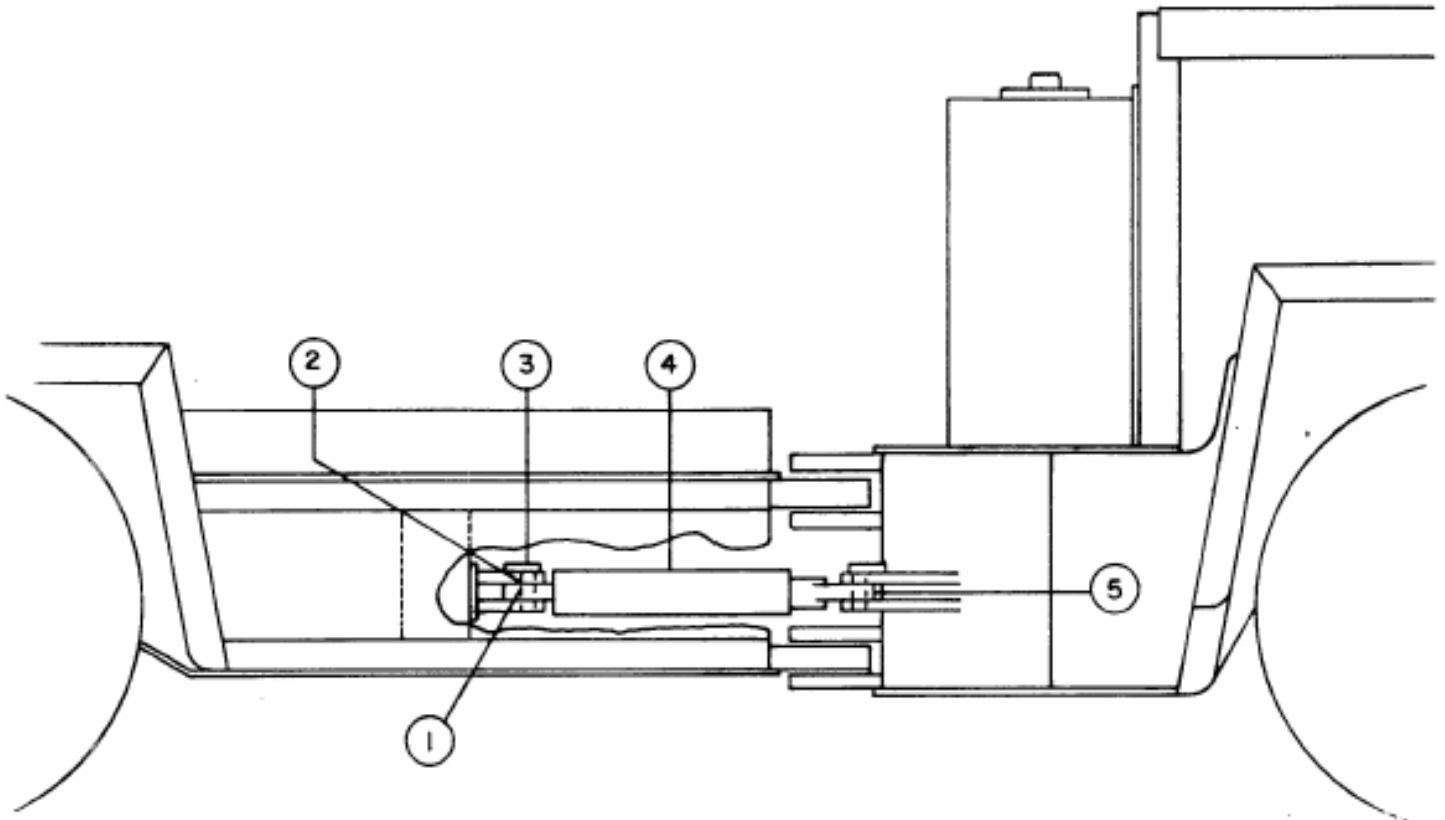




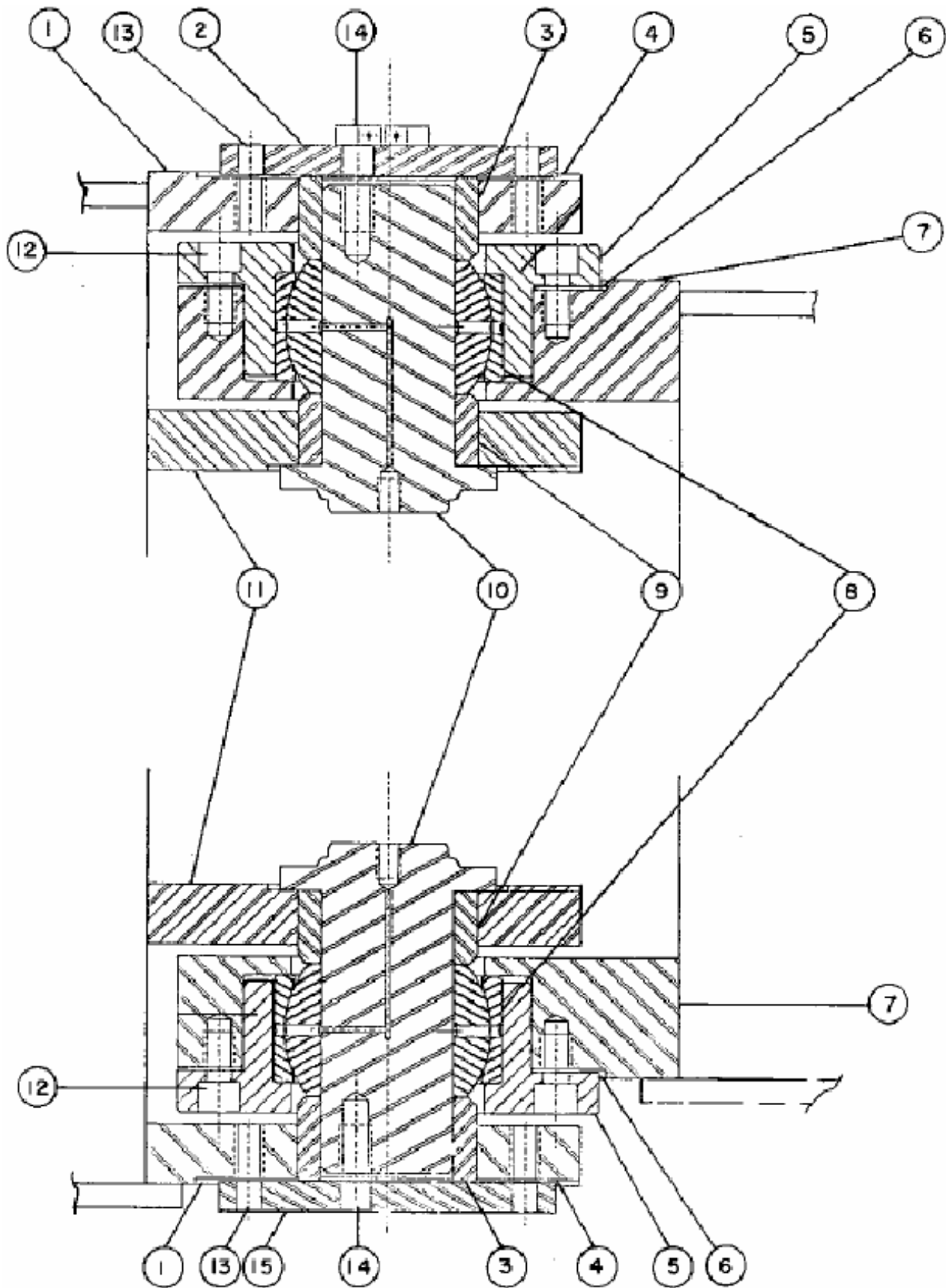
SEAT ASSEMBLY

13758
Page 2 of 2

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	424396	SEAT ASSEMBLY	1
1	424396-01	SEAT BACK COVER	1
2	424396-02	SEAT BACK FOAM	1
3	424396-03	SEAT BOTTOM COVER	1
4	424396-04	SEAT BOTTOM FOAM	1
5	424396-05	FRAME	1
6	424396-06	SEAT MOUNTING CHANNELS	1
7	424396-07	DAMPER KIT	1
8	424396-08	WEIGHT ADJUSTER KIT	1
9	424396-09	SUSPENSION	1
10	424396-10	SEATBELT BRACKET	1
11	424396-11	SLIDERAILED MOUNTING PLATE	1
12	424396-12	SUSPENSION COVER	1
13	424396-13	SLIDERAIL KIT	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	26409-01	BEARING (IN CYLINDER TUBE END)	2
2	524202	BUSHING (STEERING EAR)	8
3	13796-01	PIN (STEERING CYLINDER)	4
4	465411	STEERING CYLINDER	2
5	524203	BUSHING (STEERING CYLINDER)	2





ARTICULATION JOINT

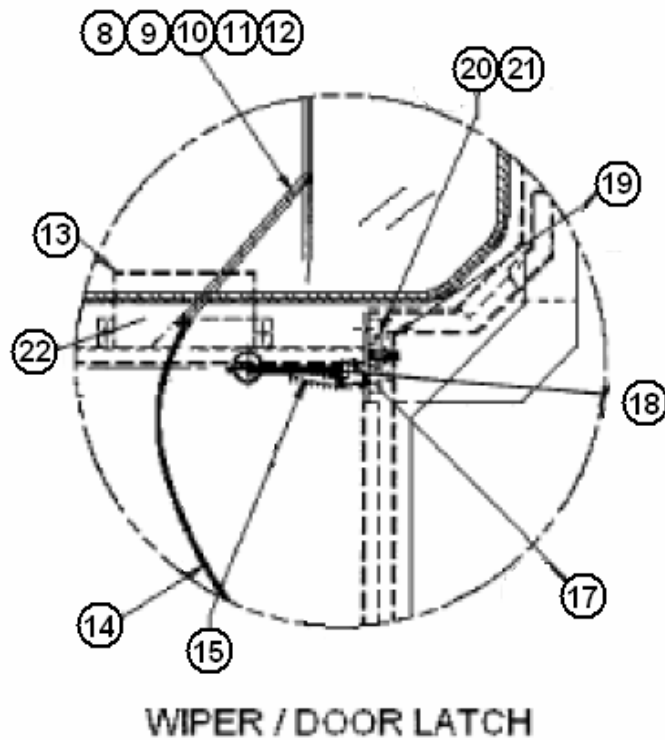
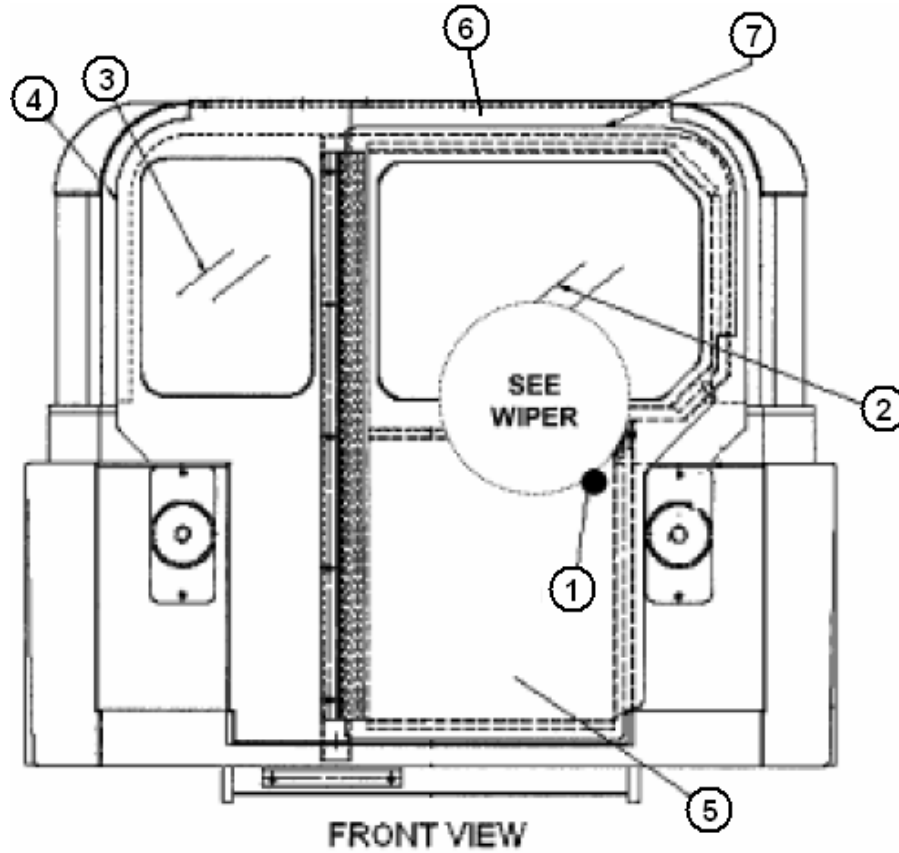
12043
Page 2 of 3

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	464332	ARTICULATION JOINT KIT (LRD 220) (INCLUDES ITEMS 1-14)	1
	464469	ARTICULATION JOINT KIT (A-64 WIDE) (INCLUDES ITEMS 1-14)	1
	464579	ARTICULATION JOINT KIT (A-64 STANDARD) (INCLUDES ITEMS 1-14)	1
	464739	ARTICULATION JOINT KIT (LRD 220) (INCLUDES ITEMS 1-14)	1
1	NSS	JOINT PLATE	2
2	10697-01	CAP PIN	1
3	16369-02	BUSHING - CAP SIDE	2
4	594572	SHIM CAP (.005 IN.) (.13MM)	A/R
	594573	SHIM CAP (.007 IN.) (.18MM)	A/R
	594574	SHIM CAP (.020 IN.) (.51MM)	A/R
5	16367-03	BEARING INSERT ASSEMBLY (INCLUDES ITEM 8)	2
6	594575	SHIM INSERT (.005 IN.) (.13MM)	A/R
	594576	SHIM INSERT (.007 IN.) (.18MM)	A/R
	594577	SHIM INSERT (.020 IN.) (.51MM)	A/R
7	NSS	JOINT PLATE	2
8	264032	BEARING	2
9	16369-03	BUSHING PIN SIDE	2
10	13796-03	PIN	2
11	NSS	JOINT PLATE	2
12	73GC08016	CAP SCREW (SCKT HD)	12
13	17GC08024	CAP SCREW (HEX HD)	12
14	464420	CAP SCREW (HEX HD)	6
15	10697-01	CAP PIN	1

Updated:
12/11/06



1. MALE ASSEMBLY: INSTALL BEARING – INSERT (ITEM 5) WITH 3 SOCKET HEAD CAPSCREWS (ITEM 12) EQUALLY SPACED WITH NO SHIMS. TORQUE SOCKET HEAD CAPSCREWS TO (65 LB. FT.) (88N-M) AND MEASURE THE SPACE FOR THE NUMBER OF (7" DIA.) (178MM) B.C. SHIMS REQUIRED (APPROX. .060). DISASSEMBLE AND INSERT REQUIRED NUMBER OF SHIMS, REASSEMBLE AND INSTALL 6 SOCKET HEAD CAPSCREWS (ITEM 12) WITH LOCKTITE AND TORQUE TO (100 LB. FT.) (135 N-M). REPEAT PROCESS FOR BOTH TOP AND BOTTOM OF JOINT.
2. JOINT ASSEMBLY: INSTALL BUSHINGS (TOP ITEM 3, BOTTOM ITEM 9) WITH PIN (ITEM 10) AND CAP (ITEM 2) AND CAPSCREW (ITEM 14) TORQUE TO (100 LB. FT.) (135 N-M) AND MEASURE THE SPACE FOR THE NUMBER OF (5 3/4") (145MM) B.C. SHIMS REQUIRED. DISASSEMBLE AND INSERT THE REQUIRED SHIMS (LESS .010") (.25MM) REASSEMBLE AND TORQUE THE (ITEM 14) CAPSCREW TO (175 LB. FT.) (235 N-M), AND LOCKWIRE THE BOLTS TOGETHER. INSTALL THE 6 CAPSCREWS (ITEM 13) WITH LOCKTITE AND TORQUE TO (100 LB. FT.) (135 LB. FT.). REPEAT PROCESS FOR BOTH TOP AND BOTTOM OF JOINT.





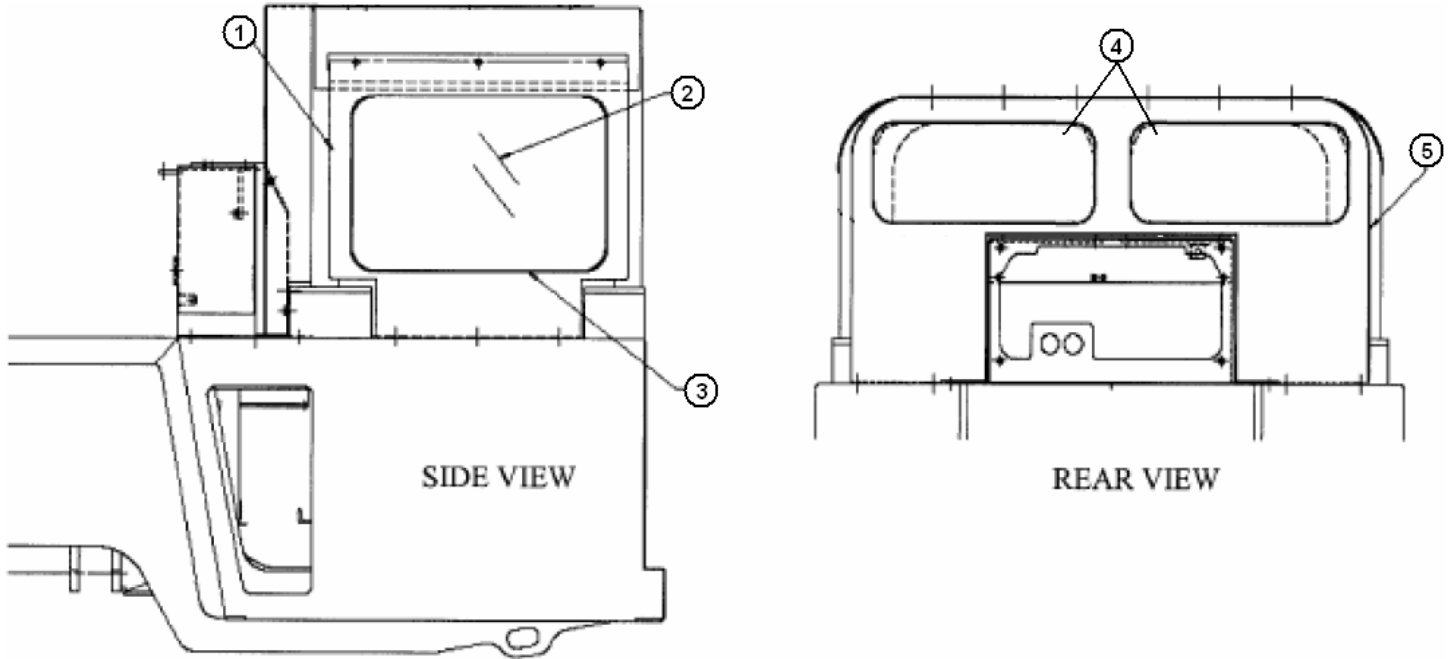
ENCLOSED OPERATOR'S COMPARTMENT

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Page 2 of 3

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	102080	DOOR KNOB	2
2	10044-19	FRONT DOOR GLASS	1
3	10044-22	FRONT GLASS	1
4	10044-14	FRONT FRAME WELDMENT	1
5	10044-09	DOOR WELDMENT	1
6	10044-16	DOOR FRAME WELDMENT	1
7	284188	DOOR EDGE TRIM	A/R
8	284227	WIPER ARM (8" – 11 1/2" ADJUSTABLE) (SIDE & REAR WINDOWS)	4
	284231	WIPER ARM (17") (FRONT DRIVER SIDE WINDOW)	1
	12569-06	WIPER ARM (13 3/8") (FRONT PASS. SIDE WINDOW)	1
9	284228	WIPER BLADE (11") (REAR WINDOWS)	2
	284235	WIPER BLADE (12") (SIDE WINDOWS)	2
	284230	WIPER BLADE (15") (FRONT WINDOWS)	2
10	605737	WIPER NOZZLE	6
11	605738	WIPER HOSE 1/8"	A/R
12	605736	WIPER COWL ASSEMBLY	6
13	12569-01	WIPER COVER WELDMENT	1
	12569-05	WIPER COVER WELDMENT	1
14	605742	WIPER HOSE 3/16"	A/R
15	34015	DOOR LATCH RETURN SPRING	1
16*	284233	WASHER KIT 24V	1
17	133011	DOOR LATCH BALL JOINT	2
18	19219-25	DOOR LATCH ROD	1
19	12581-01	LATCH POST MOUNT	1
20	605729	STRIKER STUD	1
21	605730	STRIKER LATCH	1
22	605756	WIPER PANTO ADAPT (FRONT WINDOWS)	2
23*	284232	WIPER MOTOR (FRONT PASSENGER SIDE WINDOW)	1
	605745	WIPER MOTOR (FRONT DRIVER SIDE WINDOW)	1
	284229	WIPER MOTOR (SIDE & REAR WINDOWS)	4

*ITEMS NOT SHOWN

Updated:
12/11/06



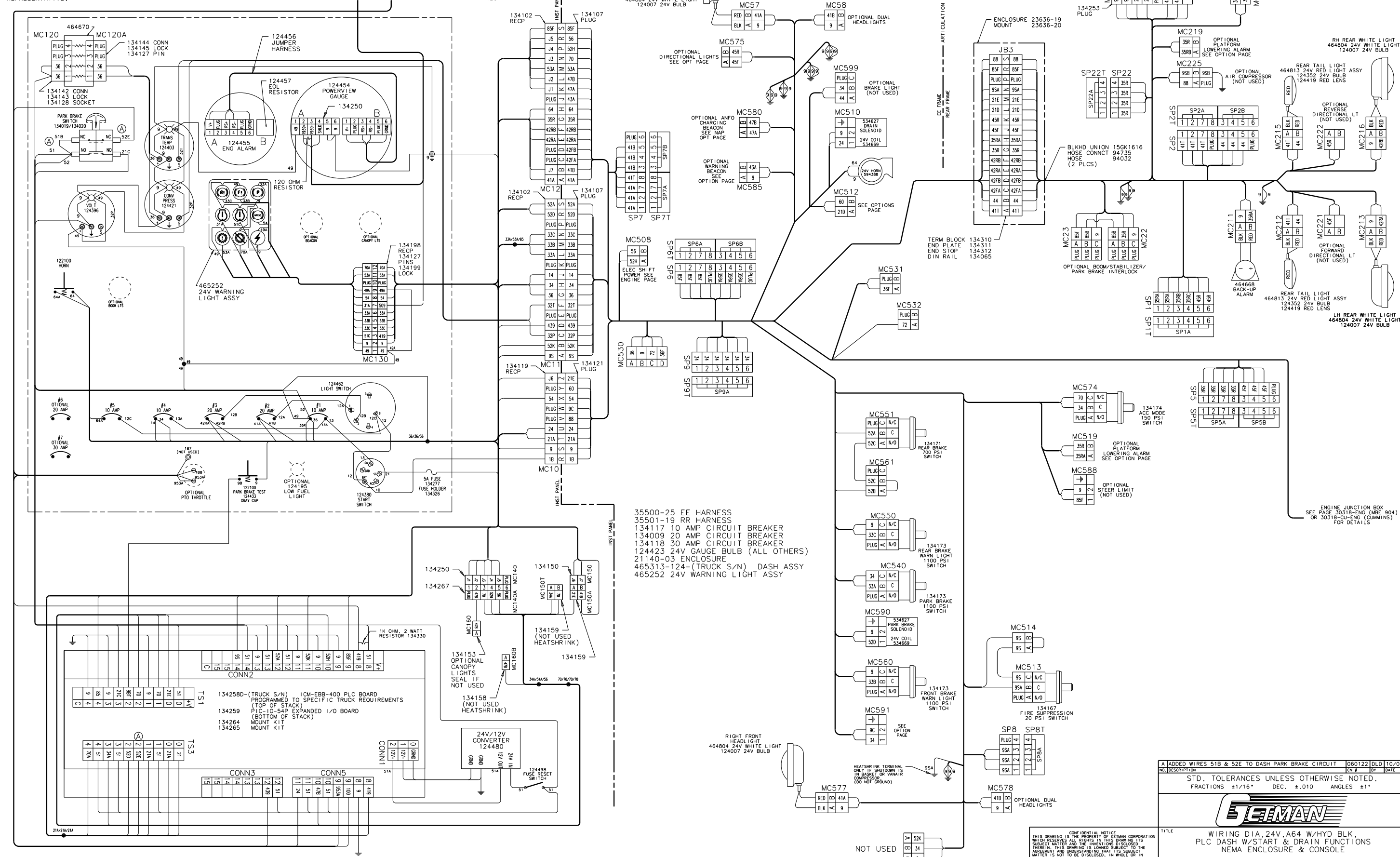
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	10044-02	SIDE FRAME (PASSENGER SIDE)	1
	10044-01	SIDE FRAME (OPERATOR SIDE)	1
2	10044-21	SIDE GLASS (PASSENGER SIDE)	1
	595391	SLIDING WINDOW (OPERATOR SIDE)	1
3	248140	WINDOW RUBBER (FOR ALL WINDOWS)	A/R
4	10044-18	REAR GLASS	2
5	10044-15	REAR FRAME WINDOW WELDMENT	1
6*	465243	DEFROSTER FAN	2
7*	SEE ELEC. DRAWING	AIR CONDITIONER (OPTIONAL)	1
8*	SEE ELEC. DRAWING	HEATER (OPTIONAL)	1

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

3. ELECTRICAL SYSTEM AND INSTRUMENTS

30318	WIRING DIAGRAM
13907	INSTRUMENT PANEL
13747	ENGINE FUNCTION DISPLAY PANEL
13663	ALTERNATOR
13691	BACK-UP ALARM

THIS VIEW SHOWS THE APPROXIMATE LOCATIONS OF THE GAUGES AND SWITCHES FROM THE BACK OF THE PANEL (INDICATED BY DOTTED LINE). LOCATIONS OF THE PLC BOARDS AND CONNECTORS MC10-13 ARE NOT REPRESENTATIVE.



35500-25 EE HARNESS
 35501-19 RR HARNESS
 134117 10 AMP CIRCUIT BREAKER
 134009 20 AMP CIRCUIT BREAKER
 134118 30 AMP CIRCUIT BREAKER
 124423 24V GAUGE BULB (ALL OTHERS)
 21140-03 ENCLOSURE
 465313-124-(TRUCK S/N) DASH ASSY
 465252 24V WARNING LIGHT ASSY

A ADDED WIRES 51B & 52E TO DASH PARK BRAKE CIRCUIT 060122/DLD 10/06
 NO. DESCRIPTION CN # BY DATE
 STD. TOLERANCES UNLESS OTHERWISE NOTED.
 FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°

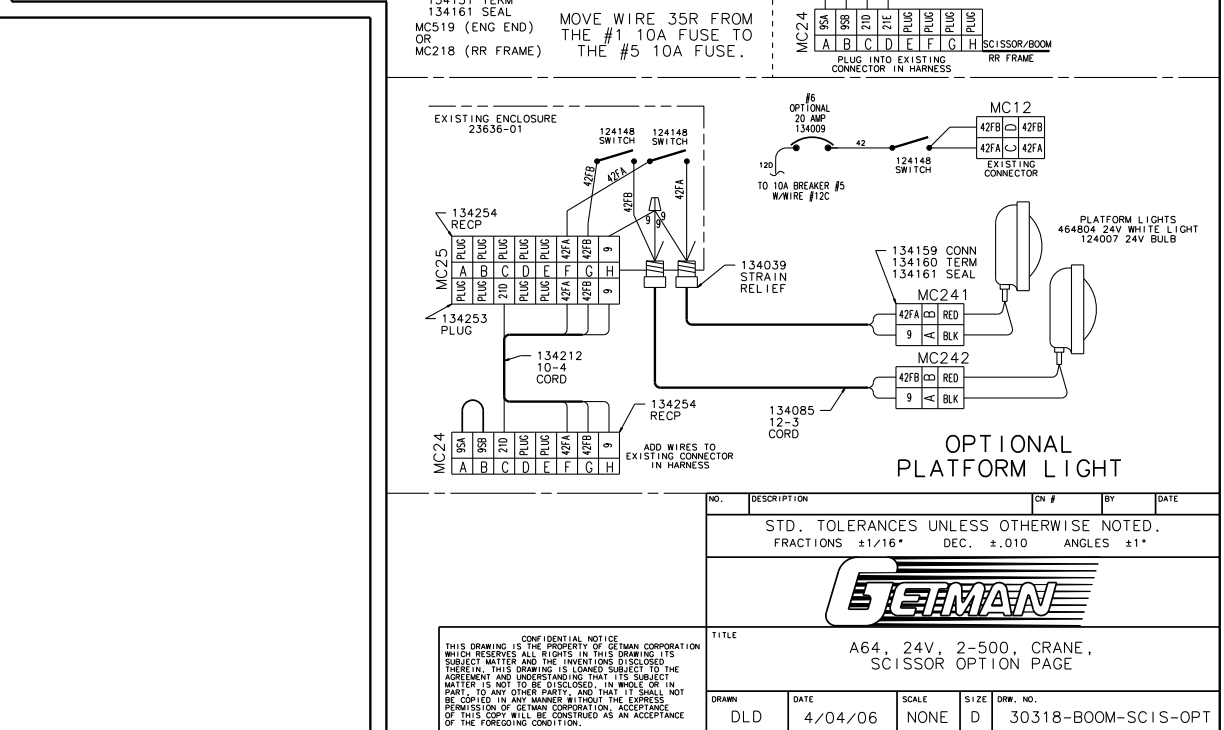
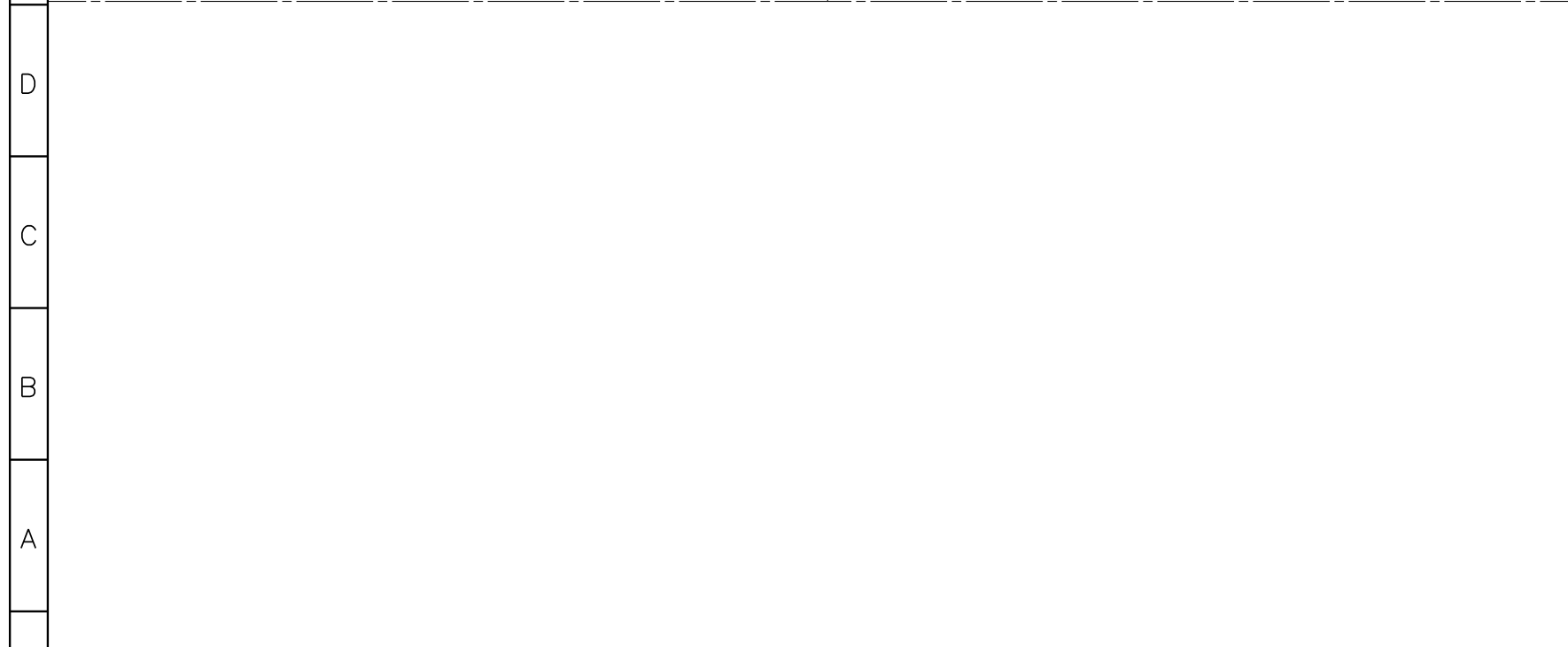
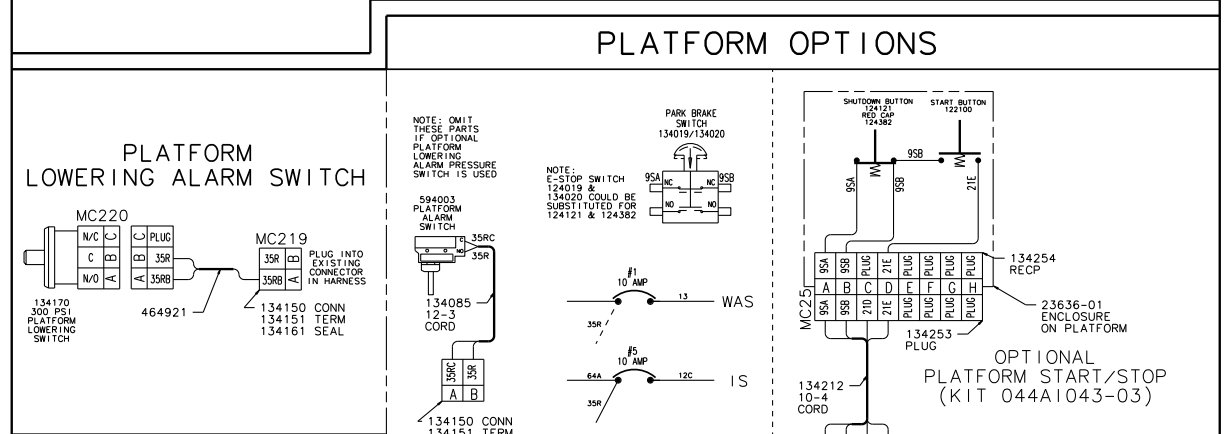
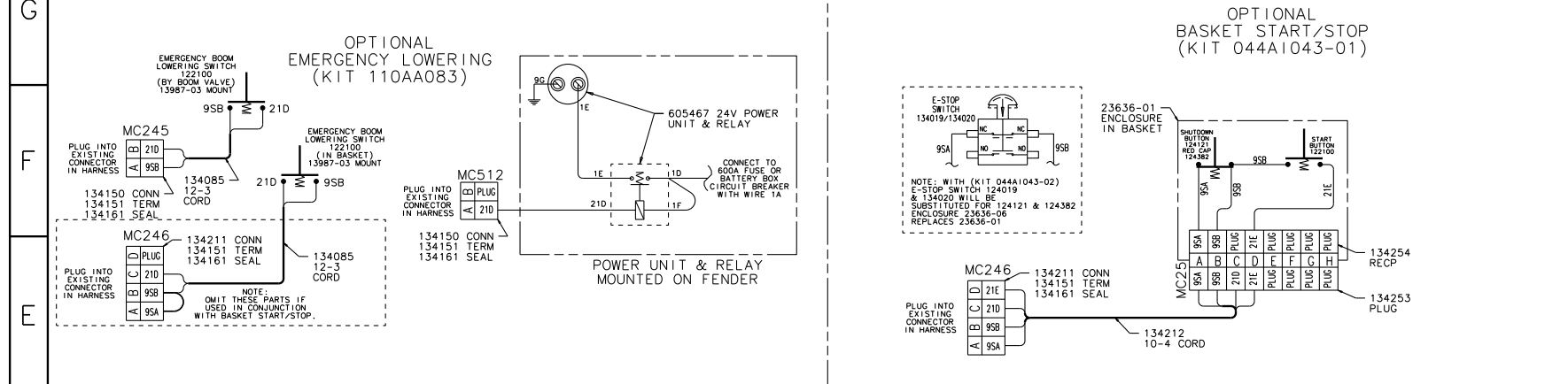
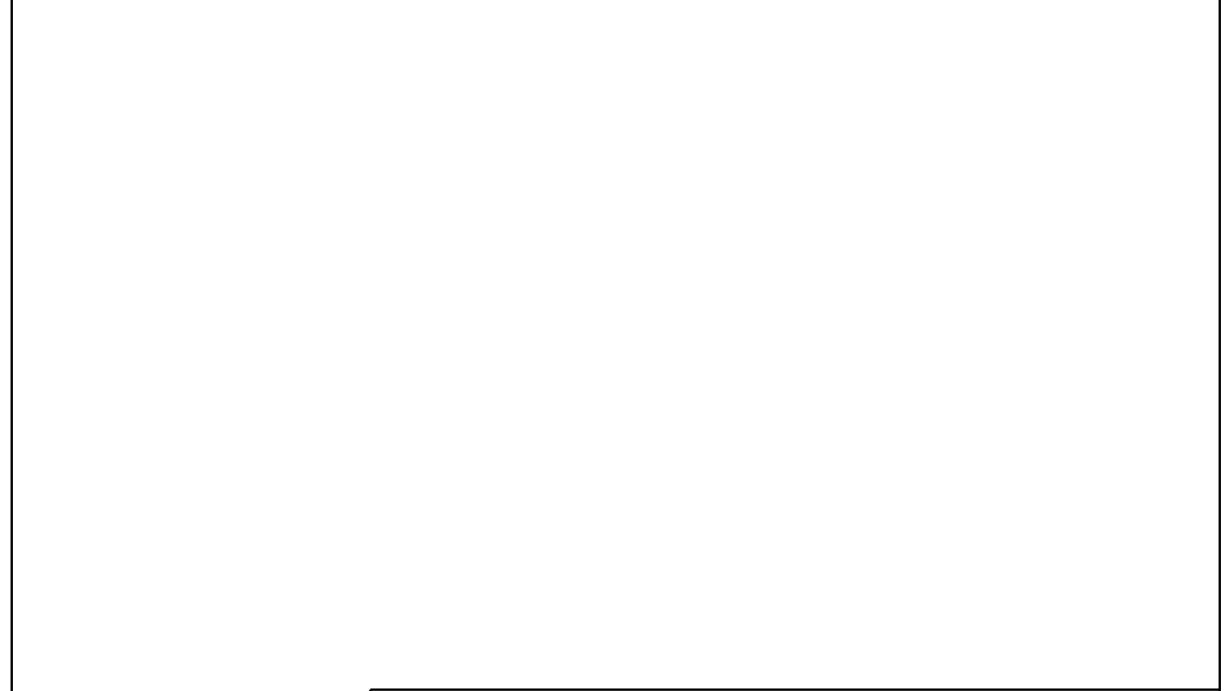
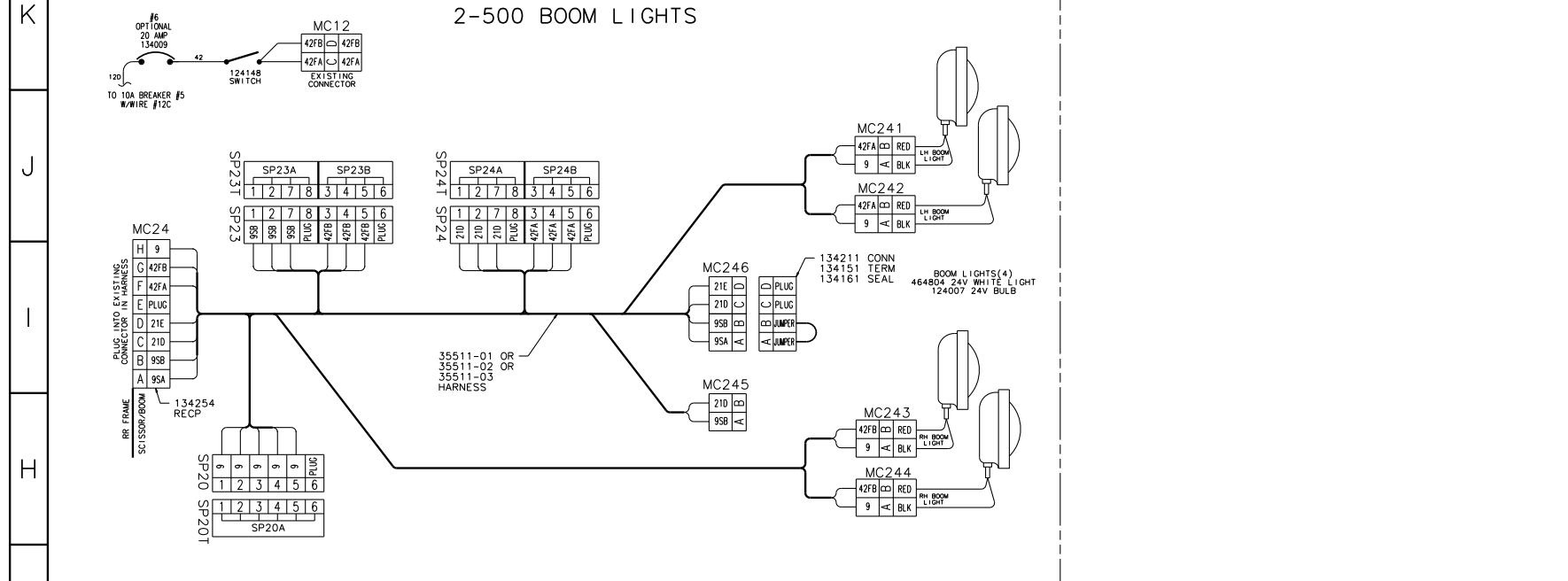


TITLE
 WIRING DIA., 24V, A64 W/HYD BLK,
 PLC DASH W/START & DRAIN FUNCTIONS
 NEMA ENCLOSURE & CONSOLE
 DRAWN DLD DATE 2/21/06 SCALE NONE SIZE D DRW. NO. 30318

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2-500 OPTIONS

CRANE OPTIONS

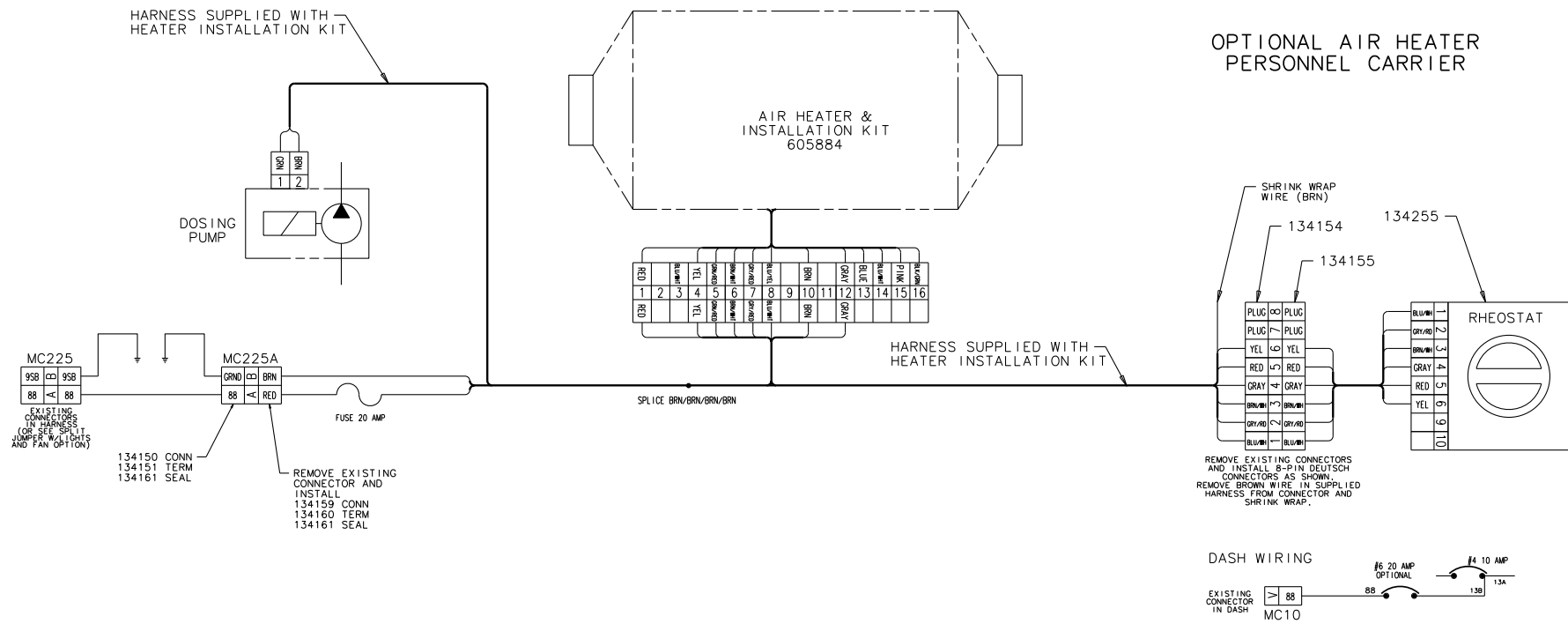


NO.	DESCRIPTION	QTY	BY	DATE
STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°				
GETMAN				
TITLE: A64, 24V, 2-500, CRANE, SCISSOR OPTION PAGE				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
DLD	4/04/06	NONE	D	30318-BOOM-SCIS-OPT

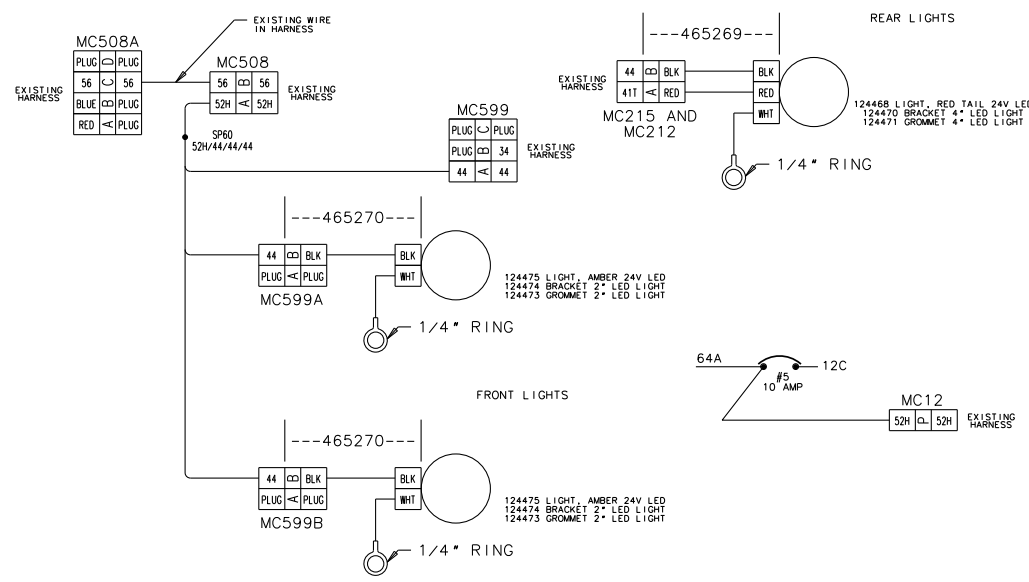
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NAP OPTIONS

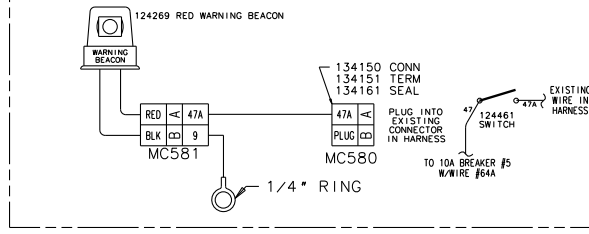
OPTIONAL AIR HEATER PERSONNEL CARRIER



OPTIONAL LED PARKING LIGHTS



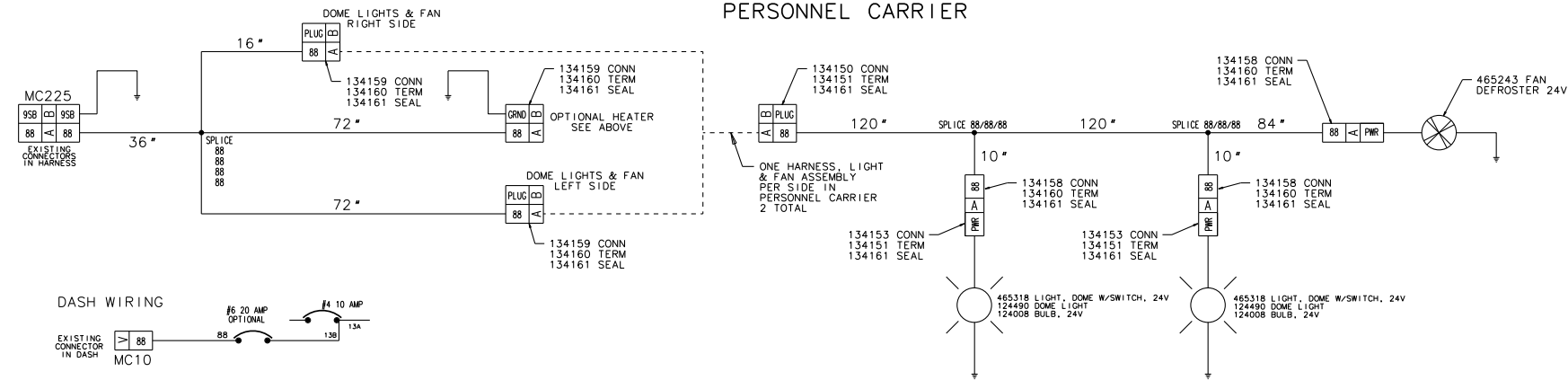
OPTIONAL ANFO CHARGING BEACON



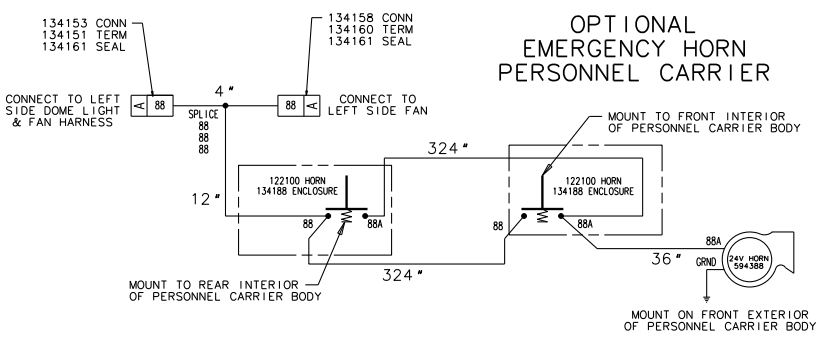
OPTIONAL ANFO CHARGING BEACON					
WIRE NO	GAUGE	COLOR	TERMINAL A	TERMINAL B	
9	12	BLACK	MC581(PIN A)	#10 RING	
47	12	PINK	BREAKER #5	OPT BEACON SW	
47A	12	PINK	MC580(PIN B)	MC581(PIN B)	

OPTIONAL LED PARKING LIGHTS					
WIRE NO	GAUGE	COLOR	TERMINAL A	TERMINAL B	
52H	12	BLUE	BREAKER #5	MC12(PIN P)	
44	12	YELLOW	MC508 (PIN A)	SP 60	
			MC599 (PIN A)	SP 60	
			SP 60	MC599A	
			SP 60	MC599B	

OPTIONAL DOME LIGHTS & FANS PERSONNEL CARRIER



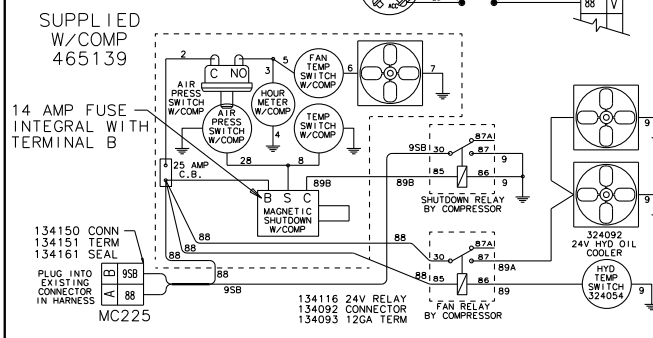
OPTIONAL EMERGENCY HORN PERSONNEL CARRIER



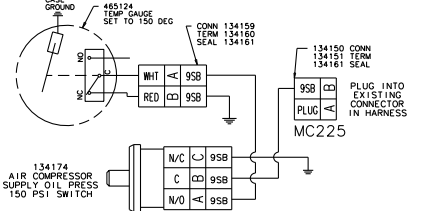
NO.	DESCRIPTION	ON #	BY	DATE
	STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°			
GERMAN				
TITLE 24V A64 W/HYD BLK NAP OPTIONS PAGE				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
DLD	10/11/06	NONE	D	30318-NAP-OPT

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OPTIONAL 125 CFM VANAIR COMPRESSOR

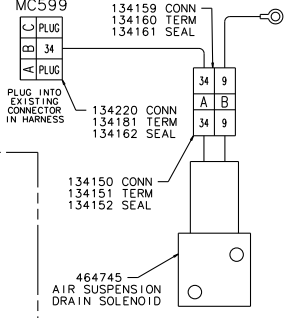


TEMP GAUGE/SHUTDOWN FOR LE110 COMPRESSOR

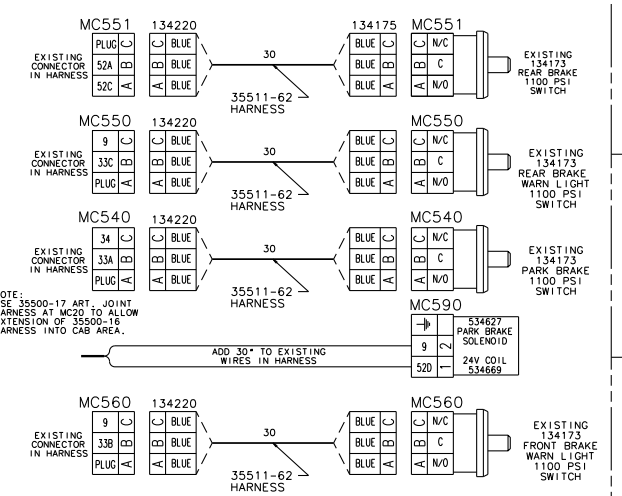


STANDARD OPTIONS

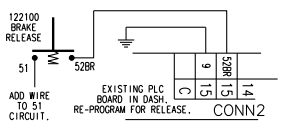
OPTIONAL AIR SUSPENSION DRAIN



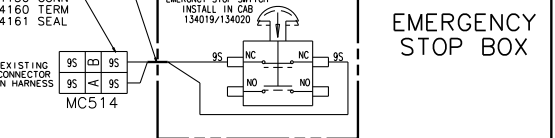
OPTIONAL HARNESS LENGTH MODIFICATIONS FOR FFC FRAME FOUND IN 0038AX043



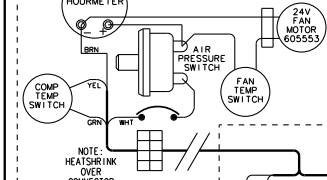
OPTIONAL PARK BRAKE SECONDARY RELEASE



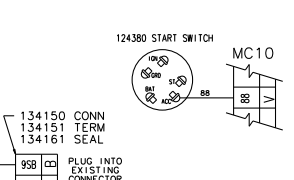
EMERGENCY STOP BOX



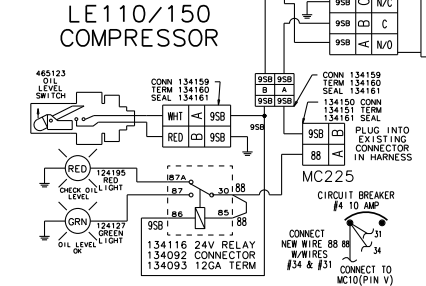
SUPPLIED WITH VANAIR COMPRESSOR (464892)



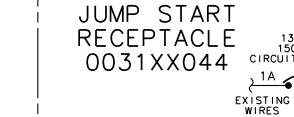
OPTIONAL 85 CFM VANAIR COMPRESSOR



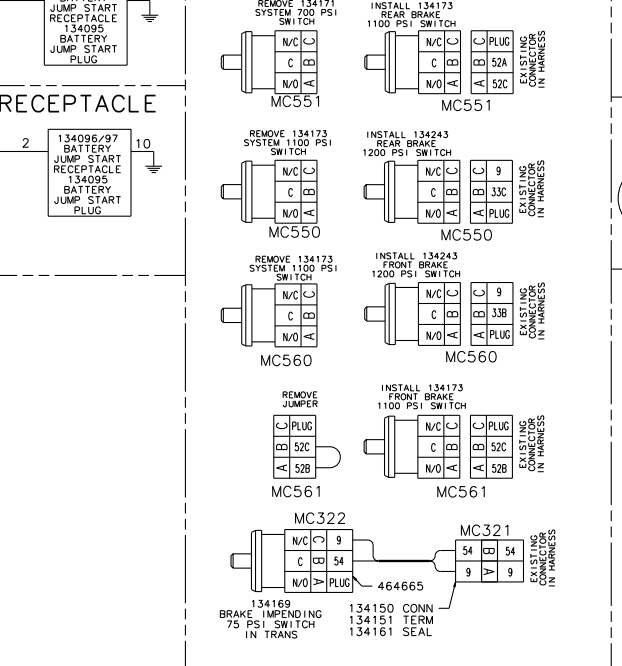
OPTIONAL OIL LEVEL FOR LE110/150 COMPRESSOR



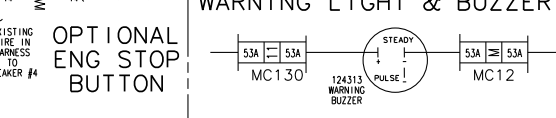
OPTIONAL 24V BATTERY JUMP START RECEPTACLE 0031XX044



OPTIONAL BRAKE IMPENDING



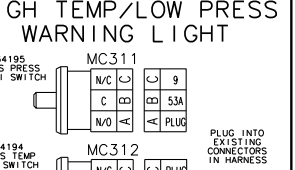
OPTIONAL TRANSMISSION HIGH TEMP/LOW PRESS WARNING LIGHT & BUZZER



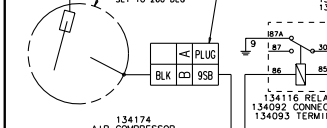
OPTIONAL 24V/12V CONVERTER



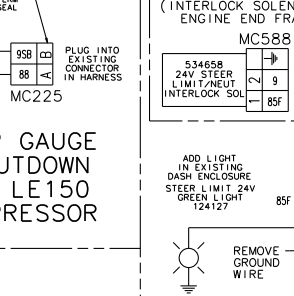
OPTIONAL TRANSMISSION HIGH TEMP/LOW PRESS WARNING LIGHT



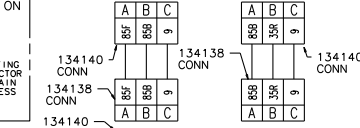
OPTIONAL 150 PSI SWITCH



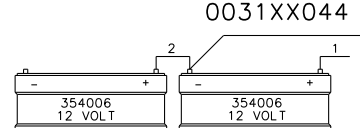
STEER LIMIT OPTION



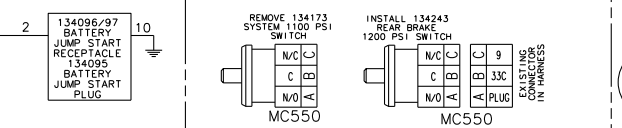
OPTIONAL 12V JUMP START RECEPTACLE 0031XX044



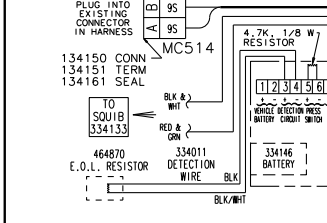
OPTIONAL 12V JUMP START RECEPTACLE 0031XX044



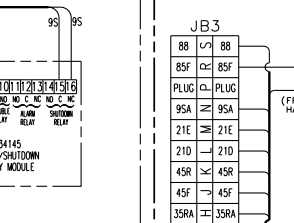
OPTIONAL AIR POWERED ELECTRIC 0129AX255-01



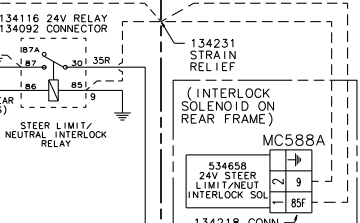
OPTIONAL FIRE SUPPRESSION (AUTO DETECT)



TEMP GAUGE/SHUTDOWN FOR LE150 COMPRESSOR



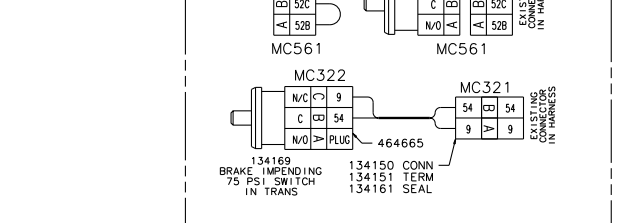
STEER LIMIT OPTION (INTERLOCK SOLENOID ON ENGINE END FRAME)



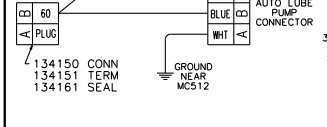
OPTIONAL 24V STEER LIMIT/NEUT INTERLOCK SOL 0031XX044



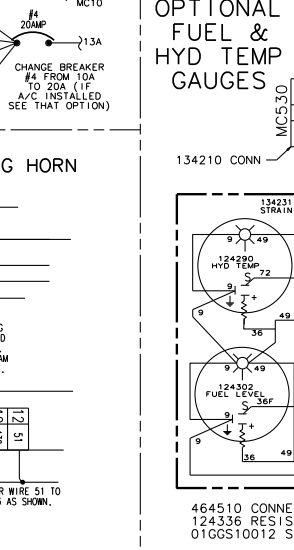
OPTIONAL 150 PSI SWITCH



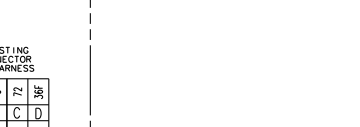
AUTO LUBE OPTION



OPTIONAL FUEL & HYD TEMP GAUGES



OPTIONAL 150 PSI SWITCH



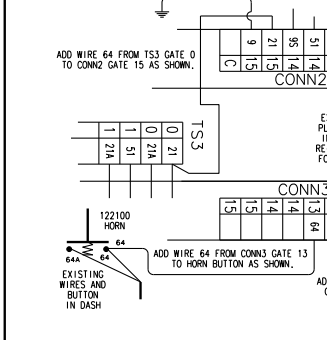
OPTIONAL 150 PSI SWITCH



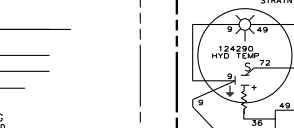
OPTIONAL 150 PSI SWITCH



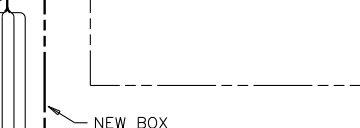
OPTIONAL START-UP WARNING HORN (FREEPORT)



OPTIONAL 150 PSI SWITCH



OPTIONAL 150 PSI SWITCH



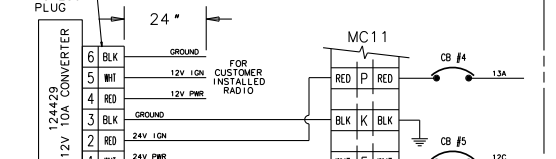
OPTIONAL 150 PSI SWITCH



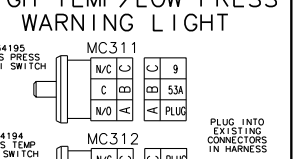
OPTIONAL 150 PSI SWITCH



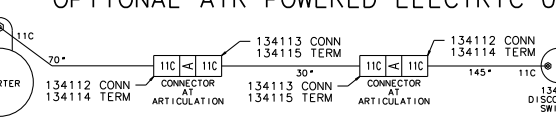
OPTIONAL 24V/12V CONVERTER



OPTIONAL TRANSMISSION HIGH TEMP/LOW PRESS WARNING LIGHT



OPTIONAL AIR POWERED ELECTRIC 0129AX255-01



OPTIONAL TRANSMISSION HIGH TEMP/LOW PRESS WARNING LIGHT

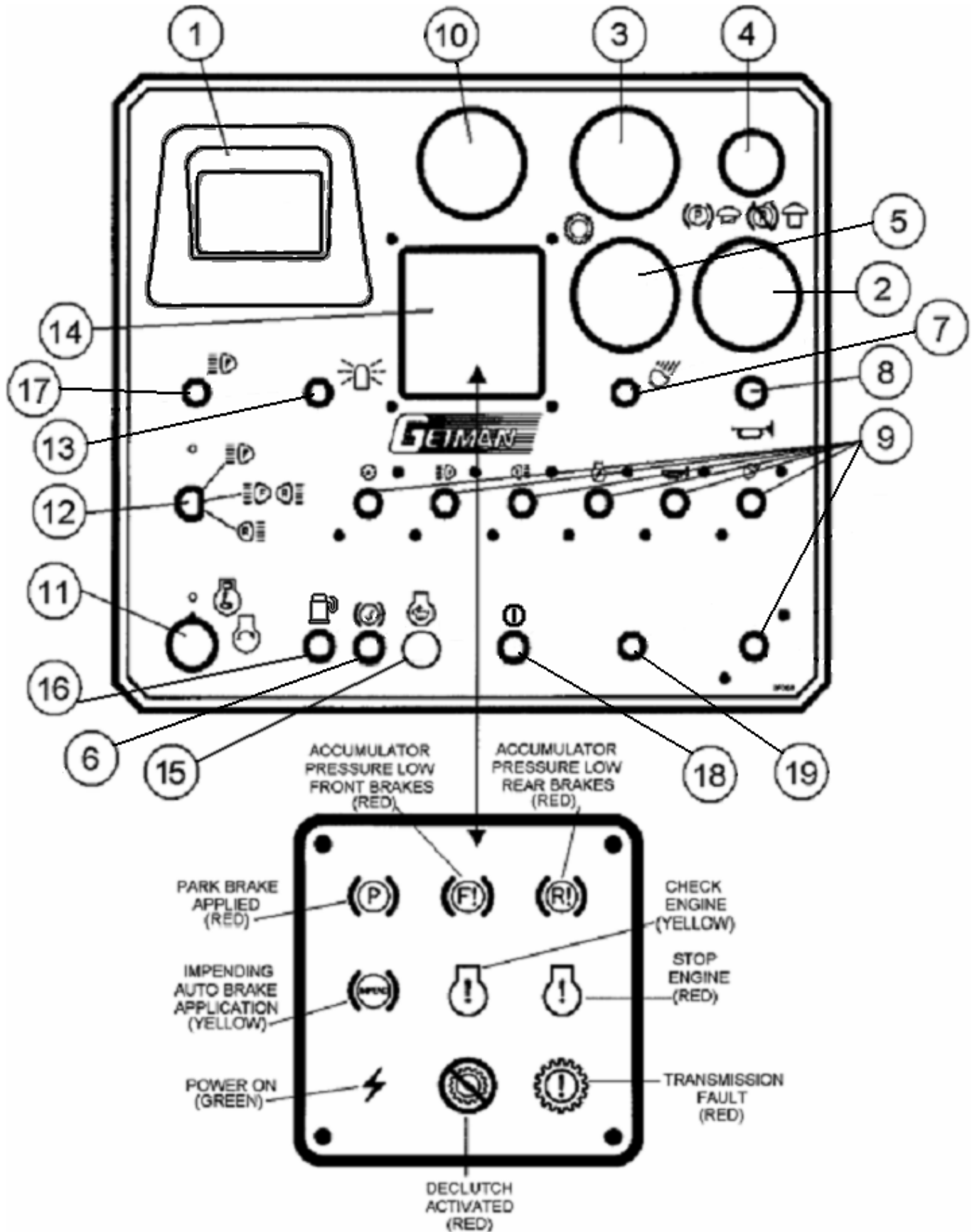


SEE 30318 FOR CHANGES

NO.	DESCRIPTION	ON #	BY	DATE
STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°				
GETMAN				
TITLE 24V, A64, W/HYD BLK, OPTIONS PAGE				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
DLD	4/04/06	NONE	D	30318-OPT

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STANDARD WIRING					STANDARD WIRING					MC MULTI-CONNECTOR	LOCATION ON MAIN PAGE	COMPONENT	SPLICE	LOCATION ON MAIN PAGE	SPLICE TERMINATION CONNECTOR
WIRE NO	GAUGE	COLOR	TERMINAL A	TERMINAL B	WIRE NO	GAUGE	COLOR	TERMINAL A	TERMINAL B						
1B	8	RED	START SW *BAT*	MC10 (PIN R)	42FA	12	LT BLUE	MC12 (PIN C)	JB3 (PIN C)	MC10	F7	DASH PANEL CONNECTION			
	4	RED	MC10 (PIN R)	JB2 (PIN A)						MC11	G7	DASH PANEL CONNECTION			
9	10	BLACK	NOT E:W/CUMMINS ENGINE USE	JB2 (PIN B)	42FB	12	LT BLUE	MC12 (PIN D)	MC24 (PIN F)	MC12	I7	DASH PANEL CONNECTION			
	12	BLACK	MC10 (PIN S)	GROUND						MC13	K5	DASH PANEL CONNECTION			
			DASH GROUND BOLT	MC10 (PIN S)	42RA	14	WHITE	BREAKER #3 *20A*	MC24 (PIN G)	MC120A	J1	GAUGE RESISTOR PACK (464670)			
			MC24 (PIN H)	GROUND						MC130	G5	INDICATOR PANEL (465252)			
			MC213, MC216, MC57, MC58, MC585, MC578, MC211, MC577 (PIN A)	GROUND	42RB	14	WHITE	BREAKER #3 *20A*	MC213 (PIN E)	MC140A	D7	A64 FUNCTION CONNECTOR			
			MC22, MC23 (PIN C)	GROUND						MC150	D8	FUNCTION CONNECTOR			
	16	BLACK	MC590, MC588	GROUND						MC150A	D8	A64 FUNCTION CONNECTOR			
			MC510 (PIN 2)	GROUND	43A	12	PINK	MC12 (PIN J)	MC585 (PIN B)	MC150T	D7	220 FUNCTION CONNECTOR (NOT USED)			
			MC530 (PIN B)	GROUND	44	12	YELLOW	MC599 (PIN A)	JB3 (PIN B)	MC160	C7	WIRE 47B CONNECTOR			
			MC550	GROUND						MC160B	C7	WIRE 47B CONNECTOR (NOT USED)			
			MC560, MC595 (PIN C)	GROUND						MC22	H14				
			HORN	GROUND						MC23	H14				
			DASH GROUND BOLT	MC130 (PIN 2)						MC24	K14	SEE OPTIONAL PAGE			
			POWERVIEW A (PIN 5&6)	GROUND						MC211	H15	BACK-UP ALARM CONNECTION (484668)			
			DASH GROUND BOLT	MC221 (PIN A)						MC212	H16	REAR TAIL LIGHT CONNECTION (464813)			
			DASH GROUND BOLT	MC221 (PIN A)						MC213	H17	REAR WHITE LIGHT CONNECTION (464804)			
			PARK BRAKE TEST	TS1 (PIN 2)	45F	12	LT GRN	JB3 (PIN J)	SP5 (PIN 4)	MC215	I16	REAR TAIL LIGHT CONNECTION (464813)			
			PLC CONNECTIONS	GROUND						MC218	I17	REAR WHITE LIGHT CONNECTION (464804)			
9BT	18	BLACK	DASH GROUND BOLT	GAUGES AND GAUGE LTS	45R	12	LT GRN	SP5 (PIN 3)	MC575 (PIN A)	MC219	J15	OPTIONAL PLATFORM LOWERING ALARM			
9C	16	BLACK	DASH GROUND BOLT	PLC CONNECTIONS						MC221	H17	OPTIONAL REVERSE DIRECTIONAL LIGHT			
9S	18	BLACK	PARK BRAKE TEST	TS1 (PIN 2)						MC222	I17	OPTIONAL FORWARD DIRECTIONAL LIGHT			
			MC10 (PIN W)	MC591 (PIN 2)						MC225	I15	AUX POWER OPTION CONNECTION			
			CONN2 (PIN 14)	MC11 (PIN A)	47A	12	WHITE	MC12 (PIN K)	MC580 (PIN A)	MC57	K10	FRONT HEADLIGHT CONNECTION (464804)			
			MC11 (PIN A)	MC514 (PIN B)	47B	12	WHITE	MC12 (PIN L)	MC580 (PIN B)	MC58	K11	OPTIONAL DUAL HEADLIGHT CONNECTION			
			MC514 (PIN A)	MC513 (PIN C)						MC508	H9	ELECT SHIF			
			SP8 (PIN 2)	MC513 (PIN B)						MC510	H11	DRAIN SOLENOID			
			SP8 (PIN 3)	GROUND	49	18	PURPLE	BREAKER #1 *10A*	MC140A (PIN 2)	MC512	H11	SEE OPOTION PAGE			
			SP8 (PIN 1)	JB3 (PIN N)						MC513	B14	FIRE SUPPRESSION SWITCH (134167)			
			JB3 (PIN N)	MC24 (PIN A)	49A	18	PURPLE	GAUGE/GAUGE LTS	MC130 (PIN 1)	MC514	B14				
			MC24 (PIN B)	MC225 (PIN B)	51	18	WHITE	MC130 (PIN 9)	PARK BRAKE SW *NO*	MC519	F14				
			MC225 (PIN B)	GROUND						MC530	F9				
12	10	ORANGE	START SW *BAT*	LIGHT SW *B*	51A	18	YELLOW	PLC CONNECTIONS	PARK BRAKE SW *NO*	MC531	G11				
12A	14	ORANGE	BREAKER #1 *20A*	BREAKER #2 *20A*	51B	18	GREEN	PLC CONNECTIONS	FUSE RESET SWITCH	MC532	G12				
12B	14	ORANGE	LIGHT SW *2*	BREAKER #3 *20A*	52	18	WHITE	FUSE RESET SWITCH	12/24 CNTR *24V IN*	MC540	D11	PARK BRAKE SWITCH (134173)			
12C	16	ORANGE	LIGHT SW *B*	BREAKER #5 *10A*	52A	18	WHITE	12/24 CNTR *12V OUT	CONN1 (PIN 2)	MC550	D11	REAR BRAKE SWITCH (134173)			
13	16	RED	START SW *1GN*	BREAKER #1 *10A*	52B	16	WHITE	CONN2 (PIN 12)	MC11 (PIN S)	MC551	F11	PRESSURE SWITCH (134171)			
13A	16	RED	BREAKER #1 *10A*	BREAKER #4 *10A*	52C	16	BROWN	MC11 (PIN 12)	MC551 (PIN B)	MC560	C11	FRONT BRAKE SWITCH (134173)			
14	16	GREEN	BREAKER #4 *10A*	MC11 (PIN J)	52D	16	BROWN	MC561 (PIN A)	JB1 (PIN 1)	MC561	F14	JUMPER			
			MC11 (PIN J)	JB1 (PIN 2)						MC577	J10	ACC MODE PSI SWITCH (134174)			
			START SW *ST*	5A FUSE						MC578	A13	DIRECTIONAL LIGHTS OPTION			
			5A FUSE	TS3 (PIN 0)						MC580	A11	FRONT HEADLIGHT CONNECTION (464804)			
21A	16	WHITE	TS3 (PIN 0)	MC10 (PIN T)	52E	18	BLUE	MC580 (PIN R)	MC11 (PIN R)	MC578	A13	OPTIONAL DUAL HEADLIGHT CONNECTION			
			TS3 (PIN 1)	MC10 (PIN T)	52H	16	BLUE	MC590 (PIN I)	PARK BRAKE SW *NC*	MC588	I10	OPTIONAL ANFO CHARGING BEACON			
			MC10 (PIN T)	JB1 (PIN 3)						MC588	E14	OPTIONAL BEACON			
21C	16	WHITE	PARK BRAKE *NO*	TS1 (PIN 3)	52K	16	PINK	MC508 (PIN A)	CONN2 (PIN 10)	MC590	E11	OPTIONAL STEER LIMIT			
21D	12	YELLOW	MC512 (PIN A)	JB3 (PIN L)						MC591	B11	BRAKE SOLENOID CONNECTION (534669)			
			JB3 (PIN L)	MC24 (PIN C)						MC595	A12	DRIVELINE PARK BRAKE TEST			
21E	16	YELLOW	MC24 (PIN D)	JB3 (PIN M)	53A	18	PINK	MC11 (PIN B)	CONN2 (PIN 11)	MC599	J11	OPTIONAL BRAKE LIGHT			
			JB3 (PIN M)	MC10 (PIN Z)						ART JNT	K13	ARTICULATION JOINT CABLE (464694)			
			MC10 (PIN Z)	TS1 (PIN 0)						CABLE					
			MC150A (PIN A)	MC10 (PIN U)											
			CONN5 (PIN 11)	MC510 (PIN 1)											
			MC10 (PIN U)	MC11 (PIN C)											
			TRANS PRESS *S*	MC11 (PIN C)											
			TRANS PRESS *S*	MC11 (PIN C)											
			TRANS TEMP *S*	MC11 (PIN F)											
			TRANS TEMP *S*	MC11 (PIN F)											
			MC11 (PIN 6)	MC11 (PIN 6)											
			MC130 (PIN 6)	MC11 (PIN 6)											
			MC11 (PIN 6)	MC540 (PIN B)											
			MC130 (PIN 5)	MC11 (PIN M)											
			MC11 (PIN M)	MC560 (PIN B)											
			MC130 (PIN 4)	MC11 (PIN N)											
			MC11 (PIN N)	MC550 (PIN B)											
			BREAKER #4 *10A*	MC11 (PIN H)											
			MC11 (PIN H)	SP9 (PIN 1)											
			SP9 (PIN 2)	MC599 (PIN B)											
			SP9 (PIN 3)	MC574 (PIN B)											
			SP9 (PIN 4)	MC595 (PIN B)											
			SP9 (PIN 5)	MC540 (PIN C)											
			SP9 (PIN 6)	MC591 (PIN 1)											
34A	18	BROWN	MC150T (PIN A)	SPLICE-WIRE 34A/56	88	12	GRAY	MC10 (PIN V)	JB3 (PIN S)						
			SPLICE-WIRE 34A/56	TS3 (PIN 3)											
			BREAKER #1 *10A*	MC12 (PIN G)											
			MC12 (PIN G)	SP5 (PIN 1)											
			SP5 (PIN 2)	JB3 (PIN G)											
			SP5 (PIN 8)	MC519 (PIN B)											
			SP5 (PIN 7)	JB1 (PIN 9)											
			JB3 (PIN G)	SP22 (PIN 1)											
			SP22 (PIN 2)	MC219 (PIN B)											
			SP22 (PIN 3)	MC218 (PIN B)											
			SP22 (PIN 4)	MC22 (PIN B)											
			JB1 (PIN 10)	SP6 (PIN 4)											
			SP6 (PIN 5)	MC519 (PIN A)											
			SP6 (PIN 3)	JB3 (PIN H)											
			JB3 (PIN H)	SP1 (PIN 1)											
			SP1 (PIN 2)	MC211 (PIN B)											
			SP1 (PIN 3)	MC219 (PIN A)											
			SP1 (PIN 4)	MC218 (PIN A)											
			BREAKER #1 *10A*	MC120 (PIN 1-4)											
			MC120 (PIN 1)	TRANS TEMP *+*											
			MC120 (PIN 2)	TRANS PRESS *+*											
			BREAKER #1 *10A*	MC11 (PIN G)											
			MC11 (PIN G)	MC530 (PIN A)											
			MC530 (PIN D)	MC531 (PIN A)											
			BREAKER #2 *20A*	MC12 (PIN A)											
			MC12 (PIN A)	SP7 (PIN 1)											
			SP7 (PIN 2)	MC57 (PIN B)											
			SP7 (PIN 7)	MC577 (PIN B)											
			BREAKER #2 *20A*	MC150A (PIN B)											
			MC12 (PIN B)	SP7 (PIN 3)											
			SP7 (PIN 4)	MC58 (PIN B)											
			SP7 (PIN 5)												



*ITEMS NOT SHOWN
†CONFIRM WHICH PART NUMBER IS USED ON YOUR TRUCK



INSTRUMENT PANEL

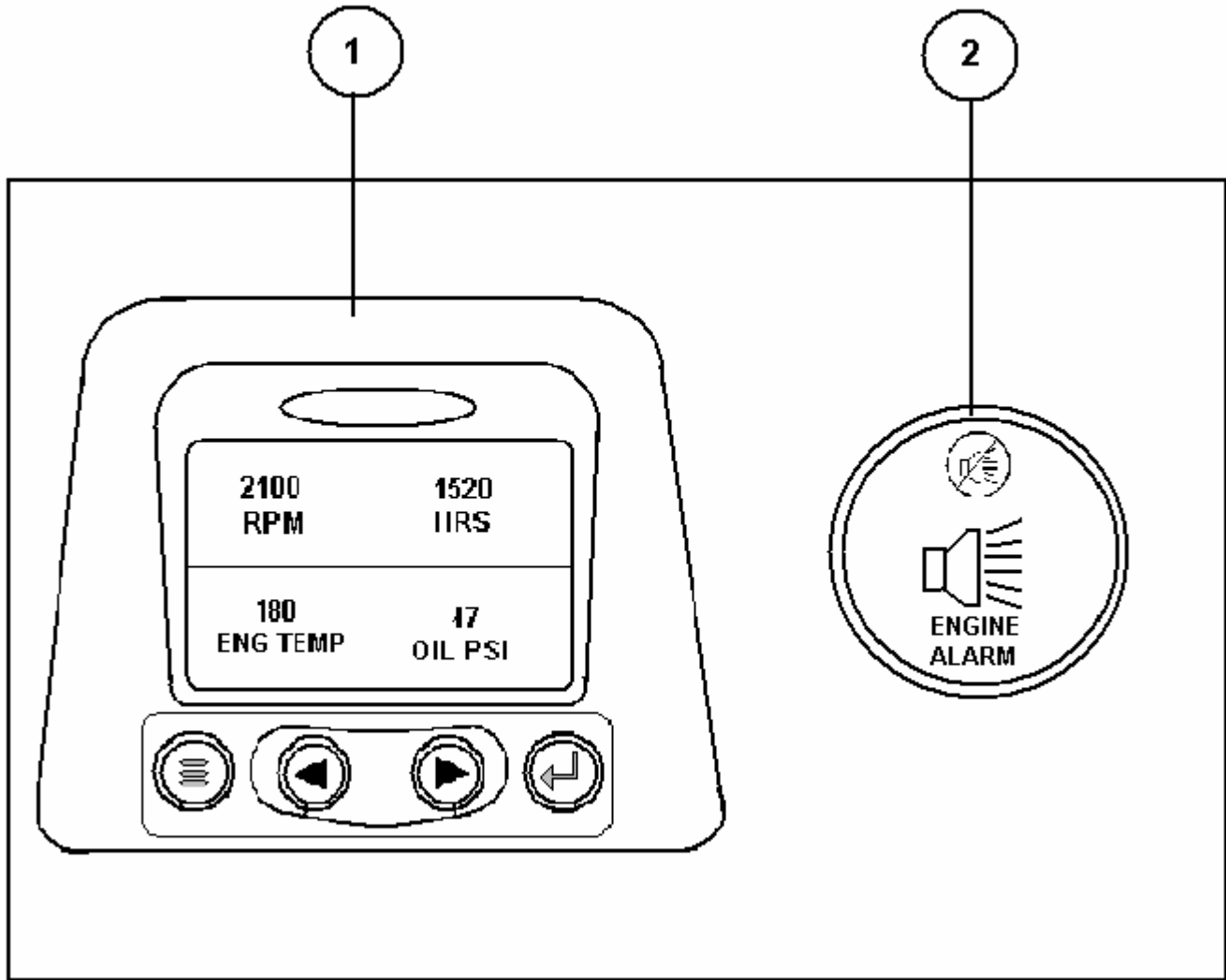
13907
Page 2 of 2

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	124454	ENGINE POWERVIEW GAUGE	1
2	124396	VOLTMETER	1
3	124403	TRANSMISSION TEMPERATURE GAUGE	1
*	124406	TRANSMISSION TEMPERATURE SENDER	1
4	134019	PARK BRAKE SWITCH	1
*	134020	PARK BRAKE BUTTON	1
5	124421	CONVERTER PRESSURE GAUGE	1
*	124278	CONVERTER PRESSURE SENDER	1
6	122100	PARK BRAKE TEST BUTTON	1
	124433	GREY CAP	1
7†	124148	WORK LIGHT SWITCH (OPTIONAL)	1
	124461		
8	122100	HORN BUTTON	1
9	134117	(10 AMP)CIRCUIT BREAKER	A/R
	134009	(20 AMP)CIRCUIT BREAKER	A/R
	134118	(30 AMP)CIRCUIT BREAKER	A/R
10	124455	ENGINE WARNING ALARM	1
11	124380	START SWITCH	1
12	124462	HEADLIGHT SWITCH	1
13†	124148	STROBE BEACON LIGHT (OPTIONAL)	1
	124461		
14	SEE GETMAN	WARNING PANEL	1
15†	124148	PTO FAST IDLE SWITCH	1
	124461		
16†	124195	LOW FUEL LIGHT (OPTIONAL)	1
	124121	ENGINE STOP BUTTON (OPTIONAL)	1
	124382	RED BUTTON (WITH 124121)	1
	124127	STEER LIMIT LIGHT (OPTIONAL)	1
17†	124148	CANOPY LIGHT SWITCH (OPTIONAL)	1
	124461		
18	124498	PLC RESET SWITCH	1
19	124434	WIPER SWITCH (OPTIONAL)	1
20*	SEE GETMAN	WARNING PANEL BULBS	9
21*	464670	RESISTOR PACK	1

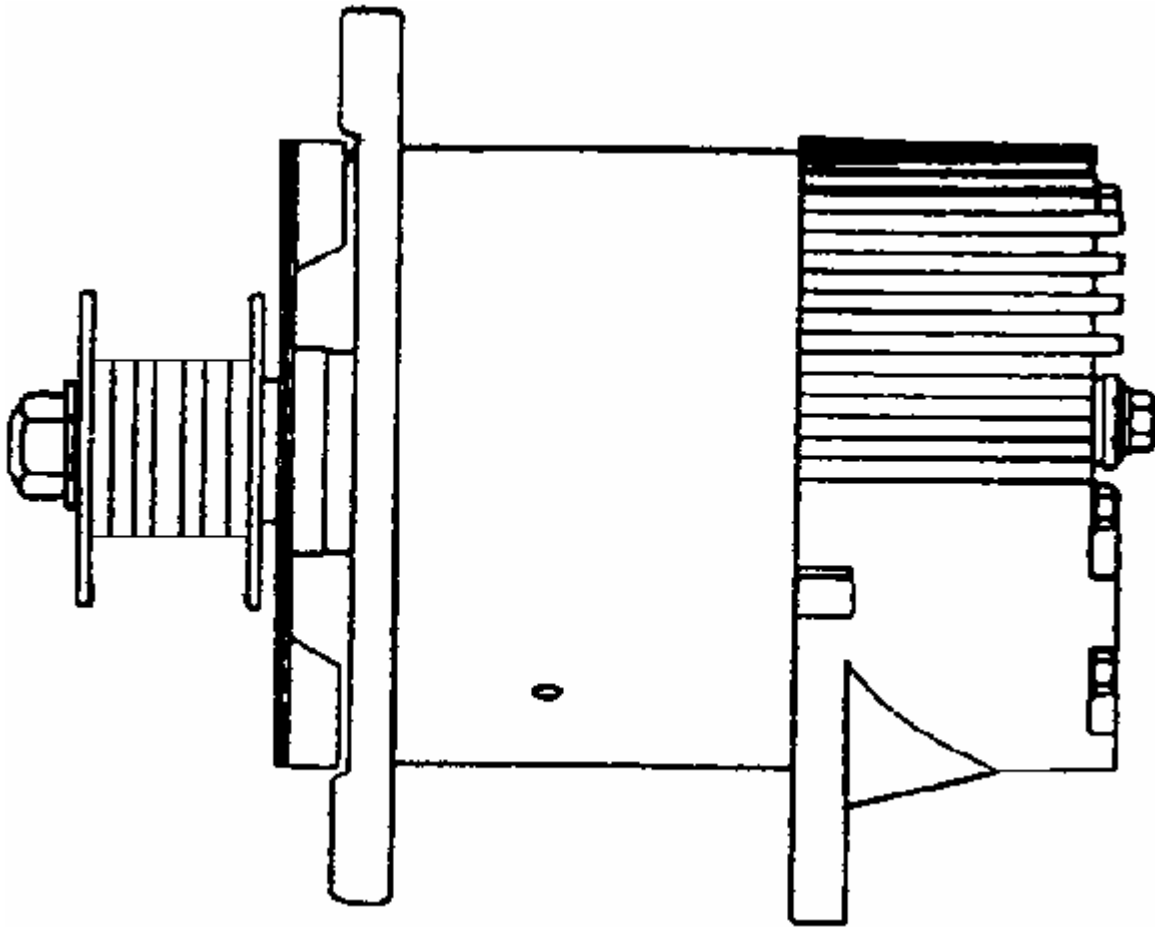
*ITEMS NOT SHOWN

†CONFIRM WHICH PART NUMBER IS USED ON YOUR TRUCK

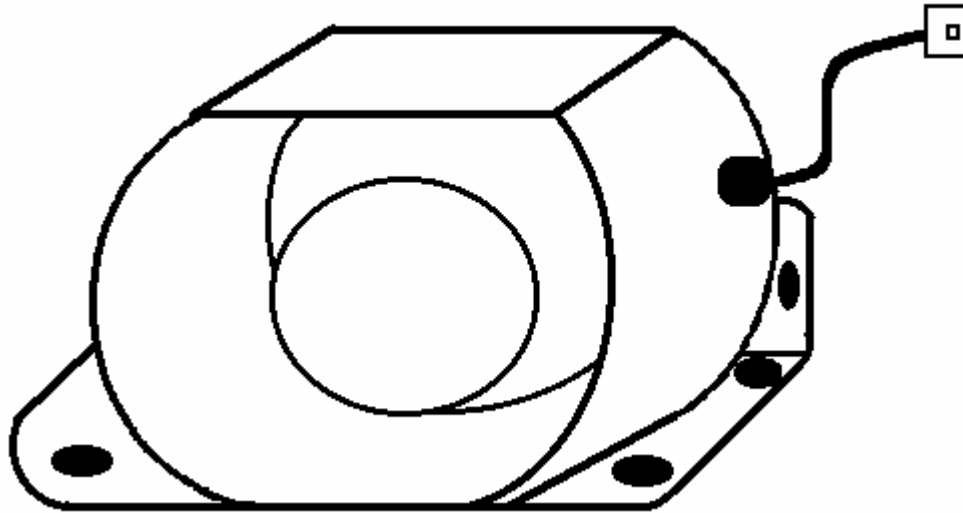
Updated:
12/11/06



ITEM	PART #	DESCRIPTION	QTY.
1	124454	MURPHY POWERVIEW DISPLAY	1
2	124457	MURPHY AUDIO ENGINE ALARM	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	146009	ALTERNATOR (DETROIT OM904 24V)	1
2	146015	ALTERNATOR BELT (VEHICLE WITH NO AIR COND)	1
3	146014	ALTERNATOR BELT (VEHICLE WITH AIR COND)	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	464668	BACK-UP ALARM WITH WP CONNECTOR	1
2*	134168	60 PSI PRESSURE SWITCH NC/NO	1

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

4. ENGINE AND ACCESSORIES

-----	DETROIT DIESEL WARRANTY
-----	ENGINE OPERATION & MAINTENANCE MANUAL
-----	ENGINE PARTS MANUAL
13807	ENGINE FILTERS
13661	RADIATOR INSTALLATION
13660	CHARGE AIR INSTALLATION
13681	INTAKE SYSTEM
11637	AIR CLEANER
13676	EXHAUST SYSTEM
-----	EXHAUST INFORMATION

Limited Warranty on New Detroit Diesel Series 900 Engines Used In Agricultural, Construction and Industrial Applications



Terms of Coverage:

Uses

This warranty applies to the first retail purchaser and subsequent owners during the WARRANTY PERIOD of new Detroit Diesel Series 900 engines (referred to as Engine) manufactured or supplied by Detroit Diesel Corporation (referred to as DDC) which are used in construction and industrial applications operated in the United States, Canada or Mexico.

Defects

This warranty covers Engine REPAIRS to correct any malfunction occurring during the WARRANTY PERIOD resulting from defects in material or workmanship.

Repairs

To obtain warranty repairs, you must request the needed repairs within the WARRANTY PERIOD from an authorized Detroit Diesel Corporation (referred to as DDC)* service outlet. Only new genuine parts or remanufactured parts or components supplied or approved by DDC will be used. DDC may, at its discretion, replace rather than repair components. A reasonable time must be allowed to perform the warranty repair. Repairs will be performed during normal business hours.

Warranty Period

The WARRANTY PERIOD begins on the date the Engine is delivered to the first retail purchaser or put in use prior to sale at retail, whichever date occurs first, and ends at the time limits shown below:

WARRANTY PERIOD				
Item	Warranty Limitations (Whichever Occurs First)		Repair Charge To Be Paid By Owner	
	MONTHS	ENGINE HOURS	PARTS	LABOR
Engine	0-24	3,000	No Charge	No Charge

Service Supplies

The cost of service supplies such as coolant, oil and filters, which are not reusable due to needed repairs is covered by this warranty.

Like Replacement Engine

Engine(s) supplied by DDC as a replacement for an Engine still under warranty will assume the identity of the Engine being replaced and be entitled to the remaining warranty coverage.

Mechanic's Travel Expenses

Mercedes-Benz will pay reasonable travel expenses for the repairing mechanic to travel to and from the repair site.

Engine Removal And Reinstallation

Reasonable labor costs for engine removal and reinstallation, when necessary to make a warranty repair, are covered by this warranty.

*In Canada, the reference is to Detroit Diesel of Canada Limited, in Mexico, the reference is to Detroit Diesel Allison de Mexico.

This Warranty Does Not Cover:

Repairs Due To Accidents, Misuse, Storage Damage, Negligence or Certain Modifications

Repairs due to an accident, misuse, misapplication, storage damage, negligence or modification exceeding DDC specifications, are not covered by this warranty.

Non-DDC Supplied/Manufactured Components

DDC is not responsible for repair of components and/or assemblies which are supplied by another manufacturer, such as power take-offs, intake and exhaust system. Such items may be covered by the manufacturer or supplier.

Maintenance

DDC is not responsible for the cost of maintenance or repairs due to lack of performance of required maintenance service or the failure to use fuel, oil, lubricants and coolant meeting DDC-recommended specifications. Performance of required maintenance and use of proper fuel, oil, lubricants and coolant are the responsibility of the owner. See the Operating Manual for details.

Incidental or Consequential Damages

DDC is not responsible for incidental or consequential costs or expenses which the owner may incur as a result of a malfunction or failure covered by this warranty, such as communication expenses, meals, lodging, overtime, towing, loss of use of the Engine or equipment ("downtime"), loss of time, inconvenience, cargo loss or damage, and other similar costs and expenses.

Other Limitations

The performance of REPAIRS is the exclusive Owner's remedy under this warranty. DDC does not authorize any person to assume or create for it any other obligation or liability in connection with the Engine.

THIS LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THIS ENGINE AS USED IN AGRICULTURAL, CONSTRUCTION AND INDUSTRIAL APPLICATIONS. DETROIT DIESEL CORPORATION MAKES NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. DETROIT DIESEL CORPORATION SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS DESCRIBED ABOVE.

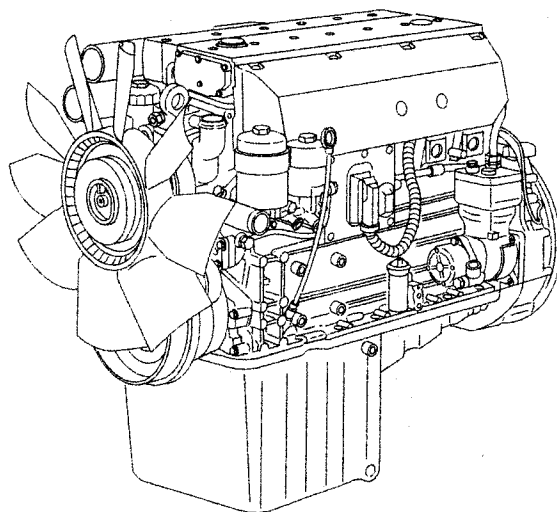
Some states do not allow the limitation of how long this warranty may last or the limitation or exclusion of incidental or consequential damages, so the above may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

DETROIT DIESEL
CORPORATION



DETROIT DIESEL

OM 904/906 LA

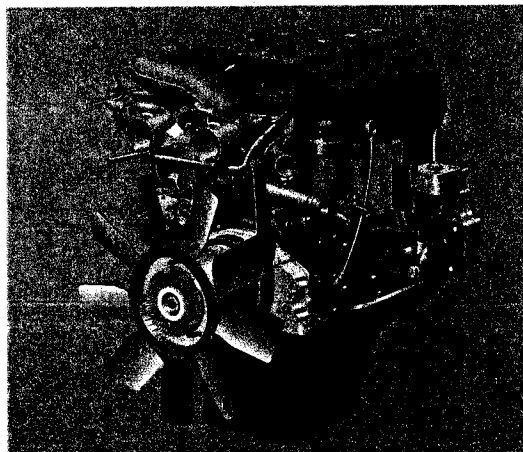


Engine Operator's Guide

DaimlerChrysler

Engines

Operating Manual



OM 904 LA - OM 906 LA

**CALIFORNIA
Proposition 65 Warning**

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Protection of the environment




DaimlerChrysler declared policy is integrated environmental protection, starting at the root causes and encompassing in its management decisions all the consequences for the environment which could arise from the production processes or the products themselves.

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

You too can help to protect the environment by operating your DaimlerChrysler engine in an environmentally responsible manner:

Both fuel consumption and the rate of engine wear depend on operating conditions, and you should therefore

- not warm the engine up by allowing it to idle,
- switch the engine off during lengthy breaks in operation,
- keep a check on fuel consumption,
- ensure that the specified maintenance work is carried out regularly.

 This Operating Manual includes further information on the protection of the environment, marked with this symbol.

IMPORTANT ENGINE INFORMATION

DaimlerChrysler AG	
ENGINE MODEL:	CODE:
ENGINE FAMILY:	CID:
ENGINE SERIAL NO.:
EXH. EMISSION CONTROL SYSTEM:	EM, SPL
MAX. ADV. KW:	FUEL RATE (MM ³ /STR.):
RATED SPEED (RPM):	LOW IDLE (RPM):
INITIAL TIMING (DEC: BTDC):	
VALVE LASH (MM): 0.4 INT., 0.6 EXH.	
This engine conforms to U.S. EPA and California regulations for large non-road compression-ignition engines. This engine is certified to be operated on diesel fuel.	

These Operating Instructions also describe special equipment if its operation needs to be explained. Since the delivered specification depends on the client's order, it may differ in certain respects from the descriptions and illustrations provided here.

We are engaged in ongoing development work on our engines. You are therefore asked to appreciate that we must reserve the right to make modifications to the design, equipment or technical features. For this reason, no claims whatsoever can be entertained on the basis of the details, illustrations or descriptions given in this manual.

Note:

As the illustrations in this manual only show one of many possible versions, your engine may differ in certain details. Some of the illustrations in this manual are of exemplary nature only. This applies in particular to instrumentation (indicator lamps), whose layout is determined by the customer; in such cases, the illustrations show DaimlerChrysler AG applications.

If your engine is equipped with items of equipment not illustrated or described in these Operating Instructions, any Detroit Diesel Distributor will gladly supply information on their correct operation and maintenance.

The Operating Instructions and Maintenance Booklet are important documents which should always be kept where the engine is being operated.

Order No

Part No.

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(Important! Every user and owner should carefully and thoroughly read this introduction and any applicable portions of the Operating Manual.)

4

This Operating Manual and the Maintenance Booklet are important documents which should be kept in a safe place and always available to any user or owner of the engine. **If any user or owner has any questions about the engine, they should immediately contact the appropriate, authorized Detroit Diesel Distributor. Every user and owner should carefully and thoroughly read this INTRODUCTION section and familiarize himself with the rest of this Operating Manual.**

Unique features of your engine

Your specific engine may have different features from those listed or those features depicted in the various illustrations in this Operating Manual. For example, instrumentation (indicator lamps) is often determined by the customer and therefore, the illustrations may be different from your engine. If you have any questions about operation or maintenance regarding the different features of your engine which are not addressed in this Operating Book, contact the appropriate, authorized Detroit Diesel Distributor to obtain such information. Please also be aware that certain descriptions and illustrations may not be specifically applicable for your engine and therefore, you again may be required to have the appropriate, authorized Detroit Diesel Distributor provide the necessary information.

We continuously strive to improve our product, and ask for your understanding that we reserve the right to make changes in design and equipment. Therefore, information, illustrations and descriptions in this Operating Manual might differ from your engine.

Use engine only for the intended purpose

The engine is intended and designed only for the purpose stated in the Purchase Agreement. Any other use or an extension of the stated use could create a serious risk of personal injury, death or property damage. Your warranty will automatically be voided if your engine is used for any other purpose than that which is stated in the Purchase Agreement (see Warranty for the specifics about the terms of such). Please contact the appropriate, authorized DaimlerChrysler AG engine service center if you have any questions.

5

General operation instructions

The engine is a very powerful and highly technical instrument which if not used properly or by a properly trained operator, could create a serious risk of personal injury, death or property damage. Therefore, only skilled professional operators who have received proper training should operate this engine. Furthermore, correct operation is also a crucial factor in ensuring a long and productive engine life. All users of the engine should familiarize themselves with all of the operating instructions with specific attention to technical safety instructions. Any questions you have about operation of the engine should be immediately addressed to the appropriate Detroit Diesel Distributor.

General maintenance and repair instructions

To ensure a long and productive engine life, the engine must be maintained and repaired in the proper manner. It is recommended that all maintenance and repair works be done by the appropriate Detroit Diesel Distributor (please also read your Warranty regarding the possibility of warranty denial if there is improper service, neglect or abuse of your engine). The maintenance schedule as listed in the Maintenance Booklet and all the instructions in this Operating Manual, including those relating to maintenance, care and repair, must be strictly followed. Please contact the manufacturer of the industrial machine or vehicle or Detroit Diesel Corporation for the closest Detroit Diesel Distributor.

Safety instructions and warnings

Notwithstanding the fact that it is highly recommended that only the appropriate, Detroit Diesel Distributor performs all the maintenance and repair works on your engine, there are many safety instructions and warnings throughout this Operating Manual. All of these warnings and safety instructions must be followed to prevent personal injury, death or property damage. The following are the symbols used in this Operating Manual:

6

Symbols

The instructions which follow are shown along with various symbols. Their meanings are as follows:



Warning - Risk of injury or death!

This symbol represents all safety instructions which must be complied with in order to avoid a direct risk of danger to life and body.



This symbol represents all safety instructions which, if disregarded, could give rise to the danger of material damage or malfunctions.



This symbol identifies instructions relevant to the protection of the environment

Note:

Instructions identified in this manner provide valuable information on engine operation and maintenance.

For example, a few of the more important Safety Instructions and Warnings (see other sections of this Operating Manual for the specific instructions or warnings) are:



Warning - Risk of injury or death!

- If possible, do not perform any work on the engine while the engine is running and at all times, stay clear of hot, rotating or moving parts.
 - Never check the coolant level when the engine is hot or warm since hot coolant can cause serious personal injury.
 - Only change engine oil when the engine and the oil are warm not when hot.
 - Never unfasten or remove lead seals or sealed bolts.
-

7

Do not convert or modify your engine

The function, safety, performance, warranty and emissions of your engine could be adversely affected if there is any tampering, conversion or modification of your engine and therefore, under no circumstances should there be any modification or conversion done to your engine. If it is determined that your engine was improperly tampered with, your Warranty will be voided, your engine may not conform to applicable regulations and/or the changes could create a risk of personal injury, death or property damage.

Warranty claims

Please submit warranty claims either to the manufacturer of the industrial machine or vehicle, to Detroit Diesel Corporation or to the appropriate, authorized Detroit Diesel Distributor (see addresses in the Warranty).

Safety

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Safety precautions for engines with electronic control units	13
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Safety and emergency running programme	15

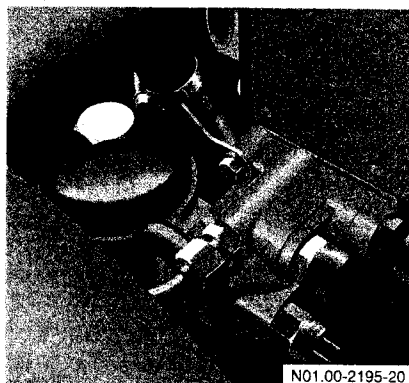
Service personnel requirements

Work on the engine should only be carried out by specially skilled persons or those who have received training from Detroit Diesel Corporation, or by persons employed by a Detroit Diesel Distributor.

Persons should be clearly designated as responsible for operation and for maintenance and repair work.

They should be of the minimum age as specified by state and/or federal law.

10



Front support eyelet

N01.00-2195-20

Transport

Raise the engine only by the lifting fixtures attached to the engine. Comply with lifting instructions.

Move the engine only with the transportation fixture specified by DaimlerChrysler AG.

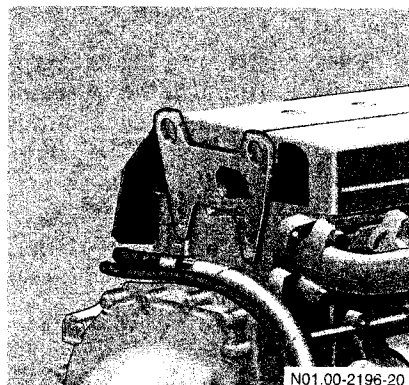
Move the engine only in its normal installed position.



Warning - Risk of injury!

The engine is supplied from the factory with oil filled. Leaks with loss of oil must be rectified without delay, consequences are environmental damage and risk of injury on a slippery floor. Exercise extreme caution in the vicinity of moving engine during the lifting and transportation process.

Comply with lifting and transportation instructions specified by DaimlerChrysler AG in order to avoid severe personal injury.



Rear support eyelet

N01.00-2196-20

11

Installation

The engine is only intended for installation in the manner specified in the purchase agreement.

Please note and comply with the sections headed "Use engine only for the intended purpose" (page 5) and "Do not convert or modify your engine" (page 8).

The section of this manual entitled "Technical data" contains data relevant to engine installation. Should questions arise, please contact your Detroit Diesel Distributor.

Organizational measures

The Operating Manual and Maintenance Booklet must be supplied to persons entrusted with operation of the engine or with any work on it, and should be kept at the point where the engine is operated and if possible be readily accessible.

With the aid of this Operating Manual, personnel must be familiarized with the operation of the engine, paying special attention to the technical safety instructions. This applies in particular to personnel that only works on the engine occasionally.

In addition to this Operating Manual, comply with local legal stipulations and other obligatory accident prevention and environmental protection regulations in the country of operation.

12

Safety precautions for engines with electronic control units

The safety precautions stated below must be applied at all times in order to avoid damage to the engine, its components and wiring, and to avoid personal injury.



Warning - Risk of injury!



- Only start the engine with the batteries securely connected.
- Do not disconnect the batteries when the engine is running.
- Only start the engine with the engine speed sensor connected.
- Do not start the engine with the aid of a rapid battery charger. If emergency starting is necessary, only start using separate batteries.
- The battery terminal clamps must be disconnected before a rapid charger is used. Comply with the Operating Manual for the rapid charger.
- If any electrical welding work is performed, the batteries must be disconnected and the two cables (+ and -) connected firmly together.
- The control unit connectors must only be connected/disconnected with the electrical system switched off.
- Interchanging the poles of the control unit's voltage supply (e.g. by interchanging the battery poles) can damage the control unit beyond repair.
- Fasten plug-type connectors on the fuel injection system with the specified tightening torque.
- If temperatures above 176 °F (80 °C) (e.g. in a drying kiln) are to be expected, the control units must be removed.
- Only use properly fitting test leads for measurements on plug connectors.
- Telephones and two-way radios which are not connected to an external aerial can cause malfunctions in the vehicle electronics and thus jeopardize the engine's operating safety.

13

DaimlerChrysler original parts

DaimlerChrysler original parts are subject to the most stringent quality checks and guarantee maximum functional efficiency, safety and retention of value. Each part is specially designed, produced, selected and approved for DaimlerChrysler AG.

For this reason, we are obliged to disclaim all liability for damage resulting from the use of parts and accessories which do not meet the above requirements.



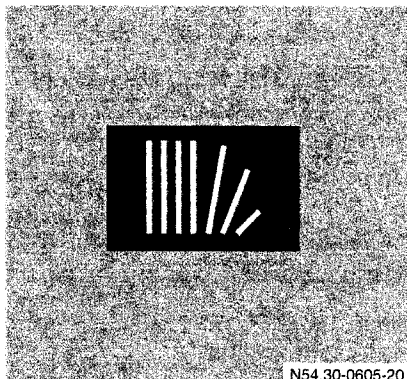
For economical repairs in accordance with sound recycling principles, DaimlerChrysler AG also offers reconditioned parts and assemblies to the same quality standards and with the same warranty cover as new parts.

In Germany, and in some other countries, certain parts, for instance those designated as safety-relevant, must only be installed or used for conversion work if they comply with valid legal requirements. DaimlerChrysler original parts always satisfy these requirements.

If other parts, which have not been tested and approved by DaimlerChrysler AG, are installed, even if in individual circumstances they have been granted an official operating permit, DaimlerChrysler AG is unable to assess them or grant any form of warranty, although it endeavours to monitor market developments as far as possible. The installation of such parts may therefore restrict the validity of the warranty.

When ordering DaimlerChrysler original parts, or if any technical enquiries arise, please quote the engine number and model designation Engine data card (page 20).

14



Electronics indicator lamp

Safety and emergency running programme

The engine is fitted with an electronic control system, which monitors both the engine and itself (self-diagnosis).

As soon as a fault is detected it is evaluated and one of the following measures is initiated:

- Faults during operation are indicated by the electronics indicator lamp.
- In conjunction with VDS (vehicle diagnosis system), the fault code can be read off immediately on the display.
- Switch over to a suitable substitute function for continued, albeit restricted engine operation (e.g. constant emergency engine speed).



Warning - Risk of injury!
Have any faults rectified without delay by the responsible
Detroit Diesel Distributors Service Center.

Note:

The DaimlerChrysler diagnosis testers (HHT - hand-held tester or special tool Minidiag), which are connected to the 14-pin diagnosis socket (on the unit), can be used to read off the fault code.

For fault codes and their meanings, see "Telligent® engine system fault finding" (page 92).

15

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Note:

DaimlerChrysler AG engines may be used for a wide variety of applications and are therefore designed and built to suit specific requirements.

As the illustrations in this manual only show one of many possible versions, your engine may differ in certain details.

Type reference

OM 904 LA	
OM	Compression ignition (diesel) engine
904	Engine type (904: 4 cylinders/906: 6 cylinders)
L	Charge air intercooling
A	Turbocharger

18



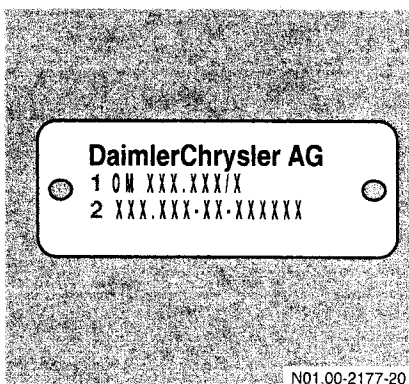
Location of engine type plate

N01.00-2179-20

Type plate

Position

The type plate is located on the rear left of the engine (arrow), on the joint to the valve case, diagonally above the air compressor.



Engine type plate (sample)

- 1 Engine type reference
- 2 Engine number

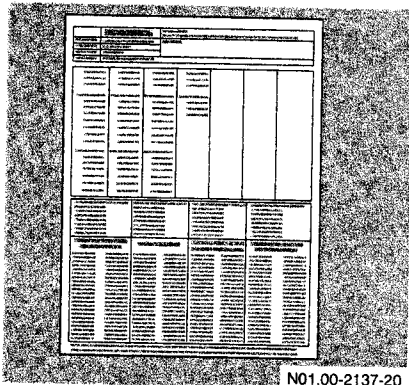
N01.00-2177-20

Details on the type plate

For engines installed in vehicles, the engine type reference (1) and the complete engine serial number (2) appear beside the name of the manufacturer.

On engines for mobile units, the engine family designation and approval number are also given.

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N01.00-2137-20

Engine data card

The engine data card (DIN A4 sheet) forms an integral part of the engine's documents and must therefore always be kept with the Maintenance Booklet. It contains details of the engine's build status, including special equipment features.

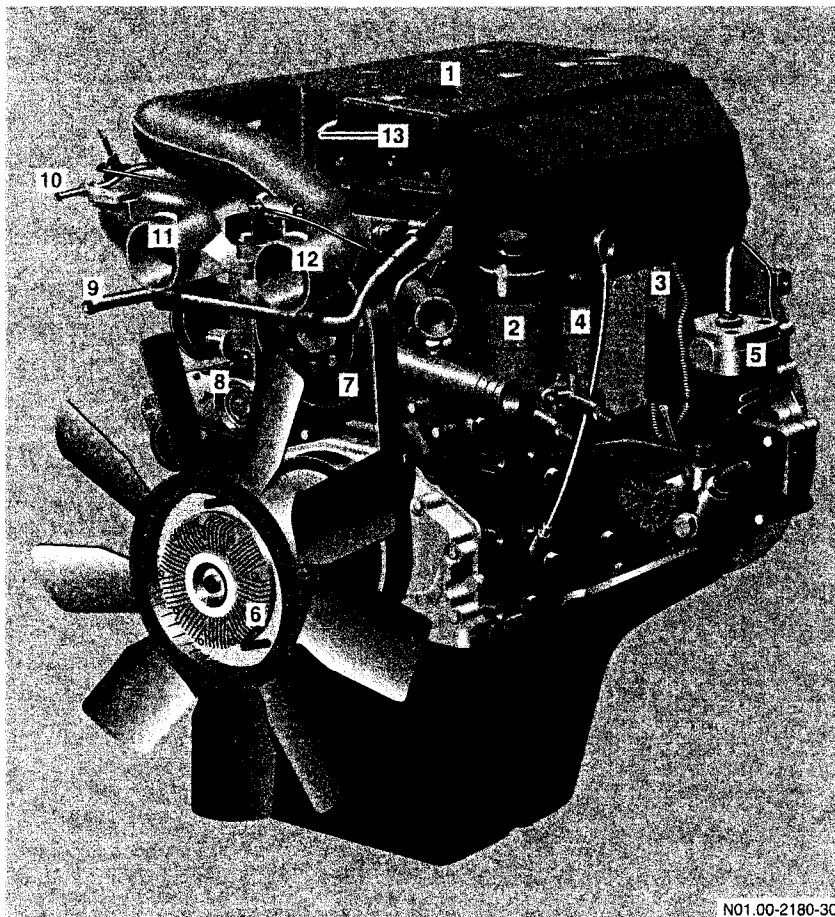
When original parts have to be purchased, it is essential to have the engine data card available.

Note:

The engine data card describes the engine's bill of materials when it leaves the factory. Subsequent modifications to the bill of materials are not recorded.

Always keep the engine data card in the Maintenance Booklet - attach it at the rear.

20



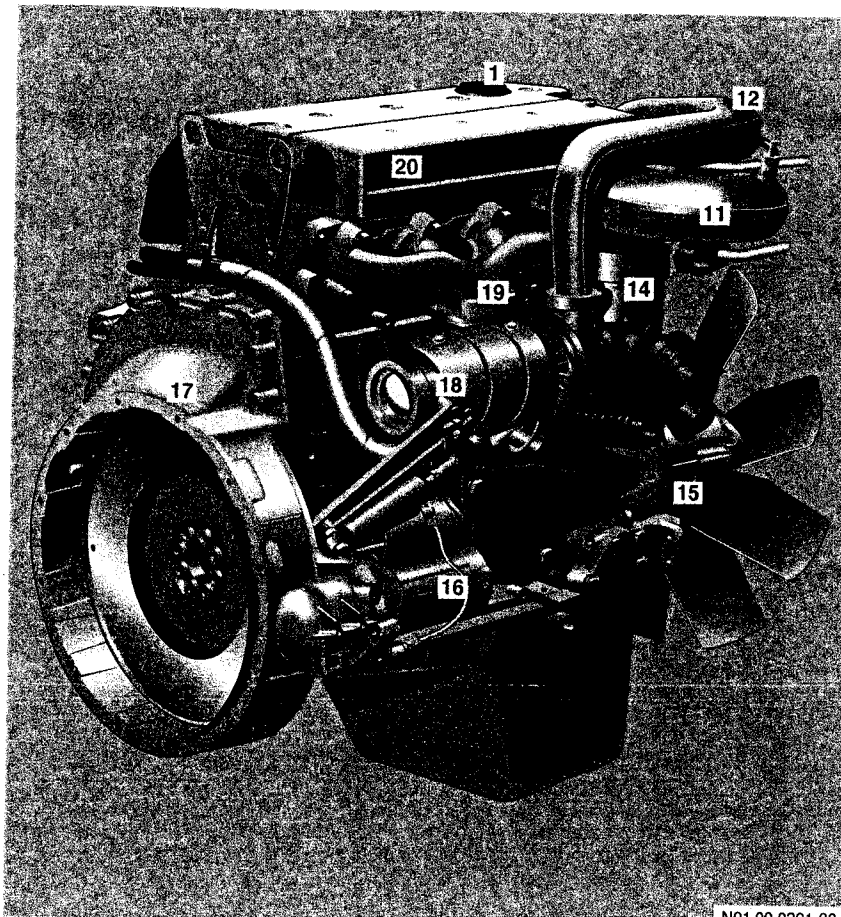
N01.00-2180-30

General view of OM 904 LA engine

- 1 Oil filler neck
 - 2 Fuel filter
 - 3 ECU control unit
 - 4 Fuel pre-filter
 - 5 Air compressor (with power assisted steering pump*)
 - 6 Fan
 - 7 Coolant pump
 - 8 Poly-V-belt tensioner
 - 9 Coolant pipe - heater feed*
 - 10 Coolant pipe - bleed connection
 - 11 Charge pressure pipe (with flame start system*) from charge air intercooler
 - 12 Charge pressure pipe to charge air intercooler
 - 13 Crankcase breather
- * optional

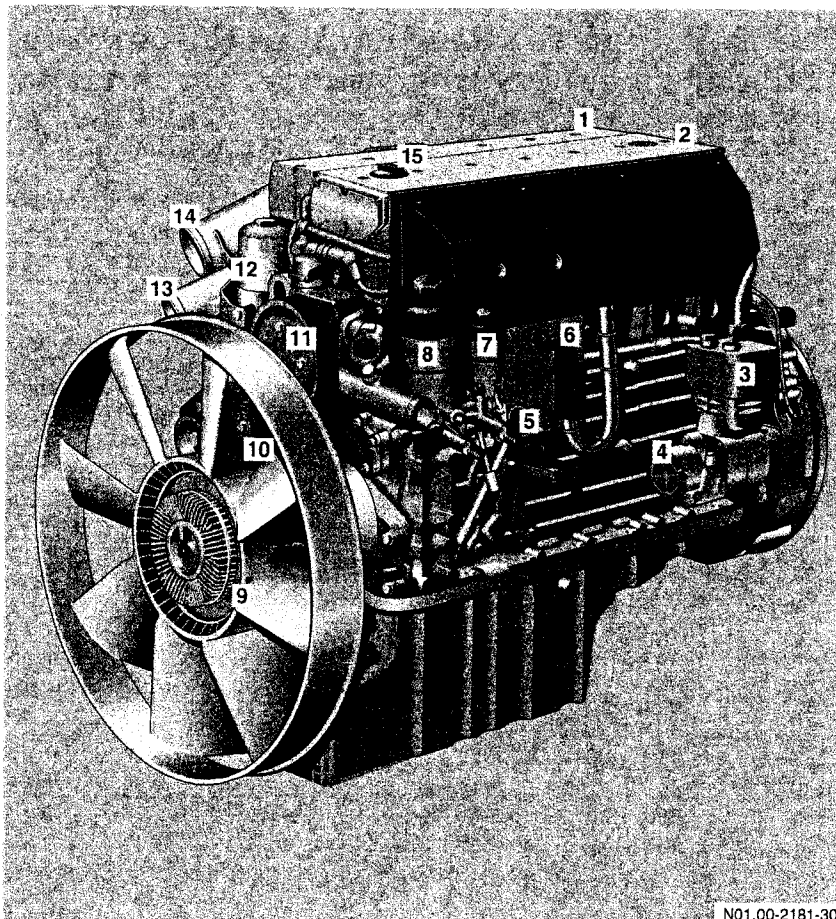
21

General view of OM 904 LA engine



- 1 Oil filler neck
 - 11 Charge pressure pipe from charge air intercooler (with flame start system*)
 - 12 Charge pressure pipe to charge air intercooler from turbocharger
 - 14 Oil filter
 - 15 Alternator
 - 16 Starter motor
 - 17 Flywheel housing
 - 18 Turbocharger with throttle valve* (engine brake)
 - 19 Exhaust manifold
 - 20 Charge air housing
- * optional

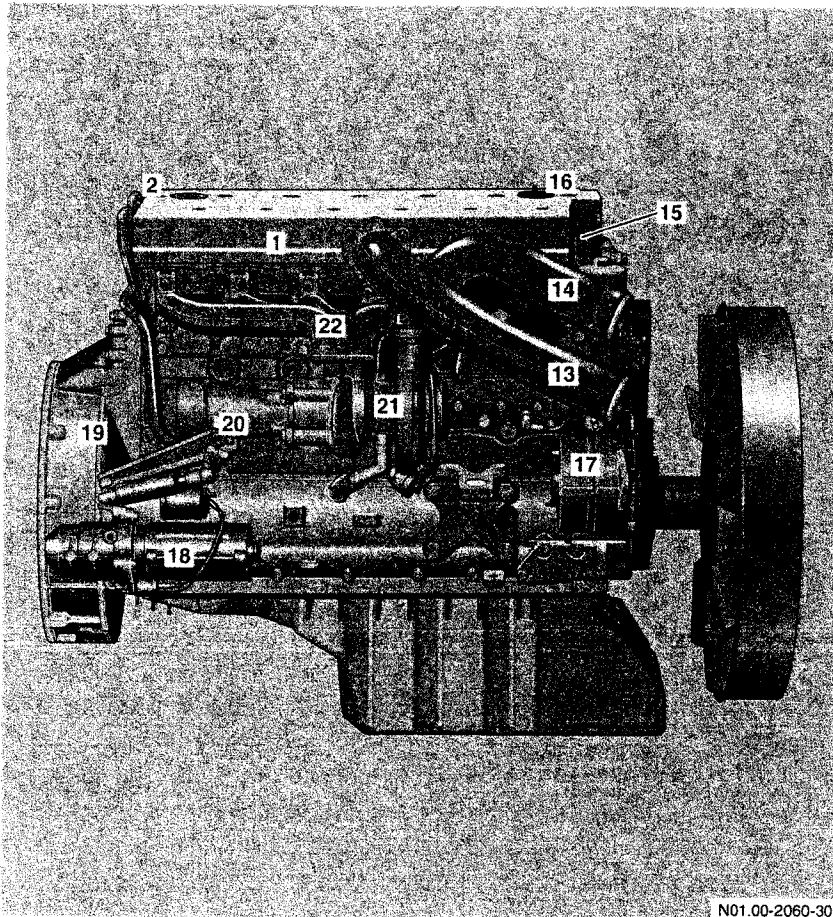
General view of OM 906 LA engine



- 1 Charge air housing
- 2 Cylinder head cover
- 3 Air compressor*
- 4 Power assisted steering pump*
- 5 Oil dipstick
- 6 ECU control unit
- 7 Fuel pre-filter
- 8 Fuel filter
- 9 Fan
- 10 Poly-V-belt tensioner
- 11 Coolant pump
- 12 Oil filter
- 13 Charge pressure pipe from charge air intercooler
- 14 Charge pressure pipe to charge air intercooler
- 15 Oil filler neck

* optional

General view of OM 906 LA engine



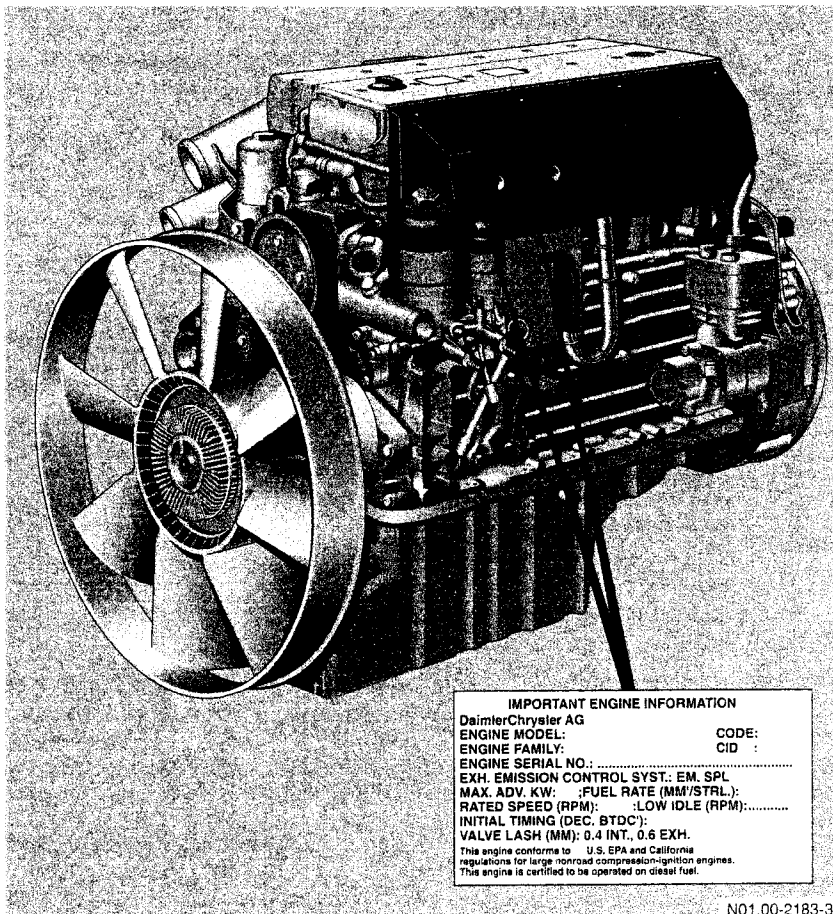
- 1 Charge air housing
- 2 Cylinder head cover
- 13 Charge pressure pipe from charge air intercooler
- 14 Charge pressure pipe to charge air intercooler
- 15 Crankcase breather
- 16 Oil filler neck
- 17 Alternator
- 18 Starter motor
- 19 Flywheel housing
- 20 Throttle valve* (engine brake)
- 21 Turbocharger
- 22 Exhaust manifold

* optional

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N01.00-2060-30

Location of sample of the emission control information label OM 906 LA engine



IMPORTANT ENGINE INFORMATION
 DaimlerChrysler AG
 ENGINE MODEL: CODE:
 ENGINE FAMILY: CID :
 ENGINE SERIAL NO. :
 EXH. EMISSION CONTROL SYST.: EM, SPL
 MAX. ADV. KW: ; FUEL RATE (MM/STRL.):
 RATED SPEED (RPM): ; LOW IDLE (RPM):
 INITIAL TIMING (DEC. BTDC):
 VALVE LASH (MM): 0.4 INT., 0.6 EXH.
 This engine conforms to U.S. EPA and California regulations for large nonroad compression-ignition engines.
 This engine is certified to be operated on diesel fuel.

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N01.00-2183-30

Description of engine

The OM 904 LA (four-cylinder) and OM 906 LA (six-cylinder) engines are water-cooled four-stroke direct injection diesel engines. The cylinders are arranged in line and each has a separate fuel injection pump (unit pump) with a short injection line to the injection nozzle, which is located in the centre of the combustion chamber. The unit pumps are attached to the crank casing and are driven via roller tappets by the camshaft. Each cylinder has two inlet valves and one exhaust valve.

The engine is fitted as standard with an exhaust gas turbocharger (some also with charge pressure limitation) and charge air intercooling.

The engine has a fully electronic control system, which regulates the injection quantity and timing via solenoid valves, allowing especially low-emission operation (Euro 2, non-road).

The control system consists of an engine-resident control unit (the ECU control unit) and an additional control unit specific to the appliance (VCU control unit) which are connected by a CAN wire.

Optional engine braking is guaranteed by a pneumatically operated throttle valve on the turbocharger and by constant throttling.

The grey cast iron cylinder block has integrated oil and water channels. The upper section of the cylinder track is induction hardened.

The single-piece cylinder head is made of grey cast iron. The cylinder head gasket is a single layer, adjustment-free seal with viton sealing elements.

The pistons, made of aluminium alloy with ring carriers and a shallow combustion chamber recess, are spray-cooled.

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The crankshaft is precision forged, with five sets of bearings, four of which have forged counterweights, and a vibration damper at the front end.

The camshaft is made of inductively hardened steel, has five sets of bearings, each cylinder has cams for inlet and exhaust valves and a unit pump.

The steel conrods are manufactured by the method of crack separation of the cap and the rod.

The valves are controlled by mushroom tappets, stop rods and rocker arms. The inlet valves are opened and closed together by means of a pin-guided bridge. Valves are made of two different materials with a separate seating ring.

There is a force-feed lubricating oil circuit supplied by a rotary oil pump positioned at the front of the crankcase and driven by gears from the crankshaft.

The oil cooler is located at the front of the crankcase.

The gear-type fuel pump is bolted to the front of the crankcase.

The air compressor (with power assisted steering pump attached at the rear) is driven via a gear on the camshaft (optional).

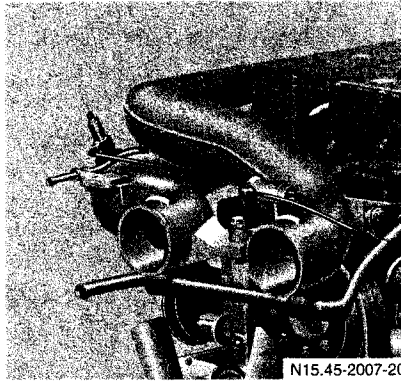
Coolant recirculation cooling; automatic temperature regulation by means of a thermostat.

The fan can be fitted to the crankshaft or to the coolant pump shaft.

The alternator and coolant pump (and any other ancillaries) are driven by a poly-V-belt with automatic belt tensioner.

Electrical equipment includes a starter motor and alternator.

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Flame start system

N15.45-2007-20

Flame start system (optional extra)

The flame start system improves engine starting at low ambient temperatures. It reduces the emission of white smoke after starting. The reduction in the time needed to start the engine in turn reduced the load on the batteries and the starter motor.

A flame plug located in the charge pressure pipe from the charge air intercooler is used to ignite the fuel. Fuel is supplied to the flame plug via a solenoid valve with a metering nozzle.

After a preglow time which is governed by the ambient temperature, (maximum 20 seconds), the flame start system is operational and the flame start indicator lamp goes out.

After the engine has started, the flame start system is supplied with fuel by the engine's own fuel delivery pump.

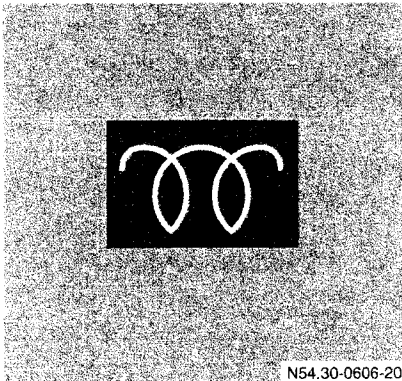
The flame start system is only operational if the engine is started within 30 seconds of the flame start indicator lamp going out.

Note:

If the flame start indicator lamp does not go out after more than 20 seconds, there is a fault in the flame start system.

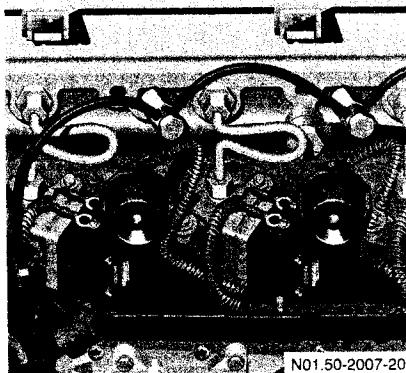


For operation at low ambient temperatures, see the notes in the sections headed "Diesel fuels" (page 105) and "Coolant" (page 109).



Flame start indicator lamp

N54.30-0606-20



Constant throttle activation

N01.50-2007-20

Engine brake/Constantly open throttle valves (optional)

To increase its braking performance, the engine can be equipped with a brake valve on the turbocharger together with constantly open throttle valves on the cylinders.

The exhaust back-pressure is utilised by the brake valve to increase the braking performance; the constantly open throttle valves reduce the pressure during the working stroke (3rd stroke), while the compression (2nd stroke) is practically unaffected.

The constantly open throttle valves are small valves which are built into the cylinder head and positioned opposite the exhaust valve. When open, they create a link between the combustion chamber and the exhaust duct.

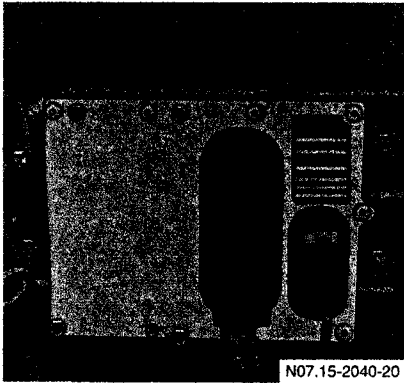
When the engine brake is activated (in vehicles by a switch in front of the driver's seat), the constantly open throttle valves are placed under pressure, which in turn opens the valves. At the same time, the brake valve in the turbocharger is closed.

The engine brake is activated by the VCU control unit (page 32). The engine brake can only be activated at engine speeds up to 2,700 rpm.

Below 900 rpm, the engine brake is always inactive to prevent the engine from stalling. The engine brake is automatically deactivated when the throttle potentiometer (e.g. accelerator pedal) is activated.

Note:

When in emergency running mode (constant rpm), the engine brake can only be activated when the engine is in overrun. When constant rpm has been attained, the engine brake is automatically deactivated.



ECU control unit

Telligent® engine system

The engine is equipped with a fully electronic control system, which, besides the engine and its related sensors, consists of the

- ECU control unit, and the
- ADM2 control unit or other vehicle-specific control units.

The two control units are linked by a CAN (controller area network) wire, through which all necessary data/information can be exchanged.

The engine control system monitors both the engine and itself. In the event of a fault or system failure, precautions are taken, e.g. a safety and emergency running programme (page 15) may be selected.

ECU control unit (engine-resident)

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

The ECU control unit processes the data received from the VCU control unit, for example the position of the speed control (accelerator pedal or throttle lever), engine start/stop, engine brake etc.

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ECU control unit type plate

- 1 Data record
- 2 Certification no.
- 3 Engine number
- 4 Appliance code

This data is evaluated together with the data from the sensors on the engine, e.g.:

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

and compared to the characteristic maps or lines stored in the ECU control unit.

From this data, commencement and duration (quantity) of injection are calculated and the plug pumps are actuated accordingly via solenoid valves.

Note:

All data given on the control unit data plate are required if a replacement control unit needs to be obtained.

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ADM2 control unit

N15.00-2013-20

ADM2 control unit (appliance-resident)

The ADM2 control unit (vehicle control) can be used to adapt the engine to different application-specific requirements.

Within the ADM2 control unit, there are diverse sets of data for specific applications, for instance idling speed, maximum working speed or speed limitation.

The ADM2 module receives data from

- the operator (throttle potentiometer position, engine start/stop, engine brake switch)
- other systems (e.g. ASR: acceleration skid control)
- the ECU control unit (such as oil pressure and coolant temperature).

From this data, instructions are computed for the engine control (ECU control unit) and transmitted to the latter via the CAN wire.

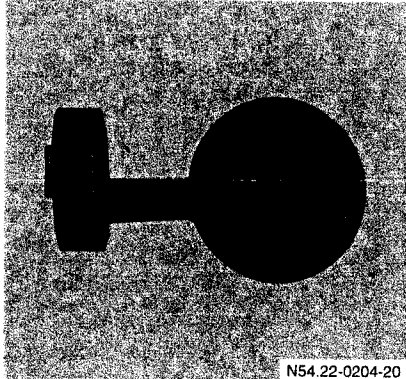
The ADM2 control unit controls various displays (e.g. electronics indicator lamp), the engine brake and the constantly open throttle valves.

If the Telligent® engine system detects a fault, this is stored as a fault code in the control units and can be read off using an appropriate diagnosis tester (DaimlerChrysler hand-held tester or special tool Minidiag).

In conjunction with VDS the fault code can be read off directly on the display. In addition, the electronics indicator lamp is also switched on.

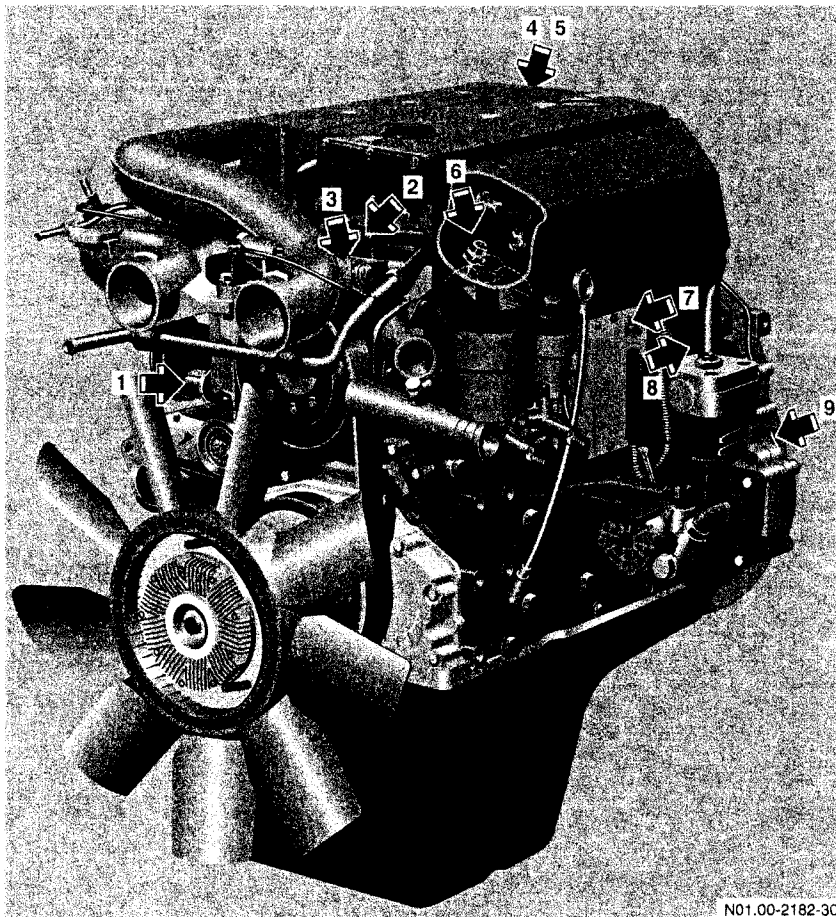
Note:

The DaimlerChrysler diagnosis testers can be connected to the appliance using the 14-pin diagnosis socket. Both the fault memory and the engine data stored can be read off using these units.



Diagnosis socket

N54.22-0204-20



N01.00-2182-30

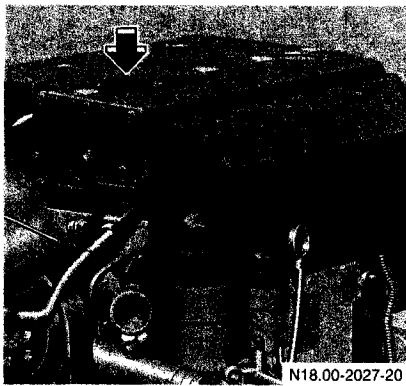
Location of sensors

(OM 904 LA, similar on 906 LA)

- 1 Oil pressure sensor
- 2 Coolant temperature sensor
- 3 Coolant temperature sensor, flame start system
- 4 Charge pressure sensor
- 5 Charge air temperature sensor
- 6 Fuel temperature sensor
- 7 Atmospheric pressure sensor (integrated into ECU control unit)
- 8 TDC sensor (on camshaft gear)
- 9 Crankshaft angle sensor (on flywheel)

Operation

Safety precautions for engine operation	36
Preparing to start the engine.....	36
Initial operation	38
Starting the engine	40
Monitoring engine operation.....	42
Stopping the engine	45
Winter operation.....	46



Oil filler neck

Safety precautions for engine operation

Comply with the safety precautions stated on page 13.

Whenever possible, only work on or near the engine when it is stopped. Note the safety precautions in the relevant sections of this manual.

Keep a safe distance away from hot, rotating or moving parts.

Preparing to start the engine

Oil filling

The engine is delivered from the factory filled with an engine oil conforming to page 228.5 of the DaimlerChrysler AG Specifications for Service Products.

These are extremely high-quality engine oils which improve the process of running in and allow the first oil change to be made in accordance with the standard oil change intervals. The use of a special initial operation oil and the additional oil change for a regular oil are thus eliminated.

Only if engine oils corresponding to page 228.5 of the DaimlerChrysler AG Specifications for Service Products can the extended service intervals be used.

Check the oil level. If necessary, top up by filling engine oil through the oil filler neck (arrow) until the "max" mark on the oil dipstick has been reached, see "Engine: Oil change and filter replacement" (page 55).

Adding coolant

- For coolant mixing ratio, see "Coolant" (page 109).
- Bleeding the cooling system, see "2080 Coolant renewal" (page 77).

Adding fuel

Use winter or summer grade fuel according to the season of the year. For further notes, see "Diesel fuels" (page 105).



Ensure that conditions are as clean as possible when refuelling.
On no account allow water ingress!

Bleeding the fuel system

If the engine has been run until the fuel tank is completely empty, the fuel system is bled when the engine is started after refuelling. The system is constantly bled via the filter.



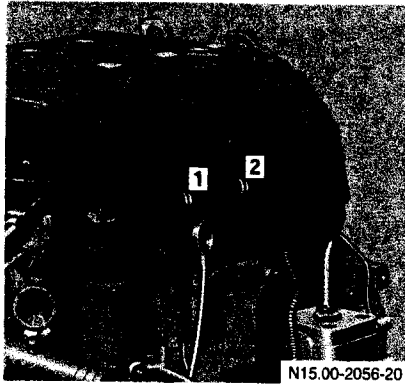
The battery must have sufficient capacity to bleed the fuel system during engine start-up.

Checking batteries

Only use batteries that have been correctly filled and serviced. Protect the terminals with acid-proof grease (terminal grease).

Note:

Cable cross-sections depend on the distance between the battery and the starter motor.



1 STOP button
2 START button

Initial operation

Before the engine is first operated, carry out the work described in "Preparing to start the engine" (page 36).

- Switch the ignition on.
- With the speed control (e.g. accelerator pedal) in the idle position, start the engine, for example by pressing the start button (2) on the engine, see "Starting the engine" (page 40).

Note:

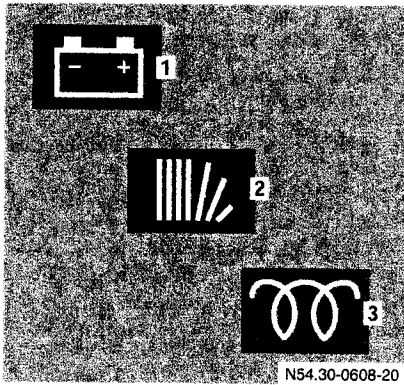
As a safety function, the Telligent® engine system offers the possibility to allow an engine start only if the transmission is in neutral.



Warning - Risk of injury!

Exercise extreme caution in the vicinity of hot, rotating or moving parts.

- Bleed the cooling system:
Allow the engine to run for approximately 5 minutes at a moderate speed. Then, with the coolant temperature $<122\text{ }^{\circ}\text{F}$ ($<50\text{ }^{\circ}\text{C}$), recheck the coolant level. Add more coolant if necessary. If the cooling system is connected to a heating system, all heater valves must be opened when coolant is added. Do not close the heater valves until the engine has been run briefly and the coolant level again checked and corrected as necessary.
 - Examine the engine for leaks.
-
- Check hoses, hose clips and pipe unions on the engine and the oil feed and return lines at the turbocharger for leaks and tightness. Retighten if necessary.
 - Check the engine oil level approximately 5 minutes after stopping the engine. If necessary, add oil up to the "max" mark on the oil dipstick.
 - Check all mountings on the engine for tightness. Retighten securing bolts for the exhaust manifold, engine mountings, coolant pump, starter motor, air compressor etc. For specified tightening torques, see "Tightening torques" (page 118).



Starting the engine

Note:

Before starting the engine for the first time, see "Initial operation" (page 38).

Before starting an engine which has not been run for a long time, certain special work must be carried out. See the section "Cleaning, protective treatment".

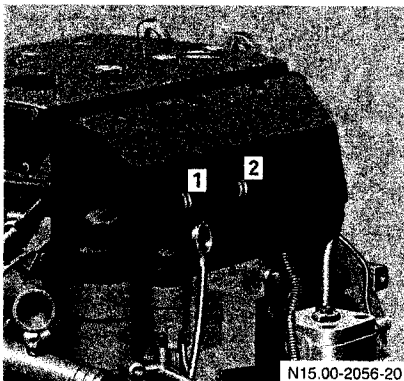


At ambient temperatures below -22 °F (-30 °C), we recommend the use of a coolant pre-heater (e.g. an electric pre-heater).

If the engine is fitted in a vehicle, safeguard the vehicle against moving away unintentionally:

- Shift the transmission to neutral,
- Apply the parking brake
- Place chocks in front of and behind the wheels.
- Switch on the power supply.
- The following indicator lamps will light up:
 - 1 Battery charge
 - 2 Electronics
 - 3 Flame starting system (if fitted)

40



- 1 STOP button
- 2 START button

Start the engine within 30 seconds of the flame start indicator lamp going out

- with the starter switch on the appliance
- with the start button (2) on the engine.

Monitor the oil pressure gauge immediately after starting the engine.



Do not rev the engine up until oil pressure is indicated.

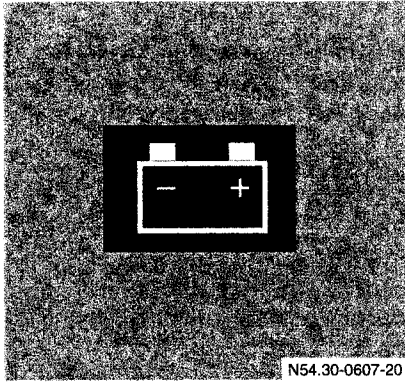
If no oil pressure is shown after approximately 10 seconds, stop the engine and determine the cause. See the section headed "Oil pressure" (page 44).

Note:

- If necessary, interrupt the starting procedure after at most 20 seconds and repeat after about 1 minute.
- The battery charge and electronics indicator lamps must go out when the engine starts. If they remain on, faults are present in the respective systems. See the sections headed "Charge current" (page 42) and "Telligent[®] engine system" (page 42).
- Depending on the ambient temperature, the flame start indicator lamp will go out after
 - about 2 seconds (functional check, flame starting system not active)
 - up to approx. 20 seconds (maximum preglow time).
- If the flame start indicator lamp has not gone out after about 20 seconds, a fault has developed in the system. See section headed "Telligent[®] engine system" (page 42).

Do not place the engine under full load at extremely low ambient temperatures.

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Battery charge indicator lamp

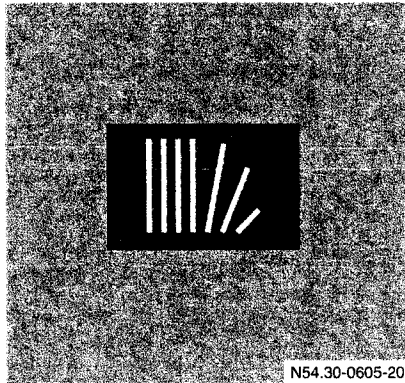
Monitoring engine operation

Battery charge

The battery charge indicator lamp must go out when the engine starts. If the indicator lamp lights up while the engine is running, stop the engine and check the poly-V-belt.



Do not run the engine without a poly-V-belt.



Electronics indicator lamp

Telligent® engine system

The electronics indicator lamp must go out when the engine starts.

If the indicator lamp does not go out when the engine starts, or if it lights up while the engine is running, there is a fault in the Telligent® engine system.

Any fault will be stored in the system with a special fault code. Intermittent faults are also stored.

In conjunction with FDS (vehicle diagnosis system), the fault code can be read off on a display.

Without FDS, fault codes can be read using a DaimlerChrysler special Minidiag diagnosis tester, cf. section headed "ADM2 module (appliance-resident)", page 32.

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If the electronics indicator lamp lights up while the engine is running, read off or identify the fault code.

In the 5-digit fault code, the first digit indicates the fault group (0, 1 or 2). Proceed as follows, depending on the fault group:

Fault group 0

If necessary, these faults can be rectified during the next maintenance service.

Fault group 1

The fault must be rectified as soon as possible.



Warning – Risk of accident!

It can be expected that the running characteristics of the engine will be affected.

Fault group 2

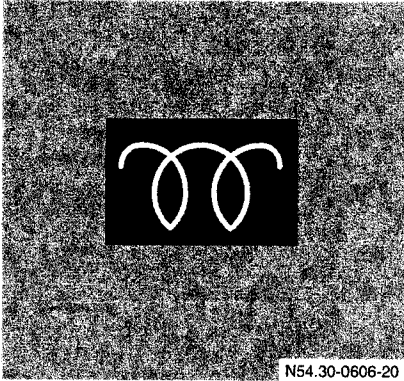
The fault must be rectified immediately.



Warning – Risk of accident!

The running characteristics of the engine will be affected (emergency running programme).

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Flame start indicator lamp (example)

Flame start system (optional extra)

There is a fault in the flame start system if:

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

Have the flame start system checked by a DaimlerChrysler Service Station.

Note:

The flame start system switches off automatically if:

- the engine is not started within 30 seconds of the flame start indicator lamp going out
- the engine is started while the flame start indicator lamp is still on
- the battery charge indicator lamp does not go out when the engine is running
- the engine reaches a temperature at which it no longer requires the flame start system.

Oil pressure

When the engine has reached its normal operating temperature, the engine oil pressure must not drop below

- 36.27 psi (2.5 bar) at rated speed
- 7.25 psi (0.5 bar) at idling speed

If engine oil pressure drops below these values, stop the engine and determine the cause.

44



1 STOP button
2 START button

Stopping the engine

- After running the engine at full output or a high coolant temperatures, allow the engine to idle for 1 - 2 minutes without load.
- Press the stop button (1) on the engine or on the appliance.



The engine should be stopped immediately if:

- The oil pressure drops below its normal level or fluctuates heavily
- output and engine speed drop despite throttle potentiometer position (accelerator pedal/throttle lever) remaining unchanged
- severe smoke from exhaust
- coolant or oil temperature climbing above their normal levels
- Sudden unusual noises from the engine or turbocharger.

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Winter operation

Note the following precautions at the onset of winter:

Fuel

Use cold-resistant diesel fuel, see "Diesel fuels in extreme cold" (page 105).

Engine oil

When changing the engine oil, take the period of time into account in which the new oil will remain in the engine and choose an SAE viscosity class that will suit the ambient temperatures anticipated during this period of operation, see "Engine oils" (page 108).

Coolant

Check the antifreeze in the coolant in good time, and if necessary increase the concentration of corrosion inhibitor/antifreeze, see "Coolant" (page 109).



Warning - Risk of scalding!

Never check the coolant, when the engine is warm or hot. Hot coolant could cause severe burns and damages to one's eyes.

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Batteries

Batteries should receive more frequent maintenance and recharging during the cold season of the year.



Warning - Risk of injury!

Take all appropriate safety precautions when handling batteries (battery acid is caustic). Refrain from smoking, do not create sparks and keep away from naked flames (risk of explosion).

Careful maintenance and low current consumption will help to maintain the full battery charge. Starting capacity will drop severely in cold weather. For example at 14 °F (-10 °C) it is only about 60% of the normal capacity. Batteries should therefore be stored in a heated area if the engine is shut down out of use for a lengthy period. Ensure good ventilation when recharging.

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Maintenance

Service intervals	51	0953 Intake pipe between air cleaner and engine: Check for leaks and general condition	67
Work schedules	52	0980 Air cleaner with paper filter element: Filter element renewal	67
0050 Engine: Check for leaks and general condition	54	1351 Poly-V-belt: Condition check	68
0051 Lines and hoses on the engine: Check for leaks and general condition	54	1450 Engine brake: Check of condition and adjustment	72
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0560 Valve clearance adjustment	58	2050 Cooling and heating system: Check for leaks and general condition	75
0730 Fuel pre-filter: Cleaning filter element	62	2080 Coolant renewal	77
0780 Fuel filter element renewal	63		
0950 Air cleaner with paper filter element: Filter element renewal as necessary	65		

This chapter describes all maintenance work required on the engine.



All service intervals and maintenance operations are based on DaimlerChrysler original parts and accessories expressly approved by DaimlerChrysler AG for your engine.

Operation item number

Each maintenance operation is preceded by a 4-digit operation item number.

The operation item numbers are also listed in the engine's Maintenance Booklet. In this way, the description of the maintenance work in the Operating Manual can be located immediately.

The operation item number is made up of the 2-digit numbers for the assembly group and the actual maintenance operation.

Example: 07 80		(operation item number)
07	Fuel system, engine	(assembly group number)
80	Fuel filter renewal	(maintenance operation)

50

Operations involving a particularly large amount of work are divided up according to the type or the mechanical assembly to which they refer.

Service intervals

Scope and frequency of maintenance work are determined by the engine's operating conditions and are detailed in the Maintenance Booklet.

In conjunction with the Telligent[®] service system FSS (optional), the timing of oil changes and maintenance services is calculated accordingly and shown on a display. The number of operating hours or kilometres specified in the Maintenance Booklet can then be disregarded.

All work carried out should be confirmed in the Maintenance Booklet.

This evidence of regular maintenance is essential in the event of a warranty claim having to be submitted.

Please comply also with maintenance requirements for optional extras.

Important:

The engine is filled at the factory with oil conforming to page 225.5 of the DaimlerChrysler AG Specifications for Service Products. If the engine is stored for more than 12 months before it is taken into service, this oil must first be changed.

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Work schedules

Maintenance service

- 0101 Engine:
Oil change and filter replacement
(when due; note details in Maintenance Booklet/FSS)
- 0560 Valve clearance adjusted
(1st maintenance service only)
- 0780 Fuel filter element renewed
- 0950 Air cleaner with paper filter element:
Checked for contamination, renewed if necessary
- 1351 Poly-V-belt:
Condition checked

Check for leaks and general condition

Note points of abrasion and incorrect positioning!

- 0050 Engine
- 0051 Lines and hoses on the engine
- 0953 Intake pipe between air cleaner and engine

Fluid level checked, corrected

If more fluid is lost than can be accounted for by normal consumption, trace the cause and rectify.

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- 2010 Engine cooling system:
Fluid level and corrosion inhibitor/antifreeze concentration checked,
corrected

Additional work during every second maintenance service

- 0560 Valve clearance adjusted
- 0730 Fuel pre-filter:
Filter element cleaned
- 1450 Engine brake:
Condition and setting checked

Additional maintenance work after ... years

Note:

Engine oil change at least every 12 months.

Every 2 years

Check for leaks and general condition

Note points of abrasion and incorrect positioning!

- 2050 Cooling and heating system

Every 3 years

- 2080 Coolant renewed

Every 4 years

- 0980 Air cleaner with paper filter element:
Filter element renewed

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0050 Engine: Check for leaks and general condition

- Visual check of engine for signs of leakage.
Slight dampness at sealing points need cause no alarm.



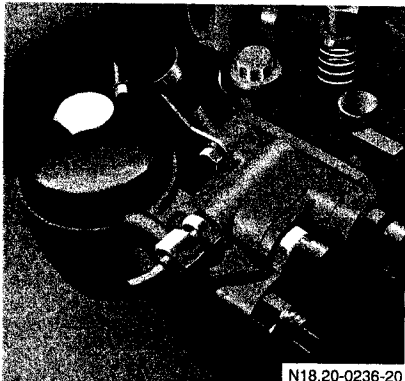
More severe leaks with a continual loss of oil must be rectified without delay.

0051 Lines and hoses on the engine: Check for leaks and general condition

- Visually inspect lines and hoses and listen for leaks. At the same time, check that all pipes and hoses are undamaged, correctly positioned to avoid abrasion and properly secured.



Warning – Risk of injury!
Exercise extreme caution in the vicinity of hot, rotating or moving parts.



N18-20-0236-20

Oil filter cap

0101 Engine: Oil change and filter replacement

Note:

Only change engine oil when warm.



Warning!
Risk of burns from hot oil.

- Unscrew the cap from the oil filter using a socket wrench WAF 1.41 in (WAF 36 mm).
Drain the oil from the filter casing.



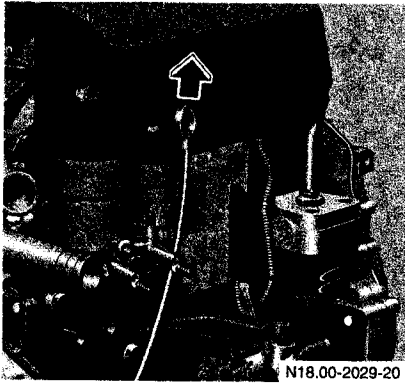
N18-20-0235-20

Cap with oil filter element

- Remove cap (1) together with the oil filter element and unclip the filter element (3) by pressing the lower edge to the side.



Ensure that no foreign objects get into the filter casing. On no account should the filter casing be wiped clean.



Oil dipstick

Siphoning/draining engine oil

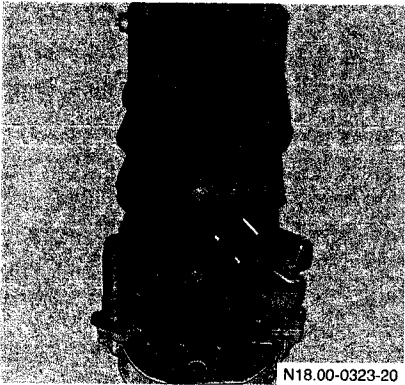
- Siphon out the engine oil through the dipstick guide tube. To do this, take out the dipstick (arrow) and push the suction probe into the dipstick guide tube until it is felt to strike the bottom of the sump.

Alternatively,

- Place a suitable receptacle beneath the oil drain plug on the underside of the oil sump. Carefully unscrew the oil drain plug and allow the oil to drain out.

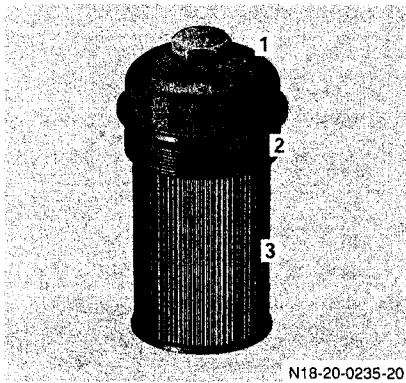


Dispose of the engine oil and filter in accordance with applicable legal stipulations.



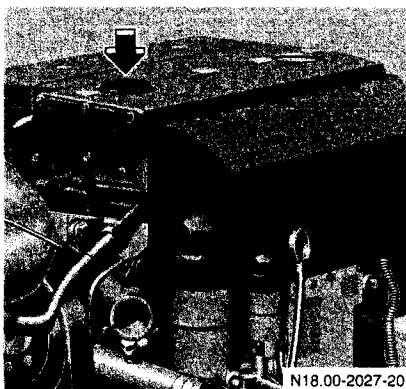
Engine oil drain plug, sump

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Cap with oil filter element

- Renew the rubber seal on the cap (2).
- Insert the new filter element into the cap and apply pressure to clip into place.
- Screw the cap onto the oil filter casing and tighten. Tightening torque 18.47 ft. lb. (25 Nm).
- If the engine oil has been drained from the oil sump, screw the oil drain plug back in, using a new seal, and tighten. Tightening torque 59.1 ft. lb. (80 Nm).



Oil filler neck

- Add new engine oil through the oil filler neck (arrow) until the "max" mark on the oil dipstick has been reached.
- Start the engine with the throttle potentiometer in the idle position, monitor the oil pressure gauge.

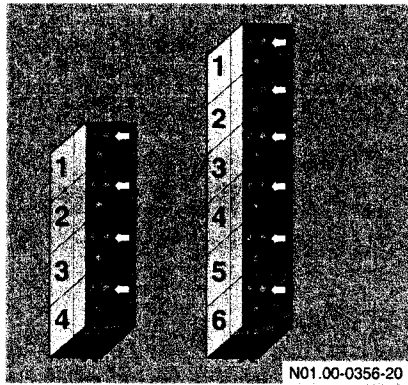


Keep the engine running at idling speed until an oil pressure reading is obtained.

If no oil pressure is shown after approximately 10 seconds, stop the engine and determine the cause.

- Check the filter and oil drain plug for signs of leakage.
- Stop the engine. Check the oil level again after approximately 5 minutes. If necessary, add oil up to the "max" mark on the oil dipstick.

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0560 Valve clearance adjustment

Layout of cylinders and valves

- ⇨ = Inlet valve
- ⇩ = Exhaust valve
- X = Flywheel end

Special tool

Turning tool 904 589 04 63 00

Valve clearance

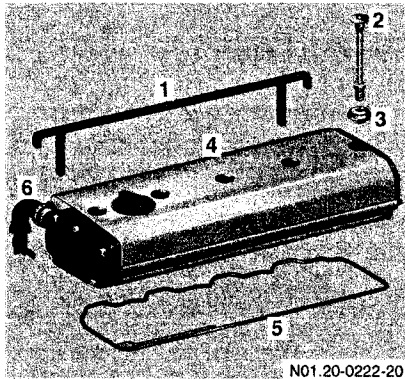
Inlet valves = 15.74 mil (0.40 mm)
 Exhaust valve = 23.62 mil (0.60 mm)

Note:

Adjust the valve clearance when the engine is cold (at least 30 minutes after it was switched off, even if it was only run for a short time).

Clean a heavily soiled cylinder head cover before removing it.

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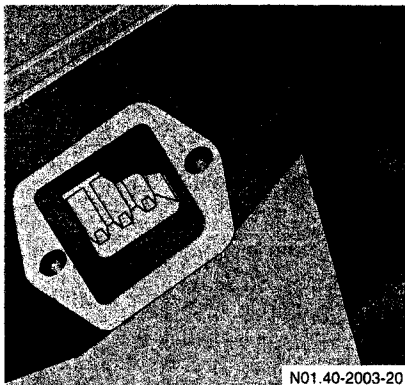


Removing/installing cylinder head cover

- Remove engine trim components.
- Remove the crankcase breather hose (6) from the cylinder head cover.
- Unscrew the hexagon socket-headed bolt (2) from the cylinder head cover, together with its sealing washer (3).
 To install:
 Insert the hexagon socket-headed bolt with a new sealing washer and tighten with a tightening torque of 22.16 ft. lb. (30 Nm).
- Remove cylinder head cover (4).
 To install:
 Clean the sealing surfaces of the cylinder head and the cylinder head cover as necessary. Check the gasket between the cylinder head cover and the charge air manifold (1). Renew if necessary. The gasket between the cover and the cylinder head (5) must always be renewed.

The cylinder head cover is installed by reversing the above sequence.

- Fit the turning tool 904 589 04 63 00 into the hose opening on the flywheel housing.



Inspection hole, flywheel housing

59

Valve clearance adjustment

All valves can be adjusted in two crankshaft positions

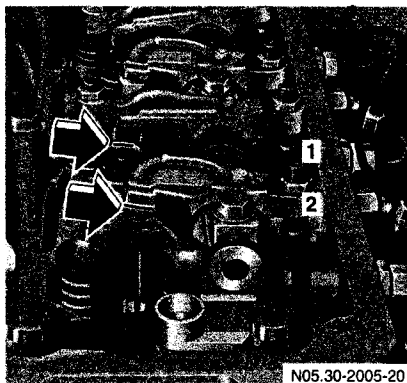
- Use the turning tool to turn the crankshaft until No. 1 cylinder is at the ignition TDC position or at the overlap TDC position (at ignition TDC, all valves are closed and the valves of No. 4 cylinder overlap).
- Use the turning tool to turn the crankshaft until No. 5 cylinder is at overlap TDC (No. 1 cylinder at ignition TDC). Now set No. 1 cylinder to overlap TDC (No. 5 cylinder at ignition TDC).
- Check and adjust valves in accordance with the following table.

Engine	Crankshaft position No. 1 cylinder	Cylinders/valves to be adjusted					
		1	2	3	4	5	6
OM 904 LA	Ignition TDC	I/E	I	E	-		
	Overlap TDC	-	E	I	I/E		
OM 906 hLA	No. 5 cylinder valve overlap	I/E	E	I	E	-	I
	No. 1 cylinder valve overlap	-	I	E	I	I/E	E

I - Inlet valve

E - Exhaust valve

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- 1 Adjusting screw
- 2 Locknut

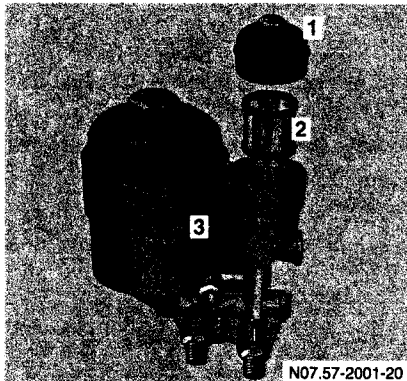
Checking/adjusting valve clearance

- Measure the valve clearance with a feeler gauge between the rocker arm and valve stem (exhaust valve) or valve bridge (inlet valve) (arrows). It should be possible to pull the feeler gauge through with no more than light resistance.
- To adjust the valve clearance, unscrew the locknut (2). Set the correct valve clearance by turning the adjusting screw (1).
- Retighten the locknut to a tightening torque of 18.47 ft. lb. (25 Nm).
- Check the valve clearance again and re-adjust if necessary.

Concluding operations

- Re-install cylinder head cover, (page 59).
- Remove the turning tool from the hose opening in the flywheel housing.

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Fuel pre-filter (on engine control unit)

- 1 Filter pan
- 2 Filter element
- 3 Seal

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0730 Fuel pre-filter: Filter element cleaned

- Clean the outside of the fuel pre-filter and cover over any hoses or pipes located beneath it.
- Unscrew the filter pan (1).
- Clean the filter pan and filter element.

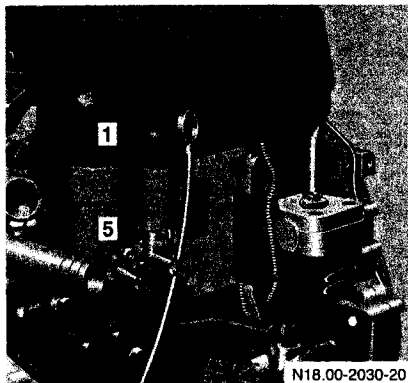
Note:

If the filter element is heavily soiled or damaged, it should be renewed.



Dispose of the used filter and of residual fuel in accordance with applicable legal stipulations.

- Check the rubber seal (3) for the filter casing and renew if necessary.
- Insert the filter element into the filter pan and screw the filter pan onto the filter casing with a tightening torque of 7.37 ft. lb. (10 Nm).

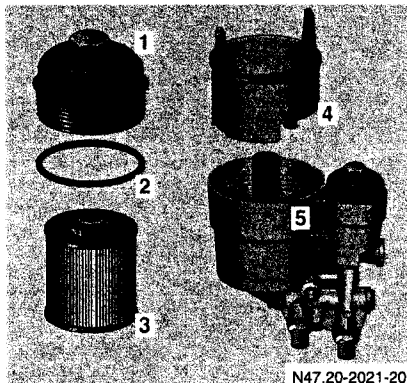


0780 Fuel filter element renewal

- Open the tank seal to prevent pressurisation of the tank.
- Unscrew the cap (1) together with the filter element and pull a short distance out of the filter casing (5). Allow the fuel to drain off.
- Remove the cap with the filter element. Unclip the filter element (3) by pressing the lower edge of the filter element to the side.
- Pull the dirt collector (4) from the filter casing by the tags.



Dirt must not be allowed to get into the filter casing. Do not empty the dirt collector into the filter casing.



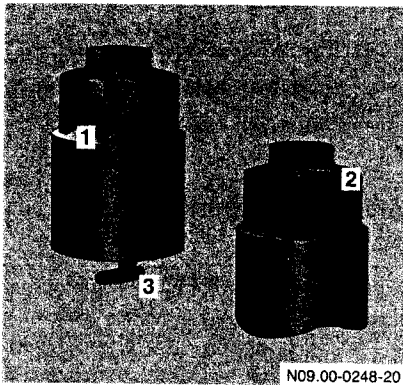
- 1 Cap
- 2 Seal
- 3 Filter element
- 4 Dirt collector
- 5 Filter casing

- Clean the cap and the dirt collector.
- Renew the rubber seal (2).
- Clip the new filter element into place in the cap.

63

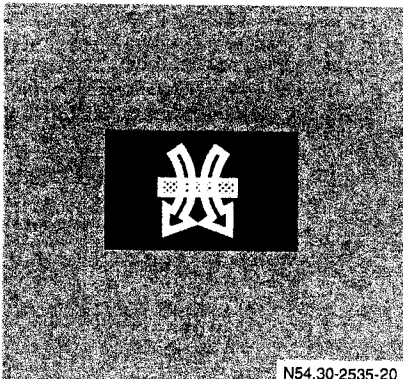
- Oil the rubber seal and filter element seals lightly.
- Insert the dirt collector into the filter casing, ensuring the correct installation position.
- Screw the cap with the filter element and tighten. Tightening torque 18.41 ft. lb. (25 Nm).
- Start the engine. As soon as oil pressure is indicated, run the engine at a moderate speed for about 10 seconds. Check the fuel filter for leaks.

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N09.00-0248-20

- Maintenance indicator
- 1 Air cleaner OK
 - 2 Air cleaner maintenance due
 - 3 Reset button



N54.30-2535-20

Filter warning lamp

0950 Air cleaner with paper filter element: Filter element renewal as necessary

Note:

It is not normally necessary to conduct maintenance on the air cleaner, only when this indicated by, for example the maintenance indicator on the air cleaner or by a filter maintenance indicator lamp (illustration below).

If the air cleaner is fitted with a maintenance indicator, the need for maintenance work is shown by a red marker becoming visible.

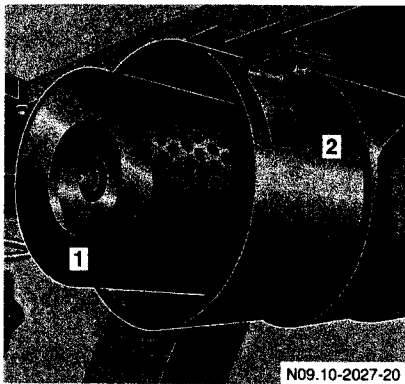
After the filter maintenance work is complete, the red marker is cancelled by pressing the reset button.

Maintenance switches are always operational and do not have to be reset.

To determine whether filter maintenance is necessary, a depression test can also be performed (special tool 201 589 13 21 00). To do this, disconnect the maintenance indicator, or the connecting hose to the maintenance indicator and connect the tester.

Take the depression reading at the engine's maximum governed running speed. If a value of 104.43 psf (50 mbar) is exceeded, filter maintenance is necessary.

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1 Filter element
2 Filter casing

- Remove the filter element (1).
- Clean the interior and the sealing surfaces of the air cleaner housing (2).
- Check the filter element for damage, Check the filter element for damage, for example by shining a torch through.



Damaged filter elements should always be renewed.

- Filter elements which are four years old or more should also be renewed.
- Record the renewal with permanent ink on the adhesive label or on the end of the filter element.
- Install the filter element.
- Refit the cap of the air cleaner housing.

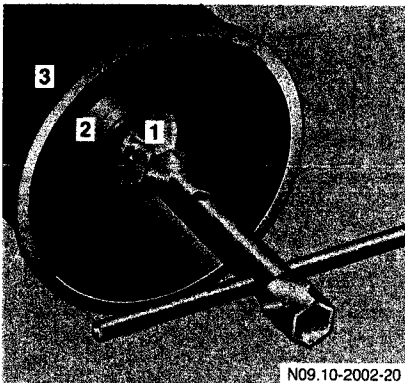
If the air cleaner is fitted with a maintenance indicator (page 65):

If the red marker was visible, press the reset button.

Note:

If a Piclon combination air cleaner with safety element is used, the following points should be noted:

- Do not remove the safety element from the filter housing when the main filter element is serviced. Mark the number of services on the spaces provided on the safety element.



1 Hexagon bolt WAF 0.94 in (WAF 24 mm)
2 Safety element
3 Filter casing

Renew the safety element:

- after the fifth service of the main filter element or if the main filter element is defective,
- after no more than 2 years in service,
- if maintenance is indicated as being due after a service has been carried out.

The safety element is accessible for servicing after the main filter element has been removed.

- Unscrew the hexagon bolt WAF 0.94 in (WAF 24 mm) on the centre shaft.
- Remove and dispose of the safety element.
- Insert a new safety element and tighten the hexagon bolt.



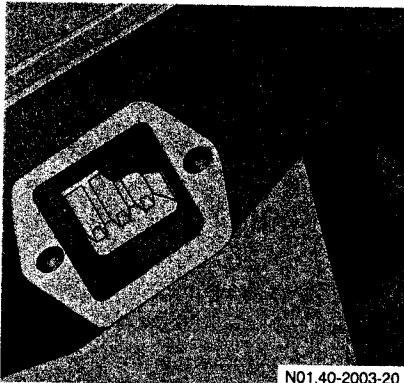
On no account is the safety element to be cleaned and reused.
The engine must not be run without the main filter element being fitted.
See the notes in the maintenance instructions.

**0953 Intake pipe between air cleaner and engine:
Check for leaks and general condition**

- Check that rubber boots, intake pipes and connecting hoses are undamaged and free from leaks.
- Check tightness of hose clips, flange connections and the intake manifold.

**0980 Air cleaner with paper filter element:
Filter element renewed**

- For work involved, see operation item "0950 Air cleaner with paper filter element: Filter element renewal as necessary". The filter element should however generally be renewed.



Inspection hole, flywheel housing

N01.40-2003-20

1351 Poly-V-belt: Check condition

Special tool

Turning tool 904 589 04 63 00

- Fit the turning tool to the hose opening in the flywheel housing.
- Make a mark on the poly-V-belt with chalk.
- Check the poly-V-belt section for signs of damage. To do this, turn the engine or poly-V-belt gradually on until the chalk mark is reached again.

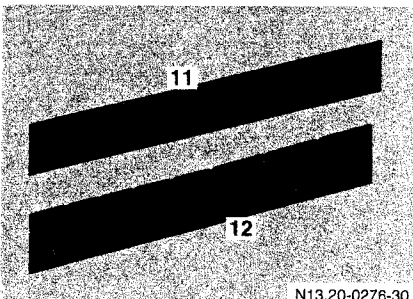
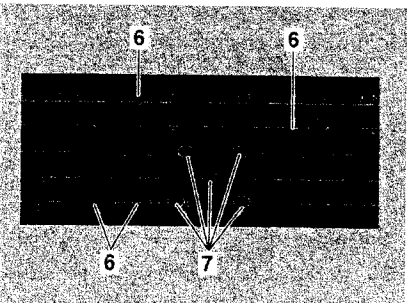
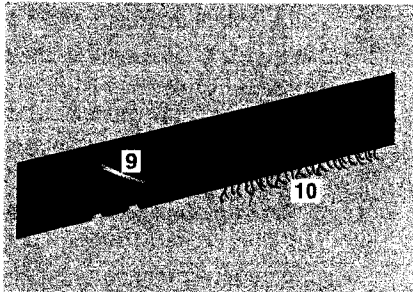
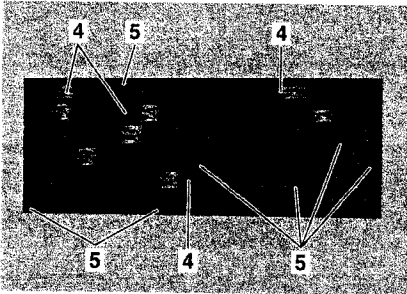
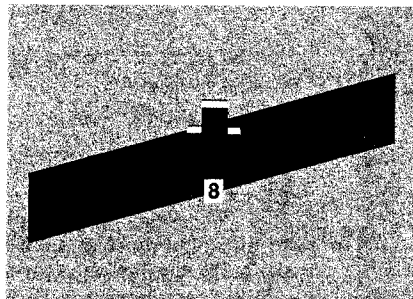
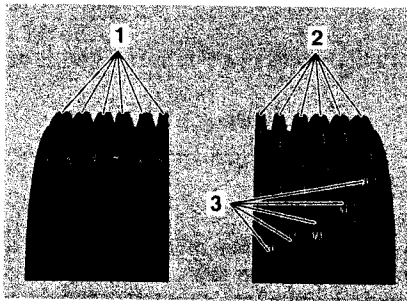


The poly-V-belt must be renewed if any of the damage patterns listed overleaf appear.

Removing and installing the poly-V-belt, (page 59).

- Remove the turning tool again.

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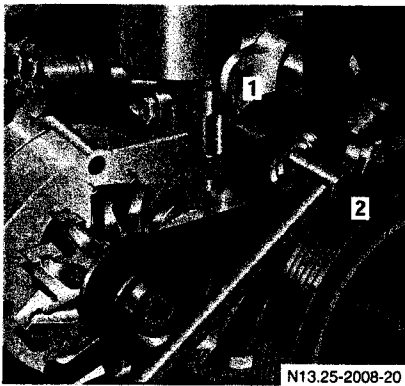


N13.20-0276-30

Damage patterns

- 1 Condition as new (as reference: trapezoidal ribs)
- 2 Wear on one side: Wedge-shaped ribs
- 3 Cord visible in base of ribs
- 4 Ribs split
- 5, 12 Fractures in several ribs
- 6 Nodules of rubber in base of belt
- 7 Deposits of dirt/stones
- 8 Ribs separated from base of belt
- 9 Cord torn out to the side
- 10 Outer cords frayed
- 11 Fractures on the reverse of belt

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1 Tensioner pulley
2 Spanner

N13.25-2008-20

Removing/installing poly-V-belt

- Plug the spanner (2) with a 669.29 mil (17mm) socket insert onto the hexagonal bolt on the tensioner pulley (1).
- Turn the tensioner pulley upwards and remove the poly-V-belt.

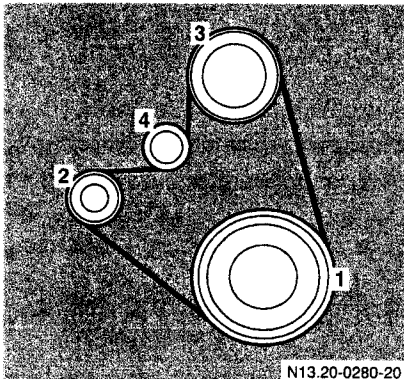


Warning - Risk of injury!

The tensioning mechanism is spring-loaded. When releasing the mechanism, do not hold the pulley with your hand, to avoid any risk of it becoming trapped.

- Turn the tensioning mechanism back.
- Check the tensioning mechanism and the pulleys for damage (e.g. worn bearing on tensioning mechanism, tensioner and deflector pulleys, or pattern wear on poly-V-belt pulleys). If necessary, renew parts.
- Lay the poly-V-belt (new) on all the pulleys except for the tensioner pulley (see illustrations for correct routing of the poly-V-belt).
- Turn the tensioner pulley upward with the lever, place the poly-V-belt onto the tensioner pulley and turn the tensioner pulley downward.
- Remove the spanner and check that the poly-V-belt is seated correctly on the pulleys.

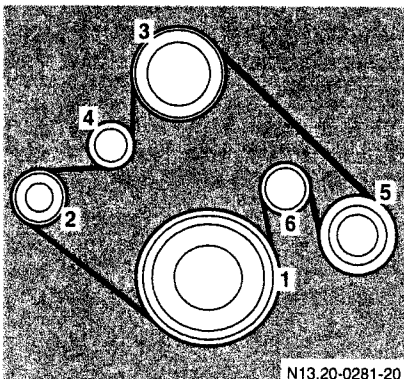
70



N13.20-0280-20

Routing of poly-V-belt (engine without refrigerant compressor)

- 1 Crankshaft
- 2 Alternator
- 3 Coolant pump
- 4 Tensioner pulley

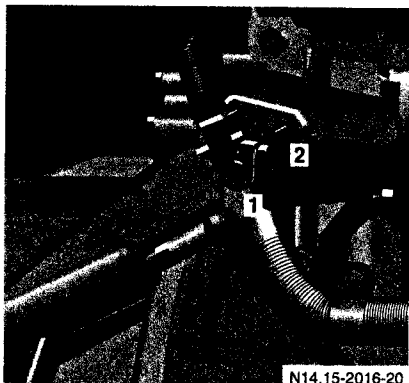


N13.20-0281-20

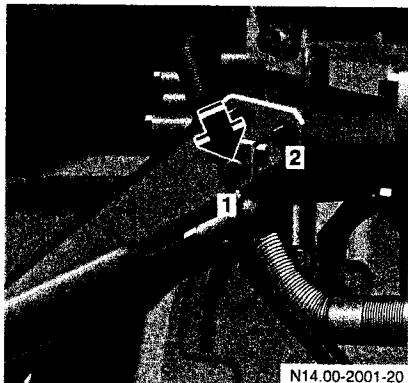
Routing of poly-V-belt (engine with refrigerant compressor)

- 1 Crankshaft
- 2 Alternator
- 3 Coolant pump
- 4 Tensioner pulley
- 5 Refrigerant compressor
- 6 Deflector and guide pulley

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1 Throttle valve lever
2 Stop



1 Throttle valve lever
2 Stop

1450 Engine brake: Check condition and adjustment

Checking condition

- Remove the wire safety ring from the ball socket of the engine brake cylinder.
- Press the ball socket from the ball head of the throttle valve lever (1).
- Check the engine brake cylinder, ball head and socket and the throttle valve shaft for signs of wear.
- Check the tightness of the throttle valve lever on the throttle valve shaft. If necessary, tighten the locking screw.
- Press the ball socket back onto the ball head, attach the wire safety ring.

Checking adjustment

Note:

- When the engine brake is activated, the throttle valve lever (1) must be against the stop (2) in the active position (cylinder extended).
- When the engine brake cylinder is in the rest position (cylinder retracted), the throttle valve lever must also be against the stop. The pre-tension of the engine brake cylinder return spring is then sufficient.
- Check the position of the throttle shaft: In the engine brake rest position, the groove (arrow in upper illustration) must be parallel to the direction of exhaust flow. In the active position it must be positioned across the flow.

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2010 Engine cooling system: Check and correct fluid level and corrosion inhibitor/antifreeze concentration



Only use service products approved by DaimlerChrysler AG. See "Coolant" (page 109).



Risk of scalding !

Never open the cap of the engine cooling system if the coolant is at normal operating temperature.

Note:

Only check and correct coolant level when the coolant temperature is below 122 °F (50 °C). Before correcting the coolant level, check the corrosion inhibitor/antifreeze concentration. When topping up, use only a pre-prepared coolant mixture containing 50% corrosion inhibitor/antifreeze by volume.

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- Open the cap of the engine's cooling system slowly to allow excess pressure to escape.
- Check the concentration of corrosion inhibitor/antifreeze with a suitable tester. The correct concentration of corrosion inhibitor/antifreeze, that is 50% by volume, protects the system down to a temperature of -34.5 °F (-37 °C). If a lower level of antifreeze protection is shown, correct the concentration.



If the concentration is too low, there is a risk of corrosion/cavitation in the cooling system.

Note:

Concentrations of more than 55% by volume should not be used, as this is the level which affords maximum antifreeze protection down to -48.5 °F (-45 °C), whereas higher concentrations adversely affect heat dissipation.

- Check the coolant level. The cooling system is correctly filled when the coolant has reached the mark in the filler neck or to the rim of the filler system.

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1 Compressed air valve

N58.40-0201-20

2050 Cooling and heating system: Check for leaks and general condition

Special tool

Pressure tester 001 589 83 21 00

Note:

The operation item "2010 Engine cooling system: Check and correct the fluid level and corrosion inhibitor/antifreeze concentration" must first be performed.



Warning – Risk of scalding!

Perform the check for leaks when the engine is cold.

- On heating systems: Open the regulating and cut-off valves.
- Remove the cap from the coolant expansion tank.
- Connect up the tester.
- Connect the compressed air hose with the tyre inflation union to the valve and allow pressure to build up to a level corresponding to the opening pressure of the cooling system.

The opening pressure of the cooling system can be identified from the code on the cap or on the pressure relief valve.

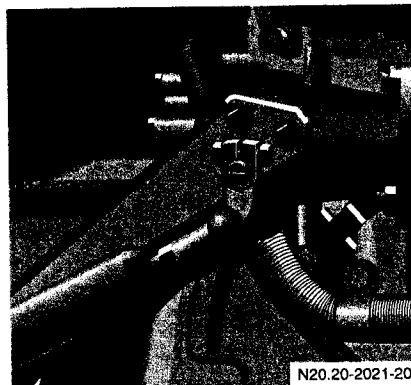
Example: Code 70 = 10.15 psi (0.7 bar) gauge pressure.

Note:

A safety valve is incorporated into the tester to prevent the pressure from exceeding 17.41 psi (1.2 bar.)

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- Check all radiators, the coolant pump, the engine oil cooler, the engine covers (core-hole covers) and the heat exchanger for leaks.
- Check all pipes and hoses for the cooling and heating system for freedom from leaks and damage, correct positioning to avoid abrasion and secure fastening in the specified manner.
- Check the radiator for external contamination. The fins must not be blocked with dirt.
- Relieve pressure in the cooling and heating system at the valve on the tester. Remove the tester and re-attach the cap.
- Close the heating system regulating valves.



Coolant drain plug

2080 Coolant renewal



Only use a corrosion inhibitor/antifreeze approved by DaimlerChrysler AG. See "Service products".

Note:

Before renewing the coolant, check that the cooling and heating system is in good condition and free from leaks. Confirm the coolant renewal with an entry in the Maintenance Booklet.



Warning – Risk of scalding!

Perform the work described below only when the coolant temperature is below 122 °F (50 °C).

- Open the cap of the engine's cooling system slowly to allow excess pressure to escape and remove the cap.
- If a heating system is installed: Open the heating system regulating valve.
- To drain the coolant from the engine, attach the hose (interior diameter approx. 492.13 mil (12.5 mm)) to the drain plug (arrow) on the engine. The coolant will drain off after the plug has been turned through 1 to 2 turns.

Note:

There are other drain plugs, for example on the radiator. Pipes etc. below the drain plug should first be covered over and a receptacle suitable for the quantity of coolant should be placed underneath.



Dispose of the used coolant in accordance with applicable legal stipulations, see "Disposal" (page 111).

- Free drain apertures if blocked by deposits.
- Screw in the coolant drain plug on the engine tight again and remove the drain hose.
- Screw in other drain plugs (without hose connection) with new seals.

Adding coolant

- Add coolant in the specified concentration until the mark in the filler neck or the rim of the filler neck is reached. Seal the cooling system again.
- Start the engine and run it for about 1 minute at varying speeds.
- Stop the engine and check the coolant level. Top up if necessary (see operation item 2010).

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Cleaning, protective treatment

Cleaning the engine	80
Cleaning the cooling system	81
Protective treatment	82

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Cleaning the engine



Observe environmental protection regulations.

High-pressure cleaning equipment

Note the equipment manufacturer's operating instructions.

Comply with the minimum working distance between the high-pressure nozzle and the surface being cleaned:

- approximately 27.55 in (700 mm) for circular pattern jets,
- approximately 11.81 in (300 mm) for (25°) flat jets and dirt cutters.



During the cleaning process, keep the water jet moving all the time and do not direct it onto electrical components, plug connectors, seals or flexible hoses.

Information on suitable cleaning and protective products is available from any Detroit Diesel Distributor Service Center.

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Cleaning the cooling system



Collect used coolant, cleaning solutions and washing liquid and dispose of in accordance with applicable legal stipulations.

- Remove foreign bodies (dust, insects etc.) from the fins of the radiator grille by blowing them through with compressed air or spraying them out with water, working from the rear of the radiator (in the opposite direction to the normal cooling air flow).



Clean at moderate pressures only, or else the fins of the radiator grille could be damaged.

- Drain the coolant when the engine is cold, see operation item 2080.
- If a heater is connected to the cooling system, open the regulating valves fully.

Degreasing

- Fill the cooling system with a 5% solution (1.76 oz (50 g) cleaning agent per litre of water) of a mildly alkaline cleaning agent in water, e.g. P3 Croni (manufactured by Henkel).
- Run the engine at moderate speed until its operating temperature reaches approximately 176 °F (80 °C) (temperature at which the thermostat starts to open), then run it for about 5 minutes longer.
- Stop the engine and allow it to cool down to approximately 122 °F (50 °C).
- Drain out all the cleaning solution.
- Immediately after this, fill the system twice in succession with clean water, allow the engine to warm up and after a further 5 minutes, drain it again.
- Filling the cooling system with new coolant, see operation item "2080 Coolant renewal" (page 77) and the section entitled "Coolant" (page 109).

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Protective treatment

The degree of protective measures will depend on the period out of use and on climatic conditions at the engine's location or storage point.

After being cleaned, engines should whenever possible, be placed in a dry, well-ventilated place. If this is not possible, the intervals for work to be performed regularly should be halved.

In all cases, the engine must be protected against direct exposure to moisture (rain / splash water).

If the engine is to be laid up for up to 12 months, anti-corrosion protection measures are not necessary, provided that the conditions at the place of storage are as described above.

If the engine is to be laid up for over 12 months or under extraordinary storage or transportation conditions special protective treatment measures are necessary. Information is available from any Detroit Diesel Service Center. An enquiry is strongly recommended.

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Practical hints

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Malfunctions, causes and remedial action

Besides careful operation and maintenance of the engine, it is important that any malfunction is rectified promptly. The measures listed below under "Remedial action" are described in more detail in the sections "Maintenance" and "Test procedures and other fault elimination operations".

For more extensive operations, we recommend you consult a Detroit Diesel Distributor Service Center.

Trouble-shooting, general

Malfunction	Cause	Remedial action
Starter motor pinion does not turn or turns too slowly	Insufficient battery charge	Recharge the battery
	Connector lead to starter motor loose	Tighten lead firmly at terminal or solder on a new terminal if necessary
	Starter motor solenoid switch defective	Have switch checked by a specialist
The engine will not start or stops again immediately	Fuel tank empty	Add fuel and bleed the fuel system
	Fuel filter blocked	Clean the filter, renew filter element if necessary

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Malfunction	Cause	Remedial action
The engine will not start or stops again immediately	Fuel line, pre-filter or screen in fuel tank blocked	Clean and bleed the system
	Fuel system or filter seals leaking	Eliminate leaks
	Fuel not cold-resistant	Clean pre-filter, renew main fuel filter, use winter-grade fuel.
	Ambient temperature too low	Note measures for winter operation
Poor engine starting	Fuel temperature too high or sensor defective	Renew fuel temperature sensor; consult a Detroit Diesel Service Center
	ECU control unit defective	Read ECU control unit fault memory; consult a Detroit Diesel Service Center
	Leaks/insufficient pressure in fuel low pressure circuit	Check for leaks (visual check); have pressure checked by a Detroit Diesel Service Center

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Malfunction	Cause	Remedial action
Engine cuts out unintentionally	ECU control unit defective (total failure);	Consult a Detroit Diesel Distributor Service Center
	Voltage supply interrupted; short circuit in wiring or at stop button;	Consult a Detroit Diesel Distributor Service Center
	VCU module defective	
	Leaks/insufficient pressure in fuel low pressure circuit or fuel delivery pump drive defective	Check for leaks (visual check); have pressure checked by a Detroit Diesel Distributor Service Center
Engine in emergency running mode (constant speed 1,300 rpm) autom. 900 rpm	ECU or VCU control unit defective	Read control unit fault memories; consult a Detroit Diesel Distributor Service Center
Engine runs irregularly, vibrates, runs roughly	Crank angle sensor or TDC sensor (camshaft angle sensor) poles reversed	Unplug each sensor in turn; if engine running improves (emergency running speed), sensor poles are reversed - switch poles; consult a Detroit Diesel Distributor Service Center

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Malfunction	Cause	Remedial action
Engine does not develop full power	Charge pressure sensor defective	Check with DaimlerChrysler diagnosis tester, renew if necessary. Consult a Detroit Diesel Distributor Service Center
	Charge air temperature too high or temperature sensor defective	Check temperature sensor, renew if necessary. Consult a Detroit Diesel Distributor Service Center
	Fuel temperature too low	Check temperature sensor, renew if necessary
	Coolant temperature too high	Check temperature sensor, renew if necessary
	Engine brake valve defective	Functional or visual check
	Fault in fuel system (blocked, leaking)	Visual check for signs of leakage, consult a Detroit Diesel Distributor Service Center
	ECU or VCU module defective	Read control unit fault memory; consult a Detroit Diesel Distributor Service Center

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Malfunction	Cause	Remedial action
Tractive power interrupted	Loose connection in voltage supply	Check battery terminal clamps and connector plugs on ECU control unit for tightness and corrosion
	Leaks/insufficient pressure in fuel low pressure circuit	Check for leaks (visual check); have pressure checked by a Detroit Diesel Distributor Service Center
Poor engine brake performance	VCU control unit defective	Read VCU control unit fault memory. Consult a Detroit Diesel Distributor Service Center
	Constantly open throttle valve defective	Check throttle valve activation; consult a Detroit Diesel Distributor Service Center
	Engine brake valve defective	Functional or visual check

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Malfunction	Cause	Remedial action
Fuel consumption too high	Fuel temperature too high or sensor defective	Renew fuel temperature sensor; consult a Detroit Diesel Distributor Service Center
	Leak on pressure side of turbocharger	Check for leaks; consult a Detroit Diesel Distributor Service Center
	Connection points plug pump - fuel line and injectors defective or leaking	Pump calibration with minidiag; (Detroit Diesel Distributor Service Center)
Engine does not reach maximum speed	VCU control unit defect/incorrectly programmed	Read fault memory with Daimler Chrysler minidiag diagnosis tester
Engine becomes too hot (according to coolant temperature display)	Coolant temperature sensor defective	Renew sensor
	Insufficient coolant or cooling system not completely bled	Add coolant, bleed the system
	Poly-V-belt insufficiently tensioned or defective	Re-tension or renew
	Radiator contaminated or calcified internally, radiator severely contaminated externally	Clean and/or decalcify
	Thermostats defective	Check and renew if necessary; consult a Detroit Diesel Distributor Service Center

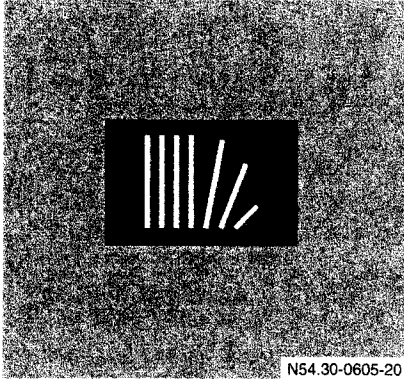
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Malfunction	Cause	Remedial action
Battery charge indicator lamp does not light up when the engine is not running	Bulb defective or connecting lead is interrupted	Change bulb or repair the break in the circuit
Battery charge indicator lamp lights up when the engine is running	Poly-V-belt tension insufficient	Check belt tension; if necessary, renew tensioner pulley
	Poly-V-belt tensioner defective	Renew poly-V-belt tensioner
	Alternator, rectifier or voltage regulator defective	Check parts. Consult a Detroit Diesel Distributor Service Center
Black exhaust smoke	Charge air, coolant or fuel temperature sensor defective	Consult a Detroit Diesel Distributor Service Center
	Injector defective	Consult a Detroit Diesel Distributor Service Center
	Turbocharger or charge air pipes defective, air cleaner contaminated	Visual check; consult a Detroit Diesel Distributor Service Center
	Constantly open throttle valve defective	Consult a Detroit Diesel Distributor Service Center

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Malfunction	Cause	Remedial action
Blue exhaust smoke	Engine oil level too high, engine oil reaching combustion chamber	Correct oil level, have this checked at a Service Station
White exhaust smoke	Leak at cylinder head or cylinder head gasket, coolant reaching combustion chamber	Locate the defective cylinder by testing for pressure loss and rectify the fault, or consult a Detroit Diesel Distributor Service Center
Engine "rattles"	Combustion defect	Consult a Detroit Diesel Distributor Service Center
Engine "knocks"	Bearing damage	Consult a Detroit Diesel Distributor Service Center
Unusual noises	Whistling sound caused by leakage at inlet and/or exhaust pipe	Eliminate the leak, replace the seals if necessary
	Turbine or compressor blades scraping against housing; foreign bodies in compressor or turbine; seized bearing on a rotating part	Exchange turbocharger Consult a Detroit Diesel Distributor Service Center

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N54.30-0605-20

Electronics indicator lamp

Troubleshooting, Telligent[®] engine system

When the Telligent[®] engine system detects a fault, this is indicated by the electronics indicator lamp lighting up.

Reading fault memory

- Switch the ignition off.
- Connect the DaimlerChrysler diagnosis tester hand-held Minidiag (special tool) to the 14-pin diagnosis socket (on vehicle/appliance).
- Switch ignition on again.

Note:

Do not start the engine. Fault codes cannot be deleted when the engine is running.

If no fault codes can be read, check diagnosis socket fuse and earth connection.

- Call up the appropriate menu to read fault codes from the ECU or ADM2 control unit.
- Call off fault codes.

The correct cause of the fault or the faulty assembly groups can be taken from the following Fault codes table (page 93 to 96).

Note:

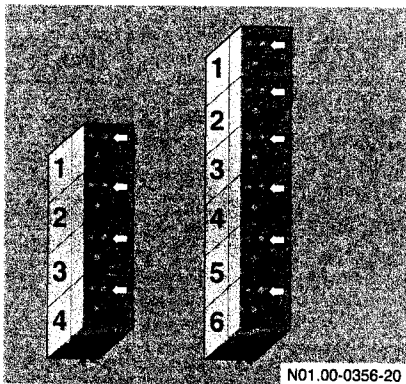
The tables contain a selection of possible fault codes. If you have any questions, for example if another fault code is displayed, please contact a Detroit Diesel Distributor Service Center.

ECU fault codes

(Selection)

Fault code	Meaning/cause
01015/6	Oil temperature too high/low or oil temperature sensor defective
01115/6	Fuel temperature too high/low or fuel temperature sensor defective
01215/6	Charge air temperature too high/low or charge air temperature sensor defective
01315/6	Atmospheric pressure too high/low or atmospheric pressure sensor defective
01415/6	Charge air pressure too high/low or charge air pressure sensor defective
01417	Charge air pressure measured value implausible
01418	Charger circuit defective
02219	Terminal 15 ECU/VCU (□) recognition
02319	Terminal 50 ECU/VCU (□) recognition
03015/6	Fuel pressure too high/low or fuel pressure sensor defective
04037/47	Internal fault (ECU)
04038/40	Defect in starter motor actuation
09x44	Limitation of smooth running control, segment x (cylinder allocation, (page 95))
09x45	Limitation of individual cylinder calibration, segment x (cylinder allocation, (page 95))

Fault code	Meaning/cause
10100/1/4	Open circuit in CAN wire
10102	VCU data implausible
10308	Crankshaft angle sensor - earth connection
10309	Crankshaft angle sensor - open circuit
10311	Allocation crankshaft angle sensor/camshaft angle sensor implausible
10312	Crankshaft angle sensor - no signal
10313	Crankshaft angle sensor - terminals reversed
10408	Camshaft angle sensor - earth connection
10409	Camshaft angle sensor - open circuit
10412	Camshaft angle sensor - no signal
10413	Camshaft angle sensor - terminals reversed
11515/6	Coolant temperature too high/low or coolant temperature sensor defective
11615/6	Oil pressure too high/low or oil pressure sensor defective
14024	ECU control unit internal fault
15x26	Missing end position recognition, ECU solenoid valve, segment x (cylinder allocation, (page 95))
15x27	Activation of ECU solenoid valve, segment x faulty (cylinder allocation, (page 95))
18008	Starter motor actuation - earth connection
18033	Starter motor relay does not respond
25x28	Short circuit in solenoid valve, segment x (cylinder allocation, (page 95))



Allocation of segment to cylinder

In various fault codes, the letter x represents a segment of the engine which is allocated to a particular cylinder.

The allocation can be taken from the following table.

Segment (x)	0	1	2	3	4	5
Cylinder	1	2	3	4	5	6

Example:

Fault code displayed: 15127 (corresponds to 15x27 / segment x = 1)

Segment 1 = No. 2 cylinder (see table)

Meaning is accordingly: Actuation of PLD solenoid valve for No. 2 cylinder faulty.

The location of the corresponding cylinder can be seen in the illustration to the left.

- ⇨ = Inlet valve
- ⇦ = Exhaust valve
- X = Flywheel end

VCU fault codes

(Selection)

Fault code	Meaning/cause
00202	Defect in ECU control unit (engine in emergency running mode)
00307	Flame start system relay defective
01120	Alternator - short circuit (faulty charge signal)
01125	Alternator - open circuit or earth connection
03031	Overvoltage, terminal 30
03032	Undervoltage, terminal 30
04041	Terminal W, open circuit short circuit, poly-V- belt slipping
04644	Accelerator pedal sensor blocked (idle position not reached)
04642	Idle position restricted (no idle position within 2 minutes of engine start)
04643	Accelerator pedal sensor value outside learnt range
10201	CAN wire defective (single-wire communication)
10203	No connection to ECU control unit
14641	Accelerator pedal sensor defective
17070	Accelerator pedal sensor, learning error
17072	Terminal W (gear ratio), learning error
17074	CAN configuration, learning error

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Test procedures and other fault elimination operations

The safety precaution listed on (page 13) are also to be observed for all operations described below.

If in doubt, have the work carried out by a Detroit Diesel Distributor Service Center.

Checking the thermostat

Removing/installing

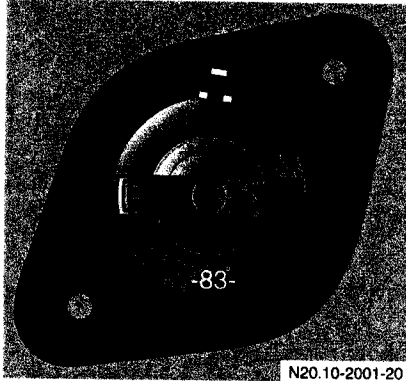


Warning!

Risk of scalding from hot coolant.

- Drain off the coolant; see "Coolant renewal" (page 77).
To install:
Add coolant
- Release the hose clip and remove the coolant hose from the hose connection. Collect any escaping residual coolant.
- Unscrew the hose connection from the coolant pump casing.
To install:
Securing bolts tightening torque 18.43 ft. lb. (25 Nm).

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Thermostat (example)

- Remove the O-ring and thermostat.

To install:

Insert problem-free thermostat with a new O-ring.



Note the installation location of the thermostat: The breather orifice (arrow) must always point upwards.

Do not start the engine up without a thermostat.

The thermostat is installed by reversing the above sequence.

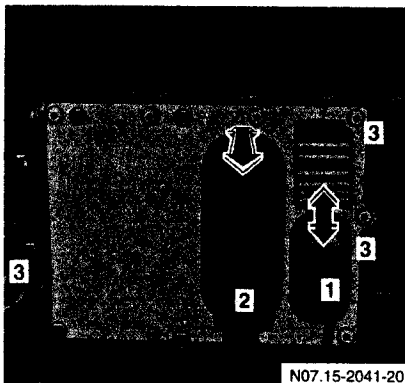
When installation is complete, add coolant.

Check in water-bath

- Suspend the thermostat on a piece of wire in a vessel full of water.
- Heat the water, stirring it at the same time.

The thermostat should start to open at about 181.5 °F (83 °C) and be fully open at 203 °F (95 °C).

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ECU control unit

- 1 Plug connector, appliance wiring harness
- 2 Plug connector, engine wiring harness
- 3 ECU control unit securing bolts

Exchanging the ECU control unit

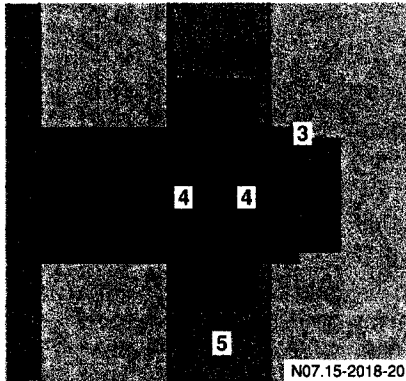
Note:

The ECU control unit is affixed to the engine and must only be exchanged for a correctly programmed DaimlerChrysler original part. All data given on the ECU control unit data plate are required to order a replacement control unit.

Removing/installing

- Switch the ignition off.
- Release the plug connector from the appliance wiring harness (1) to the ECU control unit by pulling the locking arm up and then pull the connector off. When installing, ensure the unit is correctly seated (engaged).
- Release the plug connector from the engine wiring harness (2) to the ECU control unit by folding up and separate. When installing, plug the connector in, fold the locking arm up and engage.

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- 3 ECU control unit securing bolts
- 4 Rubber vibration damper
- 5 ECU control unit

- Unscrew the ECU control unit securing bolts (3), remove the rubber vibration dampers (4).
- Remove the ECU control unit (5)

When installing:

The rubber vibration dampers (4) must be in place on the ECU control unit (5) before the new control unit is installed.

Ensure the rubber vibration dampers (4) are correctly positioned. Securing bolts (3) tightening torque 11.06 ft. lb. (15 Nm).

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Emergency starting

If the battery is flat, the engine can be started with jump leads from a second battery.



Warning – Risk of injury!

Ensure that both batteries have the same nominal voltage.

If a battery is flat, it can freeze at approximately 14 °F (-10 °C). It must be thawed out before emergency starting.

Before starting the engine with the aid of a mobile charger (batteries with mains connection), disconnect the mains plug.

Do not lean over the battery during the emergency starting procedure (risk of acid burns).

Do not bring a naked flame near the battery or cause sparks. Refrain from smoking (risk of explosion).

Do not place metallic objects on top of the battery (risk of short circuit).

Use only jumper leads with a wire cross-section of approximately 0.108 in² (70 mm²) and with insulated terminal clamps.



If starting the engine with an outside power source, the maximum permissible voltage of 28 V must not be exceeded (exceeding this voltage could result in damage to the electronic regulating section).

- Connect the two batteries positive terminals together first, then the negative terminals.
- Start the engine (page 40) and allow it to run for a short time.
- Disconnect the jumper leads in the reverse sequence.

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Service products

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Service products



Warning – Risk of poisoning!

Service products constitute a health hazard. Consult a doctor immediately if any service product is swallowed. Keep service products out of the reach of children.

Components of the engine and the lubricants they need have to be carefully matched together. For this reason, only brands which have been tested and approved by DaimlerChrysler AG should be used. These are stated in the DaimlerChrysler AG Specifications for Service Products.

No special lubricant additives are needed. The use of additives could affect warranty rights.

Information is available from any Detroit Diesel Distributor Service Center.



Service products and parts which have been in contact with them (e.g. filters) must be disposed of in an environmentally responsible manner. Comply with legal requirements.

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Diesel fuels

Only use commercially available vehicle diesel fuel (DIN EN 590). Grades such as marine diesel fuel, heating oil etc. are not permissible.

No fuel additives are needed. The use of fuel additives could affect warranty rights.

If diesel fuel with a sulphur content exceeding 0.3 % by weight is used, change the engine oil at shorter intervals. Comply with the instructions in the Maintenance Booklet.

Note:

If the Telligent[®] maintenance system is used, the sulphur content of the diesel must be entered in the system or adapted to the current value.

Fuel added from drums or cans could be contaminated. This could lead to malfunctions in the fuel system. Always filter the fuel before adding it to the tank.

Diesel fuel in extreme cold

At low ambient temperatures, paraffin may separate from the diesel and affect its ability to flow freely.

To avoid breakdowns caused by this problem (e.g. blocked filters), diesel fuel with improved low-temperature flow characteristics is sold in the winter months. Differences are possible in different countries and in the transitional periods before and after the cold season. In Germany, particularly cold-resistant winter diesel fuels keep the engine operational down to a temperature of approximately -4 °F (-20 °C). In most cases, winter-grade diesel can be used without problems at the ambient temperatures encountered locally.

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If summer-grade diesel, or a less cold-resistant winter-grade diesel is in use, a flow improver or kerosene can be added to it, the actual quantity being dependent on the ambient temperature.



Do not add petrol (gasoline) to the diesel.

Mix the flow improver or petroleum spirit with the diesel in good time, before the fuel's flow characteristics have been adversely affected by paraffin separation. If faults have already been caused by paraffin separation, they can only be rectified by heating the entire fuel system.

Do not add anything to cold-resistant winter-grade diesel fuels. The fuel's low-temperature flow characteristics could actually deteriorate with such an additive.

Flow improvers

The effectiveness of flow improvers is not guaranteed with all fuels. Comply with the product manufacturer's recommendations. Any Detroit Diesel Distributor Service Center can provide information on approved flow improvers.

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Kerosene

Keep the quantity added as low as possible, bearing in mind the ambient temperature. The addition of 5% by volume of kerosene will improve the fuel's resistance to cold by about 34 °F (1 °C). Never add more than 50% kerosene to the fuel.

For reasons of safety, add the kerosene to the diesel only in the fuel tank. Add the kerosene first, then the diesel. Run the engine for a short time to allow the mixture to reach all parts of the fuel system.

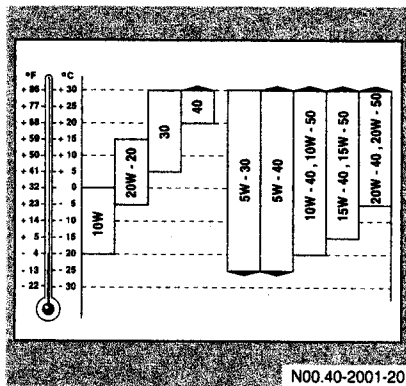


Warning - Risk of fire and explosion!

The addition of kerosene lowers the flash point of the diesel.

This increases the risk involved when handling the fuel mixture. Comply with appropriate safety regulations.

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Engine oils SAE classifications

Engine oils

Engine oils are specially tested to ensure their suitability for our engines. For this reason, use only engine oil brands which we have approved. These are stated in the DaimlerChrysler AG Specifications for Service Products. Comply with the instructions in the Maintenance Booklet.

The use of non-approved engine oils could affect warranty rights.

Information is available from any Detroit Diesel Distributor Service Center.

Select the SAE classification of the engine oil in accordance with ambient temperatures.

When maintenance work is performed, engine oil changes will be recorded in the Maintenance Booklet, together with details of the brand, quality category and SAE classification of the oil.

When topping up, only use engine oils of the same quality and SAE classification.

Note:

If an oil of a lower quality grade is added, the characteristics of the oil will be adversely affected. Oil change and filter replacement should then be brought forward.

Enter a lower quality grade engine oil in the Telligent[®] maintenance system (FSS). If adding a higher quality grade oil, this need not be entered in the Telligent[®] maintenance system.

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Coolant

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

Renew the coolant every three years as the degree of corrosion protection gradually drops with time.

Water

Water containing no additives is not suitable as a coolant, even if no antifreeze protection is needed.

The water used in the coolant must comply with certain requirements, which are not always satisfied by drinking water.

If water quality is inadequate, the water must undergo suitable treatment.

Information is available from any Detroit Diesel Distributor Service Center.

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Corrosion inhibitor/antifreeze

To avoid damage to the cooling system:

- Only use an approved corrosion inhibitor/antifreeze. Information is available from any Detroit Diesel Distributor Service Center.
- When topping up the cooling system (after a drop in the coolant level), the concentration of corrosion inhibitor/antifreeze in the coolant must be 50% by volume (affords protection down to a temperature of -34.5 °F (-37 °C)).



If the concentration is too low, there is a risk of corrosion/cavitation in the cooling system.

- Do not increase the proportion of corrosion inhibitor/antifreeze beyond 55% by volume (= maximum antifreeze protection). This would reduce the level of antifreeze protection and adversely affect the coolant's ability to dissipate heat.

Coolant mixing ratio:

Antifreeze protection down to (°C)	Water % by volume	Corrosion inhibitor/antifreeze % by volume
-34.5 °F (-37)	50	50
approx. -48.5 °F (-45)	45	max. 55

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In exceptional circumstances, if corrosion inhibitor/antifreeze is unavailable and/or no antifreeze protection is needed (for instance in the tropics), an approved coolant additive without antifreeze properties as stated on page 312.0 of the DaimlerChrysler AG Specifications for Service Products should be used (e.g. 10% by volume = 6.102 in³/1.05 US qt (100 cm³/ litre) of VP1749, manufactured by Hoechst of Burghausen).

In this case, renew the coolant every 12 months.

Disposal

Coolants are biologically degradable substances.

When disposing of used coolant, comply with local legal stipulation and/or waste water regulations.

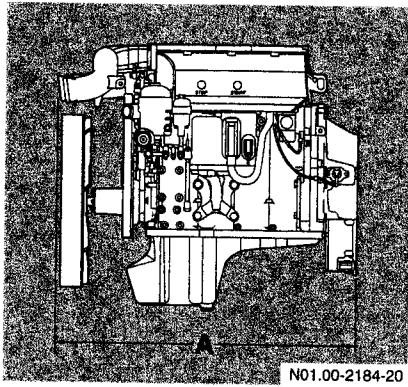
You are recommended to consult the local water supply authorities to determine the best method of disposal.

Since a modern engine coolant has complex tasks to perform, any form of inexpert "reprocessing" which consists only of mechanical purification is to be emphatically rejected.

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Technical data

Engine data	114
Testing and adjusting values	117
Tightening torques	118



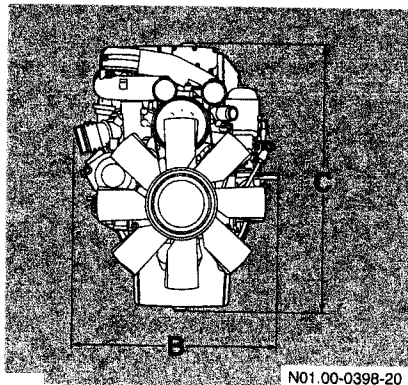
Engine data

Dimensions in millimetres:
(basic version, other versions on request)

OM 904 LA	OM 906 LA
A = 40.04 in (1017 mm)	A = 47.99 in (1219 mm)
B = 25.39 in (645 mm)	B = 25.39 in (645 mm)
C = 36.42 in (925 mm)	C = 37 in (940 mm)

Weights

Engine dry weight	OM 904 LA: 870.82 lb (395 kg)
	OM 906 LA: 1168.44 lb (530 kg)
Engine weight, ready for operation.....	OM 904 LA: 925.93 lb (420 kg)
	OM 906 LA: 1263.24 lb (573 kg)



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General technical information

Type	vertical, in-line cylinder block with turbocharger and charge air intercooler
Cooling system	liquid circuit
Combustion principle	4-stroke direct injection diesel
Number of cylinders	OM 904 LA: 4 OM 906 LA: 6
Bore	4.02 in (102 mm)
Stroke	5.12 in (130 mm)
Displacement, total	OM 904 LA: 0.15 ft ³ (4.25 dm ³) OM 906 LA: 0.23 ft ³ (6.37 dm ³)
Compression ratio	17.4 : 1
Direction of engine rotation, looking at flywheel	anti-clockwise
Starter	electric motor
Coolant capacity of engine without cooling system ...	OM 904 LA: 8.99 US qt (8.5 ltr.) OM 906 LA: 13.2 US qt (12.5 ltr.)
Lubricating oil in standard sump including oil filter	OM 904 LA: min. 13.81 US qt (13 ltr.) min. 17.0 US qt (16 ltr.) OM 906 LA: max. 25.5 US qt (24 ltr.) max. 30.81 US qt (29 ltr.)

Cold-start temperature limit without starting aids and with battery 75% charged down to -4 °F (-20 °C)

Starter motor, battery and alternator (standard)

Starter motor

Voltage 24 V

Rating 5.38 hp (4 kW)

Battery (not supplied with engine)

Voltage 24 V

Capacity □ 115 Ah

Alternator

Voltage 28 V

Current rating 10/80 A

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Testing and adjusting values

Engine oil pressure

at idling rpm □ 7.25 psi (0.5 bar)

at maximum rpm □ 36.26 psi (2.5 bar)

Cylinder head bolts (M16x2)

shaft length when new 5.87 in (149.0 mm)

maximum shaft length 5.94 in (151.0 mm)

Valve clearance

inlet valves 15.74 mil (0.40 mm)

exhaust valve 23.62 mil (0.60 mm)

Coolant thermostat

starts opening at 181.5 °F □ 3,6 °F (83 □ 2 °C)

fully open at 203 °F (95 °C)

minimum lift 0.31 in (8 mm)

Injectors

opening pressure 3555.88 psi to the max. 3730.04 psi (245⁺¹²)bar

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Tightening torques

Note:

All threads on mechanical components and the corresponding contact surfaces must be clean and smooth and should be coated with engine oil. Other lubricants will cause considerable changes in the required tightening torques.

Item	Nm
Engine block	
Cylinder head cover to cylinder head	22.12 ft.lb. (30)
Oil sump to crankcase	18.43 ft.lb. (25)
Poly-V-belt tensioning device to crankcase	36.87 ft.lb. (50)

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Item	Nm
Fuel/injection system	
Injection pipe to plug pump pressure pipe neck	18.43 ft.lb. (25)
Fuel pump to crankcase	18.43 ft.lb. (25)
Banjo bolt for fuel lines	29.50 ft.lb. (40)
Cap to fuel filter casing	18.43 ft.lb. (25)
Air intake/turbocharger	
Turbocharger to exhaust manifold	22.12 ft.lb. (30)
Oil pressure pipe to turbocharger	5.90 ft.lb. (8)
Oil return line to turbocharger	5.90 ft.lb. (8)
Engine brake valve neck to turbocharger	22.12 ft.lb. (30)

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Item	Nm
Intake/exhaust manifolds	
Charge air manifold to cylinder head	18.43 ft.lb. (25)
Exhaust manifold to cylinder head M10 (max. shaft length 1.87 in (47.5 mm))	10/50/90□+10□
Starter motor/alternator	
Starter motor to timing case	36.87 ft.lb. (50)
Alternator mount to crankcase	73.75 ft.lb. (100)
Alternator to mount	29.50 ft.lb. (40)
Alternator to bracket	44.25 ft.lb. (60)
Oil circuit	
Oil drain plug to oil sump	59.00 ft.lb. (80)
Alternator bracket to oil filter	29.50 ft.lb. (40)
Oil filter casing to crankcase	18.43 ft.lb. (25)
Oil filter casing neck to crankcase	18.43 ft.lb. (25)
Oil filter cap to oil filter casing	18.43 ft.lb. (25)
Oil pressure sensor to oil filter casing	18.43 ft.lb. (25)
Oil filter by-pass valve seal plug to oil filter casing	36.87 ft.lb. (50)

Item	Nm
Oil cooler	
Sealing plug to oil-water heat exchanger	25.81 ft.lb. (35)
Oil-water heat exchanger to crankcase	18.43 ft.lb. (25)
Casing cap to oil-water heat exchanger	18.43 ft.lb. (25)
Coolant circuit	
Connecting piece, coolant pump to cylinder head	18.43 ft.lb. (25)
Coolant pipe, coolant thermostat to coolant pump	18.43 ft.lb. (25)
Coolant pump to crankcase	18.43 ft.lb. (25)
Pulley to coolant pump	18.43 ft.lb. (25)
Engine electronics	
ECU control unit to engine casing	11.06 ft.lb. (15)
Compressor	
Coolant pipe to compressor	29.50 ft.lb. (40)
Compressor to crankcase	36.87 ft.lb. (50)
Compressed air line to compressor	73.75 ft.lb. (100)
Intake line to compressor	73.75 ft.lb. (100)
Power-assisted steering pump to compressor	36.87 ft.lb. (50)

Limited Warranty on New Detroit Diesel Series 900 Engines Used In Agricultural, Construction and Industrial Applications



Terms of Coverage:

Uses

This warranty applies to the first retail purchaser and subsequent owners during the WARRANTY PERIOD of new Detroit Diesel Series 900 engines (referred to as Engine) manufactured or supplied by Detroit Diesel Corporation (referred to as DDC) which are used in construction and industrial applications operated in the United States, Canada or Mexico.

Defects

This warranty covers Engine REPAIRS to correct any malfunction occurring during the WARRANTY PERIOD resulting from defects in material or workmanship.

Repairs

To obtain warranty repairs, you must request the needed repairs within the WARRANTY PERIOD from an authorized Detroit Diesel Corporation (referred to as DDC)* service outlet. Only new genuine parts or remanufactured parts or components supplied or approved by DDC will be used. DDC may, at its discretion, replace rather than repair components. A reasonable time must be allowed to perform the warranty repair. Repairs will be performed during normal business hours.

Warranty Period

The WARRANTY PERIOD begins on the date the Engine is delivered to the first retail purchaser or put in use prior to sale at retail, whichever date occurs first, and ends at the time limits shown below:

WARRANTY PERIOD				
Item	Warranty Limitations (Whichever Occurs First)		Repair Charge To Be Paid By Owner	
	MONTHS	ENGINE HOURS	PARTS	LABOR
Engine	0-24	3,000	No Charge	No Charge

Service Supplies

The cost of service supplies such as coolant, oil and filters, which are not reusable due to needed repairs is covered by this warranty.

Like Replacement Engine

Engine(s) supplied by DDC as a replacement for an Engine still under warranty will assume the identity of the Engine being replaced and be entitled to the remaining warranty coverage.

Mechanic's Travel Expenses

Mercedes-Benz will pay reasonable travel expenses for the repairing mechanic to travel to and from the repair site.

Engine Removal And Reinstallation

Reasonable labor costs for engine removal and reinstallation, when necessary to make a warranty repair, are covered by this warranty.

*In Canada, the reference is to Detroit Diesel of Canada Limited, in Mexico, the reference is to Detroit Diesel Allison de Mexico.

This Warranty Does Not Cover:

Repairs Due To Accidents, Misuse, Storage Damage, Negligence or Certain Modifications

Repairs due to an accident, misuse, misapplication, storage damage, negligence or modification exceeding DDC specifications, are not covered by this warranty.

Non-DDC Supplied/Manufactured Components

DDC is not responsible for repair of components and/or assemblies which are supplied by another manufacturer, such as power take-offs, intake and exhaust system. Such items may be covered by the manufacturer or supplier.

Maintenance

DDC is not responsible for the cost of maintenance or repairs due to lack of performance of required maintenance service or the failure to use fuel, oil, lubricants and coolant meeting DDC-recommended specifications. Performance of required maintenance and use of proper fuel, oil, lubricants and coolant are the responsibility of the owner. See the Operating Manual for details.

Incidental or Consequential Damages

DDC is not responsible for incidental or consequential costs or expenses which the owner may incur as a result of a malfunction or failure covered by this warranty, such as communication expenses, meals, lodging, overtime, towing, loss of use of the Engine or equipment ("downtime"), loss of time, inconvenience, cargo loss or damage, and other similar costs and expenses.

Other Limitations

The performance of REPAIRS is the exclusive Owner's remedy under this warranty. DDC does not authorize any person to assume or create for it any other obligation or liability in connection with the Engine.

THIS LIMITED WARRANTY IS THE ONLY WARRANTY APPLICABLE TO THIS ENGINE AS USED IN AGRICULTURAL, CONSTRUCTION AND INDUSTRIAL APPLICATIONS. DETROIT DIESEL CORPORATION MAKES NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. DETROIT DIESEL CORPORATION SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES AS DESCRIBED ABOVE.

Some states do not allow the limitation of how long this warranty may last or the limitation or exclusion of incidental or consequential damages, so the above may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

DETROIT DIESEL
CORPORATION



Federal Emission Control System Warranty

In accordance with the requirements of the Federal Clean Air Act as amended, **DaimlerChrysler AG (DCAG)** warrants to the original and each subsequent owner of a **DaimlerChrysler** offroad diesel engine that:

(1) the engine was designed, built, and equipped so as to conform at the time of sale to the original owner with the then applicable regulations issued by the Federal Environmental Protection Agency under authority of the Federal Clean Air Act as amended and

(2) the emission-related components of such engine are free from defects in material and workmanship at the time of sale. The emission control system warranty covers these emission-related components over a period of five years or 3000 hours of engine operation from the date of initial operation of the engine, whichever occurs first. Failures, which arise solely as a result of owner abuse and/or lack of proper maintenance are not covered by the warranty.

For further information concerning the emission control system maintenance and the cases in which this warranty does not apply reference is made to the above-mentioned Owner's Warranty Policy Information in the Owner's Instruction Manual.

California Emission Control System Warranty Your Warranty Rights And Obligations

The **California Air Resources Board** and **DaimlerChrysler AG (DCAG)** are pleased to explain the emission control system warranty on your 1996 and subsequent model years heavy-duty offroad diesel engine. In California, new heavy-duty offroad diesel engines must be designed, built and equipped to meet the State's stringent anti-smog standards.

DCAG must warrant the emission, control system on your heavy-duty offroad diesel engine for the periods of time listed below, provided there has been no abuse, neglect or improper maintenance of your engine. Your emission control system may include parts such as fuel-injection, catalytic converter and engine computer. Also included may be hoses, belts, connectors and other emissionrelated assemblies. Where a warrantable condition exists, DCAG, will repair your heavy-duty off-road engine at no cost to you including diagnosis, parts and labor.

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Maintenance And Warranty – Cont.

California Emission Control System Warranty – Cont.

Manufacturer's Warranty Coverage:

The 1996 and later heavy-duty off-road engines are warranted for 5 years or 3000 hours of engine operation (whichever occurs first):

If an emission-related part of your engine is defective, the part will be repaired or replaced by DCAG. This is your emission control system **Defects Warranty**.

Owner's Warranty Responsibilities:

- Your engine is designed to be operated on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.
- As the engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. DCAG recommends that you retain all receipts covering maintenance on your engine. DCAG cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all required maintenance.
- You are responsible for presenting your engine to a DCAG service dealer as soon as a problem exists. The warranty repair should be completed in a reasonable amount of time as expeditiously as possible.
- As the engine owner you should also be aware that DCAG may deny you warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

If you have any questions regarding the engine owner's warranty rights and responsibilities, you should contact the:

Detroit Diesel Corporation (DDC)
telephone 313/592 - 7136, fax 313/592 - 7888

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Owner's Warranty Rights:

DaimlerChrysler AG (DCAG) warrants to the original and each subsequent owner of a **DaimlerChrysler** heavy-duty offroad diesel engine that:

- (1) the engine was designed, built and equipped so as to conform at the time of sale with the applicable regulations adopted by the Federal Environmental Protection Agency and the California Air Resources Board,
- (2) the emission control system of such engine is free from defects in materials and workmanship which would cause it not to conform with those regulations for a period of use of five years or 3000 hours of engine operation, whichever occurs first.

The 5-years/3000-hours warranty period shall begin on the date the engine is delivered to the first retail purchaser or, if the engine is first placed in service as a dealer demonstrator prior to sale at retail, on the date the engine is first placed in such service.

Maintenance And Warranty - Cont.

California Emission Control System Warranty - Cont.

Owner's Warranty Rights: - Cont.

The emission control system of your new **DaimlerChrysler AG** heavy-duty offroad diesel engine was designed, built and tested using **DaimlerChrysler AG** approved parts and the engine is certified as being in conformity with Federal and California Air Resources Board emission control regulations.

If an emission-related engine part is defective, it will be repaired or replaced by DCAG under this emission control system defects warranty.

Additional warranty coverage under Federal regulations, differing from California regulations, may be applicable.

Accordingly, it is recommended that any replacement parts used for maintenance, repair or replacement of emission-related components be **DaimlerChrysler AG Approved Service Parts** or **Authorized Remanufactured Parts**.

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The owner may elect to have maintenance, repair or replacement of the emission control devices and systems performed by any automotive repair establishment or individual, and may elect to use parts other than genuine **DaimlerChrysler AG**

Service Parts or **Authorized Remanufactured Parts** for such maintenance, repair or replacement without invalidating this warranty; the cost of such service or parts, however, will not be covered under the warranty, except in an emergency situation.

Use of replacement parts which are not of equivalent quality may impair the effectiveness of emission control systems. If other than **DaimlerChrysler AG Service Parts** or **Authorized Remanufactured Parts** are used for maintenance, repair or replacement of components affecting emission control, the owner should obtain assurances that such parts are warranted by their manufacturer to be equivalent to genuine **DaimlerChrysler AG** parts in performance and durability. DCAG, however, assumes no liability under this warranty with respect to parts other than **DaimlerChrysler AG Service Parts** or **Authorized Remanufactured Parts** except for consequential damage to a non-**DaimlerChrysler AG** warranted part caused by failure of a **DaimlerChrysler AG** part. However, the use of non-**DaimlerChrysler AG** replacement parts does not invalidate the warranty on other components unless non-**DaimlerChrysler AG** parts cause damage to warranted parts.

Repairs covered by this warranty will be performed by any authorized **DaimlerChrysler** service dealer at his place of business with no charge for parts and labor (including diagnosis), using genuine **DaimlerChrysler AG Service** or **Authorized Remanufactured Parts** for any part of the emission control system covered by this warranty and found to be defective.

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Maintenance And Warranty – Cont.
California Emission Control System Warranty – Cont.

Owner's Warranty Rights: – Cont.

The attached list sets forth the emission-related components covered by this emission control system warranty. You are advised to perform all recommended maintenance or repairs on your new **DaimlerChrysler AG** engine. You are responsible for the required maintenance. DCAG will not deny a warranty claim solely because you have no record of maintenance; however, DCAG may deny a warranty claim if your failure to perform required maintenance resulted in the failure of a warranted part. Receipts covering the performance of regular maintenance should be retained in the event questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the engine.

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Exclusions:

This warranty does not cover:

- (1) Malfunctions in any part caused by any of the following:
misuse, improper adjustment, modification, alteration, tampering,
disconnection, improper or inadequate maintenance.
- (2) Damage resulting from accident, acts of nature or other events beyond the control of DCAG.
- (3) The repair and replacement of warranted parts which are scheduled for replacement prior to 3000 hours of operation (such as fuel and air filters etc.), once these parts have been replaced at the first replacement interval as a part of required maintenance service.
- (4) Incidental or consequential damages such as loss of time, inconvenience, loss of use of the engine.
- (5) Repairs consisting solely of adjustments to idle speed, valve clearance or injection timing, or any combination thereof.

This warranty is applicable to engines certified for sale and registered in the state of California. In all other states and countries defective parts will be repaired or replaced in accordance with the terms and limitations of the warranty for new **DaimlerChrysler AG** engines in effect at the time in such states and countries.

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Maintenance And Warranty - Cont.
California Emission Control System Warranty - Cont.

Exclusions: - Cont.

With respect to emission-related components, this warranty is expressly in lieu of all other warranties and representations, expressed or implied including, but not limited to, implied warranties of merchantability or fitness for a particular purpose, and all other obligations or liabilities on the part of the warrantor. DaimlerChrysler AG neither assumes nor authorizes any other person to assume for it any other liability in connection with such emission-related components.

California Emission Warranty Parts List:

Warranted emission-related components on engines of above family:

- (I) **Fuel Metering System**
 - a) Fuel Injection Pump
 - b) Injection Nozzles
- (II) **Air Induction System**
 - a) Turbocharger
 - b) Intake Manifold
 - c) Aftercooler (equipment manufacturer's component, which is not warranted by the engine manufacturer; refer to section 10.06.01.00)
- (III) **Exhaust Manifold**

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Mercedes-Benz

Motor / *Engine* / *Moteur*

OM 904/907 LA

OM 906/909/926 LA

DaimlerChrysler AG · Global Service & Parts · GSP/SID · D-70546 Stuttgart

Vorbemerkungen

Dieser Bildkatalog soll Ihnen die Ermittlung und Bestellung von Teilen für die Wartung bzw. Reparatur Ihres MERCEDES-BENZ erleichtern. Er enthält die Bildtafeln der Grundausrüstung, die mit den jeweiligen Bildtafeln in den Microfiches korrespondieren. Die auf den Bildtafeln abgebildeten Teile entsprechen nicht in jedem Fall der neuesten Ausführung.

Ihr MERCEDES-BENZ-Produkt kann mit Sonderausführungen (SA) ausgerüstet sein, die in diesem Katalog **nicht** aufgeführt sind. Für die Ermittlung der richtigen Teile ist die Vorlage der Fahrzeug- bzw. Motoren-Datenkarte bei den MERCEDES-BENZ-Serviceorganen eine zwingende Notwendigkeit.

Die für Ihr MERCEDES-BENZ-Produkt gültigen Bildtafeln sind jeweils von der Fahrzeug-Ident-No. (Fahrgestell-No.), Motornummer, Fahrerhausnummer, Aufbaunummer (bei Omnibussen) abhängig (siehe Fahrzeug-Datenkarte). Beachten Sie bitte die ersten 6 Zahlen dieser Nummer, wobei es sich um das sogenannte Baumuster handelt.

Benennung	Baumuster	Seite	Katalog
Motor	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
Motor	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		06V

Für Teile-Bestellungen ist sehr wichtig, dass Sie auch angeben, auf welcher Seite die benötigten Teile ausgewählt wurden.

Bei der Bestellung von Teilen sind, in Abhängigkeit von Teile-Bedarf, folgende Angaben unbedingt erforderlich (siehe Fahrzeug-Datenkarte):

1. Fahrzeug-Ident-No. (Fahrgestell-No.), Motor-, Aufbau- bzw. Fahrerhausnummer.
Bei Aggregaten die vollständige Nummer des Getriebes, der Vorder- oder Hinterachse oder der Lenkung (siehe Datenkarte).
2. Druck-Nummer und Ausgabe dieses Kataloges.
3. Nummer der Bildtafel (rechts oben) und die Bildnummer.
4. Gewünschte Menge.

Für die Lieferung von Teilen ist ausschließlich die Kundendienstorganisation der Mercedes-Benz AG zuständig.

Beispiel für eine Bestellung

Für Motor 314.910-10-096127, Druck-Nr. 6450 000180 Ausgabe A
Seite 23, Gruppe 01, Bild 21 1 Stück
Seite 32, Gruppe 07, Bild 260 3 Stück

Die Teile für Motor, Fahrgestell und bei Nutzfahrzeugen auch Aufbau/Fahrerhaus sind in getrennten Katalogen erfaßt.
Die Bildtafeln für die Aggregate sind im Anhang des Fahrgestell-Bildkatalogs enthalten.

Preliminary Remarks

This Catalog of Illustrations has been compiled to help you finding out and ordering the parts required for the maintenance and repair of your MERCEDES-BENZ.

It comprises the illustrations of the Standard Equipment, in accordance with the illustrations on the microfiches.

The parts illustrated do not in any case conform to the latest version.

Your MERCEDES-BENZ product may be equipped with Special Versions (SA's) which have **not** been listed in this catalog. In order to identify the appropriate parts, it is mandatory to submit your vehicle data card, or engine data card, to the MERCEDES-BENZ services.

The illustrations applicable to your MERCEDES-BENZ product are relative to the respective vehicle ident. No. (chassis No.), engine number, cab number, or (in the case of buses) body number - see vehicle data card. Please mind the first six digits of this number representing the so-called model.

Designation	Model	Page	Catalog
Engine	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
Engine	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		06V

When ordering parts, be sure to indicate the page from which you have selected the spare parts required.

When placing orders for parts, it is a must to specify - depending on parts requirements - the following points (see vehicle data card):

1. Vehicle Ident No (Chassis No), Engine No, Body/Cab No.
In the case of Units, the complete number of transmission, or front axle, or rear axle, or steering (see data card).
2. Print No and Edition of this Catalog.
3. Illustration No (right top) and Fig. No.
4. Quantity required.

Only our Mercedes-Benz AG Dealer Organizations are competent for delivery of parts.

Example for Ordering Parts

For engine 314.910-10-096127, Print No 6450 000180 Edition A

Page 23, Group 01, Fig. 21 1 piece

Page 32, Group 07, Fig. 260 3 pieces

The parts for engine, chassis, and with commercial vehicles also for body/cab, have been compiled in separate catalogs.

The illustrations of units will be found in the annex of the chassis catalog of illustrations.

Préliminaires

Ce catalogue illustré doit vous faciliter la recherche et la commande de pièces pour la maintenance et la réparation de votre MERCEDES-BENZ. Il contient les planches illustrées de la version de base correspondant aux planches illustrées sur les microfiches.

Les pièces figurant sur les planches illustrées ne sont pas toujours conformes à la version la plus récente.

Votre véhicule MERCEDES-BENZ peut être équipé de versions spéciales (SA) **ne figurant pas** dans ce catalogue. La présentation de la fiche signalétique du véhicule ou du moteur auprès du service après-vente MERCEDES-BENZ est indispensable pour la recherche des pièces exactes.

Les planches illustrées valables pour votre MERCEDES-BENZ sont fonction des numéros d'identification du véhicule (n° de châssis), de moteur, de cabine, de carrosserie (autocars/autobus). Voir à cet effet la fiche signalétique du véhicule. Il faut absolument tenir compte des 6 premiers chiffres de ces numéros correspondant à ce que nous appelons le modèle.

Désignation	Modèle	Page	Catalogue
Moteur	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
Moteur	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		06V

En cas de commandes de pièces, vous devez absolument indiquer la page sur laquelle figurent les pièces en question.

En cas de commande de pièces, il faut - en fonction des besoins - absolument indiquer les données suivantes (voir fiche signalétique du véhicule):

1. Numéros d'identification du véhicule (n° de châssis), de moteur, de carrosserie, de cabine.
Pour les organes mécaniques, indiquer le numéro complet de la boîte de vitesses, des essieux AV/AR ou de la direction (voir fiche signalétique).
2. Numéro d'impression et édition de ce catalogue.
3. Numéro de la planche illustrée (en haut à droite) et numéro de la figure.
4. Quantité souhaitée.

C'est le réseau de service après-vente de la Mercedes-Benz AG qui est seul responsable pour la livraison de pièces.

Exemple d'une commande

Pour moteur 314.910-10-096127, n° d'impression 6450 000180 Edition A
Page 23, planche illustrée 01, figure 21 1 unité
Page 32, planche illustrée 07, figure 260 3 unités

Les pièces pour moteur et châssis et - lorsqu'il s'agit de véhicules utilitaires - également pour carrosserie/cabine figurent dans des catalogues séparés.

Les planches illustrées pour les organes mécaniques se trouvent à l'annexe du catalogue illustré des châssis.

Advertencias preliminares

El presente catálogo ilustrado tiene por objeto facilitar la búsqueda y el pedido de piezas para el mantenimiento o reparación de su MERCEDES-BENZ. Contiene las láminas ilustradas de la ejecución básica, que son idénticas a las contenidas en las microfichas.

Las piezas reproducidas en las láminas no corresponden siempre a la última ejecución.

Su producto MERCEDES-BENZ puede ir equipado con ejecuciones especiales (SA) que **no** estén incluidas en el presente catálogo. Para la localización de las piezas correctas es imprescindible presentar la documentación del vehículo o la tarjeta de los datos del motor a los organismos de servicio postventa MERCEDES-BENZ.

Las láminas válidas para su producto MERCEDES-BENZ pueden reconocerse siempre por el número de identificación del vehículo (núm. de chasis), así como por los números del motor, cabina y superestructura (en autobuses); véase la ficha de datos del vehículo. Sírvase fijarse en las seis primeras cifras de dicho número, que corresponde al de la ejecución.

Denominación	Modelo	Página	Catálogo
Motor	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
Motor	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		06V

Es muy importante que, al efectuar pedidos de piezas, se indique también la página en la que se eligieron las piezas requeridas.

Para la formulación del pedido de piezas, según la demanda, son indispensables los siguientes datos (véase ficha de datos del vehículo):

1. Número de identificación del vehículo (núm. de chasis), así como números de motor, superestructura o cabina. En caso de grupos: número completo del cambio, eje delantero o eje trasero, o de la dirección (véase ficha de datos).
2. Número de impresión y edición del presente catálogo.
3. Número de lámina (arriba, a la derecha) y de ilustración.
4. Cantidad deseada.

Únicamente la organización del servicio postventa es la encargada del suministro de piezas de la Mercedes-Benz AG.

Ejemplo para la formulación de un pedido

para motor 314.910-10-096127, N° de impresión 6450 000180 Edición A
 página 23, grupo 01, ilustración 21 1 unidad
 página 32, grupo 07, ilustración 260 3 unidades

Las piezas para motor, chasis y, en vehículos industriales, también para superestructura o cabina se encuentran en catálogos aparte.

Las tablas gráficas de grupos se encuentran en el apéndice del catálogo de chasis.

Considerazioni preliminari

Questo catalogo illustrato vi servirà a determinare ed ordinare i pezzi necessari per la manutenzione risp. riparazione della vostra MERCEDES-BENZ. Esso contiene le tavole illustrate dell'Equipaggiamento di Base corrispondenti alle relative tavole illustrate nelle microfiches.

Talvolta i pezzi raffigurati nelle tavole illustrate non corrispondono più all'ultima versione.

Il vostro prodotto MERCEDES-BENZ può essere dotato di equipaggiamenti speciali (SA) che **non** sono elencati in questo catalogo. Per stabilire gli esatti pezzi è assolutamente necessario presentare agli organi di servizio MERCEDES-BENZ la cartolina del veicolo ovvero dei dati del motore.

Le tavole illustrate valide per la vostra MERCEDES-BENZ dipendono generalmente dai numeri d'identificazione del veicolo (del telaio), del motore, della cabina e, per gli autobus, della carrozzeria. (Vedi scheda dei dati del veicolo). Si prega di tener conto delle prime 6 cifre di questo numero riferentesi al cosiddetto modello di costruzione.

Denominazione	Modello costruzione	Pagina	Catalogo
Motore	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
Motore	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		06V

Per le ordinazioni dei pezzi è importante che indichiate anche la pagina dalla quale sono stati scelti i pezzi necessari.

Per l'ordinazione di pezzi è strettamente necessario, a seconda del fabbisogno, fornire i seguenti dati (vedi scheda dei dati del veicolo):

1. N° d'identificazione del veicolo (N° di telaio), numeri del motore, della carrozzeria e della cabina. Per gli aggregati l'intero numero del cambio, dell'assale anteriore o posteriore o dello sterzo (vedi scheda dei dati).
2. Numero di stampa ed edizione di questo catalogo.
3. Numero della tavola illustrata (in alto a destra) e della figura.
4. Quantità desiderata.

Per la consegna dei pezzi il solo responsabile è l'organizzazione assistenza clienti della Mercedes-Benz AG.

Esempio di ordinazione

Per il motore 314.910-10-096127, N° di stampa 6450 000180 Edizione A
Pagina 23, Tavola illustrata 01, Figura 21 N° di pezzi 1
Pagina 32, Tavola illustrata 07, Figura 260 N° di pezzi 3

I pezzi per motore, telaio e, per i veicoli industriali, anche per la carrozzeria e la cabina si trovano in cataloghi separati. Le tavole illustrate per gli aggregati sono contenute nell'appendice del catalogo illustrato del telaio.

Advertências preliminares

Este catálogo ilustrado tem por fim facilitar a V. Sa. a identificação e a encomenda de peças para a manutenção e a reparação do seu MERCEDES-BENZ. Ele contém os quadros ilustrados da versão básica, que correspondem aos respectivos quadros ilustrados nas microfichas.

As ilustrações nos quadros não correspondem, em todos os casos, à versão mais recente das peças.

É possível que o seu veículo MERCEDES-BENZ disponha de equipamentos especiais (SA) não mencionados neste catálogo. Para a determinação das peças adequadas, é absolutamente indispensável a apresentação do cartão de dados do veículo ou do cartão de dados do motor nos postos de serviço MERCEDES-BENZ.

Os quadros válidos para o seu produto MERCEDES-BENZ dependem do respectivo número de identificação do veículo (número do chassi), do número do motor, do número da cabina, do número da carroçaria (em se tratando de autocarros/ônibus) - (vide cartão de dados do veículo). Queira observar os primeiros 6 algarismos desse número, pois trata-se da identificação do respectivo modelo.

Denominação	Modelo	Página	Catálogo
Motor	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
	907.910, 920, 930, 940, 941, 960, 970, 980, 990		
Motor	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
	909.900, 901, 910, 911, 920, 921, 960, 970, 971		
	926.911, 912, 914		

Para a encomenda de peças, é de suma importância que V. Sa. mencione também a página da qual selecionou as peças necessitadas.

Na encomenda de peças, são absolutamente necessários os seguintes dados, em dependência da necessidade de peças (vide cartão de dados do veículo):

1. Número de identificação do veículo (número do chassi), número do motor, da carroçaria ou da cabina, resp.
Em se tratando de grupos de máquinas, fornecer o número completo da caixa de mundaças, do eixo dianteiro ou traseiro, ou da direção (vide cartão de dados).
2. Número de impressão edição deste catálogo.
3. Número do quadro ilustrado (no alto à direita) e o número da ilustração.
4. Quantidade desejada.

A entrega de peças compete exclusivamente ao serviço de atendimento aos clientes da Mercedes-Benz AG.

Exemplo para uma encomenda

Para motor 314.910-10-096127, número de impressão 6450 000180 Edição A
Página 23, grupo 01, ilustração 21 1 peça
Página 32, grupo 07, ilustração 260 3 peças

As peças para o motor, o chassi e, para veículos utilitários, também para a carroçaria e a cabina do motorista, foram agrupadas em catálogos em separado.

As ilustrações para os grupos de máquinas constam do anexo do catálogo ilustrado para o chassi.

Предварительные замечания

Данный иллюстрированный каталог имеет целью облегчить определение и заказ запчастей, необходимых для технического обслуживания или ремонта Вашей машины „МЕРСЕДЕС-БЕНЦ“. В нем указаны изображения основного исполнения, совпадающие с соответствующими изображениями на микрофишах.

Показанные на изображениях детали не во всех случаях соответствуют новейшему исполнению.

Ваш автомобиль „МЕРСЕДЕС-БЕНЦ“ может иметь специальную оснастку (SA), не указанную в данном каталоге.

Для определения соответствующих запчастей предъявление технического паспорта автомобиля на страницах автосервиса „МЕРСЕДЕС-БЕНЦ“ обязательно.

Изображения, относящиеся к Вашему автомобилю „МЕРСЕДЕС-БЕНЦ“, зависят от идентификационного № автомобиля/ № шасси/, № двигателя, № кабины водителя, № кузова (у автобусов)/, смотрите технический паспорт автомобиля. Просьба обращать внимание на первые 6 цифр этого номера; здесь речь идет о так называемой модификации.

модификация	Стр.	каталоге
904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955	21 - 79	06T
907.910, 920, 930, 940, 941, 960, 970, 980, 990		06T
906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965	83 - 160	06V
909.900, 901, 910, 911, 920, 921, 960, 970, 971		
926.911, 912, 914		06V

Для заказа запчастей очень важно указать, на какой странице приведены требуемые детали.

При заказе запчастей обязательно указать следующие данные:
(См. технический паспорт автомобиля)

1. Идентификационный № автомобиля (№ шасси), № двигателя, № кузова/ кабины водителя.
Для агрегатов полный № коробки передач, передней или задней оси или рулевого управления (см. технический паспорт).
2. № печати и издание данного каталога.
3. № изображения / наверху, на правой стороне/ и № картины.
4. Желаемое количество.

За поставку запчастей отвечает исключительно отдел автосервиса фирмы „МЕРСЕДЕС-БЕНЦ АГ“.

Пример оформления заказа

для двигателя 314.910-10-096127, № печати 6450 000180, издание А
страница 23, группа 01, картина 21 1 штука
страница 32, группа 07, картина 260 3 штуки

Запчасти для двигателя, шасси и – применительно к грузовым автомобилям – также для кузова/кабины водителя
представлены в отдельных каталогах.

Изображения агрегатов входят в состав иллюстрированного каталога шасси как приложение.

ملاحظات أولية

الفرض من هذا الكتاب المصور هو تسهيل تحديد وطلب قطع الغيار اللازمة لصيانة أو إصلاح سياراتكم مرسيدس-بنز. يتضمن الكتاب لوحات المصورة الخاصة بالانتاج النمطي المناظرة للوحات المصورة المسجلة على شرائح الميكروفيلم (ميكروفيلم) .

الاجزاء الموضحة في اللوحات المصورة لا تطابق دائما أحدث الانواع المنتجة . من الطبيعي أنه يمكنكم تزويد سياراتكم مرسيدس-بنز بالتجهيزات الخاصة الغير واردة في هذا الدليل . من أجل التحدد الدقيق لقطع الغيار المطلوبة لابد من تقديم بطاقة بيانات السيارة أو بطاقة بيانات المحرك الى الهيئة المختصة بخدمات مرسيدس-بنز .

اللوحات المصورة الخاصة بسياراتكم مرسيدس-بنز ترتبط تماما برقم تمييز السيارة (رقم الهيكل) ، رقم مقصورة السائق ، رقم جسم السيارة (بالنسبة للاوتوبيسات) - (انظر بطاقة بيانات السيارة) . نرجو ملاحظة الستة اعداد الاولى من الرقم المعنى اذا انها تعبر عما يسمى " النموذج الانشائي " .

المنتحة	صفحة	للمودج الانشائي
06T	79 - 21	944 ,942 ,936 ,931-927 ,923-921 ,917-914 ,911-904.904 955 ,953-948
06T		990 ,980 ,970 ,960 ,941 ,940 ,930 ,920 ,910.907
06V	160 - 83	928-925 ,923-919 ,916 ,915 ,911 ,910 ,903 ,901 ,900.906 965-960 ,956-954 ,952-949 ,941-937 ,935 ,931 ,930 971 ,970 ,960 ,921 ,920 ,911 ,910 ,901 ,900.909
06V		914 ,912 ,911.926

عند طلب قطع الغيار يجب أيضا تحديد رقم الصفحة المذكور بها قطع الغيار المطلوبة .

عند طلب قطع الغيار لابد ارتباطا بالكمية المطلوبة من ذكر البيانات الاتية (أنظر بطاقة بيانات السيارة) :

- ١ - رقم تمييز السيارة (رقم الهيكل) ، رقم المحرك ، رقم جسم السيارة أو رقم مقصورة السائق . بالنسبة للمجموعات الكاملة يذكر الرقم الكامل لصندوق التروس ، المحور الامامى أو الخلفى أو رقم مجموعة التوجيه (أنظر بطاقة البيانات) .
- ٢ - رقم طباعة هذا الكتالوج وكذلك رقم الطبعة .
- ٣ - رقم اللوحة المصورة (يمينا من أعلى) وكذلك رقم الصورة .
- ٤ - الكمية المطلوبة .

محطات خدمة العملاء التابعة لشركة "دايملر-بنز" هى الهيئات الوحيدة المسئولة عن توريد قطع الغيار .

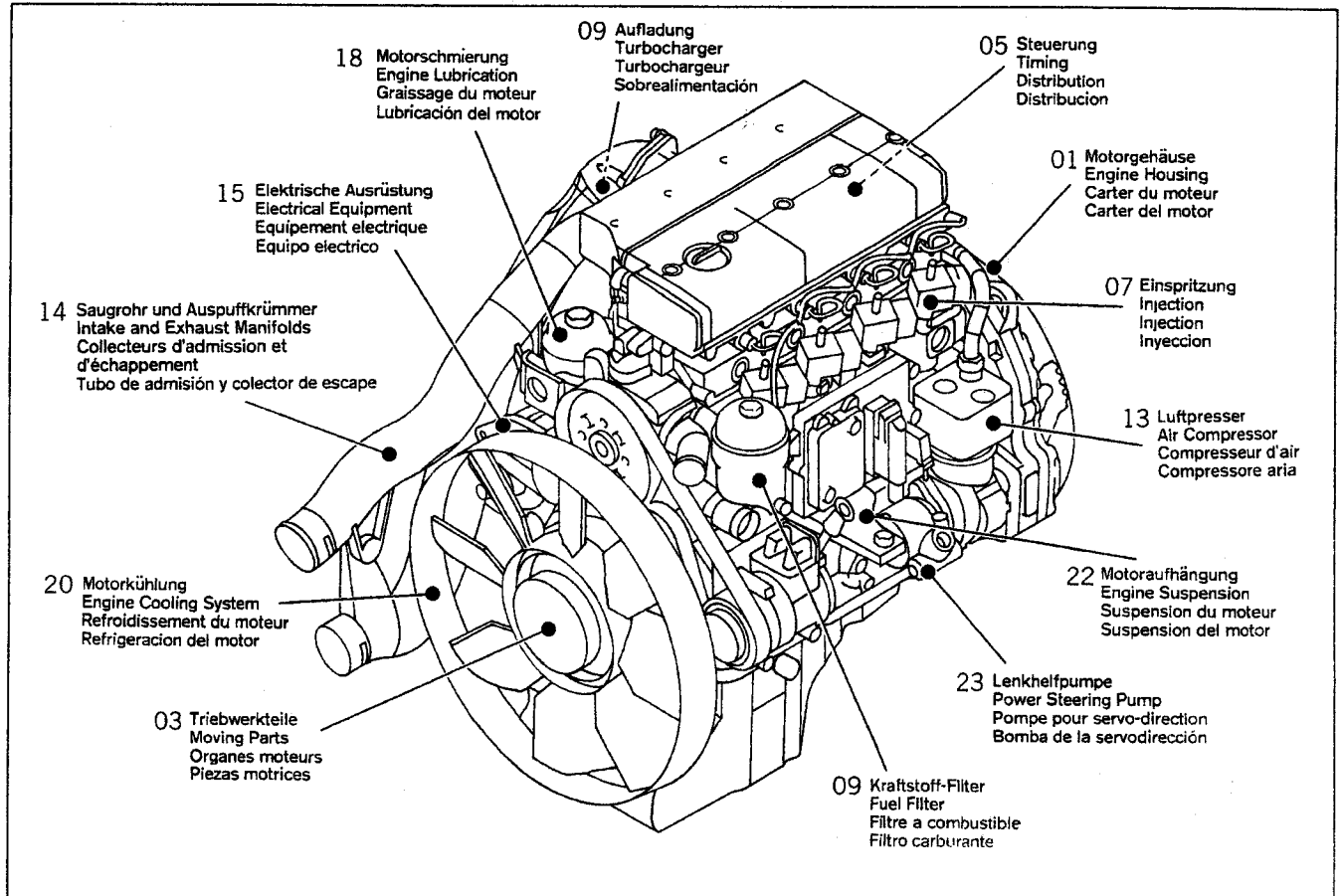
مثال لطلب قطع الغيار
للمحرك رقم ٩١٠/٣١٤ - ١٠ - ٠٩٦١٢٧ ، رقم الطباعة ٦٤٥٠٠٠٠١٨٠ ، الطبعة (١)
الصفحة (٢٣) ، المجموعة (٠١) ، الصورة (٢١) ، قطعة واحدة
الصفحة (٣٢) ، المجموعة (٠٧) ، الصورة (٢٦٠) ، ٣ قطع

قطع الغيار الخاصة بالمحرك ، هيكل السيارة وكذلك هذه الخاصة بجسم السيارة / مقصورة السائق فى حالة المركبات والشاحنات موجودة فى كتالوجات خاصة بها .
اللوحة المصورة الخاصة بالوحدات الكاملة موجودة بالملحق الخاص بالكتالوج المصور لهيكل السيارة .

