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Wollard Model 888 Belt Loader Manual

Revision #1

December 12, 1996

Effective Pages

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Chapter 1:	1/2, 3/4, 5/6, 7/8, 9/10, 11/12, 19/20, 21/22, 23/24, 27/28, 29/30, 31/32, 33/34, 37/38.
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Chapter 5:	1/2, added Char-Lynn motor, C-6 Transmission Service, C-6 Transmission Parts

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Wollard Model 888 Belt Loader Manual

Revision #2

June 25, 1997

Effective Pages

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Chapter 5: C-6 Transmission Parts

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Limited Warranty

Wollard Equipment

Wollard Airport Equipment Company (WAE) warrants to the original owner that all components of the Wollard equipment are free from defects in material and workmanship under normal use and service for 12 months or 1,000 hours, whichever comes first, from the earlier of the date of delivery or first use of the equipment.

This warranty provides for authorized representative or factory repair or replacement, at WAE's option, of any Wollard equipment component that fails because of defects in material or workmanship during the warranty period, without charge to the owner for parts or labor. The owner must provide the authorized dealer prompt notice of the defect and allow reasonable time for replacement or repair. The owner will pay all shipping costs of the equipment or parts to and from the warranty service facility.

This warranty applies only to parts manufactured by WAE. Components installed on the Wollard equipment but not manufactured by WAE shall be covered under the original manufacturer's warranty, if any, and WAE will pass on all such warranties, with the exception of tires, battery, and other expendable parts, for which the owner will be required to deal directly with the original manufacturer for warranty service. Neither tune-ups and other normal maintenance, nor the repair or replacement of expendable parts (such as oil, lubricants, belts, filters, tires, battery, etc.) are covered by this warranty.

This warranty does not cover damage resulting from carelessness or neglect; accidents, fire, or other casualties; improper repair, operation, transportation, or storage; or failure to provide necessary or appropriate maintenance. This warranty does not cover deterioration or failure caused by chemicals, falling objects, dirt and sand, or excessive heat or moisture. This warranty applies only to equipment sold within the United States and Canada.

The Wollard equipment must be maintained according to the instructions provided with it or this warranty may be considered void. Warranted components must be replaced with parts manufactured or approved by WAE. Warranty determination will be made after WAE or its authorized representative inspects the failed part.

WAE is not liable for damage or injury resulting from improper installation, use, abuse, inability to use or misapplication of WAE equipment, nor is WAE liable for damage resulting from equipment repaired or modified by persons not authorized by WAE. Wollard Airport Equipment Company does not warrant any part or product to meet local, municipal, state, provincial, or national laws or regulations.

This Limited Warranty is in lieu of all other warranties, whether express, implied, or statutory. No other express warranty is given or authorized by WAE. Wollard Airport Equipment Company expressly disclaims any implied warranty of merchantability or fitness for a particular purpose or otherwise. WAE shall not be liable for loss of use of equipment, loss of time, loss of business, or for any other special, incidental, or consequential damages. No authorized WAE representative has the right to change or modify this warranty in any respect.

This warranty is non-transferable.

TO OBTAIN WARRANTY SERVICE

Warranty service can be obtained from the Wollard Airport Equipment Company (WAE) factory or from a WAE representative authorized to make warranty repairs. If you need warranty service, contact WAE. For the name and location of the nearest representative providing warranty service, contact Wollard Airport Equipment Company, 1125 Starr Avenue, Eau Claire, WI 54703, 715/835-3151 (Fax 715/835-6625).

Warranty Procedures for Wollard Equipment

All Wollard models are covered under Wollard Airport Equipment Company's (WAE) new equipment warranty, which applies to all Wollard components except those not manufactured by WAE. Components installed on the unit but not manufactured by WAE are covered under the original manufacturer's warranty, if any.

What is covered by warranty?

- All parts determined to be defective during the period that the unit is under warranty.
- Normal ground freight to deliver replacement parts.

What is not covered by warranty?

- Failure resulting from neglect, such as improper operation and lack of required maintenance.
- Modifications to equipment without approval from the WAE Engineering Department.
- Failures caused by carelessness or accidents such as improper operation, transportation, or storage of the equipment.
- Deterioration or failure caused by chemicals, falling objects, dirt and sand, or excessive heat or moisture. Warranty determination will be made after WAE engineers inspect the failed part.
- Failure caused by not performing scheduled maintenance or not tightening or replacing loose or missing bolts, nuts, and other fittings.
- Maintenance items such as oils and lubricants, filter elements, belts, pivot pins, etc. are not warranted.
- Time required to diagnose and repair a warranty problem. Only part replacement is covered under the warranty.
- Damage during transportation.
- Freight to return defective parts.

Warranted components must be replaced with Wollard parts.
Warranty repairs must be authorized by WAE.

Refer to the Warranty text for more specific conditions.

Wollard Airport Equipment Company attempts to use only the finest readily available components in the manufacture of its equipment. These components are warranted to us and require us to follow certain procedures in order to ensure our customers receive proper credit.

What to do when you receive a new unit.

- Make sure that you have received all equipment, including manuals and registration card. Return the registration card immediately.
- Inspect the unit for any transportation damage, including broken glass, leaks, or loose wires or belts.
- Clean the unit as necessary to make it presentable and ready for use.

What to do when you discover a possible warranty problem.

Call Wollard Airport Equipment Company (715-835-3151). We will require the serial number, number of hours on the unit, and a description of the problem. You will be given a warranty authorization number and assistance in preliminary troubleshooting.

Important . . . !

- Clear and immediate communication with the factory is the key to obtaining a satisfactory and timely resolution of your warranty problem.
- Every warranty situation is different and so there are no hard rules. We will work with your maintenance personnel and service managers to equitably resolve all claims.

What to do after warranty problem has been resolved.

- Complete and return the warranty claim form within 10 days. The sooner you return the claim, the sooner we will issue credit. Use the warranty authorization number we gave you when you first called us with the problem.
- Return defective parts immediately. Your claim cannot be processed until all defective parts have been returned to Wollard Airport Equipment Company. Identify returned parts with the warranty authorization number.

What labor rate and time should be used?

The labor rate is reviewed annually with the service manager. If you do not have an established rate at this time, call Wollard Airport Equipment Company. We do not publish a rate book; instead, we have accumulated over many years average times for repairs. We will authorize times for most repairs once we have approved the repair. If unforeseen circumstances cause a significantly greater repair time than originally allowed, please contact us before sending in your claim.

This manual is available on CD-ROM.

Keep a copy of your Wollard or NMC manuals on your computer or CD-ROM! You will be able to print pages and adjust page view anywhere between 25%-400%. Our view-only manuals contain hypertext links in the tables of contents, so by mouse-clicking on a table of contents entry, the page containing that item will automatically be displayed. Part number and description indexes also contain links to the part number or item on the referenced illustrated parts page.

- Requirements (minimum): PC with Windows 95, 486 processor (586 recommended), 8MB RAM, VGA monitor, mouse.
- Document-viewing software (FrameViewer 5.1.1) is required (P/N 302261).
- Hard disk memory: 10-12 MB for document-viewing software.

For pricing, call the NMC/Wollard Parts Dept. (715-835-3151)

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FRONT BRAKE PARTS

REAR BRAKE PARTS

Axle Model 44 Repair Manual–Dana/Spicer

* There is no manual available for the Cessna or Vickers pump.

Chapter 1 Tab

Chapter 1
GENERAL INFORMATION AND OPERATING INSTRUCTIONS

Page

SECTION 1
DESCRIPTION OF THE BELT LOADER

The Wollard Belt Loader, Model TC-888, is a belt conveyor with a center-mounted conveyor belt specifically designed to assist airport ground service personnel in the loading and unloading of passenger baggage and cargo. For load capacities, weights and sizes, elevating ranges, etc., refer to Section 3.

Main Chassis

The chassis is a welded-steel structure containing the operator's station, power pack (engine package) and drive train, stabilizers, and independent hydraulic system. Steering is powered by the independent hydraulic system. The drive train is a conventional rear-wheel design, having a transmission, driveshaft, and differential. The alternator/battery electrical system powers all electrical requirements.

Conveyor Bed Lift Mechanism

Two lift frame weldments, one under each end of the conveyor bed and each actuated by a separate hydraulic cylinder, comprise the bed lift mechanism. Both frames are attached to conveyor bed and chassis by pivot pins.

Conveyor Bed

The conveyor bed is composed of a steel frame upon which the drive roller, tail roller, bed and idler rollers, rubber conveyor belt, and the hydraulic drive components are assembled. The drive roller is driven by a roller chain and sprocket mounted on the hydraulic drive motor shaft. Rotational direction of the motor is controlled by a valve. Rubber bumpers are located at the forward and aft ends of the bed.

Hydraulic System

Figure 1

The hydraulic system powers the conveyor bed lift cylinders, the conveyor belt drive, and vehicle power steering. The system consists of the engine-driven hydraulic pump, oil reservoir, control valves, oil filter, and hydraulic work cylinders (steering and lift); check, flow control and gate valves; and the associated plumbing, fittings and hoses. The following functional units are explained on the next three pages: Conveyor Bed Lift System, Conveyor Belt Drive System, and Power Steering.

Use Mobil DTE-13 in operating temperatures of +20°F to +120°F (-7°C to +50°C).

Use Mobil Aero HFA (MIL-H-5606A) in operating temperatures of -25°F to +50°F (-32°C to +10°C).

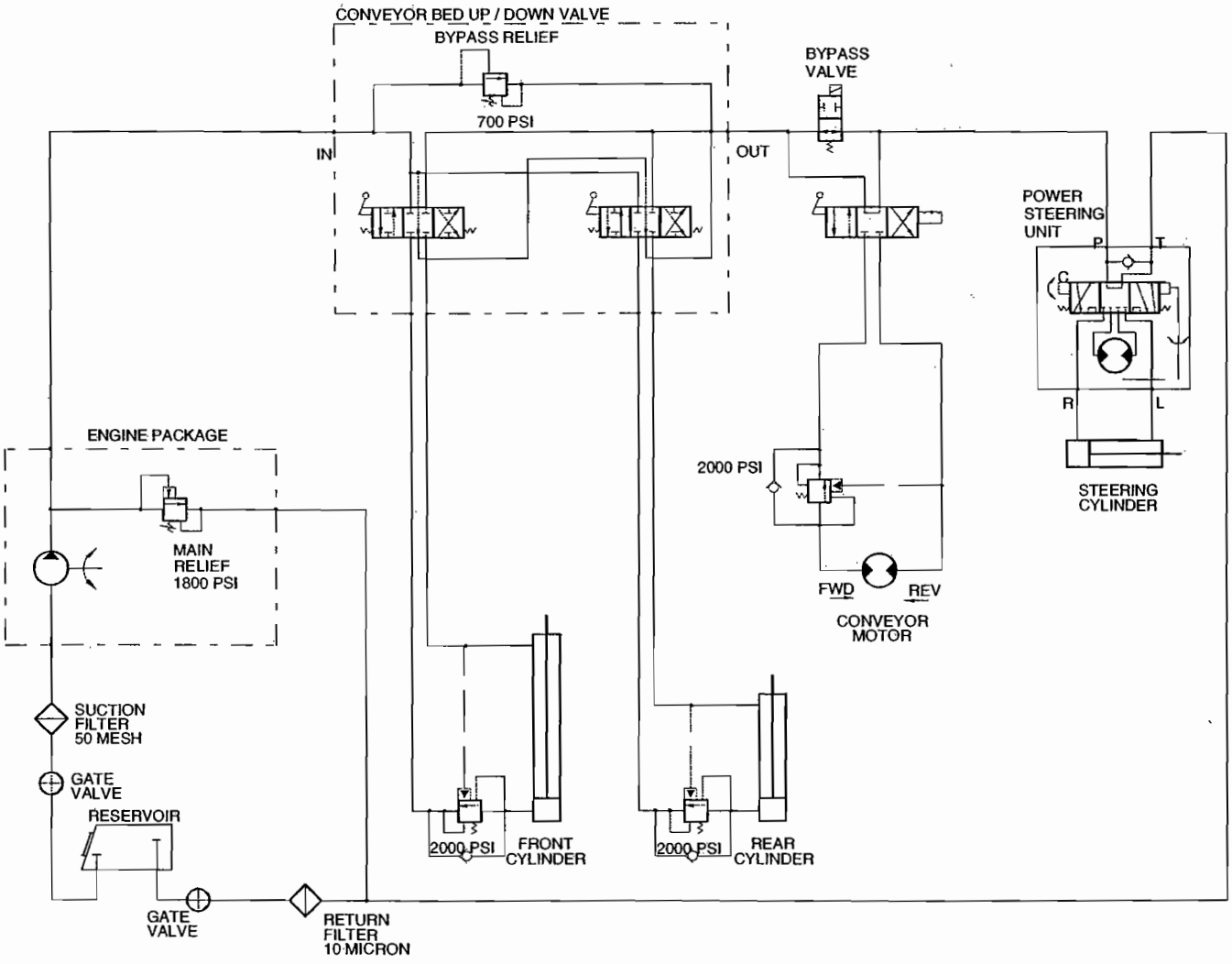


Figure 1
Hydraulic Schematic.

Hydraulic Oil Reservoir

The hydraulic oil reservoir is behind the operator's station. The tank is made of welded aluminum to reduce internal corrosion and scale buildup. Working oil capacity is 8.5 U.S. gallons (32 liters). The reservoir is fitted with a magnetic drain plug, sight gauge, and a vented filler/strainer located in the center of a cleanout cover.

A shutoff valve and an 80-mesh external Y-strainer are installed in the suction line between the reservoir and the pumps. A 10-micron filter unit, with a replaceable element and a shutoff valve, is located in the return line.

Hydraulic Pumps

The hydraulic pump is driven by the vehicle engine. It is a fixed-displacement gear-type mounted on the engine. The main pressure relief valve is with the engine package and limits system pressure to a specified setting. All main valves are open-center types which allow unused hydraulic oil to return freely to reservoir when a function is not being used.

Conveyor Bed Lift System

⚠CAUTION Do not use the conveyor bed as a lifting mechanism. The conveyor is designed to support only the specified loads.

Description

The front and rear sections of the bed are raised and lowered by two single-acting work cylinders mounted to the chassis. A check valve on each cylinder locks the cylinder in place when in raised (extended) position. The bed is not powered down; instead, the cylinders retract because of the weight of the bed and scissor assemblies. Check valves allow oil to be diverted from the cylinder blind end directly to the rod end to keep the rod end full of oil when lowering the bed. The counterbalance valve limits lowering speed.

How the Lifts Work

The conveyor bed "Raise" and "Lower" control levers are located to the operator's right, just below seat level. The two levers are attached to the "Conveyor Bed Up/Down Valve." Pulling a lever up shifts the spool, directing fluid to extend the cylinder, and pushing the lever down shifts the spool in the other direction, directing fluid to retract the cylinder. When the lever is in center position, fluid free-flows through the valve's open center.

When extending a cylinder, fluid free-flows through the counterbalance valve.

When retracting a cylinder, fluid pressure builds up in the cylinder retract line until it is sufficient to force the counterbalance valve open and allow fluid to escape from the blind end of the cylinder. The counterbalance valve controls pressure in the retract line to prevent the cylinder from retracting too quickly.

Conveyor Belt Drive System

The belt is powered through a chain-and-sprocket reduction by a geroler-type hydraulic motor mounted within the bed frame.

A counterbalance valve in the belt motor hydraulic circuit prevents runaway of heavy packages when in the "Unload" or "Reverse" mode of operation.

Important! Unless the handbrake is applied and the gearshift lever is in neutral position, a bypass valve remains open, disallowing pressure in the belt motor circuit.

Setting the parking brake "On" and placing the gearshift in "Neutral" energizes the solenoid on the bypass valve, closing the bypass valve and forcing fluid to flow through the belt valve.

Operating the belt control lever causes the spool to shift, directing fluid to turn the hydraulic motor either forward or reverse as required.

When running forward, fluid free-flows through the counterbalance valve. When running in reverse, the counterbalance valve remains closed until sufficient pilot pressure builds up and shifts the spool to allow fluid to escape.

A heavy "overrunning" load on the belt will tend to pull the hydraulic motor faster than the pump can supply fluid. This has the effect of reducing pressure going into the motor, which in turn reduces pilot pressure on the counterbalance valve, allowing the spool to start closing. The valve spool will close until it restricts flow out of the motor as much as is required to return the belt to its original speed.

Power Steering System

The steering gear is powered by a gimbal-mounted, double-acting hydraulic cylinder mounted on the front axle. The control unit is actuated directly by the steering wheel to control flow of hydraulic power to the steering cylinder.

Turning the steering wheel actuates the rotary valve in the power steering unit. As the valve opens, hydraulic oil travels into a metering motor within the power steering unit, then out from the motor, through the valve, and out to the retract side of the steering cylinder. Return oil from the extend side flows through the valve to the reservoir. Oil flowing through the metering motor causes it to turn, and as it turns, it moves a feedback linkage that returns the rotary valve to center and locks the steering cylinder in position. The metering motor therefore ensures that the steering cylinder is precisely controlled by the command received from the steering wheel.

In the event of a power failure, steering can be done manually by spinning the steering wheel. In this case, steering wheel movement turns the metering motor directly through the feedback linkage. The motor is then used as a pump to force oil into the cylinder, while drawing oil into the suction side (through check valve) from the return line.

Electrical System

See schematics at the end of this Section

All electrical power is supplied by the alternator/battery system. This includes starting, control and monitoring, vehicle lighting, and accessory equipment. The system consists of three main groups:

Instrument Panel Assembly

The instrument panel, located at the operator's station, contains all necessary controls for the engine, lighting systems, and engine system monitors. The controls and indicators are grouped and labeled for ease of use and identification.

Fuses for the control circuits are located on a sub-panel at the lower right-hand corner of the instrument panel. All fuses are labeled as to circuit and current rating. The complete panel can be unplugged and removed for service or replacement.

Engine Package Electrical Assembly

All wiring for the engine package is self-contained and may be unplugged from the vehicle chassis harness for quick removal of engine/transmission assembly. A sub-panel on the engine contains the starter and glow plug (diesel engine) relays and the main system and glow plug system power fuses.

Chassis and Lift Platform Systems

A single harness on the main chassis interconnects the instrument panel and engine package with all other electrical components, lighting, and accessories. All components installed are of standard automotive type for easy procurement and replacement. All components that are not weatherproof are adequately protected from the elements.

A second harness interconnects the bed devices.

Power Distribution and Control Circuits

Power for all vehicle control and lighting circuits is supplied to the engine sub-panel from the positive battery cable connection on the engine starter. At this point, the power circuit is divided into two circuits:

- Wire #10 (through 30-ampere fuse, feeds the instrument panel keyswitch.
- Wire #7 (through a 30-ampere Slo-Blo fuse) feeds the glow plugs (diesel engines only).

At the instrument panel, power is fed through the keyswitch to the run, start, and accessory circuits. The keyswitch (SW1) is a 3-position conventional anti-restart automotive rotary switch with OFF-RUN-START positions. The START position is mechanically interlocked so that SW1 must be turned to OFF before the starter may be re-engaged. Each of these circuits is in turn divided as necessary and all are fused in accordance to wire size and circuit load.

Engine Start Circuit

The solenoid (CR1) on the engine starter is energized as follows:

Power is fed to SW1 as described in above. When the switch is turned to the START position, SW1 contact closes, energizing relay CRR coil through the closed emergency stop switches (LB, RB, LF, RF). Start enable relay CR2 is energized when CRR contact closes. CR2 contact closes to energize engine start relay CR1 through the transmission neutral switch LS-N1.

CR1 contact energizes the starter solenoid to run the starter motor.

CRE contact closes to complete the circuit through engine ignition system and keep CR1 energized. If neutral switch LS-N1 is open, i.e., the transmission is not in neutral, CR1 will not energize and the engine will not start. Likewise, if any emergency stop switch (LB, RB, LF, RF) is open, relay CRR will not energize and none of the "Start/Run" circuit will function.

Engine Run Circuit

Diesel engines are controlled by a solenoid-operated fuel pump shutdown, and gasoline engines are controlled by ignition. These operate similarly from the operation viewpoint (energized to run, deenergized to shut down). The fuel shut-down solenoids on diesel engines are integral parts of the engines.

Power is fed through SW1 (in the RUN and START positions only) to energize the fuel solenoid or ignition. Turning the SW1 to OFF position deenergizes the fuel solenoid or ignition and stops the engine.

Battery Recharging and Monitoring System

The battery is recharged by an engine-driven alternator/regulator system. A red "Low Volts" light on the instrument panel warns of alternator system malfunction, and a resistor across the light provides start-up current to the alternator.

Power is fed to the "Low Volts" light through SW1 contact when SW1 is in the "Run" or "Start" position. Initially, with the engine stopped, current flows through the bypass resistor RES1, the light PL1, and the diode (rectifier) REC1 into the alternator field. This provides the initial excitation to the alternator when the engine first starts. With the engine running, the alternator quickly builds up its own voltage and feeds the field internally. The voltage on the field terminal then rises to system voltage, current stops flowing through the light and resistor, and the light extinguishes.

When SW1 is turned to "Off", REC1 blocks any reverse flow of current from the alternator and prevents the fuel solenoid from being held in by a backfeed of current through the resistor/light circuit.

Engine and Brake System Monitoring

Engine water temperature, oil pressure, and running hours are monitored by sensors, lights, and gauges on the instrument panel and engine. A single light monitors the condition of the brake system. All indicator lights are automatically tested every time the engine is switched on or off.

Power feeds the indicator lights and hourmeter through SW1 when in the "Run" or "Start" position.

Oil pressure and water temperature switches on the engine operate the "Low Oil Pressure" and "High Water Temp" indicators on the instrument panel.

The pressure differential/metering valve on the split brake system contains a switch that closes and illuminates the "Brake Fault" light if there is any pressure imbalance in the brake system.

The "High Water Temp" and "Brake Fault" indicators are self-testing, because the corresponding switches always stay open unless a fault condition occurs. When the keyswitch is off, capacitors CAP1 and CAP2 are not charged. As SW1 closes, power is applied and current begins to flow through indicator lamps PL3 and PL4 into the capacitors to charge the capacitors up to system voltage. As the capacitors charge and their voltage rises, the current through the lamps is correspondingly reduced until the current stops completely. When SW1 is turned to "Run", the lamps immediately illuminate, then gradually dim until they go out.

When SW1 is turned to "Off", voltage is removed from wire #17. The capacitors, which are charged up to system voltage, then discharge through the lamps back to ground, causing the lamps to illuminate momentarily.

Engine Glow Plugs or Preheat (Not applicable to gasoline engines)

When equipped with a diesel engine, glow plugs are furnished to aid in cold-weather starting. The procedure for glow plug operation varies with the engine.

Running Lights, Work Lights, Horn, and Other Accessories

Running lights and work lights are energized in the SW1 RUN position.

The headlights and rear lights are controlled by a two-position toggle switch on the instrument panel. The stoplights are controlled by a hydraulic pressure switch in the brake line. The backup lights are controlled by a switch on the automatic transmission shifter shaft.

Optional turn signal lights are controlled by a lever-operated switch on the steering column and a flasher.

Head lights, stop light, turn signals, and various other accessories are protected by a 15A fuse (6FU, see schematic).

Other accessories are energized through fuse 7FU, including the front and optional rear spotlights, which are controlled by toggle switches on the instrument panel. The horn is controlled by a center-mounted button on the steering wheel.

Conveyor Belt Interlock Circuit

Operation of the conveyor belt drive is hydraulically prevented by the belt interlock bypass valve, as explained in *Conveyor Belt Drive System.* Power to energize the belt interlock valve solenoid must first flow through handbrake switch LS-HB and the Neutral switch LS-N2.

The handbrake switch is mounted on the handbrake mechanism, and the contacts will close only when the handbrake is fully applied.

The Neutral switch is mounted on the gearshift selector mechanism, and is closed only when the gearshift is in Neutral. When the handbrake is applied, power feeds the "Park Brakes On" light (PL6) on the instrument panel.

Diode REC2 across the "Park Brakes On" light is a "flyback" type. This diode allows the inductive energy stored by the solenoid coil (when energized) to bypass the light (PL6) and discharge harmlessly when the solenoid is deenergized. If REC2 were not present, a high voltage spike would momentarily appear across the filament of PL6, resulting in greatly reduced bulb life.

Engine and Drive Train

The TC-888 Belt Loader is designed with a self-contained quick-change modular power package (engine, transmission, driveshaft, cooling system, engine electric pack, and the engine-driven hydraulic pump system) which is assembled into an easily removable frame.

The quick-change feature makes it possible to remove and replace the complete power package for rapid turnaround of the vehicle. The self-contained package can be run for testing outside of the chassis. A test stand with fuel tank and electrical controls is available from Wollard for this purpose.

Because of the modularity of the power package, it is possible to furnish the TC-888 with a selection of engine systems, both diesel and gasoline.

Both front and rear axles and driveshaft are conventional automotive type, with disc brakes on the front and drum brakes on the rear. The rear axle has a limited slip differential to provide improved traction in wet, ice, and snow conditions.

Brake System

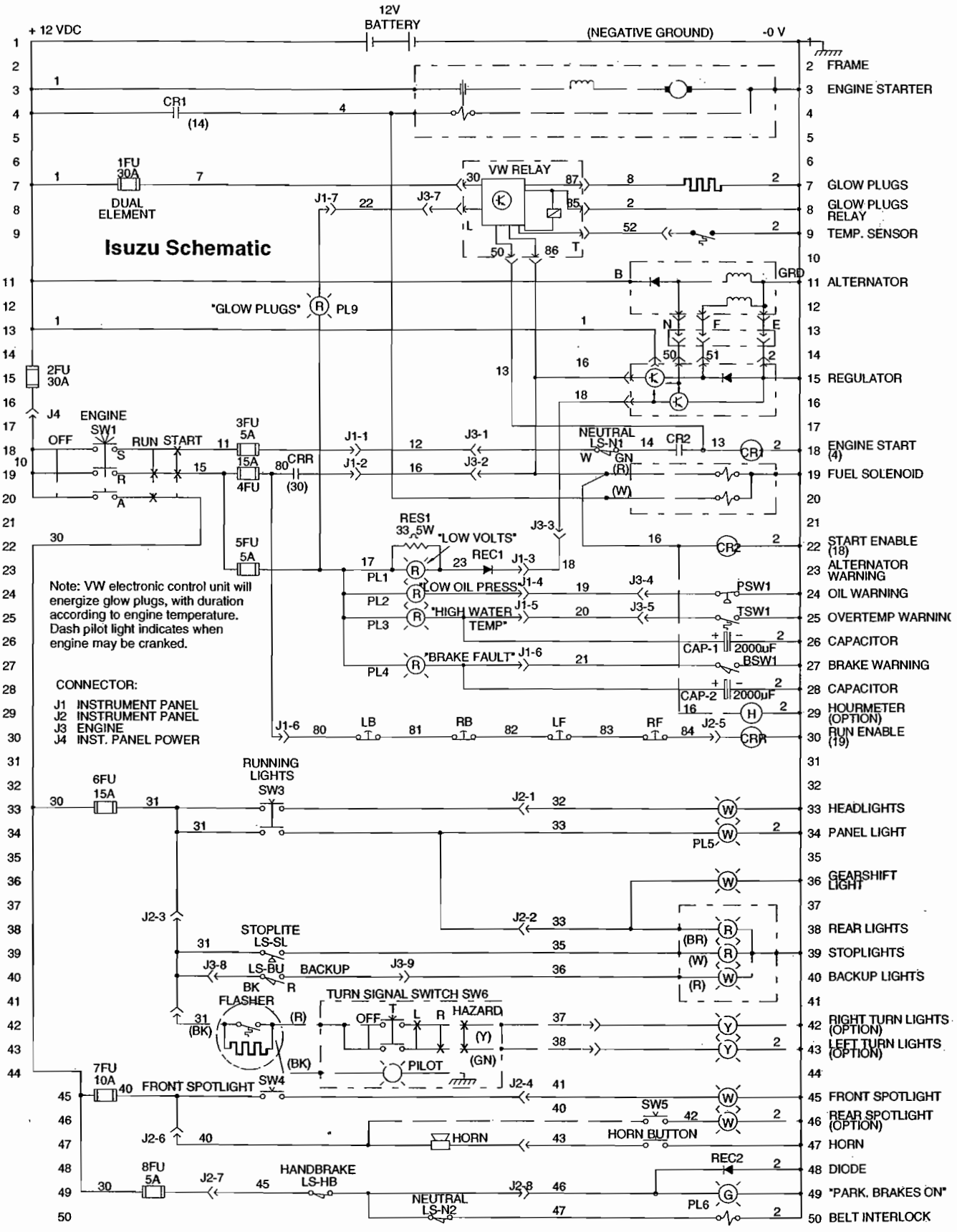
The standard brake system is a non-powered, dual-circuit system using standard automotive components. The front wheels have disc brakes and the rear have self-adjusting drum brakes. A pressure differential metering valve balances the pressures between the front and rear brake systems to assure safe, effective braking. This valve also monitors pressures in both systems and signals system malfunctions via the "Brake Fault" light on the instrument panel.

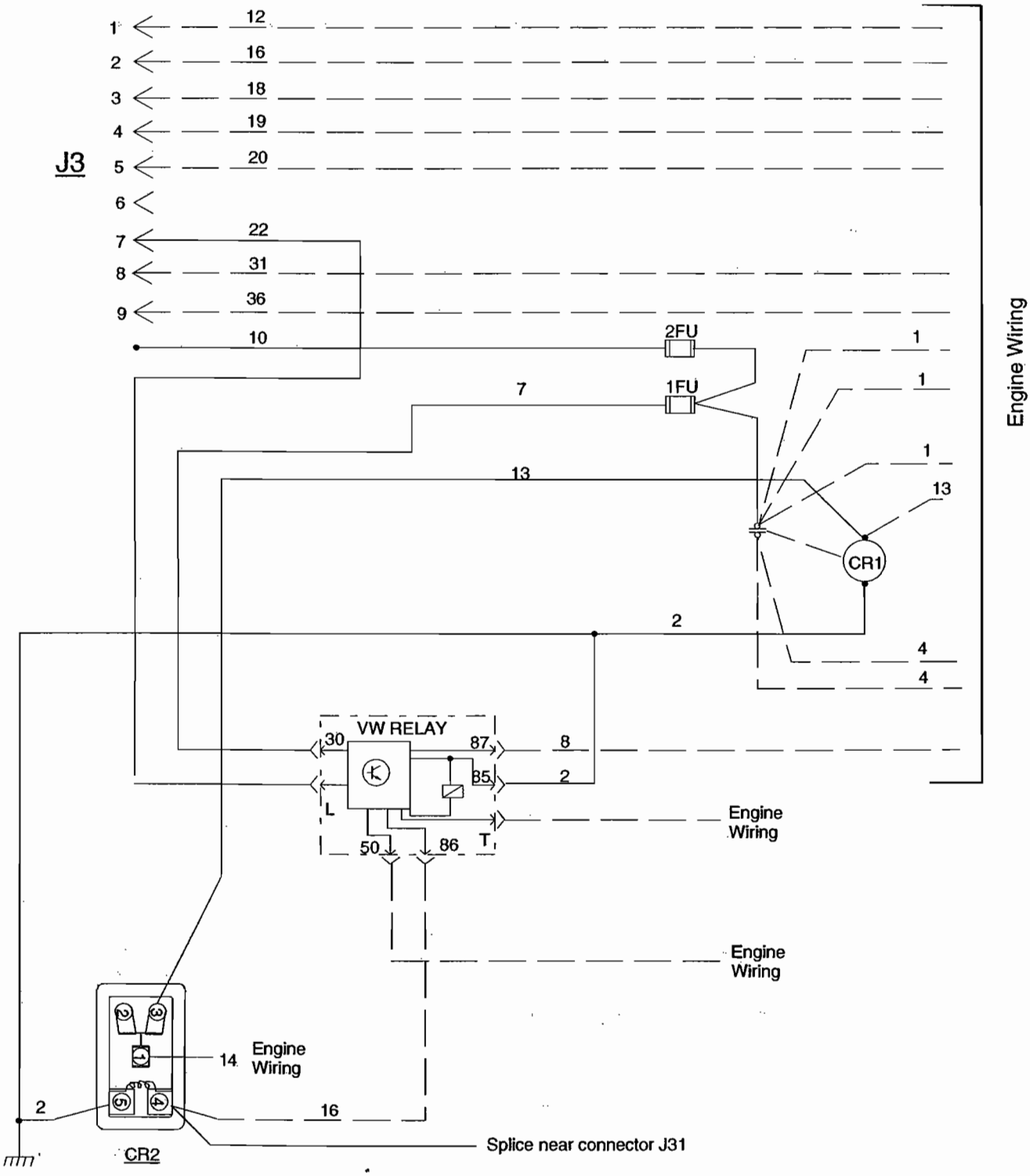
Handbrake

Rear axle brakes are also cable-operated by the handbrake lever. The lever is provided with a locking setscrew to prevent unauthorized adjustment.

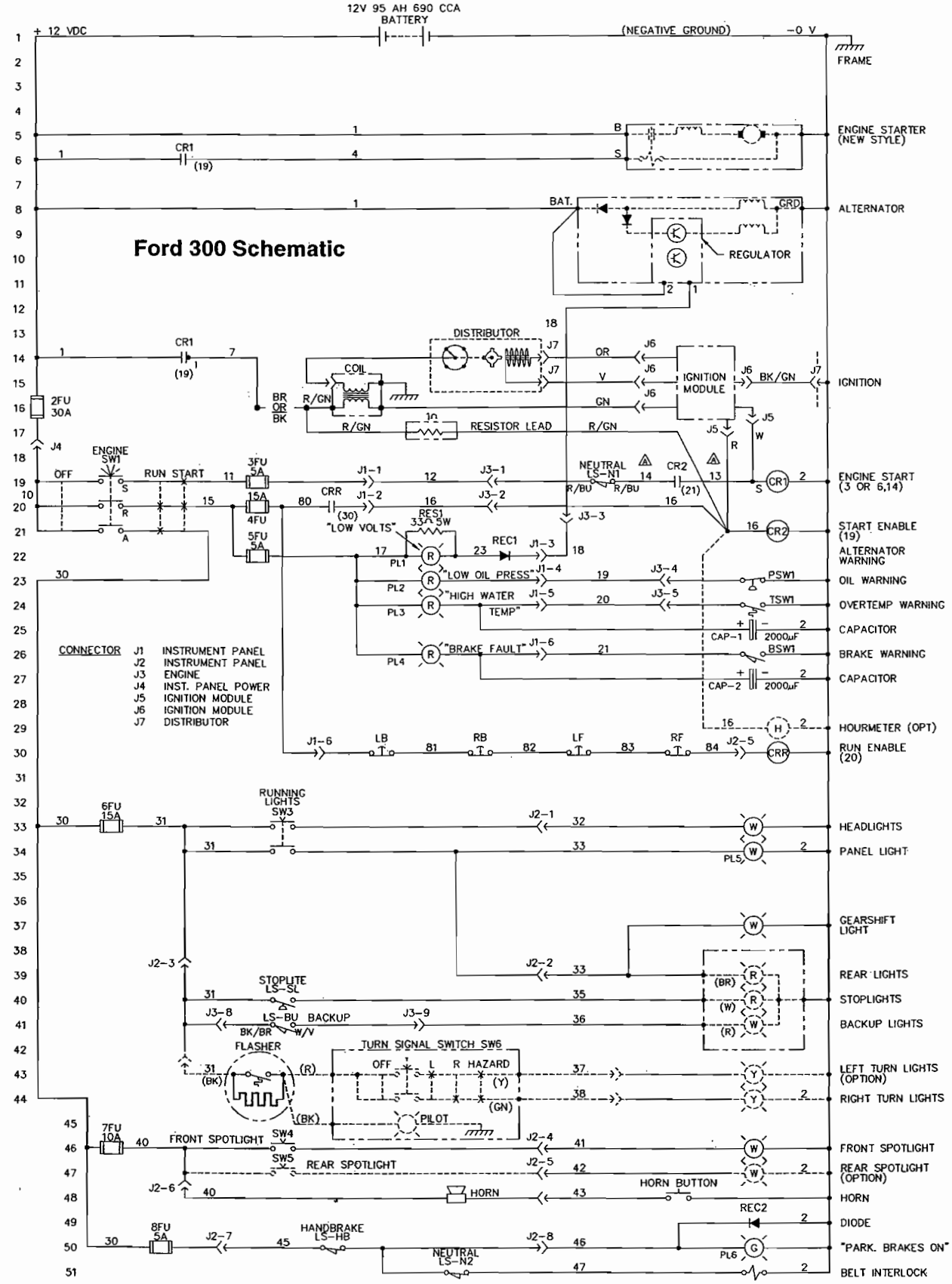
Electrical Schematics

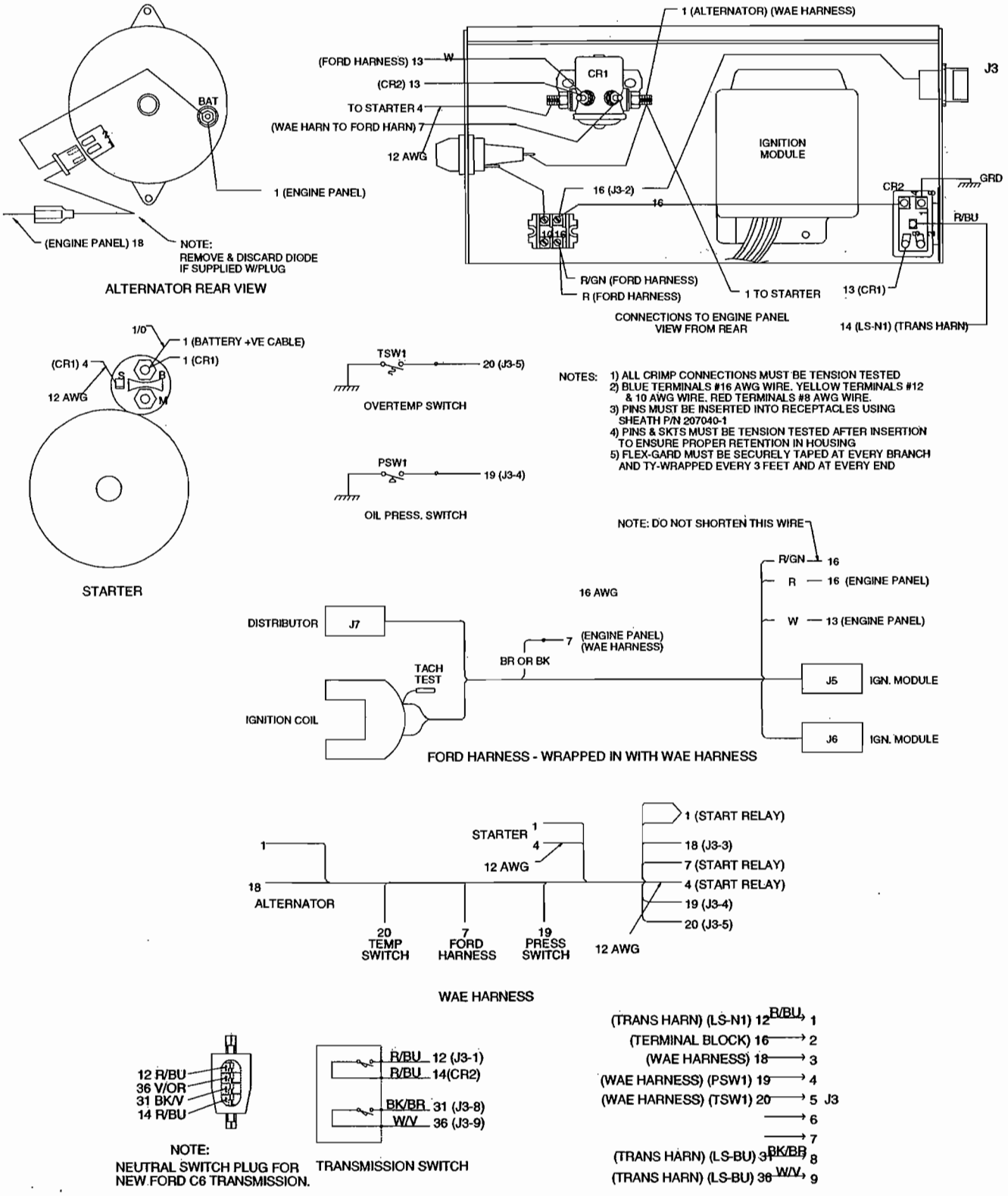
On the following pages are electrical schematics.


Isuzu Schematic
12V BATTERY
+ 12 VDC
(NEGATIVE GROUND)
-0 V
FRAME
ENGINE STARTER
GLOW PLUGS
GLOW PLUGS RELAY
TEMP. SENSOR
ALTERNATOR
REGULATOR
ENGINE START (4)
FUEL SOLENOID
START ENABLE (18)
ALTERNATOR WARNING
OIL WARNING
OVERTEMP WARNING
CAPACITOR
BRAKE WARNING
CAPACITOR
HOURMETER (OPTION)
RUN ENABLE (19)
HEADLIGHTS
PANEL LIGHT
GEARSHIFT LIGHT
REAR LIGHTS
STOPLIGHTS
BACKUP LIGHTS
RIGHT TURN LIGHTS (OPTION)
LEFT TURN LIGHTS (OPTION)
FRONT SPOTLIGHT
REAR SPOTLIGHT (OPTION)
HORN
DIODE
"PARK. BRAKES ON"
BELT INTERLOCK
VW RELAY
DUAL ELEMENT
"GLOW PLUGS" PL9
ENGINE SW1
OFF
RUN
START
"LOW VOLTS"
"LOW OIL PRESS"
"HIGH WATER TEMP"
"BRAKE FAULT"
NEUTRAL LS-N1
NEUTRAL LS-N2
HANDBRAKE LS-HB
RUNNING LIGHTS SW3
STOPLITE LS-SL
BACKUP LS-BU
FLASHER
TURN SIGNAL SWITCH SW6
HAZARD
PILOT
SW4
SW5
HORN BUTTON
PSW1
TSW1
BSW1
CAP-1 2000uF
CAP-2 2000uF
REC1
REC2
Note: VW electronic control unit will energize glow plugs, with duration according to engine temperature. Dash pilot light indicates when engine may be cranked.
CONNECTOR:
J1 INSTRUMENT PANEL
J2 INSTRUMENT PANEL
J3 ENGINE
J4 INST. PANEL POWER



Isuzu Engine Wiring


Ford 300 Schematic
12V 95 AH 690 CCA BATTERY
+ 12 VDC
(NEGATIVE GROUND)
-0 V
FRAME
ENGINE STARTER (NEW STYLE)
ALTERNATOR
REGULATOR
DISTRIBUTOR
COIL
IGNITION MODULE
IGNITION
RESISTOR LEAD
ENGINE SW1
OFF
RUN START
NEUTRAL LS-N1
ENGINE START (3 OR 6,14)
START ENABLE (19)
ALTERNATOR WARNING
"LOW VOLTS"
"LOW OIL PRESS"
"HIGH WATER TEMP"
"BRAKE FAULT"
OIL WARNING
OVERTEMP WARNING
BRAKE WARNING
CAPACITOR
HOURMETER (OPT)
RUN ENABLE (20)
CONNECTOR J1 INSTRUMENT PANEL
J2 INSTRUMENT PANEL
J3 ENGINE
J4 INST. PANEL POWER
J5 IGNITION MODULE
J6 IGNITION MODULE
J7 DISTRIBUTOR
RUNNING LIGHTS SW3
HEADLIGHTS
PANEL LIGHT
GEARSHIFT LIGHT
REAR LIGHTS
STOPLIGHTS
BACKUP LIGHTS
STOPLITE LS-SL
LS-BU BACKUP
FLASHER
TURN SIGNAL SWITCH SW6
LEFT TURN LIGHTS (OPTION)
RIGHT TURN LIGHTS
PILOT
FRONT SPOTLIGHT SW4
REAR SPOTLIGHT SW5
FRONT SPOTLIGHT
REAR SPOTLIGHT (OPTION)
HORN
HORN BUTTON
DIODE
HANDBRAKE LS-HB
NEUTRAL LS-N2
"PARK. BRAKES ON"
BELT INTERLOCK

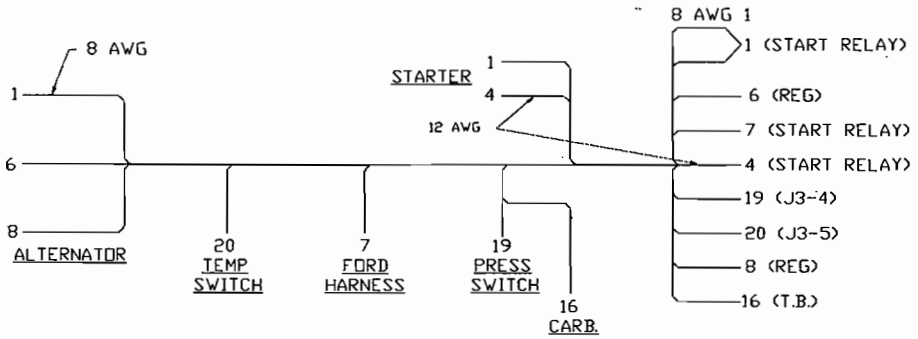


Ford 300 Engine Wiring

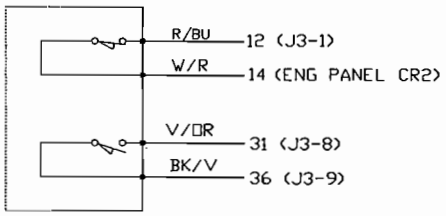
Ford 2.3L Schematic

Drawing not available at
time of printing

NOTES:
1) ALL CRIMP CONNECTIONS MUST BE TENSION TESTED
2) BLUE TERMINALS #16 AWG WIRE. YELLOW TERMINALS #12 & 10 AWG WIRE. RED TERMINALS #8 AWG WIRE.
3) PINS MUST BE INSERTED INTO RECEPTACLES USING SHEATH P/N 207040-1
4) PINS & SKTS MUST BE TENSION TESTED AFTER INSERTION TO ENSURE PROPER RETENTION IN HOUSING
5) FLEX-GARD MUST BE SECURELY TAPED AT EVERY BRANCH AND TY-WRAPPED EVERY 3 FEET AND AT EVERY END

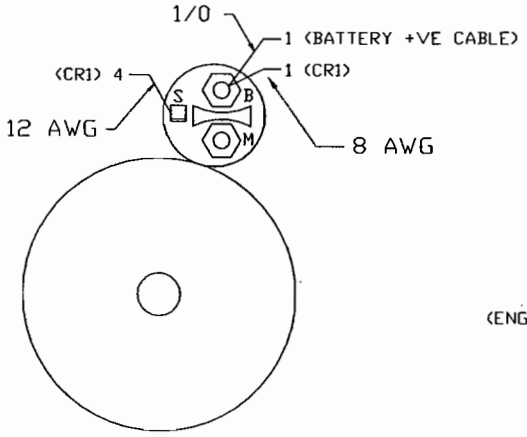


WAE HARNESS



TRANSMISSION SWITCH

(TRANS HARN) (LS-N1) 12 —R/BU→ 1
(TERMINAL BLOCK) 16 → 2
(REGULATOR) 18 → 3
(WAE HARNESS) (PSW1) 19 → 4
(WAE HARNESS) (TSW1) 20 → 5 J3
→ 6
→ 7
(TRANS HARN) (LS-BU) 31 —V/DR→ 8
(TRANS HARN) (LS-BU) 36 —BK/V→ 9



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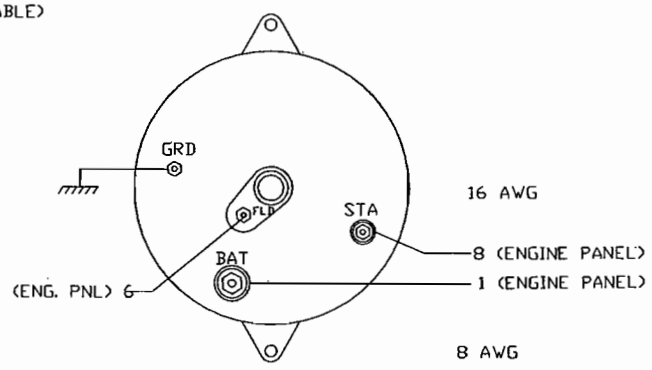
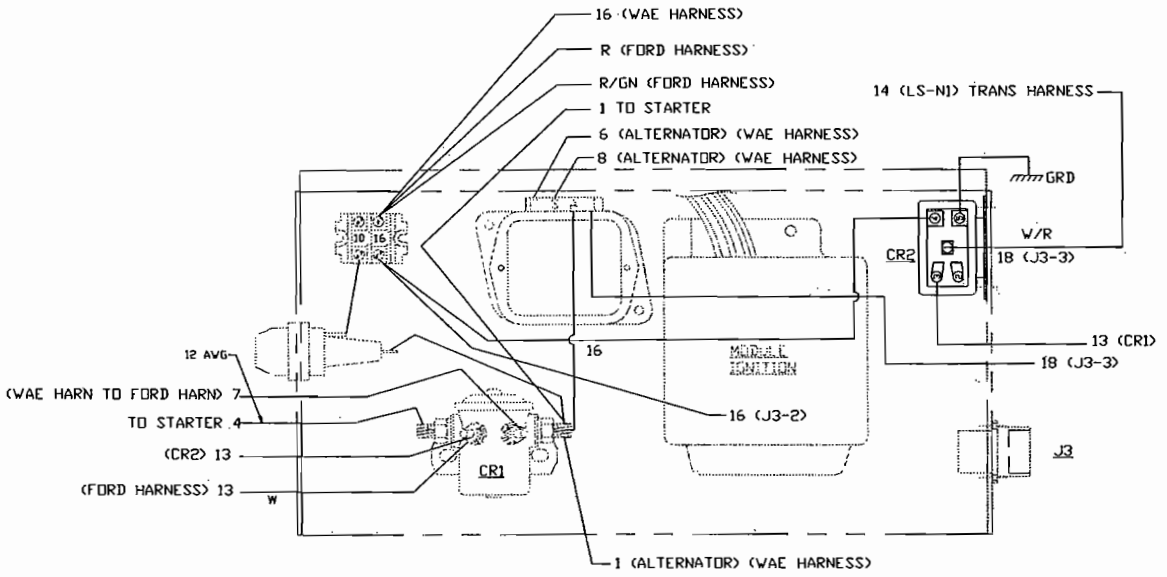
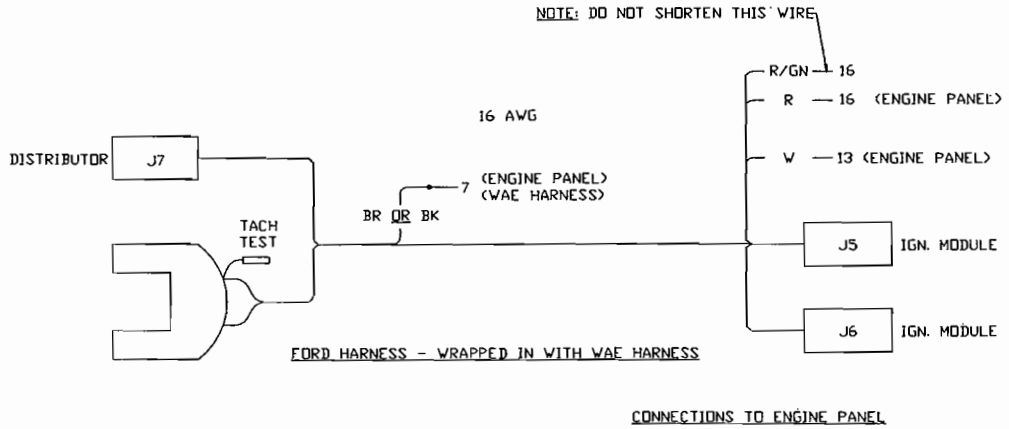


ALTERNATOR REAR VIEW

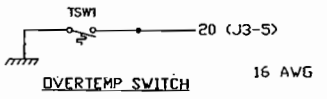
VIEW FROM REAR

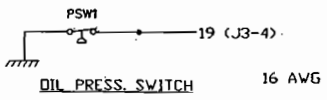
Ford 2.3L Engine Wiring

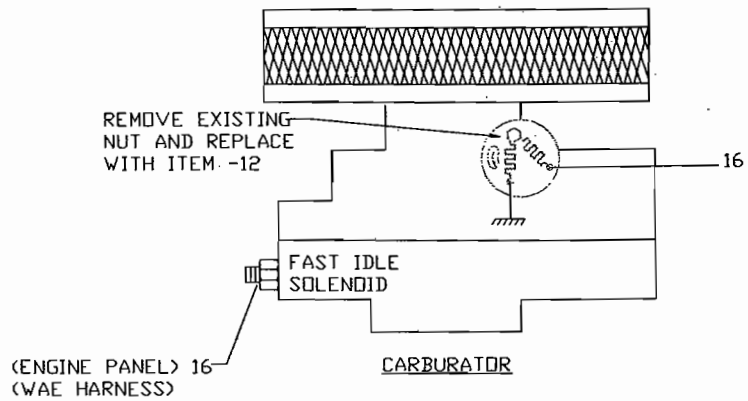




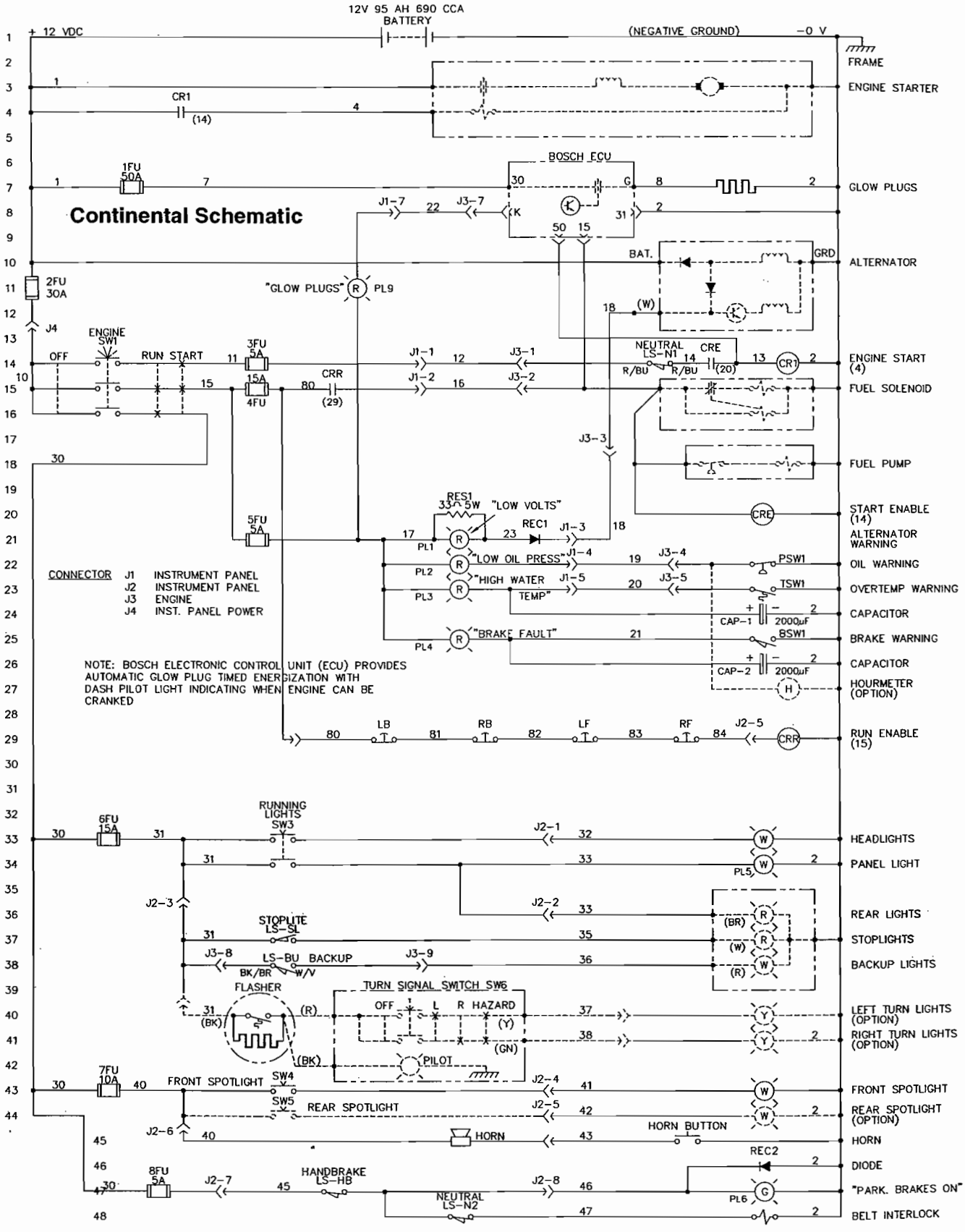
CONNECTIONS TO ENGINE PANEL



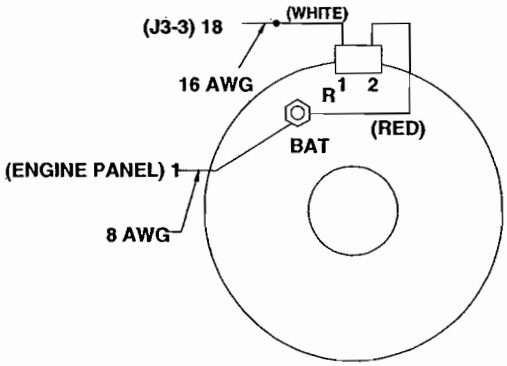




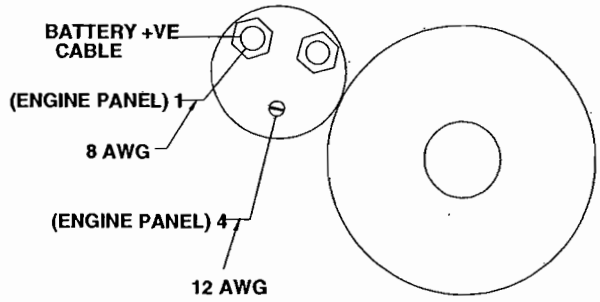
Ford 2.3L Engine Wiring


Continental Schematic
12V 95 AH 690 CCA BATTERY
+ 12 VDC
(NEGATIVE GROUND)
−0 V
FRAME
ENGINE STARTER
CR1
(14)
BOSCH ECU
1FU 50A
GLOW PLUGS
ALTERNATOR
2FU 30A
"GLOW PLUGS" R PL9
ENGINE SW1
OFF
RUN START
3FU 5A
4FU 15A
CRR
(29)
NEUTRAL LS-N1
CRE
(20)
CR1
ENGINE START (4)
FUEL SOLENOID
FUEL PUMP
5FU 5A
RES1 33Ω 5W
"LOW VOLTS"
REC1
START ENABLE (14)
ALTERNATOR WARNING
"LOW OIL PRESS"
PSW1
OIL WARNING
"HIGH WATER TEMP"
TSW1
OVERTEMP WARNING
CAP-1 2000µF
CAPACITOR
"BRAKE FAULT"
BSW1
BRAKE WARNING
CAP-2 2000µF
CAPACITOR
HOURMETER (OPTION)
CONNECTOR J1 INSTRUMENT PANEL
J2 INSTRUMENT PANEL
J3 ENGINE
J4 INST. PANEL POWER
NOTE: BOSCH ELECTRONIC CONTROL UNIT (ECU) PROVIDES AUTOMATIC GLOW PLUG TIMED ENERGIZATION WITH DASH PILOT LIGHT INDICATING WHEN ENGINE CAN BE CRANKED
LB
RB
LF
RF
CRR
RUN ENABLE (15)
6FU 15A
RUNNING LIGHTS SW3
HEADLIGHTS
PANEL LIGHT
REAR LIGHTS
STOPLITE LS-SL
STOPLIGHTS
LS-BU BACKUP
BK/BR
W/V
BACKUP LIGHTS
FLASHER
TURN SIGNAL SWITCH SW6
OFF
L
R
HAZARD
LEFT TURN LIGHTS (OPTION)
RIGHT TURN LIGHTS (OPTION)
PILOT
7FU 10A
FRONT SPOTLIGHT SW4
SW5
REAR SPOTLIGHT
FRONT SPOTLIGHT
REAR SPOTLIGHT (OPTION)
HORN
HORN BUTTON
8FU 5A
HANDBRAKE LS-HB
NEUTRAL LS-N2
REC2
DIODE
"PARK. BRAKES ON"
BELT INTERLOCK

Continental Engine Wiring



ALTERNATOR



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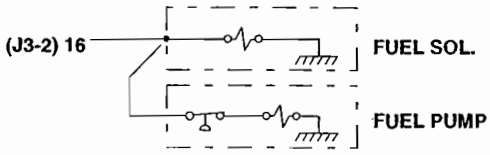
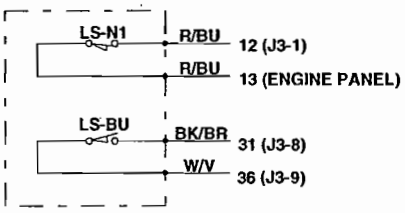
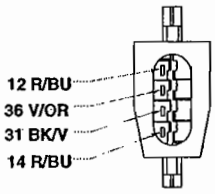


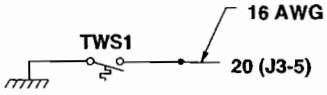
FUEL SOLENOID & FUEL PUMP



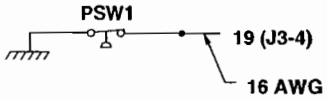
TRANSMISSION SWITCH



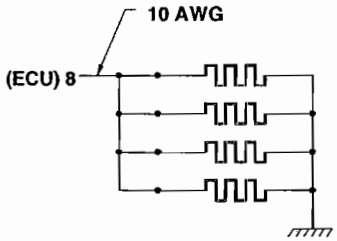
NEUTRAL SWITCH PLUG



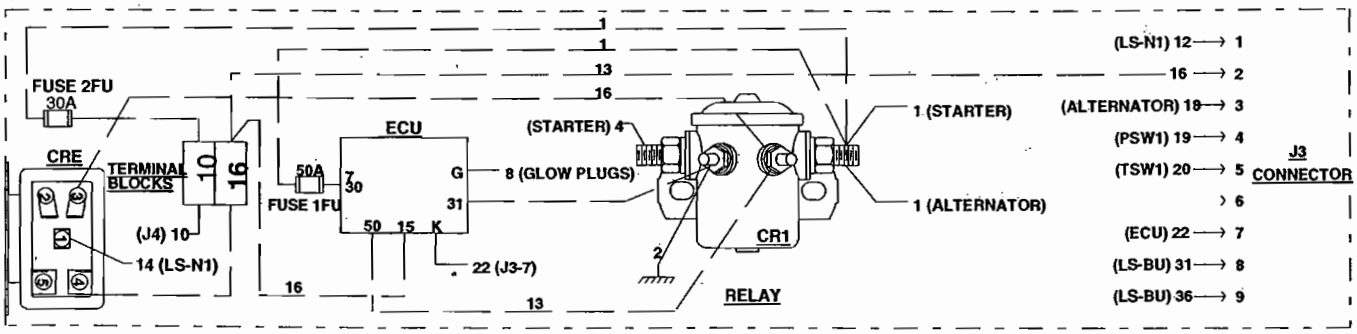
OVERTEMP SWITCH



OIL PRESS. SWITCH

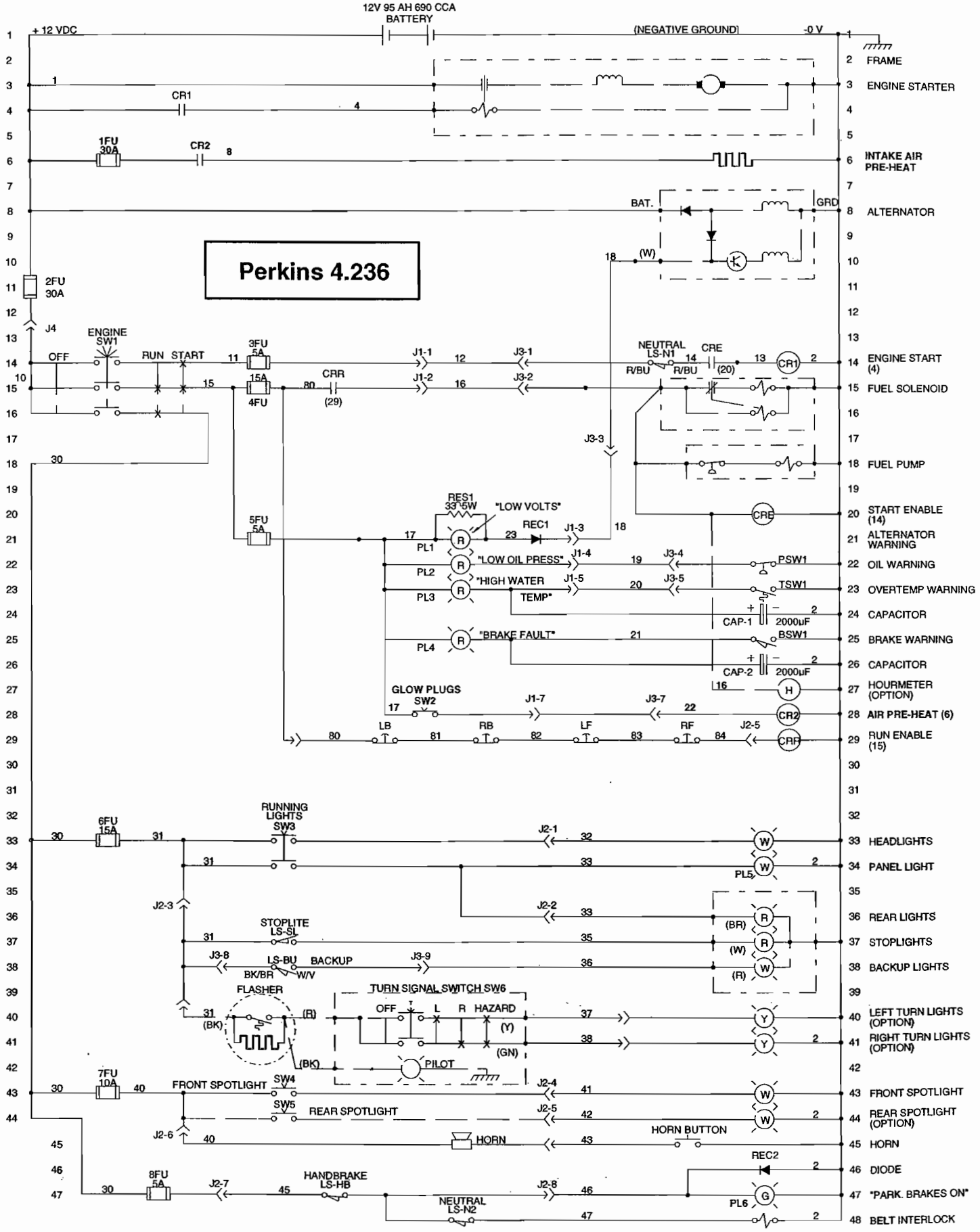


GLOW PLUGS

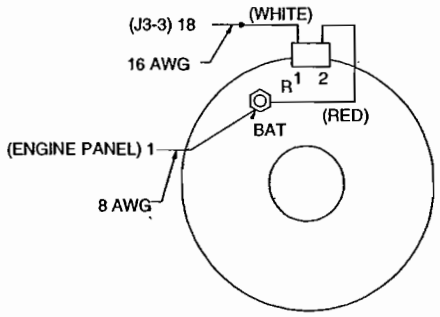


ENGINE PANEL

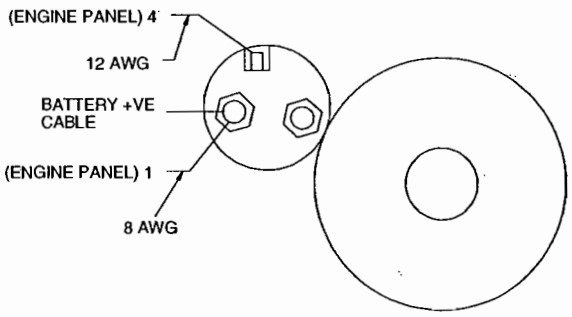
ZOLLARD™
Airport Equipment Company
Conveyor Truck TC-888



2/12/96



ALTERNATOR



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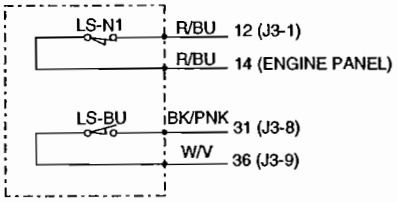
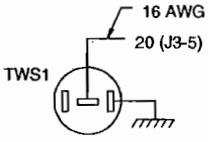
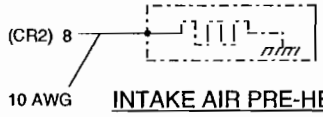


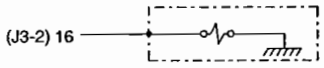
TRANSMISSION SWITCH



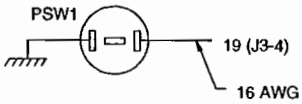
OVERTEMP SWITCH



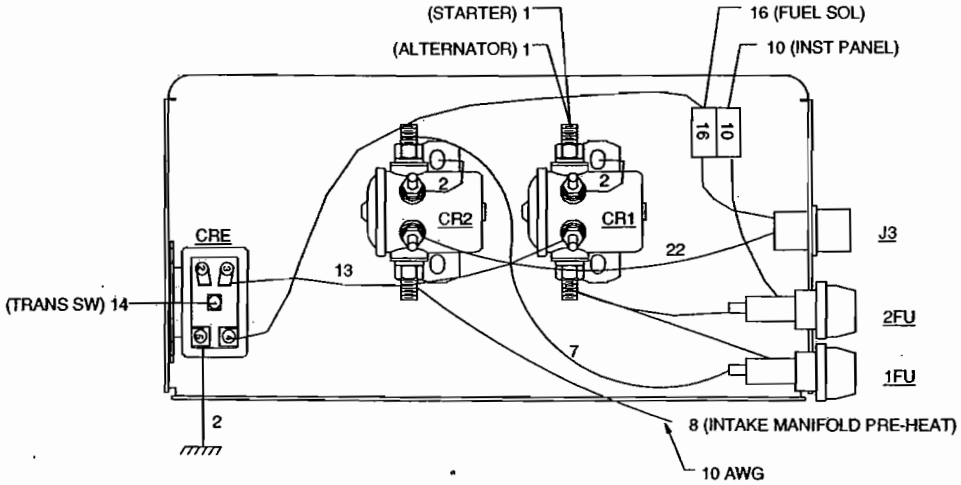
INTAKE AIR PRE-HEAT



FUEL SOLENOID



OIL PRESS. SWITCH

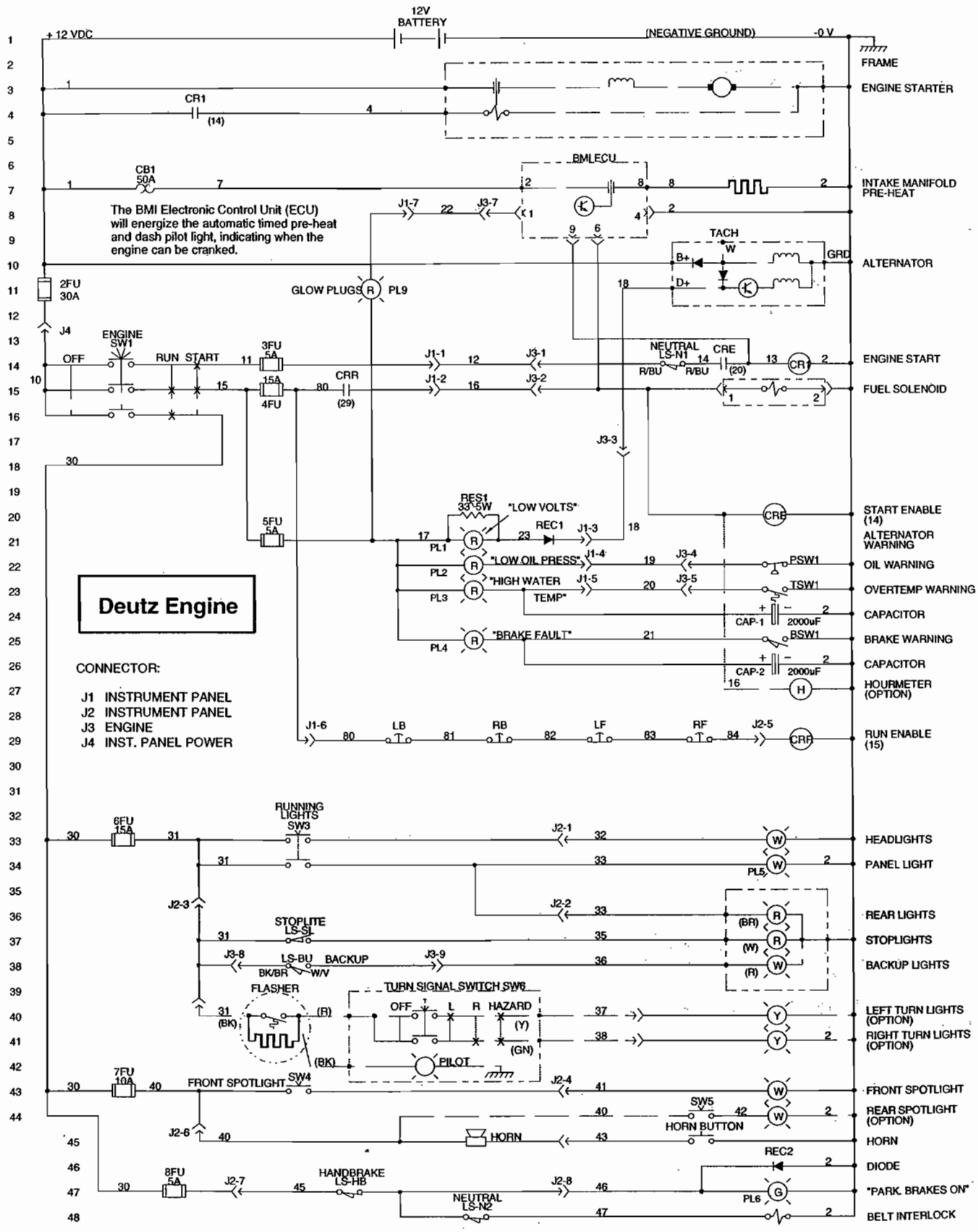


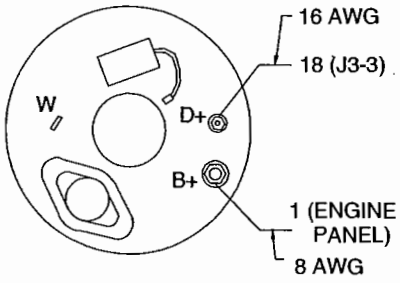
ENGINE PANEL CONNECTIONS

(LS-N1) 12 → 1
16 → 2
(ALTERNATOR) 18 → 3
(PSW1) 19 → 4
(TSW1) 20 → 5
→ 6
(CR2) 22 → 7
(LS-BU) 31 → 8
(LS-BU) 36 → 9

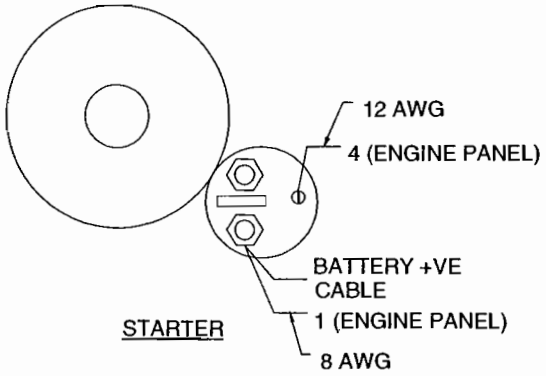
J3
CONNECTOR

Perkins Engine Wiring


12V BATTERY
+ 12 VDC
(NEGATIVE GROUND)
-0 V
FRAME
ENGINE STARTER
CR1
(14)
CB1 50A
BMI ECU
INTAKE MANIFOLD PRE-HEAT
The BMI Electronic Control Unit (ECU) will energize the automatic timed pre-heat and dash pilot light, indicating when the engine can be cranked.
TACH
ALTERNATOR
2FU 30A
GLOW PLUGS
PL9
ENGINE SW1
OFF
RUN
START
3FU 5A
4FU 15A
CRR
(29)
NEUTRAL LS-N1
CRE
(20)
ENGINE START
FUEL SOLENOID
Deutz Engine
CONNECTOR:
J1 INSTRUMENT PANEL
J2 INSTRUMENT PANEL
J3 ENGINE
J4 INST. PANEL POWER
5FU 5A
RES1 33 5W
"LOW VOLTS"
REC1
START ENABLE (14)
ALTERNATOR WARNING
"LOW OIL PRESS"
OIL WARNING
PSW1
"HIGH WATER TEMP"
TSW1
OVERTEMP WARNING
CAP-1 2000uF
CAPACITOR
"BRAKE FAULT"
BSW1
BRAKE WARNING
CAP-2 2000uF
CAPACITOR
HOURMETER (OPTION)
RUN ENABLE (15)
6FU 15A
RUNNING LIGHTS SW3
HEADLIGHTS
PANEL LIGHT
STOPLITE LS-SL
REAR LIGHTS
STOPLIGHTS
BACKUP
LS-BU
BACKUP LIGHTS
FLASHER
TURN SIGNAL SWITCH SW6
OFF
L
R
HAZARD
PILOT
LEFT TURN LIGHTS (OPTION)
RIGHT TURN LIGHTS (OPTION)
7FU 10A
FRONT SPOTLIGHT SW4
FRONT SPOTLIGHT
SW5
HORN BUTTON
REAR SPOTLIGHT (OPTION)
HORN
8FU 5A
HANDBRAKE LS-HB
NEUTRAL LS-N2
REC2
DIODE
"PARK. BRAKES ON"
BELT INTERLOCK



ALTERNATOR



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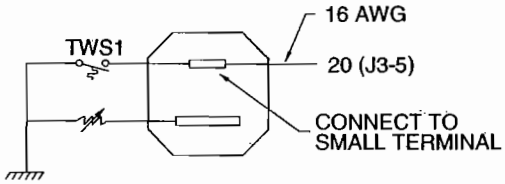
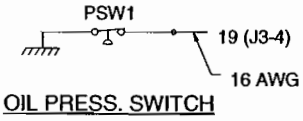
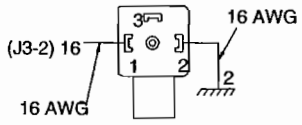


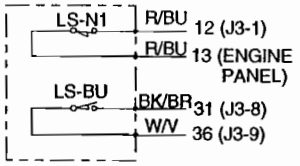
OVERTEMP SWITCH



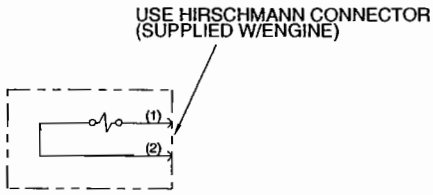
OIL PRESS. SWITCH



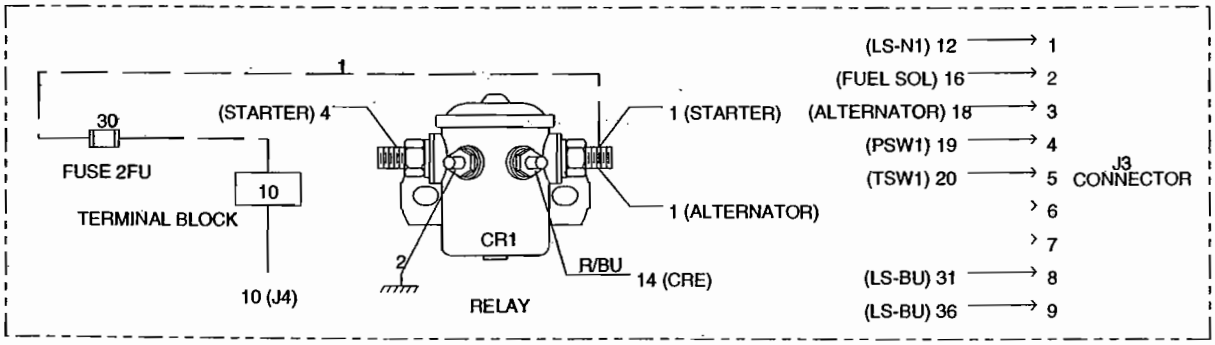
HIRSCHMANN CONNECTOR
(SUPPLIED W/ENGINE)



TRANSMISSION SWITCH



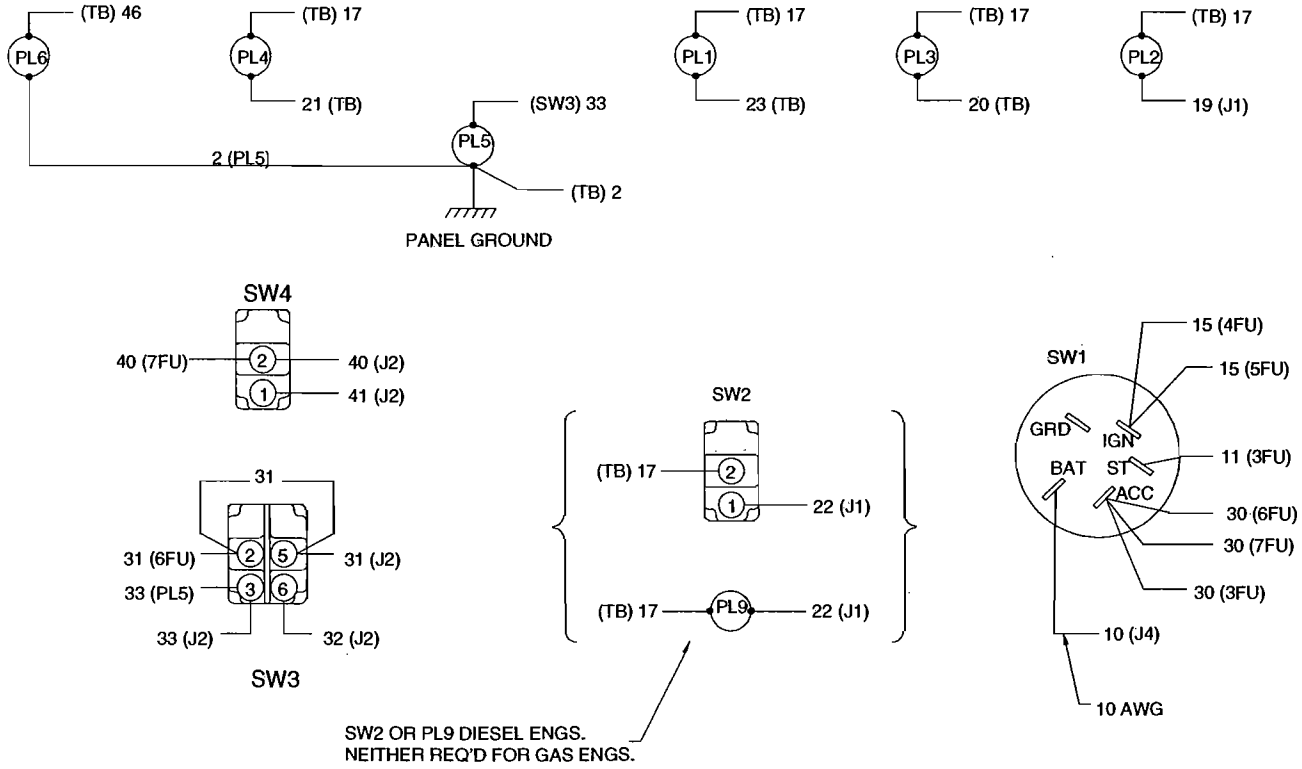
FUEL SOLENOID

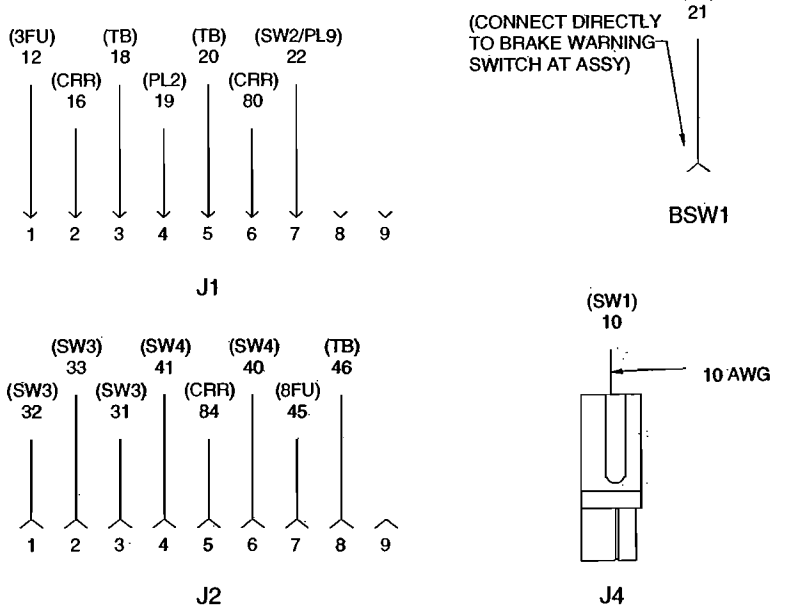


ENGINE PANEL

Deutz Engine Wiring

PANEL REAR VIEW





Instrument Panel Wiring

NOTES:

1) ALL CRIMP CONNECTIONS MUST BE TENSION TESTED

2) ALL WIRES MUST BE MARKED AT ALL STATIONS & TERMINATIONS

3) USE YELLOW TERMINALS FOR #10 AWG TERMINATIONS

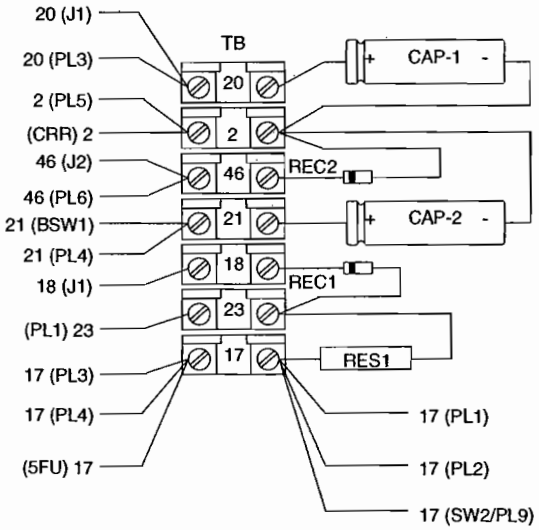
4) USE BLUE TERMINALS FOR #16 AWG TERMINATIONS

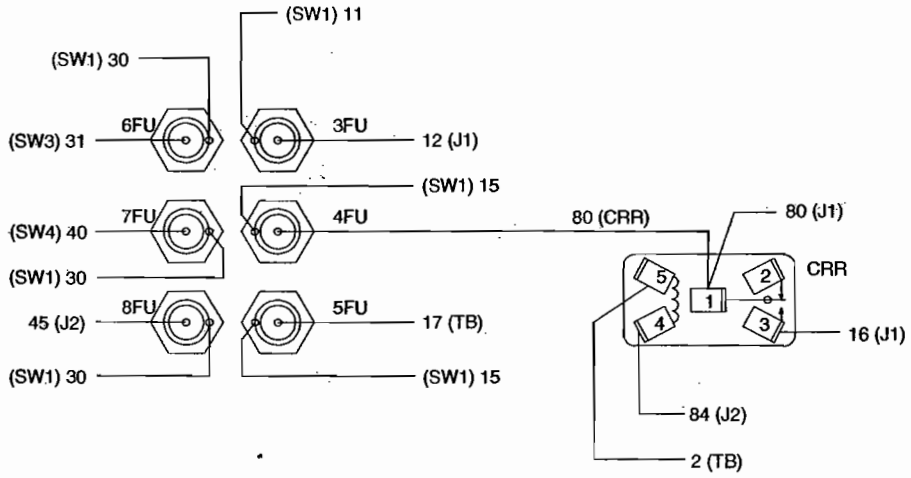
5) PINS MUST BE INSERTED INTO RECEPTACLE USING SHEATH P/N 207040-1 (2-3054)

6) PINS AND SOCKETS MUST BE TENSION TESTED AFTER INSERTION TO ENSURE PROPER RETENTION IN HOUSINGS

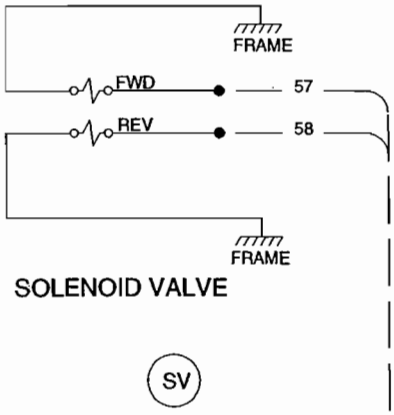
7) ALL WIRING #16 AWG EXCEPT AS NOTED

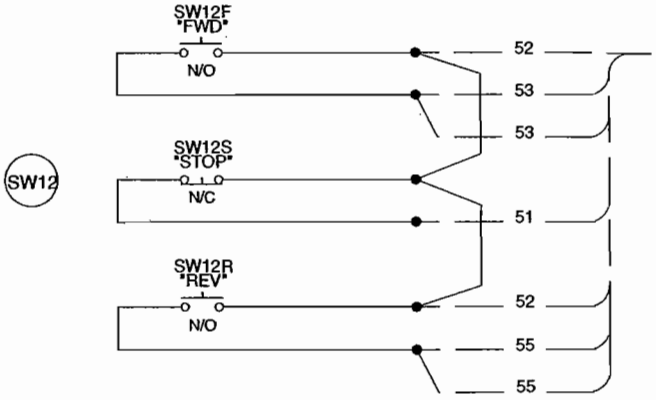
8) USE RED TERMINALS FOR #18 AWG WIRE

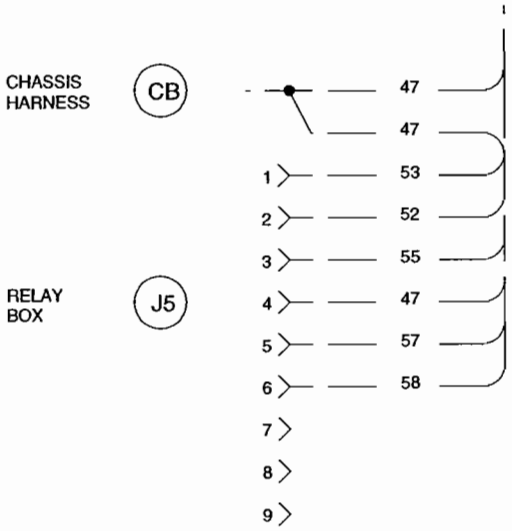


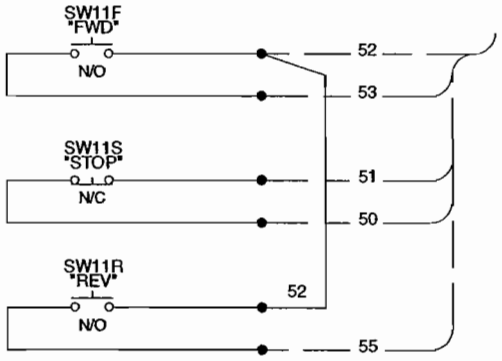


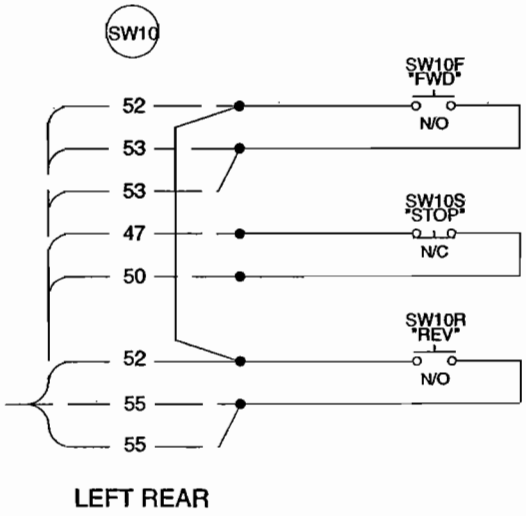
Instrument Panel Wiring











Conveyor Bed Wiring

SECTION 2
OPERATING INSTRUCTIONS

Operator station controls are conventional in design, clearly labeled, and conveniently grouped at the operator station. Functional and operational interlocks are provided for operator safety and protection of the vehicle to permit long, trouble-free service.

General instructions for operation of the unit are given in this section. For a more detailed description of engine operation, refer to the manufacturer's manuals provided in Chapter 5.

⚠WARNING **Before working beneath the raised conveyor bed, always raise the safety stand and set securely into place.**

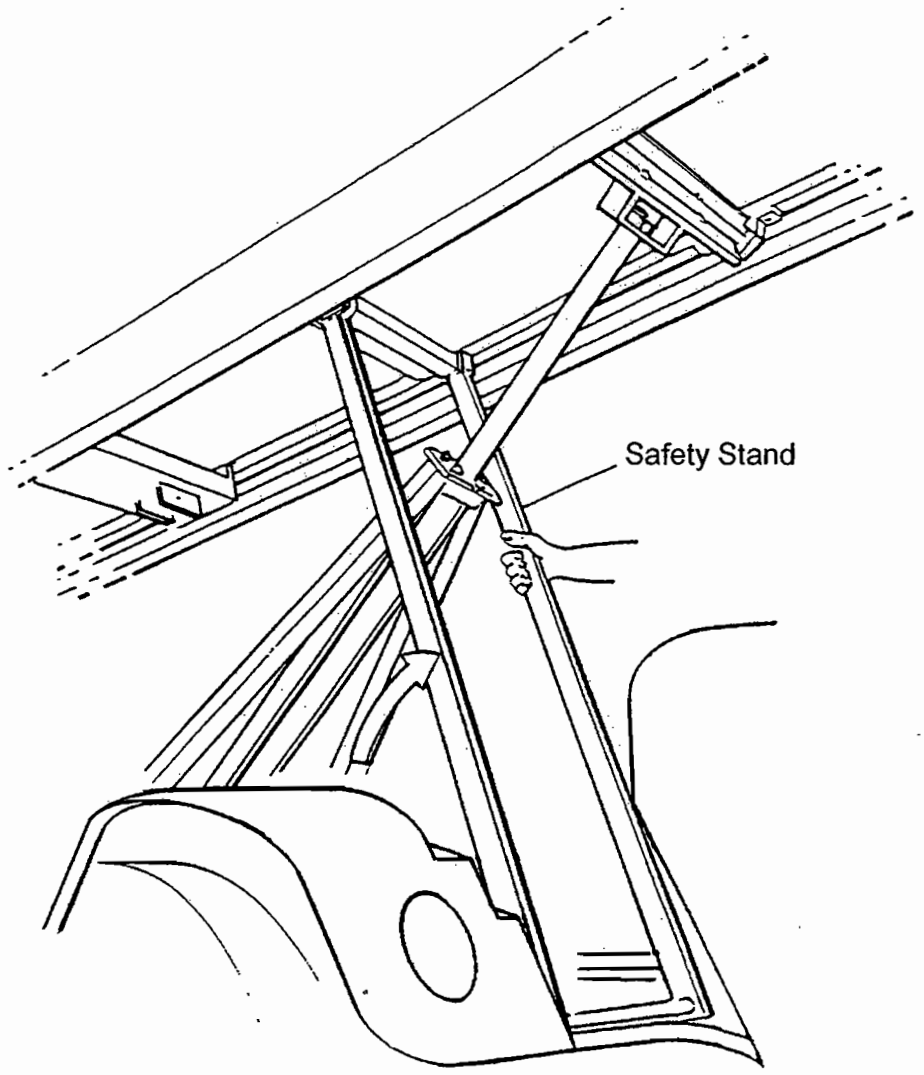


Figure 2.
Safety Stand.

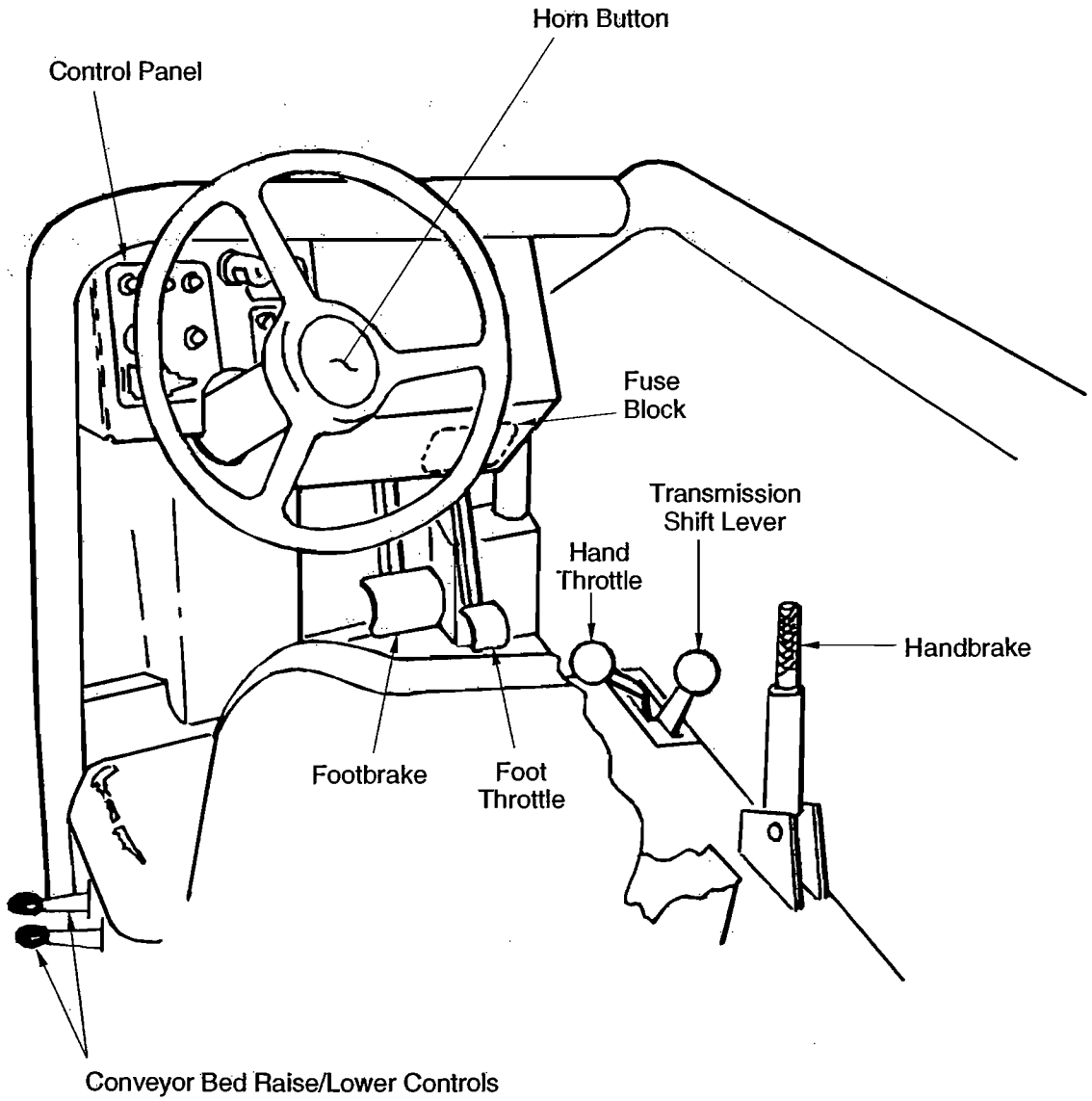
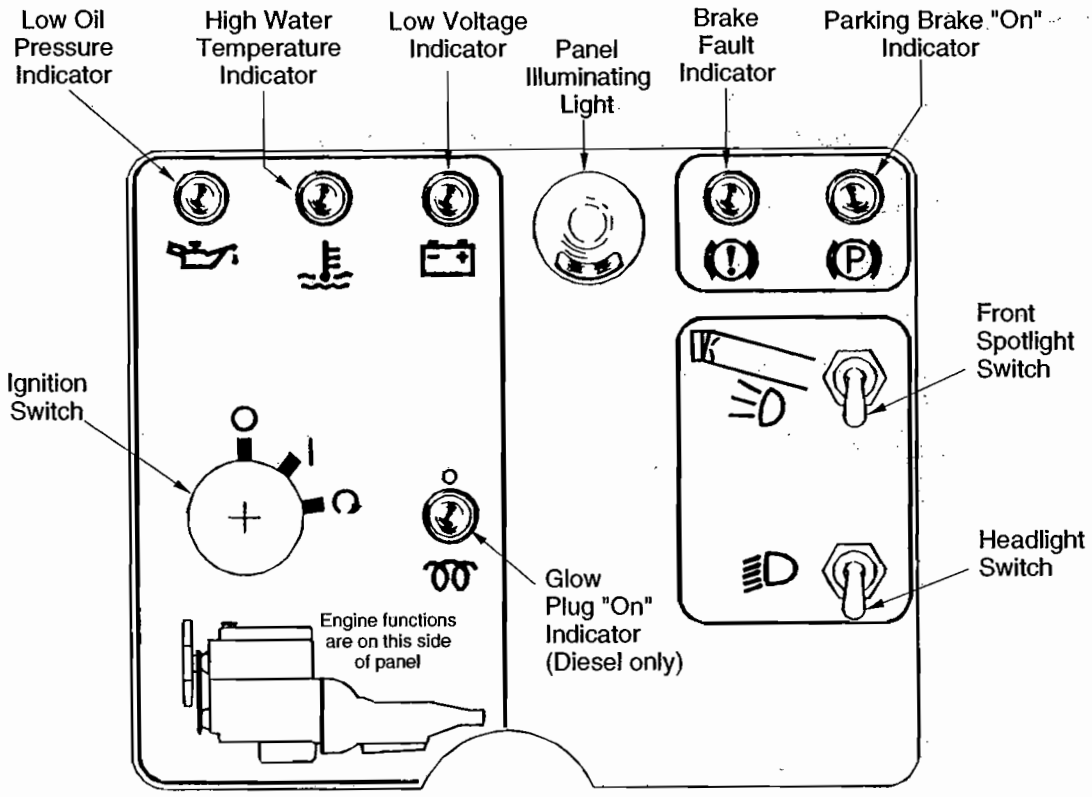
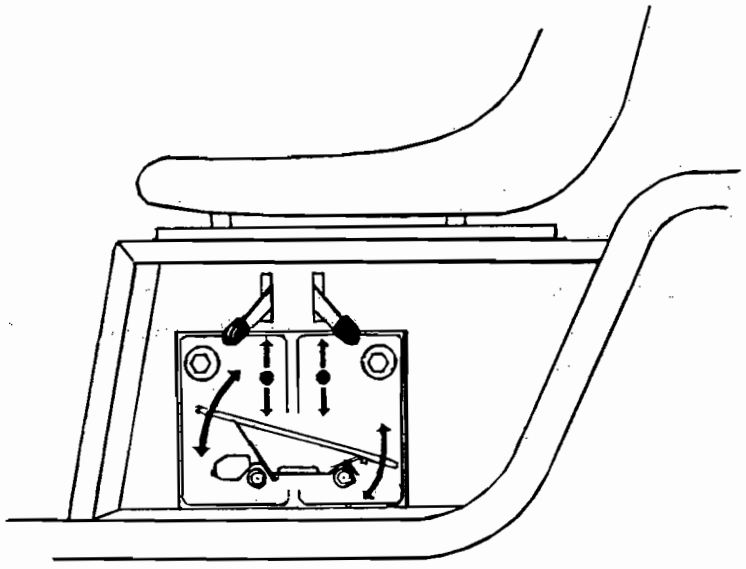


Figure 3. Operator Controls.



Control Panel



Conveyor Bed Raise/Lower Control Levers

Figure 4. Operator Controls.

Daily Inspection

Before putting the unit into service and each day before operating the unit, always walk around unit and make the following checks:

Conveyor Belt

- General condition.
- Tension.
- Alignment–Belt centered on head and tail rollers.

⚠CAUTION **Do not exceed bed capacity of 2,000 pounds distributed over total platform area or a 200 pound concentrated load.**

Tires

- Check condition and pressure. Correct cold pressure is 35 PSI (2.4 kg/cm^2) on all tires.

⚠CAUTION **The 35 psi cold tire pressure is for standard P225/75R15 radial tire only. Optional tires may have a higher pressure. Check marking on tires to determine maximum inflation of optional tires.**

Hydraulic System

Check level of hydraulic oil by observing sight gauge on hydraulic tank (behind operator station).

Use Mobil DTE-13 in operating temperatures of +20°F – +120°F (-7°C – +50°C).

Use Mobil Aero HFA (MIL-H-5606A) in operating temperatures of -25°F – +50°F (-32°C – +10°C).

Important! Check hydraulic oil level with cylinders completely lowered or overfilling might result, causing damage to the hydraulic system.

Fuel Tank

Check fuel gauge on instrument panel (or on fuel tank) for sufficient fuel for the day's operation.

Electrical System

Turn ignition switch to **RUN** position. Check that headlights, taillights, stoplights, backup lights, and spotlights are operational.

Engine and Transmission

1. With the transmission shift lever set in Neutral position and parking brake set, turn ignition switch to the **RUN** position.
   - Check that **LOW VOLTS** and **LOW OIL PRESS** indicators are illuminated.
   - Check that **HIGH WATER TEMP** and **BRAKE FAULT** indicators flash briefly and then go out.
2. Start engine and allow to warm up at idle speed for a few minutes.

Note: The engine starter will not engage unless the transmission shift lever is in neutral position and no emergency stop buttons are pushed in.

Note: The instrument panel ignition switch is of the anti-restart type. Once the engine has been cranked, the switch must be returned to "OFF" before the engine can be cranked again.

Note: For diesel cold weather starting, refer to the next page.

3. Check operation of horn and power steering.
4. Check forward and reverse operation of conveyor belt from all operating stations.
5. Check operation of conveyor lift, using the levers next to the operator's seat.

⚠CAUTION Be sure there is sufficient overhead clearance before raising conveyor bed.

6. Raise the rear of the conveyor to the full up position. Raise the front and position the safety stand as shown in Figure 2. Lower the front until the bed barely rests on the stand and is captured between the tongues on the stand.

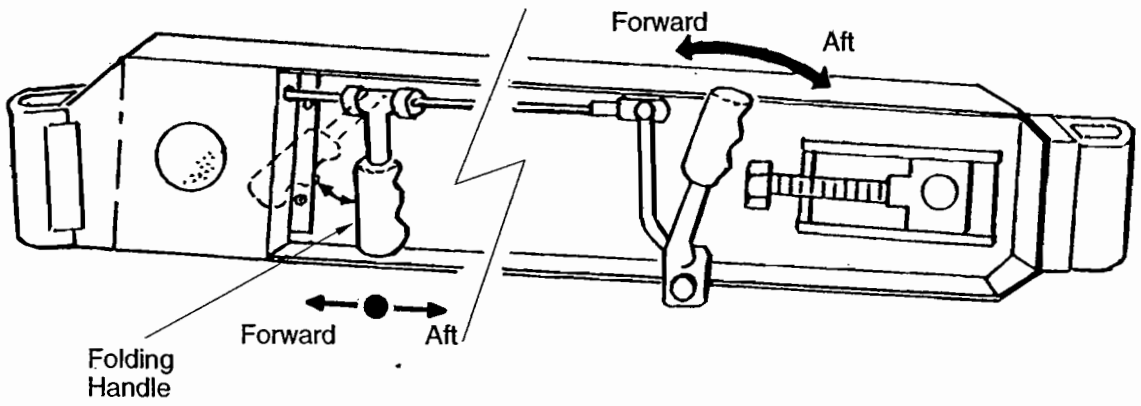


Figure 5. Conveyor Belt Control.

⚠CAUTION Do not force the front lift down while it is on the safety stand. Also, do not raise the rear lift while the front rests on the safety stand. Either action may result in damage to the safety stand.

7. Stop engine.
8. Open engine cover.
9. Check engine oil level.
10. Check coolant level in radiator.
11. Check fuel filter for presence of water (diesel engines). Drain if necessary.
12. Check condition and tension of all drive belts.
13. Close engine cover, lower safety stand, and lower bed.

If all of the above checks are satisfactory, the unit is ready to service aircraft. If trouble is discovered during any of the above checks, report the problem to the proper maintenance personnel for correction before further operation.

Diesel Engine Starting

⚠WARNING Starting aids such as ether should <u>never</u> be used at the same time as glow plugs.

Glow plugs should always be used to assist starting diesel engines at temperatures below 70° F. (21° C.), and preferably above this temperature as well. With some diesel engines, use of glow plugs is at the discretion of the operator, while with others, a control circuit is built into the electrical system, that automatically operates the glow plugs for a set period of time before permitting engine cranking.

Where glow plug operation is manual, turn ignition switch to **RUN**, then hold glow plug switch to "ON" for 20 seconds, then while still holding glow plugs "ON", crank engine until it starts. Continue to hold glow plugs on for a few seconds after engine starts until even running has been attained.

When glow plug operation is automatic, turn ignition switch to **RUN**. Glow plugs and red pilot light on dash will go on. DO NOT crank until light goes out.

Note: It is possible to crank engine before light goes out, but this practice should be avoided, unless restarting after short "engine off" intervals.

The use of ether or similar starting aids is not approved by Wollard Airport Equipment Company.

Interlocks and Fault Indicators

- The engine starter will not engage unless the transmission shift lever is in neutral, ignition switch is in **RUN** position, and no emergency stop buttons are depressed.
- The instrument panel **ignition switch** is of the anti-restart type. Once the engine has been cranked, the switch must be returned to **OFF** before the engine can be cranked again.
- The **conveyor belt drive** function will not operate unless the transmission shift lever is in neutral and the parking brake is set.
- Vehicle running and work lights operate only when the instrument panel ignition switch is in **RUN** position.

Servicing Aircraft

How to Safely Approach the Aircraft

⚠CAUTION This unit has restricted visibility on the right-hand side and rear. Before moving unit, walk around and ensure that there are no obstructions in the desired direction of movement. Be extra cautious when driving in reverse or making right turns.

The operator position is forward of the front wheels. Be sure to compensate for this by steering late. Make wide turns until you are accustomed to driving the unit.

1. With the bed down, drive the unit to within approx. 10 feet (3 meters) of the aircraft to be serviced. Position unit at right angles to door threshold.
2. Place transmission shift lever in Neutral position.
3. Raise front end of conveyor bed to approximate height of door threshold. Raise aft end to working height of baggage carts.
4. Shift transmission into Drive position and slowly drive to within approx. 6 inches (15 cm) of threshold. Check alignment of conveyor bed with threshold. Make any adjustments required. Place transmission lever in Neutral position and set parking brake.

⚠CAUTION Be sure that shift control lever is secure in detent.

5. Adjust throttle for the desired operating speed of the conveyor belt drive.

Important! Belt will not operate unless shift lever is in Neutral and parking brake is set.

6. Operate the belt from levers located on the left side of the conveyor bed, both forward and aft.

Note: Electric pushbutton stations are optional.

How to Safely Leave the Aircraft

1. Place transmission shift lever in reverse position, release parking brake and slowly back unit a few feet (one or two meters) away from the aircraft.
2. Place shift lever in Neutral position while holding footbrake depressed.

⚠CAUTION Be sure there is sufficient clearance around and under the conveyor bed before lowering.

3. Lower conveyor bed.
4. Continue depressing the footbrake pedal and place the transmission shift lever in appropriate drive position, then release the footbrake and slowly drive unit away.

Although it is possible to raise and lower the bed with the vehicle in motion, it is a distraction to the driver and should therefore be attempted only by an experienced operator and with the consent of the operations supervisor.

⚠CAUTION Do not use the conveyor bed as a lifting mechanism. The conveyor is designed to support only 2,000 pounds distributed over total platform area or a 200-pound concentrated load.

⚠DANGER

Do not stand on any area of the belt loader that is not specifically designed to be stood on. Stand only on areas constructed with "gripstrut" or otherwise covered with a skid-resistant surface.

Immediately repair any damaged gripstrut or skid-resistant material.

Do not ride on the belt loader except in a passenger seat.

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN INJURY OR DEATH.

Emergency Shutdown

Complete engine shutdown can be done in emergency situations by pushing in the red mushroom actuators at either end of the conveyor bed. The knobs must be pulled back out before the engine will restart.

In Case of Engine or Hydraulic Pump Failure

Using the optional hand pump

An optional manually operated hydraulic pump is available to permit raising or lowering either end of the conveyor bed in the event of engine or hydraulic system failure. Location of the pump is just aft of the hydraulic tank behind the operator seat.

To operate the hand pump, remove handle from stowed position and insert over pump actuator. The appropriate conveyor lift lever must be held in the desired position while operating the pump handle. Conveyor will raise or lower while manually pumping.

Important! **Any time the pump is <u>not</u> being operated, the lanyard connected to the pump body and looped around the groove in the actuator must be in place. This will prevent the piston creeping up due to system back pressure and protect against rust.**

Towing the Conveyor Bed

If there is a failure in the engine/power train and the unit must be towed, retract the stabilizers and disconnect the drive shaft (or raise rear wheels off the ground). This will prevent damage to the transmission while towing. Towing speed **must not exceed** 10 miles per hour.

SECTION 3
VEHICLE SPECIFICATIONS

This vehicle is designed to service all aircraft having doorsill heights ranging from 39.5 in. (100 cm) to 168 in. (427 cm).

Chassis

Frame - welded steel tubular construction

Wheelbase -130 inches (330 cm)

Wheeltrack

Front- 69 in. (175 cm)

Rear - 66 in. (168 cm)

Vehicle Speed - - - - - - - - - - - - - - 25 MPH (40 KPH) (All engine options)

Turning Radius - 22 feet (6.7 m)

Ground Clearance- 5.5 inches (14 cm)

Conveyor Bed

Up/Down Controls- - - - - - - - - - - -Manually actuated hydraulic valve levers located below driver seat

Belt Controls - - - - Manual levers at the front and rear ends of conveyor bed.

Length -301 in. (765 cm)

Width - 31.5 in. (80 cm)

Belt Width- 24 in. (61 cm)

Rated Capacity

- 2000 lbs. (909 kg) distributed

- 200 lbs/sq. ft. (91 kg/m^2) concentrated

Belt Speed - 40–120 fpm (0.2–0.6 m/sec)

Belt Movement - - - - - - - - - - - - - - - - - - Forward-Stop-Reverse positions

Dual Front Rubber Bumpers- - - - - - - 4 in. (10 cm) O.D. X 3 in. (7.6 cm) I.D.

Dual Rear Rubber Bumper - - - - - - - - - - 4 in. (10 cm) X 6-3/4 in. (17 cm)

Roller Spacing - 3 in. (8 cm) for 2 ft. (61 cm) from end, 6 in. (15 cm) on balance

Engine Alternatives

- Ford LSG-423 in-line, 4-cylinder gasoline, 4-cycle, 63 hp at 2800 rpm, 140 in^3 (2.3L) displacement.
- Ford CSG-649 in-line, 6-cylinder gasoline, 120 hp at 2900 rpm, 300 in^3 (4.9L) displacement.
- Isuzu C240 PW07 in-line, 4-cylinder diesel, 4-cycle, 56 hp at 3000 rpm, 146 in^3 (2.4L) displacement.
- Deutz F4M-1011F in-line, 4-cylinder diesel, 4-cycle, 59 hp at 2600 rpm, 167 in^3 (2.7L) displacement.
- Continental TMD 27 in-line, 4-cylinder diesel, 4-cycle, 66.5 hp at 3000 rpm, 164in^3 (2.68L) displacement.
- Perkins 4.236 V4, 4-cycle diesel, 80 hp, 236 in^3 (3.86 L) displacement.
- Perkins 1004, in-line, 4-cylinder, 4-cycle diesel, 236 in^3 (3.86 L) displacement.

Transmissions

- Ford A4LD
- Ford C-6
- Aisin Warner (Isuzu) Model AW03-55

Shift Control - - - - - - - - - - - - - - - - - - - 2 lever, one with detented R-N-F

- -one with belt speed throttle interlock

Heights of Conveyor Bed from Ground (Isuzu, Ford 2.3L, Continental)

Condition	Front	Rear	Angle
Front extended, rear retracted	167.8 in. (426 cm)	10.6 in. (27 cm)	33.9°
Front extended, rear extended	156.2 in. (397 cm)	37.9 in. (96 cm)	24.9°
Front retracted, rear extended	30.2 in. (77 cm)	55.9 in. (142 cm)	- 5.2°
Front retracted, rear retracted	40.5 in. (103 cm)	30 in. (76 cm)	2.1°

Heights of Conveyor Bed from Ground (Deutz Air-Cooled, Perkins)

Condition	Front	Rear	Angle
Front extended, rear retracted	166.7 in. (423 cm)	20.3 in. (51.6 cm)	31.3°
Front extended, rear extended	153.5 in. (390 cm)	46.7 in. (118.6 cm)	22.3°
Front retracted, rear extended	29.3 in. (74.4 cm)	64.1 in. (163 cm)	- 7.1°

Heights of Conveyor Bed from Ground (Ford 300 6-Cyl)

(Complete data not available)

Condition	Front	Rear	Angle
Front retracted, rear retracted	39.1 in. (99.3 cm)	37.9 in. (96.3 cm)	

Axles

Front - - - - - - - - - - - - - - - - - - - Automotive type, non-drive, steerable

Rear - Automotive type, drive ratio 5.89:1

Capacity - 3,300 lbs. (1,500 kg)

Tires - 4-ply rating, P225/75R15

Load Capacity - - - - - - - - - - - - - - - 1874 lbs (850 kg) at 35 psi (cold)

Brakes

System - 4-wheel split cylinder

Front- Disc type

Rear - Drum type

Parking - Orscheln lever, rear wheels

Electrical System

Type - 12 VDC, negative ground

Alternator - 60 Amp

Battery - 627 amps cold crank

Fuel Tank - - - - - - - - - - - - - Aluminum with sight gauge and vented cap

- -22 U.S. gallon (83 liter) capacity.

Cooling System

All engines except Deutz - - Water-cooled, capacity 2 US gallons (7.6 liters)

Deutz Engine - Oil Cooled

Transmission - Water or air cooled

Steering System

Type - - - - - - - - - - - - - - - - - - - Power steering; Char-Lynn Orbitrol

Cylinder - Single-stage hydraulic

Hydraulic System

Lift cylinders - Single-acting (lift)

Valves - Manually actuated

Pumps - Main: engine-driven

- Emergency: Hand-operated (optional)

System pressure - - - - - - - - - - - - - 1,800 psi max. (126.5 kg/sq.cm.)

Filter - - - - - - - - - - - - - - In return line, 10 micron, replacable element

Strainer- In suction line, 80 mesh

Hydraulic reservoir - - - - - - - - - - - - - - Sight gauge, breather/strainer

- Capacity 8.5 U.S. gallons (32 liters)

Use Mobil DTE-13 in operating temperatures of +20°F – +120°F (-7°C – +50°C).

Use Mobil Aero HFA (MIL-H-5606A) in operating temperatures of -25°F – +50°F (-32°C – +10°C).

Instrumentation

Warning indicators - - - - - - - - - - - - - - - - - - Volts, oil, water, brakes

On-Off switches: Running lights, front spotlight, glow plugs (for cold starting)

Hourmeter - - - - - - - - - - - - - - - - - - - Records engine running time

SECTION 4
SHIPPING

The Belt Loader is sized for shipping by motor carrier. No special shipping precautions are required other than those specified by the appropriate regulatory authority and the carrier.

The fuel and hydraulic reservoirs may be easily drained.

For long term storage, refer to Section 5.

Shipping Dimensions

Length -297.5 inches (756 cm)

Width - 82 inches (208 cm)

Height - 47.5 inches (121 cm)

Shipping Weight- 6,000 lbs (2727 kg)

Parts Shipping

Shipping major vendor replaceable components, such as engines, transmissions, control valves, hydraulic power unit, cylinders, etc., should be done as per the manufacturer's instructions and should be shipped in the original carton. If replacement is necessary, repack defective unit in the new component's carton. Then return the defective part to original manufacturer for overhaul.

SECTION 5
STORAGE

Short Term Storage (up to 1 month)

The unit may be stored under cover with the wheels blocked for a period not to exceed one month. No special precautions are required.

Long Term Storage (1 month or longer)

Common sense should be applied to preparing the vehicle for storage. No special instructions are necessary except for those provided below:

Engine

Engine preservation instructions are given in the manufacturer's handbook supplied with this manual.

Hydraulic System

1. Drain hydraulic tank and refill with clean, new oil.
2. Run complete system through several cycles to flush new oil into all lines, cylinders and pumps.
3. Drain and clean hydraulic tank.
4. Refill tank with clean, new oil.

Brake System

Special storage precautions are not required; however, to prevent rusting of brakes and water absorption by the brake fluid, the following procedures may be followed:

1. Drain master cylinder reservoir and refill with clean brake fluid to DOT-5 specification.

Note: DOT-5 is a moisture-repellant fluid.

2. Bleed each wheel brake until all original fluid is expelled.
3. Refill reservoir with DOT-5 fluid.
4. Coat all wheel discs and drums with a protective film of grease.

Important! Wheel brake liners must be changed after this operation.

Hydraulic Cylinders

All cylinders should be stored with rods fully retracted. If this is not possible, apply a light coat of automotive grease to all exposed cylinder rod surfaces. Wrap rods securely with heavy-duty plastic sheeting.

Battery

The battery should be removed and kept on a trickle charge in an appropriate storage area.

Fuel Tank

Drain and clean the fuel tank. Upon removal from storage, flush tank completely before refilling.

Axles

Drain oil and remove access cover from rear axle. Clean inside of differential with a lint-free rag; replace and refill with clean, new oil. Run the axle for 2-5 minutes to make sure that oil is evenly distributed. Lubricate wheel bearings on both axles.

Tires

Support the vehicle on blocks to take the weight off the tires. Reduce tire pressure to 15 PSI.

Chassis

Thoroughly clean all structural elements and paint or coat with protective grease on all exposed bare metal. Lubricate all rotating and sliding elements, including bearings, bushings, chains, rollers, etc. In particular, remove conveyor bed rollers and liberally lubricate internal bearings at both ends with 30W engine oil.

Chapter 2 Tab

Chapter 2
MAINTENANCE

Page

SECTION 1
PREVENTIVE MAINTENANCE

The following is a guide for conducting periodic inspections on the conveyor truck to ensure long service life. The frequencies shown are for the unit operating in average U.S. climate. If the unit is operated in adverse climatic conditions, such as salt spray and extreme cold or dusty environments, adjust the inspection schedules to a more realistic frequency.

Servicing the Wollard Conveyor Truck TC-888 requires little more attention than other conventional vehicles of its type. No special tools are required, other than those normally found in any modern garage or airline ground support equipment servicing facility. All work should be performed in accordance with authorized standard shop practices.

⚠WARNING **Before working beneath the raised conveyor bed, always raise the safety stand and set securely into place.**

As Required

Important! **THIS MANUAL DOES NOT COVER ENGINE OR TRANSMISSION MAINTENANCE. Inspect and service engine and transmission according to the manufacturers' recommended maintenance schedules. A separate manual for this purpose has been included in Chapter 5, Manufacturer's Information.**

Weekly

Park the unit on a clean and dry surface. After several hours, check under the unit for fluid leaks. If you find any, try to determine its exact source. Fix the problem or report the problem to the proper authority.

Every 100 Operating Hours or Monthly (whichever comes first)

- Remove air cleaner cartridge and blow out (from inside) or shake out accumulated dirt. Clean housing and reinstall.

Important! **Do not exceed 100 psi (7.0 kg/cm^2) air pressure at nozzle because high pressures can rupture the paper.**

Important! **Under extreme dust conditions, service cartridge more often (as required).**

- Replace hydraulic oil filter.
- Check hydraulic lines, fittings, and hydraulic cylinders for leakage.
- Check plumbing assemblies for dents, kinks, abrasions, leakage, and security.
- Check hose and tubing attachments for security.
- Check condition of Y-strainer.
- Perform a complete check of the following belt loader components:

  Lift–Operate the forward and rear lift cylinders up and down several times. Check for smoothness of operation. Listen for any unusual noises.

  Conveyor Belt–Examine the belt for wear, damage, alignment and deterioration. Operate the drive in both directions and check for proper belt tension, ease of movement, and smoothness of controls. Belt should be centered on head and tail rollers and move smoothly in both directions. Adjust belt according to procedures in Chapter 2, Section 5, if required.

  Drive Chain–Remove cover to check chain tension. The chain should be tight.

Every 250 Operating Hours or 2 Months (whichever comes first)

- Check security of fasteners and mountings.
- Replace air filter cartridge (every 250 hours).
- Lubricate, using auto chassis lube:

  Tail roller and head roller bearings.

  Cylinders: Front and rear, lower pivot zerks
- Lubricate, using #10 general-purpose oil:

  Handbrake (see Figure 1)

  Cylinders: Front and rear, upper pivot.

  A-frame and scissor frame: lower pivots
- Lubricate, using multi-purpose graphite-based grease:

  A-frame and scissor frame: Lower pivot zerks.

Every 500 Operating Hours or 4 Months (whichever comes first)

- Perform 100-hour, 1-month service.
- Perform 250-hour, 2-month service.
- Check security of wiring, ties, and clamps.
- Check condition of lamps and security of fixtures.
- Give system a complete functional check using controls at both operator station and platform.
- Check stations for waterproof sealing integrity and good mechanical and electrical condition.
- Lubricate, using multi-purpose graphite-based grease:

  Roller drive chain

  Driveshaft universal joints
- Lubricate, using auto chassis grease:

  Steering knuckles and tie rod ends

  Steering cylinder pivots

Every 1,000 Hours or 8 Months (whichever comes first)

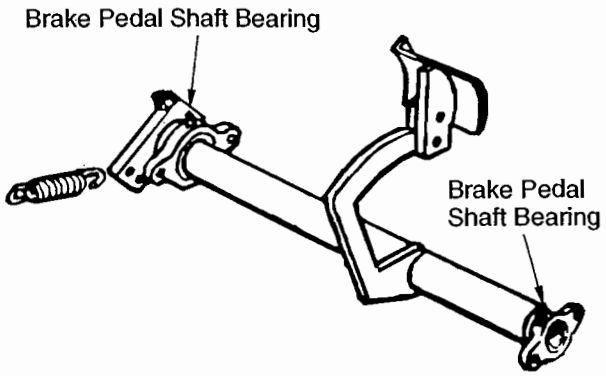
- Perform 100-hour, 1-month service.
- Perform 250-hour, 2-month service.
- Perform 500-hour, 4-month service

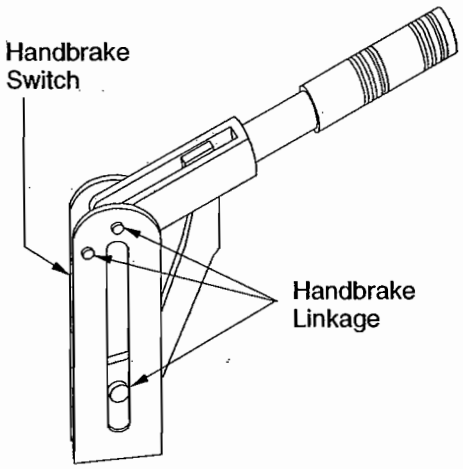
Lubricate, using #10 general-purpose oil:

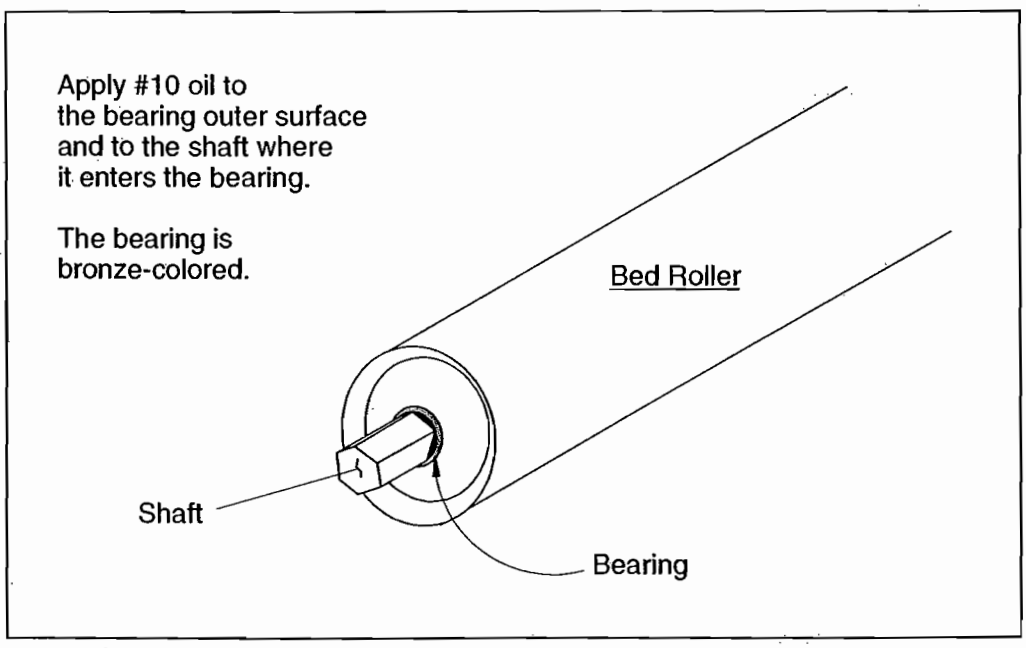
- Bed roller bearings and shafts (See Figure 1)
- Handrail pivots
- Operator seat adjustment lever

Lubricate, using auto chassis grease:

- Operator seat slide







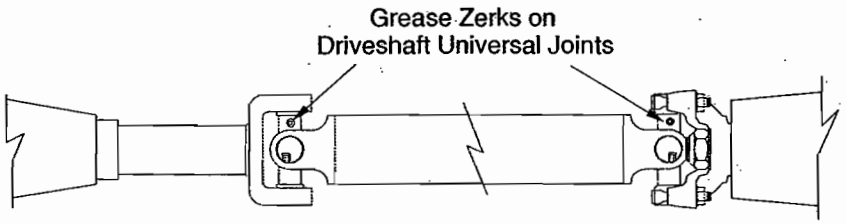


Figure 1.

Selected Lubrication Points

Every 2,000 Hours or Yearly (whichever comes first)

- Perform 100-hour, 1-month service.
- Perform 250-hour, 2-month service.
- Perform 500-hour, 4-month service
- Perform 1,000-hour, 8-month service
- Change oil in differential. Use SAE 90 hypoid oil 44 fl. oz. with 4 oz. friction modifier (Ford #C8AZ19546A).
- Drain hydraulic tank and refill with new, filtered oil.
- Grease front wheel bearings using all-purpose bearing grease. Refer to the Spicer Axle manual in Section 5.
- Grease handbrake switch using light silicone grease
- Lubricate master cylinder actuating rod clevis using SAE #10 oil.

Fuel System – Special Instructions

Gasoline engine fuel lines are equipped with conventional filters. Normal automotive practice is recommended for maintaining the fuel system. A drain is provided at the bottom of tank to remove dirty or contaminated fuel, water, etc., if necessary.

The vehicle fuel tank has a capacity of 21.2 US gallons (80 liters). Use regular non-leaded gasoline (or diesel if diesel engine). The fuel cap is located midway along the inside of the left running board. A placard over the filler cap opening indicates the type of fuel used.

Diesel engines are far more sensitive to fuel problems than gasoline, and if your unit is equipped with a diesel engine, more attention must be given to fuel management than for gasoline units. Diesel units are equipped with state-of-the-art Racor diesel fuel filters, which separate water from fuel and filter out both particulates and biological contaminants. Fuel tanks are treated with a powerful biocide with the first fuel fill-up at the factory.

Change **diesel fuel filters** regularly and treat the tank with **biocide** on a periodic basis. It is impossible to recommend a specific time period for the fuel system service because of the widely differing operating conditions that the conveyor trucks are subject to at different stations and different seasons.

Treatment of diesel fuel with a **biocide** deters the growth of algae and other biological contaminates in the fuel. It is recommended that Racor 300X Biocide (WAE Stk #1.8169) be used regularly at the rate of one-half can per full tank. If a standard biocide is to be used, then use according to instructions given with its package. Other biocides have different concentrations, so instructions may vary.

Inspect the diesel fuel filter **sedimentation bowl** daily until a pattern of water accumulation has been established, then establish a maintenance schedule.

A loss of engine power will signify the need for changing the Racor **filter element.** A vacuum gauge is available from Racor or can be rigged by the user. A low vacuum indicates a clogged filter element.

HYDRAULIC SYSTEM SAFETY

⚠WARNING

- **Wear proper eye protection before removing or installing any gauges or fittings. There may be residual pressure in the hydraulic system which may cause oil to enter the eyes. If oil gets in someone's eyes, flush out immediately with large quantities of water and seek medical attention.**
- **If oil gets injected into the skin, it must be removed immediately by a doctor. Serious infection or reactions can develop if proper medical treatment is not administered immediately.**
- **Allow fluid to cool before working on system.**
- **Dirt or contamination is the greatest enemy of any type of hydraulics!**
- **Cleanliness is the best way to insure satisfactory system life, on either new or repaired units. Cleaning parts by using a solvent wash and air drying is adequate if clean solvent is used. This is precision equipment. The internal mechanisms and related items must be kept free of foreign materials and chemicals.**
- **Protect all exposed sealing surfaces and open cavities from damage and foreign materials.**
- **Always replace gaskets and O-rings. Clean gasket sealing surfaces prior to installing new gasket.**
- **Lightly lubricate all O-rings with clean petroleum jelly prior to assembly.**

Hydraulic System – Special Instructions

The hydraulic oil is supplied to the hydraulic system from a reservoir installed in the truck chassis next to the left front fender behind the operator's seat. The reservoir has a sight gauge attached for determining the level of oil. Working capacity of the reservoir is 8.5 U.S gallons (32 liters).

Important! Always check hydraulic oil level with the bed fully lowered and cylinders fully retracted. Failure to follow these instructions could cause overfilling.

⚠CAUTION Use only MOBIL DTE-13 or equivalent in operating temperatures of +20°F to +120°F (-7°C to +50°C).

Use Mobil Aero HFA or equivalent (MIL-H-5606A) in operating temperatures of -25°F to +50°F (-32°C to +10°C).

⚠CAUTION Always take every precaution to keep dirt out of the hydraulic system. By adhering to the following recommendations, you can significantly reduce downtime and repair costs over the life of your machine.

- **Keep oil storage areas clean and dry.**
- **Keep barrel bungs covered and sealed** until you're ready to use the oil. Clean the bung seals before removing them, and clean the bung before removing it.
- **Use only clean pumps and conduits** to transfer fluid from barrels to the reservoir. Clean the system's entry port thoroughly.
- **Filter all fluid introduced into the reservoir** through a nominal, no-bypass, 10-micron filter. Do not use a bucket or such method.
- **Clean all components and hoses in the area** when repairing or replacing a component of the hydraulic system. Use only clean tools and lint-free rags.
- **Never add used fluid to the system.** The high costs of downtime and component replacement is more costly than the price of new oil.
- **In the event of a catastrophic failure of a pump or motor:** Drain, clean, flush the system, and change filters. Otherwise, metal particles and dirt can remain in the system to cause damage after you replace the component.

Hydraulic Reservoir - Cleaning

Drain and replace oil if there is any doubt as to its purity.

1. To drain reservoir, place a container underneath and remove the magnetic drain plug.
2. Inspect plug for metallic particles.
3. Drain and discard oil, clean drain plug, and replace oil filter element.

Clean the exterior of reservoir with mineral spirits or a similar type solvent.

1. To clean interior of reservoir, place a suitable container under drain opening and flush tank with mineral spirits only. Allow sufficient time for cleaning material to thoroughly drain and interior to dry. A jet of air under low pressure directed into the interior will speed the drying time. Keep reservoir clean.

Note: A removable cleanout cover is provided which will allow interior access if necessary.

2. Replace drain plug and fill reservoir with the recommended oil to proper level.
3. Start engine and operate system in all modes. Recheck oil level. Add oil if required.
4. Remove suction strainer plug. Drain sediment and remove contaminants from screen.

SECTION 2
TROUBLESHOOTING

⚠WARNING Before working beneath the raised conveyor bed, always raise the safety stand and set securely into place.

Troubleshooting the conveyor truck is relatively simple for maintenance personnel who have a working knowledge of automotive repair and electrical and hydraulic systems. The work requires no tools other than those found in any well-equipped automotive maintenance shop.

The following notes may help with your understanding of how the conveyor truck is designed to operate:

- The engine starter will not engage unless the transmission shift lever is in neutral position, the ignition switch is in "Run" position, and no emergency stop switches are depressed
- The ignition switch on the instrument panel is of the anti-restart type, which means once the engine has been cranked, the switch must be turned back to OFF before the engine can be cranked again.
- The "High Water Temp." and "Brake Fault" lights are self-testing and designed to flash briefly whenever the ignition switch is turned on or off. This tests the lamp and socket to ensure proper functioning.
- Vehicle running and work lights will operate only when the instrument panel ignition switch is in the "Run" position.
- Due to tire static resistance on dry pavement the wheels may not be able to turn fully from lock to lock when unit is stationary.

Hydraulic Power and Distribution System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Limited or no hydraulic power, and/or erratic operation in all functions.		H1, H2 H5 H7, H14 H15, H16	M1 M3, M4	Pump Counter-balance relief Pump
Hydraulic oil foaming		H4, H5, H6, H16		
Noisy engine pump		H2, H5 H7, H10 H15, H16	M1, M3	Relief valve Pump
Noise in vicinity of reservoir		H2, H3, H5		
Hydraulic oil milky or discolored		H4, H6, H15, H16		
Hydraulic system running hot		H1, H7 H10, H15, H17	M5, M16	

Electrical Power and Distribution System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
No power to unit; all functions	E1 E2, E3, E4 E20, E21 E22		 M1	Fuse 2FU Battery Alternator
Lights dim excessively when engine is cranked	E2, E3 E20, E21 E22		 M1	 Battery Alternator
"Low Volts" light does not illuminate at any time; all other systems normal	E2. E4 E12, E13 E16, E22			
"Low Volts" light stays on all the time	E18, E22		M1	Alternator
No warning indicators functioning	E1 E2			Fuse 5FU
No running lights functioning	E1, E2 E5			Fuse 6FU Ignition Sw.
Horn and spotlights not functioning	E1, E2 E5			Fuse 7FU Ignition Sw.

Power Steering

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Steering response sluggish or intermitent. All other systems OK		H1, H10, H12, H19, H20 H7, H14		Crossover relief
Unit steers in one direction only		H7, H14		Crossover relief
Unit wanders excessively when driven		H12	M19	
Steering "feels loose" and excesssively sensitive		H18, H20		

Bed Lift System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Bed will not raise; all other systems OK		H1, H8, H10, H12		
Bed will not lower.		H1, H8, H10		
Chattering noise and/or jerkiness noted when lowering bed.		H8, H10		Counterbalance
Cylinder "leaks down" gradually over a period of time		H8, H10, H12		
Excessive continuous or intermittent rod seal leakage		H11		
Cylinder "hunts" when lowering (large variations in speed at regular intervals)		H8, H10		Counterbalance
Bed lowers very slowly		H8		
Bed noisy when raising or lowering		H8, H12	M25, M26	Front lift cyl. Rear lift frame

Belt Conveyor and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Belt will not turn in either direction (all other systems OK)	E1, E2 E3, E7 E4 E2, E5, E11	 H1, H10, H17	 M1, M4, M5, M7, M11, M16, M21, M22	Fuse 8FU Bypass valve Conveyor bed Switches
Belt can be operated when handbrake is released and/or shift lever is not in neutral.	E6, E11	H13		Bypass valve
Fuse 8FU blows repeatedly (Check for short to ground)	E8, E17			
Parking brake ON light flashes brightly when handbrake is released.	E2, E3, E16			Diode REC 2
Belt speeds up excessively when unloading heavy packages..		H8, H10, H14 H17		Counterbalance

Belt Conveyor and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Belt creepage excessive when heavy packages are stopped with bed at an angle (some creepage is normal).		H8, H10 H6, H17	M1, M4, M5, M11, M17	Counterbalance Conveyor bed
Belt very slow or will not load heavy packages	E2, E3, E4, E11	H7, H8, H15, H17 H10	M1, M2, M4, M5, M6, M15, M16, M17	Conveyor bed Bypass valve
Belt operation excessively noisy		H17	M1, M2, M5, M16	Conveyor bed
Belt runs slow, will not speed up adequately (also see Hydraulic Power and Distribution System)		H1, H2, H5, H8, H10, H14, H17	M4, M5, M6, M13, M16, M17	
Belt runs slow in one direction.		H10	M1, M11, M16, M17	
Belt will not track (runs to one side or both)			M15, M16, M17, M18	
Belt control levers cannot be moved.			M11, M21, M22	

Lighting and Accessory Systems

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
No running or accessory lights; all other circuits OK	E5, E2			Keyswitch
No running lights; all other circuits OK	E1, E2			Fuse 6FU
No spotlights or horn; all other circuits OK	E1, E2, E4			Fuse 7FU
Malfunction in one light or group of lights	E2, E3, E4, E5, E6, E12, E13			
No horn	E1, E2, E3, E4, E5			Fuse 7FU Horn button

Lighting and Accessory Systems

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Stoplight malfunction. Backup lights stay on all the time. (Also see Brake System)	E6, E11		M12	
Fuses blow repeatedly				Check for short circuits

Brake System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Brakes feel excessively spongy with poor or no stopping power		H21, H22, H25, H26	M4, M8, M21	
Stoplights stay on all the time (Also see Lighting & Accessory Systems.)	E6	H1, H23	M8, M20, M22	
No Stoplights. (Also see Lighting & Accessory Systems.)	E2, E3, E4, E5, E6, E12, E13			
Brakes feel normal, vehicle has poor stopping power		H27, H1		

Brake System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
"Brake Fault" light on instrument panel glows when brakes are depressed		H21, H22 H23, H25, H26		
"Brake Fault" light glows continously	E6, E14, E4	H1, H23		
Vehicle pulls to one side when braking		H1, H22, H23, H25, H26, H27	M21, M22	Check rear brakes
Handbrake will not hold		H26, H27	M23 M21, M22	Cable and/or rear brakes
Brake fluid milky or discolored		H24		
Brake pedal gradually goes down to floor when depressed with a constant force		H21, H22		
"Brake Fault" light does not flash when ignition is turned on or off	E2, E12, E13, E3, E15			Capacitor

Engine and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Starter will not crank; all other systems OK	E2, E4, E5, E7, E8 E1, E2 E3, E7, E9 E11		M12 M21, M22	Fuse 3FU Relay CR1 Neutral Sw. Starter
Starter cranks continuously	E6, E10			

Engine and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Engine cranks but will not start	E1, E2 E5, E2		 M3 M9, M12	Fuse 4FU Keyswitch
Engine will not stop.	E6		M20, M21, M22	
Engine runs rough, speed "hunts" up and down.			M10 M14, M24	
Oil warning light does not illuminate at any time	E2, E4, E5, E12, E13			
Oil warning light stays on when engine is running	E4, E6			
"High Water Temp" light does not flash when ignition is turned on or off	E2, E12, E13 E3, E15			Capacitor
"High Water Temp" light glows continuously	E4, E6 E14			
Hourmeter does not register when ignition is turned on	E2, E3, E19			
Engine starts with difficulty when cold. Glow plugs have no effect.	E1, E2 E3, E7, E9 E4, E5, E23			1FU CR 2
Fuse 1FU blows repeatedly	E6, E10			
Engine idles high (Check idle stop adjustment)			M14, M20, M21, M22	Accelerator
Engine will not accelerate when driving.			M14, M21, M22, M24	Accelerator

Automatic Transmission and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Water in transmission fluid		H28		
Transmission overheats		H1, H29		

Automatic Transmission and Control System

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Transmission does not shift into neutral when gearshift lever is in neutral position			M12, M21, M22	
Transmission fluid milky and dirty				Drain and flush
Transmission will not shift			M21, M22, M27	

Axles, Wheels and Tires

Trouble Symptom	Electrical	Hydraulic	Mechanical	Remarks
Uneven tire wear.			M19, M28	
Excessive noise from rear when first shifting into gear or accelerating			M29, M30	

Probable Cause/Remedies by Code: Electrical

Code Number	Probable Cause	Test/Remedy
E1	Fuse blown	Check for short circuit. Replace with fuse of correct type and rating.
E2	Wiring disconnected or open circuit	Check continuity from point to point. Check for damaged or disconnected terminals.
E3	Bad ground connection	Check and reconnect ground.
E4	Connector damaged	Check for damaged, burned or open circuit pins or sockets.
E5	Switch contact not closing	Test switch. Replace or repair as required.
E6	Switch contacts shorted	Test switch. Check for water infiltration. Replace or repair as required.
E7	Relay/solenoid coil open circuit	Check coil. Replace if required.
E8	Relay/solenoid coil short circuit	Test coil. Replace if required.
E9	Relay contacts not closing	Test. Repair or replace as required.
E10	Relay contacts welded shut	Test. Repair or replace as required.
E11	Limit switch not being actuated properly	Check operation of mechanical linkage. Test for contact closing or opening. Adjust or repair as required.
E12	Bulb defective	Check. Replace.
E13	Socket contacts dirty or corroded	Clean or replace as required.
E14	Capacitor short circuit	Check with meter on resistance range. If capacitor shows a continuous low resistance, replace. NOTE: Positive (+) lead on meter must be connected to positive (+) terminal on capacitor.
E15	Capacitor open circuit	Check with meter on resistance range. If meter does not show any initial deflection when connected for the first time, replace capacitor.
E16	Diode open circuit	Check with meter on resistance range. Switch meter leads to check polarities. If meter does NOT deflect approximately 1/2 scale for one polarity only, replace diode.
E17	Diode short circuit	Check as in #16 above. If meter reads low resistance for both polarities, replace.
E18	Resistor defective	Check resistance with meter after first zeroing meter. If resistance is not within +/- 15% of rated value, replace resistor.

Probable Cause/Remedies by Code: Electrical

Code Number	Probable Cause	Test/Remedy
E19	Meter defective	Test, replace if required.
E20	Battery open circuit or not charged	Check no-load voltage with meter. Crank engine and observe voltage. If voltage drops below 9 volts while cranking, check charging system. If charging system is OK, replace battery.
E21	Battery short circuit or not charged	Check no-load voltage with meter. If voltage is less than 12.0 volts, check charging system. If charging system is OK, replace battery.
E22	Alternator/regulator defective	With engine stopped, connect an ammeter with a range of 0-60 DC in-line between battery and alternator. Start engine. Check current and voltage. If voltage does not rise above 13V and current is less than 6 amps, replace alternator. If voltage rises above 15V, replace alternator.
E23	Glow plugs defective (diesel only).	Disconnect individual glow plugs. Connect a meter with a range of 0-10 amps in line and touch the meter lead to battery positive. Glow plug current should be approx. 8 amps. If less, check connection or replace glow plug.