	Baumuster/Model/Modèle	Katalog
Motor / Engine / Moteur	904.904-911, 914-917, 921-923, 927-931, 936, 942, 944, 948-953, 955 907.910, 920, 930, 940, 941, 960, 970, 980, 990	06T

Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore
 Carter do motor
 Carter del motor
 на́ртер дви́гателя
 هيكل المُوَور

Gruppe | Grupo
 Group | Grupo
 Groupe | группа
 Gruppo | المجموعة
 01 005 00027



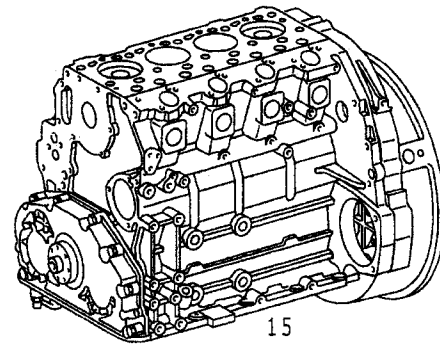
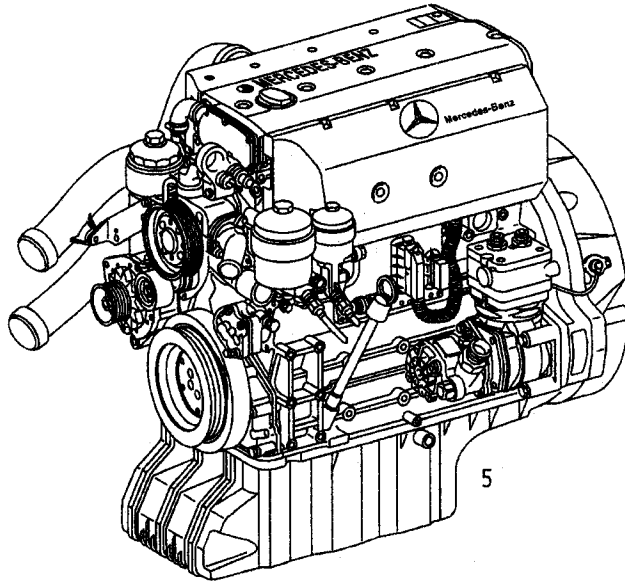
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cáster del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

01 010 00034



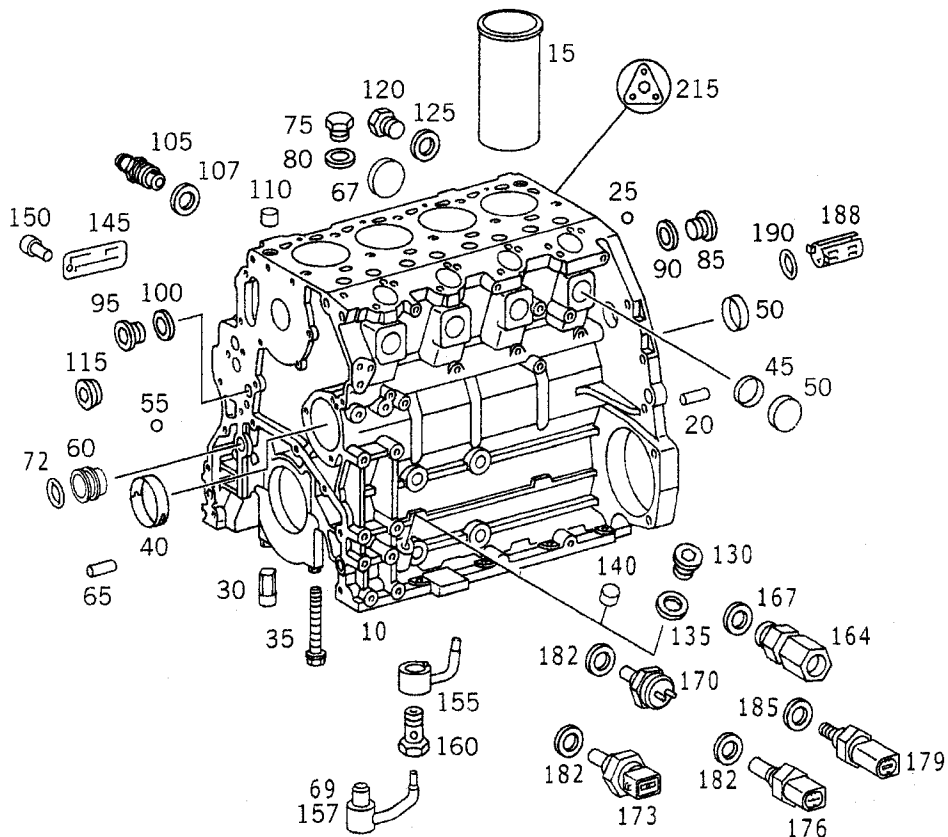
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cáster del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

01 015 00227



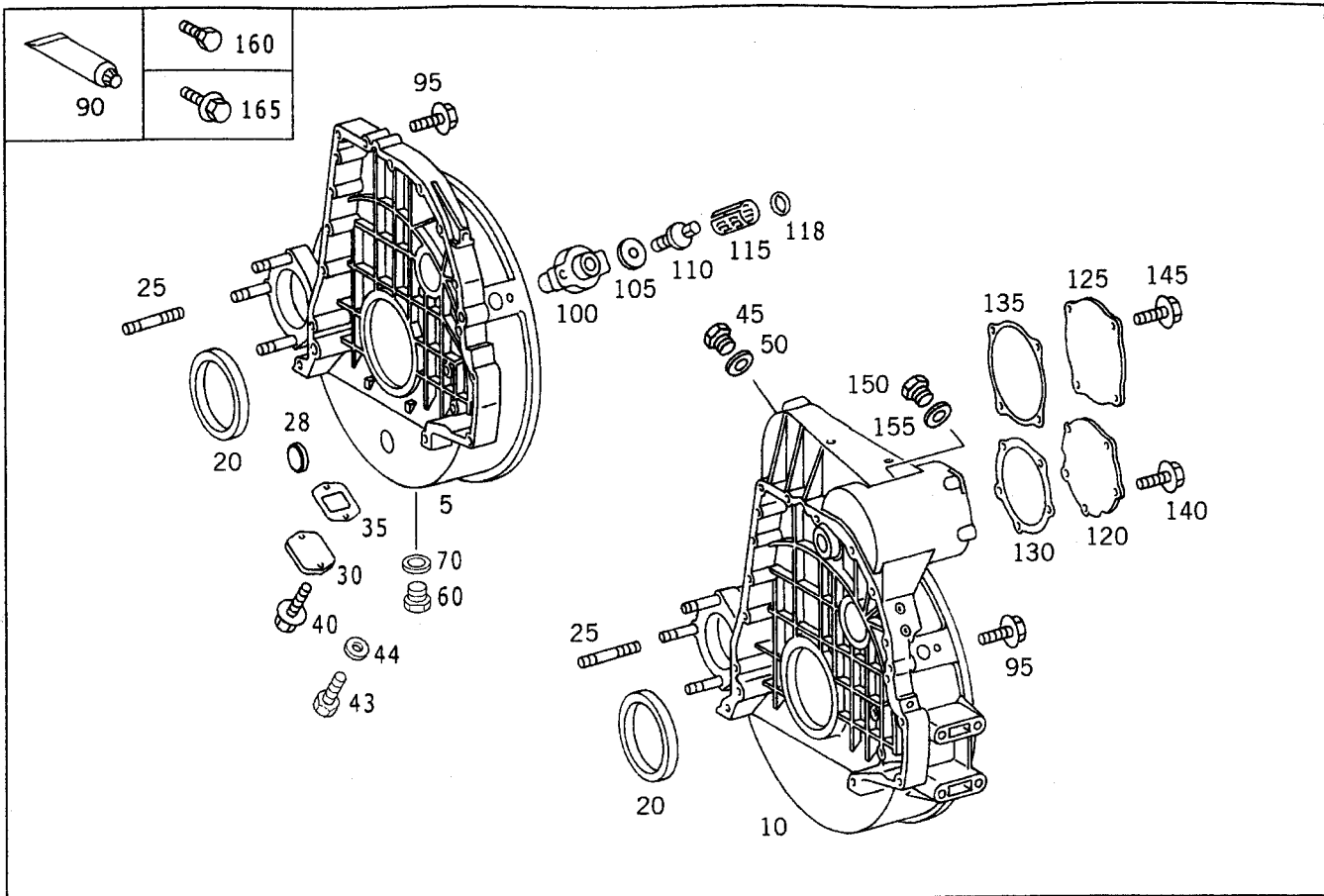
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cártel del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupa
 группа
 المجموعة

01 045 00206



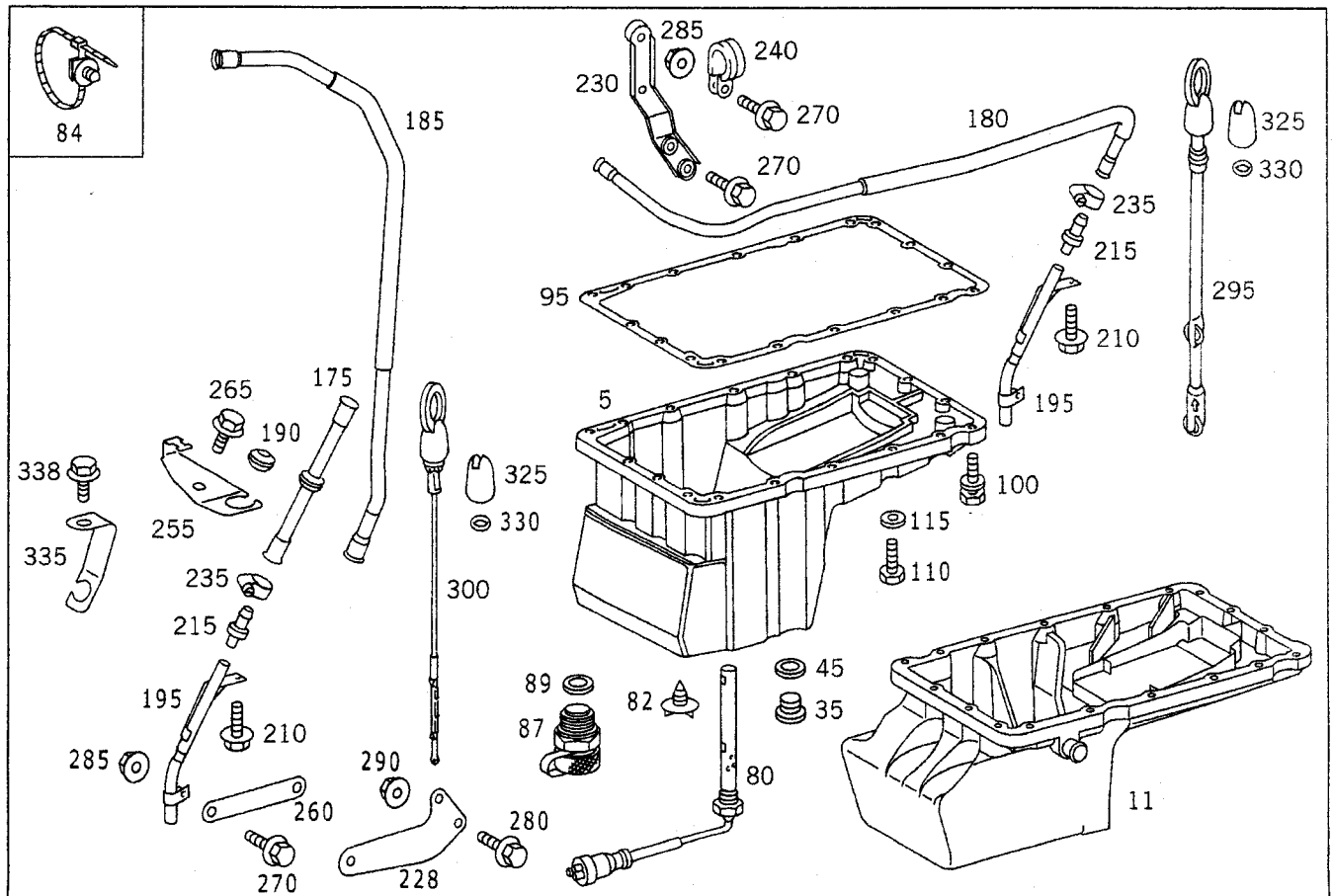
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cártel del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupa
 группа
 المجموعة

01 060 00137



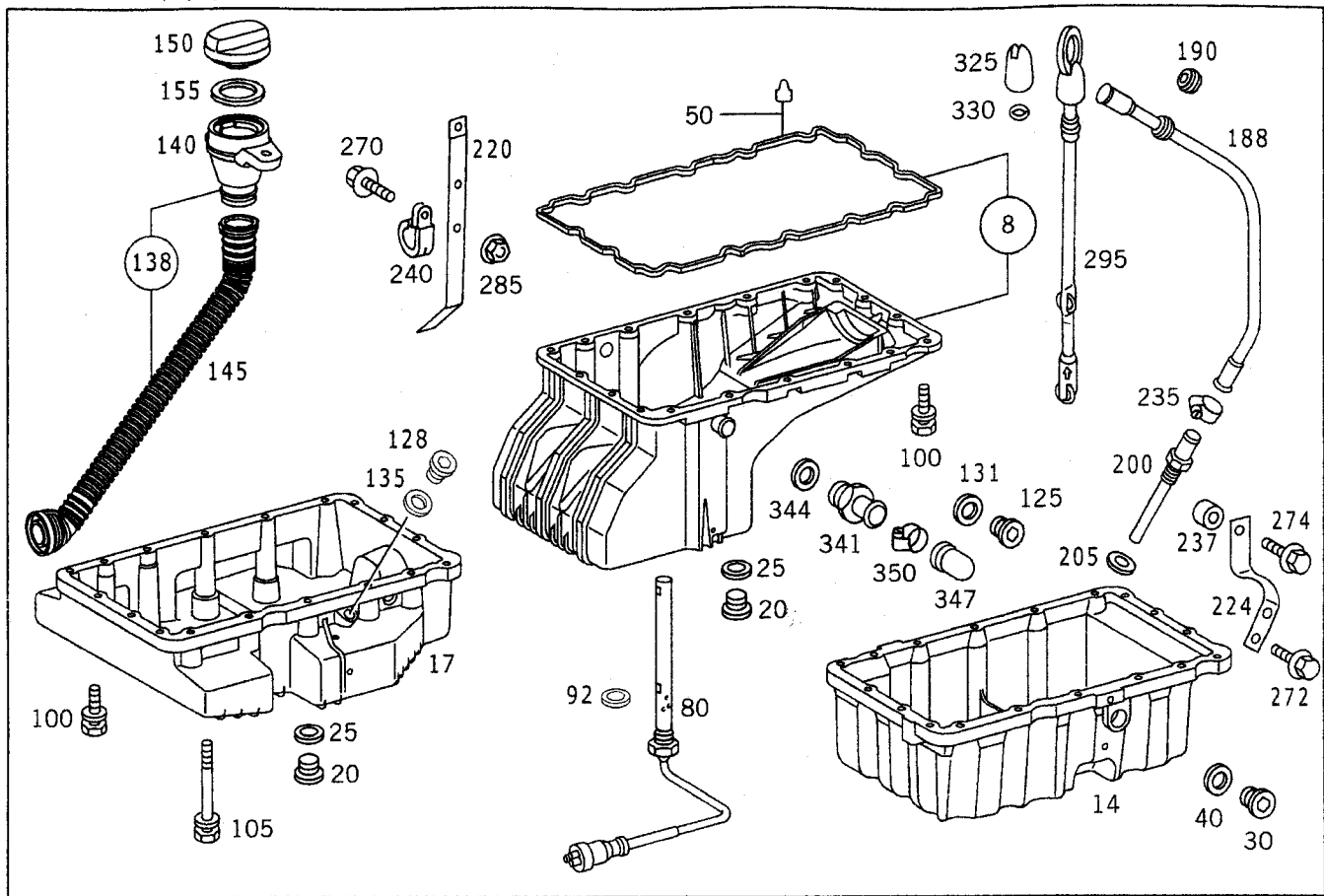
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cártel del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

01 060 00178



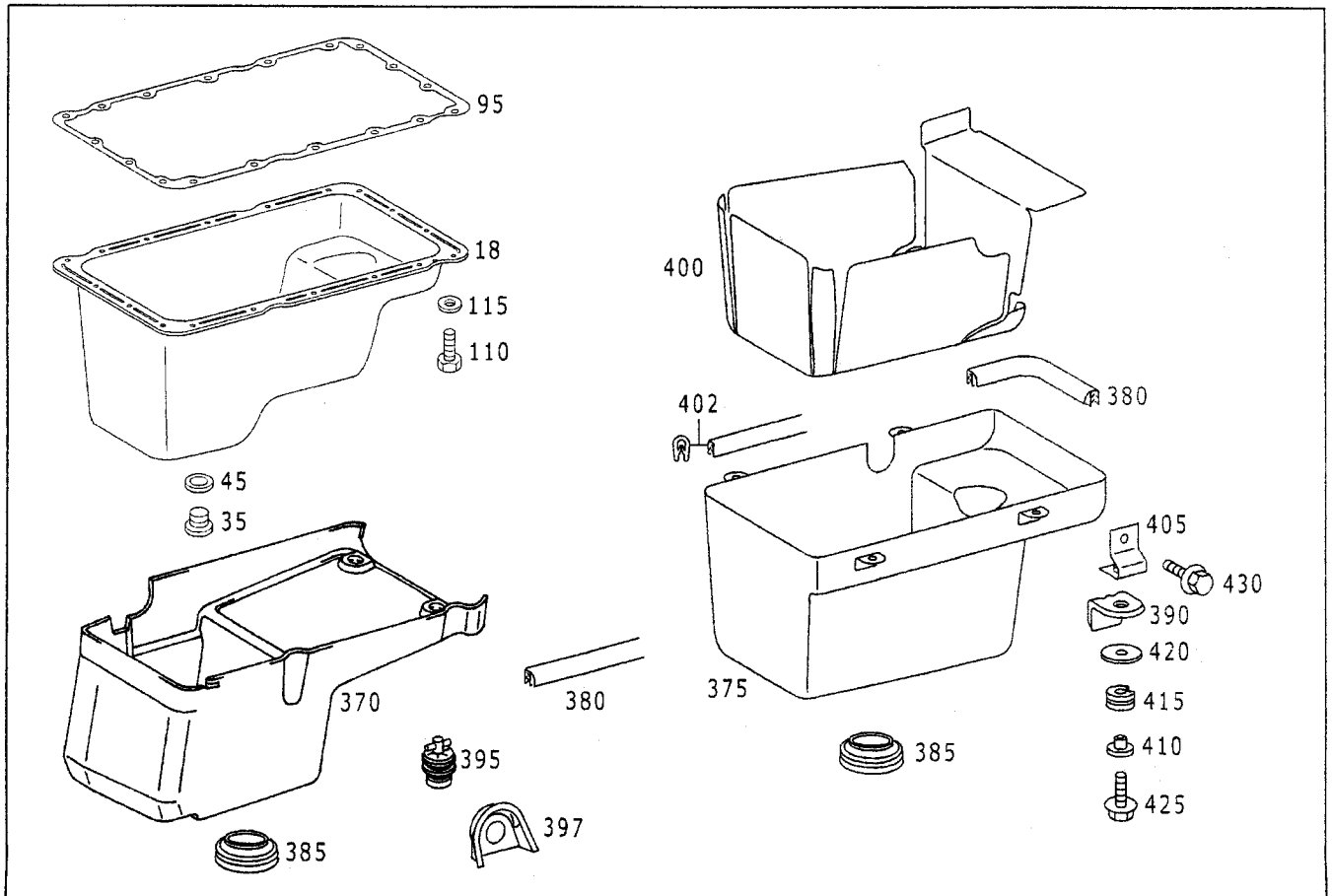
Motorgehäuse
 Engine Housing
 Carter du moteur
 Basamento motore

Carter do motor
 Cártel del motor
 картер двигателя
 هيكل الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

01 060 00198



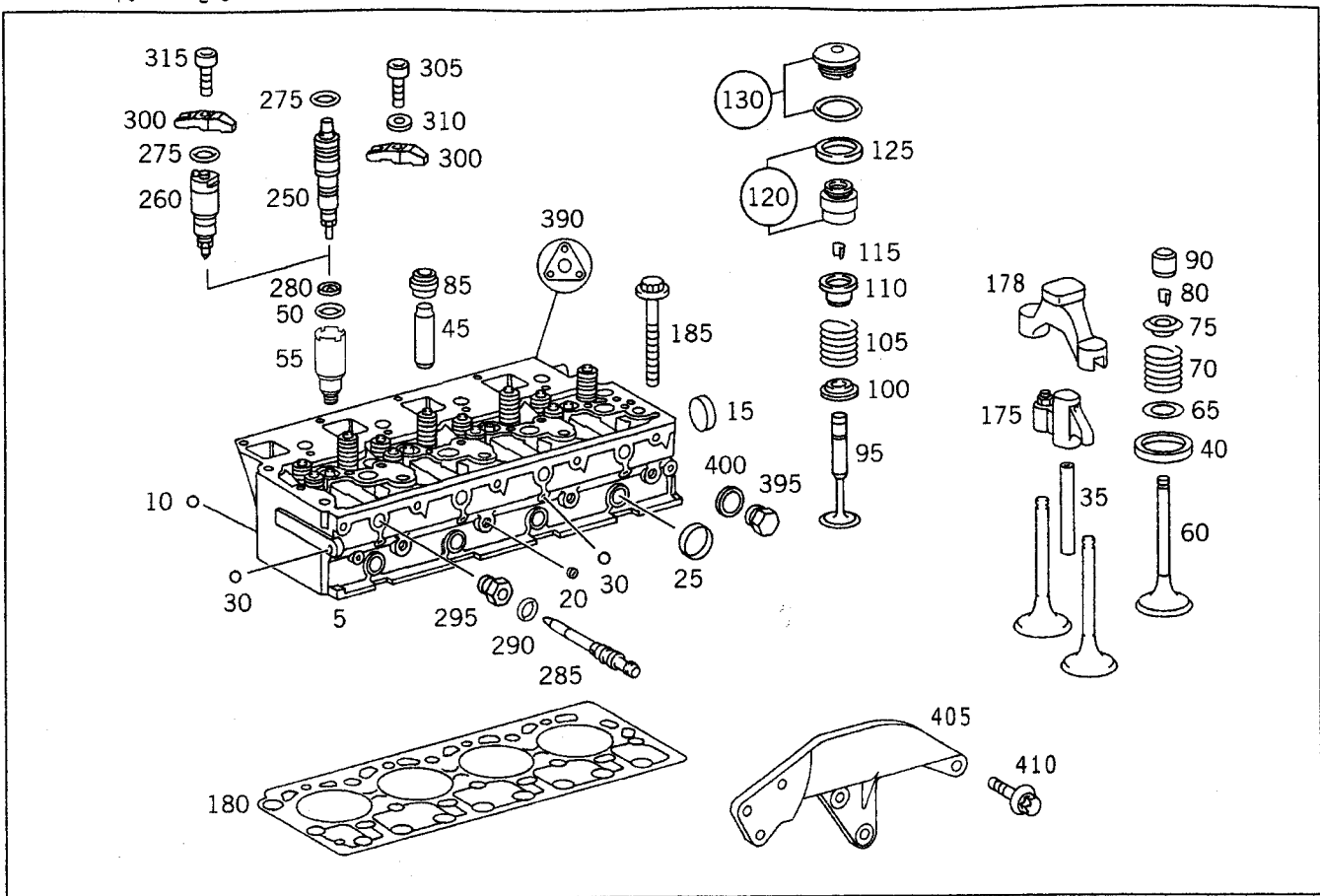
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блона цилиндров
رأس السندر

Gruppe
Group
Groupe
Gruppo

01 075 00208

Grupo
Gruppo
группа
المجموعة



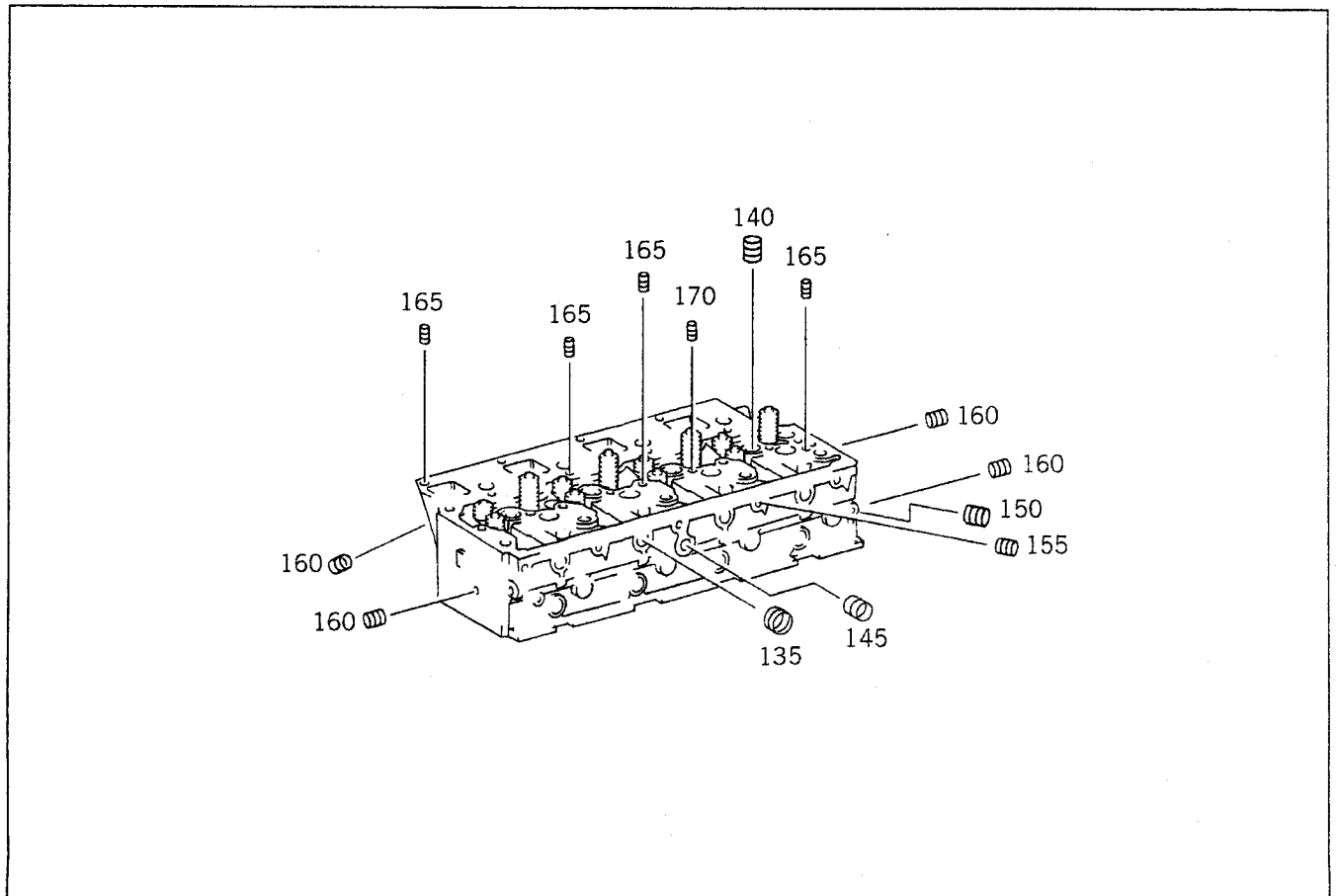
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блона цилиндров
رأس السندر

Gruppe
Group
Groupe
Gruppo

01 075 00288

Grupo
Gruppo
группа
المجموعة



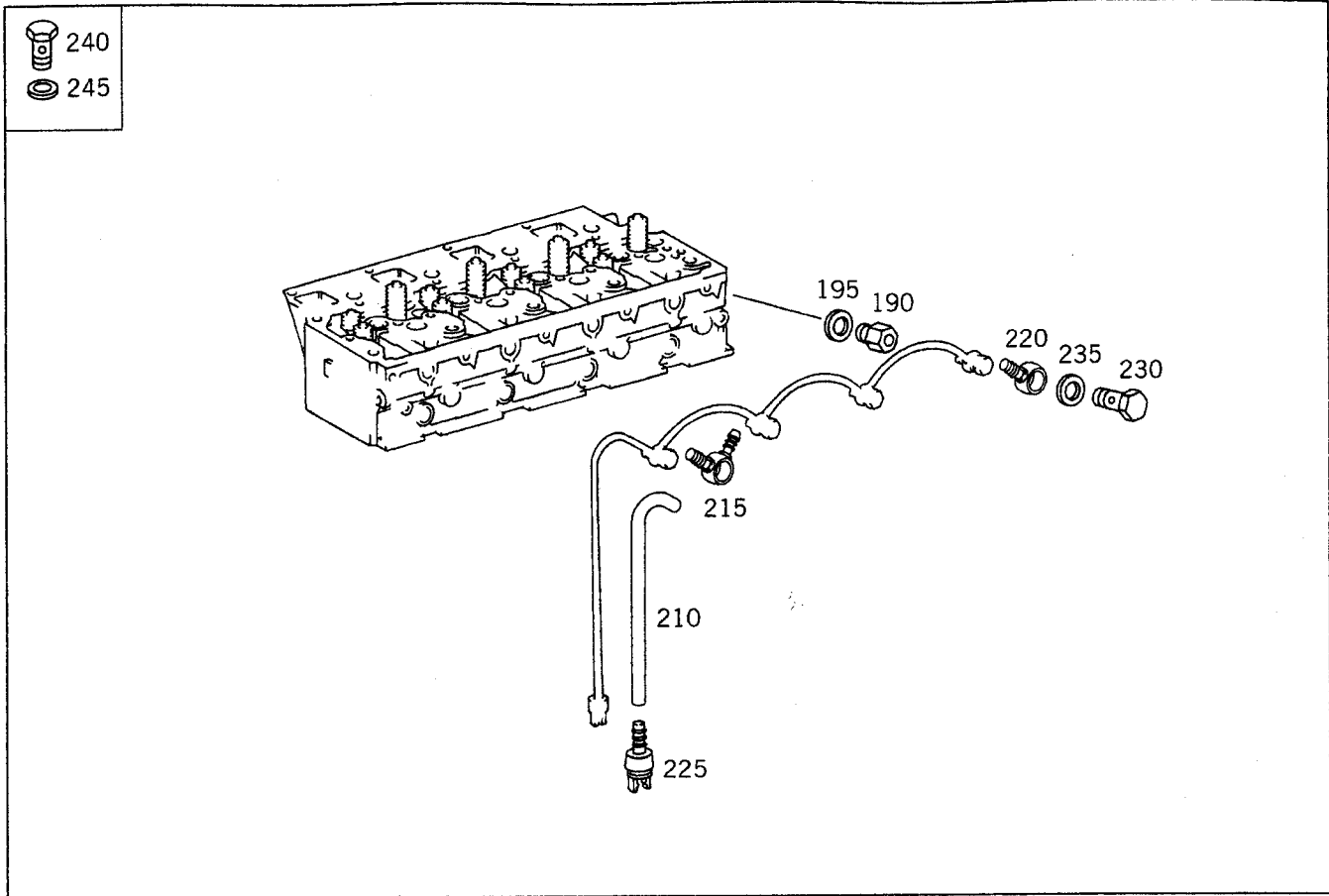
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блоча цилиндров
رأس السندبر

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

01 075 00235



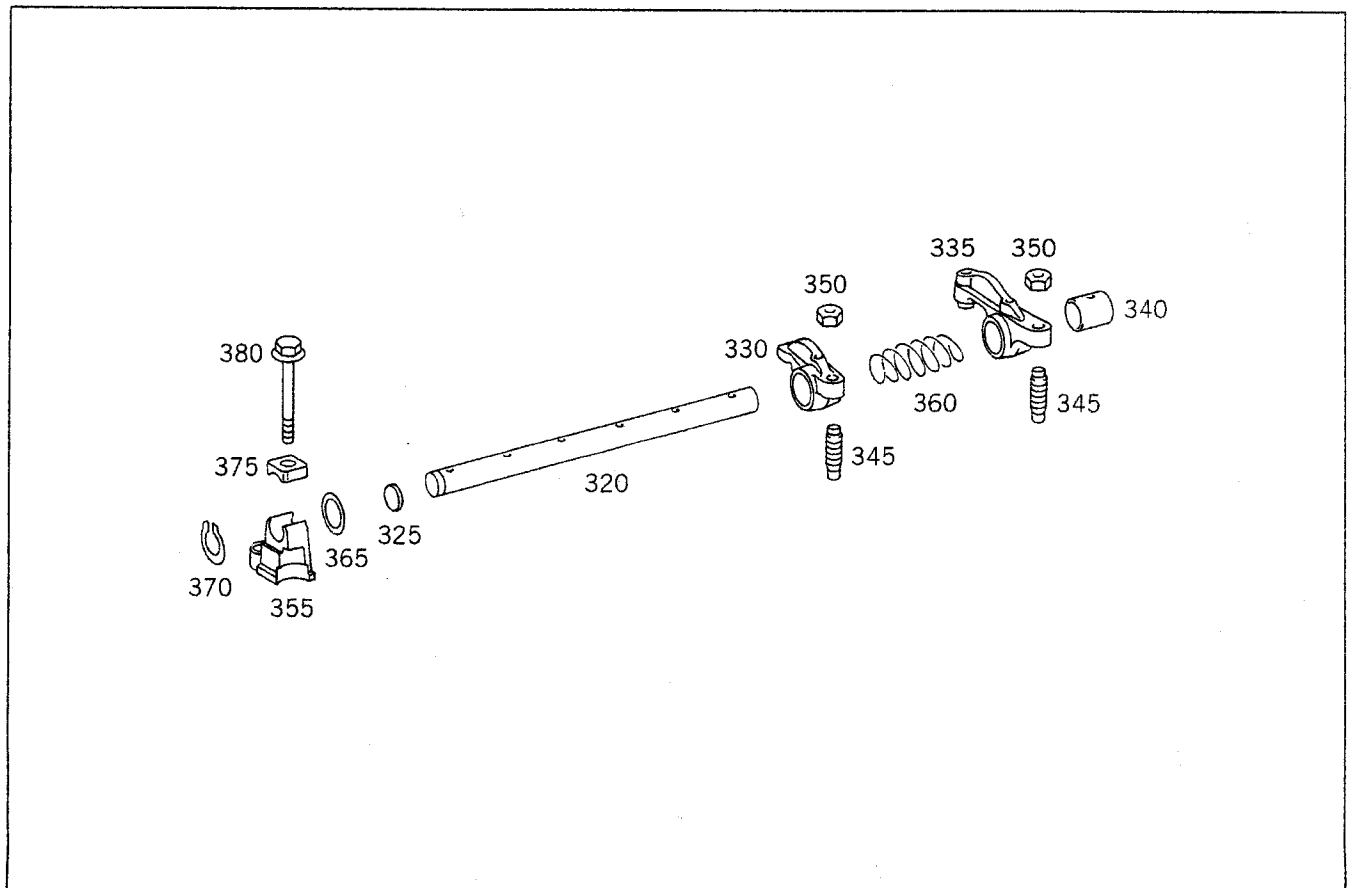
Zylinderkopf
Cylinder Head
Culasse
Testata

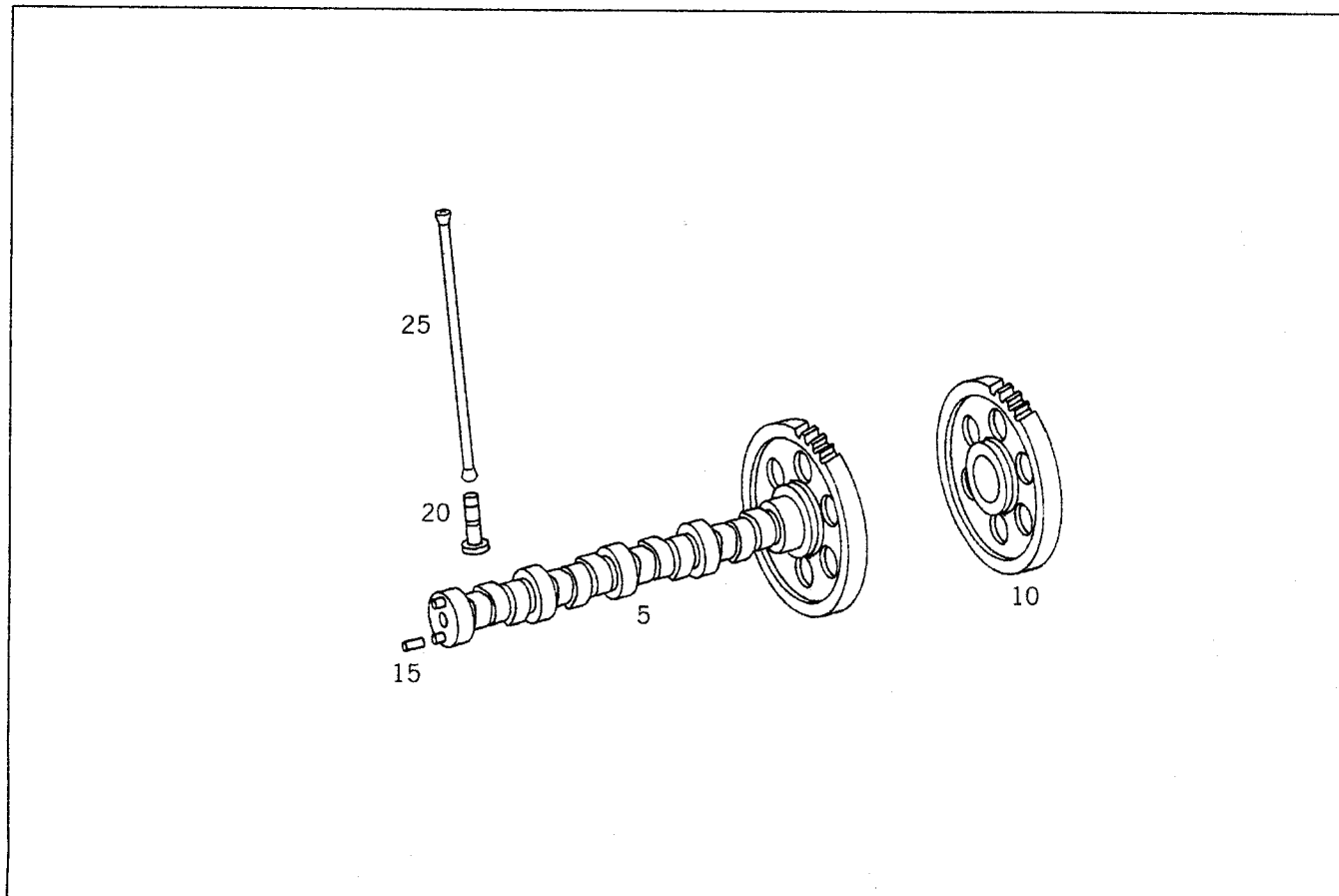
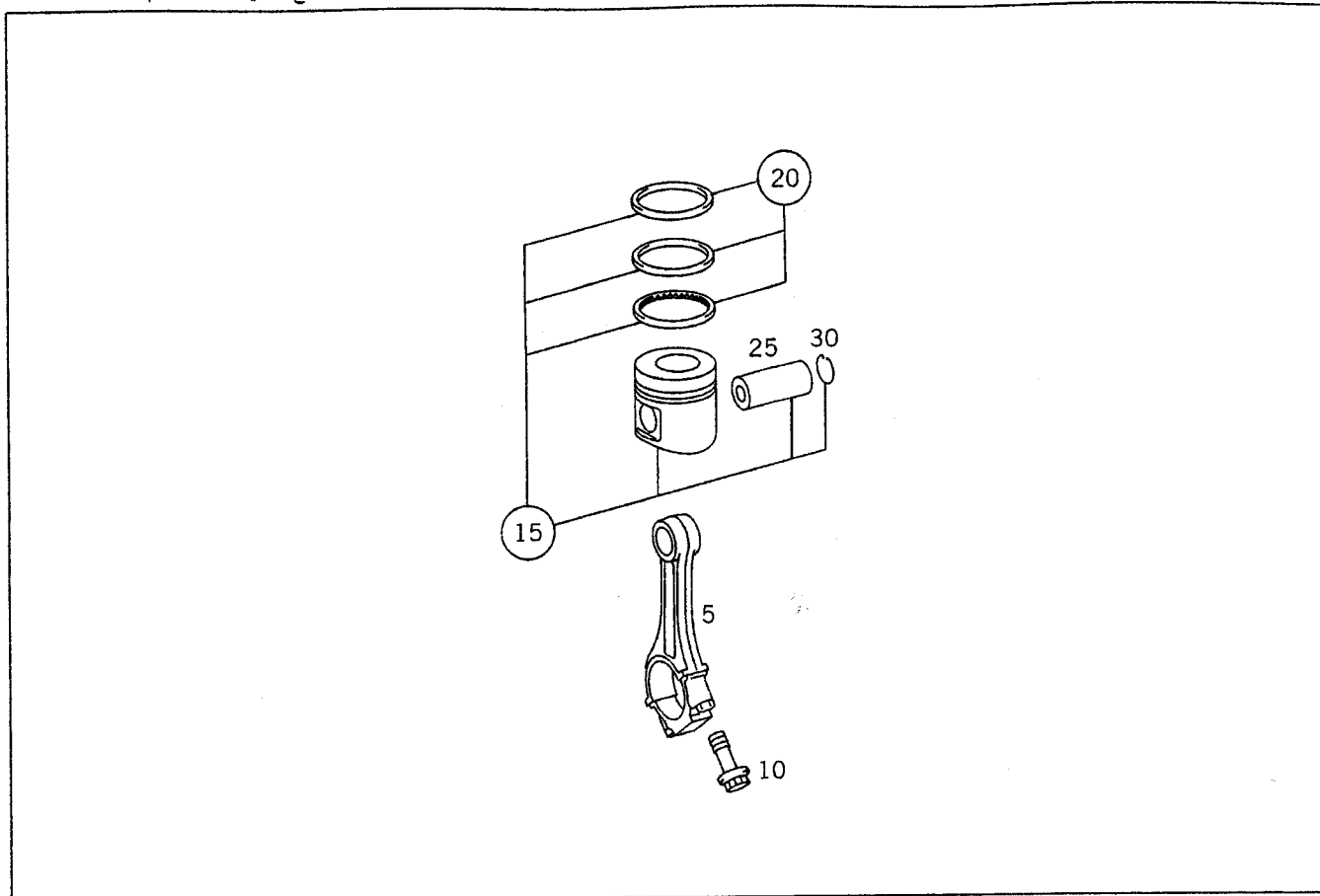
Culatra
Culata
головна блоча цилиндров
رأس السندبر

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

01 075 00289





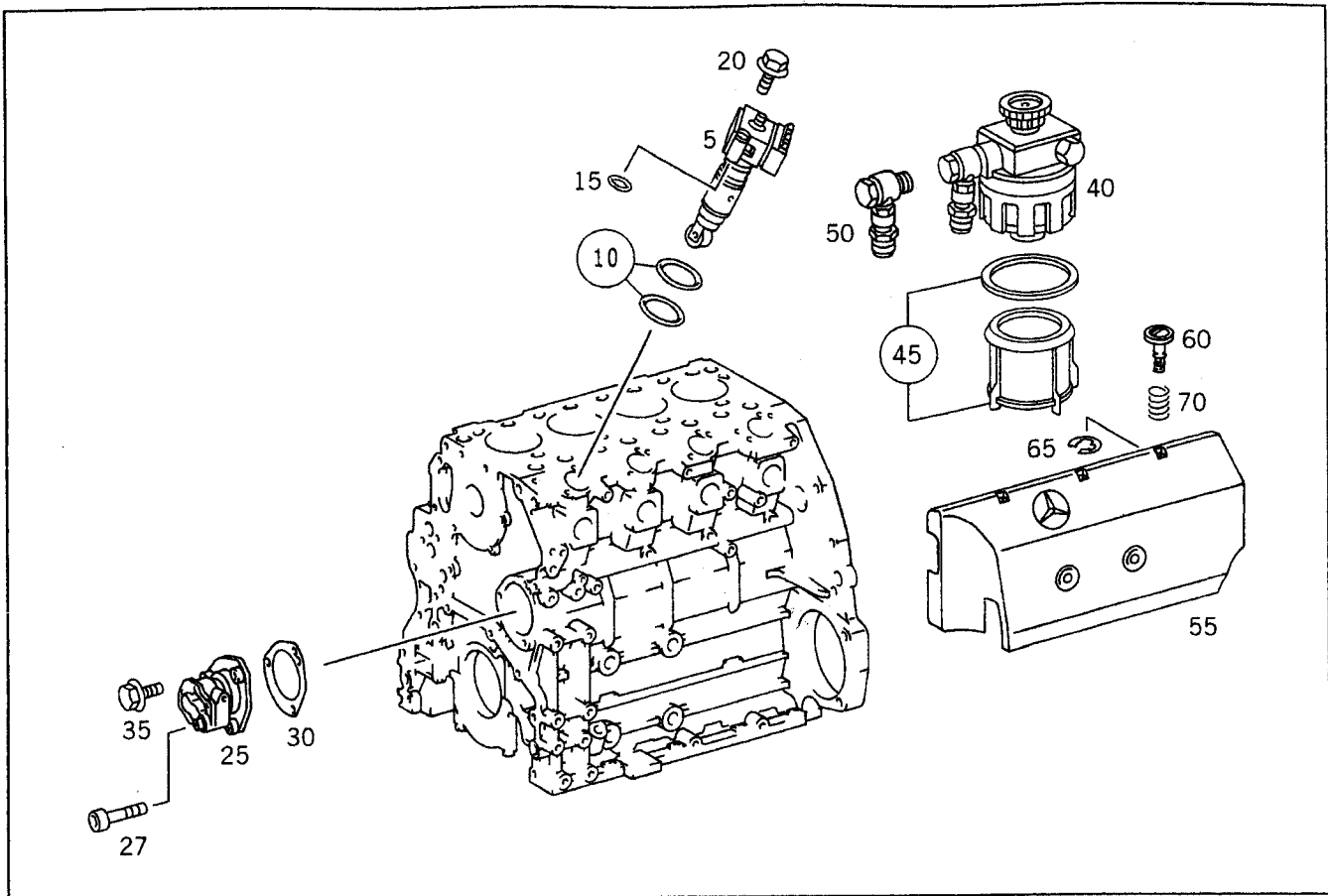
Kraftstoffpumpe
Fuel Pump
Pompe d'alimentation
Pompa combustibile

Bomba de combustivel
Bomba de combustible
топливный насос
مضخة الوقود

Gruppe
Group
Groupe
Grupa
Gruppo

Grupo
Grupa
группа
المجموعة

07 030 00269



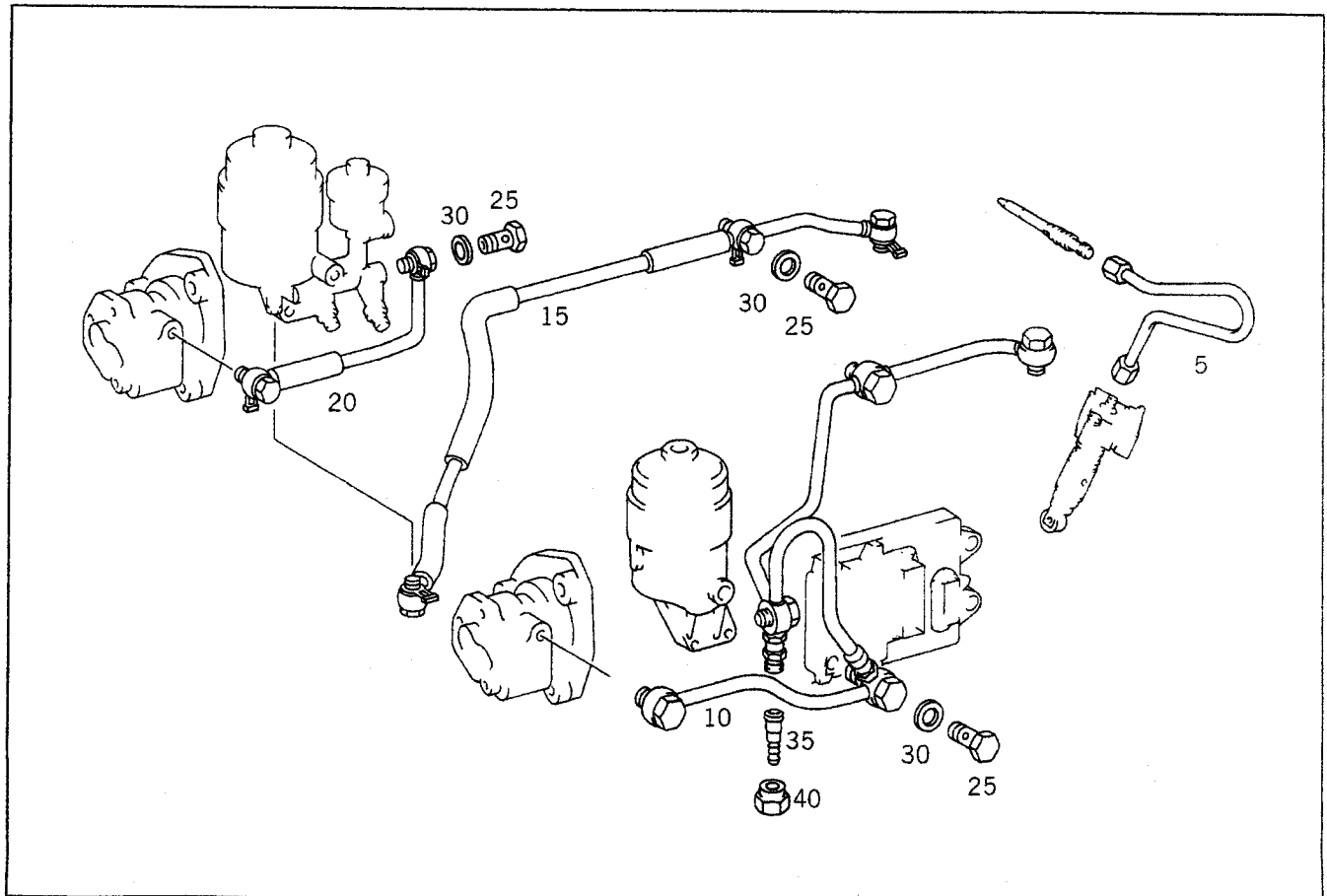
Kraftstoffpumpe
Fuel Pump
Pompe d'alimentation
Pompa combustibile

Bomba de combustivel
Bomba de combustible
топливный насос
مضخة الوقود

Gruppe
Group
Groupe
Grupa
Gruppo

Grupo
Grupa
группа
المجموعة

07 090 00144



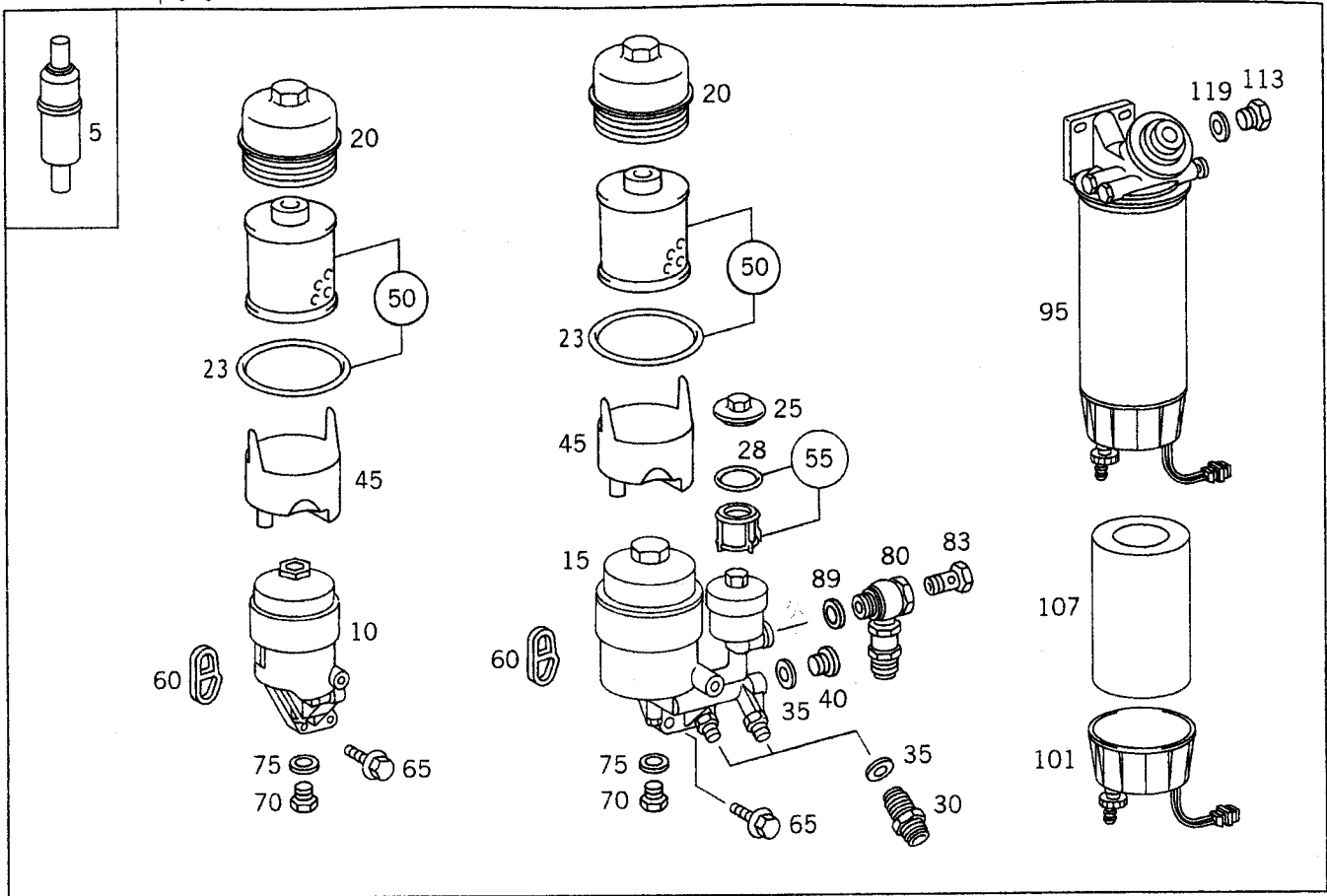
Kraftstoff-Filter
Fuel Filter
Filtre à combustible
Filtro carburante

Filtro de combustible
Filtro de combustible
топливный фильтр
مصفاة الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

09 030 00111



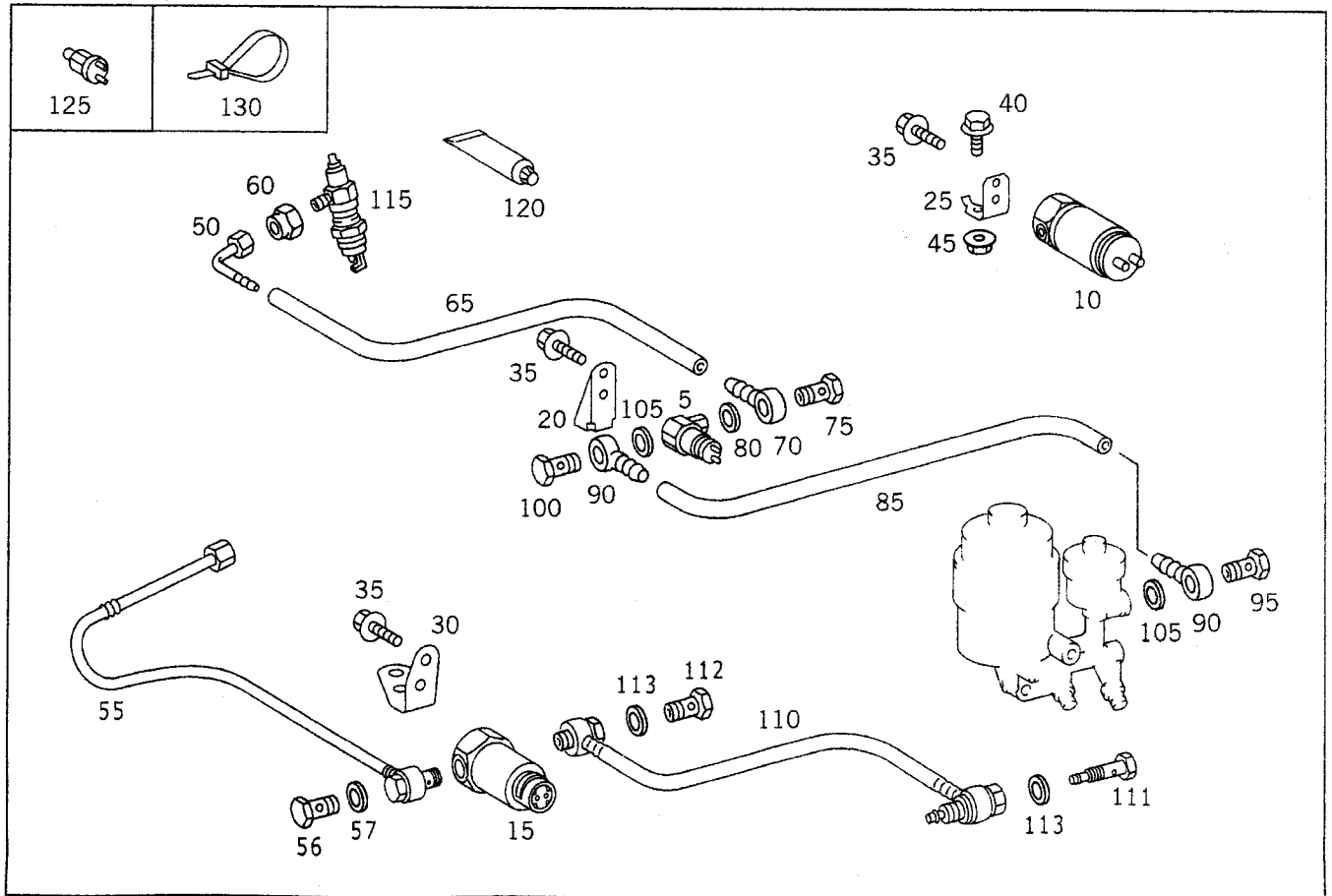
Kraftstoff-Filter
Fuel Filter
Filtre à combustible
Filtro carburante

Filtro de combustible
Filtro de combustible
топливный фильтр
مصفاة الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

09 060 00029



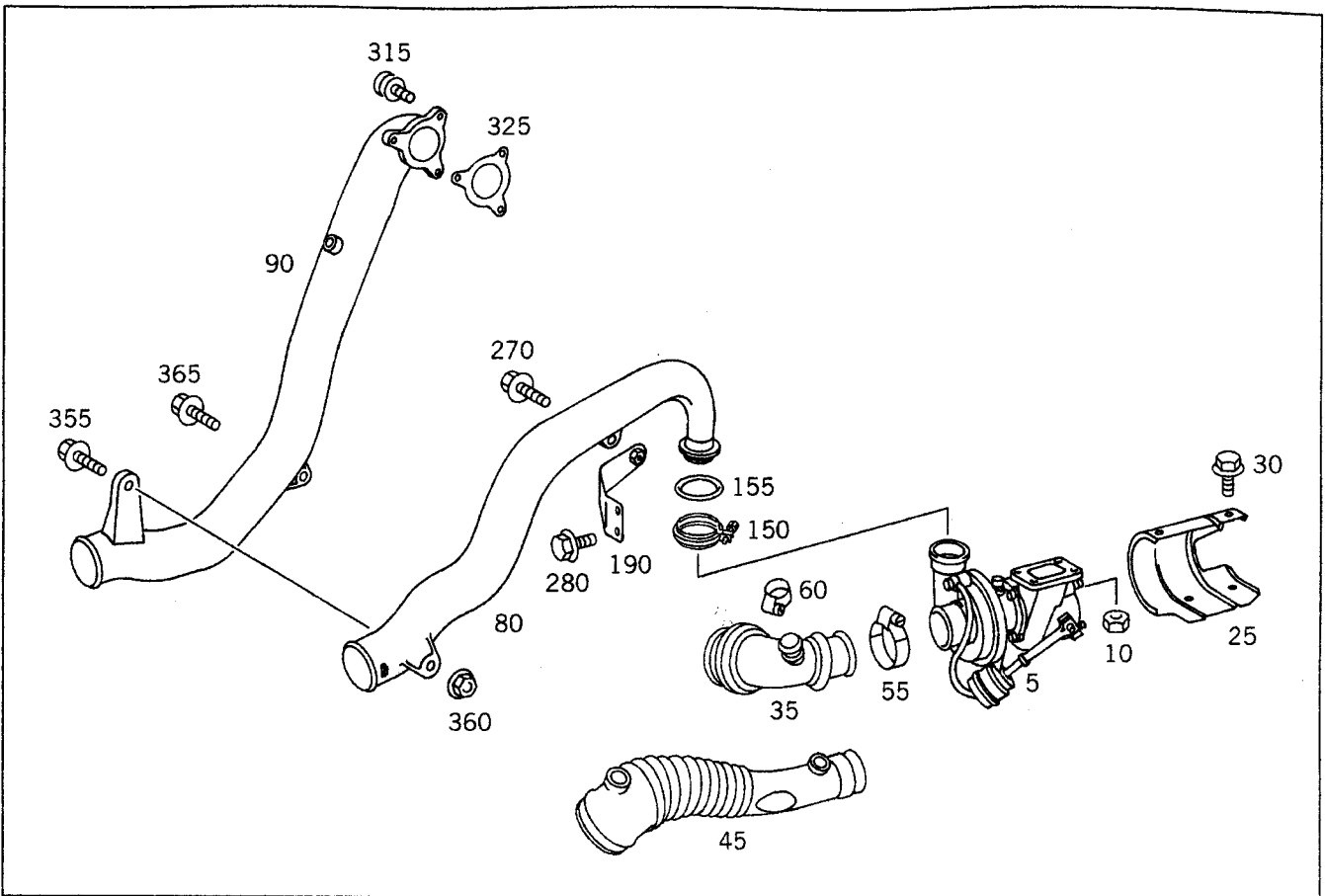
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

Grupo
Grupa
группа
المجموعة

09 075 00129



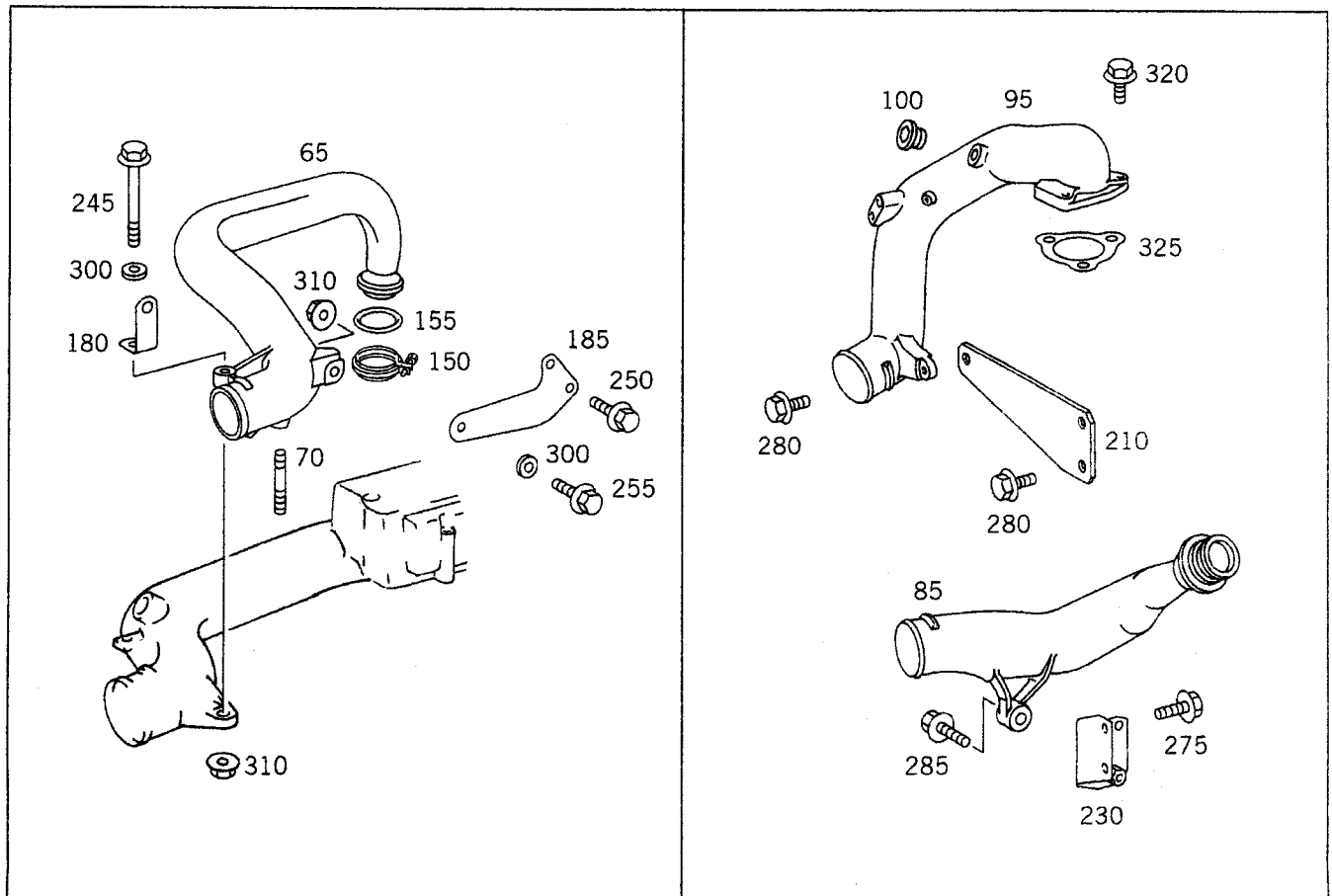
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

Grupo
Grupa
группа
المجموعة

09 075 00149



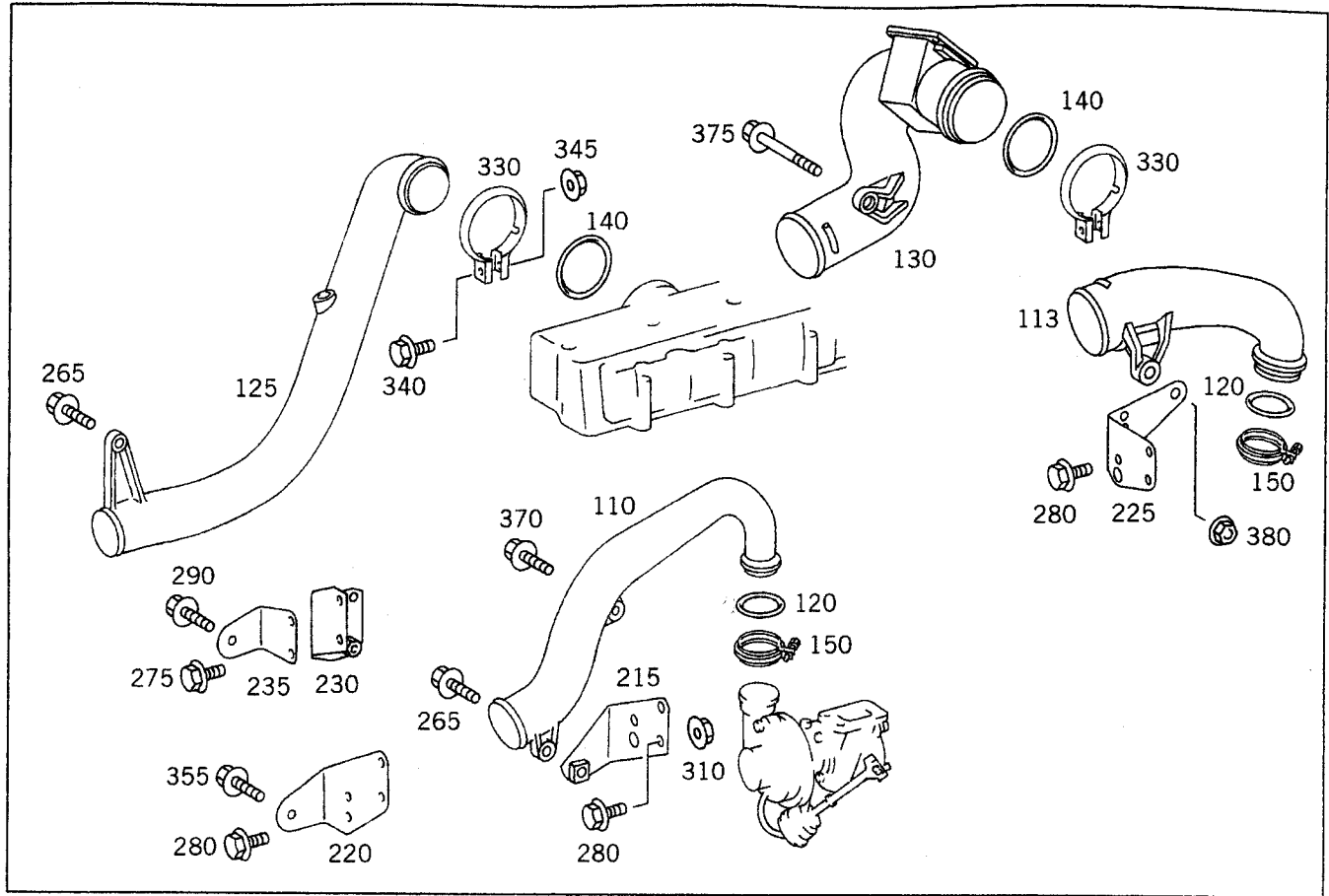
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

09 075 00158



42

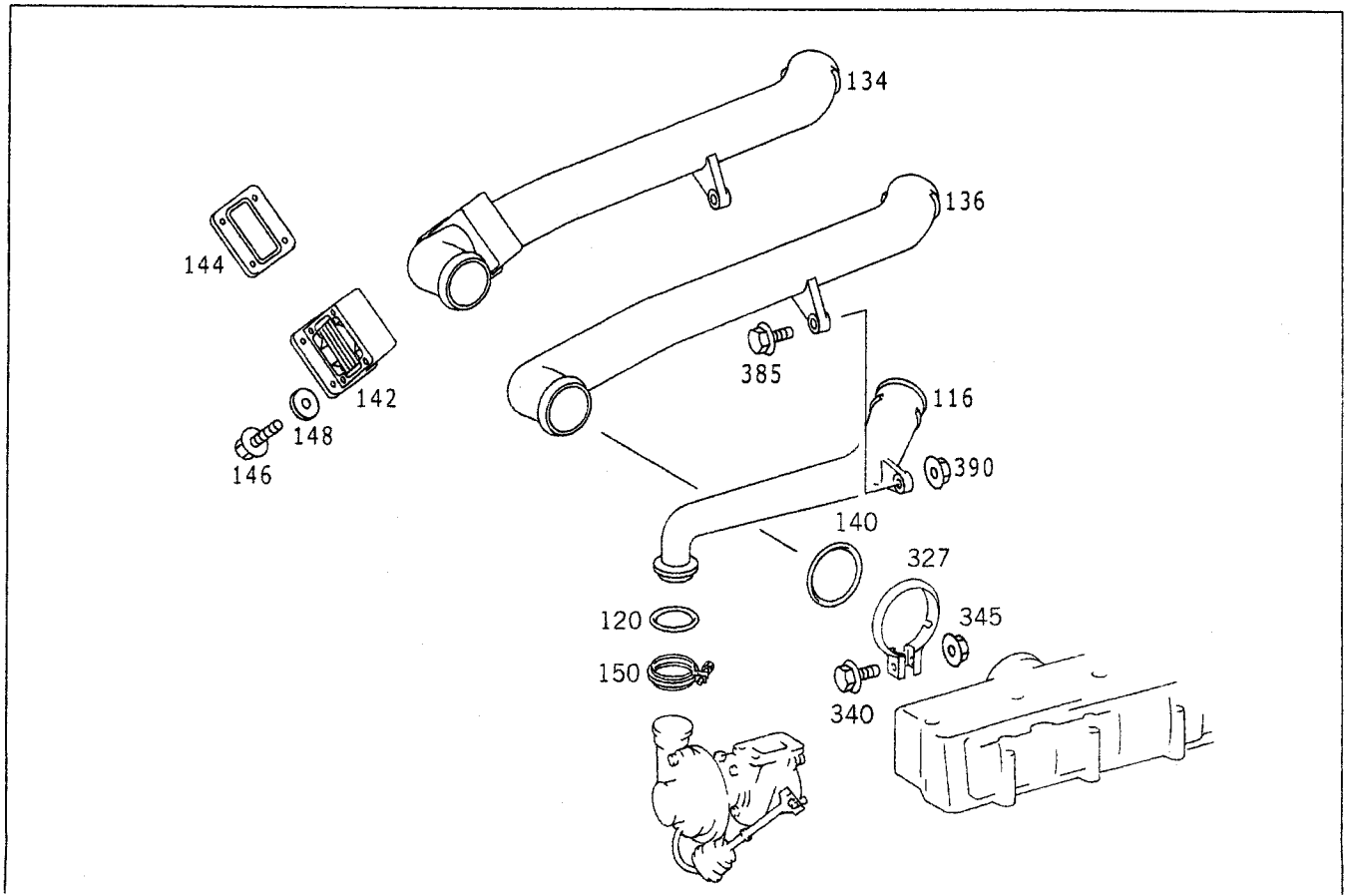
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

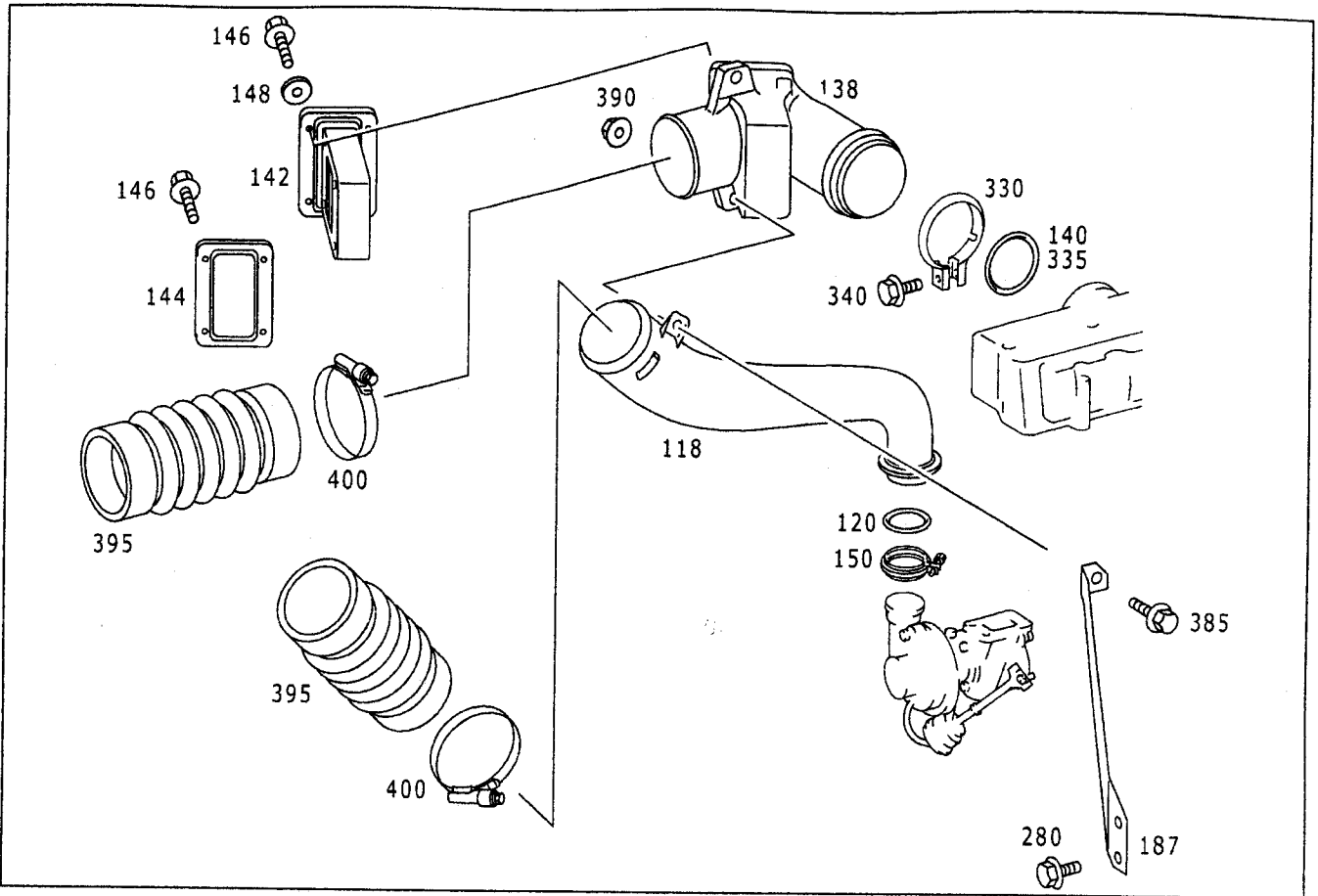
Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

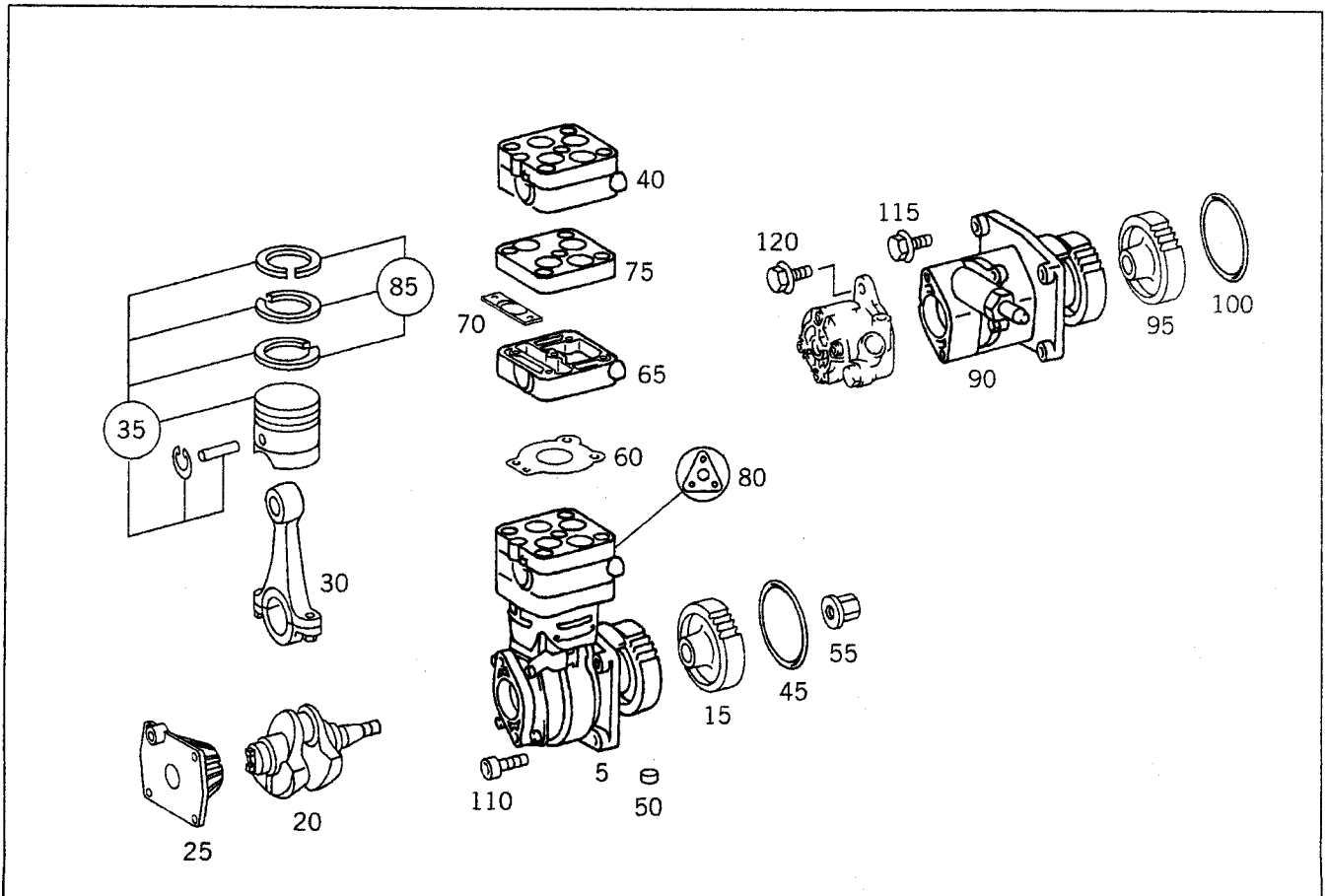
Grupo
Grupo
группа
المجموعة

09 075 00185



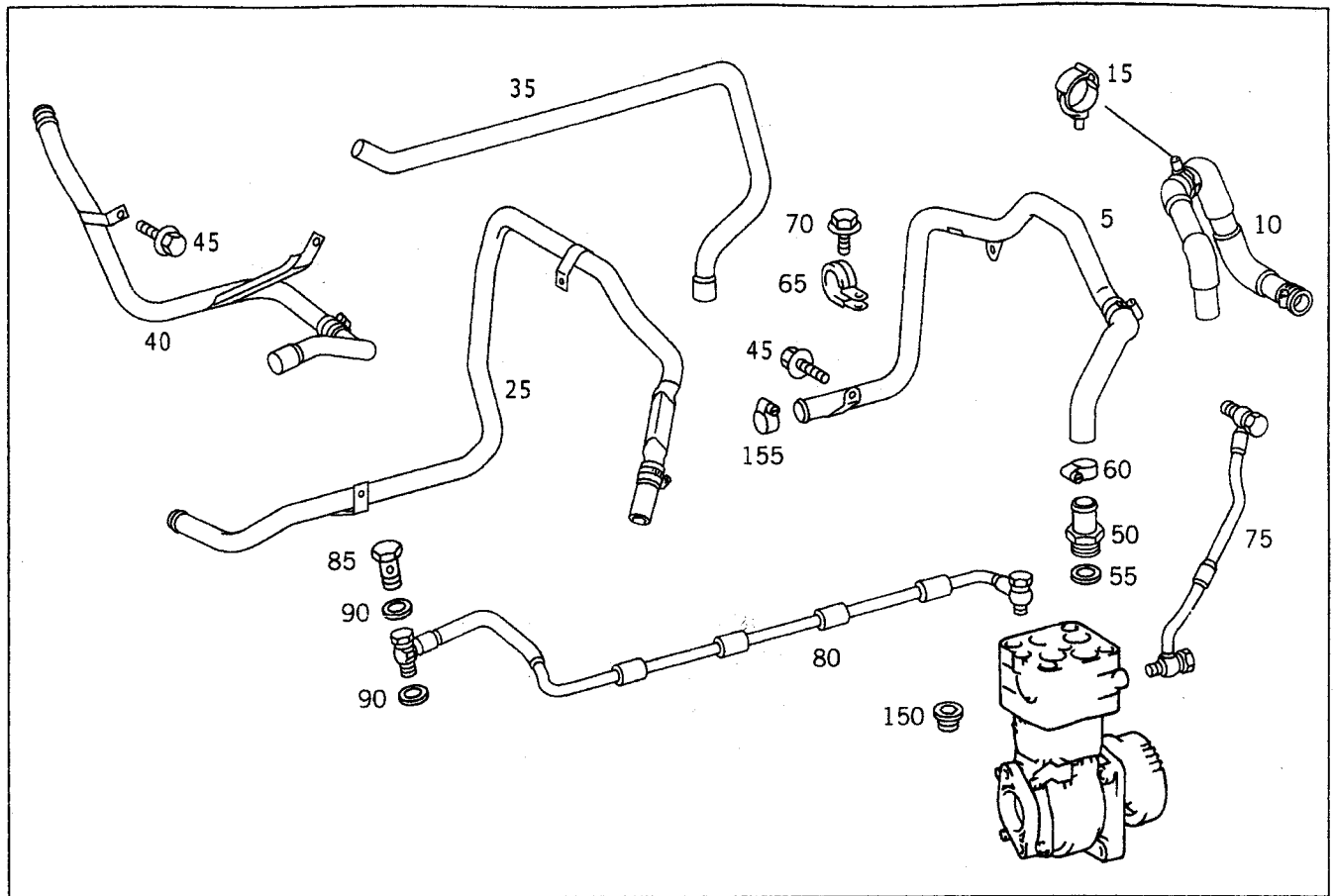


44



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

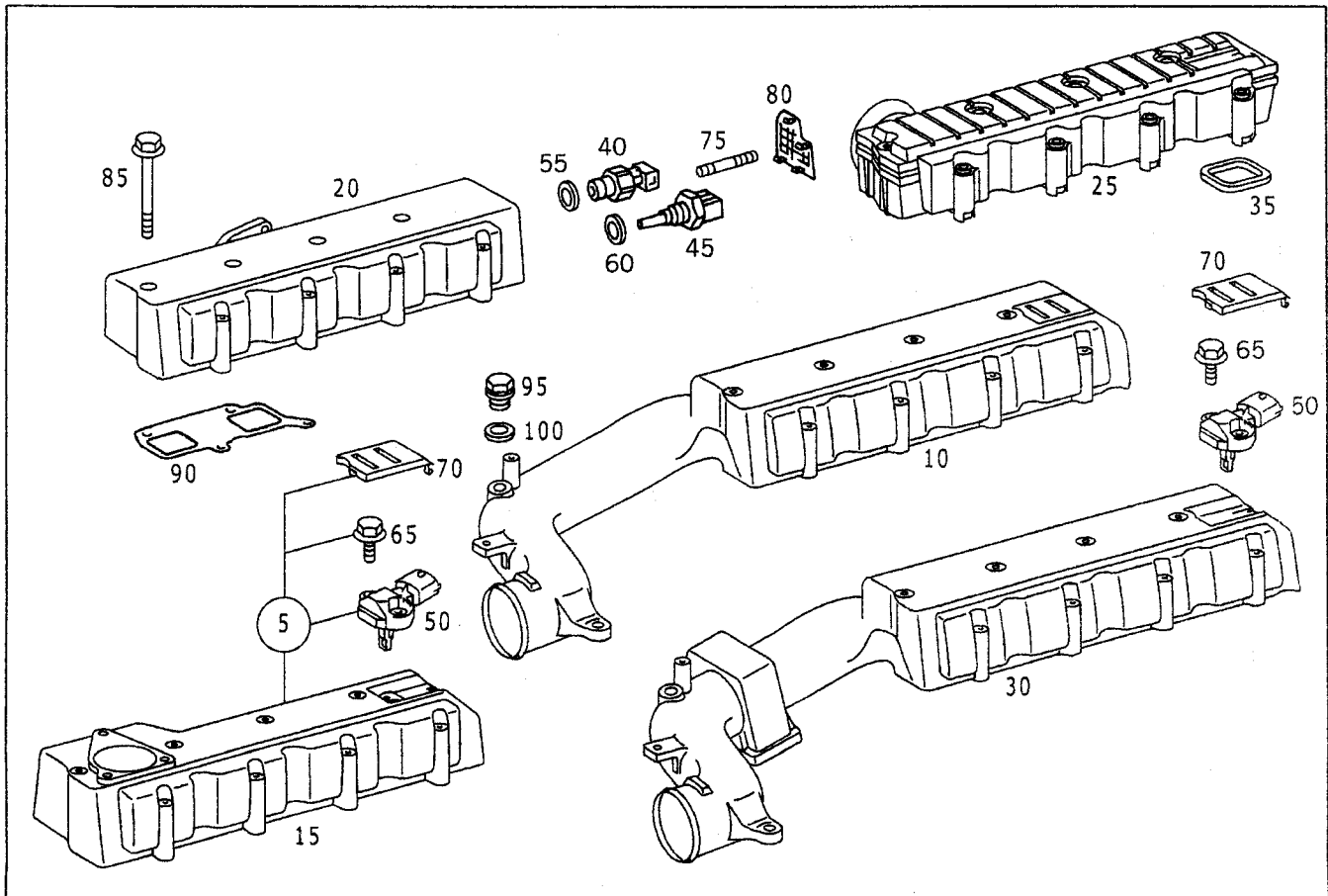
Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة
13 075 00126



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

Tubo de admisión y colector de escape
Tubo de admisión y colector de escape
выпускная труба и колено
выпускного трубопровода
أنبوب امتصاص والعامد المشعب

Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة
14 015 00194



Luftpresser
Air Compressor
Compresseur d'air
Compressore aria

Compressor de ar
Compresor de aire
воздушный компрессор
ضاغط الهواء

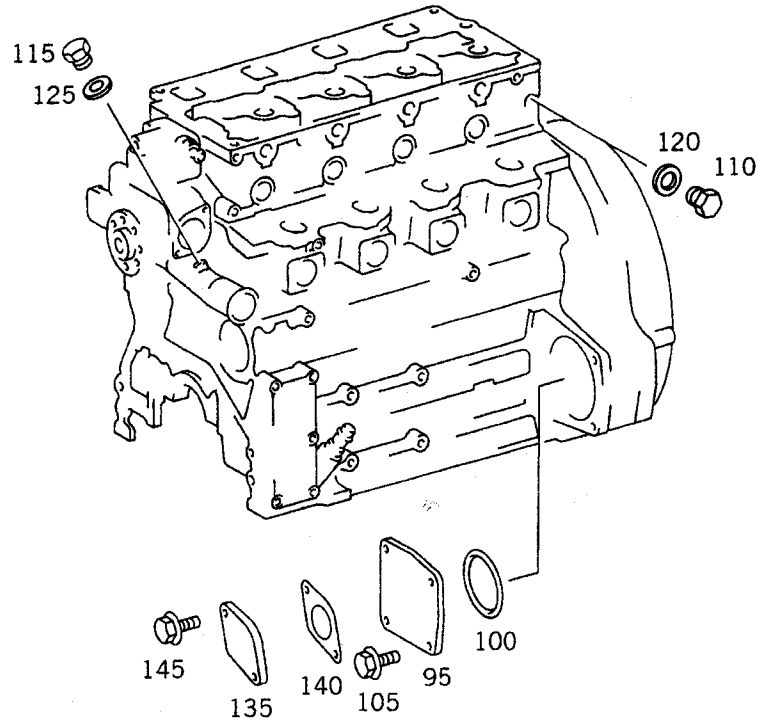
Gruppe
Group
Groupe
Gruppo

Grupo
Grupa
группа
المجموعة

13 075 00142



130



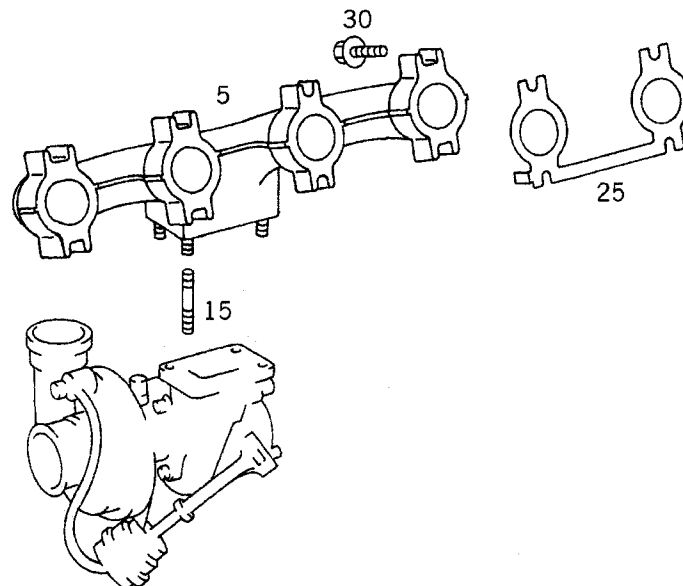
Auspuffkrümmer
Exhaust Manifold
Collecteur d'échappement
Collettore scarico

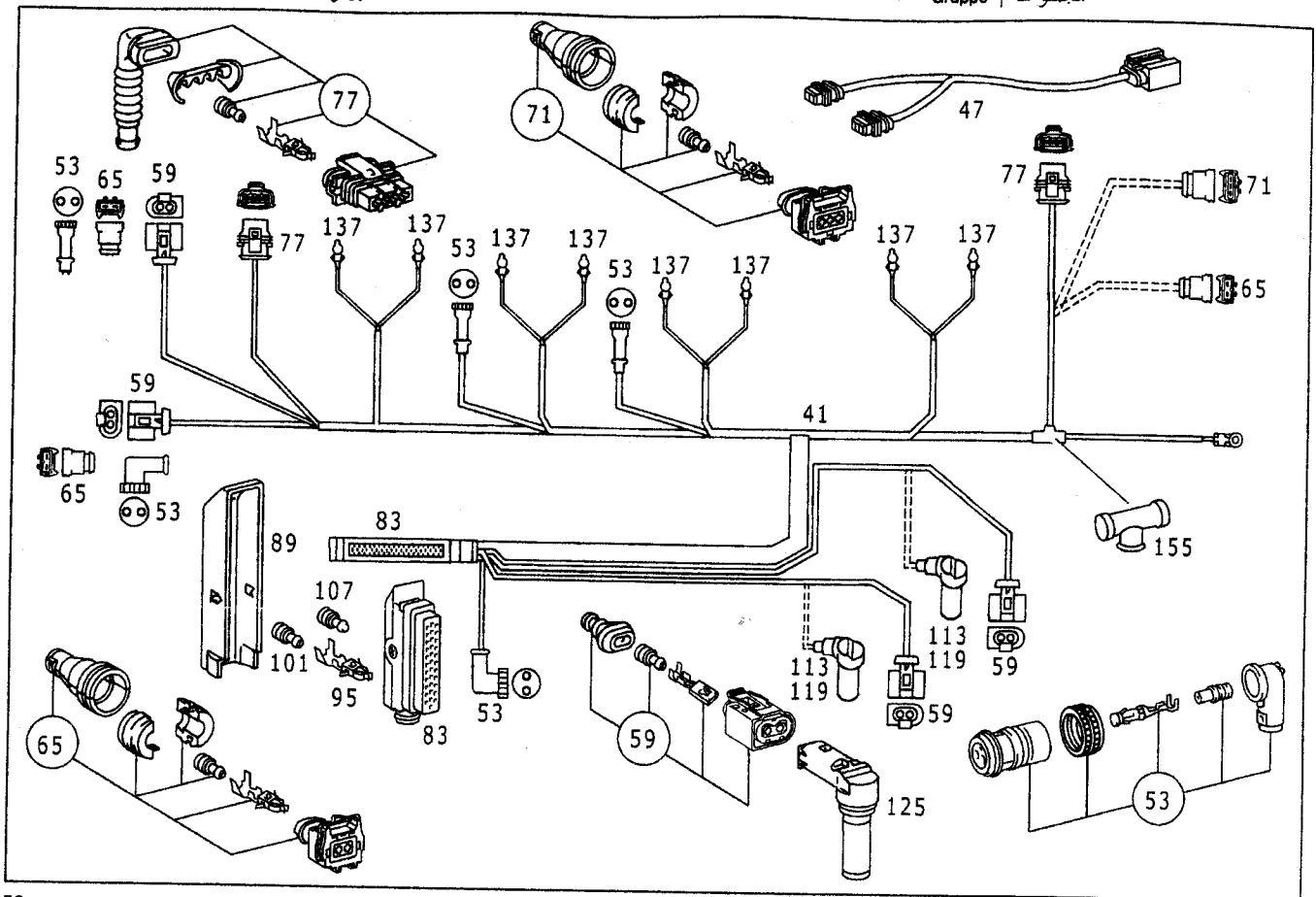
Colector de escape
Colector de escape
коллено выпускного трубопровода
العلم المشعب

Gruppe
Group
Groupe
Gruppo

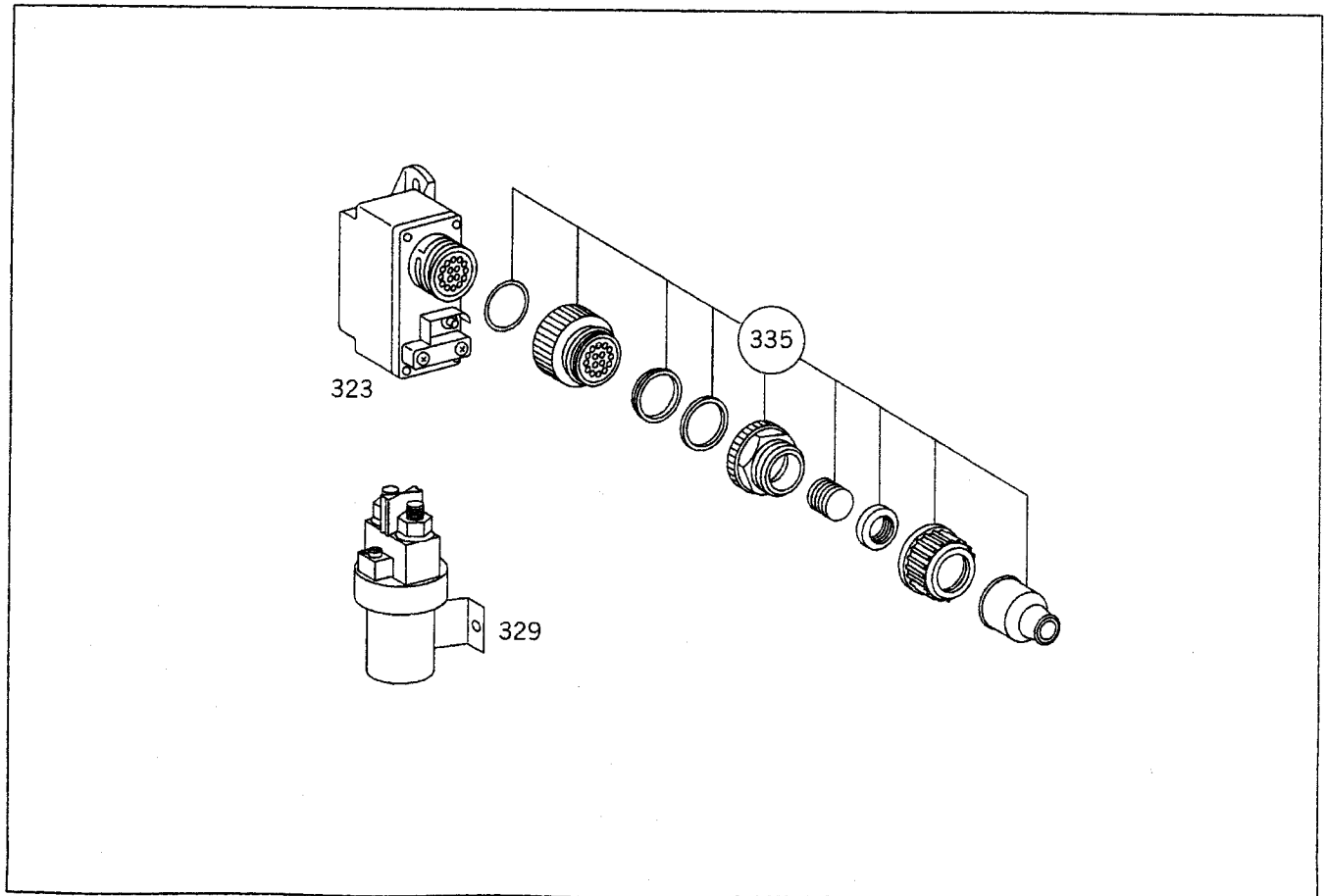
Grupo
Grupa
группа
المجموعة

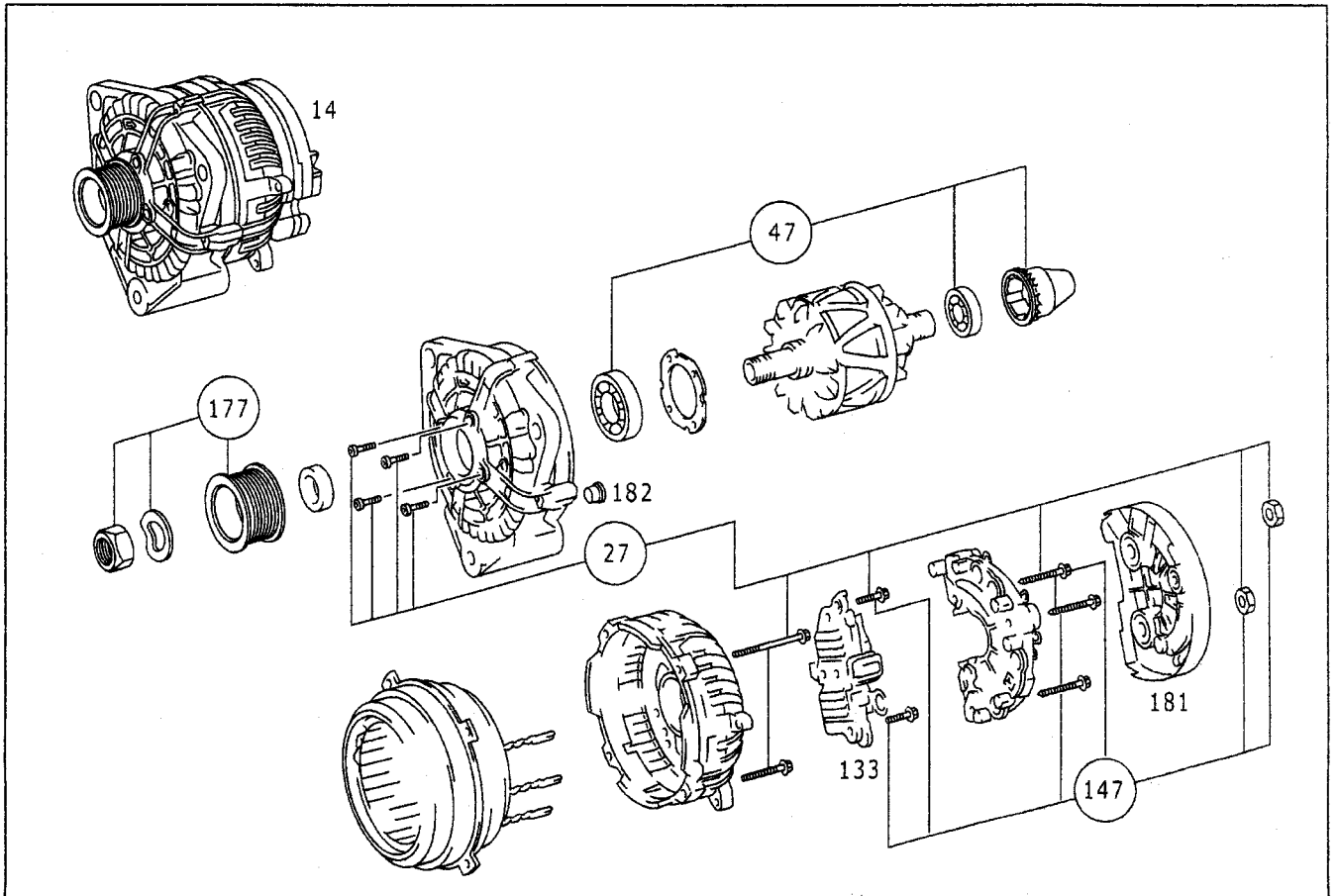
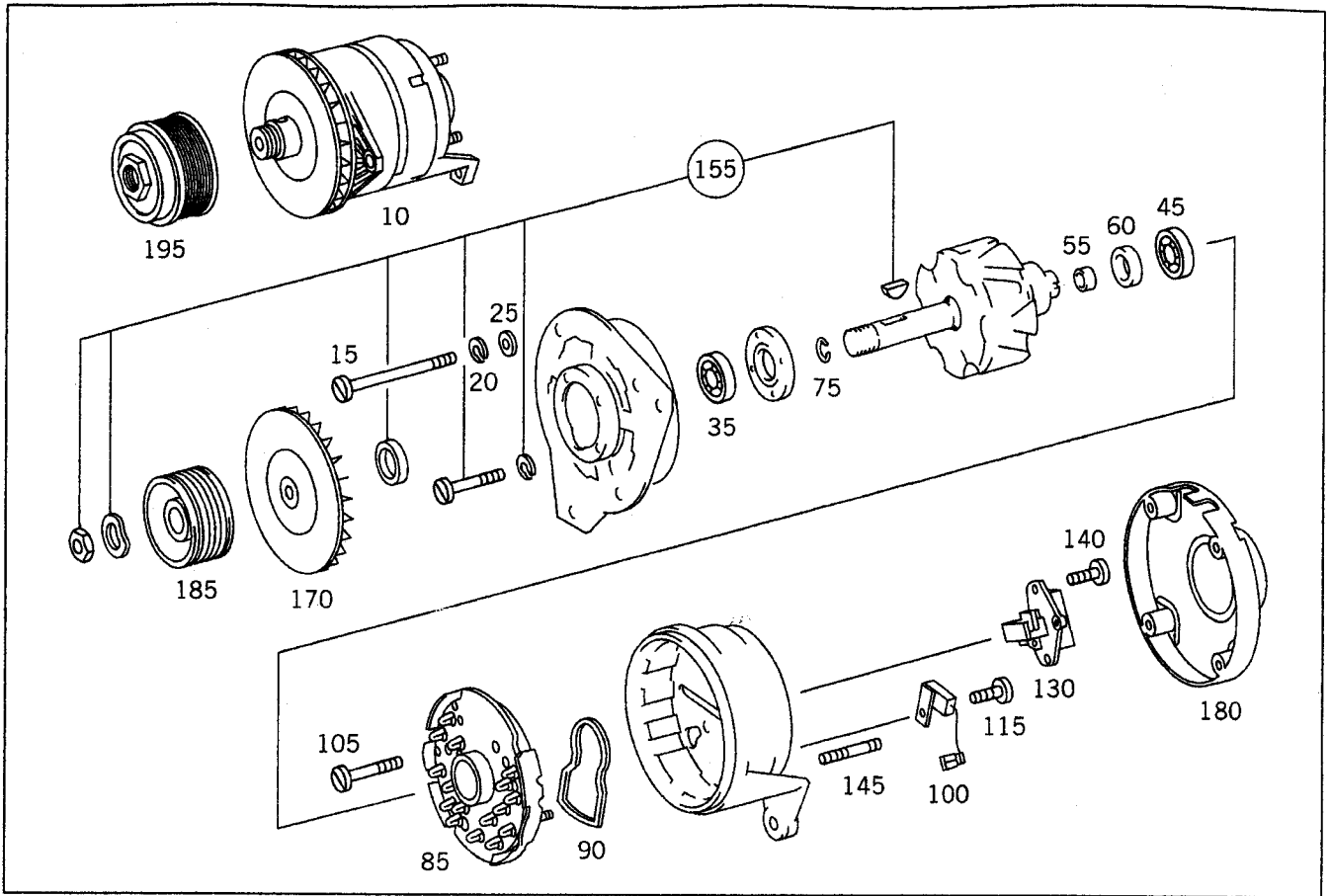
14 030 00217

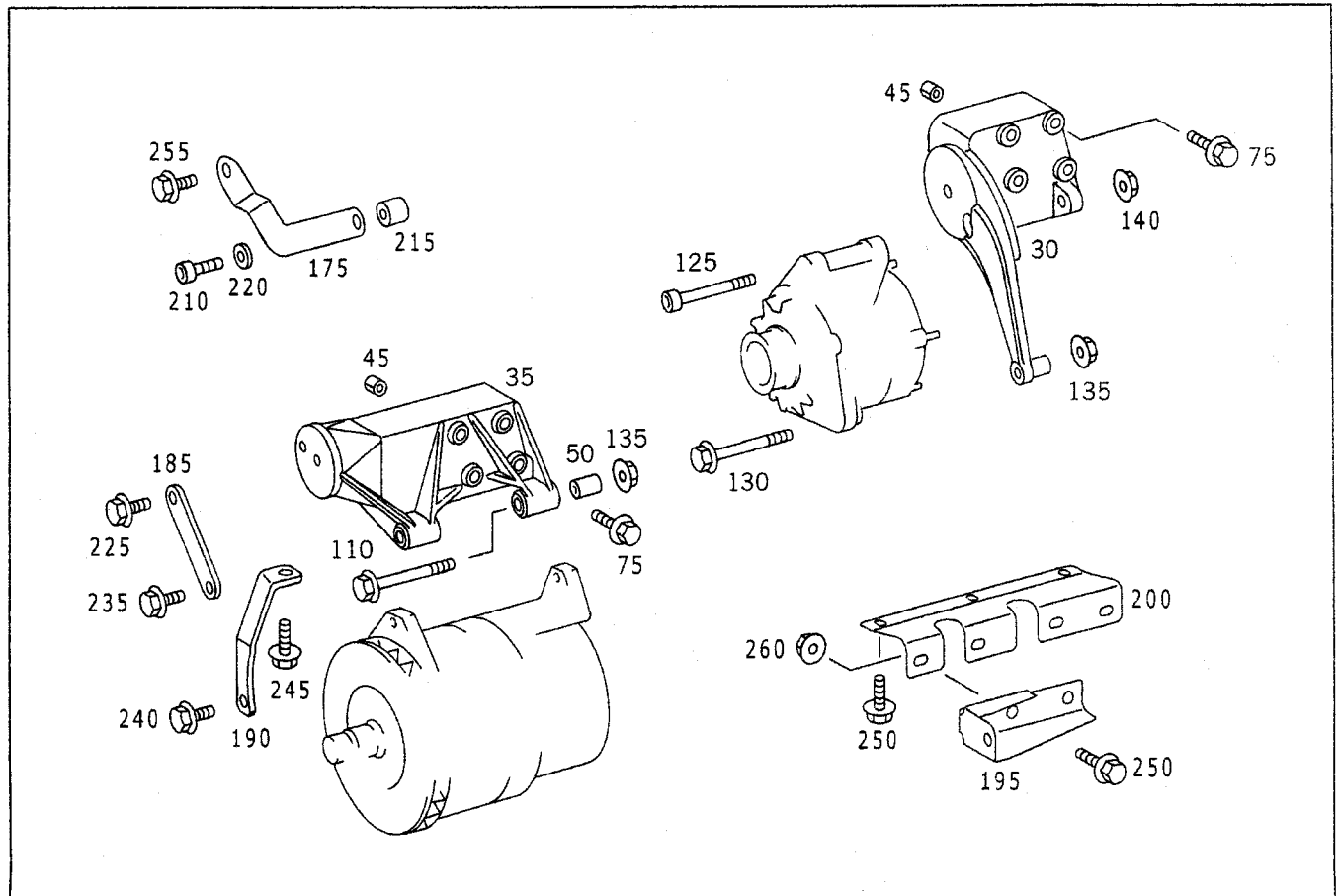
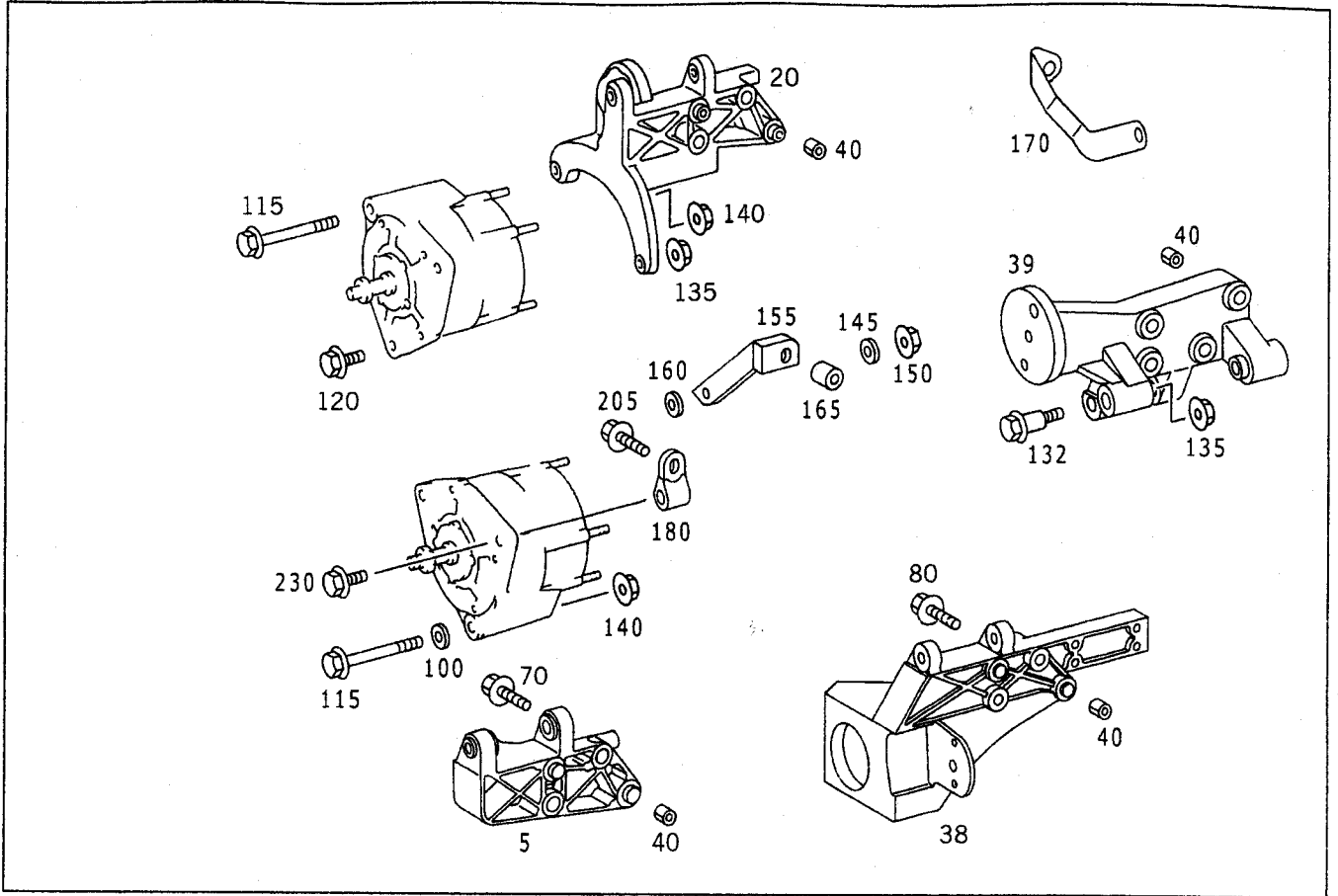




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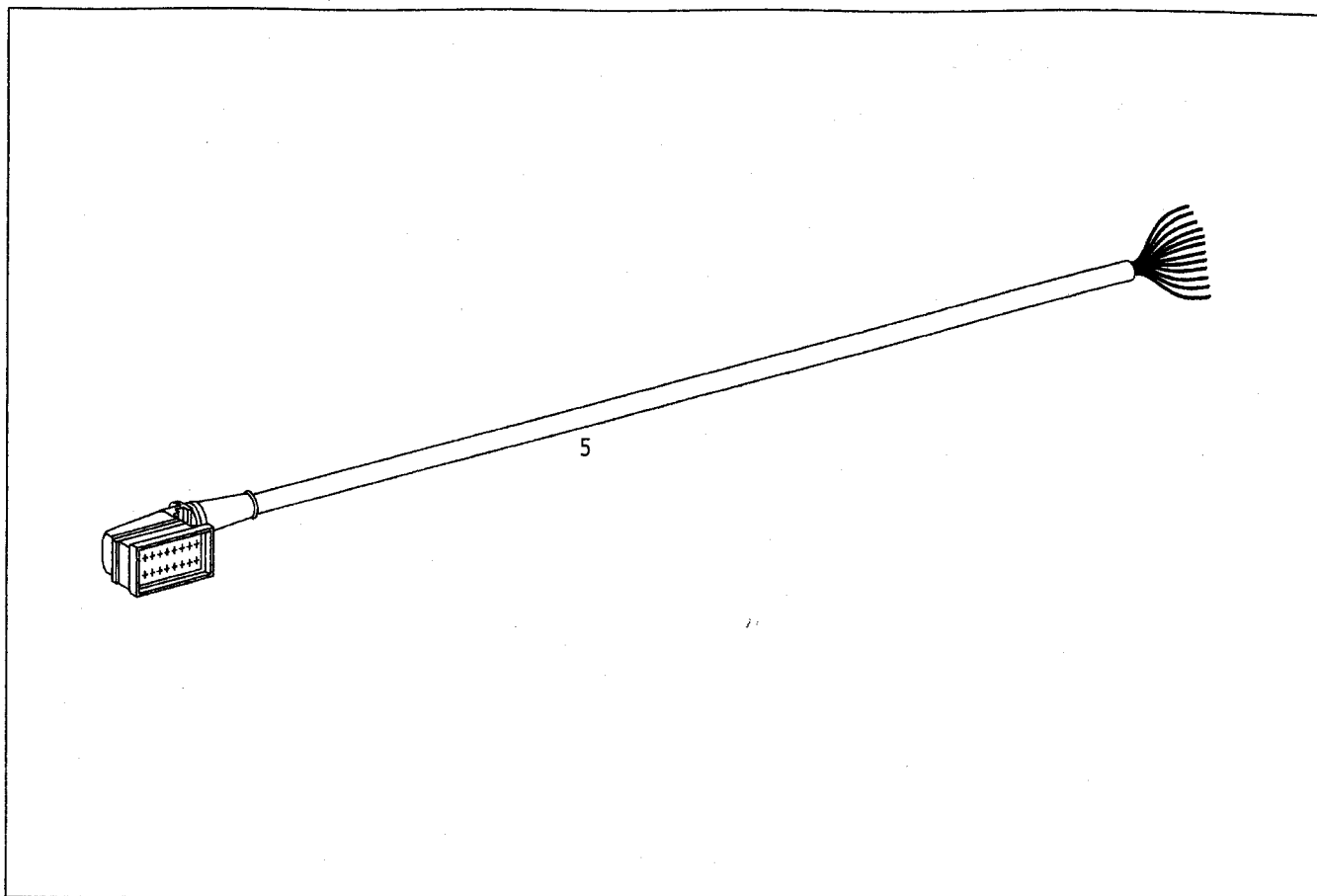






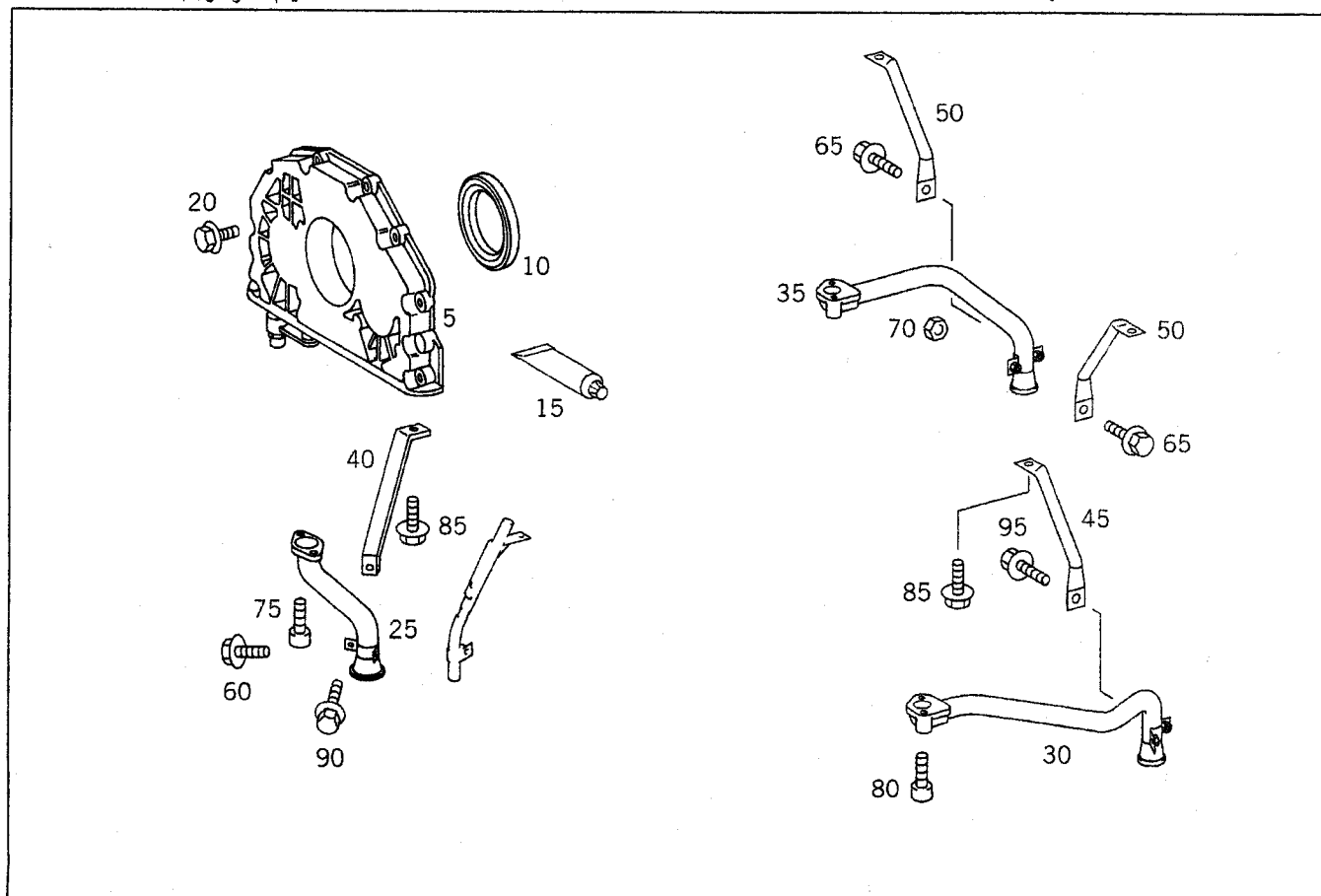
Elektrische Ausrüstung | Equipamento eléctrico
 Electrical Equipment | Equipo eléctrico
 Equipement électrique | элентрооборудование
 impianto elettrico | التجهيزات الكهربائية

Gruppe | Grupo
 Group | Grupo
 Groupe | группа
 Gruppo | المجموعة 15 150 00001



Motorschmierung | Lubrificação do motor
 Engine Lubrication | Lubricación del motor
 Graissage du moteur | смазка двигателя
 Lubrificazione motore | تشحيم الموتور

Gruppe | Grupo
 Group | Grupo
 Groupe | группа
 Gruppo | المجموعة 18 015 00165



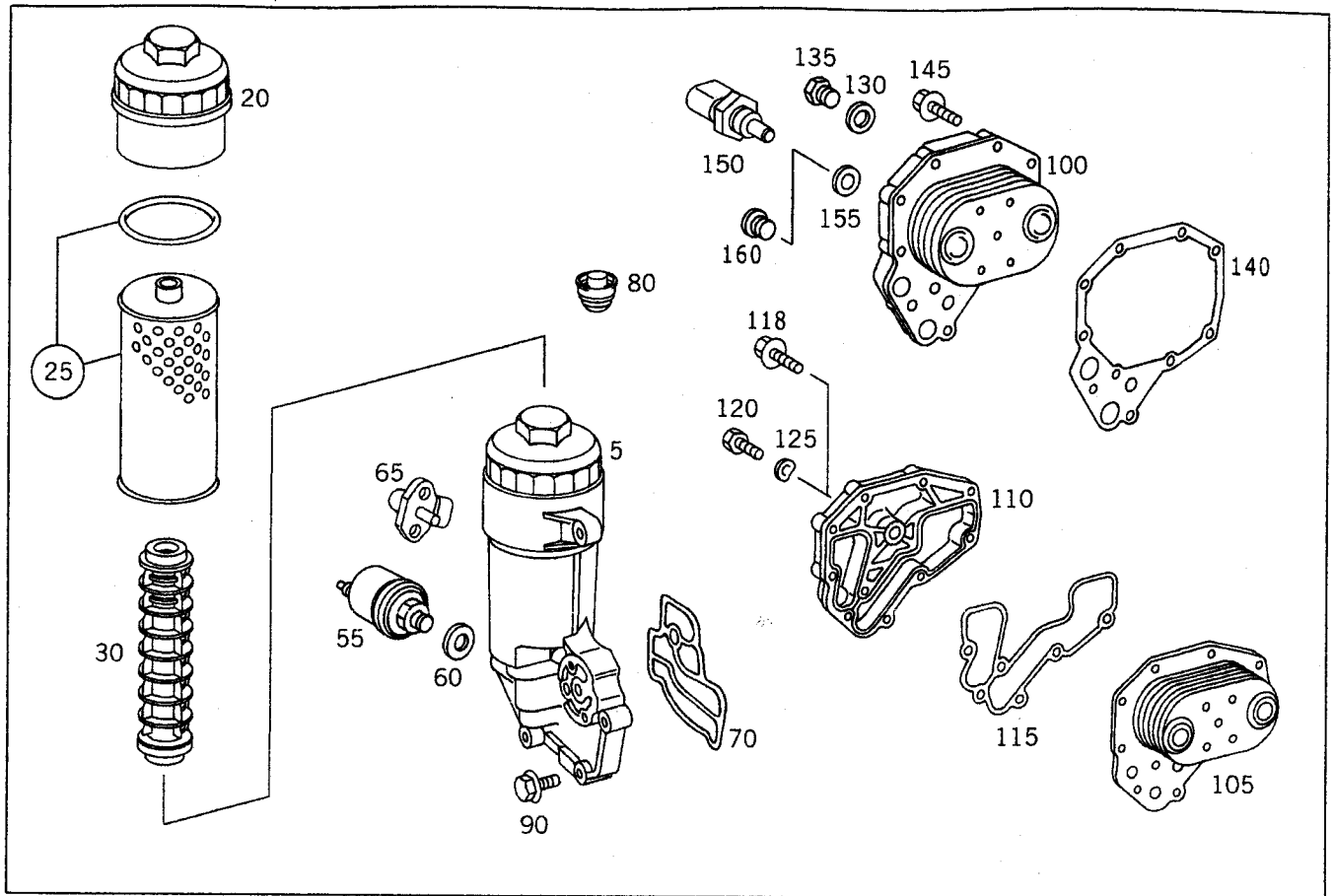
Motorschmierring
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

Lubrificação do motor
 Lubricación del motor
 смазна двигателя
 تشحيم موتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

18 045 00270



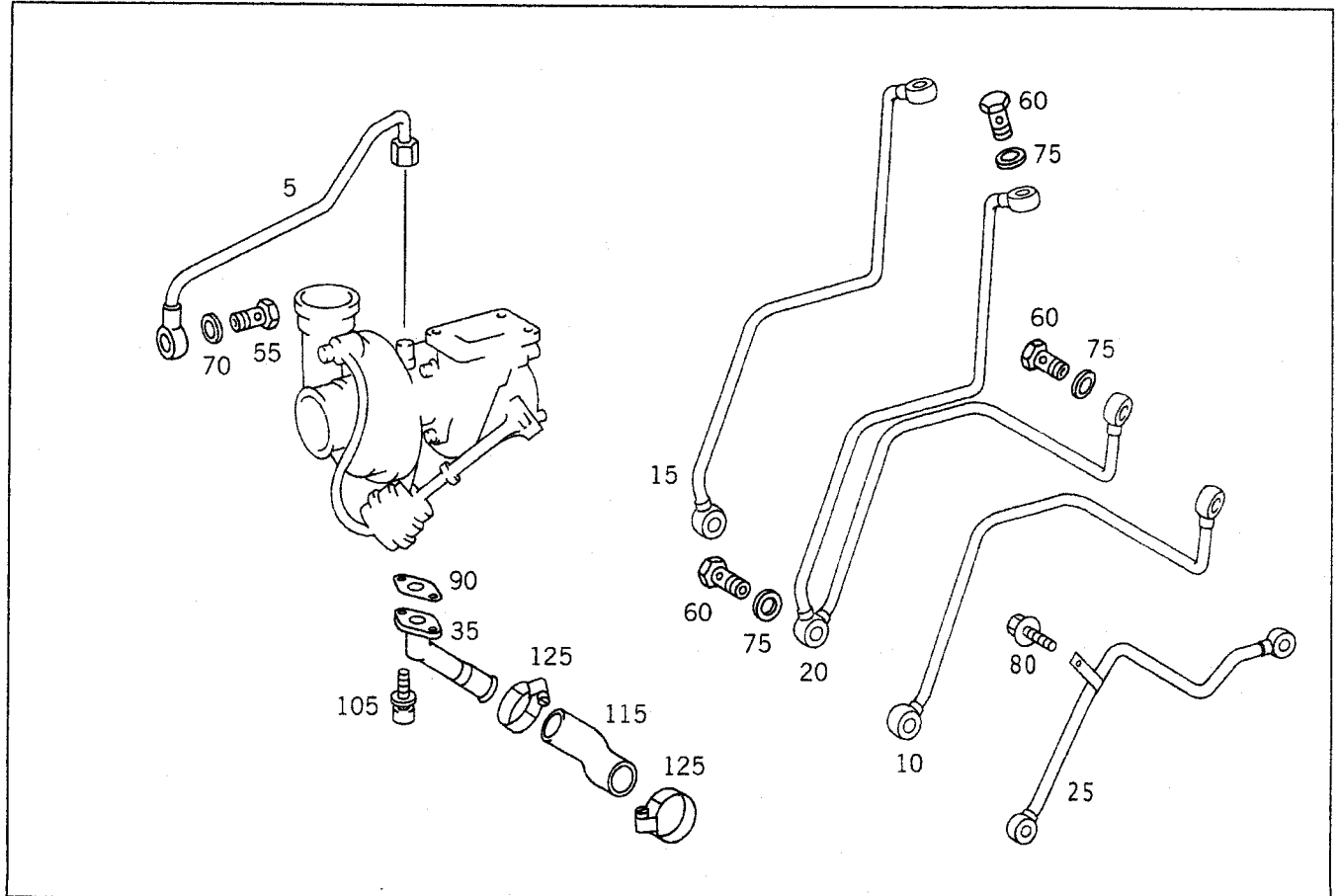
Motorschmierring
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

Lubrificação do motor
 Lubricación del motor
 смазна двигателя
 تشحيم موتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

18 060 00142

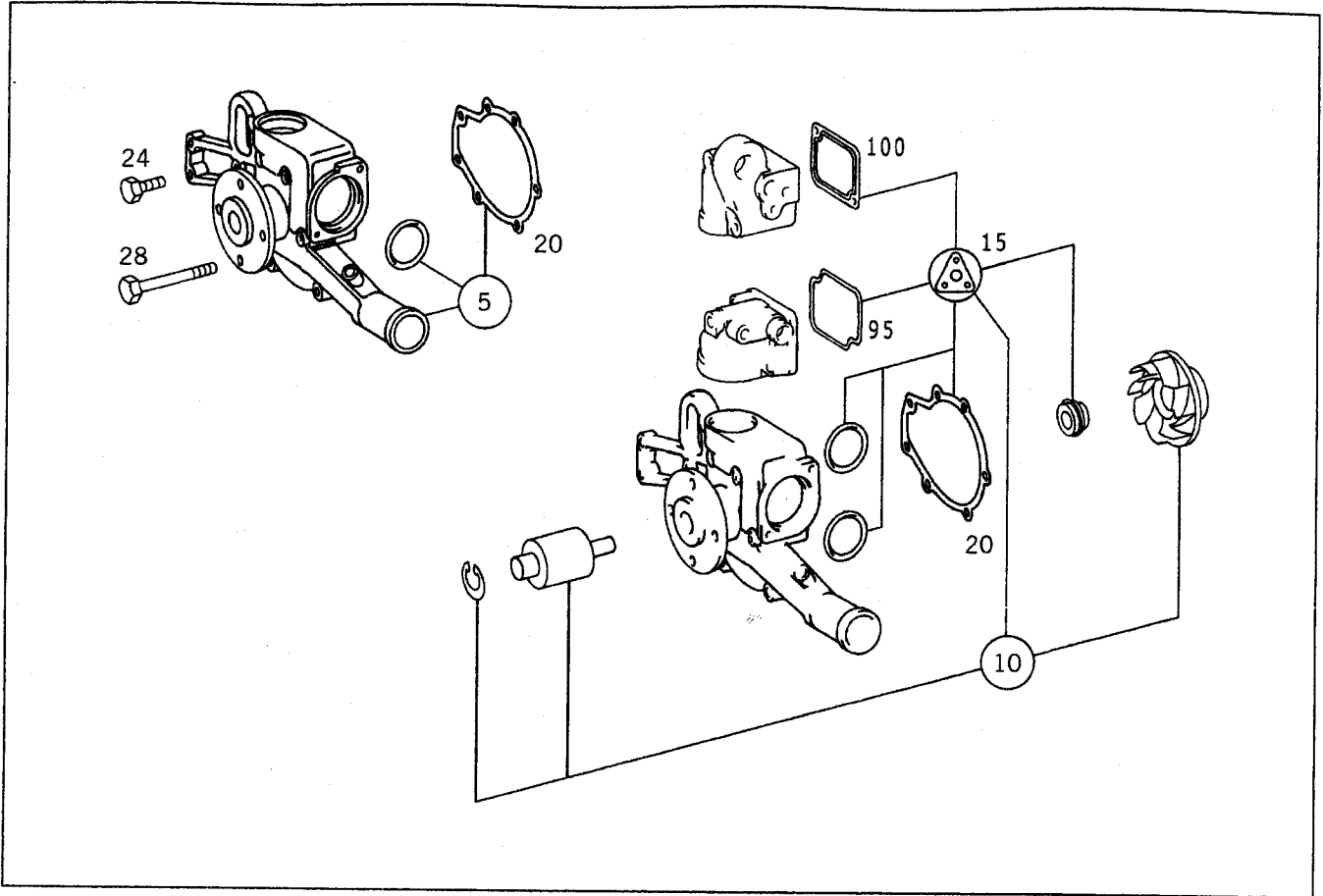


Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeración do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

Gruppe
 Group
 Grupo
 Grupa
 المجموعة

20 015 00347



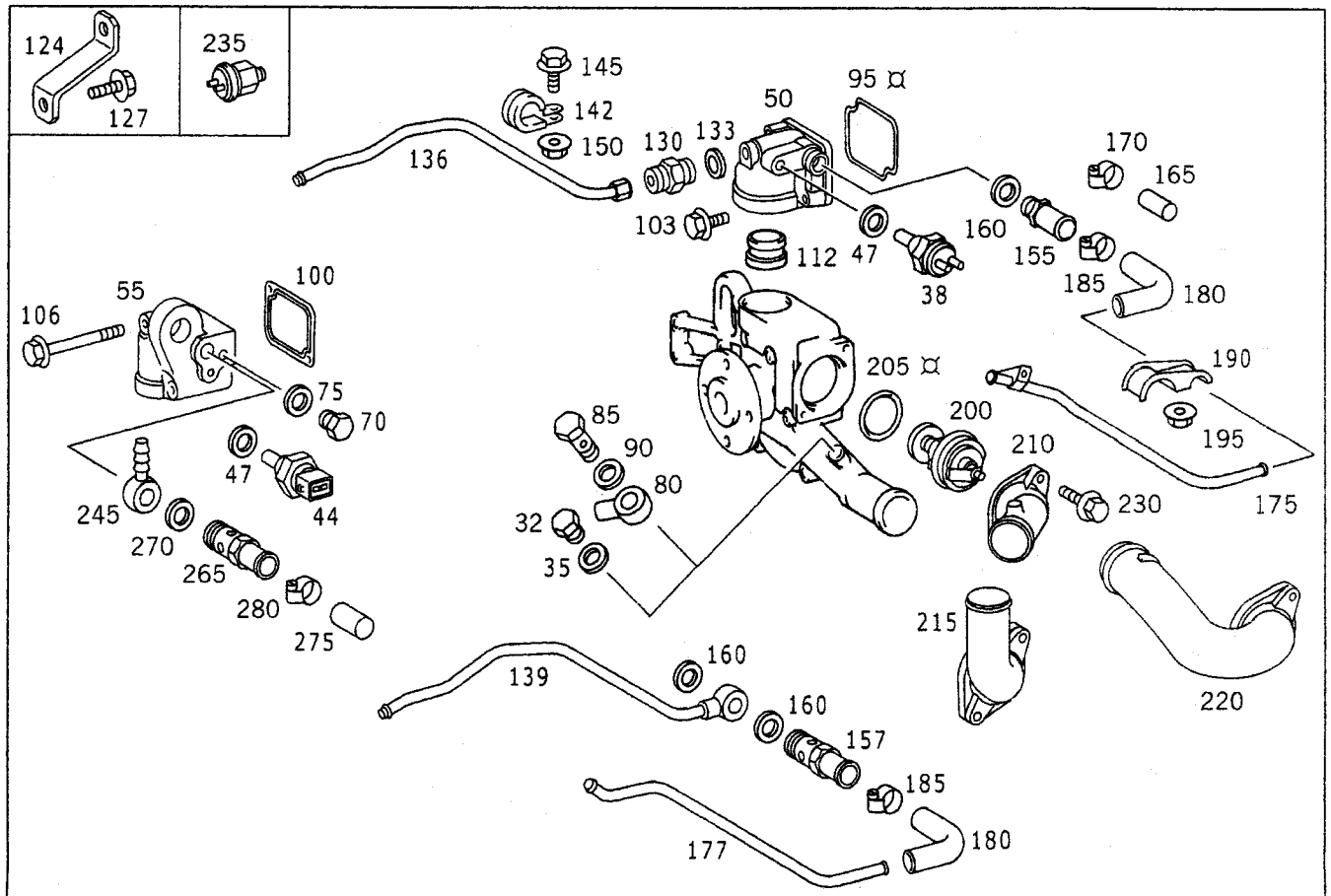
64

Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeración do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

Gruppe
 Group
 Grupo
 Grupa
 المجموعة

20 015 00294

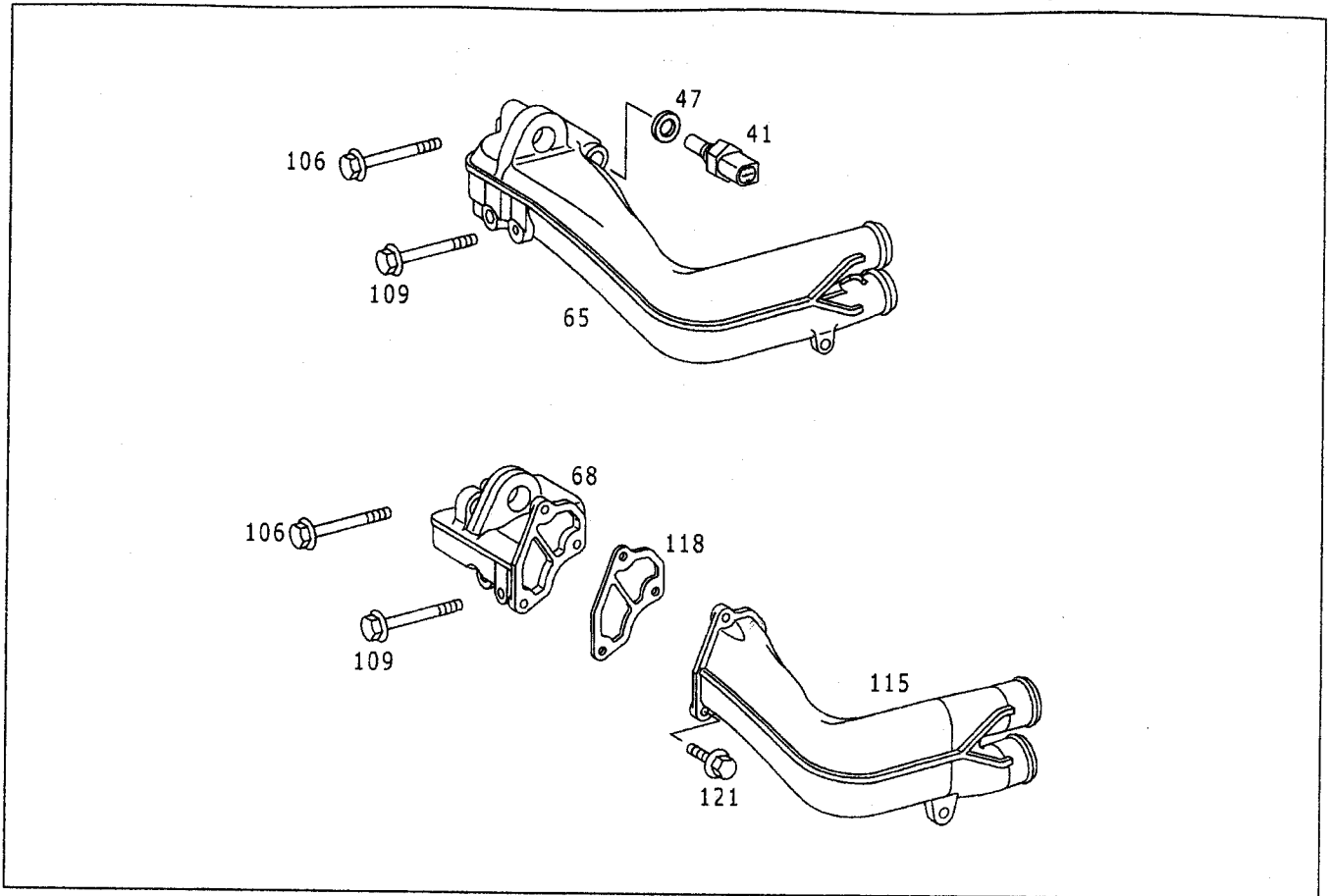


Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeração do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

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

20 015 00399

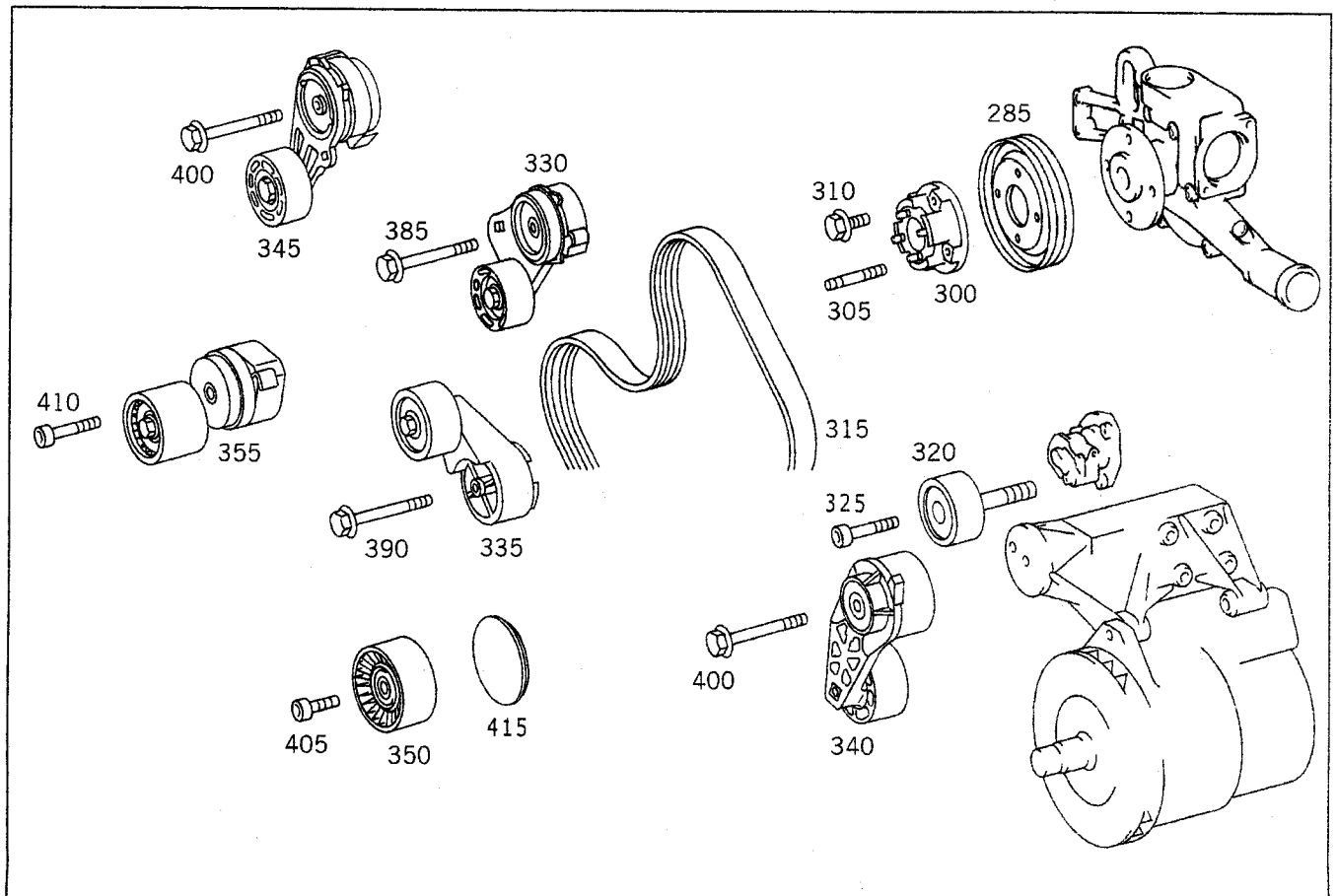


Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeração do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

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

20 015 00366



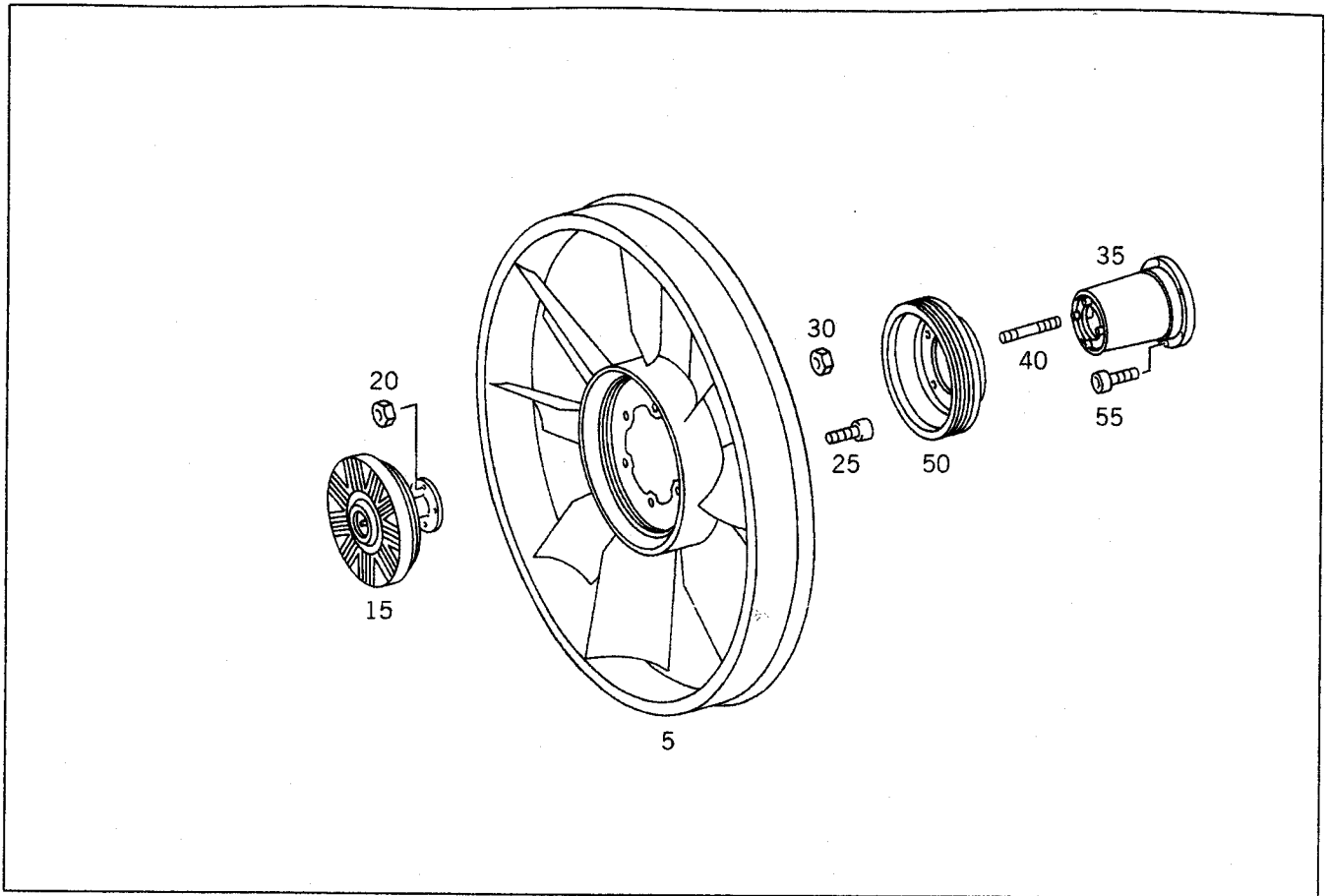
Motorkühlung
Engine Cooling System
Refrondissement du moteur
Raffreddamento motore

Refrigeração do motor
Refrigeración del motor
охлаждение двигателя
تبريد الموتور

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
المجموعة

20 030 00125



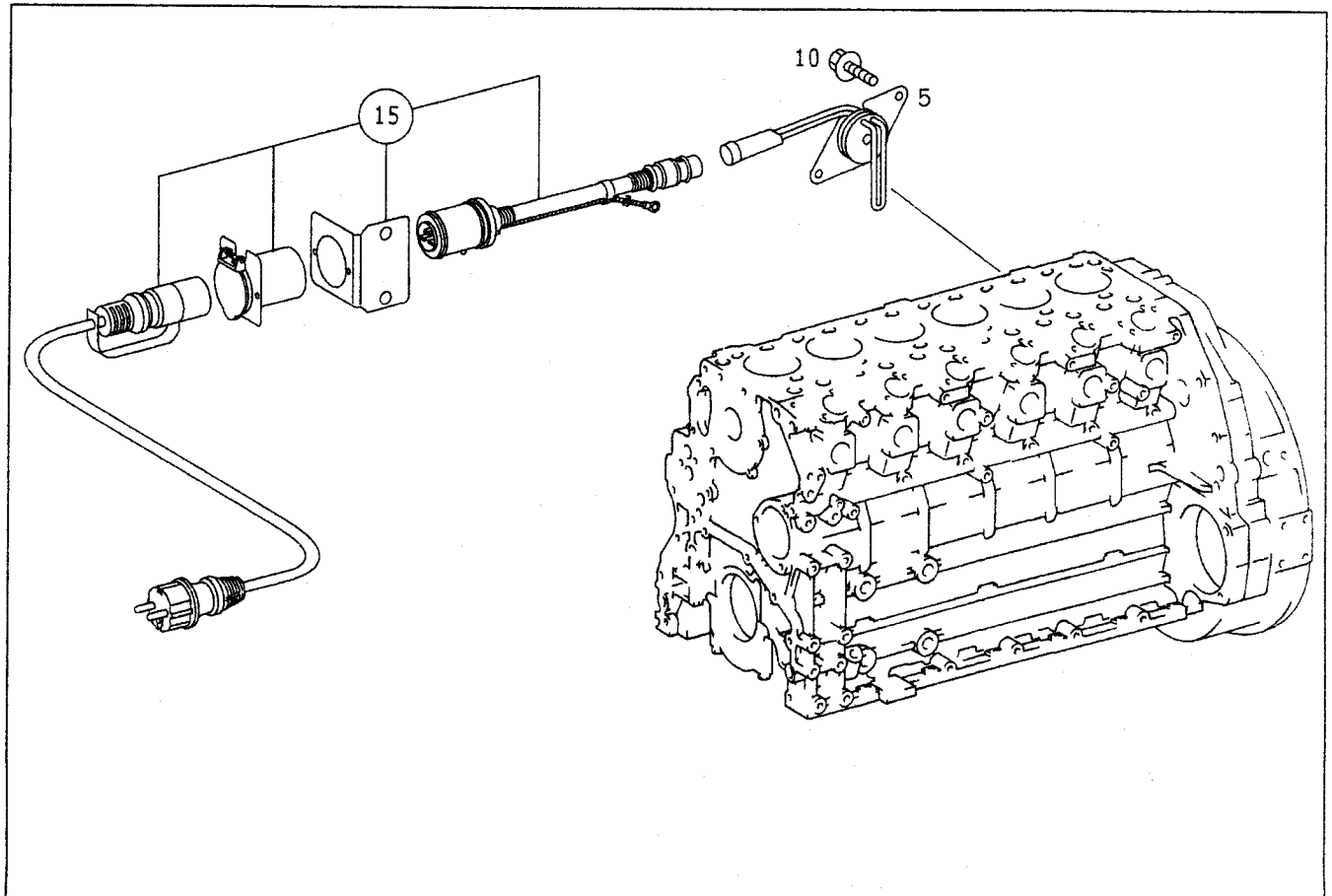
Motorkühlung
Engine Cooling System
Refrondissement du moteur
Raffreddamento motore

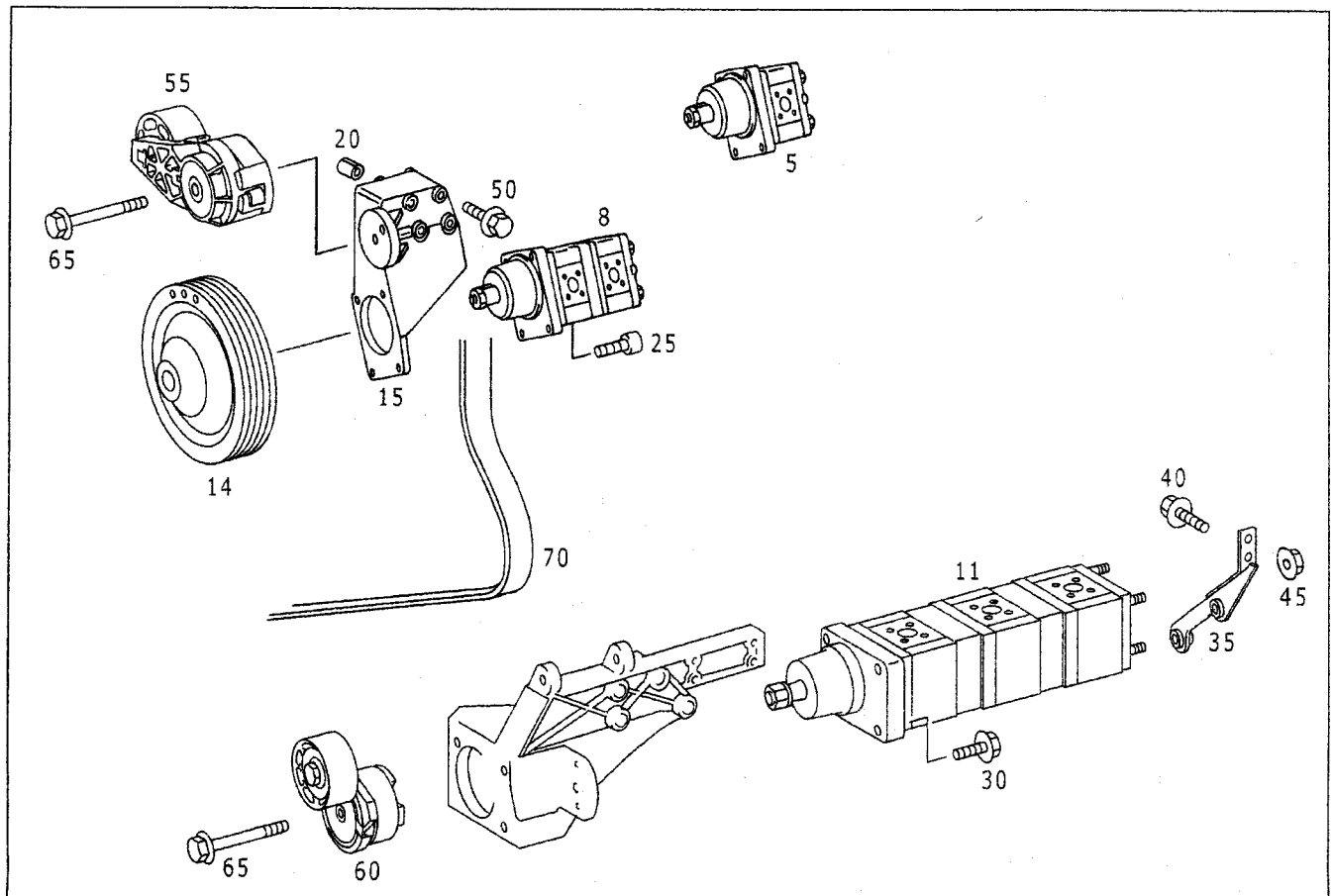
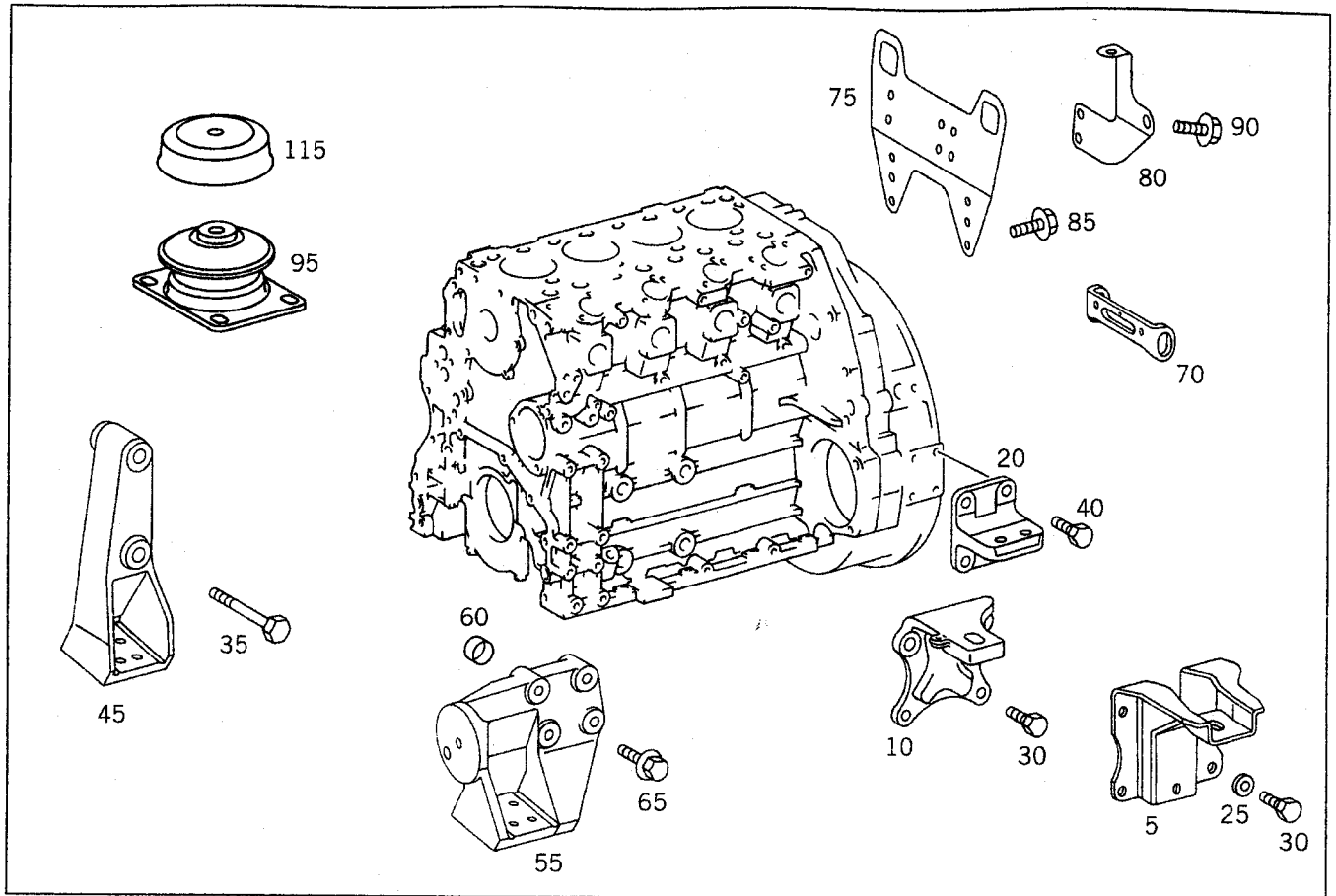
Refrigeração do motor
Refrigeración del motor
охлаждение двигателя
تبريد الموتور

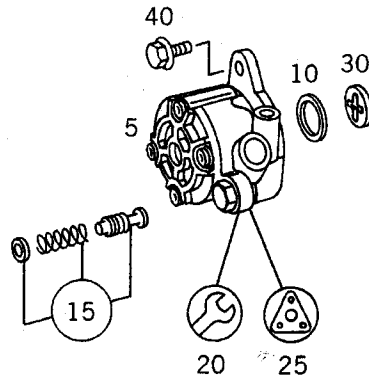
Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
المجموعة

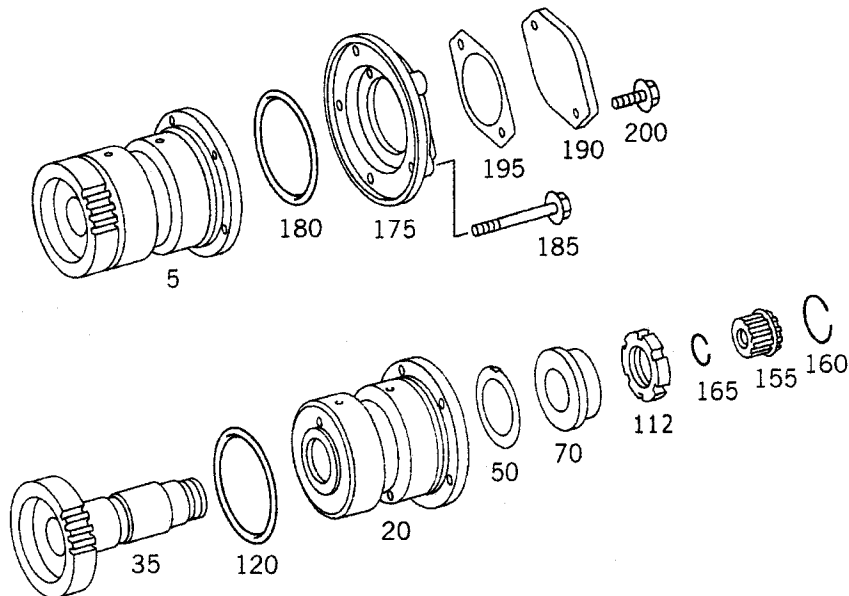
20 100 00007







70



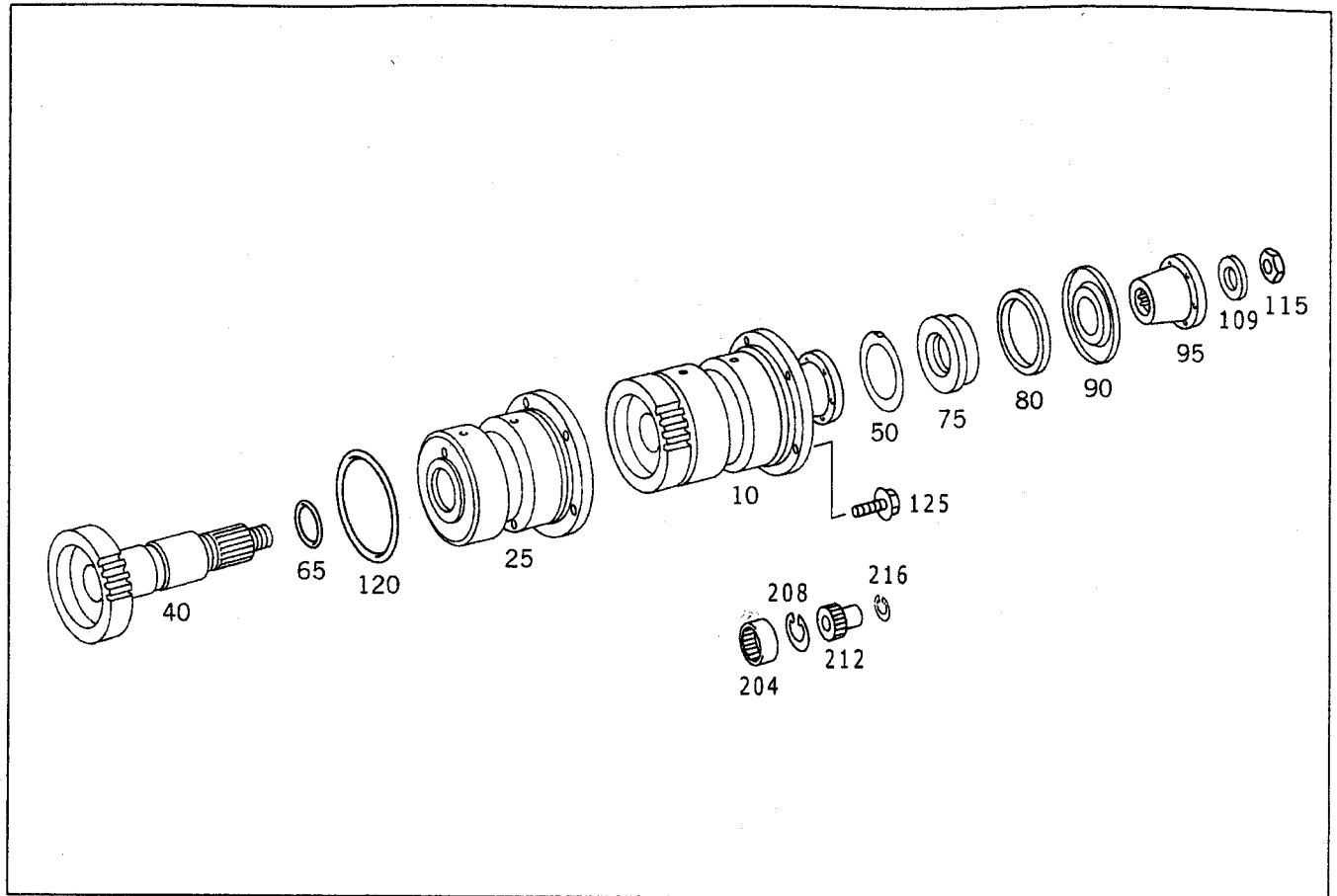
Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presă de forță

Tomada de forță
Toma de fuerza
отбор мощности
التشغيل الأضافي أو الاحتياطي

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

23 045 00031



74

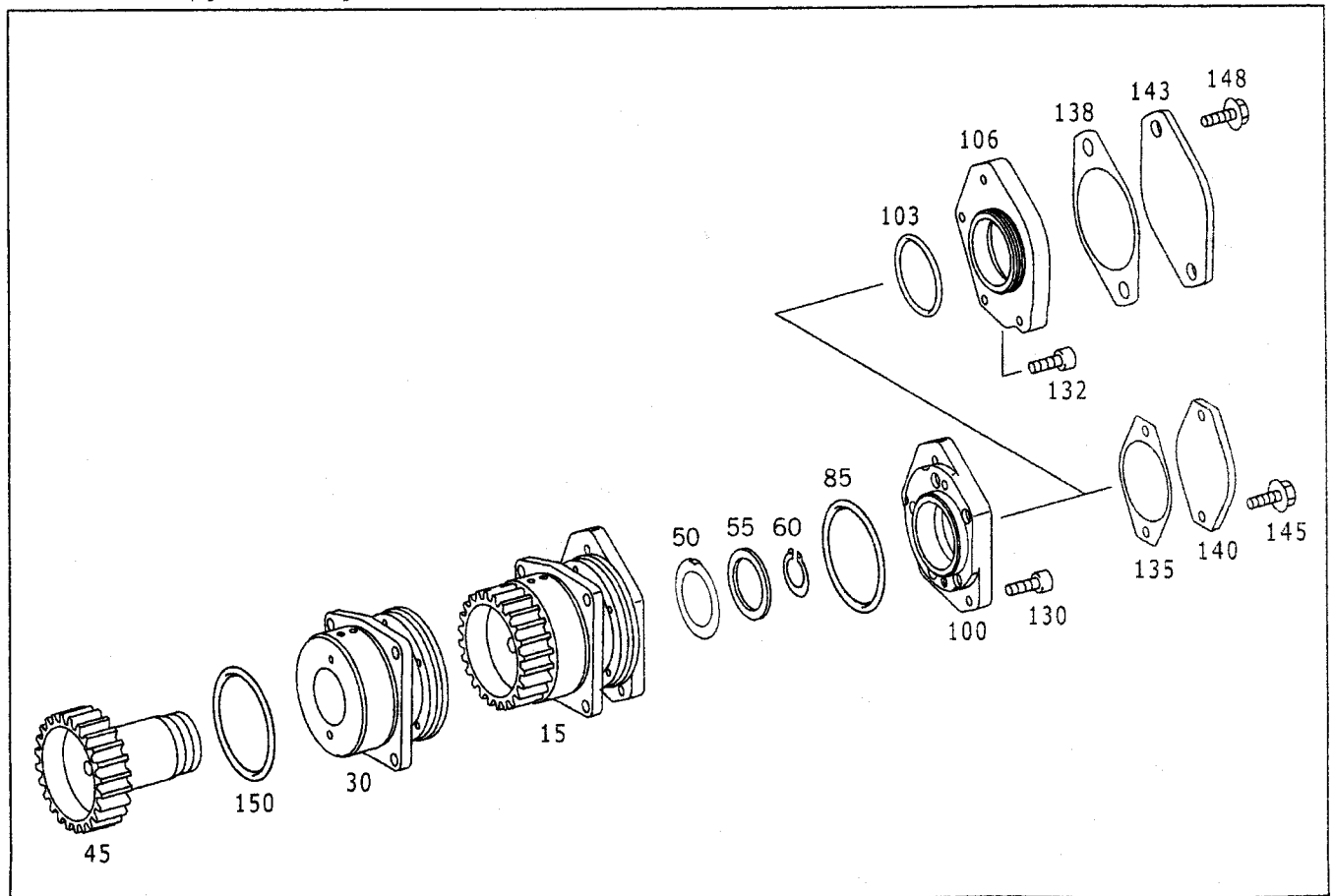
Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presă de forță

Tomada de forță
Toma de fuerza
отбор мощности
التشغيل الأضافي أو الاحتياطي

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

23 045 00032



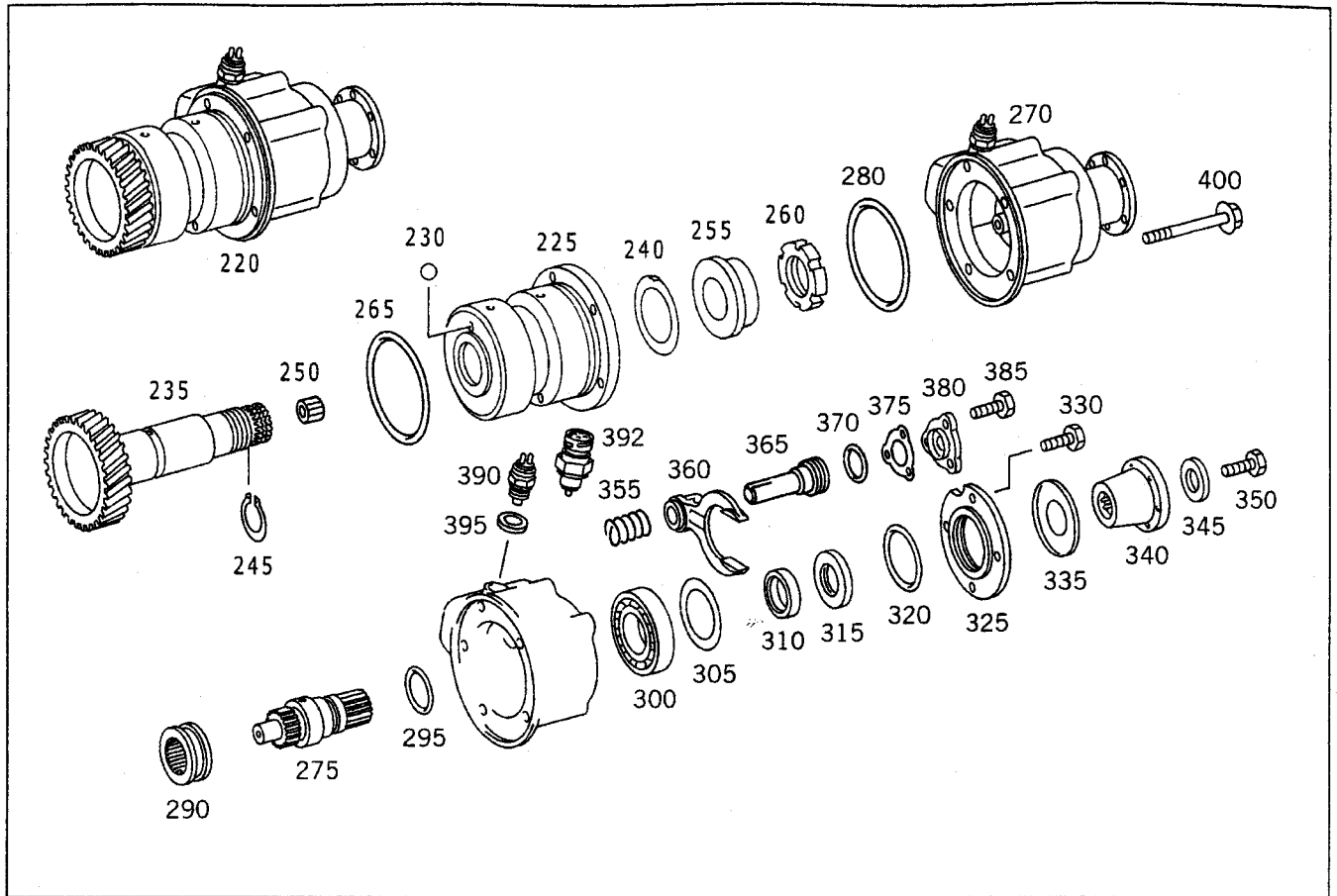
Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presă di forza

Tomada de forța
Toma de fuerza
отбор мощности
التشغيل الأماقي أو الأحياطي

Gruppe
Group
Group
Gruppo

Grupo
Grupa
المجموعة

23 045 00035



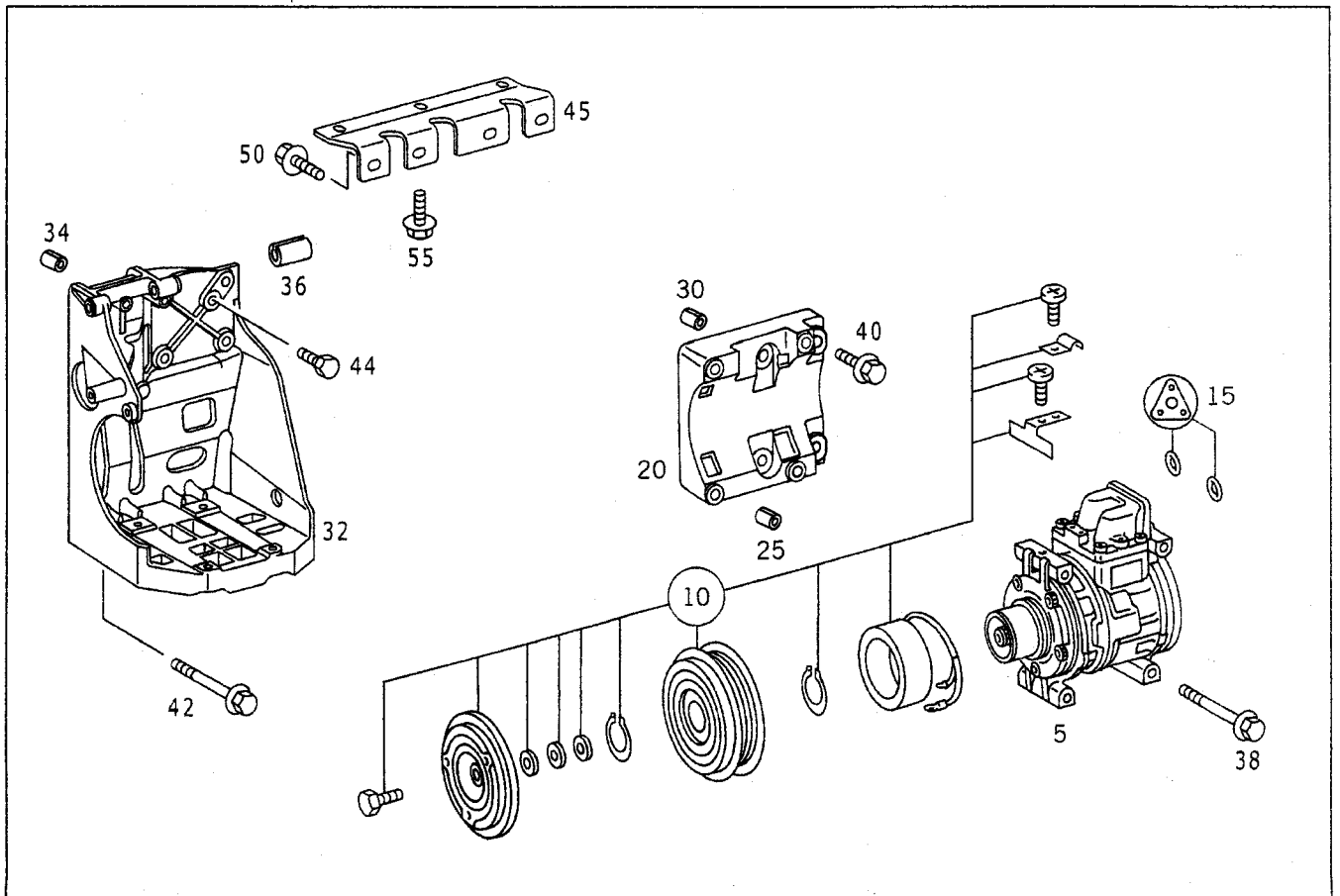
Kältekompressor
Refrigerant Compressor
Compresseur pour installation d'air
conditionné
Compressore impianto refrigeratore

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

Gruppe
Group
Group
Gruppo

Grupo
Grupa
المجموعة

23 075 00010

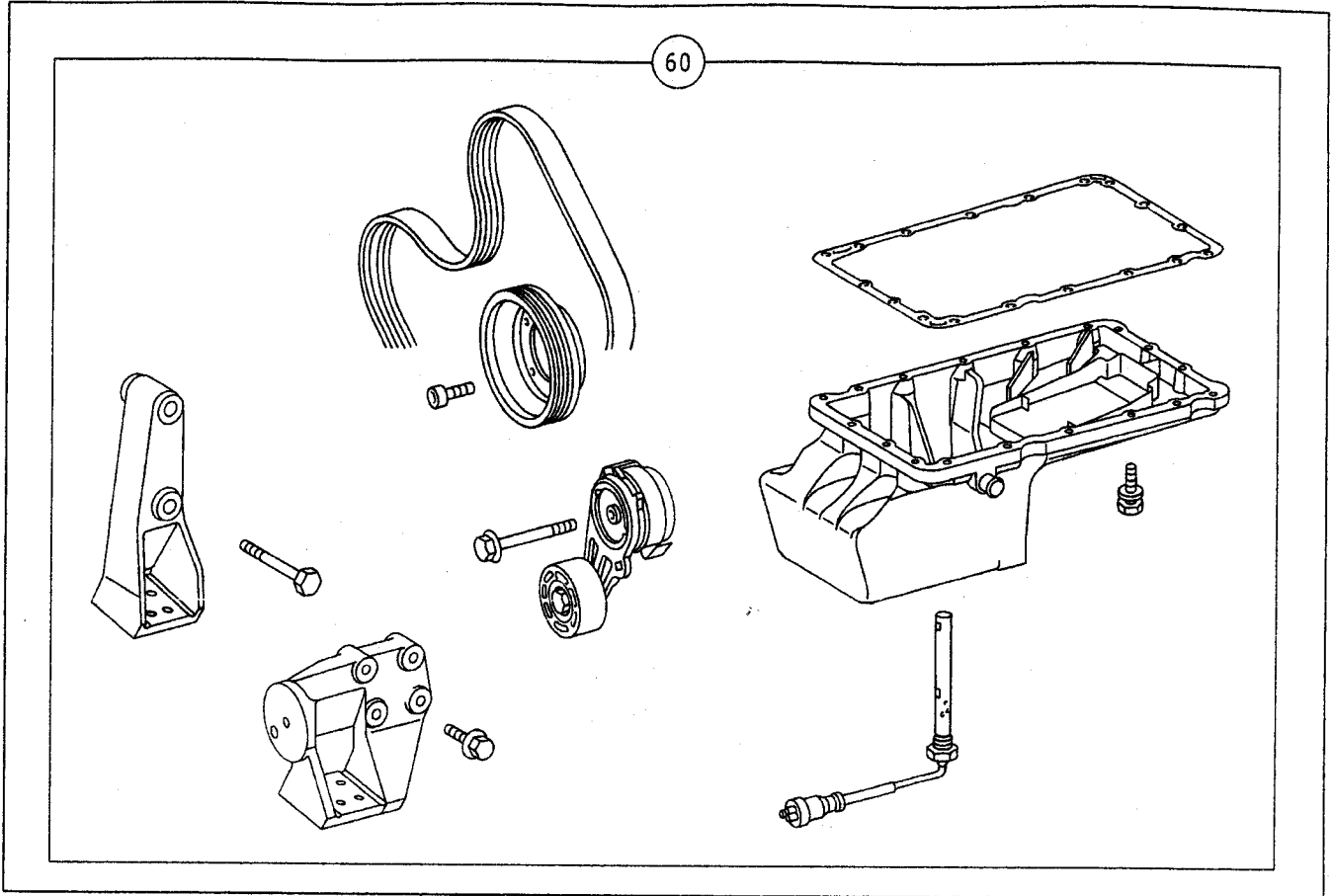


Kältekompressor
 Refrigerant Compressor
 Compresseur pour installation d'air
 conditionné
 Compressore impianto refrigeratore

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

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

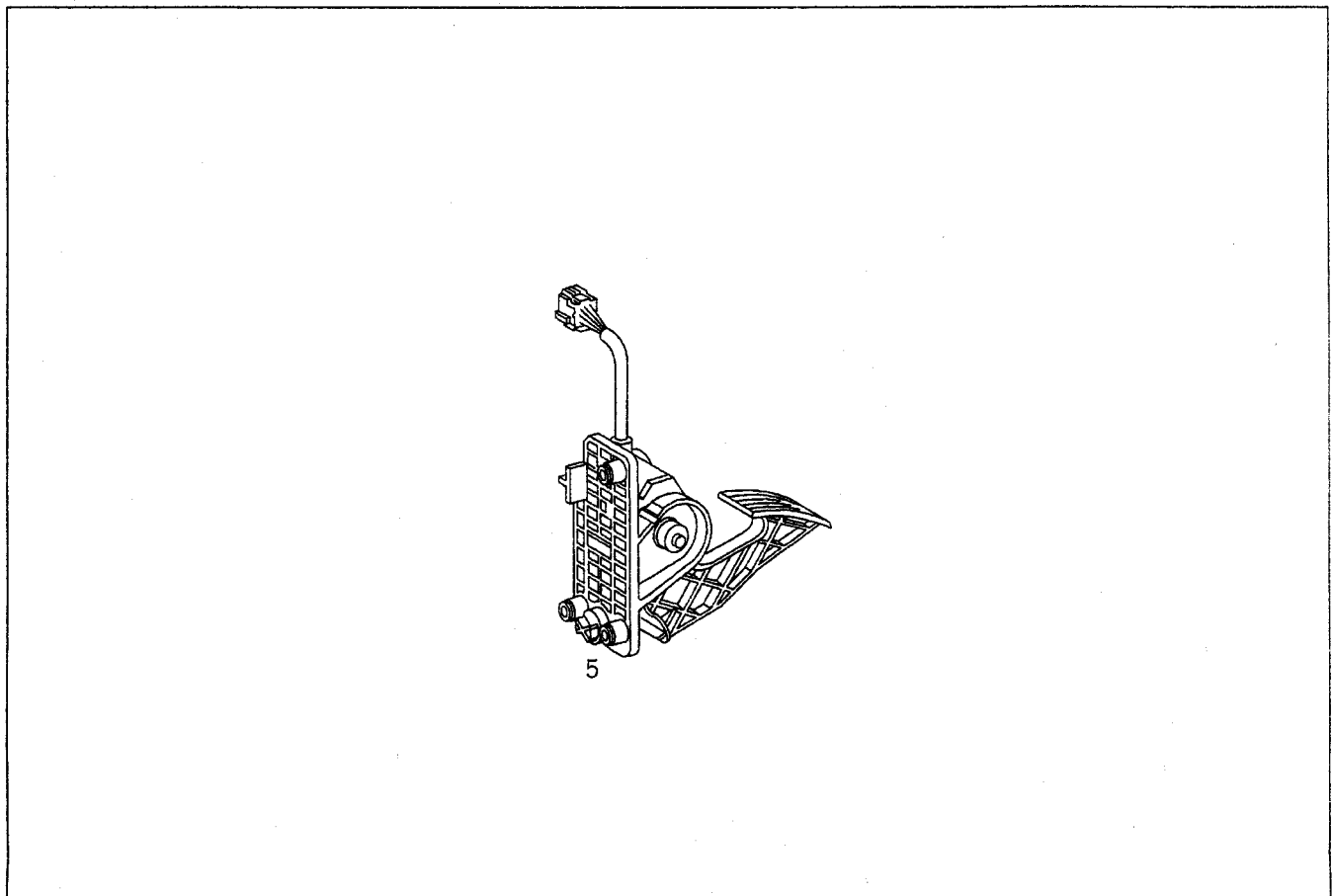
23 075 00018



Sonderausführungen | Versões especiais
 Special Versions | Ejecuciones especiales
 Versions spéciales | специальная комплектация
 Versioni speciali | أطرارات أو الأجزاء الخاصة

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

23 100 00001



Motor / Engine / Moteur	Baumuster/Model/Modèle	Katalog
	906.900, 901, 903, 910, 911, 915, 916, 919-923, 925-928, 930, 931, 935, 937-941, 949-952, 954-956, 960-965 909.900, 901, 910, 911, 920, 921, 960, 970, 971 926.911, 912, 914	06V

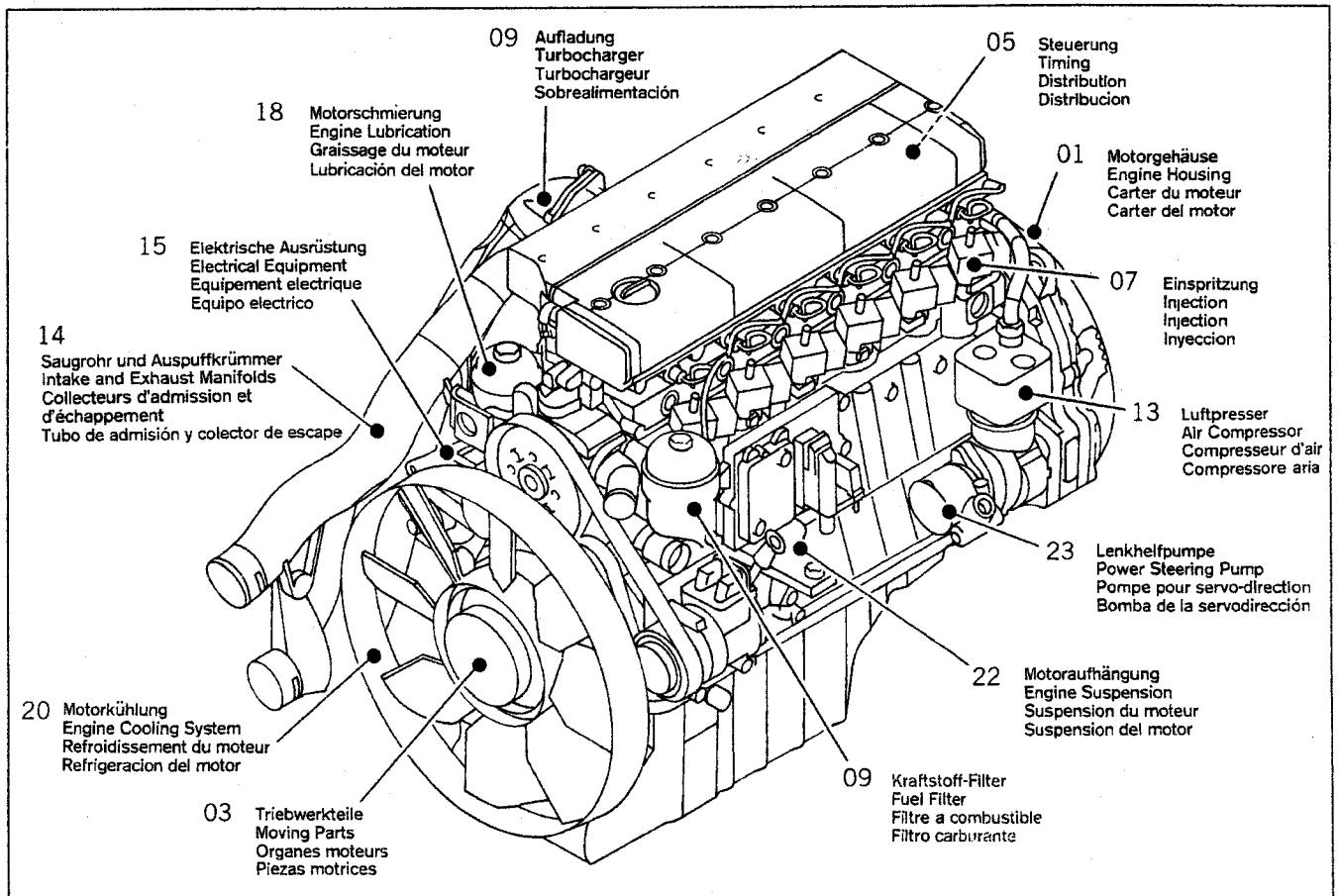
Motorgehäuse
Engine Housing
Carter du moteur
Basamento motore

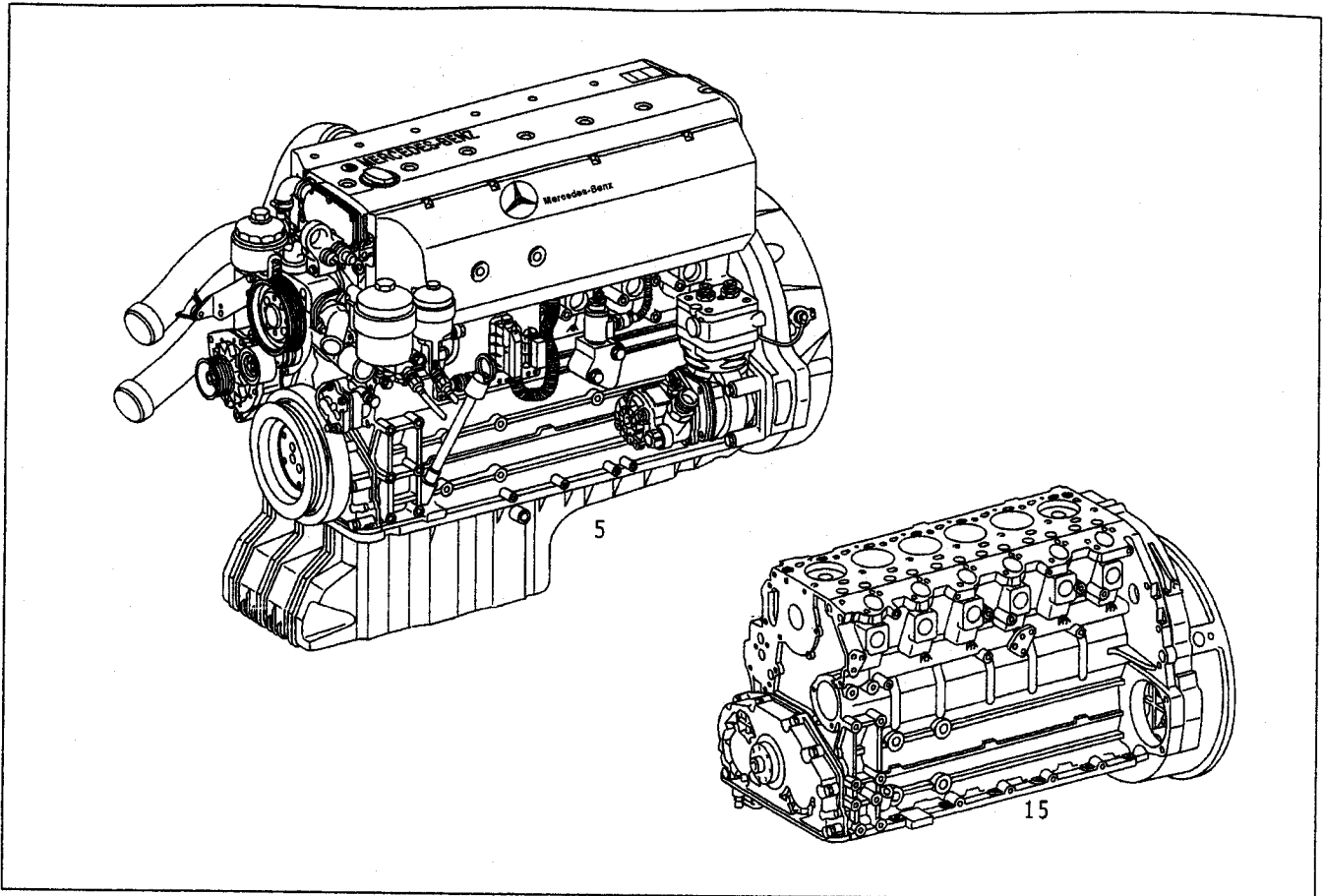
Carter do motor
Carter del motor
картер двигателя
هسكل المويور

Gruppe
Group
Groupe
Gruppo

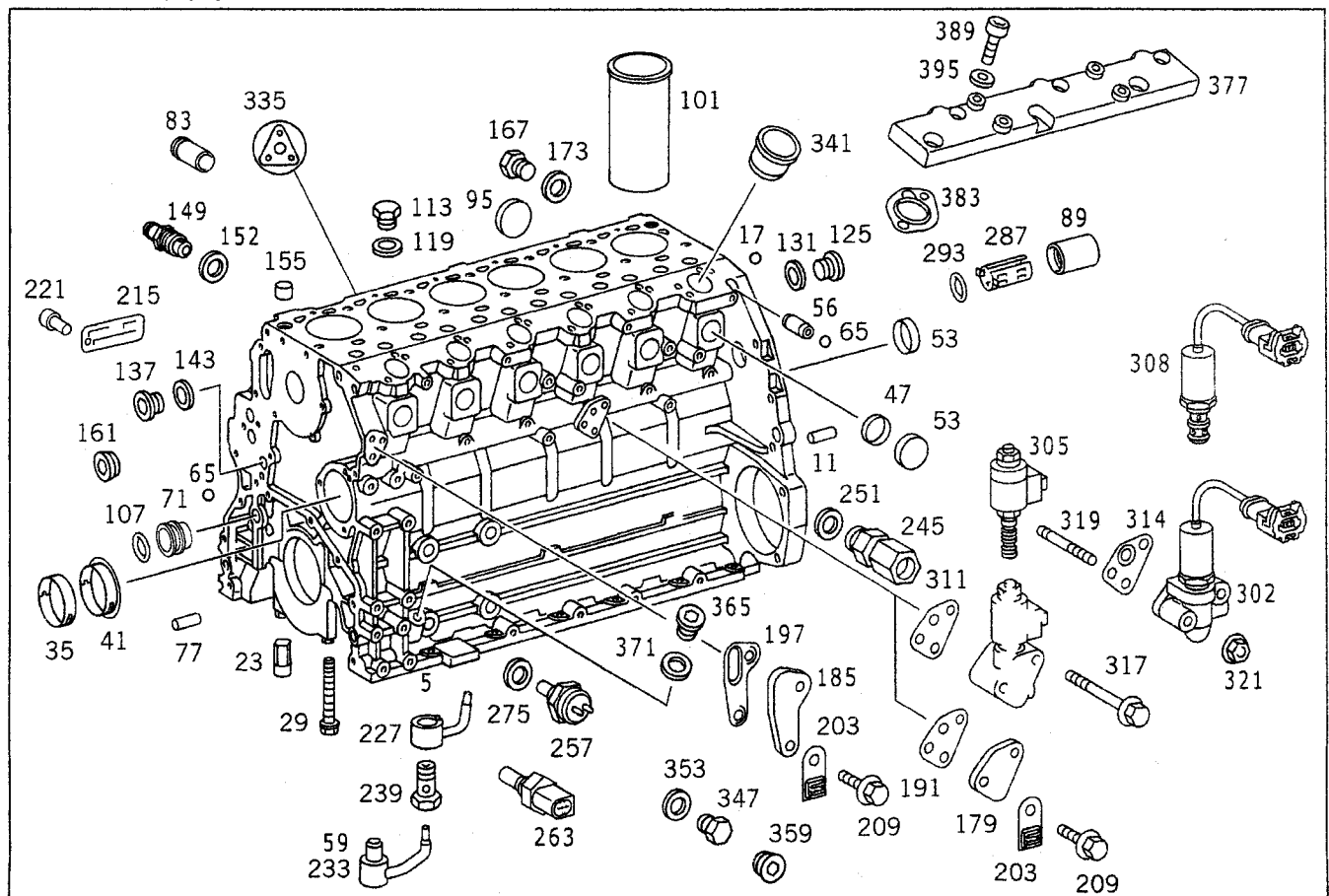
Grupo
Gruppo
группа
المجموعة

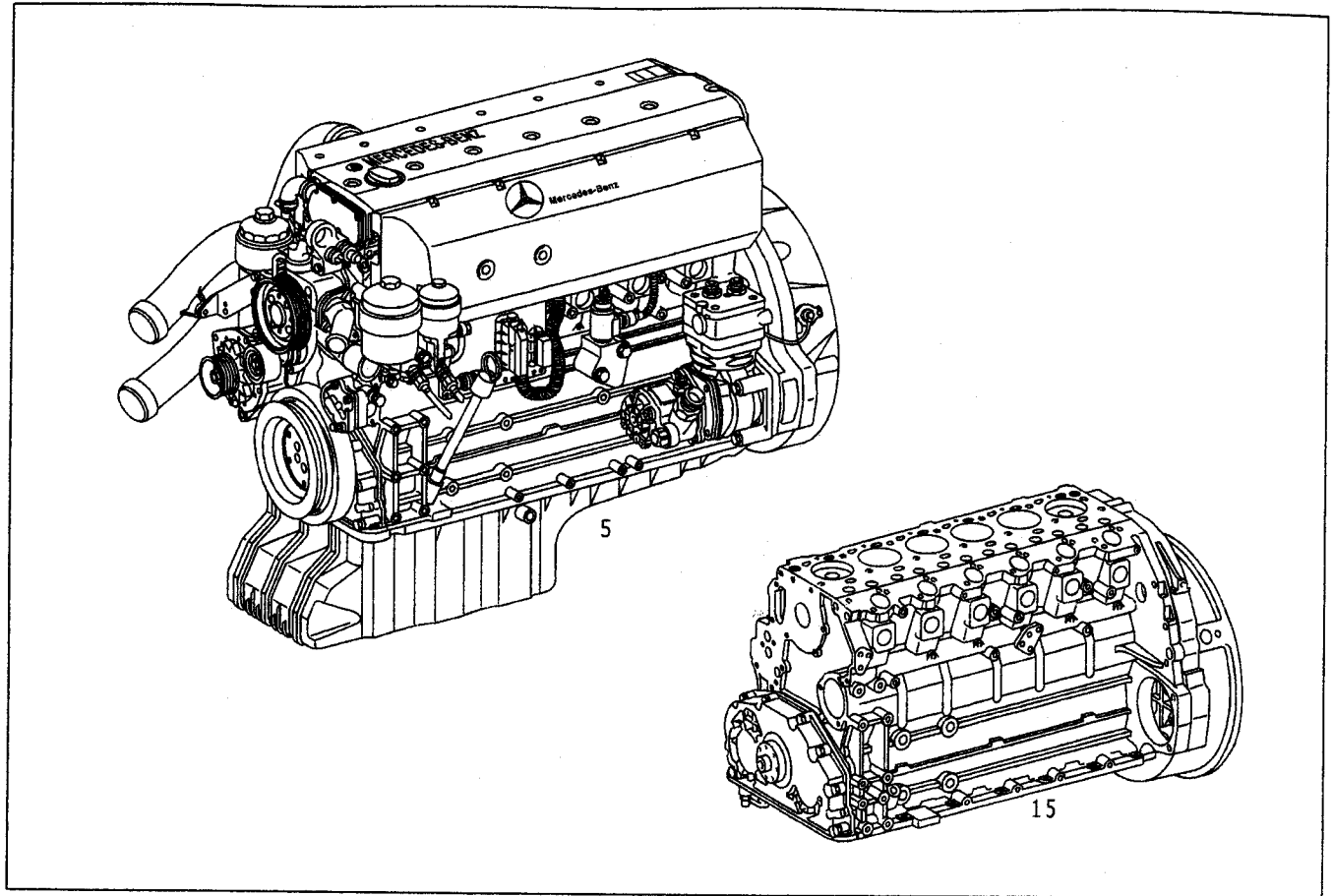
01 005 00039



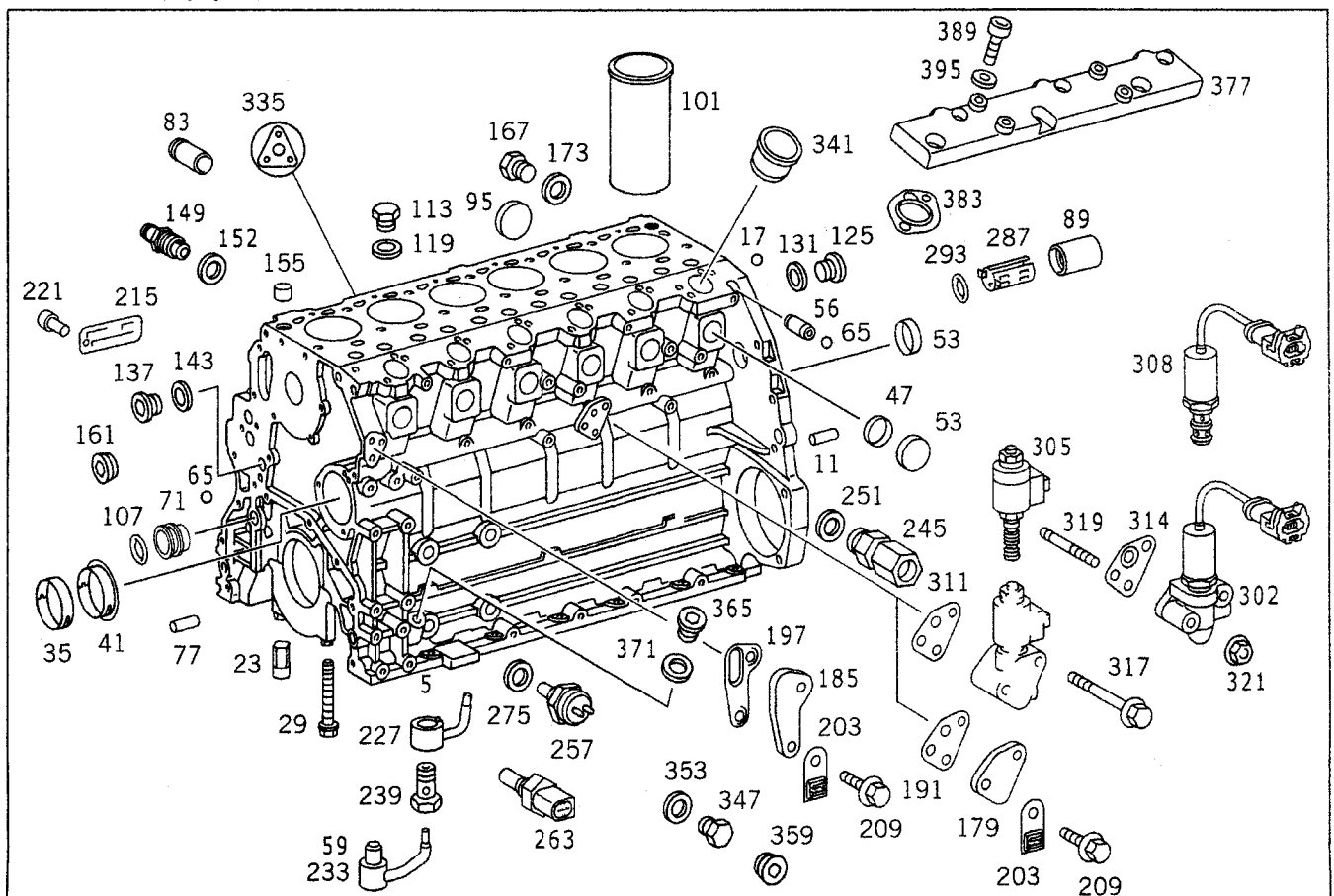


84





84

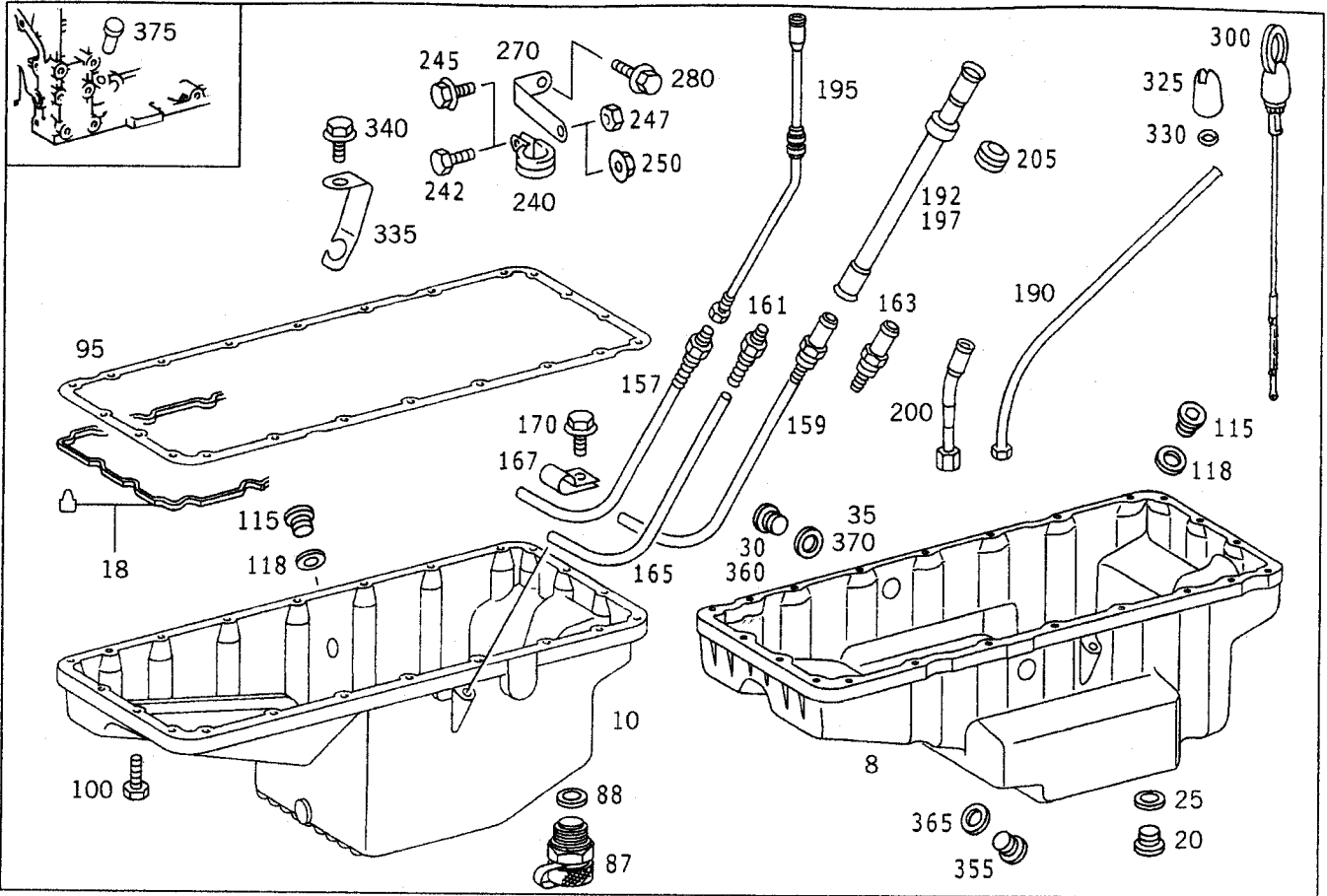


Motorgehäuse
Engine Housing
Carter du moteur
Basamento motore

Carter do motor
Cárter del motor
картер двигателя
هيكل الموتور

Gruppe
Group
Gruppo
Groupo
المجموعة

01 060 00177

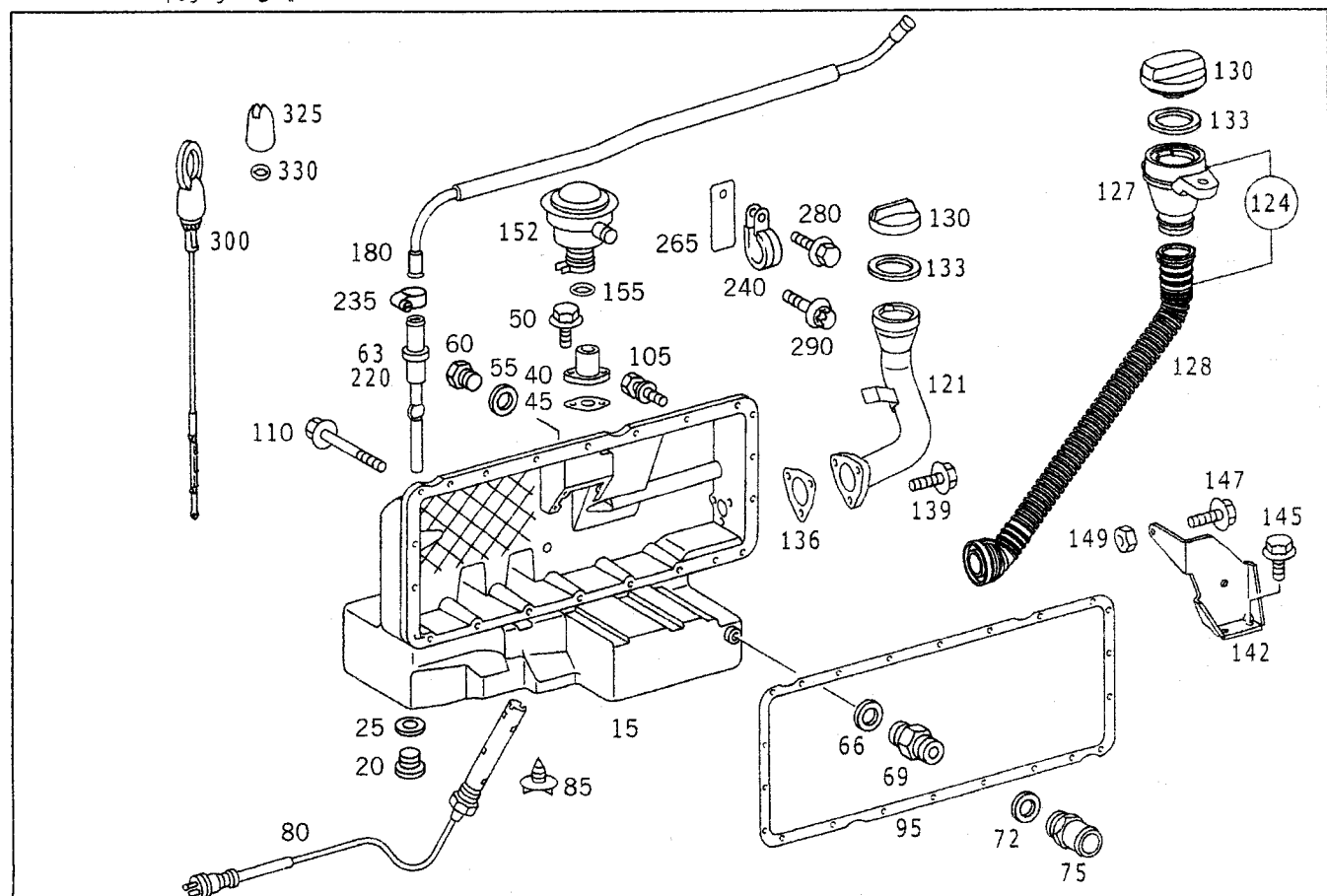


Motorgehäuse
Engine Housing
Carter du moteur
Basamento motore

Carter do motor
Cárter del motor
картер двигателя
هيكل الموتور

Gruppe
Group
Gruppo
Groupo
المجموعة

01 060 00157



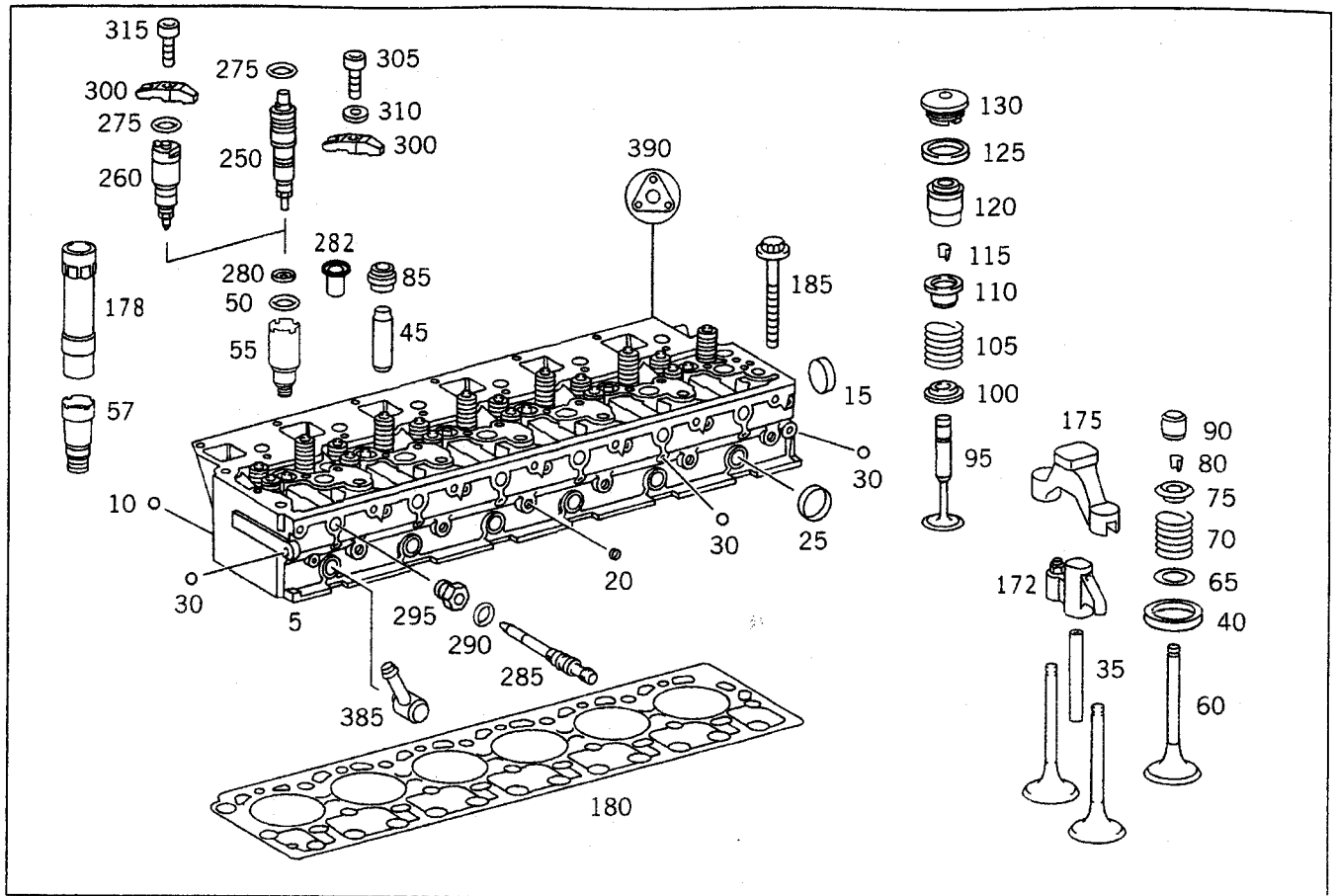
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головка блока цилиндров
راس السندبر

Gruppe
Group
Groupe
Gruppo

01 075 00228

Grupo
Grupo
группа
المجموعة



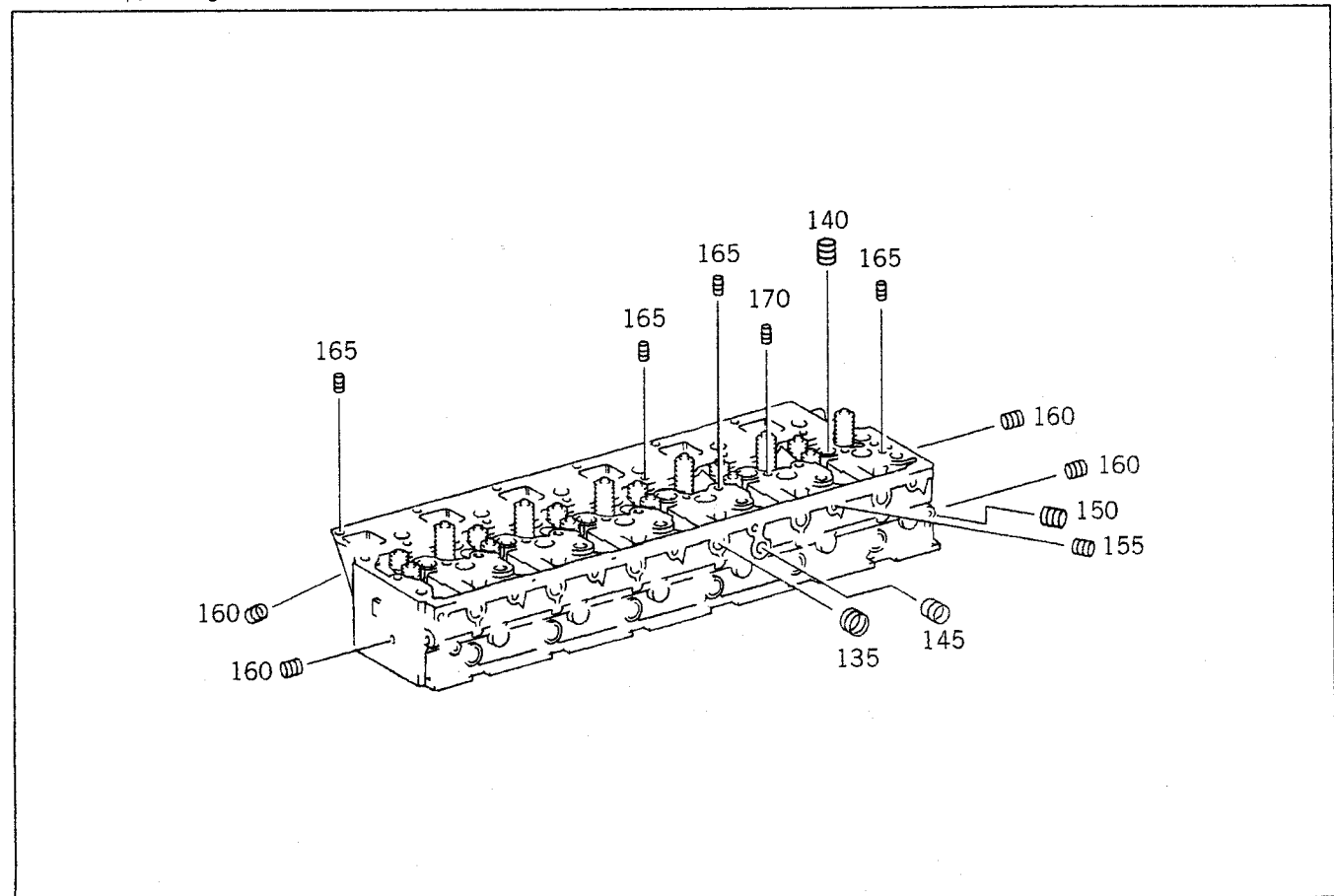
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головка блока цилиндров
راس السندبر

Gruppe
Group
Groupe
Gruppo

01 075 00291

Grupo
Grupo
группа
المجموعة



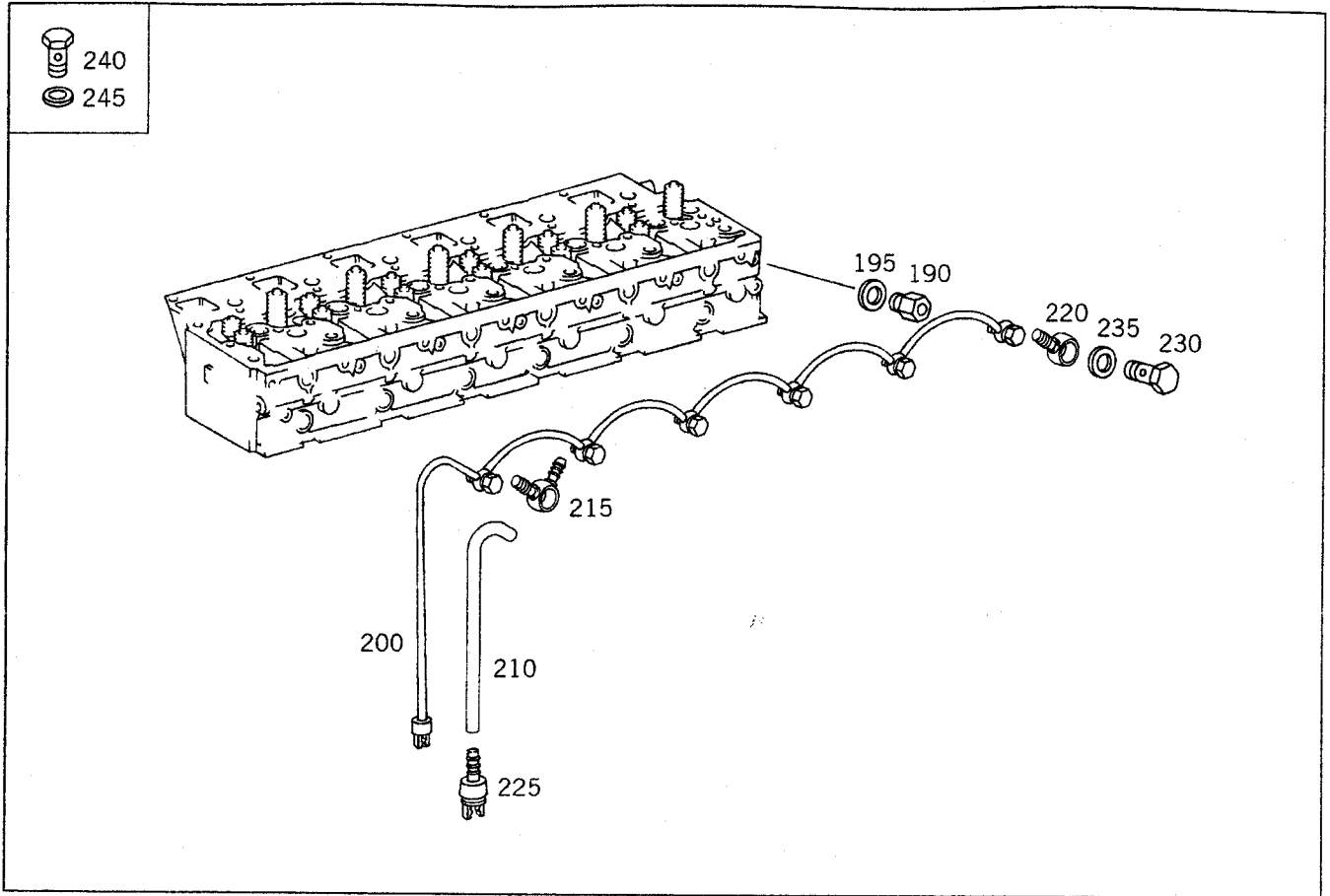
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блоча цилиндров
رأس السلندر

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

01 075 00229



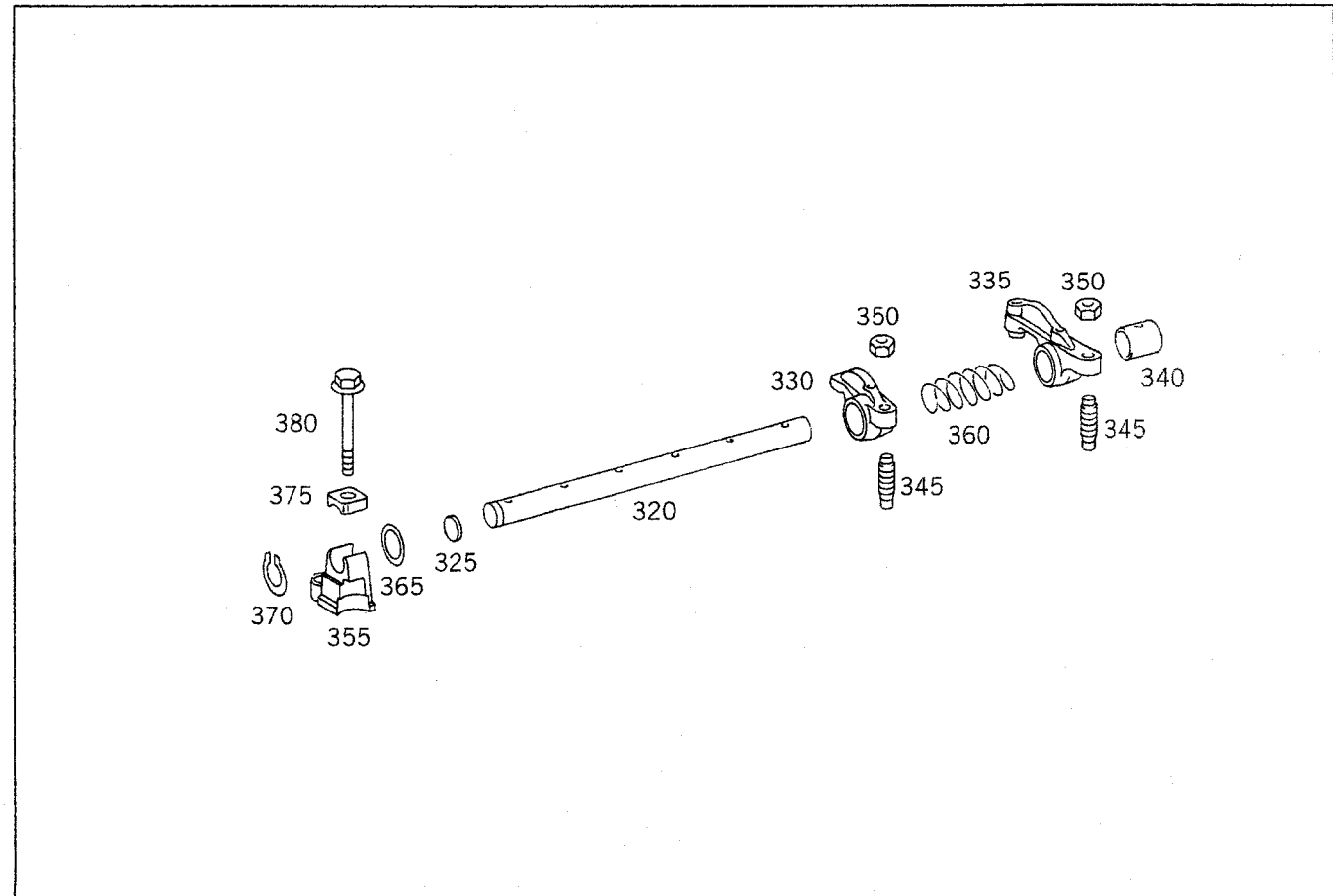
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блоча цилиндров
رأس السلندر

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

01 075 00230



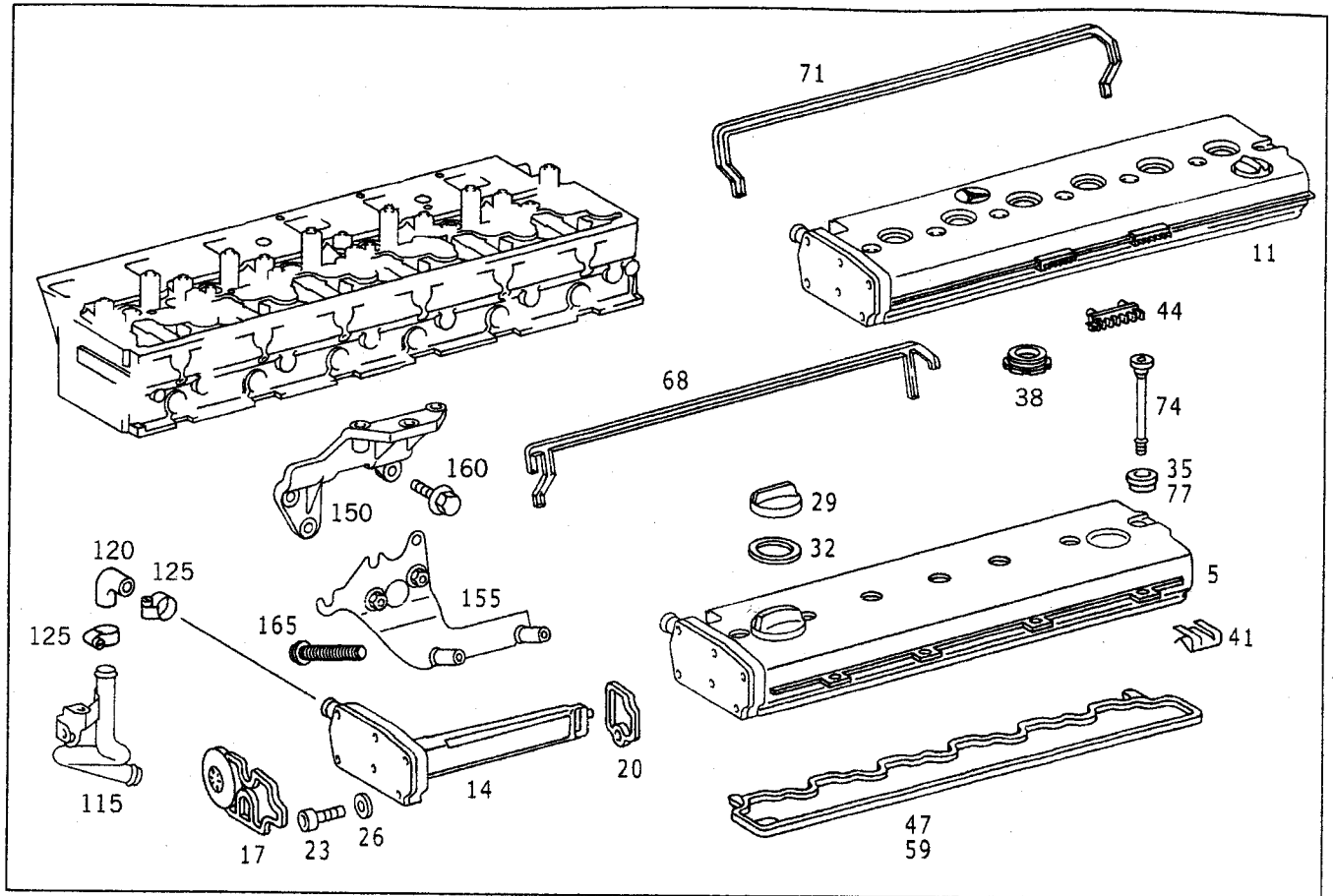
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блока цилиндров
رأس السندبر

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
grúppa
المجموعة

01 105 00069



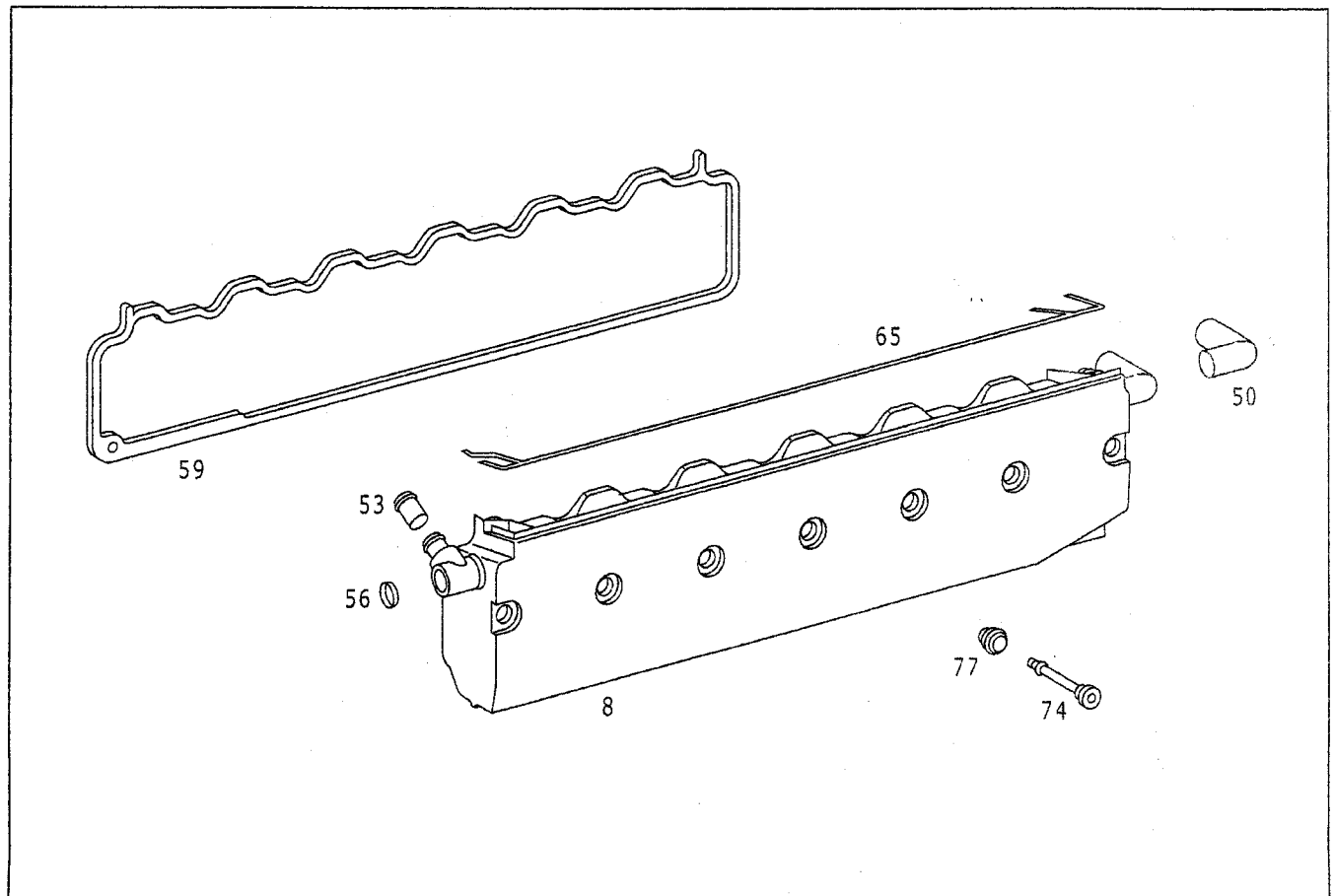
Zylinderkopf
Cylinder Head
Culasse
Testata

Culatra
Culata
головна блока цилиндров
رأس السندبر

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
grúppa
المجموعة

01 105 00080



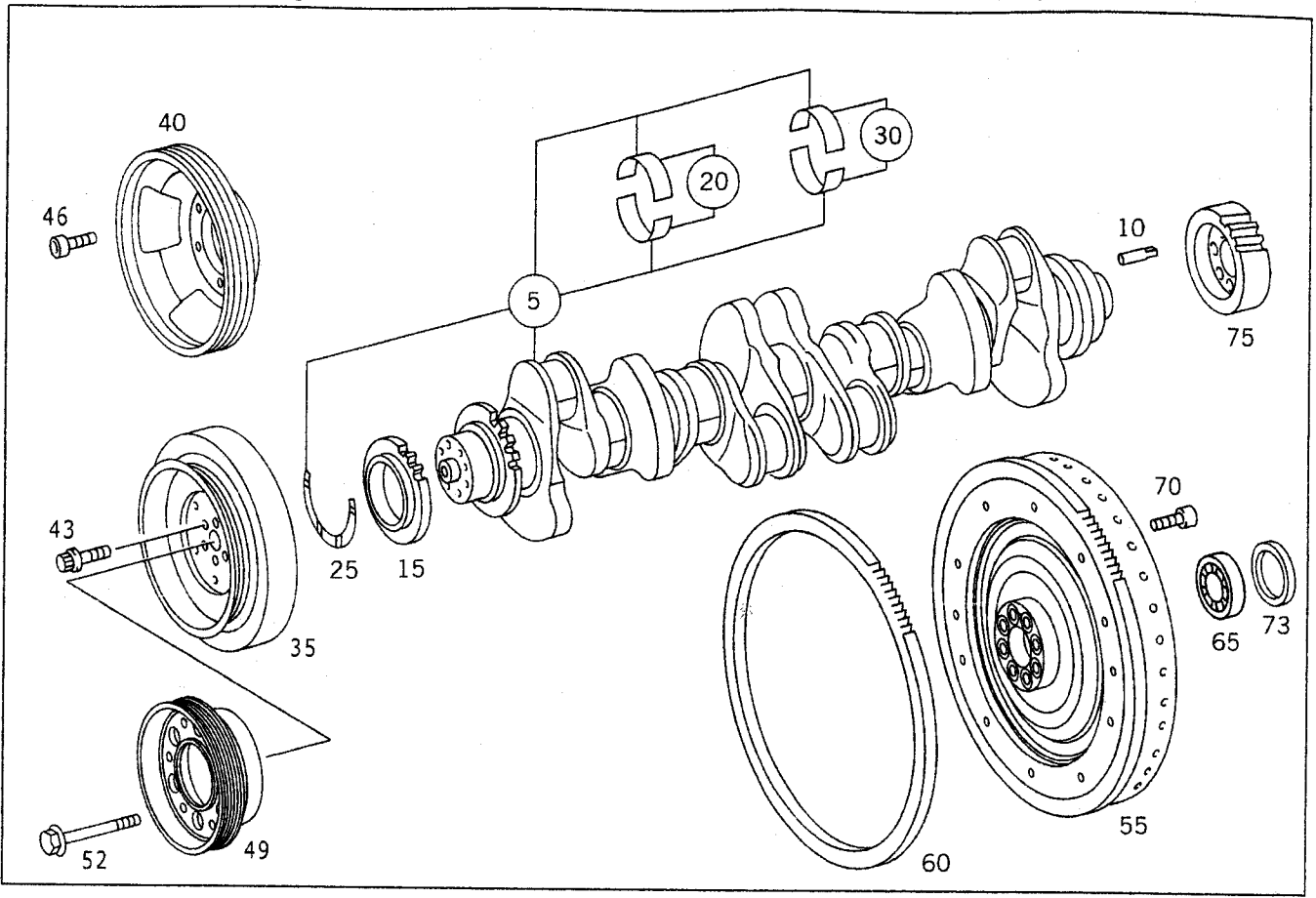
Triebwerkerteile
 Moving Parts
 Organes moteurs
 Manovellismo

Orgãos motores
 Piezas motrices
 детали двигателя
 قطع مكينات الآبارة

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

03 015 00195



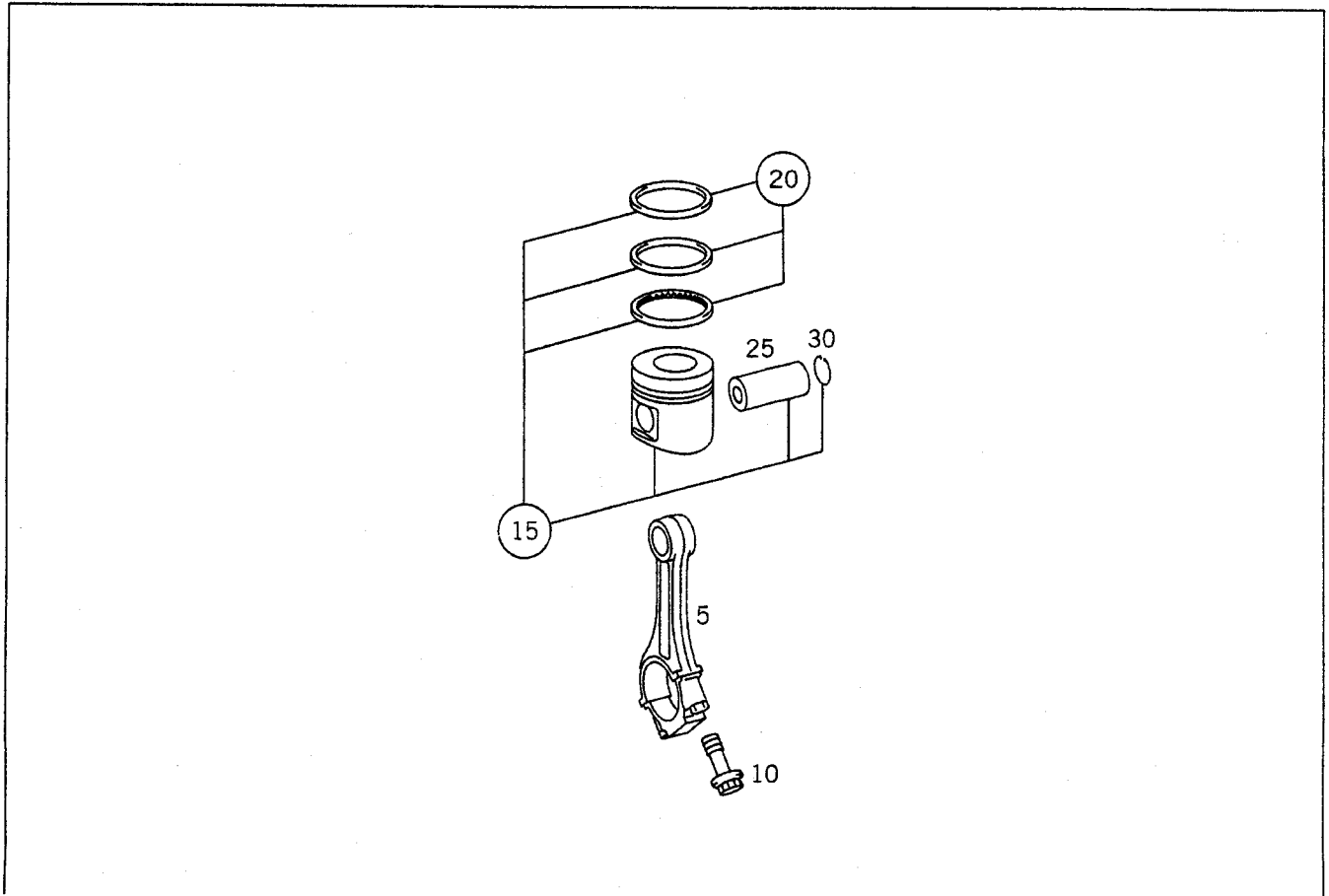
Triebwerkerteile
 Moving Parts
 Organes moteurs
 Manovellismo

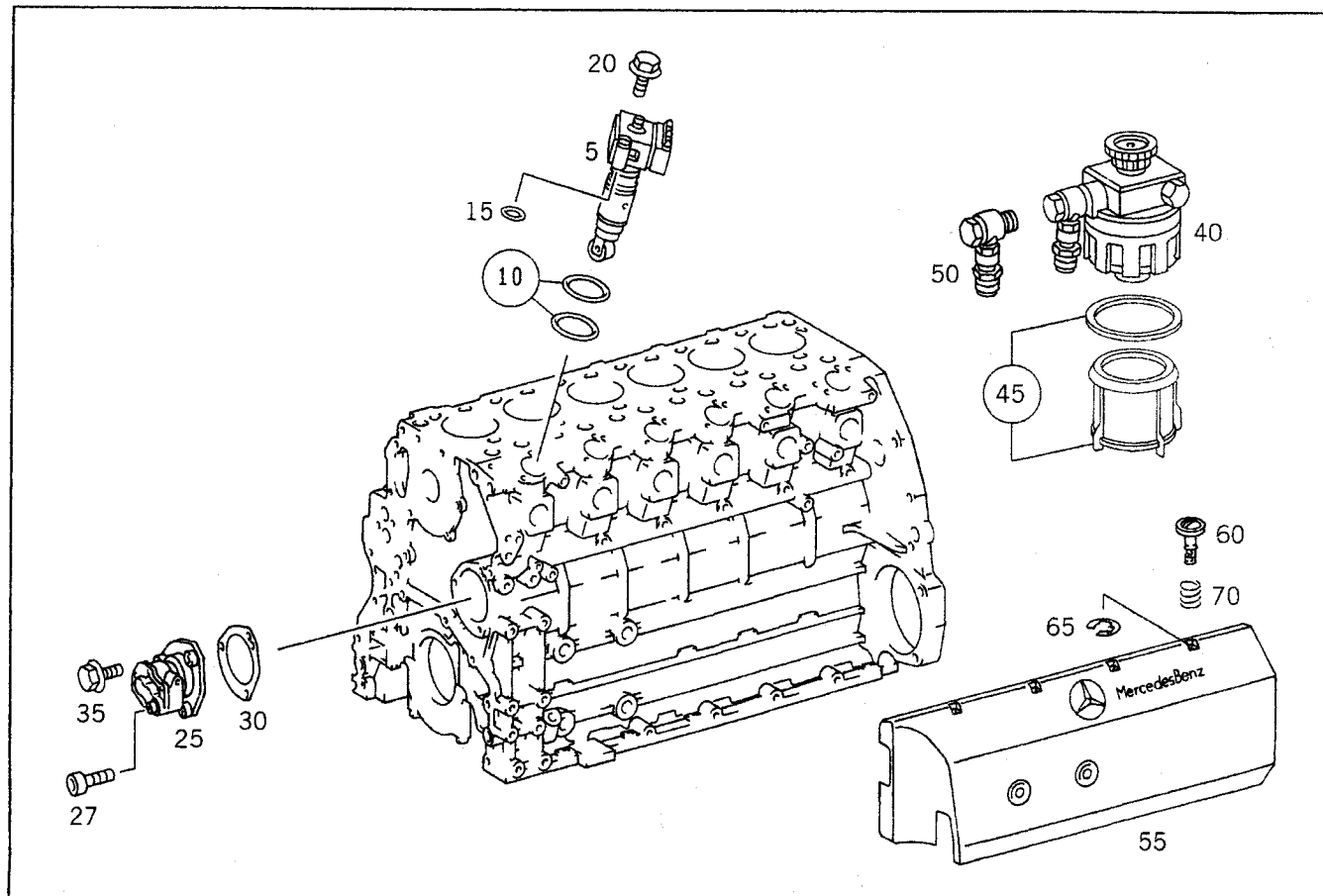
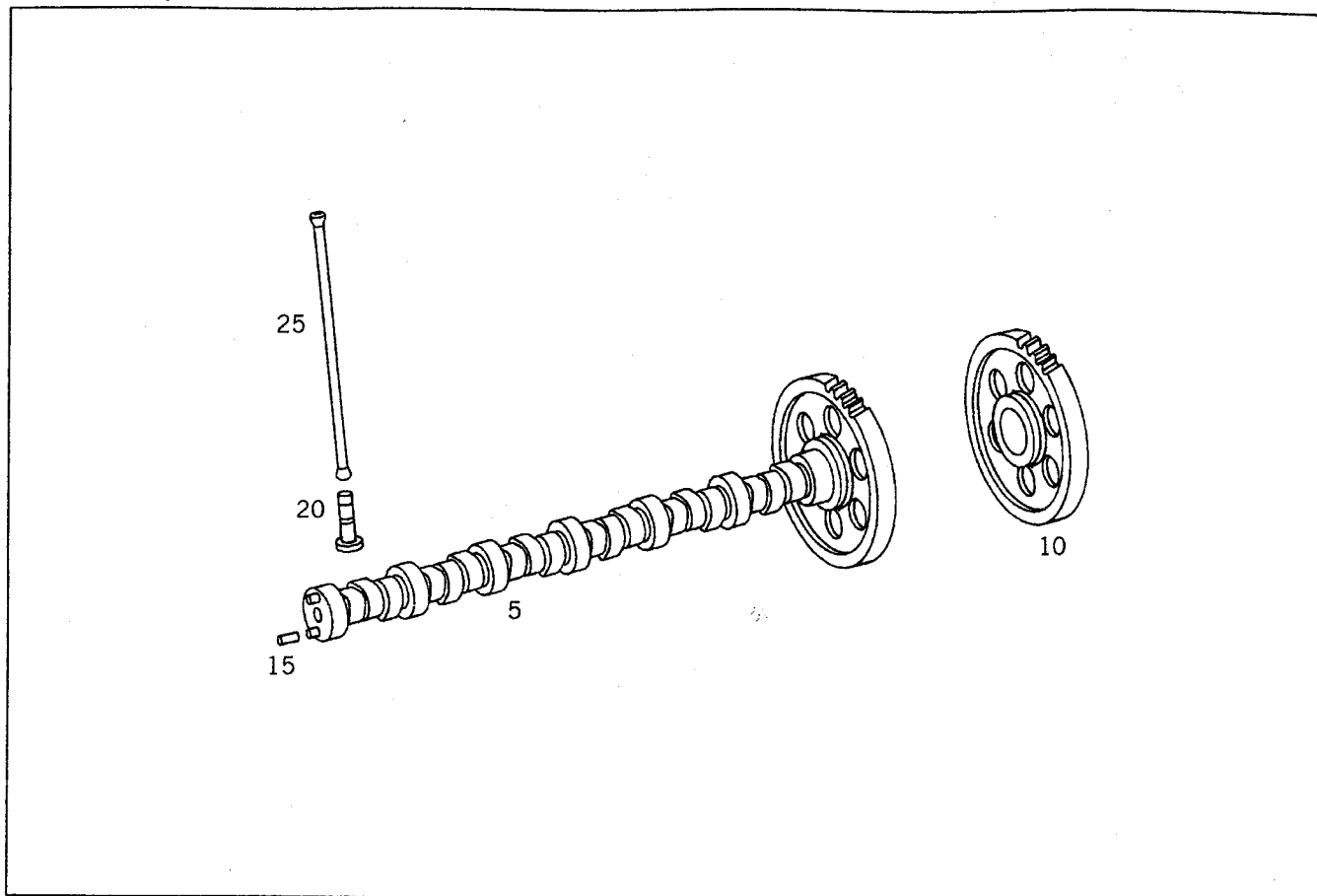
Orgãos motores
 Piezas motrices
 детали двигателя
 قطع مكينات الآبارة

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

03 045 00159





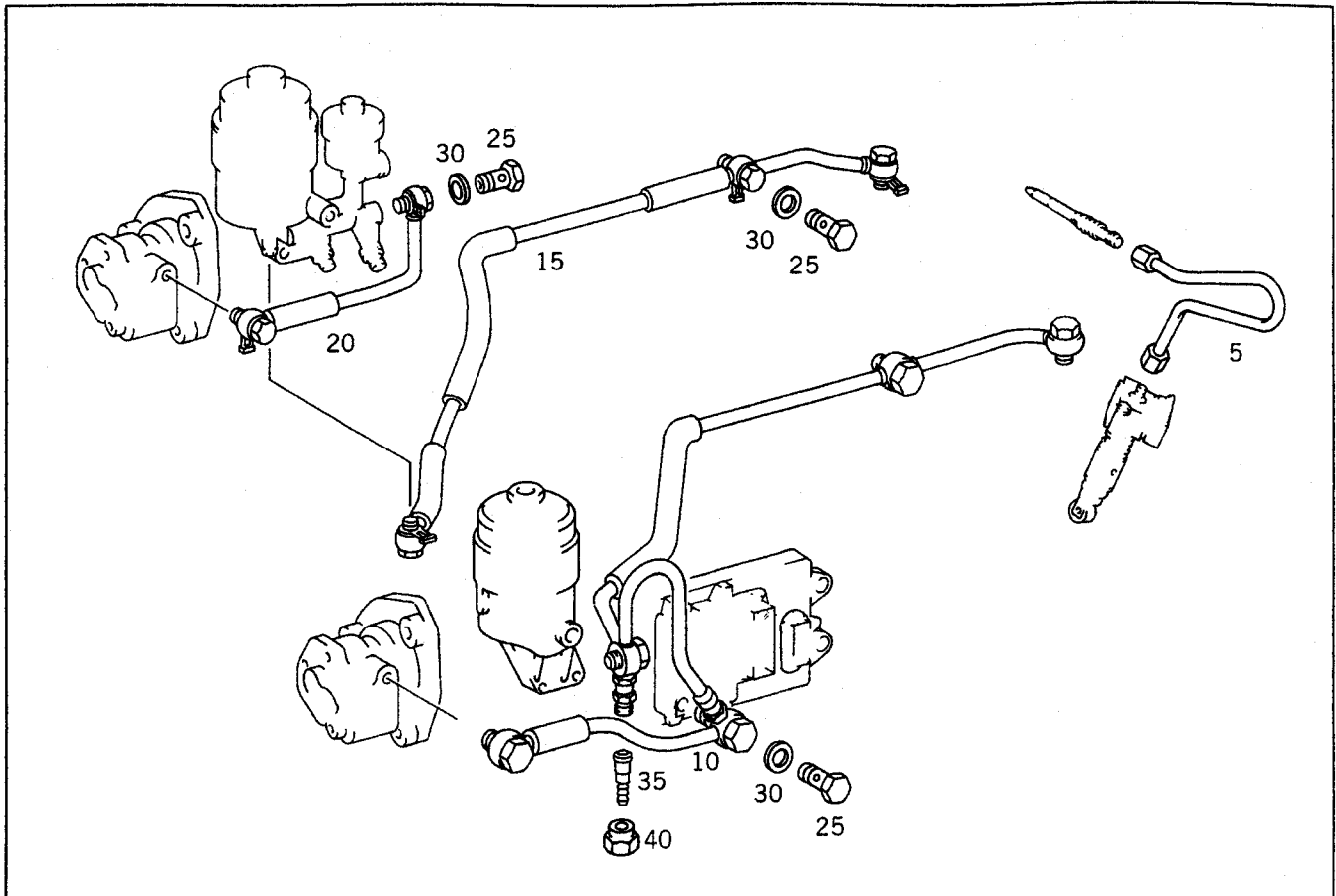
Kraftstoffpumpe
Fuel Pump
Pompe d'alimentation
Pompa combustibile

Bomba de combustivel
Bomba de combustible
топливный насос
مضخة الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

07 090 00157



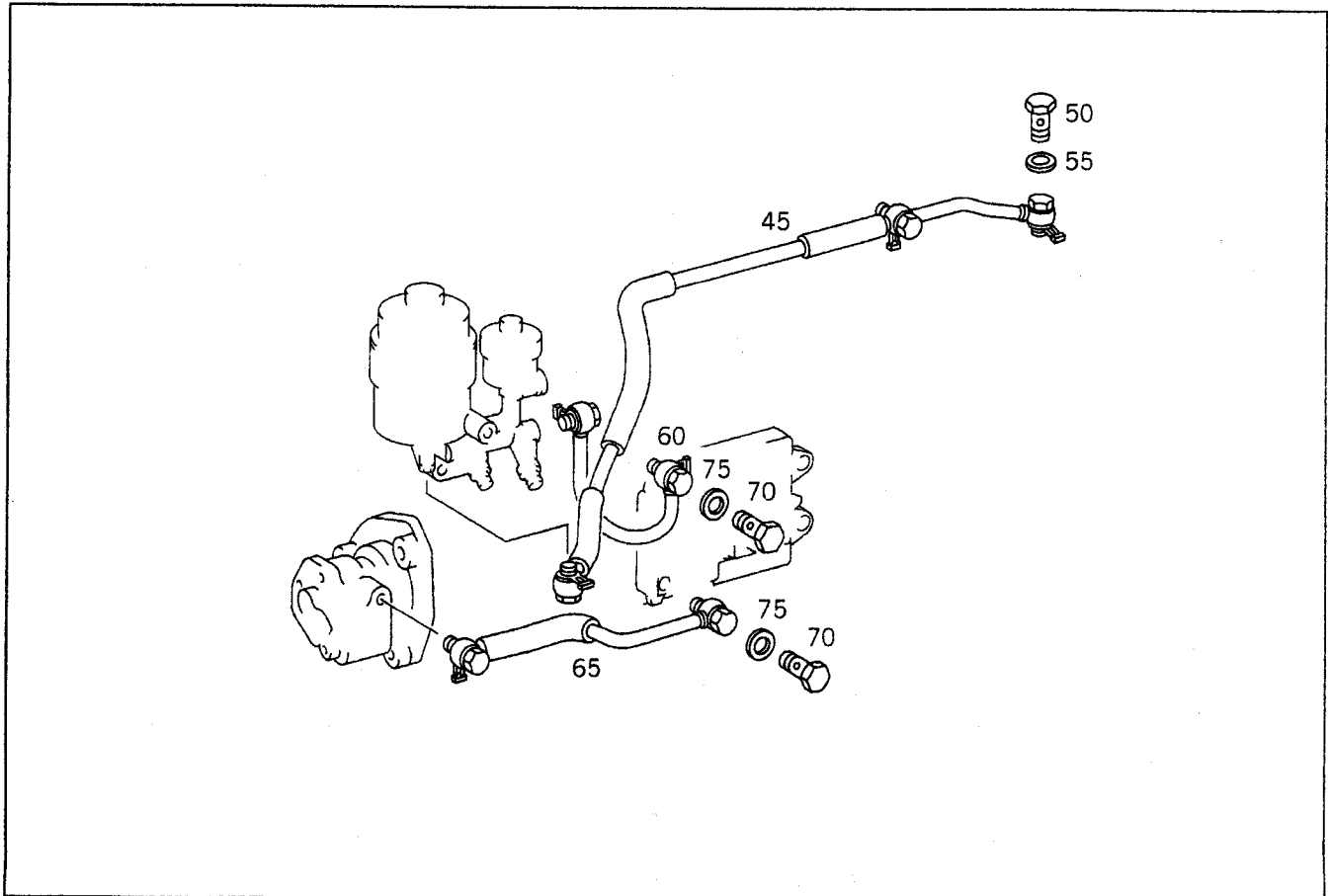
Kraftstoffpumpe
Fuel Pump
Pompe d'alimentation
Pompa combustibile

Bomba de combustivel
Bomba de combustible
топливный насос
مضخة الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Gruppo
группа
المجموعة

07 090 00161



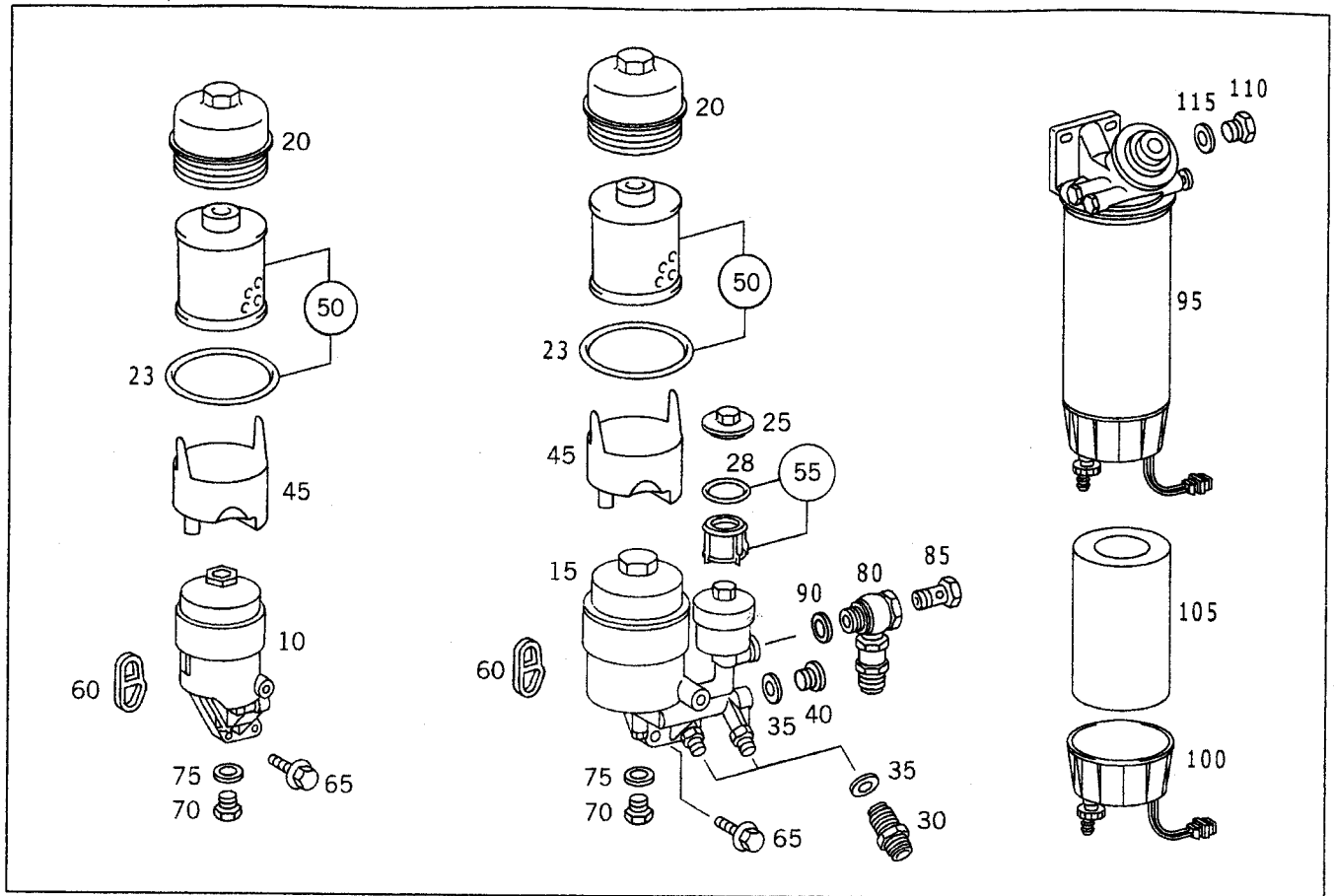
Kraftstoff-Filter
 Fuel Filter
 Filtre à combustible
 Filtro carburante

Filtro de combustivel
 Filtro de combustible
 топливный фильтр
 مصفاة الوقود

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

09 030 00116



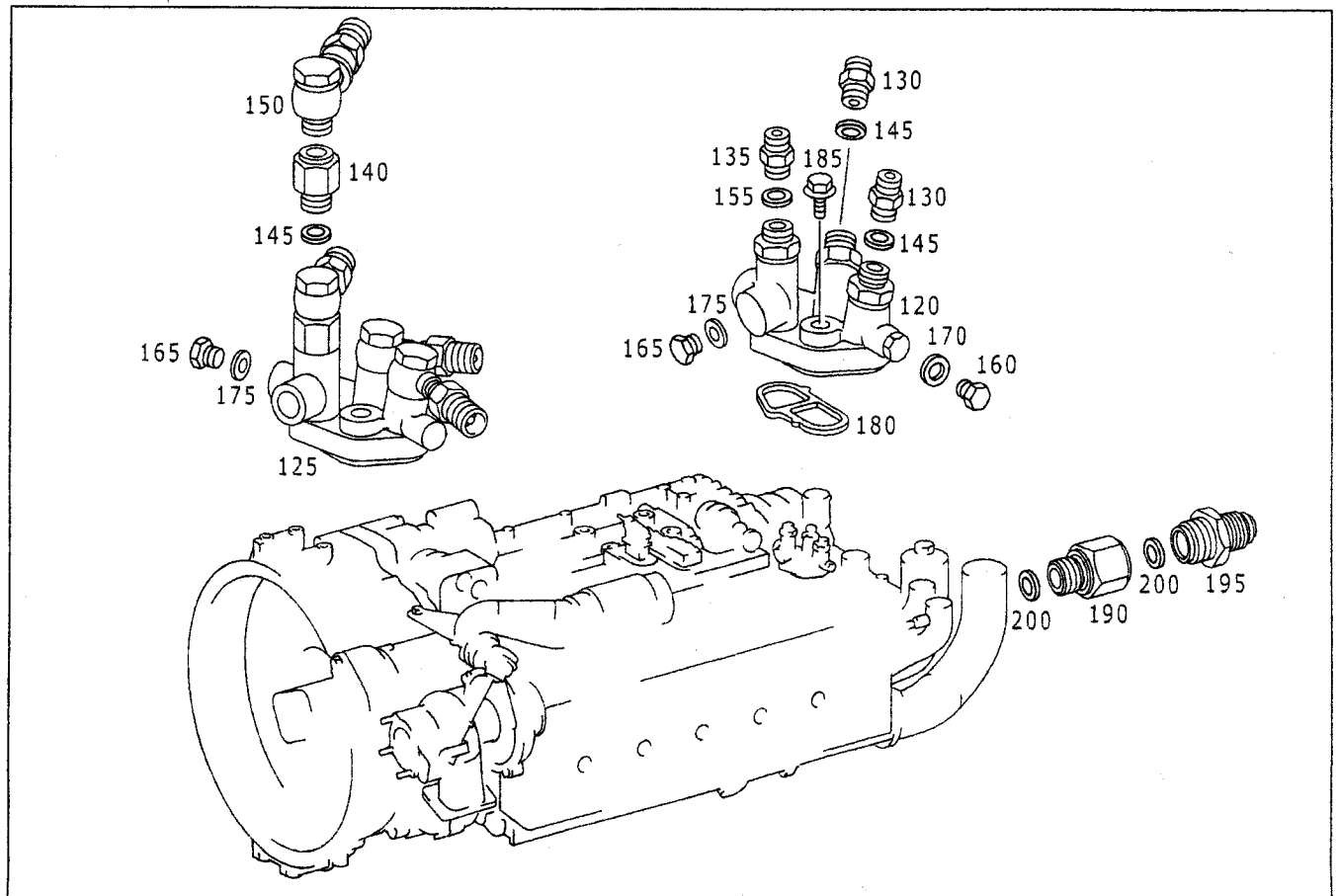
Kraftstoff-Filter
 Fuel Filter
 Filtre à combustible
 Filtro carburante

Filtro de combustivel
 Filtro de combustible
 топливный фильтр
 مصفاة الوقود

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

09 030 00125



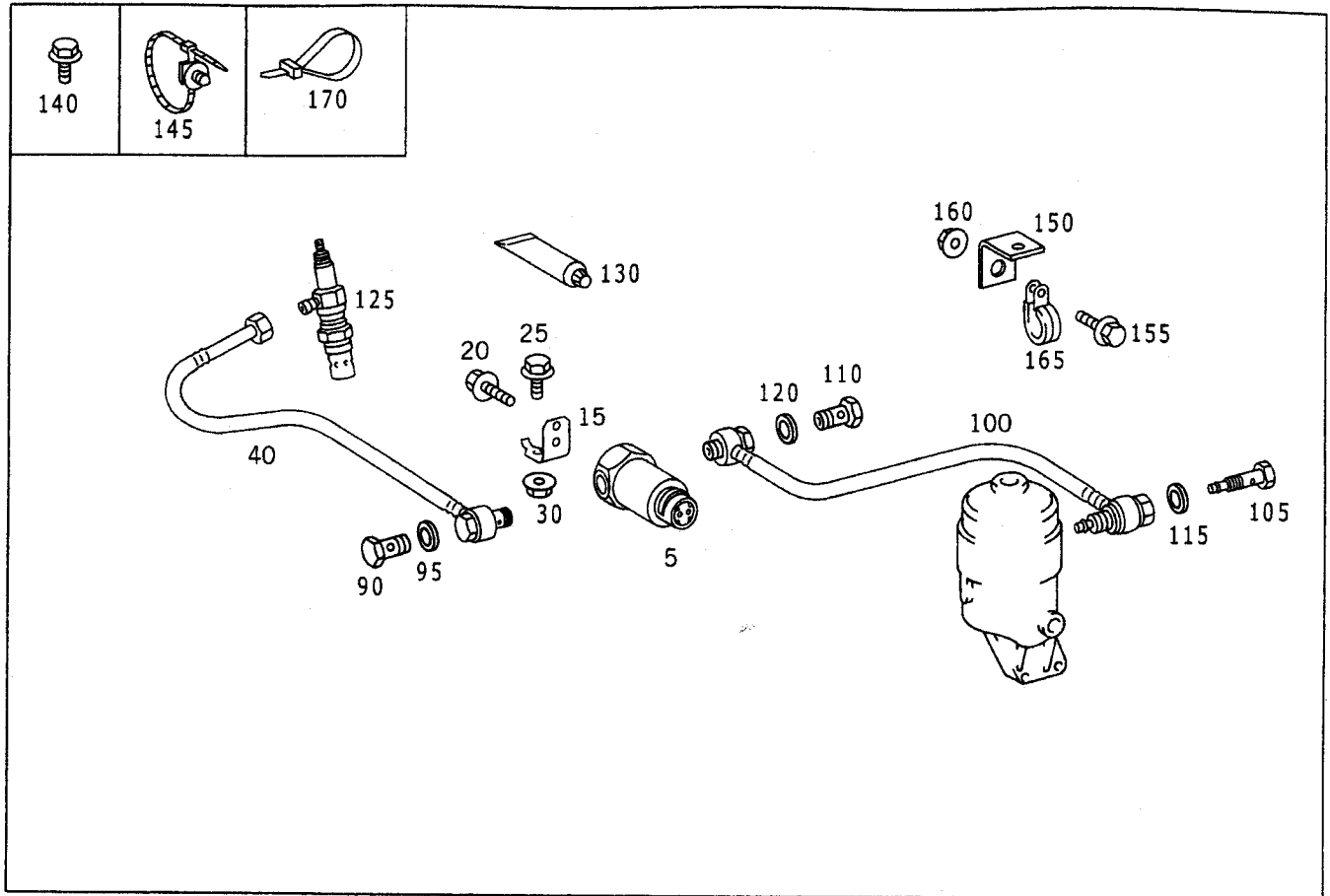
Kraftstoff-Filter
Fuel Filter
Filtre à combustible
Filtro carburante

Filtro de combustível
Filtro de combustible
топливный фильтр
مصفاة الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

09 060 00032



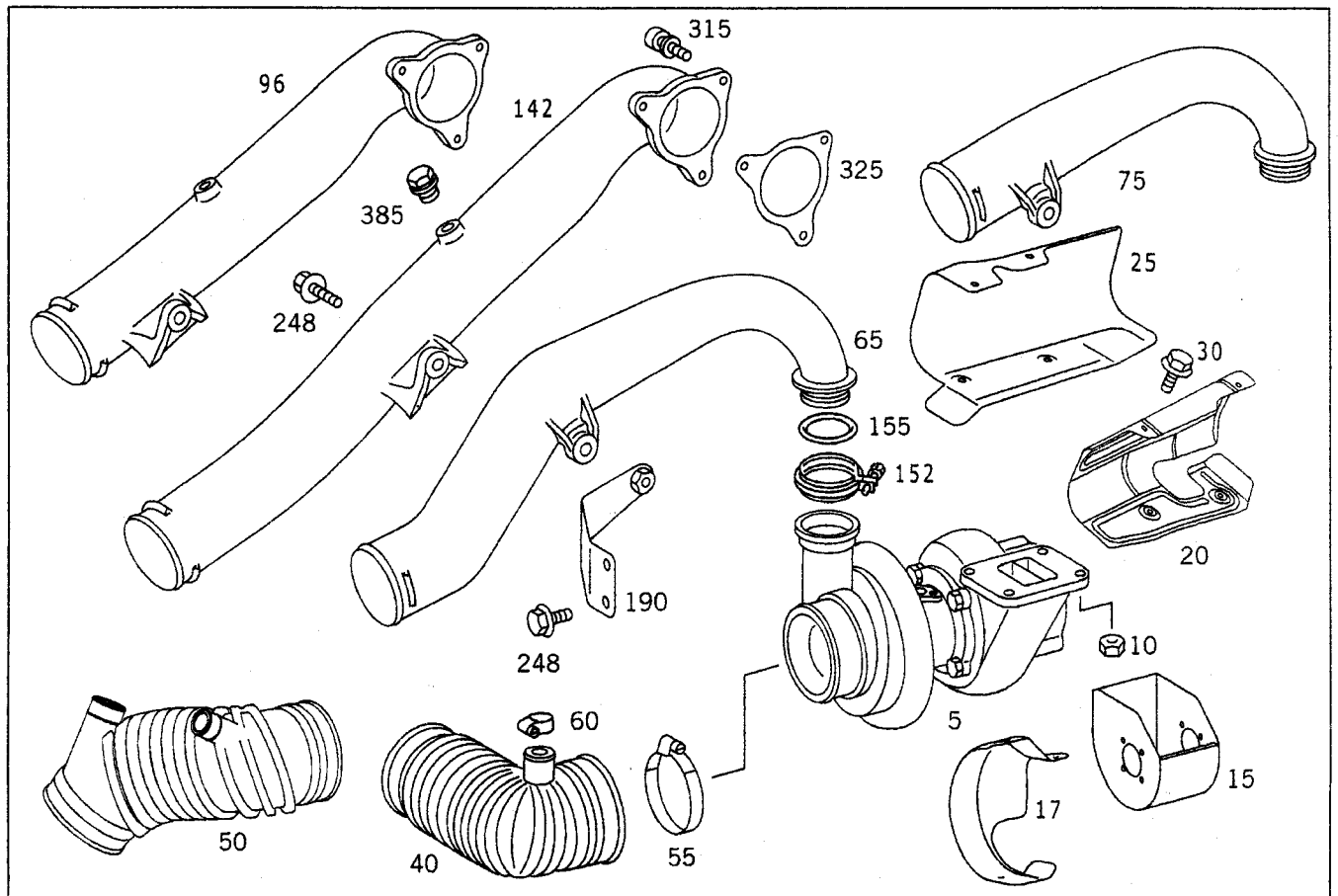
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

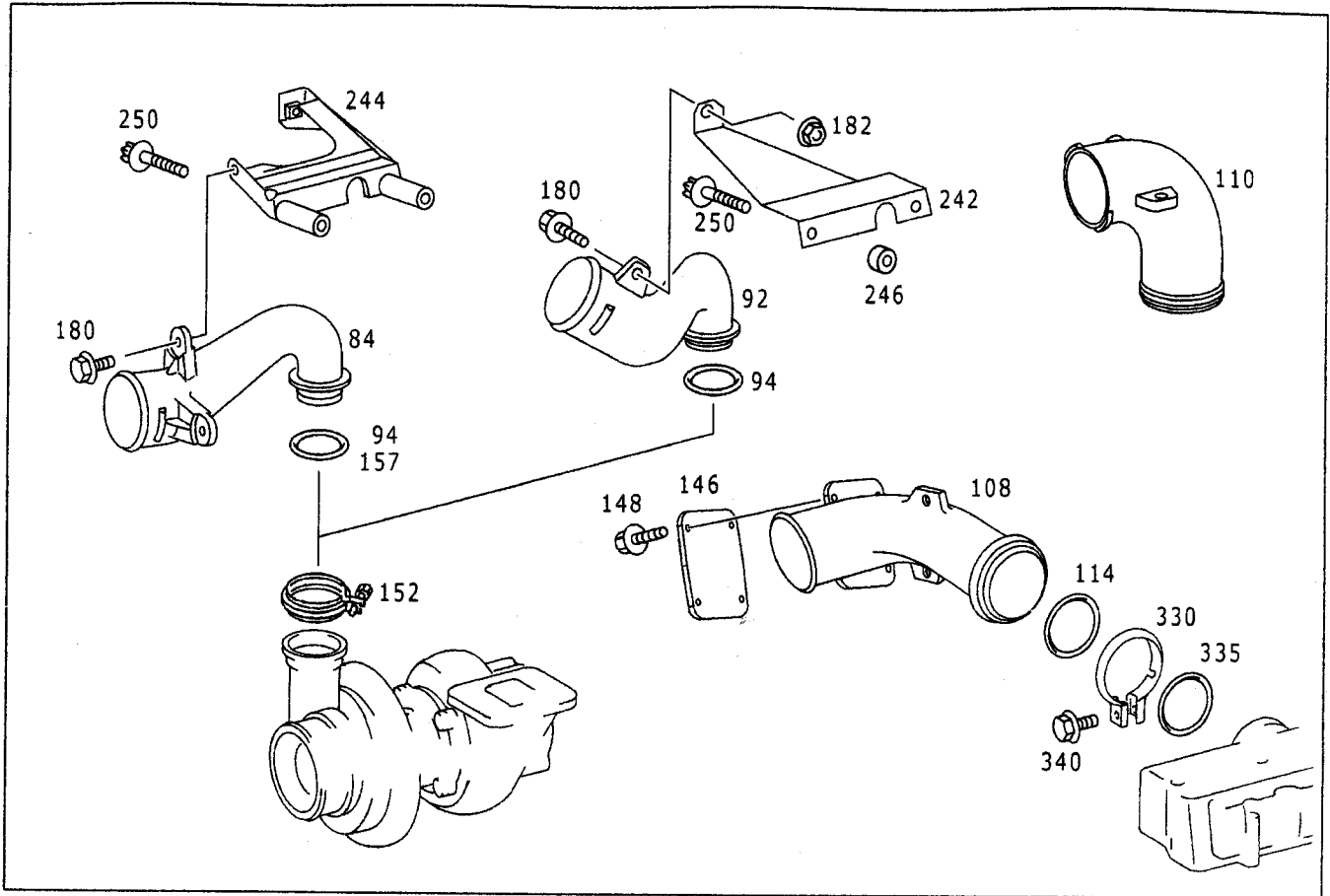
Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

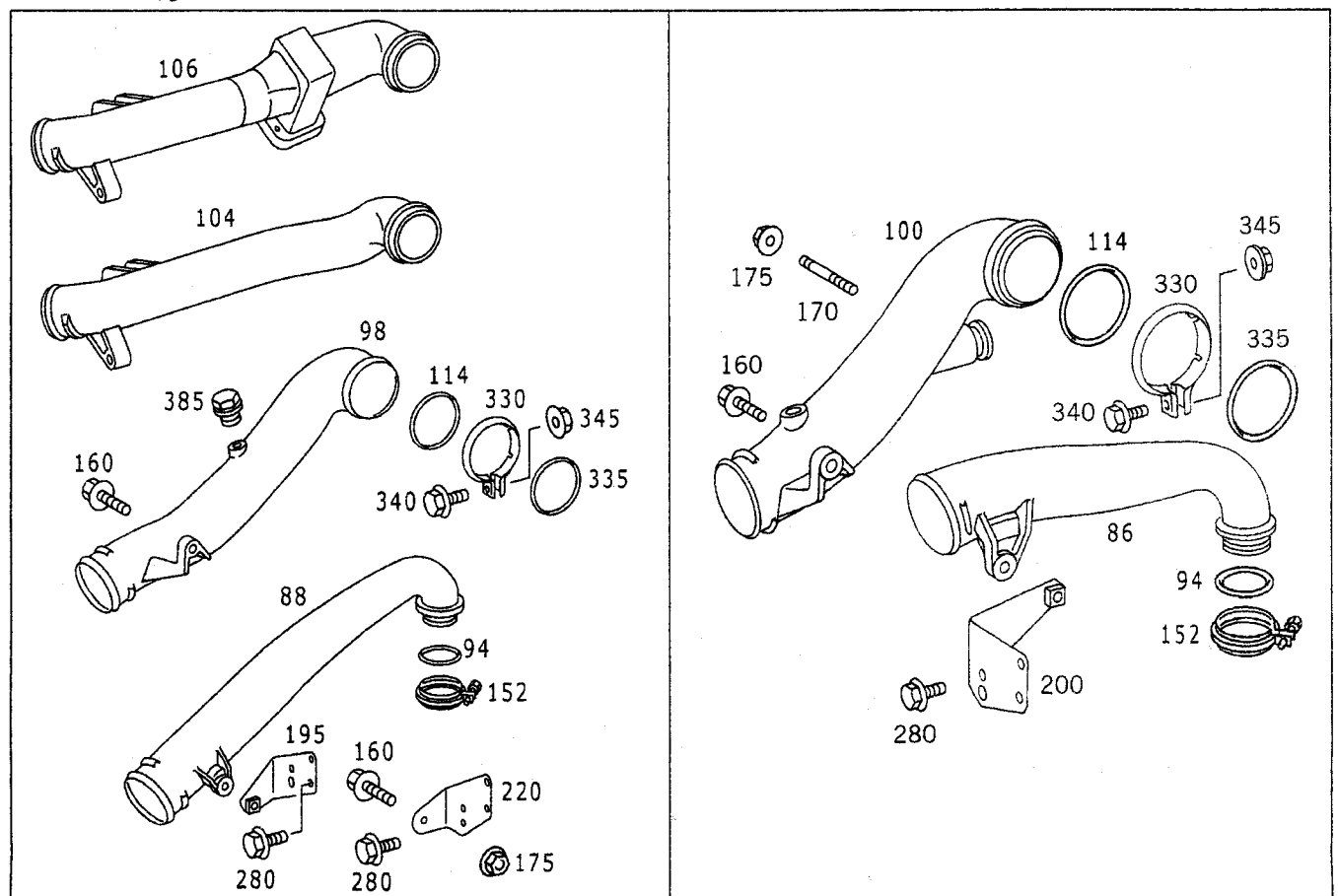
Grupo
Grupo
группа
المجموعة

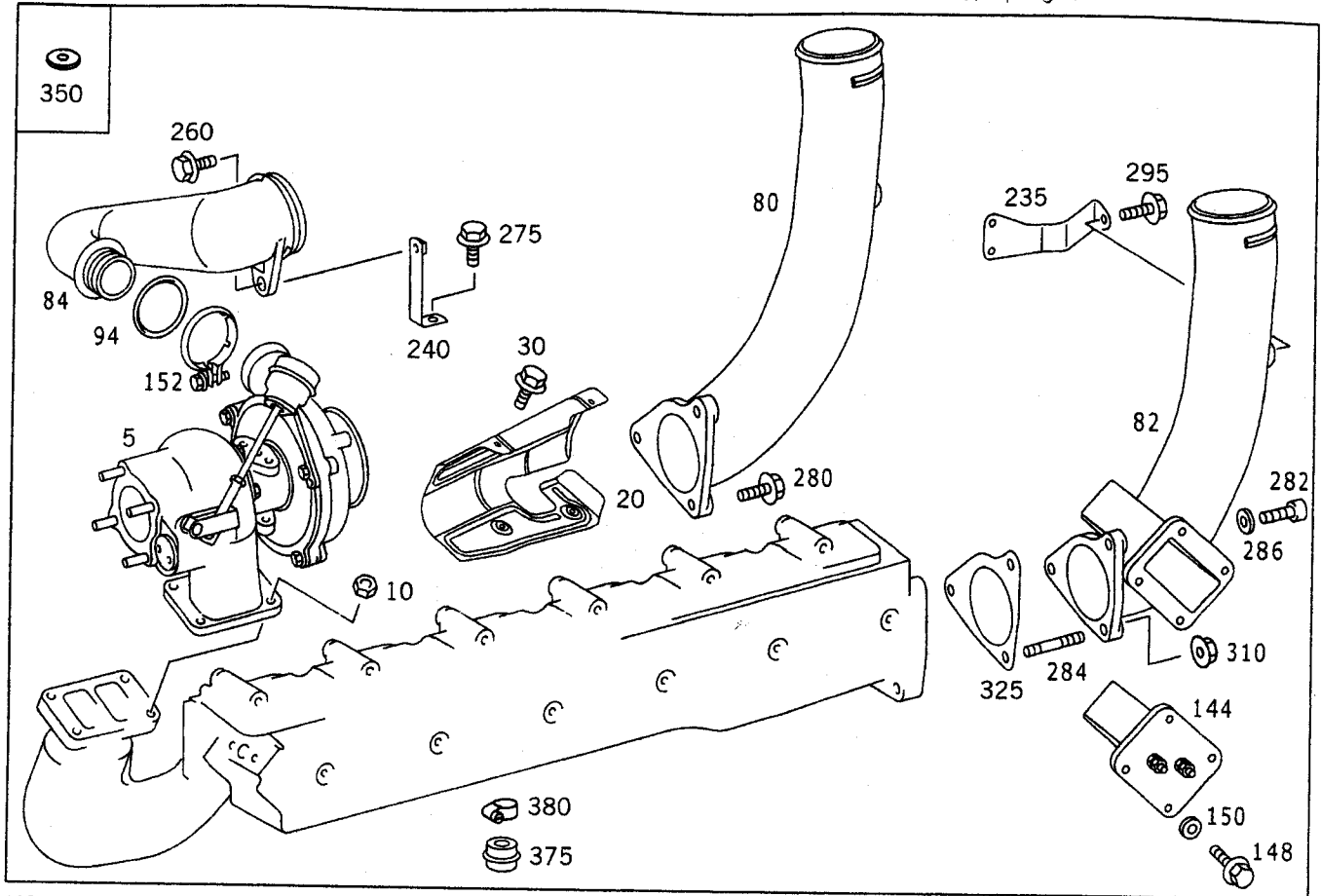
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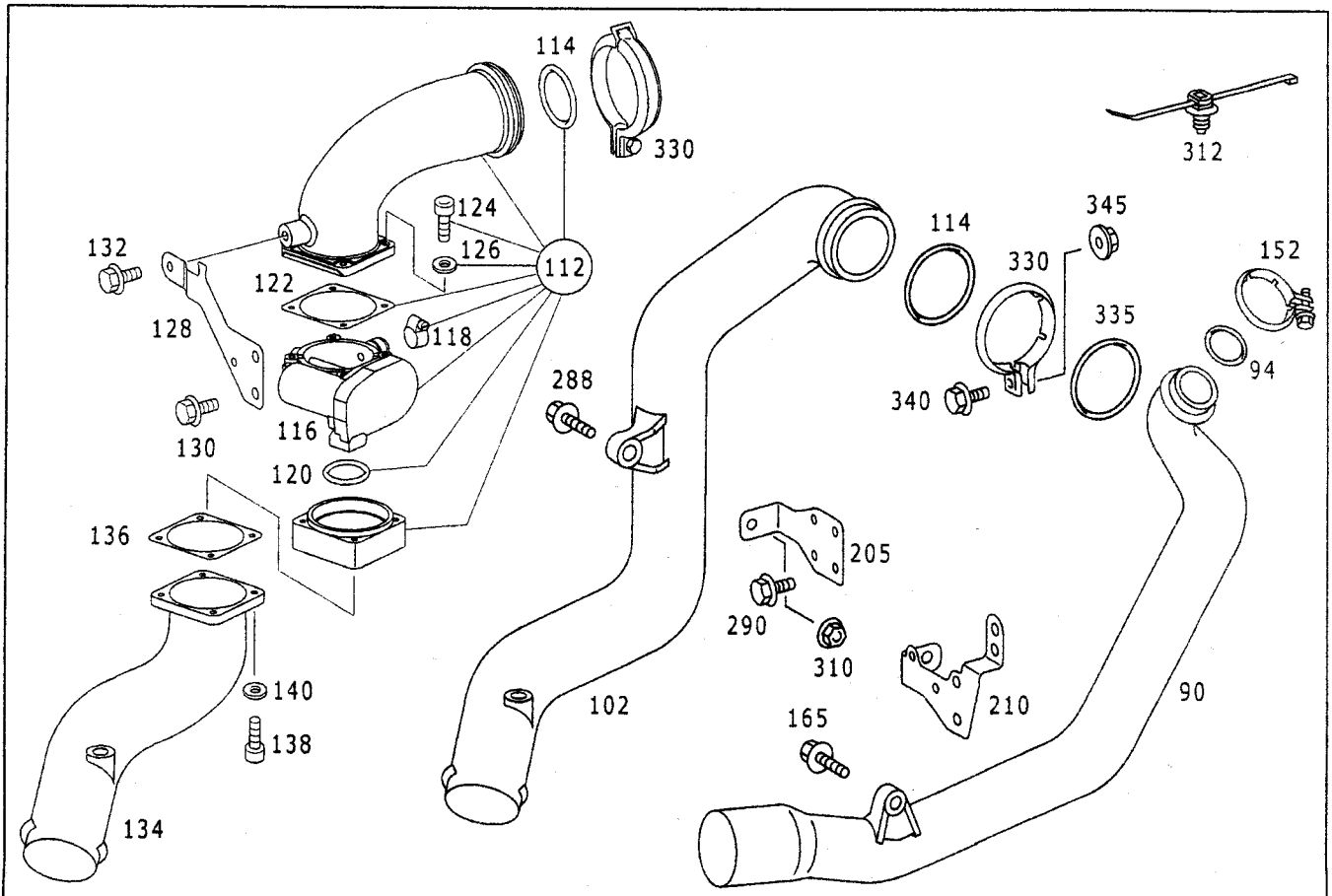


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108



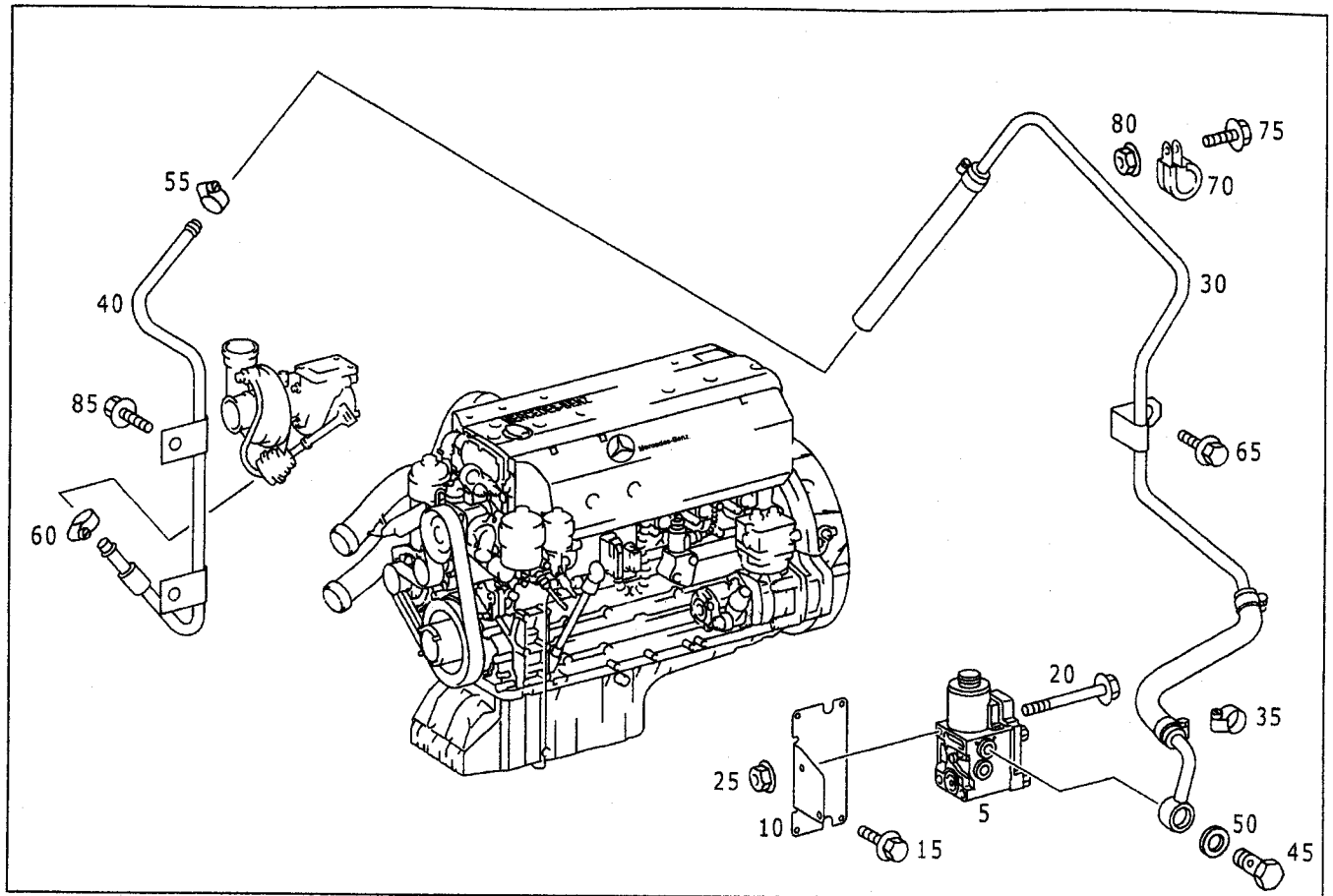
Aufladung
Turbocharger
Turbochargeur
Sovralimentazione

Sobrealimentação
Sobrealimentación
наддув
جهاز الشحن

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

09 110 00001



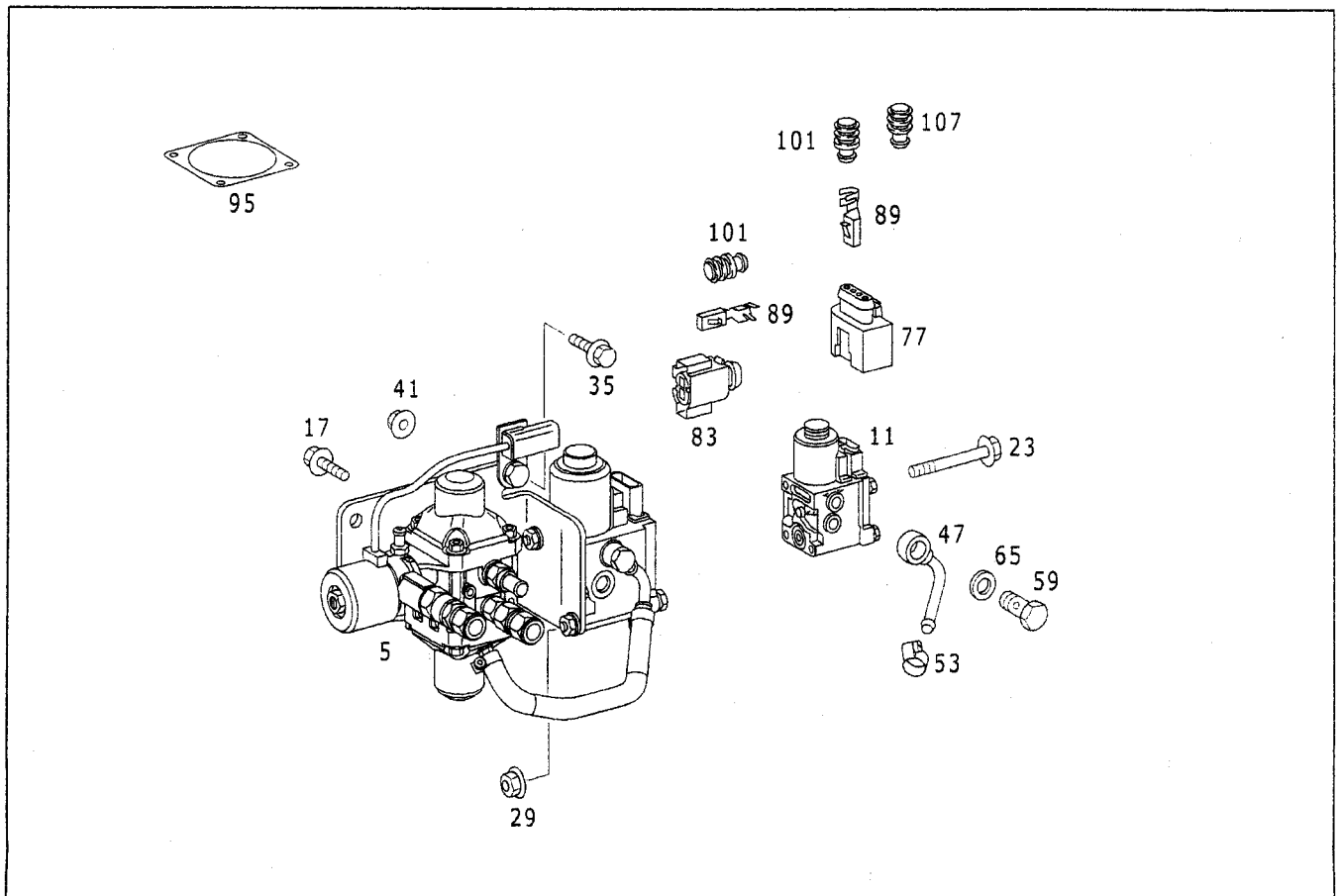
Kraftstoffanlage
Fuel System
Alimentation
Impianto del combustibile

Sistema de combustible
Sistema de alimentación de combustible
топливная система
جهاز خزان الوقود

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

11 015 00001



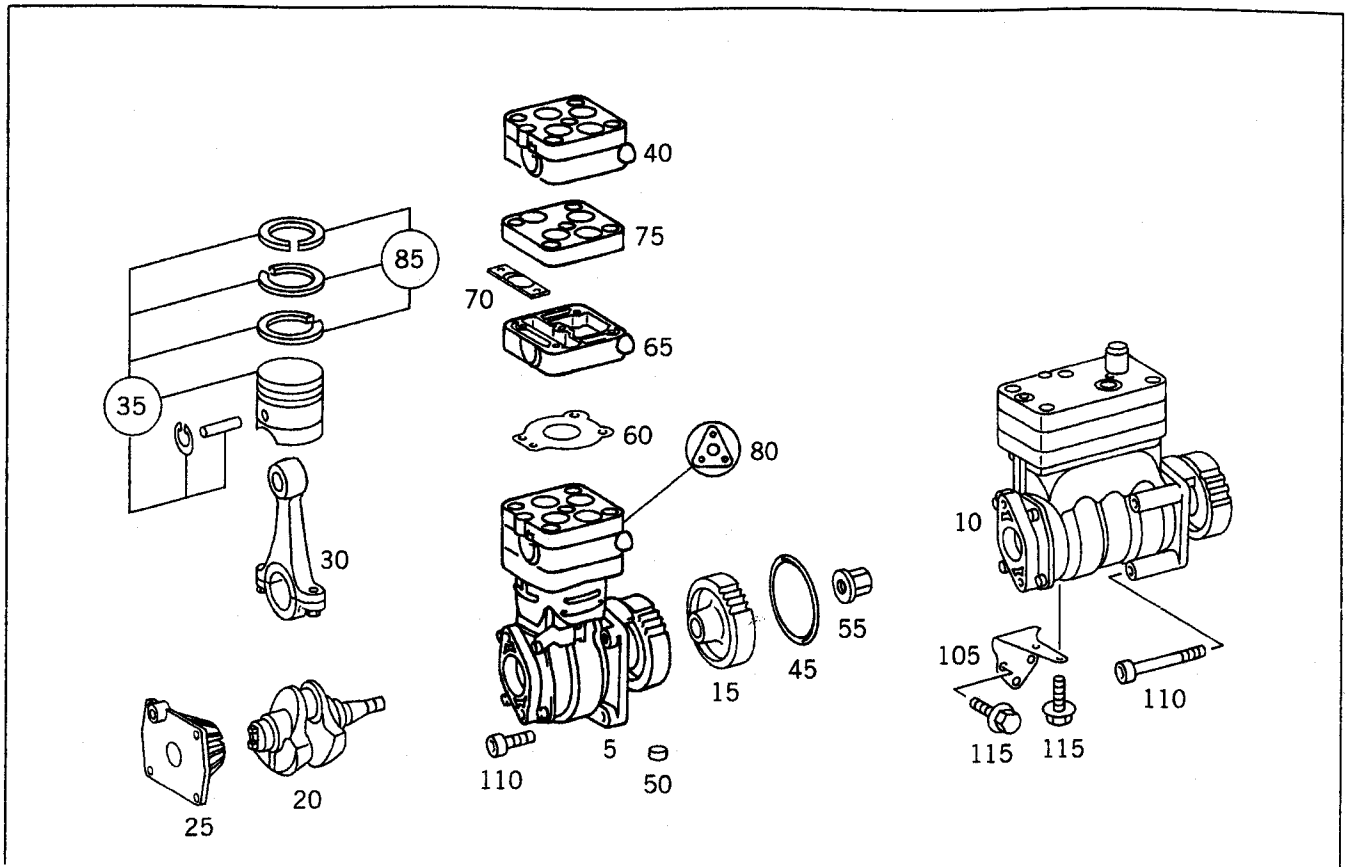
Luftpresse
Air Compressor
Compresseur d'air
Compressore aria

Compressor de ar
Compresor de aire
воздушный компрессор
ضاغط الهواء

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

13 060 00089



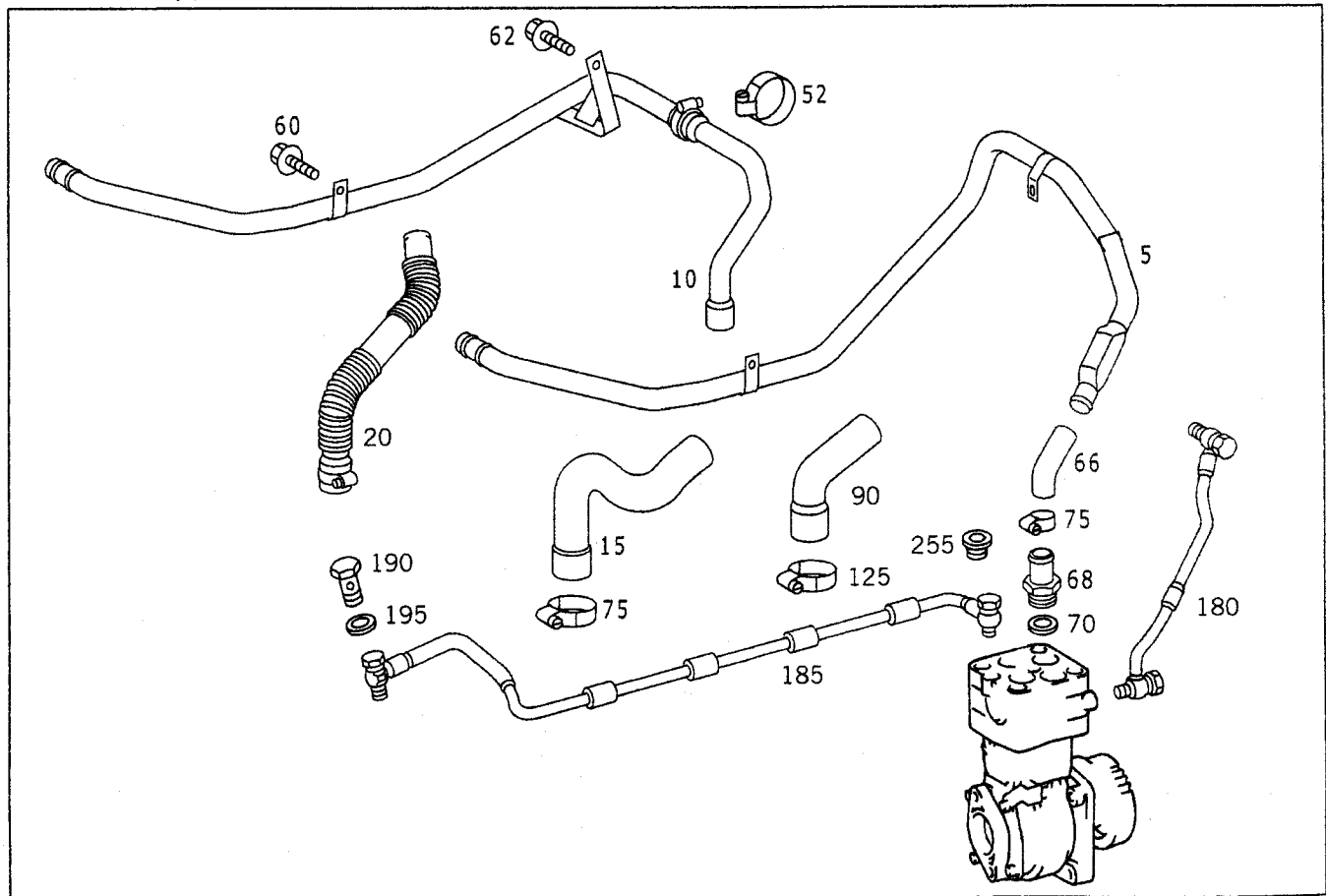
Luftpresse
Air Compressor
Compresseur d'air
Compressore aria

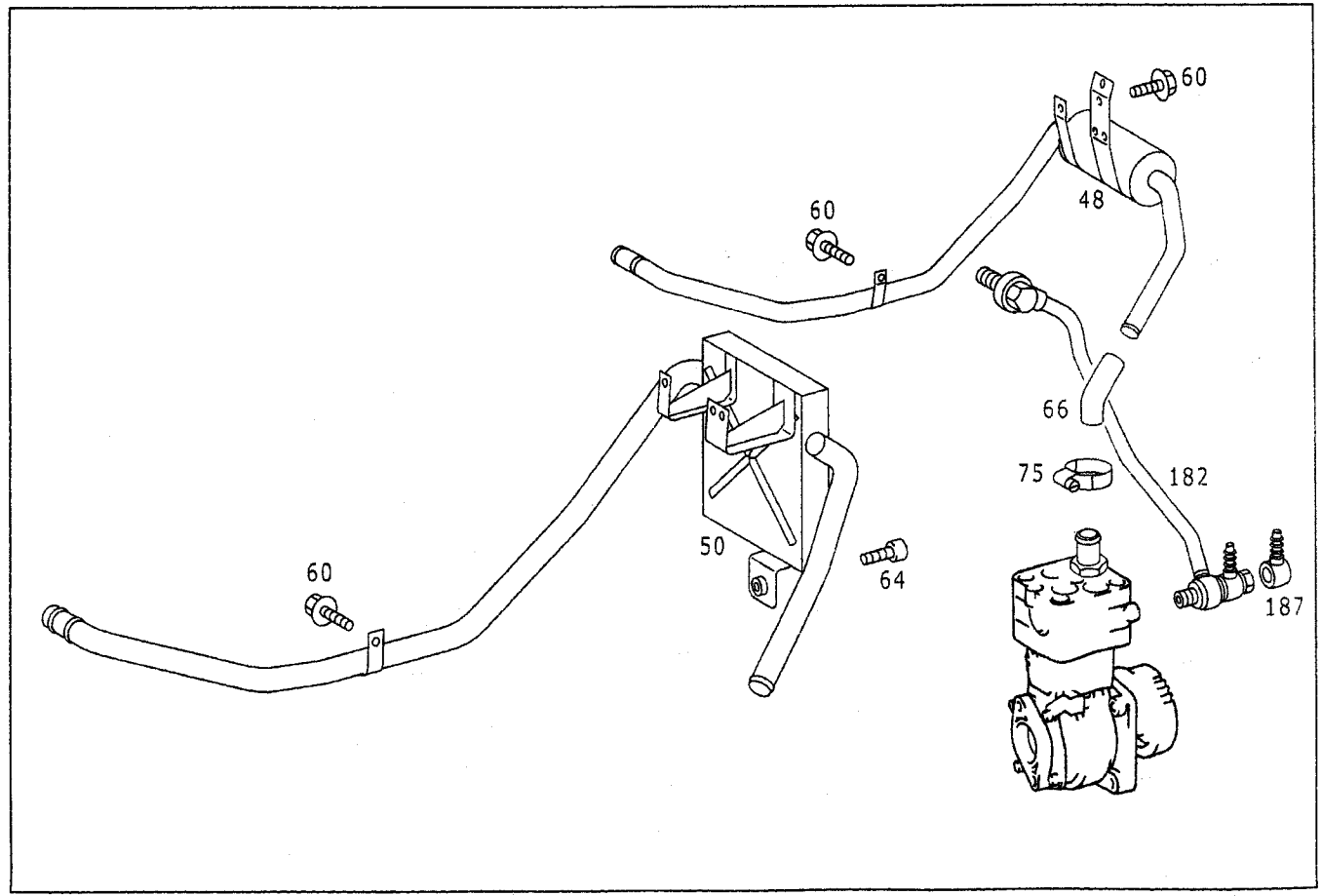
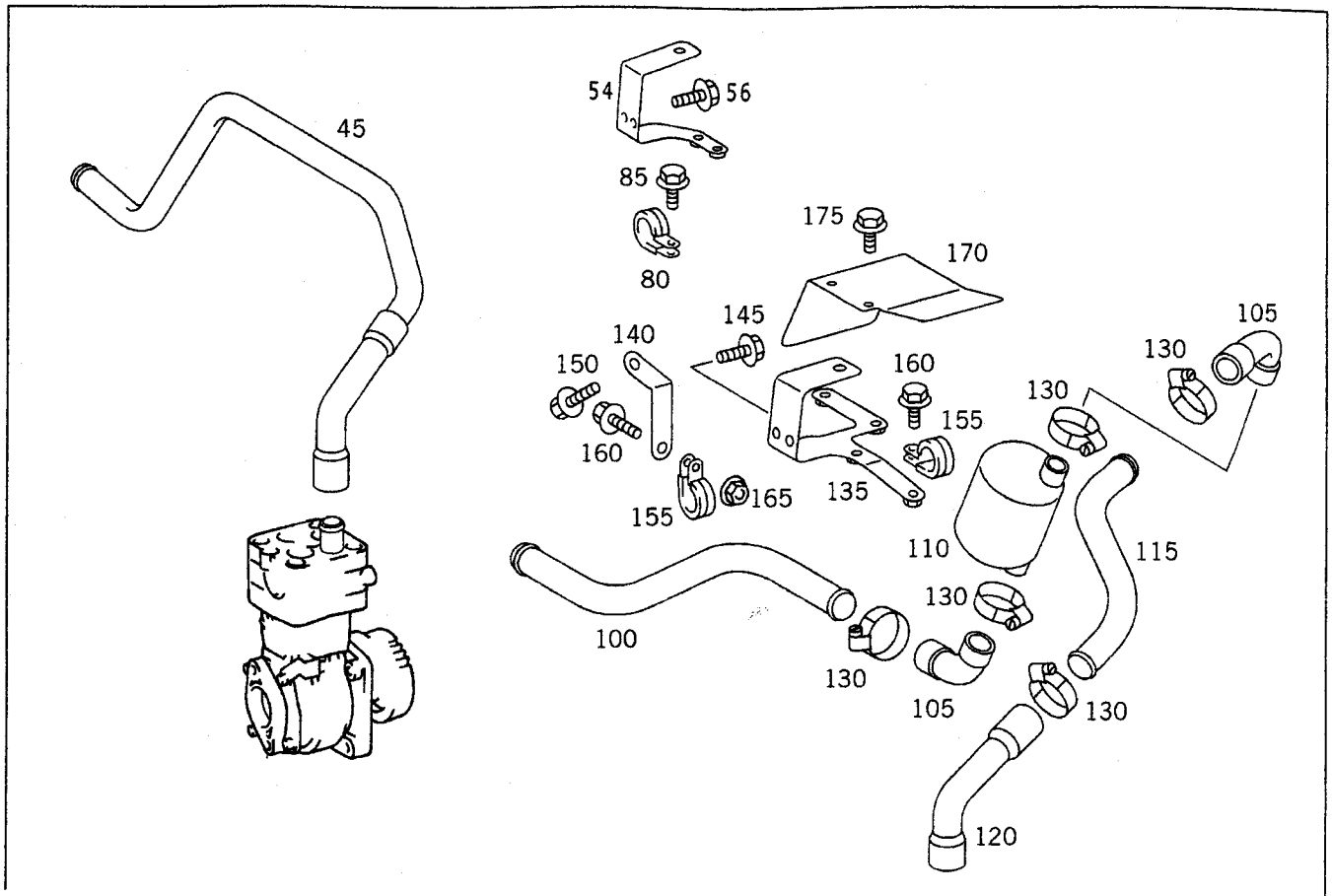
Compressor de ar
Compresor de aire
воздушный компрессор
ضاغط الهواء

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

13 075 00123



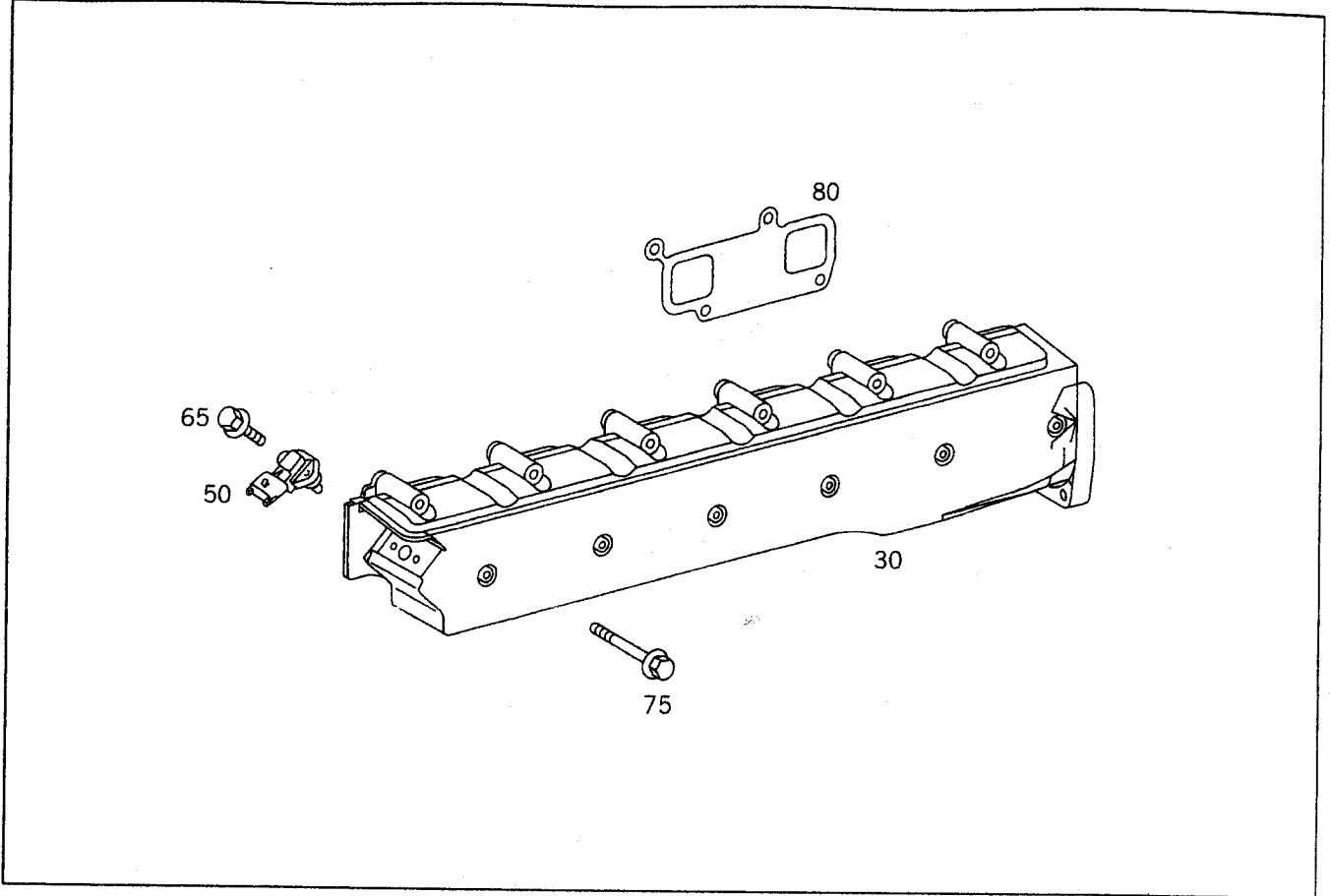


Saugrohr und Auspuffkrümmer
 Intake and Exhaust Manifolds
 Collecteurs d'admission et
 d'échappement
 Condotto aspirazione e collettore scarico

Tubo de admissão e colector de escape
 Tubo de admisión y colector de escape
 впускная труба и колено
 выпускного трубопровода
 أنبوب امتصاص والعامد المشعب

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

14 015 00207

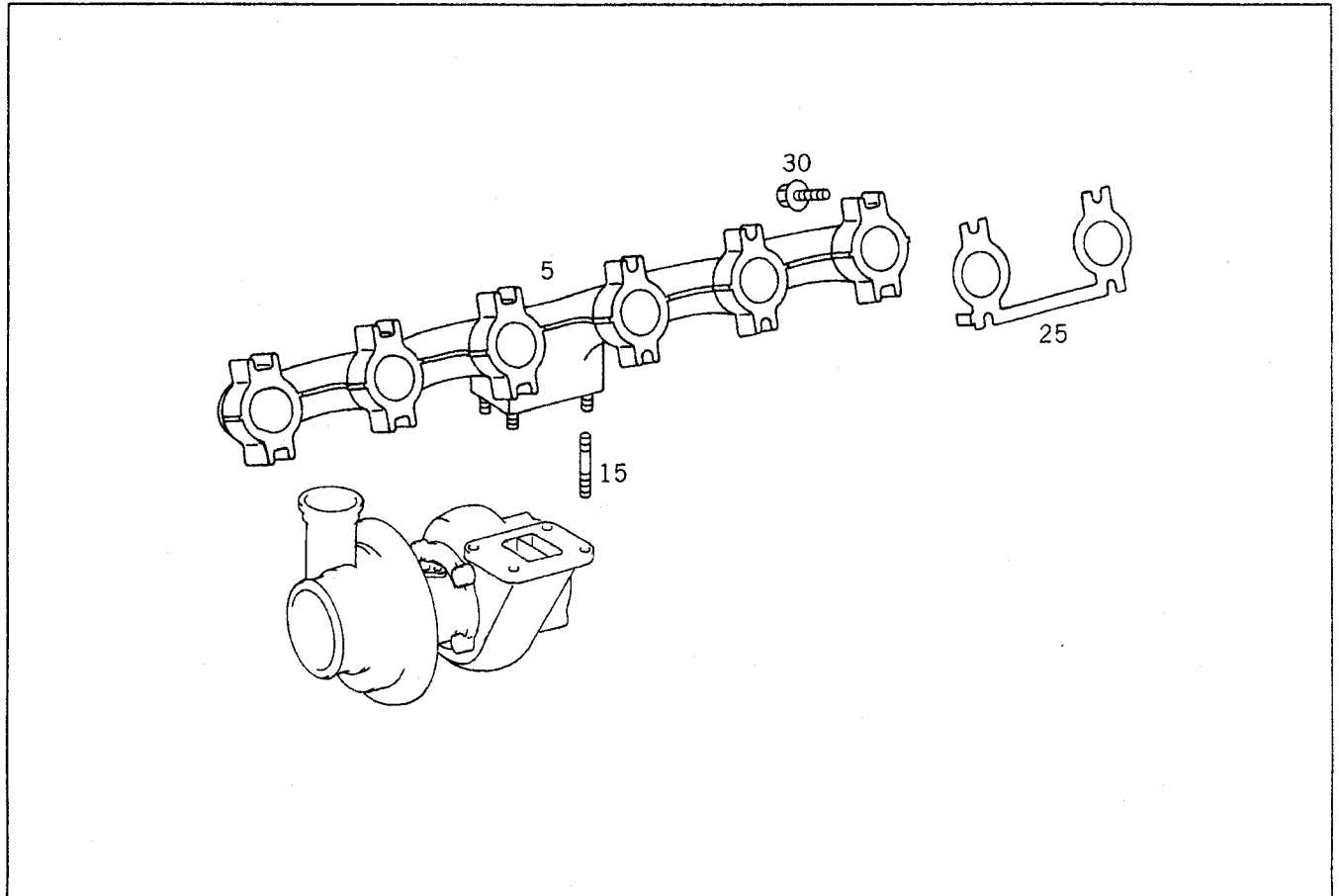


Auspuffkrümmer
 Exhaust Manifold
 Collecteur d'échappement
 Collettore scarico

Colector de escape
 Colector de escape
 колено выпускного трубопровода
 العامد المشعب

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

14 030 00249



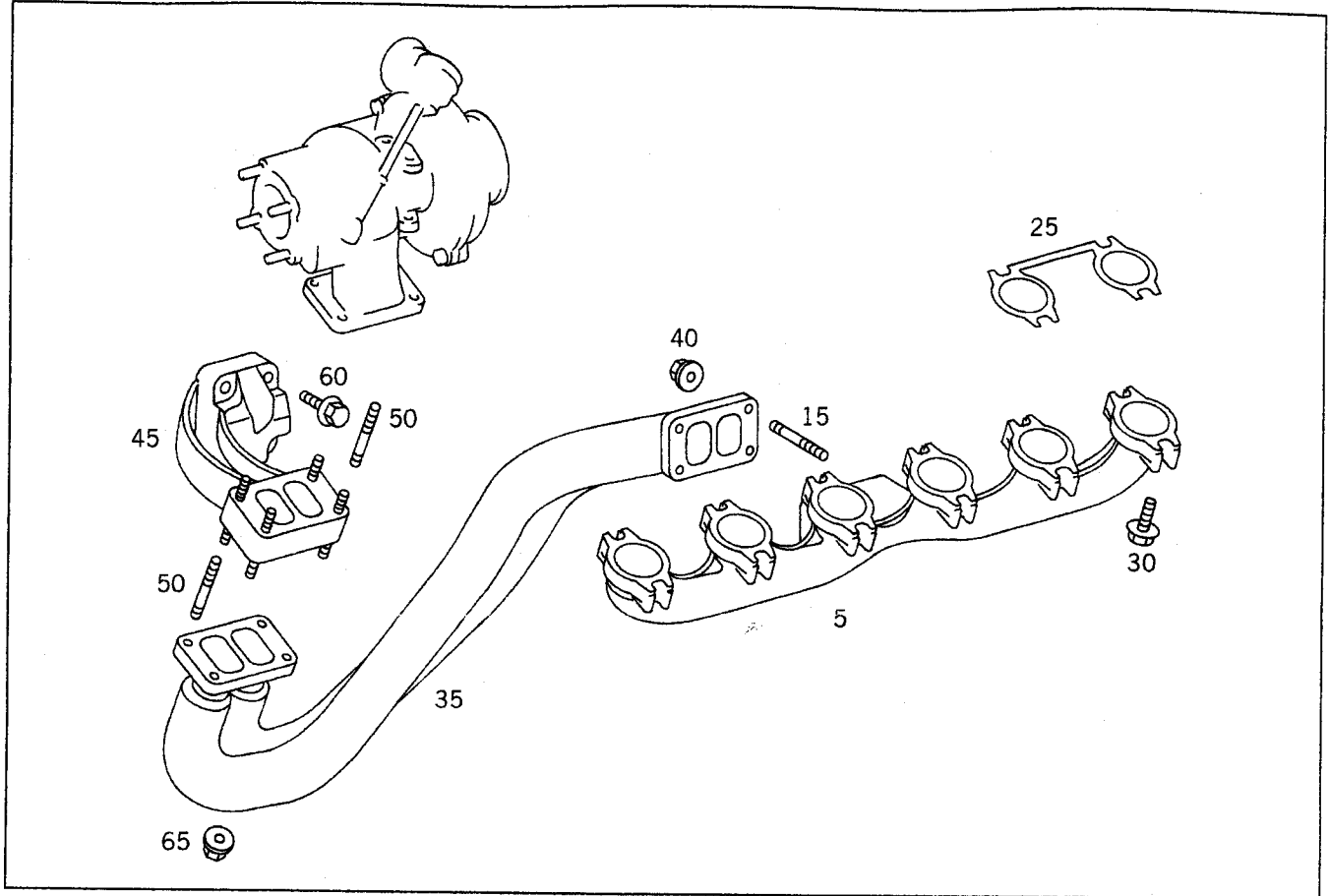
Auspuffkrümmer
Exhaust Manifold
Collecteur d'échappement
Collettore scarico

Colector de escape
Colector de escape
колесо выпускного трубопровода
العام انشعب

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

14 030 00250



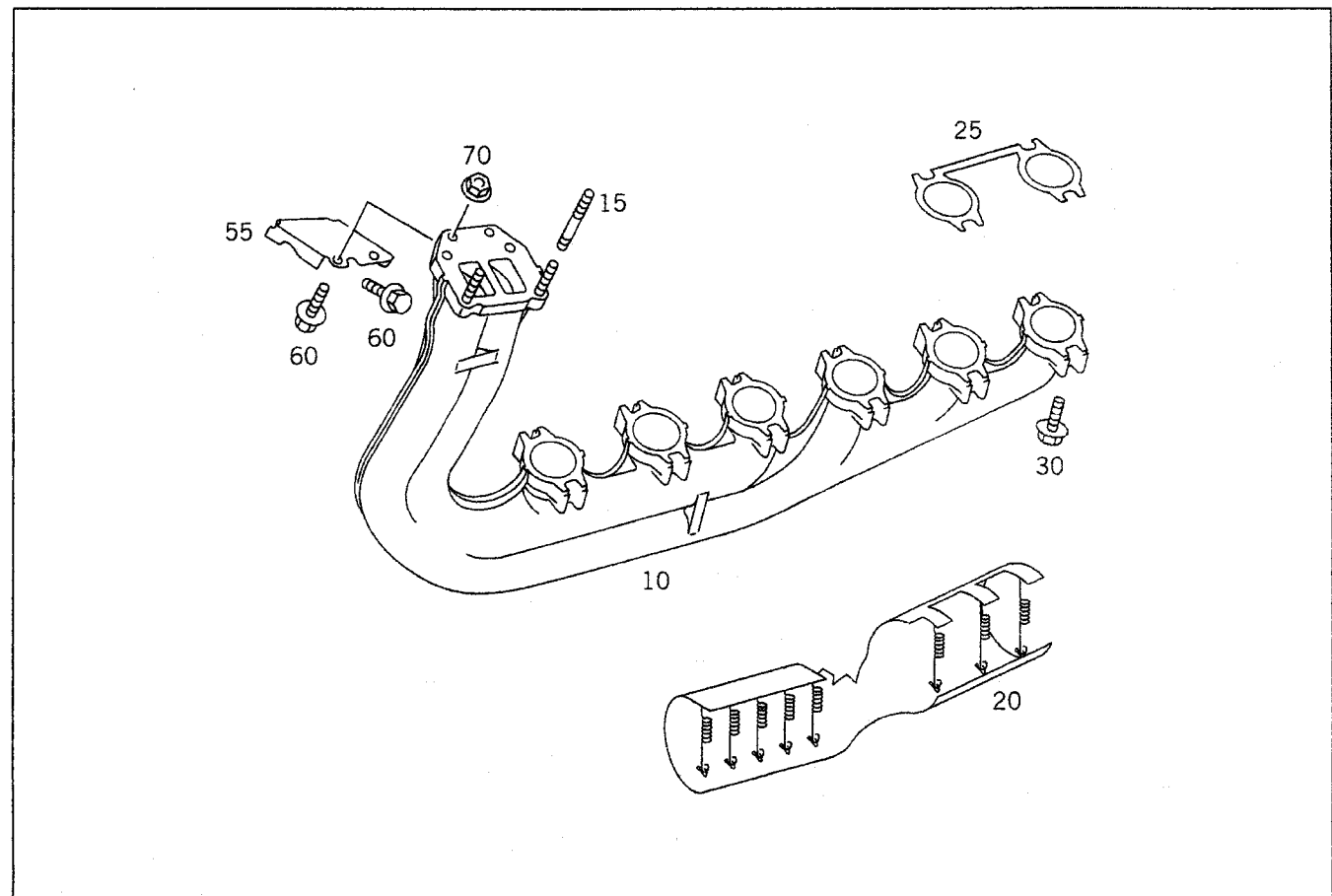
Auspuffkrümmer
Exhaust Manifold
Collecteur d'échappement
Collettore scarico

Colector de escape
Colector de escape
колесо выпускного трубопровода
العام انشعب

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

14 030 00233



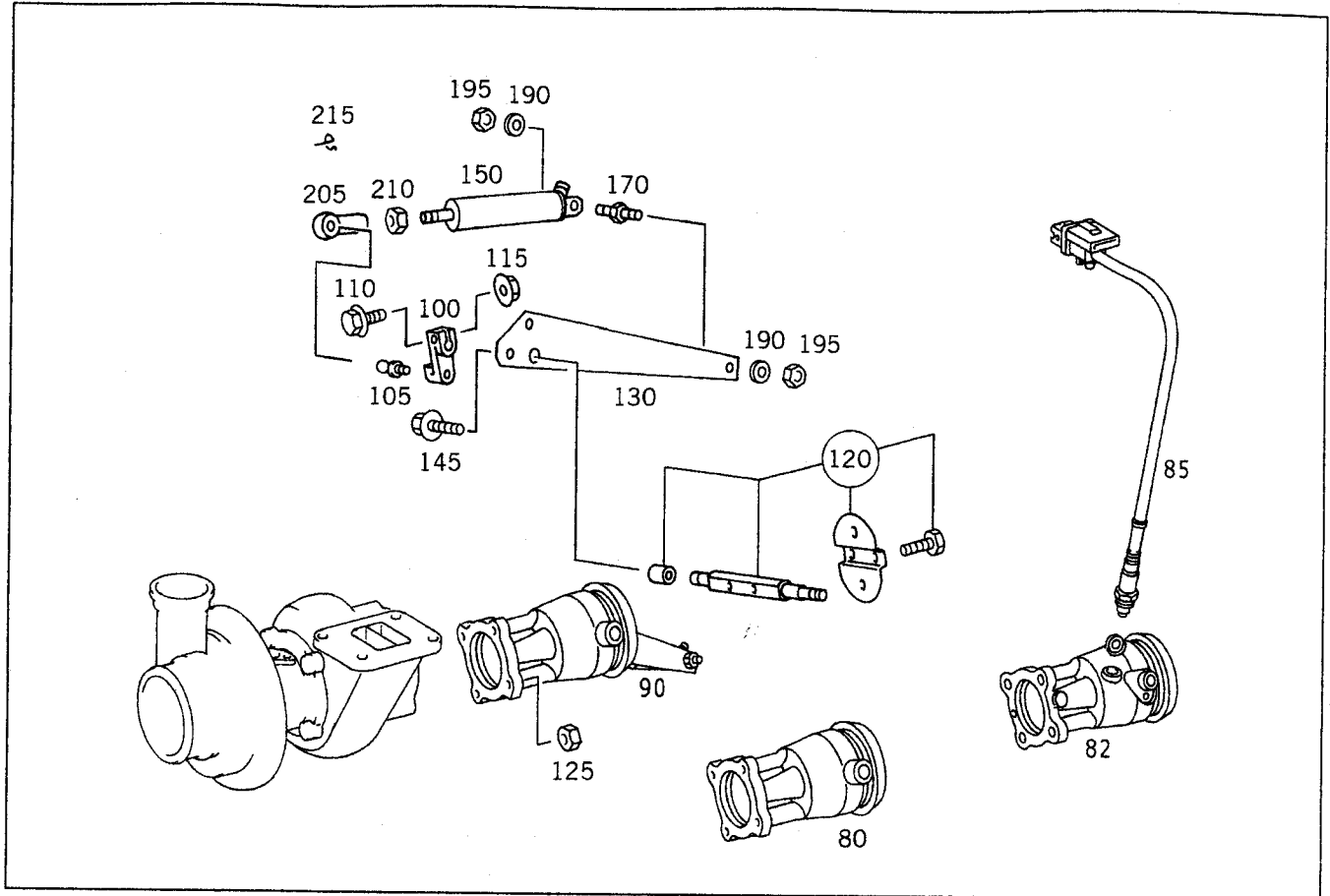
Auspuffkrümmer
Exhaust Manifold
Collecteur d'échappement
Collettore scarico

Colector de escape
Colector de escape
нолено выпускного трубопровода
العماد المشعب

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

14 030 00254



122

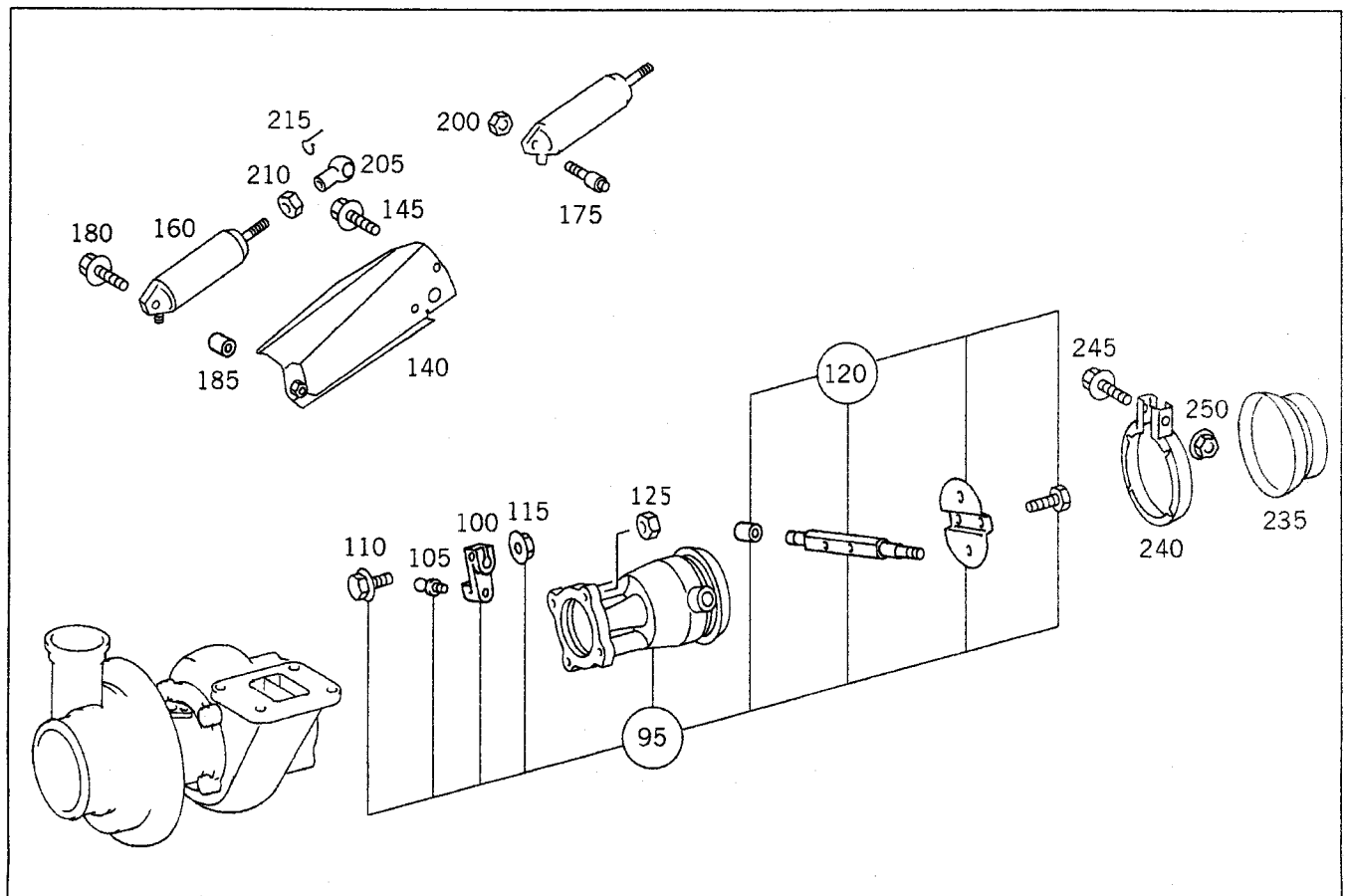
Auspuffkrümmer
Exhaust Manifold
Collecteur d'échappement
Collettore scarico

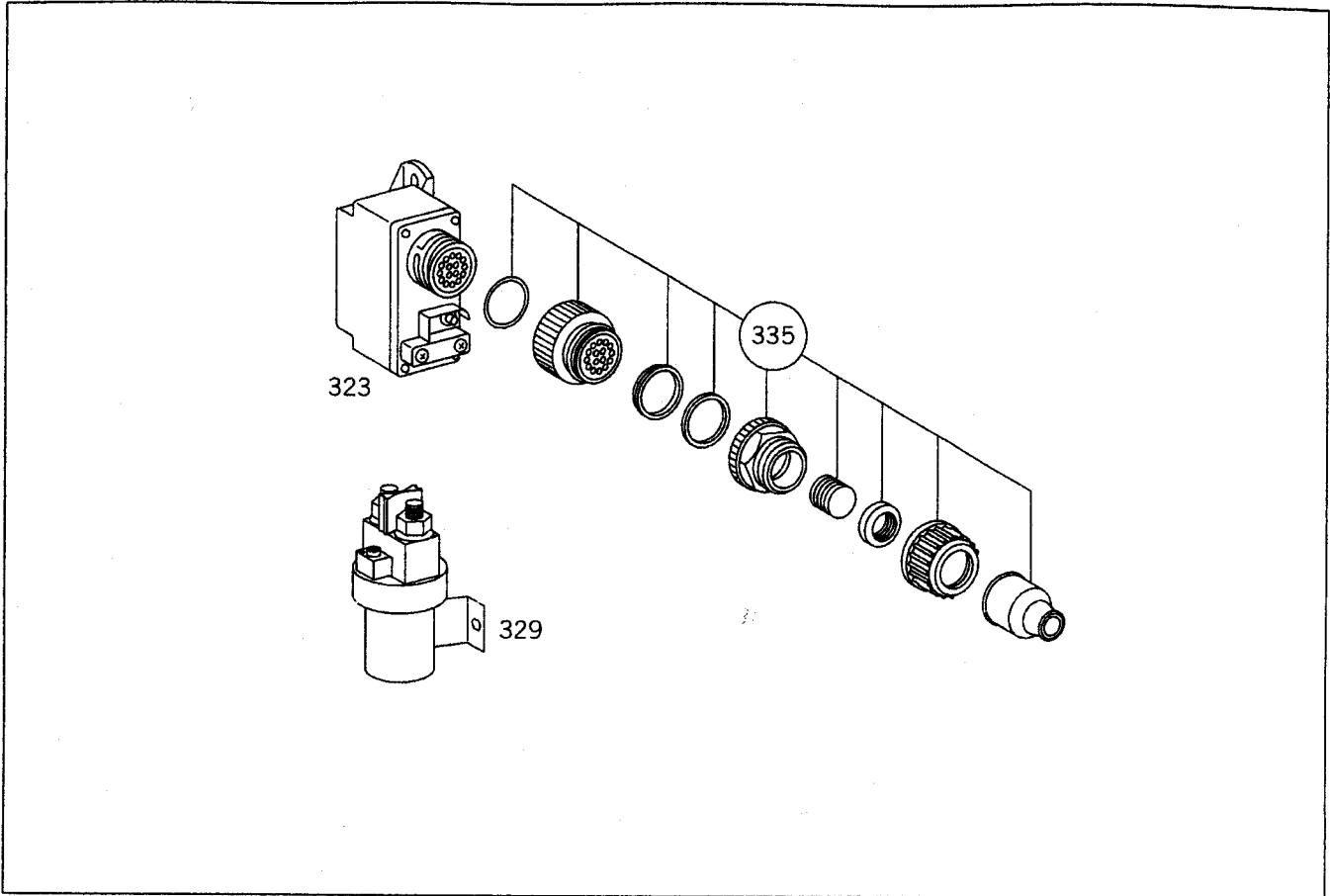
Colector de escape
Colector de escape
нолено выпускного трубопровода
العماد المشعب

Gruppe
Group
Groupe
Gruppo

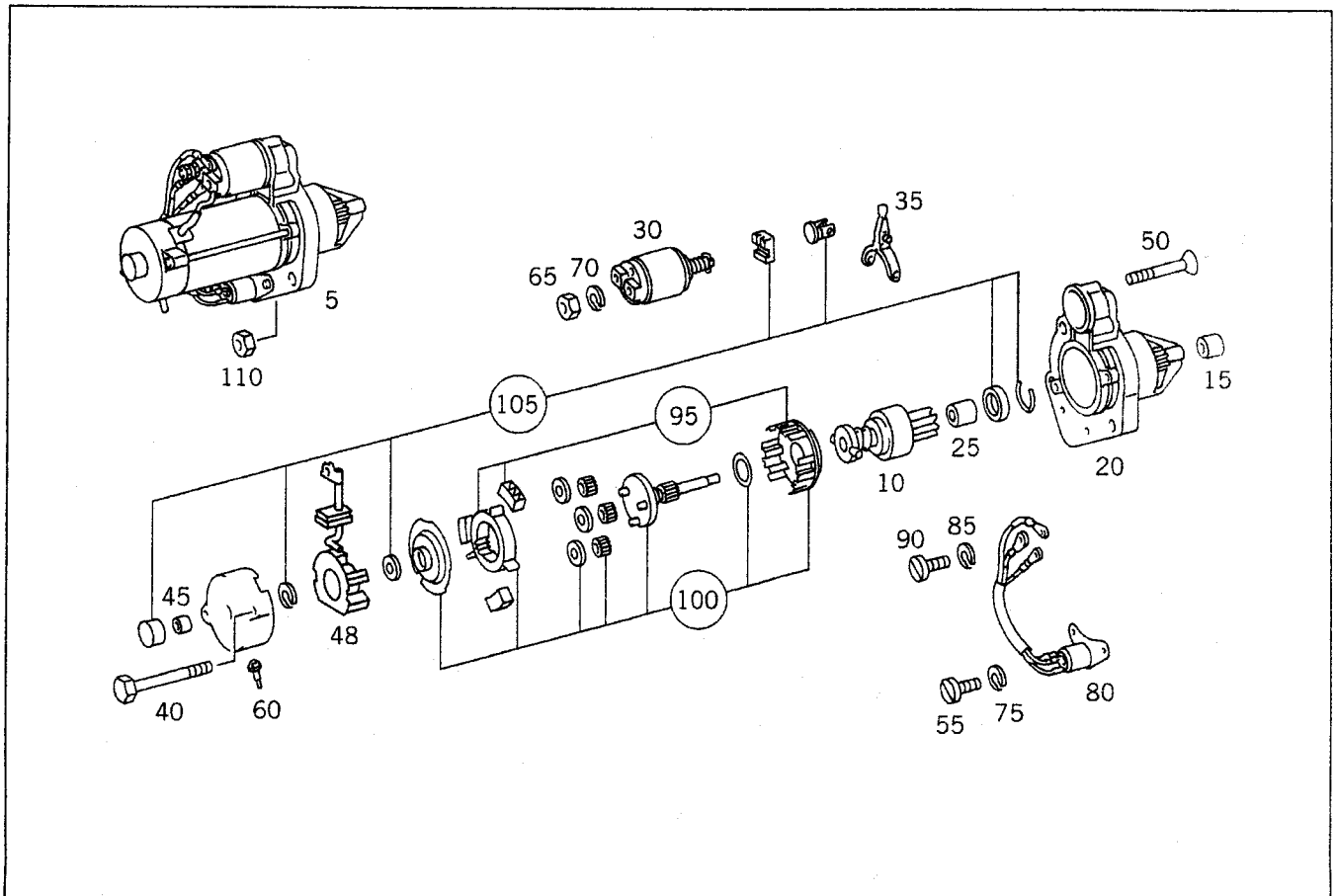
Grupo
Grupo
группа
المجموعة

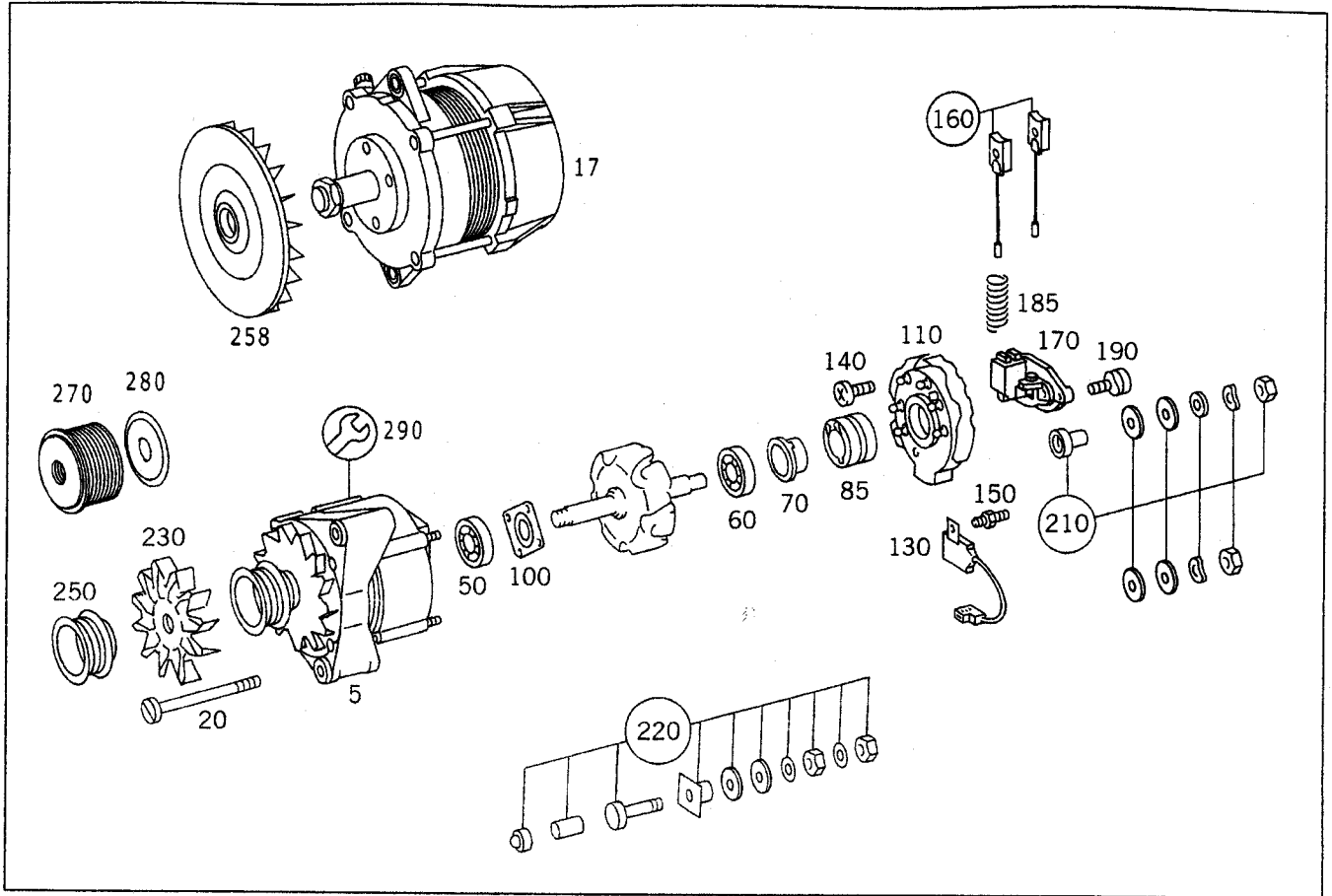
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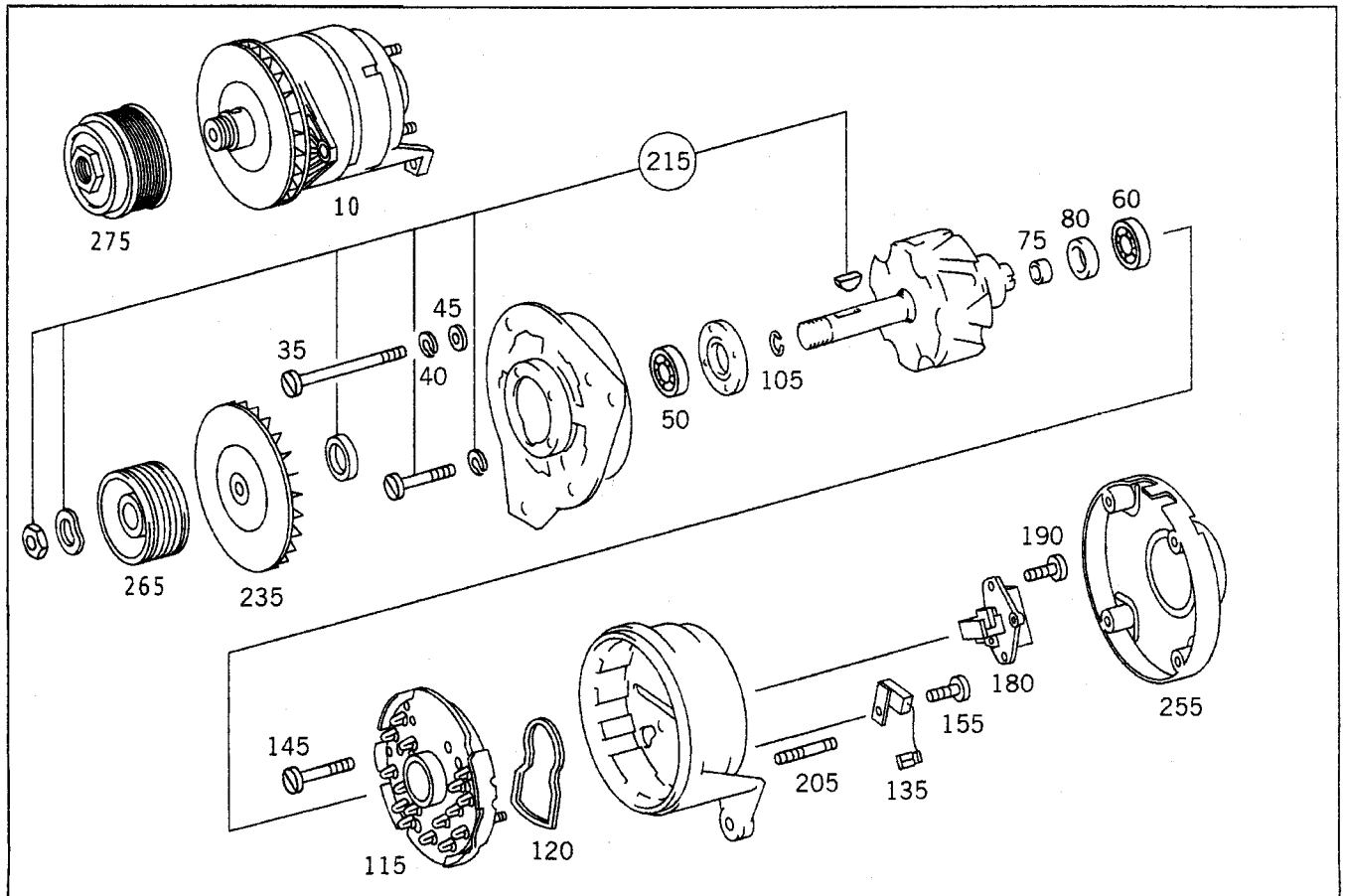


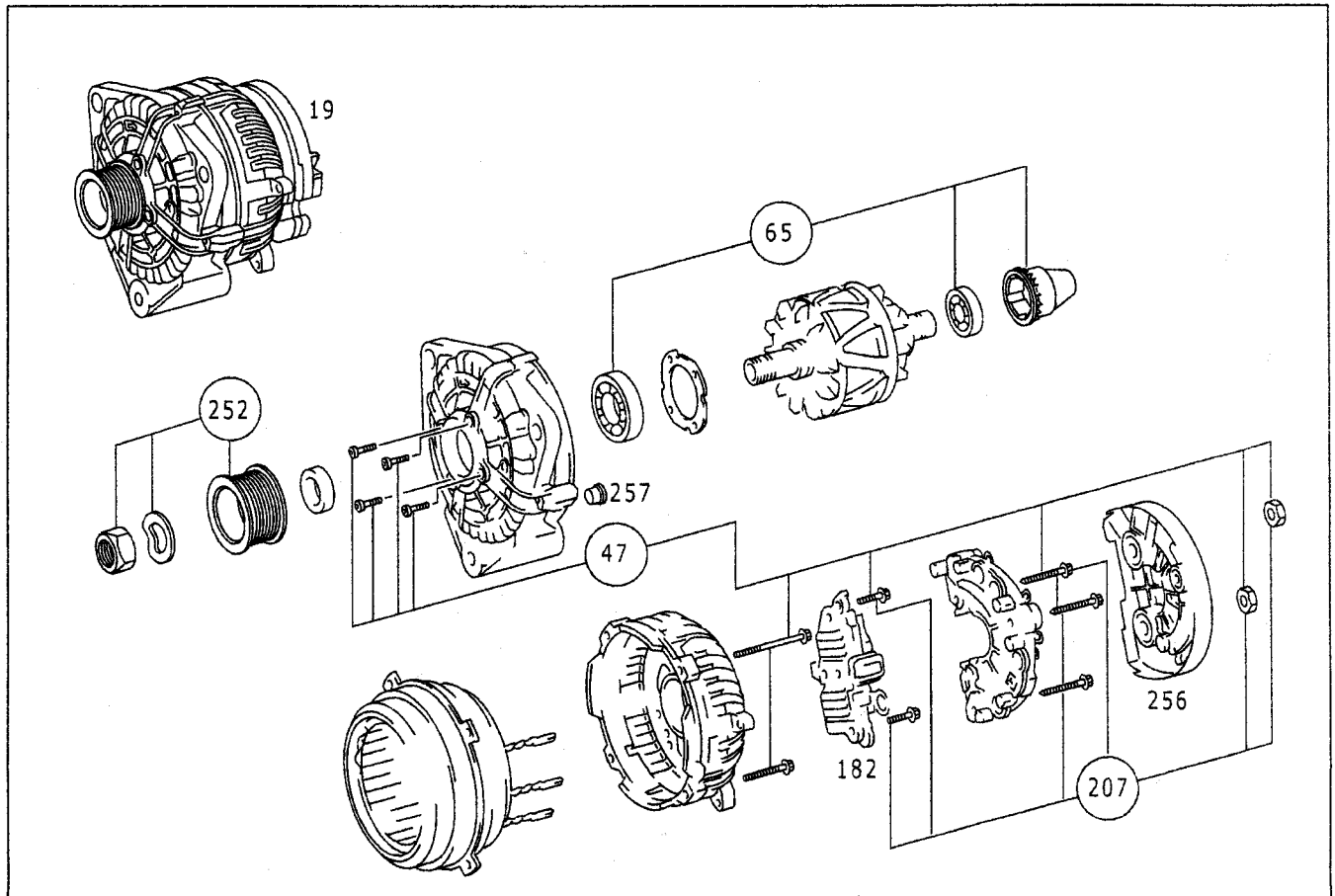
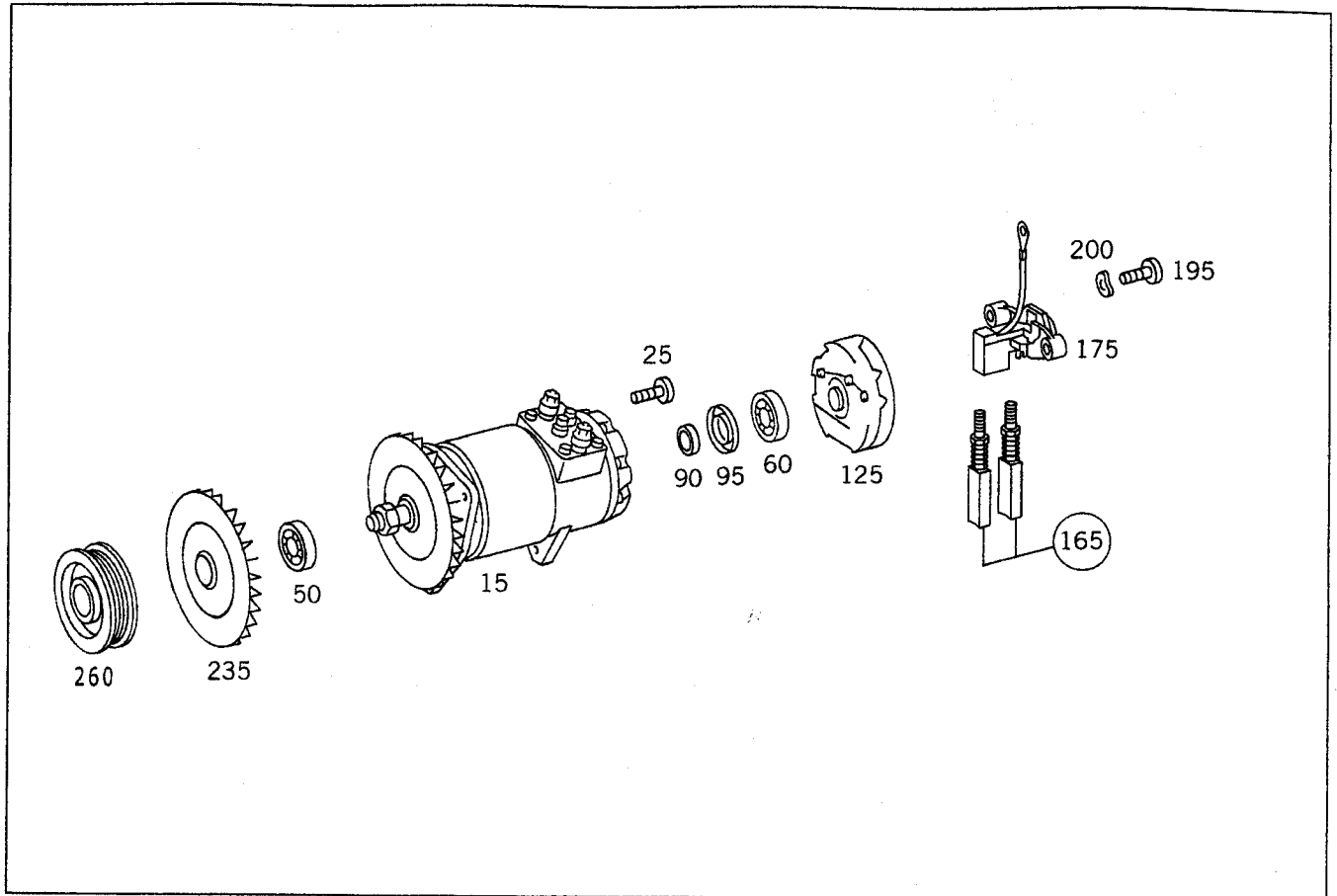
126

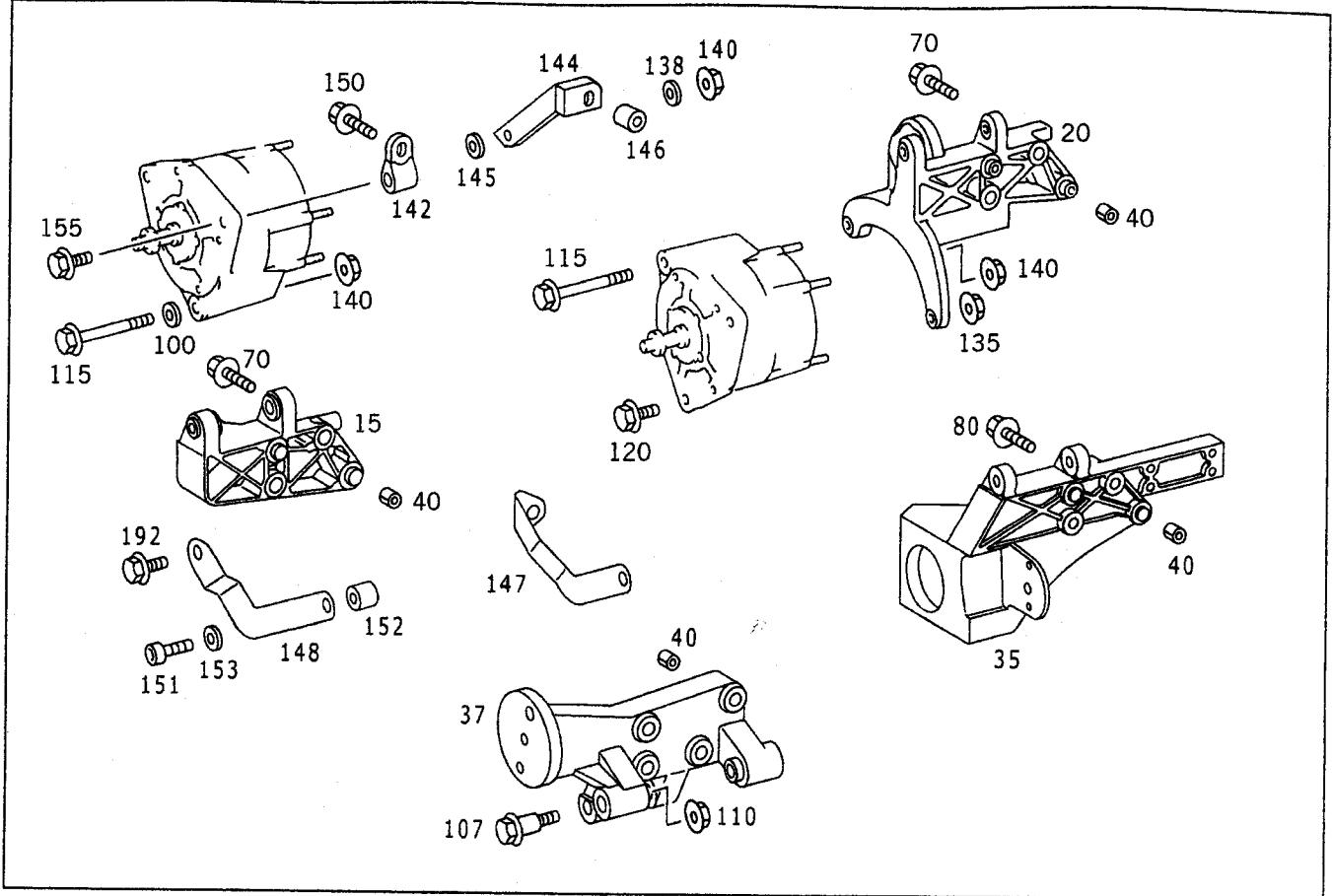




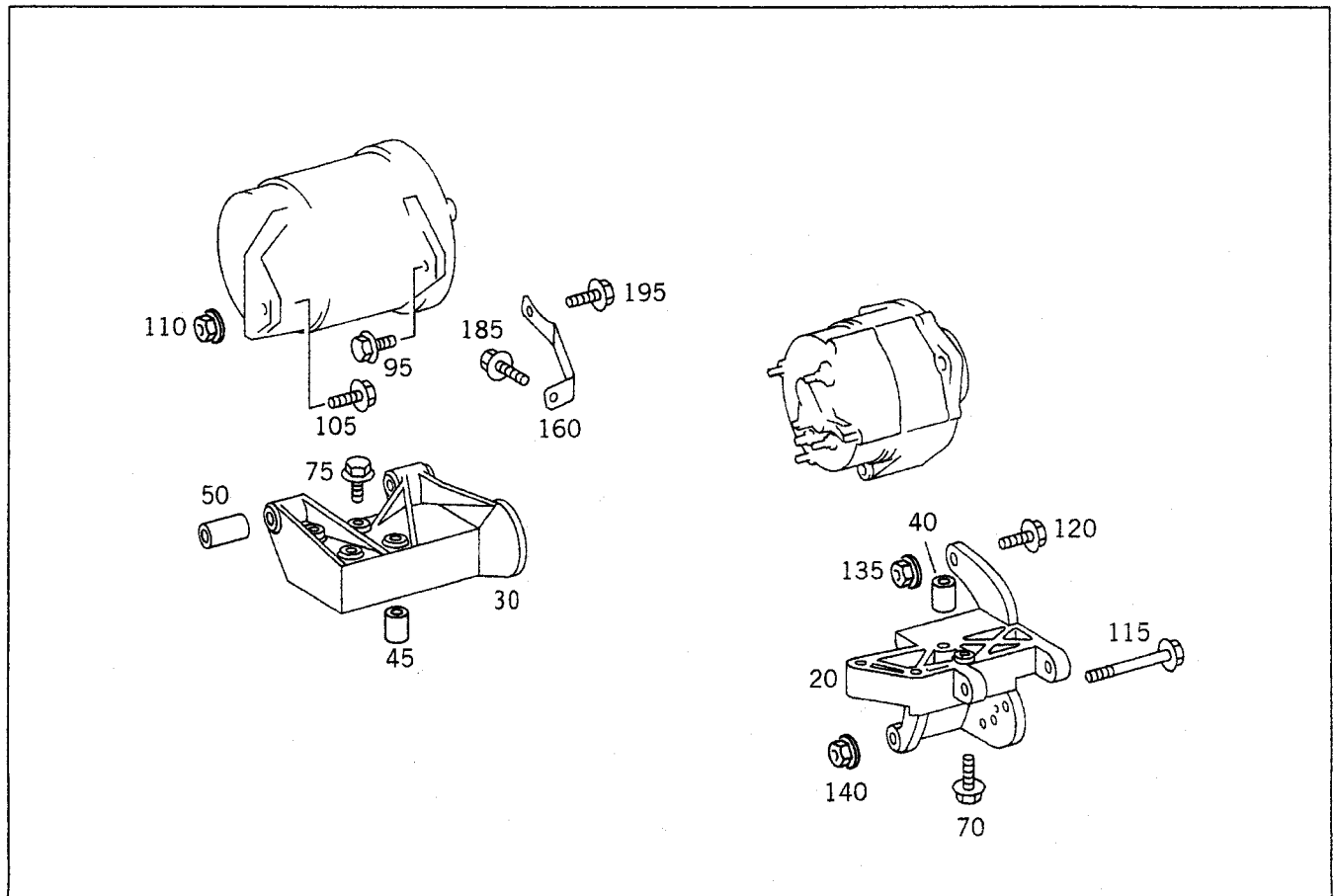
122

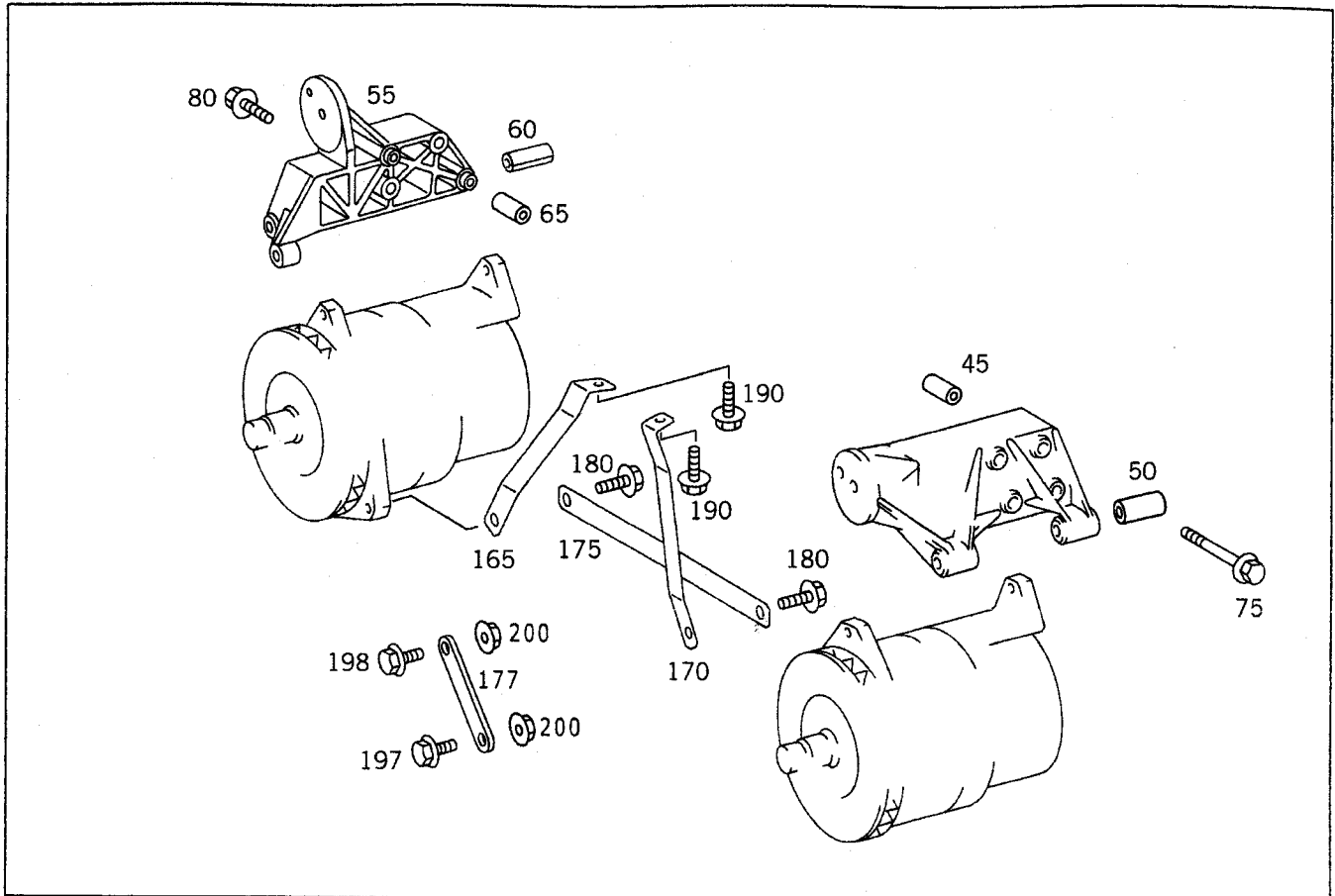




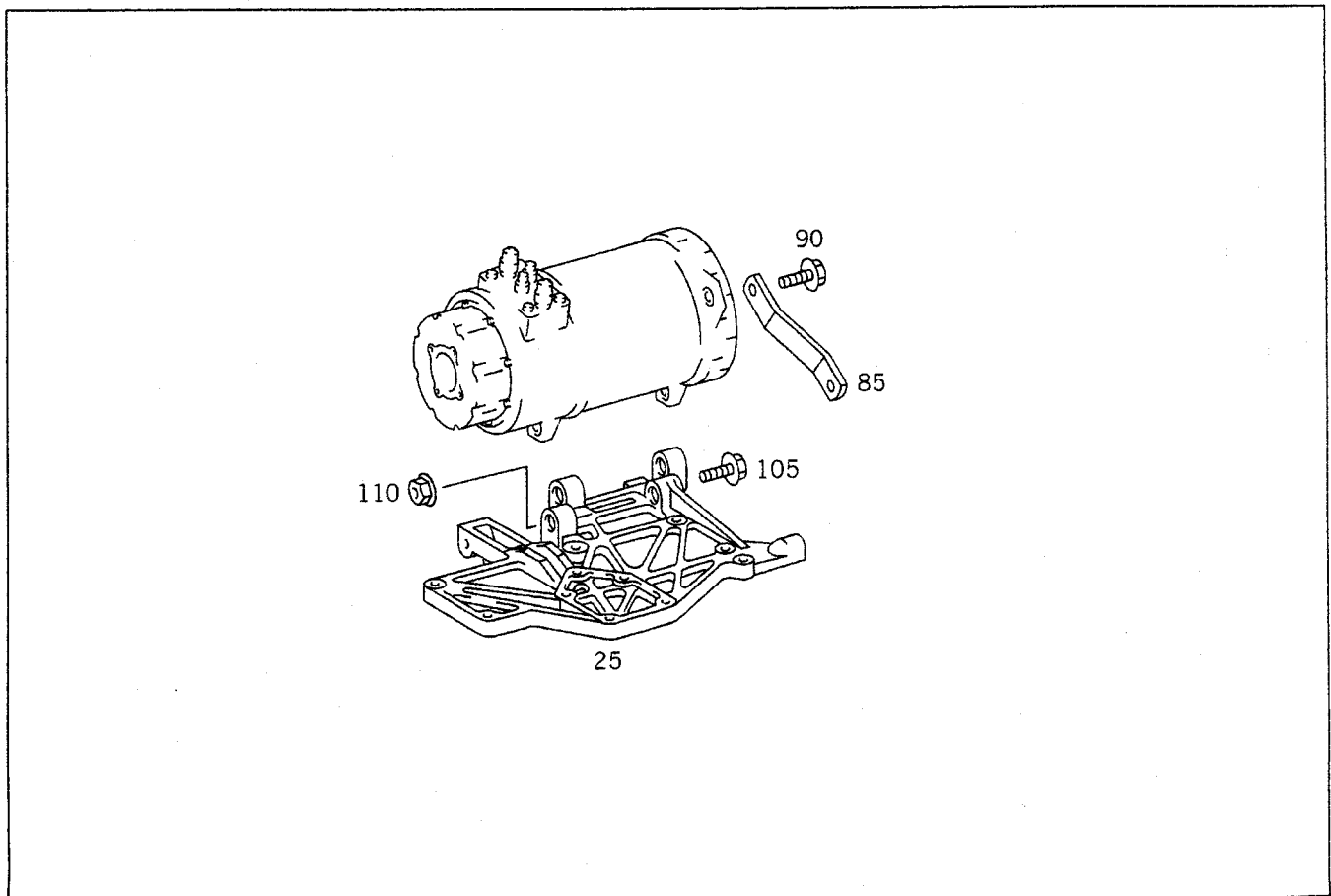


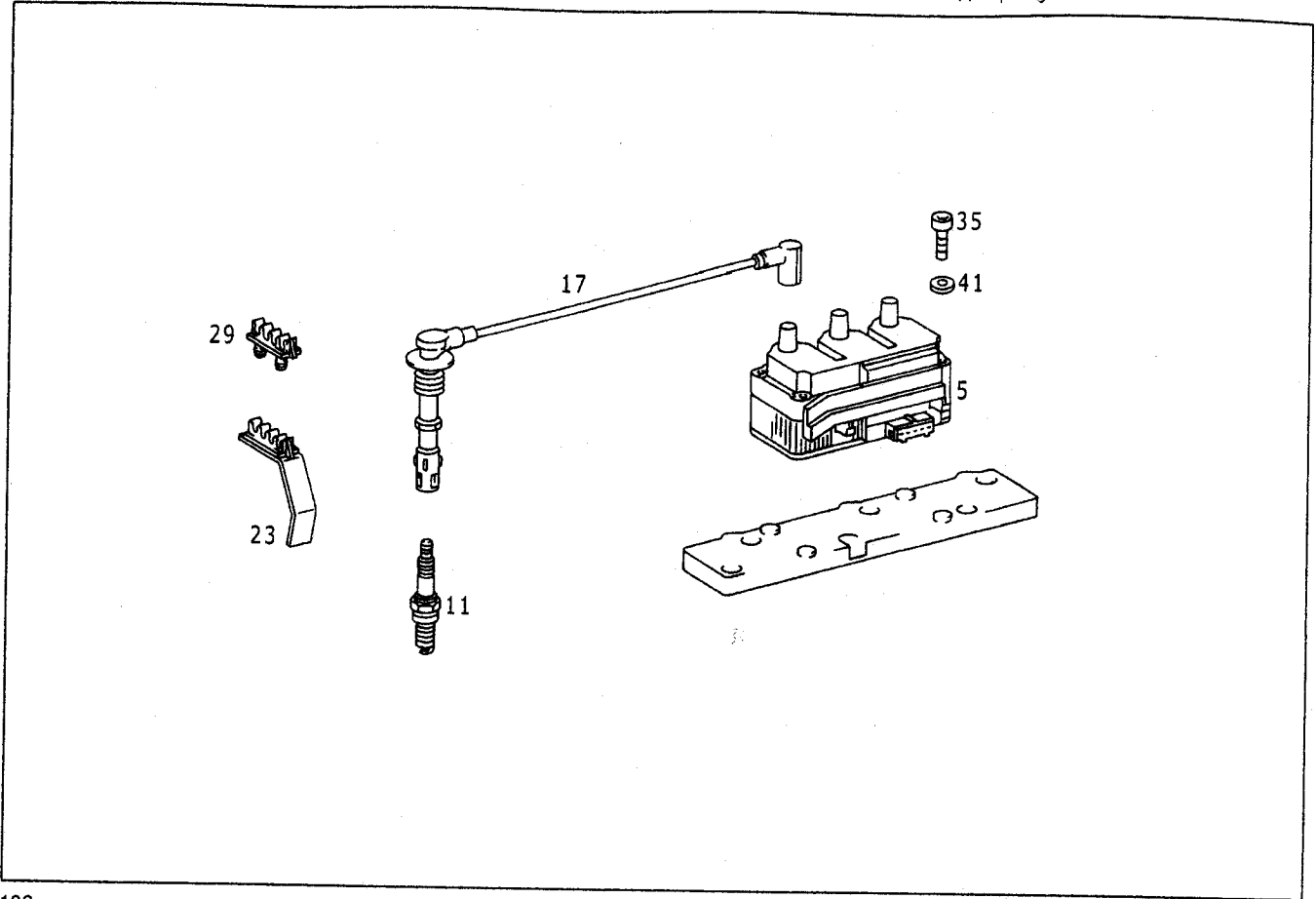
132



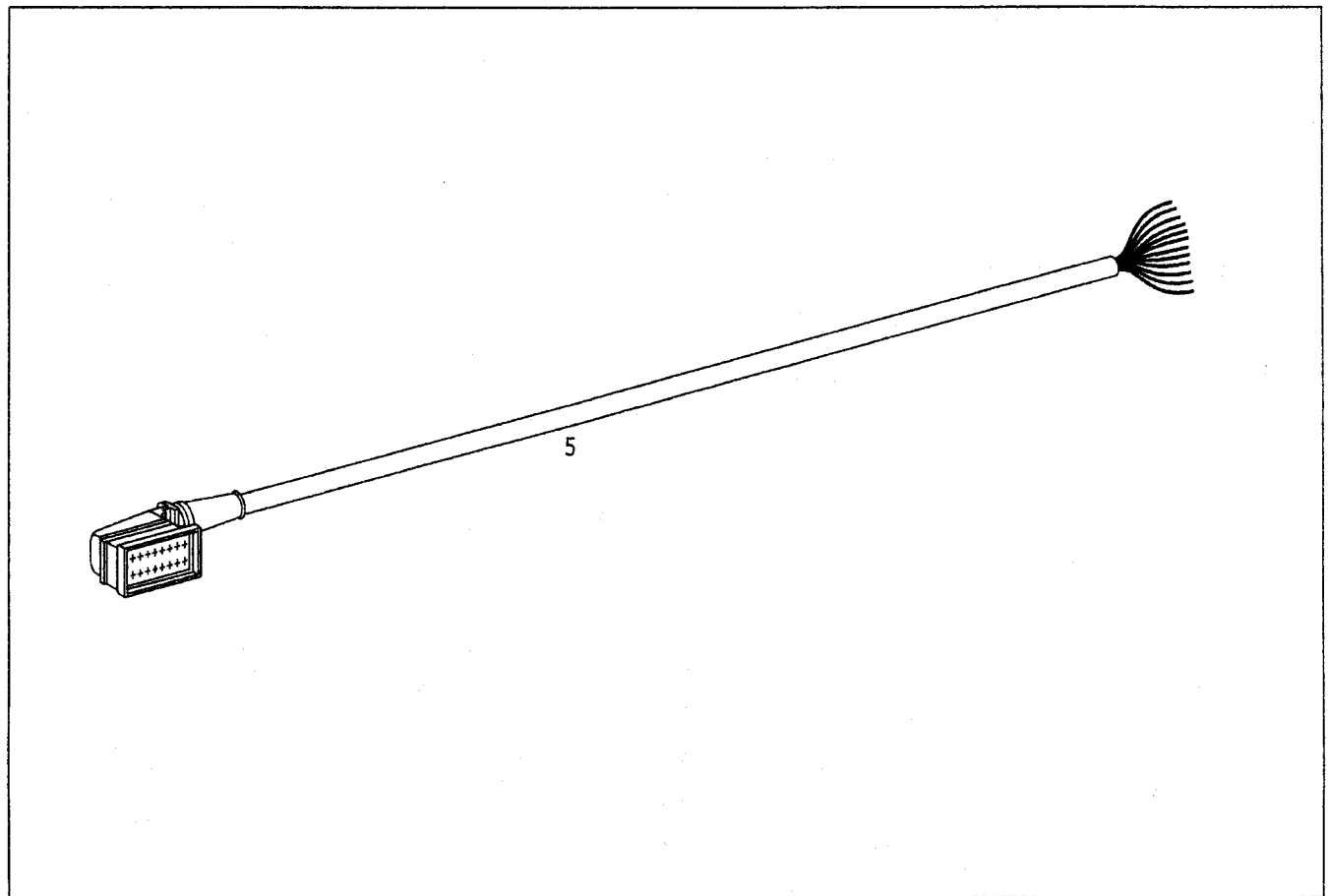


134





136



137

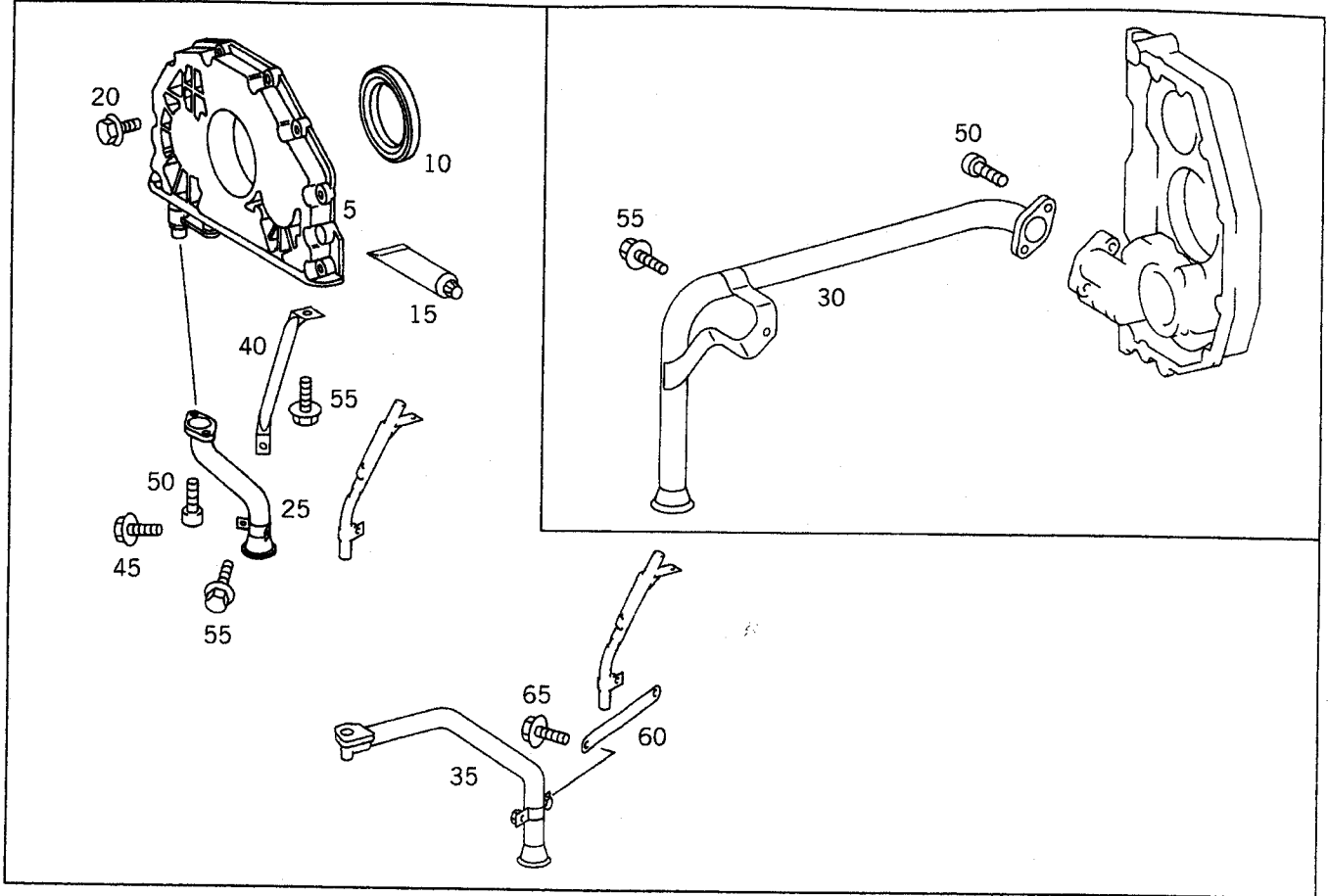
Motorschmiierung
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

Lubrificação do motor
 Lubricación del motor
 смазна двигателя
 تشحيم موتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

18 015 00156



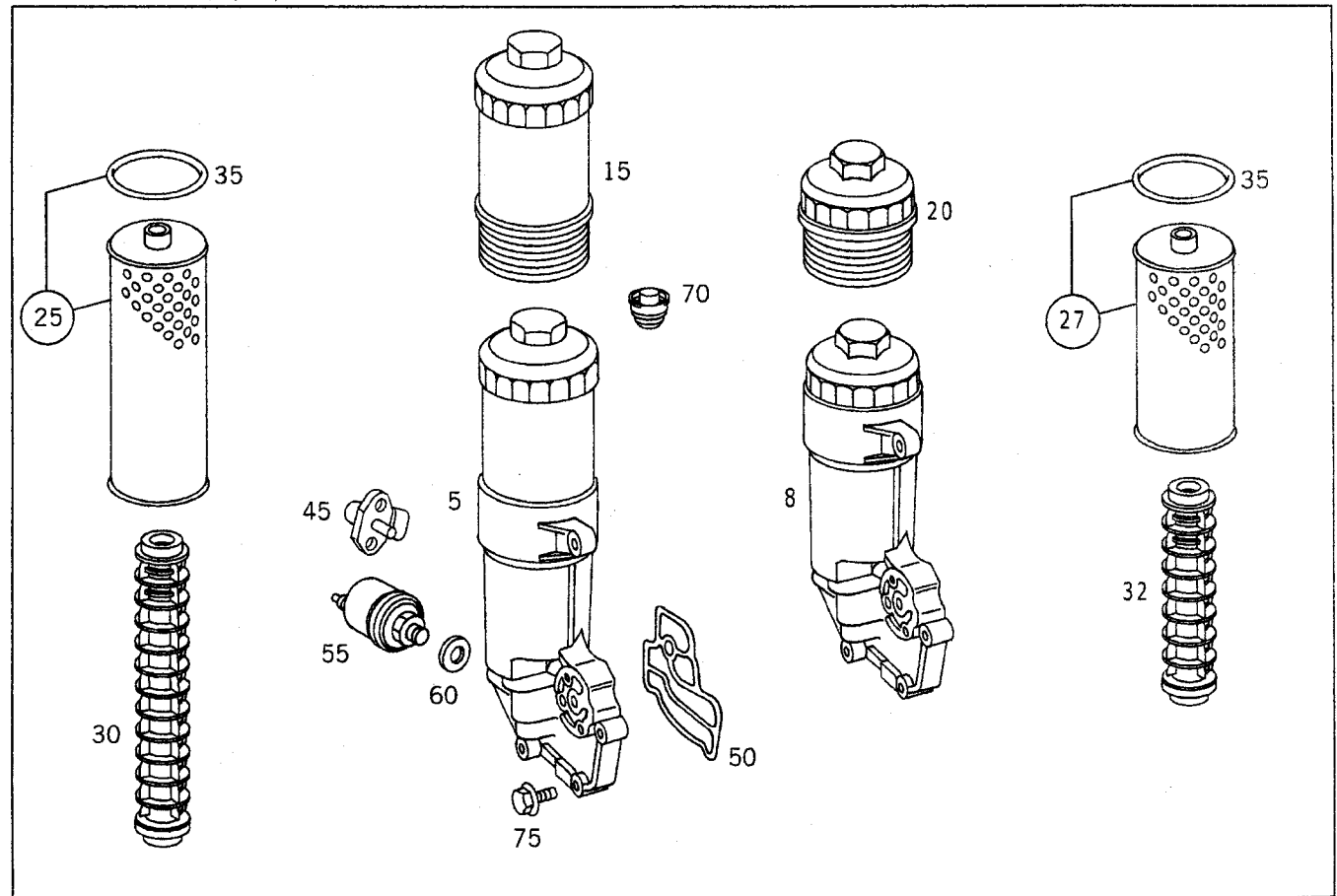
Motorschmiierung
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

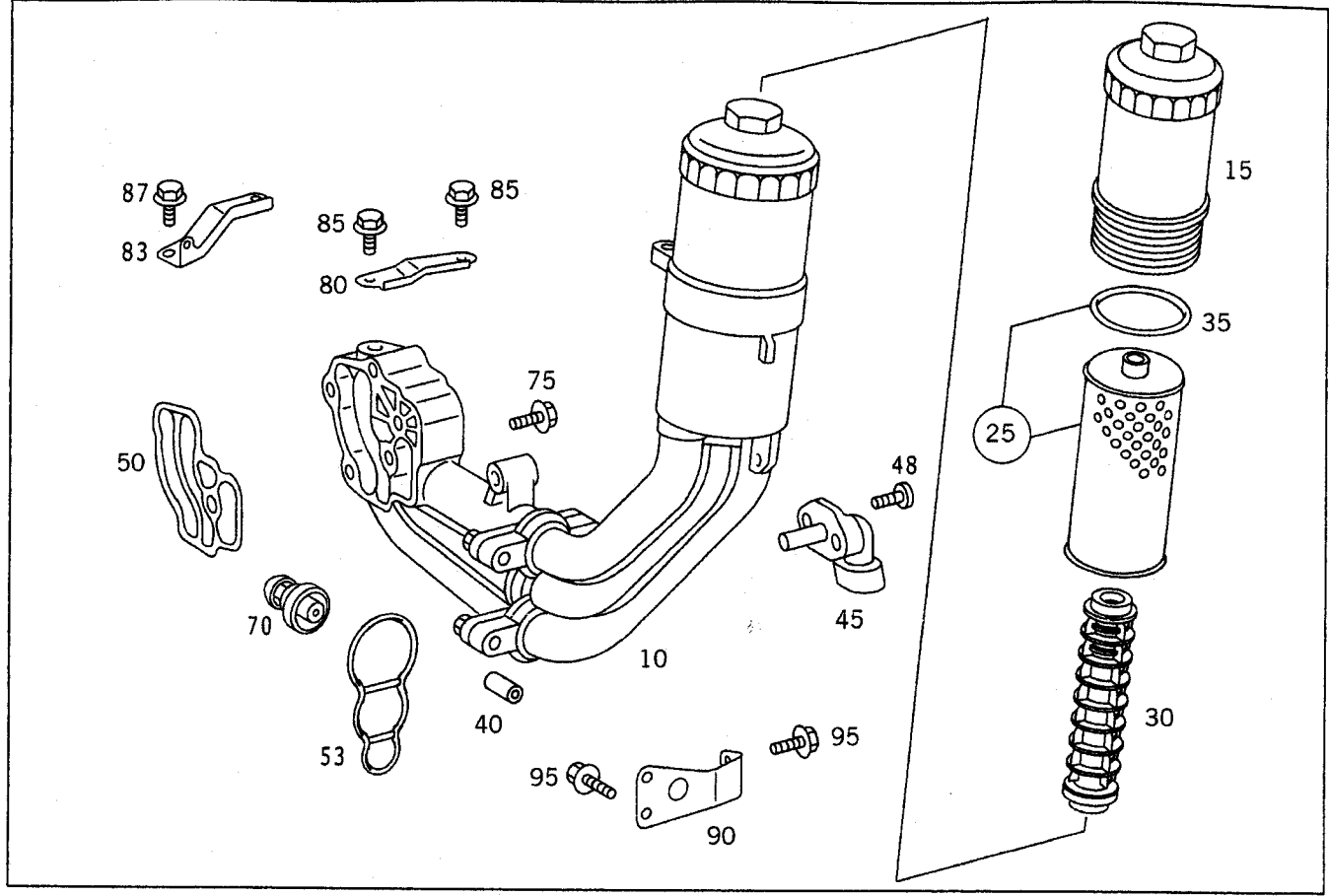
Lubrificação do motor
 Lubricación del motor
 смазна двигателя
 تشحيم موتور

Gruppe
 Group
 Groupe
 Gruppo

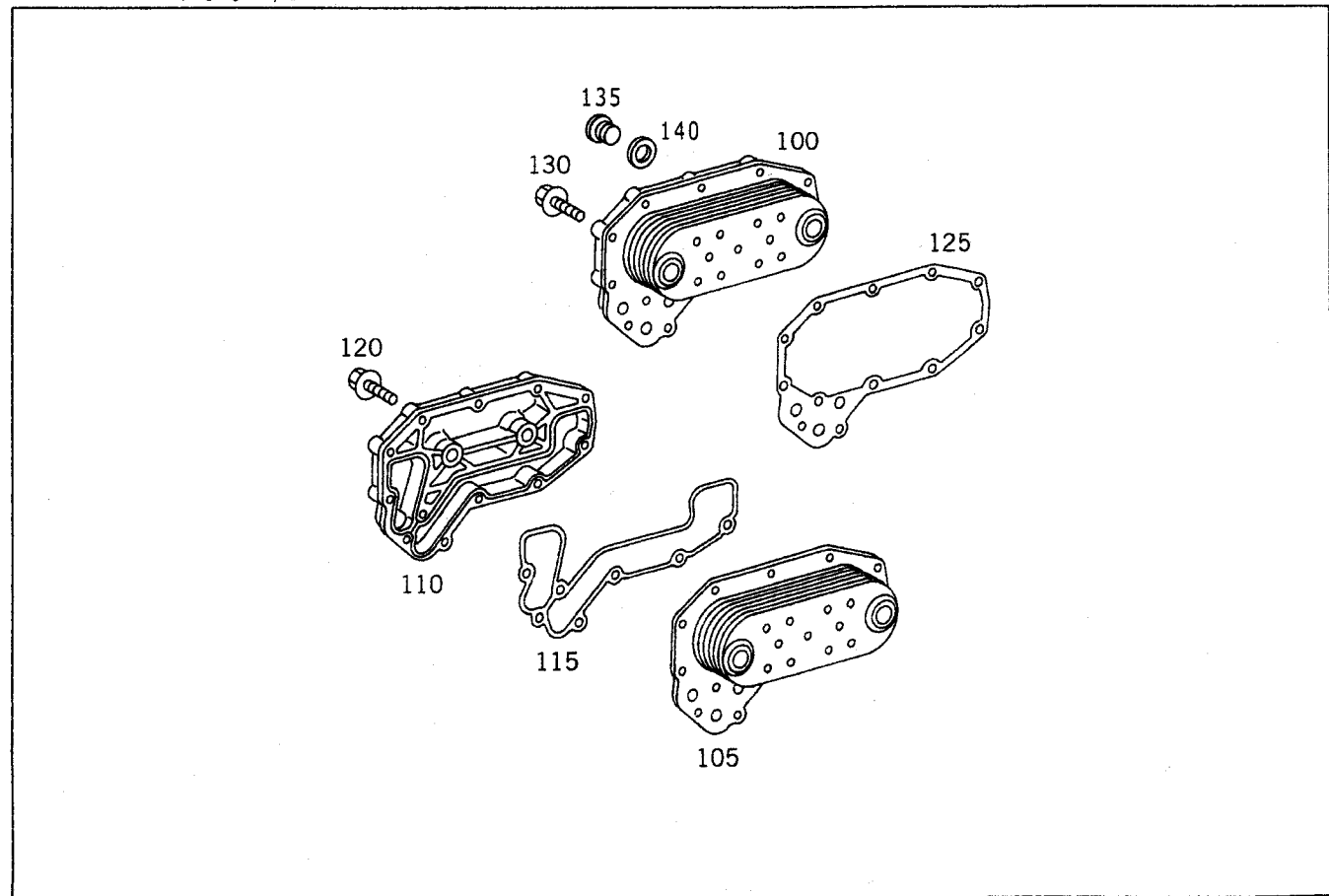
Grupo
 Grupo
 группа
 المجموعة

18 045 00251





140

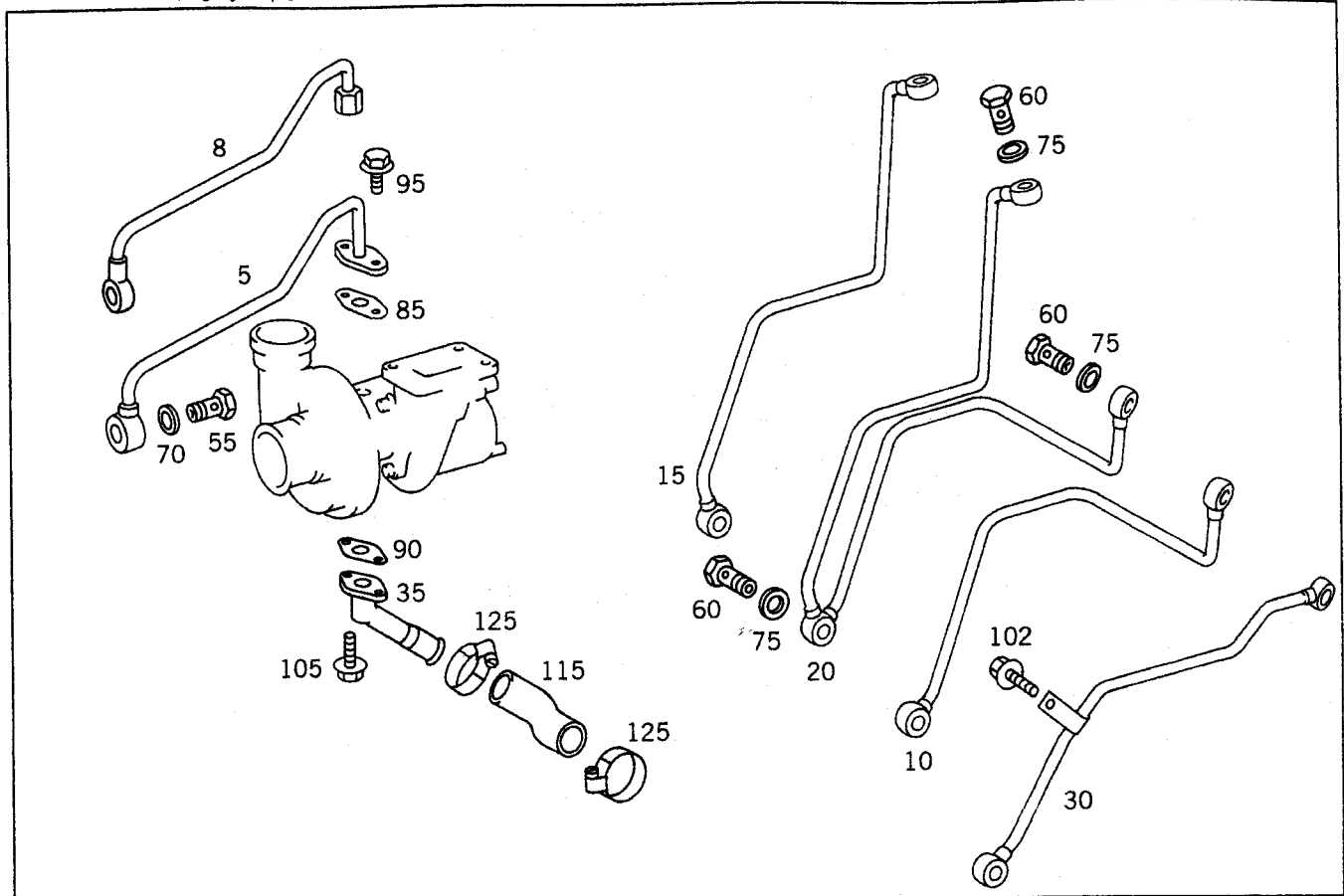


Motorschmiering
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

Lubrificação do motor
 Lubricación del motor
 смазка двигателя
 تشحيم موتور

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

18 060 00143

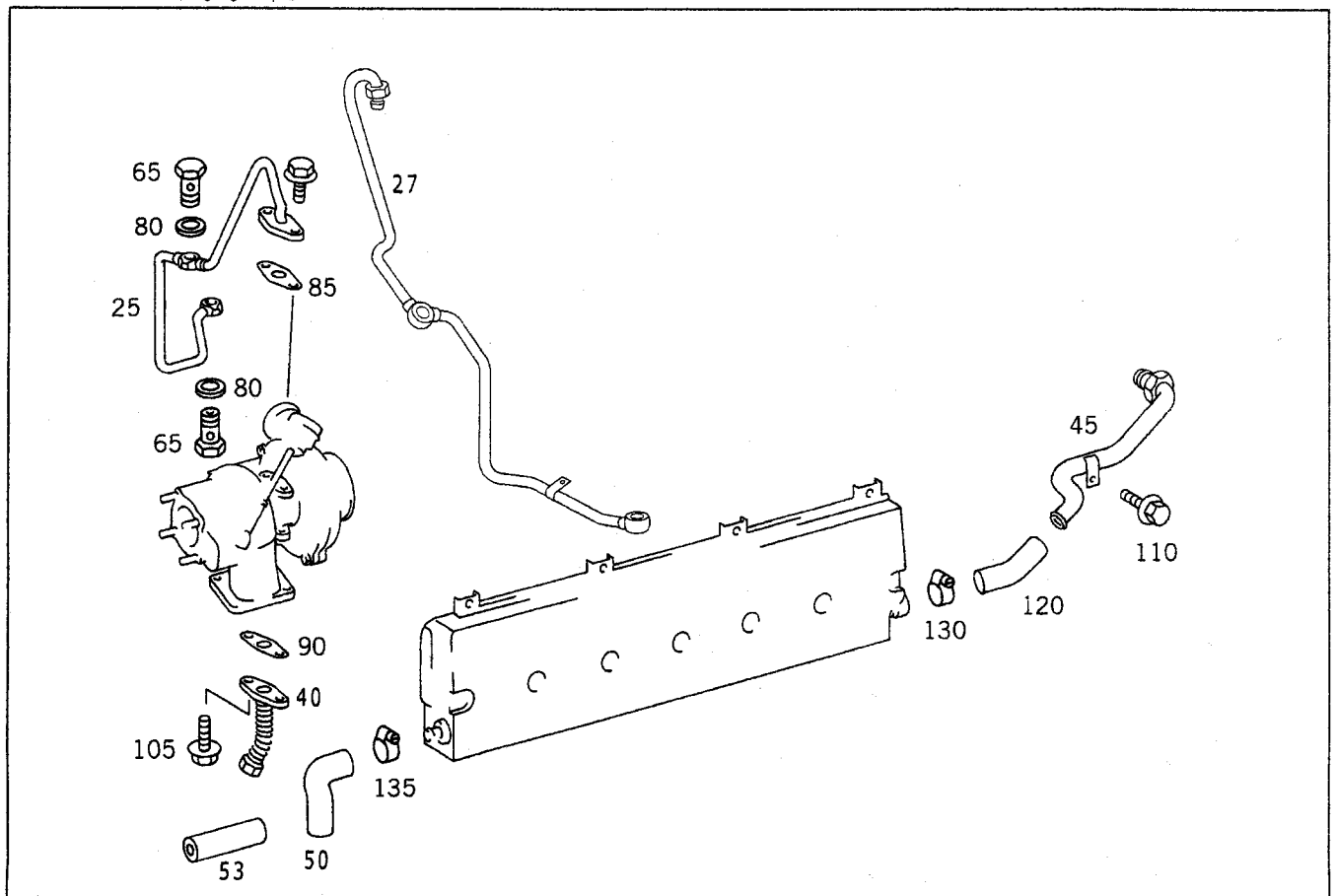


Motorschmiering
 Engine Lubrication
 Graissage du moteur
 Lubrificazione motore

Lubrificação do motor
 Lubricación del motor
 смазка двигателя
 تشحيم موتور

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

18 060 00144



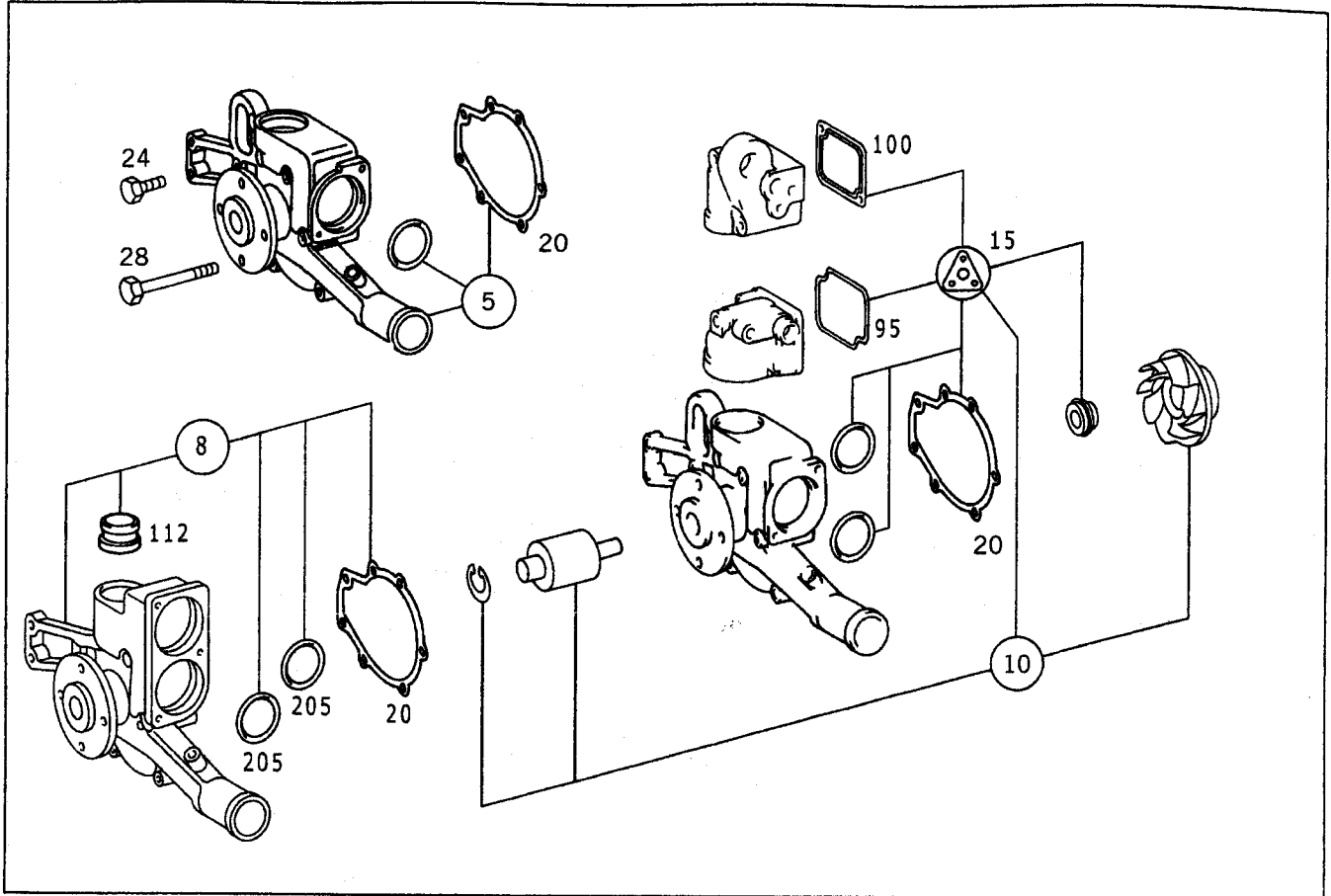
Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeração do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

20 015 00387



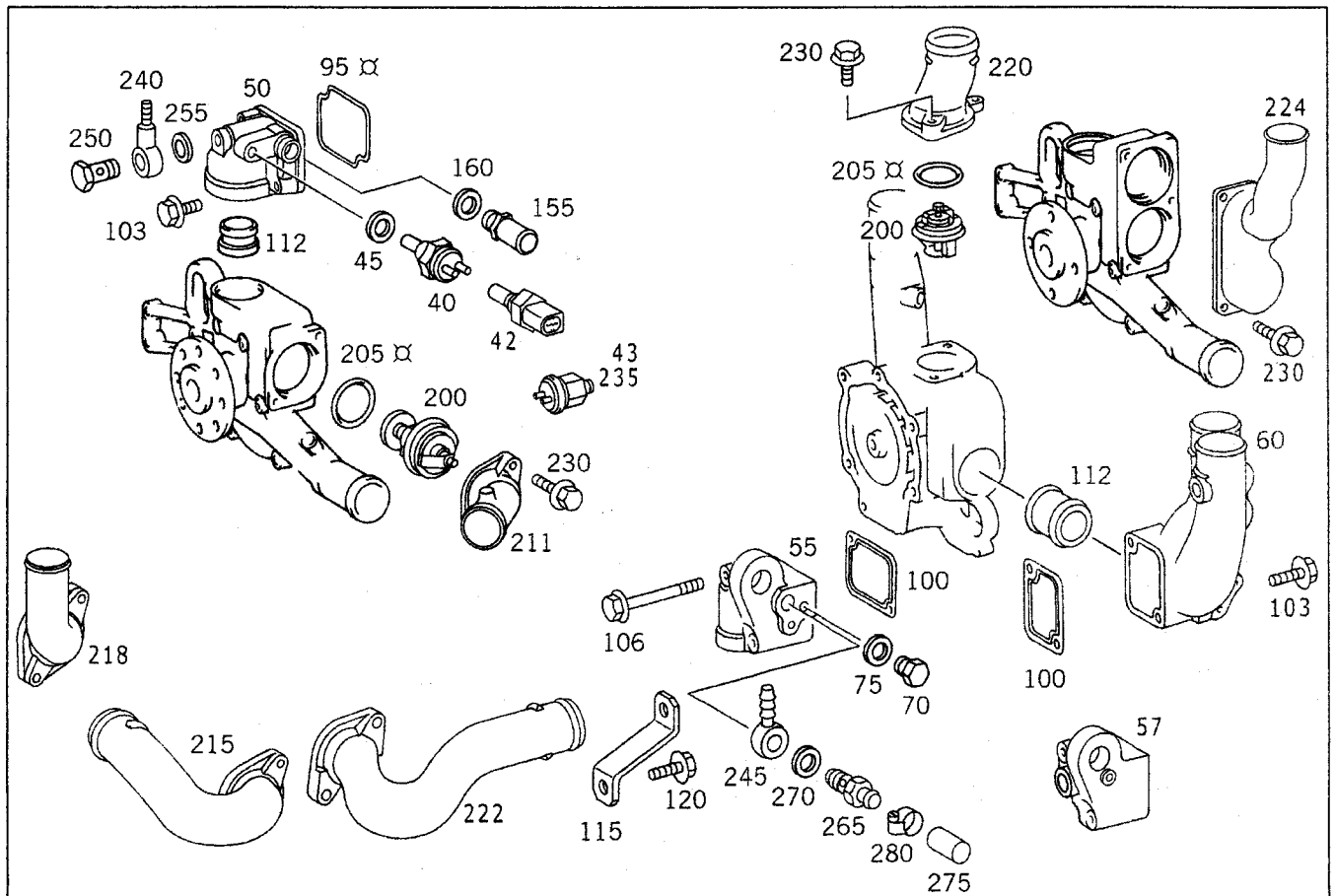
Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeração do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

20 015 00317

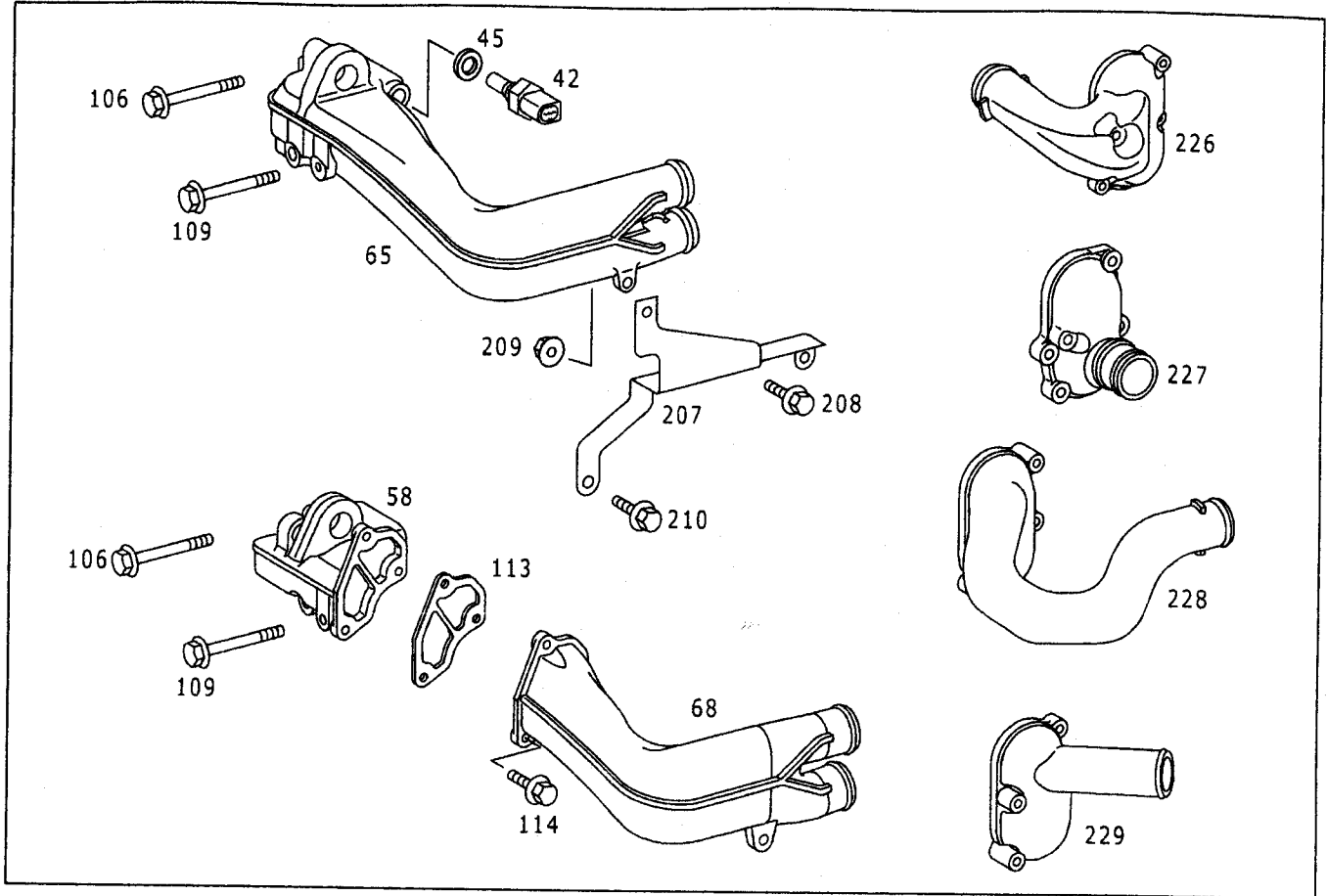


Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeración do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

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

20 015 00400

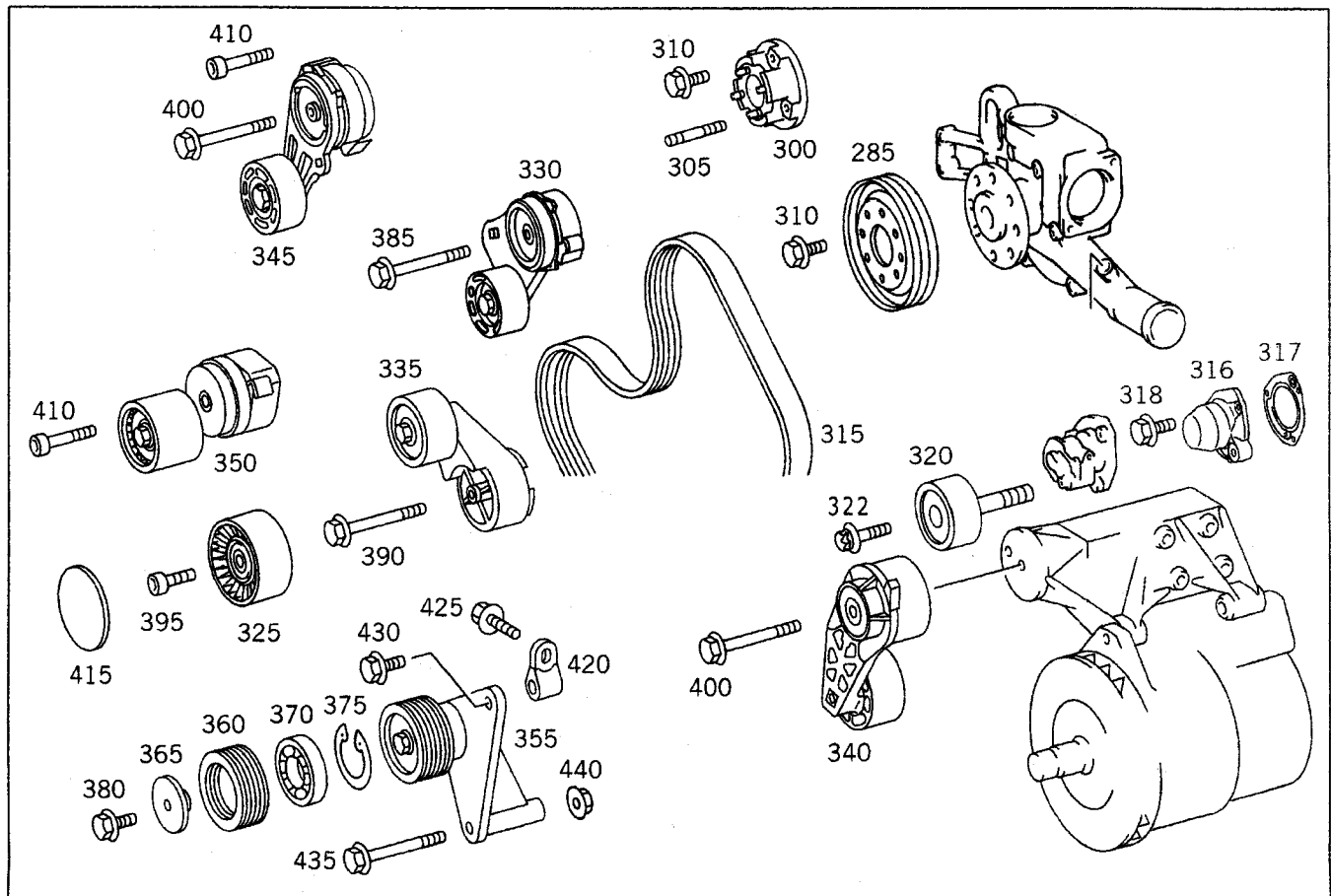


Motorkühlung
 Engine Cooling System
 Refroidissement du moteur
 Raffreddamento motore

Refrigeración do motor
 Refrigeración del motor
 охлаждение двигателя
 تبريد الموتور

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

20 015 00327



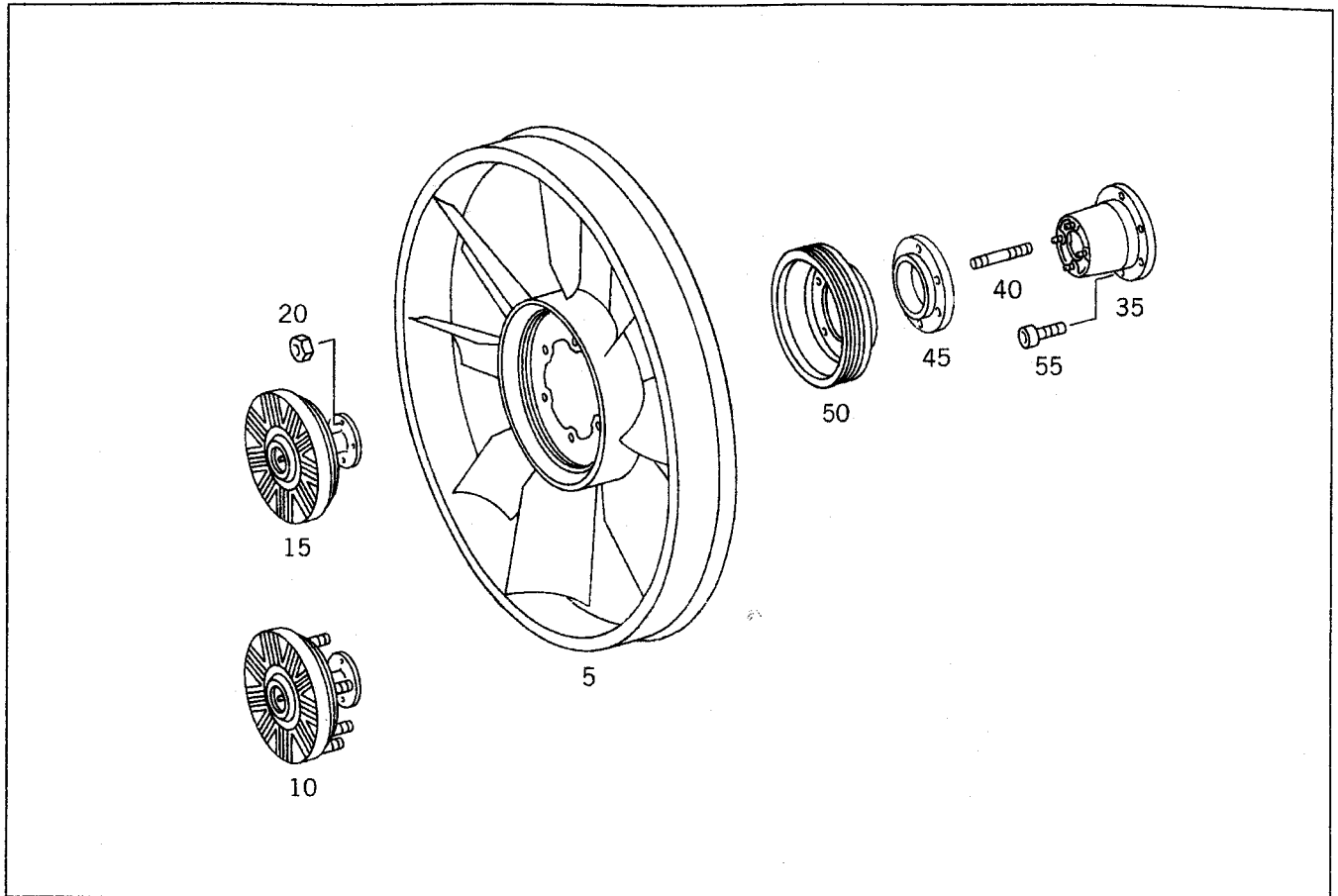
Motorkühlung
Engine Cooling System
Refrondissement du moteur
Raffreddamento motore

Refrigeração do motor
Refrigeración del motor
охлаждение двигателя
تبريد الموتور

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

20 030 00133



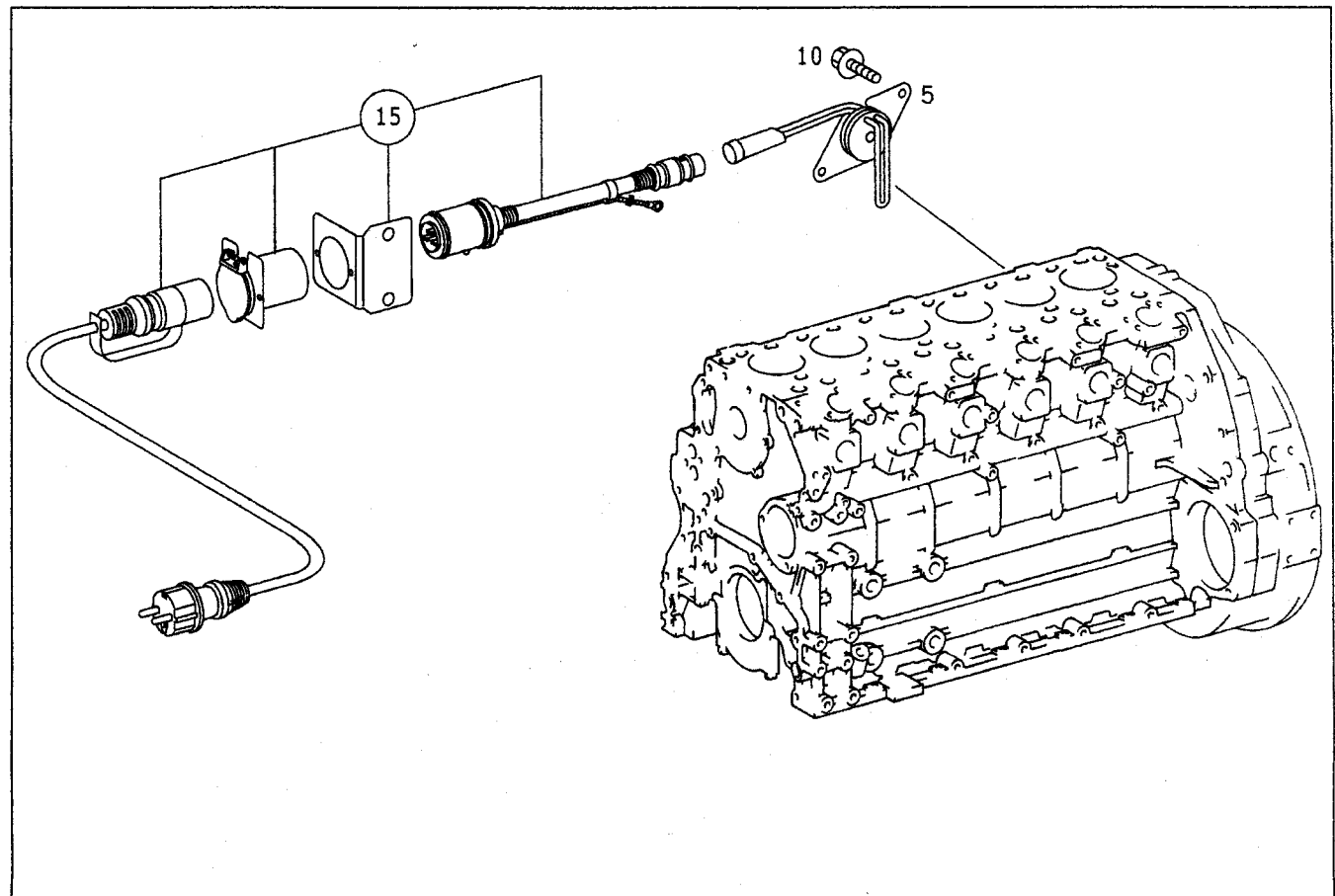
Motorkühlung
Engine Cooling System
Refrondissement du moteur
Raffreddamento motore

Refrigeração do motor
Refrigeración del motor
охлаждение двигателя
تبريد الموتور

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

20 100 00007



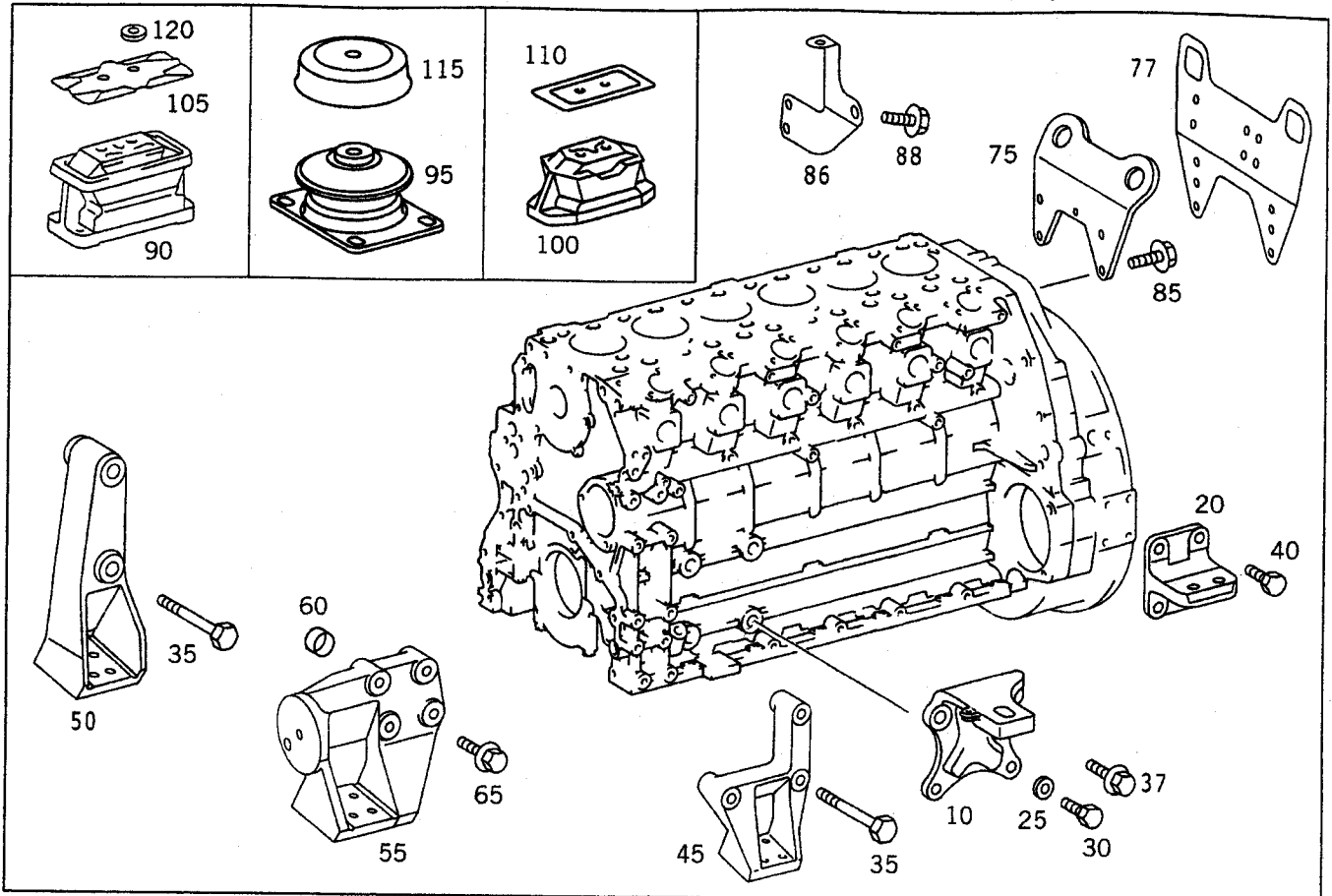
Motoraufhängung
 Engine Suspension
 Suspension du moteur
 Sospensione del motore

Suspensão do motor
 Suspensión del motor
 подвесна двигателя
 حمالات الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

22 015 00110



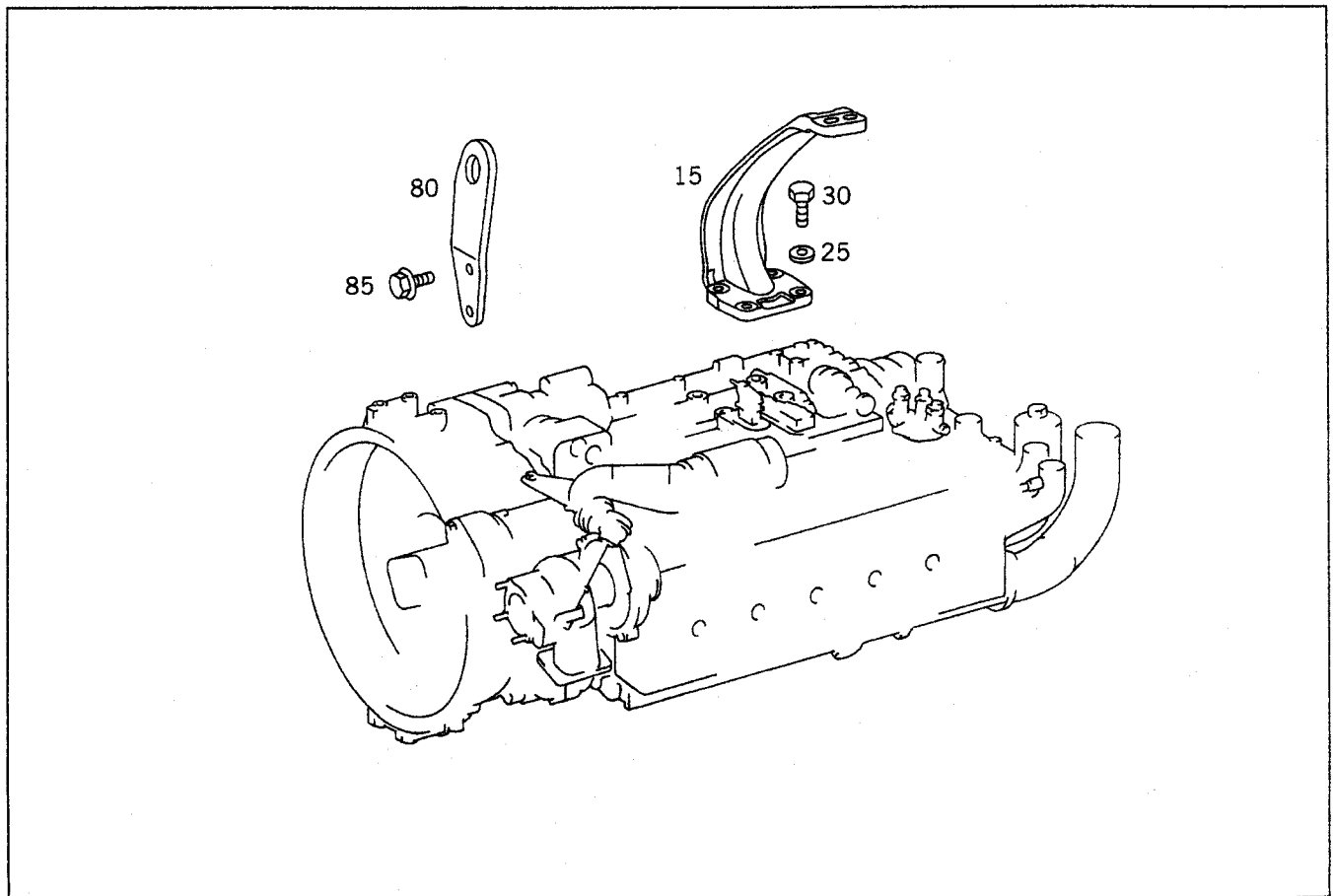
Motoraufhängung
 Engine Suspension
 Suspension du moteur
 Sospensione del motore

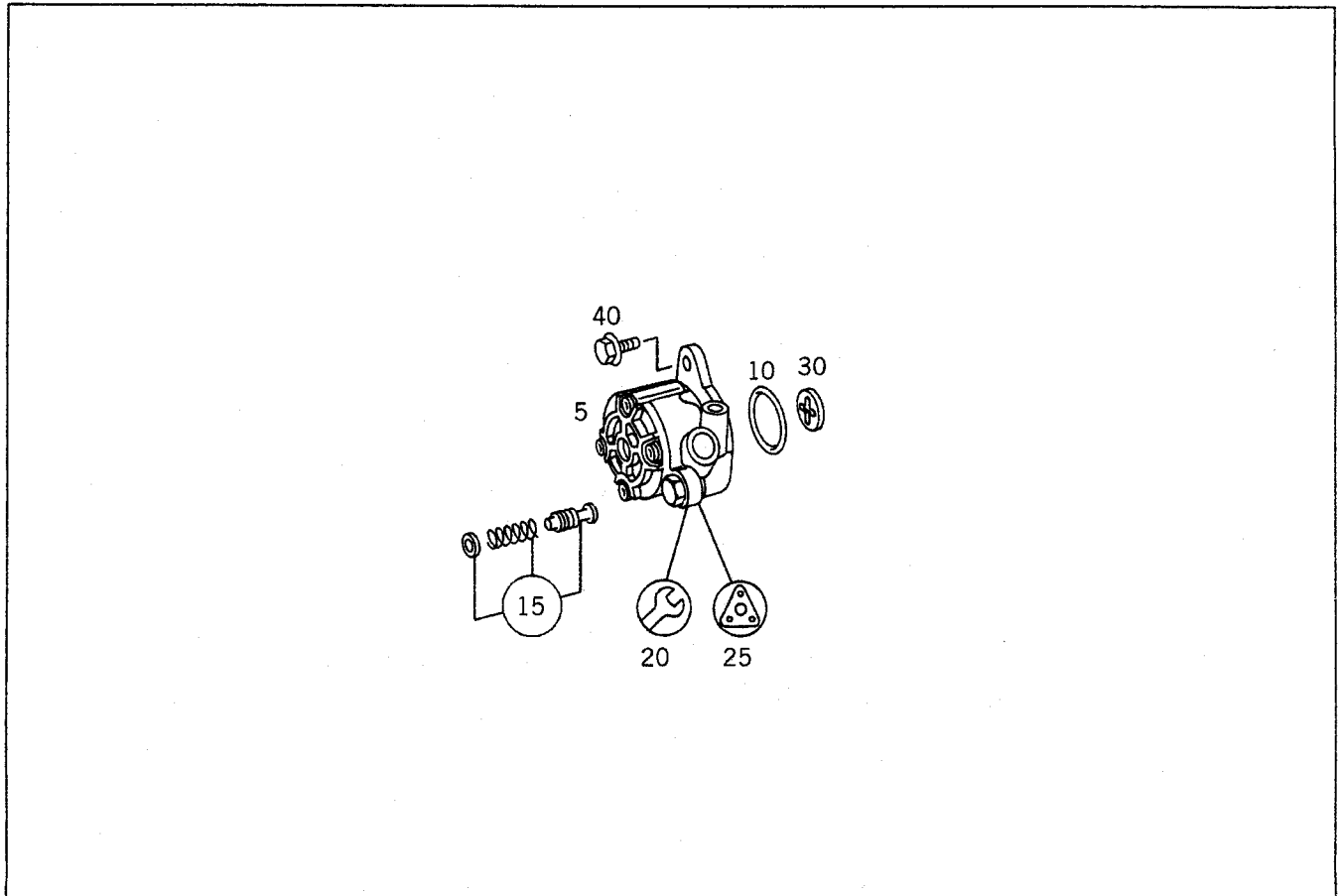
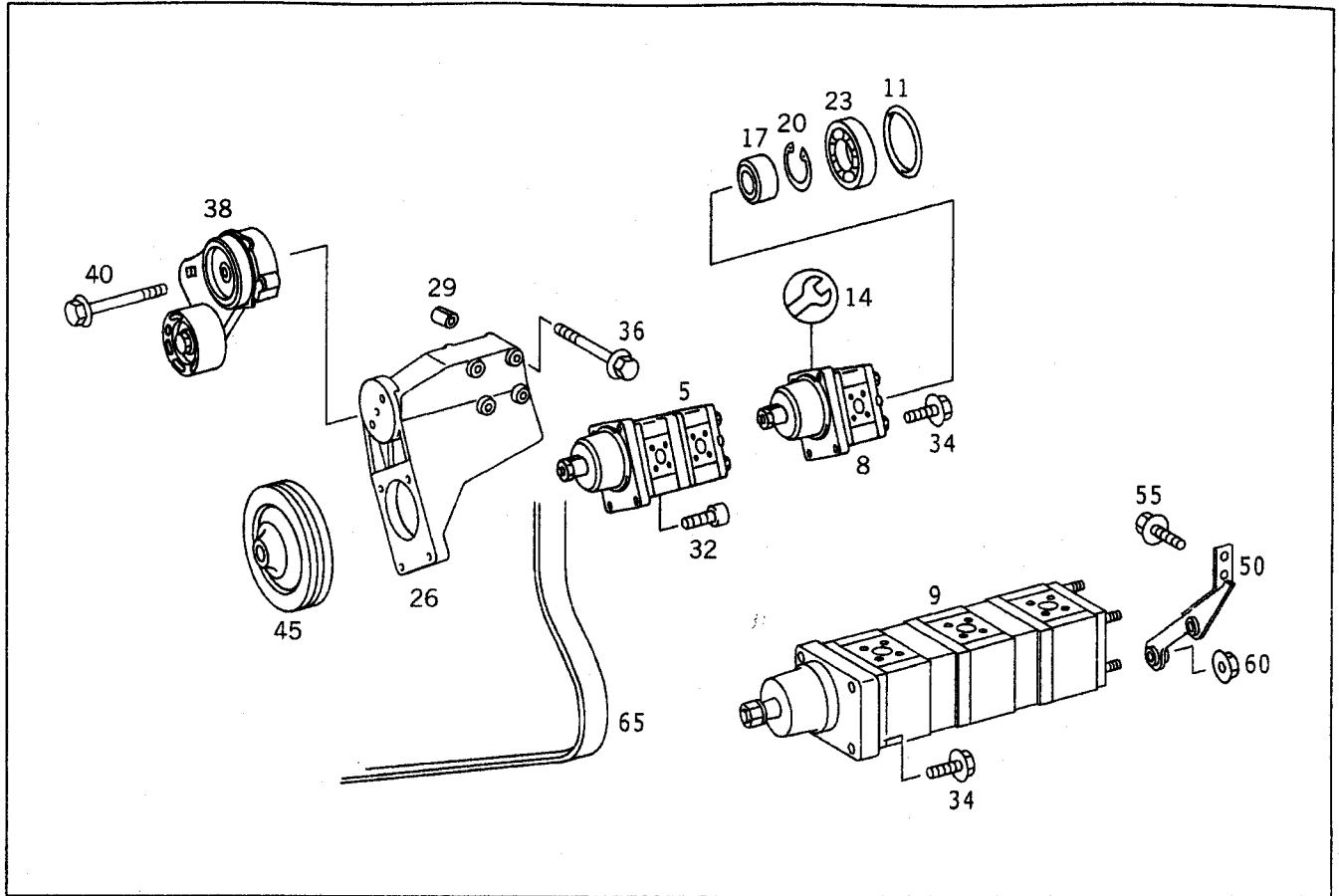
Suspensão do motor
 Suspensión del motor
 подвесна двигателя
 حمالات الموتور

Gruppe
 Group
 Groupe
 Gruppo

Grupo
 Grupo
 группа
 المجموعة

22 015 00121



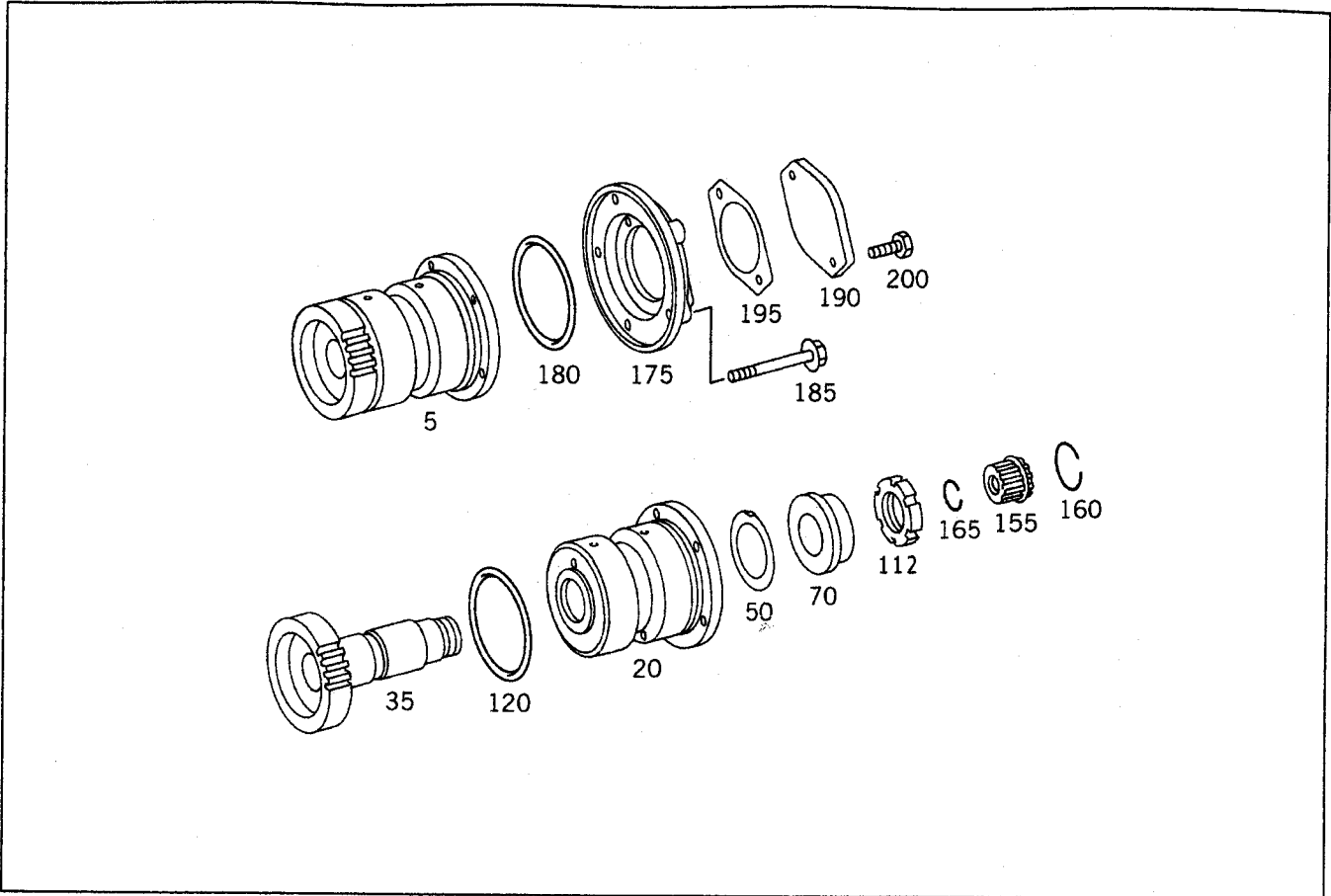


Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presă di forza

Tomada de forța
Toma de fuerza
отбор мощности
ألتشغيل الأضافي أو الأحتياطي

Gruppe
Group
Groupe
Gruppo
المجموعة

23 045 00016



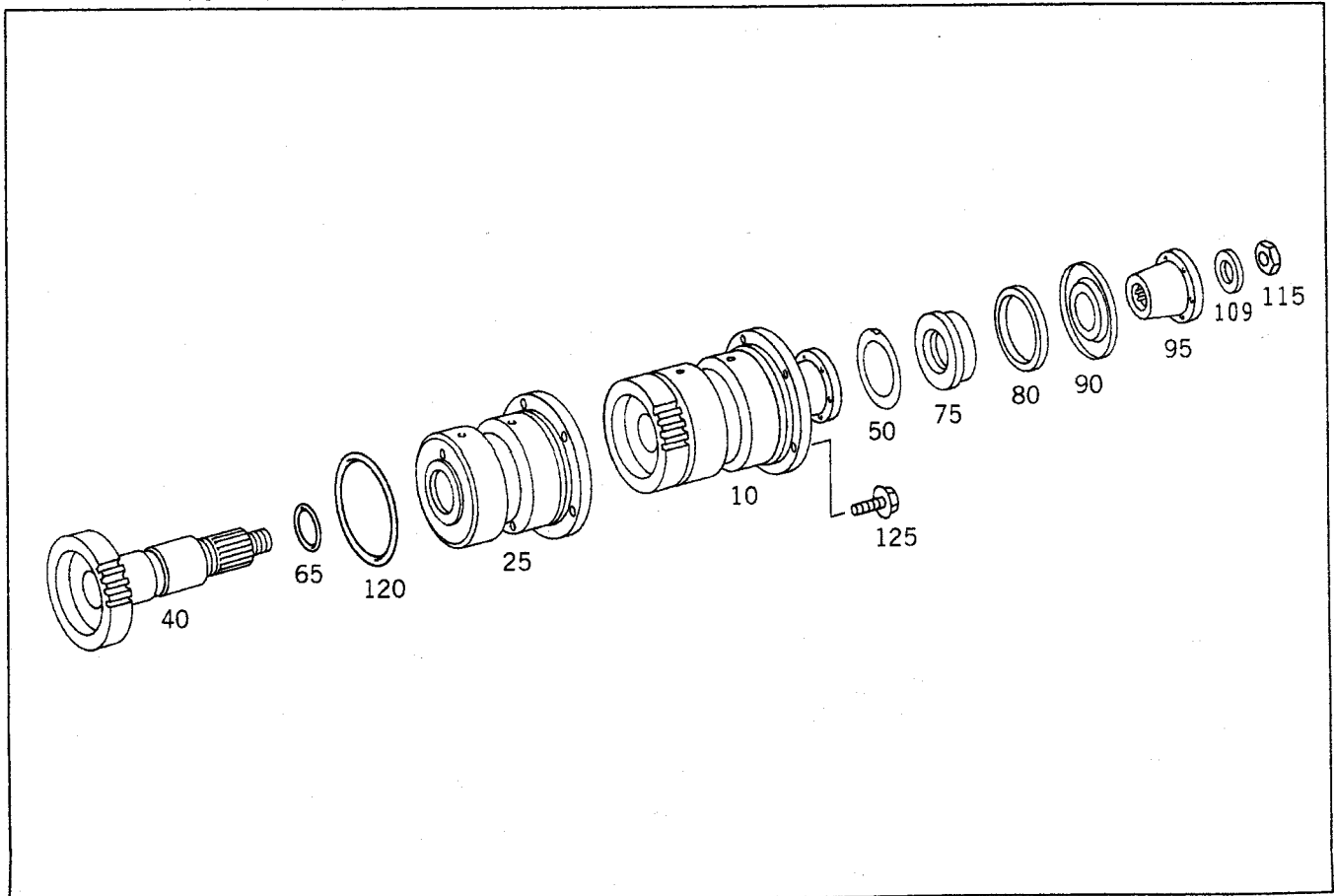
154

Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presă di forza

Tomada de forța
Toma de fuerza
отбор мощности
ألتشغيل الأضافي أو الأحتياطي

Gruppe
Group
Groupe
Gruppo
المجموعة

23 045 00029



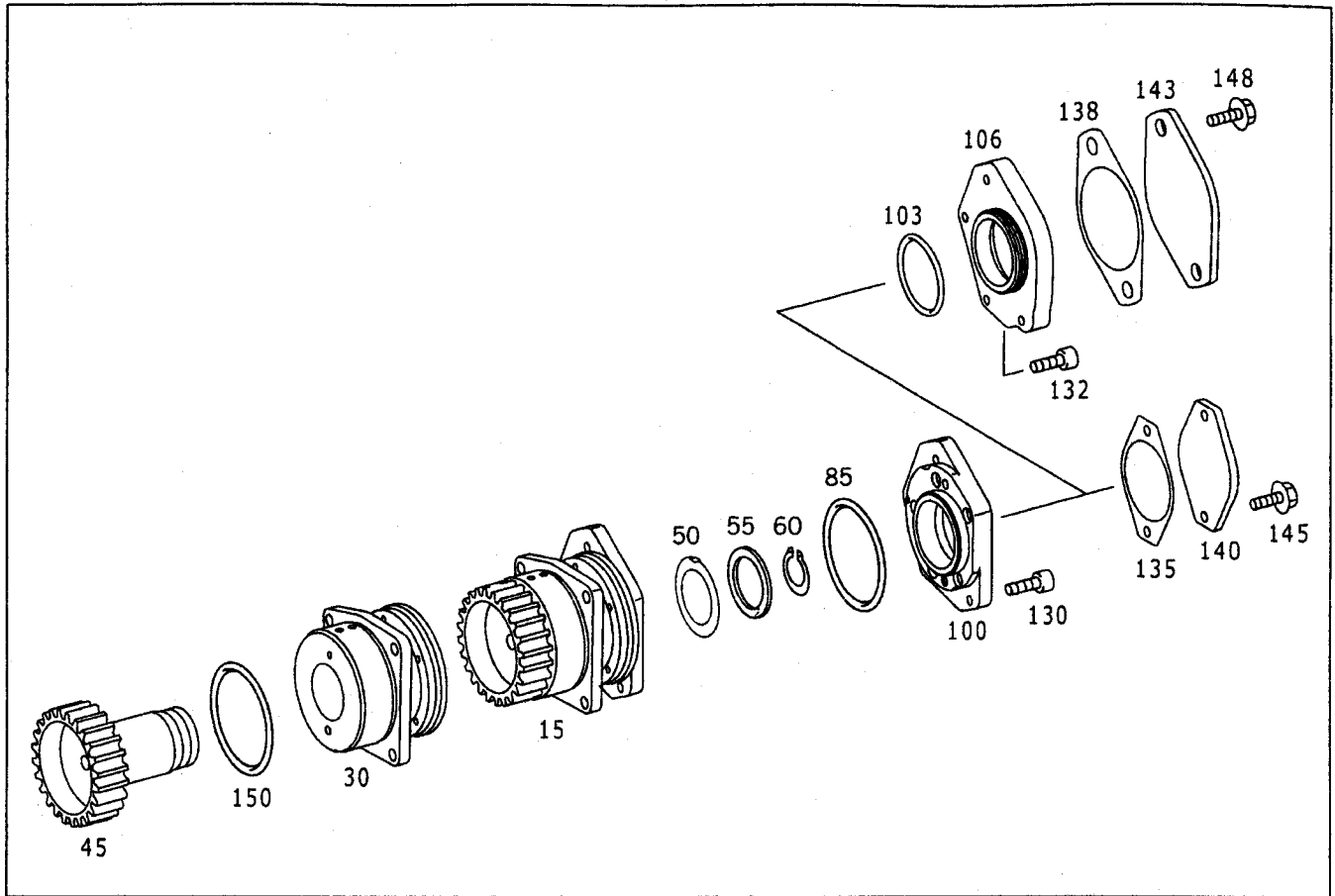
Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presi di forza

Tomada de forca
Toma de fuerza
отбор мощности
التشغيل الإضافي أو الاحتياطي

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

23 045 00032



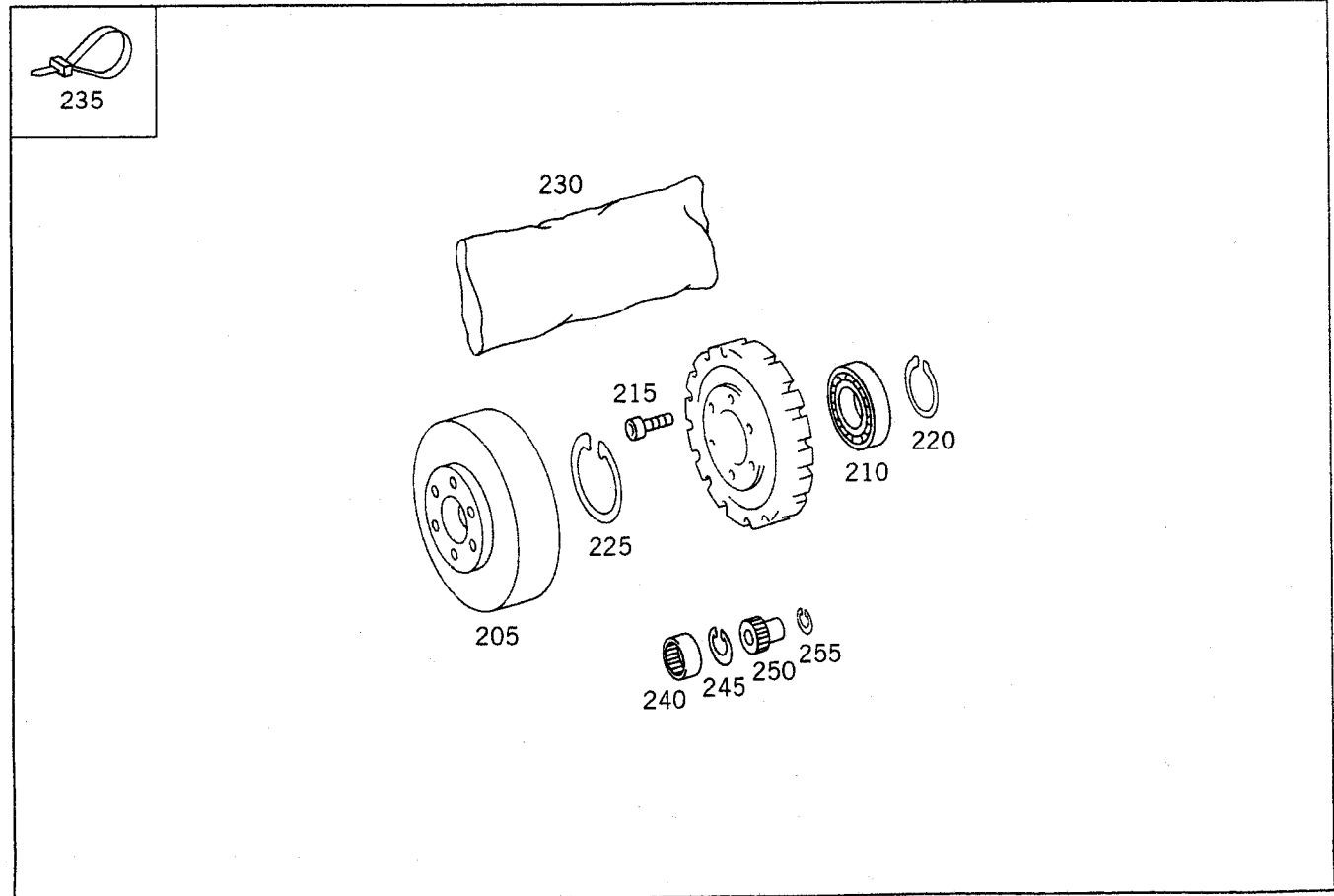
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P. T. O.
Prise de force auxiliaire
Presi di forza

Tomada de forca
Toma de fuerza
отбор мощности
التشغيل الإضافي أو الاحتياطي

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

23 045 00030



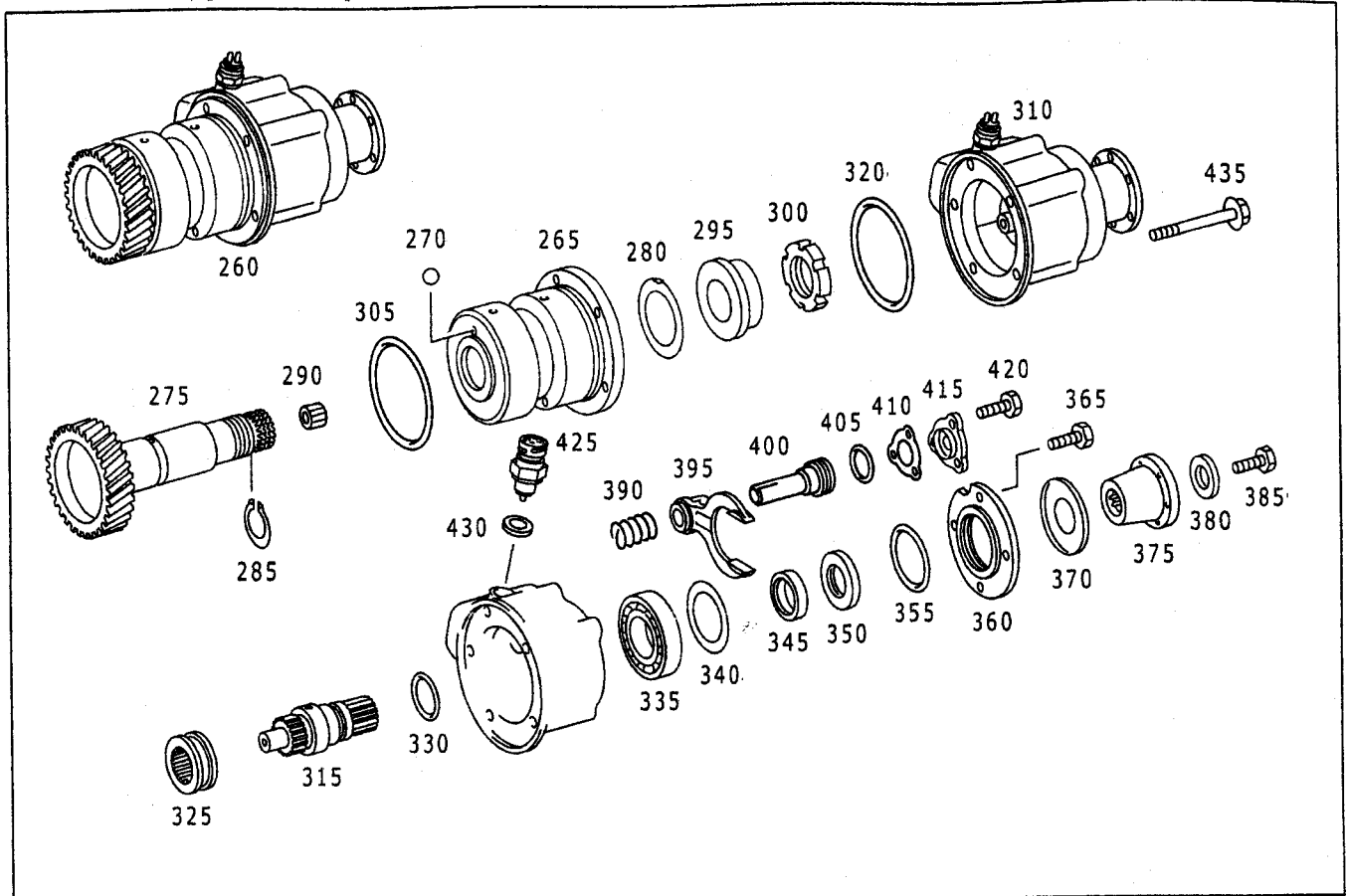
Nebenantrieb
P. T. O.
Prise de force auxiliaire
Presa di forza

Tomada de força
Toma de fuerza
отбор мощности
التشغيل الإضافي أو الاحتياطي

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

23 045 00037



158

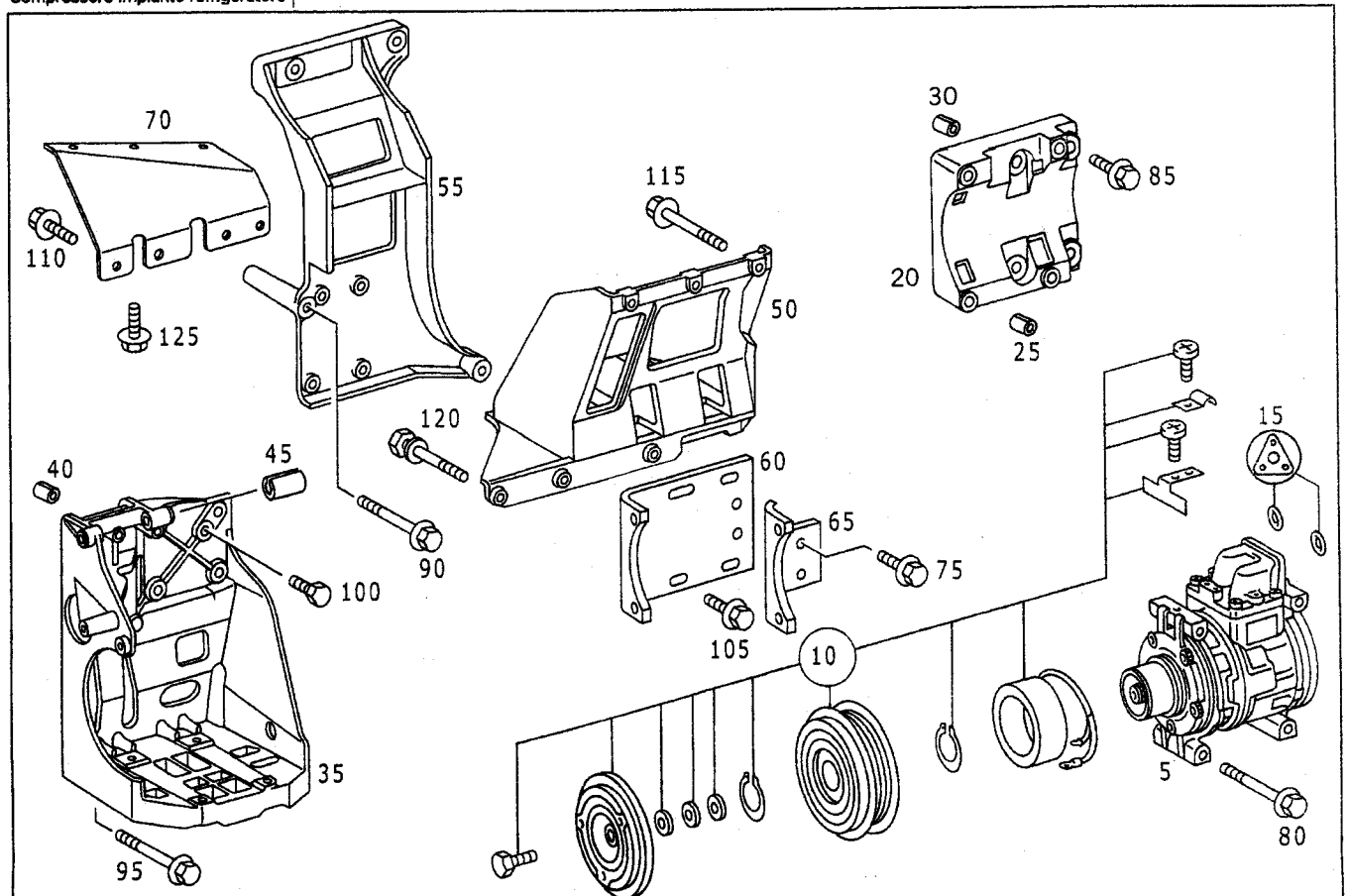
Kältekompressor
Refrigerant Compressor
Compresseur pour installation d'air
conditionné
Compressore impianto refrigeratore

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

Gruppe
Group
Groupe
Gruppo

Grupo
Grupo
группа
المجموعة

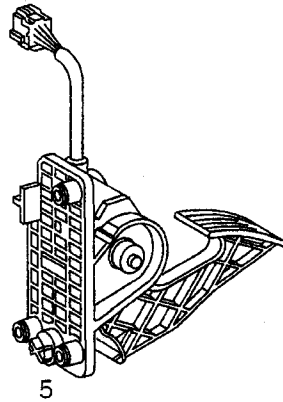
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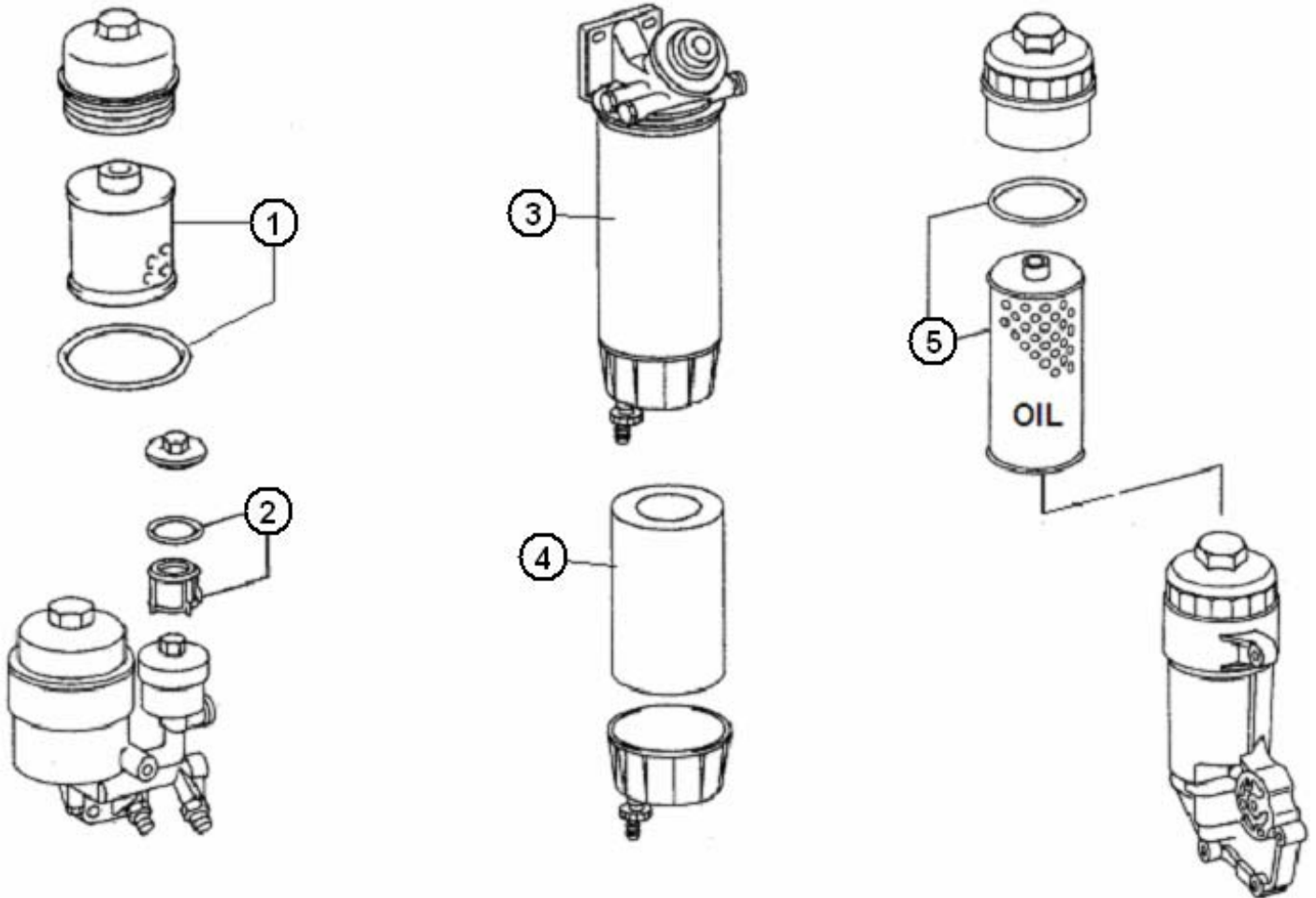


Sonderausführungen | Versões especiais
Special Versions | Ejecuciones especiales
Versions spéciales | специальная комплектация
Versioni speciali | الطرازات أو الأجزاء الخاصة

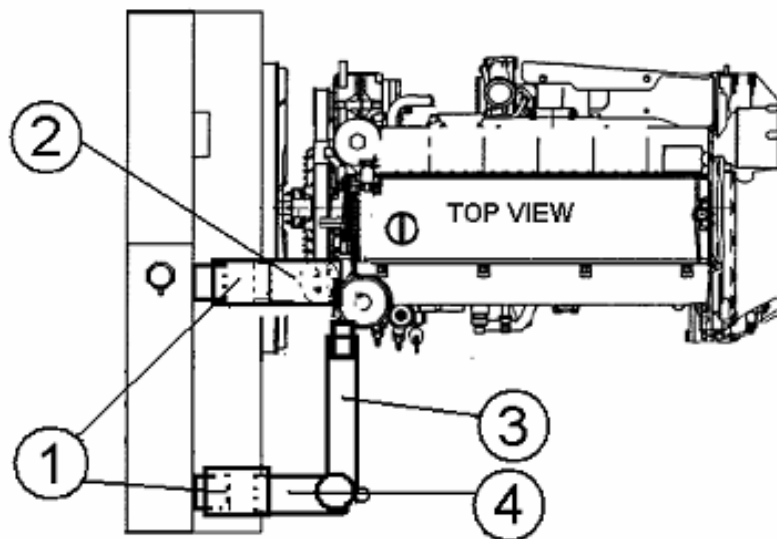
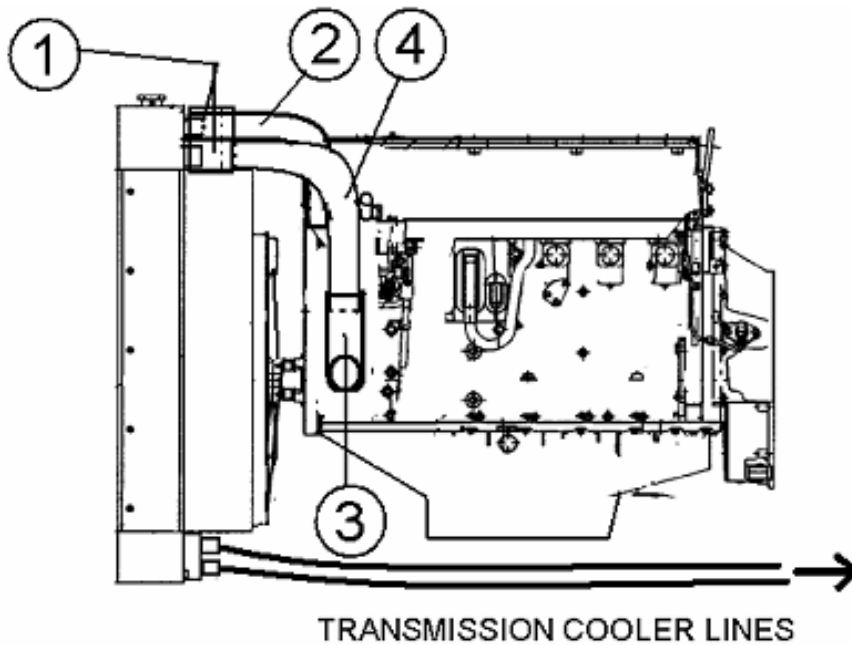
Gruppe | Grupo
Group | Grupo
Groupe | группа
Gruppo | المجموعة

23 100 00001

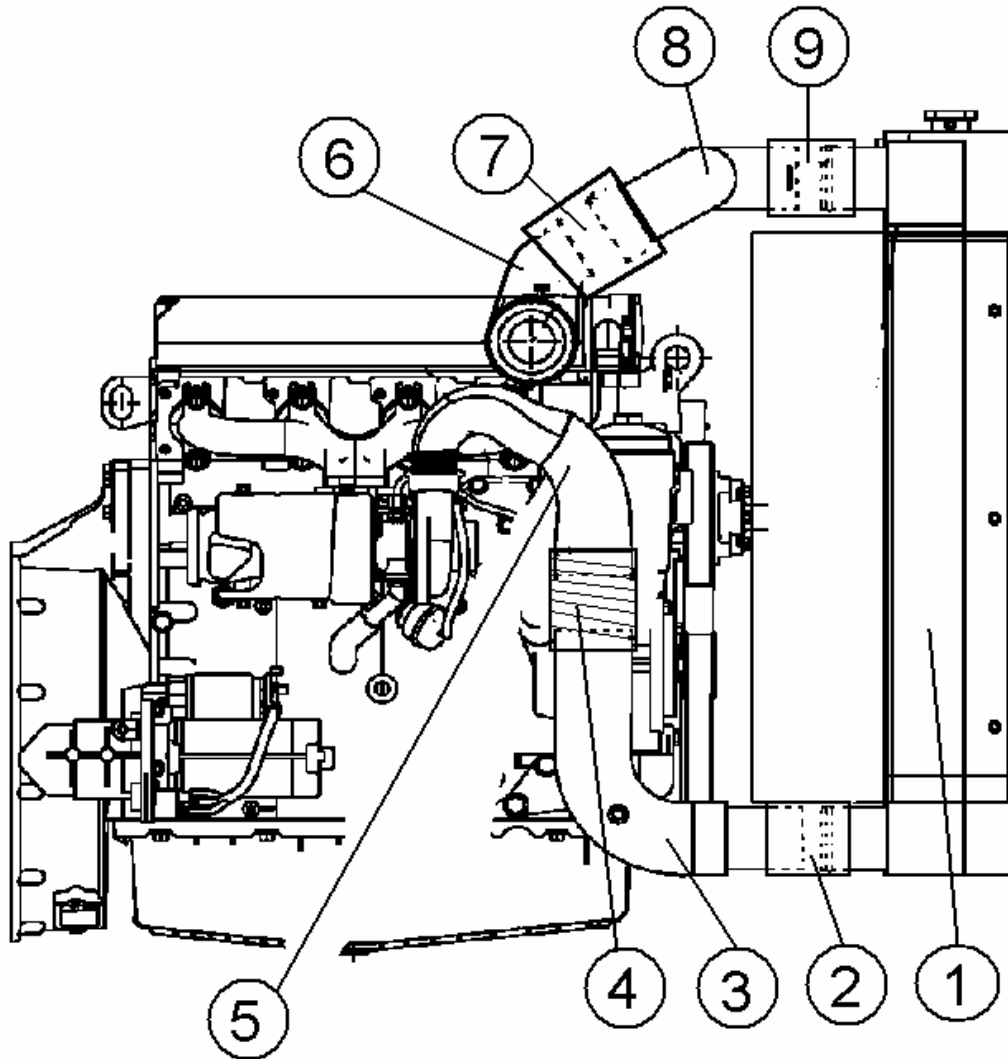




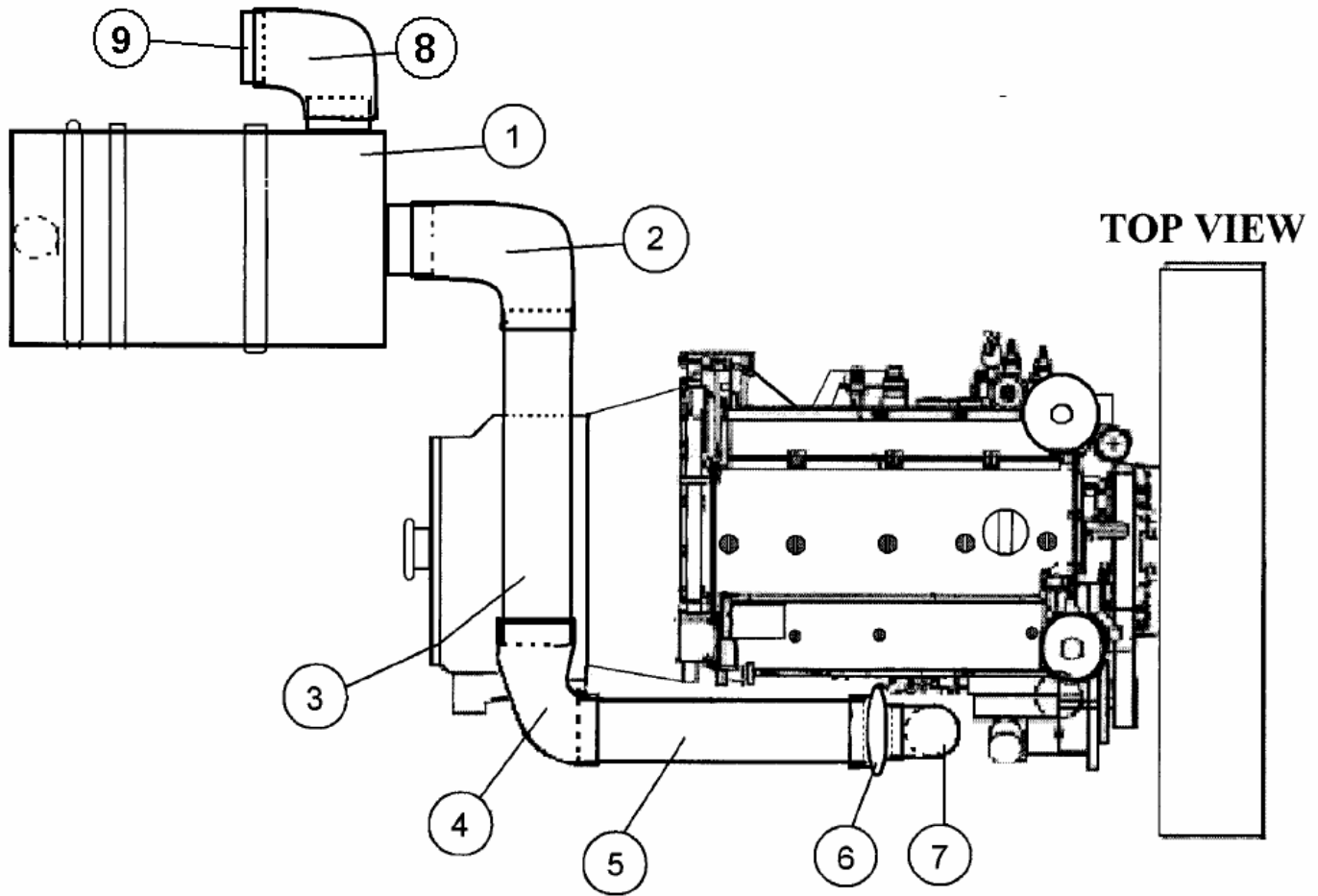
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	146001	FUEL FILTER ELEMENT KIT (OM 904 & 906)	1
2	146018	FUEL PRE FILTER KIT - SCREEN (OM 904 & 906)	1
3	146040	FUEL/WATER SEPARATOR ASSEMBLY (OM 904 & 906)	1
4	146022	FUEL/WATER SEPARATOR ELEMENT (OM 904 & 906)	1
5	146000	OIL FILTER ELEMENT (OM 904 ONLY)	1
	146017	OIL FILTER ELEMENT (OM 906 ONLY)	1



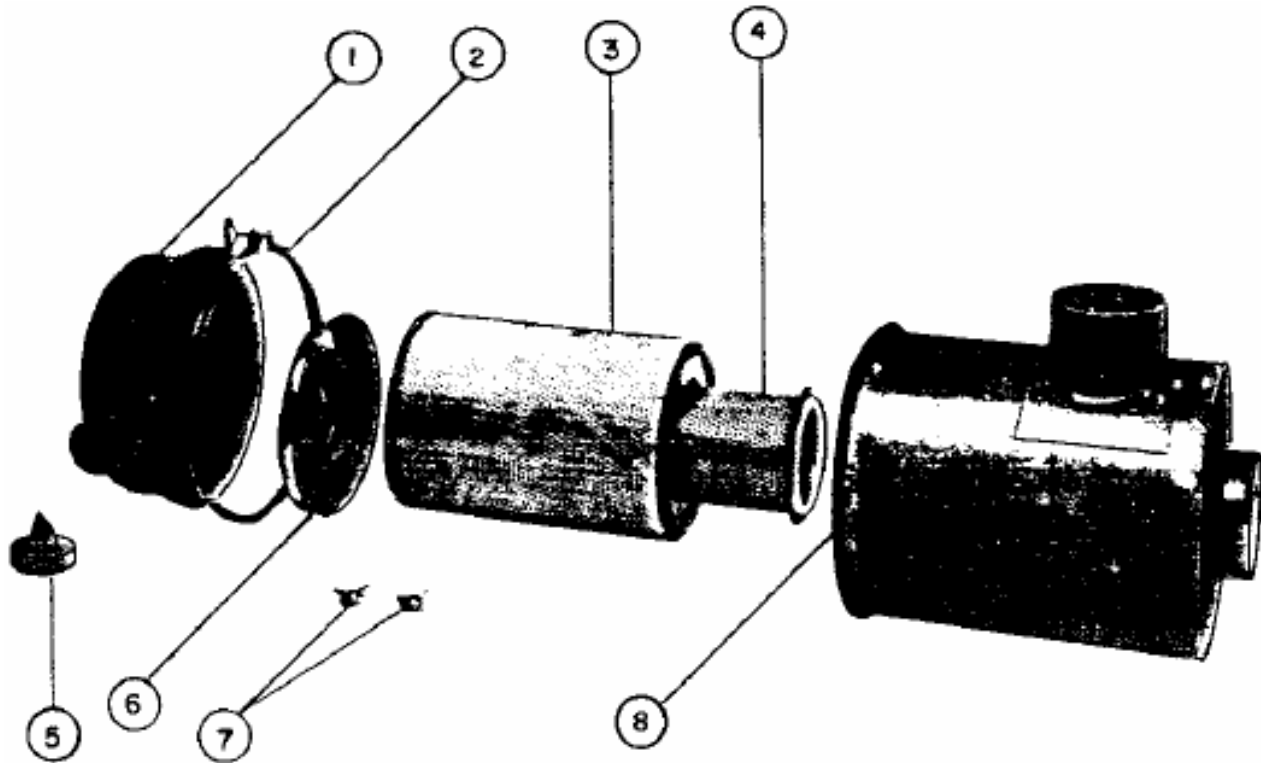
ITEM	PART #	DESCRIPTION	QTY.
	465216	RADIATOR/CHARGE AIR COOLER ASSEMBLY	1
1	605726	RADIATOR HOSE (2")	2
2	20611-03	TUBE WELDMENT (RADIATOR)	1
3	12326-06	RADIATOR HOSE (ELBOW)	1
4	12922-04	TUBE WELDMENT (RADIATOR)	1



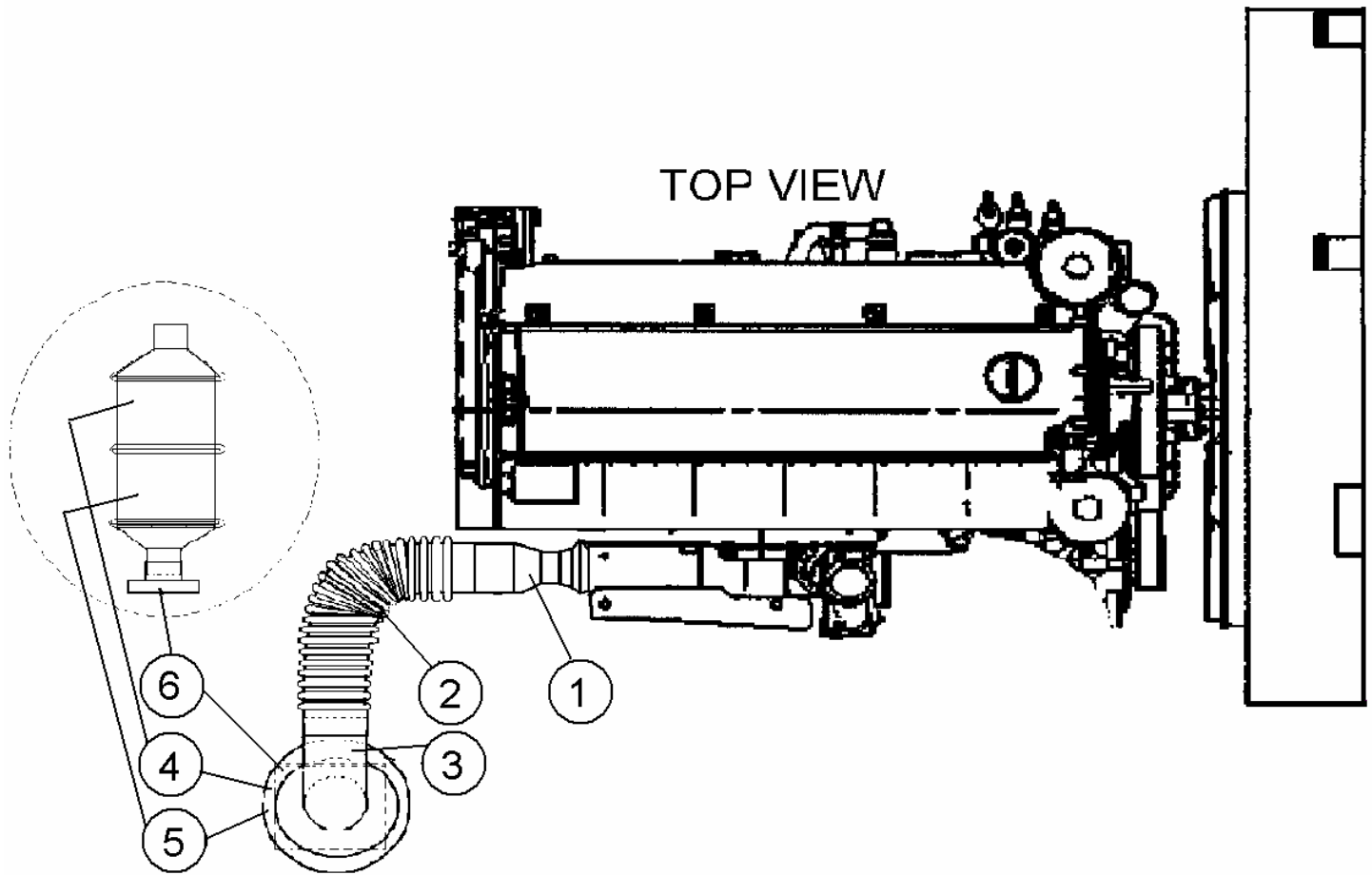
ITEM	PART #	DESCRIPTION	QTY.
1	465216	RADIATOR ASSEMBLY (DDC 904)	1
2	12567-05	SILICONE HOSE 4"	1
3	12964-01	TUBE WELDMENT LOWER (CHARGE AIR)	1
4	605663	SILICONE HUMP HOSE (3 1/2" ID)	1
5	N/A	CHARGE AIR TUBE (SEE DETROIT DIESEL)	1
6	N/A	CHARGE AIR TUBE (SEE DETROIT DIESEL)	1
7	595320	SILICONE CONNECTOR (3 1/2" ID)	1
8	12964-05	TUBE WELDMENT UPPER (CHARGE AIR)	1
9	12567-05	SILICONE HOSE 4"	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	604686	AIR FILTER ASSEMBLY	1
2	604409	RUBBER ELBOW (5")	1
3	19224-225	INTAKE TUBE (SS)	1
4	604119	RUBBER ELBOW (4" - 5")	1
5	19224-224	INTAKE TUBE (SS)	1
6	605360	RUBBER REDUCER (4" - 2.75")	1
7	12979-01	AIR INTAKE TUBE WELDMENT (SS)	1
8	604409	RUBBER ELBOW (5")	1
9	29937-05	INTAKE SCREEN (5")	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	604686	AIR CLEANER ASSEMBLY (INCLUDES ITEMS 1-8)	1
1	604707	CUP ASSEMBLY	1
2	604710	CLAMP ASSEMBLY	1
3	604711	PRIMARY ELEMENT	1
4	604709	SAFETY ELEMENT	1
5	604264	VACUATOR VALVE	1
6	604706	BAFFLE ASSEMBLY	1
7	604708	NUT ASSEMBLY	1
8	604704	O-RING	1
9*	604464	RESTRICTION INDICATOR 20 (DEUTZ 912W)	1
	605505	RESTRICTION INDICATOR 30 (3304, 3306PCT, 3056DIT)	1
	605512	RESTRICTION INDICATOR 25 (3304, 3306 PCNA)	1
10*	604921	INLET HOOD	1
11*	604687	PRECLEANER	1
12*	604691	MOUNTING BAND	2



ITEM	PART #	DESCRIPTION	QTY.
1	12964-07	EXHAUST ADAPTER WELDMENT	1
2	12964-08	EXHAUST TUBE WELDMENT (FLEX)	1
3	604922	EXHAUST ELBOW	1
4	594995	EXHAUST PURIFIER	1
5	594372	EXHAUST SILENCER	1
6	15951-01	EXHAUST DISSFUSER	1
7*	19188-11	FLAME ARRESTOR (OPTIONAL)	1

WARRANTY

diesel exhaust gas purifiers are warranted for six months or 1,000 engine hours, whichever occurs first from the date of shipment, against defects or failure due to material or workmanship at the sole discretion of the Corporation.

Subject to the terms herein the sole obligation of the Corporation shall be to repair or to replace in part or in whole any failed unit or components thereof provided same are returned "Transportation Prepaid" to the Corporation's nearest plant within the warranty time period.

This warranty does not cover improper or careless installation, sizing, storage or handling, or usage contrary to the Corporation's directions, design or specifications or other defects or failures due to any welding to or damage to the cannister. The Corporation shall make all determinations as to the cause of such defects or failures.

The Corporation reserves the right to request that the purifier not be removed from nor altered on the vehicle on which it is installed without a prior physical inspection by the Corporation.

The Corporation denies all liability for costs or damages related to return transportation charge following repair or replacement as aforesaid or for re-installation costs. No liability for loss or damage of any nature or kind, whether arising out of or from the use of the purifier whether or not defective, is assumed.

Except as expressly stated herein, any or other warranties either express or implied, intended or otherwise given are hereby excluded and are null and void.

RECOMMENDED CLEANING PROCEDURE

FOR HARD CARBON DEPOSITS:

1. Dry-brush inlet face of catalyst.
2. Air clean through outlet face of catalyst.
3. Continue steps 1 and 2 until inlet face of catalyst is clean.
4. Completely soak catalyst in cleaning solution for one hour. Note caution below.
5. Solvent-air clean through outlet face of catalyst for 10 minutes.
6. Air clean through outlet face.
7. Repeat steps 4, 5 & 6 until purifier is as clean as possible.
8. High pressure water wash purifier through outlet face and air dry. Maximum pressure 50 PSI.
9. Re-install purifier. Make sure that purifier is re-installed so that the exhaust gas flows through purifier in the same direction as before the cleaning.

FOR SOFT CARBON DEPOSITS:

If high pressure steam is available, steam clean through outlet face towards catalyst inlet face.

Keep nozzle 2" away from catalyst face. Maximum allowed pressure 50 PSI.

RECOMMENDATION:

1. Incorporate this procedure into preventive maintenance schedule of vehicle for minimal particulate accumulation and maximum purifier performance.
2. The catalyst life may exceed 10,000 hours. The main reasons for catalyst failure are improper cleaning or damage to catalyst during cleaning. Try to perform catalyst cleaning without causing any mechanical damage to catalyst.

CAUTION – INFLAMMABLE SOLUTION

Use in accordance with manufacturers recommendations – and in a properly ventilated area.

RECOMMENDED CLEANING PROCEDURE continued

The purifier cleaning cycle depends on the condition of the engine. For installations on new engines, purifier may not need cleaning for 6 to 8 months. For installations on old or poorly-tuned engines, purifier may need cleaning every two months or more.

Purifier location in the engine exhaust system should be as close to the engine exhaust manifold as possible. This close-to-engine installation will allow soot and exhaust particulates deposited on the inlet face of the catalyst to be burned off by the heat in the exhaust gas and will extend the cleaning cycle.

INSTALLATION, OPERATION AND SERVICE

INSTALLATION

Because high temperature is the primary requirement for high efficiency operation of the purifier, install the purifier as close to engine exhaust manifold as possible. The heat in the exhaust gas is necessary to activate the purifier for high exhaust gas purification as well as to burn off carbon particles deposited on the inlet face of the metallic honeycomb for a longer cleaning cycle.

Do not perform any welding on the purifier container. Any welding on the container (centre body) will void our warranty.

It is recommended that the purifier be installed in the exhaust system using standard muffler clamps.

The inlet exhaust pipe should be fitted into the inlet of the end cone bottoming on the built-in stop ring.

Check your installation to determine whether the purifier is firmly located in the exhaust system and that it is not in contact with any structural members of the vehicle or engine accessories.

If situation requires, attach your purifier support to engine. If purifier support is attached to part of a vehicle other than engine, install flex between engine and purifier. Any supports should be located on the end cones in order not to interfere with centre body removal.

OPERATION

1. Check engine exhaust back pressure before installing the purifier.
2. Regularly check exhaust back pressure using 1/8 N.P.T. back pressure port on the inlet side of the purifier. Compare the readings with the

engine manufacturer's recommendations. If the purifier back pressure readings approach engine back pressure limits, remove centre body for cleaning. Keep one additional centre body in stock to avoid equipment downtime during cleaning.

3. In order to reduce honeycomb clogging and to extend cleaning cycle, avoid prolonged engine idling periods. Remember that the higher the engine load, the higher the exhaust gas temperature and the higher the gas purification efficiency.

SERVICE

1. When replacing the purifier centre body, make sure that non-asbestos sealing gaskets are in good condition. If necessary, order new gaskets from DCL or our representatives.
2. Use standard SAE grade 5, 1/4"-28 x 1" cadmium-plated bolts to connect the centre body to end cones.

Use cadmium-plated internal type, anti-vibration tooth lock washers and our cadmium-plated heavy-duty self-locking nuts.

Apply approx. 8 ft. lbs. torque to secure the connection.

Bolts, washers and nuts can be ordered from DCL or our representatives.

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

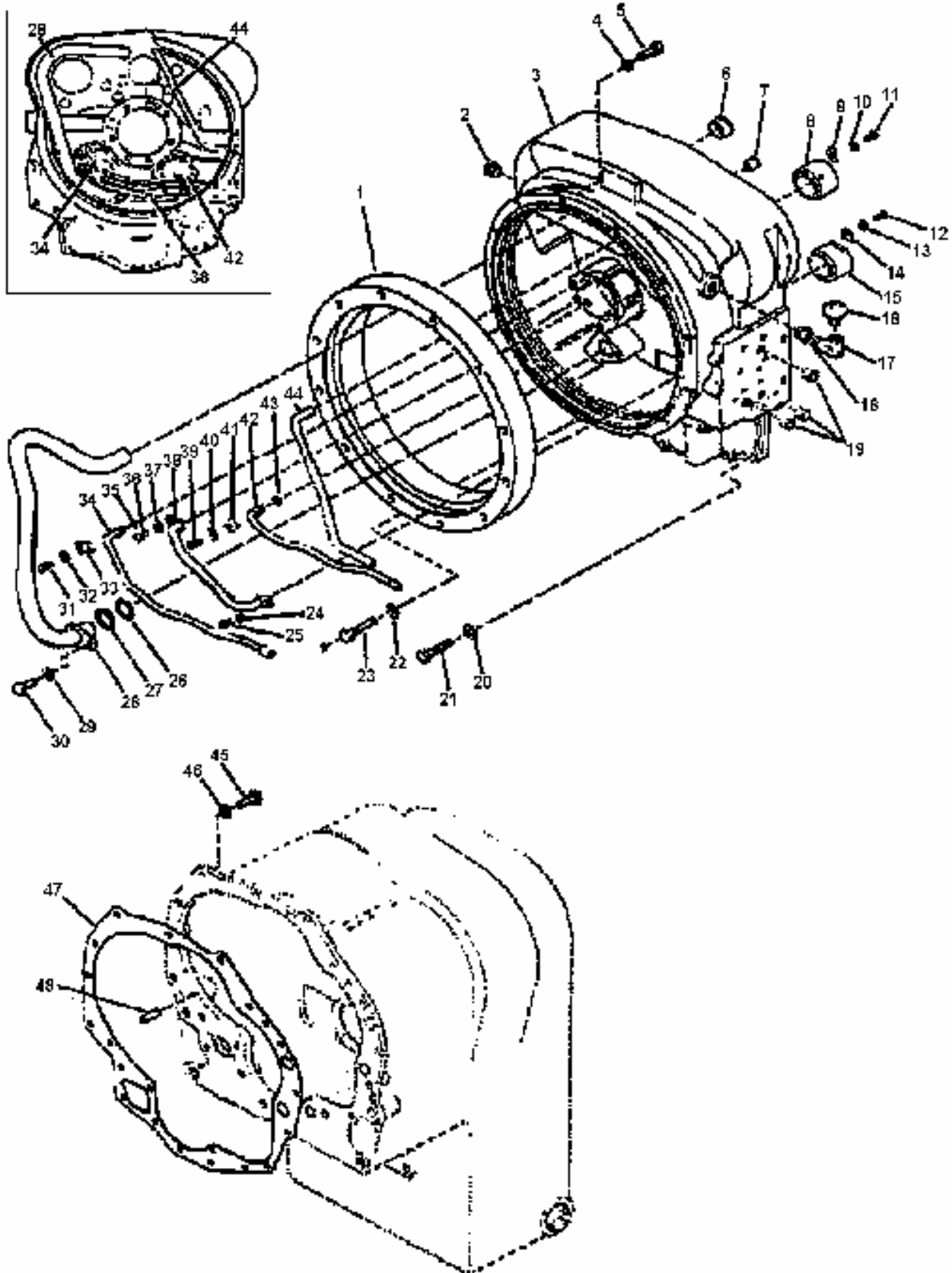
5. DRIVE TRAIN

13650	TRANSMISSION
13436	TRANSMISSION MOUNTS
-----	TRANSMISSION MAINTENANCE & SERVICE MANUAL
13731	DRIVELINE INSTALLATION



TRANSMISSION ASSEMBLY 465157

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*ITEMS NOT SHOWN

Updated:
12/19/06



TRANSMISSION ASSEMBLY
465157

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	465157	TRANSMISSION ASSEMBLY	1
1		NOT USED ON THIS MODEL	1
2	23033	PIPE PLUG	1
3	244390	CONVERTER HOUSING & TUBE ASSEMBLY (INCLUDES ITEMS 6-15, 19, 24-44)	1
4-5		NOT USED ON THIS MODEL	1
6	24913	TUBE SLEEVE	1
7	24337	TUBE SLEEVE	1
8	24594	CONVERTER HOUSING SLEEVE	1
9	24595	CONVERTER HOUSING SLEEVE LOCK	1
10	24473	CONVERTER HOUSING SLEEVE SCREW LOCKWASHER	1
11	24474	CONVERTER HOUSING SLEEVE SCREW	1
12	24474	CONVERTER HOUSING SLEEVE SCREW	1
13	24473	CONVERTER HOUSING SLEEVE SCREW LOCKWASHER	1
14	24595	CONVERTER HOUSING SLEEVE LOCK	1
15	24594	CONVERTER HOUSING SLEEVE	1
16	24240	BREATHER	1
17	244160	STREET ELBOW	1
18	244157	BREATHER REDUCING BUSHING	1
19	24337	TUBE SLEEVE	3
20	24435	CONVERTER HOUSING TO TRANSMISSION HOUSING SCREW LOCKWASHER	4
21	244195	CONVERTER HOUSING TO TRANSMISSION HOUSING SCREW	4
22	24435	CONVERTER HOUSING TO TRANSMISSION HOUSING LOCKWASHER	4
23	244196	CONVERTER HOUSING TO TRANSMISSION HOUSING SCREW	4
24	24473	LUBE TUBE RETAINING SCREW	1
25	24474	LUBE TUBE RETAINING SCREW	1
26	24952	SUCTION TUBE O-RING	1
27	244057	SUCTION TUBE SPACER RING	1
28	24933	SUCTION TUBE ASSEMBLY	1

*ITEMS NOT SHOWN

Updated:
12/19/06



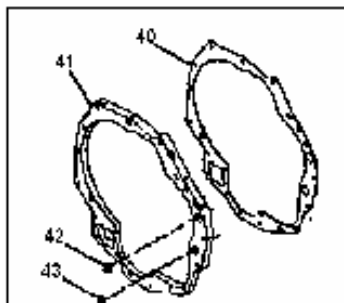
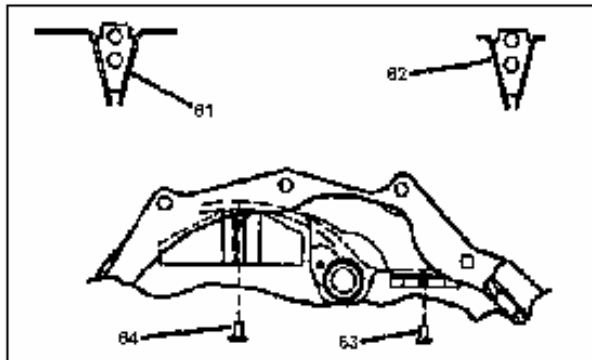
TRANSMISSION ASSEMBLY 465157

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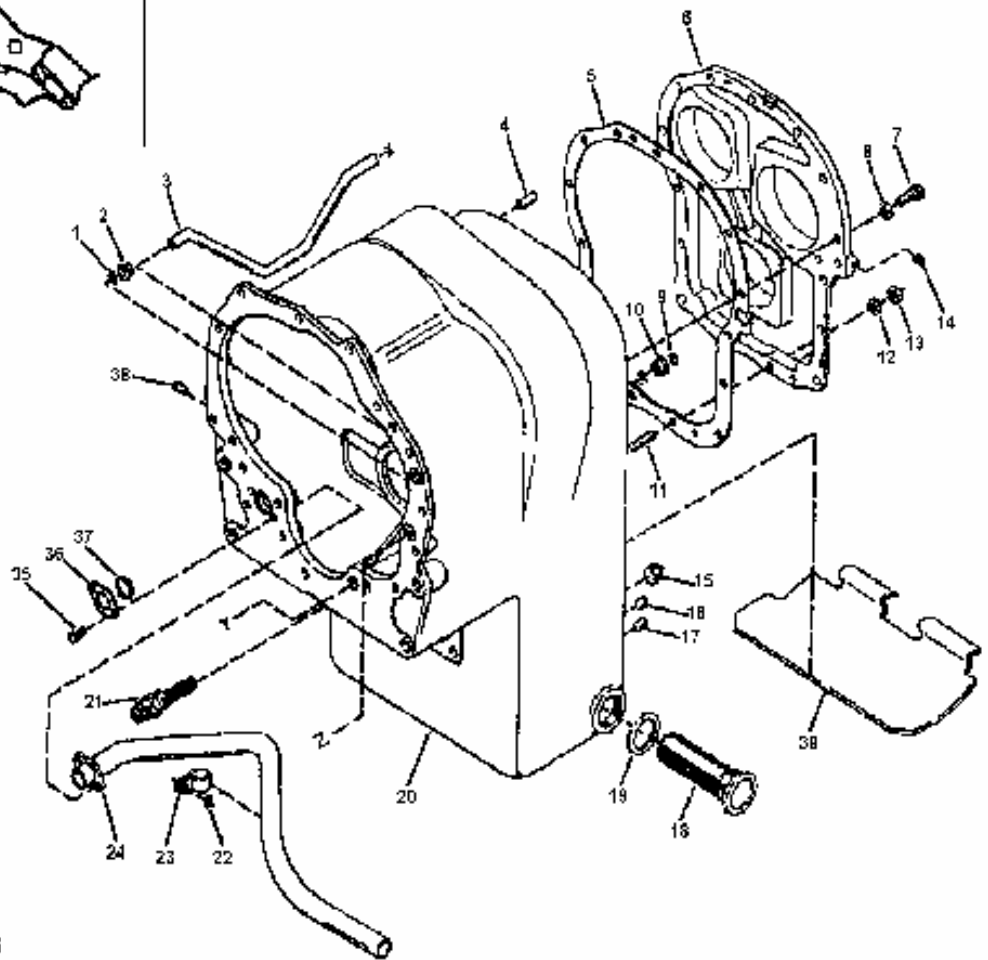
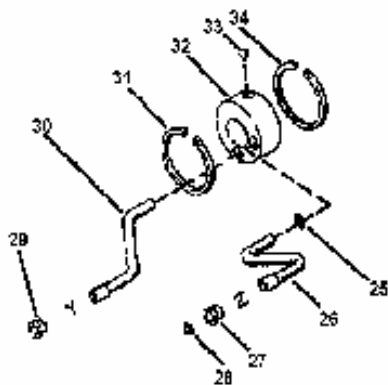
29	24432	SUCTION TUBE RETAINER SCREW/LOCKWASHER (PART OF ITEM 30)	1
30	24191	SUCTION TUBE RETAINER SCREW & LOCKWASHER	1
31	24474	TUBE CLIP SCREW	1
32	24473	TUBE CLIP SCREW LOCKWASHER	1
33	24592	TUBE CLIP	1
34	24921	REVERSE TUBE ASSEMBLY	1
35	24684	REVERSE TUBE O-RING	1
36	24474	LUBE TUBE RETAINER SCREW	1
37	24473	LUBE TUBE RETAINER SCREW LOCKWASHER	1
38	24920	LUBE TUBE ASSEMBLY	1
39	24474	TUBE CLIP SCREW	1
40	24473	TUBE CLIP SCREW LOCKWASHER	1
41	24592	TUBE CLIP	1
42	24922	3RD SPEED TUBE ASSEMBLY	1
43	24684	3RD SPEED TUBE O-RING	1
44	24924	VALVE OIL SUPPLY TUBE	1
45	24686	TRANSMISSION CASE TO CONVERTER HOUSING SCREW	10
46	24435	TRANSMISSION CASE TO CONVERTER HOUSING SCREW LOCKWASHER	10
47	24047	CONVERTER HOUSING TO TRANSMISSION CASE GASKET	1
48	24338	CONVERTER HOUSING TO TRANSMISSION CASE DOWEL PIN	2
57	244384	SPEED SENSOR ADJUSTER BUSHING	1
58	244387	SPEED SENSOR ADJUSTER SHIM	A/R
59	244388	SPEED SENSOR HOLE PLUG	1
60	244389	SPEED SENSOR O-RING	1

*ITEMS NOT SHOWN

Updated:
12/19/06



CONVERTER HOUSING TO TRANSMISSION
CASE SPACER USED ONLY WITH 17 PLATE
CLUTCH PACK ASSEMBLY





TRANSMISSION ASSEMBLY 465157

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	465157	TRANSMISSION ASSEMBLY	1
1	24685	PRESSURE TUBE O-RING	1
2	24337	PRESSURE TUBE SLEEVE	1
3	24598	LOW SPEED CLUTCH PRESSURE TUBE	1
4	24566	CASE TO COVER DOWEL PIN	2
5	24046	CASE TO COVER GASKET	1
6	244726	REAR COVER	1
7	24686	REAR COVER TO TRANSMISSION CASE SCREW	21
8	24435	REAR COVER TO TRANSMISSION CASE SCREW LOCKWASHER	21
9	24685	PRESSURE TUBE O-RING	1
10	24337	PRESSURE TUBE SLEEVE	1
11	24654	REAR COVER TO TRANSMISSION CASE STUD	2
12	24435	REAR COVER TO TRANSMISSION CASE STUD LOCKWASHER	2
13	24389	REAR COVER TO TRANSMISSION CASE STUD NUT	2
14	24242	REAR COVER PIPE PLUG	1
15	24339	MAGNETIC DRAIN PLUG	1
16	24689	OIL LEVEL PLUG	1
17	24689	OIL LEVEL PLUG	1
18	24244	SCREEN ASSEMBLY	1
19	24203	SCREEN ASSEMBLY GASKET	1
20	244741	TRANSMISSION CASE ASSEMBLY (INCLUDES ITEMS 2, 3, 10, 22-24, 35-38, 60-72)	1
21		NOT USED ON THIS MODEL	
22		NOT USED ON THIS MODEL	
23	24692	SUCTION TUBE CLIP	1
24	24601	SUCTION TUBE ASSEMBLY	1
25-34		NOT USED ON THIS MODEL	
35	24693	RETAINING WASHER SCREW	2
36	24602	RETAINING WASHER	1
37	24694	SUCTION TUBE O-RING	1

*ITEMS NOT SHOWN

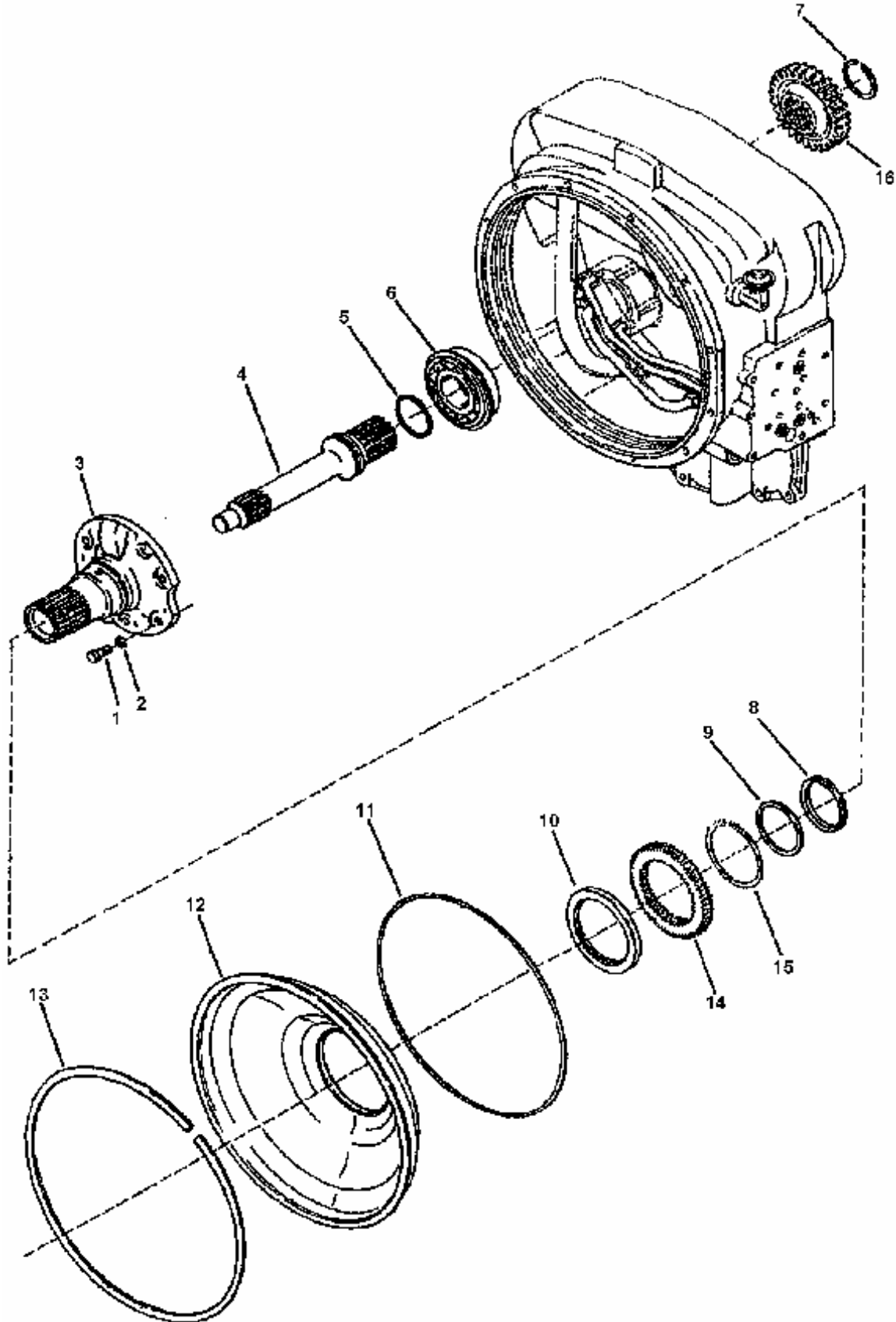
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TRANSMISSION ASSEMBLY
465157

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38	244391	SUCTION TUBE CLIP RIVET	1
39-59		NOT USED ON THIS MODEL	
60	244391	RIVET	2
61	244256	OIL BAFFLE	1
62	244257	OIL BAFFLE	1
63	244391	RIVET	2
64*	244384	SENSOR ADJUSTING BUSHING	1
65*	244203	SENSOR ADJUSTING BUSHING PLUG	1
66*	244204	SENSOR ADJUSTING BUSHING PLUG O-RING	1
67*	244387	SENSOR ADJUSTING BUSHING SHIM	A/R





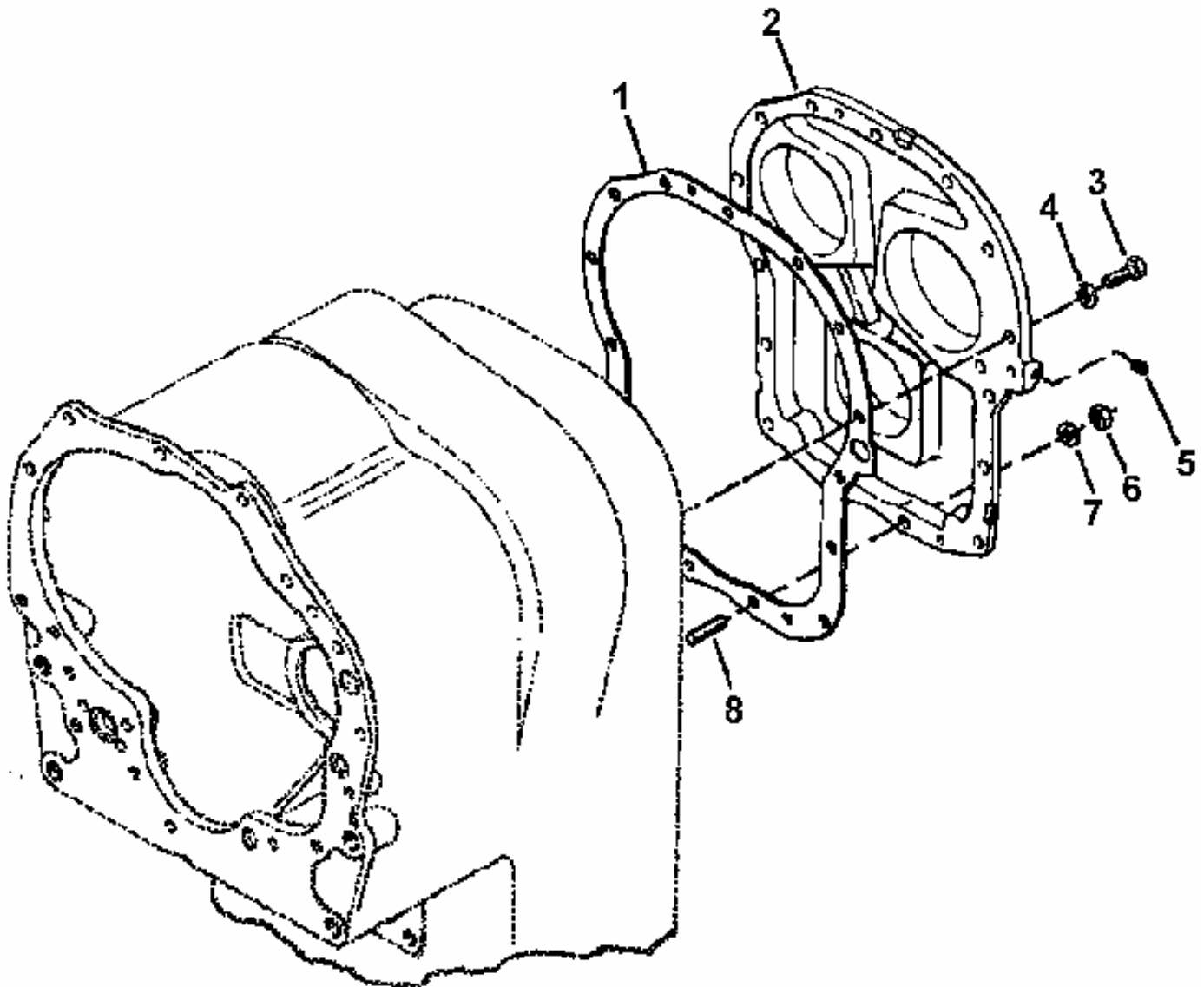
TRANSMISSION ASSEMBLY
465157

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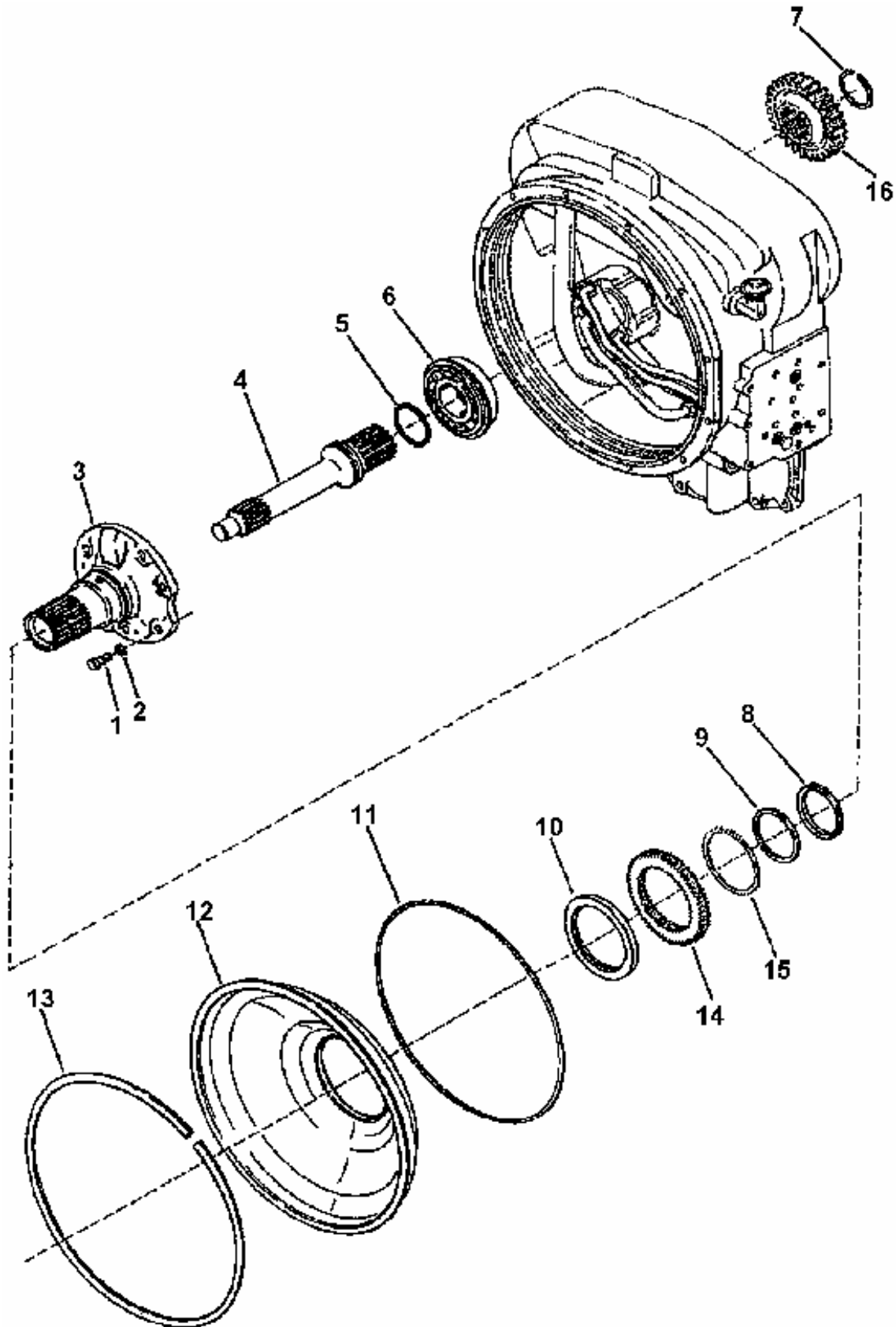
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	24670	STATOR SUPPORT SCREW	6
2	24680	STATOR SUPPORT SCREW LOCKWASHER	6
3	24936	STATOR SUPPORT & SLEEVE ASSEMBLY	1
4	244728	TURBINE SHAFT	1
5	244365	TURBINE SHAFT PISTON RING	1
6	24306	TURBINE SHAFT BEARING	1
7	24219	TURBINE SHAFT GEAR SNAP RING	1
8	244364	PISTON RING	1
10	24022	OIL BAFFLE OIL SEAL	1
11	24929	OIL BAFFLE SEAL RING	1
12	24911	OIL BAFFLE	1
13	244128	OIL BAFFLE RETAINER RING	1
14	24910	IMPELLER HUB GEAR	1
15	24576	IMPELLER HUB GEAR SNAP RING	1
16	244265	TURBINE SHAFT GEAR	1

*ITEMS NOT SHOWN

Updated:
12/19/06



ITEM	PART #	DESCRIPTION	QTY.
1	24046	CASE TO COVER REAR GASKET	1
2	244726	REAR COVER	1
3	24686	REAR COVER TO CASE SCREW	21
4	24435	REAR COVER TO CASE SCREW LOCKWASHER	21
5	24242	REAR COVER PLUG	1
6	24389	REAR COVER TO CASE STUD NUT	2
7	24435	REAR COVER TO CASE SCREW LOCKWASHER	2
8	24654	REAR COVER TO CASE STUD	2





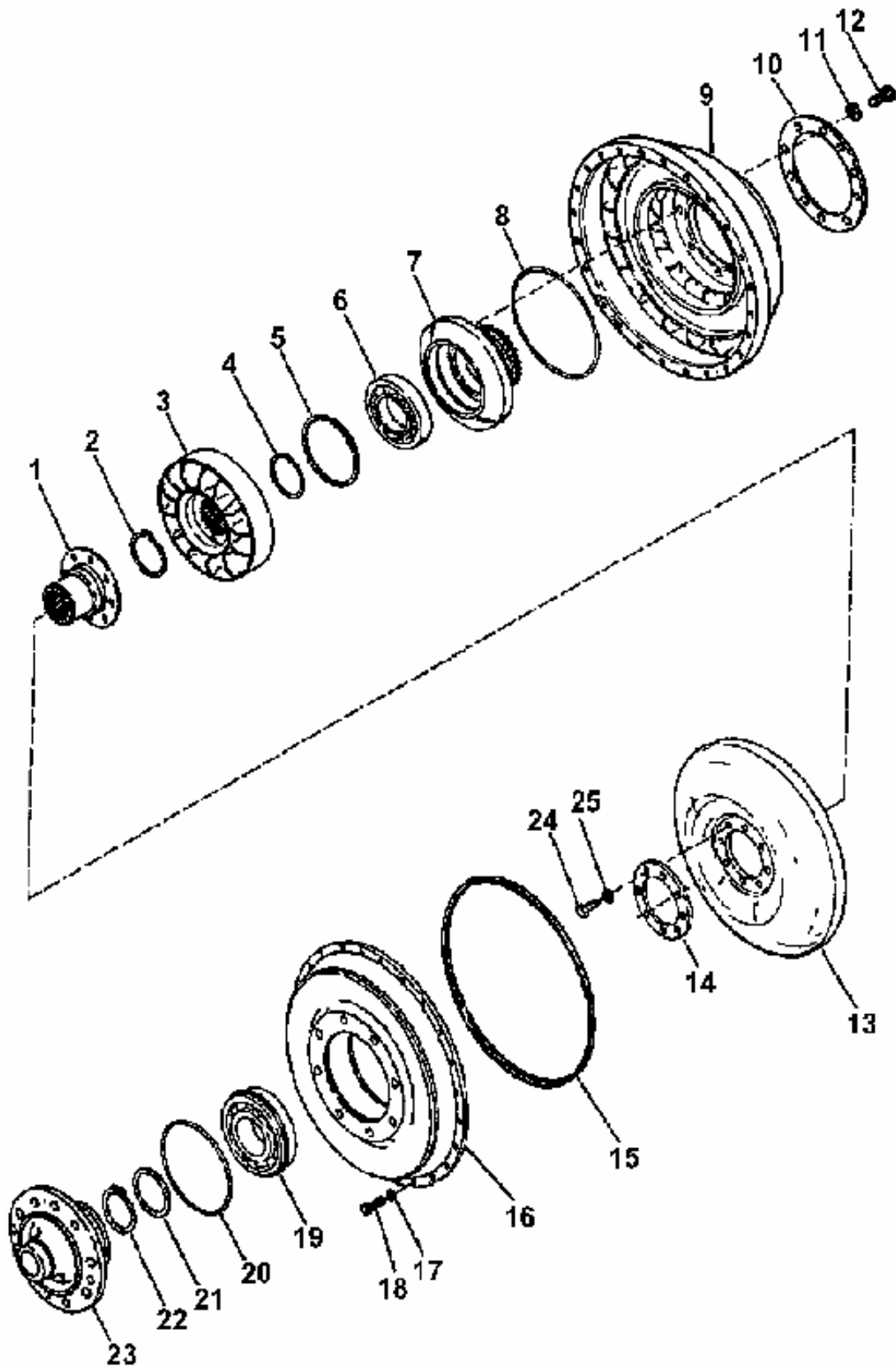
TRANSMISSION ASSEMBLY
465157

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	24670	STATOR SUPPORT SCREW	6
2	24680	STATOR SUPPORT SCREW LOCKWASHER	6
3	24936	STATOR SUPPORT & SLEEVE ASSEMBLY	1
4	244728	TURBINE SHAFT	1
5	244365	TURBINE SHAFT PISTON RING	1
6	24306	TURBINE SHAFT BEARING	1
7	24219	TURBINE SHAFT GEAR SNAP RING	1
8	244364	PISTON RING	1
10	24022	OIL BAFFLE OIL SEAL	1
11	24929	OIL BAFFLE SEAL RING	1
12	24911	OIL BAFFLE	1
13	244128	OIL BAFFLE RETAINER RING	1
14	24910	IMPELLER HUB GEAR	1
15	24576	IMPELLER HUB GEAR SNAP RING	1
16	244265	TURBINE SHAFT GEAR	1

*ITEMS NOT SHOWN

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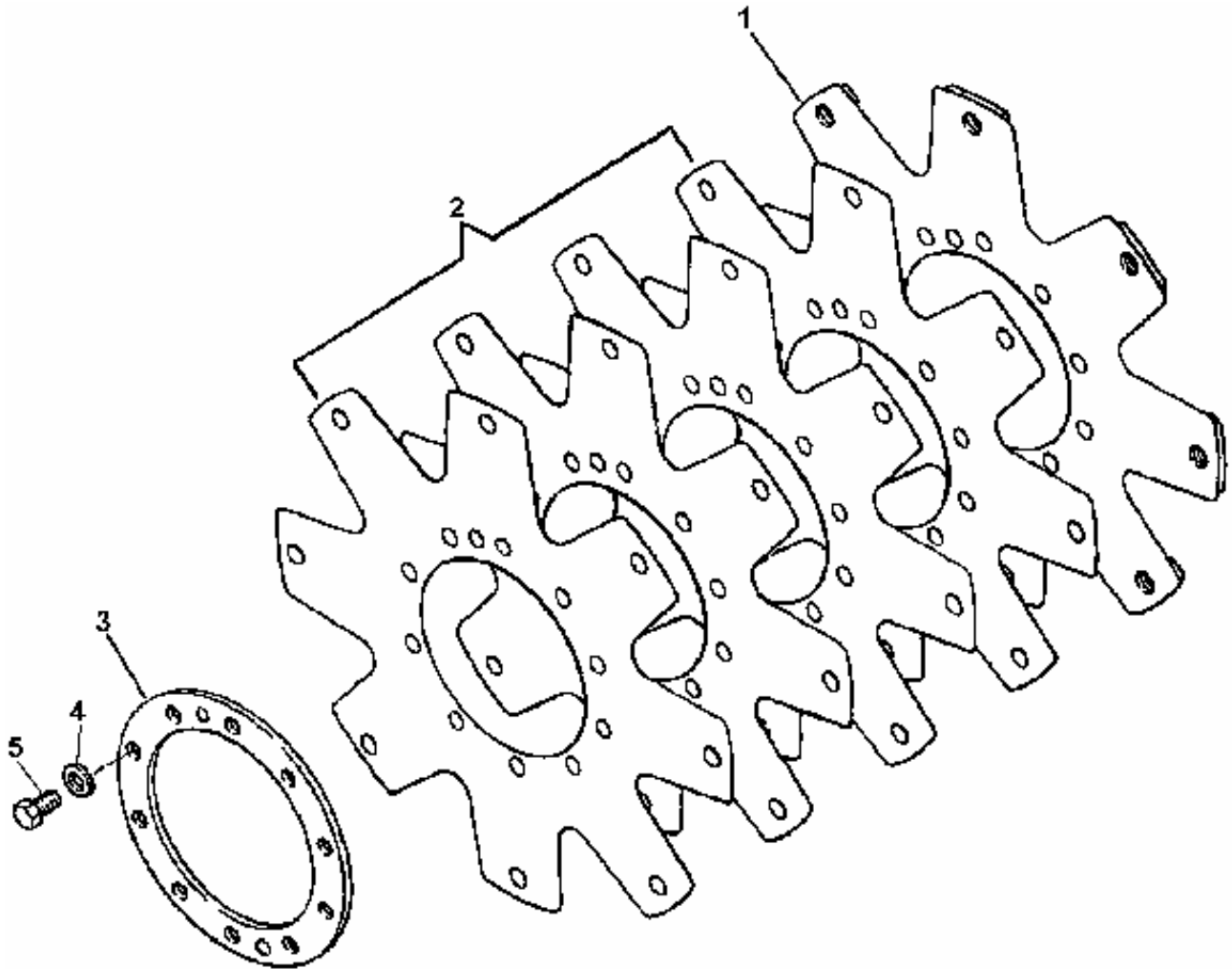
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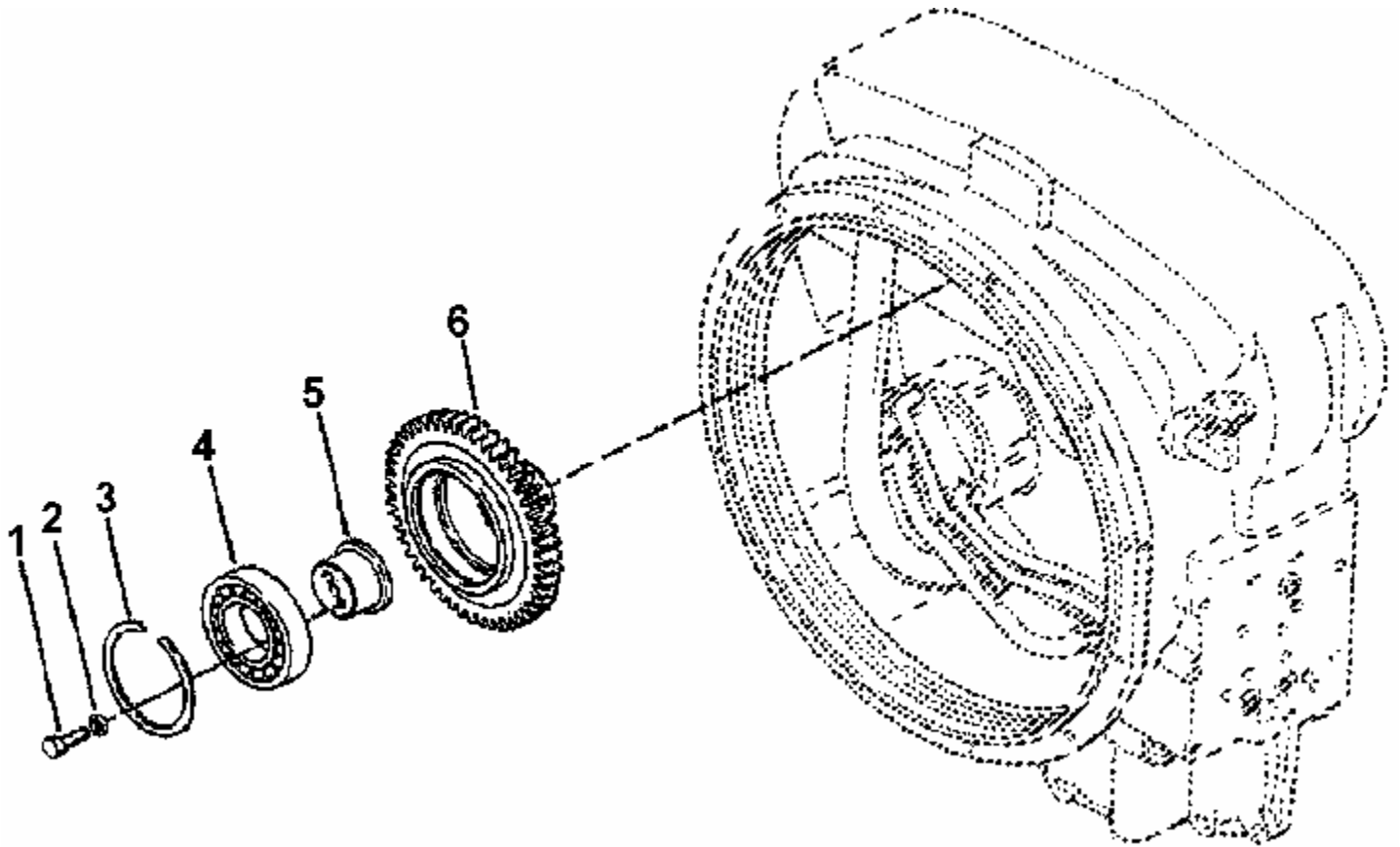
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	244729	TURBINE HUB	1
2	244123	REACTION MEMBER SNAP RING	1
3	244281	REACTION MEMBER	1
4	24577	REACTION MEMBER SPACER	1
5	244280	BEARING SNAP RING	1
6	244279	IMPELLER HUB BEARING	1
7	244278	IMPELLER HUB	1
8	244557	IMPELLER HUB O-RING	1
9	244730	IMPELLER	1
10	244275	IMPELLER HUB SCREW BACKING RING	1
11		NOT USED ON THIS MODEL	12
12	244274	HUB TO IMPELLOR SCREW	1
13	24599	TURBINE	1
14	244185	TURBINE HUB SCREW BACKING RING	1
15	24054	IMPELLER TO COVER O-RING	1
16	244187	IMPELLER COVER	1
17	24432	IMPELLER TO COVER SCREW LOCKWASHER	24
18	24673	IMPELLER TO COVER SCREW	24
19	ZZ240234	IMPELLER COVER BEARING	1
20	244664	BEARING CAP TO IMPELLOR COVER O-RING	1
21	244570	BEARING WASHER	1
22	244569	BEARING SNAP RING	1
23	244731	IMPELLER COVER BEARING CAP	1
24	24476	TURBINE HUB SCREW BACKING RING	8
25		NOT USED ON THIS MODEL	

*ITEMS NOT SHOWN

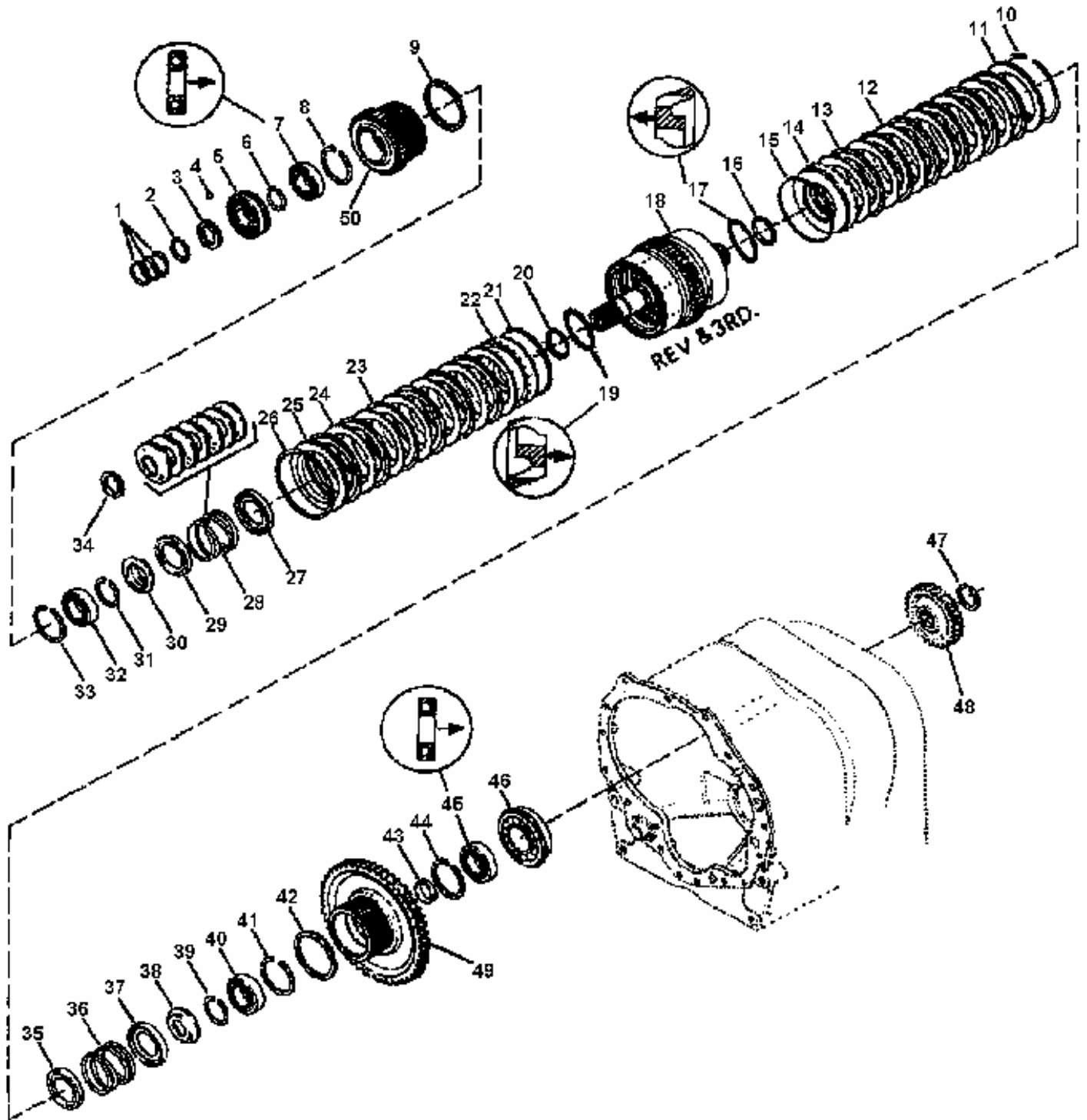
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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1		NOT USED ON THIS MODEL	
2	244392	DRIVE PLATE KIT (INCLUDES ITEMS 2 & 5)	1
3	244062	DRIVE PLATE BACKING RING	1
4	24505	WASHER	10
5	244393	DRIVE PLATE MOUNTING SCREW	10



ITEM	PART #	DESCRIPTION	QTY.
1	24947	BEARING SUPPORT SCREW	6
2	24435	BEARING SUPPORT SCREW LOCKWASHER	6
3	24908	DRIVE GEAR SNAP RING	3
4	244112	PUMP DRIVE GEAR BEARING	3
5	24912	PUMP DRIVE BEARING SUPPORT	3
6	24941	PUMP DRIVE GEAR	3



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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	24347	REVERSE & 3RD CLUTCH SHAFT PISTON RING	3
2	244190	FRONT BEARING RETAINER RING	1
3	244572	REVERSE & 3RD SHAFT FRONT BEARING END PLATE	1
4	244573	REVERSE & 3RD SHAFT BEARING END PLATE BALL	1
5	244006	REVERSE & 3RD SHAFT FRONT BEARING	1
6	244190	FRONT BEARING RETAINER RING	1
7	24291	CLUTCH DRIVEN GEAR BEARING – SHIELD IN	1
8	244652	CLUTCH DRIVEN GEAR BEARING SNAP RING	1
9	244124	CLUTCH HUB OIL BAFFLE RING	1
10	24568	END PLATE RETAINER RING	1
11	244574	END PLATE - 3RD CLUTCH	1
12	24058	CLUTCH OUTER DRIVE – 3RD CLUTCH	7
13	244546	CLUTCH INNER DISC – 3RD CLUTCH	7
14	244691	CLUTCH PISTON ASSEMBLY - 3RD CLUTCH	1
15	24526	CLUTCH PISTON OUTER SEAL	1
16	24529	CLUTCH PISTON INNER SEAL	1
17	244692	CLUTCH PISTON METERING SEAL	1
18	244693	REVERSE & 3RD CLUTCH DRUM & PLUG ASSEMBLY	1
19	244692	CLUTCH PISTON METERING SEAL	1
20	24529	CLUTCH PISTON INNER SEAL	1
21	24526	CLUTCH PISTON OUTER SEAL	1
22	244694	CLUTCH PISTON ASSEMBLY- REVERSE CLUTCH	1
23	244546	CLUTCH INNER DISC – REVERSE CLUTCH	6
24	24058	CLUTCH OUTER DISC – REVERSE CLUTCH	6
25	24583	END PLATE – REVERSE CLUTCH	1
26	24568	END PLATE RETAINER RING	1
27	24610	SPRING RETAINER	1
28	24609	PISTON RETURN SPRING	1
29	24607	SPRING RETAINER	1
30	24962	SPRING RETAINER SNAP RING RETAINER	1