Probable Cause/Remedies by Code: Hydraulics

Code Number	Probable Cause	Test/Remedy
H1	Hydraulic hose or tubing blocked or pinched	Remove and inspect. Replace if necessary.
H2	Suction strainer clogged	Remove and clean with mineral spirits. Check condition of reservoir and reinstall strainer.
H3	Return filter clogged	Replace element. Check condition of reservoir and suction strainer.
H4	Reservoir contaminated	Open reservoir and check for contamination. Drain and clean with mineral spirits and a lint-free cloth if necessary. Flush system and refill with new oil. (MOBIL-DTE-13)
H5	Oil level low	Add oil to proper level on sight gauge.
H6	Wrong type hydraulic oil or contaminated oil	Flush system, drain and refill with new oil. See H4.
H7	Defective or improperly adjusted relief valve	Check pressures. Readjust or replace valve as required.
H8	Counterbalancel valve out of adjustment	Remove and readjust as required, or replace.
H9	Not applicable	
H10	Valve clogged or damaged	Remove and inspect. Clean or replace as necessary.
H11	Cylinder rod seal defective	Remove and inspect. Clean or replace as required. Check rod surfaces for damage. Replace if required.
H12	Cylinder piston seal defective	Replace and test. Check cylinder bore for wear or damage.
H13	Return spring broken	Remove and inspect. Replace spring or valve as required.
H14	Pressure regulating spring broken	Remove and inspect. Replace spring or valve as required.
H15	Hydraulic pump defective	Remove and test on a hydraulic test bench. Repair or replace as necessary. (See Mfr's service data, Chap. 5.)
H16	Hydraulic pump shaft seal leaking	Allow any air in reservoir to disperse. Run system. Stop pump and crack the pump pressure line, check for air in the oil. Remove and repair pump if required.
H17	Hydraulic motor defective	Refer to manufacturer's service information. (Replacement is usually the best option)

Probable Cause/Remedies by Code: Hydraulics

Code Number	Probable Cause	Test/Remedy
H18	Power steering centering spring broken	With engine stopped, gently move wheel in both directions. The wheel should always tend to return to its original position. If not, remove and repair steering unit as required. (See Mfr's data, Chap. 5.)
H19	Power steering internal check valve blocked open or damaged	Check system pressure by "bottoming out" lift cylinder. Operate power steering until wheels stop turning. If system pressure is below 1,800 psig, remove and repair power steering unit.
H20	Power steering unit worn or damaged	Remove, repair or replace. (See Mfr's data, Chap. 5.)
H21	Brake master or wheel cylinder seals bad	Remove and repair as required.
H22	Air in brake system	Pressure bleed all brake lines.
H23	Master or wheel cylinder(s) seized	Remove and repair or replace as required.
H24	Brake fluid contaminated	Drain system. Refill with new fluid; purge all lines. Disassemble all components and clean with new fluid; also replace any damaged/corroded components. Refill system with fresh fluid. Pressure bleed system.
H25	Brake fluid level low	Refill with new fluid. Check for leaks. Pressure bleed system.
H26	Brake linings worn or out of adjustment	Check condition of linings. Replace and/or adjust as required.
H27	Brake linings contaminated (oil, etc.)	Drain system. Refill with fresh fluid. Purge all brake lines. Disassemble all components and clean with new brake fluid. Replace any damaged or corroded components. Reassemble, refill with fresh, new fluid and pressure bleed system. Replace linings.
H28	Oil cooler perforated	Pressure test radiator and check for leaks from cooler. Replace if required.
H29	Oil cooler blocked	Check and replace if required.

Probable Cause/Remedies by Code - Mechanical/Structural

Code Number	Probable Cause	Test/Remedy
M1	Engine belt slipping or broken	Check belt tension. Adjust or replace if required.
M2	Chain loose	Check tension, adjust if required.
M3	Taperlock bushing loose or damaged.	Inspect, replace, or adjust as required.
M4	Shaft key missing or damaged.	Inspect and replace if necessary. Inspect keyways.
M5	Sprocket damaged or worn.	Inspect and replace if necesary.
M6	Drive chain worn.	Inspect and replace if necessary.
M7	Drive chain broken.	Repair or replace.
M8	Footbrake linkage out of adjustment	Readjust linkage.
M9	Not applicable	
M10	Broken, perforated or loose fuel line between tank and engine	Visually inspect and vacuum test fuel line. Repair or replace as necessary.
M11	Control rods out of adjustment or damaged	Check, repair or readjust as required.
M12	Transmission linkage out of adjustment	Check and readjust.
M13	Throttle linkage out of adjustment	Readjust linkage.
M14	Accelerator linkage out of adjustment	Readjust linkage.
M15	Tail roller out of adjustment	Adjust.
M16	Foreign material jammed between head or tail rollers, or in drive sprocket	Remove obstructions and repair any damage.
M17	Belt damaged	Check for tearing or excessive stretch. Replace if required.
M18	Belt guide damaged	Check for wear or broken springs. Repair or replace as required.
M19	Tie rod ends defective	Check for free play; replace as required.
M20	Return spring broken	Replace spring.
M21	Linkage broken	Check and repair or replace as required.

Probable Cause/Remedies by Code - Mechanical/Structural

Code Number	Probable Cause	Test/Remedy
M22	Linkage seized	Check, clean/lubricate or repair.
M23	Handbrake cable linkage out of adjustment	Readjust linkage.
M24	Fuel filter clogged	Clean filter.
M25	Rear lifting frame shifted to one side	Center the rear lifting frame pivot shaft.
M26	Bearings worn	Inspect and replace as required.
M27	Modulator cable out of adjustment	Check and adjust if necessary.
M28	Toe-in alignment	Check and adjust wheel alignment to manufacturer's specifications.
M29	Axle U-bolts loose	Tighten U-bolts
M30	Driveshaft universal joints loose	Replace as required.

SECTION 3
REMOVAL AND INSTALLATION

Removal and installation of components and assemblies from the unit are generally not difficult and no special tools are required. Instructions given here are for those components and assemblies that may pose the greater challenge. All fastenings are standard SAE. Some components will require suitable hoists or slings for removal and installation.

The following procedures are given only as a guide and do not in any way restrict technicians from developing their own procedures. No procedures are given where the type of work required is obvious. Assembly is normally done in reverse order of disassembly unless a special procedure is required.

⚠WARNING Make sure that:

- **the conveyor front is properly stored on the safety stand before removing any plumbing from the front cylinder.**
- **the rear scissor is blocked before removing any plumbing from rear cylinder.**
- **the conveyor bed is stored on the safety stand (See Figure 2, Chapter 1) before performing any work under the bed.**

Conveyor Bed Removal and Installation

1. Chock wheels and start the engine.
2. Raise rear of conveyor bed hydraulically to the maximum height.
3. Raise front of conveyor bed hydraulically so the bed is horizontal.
4. Shut off engine.
5. Using hoists, forklifts, or other suitable lifting equipment, provide support at both the front and rear of the conveyor bed. **Conveyor bed weight: approx. 1200 lbs., or 550 kg.**
6. Locate a suitable splice point in the electrical wires connecting vehicle chassis and conveyor bed harnesses in the vicinity of rear lifting frame. Mark wires for identification and cut wires at this point. Also disconnect the electric control harness from relay box near left rear fender.
7. Close the two valves located next to the hydraulic tank.
8. Work over a suitable container and disconnect the two hydraulic lines to rear lift cylinder.

Important! **Cap all ends of hoses and fittings to prevent contamination of hydraulic system.**

9. Remove rear lift cylinder upper cotter pin, washer, and clevis pin. Retract cylinder until clevis is free from lift frame. Replace clevis pin.

⚠WARNING **The front cylinder assembly is very heavy. Attempting to remove the crosshead bearings without adequate support for the assembly may result in injury.**

10. Using appropriate lifting equipment, support the front cylinder and lift arm A-frame.
11. Remove the bolts that secure the crosshead bearings to the underside of the conveyor bed.
12. Carefully lower the front cylinder/A-frame assembly until it rests on the right front axle pad.
13. Remove bolts securing the rear flange bearings to the underside of the conveyor bed. Lower the rear lifting frame.
14. Wrap lifting straps around conveyor bed, and using suitable lifting device, lift conveyor bed assembly from chassis.
15. Install conveyor bed using the reverse of these procedures. Operate conveyor bed up and down through several cycles to assure proper operation.

Front Lift Cylinder Removal and Installation

1. Chock vehicle wheels.
2. Raise front and rear of conveyor bed assembly hydraulically to allow adequate working area.
3. Wrap lifting straps around front of conveyor bed. Attach straps to lifting device capable of supporting 1,000 pounds.
4. Close the two valves located next to the hydraulic tank.
5. On the lift cylinder, disconnect the two hydraulic lines to the bypass relief valve.

Important! **Cap all ends of hoses and fittings to prevent contamination of hydraulic system.**

⚠WARNING **The front cylinder assembly is very heavy. Attempting to remove the crosshead bearings without adequate support for the assembly may result in injury.**

6. Support the cylinder assembly by attaching a lifting device to the cylinder. Then connect the other end to a sling wrapped around the conveyor bed.
7. Remove the four screws holding the upper bearings to the conveyor bed.
8. Lower the cylinder assembly until it rests on the front right axle pad.
9. Remove the nylock nuts from the lower end of the cylinder A-frame.

Note: The cylinder assembly can now be removed. If desired, you may first remove the A-frame and crosshead, as described in the next steps.

10. Remove the four nylock nuts from the upper end of the cylinder A-frame and remove the A-frame.
11. Remove the cotter pin and link pin securing the rod end to the crosshead.
12. Remove the cylinder for repair or replacement.
13. Install the cylinder assembly in reverse of the removal procedures.

Rear Lift Cylinder Removal and Installation

1. Chock wheels.
2. Start engine and raise front and rear of conveyor bed hydraulically so that the bottom of the conveyor bed is approximately 6" above the left front fender and parallel to ground.
3. Wrap lifting straps around rear of conveyor bed. Attach straps to lifting device capable of supporting 1,000 pounds.
4. Remove rear lift cylinder upper cotter pin, washer, and clevis pin. Slowly retract cylinder until clevis is free from lift frame. Replace clevis pin. Shut off engine.
5. Close the two valves located next to the hydraulic tank.
6. Work over a suitable container and disconnect the two hydraulic lines to cylinder. Mark for identification if necessary.

Important! Cap all ends of hoses and fittings to prevent contamination of hydraulic system.

7. Remove lower clevis pin that connects cylinder body to vehicle chassis.
8. Lift out cylinder.

Rear Lifting Frame

Removal

1. Chock wheels and start the engine.
2. Raise rear of conveyor bed hydraulically to the maximum height.
3. Raise front of conveyor bed hydraulically so the bed is horizontal.
4. Shut off engine.
5. Using hoists, forklifts, or other suitable lifting equipment, provide support at both the front and rear of the conveyor bed. **Conveyor bed weight: approx. 1200 lbs., or 550 kg.**
6. Remove rear lift cylinder upper cotter pin, washer, and clevis pin. Slowly retract cylinder until clevis is free from lift frame. Replace clevis pin. Shut off engine.
7. Place a length of 4 x 4 lumber across the rear fenders. Tie the rear lifting frame to lumber support.
8. Close the two valves located next to the hydraulic tank.
9. Work over a suitable container and disconnect the two hydraulic lines to cylinder. Mark for identification if necessary.

Important! **Cap all ends of hoses and fittings to prevent contamination of hydraulic system.**

10. Remove four screws that clamp lifting frame forward shaft to vehicle chassis and remove clamps. Mark these left and right for identification because they are matched parts to those welded to chassis.
11. Lift out frame after untying it from lumber support.

Installation

1. Position rear lifting frame under conveyor bed and tie it to underside of lumber support.
2. Position forward shaft of lifting frame back onto chassis using four screws and two clamps. Make sure that the lug that receives lift cylinder rod clevis is pointing downward and to rear.

⚠CAUTION **Before tightening clamp screws, make sure that the lifting frame is centered on its supports.**

3. Follow steps 9-1 above, in reverse of installation.

Engine and Transmission Assembly

Removal

1. Chock wheels. Start engine.
2. Raise rear of conveyor bed hydraulically to the maximum height.
3. Raise front of conveyor bed hydraulically so the bed is horizontal.
4. Shut off engine. Disconnect battery.
5. Using hoists, forklifts, or other suitable lifting equipment, provide support at both the front and rear of the conveyor bed. **Conveyor bed weight: approx. 1200 lbs., or 550 kg.**
6. Remove engine cover.
7. Disconnect two driveshaft U-bolts and remove driveshaft.
8. Disconnect parking brake cable and move clear of engine frame.
9. Using a suitable container to prevent spillage, disconnect the fuel lines and plug them to prevent leaking. Mark for identification if necessary.
10. Disconnect transmission shift cable and move clear of engine frame. Mark for identification if necessary.
11. Disconnect throttle cable and move clear of engine frame. Mark for identification if necessary.
12. Close off hydraulic tank valves. Using a suitable container, disconnect one hydraulic line from hydraulic pump and two from the relief valve body. Mark lines for identification if necessary. Cap all ends of hoses and fittings.

Note: Perkins engine only: The hydraulic pump must be moved to prevent interference. Disconnect the pump bracket from the tension arm, allowing the pump to hang free from the bracket bolt. Make sure that all components will clear vehicle chassis frame when engine frame is lifted out. Set aside V-belt.

13. Disconnect the exhaust pipe from the exhaust manifold. Disconnect exhaust system hangers and remove exhaust system.
14. Disconnect the harness plug from the engine electrical panel.
15. Lift the engine electrical panel. Disconnect the four wires that split off the harness just behind the plug removed in the previous step.
16. Remove two bolts and nuts that secure engine frame to vehicle chassis.
17. Connect a low profile sling or rigid frame to the four lifting points on engine frame. Lift out engine frame assembly from vehicle chassis with sling using a forklift truck or similar boom lifting device.

Installation

1. Connect a low profile sling or rigid frame to the four lifting points on engine frame.
2. CAREFULLY lift engine frame assembly back into vehicle chassis with sling, using a forklift truck or similar boom lifting device. Make sure that all engine components clear chassis.
3. Align the two engine frame tie-down points with mating holes in vehicle chassis. Reinstall the two bolts and nuts that secure engine frame to vehicle chassis, but do not tighten them.
4. Perform the previous steps 15-5, the reverse of installation.
5. Remove conveyor bed supports.
6. Connect battery. Check all fluid levels.
7. Start engine and check for proper operation.

New Transmission Installation Notes

- Use a teflon sealer on transmission cooling line fittings that thread in side of transmission case.
- Do not start engine with new transmission installed without adding a minimum amount of transmission fluid. Do not operate unit under load before having proper fluid level.

SECTION 4
REPAIR

Repairs should consist of part replacement or replacement of the entire assembly. Repair of electrical and hydraulic components should be restricted to the procedures outlined in this section. Refer to Chapter 4 for parts identification and location.

⚠WARNING Before any extended periods of work beneath the platform or for maintenance/repair activities that involve removing or disconnecting the bed lift system hydraulic components, raise the bed sufficiently to the safety stand.

Note: Parts for the automatic transmission should be obtained from the local authorized Ford parts dealer. Serial and model numbers of the transmission will be required. Overhaul data for both the engine and transmission can be obtained direct from the manufacturer, or at a nominal cost from Wollard Airport Equipment Co.

All structural repair is performed at the discretion of the user's maintenance shop and should follow prevailing practices for that shop. The instructions below are offered only to advise the user of Wollard's recommended procedures.

Metal Cracks

Small cracks or fractures in non-critical areas may be stop-drilled, welded or patched. The user should also determine if the component is beyond economical repair and should be replaced.

Welding

Welding repair to major structural members, assemblies of subassemblies, which effect their structural integrity, should not be attempted without first contacting the engineering department at Wollard Airport Equipment Co. for instructions.

Axle Bearings, Brake Assemblies, and Differential

Refer to Chapter 5 and the illustrated parts breakdowns in Chapter 4.

Conveyor Belt Replacement

Figures 2, 3, and 4

You may purchase a ready-made belt from Wollard. Refer to Chapter 4 for the part number and other ordering information. The belt kit consists of the belt cut to proper length with the lacing attached and a length of steel pin to join the ends.

1. Park the unit in a service facility.
2. Using the tail roller adjusting bolts, fully retract the take-up bearings to relieve belt tension.
3. Remove steel pin from lacing and remove belt from conveyor bed. Observe belt routing when removing.

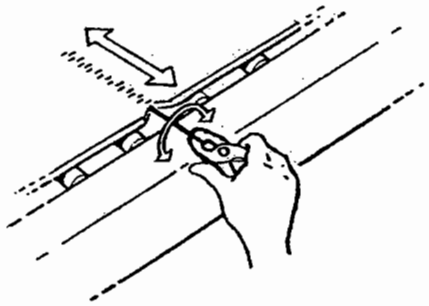


Figure 2.
Removing/Installing Steel Pin.

4. Thread new belt through rollers and guides so that ends of belt rest on top of conveyor bed when threading is completed. Assemble laced ends with new steel pin. (Use of a belt stretcher may be required).

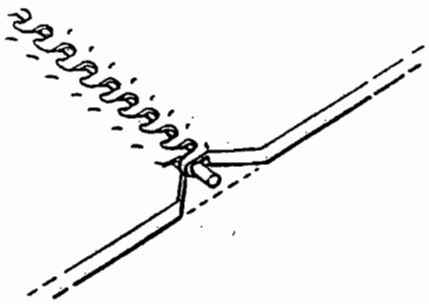


Figure 3.
Steel Pin Installed, Belt Edges Aligned.

5. Using the adjusting bolts, move the take-up bearings rearward until all slack is taken up on both edges (Also see figure 4). Keep belt aligned on rollers.

⚠CAUTION **Do not over-tension the belt. Over-tensioning will cause belt damage, such as pulled-out lacing.**

6. Operate conveyor in both directions and check for looseness or too-tight condition. Check for belt runout on either side of head and tail rollers. (Refer to Figures 6 and 7).

Belt Repair

Figures 2, 3, and 4

Users having belt lacing equipment can make their own belt repairs by cutting out damaged areas and splicing in new sections.

Important! This procedure should be done only by someone qualified to repair conveyor belts.

1. Park the unit in a service facility.
2. Using the tail roller adjusting bolts, fully retract the take-up bearings to relieve belt tension.
3. Remove steel pin from lacing and remove belt from conveyor bed. Observe belt routing when removing
4. Lay belt on a flat, smooth surface and examine damaged areas.
5. Mark belt for cutting. Cuts should be made at least 2 inches (5 cm) back from defective areas. Save old section cut from belt.

Important! Make sure that the cut end is square with the centerline of the belt.

6. Using section cut from belt as a pattern, cut new piece from new belt material. Make sure that new piece is of proper length and that cut ends are absolutely square.

Important! New splice pieces must be installed full width of belt. Patches will not work satisfactorily.

7. Carefully remove enough rubber tread from the belt ends (approx. 1-inch) to provide a solid surface for the new lacing. Be careful not to damage the belt fabric.

Note: A special tool called a "hand skiver" may be used to remove raised belt material, or a small hand sander with a coarse-grit disc may also be used.

8. Apply steel belt lacing to cut ends of splice section and belt using a commercial belt lacer.
9. Mate newly laced end of splice with newly laced end of belt. Assemble splice to belt using steel lacing pins.
10. Thread repaired belt through rollers and guides so that ends of belt rest on top of conveyor bed when threading is completed. Assemble laced ends with new steel pin. (Use of a belt stretcher may be required).
11. Using adjusting bolts, move the take-up bearings rearward until all slack is taken up on both edges. Keep belt aligned on rollers. **Do not over-tension.**
12. Operate conveyor in both directions and check for looseness or too-tight condition. Check for belt runout on either side of head and tail rollers. (See Figures 6 and 7).

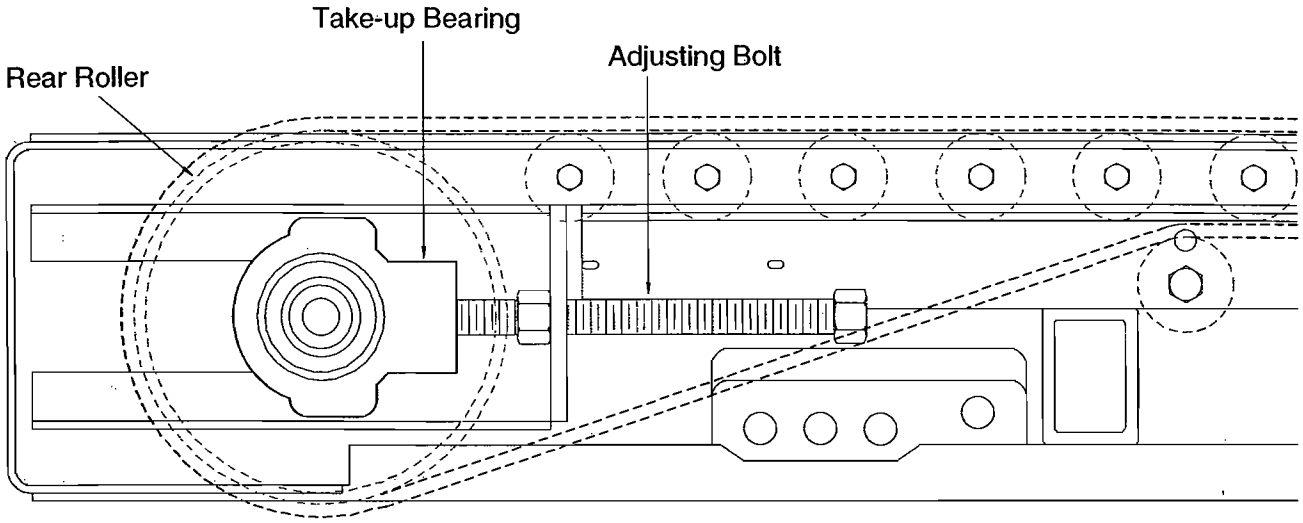


Figure 4.
Components Used to Adjust Belt Tension

Abrasive Coating Replacement - Head and Tail Rollers

Note: Abrasive coating is not applied to rubber-faced rollers.

Wear of abrasive coating will be evidenced by belt slippage. This condition is seldom seen, and then only after extensive use of the belt drive. However, should slippage occur, the following corrective action must be taken:

1. Refer to steps 1-3, *Conveyor Belt Replacement* to remove belt from conveyor.
2. Thoroughly clean head and tail rollers using suitable solvent. Allow to air dry.
3. Use stiff bristle brush and apply liberal even coat of abrasive coating.

Note: "Ferrox" non-slip coating manufactured by Martex Safety Products, 1A Paine Avenue, Irvington, NJ 07111, is the only abrasive coating recommended by Wollard for this application.

4. Allow coating to dry completely (overnight or at least 6 hours).
5. Re-install conveyor belt. Refer *Conveyor Belt Replacement,* steps 4-6.

SECTION 5
ADJUSTMENTS

⚠WARNING Make sure that:

- **the conveyor front is properly stored on the safety stand before removing any plumbing from the front cylinder.**
- **the rear scissor is blocked before removing any plumbing from rear cylinder.**
- **the conveyor bed is stored on the safety stand before performing any work under the bed.**

Electrical System

Transmission Neutral/Backup Switch

This switch is a combination unit located on the automatic transmission shifter shaft in the engine package.

1. Remove clevis pin holding shifter arm to cable clevis.
2. Connect a volt-ohm meter (on resistance range) or a continuity tester across both Red/Blue wires coming out of the switch.
3. Loosen hold-down bolts on switch and rotate switch until contact opens for the same throw of shifter arm either side of Neutral.
4. Retighten switch bolts and recheck adjustment.
5. Replace clevis pin.

Quadrastat Neutral Switch

This switch is an integral part of the gearshift selector mechanism located at the operator station.

1. Remove shifter side cover.
2. Connect a volt-ohm meter (on resistance range) or continuity tester across the switch wires.
3. Loosen the single adjusting bolt and adjust switch until contact opens for the same throw of lever either side of Neutral.
4. Retighten adjusting bolt and replace side cover.

Hydraulic System

Some adjustments to the hydraulic system will require a pressure gauge. Figure 5 shows an inexpensive test gauge kit which can be readily assembled and adapted to fit almost any part of the hydraulic system by removing a hose and connecting the gauge in line or directly to a fitting. Kits are available from Wollard.

Main Relief Valve Pressure

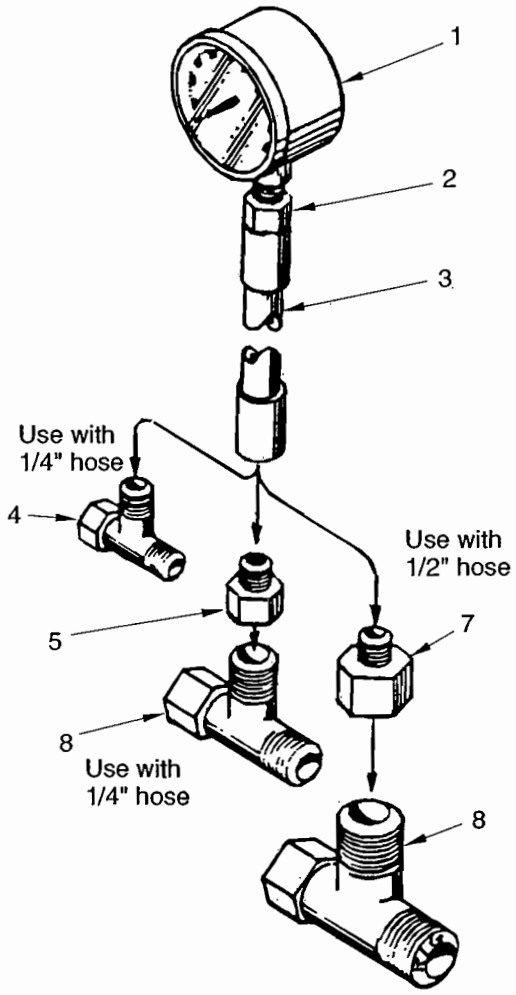
If the unit has a Hydreco hydraulic pump (diesel), the pressure relief valve is integral with the pump. On the gasoline truck, the valve is a separate component mounted on the engine package close to the pump. Procedures for setting relief valve pressure does not change.

1. With engine off, disconnect the pressure hose from the hydraulic pump.
2. Connect the test gauge in line and reconnect the hose.
3. Remove the hex-head protective cap over the relief adjusting screw and loosen the locknut.
4. Back the adjusting screw out to reduce pressure.
5. Start engine. Fully retract the rear cylinder. While an assistant holds the rear cylinder manual valve in the "down" position, gradually increase relief valve setting to 1800 PSI.
6. Tighten locknut and replace protective cap.
7. Stop engine, remove test gauge, and replace hose.

Counterbalance Valve Pressure

The conveyor forward/reverse valve is located under the conveyor bed. It controls the "Reverse" or "Unload" operation of the belt to prevent heavy packages running away. The pressure cannot be set while the valve is on the vehicle. The front and rear cylinder counterbalance valves are located in the plumbing adjacent to their respective cylinder. Remove and adjust in the same manner as for the conveyor forward/reverse valve.

1. With engine off, disconnect and remove the valve.
2. Use a suitable test bench and connect the pressure line to port #1 on the valve, leaving port #3 (pilot port) open to atmosphere. Port #2 will be the output port.
3. Gradually increase test pressure to 2,000 psi, and adjust the counterbalance valve to relieve at 2,000 psi.
4. Lock setting, remove from test bench, and reinstall on vehicle.



1. Gauge, 0-3000 PSI
   (Marsh P/N J7678P) (WAE STK #1.0474)
2. Adapter
   (Aeroquip P/N 2022-4-4) (WAE STK #3.3097)
3. Hose Assy., Hydraulic, 1/4" X 12" Lg
   (WAE STK #14762-2)
4. Tee, Swivel
   (Aeroquip P/N 203102-4-4)(WAE STK #3.2966)
5. Reducer
   (Aeroquip P/N 221501-6-4) (WAE STK #3.2941)
6. Tee, Swivel
   (Aeroquip P/N 203102-6-6) (WAE STK #3.2769)
7. Reducer
   (Aeroquip P/N 221501-8-4) (WAE STK #3.2965)
8. Tee, Swivel
   (Aeroquip P/N 203102-8-8) (WAE STK #3.2679)

Complete Kit: WAE STK #19432.

Figure 5.
Test Kit.

Mechanical Systems

Front Return Roller Adjustment (to remedy a drifting belt)

Figure 6

Adjust front main <u>return</u> roller (also known as "crowder" roller) when belt tracks to one side when going forward, but goes over to the other side when in reverse. The front main return roller has a slot in the left mounting hole to allow for adjustment. The roller shaft is secured in adjusted position by a 1/2" bolt and lockwasher.

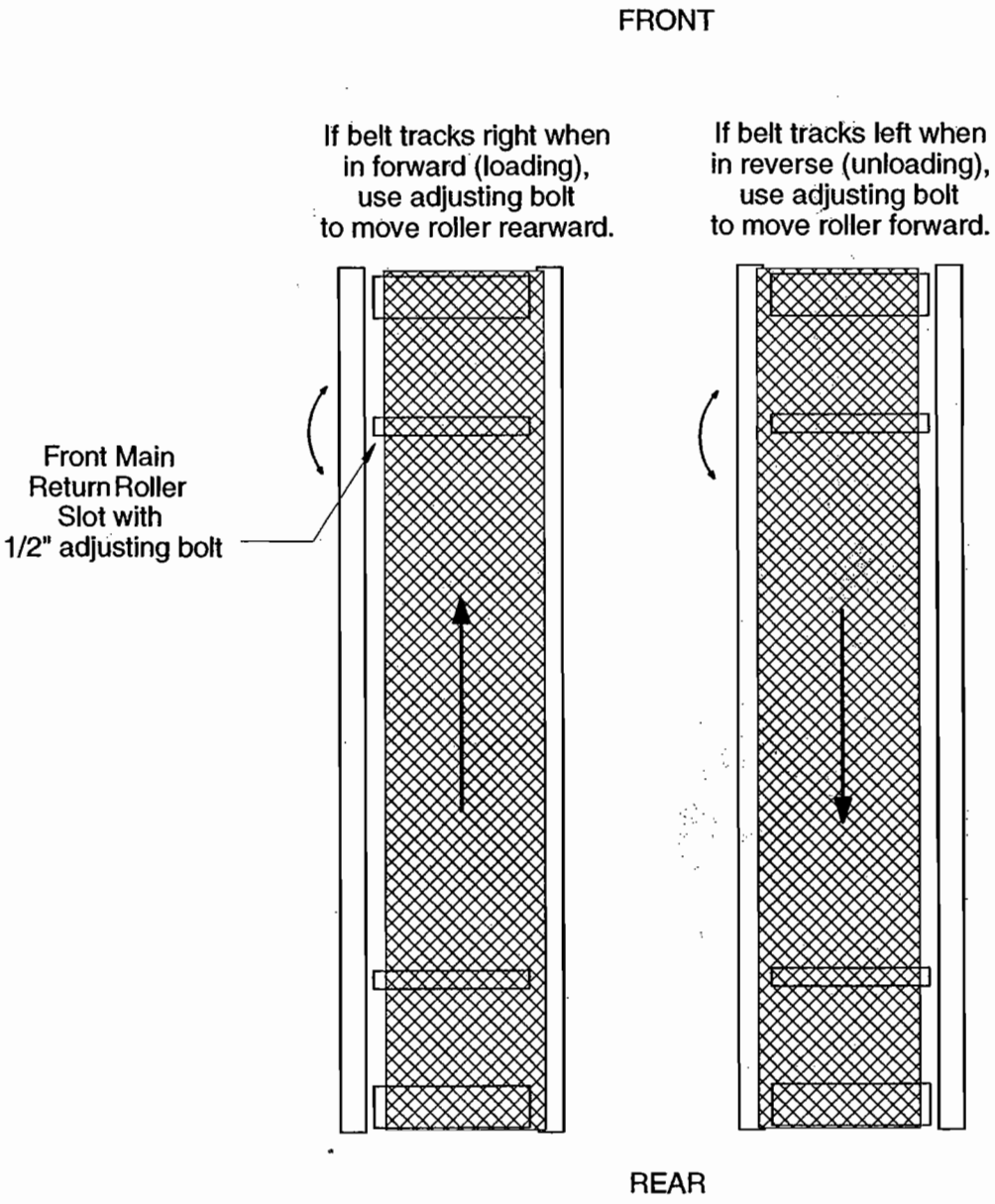


Figure 6. Adjustment for a Drifting Belt.

Front Head Roller Adjustment (to remedy a belt running at an angle)

Figure 7

Adjust front head roller when belt angles to one side. The front head roller bearing block has mounting slots to allow for adjustment.

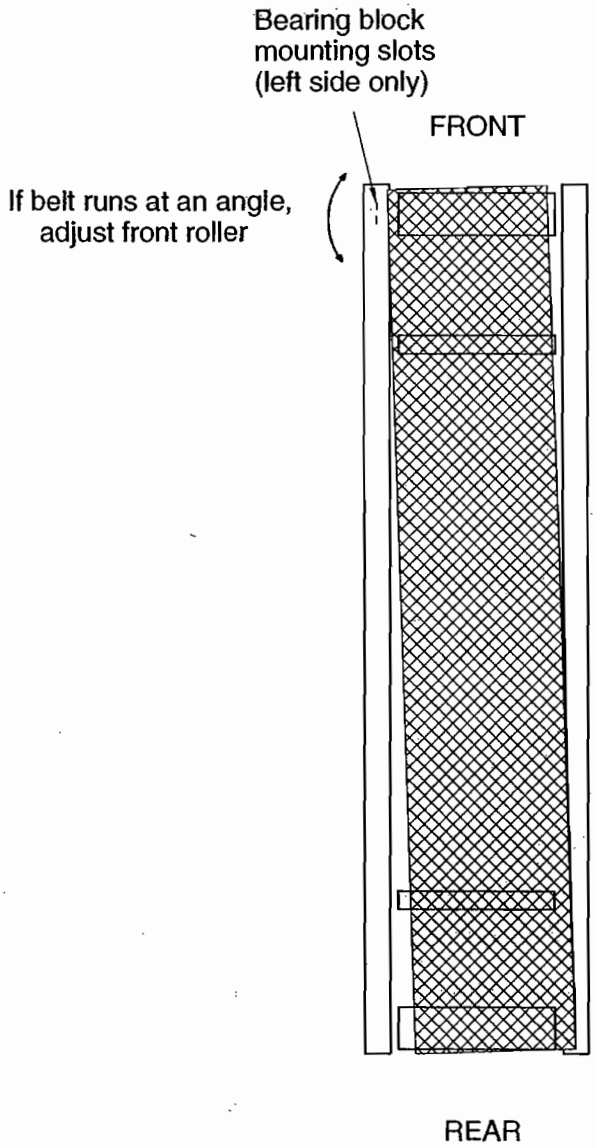


Figure 7. Adjustment for an Angling Belt.

Conveyor Belt Drive Chain Adjustment

1. Remove chain cover to gain access to chain.
2. Loosen the hydraulic motor mounting bolts and move the motor frame until the chain is tight.

Control Rod Linkage for Conveyor Belt

The control rod linkages have adjustable yokes fitted at each end of the rods. Loosen jamb nut securing yoke, remove pin, and screw yoke in or out as required for proper adjustment. Reconnect yoke with pin and tighten jamb nut.

Footbrake Adjustment

Instructions are on Figure 8

Rear Wheel Brakes

The rear brakes are of the self-adjusting type.

1. Start engine.
2. Ensuring that there is sufficient space around the conveyor, engage Reverse, and back up at normal speed. Step on the brake firmly until the unit stops.
3. Repeat this procedure 2 or 3 times.

V-Belt Adjustment

All V-belts should be adjusted to obtain approximately 1/2-inch deflection (for an applied force of approximately 10 lbs.) at the center of the longest belt span. Also refer to the engine manual.

Handbrake (Parking Brake) Adjustment

Adjustment of the handbrake is made by turning the knurled handle on the Orscheln lever until the desired tension is achieved.

1. Locate the setscrew in the Orscheln handle.
2. Remove the setscrew completely to free the knurled handle.
3. Adjust as required, then replace the setscrew.

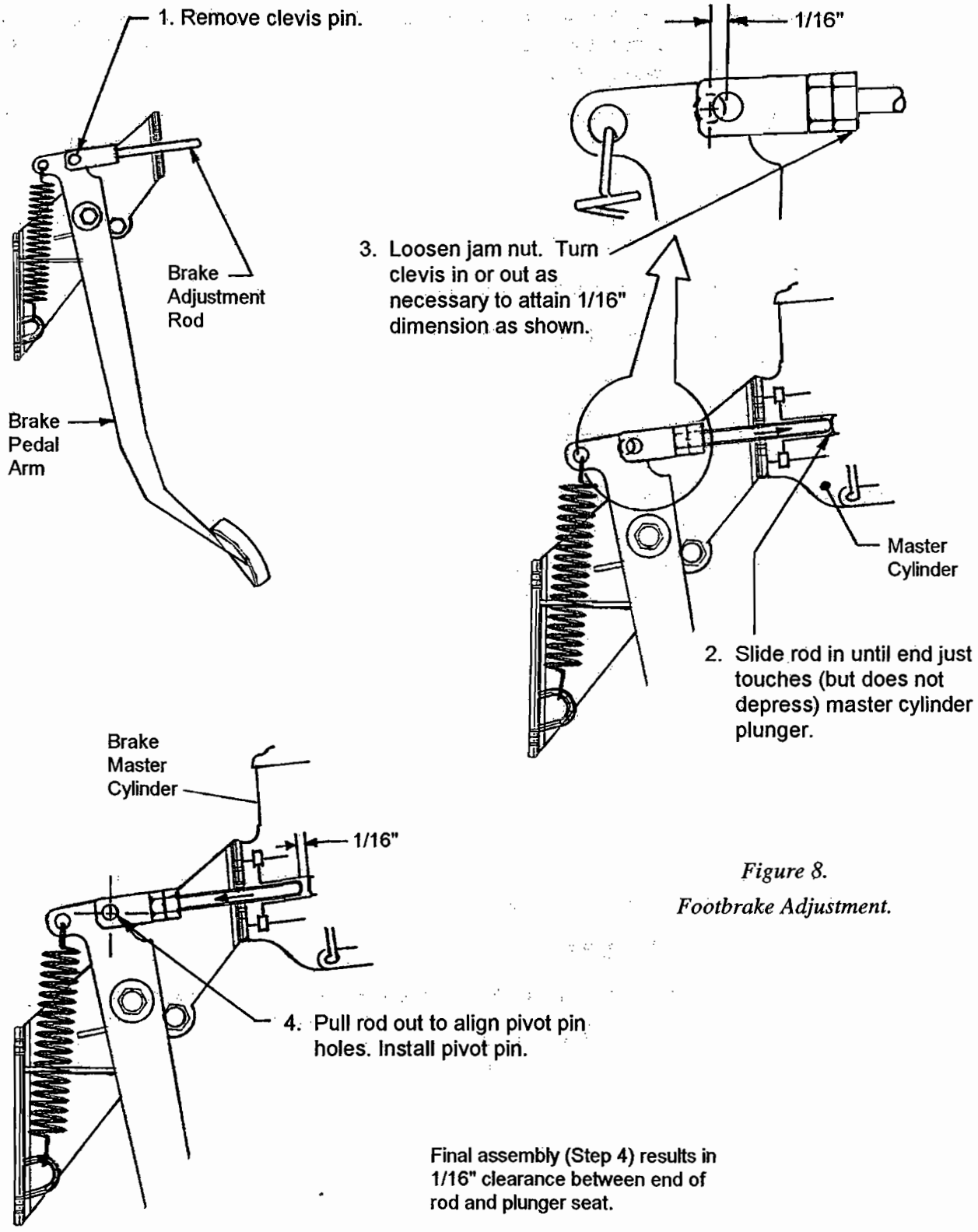


Figure 8.
Footbrake Adjustment.

Engine Speed Adjustments

Important! **Adjustment of engine speeds should only be attempted by competent maintenance personnel. A reliable tachometer with a range of 0-3000 RPM will be required.**

Engine speed is adjusted at the Wollard factory and under normal conditions should not be tampered with. If you are installing a new throttle cable, then you will need the following instructions.

1. Start engine and allow to warm up for about 5 minutes. Operate throttle 2 or 3 times.
2. Adjust idle speed to 850-900 RPM and lock in position.
3. Loosen the two jam nuts holding the throttle cable to the bracket on the engine.
4. By moving the jam nuts either direction, adjust maximum speed to 2400 RPM and lock in position.

Transmission Linkages and Cables

The transmission cable is adjusted at the Wollard factory and under normal conditions should not be tampered with. If you are installing a new cable, then you will need the following instructions.

Adjustments are provided for the transmission linkage on the Quadrastat shift lever and on the push-pull cable.

1. With engine off, remove the clevis pin holding transmission shifter arm to cable clevis.
2. Place transmission in Neutral.
3. Place Quadrastat shift lever in Neutral.
4. Adjust the cable sleeve and clevis attached to the vertical leg (of the same arm) so that the shift lever throws equally Forward and Reverse.
5. Lock all adjustments in place.
6. Set transmission shifter and Quadrastat shift lever in the Neutral position.
7. Adjust cable sleeve and clevis at transmission end until hole in shifter arm matches up with hole in clevis.
8. Replace clevis pin and lock all adjustments in place.

Accelerator Linkage Adjustment

Engine speed is adjusted at the Wollard factory and under normal conditions should not be tampered with. If you are installing a new throttle cable, then you will need the following instructions.

With engine stopped, perform the following:

1. Loosen the two jam nuts holding the throttle cable to the bracket on the engine.
2. Press accelerator all the way to the floorboard.
3. Adjust accelerator push-pull cable sleeve in the cockpit area so that the cable stops movement of the pedal just as it touches the floorboard.
4. Lock cable in position using the jam nuts.
5. Press accelerator all the way to the floorboard.
6. Adjust cable sleeve so that the throttle arm maximum speed adjuster stops throttle motion just before the cable stops the motion of the accelerator pedal.
7. Lock cable in position.

Manual Throttle Adjustment

The throttle adjustment allows the maximum speed of the conveyor belt to be preset as desired.

Note: The minimum speed of the belt is fixed by the engine idle speed, and is therefore not adjustable.

1. Adjust the accelerator linkage as described above.
2. With the throttle lever at rest in the detent, adjust the linkage rod on the front end of the Quadrastat so that the upper leg of the L-shaped arm (to which it is attached) is horizontal.
3. Start engine and place throttle lever in maximum speed position. Run the conveyor belt.
4. Adjust linkage arm between accelerator pedal and Quadrastat to obtain the maximum belt speed required.

Other Engine Adjustments

Refer to the engine manufacturer's manual, which has been supplied with this manual.

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Chapter 3 Tab

CHAPTER 3
OVERHAUL

Component Overhaul

Overhaul of components in the Conveyor Truck is limited to procedures provided by manufacturers in Chapter 5, Manufacturers' Information. Other components are not recommended for overhaul. Further overhaul must be done at the manufacturer's facility or an authorized repair station.

Parts for the Ford engine and automatic transmission should be obtained from a Ford authorized parts dealer. Serial No. and Model No. are required.

Limited Repair Items

Certain components, although not recommended for overhaul, are subject to limited repair procedures. Repairs consist mainly of removal and replacement of parts, the installation of seal kits, etc. Components not covered in the overhaul and repair sections in this manual are not considered reparable items and should be replaced when defective.

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Chapter 4 Tab

Chapter 4
ILLUSTRATED PARTS BREAKDOWN

Page

Note: Beginning with ser. #458, engine pack pages will be in Chapter 6 Options.

OPTIONS: Many of the options available for the TC-888 are included in Chapter 4. Any additional options installed on your unit that require their own parts list and illustration can be found in *Chapter 6 Options.*

IMPORTANT! The drawings in this manual are designed for parts identification only and should not be relied upon for installation purposes. For installation drawings, contact the Wollard Engineering Dept.

LIST OF VENDORS

This listing includes vendors for all available engine packages and options.

The vendors referenced here and in the parts lists do not necessarily represent Wollard's current suppliers.

Federal Supply Code	Vendor
NVC	Air Dro, Inc. (Defco), 1112 Brooks St. S.E., Decatur, AL, 35602
NVC	Anchor Brass Corp., 92-T Taft Ave., P.O. Box 400, Hempstead, NY 11551
NVC	Deka Batteries, 5640 NW 78th Ave., Miami, FL 33166
NVC	EPHA, Inc., 5 Campbell Dr., Hermiston, OR 97838
NVC	Isuzu Motors Ltd. (Purchase locally)
NVC	Midas Muffler Shops (Purchase locally)
NVC	Power Great Lakes, Inc., 655 Wheat Lane, Wood Dale, IL 60191
NVC	Sams Auto Supply (Purchase locally)
NVC	Unlimited Services, 170 Evergreen Rd., Oconto, WI 54153
NVC	Volkswagen of America, Inc., 3737 Lake Cook Road, Deerfield, IL 60015
V00502	Hydro-Aire Division, Crane Co., (ADEL), 3000 Winona Ave., Burbank, CA 91510
V0CES5	U.S. Radiator Corp., 6710 S. Avalon Blvd., Los Angeles, CA 90003
V0C7Z2	Hydraforce Inc., 673 Academy Drive, Northbrook, IL 60062
V0LF97	Hub City Inc., 2914 Industrial Ave., Aberdeen, SD 57402-1089
V01276	Aeroquip Corp., 1225 W Main St., Van Wert, OH 45891-0389
V02249	Gresen Mfg., Dana Corp., 600 Hoover St. NE, Minneapolis, MN 55413
V02575	American Auto Parts Co., Inc., 1212 E 19th St., Kansas City, MO 64108
V02892	Hydreco (General Signal Corp.), 9000 East Michigan Ave., Kalamazoo, MI 49003
V04034	IMO Deleval Inc., Gems Sensor Div., Cowles Rd., Plainville, CT 06062
V06970	Cablecraft Inc., 4401 South Orchard, Tacoma, WA 98411
V07988	Fluid Power Systems (United Technologies Corp.), 511 S Glenn Ave., Wheeling, IL 60090
V08484	Transtechnology Corp., Breeze-Eastern Div., 700 Liberty Ave., Union, NJ 07083-8107
V09393	Rochester Gauges Inc., 11616 Harry Hines Blvd., Dallas, TX 75229
V09769	AMP, Inc., 400 Eisenhower Boulevard, Harrisburg, PA 17105
V1CP11	VSL Corporation, 1077 Dell Avenue, Campbell, CA 95008
V1DF85	Genuine Parts Company (NAPA), (Purchase locally)
V1F337	TRW, Inc., Commercial Steering Division, 800 Heath St., Lafayette, IN 47904
V1Z829	AMP Incorporated, 2800 Fulling Mill, Harrisburg, PA 17105

V11341	Cross Manufacturing, Inc., 100 Factory St., Lewis, KS 67552
V11671	Tyrone Hydraulics, Inc., Dana Corp., P.O. #511, Corinth, MS 38834
V13445	Cole Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2405
V14652	United Brass Works, Inc., South Main St. Extension, Randleman, NC 27317
V14726	Interconnection Products, Inc., 1601 N. Powerline Rd., Pompano Beach, FL 33069
V14894	Allied Automotive Aftermarket Div., 1094 Bendix Dr., Jackson, TN 38301
V16327	Dayton Electric Mfg. Co., 5959 W. Howard St., Chicago, IL 60648
V16476	Datcon Instrument Co., P.O. Box 128, East Petersburg, PA 17520
V18108	Green Manufacturing, Inc., 1032 S. Maple, Bowling Green, OH 43402
V18265	Donaldson, Inc., 1400 W 9th St., Minneapolis, MN 55440
V19184	Brand Hydraulics, 2332 S 25th St., Omaha, NB 68105-3229
V19738	Avdel Corporation, 50 Lackawanne Ave., Parsippany, NJ 07054-1008
V20984	Arrow Safety Device Co., Route 113, Georgetown, DE, 19947-9524
V24161	Gates Rubber Co., 999 S. Broadway, Denver, CO 80217
V24346	Lube Devices, Inc., P.O. 1184, 1864 Nagle Ave., Manitowoc, WI 54220-1702
V26377	Ford Motor Company, General Parts Division, P.O. 412, Ypsilanti, MI 48197-0412
V27007	The Cessna Aircraft Company, Fluid Power Div., P.O. #1028, Hutchinson, KS 67501
V27797	The Wise Company, Inc., 1298 Farmville Road, Memphis, TN 38122-1002
V3F808	Easton Corporation, Engineered Fasteners Div. (Formery Tinnerman), 8700 Brookpark Road, Cleveland, OH 44101
V36381	Minnesota Mining and Manufacturing Co., 3M Center, St. Paul, MN 55101
V37942	Mallory Capacitor Company, 3029 E Washington Street, Indianapolis, IN 46206
V39569	Northern Power Products, 2815 Eagandale Blvd., Eagan, MN 55121
V4N530	Isuzu Diesel of North America, 41169 Vincenti Court, Novi, MI 48050
V40157	Michigan Seating Co., Jackson, MI
V41197	Modine Mfg. Co., 1500 Dekoven Ave., Racine, WI 53401
V41625	Incom International, Inc., Morse Controls Divison, 21 Clinton St., Hudson, OH 44236
V49234	Protectoseal Company, 225 W Foster Avenue, Bensonville, IL 60106
V5N603	Buchannan Crimp Tool Products, Amerace Corp., 1065 Floral Ave., Union, NJ 07083
V50292	Control Line Equipment, Inc., 3829 Willow Ave., Pittsburg, PA 15234
V52343	GTE Products Corp., Lighting Products Group, 100 Endicott St., Danvers, MA 09123
V53010	SSAC, Inc., 8242 Loop Rd., Baldwinsville, NY 13027
V54035	Sun Hydraulics Corp., 1500 University Pkwy, P.O. 3377, Sarasota, FL 34230
V54173	Custom Connector Corp., 1738 E. 30th St., Cleveland, OH 44114

V55752	Racor Div., Parker Hannifin Corp., 3400 Finch Rd., Modesto, CA 95353
V57733	Stewart-Warner Instrument Co., 580 Slawin Ct., Mt Prospect, IL 60056-9448
V57797	Appleton Electric Company, 1701 W. Wellington Ave., Chicago, Il 60657-4027
V58051	Quadrastat Controls Corp., 3860 S Capitol Avenue, City of Industry, CA 91749
V58114	The Rexroth Corp., Mobile Hydraulic Div., 1700 Old Mansfield Rd., Wooster, OH 44691
V58961	Waytek, P.O. Box 690, Channassen, MN 55317
V6A144	Browning Mfg. Div., Emerson Electric Co., 1248 E. Second Avenue, Maysville, KY 41056
V6N299	Deutz-Allis Corp. Parts Operation, 1500 N. Raddat Road, Batavia, IL 60510
V62789	Breeze Clamp Products Division, Federal Laboratories, Inc., 100 Aeroseal Drive, Saltsburg, PA 15681
V63477	Cooper Industries, Inc., Wagner Brake Div., 3700 Forrest Park Blvd, St. Louis, MO 63018
V67373	Medallion Instruments, Inc., 917 Savidge St., Spring Lake, MI 49456
V7J764	BACO Controls, Inc., 69 Albany Street, Cazenovia, NY 13035-1219
V7Z043	Van Tielen Enterprises, 996 Mackinaw Hwy, Pellston, MI 49769
V71041	Boston Gear Div., Inc., Incom International, 14 Hayward St., Quincy MA 02171
V70466	Schwinn Bicycle Co., 217 N. Jefferson, Chicago, IL 60606
V70903	(Beldon) Cooper Beldon Electronic Wire and Cable Subdivision/Cooper Industries, Inc., 2000 S. Batavia Ave., Geneva, Il 60134-3325
V71400	Bussman Mfg. Division of Cooper Industries Inc., 114 Old State Street, St. Louis, MO 63178
V71956	Reliance Electric Industrial Co., Mechanical Group Headquarters, 6045 Ponders Ct., Greenville, SC 29602
V72447	Dana Corporation, Spicer Universal Joint Division, 6201 Trust Drive, Holland, OH 43528
V72582	Detroit Diesel Corp., 13400 Outer Drive, Detroit, MI 48239
V72635	R.E. Dietz Co., 225 Wilkinson St., Syracuse, NY 13201
V74545	Harvey Hubbell, Inc. Wiring Devices Division, 1613 State Street, Bridgeport, CT 06605
V74821	Epicore Industries, Ideal Div., 3200 Parker Dr., St. Augustine, FL 32084
V75175	KD Lamp Company, 1910 Elm Street, Cincinnati, OH 45210-2451
V75915	Littlefuse, Inc. (Tracor), 800 E. Northwest Hwy., Des Plaines, IL 60016
V76005	Lord Corporation, 1635 W. 12th St., Erie, PA 16514
V76364	Milwaukee Valve Company, 2375 S Burrell Street, Milwaukee, WI 53207-1519
V77060	Packard Electric Division, 408 Dana Street NE, Warren, OH 44486
V77326	Pollack Engineering Corporation, 195 Freeport Street, Boston, MA 02122-2827

V78225	Stant Manufacturing Co., 1620 Columbia, Connersville, IN 47331
V79470	Weatherhead Div., Dana Corp., 6615 Brotherhood Way, Ft. Wayne, IN 46825
V80089	Essex Electro-Mechanical Div. of Hamilton Standard Controls Inc., 131 Godfrey Street, Logansport, IN 46947-1843
V80495	Anderson Power Products Corporation, 145 Newton Street, Boston, MA 02135
V80734	Dorman Division of Thriftmaster Products, Inc., 1600 Sixth Avenue, York, PA 17405
V80753	Griffin Lamp Co., Highway 61 South, Shelby, MS 38774
V81483	International Rectifier, Semi-Conductor Div., 233 Kansas St., El Segundo, CA 90245
V81834	Grote Manufacturing Co., Inc., Box 1550-T, State Route 7, Madison, IN 47250
V82634	McGill Mfg. Co., Inc., Electric Division, 1102 N. Campbell, Valparaiso, IN 46383-3450
V83079	Amerace Corporation (Buchanan), IEP Division, 530 W. Mt. Pleasant Avenue, Livingston, NJ 07039
V83330	Dialight Corporation, Manasquan Division, 1913 Atlantic Avenue, Manasquan, NJ 08736-1005 (Formerly Herman H. Smith, Inc.)
V84830	Lee Spring Co., Inc., 1462 62nd Street, Brooklyn, NY 11219
V85814	The Nason Co., P.O. Box 505, West Union, SC 29696
V86768	Teledyne Republic Manufacturing Co., 15655 Brookpark Rd., Cleveland, OH 44142
V9N153	Paul-Monroe Hydraulics, Inc., 1701 W Sequoia Ave., Orange, CA 92668-1015
V90201	Mallory Distributor Products Co., 4760 Kentucky Avenue, Indianapolis, IN 46206
V91929	Micro Switch Division of Honeywell Inc., 11 West Spring Street, Freeport, IL 61032
V92194	Alpha Wire Corporation, 711 Lidgerwood Avenue, Elizabeth, NJ 07207
V92219	Waldon Electronics Inc., 4301 W. 69th St., Chicago, IL 60629
V92563	McGill Mfg. Company, Inc., Bearings Division, 909 Lafayette, Valparaiso, IN 46383
V92867	Orscheln Brake Lever Company, 1177 N Morley, Moberly, MO 65270-2736
V93990	Climax Metal Products, Co., 30202 Lakeland Blvd., Wickliffe, OH 44092-1747
V94499	Dow Corning Corporation, 50 Commerce Drive, Trumbull, CT 06601
V96151	Eaton Corporation, Fluid Power Operations, Hydraulic Division, 15151 Hwy 5, Eden Prairie, MI 55344 (Formerly Char-Lynn)
V96881	Thomas Industries Inc., (Nyliner) Shore Road at Channel Dr., Port Washington, NY 11050
V97539	Apm-Hexseal Corp., 44 Honeck, NJ 07631-4134

HOW TO USE THE PARTS LISTING

THE ABBREVIATION "Comm" (commercial) indicates several manufacturers make the part and it is readily available from local sources. HHCS means "hex-head capscrew," SHCS means "socket head capscrew," RHMS means "round-head machine screw," LH means "left-hand", RH means "right-hand," OD means "outside diameter," ID means "inside diameter," OA means "over-all," SPDT means "single-pole, double-throw," DPST means "double-pole, single-throw," NSS means "not sold separately," NS means "not shown," and A/R means "as required,"

VENDOR PART NUMBER column lists the original manufacturers' part numbers of items purchased by Wollard. Although these parts may be purchased from Wollard by using the Wollard part number, you may wish to purchase directly from the original manufacturer.

NOMENCLATURE column contains the part description required for identification or procurement. If the part is an item purchased by Wollard and has not been modified by Wollard, then following the description will be the vendor's federal supply (CAGE) code. The code number is preceded by the letter "V." If the vendor has no CAGE code, the vendor's name will be used. Where there is no vendor or CAGE code, Wollard Airport Equipment Co. is the manufacturer.

EFF (Effectivity) column identifies by code the model or serial number/s on which a particular part is used. Absence of the code in the "EFF" column indicates that the part or assembly is used on all models with Ser #220 and on.

The parts list is effective on units having the following serial numbers:

Effectivity Code	Serial Numbers

This manual represents units having Serial #220 or higher.

UNITS PER ASSEMBLY column lists the quantity of each item used in the assembly.

PART NUMBER INDEX

(Options are not included in this index)

Part No.	Airline Part No.	Page No.	Part No.	Airline Part No.	Page No.

Part No.	Airline Part No.	Page No.	Part No.	Airline Part No.	Page No.

PART DESCRIPTION INDEX

(Options are not included in this index)

Description **Page**

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FIGURE 1A
MAIN ASSEMBLY

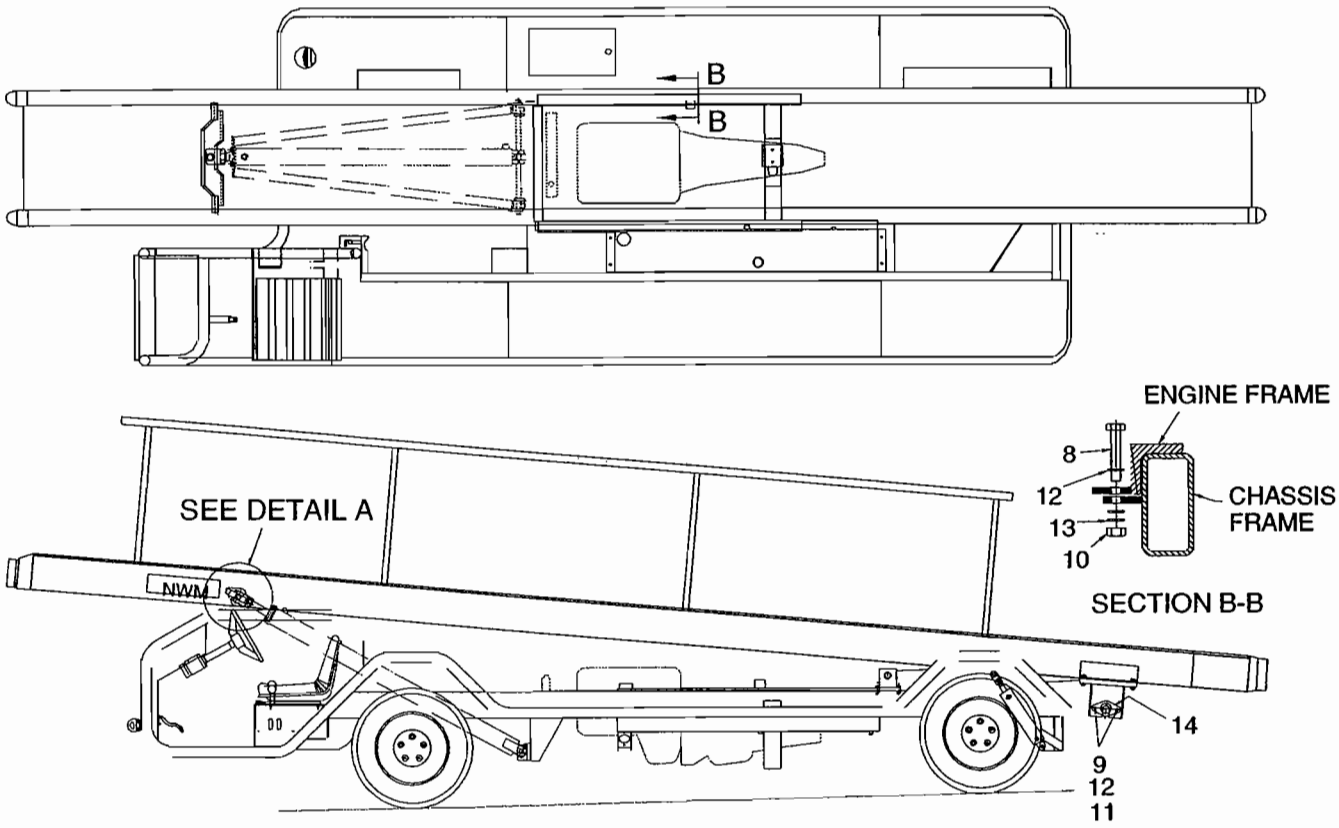
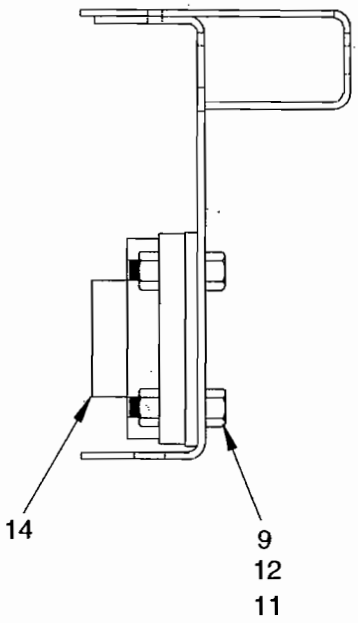
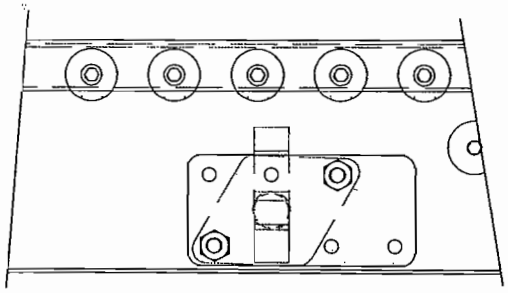


FIGURE 1A AND 1B
MAIN ASSEMBLY

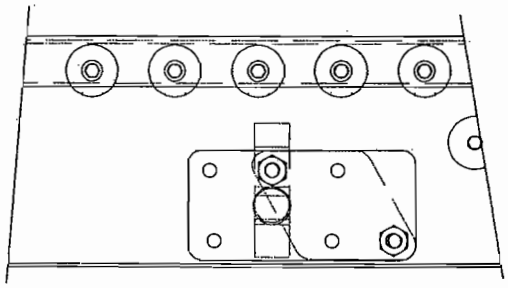
Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19108		TC-888 Main Assembly		Ref
1-7				Not Used		
8		Comm		HHCS, 1/2-13 x 2.00		2
9		Comm		HHCS, 1/2-13 x 1.50		8
10		Comm		Nut, Hex, 1/2-13		2
11		Comm		Nut, Lock, 1/2-13		8
12		Comm		Washer, Flat, 1/2		12
13		Comm		Washer, Lock, 1/2		2
14		1.7924		Bearing, Flange, 2-hole, 1-3/8" Bore (V0LF97)		4

FIGURE 1B
MAIN ASSEMBLY

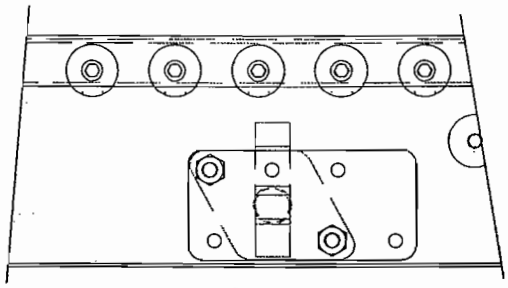




FORD 300 CID
DEUTZ OIL COOLED



DEUTZ AIR COOLED

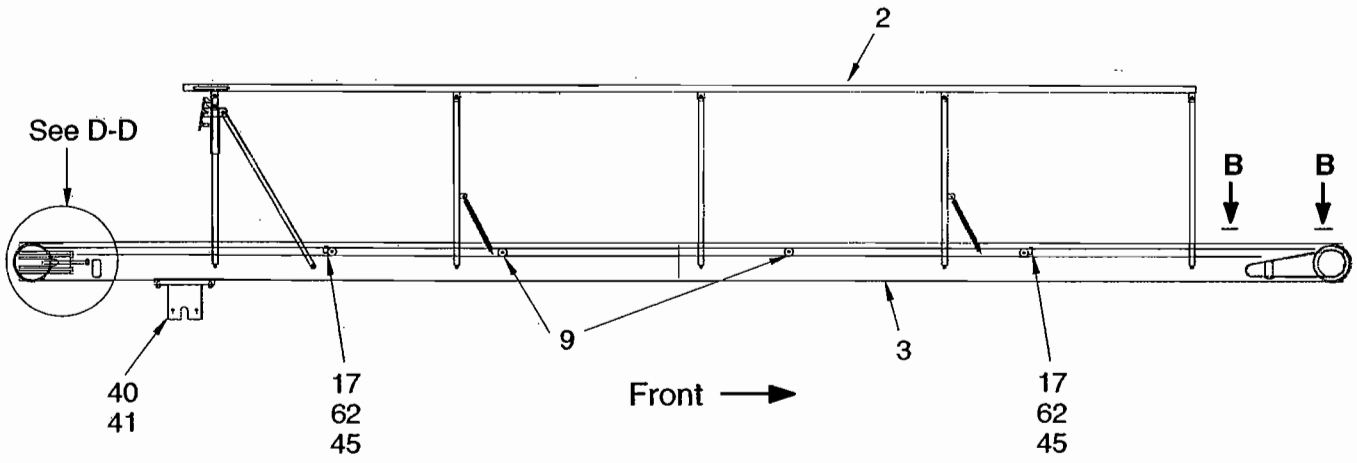


STANDARD

DETAIL A

BEARING INSTALLATION

FIGURE 2
CONVEYOR BED



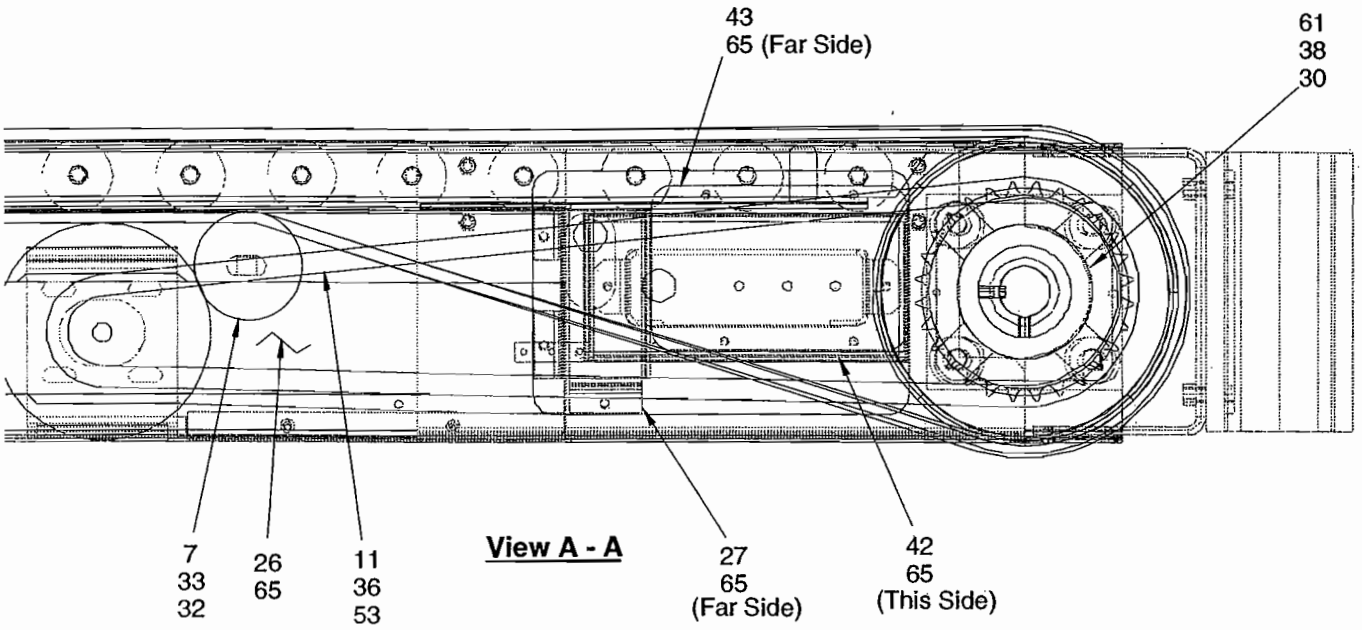
Available Conveyor Belt Option:

"Plylon" 100 Wedge-Grip w/Bare Back

Rated 100 lbs/inch

P/N 20514

FIGURE 2
CONVEYOR BED



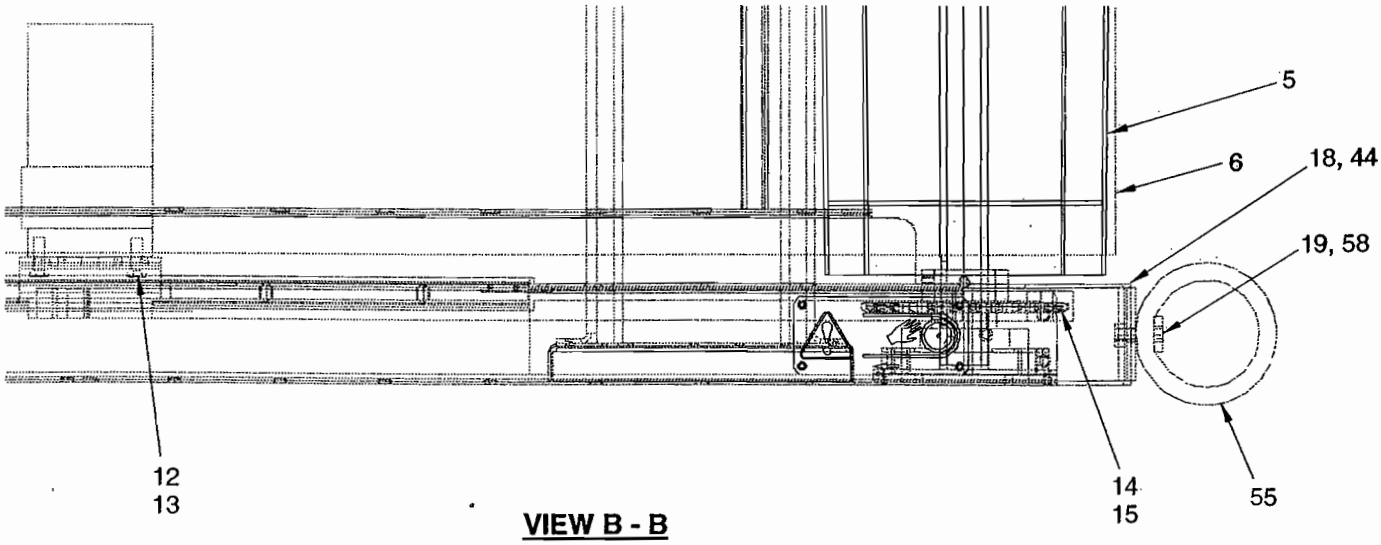
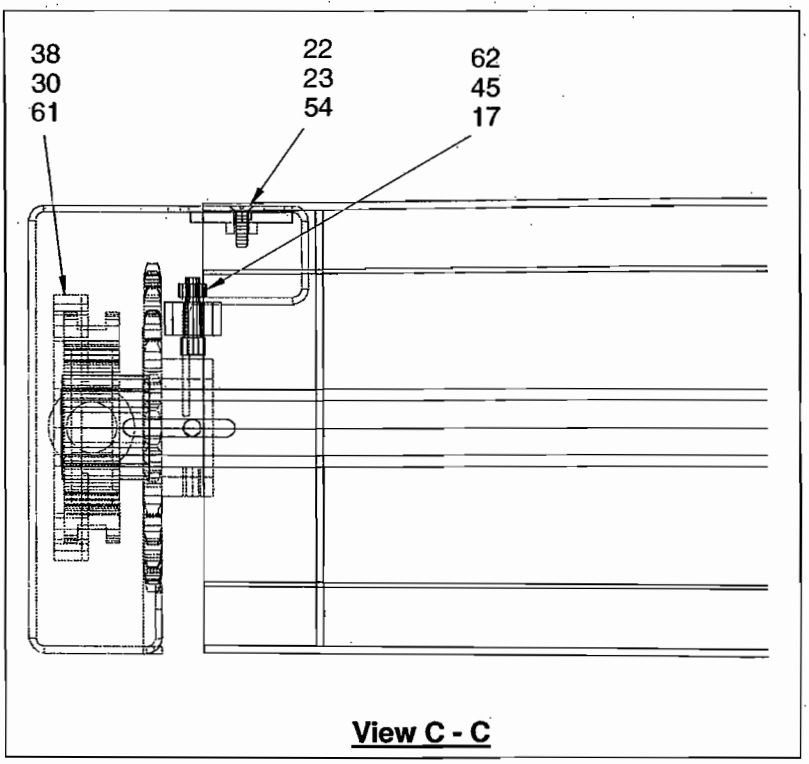


FIGURE 2
CONVEYOR BED



View C - C

FIGURE 2
CONVEYOR BED

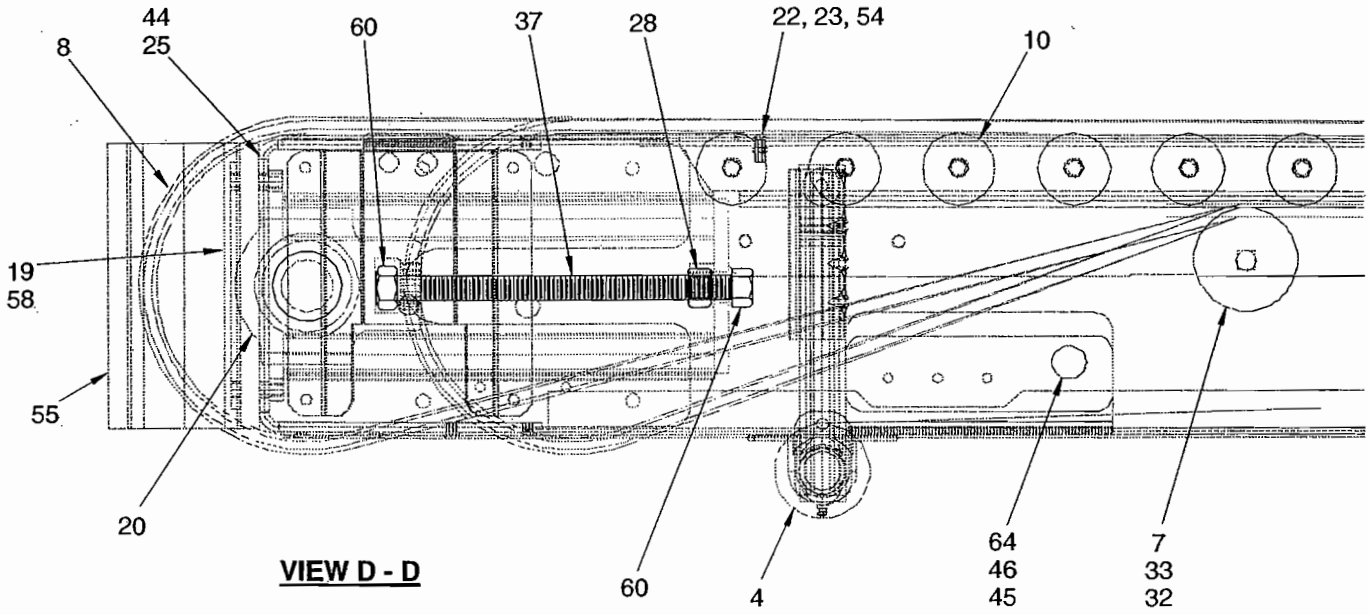


FIGURE 2
CONVEYOR BED

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20578		Conveyor Bed Assembly		Ref
2		20579		Weldment, Conveyor Bed		1
3		20628		Handrail Assembly, RH (See Figure 4)		1
4		20608		Belt Control Assembly, Manual (See Figure 3)		1
5		20584 or 300739		Roller, Front Main or Roller, Rubber, Front Main (Option #301512)		1 Opt.
6		1.7901 or 1.9011		Belt, 24" x 48'-3" (Precut) or Belt, Rough Top		1 Opt.
7		20586		Roller, Main Return		2
8		20585		Roller, Rear Main		1
9		1.9009		Roller, 25-5/8" BF Galv		4
10		1.8794		Roller, 21-3/8" BF Galv		54
11		1.0251		Chain, RC50, CC Inside Links Both Ends		63"
12		Comm		HHCS, 3/8-16 x 1.00		4
13		Comm		Washer, Spring Lock, 3/8"		4
14		1.7805	50B28	Sprocket, 1-3/8" Bore (V6A144)		1
15		20578.15		Key, CRS, 5/16 square x 1-1/4" Lg		1
16		300741		Sprocket, 1" Bore		1
17		20594		Roller, Belt Tracking		4
18		20618		Weldment, Front Endcap		2
19		20622		Retainer, Bumper		4
20		1.8797	UTST207-22	Bearing, Takeup (V1GX90)		2
21				Not Used		
22		3.3363	Comm	T-nut, 1/4-20, Threaded Thru		2
23		20627		Bar, Slide		2
24				Not Used		
25		20624		Weldment, Rear Endcap		2
26		20604		Weldment, Chain Cover		1
27		20602		Mount, Left Hand Switch		1
28		Comm		Nut, Hex, 3/4-10		2
29				Not Used		
30		Comm		HHCS, 1/2-13 x 1.25		8
31				Not Used		
32		Comm		HHCS, 1/2-20 x 0.75		2

FIGURE 2
CONVEYOR BED

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
33		Comm		Washer, Lock, 1/2		2
34-35				Not Used		
36		1.0558	50 S/C C/L	Link, Connecting (Spring Clip) (V6A144)		1
37		20650		Assembly, Takeup Bolt		2
38		1.5693	SCJ 1-3/8	Bearing, Flange Block, 1-3/8" Bore, 4-hole (1GX90)		2
39				Not Used		
40		10012		Bracket, Pivot		2
41		Comm		HHCS, 1/2-13 x 2.50		4
42		20600		Mount, RH Front Switch		1
43		20603		Cover, Left Front Blank		1
44		Comm		Screw, Truss Hd, 1/4-20 x 0.75		28
45		Comm		Nut, Lock, 1/4-20		8
46		Comm		HHCS, 1/4-20 x 1.00		4
47-52				Not Used		
53		1.1832	RC 50	Link, Offset (V6A144)		1
54		Comm		FHMS, 1/4-20 X 1.00		2
55		302905		Bumper, Non-marring		4
56-57				Not Used		
58		Comm		HHCS, 3/8-16 x 1.50		8
59				Not Used		
60		Comm		Pin, Roll, 3/16 x 1-1/8" Lg		4
61		Comm		Nut, Jam, 1/2-13		8
62		Comm		Bolt, Shoulder, 5/16 Dia x 1/4-20 x 5/8" Lg		4
63				Not Used		
64		20617		Mount, Rear Pushbutton		2
65		Comm		Screw, Sht Mtl, #10 x 0.75		12

FIGURE 3
MANUAL BELT CONTROL

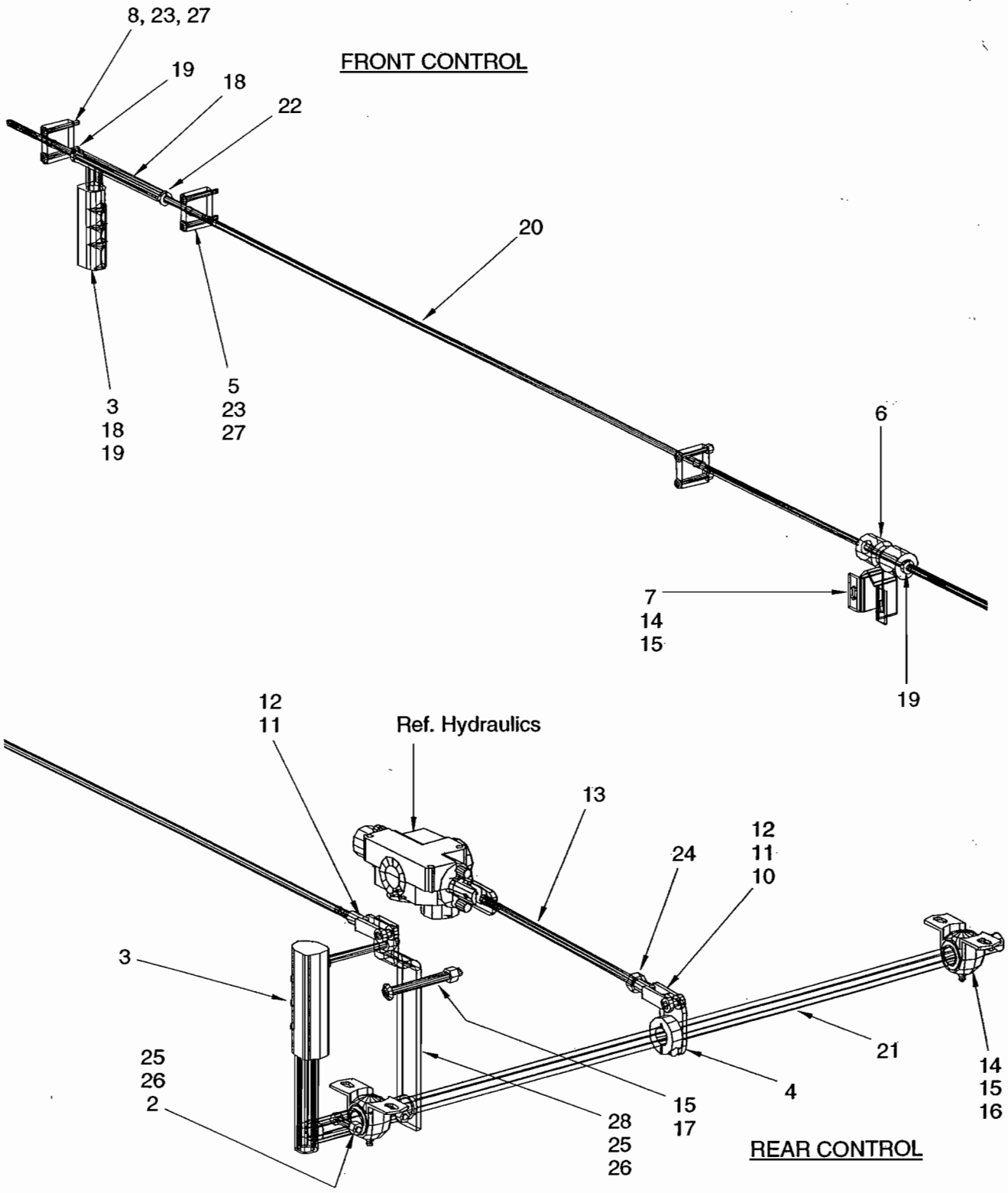


FIGURE 3
MANUAL BELT CONTROL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		20608		Belt Control, Manual		Ref
1				Not Used		
2		20615		Weldment, Left Rear Handle		1
3			Vinyl 4750	Handle, Grip, 7/8" I.D. Black (V70466)		2
4		19745		Weldment, Actuator Arm		1
5		20609		Guide, Rod, UHMWPE		10
6		19748		Sleeve, Detent Cam, UHMWPE		1
7		19749		Bracket, Cam Detent		1
8		302453		Guide, Rod, Short		1
9				NOT USED		
10		1.7172	AC212	Clevis, Adjustable, 5/16" Pin (V06970)		1
11		1.5441	CP102	Pin, Clevis, 5/16" x 3/4" (V06970)		2
12		Comm		Pin, Cotter, 3/32" x 1/2"		2
13		20647		Rod, Hydraulic Valve		1
14		Comm		HHCS, 5/16-18 x 0.75		6
15		Comm		Nut, Jam, 5/16-18		8
16		1.8941	BBH12G 3/4"	Bearing, Pillow Block		2
17		Comm		Screw, Pan Hd, 5/16-18 x 3.50		2
18		20653		Handle, Front Control		1
19		1.9012	H1C037	Collar, Split, 1-pc. (V93990)		3
20		20648		Rod, Manual Control		1
21		20614		Shaft, Manual Control		1
22		301890		Collar, Modified		1
23		Comm		Washer, Lock, 1/4"		4
24		Comm		Nut, Hex, 5/16-24		1
25		3.3375	Comm	HHCS, 1/4-20 x 1-3/8" Lg, Grade B		2
26		Comm		Nut, Self-tap, 1/4-20		20
27		Comm		Screw, Pan Hd, 1/4-20 x 2.25		22
28		20611		Link, Offset		1

FIGURE 4
HANDRAIL

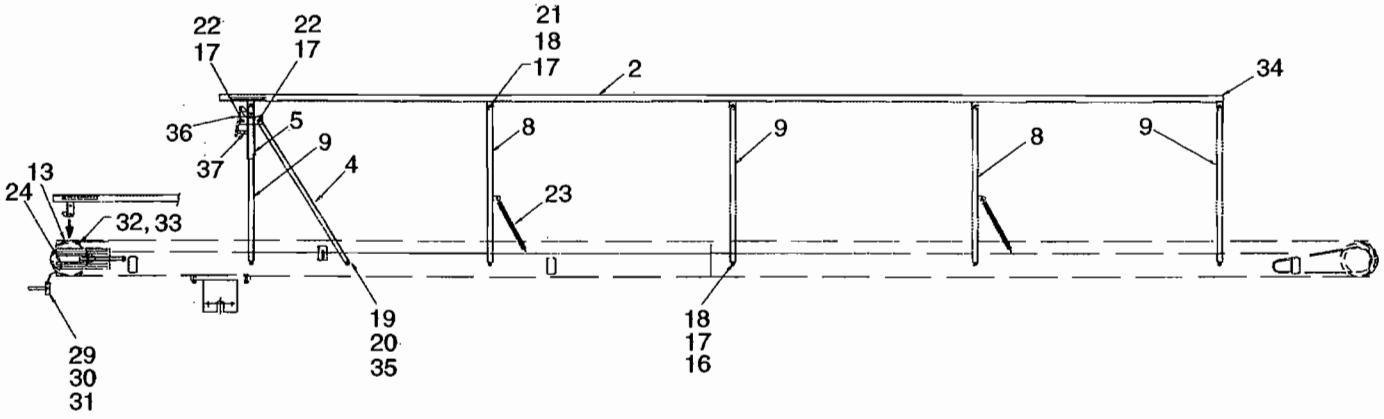


FIGURE 4
HANDRAIL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		20628		Handrail Assembly, RH		Ref
1				Not Used		
2		20631.1		Top Rail		1
3				Not Used		
4		19702		Brace, Diagonal		1
5		19710		Slide, Handrail		1
6-7				Not Used		
8		19722		Post, Handrail Pivot		2
9		19725		Post, Handrail		3
10-12				Not Used		
13		20634		Bracket, Handrail Pin		1
14-15				Not Used		
16		Comm		HHCS, 3/8-16 x 3.50		5
17		Comm		Nut, Lock, 3/8-16		12
18		Comm		Washer, Flat, 3/8		11
19		Comm		HHCS, 1/2-13 x 3.25		1
20		Comm		Washer, Flat, 1/2		1
21		Comm		Bolt, Carriage, HH, 3/8-16 x 2.50		5
22		Comm		Bolt, Carriage, HH, 3/8-16 x 3.00		2
23		12417 302026		Spring, Extension (to ser. #470) Spring, Extension (Ser. #471 and on)		2 2
24		Comm		Rivet, Pop, #6-5		1
25-28				Not Used		
29		14816		Pin, Detent, "T"-type		1
30		1.1241		Ring, Key, 1-1/2"		1
31		1.6295	LT-1504-C6-6	Lanyard Assembly (V19738)		1
32		Comm		HHCS, 1/4-20 x 1.00		4
33		Comm		Nut, Lock, 1/4-20		4
34		3.3343		Plug, 1-1/2" Square Plastic		1
35		Comm		Nut, Lock, 1/2-13		1
36		19700		Latch, Handrail		1
37		1.8853		Spring, Compression, S/S, 0.720" O.D. x 0.080" I.D. x 2.25" Lg		1

FIGURE 5

Figure 5 is no longer applicable.

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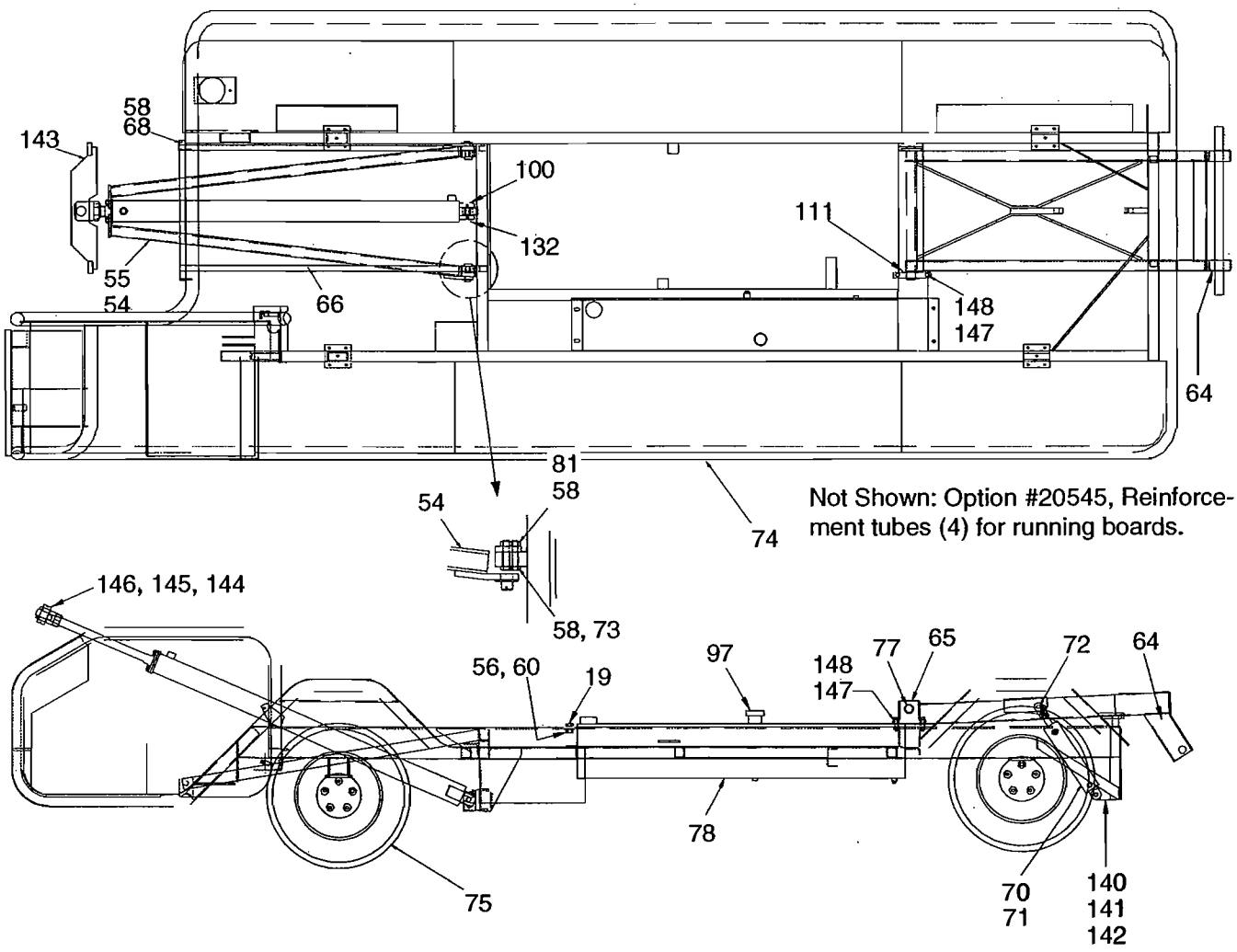
FIGURE 6
CHASSIS PREPARATION

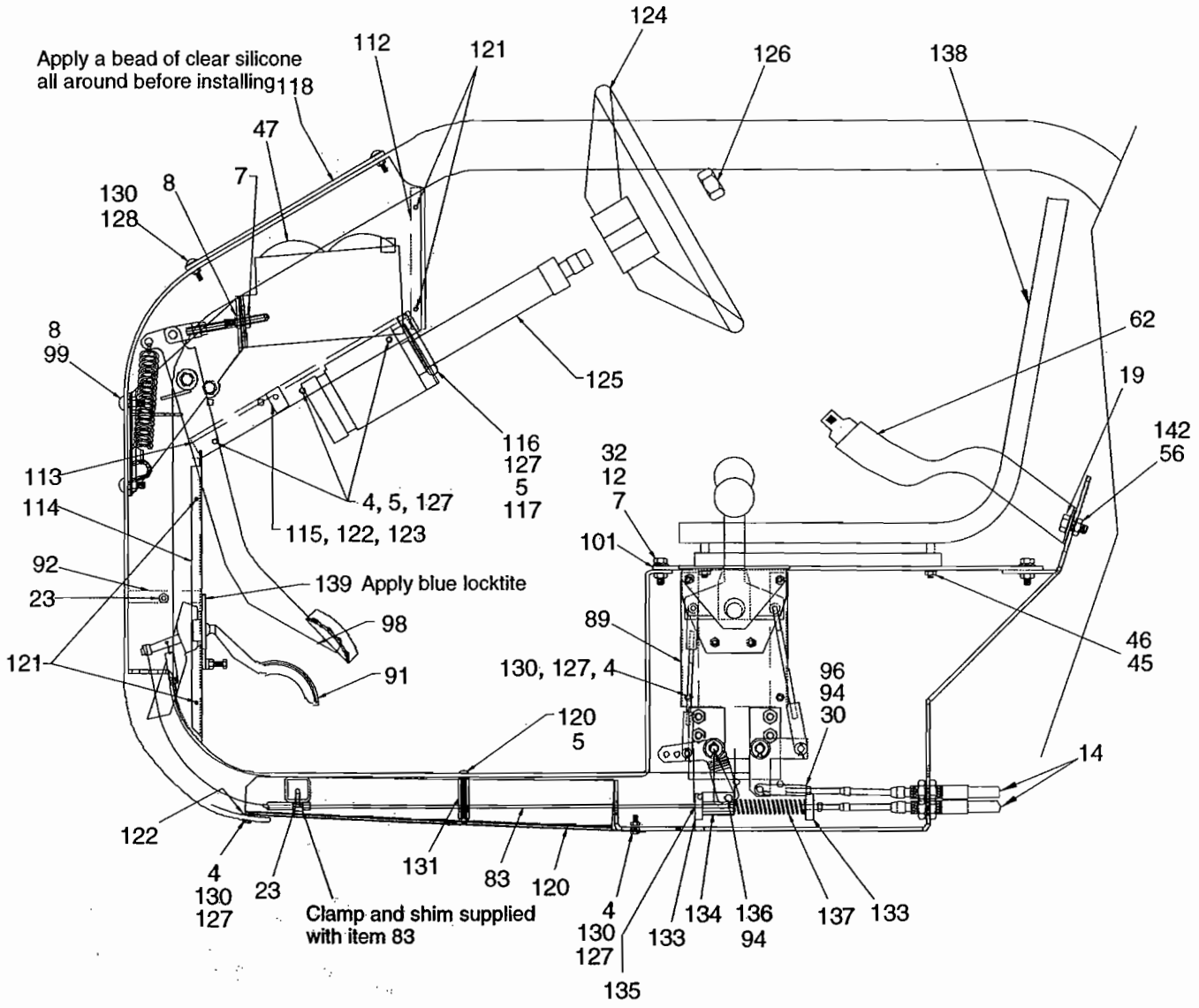
Not Shown: Option #20697: Left front fender light guard.

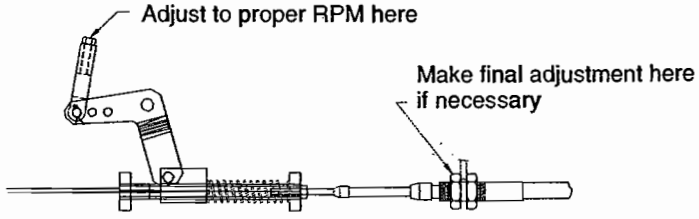
Not Shown: Option #300402 10# Fire Extinguisher and base, P/N #NW33236.



Not Shown: Option #20545, Reinforcement tubes (4) for running boards.

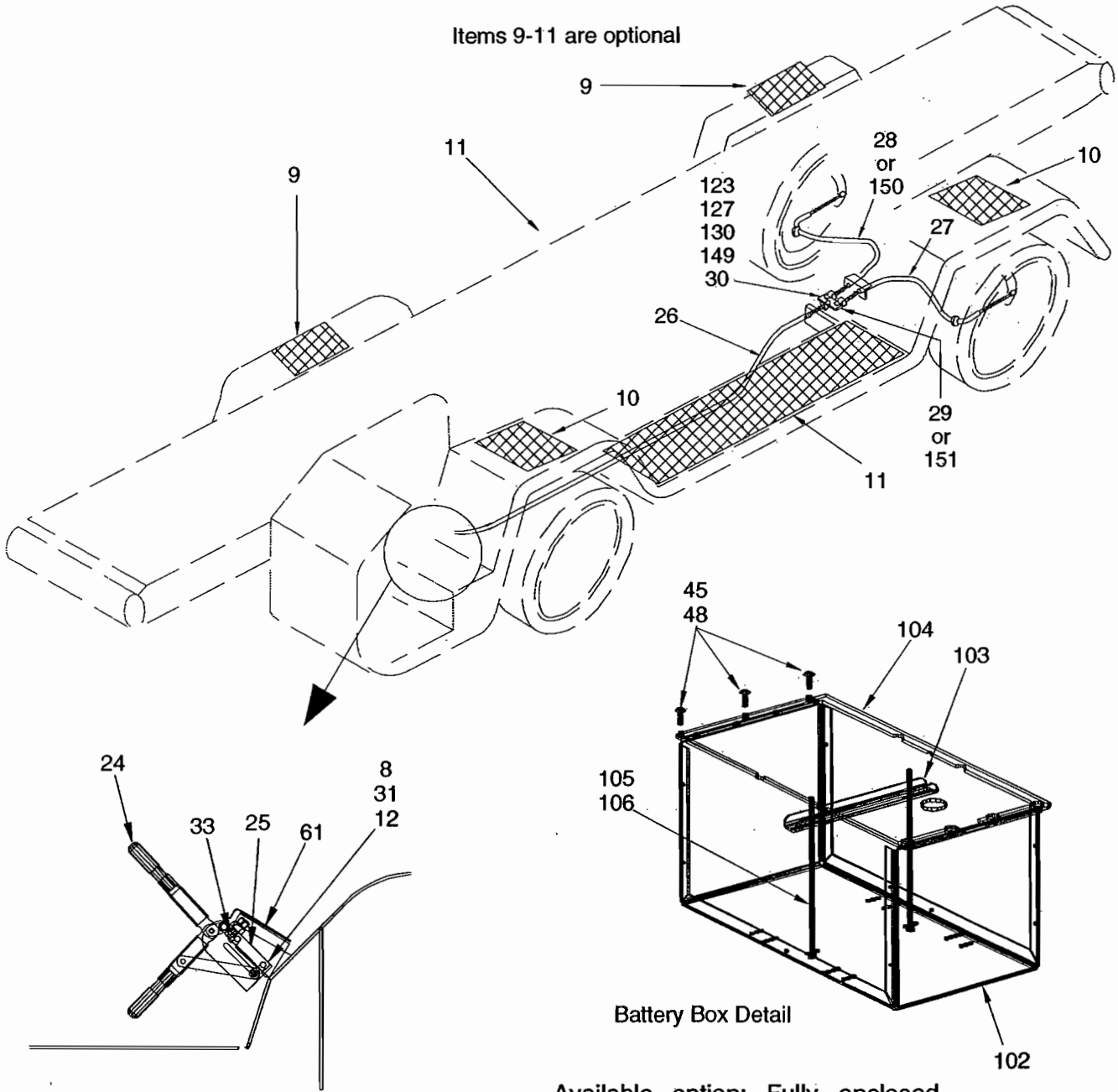
FIGURE 6
CHASSIS PREPARATION





FORD 2.3L THROTTLE LINKAGE SET UP

FIGURE 6
CHASSIS PREPARATION



Available option: Fully enclosed Battery Box, P/N 20101

FIGURE 6
CHASSIS PREPARATION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19110		Chassis Preparation		Ref
1-3				Not Used		
4		Comm		HHCS, 1/4-20 x 1.00		9
5		Comm		Nut, Lock, 1/4-20		13
6				Not Used		
7		Comm		HHCS, 3/8-16 x 1.00		8
8		Comm		Nut, Lock, 3/8-16		10
9		20520		Gripstrut Fender Step, LH (Optional)		Opt
10		20532		Gripstrut Fender Step, RH (Optional)		Opt
11		20522		Gripstrut Running Boards (Optional)		Opt
12		Comm		Washer, Flat, 3/8		4
13				Not Used		
14		1.7908	173-LD-TT-2-120	Cable, Throttle and Transmission		2
15-18				Not Used		
19		Comm		HHCS, 1/2-13 x 1.25		4
20-23				Not Used		
24		1.0552	01116001	Lever, Park Brake (V92867)		1
25		10102		Mount, Switch, Single		1
26		1.8325	15551900	Cable, Fwd. Brake (V92867)		1
27		1.8323	15551800	Cable, LH Rear Brake (V92867)		1
28		1.8324	15551801	Cable, RH Rear Brake (V92867) (to ser. #476)		1
29		10101		Equalizer (to ser. #476)		1
30		1.0610		Pin, Clevis		4
31		Comm		HHCS, 3/8-16 x 1-1/2"		4
32		Comm		Washer, Lock, 3/8		2
33		Comm		Pin, Clevis, 5/16" Dia x 3/8"		1
34-44				Not Used		
45		Comm		Nut, Lock, 5/16-18		11
46		Comm		Washer, Flat, 5/16		4
47		19974		Hydraulic Brake Assy (See Fig. 10)		1
48		Comm		Screw, Pan Hd, 5/16-18 x 1.00		7
49-53				Not Used		
54		14129		Tube, A-Frame Outer		2
55		19520		A-frame Assembly		1
56		Comm		Washer, Flat, 1/2		4
57		Comm		Washer, Lock, 1/2		2

FIGURE 6
CHASSIS PREPARATION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
58		Comm		Washer, Flat, 1.00		4
59				Not Used		
60		Comm		Nut, Lock, 1/2-13		6
61		19796		Cover, Handbrake Switch		1
62		1.0106		Belt, Safety		1
63				Not Used		
64		19350		Arm, Lift		1
65		19369		Bracket, Lift, LH Rear		1
66		19482		Support, Maintenance		1
67				Not Used		
68		Comm		Pin, Cotter, 1/8 x 1.50		1
69				Not Used		
70		10297		Cylinder, Rear Lift (See Fig. 11)		Ref
71		1.6646		Clevis, Cylinder (See Fig. 11)		Ref
72		Comm		Washer, Flat, 3/4		4
73		Comm		HHCS, 1-8 x 3.00		2
74		19113		Chassis Structure		1
75		19967		Running Gear Assy (See Fig. 7)		1
76				Not Used		
77		19396		Bearing, Flange		2
78		19871 11511		Fuel Tank Optional: Unleaded Fuel Restrictor		1 Opt.
78A		3.0649		Plug, Brass, 1/4" NPT		1
78B		1.8172	6781-248	Gauge, Fuel (V09393)		1
78C		3.0651		Plug, Brass, 1/2" NPT		1
79-80				Not Used		
81		Comm		Nut, Lock, 1-8		2
82				Not Used		
83		19922		Cable Assy., Accelerator		1
83A			C309105-002-36	Cable, 36" (V41625)		1
83B			A31509	Clamp (V41625)		1
83C			A31538	Shim (V41625)		A/R
84		3.3317	031509	Clamp, Throttle Cable (V41625)		1
85		Comm		Nut, Hex, 1/4-28		2
86		Comm		Setscrew, #10-32 x 3/8"		1
87-88				Not Used		

FIGURE 6
CHASSIS PREPARATION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
89		19966		Quadrastat Assy (See Fig. 8)		1
90				Not Used		
91		1.8770	309109	Pedal, Accelerator, Bulkhead Mount (V41625)		1
92		19141		Cover, Accelerator Mount		1
93				Not Used		
94		Comm		Cotter Pin, 3/32" Dia x 1/2"		1
95				Not Used		
96		1.5437	AC210	Clevis, 5/16" Dia x 1/4-28 (V06970)		1
97		1.8092	1273A-10S	Fill Unit w/Fire Baffle (V49234)		1
98		19882		Brake Pedal Assy (See Fig. 9)		1
99		Comm		Bolt, Carriage, 3/8-16 x 1.00		4
100		1.8945		Pin, Cotter		2
101		19878		Base, Driver Seat		1
102		19910		Tray, Battery		1
103		19911		Strap, Battery		1
104		19912		Cover, Battery Enclosure		1
105		19916		HHCS, S/S, 1/4-20 x 10.00 w/2" Full Thd		2
106		Comm		Nut, Lock, S/S, 1/4-20		2
107-109				Not Used		
110		302259		Gasket, Cover, Upper Step		1
111		Comm		Washer, Flat, 1-3/8" USS		2
112		19879		Panel, Instrument		1
113		19398		Mounting Plate, Power Steering		1
114		19458		Cover, Bottom Console		1
115		19880		Clip, Instrument Panel		1
116		12654.13		U-bolt, Round, 1/4-20 x 3.25L x 1.625W x .75T		1
117		10011		Stiffener		1
118		19877 20096		Cover, Master Cylinder Access Gasket, Cover, Master Cylinder Access		1 1
119		19951		Plate, Cover		1
120		302025		Cover, Accelerator Cable		1
121		Comm		Screw, Self-drill, 1/8 x 1/2"		8
122		3.3089	C8738-1420-4	Speednut, Type "U", 1/4-20 (V3F808)		2
123		Comm		Screw, Truss Hd, 1/4-20 x 0.75		6
124		1.7174		Steering Wheel, 15"		1
125		1.7138	204-1043	Column, Steering, 8", 1-wire (V96151)		1
126		1.3829	21084	Nut, Steering Column (V96151)		1
127		Comm		Washer, Flat, 1/4		12

FIGURE 6
CHASSIS PREPARATION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
128		Comm		Pin. Cotter, 1/8 X 2-1/2"		2
129		Comm		Screw, Truss Hd, 1/4-20 x 1.00		4
130		Comm		Washer, Lock, 1/4		8
131		19909		Block, Cable Guide		1
132		1.8944		Pin, Headless, Grooved, 1" Dia. x 4"		1
133		1.8198		Clamp, Collar, 1/2" Bore		2
134		19907		Block, Slide		1
135		19906		Coupling, Throttle		1
136		3.2823		Pin, Clevis, 5/16"		1
137		1.8877	LC-072J-1255	Spring, Compression (V84830)		1
138		1.8947	V560	Seat Assembly, Padded (V40157)		1
139		Comm		FHMS, 1/4-20 x 1.00		3
140		19996		Cylinder Lug Assy		1
141		Comm		HHCS, 1/2-13 x 1.50		4
142		Comm		Nut, Lock, 1/2-13		8
143		19364		Crosshead		1
144		19423		Pin		1
145		Comm		Washer, Flat, 1-3/4		2
146		Comm		Cotter Pin, 1/8 x 2-1/2"		2
147		Comm		Nut, Lock, 9/16-12		2
148		Comm		HHCS, 9/16-12 x 2.50		2
149		302445		Cover, Brake Cable (Ser. #477 and on)		1
150		301080		Cable, Brake, RR (Ser. #477 and on)		1
151		301083		Equalizer (Ser. #477 and on)		1

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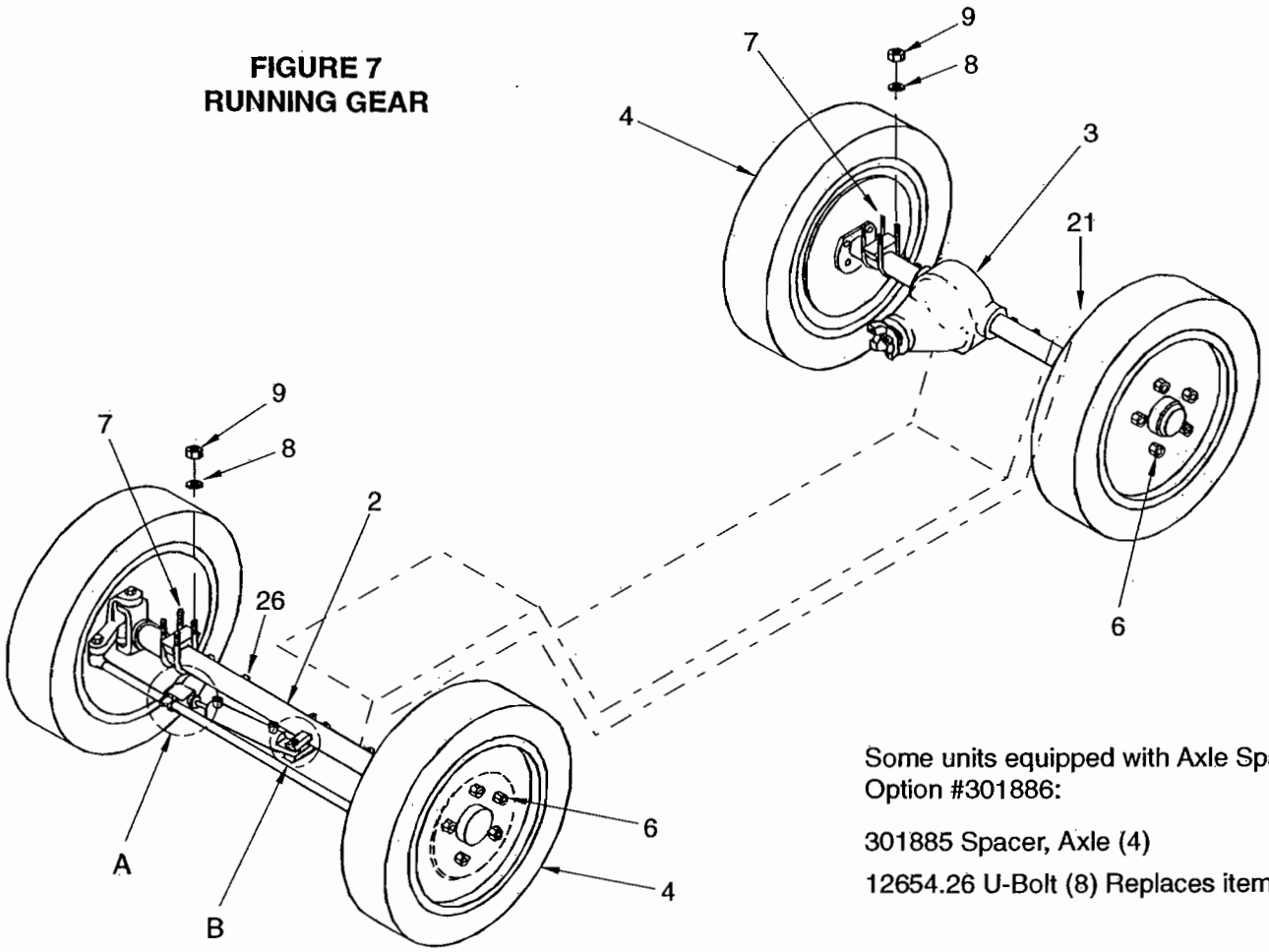
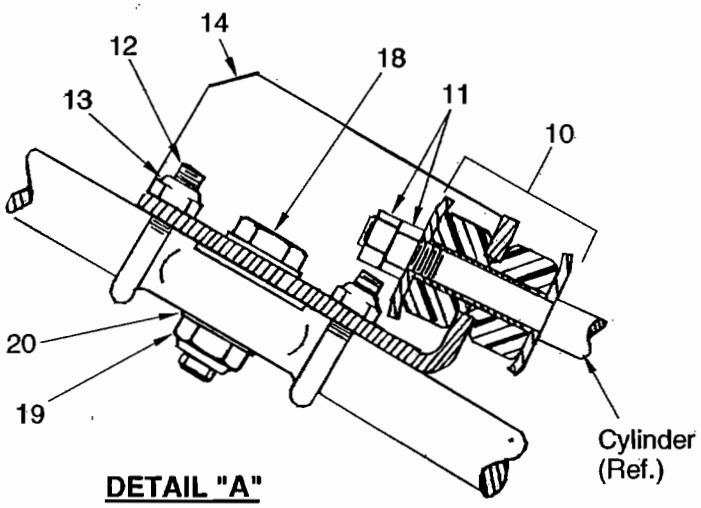
FIGURE 7
RUNNING GEAR



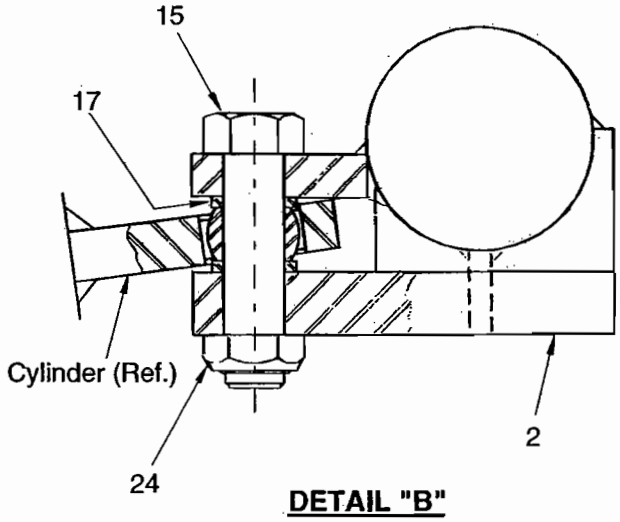
Some units equipped with Axle Spacer Option #301886:

301885 Spacer, Axle (4)

12654.26 U-Bolt (8) Replaces item #7.



DETAIL "A"



DETAIL "B"

FIGURE 7
RUNNING GEAR INSTALLATION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		19967		Running Gear Installation		Ref
2		10076		Axle Assy, Front (See parts list in Chap. 5)		1
3		18030		Axle Assy, Rear (See parts list in Chap. 5)		1
4		16776.4		Wheel & Tire Assy		4
4A		1.8396 302448		Tire, P225/75R15 Blk, Std Ld Range, Max. Load 1874 Lbs. Tires, P235/75R15 (Optional)		Ref Ref
4B		1.8397		Rim, 5 x 5-1/5" Bolt Pattern		Ref
5				Not Used		
6		SW10H1035	Comm	Nut, Lug, 1/2-20, 60-deg.		20
7		12654.03		U-Bolt, Type 7, Rd. 1/2-13		16
8		Comm		Washer, Lock, 1/2		16
9		Comm		Nut, 1/2-13		16
10		1.7862	D3TZ-3C590-A	Kit, Power Steering Rod Bushing (V26377)		1
11		Comm		Nut, Jam, 1/2-20		2
12		12654.04		U-Bolt		2
13		Comm		Nut, Lock, 3/8-16		4
14		10086		Bracket, Steering		1
15		Comm		HHCS, 3/4-16 x 3.00		1
16				Not Used		
17		3.0293		Spacer		2
18		3.0445	Comm	HHCS, 5/8-11 x 2.50		
19		3.0391	Comm	Nut, Lock, 5/8-11		1
20		3.0291	Comm	Washer, 5/8		2
21		Comm		HHCS, 7/16-14 x 1.25		1
22		9.1838		Lube, Gear, SAE, HD-80W-90		1
23		9.1835	C8AZ19B546A	Friction Modifier, 4 Fl oz. (V26377)		1
24		3.0376	Comm	Nut, Jam, 3/4-16		1
25				Not Used		
26		19967.26		Clamp, Brake Line		9

FIGURE 8
QUADRASTAT ASSEMBLY

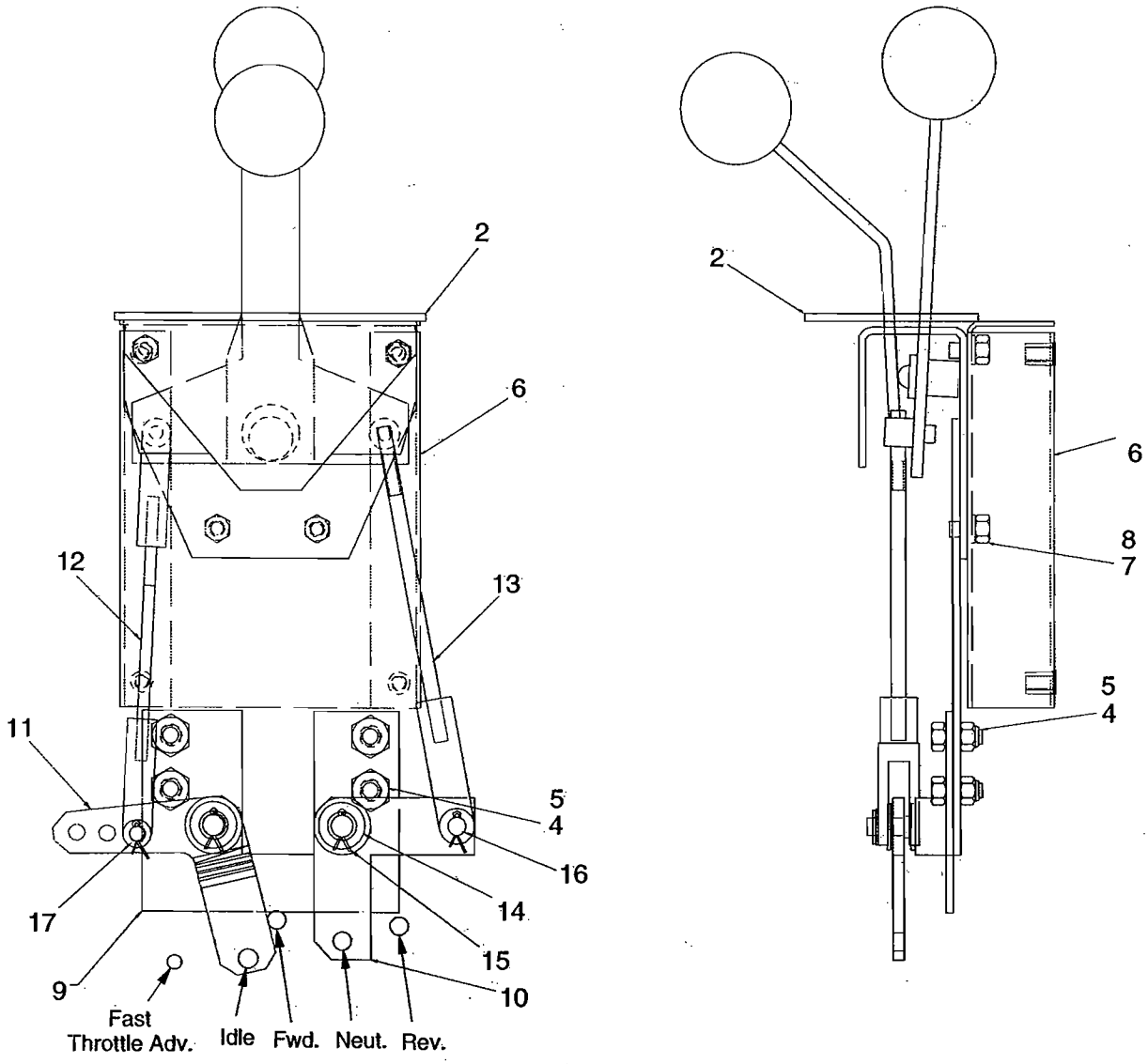


FIGURE 8
QUADRASTAT ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19966	T49065	Quadrastat Assembly (V58051)		Ref
1				Not Used		
2		1.8145		Quadrastat Unit		1
3				Not Used		
4		Comm		HHCS, 1/4-20 x 5/8		4
5		Comm		Nut, Lock, 1/4-20		4
6		10265		Mount Assembly		1
7		Comm		HHCS, 1/4-20 x 3/8		4
8		Comm		Washer, Lock, 1/4		4
9		10268		Weldment, Base		1
10		10271		Crank, 90 degree		1
11		19904		Crank, Throttle		1
12		10273		Throttle Rod Assembly		1
13		10275		Shifter Rod Assembly		1
'4		Comm		Washer, Flat, 3/8 SAE		4
15		Comm		Pin, Cotter, 3/32 x 1		2
16		1.0610		Pin, Clevis, 5/16		1
17		1.7524		Pin, Clevis, 1/4		1

FIGURE 9
BRAKE PEDAL ASSEMBLY

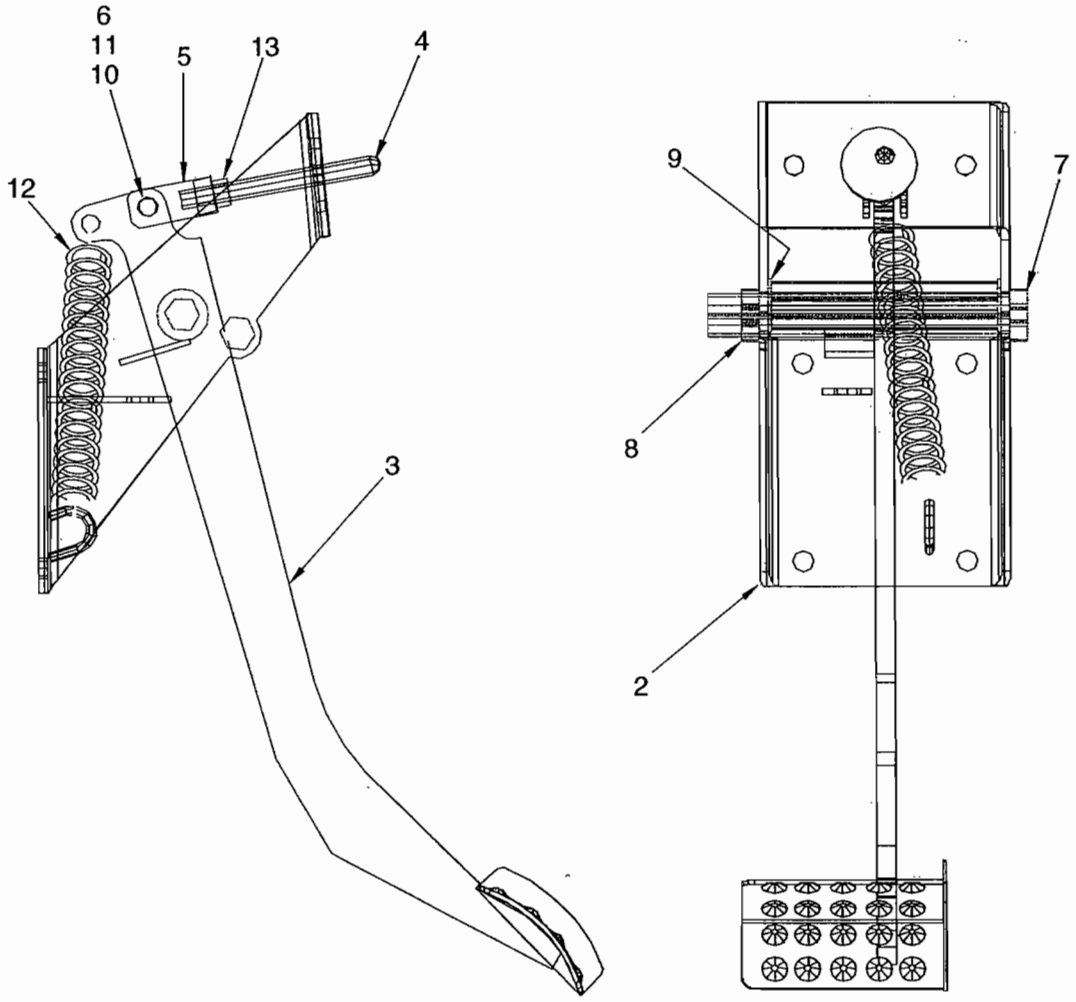


FIGURE 9
BRAKE PEDAL ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
		19882		Brake Pedal Assembly		Ref
1				Not Used		
2		19883		Bracket, Footbrake		1
3		19886		Pedal Assy, Brake		1
4		302238		Push Rod, Brake Master Cyl.		1
5		302239		Clevis, Push Rod		1
6		302240		Pin, Clevis		1
7		Comm		HHCS, 1/2-13 x 6.00		2
8		Comm		Locknut, 1/2-13		2
9		1.8869	8L8-F	Bearing, Nyliner (V96881)		2
10		Comm		Cotter Pin, 5/32 x 1.00		1
11		Comm		Washer, 3/8		1
12		1.7472	E1000-095-5000	Spring (V6L202)		1
13		Comm		Nut, Hex, 3/8-16		1

FIGURE 10
HYDRAULIC BRAKES ASSEMBLY

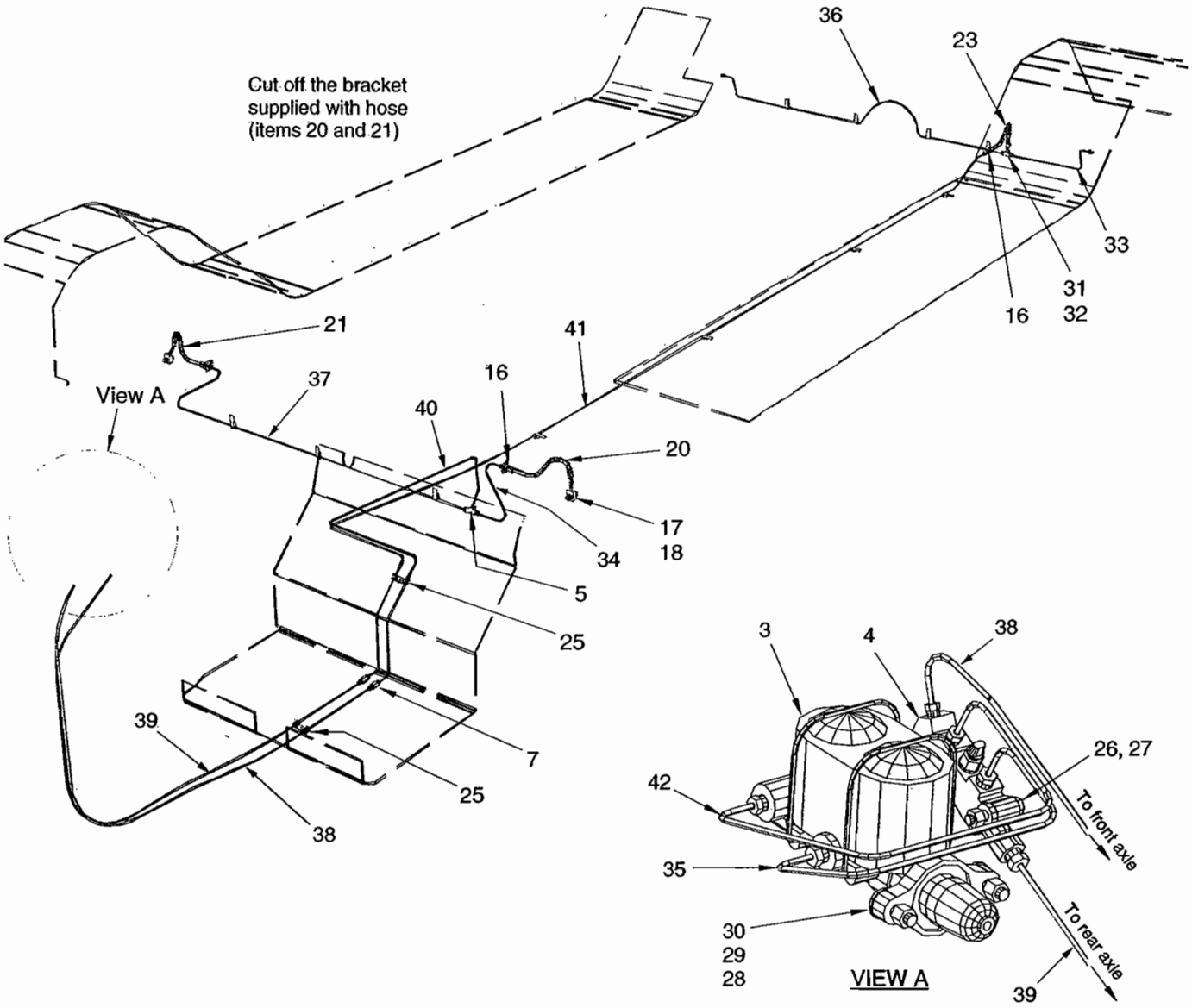


FIGURE 10
HYDRAULIC BRAKES ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
		19974		Hydraulic Brakes Assembly		Ref
1-2				Not Used		
3		1.8449	36280	Master Cylinder, 1-1/8" bore (V1DF85)		1
4		1.7276	D4TZ-2B257-A	Valve, Brake Meter (V26377)		1
5		3.2893	702x3	Tee, Inv. Flr, Brass, 3/16" (V79470)		1
6				Not Used		
7		1.8426	302x3	Union, Invert Flare, 3/16" (V79470)		1
8-9				Not Used		
10		3.2792	131x3	Plug, Inv. Flr, Steel, 3/16" (V79470)		1
11-15				Not Used		
16		1.7376	A7AZ-2814-A	Washer, Clamp (V26377)		3
17		1.7912	D3TZ-2149-A	Washer, Copper Seal (V26377)		4
18		1.7896	38516-S2	HHCS, Brake Caliper (V26377)		2
19				Not Used		
20		1.7348	36831	Hose Assy, Brake (V26377)		1
21		1.7347	36830	Hose Assy, Brake (V26377)		1
22				Not Used		
23		1.8919	F98946	Hose Assy (V63477)		1
24				Not Used		
25		3.1072		Clamp, Loop Type, 1/4" (V00502)		4
26		Comm		HHCS, 5/16-18 x 1-3/4		2
27		Comm		Nut, Lock, 5/16-18		2
28		Comm		HHCS, 3/8-16 x 1-1/4		2
29		Comm		Nut, Lock, 3/8-16		2
30		Comm		Washer, Flat, 3/8		2
31		Comm		Nut, Lock, 7/16-14		1
32		Comm		Washer, 7/16 SAE		1
33		300030		Brake Line Assy		1
34		300031		Brake Line Assy		1
35		300032		Brake Line Assy		1
36		300033		Brake Line Assy		1
37		300034		Brake Line Assy		1
38		300035		Brake Line Assy		1
39		300036		Brake Line Assy		1
40		300037		Brake Line Assy		1
41		300038		Brake Line Assy		1
42		300039		Brake Line Assy		1

FIGURE 11
HYDRAULIC ASSEMBLY

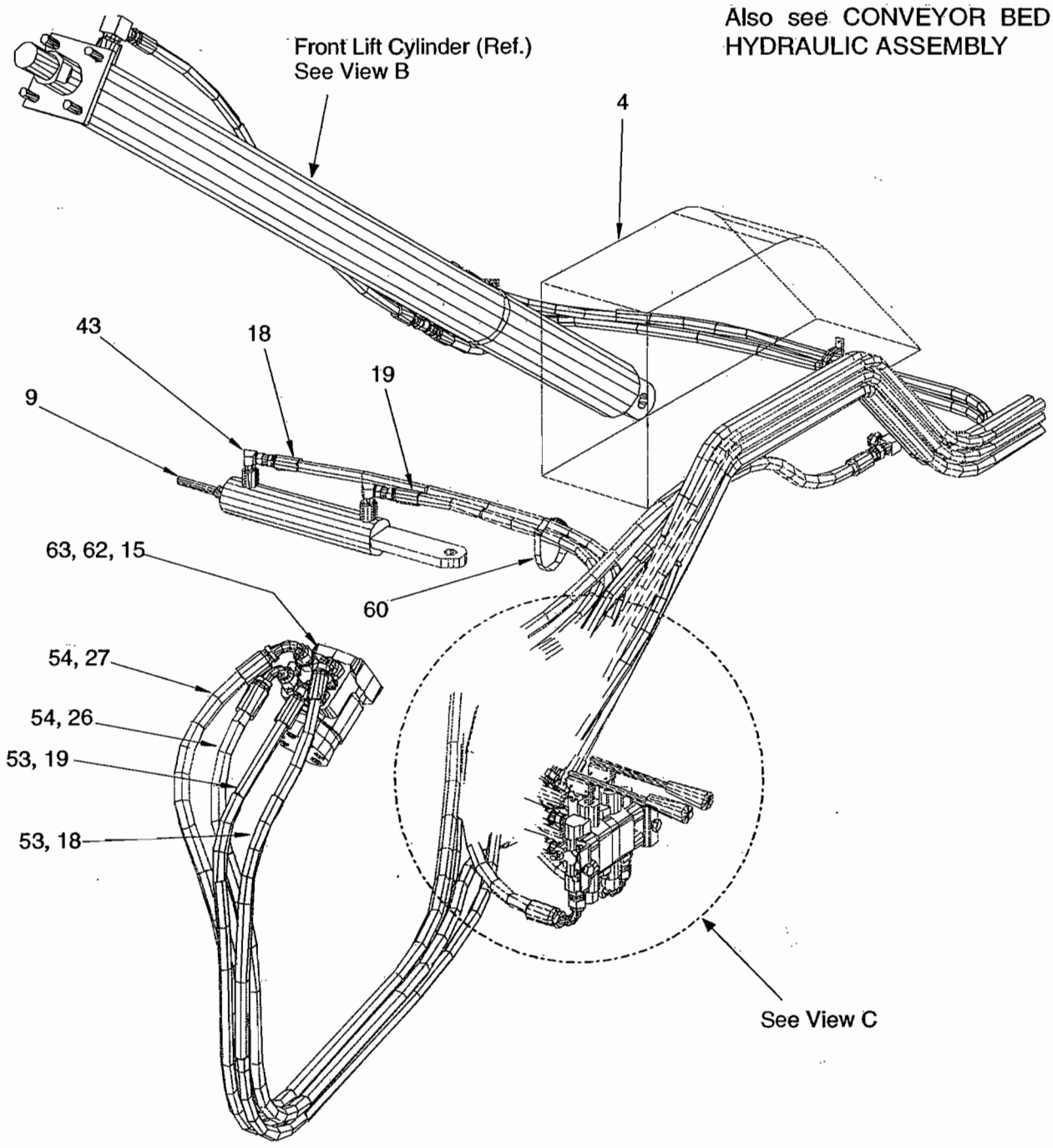


FIGURE 11
HYDRAULIC ASSEMBLY

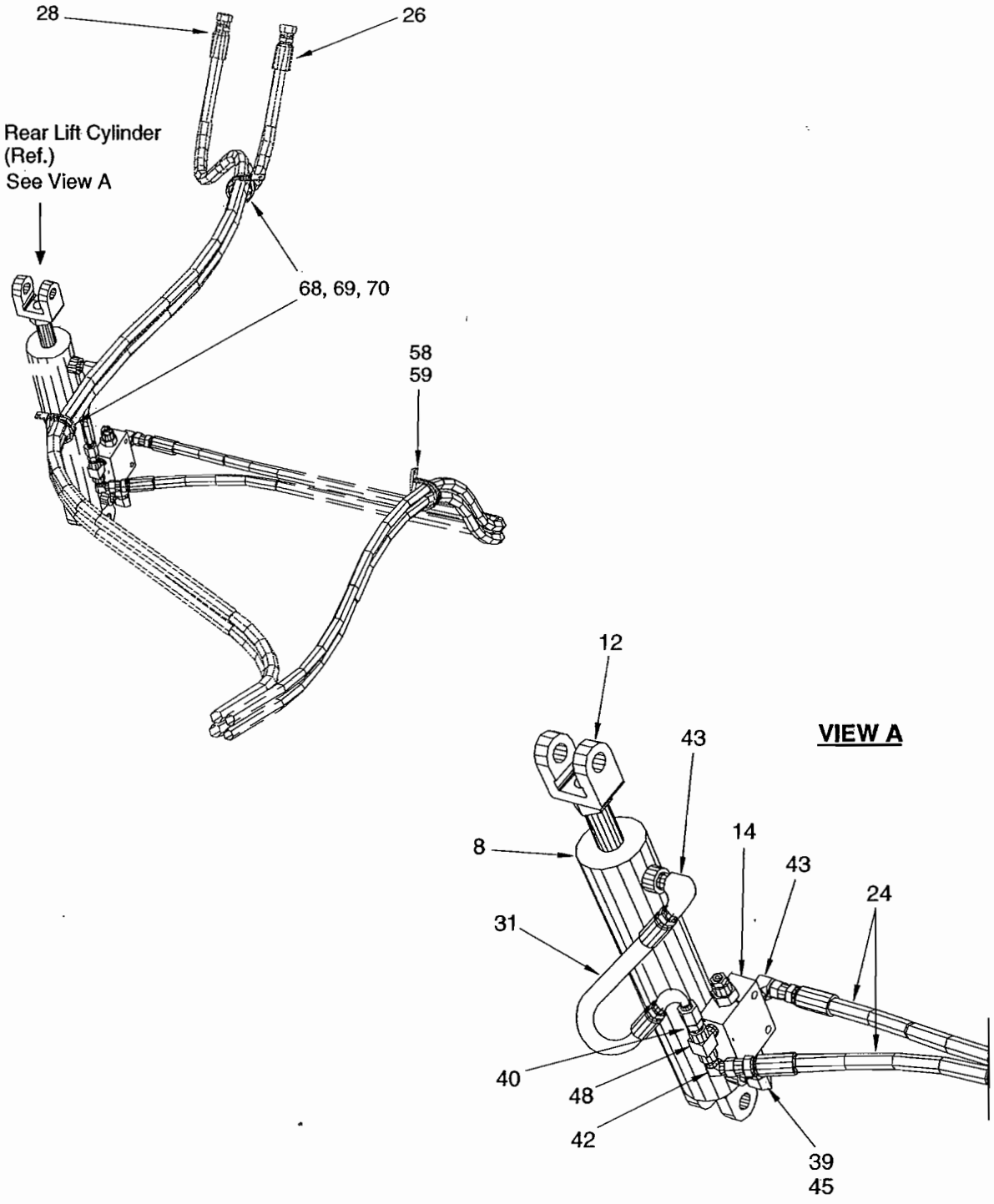
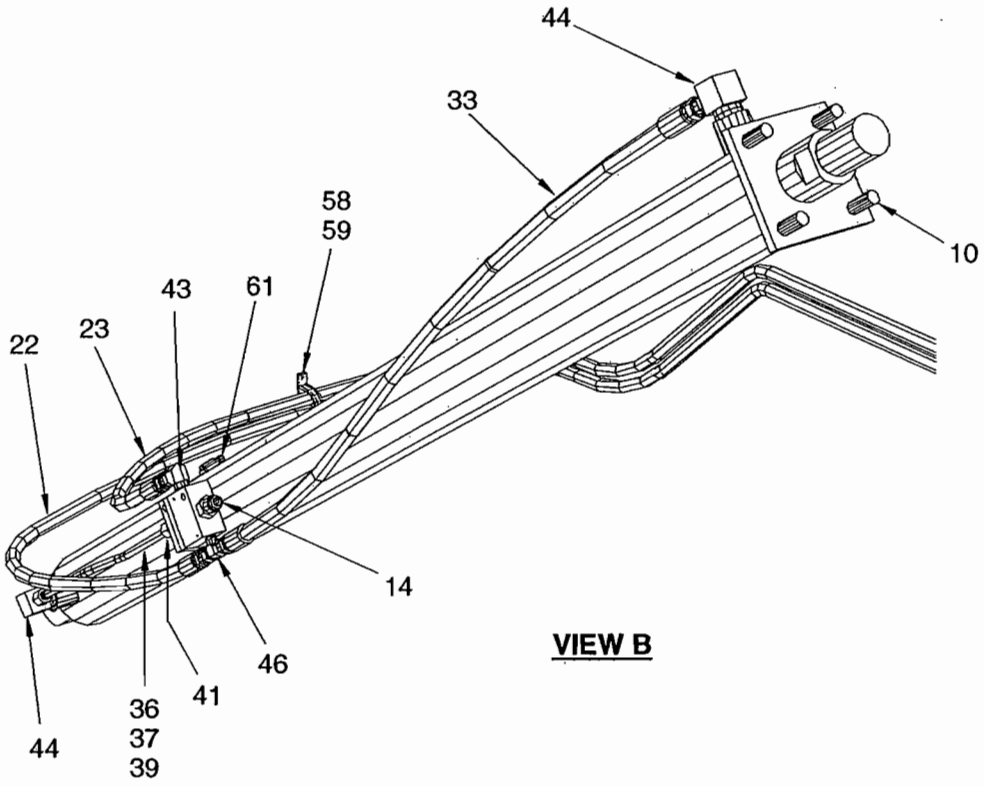


FIGURE 11
HYDRAULIC ASSEMBLY



VIEW B

FIGURE 11
HYDRAULIC ASSEMBLY

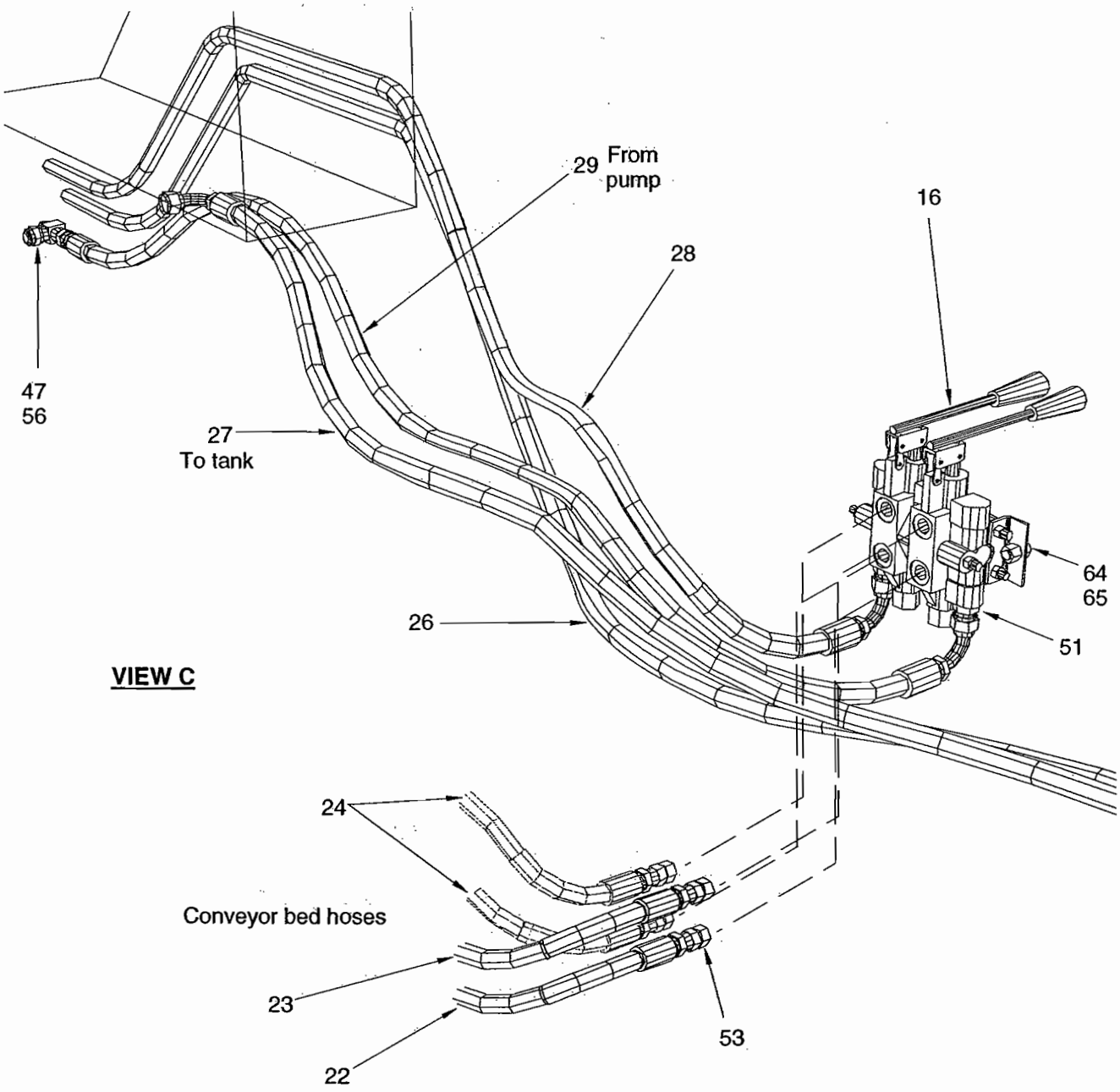


FIGURE 11
HYDRAULIC ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1		20388		Hydraulic Assembly		Ref
2				Not Used		
3		20649		Conveyor Bed Hydraulic Assembly (See Figure 12)		1
4		19334		Hydraulic Reservoir Assembly (See Figure 13)		1
5		20027		Engine Package Hydraulics		Ref
6				Not Used		
7		20573		Hydraulic Schematic (See Chapter 1)		Ref
8		10297	600-2104	Cylinder, Rear Lift, 2.50" Bore, 2.50" Rod, 8.00" Stroke (V18018)		1
NS		1.8894	44-2144S	Seal Kit, Cylinder #10297 (V18018)		Ref
9		12409	600-2127	Cylinder, Steering, 2.00" Bore,.75" Rod, 8.00" Stroke (V18018)		1
NS		1.8895	44-2127S	Seal Kit, Cylinder #12409 (V18018)		Ref
10		14011	600-2112	Cylinder, Front Lift, 3.50" Bore, 2.00" Rod, 58.50" Stroke (V18018)		1
11				Not Used		
NS		1.8893	44-2112S	Seal Kit, Cylinder #14011 (V18018)		Ref
12		1.6646	AS426	Clevis, 0.75-16 (Air Dro)		1
13				Not Used		
14		1.7818	CBCHLD-NECB	Valve, Counterbalance, 2000 PSI (V54035)		2
NS		1.8525	990-001-006	Seal Kit, Counterbalance Valve (V54035)		A/R
15		1.7864	211-1008	Power Steering Unit (V96151)		1
NS		1.8523	64418	Seal Kit, Power Steering Unit (V96151)		A/R
16		1.8997	3710-10-R700	Valve, Hyd, Conveyor Bed Raise/ Lower (V07988)		1
17				Not Used		
18		8796.91		Hose Assy, #6 x 12.68" Lg OA, 90° Fm Swivel One End, Type C		1
19		8796.92		Hose Assy., #6 x 68.93" Lg OA, 90° Fm Swivel One End, Type C		2
20-21				Not Used		
22		8945.66		Hose Assembly, #6 x 112.64" Lg OA, Type A		1
23		8945.67		Hose Assembly, #6 x 109.14" Lg OA, Type A		1
24		8945.68		Hose Assembly., #6 x 211.14" Lg OA		2
25				Not Used		
26		8797.70		Hose Assembly., #8 x 283.08" Lg OA, Type C		1
27		8797.71		Hose Assembly, #8 x 97.58" Lg OA, Type C		1
28		8797.72		Hose Assembly, #8 x 232.48" Lg OA, Type C		1
29		8797.73		Hose Assembly, #8 x 63.33" Lg OA, Type C		1

FIGURE 11
HYDRAULIC ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
30				Not Used		
31		1.8939		Hose Assembly, #8 x 13.90" Lg OA, 3000#		1
32				Not Used		
33		8945.63		Hose Assembly, #6 x 43.64" Lg OA, Type A		1
34-35				Not Used		
36		7.0394		Tubing, S/S 304, Rd, 3/8" OD, 2580 PSI Max		13"
37		3.1104	1290-06S	Nut, Tube, 3/8" (V01276)		2
38		3.1106	900605-6	Sleeve, Tube, 3/8" (V01276)		2
39		3.3250	2018T-6-8S	Adapter, Swivel, 37° Flare, Fm Pipe		1
40		3.1571	2021-4-6S	Nipple (V01276)		1
41		3.1572	2021-6-6S	Nipple (V01276)		2
42		3.1679	2024-6-6S	Elbow (V01276)		1
43		3.1564	2024-6-6S	Elbow (V01276)		5
44		3.2846	2024-12-6S	Elbow (V01276)		2
45		3.1317	2024-6-8S	Elbow (V01276)		1
46		3.1581	2030-6-4S	Tee (V01276)		1
47		3.1840	2033-8-8S	Tee (V01276)		1
48		3.1604	2091-4-4S	Tee (V01276)		1
49-50				Not Used		
51		3.2882	203702-6-8S	Nipple (V01276)		2
52		3.2518	202702-6-6S	Nipple (V01276)		4
53		3.2519	203702-8-6S	Nipple (V01276)		2
54		3.2478	202702-8-8S	Nipple (V01276)		2
55				Not Used		
56		3.0127	210292-8S	Cap Nut (V01276)		1
57				Not Used		
58		Comm		Rivet, Pop, Alum, 3/16 x 3/8" Grip		2
59		3.1080	DG24-1-1/2	Clamp, Loop Type, 1.50", Alum (V00502)		2
60		3.2561	QS200-M52S	Clamp, S/S, 2-13/16" (V62789)		1
61		3.2237	QS200-M88S	Clamp, S/S, 5-1/8" (V62789)		1
62		Comm		Screw, Soc Hd, 3/8-24 x 0.75" Lg		2
63		Comm		Washer, Lock, SAE 3/8"		2
64		Comm		HHCS, 3/8-16 x 0.75" Lg		2
65		Comm		Nut, Lock, 3/8-16		2
66				Not Used		
67		1.8990		Protector, Hose (Epha, Inc.)		4
68		302140	Comm	Clamp, Loop Type, 1-1/2"		2
69		Comm		HHCS, 1/4-20 x 0.75		2
70		Comm		Nut, Lock, 1/4		2