*ITEMS NOT SHOWN

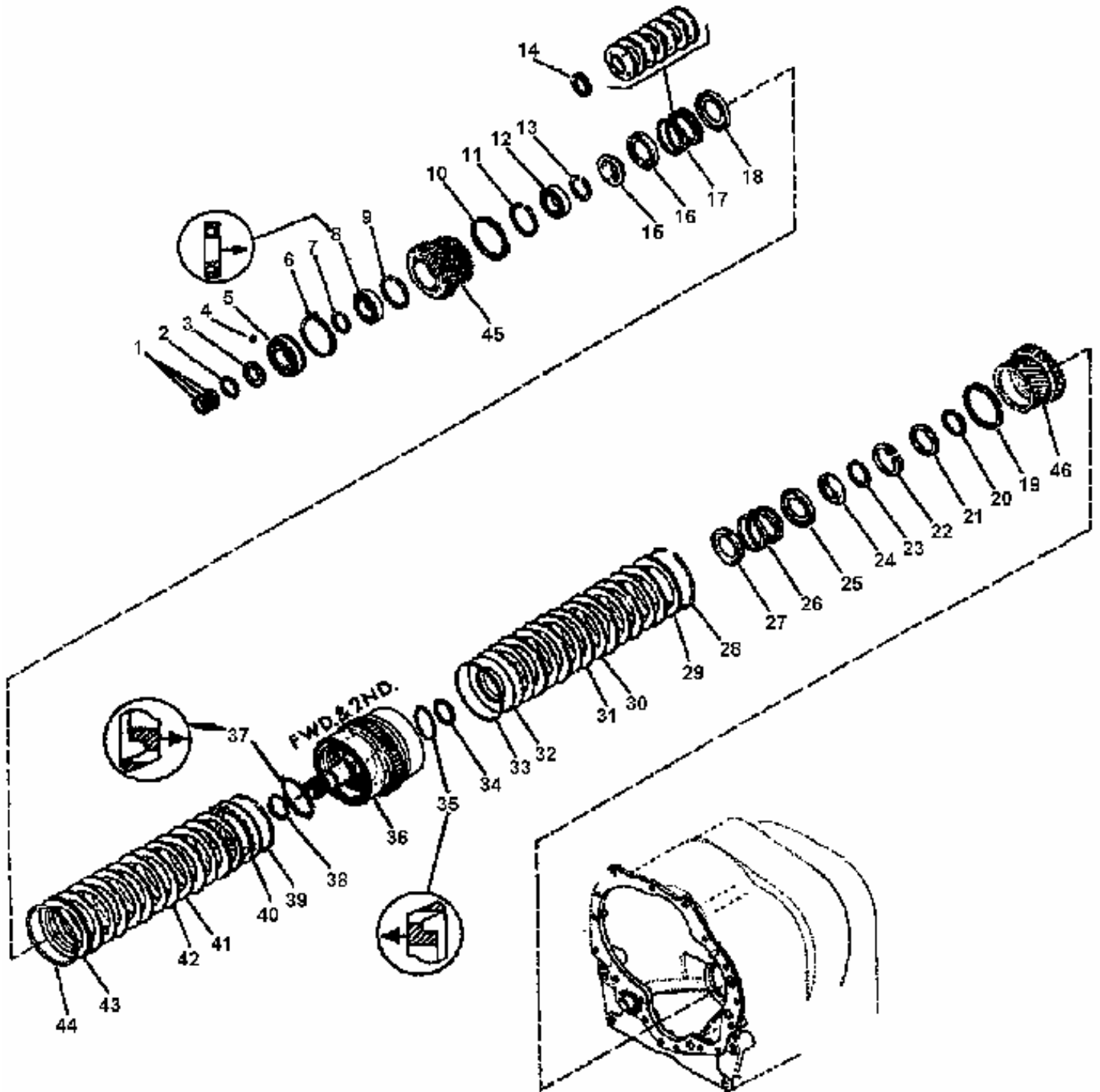
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31	24298	SPRING RETAINER SNAP RING	1
32	24293	CLUTCH DRIVEN GEAR BEARING	1
33	244652	CLUTCH DRIVEN GEAR BEARING SNAP RING	1
34		NOT USED ON THIS MODEL	
35	24610	SPRING RETAINER	1
36	24609	PISTON RETURN SPRING	1
37	24607	SPRING RETAINER	1
38	24962	SPRING RETAINER SNAP RING RETAINER	1
39	24298	SPRING RETAINER SNAP RING	1
40	24611	3RD GEAR BEARING	1
41	24579	3RD GEAR BEARING SNAP RING	1
42	244124	CLUTCH HUB OIL BAFFLE RING	1
43	24613	3RD GEAR BEARING SPACER	1
44	24579	3RD GEAR BEARING SNAP RING	1
45	24614	3RD GEAR BEARING – SHIELD OUT	1
46	244559	REVERSE & 3RD SHAFT REAR BEARING	1
47	24581	GEAR RETAINING RING	1
48	244695	LOW CLUTCH DRIVE GEAR	1
49	24612	3RD GEAR	1
50	244266	CLUTCH DRIVEN GEAR	1





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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	24347	FORWARD & 2ND SHAFT PISTON RING	3
2	244190	FRONT BEARING RETAINER RING	1
3	244572	FORWARD & 2ND SHAFT FRONT BEARING (PLATE)	1
4	244573	FORWARD & 2ND SHAFT FRONT END BALL	1
5	244006	FORWARD & 2ND SHAFT FRONT BEARING	1
6	24290	FRONT BEARING LOCATING RING	1
7	244190	FRONT BEARING RETAINER RING	1
8	24291	CLUTCH DRIVEN GEAR BEARING – SHIELD IN	1
9	244652	CLUTCH DRIVEN GEAR BEARING SNAP RING	1
10	244124	CLUTCH HUB OIL BAFFLE RING	1
11	244652	CLUTCH DRIVEN GEAR BEARING SNAP RING	1
12	24293	CLUTCH DRIVEN GEAR BEARING	1
13	24298	SPRING RETAINER SNAP RING	1
14		NOT USED ON THIS MODEL	
15	24962	SPRING RETAINER - SNAP RING RETAINER	1
16	24607	SPRING RETAINER	1
17	24609	PISTON RETURN SPRING	1
18	24610	SPRING RETAINER	1
19	244124	CLUTCH HUB OIL BAFFLE RING	1
20	24298	2ND GEAR RETAINING RING	1
21	244580	2ND GEAR LOCATING RING RETAINER	1
22	244224	2ND GEAR LOCATING RING RETAINER SNAP RING	1
23	24298	SPRING RETAINER SNAP RING	1
24	24962	SPRING RETAINER - SNAP RING RETAINER	1
25	24607	SPRING RETAINER	1
26	24609	PISTON RETURN SPRING	1
27	24610	SPRING RETAINER	1
28	24568	END PLATE RETAINER RING	1
29	244574	END PLATE – 2ND CLUTCH	1
30	24058	CLUTCH OUTER DISC – 2ND CLUTCH	7

*ITEMS NOT SHOWN

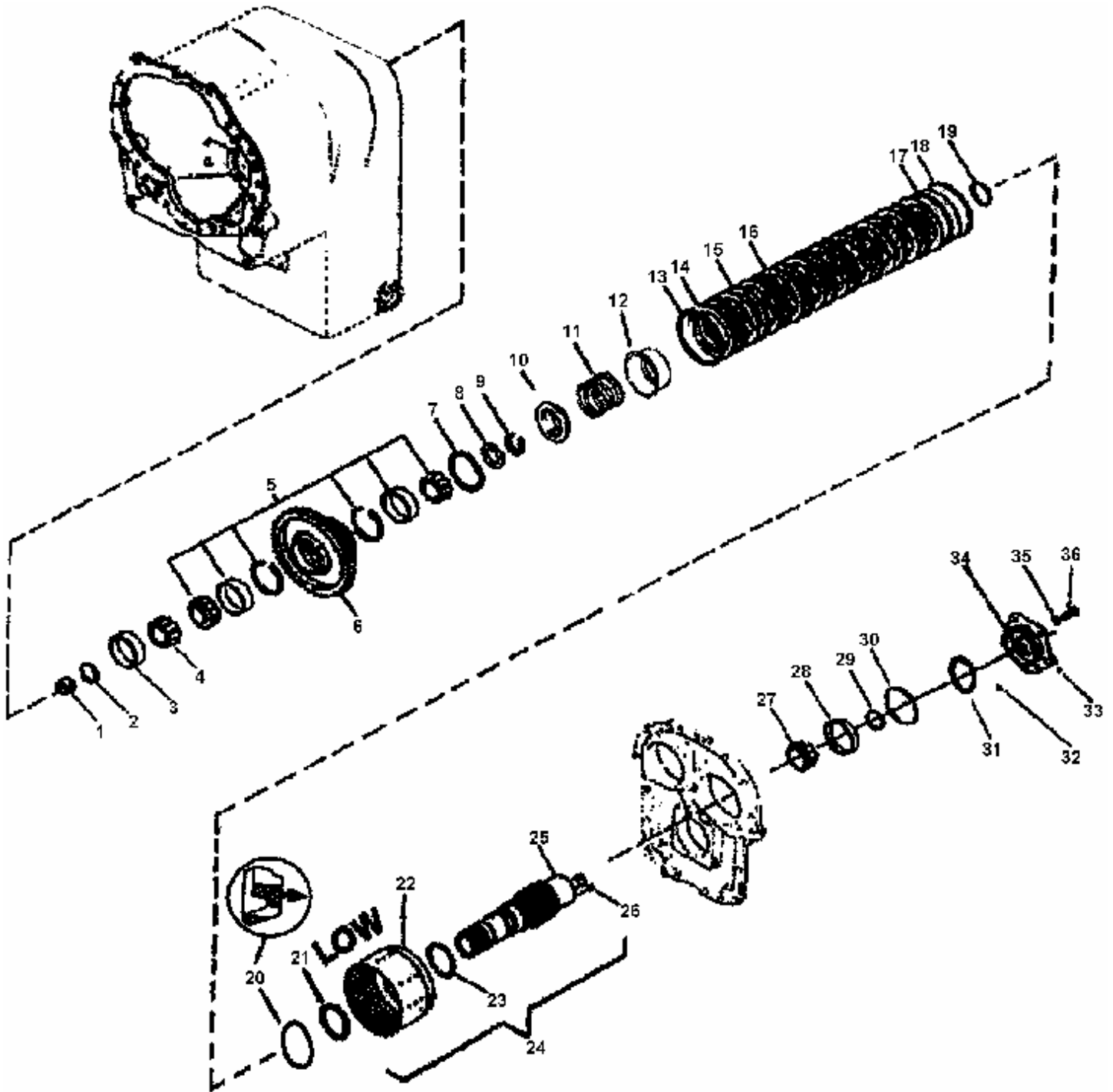
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31	244546	CLUTCH INNER DISC – 2ND CLUTCH	7
32	244691	CLUTCH PISTON ASSEMBLY – 2ND CLUTCH	1
33	24526	CLUTCH PISTON OUTER SEAL	1
34	24529	CLUTCH PISTON INNER SEAL	1
35	244692	CLUTCH PISTON METERING RING	1
36	244696	FORWARD & 2ND SHAFT, CLUTCH DRUM & PLUG ASSEMBLY	1
37	244692	CLUTCH PISTON METERING RING	1
38	24529	CLUTCH PISTON INNER SEAL	1
39	24526	CLUTCH PISTON OUTER SEAL	1
40	244694	CLUTCH PISTON ASSEMBLY – FORWARD CLUTCH	1
41	24058	CLUTCH OUTER DISC. – FORWARD CLUTCH	6
42	244546	CLUTCH INNER DISC. – FORWARD CLUTCH	6
43	24583	END PLATE – FORWARD CLUTCH	1
44	24568	END PLATE RETAINER RING	1
45	244266	FORWARD CLUTCH DRIVEN GEAR	1
46	244235	2ND GEAR	1





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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	24915	FORWARD & 2ND SHAFT PILOT BEARING	1
2		NOT USED ON THIS MODEL	
3	244703	LOW SHAFT FRONT BEARING CUP	1
4	244704	LOW SHAFT FRONT BEARING CONE	1
5	244732	LOW SPEED GEAR BEARING ASSEMBLY	1
6	244701	LOW SPEED GEAR	1
7	244124	CLUTCH HUB OIL BAFFLE RING	1
7A	244702	WASHER – BEARING SPACER	1
8	244699	SPRING RETAINING RING RETAINER	1
9	24219	SPRING RETAINING RING	1
10	244698	SPRING RETAINING	1
11	244697	SPRING - WAVE	1
12	244119	RETAINER – WAVE SPRING	1
13	24568	END PLATE RETAINER RING	1
14	24583	END PLATE	1
15	24057	CLUTCH INNER DISC	9
16	24058	CLUTCH OUTER DISC	9
17	244694	CLUTCH PISTON ASSEMBLY	1
18	24526	CLUTCH PISTON OUTER SEAL	1
19	24529	CLUTCH PISTON INNER SEAL	1
20	244692	SEAL – CLUTCH PISTON METERING	1
21	244394	LOW CLUTCH HUB RETAINING RING	1
22	244705	LOW CLUTCH HUB & DRUM ASSEMBLY	1
23	244706	LOW DRUM & SHAFT O-RING	1
24	244709	LOW SHAFT & DRUM ASSEMBLY (INCLUDES ITEMS 21-26)	1
25	244707	LOW SHAFT	1
26	244708	LOW SHAFT PLUG	1
27	244601	LOW SHAFT REAR BEARING CONE	1
28	24667	LOW SHAFT REAR BEARING CUP	1
29	244523	LOW SHAFT PRESSURE PISTON RING	1

*ITEMS NOT SHOWN

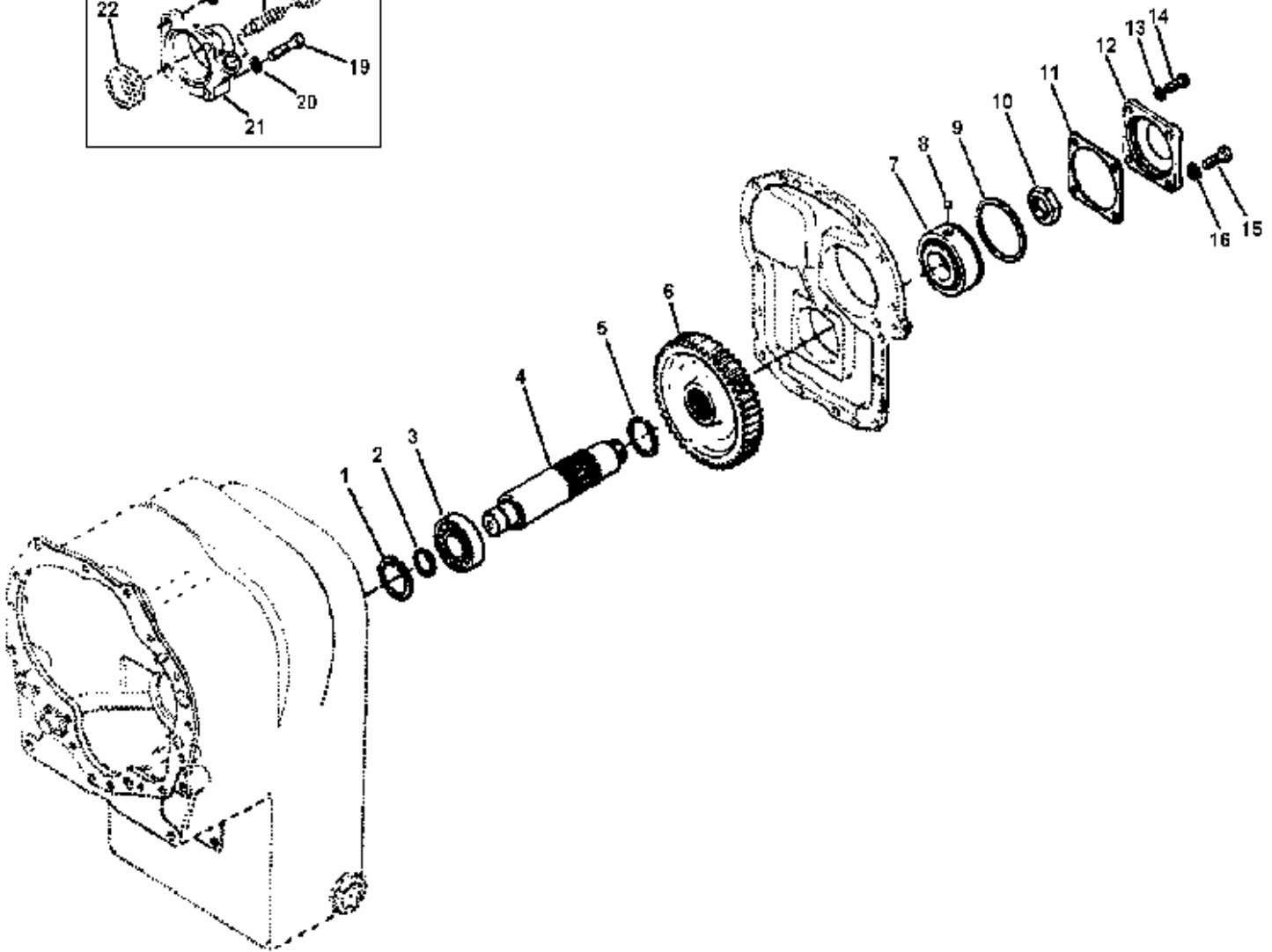
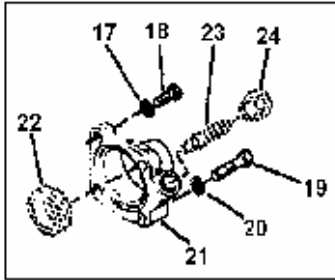
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30	244715	REAR BEARING CAP O-RING	1
31	244710	BEARING CAP SHIM - .004	A/R
31A	244711	BEARING CAP SHIM - .007	A/R
31B	244712	BEARING CAP SHIM - .010	A/R
31C	244713	BEARING CAP SHIM - .020	A/R
32	244716	O-RING PRESSURE TUBE	1
33	244453	REAR BEARING CAP PLUG	1
34	244714	REAR BEARING CAP	1
35	24432	REAR BEARING CAP LOCKWASHER	5
36	24673	REAR BEARING CAP CAPSCREW	5





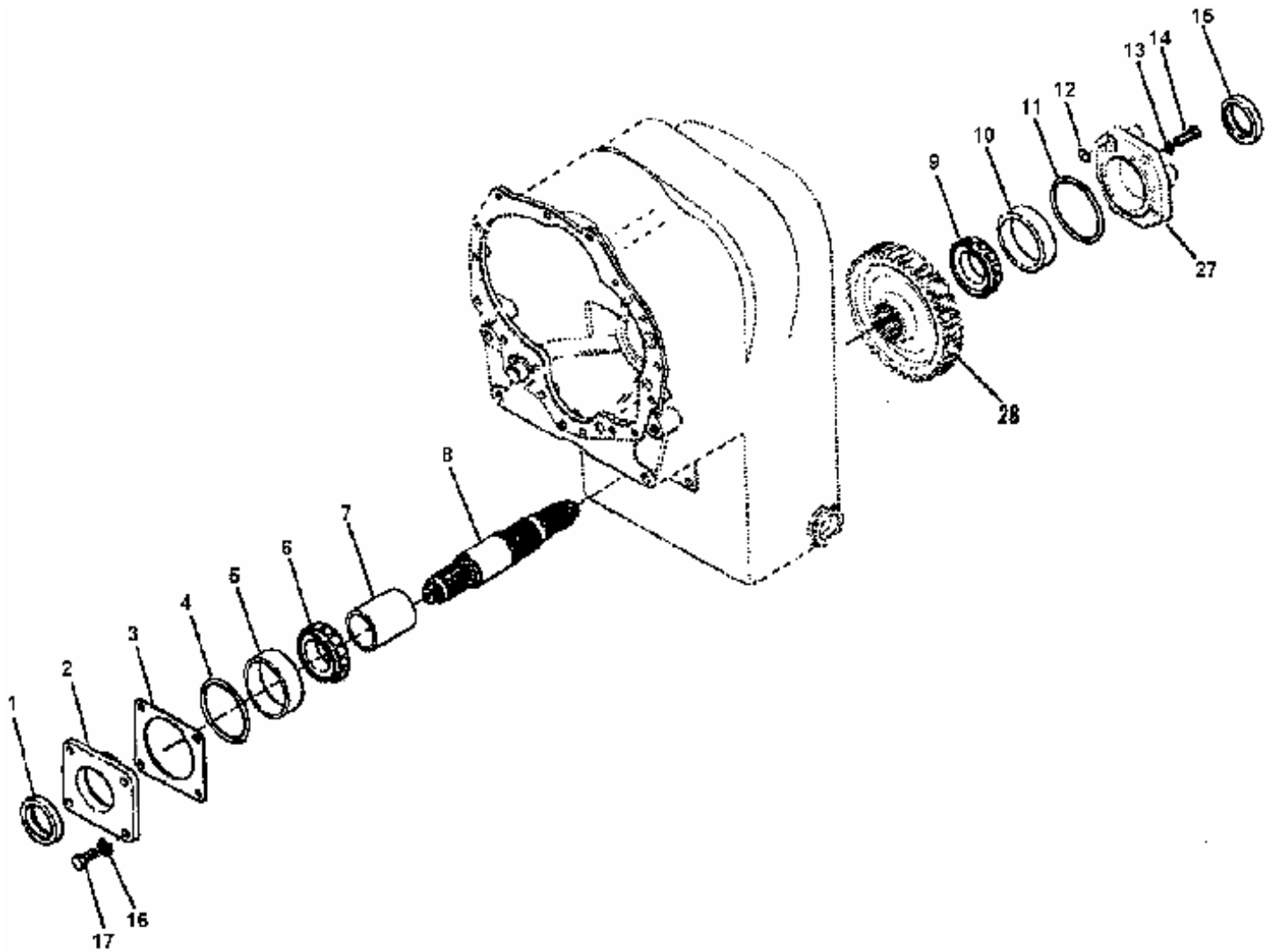
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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	244190	BEARING RETAINER RING	1
2	24575	BEARING LOCATING RING	1
3	24100	IDLER SHAFT FRONT BEARING	1
4	244594	IDLER SHAFT	1
5	244595	IDLER SHAFT LOCATING RING KEY-WAY	1
6	244733	IDLER SHAFT GEAR	1
7	24997	IDLER SHAFT GEAR BEARING	1
8	24697	IDLER SHAFT REAR BEARING LOCK BALL	1
9	24627	REAR BEARING LOCATING RING	1
10	244596	IDLER SHAFT NUT	1
11	244561	IDLER SHAFT BEARING CAP GASKET	1
12		SEE ITEM # 21	
13-16		NOT USED ON THIS MODEL	
17	244536	IDLER SHAFT BEARING CAP SCREW LOCKWASHER	2
18	244597	IDLE SHAFT BEARING CAP SCREW	2
19	244598	IDLE SHAFT BEARING CAP SCREW	2
20	244536	IDLER SHAFT BEARING CAP SCREW LOCKWASHER	2
21	244599	IDLE SHAFT BEARING CAP ROTATED 90 DEGREES (C.C.W.)	1
22	244734	SPACER – IDLER BEARING	1
23		NOT USED ON THIS MODEL	
24	244735	PLUG – IDLER CAP SPEEDO	1

*ITEMS NOT SHOWN

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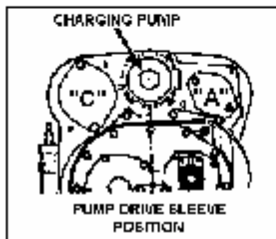
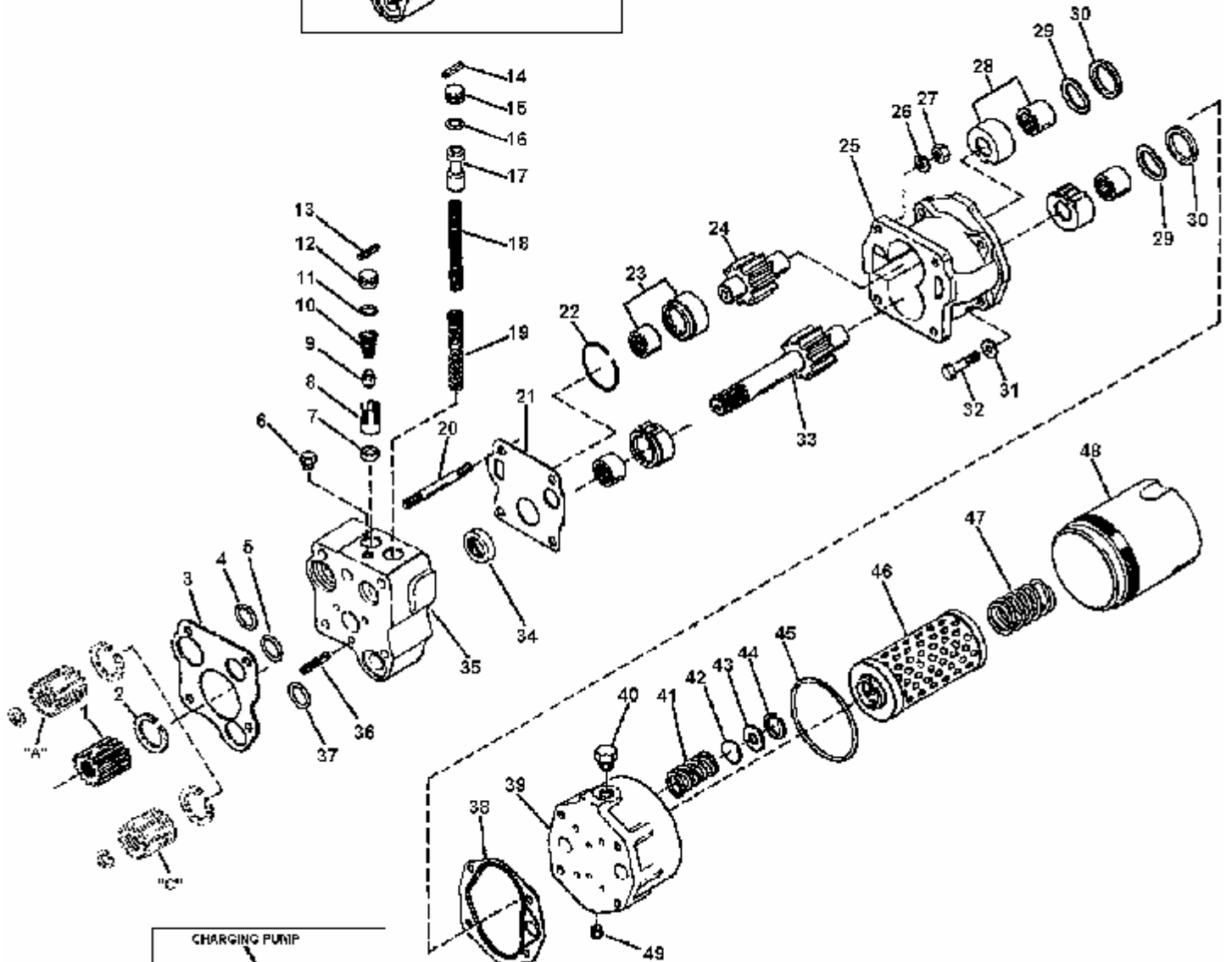
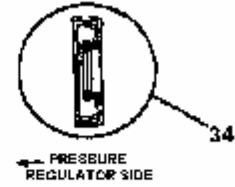
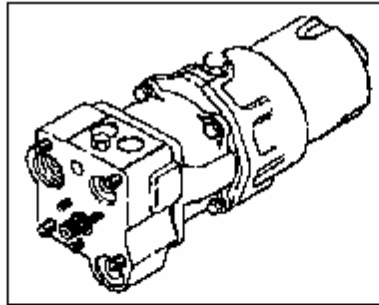
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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	244562	FRONT BEARING CAP OIL SEAL	1
2	24636	FRONT BEARING CAP	1
3	24632	BEARING CAP SHIM (.004)	A/R
3A	24633	BEARING CAP SHIM (.007)	A/R
3B	24634	BEARING CAP SHIM (.010)	A/R
3C	24635	BEARING CAP SHIM (.013)	A/R
4	24699	FRONT BEARING CAP O-RING	1
5	244600	FRONT BEARING CUP	1
6	244601	FRONT BEARING CONE	1
7	244602	OUTPUT SHAFT GEAR SPACER	1
8	244603	OUTPUT SHAFT	1
9	244601	REAR BEARING CONE	1
10	24667	REAR BEARING CUP	1
11	24953	REAR BEARING CAP O-RING	1
12	24698	REAR BEARING CAP O-RING	1
13	244528	REAR BEARING CAPSCREW LOCKWASHER	4
14	24675	REAR BEARING CAPSCREW	4
15	244562	REAR BEARING CAP OIL SEAL	1
16	244654	FRONT BEARING CAPSCREW LOCKWASHER	4
17	24674	FRONT BEARING CAPSCREW	4
18-26		NOT USED ON THIS MODEL	
27	244605	REAR BEARING CAP	1
28	244606	OUTPUT SHAFT GEAR	1

*ITEMS NOT SHOWN

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	244110	CHARGING PUMP DRIVE SLEEVE ASSEMBLY (INCLUDES ITEM 28)	1
2	24574	PUMP SLEEVE SNAP RING	1
3	244111	VALVE TO HOUSING GASKET	1
4	24950	VALVE BODY O-RING	1
5	24467	VALVE BODY O-RING	1
6	24689	PIPE PLUG	1
7	244091	SAFETY VALVE SEAT	1
8	244092	SAFETY VALVE SPACER	1
9	24534	SAFETY VALVE PLUNGER	1
10	24533	SAFETY VALVE SPRING	1
11	24490	VALVE STOP O-RING	1
12	244070	VALVE STOP	1
13	244286	VALVE STOP ROLL PIN	1
14	244286	VALVE STOP ROLL PIN	1
15	24570	VALVE STOP	1
16	24080	VALVE STOP O-RING	1
17	244736	VALVE PISTON	1
18	24572	VALVE SPRING - INNER	1
19	244109	VALVE SPRING - OUTER	1
20	244079	VALVE TO CONVERTER HOUSING STUD	4
21	244078	VALVE BODY TO PUMP GASKET	1
22	244094	PUMP BODY SNAP RING	1
23	244105	THRUST PLATE & BEARING ASSEMBLY	2
24	244104	PUMP DRIVEN SHAFT ASSEMBLY	1
25	244107	CHARGING PUMP ASSEMBLY (INCLUDES ITEMS 22-24, 28-30, 33)	1
26	24435	VALVE TO HOUSING STUD LOCKWASHER	4
27	24464	VALVE TO HOUSING STUD NUT	4
28	244101	THRUST PLATE & BEARING ASSEMBLY	2
29	244100	WAVE SPRING	2
30	244102	PUMP SHAFT SEAL	2

*ITEMS NOT SHOWN

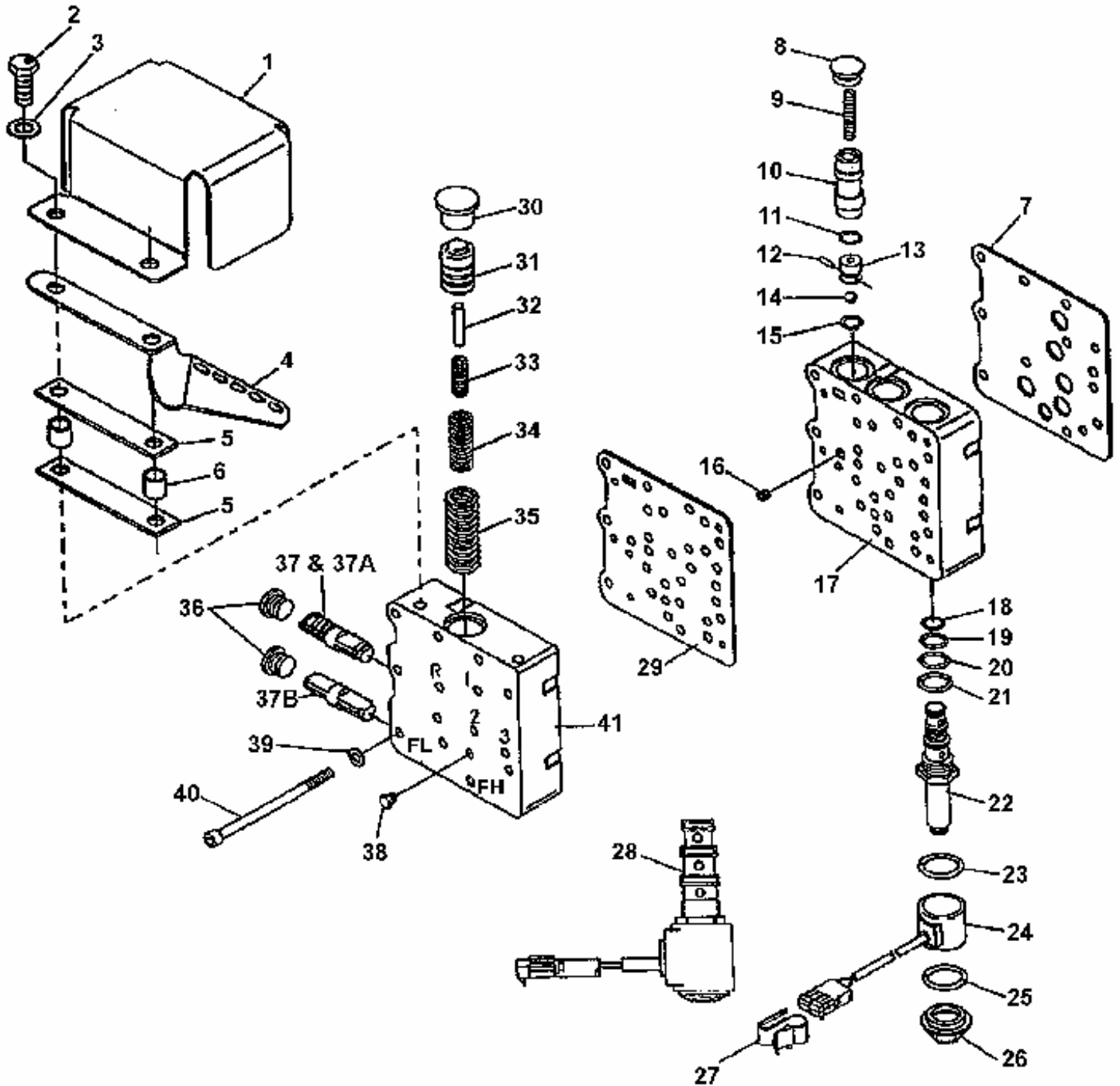
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31	244192	PUMP TO FILTER ADAPTOR SCREW LOCKWASHER	4
32	244287	PUMP TO FILTER ADAPTOR SCREW	4
33	244103	PUMP DRIVE SHAFT ASSEMBLY	1
34	24982	PUMP DRIVE SHAFT OIL SEAL	1
35	244076	PRESSURE REGULATOR VALVE ASSEMBLY (INCLUDES ITEMS 6-19, 34, 36)	1
36	244093	VALVE BODY ROLL PIN	3
37	24951	VALVE BODY O-RING	1
38	244080	PUMP TO FILTER GASKET	1
39	244182	FILTER ADAPTOR	1
40	24689	FILTER ADAPTOR PLUG	1
41	244071	BY-PASS FILTER DISC SPRING	1
42	244072	BY-PASS FILTER DISC	1
43	244073	BY-PASS FILTER DISC SEAT	1
44	24043	FILTER SEAT RETAINER RING	1
45	244165	FILTER HOUSING O-RING (INCLUDES ITEM 46)	1
46	24069	OIL FILTER ELEMENT ASSEMBLY (INCLUDES ITEM 45)	1
47	244074	OIL FILTER ELEMENT SPRING	1
48	244075	FILTER HOUSING	1
49	244166	PIPE PLUG	1
50		NOT USED ON THIS MODEL	1
51	244186	CHARGING PUMP & OIL FILTER ASSEMBLY (INCLUDES ITEMS 22-25, 28-33, 38-49)	1





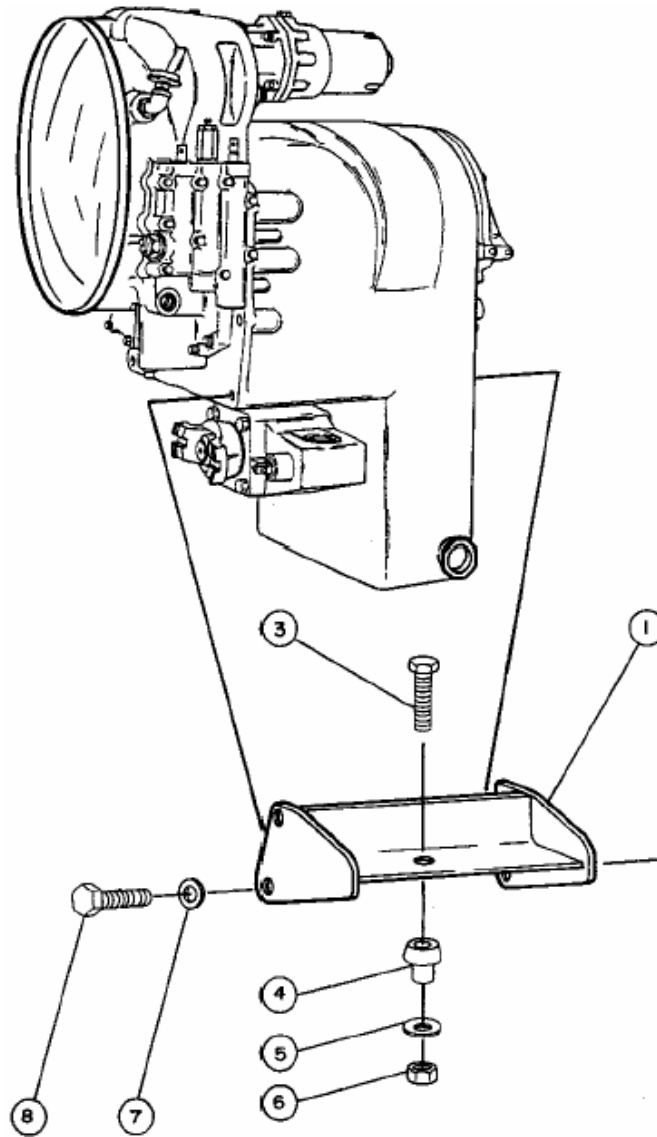
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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1-6		NOT USED ON THIS MODEL	
7	244628	CONTROL VALVE ASSEMBLY TO CONVERTER HOUSING GASKET	1
8	244167	MODULATOR PRESSURE REGULATOR BORE PLUG	1
9-16		NOT USED ON THIS MODEL	
17	244629	CONTROL VALVE HOUSING ASSEMBLY (INCLUDES ITEMS 8-16, 28, 29, 41)	1
18	244405	CARTRIDGE O-RING	5
19	244171	CARTRIDGE O-RING	5
20	244630	CARTRIDGE O-RING	5
21	244631	CARTRIDGE O-RING	5
22	244632	VALVE CARTRIDGE -4 WAY (INCLUDES ITEMS 18-21)	4
23	244633	SOLENOID COIL TO CARTRIDGE O-RING	4
24	244634	SOLENOID COIL - 24 VOLT	4
25	244635	SOLENOID NUT TO COIL O-RING	4
26	244636	SOLENOID COIL NUT	4
27		NOT USED ON THIS MODEL	
28	244637	SPOOL TYPE SOLENOID CARTRIDGE ASSEMBLY (INCLUDES ITEMS 18-26)	4
29	244638	CONTROL VALVE COVER TO HOUSING GASKET	1
38	244639	CLUTCH PRESSURE PORT PLUG	6
39	244154	CONTROL VALVE ASSEMBLY SCREW WASHER	9
40	244640	CONTROL VALVE ASSEMBLY - TO CONVERTER HOUSING SCREW	9
41	244641	CONTROL VALVE COVER ASSEMBLY (INCLUDES ITEM 38)	1
42	244642	ELECTRIC CONTROL VALVE ASSEMBLY (INCLUDES ITEMS 17, 29, 41)	1
43	244643	PORT 4 WAY PLUG	1
44	24242	PIPE PLUG	1

*ITEMS NOT SHOWN

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	13256-02	TRANSMISSION MOUNT (R.H. SIDE)	1
2	13256-01	TRANSMISSION MOUNT (L.H. SIDE)	1
3	17GC12072	BOLT	2
4	32290	RUBBER MOUNT	2
5	17503-01	WASHER	2
6	59GD12	NUT	2
7	02GE12	WASHER	8
8	17GC12030	BOLT	8

Specifications

Model 32000 Series Transmission



SPICER OFF-HIGHWAY PRODUCTS



TOWING OR PUSH STARTING

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

NOTE: If the transmission has 4 wheel drive, disconnect both front and rear drivelines. Because of the design of the hydraulic system, the engine **cannot be started by pushing or towing.**

FORWARD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the **SPICER OFF-HIGHWAY COMPONENTS DIVISION** product.

Extreme care has been exercised in the design, selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.

In order to become familiar with the various parts of the product, its principle of operation, trouble shooting and adjustments, it is urged that the mechanic study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.

Whenever repair or replacement of component parts is required, only **Spicer Off-Highway Components Division**-approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. **Spicer Off-Highway Components Division** does not warrant repair or replacement parts, nor failures resulting from the use of parts which are not supplied by or approved by **Spicer Off-Highway Components Division**. **IMPORTANT: Always furnish the Distributor with the serial and model number when ordering parts.**

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NOTE: Metric Dimensions Shown in Brackets [].

TRANSMISSION ASSEMBLY

The transmission and hydraulic torque portion of the power train enacts an important role in transmitting engine power to the driving wheels. In order to properly maintain and service these units it is important to first understand their function and how they operate.

The transmission and torque converter function together and operate through a common hydraulic system. It is necessary to consider both units in the study of their function and operation.

To supplement the text below, and for reference use therewith, the following illustrations are provided:

- Basic Design Silhouette
- Converter Group
- Converter and Transmission Case Group
- Reverse and 3rd, Forward and 2nd Clutch Group
- Low (1st) Clutch and Output Group
- Regulating Valve, Charging Pump and Filter Group
- Control Valve Assembly
- Axle Disconnect and Mechanical Parking Brake
- Assembly Instruction
- Ring Gear Installation
- Clutch and Gear Arrangement
- Three Speed Power Flow
- External Plumbing

The R, HR, and MHR Model Transmissions are of three basic designs.

The R Model consists of a separate torque converter, mounted to the engine with the powershift transmission remotely mounted and connected to the torque converter with a drive shaft.

The HR Model consists of a torque converter and powershifted transmission in one package mounted directly to the engine.

The MHR version is a mid-mount torque converter and transmission assembly connected to the engine by means of a drive shaft. (See Fig. A for basic design silhouette.)

The shift control valve assembly may be mounted directly on the side of the converter housing or front transmission cover, or remote mounted and connected to the transmission by means of flexible hoses. The function of the control valve assembly is to direct oil under pressure to the desired directional and speed clutch. A provision is made on certain models to neutralize the transmission when the brakes are applied. This is accomplished through use of a brake actuated shutoff valve. The speed and direction clutch assemblies are mounted inside the transmission case and are connected to the output shaft of the converter either by direct gearing or drive shaft. The purpose of the speed or directional clutches is to direct the power flow through the gear train to provide the desired speed range and direction.

An axle disconnect is optional and is located on the output shaft. The drive to the front or rear axle can be disconnected or connected by manual shifting.

HOW THE UNITS OPERATE

With the engine running, the converter charging pump draws oil from the transmission sump through the removable oil suction screen and directs it through the pressure regulating valve and oil filter.

The pressure regulating valve maintains pressure to the transmission control cover for actuating the direction and speed clutches. This requires a small portion of the total volume of oil used in the system. The remaining volume of oil is directed through the torque converter circuit to the oil cooler and returns to the transmission for positive lubrication. This regulator valve consists of a hardened valve spool operating in a closely fitted bore. The valve spool is spring loaded to hold the valve in a closed position. When a specific pressure is achieved, the valve spool works against the spring until a port is exposed along the side of the bore. This sequence of events provides the proper system pressure.

After entering the converter housing the oil is directed through the stator support to the converter blade cavity and exits in the passage between the turbine shaft and converter support. The oil then flows out of the converter to the oil cooler. After leaving the cooler, the oil is directed to a fitting on the transmission. Then through a series of tubes and passages lubricates the transmission bearings and clutches. The oil then gravity drains to the transmission sump.

The hydraulic torque converter consists basically of three elements and their related parts to multiply engine torque. The engine power is transmitted from the engine flywheel to the impeller element through the impeller cover. This element is the pump portion of the hydraulic torque converter and is the primary component which starts the oil flowing to the other components which results in torque multiplication. This element can be compared to a centrifugal pump in that it picks up fluid at its center and discharges at its outer diameter.

The torque converter turbine is mounted opposite the impeller and is connected to the output shaft of the torque converter. This element receives fluid at its outer diameter and discharges at its center. Fluid directed by the impeller out into the particular design of blading in the turbine and reaction member is the means by which the hydraulic torque converter multiplies torque.

The reaction member of the torque converter is located between and at the center or inner diameters of the impeller and turbine elements. Its function is to take the fluid which is exhausting from the inner portion of the turbine and change its direction to allow correct entry for recirculation into the impeller element.

The torque converter will multiply engine torque to its designed maximum multiplication ratio when the output shaft is at zero RPM. Therefore, we can say that as the output shaft is decreasing in speed the torque multiplication is increasing.

The shift control valve assembly consists of a valve body with selector valve spools. A detent ball and spring in the selector spool provides one position for each speed range. A detent ball and spring in the direction spool provides three positions, one each for forward, neutral and reverse.

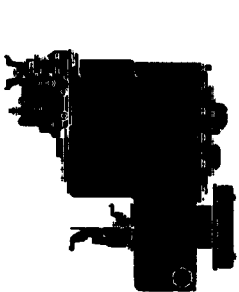
With the engine running and the directional control lever in neutral position, oil pressure from the regulating valve is blocked at the control valve, and the transmission is in neutral. Movement of the forward and reverse spool will direct oil, under pressure to either the forward or reverse direction clutch as desired.

When either directional clutch is selected the opposite clutch is relieved of pressure and vents back through the direction selector spool. The same procedure is used in the speed selector.

The direction or speed clutch assembly consists of a drum with internal splines and a bore to receive a hydraulically actuated piston. The piston is "oil tight" by the use of sealing rings. A steel disc with external splines is inserted into the drum and rests against the piston. Next, a friction disc with splines at the inner diameter is inserted. Discs are alternated until the required total is achieved. A heavy back-up plate is then inserted and secured with a snap ring. A Hub with O.D. splines is inserted into the splines of discs with teeth on the inner diameter. The discs and hub are free to increase in speed or rotate in the opposite direction as long as no pressure is present in that specific clutch.

To engage the clutch, as previously stated, the control valve is placed in the desired position. This allows oil under pressure to flow from the control valve, through a tube, to a chosen clutch shaft. This shaft has a drilled passageway for oil under pressure to enter the shaft. Oil pressure sealing rings are located on the clutch shaft. These rings direct oil under pressure to a desired clutch. Pressure of the oil forces the piston and discs against the heavy back-up plate. The discs, with teeth on the outer diameter, clamping against discs with teeth on the inner diameter, enables the hub and clutch shaft to be locked together and allows them to drive as a unit.

There are bleed balls in the clutch piston which allow quick escape for oil when the pressure to the piston is released.



R-32000



HR-32000



MHR-32000

FIG. A

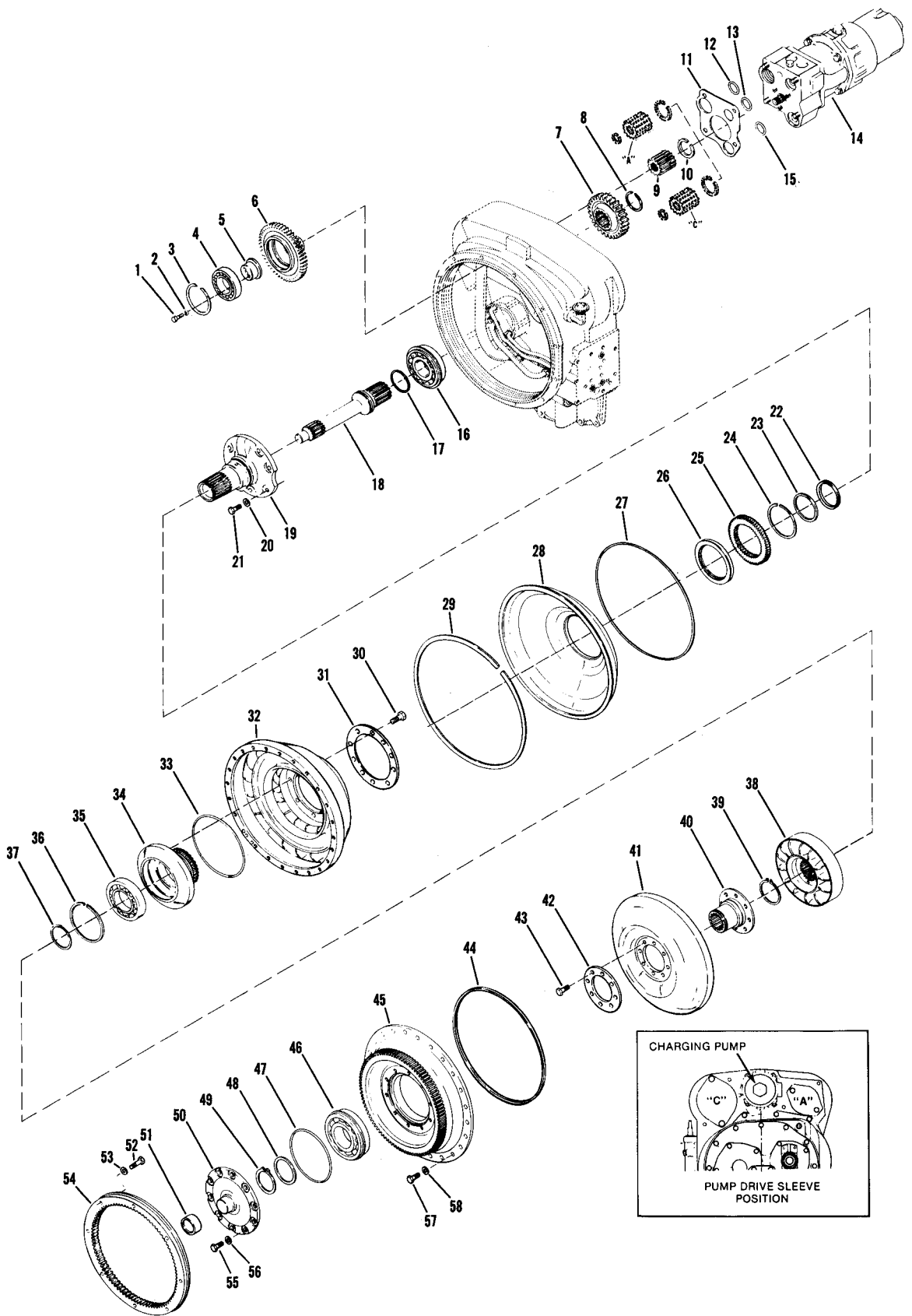
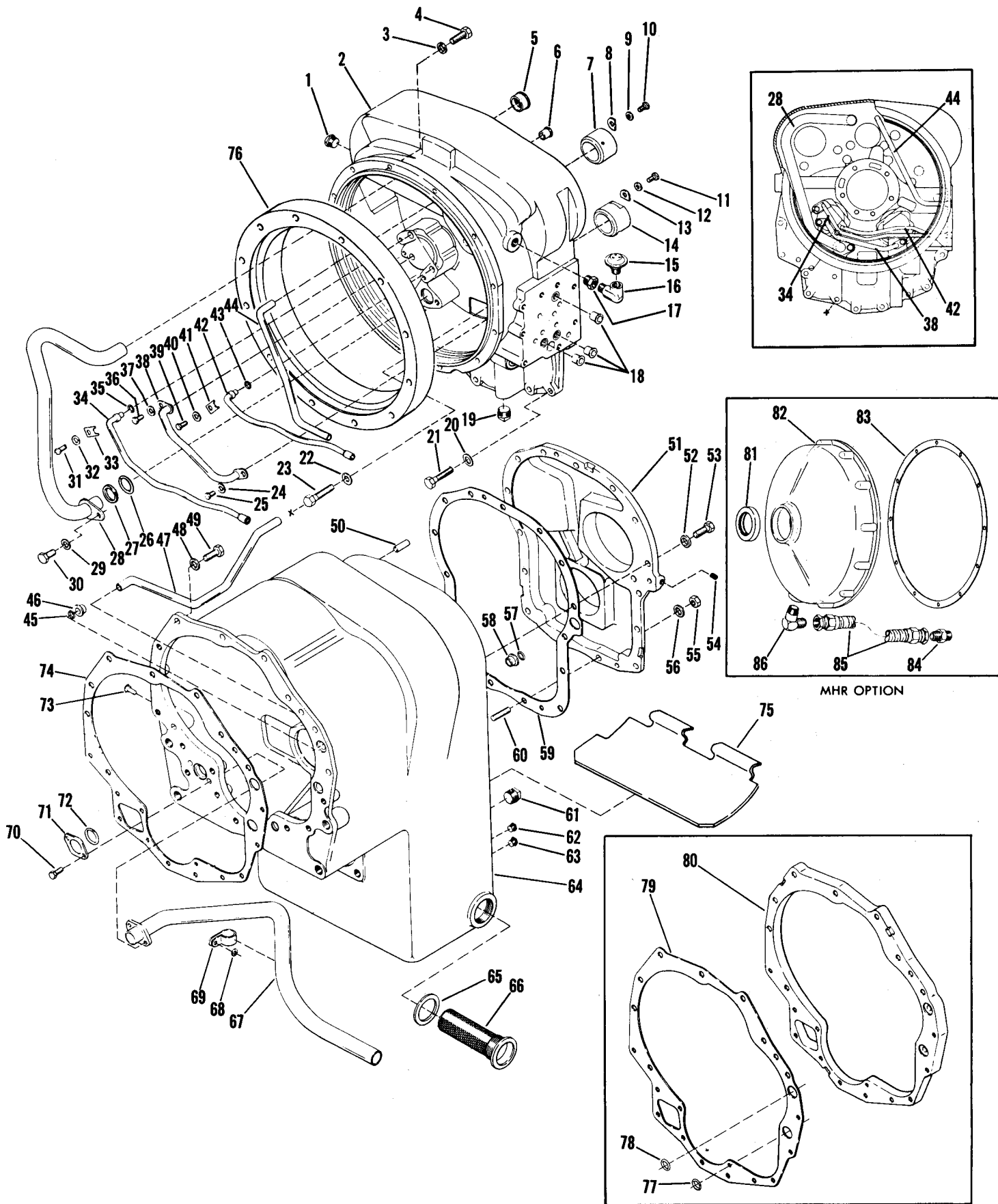


Figure B

HR32000 CONVERTER GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Bearing Support Screw	6	30	Hub to Impeller Screw.	12
2	Bearing Support Screw Lockwasher. . .	6	31	Impeller Hub Screw Backing Ring	1
3	Drive Gear Snap Ring	3	32	Impeller.	1
4	Pump Drive Gear Bearing	3	33	Impeller Hub "O" Ring	1
5	Pump Drive Bearing Support.	3	34	Impeller Hub.	1
6	Pump Drive Gear	3	35	Impeller Hub Bearing.	1
7	Turbine Shaft Gear.	1	36	Bearing Snap Ring.	1
8	Turbine Shaft Gear Snap Ring	1	37	Reaction Member Spacer	1
9	Charging Pump Drive Sleeve.	1	38	Reaction Member.	1
10	Pump Sleeve Snap Ring	1	39	Reaction Member Snap Ring	1
11	Valve to Housing Gasket.	1	40	Turbine Hub	1
12	Valve Body "O" Ring	1	41	Turbine	1
13	Valve Body "O" Ring	1	42	Turbine Hub Backing Ring	1
14	Charging Pump & Oil Filter Assembly . . .	1	43	Turbine Hub Screw	8
15	Valve Body "O" Ring	1	44	Impeller to Cover "O" Ring.	1
16	Turbine Shaft Bearing	1	45	Impeller Cover	1
17	Turbine Shaft Piston Ring.	1	46	Impeller Cover Bearing	1
18	Turbine Shaft	1	47	Bearing Cap to Impeller Cover "O" Ring	1
19	Stator Support	1	48	Bearing Washer	1
20	Stator Support Screw Lockwasher. . . .	6	49	Bearing Snap Ring	1
21	Stator Support Screw.	6	50	Impeller Cover Bearing Cap.	1
22	Piston Ring	1	51	Impeller Cover Sleeve	1
23	Piston Ring Expander Spring	1	52	Ring Gear Screw	16
24	Impeller Hub Gear Snap Ring.	1	53	Plain Washer.	16
25	Impeller Hub Gear	1	54	Flywheel Ring Gear	1
26	Oil Baffle Oil Seal.	1	55	Bearing Cap to Impeller Cover Screw . . .	10
27	Oil Baffle Seal Ring	1	56	Bearing Cap to Impeller Cover Screw Lockwasher.	10
28	Oil Baffle.	1	57	Impeller to Cover Screw	24
29	Oil Baffle Retainer Ring.	1	58	Impeller to Cover Screw Lockwasher . . .	24



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

Figure C

HR32000 CONVERTER & TRANSMISSION CASE GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Pipe Plug	1	45	Clutch Pressure Tube "O" Ring	1
2	Converter Housing Assembly	1	46	Tube Sleeve	1
3	Converter Housing to Front Cover Screw Lockwasher	12	47	Low Speed Clutch Pressure Tube	1
4	Converter Housing to Front Cover Screw	12	48	Transmission Case to Converter Housing Screw Lockwasher	10
5	Tube Sleeve	1	49	Transmission Case to Converter Housing Screw	10
6	Tube Sleeve	1	50	Rear Cover Dowel Pin	2
7	Converter Housing Sleeve	1	51	Rear Cover	1
8	Converter Housing Sleeve Lock	1	52	Rear Cover to Transmission Case Screw Lockwasher	13
9	Converter Housing Sleeve Screw Lockwasher	1	53	Rear Cover to Transmission Case Screw	13
10	Converter Housing Sleeve Screw	1	54	Rear Cover Pipe Plug	1
11	Converter Housing Sleeve Screw	1	55	Rear Cover to Case Stud Nut	2
12	Converter Housing Sleeve Screw Lockwasher	1	56	Rear Cover to Case Stud Lockwasher	2
13	Converter Housing Sleeve Lock	1	57	Clutch Pressure Tube "O" Ring	1
14	Converter Housing Sleeve	1	58	Tube Sleeve	1
15	Breather	1	59	Rear Cover to Transmission Case Gasket	1
16	Street Ell	1	60	Rear Cover to Case Stud	2
17	Breather Reducing Bushing	1	61	Magnetic Drain Plug	1
18	Tube Sleeve	3	62	Oil Level Plug	1
19	Pipe Plug	1	63	Oil Level Plug	1
20	Converter Housing to Transmission Housing Screw Lockwasher	4	64	Transmission Case Assembly	1
21	Converter Housing to Transmission Housing Screw	4	65	Screen Assembly Gasket	1
22	Converter Housing to Transmission Housing Lockwasher	4	66	Screen Assembly	1
23	Converter Housing to Transmission Housing Screw	4	67	Suction Tube	1
24	Lube Tube Retaining Screw Lockwasher	1	68	Suction Tube Clip Washer	1
25	Lube Tube Retaining Screw	1	69	Suction Tube Clip	1
26	Suction Tube "O" Ring	1	70	Suction Line Screw	2
27	Suction Tube Spacer Ring	1	71	Suction Line Washer	1
28	Suction Tube Assembly	1	72	Suction Line "O" Ring	1
29	Suction Tube Retainer Screw Lockwasher	1	73	Suction Tube Clip Rivet	1
30	Suction Tube Retainer Screw	1	74	Converter Housing to Transmission Case Gasket	1
31	Tube Clip Screw	1	75	Oil Baffle	1
32	Tube Clip Screw Lockwasher	1	76	Converter Housing Adaptor Ring	1
33	Tube Clip	1	77	4th Speed Pressure Tube "O" Ring	1
34	Reverse Tube Assembly	1	78	Low Speed Pressure Tube "O" Ring	1
35	Reverse Tube "O" Ring	1	79	Converter Housing to Transmission Case Gasket	1
36	Lube Tube Retainer Screw	1	80	Converter Housing to Transmission Case Spacer (12 plate clutch pack only)	1
37	Lube Tube Retainer Screw Lockwasher	1	81	Front Cover Oil Seal	1
38	Lube Tube Assembly	1	82	Converter Housing Front Cover	1
39	Tube Clip Screw	1	83	Converter Housing Front Cover Gasket	1
40	Tube Clip Screw Lockwasher	1	84	Hose Fitting	1
41	Tube Clip	1	85	Hose Assembly	1
42	3rd Speed Tube	1	86	Hose Fitting	1
43	3rd Speed Tube "O" Ring	1			
44	Valve Oil Supply Tube	1			

ITEMS 81 THRU 86 FOR MHR ONLY.

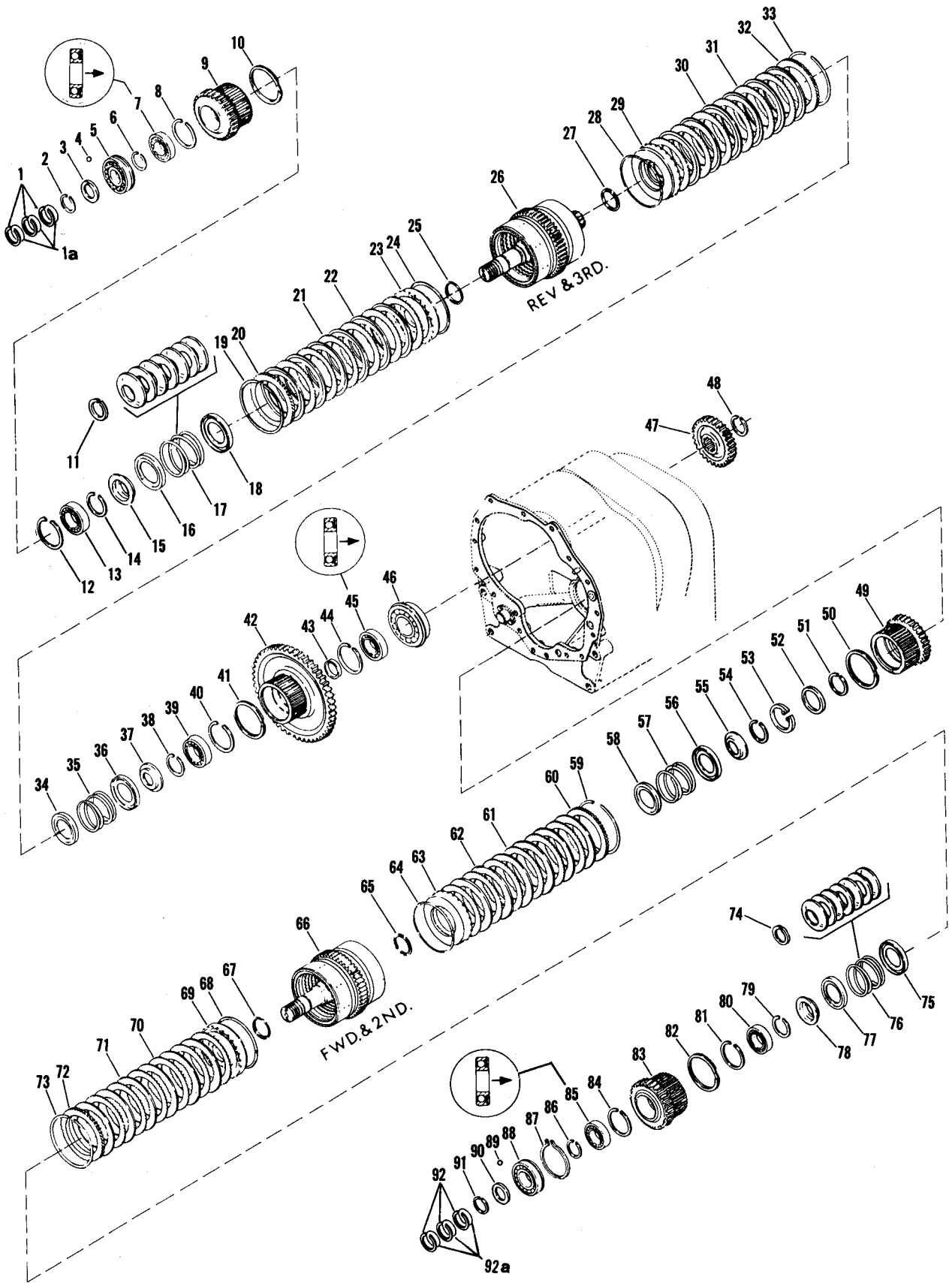


Figure D

R OR HR32000

REVERSE & 3RD & FORWARD & 2ND CLUTCH GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Reverse & 3rd Clutch Shaft Piston Ring	3	47	Low Clutch Drive Gear	1
1A	Piston Ring Expander Springs	3	48	Gear Retaining Ring	1
2	Front Bearing Retainer Ring	1	49	2nd Gear	1
3	Reverse & 3rd Shaft Front Bearing End Plate	1	50	Clutch Hub Oil Baffle Ring	1
4	Reverse & 3rd Shaft Bearing End Plate Ball	1	51	2nd Gear Retainer Ring	1
5	Reverse & 3rd Shaft Front Bearing	1	52	2nd Gear Retainer Ring Retainer	1
6	Front Bearing Retainer Ring	1	53	2nd Gear Retainer Ring Retainer Snap Ring	1
7	Clutch Driven Gear Bearing - Shield In	1	54	Spring Retainer Snap Ring	1
8	Clutch Driven Gear Bearing Snap Ring	1	55	Spring Retainer Snap Ring Retainer	1
9	Clutch Driven Gear	1	56	Spring Retainer	1
10	Clutch Hub Oil Baffle Ring	1	57	Piston Return Spring	1
11	Spring Retainer Snap Ring	1	58	Spring Retainer	1
12	Clutch Driven Gear Bearing Snap Ring	1	59	End Plate Retainer Ring	1
13	Clutch Driven Gear Bearing	1	60	End Plate - 2nd Clutch	1
14	Spring Retainer Snap Ring	1	61	Clutch Outer Disc - 2nd Clutch	6
15	Spring Retainer Snap Ring Retainer	1	62	Clutch Inner Disc - 2nd Clutch	6
16	Spring Retainer	1	63	Clutch Piston Assembly - 2nd Clutch	1
17	Piston Return Spring	1	64	Clutch Piston Outer Seal	1
18	Spring Retainer	1	65	Clutch Piston Inner Seal	1
19	End Plate Retainer Ring	1	66	Forward & 2nd Clutch Drum	1
20	End Plate - Reverse Clutch	1	67	Clutch Piston Inner Seal	1
21	Clutch Outer Disc - Reverse Clutch	6	68	Clutch Piston Outer Seal	1
22	Clutch Inner Disc - Reverse Clutch	6	69	Clutch Piston Assembly - Forward Clutch	1
23	Clutch Piston Assembly - Reverse Clutch	1	70	Clutch Outer Disc - Forward Clutch	6
24	Clutch Piston Outer Seal	1	71	Clutch Inner Disc - Forward Clutch	6
25	Clutch Piston Inner Seal	1	72	End Plate - Forward Clutch	1
26	Reverse & 3rd Clutch Drum	1	73	End Plate Retainer Ring	1
27	Clutch Piston Inner Seal	1	74	Spring Retainer Snap Ring	1
28	Clutch Piston Outer Seal	1	75	Spring Retainer	1
29	Clutch Piston - 3rd Clutch	1	76	Piston Return Spring	1
30	Clutch Inner Disc - 3rd Clutch	6	77	Spring Retainer	1
31	Clutch Outer Disc - 3rd Clutch	6	78	Spring Retainer Snap Ring Retainer	1
32	End Plate - 3rd Clutch	1	79	Spring Retainer Snap Ring	1
33	End Plate Retainer Ring	1	80	Clutch Driven Gear Bearing	1
34	Spring Retainer	1	81	Clutch Driven Gear Bearing Snap Ring	1
35	Piston Return Spring	1	82	Clutch Hub Oil Baffle Ring	1
36	Spring Retainer	1	83	Forward Clutch Driven Gear	1
37	Spring Retainer Snap Ring Retainer	1	84	Clutch Driven Gear Bearing Snap Ring	1
38	Spring Retainer Snap Ring	1	85	Clutch Driven Gear Bearing - Shield In	1
39	3rd Gear Bearing	1	86	Front Bearing Retainer Ring	1
40	3rd Gear Bearing Snap Ring	1	87	Front Bearing Locating Ring	1
41	Clutch Hub Oil Baffle Ring	1	88	Forward & 2nd Shaft Front Bearing	1
42	3rd Gear	1	89	Forward & 2nd Shaft Bearing End Plate Ball	1
43	3rd Gear Bearing Spacer	1	90	Forward & 2nd Shaft Front Bearing End Plate	1
44	3rd Gear Bearing Snap Ring	1	91	Front Bearing Retainer Ring	1
45	3rd Gear Bearing - Shield Out	1	92	Forward & 2nd Shaft Piston Ring	3
46	Reverse & 3rd Shaft Rear Bearing	1	92A	Piston Ring Expander Springs	3

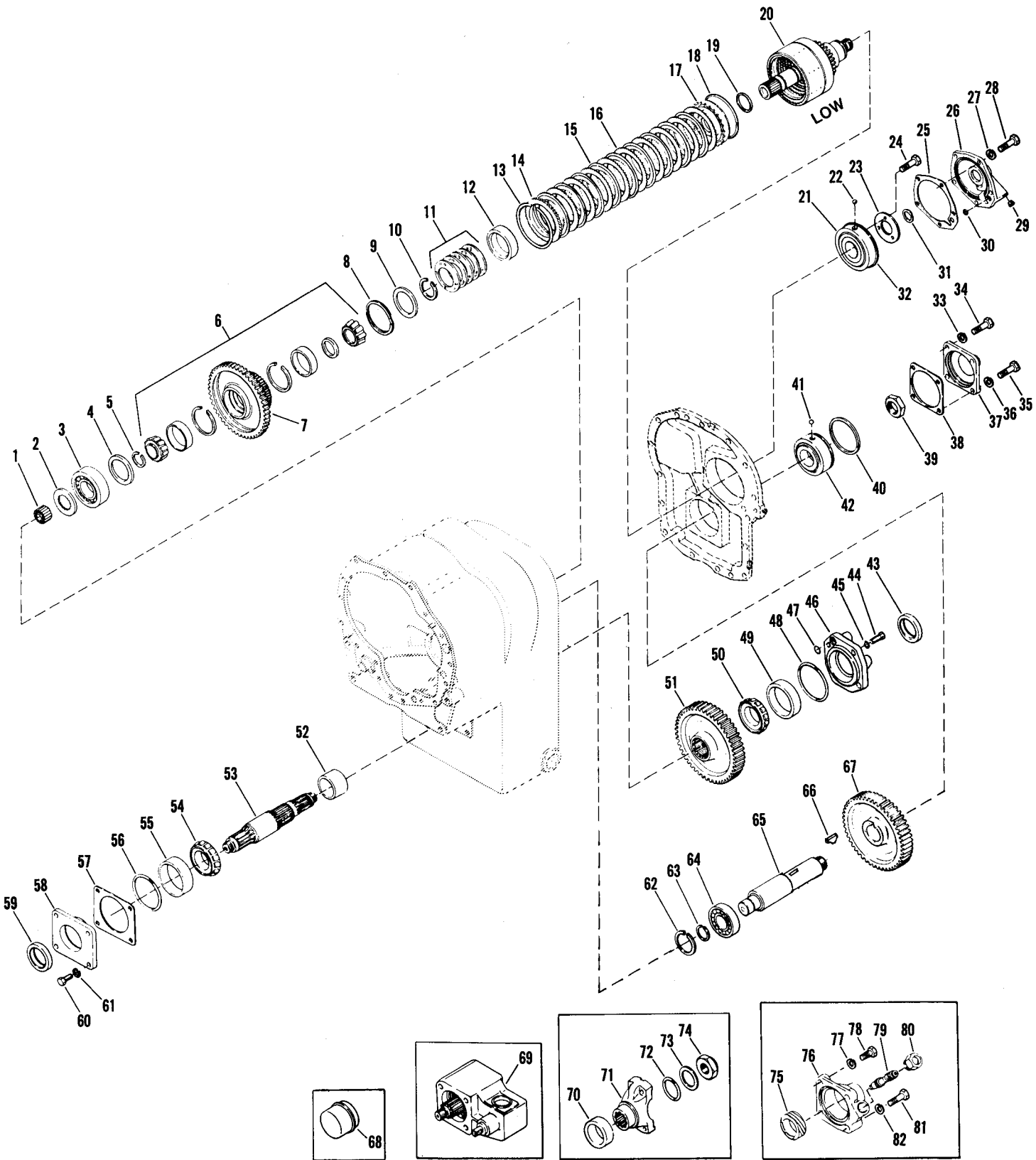


Figure E

R OR HR32000 LOW (1ST) CLUTCH & OUTPUT GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY.
1	Low Speed Clutch Shaft Pilot Bearing	1	42	Idler Shaft Rear Bearing	1
2	2nd Gear Bearing End Plate	1	43	Rear Bearing Cap Oil Seal	1
3	2nd Gear Bearing	1	44	Rear Bearing Cap Screw	4
4	Bearing Retaining Ring Retainer	1	45	Rear Bearing Cap Screw Lockwasher	4
5	Low Speed Gear Bearing Retainer Ring	1	46	Rear Bearing Cap	1
6	Low Speed Gear Bearing Assembly	1	47	Rear Bearing Cap "O" Ring	1
7	Low Speed Gear	1	48	Rear Bearing Cap "O" Ring	1
8	Clutch Hub Oil Baffle Ring	1	49	Rear Bearing Cup	1
9	Spring Retaining Ring Retainer	1	50	Rear Bearing Cone	1
10	Spring Retaining Ring	1	51	Output Shaft Gear	1
11	Piston Return Disc Springs	5	52	Output Shaft Gear Spacer	1
12	Piston to Piston Return Disc Springs Spacer	1	53	Output Shaft	1
13	End Plate Retainer Ring	1	54	Front Bearing Cone	1
14	End Plate	1	55	Front Bearing Cup	1
15	Clutch Inner Disc	9	56	Front Bearing Cap "O" Ring	1
16	Clutch Outer Disc	9	57	Bearing Cap Shim	AR
17	Clutch Piston	1	58	Front Bearing Cap	1
18	Clutch Piston Outer Seal	1	59	Front Bearing Cap Oil Seal	1
19	Clutch Piston Inner Seal	1	60	Front Bearing Cap Screw	4
20	Low Speed Clutch Drum	1	61	Front Bearing Cap Screw Lockwasher	4
21	Low Speed Shaft Rear Bearing	1	62	Bearing Retainer Ring	1
22	Bearing Lockball	1	63	Bearing Locating Ring	1
23	Rear Bearing Retainer Plate	1	64	Idler Shaft Front Bearing	1
24	Rear Bearing Retainer Plate Screw	3	65	Idler Shaft	1
25	Rear Bearing Cap Gasket	1	66	Idler Shaft Gear Key	1
26	Rear Bearing Cap	1	67	Idler Shaft Gear	1
27	Rear Bearing Cap Screw Lockwasher	5	68	Bore Plug (optional)	1
28	Rear Bearing Cap Screw	5	69	Disconnect Assembly (optional)	1
29	Rear Bearing Cap Plug	1	70	Oil Seal	1
30	Rear Bearing Cap "O" Ring	1	71	Output Flange	1
31	Clutch Shaft Piston Plug	1	72	Output Flange "O" Ring	1
32	Low Speed Shaft Rear Bearing Locating Ring	1	73	Output Flange Washer	1
33	Bearing Cap Screw Lockwasher	2	74	Output Flange Nut	1
34	Bearing Cap Screw	2	75	Speedo Drive Gear	1
35	Bearing Cap Screw	2	76	Rear Bearing Cap	1
36	Bearing Cap Screw Lockwasher	2	77	Rear Bearing Cap Screw Lockwasher	3
37	Idler Shaft Bearing Cap	1	78	Rear Bearing Cap Screw	3
38	Idler Shaft Bearing Cap Gasket	1	79	Speedo Driven Gear	1
39	Idler Shaft Nut	1	80	Speedo Tube Nut	1
40	Rear Bearing Locating Ring	1	81	Rear Bearing Cap Screw	1
41	Idler Shaft Rear Bearing Lockball	1	82	Rear Bearing Cap Screw Lockwasher	1

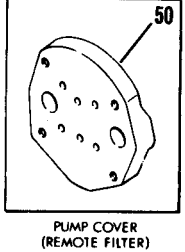
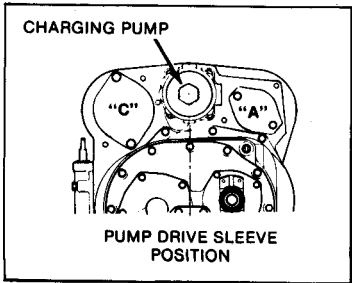
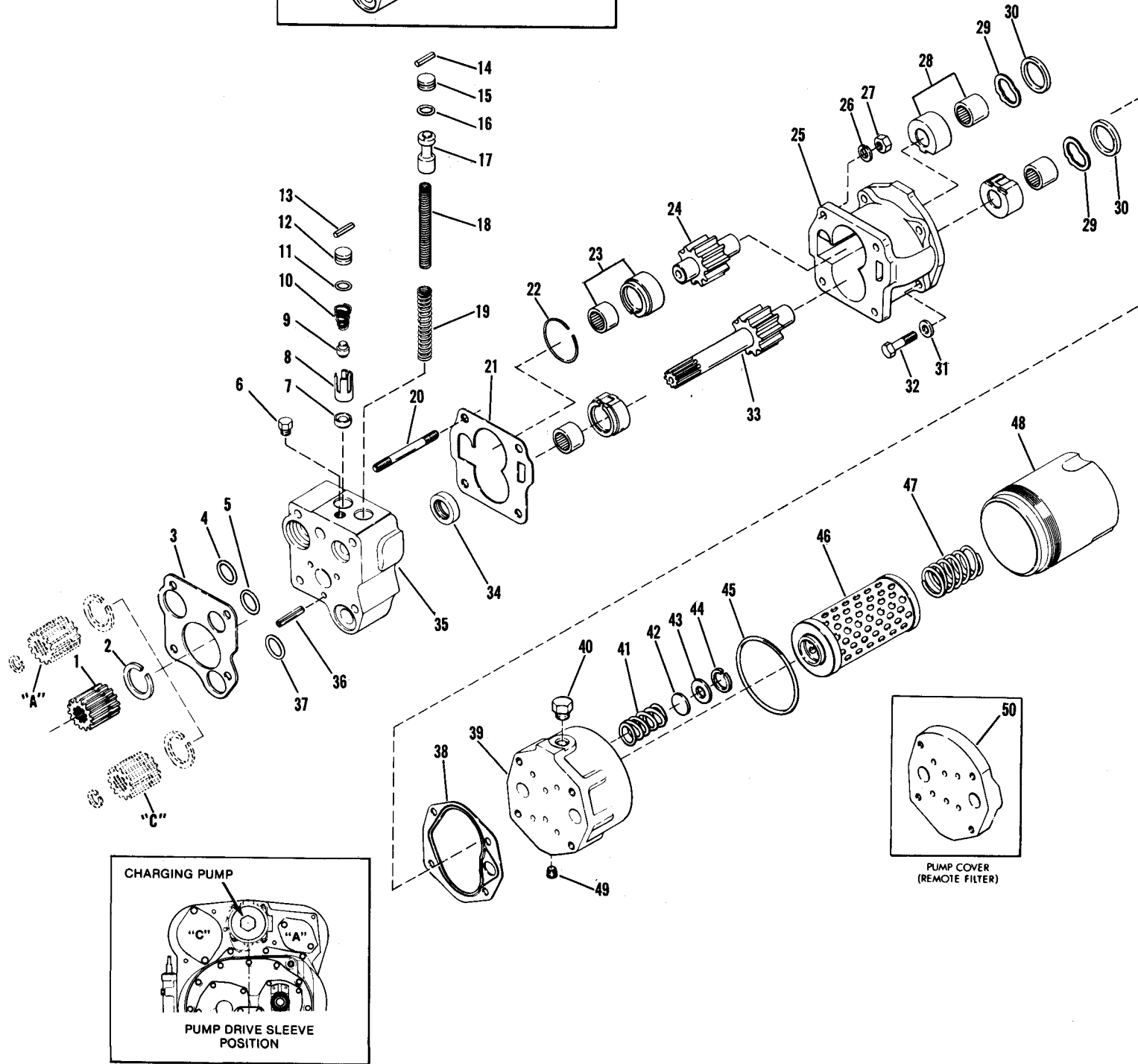
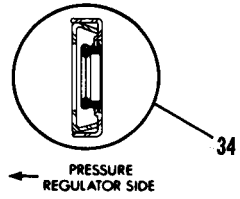
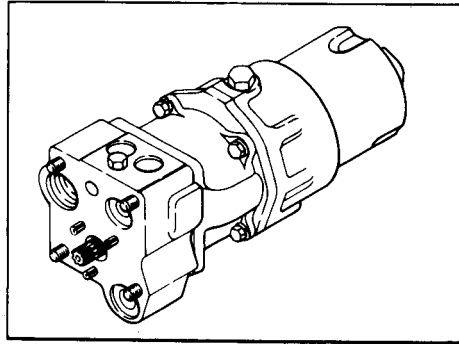
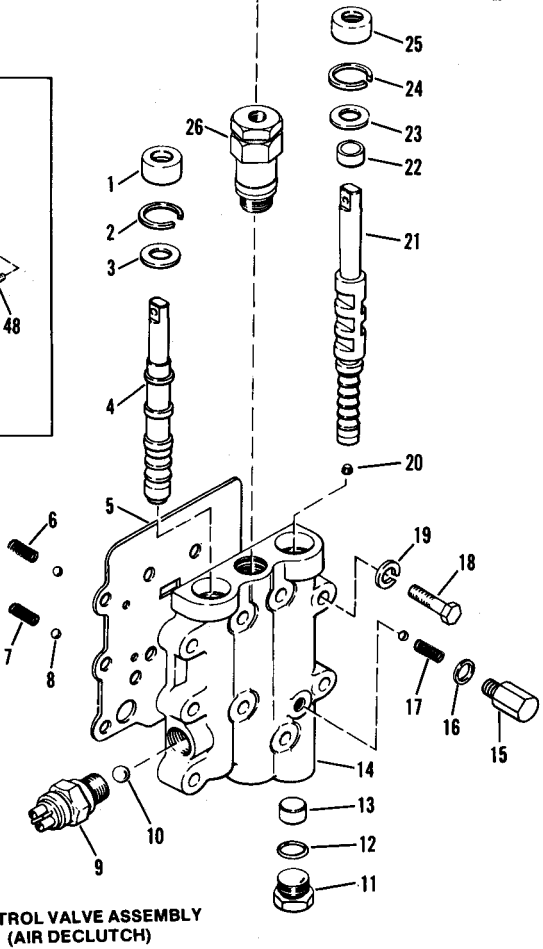
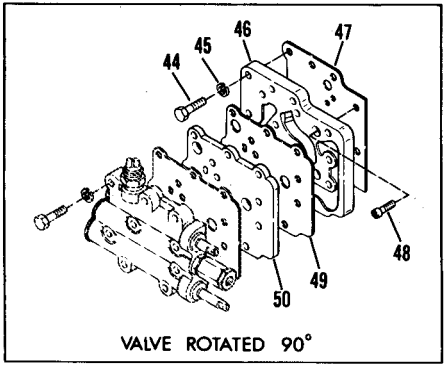
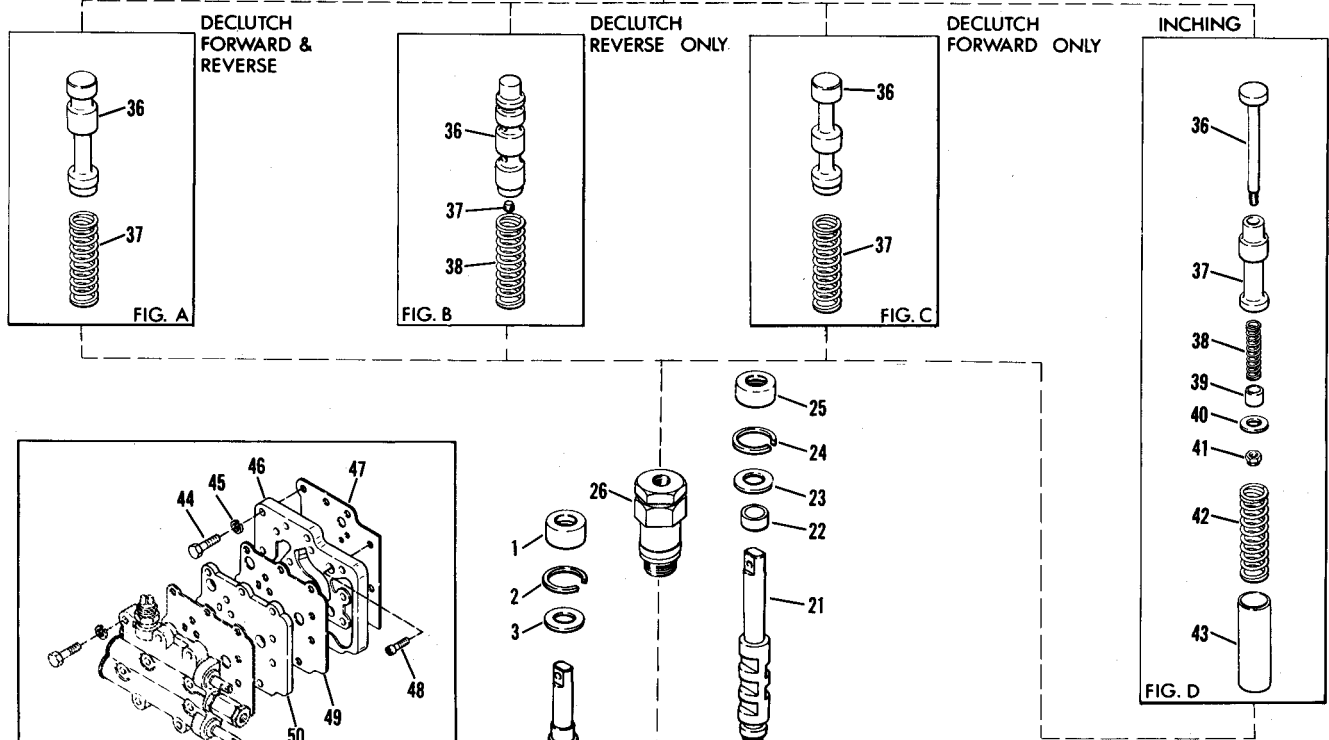
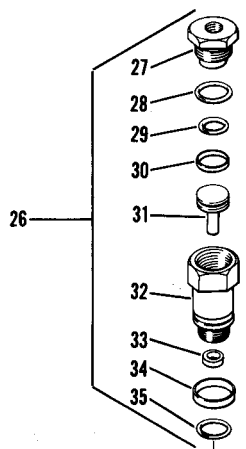


Figure F

PRESSURE REGULATOR VALVE, CHARGING PUMP & OIL FILTER GROUP

ITEM	DESCRIPTION	QTY.	ITEM	DESCRIPTION	QTY.
1	Charging Pump Drive Sleeve.....	1	26	Valve to Housing Stud Lockwasher ...	4
2	Pump Sleeve Snap Ring	1	27	Valve to Housing Stud Nut	4
3	Valve to Housing Gasket.....	1	28	Thrust Plate & Bearing Assembly.....	2
4	Valve Body "O" Ring	1	29	Wave Spring.....	2
5	Valve Body "O" Ring	1	30	Pump Shaft Seal.....	2
6	Pipe Plug.....	1	31	Pump to Filter Adaptor Screw Lockwasher.....	4
7	Safety Valve Seat.....	1	32	Pump to Filter Adaptor Screw.....	4
8	Safety Valve Spacer.....	1	33	Pump Drive Shaft Assembly	1
9	Safety Valve Plunger	1	34	Pump Drive Shaft Oil Seal.....	1
10	Safety Valve Spring	1	35	Pressure Regulator Valve.....	1
11	Valve Stop "O" Ring	1	36	Valve Body Roll Pin	3
12	Valve Stop.....	1	37	Valve Body "O" Ring	1
13	Valve Stop Roll Pin	1	38	Pump to Filter Gasket	1
14	Valve Stop Roll Pin	1	39	Filter Adaptor	1
15	Valve Stop.....	1	40	Filter Adaptor Plug.....	1
16	Valve Stop "O" Ring	1	41	By-Pass Filter Disc Spring.....	1
17	Valve Piston	1	42	By-Pass Filter Disc.....	1
18	Valve Spring - Inner.....	1	43	By-Pass Filter Disc Seat	1
19	Valve Spring - Outer	1	44	Filter Seat Retainer Ring	1
20	Valve to Converter Housing Stud.....	4	45	Filter Housing "O" Ring.....	1
21	Valve Body to Pump Gasket	1	46	Oil Filter Element Assembly	1
22	Pump Body Snap Ring.....	1	47	Oil Filter Element Spring.....	1
23	Thrust Plate & Bearing Assembly.....	2	48	Filter Housing.....	1
24	Pump Driven Shaft Assembly	1	49	Pipe Plug.....	1
25	Charging Pump Housing	1	50	Optional Adaptor for Remote Filter ...	1



NOTE:
 Speed selector spacers (items 13 and 22) and the declutch valve (item 26) are not included when the control valve housing assembly (item 14) is ordered.
 When ordering the control valve housing assembly (item 14) from the Service Parts List also order the spacer or spacers listed as items 13 and 22 and the declutch valve, spool and spring needed. **NOTE:** Some valves will require no spacers, some valves will require 1 spacer and some will require 2 spacers.

Figure G

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

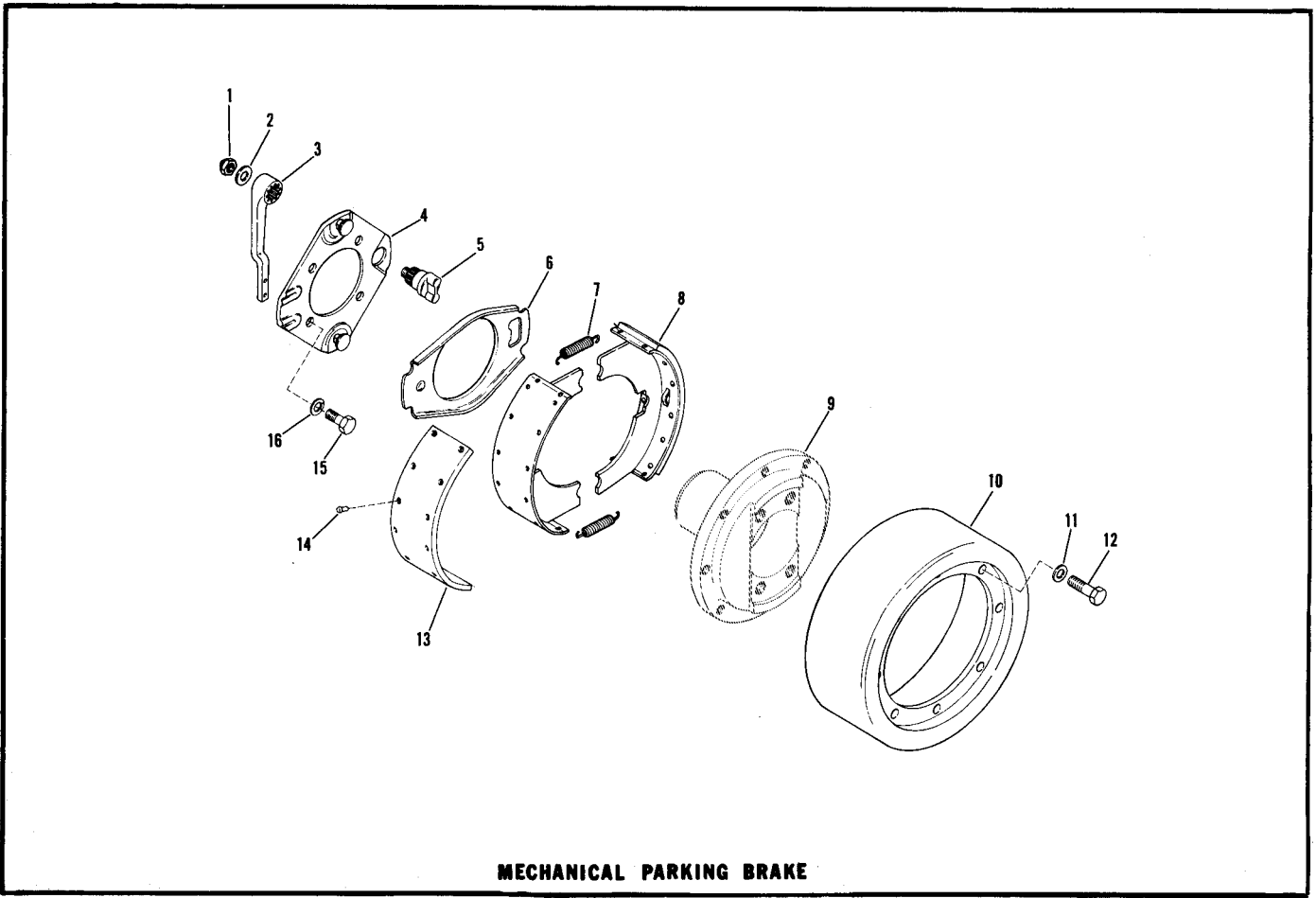
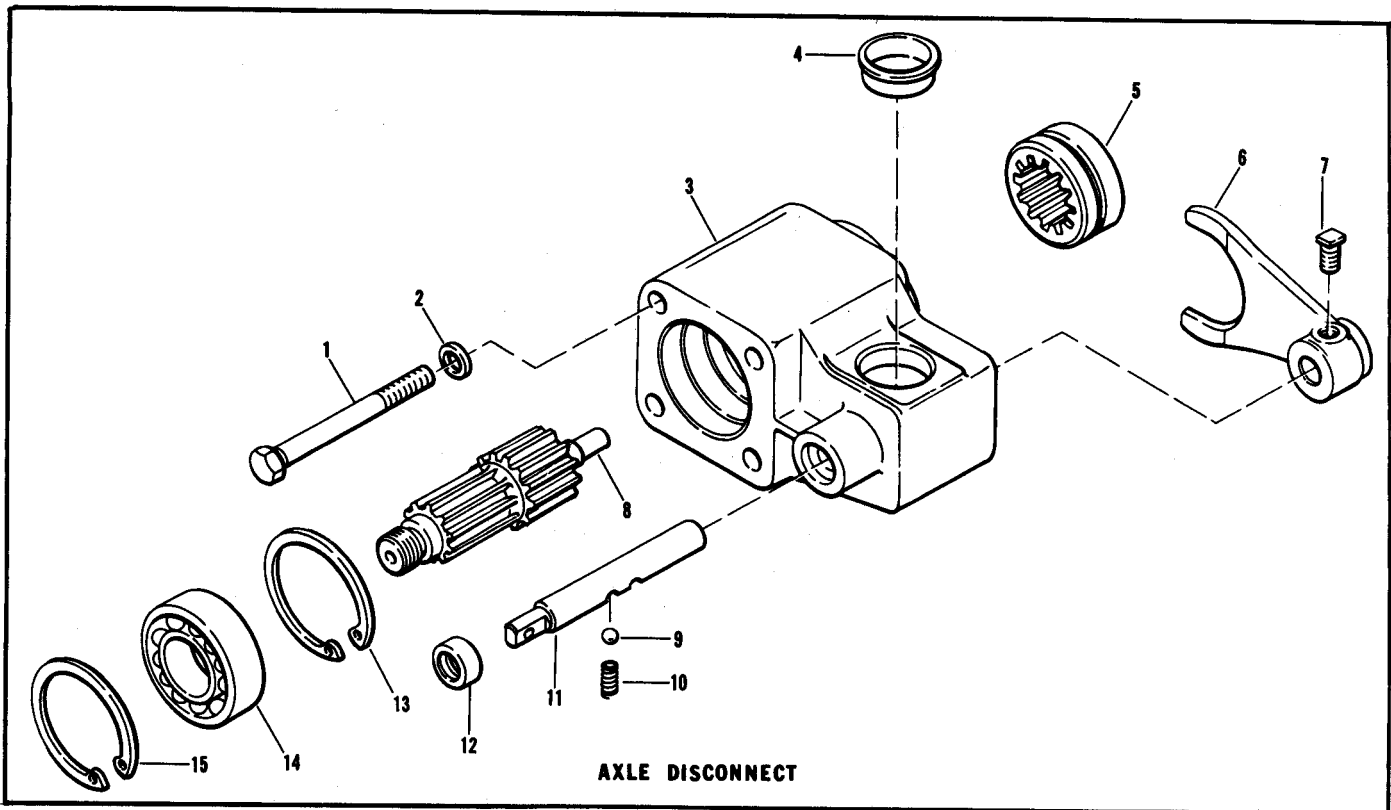


Figure H

AXLE DISCONNECT

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

PARKING BRAKE GROUP 10 X 3 BRAKE

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

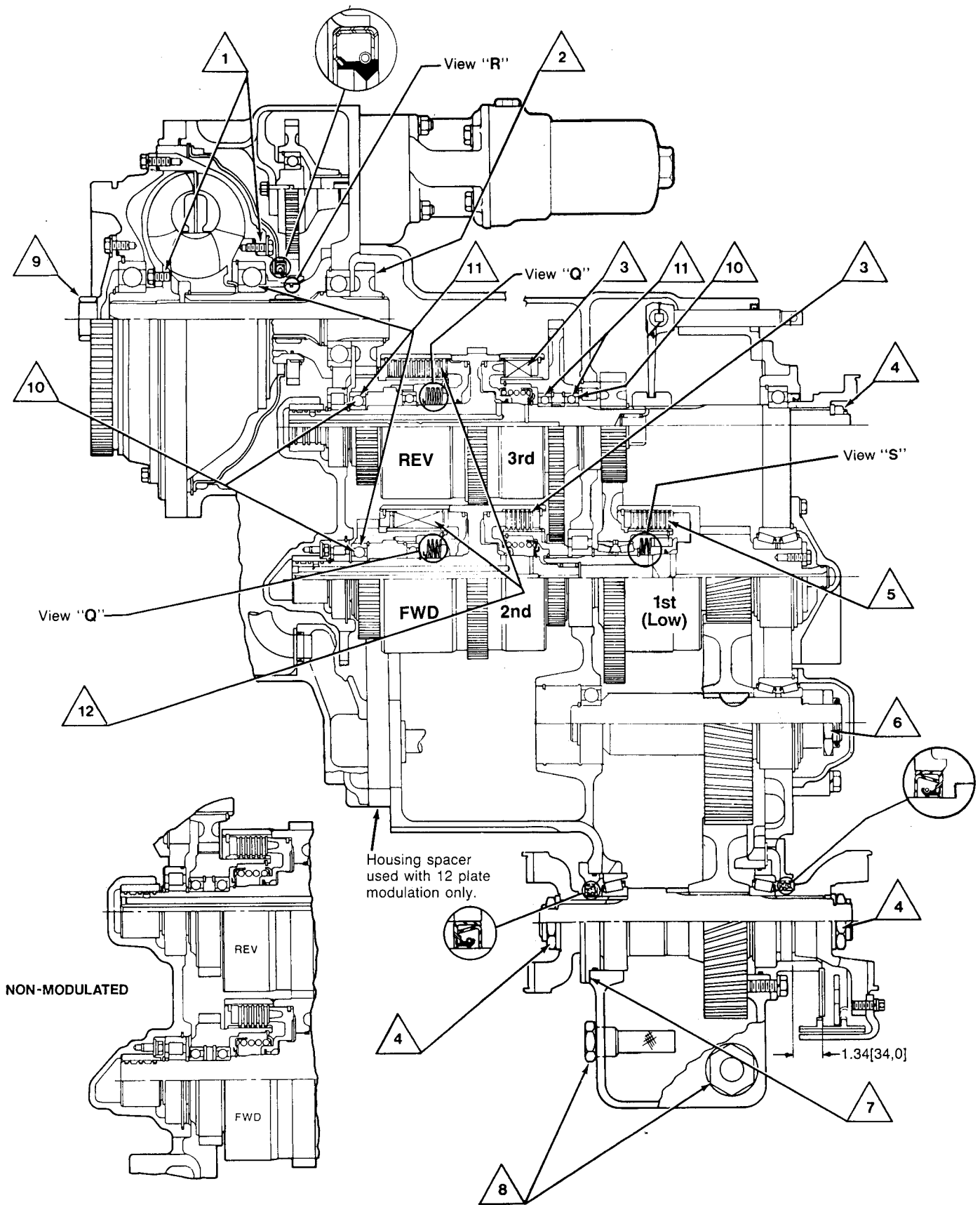


Figure I

- 1. Impeller Hub and Turbine Hub Assembly with Backing Ring and Special Self Locking Screws.
 1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry & clean.
 2. Install backing ring and special self locking screws.

Tighten screws 40 to 45 Lbs. Ft. [54,3-61,0 N·m]

Note: Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.
- 2. Gear to be assembled with long hub length to this side.
- 3. Three clutches, 6-outer steel plates, 6-inner friction plates. Assemble alternately, starting with outer steel plate.
- 4. See Elastic Stop Nut Torque Chart
- 5. Low clutch, 9-outer steel plates, 9-inner friction plates. Assemble alternately, starting with outer steel plate.
- 6. See Elastic Stop Nut Torque Chart
- 7. Shim output shaft bearings to produce 6 to 8 Lbs.-In. [0,68,-0,90 N·m] preload.
- 8. Tighten oil screen ass'y. 10 to 15 Lbs. Ft. [13,6-20,0 N·m]

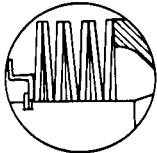
- 9. Heat nose bushing to 200° F^o (93°C) before ass'y. of bushing to cover.
- 10. Bearing shield **OUT** on 3rd speed clutch. Bearing shield **IN** on Fwd. & Rev. clutch.
- 11. Must be loose internal fit bearings, No. "3" etched on bearing.
- 12. (12 Plate Modulation) Two clutches, 12-outer steel plates, 12-inner friction plates. Assemble alternately, starting with outer steel plate.

Notes

- A. - Use Permatex & Crane Sealer only where specified.
- B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
- C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
- D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
- E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
- F. - Apply light coat of Crane Sealer to all pipe plugs.
- G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
- H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

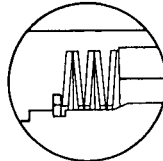
NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc.

View "Q" 2 Places Modulation only



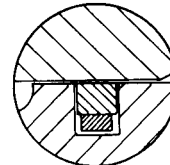
Low Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining four springs to be stacked alternately reversed as shown.

View "S"



Forward & Reverse Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining six springs of each clutch to be stacked alternately reversed as shown. See note on page 77.

View "R"

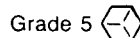


Enlarged view of Piston Ring & Expander
Note: Expander gap to be approx. 180° from ring hook joint to aid ring assembly.

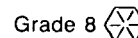
NOTE: Metric dimensions shown in brackets [].

ELASTIC STOP NUT TORQUE

THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1¼" - 18	200 - 250	[271,2 - 338,9]
1½" - 18	300 - 350	[406,8 - 474,5]
1¾" - 12	400 - 450	[542,4 - 610,1]



Torque Specification for Lubricated or Plated Screw Threads



NOM. SIZE	FINE THREAD		COARSE THREAD		FINE THREAD		COARSE THREAD	
	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]

Figure I

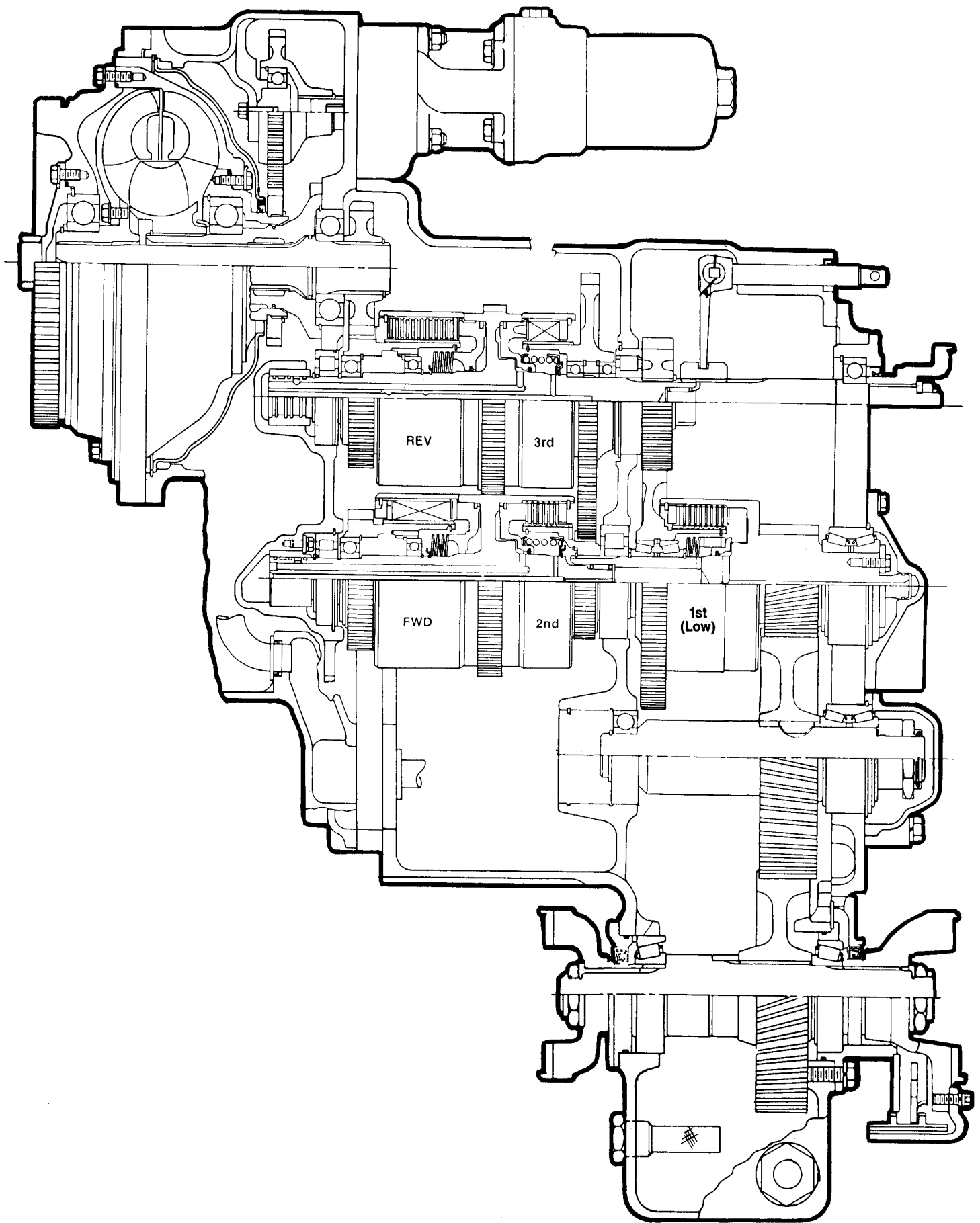


Figure J

MAINTENANCE AND SERVICE

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must also be understood that this is a basic HR32000 3 speed long drop transmission with many options. Companion flanges and output

shafts with and without disconnect assemblies may vary on specific models. The units are very similar to trouble shoot, disassemble, repair, and reassemble. Drain as much oil as possible before disassembly. See page 70 for R-Model (remote mounted) transmission front cover section. See page 85 for 6 & 8 speed maintenance information.

DISASSEMBLY

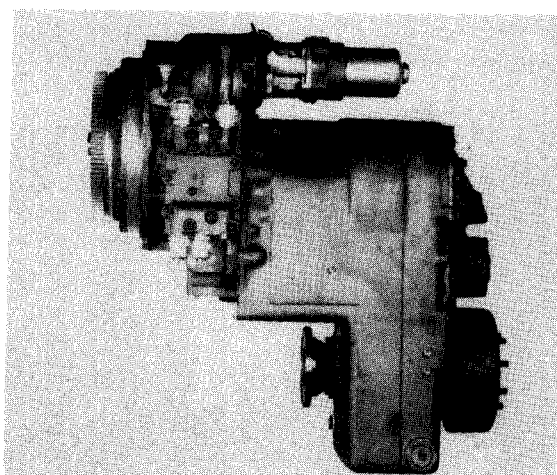


Figure 1

Side view of 3 speed HR32000 long drop transmission.

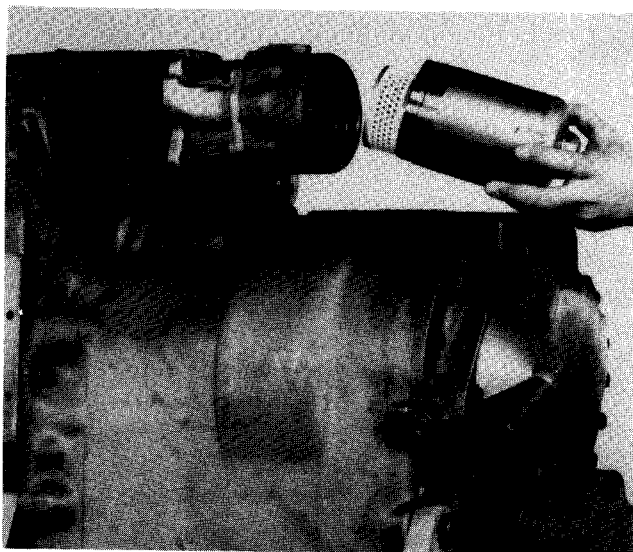


Figure 3

Remove filter element housing and element. **NOTE:** It is recommended a small pan be used to catch remaining oil in element housing.

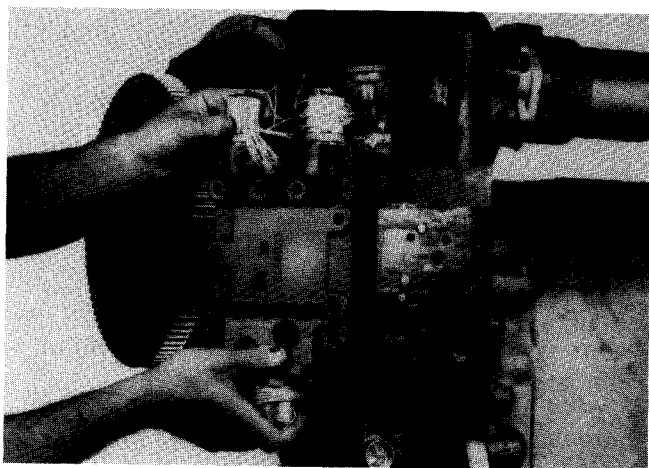


Figure 2

Remove two valve to converter housing cap screws. Install two aligning studs as shown. Remove remaining cap screws. Remove control valve and gasket.



Figure 4

Remove charging pump to pressure regulating valve stud nuts.

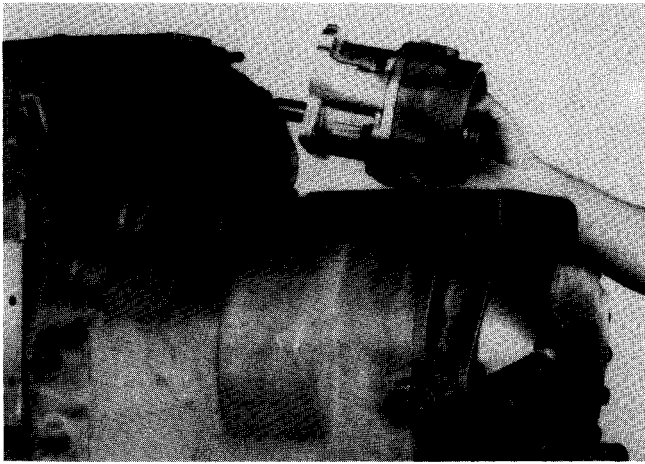


Figure 5
Remove charging pump and filter adaptor assembly.



Figure 8
Remove pump adaptor bolts, adaptor and gasket.



Figure 6
Remove pressure regulating valve assembly and "O" rings.

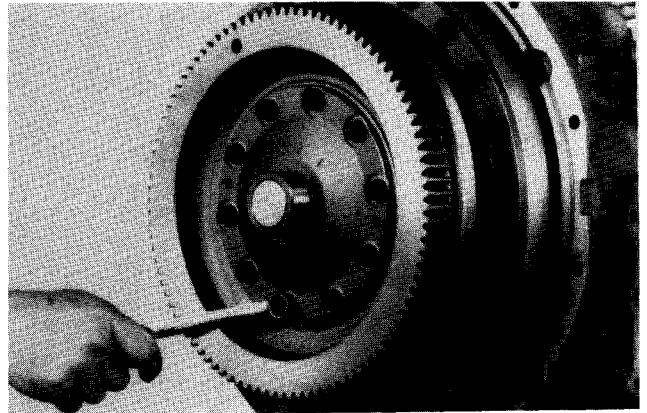


Figure 9
Remove impeller cover bearing cap bolts. **NOTE: Some units will have drive plates instead of ring gear. Remove drive plates.**

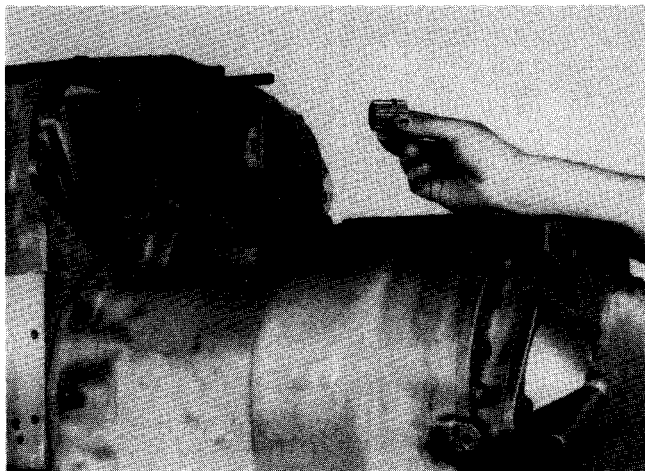


Figure 7
Remove pump drive sleeve and gasket.

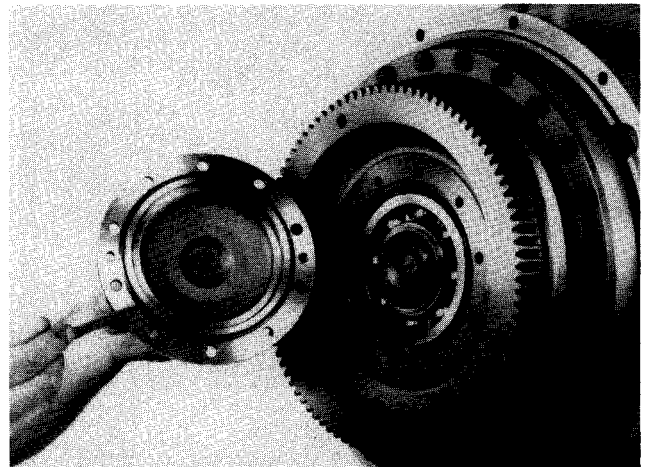


Figure 10
Remove bearing cap and "O" ring.

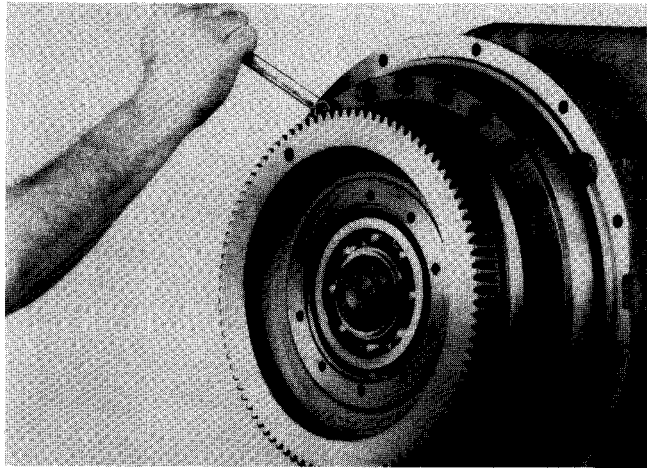


Figure 11

Remove impeller cover to impeller bolts.

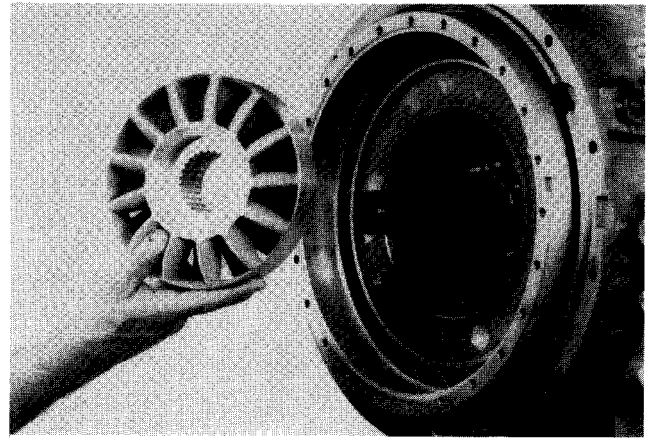


Figure 14

Remove reaction member.

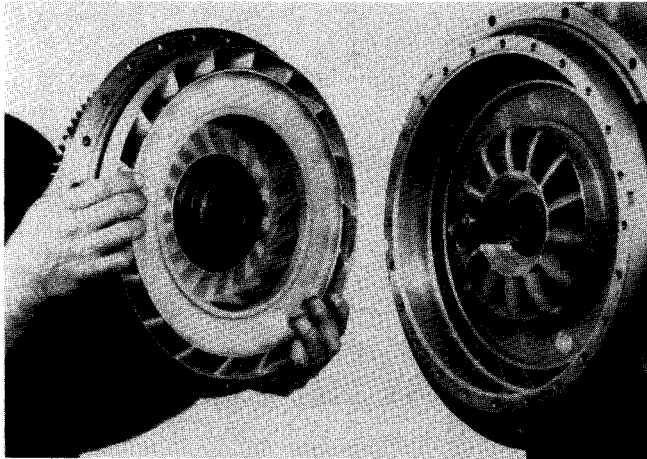


Figure 12

Remove impeller cover and turbine as an assembly.

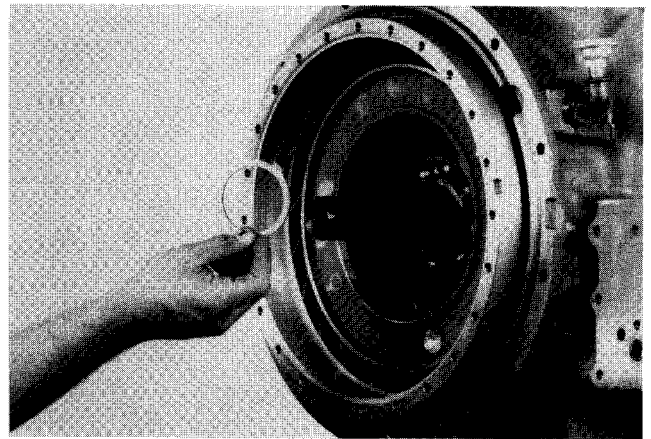


Figure 15

Remove reaction member spacer.

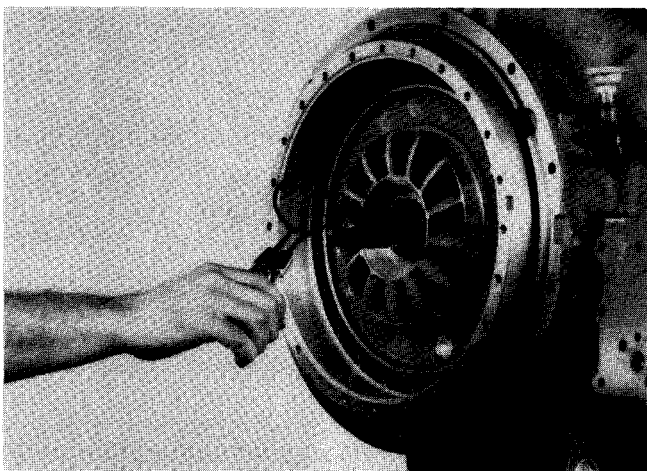


Figure 13

Remove reaction member retainer ring.

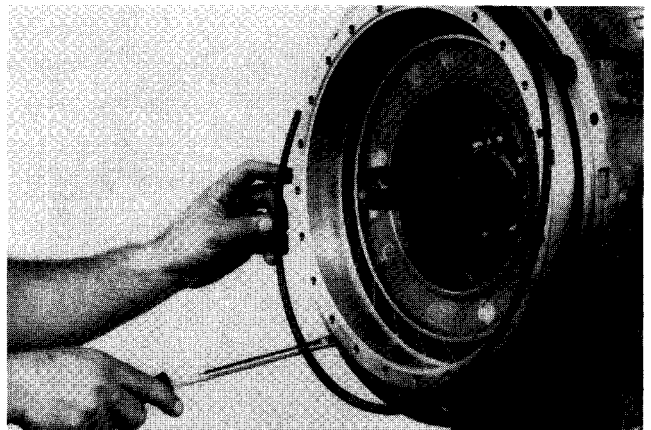


Figure 16

Remove oil baffle retainer ring. Using pry slots in converter housing, pry oil baffle and impeller from housing. **NOTE:** Impeller, oil baffle and impeller hub gear are removed as an assembly.

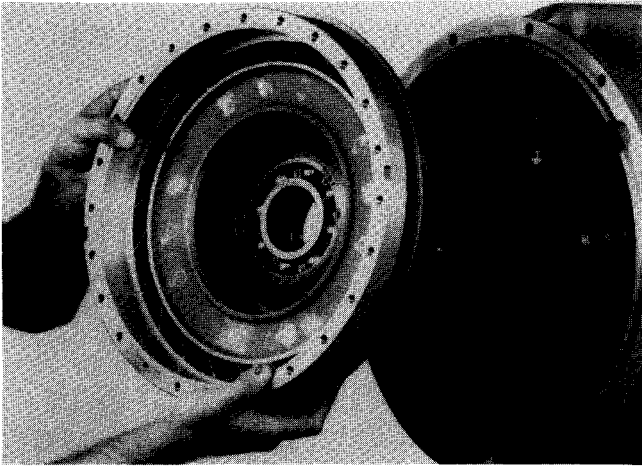


Figure 17

Remove impeller assembly.

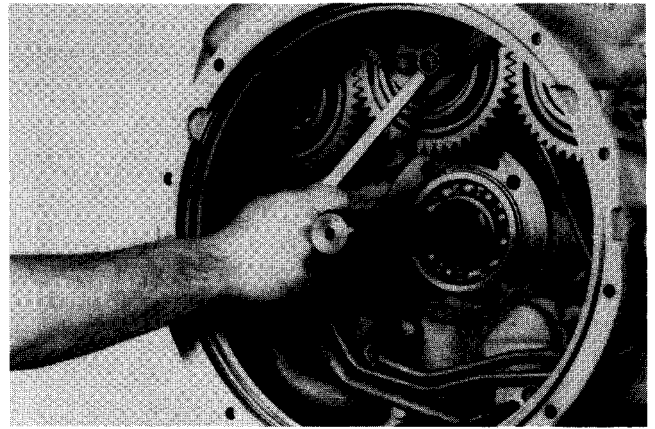


Figure 20

Remove pump drive gear support bolts.

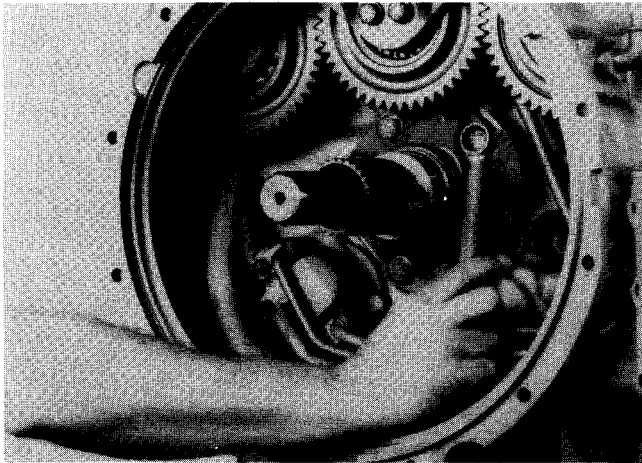


Figure 18

Remove stator support to housing bolts.

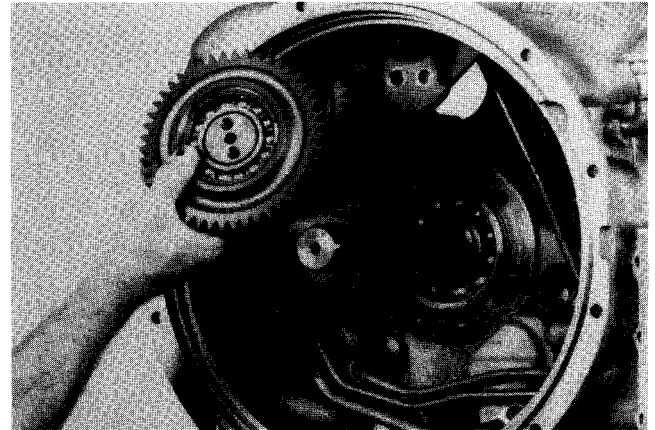


Figure 21

Remove pump drive gear and bearing assemblies.

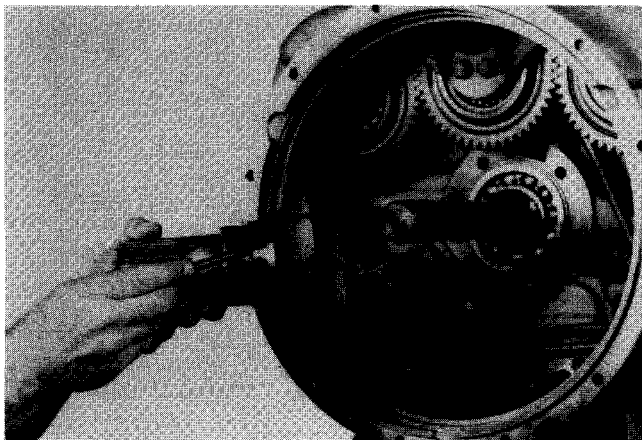


Figure 19

Remove stator support. **NOTE:** Support must be turned to clear pump drive gear.

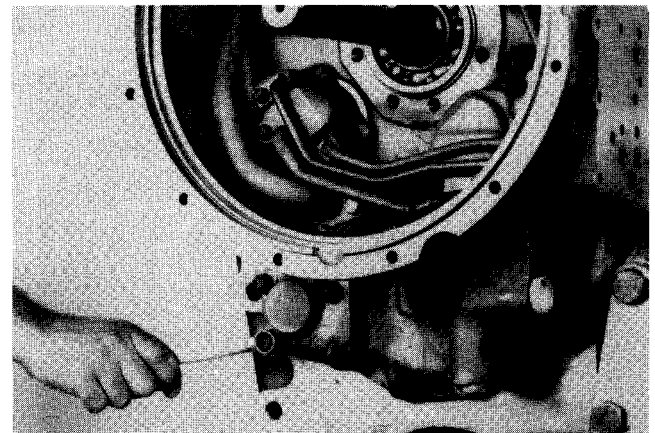


Figure 22

Support converter housing with a chain fall. Remove converter housing to transmission housing bolts. **NOTE:** For converter housing removal on the 8 speed transmission, see Figure 1 in the 8 speed section, page 93.

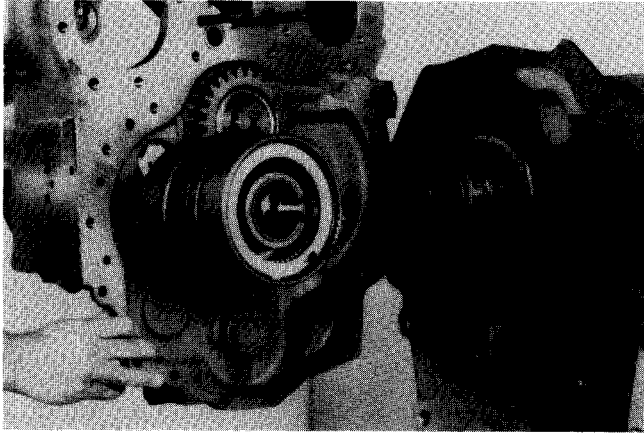


Figure 23

Separate the converter housing from the transmission housing. Remove gasket. **NOTE:** Forward and 2nd clutch will remain in converter housing.

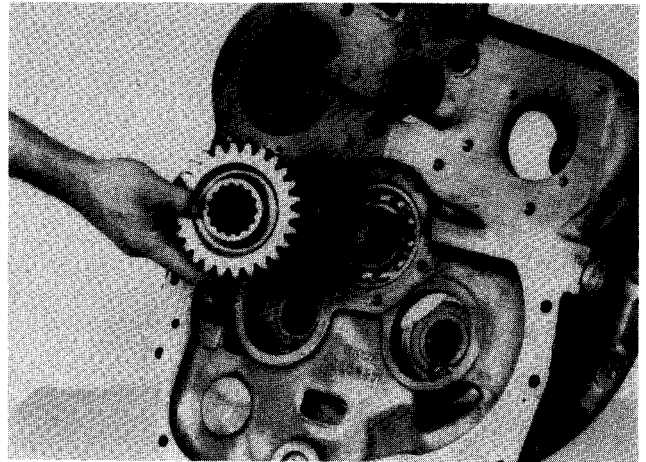


Figure 26

Remove turbine shaft gear.

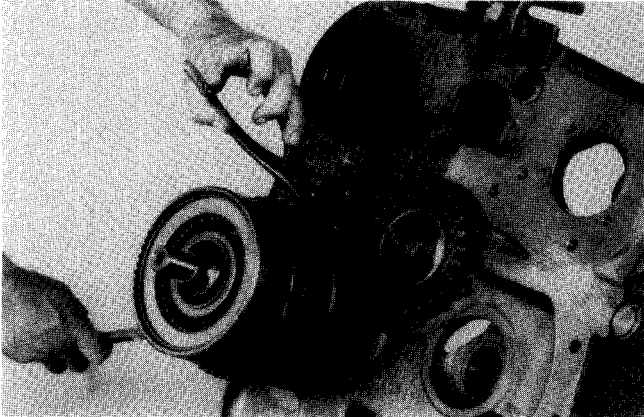


Figure 24

Use a spreading type snap ring pliers to spread the ears on forward clutch front bearing retainer ring. Remove forward clutch with pry bar.

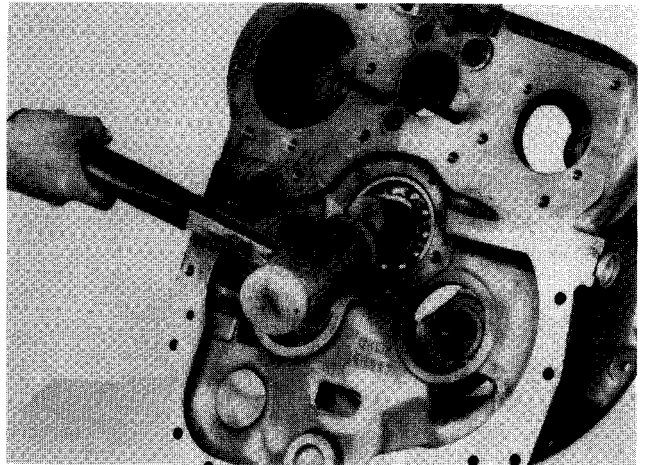


Figure 27

Tap turbine shaft and bearing from converter housing.

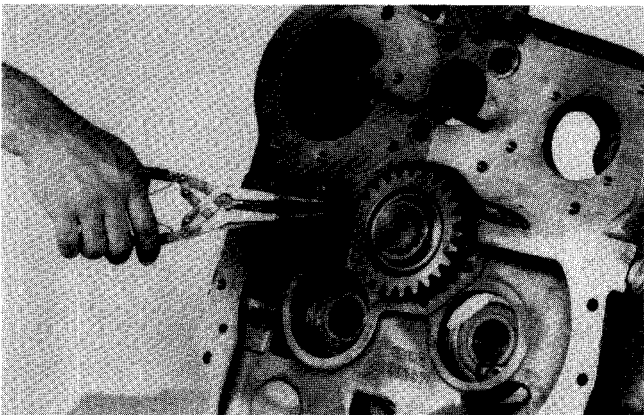


Figure 25

Remove turbine shaft gear retainer ring.

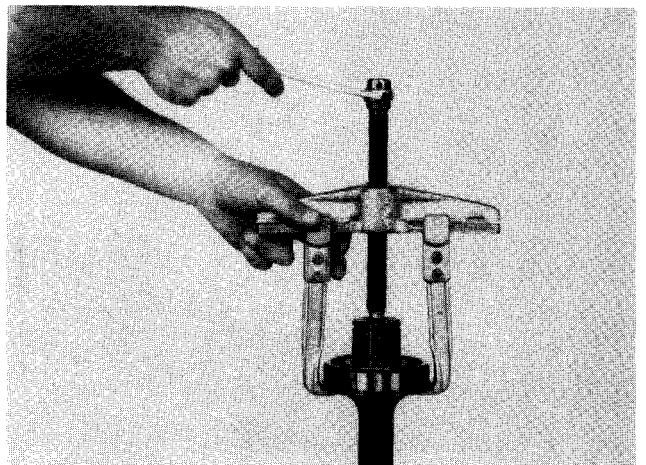


Figure 28

Remove bearing from turbine shaft.



Figure 29

Remove 2nd clutch disc hub retainer ring retainer.

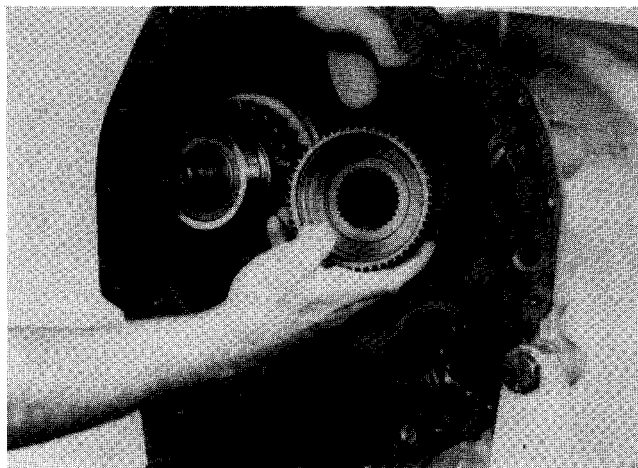


Figure 32

Remove disc hub.



Figure 30

Remove disc hub ring retainer.



Figure 33

Remove bearing end plate.



Figure 31

Remove disc hub retainer ring.

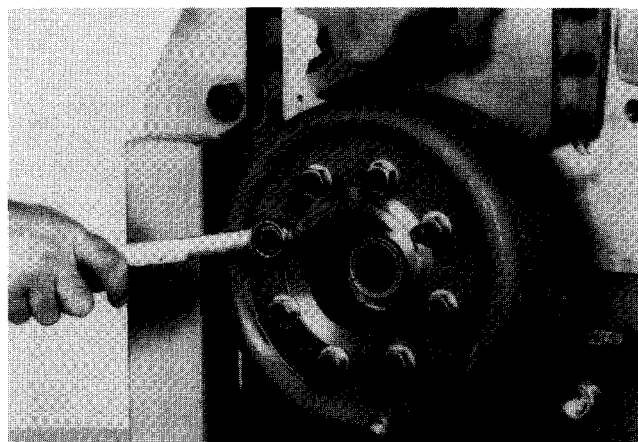


Figure 34

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

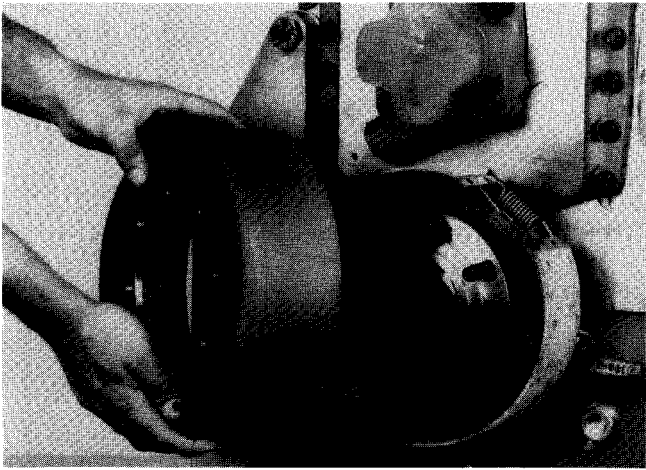


Figure 35

Remove brake drum.

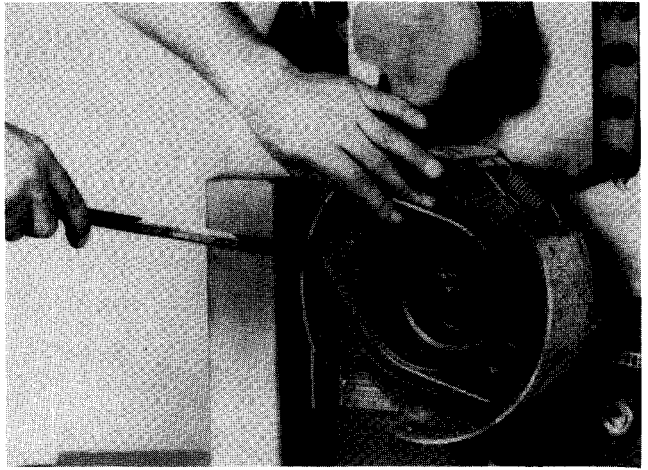


Figure 38

Pry brake strut from brake bands.

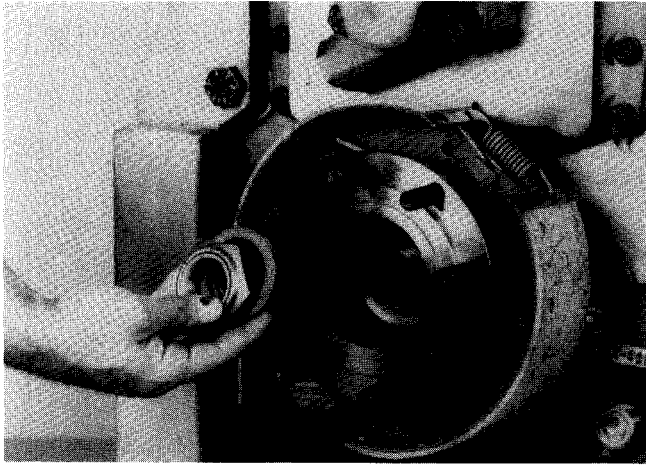


Figure 36

Remove output flange nut, washer and "O" ring.

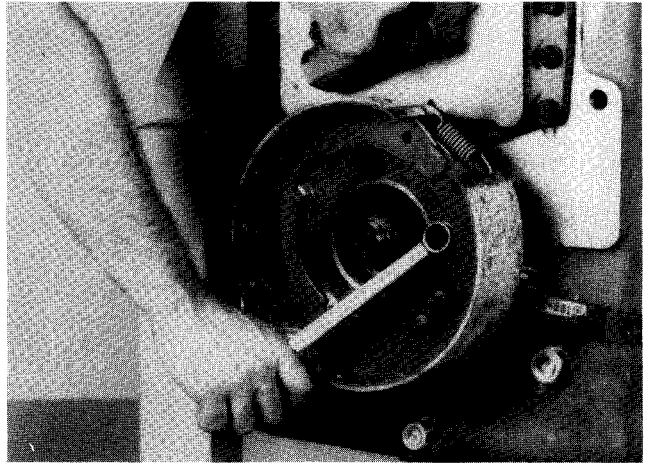


Figure 39

Remove brake backing plate bolts.

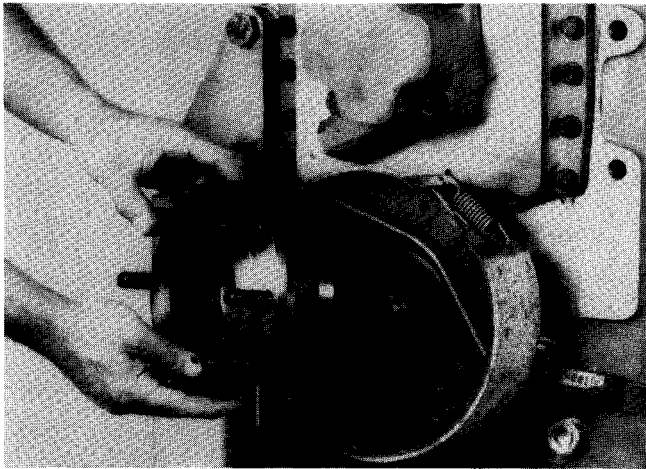


Figure 37

Remove output flange.

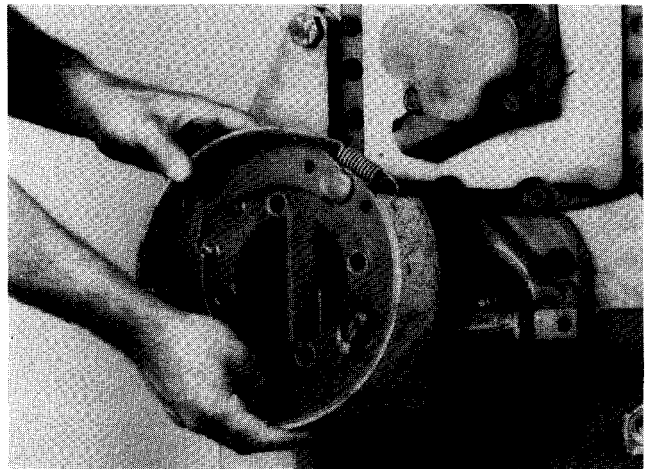


Figure 40

Remove backing plate and brake band assembly.

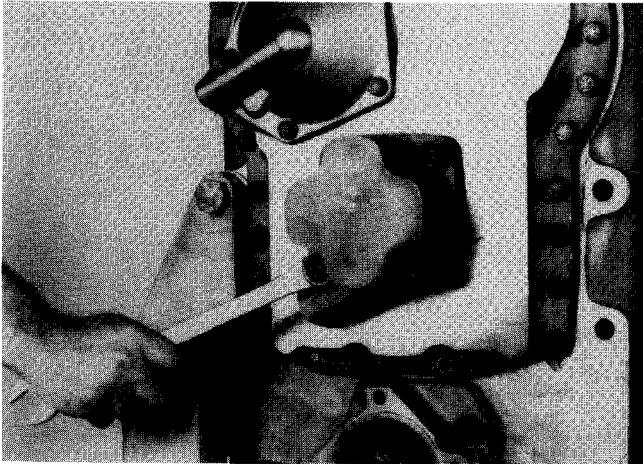


Figure 41
Remove idler shaft rear bearing cap bolts and washers.

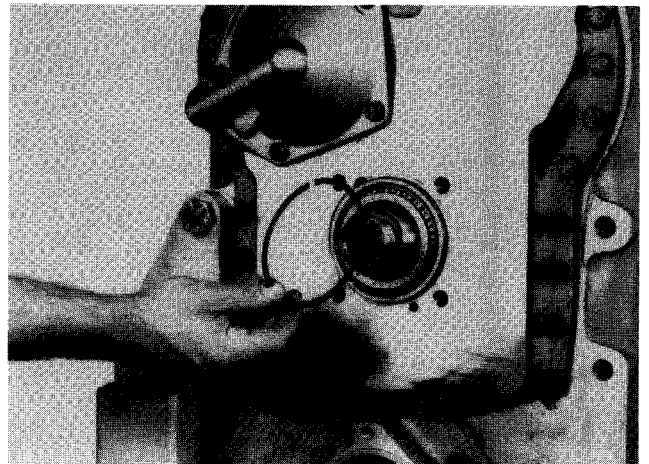


Figure 44
Remove rear bearing locating ring.

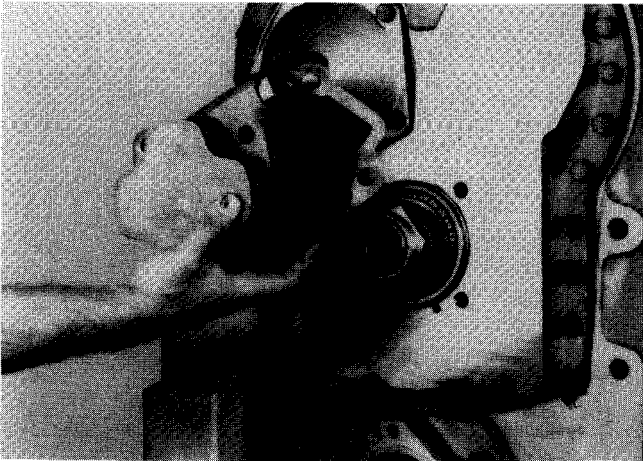


Figure 42
Remove bearing cap and gasket.

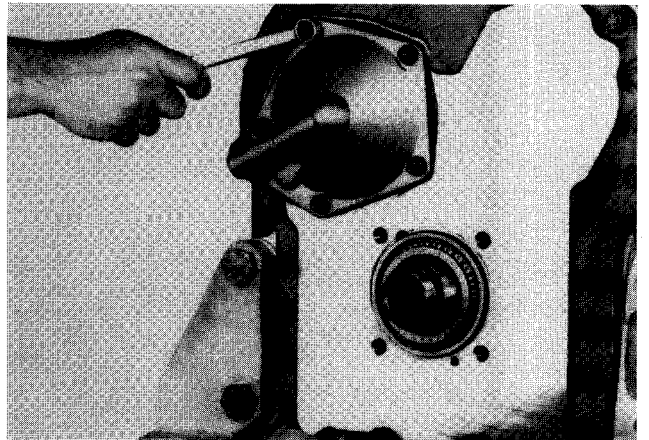


Figure 45
Remove 1st speed clutch (low) rear bearing cap bolts and washers.

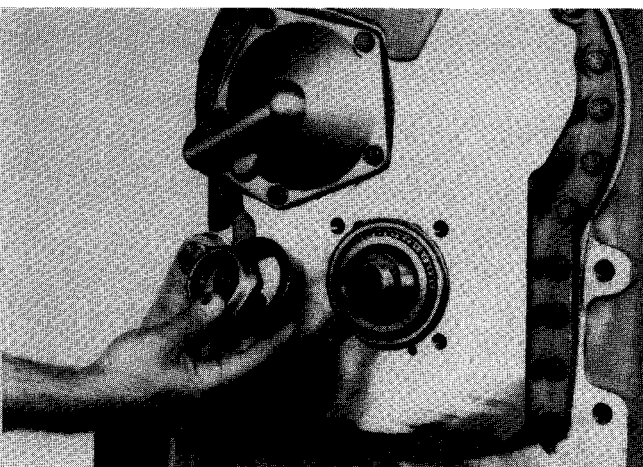


Figure 43
Remove idler shaft rear bearing retainer nut and spacer.

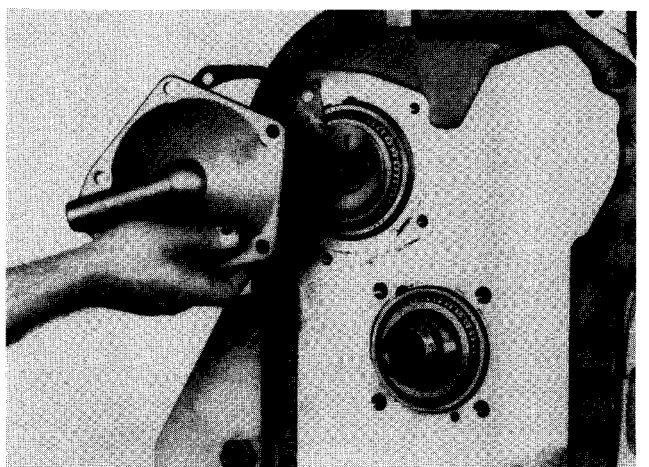


Figure 46
Remove bearing cap and gasket.

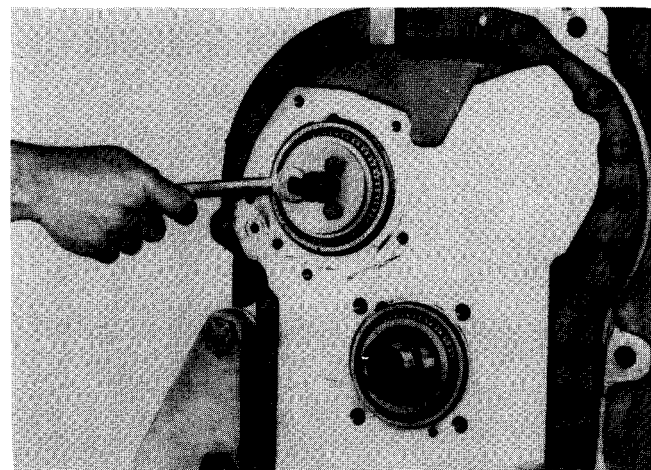


Figure 47

Remove rear bearing retainer plate bolts.

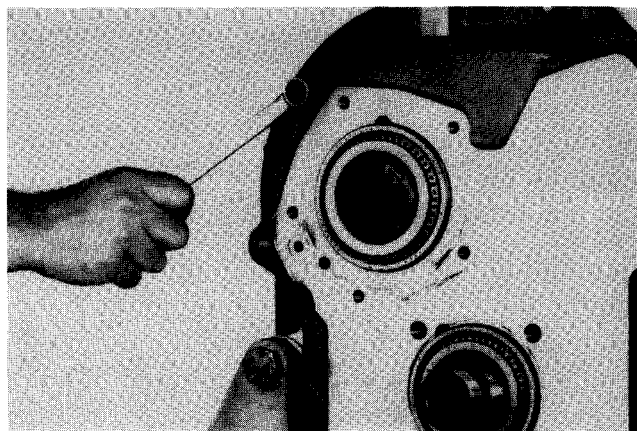


Figure 50

Remove rear cover bolts and washers.

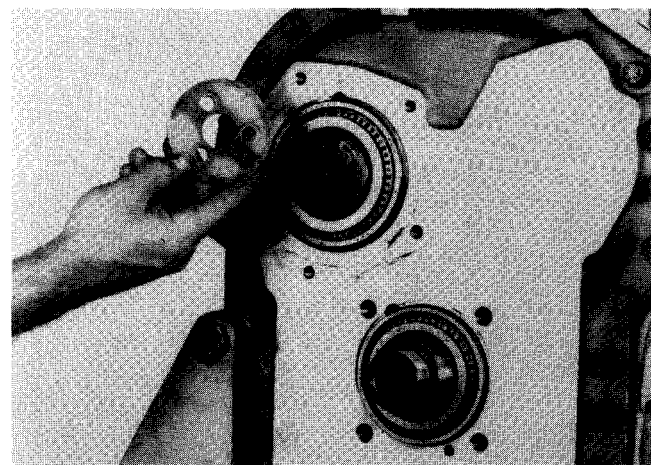


Figure 48

Remove retainer plate.

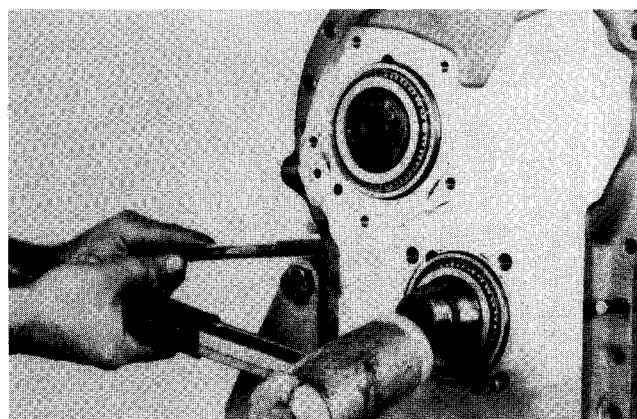


Figure 51

Using pry slots provided, pry cover from transmission housing tapping on 1st speed clutch and idler shaft to allow cover to be removed without shaft binding. **NOTE:** The use of alignment studs will facilitate cover removal.

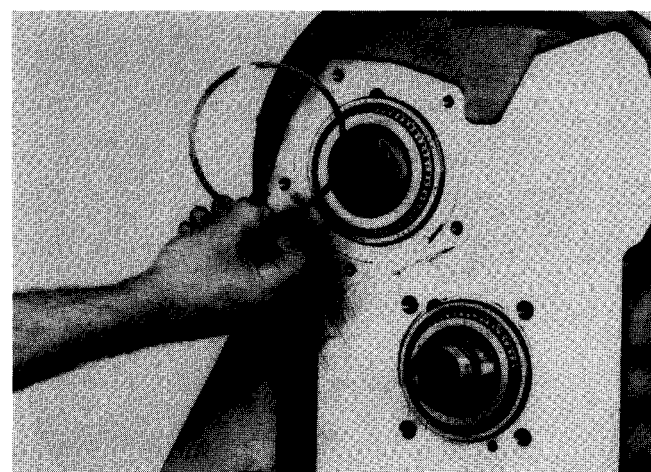


Figure 49

Remove bearing locating ring.

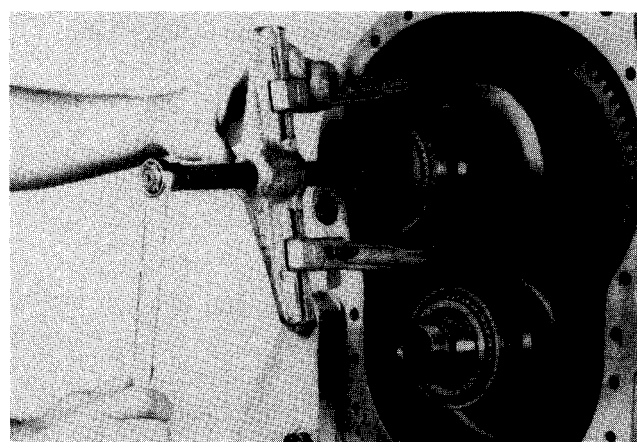


Figure 52

Remove 1st speed clutch double bearing cup, outer taper bearing and spacer.

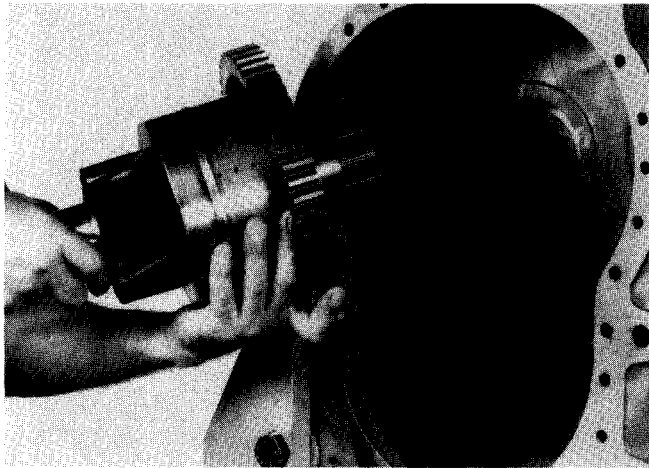


Figure 58

Remove 1st speed clutch assembly.

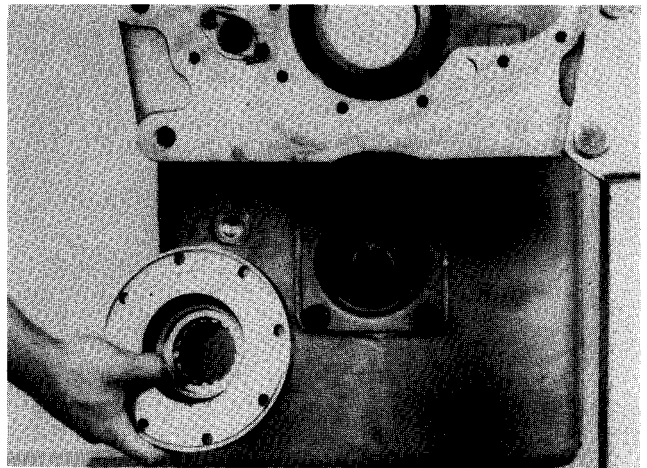


Figure 61

Remove front output flange nut, washer, "O" ring and flange. See 6 & 8 Speed Section for Range Shift Output Shaft Removal.

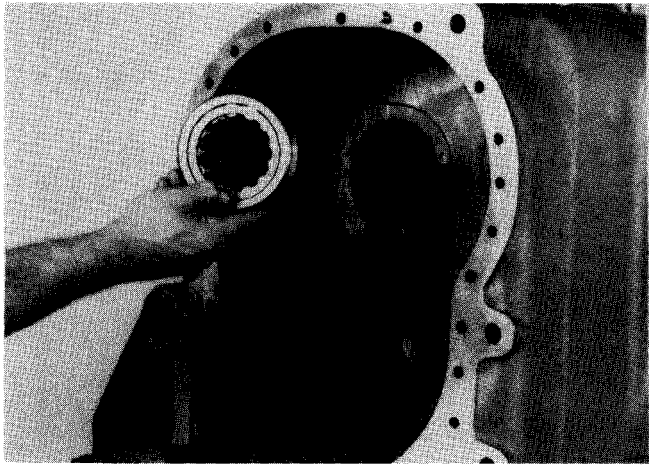


Figure 59

Remove 1st speed front bearing.

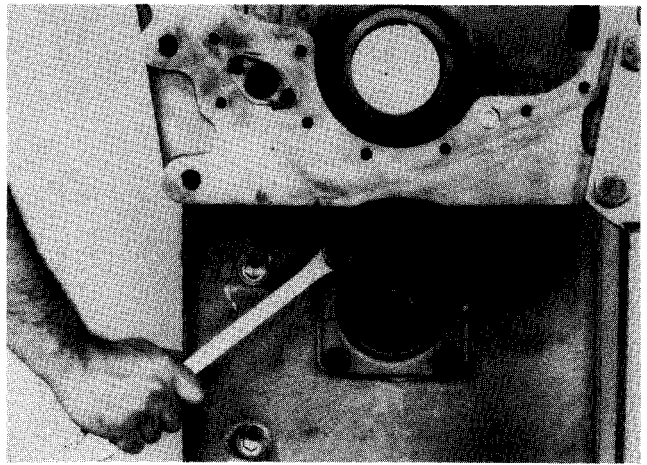


Figure 62

Remove output shaft front bearing cap bolts and washers.

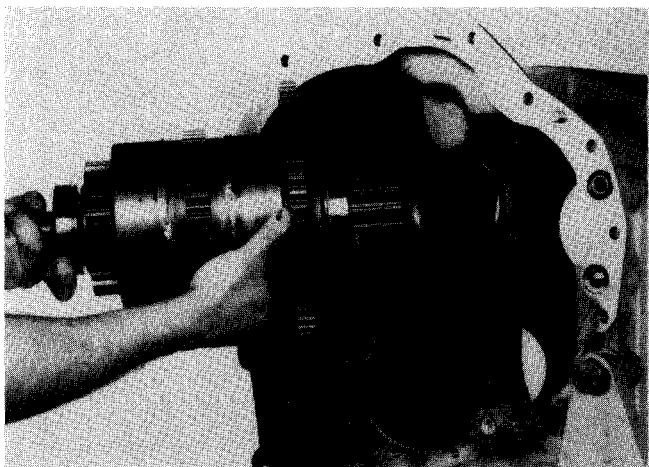


Figure 60

Remove reverse and 3rd clutch assembly.

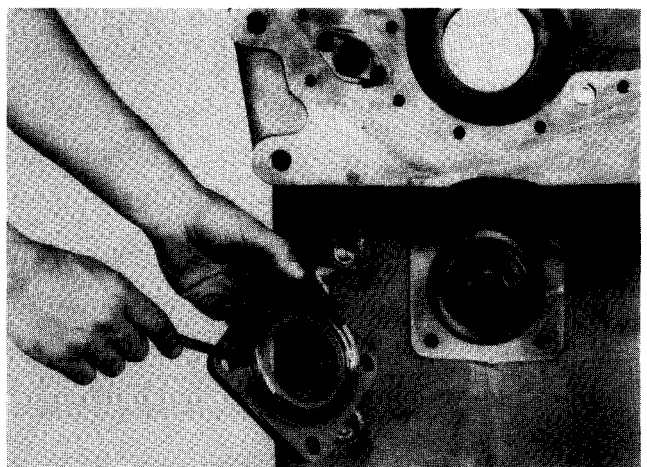


Figure 63

Remove bearing cap, "O" ring and shims.

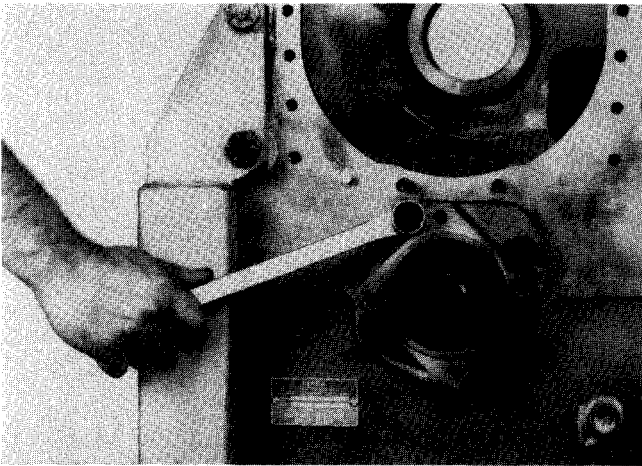


Figure 64
Remove output shaft rear bearing cap bolts and washers.

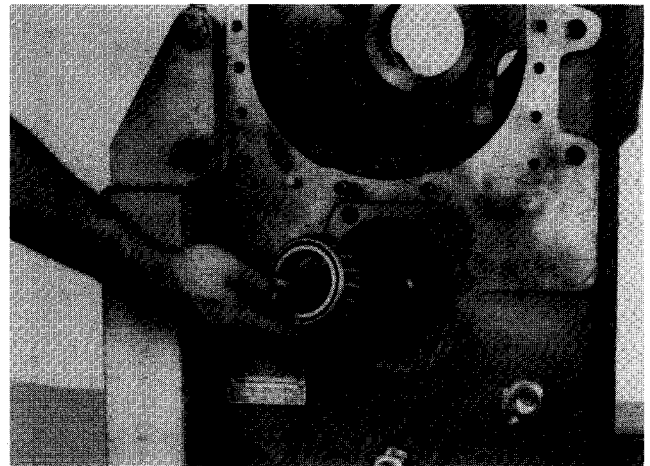


Figure 67
Remove rear taper bearing.

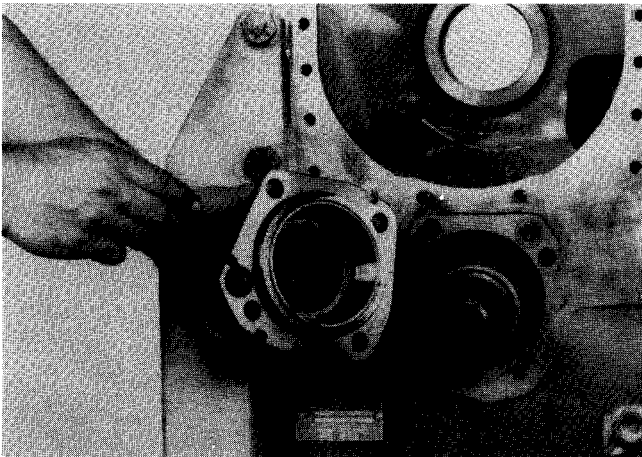


Figure 65
Remove bearing cap and "O" rings.

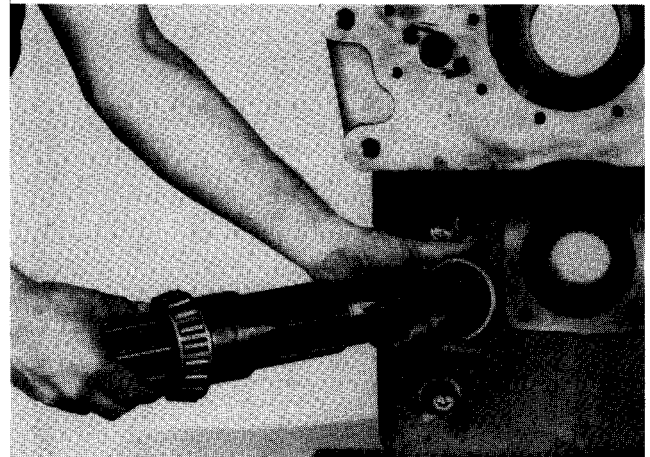


Figure 68
Remove output shaft, gear spacer and front taper bearing.

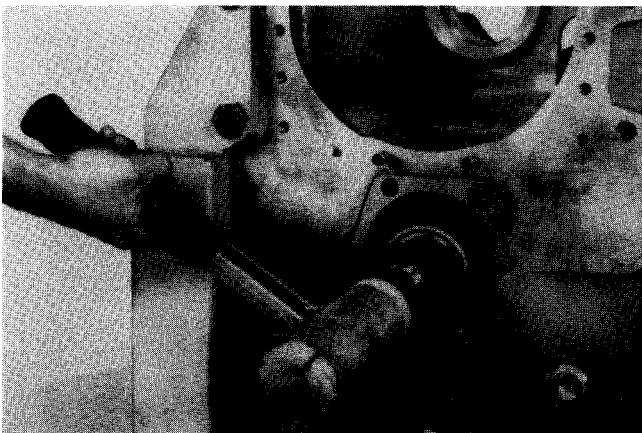


Figure 66
Block output gear. Push or drive output shaft through taper bearing and output gear.

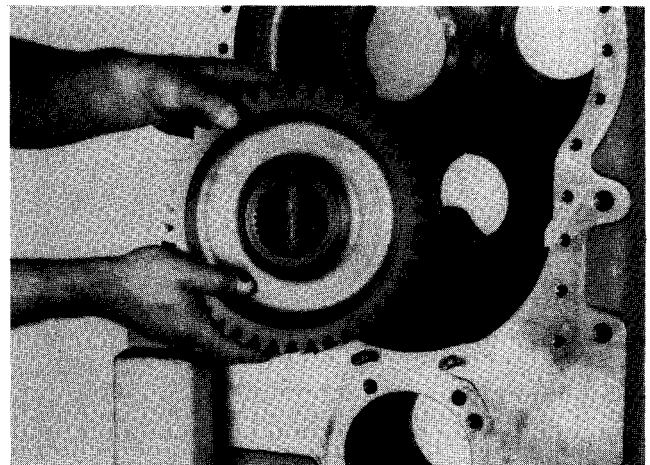


Figure 69
Remove output gear.

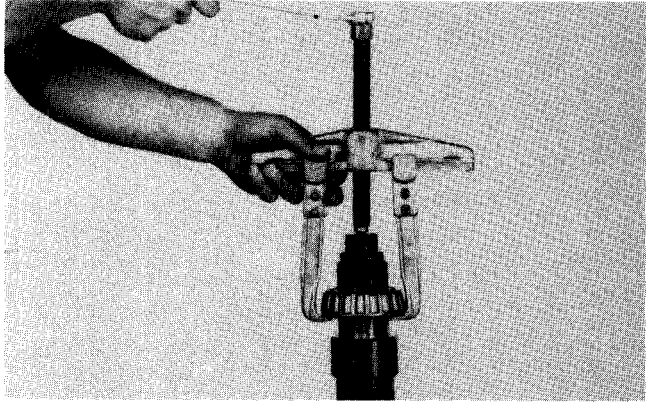


Figure 70

Remove front bearing.

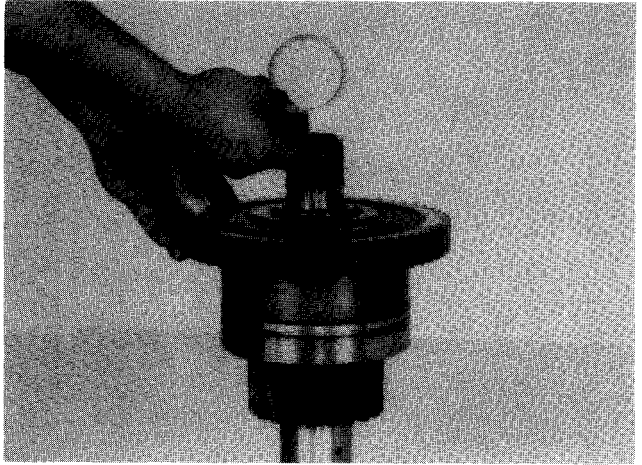


Figure 73

Remove taper bearing retainer ring retainer.

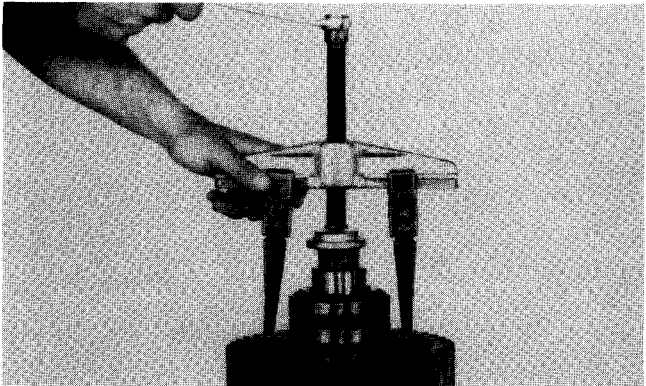


Figure 71

If idler shaft, idler gear or rear bearing are to be replaced, remove bearing and gear. Turn shaft over and remove the front bearing retainer ring and bearing.

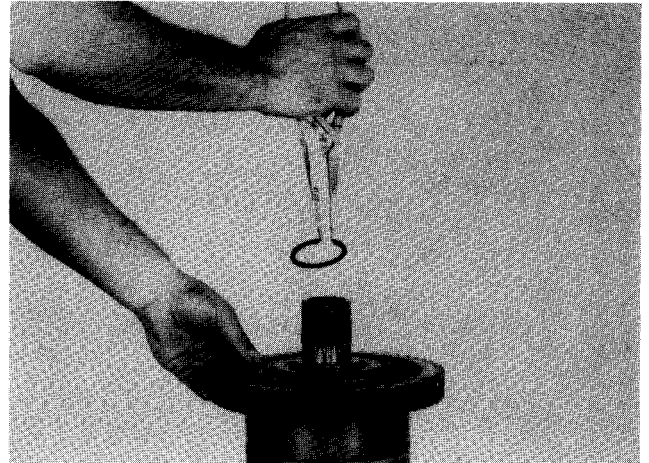


Figure 74

Remove bearing retainer ring.

**1ST SPEED CLUTCH (LOW)
DISASSEMBLY AND REASSEMBLY**
See 8 Speed Section for 4th Speed Clutch Repair

DISASSEMBLY
See Note in Figure 83

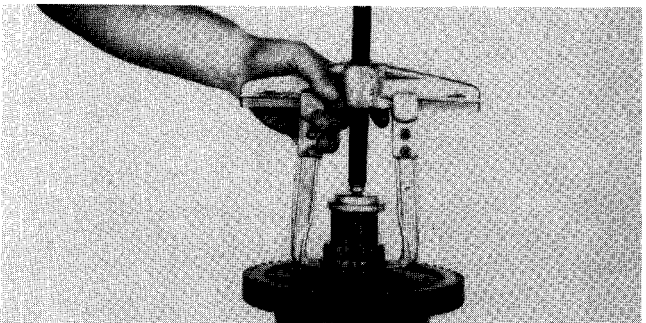


Figure 72

Remove clutch assembly front bearing inner race.

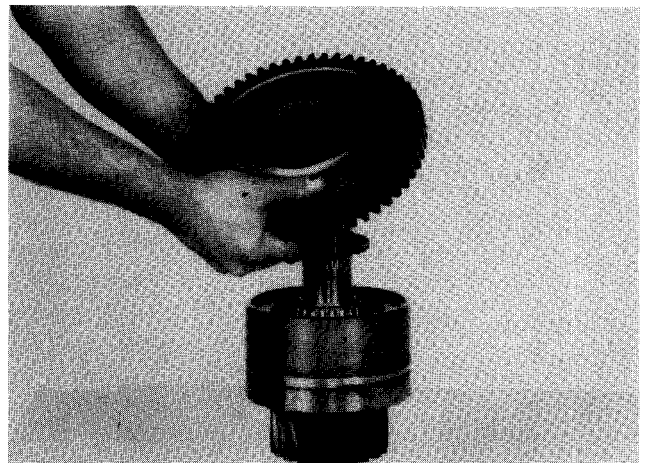


Figure 75

Remove 1st speed gear and outer taper bearing.

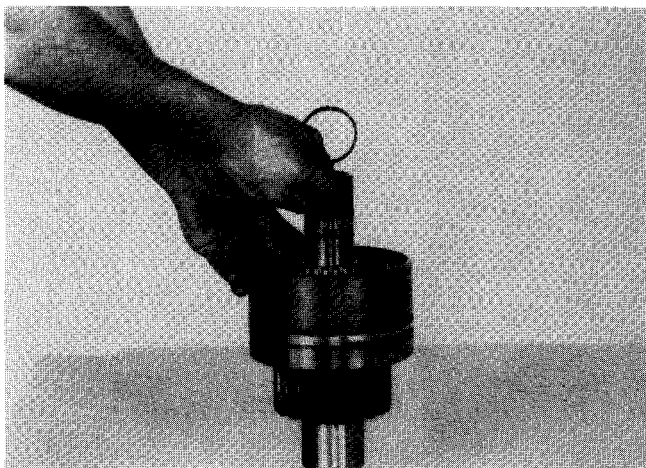


Figure 76
Remove taper bearing spacer.

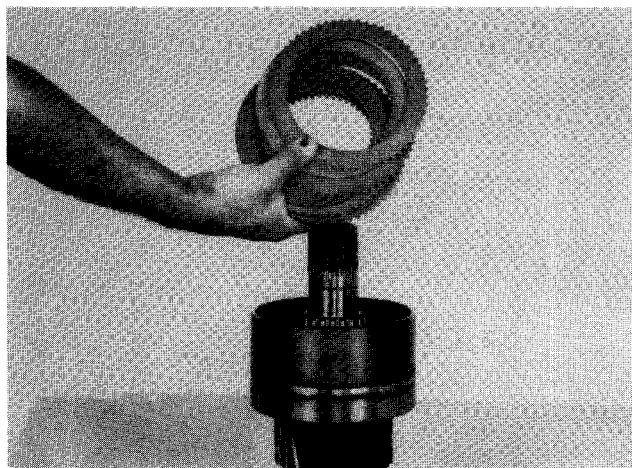


Figure 79
Remove inner and outer clutch discs.

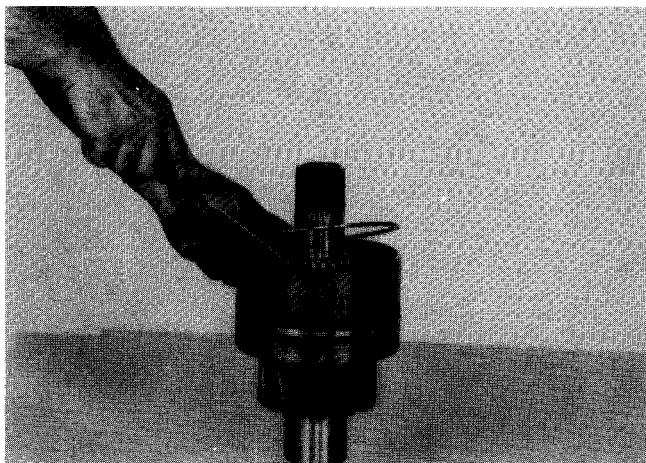


Figure 77
Remove clutch end plate retainer ring.

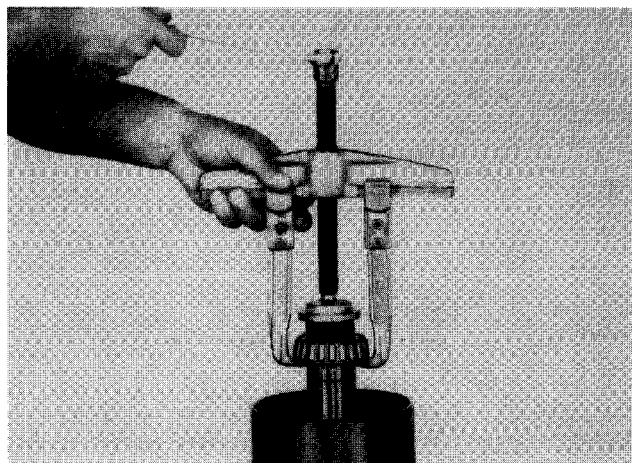


Figure 80
Remove inner taper bearing.

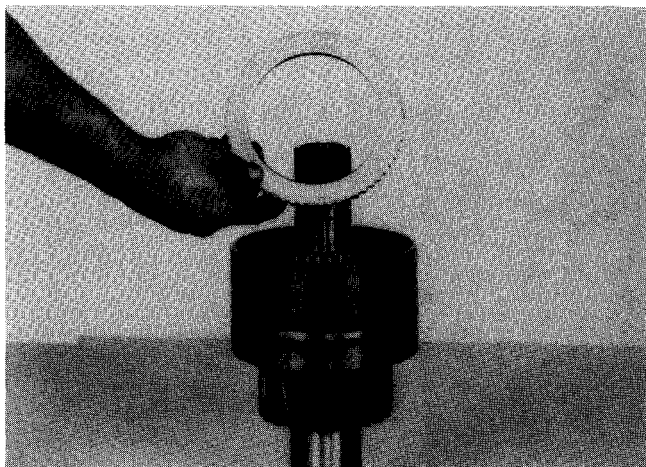


Figure 78
Remove end plate.

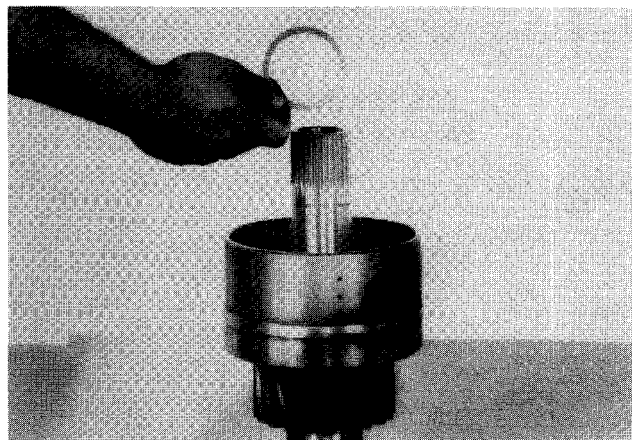


Figure 81
Remove piston return disc spring retainer ring retainer washer.

NOTE: Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs.

The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

1ST SPEED CLUTCH REASSEMBLY

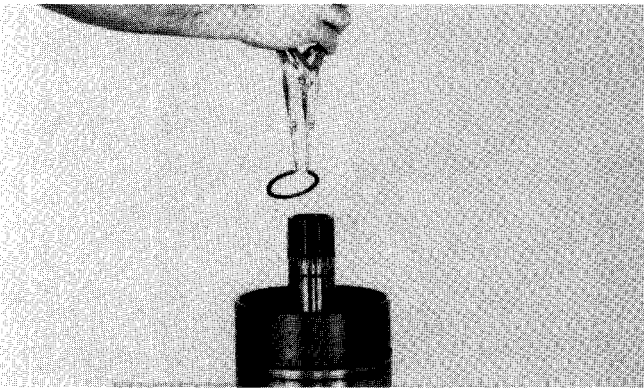


Figure 82

Remove return disc spring retainer ring.

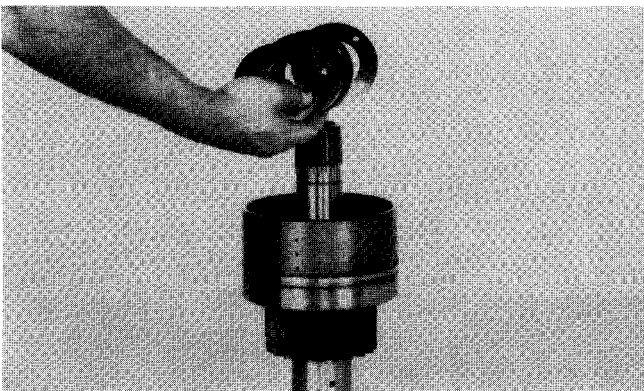


Figure 83

Remove piston return disc spring. **NOTE:** Disc springs in the low clutch are different than springs in the forward and reverse clutch. Do not mix low clutch springs with forward and reverse springs (see note at top of page). Non modulated units will have return springs in forward & reverse clutches.

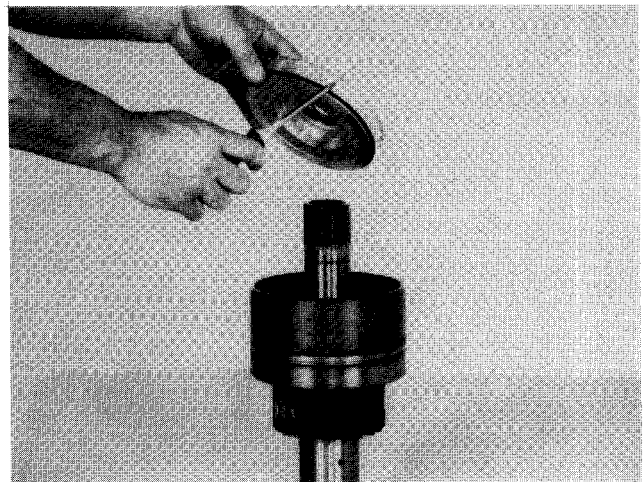


Figure 85

Install clutch piston outer seal ring.

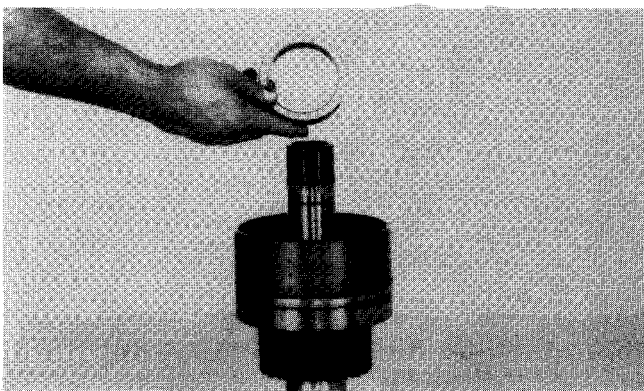


Figure 84

Remove return spring to piston spacer. Turn clutch over and tap clutch shaft on a block of wood to remove clutch piston.

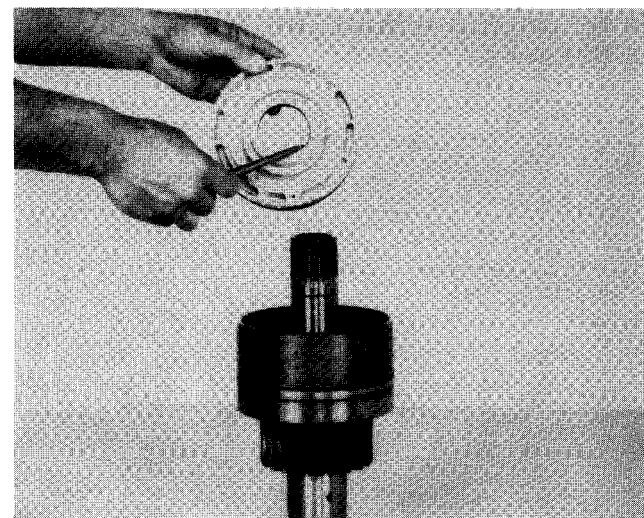


Figure 86

Install clutch piston inner seal ring. Install piston into clutch drum. Use caution as not to damage seal rings.

See cleaning and inspection page.

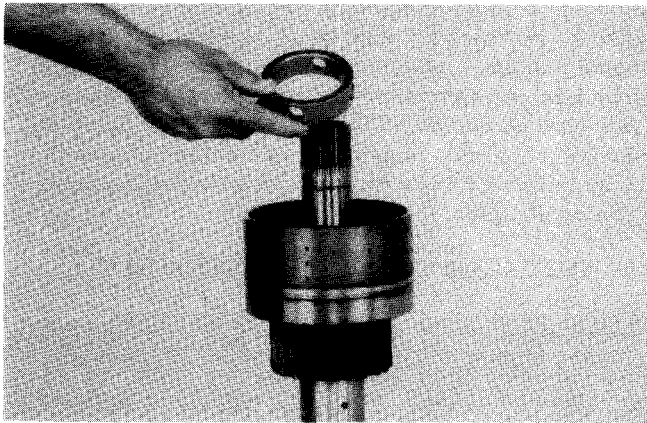


Figure 87

Install piston spacer.

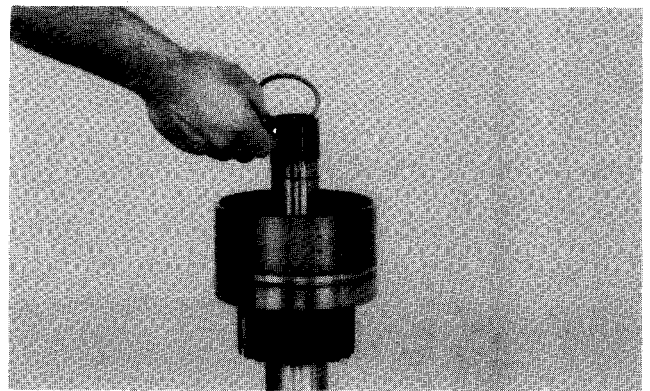


Figure 90

Position ring retainer over retainer ring.

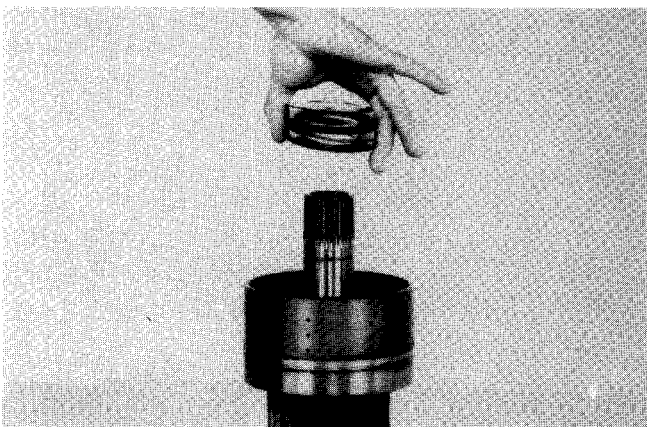


Figure 88

See NOTE in figure 83. Install disc springs. First spring with large diameter toward spacer. Alternate (5) five washers. **See page 59, Figure C.**

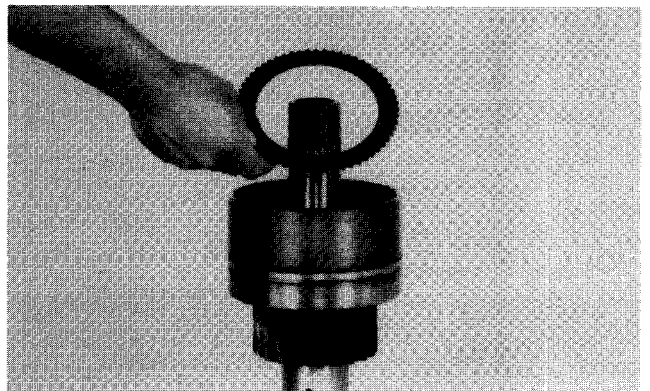


Figure 91

Install one steel disc.

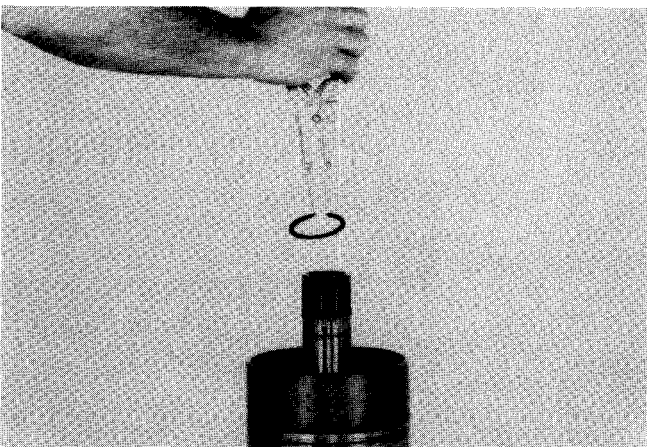


Figure 89

Position return spring retainer ring on clutch shaft. Compress disc springs and install retainer ring.

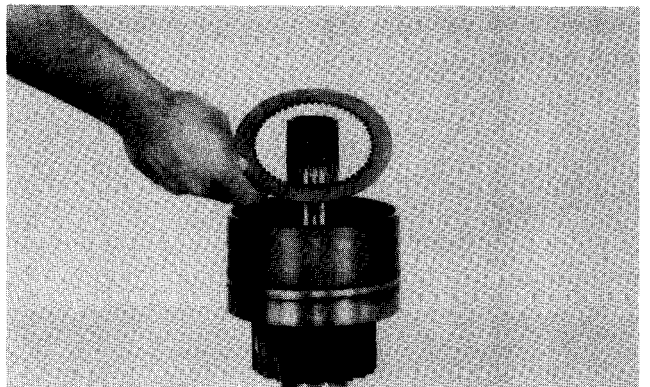


Figure 92

Install one friction disc. **NOTE:** The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

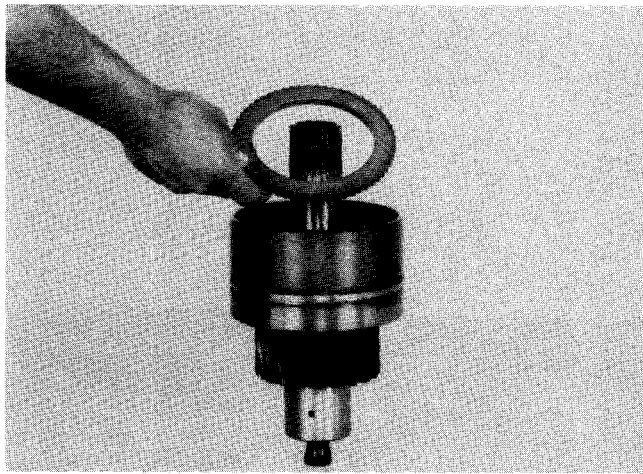


Figure 93

Install clutch disc end plate.

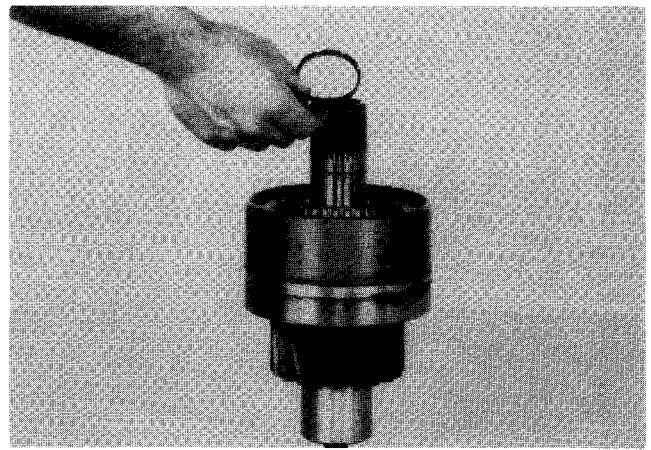


Figure 96

Position taper bearing spacer on shaft.

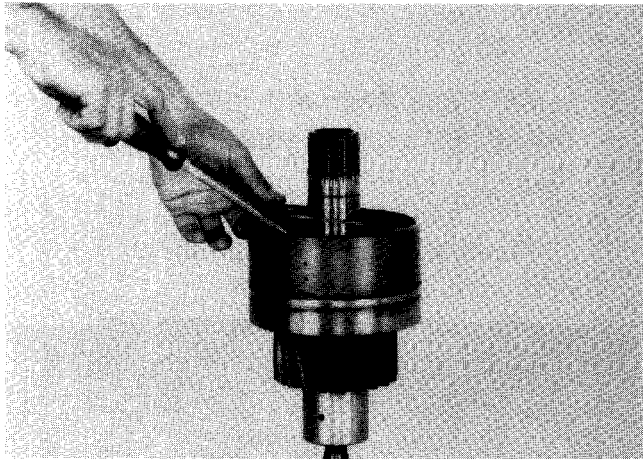


Figure 94

Install end plate retainer ring.

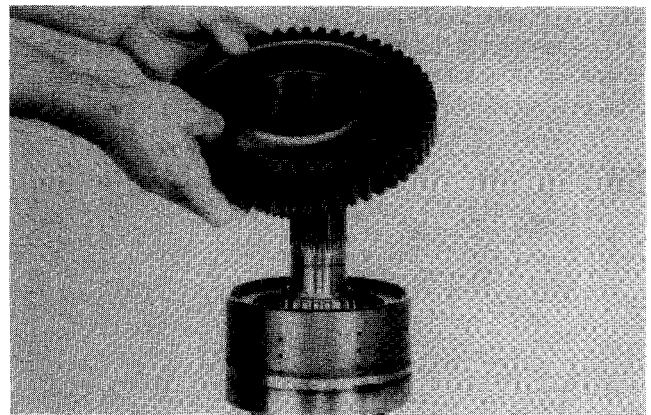


Figure 97

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.

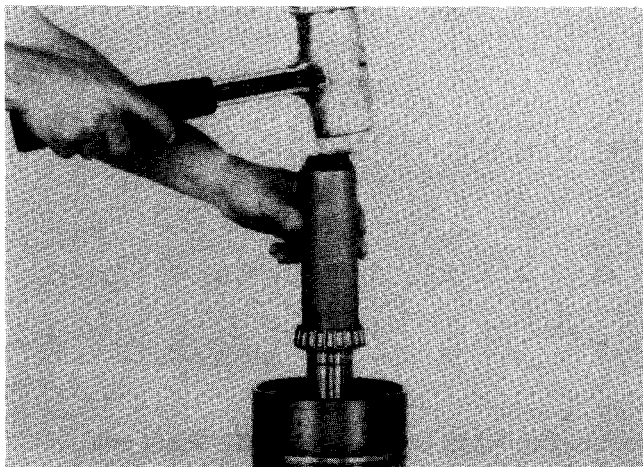


Figure 95

Install inner clutch gear taper bearing.

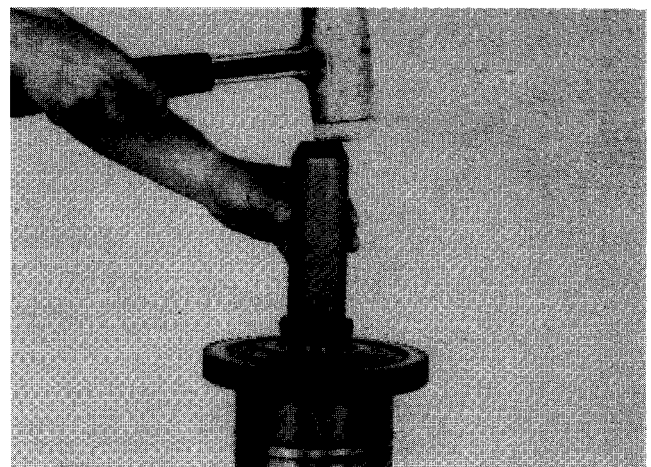


Figure 98

Install outer taper bearing.

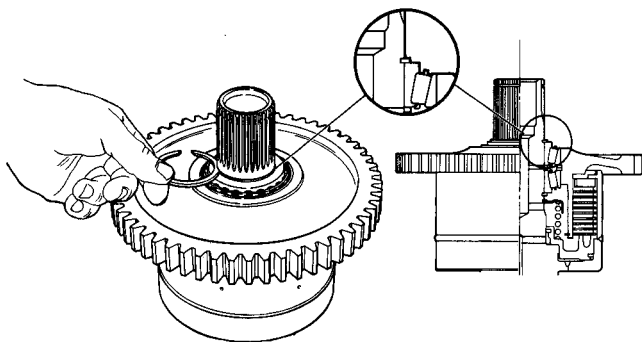


Figure 99

Install low clutch taper bearing retainer ring.

NOTE: Retainer ring is selected at assembly for proper thickness. A snap ring kit is available. Select the thickest of the three rings in the kit that can be fitted into the snap ring groove to assure a proper taper bearing tightness. Check ring as shown for tight ring to bearing fit.

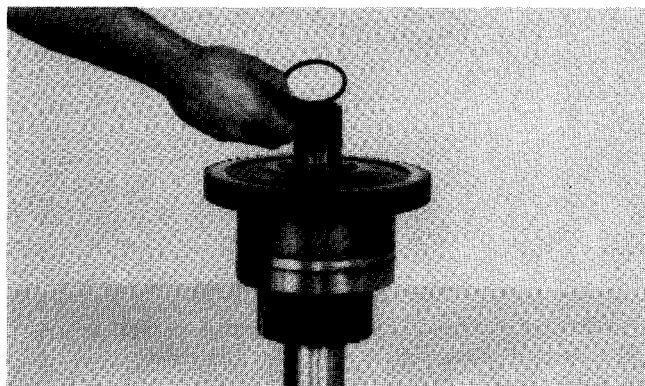


Figure 100

Position ring retainer over retainer ring.

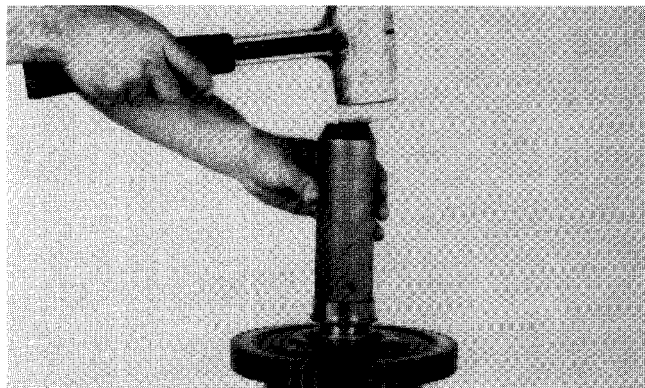


Figure 101

Install clutch shaft front bearing inner race with large diameter of race down.

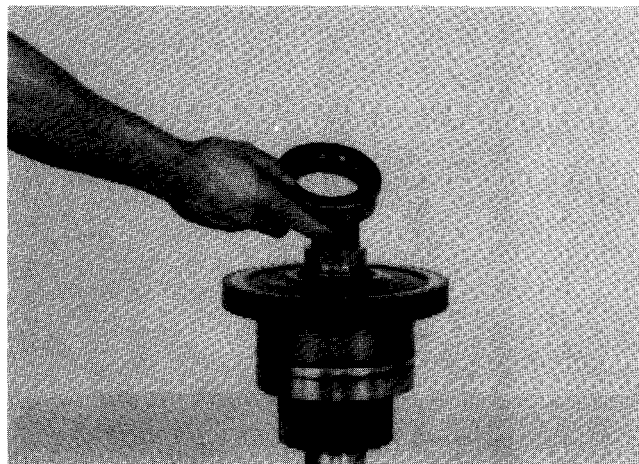


Figure 102

Position front bearing on clutch shaft inner race. **NOTE:** Bearing could be installed in transmission case before installing clutch.

REVERSE AND 3RD CLUTCH DISASSEMBLY AND REASSEMBLY

DISASSEMBLY (Reverse being disassembled)

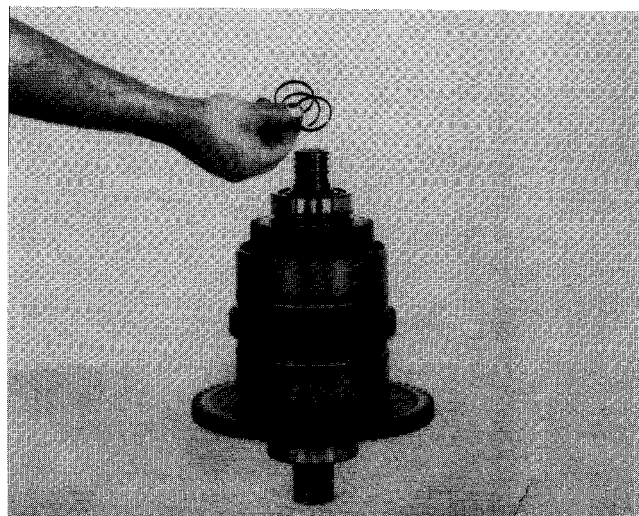


Figure 103

Remove clutch shaft piston rings. **NOTE:** Some units will have Telfon piston rings and expander springs. these rings are to be replaced with a new style ring and does **NOT** use an expander spring. See page 79 for proper piston ring installation.

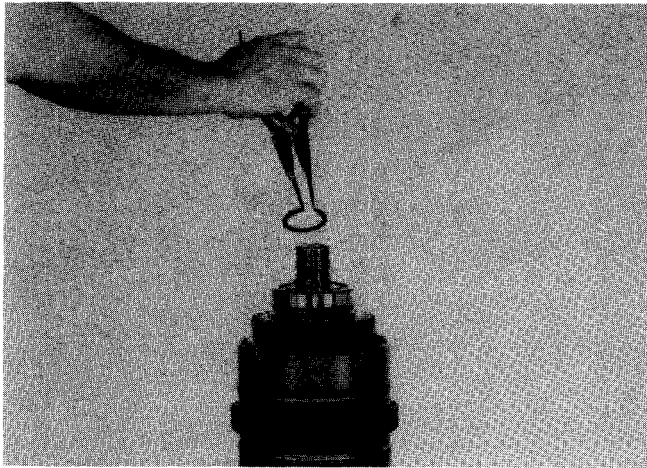


Figure 104

Remove front bearing retainer ring.

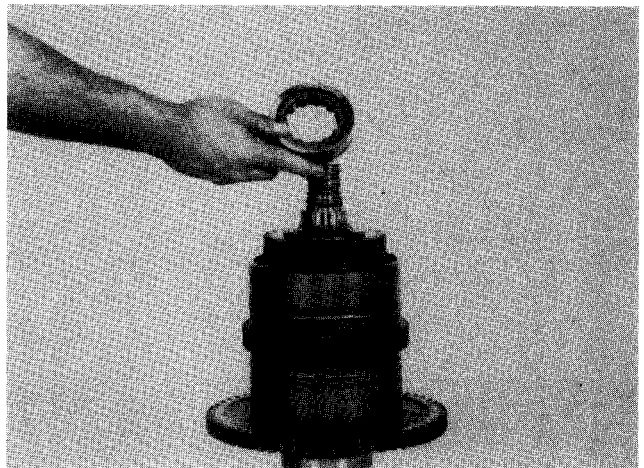


Figure 107

Remove front bearing.

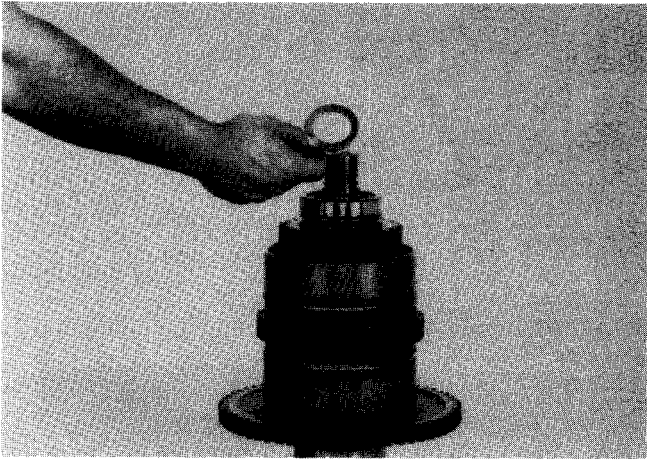


Figure 105

Remove front bearing end plate.

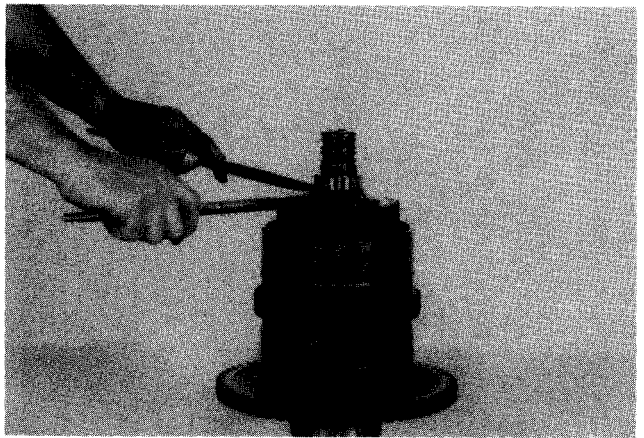


Figure 108

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

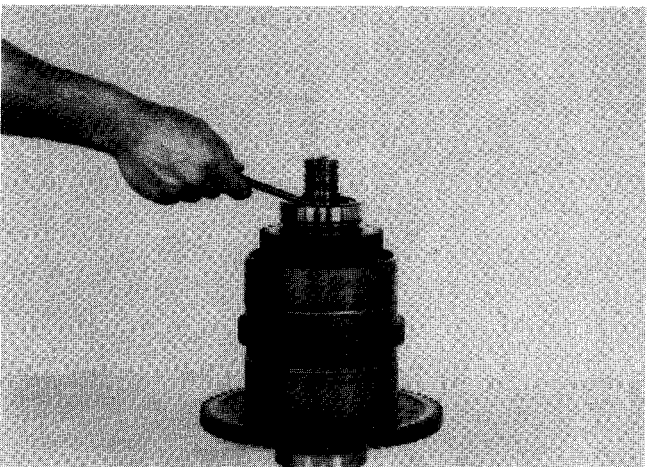


Figure 106

Remove end plate lock ball.

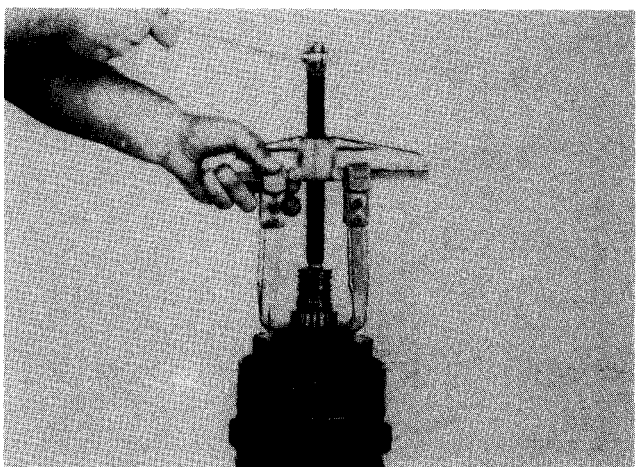


Figure 109

Remove bearing inner race.

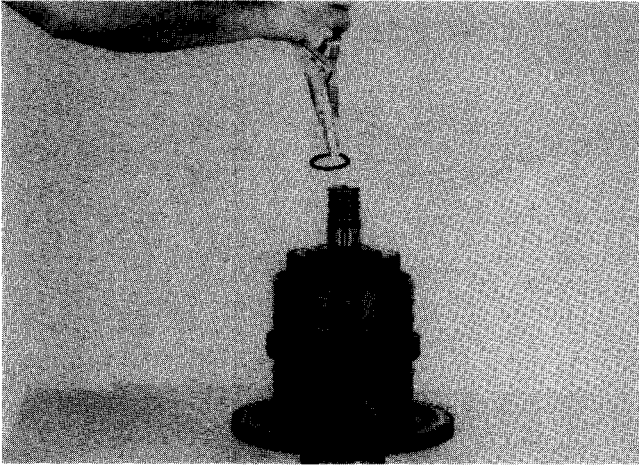


Figure 110

Remove clutch driven gear outer bearing retainer ring.

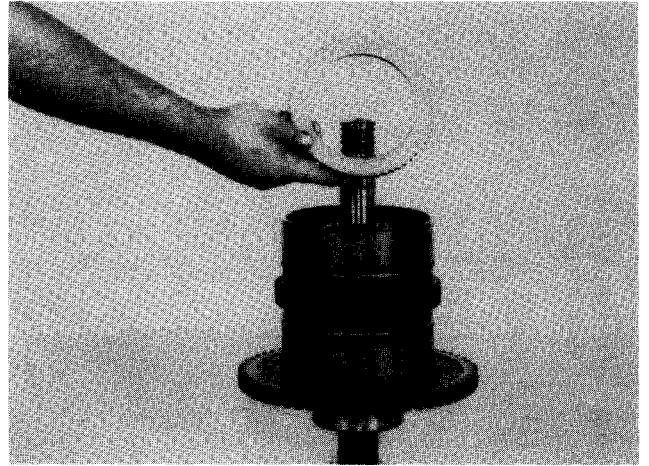


Figure 113

Remove end plate.

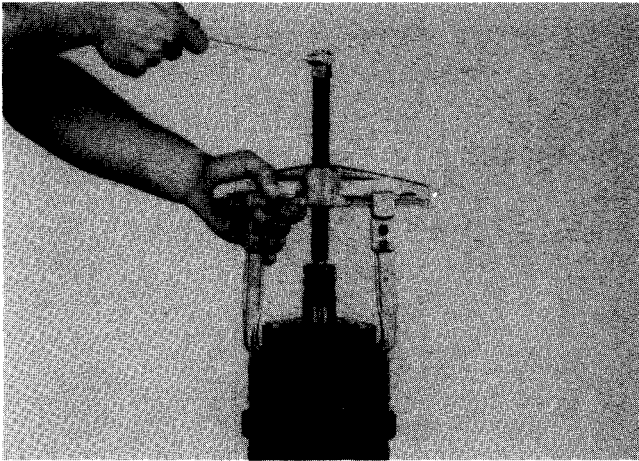


Figure 111

Remove clutch gear and outer bearing.

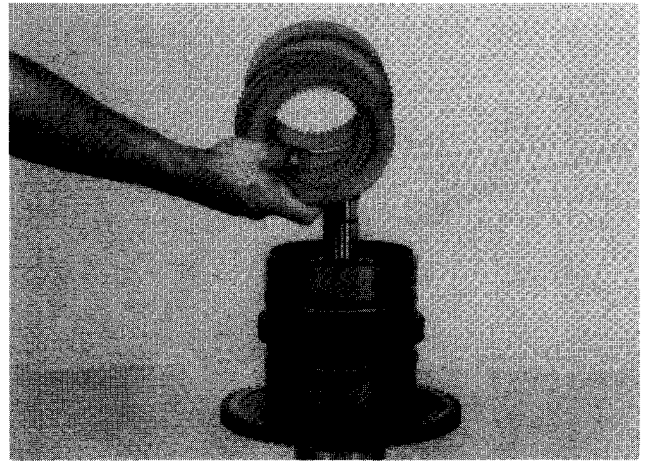


Figure 114

Remove inner and outer clutch discs.

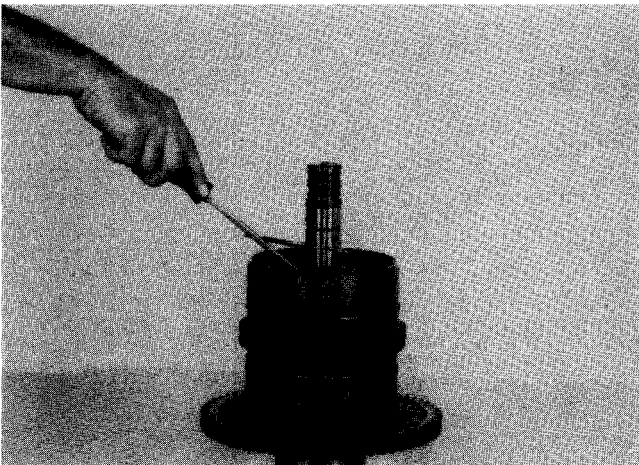


Figure 112

Remove clutch disc end plate retainer ring.

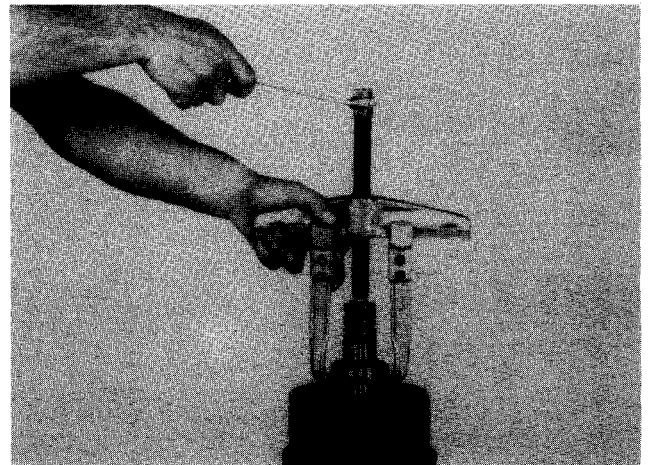


Figure 115

Remove inner bearing.

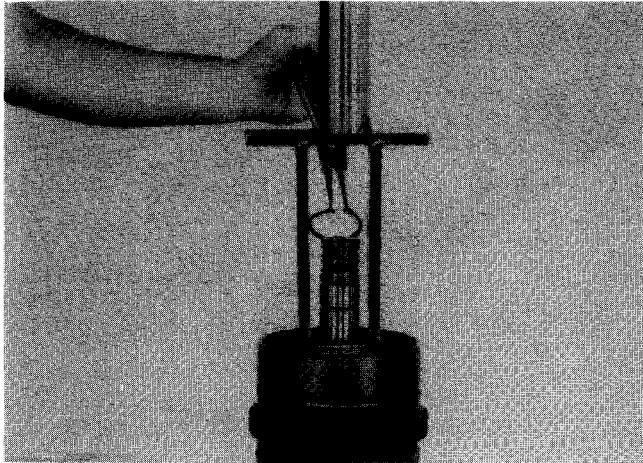


Figure 116

Compress piston return spring. Remove spring retainer ring.

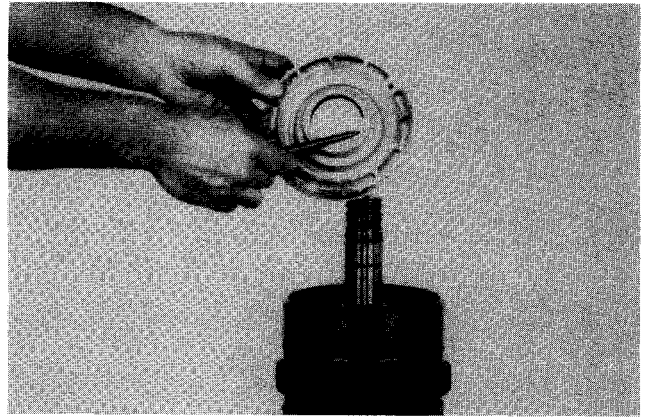


Figure 119

Remove clutch piston.

3RD SPEED CLUTCH DISASSEMBLY

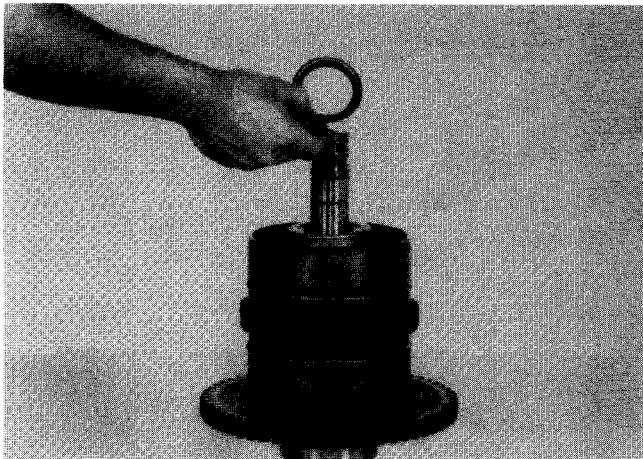


Figure 117

Remove retainer ring retaining washer.

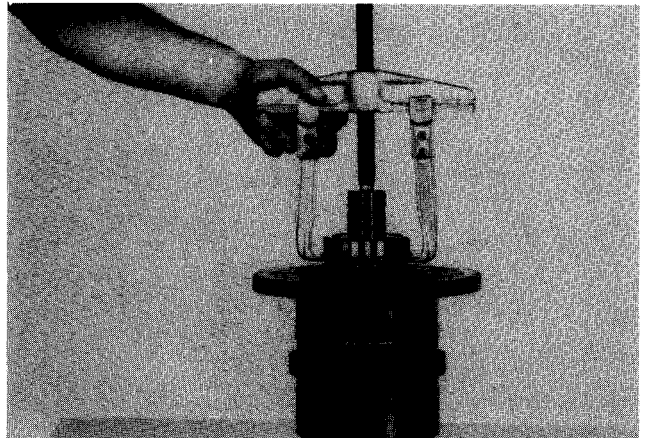


Figure 120

Remove 3rd speed clutch shaft bearing.

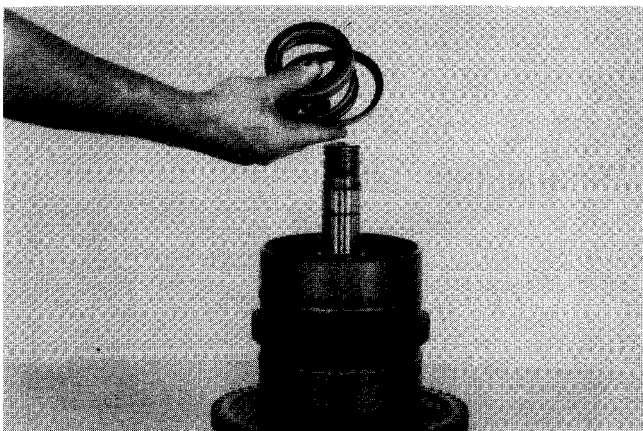


Figure 118

Remove piston return spring and retainers. **NOTE: Modulated forward and reverse clutches will have piston return disc springs. (See note on page 15, Figure 83.)**

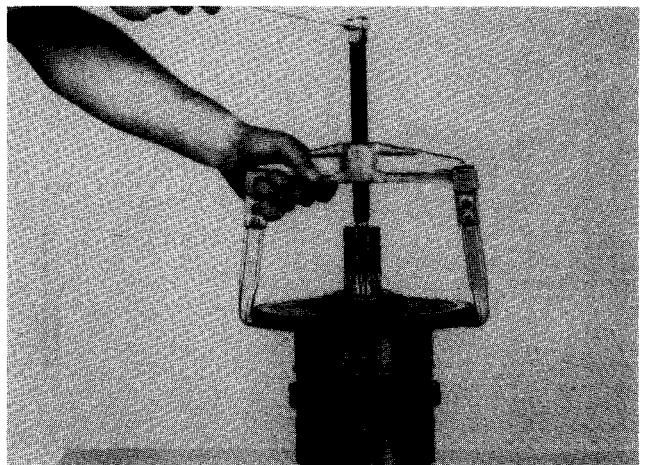


Figure 121

Remove 3rd speed gear and outer bearing.

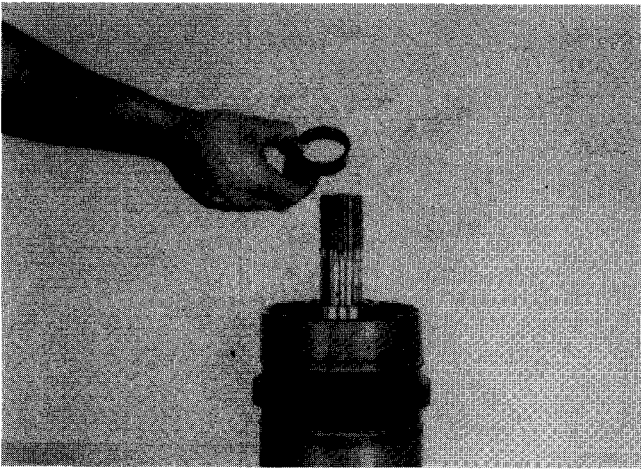


Figure 122
Remove clutch gear outer and inner bearing spacer.

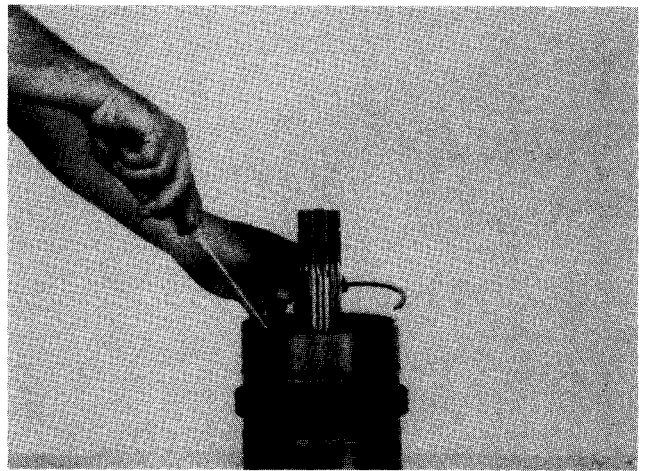


Figure 125
Remove clutch disc end plate retainer ring.

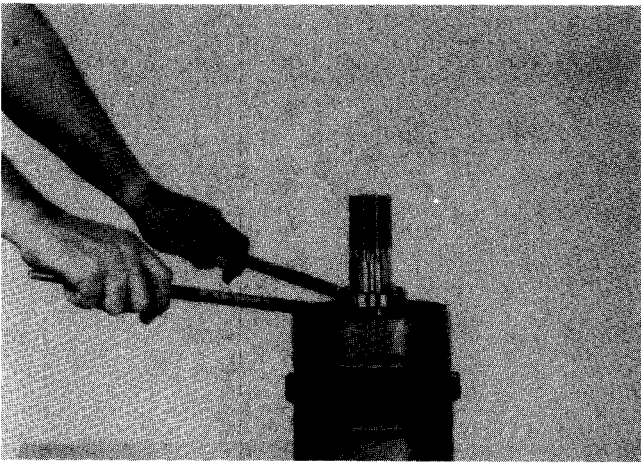


Figure 123
Pry inner bearing up far enough to use a bearing puller.

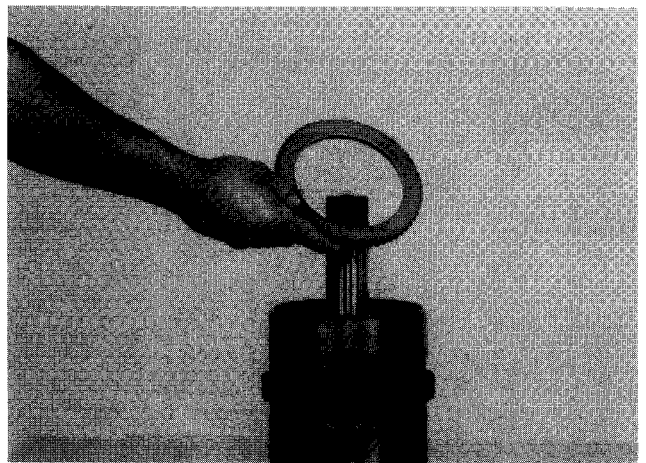


Figure 126
Remove end plate.

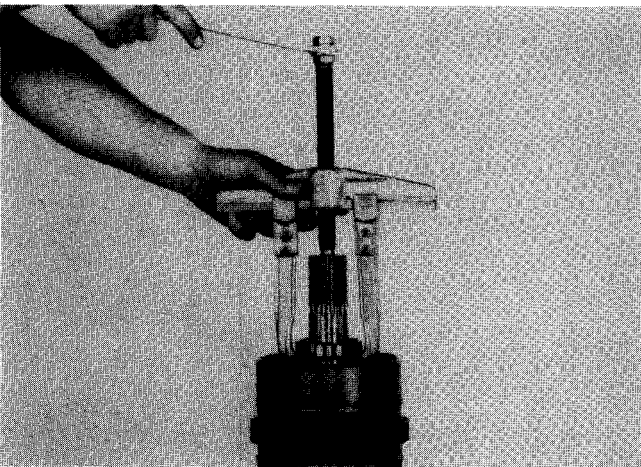


Figure 124
Remove inner bearing.

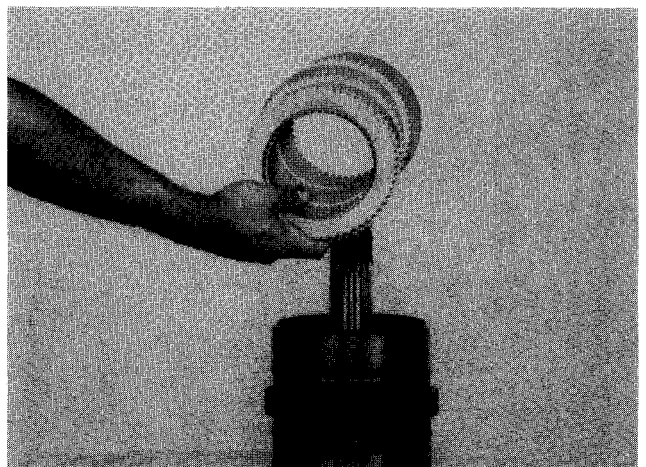


Figure 127
Remove inner and outer clutch discs.

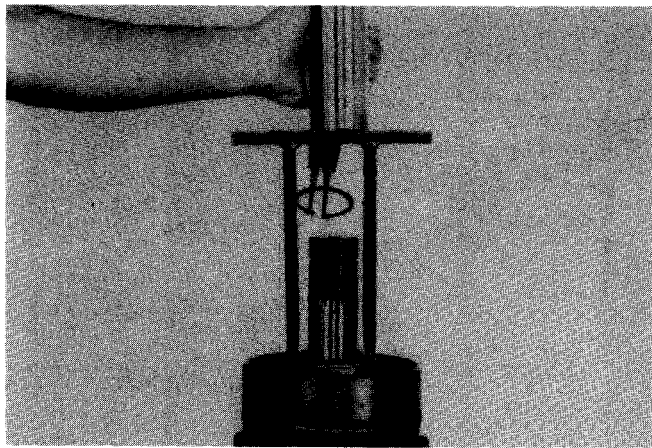


Figure 128

Compress piston return spring. Remove return spring retainer ring.

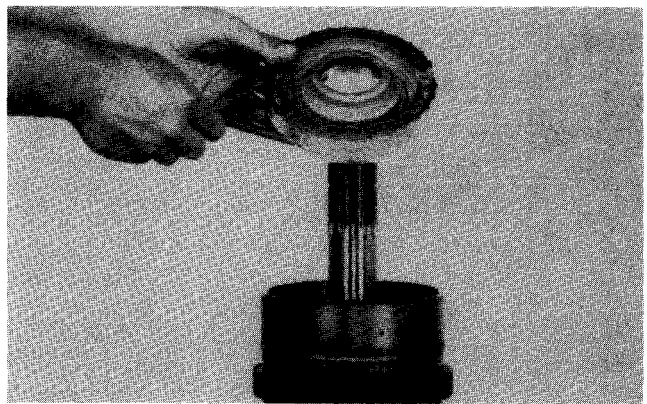


Figure 131

Remove clutch piston.

See cleaning and inspection page.

3RD SPEED CLUTCH REASSEMBLY

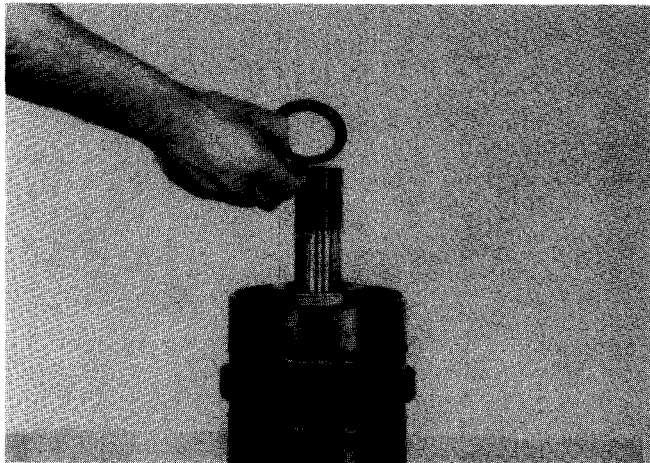


Figure 129

Remove retainer ring retaining washer.

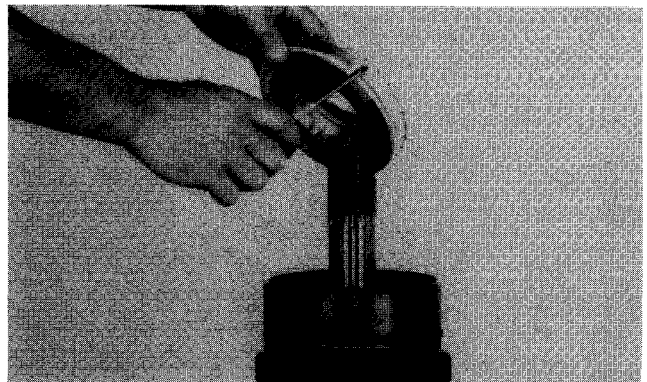


Figure 132

Install clutch piston inner and outer seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.

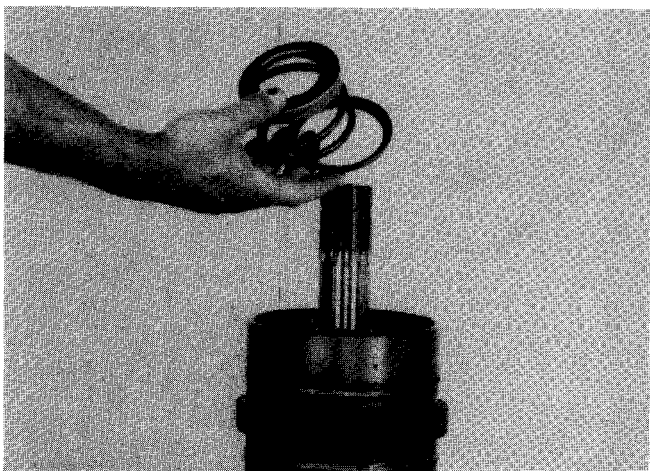


Figure 130

Remove return spring retainers and spring.

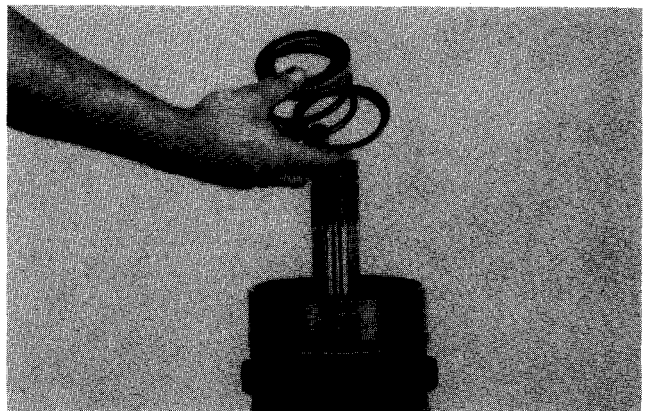


Figure 133

Position the inner return spring retainer, the return spring and the outer spring retainer on clutch shaft.

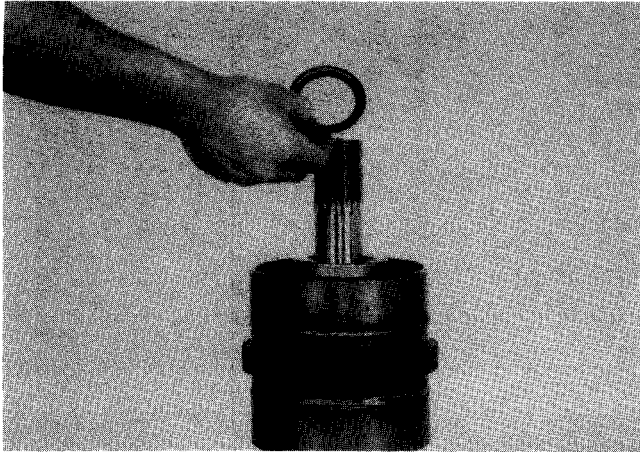


Figure 134

Position return spring retainer ring retaining washer on clutch shaft.

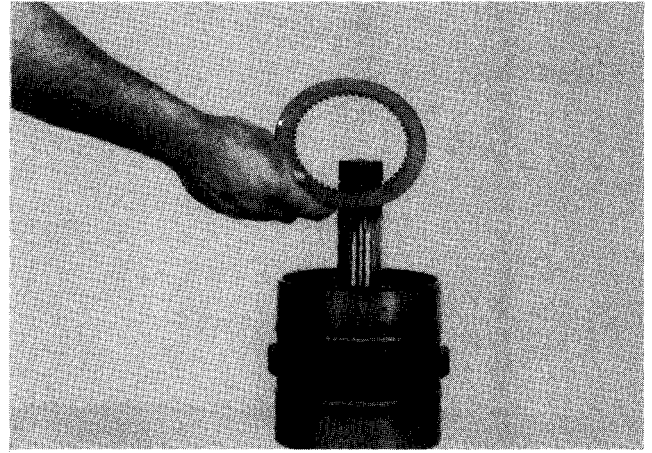


Figure 137

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed in friction.

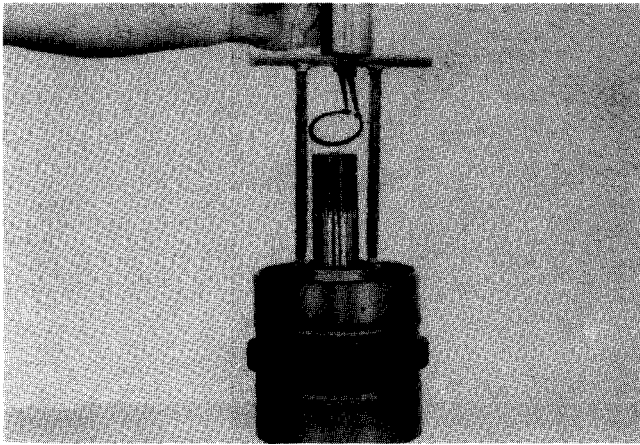


Figure 135

Compress return spring and install retainer ring being certain ring is in full position in retaining washer and ring groove.

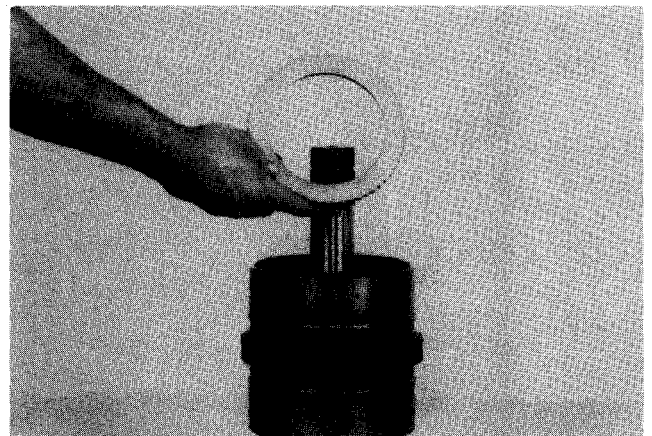


Figure 138

Install clutch disc end plate.

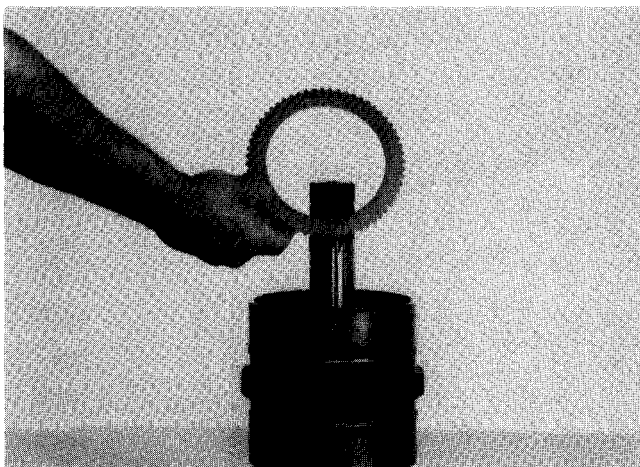


Figure 136

Install one steel disc.

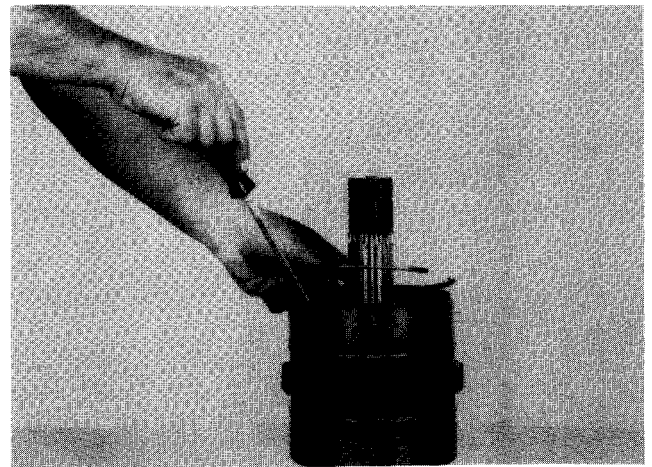


Figure 139

Install end plate retainer ring.

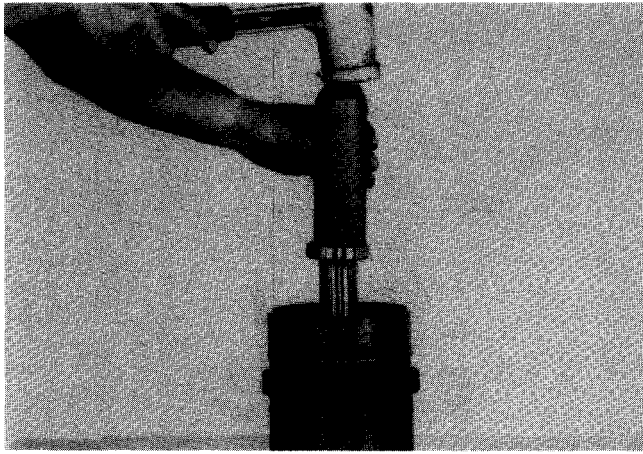


Figure 140

Install clutch gear inner bearing. **NOTE:** The inner bearing does not have a bearing shield.

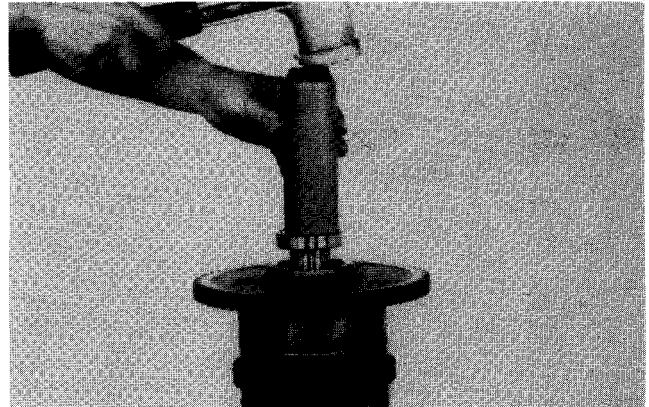


Figure 143

Install clutch gear outer bearing. **NOTE:** Outer bearing has a shield in it, this shield must be up.

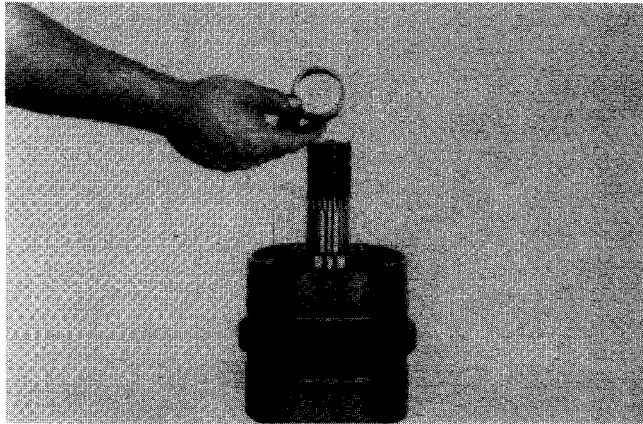


Figure 141

Install clutch gear inner and outer bearing spacer.

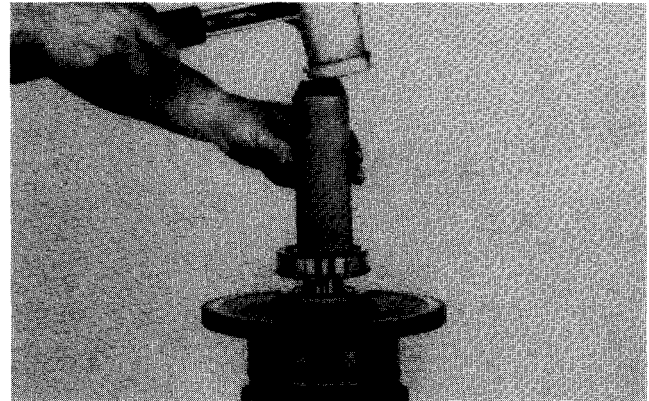


Figure 144

Install 3rd speed clutch shaft rear bearing. **NOTE:** Bearing outer diameter locating ring must be down.

REVERSE CLUTCH REASSEMBLY

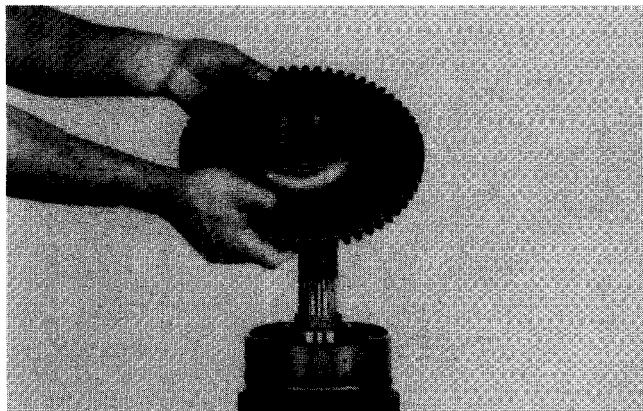


Figure 142

Install clutch gear into clutch drum. Align splines on clutch 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.

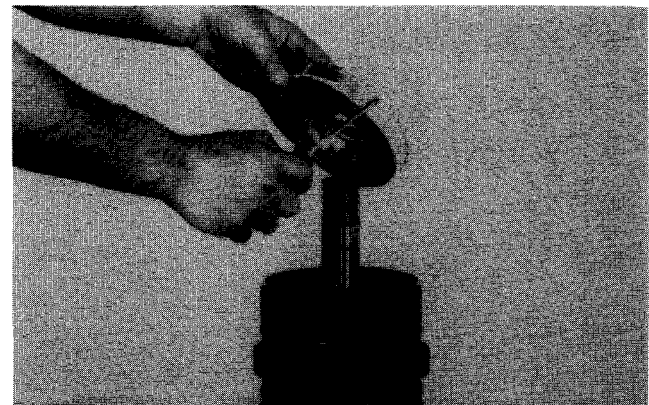


Figure 145

Install clutch piston inner and outer oil seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.

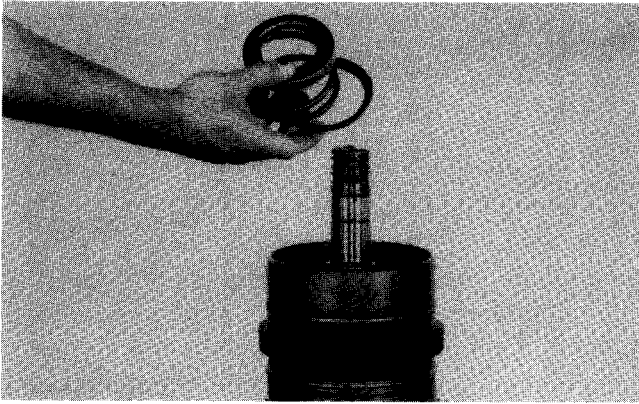


Figure 146

Position the inner return spring retainer, the return spring and the outer spring retainer. **NOTE: If reverse and forward clutches are modulated, assemble disc springs as shown in Figure A on page 59.**

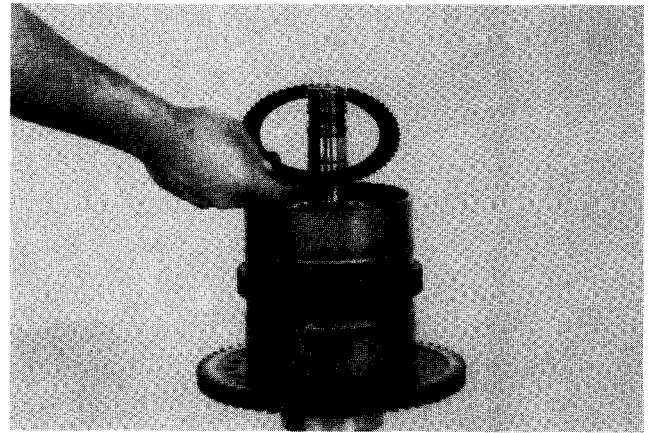


Figure 149

Install one steel disc.

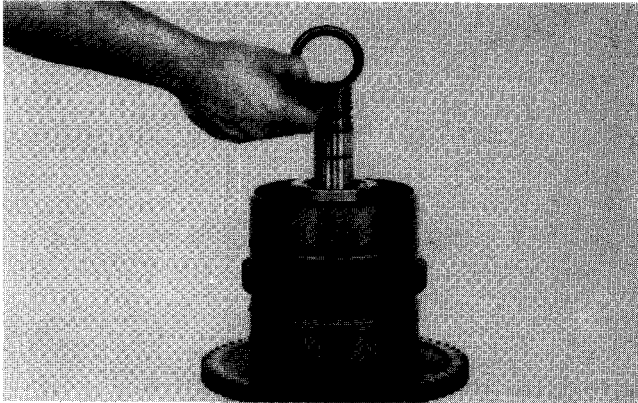


Figure 147

Position return spring retainer ring retaining washer on clutch shaft.

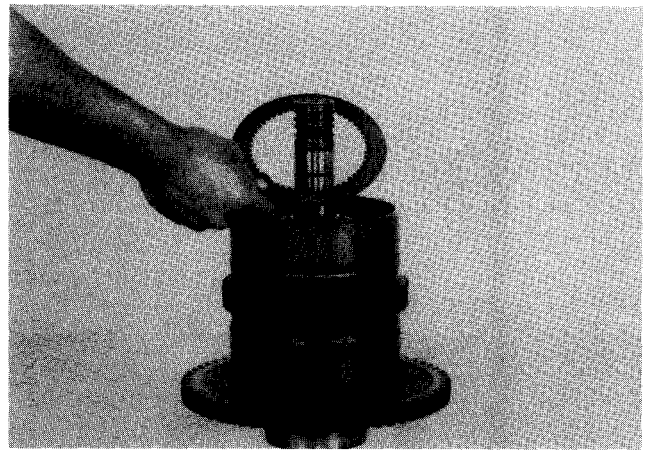


Figure 150

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

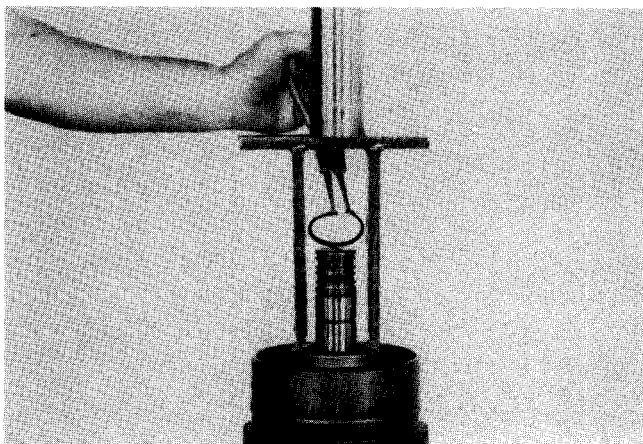


Figure 148

Compress return spring and install retainer ring being certain ring is in full position in retaining washer and ring groove.

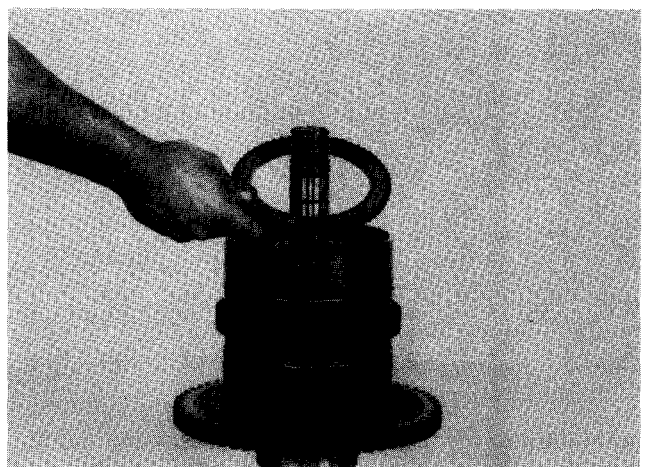


Figure 151

Install clutch disc end plate.

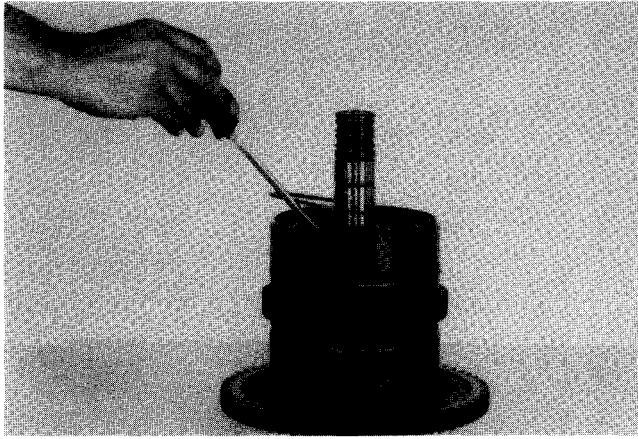


Figure 152

Install end plate retainer ring.

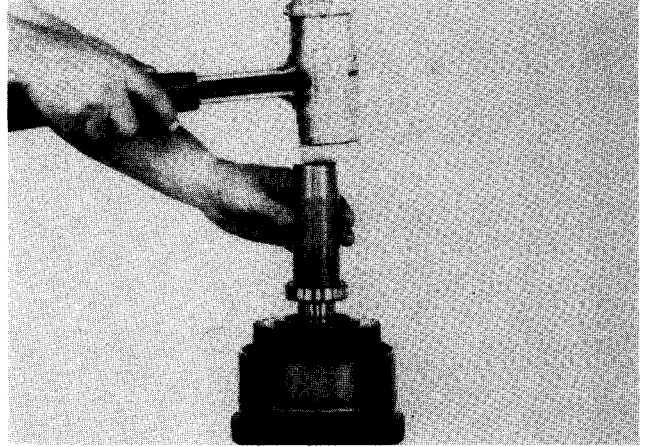


Figure 155

Install clutch gear outer bearing. **NOTE: Outer bearing has a shield in it, this shield must be down.**

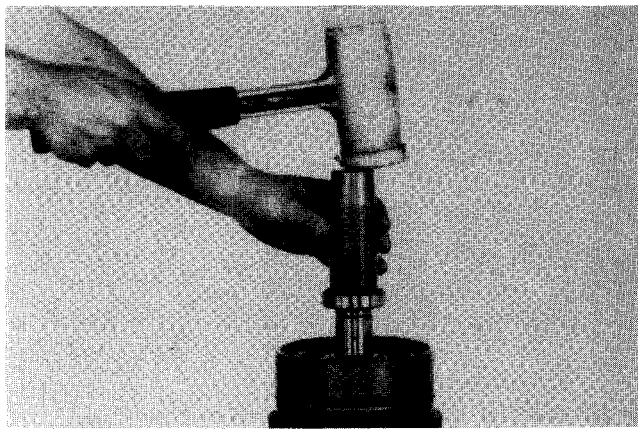


Figure 153

Install clutch gear inner bearing. **NOTE: This bearing does not have a shield in it.**

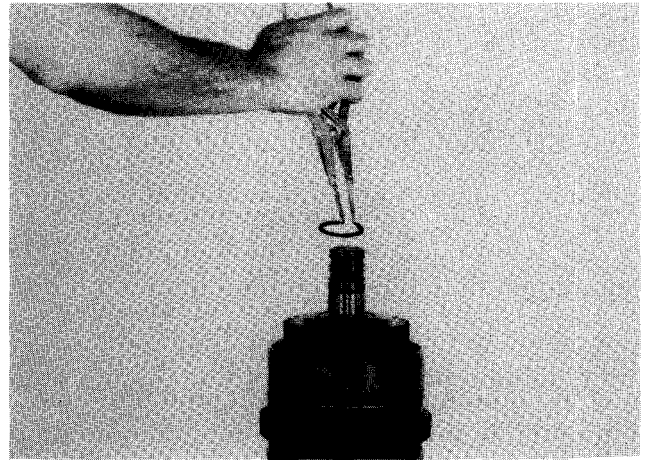


Figure 156

Install clutch gear outer bearing retainer ring.

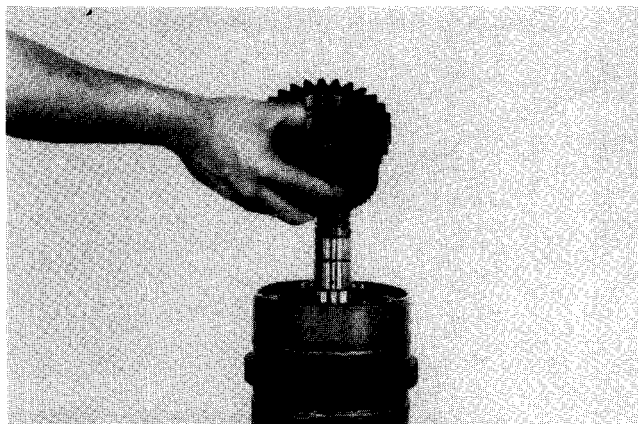


Figure 154

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

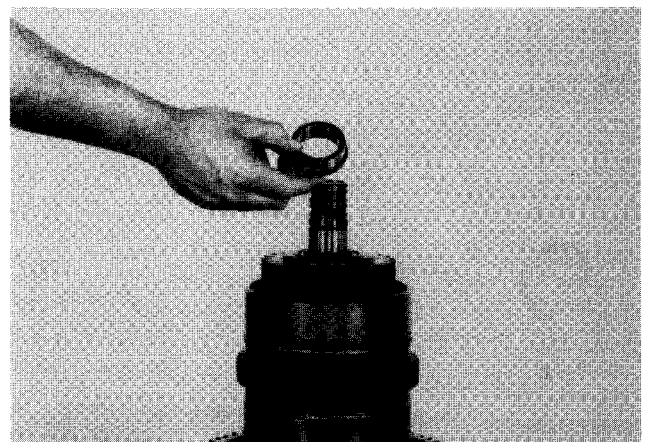


Figure 157

Install clutch shaft front bearing inner race with large diameter of race down.

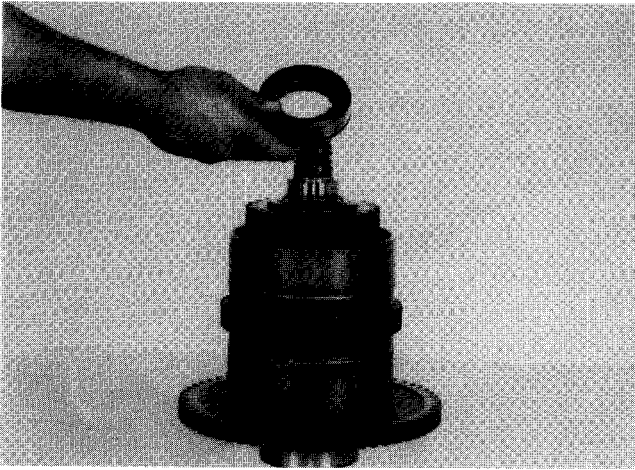


Figure 158

Position front bearing over bearing race.

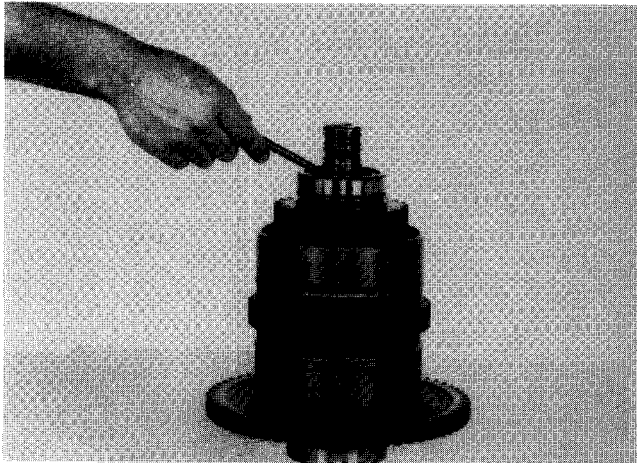


Figure 159

Position end plate lock ball in clutch shaft.



Figure 160

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

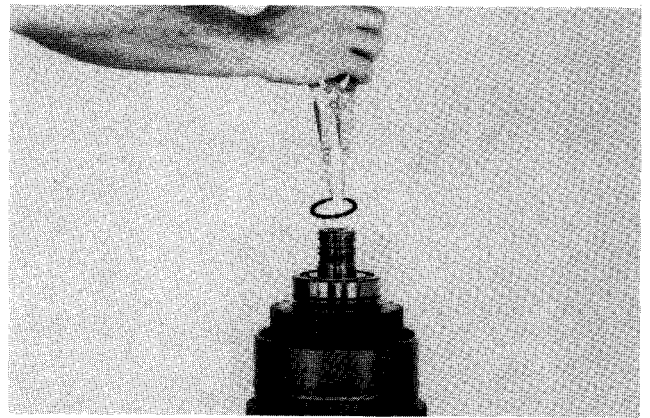


Figure 161

Install bearing retainer ring.

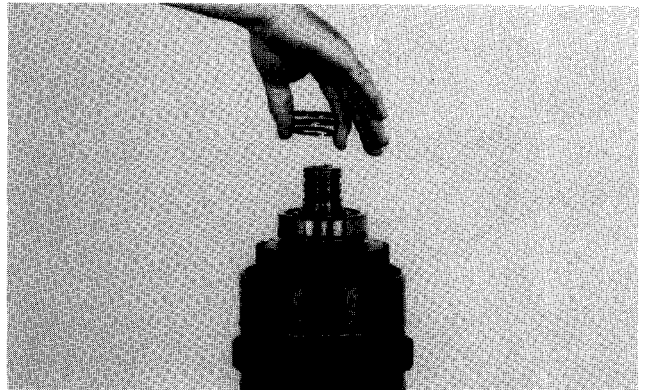


Figure 162

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

DISASSEMBLY AND REASSEMBLY OF THE FORWARD AND 2ND CLUTCH

(Forward being disassembled)

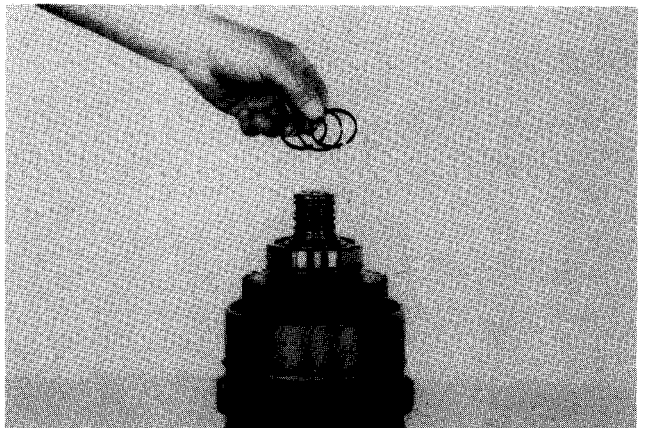


Figure 163

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



Figure 164

Remove front bearing end plate retainer ring.

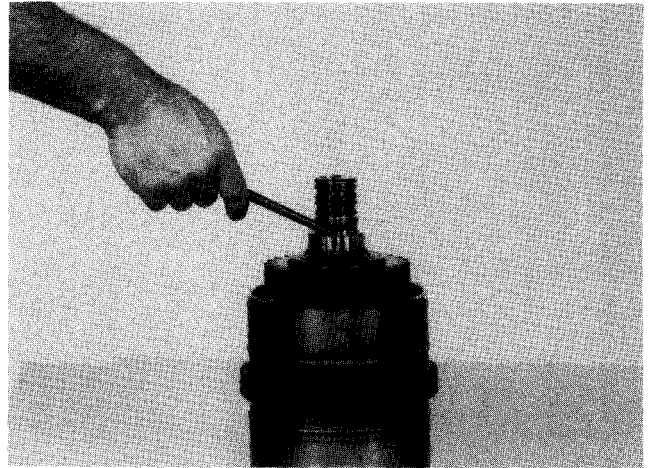


Figure 167

Remove bearing end plate lock ball.

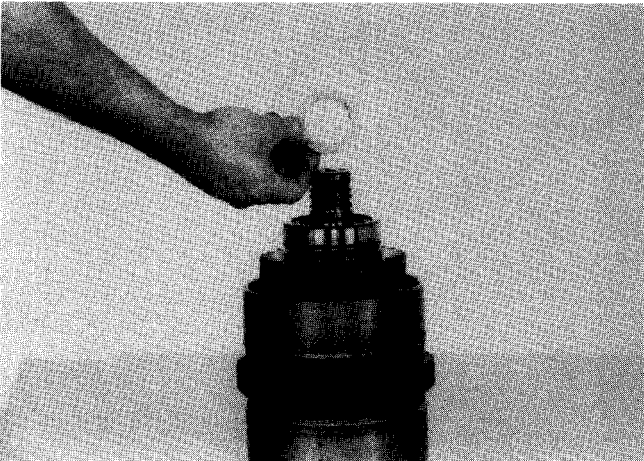


Figure 165

Remove end plate.

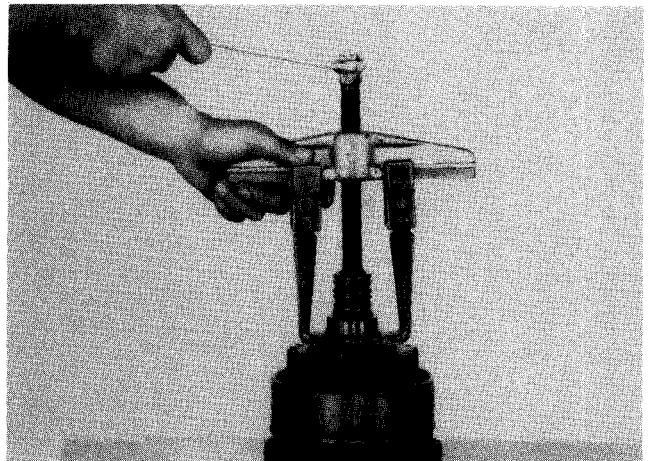


Figure 168

Remove front bearing inner race.

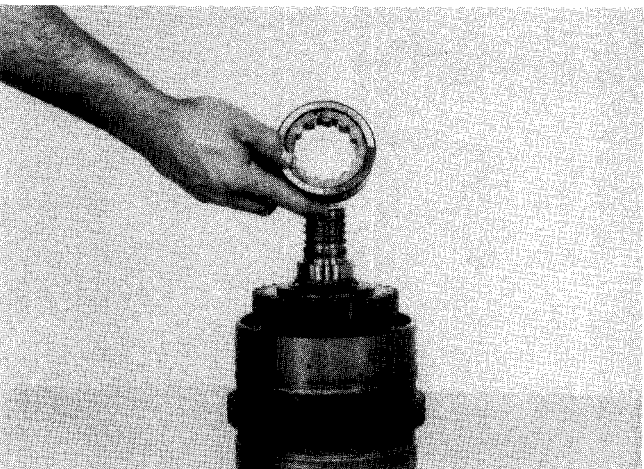


Figure 166

Remove front bearing.

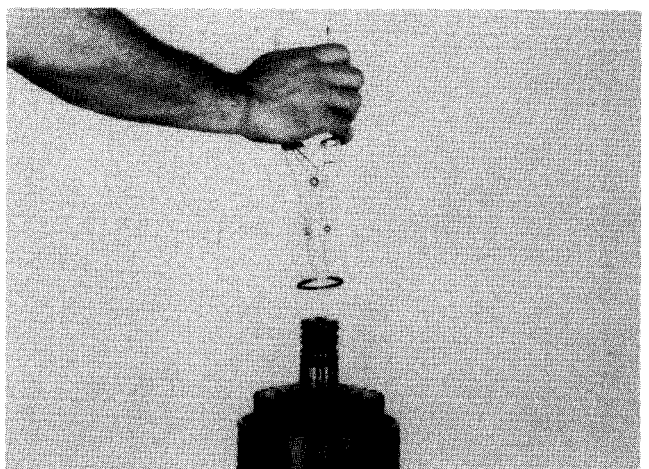


Figure 169

Remove clutch gear outer bearing retainer ring.