FIGURE 12
CONVEYOR BED HYDRAULICS

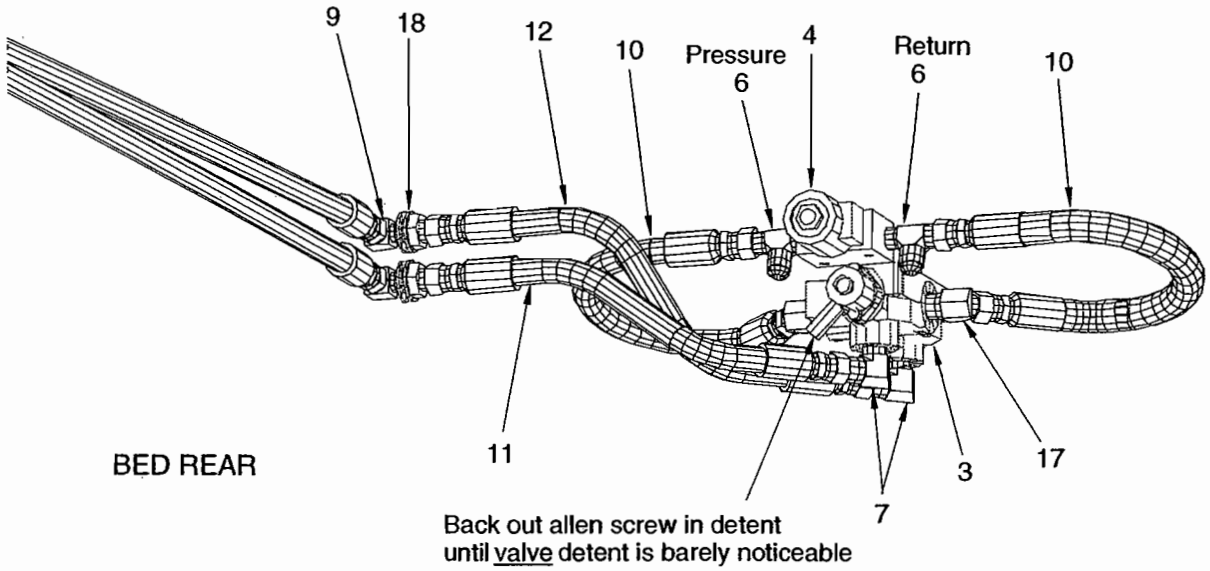


FIGURE 12
CONVEYOR BED HYDRAULICS

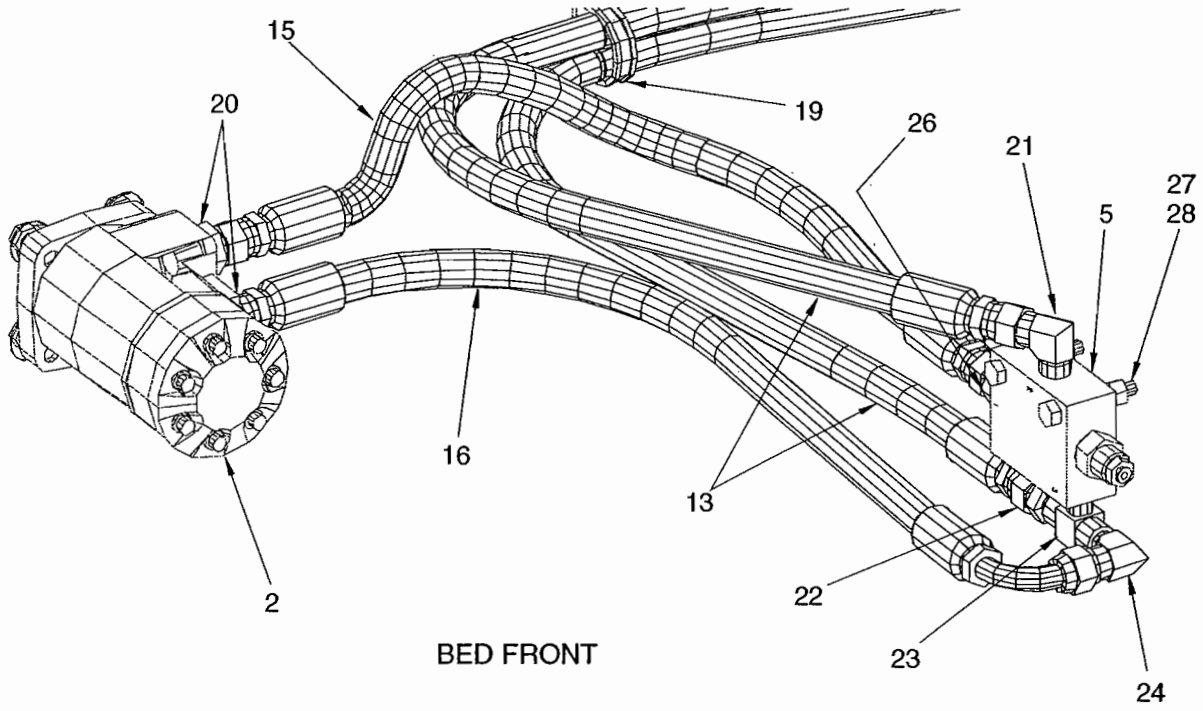


FIGURE 12
CONVEYOR BED HYDRAULICS

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20649		Conveyor Bed Hydraulic Assembly		Ref
2		1.8867	101-1013	Motor, Hydraulic (V96151)		1
NS		302270	60540	Seal Kit, Motor (V96151)		Ref
3		1.8857	A0755-T4-JD	Valve (V19184)		1
4		1.8308	14C255-12VDC/ HF890118	Valve, Solenoid (V0C7Z2)		1
NS		2.3941	6350012	Coil, 12V (For solenoid valve)		A/R
5		1.7818	CBCHLDNECB	Valve, Counterbalance, B-2000 E/W Lanyard (V54035)		1
6		3.1630	2028T-08-06S	Tee, 37° F/EXT P (V01276)		2
7		3.1566	2024T-08-08S	Elbow, 37° F/EXT P (V01276)		2
8				Not Used		
9		3.1814	2043-8-8	Fitting, Bulkhd, 90° Flare W/37° Flare (V01276)		2
10		1.8970		Assembly, Hose, 3000 Lb., 23"		2
11		8946.32		Assembly, Hose, 1" Brd, 2,000 Lbs., 1/2" x 14.72" OA		1
12		8946.17		Assembly, Hose, 1" Brd, 2,000 Lbs., 1/2" x 16.72" OA		1
13		8946.33		Assembly, Hose, 1" Brd, 2,000 Lbs., 1/2" x 227.97" OA		2
14				Not Used		
15		8946.3		Assembly, Hose, 1" Brd, 2,000 Lbs., 1/2" x 20.72" OA		1
16		8797.61		Assembly, Hose, 1" Brd, 2,000 Lbs., 1/2" x 23.58"		1
17		NW34366		Elbow		2
18		Comm		Washer, Flat		4
19		3.1080	S21919-DG24	Clamp, Loop Type, Alum (V00502)		7
20		3.2703	202702T-08-10S	Nipple, 37° F/SAE (V01276)		2
21		3.1317	2024T-D-08-06S	Elbow, 37° F/SAE (V01276)		1
22		3.1353	2021-4-8	Nipple (V01276)		1
23		3.1604	2091-04-04S	Tee, EXT P/INT P (V01276)		1
24		3.0141	2024T-08-04S	Elbow, 37° F/EXT P (V01276)		1
25				Not Used		
26		3.1215	2021T-08-08S	Nipple, 37° Flare/EXT P (V01276)		1
27		Comm		HHCS, 1/4-20 x 2.50		2
28		Comm		Nut, Hex, 1/4-20		2
29		302677		Kit, Hose (items 11, 12, 13, 15, 16, and 29)		Ref

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FIGURE 13
HYDRAULIC RESERVOIR

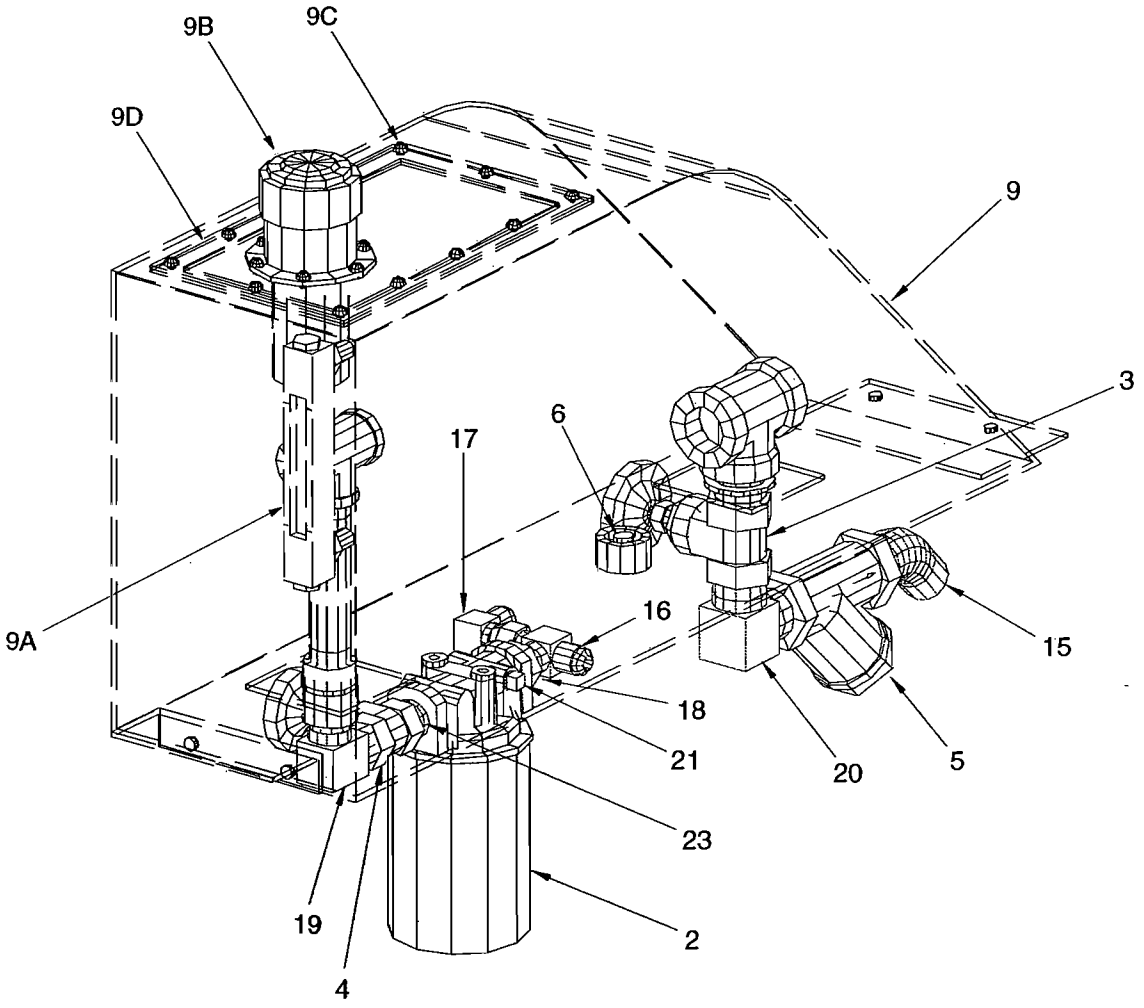

FIGURE 13
HYDRAULIC RESERVOIR

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19334		Reservoir Assembly, Hydraulic		Ref
1				Not Used		
2		1.0437	FSP107-1ED0A	Filter, Return (V02249)		1
		1.3712	K-22001	Element, 10-micron Paper (V02249)		Ref
		1.9008	PG-25	Gauge, Indicator, 0-25 psi (Berendson) (Optional)		Opt
3		1.7146	101-1"	Valve, Gate (V76364)		1
4		1.7802	101-3/4"	Valve, Gate (V76364)		1
5		1.8943	200WPB-1"/80M	Y-Strainer, 80 Mesh (V14652)		1
6		1.7162	MP-105	Plug, Magnetic Drain (V24346)		1
7-8				Not Used		
9		19494		Reservoir		1
9A		1.7180	G610-5-A-1	Gauge, Sight		1
9B		1.8090	A-115-W	Filler/strainer (V9N153)		1
9C		Comm		Screw, Sht Mtl, #10 X 1/2"		18
9D		20500		Gasket		1
10-14				Not Used		
15		3.1542	2023-16-16	Adapter, 45° (V01276)		1
16		3.2475	2030-8-8	Tee, T-P-T (V01276)		1
17		3.2241	2071-8-8	Elbow, Swivel (V01276)		1
18		3.0241	2081-12-8	Reducer, Pipe (V01276)		1
19		3.1929	2085-12-12	Elbow (V01276)		1
20		3.1704	2085-16-16	Elbow (V01276)		1
21		3.0649		Plug, Pipe, 1/4" NPT, Brass		1
22				Not Used		
23		3.0934	Comm	Nipple, Close, 3/4" BIP, SCH 30		1
24		3.0941		Plug, Pipe, BIP, 3/8-18 NPT		1

FIGURE 14
CHASSIS ELECTRICAL

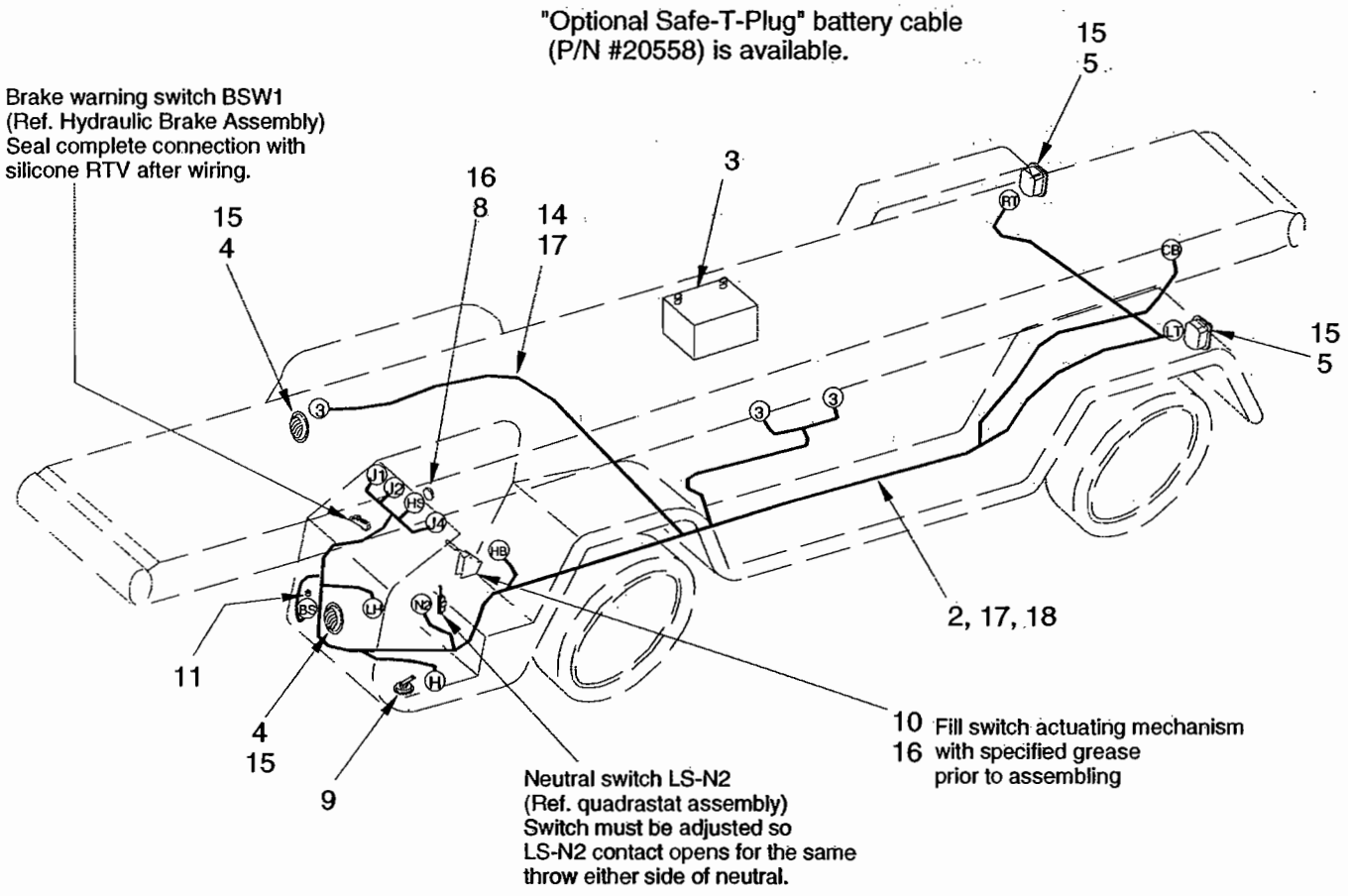

FIGURE 14
CHASSIS ELECTRICAL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19510		Chassis Electrical		Ref
1				Not Used		
2		19509		Electrical Harness (See Figure 15)		1
3		2.3268	627F-12V	Battery, Automotive, 627 CCA (Deka)		1
4		2.3608	64931	Floodlight, Rubber, 12V, 35W (V81834)		2
NS		2.3706	4411	Lamp, Floodlight		A/R
5		2.3361	50972	Taillight Assy., 12V (V81834)		2
NS		2.1455	1-10002	Lamp, Taillight (Sams)		A/R
6-7				Not Used		
8		1.7188	465611	Kit, Horn Button (V1F337)		1
9		2.3000	1-11721-12V	Horn, 2-wire (Volkswagen)		1
10		2.3356	21-361	Switch, Handbrake, 2-terminal,SPNO, Ball Operated (V77326)		1
11		2.0739	8715	Switch, Stoplight (V13445)		1
12-13				Not Used		
14		3.1075	Comm	Clamp, Loop Type, 1/2" (uses item 17)		4
15		9.1986	F1T300-1/4	Tube, Heat Shrink (V92194)		10"
16			Molycote 33	Grease, Silicone Lube, 0.5 oz. (V94499)		1
17		Comm		Rivet, Pop		5
18		3.1080	Comm	Clamp, Loop Type, 1-1/2" (uses item 17)		1

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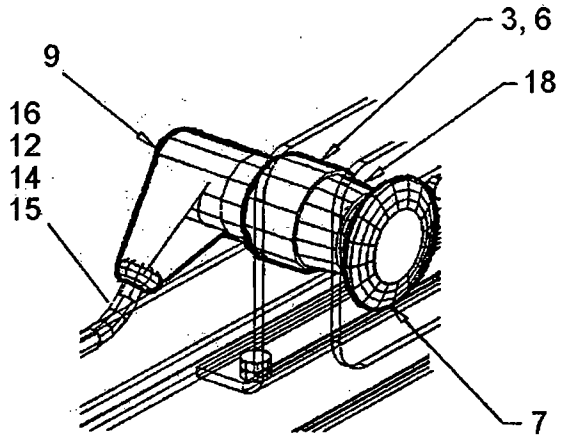
FIGURE 15
ELECTRICAL HARNESS

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19509		Electrical Harness		Ref
1-2				Not Used		
3		2.3186	208530-1	Plug, 9-circuit (V1Z829)		3
4		2.3055	66101-2	Socket, Type III+ (V1Z829)		15
5				Not Used		
6		2.3187	208538-1	Receptacle, 9-CCT. (V1Z829)		1
7		2.3048	66099-2	Pin, Type III+ (V1Z829)		8
8				Not Used		
9		2.0865		Wire, Automotive, #10 AWG, SAE J1128 Type GPT Black, 50V		17'
10		2.2612		Wire, Automotive, #16 AWG, SAE J1128 Type GPT Black, 50V		500'
11		2.3378	1300	Connector, 60A (V80495)		1
12		2.3379	5910	Bushing, Reducing (V80495)		1
13		2.3365	68275	Conduit, Flex Auto, 3/8" Gray Poly.(V77060)		30'
14		2.3366	68137	Conduit, Flex Auto, 1/2" Gray Poly. (V77060)		11
15		2.3364	68460	Conduit, Flex Auto, 3/4" Gray Poly. (V77060)		16'
16		2.3478	64496-R	Conduit, Flex Auto, 1/4" Poly. (V77060)		2'
17		9.1678	F1T300-3/16	Tube, Heat Shrink, 3/16" Adhesive (V92194)		0.5'
18				Not Used		
19		2.3845		Wire, Automotive, #16 AWG, SAE J1128, Type SXL Blue, 50V		16'
20		2.3846		Wire, Automotive, #16 AWG, SAE J1128, Type SXL Green, 50V		16'
21		2.3847		Wire, Automotive, #16 AWG, SAE J1128, Type SXL Red, 50V		16'
22		2.3848		Wire, Automotive, #16 AWG, SAE J1128, Type SXL White, 50V		16'

FIGURE 16
CONVEYOR BED ELECTRICAL



#4 spotlight not shown

FIGURE 16
CONVEYOR BED ELECTRICAL ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20651		Conveyor Bed Electrical Assembly		Ref
2		300000		Harness, Conveyor Bed		1
3		19782		Switch Adapter (V81834)		4
4		2.3608	64931	Floodlight, Rubber, 12V, 35W (V81834)		1
NS		2.3706	4411	Lamp, Floodlight		A/R
5				Not Used		
6		2.3919	21-435	Switch, 2-terminal, SPNO, Ball Operated (V77326)		4
7		2.3920	V113301S	Operator, Switch, Red Mushroom (V7J764)		4
8				Not Used		
9		2.3918	8403	Insulator, Terminal, Black Vinyl (V7Z043)		3
10-11				Not Used		
12		Comm		Ty-wrap, 6"		A/R
13				Not Used		
14		2.2612	Comm	Wire, Automotive, #16 AWG, SAE 1 J1128 Type GPT Black, 50V		720"
15		2.3478	64496-R	Conduit, Flexgard, 1/4" Poly (V77060)		240"
16		Comm		Rivet, Pop, Alum, 3/16"		11
17				Not Used		
18		2.3889	DC4	Compound, Dielectric, Medium Consistency (V94499)		1
19		3.0248	Comm	Grommet, 1" ID (Cut In Half)		1

FIGURE 17
INSTRUMENT PANEL ELECTRICAL

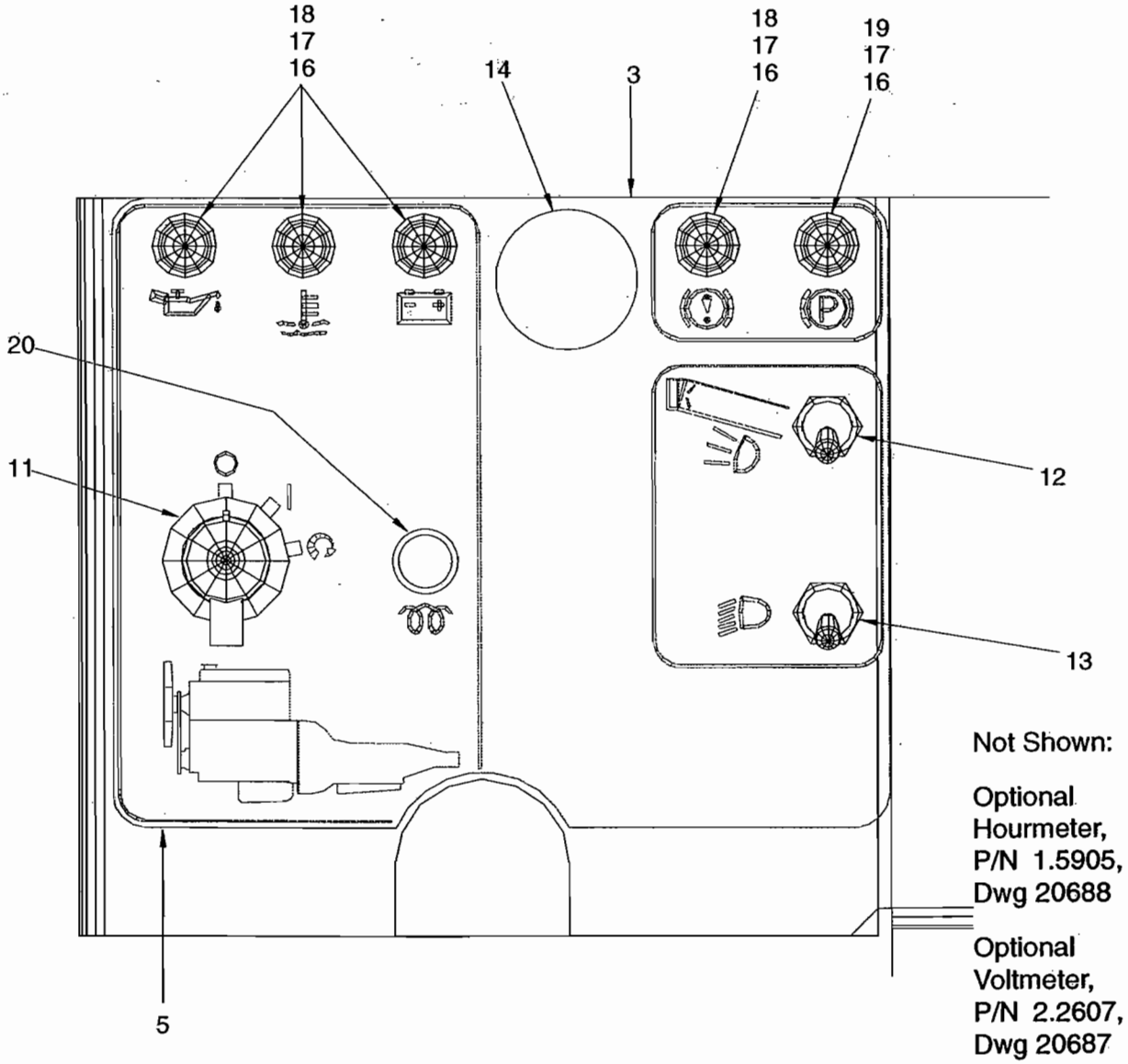
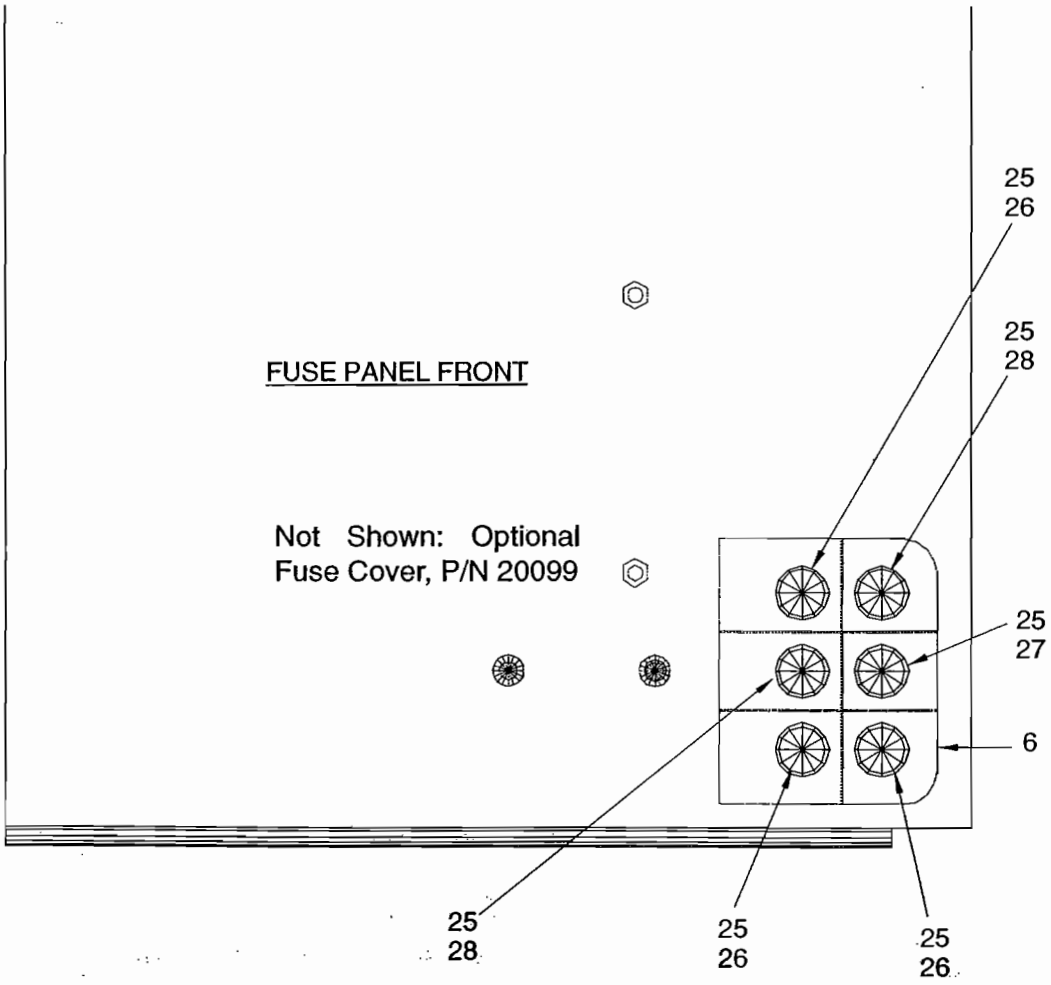


FIGURE 17
INSTRUMENT PANEL ELECTRICAL



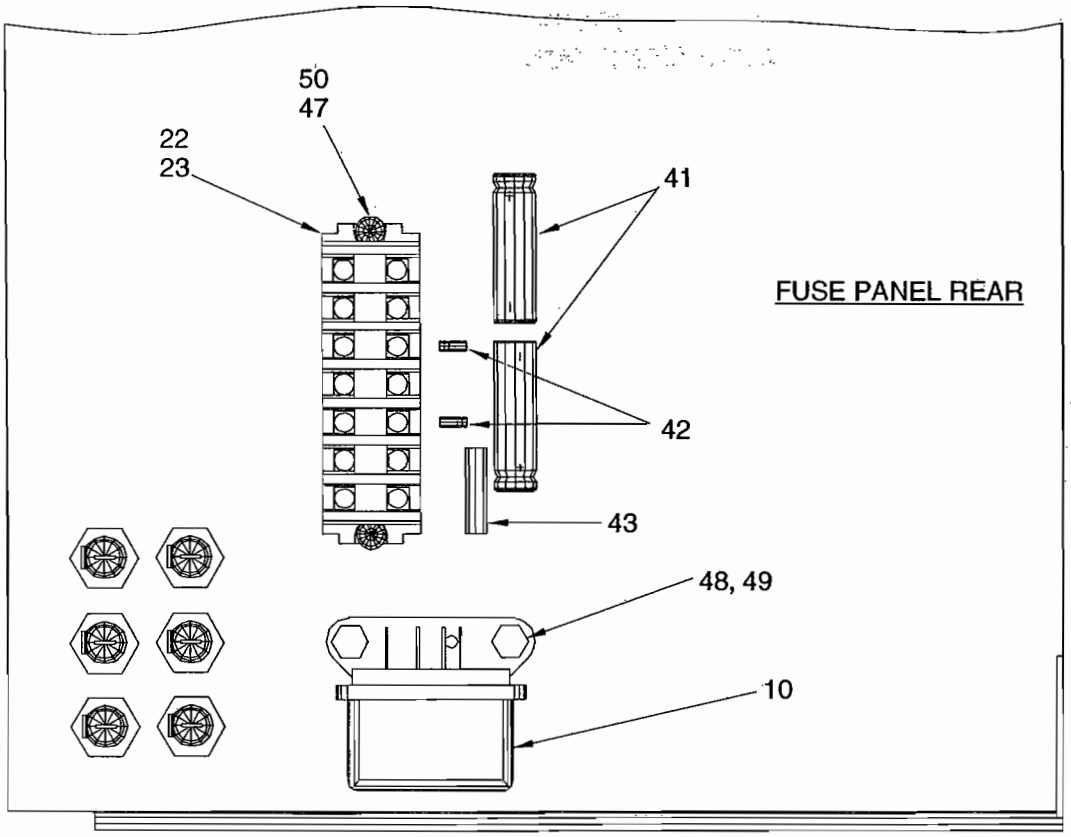


FIGURE 17
INSTRUMENT PANEL ELECTRICAL

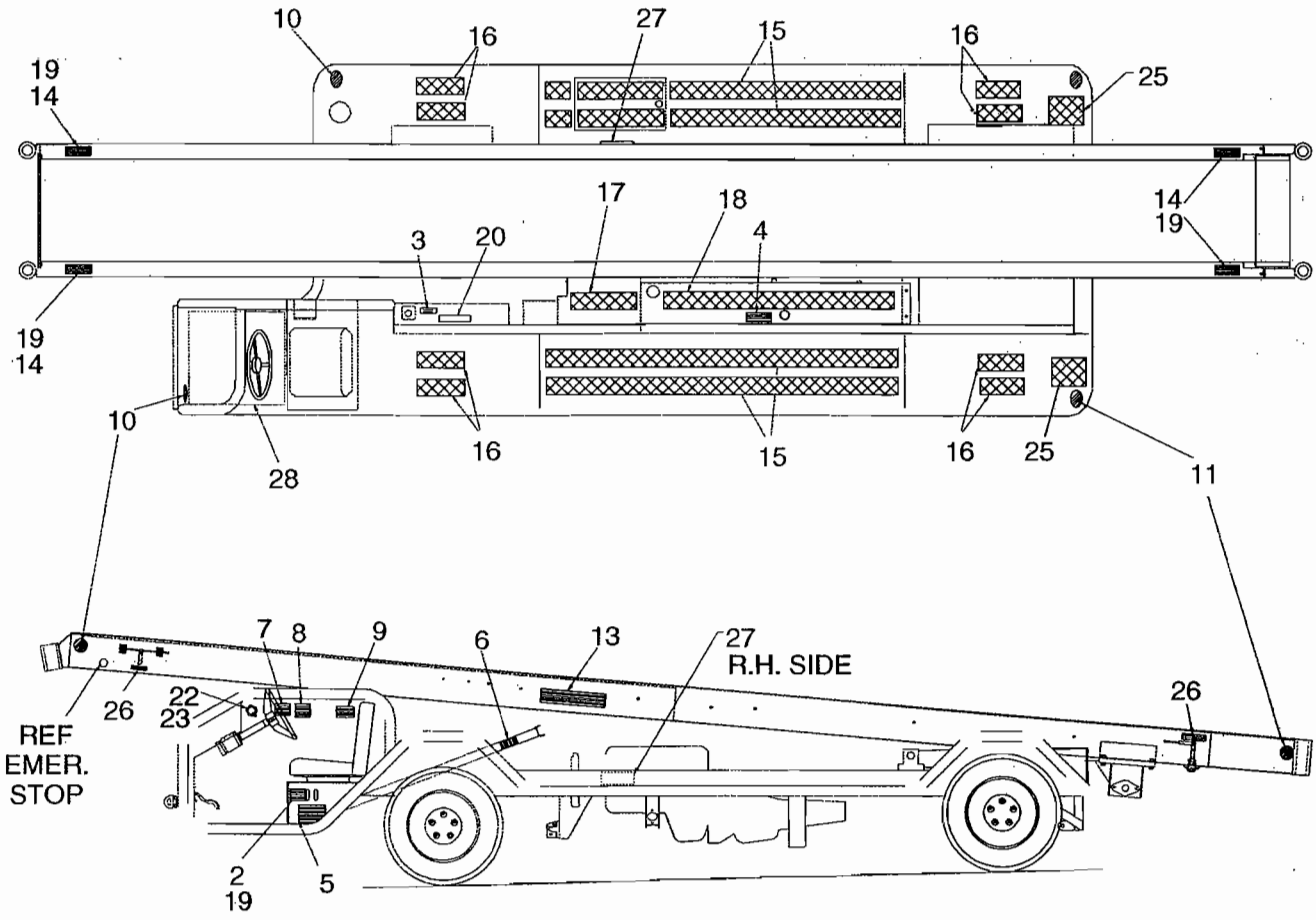
Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19900		Instrument Panel Electrical		Ref
1-2				Not Used		
3		19879		Face, Instrument Panel		Ref
4		300002		Harness, Instrument Panel (Not Shown)		1
5		19881		Placard, Instrument Panel		1
6		562A433		Placard, Fuse Panel, Alum, TC888		1
7-9				Not Used		
10		2.3648	150-905-12VDC	Relay, Automotive, SPDT (V80089)		1
11		2.3500	956-3124	Switch, Ignition (V13445)		1
11		301650 2.2585 2.2598	 31-233 L5-114C-1	Optional Pollak Ignition Switch, Includes: Keyswitch (V77326) Lever, Switch (V77326)		Opt 1 1
12		2.3013	1TL1-2	Switch, Toggle, SPST (V91929)		1
13		2.3014	2TL1-2	Switch, Toggle, DPST (V91929)		1
14		2.3003	261-3306	Light, Panel Mount (V75175)		1

FIGURE 17
INSTRUMENT PANEL ELECTRICAL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
NS		2.1002		Lamp, Panel		A/R
15				Not Used		
16		2.3511	920-401X	Holder, Lamp (V75175)		5
17		2.3002	382-14V	Lamp, Miniature (V52343)		5
18		2.3008	310RN	Lens, Red (V75175)		4
19		2.3001	310GN	Lens, Green (V75175)		1
20		1.2253	653 Chrome	Plug, Panel Hole (V83330)		1
21				Not Used		
22		2.0022	530	End, Terminal (V83079)		1
23		2.0021	524	Block, Terminal (V83079)		7
24				Not Used		
25		2.2793	HKP-HH	Holder, Fuse, 250V, 15A(V71400)		6
26		2.1464	AGC-5AMP	Fuse, Non-time Delay (V71400)		3
27		2.0312	AGC-10AMP	Fuse, Non-time Delay (V71400)		1
28		2.0313	AGC-15AMP	Fuse, Non-time Delay (V71400)		2
29-30				Not Used		
31*		2.3186	208530-1	Plug, 9-circuit (V1Z829)		1
32*		2.3055	66101-1	Socket, Type III+ (V1Z829)		7
33*		2.3187	208538-1	Receptacle, 9-CCT. (V1Z829)		1
34*		2.3048	66099-2	Pin, Type III+ (V1Z829)		7
35-36				Not Used		
37*		2.3378	1300	Connector, 60A (V80495)		1
38*		2.3379	5910	Bushing, Reducing (V80495)		1
39-40				Not Used		
41		2.3319	TC1520C	Capacitor, Axial, 2000mF, 15VDC (V37942)		2
42		2.3093	NTE 5805	Diode, Axial Lead, 3A, 200V (V6A359)		2
43		2.3358	45J33R	Resistor, Wirewound, 33 Ohm, 5 Watt Axial Leads (6A359)		1
44				Not Used		
45*		2.2612		Wire, Automotive, 50V, 16 AWG, SAE J1128 GPT Black		60'
46*		2.0865		Wire, Automotive, 50V, 10 AWG, SAE J1128 GPT Black		1'
47		Comm		RHMS, #8-32 X 0.50		2
48		Comm		THMS, 1/4-20 X 0.75		2
49		Comm		Nut, Lock, 1/4-20		2
50		Comm		Nut, Lock, #8-32		2

*These items are located on item #4.

FIGURE 18
PLACARDS



Option #301648: Tow speed placards on fenders (2)

Option #301648: Tire pressure stencils on fenders (4)

FIGURE 18
PLACARDS AND SIGNS

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19375		Placard and Sign Installation		Ref
1				Not Used		
2		562A546		Placard, "Manufactured by Wollard"		1
3				Placard, "Dte 13 ..." (Supplied by Mobil Oil Co.)		Ref
4				Placard, Fuel Type (Supplied with engine by engine manufacturer)		Ref
5		562A517		Placard, "Bed Up/Down"		1
6		562A248		Placard, "Caution-Safety Stand"		1
7		562A509		Placard, "Caution-Roller Bed Capacity"		1
8		562A249		Placard, "Warning-Low Speed"		1
9		562A200		Placard, "Emergency Brake, Off-On"		1
10		1.7965		Decal, Yellow Reflector		4
11		1.7779		Decal, Red Reflector		4
12				Not Used		
13		562A296		Placard, "Check for water in fuel.." (Diesel Only)		1
14		562A547		Placard, "Warning-Keep Hands Clear"		4
15		9.2078		Safety Walk, 4" x 82"		4
16		9.2078		Safety Walk, 4" x 12"		8
17		9.2078		Safety Walk, 4" x 16-1/2"		1
18		9.2078		Safety Walk, 4" x 68"		1
19		Comm		Screw, Drive, #6		20
20		562A284		Placard, "No Step"		1
21				Not Used		
22		562A449		Placard, "Wollard Quality"		1
23		Comm		Rivet, Pop, Alum, #4-4		2
24				Not Used		
25		9.0598		Safety Walk, 6-5/8" x 8"		2
26		561A48		Placard, Belt Direction		2
27		562A510		Placard, Battery		1
28		9.0598		Safety Walk, 24" x 24"		1

Optional: 562A545 Placard, Vehicle Characteristics

Optional: 301648 (2) Additional Tow Placards

Optional: 301649 Tire Pressure Stencil, 35 PSI

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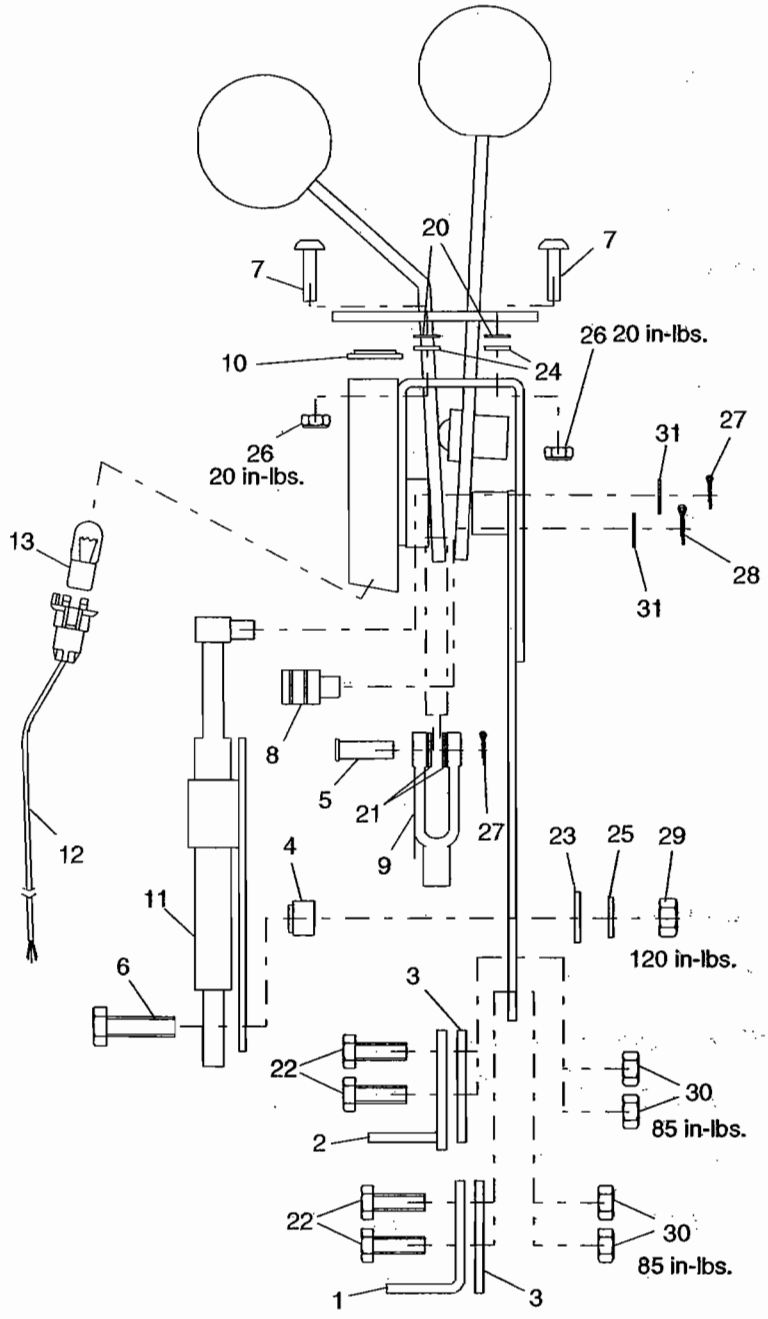
Chapter 5 Tab

Chapter 5
MANUFACTURERS' INFORMATION

CONTENTS

* There is no manual available for the Cessna or Vickers pump.

QUADRASTAT
TRANSMISSION SHIFT CONTROL



QUADRASTAT
TRANSMISSION SHIFT CONTROL
SERVICE PARTS

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		1.8145	T49065	Quadrastat Transmission Control		Ref
1			DC 061	Bracket Angle		1
2			DC 062	Bracket Angle		1
3			DG 567	Spacer		2
4			DG 591-1	Switch Spacer		1
5			DP 100-21	Clevis Pin		1
6			DP 163-1	HHCS		1
7			DP 224	Button Hd Hex Socket Screw, #10-32 x 0.75		4
8			DR 050-2	Swivel		1
9			DR 063-1	Clevis		1
10			DTP 089	Lens		1
11			DY 1631-2	Switch Assembly (T308)		1
12			DY 2300	Socket Assembly		1
13			DZ 982	Lamp		1
14-19				NOT USED		
20			DF 001-2	Washer, Flat		4
21			DF 002-2	Washer, Flat		2
22			SH-1420x34	HHCS, 1/4-20 x 0.75		4
23			WF-5702-118-75Z	Washer, Flat		1
24			WF-5702-232-60Z	Washer, Flat		4
25			WS-516	Washer, Lock		1
26			DF 505	Nut, Lock, Nylon, #10-32		4
27			PC-062 x 50	Cotter Pin, 1/32 x 1/2		1
28			PC-049 x 50	Cotter Pin, 3/32 x 1/2		1
29			NH-516-24	Nut, Hex, 5/16-24		1
30			DF 501	Nut, Center Lock, 1/4-20		4
31			DF 003-2	Washer, Flat		2

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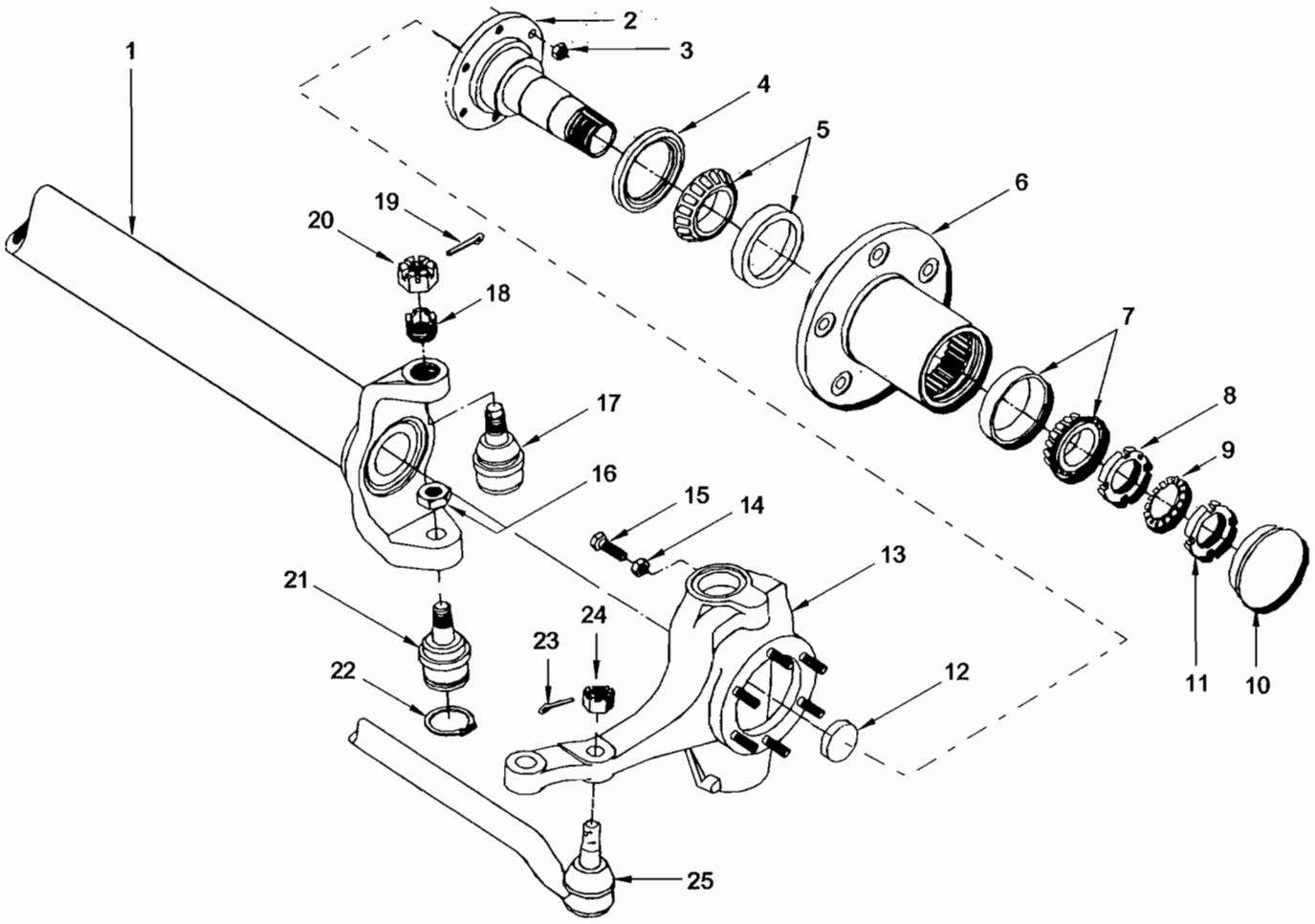
Axle and Brake Parts

Standard Dana Axle

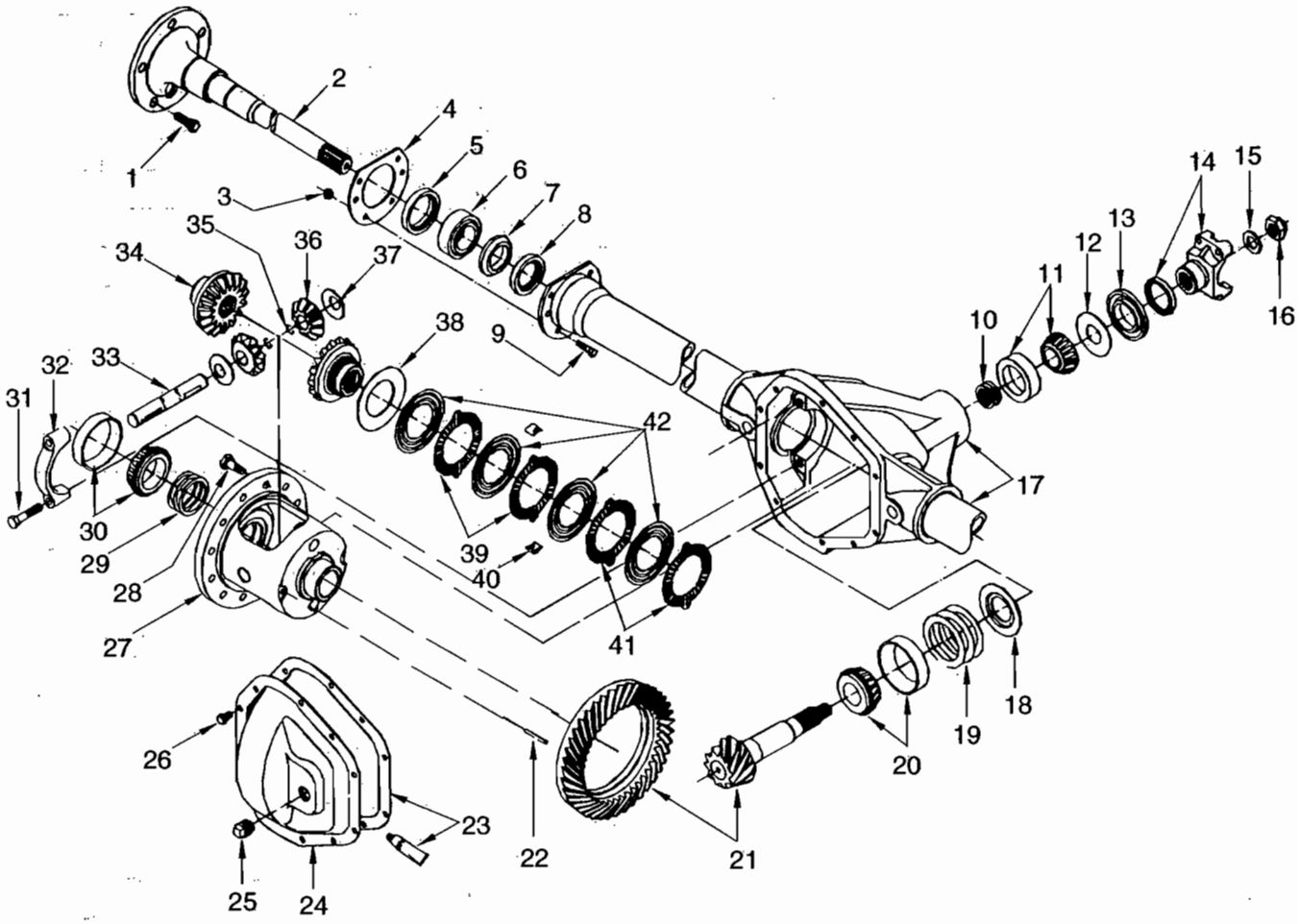
FRONT AXLE PARTS
(MODEL 44)



FRONT AXLE PARTS
(MODEL 44)

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Unit Per Assy
1		300589	29775-31X	Tube Assembly		1
2		300590	044SP100X	Spindle and Plug Assy (Incl. item 12)		2
3		300591	36805	Locknut, Hex		10
4		300592	35313	Seal, Oil		2
5		300593	706110X	Kit, Inner Wheel Bearing		2
6		300594	44615	Hub and Rotor, Wheel		2
7		300595	706111X	Kit, Outer Wheel Bearing		2
8		300596	21588X	Nut and Pin Assembly		2
9		300597	36569	Lockwasher		2
10		300598	044HK101	Cap, Hub		2
11		300599	31139	Nut, Adjusting		2
12				Plug, Cap (NSS. See item 2)		2
13		300601	660107 660108	Steering Knuckle, RH Steering Knuckle, LH		1 1
14		300602	500381-3	Nut, Jam		2
15		300603	31026-2	Screw, Stop		2
16		300604	35566	Nut, Hex, Jam		2
17				Socket Assembly, Upper (NSS, See "Kit, Socket Assembly,")		2
18			35417	Ring, Adjusting		2
19		300607	500024-8	Pin, Cotter		2
20		300608	44101	Nut, Hex, Slotted		2
21				Socket, Assembly, Lower (NSS, See "Kit, Socket Assembly,")		2
22		300610	35928	Ring, Snap		2
23		300611	500024-4	Pin, Cotter		2
24		300612	44101	Nut, Hex, Slotted		2
25		300613	044TR112-10X	Tie Rod Assembly		1
NS		300614	706116-X	Kit, Socket Assembly (Includes items 16-22)		REF
NS		300615	700035	Kit, Knuckle Assembly, LH (incl. items 13 and 16-22)		REF
NS		300616	700036	Kit, Knuckle Assembly, RH (incl. items 13 and 16-22)		REF
NS			044WB102 044WB103	Bracket, Caliper, RH Bracket, Caliper, LH		1 1
NS			37924 37925	Shield, Brake Dust, RH Shield, Brake Dust, LH		1 1

REAR AXLE PARTS
(MODEL 44)



REAR AXLE PARTS
(MODEL 44)

Item	Airline Use	Wollard Part No.	Dana Part No.	Nomenclature	Eff	Units Per Assy
1		300655	35491	Bolt, Wheel		10
2		300656 300657	044SR124-6X 044SR124-11X	Shaft Assembly, RH Shaft Assembly, LH		1 1
3		300658	35704	Nut, Axle Shaft Retaining		8
4		300659	39155	Retainer		1
5		300660	35239	Seal, Shaft Outboard		1
6		300661	565903	Axle Shaft Bearing Assembly		1
7		300662	36797	Ring, Wheel Bearing Retaining		1
8		300663	34419	Seal, Shaft Inboard		1
9		300664	34616-1	Bolt, Axle Shaft Retaining		8
10				Shim, Pinion Bearing Adjusting (NSS. See service kits)		1
11		300666	706030X	Outer Pinion Bearing (Qty. 2)		1
12		300667	13575	Slinger		2
13		300668	39118	Seal, Pinion		1
14		300669	2-4-2281-X	End Yoke Assembly (Qty. 2)		1
15		300670	30186	Washer, Pinion Nut		1
16		300671	30185	Nut, Pinion		1
17		300672	044CH149X	Housing, Axle		1
18		300673	30765	Baffle, Pinion Bearing		1
19				Shim, Drive Pinion Adjusting (NSS. See service kits)		1
20		300675	706031X	Inner Pinion Bearing (Qty. 2)		1
21		300676	23713-5X	Drive Gear and Pinion Assembly (Includes item 16) (Qty. 2)		1
22		300677	13449	Lock, Differential Shaft		1
23		300665 300674	34685 38615	Cover Gasket (for ribbed cover) RTV Sealer (for smooth cover)		1
24		300678	706694X	Cover, Carrier (Includes items 23-26)		1
25		300679	36472	Plug, Cover		1
26		300680	34279	Bolt, Carrier Cover		10
27		300681	73548X	Differential Assembly		1
28		300682	34616-1	Bolt, Axle Shaft Retaining		8
29				Shim, Differential Bearing (NSS. See service kits)		1
30		300684	706032X	Kit, Bearing, Differential		1
31		300685	500400-20	Bolt, Differential Bearing Cap		2

REAR AXLE PARTS
(MODEL 44)

31		300685	500400-20	Bolt, Differential Bearing Cap		2
32				Cap, Differential Bearing (NSS. See service kits)		1
33				Shaft, Differential (NSS. See service kits)		1
34				Gear, Differential (NSS. See service kits)		2
35				Ring, Snap (NSS. See service kits)		2
36				Pinion, Differential (NSS. See service kits)		2
37				Thrustwasher, Differential Pinion (NSS. See service kits)		2
38				Plate, Differential, Dished (NSS. See service kits)		1
39				Plate, Differential (NSS. See service kits)		2
40				Retainer, Differential Clutch (NSS. See service kits)		2
41				Plate, Differential, Selective Thickness (NSS. See service kits)		2
42				Disc, Differential (NSS. See service kits)		4
NS		300686	044KU104-9X	Kit, Drive Gear and Pinion Assembly (Includes items 10, 11-13, 15, 16, 18-23, and 27)		REF
NS		300687	707150X	Kit, Differential Case Assembly (Includes items 23, 27-30, and 33-42)		REF
NS		300688	707151X	Kit, Differential Case (Includes items 23, 27-29, and 35)		REF
NS		300689	707099	Kit, Differential Parts (Includes items 23, 28, and 33-42)		REF
NS		300690	706352X	Kit, Differential Disc And Plates (Includes items 38-42)		REF
NS		300691	044KV101-X	Kit, Pinion and Bearing Adjusting Shims (Incl. items 10, 15, 16, 19, and 23)		REF
NS		300692	706618X	Kit, Differential Adjusting Shims (Includes items 23 and 29)		REF
NS		300693	044KD101-X	Kit, Differential and Pinion Shims (Incl. items 10, 15, 16, 19, 23 and 29)		REF
NS		300694	706012X	Kit, Unit Bearing and Seal (Includes items 4-8)		REF
NS		300695	706694X	Kit, Gear Carrier Cover Assembly (Includes items 23-26)		REF

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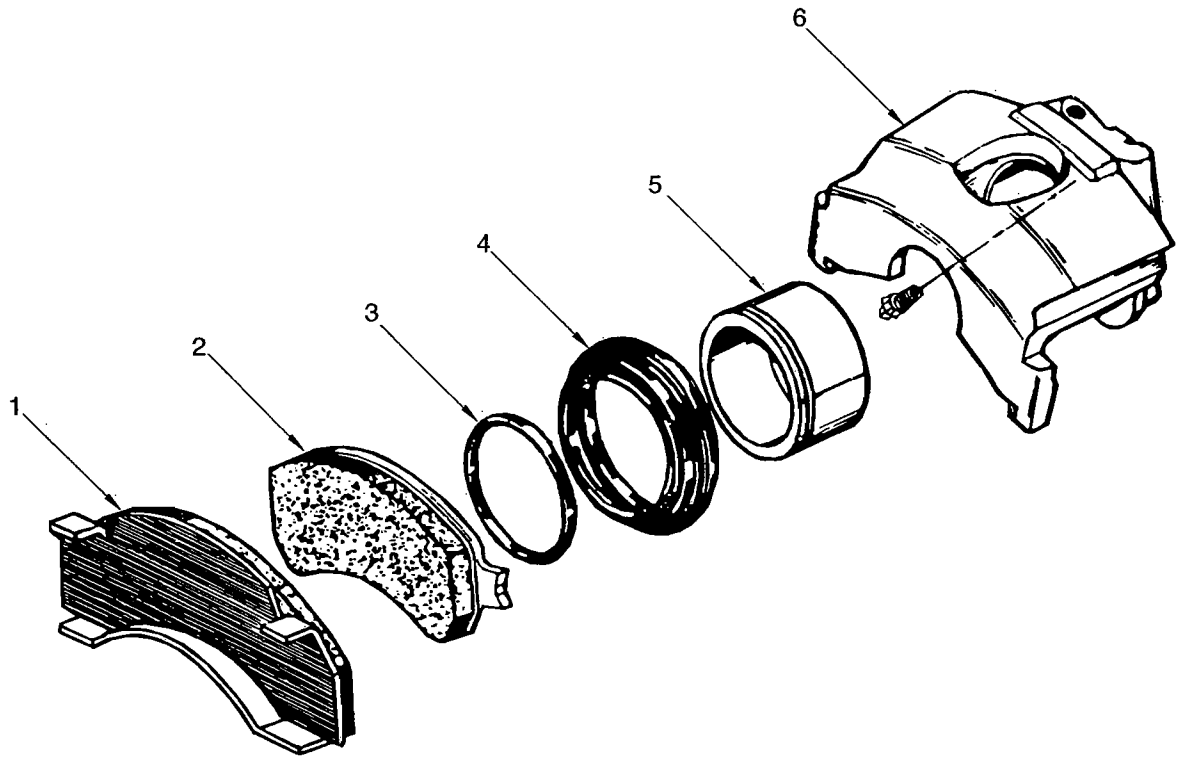
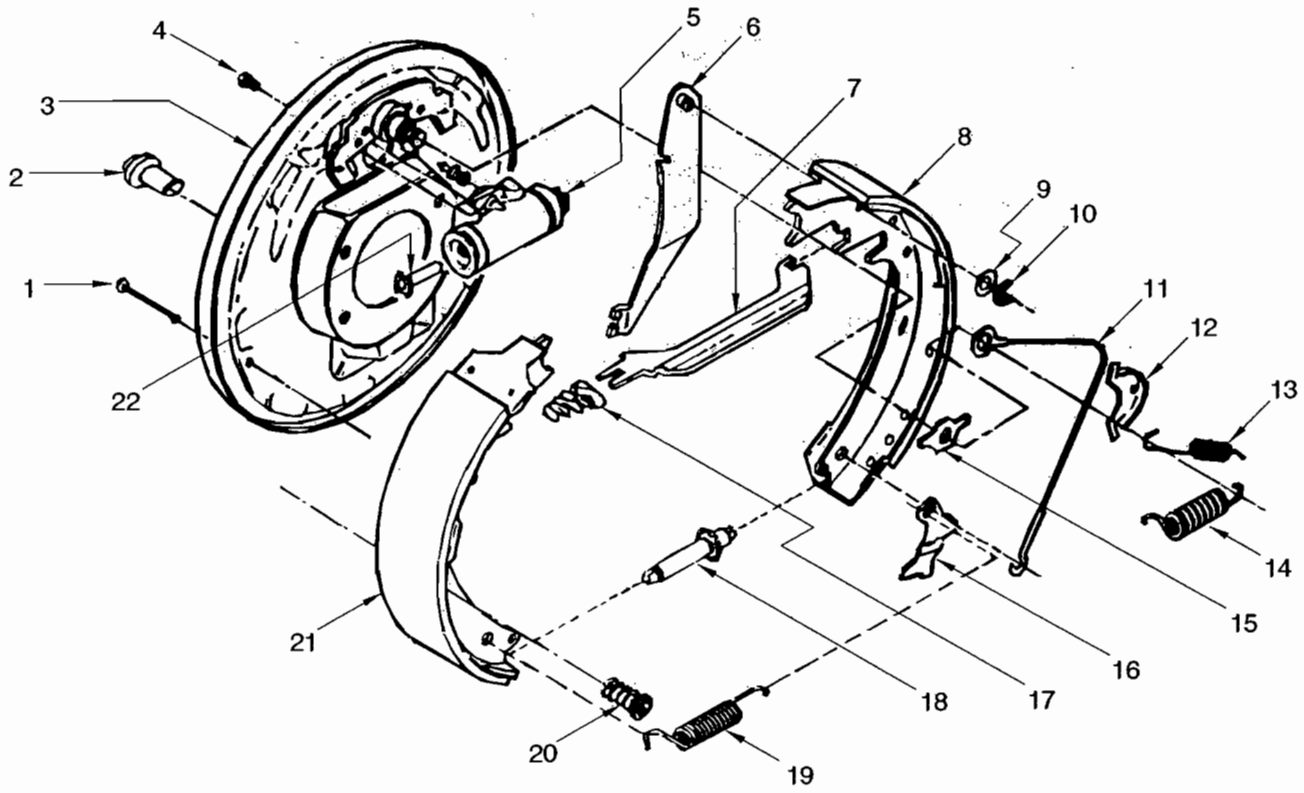
FRONT BRAKE PARTS



FRONT BRAKE PARTS

Item	Airline Use	Wollard Part No.	Dana Part No.	Bendix Part No.	Nomenclature	Eff	Units per Assy
1		300617	044KC121	4152017	Shoe/Lining Assembly, Outer		1
2		300618	044KC120	4152016	Shoe/Lining Assembly, Inner		1
3		300619	044KC122	66781	Kit, Seal and Boot (Includes items 3 and 4)		1
4		300620	044KC123	66601	Kit, Seal, Boot and Piston (Includes items 3,4, and 5)		1
5					Piston (NSS. See item 4)		1
6		300621	044WC104 044WC105	3209550 3209551	Caliper Assembly, LH Caliper Assembly, RH		1 1
NS			044WJ100		Anchor Pin		4
NS			32581		Seat, Spring		2
NS			044HR103		Clip, Anti-Rattle		2

REAR BRAKE PARTS



REAR BRAKE PARTS

Item	Airline Use	Wollard Part No.	Dana Part No.	Bendix Part No.	Nomenclature	Eff	Units per Assy
1		300622	044KB148	25831	Pin, Brake Hold Down		2
2		300623	044KB110	301055	Cover, Brake Adjusting		1
3		300624 300625	044KB129 044KB130	3208848 3208849	Plate Assembly, Backing, LH Plate Assembly, Backing, RH		1 1
4		300626	044KB113	310333	Screw and Lockwasher Assembly		2
5		300627 300628	044KB145 044KB146	3210062 3210063	Cylinder Assembly, Brake, LH Cylinder Assembly, Brake, RH		1 1
6		300629 300630	044KB137 044KB138	3205246 3205247	Lever and Pin Assembly (LH Brake) Lever and Pin Assembly (RH Brake)		1 1
7		300631 300632	044KB142 044KB143	3206136 3206137	Strut, Park Brake Lever, LH Strut, Park Brake Lever, RH		1 1
8		300633	044KB131	3211883	Shoe/Lining Assembly, Secondary (LH and RH)		1
9		300634	044KB139	3201126	Washer, Spring (Park Bracket)		1
10		300635	044KB108	41029	Ring, Retaining (Park Bracket)		1
11		300636	044KB136	320686	Cable Assembly, Auto Adjust		1
12		300637	044KB112	309992	Bracket, Brake Cable		1
13		300638	044KB134	304933	Spring, Anchor to Shoe, Black		1
14		300639	044KB133	310567	Spring, Anchor to Shoe, Red		1
15		300640	044KB140	3201598	Retainer, Brake Shoe Guide		1
16		300641 300642	044KB151 044KB152	315234 315235	Bracket, Link Adjust, LH Bracket, Link Adjust, RH		1 1
17		300643	044KB144	3201374	Spring, Compression Strut		1
18		300644 300645	044KB149 044KB150	3212514 3212515	Screw and Socket Assembly, LH Screw and Socket Assembly, RH		1 1
19		300646	044KB135	3203487	Spring, Auto Adjust		1
20		300647	044KB147	3206200	Cup and Spring Assembly, Hold Down		1
21		300648	044KB132	3211881	Shoe and Lining Assembly Primary (LH and RH)		1
22		300649	044KB141	351834	Connecting Link, Wheel Cylinder		2
NS		300683	044KB153	3212159	Kit, Shoe and Lining (Includes items 8 and 21)		REF
NS		300650 300651	044KB154 044KB155	3205248 3205249	Kit, Lever Assembly, Brake, LH Kit, Lever Assembly, Brake, RH (Both kits incl. items 6, 7, 9, 10, 11, 15)		REF
NS		300652	044KB156	66207	Kit, Wheel Cylinder (Seals) Repair (Kit services one wheel cylinder)		REF
NS		300653 300654	44900 44899	3212841 3212842	Kit, Drum Brake Assembly, LH Kit, Drum Brake Assembly, RH (Both kits incl. items 3, 5, 6, 7, 16, 18)		REF

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Ford C-6 Automatic Transmission Parts Manual

for

nmc
NORTHWESTERN
MOTOR CO., INC.

and

MOLLARD™

FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

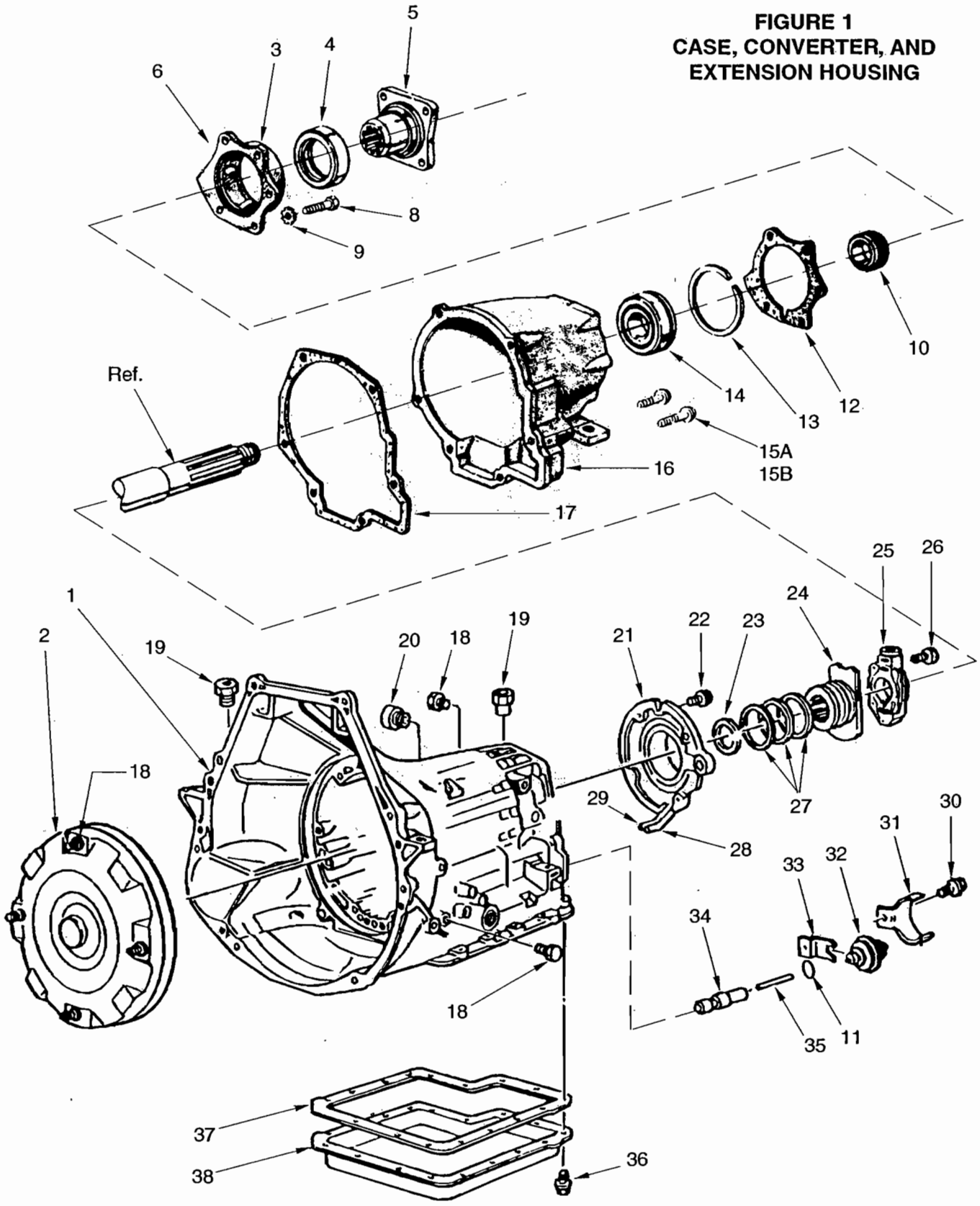

FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

Item	Airline Use	Wollard Part No.	Ford Part No.	Description	Eff	Units Per Assy
1		302281	E7TP-CA or E8TP-AA	Case Assembly, Standard Transmission or Case Assembly, Heavy Duty (used in model 100 and 140 tow tractors)		1 1
2		38792 38973	E4TP-EA or E4TP-BB	Converter Assembly, 2-speed (1.87:1) (used with case #E7TP-CA) or Converter Assembly, 3-speed (2.36:1) (used with case #E8TP-AA)		1 1
3 NS NS		302282 Comm Comm	D0TZ-7085-A 33846-S8 34944	Retainer, Rear Bearing (incl. item #4) Nut, 1/2-20 Washer, Tooth Lock, 1/2		1 4 4
4		302283	D0TZ-7A011-A	Seal, Output Shaft Oil		1
5		302284	D3TZ-7089-B	Yoke, Output		1
6		302285	C8HZ-7A002-A	Plug, Speedometer Drive Hole		1
7				NOT USED		
8		Comm	20522-S	HHCS		5
9		Comm	351487-S	Washer, Tooth Lock		5
10		302286	D1TZ-17285-A	Gear, Speedometer (used as spacer)		1
11		302287	D2AZ-7B426-A	Gasket, Throttle Control Diaphragm		1
12		302288	D0TZ-7086-A	Gasket, Bearing Retainer		1
13		302289	D5TZ-7070-A	Snap Ring, Rear Bearing		1
14		302290	8D-7065	Bearing, Rear		1
15A 15B		Comm Comm	380209-S 380207-S	HHCS, 3/8-16 x 1.25 HHCS		2 4
16		302291	D0TZ-7A039-B	Extension Assembly (includes studs)		1
17		302292	D0TZ-7086-A	Gasket, Extension Housing		1
18		302293	87650-S	Plug, Dry Seal Tapered Thread, 1/8-27"		3
19		302294 302295	E0UZ-7D273-A or D7AZ-7D273-B	Fitting, Oil, 1/4-18 male x 1/2-20 female Fitting, Oil, 1/8 male x 1/2-20 female		2 2
20		302296	D0AZ-7034-B	Vent, Case		1
21		302297	C6AZ-7C232-A	Sleeve, Oil Distributor		1
22		Comm	58618-S2	HHCS, 5/16-18 x 1.00		4
23		302298	377138-S	Ring, Retaining (copper)		1
24		302299	C7AZ-7D220-A	Body, Governor Oil Collector		1
25		302300	D8AZ-7C063-B	Body Assembly, Governor		1
25A		302301	C4AZ-7D218-B	Retainer, Governor Secondary Valve Spring (not shown)		1
26		Comm	20386-S8	HHCS		4

FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

Item	Airline Use	Wollard Part No.	Ford Part No.	Description	Eff	Units Per Assy
27		302302	C4AZ-7D011-A	Ring, Governor Housing Seal		3
28		302303	C6AZ-7D000-B	Tube, Outlet, Oil Distributor		1
29		302304	C6AZ-7D000-A	Tube, Inlet, Oil Distributor		1
30		Comm	56119-S	Screw, Hex Flange Hd, 5/16-18 x 0.82		1
31		302305	F1TZ-7F013-A	Shield, Modulator Heat		1
32		302307 302308 302309	D4TZ-7A377-A or D7OZ-7A377-A or D8AZ-7A377-A	Diaphragm Assy, Throttle Valve (Black Band-SAD) or Diaphragm Assy, Throttle Valve (Green Band-SAD) or Diaphragm Assy, Throttle Valve (Altitude Compensating)		1
33		302310	D3AZ-7F006-B	Clip, Diaphragm Retainer		1
34		302311	D5AZ-7D080-A	Valve, Transmission, Primary Throttle		1
35		302312	8DAZ-7A380-A	Rod Kit, Throttle Control		1
36		Comm	378782-S	HHCS, 5/16-18 x 9/16		17
37		37920	C6AZ-7A191-B	Gasket, Oil Pan		1
38		302313	E5TZ-7A194-D	Pan, Oil		1

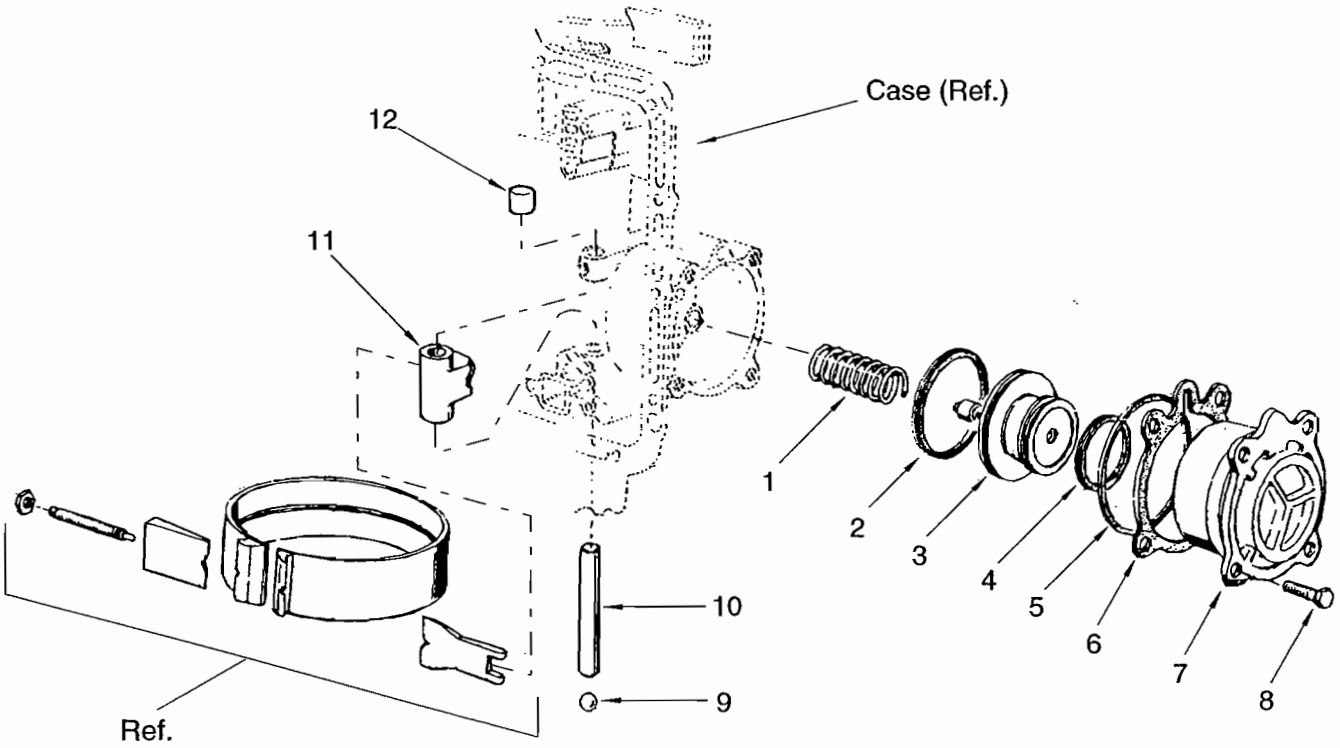

FIGURE 2
INTERMEDIATE SERVO AND BAND

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1		302314 302315 302316	C8SZ-TD028-B D1AZ-7D028-A D6OZ-7D028-A	Spring, Intermediate Band Servo (Yellow) Spring, Intermediate Band Servo (Brown) Spring, Intermediate Band Servo (Pink)		1
2		302317	D5TZ-7D024-B	Seal, Intermediate Band Servo Cover		1
3		302318	D5UZ-7D021-B	Piston Assy, Intermediate Band Servo		1
4		302319	C6AZ-7D025-A	Seal, Intermediate Brake Drum		1
5		302320	D5TZ-7D024-B	Seal, Intermediate Band Servo Cover		1
6		302321	D4AZ-7D026-A	Gasket, Inter. Band Servo Cover		1
7		302322	D3AZ-7D027-A	Cover, Intermediate Band Servo		1
8		Comm	57633-S2	HHCS, 5/16-18 x 0.75		4
9		302323	353079-S	Ball, 1/2"		1
10		302324	C6AZ-7D433-A	Shaft, Intermediate Band Actuating Lever		1
11		302325	C6AZ-7330-B	Lever, Intermediate Band Servo		1
12		302326	C7AZ-7E206-A	Retainer, Intermediate Band Servo Lever		1

FIGURE 3
VALVE BODY ASSEMBLY

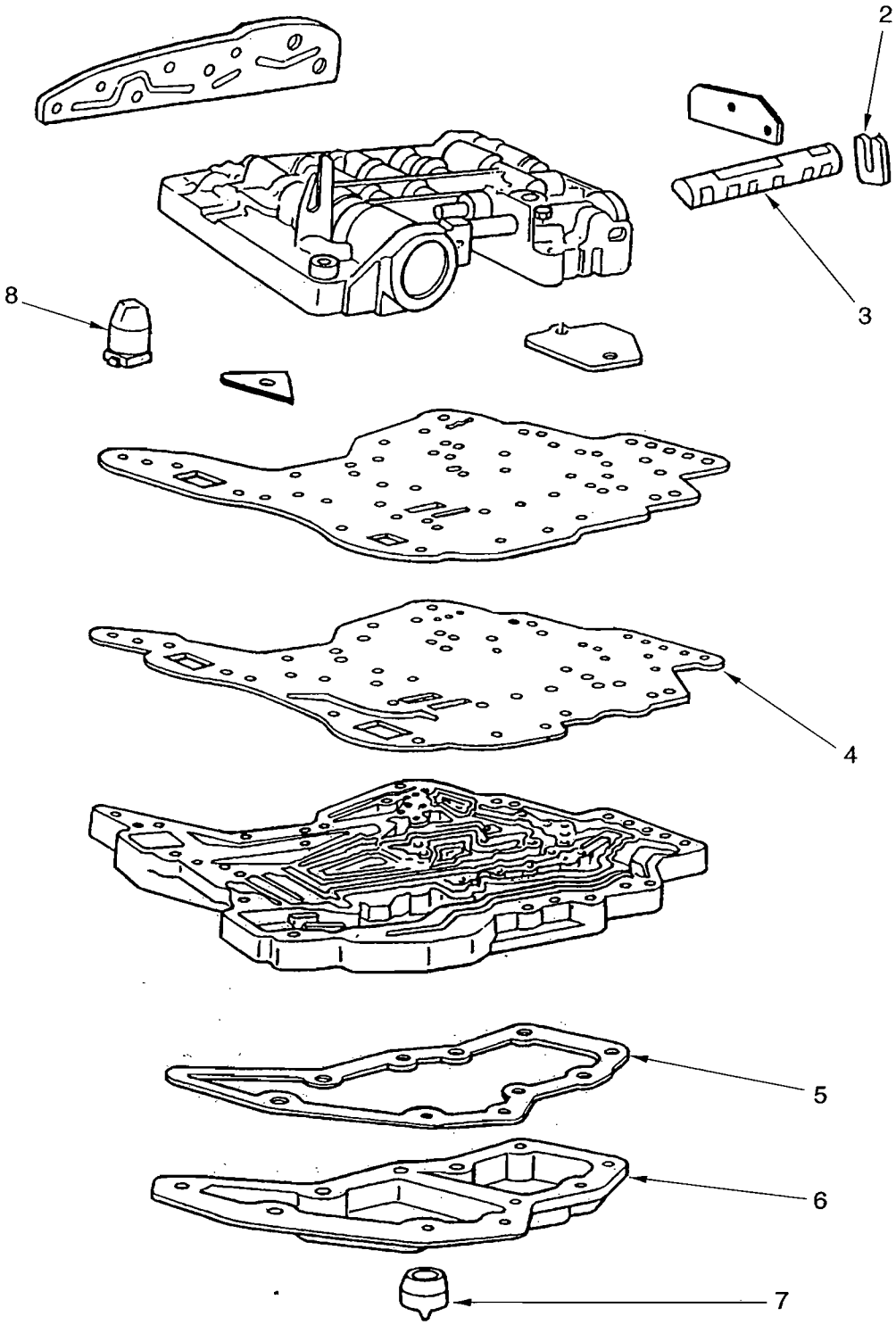

FIGURE 3
VALVE BODY ASSEMBLY

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1		302327	E0FP-7A100-BA or E0FP-7A100-AA	Valve Body, Main Control Assy (2-speed) (Includes items shown but not called out) or Valve Body, Main Control Assy (3-speed) (Includes items shown but not called out)		1 1
2		302328	C4AZ-7D227-A	Spacer, Throttle Pressure Valve		1
3		302329	E0TZ-7326-D	Rod, Gear Selector Valve		1
4		302330	6DAZ-7D100-A	Gasket, Valve Body Separator Plate		1
5		302331	C6AZ-7E062-A	Gasket, Oil Pan Screen		1
6		NW34532	D5AZ-7A098-B	Screen, Oil Pan (includes item #5)		1
7		320332	D3TZ-7A102-A	Tube, Lower Valve Body Suction		1
8		302333	D0AZ-7E387-A	Screen, Main Control Pump Inlet		1

FIGURE 4
THROTTLE AND MANUAL CONTROL LINKAGE

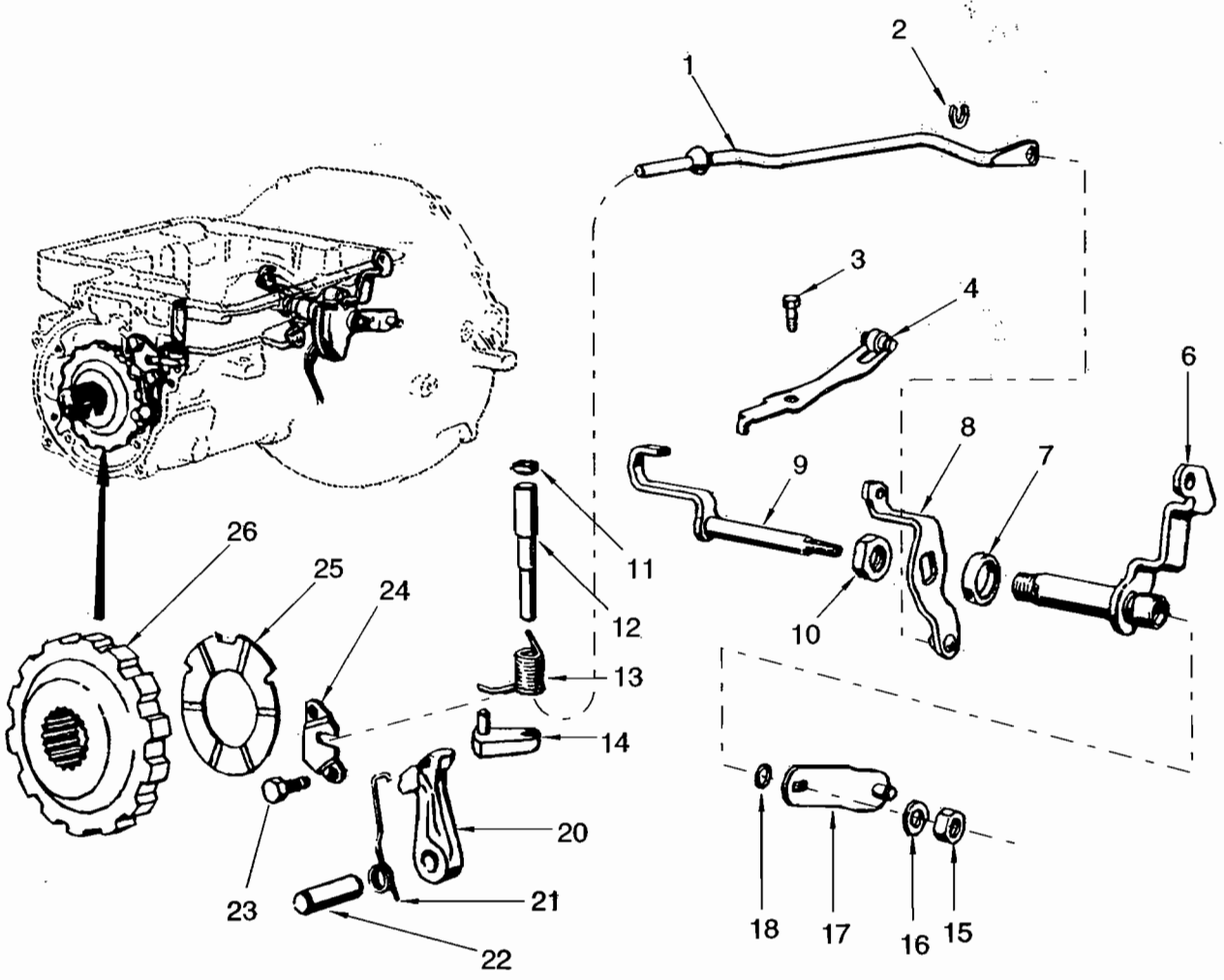

FIGURE 4
THROTTLE AND MANUAL CONTROL LINKAGE

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
1		302334	F0TZ-7D411-A	Rod, Parking Pawl Actuating (Includes item #24)		1
2		Comm	97411-S	Retainer		1
3		Comm	376562-S	Screw		1
4		302335	E0TZ-7A261-A	Spring, Manual Control Valve Detent Lever		1
5				NOT USED		1
6		302336	D2ZP-7A256-AB	Lever Assembly, Manual Control		1
7		302337	D5AZ-7B498-A	Seal Assy., Manual Control Lever		1
8		302338	E0TZ-7A115-A	Lever Assy., Manual Control Valve Detent		1
9		302339	D0AZ-7D261-B	Lever Assy., Downshift Detent Inner		1
10		Comm	33945-S	Nut		1
11		302340	EAA 6572-A	Cup, Parking Plate Shaft		1
12		302341	C6AZ-7D418-A	Shaft, Parking Plate		1
13		302342	C9AZ-7D417-A	Spring, Parking Brake Torsion		1
14		302343	C9AZ-7D414-A	Plate Assy (Includes item #13)		1
15		Comm	33798-S	Nut		1
16		Comm	34806-S7	Washer, Lock		1
17		302344	D0OZ-7A394-B	Lever, Downshift Control Outer		1
18		302345	386078-S	Seal		1
19				NOT USED		
20		302346	E0TZ-7A441-A	Pawl, Parking		1
21		302347	C6AZ-7D070-B	Spring, Parking Pawl Return		1
22		302348	C6AZ-7D071-A	Shaft, Parking Pawl Return		1
23		Comm	379058-S7-8	Screw and Washer		1
24		NSS	E0AP-7D419-BA	Plate (See item #1)		1
25		302349	D3TZ-7B368-A	Washer, Output Shaft Thrust Rear		1
26		302350	D6TZ-7A233-A	Gear, Output Shaft (Incl. item #25)		1

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

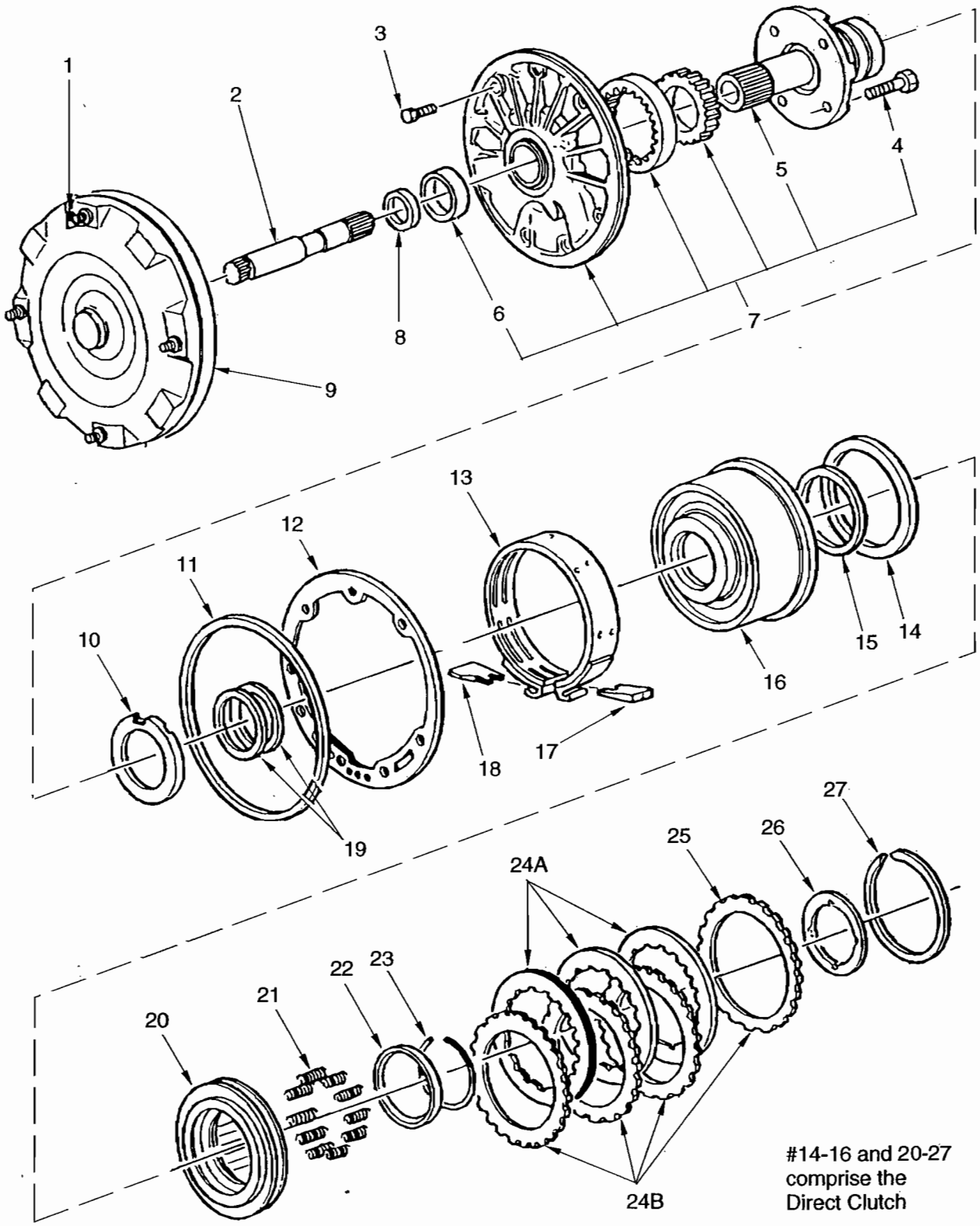

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

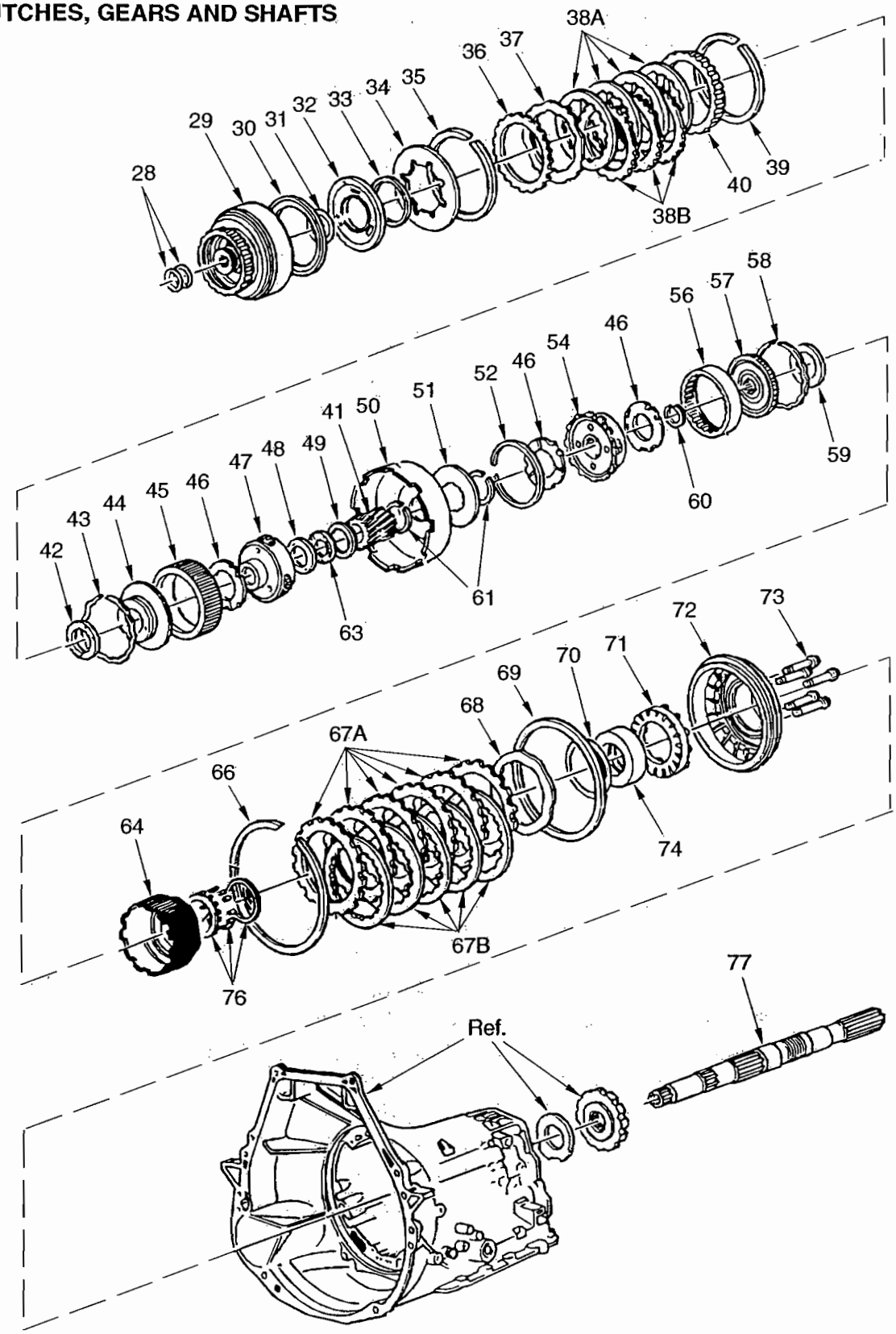

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
1		302351	87650-S2	Plug, Dry Seal Tapered Thread, 1/8-27		1
2		302352	D2AZ-7017-A	Shaft, Input		1
3		Comm	58619-S2	HHCS, 5/16-18 x 1.25		7
4		Comm	20346-S8	HHCS, 5/16-18 x 0.75		5
5		302353	C9AZ-7A108-A	Support Assy., Front Pump		1
6		302354	C6AZ-7B258-A	Bushing, Front Oil Pump		1
7		302355	C8AZ-7A103-B	Pump Assembly, Front Oil		1
8		302356	C2AZ-7A248-A	Seal Assy., Front Oil Pump, Small		1
9		38792	E4TP-EA	Torque Converter Assembly		Ref
10		302357		Washer, Front Pump Support Thrust:		
			C6AZ-7D014-A	#1, 0.057" thick		1
			C6AZ-7D014-B	#2, 5/64" thick		1
			C6AZ-7D014-C	#3, 3/32" thick		1
			C6AZ-7D014-D	#4, 0.114 thick		1
			C6AZ-7D014-E	#5, 0.119 thick		1
11		300134	C6AZ-7A248-B	Seal Assy., Front Oil Pump, Large		1
12		302358	C6AZ-7A136-A	Gasket, Front Oil Pump to Case		1
13		302359	D9AZ-7D034-B	Band Assy, Intermediate Servo		1
14		302360	C8AZ-7A548-C	Seal, Direct Clutch Piston Oil		1
15		302361	C8AZ-7C099-A	Seal, Clutch Piston Oil		1
16		302362	C9AZ-7D044-A	Drum Assembly, Intermediate Brake (Incl. Item #15)		1
17		302363	C6AZ-7D430-C	Strut, Intermediate Band Anchor		1
18		302364	C6AZ-7D029-C	Strut, Intermediate Brake Band		1
19		302319	C6AZ-7D025-A	Seal, Interm. Band Servo Piston Cover		2
20		302365	C9AZ-7A262-B	Piston Assy, Direct Clutch		1
21		302366	C7ZZ-7B488-A	Spring, Direct Clutch Piston		10
22		302367	C6AZ-7A527-A	Retainer, Direct Clutch Piston Spring		1
23		302368	377136-S	Ring, Retaining		1
24A		302369	D6AZ-7B164-B	Plate, Direct Clutch, Internal (Friction)		A/R
24B		302370	C6AZ-7B442-A	Plate, Direct Clutch, External		A/R
25		302371	C6AZ-7B066-B	Plate, Clutch Pressure		1
26		302372	C6AZ-7C096-A	Washer, Thrust		1
27		NSS		Ring, Retaining (See item #39)		1
28		302373	E0AZ-7D019-A	Seal, Forward Clutch Cylinder		2

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
29		302374	E9AZ-7A360-A	Cylinder Assy., 8-Plate Clutch Forward (Includes item #34) Note: If replacing a 6-plate clutch, you must use an additional item #24A and B)		1
30		302375	D6AZ-7A548-A	Seal, Forward Clutch Piston Oil, Outer		1
31		302376	377130-S94	Seal, Forward Clutch Piston Oil, Inner		1
32		302377	D6AZ-7A262-A	Piston Assembly, Forward Clutch		1
33		302378	C6AZ-7D256-B	Ring, Forward Clutch Piston Spring		1
34		302379	D9AZ-7B070-A	Spring, Forward Clutch Piston Disc		1
35		302380	377127-S	Ring, Retainer, 6-21/32" x 0.076" thick		1
36		302381	C6AZ-7B066-A	Plate, Clutch Pressure (has triangle depression on front face)		1
37		302382	D6AZ-7E085-B	Spring, Clutch Pressure, Forward (4 teeth in 26-tooth bank)		1
38A 38B		302383 302370	C8AZ-7B164-H C6AZ-7B442-A	Plate, Front Clutch, Internal (Friction) Plate, Front Clutch, External (Steel)		A/R A/R
39		302384	 377126-S 377127-S 377128-S 377437-S 377444-S 386841-S 386842-S	Ring, Retaining (Select fit): 6-21/32" dia. x 0.062" thick 6-21/32" dia. 0.076" thick 6-21/32" dia. 0.090" thick 0.058" thick (forward clutch) 0.094" thick (forward clutch) 7-7/64" dia. x 0.112" thick 7-7/64" dia. x 0.130" thick		A/R
40		302385	C6AZ-7D066-B	Washer, Input Shell Thrust, 3-3/4" x 3/64"		1
41		302386	C6AZ-7D063-A	Gear Assembly, Sun (34 teeth)		1
42		302387	C9AZ-7D090-A	Washer, Froward Clutch Hub Thrust		1
43		302388	377132-S	Ring, Retaining, 4-21/32"		1
44		302389	D6AZ-7B067-A	Hub, Clutch, Forward Ring Gear, 4-1/2"		1
45		302390	D6AZ-7D392-A	Gear, Forward Ring		1
46		302391	C6AZ-7A166-A	Thrust Washer, Forward Planet Carrier		1
47		302392	D5AZ-7A398-A	Planet Assy, Forward		1
48		302393	C6AZ-7D236-A	Race, Sun Gear Thrust Bearing (Front)		1
49		302394	C6AZ-7D235-A	Race, Sun Gear Thrust Bearing (Rear)		1
50		302395	C6AZ-7D064-A	Shell, Input		1
51		302396	C6AZ-7D066-B	Washer, Input Shell Thrust, 3-3/4 x 3/64		1
52		302397	377155-S	Ring, Retaining, 5-7/32"		1
53				NOT USED		
54		302398	C6AZ-7D006-B	Planet Assembly, Reverse		1
55				NOT USED		

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
56		302399	C6AZ-7A153-A	Gear Ring (74 teeth)		1
57		302400	C9AZ-7D164-A	Hub, Output Shaft		1
58		302388	377132-S	Ring, Retaining, 4-21/32"		1
59		302401	C9AZ-7D422-A	Thrust Washer, Output Shaft Hub		1
60		302402	387031-S5	Ring, Retaining, Copper, 5/64" thick		1
61		302403	377300-S	Ring, Retaining, 2"		2
62				NOT USED		
63		302404	C6AZ-7D234-A	Bearing Assembly, Sun Gear Thrust		1
64		302405	C6AZ-7B067-B	Hub, Clutch, Reverse, 5-1/2"		1
65				NOT USED		
66		302406	385044-S	Ring, Retaining, 7-1/8"		1
67A 67B		302407 302408	D6AZ-7B164-A C6AZ-7B442-B	Plate, Reverse Clutch, Internal (friction) Plate, Reverse Clutch, External (steel)		A/R A/R
68		302409	D8AZ-7E085-A	Spring, Clutch Pressure, Reverse, 6-7/8"		1
69		302410	C8AZ-7D403-A	Seal, Outer, Reverse Clutch Piston		1
70		302411	C7AZ-7D404-A	Seal, Inner, Reverse Clutch Piston		1
71		302412	D6AZ-7D406-A	Retainer and Spring, Reverse Clutch		1
72		302413	D8AZ-7D402-A	Piston Assembly, Reverse Clutch (Includes item #68)		1
73		302414	C6AZ-7D167-A	HHCS, Overrunning Clutch Case, 5/16-24 x 2.00		5
74		302415	C9AZ-7D171	Race, Inner, Overrunning Clutch		1
75				NOT USED		
76		302416	D0AZ-7A089-A	Clutch Assembly, Overrunning		1
77		302417	D6TZ-7060-A	Shaft, Output		1

FIGURE 6
FLYWHEEL AND OIL FILLER

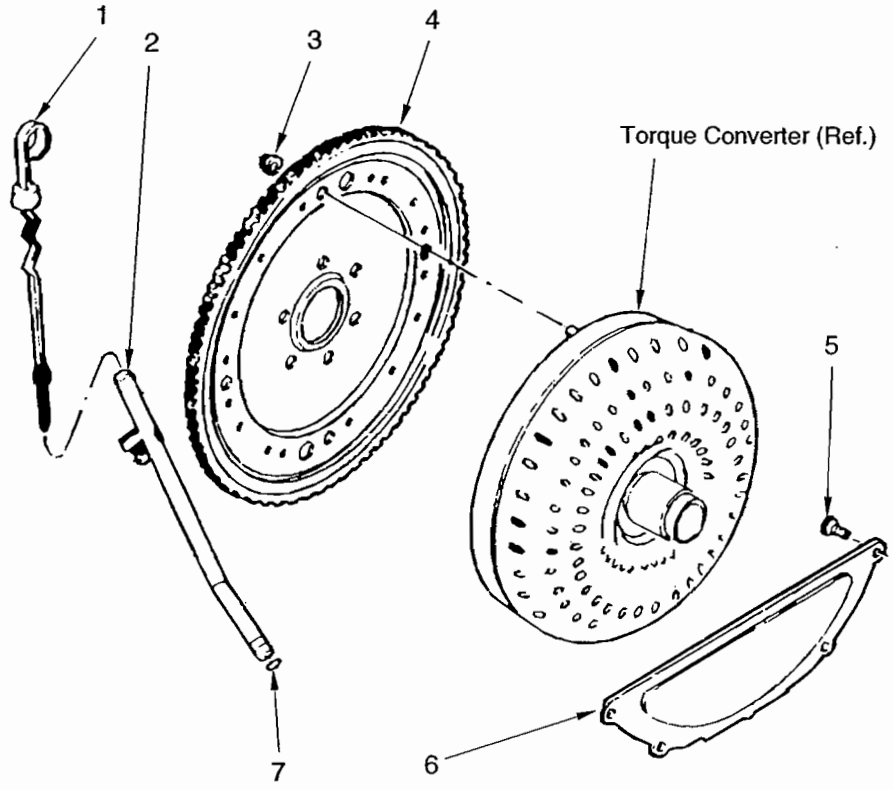

FIGURE 29F
FLYWHEEL AND OIL FILLER

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1			Numerous types-Call with description.	Indicator, Oil Level		1
2				Tube Assembly, Oil Filler		1
3		Comm	378941-S7-8	Nut, Flywheel		4
4		302418	D5TZ-6375-A	Flywheel		1
5		Comm	57632-S2	HHCS		4
6		302419	D10Z-7986-A	Cover, Converter Housing		1
7		302420	87034-S94	Seal, Oil Filler Tube		1
8		302296	D0AZ-7034-B	Vent, Case		1

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C-6 TRANSMISSION SERVICE

Available: Ford C-6 Automatic Transmission Service Manual

Wollard P/N 302157

(Ford P/N PPD 194-296)

C-6 AUTOMATIC TRANSMISSION

Removal and installation procedures are included in the event the transmission must be replaced or sent to a specialized repair facility.

The Ford C6 transmission combines a torque converter with a two-speed, fully automatic unit for transmitting engine torque to the drive axle via a drive shaft. Maintenance is limited to changing the fluid and filter at the recommended service intervals and adjusting the linkage, intermediate band, and neutral start switch.

Malfunctions

Automatic transmission malfunctions may be caused by poor engine performance or improper transmission adjustments.

You should always begin by checking engine performance, then fluid level and condition, and gearshift cable adjustment.

If the problem exists after these checks and adjustments are completed, remove unit from service and refer the transmission to a transmission repair facility.

⚠CAUTION If you ever notice unusual noises such as gear noise or grinding, a buzz or whine, knocks, scraping, clicking, etc., remove the unit from service and refer it to a transmission repair facility.

Towing the Unit

⚠CAUTION Tow the unit with the rear end picked up or with the drive shaft disconnected or the transmission will be damaged.

IN AN EMERGENCY, the unit may be towed without lifting the wheels or disconnecting the drive shaft **IF:**

- Engine is running AND transmission is in neutral.
- Towing distance must be LESS THAN 1 MILE and travel speed LESS THAN 5 M.P.H.

Important! Failure to follow these instructions will void the warranty.

Fluid Level and Condition

1. Bring transmission to normal operating temperature (about 180°F). Five minutes of driving, including frequent stops and starts, will usually produce normal fluid temperature.
2. Set gear selector to neutral (N) and withdraw transmission dipstick to check oil level.

⚠CAUTION Always check oil level with unit on a level surface and WITH FLUID AT NORMAL OPERATING TEMPERATURE.

DO NOT OVERFILL TRANSMISSION. Overfilling can result in transmission damage. It is easy to overfill the transmission. To avoid overfilling, add oil in small amounts and recheck level frequently.

3. Withdraw dipstick and examine fluid for discoloration and a foul (burned) smell. This would indicate damaged bands or clutches. If oil has a milky look, water has entered the transmission. Air bubbles mean there is an air leak in the suction lines. Report any of these conditions to your supervisor.
4. Check level indicated on dipstick. Add fluid as needed to maintain level between "FULL" and "ADD 1 PINT" marks on the dipstick. Use type Dexron R2.

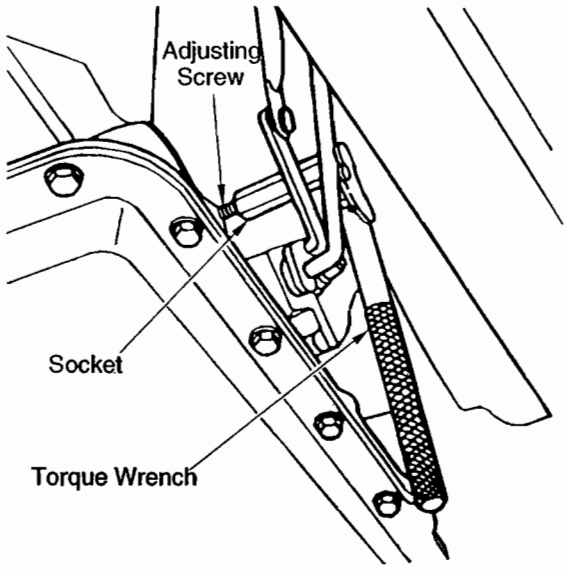
Transmission Adjustments

Most repair facilities can perform intermediate band and neutral start switch adjustments.

Intermediate Band Adjustment

⚠ CAUTION **When making band adjustments, FOLLOW SPECIFICATIONS EXACTLY. Failure to do so may cause serious damage to the transmission.**

1. Raise unit on jack stands or a hoist.
2. Clean dirt from band adjusting screw. Remove and discard locknut.
3. Install a new locknut and tighten adjusting screw to 10 ft/lbs. torque.
4. Back off adjusting screw exactly 1 1/2 turns.
5. Hold adjusting screw from turning and tighten locknut to 35-40 ft/lbs.
6. Lower the unit.



Adjusting the Intermediate Band

Neutral Start Switch

The neutral start switch is a safety device that prevents the engine from starting if the transmission is in any shift position other than NEUTRAL.

Adjusting the Neutral Start Switch

Note: The neutral start switch may also be checked by attempting to start the engine with the gear shift lever in each shift position.

This switch is a combination unit located on the automatic transmission shifter shaft in the engine package.

1. Remove clevis pin holding shifter arm to cable clevis.
2. Connect a volt-ohm meter (on resistance range) or a continuity tester across both Red/Blue wires coming out of the switch.
3. Loosen hold-down bolts on switch and rotate switch until contact opens for the same throw of shifter arm either side of Neutral.
4. Retighten switch bolts and recheck adjustment.
5. Replace clevis pin.

Replacing the Neutral Start Switch

1. Remove neutral start switch from transmission case. Catch fluid in a clean container.
2. Move control lever to NEUTRAL position. Check to see that the switch operating lever finger is centered in switch opening in transmission case.
3. Install switch and tighten to 24 ft./lbs torque. Readjust switch.

Important! Be sure the switch packing is properly installed to prevent oil leakage.

4. Add fluid to transmission if needed.

Transmission and Torque Converter Removal

⚠CAUTION **The drive plate (flywheel) will not support a load. None of the weight of the transmission must be allowed to rest on the drive plate during removal or installation.**

⚠CAUTION **The transmission and torque converter must be removed and installed as an assembly to prevent damage to the front bushing or front oil seal.**

1. Remove the engine/transmission assembly.
2. Shift transmission into NEUTRAL. Place drain pan under transmission fluid pan. Starting at rear of pan and working toward front, loosen attaching bolts and allow fluid to drain. Finally remove all of pan attaching bolts except two at front to allow fluid to further drain. With fluid drained, install two bolts on rear side of pan to temporarily hold it in place.
3. Remove converter drain plug access cover from lower end of converter housing. Matchmark torque converter with drive plate (for easier installation).

⚠CAUTION **Do not attempt to rotate the drive plate or torque converter by prying or using force or you will damage the drive plate.**

4. Remove converter-to-flywheel attaching nuts. Place a wrench on crankshaft pulley attaching bolt to turn converter to gain access to bump switch.
5. With wrench on crankshaft pulley attaching bolt, turn converter to gain access to converter drain plug. Place a drain pan under converter to catch fluid and remove plug. After fluid has been drained, re-install plug.
6. Remove capscrew and self-locking nut securing transmission shift cable to shift lever on transmission.
7. Remove all hardware securing transmission shift cable to transmission and free the cable.
8. Disconnect hydraulic lines at transmission.
9. Disconnect park brake cable. Disconnect driveshaft and slide shaft rearward from transmission. Install a seal installation tool in extension housing to prevent fluid leakage.
10. Remove vacuum hose from vacuum diaphragm unit. Remove vacuum line from retaining clip.
11. Remove transmission rear support and insulator assembly attaching bolts at bottom rear of transmission.

12. Raise transmission with transmission jack to take pressure off rear crossmember.
13. Secure transmission to jack with safety chain.
14. Remove converter housing-to-engine attaching bolts.
15. Move transmission away from engine.
16. Lower transmission jack and move transmission and converter assembly from under vehicle.

Note: This manual does not cover transmission disassembly. Disassembly must be done by specialized personnel.

Transmission/Torque Converter Installation

⚠CAUTION The transmission must be installed as an assembly, or the front pump bushing and oil seal will be damaged.

Do not allow the weight of the transmission to rest on the drive plate during installation. The drive plate will not support a load.

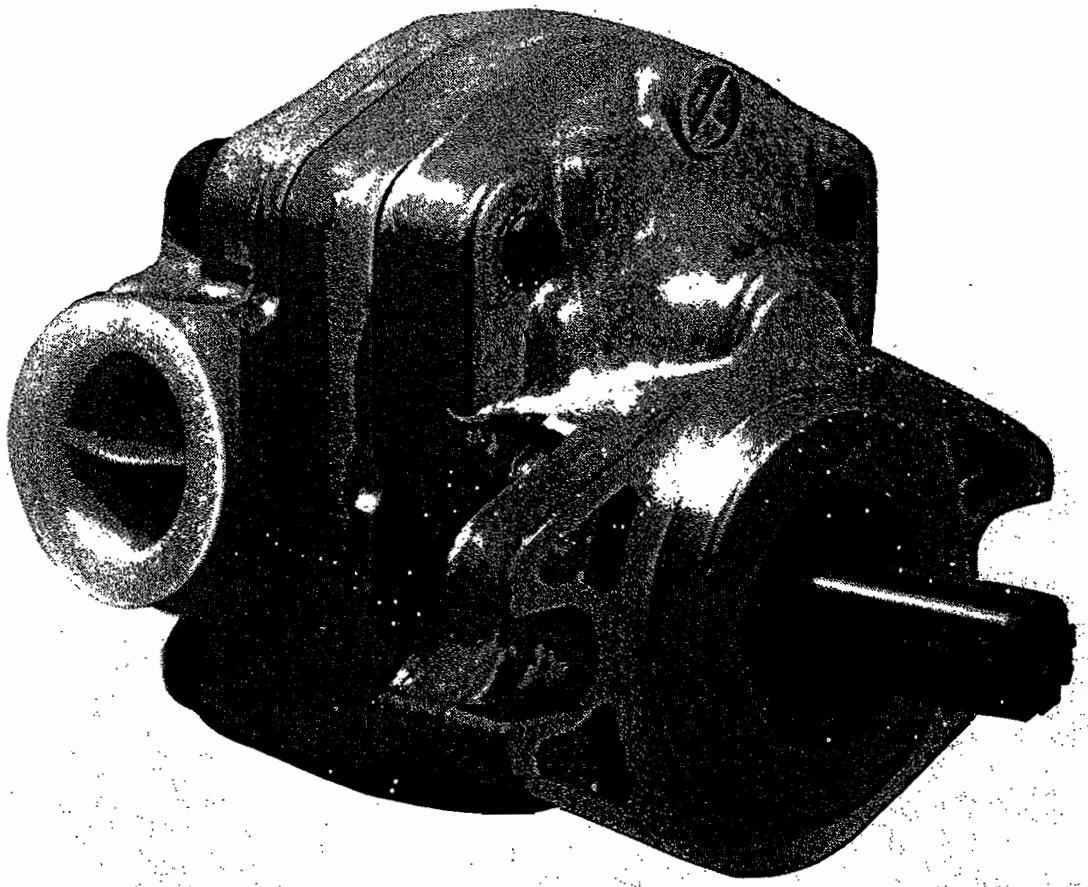
1. Tighten converter drain plug to 18-28 ft-lbs.
2. Position converter on transmission, making sure converter drive flats are fully engaged in pump gear.
3. With converter properly installed, place transmission on jack. Secure transmission to jack with chain and place under tractor.
4. Raise transmission to align with engine.
5. Rotate converter until studs, drain plug and matchmark are in alignment with flywheel.
6. The converter must rest squarely against flywheel. This indicates that converter pilot is not binding in engine crankshaft.Do not allow converter drive flats to disengage from pump gear. Move converter and transmission assembly forward into position, using care not to damage the flywheel and converter pilot.
7. Install and tighten converter housing-to-engine attaching bolts to 40-50 ft-lbs.
8. Remove transmission jack safety chain from around transmission.
9. Position transmission support crossmember to frame side rails and tighten attaching bolts.
10. Position transmission rear support and insulator assembly above crossmember and lower transmission into place. Install mounting bolts and tighten.

11. Remove jack.
12. Connect vacuum line to vacuum diaphragm making sure that line is in retaining clip.
13. Connect oil cooler lines to transmission.
14. Connect downshift and manual linkage rods or cable controls to their respective levers on the transmission.
15. Secure converter-to-flywheel attaching nuts and tighten them to 20-30 ft-lbs.
16. Install converter housing access cover and secure it with attaching bolts.
17. Install new filter and pan gasket, and fill transmission with oil.
18. Connect neutral switch wire to plug connector.
19. Connect temperature sender wire.
20. Connect oil cooler lines to transmission and install oil filler tube.
21. Install dust shield in front of converter assembly.
22. Install engine/transmission assembly into the unit.
23. Connect the battery negative cable.
24. Place gear shift lever in neutral position. Install gear shift cable.
25. Connect wires to neutral starting switch and temperature sending unit.
26. Install park brake cable.
27. Adjust shift cable as required.
28. Start engine and again check for leaks.

TYRONE®

DANA

P12 SERIES



Service Instructions

Mobile Fluid Products Division • Dana Corporation • P.O. Box 511 • Corinth, MS 38834
Mobile Fluid Products Division • Dana Corporation • P.O. Box 25000 • Greenville, SC 29616

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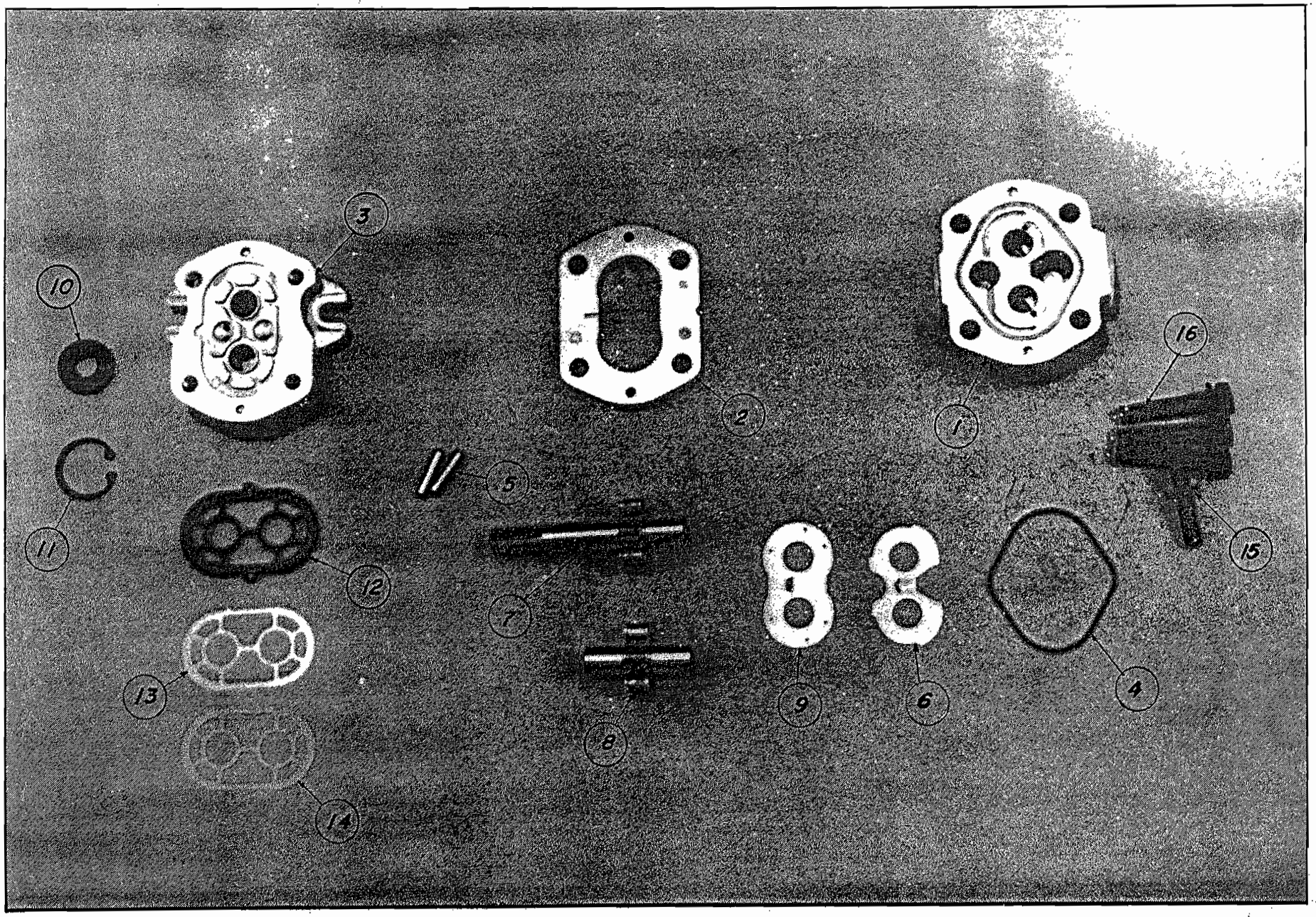


P12 PUMPS

PARTS IDENTIFICATION — P12 PUMP

EM NO.	NAME OF PART	ITEM NO.	NAME OF PART
1	COVER PLATE	28	
2	GEAR PLATE	29	
3	FLANGE PLATE	30	
4	O-RING	31	
5	DOWELS	32	
6	REAR THRUST PLATE	33	
7	DRIVE GEAR	34	
8	IDLER GEAR	35	
9	FRONT THRUST PLATE	36	
10	SHAFT SEAL	37	
11	SNAP RING	38	
12	GASKET (Rubber)	39	
13	PAPER BACKUP	40	
14	NYLON BACKUP	41	
15	WASHERS	42	
16	HEXHEAD CAPSCREWS	43	
17		44	
18		45	
19		46	
20		47	
21		48	
22		49	
23		50	
24		51	
25		52	
26		53	
27		54	

PUMP	PART NAME	PART NO.	QUANTITY REQUIRED
P12 — 17	GEAR PLATES	33549	1
P12 — 22	GEAR PLATES	33550	1
P12 — 28	GEAR PLATES	33551	1
P12 — 34	GEAR PLATES	33552	1
P12 — 40	GEAR PLATES	33553	1
P12 — 45	GEAR PLATES	33554	1
P12 — 17	DRIVE GEARS (CATALOG NO. 1)	33573	1
P12 — 22	DRIVE GEARS (CATALOG NO. 1)	33574	1
P12 — 28	DRIVE GEARS (CATALOG NO. 1)	33575	1
P12 — 34	DRIVE GEARS (CATALOG NO. 1)	33576	1
P12 — 40	DRIVE GEARS (CATALOG NO. 1)	33577	1
P12 — 45	DRIVE GEARS (CATALOG NO. 1)	33578	1
P12 — 17	DRIVE GEARS (CATALOG NO. 4)	33579	1
P12 — 22	DRIVE GEARS (CATALOG NO. 4)	33580	1
P12 — 28	DRIVE GEARS (CATALOG NO. 4)	33581	1
P12 — 34	DRIVE GEARS (CATALOG NO. 4)	33582	1
P12 — 40	DRIVE GEARS (CATALOG NO. 4)	33583	1
P12 — 45	DRIVE GEARS (CATALOG NO. 4)	33584	1
P12 — 17	IDLER GEARS (FOR NO. 1 SHAFT)	33585	1
P12 — 22	IDLER GEARS (FOR NO. 1 SHAFT)	33586	1
P12 — 28	IDLER GEARS (FOR NO. 1 SHAFT)	33587	1
P12 — 34	IDLER GEARS (FOR NO. 1 SHAFT)	33588	1
P12 — 40	IDLER GEARS (FOR NO. 1 SHAFT)	33591	1
P12 — 45	IDLER GEARS (FOR NO. 1 SHAFT)	33592	1
P12 — 17	IDLER GEARS (FOR NO. 4 SHAFT)	33585	1
P12 — 22	IDLER GEARS (FOR NO. 4 SHAFT)	33586	1
P12 — 28	IDLER GEARS (FOR NO. 4 SHAFT)	33587	1
P12 — 34	IDLER GEARS (FOR NO. 4 SHAFT)	33588	1
P12 — 40	IDLER GEARS (FOR NO. 4 SHAFT)	33589	1
P12 — 45	IDLER GEARS (FOR NO. 4 SHAFT)	33590	1
P12 — 17	DOWEL PINS	33562	2
P12 — 22	DOWEL PINS	33563	2
P12 — 28	DOWEL PINS	33564	2
P12 — 34	DOWEL PINS	33565	2
P12 — 40	DOWEL PINS	33566	2
P12 — 45	DOWEL PINS	33567	2
P12 — 17	BOLT & WASHER	33568	4
P12 — 22	BOLT & WASHER	33569	4
P12 — 28	BOLT & WASHER	33569	4
P12 — 34	BOLT & WASHER	33570	4
P12 — 40	BOLT & WASHER	33571	4
P12 — 45	BOLT & WASHER	33571	4
	FLANGES (CATALOG NO. K) 'A' ROTATION	33555	1
	FLANGES (CATALOG NO. K) 'C' ROTATION	33556	1
	COVER PLATES (CATALOG NO. 5)	33557	1
	COVER PLATES (CATALOG NO. 6)	33558	1

PARTS COMMON TO ALL UNITS

PART NAME	PART NO.	QUANTITY REQUIRED
PRESSURE PLATE (TOP)	33559	1
PRESSURE PLATE (BOTTOM)	33560	1
SEAL KIT	33548	1
SNAP RING	33595	1
BUSHINGS	33561	4

DISASSEMBLY AND ASSEMBLY INSTRUCTIONS FOR P12

DISASSEMBLY INSTRUCTIONS

1. Clean outside of pump thoroughly. (Fig. 1)

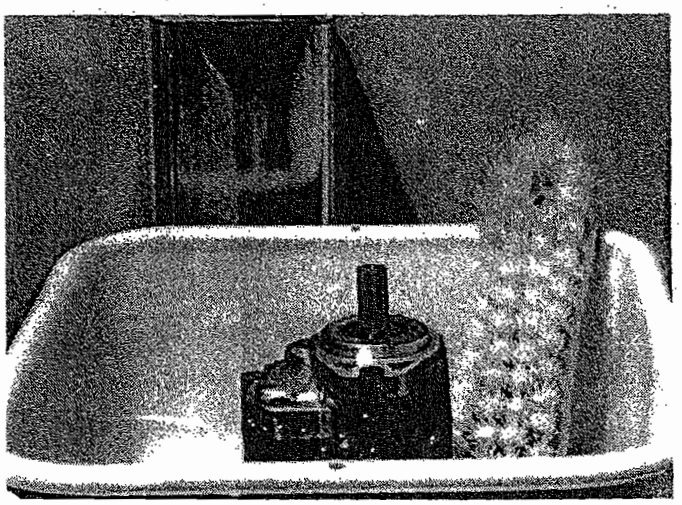


Fig. 1

2. Mark the pump plates on the side nearest to the drive shaft extension. These marks can be matched in the reassembly of the pump. (Fig. 2)

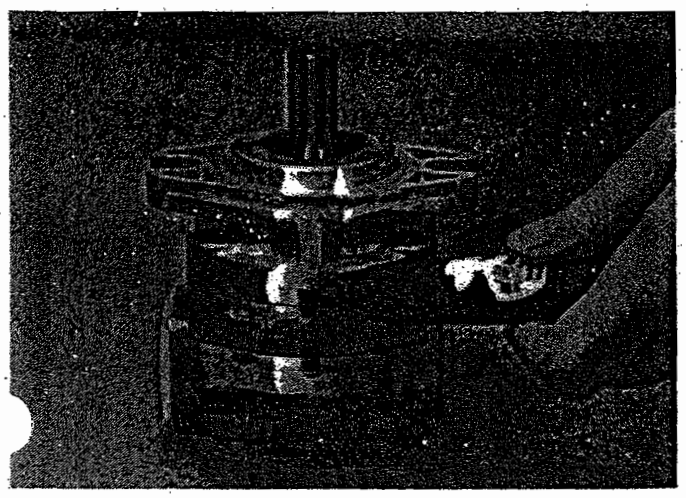


Fig. 2

3. Place pump in a machinist's vise, with hex-head capscrews up. Use cardboard between jaws of vise and sides of the pump. This will prevent marring or damaging the machined surfaces of the pump plates. (Fig. 3)

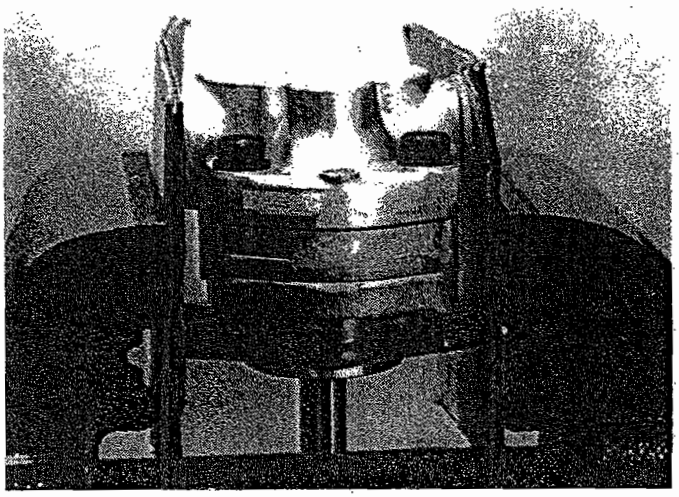


Fig. 3

4. Use 14 mm box-end wrench or socket, loosen and remove hexhead capscrews (Item 16) and washers (Item 15). (Fig. 4)

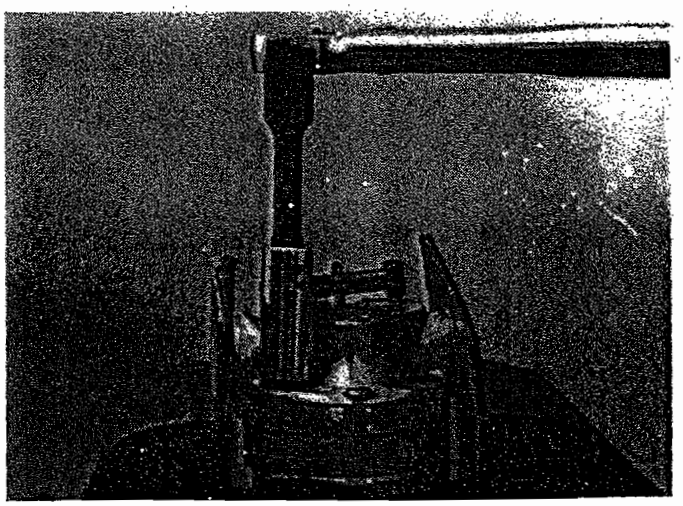


Fig. 4

5. Remove pump from vise and place on work bench.

6. Hold the pump with one hand and tap ears of flange plate (Item 3). This will loosen flange for removal. (Fig. 5)

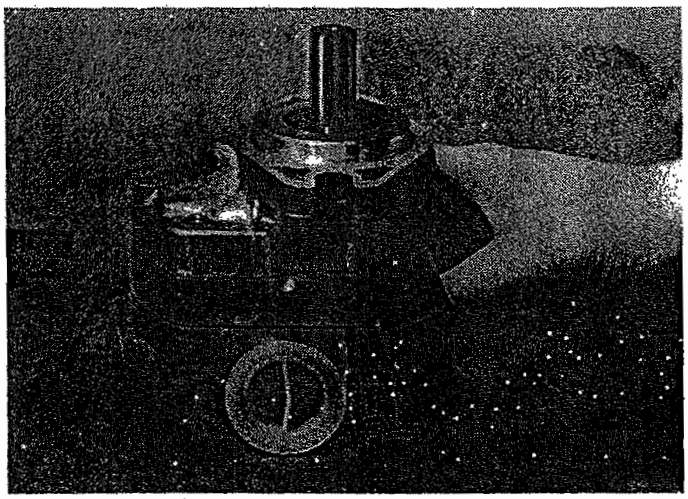


Fig. 5

7. After flange has been removed, remove nylon backup (Item 14), paper backup (Item 13), and rubber gasket (Item 12). (Fig. 6)

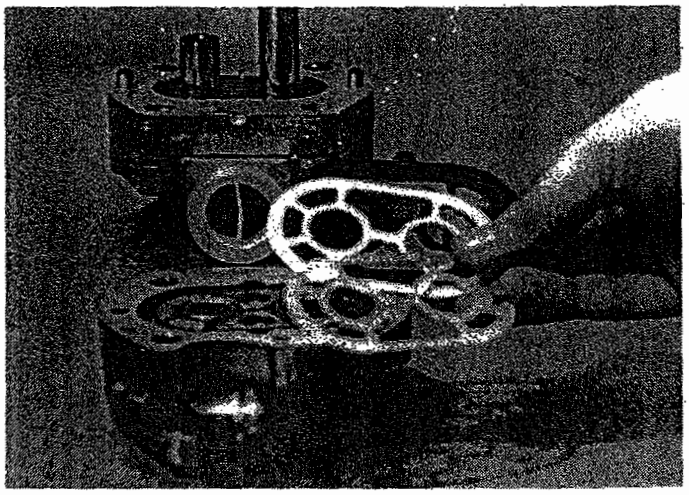


Fig. 6

8. Remove front thrust plate (Item 9), drive gear (Item 8), and idler gear (Item 7). (Fig. 7)

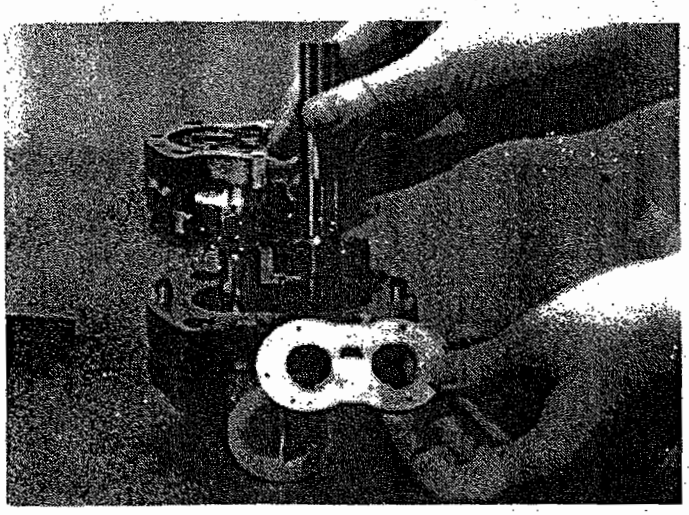


Fig. 7

9. Hold the gear plate (Item 2) and tap suction and discharge bosses on cover plate (Item 1) with a plastic hammer to loosen. (Fig. 8)

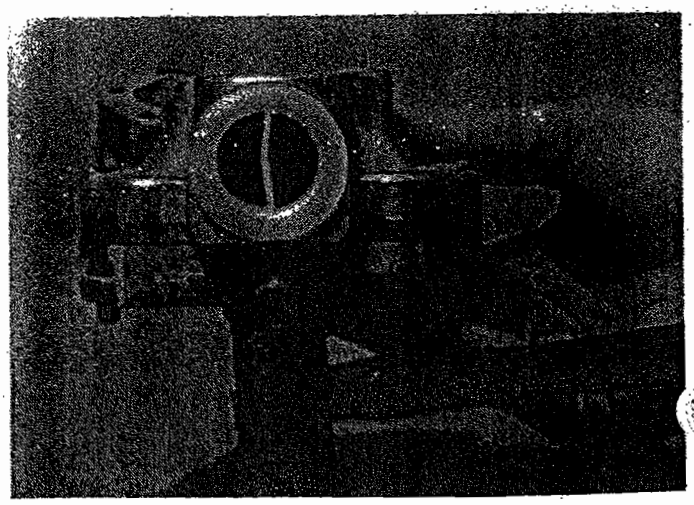


Fig. 8

10. Remove rear thrust plate (Item 6), dowels (Item 5), and o-ring (Item 4). (Fig. 9)

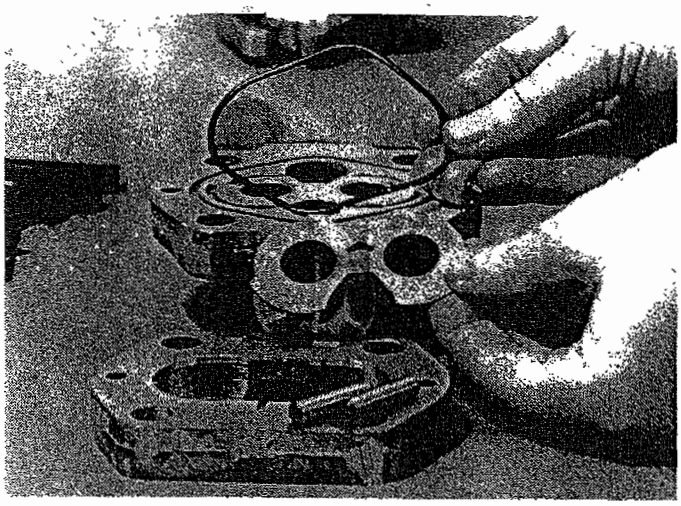


Fig. 9

11. Wash all of the parts thoroughly in clean solvent and blow dry with shop air or wipe dry with a clean shop towel.

12. Inspect the parts for cracks and deep scratches. For detailed instructions, turn to "Parts Inspection" section.

ASSEMBLY INSTRUCTIONS

13. Place cover plate (Item 1) on work bench, with o-ring groove up and matching mark toward you. (Fig. 10)

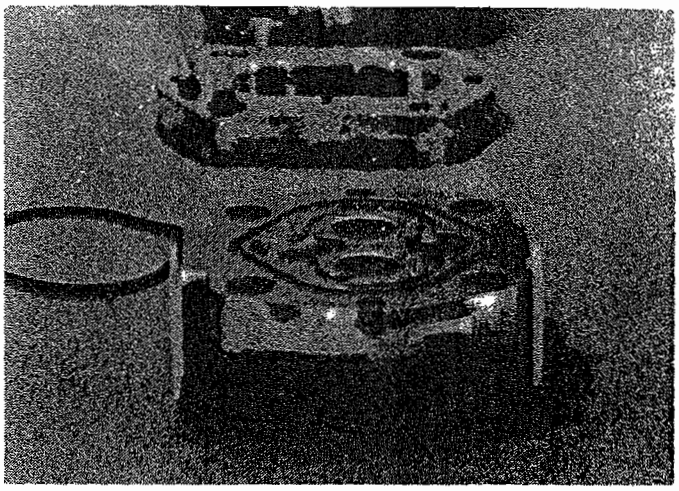


Fig. 10

14. Install o-ring (Item 4) in o-ring groove in cover plate. Use clean heavy grease to hold o-ring in the groove. (Fig. 11)

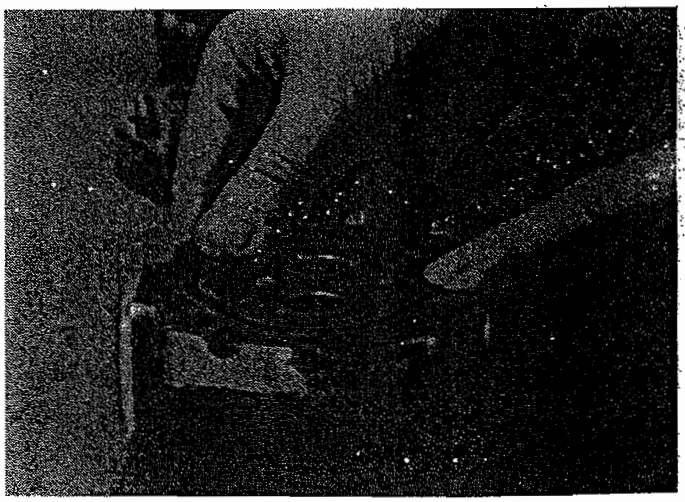


Fig. 11

15. Examine the gear plate (Item 2). You will notice a large and small recess in the plate near the gear bores. The side having the large recess is to be assembled with large recess toward the suction port in the cover plate. Line up dowel holes in gear plate with dowel holes in cover plate and install dowels (Item 5). (Fig. 12)

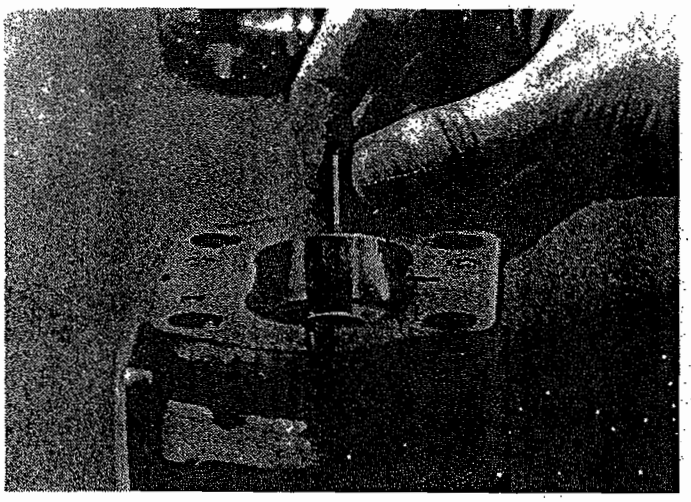


Fig. 12

16. Rear thrust plate (Item 6) has a semi-V shaped window cut in the plate. With the point of the V toward discharge port and bronze side of plate up, place it down inside of gear plate. (Fig. 13)

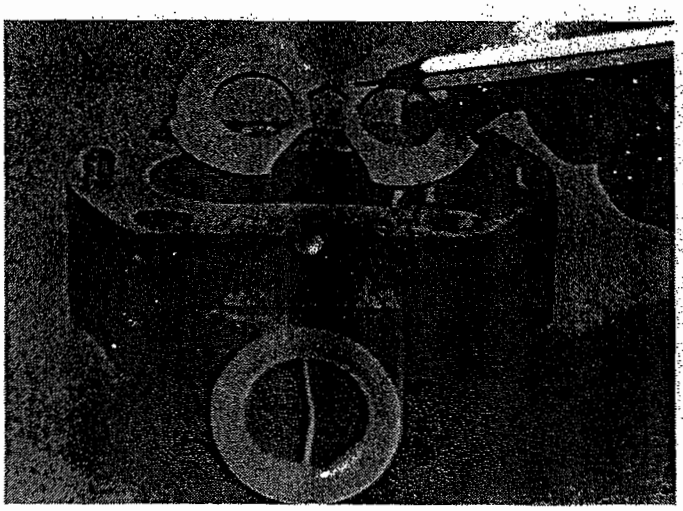


Fig. 13

17. Install drive gear (Item 7) in bearing nearest to matching mark, and idler gear (Item 8) in opposite bearing. (Fig. 14)

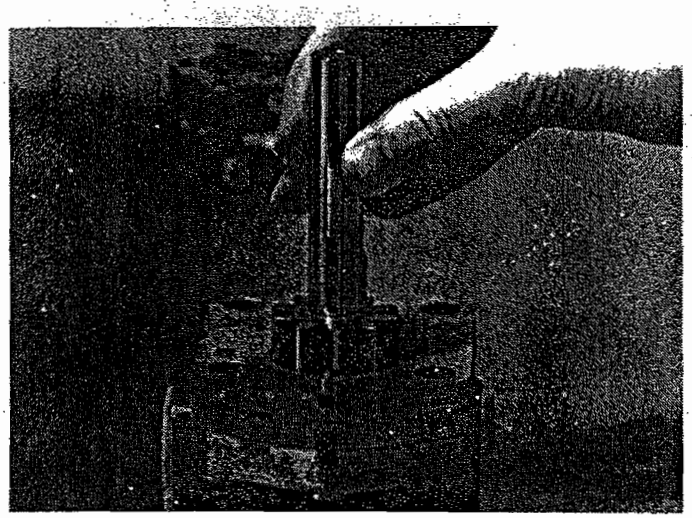


Fig. 14

18. The front thrust plate (Item 9) has a window cut in it just slightly off the center line between the shaft bores. With bronze side of thrust plate toward gear faces and window to the discharge side, place the plate over shafts and down against gear faces. (Fig. 15)

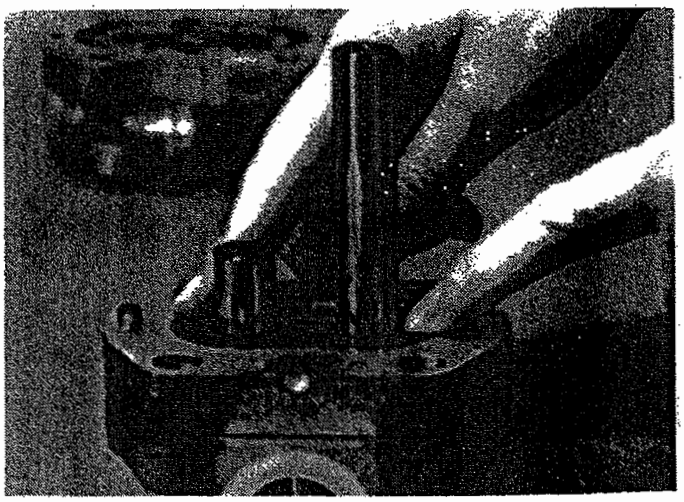


Fig. 15

19. Lip seals are relatively inexpensive compared to the time involved in removing any pump from a machine. Therefore, even though the seal may look good, a new shaft seal should be installed any time a pump is disassembled. For detailed instructions, refer to "Seal Replacement" section.

20. After shaft seal (Item 10) and snap ring (Item 11) have been installed in flange plate (Item 3), install rubber gasket (Item 12) with pressure distribution grooves facing down into flange recess. Install paper backup (Item 13) and nylon backup (Item 14). Use clean heavy grease to hold backups in place. (Fig. 16)

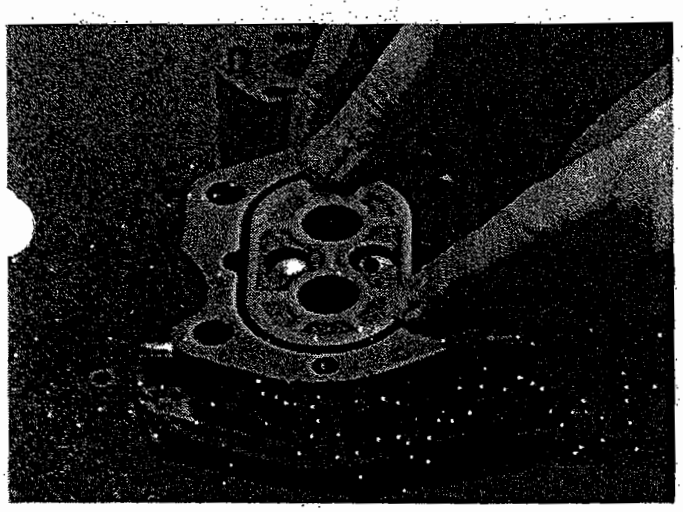


Fig. 16

21. If the extension end of drive shaft (Item 7) is splined, coat the splines with clean heavy grease to protect the lips of the seal as the flange plate slides down the shaft. If the extension end is keyed, use a piece of thin shim material to cover the keyway and protect the lips of the seal. (Fig. 17)

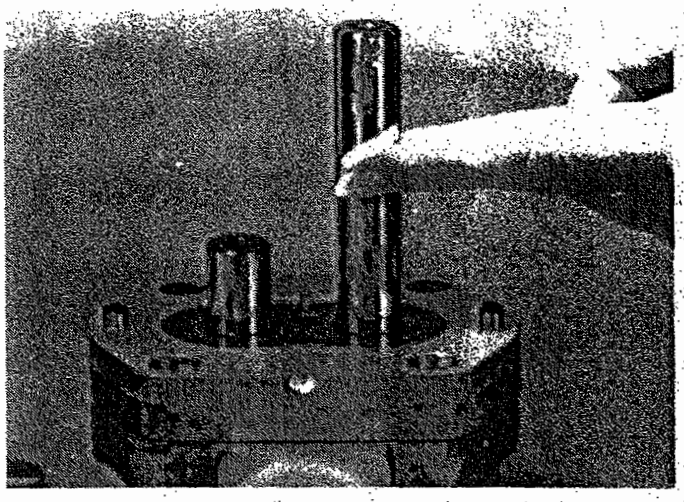
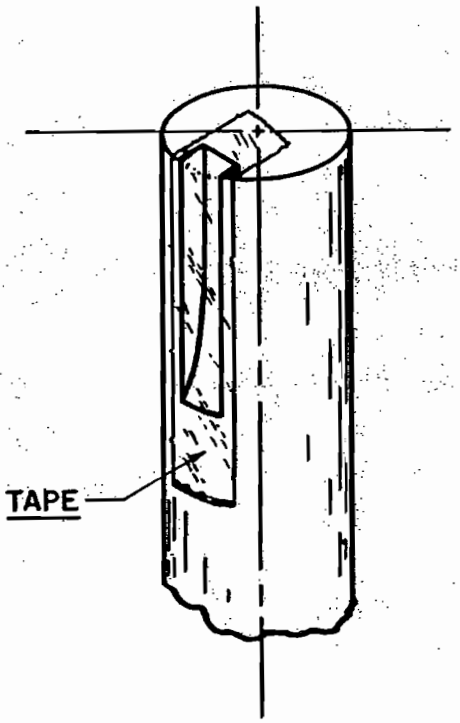


Fig. 17

NOTE: Use tape to cover keyway before installing flange to avoid nicking seal lip.



22. With rubber gasket (Item 12) and backups (Items 13 & 14) facing down, and keeping the plate true with the shafts, slide it down into position against gear plate. (Fig. 18)

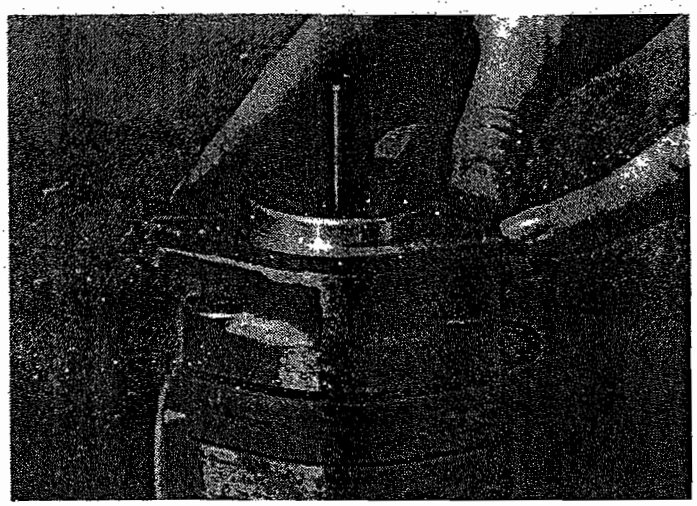


Fig. 18

23. Install washers (Item 15) and capscrews (Item 16) and run them up tight with fingers. Place pump in machinist vise with hexhead on capscrews up, use cardboard between the jaws of the vise and pump. Torque the capscrews to 30-35 ft. lbs. After capscrews have been torqued, check to see if shaft can be rotated. (Fig. 19)

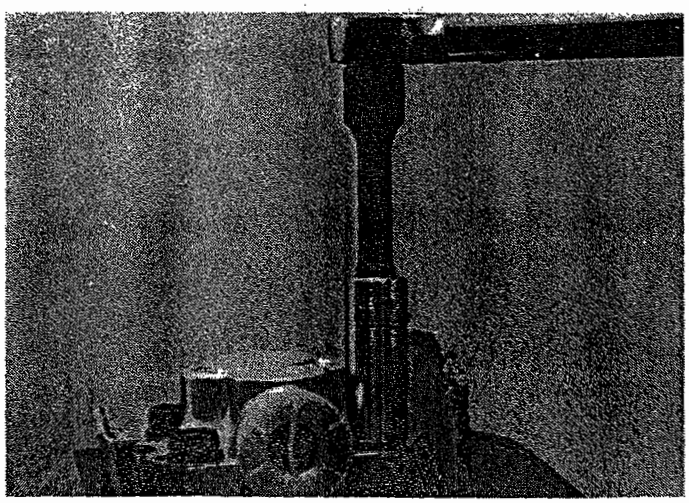


Fig. 19

24. You may not be able to rotate the shaft by hand alone. But with the aid of a small adjustable wrench, you should be able to rotate the shaft with little effort. If the shaft can not be rotated as described, disassemble the pump and check the parts for burrs, foreign material, and incorrect assembly causing interference. Remove the cause and reassemble as per instructions. (Fig. 20)

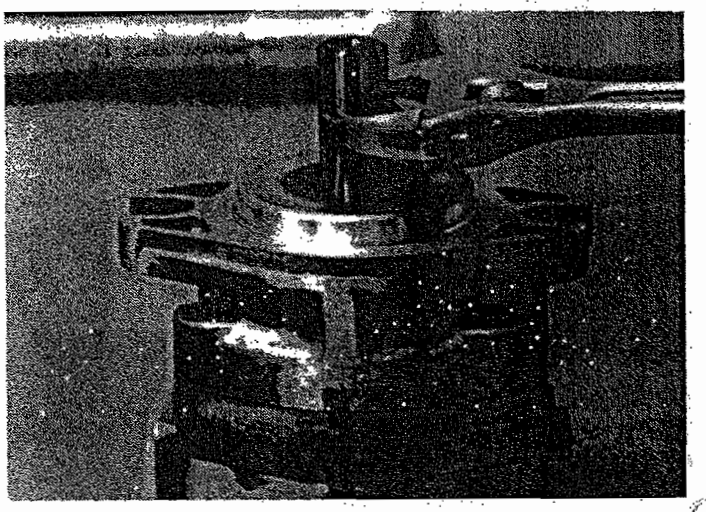


Fig. 20

SEAL REPLACEMENT

1. Place the pump in a vise or otherwise securely hold it in place with the shaft pointed up. Protect the machined surfaces from nicks and scratches. Loosen and remove the capscrews holding the flange to the body. Remove the flange. Also remove the o-ring from the flange.

2. Lay the flange on a smooth, clean surface and remove the snap ring. (Fig. 1)

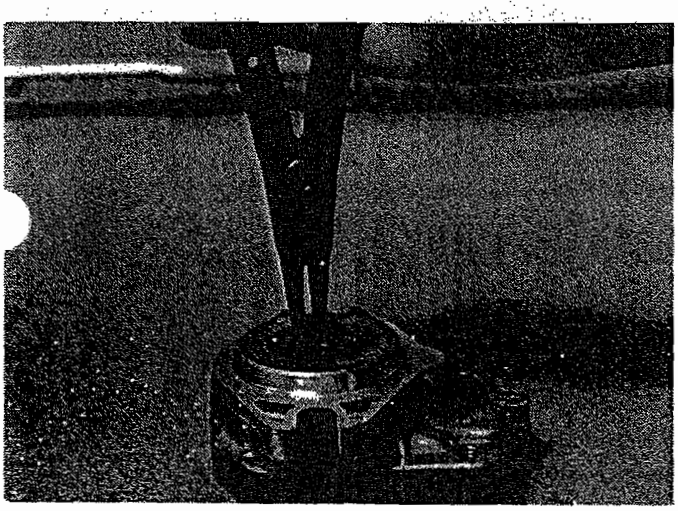


Fig.1

3. Lay the flange on the open jaws of a vise, pilot down. Protect the machined surfaces with cardboard or wood blocks. Use a punch and hammer to drive the seal out of the bore. Care must be taken not to scar the seal bore. Drive the seal out straight by moving the punch around the seal as you drive. (Fig. 2)

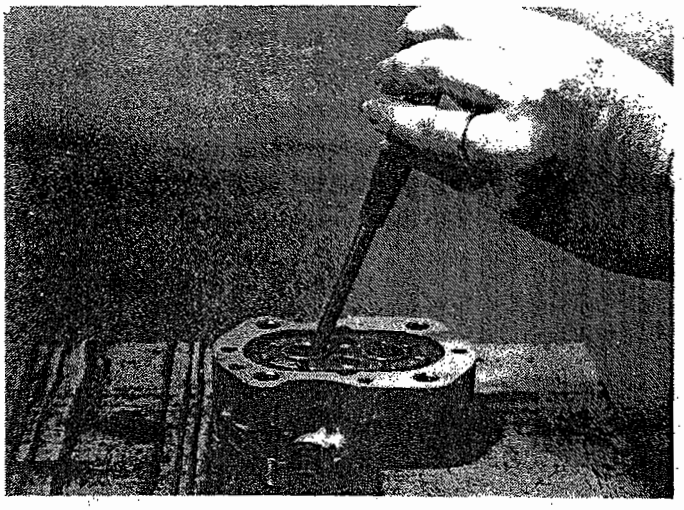


Fig. 2

4. Check the seal bore for scratches. If scratches are apparent, use a four hundred grit sandpaper to clean up the bore. Do not use coarser grit sandpaper. It will cut grooves in the bore and allow the seal to leak around the O. D.

5. Wash the flange plate in clean solvent and wipe it dry, or blow it dry with shop air if it is available.

6. If an arbor press is available, use it to install the new seal in the flange. If a press is not available, place the flange in a machinist vise with the seal bore facing the movable jaw. Arrange blocks of wood on each side of the protruding ends of the bearings at the side next to the fixed jaw. This is to prevent pressing on the bearings while the seal is being pressed in. (Fig. 3)

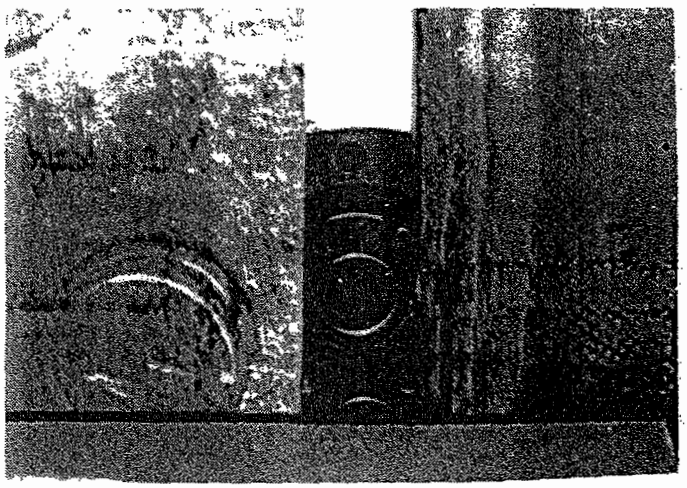


Fig. 3

7. Center the seal over the seal bore with the metal face of the seal facing the movable jaw. Place a clean block of wood against the seal and tighten the vise slowly until the wood block is against the flange. Make sure the seal starts straight and moves straight into the bore. (Fig. 4)

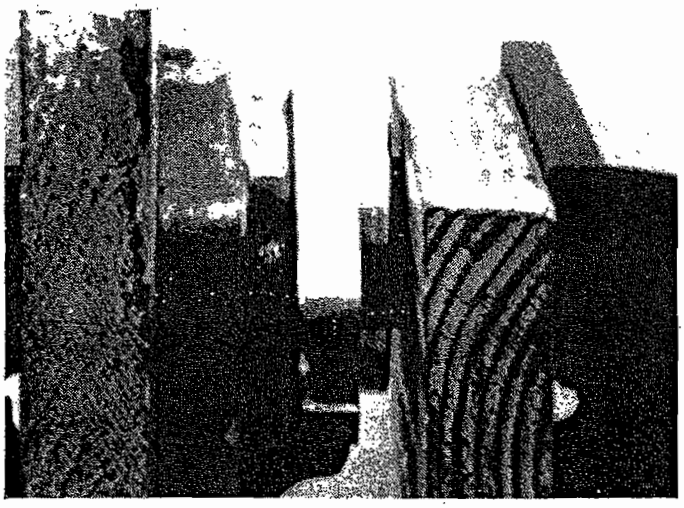


Fig. 4

8. Loosen the vise and remove the block of wood. Place a socket wrench that has an O. D. just slightly smaller than the seal bore against the seal. Tighten the vise against the socket and press the seal in until it just clears the snap ring groove in the seal bore. Remove the flange from the vise. (Fig. 5)

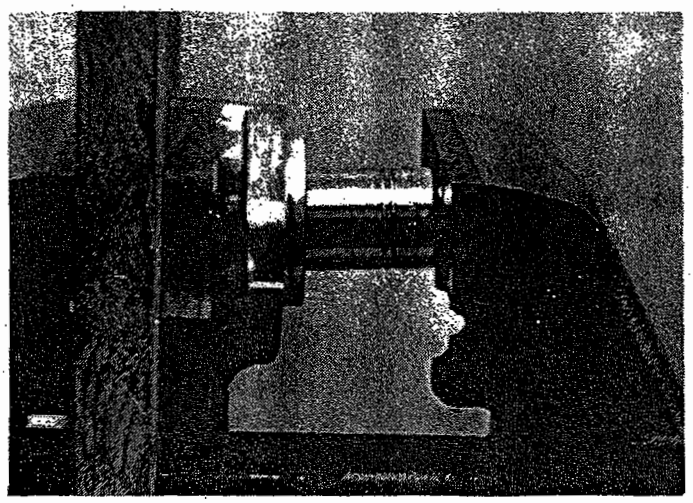


Fig. 5

9. Hold the flange at about a 45 degree angle and apply two or three drops of Loctite at the contact point of the seal casing and the bore. Rotate the flange slowly so the Loctite flows evenly all the way around the seal O. D. Install the snap ring and wipe any excess Loctite from the bore or seal lip. (Fig. 6)

Fig. 6

10. Install the flange o-ring. Use clean, heavy grease to hold the ring in position. Make sure both dowels are in place in the gear plate.

11. If the extension end of the drive shaft is splined, coat the spline with clean grease. If it has a keyway, cover the keyway with a thin transparent tape. These precautions are necessary to protect the seal lips as the flange slides down the shaft. If tape is used, make sure all of it is removed from the shaft after the flange has been put in place.

12. Install the flange, capscrews and washers, and torque the capscrews to 30-35 lb. ft.

INSPECTION OF PARTS

1. Visually inspect all parts. There will be a gear track in the bores of the pump body. Measure the depth of the tracks. The nominal depth is .004" (0,102mm) and should not exceed .008" (0,203mm). If it is less than .008", the body will be all right for assembly provided it is not cracked or damaged otherwise.

2. Examine the pressure plates. They should not show excessive wear on the bronze side. If deep, curved wear marks are visible, reject the plates.

3. Examine the gears. If excessive wear is apparent on the journals, sides, or faces of the gears, or at the point where the drive shaft rotates in the seal, reject both gears.

4. If any of the internal parts show excessive wear, replace all of the parts.

5. For further information on inspection of parts, see Troubleshooting Guide for Gear Type Hydraulic Pumps (page 14 of these instructions) or Tyrone's brochure: Diagnosing Tyrone Gear Pump Failures.

TROUBLESHOOTING GUIDE FOR GEAR TYPE HYDRAULIC PUMPS

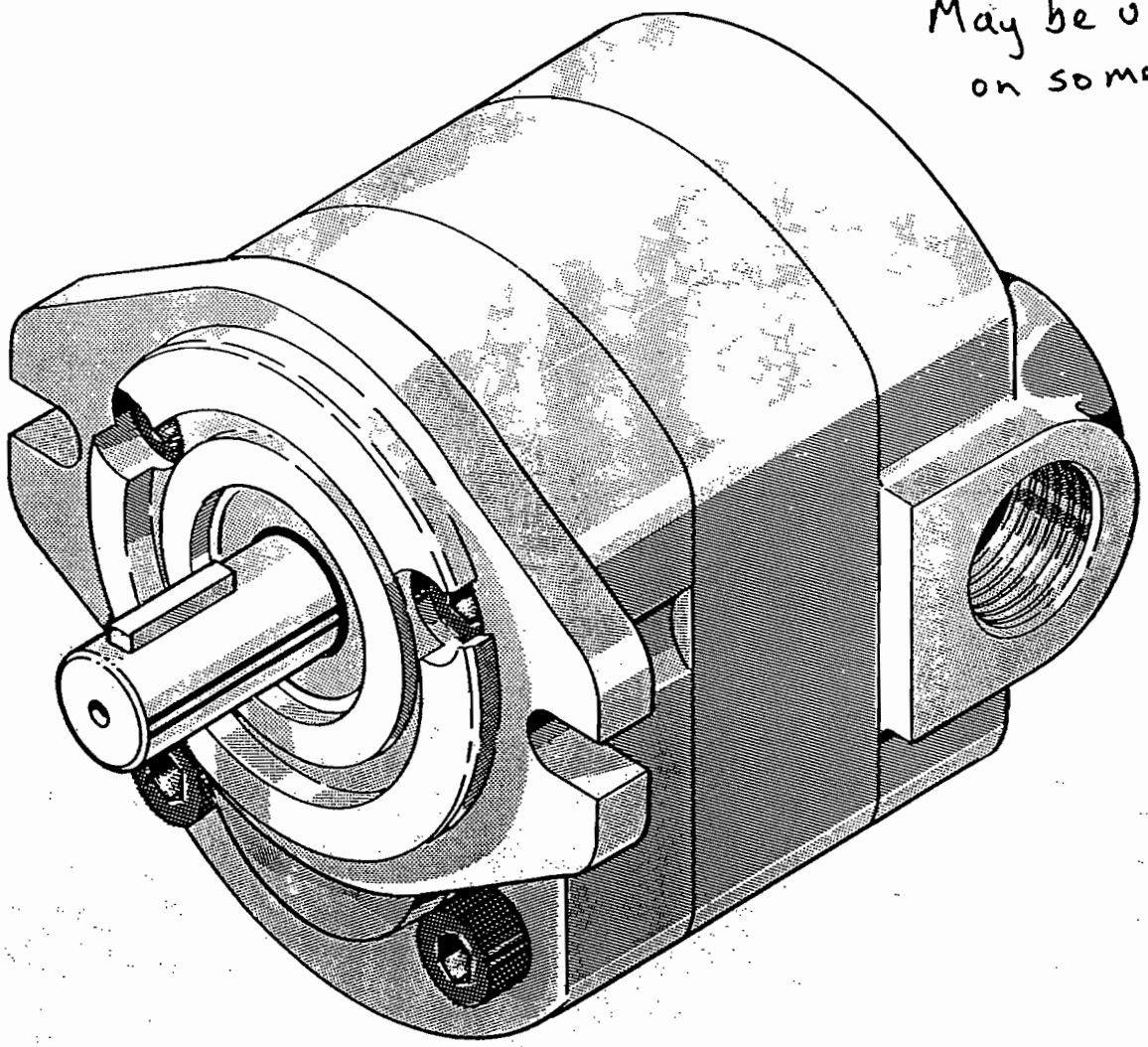
IDENTIFICATION	CAUSE	CORRECTIVE CHECKS
1. Sandblasted band around pressure plate bores 2. Angle groove on face of pressure plate 3. Lube groove enlarged and edges rounded 4. Dull area on shaft at root of tooth 5. Dull finish on shaft in bearing area 6. Sandblasted gear bore in housing	I. Abrasive wear caused by fine particles. 1. Dirt (fine contaminants, not visible to the eye)	1. Was clean oil used? 2. Was filter element change period correct? 3. Were correct filter elements used? 4. Cylinder rod wiper seals in good condition? 5. Cylinder rods dented or scored? 6. Was system flushed properly after previous failure?
1. Scored pressure plates 2. Scored shafts 3. Scored gear bore	II. Abrasive wear caused by metal particles. 1. Metal (coarse) contaminants, visible to the eye	1. Was system flushed properly after previous failure? 2. Contaminants generated elsewhere in hydraulic system? 3. Contaminants generated by wearing pump components?
1. Any external damage to pump 2. Damage on rear of drive gear and rear pressure plate only	III. Incorrect Installation	1. Did shaft bottom in mating part? 2. Any interference between pump and machine?
1. Eroded gear plate 2. Eroded pressure plates	IV. Aeration — Cavitation 1. Restricted oil flow to pump inlet 2. Aerated oil	1. Tank oil level correct? 2. Oil viscosity as recommended? 3. Restriction in pump inlet line? 4. Air leak in pump inlet line? 5. Loose hose or tube connection near or above oil level in tank? 6. Excessive operation of relief valve?
1. Heavy wear on pressure plate 2. Heavy wear on end of gear	V. Lack of Oil	1. Was oil level correct? 2. Any leaks in piping inside tank? 3. Any oil returning above oil level?
1. Gear plate scored heavily 2. Inlet peened and battered 3. Foreign object caught in gear teeth	VI. Damage caused by metal object	1. Metal object left in system during initial assembly or previous repair? 2. Metal object generated by another failure in system?
1. Pressure plate black 2. O-rings and seals brittle 3. Gear and journals black	VII. Excessive Heat	1. Was a valve stuck? 2. Was relief valve too low? 3. Was oil viscosity correct? 4. Was oil level correct?
1. Broken shaft 2. Broken gear plate or flange	VIII. Over Pressure	1. Relief valve setting correct? 2. Did relief valve function?

GEAR PUMP and MOTOR

SERIES
40

ALTERNATE

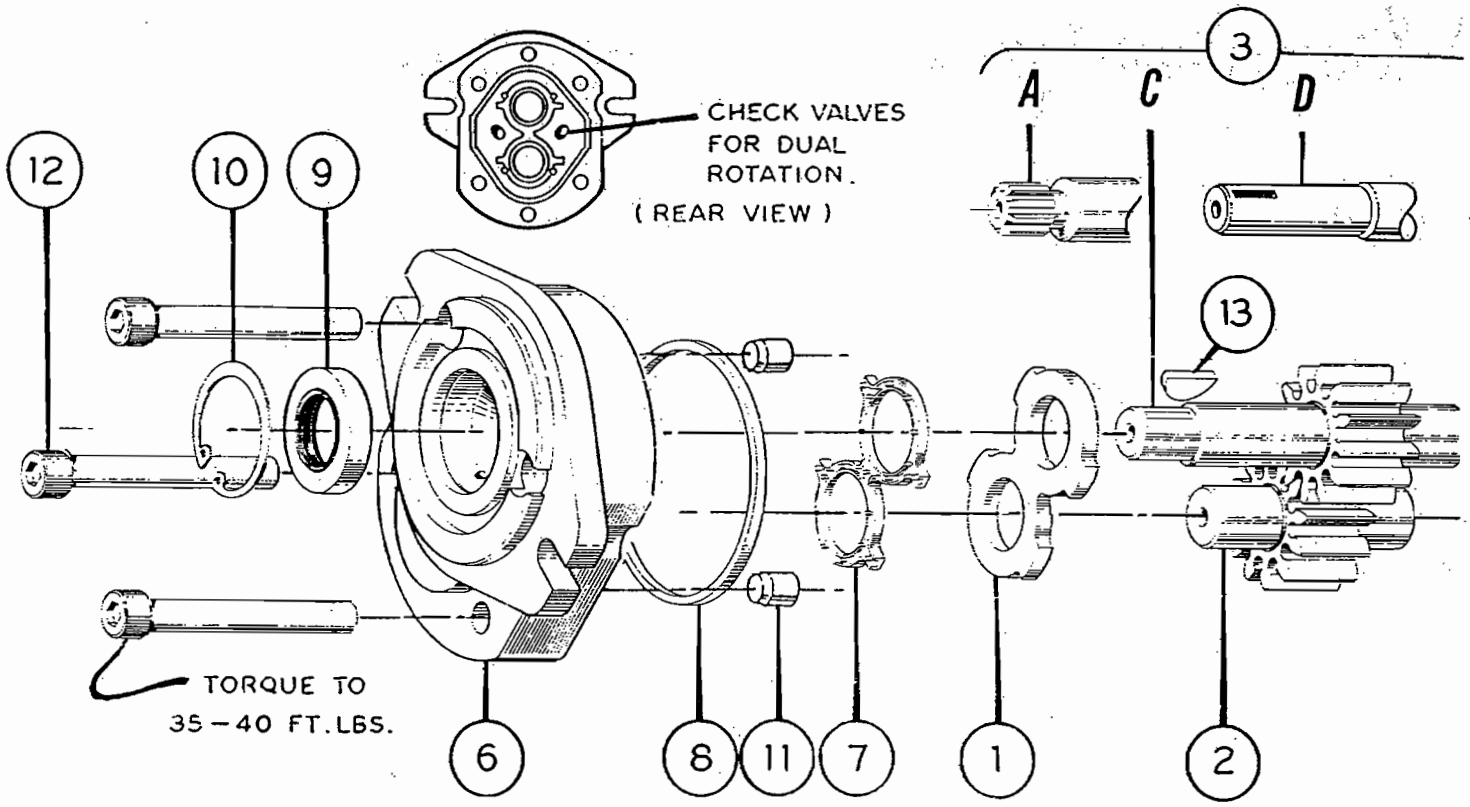
May be used on some units



CROSS MANUFACTURING, INC. LEWIS, KANSAS 67552
316-324-5525

September 1, 1995

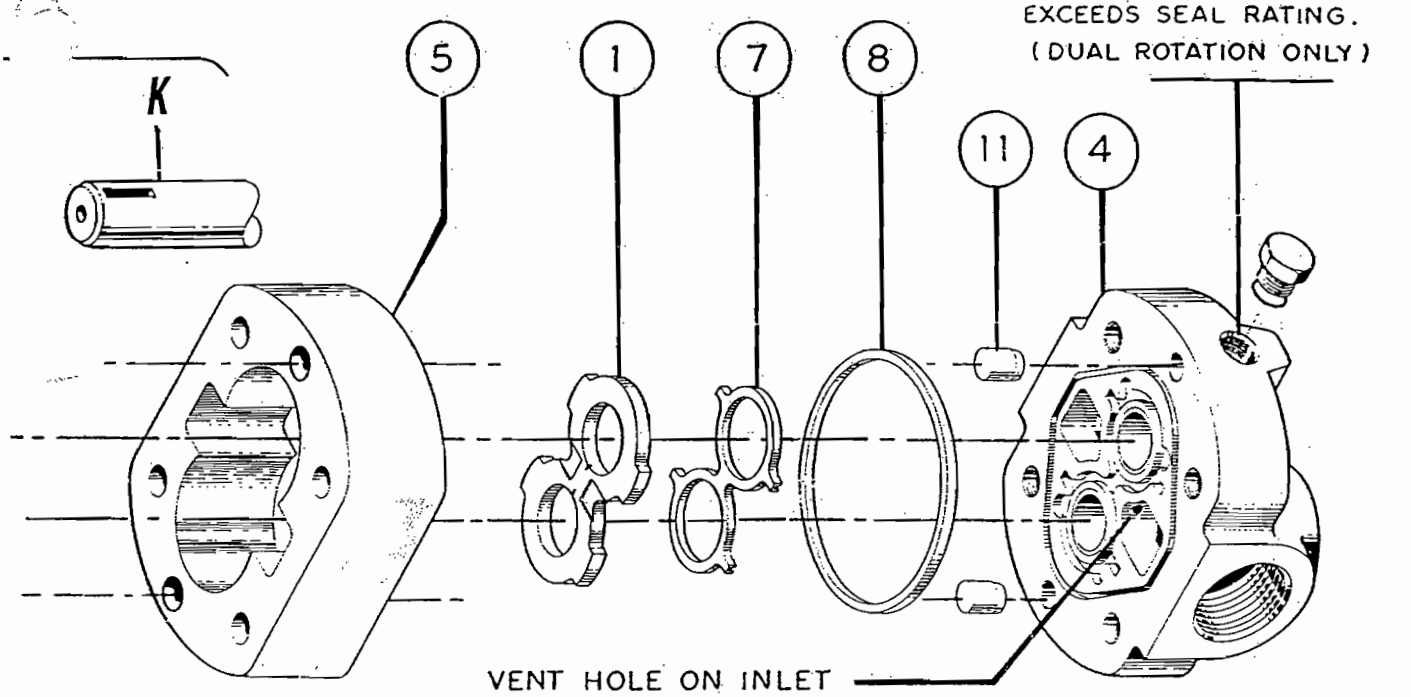
SERIES 40 GEAR PUMP and MOTOR *Part*



PARTS LIST

○	PART DESCRIPTION	DETAIL PART NO.	40P005 40M005	40P007 40M007	40P010 40M010	40P012 40M012	40P015 40M015	40P018 40M018	QTY.
			DASH NUMBER						
1	THRUST PLATE	4P0013	001						2
2	DRIVEN GEAR	4P0012	007	008	009	010	011	012	1
3	DRIVE GEAR ASSY	4P0011	SEE SHAFT						1
4	REAR COVER ASSY	4P0007	SEE PORTING						1
5	BODY	4P0004	001	002	003	004	005	006	1
6	FRONT COVER ASSY	4P0003	— 002 SINGLE ROTATION PUMP/MOTOR						1
	FRONT COVER ASSY	4P0003	— 001 DUAL ROTATION PUMP/MOTOR						
7	LOADING SEAL	5A0078							2
8	STATIC SEAL	5A0048							2
9	SHAFT SEAL	5A0081	HIGH PRESSURE (250 PSI)						1
	SHAFT SEAL	5A0050	SINGLE ROTATION (20 PSI)						
10	RETAINING RING	2A0466	150						1
11	DOWEL PIN	2A0310	604						4
12	CAPSCREW	2A0079	624	624	626	630	632	634	4
	LENGTH →		2 1/2	2 1/2	2 3/4	3	3 1/4	3 1/2	—
13	WOODRUFF KEY	5A0067							AS REQD.
	SEAL KIT	4P0017	—002 DUAL ROTATION (250 PSI)						0
	SEAL KIT	4P0017	—001 SINGLE ROTATION (20 PSI)						0
	SHIPPING PLUG	2A0353	—21 1 5/16 – 12 O-RING PORT (SAE #16)						AS REQD
	SHIPPING PLUG	2A0353	—17 1 1/16 – 12 O-RING PORT (SAE #12)						

Exploded



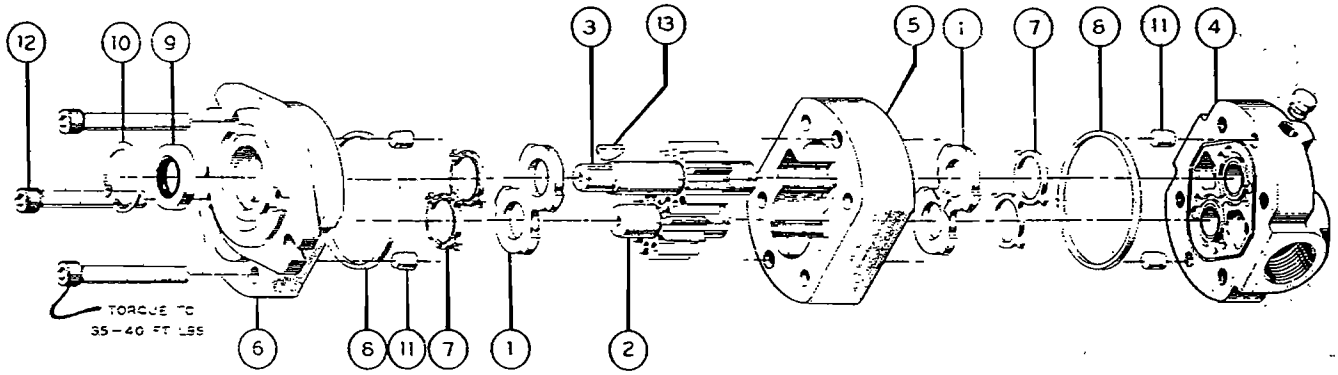
PARTS LIST

PART DESCRIPTION & SIZE SHAFT FOR DRIVE GEAR, 4P0011 (3)			40P005 40M005	40P007 40M007	40P010 40M010	40P012 40M012	40P015 40M015	40P018 40M018
			DASH NUMBER					
A. 9 TOOTH SPLINE			007	008	009	010	011	012
C. 5/8" DIA., KEYED (STD)			001	002	003	004	005	006
D. 5/8" DIA., KEYED (LONG)			013	014	015	016	017	018
K. 3/4" DIA., KEYED (LONG)			024	025	026	027	028	029
SPECS	MINIMUM AT 1800 RPM 90% VOL.	GPM	3.51	5.26	7.01	8.77	10.52	12.62
		LPM	13.3	19.9	26.5	33.2	39.8	47.8
	DISPLACEMENT	CU. IN./REV.	.50	.75	1.00	1.25	1.50	1.80
		ml/REV.	8.2	12.3	16.4	20.5	24.6	29.5
	MAXIMUM PUMP RPM IN INLET PORTS	1 1/16	3500	3400	2500	2000	1750	1400
		1 5/16	3500	3500	3500	3500	3000	2500

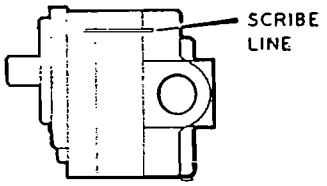
PART DESCRIPTION 4P0007 (4)			PORT SIZES INLET	PORT SIZES OUTLET	DASH NO. FOR ALL ASSY'S
SAE O-RING REAR PORTS	ROTATION SINGLE	RB	1 5/16 – 12 (#16)	1 1/16 – 12 (#12)	005
		RD	1 1/16 – 12 (#12)	1 1/16 – 12 (#12)	006
	ROTATION DUAL	RB	1 5/16 – 12 (#16)	1 1/16 – 12 (#12)	001
		RD	1 1/16 – 12 (#12)	1 1/16 – 12 (#12)	002
SAE O-RING SIDE PORTS	ROTATION SINGLE	SA	1 5/16 – 12 (#16)	1 1/16 – 12 (#12)	007
		SC	1 1/16 – 12 (#12)	1 1/16 – 12 (#12)	008
	ROTATION DUAL	SA	1 5/16 – 12 (#16)	1 1/16 – 12 (#12)	003
		SC	1 1/16 – 12 (#12)	1 1/16 – 12 (#12)	004

MAXIMUM MOTOR SPEED IS 3000 RPM. CONSULT CROSS ENGINEERING FOR APPLICATIONS ABOVE 3000 RPM.

SEAL REPLACEMENT INSTRUCTIONS



A. DISASSEMBLY:



1. Remove unit and thoroughly clean. Remove shaft key (13) and any nicks or burrs on shaft.
2. Scribe line on outside of unit across front cover, body and rear cover to assure proper reassembly.
3. Lightly clamp rear cover (4) in vise, shaft up. EXCESSIVE CLAMPING PRESSURE CAN CAUSE DISTORTION.
4. Remove cap screws (12) from front cover (6).
5. Tap upwards, underneath front cover flange and remove front cover. As unit separates, the body may remain with either the front or rear cover. Remove loose parts (rings, plates, etc.)
*6. To separate body from front cover, clamp body in vise and again tap upwards on front cover flange. To separate body from rear cover, clamp body in vise and tap downward on shaft. Remove static seals (8) and loading seals (7) from grooves. DO NOT DAMAGE GROOVE OR COVER SURFACE.
7. Remove snap ring (10) from shaft seal cavity in front cover using internal snap ring pliers.
8. Clamp front cover in vise, seal down, and drive shaft seal out of cavity using screwdriver held at about a 45° angle. USE CAUTION NOT TO DAMAGE CAVITY.

* Step 6 can be by-passed if only the shaft seal is being replaced.

B. PARTS INSPECTION:

1. Thoroughly clean all parts in solvent and dry with compressed air.
2. Inspect all parts for damage and unusual or excessive wear. If gears, bushings or body are damaged or badly worn, replace unit (Only plates and seals are replaceable).

C. REASSEMBLY:

1. Install new shaft seal (9) in front cover (6). Be sure bearing drain hole is not blocked.
2. Install snap ring (10) and new seals (7, 8) in covers (if needed).
3. Assemble body (5) and rear cover (4) aligning dowel pins (11) and scribed line.
4. Insert thrust plate (1) into body (5) flat side toward seal (7). Lubricate gears and insert.
5. Insert thrust plate (1) over shaft, flat side toward seal (7).
6. Lubricate shaft and slide front cover (6) over shaft and dowel pins (11). Tap if needed.
7. Insert cap screws (12) and tighten evenly as follows:
   Series 40: 35/40 ft. lbs. Series 50: 35/40 ft. lbs.
8. Rotate shaft, the maximum torque is:
   Series 40: 15 ft. lbs. Series 50: 20 ft. lbs.
   If greater torque is required, disassemble unit, re-clean and re-assemble.

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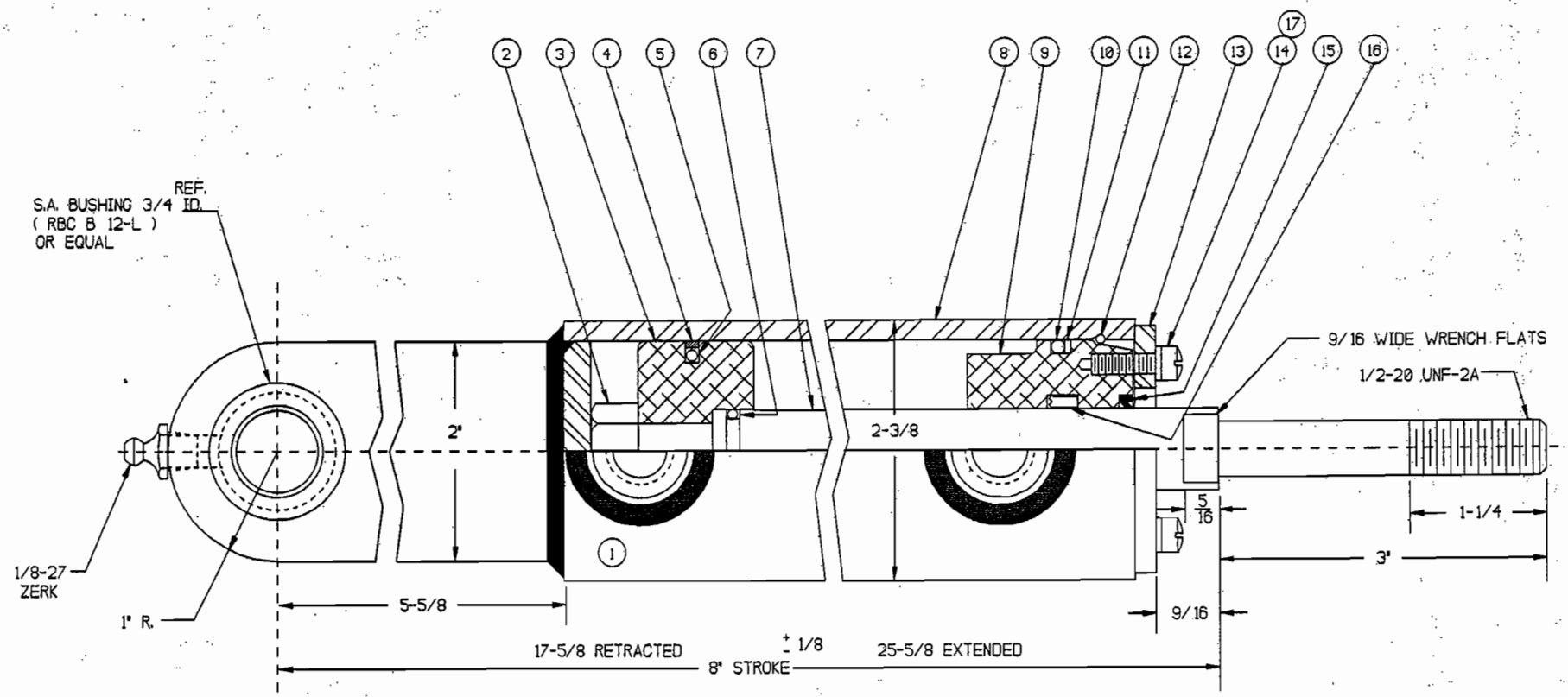


Steering

Wollard P/N 12409

NOTES:
1. 3/4 DIA. HARD CHROME PLATED ROD
2. 3/8 NPTF PORTS W/ STEEL PORT PLUGS (33-5041)
3. 3000 P.S.I. MAX. OPERATING PRESSURE
4. SEAL KIT N04-2127-S INCLUDES 4,5,6,8,11,15,16 & (1) 30-2654
5. STATIC TEST 3500 PSI IN BOTH DIRECTIONS
6. PRIME PAINTED - NO PAINT ON ROD

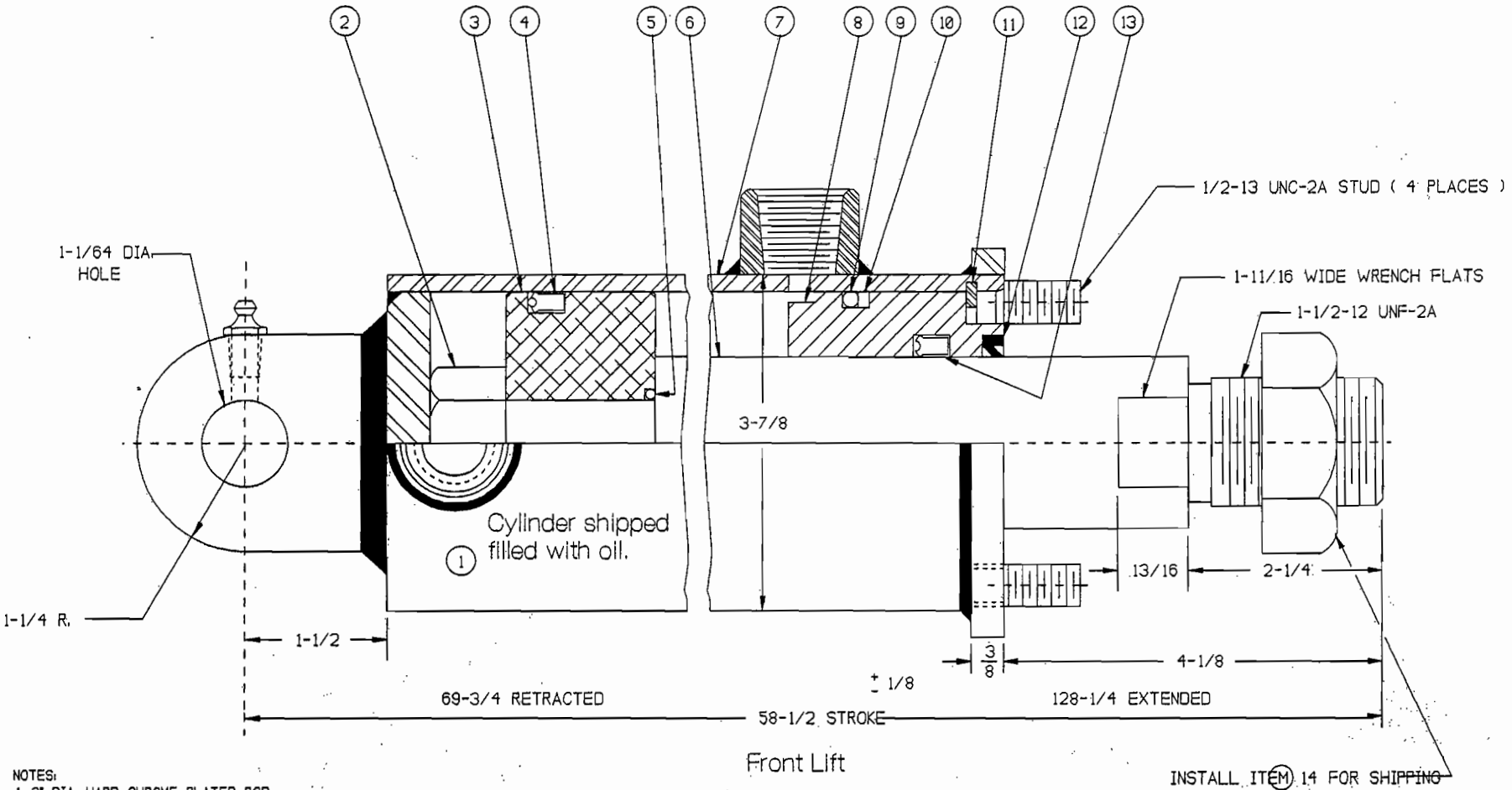
SYM	REVISION DETAIL	DATE	BY	REF. #	PART.#.	DESCRIPTION	QTY.	REF. #	PART.#.	DESCRIPTION	QTY.
				18	19-7702	HYDRAULIC OIL	.10	9	46-6122	SLEEVE	1
				17				8	47-7559	BARREL ASSEMBLY	1
G	REMOVED ITEM 17 - 26-4926	1-21-91	CW	16	29-940-UR	ROD SEAL	1	7	56-1882	ROD	1
F	NOTE 6 REVISED, LABEL ADDED	3-21-89	TLS	15	30-951	ROD WIPER	1	6	27-809-0	O-RING	1
E	CYLINDER TO BE FILLED WITH OIL	2-26-87	TLS	14	25-1512	MACHINE SCREW	2	5	27-923-0	EXPANDER RING	1
D	ITEM 15 WAS 30-2654	2-4-87	TLS	13	26-1251	WASHER	1	4	31-6571	PISTON SEAL (TFE)	1
C	5-3/8 WAS 5-5/8; 13/16 WAS 9/16	1-14-87	TLS	12	19-922	LOCK WIRE	1	3	45-7536	PISTON	1
B	REDRAWN	12-17-86	JHA	11	28-810-1	BACKUP	1	2	36-1596	FULL LOCK NUT	1
A	LENGTHENED BASE EAR BY 3"	12-17-86	JHA	10	27-810-0	O-RING	1	1	2127	CMI MONTH & YEAR BUILT	-

GREEN MANUFACTURING, INC.
BOWLING GREEN, OHIO

TOLERANCES UNLESS OTHERWISE SPECIFIED.
DECIMAL ± .005 FRACTIONS ± 1/8 BREAK ALL CORNERS .010 RADIUS MIN
REMOVE ALL BURRS. ANGLES ± 2

F.M.F.
SCALE 1-1
DATE 12-17-86
MAT'L
BY MWG
REF. DWG. M10298
CHKD.

TITLE 2" BORE X 8" STROKE
WOLLARD AIRPORT
DWG. NO.
600-2127



Front Lift

Wollard P/N 14011

INSTALL ITEM 14 FOR SHIPPING

NOTES:
1. 2" DIA. HARD CHROME PLATED ROD
2. 3/4 NPT PORTS
3. 3000 PSI MAXIMUM OPERATING PRESSURE
4. SEAL KIT NO. 44-2112-S INCLUDES ITEMS 4,5,9,10,12 & 13
5. PRIME PAINTED
6. STATIC TEST AT 3500 PSI IN BOTH DIRECTIONS

REF. #	PART.#.	DESCRIPTION	QTY.	REF. #	PART.#.	DESCRIPTION	QTY.
18				9	27-838-0	O-RING	1
17				8	46-7515	SLEEVE	1
16				7	47-7549	BARREL ASSEMBLY	1
15				6	56-1881	ROD	1
14	36-3059	FULL HEX NUT	1	5	27-807-0	O-RING	1
13	29-886-UR	ROD SEAL	1	4	29-902-UP	POLYPAK PISTON SEAL	1
12	30-926	DUST SEAL	1	3	45-3916	PISTON	1
11	31-6893	RETAINING RING	1	2	36-913	FULL LOCK NUT	1
10	28-838-1	BACKUP	1	1	2112	CMI MONTH & YEAR BUILT	-

SYM	REVISION DETAIL	DATE	BY
B	REDRAWN	12-16-86	MWG
A	ADDED ITEM 14	11-6-86	JHA

THIS CYLINDER IS USED ON 600-E-2116

GREEN MANUFACTURING, INC.
BOWLING GREEN, OHIO

TOLERANCES UNLESS OTHERWISE SPECIFIED.
DECIMAL ± .005 FRACTIONS ± 1/8 BREAK ALL CORNERS .010 RADIUS MIN
REMOVE ALL BURRS. ANGLES ± 2

F.M.F.

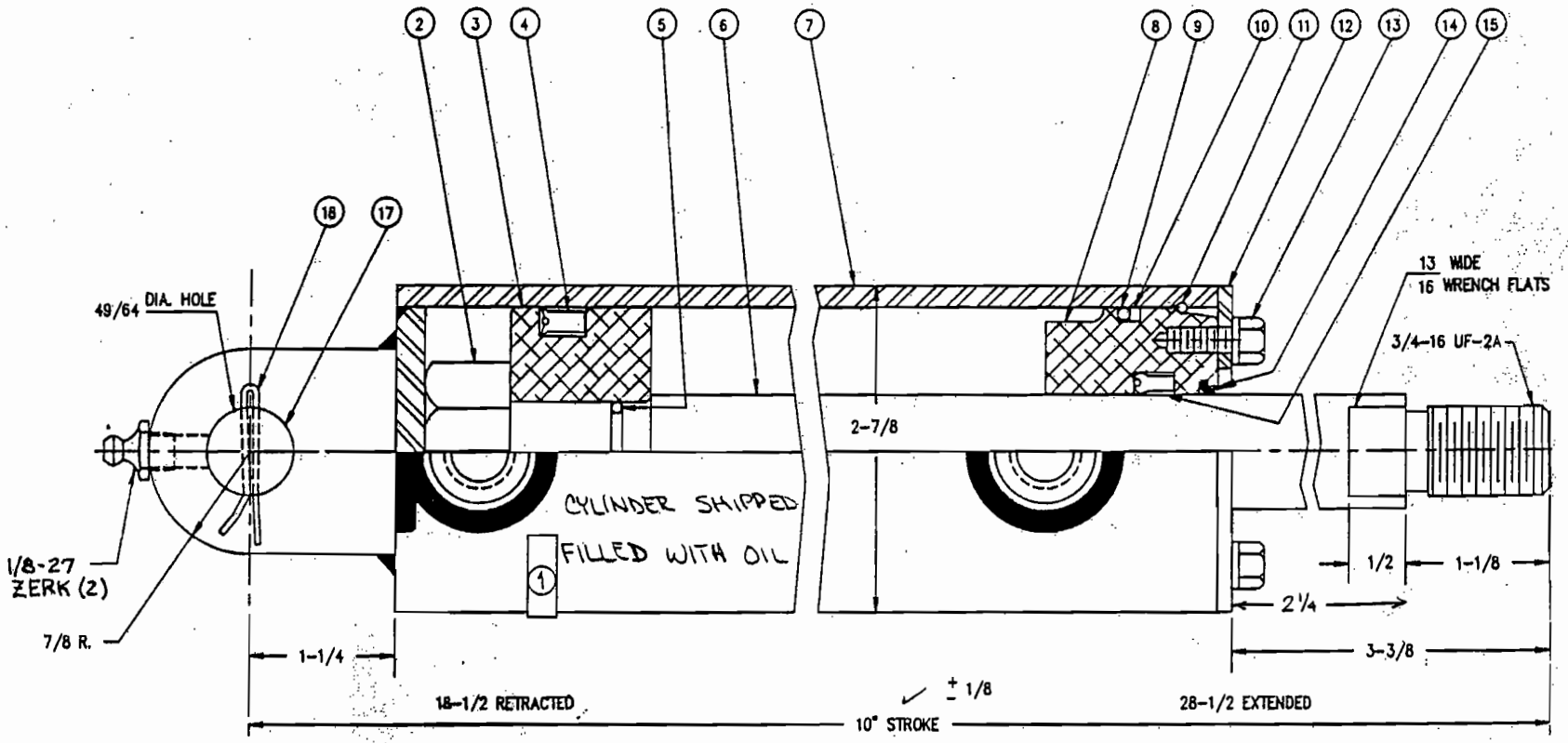
SCALE 3/4-1 DATE 12-16-86

MAT'L. BY MWG

REF. DWG. M-8139 CHKD.

TITLE 2 BORE X 58-1/2 STROKE
WOLLARD AIRPORT EQUIPMENT CO.

DWG. NO. 600-2112



REF. #	PART. #	DESCRIPTION	QTY.	REF. #	PART. #	DESCRIPTION	QTY.
18	19-7702	HYDRAULIC OIL	18	9	27-808-0	O-RING	1
17	52-7535	PIN	1	8	46-3634	SLEEVE	1
16	37-4089	COTTER PIN 3/16 X 2	2	7	47-7538	BARREL ASSEMBLY	1
15	29-934-UR	ROD SEAL	1	6	56-7575	ROD	1
14	30-937	ROD WIPER	1	5	27-826-0	O-RING	1
13	25-4584-X	CAP SCREW	2	4	29-886-UP	POLYPAK PISTON SEAL	1
12	26-625	WASHER	1	3	45-3772	PISTON	1
11	19-635	LOCK WIRE	1	2	36-961	FULL LOCK NUT	1
10	28-808-1	BACKUP	1	1	2104	GMI MONTH & YEAR BUILT	–

NOTES:
1. 1" DIA. HARD CHROME PLATED ROD
2. 3/8 NPT PORTS W/STEEL PORT PLUGS (33-504)
3. 3000 PSI MAXIMUM OPERATING PRESSURE
4. SEAL KIT NO. 44-2104-S INCLUDES ITEMS 4,5,9,10,14 & 15

GREEN MANUFACTURING, INC.
BOWLING GREEN, OHIO

TOLERANCES UNLESS OTHERWISE SPECIFIED.
DECIMAL ±.005 FRACTIONS ±1/8 BREAK ALL CORNERS .010 RADIUS MIN.
REMOVE ALL BURRS. ANGLES ± 2°

F.W.F.

SCALE 1=1 | DATE 10-7-86

MAT'L | BY MWG

REF. DWG. M-10297 | CHKD.

TITLE 2-1/2 BORE X 10" STROKE WOLLARD AIRPORT EQUIPMENT CO.

DWG. NO. 600——2104

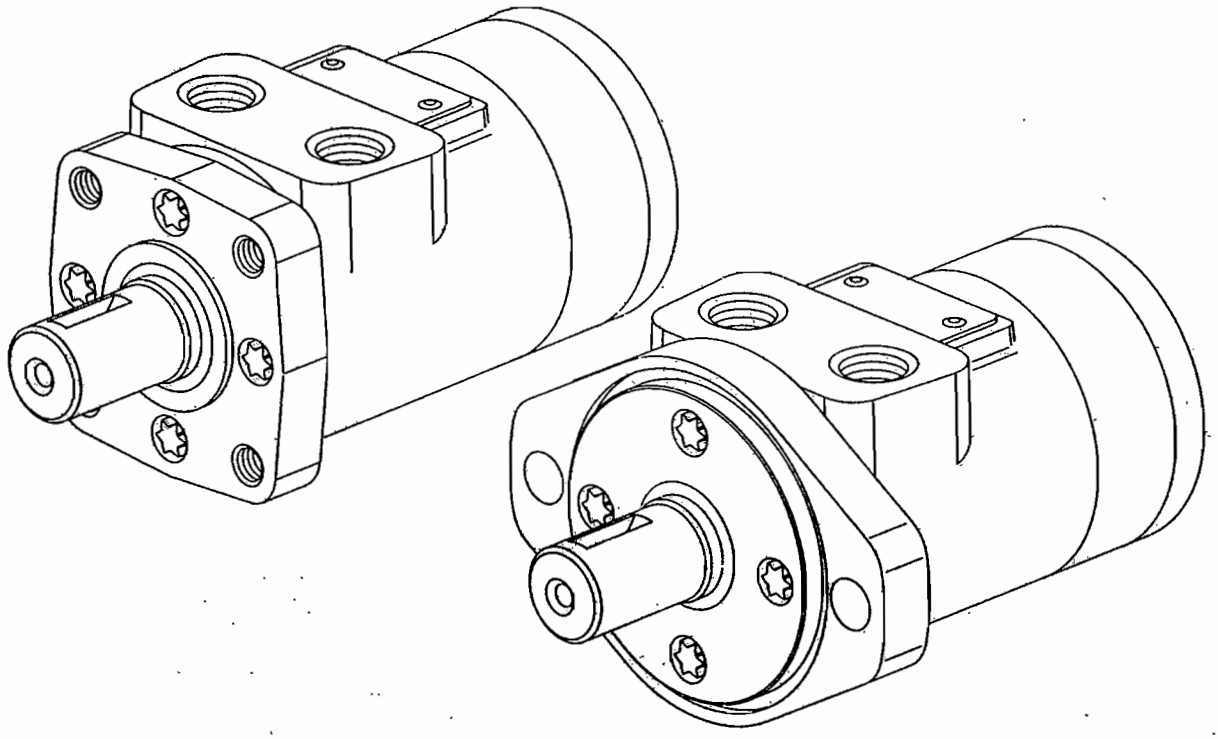
M10297
REAR LIFT

Char-Lynn®
Hydraulic Motor

No. 7-117
January, 1995

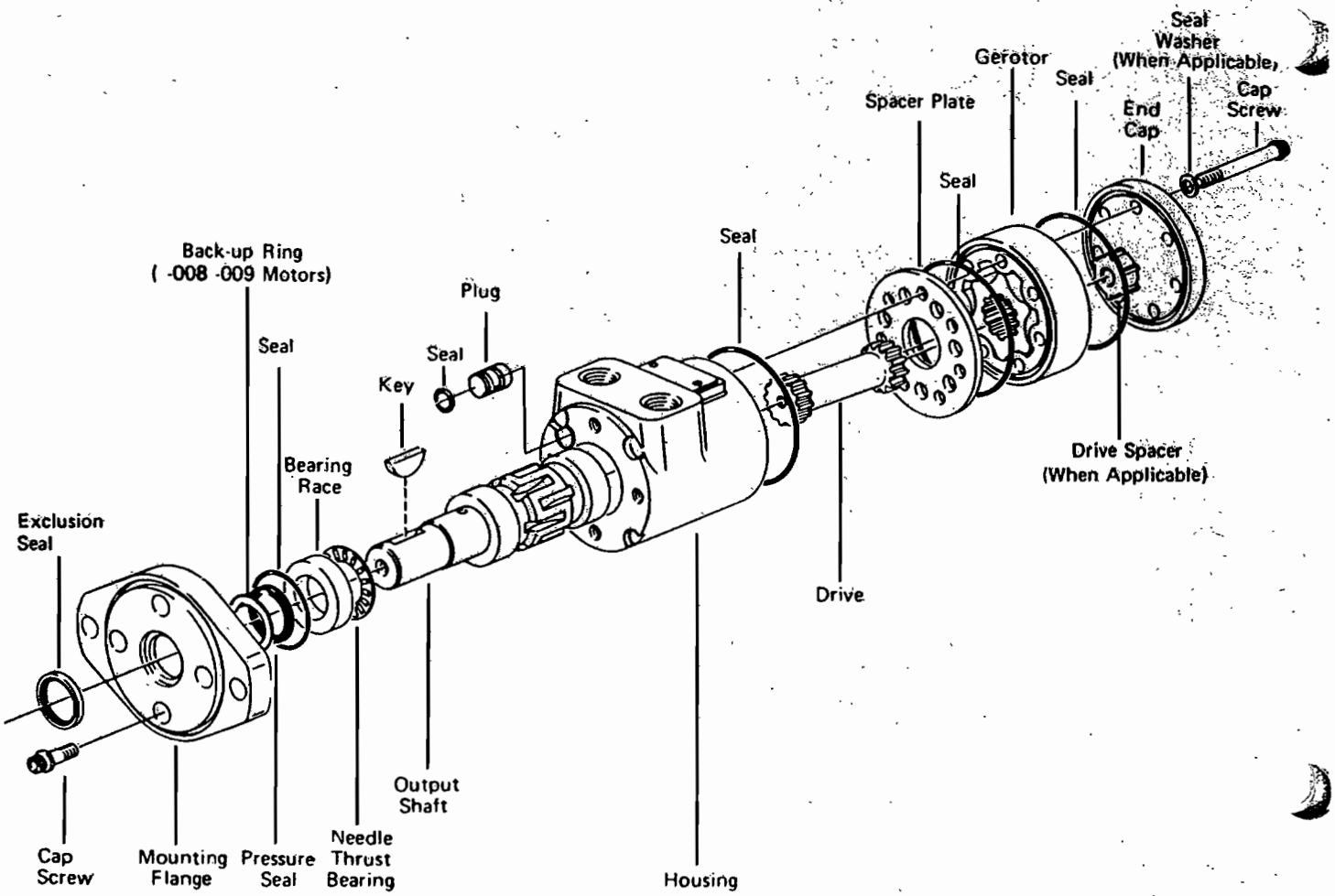
EATON

Repair Information



H Series
General Purpose Gerotor Motor

007 008 009



Tools required for disassembly and reassembly.

- Torque wrench (300 lb-in [34Nm] capacity)
- 12-16 in. [300-400mm] breaker bar
- *• 5/16 in.–12 point socket no. 5422 (Heavy Duty 500 lb-in [56Nm] Capacity)
- Small screwdriver (6-8x1/4 in. [150-200x6mm] flat blade), see page 5 for tooling information.
- 3/16 in.[5mm] hex key
- *• Shaft pressure seal installation tool for 007 motor P/N 600470, for 008 and 009 motors P/N 600523
- *• Seal sleeve or bullet P/N 600304 (1 in. dia. shaft), P/N 600466 (7/8 in. dia. shaft)

* Tools available–by special order–through our service department.

Repair Information

H Series Char-Lynn Motors

Disassembly

Instructions in this manual are for H Series Motors (101-XXXX-007, 008 and 009).

Cleanliness is extremely important when repairing these motors. Work in a clean area. Before disconnecting lines, clean port area of motor. Remove key when used. Check shaft and key slot. Remove burrs, nicks and sharp edges. Before disassembly, drain oil from motor. Then plug ports and thoroughly clean exterior of motor.

Although not all drawings show the motor in a vise, we recommend that you keep the motor in a vise during disassembly. Follow the clamping procedures explained throughout the manual.

Gerotor End

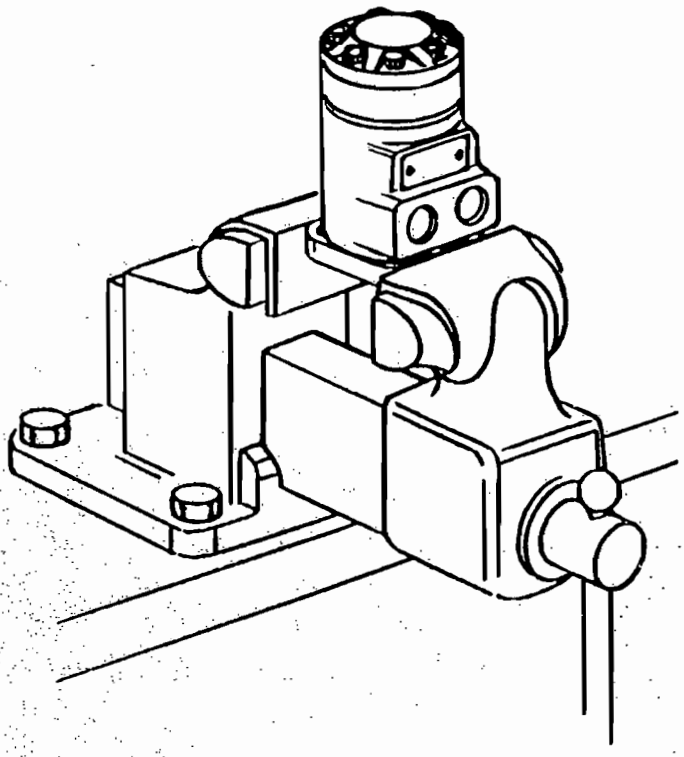


Figure 1

1 Place motor in vice and clamp across edge of flange with output shaft down. When clamping, use protective device on vise such as special soft jaws, pieces of hard rubber or board. See Figure 1.

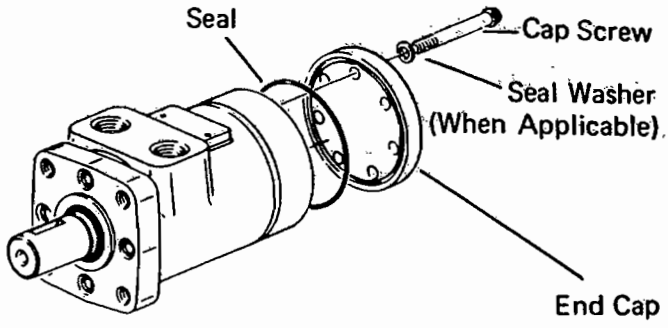


Figure 2

2 Remove cap screws and seal washers (when applicable). See Figure 2.

3 Remove end cap.

4 Remove seal from end cap.

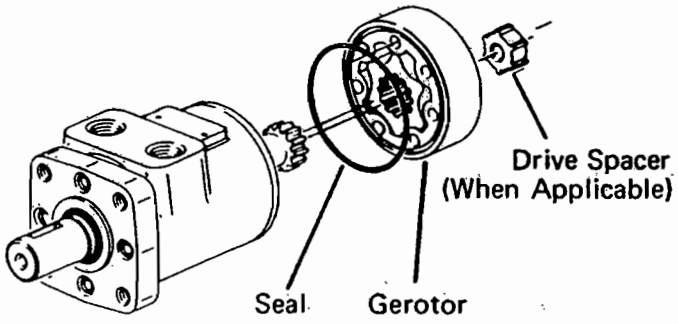


Figure 3

5 Remove gerotor.

6 Remove seal from gerotor (Figure 3).

7 Remove drive spacer if applicable.

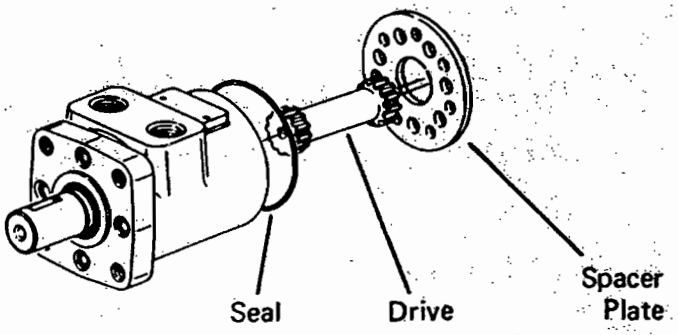


Figure 4

8 Remove drive. See Figure 4.

9 Remove spacer plate.

10 Remove seal from housing.

11 Remove output shaft from housing.

12 Remove needle thrust bearing from shaft or housing.

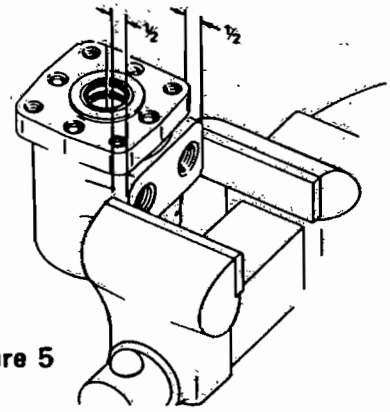


Figure 5

13 Reposition motor in vise. Clamp across ports as shown in Figure 5. Do not clamp on side of housing. Excessive clamping pressure on side of housing causes distortion.

14 Remove cap screws from mounting flange. These screws are assembled with Loctite to hold them in place.

The screws will require 300-400 lb-in [35-45 Nm] of torque to break loose and 100 lb-in [11 Nm] torque to remove. Do not use impact wrench on Loctited screws. This could result in rounded heads or broken sockets.

Note: If torque higher than given above is required to break screws loose, apply heat according to following instructions:

When heated, Loctite partially melts. This reduces torque required to remove screw. Use small flame propane torch to heat small area of housing where screw enters. See Figure 6. **Be careful not to overheat housing** and damage motor. Gradually apply torque to screw with **socket** wrench as heat is applied for 8 to 10 seconds. As soon as screw breaks loose, remove heat from housing. Continue turning screw until it is completely removed.

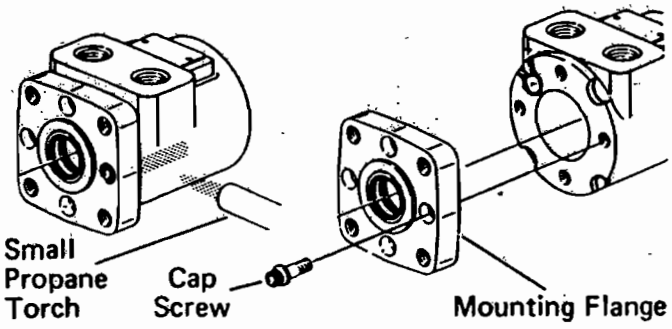


Figure 6

15 Carefully remove flange from housing.

Important: Some motors may have a quad seal and back-up ring in place of the pressure seal. The quad seal and back-up ring are no longer available and are replaced by the pressure seal. They are interchangeable, but some precautions must be taken to insure proper installation. Follow the reassembly instructions.

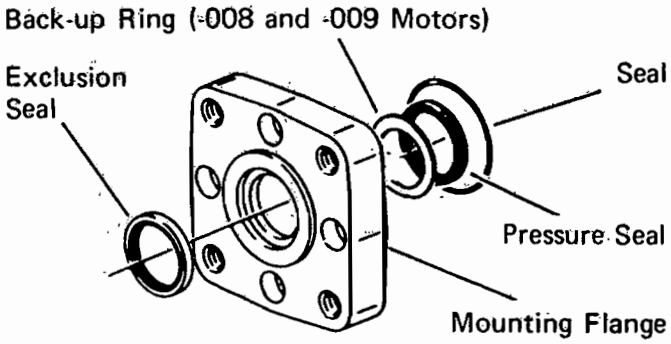


Figure 7

16 Exclusion seal, back-up ring, pressure seal and seal will come off with flange (Figure 7). Use seal removal tool, shown in Figures 8 and 9, to remove exclusion and pressure seals.

Important: Be careful not to scratch seal cavity O.D. This could create a leak path.

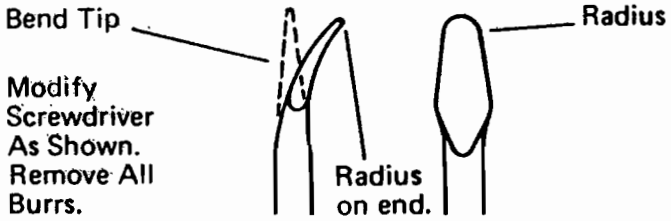
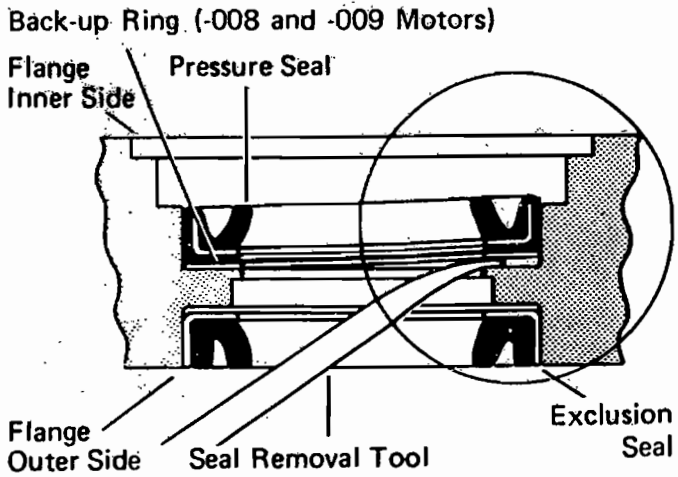


Figure 8



Work from outer side for both (either) seals.

Figure 9

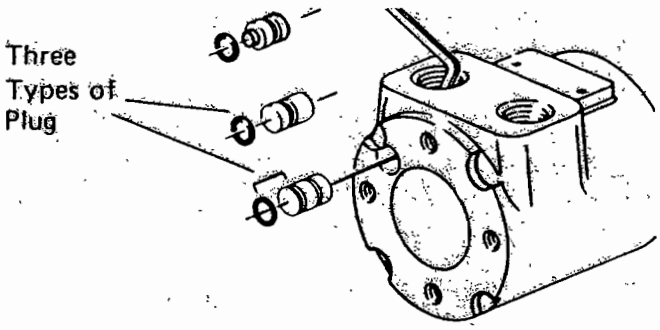


Figure 10

17 A metal plug, with seal, plugs a machining hole in the housing. It is not necessary to remove plug and replace seal unless leakage occurs around plug. To remove plug, insert 3/16 in. [5 mm] hex key through port opening and push it out. See Figure 10. The 009 plug is not interchangeable with 007 and 008 plugs.

Reassembly

Shaft End

Check all mating surfaces. Replace any parts with scratches or burrs that could cause leakage or damage. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe parts with cloth or paper towel because lint or other matter could get into the hydraulic system and cause damage.

Check around key slot and chamfered area of shaft for burrs, nicks or sharp edges that could damage seals during reassembly. Remove nicks or burrs with a hard smooth stone (such as an Arkansas stone). Do not file or grind motor parts.

Note: Lubricate all seals with petroleum jelly. Use new seals when reassembling motor. Refer to parts list 6-121 for proper seal kit numbers.

Important: Do not stretch seals before installing them.

Cleanliness is extremely important in the successful application of Loctite. Before Loctite can be applied, the parts should be cleaned as follows:

Note: Fully cured Loctite resists most solvents, oils, gasoline and kerosene and is not affected by cleaning operations. It is not necessary to remove cured Loctite that is securely bonded in tapped holes; however, any loose particles of cured Loctite should be removed.

a. Wash the housing with solvent to remove oil, grease and debris. Pay particular attention to four tapped holes on flange end.

b. Blow dry with compressed air. Clean and dry tapped holes.

c. Wire brush screw threads to remove cured Loctite and other debris. Discard any screws that have damaged threads or rounded heads.

d. Wash screws with non-petroleum base solvent. Blow dry with compressed air.

18 If you remove plug and seal, lubricate new seal and install on plug. Some plugs have two o-ring grooves but require only one o-ring. Install o-ring in groove closest to end of plug. Push plug into housing so plug and housing are flush. Be careful not to damage seal.

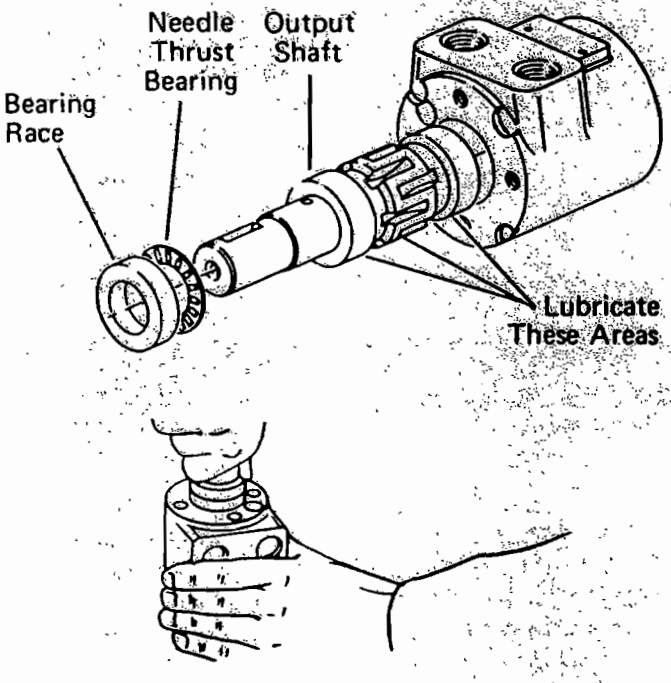
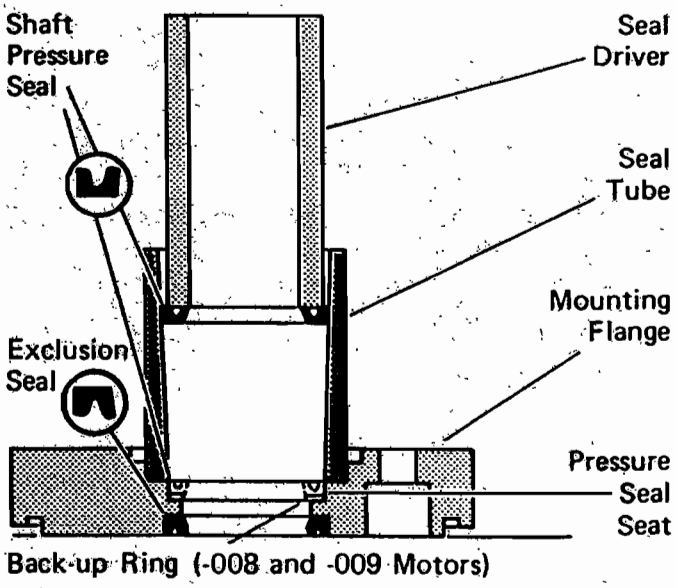


Figure 11

19 Lubricate output shaft with hydraulic oil, then install shaft in housing. See Figure 11.

Important: Do not permit oil to get into the four tapped holes.

20 Install needle thrust bearing, then bearing race on shaft. Pull shaft partially out of housing. Push all three parts in housing together. See Figure 11. The bearing race must rotate freely when in position.



Seal Installation Tool
No. 600470 (007 Motors)
No. 600523 (008, 009 Motors)

Figure 12

21 Install exclusion seal in flange. See Figure 12. Carefully press exclusion seal into place.

22 Visually check seal seat in mounting flange for scratches or other marks that might damage the pressure seal. Check for cracks in flange that could cause leakage.

23 Lubricate I.D. of seal tube and O.D. of shaft pressure seal with light film of clean petroleum jelly. Align small I.D. end of seal tube with seal seat in mounting flange. Install back-up ring and pressure seal in tube with lips of seal face up. See Figure 12. Insert seal driver in tube and firmly push seal seat with a rotating action.

Important: After installing seal in flange, examine seal condition. If damaged or improperly installed, you must replace it before continuing with reassembly.

24 Install $1\frac{15}{16}$ in. [49 mm] I.D. seal in flange.

25 It is recommended to apply a light coat of Loctite Primer NF in tapped holes of housing. Allow primer to air dry for at least 1 minute. Do not force dry with air jet; the primer will blow away.

Use of primer is optional. With primer, Loctite curing time is approximately 15 minutes. Without primer, curing time is approximately 6 hours.

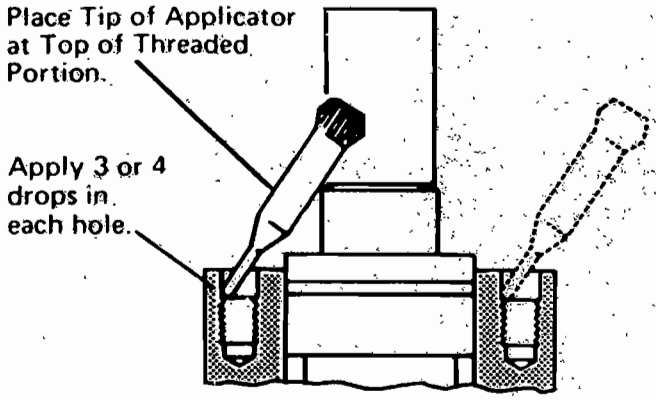


Figure 13

26 Apply 3 or 4 drops of Loctite sealant at top of thread for each of four holes in housing. See Figure 13. Do not allow parts with Loctite applied to come in contact with any metal parts other than those for assembly. Wipe off excess Loctite from housing face, using a non-petroleum base solvent.

Do not apply Loctite to threads more than 15 minutes before installing screws. If housing stands for more than 15 minutes, repeat application. No additional cleaning or removal of previously applied Loctite is necessary.

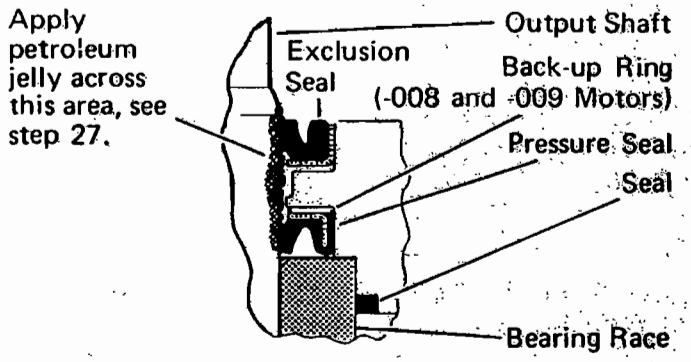


Figure 14

27 Before installing flange and seal assembly over shaft, place protective sleeve or bullet over shaft. Then lubricate space between exclusion seal and pressure seal, as well as lips of both seals. See Figure 14.

Install flange. Rotate flange slowly while pushing down over shaft. Be careful not to invert or damage seals.

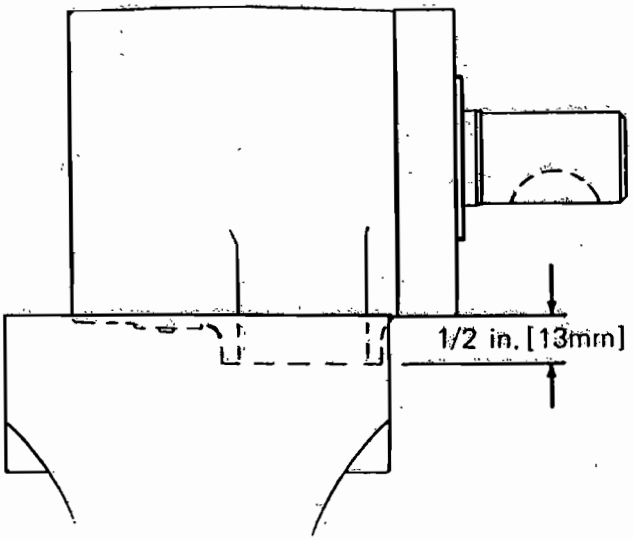


Figure 15

28 After removing bullet, clamp motor in vise as shown in Figure 15. Make sure shaft cannot fall out. Install **dry** screws and alternately torque them immediately to 250 lb-in [28 Nm]. If you use primer, allow to cure for **10 to 15 minutes.** Without primer, allow 6 hours curing time before subjecting motor to high torque reversals. On all other applications, you can run motor immediately.

If you use new screws, make sure they are the correct length: 7/8 in. [22 mm] under head length. See parts list for correct part number.

Gerotor End

29 Reposition motor with gerotor end up, then clamp across ports. Do not clamp on side of housing.

Important: To aid installation of seals, apply light coat of clean petroleum jelly to seals. Do not stretch seals before installing them in groove.

30 Pour approximately 35 cc of clean hydraulic oil in output shaft cavity.

31 Install 2 7/8 in. [73 mm] I.D. seal in housing seal groove. Avoid twisting seal.

Timing Procedure

a. Install drive. Use felt tip marker to mark one drive tooth. Align this tooth with timing dot on shaft.

Note: If drive is not symmetrical, install larger splined end into shaft.

b. Install spacer plate.

c. Install 2 7/8 in. [73 mm] I.D. seal in gerotor seal groove. Carefully place gerotor on spacer plate, seal side toward spacer plate.

Standard Rotation Align any star point with tooth marked on drive. See Figure 16.

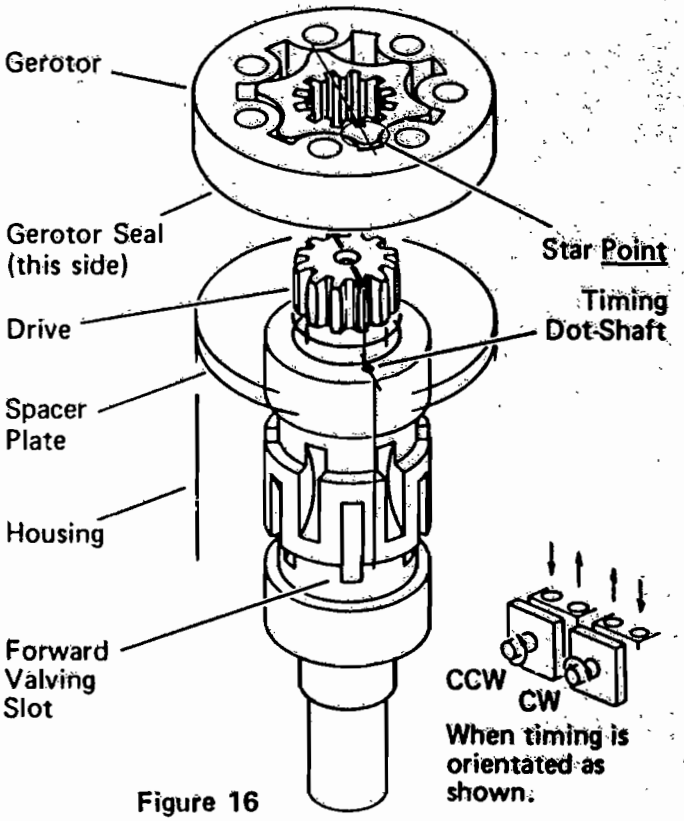


Figure 16

Reverse Rotation Align any star valley with marked tooth. See Figure 17.

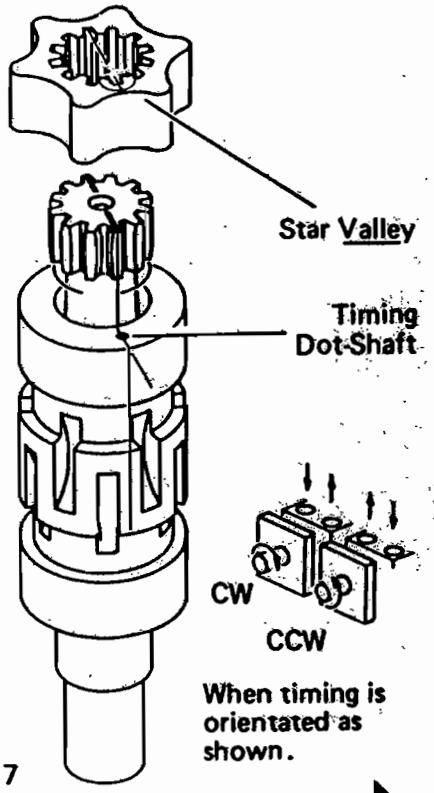


Figure 17

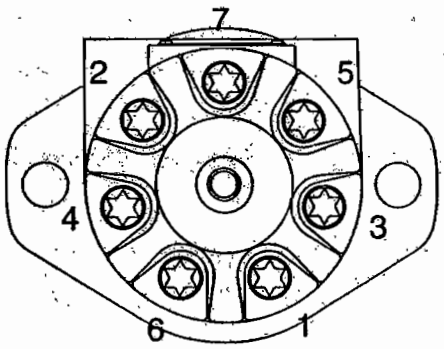
Reassembly Continued on Page 8

Reassembly Continued from Page 7

32 Rotate gerotor to line up with bolt holes. Be careful not to disengage star from drive or disturb gerotor seal.

33 Install drive spacer if applicable.

34 Install 2 7/8 in. [73 mm] seal in end cap. Carefully place end cap on gerotor.

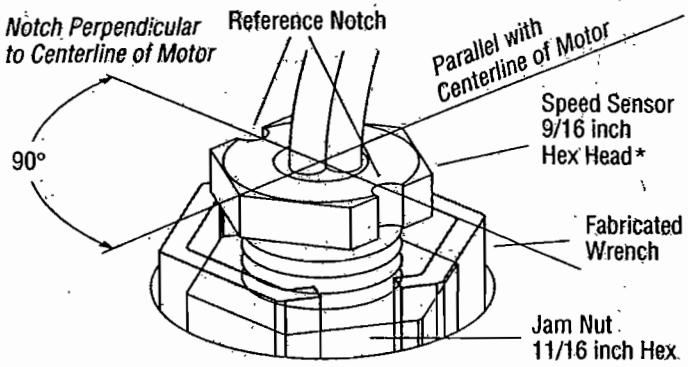


Bolt Torquing Sequence

Figure 18

35 Install cap screws and seal washers (if applicable) in end cap. Pretighten screws to 40 lb-in [7,4 Nm]. Make sure seal are properly seated. Then torque screws 275-300 lb-in [30-40 Nm] in sequence, as shown in figure 18.

Speed Sensor Installation

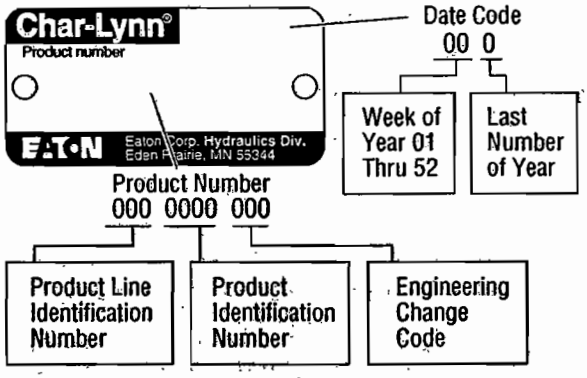


*Turn Speed Sensor in to bottom (making sure jam nut is backed off sufficiently), back off 1/4 turn (CCW) and if reference notch(s) is not positioned as shown above continue turning (CCW) to align reference notch 90° off of centerline of motor or perpendicular to motor shaft. Hold speed sensor in this position and tighten jam nut to 8,5 — 14 Nm [75 — 125 lb-in].

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



Eaton Corporation
Hydraulics Division
15151 Hwy. 5
Eden Prairie, MN 55344
Telephone 612/937-9800
Fax 612/937-7130

Eaton Ltd.
Hydraulics Division
Glenrothes, Fife
Scotland, KY7 4NW
Telephone 44/592-771-771
Fax 44/592-773-184

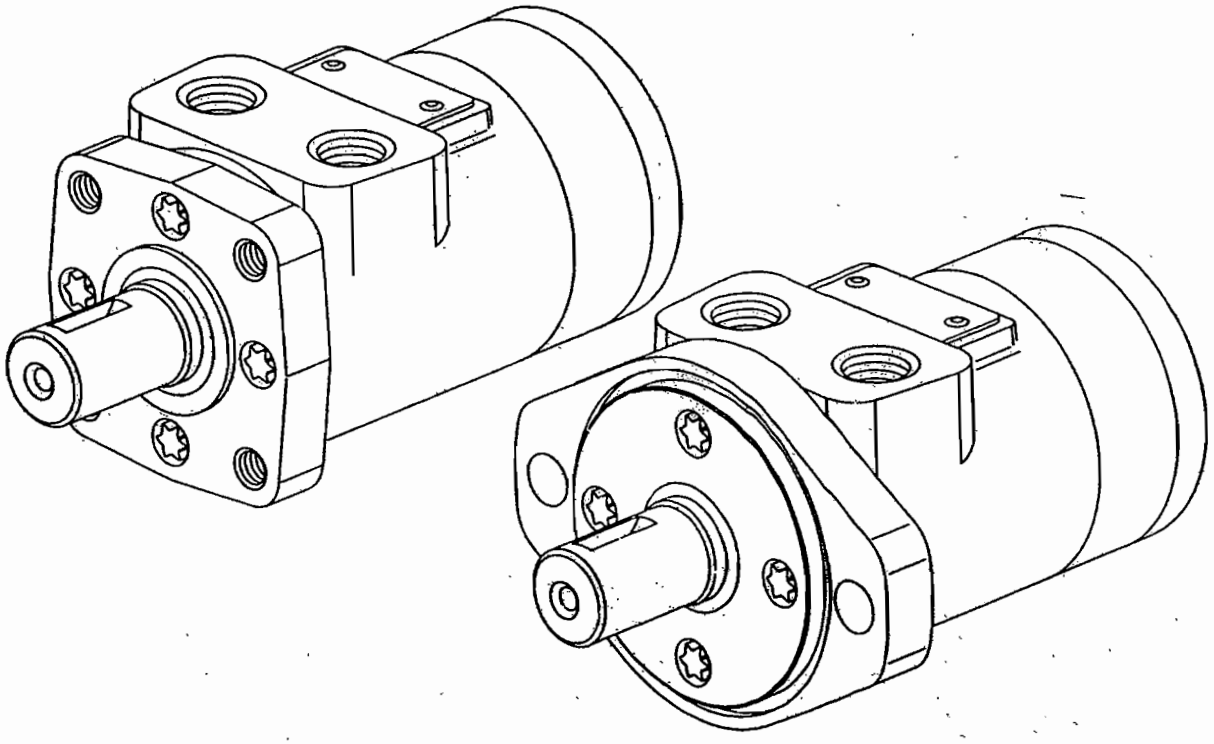
Form No. 7-117

Char-Lynn®
Hydraulic Motors

No. 6-121
June, 1996

EATON

Parts Information



General Purpose
H Series Motors

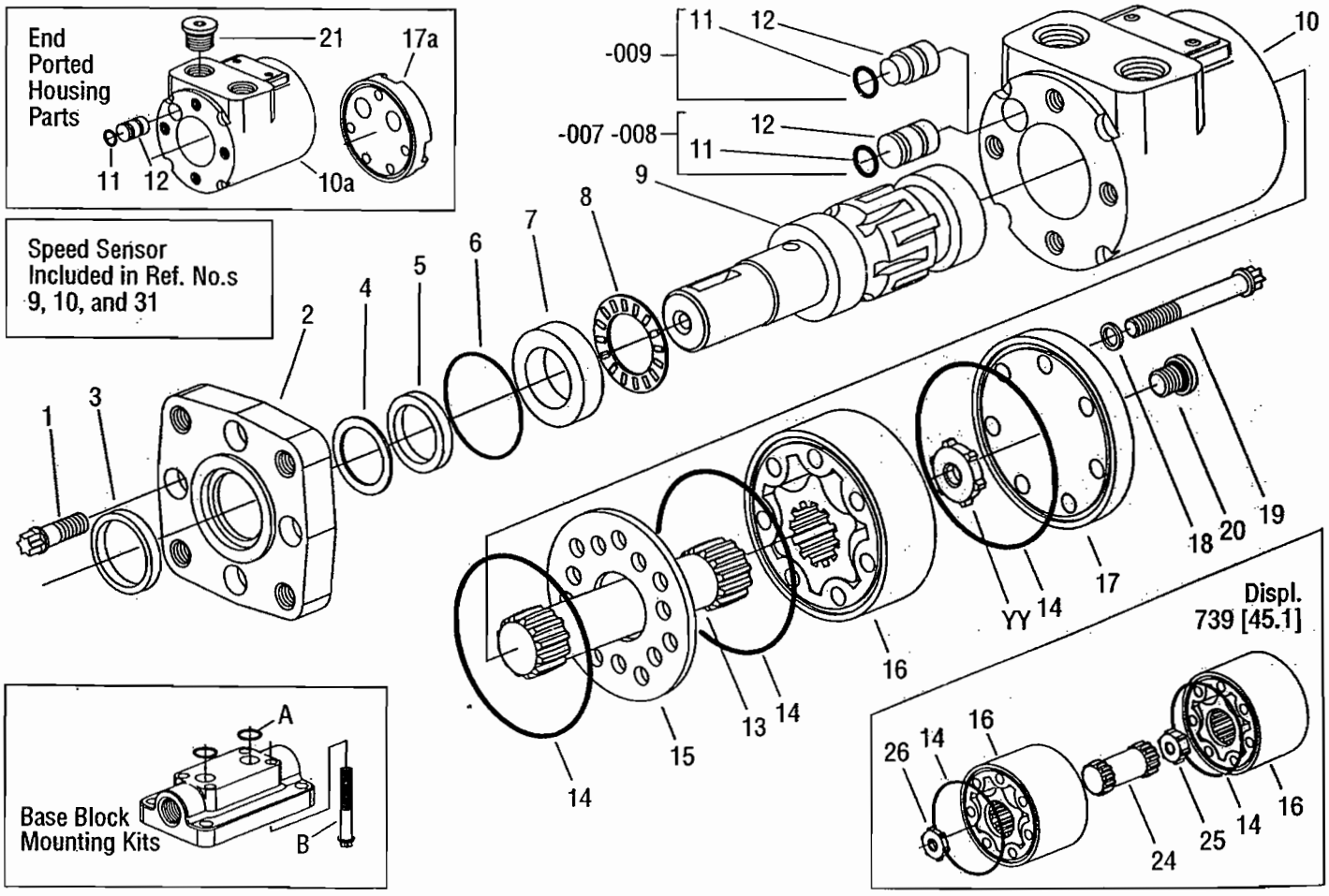
007 008 009

-007 Design Code

Displ. cm³/r [in³/r]	Ref. No. 13		Ref. No. 16		Ref. No.YY		Ref. No. 19	
	Drive	Length mm [in.]	Gerotor	Width mm [in.]	Spacer	Width mm [in.]	Screw, Cap	Length mm [in.]
49 [3.0]	602-000	76,2 [3.00]	8277-001	6,4 [.25]	N/A		16294-150	38,1 [1.50]
74 [4.5]	602-000	76,2 [3.00]	8277-002	9,7 [.38]	N/A		16294-162	41,4 [1.62]
102 [6.2]	616-000	81,8 [3.22]	8277-003	13,2 [.52]	N/A		16294-175	44,5 [1.75]
169 [10.3]	616-000	81,8 [3.22]	8277-004	21,8 [.86]	6901-002	7,9 [.31]	16294-212	54,1 [2.12]
195 [11.9]	616-000	81,8 [3.22]	8277-005	25,4 [1.00]	6901-003	12,2 [.48]	16294-225	57,1 [2.25]
244 [14.9]	616-000	81,8 [3.22]	8277-006	31,7 [1.25]	6901-005	18,5 [.73]	16294-250	63,5 [2.50]
277 [16.9]	616-000	81,8 [3.22]	8277-007	38,1 [1.50]	6901-006	24,9 [.98]	16294-275	69,8 [2.75]
390 [23.8]	616-000	81,8 [3.22]	8277-008	50,8 [2.00]	6901-008	37,6 [1.48]	16294-325	82,6 [3.25]

-008 Design Code

Displ. cm³/r [in³/r]	Ref. No. 13		Ref. No. 16		Ref. No. YY		Ref. No. 19	
	Drive	Length mm [in.]	Gerotor	Width mm [in.]	Spacer	Width mm [in.]	Screw, Cap	Length mm [in.]
49 [3.0]	602-000	76,2 [3.00]	8277-001	6,4 [.25]	N/A		16294-150	38,1 [1.50]
74 [4.5]	602-000	76,2 [3.00]	8277-002	9,7 [.38]	N/A		16294-162	41,4 [1.62]
102 [6.2]	616-000	81,8 [3.22]	8277-003	13,2 [.52]	N/A		16294-175	44,5 [1.75]
169 [10.3]	8664-000	91,7 [3.61]	8277-004	21,8 [.86]	N/A		16294-212	54,1 [2.12]
195 [11.9]	8664-000	91,7 [3.61]	8277-005	25,4 [1.00]	6901-009	3,4 [.14]	16294-225	57,1 [2.25]
244 [14.9]	8664-000	91,7 [3.61]	8277-006	31,7 [1.25]	6901-002	7,9 [.31]	16294-250	63,5 [2.50]
277 [16.9]	8634-000	107,4 [4.24]	8277-007	38,1 [1.50]	N/A		16294-275	69,8 [2.75]
390 [23.8]	8634-000	107,4 [4.24]	8277-008	50,8 [2.00]	6901-004	14,0 [.55]	16294-325	82,6 [3.25]



H Series Motors

-009 Design Code

Displ. cm³/r [in³/r]	Ref. No. 13 Drive	Length mm [in.]	Ref. No. 16 Gerotor	Width mm [in.]	Ref. No. YY Spacer	Width mm [in.]	Ref. No. 19 Screw, Cap	Length mm [in.]
37 [2.2]	602-000	76,2 [3.00]	21850-022	6,4 [.25]	N/A		16294-150	38,1 [1.50]
46 [2.8]	602-000	76,2 [3.00]	8277-001	6,4 [.25]	N/A		16294-150	38,1 [1.50]
59 [3.6]	22250-000	80,8 [3.15]	21850-023	10,2 [.40]	N/A		16294-162	44,4 [1.62]
74 [4.5]	22250-000	80,8 [3.15]	8277-024	10,2 [.40]	N/A		16294-162	41,4 [1.62]
96 [5.9]	616-000	81,8 [3.22]	8277-003	13,2 [.52]	N/A		16294-175	44,5 [1.75]
120 [7.3]	22251-000	86,2 [3.40]	8277-009	16,5 [.65]	N/A		16294-188	47,8 [1.88]
146 [8.9]	22252-000	89,9 [3.54]	8277-020	20,1 [.79]	N/A		16294-200	50,8 [2.00]
159 [9.7]	8664-000	91,7 [3.61]	8277-004	21,8 [.86]	N/A		16294-212	54,1 [2.12]
185 [11.3]	22189-000	95,8 [3.77]	8277-005	25,4 [1.00]	N/A		16294-225	57,1 [2.25]
231 [14.1]	22190-000	102,1 [4.02]	8277-025	31,7 [1.25]	N/A		16294-250	63,5 [2.50]
293 [17.9]	22253-000	110,5 [4.35]	8277-026	40,4 [1.59]	N/A		16294-288	73,2 [2.88]
370 [22.6]	22191-000	121,2 [4.77]	8277-027	50,8 [2.00]	N/A		16294-325	82,6 [3.25]
739 [45.1]	8634-000	107,4 [4.23]	21850-028 (2)	50,8 [2.00] (ea.)	(See Ref. 25 and 26)		16294-525	133,3 [5.25]

Ref. No.	Design Code/Part Number -007	-008	-009	Description	Quantity
1	16292-088	16292-088	16292-088	Screw, Cap (6 Point (E10) Drive 5/16-24 UNF x 7/8)	4
2	7463-000	22000-001	22000-001	Flange Mounting (2 Bolt)	1
	7464-000	22000-002	22000-002	Flange Mounting (4 Bolt) 3/8-16 UNC	1
	—	22000-006	22000-006	Flange Mounting (4 Bolt) M10 x 1,5	1
	—	22000-004	22000-004	Flange Mounting (2 Bolt SAE B)	1
	—	22000-005	22000-005	Flange Mounting (4 Bolt Magneto)	1
X 3	9121-002	9121-002	9121-002	Seal, Exclusion	1
X 4	N/A	22002-000	22002-000	Washer, Backup	1
X 5	9057-001	9057-014	9057-014	Seal, Pressure	1
X 6	9091-001	9091-001	9091-001	Seal	1
7	7462-000	7462-000	7462-000	Race, Thrust Bearing	1
8	7537-000	7537-000	7537-000	Bearing, Thrust Needle	1
9	7360-001	7360-001	7360-001	Shaft, Output (1 in. Dia. Straight with Woodruff Key Slot)	1
			220879-001	Shaft, Output (1 in. Dia. Straight with Woodruff Key Slot — *Sensor Shaft*)	1
	7360-002	7360-002	7360-002	Shaft, Output (SAE 6B Splined)	1
	7360-007	7360-007	7360-007	Shaft, Output (1 in. Dia. Straight with .315 Dia. Crosshole)	1
	7360-008	7360-008	7360-008	Shaft, Output (1 in. Dia. Straight with .406 Dia. Crosshole)	1
	7360-024	7360-024	7360-024	Shaft, Output (25 mm Dia. Straight)	1
	7360-016	7360-016	7360-016	Shaft, Output (7/8 in. Dia. SAE B 13 T Splined)	1
	7360-017	7360-017	7360-017	Shaft, Output (7/8 in. Dia. Straight SAE B Straight)	1
	7360-018	7360-018	7360-018	Shaft, Output (1 in. Dia. Tapered)	1
	14193-000	14193-000	14193-000	Key, Woodruff (1 in. Dia. Straight Shaft)	1
	14193-000	14193-000	14193-000	Key, Woodruff (for Tapered Shaft)	1
	14391-004	14391-004	14391-004	Key, Straight (for 7/8 in. Dia. Shaft)	1
	14462-006	14462-006	14462-006	Key, Straight (for 25 mm Dia. Shaft)	1
	14381-000	14381-000	14381-000	Nut (for Tapered Shaft)	1

Continued on Next Page (Page 4)

Continued from Page 3

Ref. No.	Design Code/Part Number -007	-008	-009	Description	Quantit
10	7359-001	7359-001	22230-001	Housing, 7/8-14 O-ring Ports	1
			201225-001	Housing, 7/8-14 O-ring Ports — *Sensor Housing*	1
	7359-002	7359-002	22230-002	Housing, 1/2 NPTF Ports	1
			201225-002	Housing, 1/2 NPTF Ports — *Sensor Housing*	1
	7359-003	7359-003	22230-003	Housing, Manifold Ports (5/16-18 UNC)	1
	7359-006	7359-006	22230-006	Housing, G 1/2 (BSP) Ports	1
	7359-004	7359-004	22230-004	Housing, Manifold Ports (M8 x 1.5)	1
10a	21388-000	21388-000	22294-001	Housing, End Ported Motor	1
X 11	15007-000	15007-000	250001-011	O-ring	1
12	8985-000	8985-000	22229-000	Plug	1
13	*	*	*	Drive	1
X 14	9086-002	9086-002	9086-002	Seal (Displ. 739 [45.1] — Qty. 4)	3
15	7358-000	7358-000	7358-000	Plate, Spacer	1
16	*	*	*	Gerotor (Displ. 739 [45.1] — Qty. 2)	1
17	7461-000	7461-000	7461-000	Cap, End (without Port(s))	1
	7611-000	7611-000	7611-000	Cap, End (with 7/16-20 O-ring Drain Port)	1
	21779-000	21779-000	21779-000	Cap, End (with G 1/4 (BSP) Drain Port)	1
17a	21387-001	21387-001	21387-001	Cap, End (with 3/4-16 O-ring Ports (2))	1
	21387-002	21387-002	21387-002	Cap, End (with 3/4-16 O-ring Ports (2) and 7/16-20 O-ring Drain Port)	1
	21387-003	21387-003	21387-003	Cap, End (with G 1/2 (BSP) Ports (2) and G 1/4 (BSP) Drain Port)	1
X 18	14488-000**	14488-000**	14488-000**	Seal, Washer	7
19	*	*	*	Screw, Cap (6 Point (E10) Drive 5/16-24 UNF) (End Ported— Qty. 5)	7
20	9072-003	9072-003	9072-003	Plug/ O-ring (7/16-20 Drain Port)	1
X	250003-904	250003-904	250003-904	O-ring for 7/16-20 Drain Port Plug	1
	9170-002	9170-002	9170-002	Plug/O-ring (G 1/4 (BSP) Drain Port)	1
	—	—	—	O-ring for G 1/4 (BSP) Drain Port Plug	1
21	9072-007	9072-007	9072-007	Plug/ O-ring, Housing (7/8-14 Plug S/A used w/End Ported Motors)	2
X	250003-910	250003-910	250003-910	O-ring for 7/8-14 Housing Port Plug	2
	9179-007	9179-007	9179-007	Plug/ O-ring (Viton), Housing (7/8-14 Plug S/A used w/End Ported Motors)	2
	250017-910	250017-910	250017-910	O-ring (Viton) for 7/8-14 Housing Port Plug	2
24	—	—	45-000	Drive (Displ. 739 [45.1] Only)	1
25	—	—	6901-002	Spacer (Displ. 739 [45.1] Only)	1
26	—	—	6901-009	Spacer (Displ. 739 [45.1] Only)	1
YY	*	*	N/A	Spacer	1
31			201137-001	Sensor, Speed (127mm [5.0 in.] Lead Wire)	1
Seal Kit	60023-000	60540-000	60540-000	Seal Kit (Buna N) — Contains Parts Indicated by X	
	60032-000	60545-000	60545-000	Seal Kit (Viton) — Contains Parts Indicated by X (Part No.s Differ from those Shown)	
Mounting Kit	123-1007	123-1007	123-1007	Base Block Mounting Kit (1/2 NPTF Ports (Manifold Mount Motors Only))	
	123-1008	123-1008	123-1008	Base Block Mounting Kit (7/8-14 O-ring Ports (Manifold Mount Motors Only))	
X A	15058-000	15058-000	15058-000	Seal, O-ring (2)	
B	267512-019	267512-019	267512-019	Screw, Cap (5/16-18 Thread (4))	
	—	—	14474-003	Screw, Cap (M8 x 1.5) Thread (4))	

* See Chart on Page 2

** Used with 12 Point Cap Screws Only *(Replacement Screws are 6 Point (E10) Drive, no Seal Washer Required).*

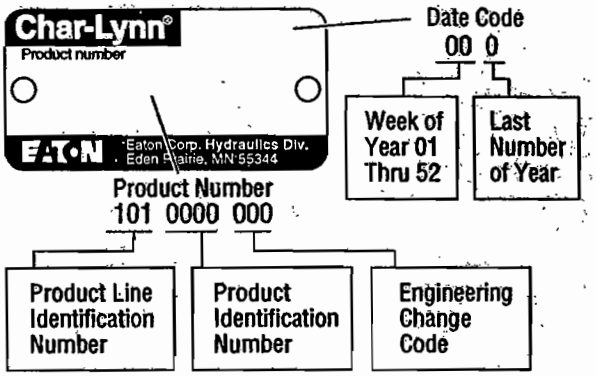
How to Order Replacement Parts

Each Order Must Include the Following:

1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts

For More Detailed Information Contact Eaton Corp. Hydraulics Division 15151 Highway 5 Eden Prairie, MN 55344.

- Specifications and performance data, Catalog No. 11-885
- When servicing H Series Motors refer to Repair Information No. 7-117. This repair manual lists tools required, and step by step disassembly and reassembly procedures.



Eaton Corporation
Hydraulics Division
15151 Hwy. 5
Eden Prairie, MN 55344
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Fax 02102-406-800

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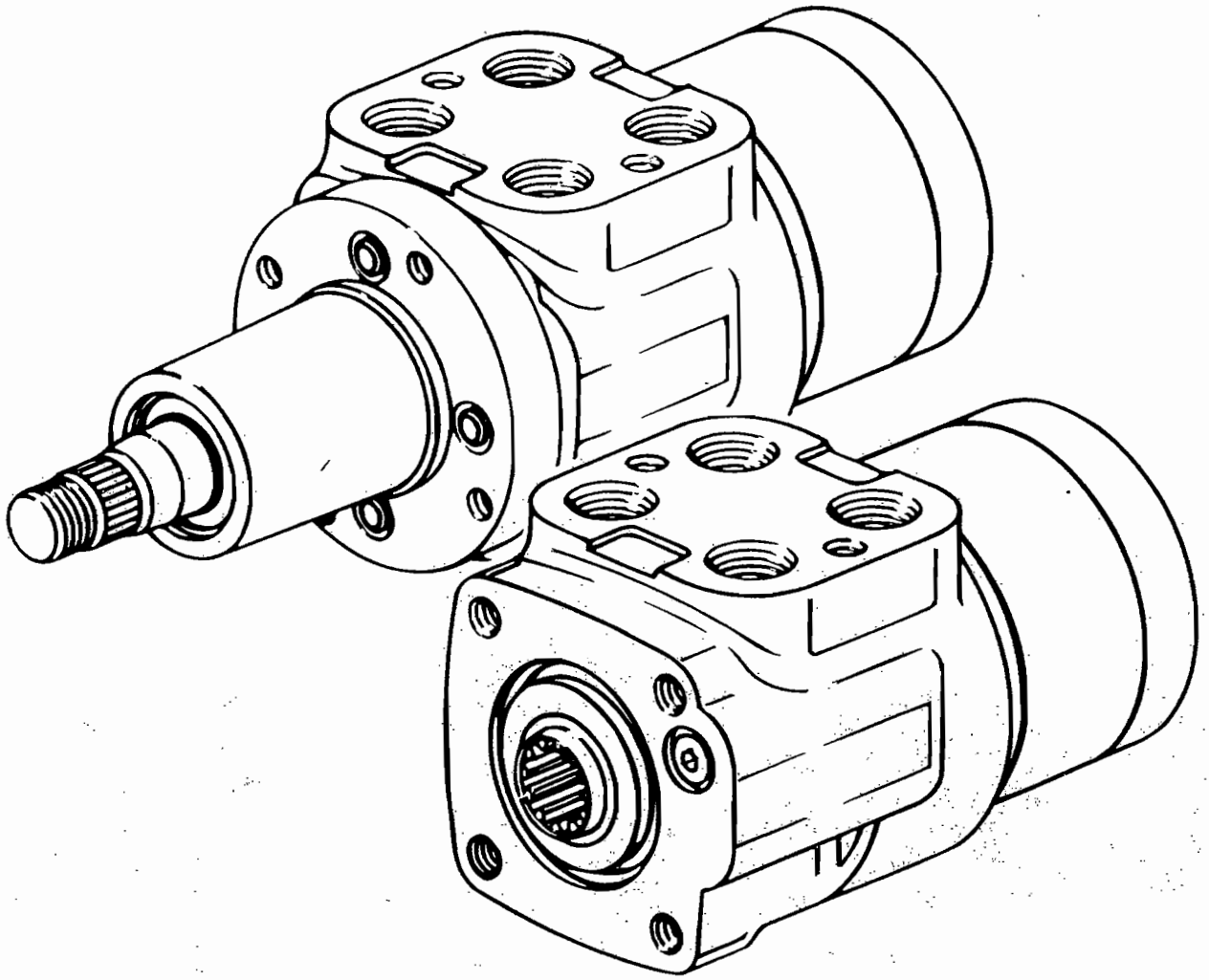
EATON

Char-Lynn®
Power Steering

No. 7-304
Revised May, 1993

EATON

Repair Information



3, 4, 6, and 12 Series Steering Control Units

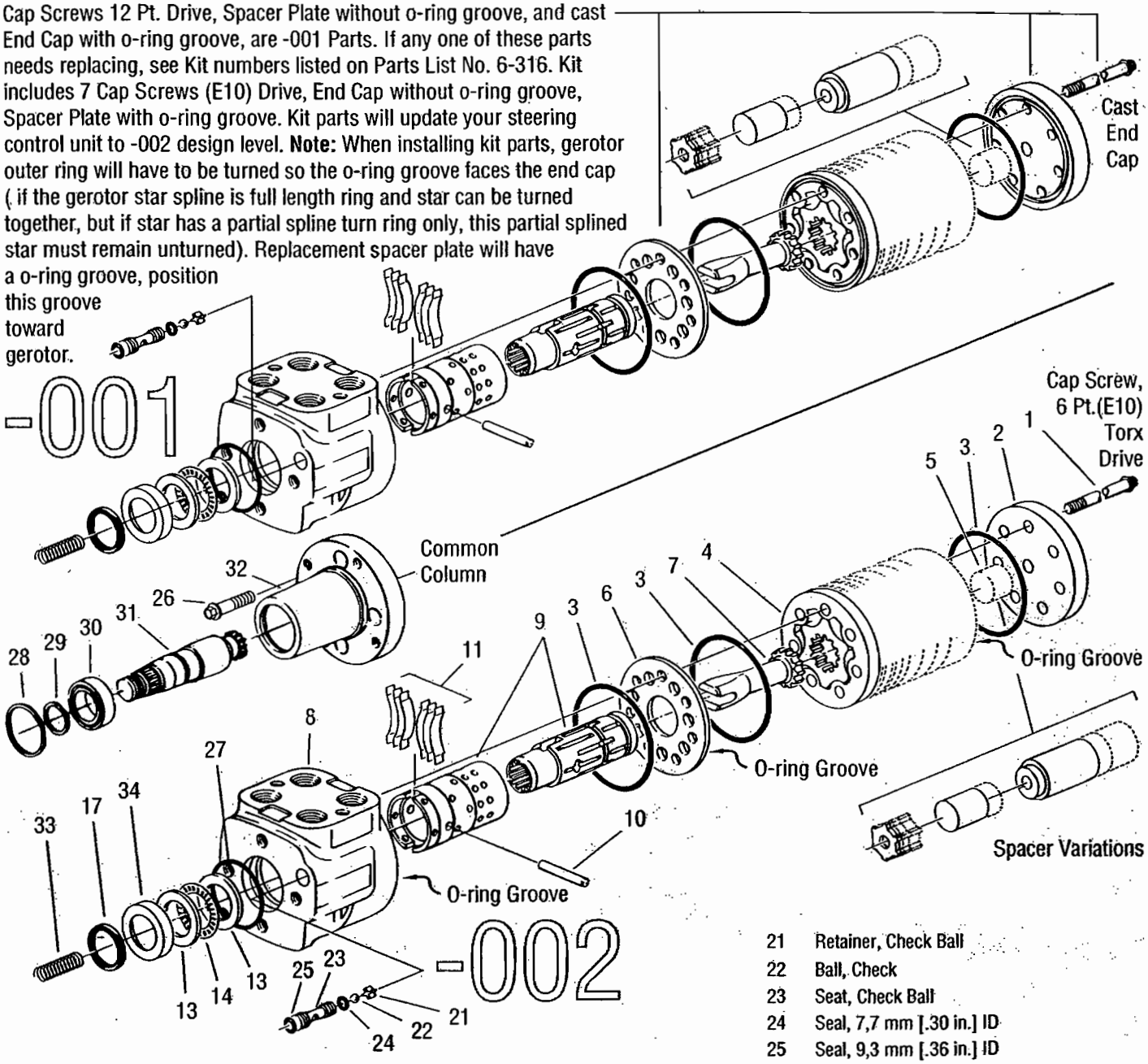
001 002

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.



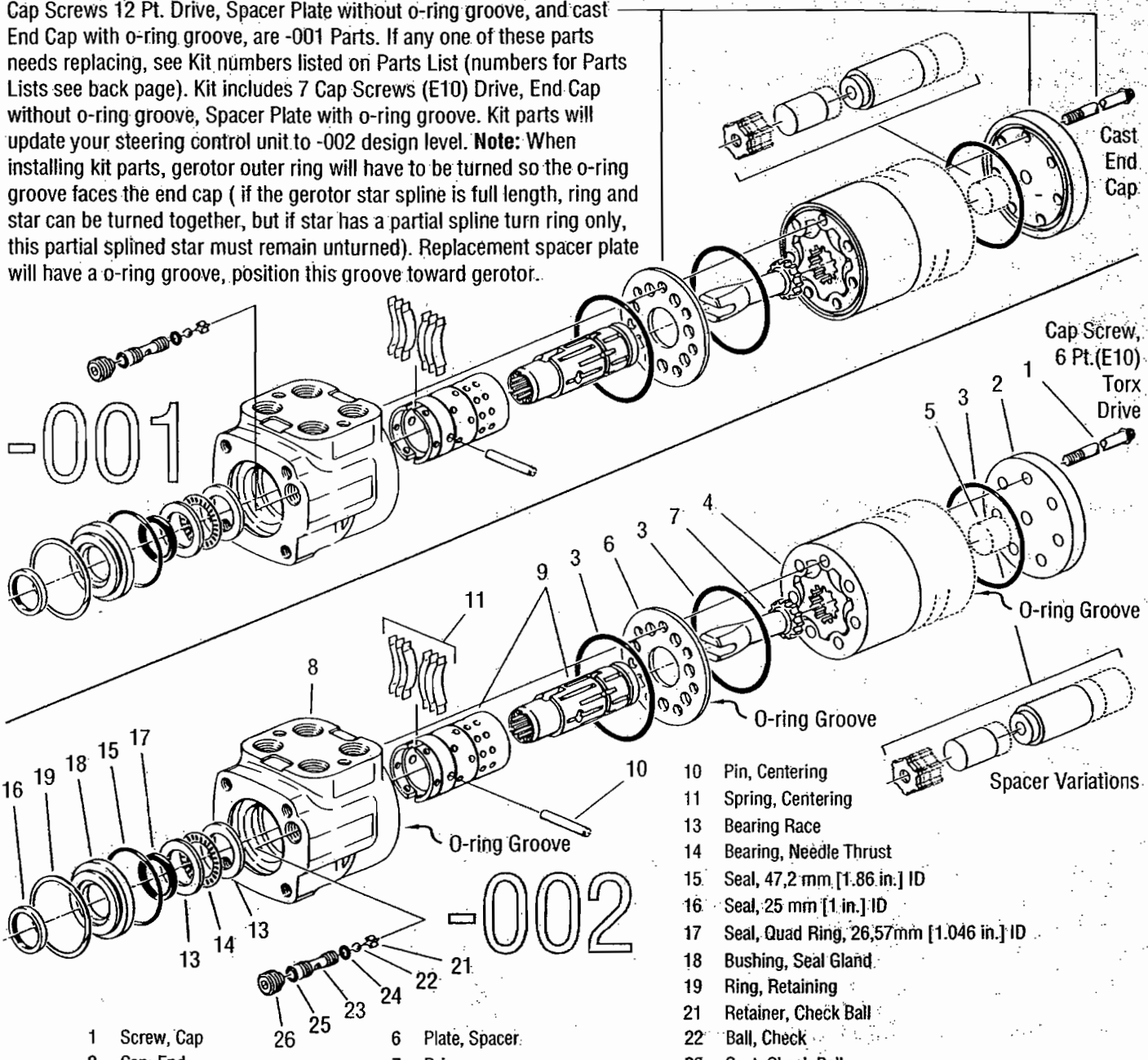
1 Screw, Cap, 6 Point (E10) Drive
2 Cap, End
3 Seal, 73,5 mm [2.89 in.] ID
4 Gerotor
5 Spacer
6 Plate, Spacer
7 Drive
8 Housing
9 Sleeve, Control
Spool, Control
10 Pin, Centering
11 Spring, Centering
13 Bearing Race
14 Bearing, Needle Thrust
15 Seal, 47,2 mm [1.86 in.] ID
17 Seal, Quad Ring, 26,57mm [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

EATON

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.



1 Screw, Cap
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 Spool, Control
10 Pin, Centering
11 Spring, Centering
13 Bearing Race
14 Bearing, Needle Thrust
15 Seal, 47,2 mm [1.86 in.] ID
16 Seal, 25 mm [1 in.] ID
17 Seal, Quad Ring, 26,57mm [1.046 in.] ID
18 Bushing, Seal Gland
19 Ring, Retaining
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, Set

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 helpfull.

—*Spring installation tool 600057-000

* Tools are available by special order — contact Eaton Corporation service department

Disassembly

Cleanliness is extremely important when repairing a steering control unit. Work in a clean area. Before disconnecting lines, clean port area of unit thoroughly. Use a wire brush to remove foreign material and debris from around exterior joints of the unit.

Note: Trouble shooting information on pages 13, 14, and 15 defines terms and problems, possible causes for problems, and recommends procedures for correcting problems.

> Although not all drawings show the unit in a vise, we recommend that you keep the unit in the vise during disassembly. Follow the clamping procedures explained throughout the manual.

Meter (Gerotor) End

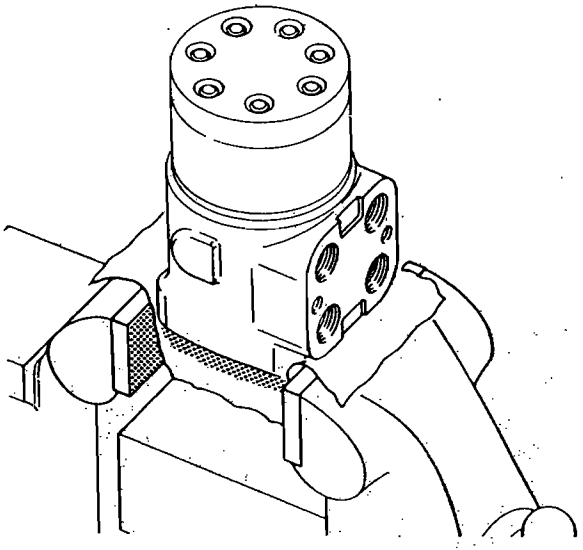


Figure 1

1 Clamp unit in vise, meter end up. Clamp lightly on edges of mounting area, see Fig. 1. Use protective material on vise jaws. Housing distortion could result if jaws are overtightened.

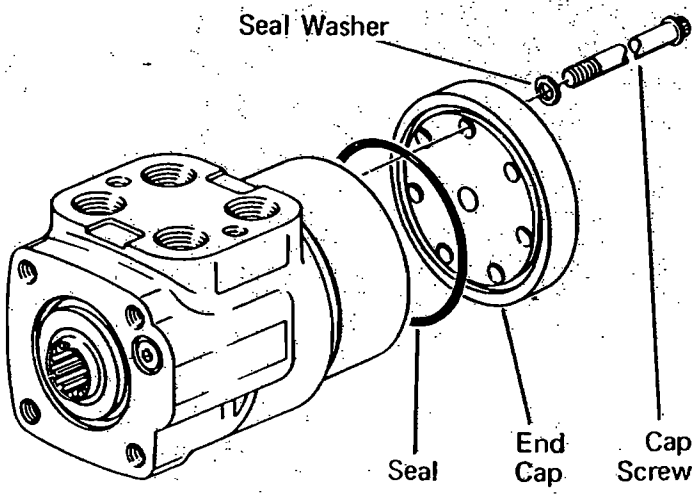


Figure 2

2 Remove 5/16" cap screws.

3 Remove end cap.

4 Remove seal from end cap.

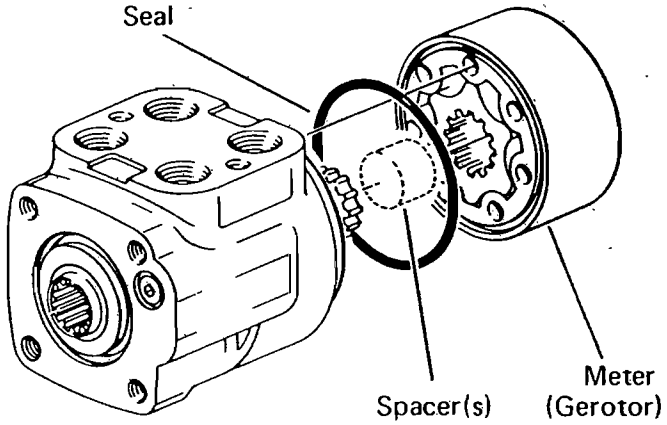


Figure 3

5 Remove meter. Be careful not to drop star.

6 Remove seal from meter.

7 Remove drive spacer(s) (not used on 4.5 cu. in displacement units).

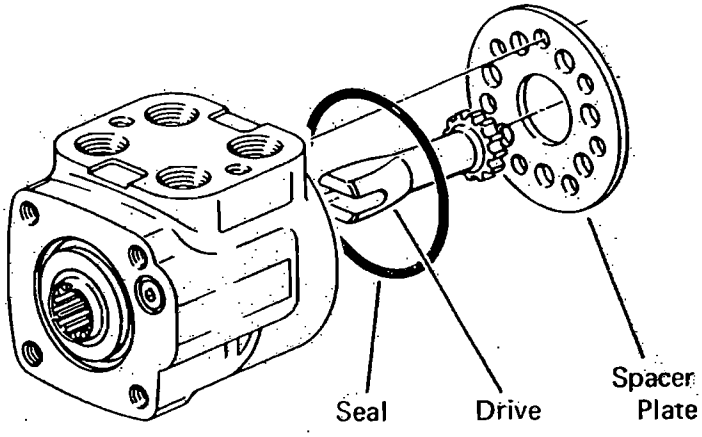


Figure 4

8 Remove drive.

9 Remove spacer plate.

10 Remove seal from housing.

Control End

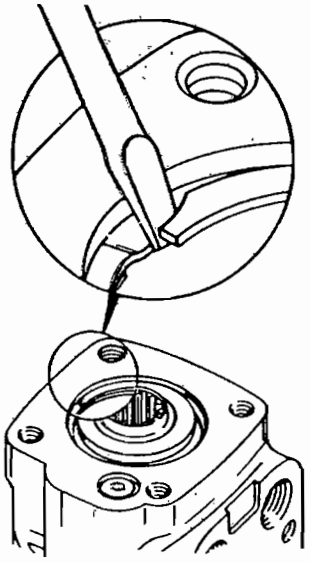


Figure 5

11 Remove housing from vise. Place housing on a clean soft cloth to protect surface finish. Use a thin bladed screwdriver to pry retaining ring from housing, as shown in Fig. 5.

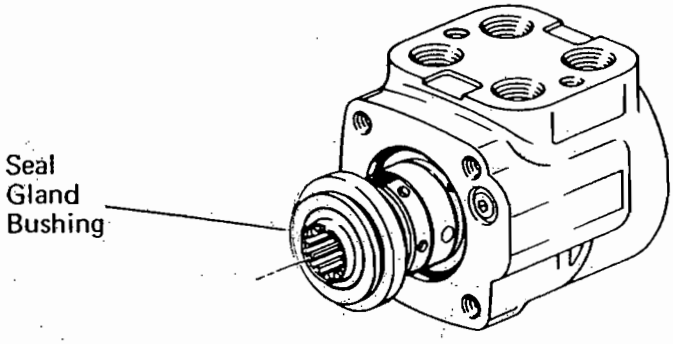


Figure 6

12 Rotate spool and sleeve until pin is horizontal. Push spool and sleeve assembly forward with your thumbs just far enough to free gland bushing from housing, see Fig. 6. Remove bushing

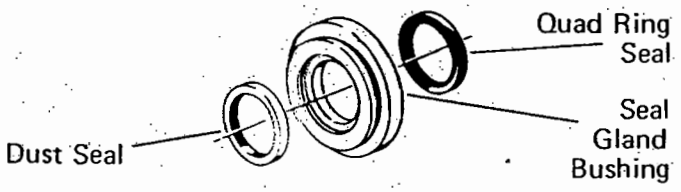


Figure 7

13 Remove quad ring seal from seal gland bushing.

14 Use a thin bladed screwdriver to pry dust seal from seal gland bushing. Do not damage bushing.

Note: If the unit you are repairing is a low input torque steering control unit, see page 12 for disassembly and reassembly procedures.

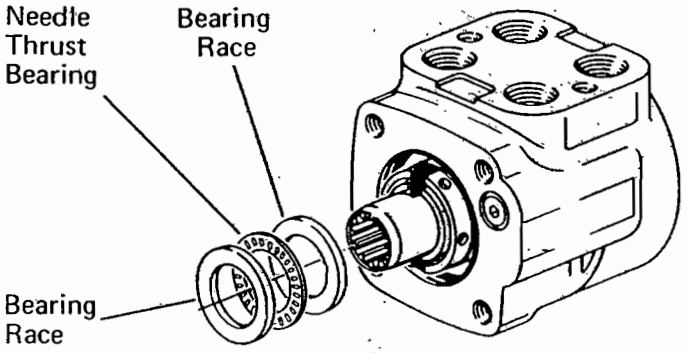


Figure 8

15 Remove 2 bearing races and the needle thrust bearing from spool and sleeve assembly.

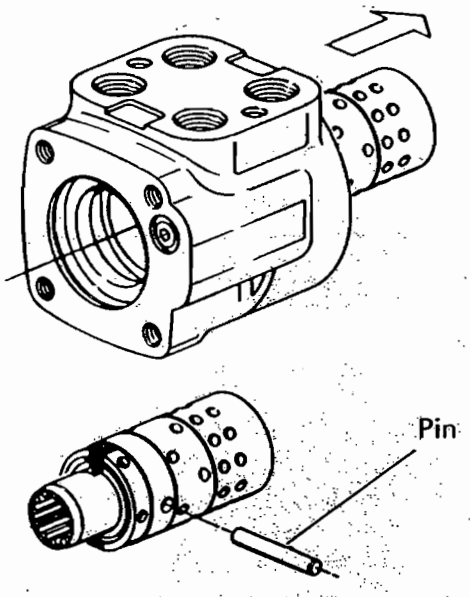


Figure 9

16 Remove spool and sleeve assembly from 14 hole end of housing, see Fig. 9.

Attention: **Do not bind spool and sleeve in housing. Rotate spool and sleeve assembly slowly when removing from housing.**

17 Push pin from spool and sleeve assembly.

Disassembly

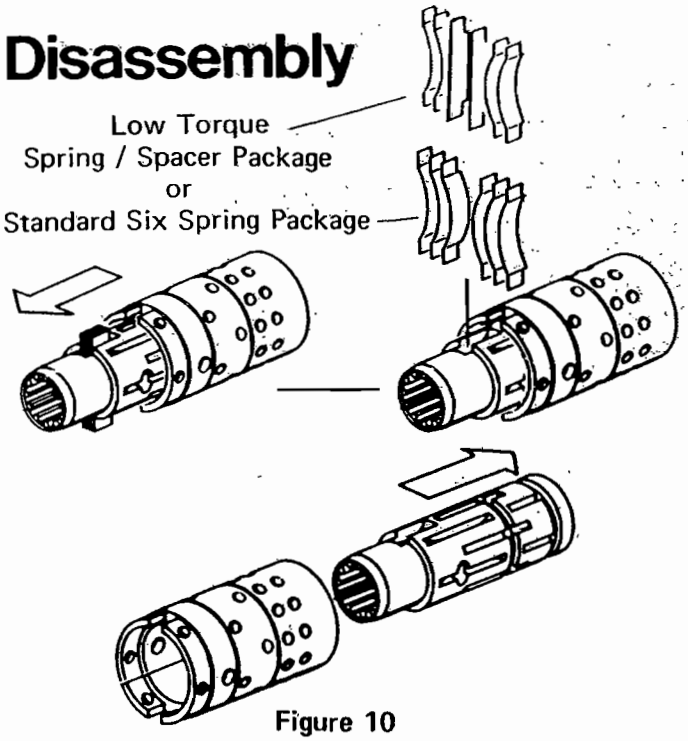


Figure 10

18 Push spool partially from control end of sleeve, then remove 6 centering springs from spool carefully by hand, see Fig. 10.

19 Push spool back through and out of sleeve, see Fig. 10. Rotate spool slowly when removing from sleeve.

20 Remove seal from housing, see Fig. 11.

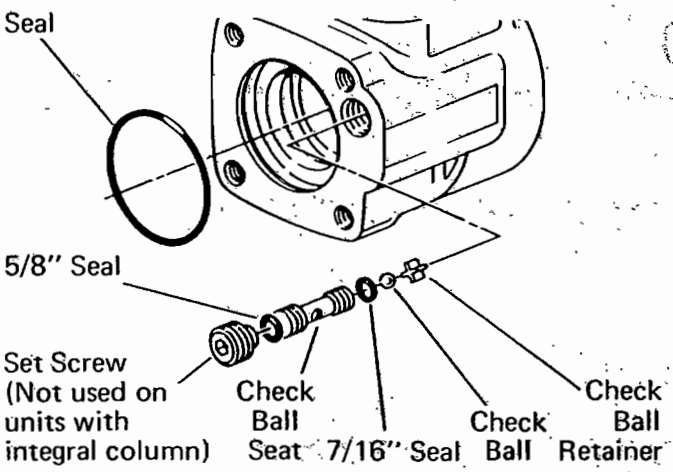


Figure 11

21 Remove set screw (not used on units with integral column) from housing, see Fig. 11.

22 Screw a #10-24 machine screw into end of check ball seat. Then by pulling on screw, with a pliers; lift seat out of housing.

23 Remove 2 seals from check valve seat.

24 Tip housing to remove check ball and check ball retainer.

Reassembly

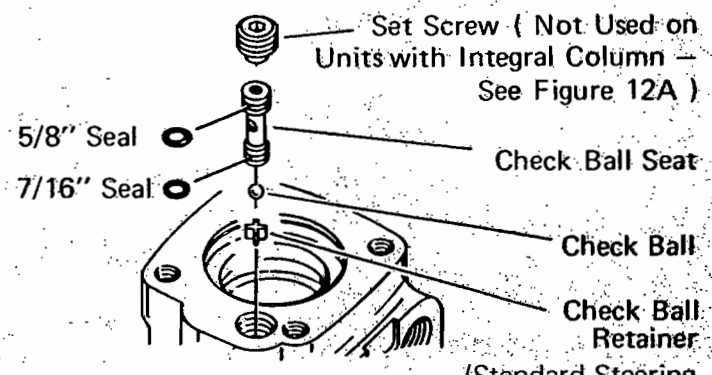
Check all mating surfaces. Replace any parts that have scratches or burrs that could cause leakage. Clean all metal parts in clean solvent. Blow dry with air. Do not wipe dry with cloth or paper towel because lint or other matter can get into the hydraulic system and cause damage. Do not use a coarse grit or try to file or grind these parts.

Note: Lubricate all seals with clean petroleum jelly such as Vaseline.

Do not use excessive lubricant on seals for meter section.

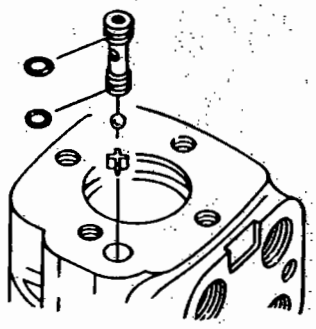
Refer to parts listings covering your steering control unit when ordering replacement parts. A good service policy is to replace all old seals with new seals.

Control End



(Standard Steering Control Unit)

Figure 12



(Integral Column Steering Control Unit)

Figure 12A

7 Reassembly

1 Use a needle nose pliers to lower check ball retainer into check valve hole of housing. Make sure retainer is straight (not tilted on edge) in housing, see Fig. 12.

2 Install check ball in housing.

3 Lubricate 5/8" diameter seal and 7/16" diameter seal. Install seals on check ball seat as shown in Fig. 12.

4 Lubricate check ball seat and seals thoroughly before installing seat in housing. When installing seat do not twist or damage seals. Install check ball seat in housing, insert open end of seat first, see Fig. 12. Push check ball seat to shoulder of hole.

5 Install set screw (not used on units with integral column, see Fig. 12A). Use a 1/4" allen wrench to torque set screw to 100 inch pounds. To prevent interference, make sure top of set screw is slightly below housing mounting surface.

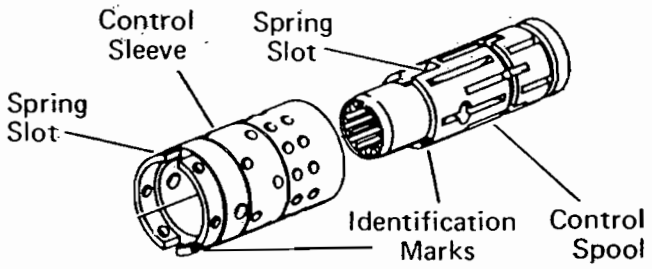


Figure 13

6 Assemble spool and sleeve carefully so that the spring slots line up at the same end. Rotate spool while sliding parts together. Some spool and sleeve sets have identification marks, align these marks as shown in Fig. 13. Test for free rotation. Spool should rotate smoothly in sleeve with finger tip force applied at splined end.

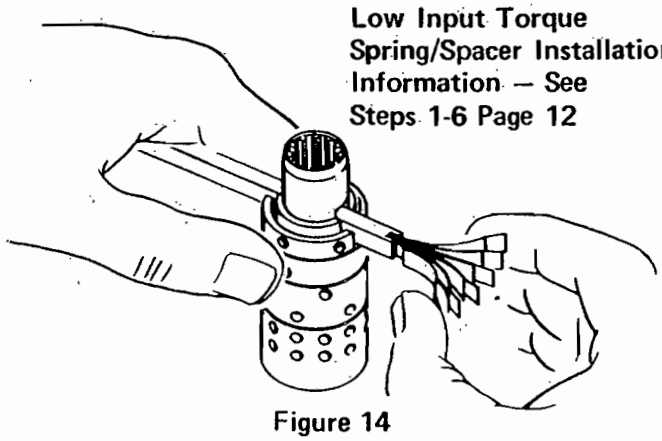


Figure 14

7 Bring spring slots of both parts in line and stand parts on end of bench. Insert spring installation tool through spring slots of both parts. Tool is available as part no. 600057. Position 3 pairs of centering springs (or 2 sets of 3 each) on bench so that extended edge is down and arched center section is together. In this position, insert one end of entire spring set into spring installation tool, as shown in Fig. 14, with spring notches facing sleeve.

8 Compress extended end of centering spring set and push into spool sleeve assembly withdrawing installation tool at the same time.

9 Center the spring set in the parts so that they push down evenly and flush with the upper surface of the spool and sleeve.

10 Install pin through spool and sleeve assembly until pin becomes flush at both sides of sleeve.

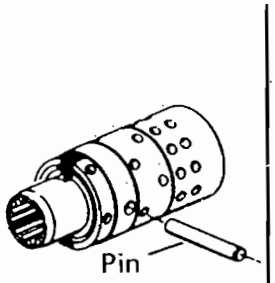


Figure 15

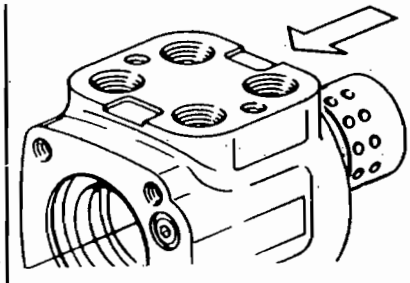


Figure 16

11 Position the spool and sleeve assembly so that the splined end of the spool enters the 14 hole end of housing first, see Fig. 16.

Attention: **Be extremely careful that the parts do not tilt out of position while inserting. Push parts gently into place with slight rotating action, keep pin nearly horizontal. Bring the spool assembly entirely within the housing bore until the parts are flush at the meter end or 14 hole end of housing. Do not pull the spool assembly beyond this point to prevent the cross pin from dropping into the discharge groove of the housing. With the spool assembly in this flush position, check for free rotation within the housing by turning with light finger tip force at the splined end.**

12 Place housing on clean, lint free cloth. Install 2-1/8" diameter seal in housing, see Fig. 17.

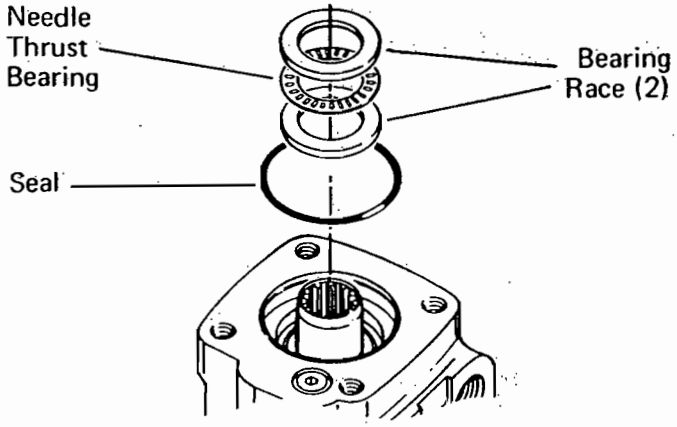


Figure 17

13 Install 2 bearing races and the needle thrust bearing in the order shown in Fig. 17.

14 Install 1-1/4" diameter dust seal in seal gland bushing, flat or smooth side of dust seal must face down towards bushing, see Fig. 19.

15 Install the quad ring seal in seal gland bushing. Smooth seal in place with your finger. Do not use any seal that falls freely into pocket of bushing, see Fig. 19.

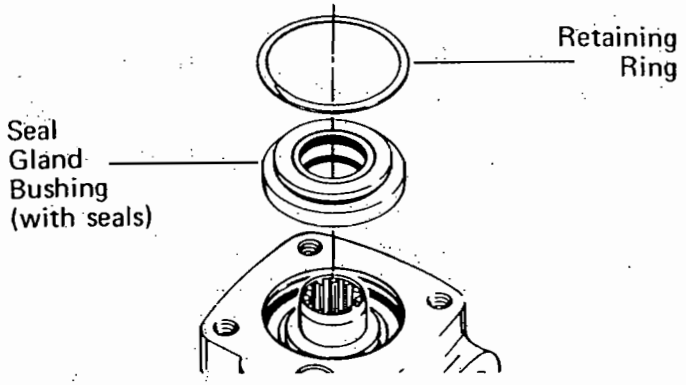


Figure 18

16 Install seal gland bushing over the spool end with a twisting motion. Tap the bushing in place with a rubber hammer. Make sure the bushing is flush against the bearing race.