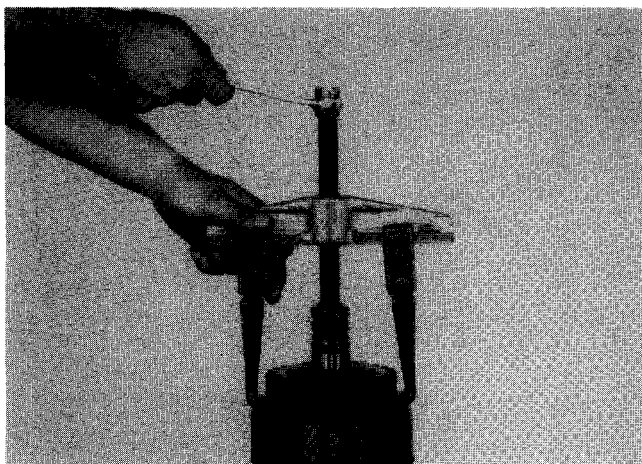


Figure 170
Remove clutch gear and outer bearing.

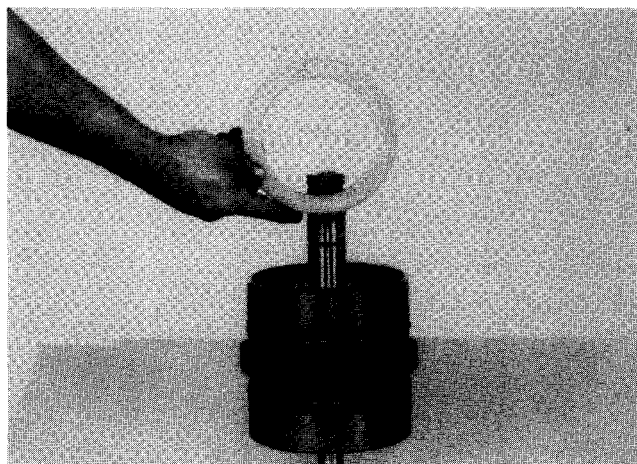


Figure 173
Remove end plate.

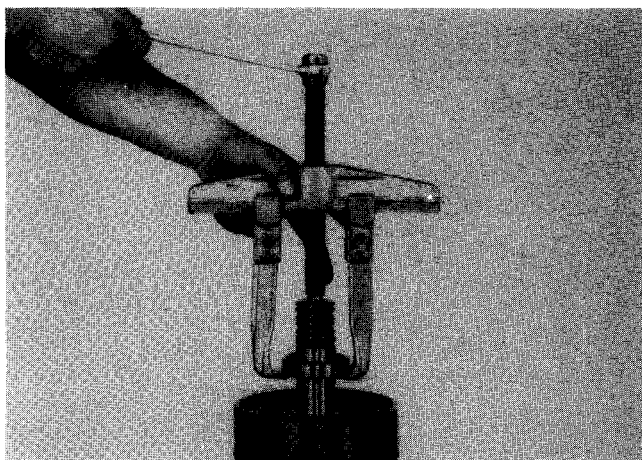


Figure 171
Remove inner bearing.

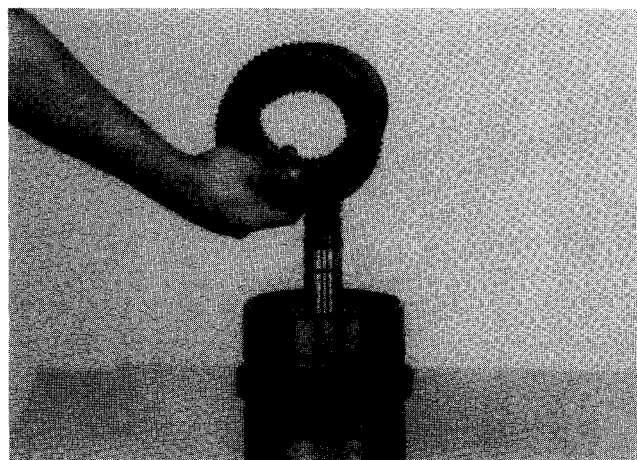


Figure 174
Remove inner and outer clutch discs.

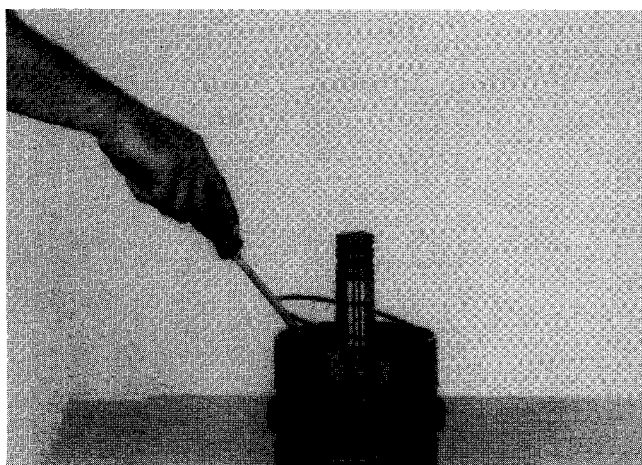


Figure 172
Remove clutch disc end plate retainer ring.

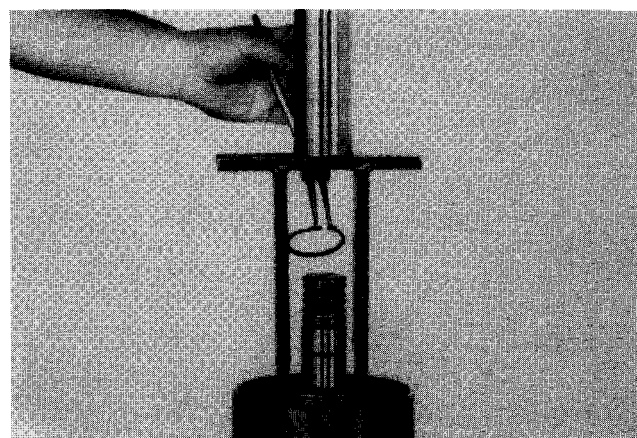


Figure 175
Compress piston return spring. Remove return spring retainer ring.

2ND CLUTCH DISASSEMBLY

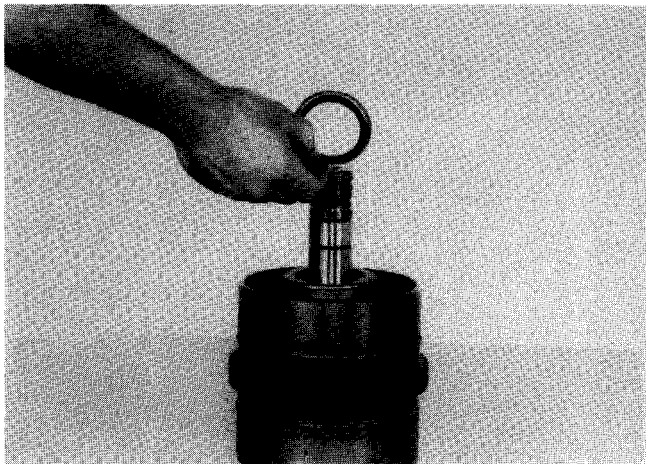


Figure 176

Remove retainer ring retaining ring.

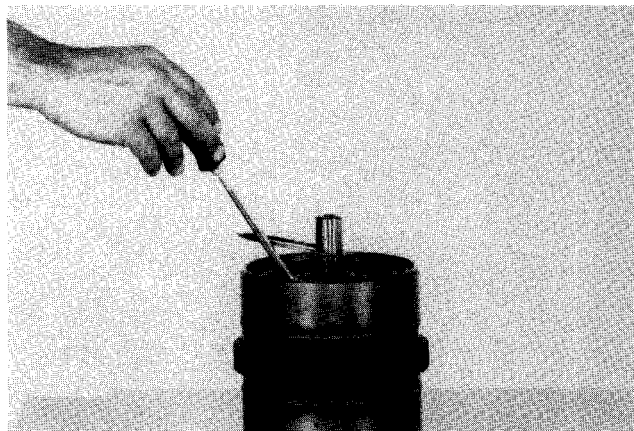


Figure 179

Remove clutch disc end plate retainer ring.

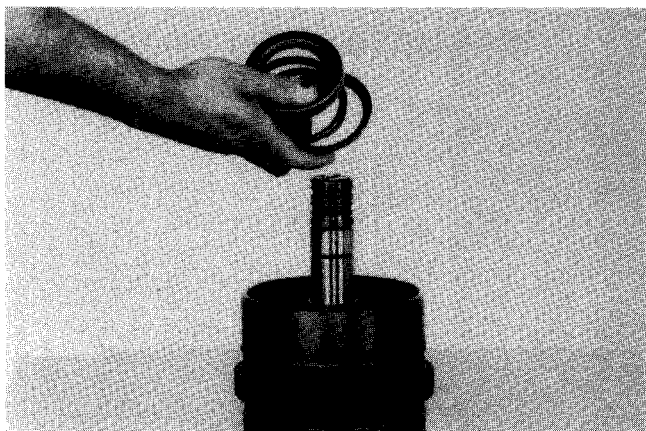


Figure 177

Remove piston return spring and retainers. See note in Figure 118.

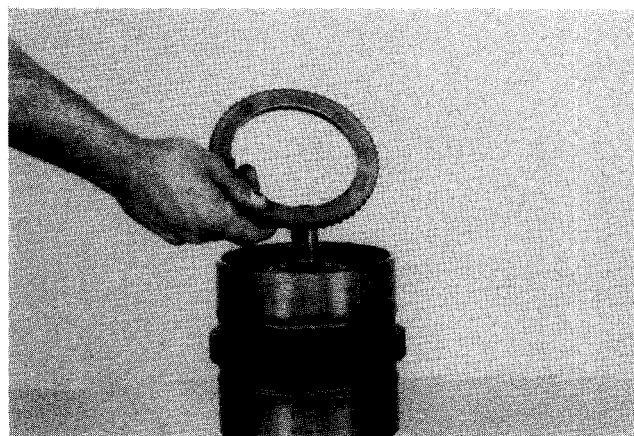


Figure 180

Remove end plate.

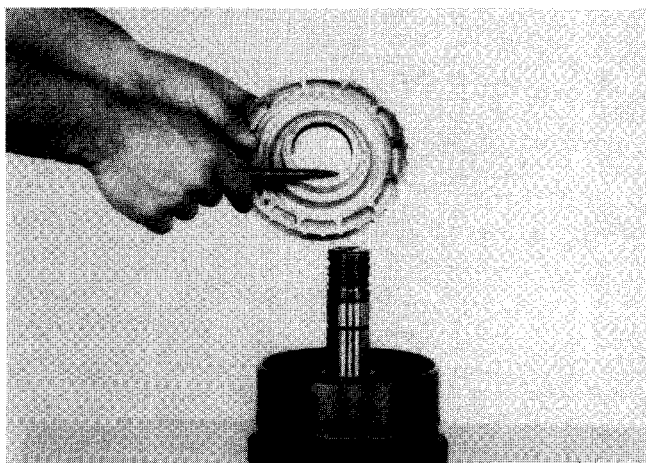


Figure 178

Remove clutch piston.



Figure 181

Remove inner and outer clutch discs.

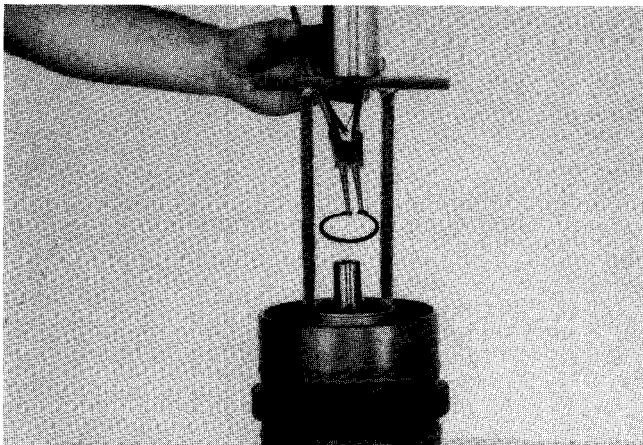


Figure 182
Compress piston return spring. Remove return spring retainer ring.

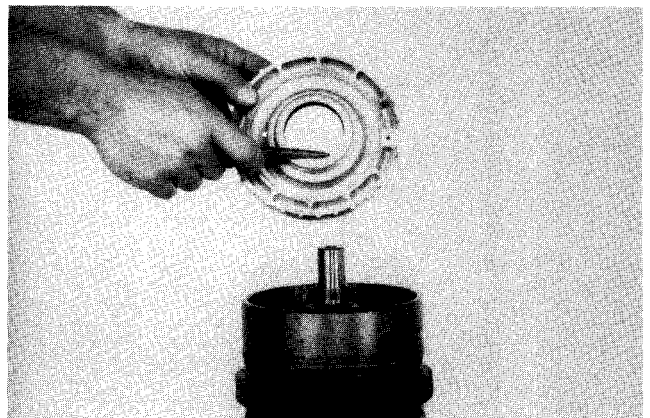


Figure 185
Remove clutch piston.

See cleaning and inspection page.

2ND CLUTCH REASSEMBLY



Figure 183
Remove retainer ring retaining washer.



Figure 186
Install clutch piston inner and outer seal rings. Install clutch piston in clutch drum, use caution as not to damage seal rings.



Figure 184
Remove return spring retainers and spring.



Figure 187
Position the inner return spring retainer, the return spring and outer spring retainer on clutch shaft.

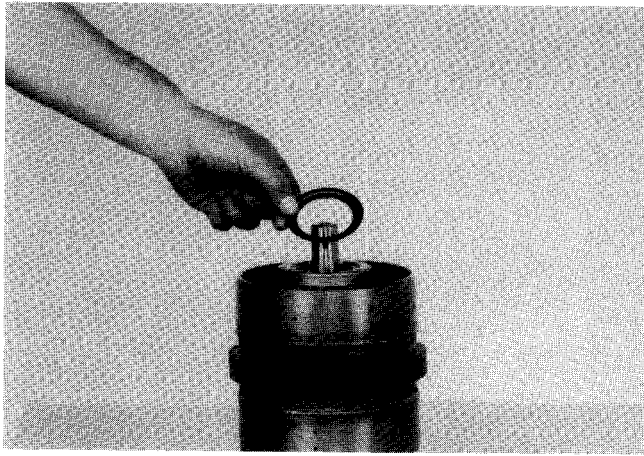


Figure 188

Position return spring retainer ring retaining washer on clutch shaft.

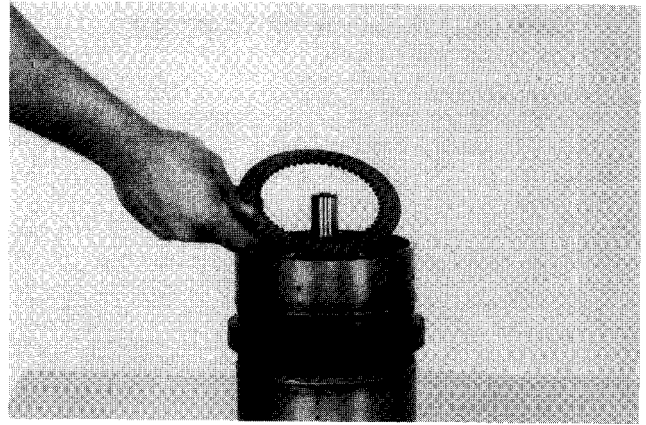


Figure 191

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

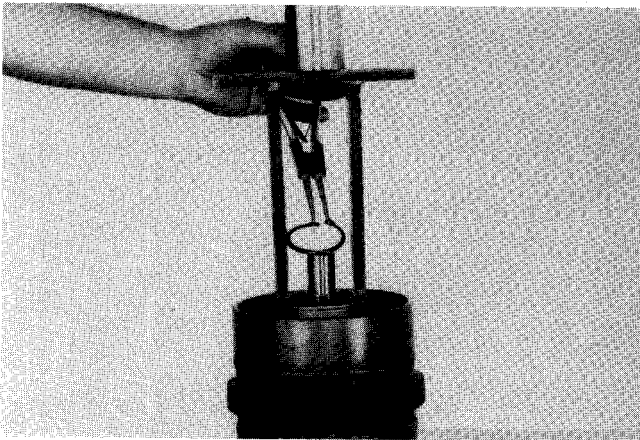


Figure 189

Compress return spring and install retainer ring, being certain ring is in full position in retaining washer and ring groove.

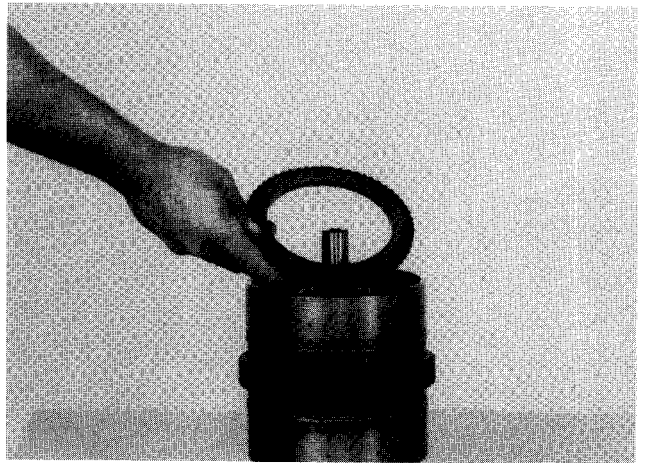


Figure 192

Install clutch disc end plate.

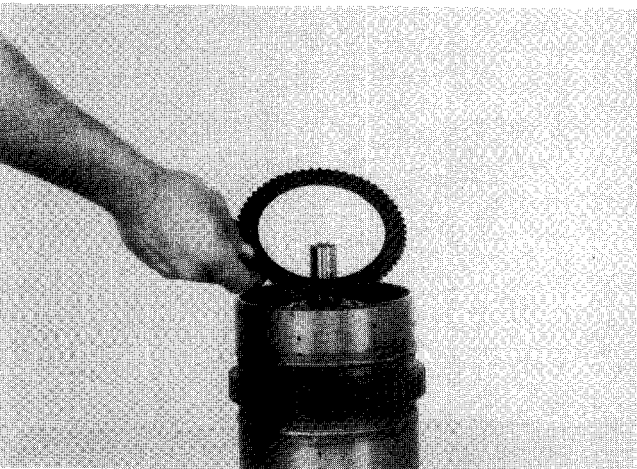


Figure 190

Install one steel disc.

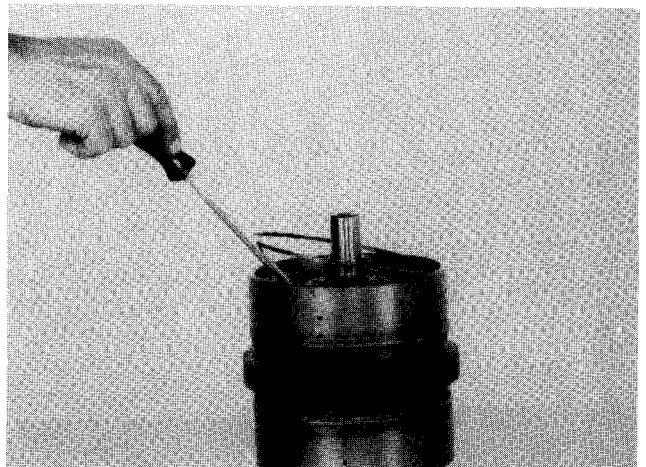


Figure 193

Install end plate retainer ring.

FORWARD CLUTCH REASSEMBLY

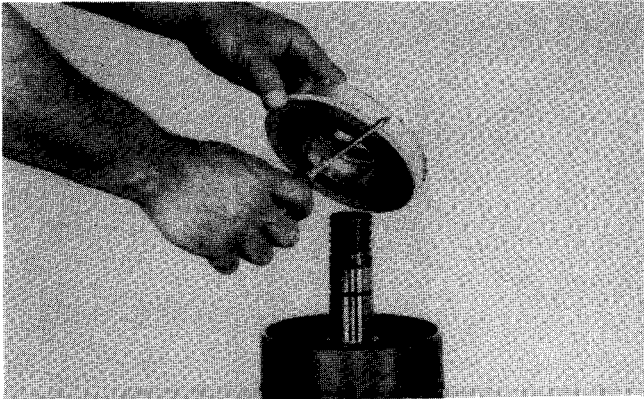


Figure 194

Install clutch piston inner and outer seal rings. Install piston in clutch drum, use caution as not to damage seal rings.

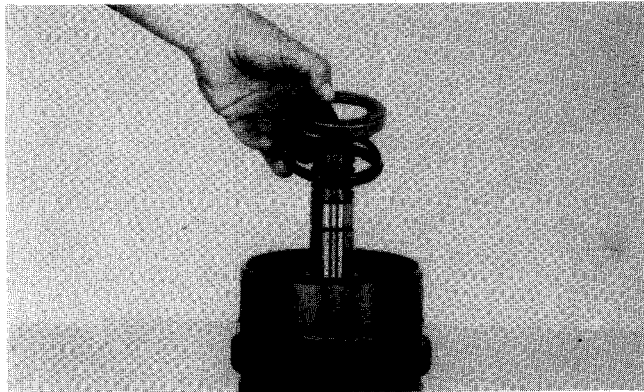


Figure 195

Position the inner return spring retainer, the return spring and outer spring retainer. **NOTE: If forward and reverse clutches are modulated, assemble piston return disc springs as shown in Figure A on page 59.**

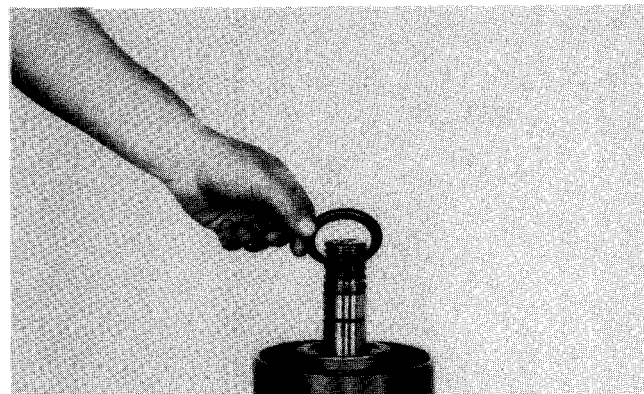


Figure 196

Position return spring retainer ring retaining washer on clutch shaft.

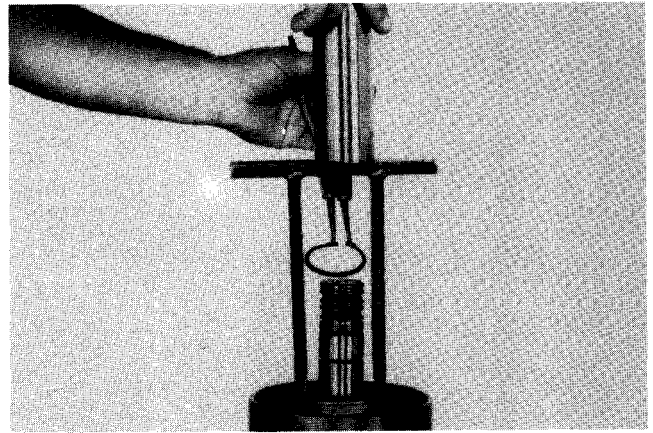


Figure 197

Compress return spring and install retainer ring, being certain ring is in full position in retaining washer and ring groove.

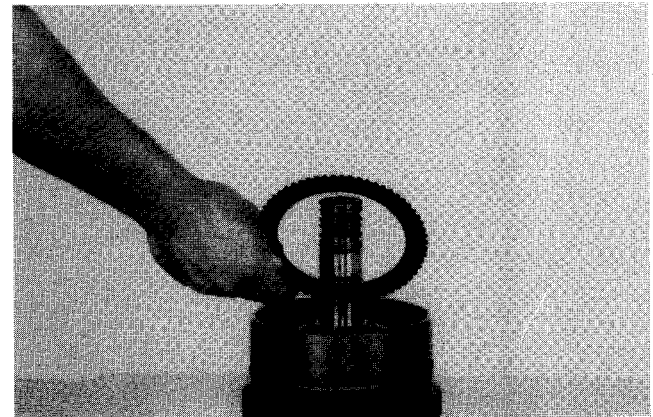


Figure 198

Install one steel disc.

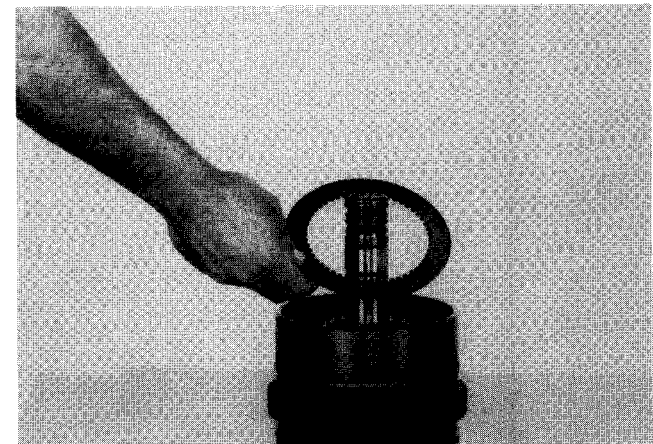


Figure 199

Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to the piston is steel, last disc installed is friction.

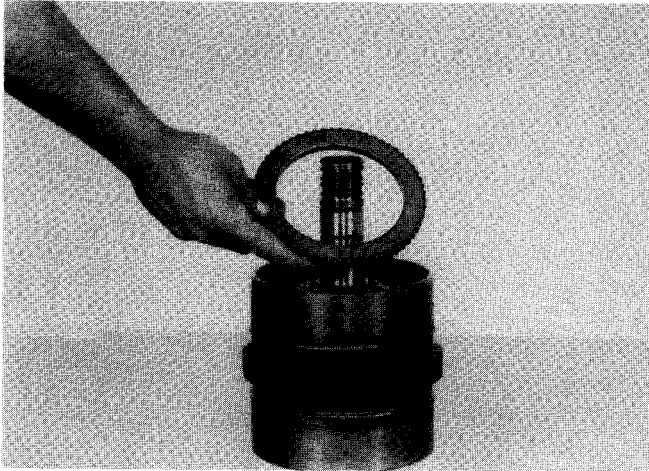


Figure 200

Install clutch disc end plate.

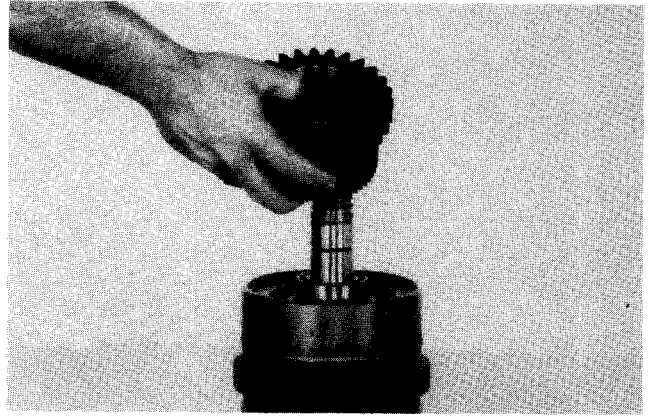


Figure 203

Install clutch gear into clutch drum. Align splines on clutch 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.

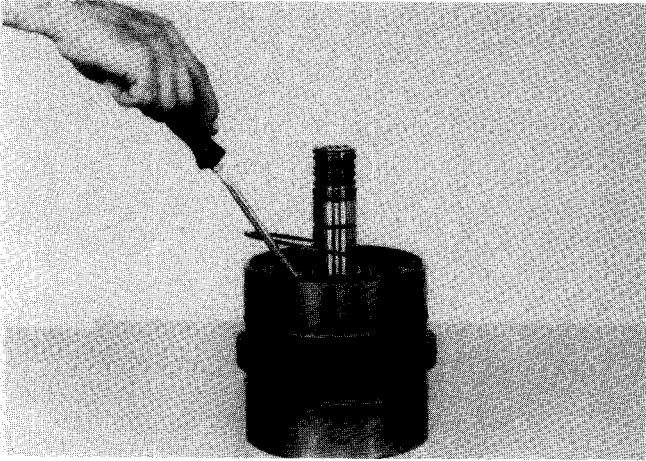


Figure 201

Install end plate retainer ring.

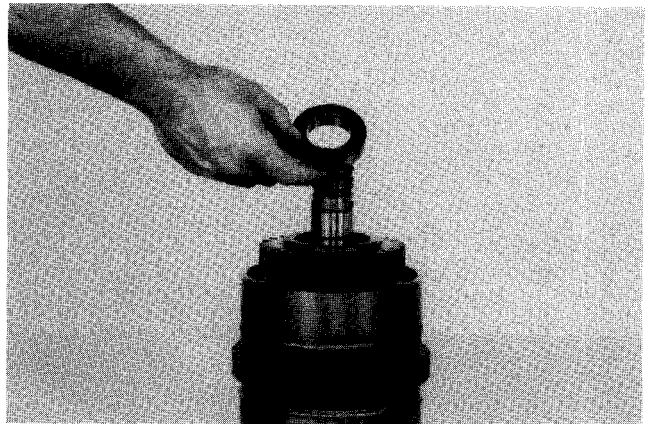


Figure 204

Install clutch gear outer bearing. **NOTE: Outer bearing has a shield in it, this shield must be down.**

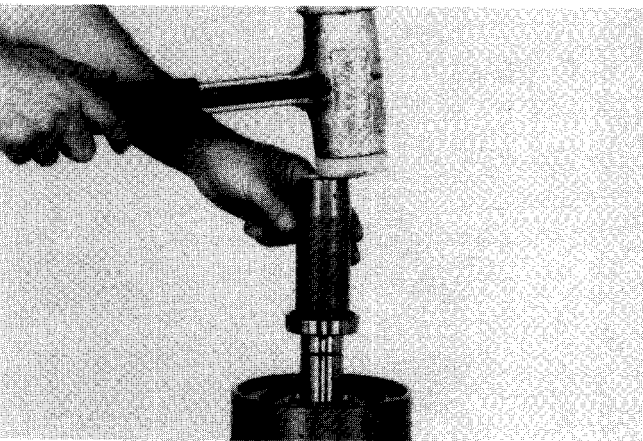


Figure 202

Install clutch gear inner bearing. **NOTE: This bearing does not have a shield in it.**

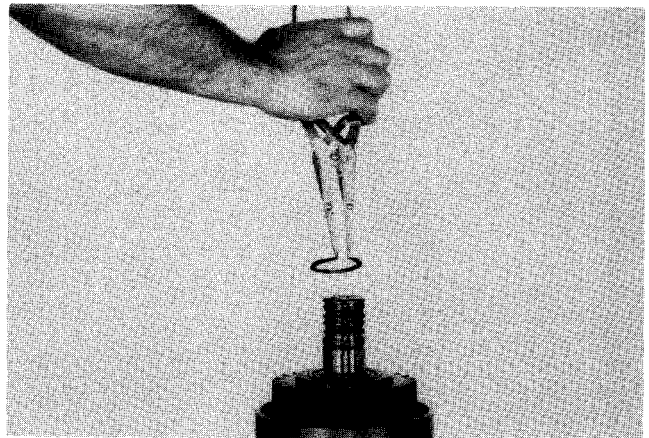


Figure 205

Install bearing retainer ring.

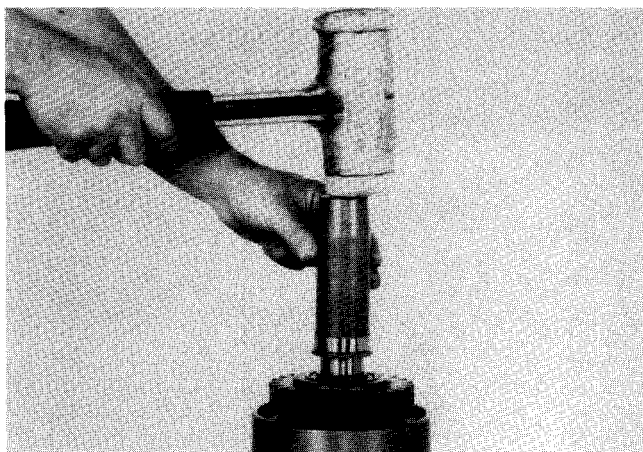


Figure 206

Install clutch shaft front bearing inner race with large diameter of race down.

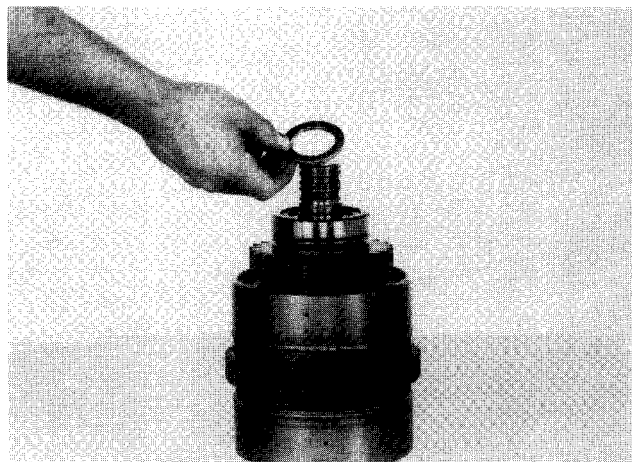


Figure 209

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

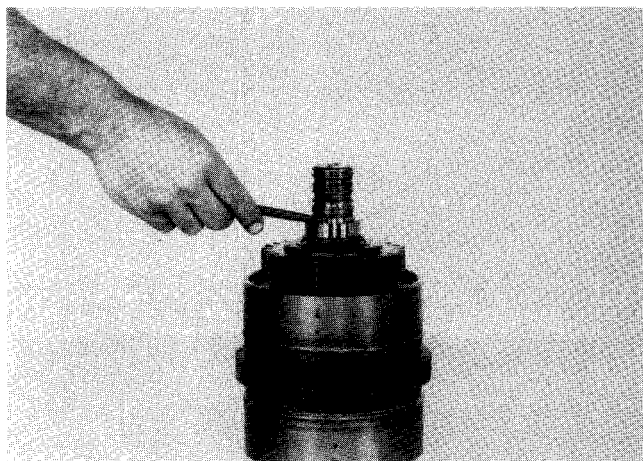


Figure 207

Position end plate lock ball in clutch shaft.

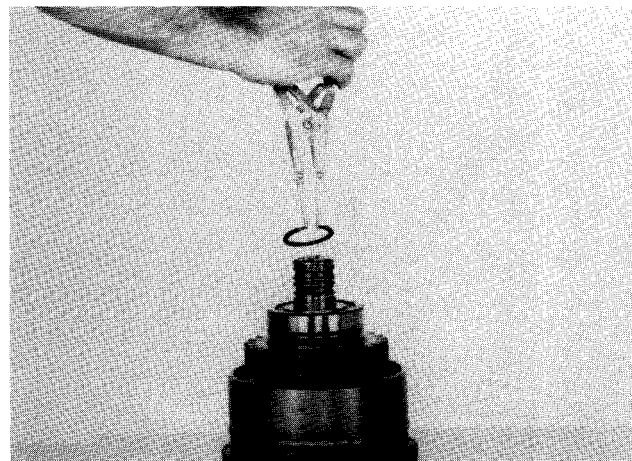


Figure 210

Install bearing retainer ring.

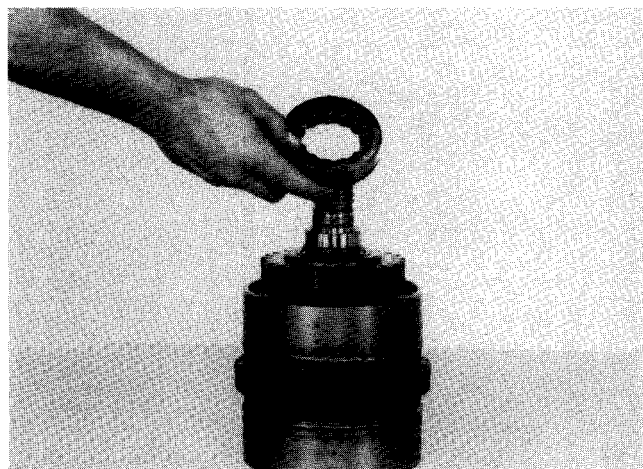


Figure 208

Position front bearing over bearing race.

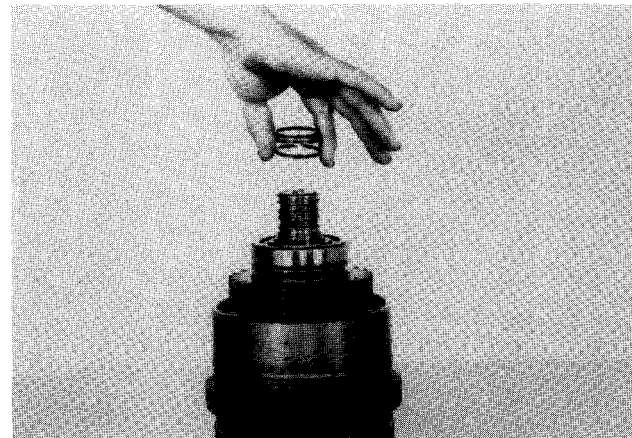


Figure 211

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

OIL SEALING RING SLEEVE REMOVAL

NOTE: The following photos are not of the HR Converter Housing but the sleeve removal procedure is identical.

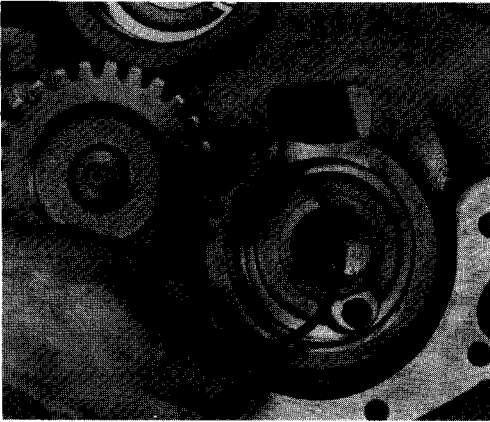


Figure 212

Remove clutch front bearing locating ring.

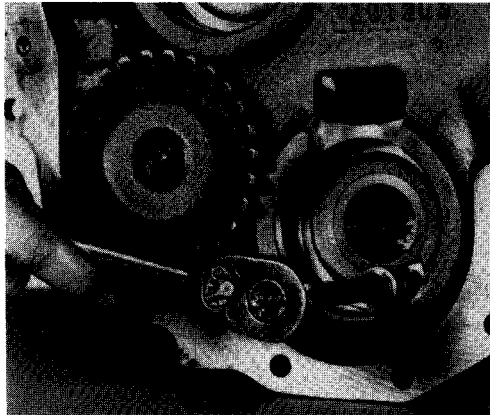


Figure 213

Remove oil sealing ring sleeve retainer screw.

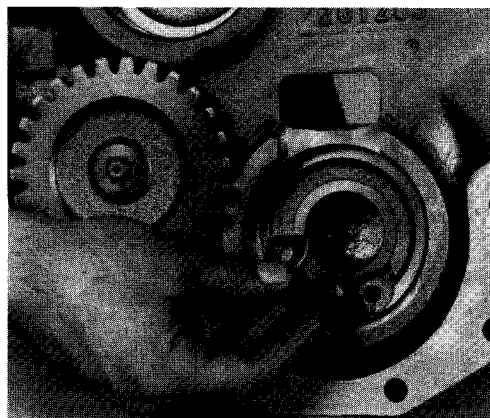


Figure 214

Remove screw and sleeve lock.

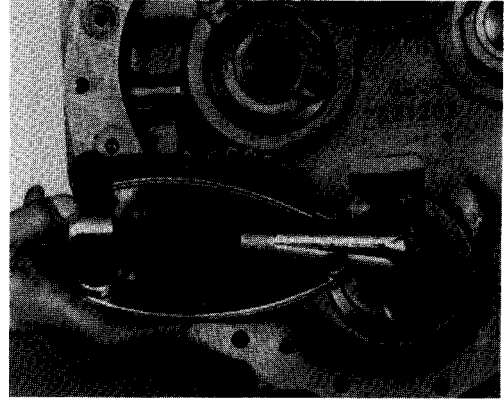


Figure 215

Use a sleeve puller like the one shown.

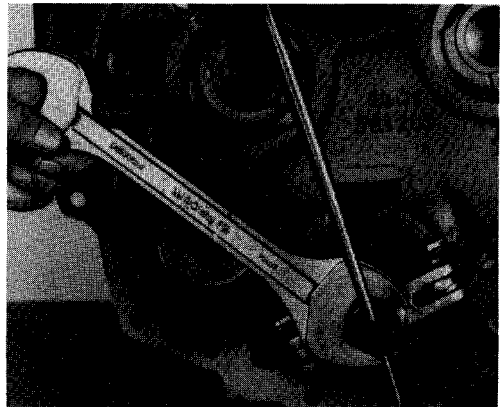


Figure 216

Sleeve being removed.

See cleaning and inspection page.

NOTE: When installing a new sleeve it is recommended a press or a driver be used to prevent damage to the sleeve and be sure the notch in the sleeve is aligned with sleeve lock notch. Install sleeve lock and capscrew. Tighten screw to specified torque. (See torque chart.)

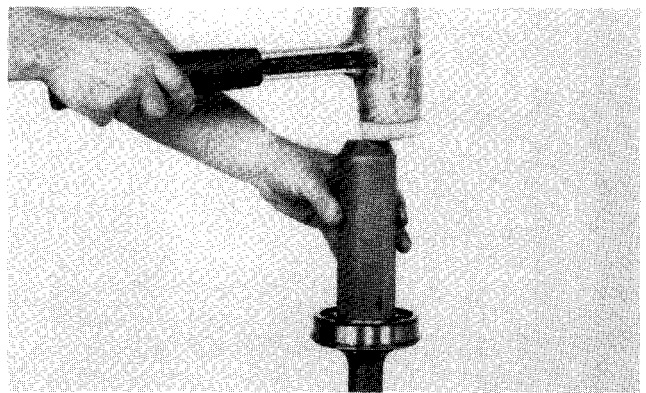


Figure 217

Position new oil sealing ring on turbine shaft. Install turbine shaft bearing on shaft with bearing outer locating ring down.

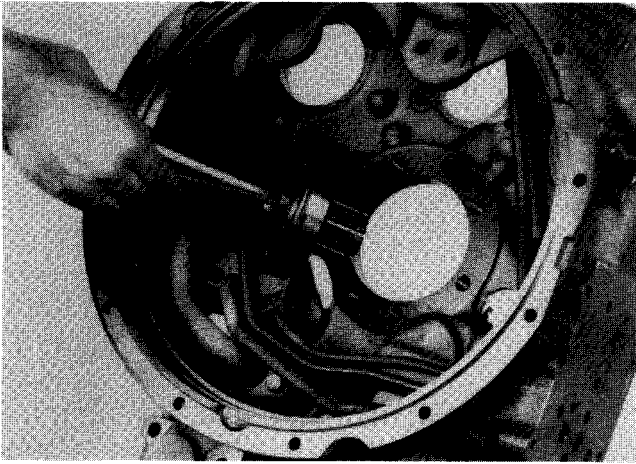


Figure 218
Install turbine shaft and bearing in converter housing.

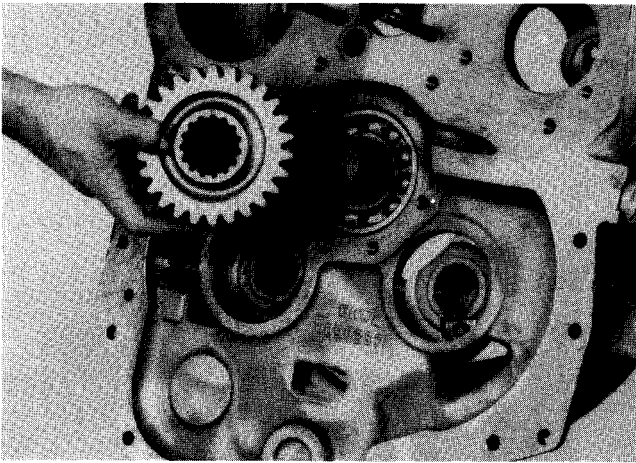


Figure 219
Install turbine shaft drive gear as shown in Figure 219-A.

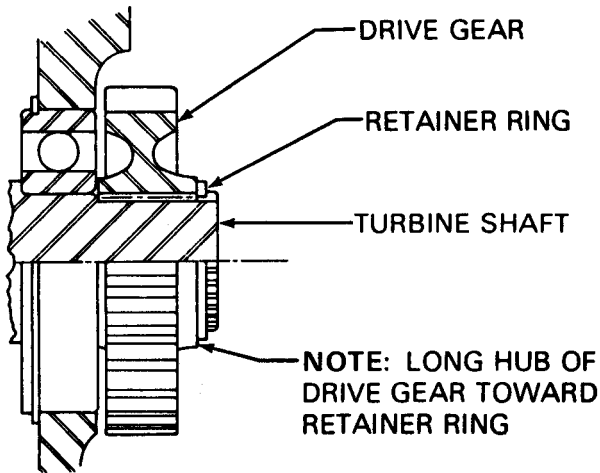


Figure 219-A

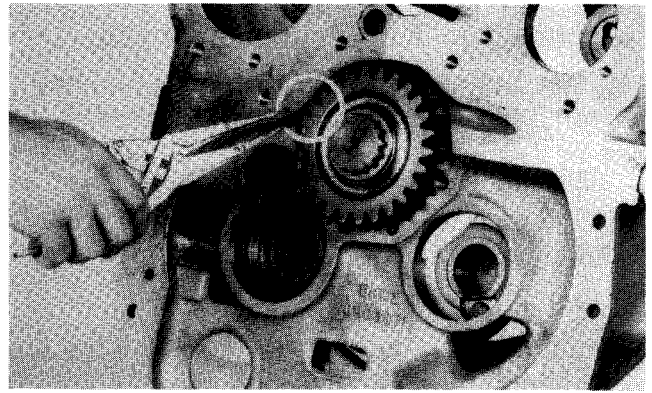


Figure 220
Install drive gear retainer ring.

TRANSMISSION REASSEMBLY

SEE 6 & 8 SPEED SECTION FOR RANGE SHIFT OUTPUT SHAFT INSTALLATION.

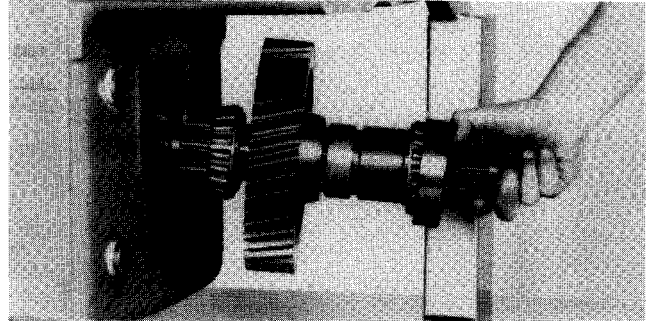


Figure 221
View of output shaft as it would be positioned in transmission case. **NOTE:** Front cone bearing shouldered on shaft with large diameter of bearing in, and long hub of gear toward gear spacer.

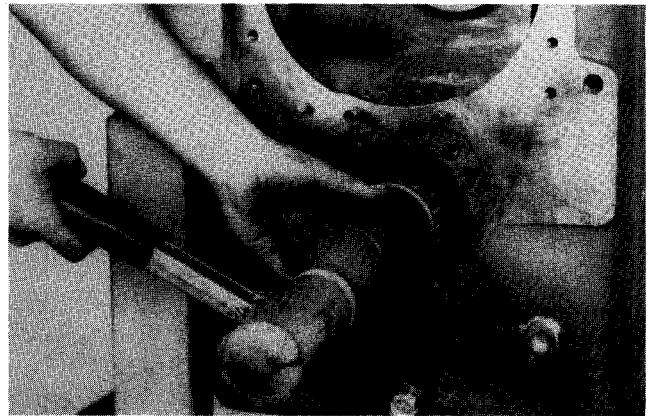


Figure 222
Position output gear in transmission case with protruding hub toward front of case. See Figure 221. Insert output shaft, gear spacer and taper bearing from front of case and through output gear. Install front taper bearing cup. Block output shaft and install rear taper bearing with large diameter in.

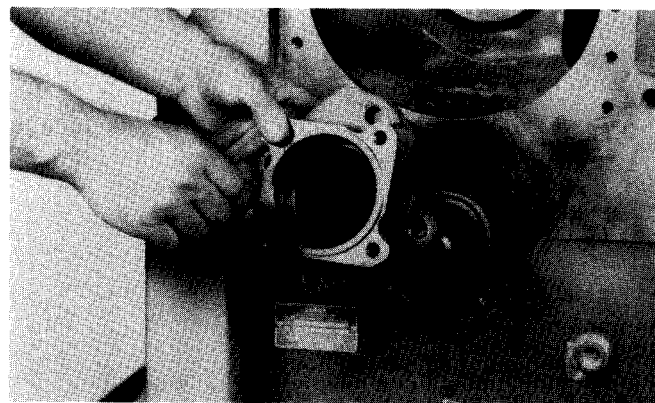


Figure 223

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.

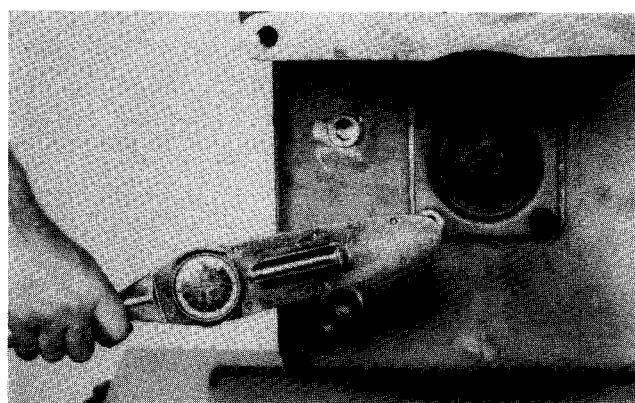


Figure 226

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.

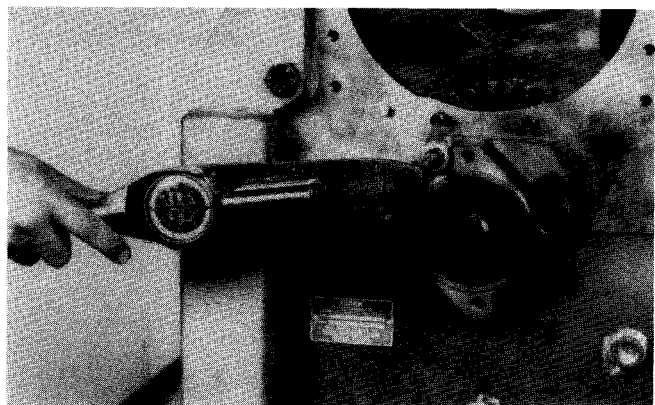


Figure 224

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

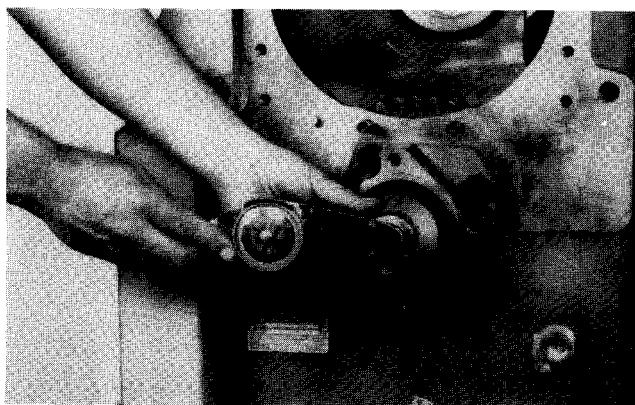


Figure 227

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.

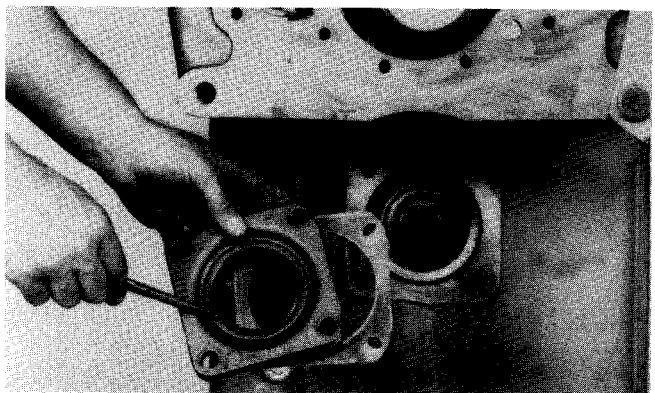


Figure 225

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

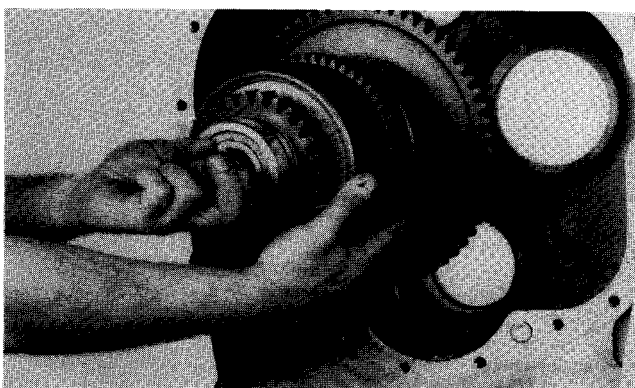


Figure 228

Position reverse and 3rd clutch in transmission housing.

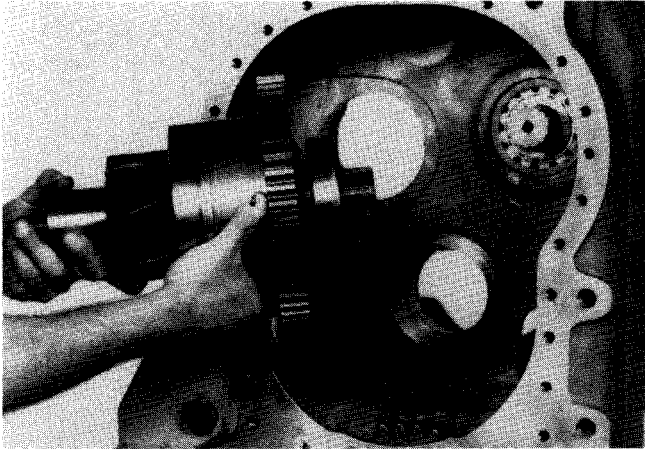


Figure 229

From the rear of the transmission case, install the low (1st) clutch.

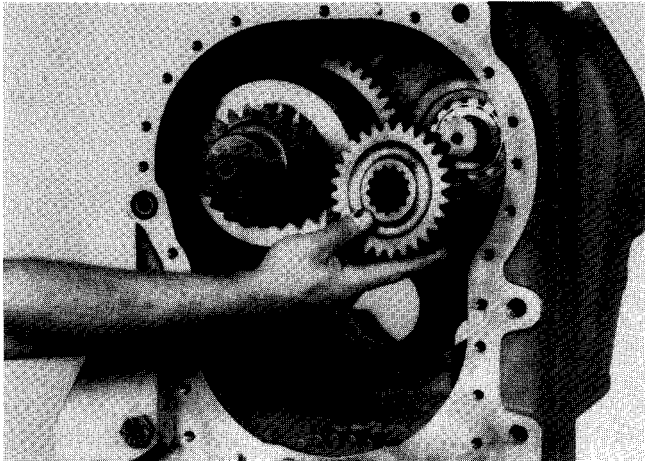


Figure 230

Install low (1st) speed drive gear on clutch shaft.

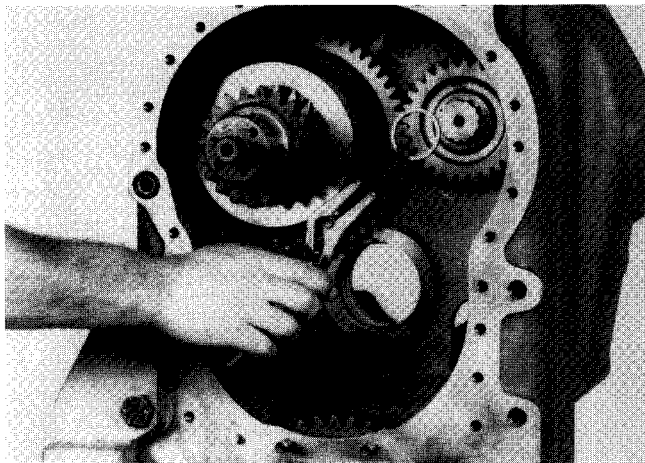


Figure 231

Install drive gear retainer ring.

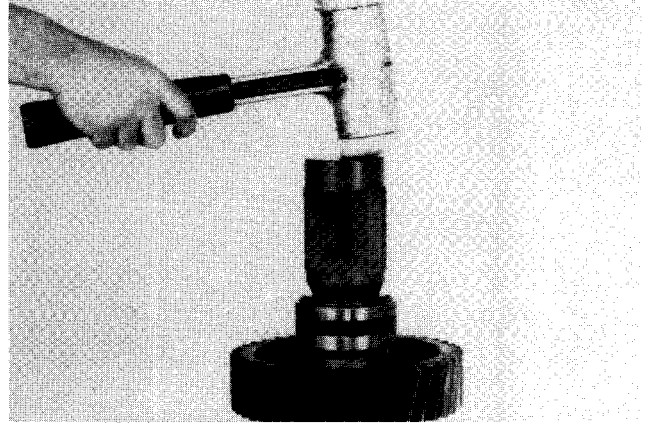


Figure 232

If idler shaft was disassembled, install front bearing. Install idler gear on shaft with long hub of gear up. (6 & 8 speed will have two gears on the idler shaft). Install rear inner taper bearing with large diameter of taper down. Install bearing spacer and double bearing cup with outer diameter locating ring groove up. Install outer taper bearing with large diameter of taper up. **NOTE: Double taper bearing must be replaced as an assembly as the bearing spacer is pre-selected at factory.**

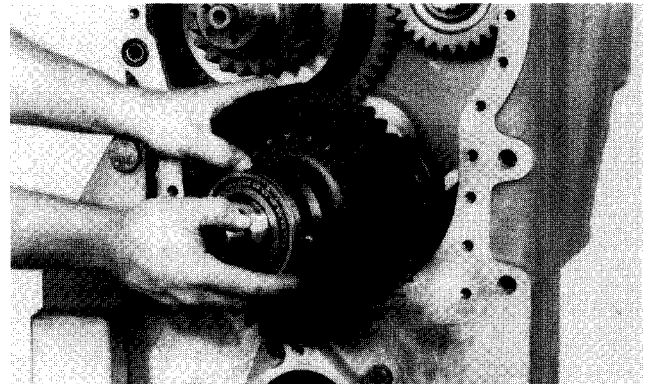


Figure 233

Install idler shaft assembly. **NOTE: Lock ball in bearing cup.**

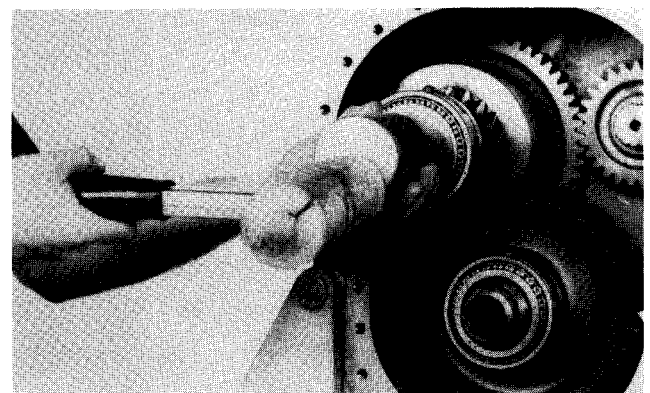


Figure 234

Install low (1st) clutch outer double taper bearing. **NOTE: Locating ring groove in bearing cup to be out (to the rear).**

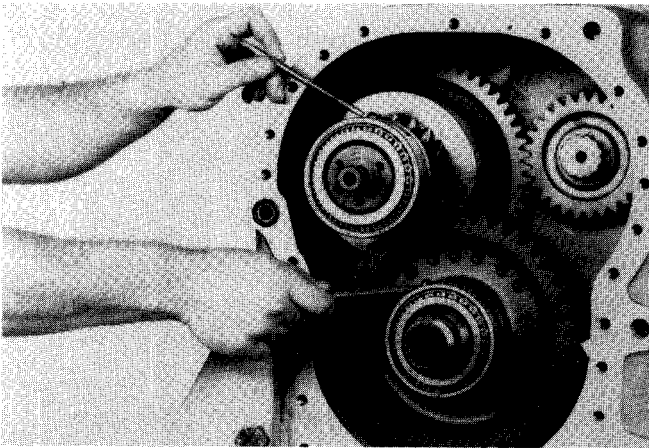


Figure 235

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

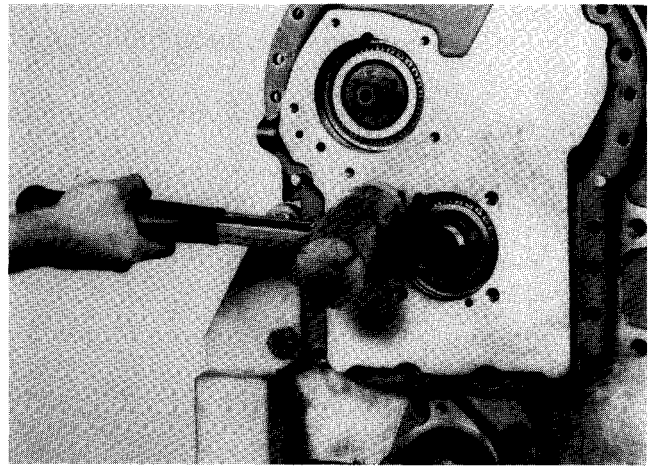


Figure 238

Tap cover in place.

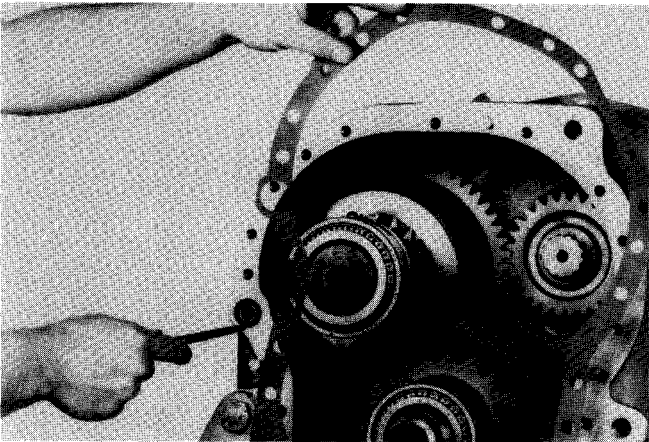


Figure 236

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

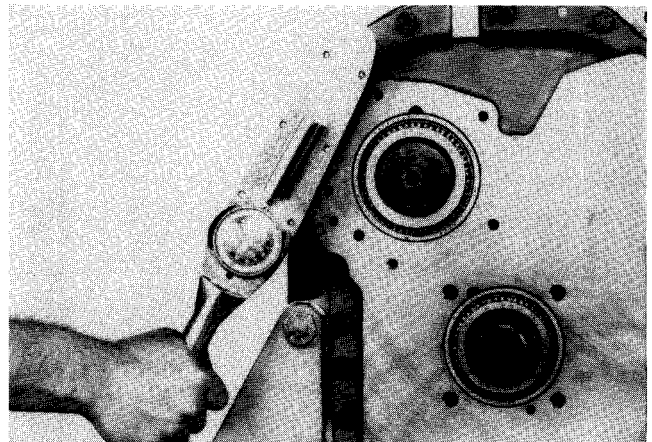


Figure 239

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

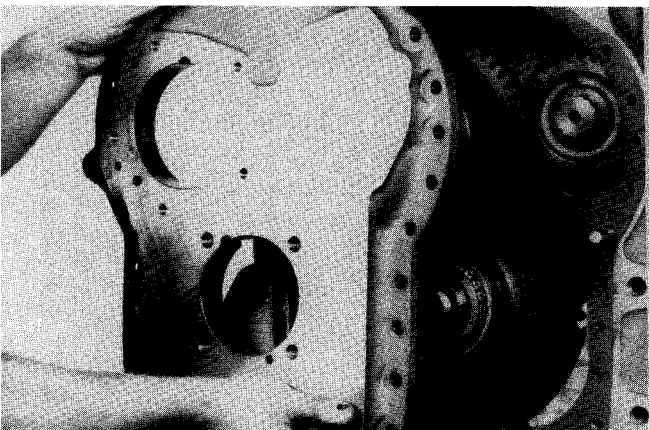


Figure 237

Align lock balls in bearing with notches in rear cover.

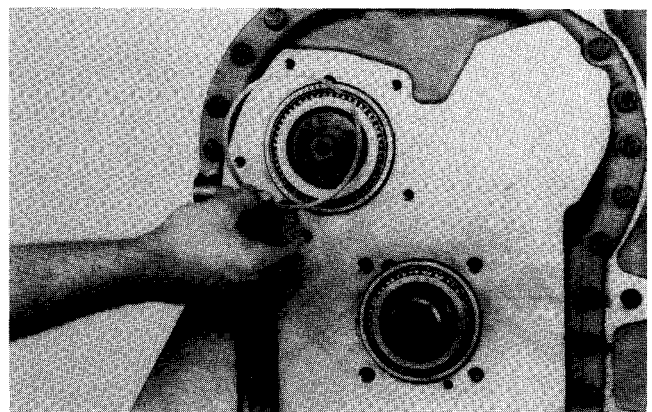


Figure 240

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

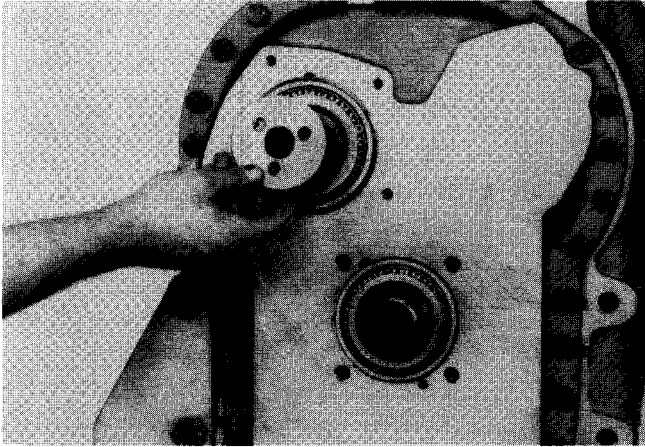


Figure 241

Install low (1st) clutch rear bearing retainer plate. **NOTE:** Inner diameter hole chamfer to go toward bearing.

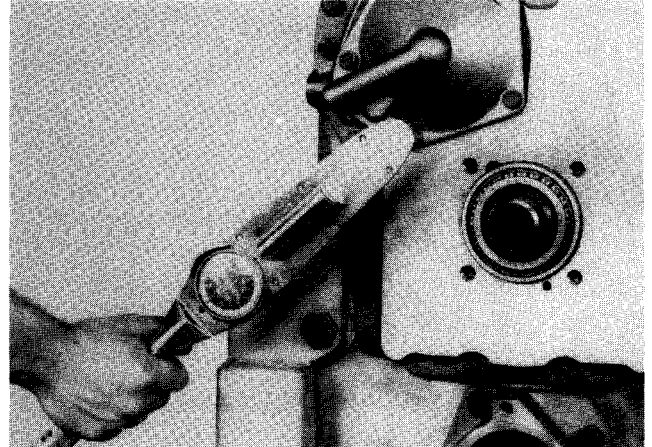


Figure 244

Position bearing cap over bearing and install bearing cap bolts. Tighten to specified torque. (See torque chart).

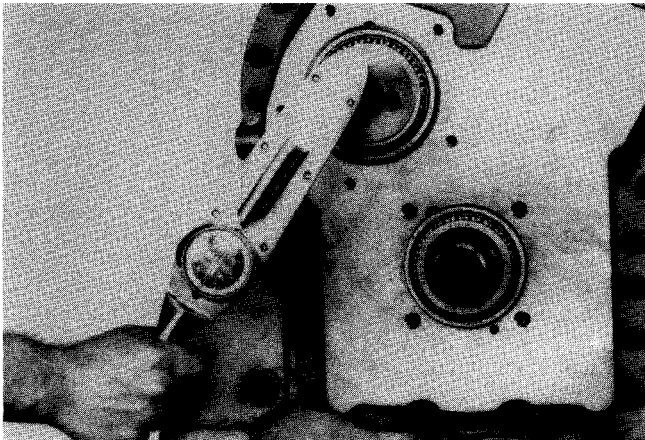


Figure 242

Install retainer plate bolts and tighten to specified torque (see torque chart). Lock wire bolts together to prevent loosening.

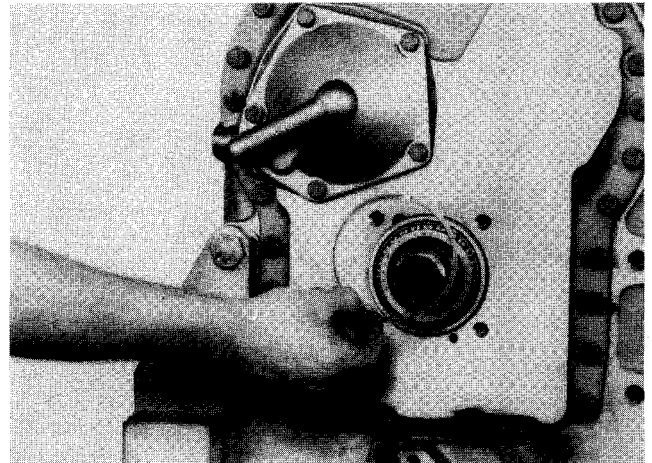


Figure 245

Install idler shaft rear bearing locating ring.

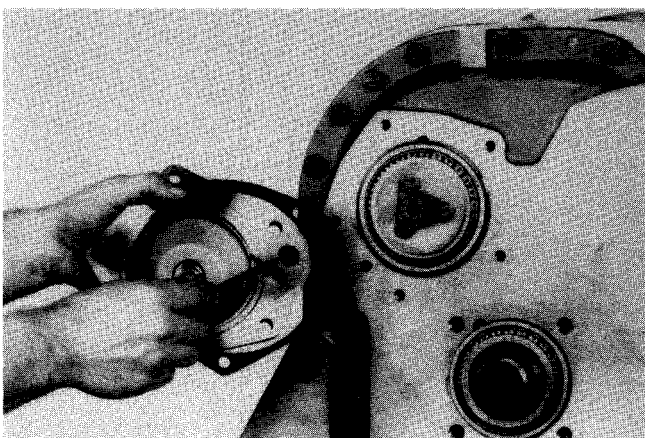


Figure 243

Install new "O" ring and gasket on low (1st) clutch shaft rear bearing cap.

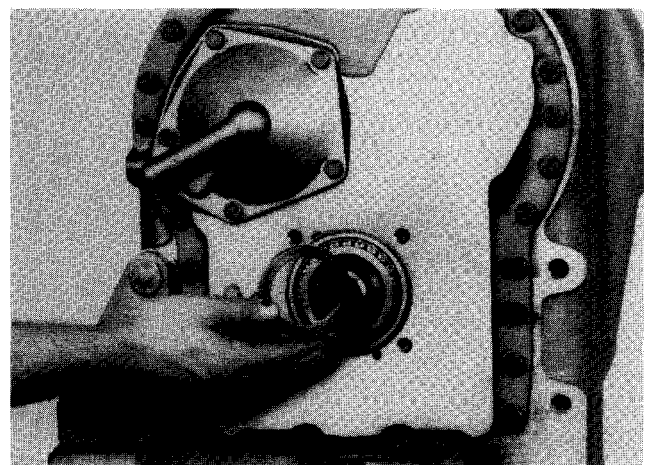


Figure 246

Install idler shaft rear bearing spacer.

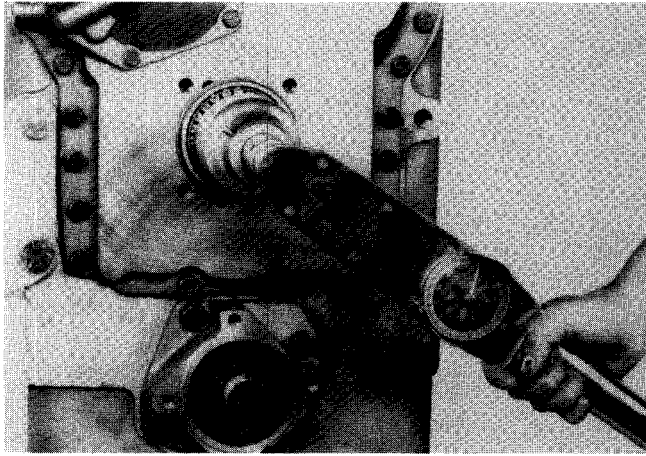


Figure 247

Install idler shaft rear bearing retainer nut. Tighten to specified torque. (See elastic stop nut torque chart).

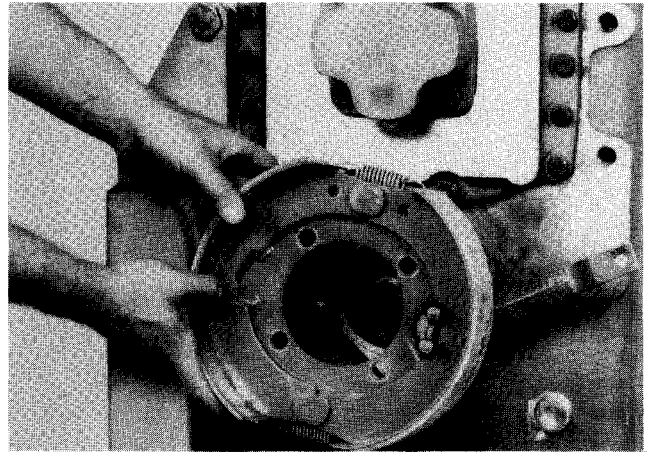


Figure 250

Install brake backing plate and brake band assembly on output bearing cap.

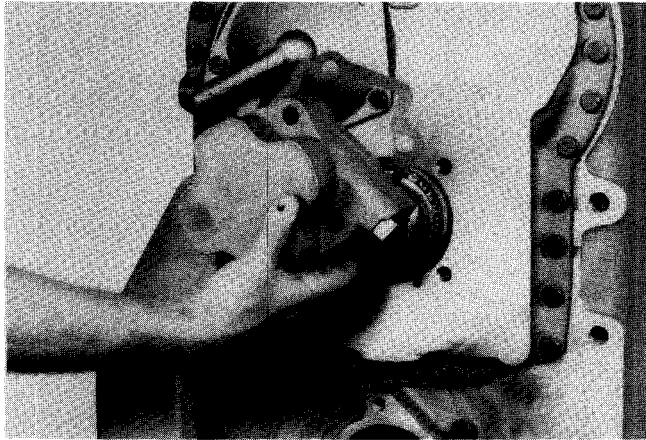


Figure 248

Position a new gasket on the idler shaft rear bearing cap, install bearing cap.

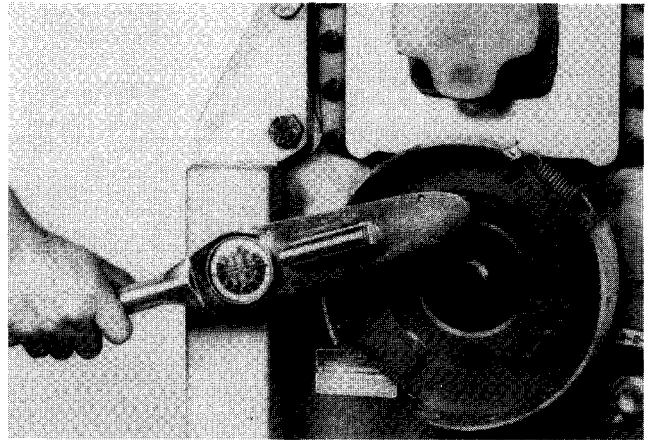


Figure 251

Install backing plate capscrews and tighten to specified torque. (See torque chart).

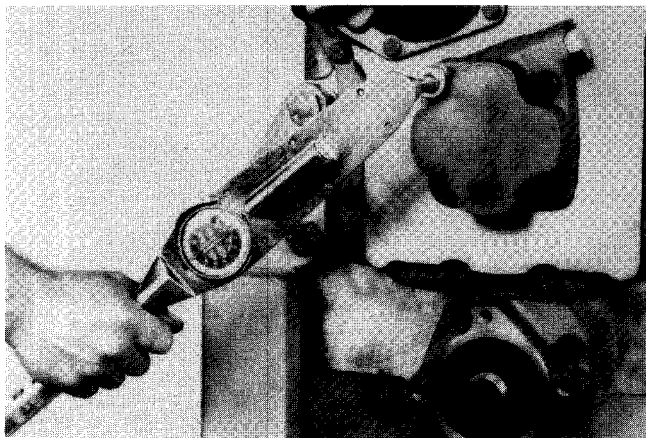


Figure 249

Install capscrews and tighten to specified torque. (See torque chart).

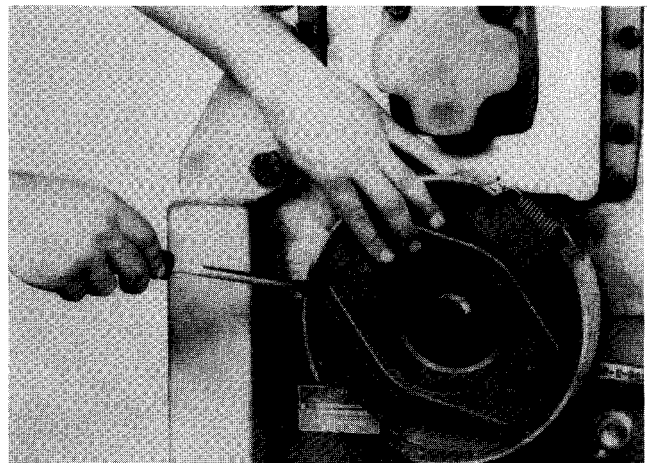


Figure 252

Install brake strut to brake bands.

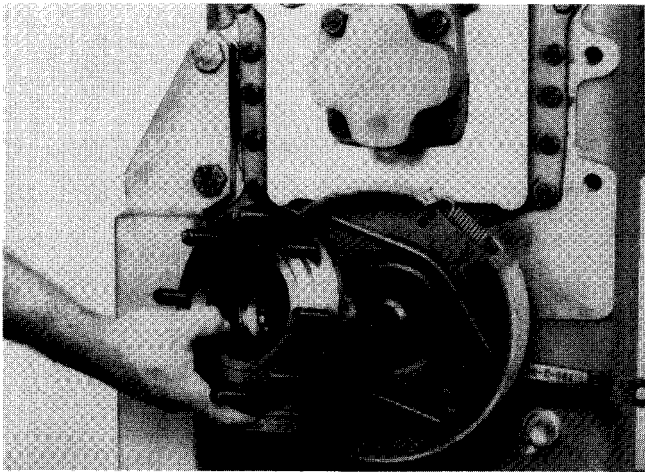


Figure 253

Install rear output flange.

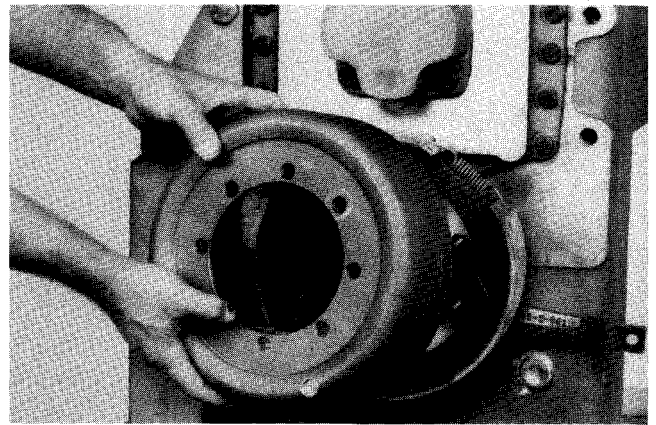


Figure 256

Position brake drum on output flange studs. Install stud nut washers and stud nuts. Tighten stud nuts enough to hold drum in place until drive shaft is installed.

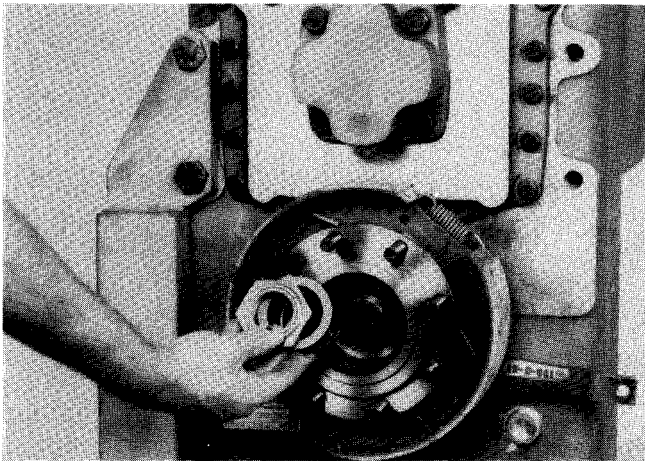


Figure 254

Install flange "O" ring, washer and lock nut.

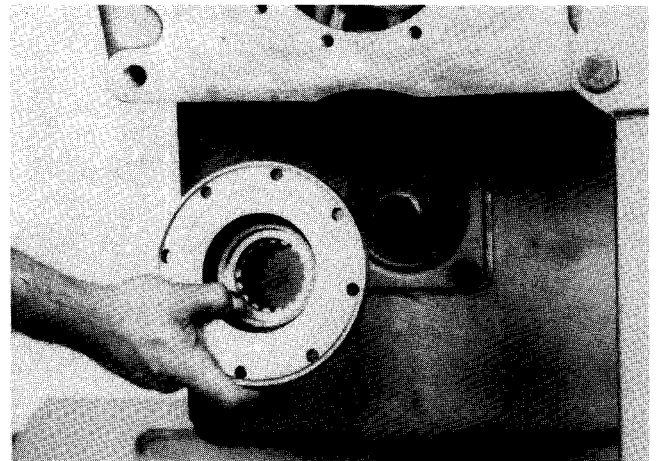


Figure 257

Install front output flange.

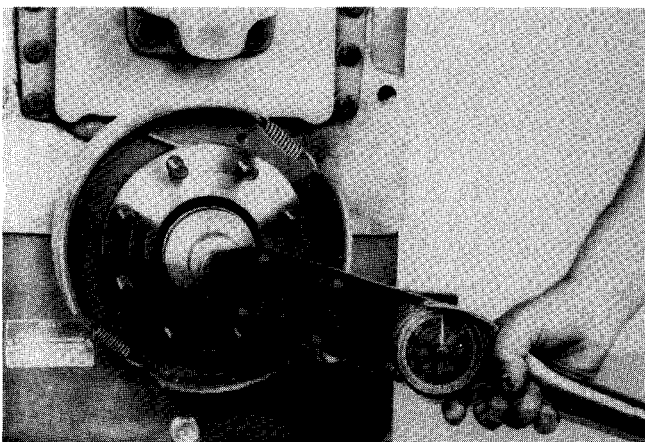


Figure 255

Tighten lock nut to specified torque. (See elastic stop nut torque chart).

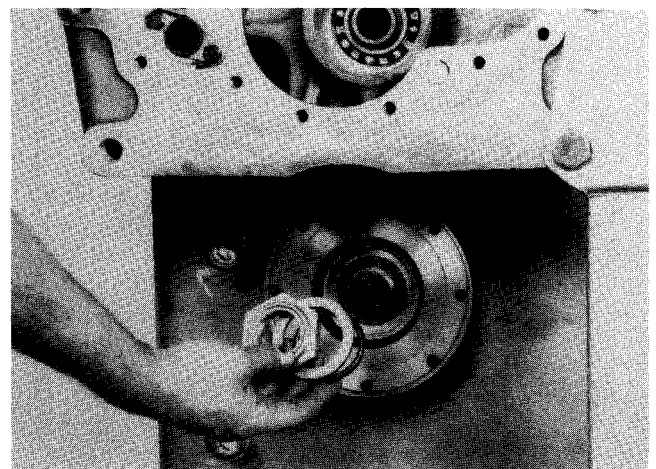


Figure 258

Install new output flange "O" ring, washer and flange nut.

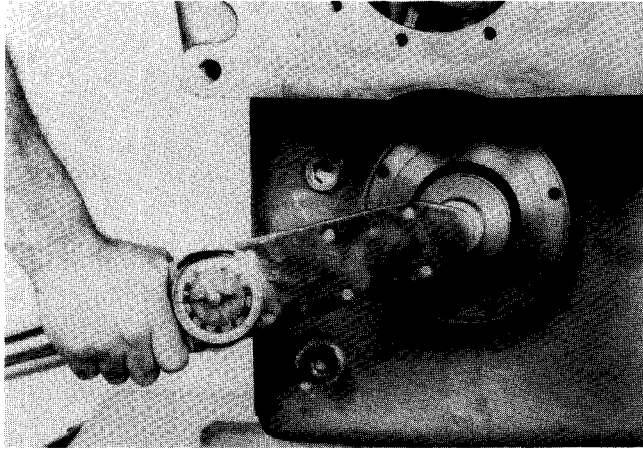


Figure 259

Tighten flange nut to proper specifications. (See elastic stop nut torque chart).

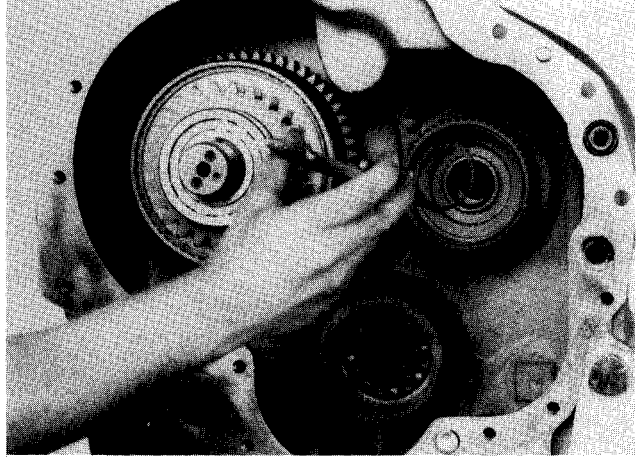


Figure 262

Install disc hub retainer ring.

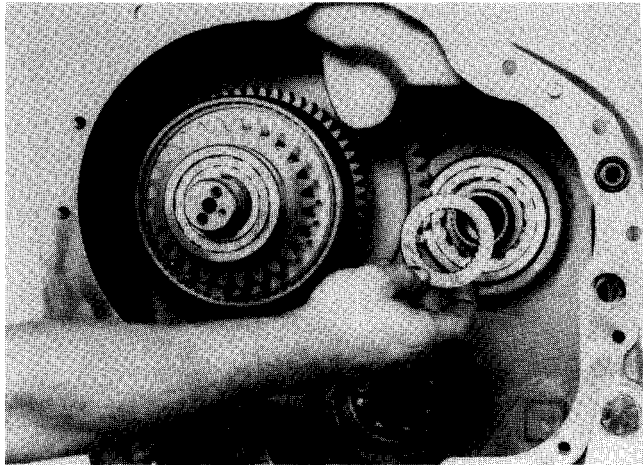


Figure 260

Position 2nd clutch bearing end plate on low (1st) clutch shaft.

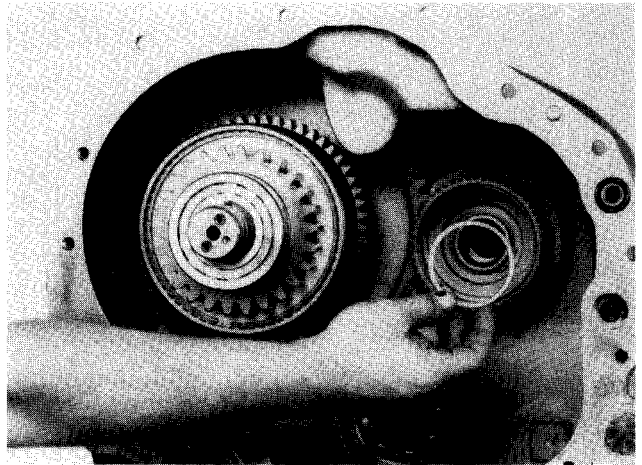


Figure 263

Install disc hub retainer ring retainer.

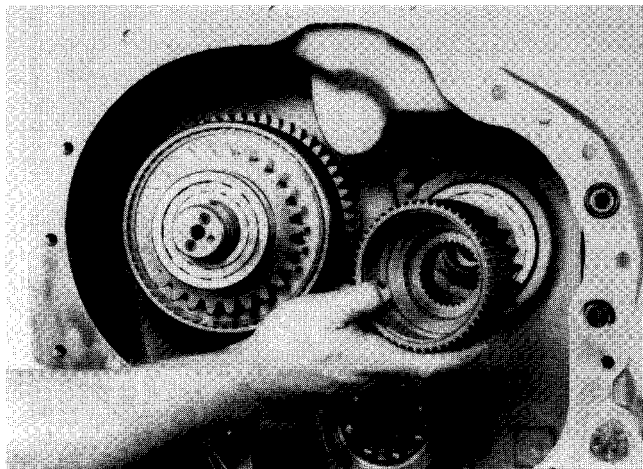


Figure 261

Position 2nd clutch disc hub on clutch shaft.

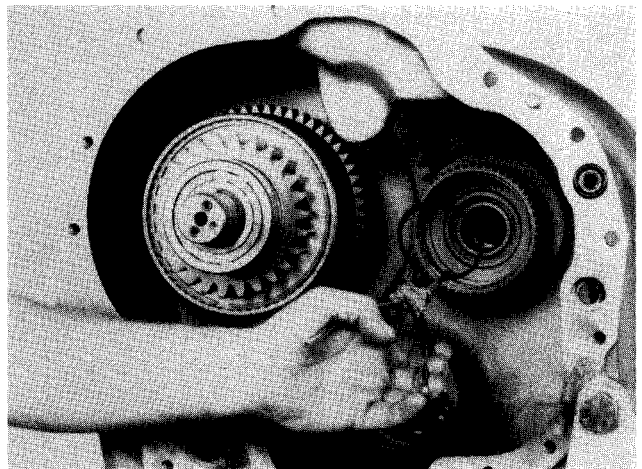


Figure 264

Install disc hub ring retainer retaining ring.

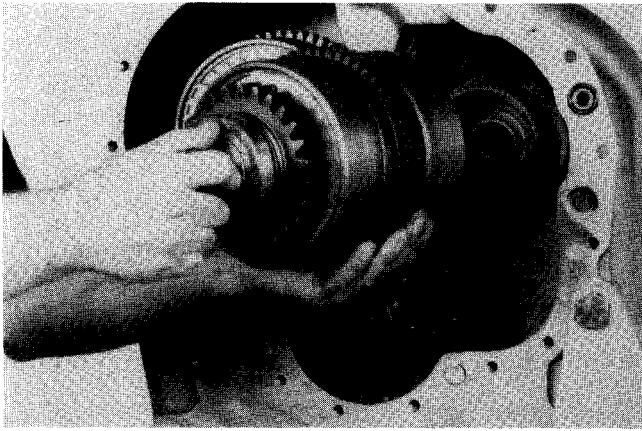


Figure 265

Position 2nd speed clutch shaft pilot bearing on clutch shaft. A light coat of grease will hold bearing in place. Install forward and 2nd clutch in clutch disc hub being certain clutch disc hub is in full position in clutch discs. **See 8 speed section for 4th speed clutch installation.**

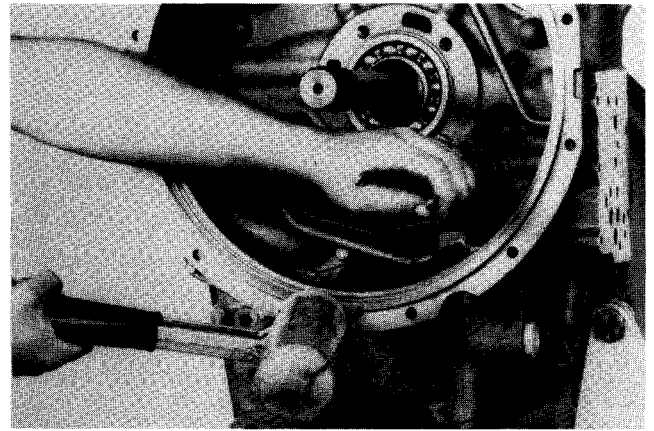


Figure 268

Spread forward clutch front bearing locating ring. Position converter housing to transmission housing. Tap housing into place using caution as not to damage clutch shaft oil sealing rings. **Do not force this operation.**

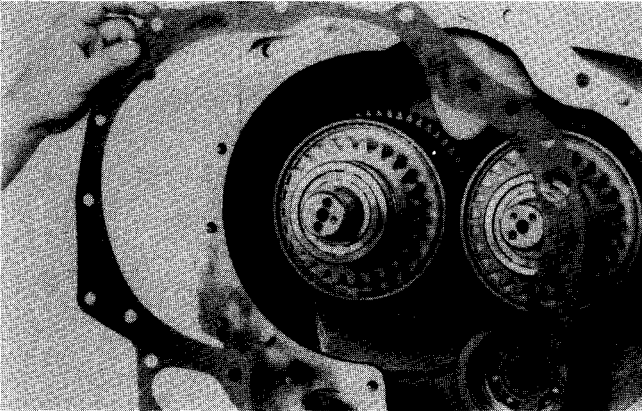


Figure 266

Position new gasket and "O" rings on housing. A light coat of grease will hold gasket and "O" rings in place.

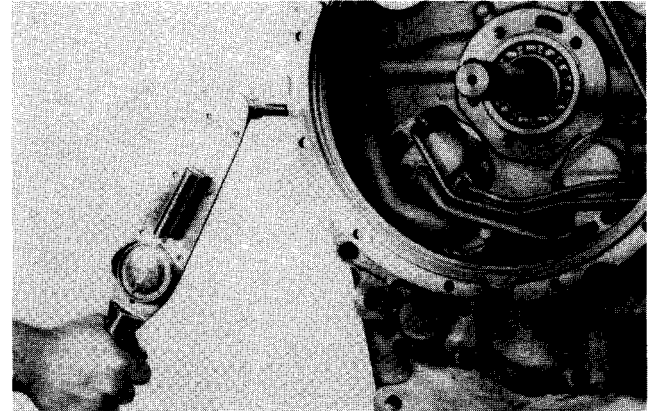


Figure 269

Install bolts and washers, tighten to specified torque (see torque chart).

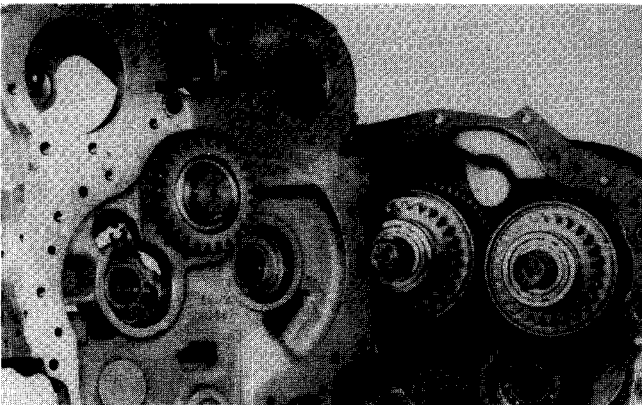


Figure 267

Install alignment studs in transmission housing to facilitate converter housing to transmission housing assembly.

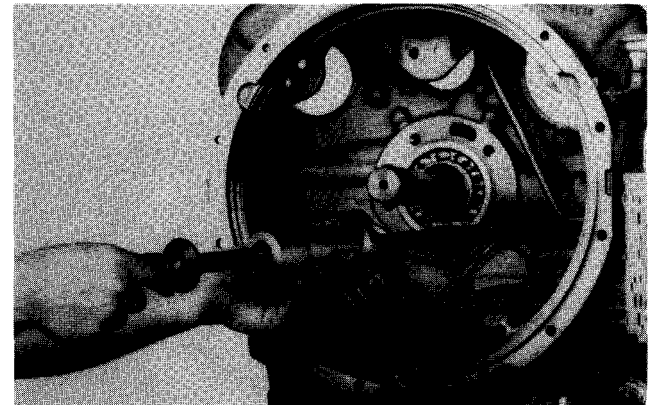


Figure 270

Using a hammer puller as shown, pull forward clutch until front bearing locating ring is in full position in ring groove.

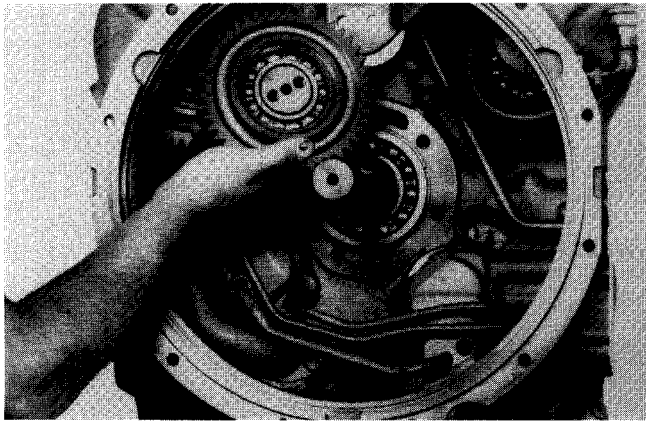


Figure 271

Install pump drive gears.

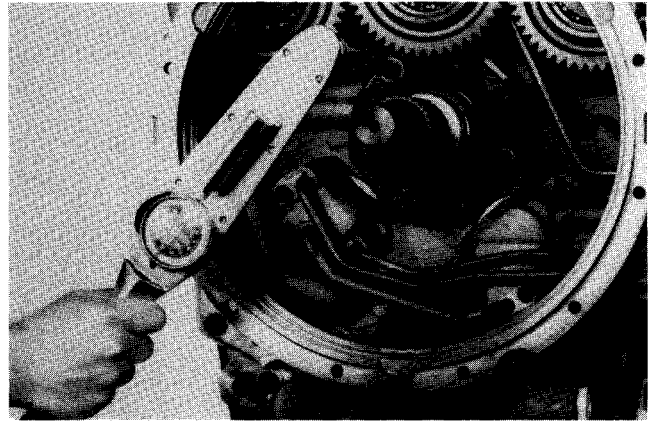


Figure 274

Install support bolts and tighten to specified torque. (See torque chart).

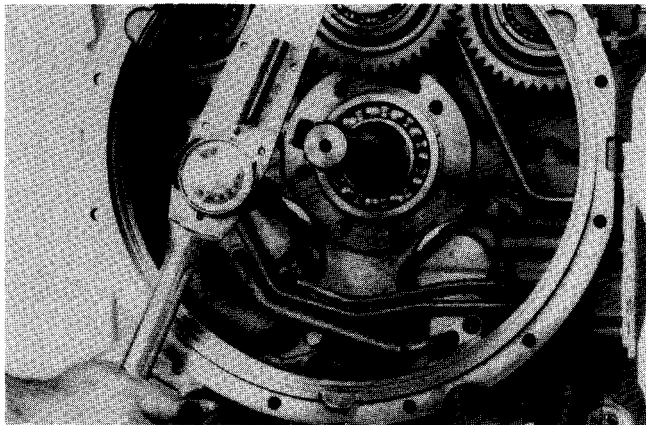


Figure 272

Tighten pump drive gear support bolts to specified torque. (See torque chart).

DISASSEMBLY AND REASSEMBLY OF IMPELLER AND BAFFLE

DISASSEMBLY

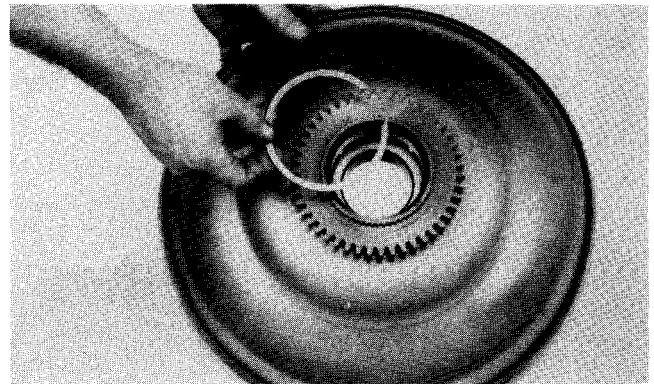


Figure 275

Remove pump drive gear retainer ring.

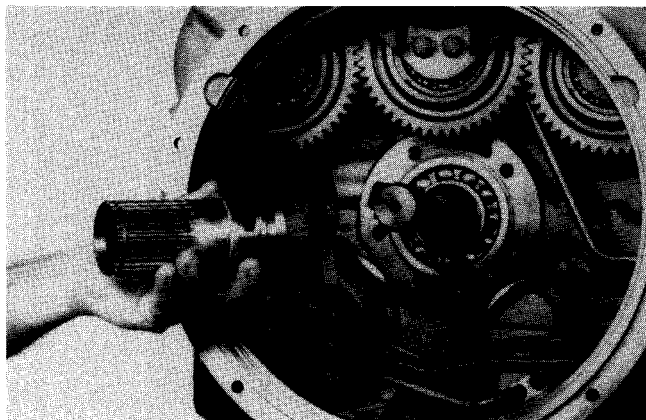


Figure 273

Install new sealing ring expander spring and oil sealing ring on support. **NOTE:** Expander spring gap to be 180° from sealing ring hook joint. Position support on turbine shaft, turn support to clear pump drive gear. Align support holes with converter housing.

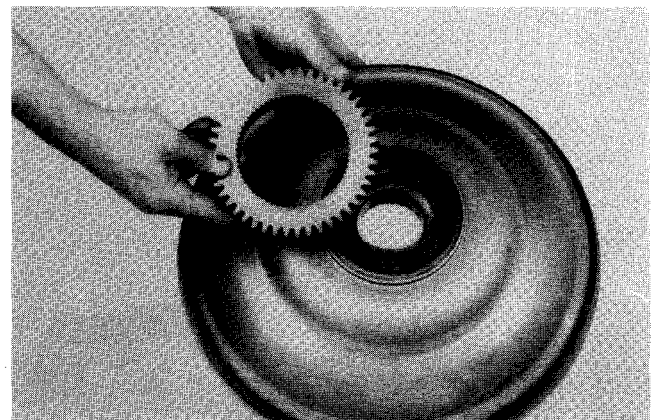


Figure 276

Remove pump drive gear.

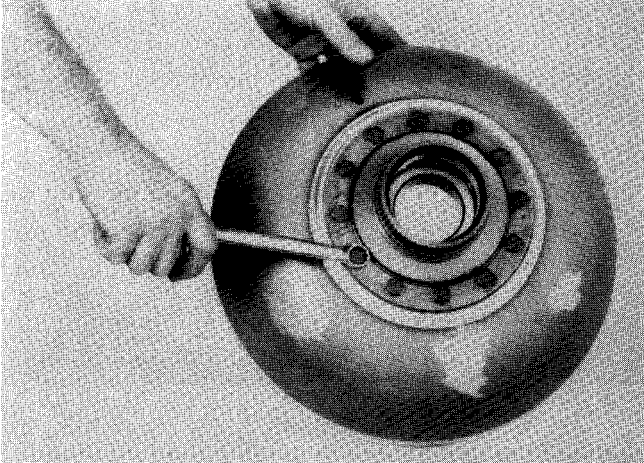


Figure 277
Remove impeller hub bolts.

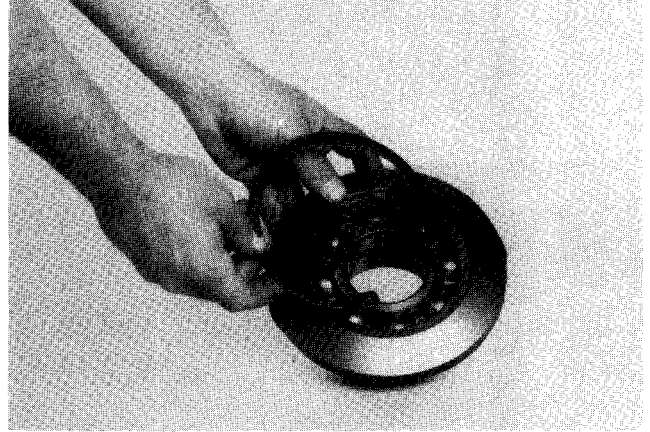


Figure 280
Remove hub bearing retainer ring.

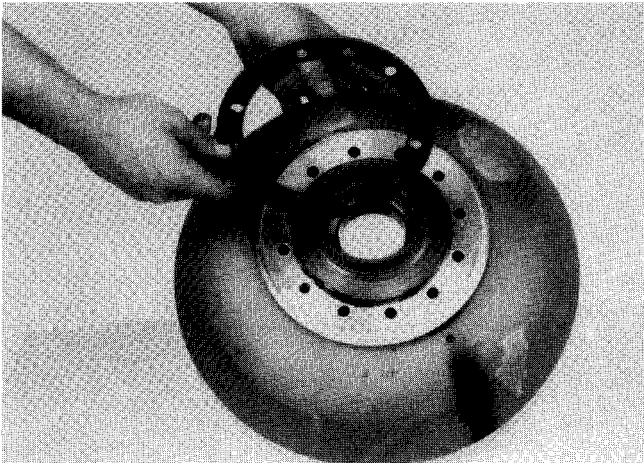


Figure 278
Remove backing ring.

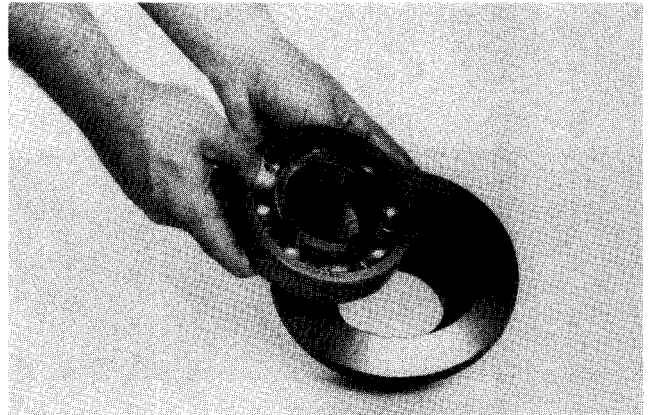


Figure 281
Remove hub bearing.

See cleaning and inspection page.

REASSEMBLY

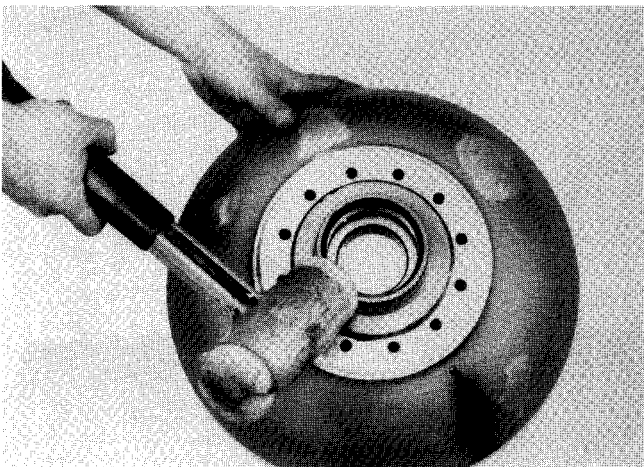


Figure 279
Tap impeller hub from impeller.

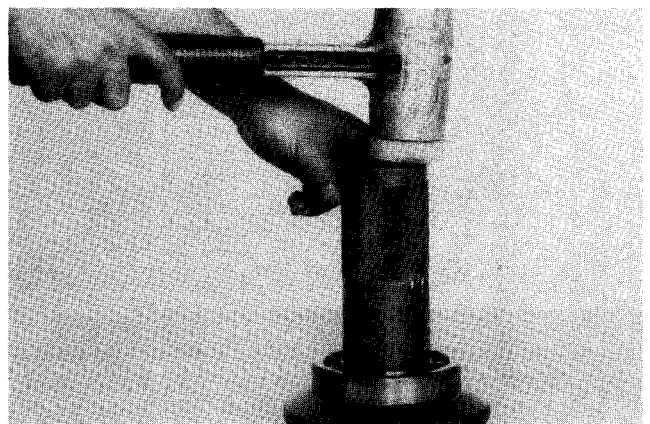


Figure 282
Install impeller hub bearing in hub.

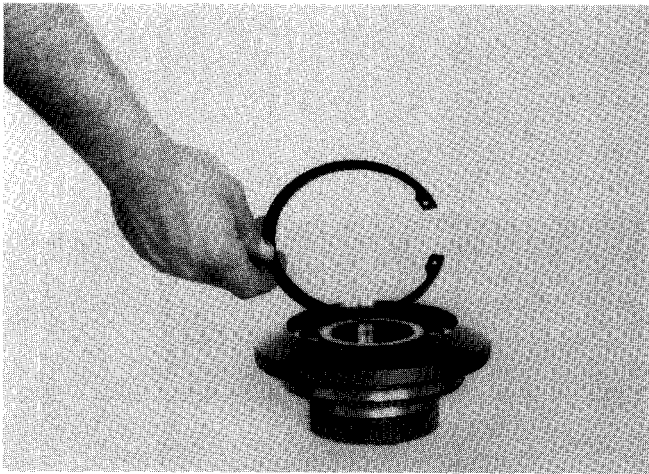


Figure 283

Install bearing retainer ring.

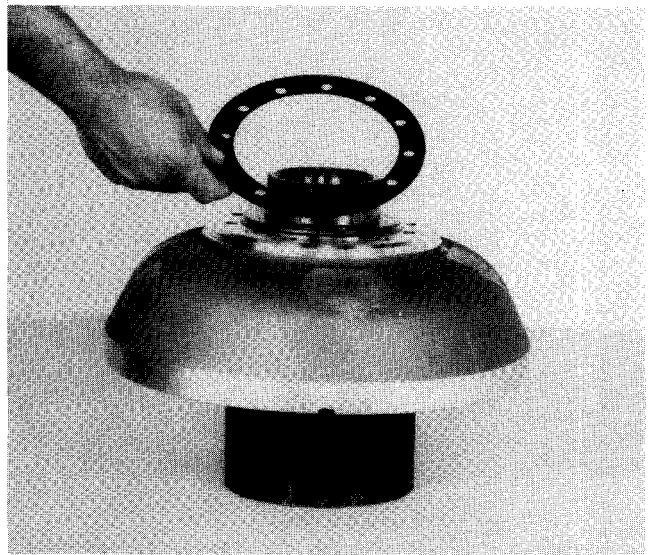


Figure 286

Position backing ring on impeller.

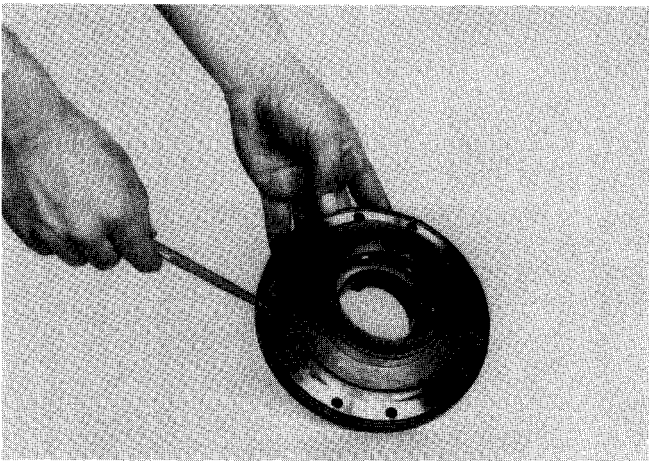


Figure 284

Position new "O" ring on impeller hub.

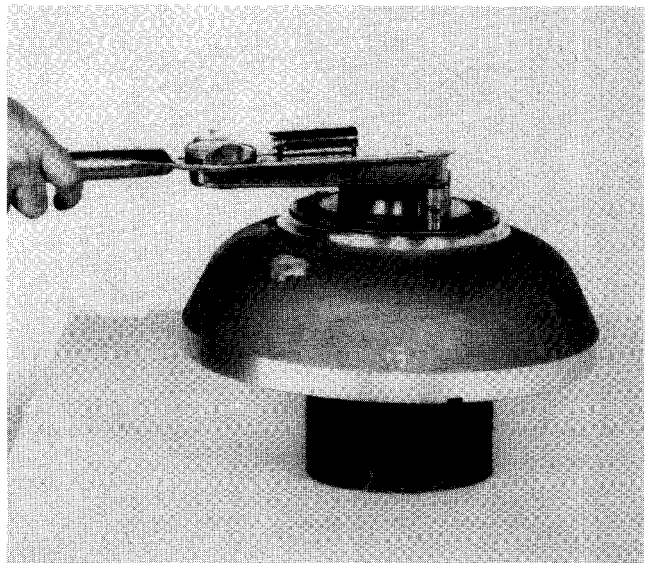


Figure 287

Install (12) impeller hub special screws to approximately .06 inch [1,5] of seated position. With a calibrated torque wrench, tighten screws to 40-45 lbs. ft. [54,3-61,0 N.m.] torque. **NOTE:** Assembly of impeller to impeller hub must be completed within a fifteen minute period from start of screw installation. The screws are prepared with a coating which begins to harden after installation in the impeller hub holes. If not tightened to proper torque within the fifteen minute period, insufficient screw clamping tension will result. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced.

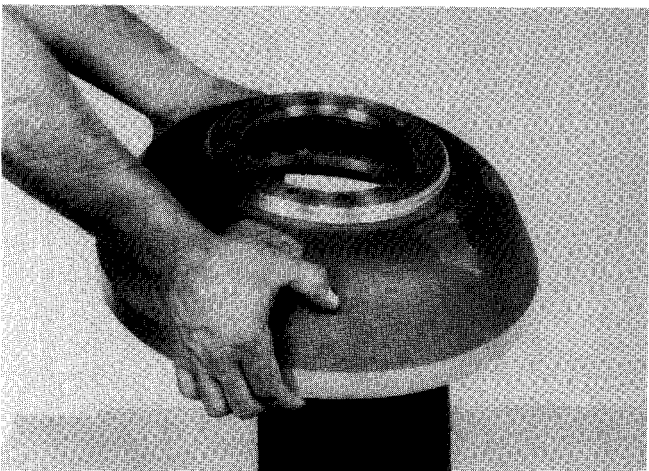


Figure 285

Align holes in impeller with holes in impeller hub.

The compound left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.

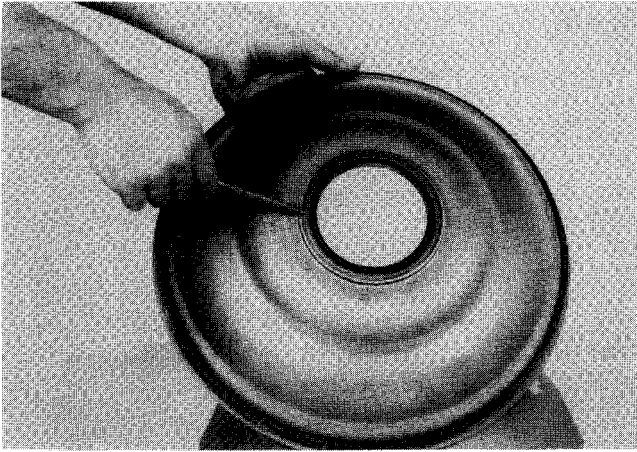


Figure 288

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.

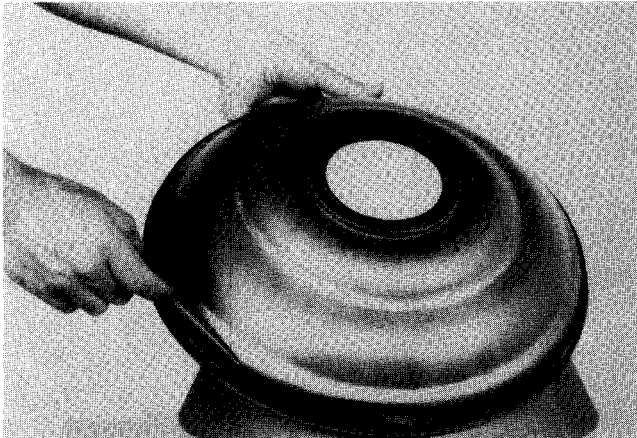


Figure 289

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

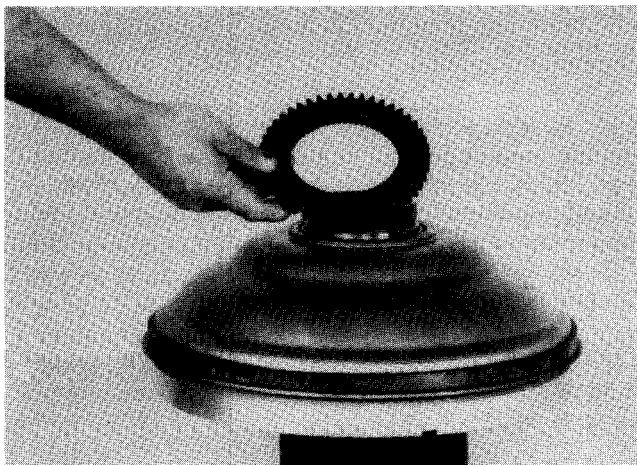


Figure 290

Install pump drive gear on impeller hub.



Figure 291

Install pump drive gear retainer ring.

DISASSEMBLY AND REASSEMBLY OF TURBINE AND IMPELLER COVER

DISASSEMBLY

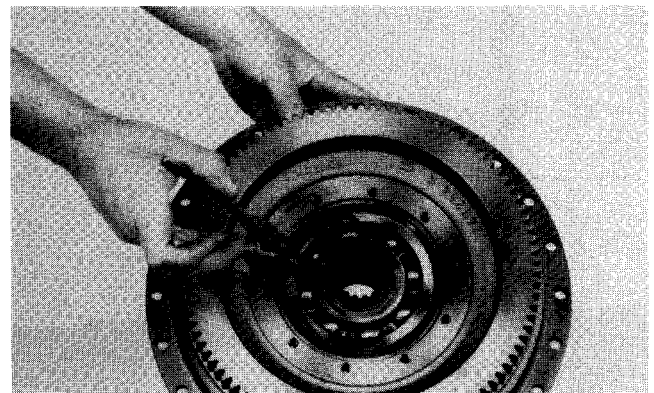


Figure 292

Remove turbine hub to impeller cover bearing retainer ring.

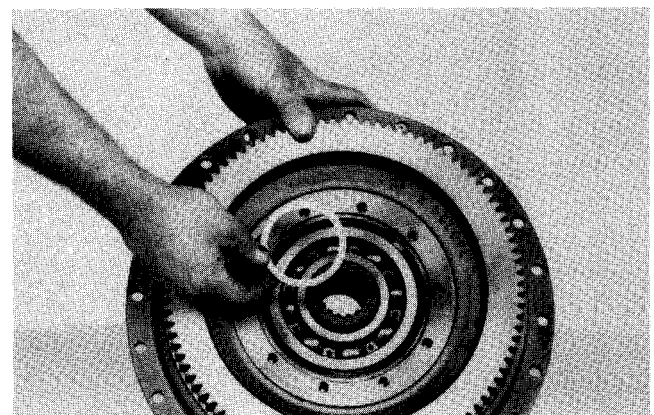


Figure 293

Remove retainer ring to bearing washer.

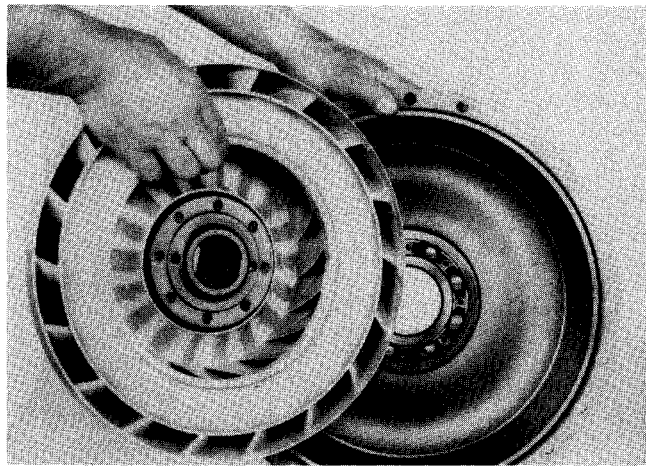


Figure 294

Separate turbine from impeller cover.

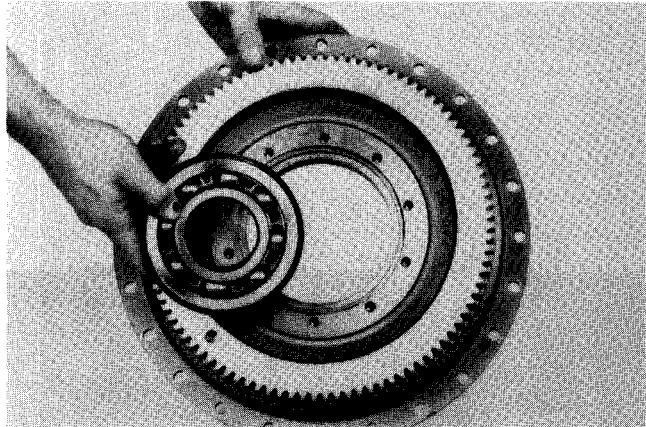


Figure 295

Remove impeller cover bearing.

See cleaning and inspection page.

REASSEMBLY

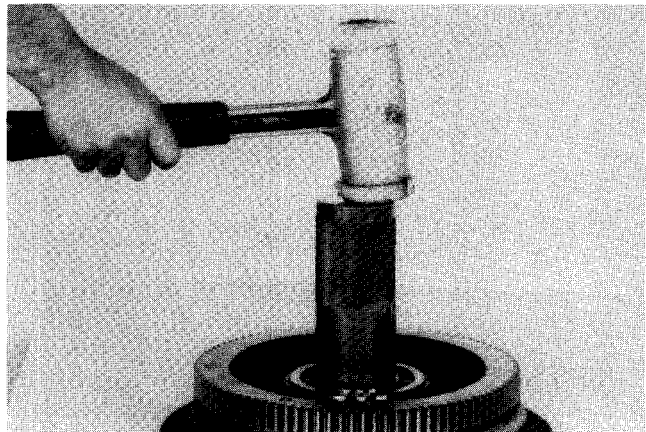


Figure 296

Install impeller cover bearing.

If turbine and hub was disassembled, use the following instructions for reassembly.

1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry and clean.
2. Install backing ring and special self locking screws.

Tighten screws 40 to 45 lbs. ft. [54,3-61,0 N.m.]. **NOTE:** Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.

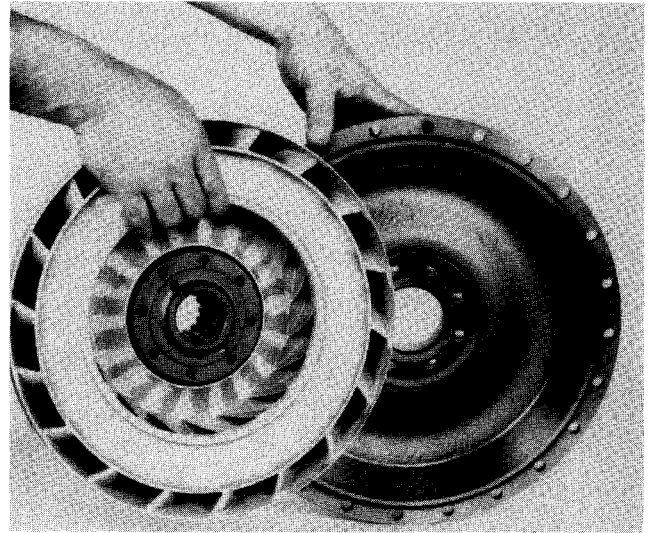


Figure 297

Position turbine and hub assembly in impeller cover assembly.

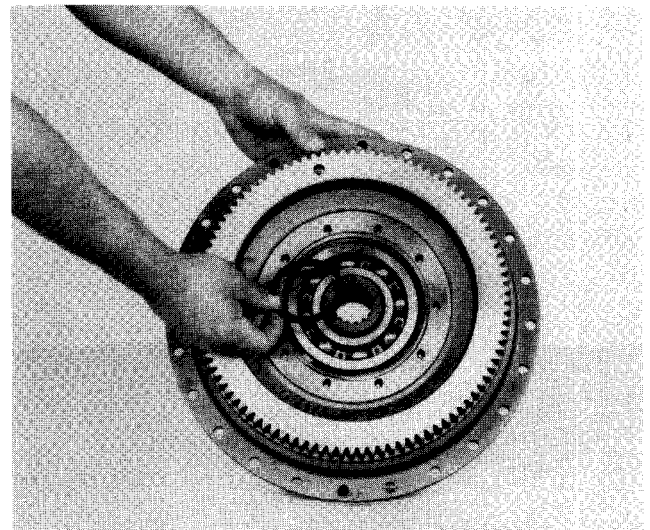


Figure 298

Position bearing washer over turbine hub.

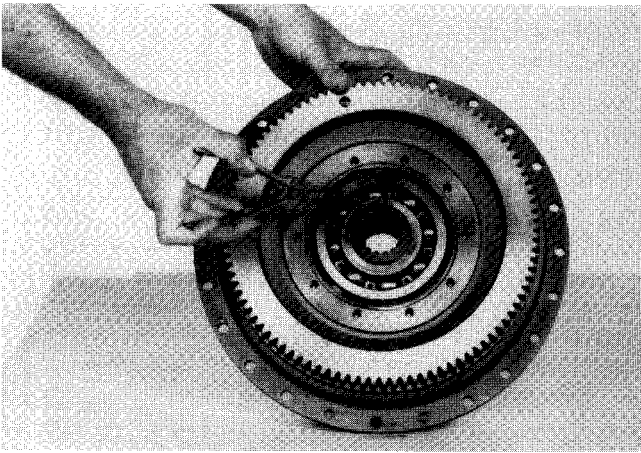


Figure 299

Install turbine hub to impeller cover retainer ring.

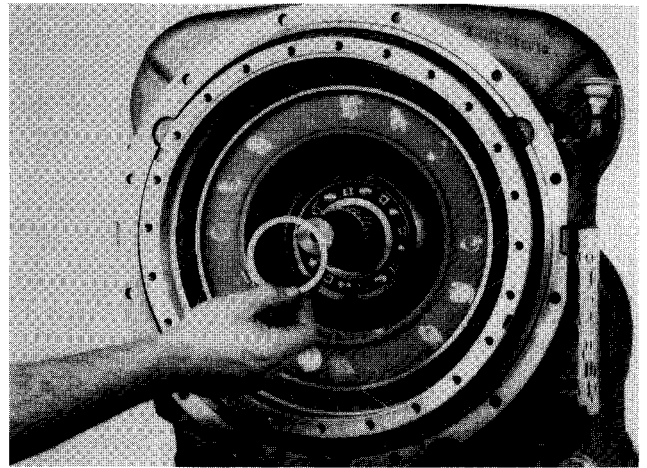


Figure 302

Install reaction member spacer with tang facing out.

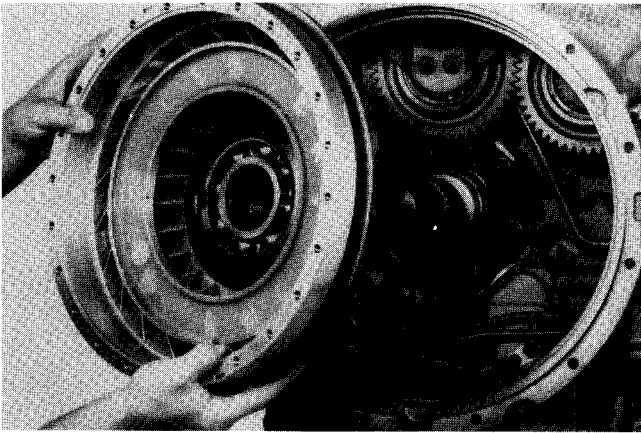


Figure 300

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

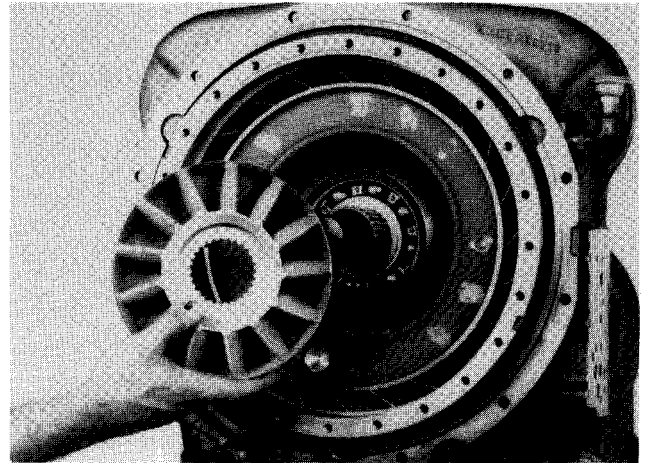


Figure 303

Install reaction member with thick part of blades out.

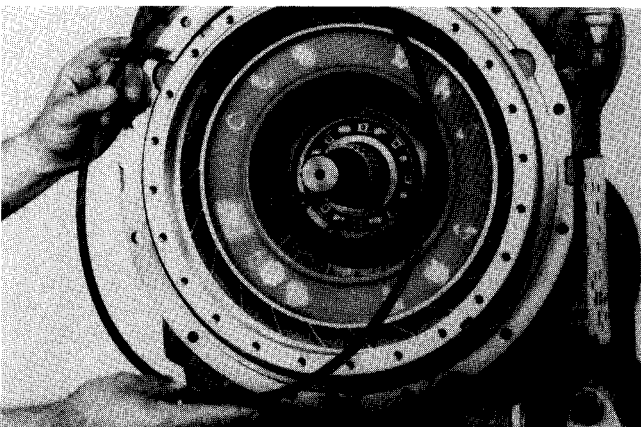


Figure 301

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

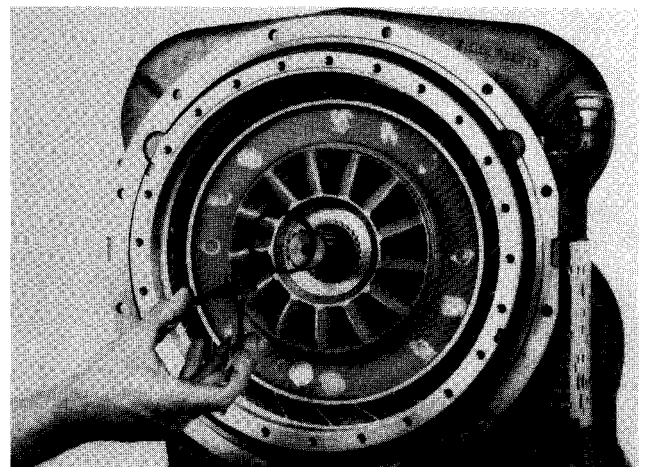


Figure 304

Install reaction member retainer ring.

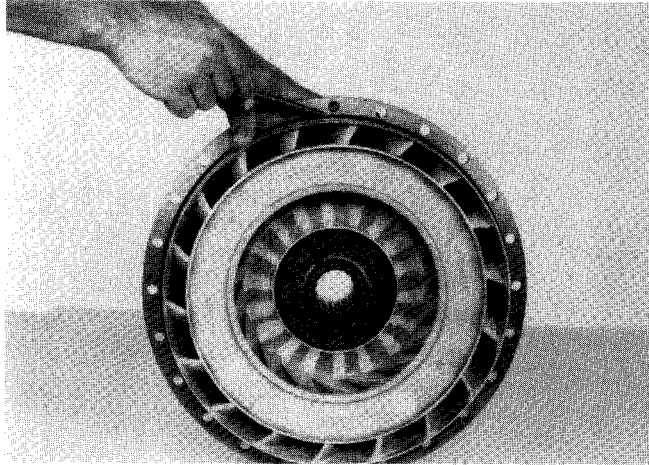


Figure 305

Position a new "O" ring on impeller cover.

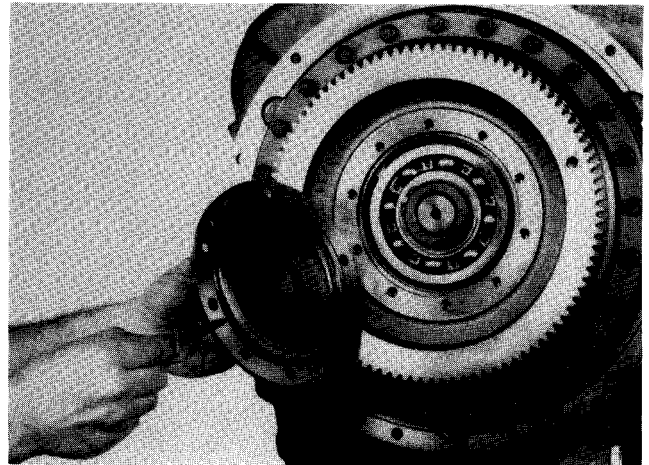


Figure 308

Position new "O" ring on impeller cover bearing cap.

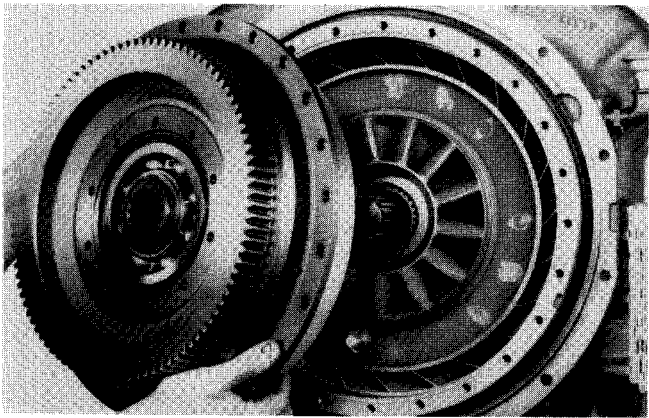


Figure 306

Position turbine and impeller cover on turbine shaft. **NOTE:** Some units will have drive plates instead of impeller cover & ring gear. See drive plate installation section.

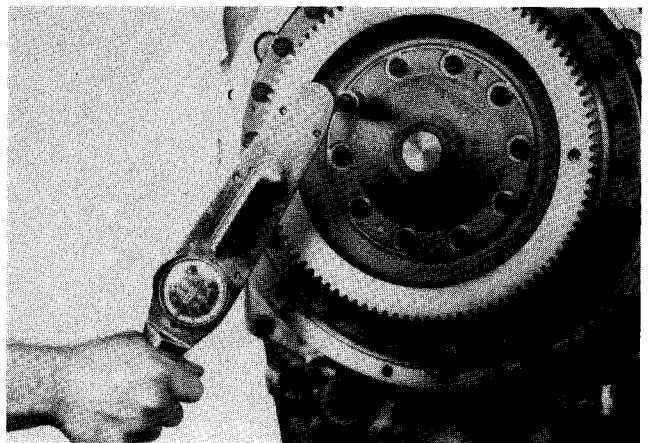


Figure 309

Install bearing cap, bolts and washers, tighten to specified torque. (See torque chart).

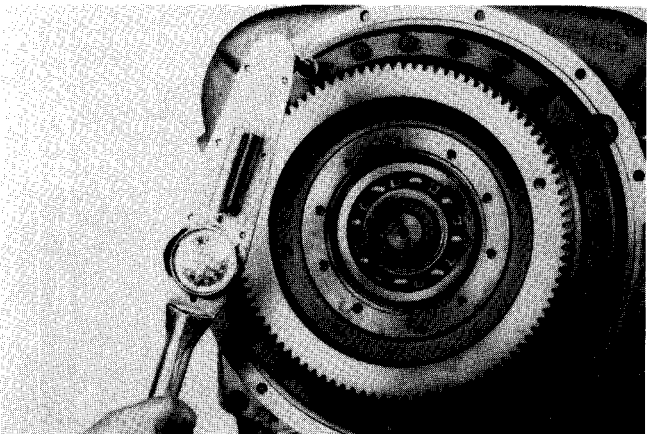


Figure 307

Install impeller cover to impeller bolts and washers. Tighten to specified torque (see torque chart).

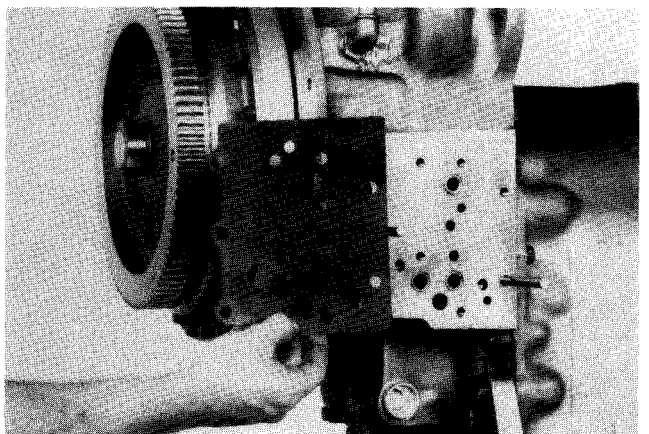


Figure 310

Install aligning studs to facilitate control valve assembly. Install new control valve gasket.

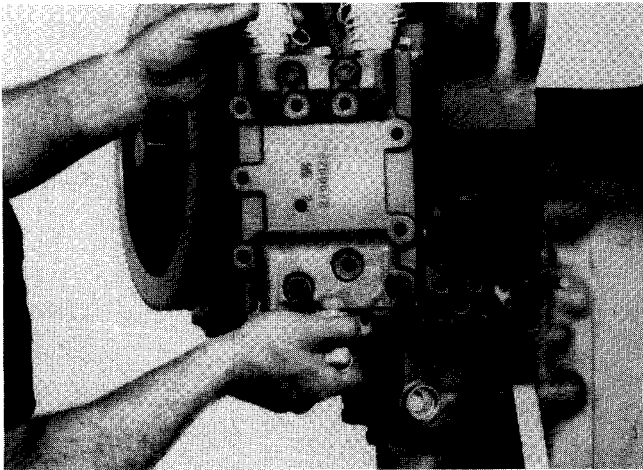


Figure 311
Position control valve assembly on aligning studs.

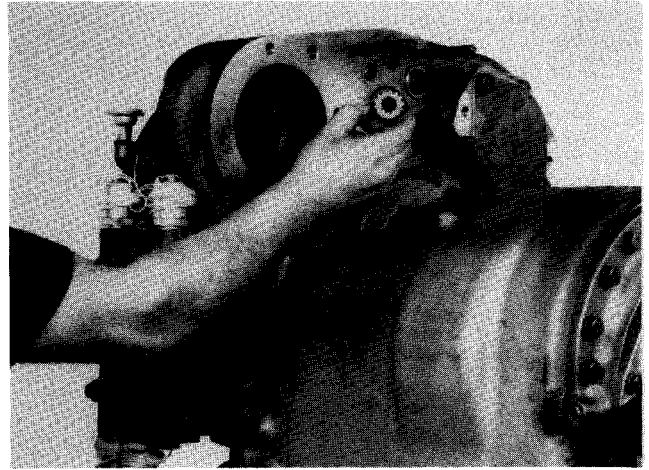


Figure 314
Install charging pump drive sleeve.

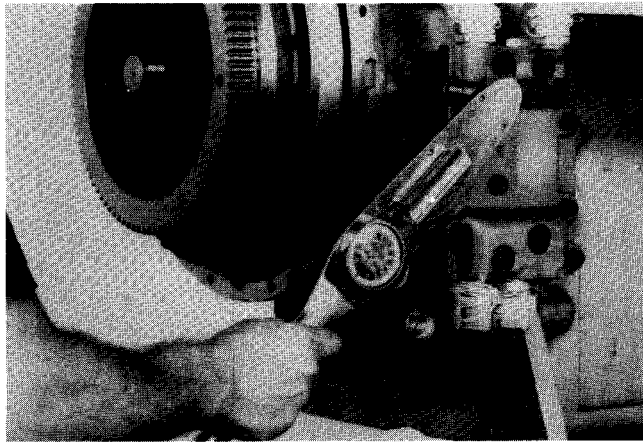


Figure 312
Install control valve bolts and washers and tighten to specified torque. (See torque chart).

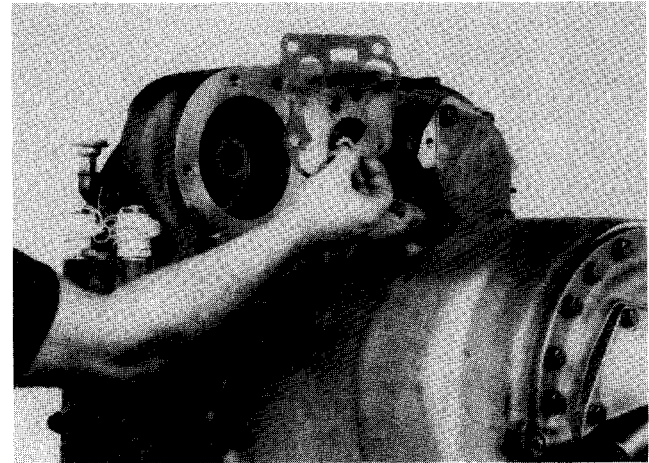


Figure 315
Install new pressure regulating valve gasket.



Figure 313
Install pump adaptor, bolts and washers. Tighten to specified torque. (See torque chart).

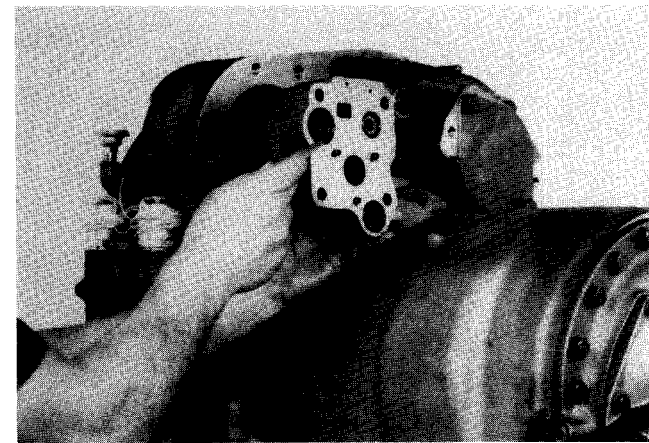


Figure 316
Install new "O" rings on pressure regulating valve. Position valve on studs.

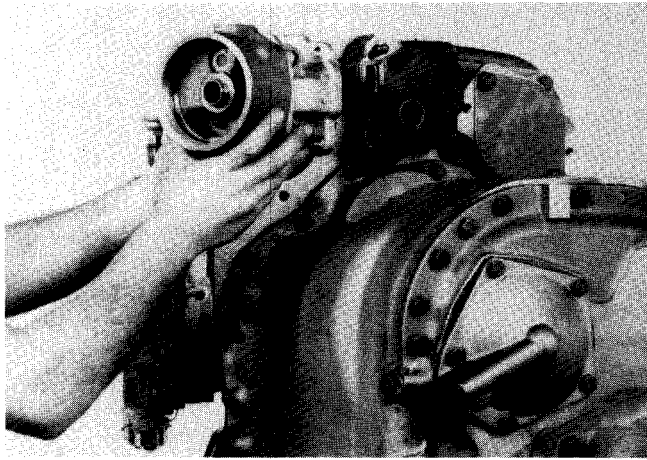


Figure 317

Position new valve to pump gasket on studs. Install charging pump and filter adaptor on studs.

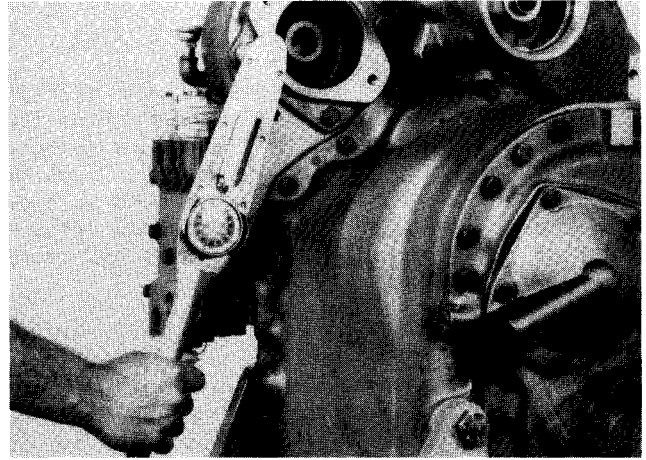


Figure 320

Install bolts and washers. Tighten to specified torque. (See torque chart).

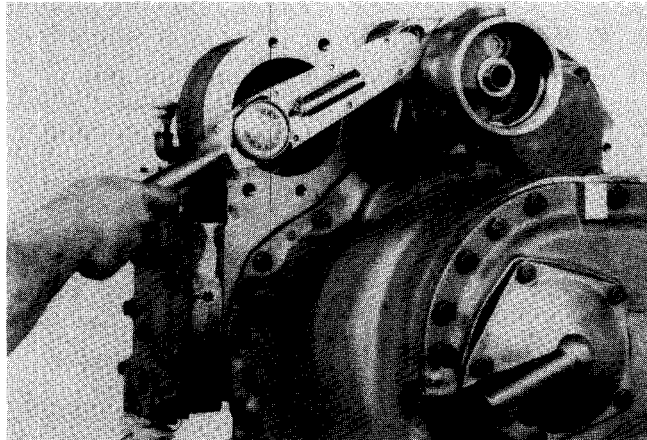


Figure 318

Install washers and nuts, tighten to specified torque. (See torque chart).



Figure 321

Install new filter element and filter housing.

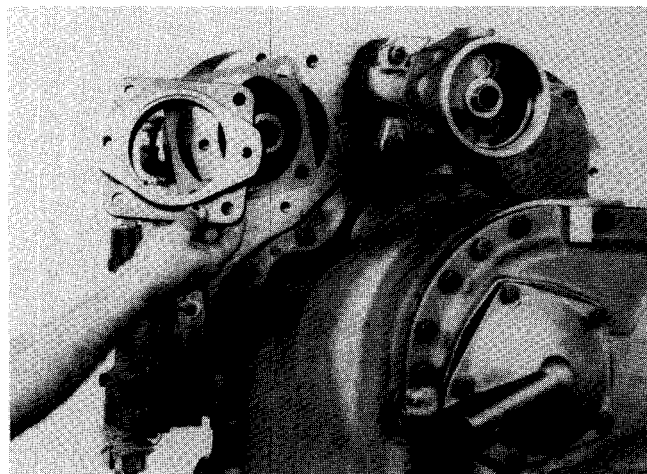


Figure 319

Install new auxiliary pump adaptor gasket and adaptor.

SERVICING MACHINE AFTER TRANSMISSION OVERHAUL

The transmission, torque converter, and its allied hydraulic system are important links in the drive line between the engine and the wheels. The proper operation of either unit depends greatly on the condition and operation of the other; therefore, whenever repair or overhaul of one unit is performed, the balance of the system must be considered before the job can be considered completed.

After the overhauled or repaired transmission has been installed in the machine, the oil cooler, and connecting hydraulic system must be thoroughly cleaned. This can be accomplished in several manners and a degree of judgment must be exercised as to the method employed.

The following are considered the minimum steps to be taken:

1. Drain entire system thoroughly.
2. Disconnect and clean all hydraulic lines. Where feasible, hydraulic lines should be removed from machine for cleaning.
3. Replace oil filter elements, cleaning out filter cases thoroughly.
4. The oil cooler must be thoroughly cleaned. The cooler should be "back flushed" with oil and compressed air until all foreign material has been removed. Flushing in direction of normal oil flow will not adequately clean the cooler. If necessary, cooler assembly should be removed from machine for cleaning, using oil, compressed air and steam cleaner for that purpose. **DO NOT** use flushing compounds for cleaning purposes.

5. On remote mounted torque converters remove drain plug from torque converter and inspect interior of converter housing, gears, etc. If presence of considerable foreign material is noted, it will be necessary that converter be removed, disassembled and cleaned thoroughly. It is realized this entails extra labor; however, such labor is a minor cost compared to cost of difficulties which can result from presence of such foreign material in the system.

6. Reassemble all components and use only type oil recommended in lubrication section. Fill transmission through filler opening until fluid comes up to **LOW** mark on transmission dipstick. **NOTE:** If the dipstick is not accessible oil level check plugs are provided.

Remove **LOWER** check plug, fill until oil runs from **LOWER** oil hole. Replace filler and level plug.

Run engine two minutes at 500-600 RPM to prime torque converter and hydraulic lines. Recheck level of fluid in transmission with engine running at idle (500-600 RPM).

Add quantity necessary to bring fluid level to **LOW** mark on dipstick or runs freely from **LOWER** oil level check plug hole. Install oil level plug or dipstick. Recheck with hot oil (180-200° F.) [82, 2-93, 3° C].

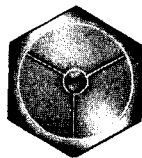
Bring oil level to **FULL** mark on dipstick or runs freely from **UPPER** oil level plug.

7. Recheck all drain plugs, lines, connections, etc., for leaks and tighten where necessary.

TORQUE IN (LBS.—FT.) BOLTS, CAPSCREWS, STUDS AND NUTS

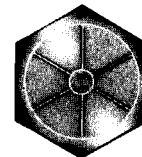
Grade 5 Identification, 3 Radial
Dashes 120° Apart on Head of Bolt

Grade 8 Identification, 6 Radial
Dashes 60° Apart on Head of Bolt



Grade 5

LUBRICATED OR PLATED



Grade 8

Nominal Size	Fine Thread		Course Thread	
	Torque Lbs. Ft./N.m.	Torque Lbs. Ft./N.m.	Torque Lbs. Ft./N.m.	Torque Lbs. Ft./N.m.
.3125	16-20 [21,7-27,1]	12-16 [16,3-21,7]	28-32 [38,0-43,4]	26-30 [35,3-40,7]
.3750	26-29 [35,3-39,3]	23-25 [31,2-33,9]	37-41 [50,2-55,6]	33-36 [44,7-48,8]
.4375	41-45 [55,6-61,0]	37-41 [50,2-55,6]	58-64 [78,6-86,8]	52-57 [70,5-77,3]
.5000	64-70 [86,8-94,9]	57-63 [77,3-85,4]	90-99 [122,0-134,2]	80-88 [108,5-119,3]
.5625	91-100 [123,4-135,6]	82-90 [111,2-122,0]	128-141 [173,5-191,2]	115-127 [156,0-172,2]

SPECIFICATIONS AND SERVICE DATA – POWER SHIFT TRANSMISSION AND TORQUE CONVERTER

<p>CONVERTER OUT PRESSURE</p>	<p>Converter outlet oil temp. 180° - 200° F. [82,3° - 93,3° C].</p> <p>Transmission in NEUTRAL.</p> <p>Operating specifications:</p> <p>25 P.S.I. [172,4 kPa] minimum pressure at 2000 R.P.M. engine speed AND a maximum of 70 P.S.I. [482,6 kPa] outlet pressure with engine operating at no-load governed speed.</p>	<p>OIL FILTRATION</p>	<p>Full flow oil filter safety by-pass, also strainer screen in sump at bottom of transmission case.</p>
<p>CONTROLS</p>	<p>Forward and Reverse - Manual</p> <p>Speed Selection - Manual</p>	<p>CLUTCH PRESSURE</p>	<p>240 - 300 psi [1654,8 - 2068, 4 kPa] - With parking brake set (see note), oil temperature 180° - 200° F. [82,2° - 93,3° C], engine at idle (400 to 600 RPM), shift thru direction and speed clutches. All clutch pressure must be equal within 5 psi. [34,5 kPa]. If clutch pressure varies in any one clutch more than 5 psi [34,5 kPa] repair clutch.</p> <p>NOTE: Never use service brakes while making clutch pressure checks. Units having brake actuated declutching in forward and/or reverse will not give a true reading. ALWAYS USE PARKING BRAKE WHEN MAKING CLUTCH PRESSURE CHECKS.</p>
<p>CLUTCH TYPE</p>	<p>Multiple discs, hydraulically actuated, spring released, automatic wear compensation and no adjustment. All clutches oil cooled and lubricated.</p>		
<p>CLUTCH INNER DISC</p>	<p>Friction.</p>		
<p>CLUTCH OUTER DISC</p>	<p>Steel.</p>		

LUBRICATION

RECOMMENDED LUBRICANTS FOR TORQUE CONVERTERS AND POWERSHIFT TRANSMISSIONS

TYPE OF OIL	See Lube Chart.
CAPACITY	Consult Operators Manual on applicable machine model for system capacity. Torque Converter, Transmission and allied hydraulic system must be considered as a whole to determine capacity.
CHECK PERIOD	Check oil level DAILY with engine running at 500-600 RPM and oil at 180° to 200° F. [82,2 - 93,3° C]. Maintain oil level to FULL mark.
NORMAL DRAIN PERIOD	Every 500 hours, change oil filter element. Every 1000 hours, drain and refill system as follows: Drain with oil at 150° to 200° F. [65,6 - 93,3° C].

NOTE: It is recommended that filter elements be changed after 50 and 100 hours of operation on new and rebuilt or repaired units.

- (a) Drain transmission and remove sump screen. Clean screen thoroughly and replace, using new gaskets.
- (b) Drain oil filters, remove and discard filter elements. Clean filter shells and install new elements.
- (c) Refill transmission to LOW mark.
- (d) Run engine at 500 - 600 RPM to prime converter and lines.
- (e) Recheck level with engine running at 500 - 600 RPM and add oil to bring level to LOW mark. When oil temperature is hot (180 - 200° F.) [82,2 - 93,3° C] make final oil level check. BRING OIL LEVEL TO FULL MARK.

Torque converter/transmission lubricant must be qualified by one of the following specifications.

ORDER OF PREFERENCE:

- | | |
|---------------------------|---|
| 1. Caterpillar TO - 4 | 4. Allison C - 4 |
| 2. John Deere J20 C, D | 5. Dexron II Equivalent - See note below. |
| 3. Military MIL-PRF-2104G | |

IMPORTANT: Dexron* II equivalent is acceptable; however it is not compatible with torque converters or transmissions equipped with graphitic friction material clutch plates.

LUBRICANTS NOT RECOMMENDED: DEXRON III, ENGINE OIL, ANY GL-5 OILS.

OIL VISCOSITY - It is recommended that the highest viscosity monograde lubricant available be used for the anticipated ambient temperature. Typically this will be a CAT TO-4 qualified lubricant. When large swings in ambient temperature are probable, J20 C, D multigrades are recommended. Multigrade lubricants should be applied at the lower viscosity rating for the prevailing ambient temperature, i.e. a 10W20 should be used where a 10W monograde is used. If a C-4 multigrade is used in place of J20 lubricant it is recommended that the viscosity span no more than 10 points, i.e. 10W20.

SYNTHETIC LUBRICANTS ARE APPROVED IF QUALIFIED BY ONE OF THE ABOVE SPECIFICATIONS. OIL VISCOSITY GUIDELINES APPLY, BUT SYNTHETIC MULTIGRADES MAY SPAN MORE THAN 10 POINTS.

FOR FIRE RESISTANT FLUID RECOMMENDATIONS PLEASE CONTACT SPICER OFF-HIGHWAY PRODUCTS.

SUMP PREHEATERS - preheat the transmission fluid to the minimum temperature for the oil viscosity used before engine start up.

NORMAL OIL CHANGE INTERVAL - drain and refill system every 1000 hours for average environmental and duty cycle conditions. Severe or sustained high operating temperature or very dusty atmospheric conditions will result in accelerated deterioration or contamination. Judgement must be used to determine the required change intervals for extreme conditions.

EXTENDED OIL CHANGE INTERVAL - Extended oil service life may result when using synthetic fluids. Appropriate change intervals should be determined for each transmission by measuring oil oxidation and wear metals, over time, to determine a baseline. Wear metal analysis can provide useful information, but a transmission should not be removed from service based solely on this analysis.

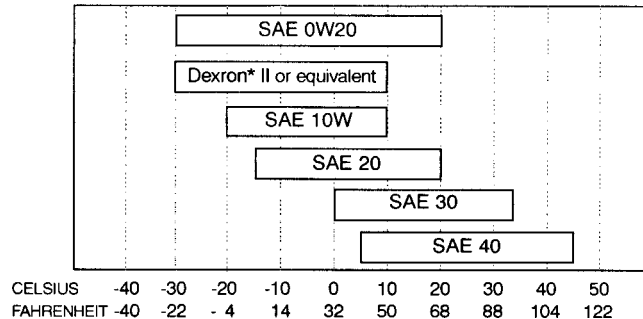
FILTERS - Service oil filter element every 500 hours under normal environmental and duty cycle conditions. Service the high performance extended life filter element every 1000 hours or upon warning indication from the filter back pressure sensor.

This recommended lubricant section does not apply to transmissions with electronic modulation where separate approved oils are identified.

Any deviation from this recommendation must have written approval from the application engineering department of Spicer Off-Highway Products.

*Dexron is a registered trademark of General Motors Corp.

RECOMMENDED SAE J300 VISCOSITY GRADE
BASED ON PREVAILING AMBIENT TEMPERATURE



POWER SHIFT TRANSMISSION AND TORQUE CONVERTER HYDRAULIC FLUID ANALYSIS

Spicer Off-Highway Components Division recommends that when chemical sampling of a power shift transmission lubrication circuit fluid is being taken that several samples be analyzed over a period of time to establish its normal base. Large changes in particle quantity from the normal level may indicate an abnormal condition within the transmission or its lubrication fluid. Any conclusion made of the transmission actual condition, or action taken by the transmission user when interpreting the sample results, is the full responsibility of the user.

The following part per million (PPM) values represent general guidelines which may be used for references as a normal limit:

Iron	Fe	125 PPM
Copper	Cu	350 PPM
Silicon	Si	20 PPM
Aluminum	Al	15 PPM
Lead	Pb	50 PPM
Chromium	Cr	5 PPM

TROUBLE SHOOTING GUIDE

For The R and HR Model, 32000 Transmission

The following data is presented as an aid to locating the source of difficulty in a malfunctioning unit. It is necessary to consider the torque converter charging pump, transmission, oil cooler, and connecting lines as a complete system when running down the source of trouble since the proper operation of any unit therein depends greatly on the condition and operations of

the others. By studying the principles of operation together with data in this section, it may be possible to correct any malfunction which may occur in the system.

TROUBLE SHOOTING PROCEDURE BASICALLY CONSISTS OF TWO CLASSIFICATIONS: MECHANICAL AND HYDRAULIC.

MECHANICAL CHECKS

Prior to checking any part of the system from a hydraulic standpoint, the following mechanical checks should be made:

1. A check should be made to be sure all control lever linkage is properly connected and adjusted at all connecting points.

2. Check shift levers and rods for binding or restrictions in travel that would prevent full engagement. Shift levers by hand at control valve, if full engagement cannot be obtained, difficulty may be in control cover and valve assembly.

HYDRAULIC CHECKS

Before checking on the torque converter, transmission, and allied hydraulic system for pressures and rate of oil flow, it is essential that the following preliminary checks be made:

Check oil level in transmission. This should be done with oil temperatures of 180 to 200° F. [82,2-93,3° C]. DO NOT ATTEMPT THESE CHECKS WITH COLD OIL. To bring the oil temperature to this specification it is necessary to either work the machine or "stall" out

the converter. Where the former means is impractical, the latter means should be employed as follows:

Engage shift levers in forward and high speed and apply brakes. Accelerate engine half to three-quarter throttle.

Hold stall until desired converter outlet temperature is reached. **CAUTION: FULL THROTTLE STALL SPEEDS FOR AN EXCESSIVE LENGTH OF TIME WILL OVERHEAT THE CONVERTER.**

LOW CLUTCH PRESSURE

Cause	Remedy
1. Low oil level.	1. Fill to proper level.
2. Clutch pressure regulating valve spool stuck open.	2. Clean valve spool and housing.
3. Faulty charging pump.	3. Replace pump.
4. Broken or worn clutch shaft or piston sealing rings.	4. Replace sealing rings.
5. Clutch piston bleed valve stuck open.	5. Clean bleed valves thoroughly.

LOW CONVERTER CHARGING PUMP OUTPUT

1. Low oil level.	1. Fill to proper level.
2. Suction screen plugged.	2. Clean suction screen.
3. Air leaks at pump intake hose and connections or collapsed hose. (R-32000 only)	3. Tighten all connections or replace hose if necessary.
4. Defective oil pump.	4. Replace pump.

OVERHEATING

1. Worn oil sealing rings.	1. Remove, disassemble, and rebuild converter assembly.
2. Worn oil pump.	2. Replace.
3. Low oil level.	3. Fill to proper level.
4. Pump suction line taking air. (R-32000 only)	4. Check oil line connections and tighten securely.

NOISY CONVERTER

1. Worn coupling gears.	1. Replace.
2. Worn oil pump.	2. Replace.
3. Worn or damaged bearings.	3. A complete disassembly will be necessary to determine what bearing is faulty.

LACK OF POWER

1. Low engine RPM at converter stall.	1. Tune engine check governor.
2. See "Overheating" and make same checks.	2. Make corrections as explained in "Overheating."

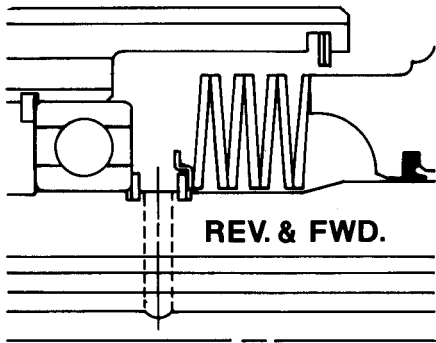
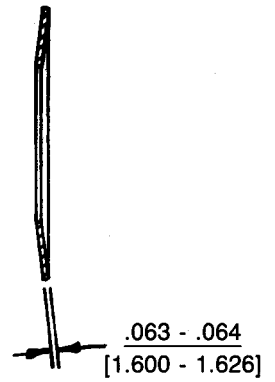


FIG. A



MODULATED FWD.
& REV. CLUTCHES

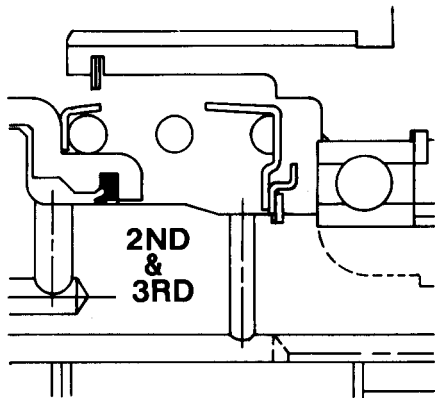


FIG. B

2nd & 3rd & NON-
MODULATED FORWARD &
REVERSE CLUTCHES

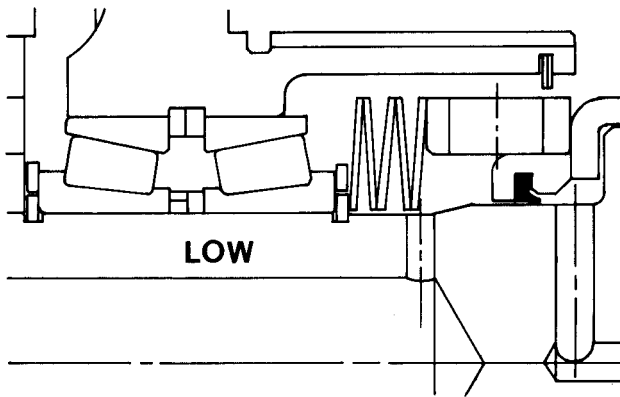
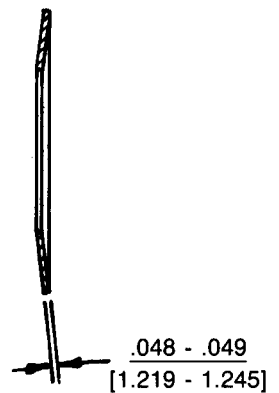


FIG. C



LOW (1st)
CLUTCH

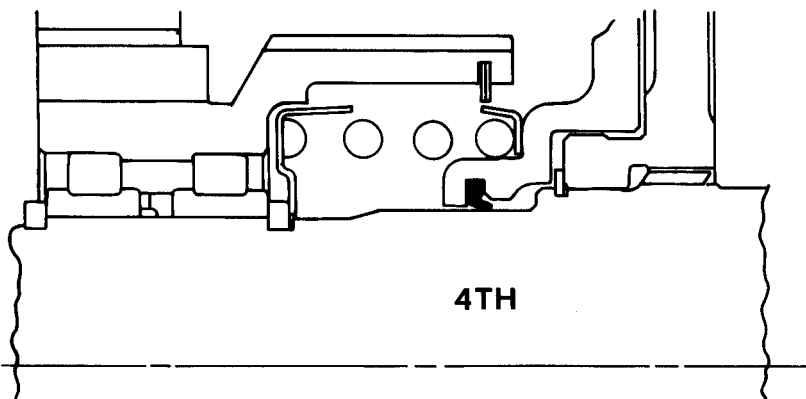
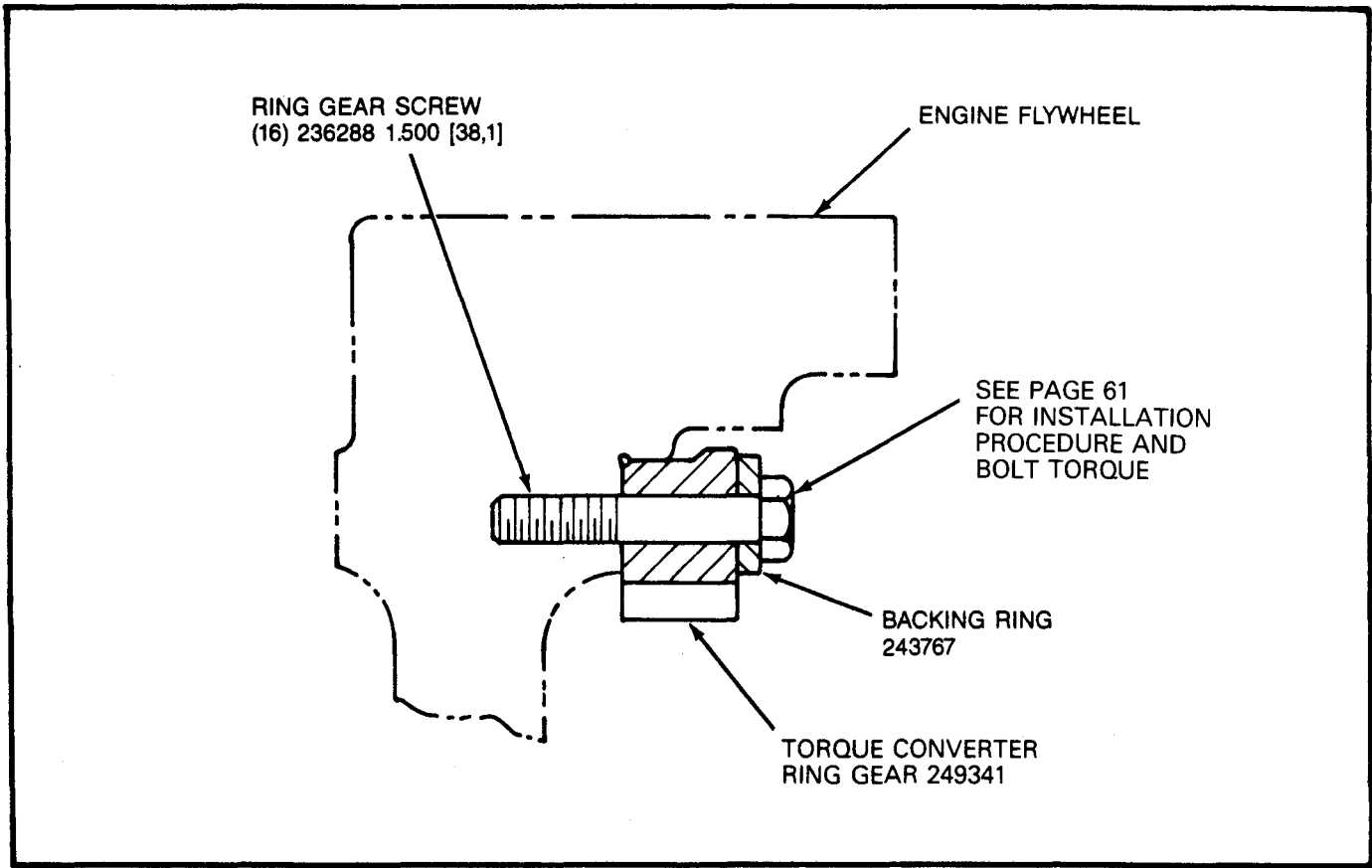
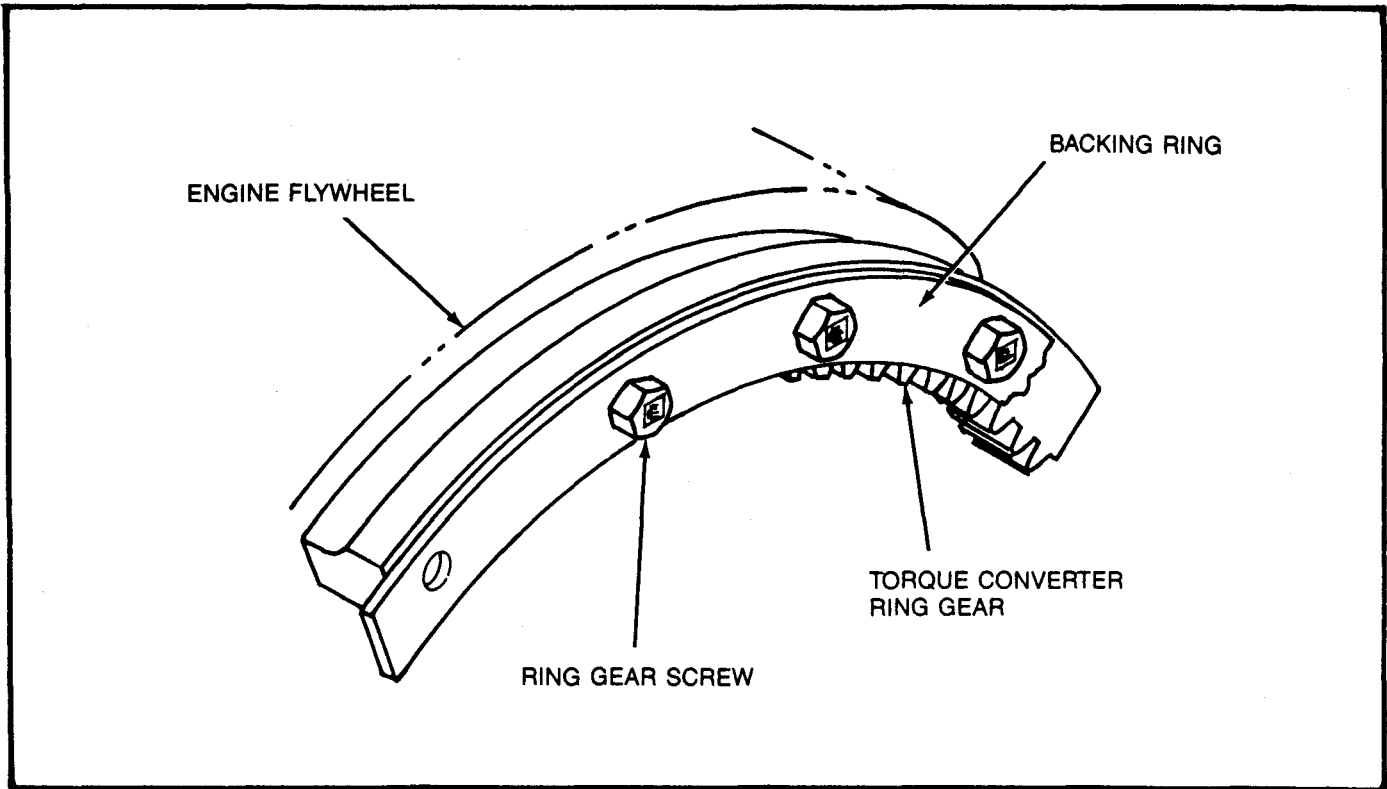


FIG. D
(4 SPEED ONLY)



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

1	249341	Torque Converter Ring Gear
16	236288	Ring Gear Screw 1.5 Inch [38,1]
1	802555	Installation Instruction Sheet

802554 — 1.5 INCH [38,1] 16 SCREW RING GEAR KIT

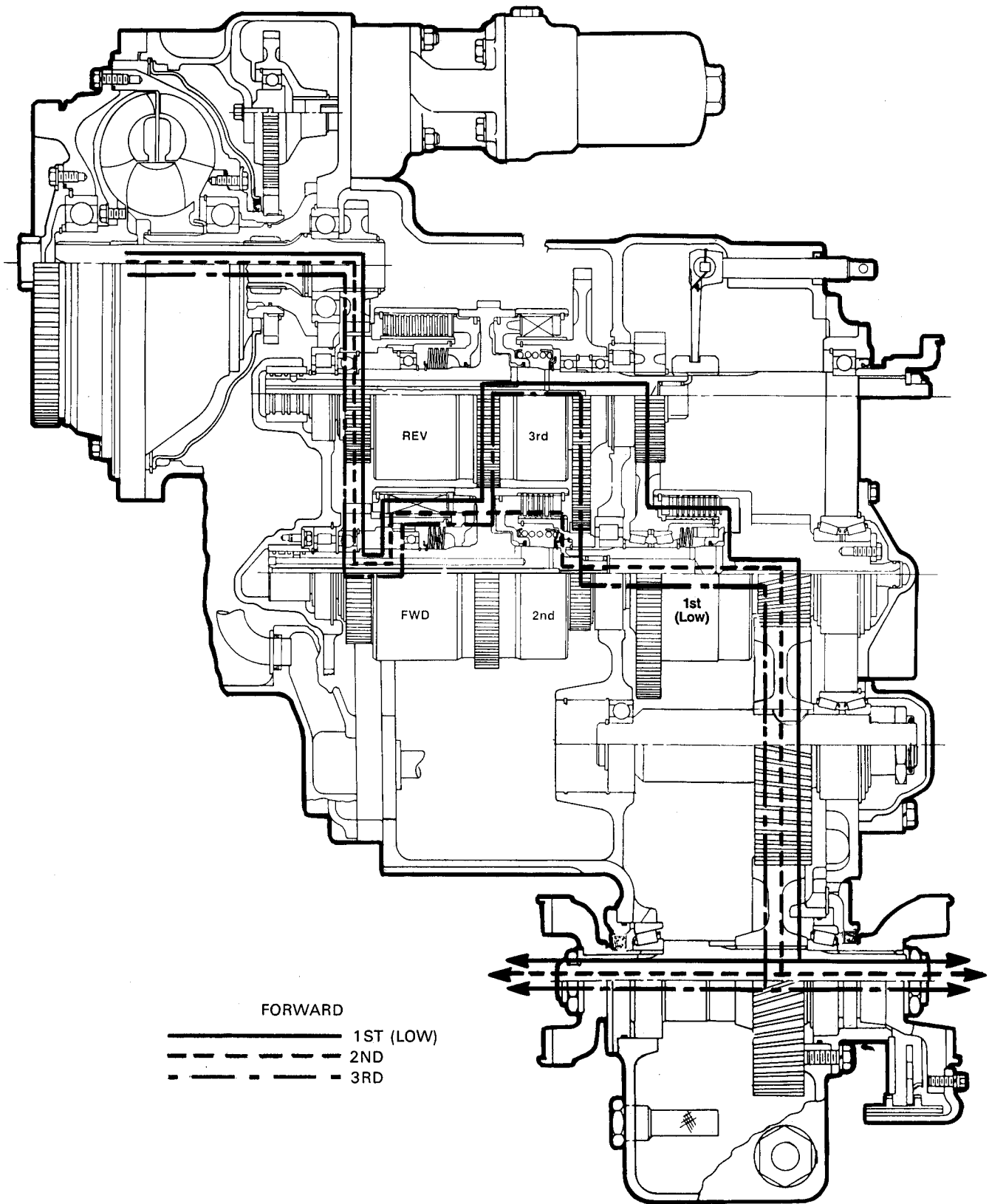
1	249341	Torque Converter Ring Gear
16	236288	Ring Gear Screw 1.5 Inch [38,1]
1	243767	Backing Ring
1	802555	Installation Instruction Sheet

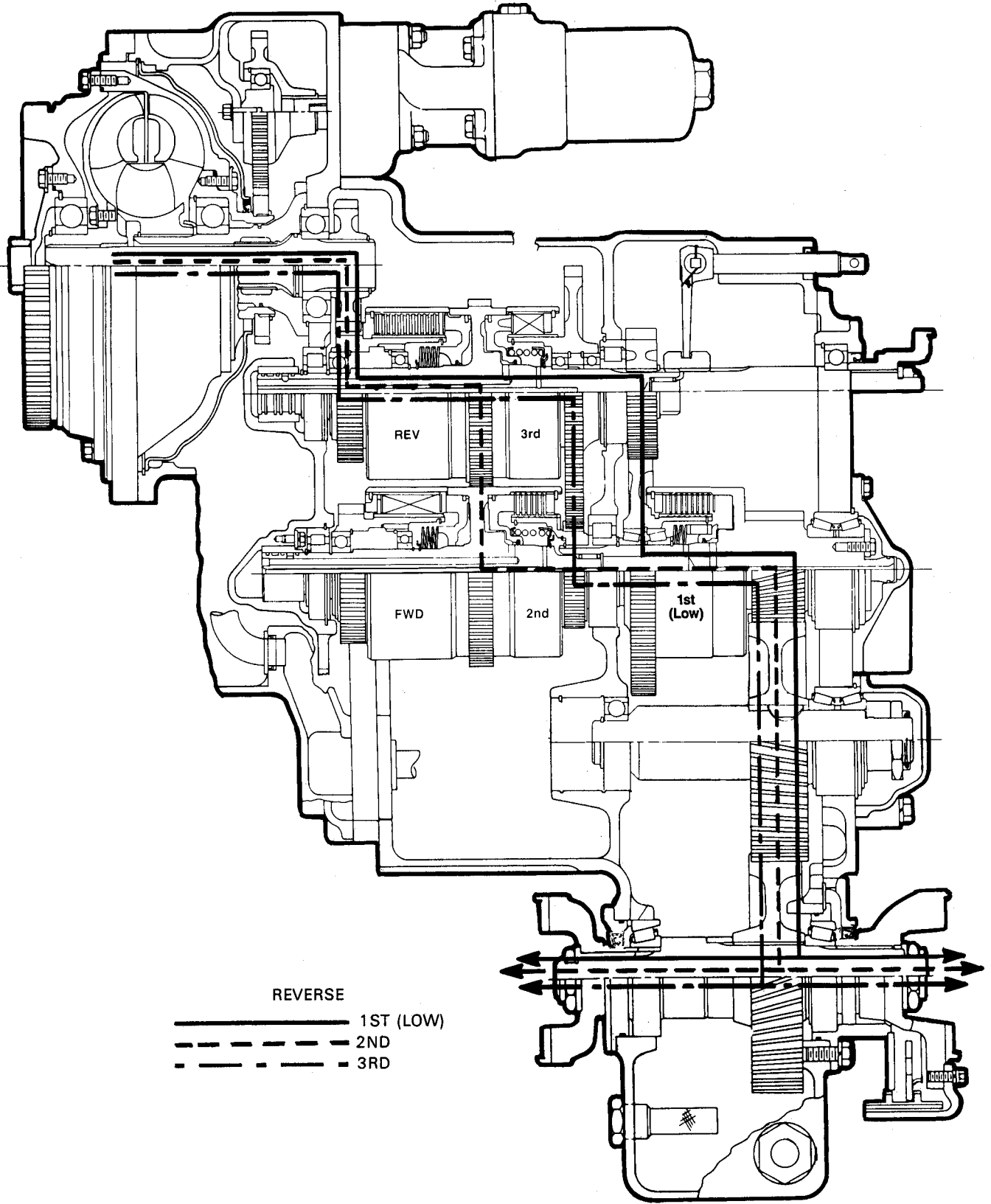
243767 Backing Ring not included in 802553 Ring Gear Kit. Must be Ordered Separately.

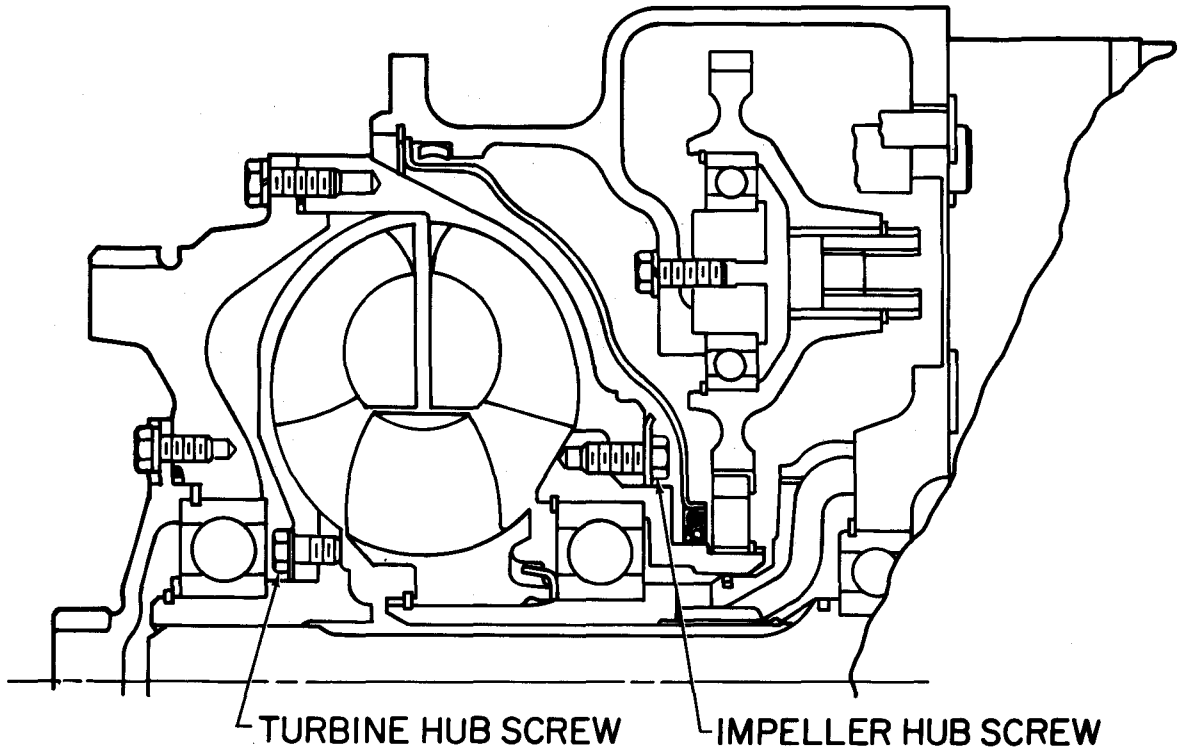
Dimensions are in inches — Dimensions in [] are mm.

SEE PAGE 60 FOR INSTALLATION ILLUSTRATIONS

SEE PAGE 69 FOR 32 BOLT INSTALLATION



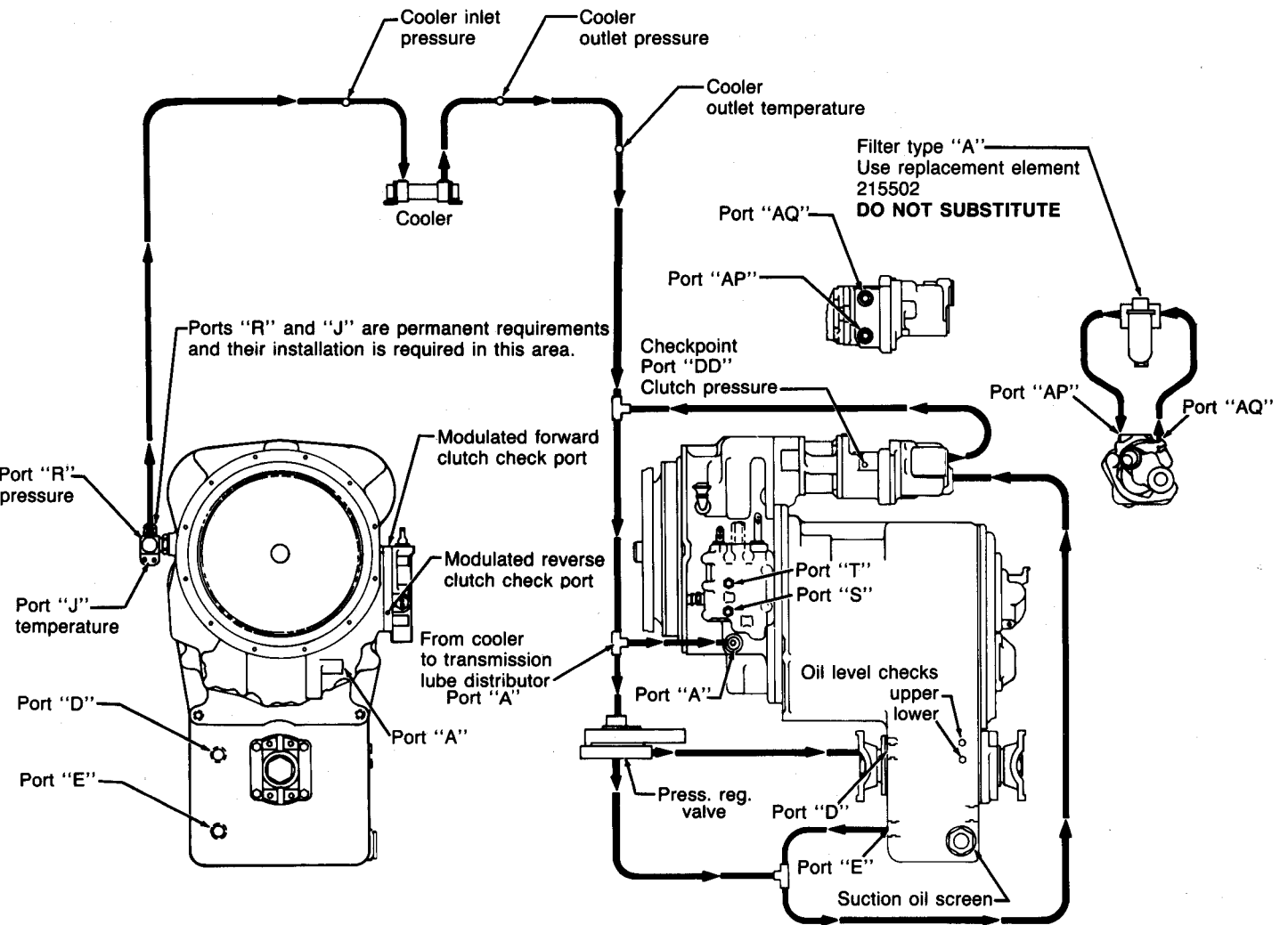




IMPELLER HUB & TURBINE HUB ASSEMBLY WITH BACKING RING AND SPECIAL SELF LOCKING SCREWS.

1. CLEAN HUB MOUNTING SURFACE AND TAPPED HOLES WITH SOLVENT. DRY THOROUGHLY BEING CERTAIN TAPPED HOLES ARE DRY AND CLEAN.

2. INSTALL BACKING RING AND SPECIAL SCREWS TO APPROXIMATELY .06 INCH [1,5] OF SEATED POSITION. WITH A CALIBRATED TORQUE WRENCH, TIGHTEN SCREWS 40 TO 45 LBS. FT. TORQUE [54,3-61,0 N.m]. NOTE: ASSEMBLY OF IMPELLER OR TURBINE HUB MUST BE COMPLETED WITHIN A FIFTEEN MINUTE PERIOD FROM START OF SCREW INSTALLATION. THE SCREWS ARE PREPARED WITH A COATING WHICH BEGINS TO HARDEN AFTER INSTALLATION IN THE HUB HOLES. IF NOT TIGHTENED TO PROPER TORQUE WITHIN THE FIFTEEN MINUTE PERIOD, INSUFFICIENT SCREW CLAMPING TENSION WILL RESULT. THE SPECIAL SCREW IS TO BE USED FOR ONE INSTALLATION ONLY. IF THE SCREW IS REMOVED FOR ANY REASON IT MUST BE REPLACED. THE COMPOUND LEFT IN THE HUB HOLES MUST BE REMOVED WITH THE PROPER TAP AND CLEANED WITH SOLVENT. DRY HOLE THOROUGHLY AND USE A NEW SCREW FOR REINSTALLATION.



Port "J" Converter outlet temperature
 Port "R" Converter outlet pressure
 Port "T" Checkpoint transmission forward clutch pressure
 Port "S" Checkpoint transmission reverse clutch pressure
 Ports "J", "R", and "DD" Used for field trouble shooting

**PLUMBING DIAGRAM FOR HR 32000
 W/12 PLATE MODULATION AND
 AUXILIARY LUBE**

CLEANING AND INSPECTION

CLEANING

Clean all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION: Care should be exercised to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

Bearings

Remove bearings from cleaning fluid and strike larger side of cone flat against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearings may be rotated slowly by hand to facilitate drying process.

Housings

Clean interior and exterior of housings, bearing caps, etc., thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

CAUTION: Care should be exercised to avoid skin rashes and inhalation of vapors when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rags free of abrasive materials such as metal filings, contaminated oil or lapping compound.

INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

Bearings

Carefully inspect all rollers, cages and cups for wear, chipping or nicks to determine fitness of bearings for further use. Do not replace a bearing cone or cup individually without replacing the mating cup or cone at the same time. After inspection, dip bearings in clean light oil and wrap in clean lintless cloth or paper to protect them until installed.

Oil Seals, Gaskets and Retaining Rings

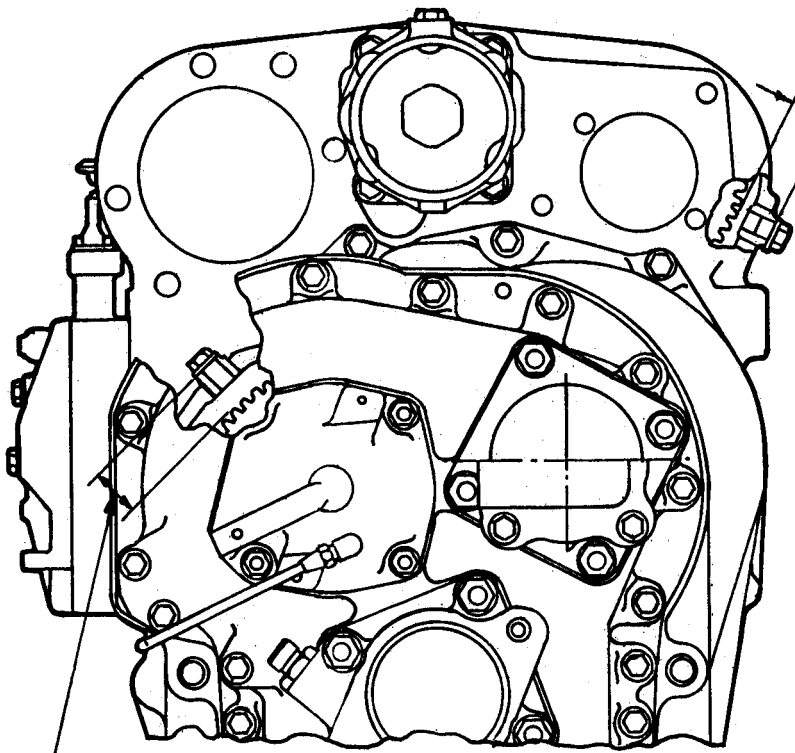
Replacement of spring load oil seals, "O" rings, metal sealing rings, gaskets and snap rings is more economical when unit is disassembled than premature overhaul to replace these parts at a future time. Further loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency. Apply a thin coat of Permatex No. 2 on the outer diameter of the oil seal to assure an oil tight fit into the retainer. When assembling new metal type sealing rings, same should be lubricated with coat of chassis grease to stabilize rings in their grooves for ease of assembly of mating members. Lubricate all "O" rings and seals with recommended type Automatic Transmission Fluid before assembly.

Gears and Shafts

If magna-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts and quills to make certain they are not sprung, bent, or splines twisted, and that shafts are true.

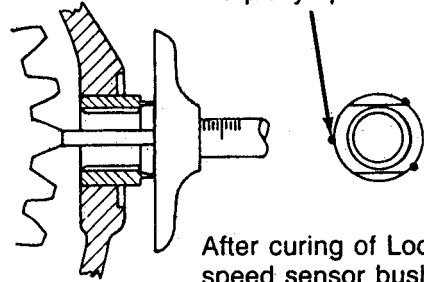
Housing, Covers, etc.

Inspect housings, covers and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.



1.060 ± .007 [26.9 ± .17]

Stake 3 places approx.
equally spaced.



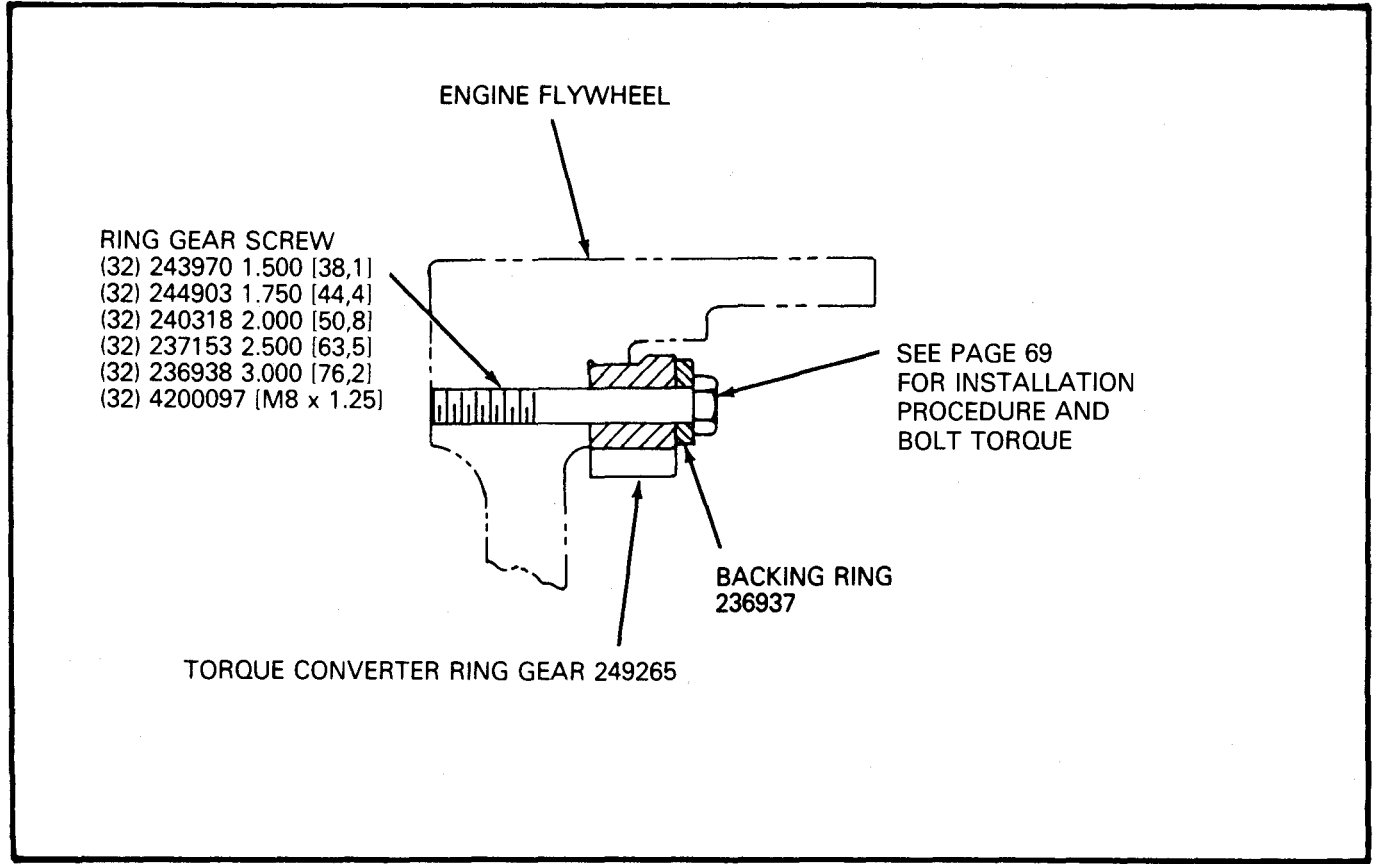
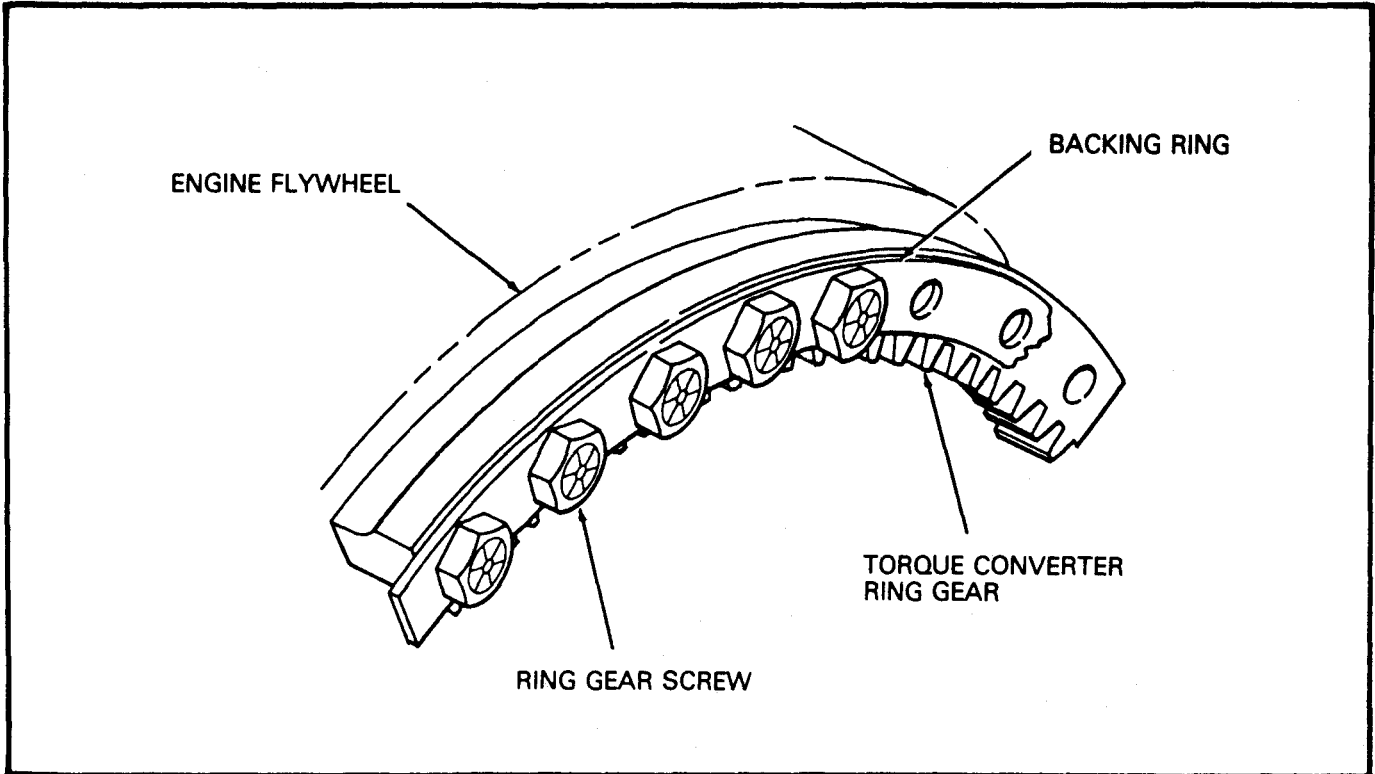
After curing of Loctite,
speed sensor bushing
must be secure with 40
Ft. Lb. [54.2 N-m] torque.

1.390 ± .007 [35.3 ± .17]

REAR VIEW

Assemble Speed Sensor Bushing in housing to specified dimension with Loctite 262 and stake (3) three places.

SPEED SENSOR BUSHING INSTALLATION



32 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 thirty-two (32) 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 23 to 25 pounds feet of torque [31,2 - 33,8 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.

802544 — 1.5 INCH [38,1] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	243970	Ring Gear Screw 1.5 Inch [38,1]
1	802550	Installation Instruction Sheet

802547 — 2.5 INCH [63,5] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	237153	Ring Gear Screw 2.5 Inch [63,5]
1	802550	Installation Instruction Sheet

802545 — 1.75 INCH [44,4] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	244903	Ring Gear Screw 1.75 Inch [44,4]
1	802550	Installation Instruction Sheet

802548 — 3.0 INCH [76,2] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	236938	Ring Gear Screw 3.0 Inch [76,2]
1	802550	Installation Instruction Sheet

802546 — 2.0 INCH [50,8] 32 SCREW RING GEAR KIT

1	249265	Torque Converter Ring Gear
32	240318	Ring Gear Screw 2.0 Inch [50,8]
1	802550	Installation Instruction Sheet

802549 — M8-32 SCREW RING GEAR KIT

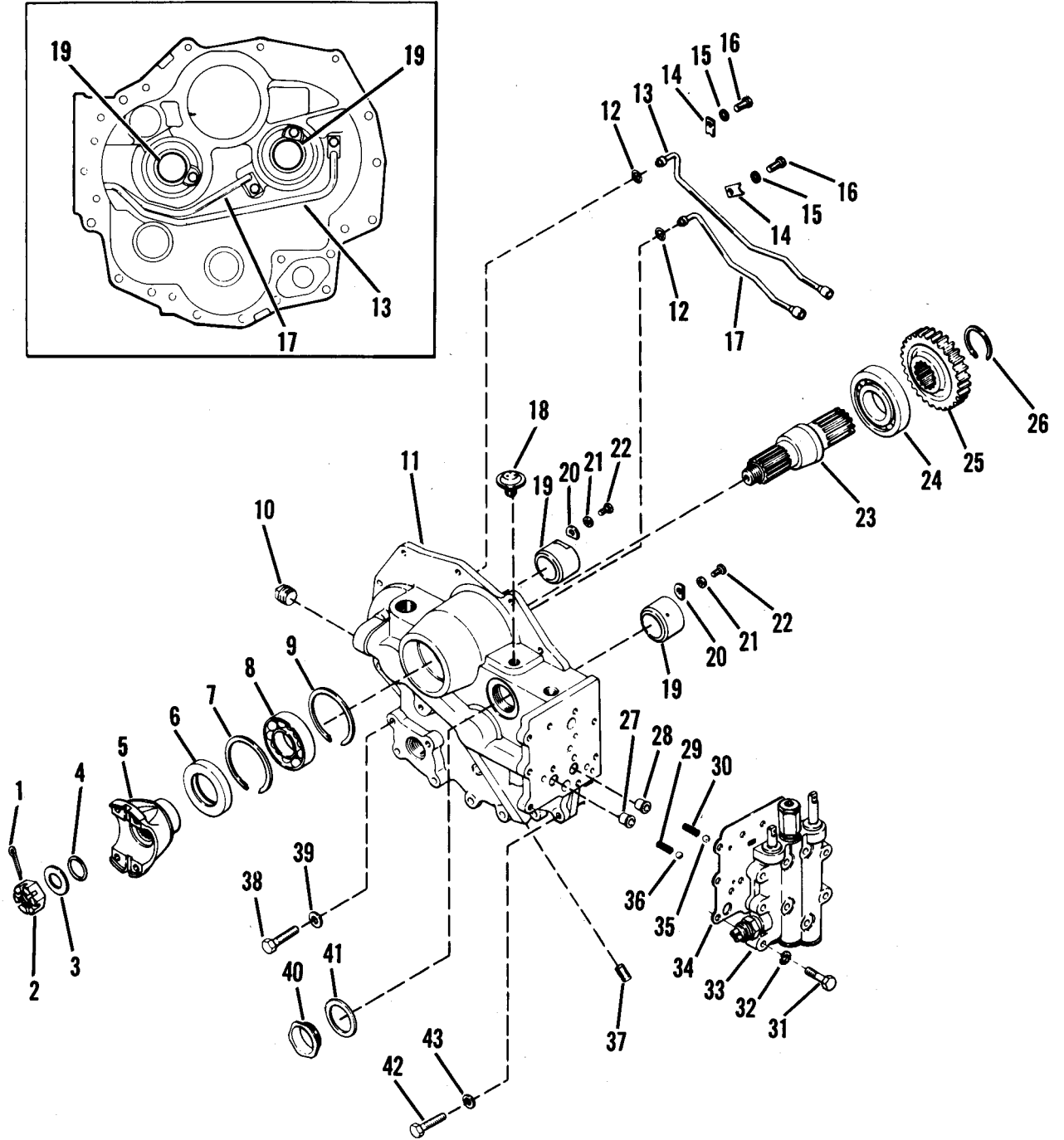
1	249265	Torque Converter Ring Gear
32	4200097	Ring Gear Screw [M8 x 1.25]
1	802550	Installation Instruction Sheet

236937 Backing Ring Not Included in Ring Gear Kit. Must be Ordered Separately.

NOTE: The initial installation drive gear mounting kit includes a converter air breather. This breather is used on C & CL 270/C & CL 320 converters only and is not required for the HR & LHR 28000/HR & LHR 32000 applications.

SEE PAGE 68 FOR INSTALLATION ILLUSTRATIONS

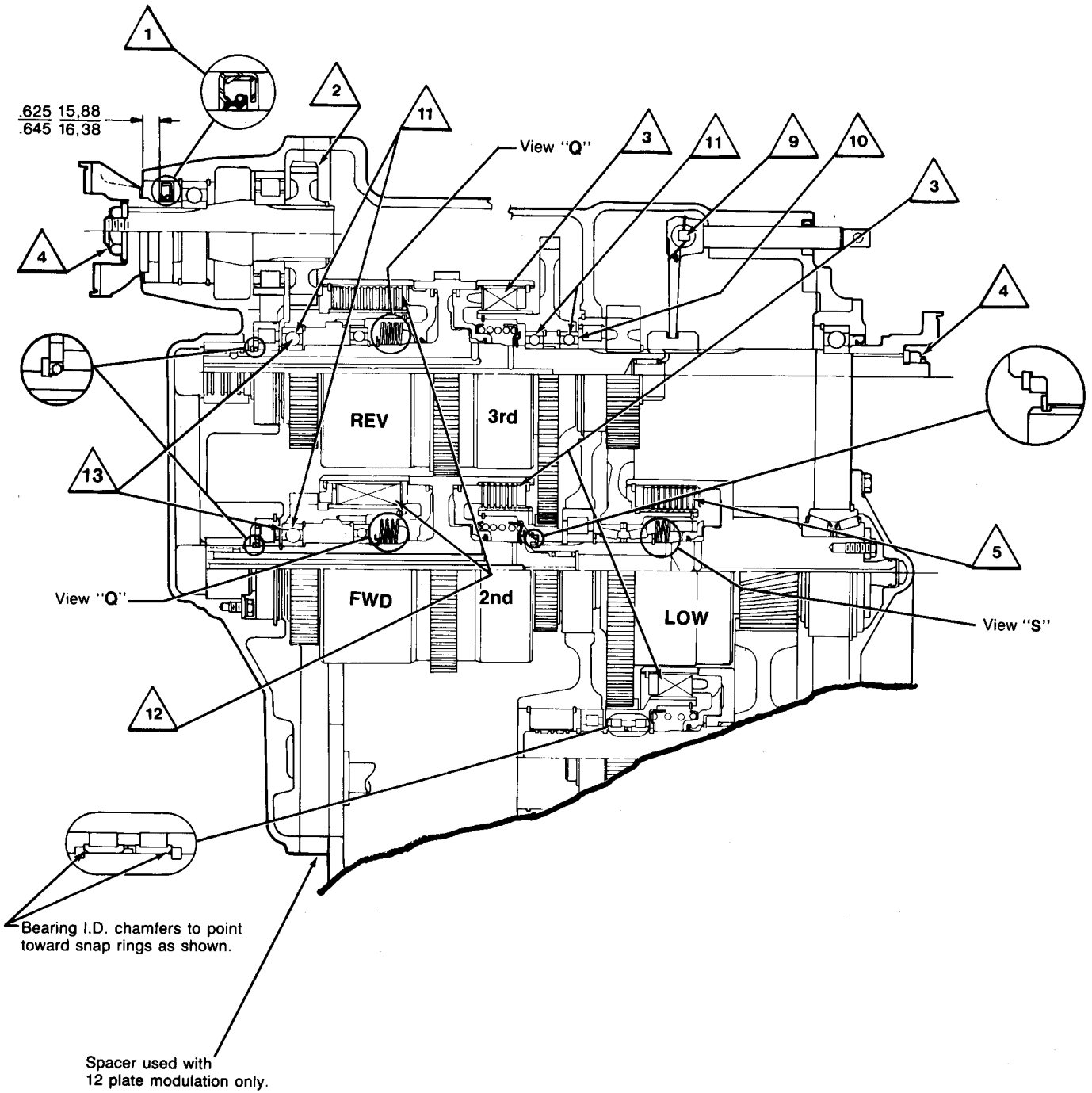
R-MODEL SECTION













R32000 FRONT COVER GROUP

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Flange Nut Cotter	1	23	Input Shaft	1
2	Flange Nut	1	24	Input Shaft Rear Bearing	1
3	Flange Nut Washer	1	25	Input Shaft Gear	1
4	Flange "O" Ring	1	26	Input Shaft Gear Retaining Ring	1
5	Input Flange	1	27	Tube Sleeve	1
6	Input Flange Oil Seal	1	28	Tube Sleeve	1
7	Input Shaft Front Bearing Retaining Ring	1	29	Detent Spring	1
8	Input Shaft Front Bearing	1	30	Detent Spring	1
9	Input Shaft Front Bearing Retaining Ring	1	31	Valve to Converter Housing Screw	9
10	Pipe Plug	1	32	Valve to Converter Housing Screw Lockwasher	9
11	Front Cover & Tube Assembly	1	33	Control Valve Assembly	1
12	"O" Ring	2	34	Control Valve Gasket	1
13	3rd Speed Tube Assembly	1	35	Detent Ball	1
14	Tube Clip	2	36	Detent Ball	1
15	Tube Clip Screw Lockwasher	2	37	Pipe Plug	1
16	Tube Clip Screw	2	38	Cover to Case Screw	4
17	Reverse Tube Assembly	1	39	Cover to Case Screw Lockwasher	4
18	Breather	1	40	Front Cover Plug	1
19	Front Cover Sleeve	2	41	Front Cover Plug Gasket	1
20	Front Cover Sleeve Lock	2	42	Cover to Case Screw	4
21	Sleeve Lockscrew Lockwasher	2	43	Cover to Case Screw Lockwasher	4
22	Sleeve Lockscrew	2			

**R-32000
ASSEMBLY INSTRUCTION ILLUSTRATION**



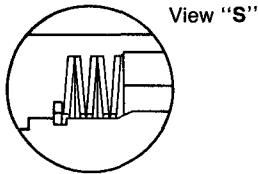
-  1 Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
-  2 Gear to be assembled with long hub length to this side.
-  3 Three clutches,6-outer steel plates,6-inner friction plates.Assemble alternately, starting with outer steel plate.
-  4 See Elastic Stop Nut Torque Chart
-  5 Low clutch,9-outer steel plates,9-inner friction plates.Assemble alternately, starting with outer steel plate.

-  9 Lockwire to prevent loosening
-  10 Bearing shield out
-  11 Must be loose internal fit bearings, No. "3" etched on bearing.
-  12 (12 Plate Modulation) Two clutches,12-outer steel plates,12-inner friction plates.Assemble alternately, starting with outer steel plate.
-  13 Bearing shield in.

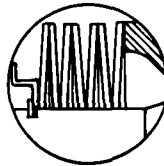
- Notes**
- A. - Use Permatex & Crane Sealer only where specified.
 - B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
 - C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
 - D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
 - E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
 - F. - Apply light coat of Crane Sealer to all pipe plugs.
 - G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
 - H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

NOTE: Metric dimensions shown in brackets [].

Low Clutch Return Springs.
Concave side of first spring to be placed against clutch piston. Remaining four washers to be stacked alternately reversed as shown.




View "Q"
2 Places




Forward & Reverse Clutch Return Springs.
Concave side of first spring to be placed against clutch piston. Remaining six washers of each clutch to be stacked alternately reversed as shown.

ELASTIC STOP NUT TORQUE

THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1¼" - 18	200 - 250	[271,2 - 338,9]
1½" - 18	300 - 350	[408,8 - 474,5]
1¾" - 12	400 - 450	[542,4 - 610,1]

Grade 5 

Torque Specification for Lubricated
or Plated Screw Threads

Grade 8 

NOM. SIZE	FINE THREAD		COARSE THREAD		FINE THREAD		COARSE THREAD	
	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]	LB-FT	[N·M]
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]

MAINTENANCE AND SERVICE

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled. It must also be understood that this is a basic 32000 transmission with many options. Companion flanges and output shafts with and without disconnect

assemblies may vary on specific models. The units are very similar to trouble shoot, disassemble, repair and reassemble.

CAUTION: Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

DISASSEMBLY

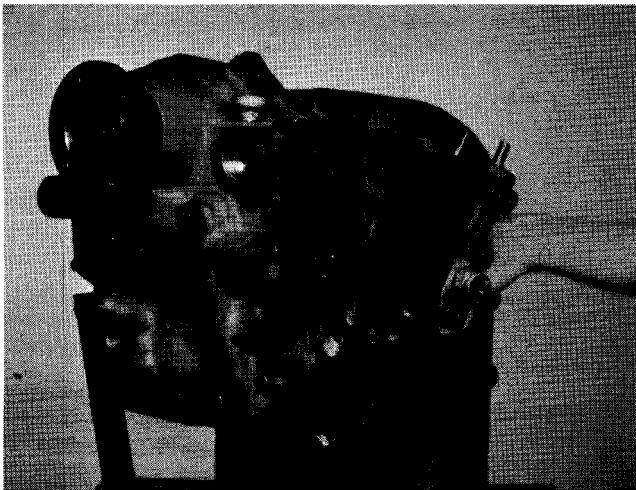


Figure 1

Remove control valve bolts and washers. Remove control valve. Use caution as not to lose detent springs and balls.



Figure 3

Remove front cover plug.

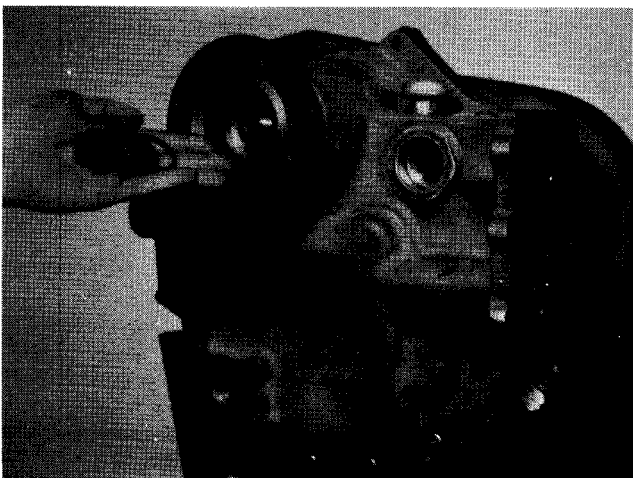


Figure 2

Remove companion flange nut, washer and "O" ring.

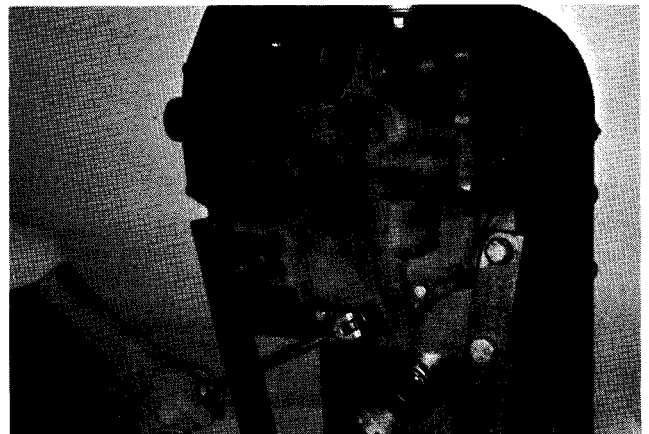


Figure 4

Remove bolts securing front cover to transmission housing.

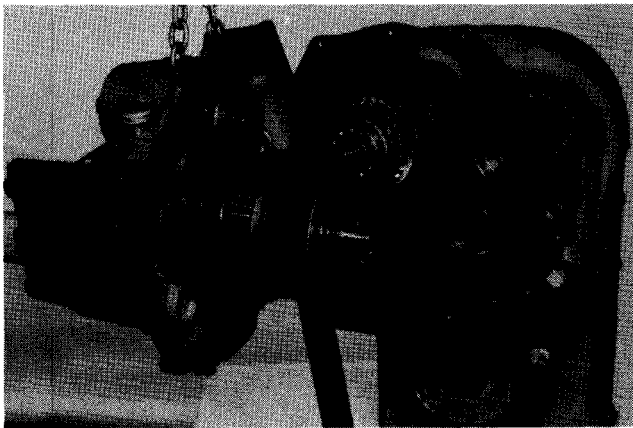


Figure 5

Remove front cover and forward and 2nd clutch.

INSTALL INPUT SHAFT OIL SEAL IN FRONT COVER AS SHOWN ON PAGE 72.

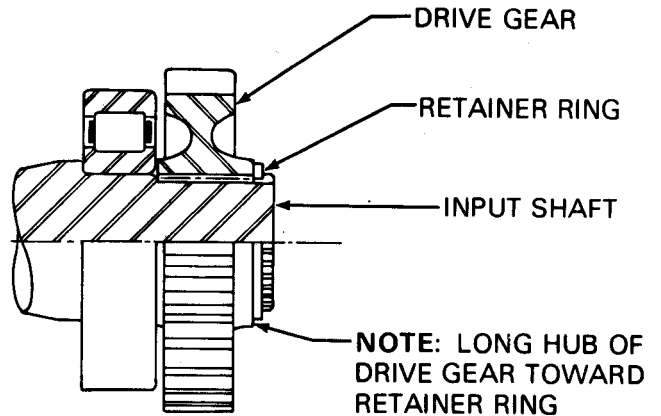


Figure 8

Input shaft, rear bearing, drive gear and snap ring.

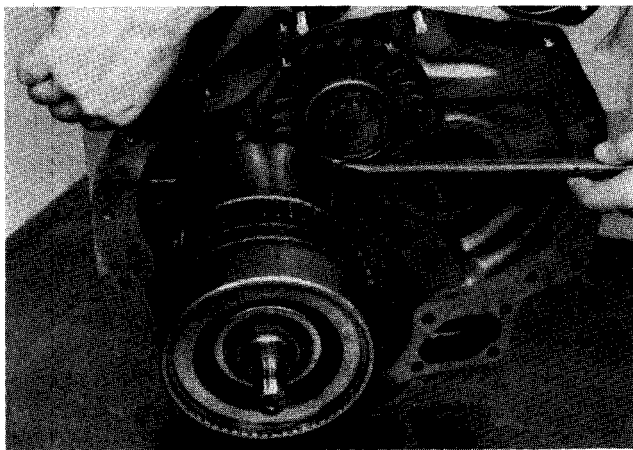


Figure 6

Use a spreading type snap ring pliers to spread the ears on forward clutch front bearing retainer ring. Remove forward clutch with pry bar.

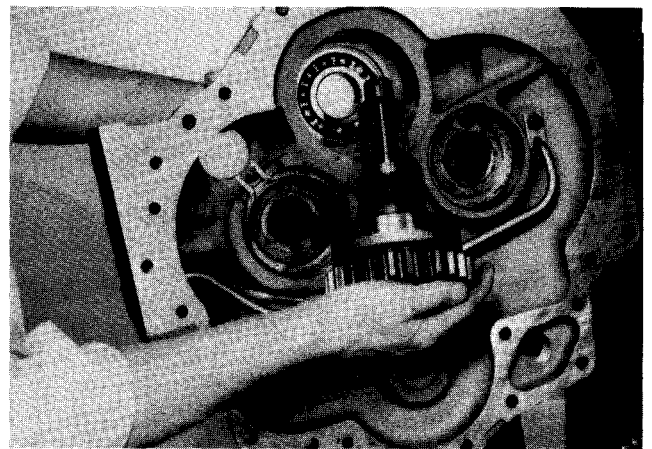


Figure 9

Install input shaft into front bearing.

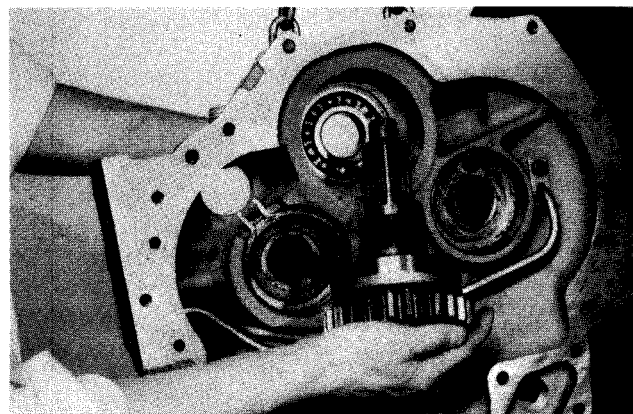


Figure 7

If input shaft is to be removed, tap on threaded end of shaft, remove input shaft, gear and bearing.

See cleaning and inspection page.

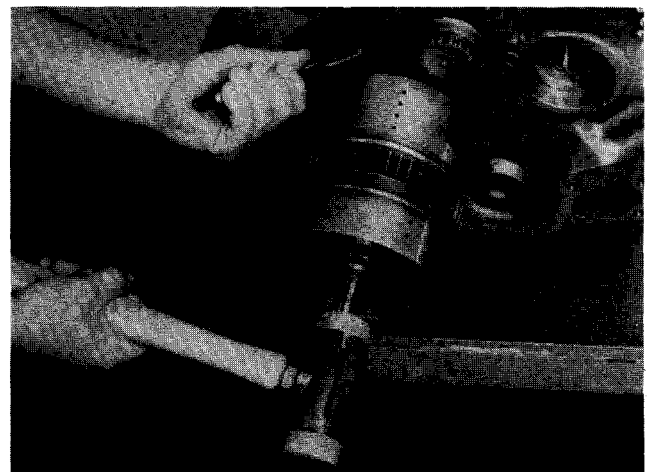


Figure 10

Support converter housing with chain fall. Spread forward clutch front bearing retainer ring and tap forward and 2nd clutch assembly into transmission case assembly. Be certain snap ring is in full position in ring groove.

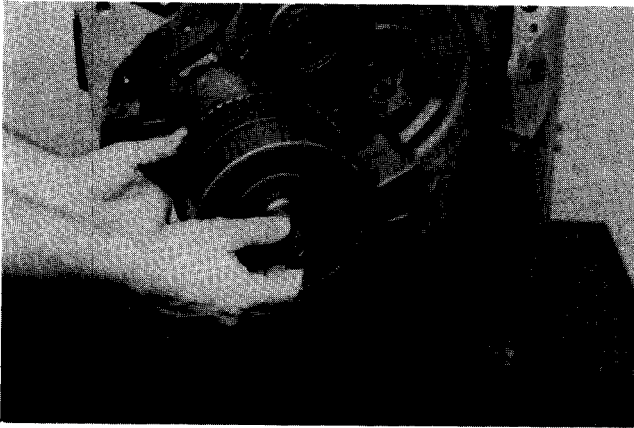


Figure 11
Install 2nd speed clutch pilot bearing.

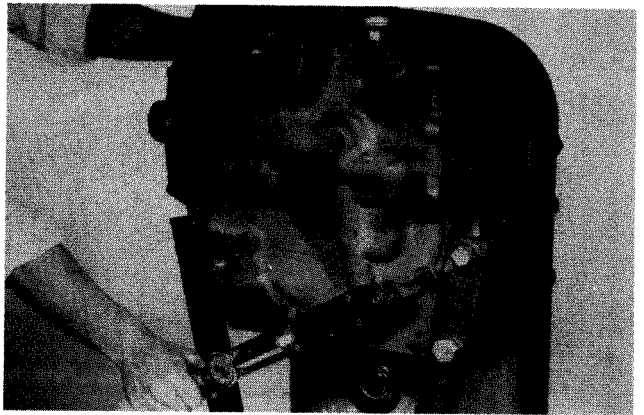


Figure 14
Support front cover with a chain fall. Install alignment studs in transmission case. Position front cover assembly on aligning studs. Turn output flange to align clutch disc hub in clutch. Do not force this operation. With front cover in position against the transmission case install cover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

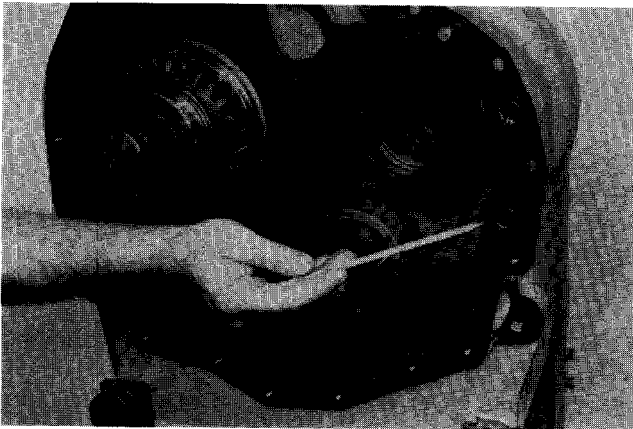


Figure 12
Install transmission case gasket and "O" ring seals.

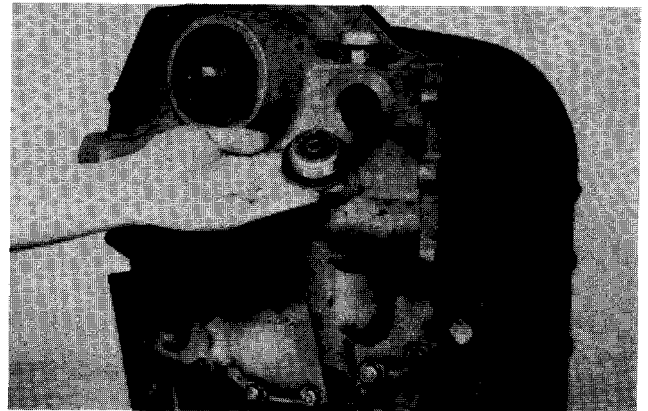


Figure 15
Install front cover plug.

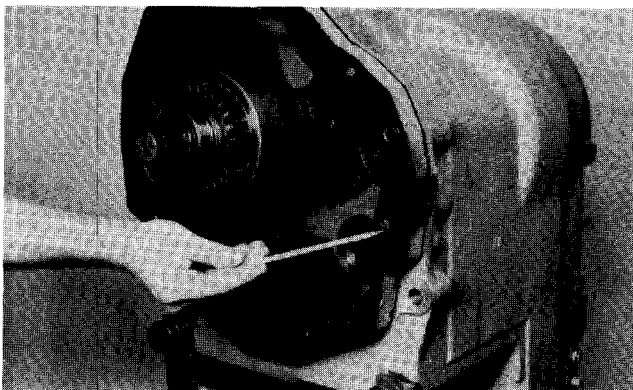


Figure 13
Install housing spacer, gasket and "O" ring seals. **NOTE:** Housing spacer is used with 12 plate clutch modulation only.

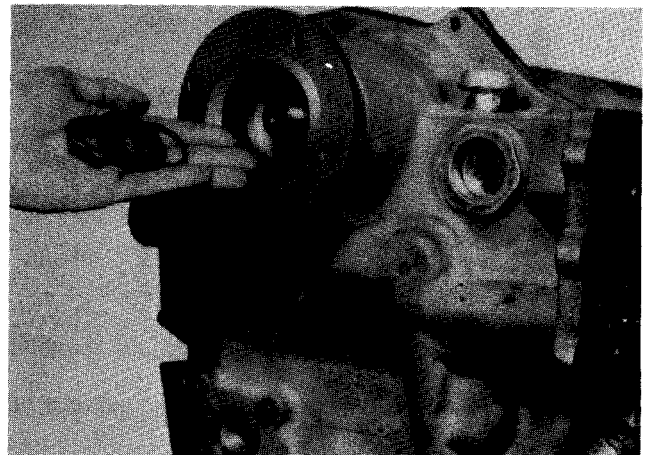


Figure 16
Install companion flange, flange "O" ring, washer and nut. Torque nut to specified torque. (See elastic stop nut torque chart).



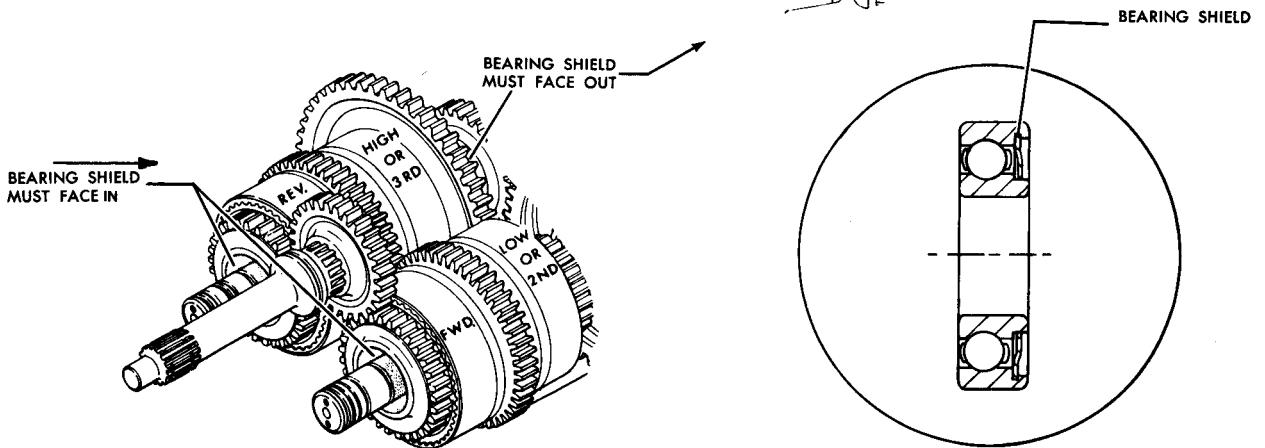
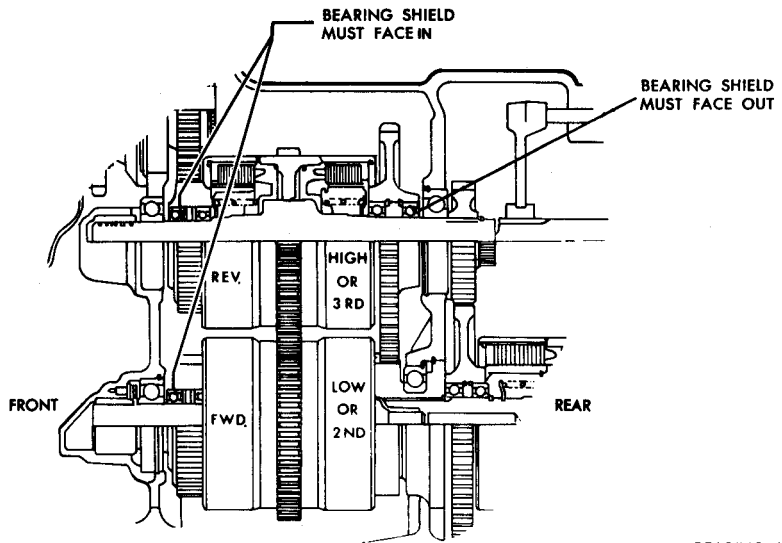
Figure 17

Locate detent balls and springs in control valve. Position new gasket. Secure valve with bolts and washers. Tighten to specified torque.

NOTE: The disc spring packs are to be used as complete assemblies and care should be taken not to intermix the individual disc springs with disc springs in another clutch or disc spring pack.

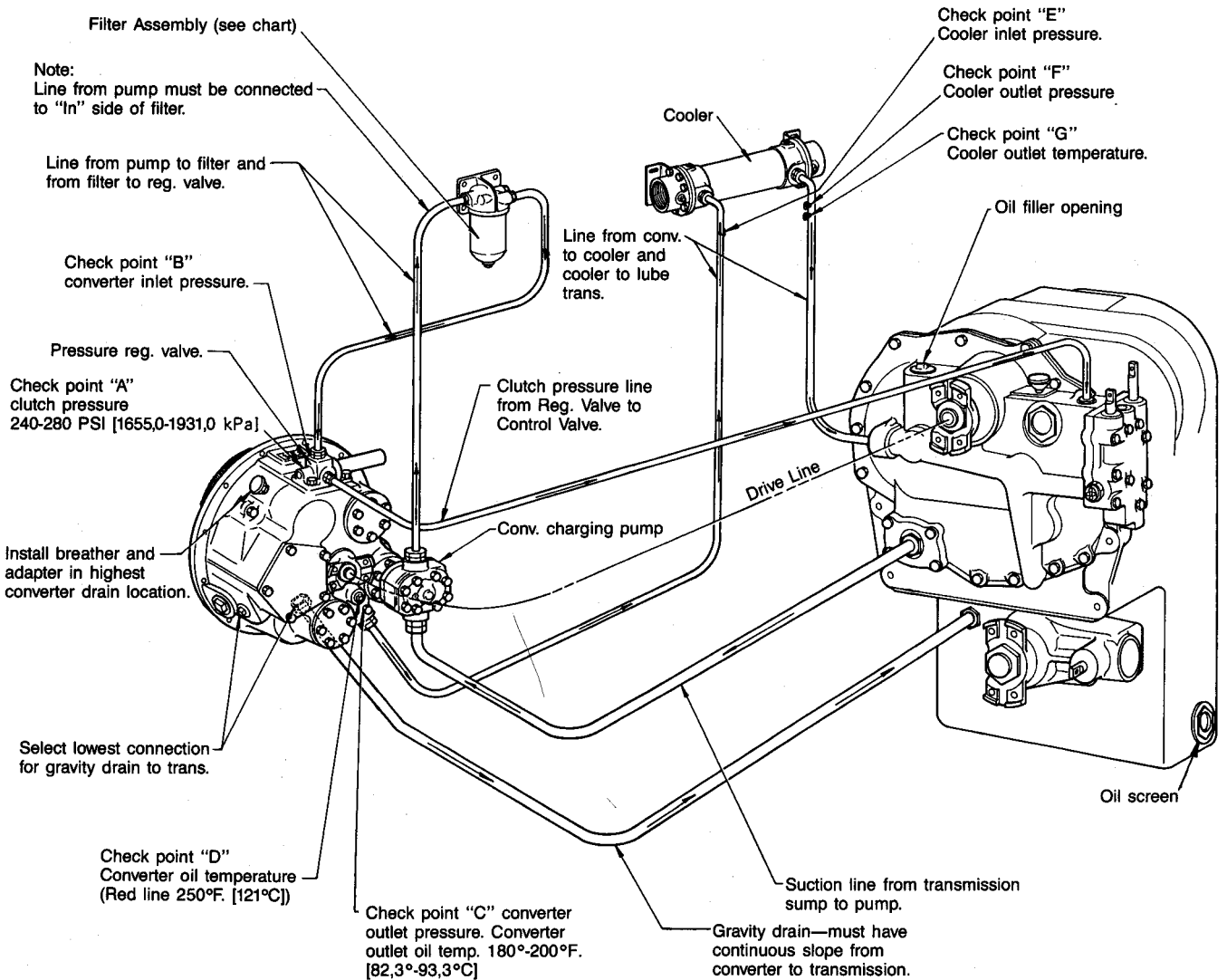
Each disc spring assembly is made up of selected springs to precisely match each part within this assembly. Failure to replace all piston return springs can result in unequal deflection within the spring pack. The result of this imbalance may adversely affect overall life of springs.

Service replacement assemblies are banded together and must be replaced as assembly.



SHIELDED BEARING INSTALLATION

R32000 - C270/C320 EXTERNAL PLUMBING DIAGRAM



Metric dimensions shown in brackets [].

Note: Do not deviate any line size.

FILTER ASSEMBLY CHART

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

Notes:

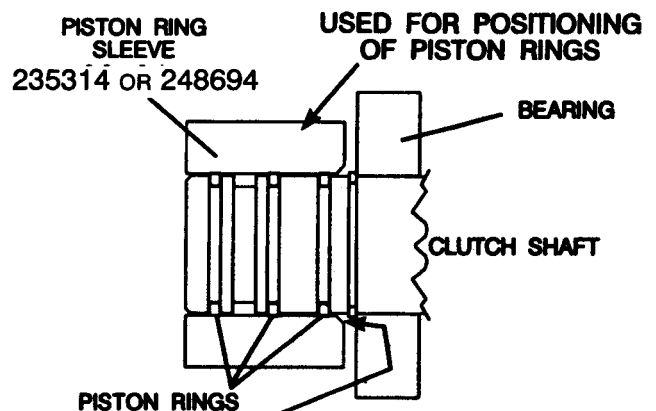
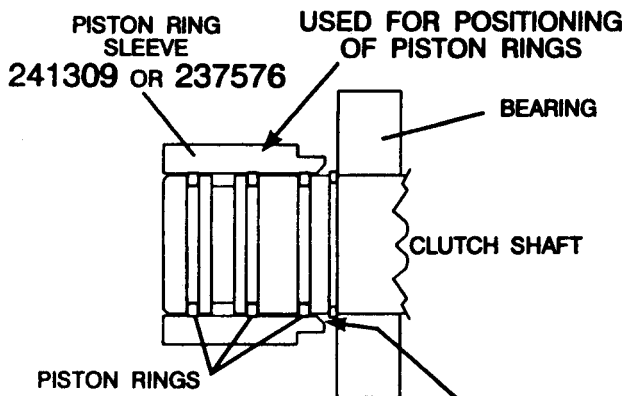
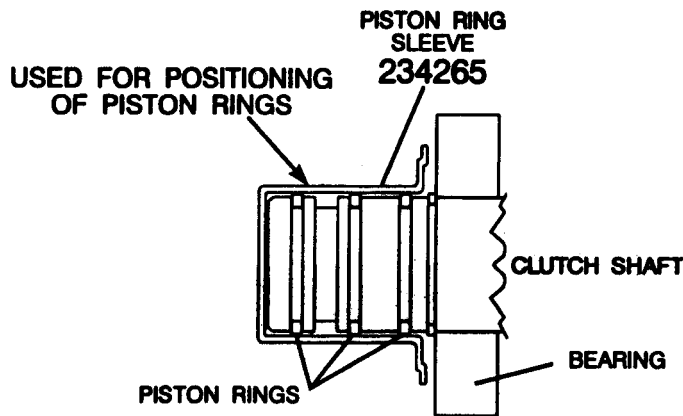
Hose line operating requirements.

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

INSTALLATION INSTRUCTIONS OF NEW NON-METALLIC SEALING RINGS

Proper oil sealing ring (piston ring) installation procedures. Refer to the appropriate transmission maintenance and service manual for disassembly, cleaning, inspection and reassembly.

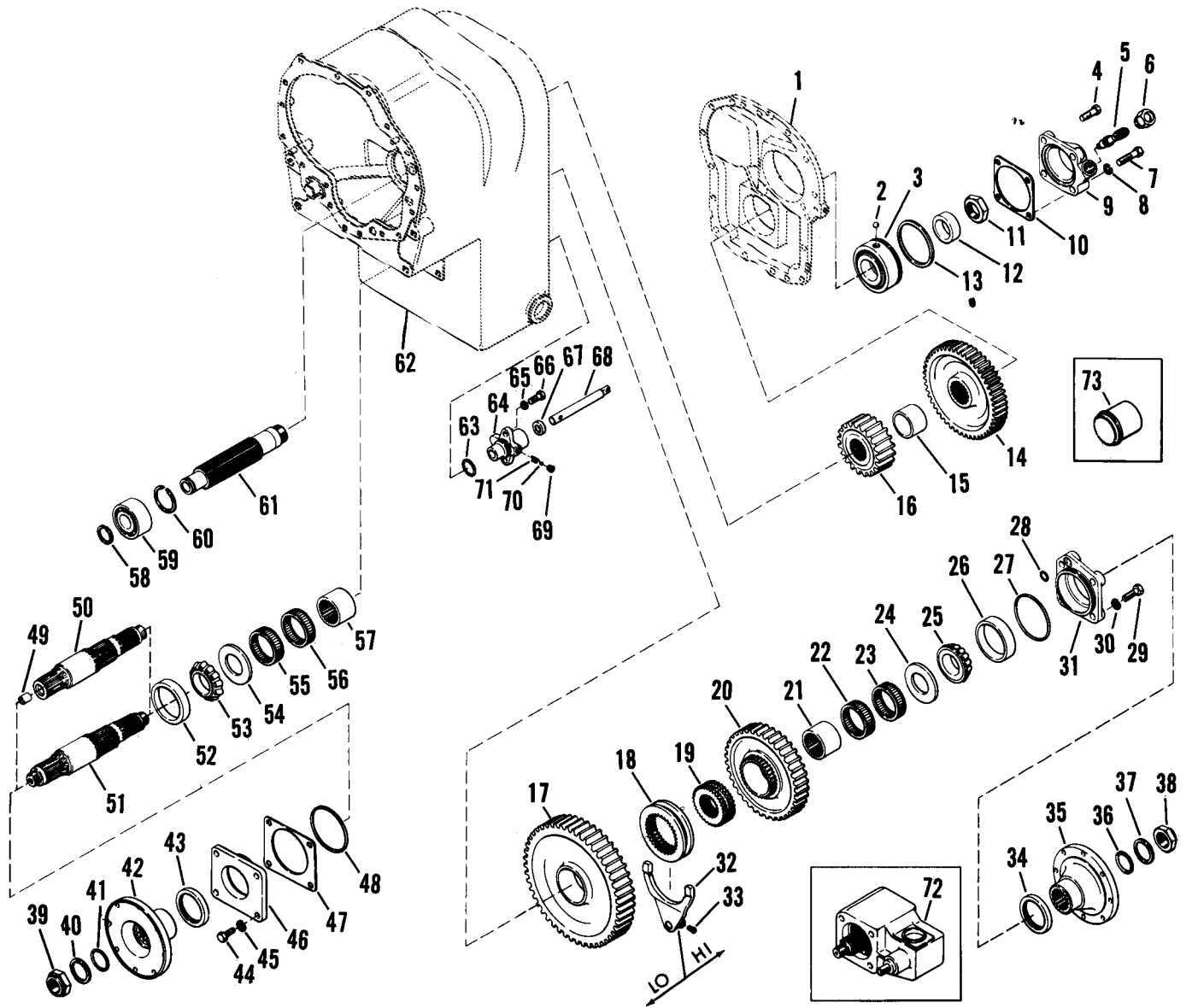
1. Fill the oil sealing ring grooves with a good grade of grease, this will help stabilize the sealing ring in the ring groove for installation.
2. Carefully position the piston ring on the shaft in the inner most ring groove. Hook the piston ring joint.
3. Repeat steps 1, and 2 for the remaining ring or rings making certain all hook joints are fastened securely.
4. Apply a heavy coat of grease to the outer diameter of the rings and shaft. Center the piston rings in the ring groove.
5. When installing the clutch assembly in the transmission case it is recommended a piston ring sleeve P/N's 241309, 237576, 234265, 235314 or 248694 be used to center all of the piston rings in their respective ring grooves. Use extreme caution to not damage piston ring when installing the clutch shaft in the transmission case, or when installing the converter housing or front cover on the clutch shafts.



Be sure that lead in chamfer and intersection of lead in chamfer to piston ring bore is free of burrs and nicks.

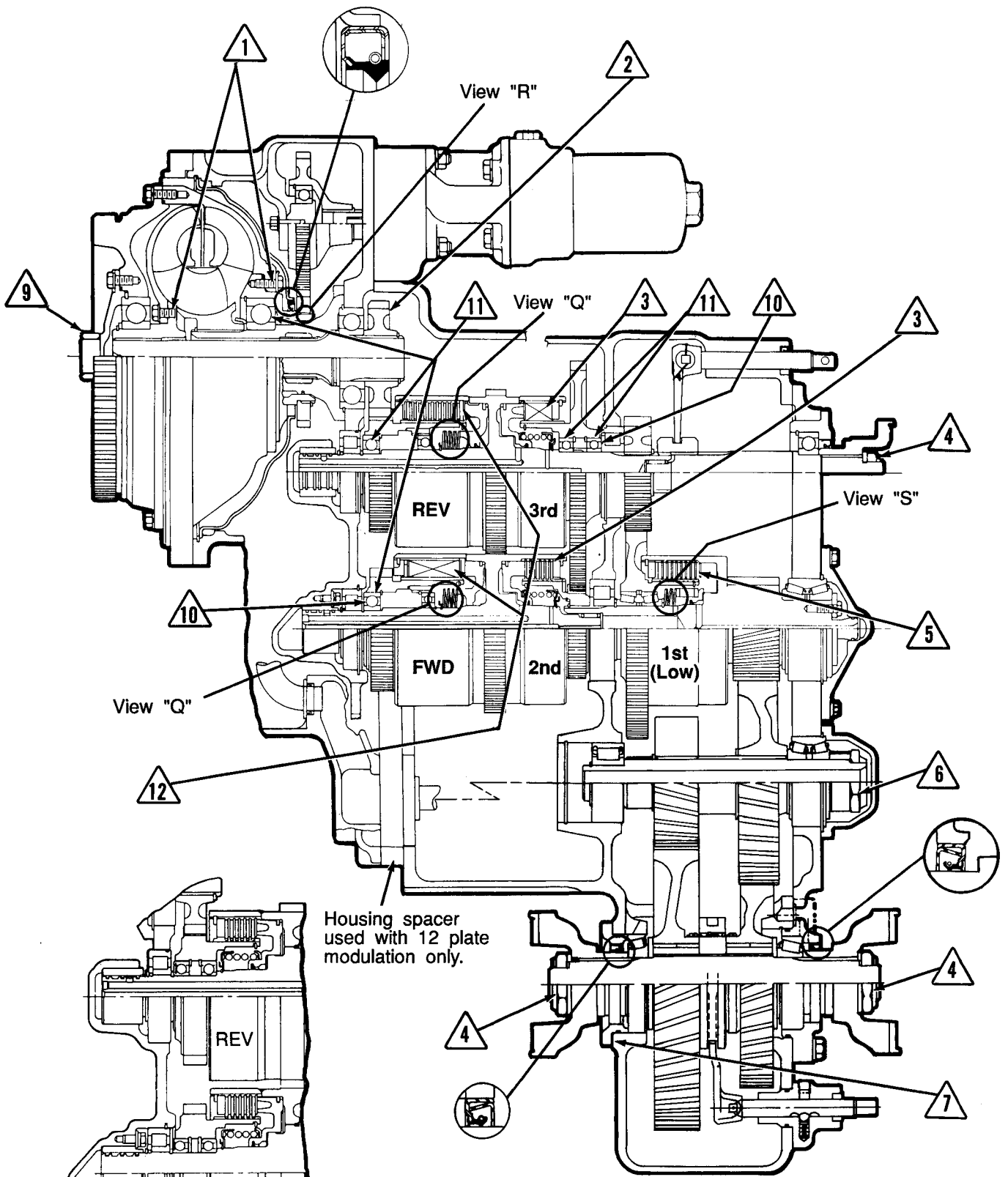
**2420, 24000, 28000, 32000, 33000
34000, 36000 SERIES**

**28000, 32000 SERIES
4TH CLUTCH SHAFT**



**32000 6 & 8 SPEED OUTPUT GROUP
WITH RANGE SHIFT**

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Rear Cover	1	38	Output Flange Nut	1
2	Idler Shaft Rear Bearing Lock Ball	1	39	Output Flange Nut	1
3	Idler Shaft Rear Bearing	1	40	Output Flange Washer	1
4	Idler Shaft Bearing Cap Screw	3	41	Output Flange "O" Ring	1
5	Speedometer Driven Gear	1	42	Output Flange	1
6	Speedometer Tube Nut	1	43	Output Shaft Front Bearing Cap Oil Seal . . .	1
7	Idler Shaft Bearing Capscrew	1	44	Output Shaft Front Bearing Cap Screw	4
8	Idler Shaft Bearing Capscrew Lockwasher . .	4	45	Output Shaft Front Bearing Cap Lockwasher	4
9	Idler Shaft Bearing Cap	1	46	Output Shaft Front Bearing Cap	1
10	Idler Shaft Bearing Cap Gasket	1	47	Front Bearing Cap Shim	AR
11	Idler Shaft Nut	1	48	Front Bearing Cap "O" Ring	1
12	Speedometer Drive Gear or Bearing Spacer .	1	49	Bushing (Used with Disconnect Only)	1
13	Idler Shaft Rear Bearing Locating Ring . . .	1	50	Output Shaft (Used with Disconnect Only) .	1
14	Idler Shaft Gear	1	51	Output Shaft	1
15	Idler Shaft Gear Spacer	1	52	Output Shaft Front Bearing Cup	1
16	Idler Shaft Low Range Gear	1	53	Output Shaft Front Bearing Cone	1
17	Low Range Gear	1	54	Output Gear Thrust Washer	1
18	High Low Shift Hub	1	55	Output Gear Bearing	1
19	Shift Hub Sleeve	1	56	Output Gear Bearing	1
20	High Range Gear	1	57	Output Gear Bearing Inner Race	1
21	Output Gear Inner Race	1	58	Idler Shaft Front Bearing Retainer Ring . . .	1
22	Output Gear Bearing	1	59	Idler Shaft Front Bearing	1
23	Output Gear Bearing	1	60	Idler Shaft Gear Locating Ring	1
24	Output Gear Thrust Washer	1	61	Idler Shaft	1
25	Output Shaft Rear Bearing Cone	1	62	Transmission Case Assembly	1
26	Output Shaft Rear Bearing Cup	1	63	Range Shift Rail Support "O" Ring	1
27	Output Shaft Rear Bearing Cap "O" Ring . .	1	64	Range Shift Rail Support	1
28	Output Shaft Rear Bearing Cap "O" Ring . .	1	65	Range Shift Rail Support Screw Lockwasher	2
29	Output Shaft Rear Bearing Cap Screw	4	66	Range Shift Rail Support Screw	2
30	Output Shaft Rear Bearing Cap Screw Lockwasher	4	67	Range Shift Rail Oil Seal	1
31	Output Shaft Rear Bearing Cap	1	68	Range Shift Rail	1
32	High and Low Range Shift Fork	1	69	Range Shift Rail Detent Plug	1
33	Shift Fork Lock Screw	1	70	Range Shift Rail Detent Ball	1
34	Rear Bearing Cap Oil Seal	1	71	Range Shift Rail Detent Spring	1
35	Rear Output Flange	1	72	Disconnect (Optional)	1
36	Output Flange "O" Ring	1	73	Bearing Cap Bore Plug (Optional)	1
37	Output Flange Washer	1			



6 SPEED TRANSMISSION

NON-MODULATED

- 1. Impeller Hub and Turbine Hub Assembly with Backing Ring and Special Self Locking Screws.
 1. Clean hub mounting surface and tapped holes with solvent. Dry thoroughly being certain tapped holes are dry & clean.
 2. Install backing ring and special self locking screws.
 Tighten screws 40 to 45 Lbs. Ft. [54,3-61,0 N·m]
 Note: Assembly of hub must be complete within a fifteen minute period from start of screw installation. The special screw is to be used for one installation only. If the screw is removed for any reason it must be replaced. The epoxy left in the hub holes must be removed with the proper tap and cleaned with solvent. Dry hole thoroughly and use a new screw for reinstallation.
- 2. Gear to be assembled with long hub length to this side.
- 3. Three clutches, 6-outer steel plates, 6-inner friction plates. Assemble alternately, starting with outer steel plate.
- 4. See Elastic Stop Nut Torque Chart
- 5. Low clutch, 9-outer steel plates, 9-inner friction plates. Assemble alternately, starting with outer steel plate.
- 6. See Elastic Stop Nut Torque Chart
- 7. Shim output shaft bearings to produce 6 to 8 Lbs.-In. [0,68,-0,90 N·m] preload.
- 8. Tighten oil screen ass'y. 10 to 15 Lbs. Ft. [13,6-20,0 N·m] (Not shown)

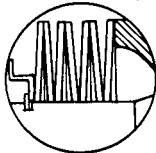
- 9. Heat nose bushing to 200° F° (93°C) before ass'y. of bushing to cover.
- 10. Bearing shield **OUT** on 3rd speed clutch. Bearing shield **IN** on Fwd. & Rev. clutch.
- 11. Must be loose internal fit bearings, No. "3" etched on bearing.
- 12. (12 Plate Modulation) Two clutches, 12-outer steel plates, 12-inner friction plates. Assemble alternately, starting with outer steel plate.

Notes

- A. - Use Permatex & Crane Sealer only where specified.
- B. - All lead in chamfers for oil seals, piston rings & "O" rings must be smooth & free from burrs. Inspect at ass'y.
- C. - Lubricate all piston ring grooves & "O" rings with oil before ass'y.
- D. - Apply very light coat of Permatex No. 2 to O.D. of all oil seals before ass'y.
- E. - After assembly of parts using Permatex or Crane sealer, there must not be any free or excess material that could enter the oil circuit.
- F. - Apply light coat of Crane Sealer to all pipe plugs.
- G. - Apply a thin coating of grease between seal lips on lip type seals prior to ass'y.
- H. - Apply light coat of Permatex No. 2 to all thru hole stud threads.

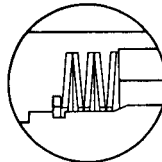
NOTE: The friction discs in the low clutch has a higher co-efficient rating than the friction discs in the other clutches, therefore the discs must not be mixed. The low clutch inner disc can be identified by an "X" stamped on one side of the inner teeth. The low clutch inner disc also has a strip of non-soluble yellow paint sprayed on the outer edge of the disc.

View "Q" 2 Places Modulation only



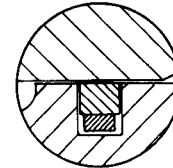
Low Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining four springs to be stacked alternately reversed as shown.

View "S"



Forward & Reverse Clutch Return Springs. Concave side of first spring to be placed against clutch piston. Remaining six springs of each clutch to be stacked alternately reversed as shown. See note on page 77.

View "R"

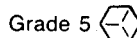


Enlarged view of Piston Ring & Expander
 Note: Expander gap to be approx. 180° from ring hook joint to aid ring assembly.

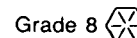
NOTE: Metric dimensions shown in brackets [].

ELASTIC STOP NUT TORQUE

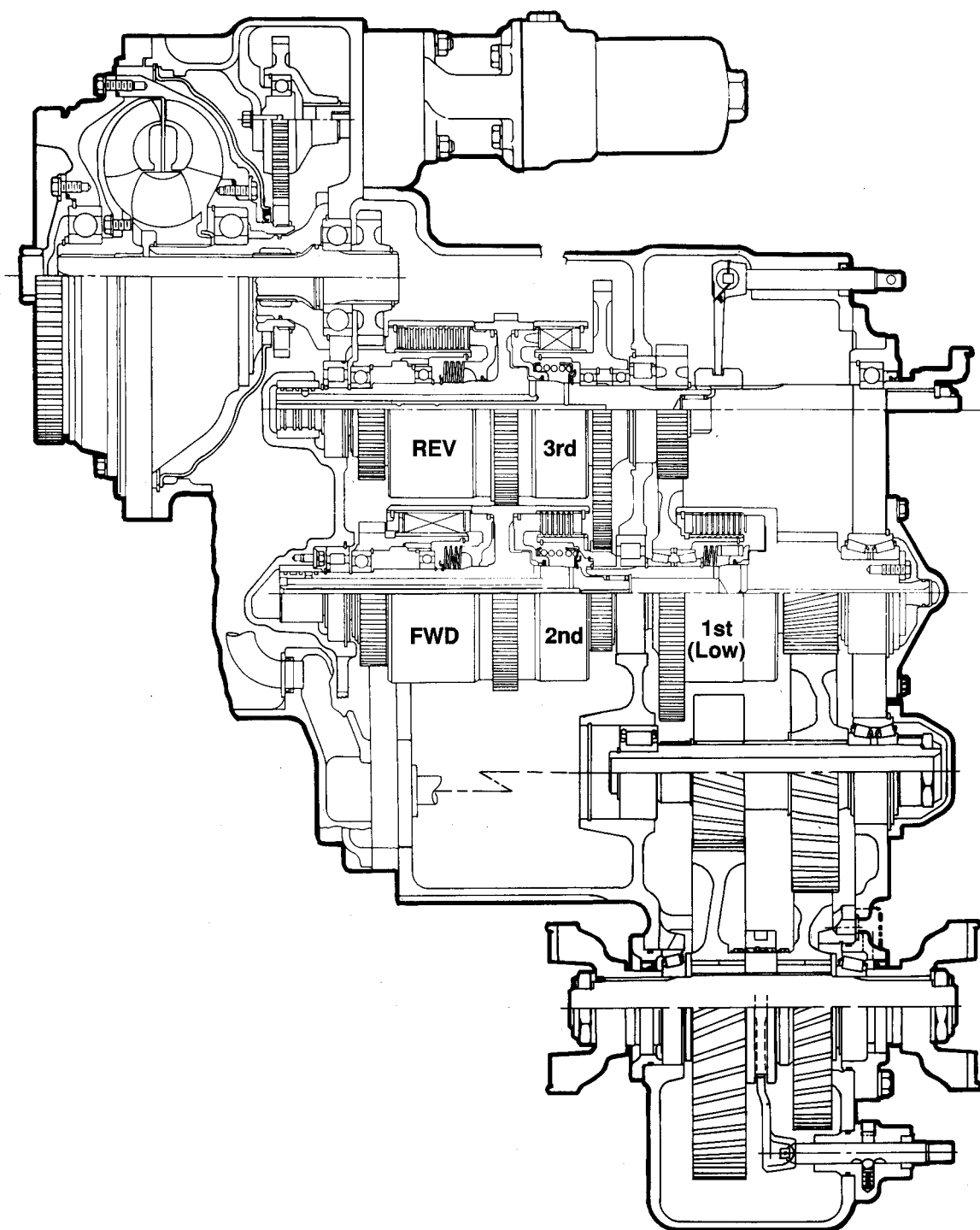
THREAD SIZE	LB.-FT.	[N·m]
1" - 20	150 - 200	[203,4 - 271,1]
1¼" - 18	200 - 250	[271,2 - 338,9]
1½" - 18	300 - 350	[406,8 - 474,5]
1¾" - 12	400 - 450	[542,4 - 610,1]



Torque Specification for Lubricated or Plated Screw Threads



NOM. SIZE	FINE THREAD		COARSE THREAD		FINE THREAD	COARSE THREAD		
	LB-FT	[N·M]	LB-FT	[N·M]		LB-FT	[N·M]	
5625	91 - 100	[123,4 - 135,5]	82 - 90	[111,2 - 122,0]	128 - 141	[173,6 - 191,1]	115 - 127	[156,0 - 172,2]
5000	64 - 70	[86,8 - 94,9]	57 - 63	[77,3 - 85,4]	90 - 99	[122,1 - 134,2]	80 - 88	[108,5 - 119,3]
4375	41 - 45	[55,6 - 61,0]	37 - 41	[50,2 - 55,5]	58 - 64	[78,7 - 86,7]	52 - 57	[70,6 - 77,2]
3750	26 - 29	[35,3 - 39,3]	23 - 25	[31,2 - 33,8]	37 - 41	[50,2 - 55,5]	33 - 36	[44,8 - 48,8]
3125	16 - 20	[21,7 - 27,1]	12 - 16	[16,3 - 21,6]	28 - 32	[38,0 - 43,3]	26 - 30	[35,3 - 40,6]
2500	9 - 11	[12,3 - 14,9]	8 - 10	[10,9 - 13,5]	11 - 13	[15,0 - 17,6]	9 - 11	[12,3 - 14,9]



R & HR MODEL 6 & 8 SPEED

The R & HR 32000 6 speed transmission is the same as the 3 speed R & HR 32000 except the difference being in the idler and output shafts. The 6-speed unit has a gear added to the idler shaft and the output shaft has a high and low range shift. The 32000 8 speed transmission is the same as the 6 speed except the 8 speed has a 4th speed clutch.

The 6-speed transmission has 3 working range shifts and 3 travel range shifts.

Gear ratio determines working and travel ranges. They are as follows:

1st - 2nd and 4th working range. 3rd - 5th and 6th travel range.

NOTE: Range shift from low to high must be made with machine stopped.

DISASSEMBLY

Figure 55 shows the idler shaft with one gear. The 6-speed unit will have two gears and a heavier front bearing. See Figure 55A below:

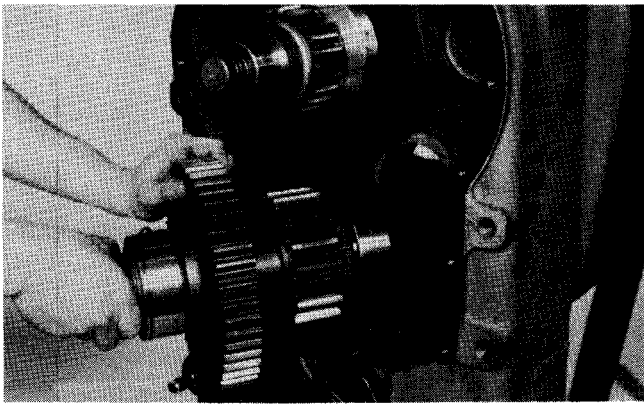


Figure 55A

6 & 8 speed idler shaft, gear and bearing assembly. **NOTE: Do not lose rear bearing lock ball.**

6 & 8 SPEED OUTPUT DISASSEMBLY

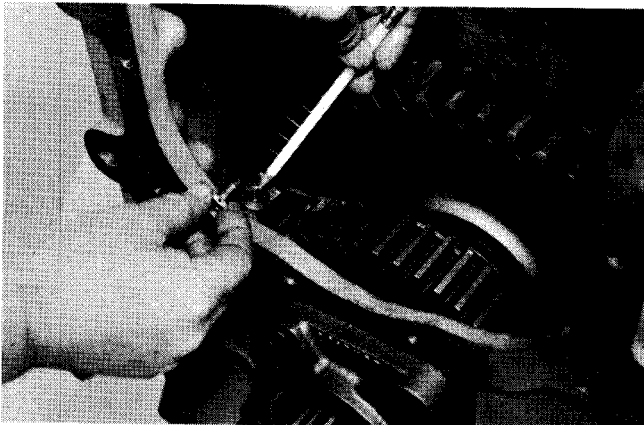


Figure 1

With all clutches and shafts removed, cut lockwire on range shift fork lockscrew. Remove fork lockscrew.

The 8-speed transmission has 8 forward speeds and 8 reverse speeds.

The 8-speed transmission has 4 working range shifts and 4 travel range shifts.

Gear ratio determines working and travel ranges. They are as follows:

1st - 2nd - 3rd and 5th working ranges 4th - 6th - 7th and 8th travel range.

NOTE: Range shift from low to high must be made with machine stopped.

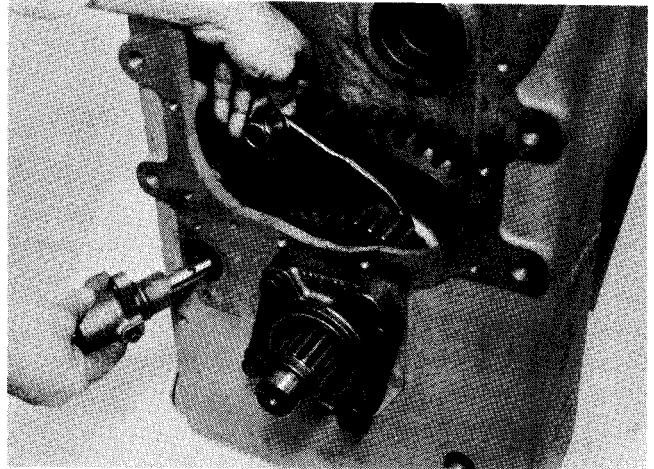


Figure 2

Remove range shift rail support bolts. Remove rail support, rail and range shift fork.

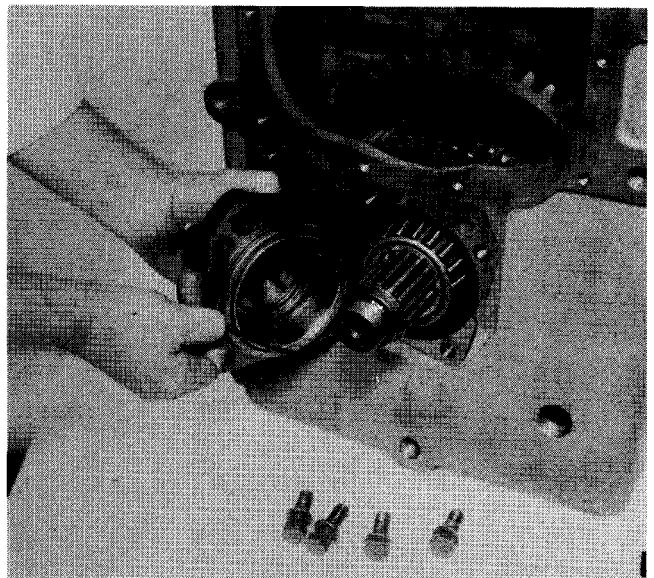


Figure 3

Remove output shaft rear bearing cap bolts and bearing cap.

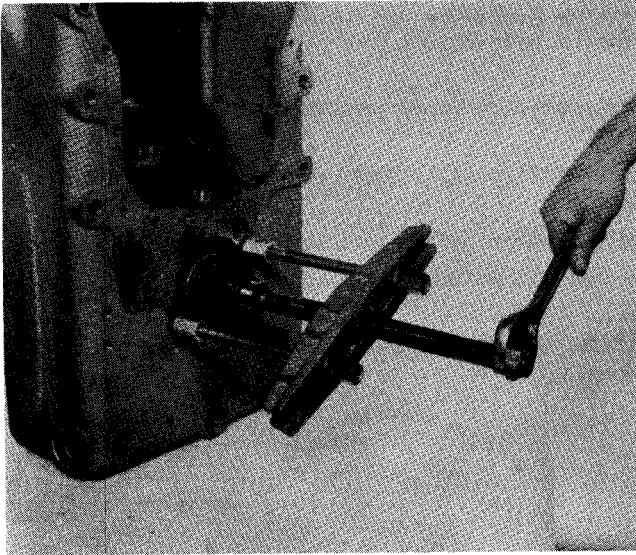


Figure 4

Remove front output flange nut, washer, "O" ring, flange and bearing cap from housing. Block output gears. Push output shaft from rear through gears and taper bearing.