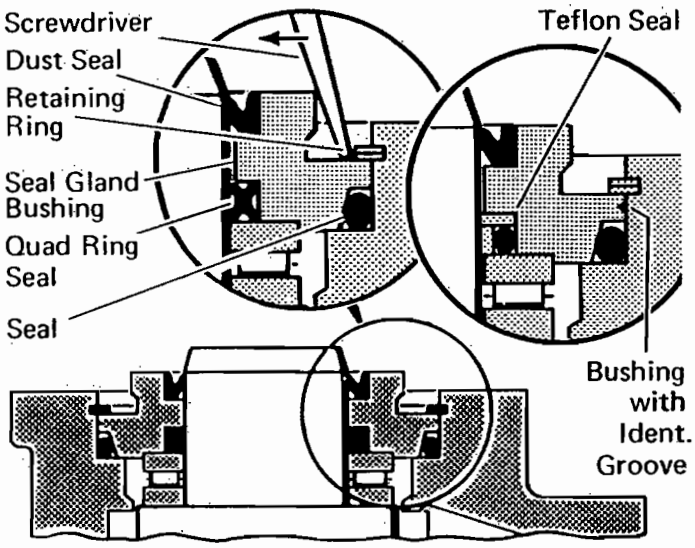


Figure 19

17 Install retaining ring (see Fig. 18-19) in housing. After installing ring, tap on ring end or pry with screwdriver around entire circumference of ring to properly seat ring in groove.

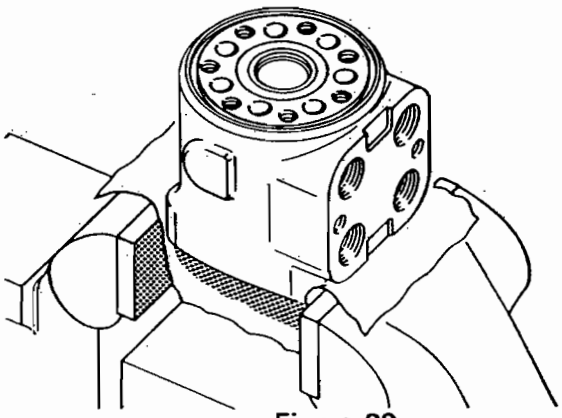


Figure 20

18 Clamp housing in vise, as shown in Fig. 20. Clamp lightly on edges of mounting area. Do not over tighten jaws.

Note: Check to insure that the spool and sleeve are flush or slightly below the 14 hole surface of the housing.

Attention: Clean the upper surface of the housing by wiping with the palm of clean hand. Clean each of the flat surfaces of the meter section parts in a similar way when ready for reassembly. Do not use cloth or paper to clean surfaces.

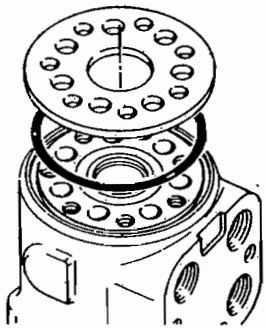


Figure 21

19 Install 3" diameter seal in housing, see Fig. 21.

20 Install spacer plate. Align bolt holes in spacer plate with tapped holes in housing.

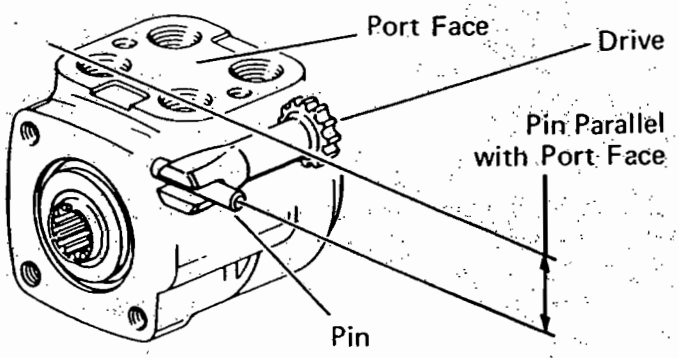


Figure 22

21 Rotate spool and sleeve assembly until pin is parrallel with port face, see Fig. 22. Install drive, make sure you engage drive with pin, To assure proper alignment, mark drive as shown in Fig. 24 (ref. B). Note relationship between slotted end of drive to splined end of drive when marking.

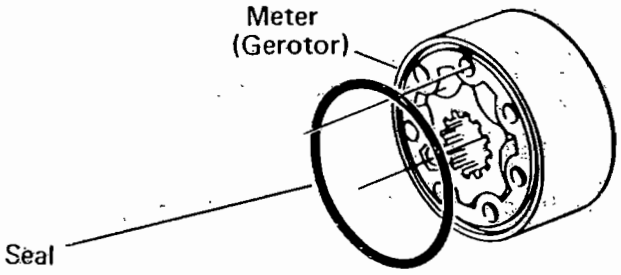


Figure 23

22 Install 3" diameter seal in meter.

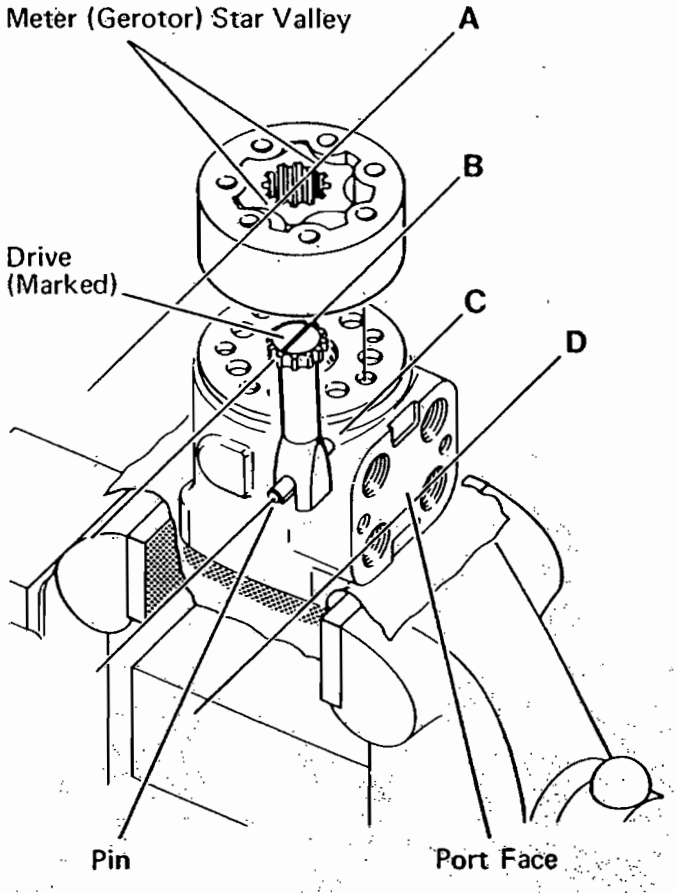
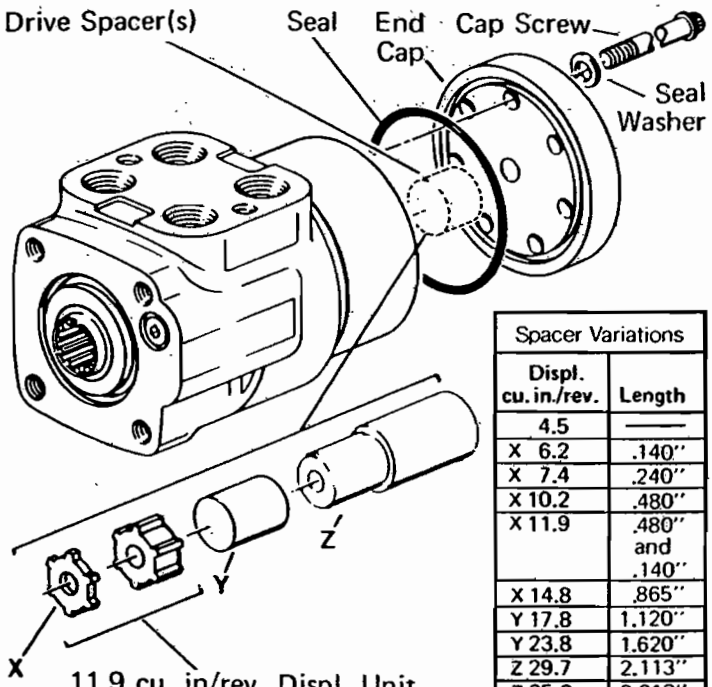


Figure 24

23 With seal side of meter toward spacer plate, align star valleys (ref. A) on drive (ref. B). Note the parallel relationship of reference lines A, B, C, and D— Fig. 24. Align bolt holes without disengaging meter from drive.

Reassembly



Spacer Variations	
Displ. cu. in./rev.	Length
4.5	——
X 6.2	.140"
X 7.4	.240"
X 10.2	.480"
X 11.9	.480" and .140"
X 14.8	.865"
Y 17.8	1.120"
Y 23.8	1.620"
Z 29.7	2.113"
Z 35.6	2.613"
Z 47.5	3.613"

Figure 25

24 Install drive spacer(s) when used, in meter, see Fig. 25.

25 Install 3" diameter seal in end cap.

26 Install end cap on gerotor, align holes.

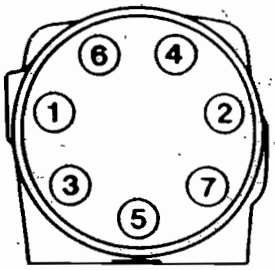


Figure 26

27 Install 7 dry cap screws with new seal washers in end cap. Pretighten screws to 150 inch pounds, then torque screws to 275 inch pounds in sequence shown in Fig. 26.

Disassembly

Disassembly of Integral Column Sub Assembly

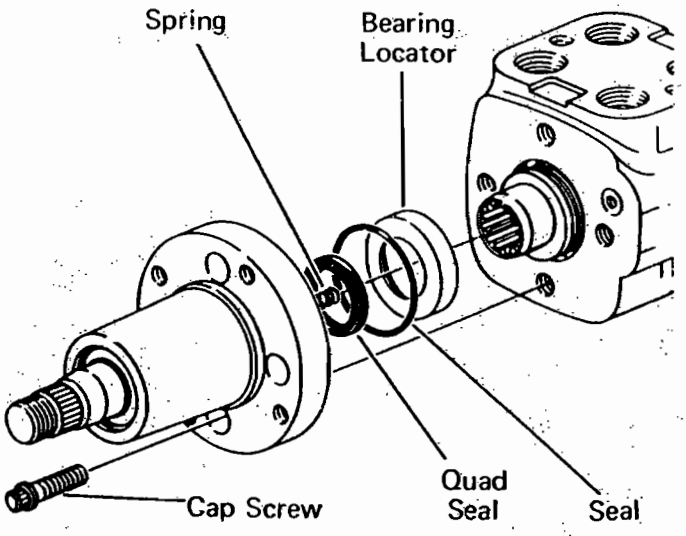


Figure 27

1 Remove 4 cap screws from column.

2 Remove column and spring, see Fig. 27.

3 Remove bearing locator.

4 Remove quad ring seal, and 1-15/16" diameter seal from column.

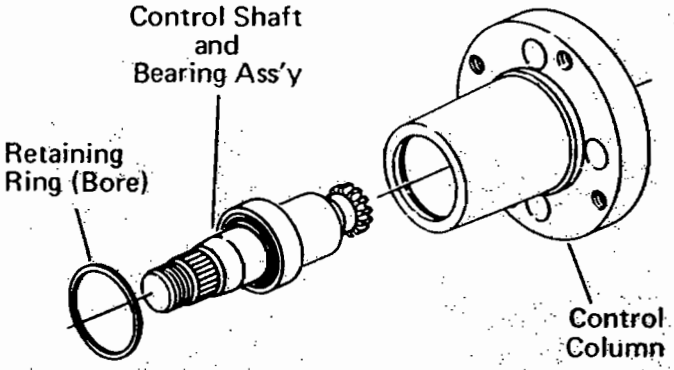


Figure 28

5 Use a thin bladed screwdriver to pry retaining ring from bore of control column.

6 Remove control shaft and bearing assembly from column, see Fig. 28. If tight, tap lightly with a plastic hammer or rubber hammer) on splined end of control shaft until the shaft breaks loose from the column.

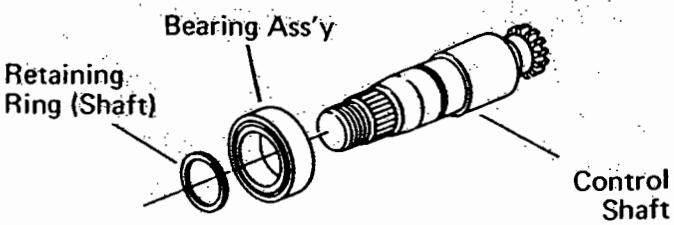


Figure 29

Disassembly

7 Use a thin bladed screwdriver to pry retaining ring from shaft. The retaining ring fits very tight, be careful not to distort it. Remove this ring only if it's necessary to remove bearing assembly from shaft, see Fig. 29.

8 Press bearing assembly from control shaft. Remove bearing assembly from threaded end of shaft, see Fig. 29. Remove this bearing assembly only if necessary.

Reassembly

Reassembly of Integral Column Sub Assembly

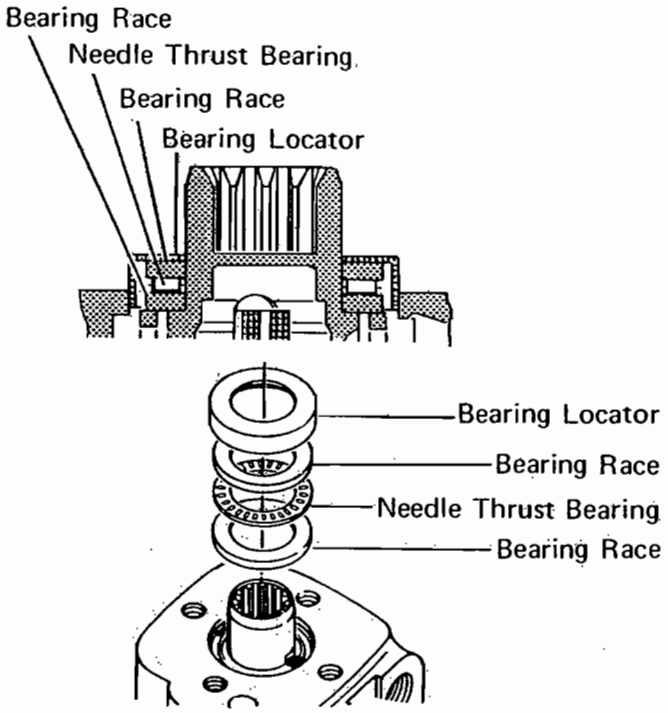


Figure 30

1 Install bearing locator over 2 bearing races and the needle thrust bearing, see Fig. 30. Use a soft plastic hammer or rubber hammer to lightly tap bearing locator in housing.

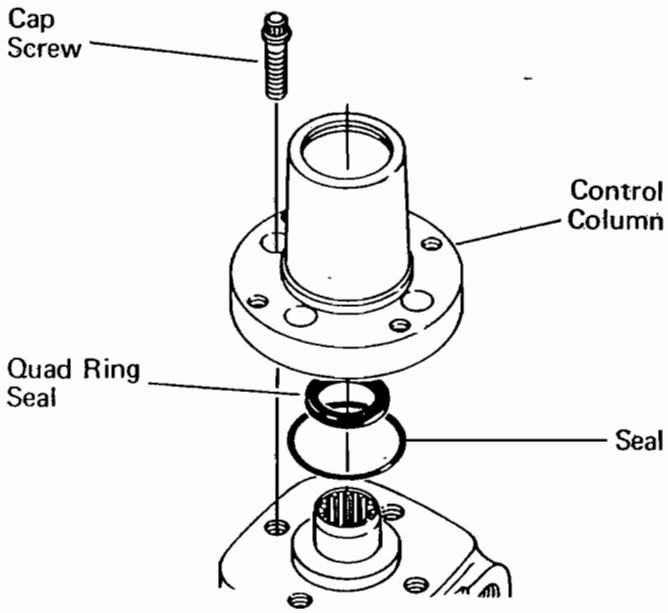


Figure 31

2 Install dry quad ring seal, and lubricated 1-15/16" diameter seal in column, see Fig. 31.

3 Install column on housing. Align bolt holes.

4 Install 4 dry cap screws. Torque screws in a criss-cross pattern to 200 inch pounds.

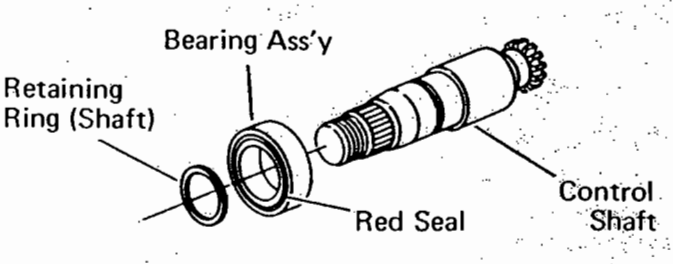


Figure 32

5 Press bearing assembly on control shaft with seal (red) side of bearing assembly facing toward threaded end of shaft. Make sure the bearing assembly seats against shoulder of shaft.

6 Install retaining ring on control shaft, see Fig. 32. Make sure ring seats properly in ring slot above bearing assembly.

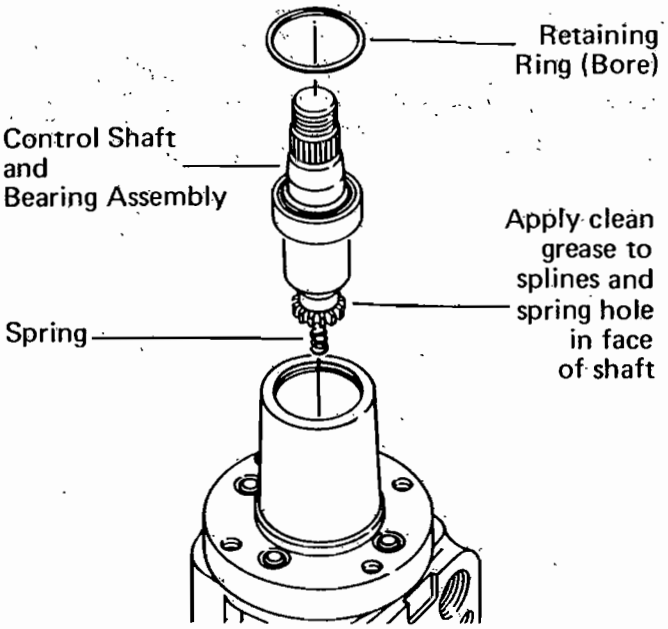


Figure 33

7 Apply clean grease to splines and spring hole located in face of control shaft, see Fig. 33. Install spring in hole. The grease should hold the spring in place until you install control shaft in column.

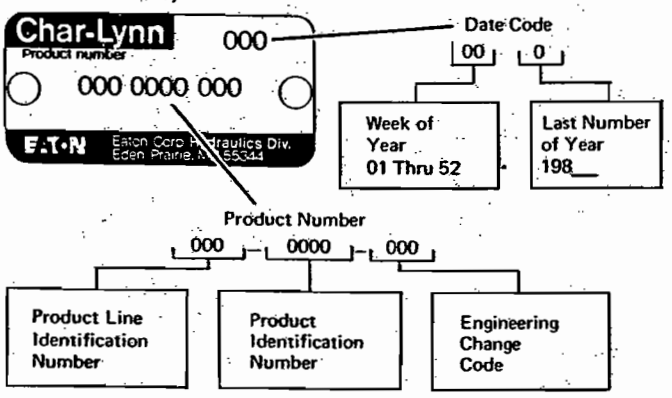
8 Install control shaft and bearing assembly in column (insert splined end of control shaft in column first), see Fig 33. Turn shaft to engage with spool. Push bearing assembly in far enough so you can in stall retaining ring in bore of column.

9 Install retaining ring in bore of column. Make sure you fully seat this retaining ring in ring groove.

How to order replacement parts.

Each order must include the following information:

1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts



Low Input Torque Steering Control Unit

1 After disassembling steering control unit, discard quad-ring seal, seal gland bushing and two centering springs. Seal gland bushings for Teflon seal and quad-ring seal are not interchangeable.

2 Low torque steering control unit has one pair of spring spacers and two pairs of centering springs. Install spring spacers between two sets of centering springs. The installation procedure is the same as that used on the standard units.

3 Install Teflon seal, o-ring and back-up ring on the spool, see Figure X.

Note: Apply a light coat of hydraulic oil to all seals before installation.

4 Install dust seal in seal gland bushing, flat or smooth side down. This bushing has identification groove in outer diameter. Non-grooved bushing cannot be used with Teflon seal.

5 Install seal gland bushing over spool end with a twisting motion. Tap bushing in place with a rubber hammer. Make sure bushing is flush against bearing race.

6 Install retaining ring (see Figure X) in housing. After installing ring , tap on ring end or pry with screwdriver around entire circumference of ring to properly seat ring in groove.

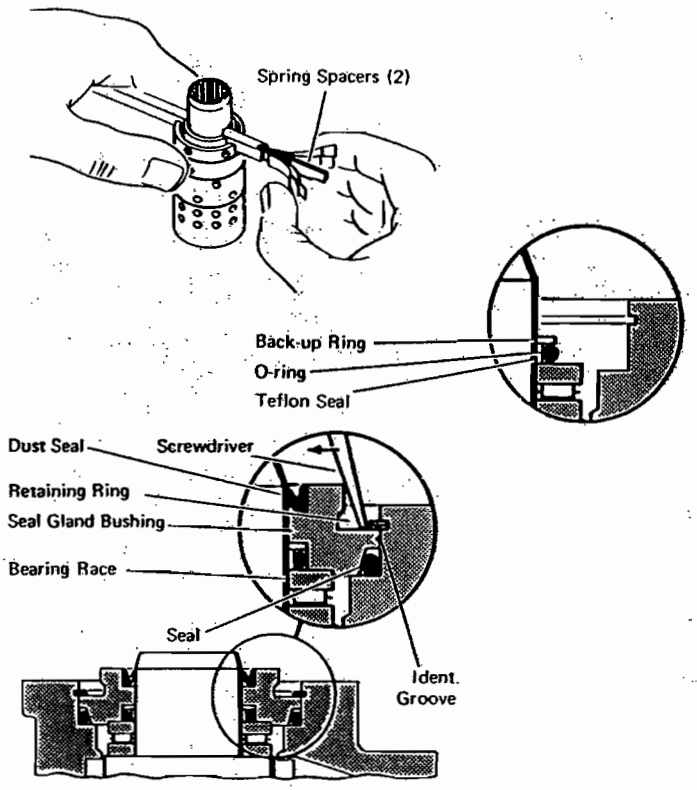


Figure X

13 Trouble Shooting

Most steering problems can be corrected if the problem is properly defined. The entire steering system should be evaluated before removing any components. The steering control unit is generally not the cause of most steering problems. The following is a list of steering problems along with possible causes and suggested corrections.

Problem	Possible Cause	Correction
1. Slow steering, hard steering, or loss of power assist.	Worn or malfunctioning pump.	Replace pump.
	Stuck flow divider piston.	Replace flow divider.
	Worn pump compensator allowing the system pressure to be less than specified.	Replace pump and compensator.
	Malfunctioning relief valve allowing the system pressure to be less than specified.	Replace the relief valve.
	Overloaded steer axle.	Reduce load.
	If load sensing system 1. Leaking or kinked load sensing signal line. 2. Malfunctioning priority valve.	Correct Check spring and sticking spool. Check damping orifices in both ends of main bore for debris. Check system pressure at SCU inlet for proper system pressure. If not correct replace priority valve relief cartridge.
2. Wander—Tendency of vehicle path to deviate from course defined by operator input.	Air in the system due to low level of oil, cavitating pump, leaky fitting, pinched hose, etc.	Correct condition and add fluid.
	Worn mechanical linkage.	Repair or replace.
	Bending of linkage or cylinder rod.	Repair or replace.
	Loose cylinder piston.	Repair or replace.
	Leaky crossover relief or anti-cavitation valve in cylinder lines.	Repair or replace the accessory valve.
	Severe wear in steering control unit.	Replace the steering control unit.
3. Drift—Diviation of vehicle path, without operator input, from normally expected continuing course.	Single rod end cylinder slowly extends without turning the steering wheel.	A small rate of extension may be normal on a closed center system.
	Worn or damaged steering linkage.	Replace linkage and align front end.
4. Slip—A slow movement of steering wheel fails to cause any movement of steered wheels.	Leakage of cylinder piston seals or accessory valve between cylinder lines or ports.	Replace seals or accessory valve.
	Worn steering control unit meter.	Replace steering control unit.
5. Temporary hard steering or hang-up—A momentary increase in steering wheel torque during steering reversal or initial input.	Thermal Shock*	Check unit for proper operation and cause of thermal shock.

*Thermal shock definition bottom of page 14.

Trouble Shooting 14

Problem	Possible Cause	Correction
6. Erratic steering.	Air in system due to low level of oil, cavitating pump, leaky fitting, pinched hose, etc.	Correct condition and add fluid.
	Loose cylinder piston.	Replace cylinder.
	*Thermal shock damage.	Replace steering control unit.
	Sticking flow control spool.	Replace flow control valve.
7. "Spongy" or soft steering.	Air in hydraulic system. Most likely air trapped in cylinders or lines.	Bleed air out of system. Placing ports on top of the cylinder will help prevent air trapping.
	Low fluid level.	Add fluid and check for leaks.
8. Free Wheeling—Steering wheel turns freely with no feeling of of pressure and no action on steered wheels.	Steering column upper shaft is loose or damaged.	Tighten steering wheel nut.
	Lower splines of column may be disengaged or broken.	Repair or replace column.
	Steering control unit meter has a lack of oil. This can happen on start-up, after repair, or long periods of non use.	Usually starting engine will cure problem.
	No flow to steering unit can be caused by: 1. Low fluid level. 2. Ruptured hose. 3. Internal steering control unit damage due to thermal shock*.	 Add fluid and check for leaks. Replace hose. Replace the unit.
9. Free Wheeling—Steering wheel turns with slight resistance but results in little or no steered wheel action.	Leaking crossover relief or anti-cavitation valve in cylinder lines.	Repair or replace the accessory valve.
	Piston seal blown out.	Determine cause. Correct and replace seal.
10. Excessive free play at steering wheel.	Loose steering wheel nut. Steering column shaft worn or damaged. There should be very little free play in the unit itself.	Repair or replace steering wheel connection or column.
11. Excessive free play at steered wheels.	Broken or worn linkage between cylinder and steered wheels.	Check for loose fitting bearings and anchor points in steering linkage between cylinder and steered wheels.
	Leaky cylinder seals.	Replace cylinder seals.

*Thermal shock—A condition caused when the hydraulic system is operated for some time without turning the steering wheel so that fluid in the reservoir and system is hot and the steering control unit is relatively cool (more than 50° F temperature differential). When the steering wheel is turned quickly the result is temporary seizure and possible damage to internal parts of the steering control unit. The temperary seizure may be followed by total free wheeling. This applies to closed center and load sensing units only.

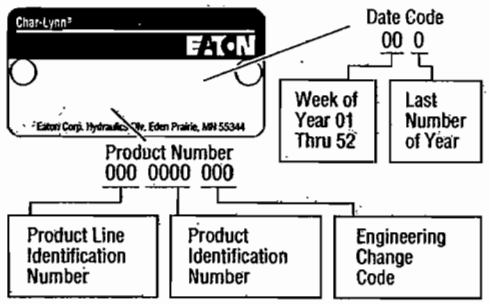
Trouble Shooting

Problem	Possible Cause	Correction
12. Binding or poor centering of steering wheel.	Binding or misalignment in steering column or splined input connection.	Align column pilot and spline to steering control unit.
	High back pressure in tank line can cause slow return to center. Should not exceed 300 psi.	Revise circuit return line.
	Large particles can cause binding between the spool and sleeve.	Clean the unit and filter the oil. If another component has failed generating contaminents, flush the system while bypassing the steering control unit.
13. Steering unit locks up.	Large particles in meter section.	Clean the unit.
	Insufficient hydraulic power (units over 15 cu. in./rev.)	Check hydraulic power supply.
	Severe wear and/or broken pin.	Replace the unit.
	*Thermal shock.	Replace the unit.
14. Steering wheel oscillates or turns by itself, either side of neutral, after operator has removed input.	Parts assembled wrong. Steering unit improperly timed.	Correct timing.
	Lines connected to wrong ports.	Reconnect lines correctly.
15. Steered wheels turn in wrong direction when operator activates steering wheel	Lines connected to wrong cylinder ports.	Reconnect lines correctly.
16. Kick—Momentary kick back of steering wheel at start of steering.	No inlet check valve on steering control unit.	Install a check valve.
17. Instability—Fluid-born oscillation.	Air in lines	Check pump inlet. Bleed sensing lines.
	Harmonic system	Add hose or an accumulator.
	Plumbing	Bleed all lines. Pilot lines should be tubing. lines to cylinder should be tubing. If 2 pilot lines are used go to 1.
	Relief Setting	Pump relief should be 300 PSI above priority relief.
	Priority Valve	Bleed by holding against stop for 30 seconds on models w/built in relief only.
		Decrease damping orifice by adding small wire.
		Increase spring rate (this will raise the standby pressure).
	Load Sensing Pump	Compensator sticky. Increase standby pressure.

*Thermal shock definition bottom of page 14.

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

Eaton Corporation
Hydraulics Division
15151 Hwy. 5
Eden Prairie, MN 55344
Telephone (612) 937-9800
Fax (612) 937-7130

Eaton G.m.b.H.
Hydraulics Division
✉ 100 410 • D-5620 Velbert 1 Germany
☎ 49-2051-2070
Teletex 205 119 EATVEL
Telefax 49-2051-207200

Form No. 7-304
1981

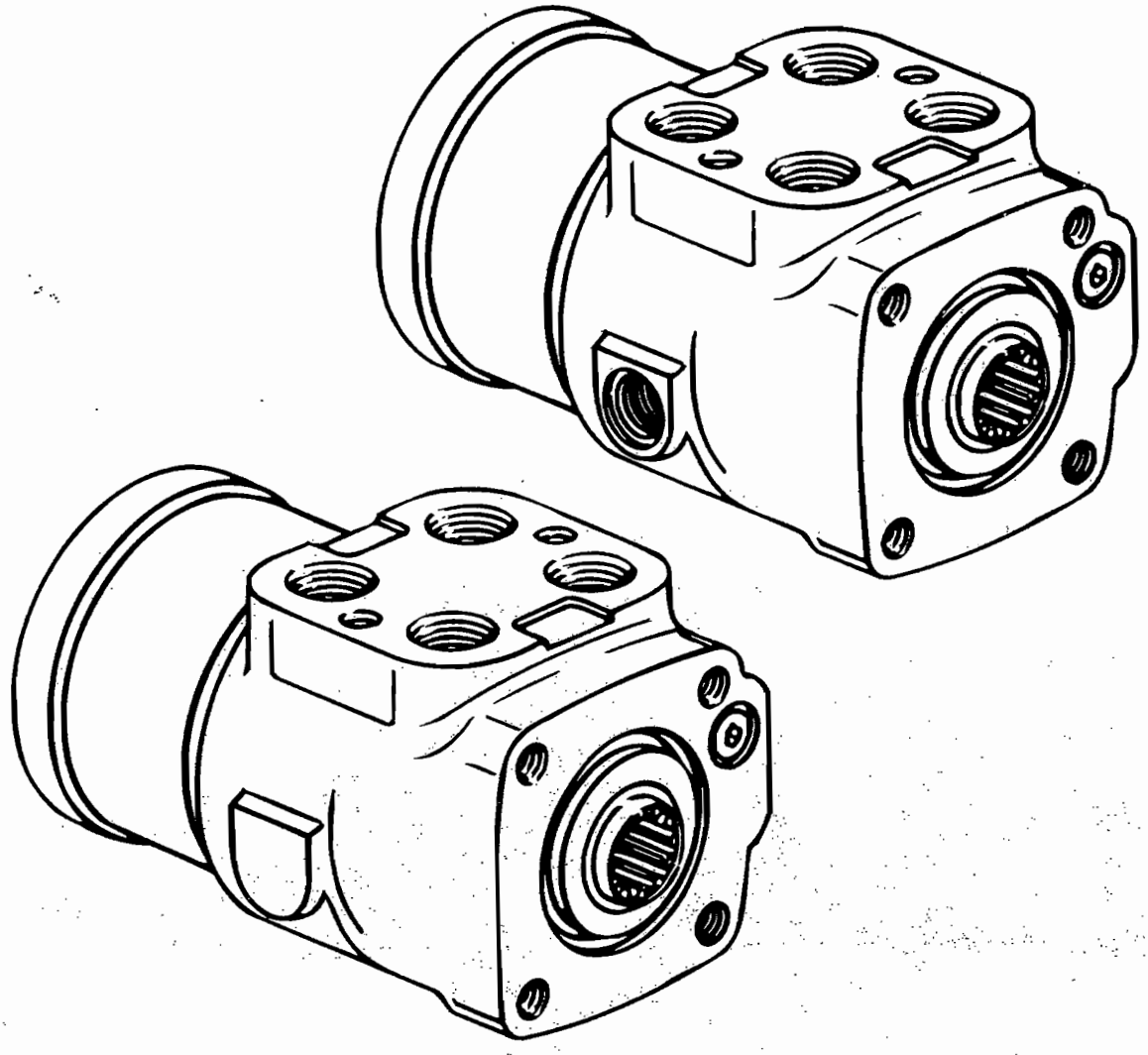
EATON

Char-Lynn®
Power Steering

No. 6-317
Revised August, 1993

EATON

Parts Information

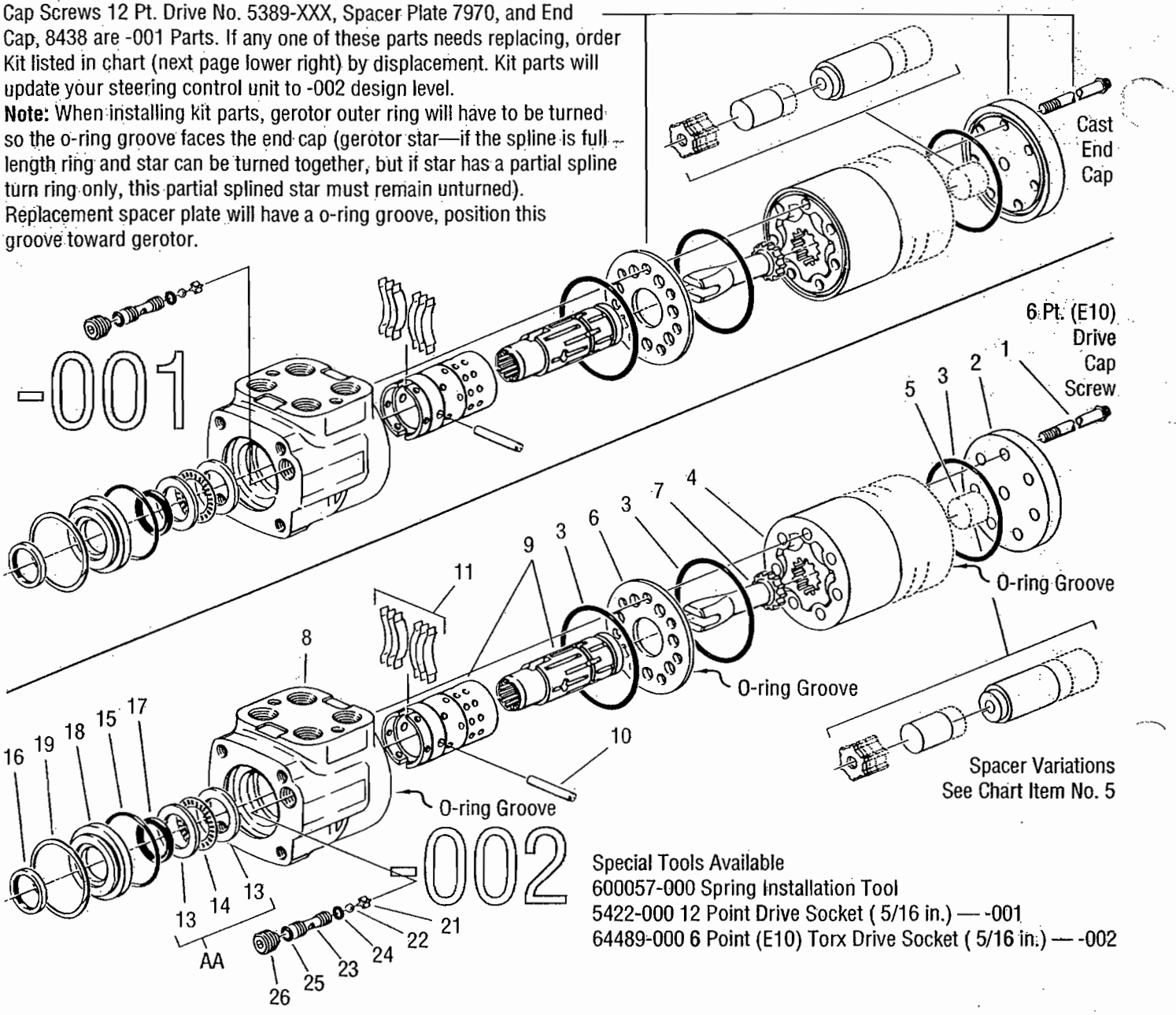


3, 4, 6, and 12 Series
Steering Contol Units

001 002

Cap Screws 12 Pt. Drive No. 5389-XXX, Spacer Plate 7970, and End Cap, 8438 are -001 Parts. If any one of these parts needs replacing, order Kit listed in chart (next page lower right) by displacement. 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 (gerotor star—if the 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.



Special Tools Available
600057-000 Spring Installation Tool
5422-000 12 Point Drive Socket (5/16 in.) — -001
64489-000 6 Point (E10) Torx Drive Socket (5/16 in.) — -002

Actual Displacement cm³/r [in³/r]	Item No. 4 Gerotor		Item No. 5 Spacer		Item No.1 Cap Screw 6 Pt. (E10) Torx Drive		Kit Including: Cap Screws (Qty. 7) Spacer Plate, and End Cap (Qty. 1 each)	
	Part No.	Width mm [in.]	Part No.	Length mm [in.]	Part No.	Length mm [in.]	Kit No.	
45 [2.8]	8618-001	6,3 [.25]	None	None	16294-138	35,0 [1.38]	64475-000	4 Series
60 [3.6]	8618-023	10,2 [.40]	None	None	16294-150	38,1 [1.50]	64476-000	
75 [4.5]	8618-024	10,2 [.40]	None	None	16294-150	38,1 [1.50]	64477-000	3 Series
95 [5.9]	8618-003	13,2 [.52]	6901-009	3,6 [.14]	16294-162	41.1 [1.62]	64478-000	
120 [7.3]	8618-009	16,5 [.65]	6901-010	6,1 [.24]	16294-175	44,5 [1.75]	64479-000	
145 [8.9]	8618-020	20,1 [.79]	6901-013	10,3 [.40]	16294-188	47,0 [1.88]	64480-000	
160 [9.7]	8618-004	21,9 [.86]	6901-003	12,2 [.48]	16294-200	50.8 [2.00]	64481-000	6 Series
185 [11.3]	8618-005	25,4 [1.00]	6901-014	15,6 [.61]	16294-212	53,8 [2.12]	64482-000	
230 [14.1]	8618-031	31,7 [1.25]	6901-011	22,0 [.86]	16294-238	60,5 [2.38]	64483-000	
295 [17.9]	8618-035	40,4 [1.59]	22638-000	28,4 [1.12]	16294-262	66,5 [2.62]	64484-000	
370 [22.6]	8618-032	50,8 [2.00]	22362-004	41,1 [1.62]	16294-312	79,2 [3.12]	64485-000	
460 [28.2]	8618-033	63,5 [2.50]	22362-001	53,8 [2.12]	16294-362	91,9 [3.62]	64486-000	12 Series
590 [35.9]	8618-036	80,8 [3.18]	22362-005	70,9 [2.79]	16294-425	108,0 [4.25]	64487-000	
740 [45.1]	8618-034	101,6 [4.00]	22362-003	91,8 [3.62]	16294-512	130,0 [5.12]	64488-000	

	Item No.	Part Number	Description	Qty. Per Unit
	1	*	Cap Screw, 6 Point (E10) Torx Dive	7
	2	23901-000	Cap, End	1
X	3	5776-000	Seal, 73,5 mm [2.89 in.] ID	3
	4	*	Gerotor	1
	5	*	Spacer	*
	6	23092-000	Plate, Spacer	1
	7	5126-000	Drive	1
	8	NSS	Housing	1
	9	NSS	Sleeve, Control	1
		NSS	Spool, Control	1
	10	15-000	Pin, Centering	1
	**11	NSS	Spring, Centering	6
	13	8329-000	Bearing Race	2
	14	5544-000	Bearing, Needle Thrust	1
X	15	15074-000	Seal, 47,2 mm [1.86 in.] ID	1
X	16	844-000	Seal, 25 mm [1 in.] ID	1
X	17	20599-000	Seal, Quad Ring, 26,57mm [1.046 in.] ID	1
	18	7443-000	Bushing, Seal Gland	1
	19	14317-000	Ring, Retaining	1
	21	6862-000	Retainer, Check Ball	1
	22	18001-000	Ball, Check	1
	23	8318-000	Seat, Check Ball	1
X	24	15006-000	Seal, 7,7 mm [.30 in.] ID	1
X	25	15007-000	Seal, 9,3 mm [.36 in.] ID	1
	26	14380-000	Screw, Set	1
	AA	64009-000	Needle Bearing Kit	
		64466-000	Seal Kit — Contains Parts Indicated by X.	
		64425-000	Viton Seal Kit (for use with synthetic fluids) — Contains Items Indicated by X (Part No.s Differ).	
		64470-000	Seal Kit with Low Input Torque Seal — Contains Items Indicated by X (Item 17 Replaced w/Seal Shown Below).	

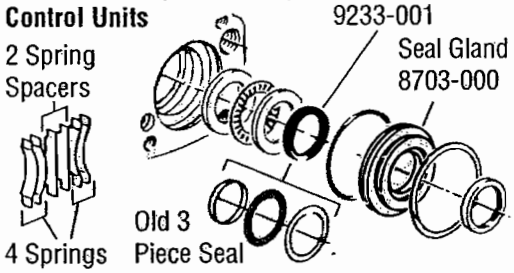
** — Item 11 Sold only in Kit form (Centering Spring Kit No. 64431-000), or Special Low Torque Spring Spacer Kit (See Kit No. Listed Above)

* — See Chart bottom this Page, for Information on Specific Models NSS — Not Sold Separately

Centering Spring Installation Kit No. 64431-000 — Includes 6 Centering Springs and 2 Spring Spacers. 6 Springs for Standard Steering Unit Spring Replacement, or 4 Springs, 2 Spring Spacers for Low Input Torque Steering Unit Spring Replacement.

Low Input Torque Seal/Spring Conversion Kit No. 64467-000 — Includes 2 Spring Spacers for use with 4 of the 6 Springs from Standard Unit, Seal Gland 8703-000, and 8 Seals for Complete Reassembly (Including New Low Input Torque one piece seal 9233-001).

Low Input Torque Steering Control Units



Gerotor/Spacer Kits — for 22.6 28.2 35.9 45.1 in3/r Displacement Units built Before July 1988

Note: Use service kit number from chart when ordering replacement gerotor, spacer is included in kit (spacer from old steering contol unit will not work with new gerotor).

Actual Displ. cm³/r [in³/r]	Gerotor/Spacer Service Kit Kit No.	Parts Included in Gerotor/Spacer Service Kit			
		Item No. 4 Gerotor Part No.	Width mm [in.]	Item No. 5 Spacer Part No.	Length mm [in.]
370 [22.6]	64421-000	8618-032	50,8 [2.00]	22362-004	41,1 [1.62]
460 [28.2]	64445-000	8618-033	63,5 [2.50]	22362-001	53,7 [2.11]
590 [35.9]	64446-000	8618-036	80,8 [3.18]	22362-005	66,4 [2.61]
740 [45.1]	64447-000	8618-034	101,6 [4.00]	22362-003	91,8 [3.61]

3 Series — Port Size 9/16-18

System	Signal	Load Circuit	Rated* Flow LPM [GPM]	Actual Displacement cm³/r [in³/r] — Product Number				
				75 [4.5]	95 [5.9]	120 [7.3]	145 [8.9]	160 [9.7]
Open Center	N/A	Non Load Reaction	2-4 [7,5-15]	211-1001	211-1002	211-1003	211-1157	—
Closed Center	N/A	Non Load Reaction	2-4 [7,5-15]	212-1009	212-1010	212-1011	212-1072	212-1012
		Load Reaction	2-4 [7,5-15]	212-1021	212-1022	212-1023	212-1073	212-1024

4 Series — Port Size 9/16-18

System	Signal	Load Circuit	Rated Flow	Displacement cm³/r [in³/r] — Product Number				
				45 [2.8	60 [3.6]	75 [4.5]	95 [5.9]	120 [7.3]
Open Center	N/A	Non Load Reaction	15 LPM [4 GPM]	241-1001 241-1034	241-1002 241-1035	241-1003 241-1036	241-1004 241-1037	241-1005 241-1038
Load Sensing	Open Center	Non Load Reaction	15 LPM [4 GPM]	243-1008	243-1009	243-1010	243-1011	243-1012

4 Series with Power Beyond

Open Center	N/A	Non Load Reaction	15 LPM [4 GPM]	241-5014	241-5015	241-5016	241-5017	241-5018

6 Series — Port Size 3/4-16

System	Signal	Load Circuit	Rated* Flow LPM [GPM]	Displacement cm³/r [in³/r] — Product Number							
				75 [4.5]	95 [5.9]	120 [7.3]	145 [8.9]	160 [9.7]	185 [11.3]	230 [14.1]	295 [17.9]
Open Center	N/A	Non Load Reaction	4-8 [15-30]	211-1007	211-1008	211-1009	211-1137	211-1010	211-1011	211-1012	211-1158
		Load Reaction	4-8 [15-30]	211-1047	211-1048	211-1049	211-1159	211-1050	211-1051	211-1052	—
Closed Center	N/A			212-1001	212-1002	212-1003	212-1069	212-1004	212-1005	212-1006	212-1070
Load Sensing	Static	Non Load Reaction	8 [30]	213-1001	213-1002	213-1003	213-1084	213-1004	213-1005	213-1006	213-1085
Load †† Sensing	Dynamic	Non Load Reaction	8 [30]	213-4001	213-4002	213-4045	213-4042	213-4046	213-4043	213-4047	213-4044

12 Series — Port Size 3/4-16

System	Signal	Load Circuit	Rated* Flow LPM [GPM]	Displacement cm³/r [in³/r] — Product Number				
				277 [16.9]**	370 [22.6]	460 [28.2]	590 [35.9]	740 [45.1]
Open Center	N/A	Non Load Reaction	8-16 [30-60]	211-1037**	211-1038	211-1039	211-1160	211-1041
Closed Center	N/A	Non Load Reaction	16 [60]		212-1014	212-1015	212-1071	212-1017
Load Sensing	Static	Non Load Reaction	12 [45]		213-1013	213-1014	213-1086	213-1016
Load †† Sensing	Dynamic	Non Load Reaction	16 [60]		213-4051	213-4048	213-4049	213-4050

†† Low Torque Centering Springs

* For closed center unit, rated flow is measured at 70 Bar [1000 PSI] pressure drop at full valve deflection.
For load sensing unit, rated flow is designed for 4,5 Bar [65 PSI] pressure drop between inlet (P) and load sensing (LS) port at full valve deflection.

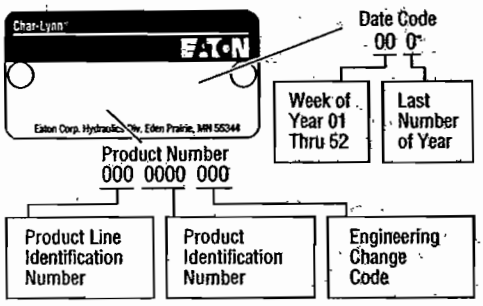
How to Order Replacement Parts

Each Order Must Include the Following:

1. Product Number
2. Date Code
3. Part Name
4. Part Number
5. Quantity of Parts

For More Detailed Information Contact Eaton Corp. Hydraulics Division 15151 Highway 5 Eden Prairie, MN 55344.

- Specifications and performance Data, Catalog No. 11-872
- When Servicing Steering Control Unit Refer to Repair Information No. 7-304. This Repair Manual List Tools Required, Step by Step Disassembly and Reassembly Procedures, and Trouble Shooting (Problem, Possible Cause, and Correction Procedure).



Eaton Corporation
Hydraulics Division
15151 Hwy. 5
Eden Prairie, MN 55344
Telephone 612/937-9800
Fax 612/937-7130

Eaton Ltd.
Hydraulics Division
Glenrothes, Fife
Scotland, KY7 4NW
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Fax 44/592-773-184

Form No. 6-317
1982

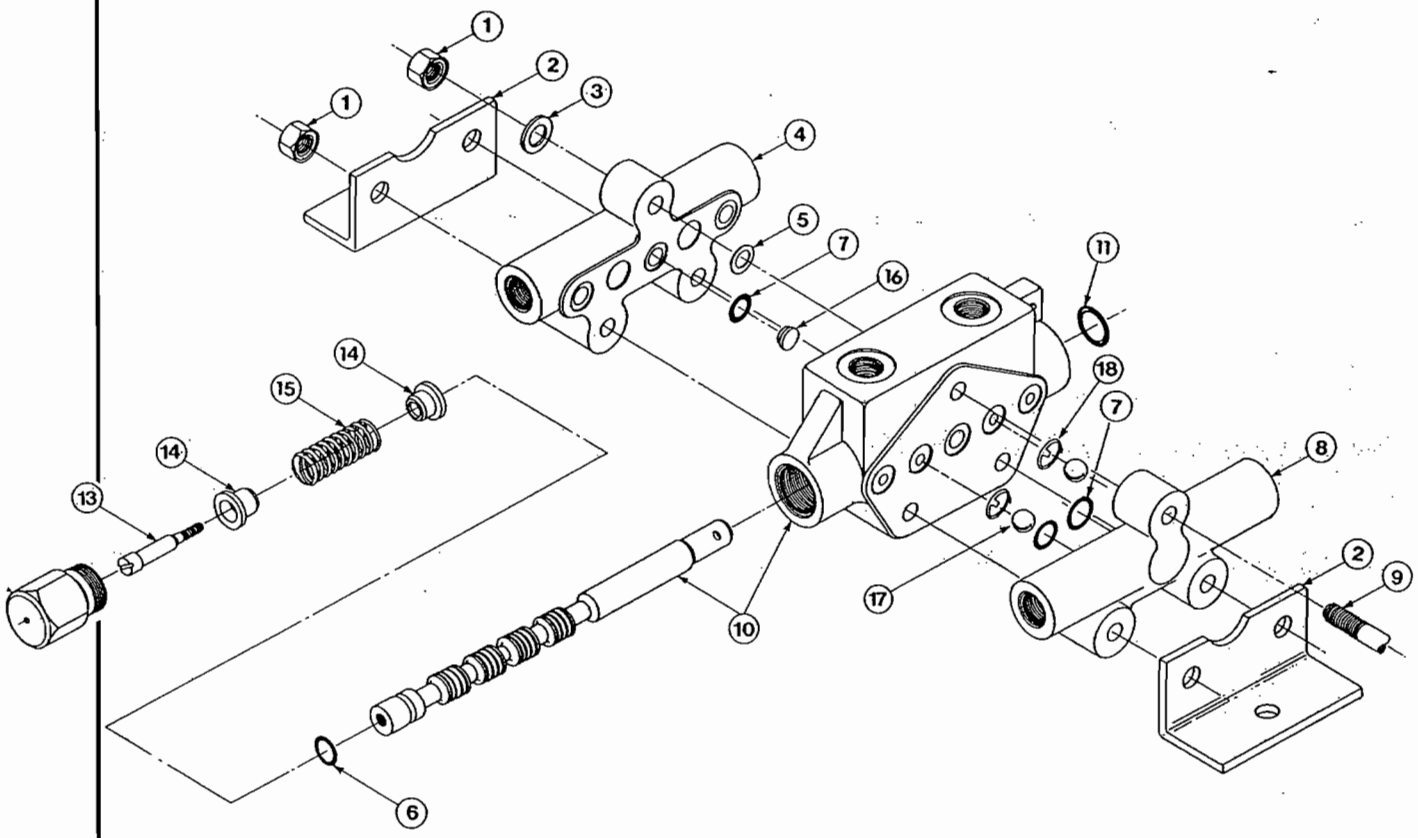
EATON

FPS Midget Valves

Maintenance and service bulletin

#3710-SP-10
Bed Raise/Lower
Walland # 1.7813

D-1.91
March 1, 1989



Parts List

Item	Part No.	Description	Item	Part No.	Description	Item	Part No.	Description
1.	1005013	Nut	7.	0101013	O-ring (10 req'd)	13.	4010520	Spring shaft
2.	4014240	Mounting bracket	8.	See Page 4	Inlet section	14.	4010530	Spring guide
3.	1008008	Washer	9.	See Page 5	Tie rod	15.	—	Spring
4.	See Page 5	Outlet section	10.	See Page 4	Body & spool S/A	16.	4011702	Closed center plug
5.	4023150	Mylar shim (between section)	11.	0101112	O-ring (in-body)	17.	1022018	Ball
			12.	4010500	Spring cap	18.	4022901	Retainer
6.	0101012	O-ring (1 req'd)						

UNITED TECHNOLOGIES AUTOMOTIVE

COMPONENTS DIVISION

FLUID POWER SYSTEMS

Assembly Information

Disassembly:

Note:
Before attempting to disassemble this or any other hydraulic component prepare a **clean** work area.

1. Remove nuts (1), mounting bracket (2) and washer (3) from inlet end of valve bank.

Note:
When removing inlet section (see page 4, inlet illustration) watch for check balls, which will fall free from inlet section when removed. Also, remove ball retainers from inlet side of the first valve section.

2. Remove the inlet section (8). Between the inlet (8), each center section and the outlet (4), are three mylar shims (5), one over each tie rod (9). Keep these shims as they will be needed during assembly.
3. Remove valve sections, one at a time, removing O-Rings (6) and mylar shims (5) between each section.
4. After valve bank is completely disassembled remove handle assemblies.

Note:
34 (4TH POSITION FLOAT) VALVE SECTIONS ONLY ARE NOT FIELD SERVICE ABLE. If any problems occur, return complete valve sections to the factory for repairs.

For "L" or "M" options only, limit switch must be removed before removing spring cap (see page 6 optional L & M for details).

5. Remove the spring cap (12) from the valve section. On detented spool sections the detent balls and spring may jump out of the detent cap.
6. Remove the spool from the body by pushing on handle end. **KEEP BODY AND SPOOL TOGETHER, AS THEY ARE A MATCHED SET.**
7. Remove O-Rings (11), from inside bore on handle end of body.
8. To remove the O-Ring (6) on the spool, first remove the spring centering or detent assembly, then the O-Ring.
9. Wash all parts in **clean** solvent, then dry with a low pressure air hose.

Assembly:

1. Inspect all parts before assembly. Remove any nicks or burrs from body and spool with fine crocus cloth.
2. Lubricate all O-Rings with clean oil.
3. Replace O-Ring (11) in bore on handle end of body. Use spool in body to guide O-Ring into groove. Make sure O-Ring is not twisted in groove.
4. Replace O-Ring (6) on spool making sure it is not twisted.
5. Replace spring centering or detent assembly on end of spool. Torque to 30 in. lbs. (see details on page 6).
6. Lubricate spool with clean hydraulic system oil. Place spool in it's bore with a slight twisting action, this will allow the O-Rings to compress and will prevent possibilities of the O-Ring shearing.
7. Replace the spring centering or detent cap. To ease assembly of detents, extend the spool slightly out of the body, assemble balls and spring on the spool, then screw detent cap into the body.

Note:
"L" or "M" limit switch (see page 6). Attach the switch bracket with the bushing nut. If the switch does not operate properly, it may be adjusted with the two screws that mount the switch to the bracket. **Caution:** Excessive tightening of switch mounting screws may crack switch housing.

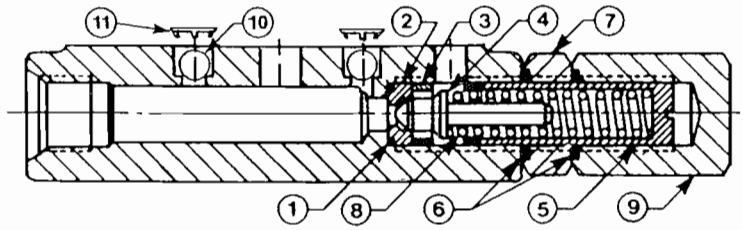
8. Replace the handle assemblies. (See page 6 for instructions and part numbers.)
9. Install one nut (1) on each tie rod (9). Place two tie rods through the mounting bracket (2). Place one flat washer (3) on the third tie rod. Push the tie rods through the outlet section (4). An aid in banking sections is to place the mounting bracket in a vice or on the edge of a flat surface with the tie rods in a vertical position. Place one mylar shim (5) over each tie rod and push them down onto the outlet sections. Place 5 O-Rings (7). Install a valve section over the tie rods. Place the O-Rings (7) and mylar shims (5) on this section. Replace remaining section as above.

   Load checks (see page 4). Before installing O-Rings in the section next to the inlet, place the ball retainer (prongs up) in the flow passages on both sides of the **center flow passage**, not the two outboard passages. Place the O-Rings (7) in the counter-bores. Place the mylar shims, one over each tie rod, on the section. Then, stand the ball on the retainers.
10. Install the inlet section (8). Place the mounting bracket (2) over the lower tie rods and install the nuts (1). Place the flat washer (3) over the top tie rod and install the nut (1).
11. Torque the tie rods in three steps of 50 in. lbs., 90 in. lbs. and finally 115 in. lbs. **THIS IS VERY IMPORTANT! OVERTORQUEING WILL CAUSE BORE DISTORTION & MAY CAUSE SPOOL BINDING OR INCREASED LEAKAGE.**
12. In order to set the relief, if installed, the complete valve must be put on a test stand capable of flow from 1 to 8 GPM. Remove the cap over the adjustment screw and loosen the lock nut (see page 4). Set incoming pressure on test stand to desired valve setting and adjust screw in to increase relief setting or out to decrease relief setting. Setting is correct when 1 GPM flows out of valve at desired pressure.
13. If painting of the valve is required, make sure all ports are plugged, handles are removed, and spools masked.

Inlets

INLET KITS		
Standard Inlet with Load Checks	NI	6401003
Dual Inlet with Load Checks	NDIP	6401011
Reverse Inlet with Load Checks	NRI	6401010
Priority Inlet with Relief & 0-500 Load Checks	NPR	6401013
Priority Inlet with Relief and 500-3000 Load Checks	NPR	6401015
Load Check and Relief (50-500)	NR	6401006
Load Check and Relief (500-3000)	NR	6401007

INLET WITH RELIEF



Item	Part No.	Description
1	0101012	O-ring
2	4015850	Seat
3	4015860	Retainer
4	4015870	Poppet
5	4011170	Adj. screw
6	0101015	O-ring (2)
7	4011240	Lock nut
8	4011231	Spring
9	4011180	Cap nut
10	1022018	Ball
11	4022901	Retainer

*Load check assembly kit 6401014 containing balls (1022018) & retainers (4022901) 2 each.

Valve Sections

SPOOL TYPE	VALVE SECTIONS/LESS HANDLES				
	STANDARD PART NO.	DETENTS		LIMIT SWITCH	
		OPERATING POS.	CENTER POS.	3 POSITION	2 POSITION
		K	A	L	M
10	6400000	6400003	6400001	6400004	6400005
14	6400040	6400043	6400041	6400044	6400045
17	6400010	6400013	6400011	6400014	6400015
25*	6400050	6400053			64000155
28	6400080	6400083			6400085
29	6400090	6400093			6400095
34	6400006				
20	6400020	6400023			6400025

*Closed Center Plug (401170) is required with No. 25 Section.

Isolator Plate	IP	6403001
Series Conversion Plate	SP	6403002

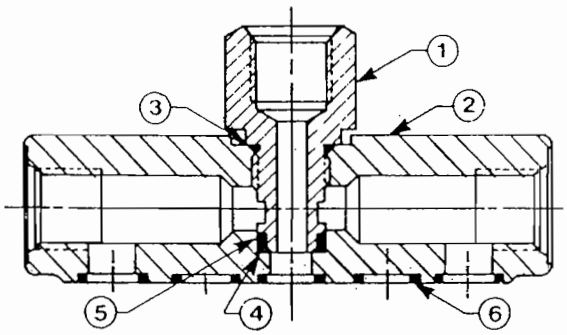
Outlets

OUTLET KITS		
SO	Open Center	6402000
SC	Closed Center (Use closed center plug)	6402003
PB	Power Beyond	6402001
DTO	Dual Tank Outlet Open Center	6402002
DTC	Dual Tank Outlet Closed Center	6402004
NO	Standard Outlet w/Reverse Check	6402005

Outlet kits include mylar shims and O-rings.

Item	Part No.	Description
1	4014283	Power beyond plug
2	4022154	Body
3	0102906	O-ring
4	0115012	Quad ring
5	0220012	Back up ring
6	0101013	O-ring (5)

OUTLET WITH POWER BEYOND



Seal Kits & Banking Kits

O-RING CROSS-REFERENCE				SEAL KITS*				
FPS No.	DASH No.	DURO.	MATERIAL	A	B	C	D	E
0101012	-012	70	Buna-N	1	1	1		1
0101013	-013	70	Buna-N			5	5	5
0101014	-014	70	Buna-N					
0101015	-015	70	Buna-N	2	1			
0101018	-018	70	Buna-N		1			
0101112	-112	70	Buna-N		2	1		
0102906	-906	90	Buna-N					1
0106008	-008	70	Buna-N					
0108008	Back up ring							
0115012	Quad ring							1
0220012	Back up ring							1
4023150	Mylar Shim					3		

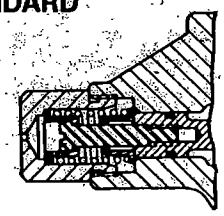
*A — 6009250 — Inlet w/standard relief
B — 6009252 — Single 34 section
C — 6029520 — Single section
D — 6029521 — Outlet without power beyond
E — 6029522 — Outlet with power beyond

NO. OF VALVE BANKS	BANKING KITS*		TIE RODS		
	STANDARD	COLLECTOR PLATE (1)	STANDARD	COLLECTOR PLATE (1)	COLLECTOR PLATE (2)
1	6404001		4023771		
2	6404002	6404003	4023774	4023776	
3	6404003	6404004	4023776	4023778	4023778
4	6404004	6404005	4023778	4023780	4023780
5	6404005	6404006	4023780	4023783	4023783
6	6404006	6404007	4023783	4023784	4023784
7	6404007	6404008	4023784	4023787	4023787
8	6404008		4023787		

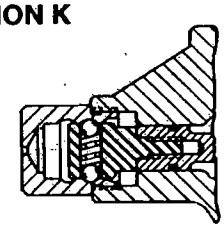
*Includes Tie Rods, Nuts, Washers, Mounting Brackets

Optional Features

STANDARD

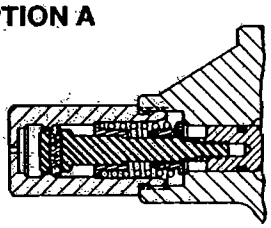


OPTION K

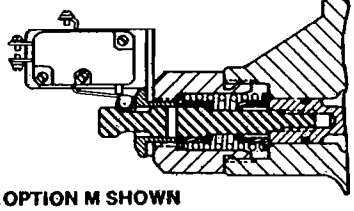


Options "L" or "M" use Limit Switch FPS #4012100. Micro Switch #V3L-3

OPTION A



OPTIONS L & M



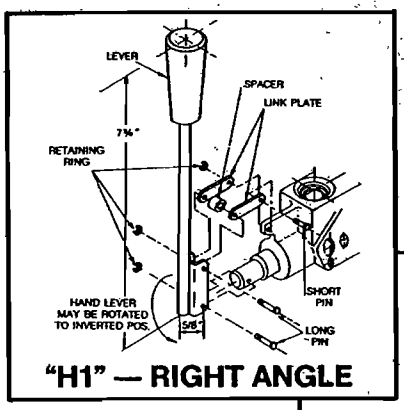
OPTION M SHOWN

OPTION CONVERSION KITS	
"A" Detent, 2 position	6009520
"K" Detent, 2 position	6006550
"K" Detent, 3 position	6006551
"L" Limit Switch, 3 position	6008590
"M" Limit Switch, 2 position	6009340

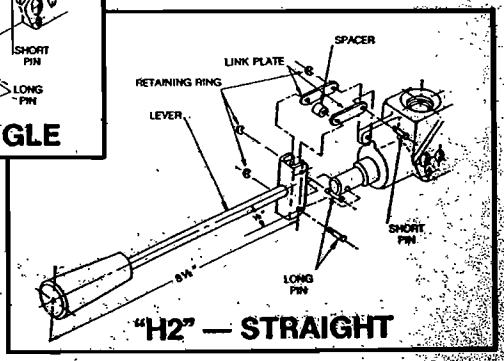
Handle Information

Assembly Instructions:

1. Assemble link plates, spacer and long pin to clevis of lever as shown. Insert retaining ring into pin groove and snap onto pin, to retain links in place.
2. Rotate spool to permit access to tang hole. Slide clevis over tang and align holes. Insert long pin and install retaining ring.
3. Rotate spool back into alignment. Hold link plates in position straddling housing rib. Insert short pin and install retaining ring.



"H1" — RIGHT ANGLE



"H2" — STRAIGHT

DESCRIPTION	PART NO.
Handle Kit "H1"	6405000
Handle Kit "H2"	6405001
Handle Linkage Kit	6009261

FOR ADDITIONAL PRODUCT INFORMATION SEE BULLETIN NO. D-1.00

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(414) 766-0113

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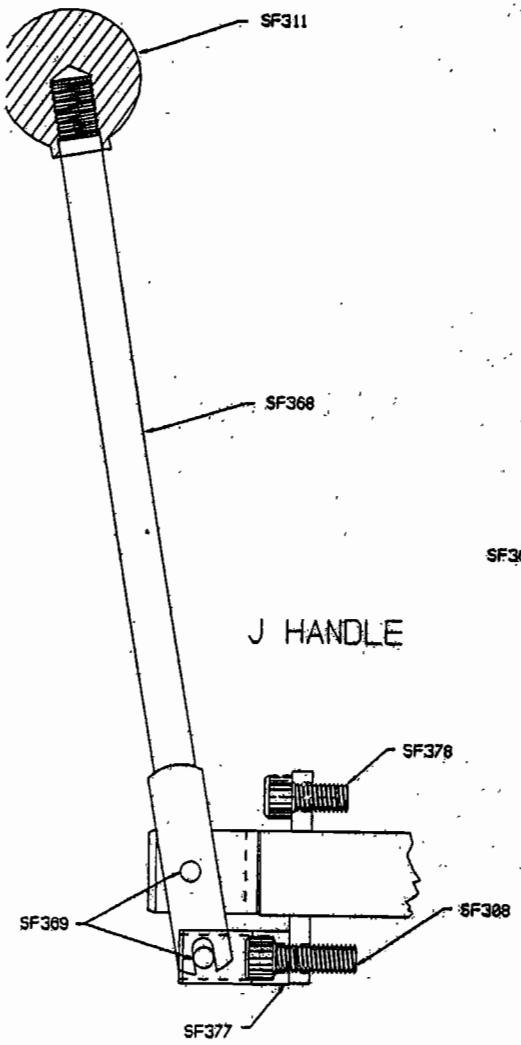
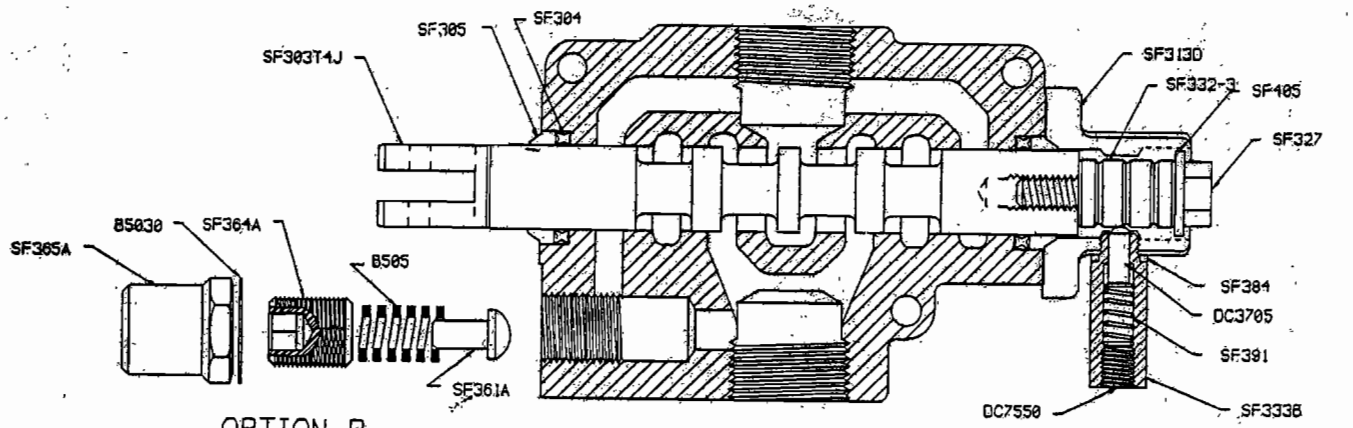


AO VALVE ASSEMBLEY



Directional Control Valve

PARTS LIST

"J HANDLE"

PART #	DESCRIPTION
SF311	BALL KNOB
SF368	HANDLE
SF378	CAP SCREW 1/4-20 x 1/2"
SF308	CAP SCREW 1/4-20 x 3/4"
SF377	CLEVIS BRACKET
SF369	HEADED PIN (2 PCS.)
SF371	COTTER PIN (2 PCS.) NOT SHOWN

"OPTION D"

SF405	STEEL WASHER
SF327	CAP SCREW 5/16-18 x 1 1/2"
SF313D	END CAP 3 POSITION DETENT
SF384	WASHER
DC3705	DETENT PLUNGER
SF391	SPRING
SF333B	DETENT HOUSING
DC7550	SET SCREW 5/16-24 x 3/8"
SF332-3	DETENT SLEAVE
SF308	CAP SCREW 1, x 3/4" (2 PCS.) NOT SHOWN

OPTION R

PART #	DESCRIPTION
SF365A	CAP NUT
B5030	WASHER
SF364A	ADJUSTMENT SCREW
B505	SPRING
SF361A	POPPET

CASTING

SF304	QUAD RING
SF305	WIPER
SF303T4J	TANDEM CENTER 4 WAY SPOOL (J HAND
AOCAST--SPECIFIY PORT SIZE	

Wolland P/N 1.8857
Brand Hydraulics P/N
AO-755-T"-JD
Omaha, Neb. 2-344-443

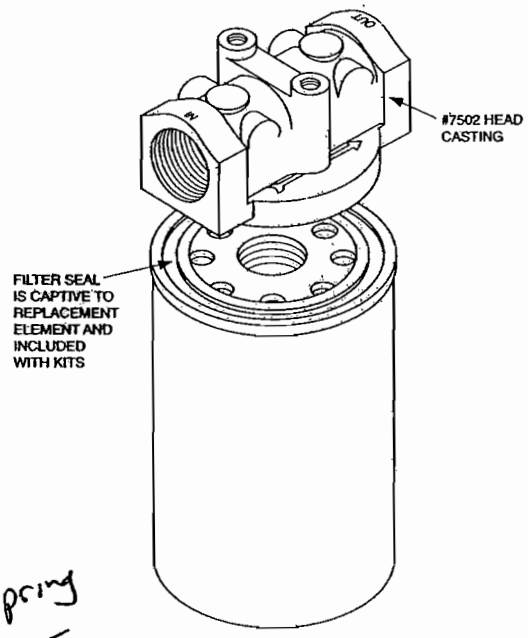
Replacement Element
Service Instructions for

GRESEN®

Model FSP1 & FSP2

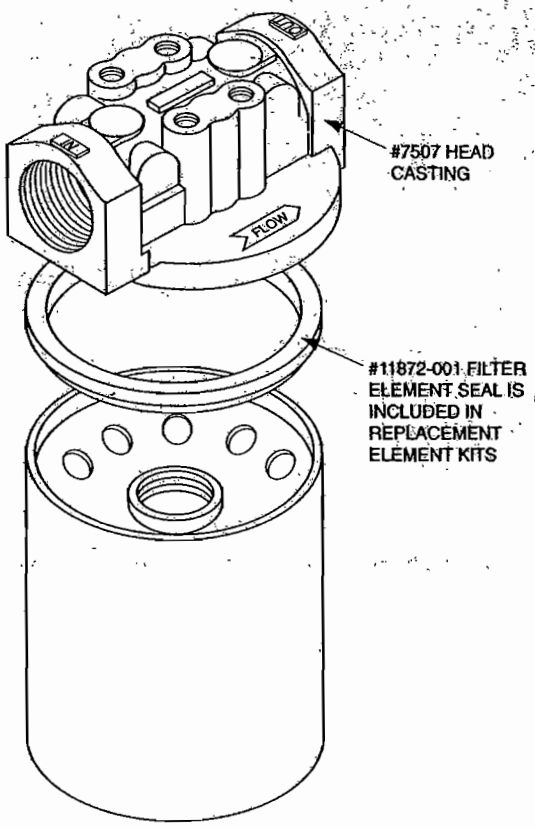
Low Pressure Spin-On Type Hydraulic Filter

DANA



By Pass Spring
#K-F1-15

FSP1



FSP2

FSP1 REPLACEMENT ELEMENTS

Micron Rating	Filter Media	Kit No.
10µ	Cellulose (5.4" long)	K-22001
33µ	Cellulose (5.4" long)	K-22002
10µ	Cellulose /Poly (8.6" long)	K-22017
10µ	Cellulose/Synthetic (5.4" long)	K-22016

Wollard # 1,3712

FSP2 REPLACEMENT ELEMENTS

Micron Rating	Filter Media	Kit No.
3µ	Cellulose (5" long)	K-23020
10µ	Cellulose (5" long)	K-23018
25µ	Cellulose (5" long)	K-23019
3µ	Synthetic (10" long)	K-23062
10µ	Synthetic (10" long)	K-23063

ELEMENT INSTALLATION INSTRUCTION

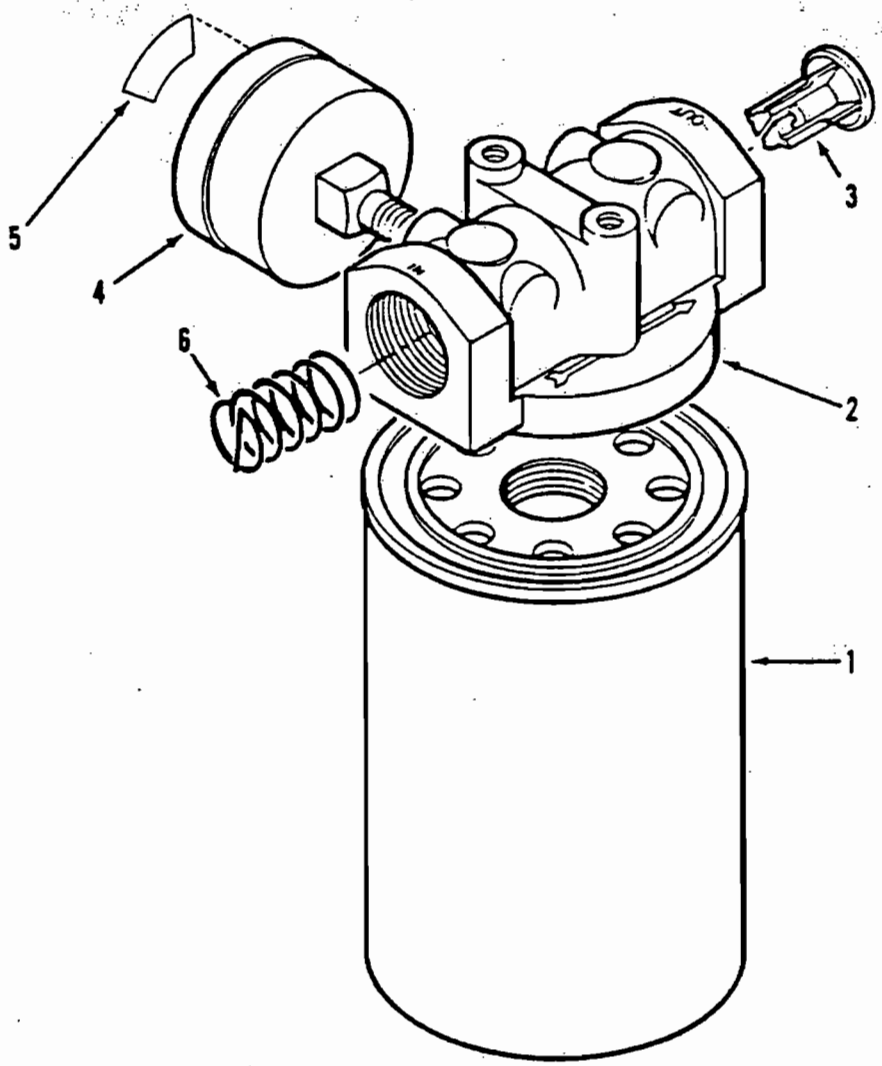
- Replace filter elements as soon as filter indicator shows a "by-pass" situation or every 250 hours, which ever comes first.
- Remove old filter element, being careful not to allow oil to drain on floor or ground.
- Apply a film of clean oil to gasket and hand tighten at least 1/4 turn after gasket contacts filter head.
- Check for leaks upon restarting system.

MOBILE FLUID PRODUCTS DIVISION • DANA CORPORATION
PO Box 1313 • Minneapolis, MN 55440 • Phone (612) 623-1960 • Fax (612) 623-1537

Catalog No. GSF-6305 Rev. 5/94

People Finding A Better Way

PARTS ORDERING INFORMATION



PARTS LIST

ITEM	PART NUMBER	DESCRIPTION	QUANTITY REQ'D
1	See Table	Filter Element	1
2	7502-XXX	Head Casting*	1
3	8402-001	Relief Valve Poppet	1
4	K-23028	No. 6671-001 Compound Indicator with No. 6673-001 Decal	1
	6672-001	30" Vacuum Indicator	1
5	6673-001	Indicator Decal, Red for Compound Indicators only	1
6	See Table	Relief Valve Spring	1

*Filter Head Casting is not available as a spare part. Order complete Filter Assembly from the Sales Catalog, No. PC-3007.

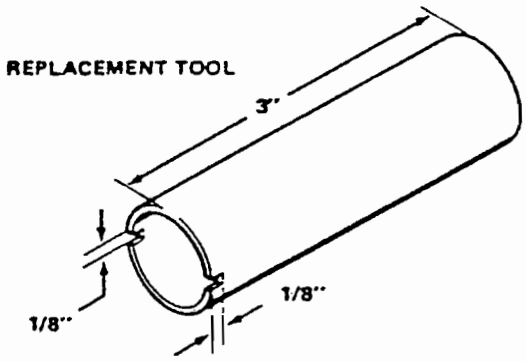
INSTRUCTIONS TO REPLACE RELIEF VALVE SPRING

TOOLS REQUIRED

One (1) 1/4" Allen Wrench
One (1) Spring Replacement Tool, made as follows:

A. Cut a section of 3/4" O.D., 5/8" I.D. by 3" long electric conduit or equal.

B. Cut 2 notches 1/8" wide by 1/8" deep.



REPLACEMENT

1. Insert Allen Wrench through outlet port and into Relief Poppet to hold Poppet in place.

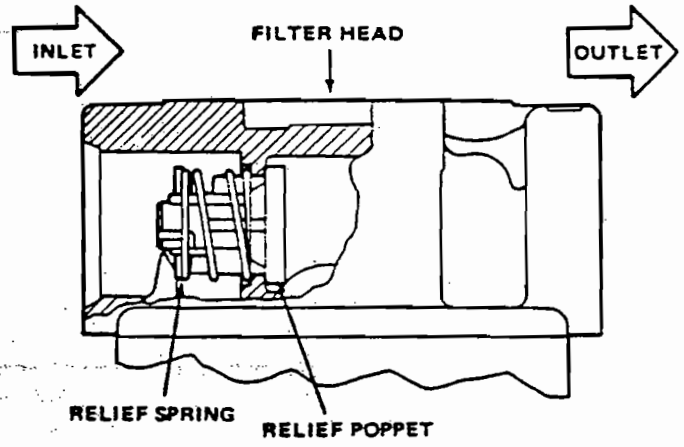
2. Place notches of Spring Replacement Tool over Spring. Depress Spring and turn clockwise.

3. Remove Spring and Poppet.

4. Install new Spring.

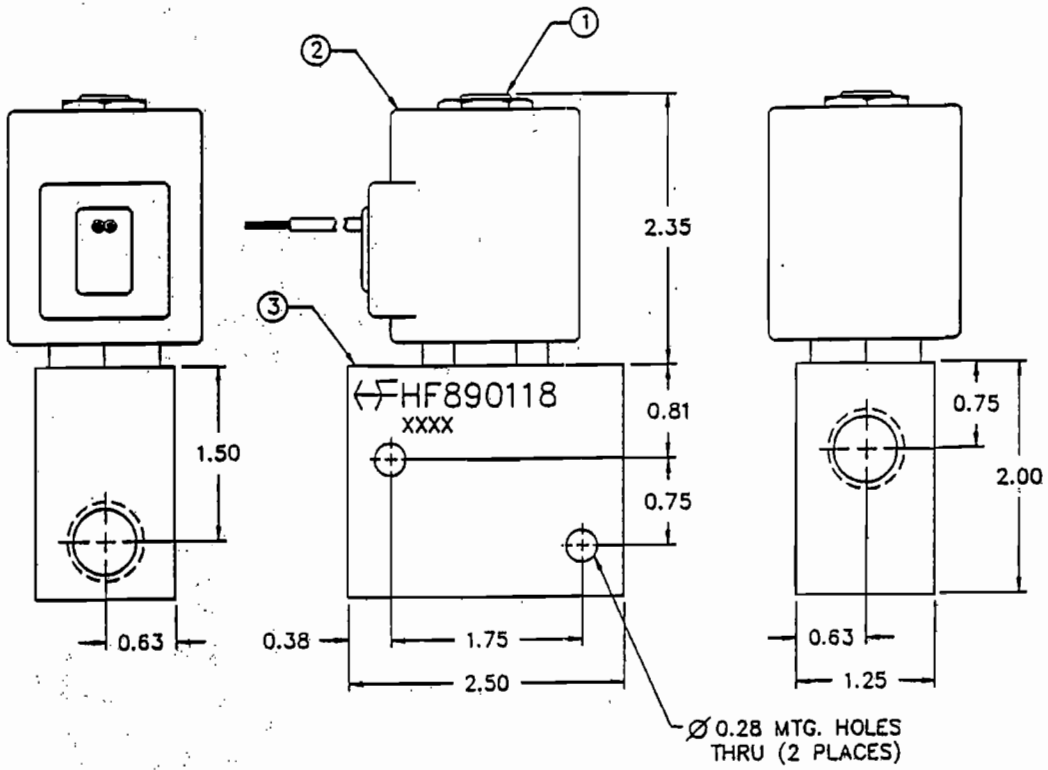
Note: The 5 PSI Spring is standard for suction line applications. The 15 PSI Spring is standard for return line applications. The 20 PSI Spring is optional.

Caution: When replacing Poppet and Spring, make sure that Poppet is always installed from the outlet side of the Filter Head and the Spring from the inlet side.



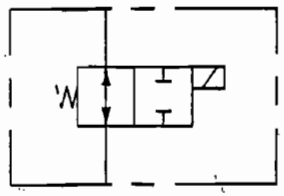
1-8308

14 Feb 92



PORTING:
PORTS ARE 3/8 NPTF.

SYMBOL



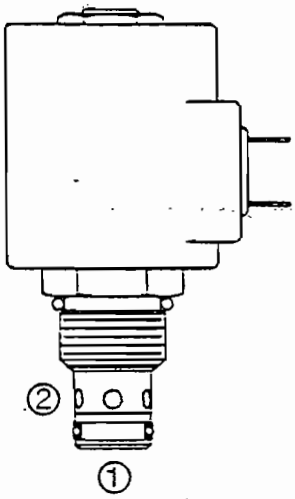
SERVICE PARTS		
1	SV10-25-0-N-00	SK10-2N-M
2	COIL 6352012 12VDC	—
3	BODY 7020340	—
ITEM	MODEL NUMBER	SEAL KIT

HYDRAFORCE INC.
WHEELING, ILLINOIS 60090

DESCRIPTION
WOLLARD
2 WAY NORMALLY OPEN
SPOOL TYPE VALVE

DATE	MODEL NUMBER	REVISED
01-19-89	HF890118	06-07-89

Spool, 2-Way, Normally Open



DESCRIPTION

A solenoid-operated, 2-way, normally open, direct-acting, spool-type, screw-in hydraulic cartridge valve, designed to function as a bidirectional blocking valve.

OPERATION

When de-energized, the SV10-25 allows flow in both directions.

When energized, the cartridge's spool shifts to close the bidirectional flow path.

Operation of Manual Override Option: To override, push button in and twist clockwise 180°. The internal spring will push the button out. In this position, the valve may be only partially shifted. To assure full override shift, pull the button out to its fullest extension and hold it in this position.

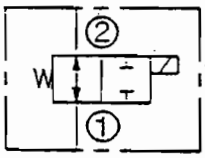
To return to normal valve function, push button in, twist clockwise 180° and release. Override will be detented in this position.

FEATURES

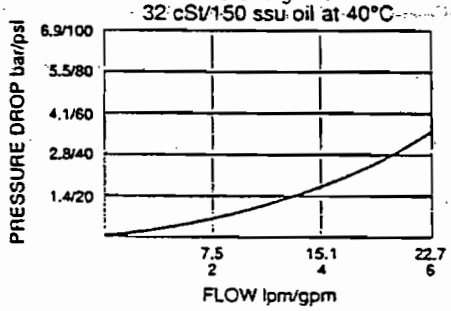
- Continuous-duty rated solenoid.
- Hardened precision spool and cage for long life.
- Optional coil voltages and terminations.
- Both ports may be fully pressurized.
- Efficient wet-armature construction.
- Cartridges are voltage interchangeable.
- Manual override option.
- Unitized, molded coil design.
- Industry common cavity.

SYMBOLS

ISI/ISO:



PERFORMANCE (Cartridge Only)



RATINGS

Operating Pressure: 207 bar (3000 psi)

Proof Pressure: 350 bar (5075 psi)

Flow: 22.7 lpm (6 gpm) max.

Internal Leakage: 82 cc/minute (5 in.³/minute) max. at 207 bar (3000 psi)

Temperature: -40 to 120°C with standard Buna seals

Coil Duty Rating: Continuous from 85% to 115% of nominal voltage

Response Time: First indication of change of state with 100% voltage supplied at 80% of nominal flow rating:
Energized: 60 msec.; De-energized: 60 msec.

Initial Coil Current Draw at 20°C: 1.67 amps at 12 VDC; 0.18 amps at 115 VAC (full wave rectified)

Minimum Pull-in Voltage: 85% of nominal at 207 bar (3000 psi)

Filtration: Recommend 10µ nominal

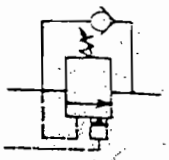
Fluids: Mineral-based or synthetics with lubricating properties at viscosities of 6 to 420 cSt (45 to 2000 ssu)

Installation: No restrictions; See page 0.020.1

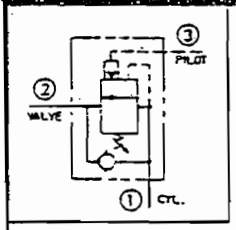
Cavity: VC10-2; See page 0.070.1

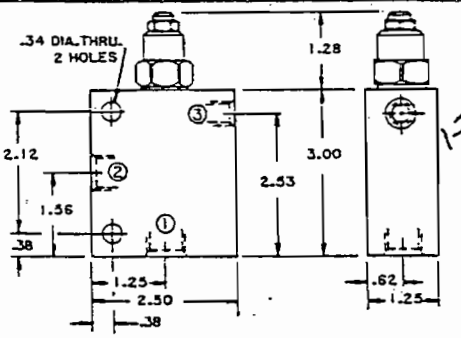
Cavity Tool: CT10-2XX; See page 6.300.1

Seal Kit: SK10-2X-M; See page 6.025.1



INTERNAL OR EXTERNAL OPERATION (WITH PILOT ASSIST)





MAIN PORTS ① ②	PILOT PORT ③	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	1/4" NPTF	CBC* *** ECA	~~43.10~~
3/8" NPTF	1/4" NPTF	CBC* *** ECB	~~43.10~~
1/2" NPTF	1/4" NPTF	CBC* *** ECC	~~43.10~~
SAE-6	SAE- 6	CBC* *** ECI	~~43.10~~
SAE- 8	SAE- 6	CBC* *** ECJ	~~43.10~~
SAE-10	SAE- 6	CBC* *** ECK	~~43.10~~
1/4" BSPP	1/4" BSPP	CBC* *** ECT	~~43.10~~
3/8" BSPP	1/4" BSPP	CBC* *** ECU	~~43.10~~
1/2" BSPP	1/4" BSPP	CBC* *** ECV	~~43.10~~

1-7818

MODEL CBC* *** EC*

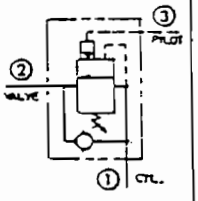
See CBC* Cartridge Modeling Coding ~~(p. 4.02)~~ below

PORTS SEE CHART

CBCH LDN ECB

SEAL KIT P/N 990-011-006 (WAE 1-8525)

CARTRIDGES



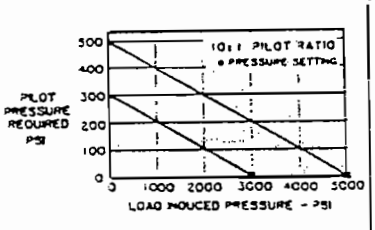
PILOT RATIO 10:1
FOR LOW LEAKAGE LOAD HOLDING (0 TO 5 DROPS/MIN., MAX.)

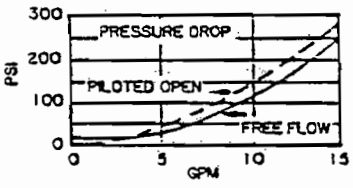
- Built-in free flow check valve
- Manual emergency load release

NOTE: Valve should be set at 1.3 times load induced pressure.

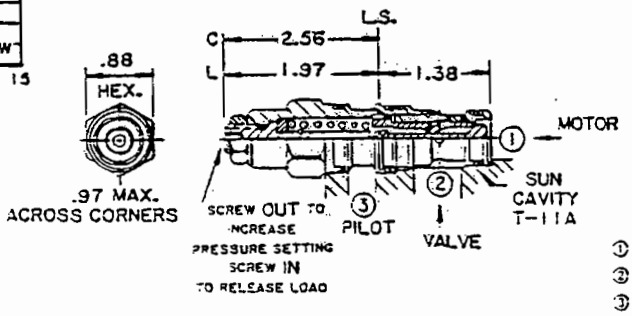
NOTE: Pilot pressure to operate SUN CB*H *** cartridges is a function of both the pressure setting of the valve and the load induced pressure in the system (see performance curves). When using a spring applied, hydraulically released brake, it is important to check all circuit operating conditions to be sure that adequate pilot pressure is available to keep the brake released at all times. If the pressure which will operate the SUN cartridge is not high enough to release the brake, the brake may drag.

TYPICAL PERFORMANCE CHARACTERISTICS





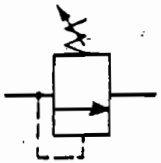
0 to 15 GPM
SUN CAVITY T-11A



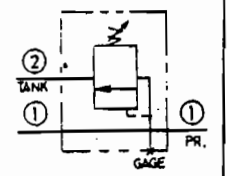
MODEL CBCH LDN ***

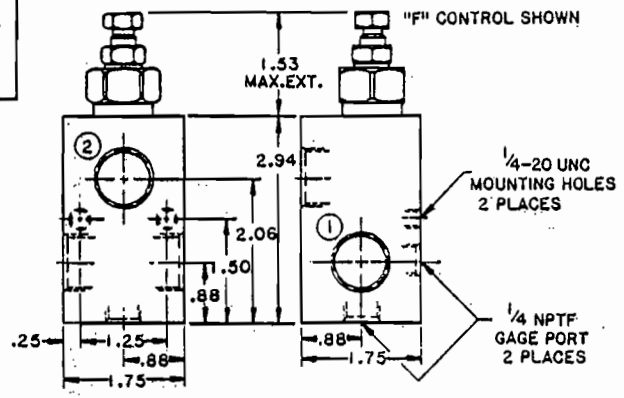
BASIC CARTRIDGE PRICE ~~32.60~~

① CONTROLS
② ADJUSTMENT RANGES
③ SEALS



LINE MOUNTED
WITH THROUGH-PRESSURE PORT AND GAGE PORT





PORTS ① ②	BASIC VALVE MODEL (a)	BASIC PRICE (a)
1/4" NPTF	RPEC *** FEA	34.30
3/8" NPTF	RPEC *** FEB	34.30
1/2" NPTF	RPEC *** FEC	34.30
SAE- 6	RPEC *** FEI	34.30
SAE- 8	RPEC *** FEJ	34.30
SAE-10	RPEC *** FEK	34.30
1/4 " BSPP	RPEC *** FET †	34.30
3/8" BSPP	RPEC *** FEU †	34.30
1/2" BSPP	RPEC *** FEV †	34.30

MODEL **RPEC** *** **FE***

See RPEC Cartridge Model Coding (p. 1.02)

PORTS SEE CHART

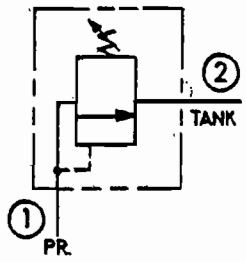
sun hydraulics CORPORATION

1500 UNIVERSITY PARKWAY • SARASOTA, FLORIDA 34243 U.S.A.
TELEPHONE 813/355-2983

RELIEF VALVES PRESSURE REGULATING TYPE

CARTRIDGES

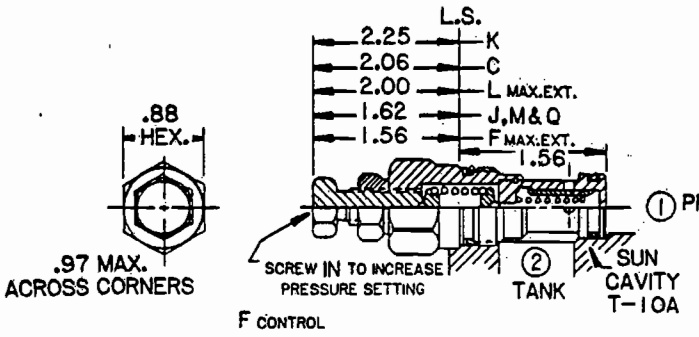
SUN pilot-operated, balanced spool valves for accurate pressure regulation
5000 psi maximum system working pressure
(6000 psi maximum overload pressure relief setting.)

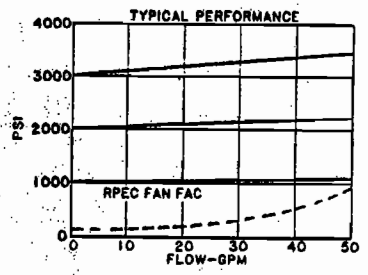


0 to 25 GPM

(0 to 50 GPM @ 2000 psi and above)

SUN CAVITY T–10A





BASIC CARTRIDGE PRICE
22.30

MODEL RPEC *

① CONTROLS
② ADJUSTMENT RANGES
③ SEALS

MAXIMUM ALLOWABLE LEAKAGE
1 CU. IN./MIN./1000 PSI

RELIEF VALVE CARTRIDGE OPTIONS

① CONTROLS (See p. xii)

CODING		RPEC RPGC	RPIC RPKC
L	Leakproof Screw adjustment	+4.00	+ .00
K	Handknob with lock knob	+6.00	+2.00
O	Panel mount with handknob	+8.00	N/A
C	Tamperproof (1–29) / Factory set (30 & over)	+8.00 / +7.00	+4.00 / +3.00
F	Standard adjustment with locknut	+ .00	N/A
J	Capped (Concealed adjustment)	+ .50	N/A
M	Capped ("J") with lockwire holes	+1.00	N/A
Q	Factory set & lockwired	+6.00	N/A

② ADJUSTMENT RANGES

CODING		ALL MODELS
A	100 to 3000 psi, 1000 psi standard setting	+ .00
B	50 to 1500 psi, 1000 psi standard setting	+ .00
C	150 to 6000 psi, 1000 psi standard setting	+2.00
D	25 to 800 psi (1–29) / 400 psi standard setting (30 & over)	+ .50 / + .00
E	25 to 400 psi (1–29) / 200 psi standard setting (30 & over)	+ .50 / + .00
	Customer specified setting (1-29) / (Setting stamped on Cartridge hex.) (30 & over)	+1.00 / + .50

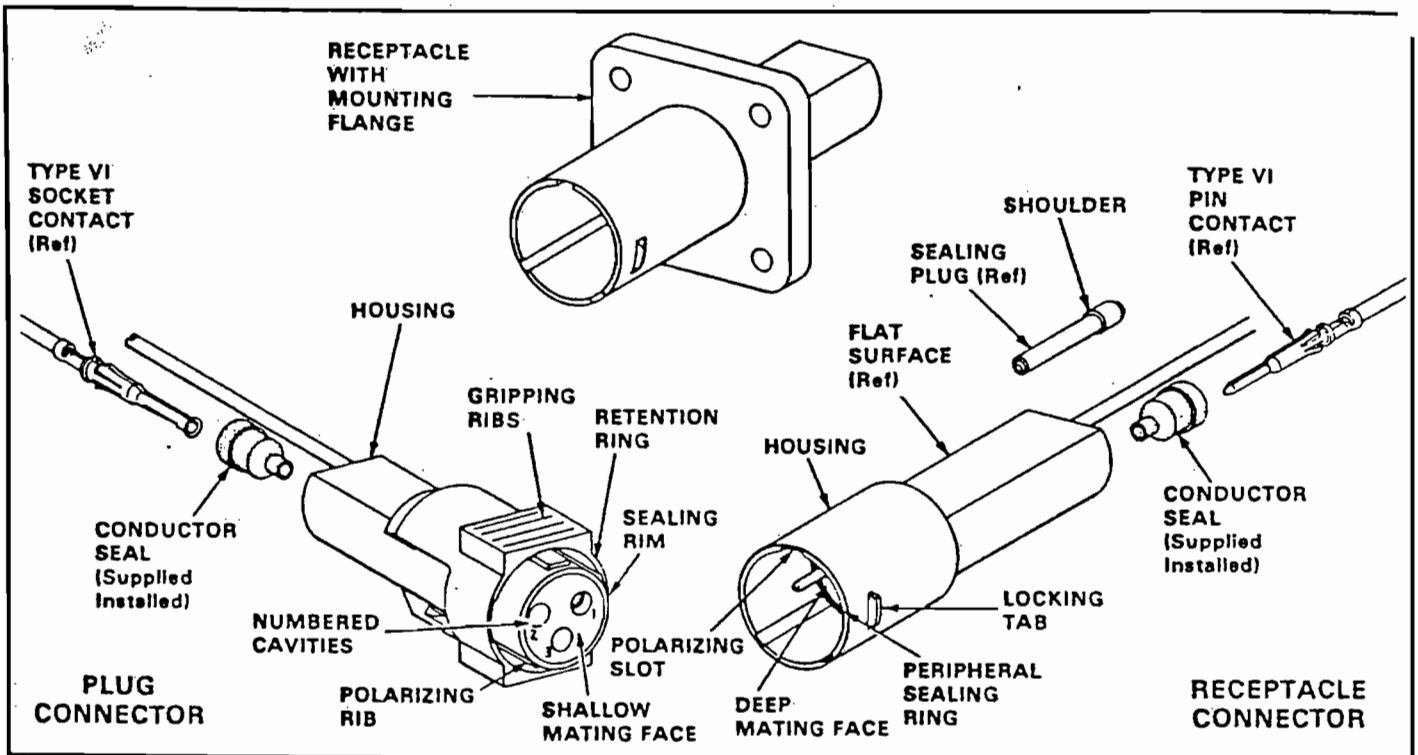
③ SEALS

CODING		RPEC RPGC	RPIC
N	Buna N	+ .00	+ .00
V	Viton	+1.00	+1.50

AMP
AMP INCORPORATED
Harrisburg, Pa. 17105

AMP★ ECONOSEAL CONNECTORS

Instruction Sheet
IS 7900
RELEASED 10-7-86



CONNECTOR				ACCESSORIES			
NUMBER OF POSITIONS	PLUG HOUSING	RECEPTACLE HOUSING		CONDUCTOR SEAL	SEALING PLUG	SEAL PROTECTOR TYPE II, III(+) & VI CONT	
		FREE HANGING	MOUNTING FLANGE			PIN	SOCKET
1	207901-1	207902-1	207982-1	207565-2	207047-2	208337-1	208338-1
2	207845-1	207846-1	207853-1	↓	↓	↓	↓
3	207567-1	207563-1	207807-1	↓	↓	↓	↓
4	207571-1	207569-1	207808-1	↓	↓	↓	↓
5	207847-1	207848-1	--	↓	↓	↓	↓
6	207849-1	207850-1	--	↓	↓	↓	↓
7	207575-1	207573-1	--	↓	↓	↓	↓
8	208678-1	211068-1	208677-1	↓	↓	↓	↓
9	208530-1	208538-1	208546-1	↓	↓	↓	↓

Fig. 1

1. INTRODUCTION

This instruction sheet (IS) covers the components and assembly procedures of the AMP Econoseal Connectors. See Figure 1.

Read this sheet and all referenced material before starting assembly.

2. DESCRIPTION (Figure 1)

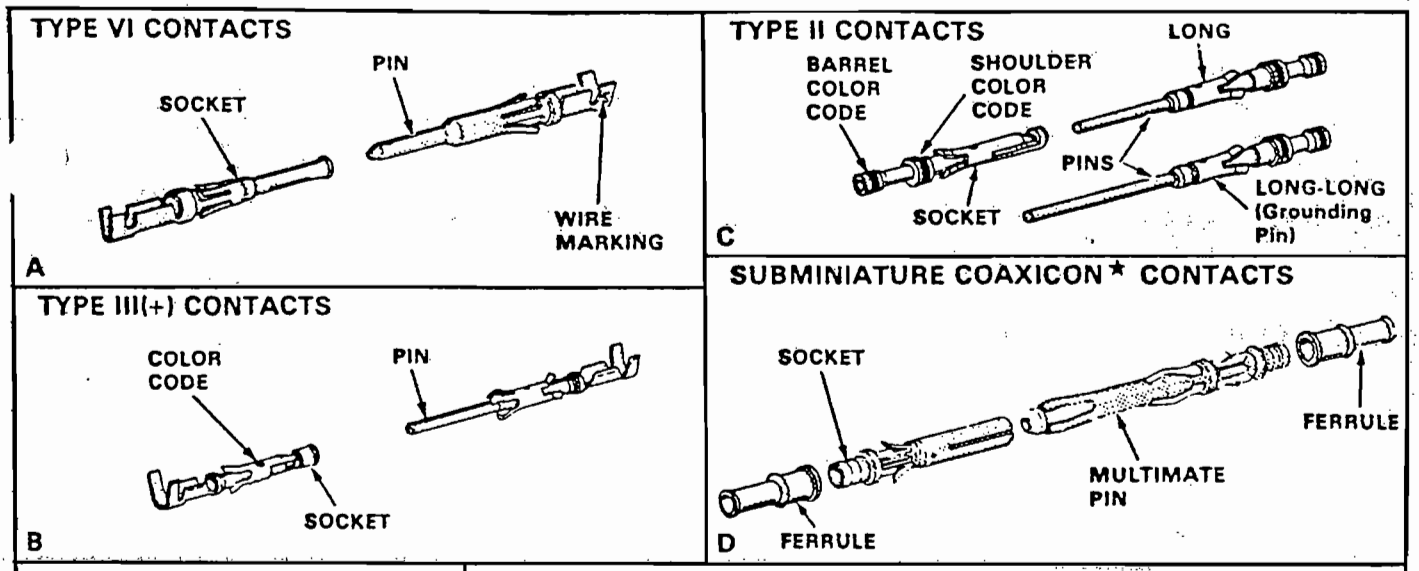
These polarized plug and receptacle connectors seal against normal environmental conditions. They are available with 1 through 9-contact position housings. Both the front (mating face) and back (contact entry) of the housings have numbered contact cavities. Free-hanging or panel-mounted applications can be made with the appropriate receptacle housing. See Figure 1.

Plug housings are shorter than receptacle housings. Plug housings feature a retention ring with gripping ribs, polarizing ribs, a shallow mating face, conductor seals, and a sealing rim. These housings are designed for socket contact configurations.

Receptacle housings feature two locking tabs, polarizing slots, a deep mating face, conductor seals, and a peripheral sealing ring. These housings are designed for pin contact configurations.

The connectors will accept any of the contacts in the AMP Multimate Program that have a wire range of No. 18 through No. 14 AWG and an insulation range of .070 through .130 in. See Figure 1.

Sealing plugs are available for unused contact cavities.



CONDUCTOR		MULTIMATE CONTACTS		
TYPE	SIZE	STYLE	DESCRIPTION	SELECTION INSTRUCTIONS
SINGLE WIRE (Solid and Stranded)	18-14 AWG	TYPE VI	1-PIECE (Precision Formed)	IS 1379
	18-14 AWG	TYPE III(+)	2-PIECE (Precision Formed Contact Body and Spring)	
	18-14 AWG	TYPE II	2-PIECE (Screw Machine/Precision Formed Spring)	
COAXIAL CABLE	RG-161, 174*, 178, 179, 187, 188, 196*, and 316	SUBMINIATURE COAXICON	3-PIECE (Screw Machine Inner Contact Body with Precision Formed Outer Shell and Ferrule)	

*BOTH SINGLE AND DOUBLE BRAID CABLE.

Fig. 2

3. CONTACT SELECTION (Figure 2)

There are three forms of contacts: (1) loose piece (all styles), (2) tape-mounted strip (Type II only), and (3) continuous metal strip (all styles except Type II). The loose-piece contacts are for low-volume applications while the Type III(+) and Type VI strip contacts are for high-volume applications.

There are four styles of contacts as shown in Figure 2. Make your selection as follows:

1. Determine the type and size of conductor specified for your application.

2. Determine the contact style that you are going to use. See Figure 2.

3. Refer to the instruction sheet (IS) packaged with the contacts for contact and tool selection. See Figure 2. If Type III(+) and Type VI strip contacts are going to be used, consult your local AMP representative for the machine that will best suit your needs.

4. ORIGINAL INSERTION OF CONTACTS

NOTE *The procedure for original insertion differs from the re-insertion procedure described in Paragraph 7.*

Type housings are supplied with conductor seals installed in the back of the contact cavity. If necessary, they can be removed by inserting a blunt tool into the front of the cavity and pushing the seal out the back of the cavity.

CAUTION *Subminiature COAXICON contacts (pin springs and socket leading edges) could damage the seal. To avoid this, remove seal from housing and install it on cable BEFORE stripping cable.*

Prepare the conductors and crimp the contacts in accordance with the instructions packaged with the crimping tool. Then match the style of contacts with one of the styles shown in Figure 2 and select the appropriate procedure from the following text.

NOTE *If the connector is to be panel mounted, do so in accordance with Paragraph 8 BEFORE inserting the contacts.*

A. Type II, III(+), and VI Contacts

1. When inserting a pin contact, install the AMP Seal Protector 208337-1 over the pin portion as shown in Figure 3, View A. When inserting a socket contact, use the AMP Seal Protector 208338-1 in the socket portion of the contact as shown in Figure 3, View C.

2. Moisten the protector with isopropyl alcohol.

3. Align the contact with the back of the cavity and insert it *straight* into the cavity until bottomed. See Figure 3, Views A and C.

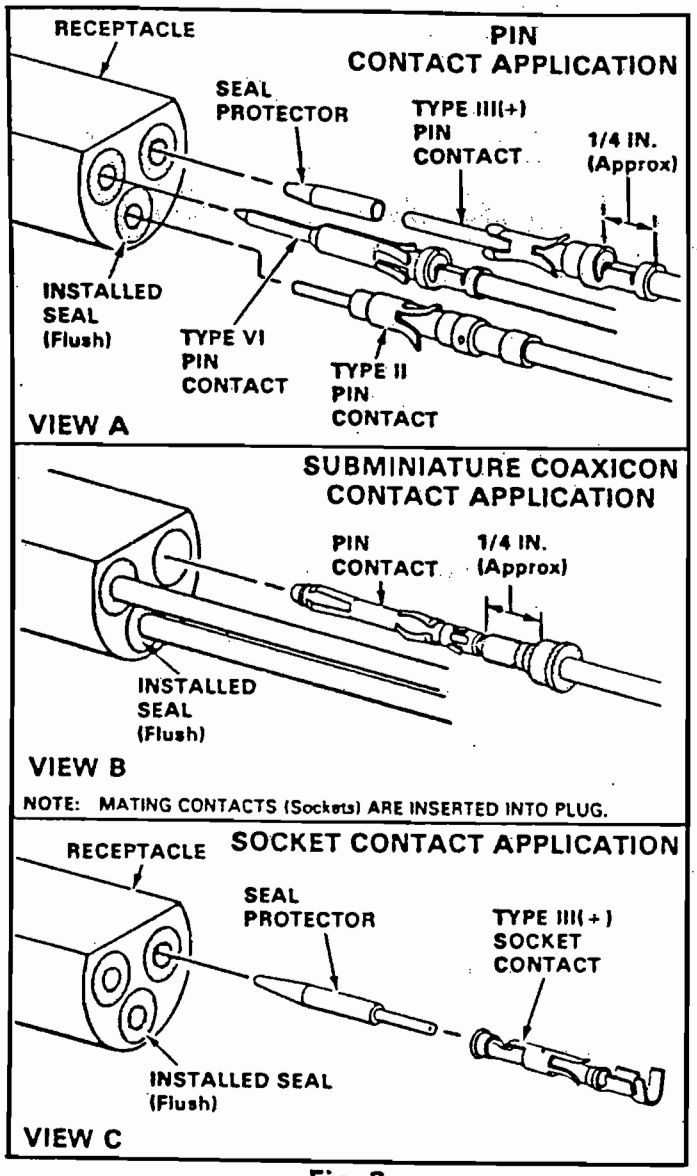


Fig. 3

4. Pull back lightly on conductor to be sure contact is locked in the cavity. Remove the seal protector from the front (mating face) of the connector.

5. If the connector has more contact cavities than required for your application, seal the unused cavities by inserting a sealing plug into conductor seal until the shoulder seats on the seal. See Figure 1.

B. Subminiature COAXICON Contacts

1. Position the seal so the collar is approximately 1/4 in. from end of contact as shown in Figure 3, View B.

2. Align the contact with the back of the contact cavity and insert it *straight* into the cavity until bottomed.

3. Pull back lightly on conductor to be sure contact is locked in position.

4. Check seal — it should have seated flush with the back of the connector. If it is NOT, push it in with your finger or a round-tip tool. See Figure 3, View B.

5. If the connector has more contact cavitie than required for your application, seal the unused cavities by inserting a sealing plug into conductor seal until the shoulder seats on the seal. See Figure 1.

5. EXTRACTION OF CONTACTS

1. Align the sleeve of AMP Extraction Tool 305183 with the front of the contact cavity. See AMP Instruction Sheet (IS 1216) for proper use of the extraction tool.

2. Push the sleeve straight into the cavity until bottomed, then twist the tool to be sure the contact lances have released.

3. With the connector firmly supported, depress the push rod button — the contact and seal should back out of the connector easily.

4. Remove tool and contact from connector. (The seal will back out of connector.)

6. INSPECTION AND REPAIR

Inspect the contact and the seal. If either is damaged, replacement is necessary.

A. Replacing Damaged Contact

1. Slide seal away from contact.

2. Cut conductor directly behind contact.

3. For all contacts except subminiature COAXICON, remove the seal from the conductor and place it in the cavity from which the contact was removed.

NOTE

Subminiature COAXICON contacts should NOT be inserted through seals unless new seals are replacing damaged seals as described in Paragraph 6,B.

4. Prepare conductor and attach a new contact. See Figure 2 for AMP Instruction Sheet references for tooling.

5. Insert contact the same as for original installation (Paragraph 4).

B. Replacing Damaged Seal

1. Carefully cut the seal off of the conductor.

2. Determine the style of contact and position the new seal accordingly.

   a. For all styles of contacts except subminiature COAXICON, insert a new sea into the cavity from which the contact was removed.

b. For subminiature COAXICON contacts only, moisten the contact and the inside of seal with isopropyl alcohol, then carefully slide seal over contact until properly positioned. See Figure 3.

CAUTION

When installing seal on coaxial socket contacts, start the seal, then carefully lift it over the leading edges of the socket with a round tip tool or damage could result to the seal. See Figure 4.

3. Insert contact just the same as an original installation (Paragraph 4,B).

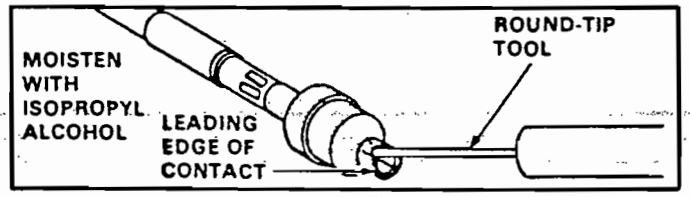


Fig. 4

7. RE-INSERTION OF UNDAMAGED COMPONENTS

The following procedure applies to contacts and seals that have been removed but NOT damaged.

1. Slide the seal over the contact approximately 1/4 in. See Figure 3.

2. Using a twisting motion, back seal off contact until collar appears — do NOT remove seal from contact. See Figure 5.

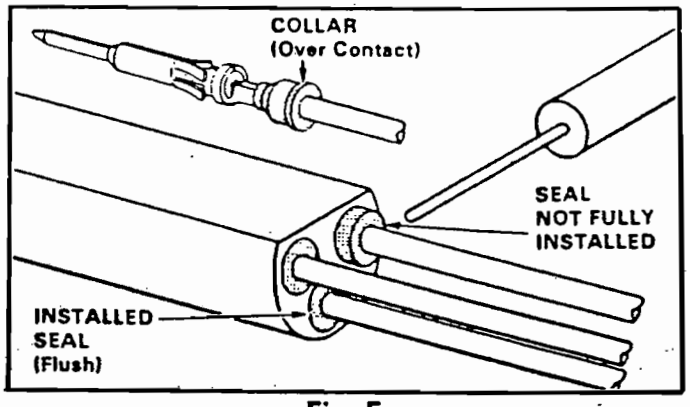


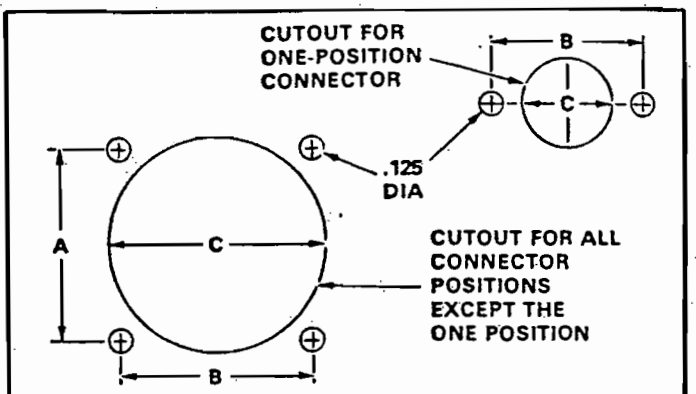
Fig. 5

3. Align the contact with back of contact cavity and insert it straight in until bottomed — then pull back lightly to be sure the contact is locked in the cavity.

4. Check seal to be sure it is flush with the back of housing. If it is NOT flush, seat it with a round-tip tool. See Figure 5.

8. PANEL MOUNTING

Make a cutout in the panel using the dimension shown in Figure 6. Seat the mounting flange on the panel and secure it with screws, washers, and nuts.



CONNECTOR POSITION	DIMENSIONS		
	A	B	C
1	--	.760	.475
2	.765	.765	.728
3	.765	.765	.728
4	.865	.865	.868
8	1.125	1.125	1.170
9	1.125	1.125	1.170

Fig. 6

9. MATING AND UNMATING CONNECTORS

A. Mating (Figure 7)

1. Check mating faces of connectors to be sure they are dry and NOT moist . . . especially after contact insertion.

2. Turn the flat surfaces of the connectors in the same direction, then align the polarizing ribs and slots.

3. Slide the plug onto the receptacle until the retention ring and locking tab engage. Squeeze retention ring to be sure it has engaged locking tabs.

B. Unmating (Figure 7)

1. Depress the gripping ribs to disengage the retention ring and locking tab.

2. Pull the plug straight away from the receptacle.

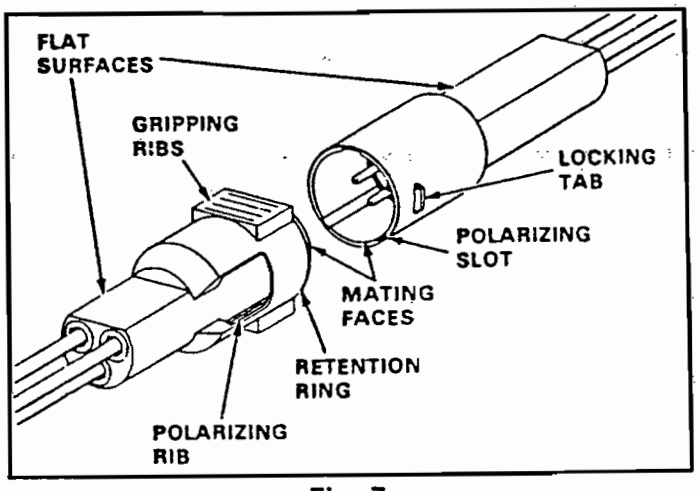


Fig. 7

9. MATING AND UNMATING CONNECTORS

A. Mating (Figure 7)

1. Check mating faces of connectors to be sure they are dry and NOT moist . . . especially after contact insertion.

2. Turn the flat surfaces of the connectors in the same direction, then align the polarizing ribs and slots.

3. Slide the plug onto the receptacle until the retention ring and locking tab engage. Squeeze retention ring to be sure it has engaged locking tabs.

B. Unmating (Figure 7)

1. Depress the gripping ribs to disengage the retention ring and locking tab.

2. Pull the plug straight away from the receptacle.

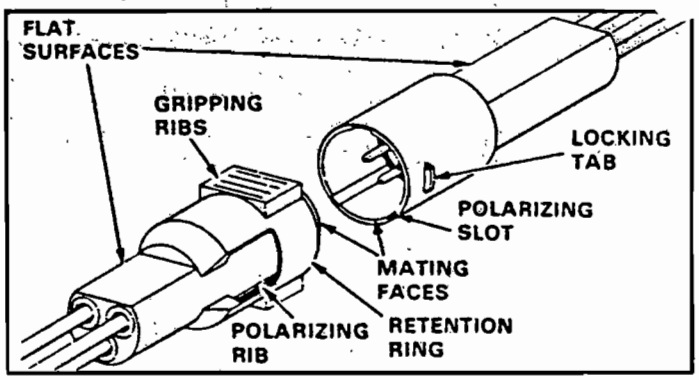


Fig. 7

Multimate Contacts

For use in:
"M" Series Connectors
Series 1 and 4 CPC Connectors
Metrimate Connectors
"G" Series Connectors

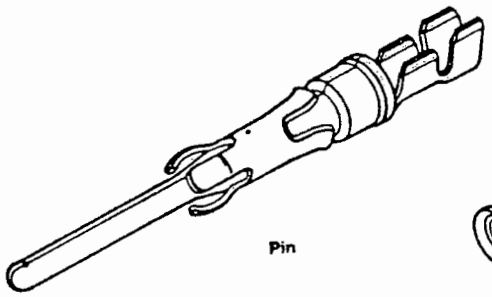
Dimensioning:
All dimensions in inches and millimetres
Values in brackets are metric equivalents
Chart contains dimensions in inches over millimetres

Type III+

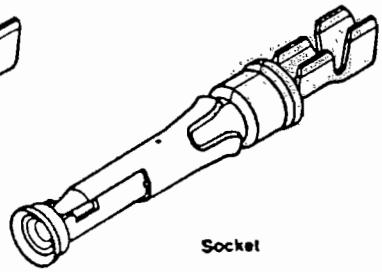
Contact Size — 16
Pin Diameter — .062 [1.57]
Test Current — 13 Amperes‡
Material:
Contact Body — Brass
Spring — Stainless Steel
Finish:
See chart below.

‡Refer to contact current carrying capability information, page 111.

AMP Extraction Tool No. 305183



Pin



Socket

Wire Size Range* AWG	Wire Size Range* [mm²]	Ins Dia Range	Contact Finish	Strip Form Contact No.† Pin	Strip Form Contact No.† Socket	Loose Piece Contact No. Pin	Loose Piece Contact No. Socket	Tooling No. Strip Form Miniature Applicator	Tooling No. Loose Piece Hand Tool
30-26	0.05-0.15	.070-.100 1.78-2.54	Gold/Nickel[3]	66477-1	66479-1	66643-1	66483-1	466054-2	90282-1
		.040-.060 1.02-1.52	Gold/Nickel[3]	66425-5	66424-5	66429-1	66428-1	687193-3	90066
			Tin	66425-6	66424-6	66429-2	66428-2		
			Gold/Nickel[3]	66425-7	66424-7	66429-3	66428-3		
			Sel. Gold/Nickel[4]	66425-8	66424-8	66429-4	66428-4		
		.014-.030 0.36-0.76	Gold/Nickel[3]	66393-5	66394-5	66406-1	66405-1	466585-2	90225-2
			Tin	66393-6	66394-6	66406-2	66405-2		
			Gold/Nickel[3]	66393-7	66394-7	66406-3	66405-3		
			Sel. Gold/Nickel[4]	66393-8	66394-8	66406-4	66405-4		
26-24	0.12-0.2	.035-.055 0.89-1.4	Gold/Nickel[3]	66106-5	66108-5	66107-1	66109-1	466321-2	90277-1[5] or 90066
			Tin	66106-6	66108-6	66107-2	66109-2		
			Gold/Nickel[3]	66106-7	66108-7	66107-3	66109-3		
			Sel. Gold/Nickel[4]	66106-8	66108-8	66107-4	66109-4		
24-20	0.2-0.6	.040-.080 1.02-2.03	Gold/Nickel[3]	66102-6	66104-6	66103-1	66105-1	466323-2	90277-1[5] 90066 or 90067
			Tin	66102-7	66104-7	66103-2	66105-2		
			Gold/Nickel[3]	66102-8	66104-8	66103-3	66105-3		
			Sel. Gold/Nickel[4]	66102-9	66104-9	66103-4	66105-4		
		.080-.100 2.03-2.54	Tin	66332-5	66331-5	66400-1	66399-1	466324-2	90277-1[5] 90067-2 or 90225-2
			Gold/Nickel[3]	66332-6	66331-6	66400-2	66399-2		
			Gold/Nickel[3]	66332-7	66331-7	66400-3	66399-3		
			Sel. Gold/Nickel[4]	66332-8	66331-8	66400-4	66399-4		
		.060-.135 1.52-3.43	Gold/Nickel[3]	66564-5	66563-5	66566-1	66565-1	466383-2	90331-1
			Tin	66564-6	66563-6	66566-2	66565-2		
			Gold/Nickel[3]	66564-7	66563-7	66566-3	66565-3		
			Sel. Gold/Nickel[4]	66564-8	66563-8	66566-4	66565-4		
18-16	0.8-1.4	.080-.100 2.03-2.54	Gold/Nickel[3]	66098-6	66100-6	66099-1	66101-1	466325-2	90277-1[5] 90067 90208-1 or 90067-2
			Tin	66098-7	66100-7	66099-2	66101-2		
			Gold/Nickel[3]	66098-8	66100-8	66099-3	66101-3		
			Sel. Gold/Nickel[4]	66098-9	66100-9	66099-4	66101-4		
18-14**	0.8-2	.110-.150 2.79-3.81	Tin	66597-1	66598-1	66602-1	66601-1	466752-2	90310-2
			Sel. Gold/Nickel[4]	66597-2	66598-2	66602-2	66601-2		
14	2	.080-.100 2.03-2.54	Gold/Nickel[3]	66359-5	66358-5	66361-1	66360-1	466326-2	90208-1
			Tin	66359-6	66358-6	66361-2	66360-2		
			Gold/Nickel[3]	66359-9	66358-9	66361-3	66360-3		
			Sel. Gold/Nickel[4]	1-66359-0	1-66358-0	66361-4	66360-4		

*Wire strip length — .156 [3.96] (all wire sizes)
[2] .000030 [0.00076] gold over .000050 [0.00127] nickel
[3] .000015 [0.00038] gold over .000050 [0.00127] nickel
[4] Gold flash over .000050 [0.00127] nickel on entire contact, with .000030 [0.00076] gold on electrical engagement area
[5] Strip form contacts are reeled for AMP miniature applicator and AMP-O-MATIC Side-Feed Stripper/Crimper Machine
*Economy hand tool
**In CPC Connectors use these contacts only for Series 1 connector (Arrangement No. 23-24) and Series 4 connectors (Arrangement Nos. 23-16M and 23-22M)
Insertion Tool No. 91002-1 (for insulation diameters .070 [1.78] or less)
Extraction Tool No. 305183.

AMP INCORPORATED
Harrisburg, PA 17105

AMP* EXTRACTION TOOLS 305183, 305183-2 THRU -8, AND 1-305183-3

Instruction Sheet
IS 1216
RELEASED 11-14-84
REDUCED FOR PACKAGING

EXTRACTION TOOL NO.	CONTACT TYPE	CONTACT SIZE
305183	II, III, III (–), VI, X, and Subminiature Coax	All Sizes
-2	I	20
-3		16 to 20
-4		14
-5		12
-6		10
-7		8
-8	I*	12
	Mintr Coax*	20
1- -3	I	10

* TOOL 305183-8 CAN BE USED FOR TYPE I AND MINTR COAX CONTACTS.

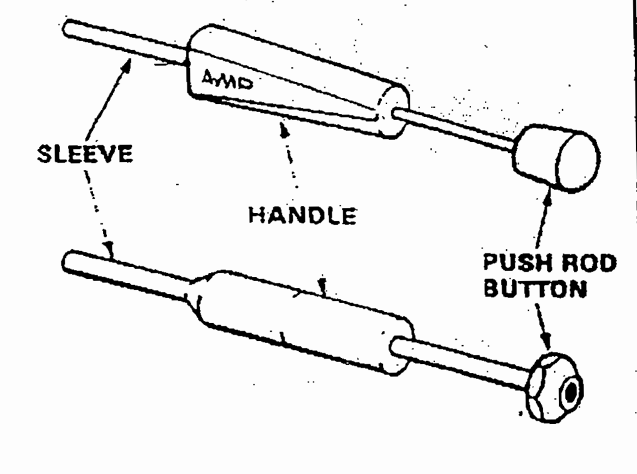


Fig. 1

1. INTRODUCTION

The AMP extraction tools listed in Figure 1 are designed to remove pin and socket contacts from various AMP Multimate connectors. Read these instructions thoroughly before starting.

NOTE *All dimensions presented on this instruction sheet are in inches.*

2. DESCRIPTION

Each tool features a handle and sleeve to release the contact locking lance, and a push rod button to eject the contact.

3. EXTRACTION PROCEDURE

Refer to the chart in Figure 1, and then select the appropriate extraction tool according to the contact type and (if applicable) contact size, to be removed.

Proceed as follows:

1. Align the sleeve of the tool with the contact to be removed (see Figure 2).
2. Holding the handle, insert the sleeve straight into the contact cavity until it bottoms. Allow the push rod button to "back out" of the handle as shown in Figure 3.
3. Rotate handle to assure contact locking lance has released.
4. Keep the sleeve firmly bottomed in the cavity, and depress the push rod button. The contact will eject as the button is depressed.
5. Remove the tool from the contact cavity.

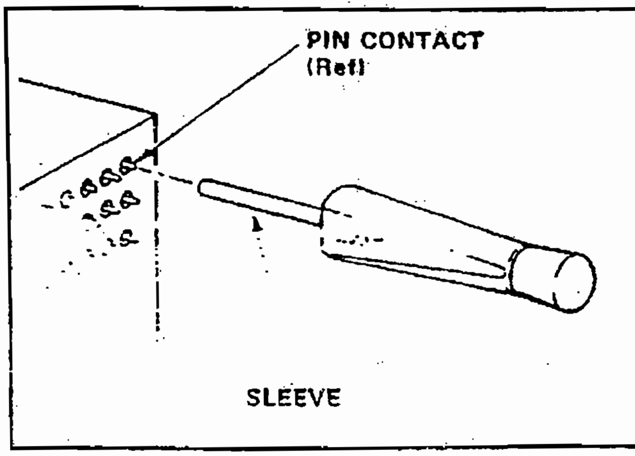


Fig. 2

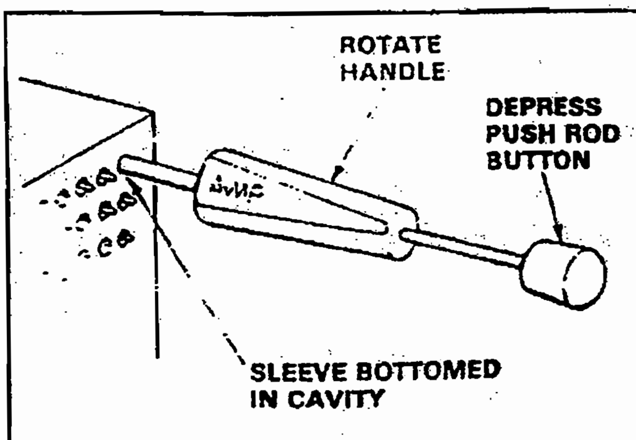
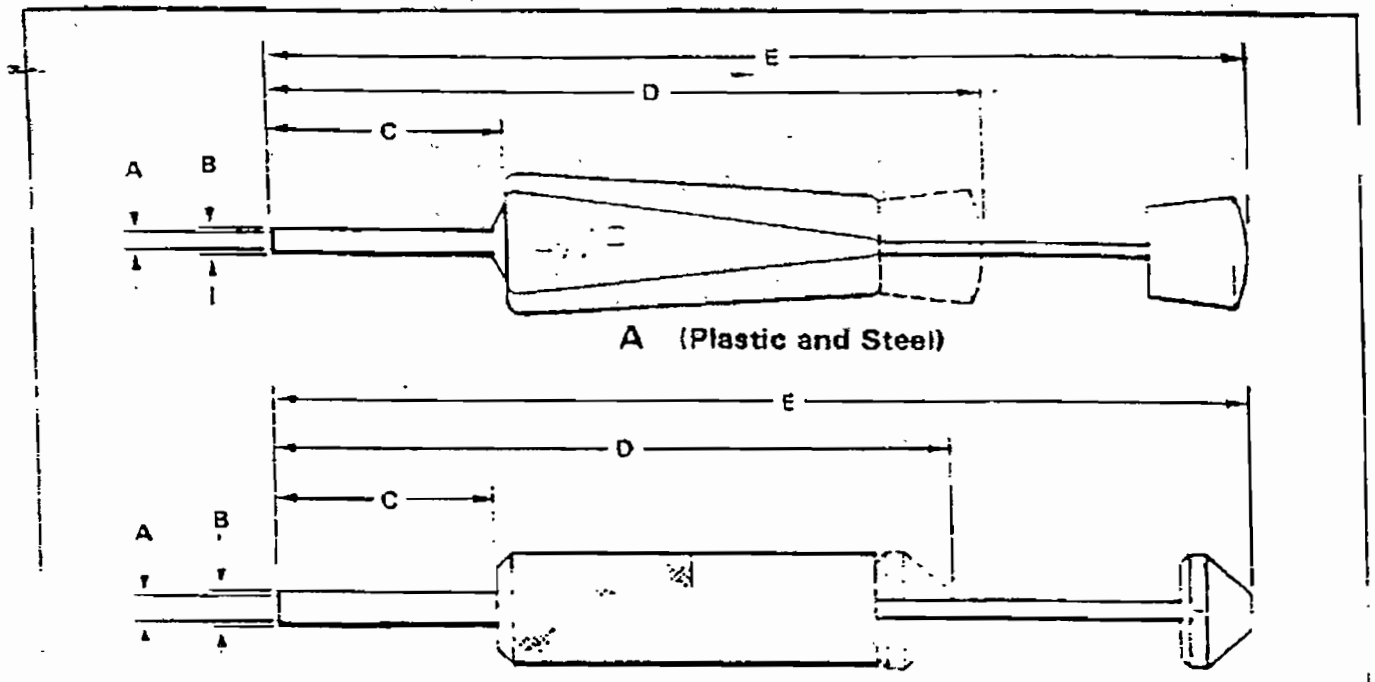


Fig. 3

*Trademark of AMP Incorporated



A (Plastic and Steel)

B (Aluminum and Steel)

EXTRACTION TOOL	DIMENSION A	B	C	D	E	ENGINEERING APPROVAL	DATE
305183*	.115	.129	1.21	3.20†	4.63	D. E. Dennis	11/14/84
-2	.103	.119	1.01	2.83	4.13		
-3	.137	.155					
-4*	.162	.179					
-5	.189	206					
-6	.227	.251					
-7	.256	284	"	"	"		
-8*	.204	224	1.15	3.14	4.41		
3	.227	243	1.01	2.83	4.13		

*THESE TOOLS CONFORM TO THE STYLE SHOWN IN "A" ABOVE.
†THIS DIMENSION WAS 3.00 PRIOR TO TOOL REVISION "B"

Fig. 4

4. TOOL CERTIFICATION

There are two styles of tools as shown in Figure 4. The style illustrated in Figure 4A is manufactured from plastic and steel (ie, plastic handle and push rod button . . . all other components are steel). The style illustrated in Figure 4B is manufactured from aluminum and steel (ie, aluminum push rod button . . . all other components are steel).

The style of each tool can be determined by the part number listed in Figure 4. Note that the part numbers of tools conforming to the style shown in Figure 4A are followed by an asterisk — those conforming to Figure 4B do NOT have an asterisk.

The extraction tools listed on this instruction sheet should be certified with the information provided in Figure 4. It is recommended that each tool be inspected immediately upon its arrival in your factory, and at regularly scheduled intervals, to assure that the tool has not been damaged during handling.

Additional tools can be purchased from:

AMP Incorporated
P.O. Box 3608
Harrisburg, Pennsylvania 17105

AMP INCORPORATED
Harrisburg, Pa. 17105

SELECTION CHARTS FOR AMP★ MULTIMATE PIN AND SOCKET CONTACTS

Instruction Sheet
IS 1379
RELEASED 6-5-81

1. INTRODUCTION

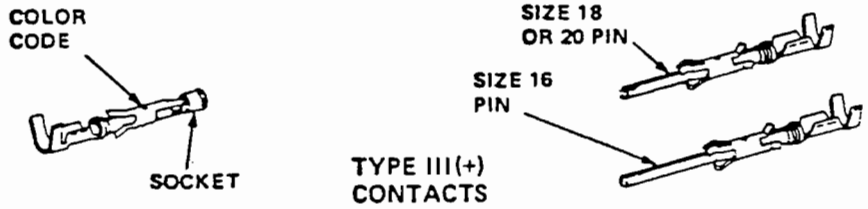
This instruction sheet (IS) provides the recommended procedures for selecting the proper AMP Type III(+), Type II, Type VI, Type X, Subminiature COAXICON★, and Fiber Optic Contacts for use in AMP "D," "DD," "G," "M," "W," and "WW" Series Connectors; Circular Plastic Connectors (CPC); Metrimate Connectors; and Econoseal Connectors.

Read these instructions thoroughly to make certain the selected contacts are compatible with the specified connector type, and the selected wire application tooling are compatible with the contacts.

2. CONTACT DESCRIPTION

A. Type III(+) (Figure 1)

Pin and socket contacts are available in size 20 (.040-in. pin diameter), size 18 (.056-in. pin diameter), and size 16 (.062-in. pin diameter). A color dot appears on the contact spring which designates the applicable wire size and matches the color dot above the hand tool crimping section.

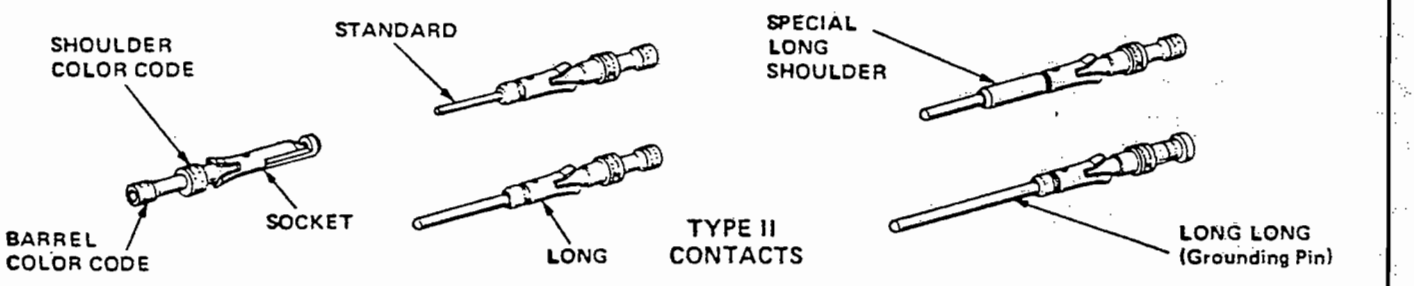


WIRE		TYPE III(+) CONTACTS					COLOR DOT	HAND CRIMPING TOOL ①	AUTO-MACH ②
SIZE (AWG)	INSUL DIA	CONT SIZE	LOOSE PIECE		STRIP				
			PIN	SOCKET	PIN	SOCKET			
26 to 24	.035 to .055	20	66306	66307	66294	66295	Red	90066, 90066-2, & 90277-1	Electric Machine with Air Feed
24 to 20	.040 to .080		66308	66309	66296	66297	Yellow	90066, 90067, & 90277-1	
18 to 16	.080 to .100		66310	66311	66298	66299	Blue	90067, 90067-2, 90208-1, & 90277-1	
16	.100 Max		--	66547	--	66548	Violet	90303-1	
(2) 16	.140 Max		--	66547	--	66548	Violet	90303-1	
30 to 26	.014 to .030	18	66422	66423	66418	66419	Brown	90225-2	
26 to 24	.035 to .055		66237	66238	66188	66190	Red	90066, 90066-2, & 90277-1	
24 to 20	.040 to .080		66239	66240	66192	66194	Yellow	90066, 90067, & 90277-1	
18 to 16	.080 to .100		66241	66242	66196	66198	Blue	90067, 90067-2, 90208-1, & 90277-1	
30 to 26	.014 to .030	16	66406	66405	66393	66394	Brown	90225-2	
	.040 to .060		66429	66428	66425	66424		90066	
	.070 to .100		--	66483	66477	66479		90282-1	
28	.035 to .055		66107	66109	66106	66108	Red	90066-4	
26 to 24			66107	66109	66106	66108		90066, 90066-2, & 90277-1	
			--	66492	--	66491		90066, 90066-2, & 90277-1	
	.080 to .100		--	66444	--	66442		90282-1	
(2) 26	.040 to .080		66103	66105	66102	66104	Yellow	90066-2 & 90277-1	
(2) 24								90066-2	
(2) 28								90066-4	
24 to 20								90066 & 90067	
	.080 to .100		66400	66399	66322	66331		90067-2 & 90225-2	
	.060 to .135		66566	66565	66564	66563		90331-1	
18 to 16	.080 to .100		66099	66101	66098	66100	Blue	90067, 90067-2, 90208-1, & 90277-1	
18 to 14	.080 to .135		66602	66601	66597	66598	--	90310-2	
14	.080 to .100		66361	66360	66359	66358	Violet	90208-1	

① REFER TO THE FOLLOWING AMP INSTRUCTION SHEET NUMBERS FOR SPECIFIC CRIMPING PROCEDURES — FOR HAND TOOLS 90066 (IS 6610), 90 (IS 6611), 90066-4 (IS 6612), 90067 (IS 6613), 90067-2 (IS 6614), AND 90208-1 (IS 6615). FOR HAND TOOL 90225-2 (IS 7414), 90282-1 (IS 7586), 90303-1 (IS 7635), 9 (IS 7942), AND 90331-1 (IS 7773). AN AMP ECONOMY HAND TOOL 90277-1 (IS 7574) AND AMP HEAD ASSEMBLY 90329-1 (IS 7755) ARE AVAILABLE TO CH LOOSE-PIECE CONTACTS.

② CONSULT YOUR LOCAL AMP REPRESENTATIVE FOR ASSISTANCE IN SELECTION OF THE MACHINE AND APPLICATOR THAT BEST SUITS YOUR NEEDS.

Fig. 1



WIRE		TYPE II CONTACTS				COLOR BAND		HAND CRIMPING TOOL ①	CRIMPING DIES FOR					
									PNEU TOOLS† ②	AMP-TAPEMATIC*		AMP-TAPETRONIC*		
										TOOL 69118-1 (CM 1773) ③	MACH 68075 (CM 2427) ④	MACH 69675 (CM 1993) ⑤	4/8 INDENT MACHINES	
SIZE (AWG)	INSUL DIA	SIZE	PIN LENGTH	PIN	SOC	BBL	SHD						MACH NO.	FUNL NO.
32 to 30	.030 to .048	20	Std	201625	201627	Wht	Red	45099 & 90118*	90230-1	--	--	--	--	--
28 to 24	.035 to .055			201607	201609	Red				90103	90249-3	90249-2	599406-6	1-125905-9
	.048 to .065			201354	201353	Red				90103	90249-3	90249-2	599406-6	2-125905-0
	.095 to .110			202189	202190	--	Grn	90093	90111	--	--	--	--	--
24 to 20	.040 to .062			201582	201584	Yel	Red	45099, 90281-1, & 90118	90230-1	90103	90249-3	90249-2	599406-6	1-125905-8
	.055 to .075			200334	200331								599406-6	1-125905-5
	.055 to .075	18		201880	201878								--	--
18 to 16	No Insul Bbl	20		201591	201589	Blu	Blu	45098 & 90281-1	90231-2	90080-2	90334-1	90250-1	599406-5	1-125905-6†† 1-125905-4
32 to 30	.030 to .048	16	Long	201555	201554	Wht	Red	45099 & 90118	90230-1	--	--	--	--	--
28 to 24	.035 to .055		Std	201649	201613	Red	Red	45099 & 90118		90103	90249-3	90249-2	--	--
			Long	201611				45099, 90118, & 601967-1					599406-6	1-125905-9
			Sp Long	204189				45099 & 90118					--	--
	.048 to .065		Long	201334	201332			45099, 90118, & 601967-1					599406-6	2-125905-0
	.095 to .110		Long	202410	202411	--	Grn	90093	90111	--	--	--	--	--
24 to 20	.040 to .062		Std	201647	201580	Yel	Red	45099, 90281-1, & 90118	90230-1	90103	90249-3	90249-2	599406-6	1-125905-8
	.040 to .062		Long	201578	201580			45099, 90281-1, & 90118						1-125905-8
	.055 to .085		Std	200679	201328			45099, 90281-1, 90118 & 601967-1						1-125905-5
			Long	201330				45099, 90281-1, 90118 & 601967-1						1-125905-5
			Sp Long	204188				45099, 90281-1, & 90118					--	--
	.055 to .075	20	Std	200334	200331			45099, 90281-1, & 90118					--	--
22 to 18	No Insul Bbl	16	--	--	201751	Grn	Blu	45098 & 90281-1	90231-2	--	--	--	--	--
(2) 18			Long	202725	202726	--		45098 & 90281-1		90080-2	90334-1	90250-1	--	--
18 to 16			Std	200335	200333	Blu		45098, 90281-1, & 601967-1**					--	--
			Std	200681				45098 & 90281-1					599406-5	1-125905-6
			Long	200336				45098, 90281-1, & 601967-1					599406-5	1-125905-6
			Sp Long	204274				45098 & 90281-1					--	--
			L Long	204219	--			45098			--	90250-3	--	--
	.080 to .105		Long	202507	202508	--	--	90136-1	--	90207-1	--	--	599406-6	1-125905-7
14	No Insul Bbl		Long	201570	201568	Vio	Blu	45098 & 90281-1	90231-2	90080-2	90334-1	90250-1	599406-5	2-125905-2
14	No Insul Bbl		Std	201645	201568	Vio	Blu	45098 & 90281-1	90231-2	90080-2	90334-1	90250-1	--	--

① REFER TO THE FOLLOWING AMP INSTRUCTION SHEET NUMBERS FOR SPECIFIC CRIMPING PROCEDURES — FOR HAND TOOLS 45098, 45099, 90093, AND 90118 (IS 1786), AND FOR 90136-1 (IS 7267). AMP ECONOMY HAND TOOLS 90281-1 (IS 7574) AND 90281-2 (IS 7836) AND HEAD ASSEMBLY 90324-1 (IS 7754) ARE AVAILABLE TO CRIMP LOOSE-PIECE CONTACTS. FOR HAND TOOL 601967-1, REFER TO IS 7516.

② CRIMPING PROCEDURES FOR DIES 90111, 90230-1, AND 90231-2 (IS 7420).

③ CRIMPING PROCEDURES FOR DIES 90080-2 AND 90103 (IS 7587) — FOR 90207-1 (IS 7324).

④ CRIMPING PROCEDURES FOR DIES 90249-1 AND 90334-1 (IS 7781).

⑤ CRIMPING PROCEDURES FOR DIES 90249-2, 90250-1, AND 90250-3 (IS 7453).

* HAND TOOL 90118 DOES NOT CRIMP CONTACT INSULATION BARREL.

** THE 601967-1 HAND TOOL CRIMPS ONLY THE 200333 CONTACT.

† PNEUMATIC TOOLS 46110, 69365, AND 69319-1 ARE DESCRIBED IN AMP CUSTOMER MANUALS CM 1986 AND CM 1983 AND ALSO IN AMP INSTRUCTION SHEET 864.

†† THE 1-125905-6 MACHINE CRIMPS THE 201591 CONTACT WHILE THE 1-125905-4 MACHINE CRIMPS THE 201589 CONTACT.

Fig. 2

Loose-piece contacts are designed for hand tool applications. Continuous strip-form contacts are designed for automatic or semi-automatic machine applications.

B. Type II (Figure 2)

Pin and socket contacts are available in size 20 (.040-in. pin diameter), and size 16 (.062-in. pin diameter). There are four pin lengths — standard, long, long-long (grounding pin), and special long shoulder. Mating socket contacts accept all pin lengths. Two color bands appear on each contact.

The shoulder color band identifies the applicable tooling by matching the colored handles of the hand tool or colored holding screws of the die assembly. The insulation barrel or wire barrel color band designates the applicable wire size and matches the color dot above the crimping section on the hand tool or die assembly.

Loose-piece contacts are designed for hand tool or pneumatic tool applications. Tape-mounted contacts are designed for pneumatic tool or semi-automatic machine applications.

C. Type VI (Figure 3)

Pin and socket contacts are available in a size 16 (.062-in. pin diameter) only. A wire size marking appears on the underside of each contact insulation barrel. This marking designates the applicable wire size and matches the wire size marking above the hand tool crimping section.

Loose-piece contacts are designed for hand tool applications. Continuous strip-form contacts are designed for automatic or semi-automatic machine applications.

D. Type X Contacts (Figure 4)

Type X contacts are available in size 16 only (.062-in.-diameter pin and mating socket), and will accept solid or stranded wire of size 28 to 14 AWG. The wire range is stamped on the insulation barrel.

Loose-piece contacts are designed for hand tool applications. Continuous strip-form contacts are designed for automatic or semi-automatic machine applications.

E. Subminiature COAXICON Contacts (Figure 5)

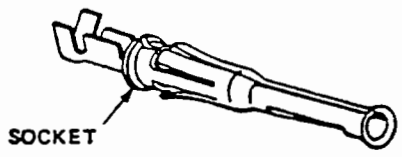
Pin contacts are available in a short length, a long length, and a medium length (Multimate pin). Mating socket contacts accept all pin lengths.