Proceed with Figure 72 through 216 in the R & HR 32000 Series 3-Speed Maintenance Section then refer to Figure 5 below.

REASSEMBLY

(See cleaning and inspection page.)

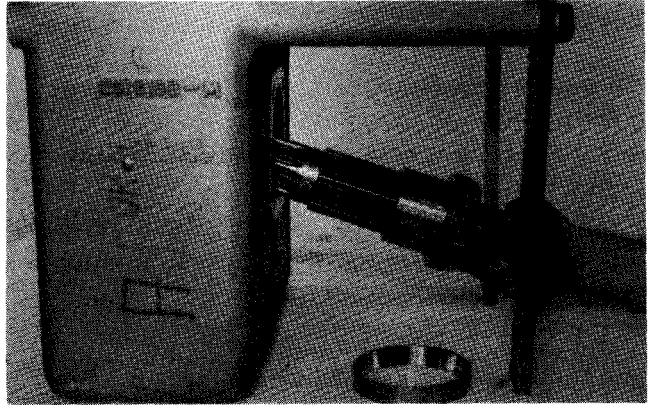


Figure 6

Position high and low range gears, shift hub, hub sleeve and needle bearings in transmission case as shown in Figure 5. Insert output shaft, front bearing and thrust washer through output gears. Use caution as not to damage high and low range gear needle bearings.

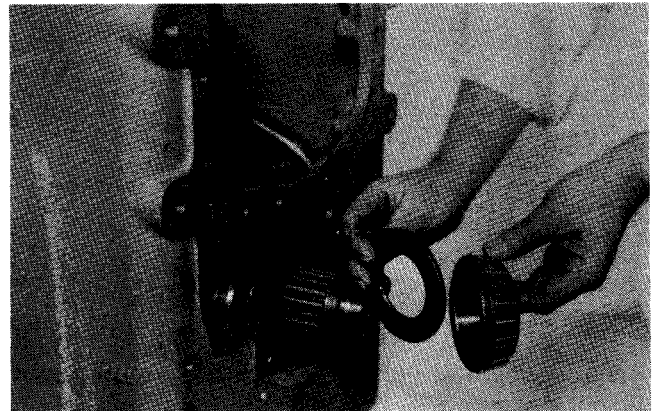


Figure 7

Position output gear thrust washer and rear taper bearing on output shaft.

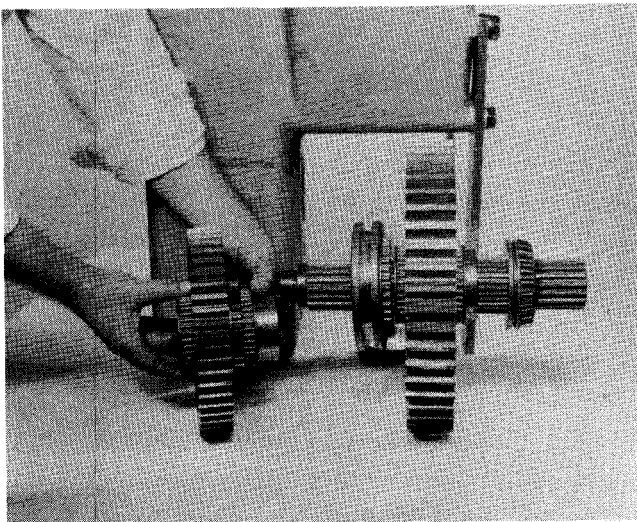


Figure 5

View of output shaft as it would be positioned in transmission case. **NOTE:** Front bearing cone and output gear thrust washer shouldered on shaft with large diameter of bearing in.

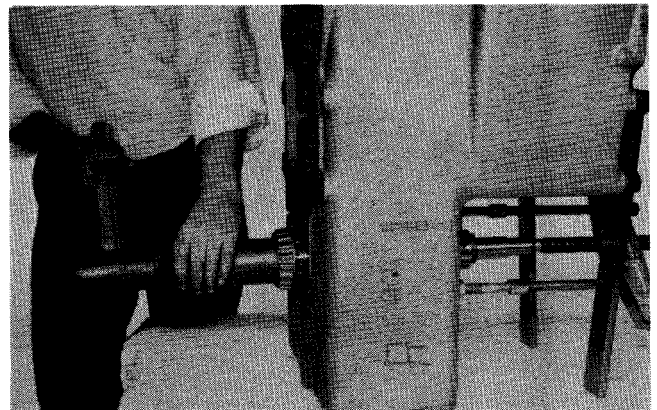


Figure 8

Block output shaft from the front and install rear taper bearing.

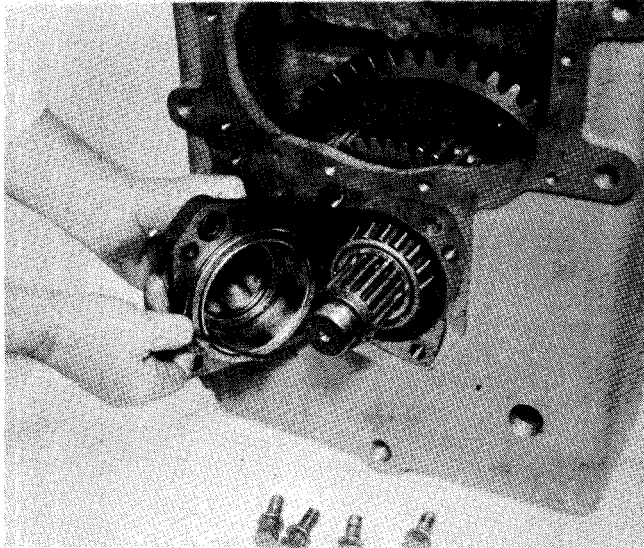


Figure 9

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.

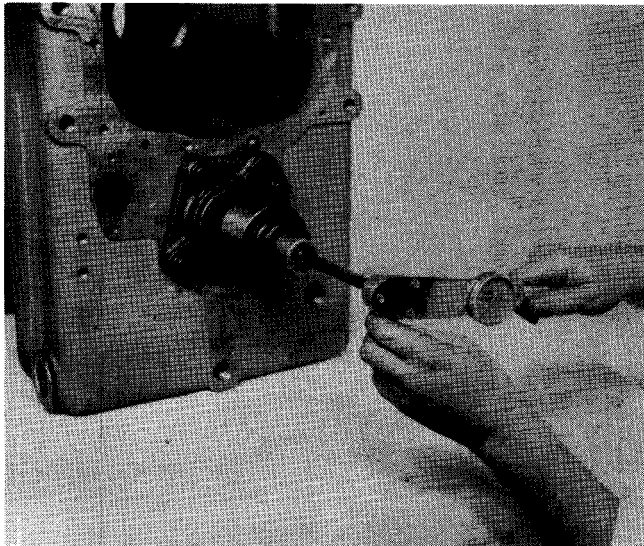


Figure 10

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.

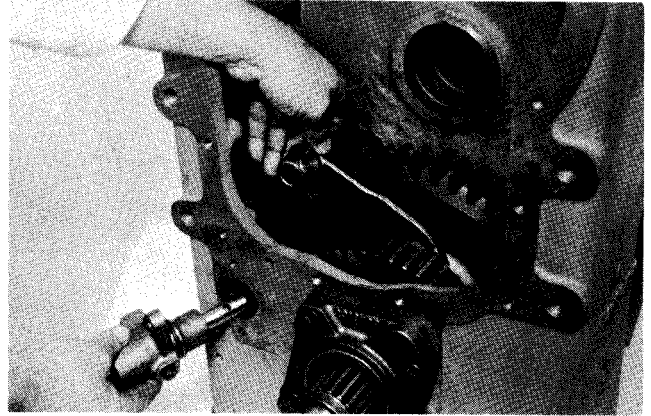


Figure 11

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.

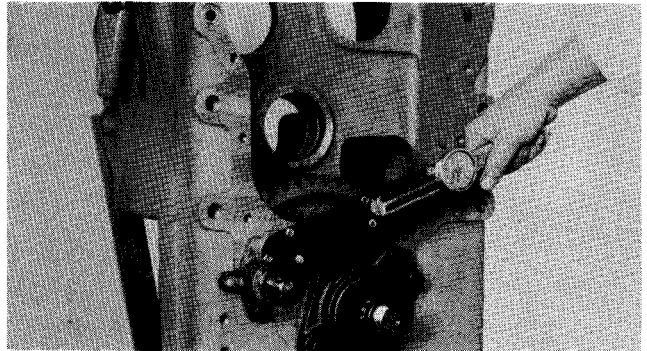


Figure 12

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

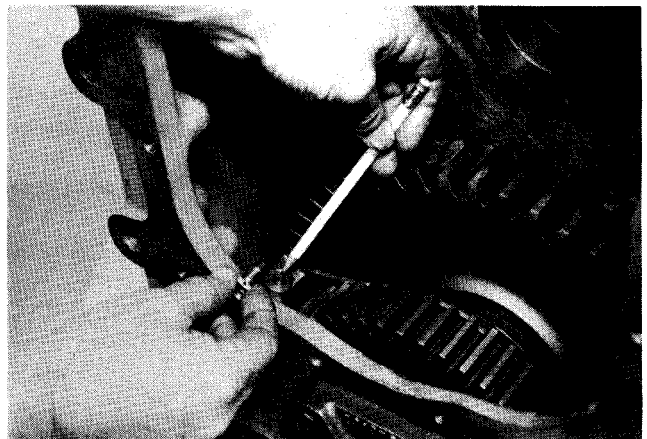
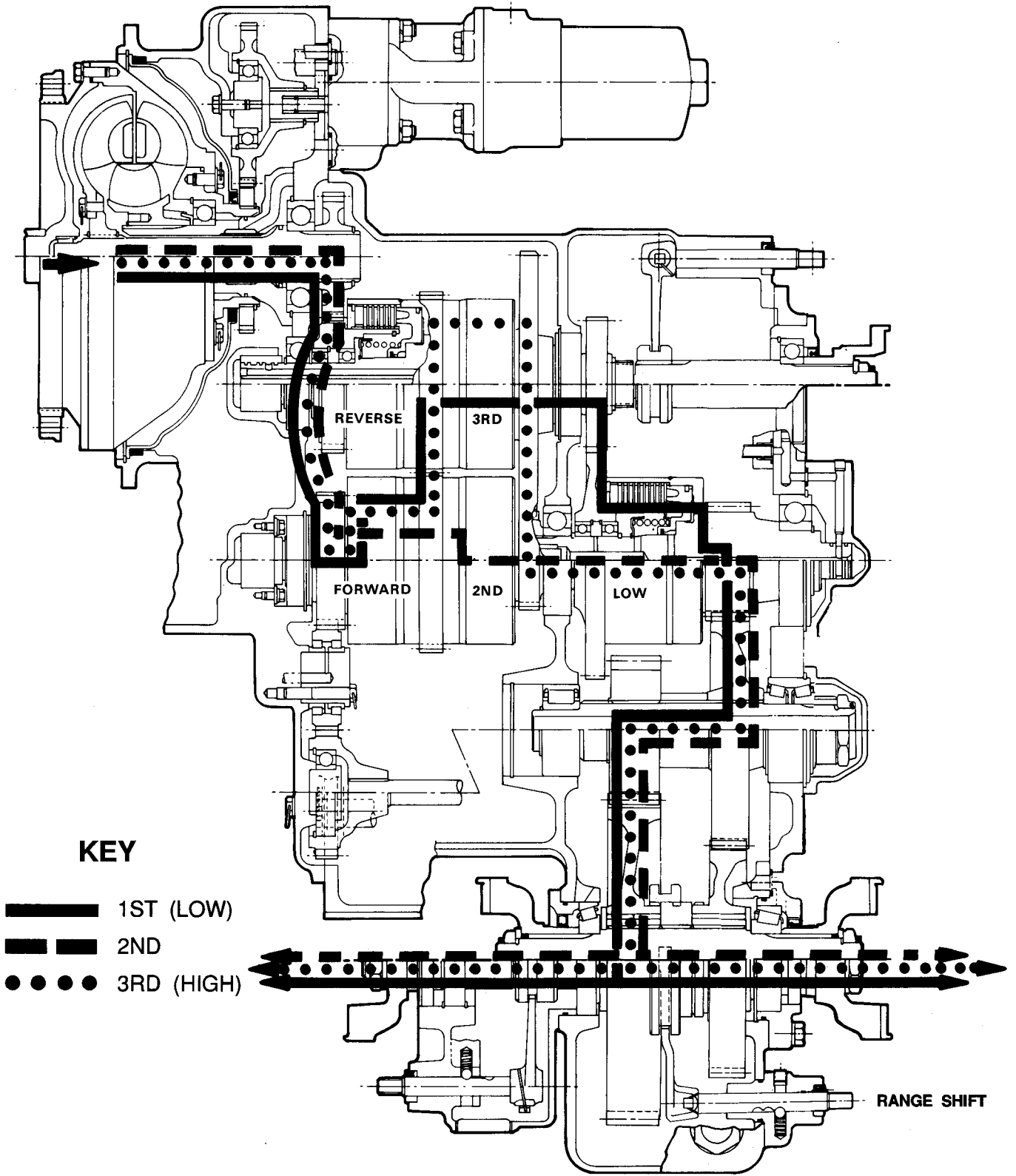


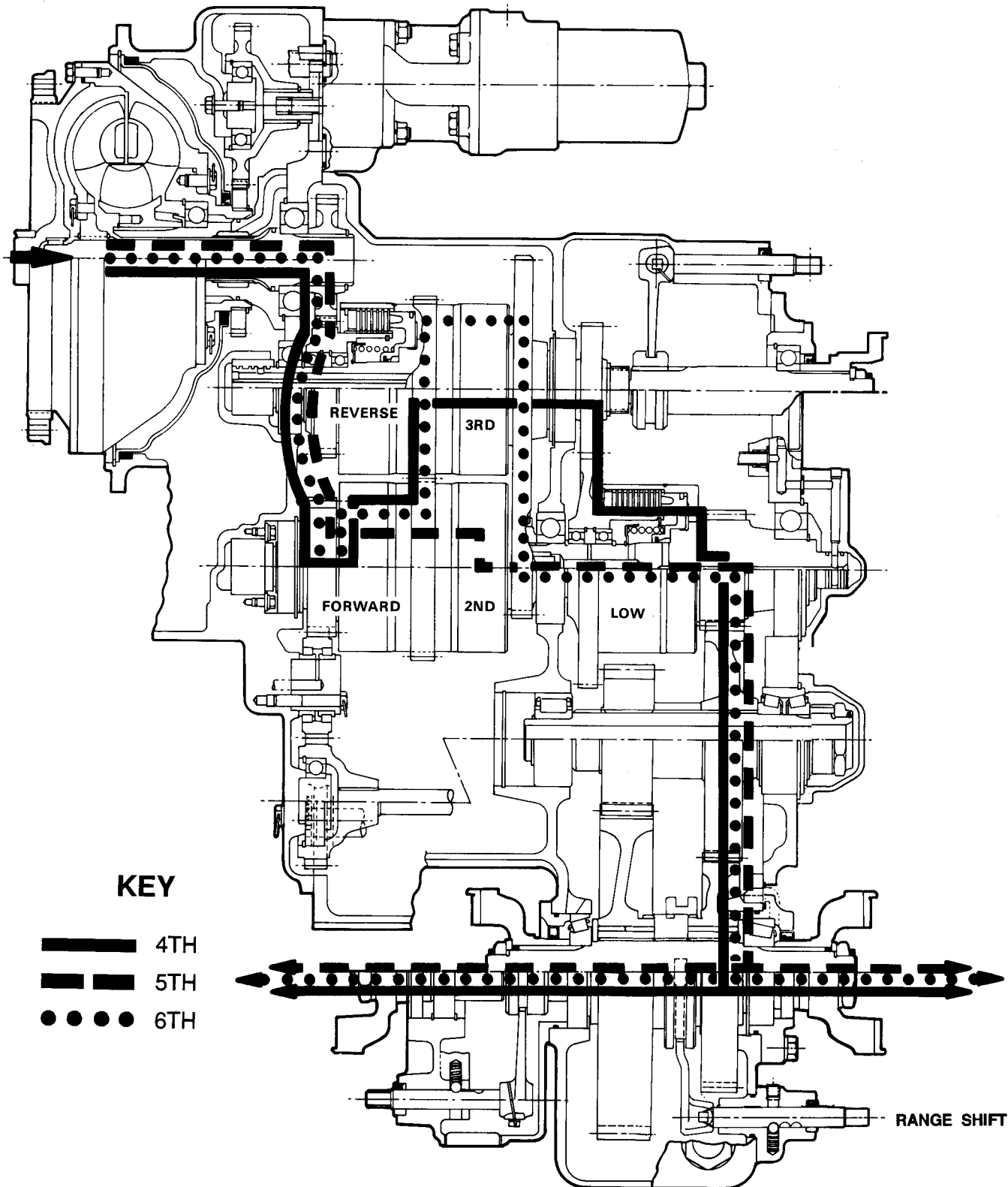
Figure 13

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

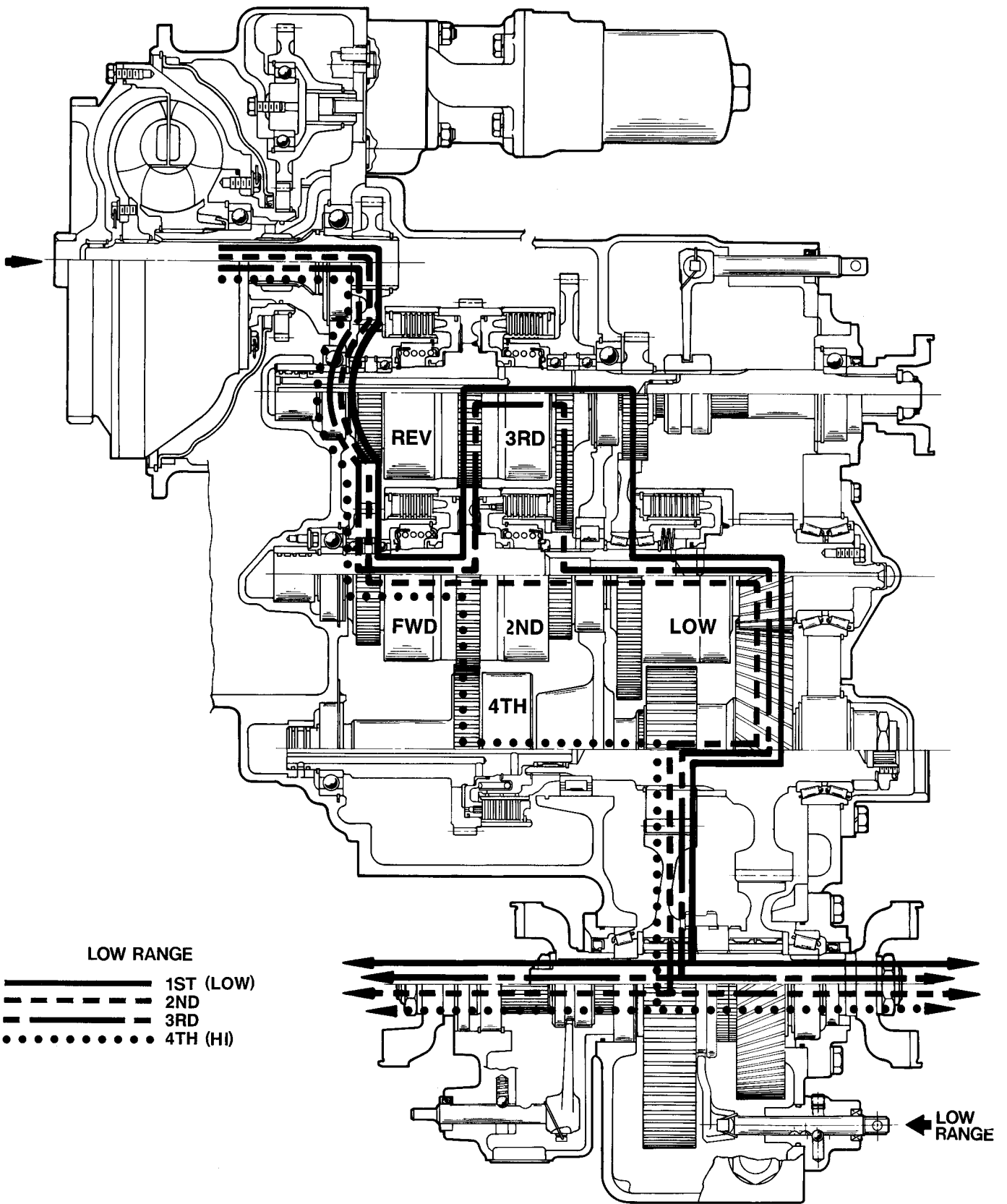
Proceed with Figure 228 in the R & HR 32000 3-Speed Section.



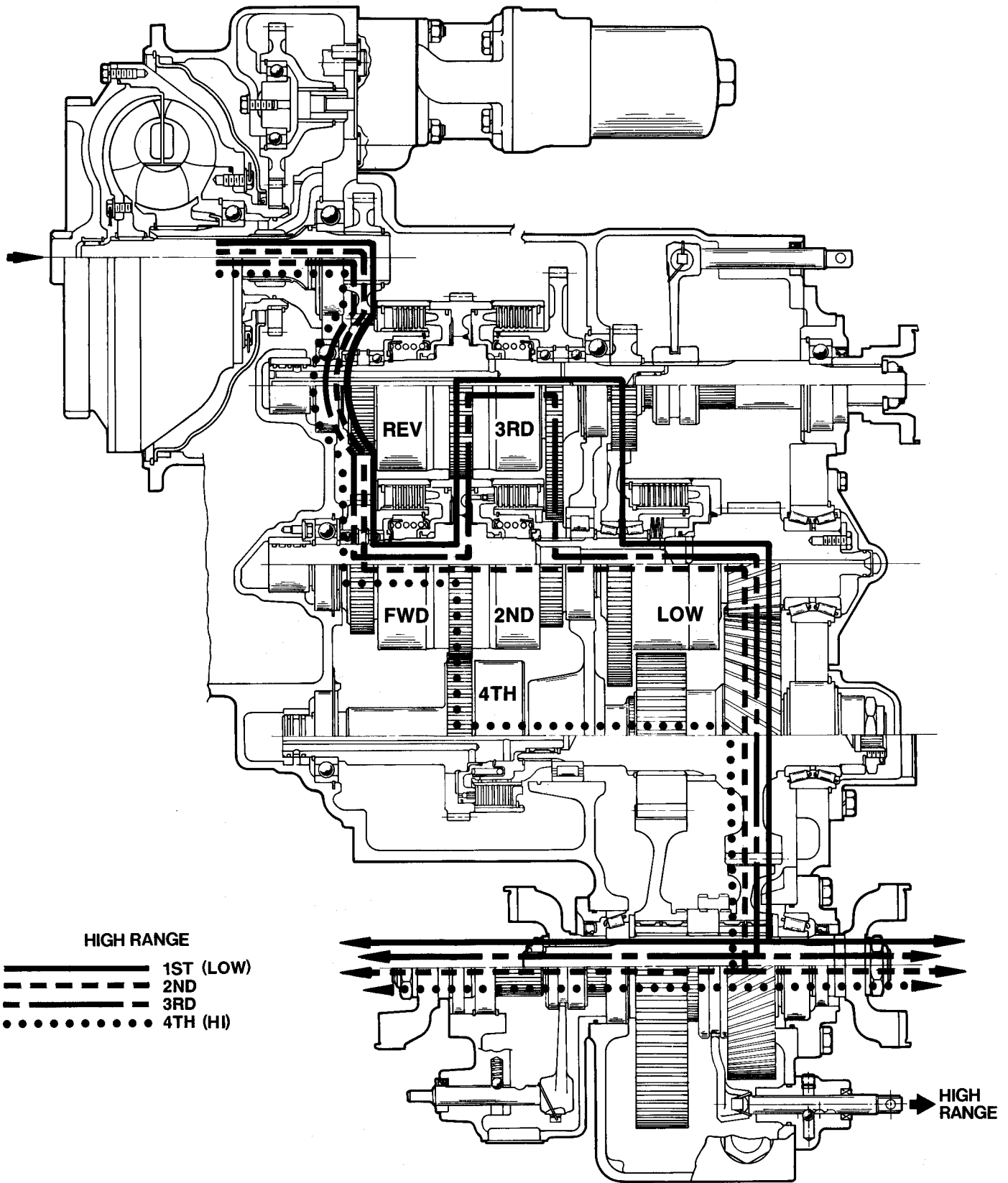
6 SPEED TRANSMISSION LOW RANGE



6 SPEED TRANSMISSION HI RANGE

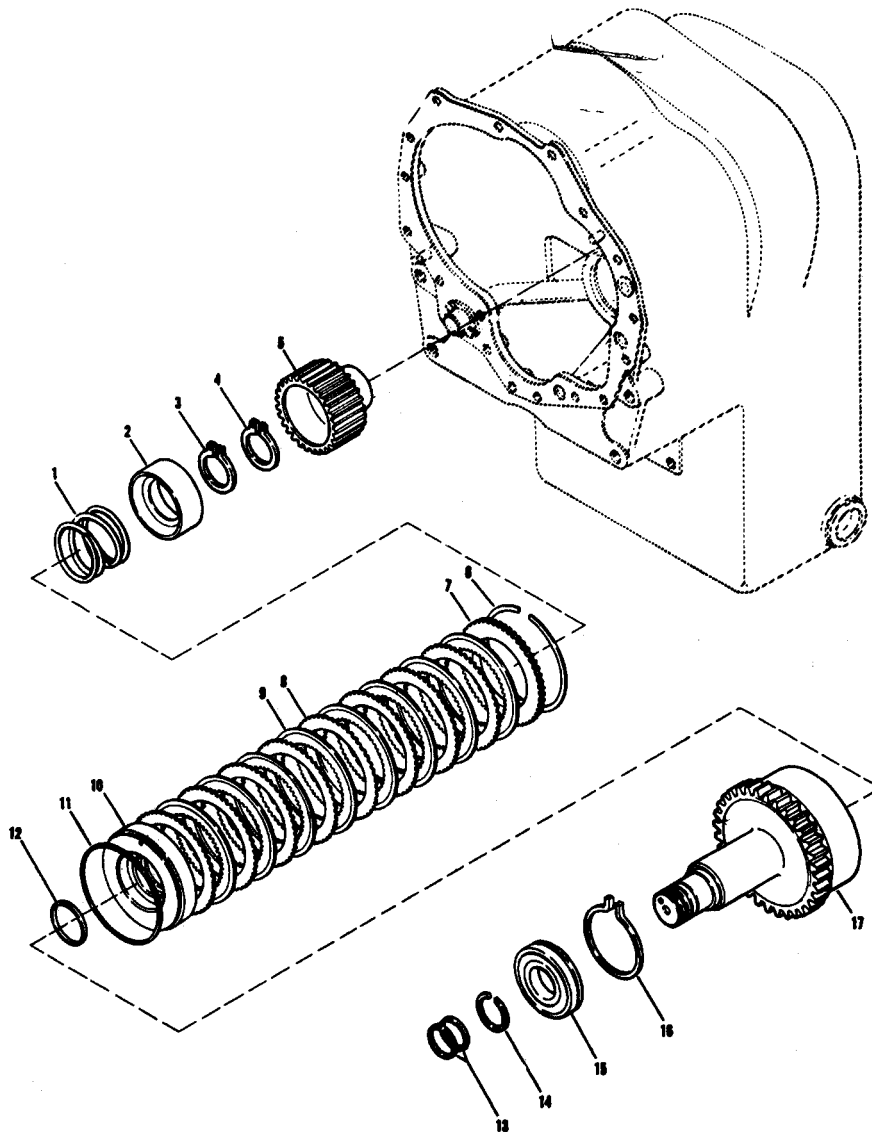


8 SPEED TRANSMISSION LOW RANGE



8 SPEED TRANSMISSION HIGH RANGE

8 SPEED CLUTCH SECTION



4TH SPEED CLUTCH GROUP 8 SPEED TRANSMISSION

ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Piston Return Spring.....	1	10	Clutch Piston Assembly.....	1
2	Spring Retainer.....	1	11	Clutch Piston Seal - Outer.....	1
3	Spring Retainer Snap Ring.....	1	12	Clutch Piston Seal - Inner.....	1
4	Clutch Hub Snap Ring.....	1	13	4th Speed Shaft Piston Ring.....	2
5	4th Speed Clutch Hub.....	1	14	Front Bearing Retainer Ring.....	1
6	Backing Plate Snap Ring.....	1	15	4th Speed Shaft Front Bearing.....	1
7	Clutch Disc Backing Plate.....	1	16	Front Bearing Snap Ring.....	1
8	Clutch Outer Disc.....	7	17	4th Speed Shaft & Plug Assembly.....	1
9	Clutch Inner Disc.....	8			

8 SPEED SECTION

The difference between the 6 speed transmission and the 8 speed is that the 8 speed has an added 4th speed clutch. This section will describe the converter housing removal and the 4th speed clutch repair.

DISASSEMBLY

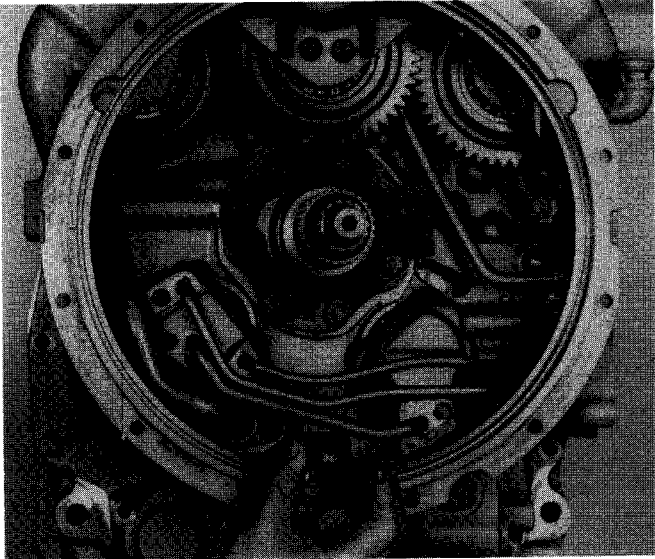


Figure 1

Remove bolts securing converter housing to transmission housing. Support converter housing with a chain fall. Using spreading type snap ring pliers, spread ears on the fourth speed clutch front bearing retaining ring. Holding snap ring open, tap converter housing from transmission housing. The fourth clutch will remain in the transmission housing.

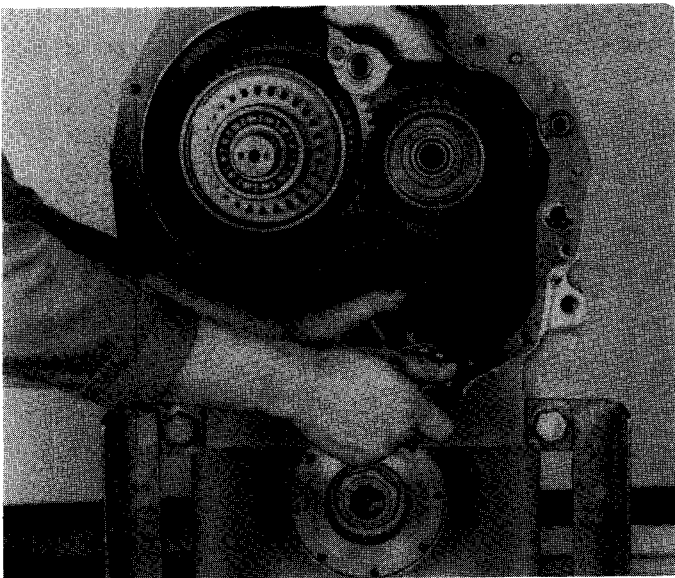


Figure 2

Remove fourth speed clutch assembly from transmission housing

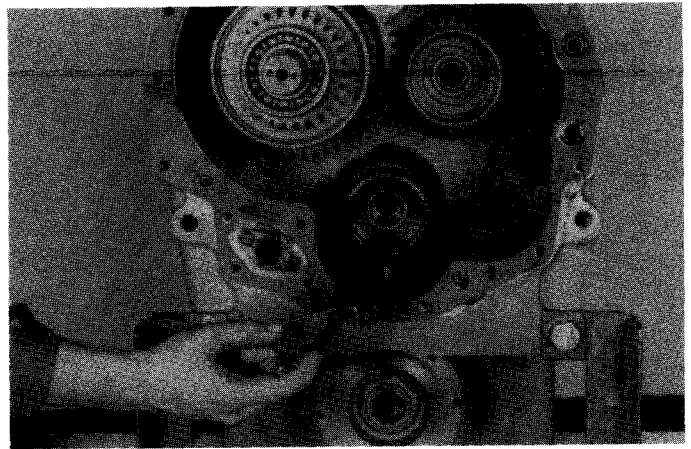


Figure 3

Remove fourth speed clutch disc hub retainer ring.

Figure

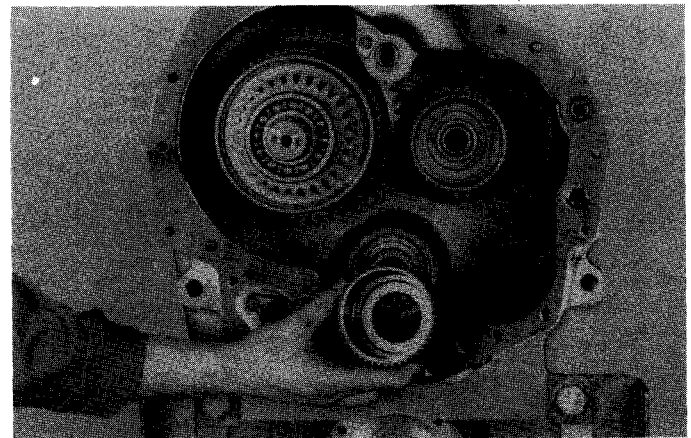


Figure 4

Remove fourth speed clutch disc hub.

4TH SPEED CLUTCH DISASSEMBLY

(8 speed transmission only)

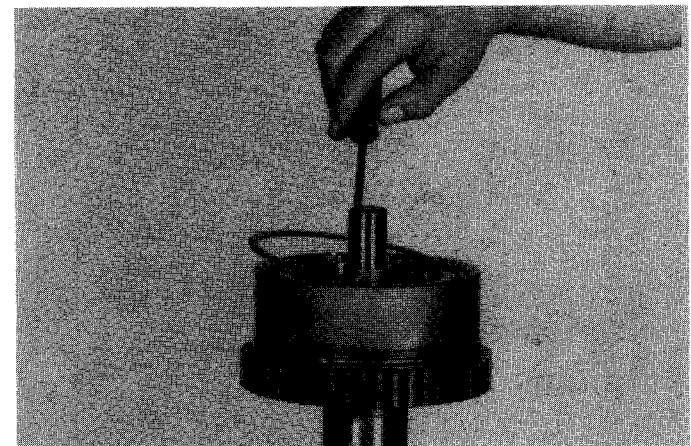


Figure 5

Remove end plate retainer.

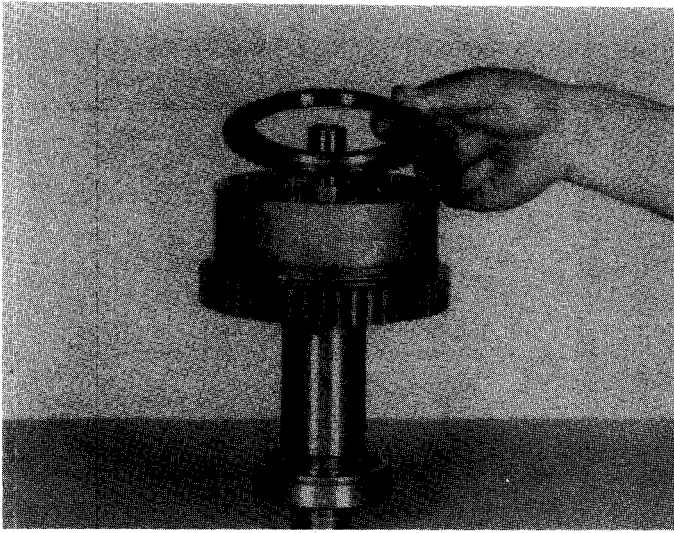


Figure 6

Remove end plate.

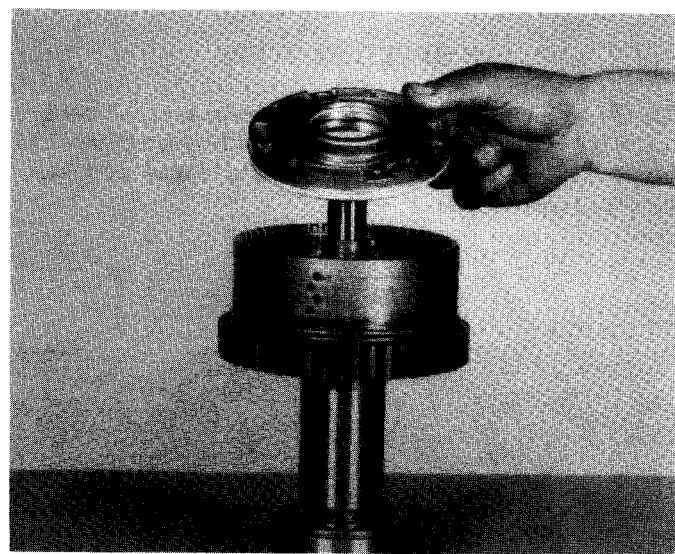


Figure 9

Remove clutch piston.

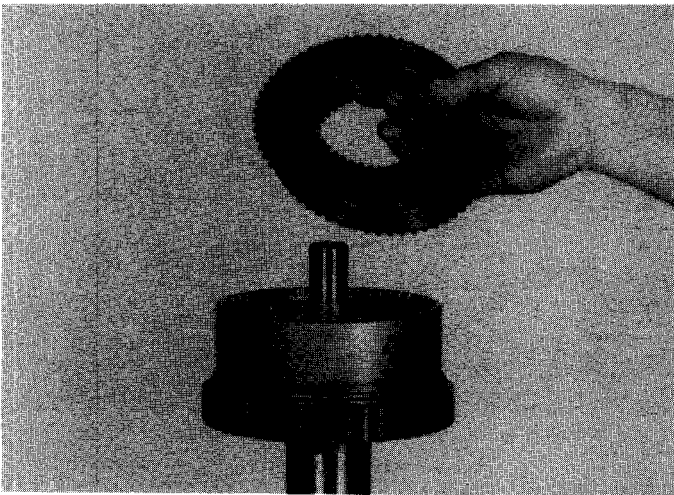


Figure 7

Remove inner and outer clutch discs.

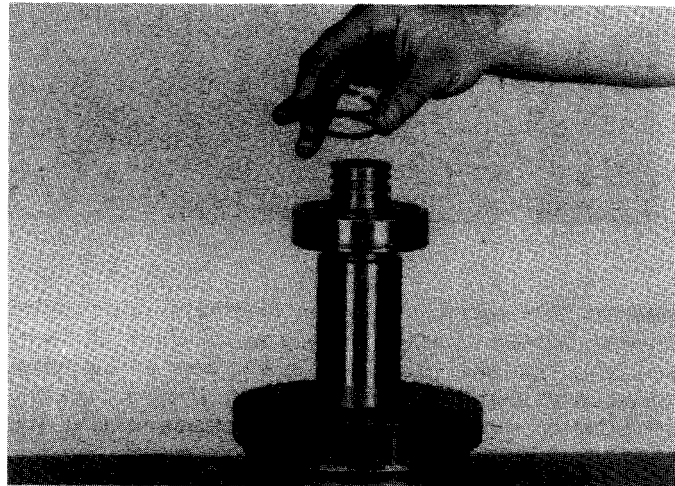


Figure 10

Remove clutch shaft piston rings and expander springs. See note in Figure 103.

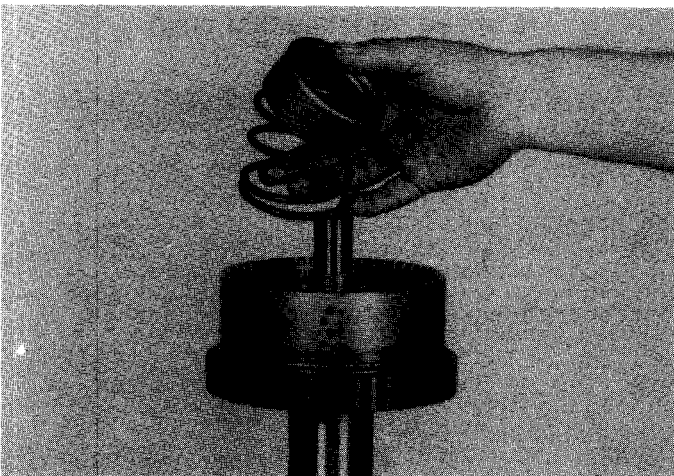


Figure 8

Compress spring retainer washer. Remove spring retainer snap ring. Release tension on spring retainer. Remove snap ring, spring retainer and return spring.

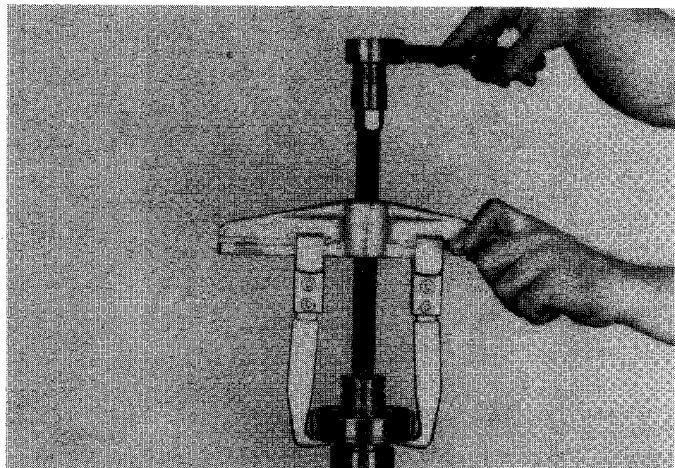


Figure 11

Remove clutch shaft bearing retainer ring. Remove shaft bearing.

See cleaning and inspection page.

**4TH SPEED CLUTCH
REASSEMBLY
(8 speed transmission only)**

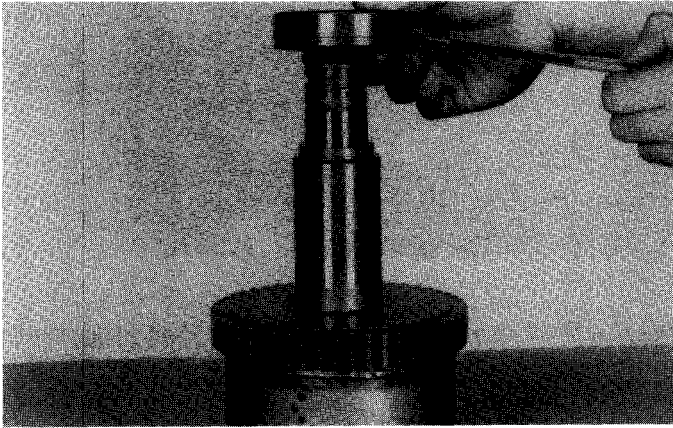


Figure 12

Install clutch shaft bearing. **NOTE:** Bearing snap ring groove must be down.

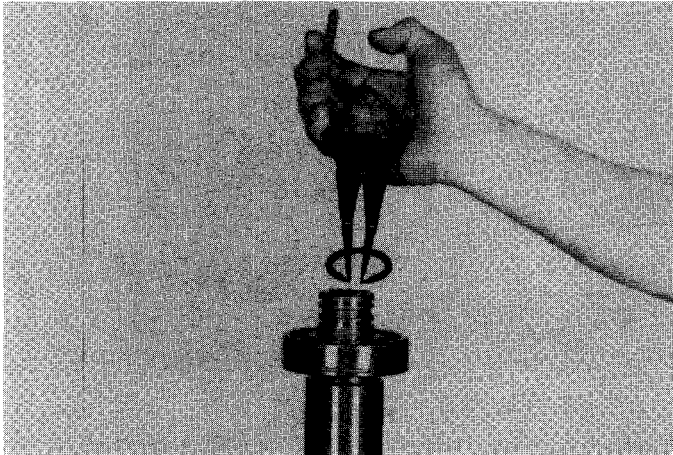


Figure 13

Install bearing retainer ring.

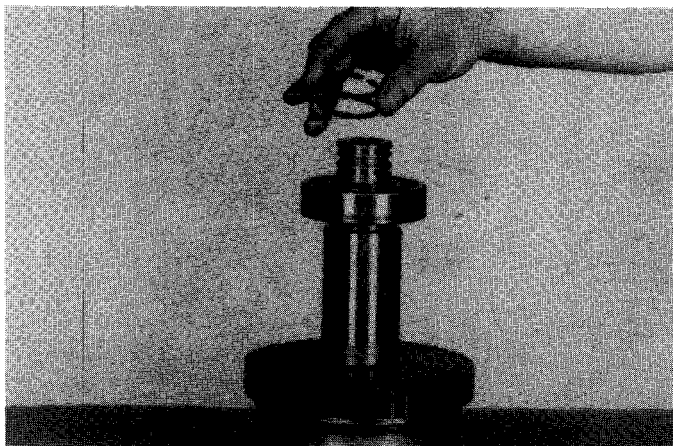


Figure 14

Install piston rings as explained on page 79.

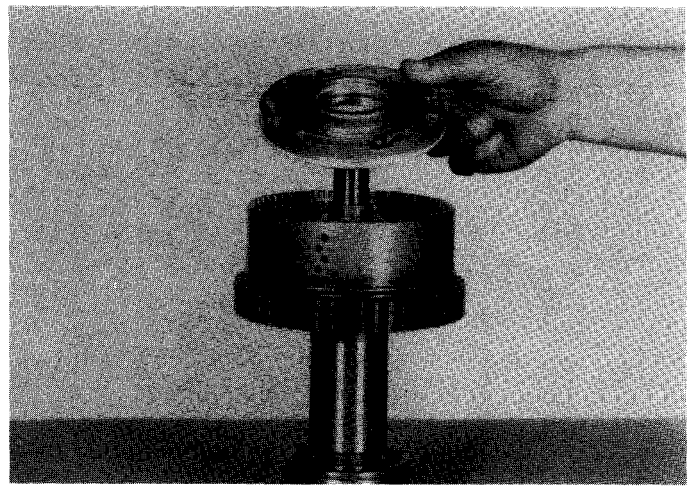


Figure 15

Install new clutch piston inner and outer sealing rings. Insert clutch piston in clutch drum. Use caution as not to damage sealing rings.

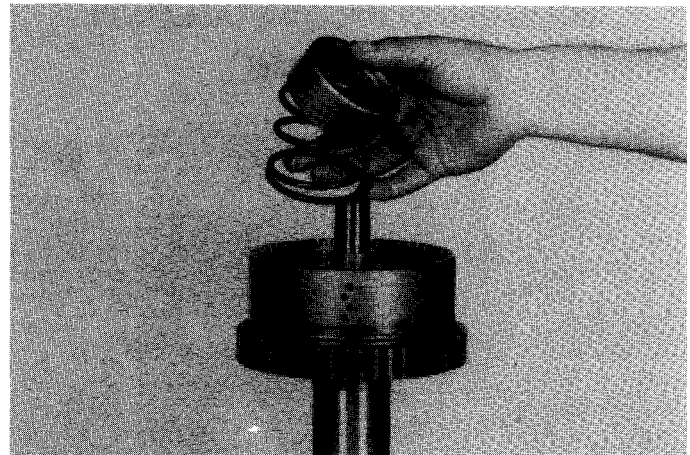


Figure 16

Install clutch piston return spring, spring retainer and retainer snap ring. Install one friction disc. Alternate steel and friction discs until the proper amount of discs are installed. First disc next to piston is friction, last disc installed is friction. (8 friction - 7 steel).

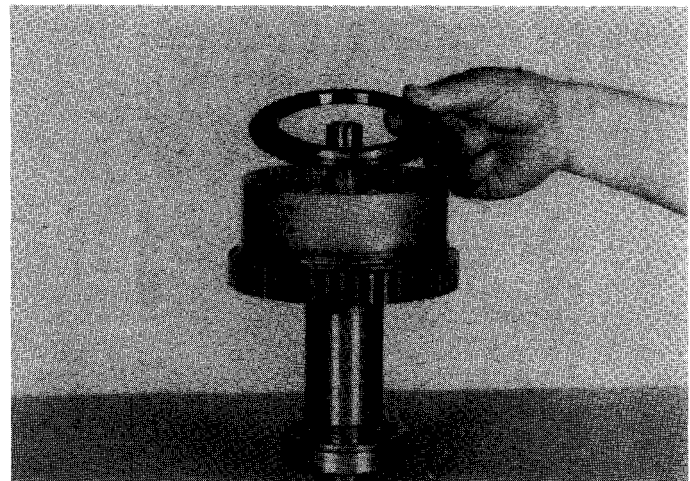


Figure 17

Install end plate.

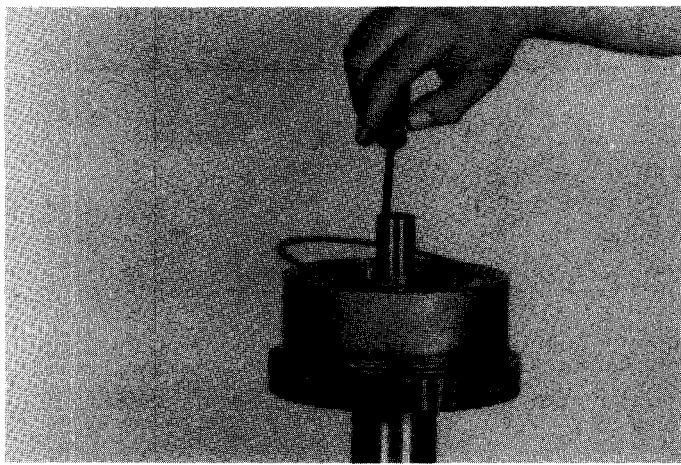


Figure 18

Install end plate retainer ring. See transmission reassembly on page 38.

4TH SPEED CLUTCH INSTALLATION (8 speed only)

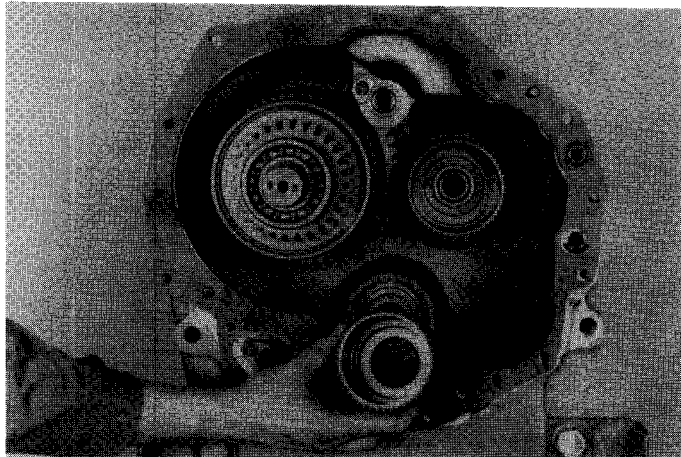


Figure 19

Position 4th speed clutch disc hub on idler shaft.

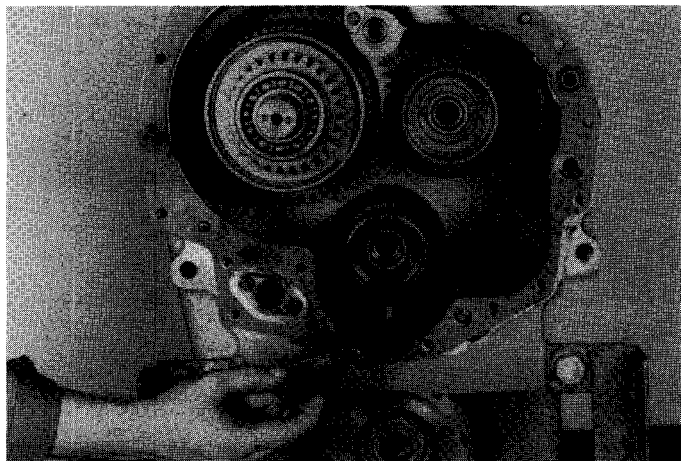


Figure 20

Install disc hub retainer ring.

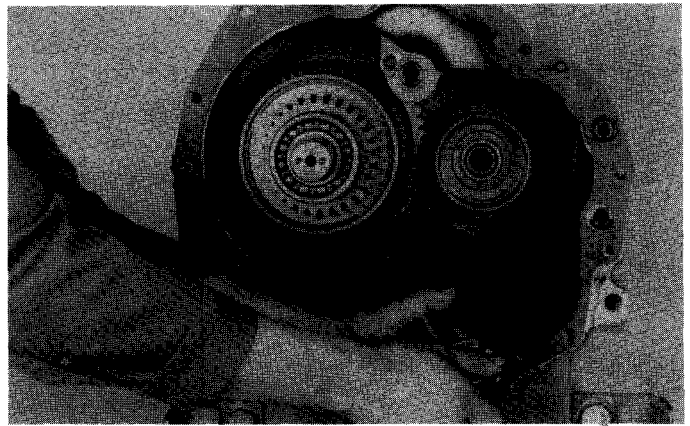


Figure 21

Position pilot bearing on fourth speed clutch shaft. Install fourth clutch on disc hub. Use caution as not to damage the pilot bearing.

CONVERTER HOUSING INSTALLATION

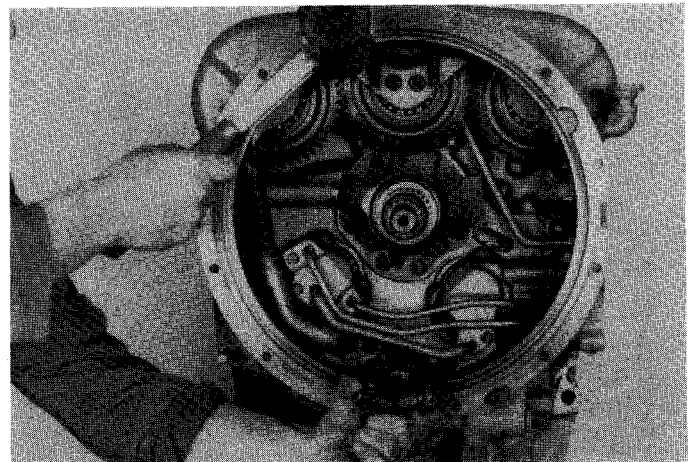


Figure 22

Support converter housing with a chain fall. Spread fourth clutch front bearing retainer ring. Position converter housing to transmission case assembly. Tap housing into place using caution as not to damage any of the clutch shaft piston rings.

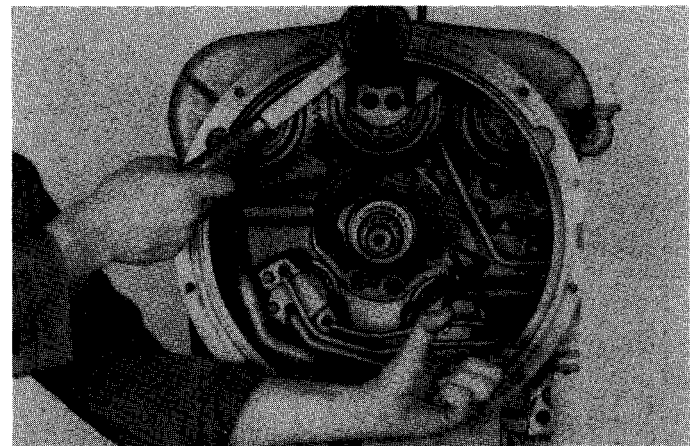


Figure 23

Spread forward clutch front bearing retainer ring to allow the converter housing to position properly.

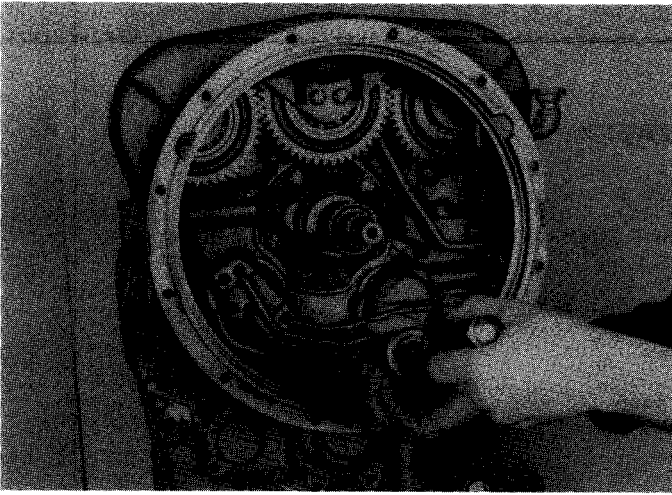


Figure 24

A hammer puller was used to pull the fourth clutch bearing forward to engage the front bearing snap ring in the bearing groove.

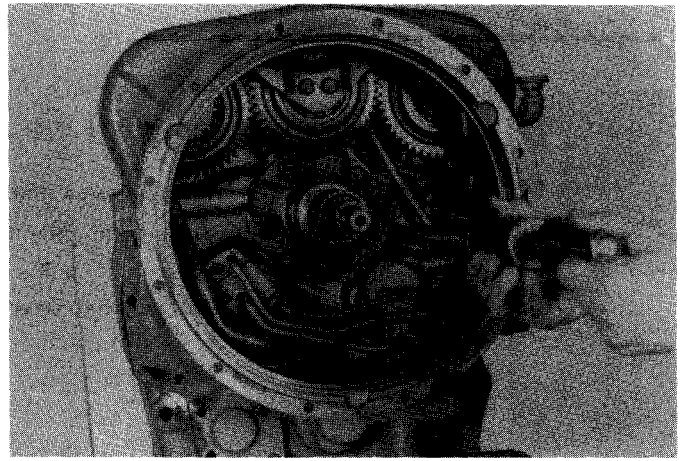


Figure 25

Use the same procedure for the forward clutch as explained in Figure 24. Be certain both snap rings are fully seated in the bearing snap ring grooves. Install converter housing to transmission housing cap screws, tighten to specified torque.

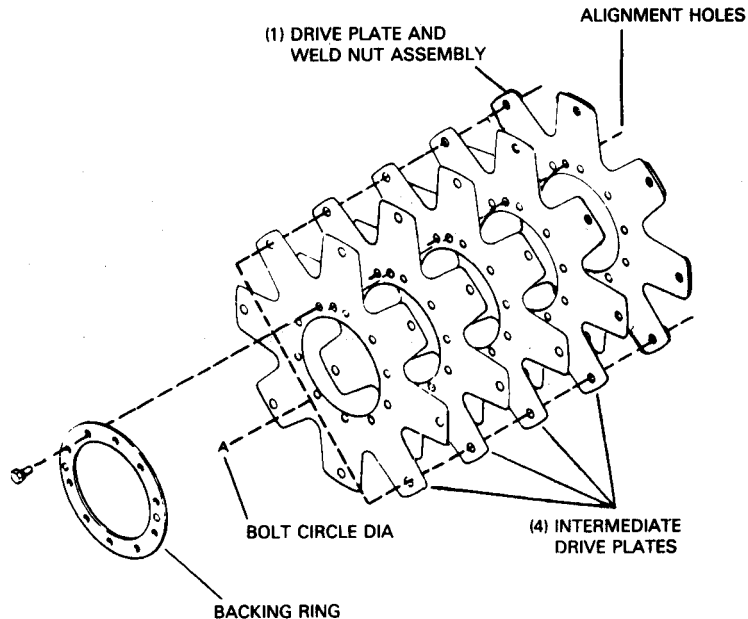
REFER TO PAGE 46 FOR COMPLETE TRANSMISSION REASSEMBLY.

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

TRANSMISSION TO ENGINE INSTALLATION PROCEDURE

1. Remove all burrs from flywheel mounting face and nose pilot bore. Clean drive plate surface with solvent.
2. Check engine flywheel and housing for conformance to standard S.A.E. #3 - S.A.E. J-927 tolerance specifications for pilot bore size, pilot bore runout and mounting face flatness. Measure and record engine crankshaft end play.
3. Install two 3.50 [88,90 mm] long transmission to flywheel housing guide studs in the engine flywheel housing as shown. Rotate the engine flywheel to align a drive plate mounting screw hole with the flywheel housing access hole.
4. Install a 4.00 [101,60 mm] long drive plate locating stud .3750-24 fine thread in a drive plate nut. Align the locating stud in the drive plate with the flywheel-drive plate mounting screw hole positioned in step No. 3.
5. Locate transmission on flywheel housing aligning drive plate to flywheel and transmission to flywheel housing.
Install transmission to flywheel housing screws. Tighten screws to specified torque. Remove transmission to engine guide studs. Install remaining screws and tighten to specified torque.
6. Remove drive plate locating stud.
7. Install drive plate attaching screw and washer. Snug screw but **do not tighten**. Some engine flywheel housings have a hole located on the flywheel housing circumference in line with the drive plate screw access hole. A screwdriver or pry bar used to hold the drive plate against the flywheel will facilitate installation of the drive plate screws. Rotate the engine flywheel and install the remaining seven (7) flywheel to drive plate attaching screws. Snug screws but do not tighten. After all eight (8) screws are installed torque each one 25 to 30 ft. lbs. torque [33,9 - 40,6 N.m.]. This will require torquing each screw and rotating the engine flywheel until the full amount of eight (8) screws have been tightened.
8. Measure engine crankshaft end play after transmission has been completely installed on engine flywheel. This value must be within .001 [0,025 mm] of the end play recorded in step No. 2.

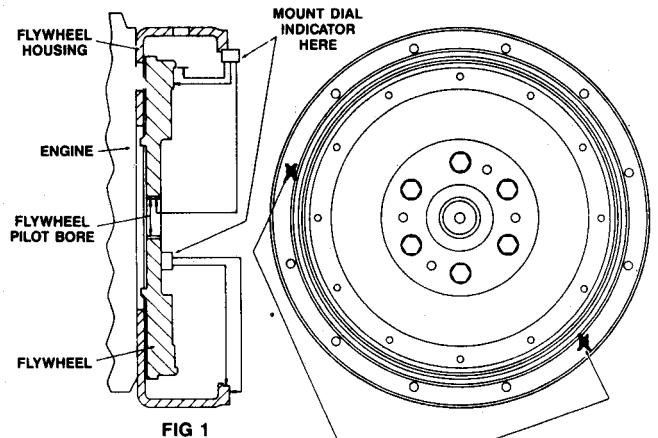


FIG 1

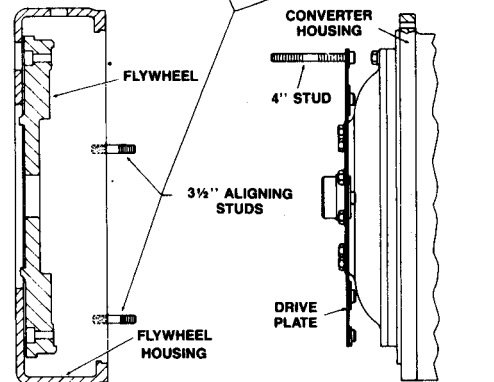


FIG 2

SPECIAL STUD, WASHER AND SELF LOCK NUT FURNISHED BY MACHINE MANUFACTURER.

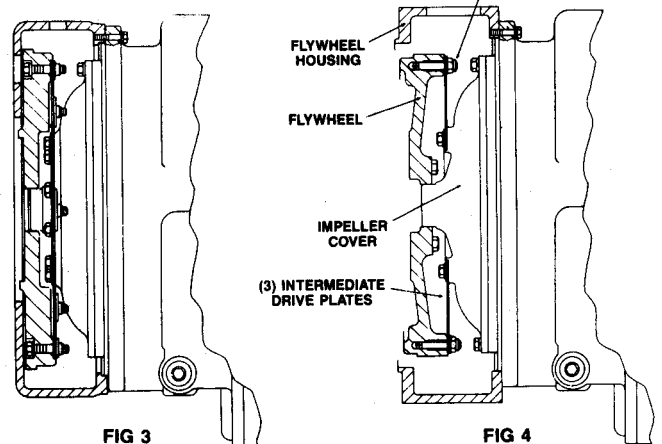
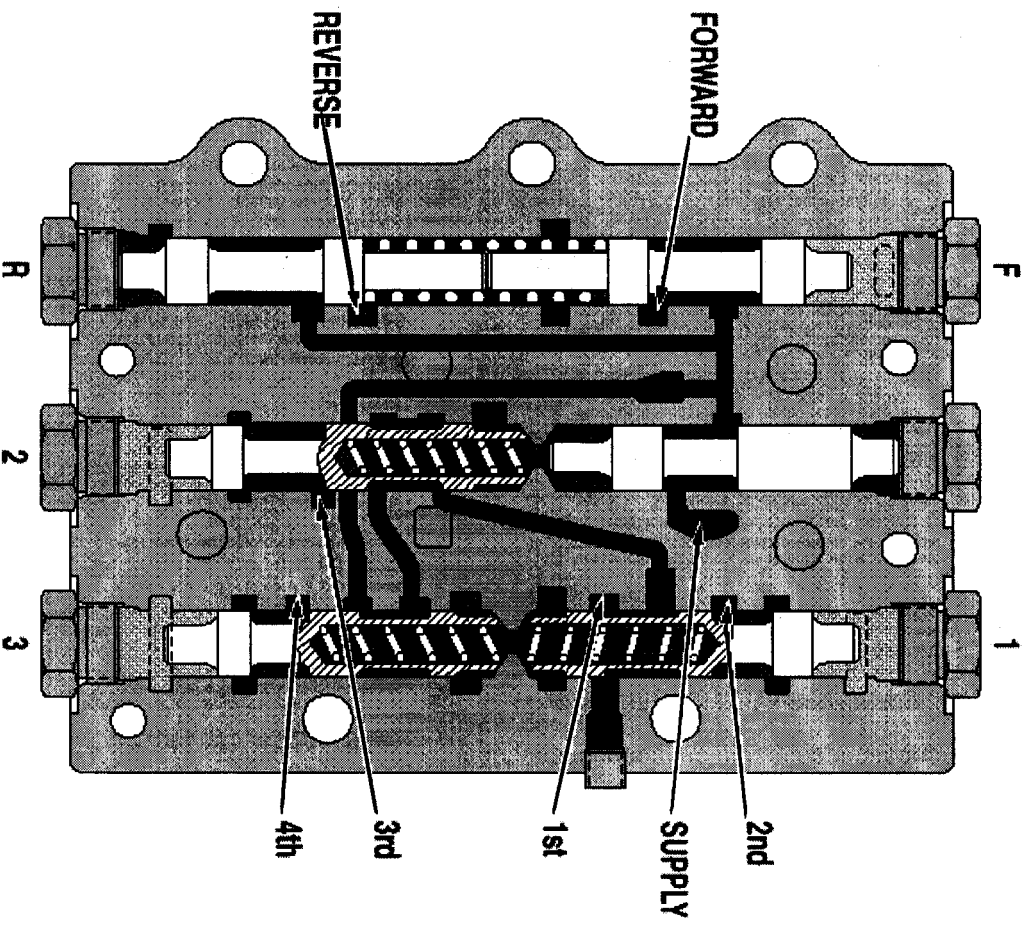
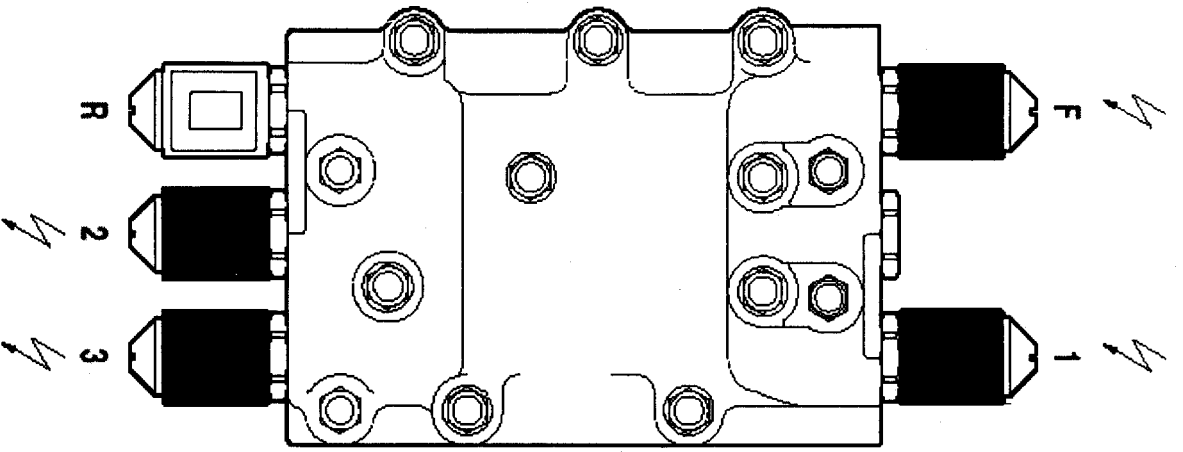


FIG 3

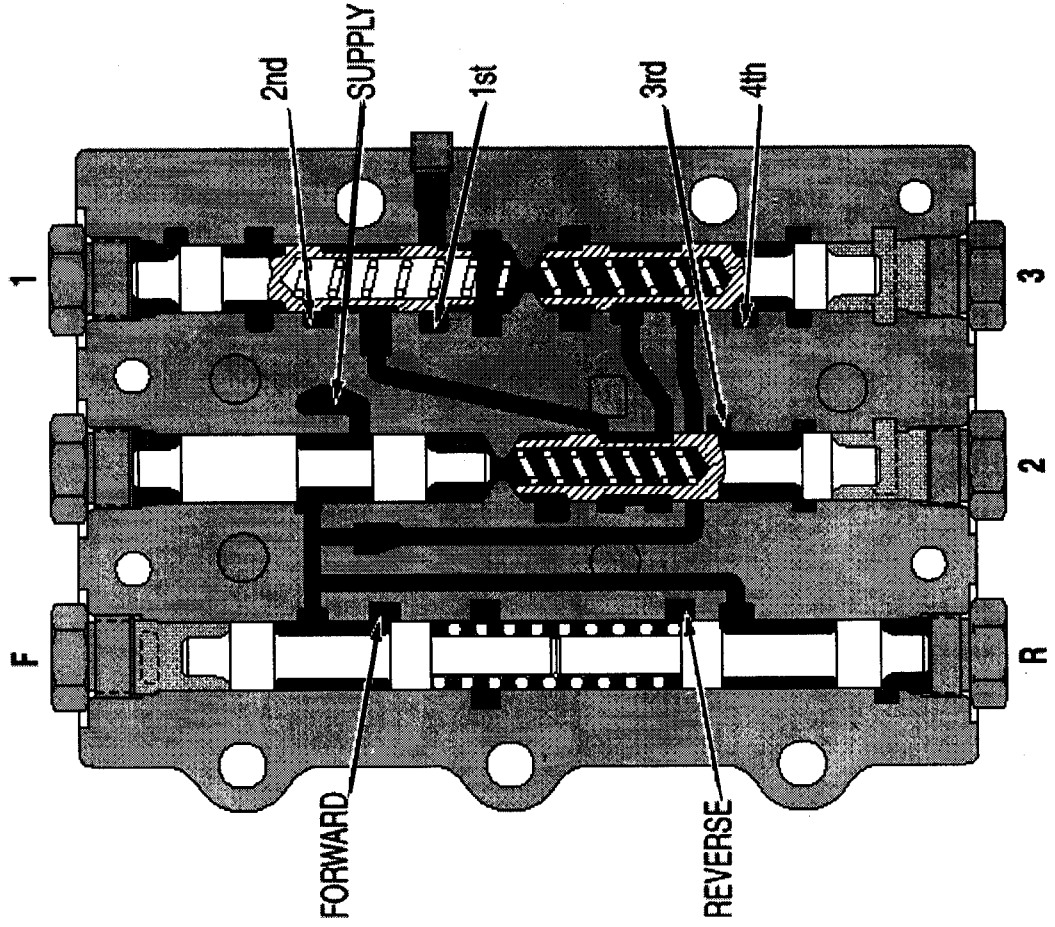
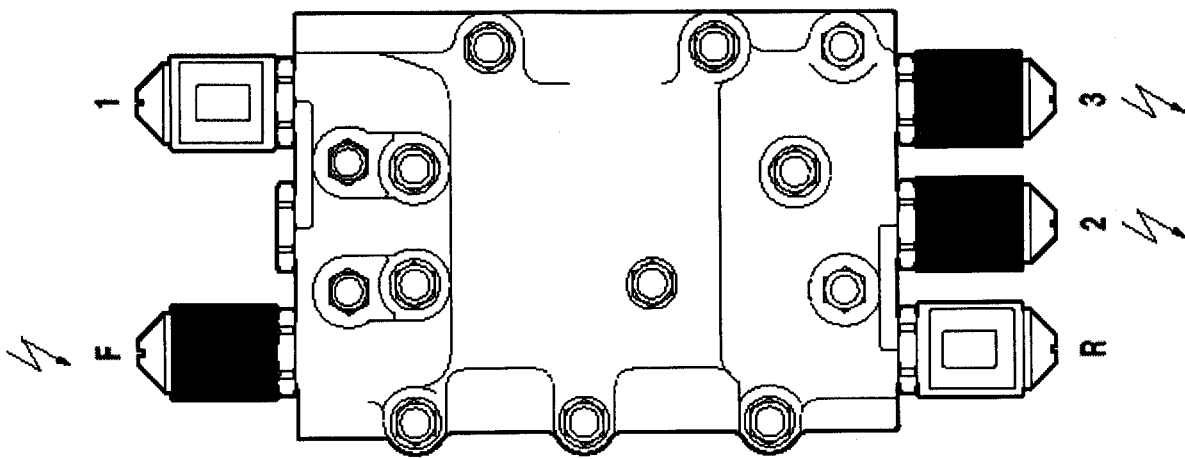
FIG 4

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

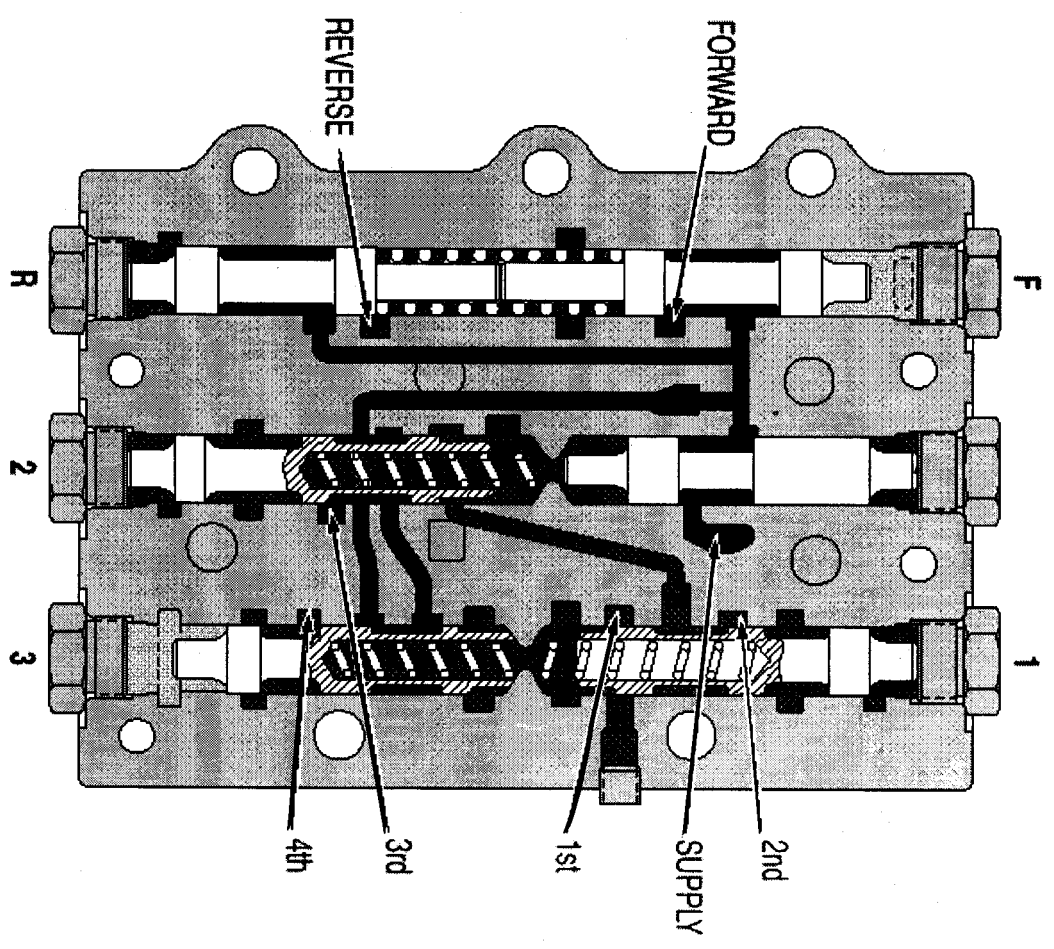
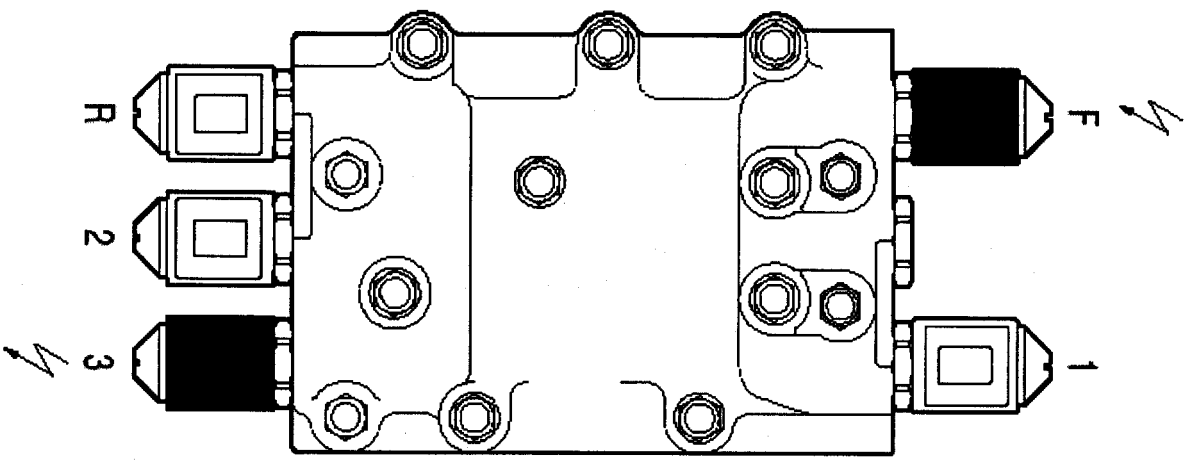


OFF-HIGHWAY COMPONENTS

Control valve function of 28000 / 32000 - 4 speed : forward 2nd

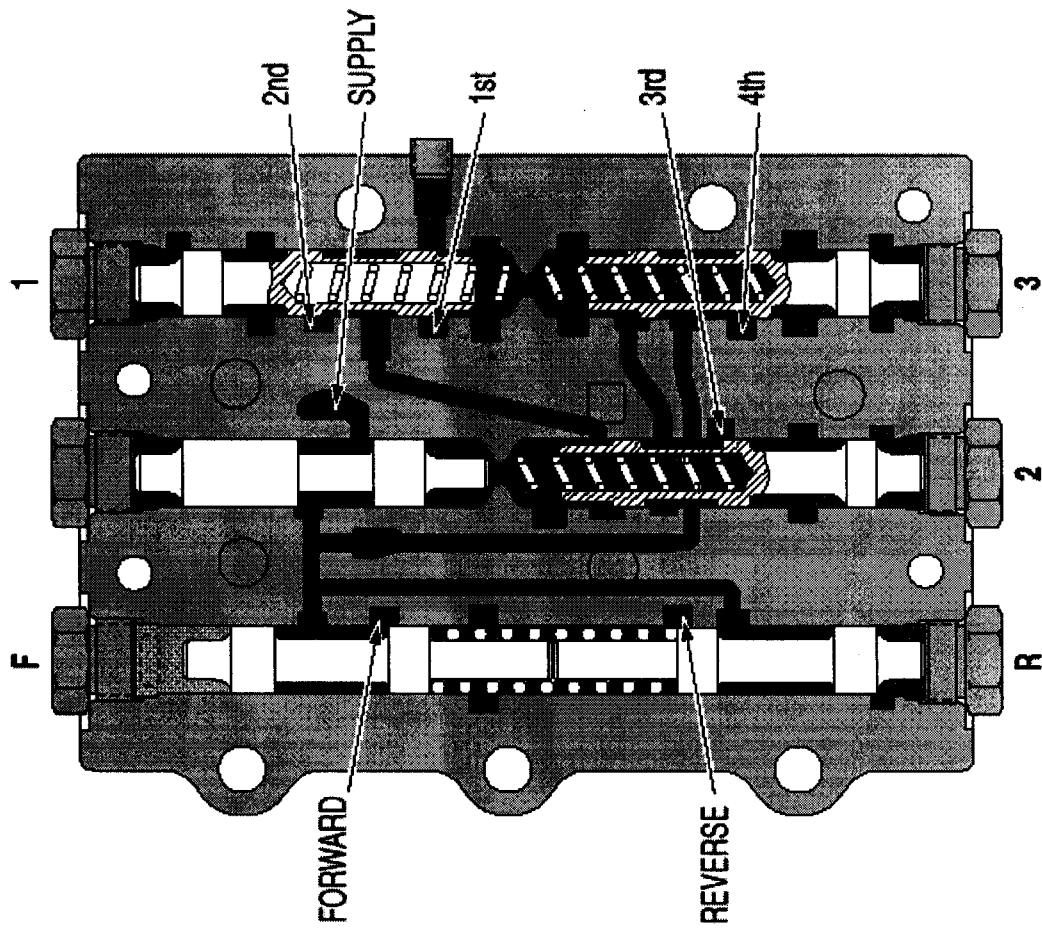
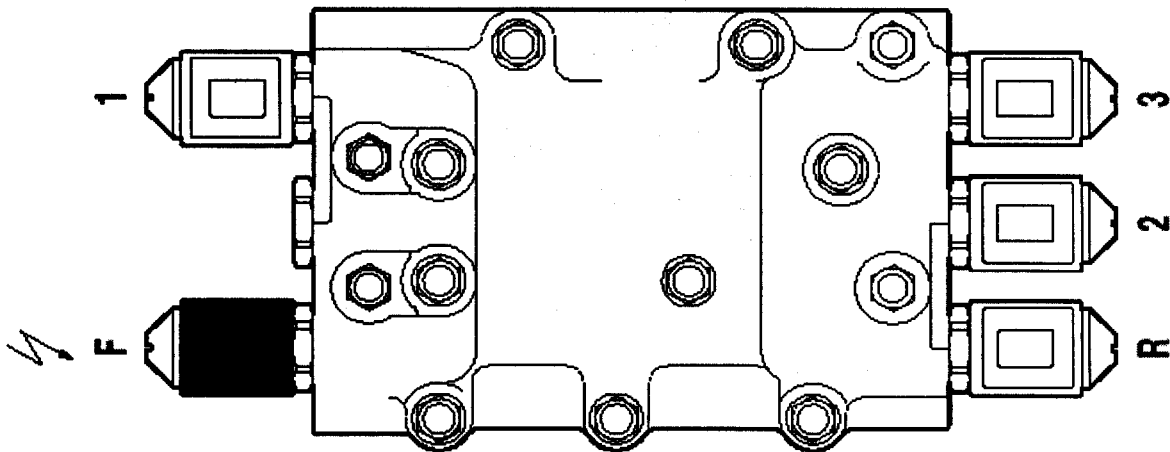


Control valve function of 28000 / 32000 - 4 speed : forward 3rd

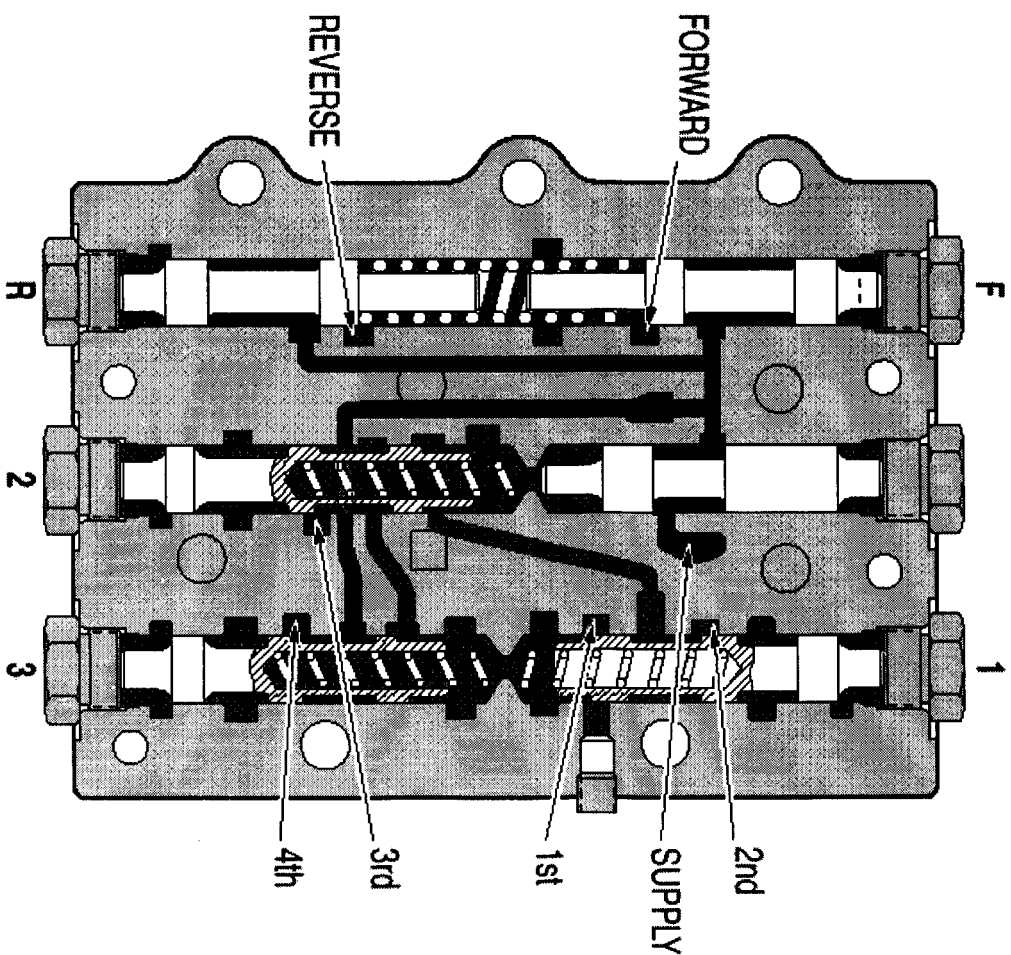
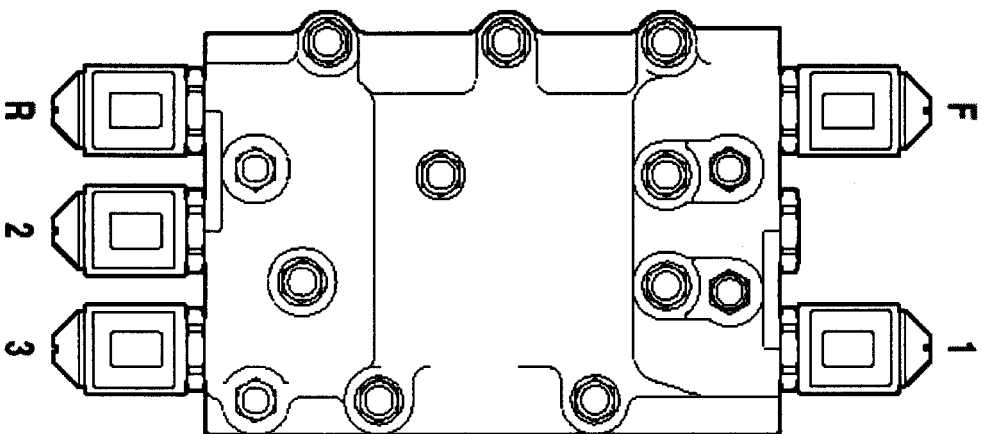


OFF-HIGHWAY COMPONENTS

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

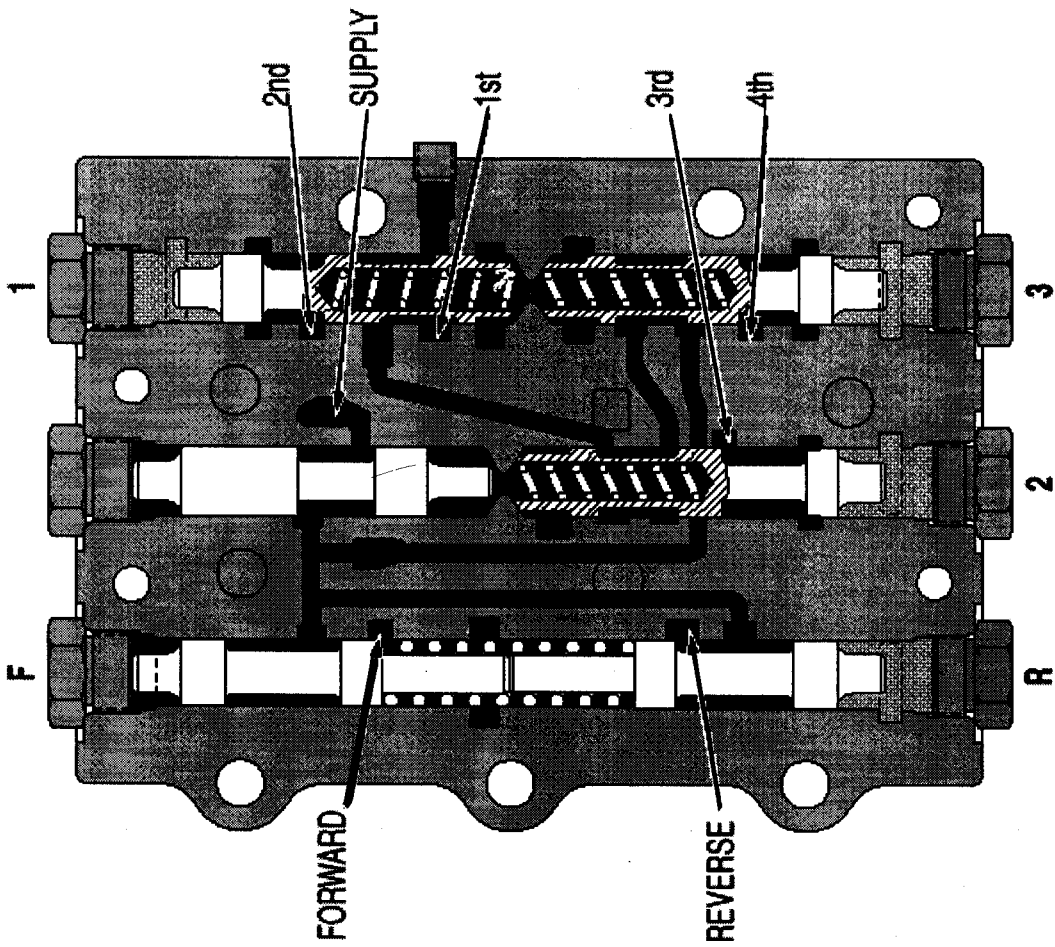
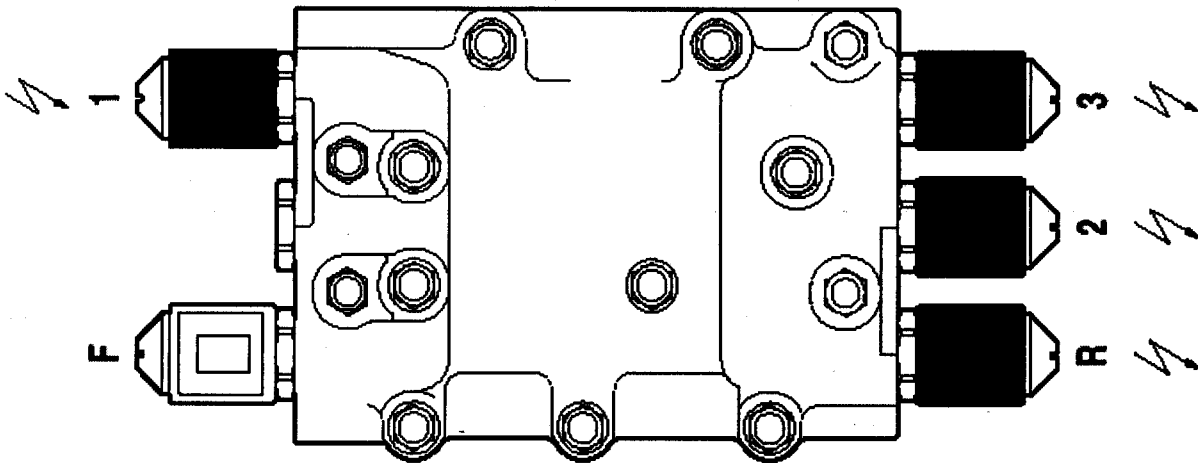


Control valve function of 28000 / 32000 - 4 speed : neutral 4th



OFF-HIGHWAY COMPONENTS

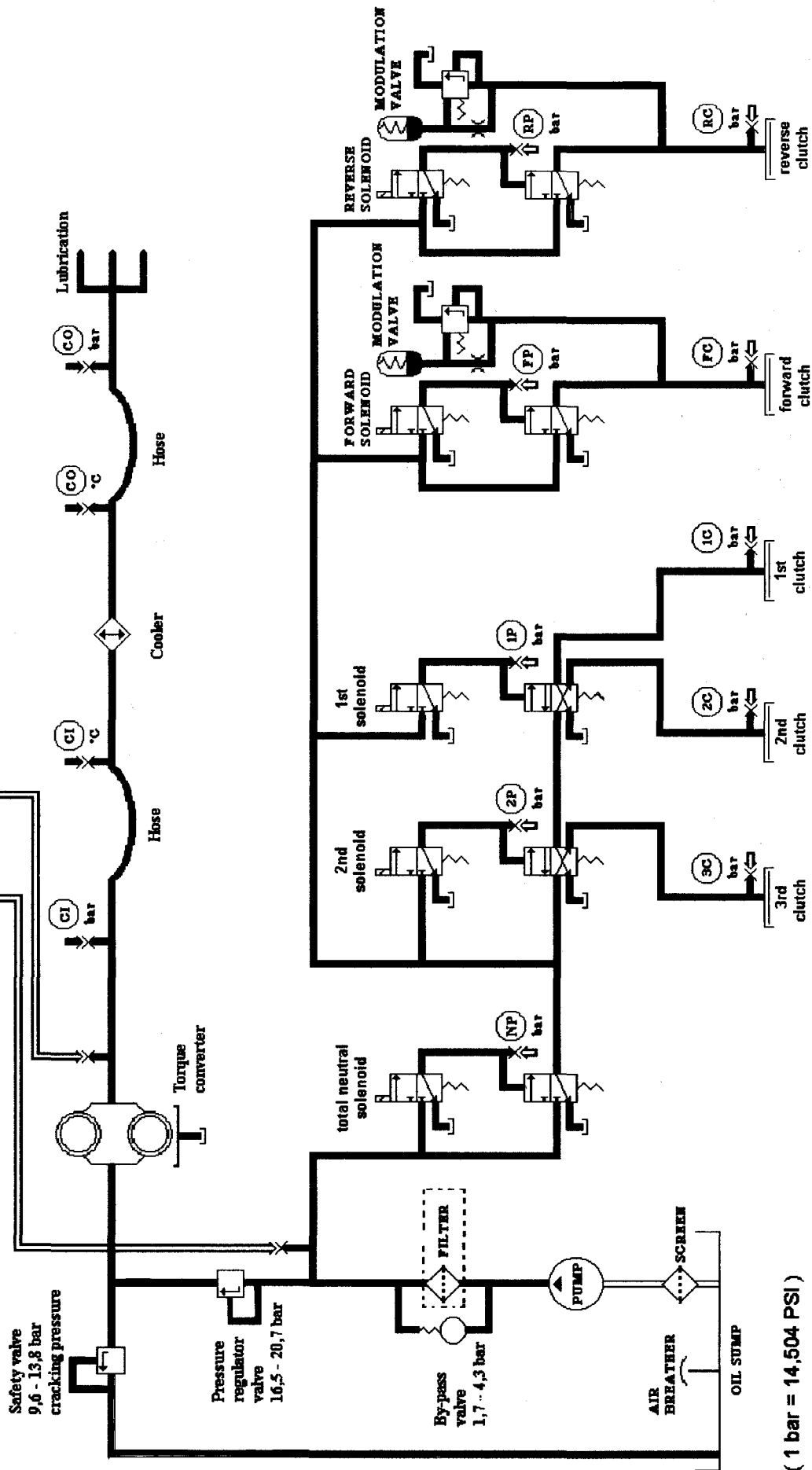
Control valve function of 28000 / 32000 - 4 speed : reverse 1st



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

Total neutral

- (X) PRESSURE CHECK-PORT bar
- (X) TEMPERATURE CHECK-PORT °C



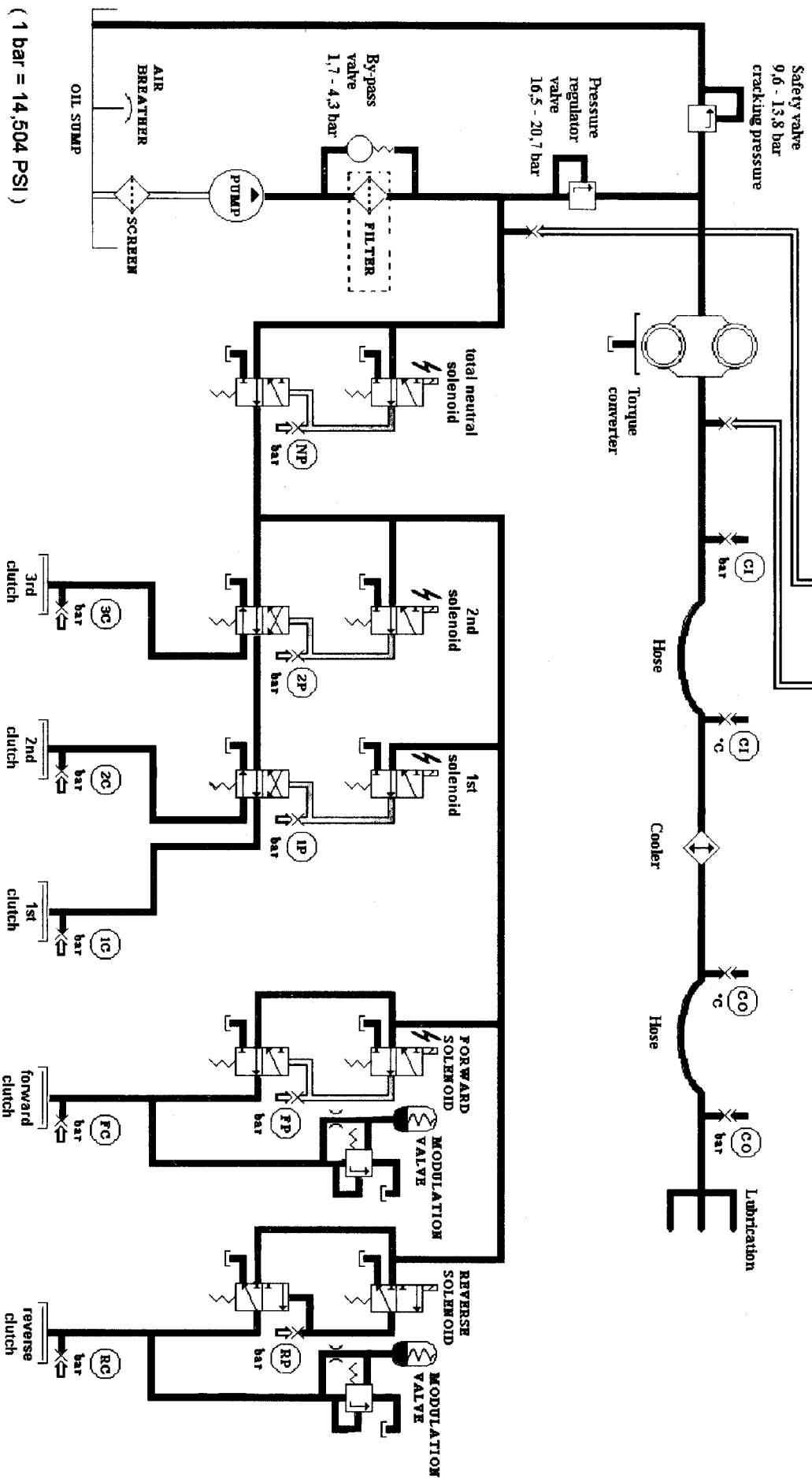
(1 bar = 14,504 PSI)

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

OPERATOR COMPARTMENT
 PRESSURE GAUGE
 TEMPERATURE GAUGE

Forward and 1st clutch engaged

(X) PRESSURE CHECK-PORT
 (C) TEMPERATURE CHECK-PORT °C



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

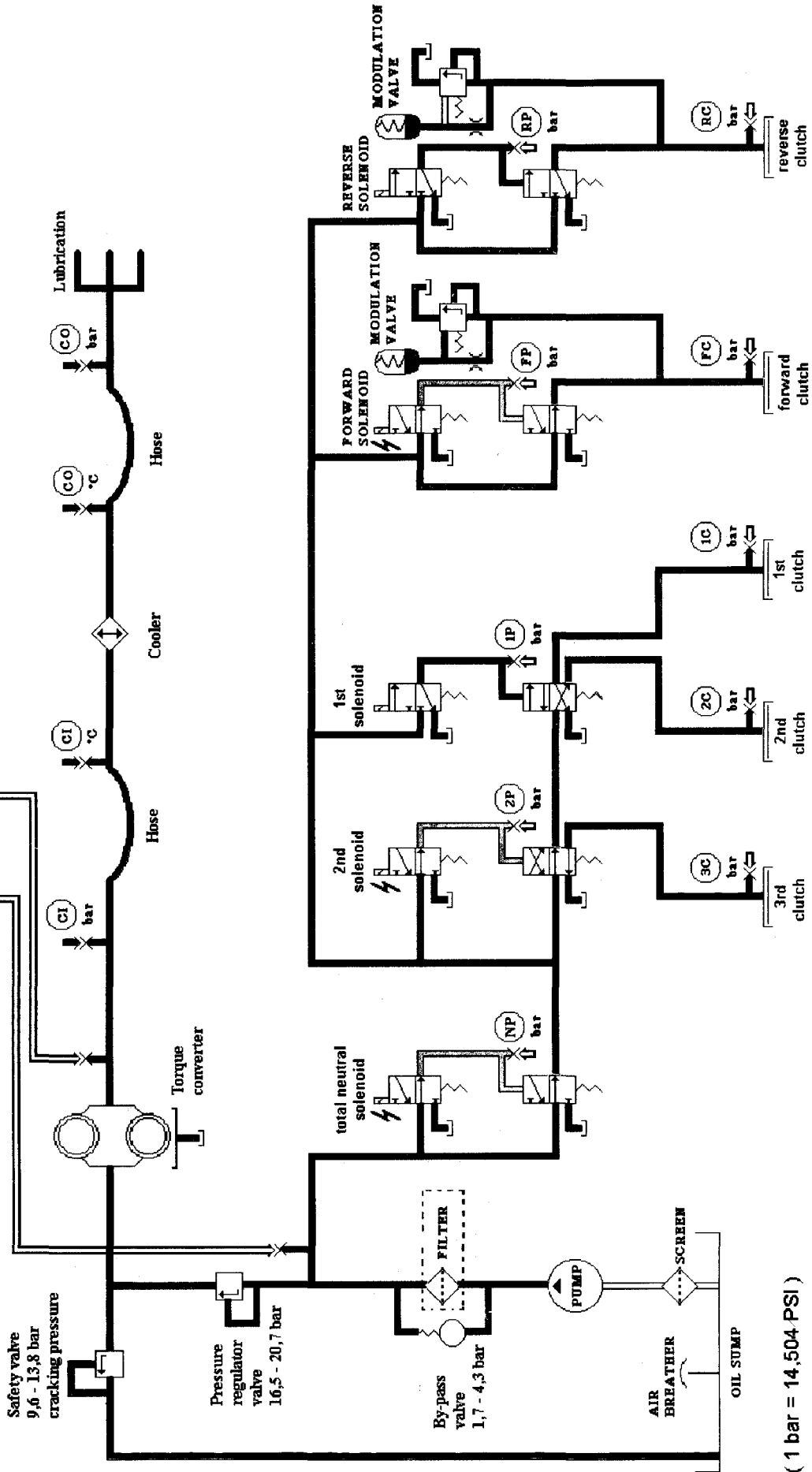
**28000 / 32000 transmission - hydraulic diagram
3 speed - with total neutral**

Forward and 2nd clutch engaged

OPERATOR COMPARTMENT

TEMPERATURE GAUGE
PRESSURE GAUGE

(X) bar PRESSURE CHECK-PORT
(X) °C TEMPERATURE CHECK-PORT

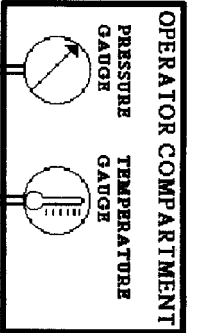


(1 bar = 14,504 PSI)



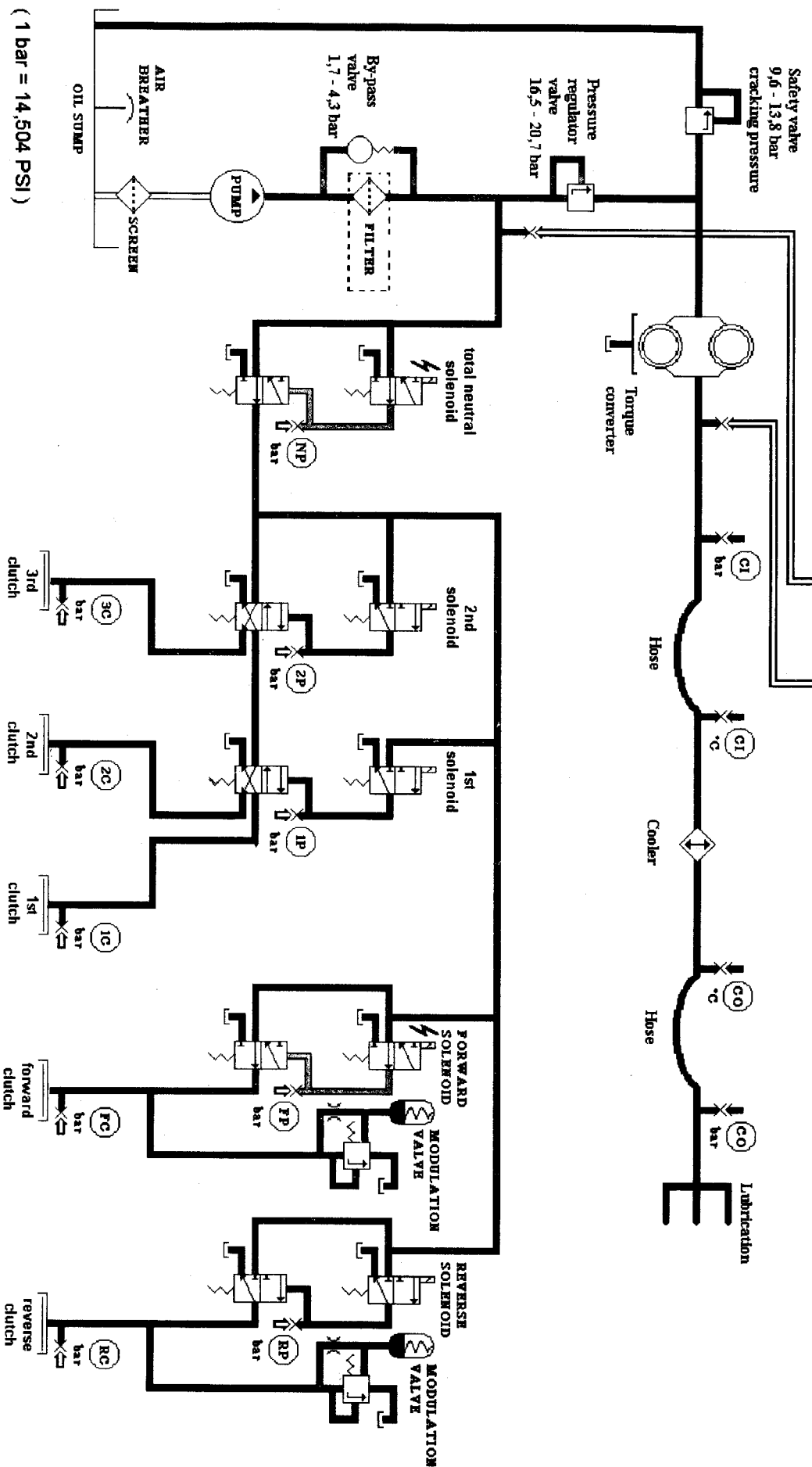
OFF-HIGHWAY COMPONENTS

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



Forward and 3rd clutch engaged

(X) PRESSURE CHECK-PORT
 bar
 (X) TEMPERATURE CHECK-PORT
 °C



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

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

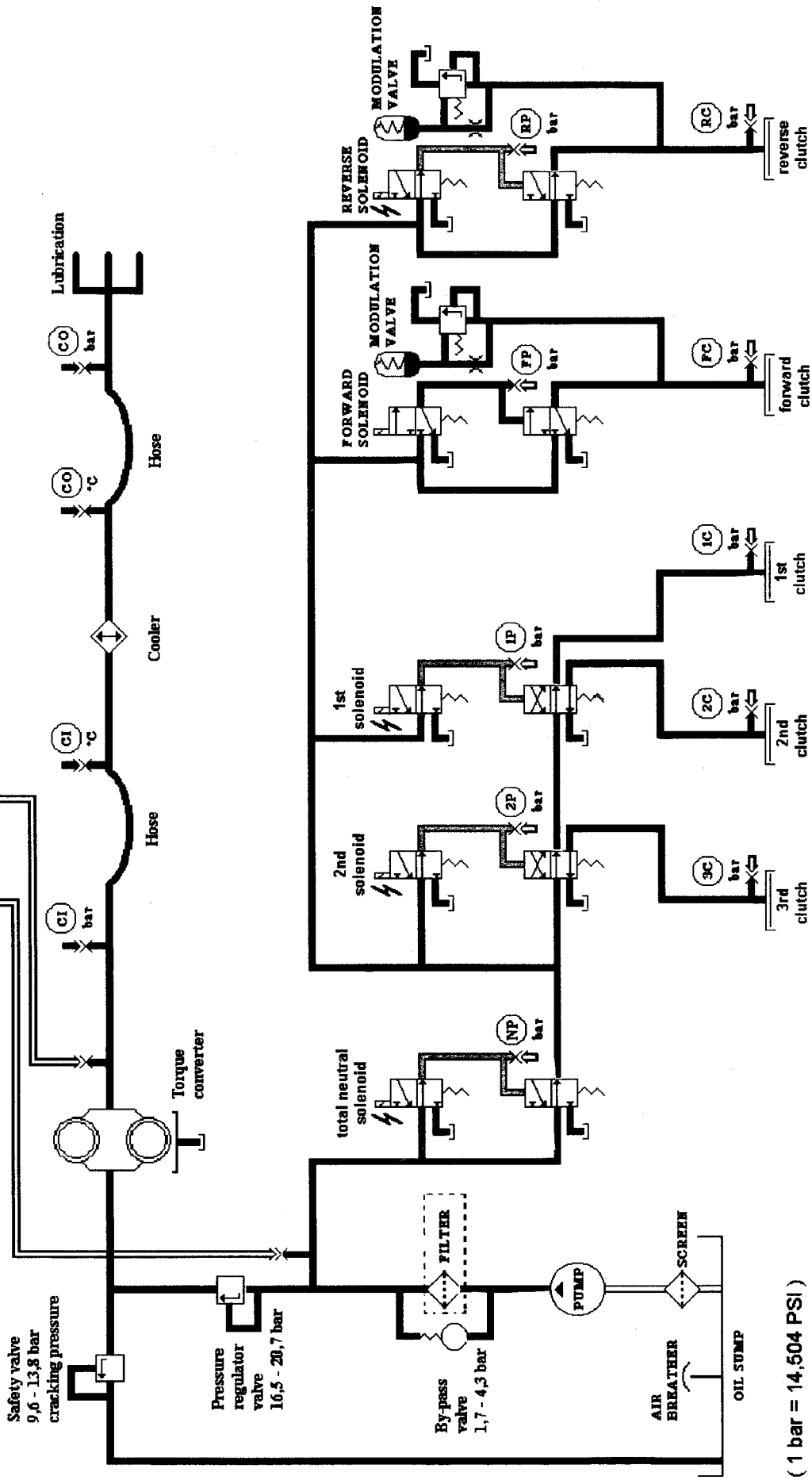
Reverse and 1st clutch engaged

OPERATOR COMPARTMENT

PRESSURE GAUGE
TEMPERATURE GAUGE

⊗ PRESSURE CHECK-PORT
bar

⊗ TEMPERATURE CHECK-PORT
°C



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

28000 / 32000 transmission - hydraulic diagram
3 speed - without total neutral

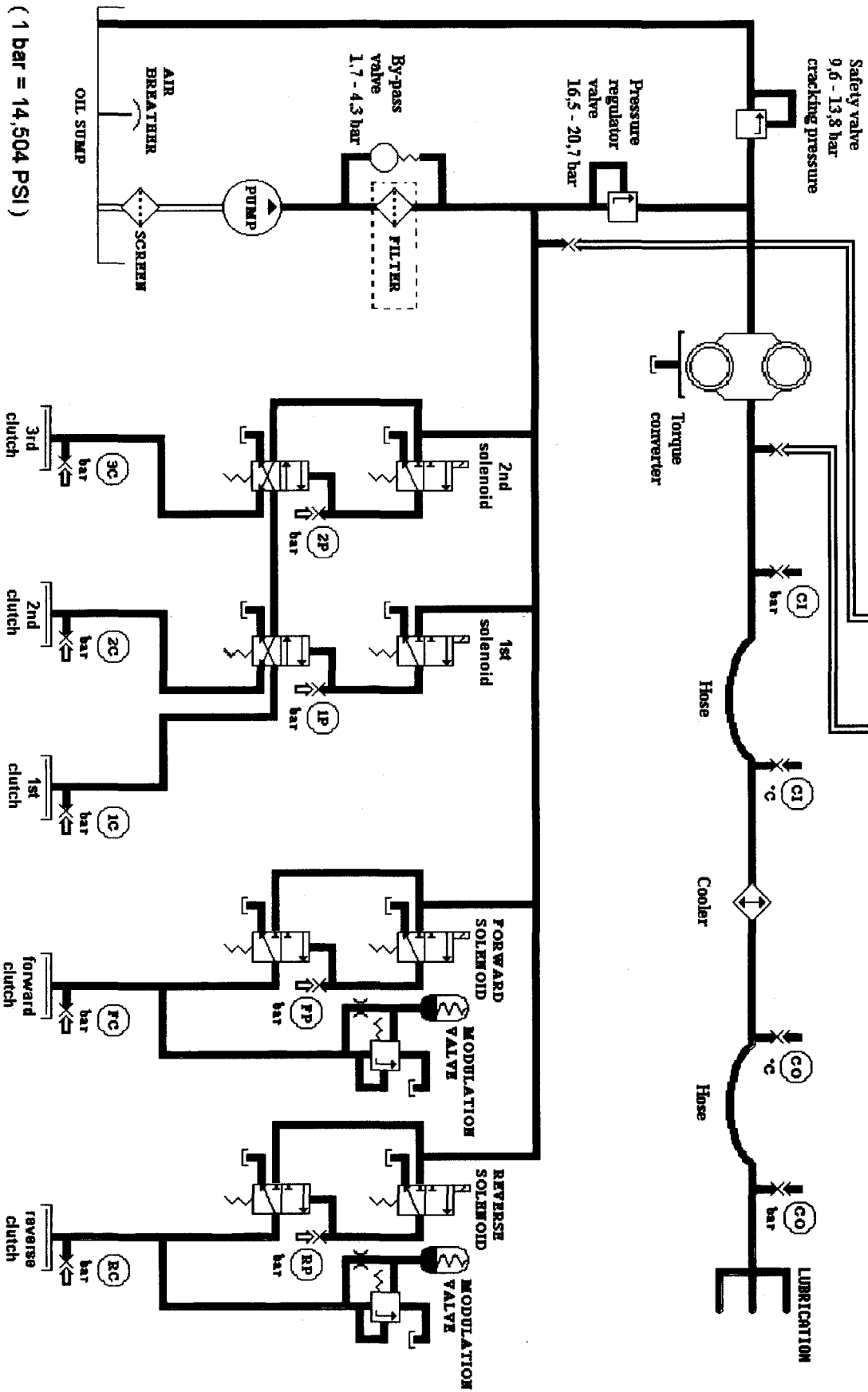
OPERATOR COMPARTMENT

PRESSURE GAUGE

TEMPERATURE GAUGE

Neutral and 3rd clutch engaged

- (X) PRESSURE CHECK-PORT
- (°C) TEMPERATURE CHECK-PORT



(1 bar = 14,504 PSI)

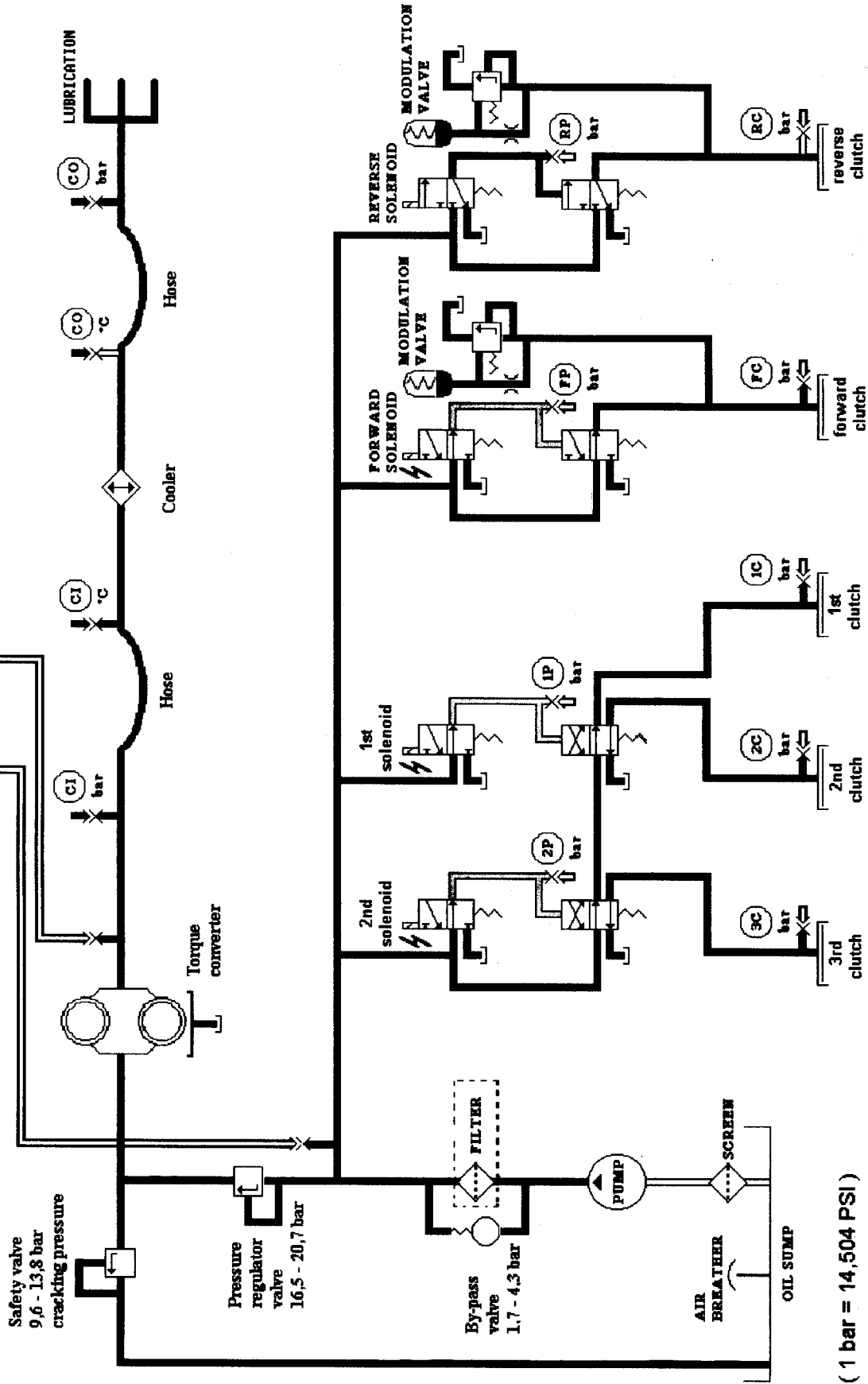


OFF-HIGHWAY COMPONENTS

**28000 / 32000 transmission - hydraulic diagram
3 speed - without total neutral**

Forward and 1st clutch engaged

PRESSURE CHECK-PORT bar
 TEMPERATURE CHECK-PORT °C

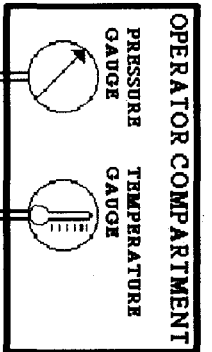


(1 bar = 14,504 PSI)



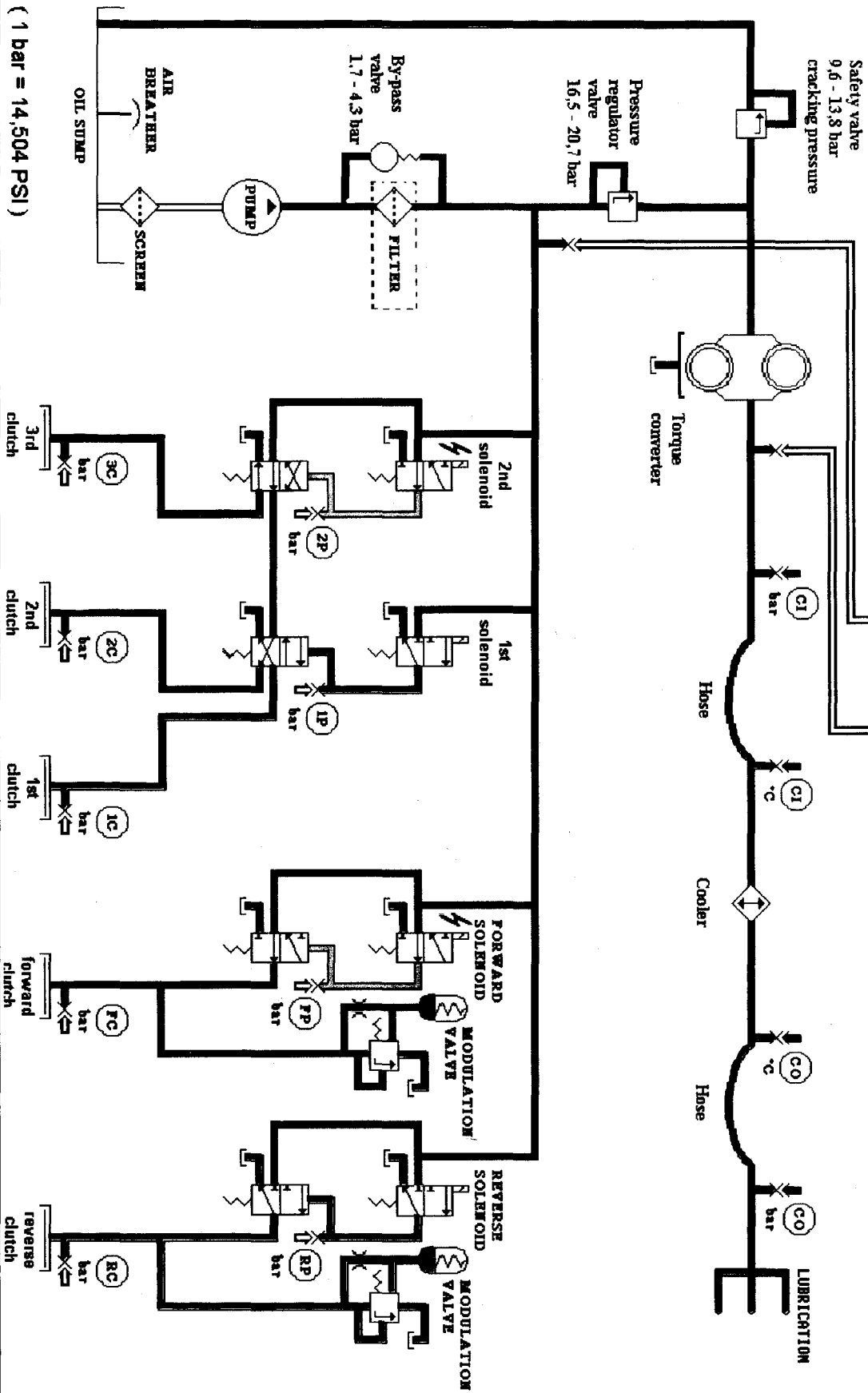
OFF-HIGHWAY COMPONENTS

28000 / 32000 transmission - hydraulic diagram
3 speed - without total neutral



Forward and 2nd clutch engaged

(X) PRESSURE CHECK-PORT
 (°C) TEMPERATURE CHECK-PORT



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

**28000 / 32000 transmission - hydraulic diagram
3 speed - without total neutral**

Forward and 3rd clutch engaged

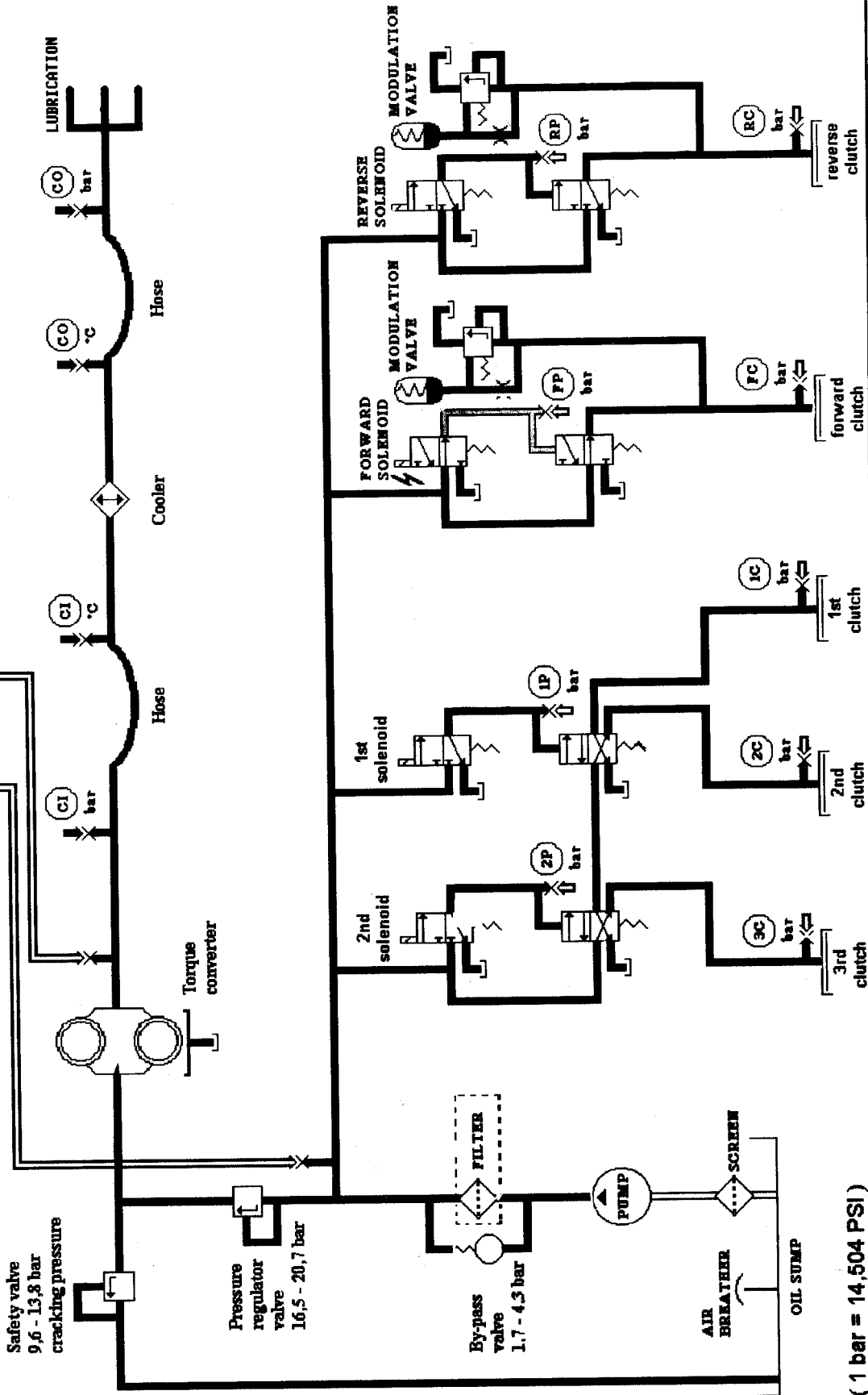
OPERATOR COMPARTMENT

PRESSURE GAUGE

TEMPERATURE GAUGE

(X) bar PRESSURE CHECK-PORT

(X) °C TEMPERATURE CHECK-PORT



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

28000 / 32000 transmission - hydraulic diagram
3 speed - without total neutral

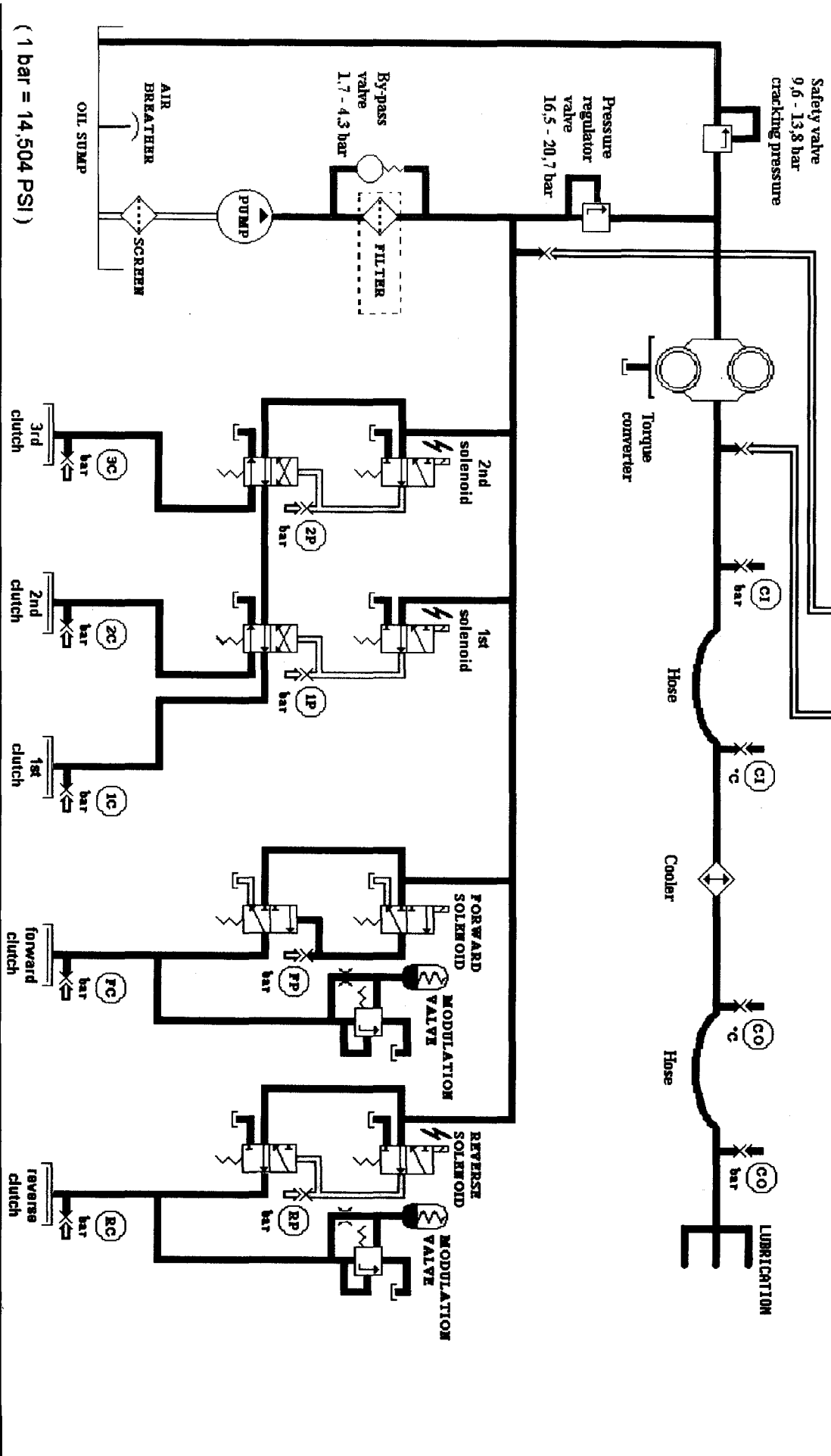
OPERATOR COMPARTMENT

PRESSURE GAUGE

TEMPERATURE GAUGE

Reverse and 1st clutch engaged

- (X) bar PRESSURE CHECK-PORT
- (°C) TEMPERATURE CHECK-PORT



(1 bar = 14,504 PSI)



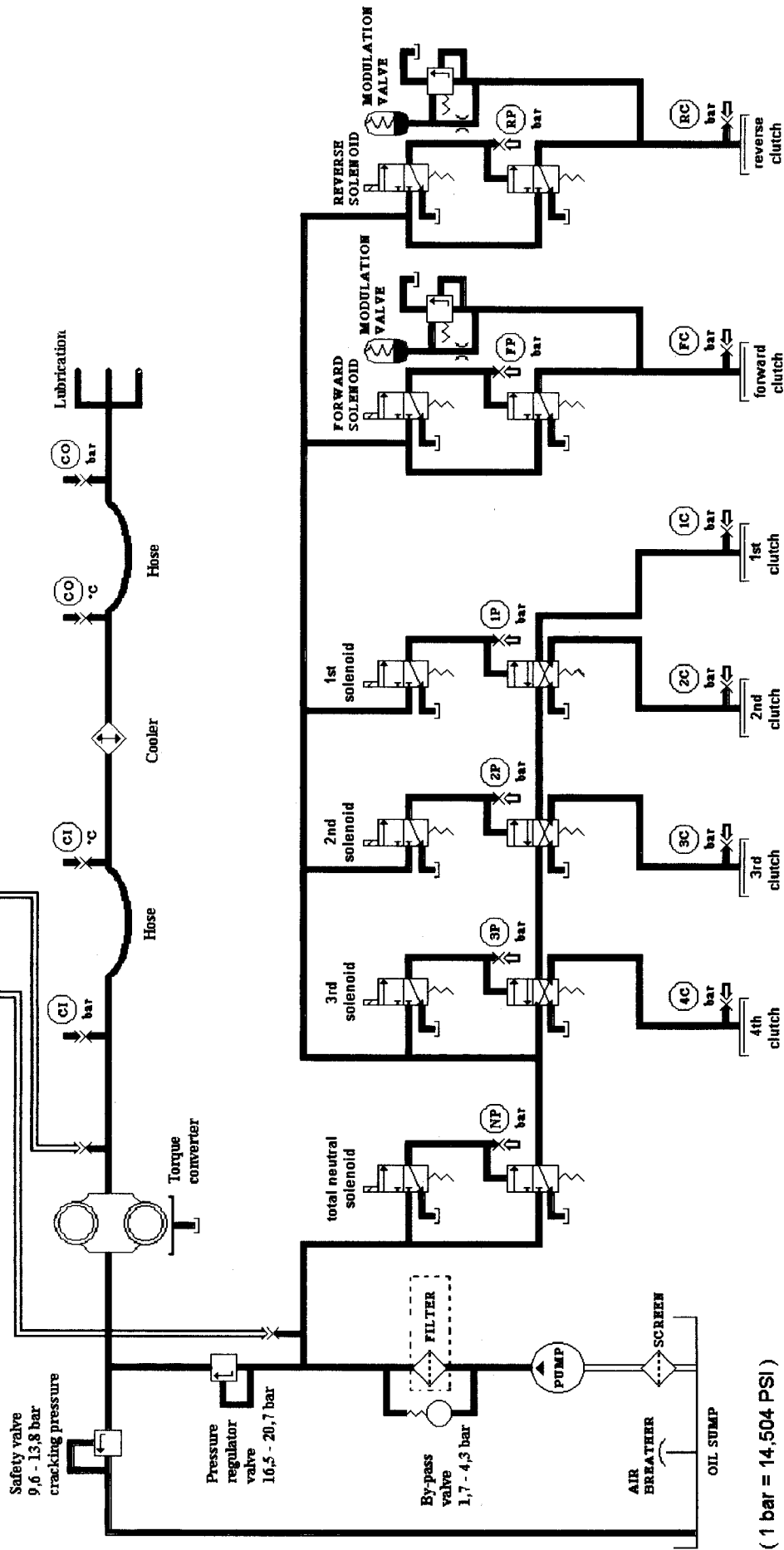
OFF-HIGHWAY COMPONENTS

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

OPERATOR COMPARTMENT
 PRESSURE GAUGE
 TEMPERATURE GAUGE

Total neutral

- (X) PRESSURE CHECK-PORT bar
- (X) TEMPERATURE CHECK-PORT °C



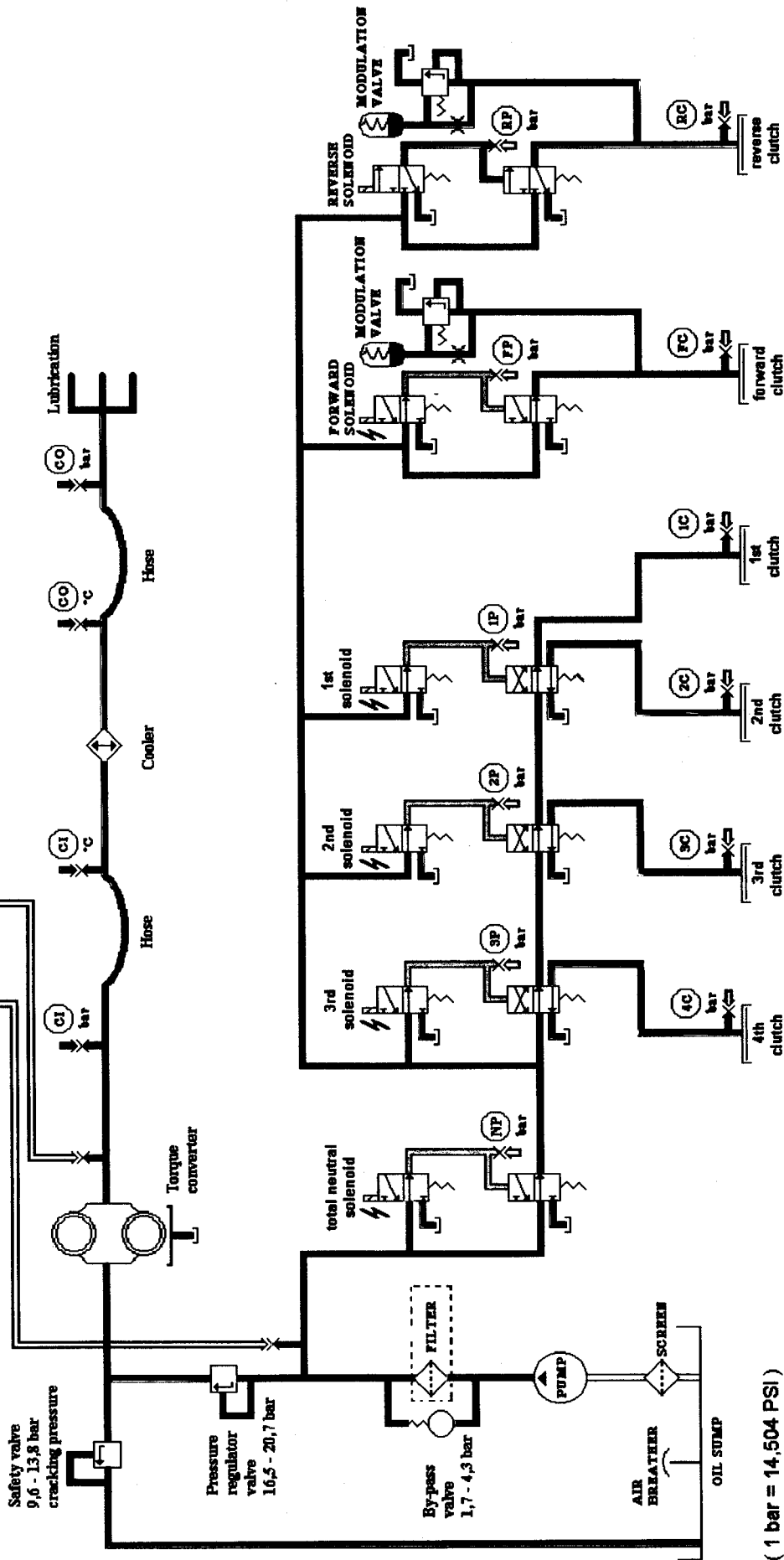
(1 bar = 14,504 PSI)

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

OPERATOR COMPARTMENT
 PRESSURE GAUGE
 TEMPERATURE GAUGE

- (X) PRESSURE CHECK-PORT bar
- (X) TEMPERATURE CHECK-PORT °C

Forward and 1st clutch engaged



(1 bar = 14,504 PSI)

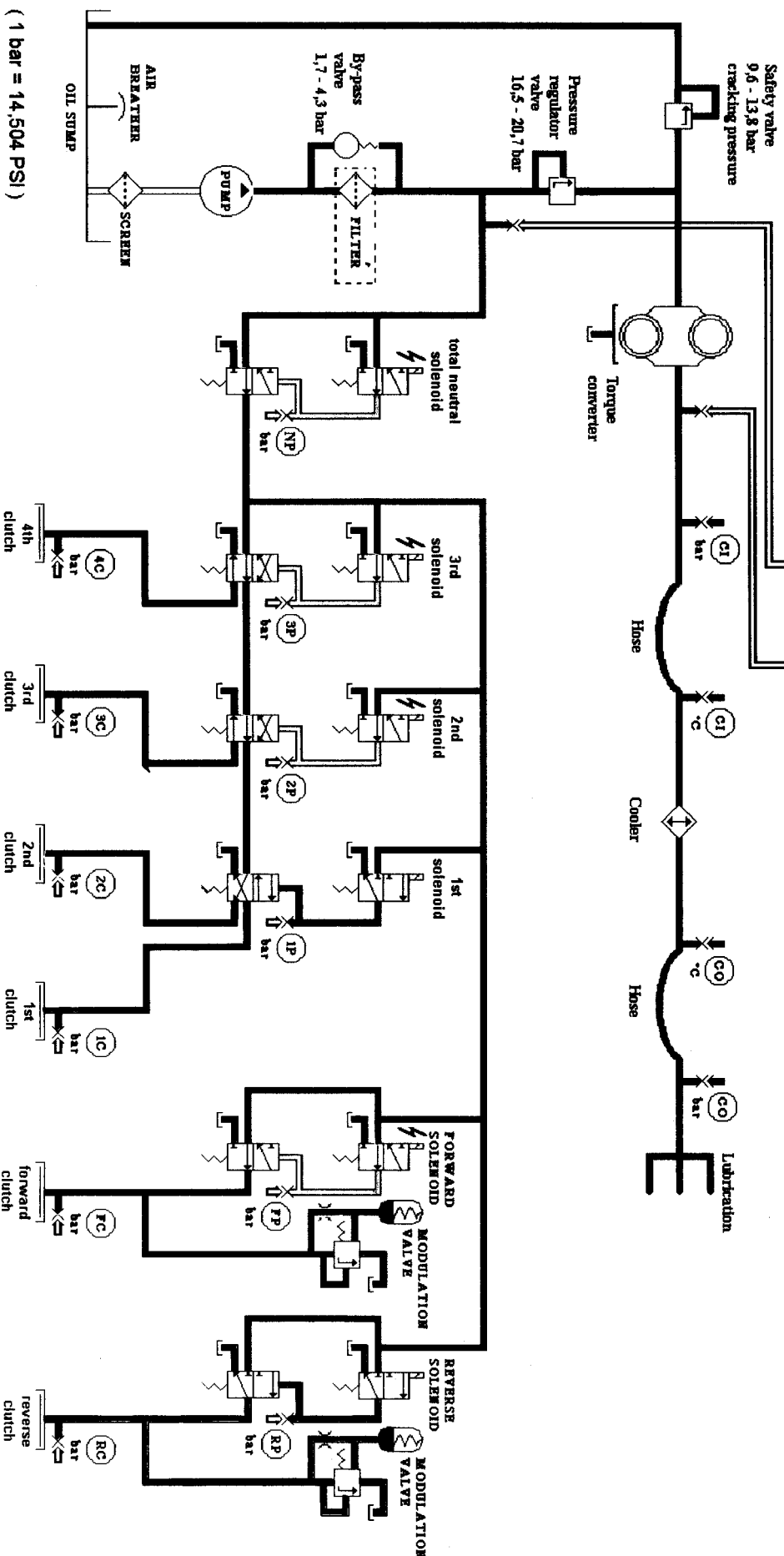
28000 / 32000 transmission - hydraulic diagram
4 speed - with total neutral

OPERATOR COMPARTMENT

PRESSURE GAUGE
 TEMPERATURE GAUGE

Forward and 2nd clutch engaged

⊗ PRESSURE CHECK-PORT
 °C TEMPERATURE CHECK-PORT



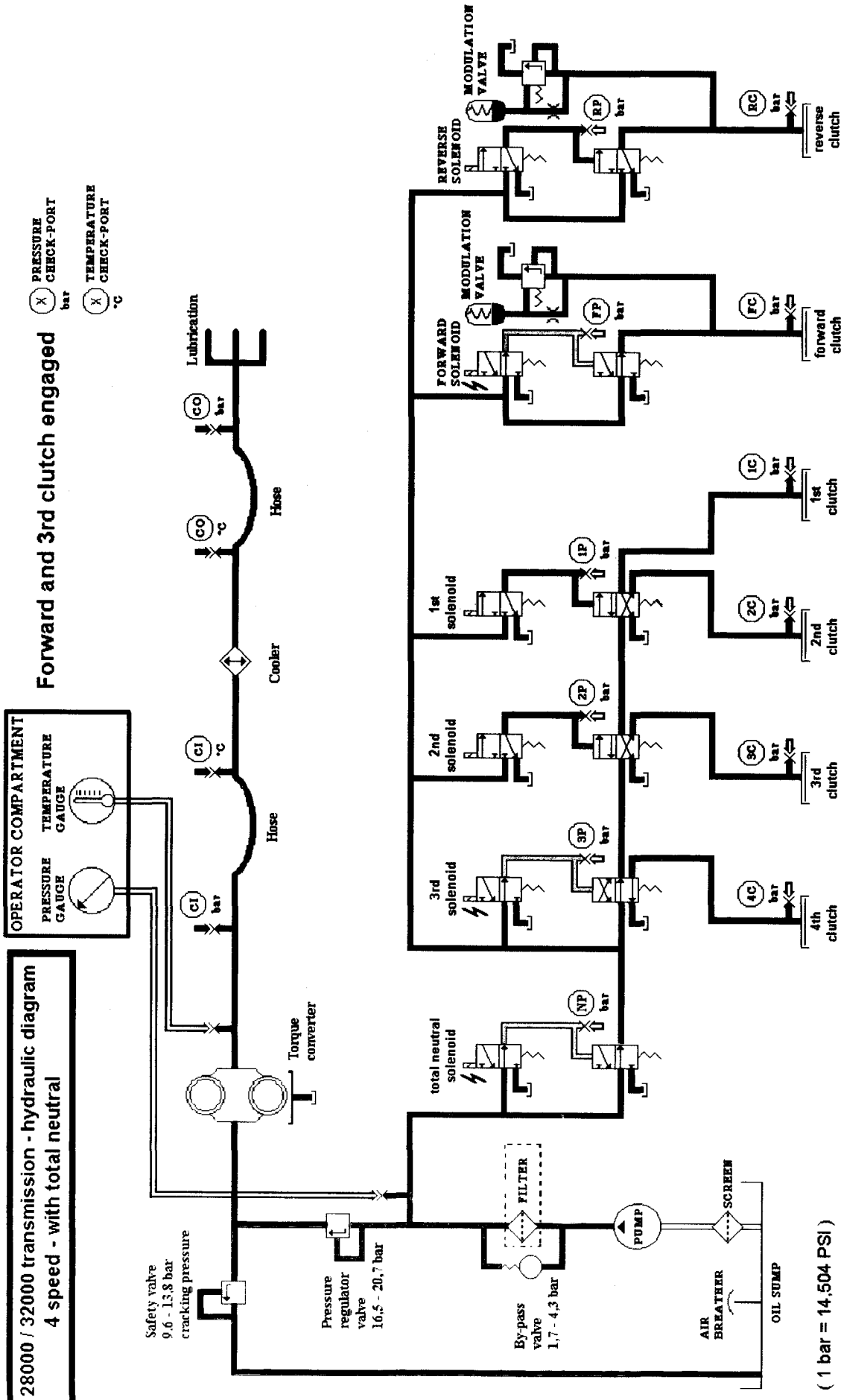
(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

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

Forward and 3rd clutch engaged

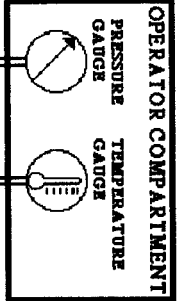


(1 bar = 14,504 PSI)



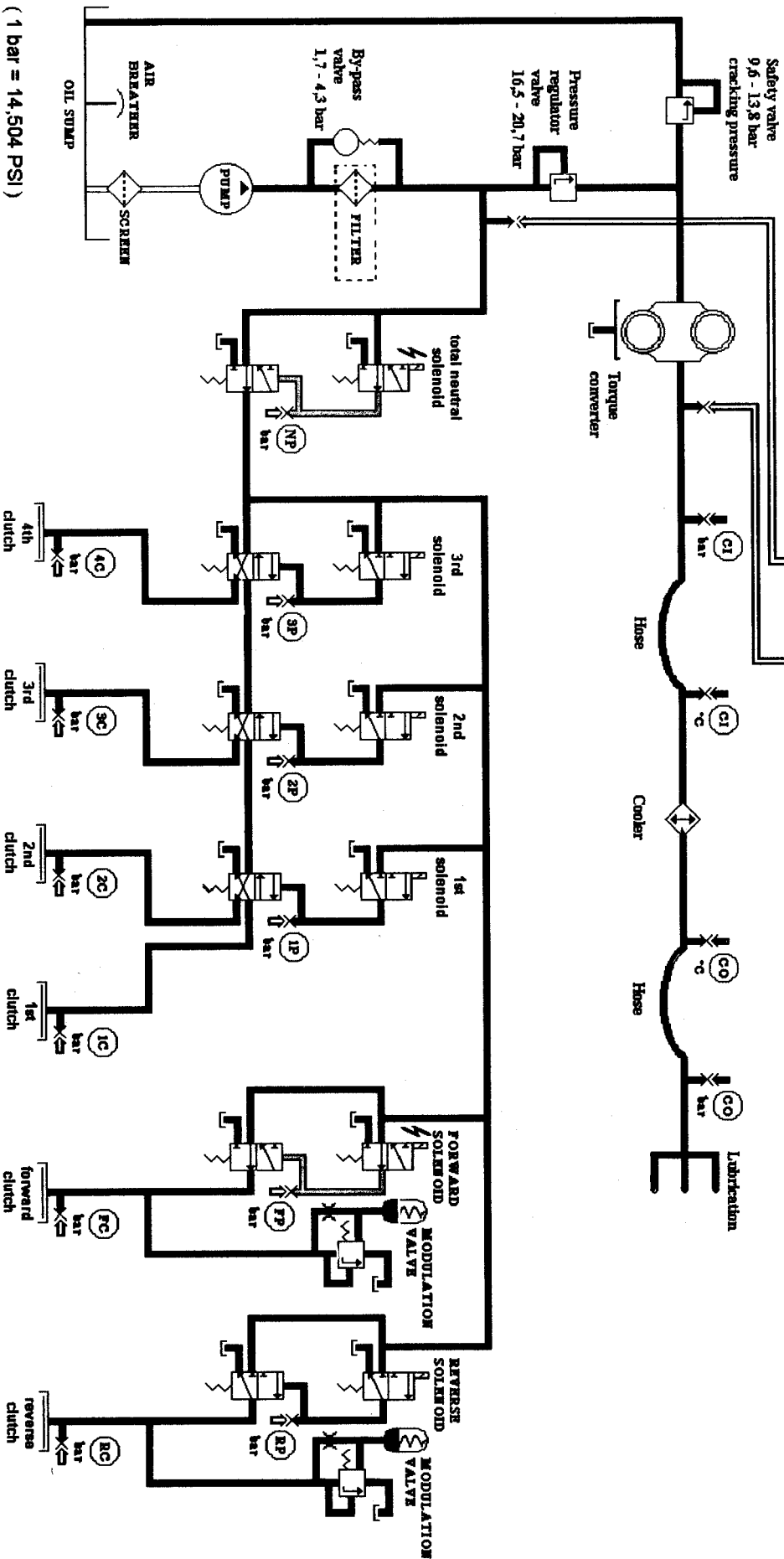
OFF-HIGHWAY COMPONENTS

28000 / 32000 transmission - hydraulic diagram
4 speed - with total neutral



Forward and 4th clutch engaged

(X) PRESSURE CHECK-PORT
 (C) TEMPERATURE CHECK-PORT



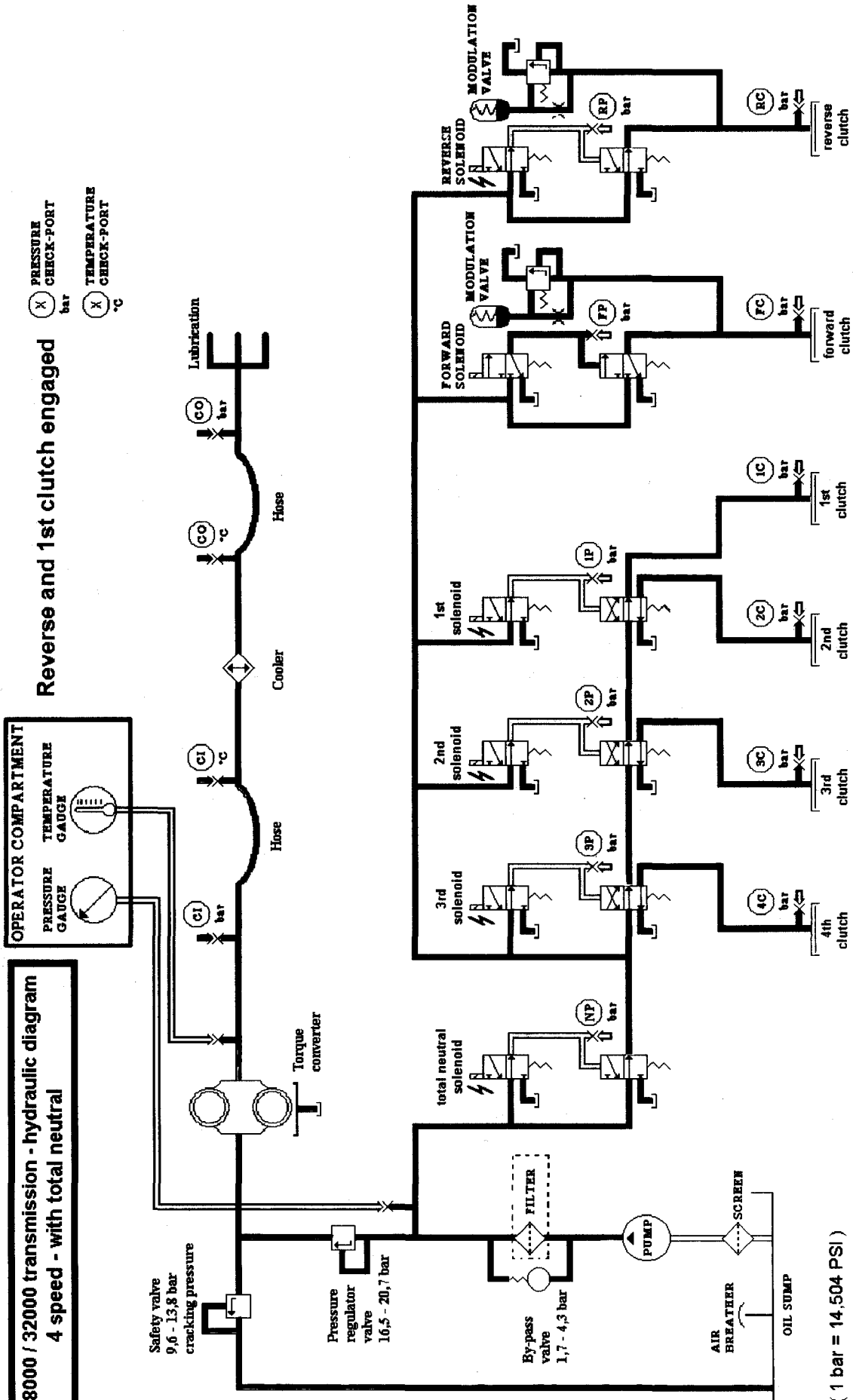
(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

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

Reverse and 1st clutch engaged



(1 bar = 14,504 PSI)



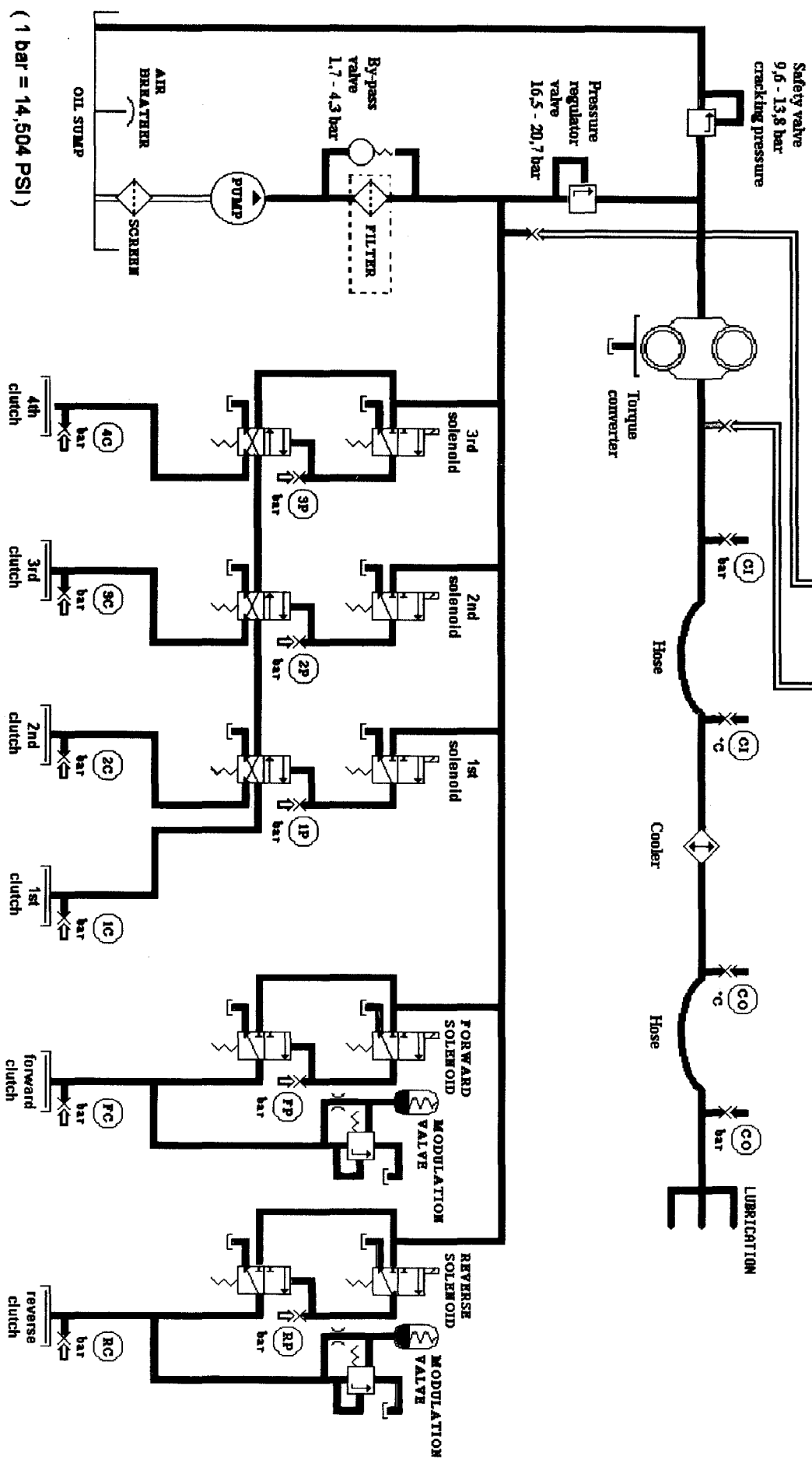
28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral

OPERATOR COMPARTMENT

Pressure Gauge
 Temperature Gauge

Neutral and 4th clutch engaged

- (X) PRESSURE CHECK-PORT
- (C) TEMPERATURE CHECK-PORT



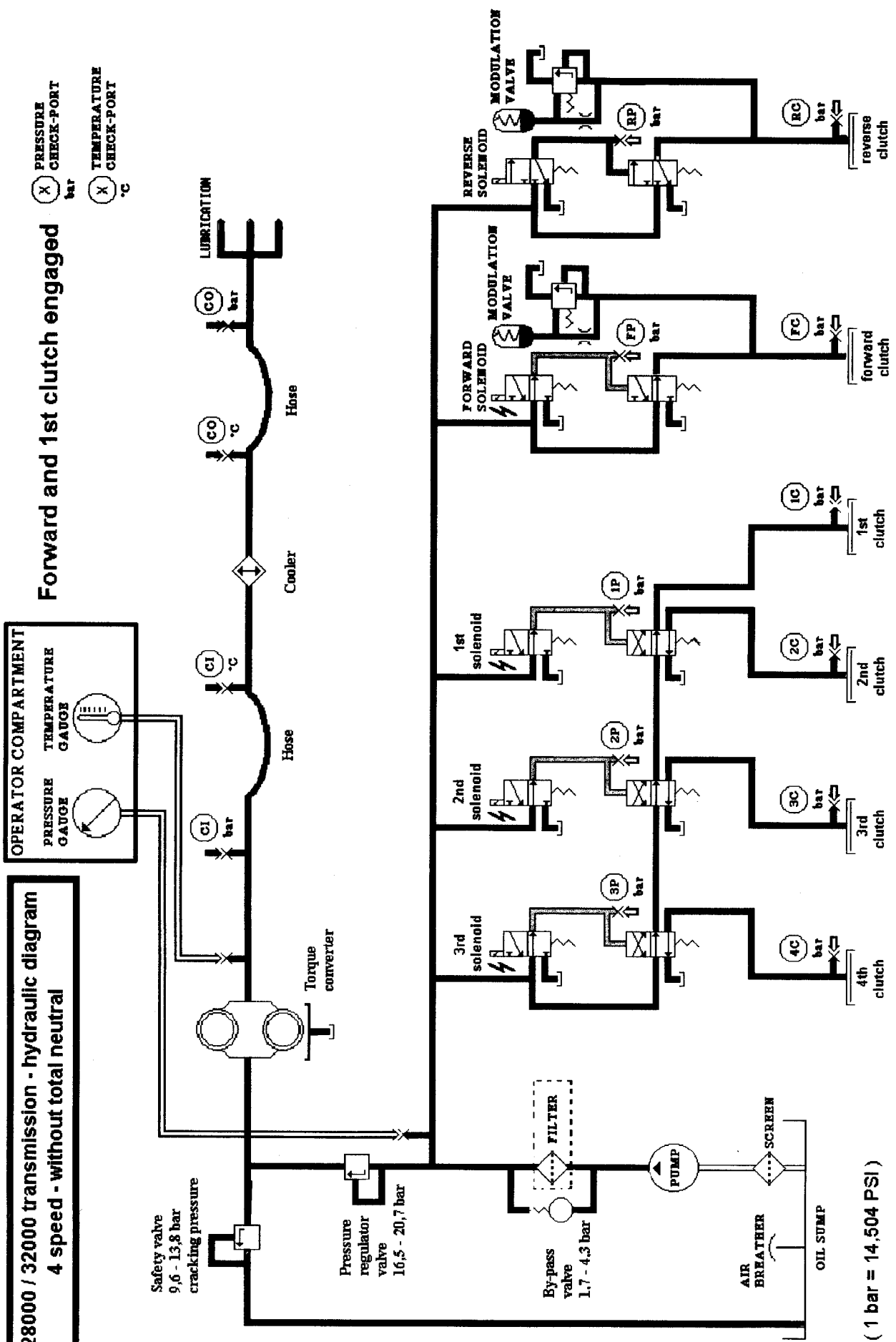
(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

**28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral**

Forward and 1st clutch engaged

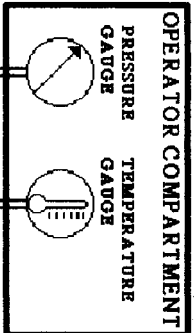


(1 bar = 14,504 PSI)



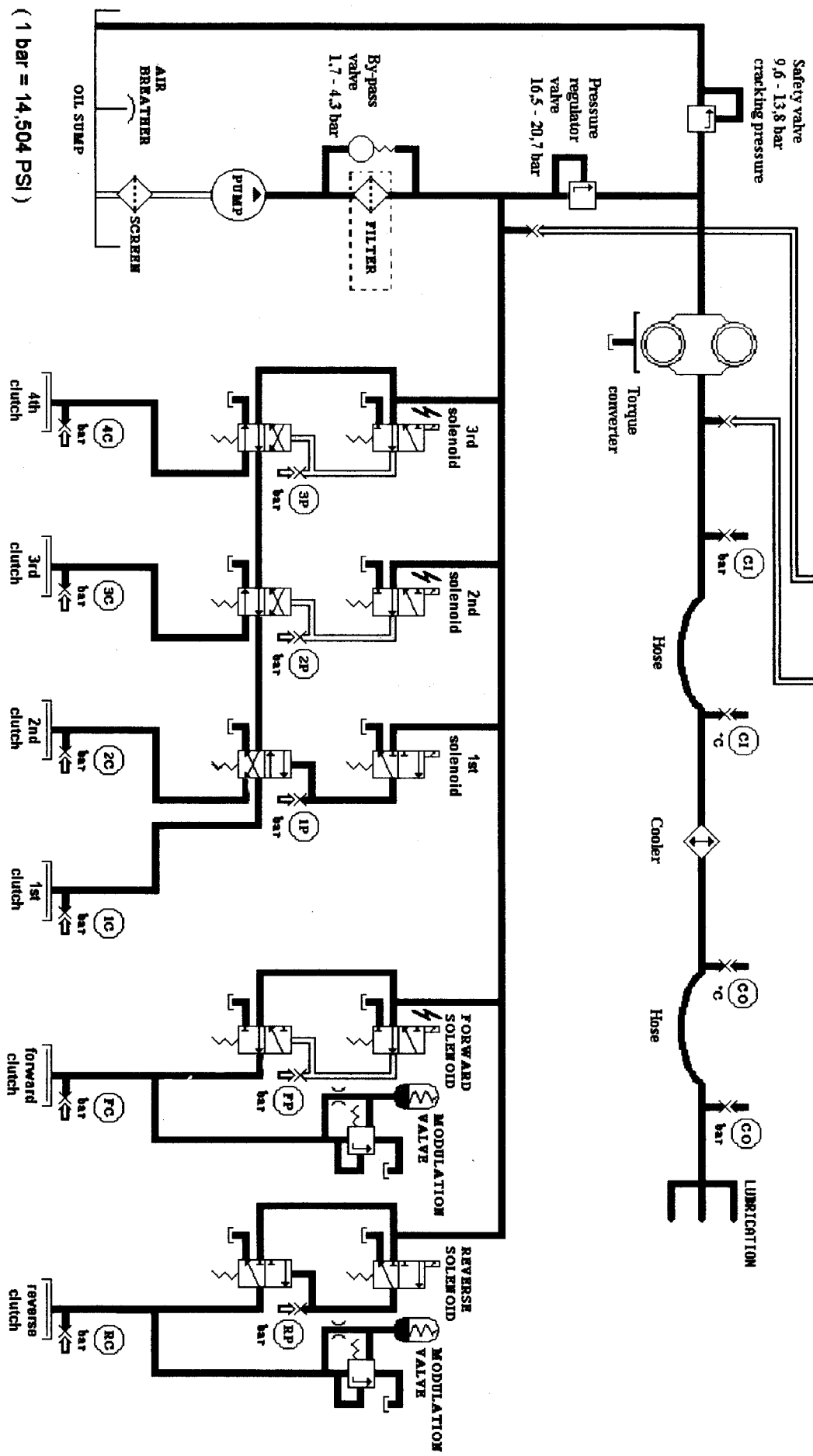
OFF-HIGHWAY COMPONENTS

28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral



Forward and 2nd clutch engaged

(X) PRESSURE CHECK-PORT
 (C) TEMPERATURE CHECK-PORT °C



(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

**28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral**

Forward and 3rd clutch engaged

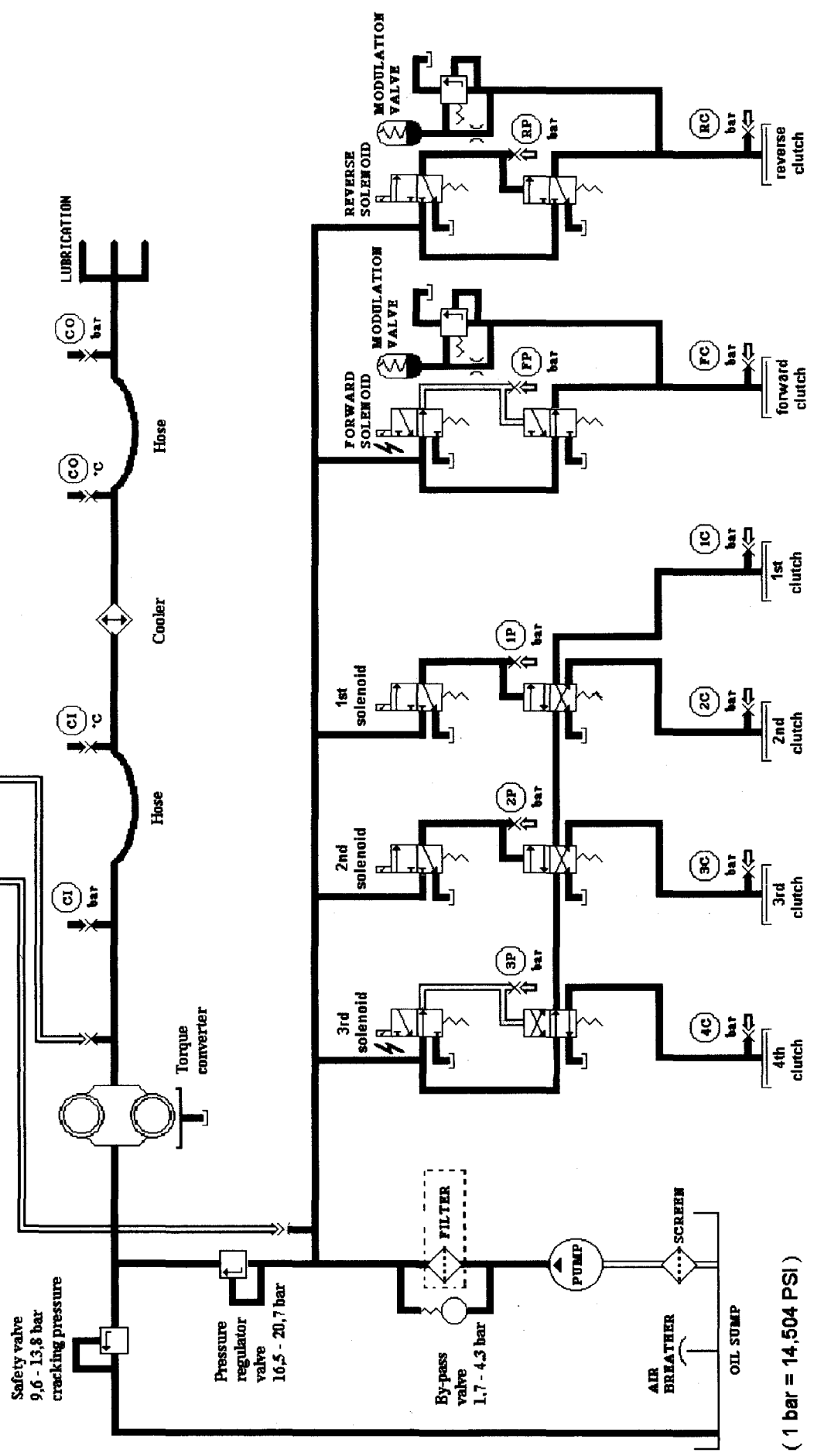
OPERATOR COMPARTMENT

PRESSURE GAUGE

TEMPERATURE GAUGE

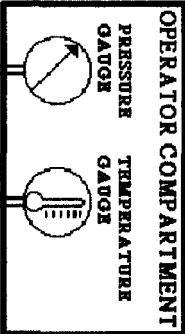
(X) bar PRESSURE CHECK-PORT

(X) °C TEMPERATURE CHECK-PORT



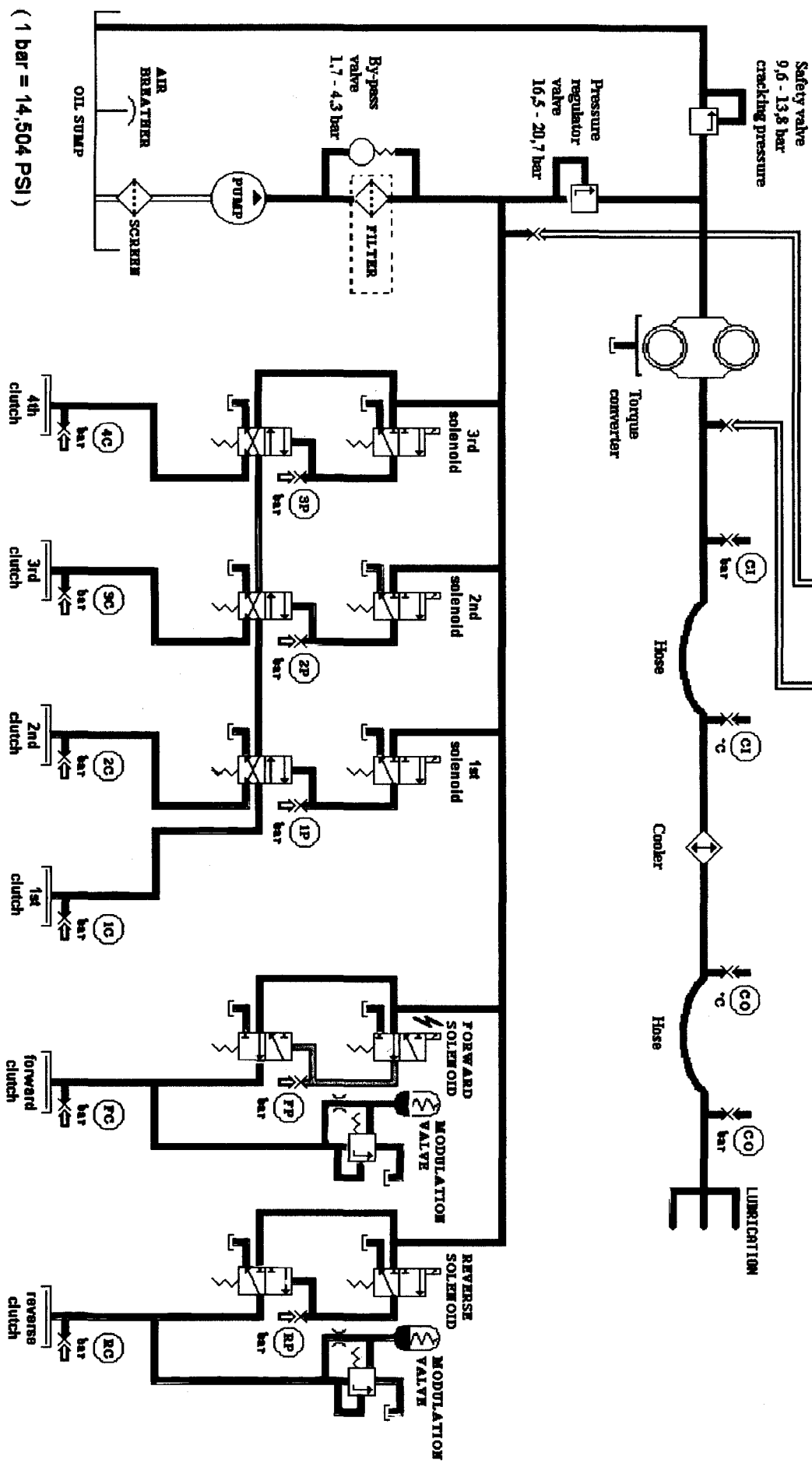
(1 bar = 14,504 PSI)

28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral



Forward and 4th clutch engaged

- (X) PRESSURE CHECK-PORT
- (C) TEMPERATURE CHECK-PORT



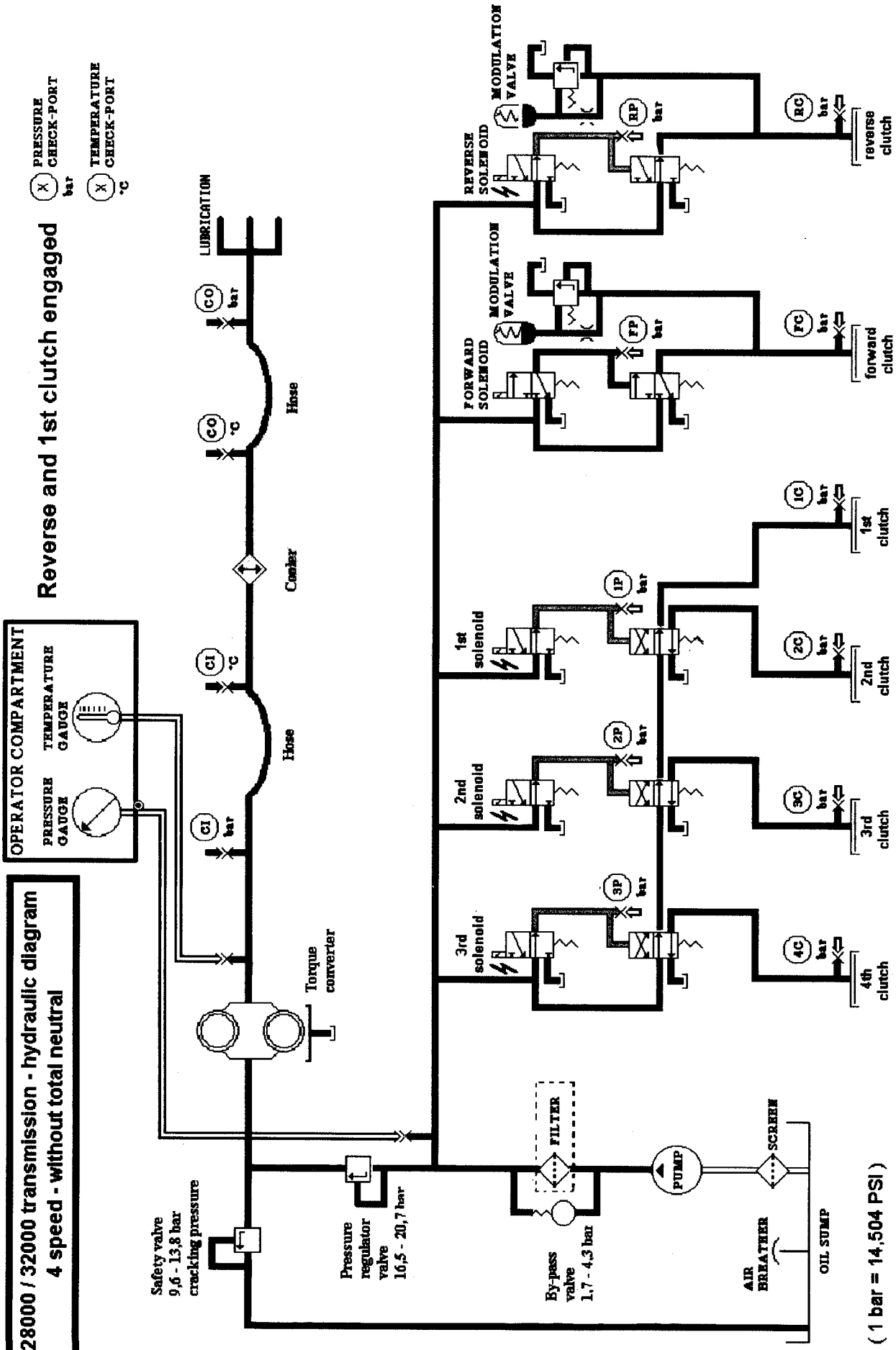
(1 bar = 14,504 PSI)



OFF-HIGHWAY COMPONENTS

**28000 / 32000 transmission - hydraulic diagram
4 speed - without total neutral**

Reverse and 1st clutch engaged



(X) PRESSURE CHECK-PORT bar
(X) TEMPERATURE CHECK-PORT °C

OPERATOR COMPARTMENT
PRESSURE GAUGE
TEMPERATURE GAUGE

(1 bar = 14,504 PSI)

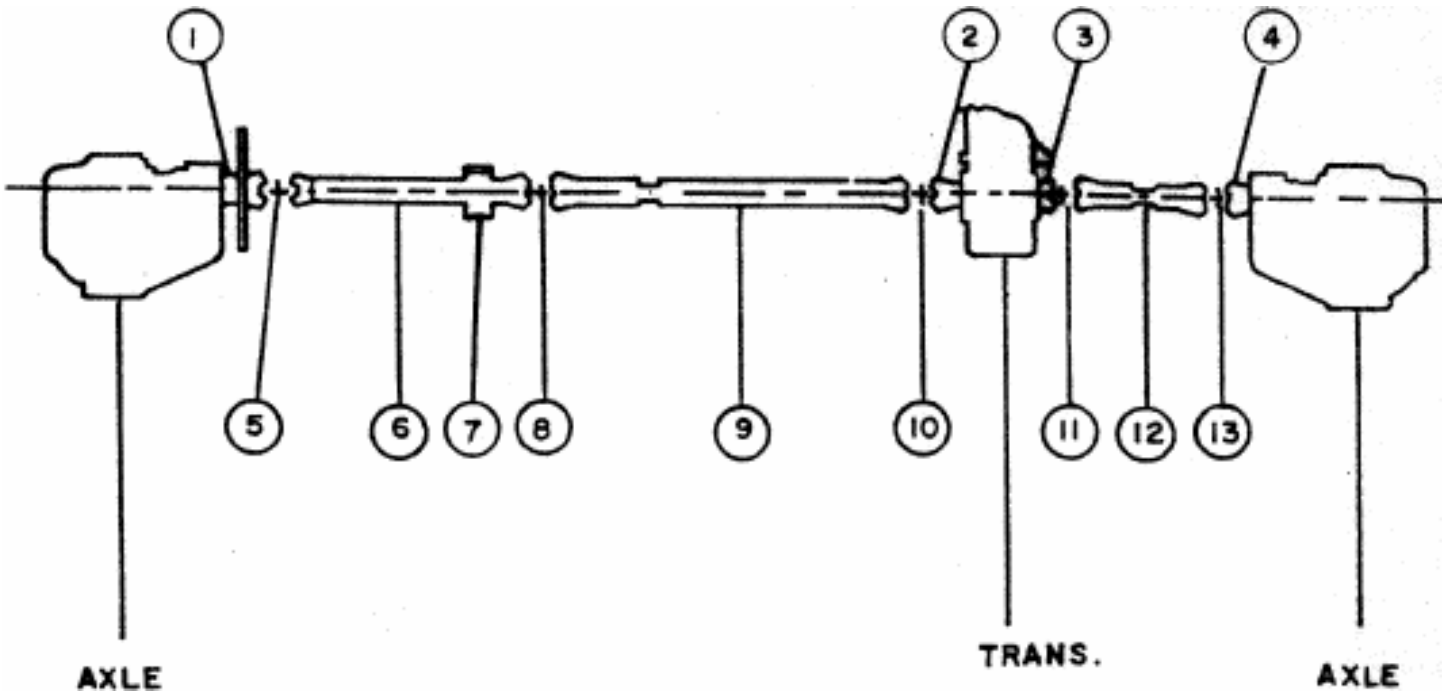
APPLICATION POLICY

Capability ratings, features and specifications vary depending upon the model type of service. Application approvals must be obtained from Spicer Off-Highway Products Division. We reserve the right to change or modify our product specifications, configurations, or dimensions at any time without notice.



SPICER OFF-HIGHWAY PRODUCTS DIVISION

1293 Glenway Drive
Statesville, NC 28625
Tel: 704-873-2811 Fax: 704-878-5616

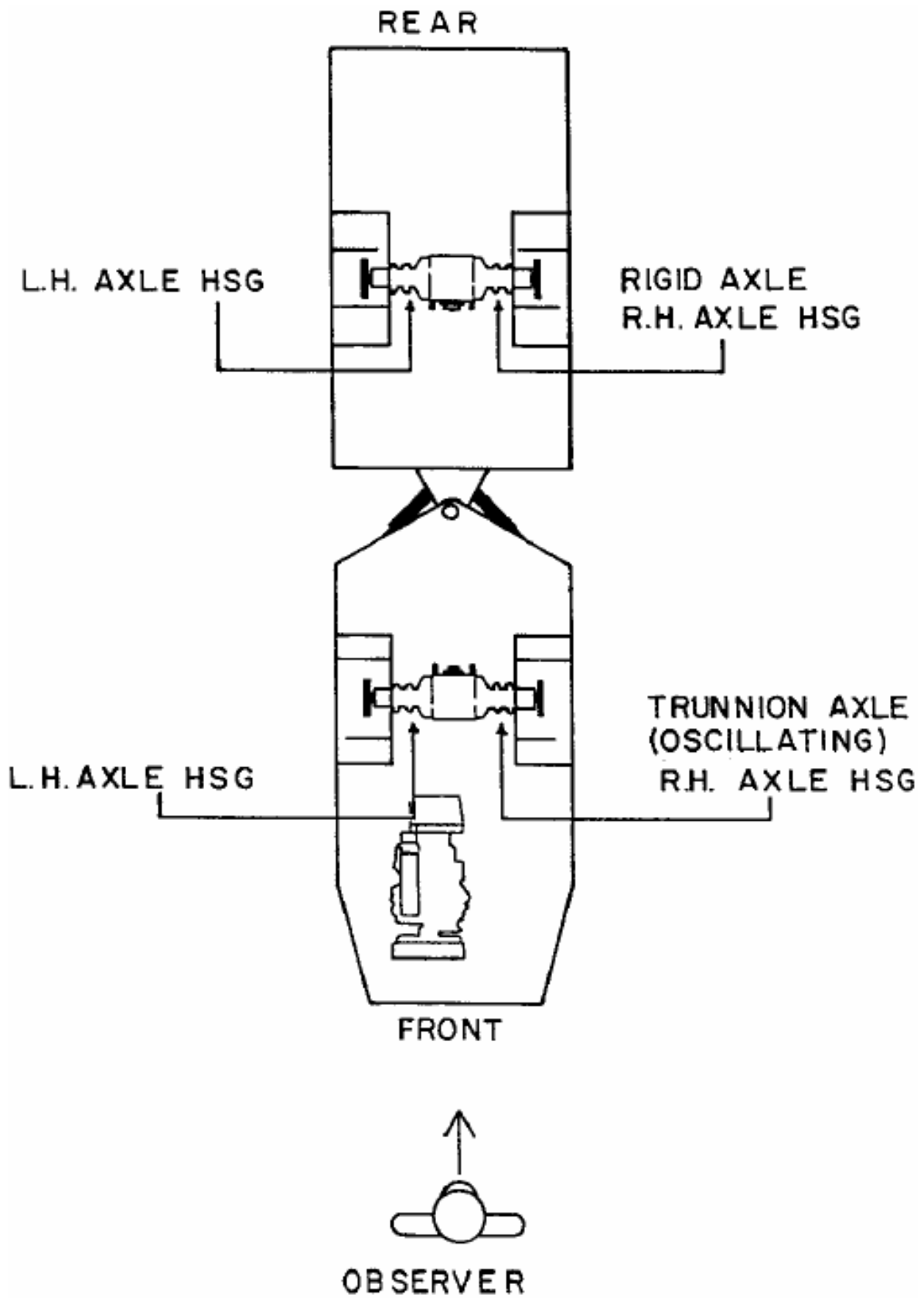


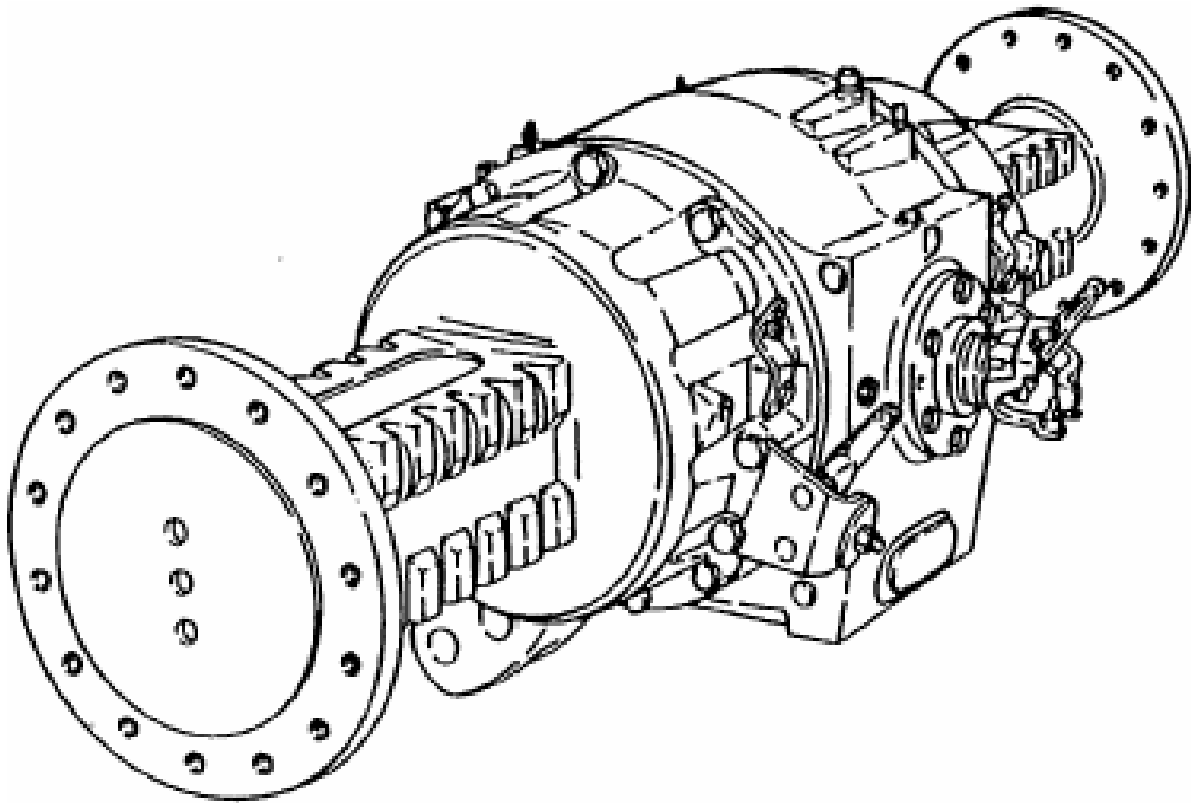
ITEM	PART #	DESCRIPTION	QTY.
1	11827-01	END YOKE (STD.)	1
2	244565	FLANGE YOKE	1
3	244565	END YOKE	1
4	11827-01	END YOKE	1
5	364024	CROSS AND BEARING KIT	1
6	19201-02	DRIVELINE ASSEMBLY (INCLUDES ITEM 7)	1
7	362120	CENTER BEARING	1
8	364024	CROSS AND BEARING KIT	1
9	464640	SLIP ASSEMBLY (INCLUDES ITEMS 8 & 10)	1
10	364024	CROSS AND BEARING KIT	1
11	364024	CROSS AND BEARING KIT	1
12	19200-14	DRIVELINE ASSEMBLY	1
13	364023	CROSS AND BEARING KIT	1

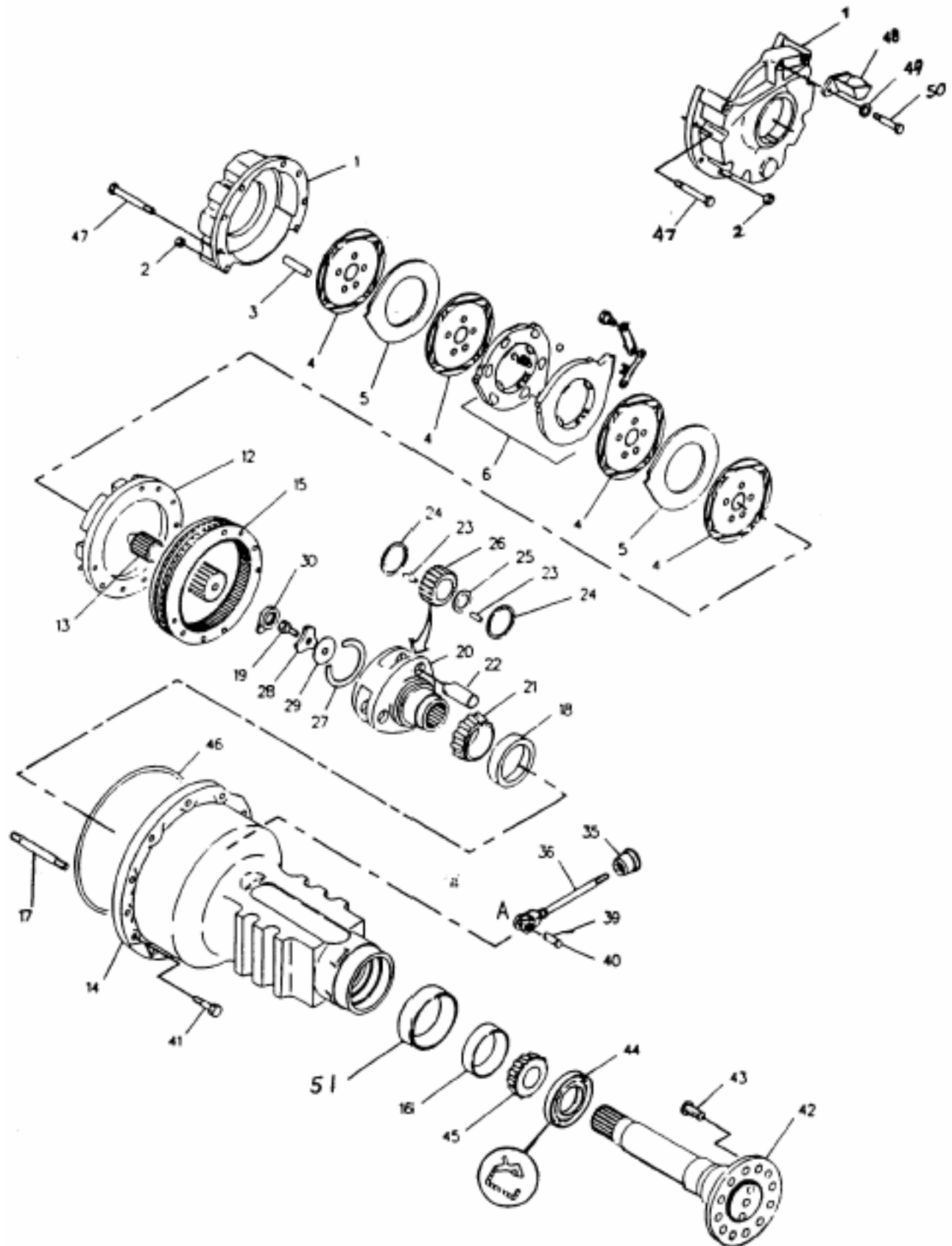
PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

6. AXLE

10829	AXLE ORIENTATION
13320	AXLE ASSEMBLY
13319	CRADLE INSTALLATION
-----	AXLE SERVICE & REPAIR MANUAL
13321	BRAKE ACTUATOR
-----	ACTUATOR INSTALLATION
13954	TIRE & RIM
-----	TIRE SERVICE









AXLE ASSEMBLY 464891

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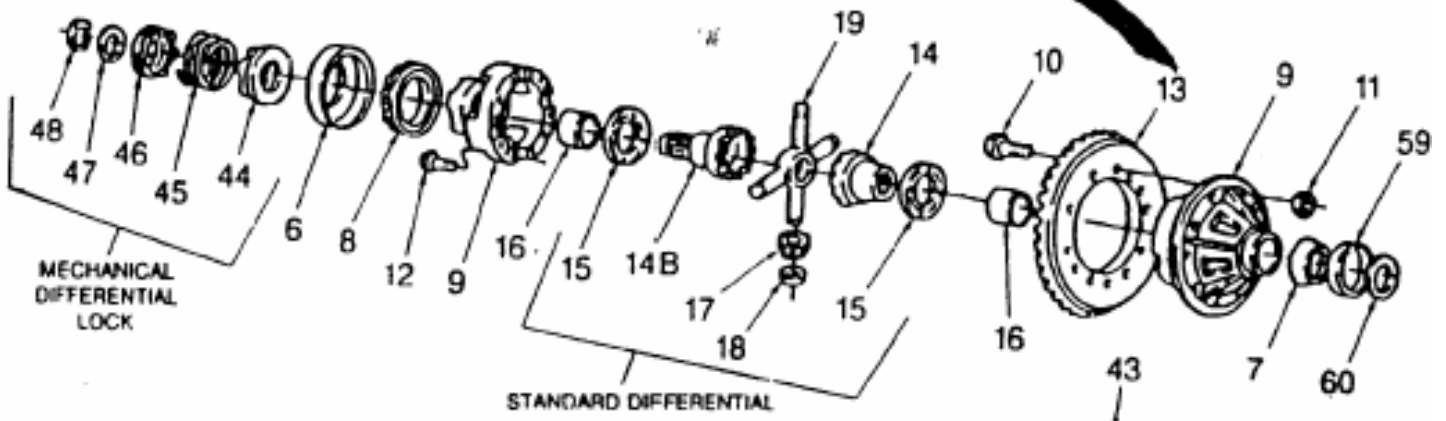
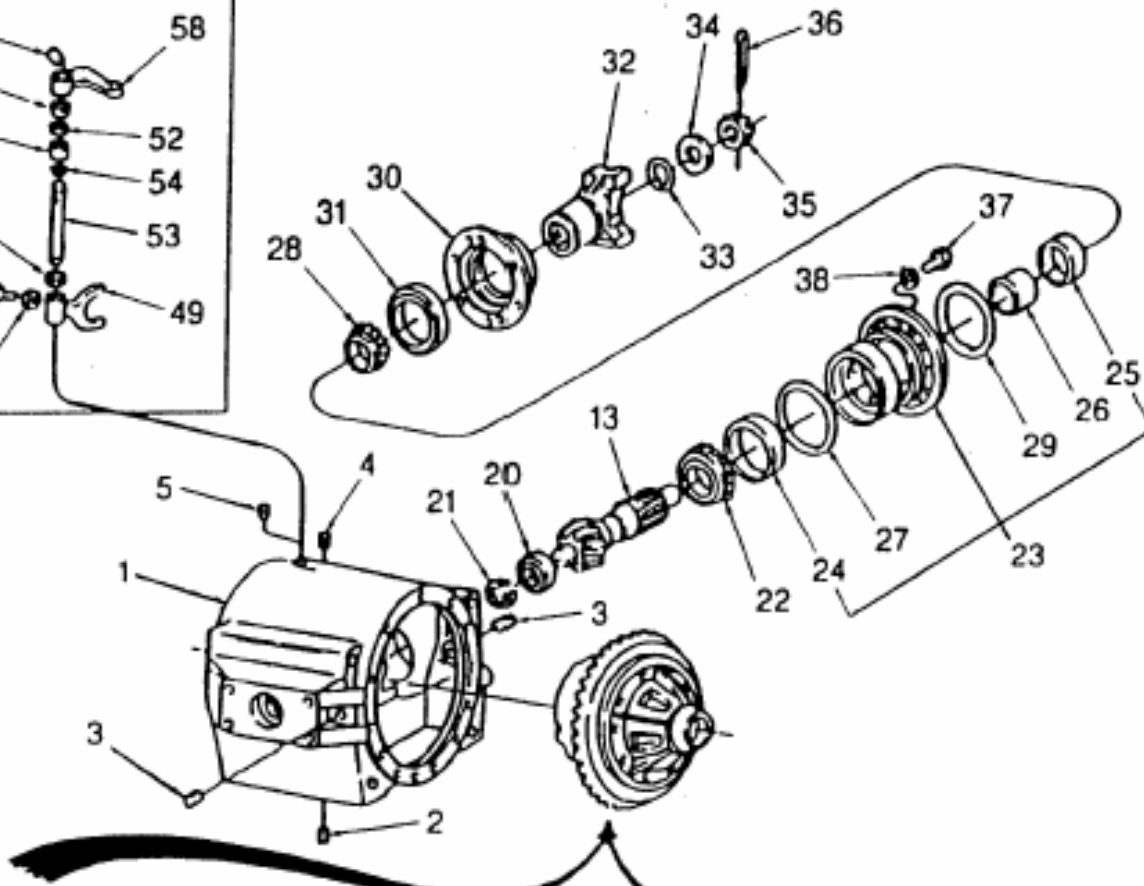
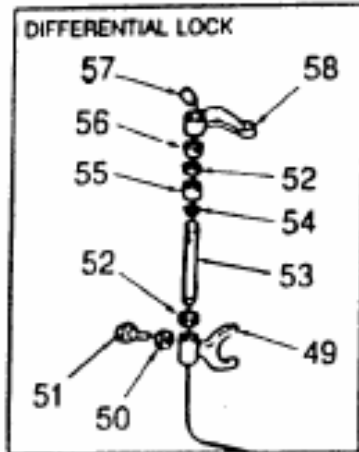
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	464891	AXLE ASSEMBLY	1
1	444285	INNER BRAKE HOUSING (RH)	1
	444286	INNER BRAKE HOUSING (LH)	1
2	444262	NUT	2
3	444268	PIN	2
4	444829	DISC ASSEMBLY	4
5	444625	DISC ASSEMBLY (INTERMEDIATE)	1
6	444830	DISC ASSEMBLY (ACTUATING)	1
12	444831	OUTER BRAKE HOUSING	1
13	444235	GEAR, PLANETARY (SUN)	1
14	444858	HOUSING ASSEMBLY (RH)	1
	444832	HOUSING ASSEMBLY (LH)	1
15	444156	GEAR, PLANETARY (OUTER)	1
16	444835	CUP, ROLLER BEARING (OUTER)	1
17	444836	STUD	2
18	444157	CUP, ROLLER BEARING (INNER)	1
19	444570	BOLT	1
20	444231	CARRIER (INCLUDES ITEMS 21-27)	1
21	444060	CONE BEARING INNER	1
22	444425	SHAFT PLANETARY GEAR	3
23	444151	KIT, NEEDLE BEARING	3
24	444150	WASHER, THRUST	6
25	444152	SPACER	3
26	444159	GEAR, PLANETARY	3
27	444158	RETAINER	1
28	444160	WASHER, RETAINER	1



AXLE ASSEMBLY 464891

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29	444205	SPACER(1.245/1.321mm)	A/R
	444105	SPACER(1.346/1.422mm)	A/R
	444118	SPACER(1.448/1.524mm)	A/R
	444119	SPACER(1.549/1.626mm)	A/R
	444120	SPACER(1.651/1.727mm)	A/R
	444106	SPACER(1.753/1.829mm)	A/R
	444122	SPACER(1.854/1.930mm)	A/R
	444123	SPACER(1.956/2.032mm)	A/R
	444145	SPACER(2.057/2.134mm)	A/R
	444237	SPACER(2.159/2.235mm)	A/R
	444097	SPACER(2.262/2.337mm)	A/R
30	444149	BOLT, LOCK	1
35	444837	SEAL ASSEMBLY BOOT	1
36	444838	ROD, BRAKE CONTROL	1
39	01GF02016	PIN, COTTER	1
40	442130	PIN, CLEVIS	1
41	444191	BOLT	11
42	444839	SHAFT	1
43	442480	BOLT	14
44	444751	SEAL	1
45	444752	CONE, ROLLER BEARING (OUTER)	1
46	444841	SEAL	1
47	444424	BOLT	6
48	444217	BLOCK, THRUST	1
49	444842	WASHER, LOCK	2
50	444269	BOLT	2
51	444843	SLEEVE	1





AXLE ASSEMBLY 464891

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	444712	HOUSING ASSEMBLY DIFF. (INCLUDES ITEMS 2-6)	1
2	444844	PLUG DRAIN (MAG.)	1
3	444272	PLUG DRAIN (STD.)	2
4	223185	PLUG DIFF. HOUSING VENT	1
5	444845	PLUG CENTER HOUSING	1
6	444177	CUP DIFF. (RH)	1
7	444008	CONE & ROLLER ASSEMBLY (RH)	1
8	444176	CONE & ROLLER ASSEMBLY (LH)	1
9	444274	CASE ASSEMBLY	1
10	442210	BOLT	12
11	444110	NUT, LOCK, HEX	12
12	444250	BOLT	8
13	444275	GEAR SET (MATCHED)	1
14	444846	GEAR DIFF. SIDE	1
15	444848	WASHER, THRUST (AXLE PINION DIFF. RH)	2
16	444173	BUSHING GEAR CASE (DIFF. RH)	2
17	444172	PINION DIFF.	4
18	444715	WASHER, THRUST (AXLE PINION DIFF. RH)	4
19	444849	SPIDER DIFF.	1
20	442220	BEARING ASSEMBLY, PINION PILOT	1
21	444850	RING DRIVE, PINION PILOT	1
22	444780	CONE BEARING	1
23	444147	RETAINER ASSEMBLY (INCLUDES ITEMS 24, 25)	1
24	444781	CUP DRIVE PINION (REAR)	1
25	442270	CUP DRIVE PINION (FRONT)	1



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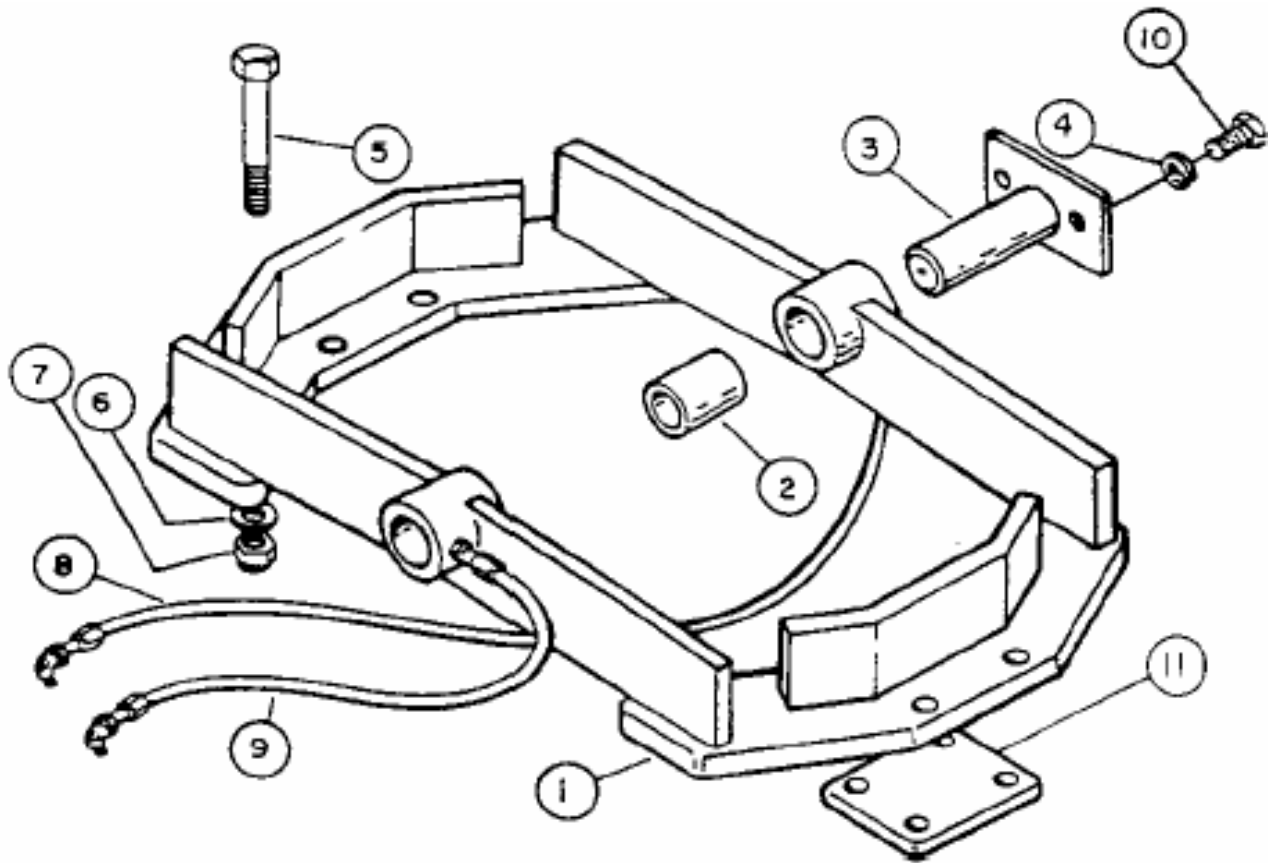
26	444219	SPACER(1.3281/1.3286)	A/R
	444220	SPACER(1.3289/1.3294)	A/R
	444221	SPACER(1.3297/1.3302)	A/R
	444222	SPACER(1.3305/1.3310)	A/R
	444223	SPACER(1.3313/1.3318)	A/R
	444239	SPACER(1.3321/1.3326)	A/R
	444224	SPACER(1.3329/1.3340)	A/R
	444225	SPACER(1.3337/1.3342)	A/R
	444240	SPACER(1.3345/1.3350)	A/R
	444226	SPACER(1.3353/1.3358)	A/R
	444227	SPACER(1.3361/1.3366)	A/R
	444228	SPACER(1.3369/1.3374)	A/R
	444229	SPACER(1.3377/1.3382)	A/R
	444230	SPACER(1.3385/1.3390)	A/R
27	442280	SEAL	1
28	442340	CONE & ROLLER ASSEMBLY	1
29	442290	SEAL, PINION RETANER BEARING	1
30	444851	RETAINER ASSEMBLY	1
31	444852	SEAL ASSEMBLY	1
32	444062	FLANGE U-JOINT	1
33	442310	SEAL, PINION DRIVE	1
34	442320	WASHER, PINION FLANGE	1
35	444853	NUT, HEX	1
36	01GF03016	PIN, COTTER	1
37	444782	BOLT	6
38	444253	WASHER, LOCK	6
44	444854	ADAPTOR, DIFF.	1
45	444855	SPRING, DIFF.	1
46	444856	COUPLING DIFF. LOCK	1
47	444252	WASHER DIFF.	1
48	444092	RING, LOCK	1
49	444788	FORK DIFF.	1
50	444857	NUT JAM	1
51	444264	SCREW	1
52	444790	WASHER, FLAT	2



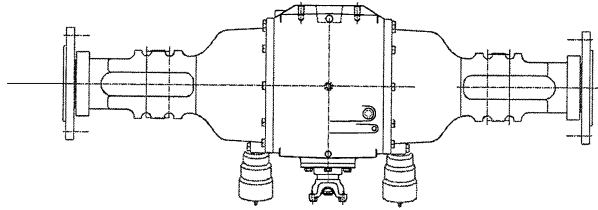
AXLE ASSEMBLY 464891

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53	444791	SHAFT, DIFF.	1
54	444792	SEAL ASSEMBLY	1
55	444793	SHIELD DIFF.	1
56	444794	RING	1
57	444260	PIN, SHACKLE	1
58	444165	LEVER, DIFF.	1
59	444164	CUP BEARING DIFF.	1
60	444125	SHIM DIFF. 0.038"(1.016mm)	A/R
	444098	SHIM DIFF. 0.044"(1.118mm)	A/R
	444126	SHIM DIFF. 0.050"(1.270mm)	A/R
	444127	SHIM DIFF. 0.056"(1.422mm)	A/R
	444108	SHIM DIFF. 0.068"(1.727mm)	A/R
	444100	SHIM DIFF. 0.074"(1.880mm)	A/R
	444109	SHIM DIFF. 0.080"(2.032mm)	A/R



ITEM	PART #	DESCRIPTION	QTY.
1	15261-01	CRADLE ASSEMBLY	1
2	464693	BUSHING	2
3	19204-88	PIVOT PIN	2
4	04GE10	WASHER	8
5	17GD10136	BOLT	8
6	27GE10	FLAT WASHER	8
7	17GD10	LOCKNUT	8
8	6474-04	GREASE HOSE ASSEMBLY	1
9	6474-04	GREASE HOSE ASSEMBLY	1
10	01GC10024	BOLT	4
11	15262-03	AXLE PAD	2



NEW HOLLAND D65

REPAIR MANUAL

**POWER
COMPONENTS**

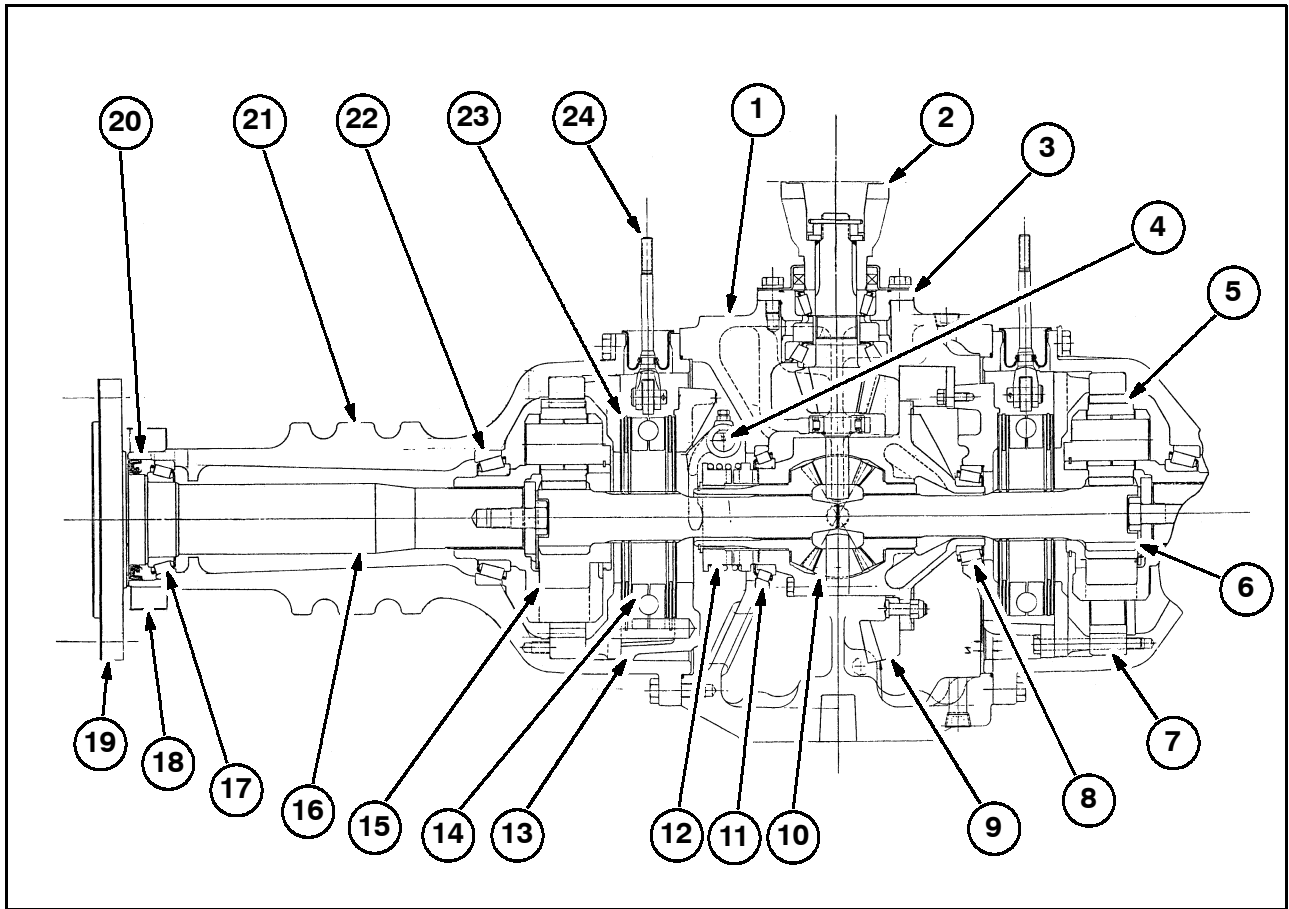


NEW HOLLAND

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Description	Page
Rear Axle Description and Operation	2
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C. Axle Bearing Preload	8
D. Planetary Gear Assembly	9
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F. Pinion Assembly	13
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H. Differential Bearing Preload	18
I. No-Spin Differential Assembly	19
J. Brake Adjustment	20
K. Specifications, Tightening Torque, and Special Tools	21

REAR AXLE DESCRIPTION AND OPERATION



1

- | | |
|--------------------------------------|------------------------------|
| 1. Rear Axle Center Housing | 13. Brake Inner Housing |
| 2. Yoke | 14. Brake Actuating Discs |
| 3. Drive Pinion Bearing Retainer | 15. Planet Gear Carrier |
| 4. Differential Lock Operating Shaft | 16. Rear Axle Shaft |
| 5. Planet Gear | 17. Axle Shaft Outer Bearing |
| 6. Sun Gear and Shaft | 18. Sleeve |
| 7. Ring Gear | 19. Rear Wheel Flange |
| 8. Differential Bearing | 20. Axle Shaft Oil Seal |
| 9. Differential Ring Gear | 21. Axle Shaft Housing |
| 10. Differential Assembly | 22. Axle Shaft Inner Bearing |
| 11. Differential Bearing | 23. Brake Discs |
| 12. Differential Lock Assembly | 24. Brake Actuating Rod |

The rear axle contains the differential, brakes, final reduction gears, axle shaft, and the differential lock (Figure 1).

TORQUE TRANSFER

The spiral bevel pinion is held by preloaded opposed tapered roller bearings. The differential ring gear is bolted to the differential case, and the drive from the case is transmitted through a conventional four pinion differential to two side gears of the differential.

In each axle housing assembly, a shaft terminates in a spur gear, which is the sun gear of the planetary reduction gear system. The planetary ring gear is pressed into the rear axle housing. The three planet gears are mounted in a carrier and positioned around the sun gear and within the planetary ring gear.

The planet gears are mounted to the carrier by shafts and rotate on uncaged needle bearings. The carrier has internal splines that engage splines on the inner end of the axle shaft.

As the sun gear is driven by the differential, the planet gears are forced to revolve inside the stationary planetary ring gear and force the carrier to revolve at a lower speed than the sun gear.

The rear shaft is held in opposed tapered roller bearings, and the play is adjusted by means of selective spacers held under the retaining bolt. The shaft terminates in a flange to which the rear wheel is bolted.

A common supply of oil is used for lubricating the rear axle and differential assemblies. The differential ring gear and differential assembly are partly immersed in oil, which provides adequate lubrication for bearing and bushings.

DIFFERENTIAL LOCK OPERATION

When one rear wheel of a unit encounters a soft patch of ground and spins, the normal-type

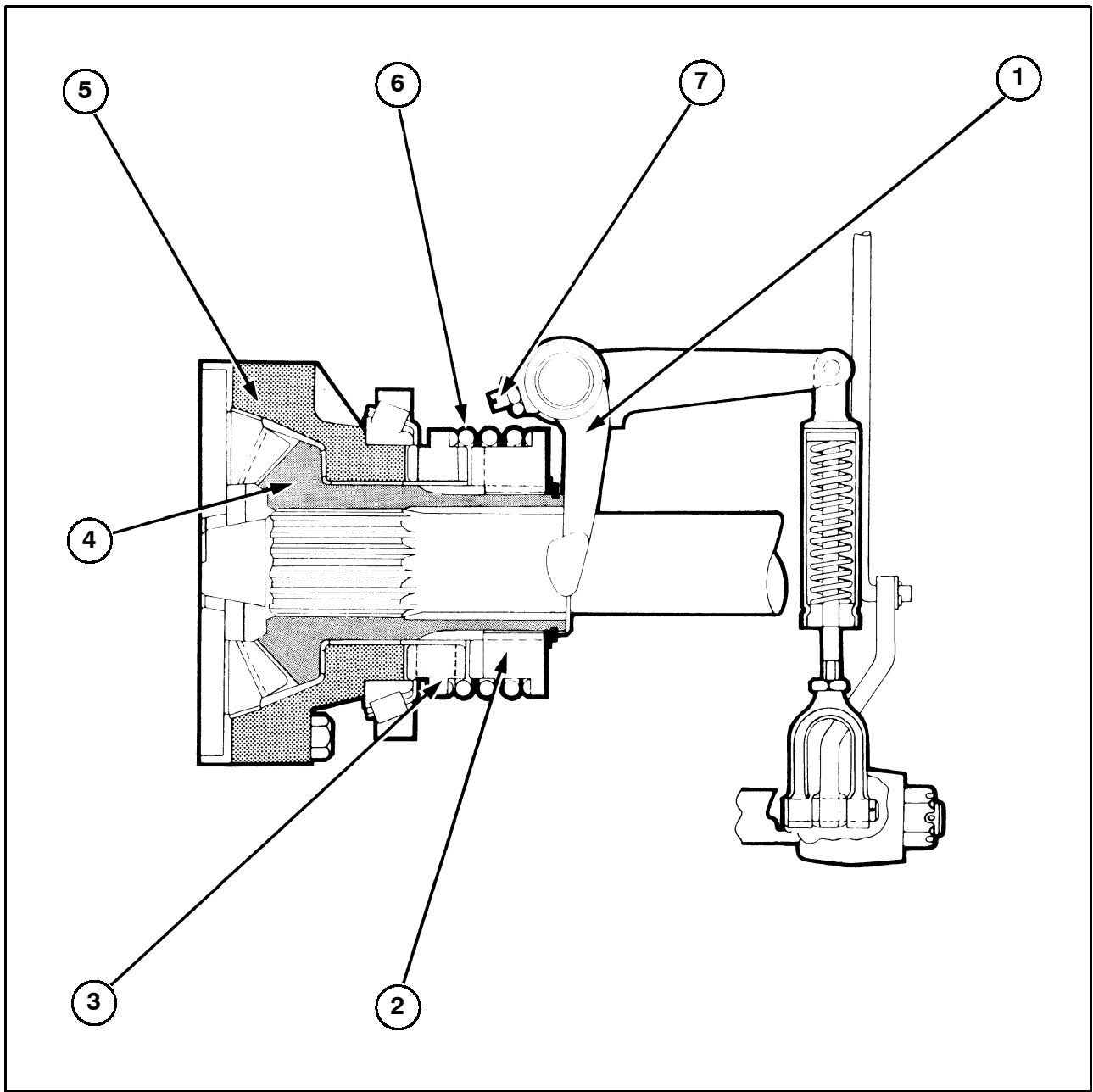
differential action allows virtually all the drive to be applied to this wheel and a little to the opposite rear wheel, which may be on firm ground. The result is that the unit is either brought to a complete halt or slowed down considerably.

When the differential lock is engaged, improved traction is possible because the lock enables traction to be obtained from the wheel, which is on firm ground, thus enabling the unit to pull through the soft ground conditions.

Basically, the locking device consists of a dog-type coupling, which is splined to, but free to slide on, the differential side gear to the differential case. The connection side is made through the differential lock adaptor, which has dog teeth on both side faces. The teeth on the inside engage with teeth on the outside, with the differential lock coupling.

In operation, pressing of the foot pedal first moves the coupling into contact with the adaptor and then compresses the spring in the operating rod assembly (Figure 2). As the teeth of the coupling come into alignment with the teeth spaced in the fixed adaptor, the spring tension will move the coupling into engagement with the adaptor. The fact that the spring supplies the final operating force prevents the possibility of damage if excessive force is applied to the foot pedal.

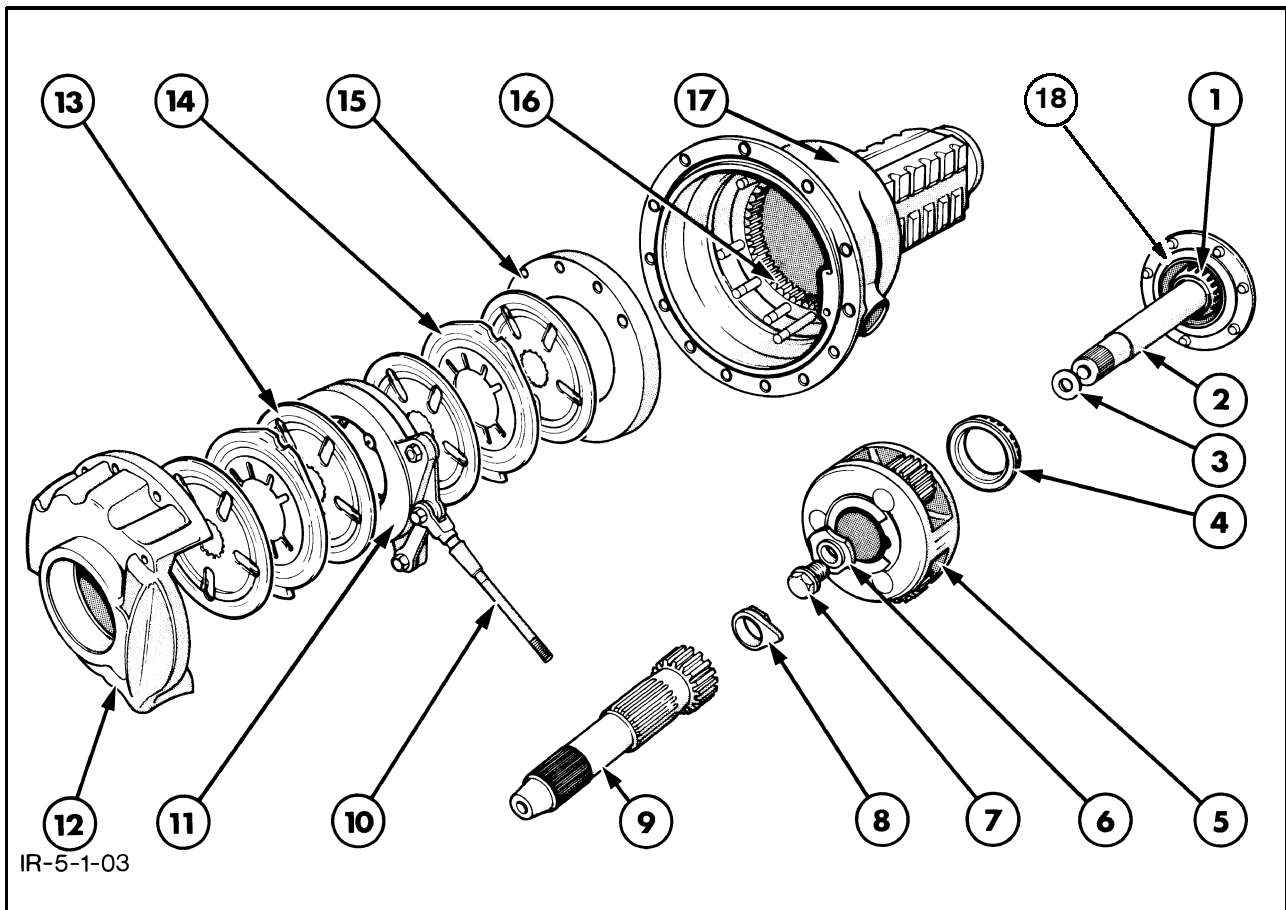
When full engagement has taken place (noticeable by the reduced pedal pressure), the foot pedal should be released. The coupling and adaptor teeth side forces, resulting from the transfer of power from one wheel to another, will keep the coupling and adapter teeth in mesh. As the drive becomes more equally distributed, the compressed operating spring overcomes the reduced teeth side forces and automatically disengages the differential lock.



2

Differential Lock Assembly

- | | |
|---------------------------|-------------------------|
| 1. Differential Lock Fork | 5. Differential Housing |
| 2. Coupling | 6. Spring |
| 3. Adaptor | 7. Fork Retaining Bolt |
| 4. Differential Side Gear | |



IR-5-1-03

3

Axle Housing Assembly-Exploded View

- | | |
|-----------------------------|---------------------------|
| 1. Axle Shaft Outer Bearing | 10. Brake Actuating Rod |
| 2. Axle Shaft | 11. Brake Actuating Discs |
| 3. Spacer | 12. Inner Brake Housing |
| 4. Bearing | 13. Rotating Brake Discs |
| 5. Planet Gear Carrier | 14. Fixed Brake Discs |
| 6. Retaining Washer | 15. Outer Brake Housing |
| 7. Retaining Bolt | 16. Ring Gear |
| 8. Lock Plate | 17. Axle Housing |
| 9. Sun Gear and Shaft | 18. Seal |

BRAKE OPERATION

The disc brakes consist of two sets of stationary and revolving discs. The revolving discs are splined to the shaft of the sun gear, located on either side of an actuator assembly (Figure 3).

The actuator assembly consists of two thrust plates with ramped "pockets" in which steel balls are located. The actuating discs are held in contact with the balls by four coil springs and connected by suitable linkage with the appropriate foot brake pedal.

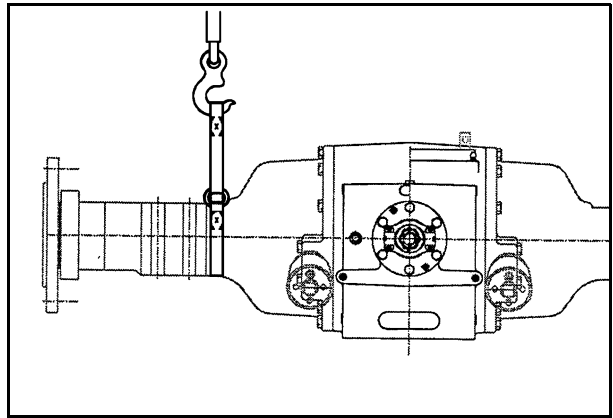
Operation of the foot brake pedal causes the rear brake actuating discs to rotate and the balls to rotate up the ramped "pockets." This rotation expands the actuating discs, which force the rear brake disc assemblies into contact with the intermediate disc, the actuating discs, and the inner and outer housings. Rotation of the stationary components of the brake unit is prevented by a large-diameter torque pin held in the outer brake housing.

A. TEARDOWN GUIDELINE AND REMOVAL OF AXLE HOUSING ASSEMBLY

Operations or repairs that can be performed on counterclockwise (CCW) D65 axle components with the left and/or right housing assembly removed.

Component	Left Axle	Right Axle
Brake Overhaul	X	X
Planetary Overhaul	X	X
Axle Shaft Bearing/Seals	X	X
Differential Operating Fork	X	
Pinion Assembly		X
Differential Gears & Differential Lock Assembly		X

1. Drain oil from axle.
2. Place axle in a low stand, and place a jack under the housing not being removed.
3. Remove brake cylinders, if installed.
4. Install half of the wheel bolts in wheel flange.
5. Remove the right housing assembly first so that the differential gear set is supported by the left sun gear when the right housing is removed. Place a strap around the square section of the housing next to the bell end (Figure 4).
6. Remove the housing attaching bolts, leaving the top bolt until last. Use an overhead hoist to remove the housing assembly, and then stand the assembly vertically on the wheel disc.
7. Remove the left housing in a similar manner after the differential assembly is removed.



Rear View of Housing Assembly Removal

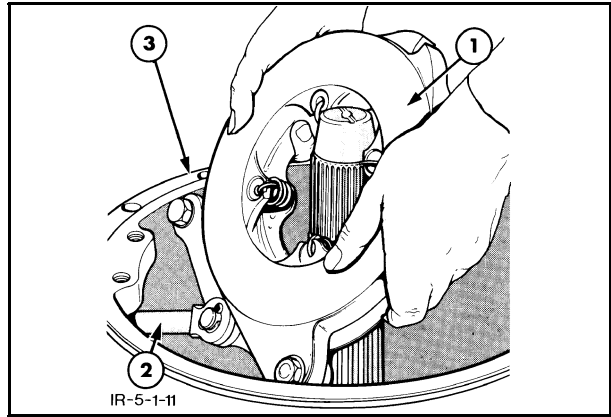
4

B. BRAKE OVERHAUL

1. Right-Hand Axle Housings-Remove the two bolts securing the differential ring gear thrust block to the brake housing, and remove the thrust block.
2. Remove the two nuts and six bolts that retain the inner disc brake housing assembly in the axle housing. Lift the brake housing out of the axle housing.
3. Remove the brake actuator (Figure 5). Remove the brake rod seal if damaged. To remove the seal, place a sharp tool between the seal flange and the rear axle housing, and pry the seal out. Remove the brake disc assemblies intermediate discs, and actuating disc assembly.
4. Lift the sun gear out of the planet gear carrier.
5. Remove the outer brake housing from the axle housing.

NOTE: Replace friction plates and separator plates if they are overheated or worn more than 0.5 mm (0.020") per friction plate. New thickness is 4.8 mm (0.0190").

6. Reassemble the brake components in the reverse order. Be sure the spring is in the groove on the pullrod boot and the boot is in the groove on the pullrod.



5

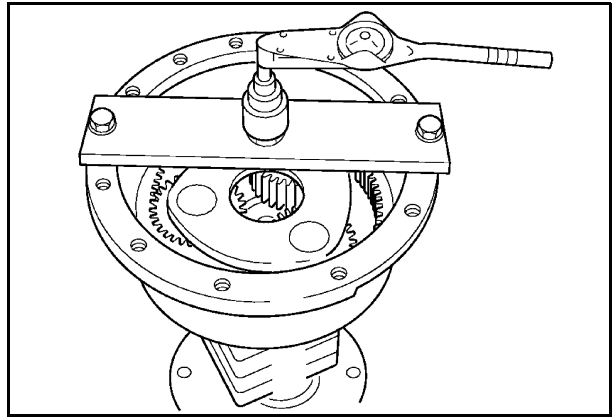
Removing and Installing Brake Actuating Mechanism

1. Actuating Discs
2. Actuating Link
3. Axle Housing

C. AXLE BEARING PRELOAD

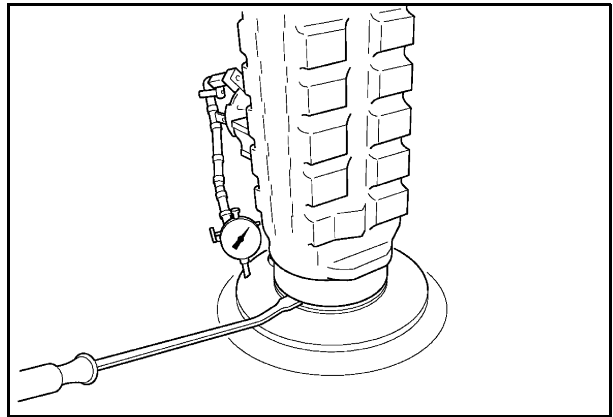
1. If the planetary gears or the axle bearings or seals are to be serviced, first check the axle shaft rolling torque and end play to see if they are correctly shimmed.
2. Install axle shaft torque tool (see Special Tools, Section K) as shown in Figure 6. Rolling torque should be as follows:
 - 50 - 150 in. lb.
3. Check axle shaft end play. If any end play is detected, use a dial indicator as shown in Figure 7 to determine the amount.
4. If torque is too high, use the next thicker spacer after the planetary or axle system repair.
5. If 0.003" or more end play is detected, install a spacer one size smaller for every 0.004" or portion of 0.004" measured (e.g., if 0.018" end play is measure, change to a spacer five sizes smaller).
6. If this check is not possible before the repair, install a 0.081" thick spacer. Position the selected spacer and shaft retaining washer, and tighten the axle shaft bolt to 407 N·m (300 ft. lb.) torque. Then, proceed with steps 2 through 5 until bearing preload is okay.
7. To position, the bolt lock may require that the bolt be tightened more, up to 350 ft. lb. so that the lock notches will fit the bolt head corners.

It may be necessary to turn the bolt lock over. Apply adhesive or grease to the bottom of the bolt lock to hold it in position while the side housing is attached to the center housing.



6

Axle Shaft Rolling Torque Measurement

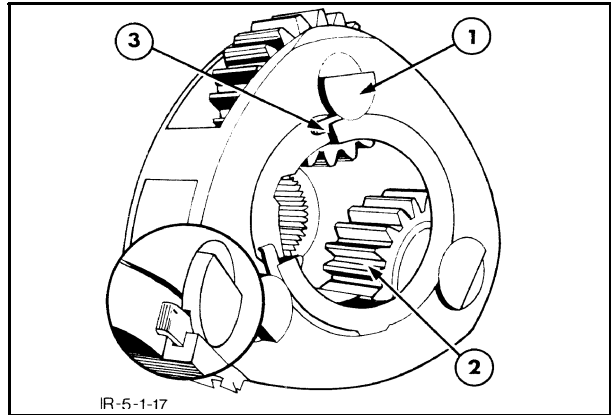


7

Axle Shaft End Play Measurement

D. PLANETARY GEAR ASSEMBLY

1. Remove the axle shaft bolt lock, axle shaft retaining bolt, axle shaft retaining washer, and selective spacer
2. Lift the carrier assembly out of the axle housing.
3. If the planetary carrier assembly must be serviced, bend up one end of the planet gear shaft retaining ring, and withdraw the ring. Pull the planet gear shafts from the carrier, and remove the planet gears, complete with needle bearings and thrust washers (Figures 8 and 9). Rebuild the carrier using new components as required. Pack the needle bearings in the planet gears with grease, and be sure to bend the ends of the retainer ring downward.

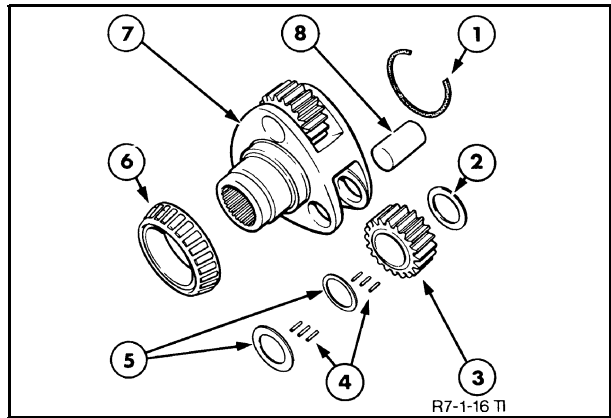


8

Planet Gear Carrier Assembly

1. Planet Gear Shaft
2. Planet Gear
3. Planet Gear Shaft Retainer

4. If the bearing on the planet gear carrier requires replacing, removing it by using pulling attachment tool FNH0926 and puller tool FNH09516. Install a step plate adapter into the end of the carrier. Install a new cone and roller assembly.
5. If necessary, remove the inner bearing cup from the housing by using puller FNH09507 and FNH09567. Install a new cup.



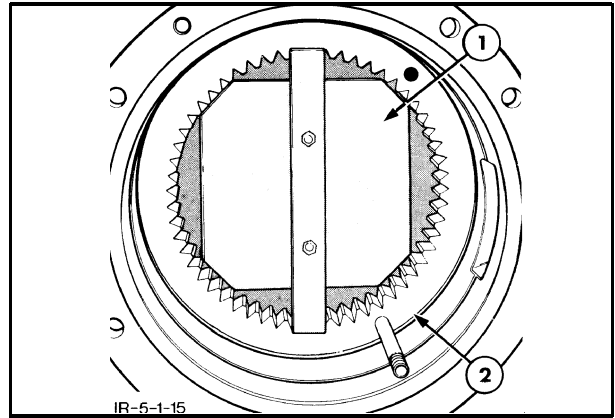
9

Planet Gear Carrier Assembly

1. Retaining Ring
2. Thrust Washer
3. Planet Gear
4. Rollers
5. Thrust Washers
6. Cone and Roller Assembly
7. Carrier
8. Planet Gear Shaft

6. Inspect the planetary ring gear located in the axle housing. If damaged or worn, replace as follows:

- Remove the axle shaft from the axle.
- Position Tool No. FNH021223 behind the ring gear and tighten the retaining nuts (Figure 10).
- Place the axle housing on a press beam with the large end down. Insert a bar of suitable length into the small end of the housing against Tool No. FNH02123. Position the other end of the bar under the press ram, and press out the ring gear.

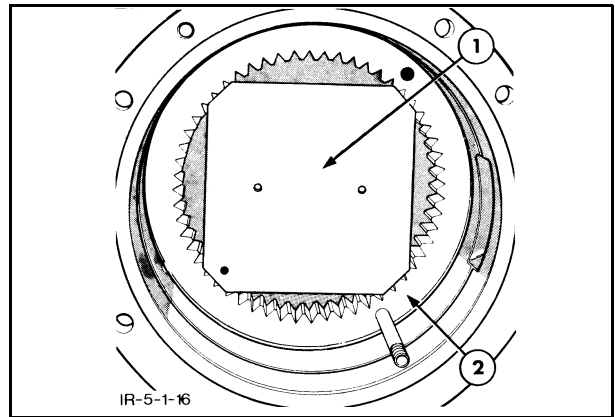


10

Removing Planetary Ring Gear

1. Tool No. FNH02123
2. Ring Gear

- Clean the new ring gear and the housing shoulder, and position the ring gear in the axle housing, ensuring that the studs in the housing are aligned with the holes in the ring gear.
- Place the axle housing on a press beam with the large end up. Position Tool No. FNH02123 on the ring gear (Figure 11), and press the ring gear into the housing. Be sure the ring gear is pressed squarely into the housing.
- To check that the ring gear is seated correctly, use a feeler gauge to ascertain if there is a gap between the ring gear and housing shoulder.



11

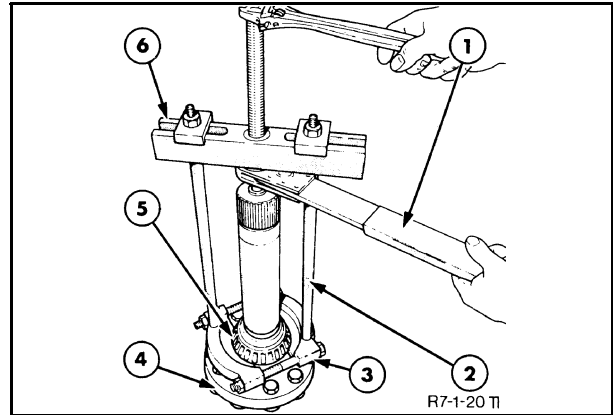
Installing Planetary Ring Gear

1. Tool No. FNH02123
2. Ring Gear

NOTE: If a new planetary ring gear has been installed in the right-hand axle housing, the differential bearing preload must be checked as described in the Differential Bearing Preload section.

E. AXLE BEARING AND SEAL REPLACEMENT

1. Starting with the axle in vertical position and the planetary carrier removed, attach a chain at two of the bolt holes on the flange of the trumpet housing.
2. Lift the housing assembly upward approximately 1", and then place a block of wood on top of the axle shaft and drive the shaft out of the housing.
3. When removing the axle shaft outer cone and roller assembly and shaft seal, use tools listed below Figure 12.

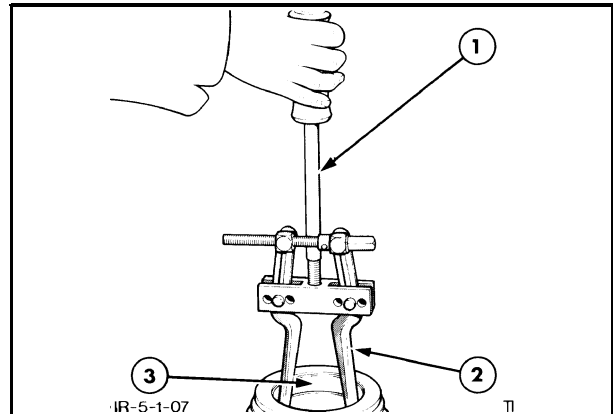


12

Axle Shaft Cone and Roller Assembly Removal

1. Ratchet, Tool No. OTC7366
2. Legs, Tool No. FNH09521
3. Pulling Attachment, Tool No. FNH09526
4. Axle Shaft
5. Cone and Roller Assembly
6. Puller, Tool No. FNH09506
7. Shaft Protector, Tool No. FNH09212

4. Use slide hammer, Tool No. FNH09567, and puller Tool No. FNH09507, to remove the bearing cup from the outer end of the axle housing (Figure 13). To replace the cup, use a suitable stepped plate and a mallet; install cup until fully seated in housing.

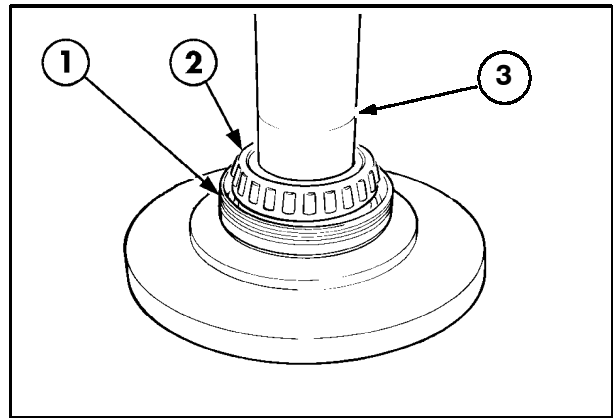


13

Removing Outer Bearing Cup from Axle Housing

1. Tool No. FNH09567
2. Tool No. FNH09507
3. Bearing Cup

5. Install a new cassette seal by using a metal sleeve to press on the OD of the seal (Figure 14)
6. Install a new bearing by using a suitable sized sleeve, which can be used as a slide hammer.
7. Using a chain attached to the housing flange, lower the axle housing over the shaft assembly, taking care to maintain alignment. Do not change direction after the seal starts to enter the bore in the end of the housing or the seal will be damaged.
8. Measure the removed spacer thickness, and then use the results obtained in Section C, Axle Bearing Preload to determine the required spacer thickness. See Specifications in Section K for the available spacers.
9. Assemble the axle shaft retaining bolt and check rolling torque and axle shaft end play as described in Section C, Axle Bearing Preload.

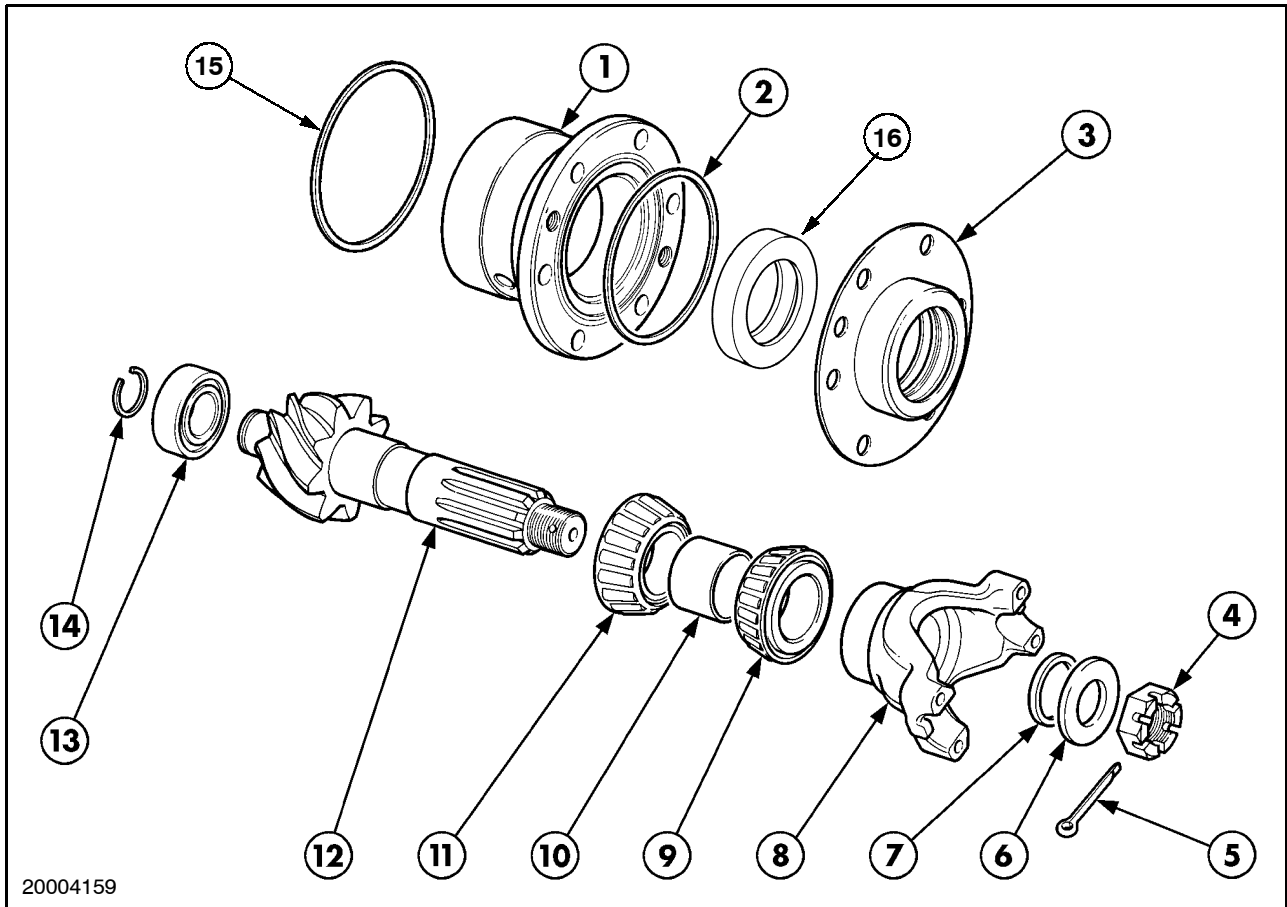


14

Axle Shaft with Seal and Bearing Installed

1. Cassette Seal
2. Bearing Assembly

F. PINION ASSEMBLY



15

Pinion Shaft Layout

- | | |
|----------------------|-------------------|
| 1. Retainer Assembly | 9. Bearing |
| 2. Seal | 10. Spacer |
| 3. Retainer | 11. Bearing |
| 4. Castellated Nut | 12. Pinion Shaft |
| 5. Cotter Pin | 13. Bearing |
| 6. Washer | 14. Lock Ring |
| 7. Seal | 15. Seal |
| 8. Yoke | 16. Seal Assembly |

Prior to disassembling the drive pinion assembly, remove the differential from the rear axle center housing.

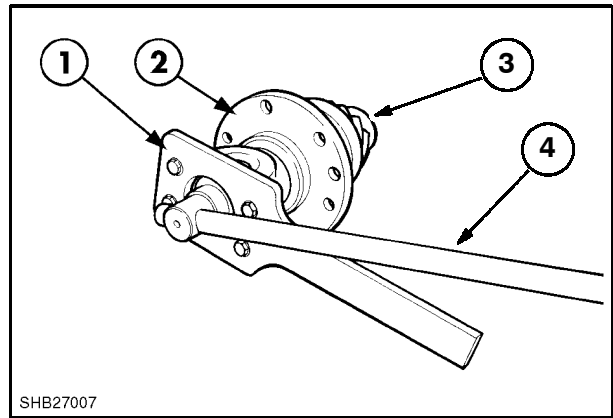
DISASSEMBLY

1. Remove the six bolts and lockwashers securing the drive pinion assembly to the rear axle center housing, and using two 9/16" National Course (NC) bolts as jacking screws, remove the drive pinion assembly.
2. Place the drive pinion assembly in a vise. Remove the cotter pin and the nut by using the yoke holding tool (See Special Tools in Section K) as shown in Figure 16.
3. Slide off the yoke, and remove the oil seal assembly and O-ring.
4. Remove the drive pinion assembly, the bearing spacer, and the front cone and roller assembly from the bearing retainer assembly.

INSPECTION AND REPAIR

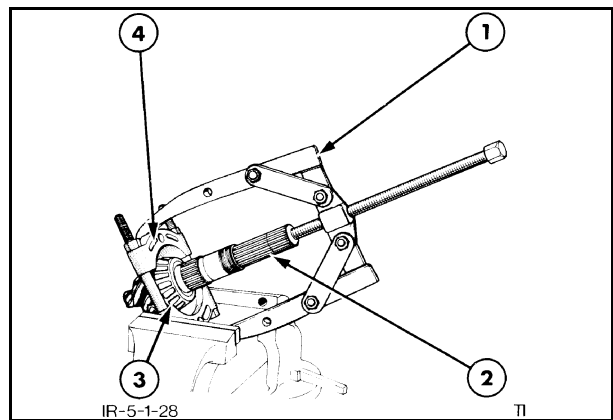
1. Thoroughly clean and inspect all parts, and if worn or damaged, install new parts.
2. If it is necessary to install a new rear pinion cone and roller assembly, the assembly may be removed as shown in Figure 17. The new cone and roller are installed by using the tools and a suitable sleeve shown in Figure 18 to enable the tool to press on the inner bearing race.
3. If it is necessary to install new retainer bearing cups, the cups may be removed from the housing by using Tool No. FNH09507 and FNH09567 or equivalent.
4. If it is necessary to replace the pilot bearing, remove the lock ring from the rear end of the pinion gear, and pull the pilot bearing off the pinion gear and replace it by using appropriate tools.

NOTE: If a new drive pinion is to be installed, a new differential ring gear must also be fitted. This installation should be carried out as outlined in Section G, Differential and Mechanical Differential Lock Assembly.



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1. Yoke Holding Tool
2. Retainer
3. Pinion
4. Wrench



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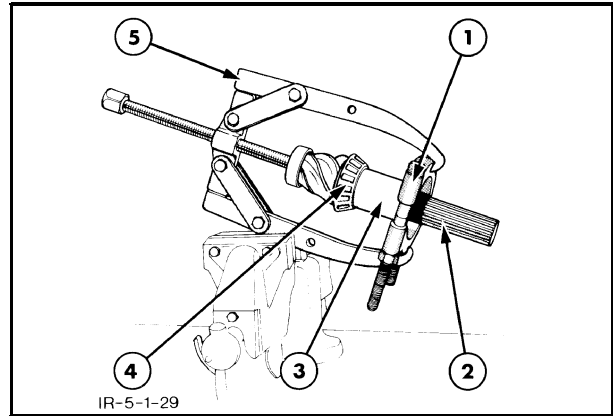
Removing Drive Pinion Rear Bearing

1. Tool No. FNH09516
2. Drive Pinion Shaft
3. Bearing Assembly
4. Tool No. FNH09190

ASSEMBLY

1. Install the pilot bearing on the pinion by using a suitable hollow sleeve, and fit a new lock ring.
2. Position the pinion shaft assembly in the retainer assembly.
3. Install the pinion bearing spacer and the front cone and roller assembly.
4. Place the oil seal O-ring in the groove, and position the oil seal assembly on the retainer assembly.
5. Lubricate the outside of splined end of the flange, and slide the splined end carefully on the pinion shaft splines and through the oil seal assembly until the splined end is stopped by the inner race of the front bearing cone and roller.
6. Install the shaft seal, the washer, and the retaining nut. Tighten the nut to 200–600 ft. lb. (271–813 N·m). At the same time, align the notches in the nut with the cotter pin hole in the pinion shaft.
7. Check the bearing preload with an in-lb torque wrench as shown in Figure 19. Preload should be 10–40 in. lb. (1.1–4.5 N·m). If the rolling torque check is done in the center housing, leave the bolts loose.
8. Insert the cotter pin, and bend each half of the pin over. If the yoke prevents insertion of the cotter pin in the hold, which aligns with the notches, remove the yoke and reposition it on the spline.

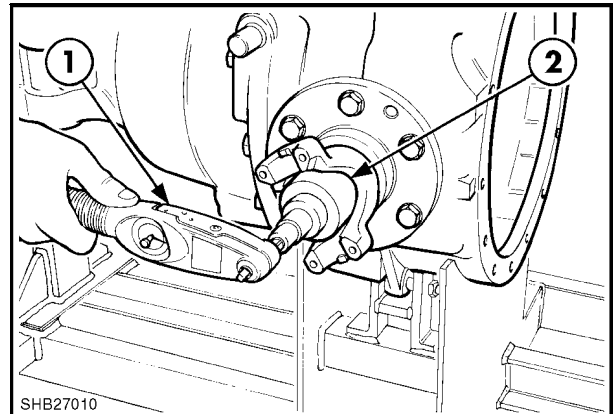
NOTE: When it is necessary to replace the bearing retainer, it may be necessary to replace the bearing spacer to obtain correct preload. In that case, repeat steps 3 through 7 until the correct preload is obtained.



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Installing Drive Pinion Rear Bearing

1. Tool No. FNH09516
2. Drive Pinion Shaft
3. Sleeve
4. Rear Bearing Assembly
5. Tool No. FNH09516

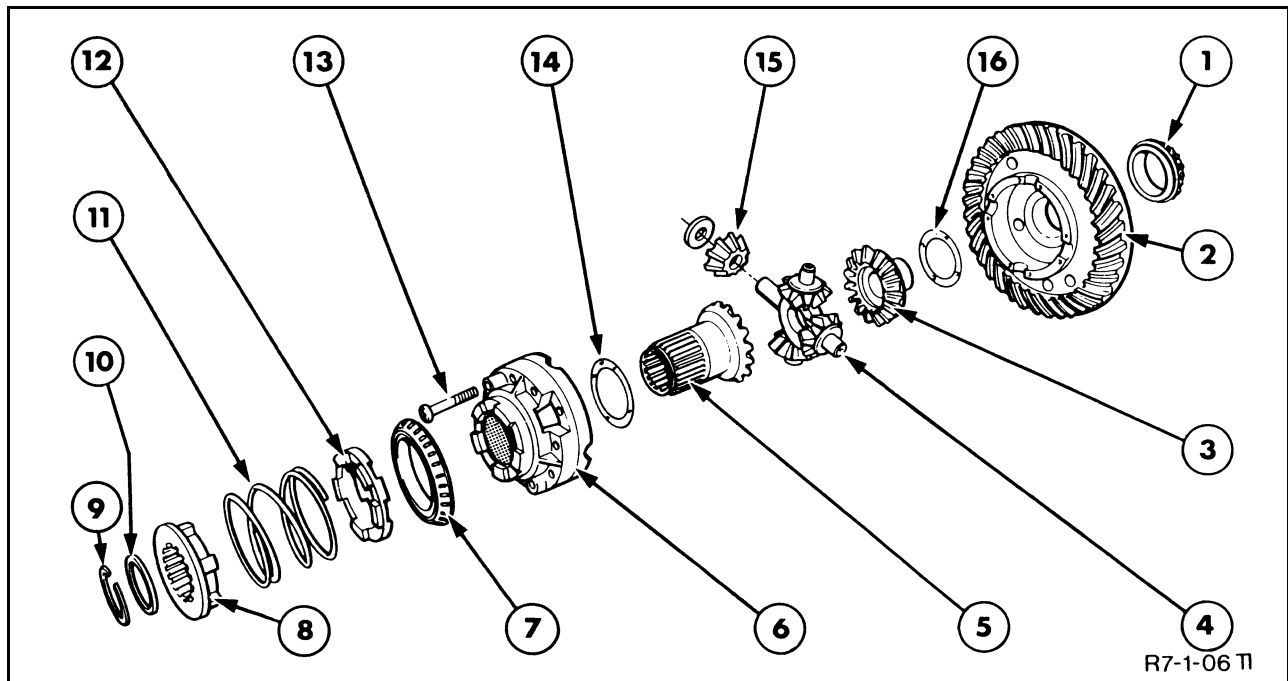


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Measuring Pinion Bearing Rolling Torque

1. Torque Wrench
2. 1-3/4" Socket

G. DIFFERENTIAL & MECHANICAL DIFFERENTIAL LOCK ASSEMBLY



20

Differential Assembly

- | | |
|-----------------------------------|----------------------------|
| 1. Cone and Roller Assembly | 9. Retaining Ring |
| 2. Ring Gear and Housing Assembly | 10. Washer |
| 3. Side Gear | 11. Spring |
| 4. Pinion Gear Assembly | 12. Adaptor |
| 5. Side Gear | 13. Retaining Bolt |
| 6. Housing | 14. Thrust Washer |
| 7. Cone and Roller Assembly | 15. Pinion Gear and Washer |
| 8. Coupling | 16. Thrust Washer |

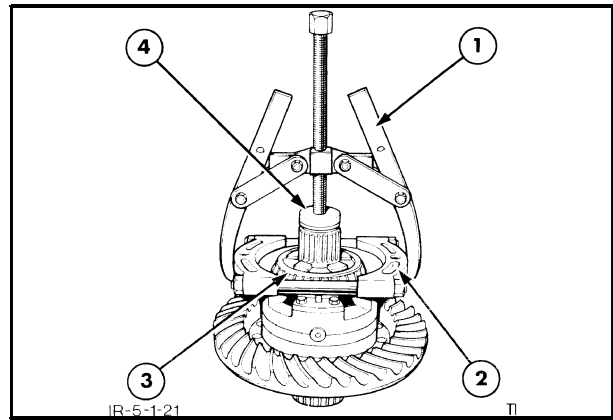
With the right axle shaft housing removed, withdraw the differential assembly from the center housing.

DISASSEMBLY

With reference to Figure 20.

1. Remove the differential lock ring from the end of the side gear. Withdraw the stop washer, coupling, spring, and adaptor.
2. Mark the two halves of the differential case to facilitate correct installation on reassembly.

3. Remove the differential cone and roller assembly from the small half of the case using tools shown in Figure 21.
4. Extract the differential case retaining bolts.
5. Separate the differential case.
6. Withdraw the thrust washer and side gear, the spider and pinion assembly, and the second side gear and washer from the case.
7. Remove the cone and roller assembly in the ring gear half of the housing by using puller, Tool No. FNH09516; pulling attachment, Tool No. FNH09526; and step place adaptor, Tool No. FNH09210.
8. Separate the pinion gears from the spider.



Removing Differential Bearing

1. Tool No. FNH09516
2. Tool No. FNH09526
3. Bearing Assembly
4. Tool No. FNH09210

INSPECTION AND REPAIR

1. Clean and inspect all components for damage or excessive wear. Install new components where necessary.
2. If a new differential ring gear is required, drill out the rivets installed during production, and replace them with nuts and bolts available from the Parts department. The bolts should be tightened to a torque value of 115 N·m (85 ft. lb.).

NOTE: *If the ring gear is replaced, a new matching drive pinion must also be installed. Refer to Section F. Pinion Assembly.*

REASSEMBLY

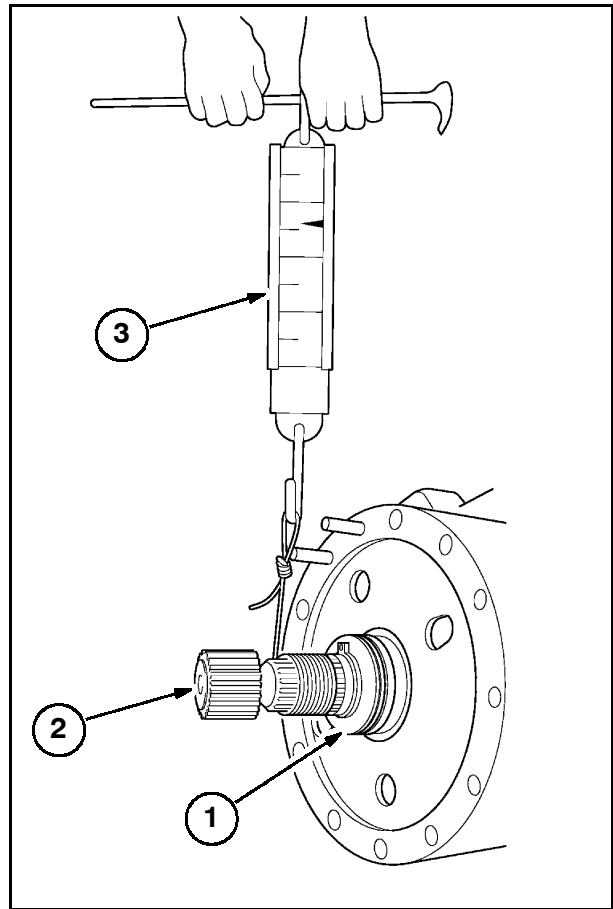
Reassembly of the differential and differential lock follows the disassembly procedure in reverse. On reassembly, observe the following requirements:

- Coat all bearing with a suitable wheel bearing grease prior to installation.
- Tighten the differential case retaining bolts to a torque of 92–125 N·m (68–92 ft. lb.).