Loose-piece contacts are designed for hand tool and pneumatic tool applications. Consult your local AMP representative concerning tooling for continuous strip-form contacts.

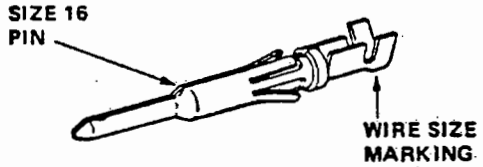
F. Fiber Optic Contacts (Figure 6)

Fiber optic contacts are available in size 16 only (.062-in.-diameter short and long), and will accept cable with a maximum jacket diameter of .091 in. The ferrule of the contact is color-coded to match proper fiber and jacket diameters.

The fiber optic contacts are designed for hand tool applications only.



TYPE VI CONTACTS

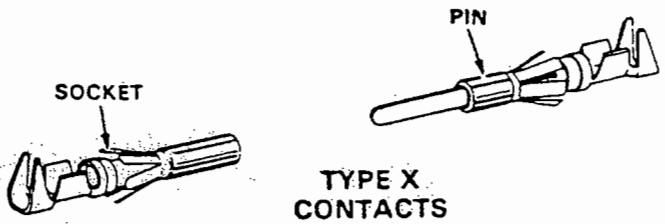


WIRE		TYPE VI CONTACTS					HAND CRIMPING TOOL ①	AUTO-MACH ②
SIZE (AWG)	INSUL DIA	CONT SIZE	LOOSE PIECE		STRIP			
			PIN	SOCKET	PIN	SOCKET		
28 to 24	.035 to .055	16	66595	66596	66585	66586	90066, 90066-2, & 90277-1	Electric Machine with Air Feed
24 to 20	.040 to .080		66593	66594	66583	66584	90066, 90067, & 90277-1	
			66645-3	66646-3	66645-2	66646-2		
			66645-5	66646-5	66645-4	66646-4		
22 to 18	.050 to .110		66591	66592	66581	66582	90327-1	
22 to 18	.080 to .110		66658	66656	66657	66655	90327-1	
18 to 16	.080 to .100		66589	66590	66579	66580	90067, 90067-2, 90208-1, & 90277-1	
18 to 14	.080 to .135		66587	66588	66577	66578	90310-1	

① REFER TO THE FOLLOWING AMP INSTRUCTION SHEET NUMBERS FOR SPECIFIC CRIMPING PROCEDURES — FOR HAND TOOL 90066 (IS 6610), (IS 6611), 90067 (IS 6613), 90327-1 (IS 7716), 90208-1 (IS 6615), AND 90310-1 (IS 7680). AN AMP ECONOMY HAND TOOL 90277-1 (IS 7574) IS AVAILABLE TO C LOOSE-PIECE CONTACTS. AN AMP HEAD ASSEMBLY 90329-1 IS AVAILABLE FOR CRIMPING LOOSE-PIECE CONTACTS. REFER TO IS 7755.

② CONSULT YOUR LOCAL AMP REPRESENTATIVE FOR ASSISTANCE IN SELECTION OF THE MACHINE AND APPLICATOR THAT BEST SUITS YOUR NEEDS.

Fig. 3



TYPE X CONTACTS

WIRE		TYPE X CONTACTS					HAND CRIMPING TOOL ①	AUTO-MACH ②
SIZE (AWG)	INSUL DIA	CONT SIZE	LOOSE PIECE		STRIP			
			PIN	SOCKET	PIN	SOCKET		
28 to 24	.035 to .055	16	66703	66707	66672	66663	90066 & 90277-1	Electric Machine with Air Feed
24 to 20	.040 to .080	↓	66702	66706	66671	66662	↓	↓
24 to 20	.040 to .080	↓	66702	66706	66641	66662	↓	↓
18 to 14	.080 to .110	↓	66701	66705	66673	66664	90208-1	↓
18 to 14	.110 to .150	↓	66700	66704	66660	66661	90310-2	↓

① REFER TO AMP INSTRUCTION SHEET IS 6610 FOR HAND TOOL 90066, IS 6615 FOR HAND TOOL 90208-1, IS 7942 FOR HAND TOOL 90310-2, AND TO IS 7574 FOR AMP ECONOMY TOOL 90277-1.

② CONSULT YOUR LOCAL AMP REPRESENTATIVE FOR ASSISTANCE IN SELECTION OF THE MACHINE AND APPLICATOR THAT BEST SUITS YOUR NEEDS.

Fig. 4

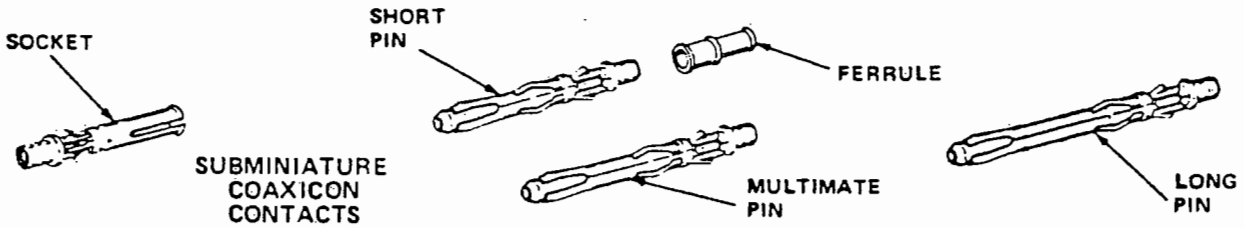
3. CONNECTORS

Determine the connector type to be assembled. Refer to the listing of compatible contacts under the appropriate connector heading and select the desired contact type and recommended size.

A. "D," "DD," "W," and "WW" Series Connectors

These connectors accept the following pin and mating socket contacts:

Type II — Sizes 20 and 16 (standard length only) from Figure 2.



CABLE SIZE	SUBMINIATURE COAXICON CONTACTS				FERRULE	HAND CRIMPING TOOL (IS 2024-2)	CRIMPING DIES (IS 2024-3) ①
	MULTIMATE PIN (LOOSE PIECE)	LONG PIN (LOOSE PIECE)	SHORT PIN (LOOSE PIECE)	SOCKET (LOOSE PIECE)			
RG-174, 188, 316	226537-1	51561-1 51561-4 226659-2	51563-1	51565-1 51565-4	1-332056-0	69656	69690
RG-174 Double Braid	↓	↓	↓	↓	225088-3	69656-7	--
RG-179, 187	↓	↓	↓	↓	1-332056-0	69656-1	69690-1
RG-187 Double Braid	↓	↓	↓	↓	225088-1	69656-8	--
RG-161	↓	↓	↓	↓	1-332056-0	69656-5	--
26 AWG Shielded .075 Max OD	↓	↓	↓	↓	1-332057-0	69656-3	69690-3
RG-178, 196	226537-2	51561-2 51561-5 226659-1	51563-2	51565-2 51565-5	1-332057-0	69656-2	69690-2
RG-196 Double Braid	↓	51561-2 51561-5 226659-1	↓	51565-2 51565-5	225088-1	69656-9	--
26 AWG Tw Pr Solid or 7 Str .0063 Dia	226537-3	51561-3 51561-6 226659-3	51563-3	51565-3 51565-6	1-332057-0	69656	69690
28 AWG Tw Pr Solid	↓	↓	↓	↓	↓	69656	69690
28 AWG Tw Pr Str .005 Dia	↓	↓	↓	↓	↓	69656-1 or 69656-2	69690-1 or 69690-2
WG Tw Pr Solid	↓	↓	↓	↓	↓	69656-2	69690-2

① USED WITH HAND CRIMPING TOOL 69710 (IS 2095), OR WITH PNEUMATIC TOOL 69365-3 (CM 1993).

Fig. 5

Type III(+) — Sizes 20, 18, and 16 from Figure 1.

Type VI — Size 16 from Figure 3.

Type X — Size 16 from Figure 4.

Subminiature COAXICON contacts — Short pins from Figure 5.

Fiber Optic — short and long contacts from Figure 6.

B. "M" Series Shallow Mating (M-SM) Connectors

These connectors accept the following pin contacts only:

Type II — Sizes 20 and 16 (standard length) from Figure 2.

Type III(+) — Sizes 20 and 18 from Figure 1.

Subminiature COAXICON contacts — Short pins from Figure 4.

C. "M" Series Deep Mating (M-DM), "G" Series, CPC, Metrimate, and Econoseal Connectors

These connectors accept the following pin and mating socket contacts:

Type II — Size 16 (long, grounding pin, and special long shoulder length) from Figure 2.

Type III(+) — Size 16 from Figure 1.

Type VI — Size 16 from Figure 3.

Type X — Size 16 from Figure 4.

Subminiature COAXICON contacts — Multimate and long pins from Figure 5.

Fiber Optic — short and long contacts from Figure 6.

4. CONTACT SELECTION

A. Type III(+) (Figure 1)

1. Locate appropriate contact size in column 3 as determined by Paragraph 3, CONNECTORS.

2. Determine wire size to be used (column 1). Make certain wire insulation diameter is within range specified in column 2.

3. Columns 4, 5, 6, and 7 indicate appropriate loose-piece and strip-form pin and socket contacts for selected wire size. Check that these contact base part numbers correspond with those on package or reel.

4. A color dot which appears on contact spring is referenced in column 8.

B. Type II (Figure 2)

1. Locate appropriate contact size and pin length in columns 3 and 4, as determined by Paragraph 3, CONNECTORS.

2. Determine wire size to be used (column 1). Make certain wire insulation diameter is within range specified in column 2.

3. Columns 5 and 6 indicate appropriate pin and socket contact for selected wire size. Check that these base part numbers correspond with those on package or reel.

4. Color bands which appear on contact shoulder and barrel are referenced in columns 7 and 8.

C. Type VI (Figure 3)

1. Determine wire size to be used (column 1). Make certain wire insulation diameter is within range specified in column 2.

2. Columns 4, 5, 6, and 7 indicate appropriate loose-piece and strip-form pin and socket contacts for selected wire size. Check that these contact base part numbers correspond with those on package or reel.

D. Type X (Figure 4)

1. Determine wire size to be used (column 1). Make certain wire insulation diameter is within range specified in column 2.

2. Columns 4, 5, 6, and 7 indicate appropriate loose-piece and strip-form pin and socket contacts for selected wire size. Check that these contact base part numbers correspond with those on package or reel.

E. Subminiature COAXICON Contacts (Figure 5)

1. Determine cable size to be used (column 1).

2. Locate appropriate pin length (multimate, long, or short) in chart heading, as determined by Paragraph 3, CONNECTORS.

3. Columns 2 through 9 indicate appropriate strip-form and loose-piece (LP) pin and socket contacts for selected cable size. Check that these contact part numbers correspond with those on package or reel.

F. Fiber Optic (Figure 6)

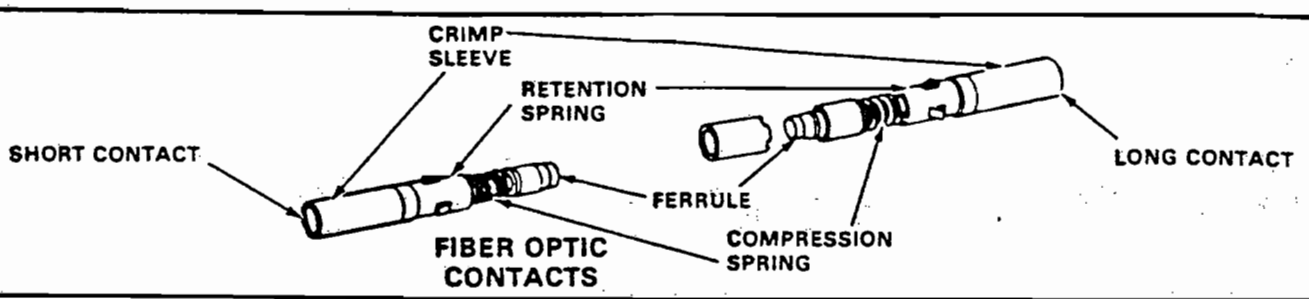
1. Determine fiber diameter and cable jacket diameter to be used (columns 1 and 2).

2. Columns 3 and 4 indicate appropriate short and long contacts for the selected fiber diameter.

3. Column 5 indicates the color code of the ferrule while column 6 shows the appropriate hand-crimping tool to crimp the contacts.

5. CONTACT INSERTION

AMP Insertion Tools 91002 and 200893 are recommended for inserting Type II, Type III(+), Type VI, and Type X contacts if wire bundle is large or if wire is fragile. AMP Insertion Tool 220035-1 is recommended for inserting Subminiature COAXICON contacts having fragile wire. No insertion tool is recommended for fiber optic contacts.



CABLE		FIBER OPTIC CONTACTS			HAND TOOLING (IS 2824)
FIBER DIAMETER	MAX JACKET DIA	SHORT	LONG	FERRULE COLOR CODE	
.016	.091	227089-2	227090-2	White	90364-2
.024	↓	227089-3	227090-3	Green	↓
.046	↓	227089-1	227090-1	Red	↓

Fig. 6

Refer to AMP Instruction Sheet IS 1817 (packaged with tool 200893), IS 2024 (packaged with tool 220035-1), or IS 7347 (packaged with tool 91002), for proper insertion procedures.

To insert a contact, grip wire insulation directly behind contact insulation barrel. Align contact with BACK of desired cavity. Insert contact straight into cavity until it bottoms. Pull back lightly on wire to be sure contact is locked in place.

6. CONTACT EXTRACTION

AMP Extraction Tool 305183 is recommended for extracting Type II, Type III(+), Type VI, Type X, and Subminiature COAXICON pin and socket contacts from their connectors. AMP Extraction Tool 91148-1 is recommended for extracting fiber optic contacts.

Refer to AMP Instruction Sheet IS 1216 (packaged with tool 305183), or IS 2837 (packaged with tool 91148-1), for proper extraction procedures.

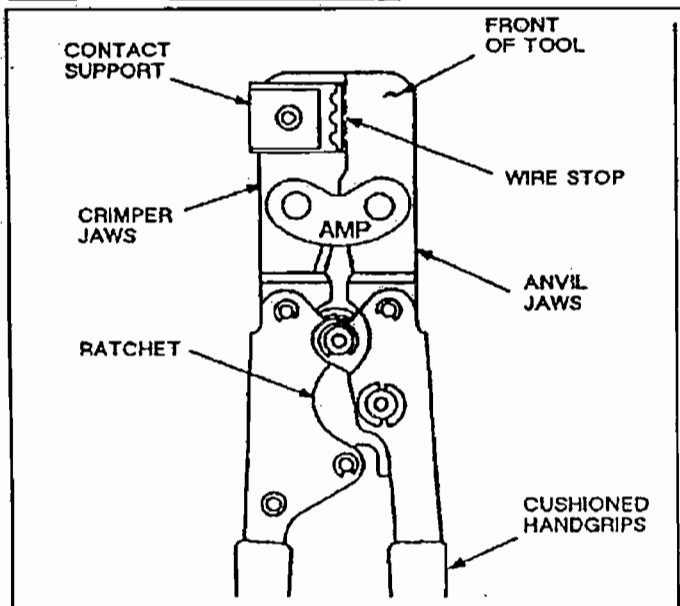
AMP INCORPORATED
HARRISBURG, PA 17105

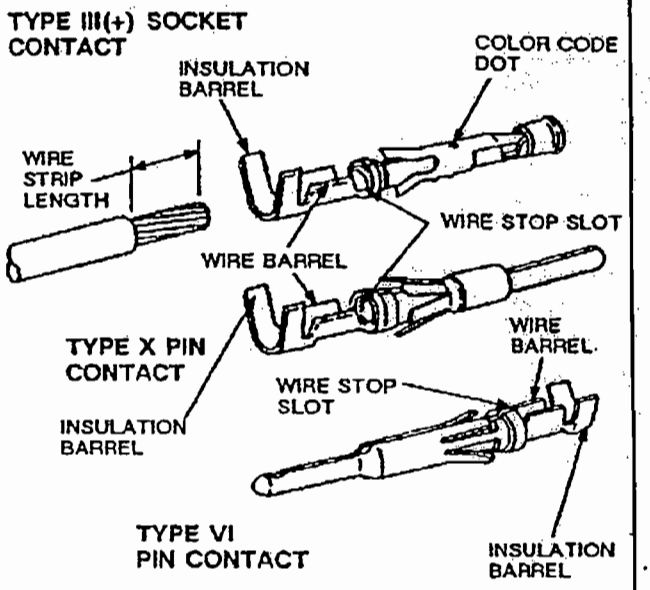
CUSTOMER HOTLINE
1 800 722-1111

APPLICATION AND MAINTENANCE FOR AMP* HAND CRIMPING TOOL 90277-1

IS 7574

RELEASED
5-10-89





WIRE			MULTIMATE CONTACTS							CRIMP SECT (Wire Size Marking)
SIZE (AWG)	INSUL DIA	STRIP LENGTH	TYPE	COLOR DOT	SIZE	LOOSE PIECE PIN	LOOSE PIECE SOCKET	STRIP PIN	STRIP SOCKET	
28 to 24	.035 to .055	1/8 (.125)	VI	None	16	66595	66596	66585	66586	28-24
28 to 24	↓	↓	X	None	16	66703	66707	66672	66663	↓
28 to 24	↓	↓	III(+)	Red	18	66107	66109	66106	66108	↓
↓	↓	↓	III(+)	Red	18	66237	66238	66188	66190	↓
↓	↓	↓	III(+)	Red	20	66306	66307	66294	66295	↓
24 to 20	.040 to .080	↓	VI	None	16	66593	66594	66583	66584	24-20
↓	↓	↓	VI	None	16	66645-3 & -5	66646-3 & -5	66645-2 & -4	66646-2 & -4	↓
↓	↓	↓	III(+)	Yellow	16	66103	66105	66102	66104	↓
↓	↓	↓	↓	↓	18	66239	66240	66192	66194	↓
↓	↓	↓	↓	↓	20	66308	66309	66296	66297	↓
↓	↓	↓	X	None	16	66702	66706	66671	66662	↓
18 to 16	.080 to .100	↓	VI	None	16	66589	66590	66579	66580	18-16
↓	↓	↓	III(+)	Blue	16	66099	66101	66098	66100	↓
↓	↓	↓	↓	↓	18	66241	66242	66196	66198	↓
↓	↓	↓	↓	↓	20	66310	66311	66298	66299	↓

Fig. 1

I. INTRODUCTION

AMP Hand Crimping Tool 90277-1 is designed to crimp the AMP Multimate Type III(+), Type VI, and Type X pin and socket contacts listed in Figure 1. Read these instructions thoroughly before crimping any contacts.

The tool is recommended for field repair use ONLY, per AMP Application Specification 114-10006.

NOTE *All dimensions on this instruction sheet are in inches.*

*Trademark of AMP Incorporated

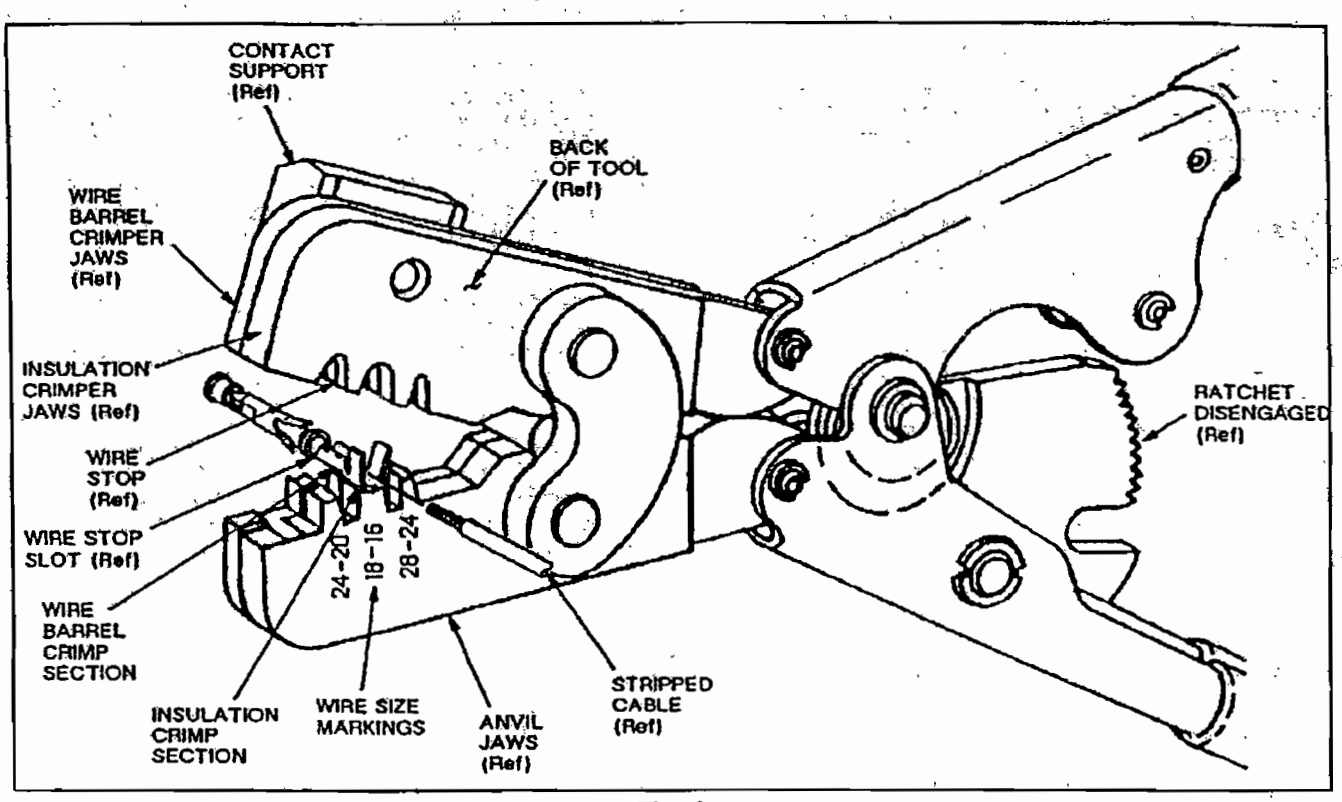


Fig. 2

2. DESCRIPTION (Figures 1 and 2)

The tool frame features two crimper jaws, two anvil jaws, three crimp sections (with applicable wire size markings), a spring-actuated contact wire stop, a contact support, a ratchet to ensure full contact crimping, and spring-actuated handles with cushioned handgrips.

Type III(+) contacts have a color dot located on the contact spring. Type VI and X contacts have the applicable wire size stamped on the underside of the insulation barrel.

3. CRIMPING PROCEDURE (Figure 2)

Refer to the chart in Figure 1, and select appropriate wire according to size and insulation diameter. Strip the wire to the length indicated. Do NOT cut or nick the wire strands.

Select a loose-piece contact (see Figure 1); then determine appropriate crimp section (according to the wire size markings on the BACK of the tool). The color dot or wire size marking on the contact must match the wire size marking on the tool jaw. Refer to Figure 2 and proceed as follows:

1. With BACK of tool facing you, squeeze tool handles together to release ratchet. Then allow tool handles to open fully.

2. Holding contact by the pin or socket end, insert contact (insulation barrel first) through the front of the tool and into the appropriate wire crimp section.

NOTE

Contact must be inserted with the "F" crimp (open end of insulation and wire barrel) positioned toward the crimping jaws.

3. Align contact wire stop slot with the wire stop in the crimping jaws. The contact insulation and wire barrels must be positioned in the crimp section as shown in Figure 2.

NOTE

Make sure both sides of the insulation barrel are started evenly into the crimper jaws. Do NOT attempt to crimp an improperly positioned contact.

4. Squeeze tool handles together until ratche engages enough to hold the contact in position. Do NOT deform insulation barrel or wire barrel.

5. Insert stripped wire into contact insulation and wire barrels until wire butts against wire stop.

6. Holding wire in place, squeeze tool handles together until ratchet releases. Allow tool handles to open FULLY, and remove crimped contact.

NOTE

Crimping gold-plated contacts may cause a gold buildup in the crimper jaws. To prolong tool life, and prevent sticking of contacts in the crimper jaws, periodically apply a small amount of oil to the crimper jaws. AMP recommends the use of AMP synthetic oil 22014-1, or any suitable commercially approved lubricant.

4. TOOL INSPECTION

Hand Crimping Tool 90277-1 is inspected before shipment. AMP recommends that the tool be inspected immediately upon its arrival at your facility, and at regularly scheduled intervals, to ensure that it has not been damaged during handling and use.

5. MAINTENANCE/QUALITY CONTROL

A. Daily Maintenance

It is recommended that each operator be made aware of — and responsible for — the following four steps of daily maintenance:

1. Remove dust, moisture, and other contaminants with a clean brush,or a soft, lint-free cloth. Do NOT use objects that could damage the tool.

2. Make sure the proper retaining pins are in place and secured with the retaining rings.

3. Make certain all pins, pivot points, and bearing surfaces are protected with a THIN coat of any good SAE No. 20 motor oil. Do NOT oil excessively.

4. When the tool is not in use, keep the handles closed to prevent objects from becoming lodged in the crimping jaws and store the tool in a clean, dry area.

B. Periodic Inspection

Regular inspections should be performed by quality control personnel. A record of scheduled inspections should remain with the tool or be supplied to supervisory personnel responsible for the tool. The inspection frequency should be based on the amount of use, working conditions, operator training and skill, and established company standards. These inspections should be performed in the following sequence:

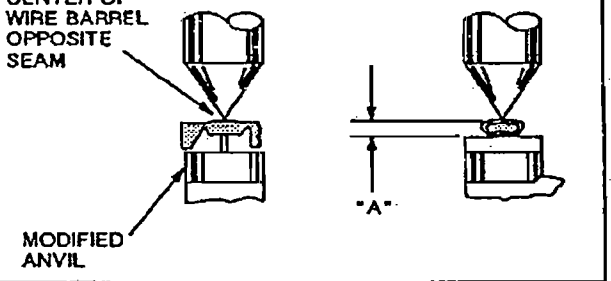
B-1. Visual Inspection

1. Remove all lubrication and accumulated film by immersing the tool (handles partially closed) in a suitable commercial degreaser that will not affect paint or plastic material.

2. Make certain all retaining pins are in place and secured with retaining rings. If replacements are necessary, refer to parts listed in Figure 4.

3. Close the tool handles until the ratchet releases, then allow handles to open freely. If they do not open quickly and fully, the spring is defective and must be replaced (see Section 6, TOOL REPLACEMENT AND REPAIR).

4. Inspect the head assembly, with special emphasis on checking for worn, cracked, or broken jaws. If damage to any part of the head assembly is evident, the tool must be repaired (see Section 6, TOOL REPLACEMENT AND REPAIR).

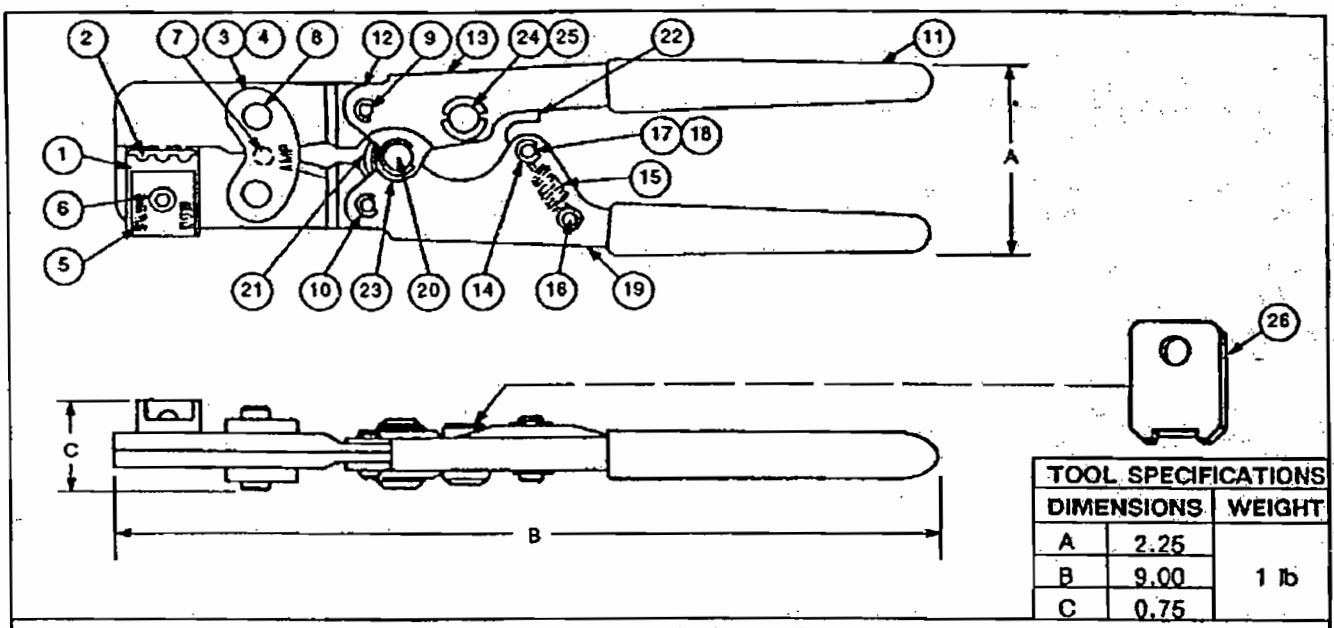


CONTACT NO. (Loose Piece)		WIRE SIZE	CRIMP SECT (Wire Size	CRIMP HGT DIM.
PIN	SOCKET	(Max)	Marking)	"A"
66595 66107 66237 66306 66703	66596 66109 66238 66307 66707	24	28-24	.030 ± .002
66593 66103 66239 66308 66645-3 and -5 66702	66594 66105 66240 66309 66646-3 and -5 66706	20	24-20	.039 ± .002
66589 66099 66241 66310	66590 66101 66242 66311	16	18-16	.051 ± .002

Fig. 3

B-2. Crimp Height Inspection

This inspection requires the use of a micrometer with a modified anvil as shown in Figure 3. AMP recommends



TOOL SPECIFICATIONS		
DIMENSIONS		WEIGHT
A	2.25	
B	9.00	1 lb
C	0.75	

REPLACEMENT PARTS

ITEM	PART NO.	DESCRIPTION	QTY	ITEM	PART NO.	DESCRIPTION	QTY
1	127264-1	CONTACT SUPPORT	1	14	127251-1	PAWL	1
2	127265-1	WIRE STOP	1	15	127292-1	SPRING, Extension	1
3	127304-1	LINK	1	16	127253-1	PIN, Spring	1
4	127266-1	LINK	1	17	127255-1	PAWL, Pivot	1
5	127299-1	SPRING	2	18	127293-1	RING, Retaining	4
6	127305-1	SCREW, 6-32 x 3/8 L	1	19	127257-1	HANDLE, Outside	1
7	127267-1	PIN	1	20	127294-1	PIN, Pivot	1
8	127301-1	RIVET	2	21	127295-1	SPRING, Torsion	1
9	127252-1	PIN	2	22	127258-1	RATCHET	1
10	127290-1	RING, Retaining	4	23	127296-1	RING, Retaining	2
11	127254-1	GRIP	2	24	127259-1	STUD, Eccentric	1
12	127291-1	WASHER	4	25	127297-1	NUT	1
13	127256-1	HANDLE, Inside	1	26	127298-1	SPANNER WRENCH	1†

† SPANNER WRENCH IS NOT SUPPLIED WITH TOOL.

Fig. 4

the modified micrometer (Crimp Height Comparator RS-1019-5L) which can be purchased from:

York Machinery & Supply Co.
20 North Penn Street
York, PA 17401-1014

or

VALCO
1410 Stonewood Drive
Bethlehem, PA 18017-3527

Proceed as follows:

1. Refer to the chart in Figure 3, and select a contact and a wire (maximum size) for each crimp section listed in the chart.

2. Refer to Section 3, CRIMPING PROCEDURE, and crimp the contact(s) accordingly.

3. Using a crimp height comparator, measure wire barrel crimp height as shown in Figure 3. If the crimp height conforms to that shown in the chart, the tool is considered dimensionally correct. If not, the tool must be repaired(see Section 6, TOOL REPLACEMENT AND REPAIR).

For additional information concerning the use of the crimp height comparator, refer to AMP Instruction IS 7424.

B-3. Ratchet Inspection

Obtain a .001-in. shim that is suitable for checking the clearance between the bottoming surfaces of the crimping jaws.

Proceed as follows:

1. Select a contact and wire (maximum size) for the tool (see Figure 3).

2. Position the contact and wire between the crimping jaws, according to Section 3, CRIMPING PROCEDURE (Steps 1 through 4). Holding the wire in place, squeeze the tool handles together until the ratchet releases. Hold the tool handles in this position, maintaining just enough pressure to keep the jaws closed.

3. Check the clearance between the bottoming surfaces of the crimping jaws. If the clearance is .001 in. or less, the ratchet is satisfactory. If clearance exceeds .001 in., the ratchet is out of adjustment and must be repaired (see Section 6, TOOL REPLACEMENT AND REPAIR).

If the tool conforms to these inspection procedures, lubricate it with a THIN coat of any good SAE No. 20 motor oil and return it to service.

6. TOOL REPLACEMENT AND REPAIR

Customer-replaceable parts are listed in Figure 4. Spare parts or tools should be stocked and controlled to prevent lost time when tool repair or replacement is necessary. Replacement parts or additional tools can be ordered by contacting:

AMP Incorporated
P.O. Box 3608
Harrisburg, PA 17105-3608

NOTE

Correspondence regarding this tool must include all identification marks, such as:

(Sample Part Number 99999-1-A)

Base Number
Dash Number
Modification or revision letter

If replacement parts affect the ratchet setting, the ratchet must be adjusted using the spanner wrench (see Figure 4). Adjust the ratchet according to the following three steps:

1. Loosen ratchet nut on the back of tool (side with wire size markings).

2. Check bottoming of tool jaws according to Section B-3, RATCHET INSPECTION. Turn screw on front of tool CLOCKWISE to tighten ratchet, or COUNTERCLOCKWISE to loosen ratchet.

3. When tool jaws bottom properly, retighten nut.

NOTE

It may be necessary to hold the ratchet screw while securing the ratchet nut.

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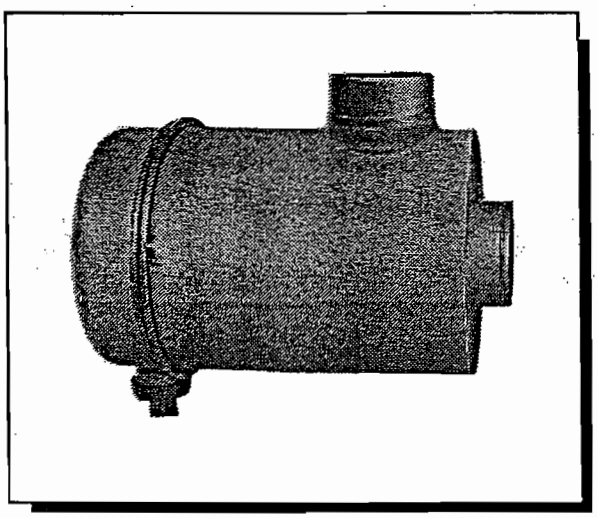
1-6691

donaldson **PRODUCT**

FWG Cyclopac® Air Cleaner

1200-27

Rev. 4/86



Applications

- Airflow range 58 to 994 CFM.
- Horizontal installation.
- Industrial equipment, off-road truck operations.
- Fork lift trucks, compressors, backhoes, cranes, street sweepers.

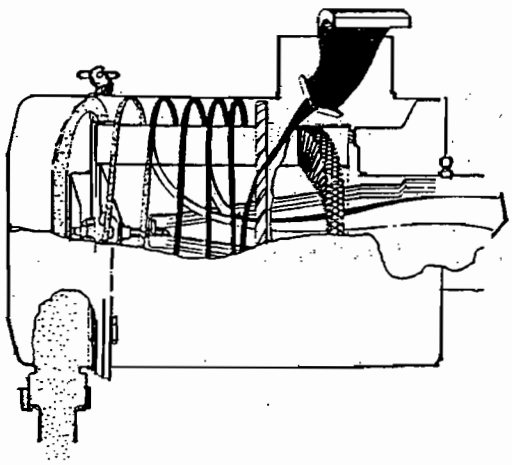
Features

- Pre cleaner spins air to separate up to 85% of incoming dust before it reaches the filter element.
- Two-stage filtration for high dust cleaning capacity.
- Optional Vacuator™ Valve releases pre-cleaned dust automatically.
- Lowest cost Cyclopac air cleaner.
- Air in the side, out the end.
- No safety element option.
- Tubular inlet permits easy moisture, snow, and leaf protection with inlet hoods (see bulletin 1200-36).
- Restriction indicator fitting standard, most models (see bulletin 1200-36 for service indicators and gauges).
- Two element choices: Extra long life XLP elements for restriction maintenance, SMP elements for scheduled maintenance.

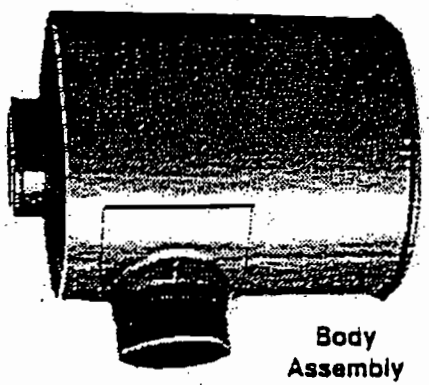
Performance

Air Cleaner Model	Vacuator™ Air Cleaner Model	CFM Operating Range Initial Restriction (H_2O)		
		6"	8"	10"
FWG04-2503	N/A	58	67	76
FWG04-2529				
FWG05-2510	FWG05-2512	77	90	101
FWG05-2619	N/A			
FWG06-5008	FWG06-5012	112	130	146
FWG06-5266	N/A			
FWG08-0023	FWG08-0026	205	238	266
FWG08-0380	N/A			
FWG10-0003	FWG10-0004	296	343	386
FWG12-0059	N/A	369	433	486
FWG12-0063				
FWG14-0077	N/A	541	635	721
FWG14-0083				
FWG16-0104	FWG16-0107	768	886	994
FWG16-0107				

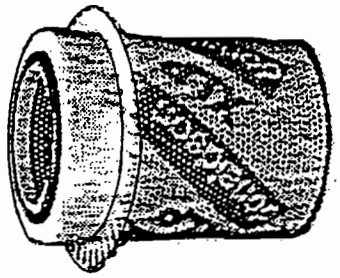
Airflow



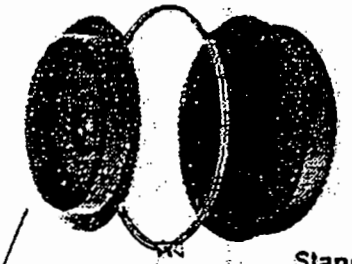
Specifications



Body Assembly



Element



Battle Assembly

Clamp Assembly

Standard Cup Assembly

Air Cleaner Model	ELEMENT XLP™	SMP™	Standard	Gasket Washer	Thumb Screw	Clamp Assy.	Baffle Assy.	Cup Assy.	Cup Gasket	Vacuator® Cup Assy.
FWG04-2503	N/A	N/A	P10-2745	P10-2784	P01-7858	P00-2846	P10-2754	P10-2755		N/A
FWG04-2529*			P14-8970*							
FWH05-2510	P18-2050	P18-1050	P10-1275	P10-1872	P10-2144	P00-2904	P10-2523	P10-3007	N/A	P10-3838
FWG05-2619*	N/A	N/A	P14-8969*							
1-6691 → FWG06-5008	P18-2052	P18-1052	P10-1222			P00-2940	P10-2510	P10-2805		P10-3836
FWG06-5266*	N/A	N/A	P14-8966*							
FWG08-0023	P18-2054	P18-1054	P10-1246			P00-3951	P10-2980	P10-3113		P10-3837
FWG08-0380*	N/A	N/A	P14-8968*							
FWG10-0003	P18-2045	P18-1045	P11-8159	P01-8462	P01-6984	P10-6071	P10-3135	P10-3519	P10-1401	P10-3827
FWG12-0059	P18-2035	P18-1035	P11-7431			P10-0808	P10-6329	P10-6589	P01-7804	P10-9296
FWG12-0063										
FWG14-0077	P18-2000	P18-1000	P11-7331			P10-0866	P10-6771	P10-6773	P01-7335	P10-9297
FWG14-0083										
FWG16-0104	P18-2001	P18-1001	P11-7332			P10-0789	P10-6637	P10-6639	P01-7336	P10-6952
FWG16-0107										

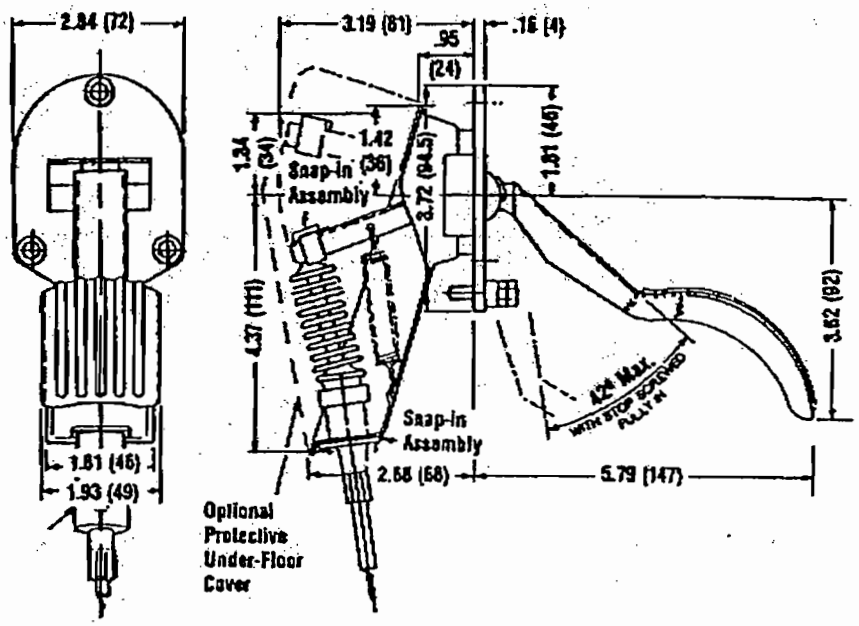
*Heavy duty Cyclopac high pulsation application; i.e. 1, 2 & 3 cylinder diesel engines and piston compressors.

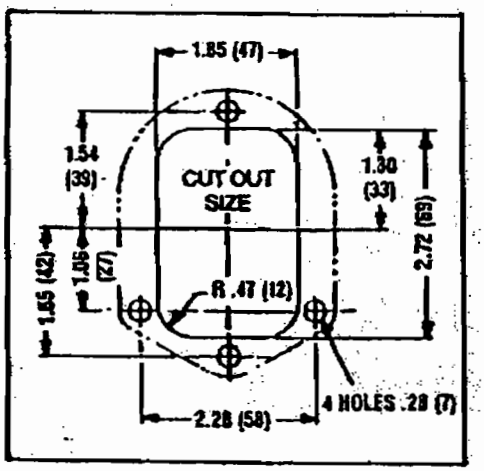
ACCELERATOR PEDAL
IMO (MORSE CONTROLS)
P/N 309109 (WAE #1-8770)

CABLE CONNECTION TO ACCELERATOR CONTROL PEDAL

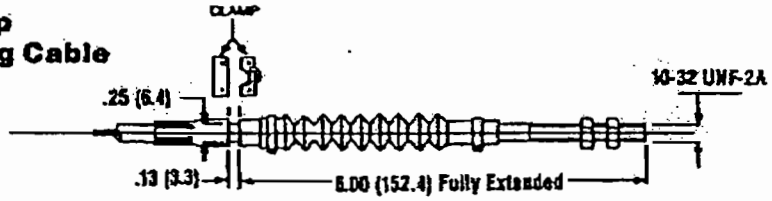
The standard accelerator cable is supplied complete with a clip for simple snap-on attachment to the accelerator control pedal.

Bulkhead Mounted Pedal

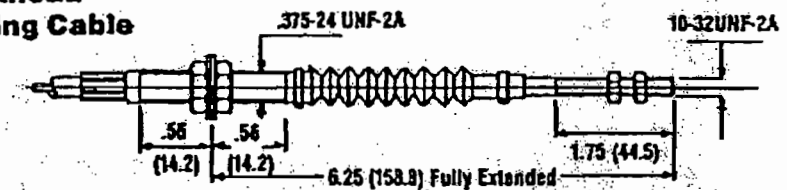




Clamp Fitting Cable



Bulkhead Fitting Cable



Utility Cable

IMO
Imo Industries Inc.

Morse Controls Division
21 Clinton Street
Hudson, Ohio 44236-2899
FAX 216-653-7799
216-653-7701

Ordering Information

Please order by part number
Complete system contains
1 Accelerator Pedal
1 Cable Assembly
Order cables in even foot increments, specify length in inches.

Accelerator Pedals

	PART NO.
Pedal assembly, floor mounted	309108
→ Pedal assembly, bulkhead mounted	309109

Cable Assemblies

	PART NO.
Clamp fitting cable	309104-002
Bulkhead fitting cable	309103-002
→ No hub fitting cable	309105-002

Optional Accessories

	PART NO.
Under-floor cover – front half	211103
Under-floor cover – rear half (Must order front and rear halves to create complete under-floor cover.)	211104
Clamp, 30 Series	031509
Shim, 30 Series	031538
Stop Collar	037693

For further information installation instructions are available on request.

Performance

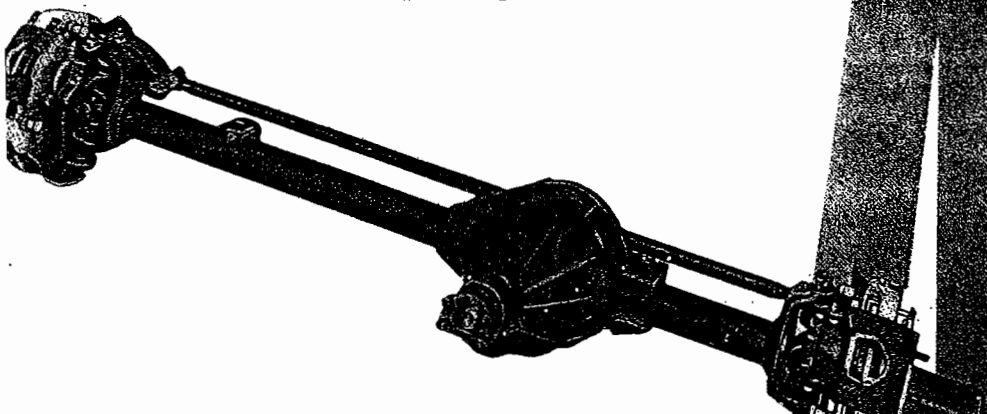
The pedal has a proven bearing design and is ergonomically positioned to maximize control with minimum operator fatigue. The pedal incorporates built-in stops on the unit to prevent excess cable loads and provides 2 in. (50 mm) cable stroke for 42° pedal movement. It also includes a built-in return spring. Minimum in-cab intrusion offers greater freedom to the vehicle designer.

IMO
Imo Industries Inc.
Morse Controls Division
21 Clinton Street
Hudson, Ohio 44236-2899
FAX 216-653-7799
216-653-7701

SPICER® AXLE

MAINTENANCE MANUAL

MODEL



44

FRONT AND REAR
CARRIER TYPE

SPICER OFF-HIGHWAY AXLE DIVISION

SPICER®
DANA

INDEX

IMPORTANT SAFETY NOTICE

Should an axle assembly require component parts replacement, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your local service dealer or other original equipment manufacturer parts supplier. CAUTION: THE USE OF NON-ORIGINAL EQUIPMENT REPLACEMENT PARTS IS NOT RECOMMENDED AS THEIR USE MAY CAUSE UNIT FAILURE AND/OR AFFECT VEHICLE SAFETY.

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles whether they be front or rear. The service procedures recommended and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tool should be used when and as recommended.

It is impossible to know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way.

Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself thoroughly that neither his safety or vehicle safety will be jeopardized by the service methods he selects.

NOTE

Throughout this manual, reference is made to certain tool numbers whenever special tools are required. These numbers are numbers of the Miller Special Tools, 32615 Park Lane, Garden City, Michigan 48135. They are used herein for customer convenience only. Dana Corporation makes no warranty or representation with respect to these tools.

Litho in U.S.A.

LUBRICATION

It is not our intent to recommend any particular brand or make of lubricant for Spicer axles. However, a S.A.E. 90 weight multipurpose gear lubricant meeting Mil. Spec. L-2105-B, or 80 W 90 multipurpose gear lubricant meeting Mil. Spec. L-2105-C, and suitable for A.P.I. Service Classificiation GL-5 is suggested as a minimum requirement.

IMPORTANT

As special equipment limited slip differentials are provided in many vehicles, the freedom from "chatter" is a function of the lubricant used and cannot be covered in the above specifications. In some applications, a special limited slip differential lubricant may be required. If required, these special lubricants are normally available through the original equipment manufacturer.

WHEEL BEARING LUBRICATION

Wheel bearings are lubricated by either grease packing the wheel bearing itself, or it can be lubricated from the hypoid gear lube in the housing.

For grease packing it is recommended that a number 2 consistency, lithium base 12 hydroxy stearate grease containing an E.P. additive be used. Such a lubricant would pass a load-carrying test at 40 pounds minimum with base oil pour point at —10° F. maximum.

Wheel bearings which depend on lubrication from the hypoid gear lube in the axle housing, it is recommended that a S.A.E. 90 multipurpose gear lube meeting Mil. Spec. L-2105-B be used.

CLOSED WHEEL END STEERING KNUCKLE LUBRICATION

The closed steering knuckle requires lubrication from a source other than the gear carrier assembly. Inboard tube seals contain the hypoid gear lube in the housing to provide an adequate lubricant level for the gears, bearings, etc. This then requires an additional lubricant level to be maintained outboard, in each steering knuckle, which can be observed by removing fill plugs on each knuckle. Adequate level would be to the bottom of the fill plug hole, when vehicle is observed to be in a normal horizontal position.

Recommended lubricant is a S.A.E. 140 grade, multipurpose gear lubricant meeting the Mil-L-2105-B specification.

COLD WEATHER OPERATION

If the vehicle is operated below 0°F (−18°C), it is advisable to use S.A.E. 80 multipurpose gear lubricant meeting Mil. Spec. L-2105-B and suitable for A.P.I. Service Classification GL-5.

SUBMERSION OR DEEP WATER FORDING

If the vehicle is exposed to water deep enough to cover the hubs of either the front or rear axles, it is recommended that the wheel ends be dissassembled and inspected for water damage, and/or contamination daily.

Clean, examine and replace damaged parts if necessary, prior to relubricating and assembling the wheel end components. Pay particular attention to the bearings and the closed steering knuckle on the front driving axle.

In the event the gear carrier housing should become submerged in water, particularly if over the breathers, it is recommended that the hypoid gear lubricant be drained daily and internal parts be inspected for water damage and/or contamination.

Clean, examine and replace damaged parts if necessary, prior to assembling the cover housing and refilling with the specified hypoid lubricant.

NOTE

It is recommended that whenever bearings are removed they are to be replaced with new ones, regardless of mileage.

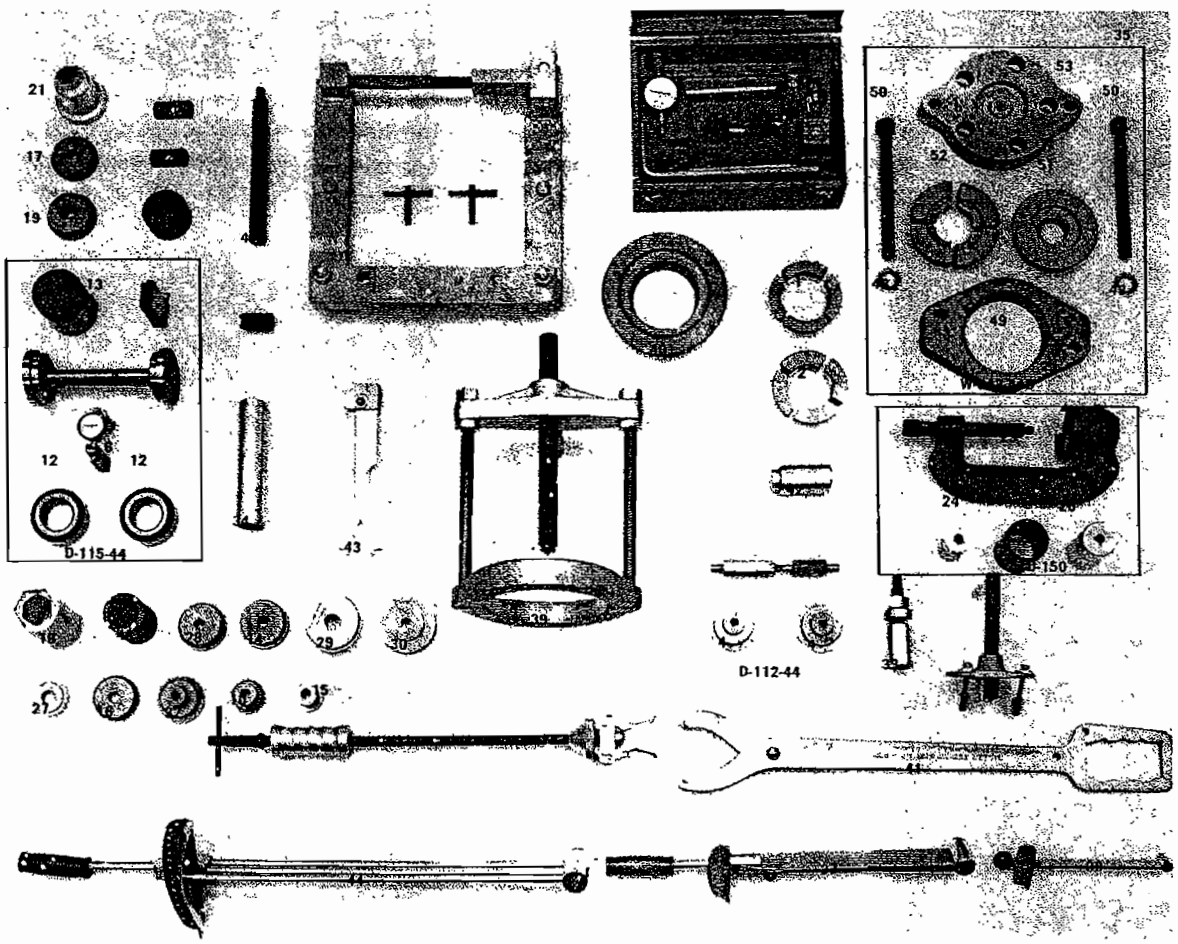


Figure 2

The following is a detailed list of all Special Service Tools required to service the Model 44 Front and Rear Axles.

Item No.	Tool No.	Description
1	C-293-18	Adapter Set—Differential Bearing Cones
2	C-293-39	Adapter Set—Rear Pinion Bearing Cone
**** 3	D-112	Screw
**** 4	D-112-1	Installer—Front Axle—Differential Inner Oil Seal
5	D-113	Spreader
* 6	D-115	Scooter Gauge
* 7	D-115-1	Pinion Height Block
* 8	D-115-3	Arbor
* 9	D-115-4	Arbor Discs
10	D-112	Installer—Front Spindle Needle Bearing
11	D-131	Puller—Slide Hammer
*12	D-135	Master Bearing Differential
*13	D-139	Master Pinion Block
14	D-140	Installer—Front Brake Hub Cup (outer)
15	D-141	Installer—Front Spindle Bushing
16	D-142	Installer—King Pin Bearing Cup (Heavy Duty)
17	D-144	Installer—Front Pinion Bearing Cup
18	W-144A	Wrench—Wheel Bearing Adjusting (Nut Type)
19	D-145	Installer—Rear Pinion Bearing Cup
20	D-147	Remover—Front Pinion Bearing Cup
21	W-147-D	Installer—Pinion Oil Seal
22	D-148	Remover—Rear Pinion Bearing Cup
***23	D-150-1	Remover & Installer—Front Axle Ball Joint
***24	D-150-2	Adjuster—Ball Joint Removing
***25	D-150-3	Sleeve—Ball Joint Removing
***26	D-150-4	Sleeve—Ball Joint Installing
27	D-151	Installer—King Pin Bearing Cup

Item No.	Tool No.	Description
28	D-153	Installer—Front Brake Hub Inner Bearing Cup (Regular)
29	D-154	Installer—Front Brake Hub Inner Bearing Cup (Heavy Duty)
30	D-155	Installer—Front Brake Hub Grease Seal (Reg. & Heavy Duty)
31	D-156	Installer—Differential Side Bearings
32	D-157	Installer—Axle Shaft Outer Oil Seal
33	W-162	Installer—Flange or Yoke
34	W-262	Installer—Rear Pinion Bearing Cone
**35	W-343-44D	Remover & Installer—Axle Shaft Bearings
36	C-452	Remover—Flange or Yoke
37	C-524-A	Torque Wrench (100 ft. lb.)
38	C-685-A	Torque Wrench (300 inch lb.)
39	DD-914-P	Press
40	DD-914-9	Adapter Ring
41	C-3281	Holder—Flange or Yoke
42	C-293-3	Adapter Plug—Differential Hub
43	C-4049	Remover—Bearing Cups
44	C-4053	Torque Wrench (300 ft. lb.)
45	C-4169	Wrench—Upper Ball Joint Removing, Installing & Torquing
46	C-4170	Wrench—Wheel Bearing Adjusting (Lug Type)
47	C-4171	Handle—Universal
**48	SP-3020	Washers
**49	SP-5017	Adapter Ring
**50	SP-5026	Bolts
**51	SP-5439	Adapter Plate—Installer
**52	SP-5442-D	Adapter Set—Removing
**53	SP-5443-A	Flange Plate
54	D-128	Dial Indicator Set

*Pinion Setting Gauge and Master Differential Bearing Kit D-115-44

**Axle Shaft Bearing Removing and Installing Kit W-343-44D

***40 Degree Steer Front Ball Joint Removing and Installing Kit D-150

****Inner Axle Shaft Seal Installing Kit D-112-44

Note: Torque wrenches C-524A, C-685-A, and C-4053 are optional and can be purchased separately. These Torque wrenches are not included in the DW-44 Axle Tool Kit.

AXLE IDENTIFICATION

All Spicer axles are identified with a manufacturing date and the complete part number stamped in the right hand tube. Also each axle contains a gear ratio tag; and if the axle is equipped with a limited slip differential, it will contain a tag requesting the use of limited slip lubricant.

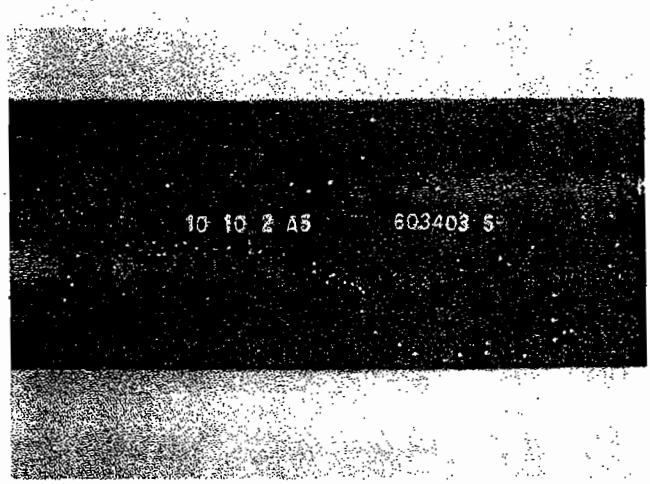


Figure 3 1009-3

In the figure the axle is identified with ⅛" high numbers stamped in the tube. For example, the numbers 10-10-2 A5 is the manufacturing or build date of the axle and is interpreted as follows. The first number is the month, the second number is the day of the month, the third number is the year, the letter is the shift and the last number is the line that built the axle. For example: October 10, 1972, first shift, line 5.

NOTE

In the event there are two build dates, the latter will be the date in which the brake components were assembled.

It is recommended that when referring to the axle, obtain the complete part number and build date. To do this, it may be necessary to wipe or scrape off the dirt, etc., from the tube.

NOTE

On front driving axles, the above numbers can be either on the long or short tube.

AXLE IDENTIFICATION

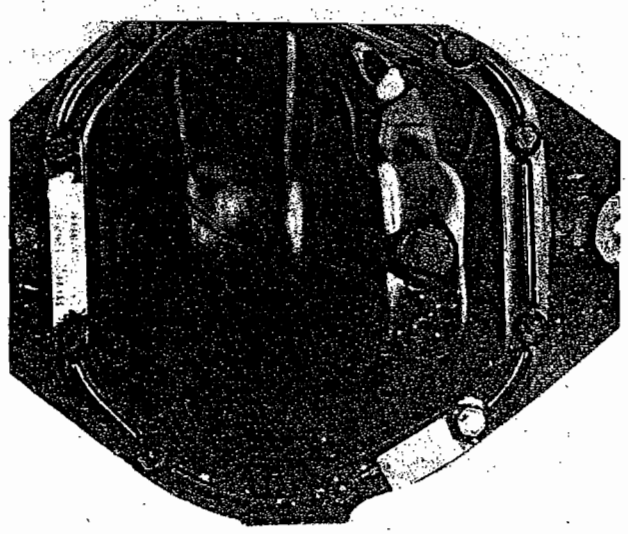


Figure 4 1009-4

The gear ratio tag is located on the left side of the cover plate and is held in place with two cover plate screws. This tag gives the tooth combination of the ring and pinion, the total gear ratio, and also the customer part number.

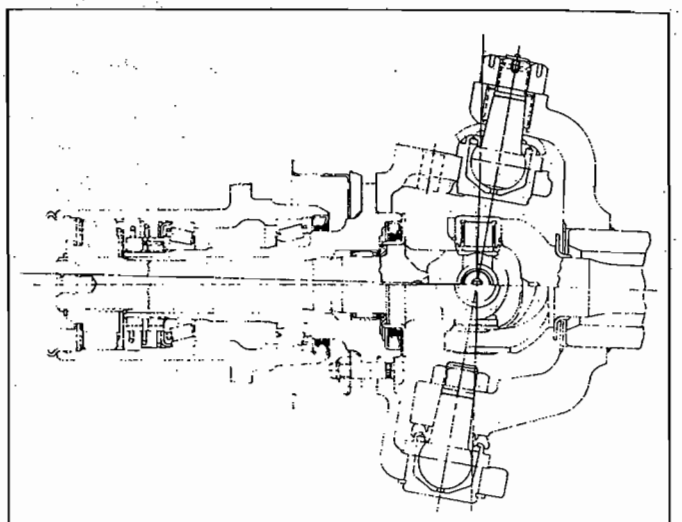


Figure 5 1009-5

40 DEGREE STEER WITH INTERNAL HUBS

FRONT AXLE

ıre 6 1009-6

Remove hub cap and snap ring.

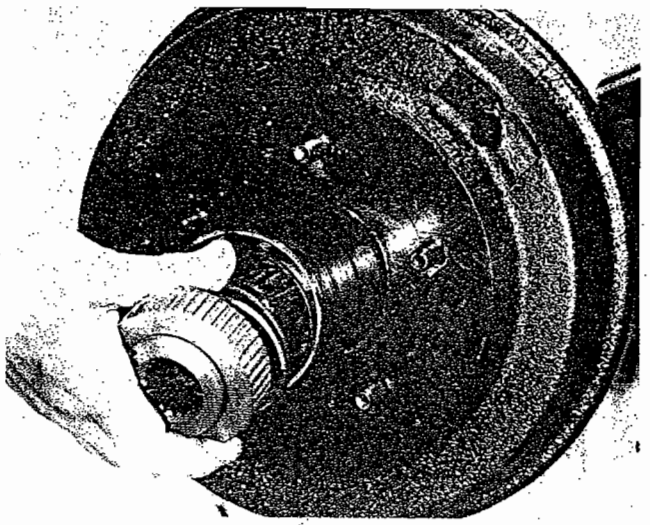


Figure 7 1009-7

Remove drive gear and pressure spring. If drive gear is stuck to the shaft, use a screw driver to pry out gear.

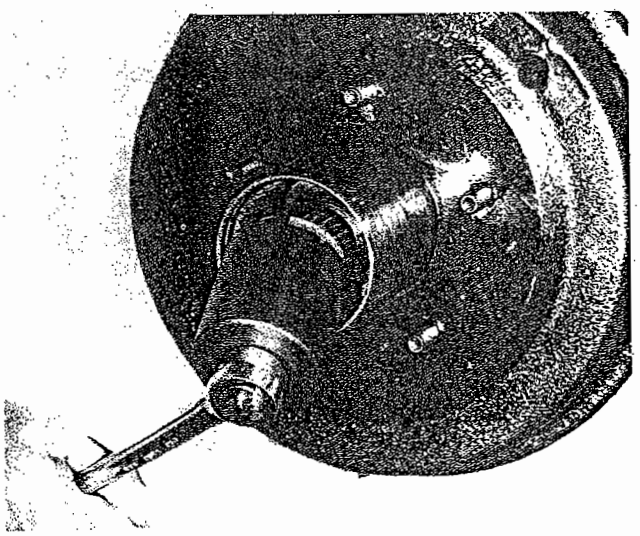


Figure 8 1009-8

Remove wheel bearing lock nut, lock ring and the wheel bearing adjusting nut.

Tool—#C-4170 Wheel bearing wrench.

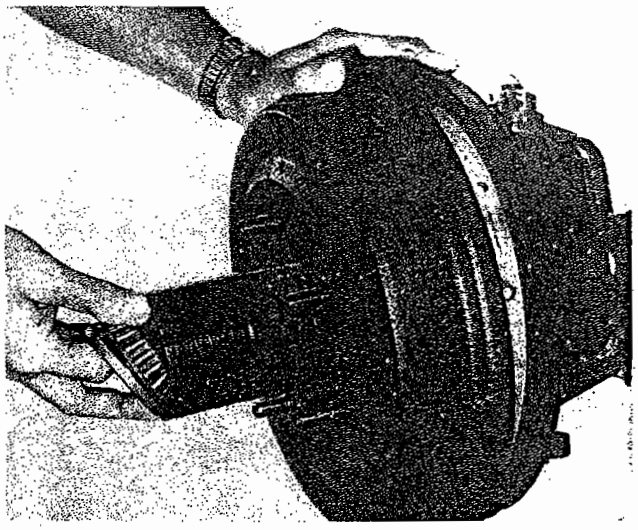


Figure 9 1009-9

Remove hub and drum assembly. Spring retainer and outer wheel bearing will slide out as drum is removed.

NOTE

If it is necessary to replace brake components such as drum, shoes, backing plate, etc., refer to vehicle service manual.

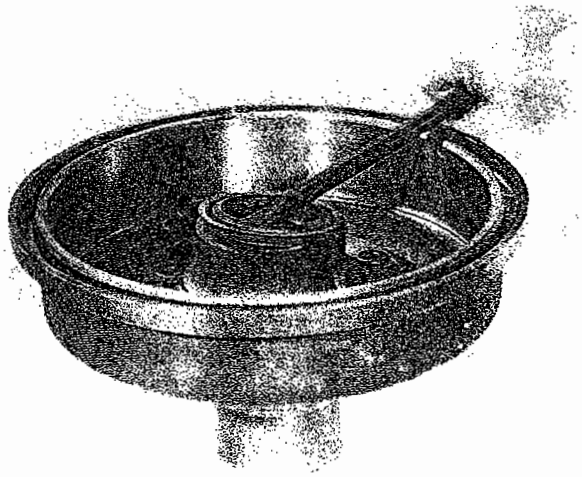


Figure 10 1009-10

Remove hub grease seal and inner wheel bearing cone.

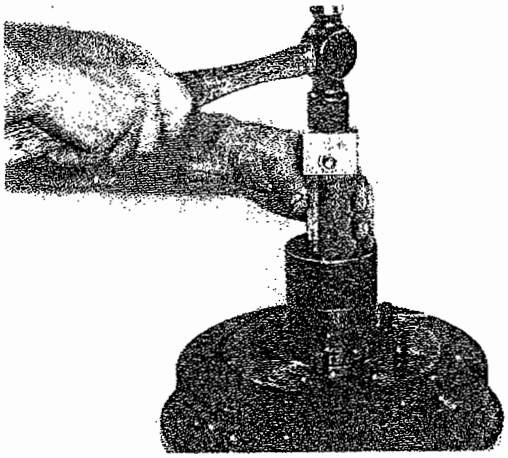


Figure 11 1009-11

Remove inner wheel bearing cup.

Tool—#C-4049 Wheel bearing cup remover.

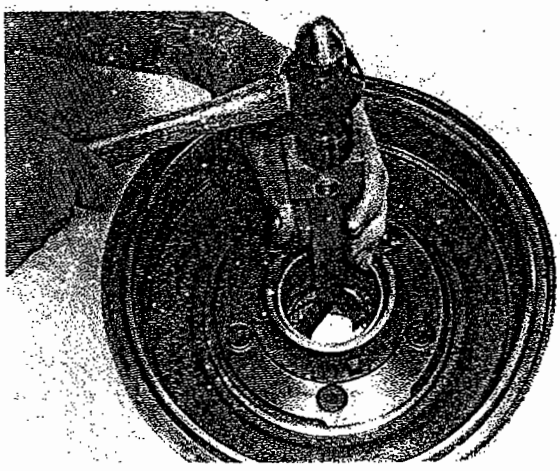


Figure 12 1009-12

Remove outer wheel bearing cup.

Tool—#C-4049 Wheel bearing cup remover.

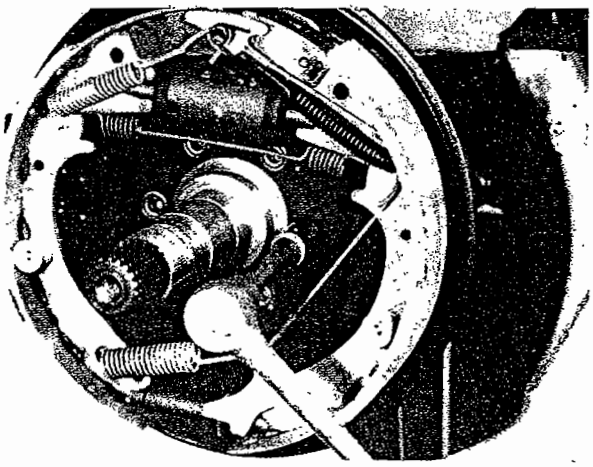
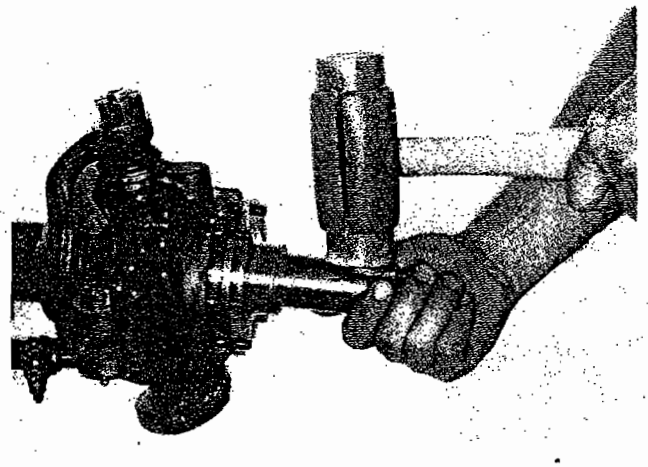


Figure 13 1009-13

Remove backing plate screws and remove backing plate.

> **NOTE**
>
> The brake backing plate assembly can be re-ained with screws or nuts. If the nuts are f the torque prevailing design, they are to be replaced with new ones.



re 14 1009-14

Remove spindle. If necessary tap lightly with a rawhide hammer to free it from the knuckle. Check brone spacer located between shaft joint assembly and bearing. If wear is evident, replace with a new one.

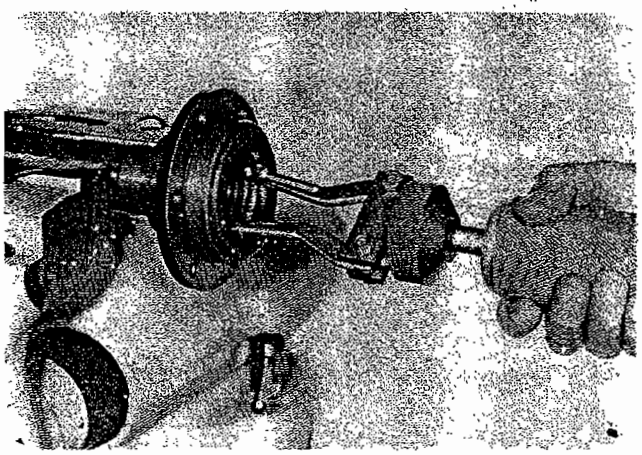


Figure 15 1009-15

Place spindle in vise. **Do not locate on bearing diameters.**

Remove grease seal. **Discard seal.**

Tool—#D-131 Slide hammer.

> **NOTE**
>
> Be sure that vise jaws are equipped with brass protectors or similar type to protect the machined surfaces of any parts that are to be placed in the vise.

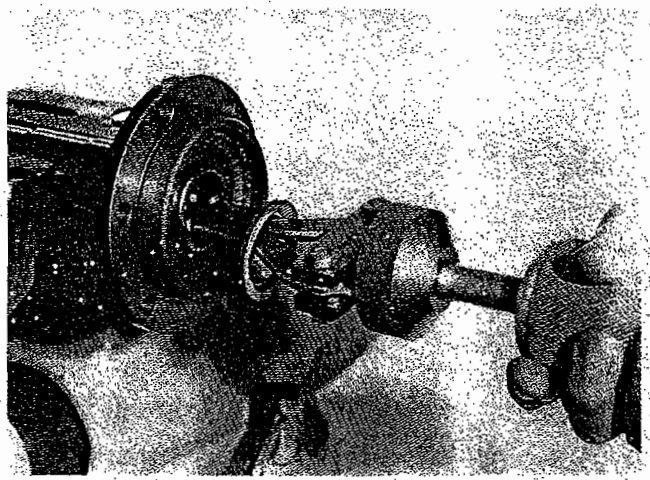


Figure 16 1009-16

Remove needle bearing. Bronze bushing may stick to the bearing as the spindle was removed, but can be removed when removing the needle bearing as shown.

Tool—#D-131 Slide hammer.

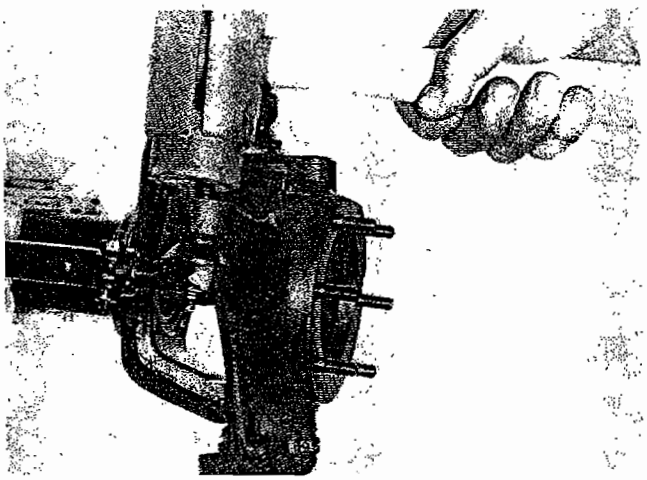


Figure 17 1009-17

Remove cotter key from tie rod nut. Remove nut. Tap on tie rod stud to free it from the steering arm.

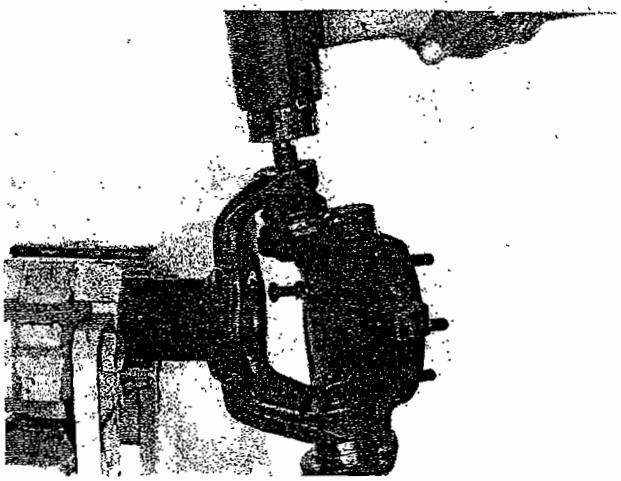


Figure 19 1009-19

Using a rawhide hammer, hit sharply on the top stud to free the knuckle from the tube yoke. After knuckle is free from the yoke, remove both the top and bottom nuts. **Discard bottom nut.** The nut on the bottom socket is of the torque prevailing design and is not to be reused.

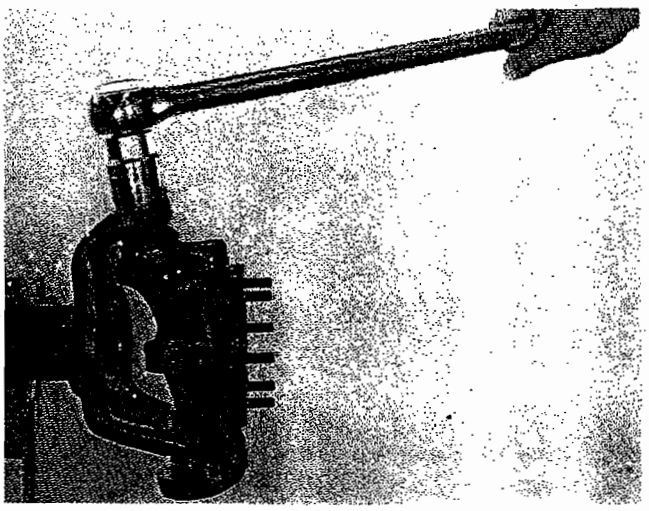


Figure 18 1009-18

Remove cotter key from top socket. Loosen both the top and bottom nuts.

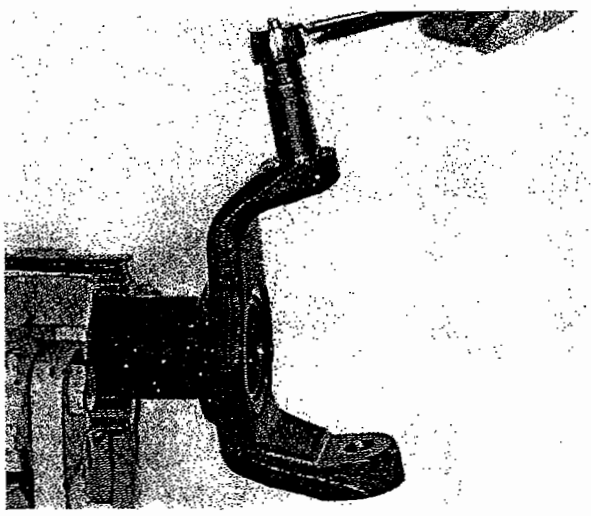


Figure 20 1009-20

Remove threaded sleeve from yokes with Tool #C-4169 socket wrench.

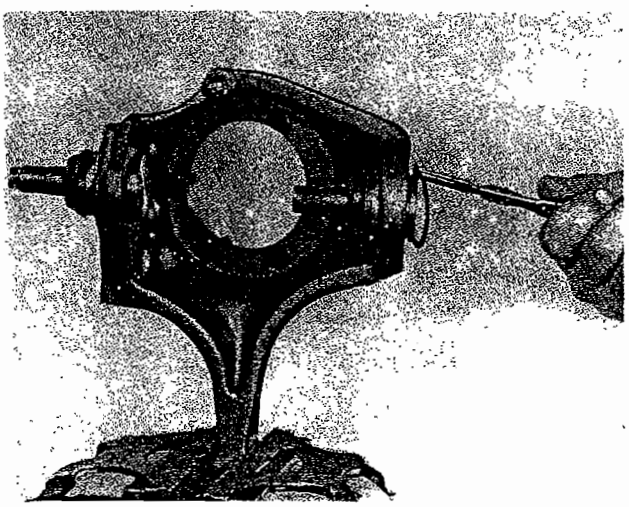


Figure 21 1009-21

Place knuckle in vise as shown. If bottom ball socket is equipped with a snap ring, remove as shown.

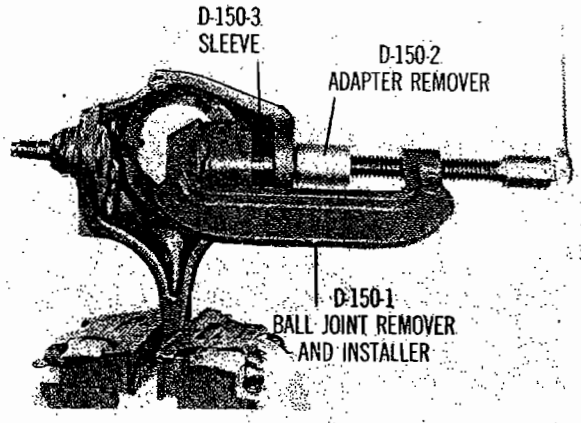


Figure 22 1009-22

NOTE: BOTTOM BALL SOCKET MUST BE REMOVED BEFORE THE TOP BALL SOCKET CAN BE REMOVED.

Assemble ball socket tools as shown. Turn forcing screw and push out bottom socket.

DISCARD BALL SOCKET

Tools—#D-150-1 Ball Joint Remover & Installer, #D-150-2 Adapter Remover, and #D-150-3 Sleeve.

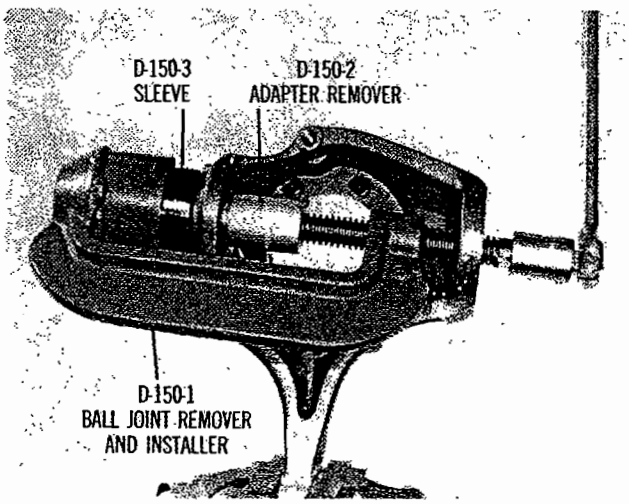


Figure 23 1009-23

Assemble ball socket tools as shown. Turn forcing screw and push out top socket.

Discard Ball Socket

Tools—#D-150-1 Ball Joint Remover & Installer, #D-150-2 Adapter Remover, and #D-150-3 Sleeve.

ASSEMBLY

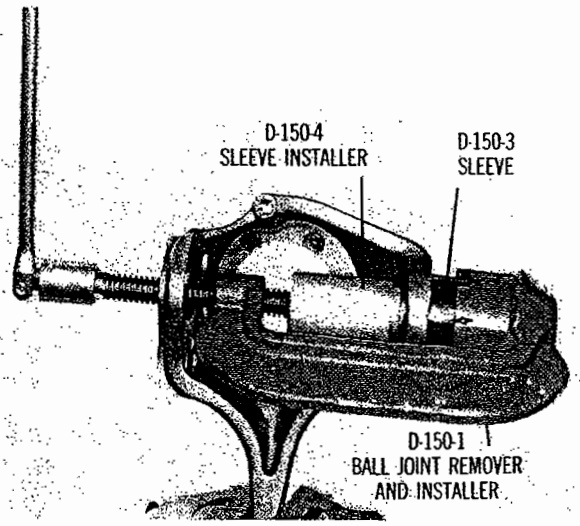


Figure 24 1009-24

(Lower ball socket does not have a cotter key hole in the stud end.)

Assemble bottom socket into the knuckle. Make sure socket is straight.

Assemble tools as shown. Turn forcing screw and push socket into knuckle as far as it will go.

Tools—#D-150-1 Ball Joint Remover & Installer, #D-150-3 Sleeve, & #D-150-4 Sleeve Installer.

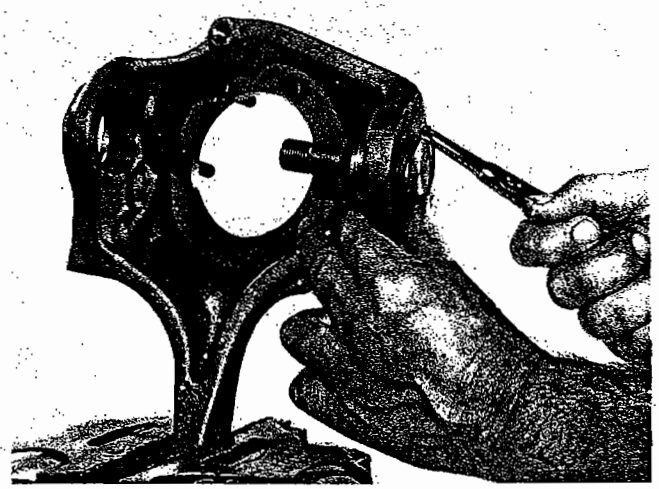


Figure 25 1009-25

If required, assemble snap ring on bottom socket.

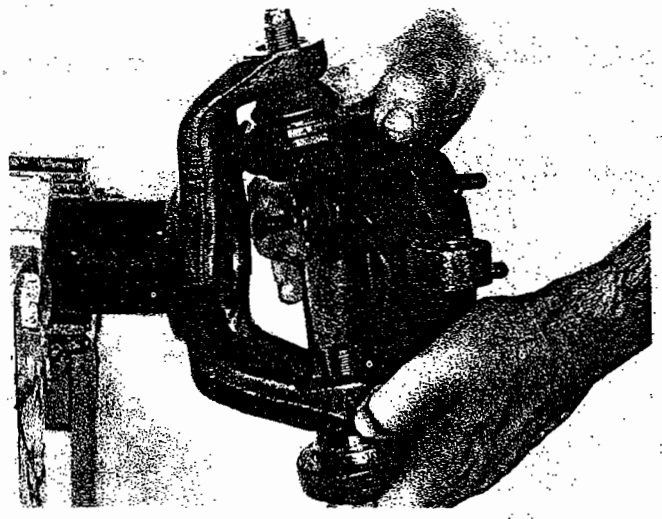


Figure 27 1009-27

Assemble knuckle and socket assembly to yoke as shown.

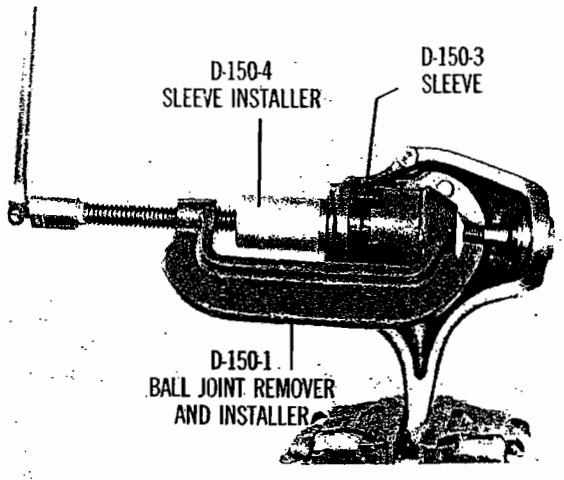


Figure 26 1009-26

Upper ball socket has a cotter key hole in the stud end. Assemble socket into knuckle. Make sure socket is straight.

Assemble tools as shown. Turn forcing screw and push socket into knuckle as far as it will go.

Tools—#D-150-1 Ball Joint Installer & Remover, #D-150-3 Sleeve, & #D-150-4 Sleeve Installer.

Remove tools. Make sure this area is free from dirt, etc.

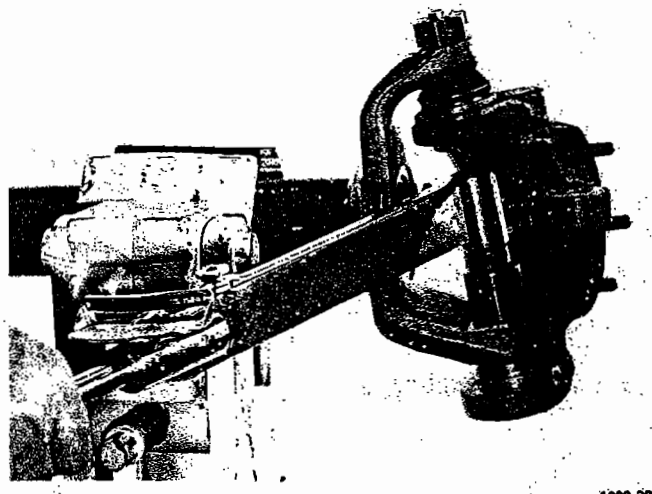


Figure 28 1009-28

Assemble new torque prevailing nut on bottom socket finger tight.

Assemble top nut on top socket. **Do not assemble at this time.**

Torque top nut until it is tight. This will p the studs of the bottom socket into the tapere hole of the yoke.

Torque bottom nut to 80 lbs. ft.

Tool—#C-524-A Torque wrench.

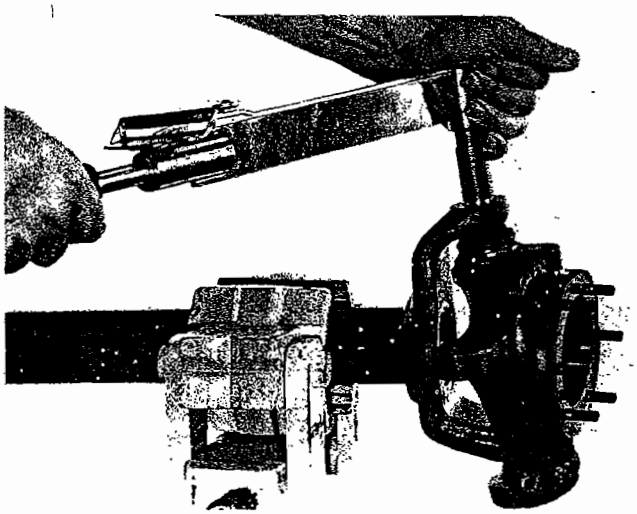


Figure 29 1009-29

Assemble new threaded sleeve into top of yoke. Using tool as shown torque sleeve to 50 lbs. ft.

Tools — #C-4169 Sleeve socket, #C-524-A Torque wrench.

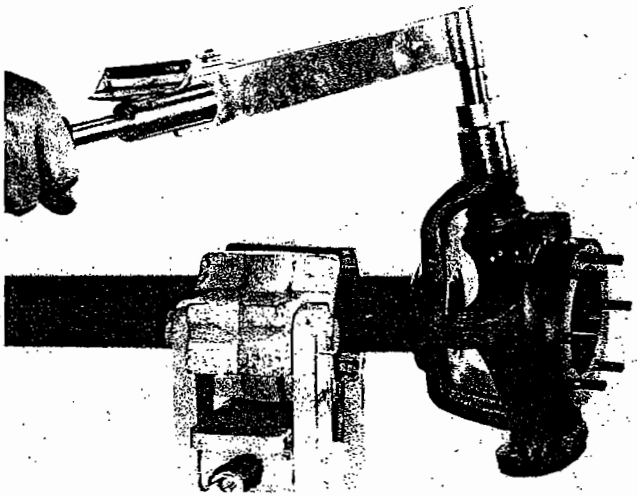


Figure 30 1009-30

Assemble top socket nut. Torque nut to 100 ft. After nut has been torqued, tighten nut to line up the cotter key hole of the stud with the next castellation or slot of the nut. **Do not loosen nut.**

Tool—#C-524-A Torque wrench.

Figure 31 1009-31

Assemble cotter key.

NOTE

In the event that knuckles are received with the sockets and snap ring assembled to the knuckle, along with new top and bottom nuts, split sleeve and cotter key. Follow procedures as illustrated through Figues 27 through 31 for assembly.

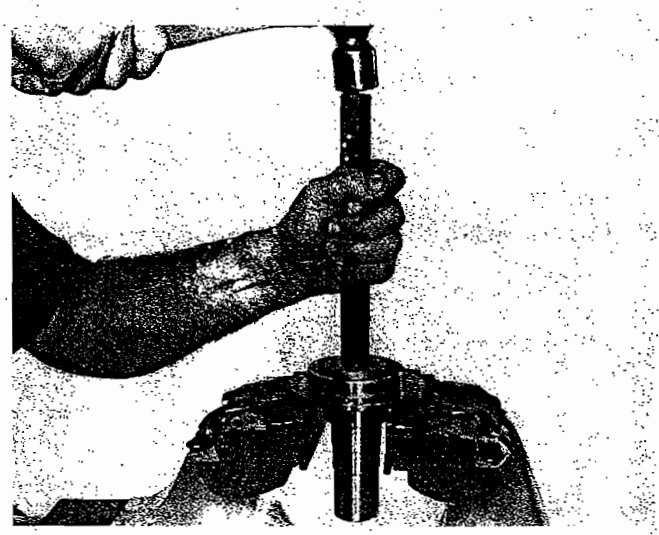


Figure 32 1009-32

Assemble new needle bearing into spindle.

Tools—#D-122 Installer, #C-4171 Handle.

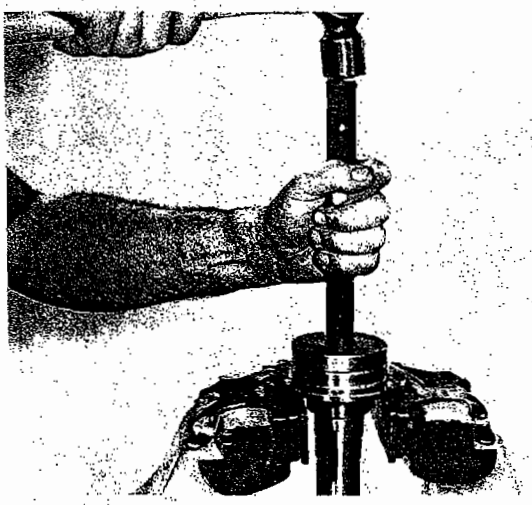


Figure 33 1009-33

Assemble new grease seal into spindle.
Tools—#D-155 Installer, #C-4171 Handle.

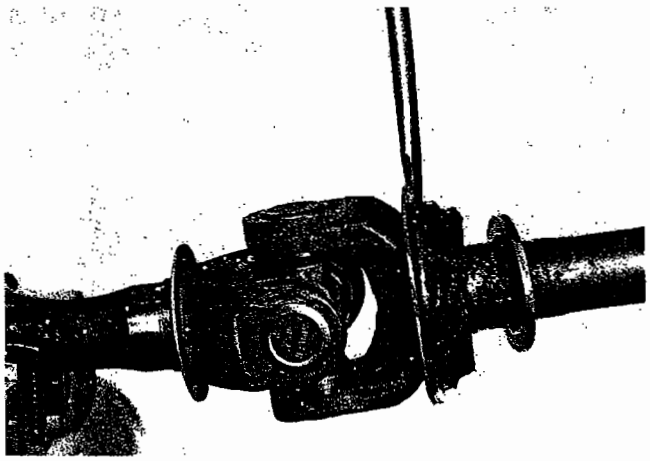


Figure 34 1009-34

Some front axles are equipped with a "V" seal which is assembled to the axle shaft stone shield as shown. If seal is worn, remove and replace with a new one.

Figure 35 1009-35

Assemble new seal as shown. Lip of the seal is to be directed towards the spindle.

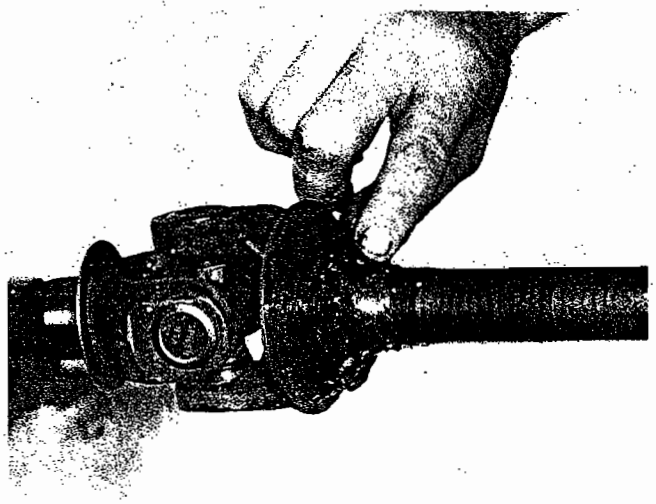


Figure 36 1009-36

Pack the area around the thrust face area of the shaft and seal full of grease. Also, fill the seal area of the spindle with grease.

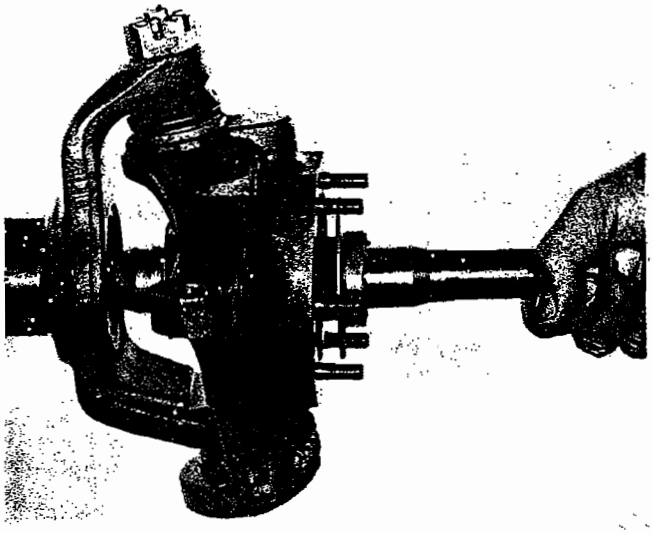


Figure 37 1009-37

Assemble axle shaft joint assembly into tube.

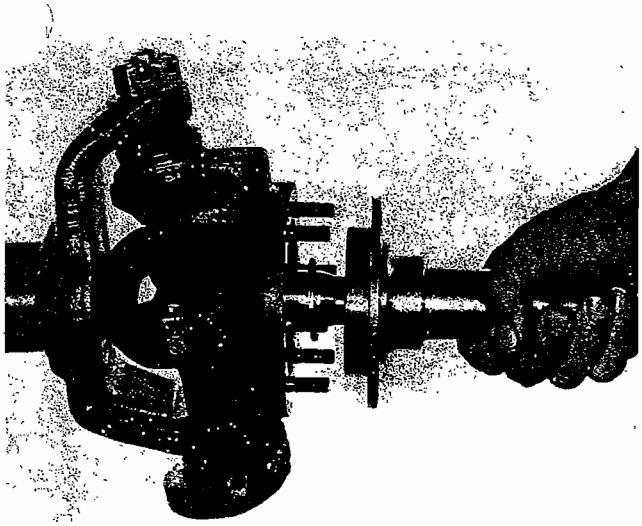


Figure 38 1009-38

Assemble new bronze spacer and spindle.

NOTE

Be sure chamfer end of spacer is directed toward the seal slinger of the axle shaft joint.

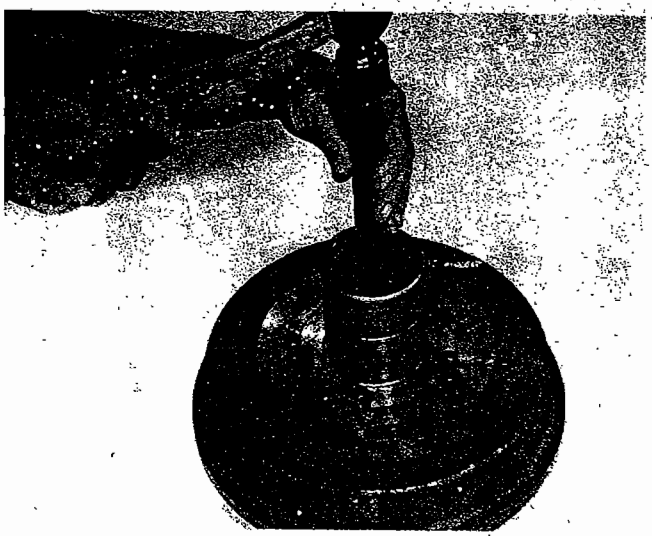
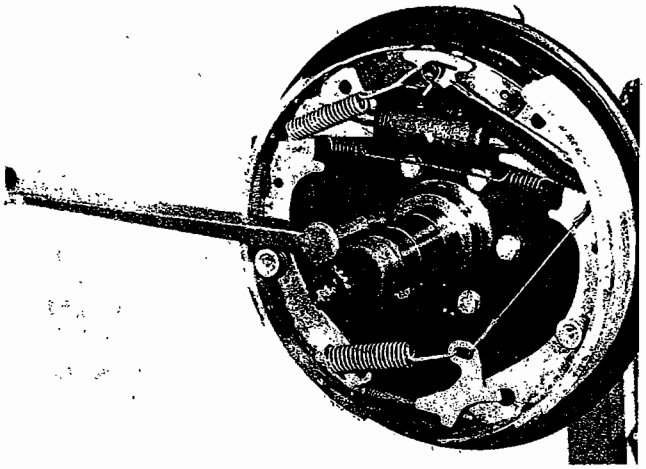


Figure 40 1009-40

Assemble new outer wheel bearing cup.
Tools—#D-140 Installer, #C-4171 Handle.



re 39 1009-39

Assemble brake backing plate assembly. Assemble new nuts. Torque nuts to 25-30 lbs. ft.
Tool—#C-524-A Torque wrench.

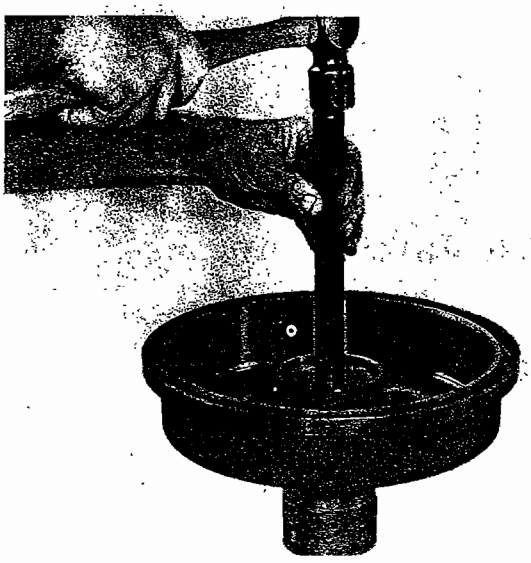


Figure 41 1009-41

Assemble new inner wheel bearing cup.
Tools—#D-153 Installer, #C-4171 Handle.

Figure 42 1009-42

Assemble new wheel bearing grease seal.
Tools—#D-155 Installer, #C-4171 Handle.

Figure 43 1009-43

Assemble brake drum and outer wheel bearing cone to spindle. Assemble inner wheel bearing adjusting nut. Torque nut to 50 lbs. ft. Rotate hub, then back off nut 90° maximum. Assemble lockwasher, line tap up with keyway of spindle, turn nut to nearest hole of the lockwasher. Assemble outer locknut. Torque nut to 50 lbs. ft. minimum.

Tool—#C-4170 Wheel bearing wrench.

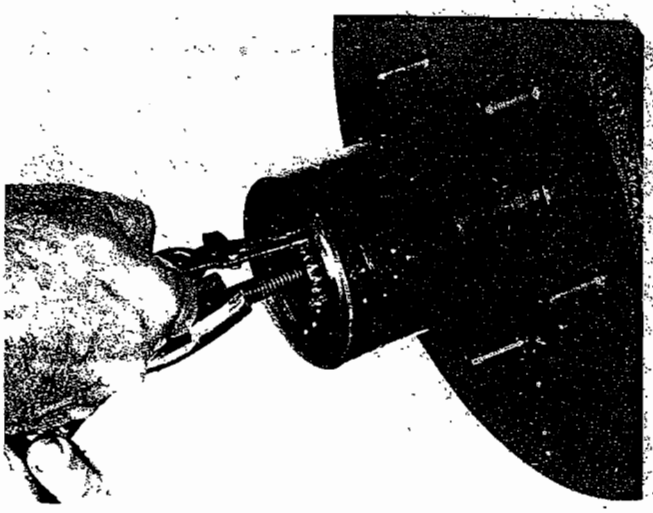


Figure 44 1009-44

Assemble drive gear and snap ring. Assemble bolt into shaft. Pull on bolt, push on gear to allow clearance of the snap ring groove. Be sure snap ring is seated in snap ring groove.

40 DEGREE STEER—
INTERNAL HUBS WITH DISC BRAKES
DISASSEMBLY

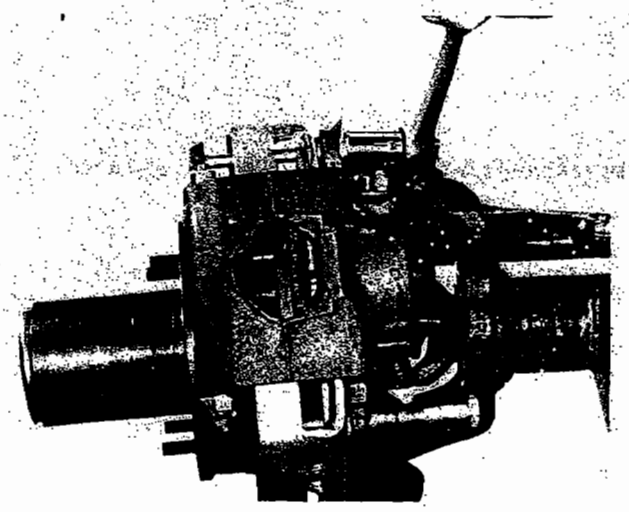


Figure 45 1009-45

Remove both brake caliper assembly bolts.

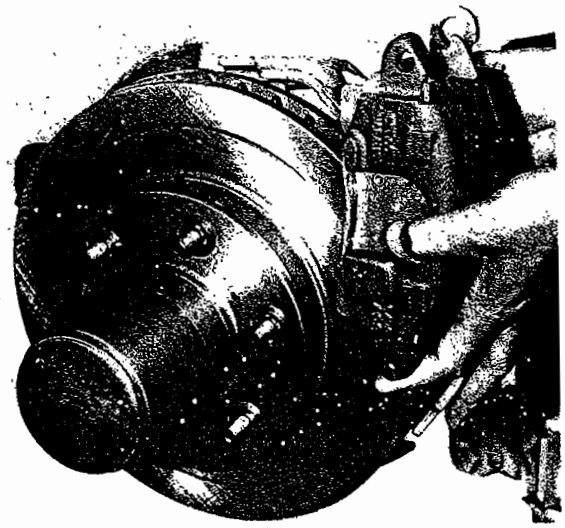


Figure 46 1009-46

Remove brake caliper assembly.

To remove the hub and brake disc assembly follow the same procedures as illustrated in Figures 7 thru 9.

To remove wheel bearings and seal from the hub follow the same procedures as illustrated in Figures 1009-10 thru 1009-12.

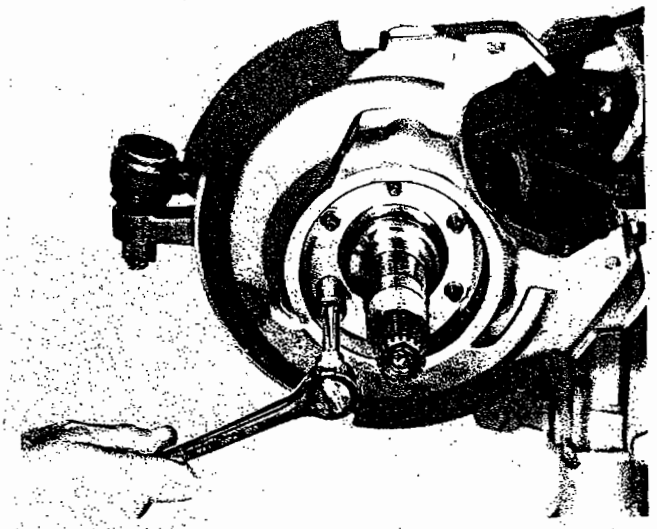


Figure 47 1009-47

Remove six (6) torque prevailing nuts from brake disc shield.

NOTE

These nuts are of the torque prevailing design and should be discarded and replaced with new ones during assembly.

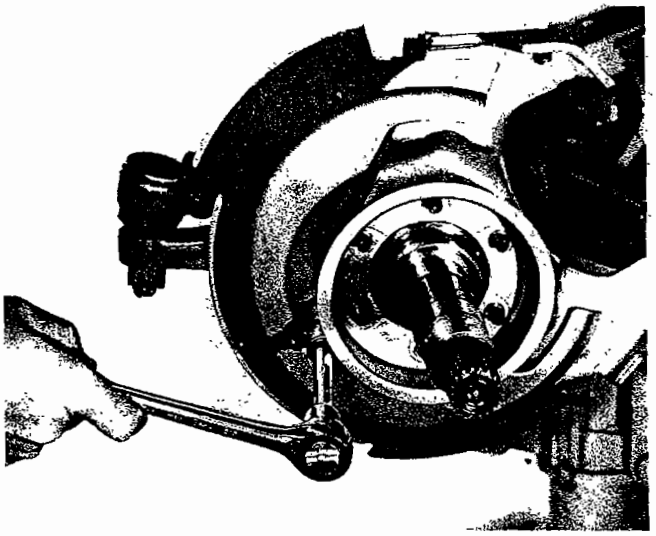


Figure 48 1009-48

Remove shield bolt which is retained in the knuckle.

Remove shield and bracket assembly from spindle.

To remove spindle, spindle seals, spindle bearings and axle shaft joint assembly, follow the same procedures as illustrated in Figures 1009-14 thru 1009-16.

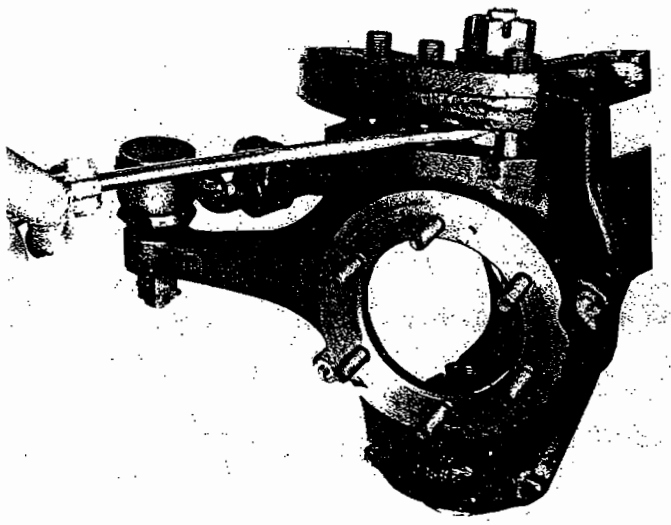


Figure 49 1009-49

Remove three steering arm nuts and cone washers and remove steering arm. Use a rawhide hammer and tap lightly on arm to free it from knuckle. Also a screw driver as shown to remove arm.

Remove cotter key, tie rod nut and remove tie rod.

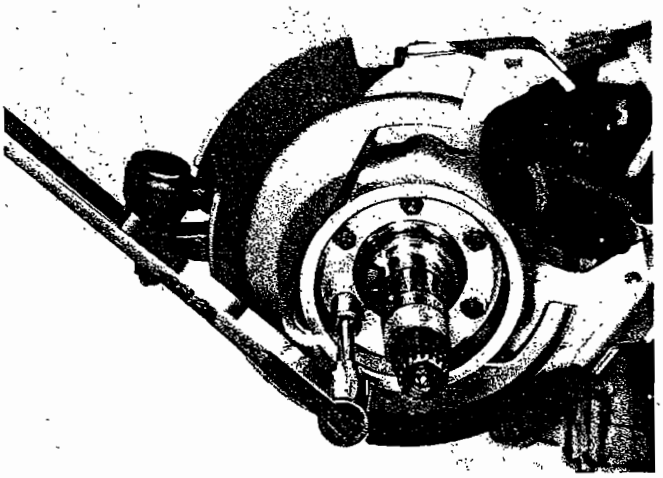


Figure 50 1009-50

Assemble brake shield bracket assembly to spindle using new torque prevailing nuts.

Torque nuts to 30-40 lbs. ft.

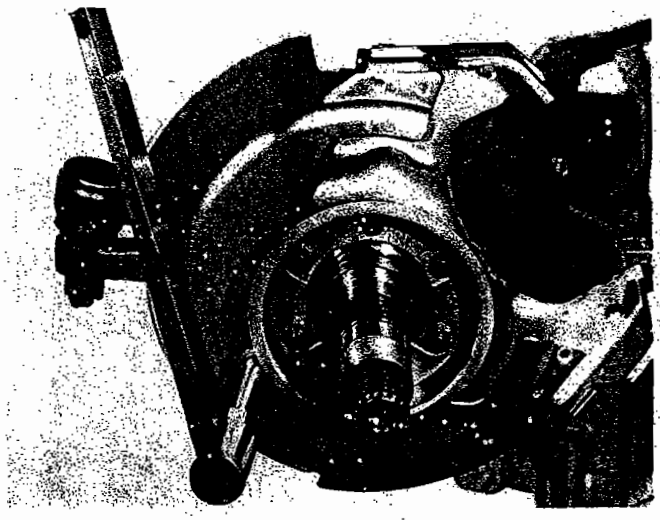


Figure 51 1009-51

Assemble shield bolt to knuckle. Torque bolt to 5-10 lbs. ft.

To assemble new wheel bearings and new seal to hub and brake disc assembly, follow the same procedure as illustrated in Figures 1009-40 thru 1009-42.

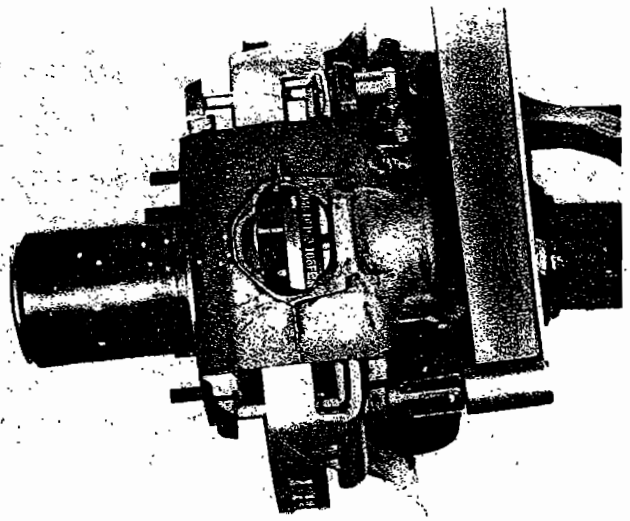


Figure 52 1009-52

Assemble brake caliper bolts. Torque bolts to 30-40 lbs. ft.

40 DEGREE STEER WITH EXTERNAL HUBS

DISASSEMBLY

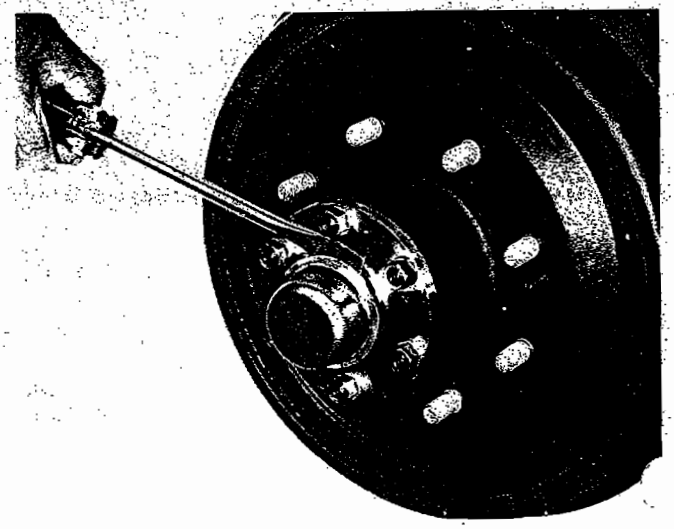


Figure 53 1009-53

Remove hub cap.

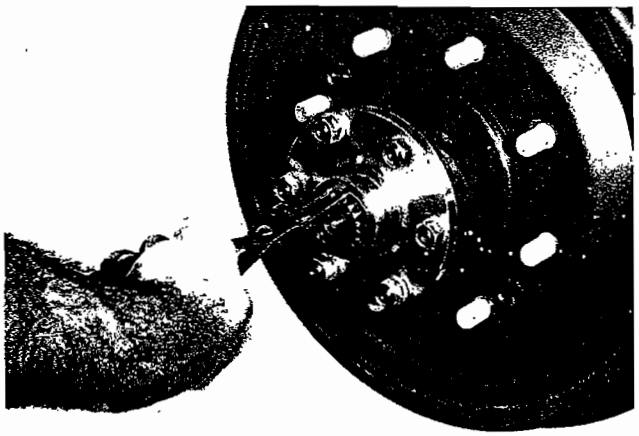


Figure 54 1009-54

Remove snap ring.

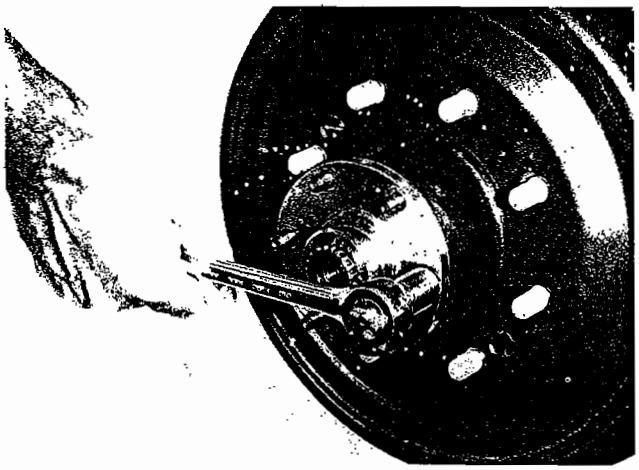
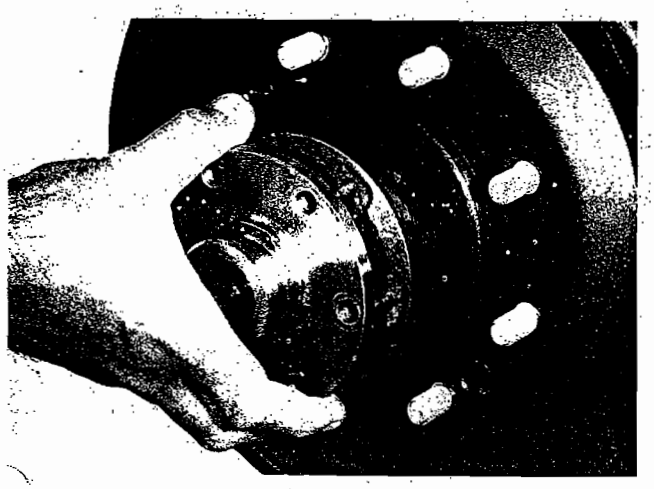


Figure 55 1009-55

Remove six flange nuts and lockwashers.



gure 56 1009-56

Remove drive flange and gasket. **Discard gasket.** To free flange from hub, tap lightly with a rawhide hammer. Replace new gasket at time of assembly.

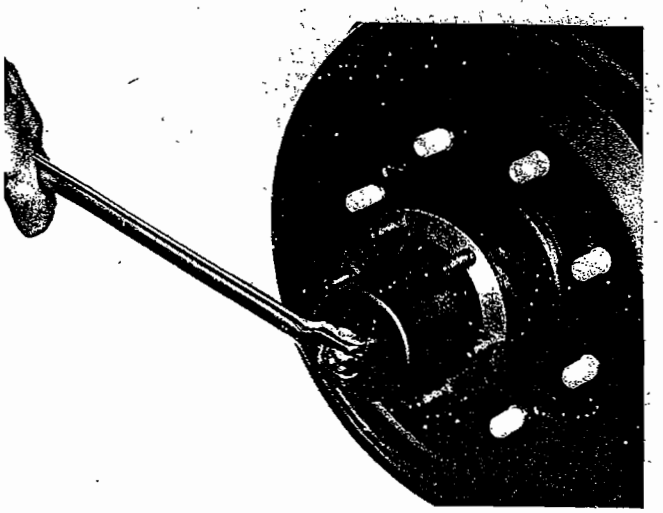


Figure 57 1009-57

Remove outer lock nut, lock ring, and wheel bearing adjusting nut.

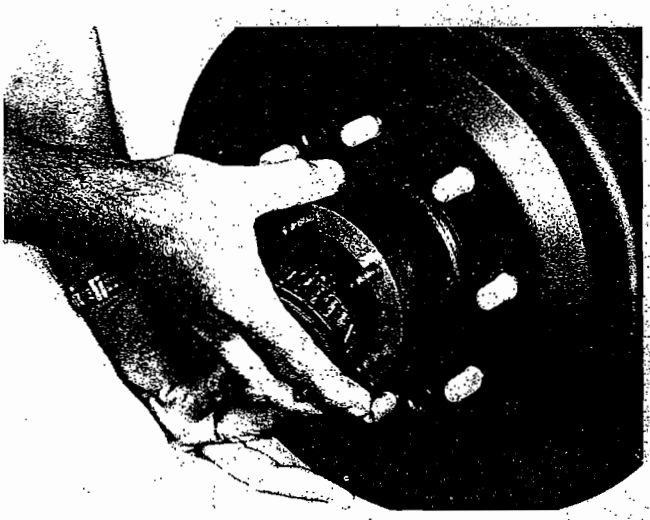


Figure 58 1009-58

Remove drum assembly. Outer wheel bearing will slide out as drum is removed.

NOTE

If it is necessary to replace brake components such as drum, shoes, backing plate, etc., refer to Vehicle Service Manual.

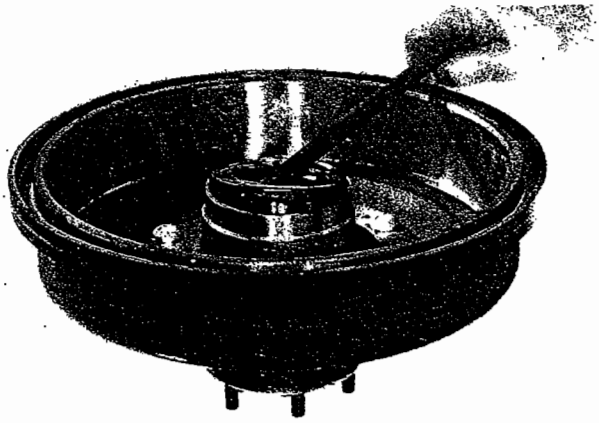


Figure 59 1009-59

Remove wheel bearing grease seal and inner bearing cone.

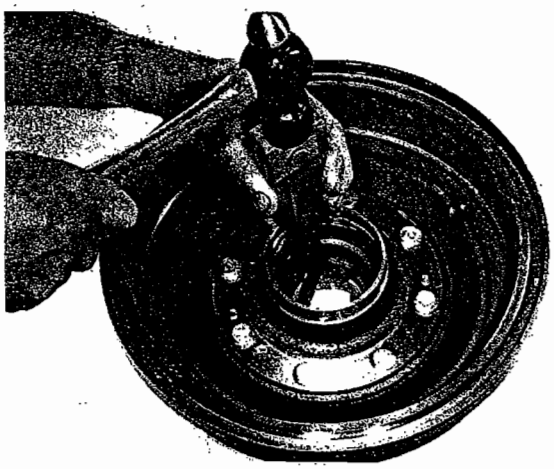


Figure 60 1009-60

Remove outer wheel bearing cup. Locate tool on cup and drive out.
Tool—#C-4049.

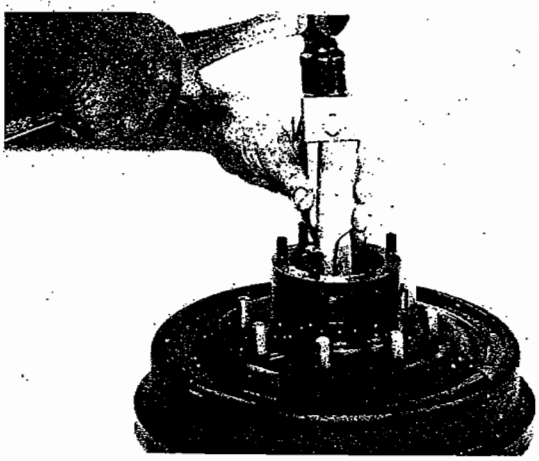


Figure 61 1009-61

Remove inner wheel bearing cup. Locate tool on cup and drive out.
Tool—#C-4049.

ASSEMBLY

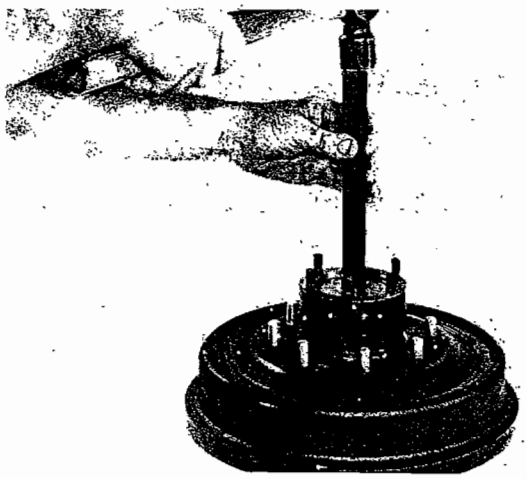


Figure 62 1009-62

Assemble new outer wheel bearing cup.
Tools—#C-4171 Handle, #D-140 Installer.

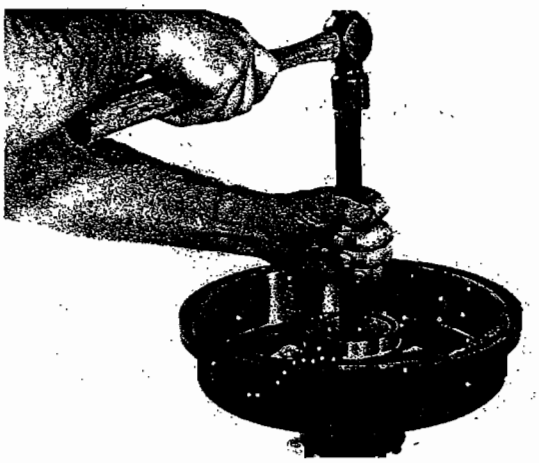


Figure 63 1009-63

Assemble new inner wheel bearing cup.
Tools—#C-4171 Handle, #D-154 Installer.

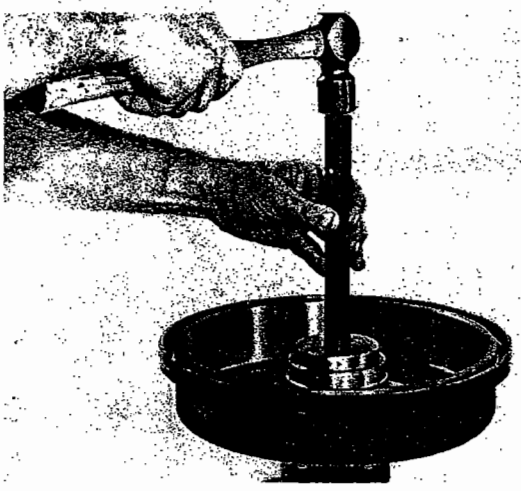


Figure 64 1009-64

Assemble new wheel bearing grease seal.
Tools—#C-4171 Handle, #D-155 Installer.

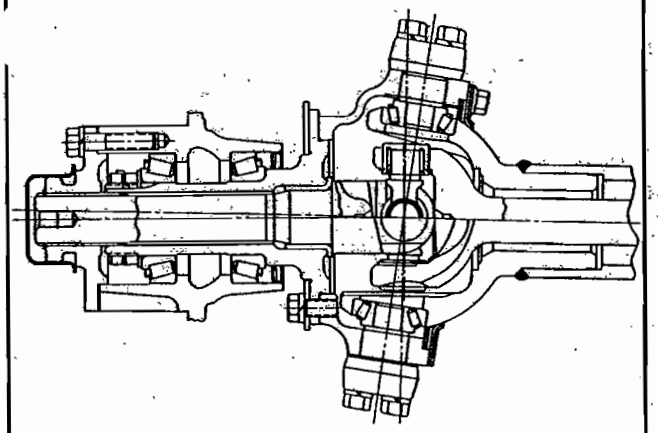


Figure 65 1009-65

LD-65.

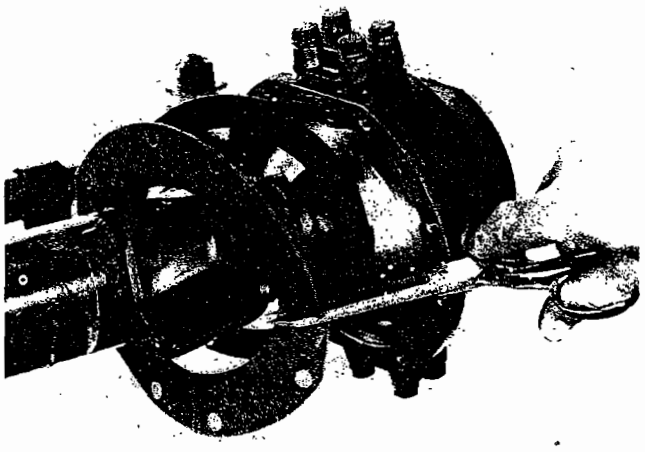
KNUCKLE OIL SEAL CONVERSION

NOTE

Some Spicer front driving axles of the closed knuckle design are available with a unitized (one piece) spherical ball knuckle oil seal.

or field conversion from the four piece seal construction (retainer plates (2), felt, and sealing ring), follow the steps as shown in Figures 1009-66 thru 1009-61. Remove retaining screws from the knuckle retaining plates.

Discard screws and both retainer plates.



re 66 1009-66

Cut felt seal in half as shown and discard. Spread split of old sealing ring over tube and discard.

ASSEMBLY

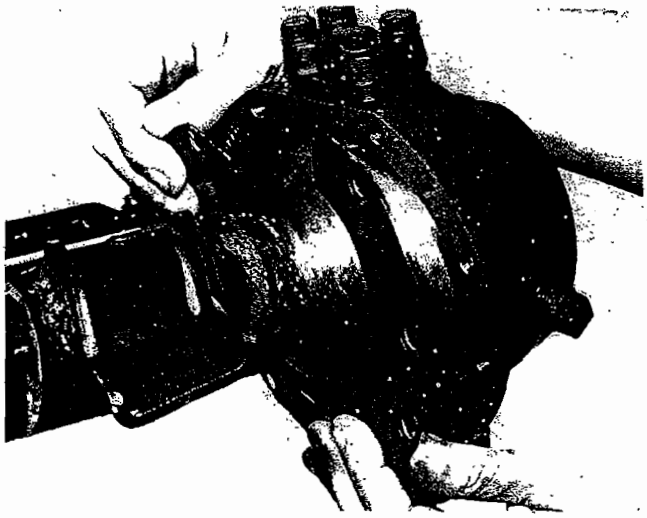


Figure 67 1009-67

Assemble new unitized seal by spreading split over tube as shown, with rubber portion towards knuckle. Be sure split of seal is at the top side of knuckle. Do not spread seal further than necessary.

Assemble new tensil lock screws. Torque screws evenly to 15-20 lbs. ft.

NOTE

It is recommended that when the seal is disassembled from the knuckle for any reason, the seal is to be replaced along with new screws.

CLOSED TYPE KNUCKLE STANDARD VERSION DISASSEMBLY

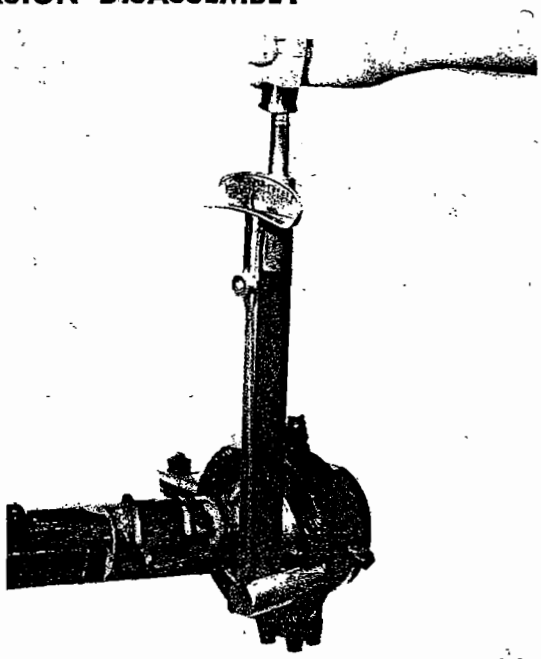


Figure 68 1009-68

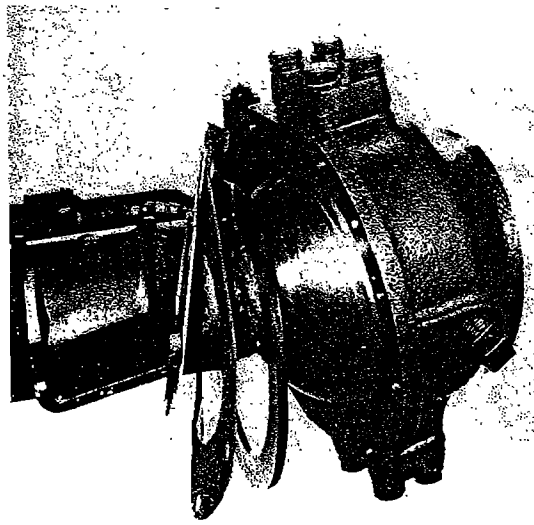


Figure 69 1009-69

Remove eight cap screws from knuckle. Remove two retainer plates, felt and seal. Discard plates, felt and seal. They are to be replaced with new parts.

Cut felt in half to remove over tube. Spread seal far enough to slip over tube.

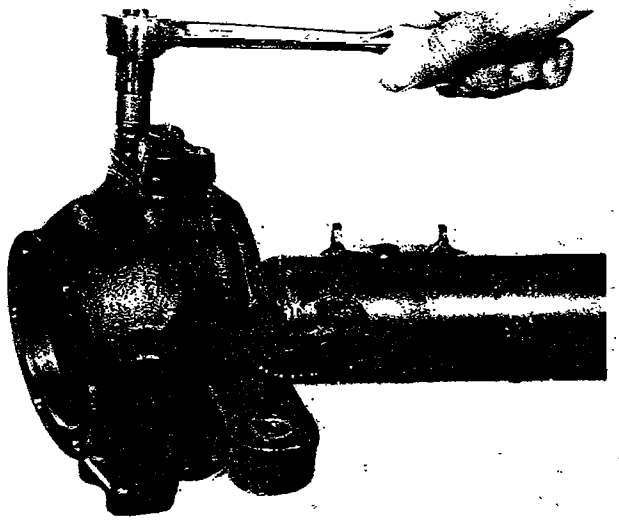


Figure 70 1009-70

Remove cap screws from the top and bottom bearing caps and nuts from steering arm if so equipped. Shims are located on the top bearing cap between the knuckle and cap. These shims control the king pin bearing preload. Save these shims since they will be required at time of assembly.

NOTE

Some front axles are designed with a bronze bushing in the top king pin instead of a roller bearing. Bushing can be either the spline or key design.

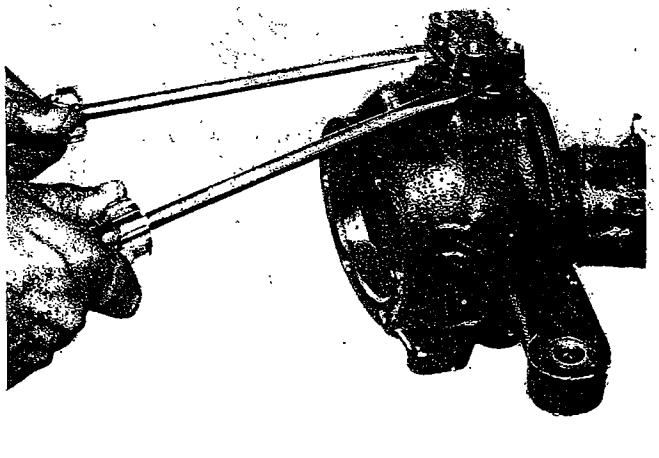


Figure 71 1009-71

Pry bearing caps loose with screwdrivers if necessary. When removing knuckle, the bottom bearing may fall out. To prevent damage, catch the bearing by hand.

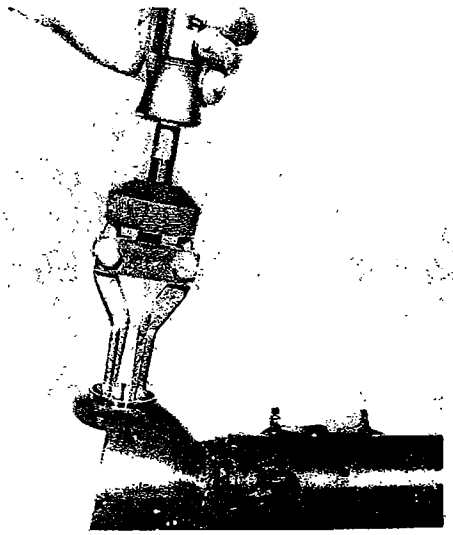


Figure 72 1009-7

Remove bearing cups from ball yoke, using puller as shown.

Tool—#D-131 Slide hammer.

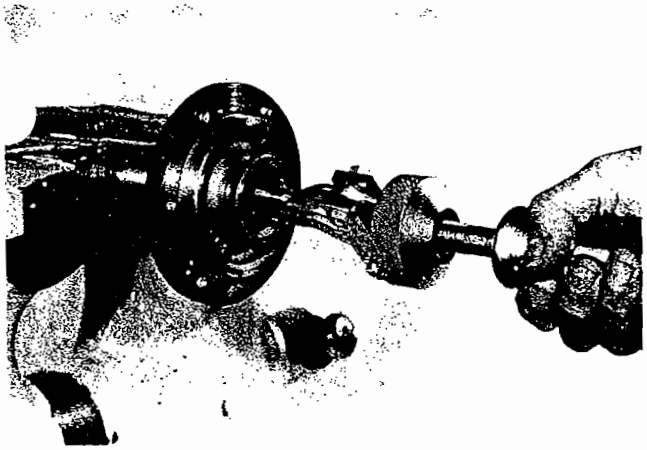


Figure 73 1009-73

Place spindle in vise. Do not clamp on bearing diameters. Remove bronze bushing using puller.

Tool—#D-131 Slide hammer.

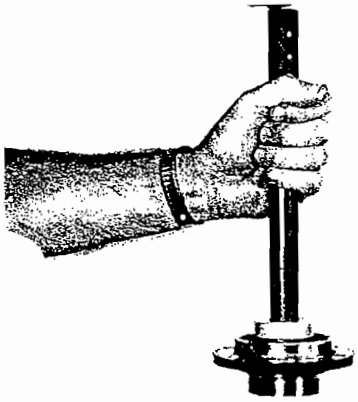
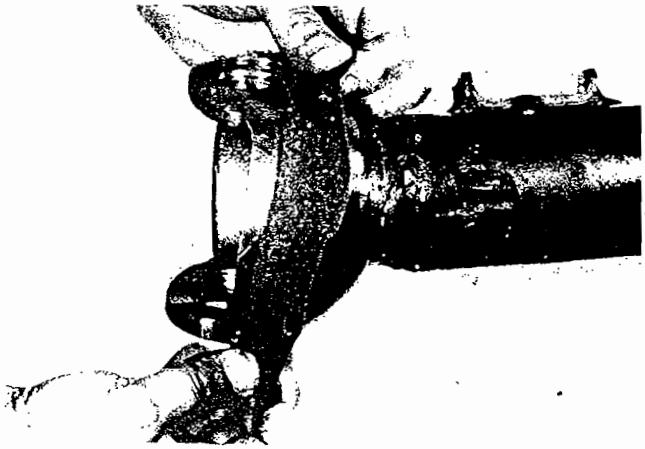


Figure 74 1009-74

Assemble new bronze bushing.

Tools—#C-4171 Handle, #D-141 Installer.

If needle bearing is used, use tool as shown in Figure 1009-32.



re 75 1009-75

Assemble new felt seal over ball yoke. Apply a thin coat of oil over ball to allow felt to slide and prevent it from tearing.

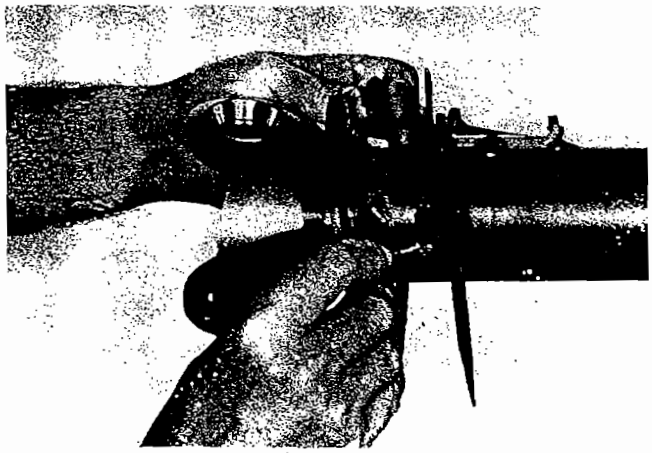


Figure 76 1009-76

Assemble new seal over tube. Spread seal just enough to clear tube; otherwise, it may become distorted. Metal portion of seal is to be towards the knuckle.

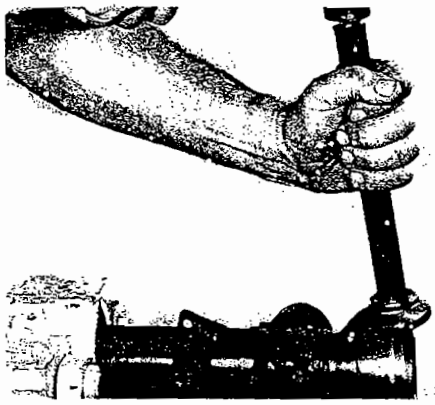


Figure 77 1009-77

Assemble new king pin bearing (top and bottom) into ball yoke.

Tools—#C-4171 Handle, #D-151 Installer.

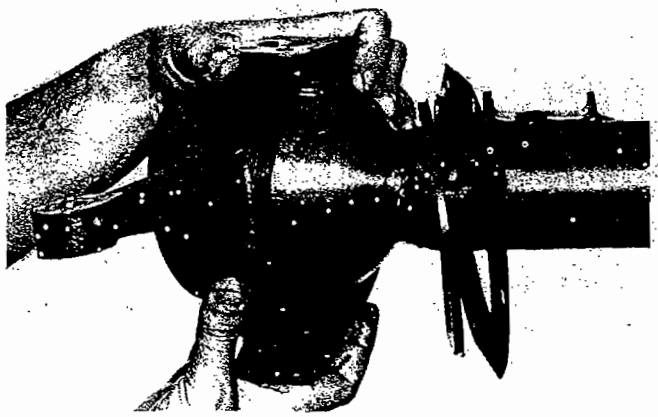


Figure 78 1009-78

Grease top and bottom bearing cones with the specified grease.

Assemble bottom bearing cap and bearing to knuckle. Assemble top bearing into bearing cup and assemble knuckle over ball yoke.

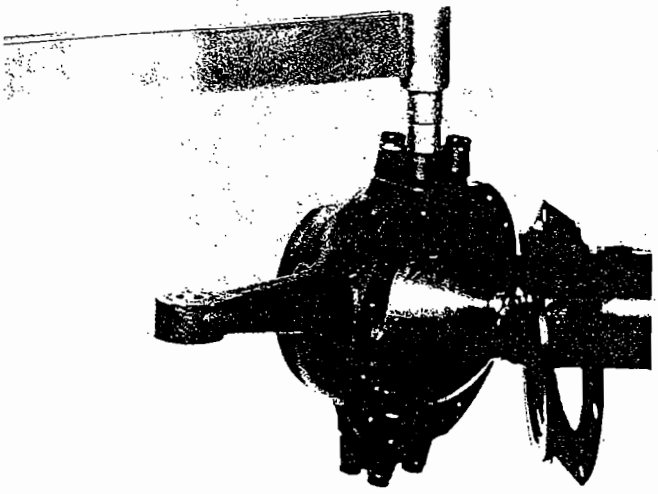


Figure 79 1009-79

Assemble preload shims top bearing cap on king pin. Assemble cap screws.

Torque screws to 30-40 lbs. ft. (top and bottom).

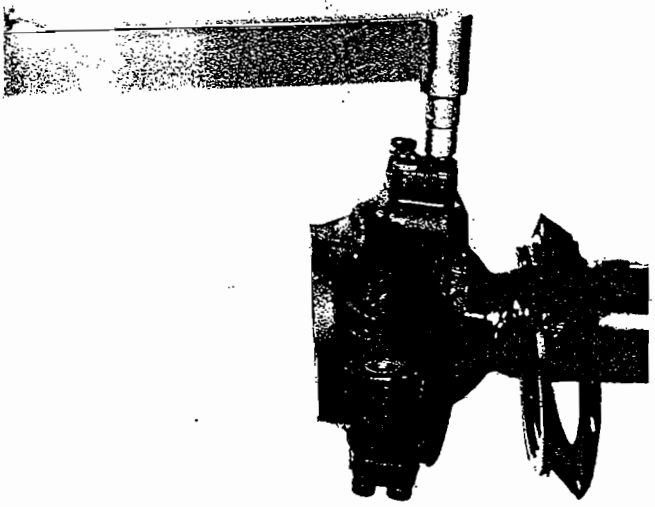


Figure 80 1009-80

Locate torque wrench on one screw to check for proper preload. Torque specification to rotate knuckle is 5-10 lbs. ft. If equipped with bronze bushing, torque specification is 10-20 lbs. ft. starting torque.

To increase torque reading, remove shims; to decrease torque reading, add shims.

NOTE

When checking king pin bearing preload, make sure the tie rod is disconnected, and also the knuckle oil seals, etc., are still disassembled.

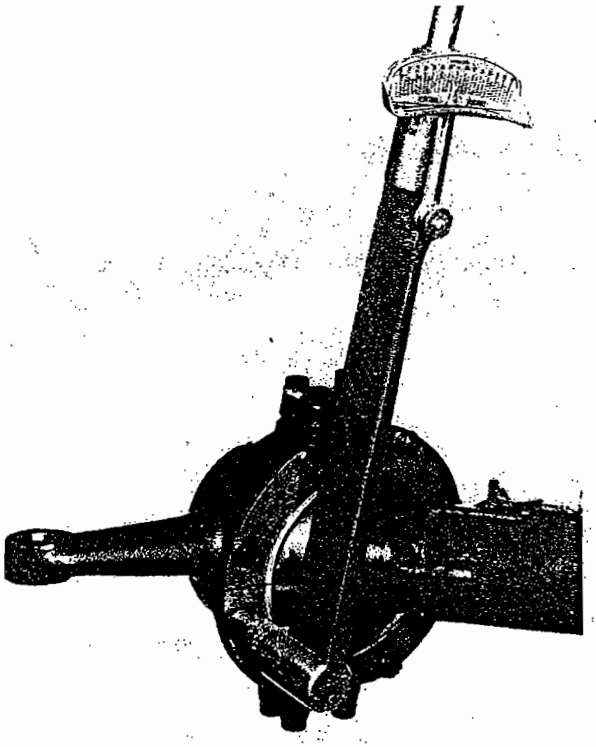


Figure 81 1009-81

Assemble new seal into knuckle, new felt seal, new retainer plates, and new screws. Torque screws to 10-25 lbs. ft.

Assemble axle shaft joint assembly, spindle, wheel ends, etc.

Refer to Vehicle Service Manual for proper torque specification, etc.

Also, refer to Vehicle Service Manual for proper setting of toe in.

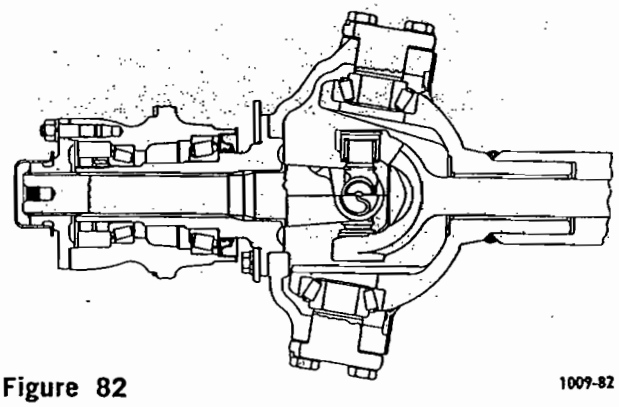


Figure 82 1009-82

CLOSED KNUCKLE-HEAVY DUTY DESIGN

Remove twelve (12) cap screws which retain the oil seal to the knuckle.

DISASSEMBLY

Remove four (4) cap screws from bottom bearg cap. Use a screwdriver to pry cap loose from nuckle.

The king pin bearing preload shims are located between the bottom bearing cap and knuckle as shown. Keep shims intact as they will be used later during assembly.

These shims are available in thicknesses of .003, .005, .010, and .030.

CAUTION

When removing the knuckle the bottom bearing cone will fall out of the cup. Catch it with your hand to prevent it from becoming damaged.

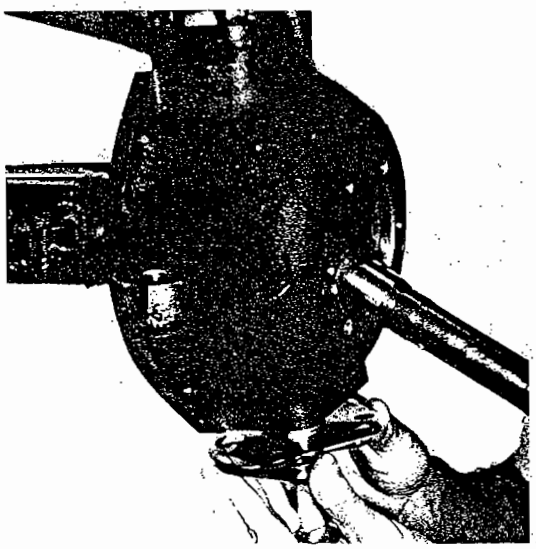
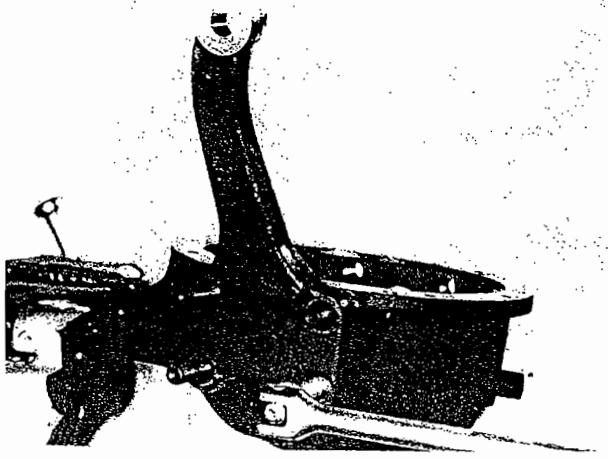


Figure 83 1009-83

Remove axle shaft joint assembly.



rigure 84 1009-84

Place knuckle in vise as shown. Remove the top bearing cap nuts.

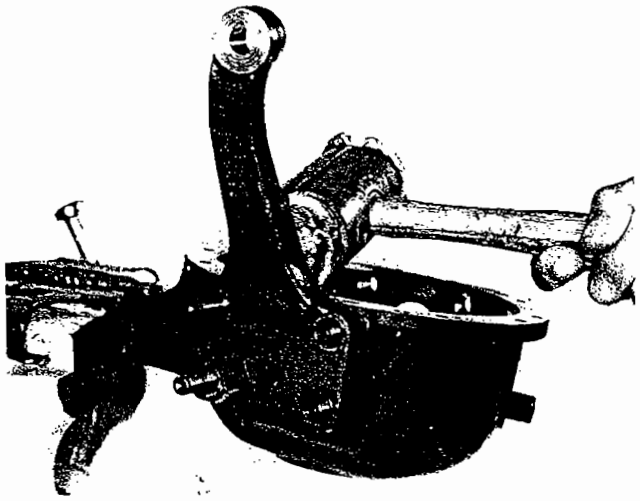


Figure 85 1009-85

Remove steering arm. Tap lightly wtih a rawhide hammer to free it from the knuckle.

NOTE

There is a constant shim pack between the steering arm and knuckle. This pack is to be saved and reused during assembly.

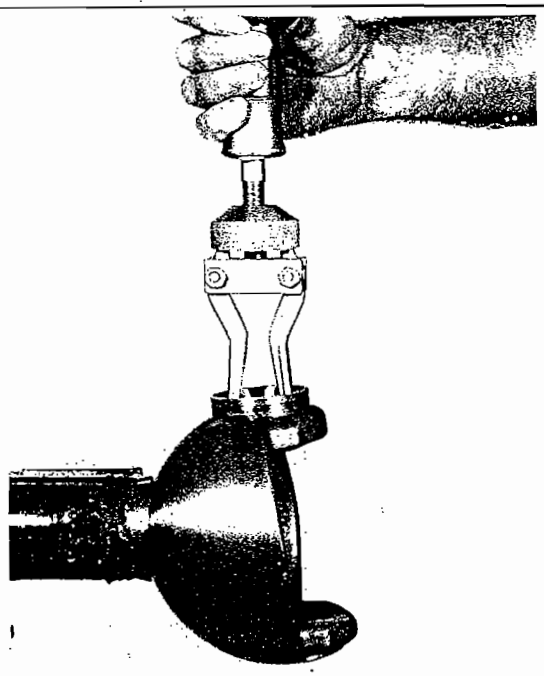


Figure 86 1009-86

Remove king pin bearing cups from spherical ball. Use puller as shown.

Tool—#D-131.

NOTE

Some axles are equipped with a bronze bushing on the top bearing cap, instead of a roller bearing. Remove bushing by using two (2) large screwdrivers until it is free of the king pin. If woodruff key is used, discard and replace with a new one during assembly.

ASSEMBLY

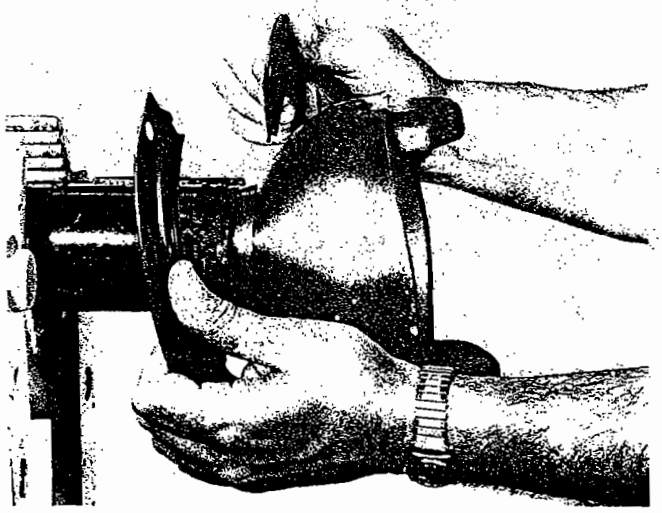


Figure 87 1009-87

Assemble new grease seal with rubber portion towards knuckle. Do not spread seal any further than necessary, this will prevent distortion of the seal.

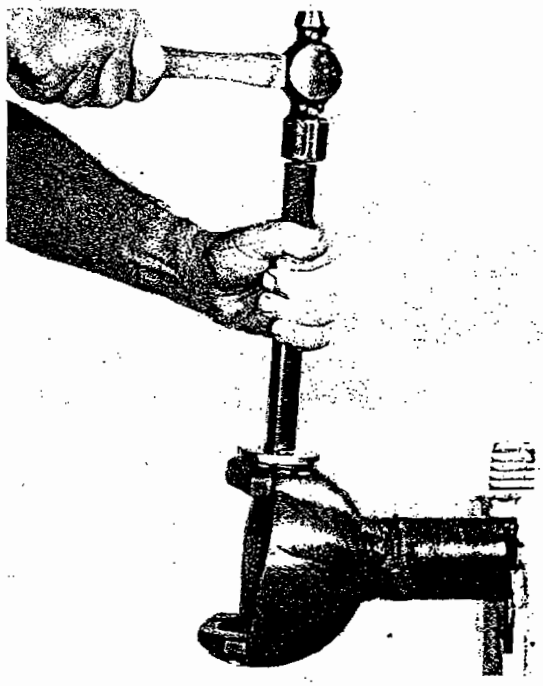


Figure 88 1009-88

Assemble new bearing cup to ball yoke.
Tools—#C-4171 Handle, #D-142 Installer.

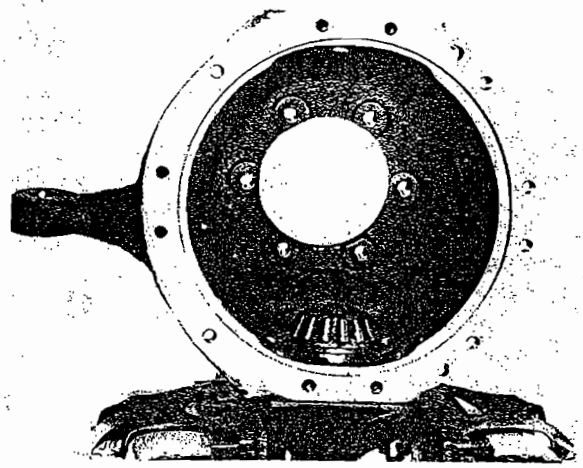


Figure 89 1009-89

Assemble steering arm king pin assembly to knuckle. Assemble new bearing cone to king pin. Grease bearing with the specified grease.

If bronze bushing is used, line up key-way of the bushing with the key-way of the pin and use new key. If bushing is of the spline design, line up the splines with those of the pin. Use a brass hammer to seat bushings.

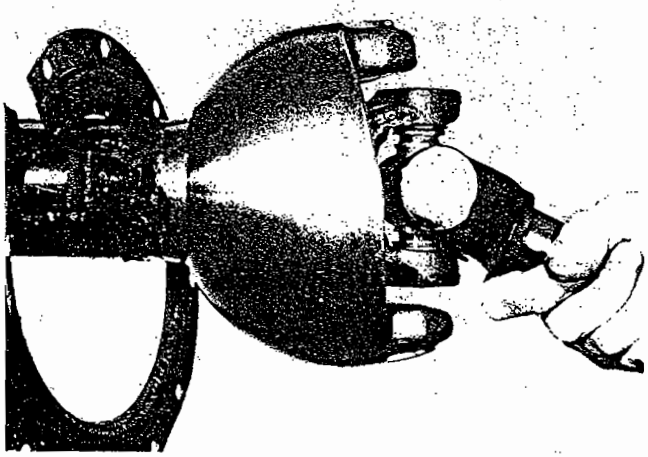


Figure 90 1009-90

Assemble axle shaft joint assembly to axle.

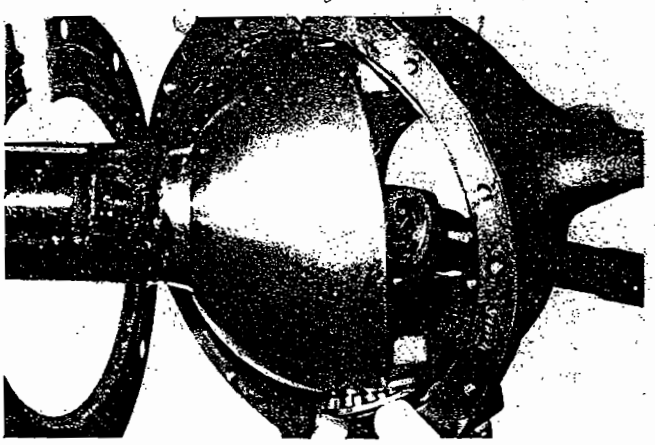


Figure 91 1009-91

Assemble knuckle to ball yoke. Hold bottom bearing as shown to prevent it from falling out.

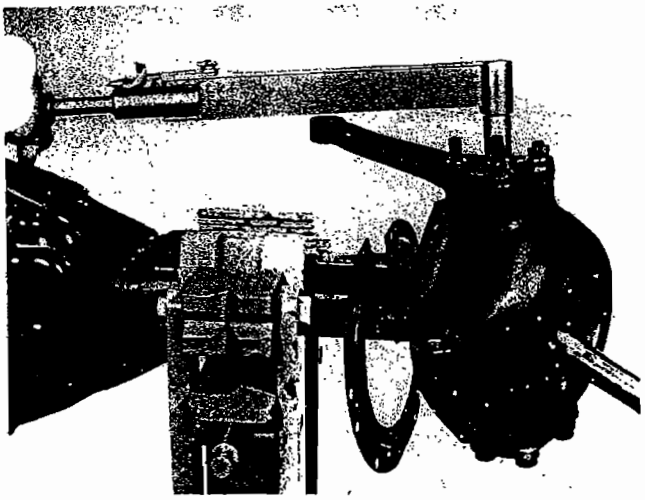


Figure 92 1009-92

Assemble bottom bearing cap with preload shims. Torque screws to 80-90 lbs. ft.

Torque top four (4) nuts on top bearing cap to 80-90 lbs. ft.

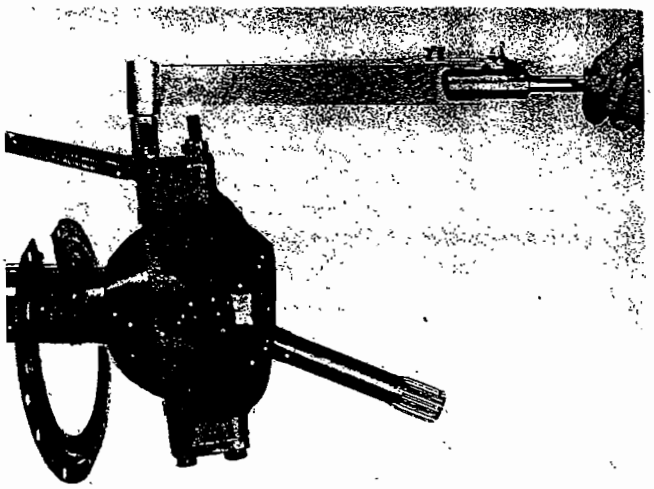


Figure 93 1009-93

Apply a torque wrench on one screw as shown. Torque to actuate knuckle with roller bearings is 10-15 lbs. ft. With bronze bushing 15-35 lbs. ft.

When checking torque rotation of knuckle, make sure tie rod and seals are not assembled to the knuckle.

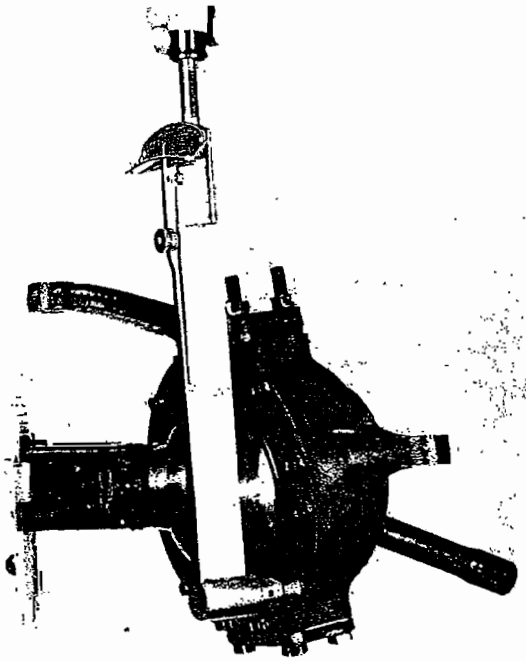


Figure 94 1009-94

Assemble grease seal to knuckle. Be sure split of seal is located at the top of the axle.
Torque screws to 10-15 lbs. ft.

UNIT WHEEL BEARING DESIGN LUBRICATED WITH HYPOID LUBRICANT

NOTE

Unit wheel bearings that are dependent on lubrication from the hypoid gear lube in the axle housing, rather than grease, are not equipped with an inner axle shaft oil seal as shown in Figue 1009-105.

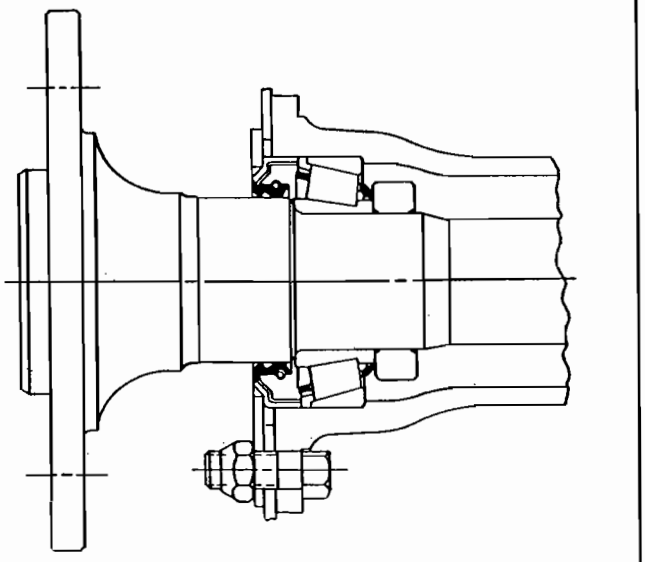


Figure 95 1009-95

Unit wheel bearing L/D without grease seal.

DISASSEMBLY

Figure 96 1009-96

After wheel is removed, remove brake drum.

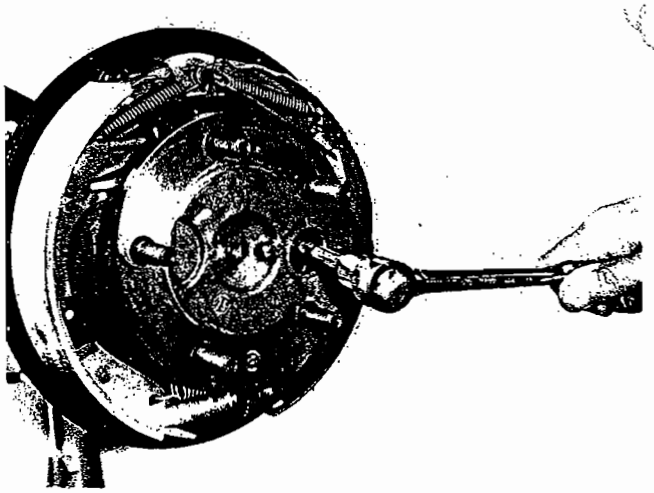


Figure 97 1009-97

Remove backing plate nuts which hold the brake backing plate to the axle housing. **Discard nuts, replace with new ones at time of assembly.** Nuts are of torque prevailing design and are not to be reused.

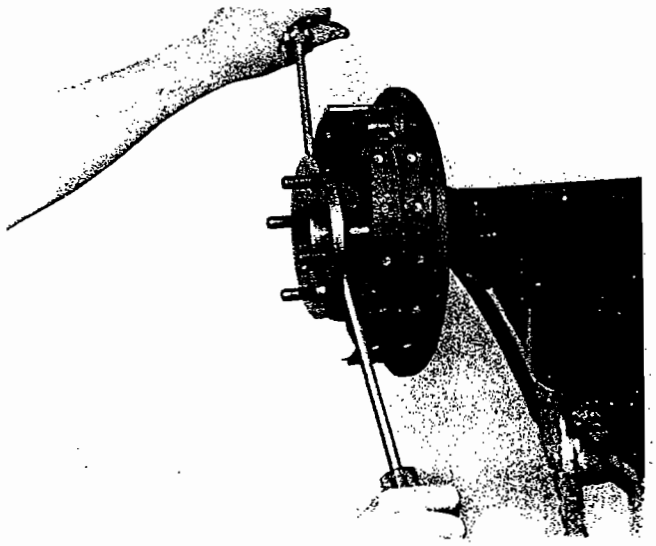


Figure 98 1009-98

Remove the axle shaft by pulling on the axle. It may be necessary to free the axle by prying it loose with two screwdrivers or pry bars as shown.

NOTE

Backing plate can normally be wired to the frame, without loosening the hydraulic brake line connection at the wheel cylinder, if desired. Use caution to avoid damage to brake line.

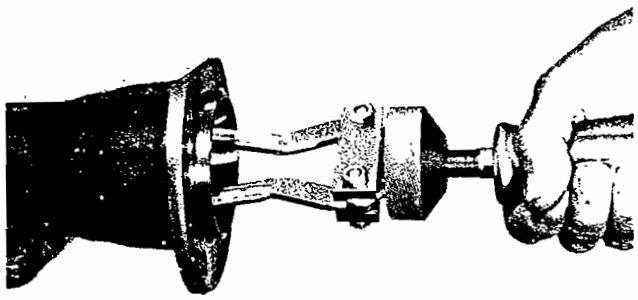


Figure 99 1009-99

The bearing cup will normally stay in place in the housing. To remove bearing cup, use puller as shown.

Tool—#D-131 Slide Hammer.

CLEANING, INSPECTING AND RELUBRICATING WHEEL UNIT BEARING

Clean bearing cup with any of the standard metal cleaning solvents. Inspect cup for any possible wear, nicks, etc.

The cone assembly can be cleaned in place on the axle shaft. Use any standard metal cleaning solvent and a stiff bristle brush to remove any dirt or any other contamination that might be present, then use compressed air. Air should be directed at the cone assembly so that it goes through the bearing from one end of the rollers to the other. It is important not to "spin dry" the bearing with compressed air. Spinning the dry bearing may score the raceways and rollers due to lack of lubricant.

Use a standard metal cleaning solvent to clean out the bearing bore in the housing. Wipe this area clean making sure it is free from dirt or any other contamination that might be present.

fter the bearing has been inspected and ap- ed for continued service, it must be lubricated prior to installation. The bearing must be lubricated by applying a small amount of the specified lube around the rollers of the bearing cone.

ASSEMBLY

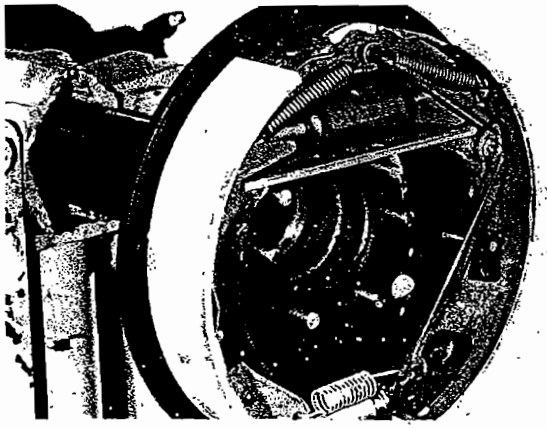


Figure 100 1009-100

Assemble backing plate bolts and backing plate assembly.

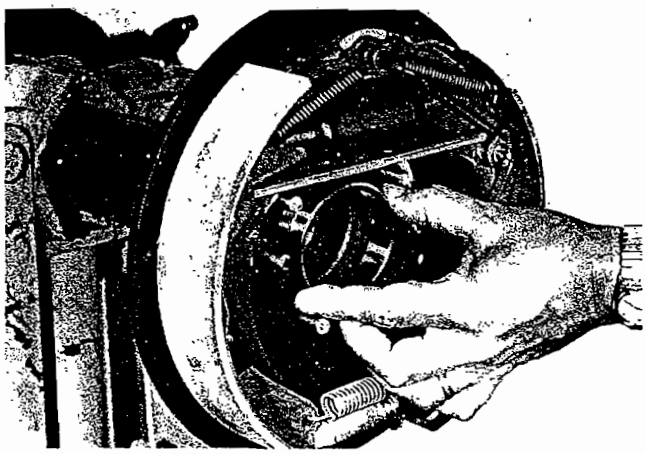


Figure 101 1009-101

Assemble bearing cup into bearing bore of the tube. Make sure the cup backface is against the bearing seat of the tube.

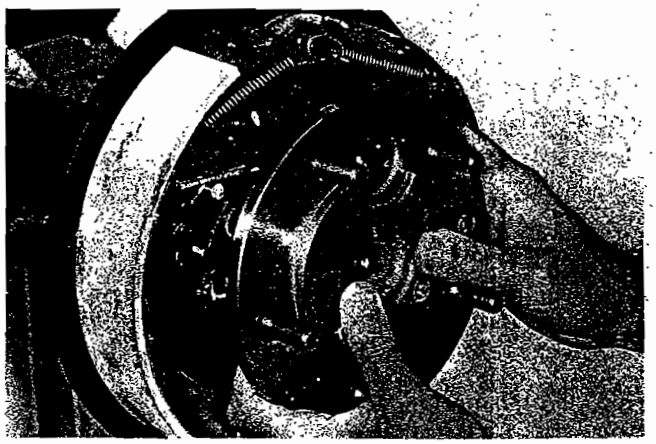


Figure 102 1009-102

Assemble axle shaft into housing. Care should be taken not to damage the bearing rollers.

Line up the holes of the retainer plate with the bolts, push axle shaft into the housing as far as possible.

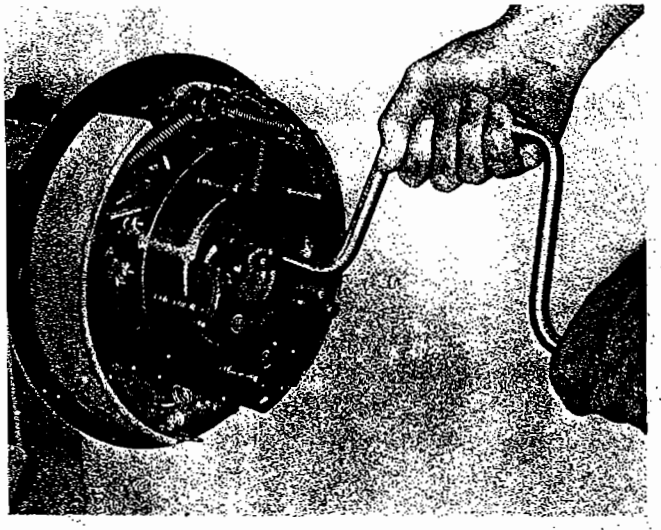


Figure 103 1009-103

Start nuts on backing plate bolts by hand. Use a speed wrench as shown and tighten to approximately 15 lbs. ft.

The nuts should be tightened in a manner that assures that the seal and cup rib ring are drawn evenly against the cup in the housing.

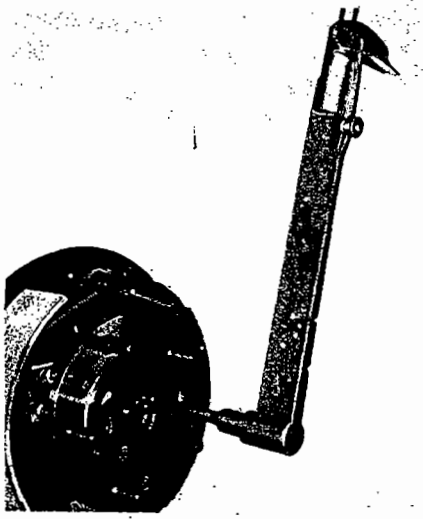


Figure 104 1009-104

Using a torque wrench as shown, torque nuts to 25-35 lbs. ft. Assembly brake drums, retainer nuts, wheels, etc.

Tool—#C-524-A Torque wrench.

UNIT WHEEL BEARING DESIGN LUBRICATED WITH GREASE

NOTE

Unit wheel bearings that are dependent on grease for lubrication, rather than hypoid gear lube from the axle housing, are equipped with an inner axle shaft oil seal as shown in Figure 1009-105.

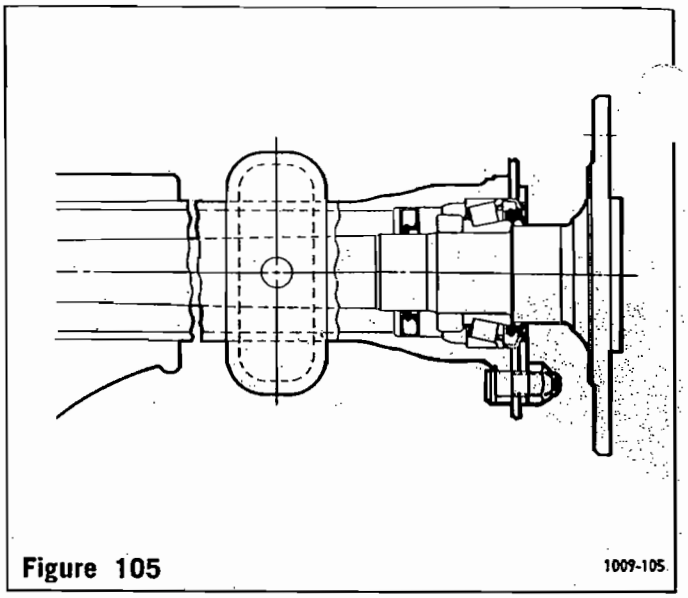


Figure 105 1009-105

Unit wheel bearing L/D with grease seal.

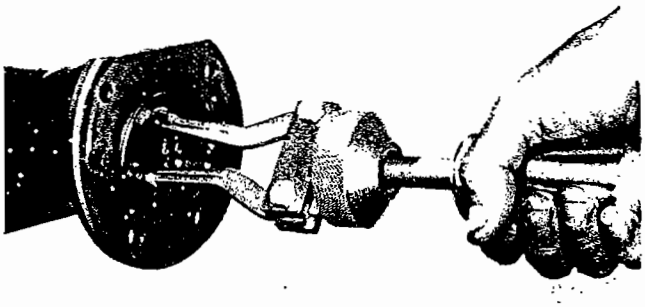


Figure 106 1009-106

Remove inner axle shaft seal using puller as shown.

Tool—#D-131 Slide hammer.

Discard seal and replace with new one at time of assembly.

NOTE

Avoid contacting seals with cleaning solvent in cleaning operation.

CLEANING, INSPECTING AND LUBRICATING UNIT BEARINGS

Clean bearing cup with any of the standard metal cleaning solvents. Inspect cup for any possible wear, nicks, etc.

The cone assembly can be cleaned in place on the shaft. Use a standard metal cleaning solvent and a stiff bristle brush to loosen the old grease. To insure removal of the old grease and any contamination that might be present, use compressed air. Air should be directed at the cone assembly so that it goes through the bearing from one end of the rollers to the other. It is important not to "spin dry" the bearing with compressed air. Spinning the dry bearing may score the raceways and rollers due to the lack of lubricant.

Use a standard metal cleaning solvent to clean out the bearing and oil seal bore in the housing. Wipe this area clean making sure it is free from any old grease or other contamination that might be present.

After the bearing has been inspected and approved for continued service, it must be lubricated prior to installation.

The grease should be a good quality number 2 E.P. (extreme pressure), lithium soap, wheel bearing grease.

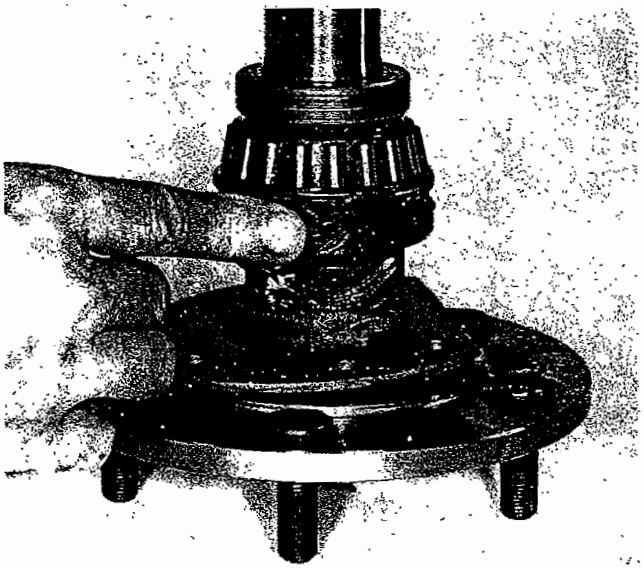


Figure 108 1009-108

Fill the area or cavity between the seal and bearing with the recommended grease.

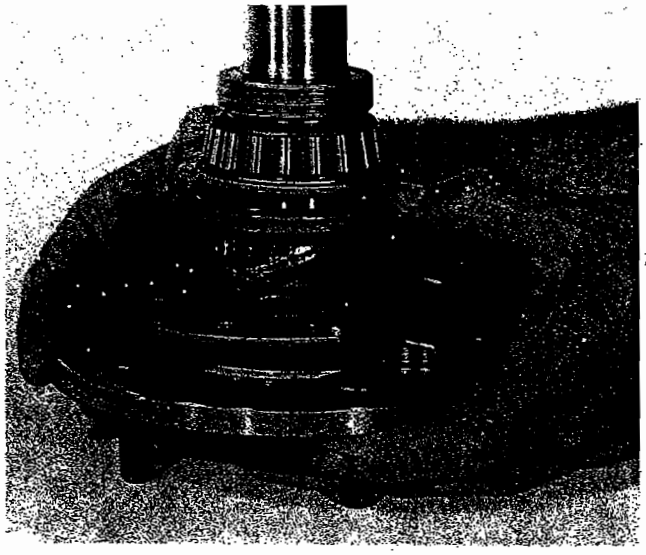


Figure 107 1009-107

Push seal and retainer away from the bearing to allow a cavity between the seal and bearing.

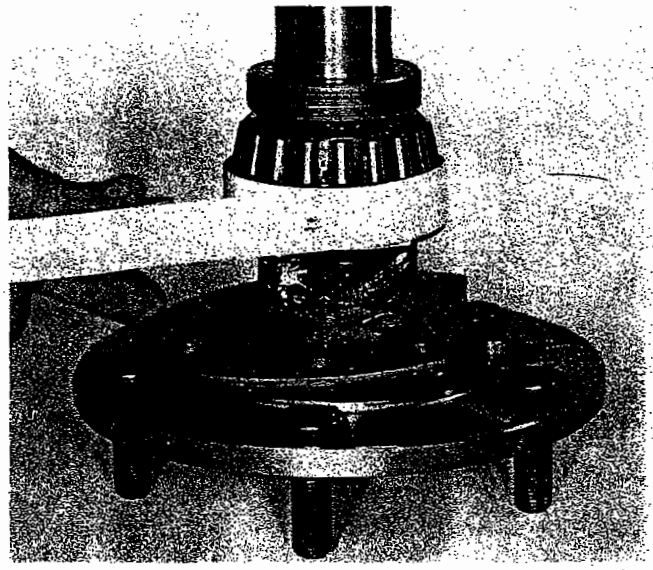


Figure 109 1009-109

After the cavity is full of grease, wrap tape compeltely around the rib ring and seal as shown to enclose the cavity.

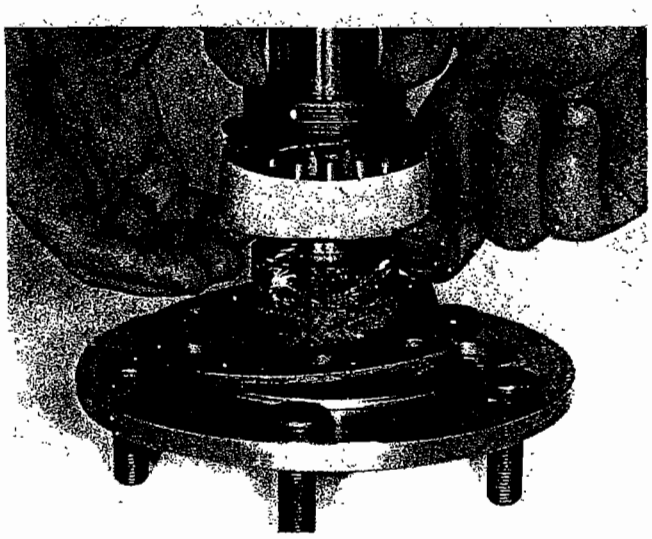


Figure 110 1009-110

With tape still wrapped around the ring, push seal up until it contacts the rib ring. This will force the grease up through the rollers.

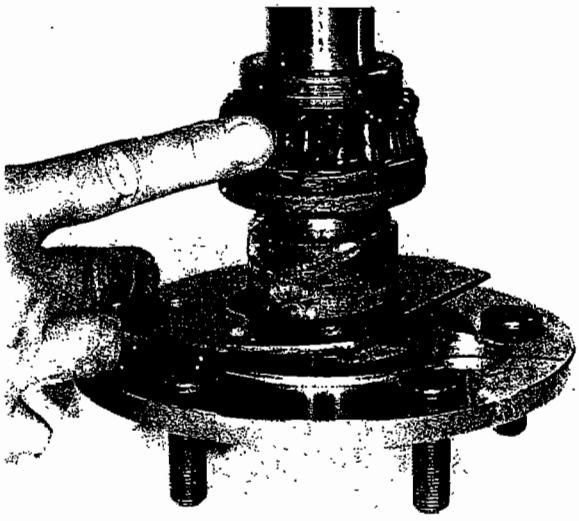


Figure 111 1009-111

NOTE

If grease is not apparent on small end of rollers, repeat these same steps until grease appears.

Remove tape and wipe excess grease on roller bodies.

ASSEMBLY

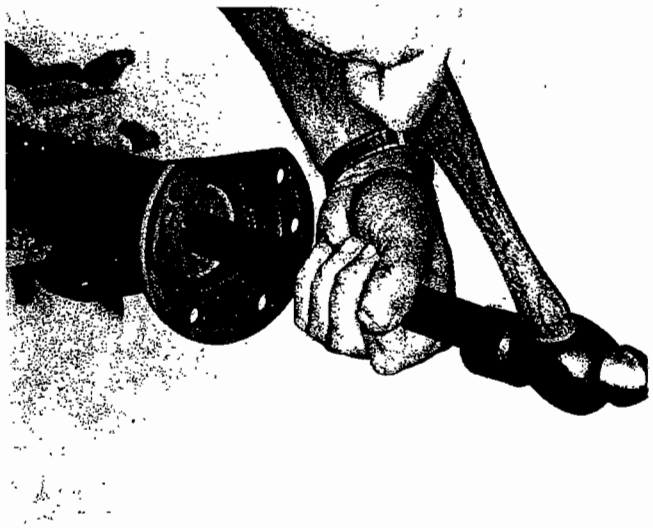


Figure 112 1009-112

Assemble new grease seal into housing.

Tools—#D-157 Seal Installer, #C-4171 Handle.

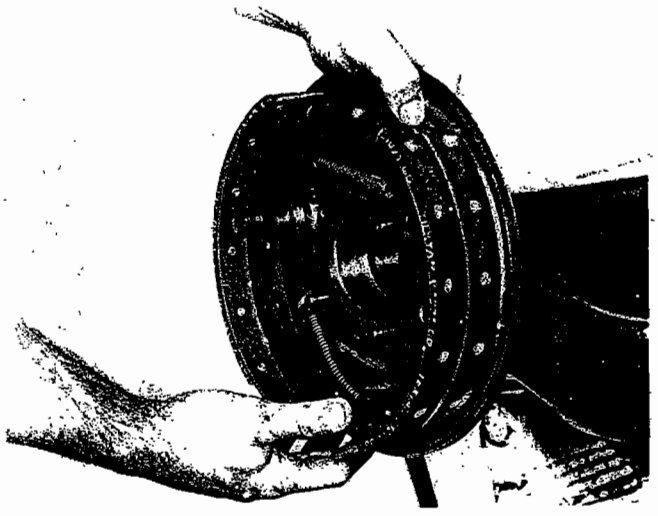


Figure 113 1009-113

After seal has been assembled, grease lip of seal.

Assemble backing plate bolts and backing plate assembly.

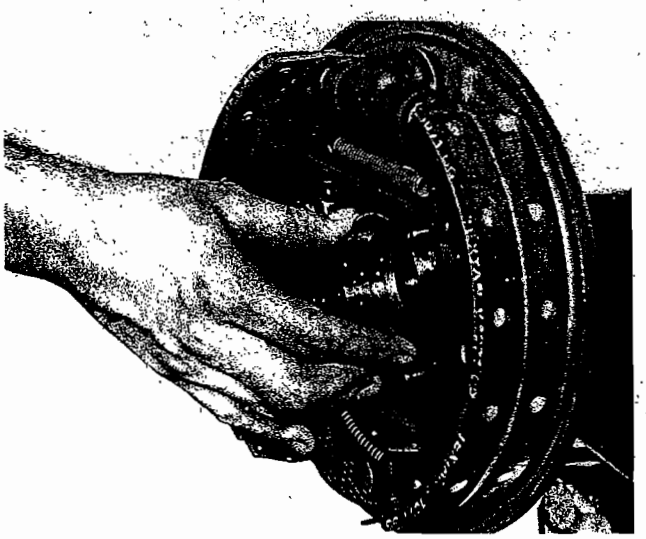


Figure 114 1009-114

Assemble bearing cup into bearing bore of the tube. Make sure the cup backface is against the bearing seat of the tube.

Figure 115 1009-115

Assemble axle shaft into housing. Care should taken not to damage the seal lip and bearing rollers.

Line up the holes of the retainer plate with the bolts; push axle shaft into the housing as far as possible.

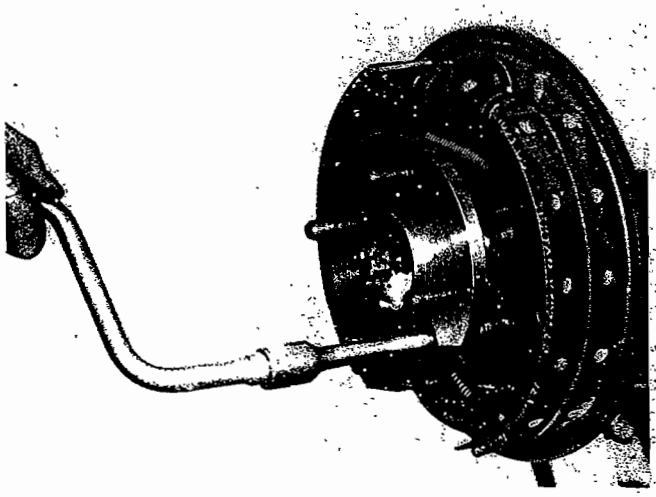


Figure 116 1009-116

Start nuts on backing plate by hand. Use a speed wrench as illustrated and tighten to approximately 15 lbs. ft.

The nuts should be tightened in a manner that assures the seal and cup rib ring are drawn evenly against the cup in the housing.

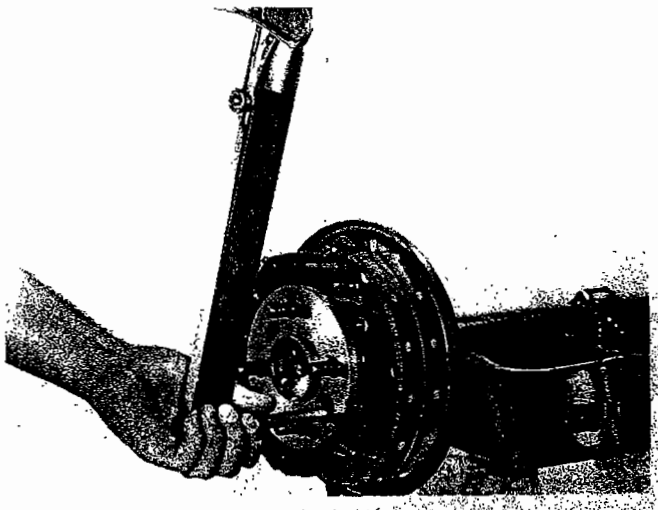


Figure 117 1009-117

Use a torque wrench and torque nuts to 25-35 lbs. ft.

REMOVAL OF UNIT BEARING FROM AXLE SHAFT

NOTE

To disassemble axle shaft from housing, follow the procedures illustrated in Figures 1109-95 thru 1009-99.

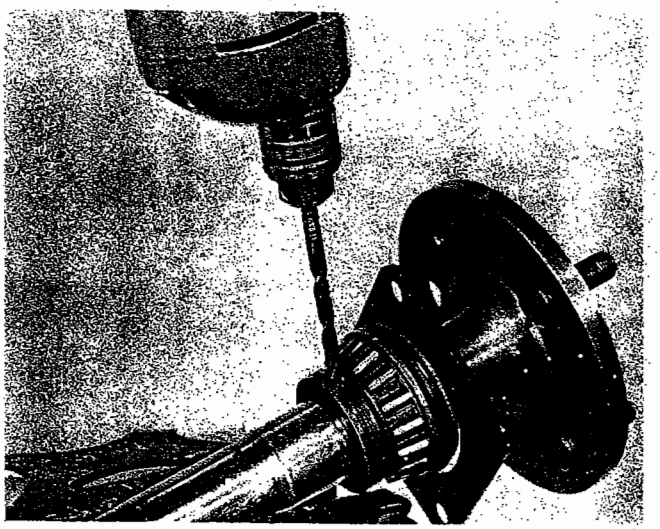


Figure 118 1009-118

Place axle shaft in a vise. Drill a ¼" hole in the outside of the retainer ring to a depth approximately ¾ the thickness of the ring. Do not drill all the way through the ring; the drill could damage the axle shaft.

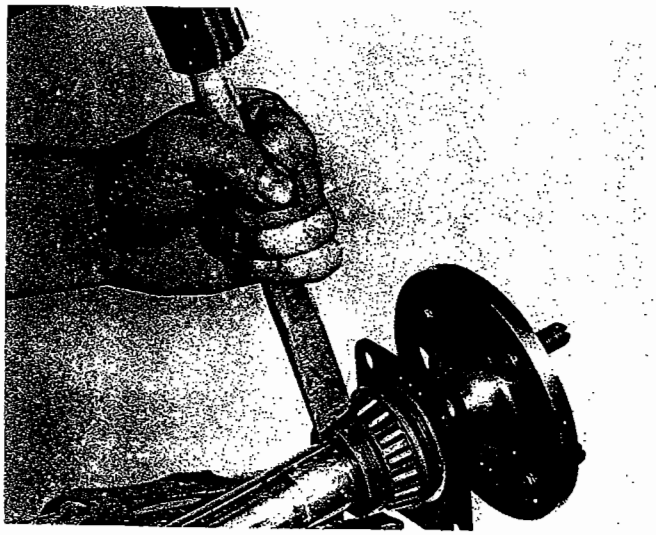


Figure 119 1009-119

After drilling the ring, use a chisel positioned across the hole and strike sharply to break the ring. Discard and replace with a new one at time of assembly.

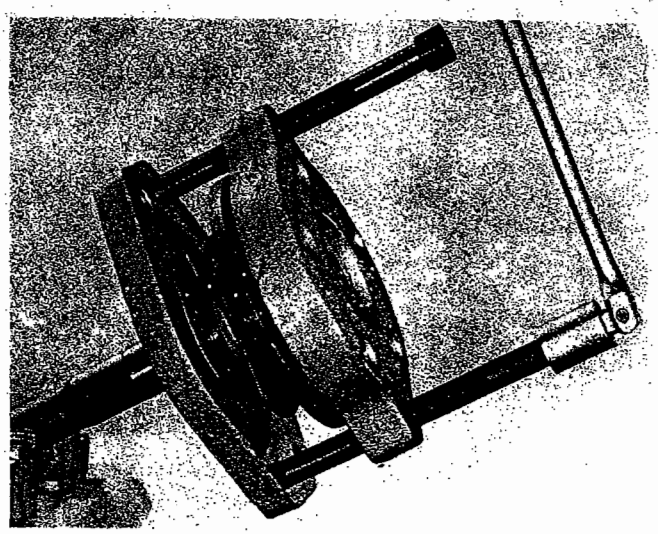


Figure 120 1009-120

Push retainer plate and seal towards flange of axle shaft. Install the flange plate to the flange of the axle shaft. Install bolts into flange plate. Slide forcing plate over the axle shaft. Install the adapters so they seat under the cup rib ring.

Gradually tighten the bolts until they locate in the dimples on the backside of the forcing plate.

Tools—#SP-5443-A Flange plate, #SP-5017 Adapter ring, #SP-5442-D Adapters, #SP-502(Bolts.

Tighten bolts of tool alternately until bearing cone is removed from axle shaft. Be careful not to mar the machined surfaces of the axle shaft.

CAUTION

Do not heat or cut the bearing cone assembly with a torch to remove. Damage to the axle shaft will result.

Remove seal and retainer plate. Discard seal. Replace with new one at time of assembly.

Inspect retainer plate for possible distortion. If any portion of the retainer plate is damaged, it should be replaced.

Inspect machined surfaces of the axle shaft, such as the seal and bearing diameters. Clean axle shaft, remove all nicks or burrs.

INSTALLATION OF NEW UNIT BEARING

NOTE

The retainer ring area of the axle shaft is 1.3790 minimum in diameter, and the retainer ring inside diameter is 1.374 maximum. Therefore, it should require some 6,000 lbs. minimum press to seat the ring against the unit bearing.

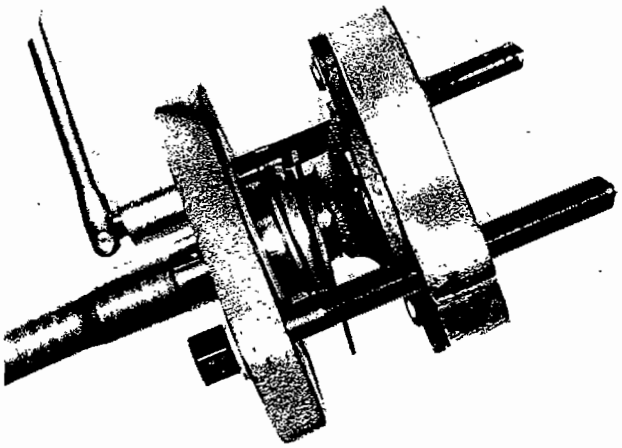


Figure 121 1009-121

Flange plate should still be assembled to the flange of the axle shaft. Remove bolts from flange plate.

Assemble new retainer plate and oil seal. The rubber portion of the oil seal, which extends beyond the casing has numbers bonded in the rubber. These numbers are to face toward the flange of the axle shaft.

Assemble new unit wheel bearing on axle shaft. Slide installing ring on axle shaft. Be sure to locate unit wheel bearing on the inside of the installing ring. Slide forcing plate on axle shaft and locate on installing ring. Install bolts and washers through the holes in the forcing plate and into the flange plate.

Tools—#SP-5443-A Flange plate, #SP-5017 Adapter ring, #SP-5439 Adapter plate installer, #SP-5026 Bolts, #SP-3020 Washers.

Tighten bolts alternately and evenly making sure bearing is not cocked on axle shaft. Continue until unit wheel bearing is seated. To make sure bearing is seated, use a .0015" feeler gage between bearing seat and bearing. If gage enters, force bearing further on the axle shaft, until gage does not enter.

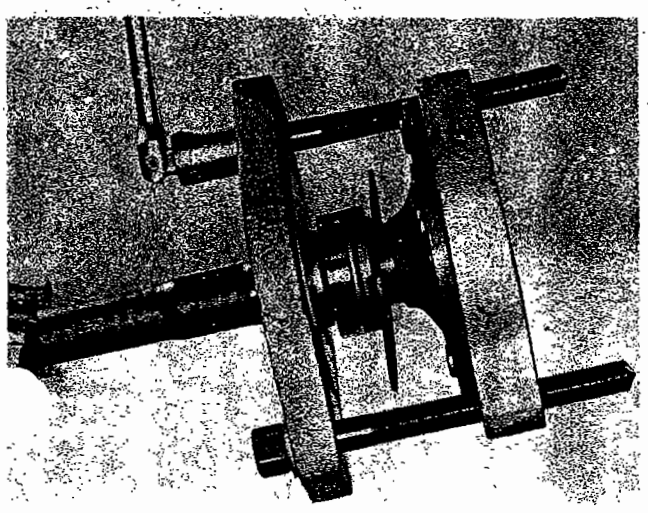


Figure 122 1009-122

Install retainer ring on axle shaft. Follow the same procedures as illustrated in Figure 1009-121 to assemble the retainer ring.

Use a .0015" feeler gage between the bearing and retainer ring to be sure that the retainer ring is seated. At least one point should exist, where the gage will not enter between the retainer ring and bearing. If gage enters completely around the diameter, retainer ring must be forced further onto the axle shaft.

To assemble axle shaft assembly into housing, follow steps as illustrated in Figures 1009-115 thru 1009-117.

LUBRICATING NEW UNIT BEARING WITH GREASE

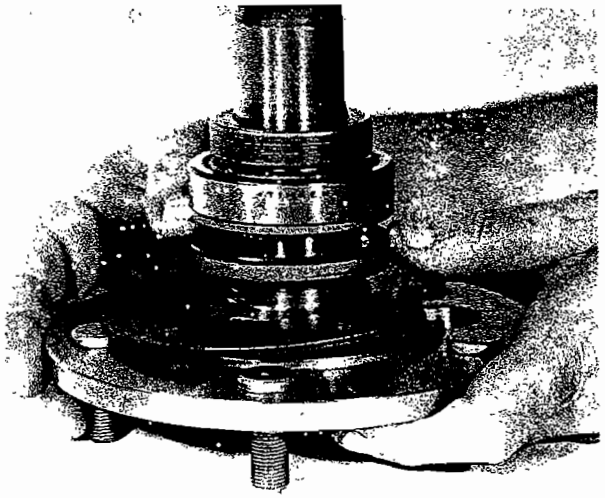


Figure 123 1009-123

Push seal and retainer away from bearing to allow a cavity between the seal and bearing.

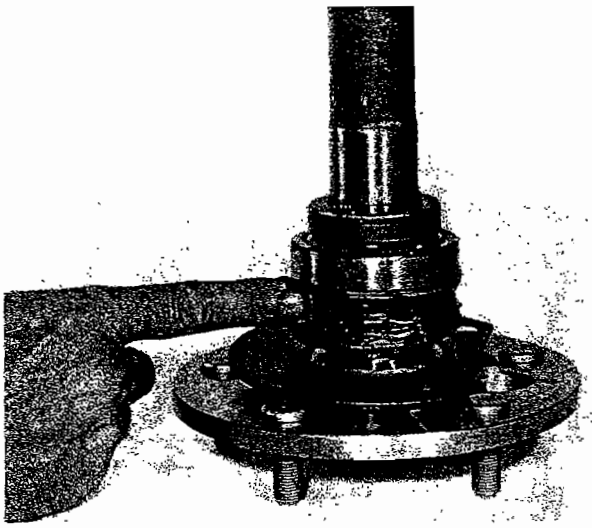


Figure 124 1009-124

Fill cavity with a good quality #2 E.P. (extreme pressure), lithium soap, wheel bearing grease.

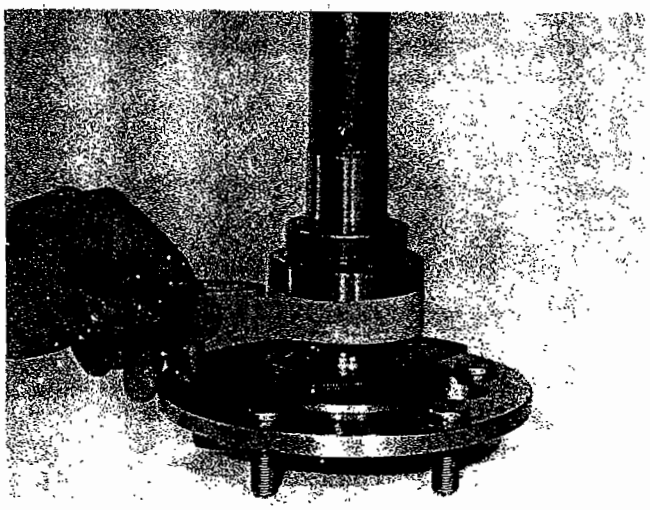


Figure 125 1009-125

After cavity is full of grease, wrap tape completely around rib ring, and seal to enclose the cavity.

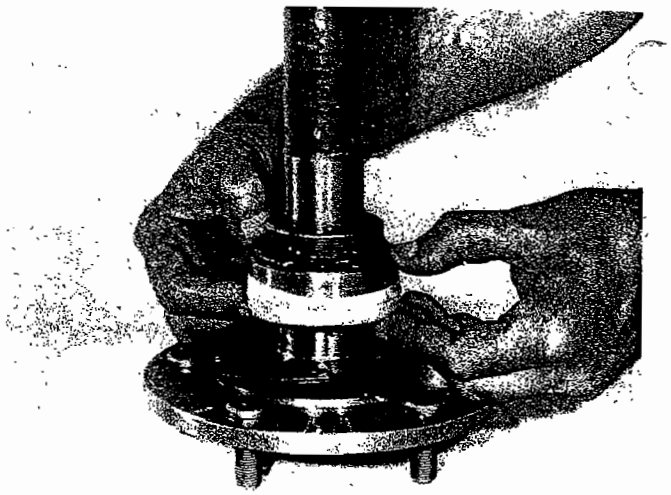


Figure 126 1009-126

Push seal towards the bearing until it contacts the rib ring. This will force the grease between the rollers and cup.

NOTE

If grease is not apparent on the small ends of the rollers, repeat the same steps until grease is evident between the small end of the roller and cup. **Remove tape.**

CARRIER SECTION

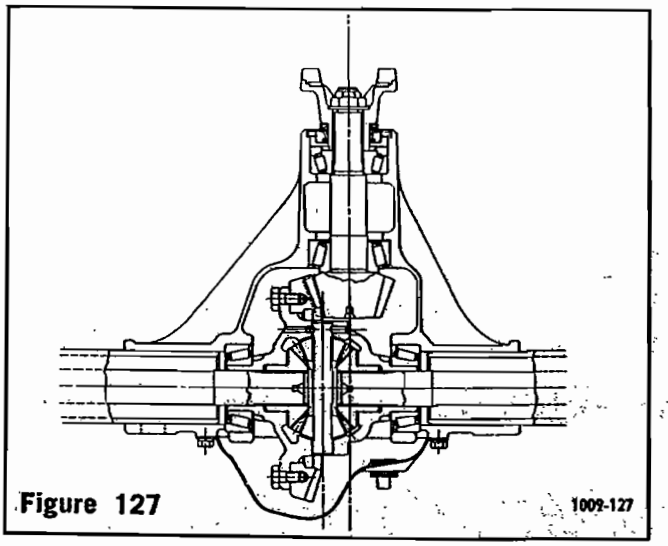


Figure 127 1009-127

L/D Carrier.

DISASSEMBLY

NOTE

If it becomes necessary to disassemble any parts inside the carrier, it is suggested that the entire axle be removed from the vehicle and held tight in a stand or rack.

Remove drain plug and drain lubricant. If there is no drain plug in the carrier, the lube will drain out as the cover plate is removed.

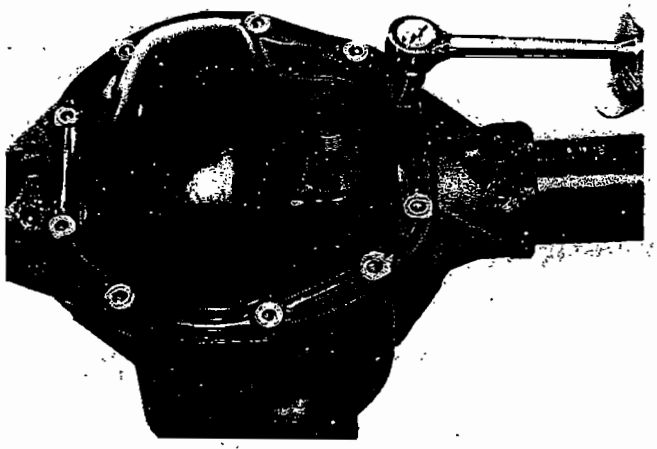


Figure 128 1009-128

Remove cover plate screws, cover plate, and cover plate gasket. **Discard old gasket.** Tip carrier to allow lube to drain completely.

Also, during this time clean the cover face of the carrier, making sure it is free from any nicks and any particles left by the old gasket.

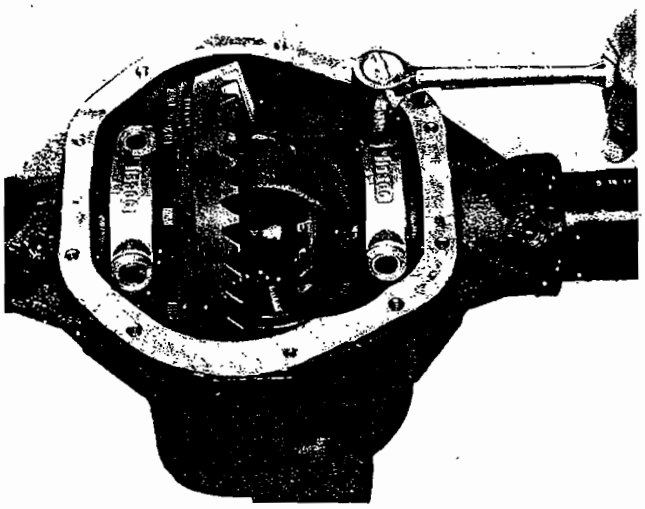


Figure 129 1009-129

Remove bearing caps. Note mating letters stamped on caps and carrier. This is important at time of assembly as they are to be assembled exactly as removed. Letters or numbers are in horizontal and vertical position.

CAUTION

Before removing differential case and ring gear, make sure the axle shafts are pulled out far enough for clearance to remove differential.

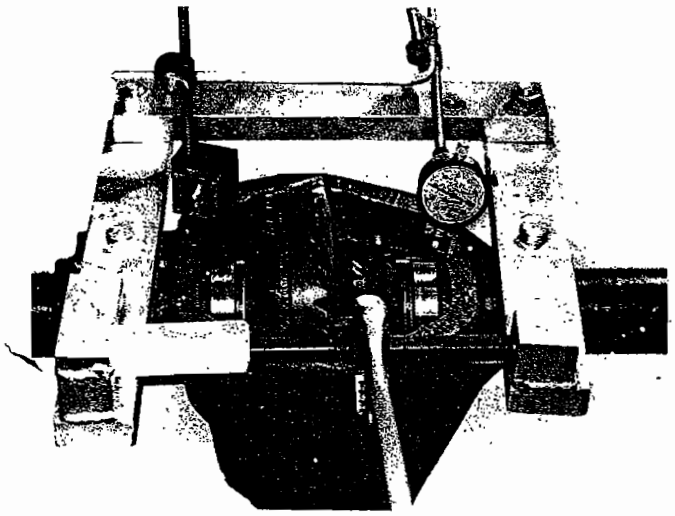


Figure 130 1009-130

Mount spreader to housing. **Do not spread carover .020".** Use dial indicator as shown. **Note:** This spreader can also be used on the Spicer Model 44 axle.

Tools — #D-113 Spreader, #D-128 Indicator set.

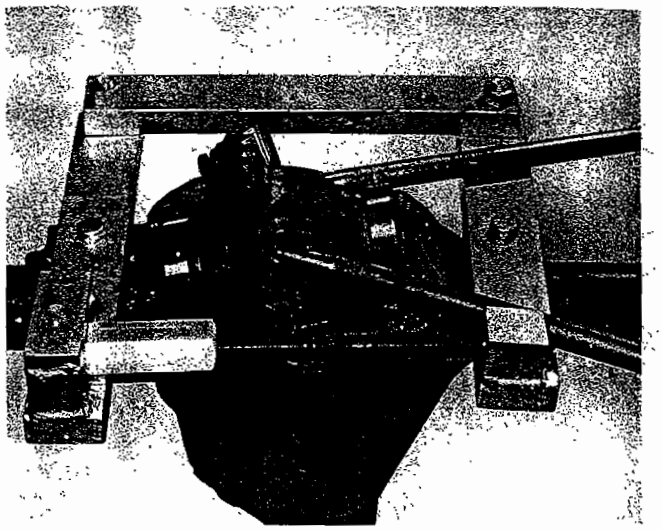


Figure 131 1009-131

Pry differential case from carrier with two pry bars as shown. **After differential case has been removed, remove spreader.** Use caution to avoid damage to ring and pinion. Mark on tag bearing cups indicating from which side they were removed.

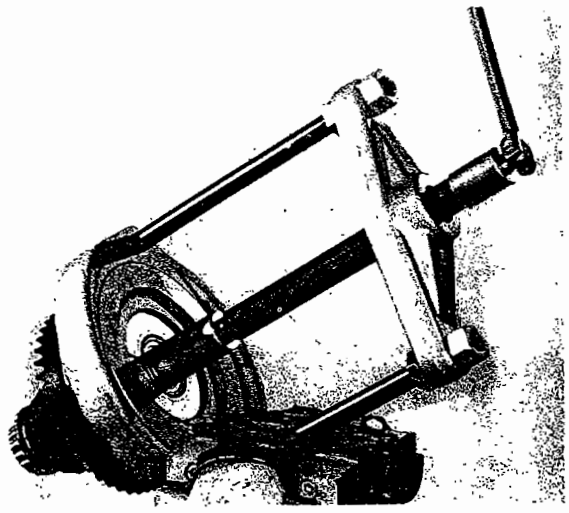


Figure 132 1009-132

Remove differential bearings with a puller as shown. Wire shims, bearing cup and bearing cone together. Identify from which side they were removed (ring gear side or opposite side). If shims are mutilated, replace with new shims at the time of assembly. Shims are available in thicknesses of .003", .005", .010", and .030". Reposition case in puller and remove other bearing cone as described above.

Tools—#DD-914-9P Press and Adapter Ring, #C-293-3 Adapter Plug, #C-293-18 Adapter Set.

NOTE

It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

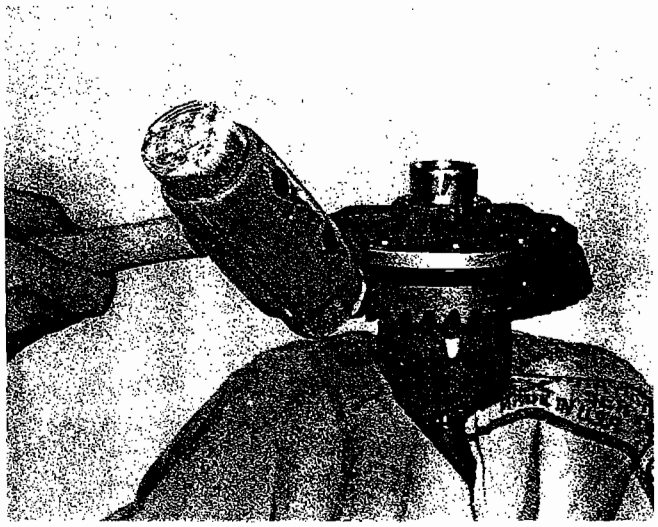


Figure 133 1009-133

Place a few shop towels over the vise to prevent the ring gear teeth from being nicked after it is free from the case.

Place case in vise. Remove ring gear screws. Tap ring gear with a rawhide hammer to free it from the case. Remove case and ring gear from vise.

> **NOTE**
> It is recommended that whenever the ring gear screws are removed, they are to be replaced with new ones.

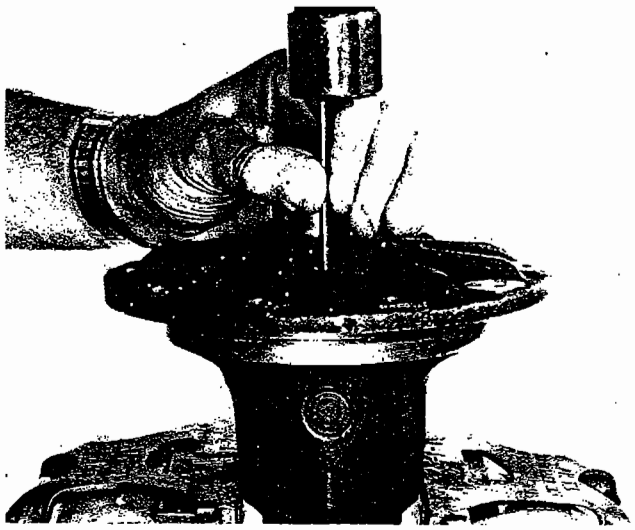


Figure 134 1009-134

Replace case in vise and drive out lock pin which secures the pinion mate shaft. Use a small drift as shown.

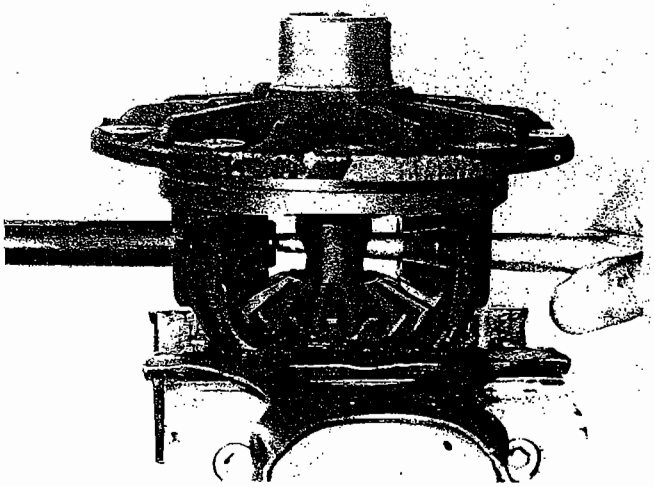


Figure 135 1009-135

Remove pinion mate shaft with drift as shown.

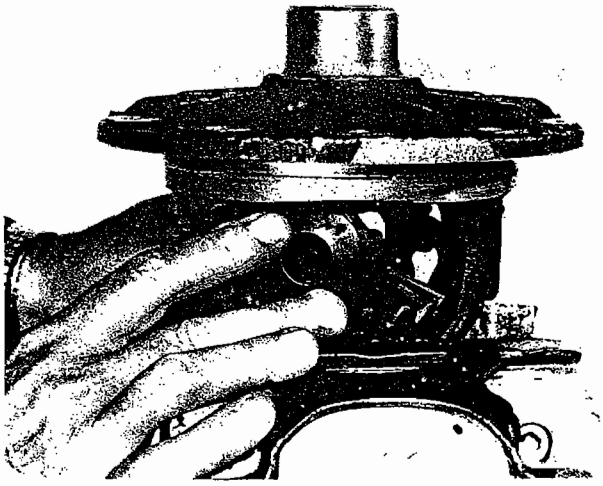


Figure 136 1009-136

To remove side gears and pinion mate gears, rotate the side gears. This will allow the pinion mate gears to turn to the opening of the case. Remove pinion mate gears and also the spherical washers behind the gears. Lift out gears and thrust washers. Inspect all parts, including the machined surfaces of the case itself. Where necessary replace all worn parts. If excessive wear is visible on all parts, it is suggested that the complete differential assembly be replaced. If any one of the gears are to be replaced, **they are to be replaced as a set.**

> **NOTE**
> Axle shafts which require end play adjustment have a spacer block in the differential case. The spacer block controls the end thrust of the axle shaft. If the ends of the spacer block are worn, it is to be replaced during assembly. Spacer block must not be used with ball or unit wheel bearings.

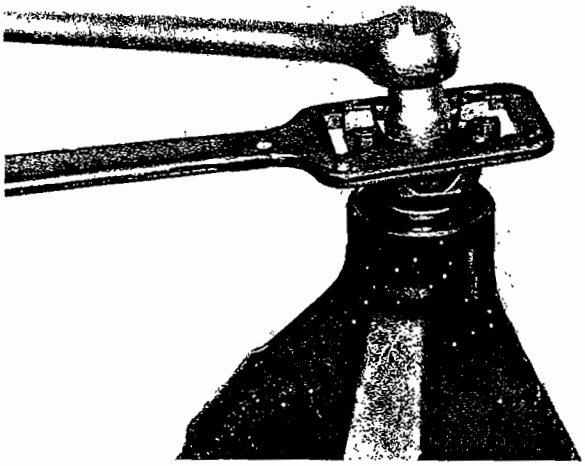


Figure 137 1009-137

Turn nose of carrier in a horizontal position to remove pinion nut. Hold end yoke or flange with tool similar to the one shown, and remove pinion nut and washer.

Tool—#C-3281 Holding wrench.

Figure 139 1009-139

Remove pinion by tapping with a rawhide hammer. Catch the pinion with your hand to prevent it from falling to the ground and being damaged.

NOTE

On the spline end of the pinion, there are bearing preload shims. These shims may stick to the bearing — pinion — or even fall out. The shims are to be collected and kept together since they will be used later in assembly. Try not to mutilate shims. If shims are mutilated, replace with new ones; shims are available in thicknesses of .003", .005", .010", and .030".

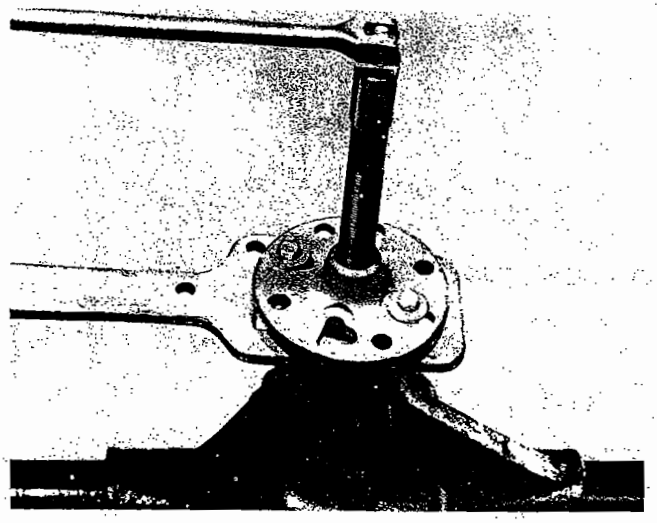


Figure 138 1009-138

Remove end yoke or flange with tools as shown. If yoke or flange shows wear in the area of the seal contact, it should be replaced.

Tool—#C-452.

Figure 140 1009-140

Pull out pinion seal with puller as shown. Discard seal. Replace with new seal at time of assembly. Remove bearing cone and outer pinion oil slinger.

Tool—#D-131 Slide hammer.

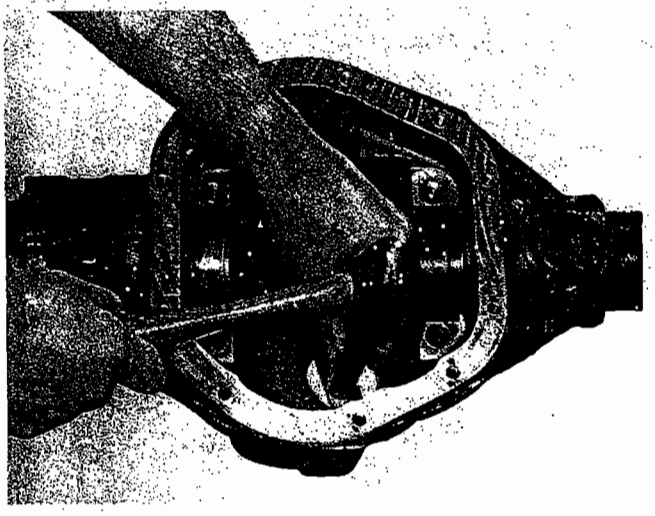


Figure 141 1009-141

Turn nose of carrier down. Remove outer pinion bearing cup as shown. Locate driver on back edge of cup; drive cup out of carrier. **Caution: Do not nick carrier bore.**

Tools—#D-147 Remover, #C-4171 Handle.

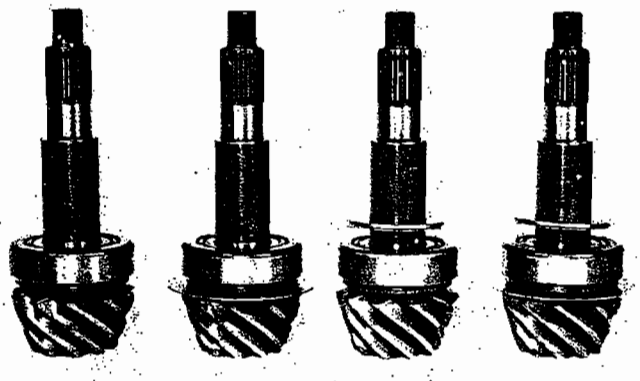


Figure 142 1009-142

NOTE

The front and rear axle carrier section may vary in pinion bore depth due to the possibility of the need for either a baffle or slinger or both.

The baffle serves the same purpose of assisting the lube to flow up through the oil channels to lubricate the pinion bearings. If used, they are part of the pinion setting adjustment. In Figure 1009-142 we show the four different options.

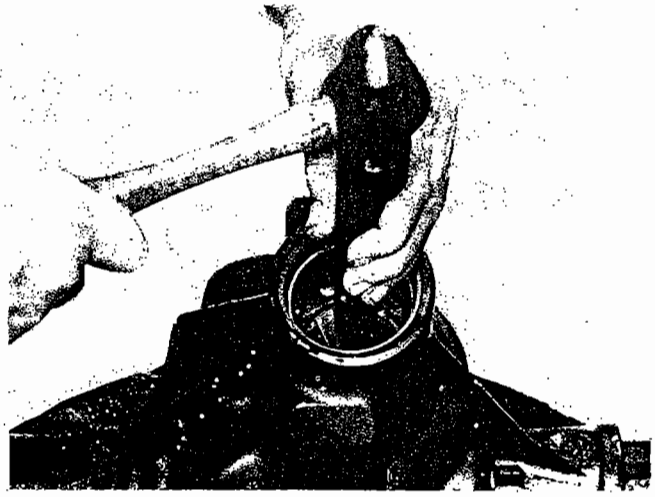


Figure 143 1009-143

Remove the inner bearing cup with tools as shown.

Tools—#D-148 Removed, #C-4171 Handle.

NOTE

Shims are located between the bearing cup and carrier bore, and, as illustrated in Figure 142, may also include an oil baffle. If shims and baffle are bent or nicked, they should be replaced at time of assembly. Wire the stacks together and measure each. If stack has to be replaced, replace with the same thickness.

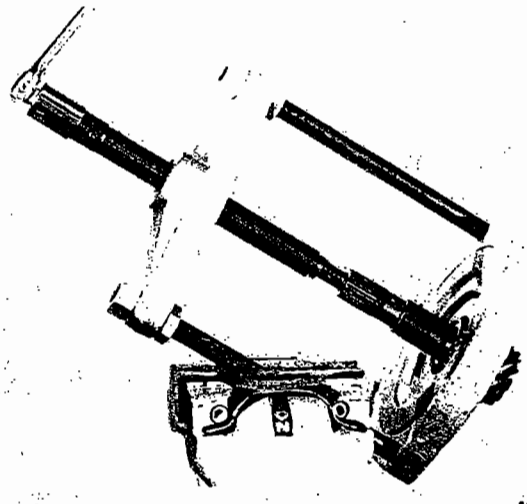


Figure 144 1009-144

Remove inner pinion bearing cone with tools as shown.

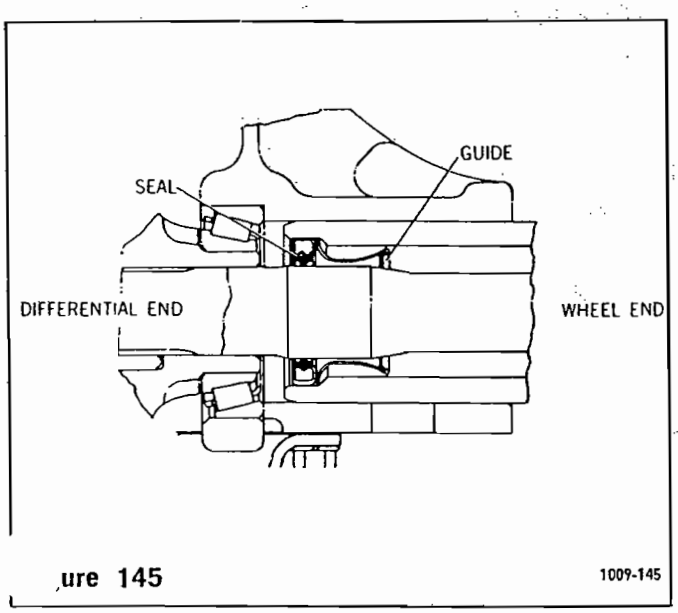
Tools—#DD-914-P Press, #DD-914-9 Adapter Ring, #C-293-39 Adapter Set.

NOTE

Both baffle and slinger are part of the pinion adjustment shims and are to be kept intact for assembly.

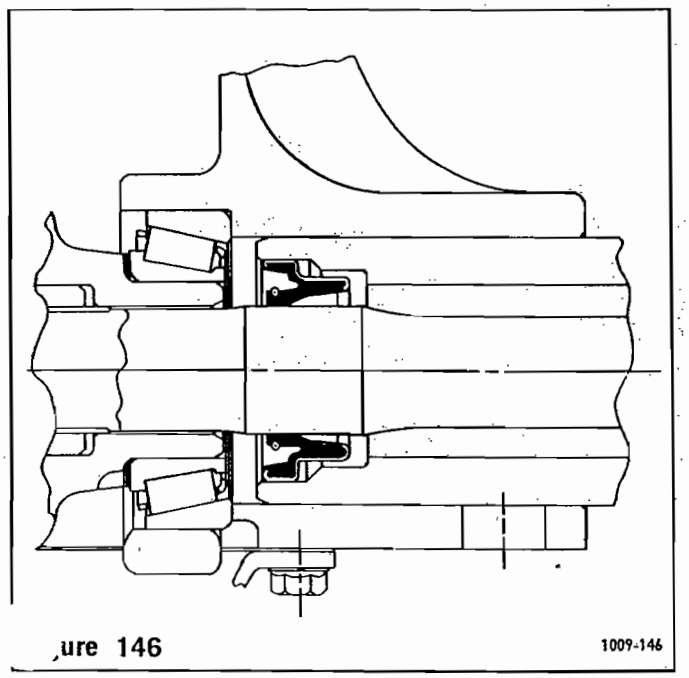
SSEMBLY

On all front axles there are axle shaft oil seals which are pressed into the tube ends of the carrier. There are two different designs.



ure 145 1009-145

As shown in Figure 1009-145, this design consists of an axle shaft guide and seal. (One guide and one seal for each side.)



ure 146 1009-146

As shown in Figure 1009-146, this design consists of the integral seal (unit) whereby the seal and guide are combined. (One seal for each side.)

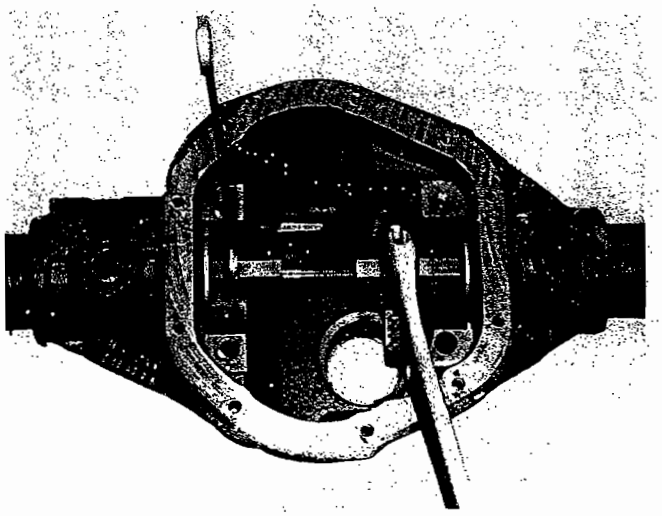


Figure 147 1009-147

Assemble inner axle shaft seals and guides. To assemble axle shaft guides and seals, use tools as described.

Tools—#D-112 Screw, #D-112-1 Adapter.

When assembling the seals make sure they are positioned straight and do not get cocked.

Turn forcing screw until it stops; seal will then be seated.

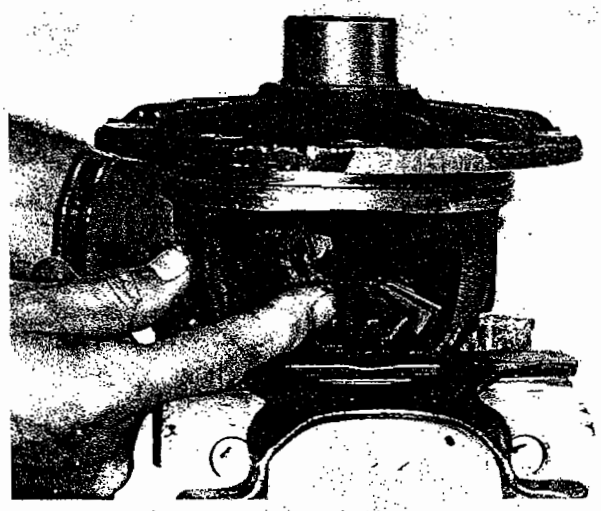


Figure 148 1009-148

Place differential case in vise as shown. Apply grease to new side gear thrust washers and hubs of side gear. Assemble both side gears. Apply grease to new pinion mate spherical washers and the pinion mate gears. Assemble pinion mate gears. An easy way to assemble the side gears and pinion mate gears is to have all parts lubricated before assembly. Assemble both side gears and thrust washers, hold them in place with hand, then assemble the pinion gears to hold the side gears in place.

Rotate the side gears until the holes of the washers and pinion gears line up with the holes of the case. If the gears cannot be rotated by hand, install one of the axle shafts into the side gear spline and use a pipe wrench to turn the shafts.

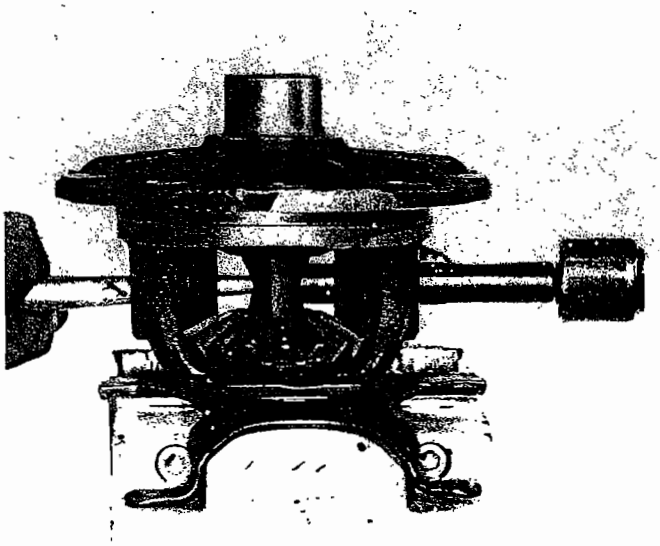


Figure 149 1009-149

If spacer block is used, assemble as shown. Use a drift to line holes of the gears up with the case. Assemble shaft, drive on shaft to remove drift. Be sure vertical lock pin hole is lined up with that of the case, and that the pinion mate spherical washers are in place and lined up with gear and case.

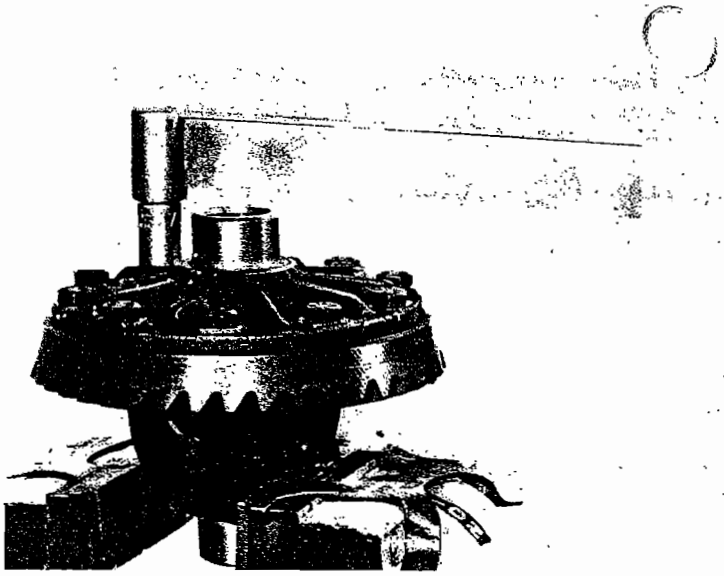


Figure 151 1009-151

Be sure flange face of the case is free of nicks or burrs. Assemble ring gear to case **using new ring gear screws.** Line up holes of gear and case. Draw up screws alternately and evenly.

Torque screws to 45-60 lbs. ft.

Tool—#C-524-A Torque wrench.

Figure 150 1009-150

Assemble lock pin. Peen metal of case over pin to lock in place.

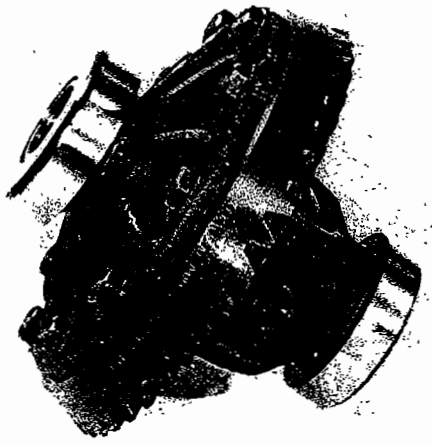


Figure 152 1009-152

Install master differential bearing onto case. Remove all nicks, burrs, dirt, etc., from hubs to allow master bearings to rotate freely.

Tool—#D-135 Master bearings.

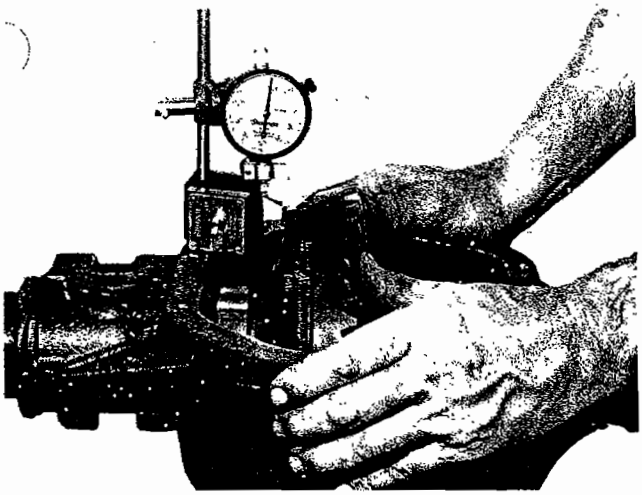


Figure 153 1009-153

Assemble differential case into carrier (less pinion). Mount dial indicator with a magnetic base as shown. Locate tip of indicator on flat surface of one of the gear screws. Mark screw with a piece of chalk. Force the differential assembly as far as possible in the direction towards the indicator. With force still applied, set indicator at zero (0).

Tool—#D-128 Indicator.

> **NOTE**
>
> Indicator should have a minimum of .200" travel.

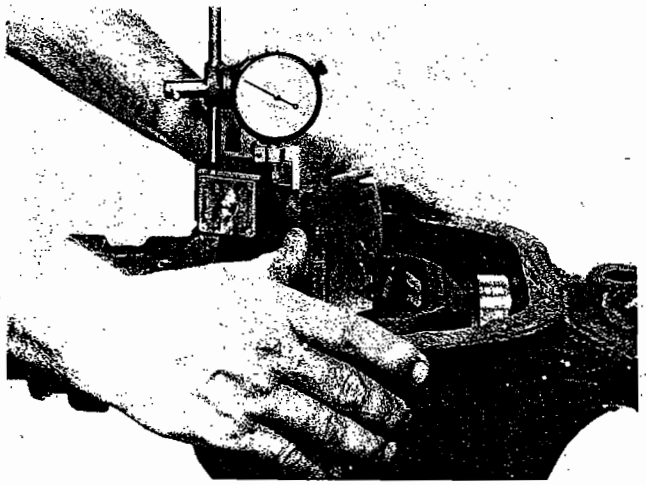


Figure 154 1009-154

Force the differential assembly as far as it will go in the opposite direction. Repeat these steps until the same reading is obtained.

Record the reading of the indicator.

This will be the total amount of shims required ess preload) and will be calculated later during sembly.

After making sure the readings are correct, remove indicator and differential assembly from housing. **Do not remove master bearings from differential case at this time.**

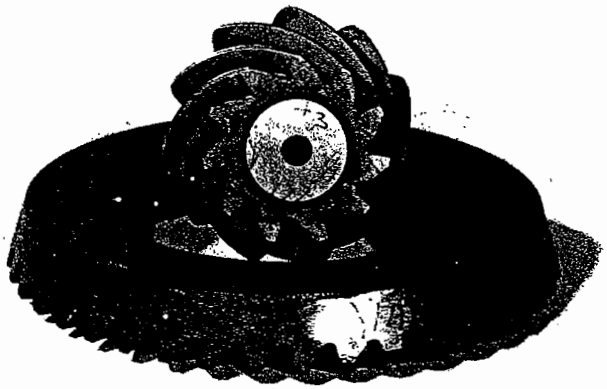


Figure 155 1009-155

View of ring and pinion set.

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring before proceeding with assembly.

The distance from the centerline of the ring gear to the button end of the pinion for the Model 44 (Front and Rear) axle is 2.625 inches.

On the button end of each pinion there is etched a plus (+) number, a minus (—) number, or a zero (0) number, which indicates the best running position for each particular gear set. This dimension is controlled by the shimming behind the inner bearing cup.

For example — if a pinion is etched +3, this pinion would require .003" less shims than a pinion etched "0". This means by removing shims, the mounting distance of the pinion is increased to 2.268" which is just what a +3 indicates. Our if a pinion is etched —3, we would want to add .003" more shims than would be required if the pinion were etched "0". By adding .003" shims the mounting distance of the pinion was decreased to 2.622" which is just what a —3 etching indicated.

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this same dimension. If a baffle is in the axle assembly, it is considered as part of the shim pack.

To change the pinion adjustment, shims are available in thicknesses of .003", .005", and .010".

> **NOTE**
>
> If baffle or slinger is bent or mutilated, it should be replaced.

Measure each shim separately with a micrometer and add together to get total shim pack thickness from original build up.

If a new gear set is being used, notice the (+) or (—) etching on both the old and new pinion and

adjust the thickness of the new shim pack to compensate for the difference of these two figures.

For example: If the old pinion reads (+) 2 and the new pinion is (—) 2, add .004" shims to the original shim pack.

The above procedures also apply to pinion adjustment on the front axle which includes the oil slinger between the inner bearing cone and pinion, and baffle between the inner bearing cup and carrier.

CARRIER SECTION

Old Pinion Marking	New Pinion Marking								
	−4	−3	−2	−1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003
0	+0.004	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004
−1	+0.003	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005
−2	+0.002	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006
−3	+0.001	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007
−4	0	−0.001	−0.002	−0.003	−0.004	−0.005	−0.006	−0.007	−0.008

Figure 156 1009-156

Pinion setting chart shown. Use this chart as a guideline to set pinion.

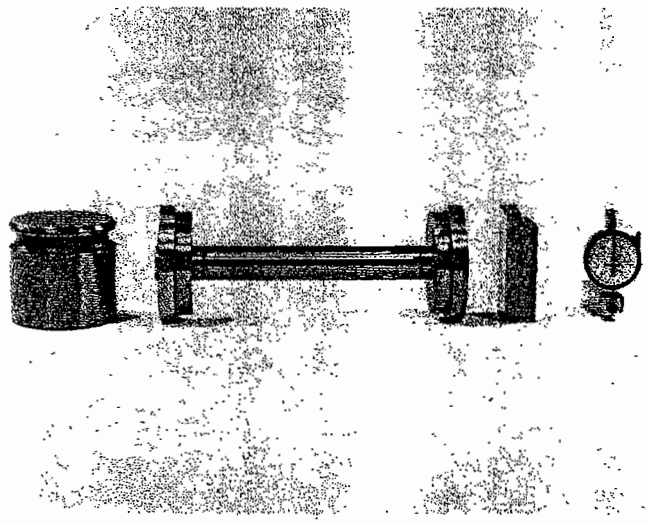


Figure 157 1009-157

View of master pinion block, pinion height block, scooter gage, cross arbor, and master bearing discs.

NOTE

Cross arbor and master bearing discs can be used on both the Model 30 and Model 44 axles. Use large diameter discs for Model 44 axle.

Be sure that all carrier bores are free from all nicks, dirt or any other contamination.

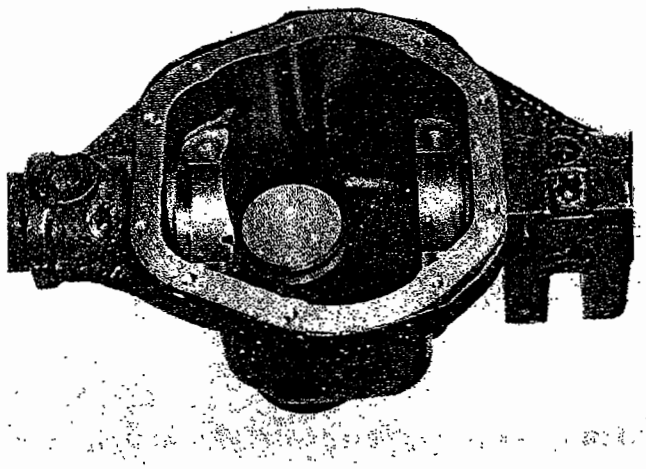


Figure 158 1009-158

Place the master pinion block into the pinion bore of the carrier as shown.

Tool—#D-139 Master pinion block.

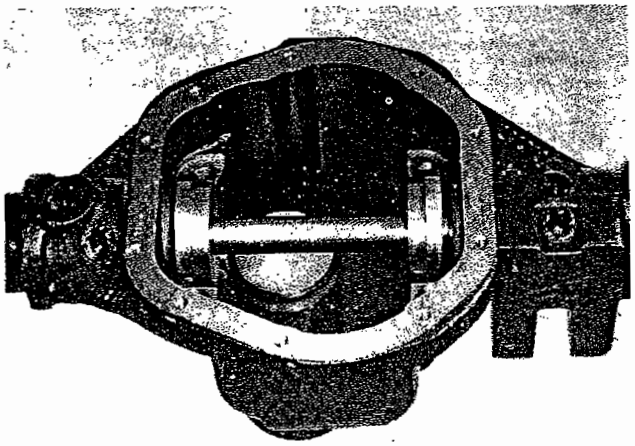
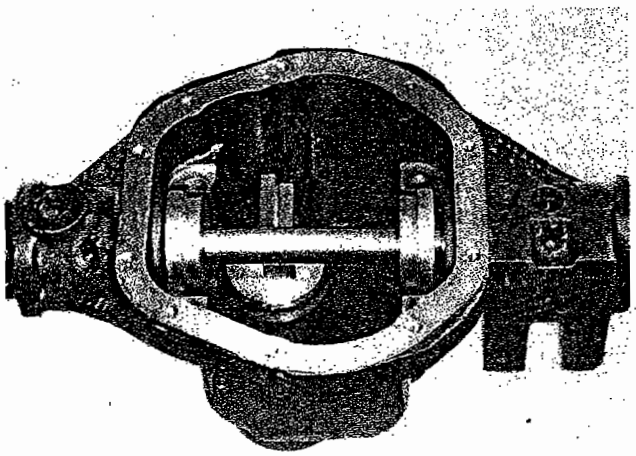


Figure 159 1009-159

Place arbor discs and arbor into cross bores of the carrier as shown.

Tools—#D-115-3 Arbor, #D-115-4 Arbor discs.



..gure 160 1009-160

Place pinion height block on top of master pinion block, and against arbor as shown.

Tool—#D-115-1 Pinion height block.

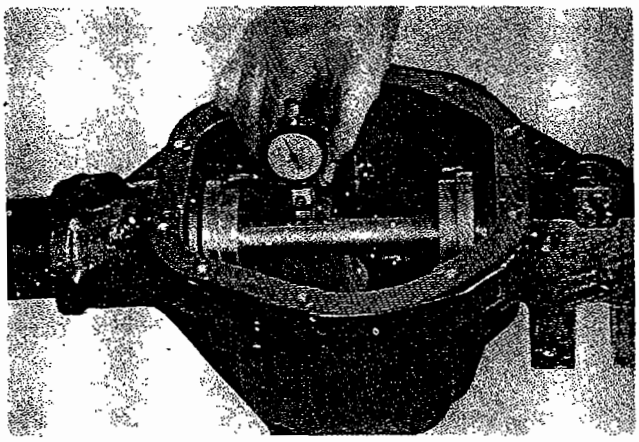


Figure 161 1009-161

Place scooter gage on small step of pinion height block. Apply pressure with fingers making sure the gage is flat on the pinion height block, while pressure is applied, set indicator at zero "0".

Tool—#D-115 Scooter gage.

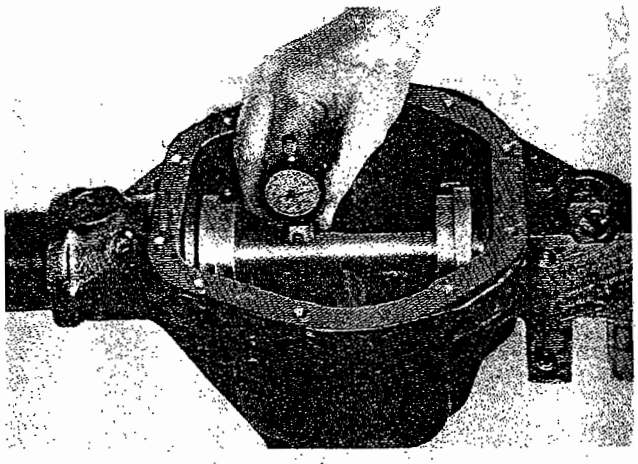


Figure 162 1009-162

Slide scooter gage over arbor. As gage slides over top of arbor, it will travel in a clockwise direction. When indicator is on center of arbor (on top), it will stop traveling in a clockwise direction. If indicator starts to travel in a counterclockwise direction, this means that you have passed the center (top) of the arbor. Record only the reading when the indicator is at the highest point. This reading indicates the amount of shims necessary to obtain the correct shim pack, plus (+) or minus (—) the etching on the bottom end of the pinion. If the etching is zero (0), the shim pack will remain unchanged.

For example: If a pinion is etched +3, this pinion would require .003" less shims than a pinion etched zero "0".

If a pinion is etched —3, we would want to add .003" more shims than would be required if the pinion were etched zero "0".

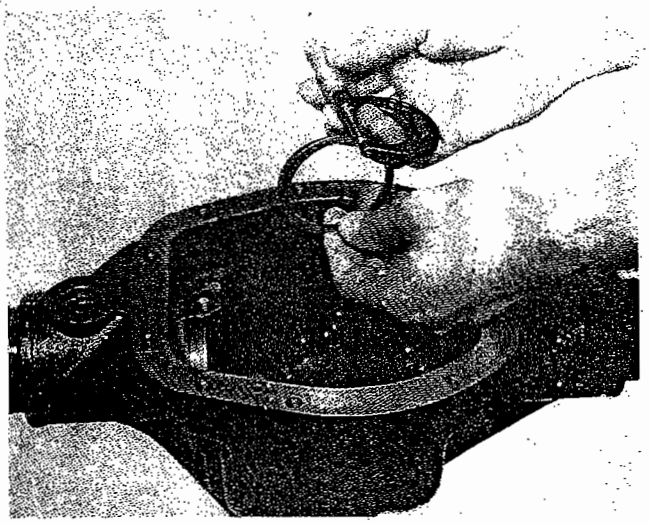


Figure 163 1009-163

Measure each shim separately with a micrometer and add together to get total shim pack thickness. If baffle is required, it is to be included in the shim pack. If slinger is used between the inner bearing cone and thrust face of pinion, the slinger is also to be measured and included as a part of the total shim pack.

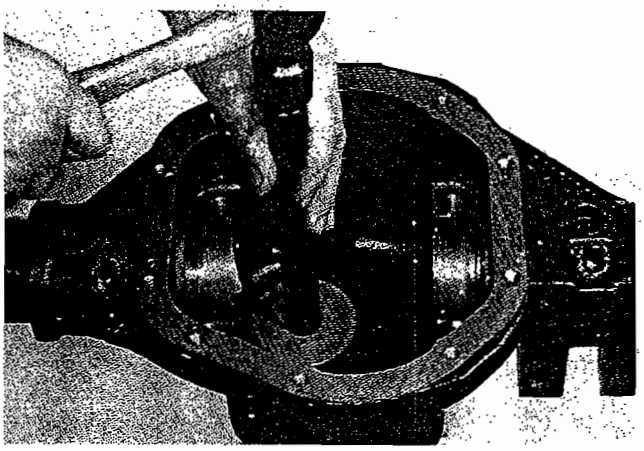


Figure 164 1009-164

Place the required amount of shims (and baffle if used) in the inner bearing bore; drive the inner bearing cup into carrier with tools as shown.

Tools—#D-145 Cup installer, #C-4171 Handle.

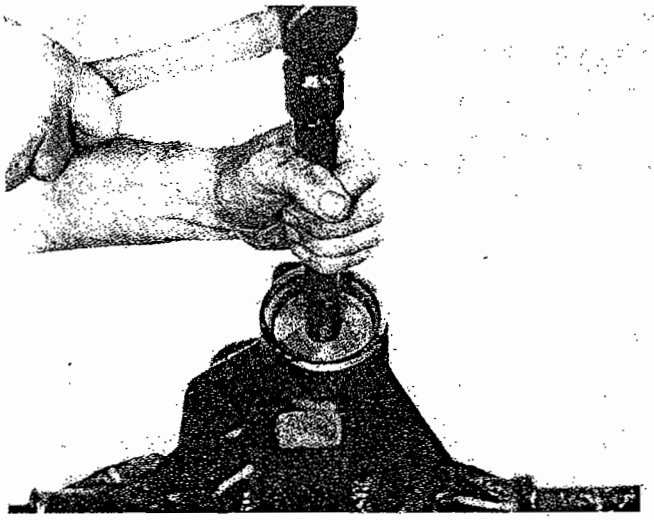


Figure 165 1009-165

Assemble the outer pinion bearing cup into carrier as shown.

Tools—#D-144 Cup installer, #C-4171 Handle.

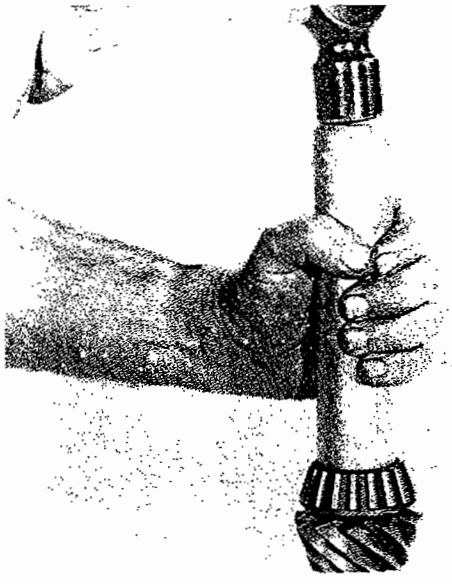


Figure 166 1009-166

Assemble inner bearing cone (and slinger if used) on pinion, place bearing installer over pinion shaft as shown. Drive bearing on shaft until it is completely seated.

Tool—#W-262.

Assemble preload shims (which were removed during disassembly) onto pinion. Assemble bearing cone, slinger.

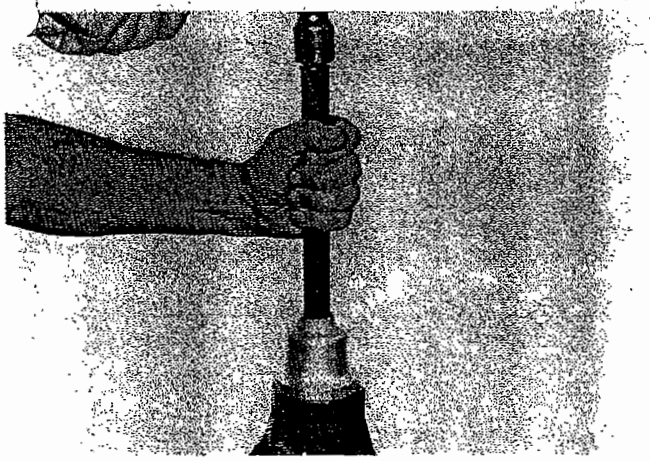


Figure 167 1009-170

Apply a light coat of hypoid lubricant to the lip of the pinion seal and assemble into housing.

Tools—#W-147D Seal installer, #C-4171 Handle.

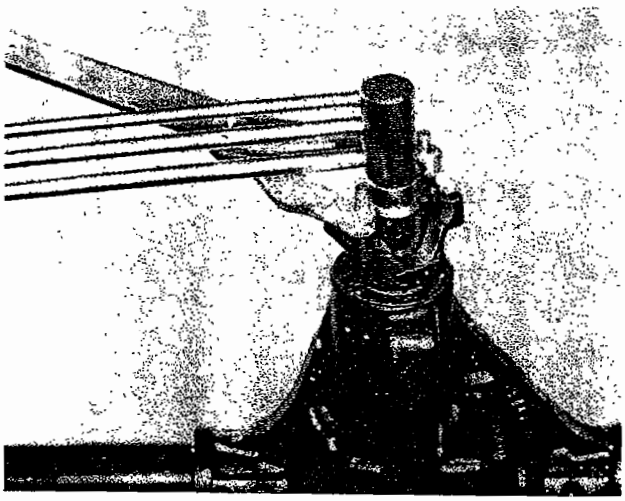


Figure 168 1009-171

ssemble end yoke, washer, and pinion nut. Torque nut to 200-220 lbs. ft.

Tools—#C-4053 Torque wrench, #C-3281 Yoke holder.

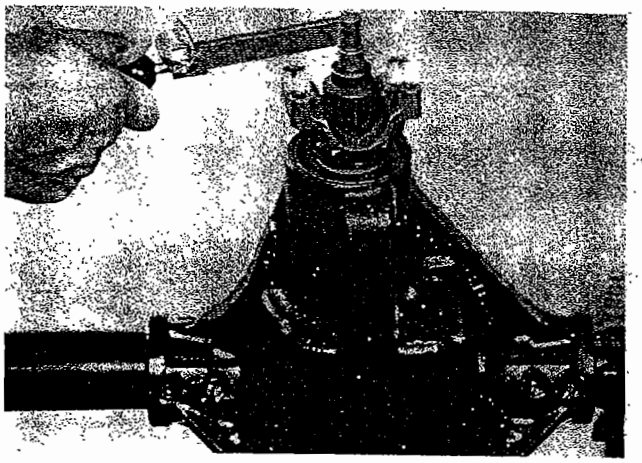


Figure 169 1009-172

Using an inch lb. torque wrench as shown, rotate pinion. Torque of pinion should read between 20-40 lbs. inch.

To increase preload, remove shims; to decrease preload, add shims.

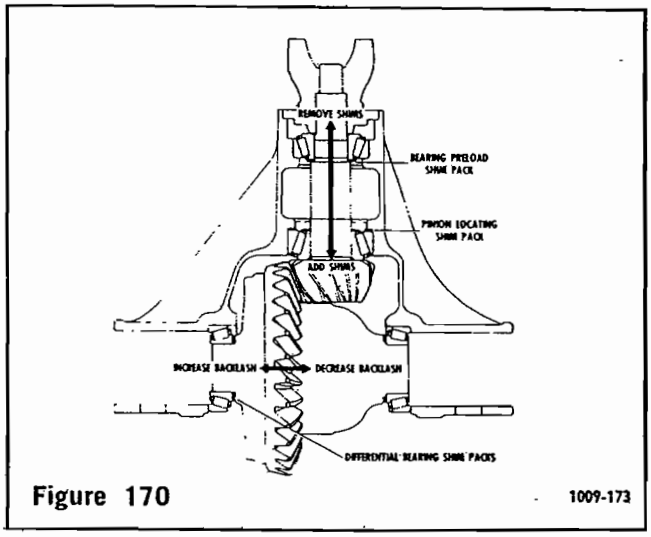


Figure 170 1009-173

L/D Carrier Section.

CARRIER SECTION

The illustration in Figure 1009-170 shows the arrow in the pinion pointing in two directions. The direction of the arrow pointing towards the end yoke indicates that by removing pinion locating shims, the distance from the center line of the axle to pinion button is increased giving a plus reading. The preload shim pack do not affect the pinion depth setting.

Arrows on the ring gear illustrate the method to increase or decrease backlash and differential bearing preload.

ASSEMBLY OF DIFFERENTIAL

Place differential assembly (with pinion assembled) into housing. Differential master bearings should still be installed to differential case.

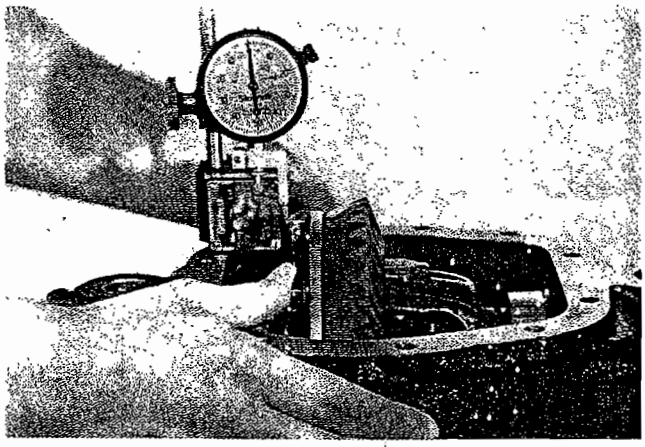


Figure 171 1009-174

Set up dial indicator as shown. Be sure to locate dial indicator on same ring gear screw as shown in Figure 171. Force ring gear to mesh with pinion gear. Rock ring gear to allow the teeth of the gears to mesh. With force still applied to the differential case, set indicator at zero "0".

Tool — #D-128 Indicator.

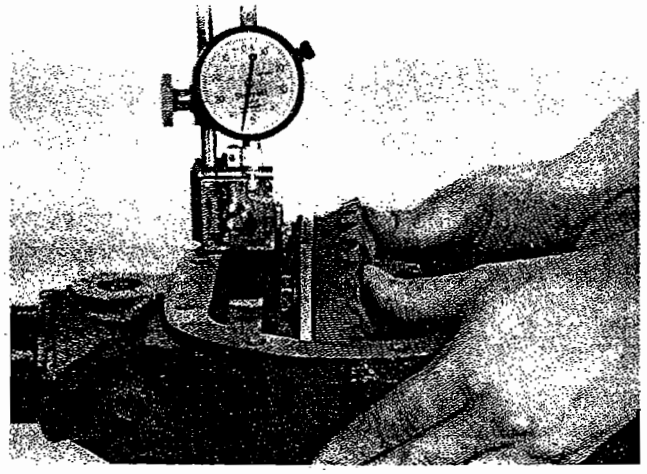


Figure 172 1009-175

Force the differential assembly (ring gear) away from the pinion gear to obtain an indicator reading. Repeat until the same reading is obtained each time. This reading will be the necessary amount of shims between the differential case and differential bearing on the ring gear side. Remove indicator and differential case from the carrier.

Remove master bearings from differential case.

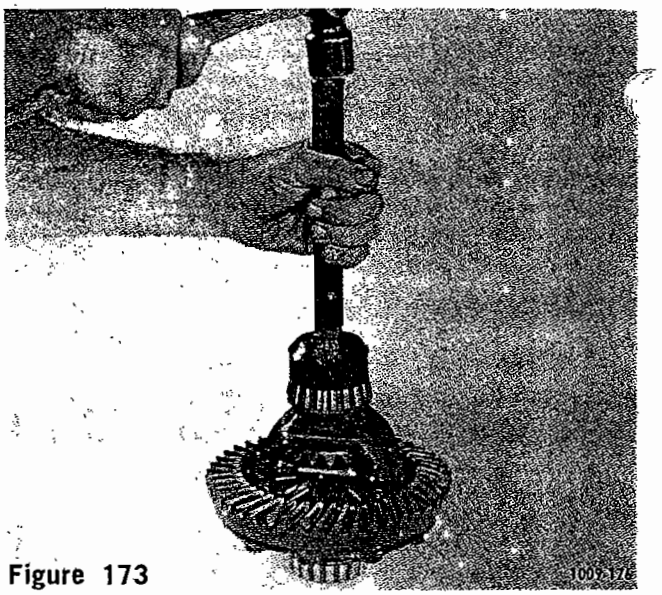


Figure 173 1009-176

Assemble the required amount of shims onto hub (ring gear side) as determined in Figure 172. Place bearing cone on hub of case. Use bearing installer to seat bearing cone as shown.

Tools — #D-156 Installer, #S-4171 Handle.

Assemble the remaining of the total shim pack which was determined in Figure 154 on the opposite side of the differential case. Add an additional .015 of shims on this side to compensate for differential bearing preload. Assemble differential bearing using the same tools as shown in Figure 173.

For example:

In Figure 154 (less pinion) a total of .085 indicator reading was recorded.

In Figure 172 (with pinion) a total of .055 indicator reading was recorded. This leaves a balance .030 of shims for the opposite side and adds up to the .085 which was first recorded.

Add an additional .015 shims on the opposite side for bearing preload and backlash.

Ring gear side — .055
Opposite side — .030
Opposite side preload — .015

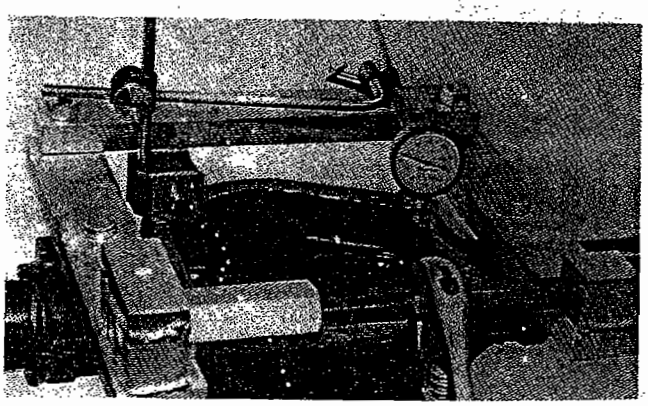


Figure 174 1009-177

Install spreader and indicator to carrier as shown. **Do not spread carrier over .015".**

Remove indicator.

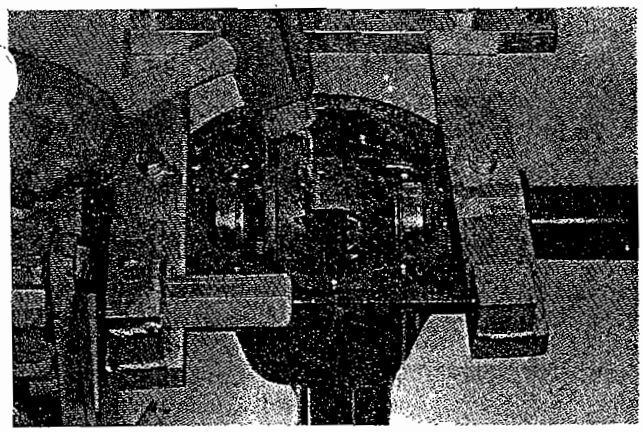


Figure 175 1009-178

Assemble differential bearing cups to differential bearing cones.

Install differential assembly into carrier.

Use a rawhide hammer to seat differential assembly into cross bore of carrier. Care should be taken to avoid nicking the teeth of the ring gear and pinion during assembly.

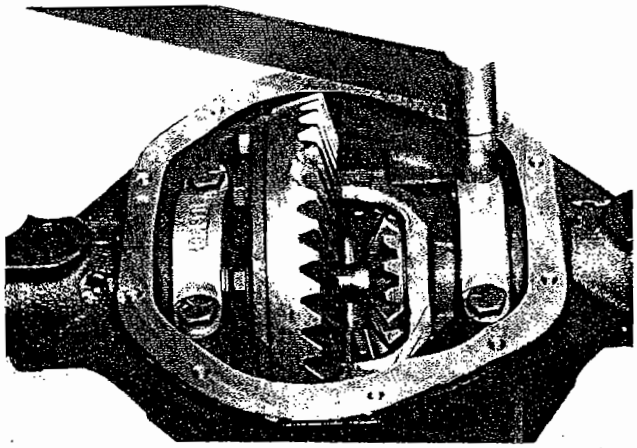


Figure 176 1009-179

Install bearing caps. Make sure the letters stamped on the caps correspond with those on the carrier; torque bearing cap screws to 70-90 lbs. ft.

Tool—#C-524-A Torque wrench.

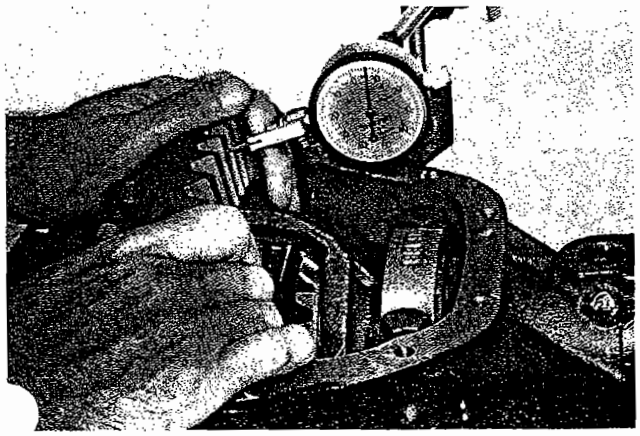


Figure 177 1009-180

Check ring gear and pinion backlash in three equally spaced points with dial indicator as shown.

Backlash tolerance is .005 to .008 and cannot vary more than .002 between points checked.

High backlash is corrected by moving the ring gear closer to the pinion.

Low backlash is corrected by moving the ring gear away from the pinion.

These corrections are made by switching shims from one side of the differential case to the other.

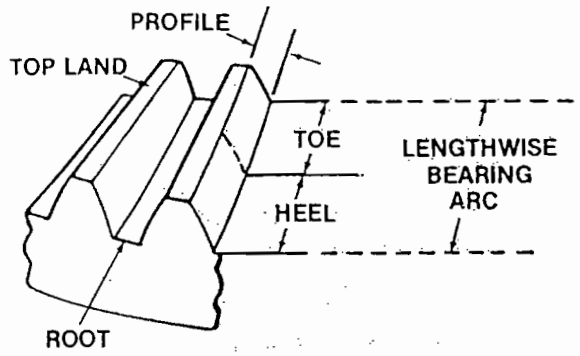
If backlash is to specification, check ring gear and pinion tooth contact pattern as follows and adjust accordingly.

RING GEAR & PINION TOOTH PATTERN INTERPRETATION

When setting the pinion position, many of the previous service manuals required a final pinion position check by using gauges that verified the dimension from the center line of the differential carrier (center line of ring gear) to the face of the pinion (button).

This surface (button) is not used on all new gears for verifying the pinion position. The service tools will be used to establish the proper amount of shims required prior to installing the pinion gear. The final pinion position will be verified by using the GEAR CONTACT PATTERN METHOD, as described below.

RING GEAR AND PINION TOOTH CONTACT PATTERN



RING GEAR TOOTH

The TOE of the gear tooth is the portion of the tooth surface at the end towards the center. The HEEL of the gear tooth is the portion of the tooth surface at the outer end. The TOP LAND of a gear tooth is the surface of the top of the tooth. Every gear has a characteristic pattern. The illustrations show typical patterns only, and explains how patterns shift as gear location is changed. When making pinion position changes, shims should be changed in the range of .002 inch (.05 mm) to .004 inch (.10 mm) until correct pattern has been obtained.

When a change in backlash is required, backlash shims should be changed in the range of 1½ times the amount of backlash required to bring the gears into specification. For example, if the backlash needed to be changed by .004 inch (.10 mm), the shim pack should be changed by .006 inch (.15 mm) as a starting point. The actual amount of backlash change obtained will vary depending upon the ratio and gear size.

High backlash is corrected by moving the ring gear closer to the pinion. Low backlash is corrected by moving the ring gear away from the pinion. These corrections are made by switching shims from one side of the differential case to the other.

NOTE

When making changes, note that two variables are involved. Example: If you have the backlash set correctly to specifications and you change the pinion position shim, you may have to readjust the backlash to the correct specification before checking the pattern. Refer to pattern interpretation.

WARNING: Gear teeth may have sharp edges. When handling gears, use care to avoid personal injury.

STEPS

(1) Paint ring gear teeth with a marking compound to both the drive and coast side.
(2) Rotate ring gear one complete revolution in both directions while load is being applied with a large screwdriver or similar tool between the carrier casting and differential case flange.

PATTERN INTERPRETATION (RING GEAR)

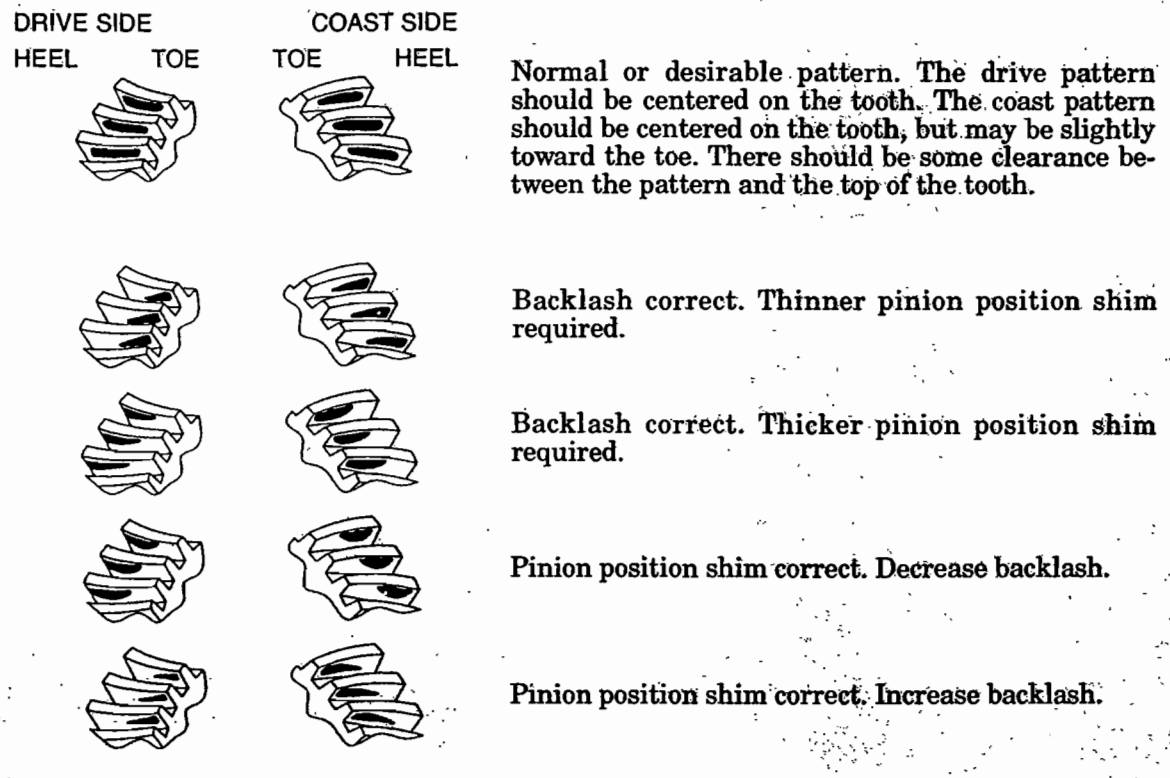


Figure 178

PATTERN MOVEMENTS SUMMARIZED

(1) Decreasing backlash moves the ring gear closer to the pinion.
Drive pattern (convex side of gear) moves slightly lower and toward the toe.
Coast pattern (concave side of gear) moves lower and toward the toe.

(2) Increasing backlash moves the ring gear away from the pinion.
Drive pattern moves slightly higher and toward the heel.
Coast pattern moves higher and towards the heel.

(3) Thicker pinion position shim with the backlash constant moves the pinion closer to the ring gear.
Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.
Coast pattern moves deeper on the tooth and toward the heel.

(4) Thinner pinion position shim with the backlash constant moves the pinion further from the ring gear.
Drive pattern moves toward the top of the tooth (face contact) and toward the heel.
Coast pattern moves toward the top of the tooth and slightly toward the toe.

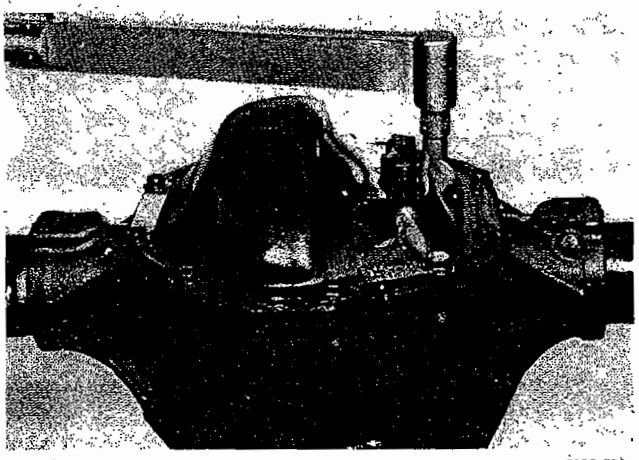


Figure 179 1009-181

Install new cover gasket and install cover plate. Torque screws to 30-40 lbs. ft.
Tool—#C-524-A Torque wrench.

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Chapter 6 Tab

DEUTZ ENGINE PACK
OPTION #302642

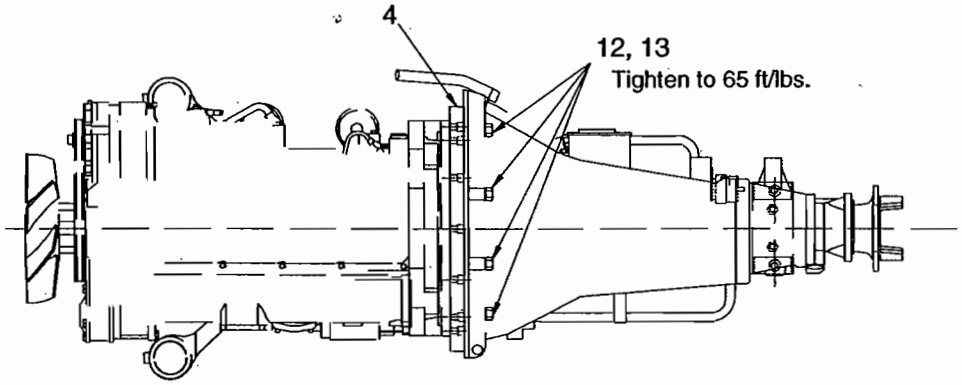
Effective on

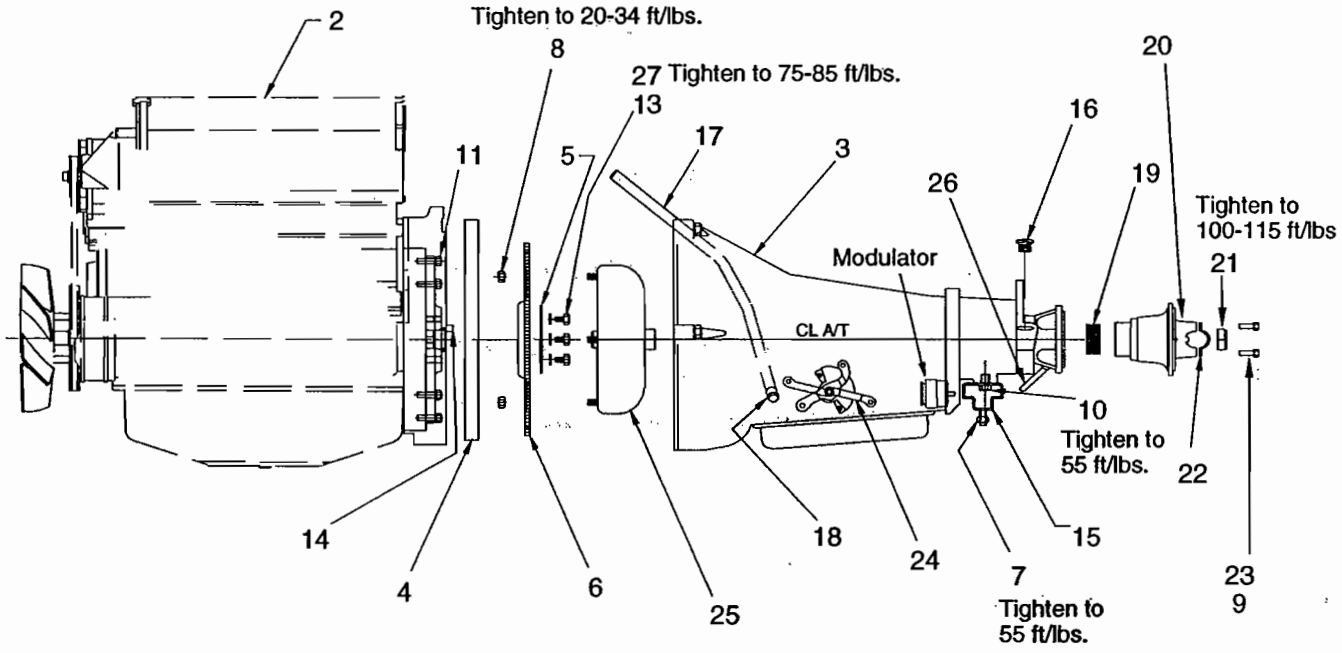
TLPH-310: SER. #170 AND ON

TML-704: SER. #183 AND ON

TC-888: SER. #458 AND ON

FIGURE 1
ENGINE / TRANSMISSION ASSEMBLY





INSTALLATION INSTRUCTIONS FOR MODULATOR MODIFICATION

1. Remove modulator valve retaining bolt and bracket.
2. Pull out modulator valve and pin.
3. Dispose of pin.
4. Reinstall modulator valve and bracket.

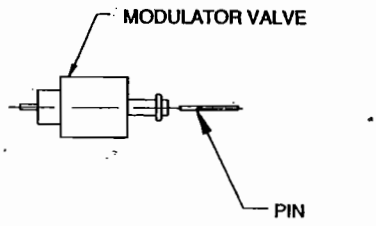


FIGURE 1
ENGINE / TRANSMISSION ASSEMBLY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		301707		Engine/Transmission Assembly		Ref
2		302642	F4M1011F	Engine, Deutz Oil-Cooled Diesel		1
3		300326		Transmission, C-6		1
4				Transmission Adaptor (Provided w/engine)		Ref
5				Support Ring (Provided w/engine)		Ref
6				Flex Plate (Provided w/engine)		Ref
7		Comm		Nut, Lock, 7/16 x 20 (Provided w/engine)		Ref
8		Comm		Nut, 3/8-24 (Provided w/engine)		Ref
9		Comm		Washer, Lock, 5/16		Ref
10		Comm		HHCS, 7/16-14 x 1.25		Ref
11		Comm		SHCS, M10 x 25mm (Provided w/engine)		Ref
12		Comm		Bolt, Shoulder, 7/16-14 x 2.25		Ref
13		Comm		Washer, Lock, 7/16		Ref
14		3.2269		Pin, Dowel, 1/2 Dia. x 1.00		Ref
15		1.7880	EITZ-6068A	Isolator, Transmission Support (V26377)		Ref
16			C8HZ-7A002A	Plug, Speedometer Cable (V26377)		Ref
17			E0TZ-7A228A	Tube, Dipstick (V26377)		Ref
18		Comm		O-Ring, 9/16 x 0.103		Ref
19			D3TZ-17285A	Gear, Speedometer Drive (V26377)		Ref
20			D3TZ-7089B	Yoke, Universal Joint (V26377)		Ref
21		Comm		Nut, Lock, 1-20		Ref
22			C6TZ-4A254B	Cap, Universal Joint		Ref
23		Comm		HHCS, 5/16-24 x 1.00		Ref
24				Kickdown Arm		Ref
25				Torque Converter		Ref
26			2A701-AA	Tube, Vent (V26377)		Ref
27		Comm		HHCS, 7/16-20 x 0.75, Gr. 8		Ref

Instructions for Assembling the Transmission to the Engine

Ref Figure 1

1. Install flex plate (16) and support ring (5) on engine using hex head bolts (27).
2. Install dowel pins (14) in adapter plate (4).
3. Align torque converter studs with corresponding holes in flex plate (6). At the same time, align transmission to the dowel pins and secure to the adapter plate (4) using supplied bolts (12) and lockwashers (13).
4. Install nuts (8) to torque converter studs after transmission is securely bolted to engine. Access studs through inspection hole in flywheel housing.
5. Install speedometer gear (19) on shaft.
6. Install universal joint yoke (20) on shaft and secure using nut (21).
7. Install speedometer cable access plug (16) in hole as shown.
8. Remove kickdown arm (24) and reinstall 180-degrees from original position.
9. Paint dipstick tube (17) black–outside only.
10. Place O-ring (18) on grooved end of dip stick tube (17).
11. Remove plastic plug and firmly insert tube (17) in hole until seated.
12. Install vent tube (26). Do not overtighten!
13. Paint the steel part of the tail housing black.

SUBASSEMBLY SPECIFICATIONS

Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff
	302642	FM 0411-024/ 02	Specification	
		2200-0240	Closing Parts, W/O Air Compressor	
		2200-1417	Engine Mounts, Flex "50" Front Only	
		2200-0635	Manifold, Exhaust, Center Down	
		2200-0645	Exhaust Flange	
		2200-0942	Factory Test Run	
		2200-1724	Fuel Filter, with Water Drain	
		2200-0311	Solenoid, Shutdown, 12V	
		2200-1595	Alternator, 14V, 55 amp	
		2200-1771	Flywheel, SAE 8/10	
		2200-1738	Starter, 12V, 2.2 KW	
		2200-1905	Starting Aid (Glow coil in manifold) with Relay	
		2200-1214	Pump, Hydraulic, 11 CC w/Drive parts	
		2200-0933	Fan, 290 mm	
		2200-0537	Drive Hub, Fan, Front PTO	
		2200-2077	Filter, Lube Oil, Vertical Mount w/Cartridge	
		2200-1810	Dipstick, Extended	
		2200-1007	3" Slipover Hose Connector, Intake Manifold	
		2200-2075	W/O Wiring Harness	
		2200-1673	Switch, Oil Overtemp. Shutdown, 130 deg. C.	
		2200-1804	W/O Speed Control Assy., W/O Counterplate	
		2200-1680	Governor, 3000 RPM, 5% droop	
		2200-1944	Timing Belt Cover for Pump Mount	
		999-0231	Oil Cooler (without hoses and attachments)	
		999-0230	Transmission Adapter	

To obtain replacement engine parts, call Wollard Airport Equipment Co. or your local Deutz dealer.