H. DIFFERENTIAL BEARING PRELOAD

Adjust the bearing preload by installing thinner or thicker shim between the differential cup and the inner brake housing. Proceed, as follows, to measure and adjust the differential bearing preload:

1. Install the differential assembly on the inner end of the left sun gear shaft in the center housing. Do not install the pinion assembly.
2. Install the right axle housing assembly without sun gear with four bolts.
3. Remove the left axle housing assembly.
4. Push the differential coupling inward to engage it, and place 1/4" square stock under the washer at two locations.
5. Install a sun gear into the differential assembly.
6. Wrap a length of string or electrical wire on evenly, without overlapping around the sun gear shaft, and using a pull scale, measure the force required to rotate the shaft and differential assembly. Read the scale during rotation of the shaft. Do not read the scale at the point where rotation starts. The pull should be 7-34 kg (15-75 lbs.). See Figure 22.
7. If necessary, remove the shim from the inner brake housing in the right axle housing assembly and install a thicker shim to increase the rolling torque or a thinner shim to reduce the rolling torque.
8. See Section K, Specifications, for available shims.
9. After the rolling torque check, reinstall the left axle housing assembly, and remove the right axle housing assembly.



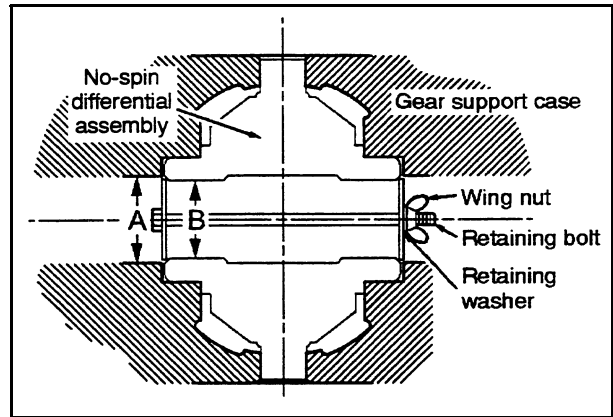
22

Differential Bearing Preload Check

1. Differential Lock Engaged with Spacers
2. Sun Gear Installed
3. Pull Scale

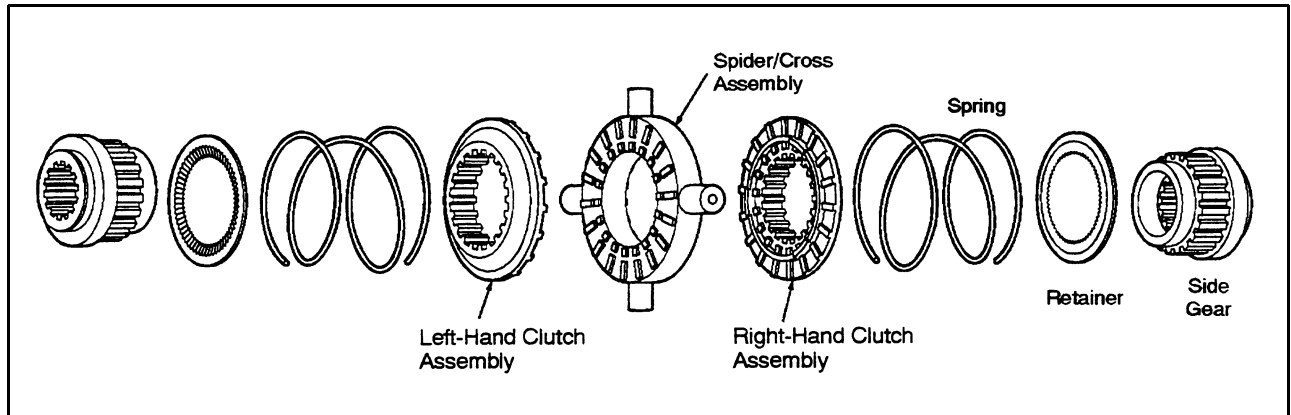
I. NO-SPIN DIFFERENTIAL ASSEMBLY

1. Install a retaining bolt, washers, and wing nut to restrain the springs in the no-spin differential during disassembly (Figure 23).
2. Remove the eight bolts holding the two halves of the differential case together.
3. Compress the springs on the no-spin assembly, and remove the wing nut and bolt.
4. Inspect the parts for wear, especially the teeth on the left-hand and right-hand clutch assemblies and the spider/cam assembly (Figure 24).



Failure to use a retaining bolt or some other restraining means when separating the differential case halves can cause injury because no-spin differentials have compressed springs.

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24

No-spin differential spider assembly, clutch assembly, springs, retainers, and side gears.

5. Replace any badly worn parts
6. Align the gaps in the holdout rings on the left and right coupling assemblies with the keys on the sides of the spider assembly.
7. Assemble the springs, retainers, and side gears to the no-spins center section. Compress the springs, and assemble the bolt, washers, and wing nut through the center of the no-spin assembly.
8. Place the differential case assembly, and install the eight retaining bolts.
9. Remove the center bolt washers and wing nut.

J. BRAKE ADJUSTMENT

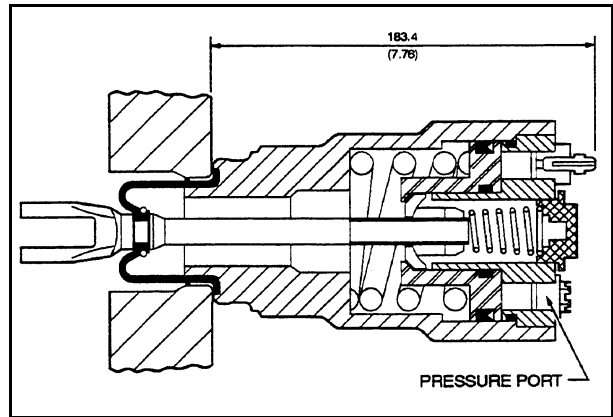
SPRING APPLY CYLINDER (FAIL SAFE BRAKE)

1. Assemble cylinder over pullrod.
2. Install bracket and U-bolt assembly with bolts and tighten.
3. Apply 300 psi hydraulic pressure to pressure port to compress the spring.
4. Install the conical nut, and tighten to approximately 1.7 N·m (15 in-lb) so that the brake has locked.
5. Back nut off eight flats.

If the brakes must be adjusted without turning the axle shafts, tighten the conical nut to 5.6 N·m (50 in-lb) and then back off the nut 2 turns (twelve flats).

6. Release hydraulic pressure.
7. Install prevailing torque nut, and tighten until it contacts the conical nut.
8. Apply pressure to port again, and confirm that axle shaft rotates freely. Install spring and nut with square head in end of cylinder.

NOTE: Brake cylinders should be filled with mineral brake fluid (e.g., NH ESN-M6C59-A).



Spring Apply-Mico

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K. SPECIFICATIONS, TIGHTENING TORQUE, AND SPECIAL TOOLS

AXLE SHAFT PRELOAD

Axle shaft rolling torque using a torque wrench:

- 50 – 150 in-lb.

AXLE SHAFT PRELOAD

North American Part Number	European Part Number	Thickness
C5NN-4374-AB	81803491	0.049" (1.24 mm)
C5NN-4374-L	81803502	0.053" (1.35 mm)
C5NN-4374-M	81803503	0.057" (1.45 mm)
C5NN-4374-N	81803504	0.061" (1.55 mm)
C5NN-4374-R	81803505	0.065" (1.65 mm)
C5NN-4374-S	81803506	0.069" (1.75 mm)
C5NN-4374-T	81803507	0.073" (1.85 mm)
C5NN-4374-U	81803508	0.077" (1.96 mm)
C5NN-4374-V	81803509	0.081" (2.06 mm)
C5NN-4374-Y	81803510	0.085" (2.16 mm)
C5NN-4374-Z	81803511	0.089" (2.26 mm)

DIFFERENTIAL BEARING PRELOAD

Differential bearing rolling torque using a spring pull gauge: 7–34kg_f (15–75 lb).

DIFFERENTIAL BEARING SHIM TABLE

North American Part Number	European Part Number	Thickness
C5NN-4548-A	81803515	0.038"–0.040" (0.965–1.018 mm)
C5NN-4548-B	81803516	0.044"–0.046" (1.118–1.168 mm)
C5NN-4548-C	81803517	0.050"–0.052" (1.270–1.321 mm)
C5NN-4548-D	81803518	0.056"–0.058" (1.422–1.473 mm)
C5NN-4548-E	81803519	0.062"–0.064" (1.575–1.626 mm)
C5NN-4548-F	81803520	0.068"–0.070" (1.727–1.778 mm)
C5NN-4548-G	81803521	0.074"–0.076" (1.880–1.930 mm)
C5NN-4548-H	81803522	0.080"–0.082" (2.032–2.083 mm)

DRIVE PINION PRELOAD

Drive pinion torque using in-lb torque wrench: 1.1–4.6 N·m (10–40 in-lb).

DRIVE PINION SPACER TABLE

North American Part Number	European Part Number	Thickness
D8NN-4662-FA R, R, R	83914106	1.3281"–1.3286" (33.734–33.746 mm)
D8NN-4662-GA R, R, B	83914107	1.3289"–1.3294" (33.754–33.767 mm)
D8NN-4662-HA R, R, Y	83914108	1.3297"–1.3302" (33.774–33.787 mm)
D8NN-4662-JA R, R, W	83914109	1.3305"–1.3310" (33.795–33.807 mm)
D8NN-4662-KA B, B, B	83914110	1.3313"–1.3318" (33.815–33.828 mm)
D8NN-4662-LA B, B, Y	83914111	1.3321"–1.3326" (33.835–33.848 mm)
D8NN-4662-MA B, B, W	83914112	1.3329"–1.3334" (33.856–33.868 mm)
D8NN-4662-NA Y, Y, R	83914113	1.3337"–1.3342" (33.876–33.889 mm)
D8NN-4662-PA Y, Y, B	83914114	1.3345"–1.3350" (33.896–33.909 mm)
D8NN-4662-SA Y, Y, Y	83914115	1.3353"–1.3358" (33.917–33.929 mm)
D8NN-4662-TA W, W, R	83914116	1.3361"–1.3366" (33.937–33.950 mm)
D8NN-4662-UA W, W, B	83914117	1.3369"–1.3374" (33.957–33.970 mm)
D8NN-4662-VA W, W, Y	83914119	1.3377"–1.3382" (33.978–33.990 mm)
D8NN-4662-XA W, W, W	83914120	1.3385"–1.3390" (33.998–33.011 mm)

Color Code: R-Red, B-Blue, Y-Yellow, W-White

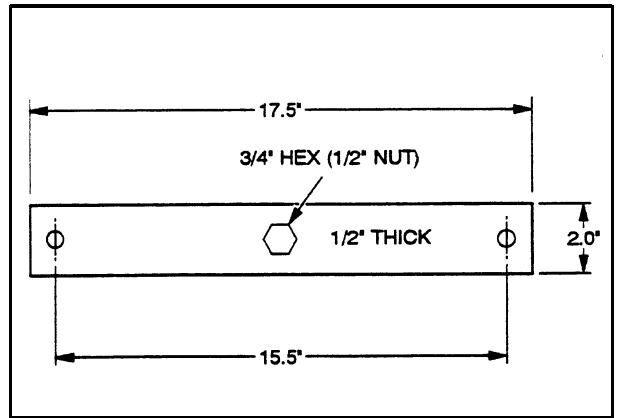
TIGHTENING TORQUE

Components	ft-lb	N·m
Axle shaft housing retaining bolts	140–170	190–230
Axle shaft retaining bolt	300–350	407–475
Differential ring gear retaining nuts	85	115
Differential case retaining bolts	68–92	92–125
Differential lock fork pivot shaft retaining bolt	24–30	32–41
Inner brake housing retaining bolts	80–95	108–129
Inner brake housing retaining nuts	80–95	108–129
Drive pinion bearing retaining bolts	100–125	135–170
Drive pinion nut	200–600	271–813
Ring gear thrust block	27–37	37–50

SPECIAL TOOLS

Description	Tool No.	Ref. Section
Axle shaft torque tool	*	C
Pusher-puller bearing cup pulling attachment	FNH09507	E, D
Puller bearing tool (slide hammer)	FNH09567	E, D
Pusher-puller bearing pulling attachment (large)	FNH09526	E, D, G
17-1/2 ton capacity pusher-puller tool	FNH09506	E
Pusher-puller legs attachment	FNH09521	E
Pusher-puller ratchet attachment	OTC7366	E
Pusher-pull shaft protectors (set of 6)	FNH09212	E
Yoke holding tool	*	F
Puller Tool	FNH09516	F, G, D
Pusher-puller bearing pulling attachment (small)	FNH09190	F
Pusher-puller tool to remove-install ring gear	FNH02123	D
Step plates (set of 11)	FNH09210	G

*See specifications for making tools on page 24.

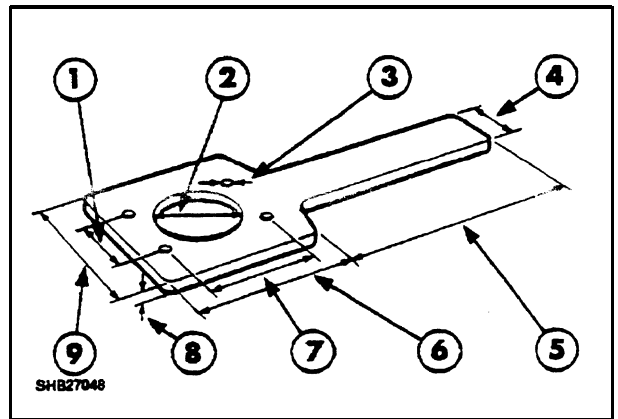


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Axle Shaft Torque Tool

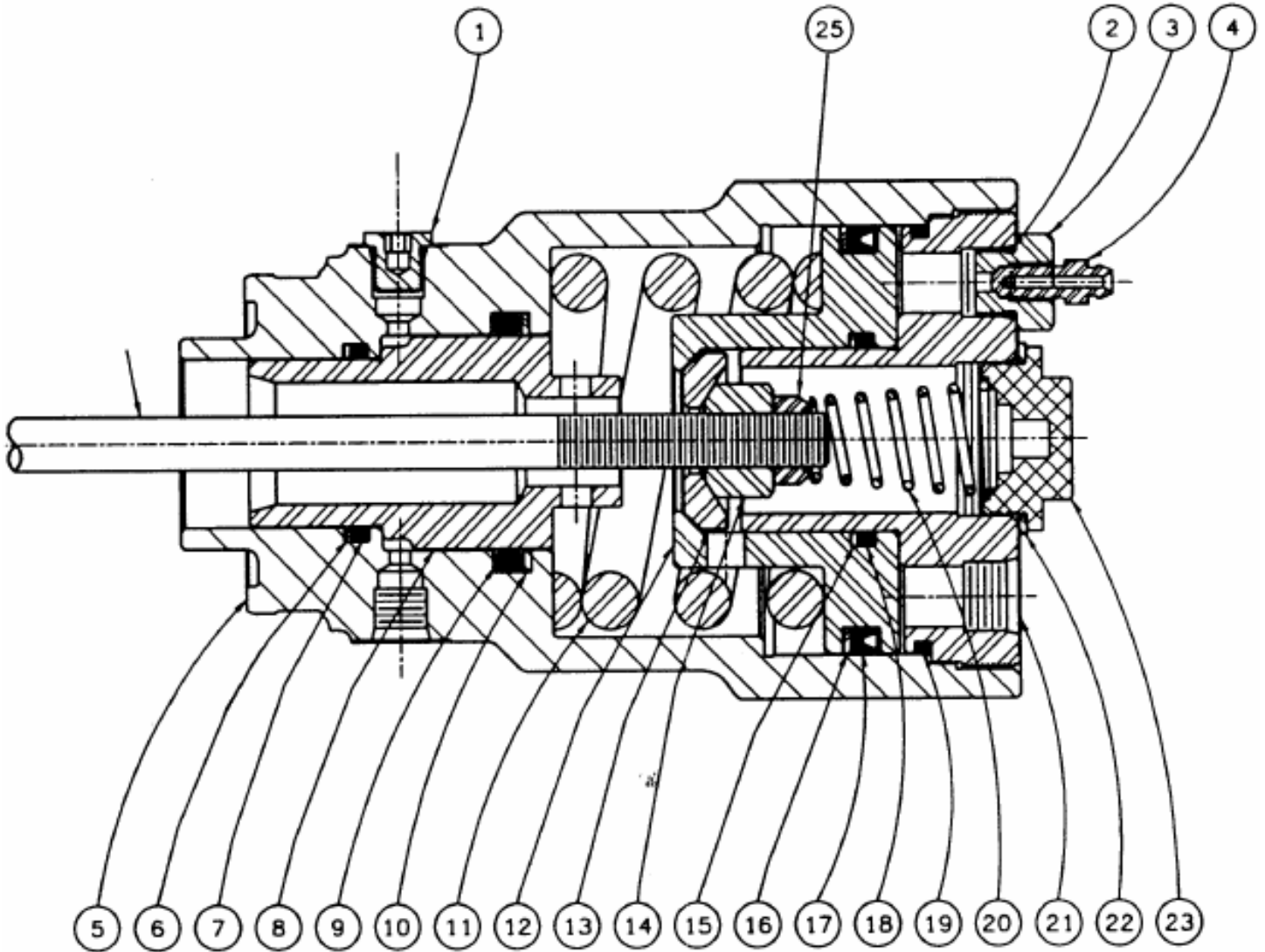
Make a yoke holding tool (1410 flange) according to the following dimensions:

1. 1.65" (42 mm)
2. 2.559" (65 mm)
3. 0.394" (10 mm)
4. 1.575" (40 mm)
5. 8.66" (220 mm)
6. 5.51" (140 mm)
7. 3.74" (95 mm)
8. 0.394" (10 mm)
9. 4.33" (110 mm)



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Yoke Holding Tool



ITEM	PART #	DESCRIPTION	QTY.
	595248	ACTUATOR ASSEMBLY	1
	534372	REPAIR KIT (INCLUDES ITEMS 2, 6, 7, 9, 10, 15-19, 22)	1
1	NSS	O-RING PLUG	1
2	NSS	O-RING	1
3	534377	BLEEDER PLUG	1
4	534387	BLEEDER SCREW	1
5	NSS	HOUSING	1
6	NSS	BACK-UP RING	1
7	NSS	O-RING	1

*ITEMS NOT SHOWN

Updated:
12/11/06



BRAKE ACTUATOR

13321
Page 2 of 2

8	534374	PISTON	1
9	NSS	O-RING	1
10	NSS	BACK-UP RING	1
11	534646	SPRING	1
12	534373	PISTON	1
13	534380	STOP	1
14	534379	RETAINER	1
15	NSS	BACK-UP RING	1
16	NSS	BACK-UP RING	1
17	NSS	CUP	1
18	NSS	O-RING	1
19	NSS	O-RING	1
20	534383	SPRING	1
21	534376	END PLUG	1
22	NSS	GASKET	1
23	534375	END PLUG	1
24*	253172	BLEEDER SCREW	1
25	444807	LOCKNUT	1

Model No.	Repair Kit	Model No.	Repair Kit
03-460-220	02-400-201	03-460-256	02-400-200
03-460-222	02-400-201	03-460-258	02-400-200
03-460-248	02-400-200	03-460-260	02-400-200
03-460-250	02-400-200	03-460-262	02-400-200
03-460-252	02-400-200	03-460-270	02-400-199
03-460-254	02-400-200	03-460-272	02-400-199

BRAKE ACTUATORS (spring/hydraulic apply) for New Holland Axles

Installation and Service Instructions



INSTALLATION

(Refer to Figures 1 & 2)

1. Remove end plug (23), gasket (22), spring (21), lock nut (20) and retainer (19) from brake actuator.
2. Carefully slide brake actuator over axle push rod and into access port of axle. **NOTE: Extreme care must be taken so as not to damage axle push rod threads and o-ring (1).**
3. Secure brake actuator to axle with bracket. Connect all necessary fluid lines to actuator and bleed system.
4. Install retainer (19) on end of axle push rod and tighten snugly. **NOTE: Apply a high pressure lubricating compound to mating surfaces of stop (16) and retainer (19).**
5. Introduce hydraulic pressure 20.7-82.7 bar (300-1200 psi) through spring brake inlet port located in end plug (18). This will expose approximately 12.7 mm (.50") more of axle push rod.
6. Bleed hydraulic release line through bleeder screw (10).
7. Retighten retainer (19). Torque 2.83-5.65 N-m (25-50 lb-in) then back off retainer two turns.
8. Install lock nut (20) on axle push rod and tighten until it contacts retainer.
9. Install spring (21), gasket (22) and end plug (23). Torque end plug (23) 24.4-27.1 N-m (18-20 lb-ft).
10. Release brake. Reapply spring release and bleed hydraulic apply section until all air is removed.

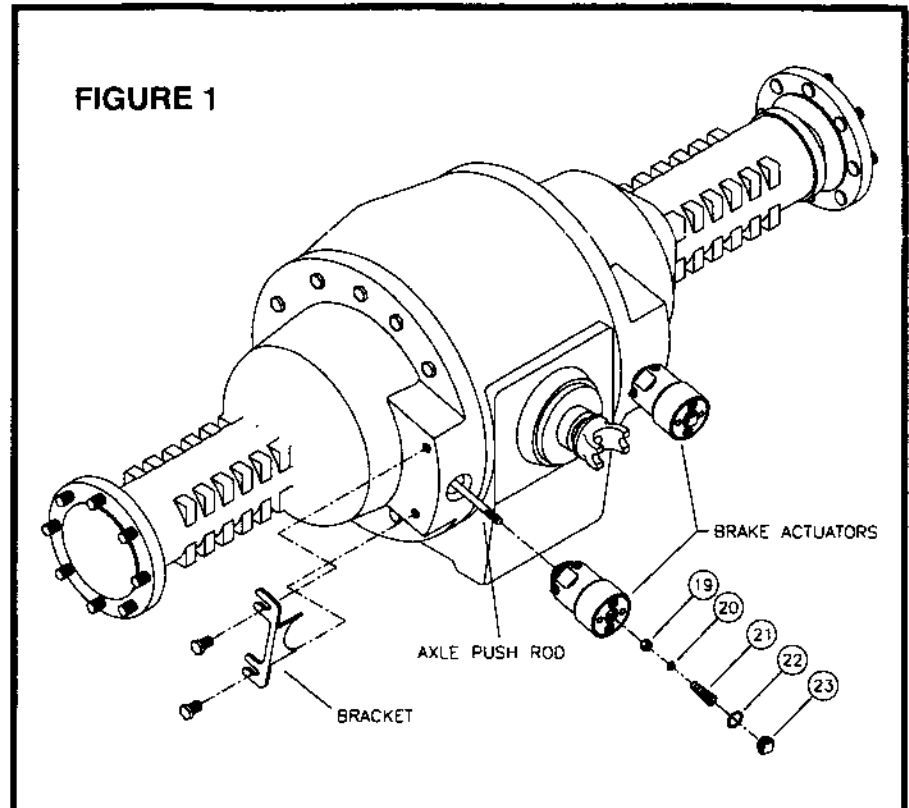


FIGURE 1

REMOVAL

(Refer to Figures 1 & 2)

1. Introduce hydraulic pressure 20.7-82.7 bar (300-1200 psi) through spring brake inlet port located in end plug (18).
2. Remove end plug (23), gasket (22) and spring (21) from brake actuator.
3. Remove lock nut (20) and retainer (19) from axle push rod.
4. Release hydraulic pressure and remove all fluid lines from brake actuator.
5. Remove bracket and carefully slide brake actuator off of axle push rod. **NOTE: Extreme care must be taken so as not to damage axle push rod threads.**
6. Proceed to Disassembly on back page.

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.

MICO has made every attempt to present accurate information in catalogs, brochures and other printed material. MICO can accept no responsibility for errors from unintentional oversights that may exist. Due to a continuous program of product improvement, both materials and specifications are subject to change without notice or obligation.

DISASSEMBLY

(Refer to Figure 2)

1. Remove o-ring (1) from housing (2). **NOTE: Not all models use o-ring (1).**
2. Using a spanner wrench, remove end plug (18) from housing (2). Remove o-ring (17) from end plug (18).
3. Remove bleeder plug (10) from end plug (18). Remove o-ring (9) from bleeder plug (10).
4. Remove stop (16) from housing (2).
5. Remove piston (11) from housing (2). Remove o-ring (15), cup (13) and back-up rings (12 & 14) from piston (11). **NOTE: Be careful not to scratch or mar piston (11).**
6. Remove spring (8) from housing (2).
7. Remove piston (7) through end plug (18) end of housing (2).
8. Remove o-rings (4 & 5) and back-up rings (3 & 6) from housing (2). **NOTE: Be careful not to scratch or mar bore of housing (2).**

ASSEMBLY

(Refer to Figure 2)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Install new o-rings (4 & 5) and new back-up rings (3 & 6) into bore of housing (2). Note the order of o-rings and back-up rings. **NOTE: Be careful not to scratch or mar bore of housing (2).**
2. Carefully install piston (7) into housing (2). Note direction of piston (7).
3. Install spring (8) into housing (2).
4. Install new o-ring (15), new cup (13) and new back-up rings (12 & 14) on piston (11). Note the order of o-ring, cup and back-up rings. **NOTE: Be careful not to scratch or mar piston (11).**

5. Install piston (11) into housing (2). Note direction of piston (11). **NOTE: Be careful not to scratch or mar bore of housing (2).**
6. Install stop (16) into housing (2). Note the direction of stop (16). **NOTE: Apply a high pressure lubricating compound to mating surfaces of stop (16) and piston (11).**
7. Install new o-ring (9) on bleeder plug (10) and install in end plug (18).
8. Install new o-ring (17) on end plug (18). Lubricate threads of end plug (18) with clean type fluid used in system. Thread end plug into housing and torque 325.4-339.0 N-m (240-250 lb-ft).
9. Install new o-ring (1) on housing (2). **NOTE: Not all models use o-ring (1).**
10. Proceed to Step 2 of Installation on front page.

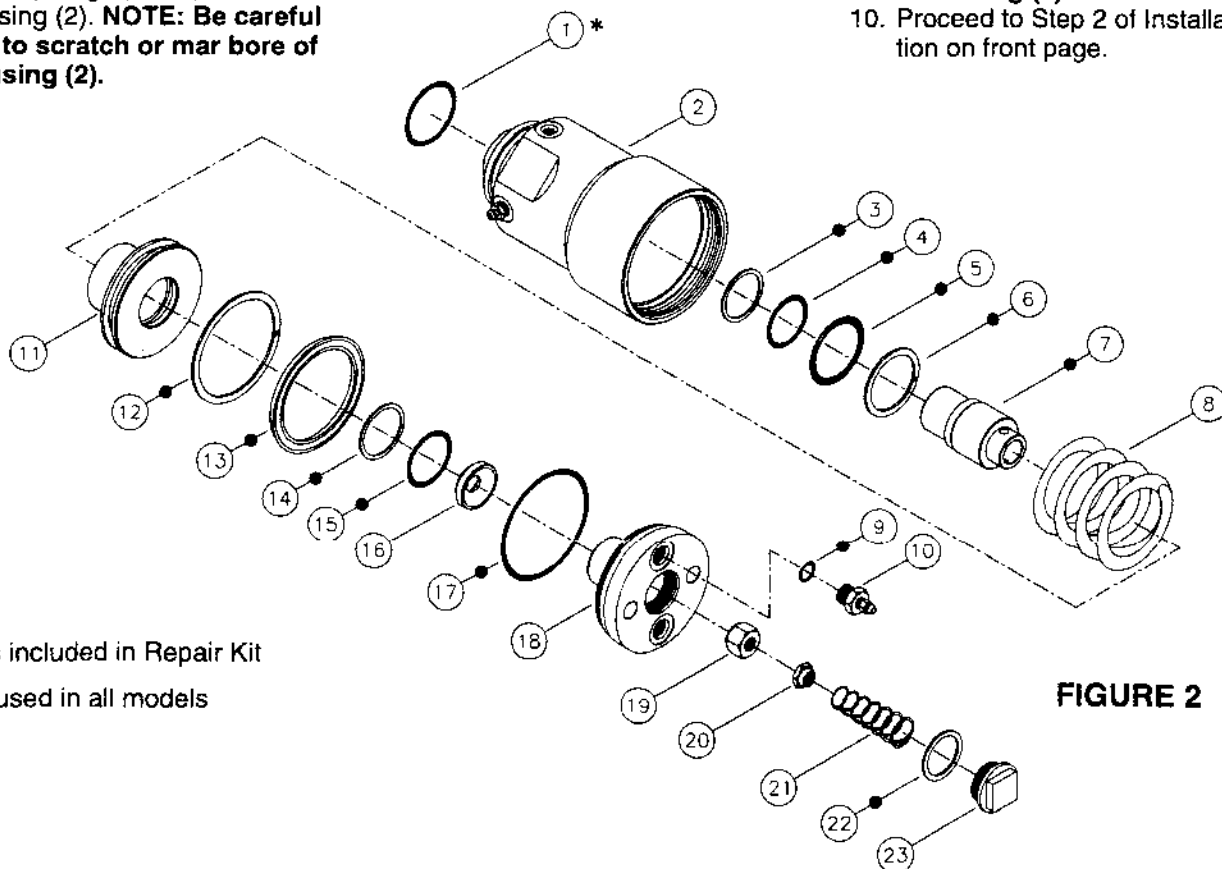


FIGURE 2

● Items included in Repair Kit

* Not used in all models

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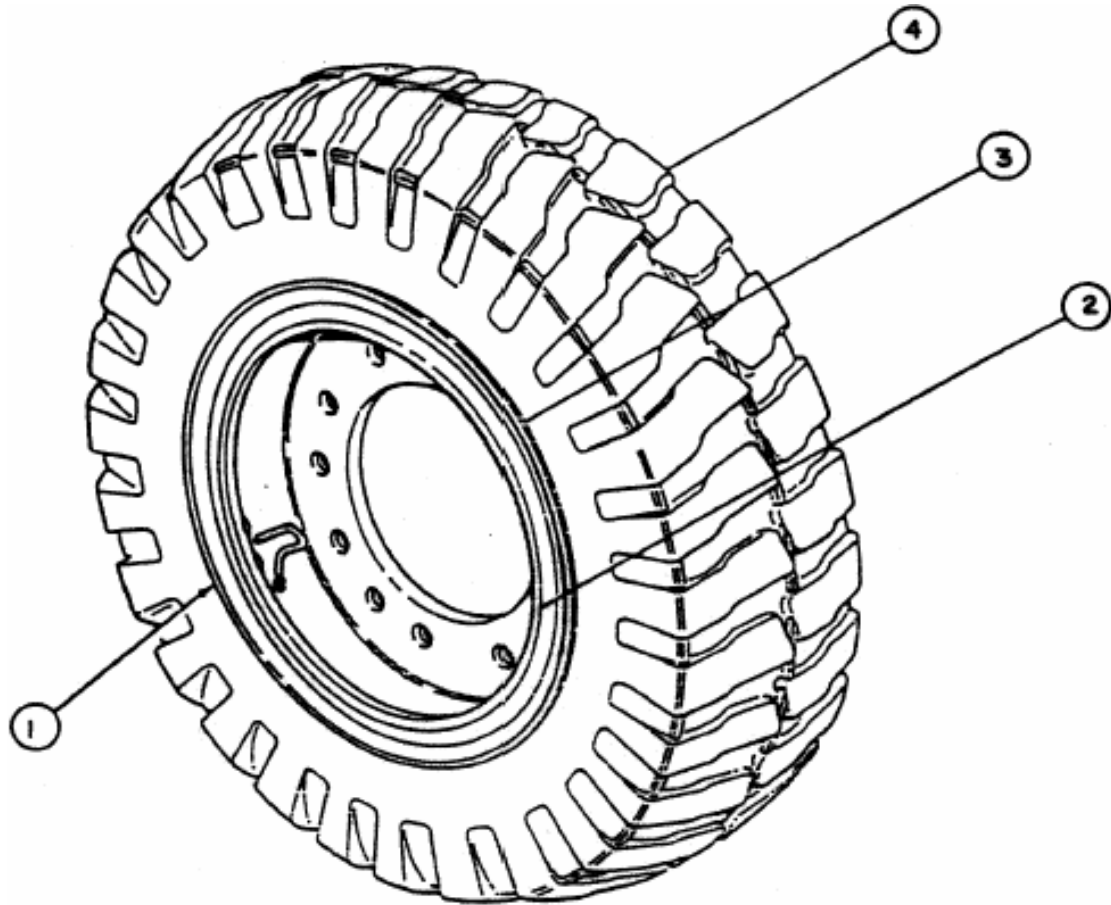
MICO, Incorporated

1911 Lee Boulevard (Zip Code 56003-2507)
P.O. Box 8118 / North Mankato, MN U.S.A. 56002-8118
☎ 507.625.6426 Facsimile 507.625.3212

MICO West Division

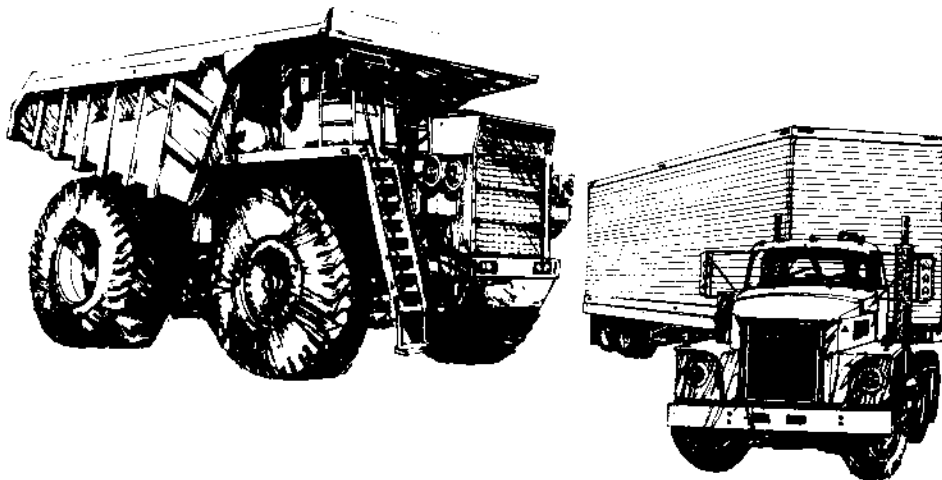
701 East Francis Street (Zip Code 91761-5514)
P.O. Box 9058 / Ontario, CA U.S.A. 91762-9058
☎ 909.947.4077 Facsimile 909.947.6054





ITEM	PART #	DESCRIPTION	QTY.
	465426	TIRE & WHEEL (INCLUDES ITEMS 1-4)	1
1	15996-01	RIM ASSEMBLY (INCLUDES ITEMS 2, 3)	1
2	284002	LOCK RING	1
3	284003	SIDE RING	1
4	484085	TIRE	1
5*	17GC12032	BOLT	14
6*	444045	WASHER	14

urge you to practice
SAFETY



WARNING:

Rim and tire servicing can be dangerous. To protect life and limb, be sure you understand and follow all mounting, demounting, maintenance, inspection, operational procedures and safety practices. Detailed information concerning such procedures may be obtained from Motor Wheel Corporation, 1600 North Larch St., Lansing, Mich. 48914.

IMPORTANT

THIS IS THE FIRST STEP IN ALL DEMOUNTING OPERATIONS.

For safety's sake, always remove the valve core and exhaust all air from a single tire and from both tires of a dual assembly prior to removing any rim components, or any wheel components, such as nuts and rim clamps.

Check the valve stem by running a piece of wire through the stem to make sure it is not plugged.



- Mixing parts of one type rim with those of another is potentially dangerous. Always check DOT chart or manufacturer for approval.
- Don't reinflate a tire that has been run flat without first inspecting the tire, tube, flap, rim and wheel assembly. Double check the side ring, flange, bead seat, lock ring and "O" ring for damage and make sure that they are secure in the gutter before inflation.

MOUNTING AND INFLATION:

- Don't try to seat rings or other components by hammering while tire is inflated or partially inflated.
- Double check to make sure all components are properly seated prior to inflation.
- Inflate in a safety cage or use safety chains during inflation.
- Don't inflate tire before all components are properly in place. Place in safety cage and inflate to approx. 10 psi, recheck components for proper assembly. If assembly is not proper, deflate and correct. Never hammer on an inflated or partially inflated tire/rim assembly. If assembly is proper at approx. 10 psi, continue to inflate to fully seat the tire beads. Then completely deflate the tire to prevent localized over stretching of tube. Reinflate to recommended operating pressure.
- Never sit on or stand in front of a tire and rim assembly that is being inflated. Use a clip-on chuck and make sure inflation hose is long enough to permit the person inflating the tire to stand to the side of the tire, not in front or in back of the tire assembly.
- Follow tire and rim manufacturers' recommended mounting, demounting, inflating and deflating procedures for tires and rims.
- Don't hammer on rims or components with steel hammers. Use rubber, lead, plastic or brass faced mallets if it is necessary to tap components together.

SERVICING TIRE AND RIM ON VEHICLE:

- Don't try to drive an assembled or partially assembled tire and rim over a cast spoke wheel by hammering. Stop - deflate and examine to determine the reason for

the improper fit. Look for distortion or for components that are not properly locked or seated.

- Block the tire and wheel on the opposite side of the vehicle before you place the jack in position.
- Regardless of how hard or firm the ground appears, put hardwood blocks under the jack. Always crib up vehicle with blocks just in case the jack should slip.

OPERATION:

Don't use undersized rims. Use recommended rim for tire. Check Goodyear/Motor Wheel catalogs for proper tire/rim matching.

- Don't overload or over-inflate tire/rim assemblies. Check your rim manufacturer if special operating conditions are required.
- Never run a vehicle on one tire of a dual assembly. The carrying capacity of the single tire and rim is dangerously exceeded and operating a vehicle in this manner can result in damage to the rim and tire.

ADDITIONAL NOTES APPLYING TO EARTHMOVER RIMS:

- Use caution when removing heavy earth-mover rim components. Use mechanical aids. This will help protect you from injury.
- Demounting tools apply pressure to rim flanges to unseat tire beads. Keep your fingers clear. Always stand to one side when you apply hydraulic pressure (if the tool slips off, it can fly with enough force to cause severe bodily injury or death).
- When using a cable or chain sling, stand clear; it might snap and lash out.
- Never attempt to weld on an inflated tire/rim assembly or on a rim assembly with a deflated tire.
- Wall charts containing mounting and demounting instructions for all Goodyear off-highway rims are available through your Goodyear rim supplier. Ask for "OFF-HIGHWAY RIM MOUNTING AND DEMOUNTING CHART SET NC EM73-2154". This set contains four charts covering all Goodyear off-highway rims.

SAFETY INSTRUCTIONS

GENERAL:

- Do not mount or demount tires without proper training. Follow all procedures and safety instructions. Wall charts containing mounting and demounting instructions for all Goodyear on-highway rims are available through your Goodyear rim supplier. Ask for "ON-HIGHWAY RIM MOUNTING AND DEMOUNTING CHART SET NO. TR71-2042". This set contains five charts covering all Goodyear on-highway rims.
- "MULTIPIECE RIM/WHEEL MATCHING CHARTS" are available through Motor Wheel Corporation and the United States Department of Transportation (DOT), Washington, D.C.

DEMOUNTING:

- Always exhaust all air from a single tire and from both tires of a dual assembly prior to removing any rim components or any wheel components such as nuts and rim clamps.
- Make sure to remove valve core to exhaust all air from the tire. Remove both cores from a dual assembly.
- Check the valve stem by running a piece of wire through the stem to make sure it is not plugged.

INSPECTION:

- Clean rims and repaint to stop detrimental effects of corrosion and facilitate checking and tire mounting. Be very careful to clean all dirt and rust from the lock ring and gutter. This is important to secure the lock ring in its proper position. A filter on the air inflation equipment to remove the moisture from the air line helps prevent corrosion. The filter should be checked periodically to see that it is working properly.
- Check rim components periodically for cracks. Replace all cracked, badly worn, damaged and severely rusted components with new parts of same size and type. When in doubt replace.
- Do not, under any circumstances, attempt to rework, weld, heat, or braze any rim components that are cracked, broken, or damaged. Replace with new parts or parts that are not cracked, broken, or damaged and which are of the same size and type.
- Make sure correct parts are being assembled. Check DOT chart, your distributor or the manufacturer if you have any doubts.
- Don't be careless or take chances. If you are not sure about the proper mating of rim and wheel parts, consult a rim and wheel expert. This may be the tire man who is servicing your fleet, the rim and wheel distributor in your area, or the Motor Wheel sales engineer.

- Mixing parts of one type rim with those of another is potentially dangerous. Always check DOT chart or manufacturer for approval.
- Don't reinflate a tire that has been run flat without first inspecting the tire, tube, flap, rim and wheel assembly. Double check the side ring, flange, bead seat, lock ring and "O" ring for damage and make sure that they are secure in the gutter before inflation.

MOUNTING AND INFLATION:

- Don't try to seat rings or other components by hammering while tire is inflated or partially inflated.
- Double check to make sure all components are properly seated prior to inflation.
- Inflate in a safety cage or use safety chains during inflation.
- Don't inflate tire before all components are properly in place. Place in safety cage and inflate to approx. 10 psi, recheck components for proper assembly. If assembly is not proper, deflate and correct. Never hammer on an inflated or partially inflated tire/rim assembly. If assembly is proper at approx. 10 psi, continue to inflate to fully seat the tire beads. Then completely deflate the tire to prevent localized over stretching of tube. Reinflate to recommended operating pressure.
- Never sit on or stand in front of a tire and rim assembly that is being inflated. Use a clip-on chuck and make sure inflation hose is long enough to permit the person inflating the tire to stand to the side of the tire, not in front or in back of the tire assembly.
- Follow tire and rim manufacturers' recommended mounting, demounting, inflating and deflating procedures for tires and rims.
- Don't hammer on rims or components with steel hammers. Use rubber, lead, plastic or brass faced mallets if it is necessary to tap components together.

SERVICING TIRE AND RIM ON VEHICLE:

- Don't try to drive an assembled or partially assembled tire and rim over a cast spoke wheel by hammering. Stop - deflate and examine to determine the reason for

the improper fit. Look for distortion or for components that are not properly locked or seated.

- Block the tire and wheel on the opposite side of the vehicle before you place the jack in position.
- Regardless of how hard or firm the ground appears, put hardwood blocks under the jack. Always crib up vehicle with blocks just in case the jack should slip.

OPERATION:

Don't use undersized rims. Use recommended rim for tire. Check Goodyear/Motor Wheel catalogs for proper tire/rim matching.

- Don't overload or over-inflate tire/rim assemblies. Check your rim manufacturer if special operating conditions are required.
- Never run a vehicle on one tire of a dual assembly. The carrying capacity of the single tire and rim is dangerously exceeded and operating a vehicle in this manner can result in damage to the rim and tire.

ADDITIONAL NOTES APPLYING TO EARTHMOVER RIMS:

- Use caution when removing heavy earth-mover rim components. Use mechanical aids. This will help protect you from injury.
- Demounting tools apply pressure to rim flanges to unseat tire beads. Keep your fingers clear. Always stand to one side when you apply hydraulic pressure (if the tool slips off, it can fly with enough force to cause severe bodily injury or death).
- When using a cable or chain sling, stand clear; it might snap and lash out.
- Never attempt to weld on an inflated tire/rim assembly or on a rim assembly with a deflated tire.
- Wall charts containing mounting and demounting instructions for all Goodyear off-highway rims are available through your Goodyear rim supplier. Ask for "OFF-HIGHWAY RIM MOUNTING AND DEMOUNTING CHART SET NC EM73-2154". This set contains four charts covering all Goodyear off-highway rims.

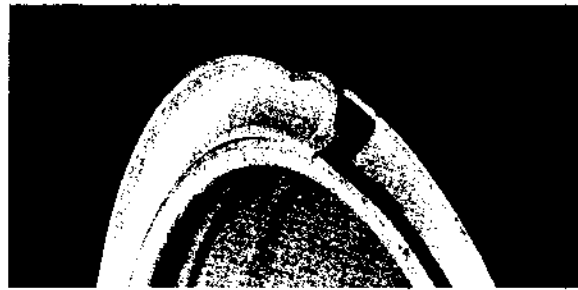
TWO-PIECE RIMS

Correct



The components in a correctly assembled and locked two-piece rim fit snugly.

Incorrect



An incorrectly assembled two-piece rim could have a large gap in side ring. Components are not firmly locked in place. **DO NOT INFLATE TIRE AND RIM ASSEMBLY UNTIL COMPONENTS ARE PROPERLY SEATED AND LOCKED.**

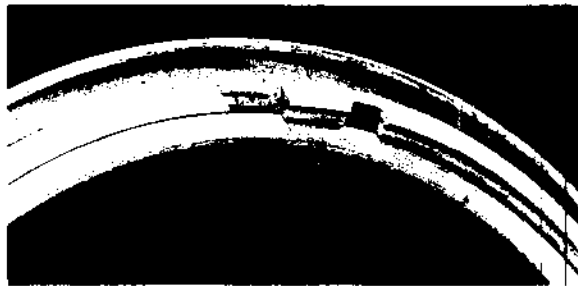
THREE-PIECE RIMS

Correct



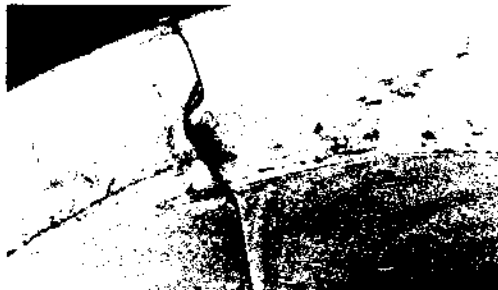
A three-piece rim that is correctly assembled has firmly-fitted components; lock ring gap is small, with lock ring completely embedded in its cavity.

Incorrect



An incorrectly assembled three-piece rim. Lock ring is not seated. **DO NOT INFLATE UNTIL LOCK RING IS PROPERLY SEATED AND LOCKED.**

KW, KB, KWX TYPE RIMS



KW, KB, and KWX type rims have unique configurations that deserve special mention. Make sure your assembly pattern matches that shown in photographs of correctly assembled rims. **DO NOT INFLATE UNTIL ALL RIM COMPONENTS ARE PROPERLY LOCKED AND SEATED.**

Correct

Side ring is seated in gutter hook.



Rim ends match; rim locking device is securely locked.



Incorrect

Side ring is not seated in gutter hook. Check for incomplete assembly or worn rim. **Do not inflate tire.**

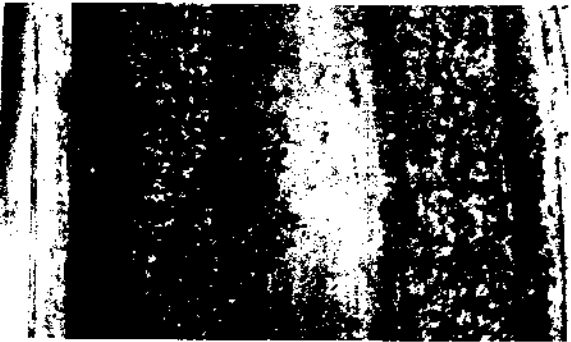
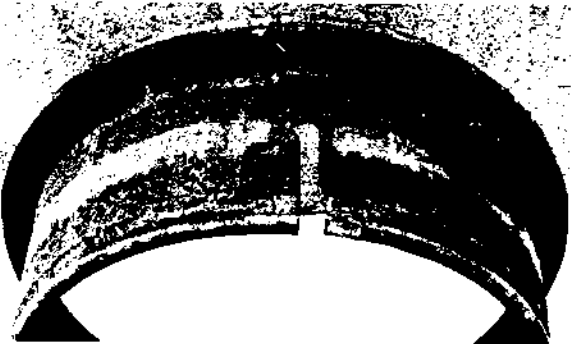


Rim base is not locked. One raised end of rim end means incorrect assembly or bent rim. **Do not inflate tire.**



Replace Worn, Rusted & Corroded Rim Parts

Badly worn, rusted and corroded rims and components are dangerous and should be replaced with new parts. Such hazards prevent proper fit of components, and can cause difficult tire mounting.



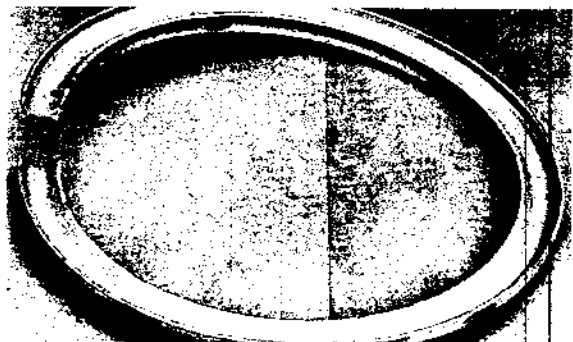
Replace Cracked & Broken Rims and Components



Fatigue-cracked or broken rims and components must be replaced. Periodically inspect all rims and components for signs of fatigue cracks or breakage.

Replace Distorted Rims & Components

Distorted rims and components will not properly lock together. They should be replaced. This hazard, besides making the tire/rim assembly unsafe through improper fit, may cause difficult tire mounting.



WARNING!

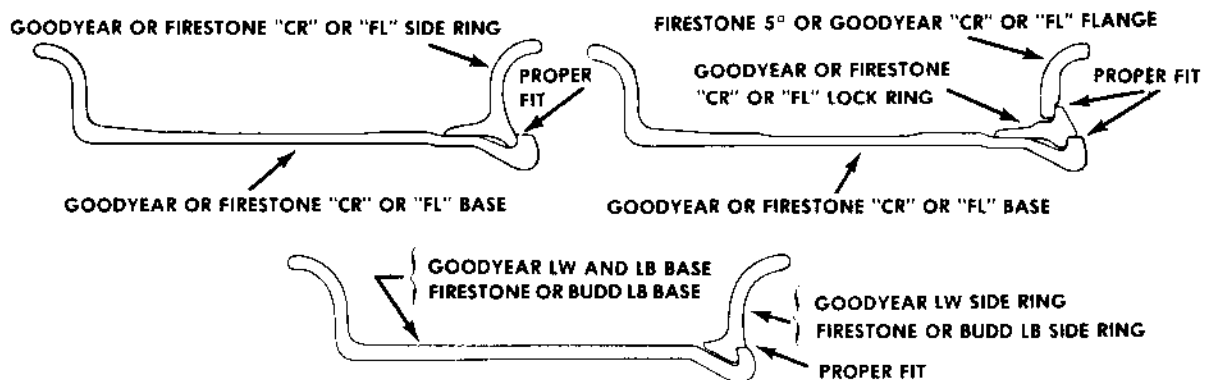
MISMATCHED RIM PARTS ARE DANGEROUS AND COULD CAUSE SEVERE INJURY

Most highway rims look alike, but all vary somewhat in certain design features. It is these differences between rims of different types that makes "part-mixing" a hazardous business. A close, proper fit between rim parts is essential to long tire life as well as to operating safety. Very often, side-rings, flanges and lock-rings of different types appear to be properly seated, but actually wide gaps

are present, frequently difficult to see. The rim cross-sections below show correct, safe matchings of rim parts . . . as well as mismatched rings and bases which almost always create an unsafe operating condition. The pictures contained herein are intended only to depict some examples of incorrect procedures. They are not intended to show all incorrect and dangerous methods.

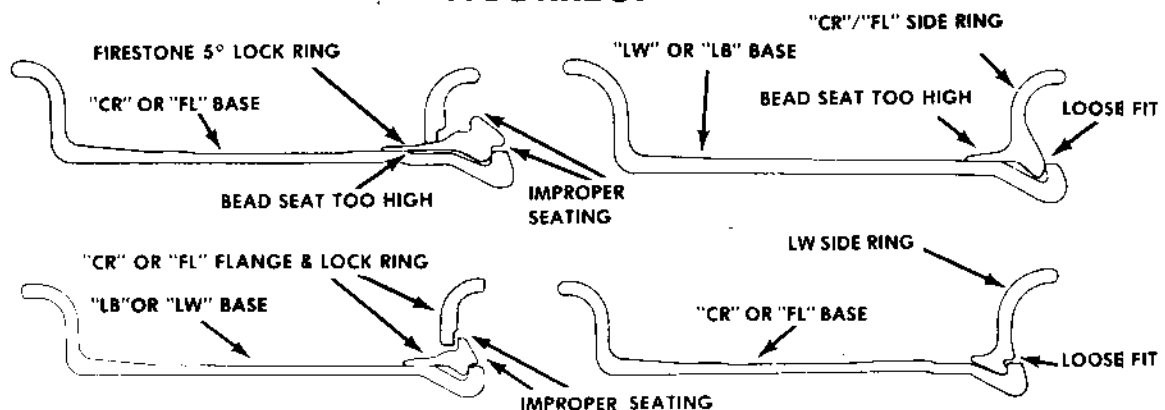
NOTE: Contact Motor Wheel Corp. for list of components that are designed to interchange with components of other manufacturers. Department of Transportation (DOT) charts show rim interchangeability.

CORRECT



Goodyear "CR" and "FL" bases and components interchangeable with Firestone "CR" and "FL". Goodyear "LB" bases and components interchangeable with Firestone and Budd "LB".

INCORRECT



IMPROPER RIM SELECTION CAN CAUSE THESE TIRE AND TUBE OPERATING PROBLEMS

- TIRE SLIPPAGE
- TUBE PINCHING
- VALVE STEM TEAR OUTS
- PLY SEPARATION
- EXCESSIVE FLEXING
- OVERHEATING
- SIDEWALL FAILURES
- BLOWOUTS



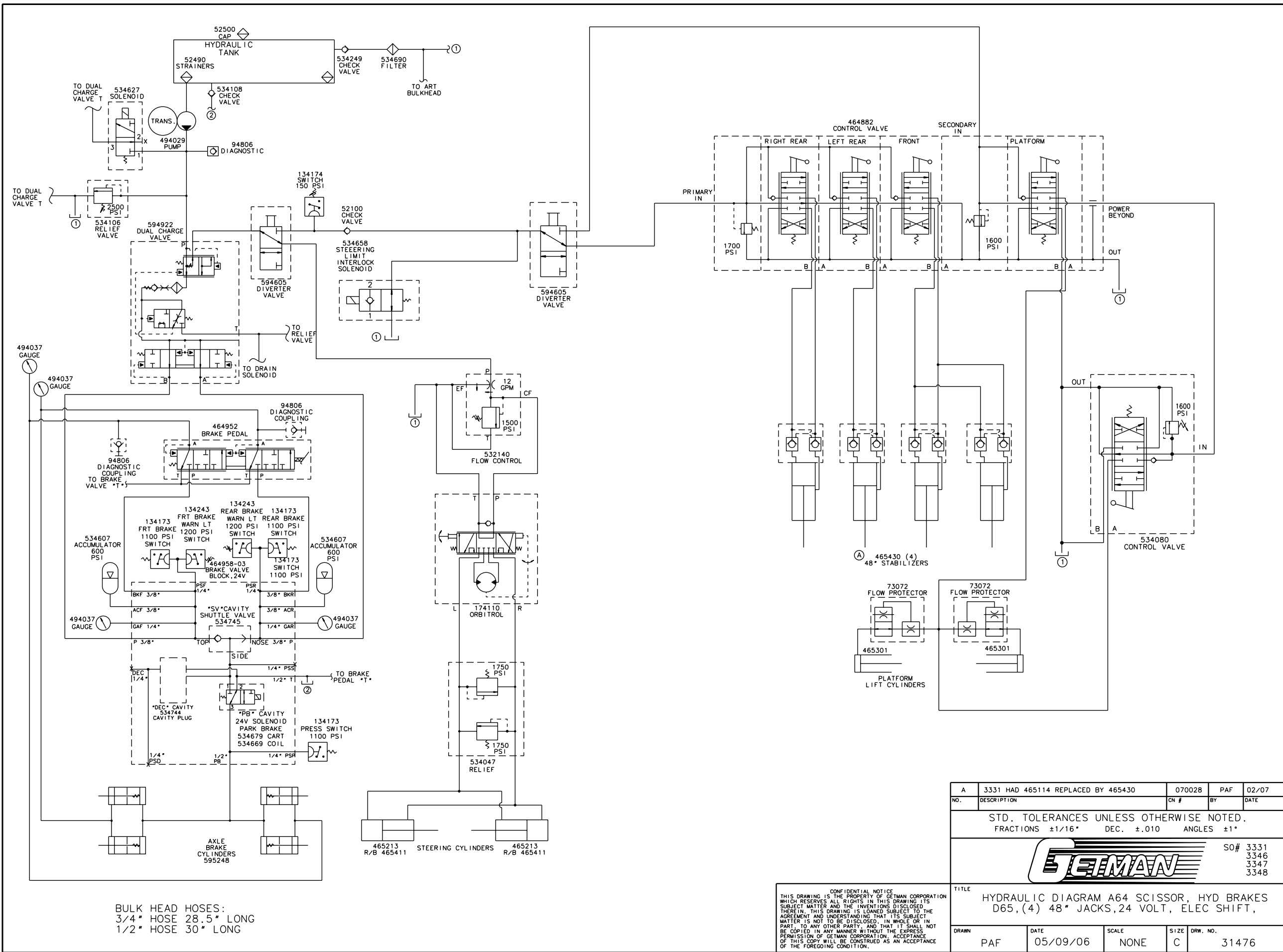
STOP

Don't touch the tire and rim assembly until you read and understand the mounting and demounting instructions for the particular rim. For proper mounting, demounting and maintenance procedures, follow manufacturer's recommendations contained in rim and wheel catalogs which are available free from your wheel distributor or manufacturer upon request. Pass this warning along.

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

7. BRAKE SYSTEM

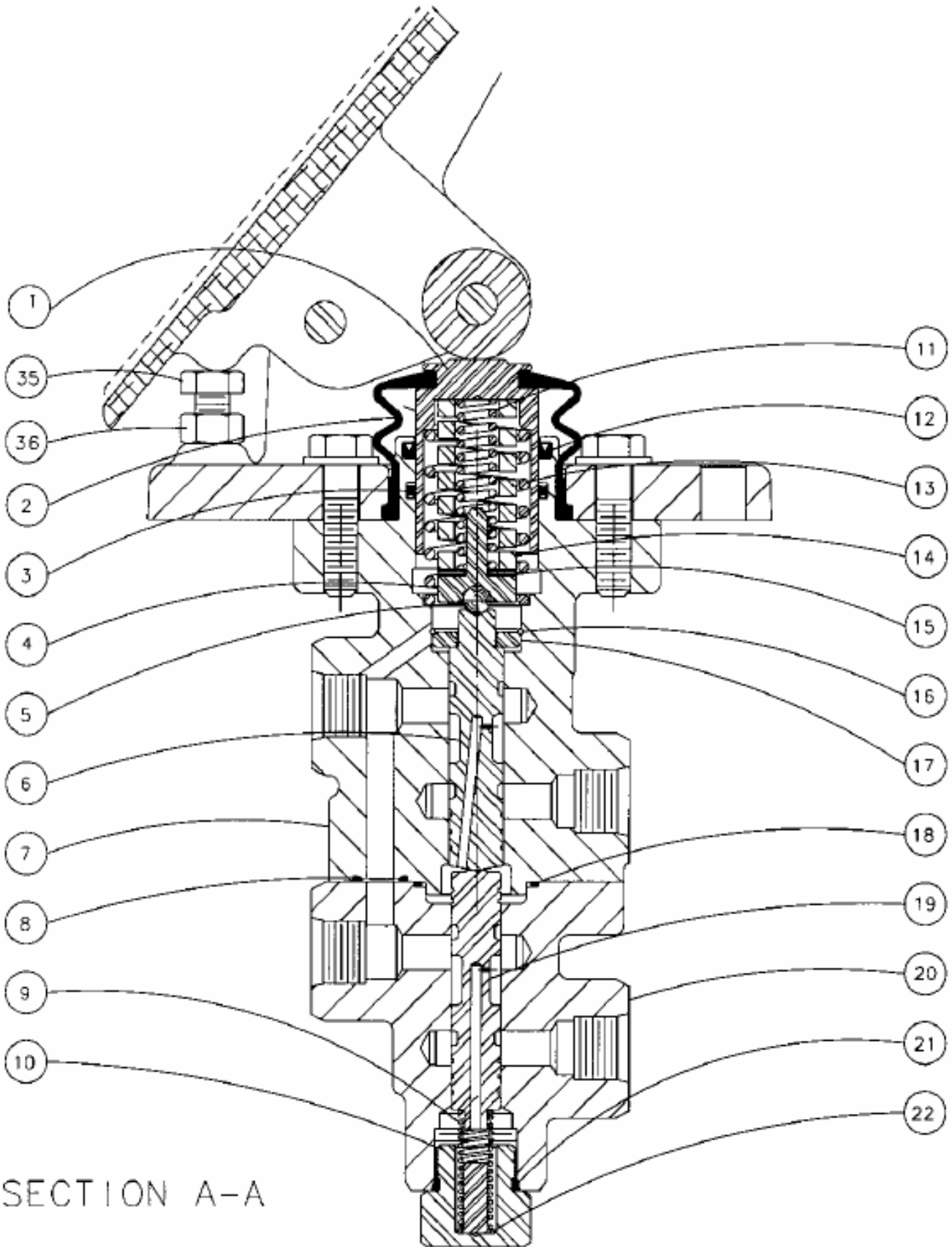
31476	HYDRAULIC SCHEMATIC
13378	BRAKE VALVE
-----	BRAKE VALVE SERVICE
16483	DUAL CHARGE VALVE
-----	DUAL CHARGE VALVE SERVICE
12976	ACCUMULATOR

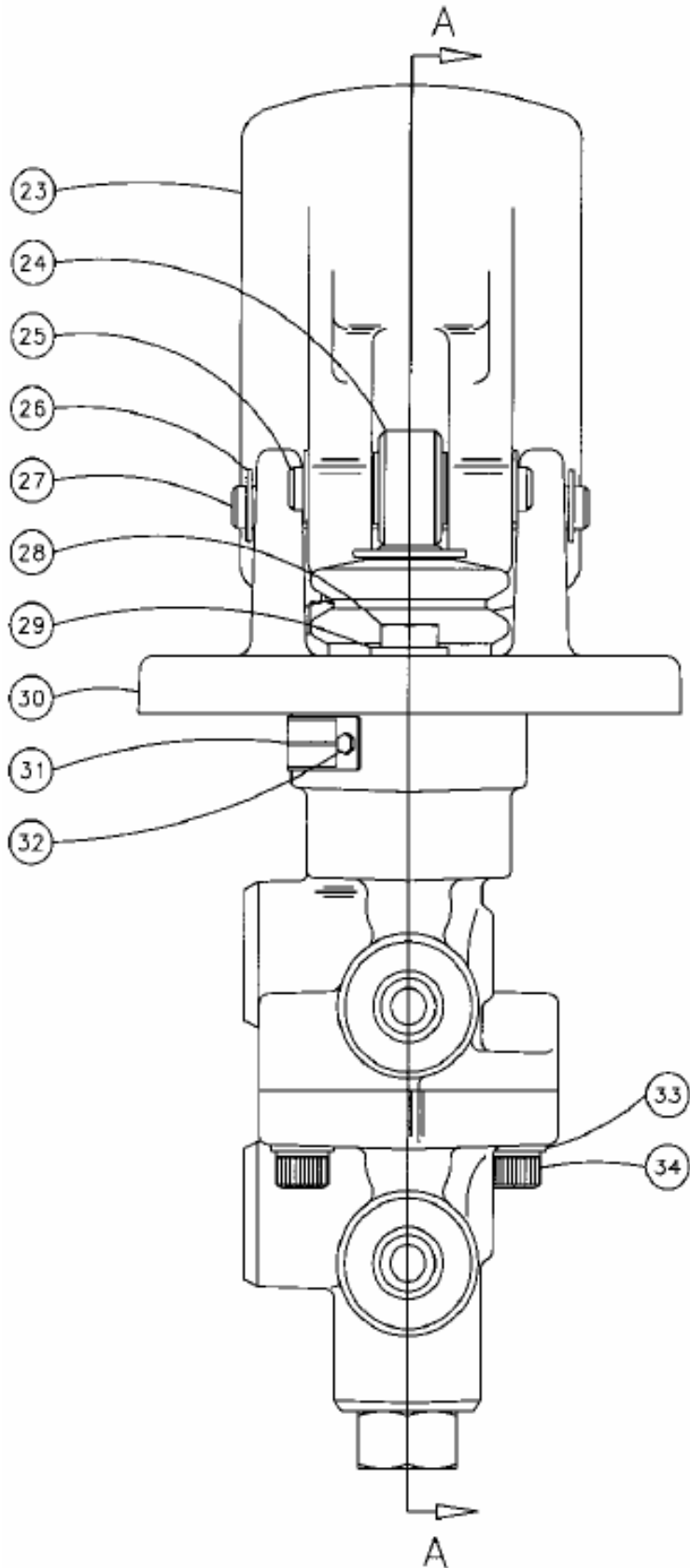


BULK HEAD HOSES:
 3/4" HOSE 28.5" LONG
 1/2" HOSE 30" LONG

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A	3331 HAD 465114 REPLACED BY 465430	070028	PAF	02/07
NO.	DESCRIPTION	CN #	BY	DATE
STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°				
GETMAN				S0# 3331 3346 3347 3348
TITLE HYDRAULIC DIAGRAM A64 SCISSOR, HYD BRAKES D65, (4) 48" JACKS, 24 VOLT, ELEC SHIFT,				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
PAF	05/09/06	NONE	C	31476







PEDAL BRAKE VALVE

13378
Page 3 of 4

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	464952	BRAKE VALVE ASSEMBLY	1
	534288	PEDAL & BASE ASSEMBLY (INCLUDES ITEMS 2, 23, 24, 28-32, 35, 36)	1
	595149	VALVE ASSEMBLY (INCLUDES ITEMS 1, 3-22, 33, 34)	1
	595145	REPAIR KIT (INCLUDES ITEMS 2, 3, 8, 12, 18, 21)	1
1	NSS	PISTON	1
2	NSS	BOOT	1
3	NSS	QUAD RING	1
4	NSS	RETAINER	1
5	NSS	BALL	1
6	NSS	SPOOL	1
7	NSS	HOUSING	1
8	NSS	O-RING	1
9	NSS	SPRING	1
10	NSS	END PLUG	1
11	NSS	SPRING	1
12	NSS	CUP	1
13	NSS	SPRING	1
14	NSS	SPRING	1
15	NSS	SHIM	1
16	NSS	RETAINER RING	1
17	NSS	SPACER	1
18	NSS	O-RING	1
19	NSS	SPOOL	1
20	NSS	HOUSING	1
21	NSS	O-RING	1
22	NSS	RETAINER	1
23	NSS	PEDAL	1
24	NSS	CAM	1
25	15248-02	PIN	1



PEDAL BRAKE VALVE

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Page 4 of 4

26	67GD06	NUT	2
	01GF01016	COTTER PIN	2
27	15248-01	PIN	1
28	NSS	CAP SCREW	2
29	NSS	WASHER	2
30	NSS	BASE	1
31	NSS	LABEL	1
32	NSS	DRIVE SCREW	2
33	NSS	WASHER	2
34	NSS	CAP SCREW	2
35	NSS	CAP SCREW	1
36	NSS	NUT	1

466 Series - Tandem POWER BRAKE VALVE

Service Instructions



TABLE 1 (Specifications)

Model Number	Repair Kit	Brake Pressure Setting		Model Number	Repair Kit	Brake Pressure Setting		Model Number	Repair Kit	Brake Pressure Setting	
		bar	(PSI)			bar	(PSI)			bar	(PSI)
** 03-466-201 (BF)	06-400-257	145 ± 5.0	(2100 ± 70)	06-466-222 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)	* 06-466-284 (HO)	06-400-152	138 ± 6.9	(2000 ± 100)
03-466-202 (HO)	06-400-192	28 ± 3.5	(400 ± 50)	06-466-230 (HO)	06-400-152	41 ± 5.2	(600 ± 75)	* 06-466-286 (HO)	06-400-152	52 ± 5.2	(750 ± 75)
03-466-204 (HO)	06-400-192	138 ± 6.9	(2000 ± 100)	06-466-232 (HO)	06-400-152	45 ± 3.5	(650 ± 50)	* 06-466-288 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)
03-466-206 (HO)	06-400-192	45 ± 3.5	(650 ± 50)	06-466-234 (HO)	06-400-152	28 ± 3.5	(400 ± 50)	* 06-466-290 (HO)	06-400-152	138 ± 6.9	(2000 ± 100)
03-466-208 (HO)	06-400-192	103 ± 5.2	(1500 ± 75)	06-466-236 (HO)	06-400-152	124 ± 6.9	(1800 ± 100)	* 06-466-292 (HO)	06-400-152	69 ± 5.2	(1000 ± 75)
■ 03-466-212 (HO)	06-400-192	131 ± 6.9	(1900 ± 100)	06-466-238 (HO)	06-400-152	55 ± 5.2	(800 ± 75)	* 06-466-295 (HO)	06-400-152	35 ± 3.5	(500 ± 50)
06-466-200 (HO)	06-400-192	83 ± 5.2	(1200 ± 75)	06-466-240 (HO)	06-400-152	53 ± 3.5	(775 ± 50)	* 06-466-296 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)
** 06-466-201 (HO)	06-400-192	138 ± 6.9	(2000 ± 100)	06-466-244 (HO)	06-400-152	48 ± 3.5	(700 ± 50)	* 06-466-297 (HO)	06-400-152	159 ± 6.9	(2300 ± 100)
06-466-202 (HO)	06-400-192	152 ± 6.9	(2200 ± 100)	06-466-246 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)	* 06-466-298 (HO)	06-400-152	159 ± 6.9	(2300 ± 100)
** 06-466-204 (HO)	06-400-192	112 ± 3.5	(1625 ± 50)	06-466-248 (HO)	06-400-152	45 ± 2.4	(650 ± 35)	*** 06-466-299 (HO)	06-400-152	52 ± 5.2	(750 ± 75)
06-466-206 (HO)	06-400-192	103 ± 5.2	(1500 ± 75)	06-466-250 (HO)	06-400-152	124 ± 6.9	(1800 ± 100)	*** 06-466-301 (HO)	06-400-152	45 ± 3.5	(650 ± 50)
** 06-466-207 (HO)	06-400-192	103 ± 5.2	(1500 ± 75)	06-466-252 (HO)	06-400-152	71 ± 1.7	(1025 ± 25)	** 06-466-916 (HO)	06-400-152	121 ± 5.2	(750 ± 75)
06-466-208 (HO)	06-400-192	138 ± 6.9	(2000 ± 100)	* 06-466-258 (HO)	06-400-152	182 ± 6.9	(2600 ± 100)	■ 20-100-730 (HO)	06-400-152	43 ± 1.7	(625 ± 25)
** 06-466-209 (HO)	06-400-192	103 ± 5.2	(1500 ± 75)	* 06-466-260 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)	■ 20-100-749 (HO)	06-400-152	91 ± 3.5	(1325 ± 50)
06-466-210 (HO)	06-400-192	69 ± 5.2	(1000 ± 75)	* 06-466-262 (HO)	06-400-152	138 ± 6.9	(2000 ± 100)	20-100-801 (HO)	06-400-152	179 ± 6.9	(2600 ± 100)
** 06-466-213 (HO)	06-400-192	35 ± 3.5	(500 ± 50)	* 06-466-264 (HO)	06-400-152	69 ± 5.2	(1000 ± 75)	■ 20-100-833 (HO)	06-400-152	62 ± 5.2	(900 ± 75)
06-466-214 (HO)	06-400-192	90 ± 5.2	(1300 ± 75)	* 06-466-266 (HO)	06-400-152	69 ± 5.2	(1000 ± 75)				
06-466-216 (HO)	06-400-192	41 ± 5.2	(600 ± 75)	* 06-466-268 (HO)	06-400-152	69 ± 5.2	(1000 ± 75)				
06-466-218 (HO)	06-400-192	69 ± 5.2	(1000 ± 75)	* 06-466-270 (HO)	06-400-152	53 ± 3.5	(775 ± 50)				
06-466-220 (HO)	06-400-192	103 ± 5.2	(1500 ± 75)	* 06-466-282 (HO)	06-400-152	103 ± 5.2	(1500 ± 75)				

HO = Hydraulic Oil BF = Brake Fluid

* Meets MSHA requirements for underground mining vehicles with diesel engine.

** Valve and base, no pedal

* Horizontal mount

** Lever actuated

*** Firewall mounted pedal

■ Valve only, no pedal or base

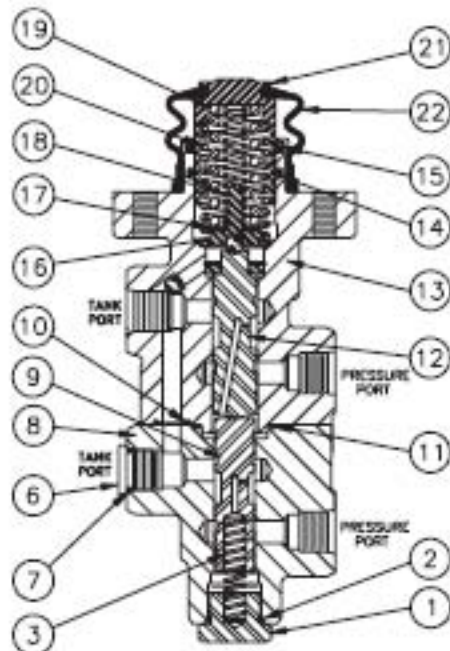


FIGURE 1

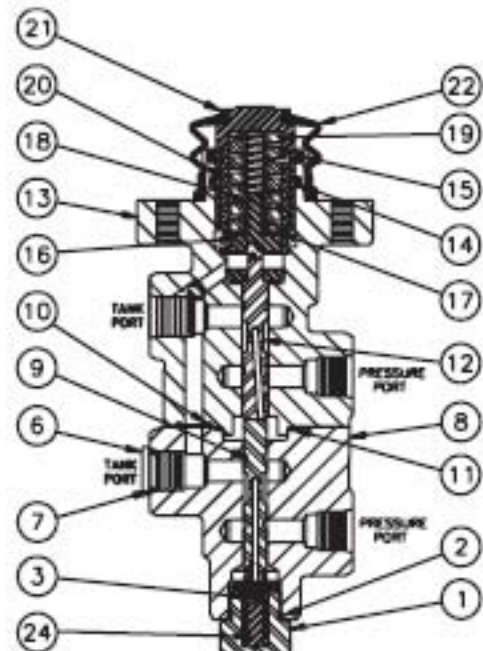


FIGURE 2

⚠ WARNING

Installation and test note: Piston (21) must be retained mechanically. This will prevent it from blowing out at high velocity if the power source is incorrectly connected to tank ports. Be sure the tank ports are connected directly to tank. Failure to do this could result in serious injury or death.

MODELS:

03-466-202	06-466-244	06-466-806
03-466-206	06-466-248	20-100-730
06-466-210	06-466-264	20-100-833
06-466-216	06-466-266	
06-466-218	06-466-268	
06-466-230	06-466-270	
06-466-232	06-466-286	
06-466-234	06-466-292	
06-466-238	06-466-295	
06-466-240	06-466-301	

DISASSEMBLY

(Refer to Figure 3)

NOTE

Housings (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (housing & spool) should not be intermixed with other parts.

1. Remove boot (22) from piston (21) and housing (13). Not all models use boot (22).
2. Remove piston (21), springs (18, 19 & 20), shim(s) (17) and retainer assembly (16) from housing (13). Not all models use spring (18). **NOTE:** Be aware of the number of shim(s) being removed from housing.
3. Carefully remove cup (15) and seal (14) from housing (13) bore. **NOTE:** Be careful not to scratch or mar housing bore.
4. Remove end plug (1) and spring (3) from housing (8). Remove o-ring (2) from end plug (1).
5. Remove plug (6) from housing (8). Remove o-ring (7) from plug (6). Not all models use plug (6) and o-ring (7).
6. Separate housings (8 & 13) by removing cap screws (4) and washers (5). Remove o-rings (10 & 11) from housings (8 & 13).
7. Carefully remove spools (9 & 12) from housings (8 & 13). **NOTE:** Be careful not to damage spools or housing bores.

CAUTION

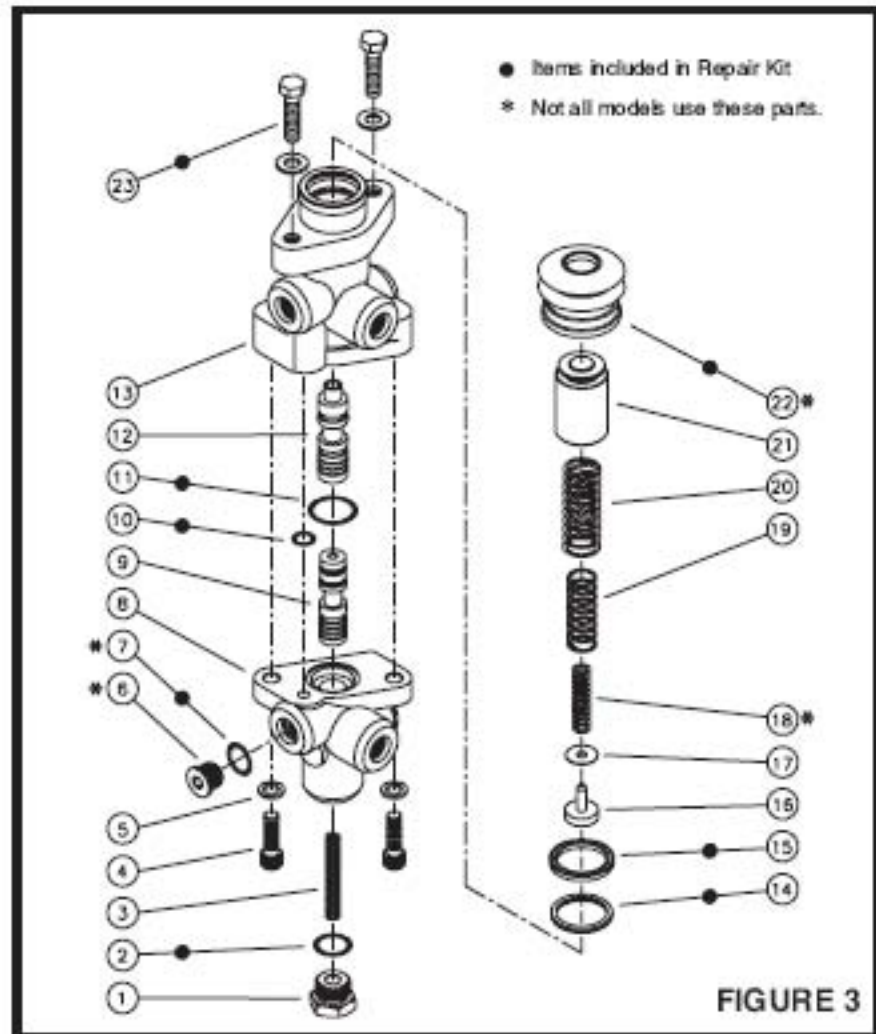
Do not intermix spools & housings. Spool (9) and housing (8) are a matched set as are spool (12) and housing (13).

ASSEMBLY

(Refer to Figure 3)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (10 & 11) in proper o-ring pockets on housings (8 & 13).
3. Lubricate spool (12) with clean system fluid and carefully slide into bottom end of housing (13) bore. Note direction of spool (12).

**FIGURE 3**

- NOTE:** Spool must slide freely into bore. If either part is damaged, a new spool/housing assembly may be required.
4. Reassemble housings (8 & 13) using cap screws (4) and washers (5). Use Loctite 242 on cap screws and torque 27.1-33.9 N-m (22-25 lb-ft). **NOTE:** Make sure housings line up correctly and that o-rings (10 & 11) remain in their pockets during assembly.
 5. Install new o-ring (7) on plug (6) and install in housing (8). Tighten securely. Not all models use plug (6) and o-ring (7).
 6. Lubricate spool (9) with clean system fluid and carefully slide into housing (8) bore. Note direction of spool (9). **NOTE:** Spool must slide freely into bore. If either part is damaged, a new spool/housing assembly may be required.
 7. Install new o-ring (2) on end plug (1).
 8. Install spring (3) and end plug (1) into housing (8). Torque end plug 47.5-54.2 N-m (35-40 lb-ft).
 9. Carefully install new cup (15) and new seal (14) into housing (13) bore. Note direction and order of cup and seal. **NOTE:** Be careful not to scratch or mar housing bore.
 10. Assemble springs (18, 19 & 20), shim(s) (17) and retainer assembly (16) in piston (21). Not all models use spring (18).
 11. Carefully install piston (21) assembly into housing (13) bore.
 12. Install new boot (22) on housing (13) and piston (21). Not all models use boot (22).
 13. When reinstalling pedal actuated valve use new hex cap screws (23), 5/16-18 grade 8. Torque cap screws 24.4-29.8 N-m (18-22 lb-ft).

NOTE

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (17) may be added or removed to obtain the correct pressure setting.

MODELS:

03-466-201	06-466-214	06-466-288
03-466-204	06-466-220	06-466-290
03-466-208	06-466-222	06-466-296
03-466-212	06-466-236	06-466-297
06-466-200	06-466-246	06-466-298
06-466-201	06-466-250	06-466-299
06-466-202	06-466-252	06-466-916
06-466-204	06-466-258	20-100-749
06-466-206	06-466-260	20-100-801
06-466-207	06-466-262	
06-466-208	06-466-282	
06-466-209	06-466-284	

DISASSEMBLY

(Refer to Figure 4)

NOTE

Housings (8 & 13) and spools (9 & 12) are manufactured as matched sets. These sets (housing & spool) should not be intermixed with other parts.

1. Remove boot (22) from piston (21) and housing (13). Not all models use boot (22).
2. Remove piston (21), springs (18, 19 & 20), shim(s) (17) and retainer assembly (16) from housing (13). Not all models use spring (18). **NOTE:** Be aware of the number of shim(s) being removed from housing.
3. Carefully remove cup (15) and seal (14) from housing (13) bore. **NOTE:** Be careful not to scratch or mar housing bore.
4. Remove end plug (1), retainer (24) and spring (3) from housing (8). Remove o-ring (2) from end plug (1).
5. Remove plug (6) from housing (8). Remove o-ring (7) from plug (6). Not all models use plug (6) and o-ring (7).
6. Separate housings (8 & 13) by removing cap screws (4) and washers (5). Remove o-rings (10 & 11) from housings (8 & 13).
7. Carefully remove spools (9 & 12) from housings (8 & 13). **NOTE:** Be careful not to damage spools or housing bores.

CAUTION

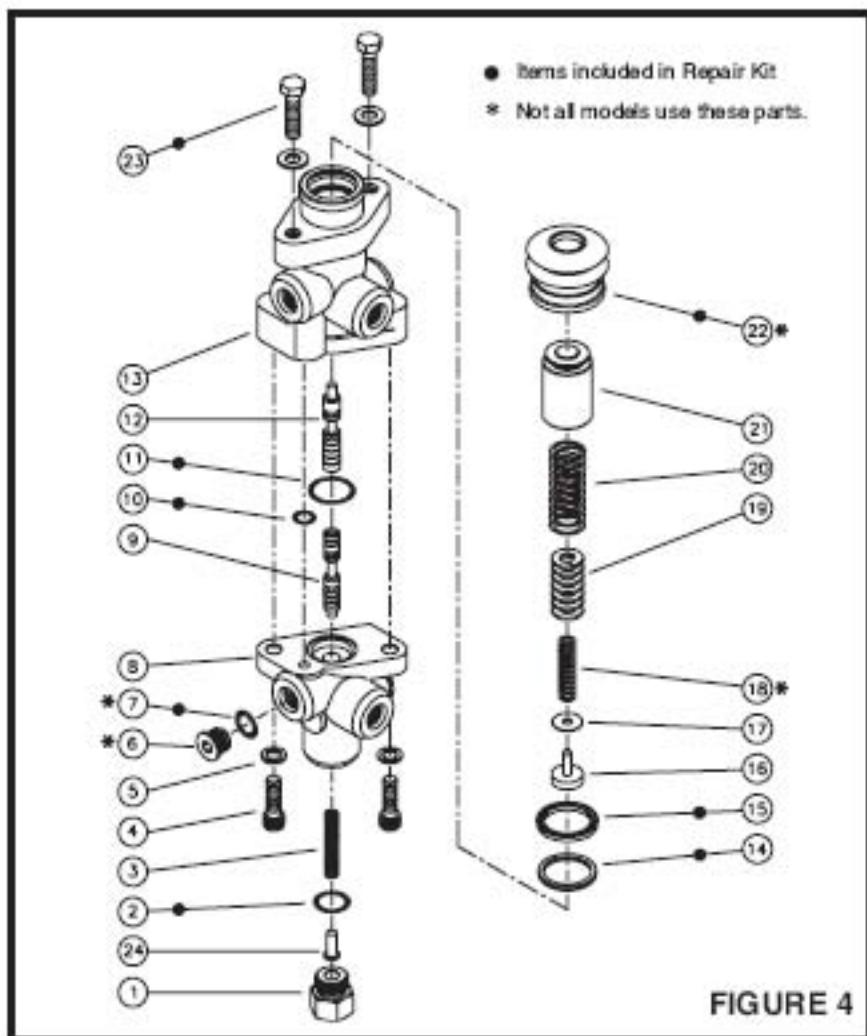
Do not intermix spools & housings. Spool (9) and housing (8) are a matched set as are spool (12) and housing (13).

ASSEMBLY

(Refer to Figure 4)

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.
2. Install new o-rings (10 & 11) in proper o-ring pockets on housings (8 & 13).
3. Lubricate spool (12) with clean system fluid and carefully slide into bottom end of housing (13) bore. Note direction of spool (12).

**FIGURE 4****NOTE**

After service, the valve must develop the pressure indicated in the specifications, TABLE 1. Shim(s) (17) may be added or removed to obtain the correct pressure setting.

BLEEDING

Brake lines should be bled very carefully as soon as the valve is installed in the machine. Air in the system will not allow the brakes to release properly and may severely damage them.

1. Start engine and allow accumulator to reach full charge. Shut down engine, then slowly apply and release brakes, waiting one minute between applications until brakes will not apply. Repeat this step three times.
2. Operate engine to maintain accumulator pressure within working limits throughout the bleeding procedure.
3. Open bleeder screw at wheel closest to brake valve and apply brakes cautiously until all air is bled out of line. Then close bleeder screw. Repeat this step at each wheel, moving to the next farthest wheel from the brake valve each time, as follows:
 - a. Left front
 - b. Right front
 - c. Right rear
 - d. Left rear
4. Release brake pressure for at least one (1) minute.

5. Apply brakes, holding pedal down 10 seconds; then release pressure for one (1) minute. Repeat this step two more times.
6. Repeat step 3.
7. Check for system leaks and be sure of proper brake operation.

SERVICE CHECKS FOR 466 SERIES POWER BRAKE VALVES

BRAKES SLOW TO APPLY

1. No or improper gas charge in accumulator
 1. Check gas charge
 2. Brakes not properly adjusted
 2. Adjust brakes
 3. Inoperative brakes
 3. Check brakes
 4. Hydraulic lines or fittings leaking
 4. Check for leaks and repair
 5. Inoperative automatic adjuster
 5. Check adjuster operation
 6. Damaged hydraulic brake lines
 6. Check lines for dents that restrict flow of oil

INSUFFICIENT BRAKES

1. No oil or low oil level in tank
 1. Check oil level in tank
 2. Brakes not properly adjusted
 2. Check brake adjustment
 3. Oil or grease on brake lining
 3. Clean or install new linings
 4. Brake line damaged
 4. Check lines and replace
 5. Inoperative automatic adjusters
 5. Check operation of adjusters
 6. No or improper gas charge in accumulator
 6. Check gas charge
 7. Inoperative brakes
 7. Check brakes

SERVICE DIAGNOSIS

(Refer to Figures 1 thru 4)

BRAKES WILL NOT RELEASE COMPLETELY

1. Piston (21) binding
2. Pedal angle out of adjustment
3. Spring (3) broken

BRAKES WILL NOT RELEASE

1. Binding spools (9 & 12)
2. Piston (21) binding

8. Brake valve inoperative
8. Replace valve
9. Inoperative system relief valve
9. Check pressure in pressure line to valve
10. Worn pump
10. Check pressure in pressure line to valve

EXCESSIVE BRAKING

1. Inoperative brakes
 1. Check brakes
 2. Inoperative brake valve
 2. Replace brake valve

BRAKES WILL NOT RELEASE COMPLETELY

1. Brakes not properly adjusted
 1. Adjust brakes
 2. Inoperative brakes
 2. Check brakes
 3. Pedal angle out of adjustment
 3. Adjust pedal angle
 4. Inoperative wheel cylinders
 4. Replace wheel cylinders
 5. Inoperative automatic adjuster
 5. Check operation of adjusters
 6. Air in brakes (when automatic adjusters used Goodrich Hi-torque Brakes only)
 6. Bleed brakes
 7. Pressure on return line too high

NO BRAKES

1. Piston (21) binding
2. Broken spring (19)

EXCESSIVE BRAKING

1. Too many shims (17) installed in valve.

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE APPLIED

1. Damaged spools (9 & 12)
2. Damaged housings (8 & 13)

7. Reduce pressure
8. Inoperative brake valve
8. Replace brake valve

NO BRAKES

1. No oil in hydraulic system
 1. Check oil level in tank
 2. Broken or damaged brake line
 2. Check lines for breaks or damaged condition
 3. Brakes not properly adjusted
 3. Adjust brakes
 4. Inoperative system relief valve
 4. Check pressure in pressure line to valve
 5. Worn pump
 5. Check pressure in pressure line to valve
 6. Inoperative automatic adjuster
 6. Check brake line pressure
 7. Inoperative or worn brakes
 7. Check brakes
 8. Inoperative brake valve
 8. Replace brake valve

PEDAL KICKBACK WHEN BRAKES ARE APPLIED

1. Air in brakes
 1. Bleed brakes

EXCESSIVE ACCUMULATOR LEAKAGE WHEN BRAKES ARE NOT BEING USED

1. Damaged spools (9 & 12)
2. Damaged housings (8 & 13)

INSUFFICIENT BRAKES

1. Broken pressure regulating spring (19)
2. Pedal travel is inhibited

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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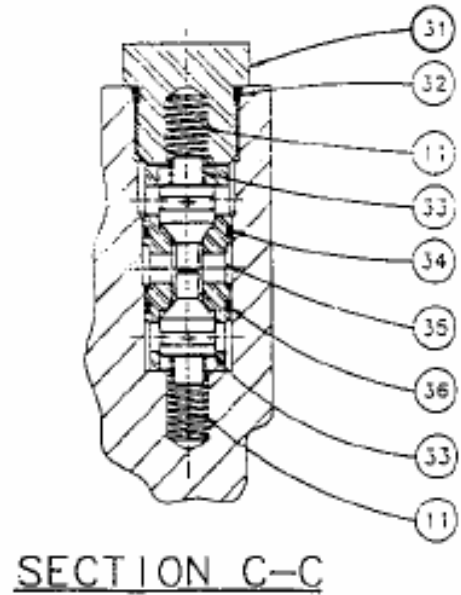
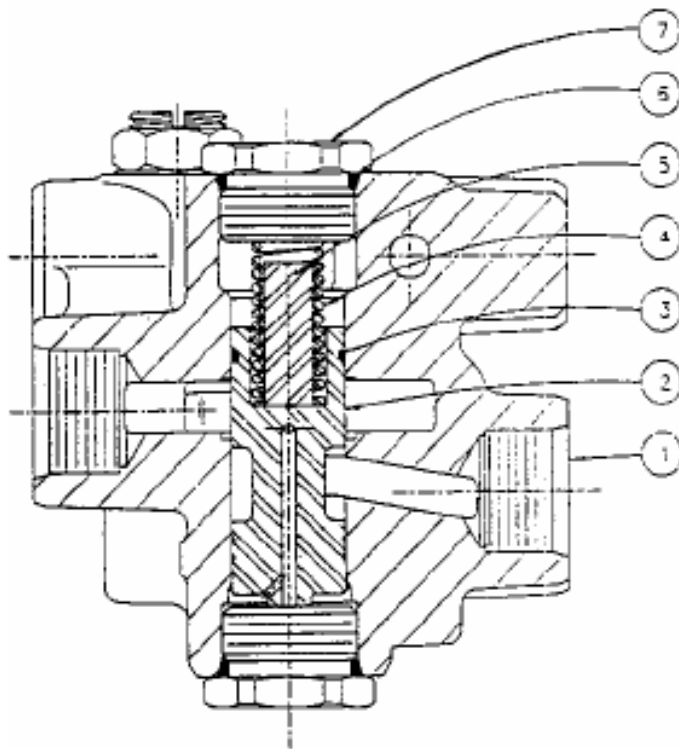
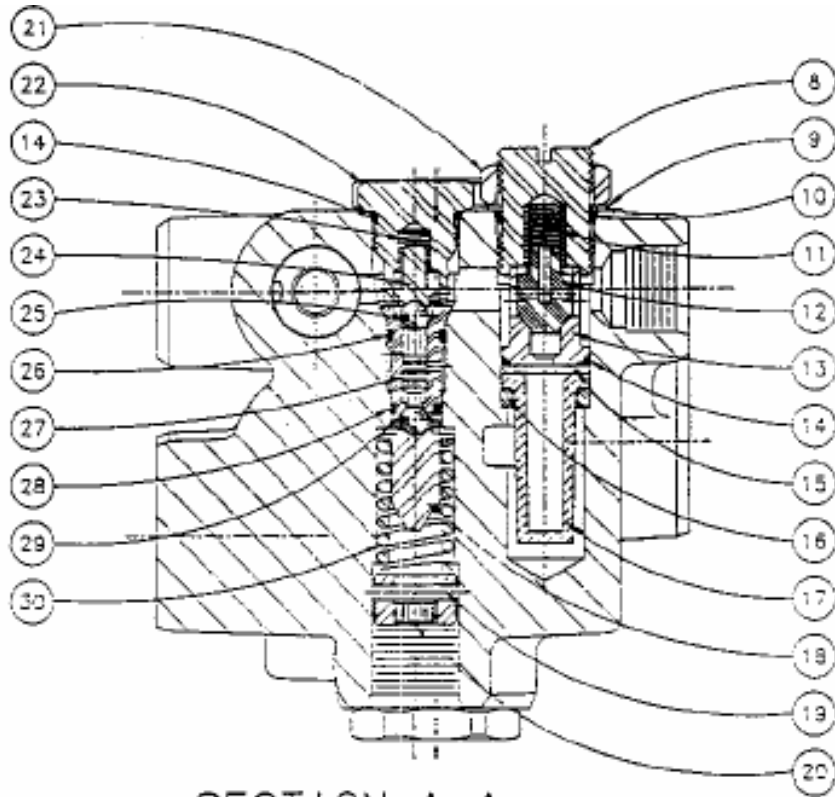
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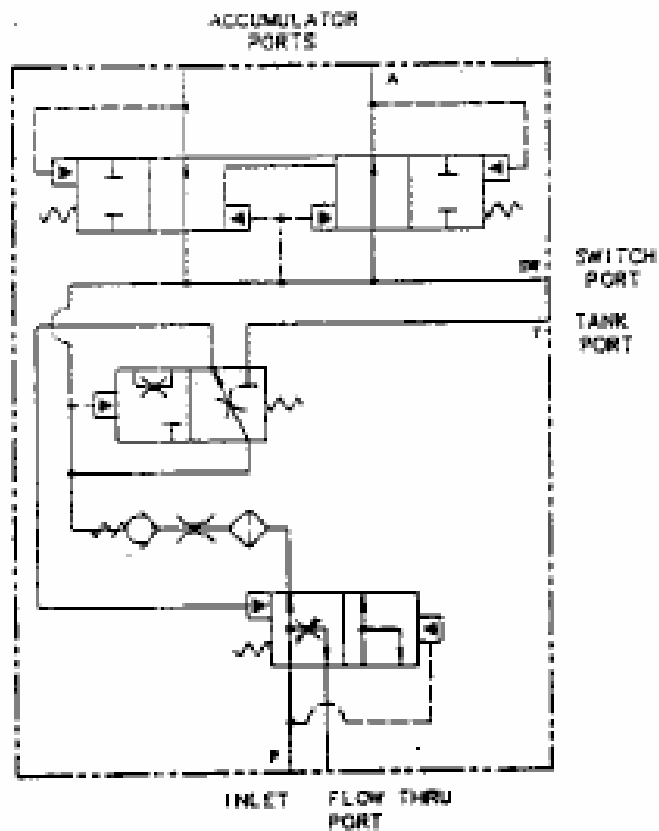
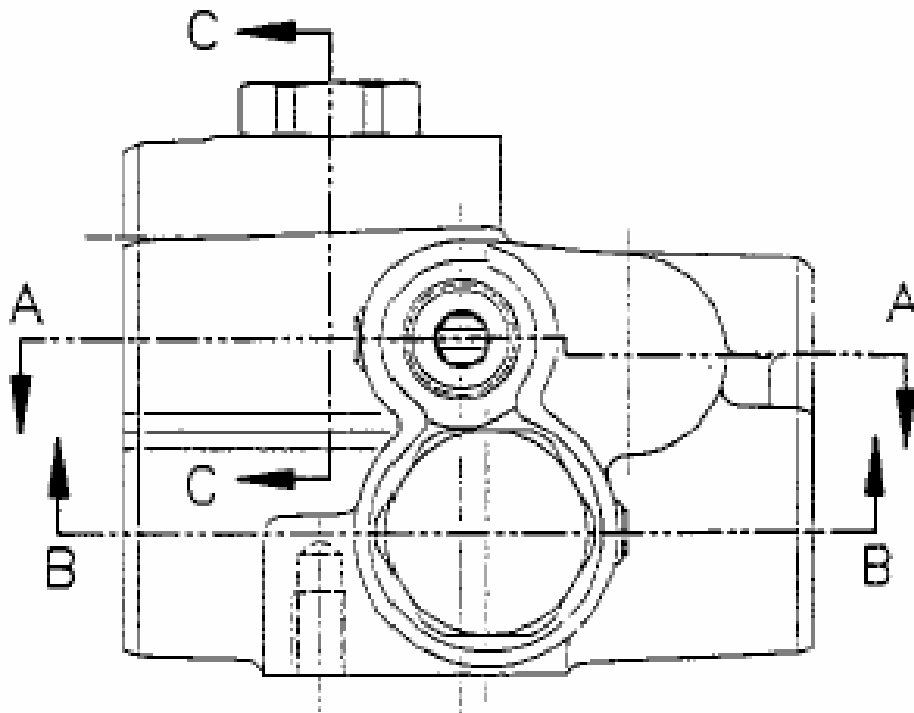
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CHARGING VALVE

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Page 3 of 4

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	594922	VALVE ASSEMBLY	1
	534293	REPAIR KIT (INCLUDES ITEMS 3, 6, 10, 12, 14, 17, 19, 26, 28, 32-34, 36)	1
1	NSS	HOUSING	1
2	NSS	SPOOL	1
3	NSS	SEAL	1
4	NSS	SPRING	1
5	NSS	ROD	1
6	NSS	O-RING	2
7	NSS	PLUG	2
8	NSS	SCREW	1
9	NSS	WASHER	1
10	NSS	O-RING	1
11	NSS	SPRING	3
12	NSS	POPPET	1
13	NSS	SEAT	1
14	NSS	O-RING	2
15	NSS	WASHER	1
16	NSS	WASHER	1
17	NSS	FILTER	1
18	NSS	RETAINER	1
19	NSS	PLUG	1
20	NSS	SCREW	1
21	NSS	NUT	1
22	NSS	PLUG	1
23	NSS	SPRING	1
24	NSS	STOP	1
25	NSS	BALL	2
26	NSS	O-RING	1
27	NSS	SPOOL	1
28	NSS	O-RING	1

Updated:
12/11/06



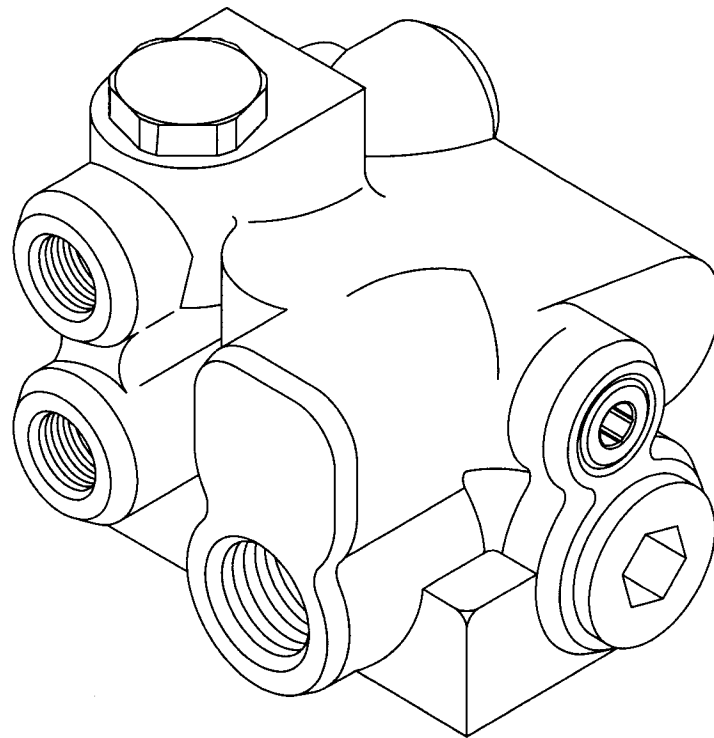
CHARGING VALVE

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29	NSS	INSEAT	1
30	NSS	SPRING	1
31	NSS	END PLUG	1
32	NSS	O-RING	1
33	NSS	POPPET	2
34	NSS	O-RING	1
35	NSS	SLEEVE	1
36	NSS	O-RING	1

463 Series - 30 GPM Dual ACCUMULATOR CHARGING VALVE

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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DISASSEMBLY

1. Remove plug (1) from housing (44). Remove o-ring (2) from plug. **NOTE: Plug is under spring tension.**
2. Remove spring (4) and rod (3) from housing.
3. Remove plug (8) from housing and remove o-ring (7) from plug.
4. Remove spool (6) from housing thru plug (1) end ONLY. Remove seal (5) from spool.
5. Loosen nut (25) and remove screw assembly (26) from housing. Remove o-ring (27) from screw assembly.
6. Remove spring (28), poppet or steel ball (29), seat (30), o-ring (31), washer (32), filter (33) and washer (34) from housing.
7. BEFORE removing screw (9), ACCURATELY MEASURE ITS DEPTH from the end of housing and record for reassembly purposes. Remove screw (9) from housing.
8. Remove spring (11), retainer (12) and ball (13). Be sure to keep ball (13) separate from ball (20) for reassembling.
9. Remove pin (10) from screw (9) using a drive pin punch. Be careful not to damage threads.
10. Remove plug (24) from housing. Remove o-ring (23) from plug.
11. Remove spring (22), stop (21) and ball (20) from housing.
12. Place housing on bench with plug (24) end down. Spool (19) may or may not fall out at this point.
13. Using a 6.35-7.87 mm (.25"-.31") dia. wood or plastic dowel, carefully remove insert (18) and spool (19) from housing. Insert (18) must come out plug (24) end of housing. Be careful not to scratch or mar valve seats on insert (18).
14. Remove spool (19) from insert (18). Remove o-rings (15 & 17) and back-up rings (14 & 16) from insert. **NOTE: Not all models use back-up rings (14 & 16).**
15. Remove plug (43) from housing. Remove o-ring (42) from plug.
16. Remove spring (41), poppet (40), sleeve (38), poppet (36), and spring (35) from housing. **NOTE: Be careful not to scratch or mar housing or sleeve bore.**

17. Remove o-rings (37 & 39) from sleeve (38).

ASSEMBLY

CLEAN ALL PARTS WITH CLEAN SOLVENT AND DRY. LUBRICATE ALL RUBBER PARTS WITH CLEAN SYSTEM FLUID PRIOR TO ASSEMBLY. BE SURE ENTIRE ASSEMBLY PROCEDURE IS DONE WITH CONTAMINATION FREE METHODS.

1. Install new o-ring (7) on plug (8). Install plug (8) into housing and torque 67.8-81.4 N-m (50-60 lb-ft).
2. Install new seal (5) on spool (6). Be sure seal does not twist in groove.
3. Lubricate spool (6) and properly insert into housing.
4. Install spring (4) and rod (3) into housing.
5. Install new o-ring (2) on plug (1). Install plug (1) into housing and torque 67.8-81.4 N-m (50-60 lb-ft).
6. Install new o-rings (15 & 17) and new back-up rings (14 & 16) on insert (18) and place into housing. Note direction of assembly. Seat insert with 12.7mm (.50") dia. wood dowel. **NOTE: Not all models use back-up rings (14 & 16).**
7. Turn housing so plug (24) is facing upward. Install spool (19) into insert (18) in housing. Note direction of spool, long shoulder end is toward end plug (24).
8. Install ball (20) on insert (19). Install stop (21) over ball and spring (22) over stop.
9. Install new o-ring (23) on plug (24). Carefully install plug into housing, centering spring (22). Torque 47.5-54.2 N-m (35-40 lb-ft).
10. Turn housing so plug (8) is vertically upward. Install ball (13), 6.35 mm (.25") dia. Be sure ball is centered in bottom of hole in housing. Drop retainer (12) and spring (11) into housing.
11. Insert new pin (10) in screw (9). Be sure pin is aligned properly and is evenly driven into screw. Do not damage screw threads.
12. Thread screw (9) in housing to the depth recorded during disassembly.
13. Install new o-ring (27) on screw assembly (26).

14. Install washer (34), new filter (33), washer (32), new o-ring (31), seat (30), new poppet or steel ball (29), spring (28) and screw assembly (26) into housing. Torque screw assembly 24.4-29.8 N-m (18-22 lb-ft).
15. Install nut (25) on screw assembly (26) and torque 43.4-51.5 N-m (32-38 lb-ft).
16. Install new o-rings (37 & 39) on sleeve (38).
17. Install spring (35), new poppet (36), sleeve (38), new poppet (40) and spring (41) into housing.
18. Install new o-ring (42) on plug (43). Install plug in housing and torque 67.8-81.4 N-m (40-50 lb-ft).

VALVE ADJUSTMENT

(Refer to Table 1)

1. Reinstall valve correctly. Tee an accurate pressure gauge into each accumulator line.
2. Start pump and allow approximately one minute for charging to start (pressure in gauge will read accumulator precharge plus). If valve does not begin to charge, turn screw (9) in, stopping when gauge shows an increase in pressure. Check the high limit specifications and adjust screw (9) until the high limit setting is met. This pressure can be checked correctly only if after each adjustment of screw (9) the accumulator pressure is reduced below the low limit setting and the system recharges the accumulator pressure to its high limit.

NOTE

It may be necessary to reconnect the tank port line after each adjustment to prevent oil leakage from this port.

● Items included in Repair Kit

* Not used in all models

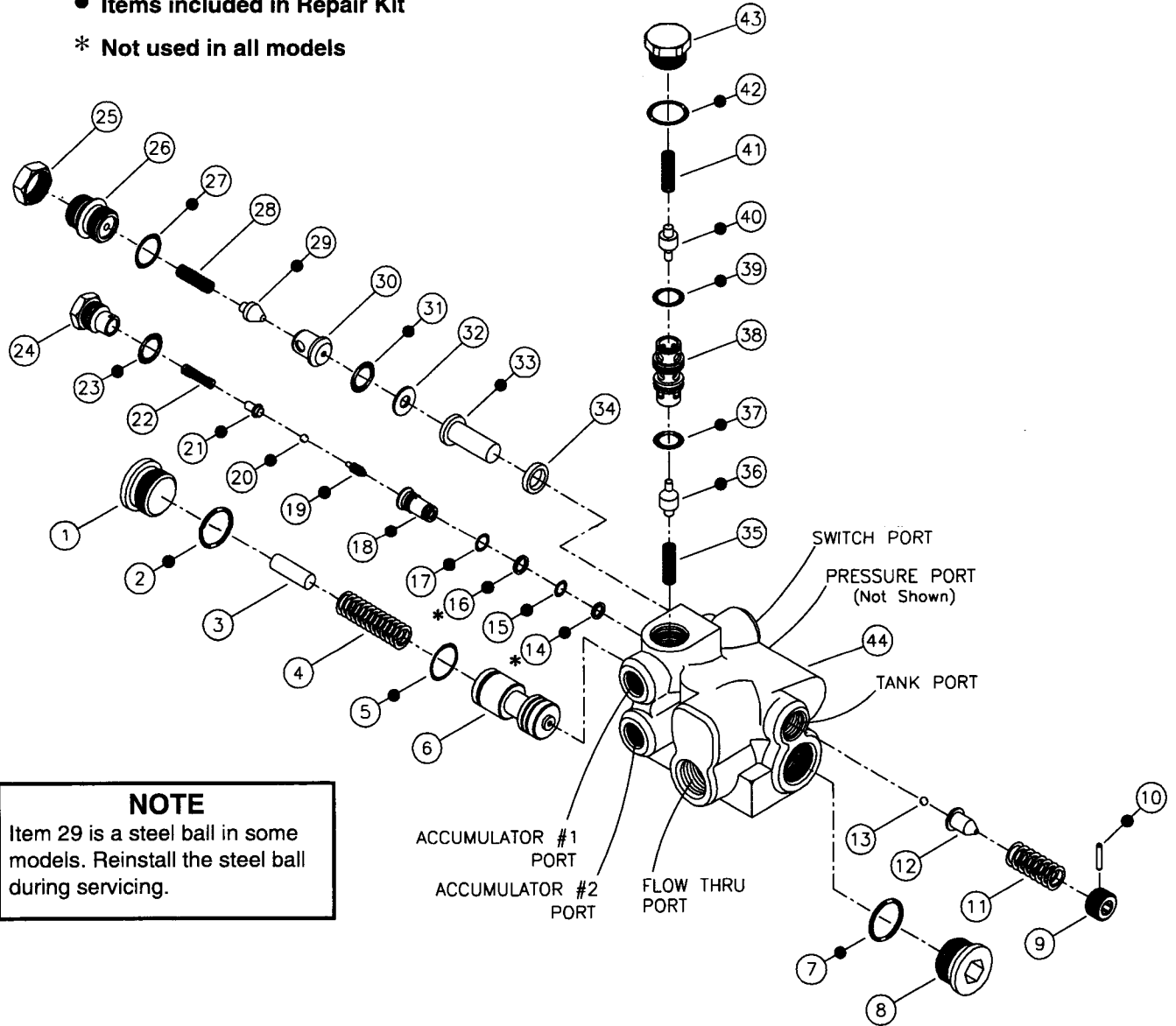


TABLE 1 (Specifications)

Model Number	Repair Kit	Accumulator Charge Rate		Accumulator High Limit		Accumulator Low Limit	
		L/min	(gpm)	bar	(psi)	bar	(psi)
06-463-200	06-400-112	10.2 ± 1.9	(2.7 ± .5)	159 ± 3.5	(2300 ± 50)	128 ± 3.5	(1850 ± 50)
06-463-202	06-400-112	10.2 ± 1.9	(2.7 ± .5)	190 ± 3.5	(2750 ± 50)	155 ± 3.5	(2250 ± 50)
06-463-204	06-400-112	10.2 ± 1.9	(2.7 ± .5)	138 ± 3.5	(2000 ± 50)	114 ± 3.5	(1650 ± 50)
06-463-206	06-400-112	10.2 ± 1.9	(2.7 ± .5)	124 ± 3.5	(1800 ± 50)	86 ± 3.5	(1250 ± 50)
06-463-208	06-400-112	10.2 ± 1.9	(2.7 ± .5)	145 ± 3.5	(2100 ± 50)	117 ± 3.5	(1700 ± 50)
06-463-210	06-400-112	10.2 ± 1.9	(2.7 ± .5)	128 ± 3.5	(1850 ± 50)	103 ± 3.5	(1500 ± 50)
06-463-212	06-400-112	10.2 ± 1.9	(2.7 ± .5)	103 ± 3.5	(1500 ± 50)	86 ± 3.5	(1250 ± 50)
06-463-214	06-400-112	10.2 ± 1.9	(2.7 ± .5)	83 ± 3.5	(1200 ± 50)	64 ± 3.5	(925 ± 50)
06-463-216	06-400-112	2.8 ± .95	(.75 ± .25)	114 ± 3.5	(1650 ± 50)	93 ± 3.5	(1350 ± 50)
06-463-218	06-400-112	6.4 ± 1.9	(1.7 ± .5)	124 ± 3.5	(1800 ± 50)	95 ± 3.5	(1375 ± 50)
06-463-220	06-400-180	6.4 ± 1.9	(1.7 ± .5)	165 ± 3.5	(2400 ± 50)	138 ± 3.5	(2000 ± 50)
06-463-222	06-400-112	10.2 ± 1.9	(2.7 ± .5)	179 ± 3.5	(2600 ± 50)	148 ± 3.5	(2150 ± 50)
06-463-224	06-400-194	6.4 ± 1.9	(1.7 ± .5)	165 ± 3.5	(2400 ± 50)	138 ± 3.5	(2000 ± 50)
06-463-226	06-400-112	2.8 ± .95	(.75 ± .25)	103 ± 3.5	(1500 ± 50)	86 ± 3.5	(1250 ± 50)
06-463-228	06-400-112	2.8 ± .95	(.75 ± .25)	179 ± 3.5	(2600 ± 50)	145 ± 3.5	(2100 ± 50)

SERVICE CHECKS FOR HYDRAULIC SYSTEMS

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATOR IS NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Leaking accumulator lines or fittings
- 1. Check lines and fittings for leak and correct**
2. Incorrect setting of accumulator gas charge
- 2. Check accumulator gas charge**
3. Line to accumulator plugged
- 3. Replace line**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR STARTS TO CHARGE BUT DOES NOT REACH HIGH LIMIT

1. No oil or low oil level in tank
- 1. Check oil level**
2. Pump worn or inoperative and not delivering full flow or pressure
- 2. Check pump**
3. Inoperative system relief valve (valve leaking or has low setting so full flow and pressure are not available)
- 3. Check relief valve**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR CHARGING CYCLE REPEATS FREQUENTLY WHEN ACCUMULATOR IS NOT NORMALLY BEING DISCHARGED IN SERVICE

1. Poppet (29) leaking.
2. O-ring (31) leaking.
3. O-ring (17) leaking.
4. Ball (20) leaking.
5. Inoperative seat on insert (18).

ACCUMULATOR STARTS TO CHARGE BUT DOES NOT REACH HIGH LIMIT

1. O-ring (15) leaking.
2. Seal (5) has been damaged or worn.

ACCUMULATOR CHARGING TIME TOO LONG

1. No oil or low oil level in tank
- 1. Check oil level**
2. Relief valve setting too low
- 2. Check valve setting**
3. Pump worn or inoperative and not delivering full flow or pressure
- 3. Check pump**
4. Inoperative charging valve
- 4. Replace charging valve**

ACCUMULATOR FAILS TO START CHARGING

1. No oil or low oil level in tank
- 1. Check oil level**
2. Worn or inoperative pump
- 2. Check pump pressure and flow**
3. Inoperative relief valve
- 3. Check relief valve setting**
4. Air in accumulator line
- 4. Bleed accumulator line**
5. Inoperative charging valve
- 5. Replace charging valve**

SERVICE DIAGNOSIS

ACCUMULATOR CHARGING TIME TOO LONG

1. Dirt in filter (33).
4. Poppet (29, 36 or 40) stuck, partially closed.
3. Seat (30) partially plugged.

ACCUMULATOR FAILS TO START CHARGING

1. Broken spring (11).
2. Broken spring (4).
3. O-ring (2) inoperative.
4. Spool (6) stuck.
5. Dirt in filter (33).

VERY RAPID CYCLING OF CHARGING VALVE

1. Incorrect setting of accumulator gas charge
- 1. Check accumulator gas charge**
2. Inoperative charging valve
- 2. Replace charging valve**

LACK OF ADEQUATE FLOW THRU VALVE

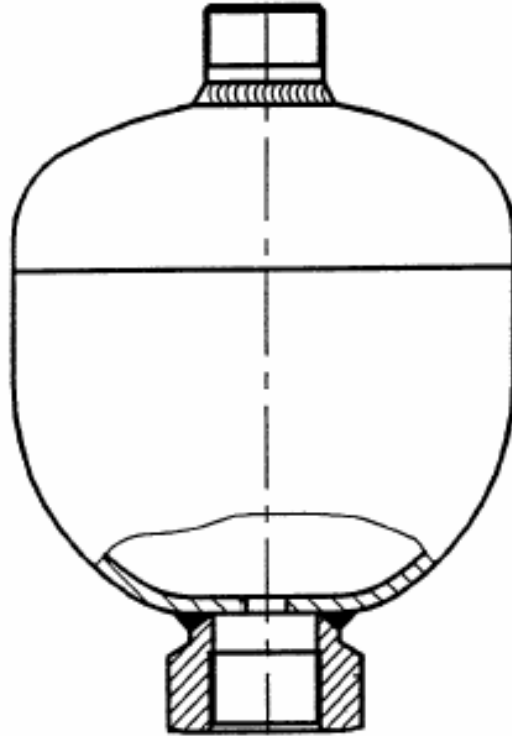
1. Inoperative pump
- 1. Check pump pressure and delivery**
2. Inoperative relief valve
- 2. Check relief valve setting**
3. Blocked lines
- 3. Replace lines**
4. Inoperative charging valve
- 4. Replace charging valve**

VERY RAPID CYCLING OF CHARGING VALVE

1. Insert (18) worn.
2. Poppets (36 or 40) stuck, partially closed.

ACCUMULATOR PRESSURES ARE NOT ISOLATED FROM ONE ANOTHER

1. O-rings (37 or 39) leaking.
2. Inoperative poppets (36 or 40).

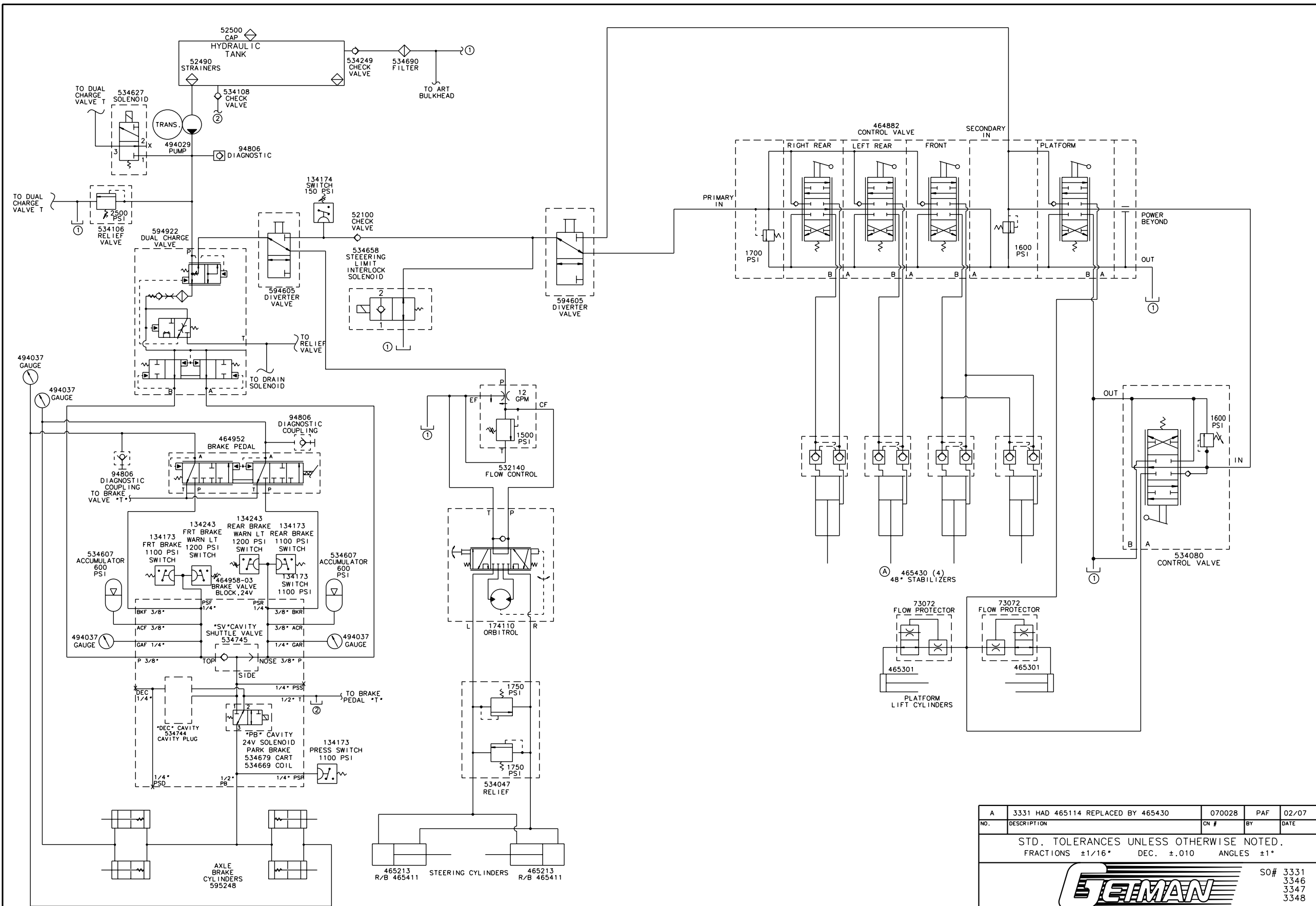


<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	534607	ACCUMULATOR ASSEMBLY	1
2*	534608	MOUNTING BRACKET	1

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

8. HYDRAULIC SYSTEM

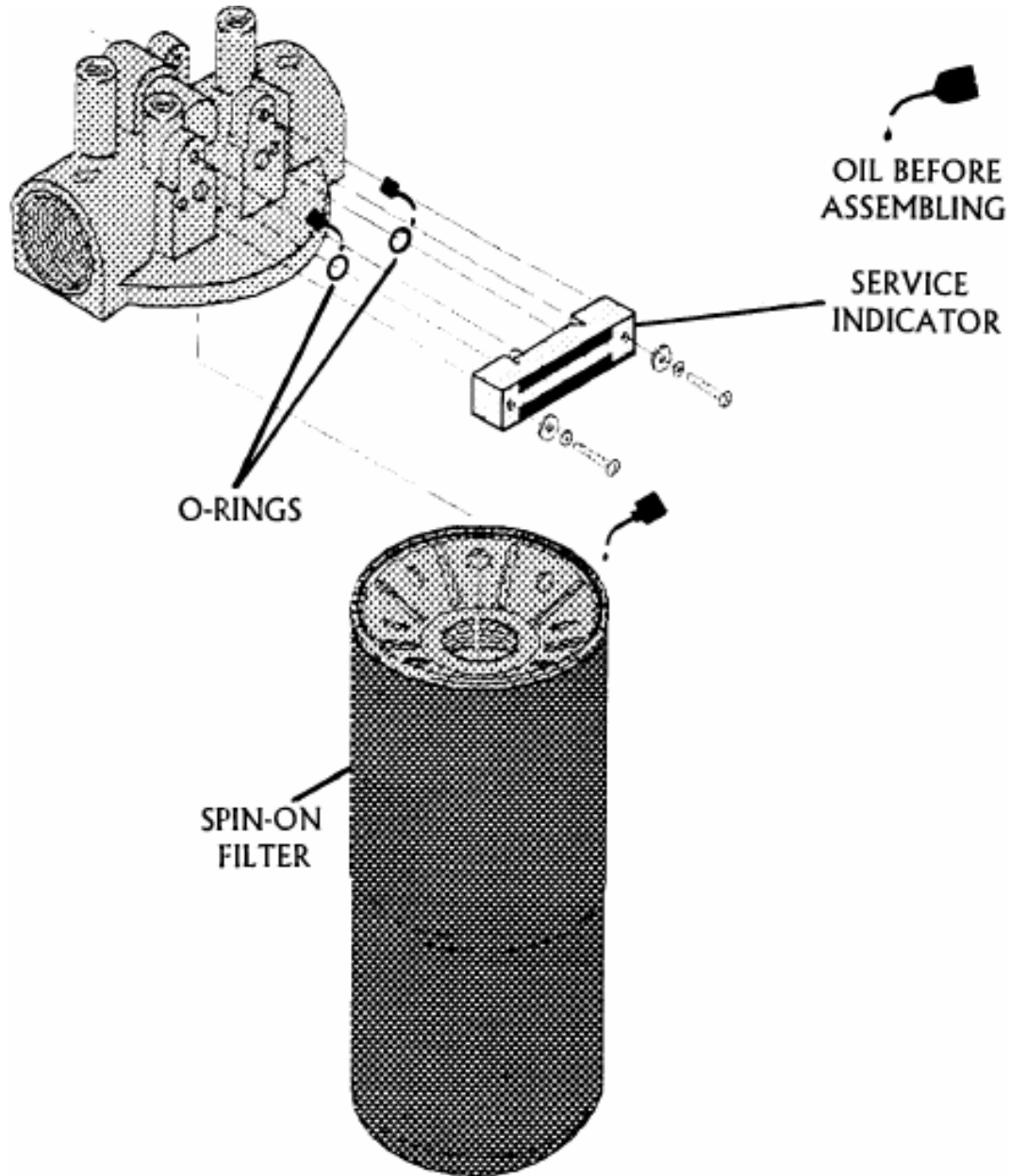
31476	HYDRAULIC SCHEMATIC
13259	FILTER (HYDRAULIC)
12860	STEERING ORBITROL
-----	STEERING ORBITROL SERVICE
-----	PUMP SERVICE
13306	FLOW DIVIDER ADJUSTMENT
13359	CONTROL VALVE ORIENTATION
13067	CONTROL VALVE
13943	STEERING CYLINDER
13975	STABILIZER CYLINDER
13763	LIFT CYLINDER (PLATFORM)



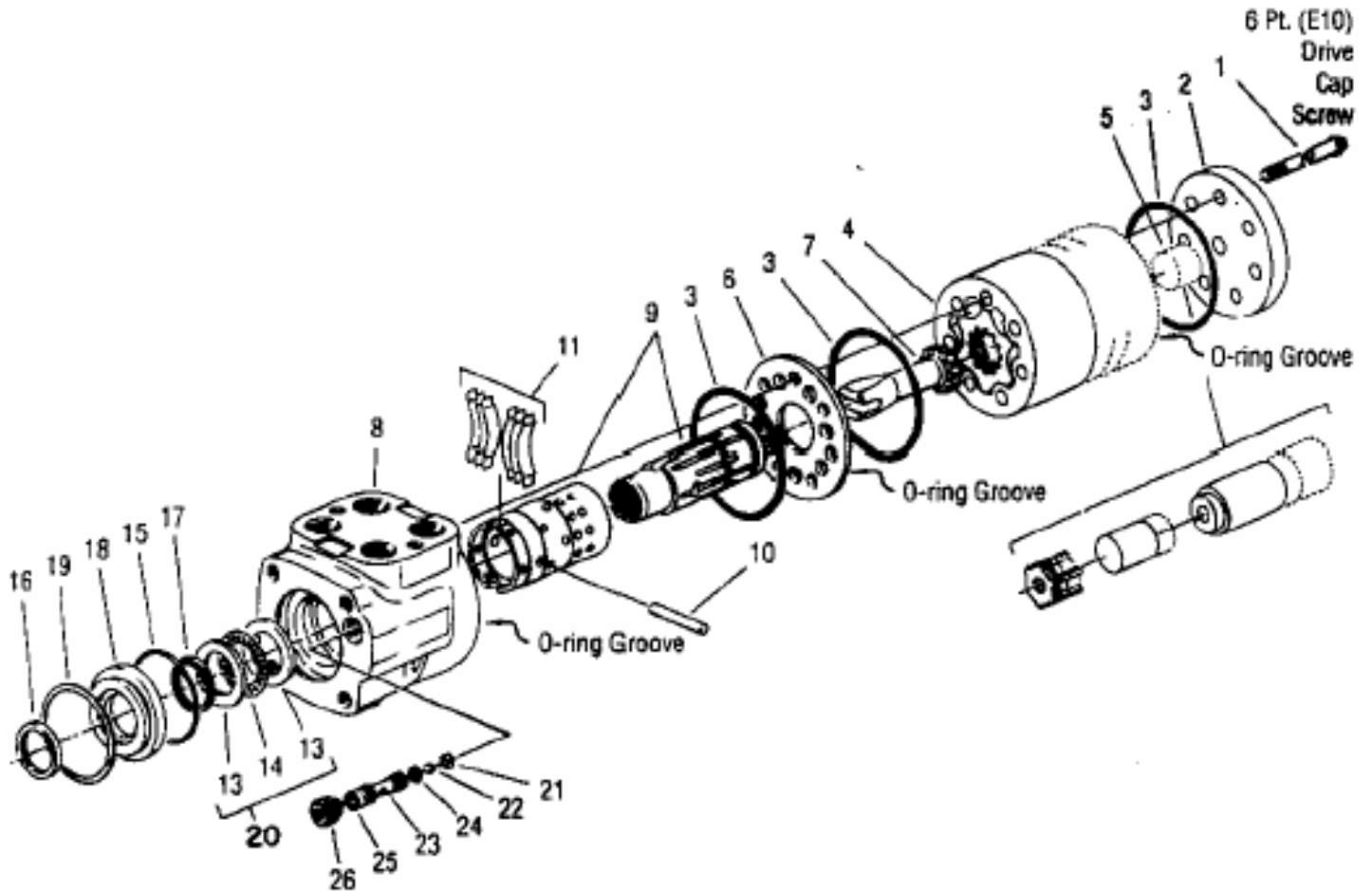
BULK HEAD HOSES:
 3/4" HOSE 28.5" LONG
 1/2" HOSE 30" LONG

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A	3331 HAD 465114 REPLACED BY 465430	070028	PAF	02/07
NO.	DESCRIPTION	CN #	BY	DATE
STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°				
GETMAN				S0# 3331 3346 3347 3348
TITLE HYDRAULIC DIAGRAM A64 SCISSOR, HYD BRAKES D65, (4) 48" JACKS, 24 VOLT, ELEC SHIFT,				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
PAF	05/09/06	NONE	C	31476



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	534690	FILTER ASSEMBLY	1
2	534691	REPLACEMENT FILTER	1
3	534712	SERVICE INDICATOR	1



ITEM	PART #	DESCRIPTION	QTY.
	174110	STEERING VALVE	1
	174116	SEAL KIT (INCLUDES ITEMS 3, 8, 9, 15, 16, 17, 24, 25)	1
	174112	SERVICE KIT (INCLUDES ITEMS 1, 4, 5)	1
1	NSS	SCREW, CAP (6 POINT)	7
2	NSS	CAP, END	1
3	NSS	SEAL	3
4	NSS	GEROTOR	1
5	NSS	SPACERS	A/R
6	174113	PLATE, SPACER	1
7	173172	DRIVE	1
8	NSS	HOUSING	1



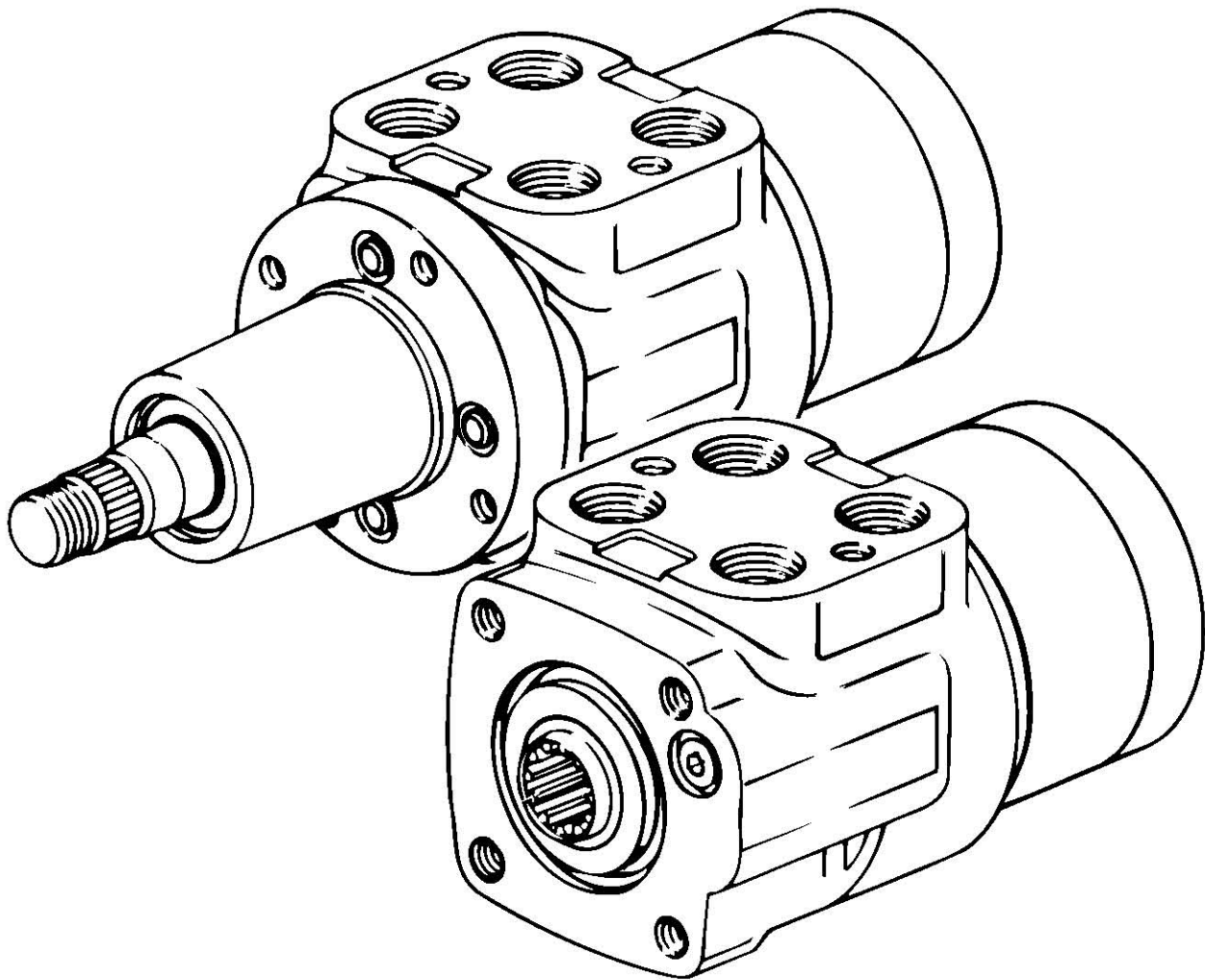
STEERING ORBITROL

12860
Page 2 of 2

9	NSS NSS	SLEEVE, CONTROL SPOOL, CONTROL	1
10	174033	PIN, CENTERING	1
11	174115	SPRING, CENTERING	6
13	174039	RACE, BEARING	2
14	174034	BEARING, NEEDLE THRUST	1
15	NSS	SEAL	1
16	NSS	SEAL	1
17	NSS	SEAL, QUAD RING	1
18	174036	BUSHING, SEAL GLAND	1
19	174044	RING, RETAINING	1
20	174046	NEEDLE BEARING KIT	1
21	174035	RETAINER, CHECK BALL	1
22	174045	BALL CHECK	1
23	174038	SEAT, CHECK BALL	1
24	NSS	SEAL	1
25	NSS	SEAL	1
26	174067	SCREW, SET	1



Repair Information



**3, 4, 6, and 12 Series
Steering Control Units**

001 002

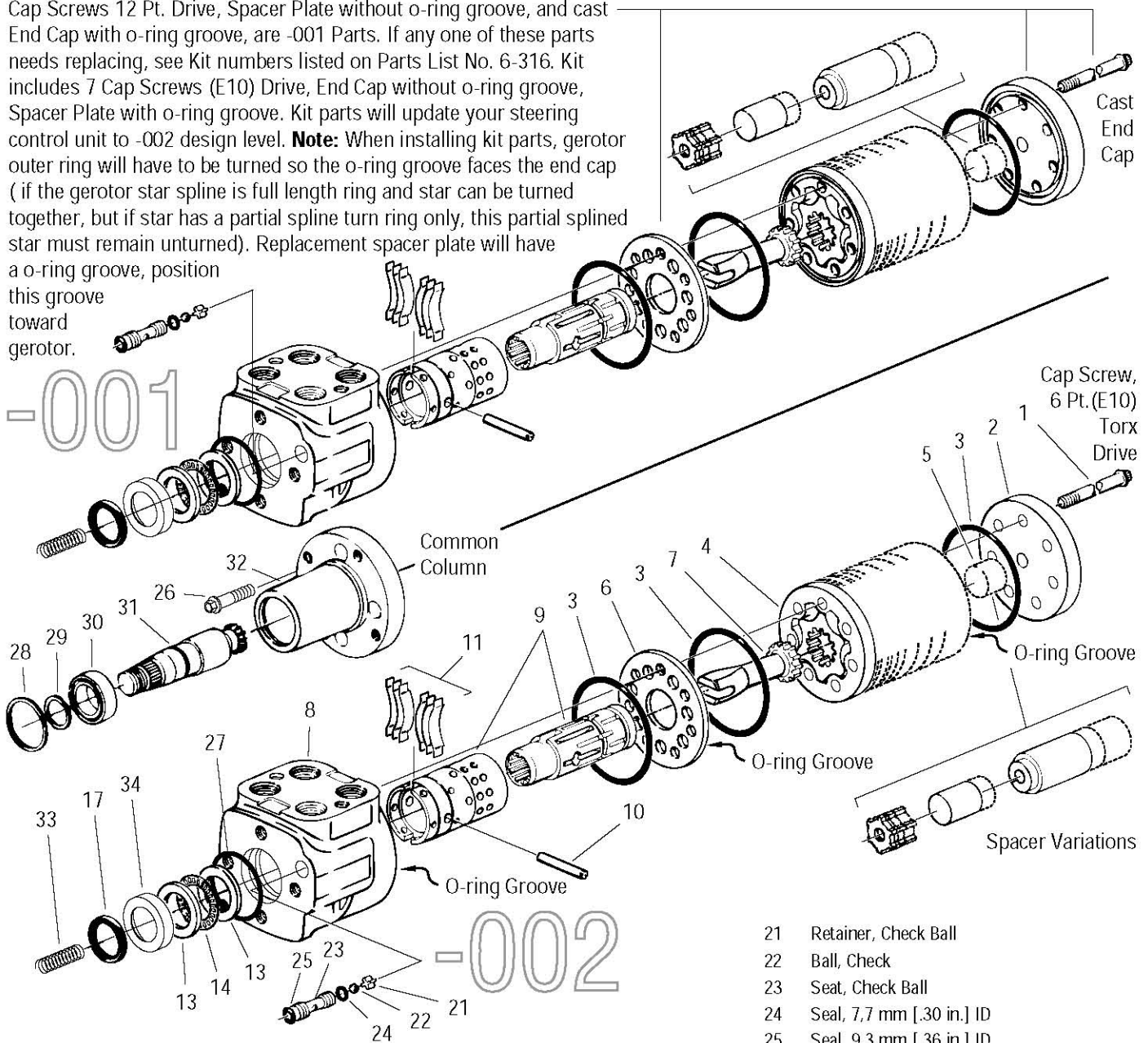
SCU with Integral Column

Steering Control Unit (SCU) with integral column — column disassembly and reassembly procedure on pages 10 through 12.

Steering Control Unit (SCU) — low input torque seal and spring spacer installation (see page 12).

Cap Screws 12 Pt. Drive, Spacer Plate without o-ring groove, and cast End Cap with o-ring groove, are -001 Parts. If any one of these parts needs replacing, see Kit numbers listed on Parts List No. 6-316. Kit includes 7 Cap Screws (E10) Drive, End Cap without o-ring groove, Spacer Plate with o-ring groove. Kit parts will update your steering control unit to -002 design level. **Note:** When installing kit parts, gerotor outer ring will have to be turned so the o-ring groove faces the end cap (if the gerotor star spline is full length ring and star can be turned together, but if star has a partial spline turn ring only, this partial splined star must remain unturned). Replacement spacer plate will have a o-ring groove, position this groove toward gerotor.

-001



- 1 Screw, Cap, 6 Point (E10) Drive
- 2 Cap, End
- 3 Seal, 73,5 mm [2.89 in.] ID
- 4 Gerotor
- 5 Spacer
- 6 Plate, Spacer
- 7 Drive
- 8 Housing

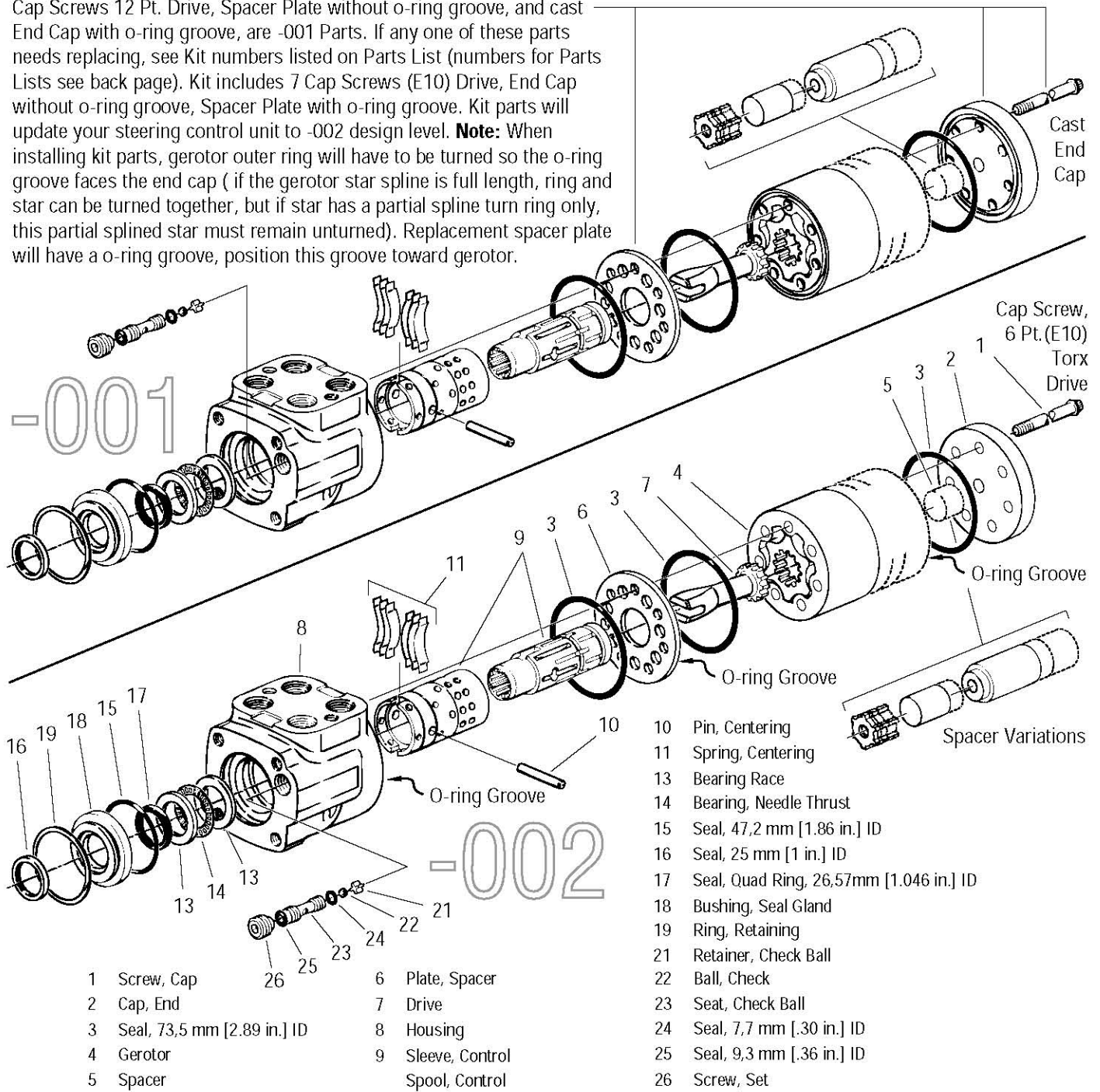
- 9 Sleeve, Control
- 10 Pin, Centering
- 11 Spring, Centering
- 13 Bearing Race
- 14 Bearing, Needle Thrust
- 15 Seal, 47,2 mm [1.86 in.] ID
- 17 Seal, Quad Ring, 26,57mm [1.046 in.] ID

- 21 Retainer, Check Ball
- 22 Ball, Check
- 23 Seat, Check Ball
- 24 Seal, 7,7 mm [.30 in.] ID
- 25 Seal, 9,3 mm [.36 in.] ID
- 26 Screw, Cap, 12 Point Drive
- 27 Seal, 49,3 mm [1.94 in.] OD
- 28 Ring, Retaining (bore)
- 29 Ring, Retaining (shaft)
- 30 Bearing Assembly, Control Column
- 31 Shaft, Control
- 32 Column, Steering Control
- 33 Spring
- 34 Bearing Locator

SCU without Column

Steering Control Unit (SCU) — low input torque seal and spring spacer installation (see page 12).

Cap Screws 12 Pt. Drive, Spacer Plate without o-ring groove, and cast End Cap with o-ring groove, are -001 Parts. If any one of these parts needs replacing, see Kit numbers listed on Parts List (numbers for Parts Lists see back page). Kit includes 7 Cap Screws (E10) Drive, End Cap without o-ring groove, Spacer Plate with o-ring groove. Kit parts will update your steering control unit to -002 design level. **Note:** When installing kit parts, gerotor outer ring will have to be turned so the o-ring groove faces the end cap (if the gerotor star spline is full length, ring and star can be turned together, but if star has a partial spline turn ring only, this partial splined star must remain unturned). Replacement spacer plate will have a o-ring groove, position this groove toward gerotor.



Tools required for disassembly and reassembly:

- Screwdriver (102-152 mm [4-6 inch] long, 3 mm [1/8 inch] flat blade)
- * 5/16 inch 12 point drive socket 5422 and/or 6 point (E10) drive socket Part No. 64489-000
- Breaker bar wrench
- Torque wrench (30 Nm [275 in-lb capacity])
- Plastic hammer or rubber hammer
- 1/4 inch hex key
- #10-24 Machine screw, 38 mm [1-1/2 inch long]
- Needle nose pliers

The following tool is not necessary for disassembly and reassembly, but is extremely helpful.

- *Spring installation tool 600057-000

* Tools are available by special order — contact Eaton Corporation service department

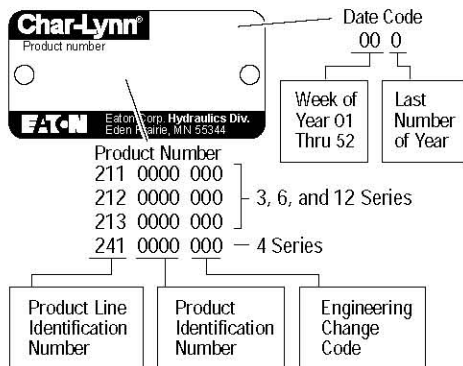
For Additional Literature Contact Eaton Corp. Hydraulics Division 15151 Highway 5 Eden Prairie, MN 55344.

- Specifications and performance data, Catalog No. 11-872
- Replacement part numbers and kit information:
 - 3, 6, and 12 Series steering control units with integral column — Parts Information No. 6-316.
 - 3, and 6 Series steering control units — Parts Information No. 6-317.
 - 12 Series steering control units — Parts Information No. 6-322.
 - 4 Series steering control units — Parts Information No. 6-319

How to Order Replacement Parts

Each Order Must Include the Following:

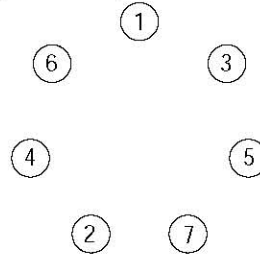
1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts



Bolt Torque Information

Continued from Page 10

Torque all screws to 11-17 Nm [100-150 lb-in] evenly, then to final torque (see chart below) in either sequence from page 10 or as shown below.



Seven cap screws for meter section, torque each evenly with less than 5% variation to value shown below and to satisfy travel limit slip rate and *manual input torque requirement*.

Displ. cm ³ /r [in ³ /r]	Bolt Torque ± 1 Nm [±10 lb-in]	Manual Input Torque Limit Max.
45 [2.8]	23 Nm [205 lb-in]	3 Nm [30 lb-in]
60 [3.6]	27 Nm [235 lb-in]	3 Nm [30 lb-in]
75 [4.5]	27 Nm [235 lb-in]	3 Nm [30 lb-in]
95 [5.9]	27 Nm [235 lb-in]	3 Nm [30 lb-in]
120 [7.3]	27 Nm [235 lb-in]	3 Nm [30 lb-in]
145 [8.9]	27 Nm [235 lb-in]	3 Nm [30 lb-in]
160 [9.7]	28 Nm [250 lb-in]	4 Nm [35 lb-in]
185 [11.3]	28 Nm [250 lb-in]	5 Nm [40 lb-in]
230 [14.1]	30 Nm [265 lb-in]	5 Nm [45 lb-in]
295 [17.9]	30 Nm [265 lb-in]	6 Nm [50 lb-in]
370 [22.6]	30 Nm [265 lb-in]	8 Nm [70 lb-in]
460 [28.2]	30 Nm [265 lb-in]	9 Nm [80 lb-in]
590 [35.9]	32 Nm [280 lb-in]	11 Nm [95 lb-in]
740 [45.1]	32 Nm [280 lb-in]	14 Nm [120 lb-in]

Eaton Corporation
Hydraulics Division
 14615 Lone Oak Road
 Eden Prairie, MN 55344
 Telephone (888) 258-0222
 Fax (952) 974-7722

46 New Lane, Havant
 Hampshire, P09 2NB
 Telephone (44) 23 92 486 451
 Fax (44) 23 92 487 110



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 Products in this catalog are manufactured
 in an ISO-9001-certified site.



**Four ways
to ruin your
new
Pump**



**We've done our part -
Now it's time for you to
do yours**



DIRTY OIL

As pumps wear, they release tiny metal particles into the hydraulic oil. The abrasive action between pistons and cylinder barrels also can release metal particles. These metal particles act as a grinding compound as they flow through the system. Ordinary dirt and water are other common hydraulic oil contaminants. *Any one* of these will contribute to *premature failure* of your hydraulic components. It's good business to flush and clean your hydraulic system and install new filter elements before installing a new or rebuilt hydraulic pump.



CAVITATION

Cavitation normally develops on the suction side of the pump, indicating that the available fluid is insufficient to fill the pump's internal space. Usual causes: 1) oil level in reservoir is too low, 2) viscosity of the oil being used is too high, 3) a restriction in the suction line, 4) excessive operating speed, 5) air in the hydraulic oil.

In areas subject to freezing temperatures, summer weight oil may become heavy enough in winter to contribute to cavitation. Winter weight oil could become too thin in summer, contributing to fluid leakage and heat. Follow your equipment's maintenance manual's recommendations on specific hydraulic oils.

A loose suction line fitting can allow air to be drawn into the oil before it reaches the pump, usually causing a loud, high-pitched chatter. The first corrective steps are to check all suction line fitting threads for damage and to be sure they are tightened correctly. If a change in fittings or hose is involved, be sure to use the type and size replacements recommended in your equipment maintenance manual. A suction line which is too small in diameter can cause cavitation and severe pump damage.



EXCESSIVE PRESSURE

Hydraulic relief valves can malfunction and permit excessive hydraulic pressure buildup. Before using this new pump, back off your system's relief valve to zero, install a pressure gauge between pump and relief valve, start the pump, move a control handle to allow a cylinder to bottom out and reset the relief valve. Set it to relieve at the maximum pressure recommended in your equipment maintenance manual.

When a hydraulic system begins to lose efficiency and ability to do its work, some operators may want to screw down the relief valve adjustment or increase pump speed or both. Either of these moves will hasten costly failures throughout the hydraulic system. If someone has tampered with your relief valve, your pump is subject to IMMEDIATE FAILURE.



EXCESSIVE SPEED

The manufacturer of your hydraulic unit designed the hydraulic system so that all hydraulic components are compatible. If you drive your pump faster than the recommended speed, your hoses, valves and filters are no longer compatible with the greater oil volume from the overspeeded pump. Before installing a new or rebuilt pump, the experienced mechanic will use a tachometer to adjust the engine governor to the speed recommended in his equipment maintenance manual.

Give this hydraulic unit a chance to serve you dependably. Avoid these four common causes of hydraulic pump failure.

Lubrication and oil recommendations

All parts, with the exception of the outboard bearing, are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep the oil in the circuit system clean. Whenever there is a pump or motor failure, and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean, and any filter screens thoroughly cleaned or replaced. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Commercial's pumps and motors should meet the following specifications:

- Viscosity:**
- 50 SSU minimum @ operating temperature
 - 7500 SSU maximum @ starting temperature
 - 150 to 225 SSU @ 100° F. (37.8° C.) (generally)
 - 44 to 48 SSU @ 210° F. (98.9° C.) (generally)

Oil Grade	Approximate SSU at . . .	
	100° F. (37.8° C.)	210° F. (98.9° C.)
SAE 10	150	43
SAE 20	330	51

Viscosity Index: .90 minimum

Aniline Point: 175 minimum.

Recommended Additives: Foam Depressant
Rust and Oxidation Inhibitors

Other Desirable Characteristics:

- Stability of physical and chemical characteristics.
- High demulsibility (low emulsibility) for separation of water, air, and contaminants.
- Resistant to the formation of gums, sludges, acids, tars, and varnishes.
- High lubricity and film strength.

General Recommendations:

A good quality hydraulic oil conforming to the characteristics listed above is essential to satisfactory performance and long life of any hydraulic system.

Oil should be changed on regular schedules in accordance with the manufacturer's recommendations, and the system periodically flushed.

Oil temperature in reservoir must not exceed 200° F., (93.3° C) with a maximum temperature of 180° F. (82.2° C.) recommended. Higher temperatures will result in rapid oil deterioration.

Reservoir capacity should equal in gallons the pump output in gpm or the total gpm of all pumps where there is more than one in the system.

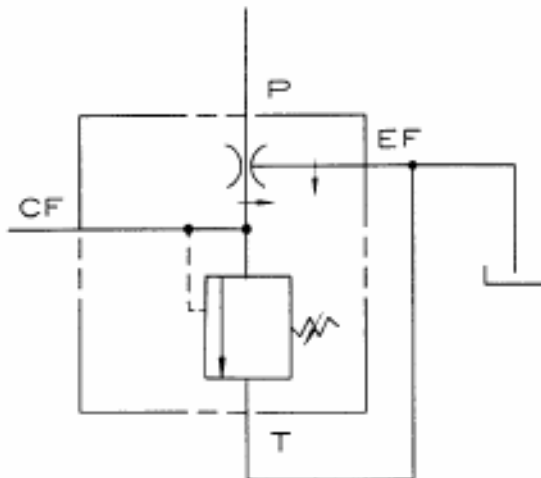
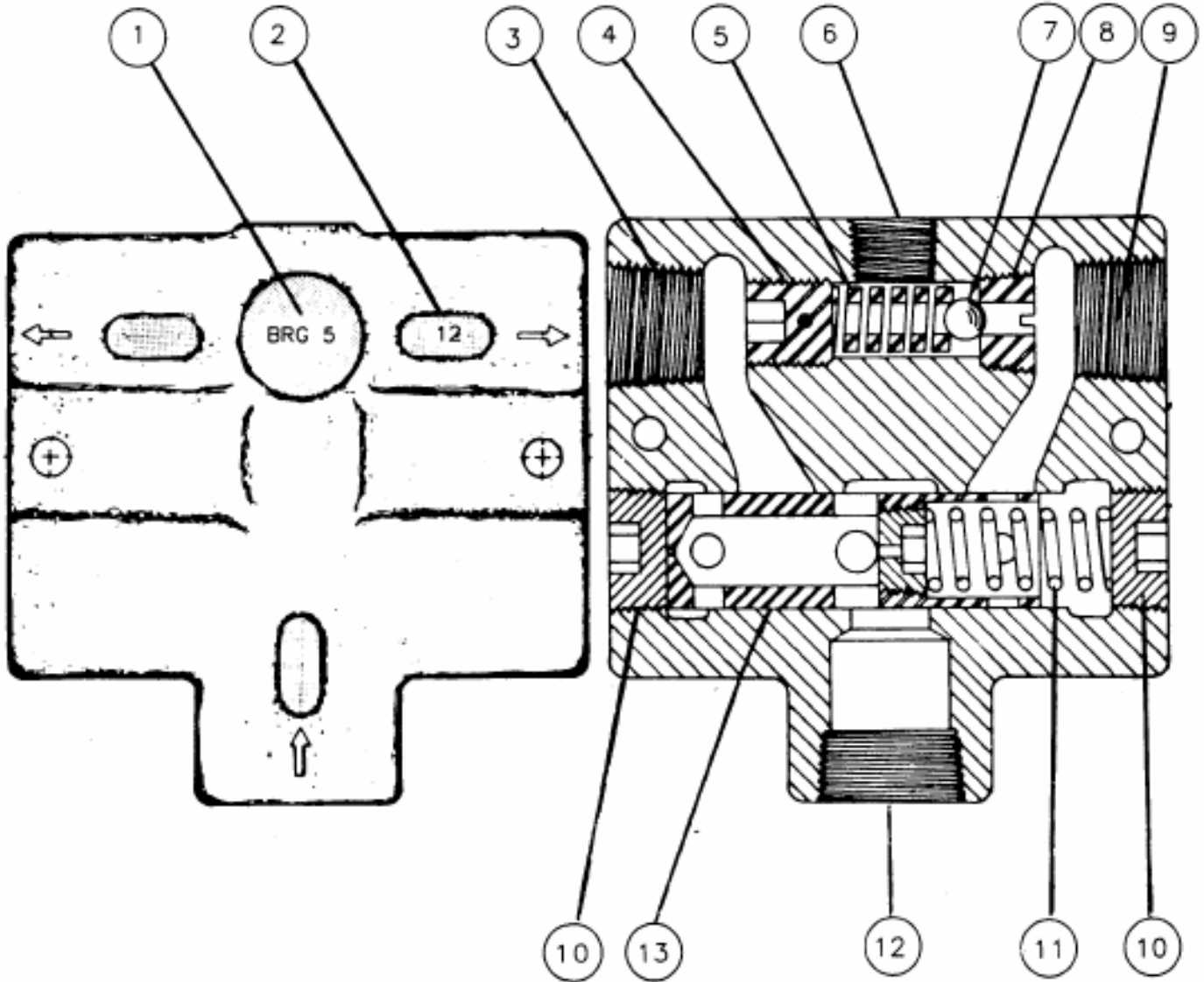
Oil poured into the reservoir should pass through a 100 mesh screen. Pour only clean oil from clean containers into the reservoir. A 100 mesh screen may be used in the suction line leading to the pump. A suction filter should be of sufficient size to handle twice the pump capacity. It must be cleaned and checked regularly to avoid damage due to contamination and cavitation.

Normal Temperatures:

0° F. (—18° C.) to 100° F. (37.8° C.) Ambient

100° F. (37.8° C.) to 180° F. (82.2° C.) System

Be sure your oil is recommended for the temperatures you expect to encounter.



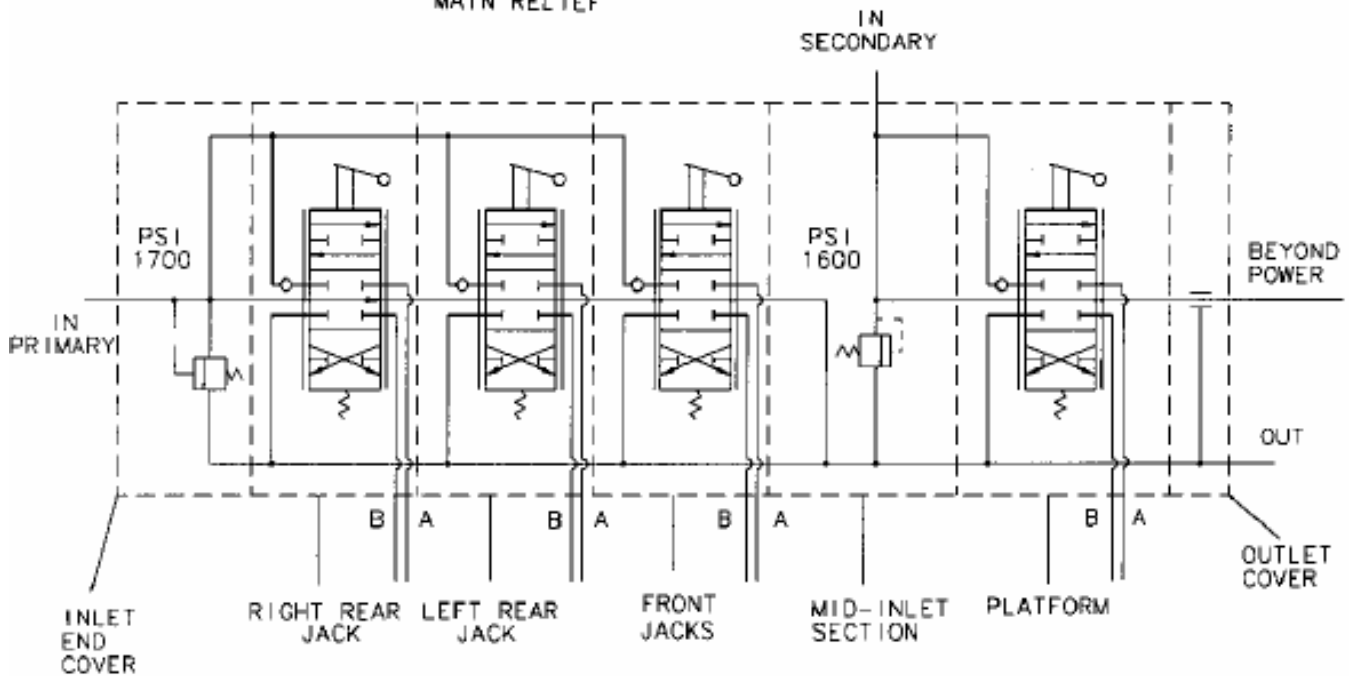
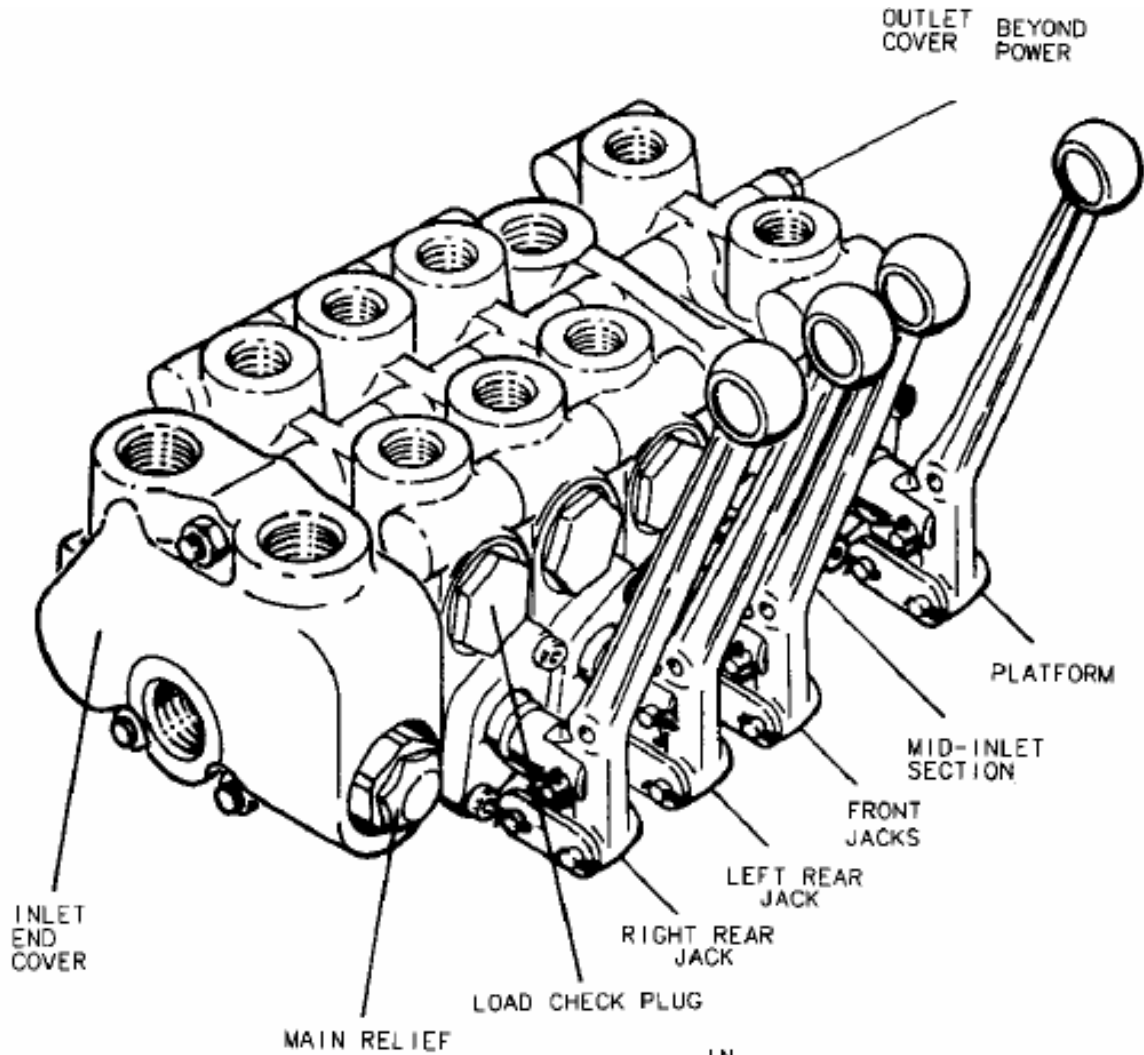


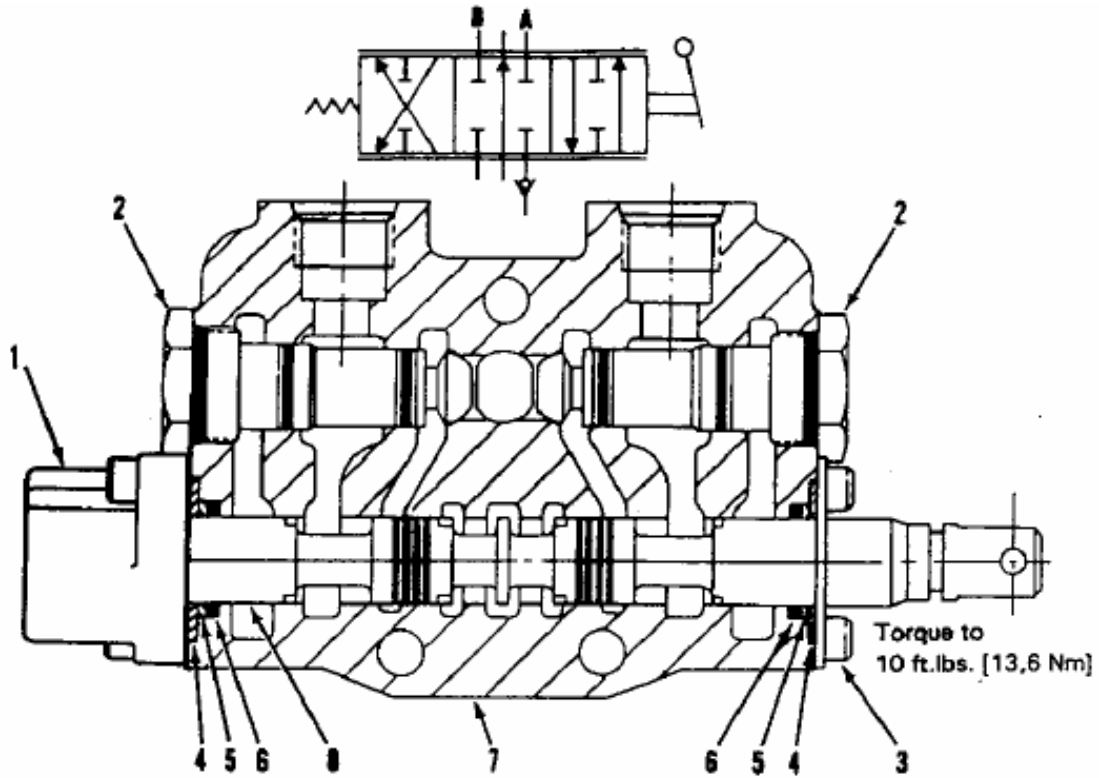
FLOW DIVIDER

13306
Page 2 of 2

<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	NSS	MODEL NUMBER	1
2	NSS	CONTROLLED FLOW GPM.	1
3	NSS	EXCESS FLOW PORT	1
4	NSS	RELIEF ADJUSTING SCREW	1
5	NSS	RELIEF SPRING	1
6	NSS	RELIEF PORT	1
7	NSS	BALL	1
8	NSS	CHECK SEAT	1
9	NSS	CONTROL FLOW PORT	1
10	NSS	PLUG	2
11	NSS	METERING SPRING	1
12	NSS	PRESSURE INLET	1
13	NSS	METERING SPOOL	1

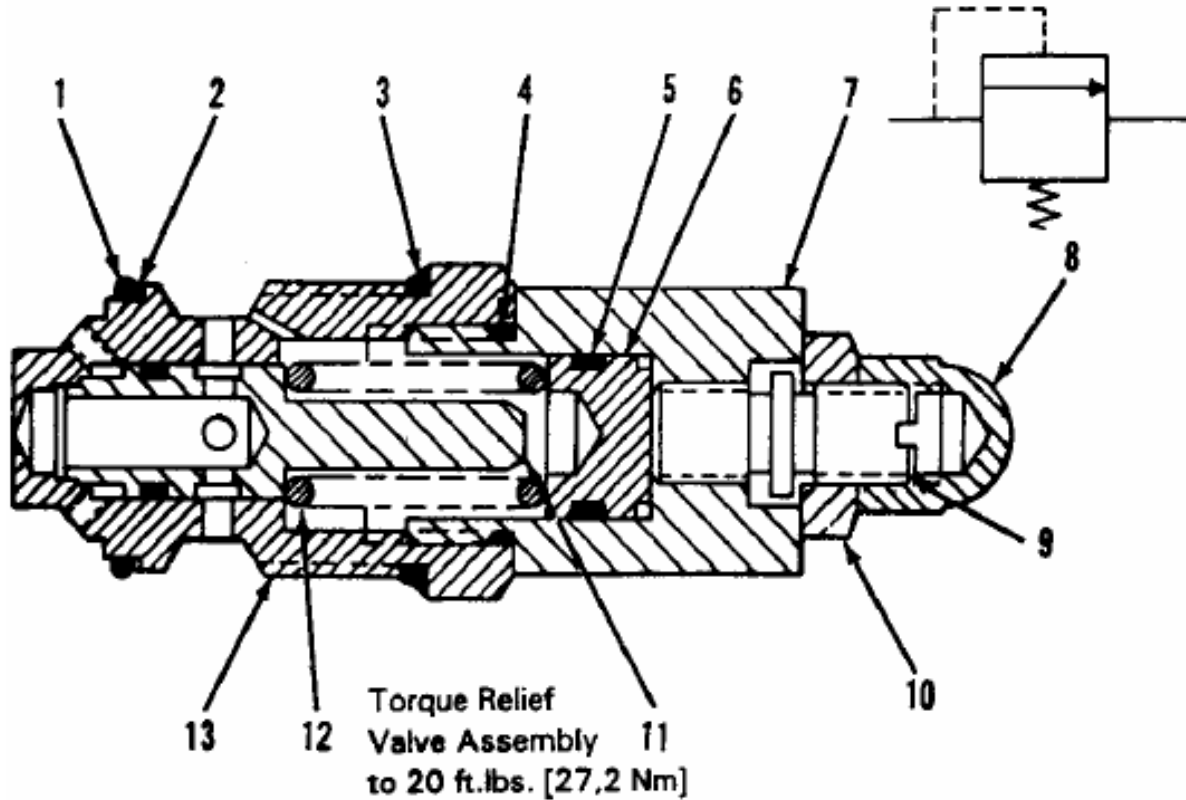
THE HYDRAULIC FLOW DIVIDER RECEIVES A SINGLE STREAM OF FLUID AND WILL DIVIDE IT INTO TWO SEPARATE OUTPUT STREAMS. ONE OF THE OUTPUT STREAMS WILL BE A "CONSTANT" FLOW RATE. THE OTHER OUTPUT STREAM WILL "BYPASS" ALL FLOW WHICH IS IN "EXCESS" OF THE "CONSTANT" FLOW. IF THE INPUT FLOW INCREASES ALL OF THE INCREASE WILL GO OUT THE "EXCESS" PORT. BOTH OUTLETS ARE PRESSURE COMPENSATED, HENCE BOTH CAN BE USED. THIS VALVE IS EQUIPPED WITH AN ADJUSTABLE RELIEF. THE ADJUSTMENT SCREW (4) FOR THIS RELIEF IS LOCATED WITHIN THE EXCESS FLOW PORT (3) OF THE VALVE. TO ADJUST THE RELIEF SETTING USE A 5/16" ALLEN WRENCH, TURN THE SCREW (4) CLOCKWISE TO INCREASE THE PRESSURE, COUNTER CLOCKWISE TO DECREASE THE PRESSURE. 1/4" TURN EQUALS APPROXIMATELY 200 PSI. THE FOLLOWING FLOW DIVIDER VALVES ARE ADJUSTABLE (52250, 54002, 532140, 532150, 532410, 534049, 534071, 534114, 534229, 534432, 534601).



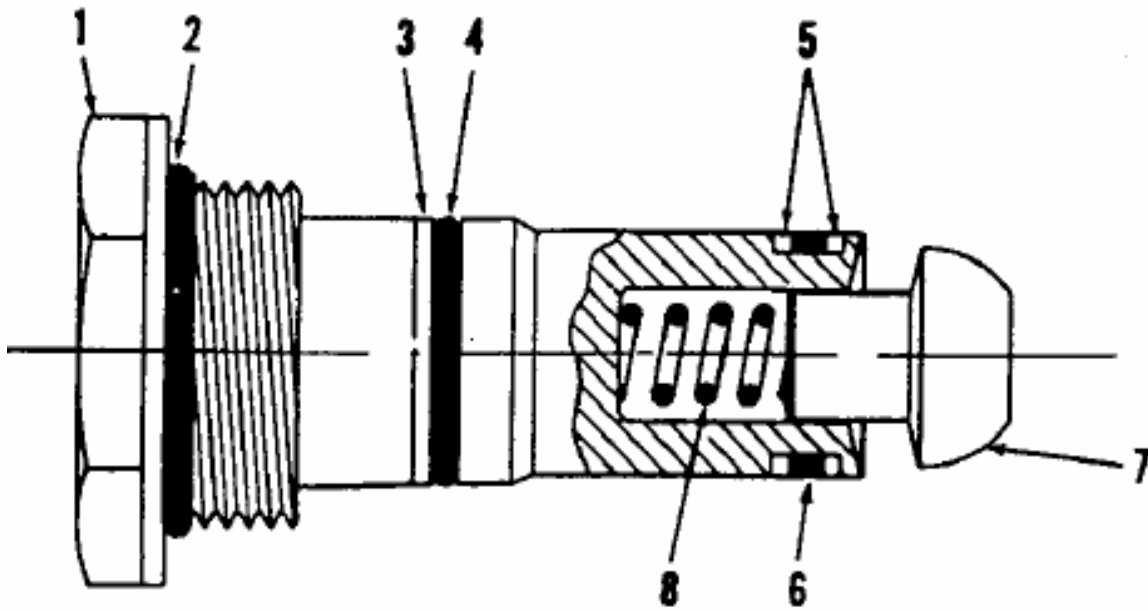


<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	464882	CONTROL VALVE (5 SECTION)(INCLUDES ITEMS 1-11)	1
	534490	SEAL KIT (INCLUDES ITEMS 5, 6)	1
1		FOR SERVICE KIT REFER TO 13359 (6 OF 7)	1
2		FOR SERVICE KIT REFER TO 13359 (4 OF 7)	2
3		FOR SERVICE KIT REFER TO 13359 (7 OF 7)	1
4	NSS	RETAINER	2
5	NSS	WASHER (BACK-UP)	2
6	NSS	SEAL (O-RING)	2
7	NSS	HOUSING	1
8	NSS	SPOOL	1
9	534603	MID-INLET SECTION SPLITFLOW	1
10		FOR SERVICE REFER TO 13359 (3 OF 7)	2
11		FOR SERVICE REFER TO 13359 (5 OF 7)	1
12	595112	STUD KIT	1

NOTE: TORQUE STUD NUTS TO 32 F.T. LBS. (43.5Nm)

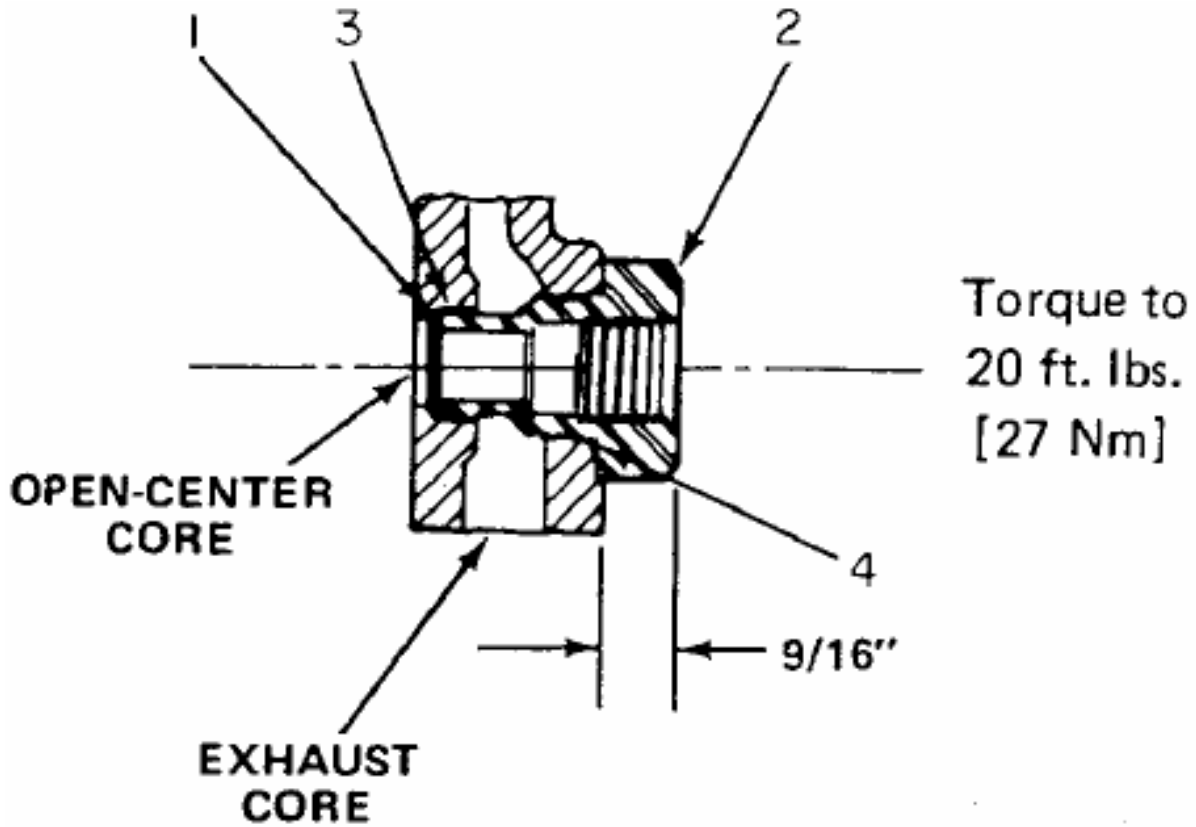


<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
		MAIN RELIEF VALVE	
	534494	SEAL KIT (INCLUDES ITEMS 1-5)	1
1	NSS	SEAL (O-RING)	1
2	NSS	RING (BACK-UP)	1
3	NSS	SEAL (O-RING)	1
4	NSS	SEAL (O-RING)	1
5	NSS	SEAL (O-RING)	1
6	NSS	PISTON	1
7	NSS	CAP	1
8	NSS	NUT	1
9	NSS	STEM	1
10	NSS	NUT	1
11	NSS	POPPET	1
12	NSS	SPRING	1
13	NSS	BODY	1

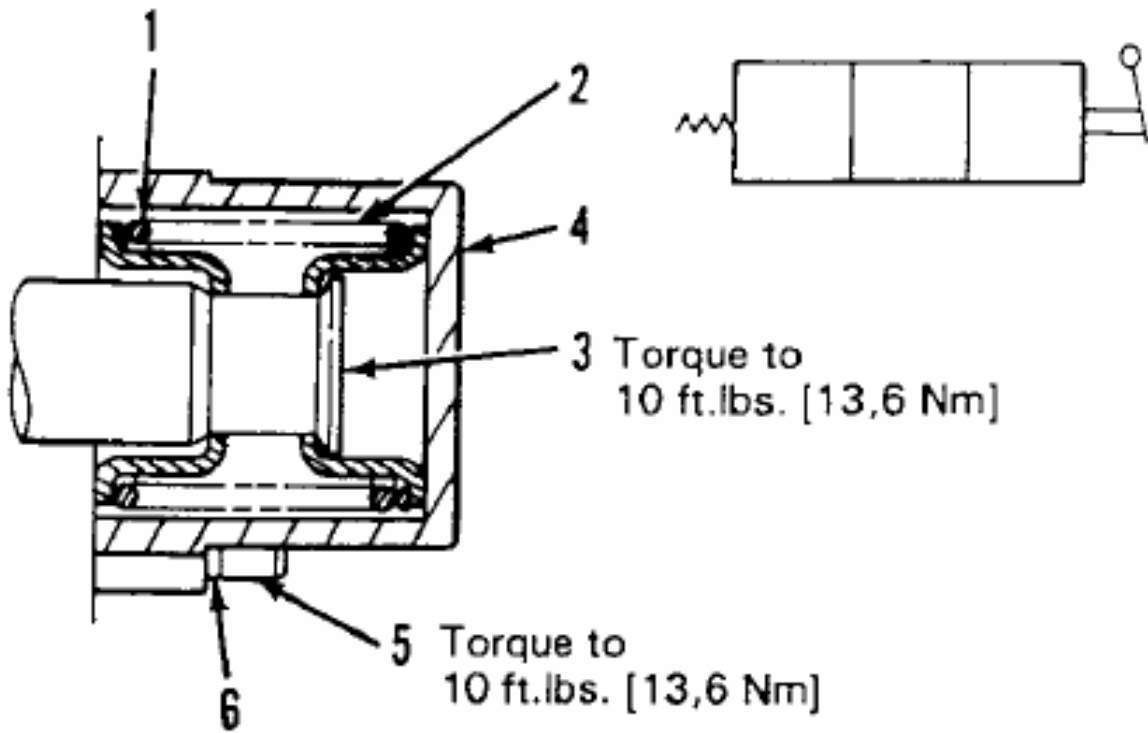


**Torque Load Check Plug
Assembly to 20 ft.lbs. [27 Nm].**

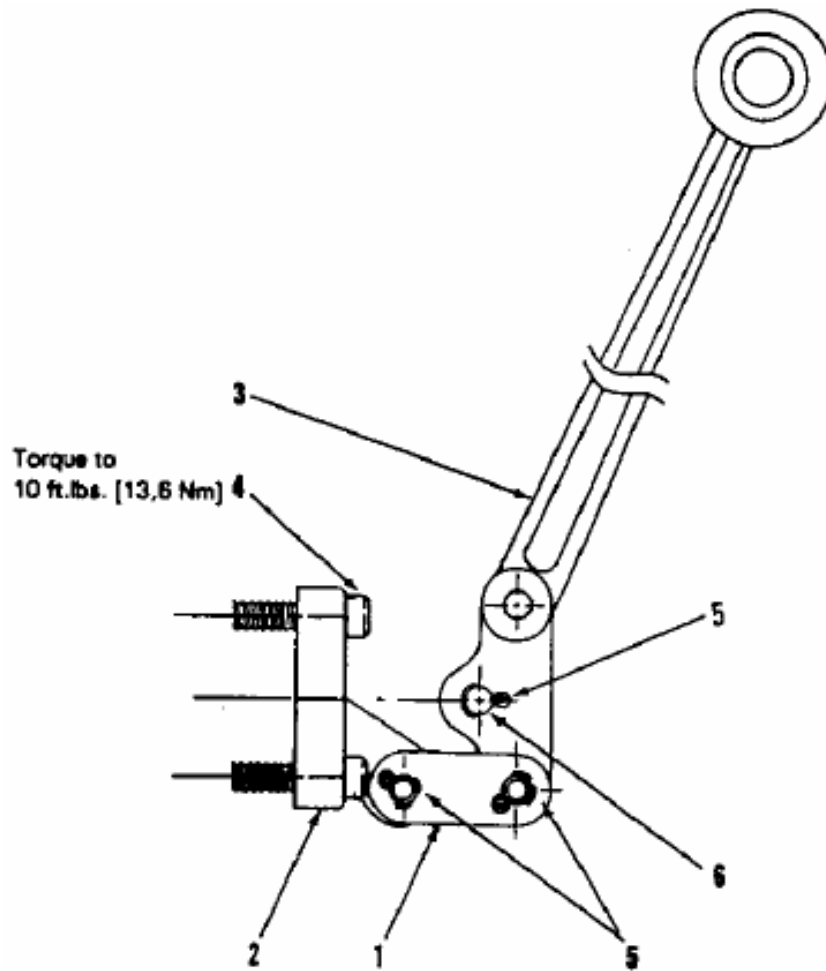
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
		LOAD CHECK PLUG	
	534495	SERVICE KIT (INCLUDES ITEMS 1-8)	1
	534496	SEAL KIT (INCLUDES ITEMS 2-6)	1
1	NSS	PLUG	1
2	NSS	SEAL (O-RING)	1
3	NSS	WASHER (BACK-UP)	1
4	NSS	SEAL (O-RING)	1
5	NSS	WASHER (BACK-UP)	2
6	NSS	SEAL (O-RING)	1
7	NSS	POPPET	1
8	NSS	SPRING	1



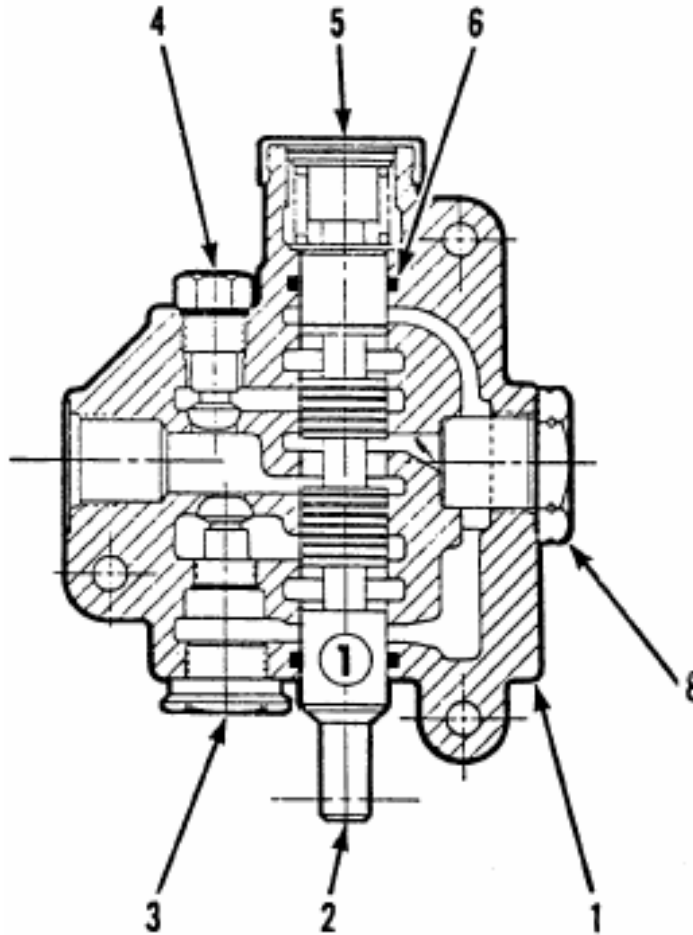
ITEM	PART #	DESCRIPTION	QTY.
		POWER BEYOND PLUG	
	534497	SERVICE KIT (INCLUDES ITEMS 1-4)	1
1	NSS	SEAL	1
2	NSS	POWER BEYOND PLUG	1
3	NSS	BACK-UP WASHER	1
4	NSS	O-RING	1



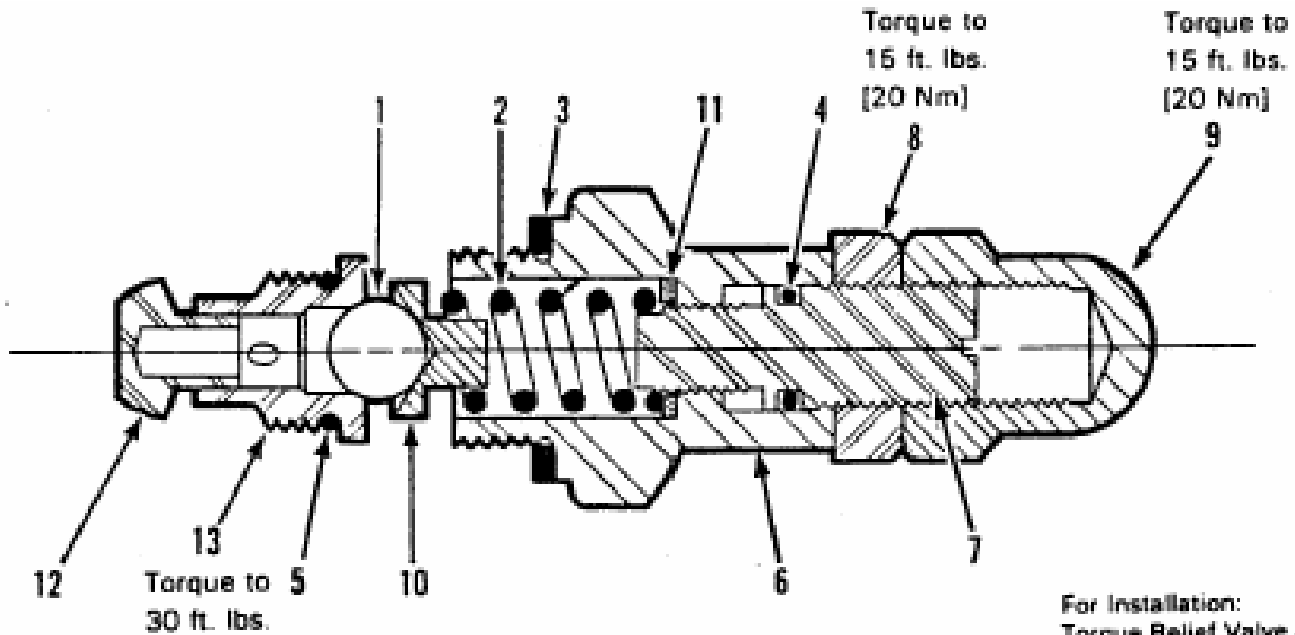
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
		SPOOL POSITIONER END	
	534498	SERVICE KIT (INCLUDES ITEMS 1-6)	1
1	NSS	SPRING (RETURN)	1
2	NSS	COLLAR (SPRING)	2
3	NSS	COLLAR (SPOOL)	1
4	NSS	BONNET	1
5	NSS	SCREW (HSHC)	2
6	NSS	LOCK WASHER	2



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
		HANDLE & BRACKET	
	534499	HANDLE KIT (INCLUDES ITEMS 1, 3, 5, 6)	1
	534587	BRACKET KIT (INCLUDES ITEMS 2, 4)	1
1	NSS	LINK	1
2	NSS	BRACKET	1
3	NSS	HANDLE	1
4	NSS	SCREW (HCHS)	2
5	NSS	PIN (COTTER)	3
6	NSS	PIN	1

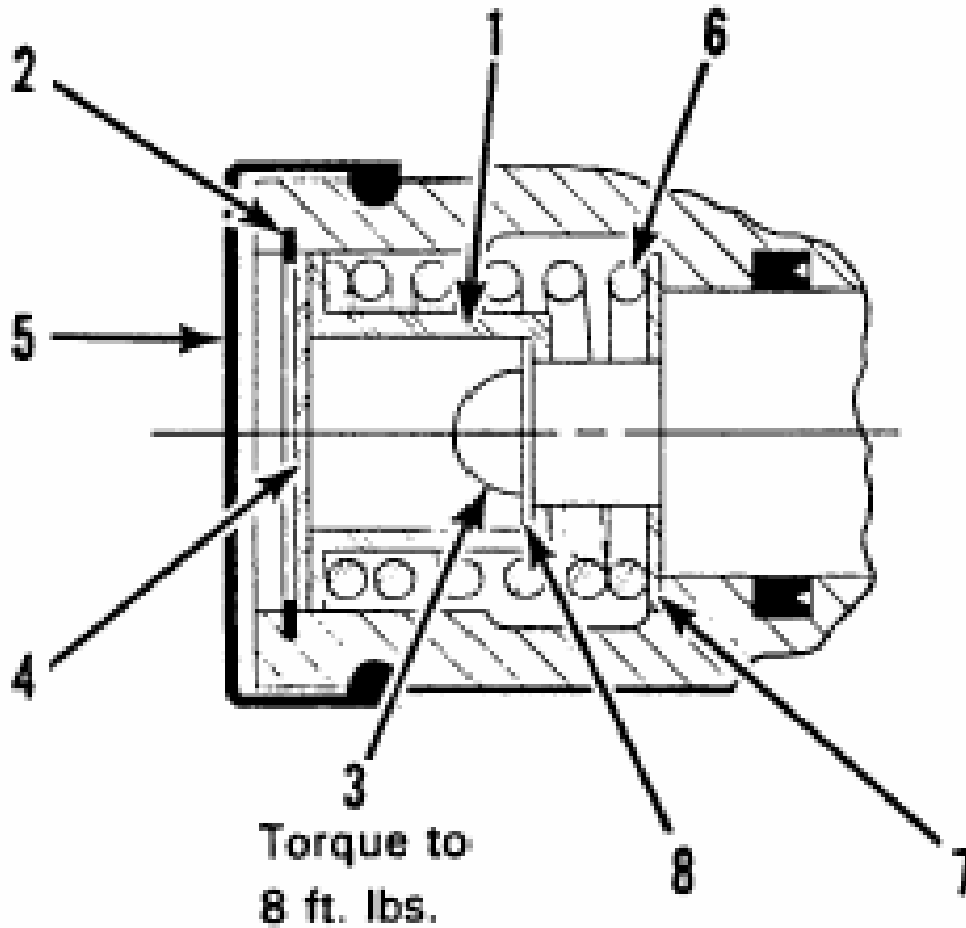


ITEM	PART #	DESCRIPTION	QTY.
	534080	CONTROL VALVE ASSEMBLY (INCLUDES ITEMS 1-6, 8, 9)	1
1	NSS	HOUSING	1
2	NSS	SPOOL	1
3		FOR SERVICE KIT REFER TO 13067 (2 OF 5)	1
4	534168	LOAD CHECK	1
5		FOR SERVICE KIT REFER TO 13067 (3 OF 5)	1
6	534162	SEAL	2
8		FOR SERVICE KIT REFER TO 13067 (4 OF 5)	1
9		FOR SERVICE KIT REFER TO 13067 (5 OF 5)	1

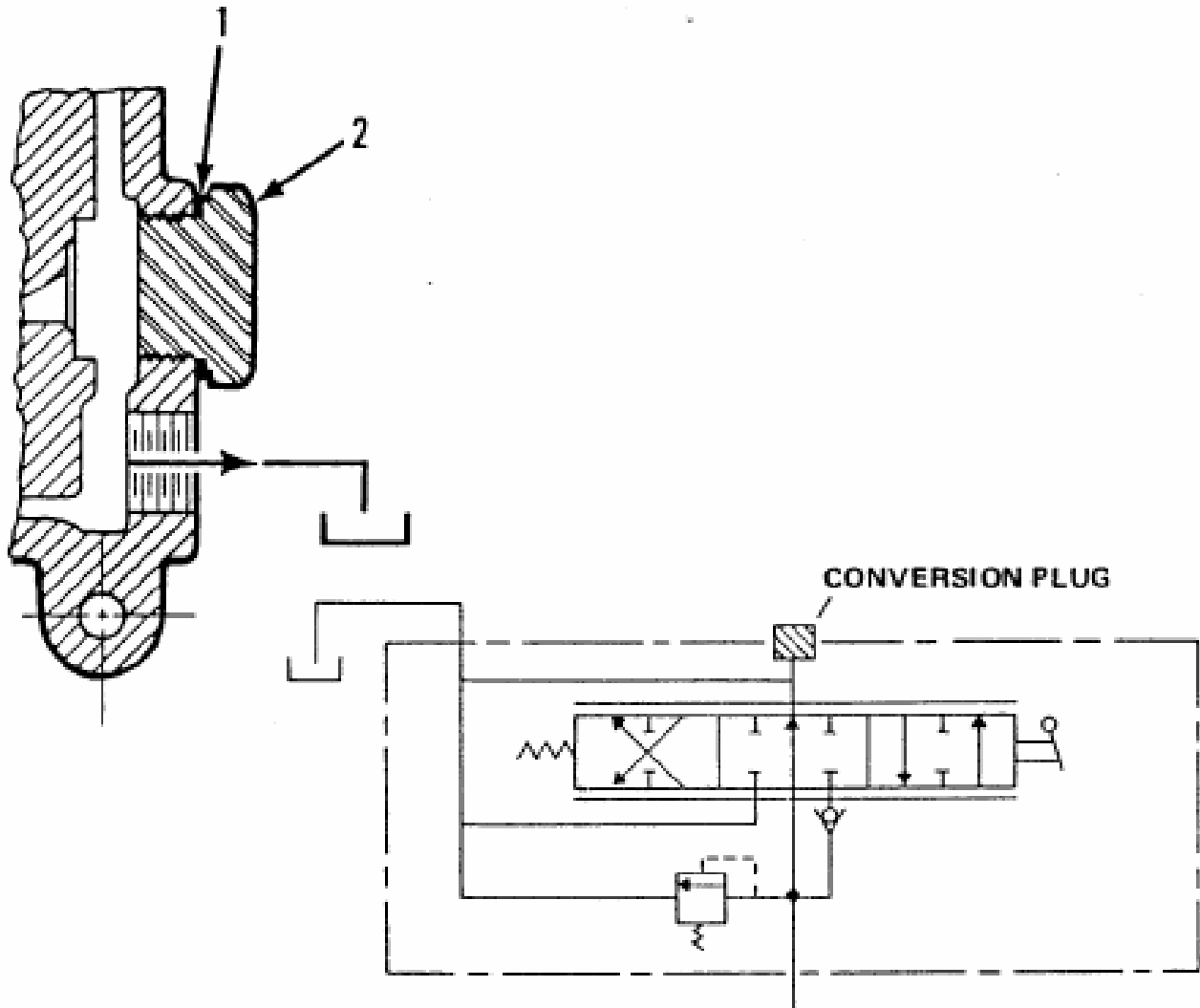


For Installation:
Torque Relief Valve Assembly
to 45 ft. lbs. [61 Nm]

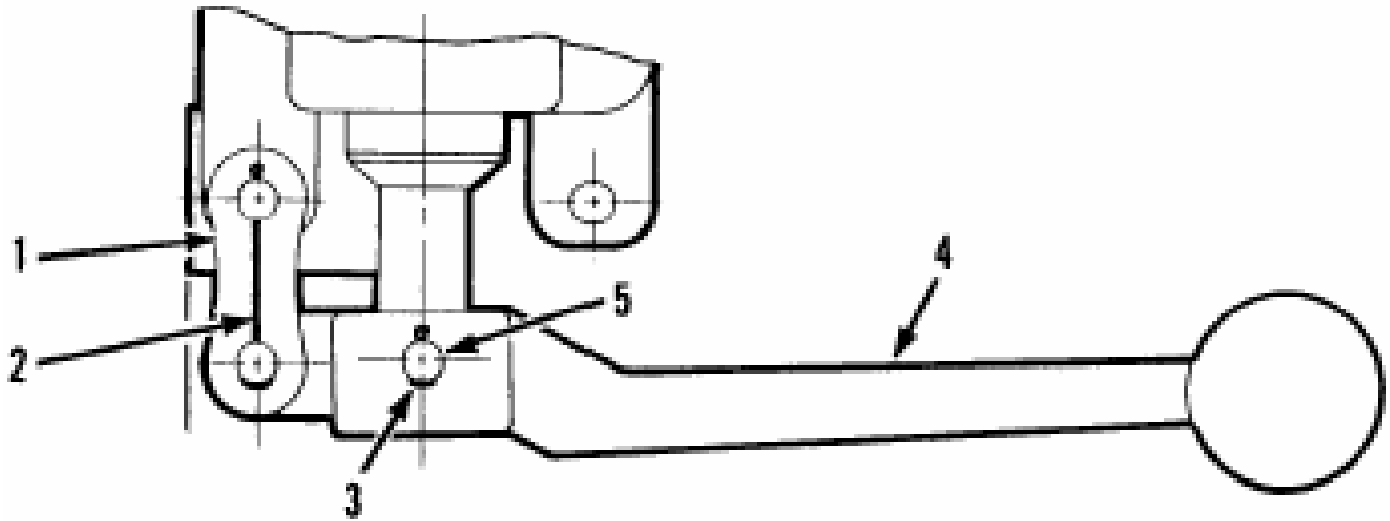
ITEM	PART #	DESCRIPTION	QTY.
	534167	SERVICE KIT (INCLUDES ITEMS 1-13)	1
	534163	SEAL KIT (INCLUDES ITEMS 3-5)	1
1	NSS	BALL	1
2	NSS	SPRING	1
3	NSS	GASKET	1
4	NSS	O-RING	1
5	NSS	O-RING	1
6	NSS	BODY	1
7	NSS	SCREW	1
8	NSS	NUT	1
9	NSS	NUT	1
10	NSS	GUIDE	1
11	NSS	WASHER	1
12	NSS	POPPET	1
13	NSS	SEAL	1



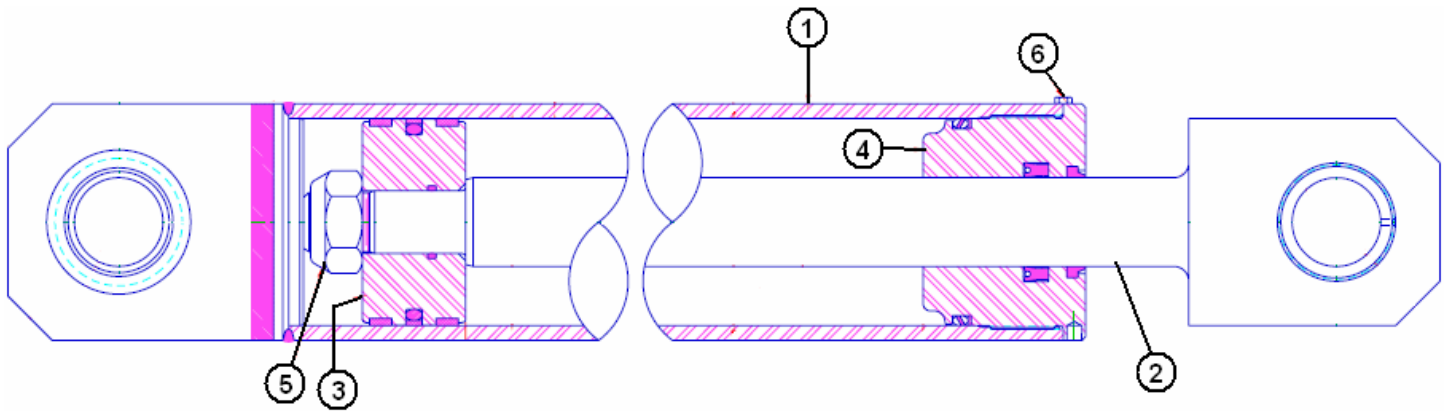
<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	534165	SERVICE KIT (INCLUDES ITEMS 1-8)	1
1	NSS	COLLAR	1
2	NSS	LOCK RING	1
3	NSS	SCREW	1
4	NSS	DISC	1
5	NSS	BONNET	1
6	NSS	SPRING	1
7	NSS	WASHER	1
8	NSS	LOCKWASHER	1



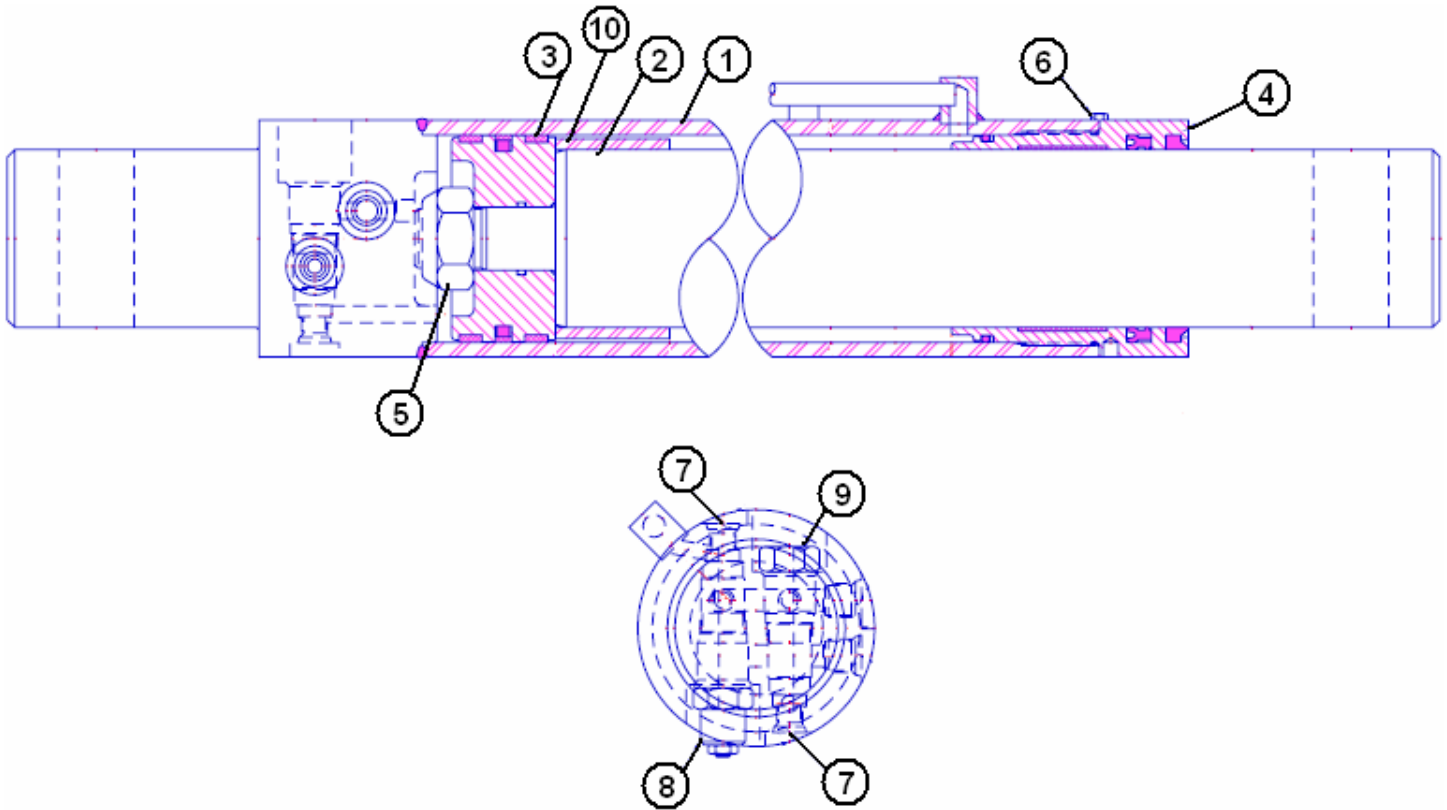
ITEM	PART #	DESCRIPTION	QTY.
	534246	SERVICE KIT (INCLUDES ITEMS 1, 2)	1
1	NSS	SEAL	1
2	NSS	PLUG	1
3	534161	GASKET	1



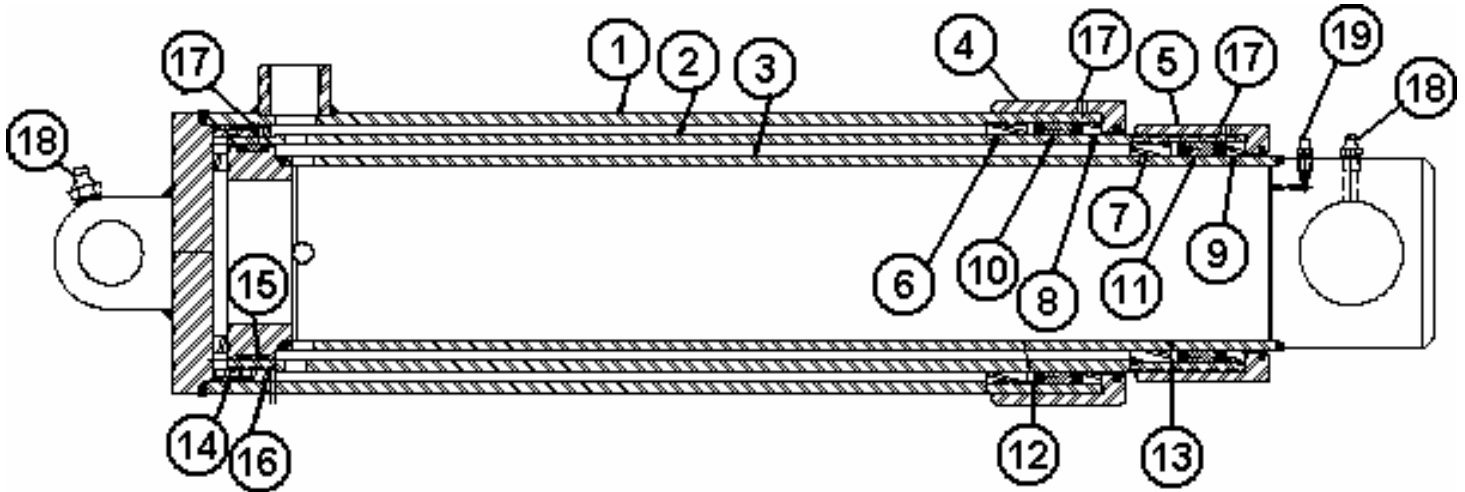
ITEM	PART #	DESCRIPTION	QTY.
	534164	SERVICE KIT (INCLUDES ITEMS 1-5)	1
1	NSS	PIN & SIDE PLATE, LINK	1
2	NSS	RETAINING RING	1
3	NSS	COTTER PIN	1
4	NSS	HANDLE, BLACK	1
5	NSS	PIN	1



ITEM	PART #	DESCRIPTION	QTY.
	465411	CYLINDER ASSEMBLY	1
	465411-07	SEAL KIT	1
1	465411-01	BARREL ASSEMBLY	1
2	465411-02	ROD ASSEMBLY	1
3	465411-03	PISTON ASSEMBLY	1
4	465411-04	ROD BEARING ASSEMBLY	1
5	465411-05	NUT	1
6	465411-06	CAP SCREW	1



ITEM	PART #	DESCRIPTION	QTY.
	465430	CYLINDER ASSEMBLY	1
	465114-01	SEAL KIT	1
1	465430-01	BARREL ASSEMBLY	1
2	465430-02	ROD	1
3	465430-03	PISTON ASSEMBLY	1
4	465430-04	ROD BEARING ASSEMBLY	1
5	465430-05	NUT	1
6	465430-06	CAP SCREW	1
7	465430-07	STEEL PLUGS	2
8	465430-08	COUNTERBALANCE VALVE	1
9	465430-09	CHECK VALVE	1
10	465430-10	STROKE LIMITER	1

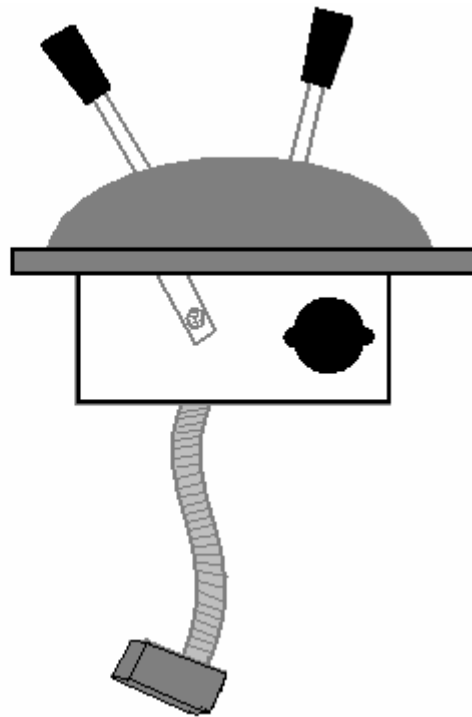
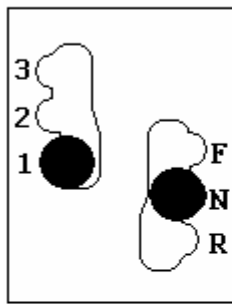


ITEM	PART #	DESCRIPTION	QTY.
	465301	CYLINDER ASSEMBLY	1
	465301-01	SEAL KIT	1
1	465301-02	BARREL ASSEMBLY	1
2	465301-03	ROD	1
3	465301-04	ROD ASSEMBLY	1
4	465301-05	BARREL RING ASSEMBLY	1
5	465301-06	BARREL RING ASSEMBLY	1
6	465301-07	STOP RING	1
7	465301-08	STOP RING	1
8	465301-09	BEARING RING	1
9	465301-10	BEARING RING	1
10	465301-11	V-PACKING	1
11	465301-12	V-PACKING	1
12	465301-13	WAVE SPRING	1
13	465301-14	WAVE SPRING	1
14	465301-15	WEAR RING	1
15	465301-16	WEAR RING	1
16	465301-17	PISTON	1
17	465301-18	SET SCREW	3
18	465301-19	GREASE FITTING	2
19	465301-20	BLEEDER	1

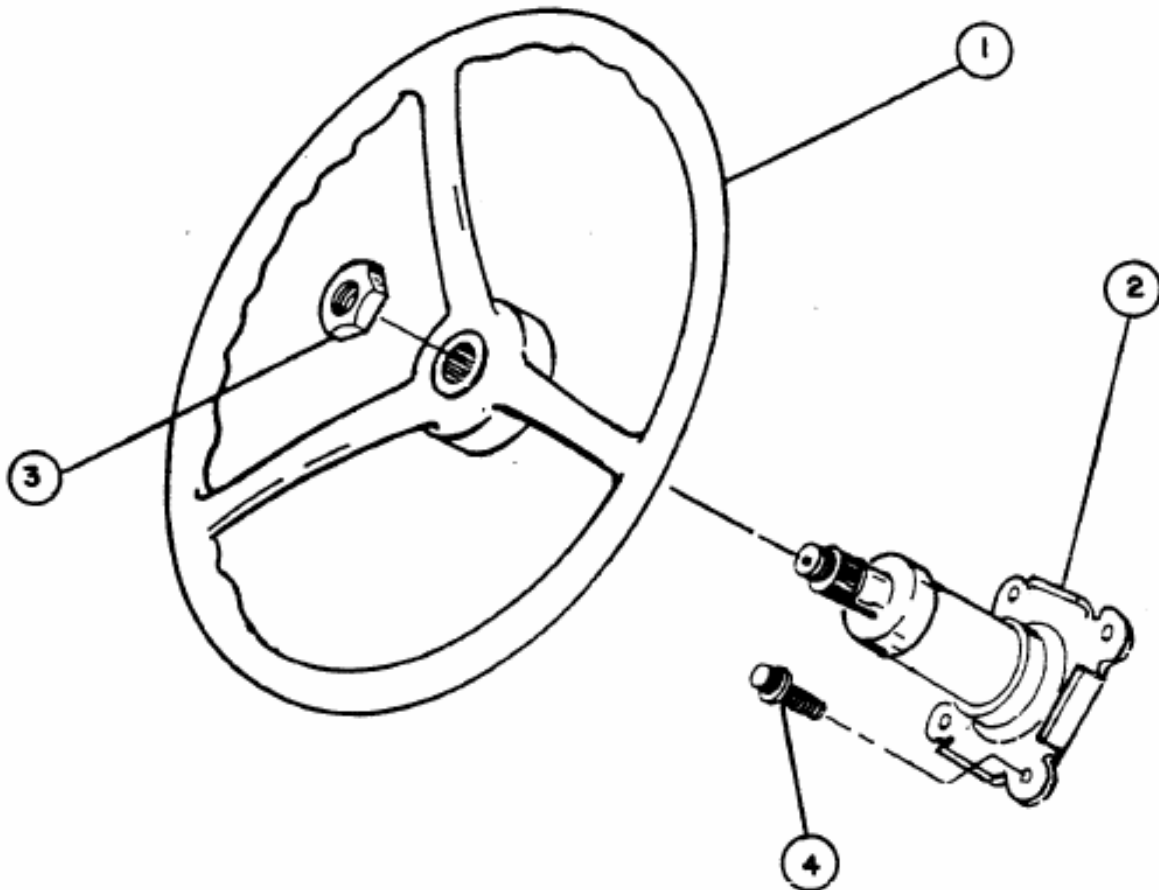
PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

9. CONTROLS

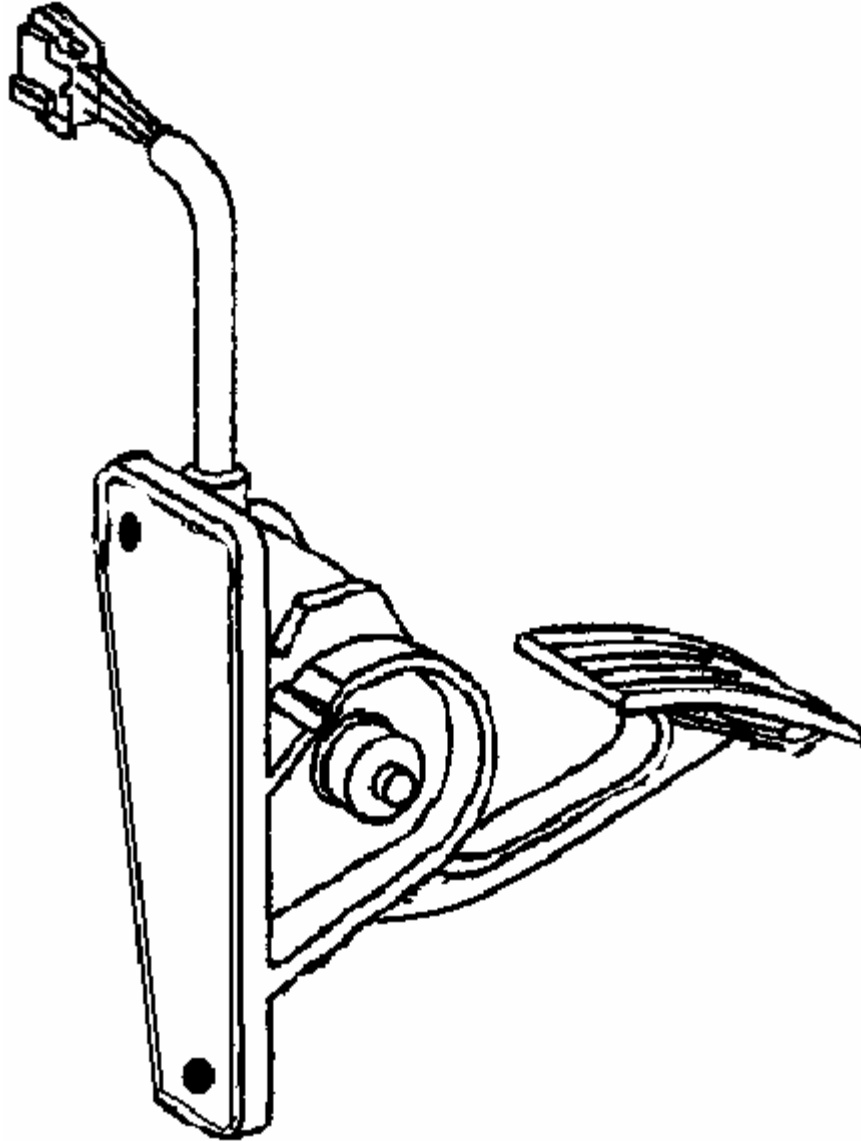
13905	ELECTRIC SHIFTER
10827	STEERING WHEEL & COLUMN
13655	THROTTLE (ELECTRONIC)



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	534772	ELECTRIC SHIFTER ASSEMBLY	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	492191	WHEEL, STEERING	1
2	171002	COLUMN	1
3	173132	NUT, ORBITROL	1
4	173175	CAPSCREW	2
5*	494081	KNOB (STEERING) (OPTIONAL)	1

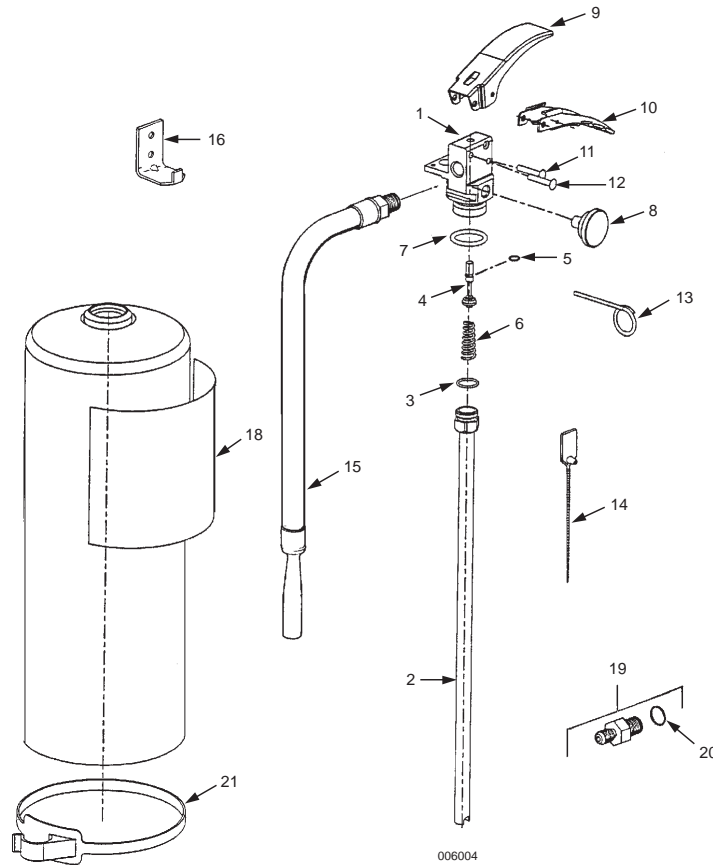


<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	595395	ELECTRONIC THROTTLE PEDAL (DETROIT 904/906)	1

PARTS LIST INDEX
A-64 SCISSOR LIFT
DEBEERS SNAP LAKE
S/N 6920
02/09/07

10. MOUNTED EQUIPMENT

-----	FIRE EXTINGUISHER 5#
-----	FIRE PROTECTION INFORMATION MANUAL
-----	FIRE SUPPRESSION MAINTENANCE MANUAL
23276	FIRE SUPPRESSION INSTALLATION
16721	FIRE SUPPRESSION SYSTEM
12482	SCISSOR LIFT PLATFORM LINKS
13995	JACK ASSEMBLY (LEFT SIDE)
13996	JACK ASSEMBLY (RIGHT SIDE)



006004

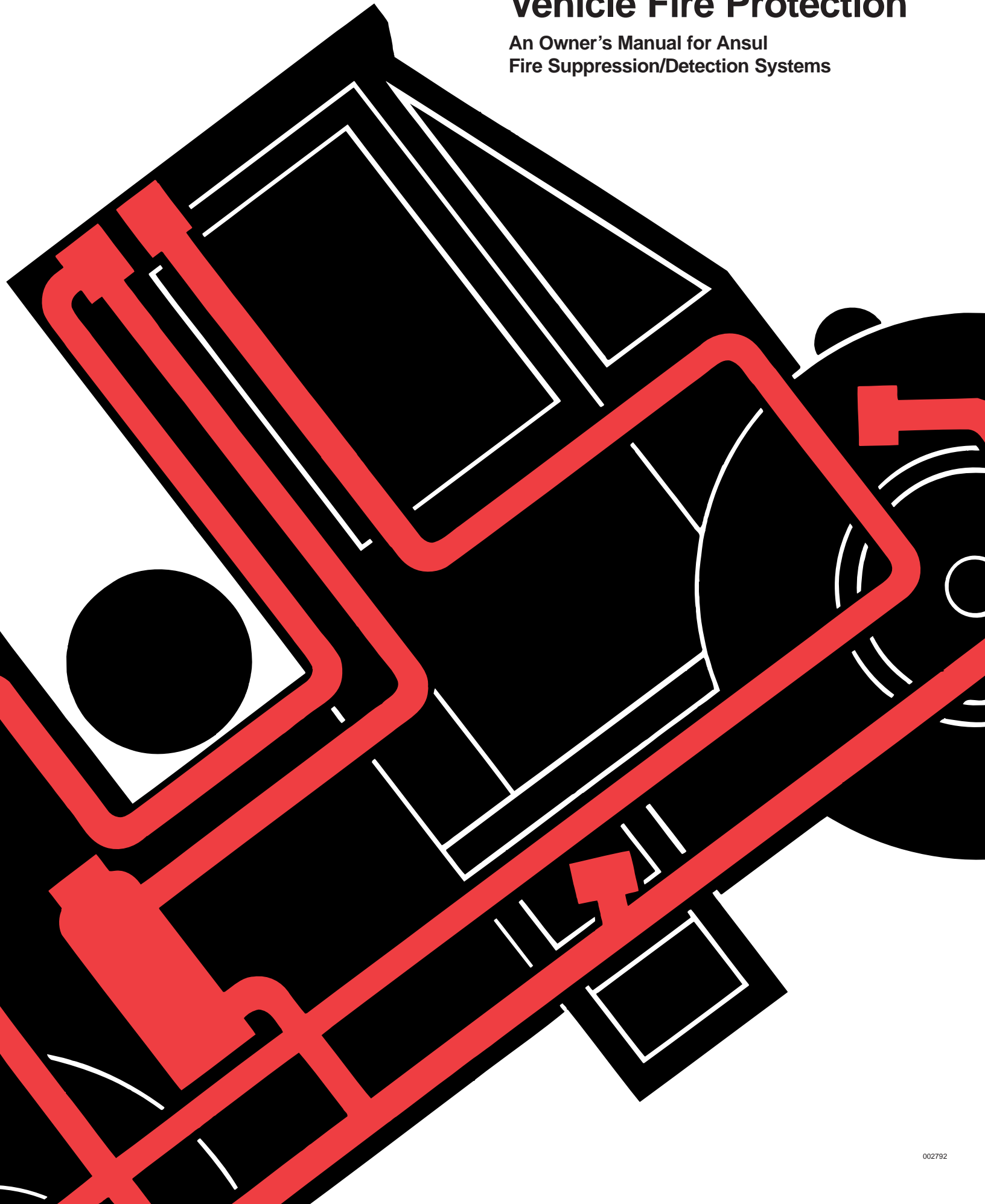
FIG. NO.	DESCRIPTION	PART NUMBER					
		AA05	AA05VB	PK05	A05	A05VB	C05
—	Valve Assembly	429084	429084	429084	429084	429084	429084
1	Valve Body, Machined	428062	428062	428062	428062	428062	428062
2	Tube, Pick-Up	428796	428796	428796	428796	428796	428796
3	O-Ring (Pick-up Tube)	76076	76076	76076	76076	76076	76076
▶ 4	Valve Stem Assembly (Includes O-Ring)	429099	429099	429099	429099	429099	429099
5	O-Ring	11873	11873	11873	11873	11873	11873
▶ 6	Spring	415565	415565	415565	415565	415565	415565
7	O-Ring	428327	428327	428327	428327	428327	428327
8	Gauge, Pressure	428280	428280	428280	428280	428280	428280
9	Lever, Operating	429096	429096	429096	429096	429096	429096
10	Handle, Carrying	429097	429097	429097	429097	429097	429097
11	Rivet, Operating Lever	428130	428130	428130	428130	428130	428130
12	Rivet, Carrying Handle	428130	428130	428130	428130	428130	428130
13	Pull Pin (Ring Pin)	16235	16235	16235	16235	16235	16235
14	Seal, Visual Inspection	419790	419790	419790	419790	419790	419790
15	Hose Assembly	428729	428729	428730	428728	429728	428731
16	Hanger Hook	54405	—	54405	54405	—	54405
17	Bracket Assembly (Not Shown)	—	429146	—	—	429146	—
▶ 18	One-Piece Nameplate, Replacement (Maintenance, w/o UL/ULC Approval)	430854	430854	—	(431049-ULC)	(431049-ULC)	—
▶ 19	Adaptor Assembly, Recharge	429642	429642	429642	429642	429642	429642
20	O-Ring	57744	57744	57744	57744	57744	57744
21	Hose Retainer	427995	427995	427995	427995	427995	427995

▶ Indicates revision

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Vehicle Fire Protection

An Owner's Manual for Ansul
Fire Suppression/Detection Systems



Off-road vehicles do have fires

Statistics show that on-road vehicles burn.....with alarming frequency. These vehicles are susceptible to fire for several reasons. They often operate steady for several hours at a time (sometimes around the clock). They use flammable liquids – lubricating oil, gasoline, diesel oil, greases and hydraulic fluids – in their normal operation. They also generate heat – from engine blocks, manifolds, turbochargers and brake systems – which can ignite these flammable liquids and debris.

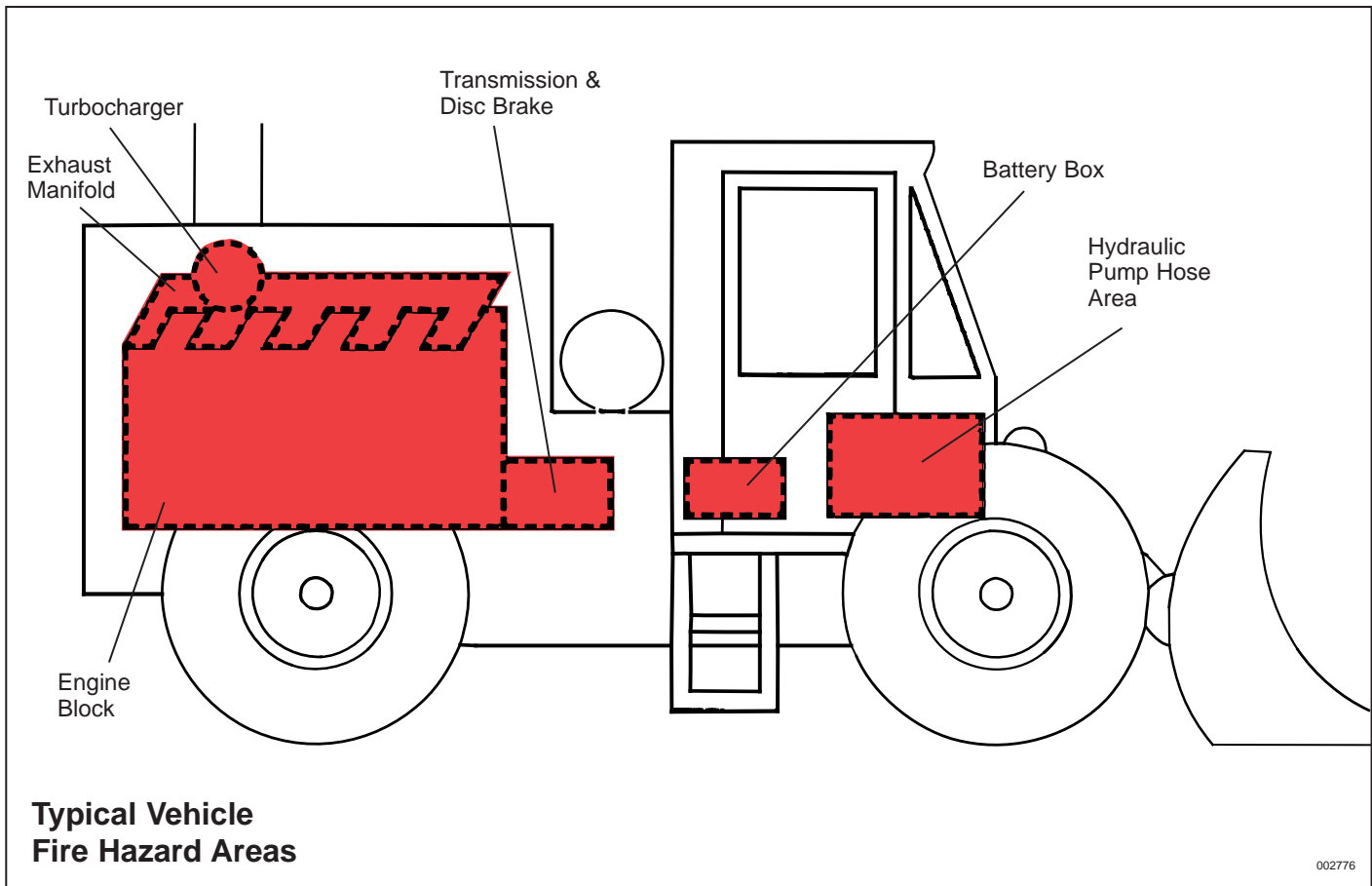
Since the passage of the federal and state clean air acts, many vehicles, including most busses operated by mass transit authorities and state agencies, have been converting to cleaner burning fuels such as LPG, LNG, and CNG instead of gasoline or diesel fuel. Use of these fuels is an essential component of improving our environment, but their use raises the possibility of dangerous gas leaks.

When fire breaks out, it can result in expensive repair or replacement of valuable equipment, costly downtime or loss of business continuity. Worse yet, it can mean serious personal injury to vehicle operators or passengers.

Insurance companies are well aware of these facts. That's why insurance rates are skyrocketing.

As the owner of a vehicle equipped with an Ansul Fire Detection/Suppression System, you've taken an important step in facing the fire problem. You are dramatically reducing your potential fire loss and helping to ensure personnel safety.

This owner's guide has been provided to help you understand how your Ansul Fire Detection/Suppression System works, your responsibilities for fire prevention and maintenance, and what to do in case of fire. In no way is this guide intended to provide detailed installation instructions. A copy of the complete Installation, Recharge, Inspection, and Maintenance Manual for the Ansul Fire Detection and Suppression System is available upon request from Ansul. Should you have any questions, contact Ansul or your nearest authorized Ansul products distributor.



SAFETY PRECAUTIONS

The fire system described in these materials is a suppression system only and is not designed or intended to extinguish all fires, particularly when unusual amounts of combustible materials and an ample oxygen supply are present. It is extremely important that alternative firefighting equipment be available in case the system does not totally extinguish a fire.

Use extreme care to prevent the accumulation of debris, combustible materials and fluids which could intensify the fire or cause it to spread to areas where there was no previous potential for fire.

If modifications are made to the equipment being protected or if the fire detection and/or suppression system is disconnected for any reason, make certain the fire equipment is immediately inspected and tested by an Ansul-authorized vehicle systems distributor.

If an automatic fire detection and actuation system has not been supplied or has been disconnected, system actuation and discharge will not occur unless the fire suppression system is manually actuated. Reliance on a manual release system usually results in a slower reaction to fire.

Your role in protecting your vehicle from fire

Your Ansul Fire Suppression System is custom-designed to protect specific hazard areas on your vehicle. It's been carefully engineered for reliability and built to the highest quality standards. Every component has been tested to ensure long life and dependable performance.

With proper maintenance, your Ansul Fire Suppression System should give you years of fire protection.

The main purpose of the manual, however, is to explain the most basic form of fire protection – fire prevention. It outlines steps you can take to prevent a disastrous fire. Precautions which can greatly reduce the risk of serious fire damage.

Fire prevention on vehicles relies upon two basic factors:

- 1.** Inspection and preventative maintenance at points where fires are most likely to start – engine blocks, electrical systems, turbochargers, exhaust manifolds and brake systems.
- 2.** Regular cleaning of all areas where flammable materials such as fuel, oil, grease, hydraulic fluid and combustible debris may collect.

Vehicle Fire Prevention Maintenance

The following is a suggested daily maintenance outline which can help reduce the risk of fire on your vehicle.

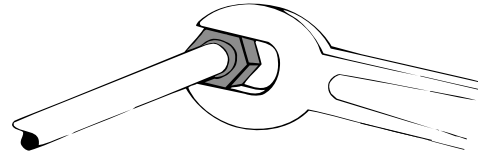
CAUTION: Take care during vehicle maintenance, cleaning, or welding. To avoid unintentionally setting off the system and the discharge of agent, do not cut, pinch, or apply heat exceeding 200 °F (93 °C) to the detection lines of the system.

1. Check all oil, hydraulic fluid and gas lines for cuts, abrasions or undue wear. Replace as needed.



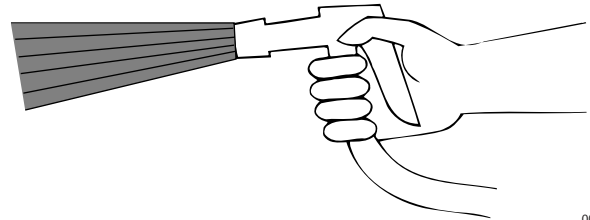
000620

2. Inspect all oil, hydraulic and gas line fittings for tightness. Clean off all residue and tighten.



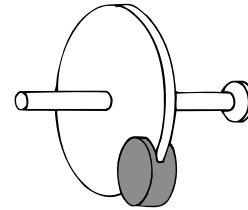
000621

3. Inspect and clean engine area. Depending upon the operation of the vehicle, use water or steam to clean it. Schedule cleaning for the end of the work shift when heat buildup may occur after the engine is shut down.



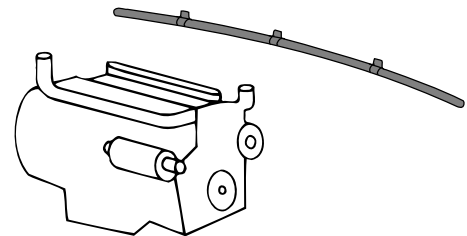
000622

4. Check braking system for proper adjustment – especially if brakes overheat when not engaged.



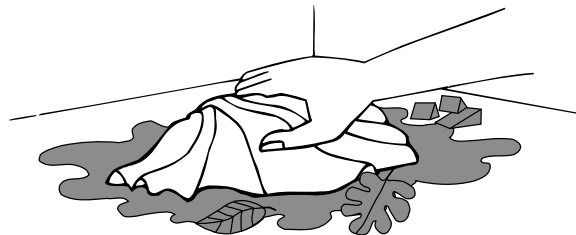
000623

5. Check all possible ignition points (engine block, exhaust manifolds, turbochargers, etc.). Make sure oil, hydraulic fluid and gas lines are not in contact with these ignition points.



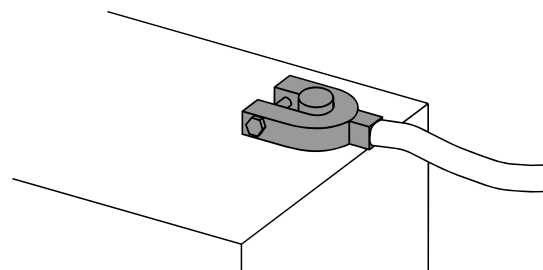
000624

6. Clean vehicle of all combustible debris – dry vegetation, grain particles, coal dust, etc. Also, remove any oil and fuel drippings.



000625

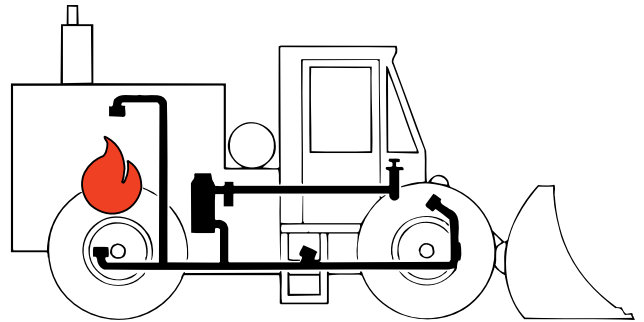
7. Check all electrical lines and connections for tight fit, wear or abrasion. Replace any defective electrical equipment or wiring.



000626

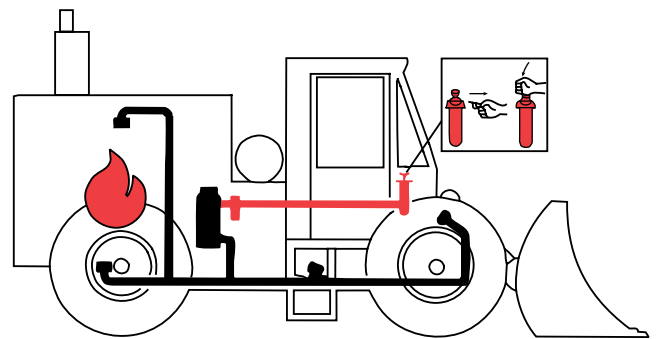
How your Ansul Fire Suppression System works . . . manually

1. A fire starts in the protected area.



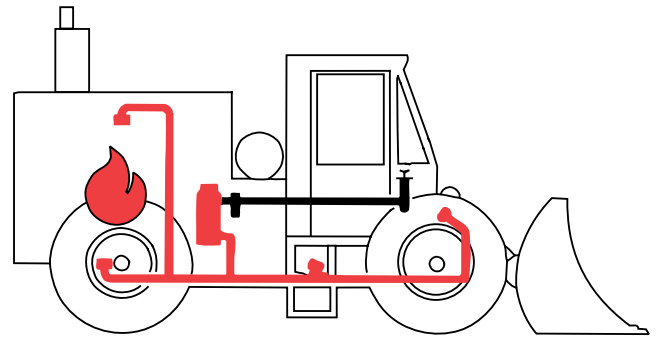
002777

2. Equipment operator pulls the ring pin and strikes the plunger on the manual actuators. Pressure from the actuator causes the Ansul Fire Suppression System to actuate.



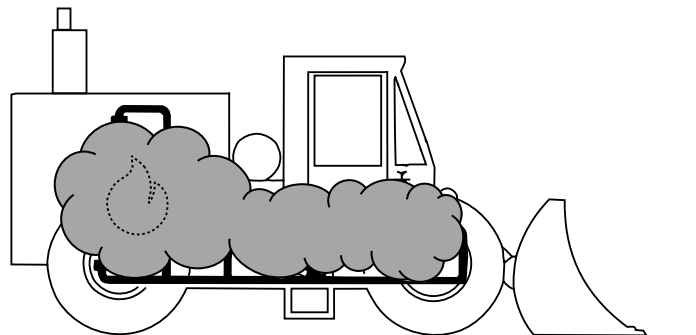
002778

3. Expellant gas pressure "fluidizes" the dry chemical extinguishing agent and propels it through distribution hose.



002779

4. Dry chemical extinguishing agent is discharged through fixed nozzles into protected areas, suppressing the fire.

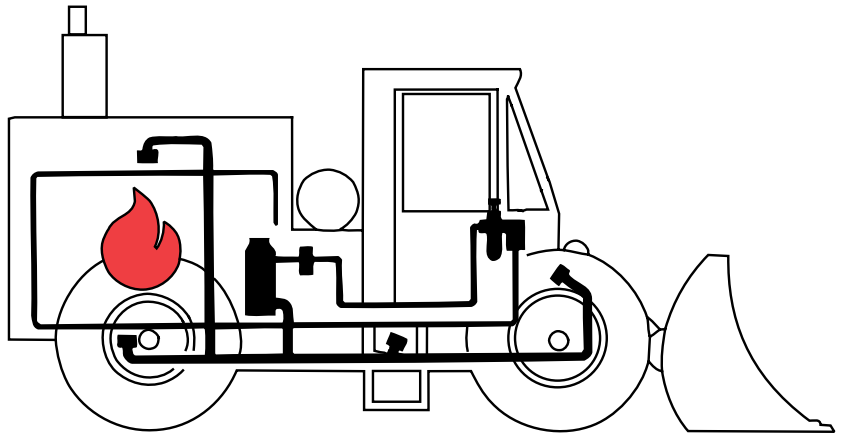


002780

And you can have automatic 24 hour protection with Ansul CHECKFIRE Detection and Actuation Systems . . .

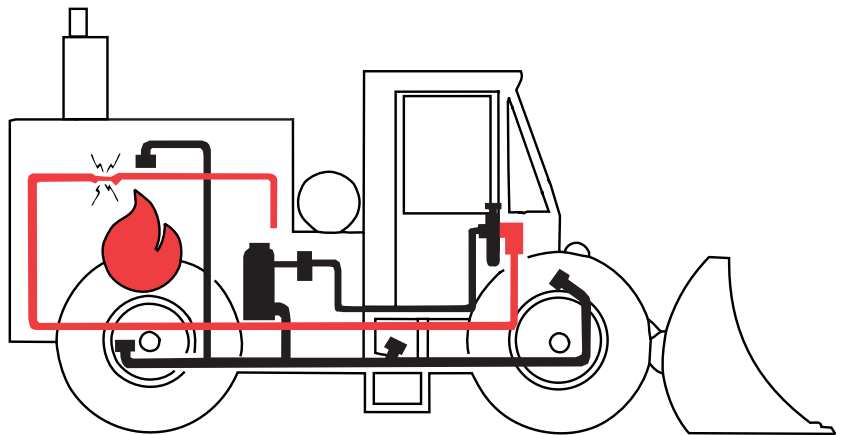
How the system works with optional CHECKFIRE Electric Detection and Actuation

1. A fire starts in the protected area.



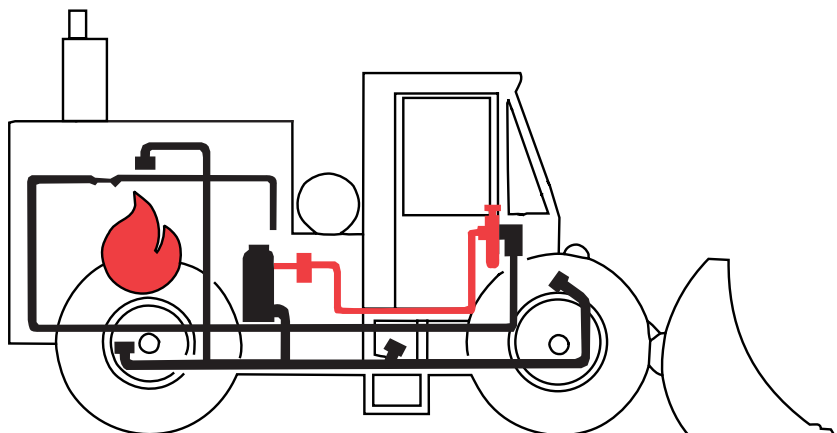
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2. Linear or spot detectors signal the system control module indicating that a fire has started in the protected area.



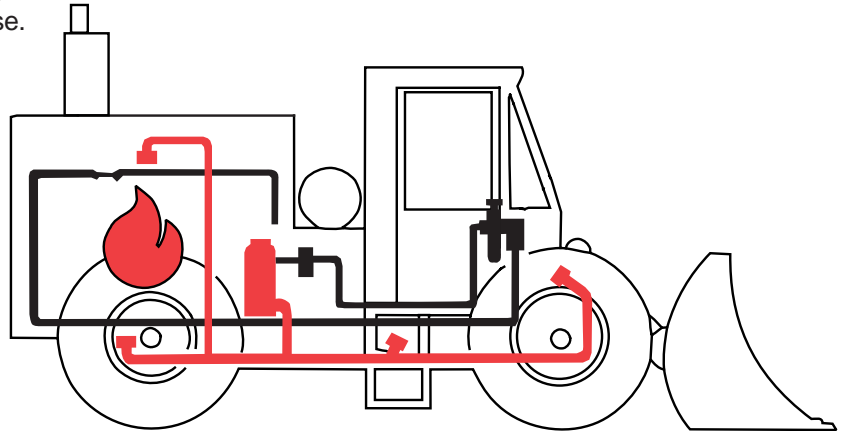
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3. The Control Module actuates the fire suppression system. The module will also provide time delay, shut down functions and activation of auxiliary vehicle components in accordance with your installation.



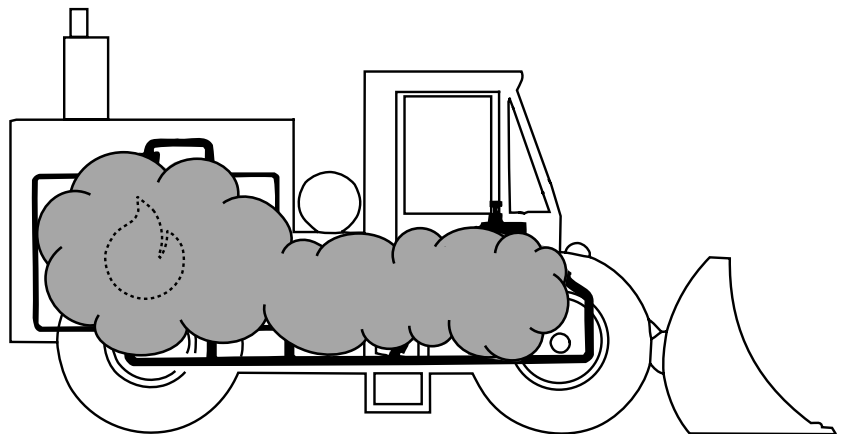
002783

-
4. Expellant gas pressure “fluidizes” the dry chemical extinguishing agent and propels it through the distribution hose.



002784

-
5. Dry chemical extinguishing agent is discharged through fixed nozzles into protected areas, to suppress the fire.



002785

Optional LVS (Twin Agent) Fire Suppression System

Along with dry chemical fire suppression system protection, some vehicles, because of their size, require an additional type of system. This type of system is called a twin agent system. An Ansul LVS, Liquid Agent System, is designed to discharge wet chemical into the protected hazard areas after the dry chemical discharge has ended. The addition of the wet chemical produces a cooling effect onto the flammable fuel and the surrounding surface areas. The wet chemical can flow into hard to reach areas where fuels may have flowed into.

Make sure your Ansul Fire Suppression System is

The Ansul Fire Suppression System is your second line of fire defense in case your fire prevention efforts are not enough. However, in order to perform properly, your Ansul System requires periodic inspection and maintenance.

Nozzles

BLOW-OFF CAPS IN PLACE (IF SUPPLIED) NOZZLES NOT CLOGGED OR COVERED WITH DEBRIS NOZZLES TIGHT IN BRACKETS

002797 002798 002799

System Hydraulic Hose

NO CUTS NO KINKS IN HOSE NO ABRASIONS ALL HOSE MOUNTS SECURELY WELDED OR BOLTED ALL FITTINGS TIGHT

002786

Agent Tank A-101

AUTHORIZED ANSUL DISTRIBUTOR CERTIFICATION TAG ATTACHED

NO EXCESSIVE WEAR NO CORROSION FIRMLY MOUNTED

002794

Agent Tank LVS or LT-A-101-125/250

FIRMLY MOUNTED NO EXCESSIVE WEAR NO CORROSION NO ABRASIONS NO CORROSION FIRMLY MOUNTED

004320

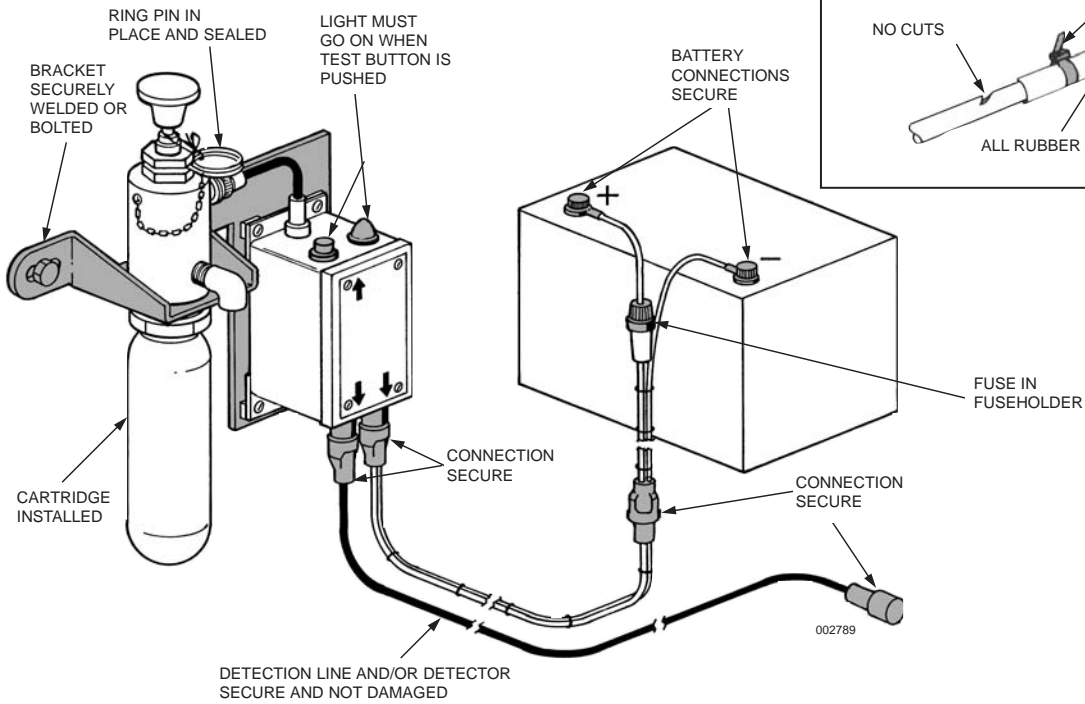
Hand Portable Fire Extinguisher

VISUAL SEAL IN PLACE DISTRIBUTOR CERTIFICATION TAG ATTACHED NO EXCESSIVE WEAR NO CORROSION FIRMLY MOUNTED

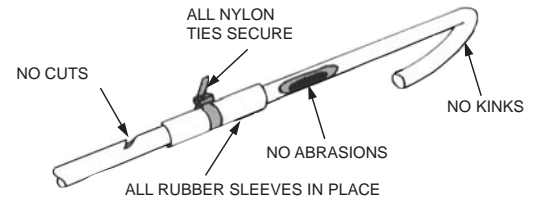
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kept in good working order.

CHECKFIRE Electric Series I Inspection

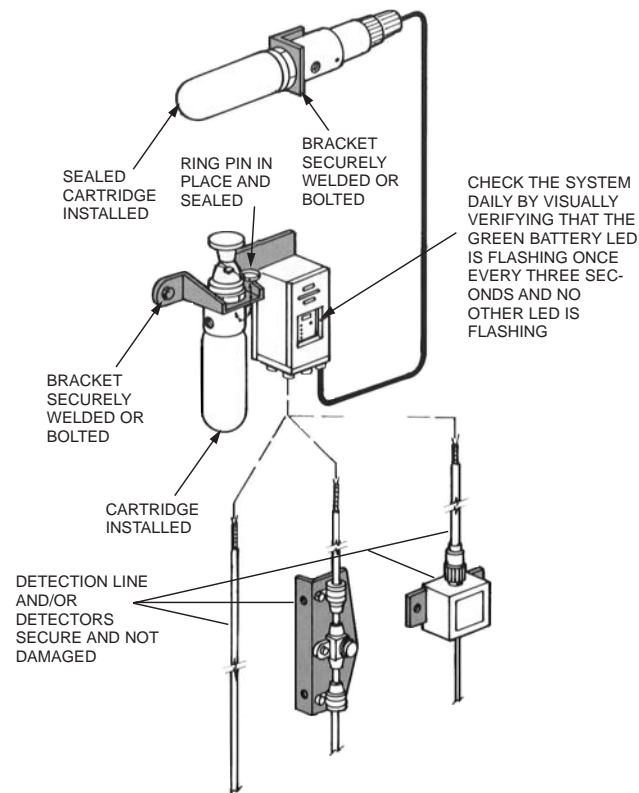


Detection Wire, Power Wire



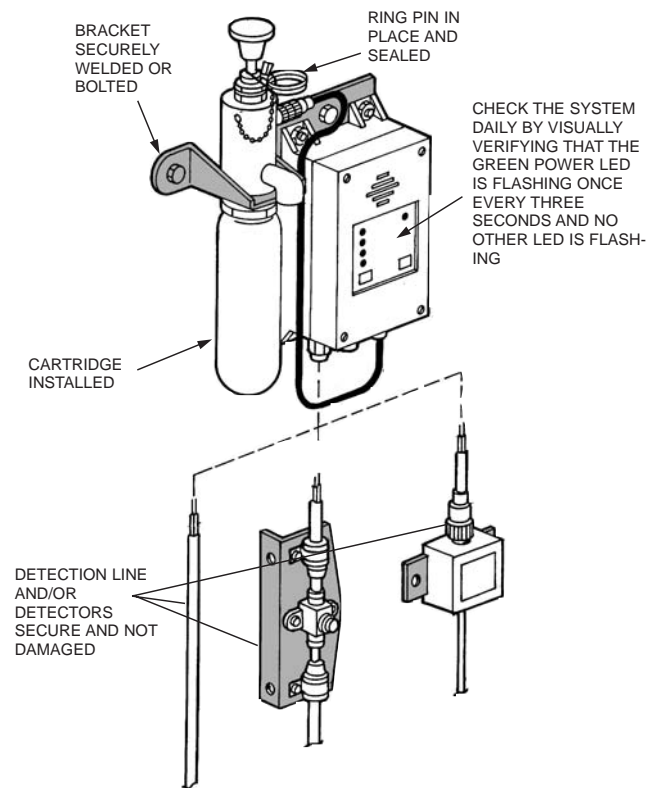
002790

CHECKFIRE MP Inspection



002791

CHECKFIRE SC-N Inspection



002775

Provide for vehicle modification

Your Ansul Fire Suppression System was custom designed and installed on your vehicle to protect specific hazard areas from fire. Should you add accessory equipment to your vehicle at a later date, or make major mechanical modifications, you may be reducing the capabilities of the Ansul Fire Suppression System.

When such modifications are made, contact your Ansul distributor. He can reevaluate your Ansul System to ensure it protects all hazard areas from fire.

Provide for periodic maintenance

Periodic maintenance is essential to ensure that your Ansul Fire Suppression System is operational. Contact your Ansul distributor for periodic follow-up, in-depth inspection and maintenance.

Protect against fires outside of the hazard area

Hand portable fire extinguishers are an effective way to suppress fires which may occur away from the vehicle, or in areas not protected by the Ansul Fire Suppression System. Your Ansul distributor can recommend the proper size, type and placement of hand portable extinguishers and train your personnel in their operation, inspection and maintenance.

Should fire occur in an area not protected by the Ansul Fire Suppression System, a hand portable fire extinguisher should be employed as follows:

1. Shut off the vehicle's engine and set brakes.
2. Evacuate the vehicle and secure a hand portable fire extinguisher.
3. Approach the fire from the upwind side.
4. Actuate the hand portable fire extinguisher per instructions printed on the extinguisher's nameplate.
5. Once the fire is extinguished, stand by in case the fire reflash.

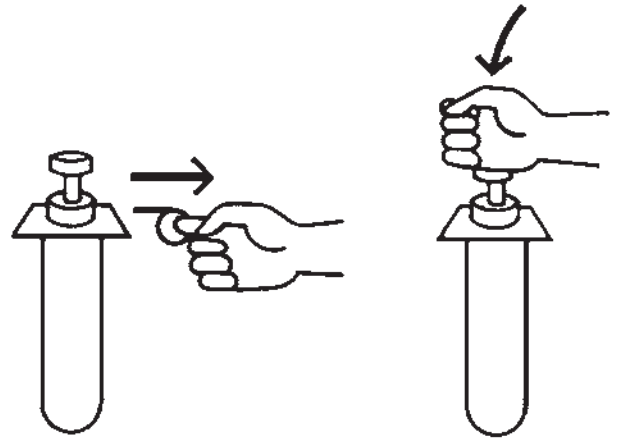
In the event of a fire on your vehicle

To manually operate system:

1. Shut off the vehicle

2. Set the brakes

3. Pull the ring pin on manual actuator and strike the red button



000627

4. Evacuate the vehicle

5. Stand by with a fire extinguisher

Inspection and Maintenance Record

Date	Authorized Ansul Distributor	Recharge	Inspection	Action Taken

ANSUL and CHECKFIRE are registered trademarks.

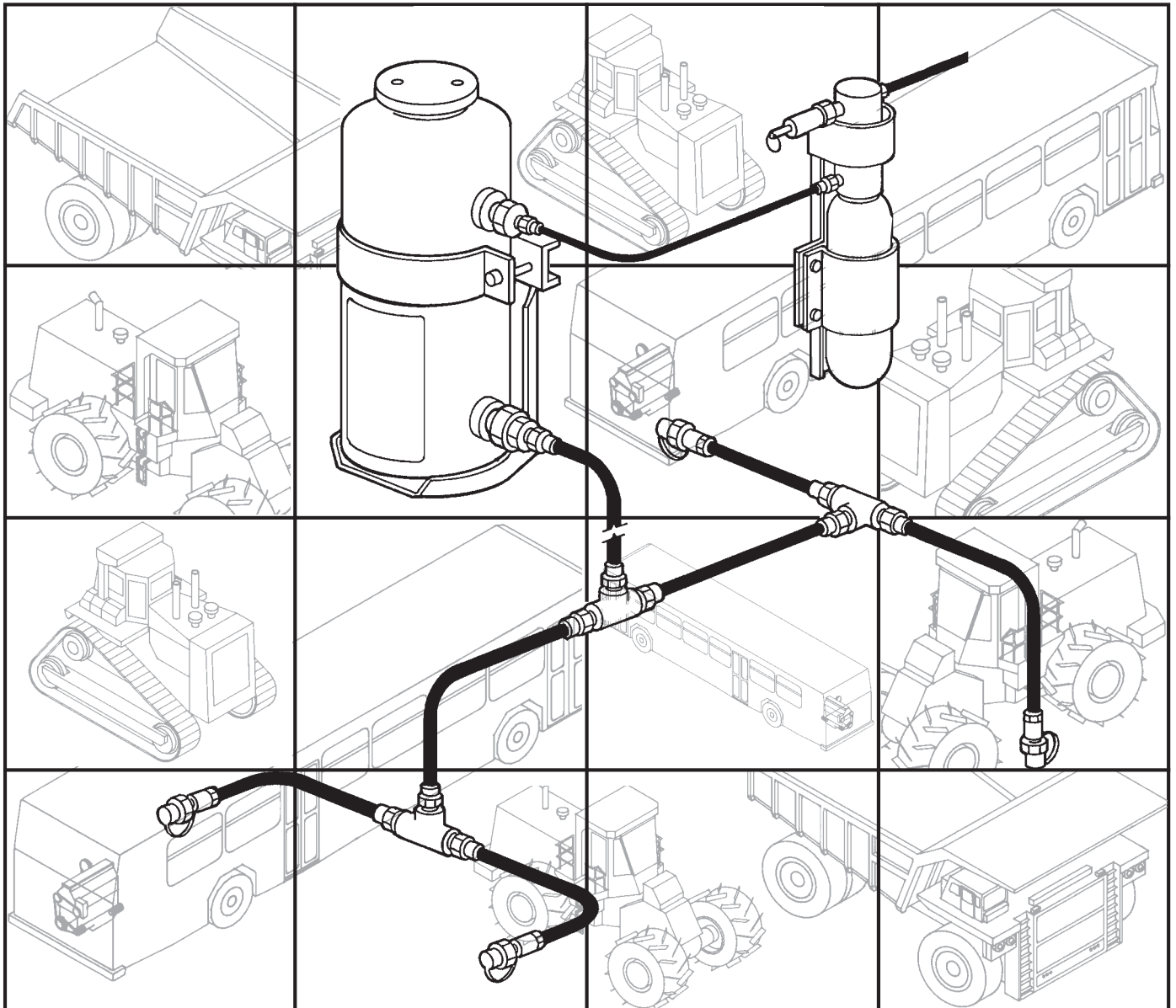
Your Authorized Ansul Distributor

Part No. 53081-08 ©1999 Ansul Incorporated Litho in U.S.A.

ANSUL®

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

**A-101-10/20/30
LT-A-101-10/20/30
VEHICLE FIRE
SUPPRESSION
SYSTEMS**



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

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

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

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

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

REVISION RECORD

5-15-02

REV. 1

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INTRODUCTION

- ▶ The Ansul A-101/LT-A-101 fire suppression system is a pre-engineered, fixed nozzle system for protection of off-highway vehicles, commercial vehicles, or industrial type applications. Typical applications include surface mining equipment, underground mining machines, forest harvesting equipment, construction equipment, farming machinery, and transportation vehicles such as municipal busses.
- ▶ The A-101/LT-A-101 system consists of three major components: a container to store the dry chemical extinguisher agent; an actuation system operated manually or automatically, and an agent distribution system which delivers the agent from the tank through hydraulic hose and fixed nozzles to the hazard areas.

The fire system described is a suppression system only and is not designed or intended to extinguish all fires, particularly when unusual amounts of combustible materials and an ample oxygen supply are present. It is extremely important that supplement fire fighting equipment be available in case the system does not totally extinguish a fire.

If an automatic fire detection and actuation system has not been supplied or has been disconnected, system actuation and discharge will not occur unless the fire suppression system is manually actuated. (Use of manual system only must be approved by authority having jurisdiction.) Reliance on a manual release system usually results in a slower reaction to fire. Means to shut down the vehicle must be added to a manual or disconnected automatic system.

The basic agent storage container is a tank filled with Ansul FORAY (monoammonium phosphate base) dry chemical which is effective on Class A, B, and C fires. A gas expellant cartridge, either carbon dioxide or nitrogen, provides pressurization of the dry chemical upon actuation.

- ▶ Automatic detection, either electric or pneumatic, and actuation, is recommended. The A-101/LT-A-101 system is actuated manually by a pneumatic actuator located on the dashboard or on the exterior of the vehicle.

The dry chemical extinguishing agent is delivered from the tank through hydraulic hose and pre-set nozzles into the fire hazard areas or onto the fire prone surfaces.

Along with the fire suppression system, the total system design must include a hand portable fire extinguisher(s) located on board the vehicle that can be used to manually suppress a fire that may be burning in an unprotected area. Refer to NFPA 10, "Standard For Portable Fire Extinguisher," for additional information.

▶ TWIN AGENT SYSTEM (NOT FM APPROVED)

The system consists of both dry chemical and liquid agent. The dry chemical portion of the system is the Ansul A-101/LT-A-101, 125, or 250 system (either standard discharge or extended discharge) and the liquid agent portion of the system consists of an agent storage tank containing a premixed solution of LVS wet chemical.

The LVS-30 (30 gallon) system is designed to discharge for approximately 2 minutes when two agent discharge nozzles are used.

The LVS Fire Suppression System is designed to operate within a temperature range of -40°F to $+120^{\circ}\text{F}$ (-40°C to 49°C).

The dry chemical system used in conjunction with the LVS system is the Ansul A-101/LT-A-101, 125 or 250. The dry chemical system is connected to the Ansul CHECKFIRE Detection and Control System. The dry chemical system can be designed as a standard discharge or as an extended discharge system per the requirements of the A-101/LT-A-101 vehicle Fire suppression Installation, Recharge, Inspection, and Maintenance Manual. Upon actuation of the dry chemical system, the pneumatic time delay for the LVS system will start. During the end of the dry chemical discharge, the time delay will allow pressure to enter the LVS actuation line. This pressure will then actuate the nitrogen cartridge on the LVS tank(s), causing the LVS system to discharge the wet chemical solution.

- ▶ For detailed instructions, refer to manual Part No. 427865 regarding the LT-A-101-125/250 system. For detailed instructions, refer to manual Part No. 427109 regarding the LVS system.

FM APPROVAL

- ▶ The Ansul A-101/LT-A-101 fire suppression system has been tested and is FM approved. These tests require extinguishment of fire initiated in open vessels and within enclosures fueled with flammable liquid. In each case, these fires are allowed to progress to maximum intensity before the system is actuated. The time of actuation in these tests is well beyond the time that a detector would take to detect the fire and actuate the system. Other tests required by FMRC are as follows:

1. Fuel in depth splash tests under a minimum hose length, maximum temperature, and minimum clearance condition to ensure that the nozzle does not cause splashing of fuel.
2. Operational flow rate tests at the minimum, average, and the maximum temperatures, with maximum and minimum hose lengths.
3. Cycle tests on all mechanical and electrical devices to determine their structural integrity.

The A-101 systems which utilize carbon dioxide as the expellant gas are approved for temperature ranges of $+32^{\circ}\text{F}$ to $+120^{\circ}\text{F}$ (0°C to 49°C).

The LT-A-101 systems which utilize nitrogen as the expellant gas are approved for temperature ranges of -65°F to $+210^{\circ}\text{F}$ (-54°C to 99°C).

SECTION I – GENERAL INFORMATION

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REV. 2

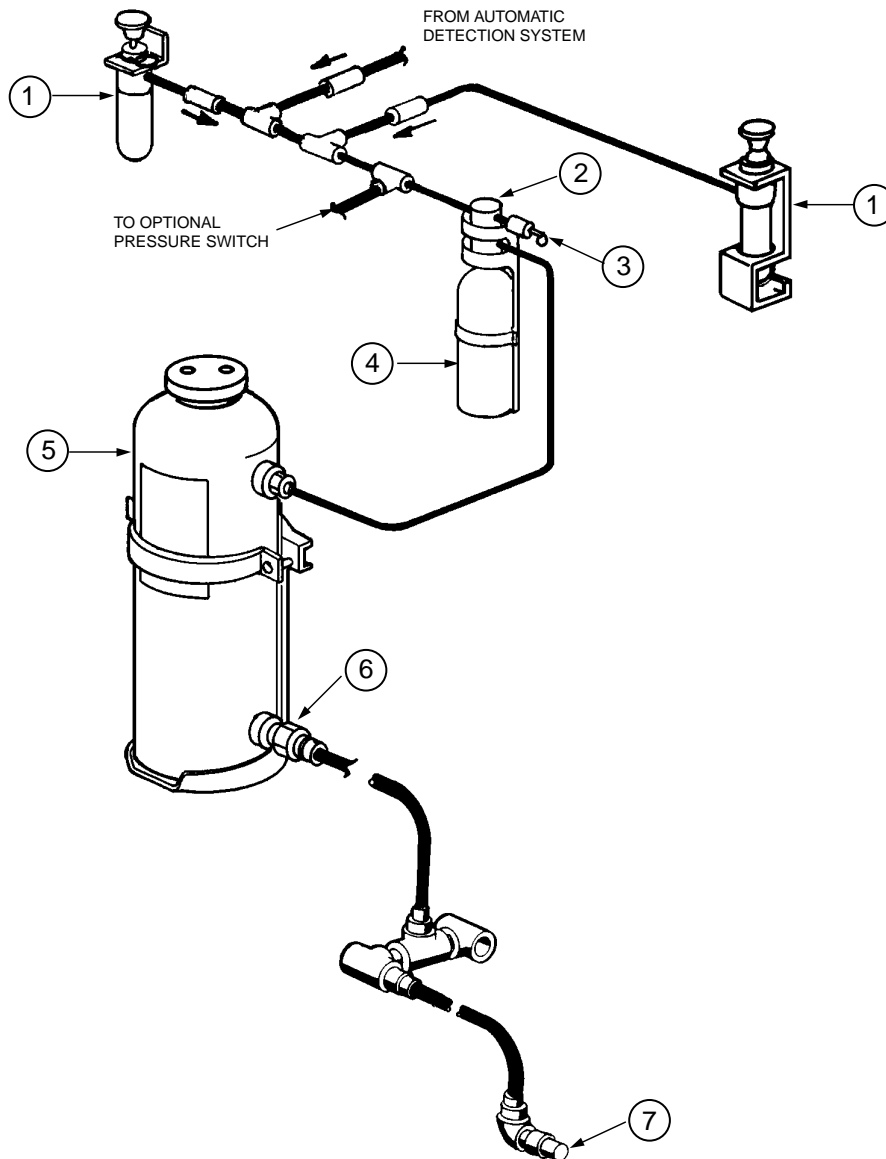


FIGURE 1

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HOW THE SYSTEM OPERATES

- ▶ Discharge of the A-101/LT-A-101 system manually is initiated from a remote actuator (1). Depressing the actuator plunger punctures the seal on the cartridge. The released pressure is transmitted to the pneumatic actuator/cartridge receiver (2). A safety relief valve (3) at this point prevents too high an actuation pressure build-up. The pressure drives a puncture pin through the seal in the expellant gas cartridge (4). This releases the expellant gas which is then transmitted to the dry chemical tank (5) where it fluidizes the dry chemical before carrying it to the fire hazard. A sealed burst disc assembly (6) prevents the flow of dry chemical until sufficient pressure is built up within the dry chemical tank. When the proper pressure is reached, the disc breaks allowing the gas/dry chemical mixture to flow to the nozzle(s) (7) and discharge onto the hazard.

Refer to appropriate CHECKFIRE design, installation and maintenance manual for information on the operation of the automatic detection system.

NOTE: Mechanical or electrical means must be provided to shut down vehicle upon system actuation.

IN CASE OF FIRE

When a fire starts, the way the operator reacts is very important. As soon as the operator is aware of a fire, he should do the following four things:

1. Turn the machine off and set the brake.
- ▶ 2. Quickly actuate the system by pulling the safety ring pin on the manual actuator and strike the red button.
3. Evacuate the vehicle.
4. Stand by with a fire extinguisher.



CAUTION

The fire system described in this manual is a suppression system only and is not designed or intended to extinguish all fires, particularly when unusual amounts of combustible materials and an ample oxygen supply are present. It is extremely important that supplemental firefighting equipment be available in case the system does not totally extinguish a fire.

APPLICATION METHOD

- ▶ The A-101/LT-A-101 system provides fire protection using total flooding and local application methods. These methods are described below.

Local Application – Vehicle

When designing a local application system for vehicle protection, each individual hazard area must be surveyed and the correct type nozzle must be chosen to give the proper coverage. It must also be determined if certain local application hazard areas require screening to adequately protect them.

Total Flooding

Total flooding is described as “volume protection” and it is applied only when a hazard is located in an enclosure. Openings such as doors, windows, and grating shall not be more than 15% of the enclosure’s total surface area (ceiling, floors, and all walls).

- ▶ Openings of 5% or less of the total surface area are acceptable and do not require screening. Hazards with openings greater than 5% but not over 15% can be protected by screening.

Total flooding application is accomplished by introducing a sufficient quantity of FORAY dry chemical through fixed nozzles throughout the volume of the enclosure.

To enhance the effectiveness of the total flooding system in industrial applications, all fan air movements should be shut down and/or dampered at discharge of the dry chemical system. Refer to NFPA 17, “Standard For Dry Chemical Extinguishing Systems,” for additional information.

PIPING ARRANGEMENT

- ▶ The A-101/LT-A-101 system utilizes three methods of splitting the dry chemical flow from the tank to the nozzles. Each method is approved for use on vehicle or industrial type applications.

Two Nozzle System

- ▶ The two nozzle system can be used in either vehicle or industrial hazard protection. It can be used in total flooding, or as a local application system on off-road vehicles. The supply line is split into two branch lines by the use of a 3/4 x 1/2 x 1/2 in. reducing tee. Two nozzle systems can be used with nominal 10, 20, and 30 lb. tank sizes.

Four Nozzle System

- ▶ The four nozzle system can be used in either vehicle or industrial hazard protection. It can be used in total flooding, or as a local application system on off-road vehicles. The supply line is divided into four branch lines by the use of a triple tee or a split tee. Four nozzle systems can only be used with nominal 20, and 30 lb. tanks. Four nozzle 30 lb. systems are preferred for all systems protecting hazards in environments which are extremely rugged, and very prone to Class A and Class B fuel build up in hard to protect areas, providing more agent per nozzle and longer discharge times.

Six Nozzle System

- ▶ The six nozzle system can be used in vehicle or industrial hazard protection. It can only be used in local application systems on off-road vehicles, when minimal discharge time and agent discharge per nozzle is acceptable. The supply line is divided into six branch lines by the use of a distribution tee and three 1/2 in. tees. Six nozzle systems can only be used with nominal 20, and 30 lb. tanks.

DETECTION

- ▶ Automatic electric detection is available for the A-101/LT-A-101 system.
- ▶ Electric detection systems (CHECKFIRE MP-N*, Series I, and SC-N) are available to provide rugged, automatic detection for vehicle protection. These systems are either powered by the vehicle battery or by the internal module battery.
 - ▶ The electric detection systems can use either linear heat detection or spot thermal detectors, or pneumatic linear detectors.

▶ * Not FM Approved

SECTION II – SYSTEM DESCRIPTION

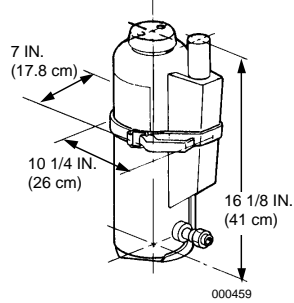
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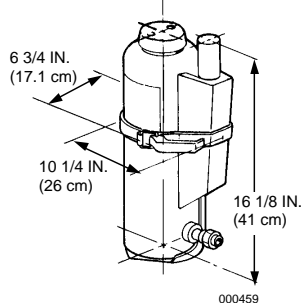
TANK ASSEMBLY

The tank assemblies, nominal 10, 20, and 30 lb. size, are factory filled with 8.5, 17, and 25 lb. respectively of FORAY dry chemical. Each tank is finished in red enamel paint. A nameplate is affixed to the exterior and contains information on recharge and maintenance. Two style of tanks are available: a tank containing a cartridge receiver and pneumatic actuator and a tank with 1/4 in. adapter for a pressure line from a remote cartridge. See Figure 1.

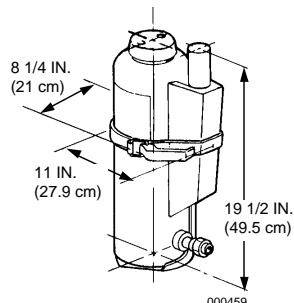
A-101 MODEL 10
PART NO. 24855



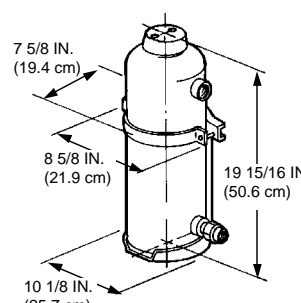
LT-A-101 MODEL 10
PART NO. 24866



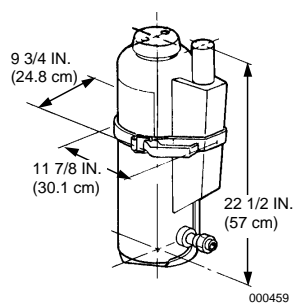
A-101 MODEL 20
PART NO. 24970



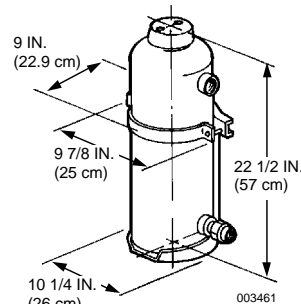
LT-A-101 MODEL 20
PART NO. 24894



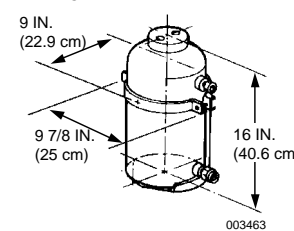
A-101 MODEL 30
PART NO. 53000



LT-A-101 MODEL 30
PART NO. 29375



LP-A-101 MODEL 20-B
PART NO. 24427



LT-LP-A-101 MODEL 20-B
PART NO. 24425

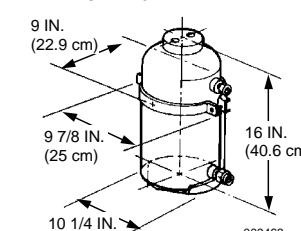
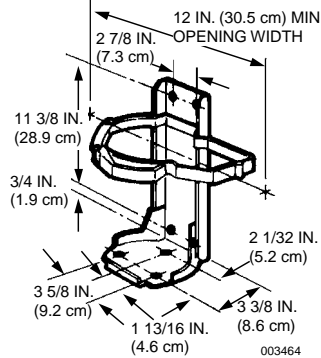


FIGURE 1

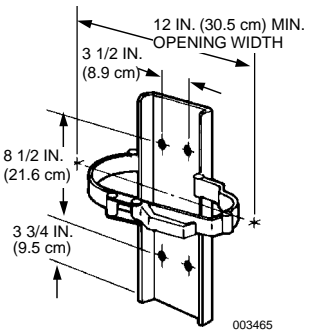
TANK BRACKET

The tank mounting bracket assemblies consist of heavy gauge steel back plates and clamp arms. Each style bracket is constructed to properly retain the agent tank from movement or damage in the rugged environment that these systems are normal used. Each tank bracket contains rubber pads to minimize the shock and vibration effect on the tank. The brackets are finished with red, air dry enamel paint. See Figure 2.

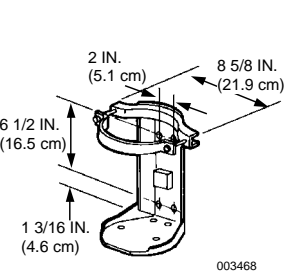
A-101 MODEL 10 / LT-A-101 MODEL 10
PART NO. 24854



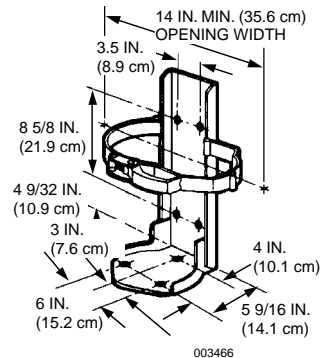
A-101 MODEL 20
PART NO. 24971



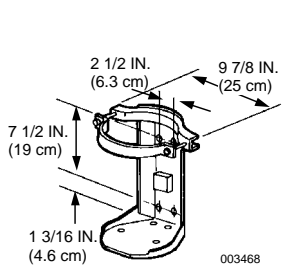
LT-A-101 MODEL 20
PART NO. 24895



A-101 MODEL 30
PART NO. 14098



LT-A-101 MODEL 30
PART NO. 30494



LP-A-101 MODEL 20B / LT-LP-A-101 MODEL 20
PART NO. 31171

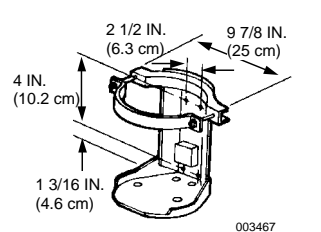


FIGURE 2

SECTION III – SYSTEM COMPONENTS

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
000417

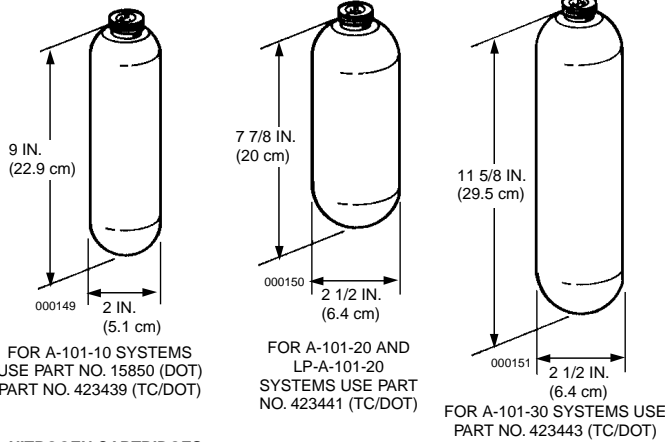
CARTRIDGE – EXPELLANT GAS

The expellant gas cartridges used on the A-101/LT-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.

Several cartridge Part No.'s have been added to comply with the requirements of Transport Canada (TC). These cartridges have been approved for both DOT and TC.

CARBON DIOXIDE CARTRIDGES



NITROGEN CARTRIDGES

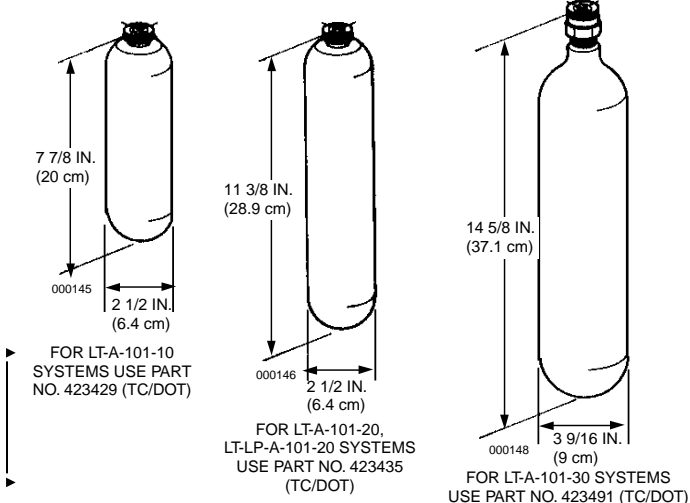
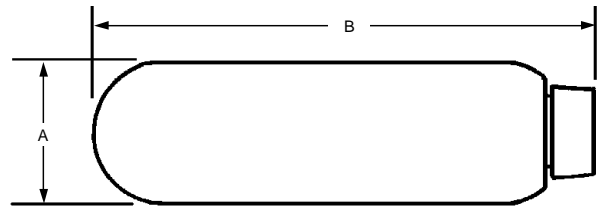


FIGURE 4

CARTRIDGE – ACTUATION GAS

The actuation gas cartridge used on the A-101/LT-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-10	2 IN. (5.1 cm)	6 13/16 IN. (17.3 cm)	PART NO. 13193 (DOT) PART NO. 423423 (TC/DOT)	PART NO. 13177 (DOT) PART NO. 423425 (TC/DOT)

FIGURE 5
000439

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.

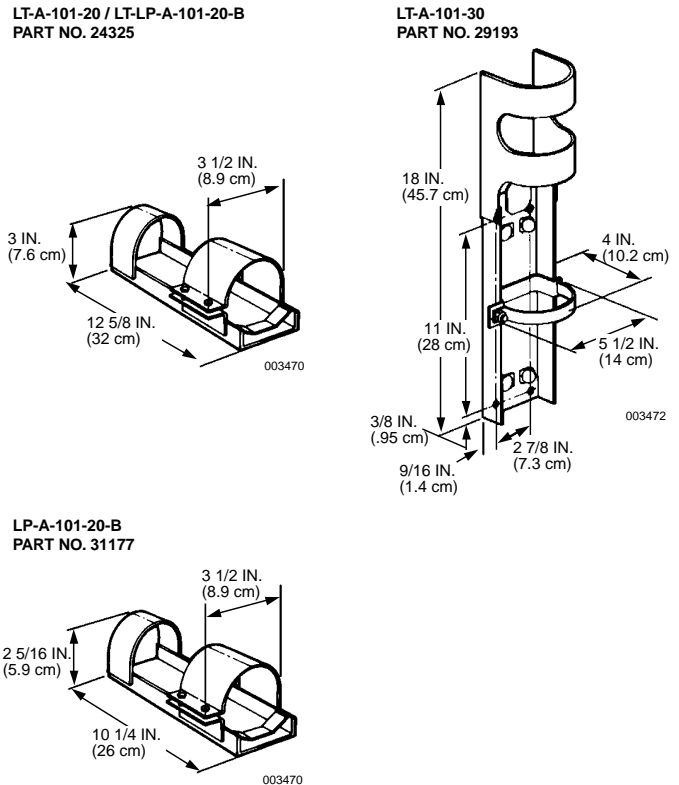


FIGURE 6

PNEUMATIC ACTUATOR

The pneumatic actuator, Part No. 430221, is constructed of brass and mounts on top of the expellant gas cartridge(s). When actuated, the actuator punctures a seal in the cartridge head, allowing the expellant gas to flow into the agent tank. See Figure 6a.

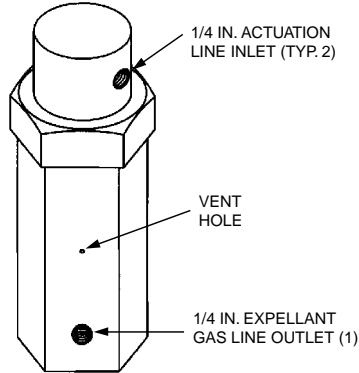
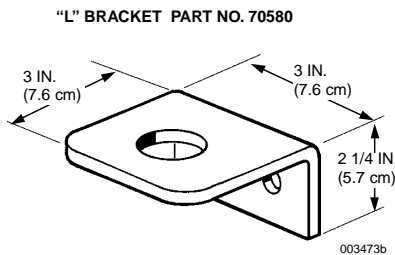
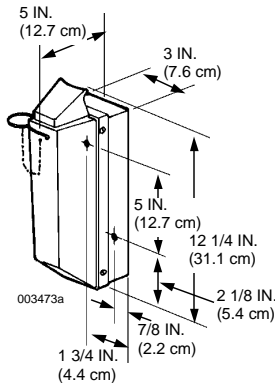


FIGURE 6a
006433

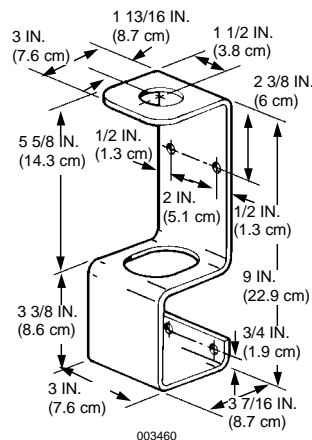
MANUAL ACTUATORS

The manual actuator is available for use with either right or left hand cartridges. Manual actuators should be mounted near the vehicle operator and/or at a point on the vehicle that can be reached from ground level. Two styles of manual actuators are available: the standard actuator with either the "S" type bracket or the "L" type bracket, and the cartridge guard type actuator. See Figure 7.

CARTRIDGE GUARD ACTUATOR FOR RIGHT HAND CARTRIDGES PART NO. 19330
CARTRIDGE GUARD ACTUATOR FOR LEFT HAND CARTRIDGES PART NO. 16186



"S" BRACKET PART NO. 57661



REMOTE ACTUATOR FOR RIGHT HAND CARTRIDGES PART NO. 57452
REMOTE ACTUATOR FOR LEFT HAND CARTRIDGES PART NO. 70581

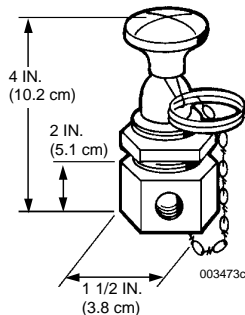


FIGURE 7

1/4 IN. CHECK VALVE

The 1/4 in. actuation line check valve, Part No. 25627, is used at the branch lines to each actuation device (whether manual or automatic). The check valve blocks the flow of actuation gas from the actuator that was actuated to the actuator(s) that was not actuated. This prevents actuation gas from escaping from an open actuator which may have had the cartridge removed. The check valve also keeps the gas from pressurizing all branch actuation lines thus allowing the main line to be of maximum length. See Figure 8.

CHECK VALVE PART NO. 25627

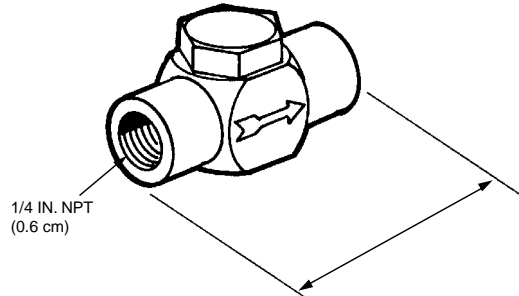


FIGURE 8
000899

DISTRIBUTION TEE

When six nozzles are to be fed from one dry chemical tank, the distribution supply line must enter the inlet of a distribution tee, Part No. 25031, and each branch line must exit from one of three outlets of the distribution tee. This is required to assure equal distribution of dry chemical to each nozzle. See Figure 9.

DISTRIBUTION TEE, 1/2 IN. X 1/2 IN. X 1/2 IN. X 3/4 IN. – PART NO. 25031

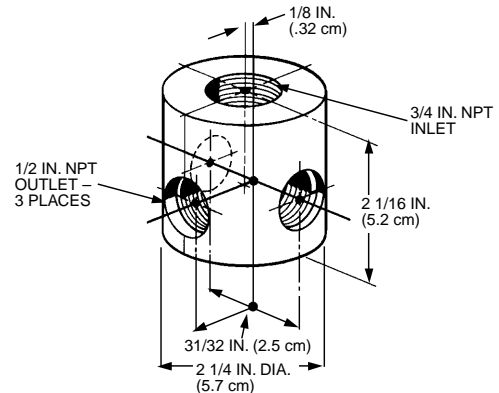


FIGURE 9
002583

SECTION III – SYSTEM COMPONENTS

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REV. 1

REDUCING TEE

When two or four nozzles are to be fed from a single dry chemical tank, a 1/2 x 1/2 x 3/4 in. reducing tee, Part No. 4655, is used to properly distribute the dry chemical from the supply line to two branch lines. See Figure 10.

REDUCING TEE, 1/2 IN. X 1/2 IN. X 3/4 IN. – PART NO. 4655

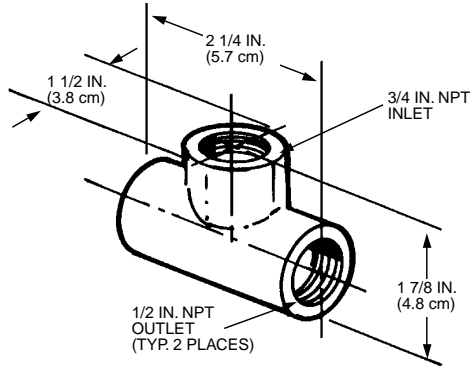


FIGURE 10
003456

TRIPLE TEE

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

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

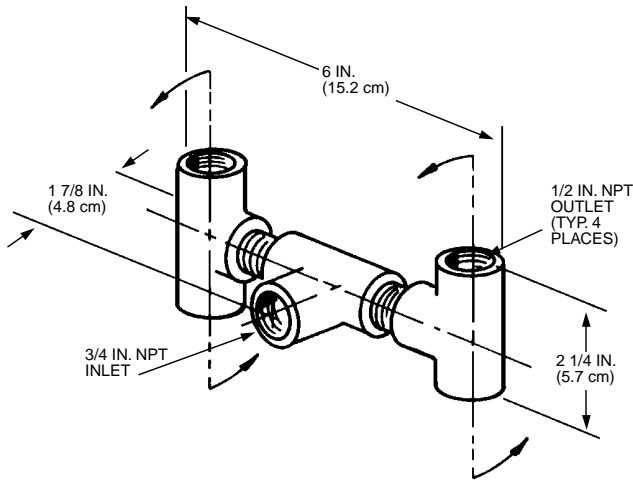


FIGURE 11
003462

SAFETY RELIEF VALVE

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

SAFETY RELIEF VALVE PART – NO. 15677

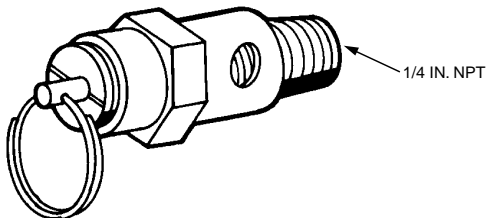


FIGURE 12
000437

AIR CYLINDER (OPTIONAL)

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

AIR CYLINDER PART NO. 15733

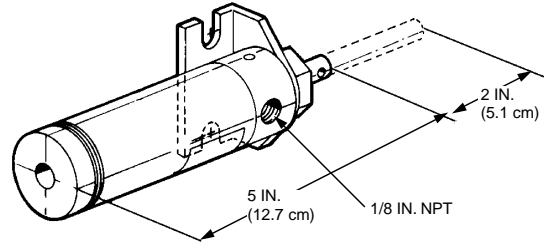


FIGURE 13
003459

PRESSURE SWITCH – WEATHERPROOF

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

PRESSURE SWITCH PART – NO. 46250

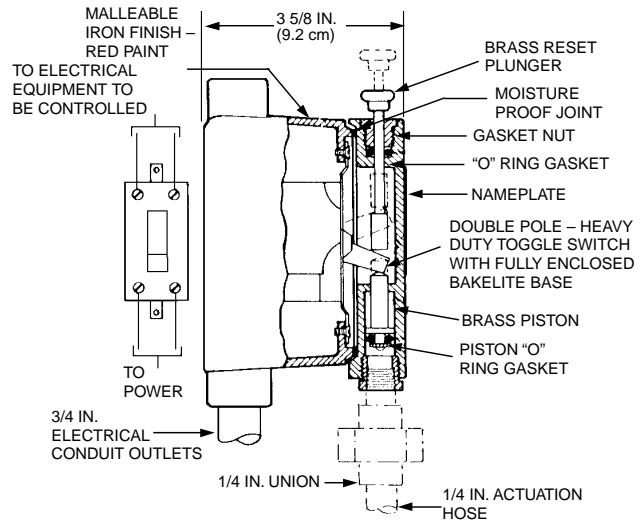


FIGURE 14
000716

PRESSURE SWITCH – NON-WEATHERPROOF

The Electric Pressure Switch, Part No. 8372, is a SPDT (Single Pole-Double Throw) pneumatically operated, resettable switch to be used for turning off pump motors, exhaust fans, conveyors and similar devices; or turning on alarms or electric door closures. The switch contacts are rated at 15 amp, 125, 250, or 480 VAC, 1/4 hp at 125 VAC, 1/2 hp at 250 VAC or 1/2 amp at 125 VDC, 1/4 amp at 250 VDC. See Figure 15.

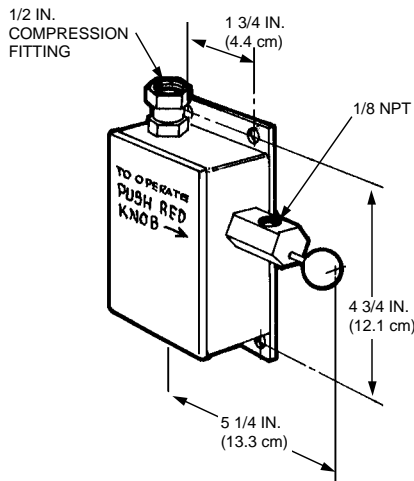


FIGURE 15
000453

Explosion-Proof Pressure Switch – DPDT

The Explosion-Proof Pressure Switch, Part No. 43241, is a DPDT (Double-Pole, Double-Throw) pneumatically operated, resettable switch to be used for turning off pump motors, exhaust fans, conveyors, and similar devices; or turning on alarms or electric door closures. The switch contacts are rated at 10 amp at 125 VAC or 5 amp at 250 VAC. The pressure switch is constructed with an explosion-proof housing suitable for hazardous environments. The switch operates off the nitrogen pressure from the ANSUL AUTOMAN release or remote pneumatic actuator.

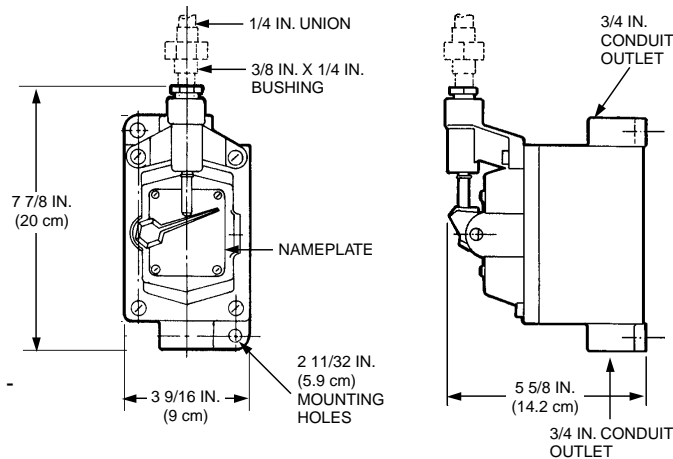
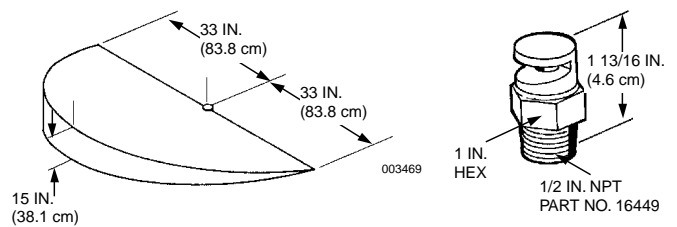


FIGURE 16
000454

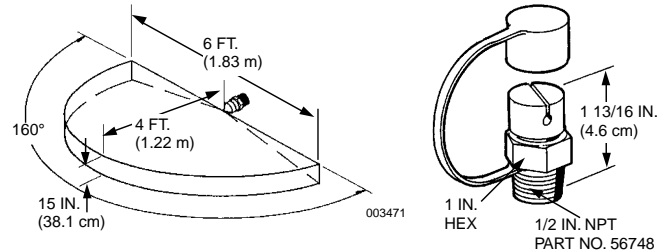
NOZZLES

► Three types of nozzles are approved for use with the A-101/ LT-A-101 system. One type is the F-1/2 nozzle. This nozzle gives a 180° fan shape pattern and can be used for either total flooding or local application. The second type of nozzle is the C-1/2. This nozzle gives a cone pattern and is used for direct application to a vehicle component or burning surface. The third type of nozzle is the V-1/2. This nozzle produces a 160° fan shape pattern and is generally used for screening engine compartments, torque converters and all other hazard areas. All nozzles are constructed of brass and require protective blow-off caps. Exception: The F-1/2 nozzle can utilize either a blow-off cap or the opening can be packed with a good grade of extreme temperature silicone grease, such as Dow Corning No. 4. See Figure 17.

F-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 16449



V-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 56748



C-1/2 NOZZLE EFFECTIVE DISCHARGE PATTERN PART NO. 53791

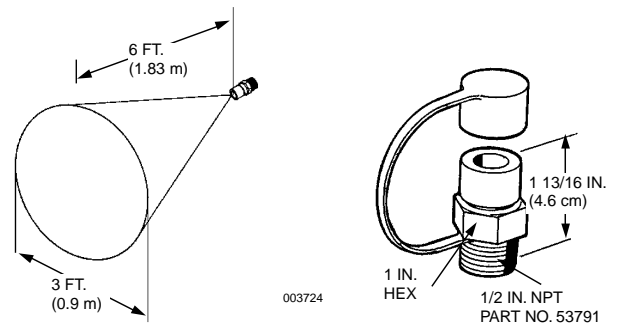


FIGURE 17

SECTION III – SYSTEM COMPONENTS

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REV. 2

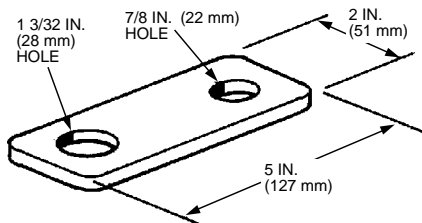
▶ NOZZLE BRACKETS

Two styles of nozzle brackets are available for the A-101/LT-A-101 system. Each style of bracket is constructed of unpainted 1/4 in. (6.4 mm) steel. They contain pre-punched mounting holes for the nozzle.

An individual “L”-shaped bracket-shipping assembly, Part No. 427149, is available. This bracket is 2 in. x 3 in. (51 mm x 76 mm). A second “L”-shaped bracket (in packs of 12), Part No. 73871, is also available. This “L” shaped bracket is 2 in. x 2 in. (51 mm x 51 mm).

A straight bracket (in packs of 4), Part No. 427228, is available. this bracket is 5 in. x 2 in. (127 mm x 51 mm). See Figure 18.

PART NO. 427228



PART NO. 427149

PART NO. 73871

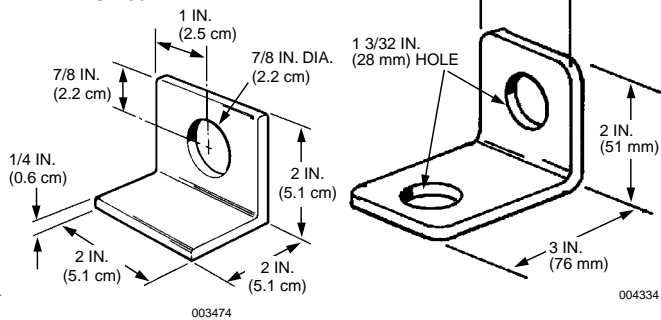


FIGURE 18

HOSE (SUPPLIED BY OTHERS)

▶ To assure proper performance of an A-101/LT-A-101 system, the hose used must meet SAE 100 R5 or 100 R1 (minimum) hose specification. For underground mining applications, the hose must also be accepted by MSHA as flame resistant and marked as follows “Flame-Resistant, USMSHA No. _____” at intervals not exceeding 3 ft. (.9 m). Letters and numbers must be at least 1/4 in. (.6 cm) high and comply all other SAE requirements including an operating temperature of -65 °F to +250 °F (-54 °C to 121 °C). (*This number is assigned to the manufacturer after samples have passed the required tests. The number will be different for each manufacturer.) See Figure 19.

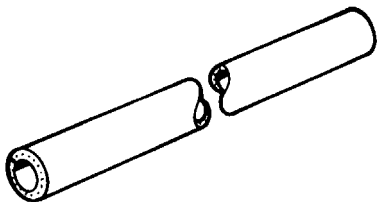


FIGURE 19

003475

▶ SEALED BURST DISC ASSEMBLY

▶ The Sealed Burst Disc Assembly, Part No. 428271, is a machined brass component containing a stainless steel burst disc inside. The disc assembly is designed to rupture when the proper expellant gas pressure is built up within the tank. The disc assembly is part of the agent tank shipping assembly. After tank discharge, the complete burst disc assembly must be removed, discarded, and replaced with a new assembly. Replacement assemblies are available in a 15 pack, Part No. 428363.

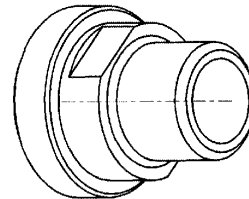


FIGURE 20

004793

▶ ENGINE SHUTDOWN DEVICE

The Ansul Engine Shutdown Device, Part No. 427425, can be used to pneumatically shut down the vehicle fuel rack by venting the hydraulic pressure through the “safety system.” This can be accomplished by installing the shutdown device in the actuation line. When the fire suppression system is actuated, the actuation pressure opens the check valve located in the shutdown device, allowing the safety system pressure to bleed into the holding tank. The drop in pressure causes the valves in the fuel rack to close, thus shutting down the engine. See Figure 21.

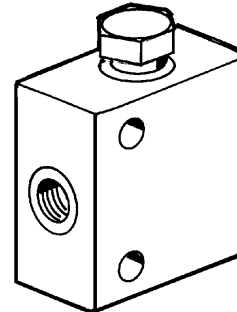


FIGURE 21

004474

CHECKFIRE ELECTRIC DETECTION AND ACTUATION SYSTEM

Three styles of electric detection and actuation systems are available: CHECKFIRE Electric Series I, CHECKFIRE Electric SC-N, and CHECKFIRE Electric MP-N*. Each electric/pneumatic system consists of detection wiring, control module, actuator with nitrogen cartridge, mounting bracket, and squib (Series I and SC-N) or gas motor (MP-N). The CHECKFIRE Electric Series I requires power from the vehicle battery where as the CHECKFIRE SC-N and MP-N contains its own internal Lithium batteries as the power source. All styles of CHECKFIRE electric* are FM Approved when consisting of all basic components.

▶ * CHECKFIRE MP-N is not FM Approved

The temperature ratings of the system are as follows:

CHECKFIRE Series I:	-40 °F to +140 °F
Manual Part No. 54894	(-40 °C to +60 °C)
CHECKFIRE Series SC-N:	-40 °F to +140 °F
Manual Part No. 79061	(-40 °C to +60 °C)
▶ CHECKFIRE Series MP-N:	+32 °F to +120 °F
▶ Manual Part No. 427310	(0 °C to +49 °C)

HAZARD ANALYSIS

- ▶ Individuals responsible for the design of an A-101/LT-A-101 system must be trained and hold a current Ansul certificate in an A-101/LT-A-101 training program. Knowledge of the fire hazards that exist in the equipment to be protected is also required. Finally, a good understanding of federal and local fire protection codes and standards is necessary. No one should begin designing without previously becoming familiar with the applicable codes.

Having read about the A-101/LT-A-101 system and the basic terminology and operation of the system, you should now begin to identify the fire hazards in the equipment to be protected. Every foreseeable hazard must be identified now while you have design flexibility; once the system is installed, adding protection for another hazard becomes more difficult. Note that the A-101/LT-A-101 system is designed only for the protection of specified equipment for the foreseeable hazards that exist due to that equipment and its operation. The areas of protection are fixed at installation and are limited in number. **An A-101/LT-A-101 system does not remove the need for a hand portable fire extinguisher on the equipment.** Fuel spills, welding (repair) heat or other unforeseeable causes may result in fires not having A-101/LT-A-101 protection. The A-101/LT-A-101 system protects the areas with high likelihood of fire and potential for high damage; seldom would an A-101/LT-A-101 system be designed to protect every square inch of the equipment to be protected.

An effective system design is based on a thorough hazard analysis. Fire is made up of heat, fuel, and oxygen. A fire hazard is any place that these three elements could be brought together. Because oxygen is always present, identifying fuel and heat sources is most critical.

- ▶ Large excavators must be considered special type hazards. See the Appendix Section for design information or contact Ansul Application Engineering Department.
- ▶ Operator safety is also a concern when designing a fire suppression system. The operator must have enough time to safely exit the vehicle. In some situations, an extended discharge dry chemical system (not FM Approved) may offer the operator the additional time he needs to get away from the burning vehicle. Consider egress time when designing the final system. See Appendix Section for extended discharge and twin agent design information.

Some common fuel sources in vehicles include flammable liquids and greases, rubber, plastics, upholstery, and environmental debris such as wood chips or coal dust.

Common vehicle heat sources are engine blocks, exhaust systems, pumps, and turbochargers, as well as bearings, gears, brakes, and electrical equipment. A potential hazard exists when a fuel comes in contact with any heat source.

Where there is dripping or leaking fuel, the hazard can become even more dangerous than initially considered. Consulting with experienced operators or owners of similar equipment can help to identify locations of previous fires and special hazards not normally considered as common hazards.

The following are typical vehicle fire hazards that require consideration:

Engine Compartment – The engine compartment contains an assortment of fluids, fuels, oils, and greases, as well as congested wires, hoses, and accumulated debris, all very near high heat sources.

Battery Compartments – Battery compartments are a potential fire hazard when combustible materials build up on the top of the battery. These materials, in the presence of moisture, can cause a short circuit.

Transmissions, Torque Converters, and Parking Brakes – All these components are a possible high heat source that could cause ignition to combustible material.

High Pressure Hoses – Hot fluid spraying from a ruptured high pressure hose, or leaking from a loose flange or fitting could find its way to a source of ignition.

Belly Pan – The belly pan can accumulate not only leaking fuel from the vehicle, but external debris, and because of its unique location, a fire starting in the belly pan could quickly engulf the entire vehicle.

Hydraulic/Fuel Pumps – Because of the high pressures involved with these pumps, fluid spraying from a leaking pump could find its way to a heat source and cause ignition.

After completing the hazard analysis, determine nozzle coverages.

NOZZLE COVERAGE AND LOCATION

The first step is to determine which nozzles are needed and where they should be placed to best protect the hazard.

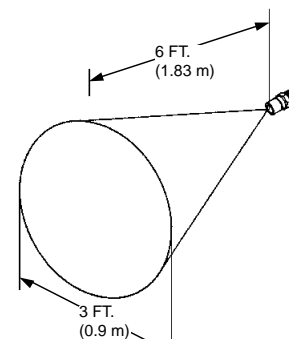
Nozzle selection can be made by first determining the size of the hazard and then comparing that to the nozzle's effective discharge pattern.

C-1/2 Nozzle Part No. 53791 – The cone-shape discharge pattern of the C-1/2 nozzle will widen to a 3 ft. (.9 m) diameter at the maximum effective discharge range of 6 ft. (1.8 m). See Figure 1.

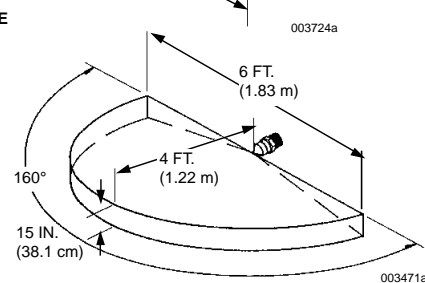
V-1/2 Nozzle Part No. 56748 – The V-1/2 nozzle creates a fan-shaped discharge pattern of 160° and has a maximum effective discharge range of 4 ft. (1219 mm) in length by 15 in. (38.1 cm) in height with a maximum width of 6 ft. (1.8 m). See Figure 1.

F-1/2 Nozzle Part No. 16449 – The F-1/2 nozzle also produces a fan-shaped discharge pattern, but with a 180° pattern at a maximum effective range of 33 in. (83.8 cm) in length by 15 in. (38.1 cm) in height with a maximum width of 5 ft. 6 in. (1.7 m). See Figure 1.

C-1/2 NOZZLE



V-1/2 NOZZLE



F-1/2 NOZZLE

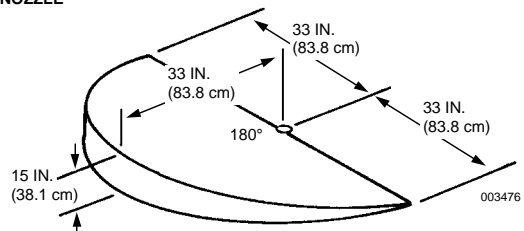


FIGURE 1

SECTION IV – SYSTEM DESIGN – VEHICLE

5-15-02 Page 4-2

REV. 1

NOZZLE COVERAGE AND LOCATION (Continued)

NOTICE

When using any of the nozzle types, make certain no obstructions interfere with the discharge pattern as it is directed to the hazard

The following rules apply to selecting nozzles and nozzle locations:

- When choosing the proper nozzle, remember the entire hazard area must be within the nozzle's pattern and maximum effective discharge range.
- The narrow pattern and longer discharge range of the C-1/2 nozzle make it a good selection for protecting small areas or hazards that are distant from the nozzle mounting location.
- Larger hazard areas may require the use of V-1/2 or F-1/2 nozzles.
- Some areas may exceed the area coverage of one nozzle and may require an additional nozzle(s) for protection.
- In some cases, a single nozzle can cover more than one area of a common hazard such as a transmission and torque converter. **NOTE:** Both areas must be within the discharge pattern of the nozzle.
- When planning nozzle locations, make certain the effective flow of dry chemical to all recognized hazard areas will not be obstructed.
- If obstructions cannot be avoided, an additional nozzle(s) may be needed to provide proper coverage.
- In areas where the environment may cause extreme build up of materials, such as wood debris, coal dust, garbage, or oil, it is always a good idea to use the largest system tank available and keep the nozzles per tank to a **maximum of four**. This allows the maximum amount of chemical per nozzle and gives the longest discharge time (excluding two nozzle systems).
- Never settle for less than full coverage of each fire hazard.

After establishing nozzle locations and number required, the type and quantity of A-101/LT-A-101 tanks can be determined.

TANK QUANTITY REQUIREMENTS

First consider the type of environment the vehicle will be operating in and its temperatures. This will determine the type of tank to choose.

- ▶ A-101/LT-A-101 systems are available in the standard model A-101 which has a temperature range of +32 °F +120 °F (0 °C to +49 °C) and are generally used on sub-surface mining equipment.

Also available is the extreme temperature model LT-A-101 which has a temperature range of –65 °F to +210 °F (–54 °C to +99 °C) and is typically used on above surface vehicles.

Knowing the number of nozzles required, next determine the type or size of tank(s) required. The following "System Selection Chart" will point out the various options.

System Selection Chart

Model Capacity	Nozzle Quantity	Effective Discharge Time	Agent per Nozzle
10	2	8.5 sec.	4 1/4 lb. (1.9 kg)
20	4	8.5 sec.	4 1/4 lb. (1.9 kg)
20	6	5.7 sec.	2 7/8 lb. (1.3 kg)
30	4	12.5 sec.	6 1/4 lb. (2.8 kg)
30	6	8.3 sec.	4 1/8 lb. (1.9 kg)

Nozzle quantities, discharge times and amount of agent per nozzle are all factors to consider in determining the proper tank size.

Keep in mind, a longer discharge time and a greater amount of agent discharge per nozzle will offer better hazard protection.

It is always best to choose the largest size tank available, but if space is a problem, choose a smaller tank or choose the low profile version.

When the number of tanks have been determined based on the number of nozzles for total protection, the next step in the design process is to determine the distribution hose network required.

DISTRIBUTION SYSTEM REQUIREMENTS

After the tank(s) and nozzle(s) location(s) have been determined, it is necessary to sketch the hose routings to each nozzle to make certain they can be run without interfering with vehicle components and that the length of the supply line(s) and branch line(s) are not exceeded.

Hose Specifications

- ▶ To ensure proper performance of the Ansul A-101/LT-A-101 system, the hose used must meet either SAE 100 R5 or 100 R1 hose specifications as a **minimum**. The hose must have an operating temperature of –40 °F to +200 °F (–40 °C to +93 °C). The following list of appropriate standards is for reference.

SAE Selection, Installation, and Maintenance of Hose and Hose Assemblies	J1273 (latest revision)
SAE Hydraulic Hose Fitting Standard	J516 (latest revision)
SAE Hydraulic Hose Standard	J517 (latest revision)
SAE Test and Procedures For SAE 100R Series Hydraulic Hose and Hose Assembly Standard	J343 (latest revision)

For underground mining applications, hose must comply with USBM specified flame resistance acceptance and all applicable SAE requirements.

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Listed below is a partial list of hose manufacturers who manufacture hose that meets the required SAE specification noted on Page 4-2:

Aeroquip	Parker
Dayco	Swagelok
Gates	Weatherhead
Goodyear	

Critical Specifications from SAE J517 are listed below for reference:

SAE 100R1 Hose

Size	Hose ID	Maximum Operating Pressure	Minimum Burst Pressure	Minimum Bend Radius
1/4 in.	.250 in. +.023 -.008	2750 psi	11000 psi	4.0 in.
1/2 in.	.500 in. +.031 -.015	2000 psi	8000 psi	7.0 in.
3/4 in.	.750 in. +.031 -.015	1250 psi	5000 psi	9.5 in.
7/8 in.	.875 in. +.031 -.015	1250 psi	5000 psi	11.0 in.

SAE 100R5 Hose

1/4 in.	.250 in. +.031 -.000	3000 psi	12000 psi	3.4 in.
1/2 in.	.500 in. +.039 -.000	1750 psi	7000 psi	5.5 in.
3/4 in.	—	—	—	—
7/8 in.	.875 in. +.042 -.000	800 psi	3200 psi	7.4 in.

Hydraulic Hose Couplings

Before connecting a hydraulic hose to the A-101/LT-A-101 fire suppression system, it must first be assembled utilizing a hose coupling attached to each end of the hose. Hose couplings installed on hydraulic hose can be the permanent crimp-on type or the reusable type. Female or male swivel hose couplings of either the crimp-on type or the reusable type are also acceptable. All couplings used with SAE 100R1 or SAE 100R5 hydraulic hose must be suitable for the hose chosen and must comply with Hydraulic Hose Fitting Standard J516 as a minimum.

When attaching a hose coupling to a hose, it is very important to follow all manufacturer's installation instructions. SAE J1273, Selection, Installation, and Maintenance of Hose and Hose Assemblies, paragraph 3.2, requires that the manufacturer's assembly instructions be followed.

NOTICE

SAE J1273, paragraph 2.10, Proper End Fitting, states that, "Care must be taken to insure proper compatibility exists between the hose and coupling selected based on the manufacturer's recommendations substantiated by testing to industry standards such as SAE J517."

Under no circumstances should hose and couplings from different manufacturers be interchanged.

Many hose manufacturers require only the couplings that they supply to be used with their hose. One manufacturer warns that they "will not be responsible when interchanging their hose and/or couplings with hose and/or couplings of any other manufacturer."

Permanent Crimp-on Hose Couplings

A permanent crimp-on hose coupling is installed as a one-piece assembly attached to the hose end and crimped on. The crimp is to be made following the manufacturer's requirements for proper hose and coupling assembly, using a machine that will hydraulically or electrically crimp the coupling permanently to the hose end.

When using permanent crimp-on type couplings, lubricate the hose end, if necessary, and push the hose end all the way into the fitting in accordance with hose and hose coupling assembly instructions. Then place the hose end in the appropriate crimping machine and crimp the coupling. Follow all hose crimping machine operating instructions using equipment specified by the hose/coupling manufacturer.

Reusable Hose Couplings

Reusable hose couplings can be attached to new hose in the field with no other tools than a wrench and a vise (or two wrenches). When reusable hose couplings are used, make certain the corresponding couplings and the assembly procedures used are in accordance with the manufacturer's specifications. **Failure to follow the manufacturer's instructions in their entirety may result in plugged nozzle orifices at system discharge due to chips and pieces of rubber cut from the inside of the hose during improper assembly.**

Reusable hose couplings include a coupling shell that fits over the end of the hydraulic hose and a coupling insert that installs inside the end of the hose and mates with the coupling shell threads. A mandrel tool may be required when using 1/4 in. through 1/2 in. SAE 100R5 hose to facilitate installation of the coupling insert.

To attach a reusable coupling to the hose, clamp the coupling shell in a vise and turn the end of the hydraulic hose counter-clockwise into the coupling shell until the end is seated against the bottom of the shell. Then, back off 1/4 to 1/2 turn to allow for expansion.

NOTE: Some-rubber covered hydraulic hose ends must be skived (stripped of the rubber cover) before attaching the coupling. Refer to the appropriate manufacturer's instructions.

Lubricate the hose, coupling insert, and mandrel tool (when required) in accordance with manufacturer's instructions and screw the insert clockwise into the coupling shell and hose. Wrench tighten the insert until the hex on the insert contacts the shell. If a female swivel end is being used, use the appropriate assembly tool and leave approximately 1/32 in. to 1/16 in. (.8 to 1.6 mm) clearance between the nut and the shell to allow the nut to swivel.

NOTE: It is important to lubricate only those surfaces specified by the manufacturer of the hose and coupling used. The lubricant will minimize the risk of cutting or shaving the inside of the hose. **Failure to use the proper lubricant or follow the appropriate lubrication instructions may result in pieces of hose plugging the gas tube in the agent storage tank or plugging a discharge nozzle orifice. Improper lubricant or lubrication procedures may also result in contamination of the hose due to the use of an incompatible lubricant.**

After attaching hose couplings to the hose, make certain that the hose is clean, dry and oil free. Use a solvent that is compatible with the hose, such as Stoddard Fluid or Varsol, to dissolve any oil remaining in the hose. Using dry air or nitrogen, blow out each hose length until dry and clear of metal or rubber shavings and any foreign matter before making any connections to the A-101 system.

SECTION IV – SYSTEM DESIGN – VEHICLE

► DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

JIC Hose Fittings and 150 lb. Fittings

JIC hose fittings meeting Hydraulic Hose Fitting Standard J516 can be used in most applications. When using JIC hose fittings as elbows, use only elbows that have a radiused bend. 150 lb. NPT elbows and tees can also be used to assemble hose or pipe and attach hose or pipe to the discharge nozzles. Make certain that all elbows used in the agent distribution line, are of the same type (i.e., either all JIC or all 150 lb. NPT elbows). Refer to the Installation Section for maximum and minimum elbow requirements.

NOTE: When figuring the maximum and minimum amount of elbows in the A-101/LT-A-101 system, two (2) 45° fittings can be counted as one 90° fitting.

Heat Resistant Fire Jacket for Hydraulic Hose (Non-FM Approved)

All hose assemblies, including actuation lines, expellant gas lines, and agent distribution hose that will be normally exposed to or located in areas with temperatures exceeding 200 °F (93 °C), should be sleeved with an extreme temperature heat-resistant fire jacket. (Do not route actuation hose through fire hazard areas. If this cannot be avoided, the hose must be fire jacketed.) Information concerning fire jacketing should be available through your local hose supplier. If not, Bentley Harris manufactures a fire jacket that will withstand continuous operating temperatures from -65 °F to 500 °F (-54 °C to 260 °C) and short term exposures up to 2000 °F (1093 °C). For a listing of distributors in your area, call Bentley Harris at either 610-363-2600 or, 800-321-2295.

Dry Chemical Flow Characteristics

The assembly of piping (hose) for a dry chemical system probably lends itself to the greatest chance for error when installing the system. Dry chemical-gas mixtures do not flow like liquids, and, as a result, certain basic rules must be followed to assure correct dry chemical distribution to the nozzles.

In order to obtain equal distribution at a tee, the dry chemical must enter the center opening (bull) of the tee and exist the two side opening which are 180° apart. See Figure 2.

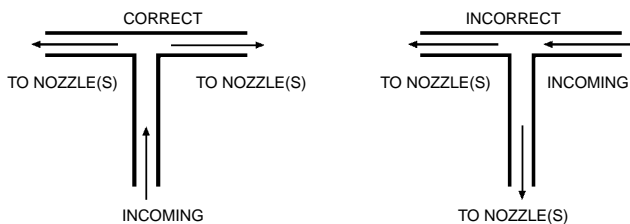
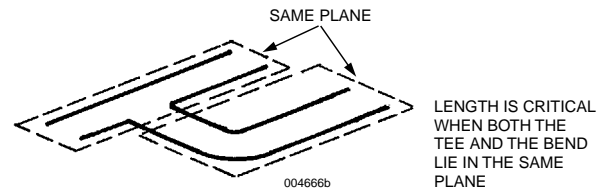
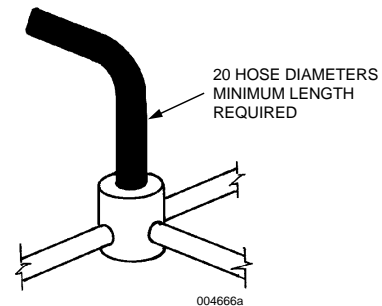
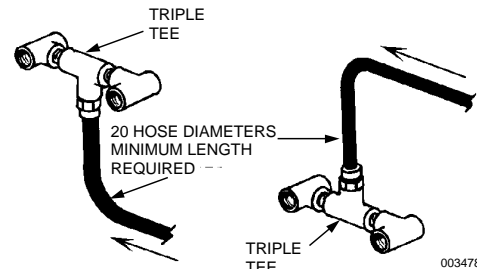
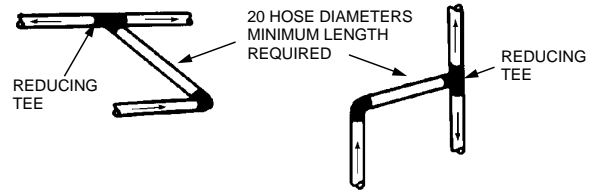


FIGURE 2
003477

When dry chemical makes a change of direction through an elbow, a tee, or a hose bend, a separation of the dry chemical and gas mixture occurs. If a tee follows this change of direction where separation can occur, and if this tee lies in the same plane as the change in direction through an elbow, tee, or hose bend, more dry chemical will discharge through one of the tee outlets and more gas will discharge out the other tee outlet. A certain minimum length of hose must be allowed from the bend (elbow) to the tee or from the first tee to the second tee in order to permit the dry chemical and gas to intermix before striking the tee. The minimum length required is equal to 20 hose diameters. 18 in. (457 mm) is required for 7/8 in. hose, 15 in. (381 mm) is required for 3/4 in. hose, and 10 in. (254 mm) is required for 1/2 in. hose.

► See Figure 3.

NOTE: When using the distribution tee, Part No. 25031, a minimum length of 15 in. (381 mm) of 3/4 in. or 18 in. (457 mm) of 7/8 in. hose, will always be required between any bend or elbow and the distribution tee.



IF LESS THAN 20 HOSE DIAMETERS, DRY CHEMICAL WILL FLOW TO THE OUTSIDE, EXPELLANT GAS WILL FLOW TO INSIDE

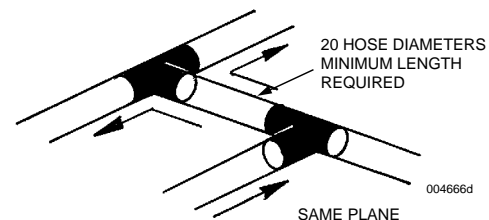
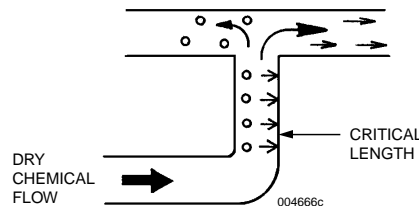


FIGURE 3

► DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Dry Chemical Flow Characteristics (Continued)

If a tee follows a change in direction through an elbow, another tee, or a hose bend and the directional change is in a plane that is perpendicular to the plane of the tee following, the dry chemical particles and gas will strike the rear of the tee before branching, intermixing of the dry chemical and gas will occur through turbulence and the length of hose from the bend (elbow) or tee preceding it is not critical. See Figure 4.

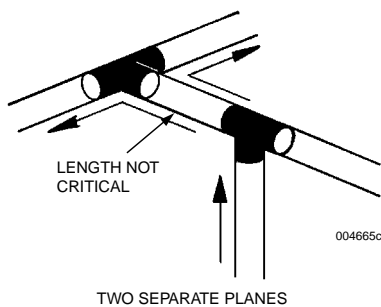
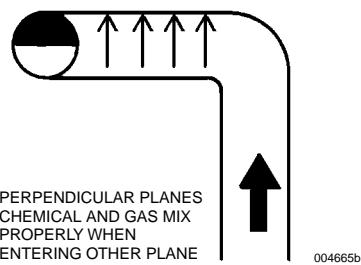
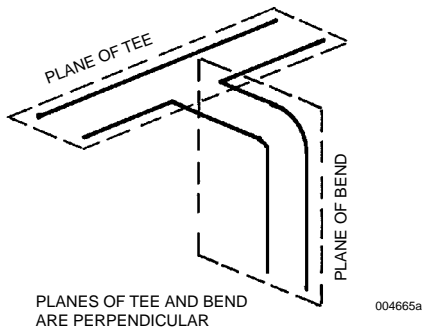
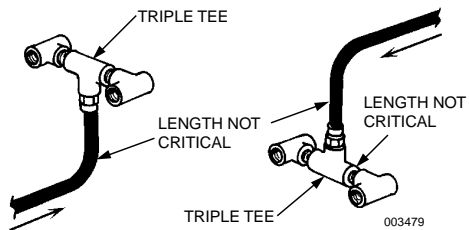
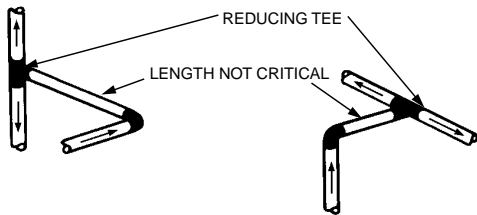


FIGURE 4

GENERAL INFORMATION

5-15-02 Page 4-6

REV. 1

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements

Supply and branch lines for the A-101/LT-A-101 system are defined as follows:

TWO NOZZLE SYSTEM – Two nozzle systems consist of a 3/4 in. or 7/8 in. supply line, a 3/4 in. x 1/2 in. x 1/2 in. reducing tee, and 1/2 in. branch lines each connected to one nozzle. See Figure 5.

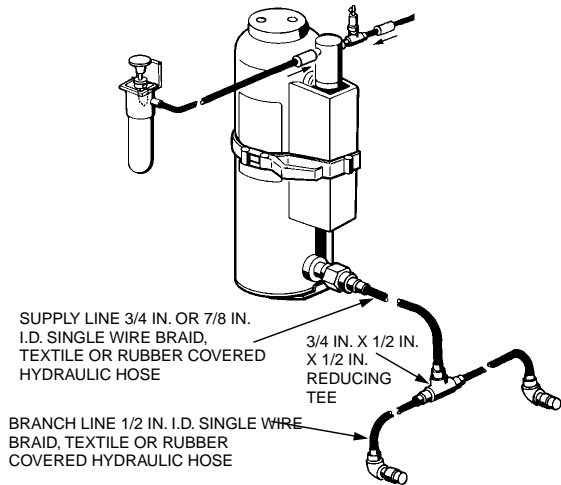


FIGURE 5
003480

FOUR NOZZLE SYSTEM – Four nozzle systems are divided into two types: Four nozzle triple tee arrangement and four nozzle split tee arrangement. Four nozzle triple tee systems consist of a 3/4 in. or 7/8 in. supply line into a triple tee assembly consisting of a 1/2 in. x 1/2 in. x 3/4 in. reducing tee, two close nipples, and two 1/2 in. tees. The primary branch line is the close nipple that connects the 1/2 in. tee to the reducing tee. Four separate secondary branch lines are run from the 1/2 in. tee outlets each connected to one nozzle. See Figure 6.

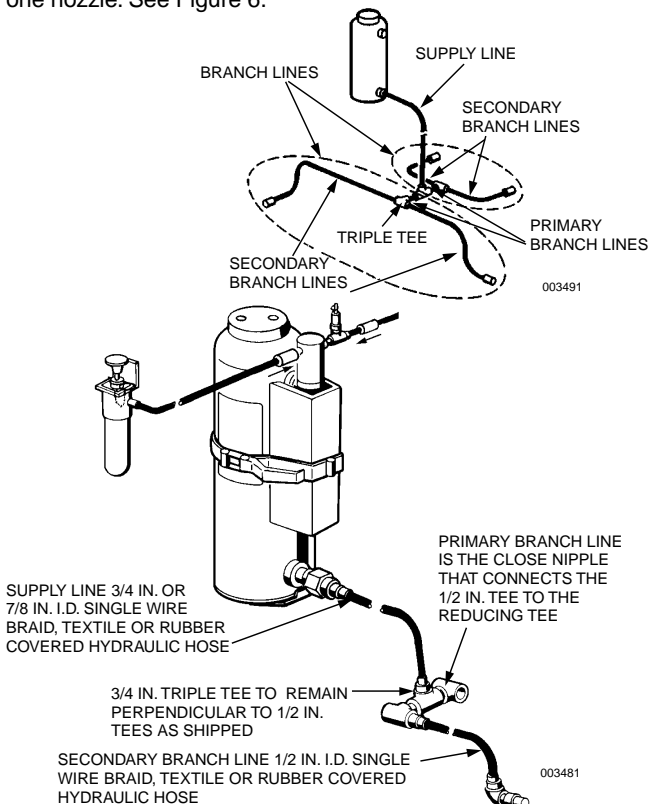


FIGURE 6

The four nozzle split tee arrangement consists of a 3/4 in. or 7/8 in. supply line, a 1/2 in. x 1/2 in. x 3/4 in. reducing tee, two 1/2 in. primary branch lines, two 1/2 in. tees, and four 1/2 in. secondary branch lines each connected to one nozzle. See Figure 7.

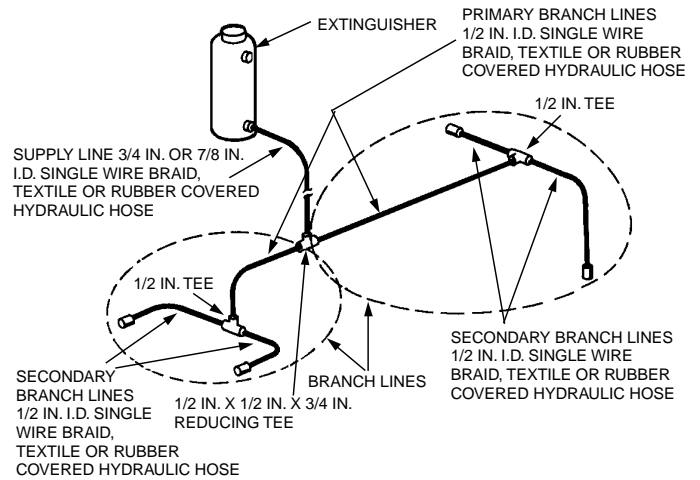


FIGURE 7
003482

NOTE: On split tee arrangements, if the 1/2 in. secondary branch line tee is not more than 20 hose diameters from the 1/2 x 1/2 x 3/4 in. primary branch line tee, then the orientation of the tees must be perpendicular to each other as they are in a triple tee arrangement.

SIX NOZZLE SYSTEM – Six nozzle systems consist of a 3/4 in. or 7/8 in. supply line, a special three outlet distribution tee, three 1/2 in. primary branch lines, three 1/2 in. tees, and six secondary branch lines each connected to one nozzle. See Figure 8.

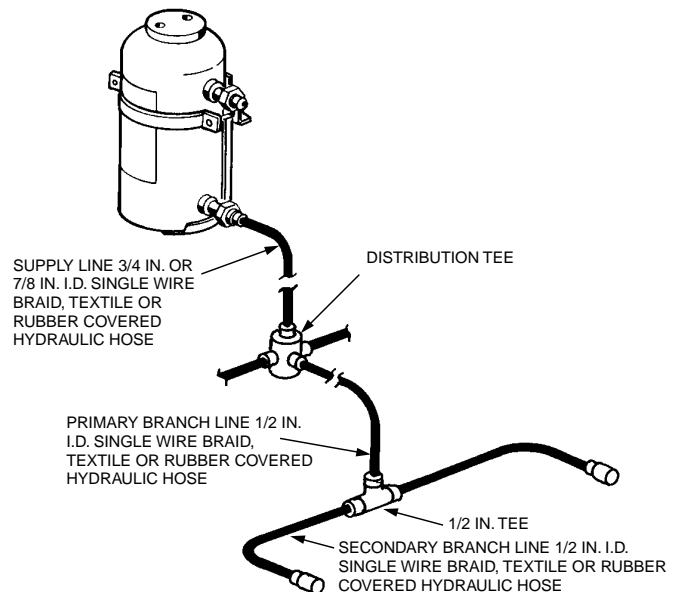


FIGURE 8
003483

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

Depending upon the hazards to be protected and the placement of the system components, a selection can be made from several balanced and unbalanced distribution network arrangements:

- A balanced system must be a distribution network where the linear length of the primary branch line on one side of the primary tee to the secondary tee must be within 10% of the linear length of the other primary branch line from the primary tee to the secondary tee. Also, the linear length of the secondary branch line on one side of the secondary tee must be within 10% of the linear length of the other secondary branch line sharing the same tee. A balanced system can be used with two, four, or six nozzle systems. See Figure 9A.

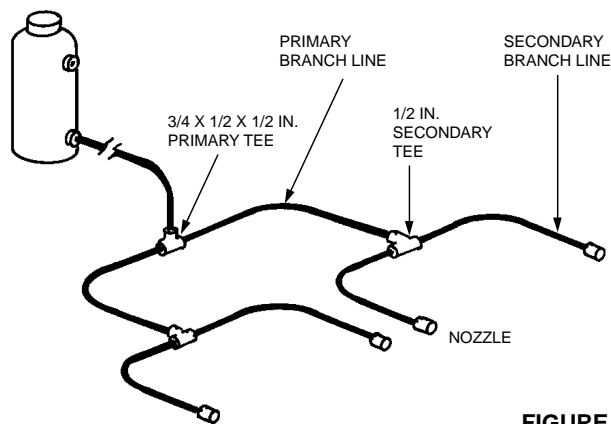


FIGURE 9A
003484

- In an unbalanced system, the longest branch line must be no longer in length than 3 times that of the shortest branch line, with a maximum of 18 ft. total (primary plus two secondary branches). See Figure 9B.

6 NOZZLE UNBALANCED DISTRIBUTION TEE

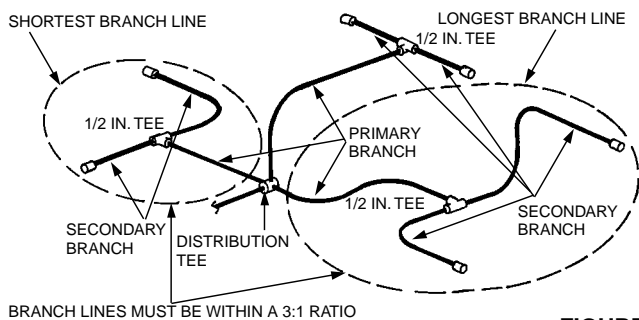


FIGURE 9B
003485

- Unbalanced secondary branch line lengths must also be within a 3 to 1 ratio when they are located in the same branch line. See Figure 9C.

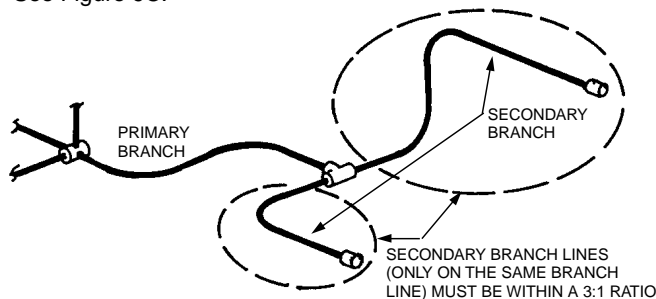


FIGURE 9C
003486

- The ten pound system must be a balanced system having two branch lines within 10% of each other, utilizing one reducing tee and a maximum of two nozzles. See Figure 9D.

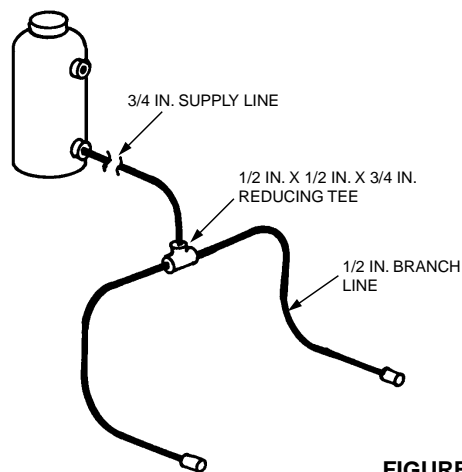


FIGURE 9D
003487

- The twenty and thirty pound systems can be either balanced or unbalanced systems, and can be arranged utilizing three different network combinations. These include the triple tee arrangement which utilizes the triple tee and four nozzles (See Figure 9E), the split tee arrangement utilizing one 3/4 in. x 1/2 in. x 1/2 in. reducing tee, two 1/2 in. tees, and four nozzles (See Figure 9F), and the distribution tee arrangement which utilizes a distribution tee, three 1/2 in. tees, and six nozzles (See Figure 9G).

4 NOZZLE UNBALANCED TRIPLE TEE

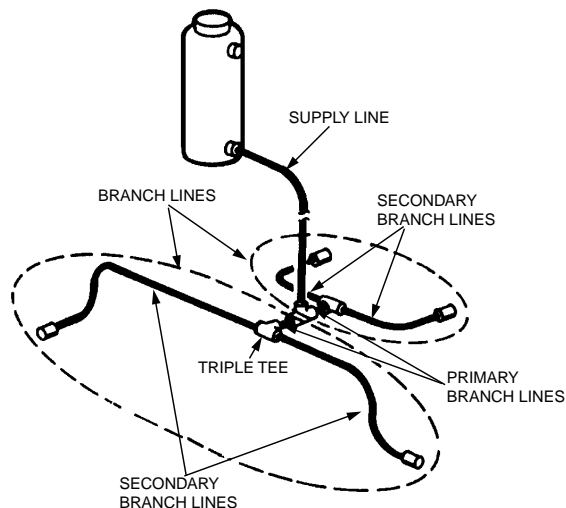


FIGURE 9E
003491

SECTION IV – SYSTEM DESIGN – VEHICLE

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

4 NOZZLE UNBALANCED SPLIT TEE

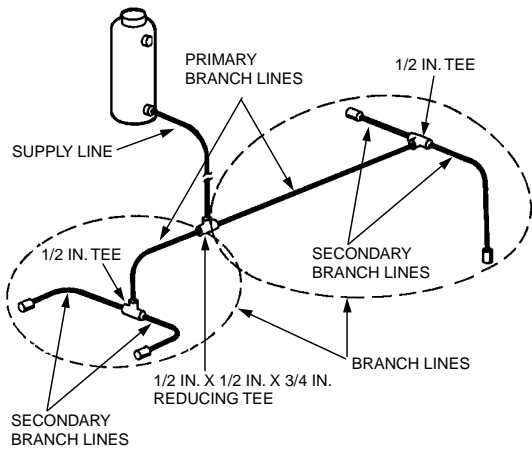


FIGURE 9F
003482

6 NOZZLE UNBALANCED DISTRIBUTION TEE

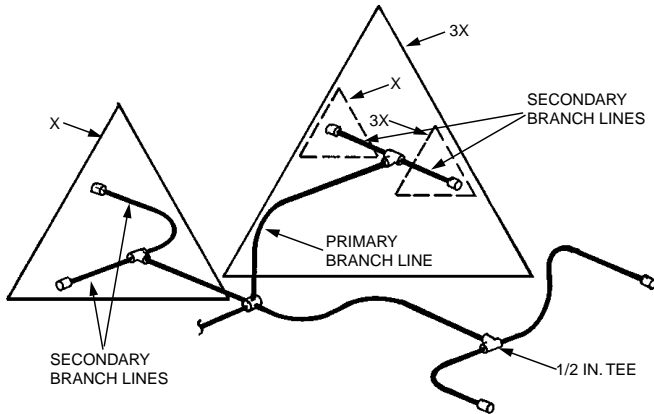


FIGURE 9G
003490

10 lb. 2 Nozzle Balanced System With Reducing Tee
See Figure 10 and 10A.

- Maximum supply line length from extinguisher to reducing tee is 30 ft. 0 in. (9.1 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% different in length from reducing tee to nozzle on one line compared to the same distance between reducing tee to nozzle on the other line.

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

2 NOZZLE BALANCED WITH REDUCING TEE – 10 LB. SYSTEM

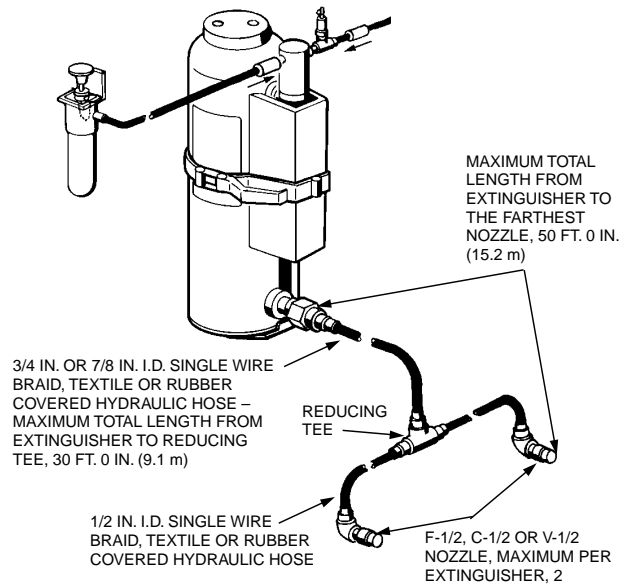


FIGURE 10
003480

EXAMPLES OF TYPICAL 2 NOZZLE SYSTEMS

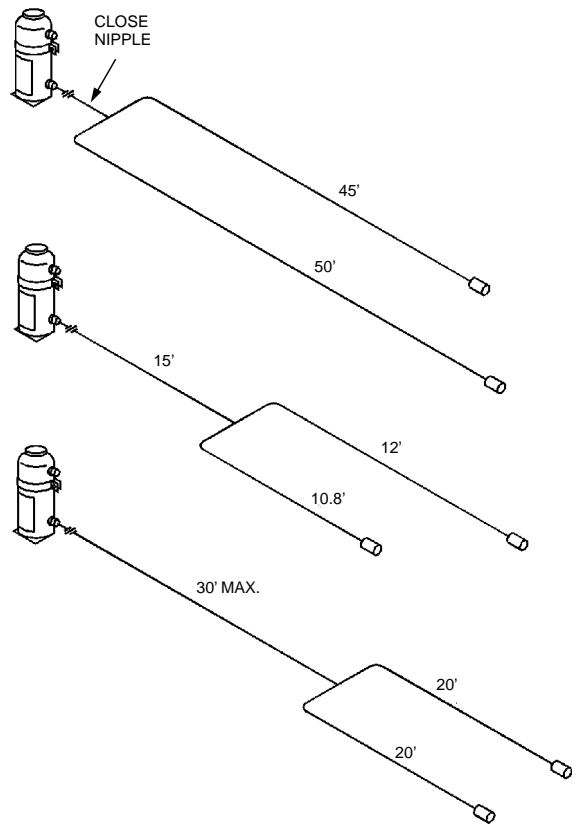


FIGURE 10A
003492

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

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 reducing 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

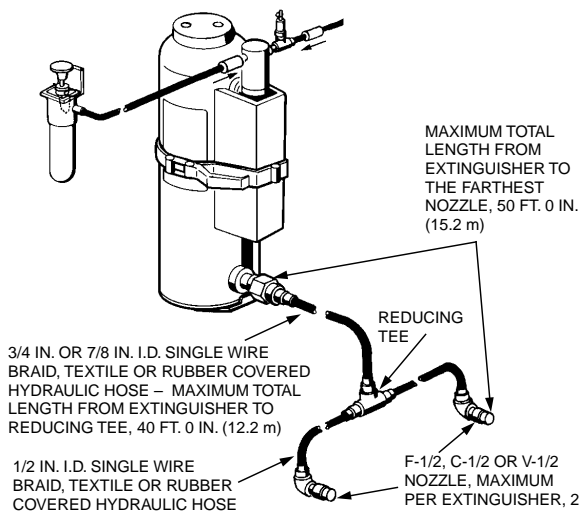


FIGURE 11
003480

EXAMPLES OF TYPICAL 2 NOZZLE SYSTEMS

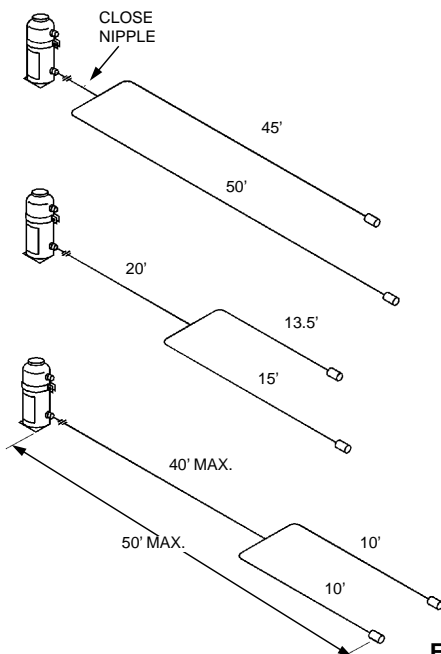


FIGURE 11A
003494

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

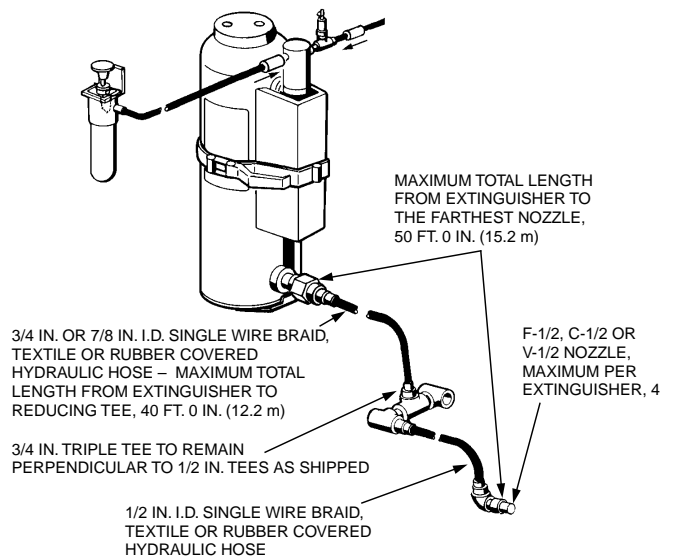


FIGURE 12
003481

EXAMPLES OF TYPICAL 4 NOZZLE SYSTEMS

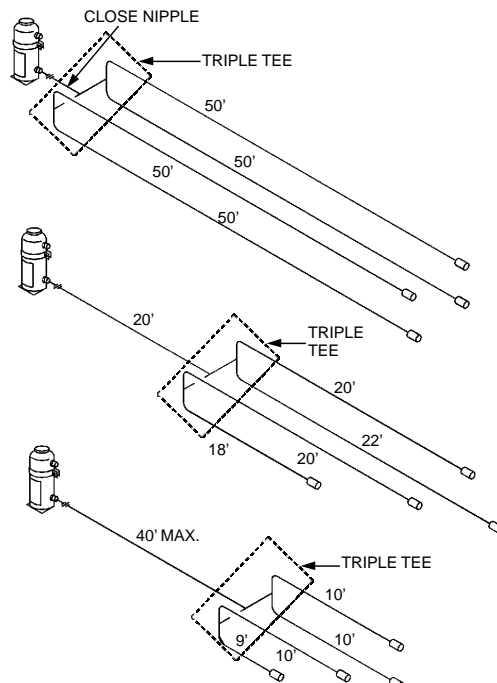


FIGURE 12A
003496

SECTION IV – SYSTEM DESIGN – VEHICLE

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

20, 30 lb. 4 Nozzle Unbalance System With Triple Tee
See Figure 13 and 13A.

- Maximum supply line length from extinguisher to the triple tee is 40 ft. 0 in. (12.2 m).
- The longest branch line (including one primary and two secondary) is 18 ft. 0 in. (5.5 m) and must not exceed a 3:1 ratio of any other branch line(s).
- The triple tee assembled using close nipples. It must remain in the configuration as shown in Figure 13.
- Any combination of F-1/2, C-1/2, or V-1/2 nozzles are acceptable. Four (4) nozzles maximum.
- Secondary branch lines located on the same branch line (sharing the same tee) must not exceed a 3:1 ratio between each other but are not required to be within a 3:1 ratio with secondary branch line located on other branch lines.

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

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

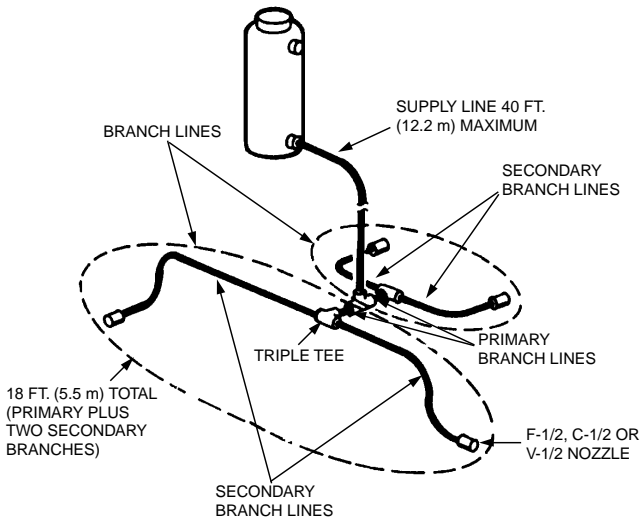
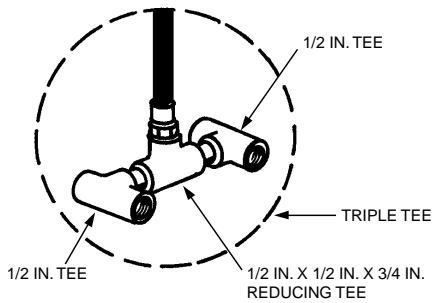


FIGURE 13
003497

EXAMPLES OF TYPICAL 4 NOZZLE SYSTEMS

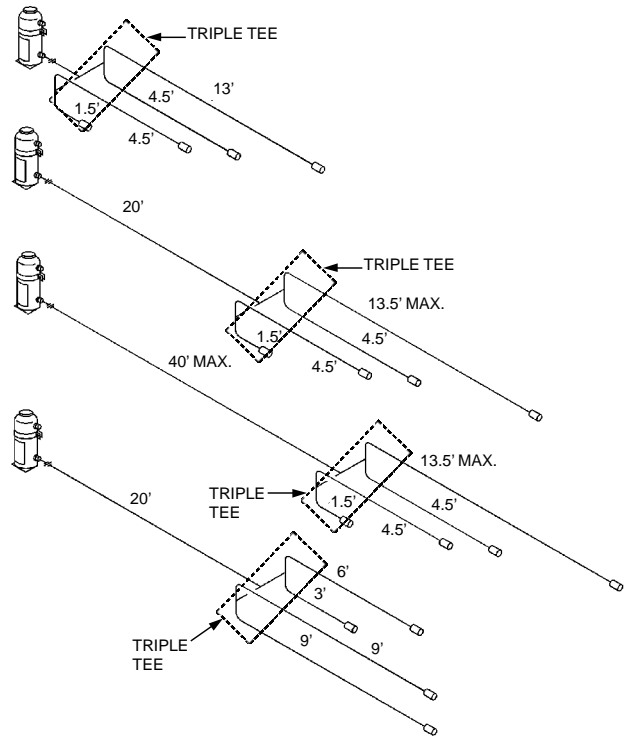


FIGURE 13A
003498

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

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

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

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

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

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

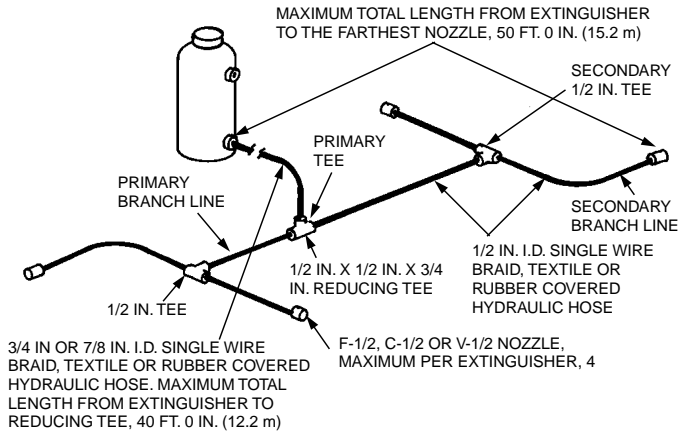
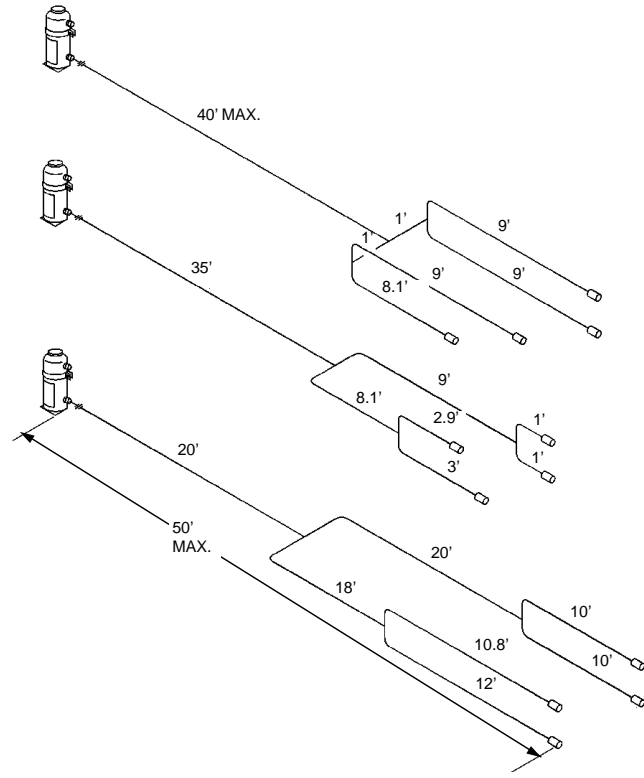


FIGURE 14
003499

EXAMPLES OF TYPICAL 4 NOZZLE SYSTEMS



EXAMPLES OF TYPICAL 4 NOZZLE SYSTEMS

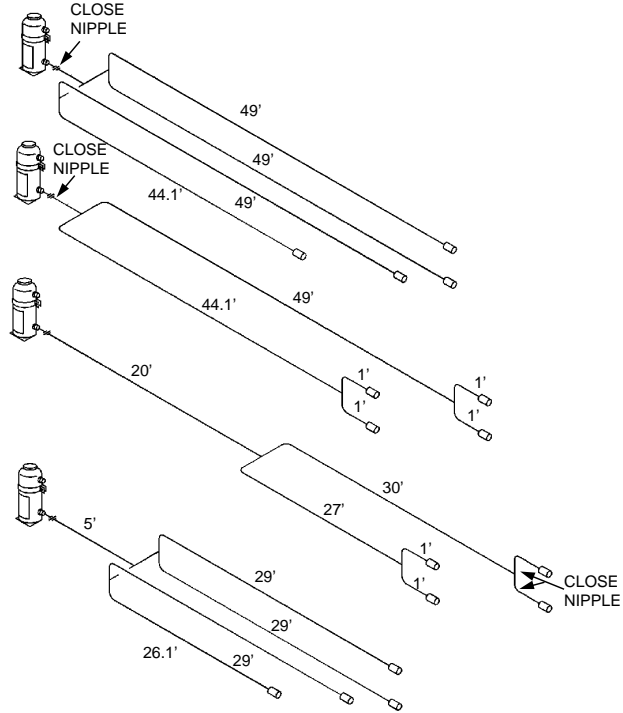


FIGURE 14A
003500

SECTION IV – SYSTEM DESIGN – VEHICLE

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

20, 30 lb. 4 Nozzle and 6 Nozzle Unbalanced System With Reducing Tee

See Figures 15 and 15A, 16 and 16A.

- Maximum supply line length from extinguisher to the reducing tee is 40 ft. 0 in. (12.2 m).
 - The longest branch line (including one primary plus two secondary) length is 18 ft. 0 in. (5.5 m) and must not exceed a 3:1 ratio of any other branch line(s).
 - Two secondary branch lines located on the same branch line (sharing the same tee) must not exceed a 3:1 ratio between other but are not required to be within a 3:1 ratio with secondary branch lines located on other branch line.
 - Any combination of F-1/2, C-1/2, or V-1/2 nozzles are acceptable. Four (4) nozzles maximum.
- NOTE:** See Page 6-5 for fitting and bend limitations.

4 NOZZLE UNBALANCED WITH TEE REDUCING

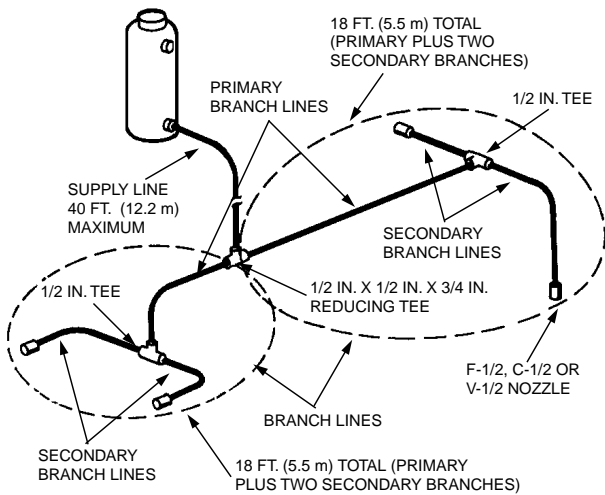


FIGURE 15
003482

EXAMPLE OF TYPICAL 4 NOZZLE SYSTEMS

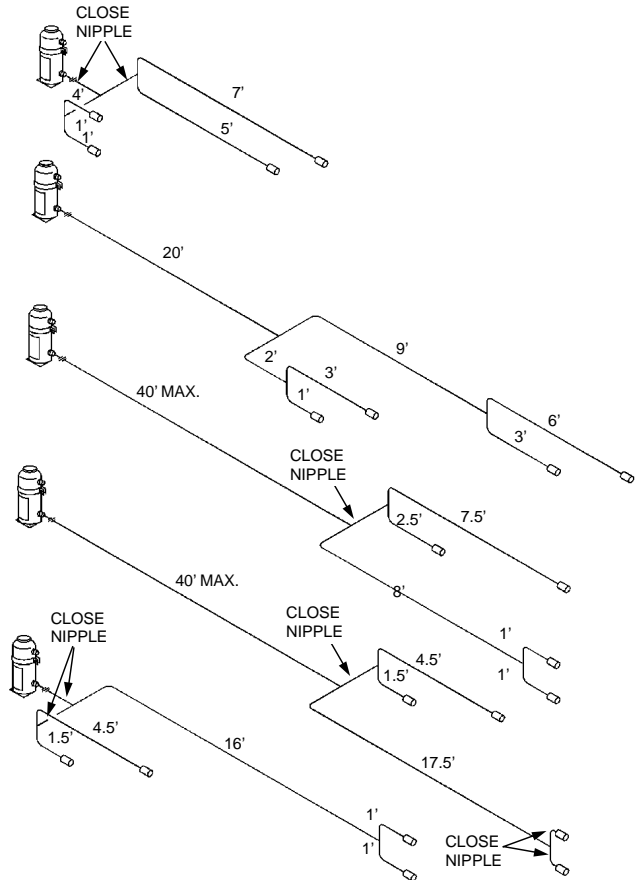


FIGURE 15A
003502

DISTRIBUTION SYSTEM REQUIREMENTS (Continued)

Supply and Branch Line Requirements (Continued)

20, 30 lb. 6 Nozzle Unbalanced System With Distribution Tee
See Figure 16 and 16A.

6 NOZZLE UNBALANCED WITH DISTRIBUTION TEE – 20 LB.-30 LB. SYSTEMS

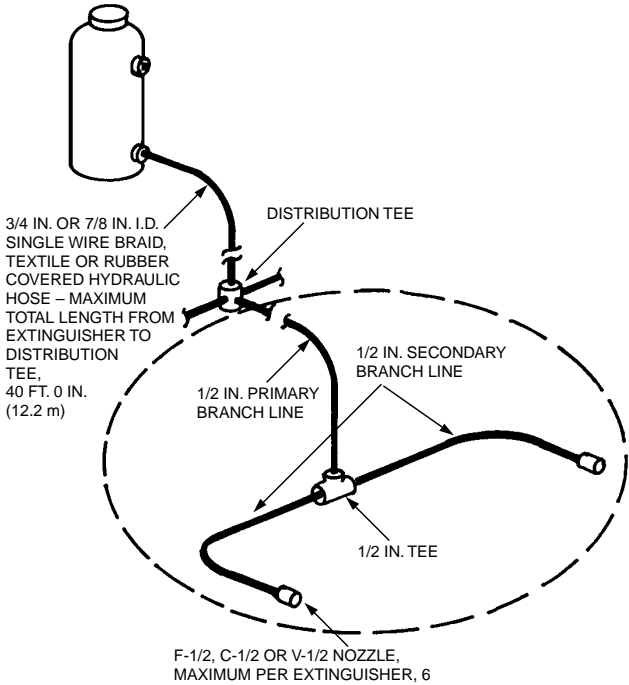


FIGURE 16
003503

EXAMPLE OF TYPICAL 6 NOZZLE SYSTEMS

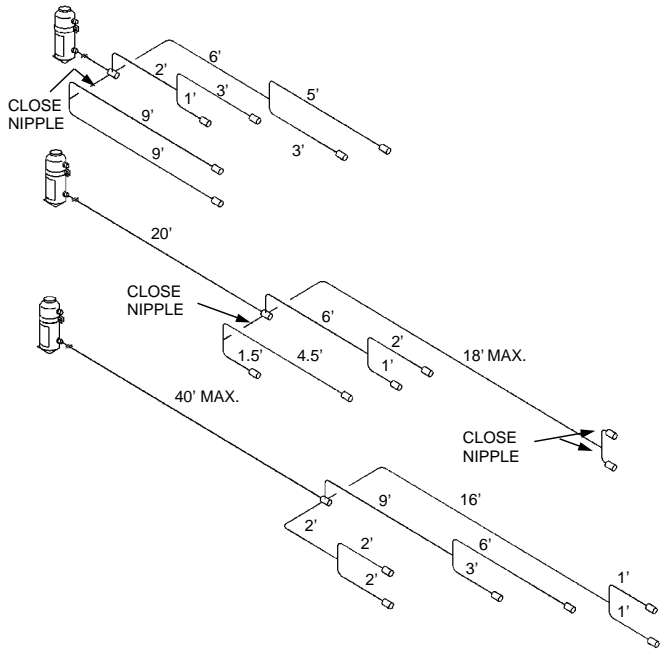


FIGURE 16A
003504

SECTION IV – SYSTEM DESIGN – VEHICLE

5-15-02 Page 4-14

REV. 1

ACTUATION AND EXPELLANT GAS LINE REQUIREMENTS

Actuation Gas Line

The actuation gas line is the line from the manual remote actuators and/or the gas cartridge on the automatic detection system to the gas cartridge actuator located on the last A-101/LT-A-101 tank or the gas cartridge actuator for the last LT or LP style tanks. The maximum number of actuators that can be actuated from a single actuator cartridge is ten (10). The actuation line can be a maximum of 100 ft. (30.5 m) when using an LT-10 cartridge. When more than one actuation cartridge is in the system, a 1/4 in. check valve, Part No. 25627, must be installed to prevent the lose of actuation gas from an actuator that may have a cartridge removed. See Figure 17.

NOTE 1: If only eight (8) or less actuators are used, the actuation line can be extended to 125 ft. (38.1 m).

NOTE 2: The actuation line can also utilize an LT-5 cartridge. When this is done, only eight (8) actuators or less can be used, with a maximum length of 75 ft. (22.9 m).

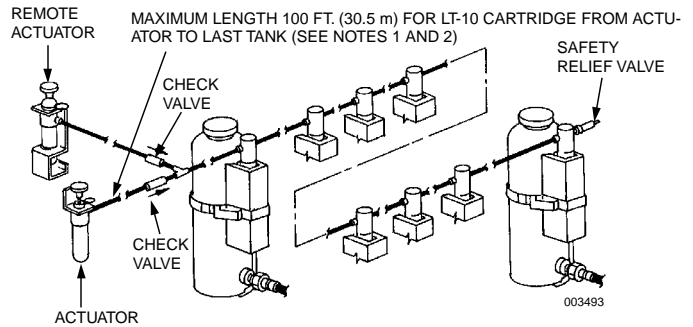
If more than one actuator is in the system, the total length of actuation line allowed from the actuator to the last tank must also include any amount of hose in the other actuation lines up to the check valves located in those lines.

The hose for the actuation system must meet the same specifications as the hose used for the dry chemical distribution network. See Pages 4-2 and 4-3 for hose and fitting specifications.

Expellant Gas Line

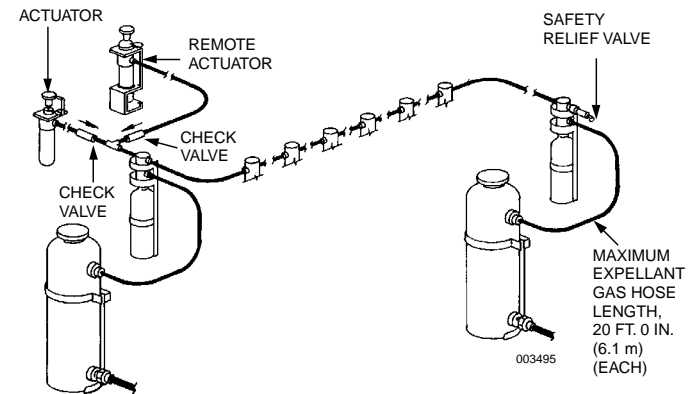
The expellant gas line is the length of 1/4 in. hose located between the remote expellant gas cartridge (required for LT and LP style tanks), and the expellant gas inlet on the tank. The maximum length of this line is 20 ft. (6.1 m). See Figure 17.

A-101 SYSTEM



NOTE: A MAXIMUM OF (10) TEN A-101/LT-A-101 SYSTEMS CAN BE ACTUATED SIMULTANEOUSLY IN ANY COMBINATION (I.E., A-101, LT-A-101, LP-A-101, OR LT-LP-A-101) (SEE NOTES 1 AND 2)

LT-A-101 SYSTEM



NOTE: REDUCE THE MAXIMUM ALLOWABLE NUMBER OF BASIC EXTINGUISHING UNITS BY ONE FOR EACH NON-EXTINGUISHING PNEUMATICALLY OPERATED DEVICE EMPLOYED, I.E., BRAKE CONTROL VALVE, FUEL CONTROL AIR CYLINDER.

FIGURE 17

The hose for the expellant gas line must meet the same specifications as the hose used for the dry chemical distribution network. See Pages 4-3 through 4-4 for hose and fitting specifications.

DETECTION SYSTEM REQUIREMENTS

Several types of automatic detection is available for use with the A-101 Fire Suppression System. Three types of electric detection and one type of pneumatic.

See the following Installation Manuals for detailed information on each type of system:

- CHECKFIRE MP-N ELECTRIC SYSTEM – Manual Part No. 427310
- CHECKFIRE SC-N ELECTRIC SYSTEM – Manual Part No. 423522
- CHECKFIRE ELECTRIC SERIES I SYSTEM – Manual Part No. 54894

SHUTDOWN REQUIREMENTS

When protecting any vehicle, especially vehicles with large amounts of hydraulic fluid and fuel on board, the engine must be shut down and hydraulic pumps shut off and lines depressurized. To accomplish this, it is necessary to wire the shutdown of these devices into the CHECKFIRE SC-N Module shutdown relay contacts. A brief description of how this is accomplished is as follows:

Engine Shutdown – Engine shutdown can be accomplished through a normally energized fuel solenoid (supplied by others) which is wired in series with the normally closed “shutdown” relay contacts of the CHECKFIRE SC-N Control Module or in a pressure switch. These “shutdown” relay contacts will operate (open) after the first time delay cycle is complete on the module.

Hydraulic Fluid Tank Air Shut Off and Venting – Solenoid valves (supplied by others) can be connected to air vents of the hydraulic tank. They can be wired to N.O. contacts on a relay (supplied by others). A solenoid (supplied by others), connected to the air supply line, if used, going to the hydraulic tank, can be wired to N.C. contracts of the same relay. The coil to the relay is

wired in series with N.C. pressure switch contacts. The pressure switch is connected to the pneumatic actuation line of the dry chemical system. The relay coil is normally energized. When the pressure switch is activated by pressure in the actuation line, the switch contacts will open. Loss of power or an open circuit will cause the solenoid valves to transfer, thus shutting down the air supply.

Another means available for fuel shutdown is to pneumatically shutdown the fuel rack by venting the hydraulic pressure through the “safety system.” This can be accomplished by installing the Ansul Engine Shutdown Device, Part No. 427425, in the dry chemical system actuation line. (This is normally only an option on some underground mining applications.) When the Ansul fire suppression system is actuated, the actuation pressure opens the check valve located in the engine shutdown device, allowing the safety system pressure to bleed into the holding tank. The drop in pressure causes the valves in the fuel rack to close, thus shutting down the engine. See Figure 18.

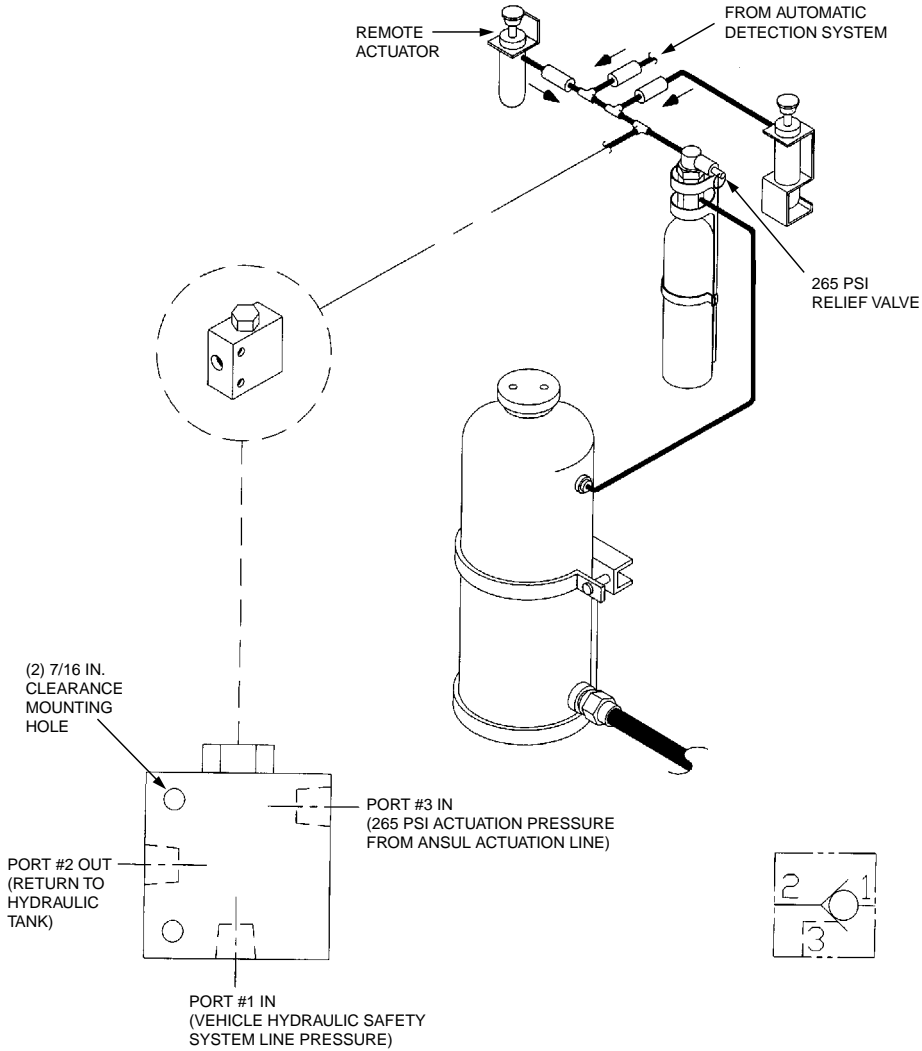


FIGURE 18

004668

ACCESSORIES

Accessories can be added to the pneumatic actuation line to mechanically shut off fuel, electrically shut off engines, and electrically sound alarms.

Air Cylinder

This component is a system accessory whose function is to shut off the fuel supply to the engine when the fire suppression system is actuated.

The fuel shut-off is a spring-return rocker arm on the side of the engine which has a cable link to the vehicle dashboard. The air cylinder rod will tie into this rocker arm, in parallel to, but not interfering with, the operator's cable control. See Figure 19.

NOTE: WHEN USING AN LT-10 CARTRIDGE, AT 125 FT. OF HOSE, THE MAXIMUM FORCE AT THE AIR CYLINDER IS 70 LBS.

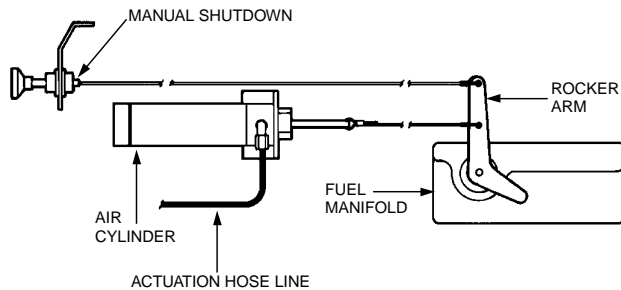


FIGURE 19

003489

Pressure Switch

Two styles of pressure switches are available for various electrical functions:

PRESSURE SWITCH PART NO. 46250 (Weatherproof) – This pressure switch is a single pole, double throw (SPDT) pressure switch constructed with a gasketed, water tight housing. The switch is rated at 10A – 125V, 5A – 250 VAC. This switch is suitable for outdoor applications.

PRESSURE SWITCH PART NO. 8372 (Non-Weatherproof) – This pressure switch is a single pole, double throw (SPDT) pressure switch. It is rated at 15A, 125, 250, or 480 VAC, 1/4 HP at 125 VAC, 1/2 HP at 250 VAC, or 1/2 A at 125 VDC. This switch is not weather-proof and should not be used for outdoor applications.

PRESSURE SWITCH PART NO. 43241 – This pressure switch is a double-pole, double-throw (DPDT) pressure switch. The switch is constructed with an explosion-proof housing suitable for hazardous environments. The switch contacts are rated at 10 amp at 125 VAC or 5 amp at 250 VAC.

NOTE: When installing pressure switches in the actuation line, the hose running to the switch must always be located downstream of any actuation check valves.

The following are typical industrial type hazards which can be protected by using the total flooding method: flammable liquid storage, dip tanks, solvent cleaning tanks, transformer vaults, quench tanks, and furnace rooms.

HAZARD ANALYSIS

A thorough hazard analysis is required to determine the type and quantity of protection required.

Review each of the following requirements when doing a hazard analysis:

1. Hazard Type

Record the size of the hazard, any obstructions, unclosable openings, size and location of external ductwork or anything else which would concern system performance. Briefly describe the type of hazard being protected. If protecting pre-fabricated booths, record the manufacturer model number and anything unique about the hazard.

2. Hazard Atmosphere

▶ The A-101/LT-A-101 system can be used in most industrial environments. If the hazard atmosphere is considered corrosive, such that the solvents, chemicals, or gases present are damaging to the A-101 system tank or actuators, the hardware should not be located in the hazard. When protecting an area defined as hazardous per NFPA 70 National Electric Code, Article 500, only equipment that has been listed or approved for the hazardous location, may be located in that area.

3. Hazardous Materials

▶ The A-101/LT-A-101 system uses FORAY (ABC) dry chemical as the extinguishing agent. The agent effectiveness and limitation is based on its ability to suppress the fire with the design parameters of the pre-engineered system.

a. FORAY dry chemical is effective on the following types of fire materials:

Class A – Surface Fires: These fires involve ordinary combustible materials such as cloth, paper, rubber, and many plastics.

Class B – Flammable Liquid and Gas Fires: These fires involve such materials as oils, grease, tars, oil-based paints, lacquers, and gasoline.

Class C – Energized Electrical Equipment Fires: Common Class C devices include control rooms, transformers, oil switches, circuit breakers, rotating equipment, pumps, and motors

b. FORAY dry chemical is **NOT** effective on the following types of fire materials:

Deep-seated Class A Materials: Deep-seated or burrowing fires in ordinary combustibles where the FORAY dry chemical cannot reach the point of combustion.

Class D – Combustible Metals: Class D type materials are reactive such as sodium, potassium, magnesium, and titanium.

Chemicals Capable of Rapid Oxidation: Chemicals or mixtures of chemicals such as cellulose nitrate.

4. Ventilation Considerations

The hazard ventilation system is very important when considering total flooding application, but should also be considered for local application overhead and tankside.

▶ The ventilation system should be shut down and/or dampered before or simultaneously with the start of the A-101/LT-A-101 system discharge.

5. Electrical Considerations

It is recommended that all electrical power sources associated with the protected hazard be shut down before system discharge. This eliminates the potential of a fire being electrically-reignited.

6. Temperature Range

The following temperature ranges must be determined and noted to ensure proper placement and operation of the A-101 system:

Hazard Area: Determine the minimum and maximum temperature of the hazard to be protected. This temperature may be any temperature that the distribution piping and detectors can withstand – only if the agent tank and accessories are located outside of the hazard area.

▶ **Agent Tank:** The temperature range for all applications is +32 °F to +120 °F (0 °C to +48 °C) for standard type A-101 tanks and –65 °F to +210 °F (–54 °C to +99 °C) for LT-A-101 low temperature type tanks.

DISTRIBUTION SYSTEM REQUIREMENTS

The distribution system for industrial hazards must follow the same requirements as listed for vehicle systems. See Section IV, SYSTEM DESIGN – VEHICLE, for detailed hose requirements for agent distribution and actuation/expellant gas lines.

Exception: For industrial hazards, only F-1/2 nozzles, Part No. 16449, are approved for total flood.

NOZZLE COVERAGE

▶ The only nozzle approved for use with A-101/LT-A-101 industrial total flooding protection is the F-1/2 nozzle.

Single System Capabilities

Model	10 lb.	20-lb.	30-lb.
Total Max.	350 cu. ft. Max.	700 cu. ft. Max.	1000 cu. ft. Max.
Flooding	(9.9 cu. m)	(19.8 cu. m)	(28.3 cu. m)
	5 ft. x 10 ft. x 7 ft. high (1.5 x 3.0 x 2.1 m)	10 ft. x 10 ft. x 7 ft. high (3.0 x 3.0 x 2.1 m)	10 ft. x 10 ft. x 10 ft. high (3.0 x 3.0 x 3.0 m)
Maximum No. of Nozzles	(2) Two F-1/2	(4) Four F-1/2	(4) Four F-1/2
See Figures 1 through 3 for nozzle layouts.			

SECTION V – SYSTEM DESIGN – INDUSTRIAL

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REV. 1

NOZZLE COVERAGE (Continued)

► 10 LB. FIRE SUPPRESSION SYSTEM – TOTAL FLOODING APPLICATION (2 NOZZLES)

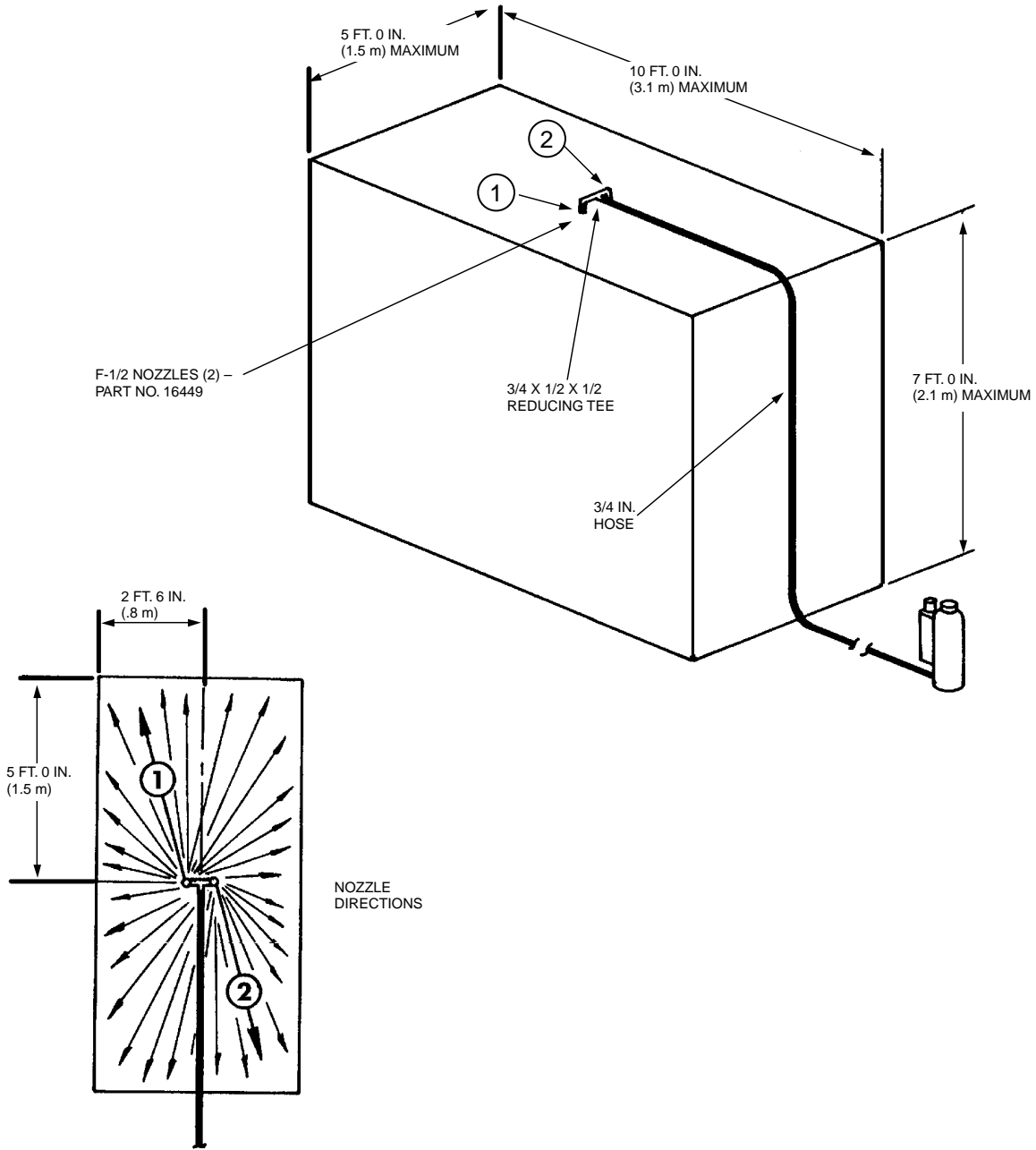


FIGURE 1
003501

Nozzle Coverage (Continued)

► 20 LB. FIRE SUPPRESSION SYSTEM – TOTAL FLOODING APPLICATION

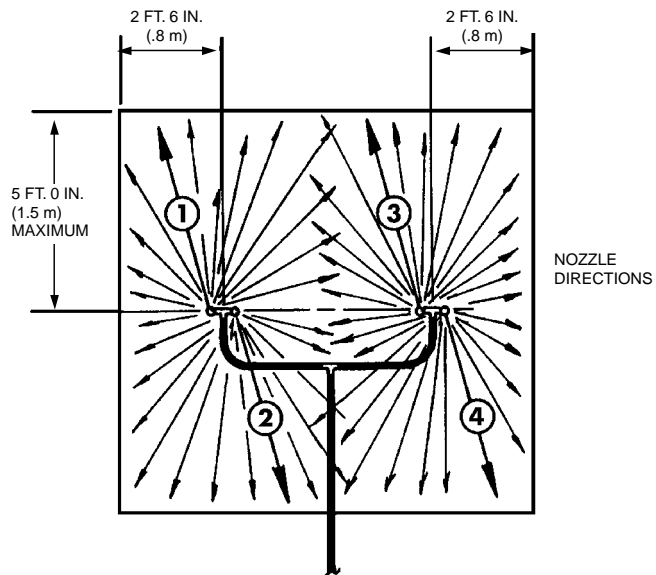
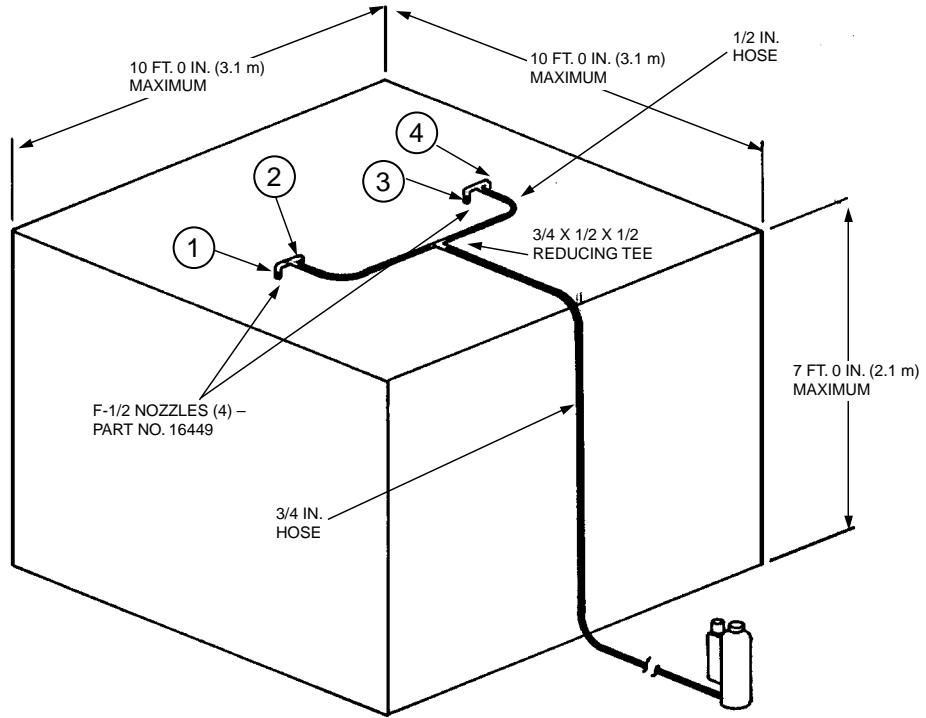


FIGURE 2
003505

SECTION V – SYSTEM DESIGN – INDUSTRIAL

5-15-02 Page 5-4

REV. 1

Nozzle Coverage (Continued)

► 30 LB. FIRE SUPPRESSION SYSTEM – TOTAL FLOODING APPLICATION

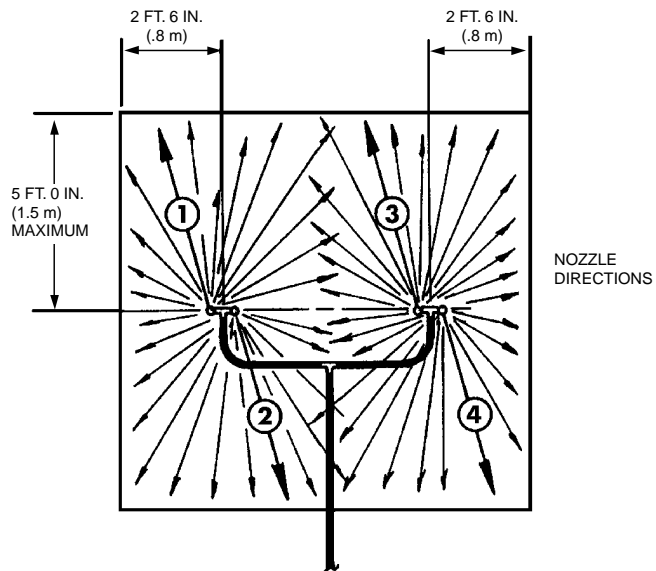
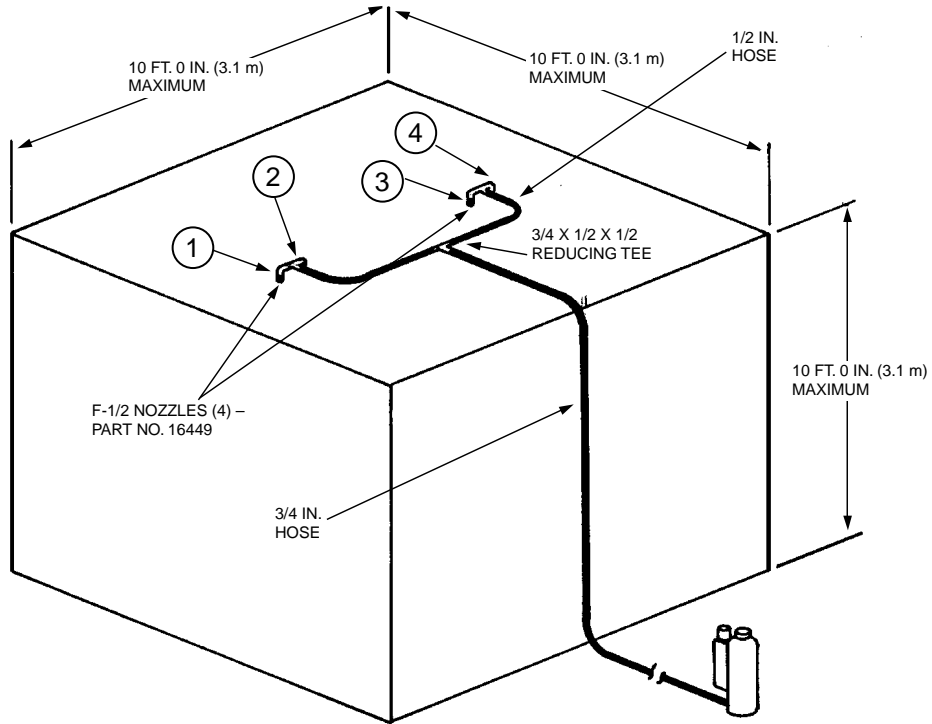


FIGURE 3
003505

► The installation of an Ansul A-101/LT-A-101 Fire Suppression system is based on the sketch developed in the System Design Section IV.

When deciding on locations for mounting the agent tanks, pneumatic actuators and manual actuators, locate areas where the components will not be abused or will not interfere with vehicle operation. Keep in mind not only the requirements for each individual component, but how the components are connected, and the maximum hose lengths required between each component.

Although the sequence of installation steps may vary with each installation, a basic A-101/LT-A-101 installation consists of four general procedures: mounting the brackets, installing the components, connecting the hoselines, and finally, installing the gas cartridges.

MOUNTING THE BRACKETS

Nozzle Bracket

The first step is to mount the nozzle brackets. Plan to attach nozzle brackets to secure places that will not be subjected to abuse and make sure the locations will not interfere with operator or vehicle functions.

NOTICE

When mounting the nozzle brackets, make certain the mounting surface is rigid and that it is allowed by the vehicle manufacturer to weld or bolt onto that surface.

1. Based on the layout sketch, locate a secure place for mounting the nozzle bracket so that the nozzle will be properly aimed, and weld the bracket to the mounting surface. When welding the bracket, make certain there is enough weld to keep the bracket properly in place. See Figure 1.

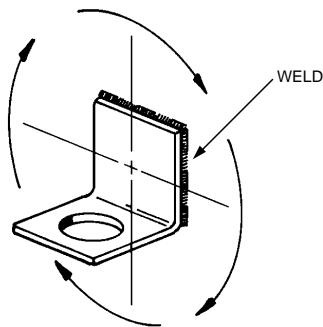


FIGURE 1
003507

If welding is not possible, the bracket can be drilled and bolted to the mounting surface with the appropriate fasteners. Make certain the bolting method does not allow the mounting bracket to rotate out of position or interfere with the nozzle discharge.

NOTE: A minimum of two bolts are required for proper mounting.

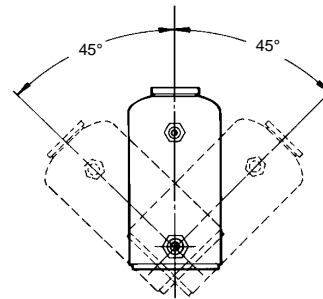
Tank Bracket

NOTICE

The location of the tank must not cause the hose length limitations to be exceeded.

When deciding on a mounting location for the agent tank, locate a rigid area where the tank can be mounted in an upright position. If necessary, the tank can be mounted up to 45° tilted to the left or right of true vertical, or tipped 45° forward from true vertical. The agent tank cannot be tipped backwards. See Figure 2.

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



NOTE: TANK SHOULD BE MOUNTED IN THE UPRIGHT POSITION SHOWN (SOLID LINES), BUT DISCHARGE WILL NOT BE IMPAIRED IF THE CENTER LINE OF THE MOUNTED TANK DOES NOT EXCEED 45° LEFT OR RIGHT OF TRUE VERTICAL.

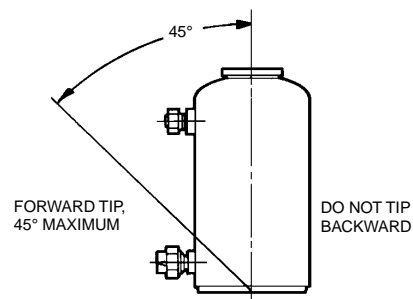


FIGURE 2
003508

1. Remove the agent tank from the bracket and weld the bracket to the mounted surface. The bracket can be secured at the base, at the back, or both, depending on the mounting surface. If the bracket cannot be welded, bolting is acceptable. 7/16 in. mounting holes are provided in the bracket to accommodate 3/8 in. fasteners. See Figure 3. Make certain when mounting the bracket that the clamp arms can swing open wide enough for removal of the tank when required.

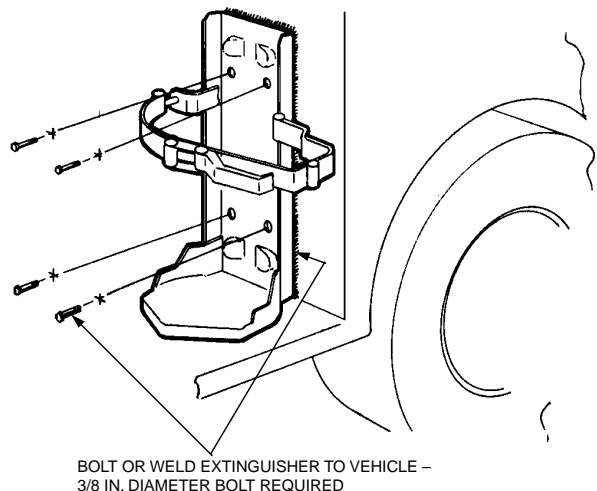


FIGURE 3
003509

SECTION VI – INSTALLATION INSTRUCTIONS

5-15-02 Page 6-2
REV. 1

Cartridge Bracket

When installing low temperature or low profile type systems, it is necessary to mount the remote cartridge bracket also. The location of this bracket must be such that the length of 1/4 in. hose between the bracket and the pneumatic inlet on the agent tank does not exceed 20 ft. (6.1 m) and the 1/4 in. hose from each remote actuator does not exceed 100 ft. (30.5 m) with 10 actuators maximum or 125 ft. (38.1 m) with 8 actuators maximum for LT-10 cartridges.

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

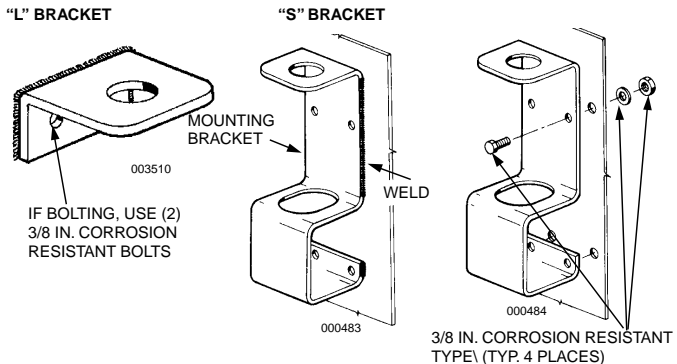
NOTE: The cartridge must be located in an area that will not exceed temperature limitations or be subject to fire or damage.

Remote Actuator Bracket

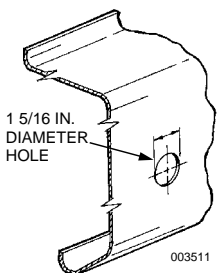
A remote manual actuator must be located in the drivers compartment within reach of the operator, and a remote manual actuator should be located at a point on the vehicle accessible from ground level. When mounting any actuator, make certain the length of hose between the actuator and the tank or remote expellant gas cartridge does not exceed 100 ft. (30.5 m) with 10 actuators maximum or 125 ft. (38.1 m) with 8 actuators maximum for LT-10 cartridges or 75 ft. (22.9 m) with 8 actuators maximum using an LT-5 cartridge. Also, make certain there is enough room for cartridge removal.

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

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



MOUNTING HOLE FOR DASHBOARD LOCATION



CARTRIDGE GUARD ACTUATOR

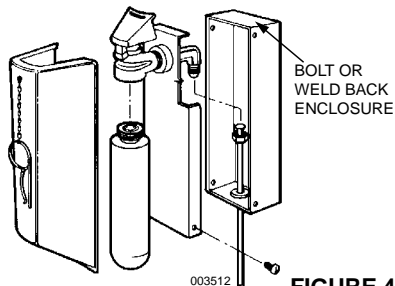


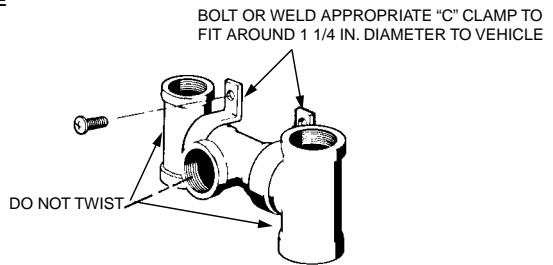
FIGURE 4

MOUNTING THE DISTRIBUTION, REDUCING, AND TRIPLE TEES

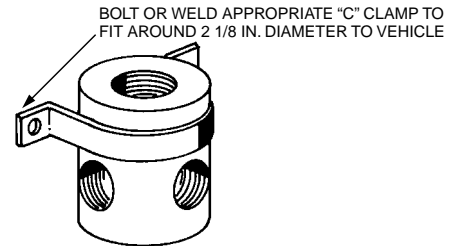
Based on the sketch done in the Design Section, locate each tee at a point which will not cause the supply line and branch line lengths to be exceeded.

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

TRIPLE TEE



DISTRIBUTION TEE



REDUCING TEE, 1/2 IN. X 1/2 IN. X 3/4 IN.

BOLT OR WELD APPROPRIATE "C" CLAMP TO FIT AROUND 3/4 IN. DIAMETER TO VEHICLE

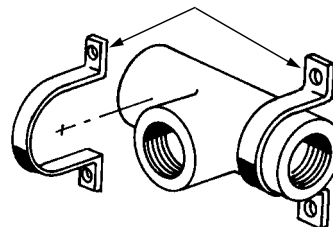


FIGURE 5
003513

INSTALLING THE COMPONENTS

Installing the Tank

1. Check each tank to make certain it is filled to its rated capacity with FORAY dry chemical. Then, re-tighten fill cap.
2. Unscrew the bursting disc union and check that the disc is free from wrinkles, dents or other deformities.
3. Reconnect the bursting disc union. Use a good grade of extreme temperature silicone grease, such as Dow Corning No. 4 or equal, on the male threads to facilitate removal during maintenance.
4. Position the tank(s) in the mounting bracket(s), and secure clamps or retaining bolts.

Installing the Nozzles

1. Refer to this system layout sketch from the Design Section IV. This sketch should give you the information concerning what nozzle to use where and the correct aiming point.
2. Choose the correct nozzle(s) for each hazard area.
3. Install nozzle(s) in bracket by using two lockwashers, and either 1/2 in. elbow(s) or coupling. See Figure 6. **Aim the nozzle correctly and securely tighten.**

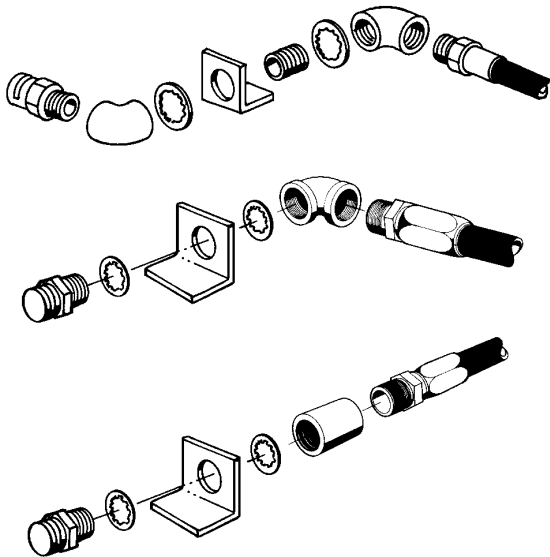


FIGURE 6
003515

4. Either install nozzle blow-off cap(s) or pack nozzle opening(s) with silicone grease to avoid build-up of foreign materials. **NOTE:** The F-1/2 nozzle is the only nozzle which silicone grease can be used in the opening.

Installing Manual Actuators

Three types of manual actuators brackets are available for the A-101/LT-A-101 system: “S” bracket, “L” bracket, and cartridge guard. Location of all actuators must be visible and easily reached by operator. Location must not expose actuator to physical abuse. Actuators using the “S” bracket and the cartridge guard type bracket are suitable for both internal and external mounting. The “L” type bracket is not suitable for external mounting and must be installed in a way that will provide protection for the exposed cartridge.

REMOTE MANUAL ACTUATOR WITH “S” BRACKET

1. If not already done, weld or bolt mounting bracket to the selected surface. If welding, to avoid corrosion, paint welded surface. See Figure 4.

NOTICE

Where bolting the mounting bracket is performed, use 3/8 in. (corrosion-resistant) bolts of appropriate length with lockwashers and nuts.

2. Unscrew the RED actuator button from the actuator stem, remove locknut, and slide actuator body through mounting hole on bracket. See Figure 7.
3. Rotate actuator body for desired location of actuation hose outlet connection. Screw locknut firmly onto actuator body and insert ring pin. Apply a non-permanent thread adhesive, such as Locktite 242 or equal, to the RED actuator button threads and then screw button onto the stem. See Figure 7.

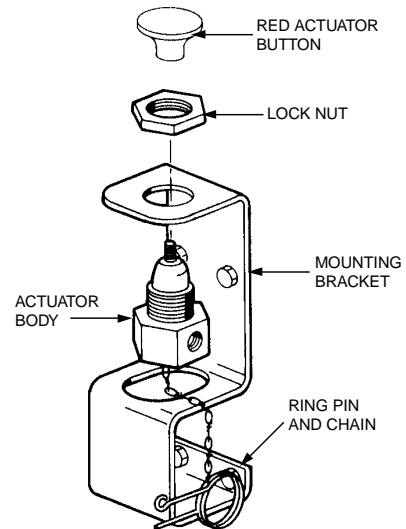


FIGURE 7
000485

SECTION VI – INSTALLATION INSTRUCTIONS

5-15-02 Page 6-4
REV. 2

INSTALLING THE COMPONENTS (Continued)
Installing Manual Actuators (Continued)

- Affix the appropriate operating nameplate adjacent to the manual actuator so that it is visible to attending personnel.
See Figure 8.

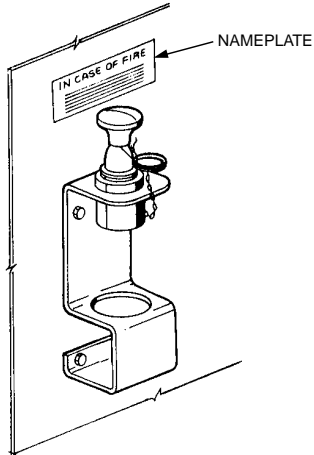


FIGURE 8
000486

- Make certain ring pin is inserted through the RED actuator button to ensure safe cartridge installation. See Figure 9.
- Seal ring pin to actuator stem with visual inspection seal, Part No. 197. Make certain visual inspection seal is looped through ring pin and around actuator stem. Do not wrap seal around the boot cover. See Figure 9. **DO NOT INSTALL CARTRIDGE AT THIS TIME.**

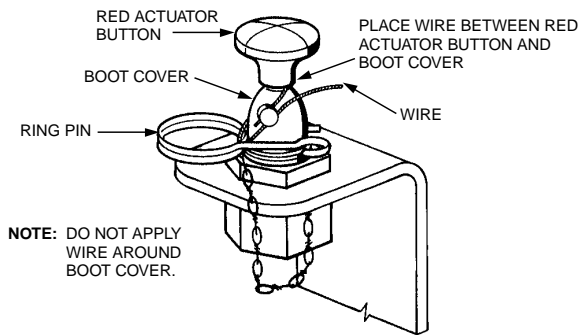


FIGURE 9
000487

REMOTE MANUAL ACTUATOR MOUNTED IN DASHBOARD

- Punch or drill a 1 5/16 in. (33.3 mm) diameter hole for mounting the actuator body. See Figure 10. Make certain there is enough room under the dash for the actuator body, cartridge, and the 1/4 actuation hose connection.

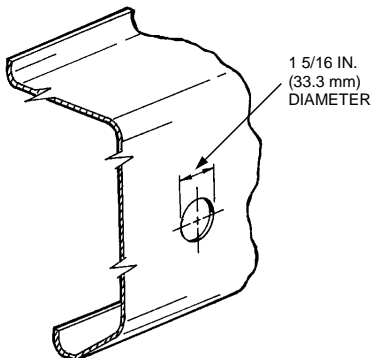


FIGURE 10
003511

- Unscrew RED actuator button from actuator stem, remove locknut, and slide actuator body through mounting hole. See Figure 11.
- Rotate actuator body for desired location of actuation hose outlet connection. Screw locknut firmly onto actuator body and insert ring pin. Apply a non-permanent thread adhesive, such as Locktite 242 or equal, to the RED actuator button threads and then screw the button onto the stem. See Figure 11.

NOTICE

The ring pin chain may not be long enough in certain dashboard mounted locations. When this occurs, remove the chain from the drive pin in actuator body and attach it to an appropriate location using either a pop rivet or a sheet metal screw. See Figure 11.

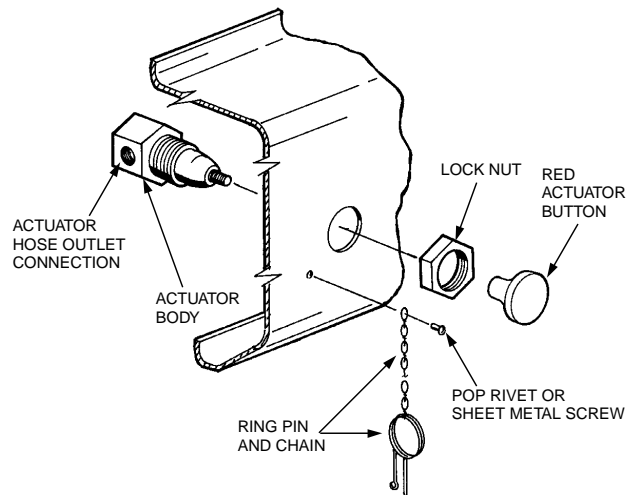


FIGURE 11
003517

- Affix the appropriate operating nameplate adjacent to the manual actuator and visible for attending operator. See Figure 12.
- Make certain ring pin is inserted through the RED actuator button to ensure safe cartridge installation. See Figure 12.
- Seal ring pin to actuator stem with visual inspection seal, Part No. 197. Make certain visual inspection seal is looped through ring pin and around actuator stem. Do not wrap seal around the boot cover. See Figure 12. **DO NOT INSTALL CARTRIDGE AT THIS TIME.**

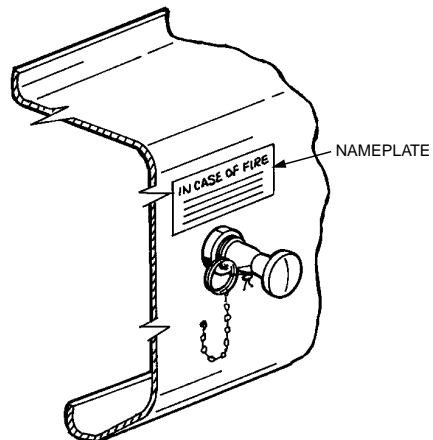


FIGURE 12
003518

INSTALLING THE COMPONENTS (Continued)

Installing Manual Actuators (Continued)

REMOTE MANUAL ACTUATOR WITH "L" BRACKET

NOTICE

Actuator must be installed in a way that will provide protection for the exposed cartridge from physical damage.

1. If not already done, weld or bolt mounting bracket to the selected surface. If welding, to avoid corrosion, paint welded surface. See Figure 4.

NOTICE

Where bolting the mounting bracket is performed, use 3/8 in. (corrosion-resistant) bolts of appropriate length with lockwashers and nuts.

2. Unscrew the RED actuator button from the actuator stem and slide actuator body through mounting hole on bracket.
3. Rotate actuator body for desired location of actuation hose outlet connection. Screw locknut firmly onto actuator body and insert ring pin. Apply a non-permanent thread adhesive, such as Loctite 242 or equal, to the RED actuator button threads and then screw button onto the stem.
4. Affix the appropriate operating nameplate adjacent to the manual actuator so that it is visible to attending personnel.
5. Make certain ring pin is inserted through the RED actuator button to ensure safe cartridge installation.
6. Seal ring pin to actuator stem with visual inspection seal, Part No. 197. Make certain visual inspection seal is looped through ring pin and around actuator stem. Do not wrap seal around the boot cover. See Figure 9. **DO NOT INSTALL CARTRIDGE AT THIS TIME.**

REMOTE MANUAL ACTUATOR WITH CARTRIDGE GUARD

1. Remove back box from actuator assembly.
2. If not already done, weld or bolt back enclosure to the selected surface. If welding, to avoid corrosion, paint welded surface. See Figure 4.

NOTICE

Where bolting the back enclosure is performed, use 3/8 in. (corrosion-resistant) bolts of appropriate length with lockwashers and nuts.

INSTALLING THE DISTRIBUTION NETWORK

General Requirements

Refer to the system layout sketch completed in the Design Section IV. Make certain all hose lengths do not exceed the maximum allowed.

When installing the distribution hose, once again remember the following:

1. Make certain the proper type and size of hose is used.
2. In order to obtain equal distribution at a tee, the center opening must be used as an inlet and the opposing openings used as outlets.
3. When any 90° bend or elbow is located in the distribution hoseline preceding a tee, a minimum length of 20 hose diameters is required between the 90° bend and the tee. This length of hose is called a "critical length" and exists only when the 90° bend and the tee lie in the same plane.
4. The use of street elbows is not allowed.
5. Per SAE J1273, "Care must be taken to insure that fluid and ambient temperatures, both static and transient, do not exceed the limitations of the hose. Special care must be taken when routing near hot manifolds."
6. Use of 90° elbows is allowed if the following requirements are not exceeded:
 - Maximum of 4 elbows from the agent tank to any nozzle
 - Maximum of 2 elbows in a primary branch line
 - Maximum of 2 elbows in a secondary branch line
 - Minimum of 1 elbow from agent tank to a nozzle
7. When bends are formed in the distribution hose, the following minimum bend radius must not be exceeded:

Hose Size	100RI	100R5
1/4 in.	4 in.	3 in.
1/2 in.	7 in.	5 1/2 in.
3/4 in.	9 1/2 in.	—
7/8 in.	11 in.	7 3/8 in.

NOTE: Minimum bend radius measured to inside of hose radius.

Distribution Hose Installation

1. Starting at the tank outlet, connect the distribution hose from the bursting disc union to the triple, distribution, or reducing tee. Make certain hose is routed in an ordering manner and avoid routing hose through fire hazard areas if possible.
2. After hose has been connected, tighten bursting disc union.
3. Follow the sketch (completed in Hazard Analysis portion of Design Section IV) and complete all hose branch line runs.
4. When connecting the hose to each nozzle, make certain the aiming angle of each nozzle is not disturbed.
5. When routing hose through bulkheads, take precautions to protect the hose from excessive wear due to constant vehicle vibration.
6. When all distribution hose has been routed, make certain all fittings are wrench tightened.
7. Finally, clamp the discharge hose securely at least every five feet using industrial duty cable ties or conduit clamps.
8. When passing through bulkheads or grates, Schedule 40 nipples up to 6 in. in length may be used in the distribution line. (Refer to NFPA17, Section 2-5 (Pipe and Fittings)).

NOTE: 3/4 in. and 1/2 in. Quik-Seal Adaptors can also be used.

SECTION VI – INSTALLATION INSTRUCTIONS

5-15-02 Page 6-6

REV. 2

INSTALLING ACTUATION AND EXPELLANT GAS LINES

General Requirements

1. Use only 1/4 in. hose for actuation and expellant gas lines when used on mobile or vibrating type of installations. Hose must meet the specifications noted in Design Section, Pages 4-3 through 4-4.
2. On non-mobile or non-vibrating type installations, 1/4 in. pipe is acceptable. Pipe must be 1/4 in. Schedule 40 black iron, hot-dipped galvanized, chrome-plated, or stainless steel pipe and fittings conforming to ASTM A120, A53, or A106. Refer to Design Section for maximum allowable lengths.
3. When using pipe, make certain all ends are carefully reamed and blown clear of chips and scale. Inside of pipe and fittings must be free of oil and dirt.
4. When using pipe, the pipe and fitting connections must be sealed with pipe tape. When applying pipe tape, start at the second male thread and wrap the tape (two turns maximum) clockwise around the threads, away from the pipe opening.

NOTICE

Do not allow tape to overlap the pipe opening, as this could cause possible blockage of the gas pressure. **Thread sealant or compound must not be used.**

5. When passing through bulkheads or grates, up to 6 in. of Schedule 40 pipe may be used in the actuation and/or expellant gas lines. (Refer to NFPA17, Section 2-5 (Pipe and Fittings)). **NOTE:** 1/4 in. Quik-Seal Adaptors can also be used.
6. Cast iron pipe and fittings are not allowed.
7. Per SAE J1273, "Care must be taken to insure that fluid and ambient temperatures, both static and transient, do not exceed the limitations of the hose. Special care must be taken when routing near hot manifolds."

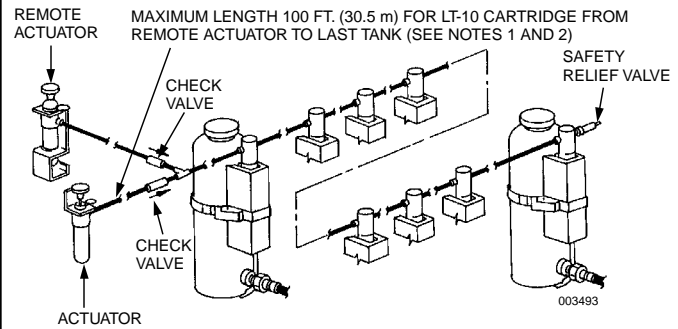
Installing The Actuation Gas line(s) and Pneumatic Actuator(s)

NOTICE

When installing actuation gas lines, teflon tape must be utilized on all male threads. Do not allow tape to overlap the pipe opening, as this could cause possible blockage of the gas pressure. **Thread sealant or compound must not be used.**

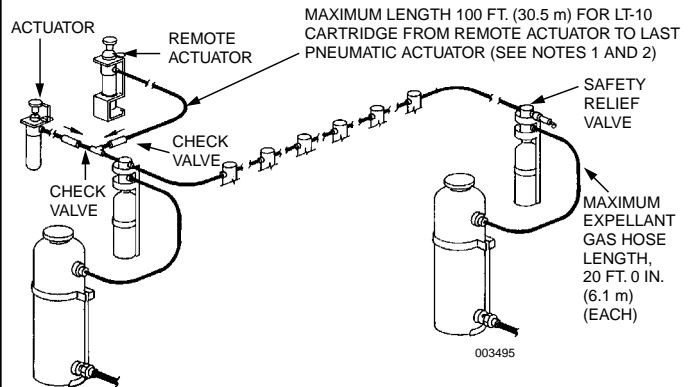
The actuation gas line is the 1/4 in. hose installed from the remote manual/automatic actuator(s) to the pneumatic actuators(s) on the agent tank expellant gas cartridge(s). See Figure 13.

A-101 SYSTEM



NOTE: A MAXIMUM OF (10) TEN A-101 SYSTEMS CAN BE ACTUATED SIMULTANEOUSLY IN ANY COMBINATION (I.E., A-101, LT-A-101, LP-A-101, OR LT-LP-A-101) (SEE NOTES 1 AND 2)

LT-A-101 SYSTEM



NOTE: REDUCE THE MAXIMUM ALLOWABLE NUMBER OF BASIC EXTINGUISHING UNITS BY ONE FOR EACH NON-EXTINGUISHING PNEUMATICALLY OPERATED DEVICE EMPLOYED, I.E., BRAKE CONTROL VALVE, FUEL CONTROL AIR CYLINDER.

FIGURE 13

If more than one remote actuator is in the system, the total length of actuation line allowed from the actuator to the last tank must also include any amount of hose in the other actuation lines up to the check valves located in those lines.

NOTE 1: If only eight (8) or less actuators are used, the actuation line can be extended to 125 ft. (38.1 m) when using an LT-10 nitrogen cartridge.

NOTE 2: The actuation line can also utilize an LT-5 cartridge. When this is done, only eight (8) actuators or less can be used, with a maximum length of 75 ft. (22.9 m).

INSTALLING ACTUATION AND EXPELLANT GAS LINES (Continued)

Installing The Actuation Gas line(s) and Pneumatic Actuator(s) (Continued)

Complete the installation of all dry chemical actuation lines and components by completing the following:

1. Install all pneumatic actuators as follows:
 - a. When removing actuator from the carton, check pin to make certain it is in the upright position. See Figure 14.

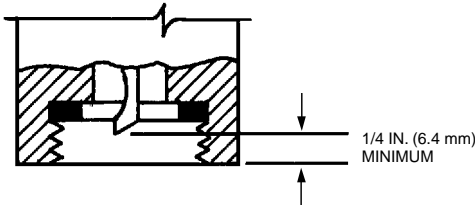


FIGURE 14
004357

- b. Securely hand tighten the pneumatic actuator cartridge body to cartridge.
- c. Position actuator and cartridge assembly into bracket.
- d. Using two wrenches, one on the swivel nut and one on the bottom portion, loosen the swivel nut, and rotate the top portion of the actuator to the correct position to align the two actuation line ports with the incoming and outgoing 1/4 in. actuation line(s).



CAUTION

Each actuator contains two (2) 1/4 in. actuation ports. If both ports are not utilized, the open port must be plugged with a 1/4 in. pipe plug. Failure to plug the port will cause loss of actuation gas pressure upon system actuation.

2. Install required 1/4 in. actuation lines from the remote actuator outlet port to all actuation ports on the upper portion of each pneumatic actuator.
3. Once all lines are securely installed, wrench tighten the swivel nut on the upper portion of each pneumatic actuator.

Installing Expellant Gas Line(s)

The expellant gas line is the 1/4 in. line between the remote expellant gas cartridge and the agent tank. The gas line is only required when the system is using either an LT or LP type tank. See Figure 13.

The maximum length of 1/4 in. expellant gas line is 20 ft. (6.1m).

Make certain the hose meets all the requirements as stated in the Design section.

INSTALLING THE DETECTION SYSTEM

When automatic detection is part of the total system design, see the appropriate Design, Installation Manual for detailed Information.

- CHECKFIRE ELECTRIC SERIES I SYSTEM – Manual Part No. 54894
- CHECKFIRE SC-N ELECTRIC SYSTEM – Manual Part No. 423522
- CHECKFIRE MP-N ELECTRIC SYSTEM – Manual Part No. 427310

INSTALLING ACTUATION CARTRIDGES

1. Weigh each manual actuator cartridge to make certain it is within the weight specifications stamped on the cartridge body. This weight check must be performed with the shipping cap removed. Refer to appropriate manual for detailed installation instructions if the system contains an automatic CHECKFIRE Detection System.
2. Check that the puncture pin in each manual actuator is fully retracted so that the pin will not pierce the cartridge seal during installation.
3. Install an LT-10 nitrogen cartridge into each manual actuator and hand tighten firmly.
4. At this time, the cartridge may be installed in the CHECK-FIRE detection system actuator.
5. Finally, document the entire installation with drawing, photographs, and/or written description of the entire vehicle system and store these documents in a permanent file for future reference.

SECTION VI – INSTALLATION INSTRUCTIONS

▶ 5-15-02 Page 6-8

NOTES:

Inspection is a “quick check” that the system is operable. It is intended to give reasonable assurance that the system is fully charged and will operate. This is done by seeing that the system has not been tampered with and there is no obvious physical damage, or condition, to prevent operation. The value of an inspection lies in the frequency, and thoroughness with which it is conducted.

The system shall be inspected visually every 250 hours of vehicle use or monthly (whichever comes first) by competent personnel following an approved schedule necessitated by conditions as determined by the operator.

- ▶ To provide reasonable assurance that your Ansul A-101/LT-A-101 system is charged and operable:
 1. Note general appearance of system components for mechanical damage or corrosion.
 2. Check all hose to make certain it is securely fastened and not cut or show signs of abrasion.
 3. Make certain all hose fittings are tight.
 4. Make certain the nozzles are correctly aimed, openings are clean and not obstructed and the blow off caps are properly installed.
 5. Check nameplate(s) for readability and make certain they are properly attached.
 6. The automatic detection system should be inspected as follows: If system is equipped with a CHECKFIRE SC-N or MP-N electric automatic detection system, make certain green “Power” LED is blinking. If system is equipped with a CHECKFIRE Series I, push button on top of module and note illumination of indicator light. If the system is equipped with a CHECKFIRE Series II, push and hold the test/control button momentarily. The internal alarm will sound and the two outside LED’s will flash. If system is equipped with a CHECK-FIRE pneumatic detection system, make certain yellow “Low Pressure” indicator light is not on.
- ▶
 7. Check to make certain hazard size or components being protected have not changed since original installation.
 8. If there are any broken or missing lead and wire seals, or any other deficiency is noted, immediately contact the authorized Ansul Distributor.
 9. Keep a permanent record of each inspection.

SECTION VII – INSPECTION

5-15-96 Page 7-2

NOTES:

Maintenance is a "thorough check" of the system. It is intended to give maximum assurance that the system will operate effectively and safely. It includes a thorough examination and any necessary repair or replacement. It will normally reveal if there is a need for hydrostatic testing of the tank.

Maintenance shall be performed every 1000 hours or semi annually (whichever comes first). The fire suppression system including alarms, shutdown and associated equipment shall be thoroughly examined and checked for proper operation by the fire protection manufacturer, authorized distributor or their designee in accordance with this manual.

► SEMI-ANNUAL/1000 HOUR MAINTENANCE

► To provide maximum assurance that your Ansul A-101/LT-A-101 system will operate effectively and safely:

1. Check to see that the hazard has not changed.
2. Remove all cartridges, install safety shipping caps, and put in a safe place for future reinstalling.
3. Note the general appearance of the system components checking for mechanical damage or corrosion, and check that the components are securely fastened and all hose fittings are tight.
4. Check nameplates to make certain they are clean, readable, and properly attached.
5. Remove tank fill cap(s) and check that the agent tank is filled to approximately 3 in. (76 mm) from the bottom of the fill opening with Ansul FORAY dry chemical. Check the dry chemical for lumps. If lumps are present, drop one from a height of 4 in. (102 mm) onto a hard surface. If the lump does not break up completely, the dry chemical must be replaced.
6. Inspect threads on fill cap and on tank fill opening for nicks, burrs, or cross-threading.
7. Check fill cap gasket and quad ring for elasticity, cuts, or checking, and lightly coat them with an extreme temperature silicone grease, such as Dow Corning No. 4 or equal.
8. Disconnect bursting disc union and make certain the disc is free from wrinkles, dents or other deformities.
9. Examine the disc to ensure that it is not wrinkled, kinked, dented, or deformed in any way and then apply a thin coat of a good grade of extreme temperature silicone grease, such as Dow Corning No. 4 or equal, to the male threads and reconnect the bursting disc union. **NOTE:** Before reconnecting, if needed, blow all lines clear with dry air or nitrogen.
10. Check that the nozzle openings are not obstructed and that the nozzles are properly aimed and have not rotated out of position.
11. Make certain each nozzle has a blow-off cap (the opening of an F-1/2 nozzle can be packed with an extreme temperature silicone grease, such as Dow Corning No. 4 or equal, to avoid build-up of foreign material) and check that the caps are pliable and free of cuts and checks.
12. Unscrew the pneumatic actuator(s) from the cartridge receiver(s) and inspect all threaded areas for nicks, burrs, and cross threads.

► 13. Clean actuator(s) (Part No. 430221) as follows: (see Figure 1)

- Using two wrenches, one positioned on the swivel nut, and one positioned on the bottom portion of the actuator, loosen the swivel nut and remove the top portion of the actuator.
- Using a wooden dowel, push pin assembly and spring out of the actuator body.

- Remove the gasket from inside the cartridge thread port. Inspect, clean, apply a good grade of low temperature grease, such as Dow Corning No. 4, and reinstall the gasket. Replace if necessary.
- Remove the O-Rings from the pin assembly and swivel adaptor. Inspect, clean, apply a good grade of low temperature grease, such as Dow Corning No. 4, and reinstall the O-Rings. Replace if necessary.
- Apply a small amount of grease to the puncture pin shaft. There is a U-Cup guide inside the actuator body and when the pin is reinstalled into the body, the grease on the shaft will lubricate the U-Cup.
- Clean the inner surface of the actuator body and, using a small diameter wire, clean the vent hole. **Make certain not to scratch the inner surface.**
- Reinstall spring onto puncture pin shaft and insert into actuator body. Push pin down several times to allow grease to coat U-Cup. When positioned back in body, make certain the tip of the pin is above the gasket in the bottom of the actuator.
- Reinstall the actuator unto the cartridge. Hand tighten.
- Reinstall swivel adaptor in the correct position for the actuation lines and wrench tighten the swivel nut. Make certain all actuation and expellant lines are properly tightened into the actuator.
- Secure the assembly into the bracket.

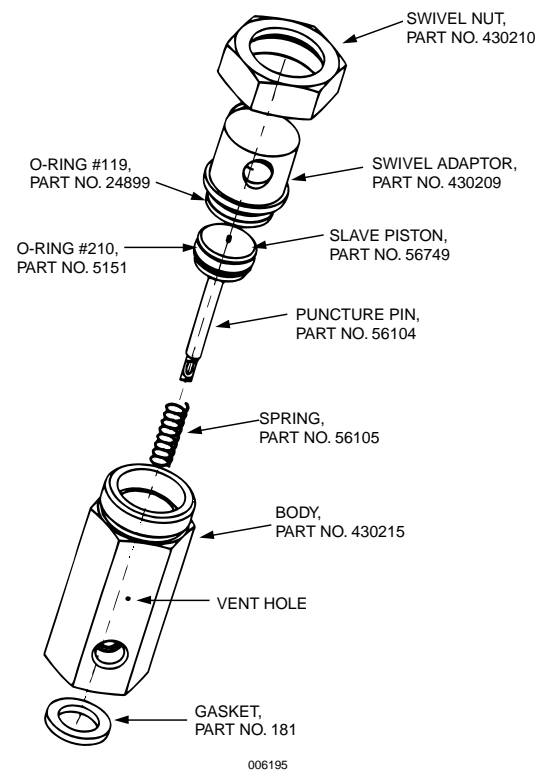


FIGURE 1

006195

SECTION VIII – MAINTENANCE

5-15-02 Page 8-2

REV. 1

▶ SEMI-ANNUAL MAINTENANCE (Continued)

14. Weigh the gas cartridge which was removed earlier. It must be +/- 1/2 oz. from the weight stamped on the cartridge. Weight cartridge with shipping cap removed.
15. Hand tighten the cartridge into the actuator.
16. Next, remove the gaskets from the manual remote actuators. Examine them for elasticity, cuts, and checking and lubricate them with a light coat of extreme temperature silicone grease, such as Dow Corning No. 4 or equal.
17. Inspect the threaded areas for nicks, burrs, or cross threading and clean them with a stiff bristle brush.
18. Make certain cartridge is removed. Pull the ring pin and operate the manual actuator to test the puncture lever for free movement.
19. Next, remove the puncture pin by disassembling the actuator and examine the pin to ensure it is sharp, straight, free of corrosion.
20. Lubricate the puncture pin O-ring and reassemble the actuator.
21. Insert ring pin and install visual seal, Part No. 197, to each actuator stem.
22. Weigh each actuator cartridge. Weight must be +/- 1/4 oz. from weight stamped on cartridge. Weight cartridge with shipping cap removed.
23. Install cartridge into each remote actuator. Hand tighten.
24. Refer to appropriate manual for detailed maintenance instructions if the system contains an automatic CHECKFIRE Detection System.
25. After all actuation devices are re-armed, record date of maintenance and inform personnel that the system is back in operation.

12-YEAR MAINTENANCE EXAMINATION

At the 12-year maintenance examination, along with completing the semi-annual maintenance requirements, some A-101 components require hydrostatic testing.

The components requiring hydrostatic testing are:

- Tank – 600 psi (40.8 bar) hydro pressure.
- Actuation hose – 1000 psi (69 bar) hydro pressure
- Cartridges – After properly discharging cartridge, return to Ansul for hydrotesting

See appropriate hydrotest requirements in NFPA 17, "Standard For Dry Chemical Extinguishing Systems," and Ansul Technical Bulletin No. 50, "Hydrostatic Retest Requirements for Ansul portables, Wheeled Units, and Pre-Engineered Vessels," Form No.

▶ F-81301.

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.

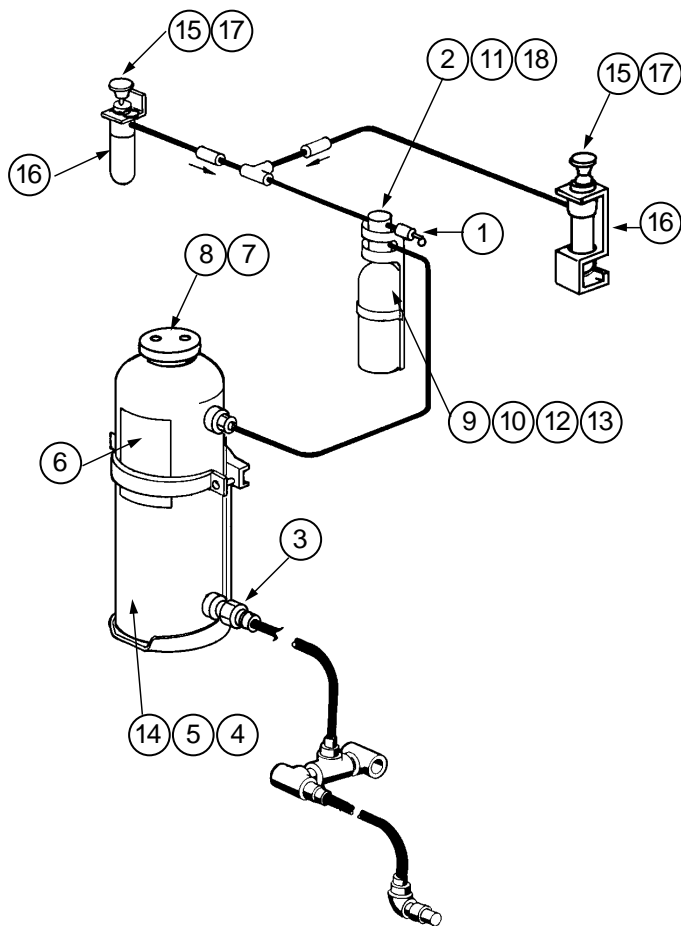


FIGURE 1

003519

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 sealed bursting disc assembly. Remove used sealed disc assembly from tank outlet. Clean tank threads. Apply a non-permanent thread sealant or Teflon tape to male threads on new burst disc assembly. Install to tank outlet. Wrench tighten. NOTE: Before reconnecting, if needed, blow all lines clear with dry air or nitrogen.

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. Disassemble and clean the cartridge actuator by following the instructions stated in Step No. 13, Section VIII – Maintenance.
- ▶ 12. Install new cartridge per the following chart. Before installing, weigh cartridge to determine if it is within specifications stamped on the cartridge. Weigh cartridge with shipping cap removed.

Type of System

Cartridge Part No.

A-101-10	15850 (DOT)	423439 (TC/DOT)
LT-A-101-10	423429 (TC/DOT)	
A-101-20	423441 (TC/DOT)	
LT-A-101-20	423435 (TC/DOT)	
LT-LP-A-101-20	423435 (TC/DOT)	
A-101-30	423443 (TC/DOT)	
▶ LT-A-101-30	423491 (TC/DOT)	

- ▶ 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 125 ft. (38.1 m), install LT-10 cartridge.

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.

NOTES:

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

NOTICE

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

► FRONT END LOADER (TYPICAL 2 TANK DESIGN)

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

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

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

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

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

► **NOTE:** Larger front end loaders will require additional protection.

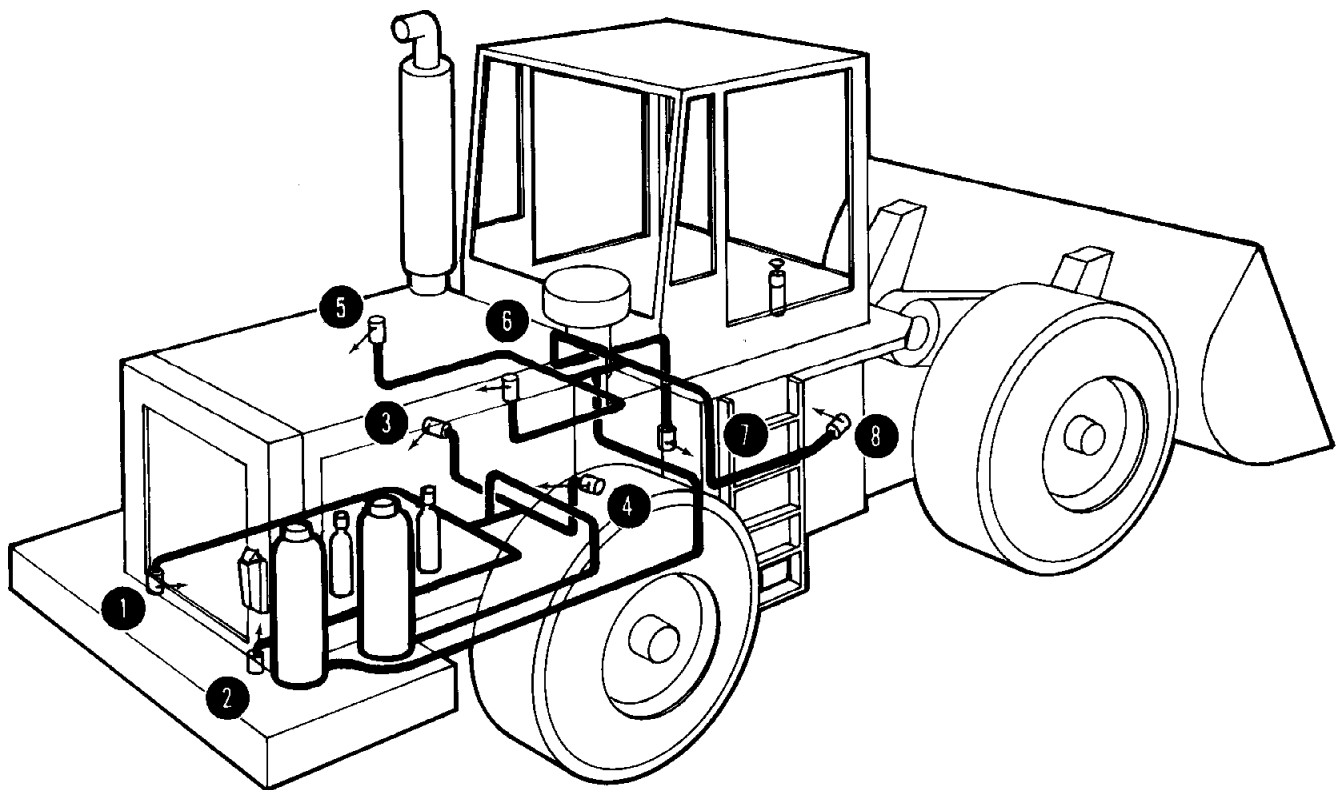


FIGURE 1

003520

SECTION X – SYSTEM APPLICATION OPTIONS

5-15-02 Page 10-2

REV. 1

► DOZER (TYPICAL 3 TANK DESIGN)

Nozzle No. 1 (N1) – Locate (1) C 1/2 nozzle to discharge dry chemical into the engine pan from front to back.

Nozzle No. 2 (N2) – Locate (1) V 1/2 nozzle to discharge dry chemical diagonally over the top of the engine.

Nozzle No. 3 (N3) – Locate (1) V 1/2 nozzle to discharge dry chemical screening right side of engine under exhaust manifold.

Nozzle No. 4 (N4) – Locate (1) V 1/2 nozzle to discharge dry chemical screening left side of engine under exhaust manifold.

Nozzle No. 5 (N5) – Locate (1) C 1/2 nozzle to discharge dry chemical onto the side of engine diagonally from top to bottom.

Nozzle No. 6 (N6) – Locate (1) V 1/2 nozzle to discharge dry chemical diagonally over the top of the engine.

Nozzle No. 7 (N7) – Locate (1) V 1/2 nozzle to discharge dry chemical across front of engine from top to bottom.

Nozzle No. 8 (N8) – Locate (1) C 1/2 nozzle to discharge dry chemical onto the side of engine diagonally from top to bottom.

Nozzle No. 9 and 12 (N9 and N12) – Locate (2) V 1/2 nozzles back to back to discharge dry chemical screening hydraulic lines and top of transmission, discharging from center to right and left sides.

Nozzle No. 10 (N10) – Locate (1) C 1/2 nozzle to discharge dry chemical into the belly pan and bottom of the transmission.

Nozzle No. 11 (N11) – Locate (1) V 1/2 nozzle to discharge dry chemical over the top of the transmission from back to front screening opening under cab and rear end.

► **NOTE:** Larger dozers may require additional protection.

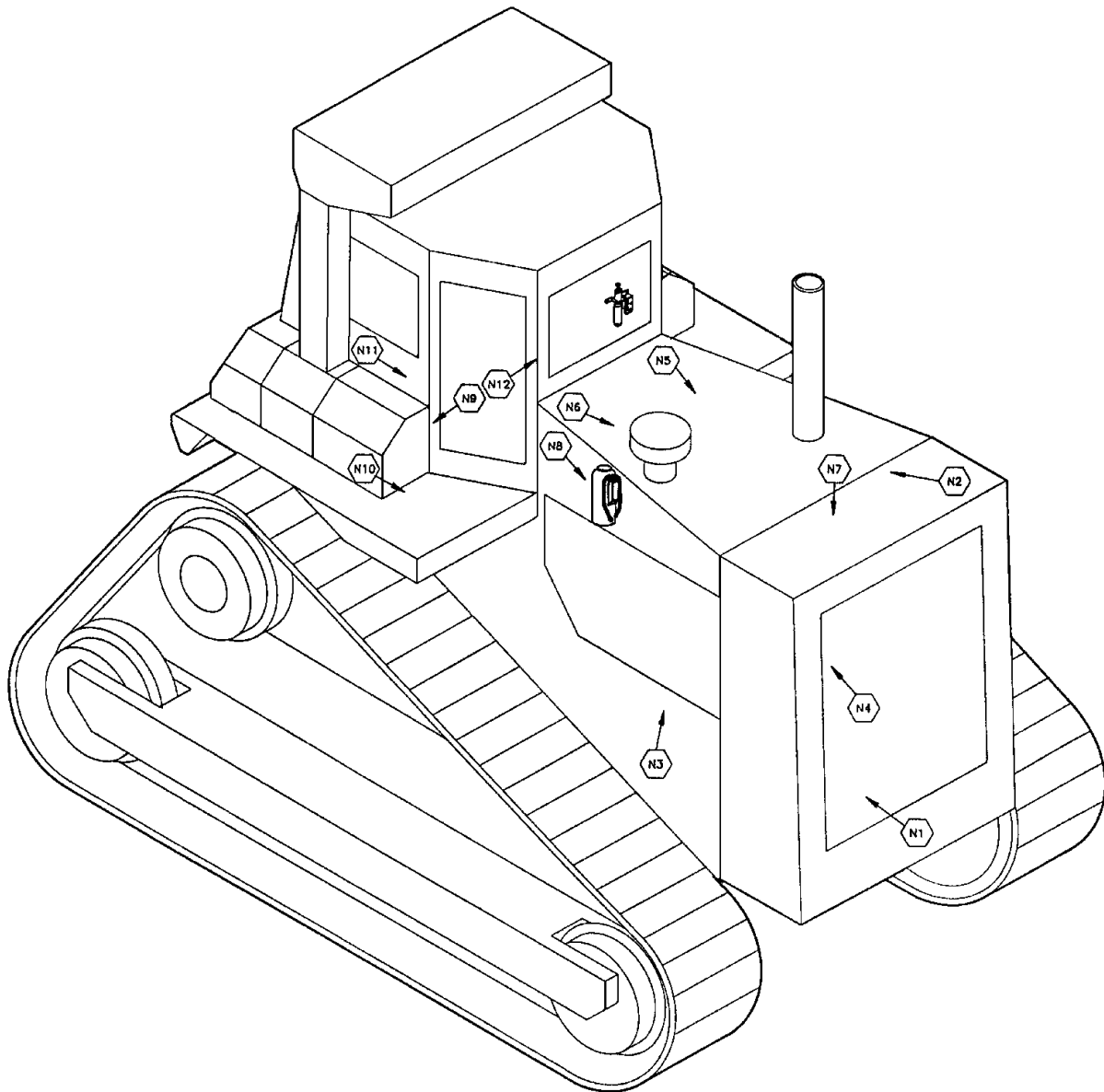


FIGURE 2

003521

► TRANSIT BUS (TYPICAL 1 TANK DESIGN)

Nozzle No. 1 (N1) – Locate (1) V 1/2 nozzle at upper left rear end of engine compartment aimed to discharge diagonally across engine rear from top left to bottom rear protecting front of engine and pump filters.

Nozzle No. 2 (N2) – Locate (1) V 1/2 nozzle at top rear aimed at center to discharge horizontally across engine top and turbo charger.

Nozzle No. 3 (N3) – Locate (1) V 1/2 nozzle on left side of engine midway from front to back aimed from rear at an angle to discharge across rear left side of engine, back of engine, and hydraulic lines protecting the generator as well as discharging into transmission area.

Nozzle No. 4 (N4) – Locate (1) V 1/2 nozzle at right side of engine midway from front to back aimed from rear to discharge across steering pump and air compressor at engine front.

Nozzle No. 5 (N5) – Locate (1) V 1/2 nozzle at right side of engine between engine and bus right side aimed from back to front to discharge horizontally across battery connections and hydraulic reservoir.

Nozzle No. 6 (N6) – Locate (1) V 1/2 nozzle midway up at right side of engine rear aimed from back to front to screen right side of engine and starter.

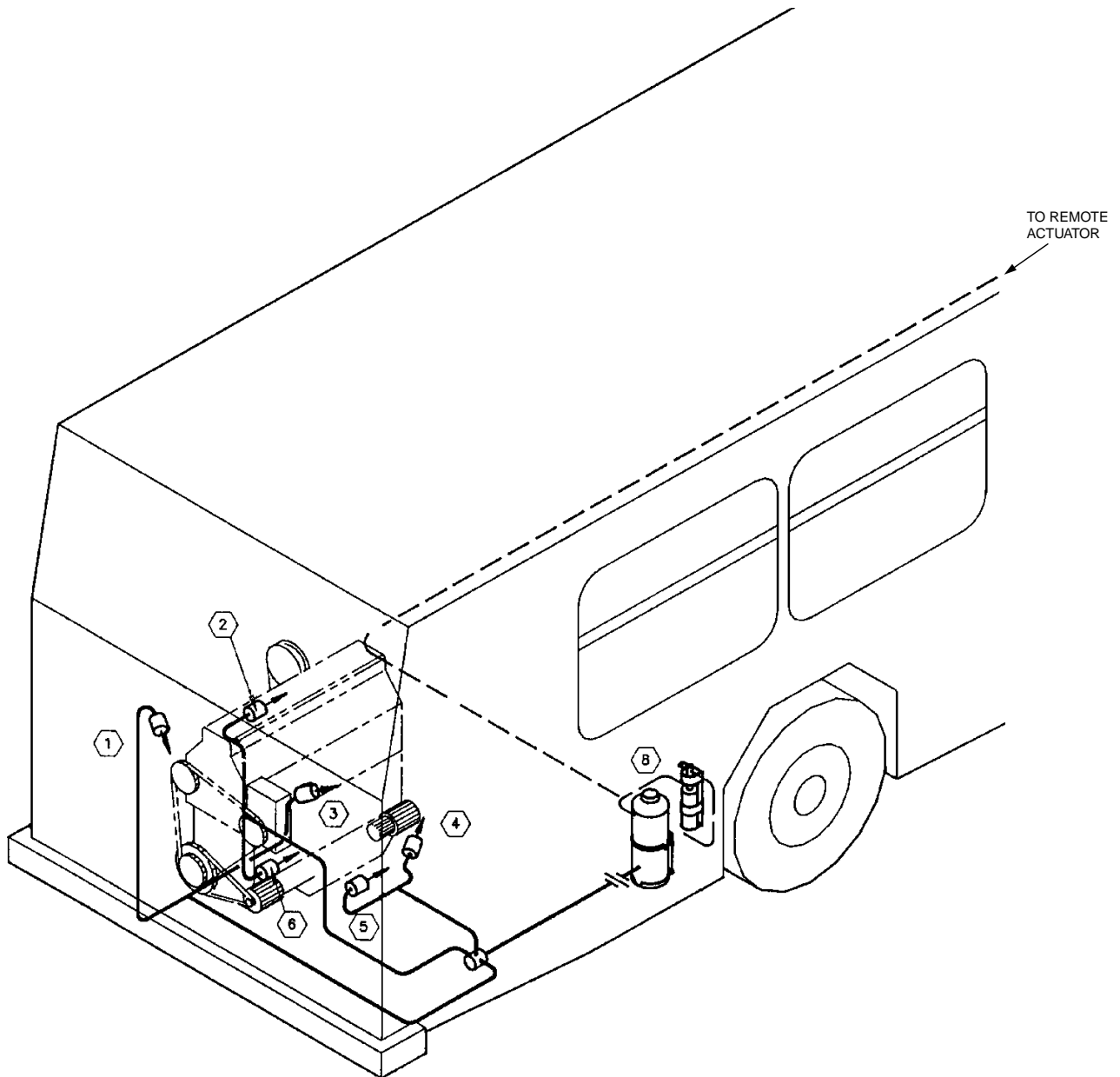


FIGURE 3

003522

SECTION X – SYSTEM APPLICATION OPTIONS

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REV. 1

► LANDFILL COMPACTOR (TYPICAL 3 TANK DESIGN)

Nozzle No. 1 and 12 (N1 and N12) – Locate (2) V 1/2 nozzles to discharge dry chemical under engine in the pan area.

Nozzle No. 2 and 3 (N2 and N3) – Locate (2) V 1/2 nozzles at each side of engine at bottom attached to engine mount-gusset, aimed up to screen engine sides.

Nozzle No. 4 (N4) – Locate (1) V 1/2 nozzle at top middle of engine compartment, in front aimed down at 45° angle, discharging vertically onto center of engine front and top.

Nozzle No. 5 (N5) – Locate (1) V 1/2 nozzle to discharge dry chemical from top left rear of engine compartment onto engine top and turbo.

Nozzle No. 6 and 7 (N6 and N7) – Locate (2) V 1/2 nozzles to discharge dry chemical from front of machine, 1/2 way up in transmission area aimed back at engine screening transmission sides and discharging into bottom of pan area with a vertical discharge pattern.

Nozzle No. 8 and 9 (N8 and N9) – Locate (2) V 1/2 nozzles to discharge dry chemical from top of transmission area aimed to discharge horizontally from rear of compartment to front of transmission top and also under cab area.

Nozzle No. 10 (N10) – Locate (1) V 1/2 nozzle at front under cab aimed to discharge dry chemical horizontally from front to back under cab protecting valve banks.

Nozzle No. 11 (N11) – Locate (1) V 1/2 nozzle up in articulation area aimed down with discharge pattern following vehicle center line, discharging into loader tower and onto hydraulic lines in articulation area.

► **NOTE:** Larger landfill compactors may require additional protection.

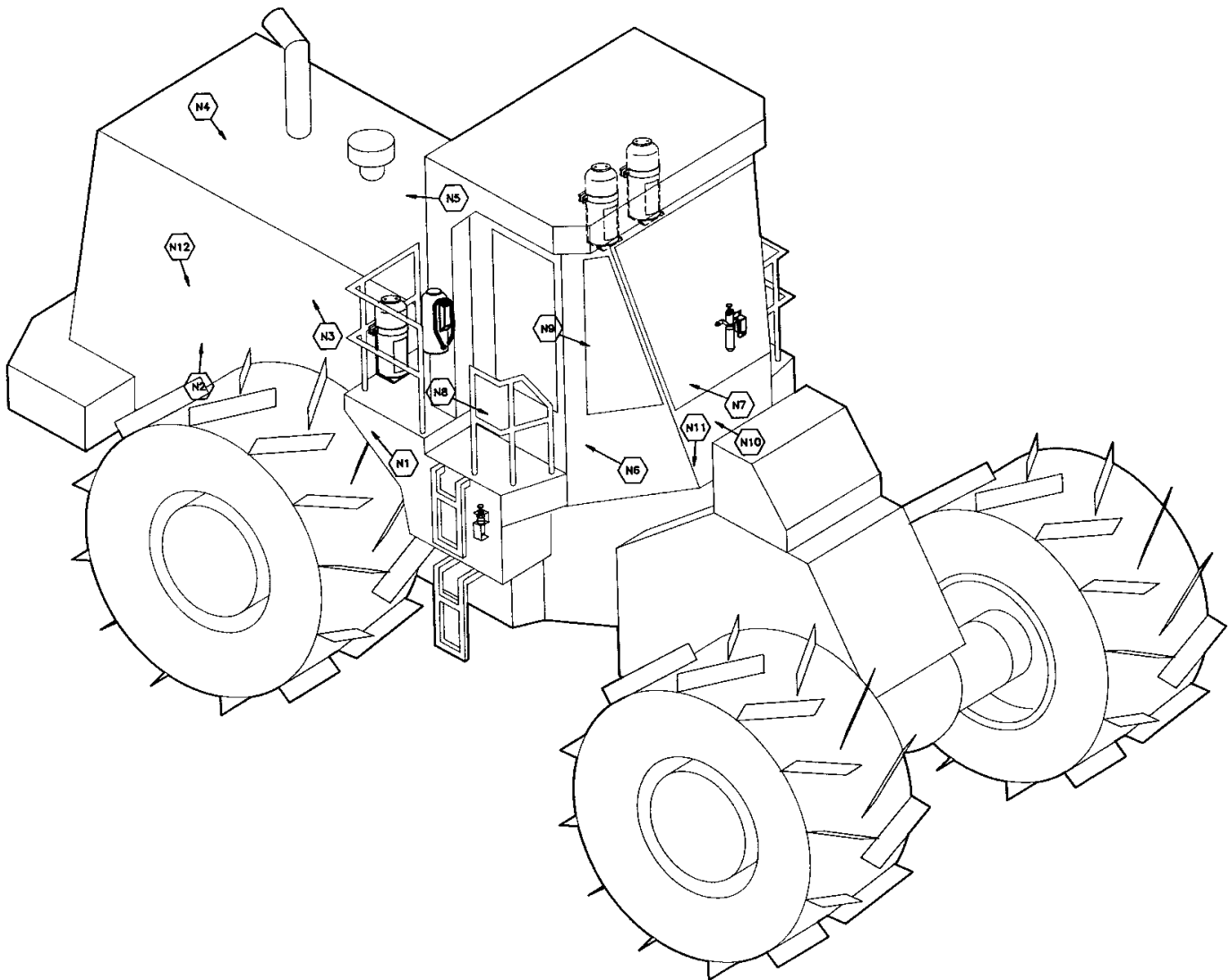


FIGURE 4

003523

► **ORE HAULAGE TRUCK (TYPICAL 2 TANK DESIGN)**

Nozzle No. 1 – Located at the top center of the engine compartment aimed toward the turbocharger at the rear of the engine. It is designed to protect the top of the engine and the front of the turbocharger.

Nozzle No. 2 – Located on the right rear corner of the engine compartment aimed toward the front corner with the pattern oriented vertically. This is intended to screen and protect the right side of the engine.

Nozzle No. 3 – Located at the top right corner of the engine compartment and is aimed across the top of the engine to the opposite corner. Its purpose is to protect the top of the engine and parts of the turbocharger and exhaust manifold.

Nozzle No. 4 – Located at mid-engine height in the right rear corner of the engine compartment. The nozzle pattern is aimed across the rear portion of the engine at the transmission housing. This nozzle is intended to protect the lower portion of the exhaust manifold, and the right side of the transmission and accessory equipment area such as hydraulic pumps, etc.

Nozzle No. 5 – Located at the top left corner of the engine compartment and aimed across the top of the engine to the opposite corner. Its purpose is to protect the top of the engine and parts of the turbocharger and exhaust manifold.

Nozzle No. 6 – Located on the left rear corner of the engine compartment and aimed toward the front corner with the discharge pattern oriented vertically. Its purpose is to screen and protect the left side of the engine.

Nozzle No. 7 – Located at mid-engine height in the left rear corner of the engine compartment. The nozzle pattern is aimed across the rear portion of the engine at the transmission housing. This is done to protect the lower portion of the exhaust manifold, and the left side of the transmission and accessory equipment area such as the hydraulic pumps, etc.

Nozzle No. 8 – Located such that the dry chemical stream will hit the parking break area.

► **NOTE:** Larger ore haulage trucks may require additional protection.

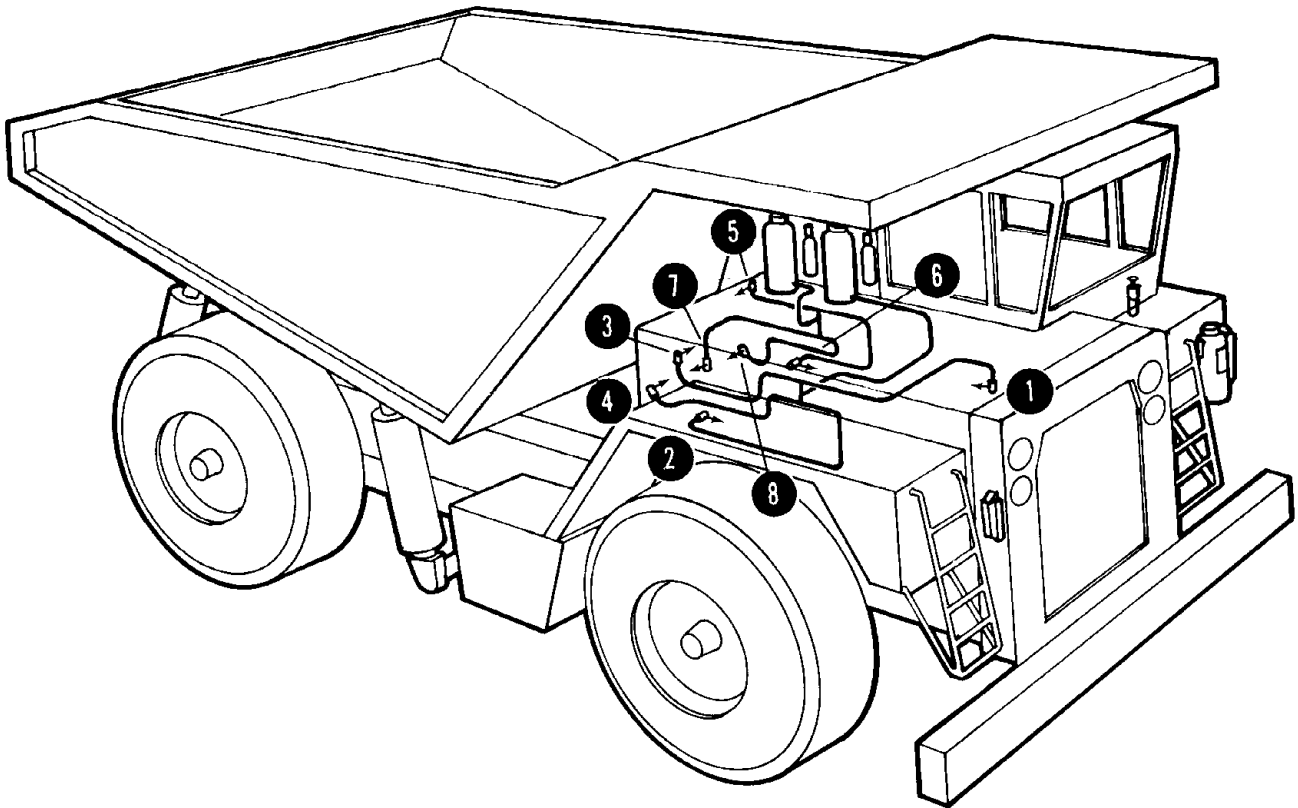


FIGURE 5

003524

SECTION X – SYSTEM APPLICATION OPTIONS

5-15-02 Page 10-6

REV. 1

► LOG SKIDDER (TYPICAL 2 TANK DESIGN)

Nozzle No. 1 and 2 – Located to discharge horizontally in the front lower portion of each side of the engine compartment. This allows each nozzle to be aimed upward and toward the center of the engine's side to completely cover the side of the engine with dry chemical.

Nozzle No. 3 – Located just above the belly pan, aimed to completely cover the pan area.

Nozzle No. 4 – Located toward the rear and top of the engine compartment. It is oriented to discharge dry chemical diagonally across the top of the engine.

Nozzle No. 5 – Located in the compartment directly under the operator's seat. It provides protection for the hydraulic lines, pump and pan area.

Nozzle No. 6 – Located to discharge dry chemical on the parking disc located on the rear portion of the skidder.

Nozzle No. 7 and 8 – Located to provide protection for both sides of the hydraulic cable reel assembly. They are located on the rear portion of the skidder and are aimed toward each side of the reel assembly.

► **NOTE:** Larger log skidders may require additional protection.

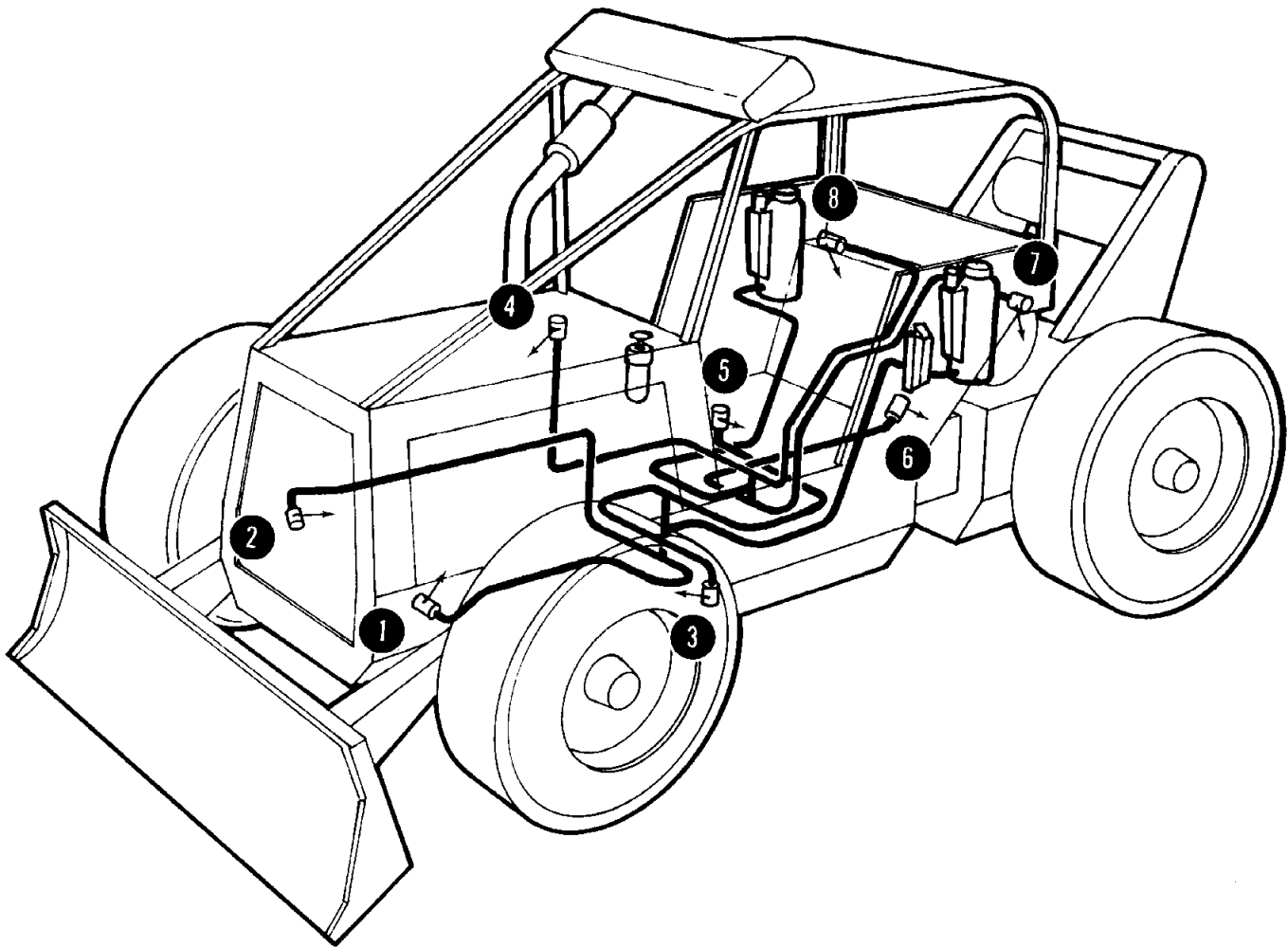


FIGURE 6

003525

SYSTEM COMPONENT INDEX**BASIC UNIT**

16559	A-101-10 Includes: Agent Tank, Tank Mounting Bracket, 101-10 Cartridge
16430	A-101-20 Includes: Agent Tank, Tank Mounting Bracket, 101-20 Cartridge
16131	A-101-30 Includes: Agent Tank, Tank Mounting Bracket, 101-30 Cartridge
31581	LT-A-101-10 Includes: Agent Tank, Tank Mounting Bracket, LT-20-R Cartridge
24306	LT-A-101-20 Includes: Agent Tank, Tank Mounting Bracket, LT-30-R Cartridge, Cartridge Bracket, and Pneumatic Actuator
53003	LT-A-101-30 Includes: Agent Tank, Tank Mounting Bracket, (Does Not Include Cartridge, Cartridge Bracket or Pneumatic Actuator)
24883	LT-A-101-30 Cartridge, Cartridge Bracket, and Pneumatic Actuator for LT-A-101-30 Unit
31344	LP-A-101-20-B Includes: Agent Tank, Tank Mounting Bracket, 101-20 Cartridge, Cartridge Bracket, and Pneumatic Actuator
24307	LT-LP-A-101-20-B Includes: Agent Tank, Tank Mounting Bracket, LT-30-R Cartridge, Cartridge Bracket, and Pneumatic Actuator

DISTRIBUTION TEES

53036	Distribution Tee Package Includes: 4 Distribution Tees
25031	Distribution Tee
53038	Triple Tee Package Includes: 2 Triple Tees
16424	Triple Tee
53040	Reducing Tee Package Includes: 2 Reducing Tees (1/2 in. x 1/2 in. x 3/4 in.)
4655	Reducing Tee (1/2 in. x 1/2 in. x 3/4 in.)
▶ 419695	Y Lateral

NOZZLES

57046	C-1/2 Nozzle Package Includes: 4 Nozzles, 4 Nozzle Brackets, 4 Blow-Off Caps and 8 Lockwashers
57044	V-1/2 Nozzle Package Includes: 4 Nozzles, 4 Nozzle Brackets, 4 Blow-Off Caps and 8 Lockwashers
53042	F-1/2 Nozzle Package Includes: 4 Nozzles, 4 Nozzle Brackets, 4 Blow-Off Caps and 8 Lockwashers
53791	Nozzle C-1/2 Includes: Nozzle, Blow-Off Cap
56748	Nozzle V-1/2 Includes: Nozzle, Blow-Off Cap
16449	Nozzle F-1/2 Includes: Nozzle Only
415192	Blow-Off Cap With Retaining Strap Package Includes: 50 Blow-Off Caps (Part No. 415108) For V-1/2 and C-1/2 Nozzle Only
73870	Blow-Off Cap Package: Includes: 50 Blow-Off Caps, Part No. 4120, For F-1/2 Nozzle
73871	Nozzle Bracket Package: Includes: 12 Brackets, 2 in. x 2 in. Angle
▶ 427149	Nozzle Bracket, 2 in. x 3 in. Angle
▶ 427228	Nozzle Bracket, Straight 5 in. x 2 in., 4 Brackets
73872	Nozzle Lockwasher Package: Includes: 50 Lock washers, Part No. 25581

ACTUATION DEVICE

▶ 70584	Remote Manual Actuator Package Includes: LT-10-L (Left Hand) Cartridge, "S" Bracket, Elbow, Check Valve, Seal, Operating Instruction Labels and Installation Instructions
▶ 71699	Remote Manual Actuator Package Includes: LT-10-L (Left Hand) Cartridge "L" Bracket, Elbow Check Valve, Seal, Operating Instruction Labels and Installation Instructions
▶ 57484	Remote Manual Actuator Package Includes: LT-10-R (Right Hand) Cartridge, "S" Bracket, Elbow, Check Valve, Seal, Operating Instruction Labels and Installation Instructions
▶ 71804	Remote Manual Actuator Package Includes: LT-10-R (Right Hand) Cartridge, "L" Bracket, Elbow, Check Valve, Seal, Operating Instruction Labels and Installation Instructions
▶ 70581	Remote Manual Actuator for LT-10-L (Left Hand) Cartridge Only
▶ 57452	Remote Manual Actuator for LT-10-R (Right Hand) Cartridge Only
57661	"S" Type Mounting Bracket for Dashboard Actuator, Part No. 70581 and 57452
70580	"L" Type Mounting Bracket for Remote Manual Actuator, Part No. 70581 and 57452
32747	Remote Actuator Package, Cartridge Guard Type (Left Hand) Includes: Actuator, LT-10-L Cartridge, Check Valve, Operating Instruction Labels, Lead Wire Seal
▶ 32739	Remote Actuator Package, Cartridge Guard Type (Right Hand) Includes: Actuator, LT-10-R Cartridge, Check Valve, Operating Instruction Labels, Lead Wire Seal
▶ 16033	Operating Instruction Labels for Manual Actuator Includes: Nameplate "IN CASE OF FIRE 1. SHUT OFF ENGINE 2. PULL RING PIN 3. PUSH LEVER"
16459	Operating Instruction Labels for Manual Actuator Includes: Nameplate "IN CASE OF FIRE 1. SHUT OFF POWER 2. PULL RING PIN 3. STRIKE BUTTON"

ACTUATION LINE DEVICES

15677	Safety Vent Relief Valve
53050	Safety Vent Relief Valve Package Includes: 2 Safety Vent Relief Valves
53051	1/4 in. Check Valve (Package of 2)
57488	LT and LP Model Pneumatic Actuator Assembly
16408	A-101 Pneumatic Actuator with Cartridge Receiver Assembly
31579	LT-A-101-10 Pneumatic Actuator Assembly
8372	Pressure Switch (Shutdown)
46250	Pressure Switch, Weather Proof, DPST (shutdown)
▶ 427425	Engine Shutdown Device

SECTION XI – APPENDIX

5-15-02 Page 11-2

REV. 2

SYSTEM COMPONENT INDEX (Continued)

SYSTEM TANKS

- 24855 A-101-10 Includes: Charged Agent Tank with Cartridge
- 24970 A-101-20 Includes: Charged Agent Tank with Cartridge
- 53000 A-101-30 Includes: Charged Agent Tank with Cartridge
- 24966 LT-A-101-10 Includes: Charged Agent Tank with Cartridge
- 24894 LT-A-101-20 Includes: Charged Agent Tank without Cartridge
- 29375 LT-A-101-30 Includes: Charged Agent Tank without Cartridge
- 24427 LP-A-101-20-B Includes: Charged Agent Tank without Cartridge
- 24425 LT-LP-A-101-20-B Includes: Charged Agent Tank without Cartridge

SYSTEM BRACKETS

- 24854 A-101-10, LT-A-101-10 Tank Mounting Bracket (1)
- 24971 A-101-20 Tank Mounting Bracket (1)
- 14098 A-101-30 Tank Mounting Bracket (1)
- 24910 A-101-30 Tank Mounting Bracket (1) (Extra Heavy)
- 24895 LT-A-101-20 Tank Mounting Bracket (1)
- 30494 LT-A-101-30 Tank Mounting Bracket (1)
- 31171 LP-A-101-20-B, LT-LP-A-101-20-B Tank Mounting Bracket (1)
- 31177 Cartridge Bracket Assembly for LP-A-101-20-B
- 24325 Cartridge Bracket Assembly for LT-A-101-20 or LT-LP-A-101-20-B
- 29193 Cartridge Bracket Assembly for LT-A-101-30

RECHARGE EQUIPMENT AND MATERIAL

- 53080 FORAY Multi-Purpose Dry Chemical 45 lb. Pail
- 16511 Fill Cap Spanner Wrench (Low Profile)
- 428363 Bursting Disc Package (Includes: 15 Bursting Disc Assemblies, Part No. 428271)
- 75382 Cartridge Scale and Hook Assembly (LT-A-101-30)
- 3923 Cartridge Scale and Hook Assembly
- 197 Lead Wire Seal
- 15496 Bursting Disc Union Assembly
- 24327 A-101 Installation, Recharge, Inspection and Maintenance Manual
- 53081 Owner's Manual

▶ SYSTEM CARTRIDGES

- 15850 A-101-10 Cartridge (DOT)
- 423439 A-101-10 Cartridge (TC/DOT)
- 423441 A-101-20, LP-A-101-20-B Cartridge (TC/DOT)
- 423443 A-101-30 Cartridge (TC/DOT)
- 423429 LT-A-101-10 Cartridge (TC/DOT)
- 423435 LT-A-101-20 and LT-LP-A-101-20-B Cartridge (TC/DOT)
- 423491 LT-A-101-30 Cartridge (TC/DOT)
- 13193 LT-10-R Cartridge (DOT)
- 423423 LT-10-R Cartridge (TC/DOT)
- 13177 LT-10-L Cartridge (DOT)
- ▶ 423425 LT-10-L Cartridge (TC/DOT)

FOR SYSTEM COMPONENT INDEX FOR THE CHECKFIRE AUTOMATIC DETECTION AND ACTUATION SYSTEMS, SEE THE FOLLOWING INSTALLATION MANUALS:

- ▶ • CHECKFIRE MP-N ELECTRIC SYSTEM – Manual Part No. 427310
- CHECKFIRE SC-N ELECTRIC SYSTEM – Manual Part No. 423522
- CHECKFIRE ELECTRIC SERIES I SYSTEM – Manual Part No. 54894

NOTES:

SECTION XI – APPENDIX

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REV. 2

LARGE EXCAVATORS

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 FM Approved) – Fire suppression on large excavators may 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-N 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-N 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-N 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-N Maintenance Contract allowing periodic service and maintenance at scheduled intervals should also be included.

▶ **NOTE:** Extended discharge can also be obtained by using the larger LT-A-101-125/250 tanks. Refer to manual, Part No. 427865, for details.

LARGE EXCAVATORS (Continued)
Design Parameters (Continued)

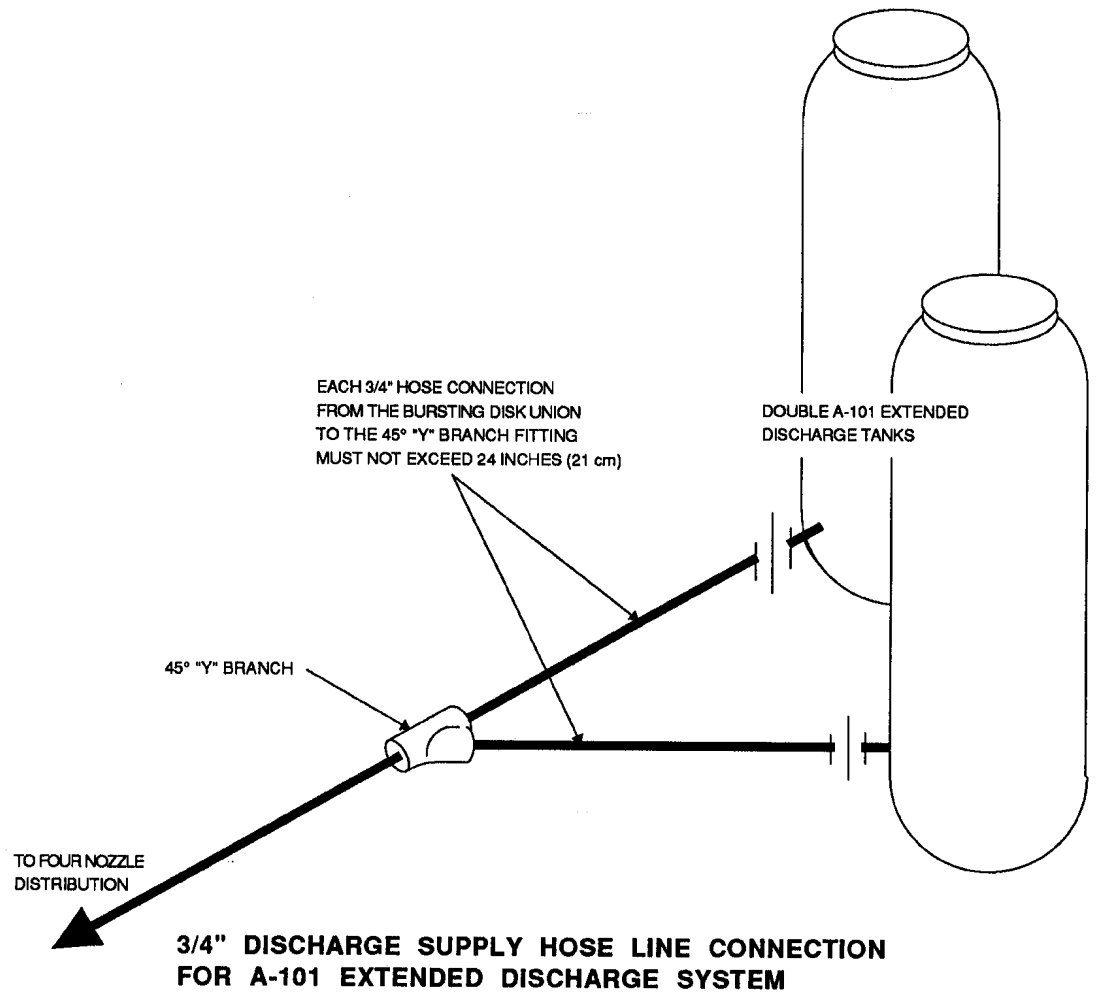
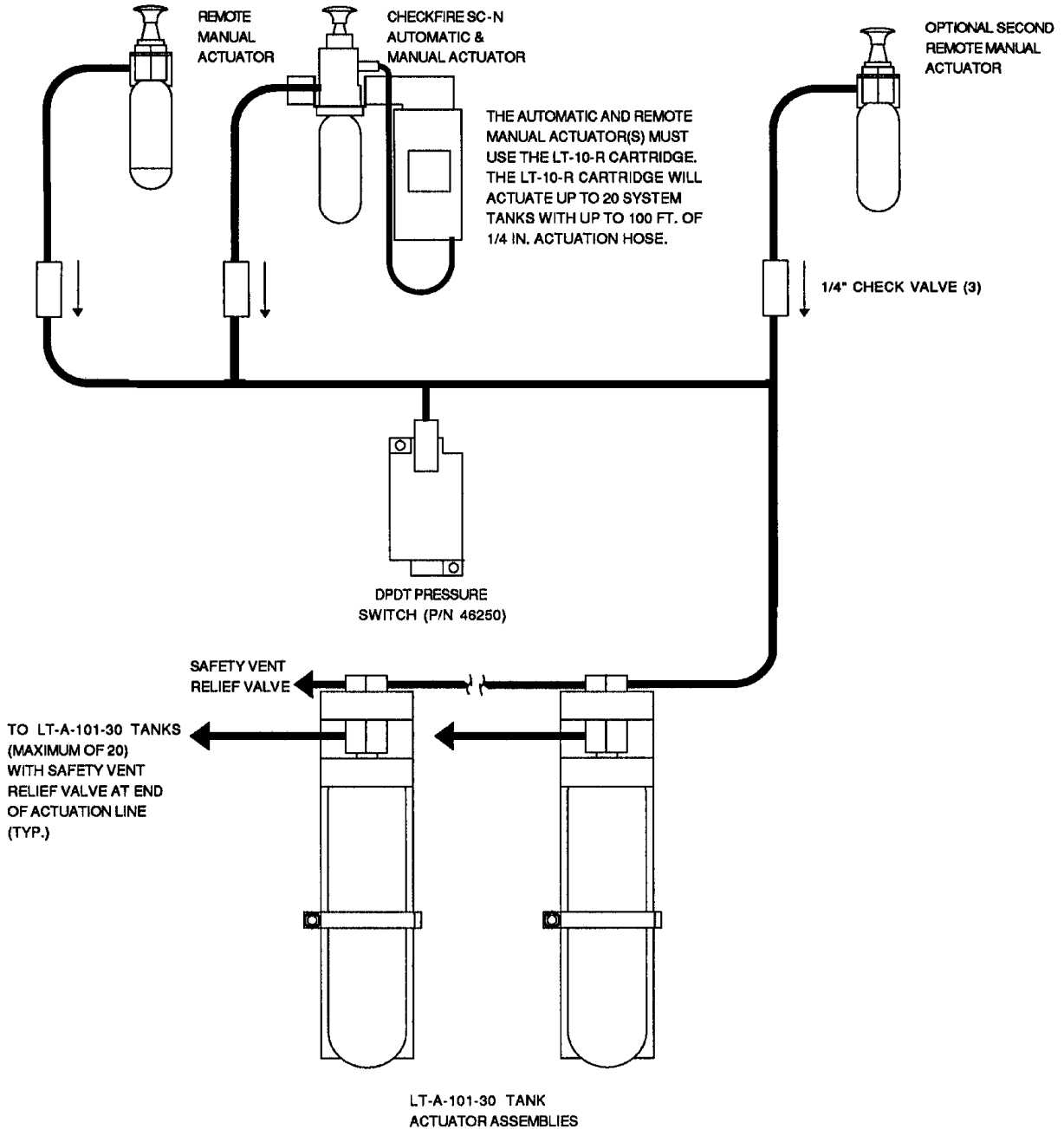


FIGURE 1
003526

LARGE EXCAVATORS (Continued)

Design Parameters (Continued)



**1/4" ACTUATION HOSE DETAIL FOR A-101
EXTENDED DISCHARGE SYSTEM**
(Not FMRC Approved)

FIGURE 2

003527

LARGE EXCAVATORS (Continued)
 Design Parameters (Continued)

CHECKFIRE SC-N WIREING DIAGRAM
 (NORMALLY ENERGIZED SHUTDOWN DEVICE)

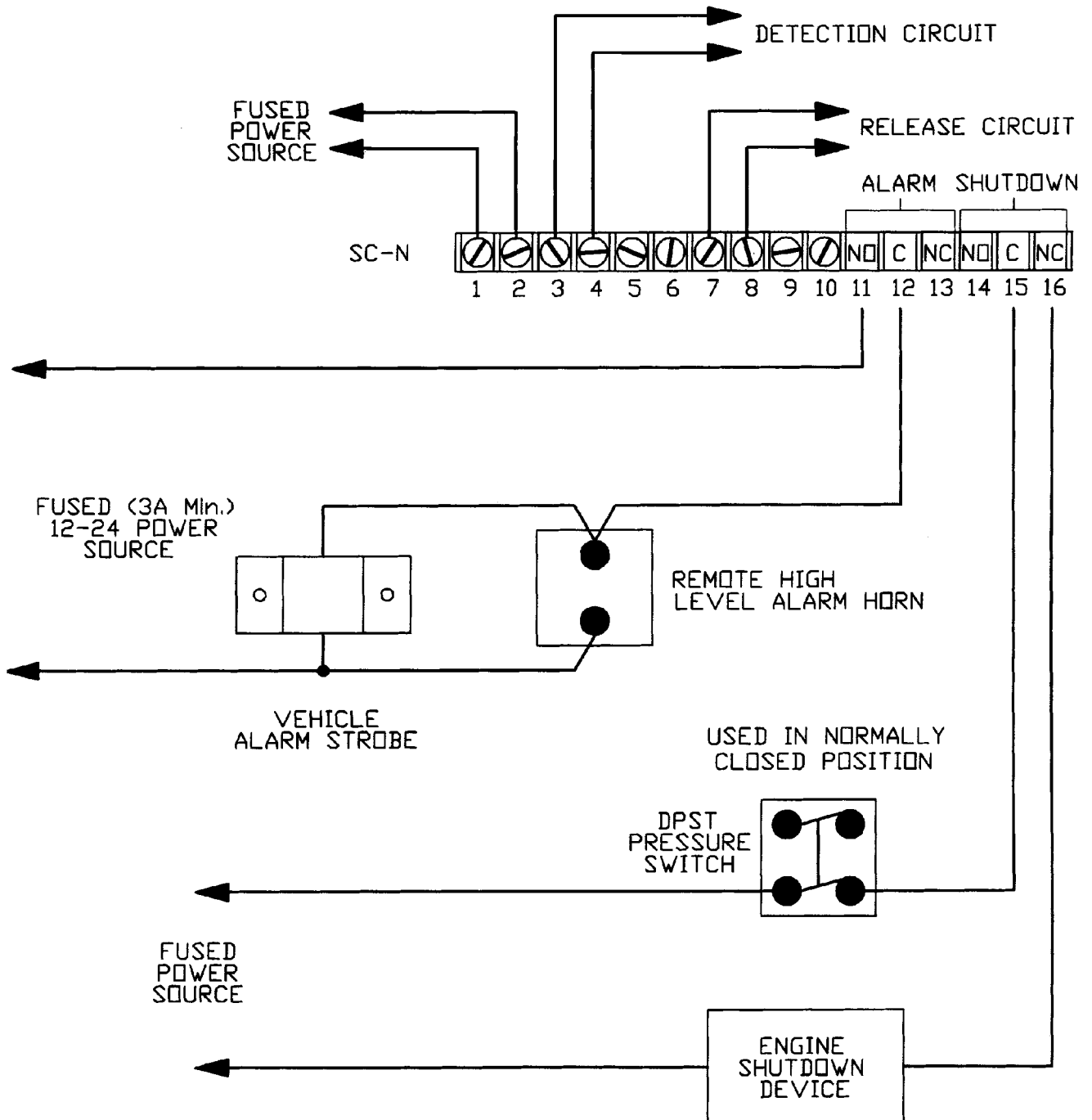


FIGURE 3
 006435

GENERAL INFORMATION

5-15-02 Page 11-8

REV. 1

LARGE EXCAVATORS (Continued)

Design Parameters (Continued)

CHECKFIRE SC-N WIRING DIAGRAM
(NORMALLY DE-ENERGIZED SHUTDOWN DEVICE)

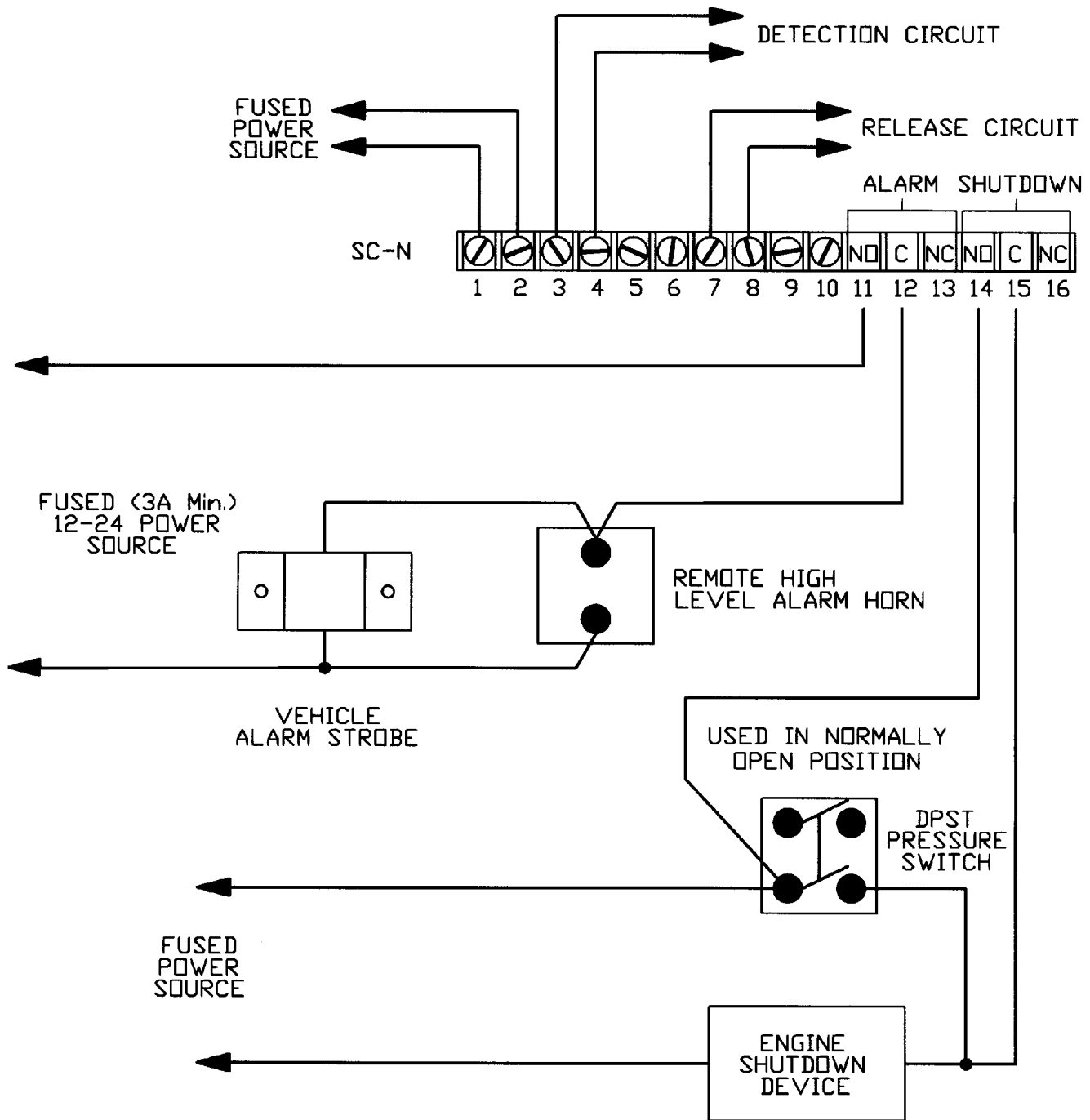


FIGURE 4
006436

EXCAVATOR PROTECTION

Excavators can be classified into three categories, depending on their hydraulic fluid capacity. Ansul has researched the hydraulic fluid capacities in regard to size of equipment (operating weight).

With the introduction of the LVS™ Liquid Agent Suppression System (not FM Approved), we can now offer an enhanced protection scheme for large excavators, as well as other non-road mobile equipment. **The following protection schemes are required for excavator of these specified sizes. They are as follows:**

- **Standard Discharge Application: Small Equipment (Operating Weight: 99,000 to 200,000 lb. (44,906 to 90,720 kg))**

Standard discharge application of an A-101 dry chemical system can be used for this smallest class of excavators. Design of the suppression system shall be in accordance with the LT-A-101-30 or LT-A-101-125/250 Installation, Recharge, Inspection, and Maintenance Manual.

Excavators that fall into this class of machine include but are not limited to:

- Caterpillar: 345BL-VG, 350, 350L, 375, 375L, 5080
- Hitachi: UH261, UH30
- Komatsu/DeMag: H65, PC 750-6
- Liebherr: R982
- Link-Belt: 5800, 6000
- O&K: RH 25D, RH 30E
- Poclain: 300, 400

- **Twin-Agent Application: Mid-Size Equipment [Operating Weight 200,000 to 1,000,000 lb. (90,720 to 453,600 kg)]**

Use of a twin-agent system consisting of the LVS liquid agent system connected to an A-101 dry chemical (extended or standard discharge) system. The A-101 system can utilize 250 lb., 125 lb. or 30 lb. (nominal) agent containers.

Note 1: When utilizing a standard discharge design, all hazard areas will require protection using both agents.

Note 2: When utilizing an extended discharge design, the liquid portion of the twin-agent scheme need only protect the engine(s) and hydraulic devices (i.e., pumps, control valves, valve banks).

Note 3: Existing systems installed in compliance with Product Service Bulletin No. 77 utilizing an extended discharge design, do not need to be changed to twin-agent systems. However, for new system installations or major changes to an existing hydraulic excavator, the design must follow the guidelines in this manual using a twin-agent system.

Excavators that fall into this class of machine include but are not limited to:

- Caterpillar: 5130, 5130B, 5130ME, 5130FS, 5230, 5230ME
- DeMag: H95, H135S, H185S, H255S, H285S
- Hitachi: EX1000, EX1100, EX1800, EX 2500, EX3500, EX 3600, UH501, UH80, UH801
- Komatsu: PC1000-6, PC1100-6, PC1400, PC1500-1, PC1600-1, PC1800-6, PC 3000, 3560 B, PC4000
- Liebherr: R984, R992, R991, R994, R995
- NW Engineering: 100-DH
- O&K: RH 40E, RH 75, RH 90C, RH 120C, RH 170
- Poclain: 600, 1000
- P&H: 1200

- **Twin-Agent Application: Large Equipment [Operating Weight: 1,000,000 lb. (453,600 kg) and greater]**

Use of a twin-agent system consisting of the LVS liquid agent system connected to an A-101-125/250 dry chemical (extended discharge) system.

Note 1: The liquid portion of the twin-agent scheme, at a minimum, must protect the engine(s) and hydraulic devices (i.e., pumps, control valves, valve banks). Additional LVS liquid agent systems may be added at the designer's discretion to cover other areas.

Note 2: Existing systems installed in compliance with Product Service Bulletin No. 77 utilizing an extended discharge design, do not need to be changed to twin-agent system. However, for new system installations or major changes to an existing hydraulic excavator, the design must follow the guidelines in this manual using a twin-agent system.

Excavators that fall into this class of machine include but are not limited to:

- DeMag: H455S, H485S, H485SP, H655S
- Hitachi: EX5500, EX7500
- Komatsu: PC5500, PC8000
- Liebherr: R996
- O&K: RH 200, RH 300, RH 400

General Discussion

Special design consideration must be given when protecting large excavators to reduce the potential for reflash and provide additional time. Ansul requires the following as a minimum:

1. Two large size agent tanks are available: a 125 lb. (56.7 kg) tank and a 250 lb. (113.4 kg) tank. The LT-A-101-125 tank can utilize an 8-nozzle extended discharge or 12- or 16-nozzle standard discharge distribution system. The LT-A-101-250 tank can utilize either an 8, 12, or 16 nozzle extended discharge or a 24 nozzle standard discharge system. Both the 125 lb. and 250 lb. tanks can be used where an extended discharge is required. See "Extended Discharge" to determine type of system required.
2. When utilizing 30 lb. agent containers, use four nozzles maximum for each single or two-tank (when used as extended discharge) system to provide additional agent per nozzle and maximum system discharge time. Single tank, two-nozzle systems may also be used for extended discharge.

NOTE: When protecting the engine, hydraulic devices (i.e. pumps, control valves, valve banks), hoses and connections on large non-road mobile equipment used in surface mining, landfill equipment, or other large specialized machines; only 4-nozzle 30 lb. tank systems, or large capacity (125 lb. and 250 lb.) type systems are to be used.
3. Fully automatic system, including automatic engine shutdown, hydraulic oil/fuel shutoff, and agent discharge.
4. Remote high level alarm and flashing alarm strobe to enhance machine operator warning.
5. A safe means of egress from the operator's compartment without having to exit past fire hazard areas.

EXCAVATOR PROTECTION (Continued)

General Discussion (Continued)

In addition to the LT-A-101 dry chemical system and/or LT-A-101/LVS twin-agent system with CHECKFIRE® Electric Detection and Control equipment, supplemental fire protection should be included when considering protection of large non-road mobile equipment:

1. Cartridge operated hand portable fire extinguishers
2. Secondary means of fire suppression

For any fire protection to be effective, training is critical. As a minimum, comprehensive training for the machine operator and site representatives should include:

1. Fire suppression system operation
2. Fire suppression system performance
3. Fire suppression system capabilities
4. Fire suppression system limitations
5. Response procedures
6. Safe egress procedures

It is important to make sure the site representative understands the LT-A-101/LVS/CHECKFIRE system capabilities as well as limitations. This information needs to be discussed and reviewed with the appropriate end-user personnel.

► FUME HOOD PROTECTION (Not FM Approved)

Fume Hood can utilize an Ansul A-101-20 or A-101-30 system with 6 nozzles. See Figure 5.

FUME HOOD

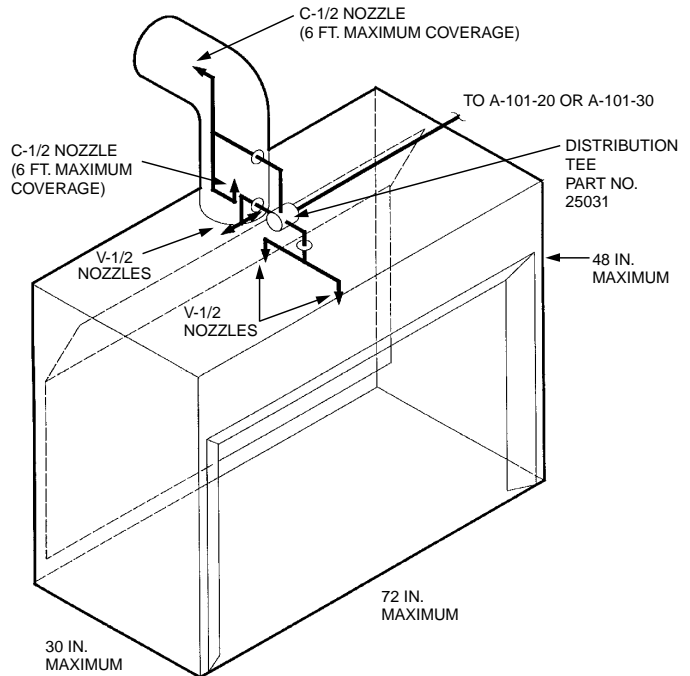


FIGURE 5
003530

The system can utilize a distribution tee and 3/4 in. supply piping and 1/2 in. branch piping.

Standard A-101 nozzles are used for dry chemical discharge. C-1/2 nozzles are used in the duct and V-1/2 nozzles are used in the plenum and hood area.

The pipe length must not exceed the maximum requirement as stated on Page 4-11 and 4-12 of this manual.

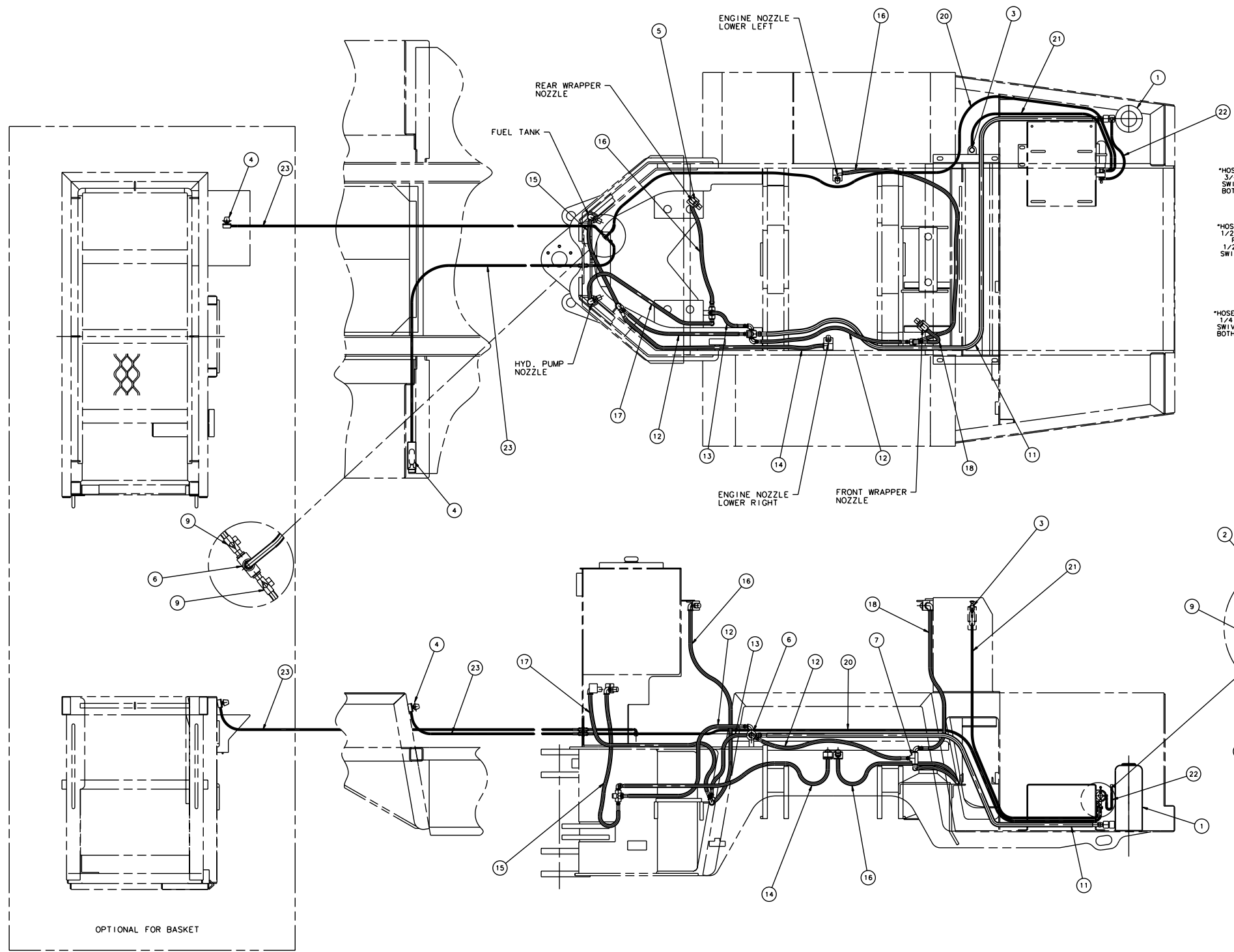
- When utilizing an Ansul AUTOMAN Release, use an LT-10-R
 ► Cartridge to supply the required actuation gas pressure to the tank cartridge.

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Litho in U.S.A.

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Part No. 24327-06



ITEM NO.	PART NO.	QUANTITY	DESCRIPTION
1	334124	1	FIRE SUPP. TANK & BRACKET
2	334125	1	CARTRIDGE & ACTUATOR KIT
3	332044	1	ACTUATOR, DASHBOARD
4	334003	1 (2)	ACTUATOR, REMOTE
5	334005	6	NOZZLE PACKAGE
6	332046	1 (2)	TEE, DISTRIBUTION
7	18GF08	3	TEE, 1/2 x 1/2 x 1/2
8	332042	1	VENT, SAFETY
9	334126	2 (4)	CHECK VALVE (SUPPLIED WITH CARTRIDGE/ACTUATOR KIT)
10			
11		1	HOSE, 1/2" I.D. x 125" LG.
12		2	HOSE, 1/2" I.D. x 32" LG.
13		1	HOSE, 1/2" I.D. x 28" LG.
14		1	HOSE, 1/2" I.D. x 50" LG.
15		1	HOSE, 1/2" I.D. x 36" LG.
16		2	HOSE, 1/2" I.D. x 64" LG.
17		1	HOSE, 1/2" I.D. x 35" LG.
18		1	HOSE, 3/4" I.D. x 29" LG.
19			
20		1	HOSE, 1/4" I.D. x 185" LG.
21		1	HOSE, 1/4" I.D. x 100" LG.
22		1	HOSE, 1/4" I.D. x 16" LG.
23		1 (2)	HOSE, 1/4" I.D. x A/R LG.

HOSE ENDS
3/4" JIC SWIVEL ST BOTH ENDS

HOSE ENDS
1/2" MALE PIPE 1/2" JIC SWIVEL ST

HOSE ENDS
1/4" JIC SWIVEL ST BOTH ENDS

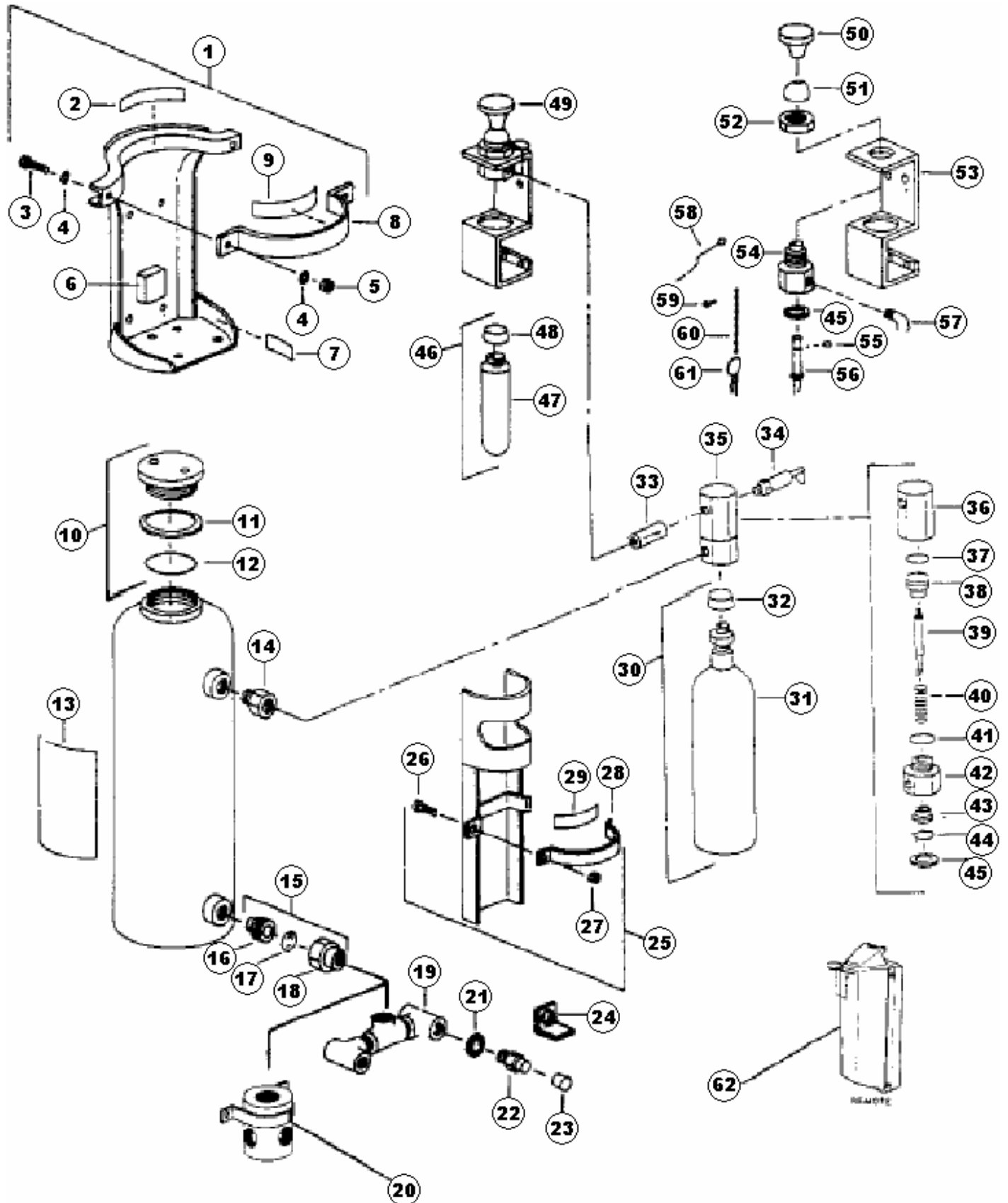
(*) QTY FOR OPTION

- NOTES:
- 1) THIS INSTALLATION IS TO BE MADE IN ACCORDANCE WITH THE L1-A-101-20 INSTALLATION MANUAL.
 - 2) ALL HOSES MUST MEET (AS A MINIMUM) SAE 100R5 OR 100R1 HOSE SPECIFICATIONS.
 - 3) FOR ALL UNDERGROUND MINING, ALL HOSES MUST COMPLY WITH USBM SPECIFIED FLAME RESISTANCE ACCEPTANCE DESIGNATION "MSHA 2G-11".
 - 4) FOR ALL HOSE FITTINGS USE ONLY GALVANIZED METAL FITTINGS. USE OF STREET ELBOWS IS NOT ACCEPTABLE. BRANCH LINES MUST BE WITHIN 3:1 RATIO (MAX.) AS DEFINED IN THE INSTALLATION MANUAL.
 - 5)

23276-04
INST DWG, A-64
FIRE SUPP. 6 NOZZLE

NO.	DESCRIPTION	DN #	BY	DATE
STD. TOLERANCES UNLESS OTHERWISE NOTED. FRACTIONS ±1/16" DEC. ±.010 ANGLES ±1°				
GETMAN				
TITLE INSTALLATION DWG. FIRE SUPPRESSION 6 NOZZLE A-64 ALL ENGINE				
DRAWN	DATE	SCALE	SIZE	DRW. NO.
BF	02/20/04	1/16	C	23276

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FIRE SUPPRESSION SYSTEM

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
	334124	FIRE SUPPRESSION SYSTEM ASSEMBLY (INCLUDES ITEMS 1-18)	1
	334125	FIRE SUPPRESSION SYSTEM ASSEMBLY (INCLUDES ITEMS 25-33)	1
	334005	NOZZLE PACKAGE (INCLUDES ITEMS 21-24)	6
1	324014	BRACKET ASSEMBLY (INCLUDES ITEMS 2-9)	2
2	NSS	PAD, CLAMP ARM	4
3	NSS	BOLT	2
4	NSS	WASHER	1
5	NSS	NUT, LOCK	1
6	NSS	BUMPER PAD	1
7	NSS	PAD, BASE	1
8	NSS	BAND, CLAMP	1
9	NSS	PAD, CLAMP BAND	1
10	334118	FILL CAP ASSEMBLY (INCLUDES ITEMS 11, 12)	1
11	NSS	GASKET	1
12	NSS	QUAD RING	1
13	NSS	TAG, INSTRUCTION	1
14	334117	ADAPTER	1
15	334057	BURSTING DISC UNION ASSEMBLY (INCLUDES ITEMS 16, 18)	1
16	NSS	ADAPTER	1
17	NSS	BURSTING DISC	1
18	NSS	UNION RING AND TAIL PIECE	1
19	332043	TEE, TRIPLE	A/R
20	332046	TEE, TRIPLE	A/R
21	332049	LOCKWASHER, NOZZLE	A/R
22	332047	NOZZLE	A/R
23	334121	CAP, BLOW OFF	A/R
24	NSS	BRACKET, NOZZLE MOUNTING	A/R
25	334119	BRACKET ASSEMBLY, CARTRIDGE (INCLUDES ITEMS 26-29)	1
26	NSS	BOLT, CARRIAGE	2

Updated:
12/11/06



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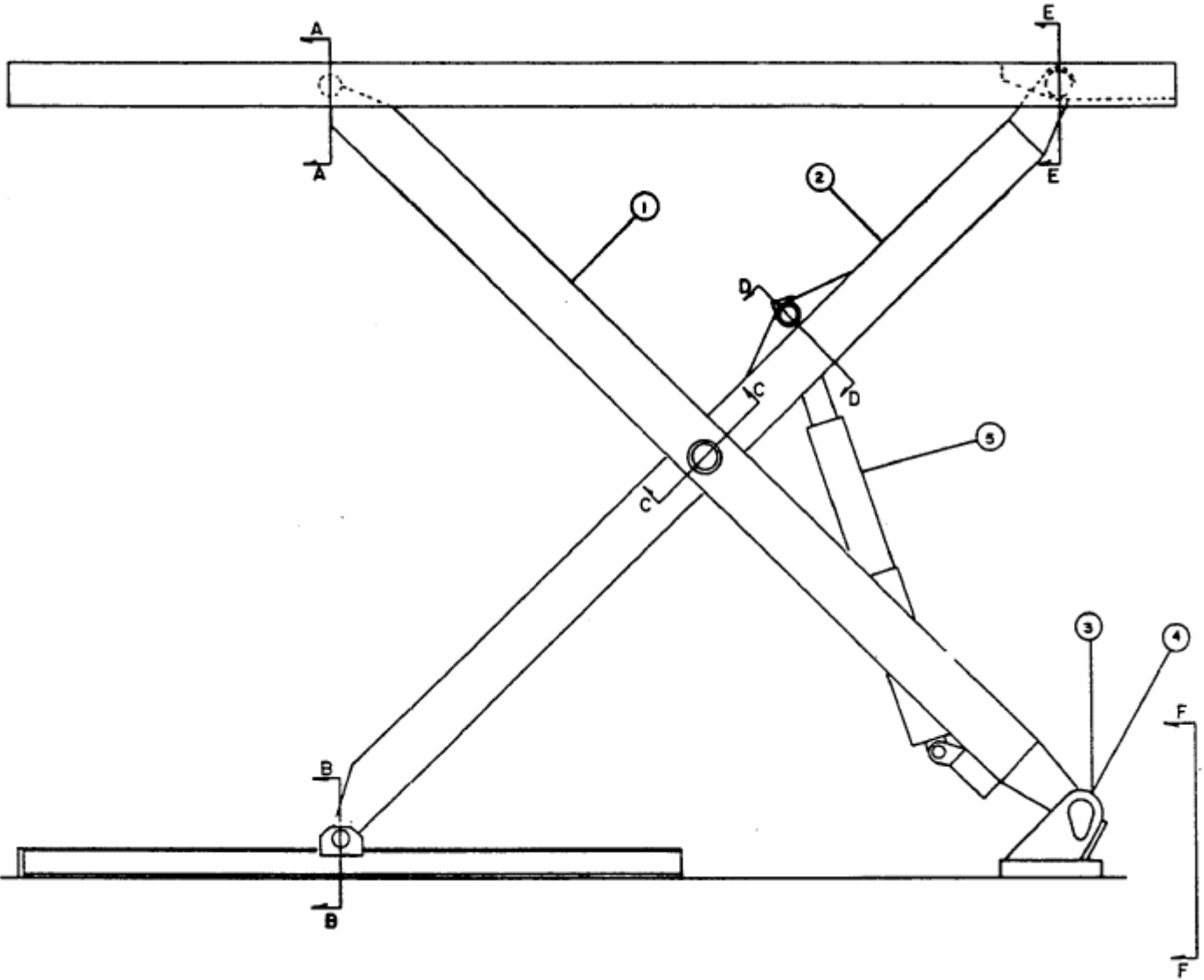
27	NSS	NUT, LOCK	2
28	NSS	ARM, CLAMP	1
29	NSS	PAD, CLAMP ARM	1
30	334123	CARTRIDGE ASSEMBLY (INCLUDES ITEMS 31, 32)	1
31	NSS	CARTRIDGE	1
32	NSS	CAP, SHIPPING	1
33	334126	VALVE, CHECK	2
34	332042	VALVE, SAFETY RELIEF	1
35	NSS	ACTUATOR ASSEMBLY, PNEUMATIC (INCLUDES ITEMS 36-45)	1
36	NSS	BODY, ACTUATOR	1
37	NSS	O-RING	1
38	NSS	PISTON, PNEUMATIC SLAVE	1
39	NSS	PIN, PUNCTURE	1
40	NSS	SPRING	1
41	NSS	O-RING	1
42	NSS	ADAPTER, BODY	1
43	NSS	WASHER	1
44	NSS	RING, RETAINING	1
45	NSS	GASKET	2
46	334013	CARTRIDGE ASSEMBLY (INCLUDES ITEMS 47, 48)	2
47	NSS	CARTRIDGE	1
48	NSS	CAP, SHIPPING	1
49	332044	ACTUATOR ASSEMBLY, MANUAL (INCLUDES ITEMS 46-48, 50-61)	1
50	NSS	KNOB	1
51	NSS	BOOT	1
52	NSS	NUT, JAM	1
53	NSS	BRACKET	1
54	NSS	BODY, ACTUATOR	1
55	NSS	O-RING	1
56	NSS	PIN, PUNCTURE	1
57	NSS	ELBOW, STREET	1

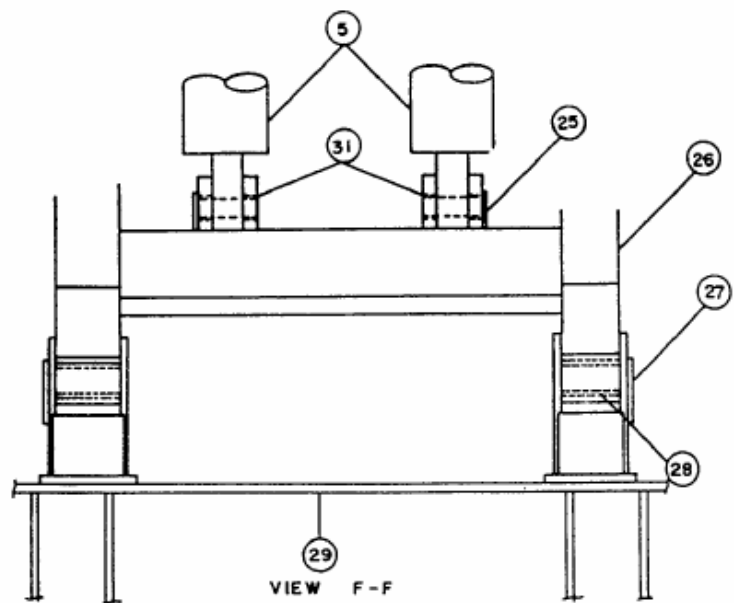
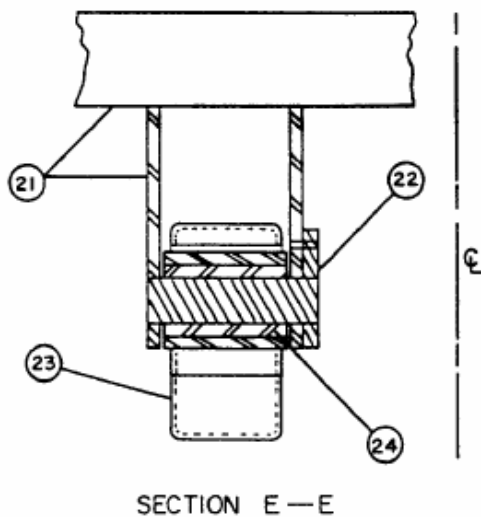
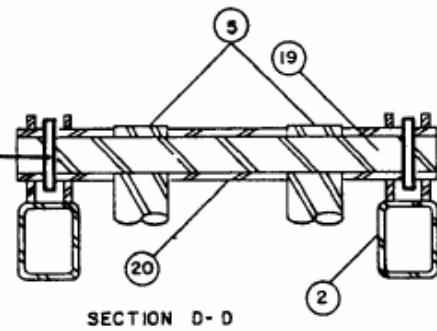
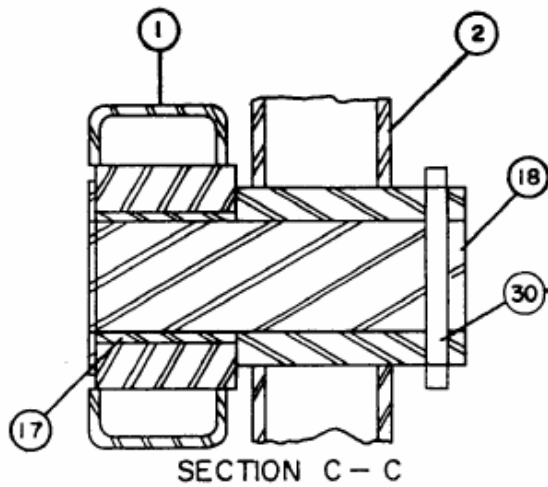
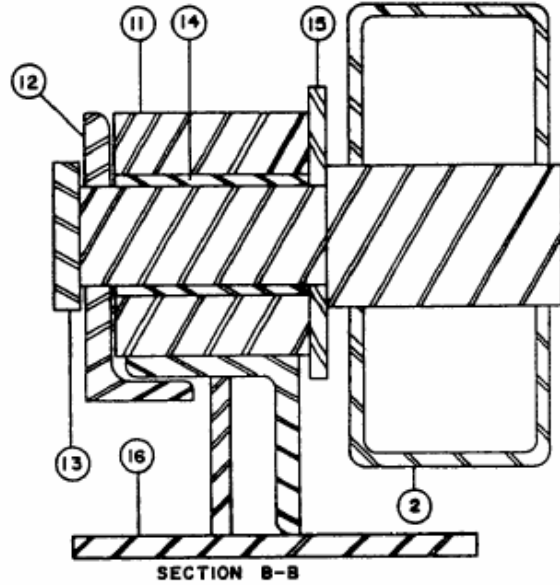
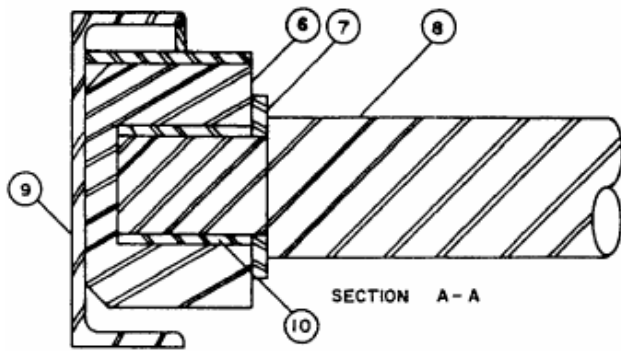


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58	NSS	SEAL, LEAD-WIRE	1
59	NSS	SCREW, DRIVE	1
60	NSS	CHAIN	1
61	NSS	RING PIN	1
62	334003	REMOTE ACTUATOR CARTRIDGE	1







SCISSOR LIFT

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<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	28418	LIFT ARM	1
2	28417	LIFT ARM	1
3	NSS	LEFT PIVOT BASE	1
4	NSS	RIGHT PIVOT BASE	1
5	SEE SEC. 8	LIFT CYLINDER	2
6	22303-05	ROLLER	2
7	22307-06	SPACER	2
8	28418	LIFT ARM	1
9	-----	FRAME	1
10	464701	BUSHING	2
11	22307-04	ROLLER	2
12	22306-04	ROLLER HOOK	2
13	9085-02	KEEPER	2
14	22307-05	BUSHING	2
15	22303-02	SPACER	2
16	-----	FRAME	1
17	BBG*48*56*88	BUSHING	2
18	21488-01	CENTER PIN	2
19	21488-02	PIN	1
20	22302-03	SPACER	1
21	-----	PLATFORM	1
22	21494-05	PIN	2
23	28417	LIFT ARM	1
24	464703	BUSHING	2
25	28483-02	PIN (STD)	2
	27877-02	PIN (FOR AUTO LUBE SYSTEM)	2
26	28418	LIFT ARM	1
27	21494-05	PIN	2
28	464703	BUSHING	2
29	-----	FRAME	1
30	605470	COTTER PIN	4

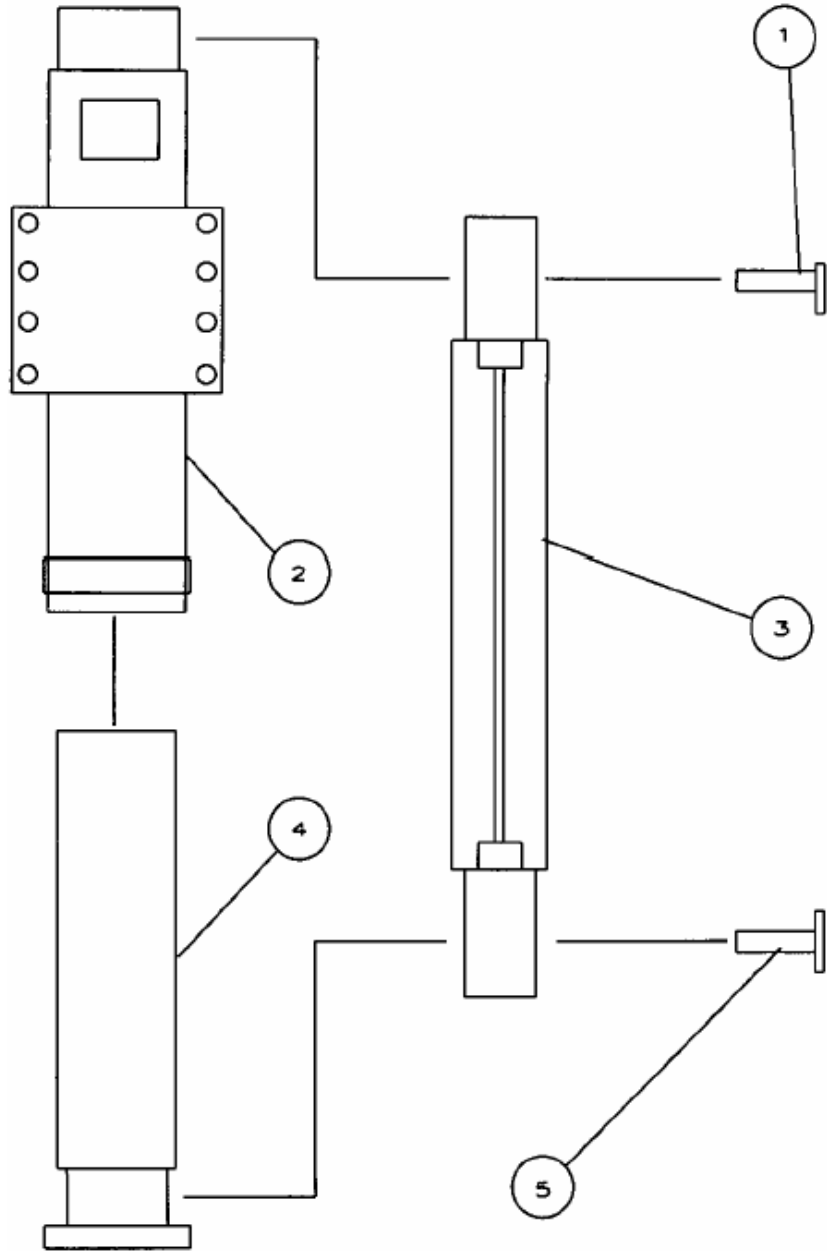
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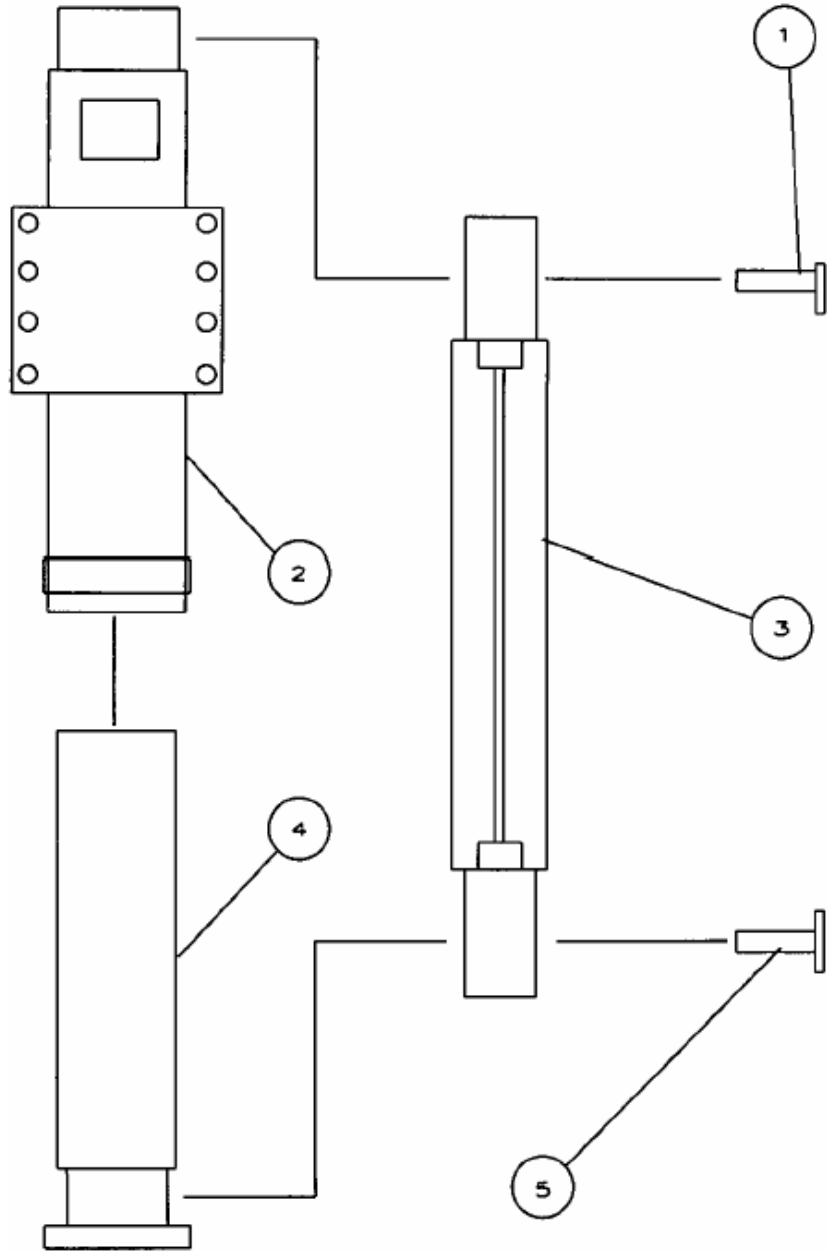
SCISSOR LIFT

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31	524387	BUSHING	4
32	22836-01	PIPE SUPPORT (PLATFORM)	A/R



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	19204-08	PIN	1
2	29299-01	OUTER TUBE	1
3	465430	CYLINDER	1
4	29298-01	INNER TUBE	1
5	19204-09	PIN	1
6*	22736-04	JACK HOSE GUARD	1



<u>ITEM</u>	<u>PART #</u>	<u>DESCRIPTION</u>	<u>QTY.</u>
1	19204-08	PIN	1
2	29299-02	OUTER TUBE	1
3	465430	CYLINDER	1
4	29298-01	INNER TUBE	1
5	19204-09	PIN	1
6*	22736-04	JACK HOSE GUARD	1