FIGURE 2
ENGINE PACKAGE -- DEUTZ

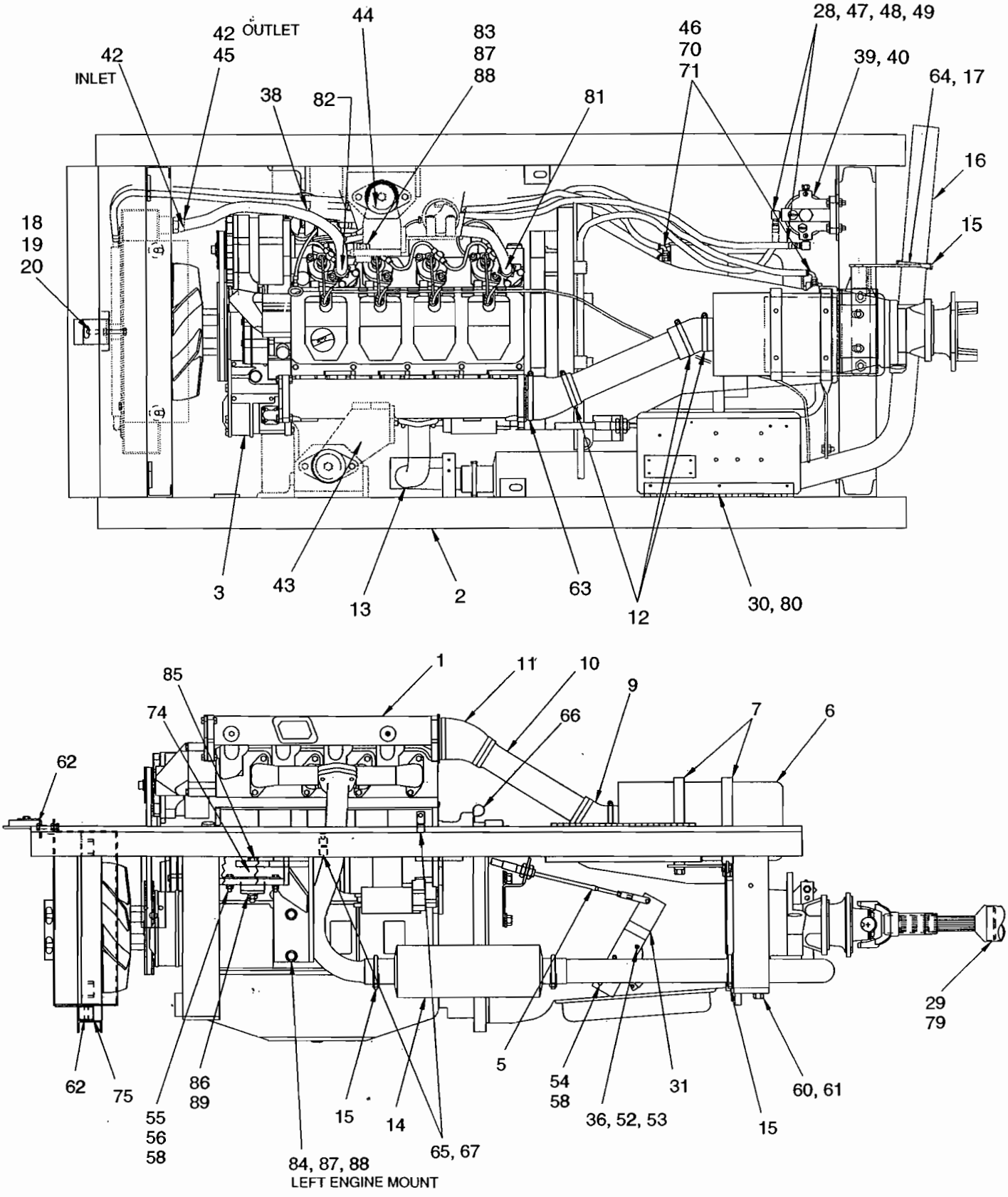
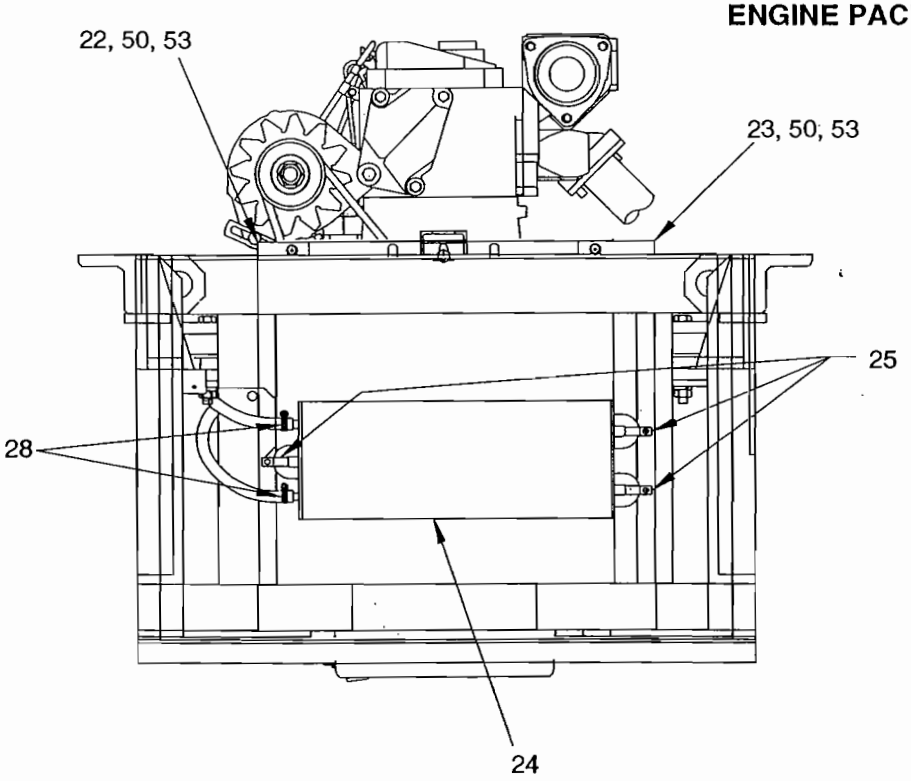


FIGURE 2
ENGINE PACKAGE–DEUTZ



Optional: Sump Heater, P/N 301144

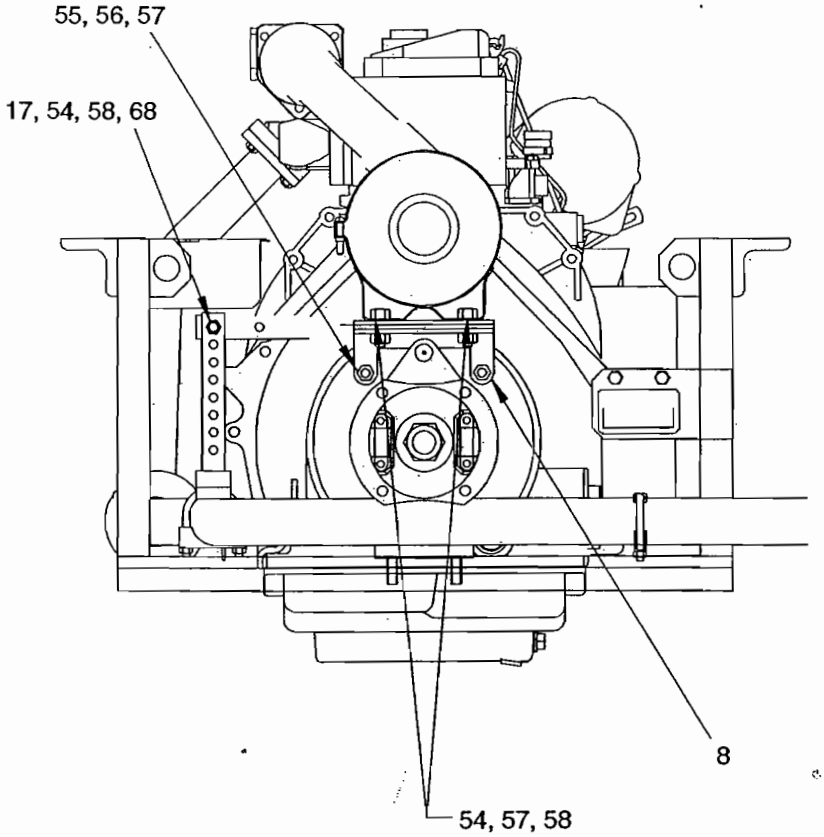
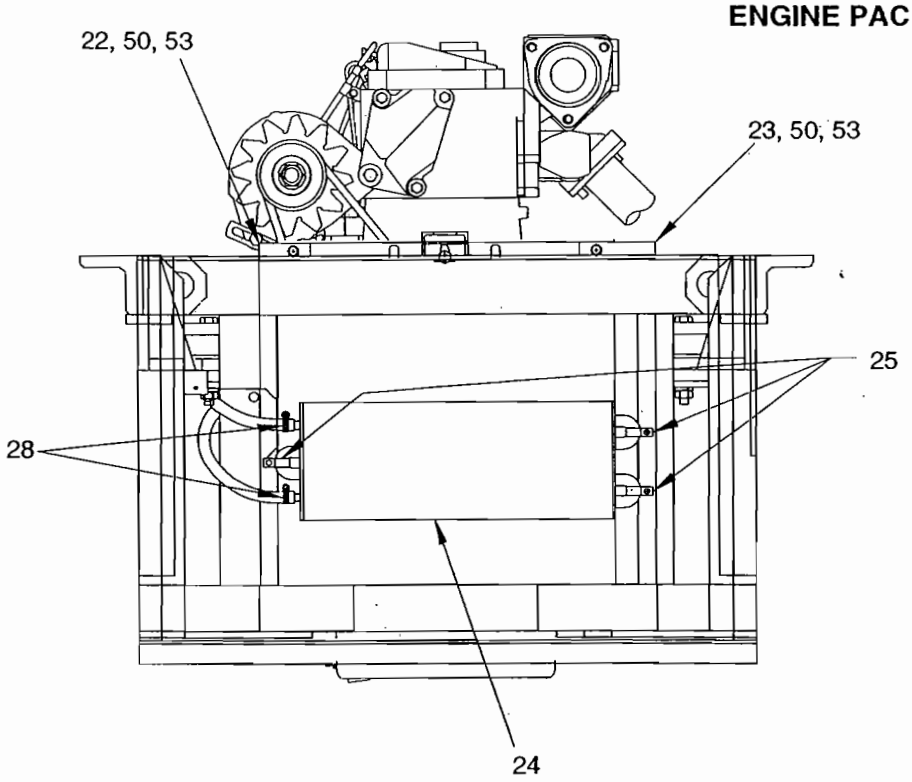


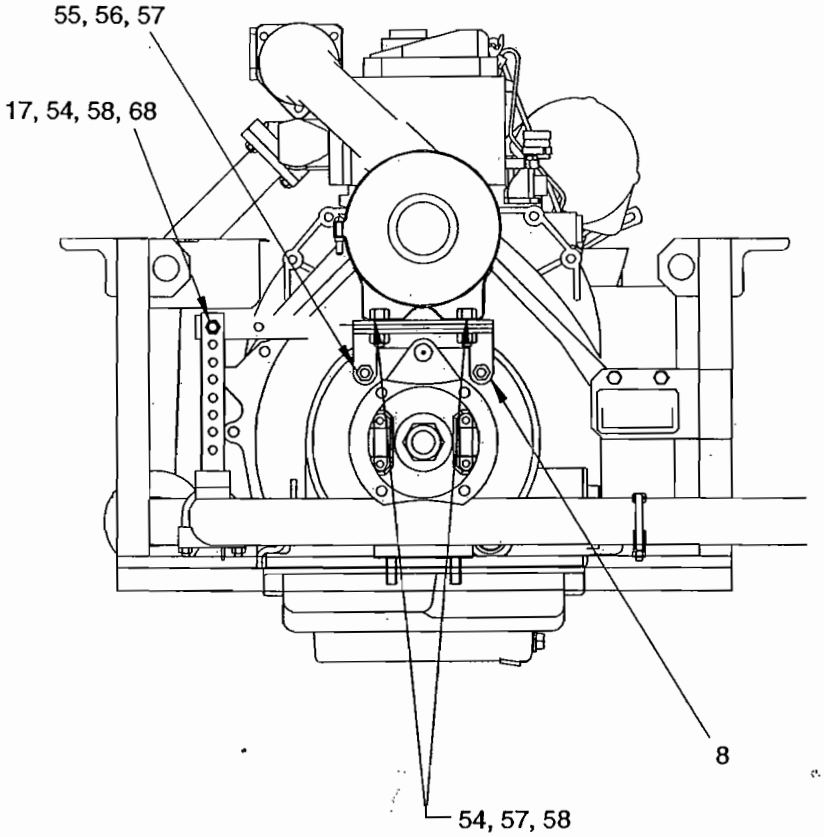
FIGURE 2
ENGINE PACKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		302642		Deutz Diesel Power Package		Ref
1		301707		Deutz Engine/transmission Assembly (See Figure 1)		1
2		302629		Frame, Engine		1
3		301711		Deutz Engine Hydraulic Package (See Figure 5)		1
4		301280		Engine Electrical Package (See Figure 3)		1
5		301282 302857		Engine Linkage (Fig. 6A) (Thru ser. #457) Engine Linkage (Fig. 6B) (Ser. #458 and on)		1 1
6		1.6691 300470	FWG065008 P181052	Filter, Air (V18265) Element, Air Filter (V18265)		1 Ref
7		1.7304	P00-7191	Band, Air Filter (V18265)		2
8		301287		Bracket, Filter Support		1
9		NW36784		Elbow		1
10		3.3307		Tube, Adapter		1
11		3.3306		Reducer		1
12		3.1091	Comm	Clamp, Hose, 2-1/4		3
13		301900		Pipe, Exhaust		1
14		301483	M045237	Muffler (V18265)		1
15		1.5494	Comm	Clamp, Exhaust		4
16		301906		Pipe, Tail		1
17		302273		Hanger, Exhaust		2
18		300843		Support, Front Cooling		1
19		Comm		HHCS, 5/16-18 x 0.50		6
20		Comm		Washer, Lock, 5/16		1
21				NOT USED		
22		302233		Bracket, Cooler, Passenger Side		1
23		302234		Bracket, Cooler, Driver Side		1
24		1.8780	1.4819	Oil Cooler, Transmission (NAPA)		1
25		3.1076	Comm	Clamp, 5/8"		4
26		Comm		Nut, Nylock, 10-32		3
27				NOT USED		
28		3.2624	Comm	Clamp, Hose, 5/8"		7
29		301095		Driveshaft (See Figure 7)		1
30		20104		Panel, Electrical		Ref
31		300706		Lever, Transmission Shift		1
32		560A89		Placard, Diesel Fuel		1
33		562A296		Placard, Check Filter		1
34				NOT USED		

FIGURE 2
ENGINE PACKAGE–DEUTZ



Optional: Sump Heater, P/N 301144



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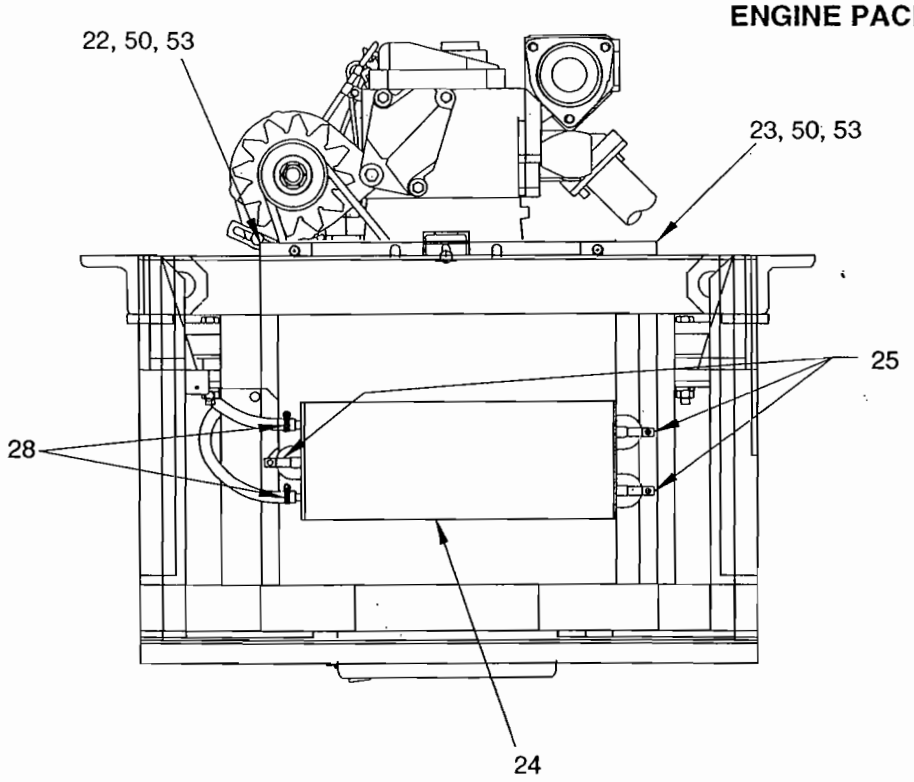
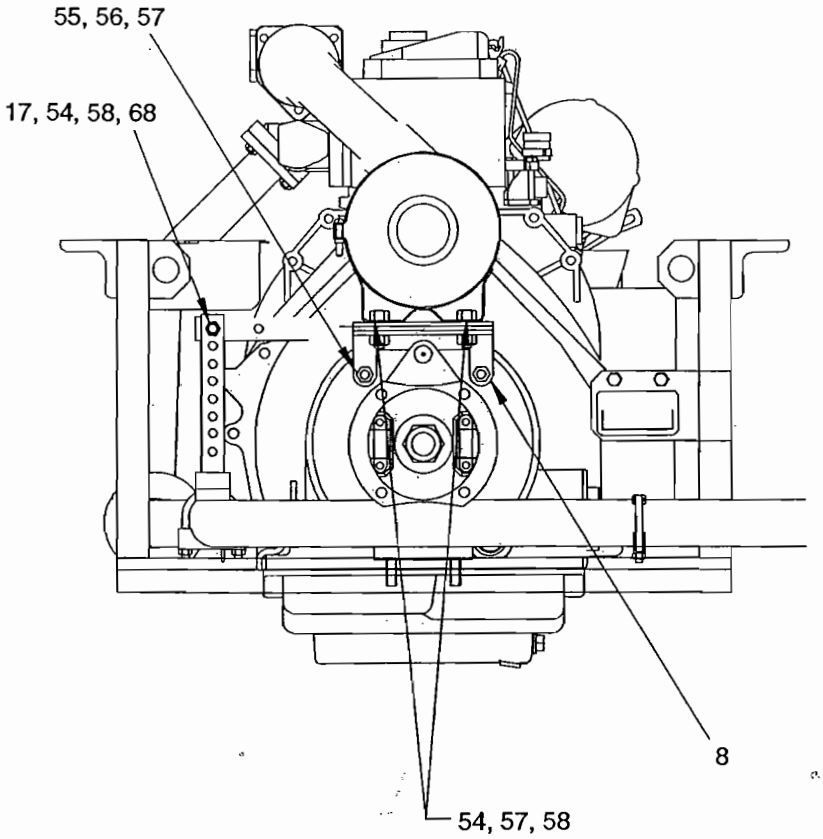
2		302629		Frame, Engine		1
3		301711		Deutz Engine Hydraulic Package (See Figure 5)		1
4		301280		Engine Electrical Package (See Figure 3)		1
5		301282 302857		Engine Linkage (Fig. 6A) (Thru ser. #457) Engine Linkage (Fig. 6B) (Ser. #458 and on)		1 1
6		1.6691 300470	FWG065008 P181052	Filter, Air (V18265) Element, Air Filter (V18265)		1 Ref
7		1.7304	P00-7191	Band, Air Filter (V18265)		2
8		301287		Bracket, Filter Support		1
9		NW36784		Elbow		1
10		3.3307		Tube, Adapter		1
11		3.3306		Reducer		1
12		3.1091	Comm	Clamp, Hose, 2-1/4		3
13		301900		Pipe, Exhaust		1
14		301483	M045237	Muffler (V18265)		1
15		1.5494	Comm	Clamp, Exhaust		4
16		301906		Pipe, Tail		1
17		302273		Hanger, Exhaust		2
18		300843		Support, Front Cooling		1
19		Comm		HHCS, 5/16-18 x 0.50		6
20		Comm		Washer, Lock, 5/16		1
21				NOT USED		
22		302233		Bracket, Cooler, Passenger Side		1
23		302234		Bracket, Cooler, Driver Side		1
24		1.8780	1.4819	Oil Cooler, Transmission (NAPA)		1
25		3.1076	Comm	Clamp, 5/8"		4
26		Comm		Nut, Nylock, 10-32		3
27				NOT USED		
28		3.2624	Comm	Clamp, Hose, 5/8"		7
29		301095		Driveshaft (See Figure 7)		1
30		20104		Panel, Electrical		Ref
31		300706		Lever, Transmission Shift		1
32		560A89		Placard, Diesel Fuel		1
33		562A296		Placard, Check Filter		1
34				NOT USED		

FIGURE 2
ENGINE PACKAGE–DEUTZ



Optional: Sump Heater, P/N 301144



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5		301282 302857		Engine Linkage (Fig. 6A) (Thru ser. #457) Engine Linkage (Fig. 6B) (Ser. #458 and on)		1 1
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7		1.7304	P00-7191	Band, Air Filter (V18265)		2
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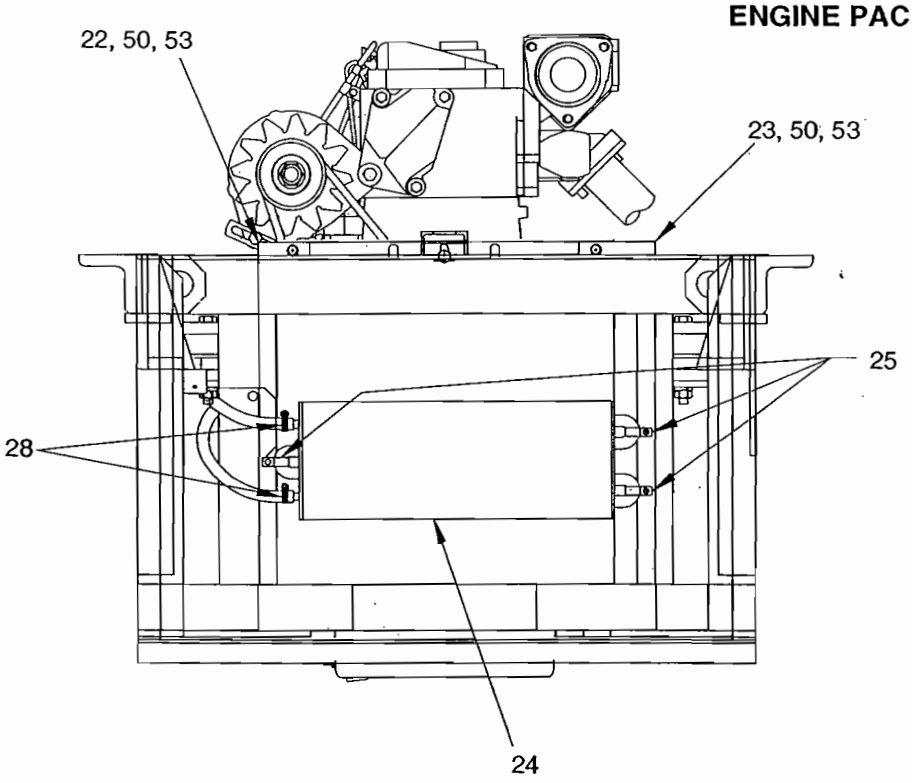
9		NW36784		Elbow		1
10		3.3307		Tube, Adapter		1
11		3.3306		Reducer		1
12		3.1091	Comm	Clamp, Hose, 2-1/4		3
13		301900		Pipe, Exhaust		1
14		301483	M045237	Muffler (V18265)		1
15		1.5494	Comm	Clamp, Exhaust		4
16		301906		Pipe, Tail		1
17		302273		Hanger, Exhaust		2
18		300843		Support, Front Cooling		1
19		Comm		HHCS, 5/16-18 x 0.50		6
20		Comm		Washer, Lock, 5/16		1
21				NOT USED		
22		302233		Bracket, Cooler, Passenger Side		1
23		302234		Bracket, Cooler, Driver Side		1
24		1.8780	1.4819	Oil Cooler, Transmission (NAPA)		1
25		3.1076	Comm	Clamp, 5/8"		4
26		Comm		Nut, Nylock, 10-32		3
27				NOT USED		
28		3.2624	Comm	Clamp, Hose, 5/8"		7
29		301095		Driveshaft (See Figure 7)		1
30		20104		Panel, Electrical		Ref
31		300706		Lever, Transmission Shift		1
32		560A89		Placard, Diesel Fuel		1
33		562A296		Placard, Check Filter		1
34				NOT USED		

FIGURE 2
ENGINE PACKAGE–DEUTZ



Optional: Sump Heater, P/N 301144

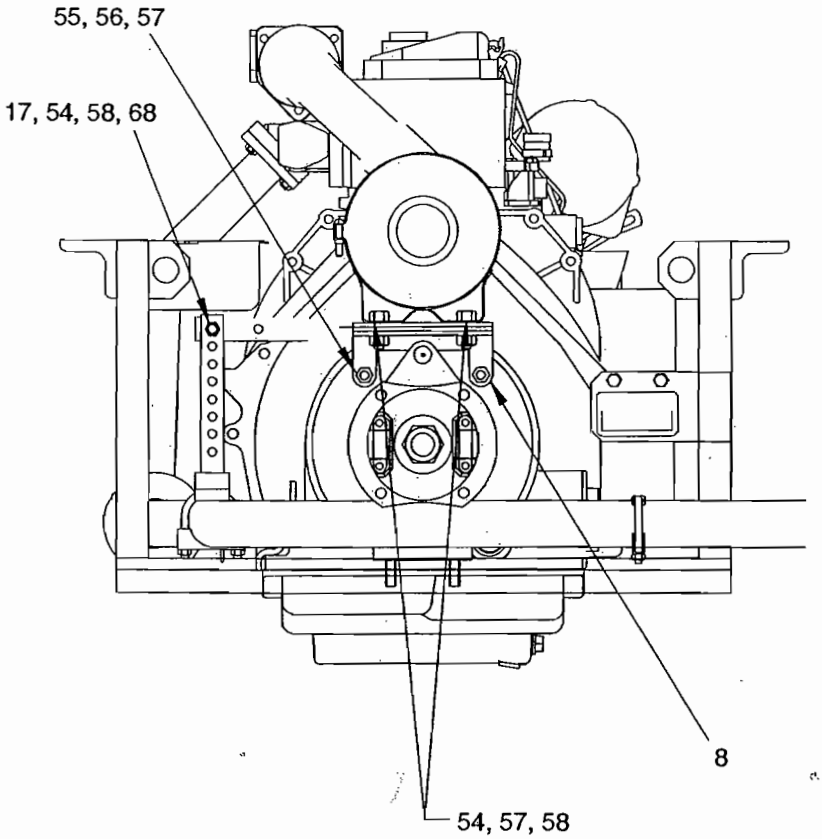


FIGURE 2
ENGINE PACKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		302642		Deutz Diesel Power Package		Ref
1		301707		Deutz Engine/transmission Assembly (See Figure 1)		1
2		302629		Frame, Engine		1
3		301711		Deutz Engine Hydraulic Package (See Figure 5)		1
4		301280		Engine Electrical Package (See Figure 3)		1
5		301282 302857		Engine Linkage (Fig. 6A) (Thru ser. #457) Engine Linkage (Fig. 6B) (Ser. #458 and on)		1 1
6		1.6691 300470	FWG065008 P181052	Filter, Air (V18265) Element, Air Filter (V18265)		1 Ref
7		1.7304	P00-7191	Band, Air Filter (V18265)		2
8		301287		Bracket, Filter Support		1
9		NW36784		Elbow		1
10		3.3307		Tube, Adapter		1
11		3.3306		Reducer		1
12		3.1091	Comm	Clamp, Hose, 2-1/4		3
13		301900		Pipe, Exhaust		1
14		301483	M045237	Muffler (V18265)		1
15		1.5494	Comm	Clamp, Exhaust		4
16		301906		Pipe, Tail		1
17		302273		Hanger, Exhaust		2
18		300843		Support, Front Cooling		1
19		Comm		HHCS, 5/16-18 x 0.50		6
20		Comm		Washer, Lock, 5/16		1
21				NOT USED		
22		302233		Bracket, Cooler, Passenger Side		1
23		302234		Bracket, Cooler, Driver Side		1
24		1.8780	1.4819	Oil Cooler, Transmission (NAPA)		1
25		3.1076	Comm	Clamp, 5/8"		4
26		Comm		Nut, Nylock, 10-32		3
27				NOT USED		
28		3.2624	Comm	Clamp, Hose, 5/8"		7
29		301095		Driveshaft (See Figure 7)		1
30		20104		Panel, Electrical		Ref
31		300706		Lever, Transmission Shift		1
32		560A89		Placard, Diesel Fuel		1
33		562A296		Placard, Check Filter		1
34				NOT USED		

FIGURE 2
ENGINE PACKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
35		1.8169	RX 300	Biocide, 10 oz. (V55752) (not installed)		Ref
36		38648		Spacer		1
37		2.3366	Comm	Conduit, Flexguard, 1/2"		23"
38		37433	Comm	Clamp, Insulated, 1-1/2"		1
39		1.8166 302150	230R30 R20	Filter, Fuel (V55752) Element, Fuel Filter (V55752)		1 Ref
40		Comm	5/16	Plug (V55752)		Ref
41				NOT USED		
42		3.2839	202702T-12-12S	Adapter (V01276)		2
43		302643		Mount, Engine, LH		1
44		302648		Mount, Engine, RH		1
45		3.2159	2071T-12-12S	Elbow		1
46		9.2066	FC332-06	Hose (V01276)		120"
47		9.1601	Comm	Hose, Fuel, 5/16 ID		192"
48		1.7917		Hose, End		2
49		3.3053		Elbow, 90-deg.		2
50		Comm		HHCS, 5/16-18 x 0.75		4
51		Comm		HHCS, 5/16-18 x 1.00		5
52		Comm		HHCS, 5/16-18 x 2.50		1
53		Comm		Nut, Lock, 5/16-18		10
54		Comm		HHCS, 3/8-16 x 1.00		8
55		Comm		HHCS, 3/8-16 x 1.25		6
56		Comm		Washer, Lock, 3/8		6
57		Comm		Washer, Flat, 3/8		8
58		Comm		Nut, Lock, 3/8-16		9
59		2.3364	Comm	Flexguard, 3/4"		281"
60		Comm		Washer, Flat, 7/16		2
61		Comm		Nut, Lock, 7/16-14		2
62		Comm		HHCS, M8 x 1.25 x 13		5
63		3.2561		Clamp, Hose, 3"		1
64		302030		Bracket, Exhaust		1
65		Comm		HHCS, M10 x 1.25 x 25		2
66		F101134	Comm	Clamp, Insulated, 3/4"		2
67		F101125	Comm	Clip		2
68		301690		Support, Tailpipe		1
69				NOT USED		
70		1.8809	190516-6S	Hose End, 90-deg. (V01276)		2
71		3.1571	2021-4-6S	Fitting, Hydraulic (V01276)		2

FIGURE 2
ENGINE PACKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
72-73		301709		NOT USED		
74		37674		Mount, Engine Rubber		2
75		301899		Isolator		2
76-78				NOT USED		
79		150376		U-Bolt Kit, 5/16 (2 per kit)		1
80		562A546		Placard, Serial #		1
81		302541.1		Hose Assembly, 40.5"		1
82		302541.2		Hose Assembly, 19.5"		1
83		Comm		HHCS, M14 x 2.0 x 55mm		2
84		Comm		HHCS, M14 x 2.0 x 40mm		2
85		Comm		HHCS, 1/2-13 x 3.50		2
86		NW14597		Washer, Snubbing, 1/2 ID x 2.0 OD x 1/4		2
87		Comm		Washer, Flat, 9/16		4
88		Comm		Washer, Lock, 9/16		4
89		Comm		Nut, Lock, 1/2		2

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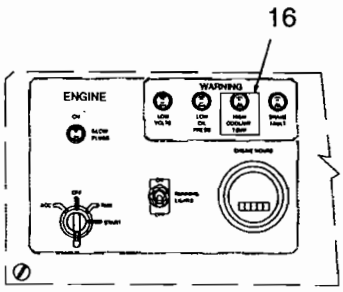
FIGURE 3
ENGINE ELECTRICAL–DEUTZ



INSTRUMENT PANEL MODIFICATION

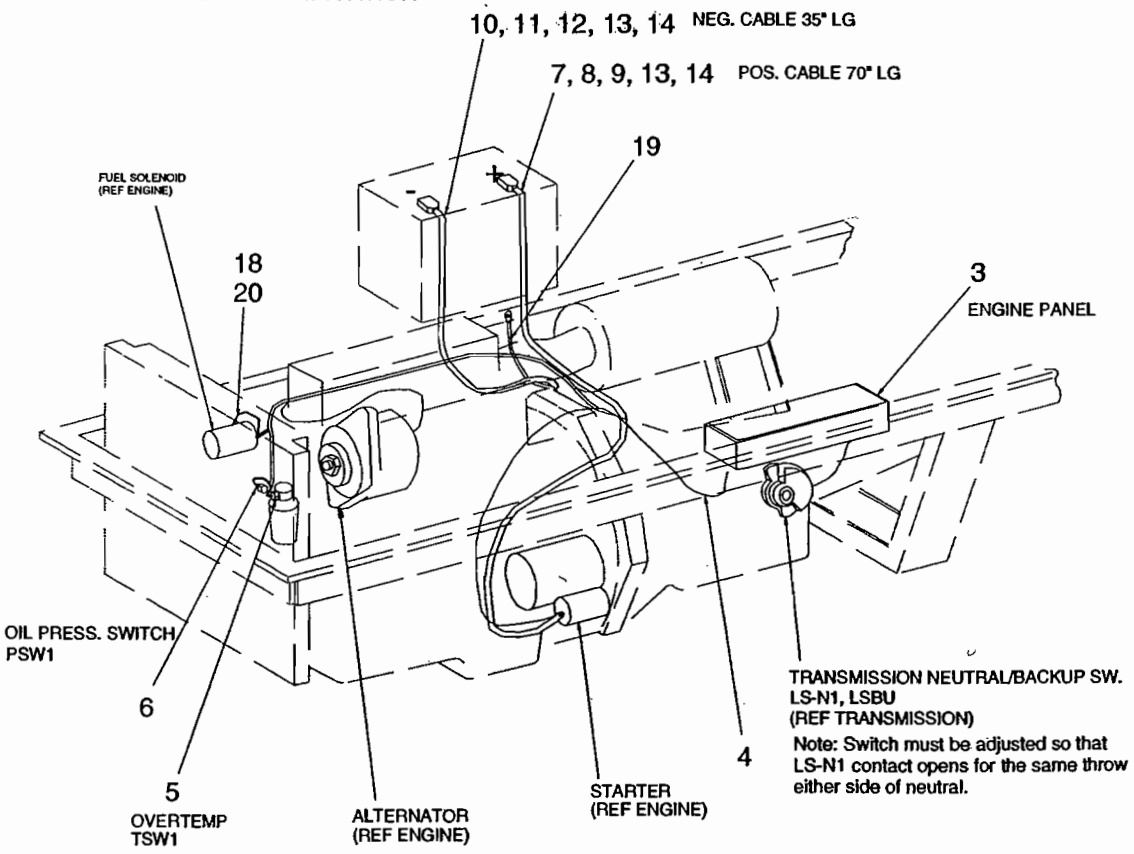


FIGURE 3
ENGINE ELECTRICAL–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		301280		Deutz Engine Package Electrical		Ref
1-2				Not Used		
3		301281		Engine Electrical Panel (See Figure 4)		1
4		301661		Engine Package Electrical Harness		1
5				Switch, Oil Pressure (Furnished w/engine)		Ref
6				Switch, Engine Temperature (Furnished w/engine)		Ref
7		2.3360	Comm	Terminal, Pos. Size 1/0 (V09769)		1
8		2.3274	B3324	Terminal, Ring, 2/0 X 3/8" (V92219)		1
9		F100930	23505	Boot, Battery Cable, Red (V58961)		1
10		2.3359	Comm	Terminal, Neg. Size 1/0 (V1Z829)		1
11		2.3373	R8403B	Terminal, Ring, 1/0 X 7/16 (V14726)		1
12		F100931	23504	Boot, Battery Cable, Black (V58961)		1
13		2.3267	Comm	Cable, Welding, Neoprene Insulated, Size 1/0 x 9'		A/R
14		2.3364	68460	Conduit, Flex Auto, 3/4" Gray Poly (V77060)		9'
15				Not Used		
16		562A502		Placard, "High Coolant Temp"		1
17				Not Used		
18		2.3807	Comm	Wire, Automotive, 50V, #16 AWG, SAE J1128, Type SXL, Black		1'
19		2.3804	Comm	Wire, Automotive, 50V, #10 AWG, SAE J1128, Type SXL, Black		3'
20		2.3478	64496-R	Conduit, Flex Auto, 1/4" Poly (V77060)		1'

FIGURE 4
ENGINE PANEL–DEUTZ

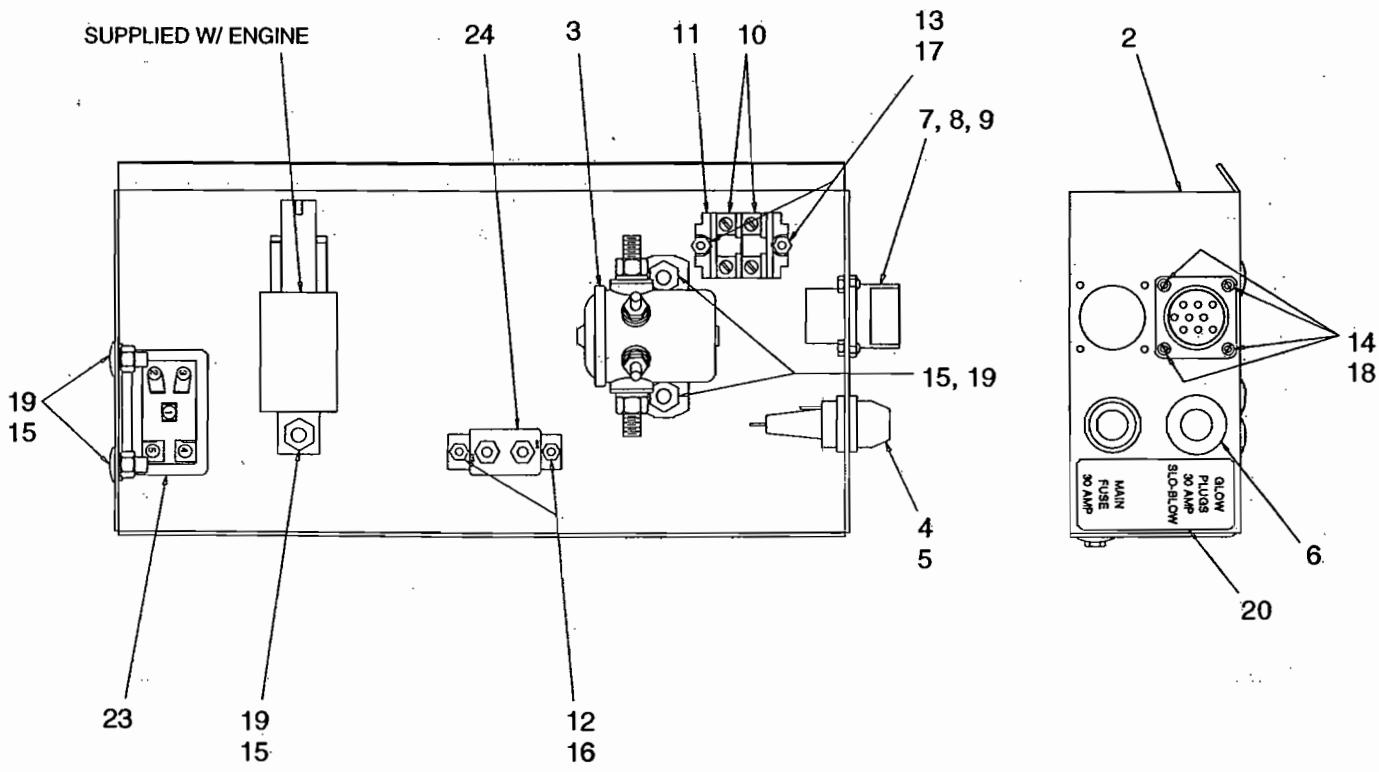


FIGURE 4
ENGINE PANEL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		301281		Engine Panel Electrical		Ref
2		20104		Panel		1
3		2.1401	70-902	Relay, 70A, 12V		1
4		2.3346	HPG	Fuse Holder, 30A (V71400)		1
5		2.3344		Fuse, 30A		1
6		3.1178	Comm	Grommet		Ref
7		2.3188	208546-1	Receptacle, Flanged, 9-CCT (V1Z829)		1
8		2.3048	66099-2	Pin, Type III+ (V1Z829)		4
9		2.3212		Plug, Sealing		Ref
10		2.0021	524	Terminal Block (V5N603)		1
11		2.0022	530	Block End (V5N603)		1
12		Comm		RHMS, 6-32 x 3/8		2
13		Comm		RHMS, 8-32 x 3/8		2
14		Comm		RHMS, 4-40 x 3/8		4
15		Comm		Screw, Truss Head, 1/4-20 x 3/8		5
16		Comm		Nut, Self-Tap, 6-32		2
17		Comm		Nut, Self-Tap, 8-32		2
18		Comm		Nut, Self-Tap, 4-40		4
19		Comm		Nut, Self-Tap, 1/4-20		6
20		562A247		Placard, "Main Fuse 30 Amp"		1
21		2.2612		Wire, #16 AWG Black		6"
22		2.0865		Wire, #10 AWG Black		12"
23		2.3648		Relay, 12VDC SPDT, 15A		2
24		301475		Circuit Breaker, 50A Auto		1

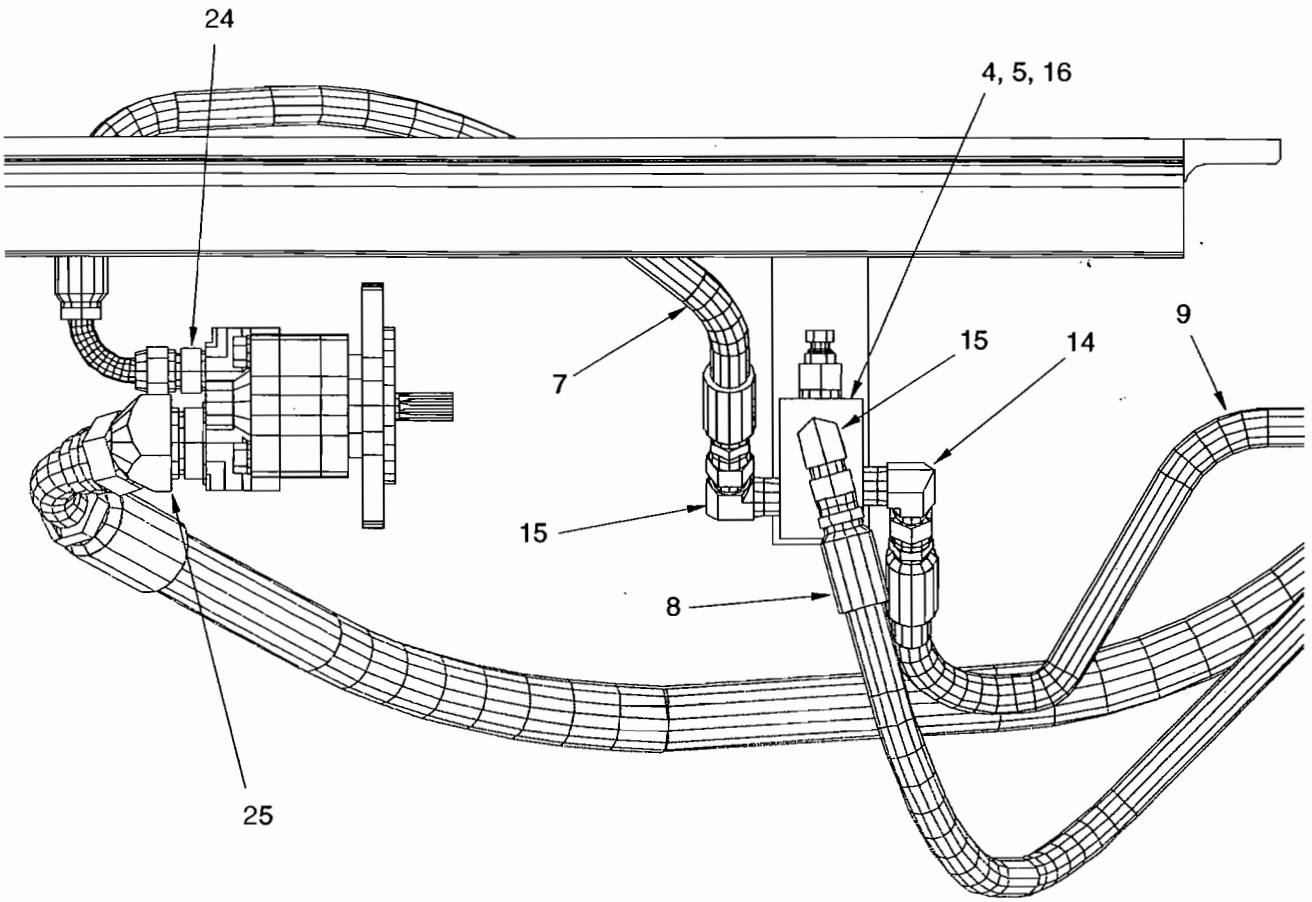


FIGURE 5
ENGINE HYDRAULICS –DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		301711		Hydraulics, Deutz Engine		Ref
2				Not Used		
3		301822	26002-RZF	Pump, Hydraulic (V96151)		1
4		1.8450	RPEC-FAN	Cartridge, Relief, 100-3000 PSI (V54035)		1
5		1.8453	FEC	Body, Relief Valve, 1/2" NPTF (V54035)		1
6				Not Used		
7		8797.27		Hose Assy, 1/2 x 19.58, Type C		1
8		8797.1		Hose Assy, 1/2 x 46.08 (Station 3)		Ref
9		8946.3		Hose Assy, 1/2 x 20.72 (Station 3)		Ref
10.		10384.29		Hose Assy, 1 x 43.57 (Station 3)		Ref
11-13				NOT USED		
14		3.1818	2023T-08-08-S	Elbow, 45-37 deg. (V01276)		1

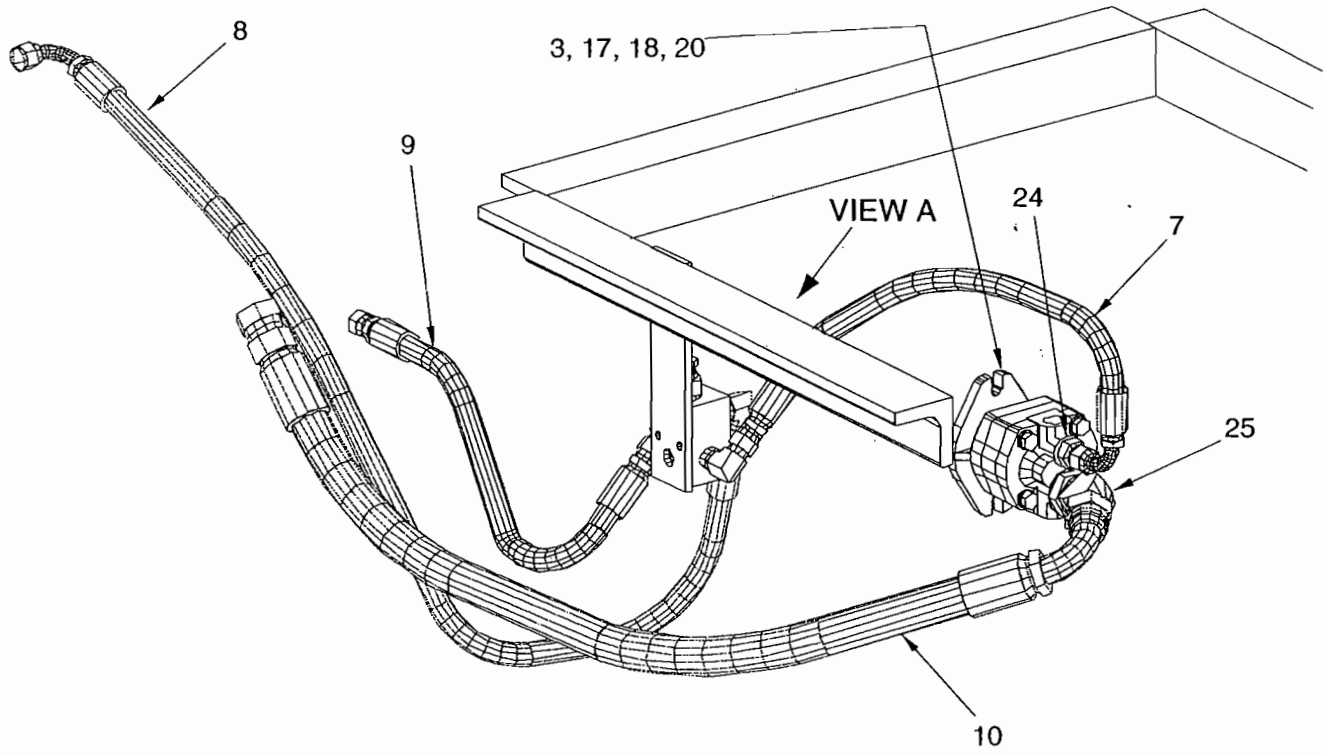
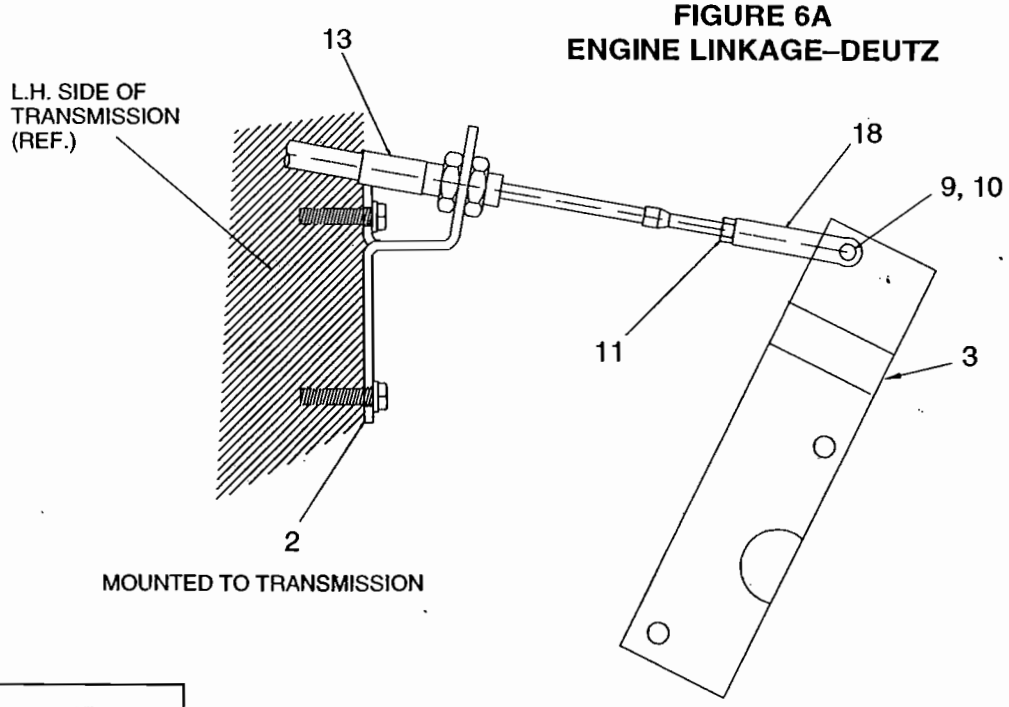


FIGURE 5
ENGINE HYDRAULICS –DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
15		3.1566	2024T-08-08-S	Elbow, 37-deg. (V01276)		1
16		3.2752	2222-4S	Plug, Socket Hd, 1/4" NPT (V01276)		2
17		Comm		SHCS, M10 x 1.50 x 30mm		Ref
18		Comm		Washer, Flat, 3/8		Ref
19				NOT USED		
20		Comm		Washer, Lock, 3/8		Ref
21-23				NOT USED		
24		3.2703	202702-10-8S	Adapter (V01276)		1
25		NW35809	2061-16-16S	Elbow, 45-deg. (V01276)		1
26				NOT USED		
27		302680		Kit, Hose (Station 3) (Not Shown)		1

FIGURE 6A
ENGINE LINKAGE–DEUTZ



Used thru ser. # 457

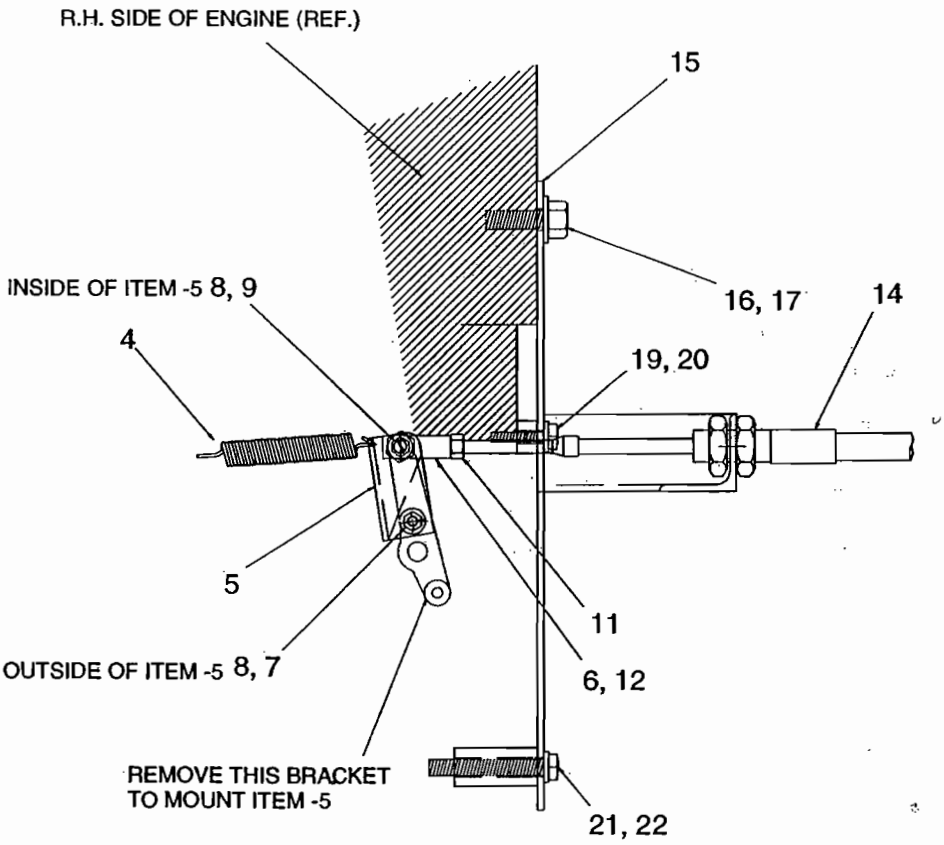
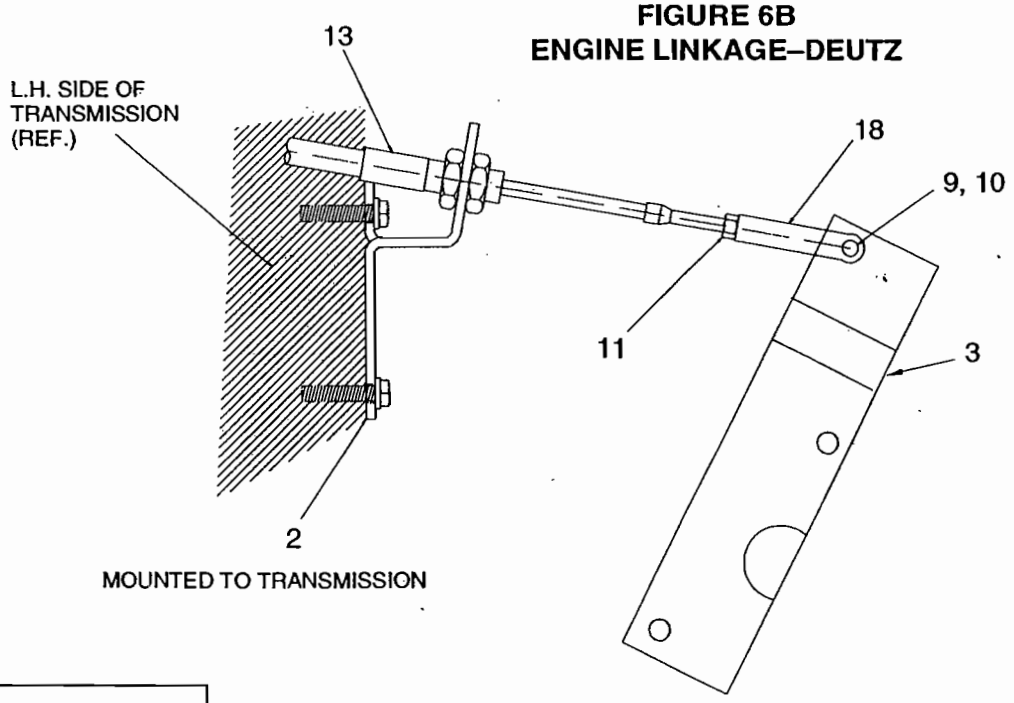


FIGURE 6A
ENGINE LINKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		301282		Linkage Assembly (thru ser. # 457)		Ref
2		19128		Bracket, Transmission Shifter		1
3		300706		Arm, Shift		Ref
4		1.8415	LE055E-9	Spring (V84830)		1
5		19150		Bracket		1
6		1.8783		Ball Joint		1
7		Comm		Washer, Lock, 1/4		3
8		153804		HHCS, M6 x 1 x 16mm		2
9		Comm		Cotter Pin, 3/32 x 1/2		1
10		1.0610		Clevis Pin, 5/16		1
11		Comm		Nut, Hex, 1/4-28		2
12		Comm		Nut, Lock, 1/4-28		1
13		1.7908	173-LD-TT-2-120"	Cable, Shift (V06970)		Ref
14		1.8784	173-LD-TT-2-103"	Cable, Throttle (V06970)		1
15		301133		Bracket, Throttle		1
16		3.3189	Comm	HHCS, M10 x 1.5 x 25mm		2
17		3.3190	Comm	Washer, Lock, M10		2
18		1.5437		Clevis, 1/4-28 x 5/16		1
19		Comm		HHCS, M6 x 1 x 90mm		1
20		Comm		Washer, Lock, 5/16		1
21		Comm		HHCS, M8 x 1.25 x 60mm		1
22		Comm		Washer, Flat, 1/4		1

FIGURE 6B
ENGINE LINKAGE–DEUTZ



Used on ser. # 458 and on

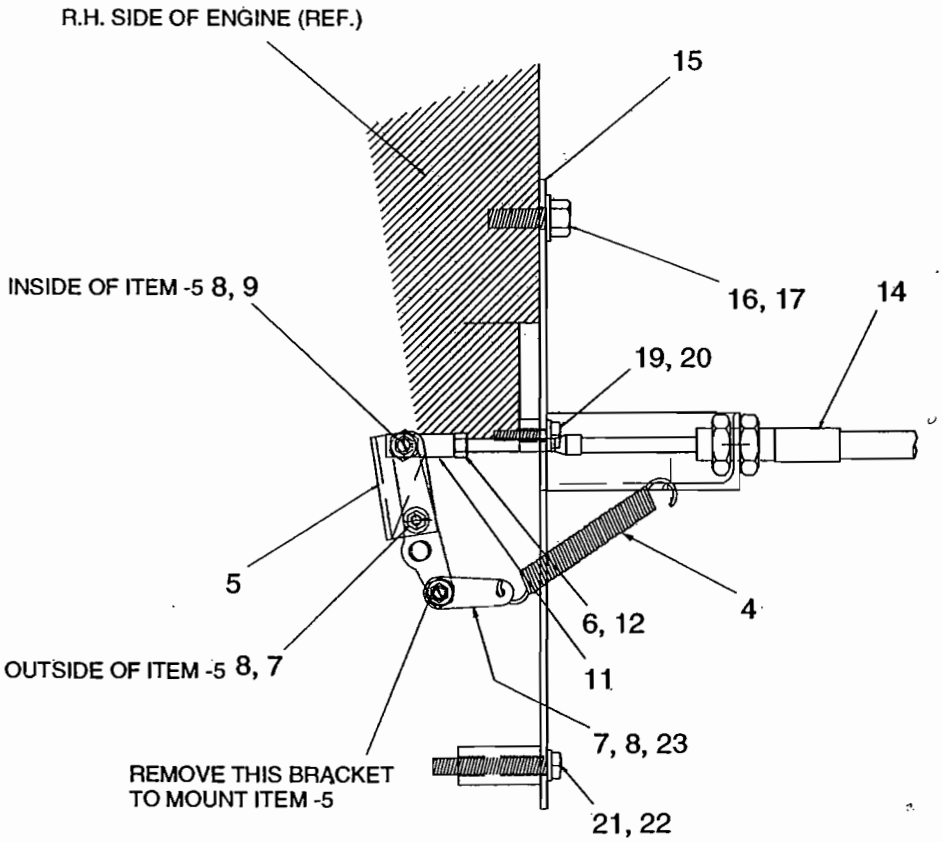
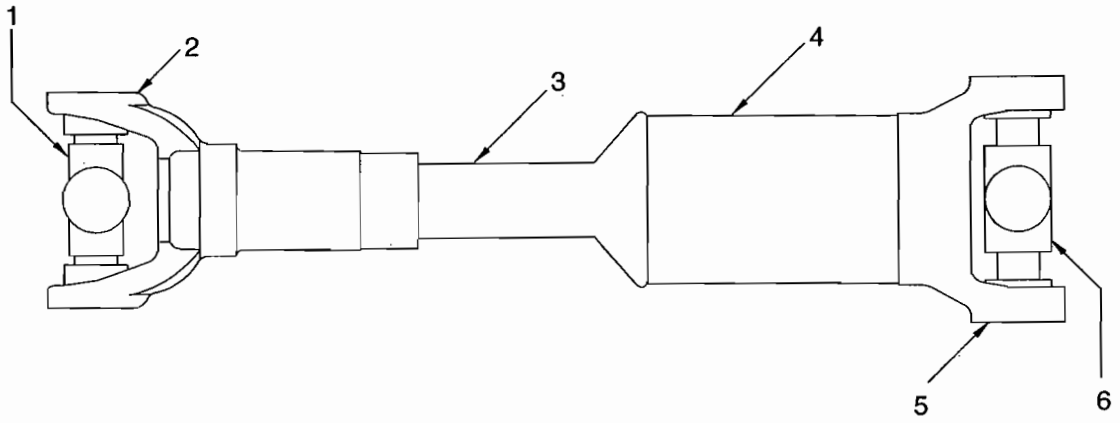


FIGURE 6B
ENGINE LINKAGE–DEUTZ

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		302857		Linkage Assembly (Ser. # 458 and on)		Ref
2		19128		Bracket, Transmission Shifter		1
3		300706		Arm, Shift		Ref
4		1.8415	LE055E-9	Spring (V84830)		1
5		19150		Bracket		1
6		1.8783		Ball Joint		1
7		Comm		Washer, Lock, 1/4		4
8		153804		HHCS, M6 x 1 x 16mm		3
9		Comm		Cotter Pin, 3/32 x 1/2		1
10		1.0610		Clevis Pin, 5/16		1
11		Comm		Nut, Hex, 1/4-28		2
12		Comm		Nut, Lock, 1/4-28		1
13		1.7908	173-LD-TT-2-120"	Cable, Shift (V06970)		Ref
14		1.8784	173-LD-TT-2-103"	Cable, Throttle (V06970)		1
15		301133		Bracket, Throttle		1
16		3.3189	Comm	HHCS, M10 x 1.5 x 25mm		2
17		3.3190	Comm	Washer, Lock, M10		2
18		1.5437		Clevis, 1/4-28 x 5/16		1
19		Comm		HHCS, M6 x 1 x 90mm		1
20		Comm		Washer, Lock, 5/16		1
21		Comm		HHCS, M8 x 1.25 x 60mm		1
22		Comm		Washer, Flat, 1/4		1
23		301608		Bracket, Throttle Return		1

FIGURE 7
DRIVESHAFT

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		301095		Driveshaft		Ref
1		NW33650	5-153X	U-joint (V72447)		1
2		NW34286	2-3-5221KX	Tube Yoke (V72447)		1
3		39993	2-40-1521	Slip Tube Shaft (V72447)		1
4		301095.4		Tubing		1
5		NW35885	3-28-97	Tube Yoke (V72447)		1
6		NW33731	5-160X	U-joint (V72447)		1



ELECTRIC EMERGENCY PUMP OPTION

The electrically operated emergency pump will operate the hydraulic system for a short time in case of engine failure. This option is an alternate to the more frequently used manually operated emergency pump option.

Description

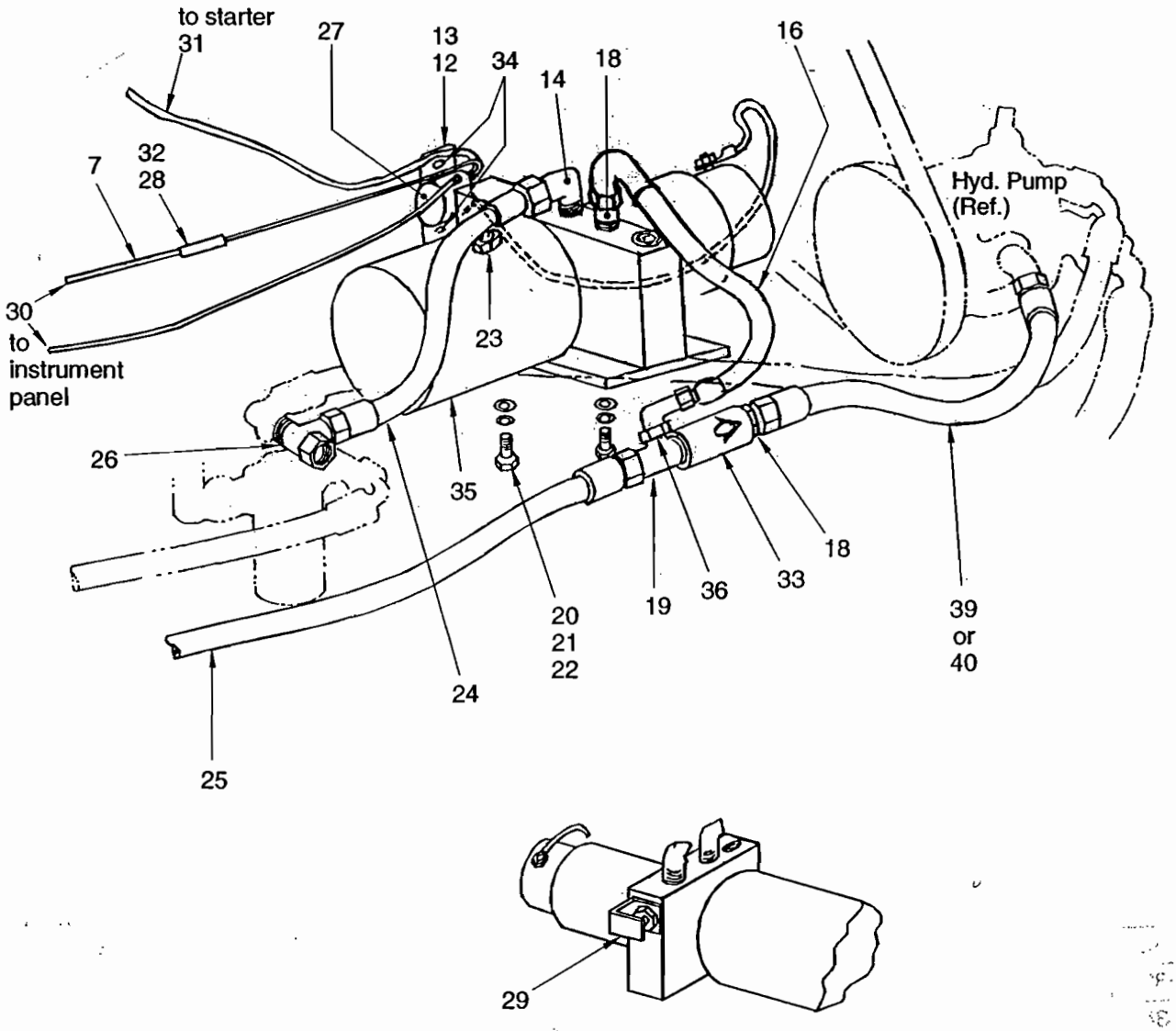
A hydraulic power unit with a 12VDC motor is mounted on the chassis in front of the fuel tank. The motor is powered by the vehicle battery through a heavy-duty DC contacter and is controlled by a momentary switch, found under the operators seat. The pump is connected in parallel with the engine-driven pump, and has a built-in load check valve. An additional check valve is in the main pump line to prevent backflow when the emergency pump is operated.

Operation

The electric emergency pump permits short-term operation of any of the vehicle hydraulic system functions. To operate this pump, push up and hold the "Emergency Pump" toggle switch while simultaneously operating the function control for any hydraulic system operation (lift, lower. etc.) desired.

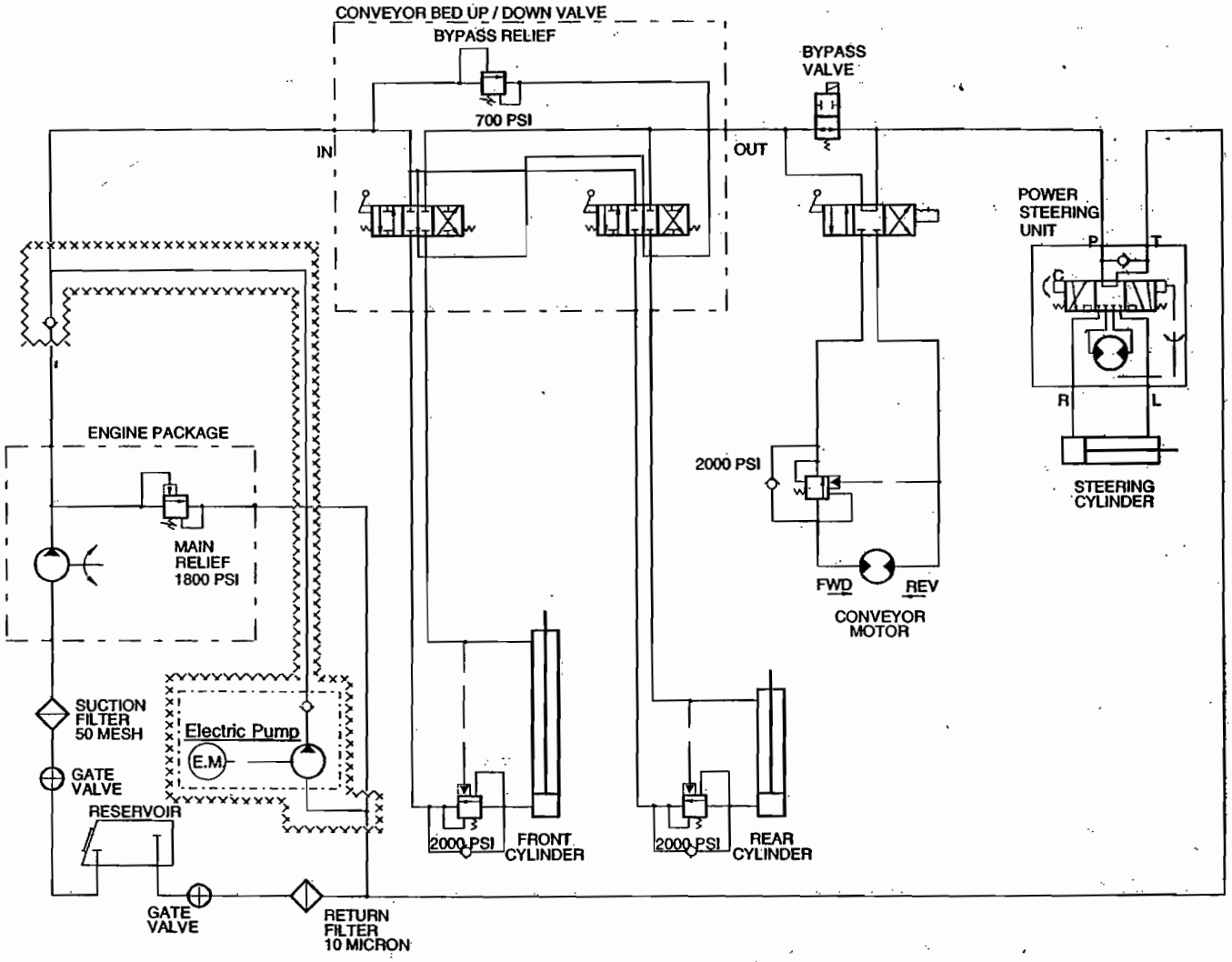
Important! **Continued or excessive use of the emergency pump will very quickly discharge the vehicle battery. Be conservative of its use.**

ELECTRIC EMERGENCY PUMP



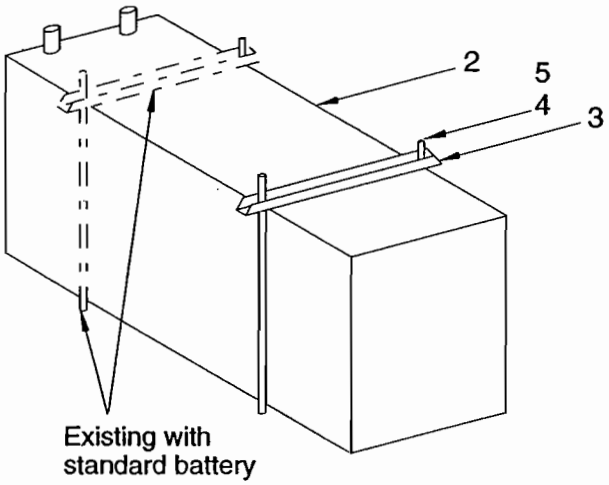
ELECTRIC EMERGENCY PUMP

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		9965-01		Electric Pump Option/		Ref
2		9965-02		Electric Pump Option/		Ref
3		9965-03		Electric Pump Option/Ford, Perkins 4.236		Ref
4-6				Not Used		
7		2.1729	725105	Terminal, Butt (V70903)		1
8		2.0800	721105	Terminal, #10 (V70903)		3
9		2.2869	721113-7413	Terminal, 5/16 (V70903)		1
10-11				Not Used		
12		10312		Switch Bracket		1
13		1.7956		Placard, "Pump On/Off"		1
14		3.1317	2024-6-8	Adapter, 90 Deg. (V01276)		1
15				Not Used		
16		8797.7		Hose Assembly		1
17				Not Used		
18		3.1215	2021-6-8	Adapter (V01276)		2
19		3.1630	2028-6-8	Tee		1
20		Comm		HHCS, 3/8-16 x 1.50		2
21		Comm		Washer, Flat, 3/8		2
22		Comm		Washer, Lock, 3/8		2
23		3.2343		Plug, Pipe		Ref
24		8946.43		Hose Assembly		1
25		8793.5		Hose Assembly		Ref
26		3.2679	203102-8-8	Tee (V01276)		1
27		2.3383	124-906	Relay, 12V (V80089)		1
28		2.3078		Fuse, 10A		1
29		10311		Plunger Retainer		1
30		2.2612	Comm	Wire, Black, 16 AWG, J1128		14'
31		2.3266 2.3276	Comm R5002B	Cable, Neoprene, #4 AWG Terminal (B.E.) (V14726)		3.5' 2
32		2.1922	726108	Holder, Fuse (V70903)		1
33		1.7142	453-3/8-S2-6	Check Valve (V86768)		1
34		Comm		Screw, Self-Drill, 1/4 x 1.00		2
35		1.7783	4Z185	Pump, Electric (V16327)		1
36		3.2241	2071-8-8S	Elbow, Swivel (V01276)		1
37		2.3478	Comm	Conduit, Flex, 1/4"		7'
38		2.1991	1TL1-6	Switch, Toggle (V91929)		1



Standard Hydraulic System with Electric Pump Option

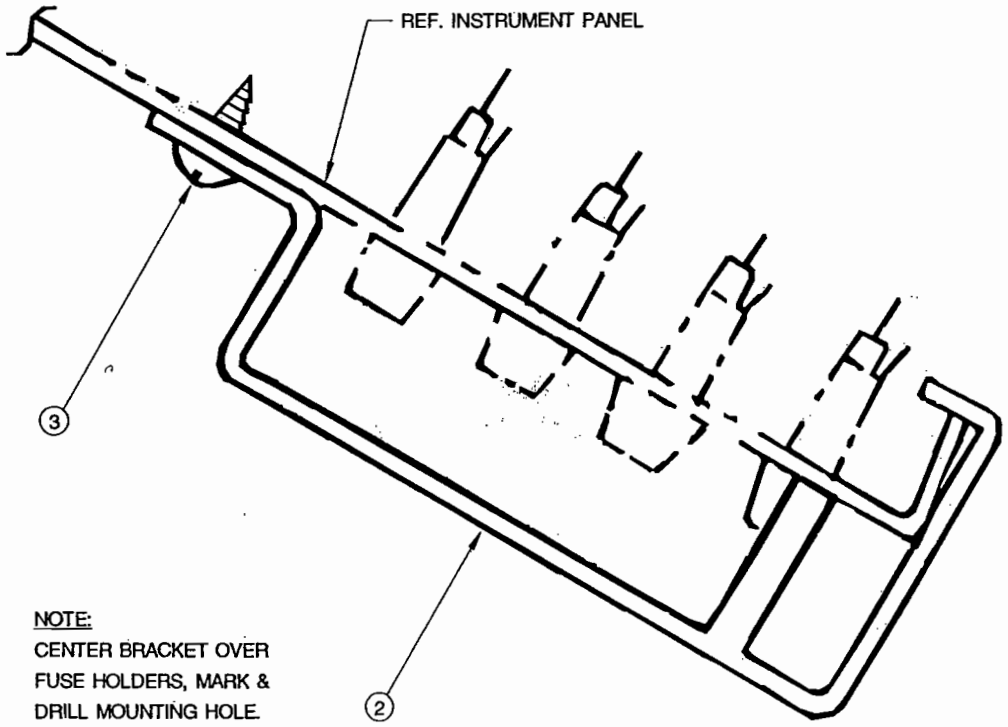
HEAVY DUTY BATTERY OPTION
OPTION #20097



HEAVY DUTY BATTERY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		20097		4D Battery Option		Ref
1				Not Used		
2		2.3555	904D-12V	Battery, 930 CCA (Deka)		1
3		19911		Battery Strap		1
4		19916		Bolt		2
5		3.3340		Nut, Lock, 1/4-20		2

FUSE COVER
OPTION #20099



FUSE COVER

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20099		Option, Fuse Cover		1
2		20100		Bracket, Fuse Cover		1
3		Comm		Pan Head Screw, Stl., #8 x 1/2" lg.		1

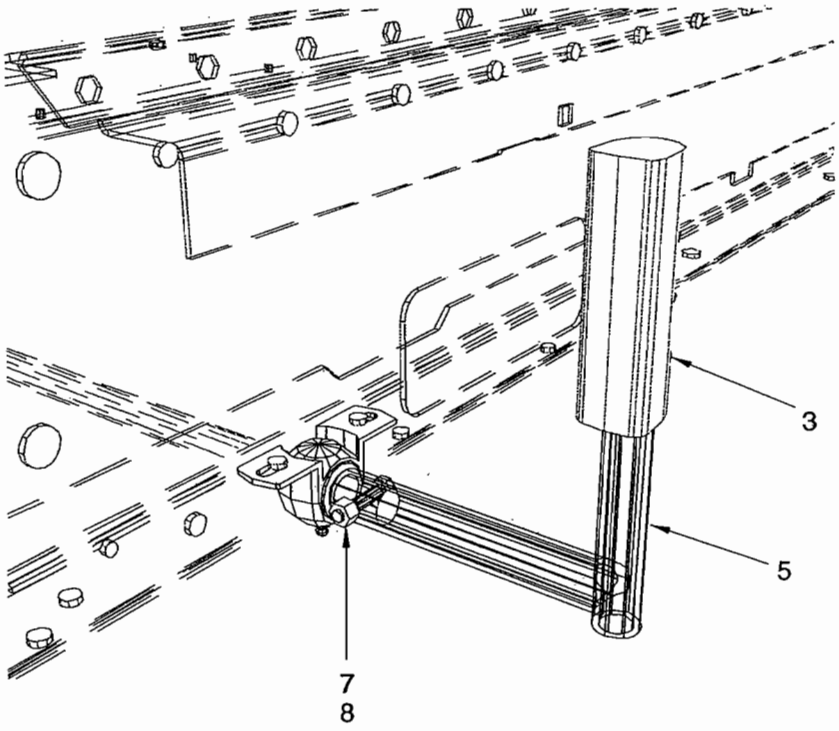
FULL WIDTH FRONT BUMPER
OPTION #20659

FULL WIDTH FRONT BUMPER

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20659		Full Width Front Bumper		Opt
2		20660		Bracket, Bumper		1
3		20658		Retainer, Bumper		1
4		20665		Bumper		1
5		Comm		HHCS, 3/8-16 x 2.00		3
6		Comm		Washer, Lock, 3/8		3

If a drawing is required, please call Wollard.

MANUAL CONTROL, RH REAR
OPTION #300781

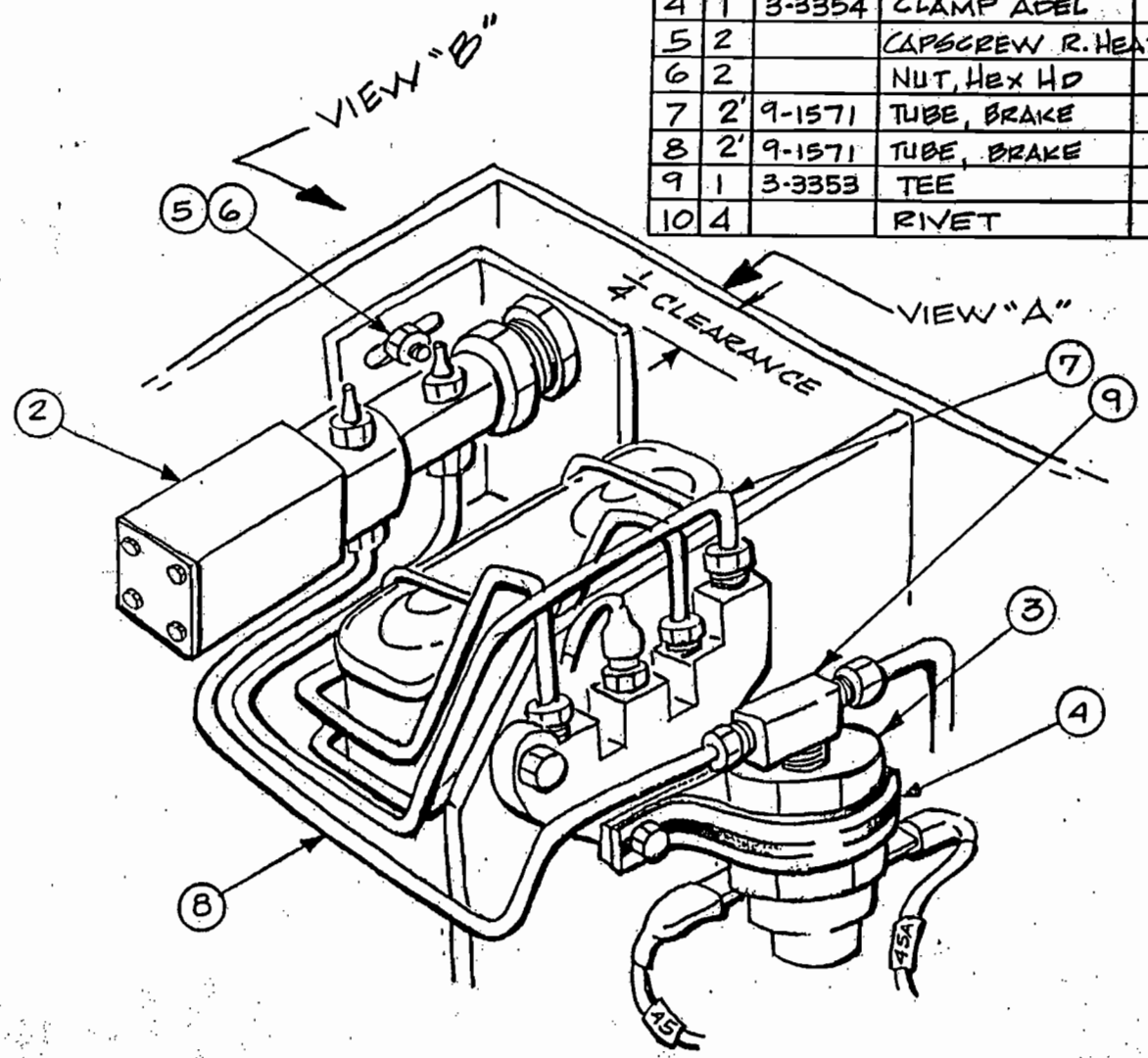


MANUAL CONTROL, RH REAR

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		300781		RH Rear Manual Control		Opt.
2				Not Used		
3		1.0495		Grip, Handle		1
4				Not Used		
5		300782		Control Handle		1
6				Not Used		
7		3.3375		HHCS, 1/4-20 x 1-3/8, Gr. 8		1
8		Comm		Nut, Lock, 1/4-20		1

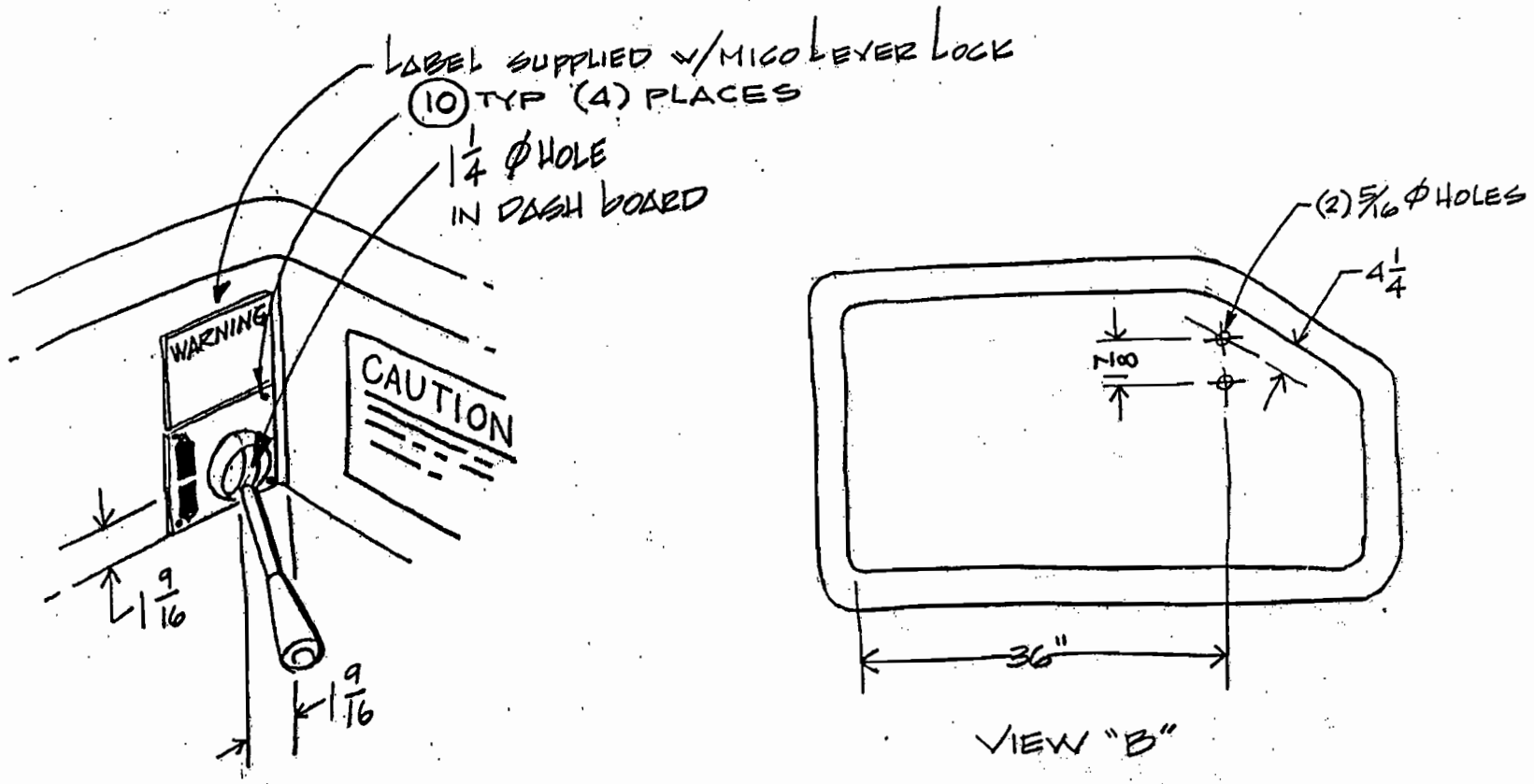
ITEM	QTY.	PART NUMBER	DESCRIPTION	MATL	SIZE/MFR. NUMBER
1	X	20014	MICO LEVER LOCK		OPTION
2	1	1-8832	MICO LEVER LOCK		# 02-640-125 MICO
3	1	2-3305	PRESS. SW		#580-009-600 PSI
4	1	3-3354	CLAMP ADEL		# DG-27
5	2		CAPSCREW R. HEAD		1/4-20 x 1"
6	2		NUT, HEX HD		1/4-20
7	2'	9-1571	TUBE, BRAKE		3/16 x .028 ANNEALED
8	2'	9-1571	TUBE, BRAKE		3/16 x .028 ANNEALED
9	1	3-3353	TEE		#602 x 3 WEATHERHEAD
10	4		RIVET		#6 x 3/16 LG.

*USE FITTINGS SUPPLIED WITH 1-8832 KIT

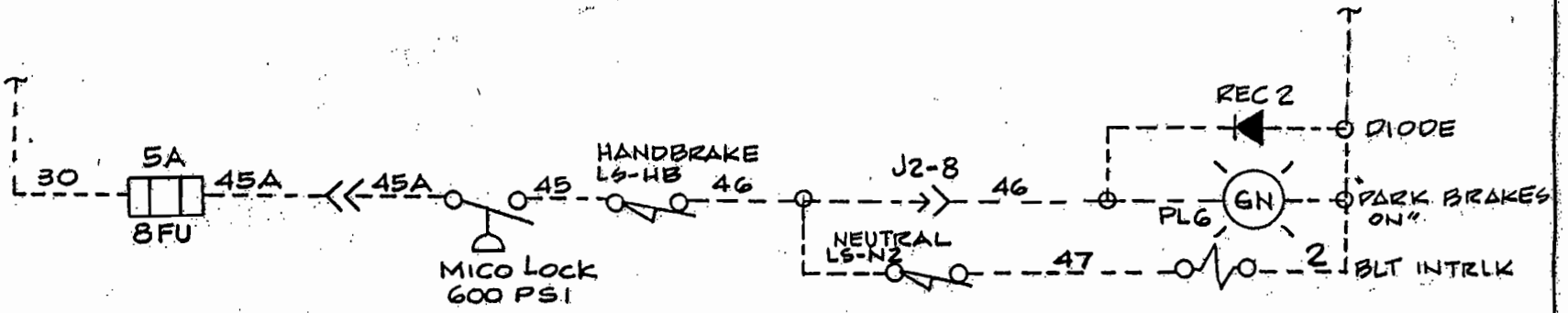


SEE NOTES SHT. (3)

TITLE MICO LEVER LOCK OPT.		
DRAWN BY IAP		DATE 10-12-93
DWG # 20014	SH 1 OF 4	



TITLE	MICO LEVER LOCK OPT.
DRAWN BY	
DATE	10·12·93
DWG #	20014
SH	2 OF 4



REFERENCE - STANDARD ELEC. SCHEMATIC

NOTES:

1) CUT INTO WIRE #45 ON CHASSIS HARNESS AT J2 CONNECTOR (INST. PANEL).

2) CONNECT BOTH ENDS OF WIRE THRU PRESSURE SWITCH AS SHOWN.

3) RENUMBER WIRE BETWEEN J2 AND PRESSURE SWITCH AS #45A.

TITLE: MICO LEVER LOCK OPT.	
DRAWN BY: LG	DATE: 10.12.93
DWG # 20014	SH 4 OF 4

GENERAL NOTES

1) PUNCH OUT ALUM PLACARD 1¼ CLEARANCE

2) RIVET ALUM PLACARD TO PANEL FACE

3) SET MICO SWITCH BRACKET ⅛" BACK FROM REAR OF PANEL FACE FOR RIVET CLEARANCE

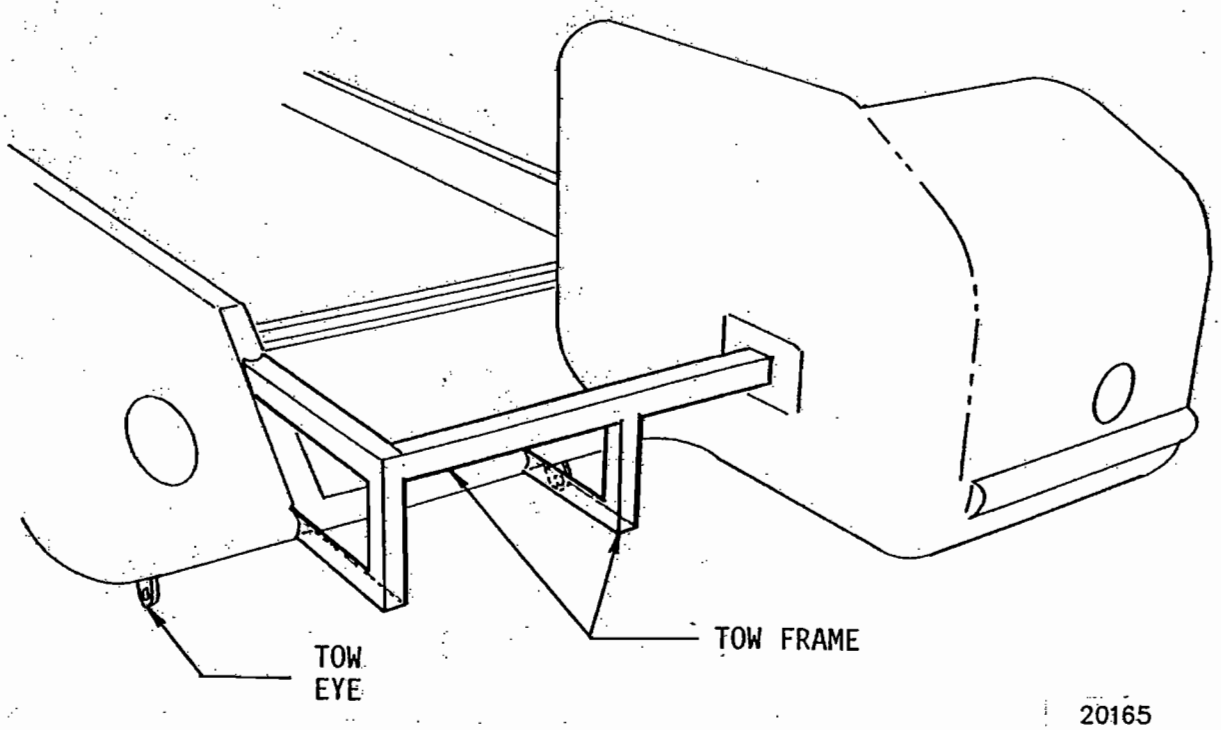
4) DRILL OUT ADEL CLAMP FOR PRESS. SWITCH (5/16" ϕ)

5) PUT MICO SWITCH STICK-ON PLACARD DIRECTLY ABOVE ALUM. PLACARD

6) SCREW MICO SWITCH HANDLE IN ALL THE WAY

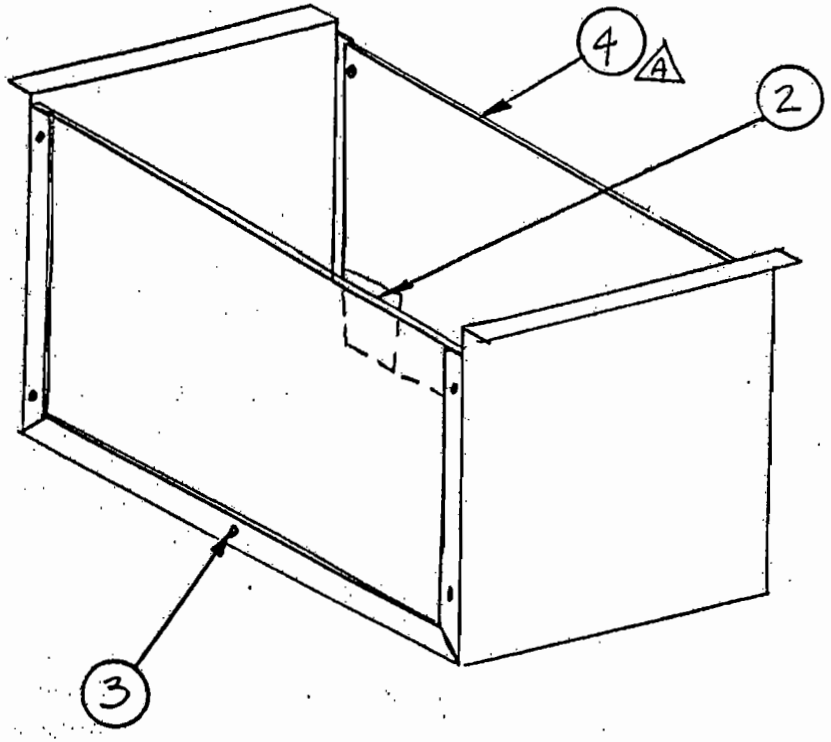
7) DO NOT! WIRE UP MICO SWITCH BUILT INTO LEVER. USE PRESS SW. WITH TEE

TITLE MICO LEVER LOCK OPT.	
DRAWN BY LR	DATE 10.12.93
DWG # 20014	SH 3 OF 4



Truckbar Towing Provision
Figure 1

ITEM	QTY.	BAE NUMBER	DESCRIPTION	MAT'L	SIZE/MFR. NUMBER
1	X	20101	FULLY ENCLOSED	D	BATTERY BOX
(A) 2	1.	20102	BATTERY BOX		SIDE (RH. SIDE)
3	10		POP RIVET	ALUM	#10 X 1/4 GRIP
(B) (A) 4	1	20202	BATTERY BOX		SIDE (L.H. SIDE)



NO DELETIONS REQUIRED

B	ECO 4549	10/26/93 JDP.
A	ECO 4519	9/22/93 MD

TITLE FULLY ENCLOSED BATTERY BOX OPTION

DRAWN BY MODESTO | DATE 7-30-93

DWG # 20101 | SH 1 OF 1

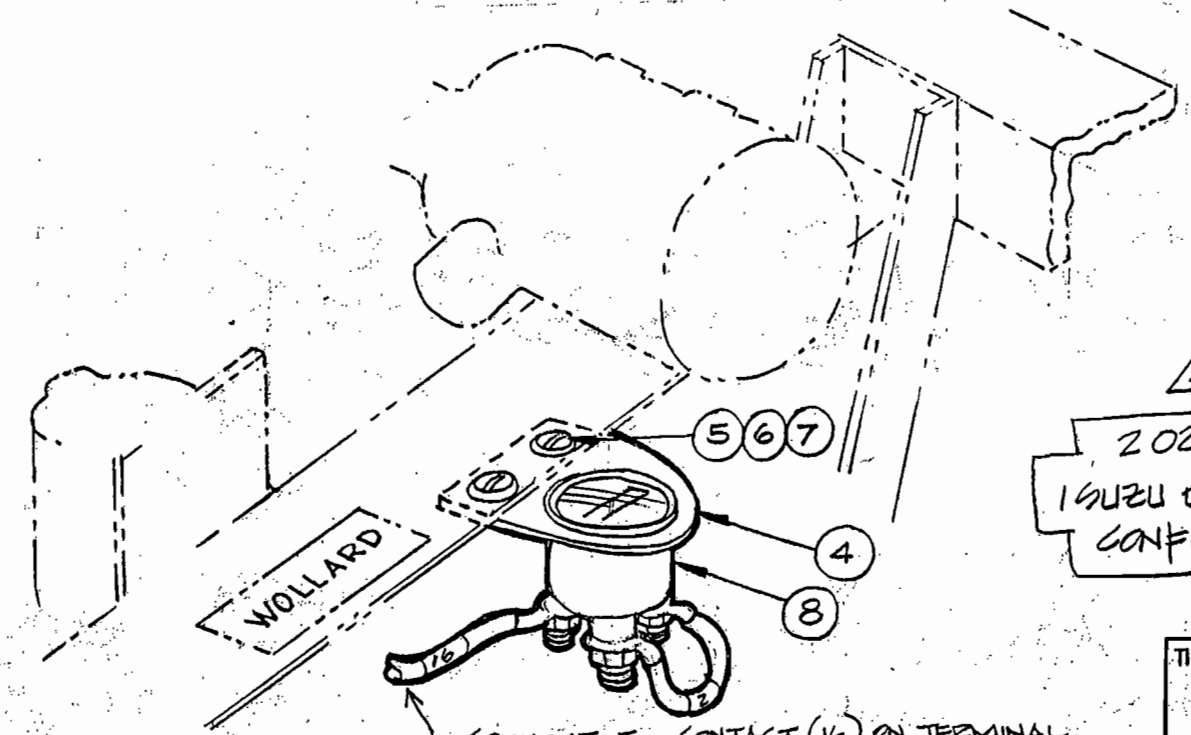
ITEM	QTY	W.E. NUMBER	DESCRIPTION	W.E. PART NUMBER
1		20206	HOURMETER INSTL.	
2	X	20206-	↓	(DIESEL ENGINE)
3	1	1-5905	HOURMETER	776-4/40 PATCON NO LEAD

HOURMETER
(BACK VIEW)

DIESEL CONFIGURATION
20206-1

Hourmeter Option
(Diesel Engine)
Figure 1

ITEM	QTY	QTY	QTY	PART NUMBER	DESCRIPTION	MATL	SIZE/MFR. NUMBER
1			X	20206-1	HOURMETER OPT.		(DIESEL)
2		X		20206-2	↓		(FORD GAS)
A 3	X			20206-3	↓		(ISUZU DIESEL)
4	1	1		M18921	HOURMETER BRACKET		
5	2	2		—	RND HEAD BOLT		10-24 x 1/2
6	2	2		—	NUT		10-24
7	2	2		3-2936	WASHER		NEOBOND #10
A 8	1	1	1	1-5905	HOURMETER		776-4/40 DATCON NO LEAD
9							
10							



A
20206-3
ISUZU DIESEL
CONFIGURATION

TITLE	HOURMETER OPTION		
DRAWN BY: AP.		DATE: 3.31.05	
DWG #		SHT 3 OF 3	A

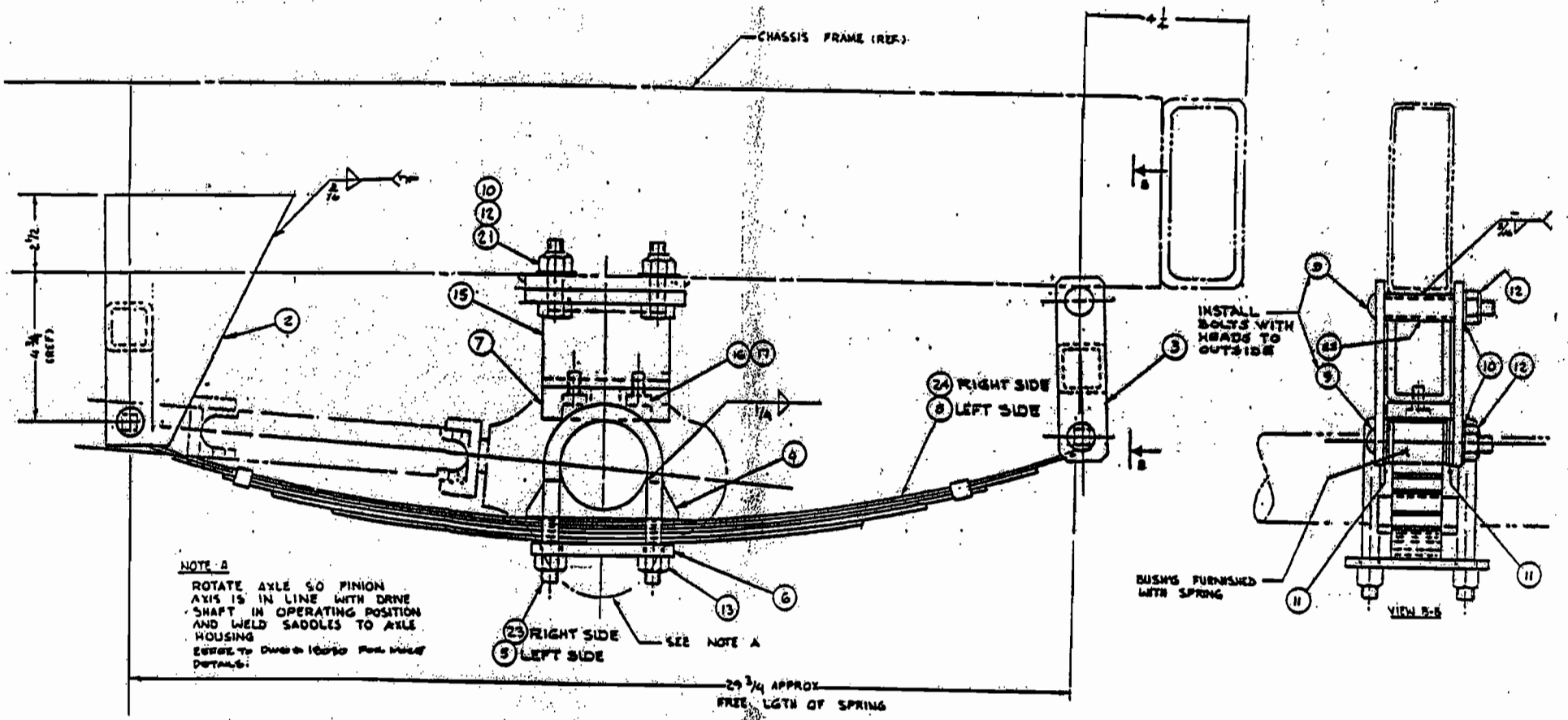
A	ECO 4811	AP 3.31.05	

HOBART AIRPORT SYSTEMS

WOLLARD AIRPORT EQUIPMENT COMPANY

WOLLARD AIRPORT EQUIPMENT COMPANY
CONVEYOR TRUCK MODEL TC-888

ITEM	QTY.	NUMBER	DESCRIPTION	MAT'L.	SIZE
1	X	M20035	SPRUNG REAR AXLE	OPT	
2	2	19272	SPRING HANGER		
3	2	16610	SPRING SHACKLE		
4	REF	——	AXLE SUPPORT (FURNISHED WITH AXLE)		
5	2	M12654-16	U-BOLT		1/2-13 UNC x 6" LG
6	2	14441	WASHER PLATE		
7	2	14442	BUMPER		
8	1	1-8336	SPRING		30 LG x 1100 UNA-036 UCF
9	6	3-3156	BOLT, CARRIAGE	GR5	1/2-13 x 4 LG, CAD PLATED
10	18	——	WASHER, FL	STL	1/2 SAE
11	12	——	WASHER, FL	STL	1/2 USS
12	14	——	NUT, ESNA	STL	1/2-13
13	8	——	NUT, HEX	STL	1/2-13
14		-			
15	2	14141	STOP WLDMT		
16	4	——	CAPSCREW SOC HD	GR8	5/16-18 x 3/4
17	4		WASHER FL	STL	5/16 AN
18					
19					
20					
21	8	-	HEX BOLT	GR.5	1/2-13 NC x 2 LG,
22	1	7-0074	TUBE, RD	SML	1.0.D. x .562 x 2 1/8 LG
23	2	M12654-20	U-BOLT		
24	1	1-8884	SPRING		



M20035

Sprung Rear Axle
Figure 1

Chapter 7 Tab

CONTINENTAL ENGINE PACK
OPTION #305163

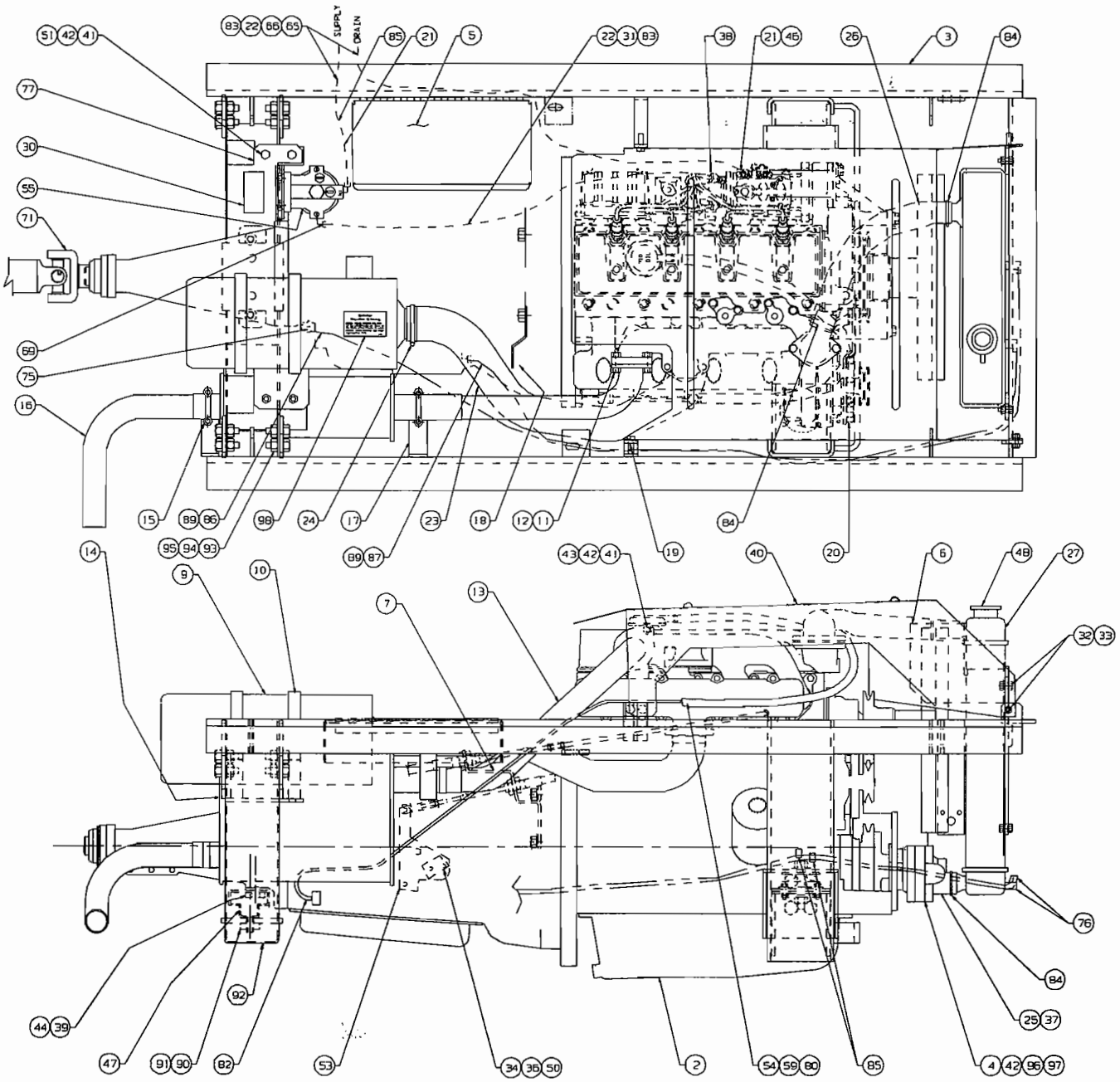


FIGURE 1
ENGINE AND TRANSMISSION

FIGURE 1
ENGINE AND TRANSMISSION

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		305163		Engine/ Transmission Assembly		Ref
2		305166		Engine/Trans Assy		Ref
3		18939		Frame Weldment		1
4		19230		Eng Pak Hydraulics		1
5		305226		Eng Pak Electrical		1
6		19370		Fan Shroud		1
7		19191		Linkage System		1
8				Not Used		
9		1.6691		Air Filter		1
10		1.7304		Band		2
13		305167		Exhaust Pipe, w/Mnt, TMD27		1
14		1.8352		Muffler		1
15		1.5494		Clamp, Exhaust		2
16		1.8350		Tail Pipe		1
17		1.7491		Hangar		2
18		18373.2		Trans. Dipstick Holder		1
19		COMM		Wing Nut, 3/8-16 NC		2
20		3.1080		Clamp		1
21		9.1601		Hose, Fill, 5/16IDx7"		1
22		3.2624		Clamp, Hose, 5/8		4
23		9.2069		Flex Hose, 2x2 1/4 IDx22		1
24		3.1090		Clamp, Hose		2
25		1.8804		Radiator Hose (Lower)		1
26		1.8807		Radiator Hose (Upper)		1
27		20169		Radiator		1
31		9.2066		Hose		5'
32		COMM		Hex Bolt, 5/16-18x3/4		5
33		COMM		ESNA Nut, 5/16-18		5
34		COMM		Hex Bolt, 1/4-20x1"		2
36		COMM		ESNA Nut, 1/4-20		2
37		19353		Spring, Radiator Hose		1
38		1.8811	190327-6S	Fitting (V01276)		1
39		Comm		Washer, Flat, 1/2		2
40		18032		Engine Cover		1
41		Comm		Nut, Lock, 3/8-16		11
42		Comm		Washer, Flat, 3/8		12
43		Comm		HHCS, 3/8-16 x 1.25		6
44		Comm		HHCS, 1/2-13 x 1.25		2

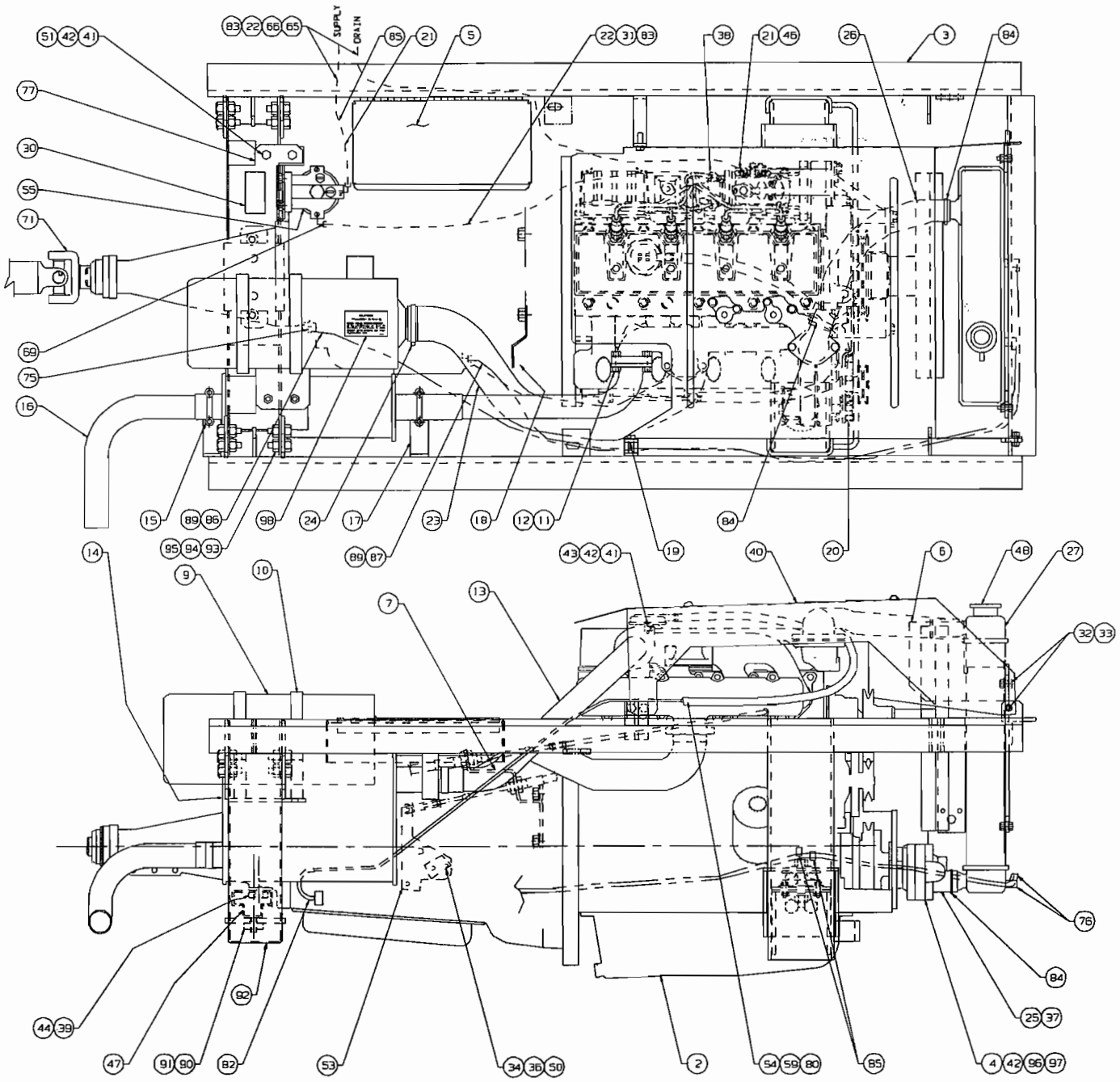


FIGURE 1
ENGINE AND TRANSMISSION

FIGURE 1
ENGINE AND TRANSMISSION

46		1.8095	Comm	Hose Fitting, Barb		1
48		1.7907	R17	Radiator Cap (V78225)		1
49		Comm				
51		Comm		HHCS, 3/8-16 x 0.75		12
52				Not Used		
56		20126		Engine Mount		2
57				Not Used		
58		3.3319		HHCS, M14 x 2 x 30mm		8
60		1.8910	283P-250	Isolator (V76005)		2
61				Not Used		
62		560A89		Placard, Diesel Fuel		1
63		3.3320		Washer, Lock, M14		8
64				Not Used		
65		3.3053	249-5 x 4	Adapter, 90 Deg. (V80089)		2
66		1.7917		Hose End, SAE 5/16		2
67-68				Not Used		
71		305198		Driveshaft (See Figure 7)		1
72		Comm		HHCS, 1/3-13 x 3.50		2
73				Not Used		
74		562A296		Placard, Check Filter		1
75		3.1571	2021-4-6S	Adaptor (V01276)		2
76		3.1940	2024-2-6S	Elbow (V01276)		2
77		16341		Bracket, Filter Support		1
78				Not Used		
79		Comm		Washer, Flat, 1/2		2
83		2.3366	Comm	Flexguard, 1/2 x 16'		1
84		3.1088	QS200-M24	Clamp (V62789)		3
85		3.1076	Comm	Clamp		3
86		9.2066	FC332-6	Hose (V62789)		5'
87		9.2066	FC332-6	Hose (V62789)		5'
88		1.8808	4741-6B	Fitting, Hose (V01276)		2
89		1.8809	190516-6S	Fitting, 90 Deg. (V01276)		2
90		Comm		Nut, Lock, 7/16-14		2
91		Comm		Washer, Flat, 7/16		2
93		Comm		HHCS, 1/2-13 x 1.25		8
94		Comm		Nut, Lock, 1/2-13		8
95		Comm		Washer, Flat, 1/2		8
96		Comm		Washer, Lock, 3/8		2
97		Comm		HHCS, 3/8-16 x 1.00		2
98		41472		Decal, Warning, Calif Diesel		1

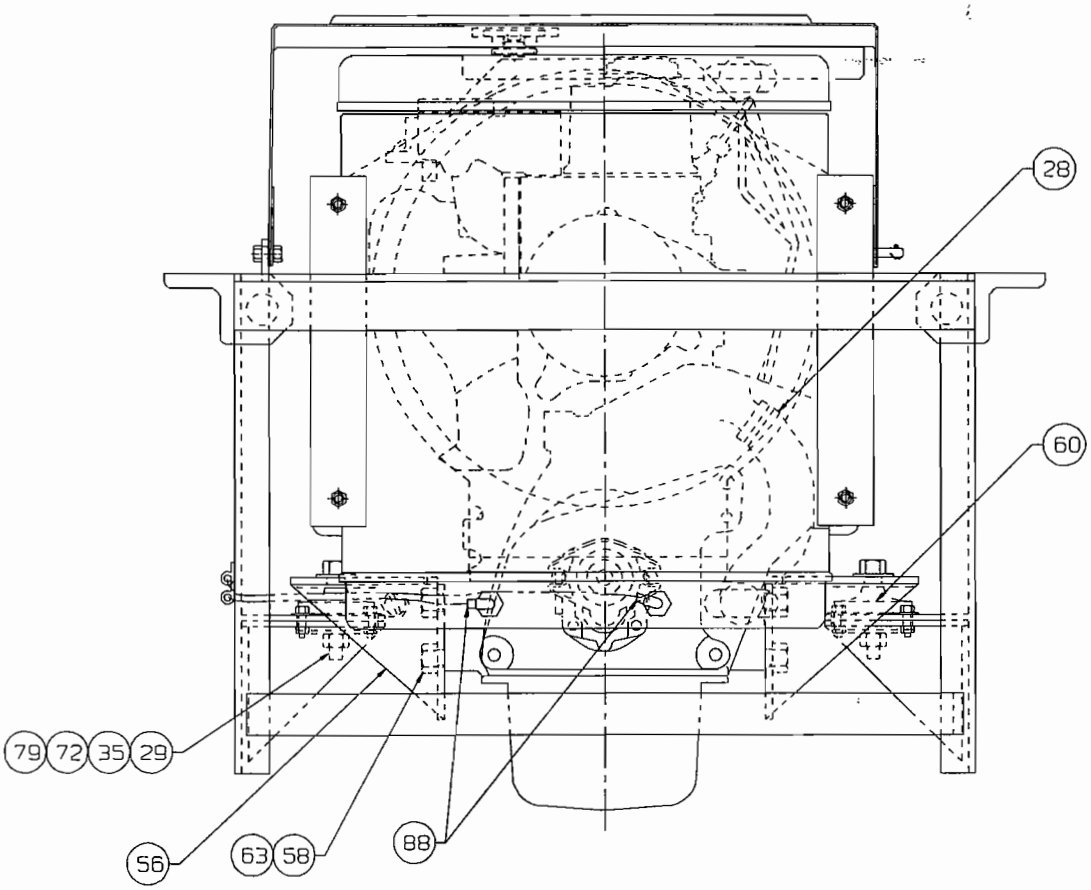
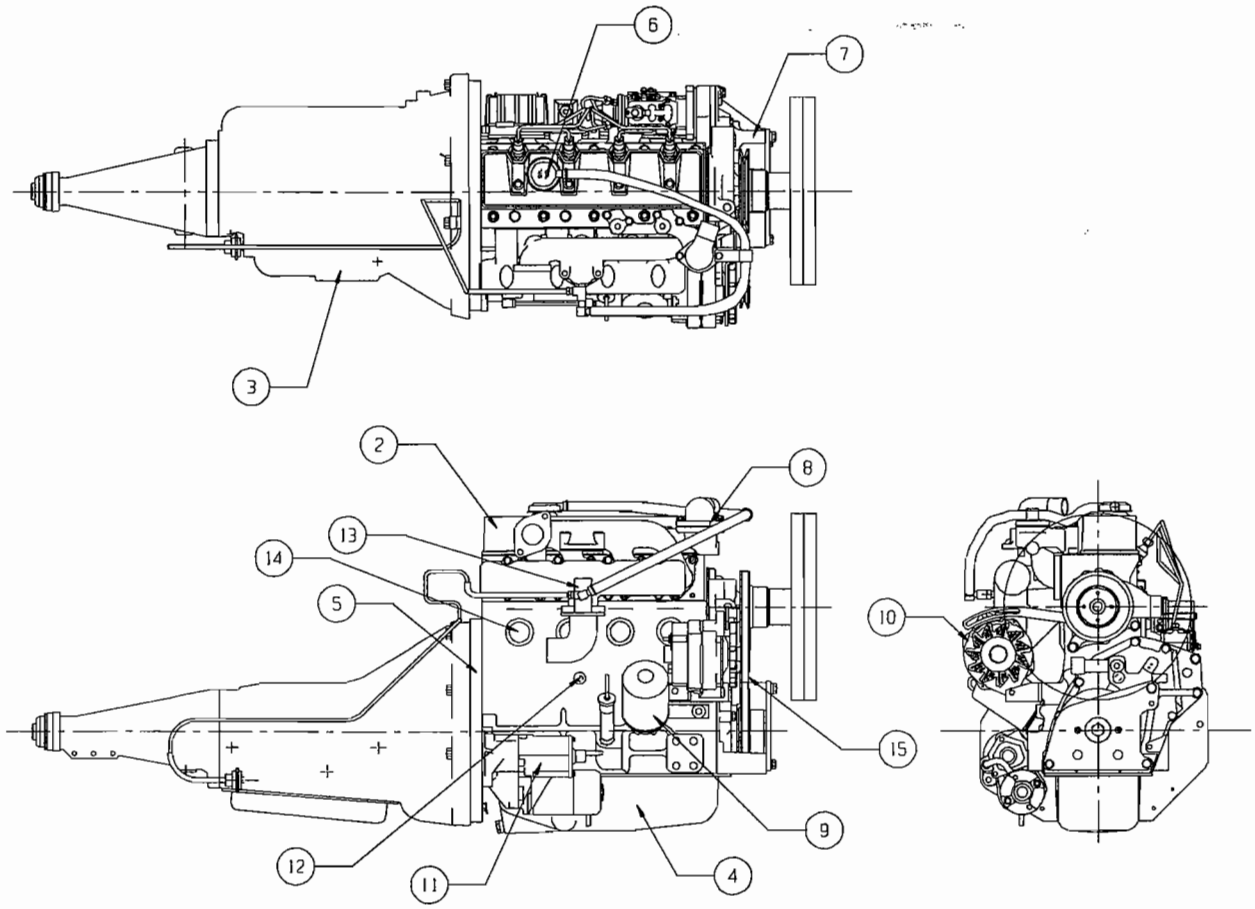


FIGURE 1
ENGINE AND TRANSMISSION

FIGURE 1
ENGINE AND TRANSMISSION

28		3.1089		Hose Clamp		1
29		COMM		Lock Nut, 1/2-13		2
35		3.3352		Snubbing Washer		4
56		20126		Engine Mount		2
58		3.3319		H. HD. Bolt, M14x2x30mm		8
60		1.8910		Isolator		2
63		3.3320		Lock Washer, M14		8
72		COMM		Hex Bolt, 1/2-13x3 1/2 LG		2
79		COMM		Flat Washer, 1/2		2
88		1.8808		ST. Hose Fitting		2


6
7
3
2
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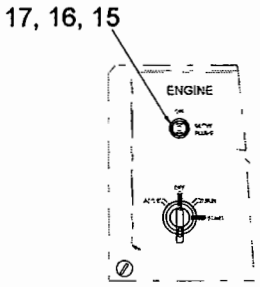
15
9
12
11
4

FIGURE 1
ENGINE AND TRANSMISSION

		305166		Eng/Trans Assy		Ref
2		1.8774		Engine, Continental, TMD27-08732		1
3		301945		Trans, C6, 3 SPD, 1.87SR		1
4			TM27L06090	Assy - Oil Pump		1
5			TMD27C06060	Flywheel Assy		1
6			TM27L00412	Cap Oil Filler		1
7			TM27K06057	Pump, Water, 10" High		1
8			TM27K00429	Thermostat, Bypass, 180 Deg		1
9			F600L03750	Filter, Oil, Full Flow, PH8ATCM		1
10		7716	10120161	Alternator Assy, 65A		1
11			TMD27M00520	Starter 12V-2.5KW #228000-0021		1
12			TM27M00302	Switch, Water Temp		1
13			TM27M00303	Switch, Low Oil Pressure		1
14			TMD27M03230	Heater Assy, Eng. Block		1
15				V-Belt		
NS			8872	Converter, Torque, F33		1

Starter could be either 228000-0020 or 228000-1780

FIGURE 3
ENGINE ELECTRICAL



INSTRUMENT PANEL MODIFICATION

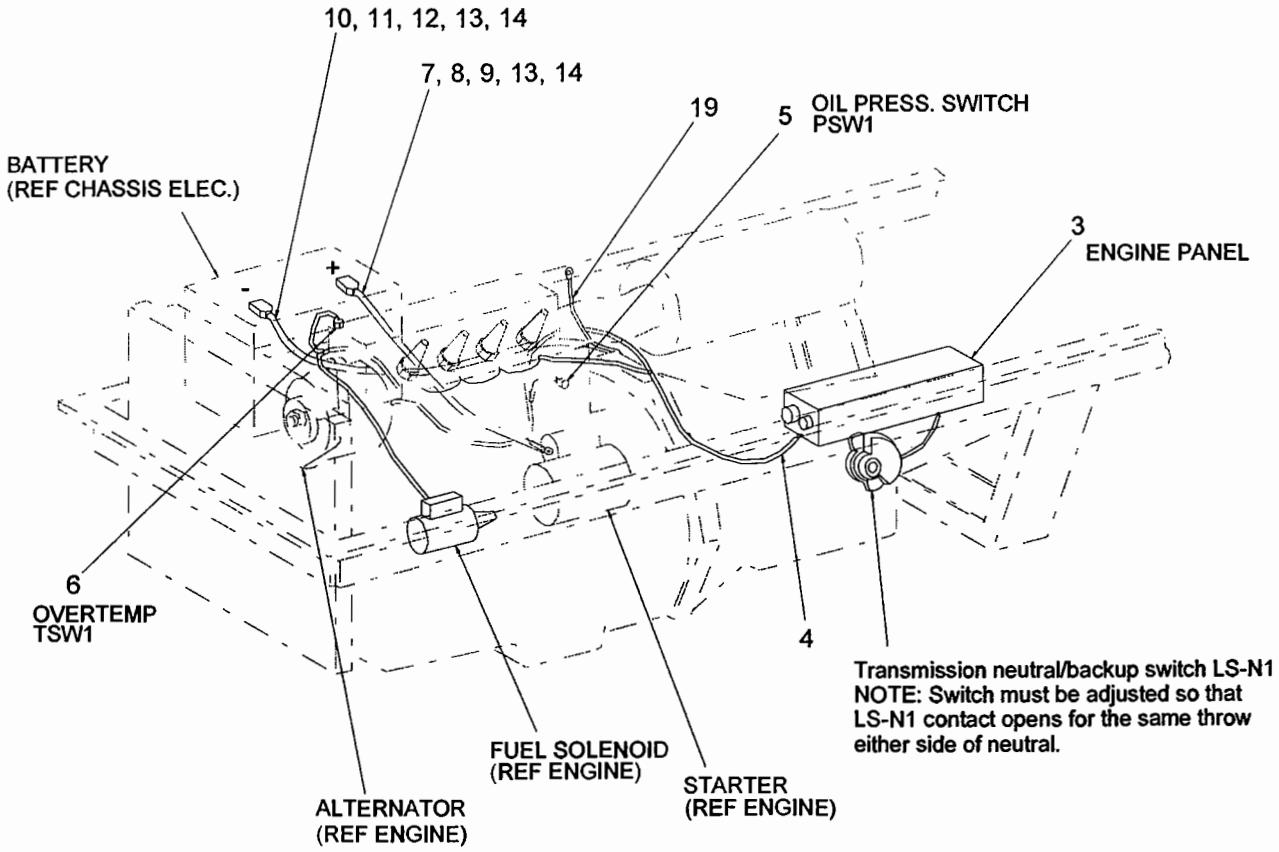
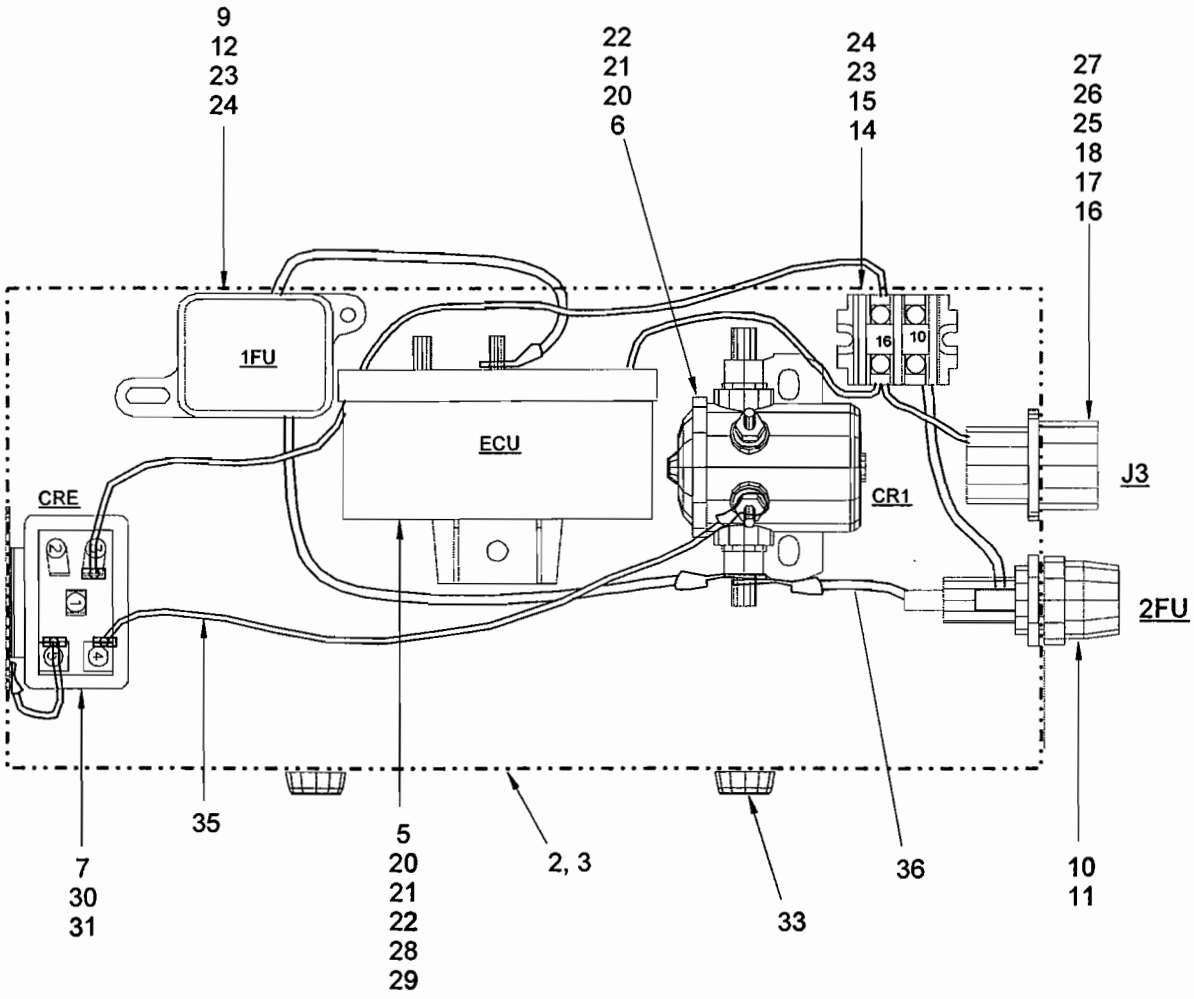


FIGURE 3
ENGINE ELECTRICAL

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
3		305226		Electric Panel Assy		Ref
4		305225		Harness, Electrical		1
		305200		*Harness, Power Pak, Cont		1
		3.1178		*Grommet,.63ID, .88HD, 1/16GR		1
5				Pressure Switch (Supplied with engine)		Ref
6				Temp. Switch (Supplied with engine)		Ref
NS		305222		Battery Cables Assy		Ref
7		2.3360	29245-5	Terminal, Battery, Neg. (V1Z829)		1
8		2.3274	2/OW 3/8S B3324	Ring, Terminal (V1Z829)		1
9		F100930		Boot, Battery Terminal, Red		1
10		2.3359	29245-3	Terminal, Battery, Pos. (V1Z829)		1
11		2.3373	R84038	Terminal, Ring, 7/16" (V14726)		1
12		F100931		Boot, Battery Terminal, Black		1
13		2.3267		Cable, Welding		5.5'
14		2.3364	68460	Conduit, Flexible (V77060)		5.5'
19		2.3804		Wire, Automotive, 50V, 10AWG, SAE J1128 Type SXL Black		3'
		305223		Indicator, Ints Panel, Pre-heat		
15		2.3511	902-401X	Holder, Lamp (V75915)		1
16		2.3008	310RN	Lens, Red (V75915)		1
17		2.3002	382-14V	Lamp, Miniature		1

FIGURE 4
ENGINE PANEL



Bottom View

ENGINE PANEL
FIGURE 4

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		305226		Electric Panel Assy		Ref
2		20104		Engine Panel Detail		1
3		562A247		Placard, Engine Panel Fuse Panel		1
4				Not Used		
5		2.3897	0-333-402-513	Control, Glow Plug (V53867)		1
6		2.1401	70-902 12VDC/ 80A	Relay, Auto Power, SPNO (Stancor)		2
7		2.3648	150-905-12VDC	Relay, Automotive, SPDT (Stancor)		1
8				Not Used		
9		2.3896	123-545-01-03	Holder, Fuse, Strip (V53867)		1
10		2.3346	HPG, 30A	Holder, Fuse, 13/32 x 1-1/2 (Buss)		1
11		2.3344	AGU-30A	Fuse, Non-Time Delay (Buss)		1
12		2.3895	1-191-017-005	Fuse, Strip, 50A (V53867)		1
13				Not Used		
14		2.0021	524	Terminal Block (V89020)		2
15		2.0022	530	Terminal End (V89020)		1
16		2.3188	208546-1	Receptacle, 9-CCT, Flanged (V1Z829)		1
17		2.3048	66099-2	Pin, Type III+ (V1Z829)		4
18		37540		Plug Assy, Elect, Ford C6		1
19				Not Used		
20		Comm		RHMS, 10-32 x 3/8		3
21		Comm		Washer, Flat, #10		3
22		Comm		Nut, Lock, 10-32		3
23		Comm		RHMS, 8-32 x 1/2		4
24		Comm		Nut, Lock, 8-32		4
25		Comm		RHMS, 4-40 x 3/8		4
26		Comm		Washer, Lock, #4		4
27		Comm		Nut, 4-40		4
28		3.3328	Comm	Nut, Hex, M5 x 0.8		2
29		3.3329	Comm	Nut, Hex, M6 x 1.0		2
30		Comm		HHCS, 1/4-20 x 1/2		2
31		Comm		Nut, Lock, 1/4-20		2
32				Not Used		
33		1.0165	A6336	Bumper (V71823)		2
34				Not Used		
35		2.2612	J1128	Wire, Auto., 16 AWG Type GPT Black		2'
36		2.0865	J1128	Wire, Auto., 10 AWG Type GPT Black		2'

FIGURE 5
ENGINE HYDRAULICS

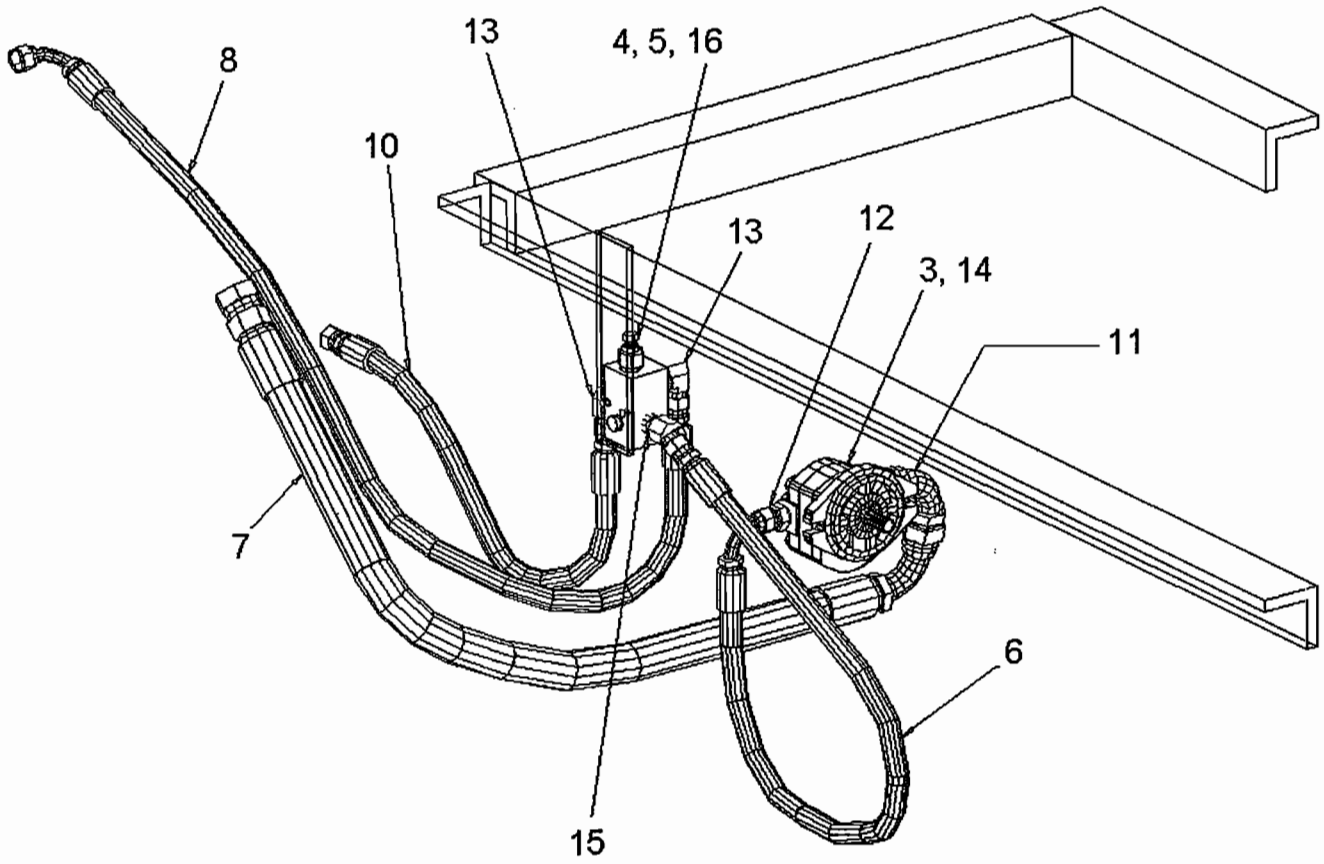


FIGURE 5
ENGINE HYDRAULICS

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19230		Hydraulics Package, Continental		Ref
2				Not Used		
3		1.8787	P12-34A-1K5	Pump, Hyd. Gear (V11671)		1
3		1.8450	RPEC-FAN	Cartridge, Relief, 100-3000 psi (V54035)		1
4		1.8453	FEC	Body, Relief Valve, 1/2" NPTF (V54035)		1
5		8797.7		Hose Assembly, 1/2 x 20.58" (2000#)		1
6		10384.8		Hose Assembly, 1/2 x 41.88" (250#)		1
8		8797.13		Hose Assembly, 1/2 x 43.58" (2000#)		1
9				Not Used		
10		8946.3		Hose Assembly, 1/2 x 20.72 (2000#)		1
11		3.3071	500454-16S	Gooseneck, 37 F/37 F (V01276)		1
12		3.2478	202702T-08-08S	Nipple, 37 F/SAE (V01276)		1
13		3.1566	2024T-08-08S	Elbow, 37 F/SAE (V01276)		2
14		3.2875	202702T-08-08S	Nipple, 37 F/SAE (V01276)		1
15		3.1818	2023T-08-08S	Elbow, 45-37 F/Ext P (V01276)		1
16		3.2752	2222-4S	Plug, Socket Head, 1/4" NPT (V54035)		3

* Not Shown coupling assy 300139 for wis-con Engines TM27C00424

FIGURE 6
ENGINE LINKAGE

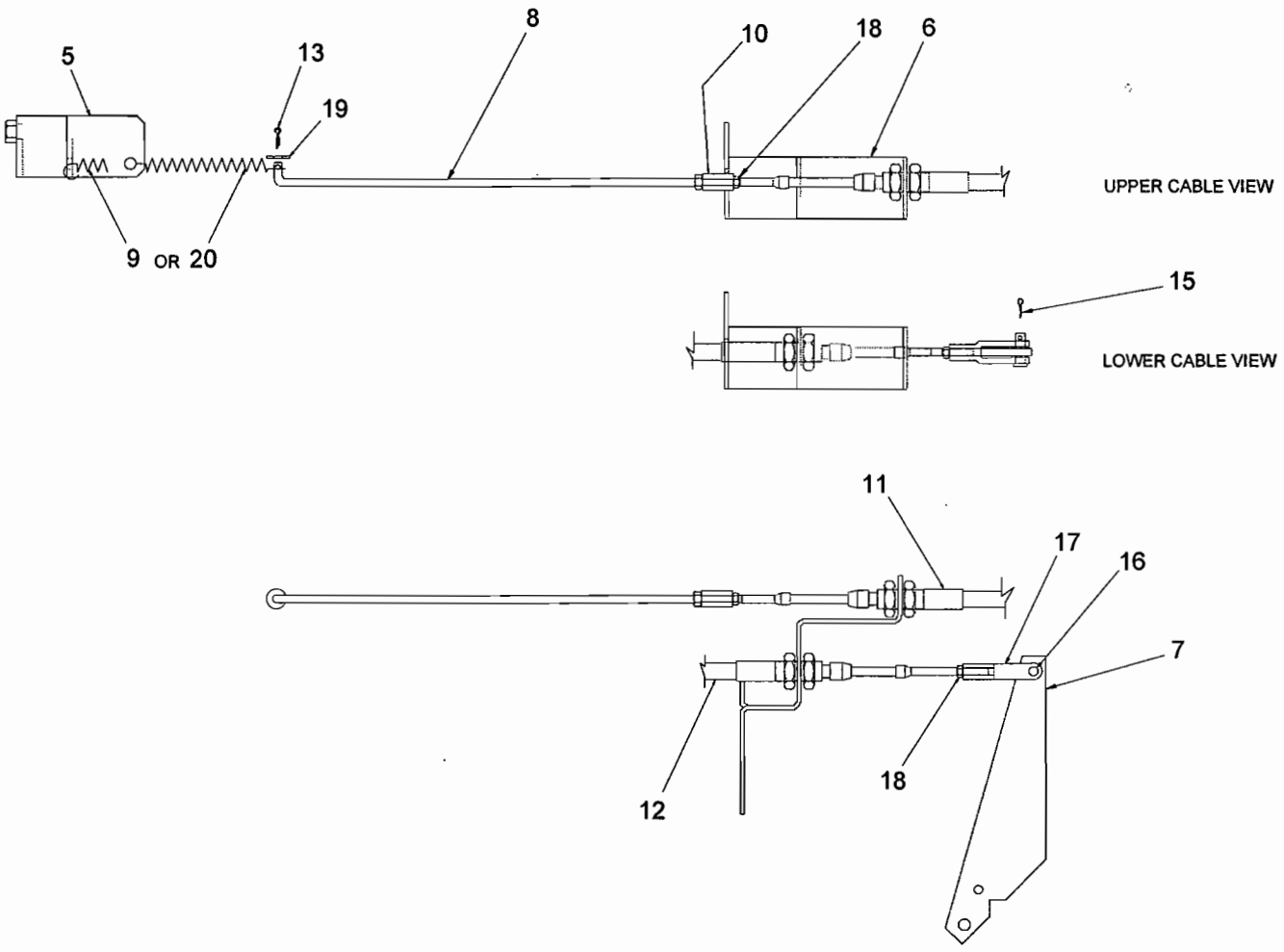
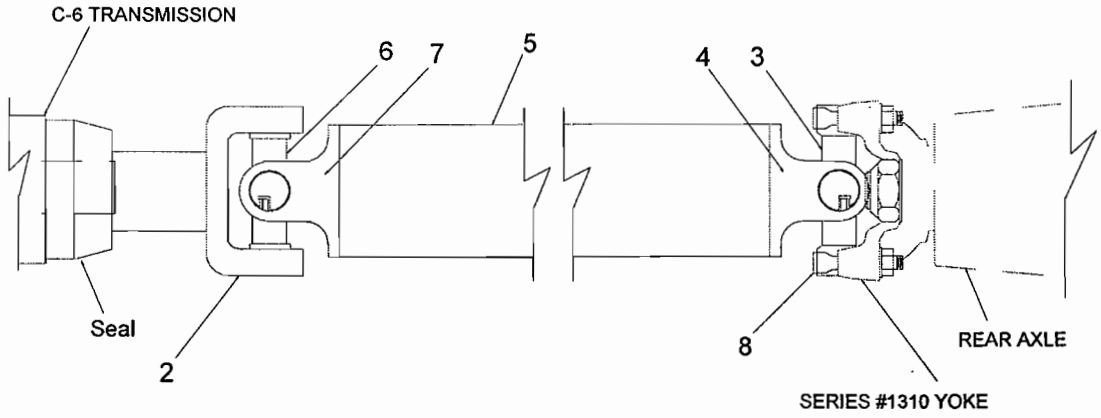


FIGURE 6
ENGINE LINKAGE

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		19191		Linkage Assembly		Ref
2-4				Not Used		
5		20171		Bracket, Throttle Return Spring		1
6		10135		Bracket, Transmission Shifter		1
8		19187		Throttle Link		1
10		3.3051		Nut, Coupling, 1/4-28		1
11		1.7909	173-LD-TT-2	Cable, Throttle, 132" (V06970)		Ref
12		1.7908	173-LD-TT-2	Cable, Throttle, 120" (V06970)		Ref
13		Comm		Cotter Pin		2
14				Not Used		
15		Comm		Cotter Pin		2
16		1.0610	Comm	Clevis Pin		1
17		1.5437		Clevis		1
18		Comm		Nut, Hex, 1/4-28		3
19		Comm		Washer, Flat, 1/4		2
20		14802.4		Spring		1

FIGURE 7
DRIVESHAFT

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		305198		Driveshaft		Ref
2				Slip Yoke (V72447)		1
3				Journal and Bearing (V72447)		2
4				End Yoke (V72447)		2
5				Tube, Driveshaft (V72447)		1
6-7				Not Used		
8				U-Bolt		2



Ford C-6 Automatic Transmission Parts Manual

for

nmc
NORTHWESTERN
MOTOR CO., INC.

and

HOLLARD™

FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

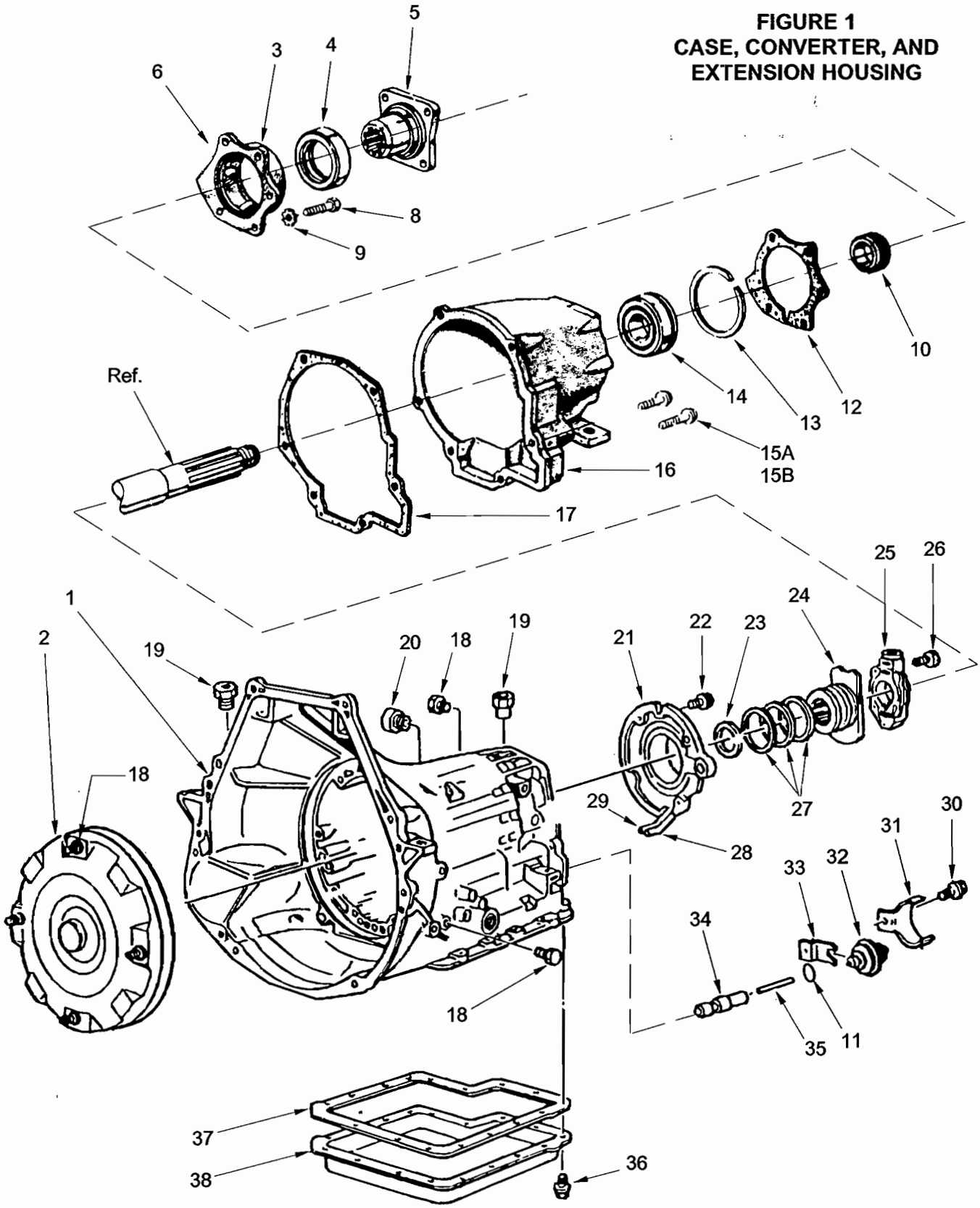


FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

Item	Airline Use	Wollard Part No.	Ford Part No.	Description	Eff	Units Per Assy
1		302281	E7TP-CA or E8TP-AA	Case Assembly, Standard Transmission or Case Assembly, Heavy Duty (used in model 100 and 140 tow tractors)		1 1
2		38792 38973	E4TP-EA or E4TP-BB	Converter Assembly, 2-speed (1.87:1) (used with case #E7TP-CA) or Converter Assembly, 3-speed (2.36:1) (used with case #E8TP-AA)		1 1
3 NS NS		302282 Comm Comm	D0TZ-7085-A 33846-S8 34944	Retainer, Rear Bearing (incl. item #4) Nut, 1/2-20 Washer, Tooth Lock, 1/2		1 4 4
4		302283	D0TZ-7A011-A	Seal, Output Shaft Oil		1
5		302284	D3TZ-7089-B	Yoke, Output		1
6		302285	C8HZ-7A002-A	Plug, Speedometer Drive Hole		1
7				NOT USED		
8		Comm	20522-S	HHCS		5
9		Comm	351487-S	Washer, Tooth Lock		5
10		302286	D1TZ-17285-A	Gear, Speedometer (used as spacer)		1
11		302287	D2AZ-7B426-A	Gasket, Throttle Control Diaphragm		1
12		302288	D0TZ-7086-A	Gasket, Bearing Retainer		1
13		302289	D5TZ-7070-A	Snap Ring, Rear Bearing		1
14		302290	8D-7065	Bearing, Rear		1
15A 15B		Comm Comm	380209-S 380207-S	HHCS, 3/8-16 x 1.25 HHCS		2 4
16		302291	D0TZ-7A039-B	Extension Assembly (includes studs)		1
17		302292	D0TZ-7086-A	Gasket, Extension Housing		1
18		302293	87650-S	Plug, Dry Seal Tapered Thread, 1/8-27"		3
19		302294 302295	E0UZ-7D273-A or D7AZ-7D273-B	Fitting, Oil, 1/4-18 male x 1/2-20 female Fitting, Oil, 1/8 male x 1/2-20 female		2 2
20		302296	D0AZ-7034-B	Vent, Case		1
21		302297	C6AZ-7C232-A	Sleeve, Oil Distributor		1
22		Comm	58618-S2	HHCS, 5/16-18 x 1.00		4
23		302298	377138-S	Ring, Retaining (copper)		1
24		302299	C7AZ-7D220-A	Body, Governor Oil Collector		1
25		302300	D8AZ-7C063-B	Body Assembly, Governor		1
25A		302301	C4AZ-7D218-B	Retainer, Governor Secondary Valve Spring (not shown)		1
26		Comm	20386-S8	HHCS		4

FIGURE 1
CASE, CONVERTER, AND EXTENSION HOUSING

Item	Airline Use	Wollard Part No.	Ford Part No.	Description	Eff	Units Per Assy
27		302302	C4AZ-7D011-A	Ring, Governor Housing Seal		3
28		302303	C6AZ-7D000-B	Tube, Outlet, Oil Distributor		1
29		302304	C6AZ-7D000-A	Tube, Inlet, Oil Distributor		1
30		Comm	56119-S	Screw, Hex Flange Hd, 5/16-18 x 0.82		1
31		302305	F1TZ-7F013-A	Shield, Modulator Heat		1
32		302307 302308 302309	D4TZ-7A377-A or D7OZ-7A377-A or D8AZ-7A377-A	Diaphragm Assy, Throttle Valve (Black Band-SAD) or Diaphragm Assy, Throttle Valve (Green Band-SAD) or Diaphragm Assy, Throttle Valve (Altitude Compensating)		1
33		302310	D3AZ-7F006-B	Clip, Diaphragm Retainer		1
34		302311	D5AZ-7D080-A	Valve, Transmission, Primary Throttle		1
35		302312	8DAZ-7A380-A	Rod Kit, Throttle Control		1
36		Comm	378782-S	HHCS, 5/16-18 x 9/16		17
37		37920	C6AZ-7A191-B	Gasket, Oil Pan		1
38		302313	E5TZ-7A194-D	Pan, Oil		1

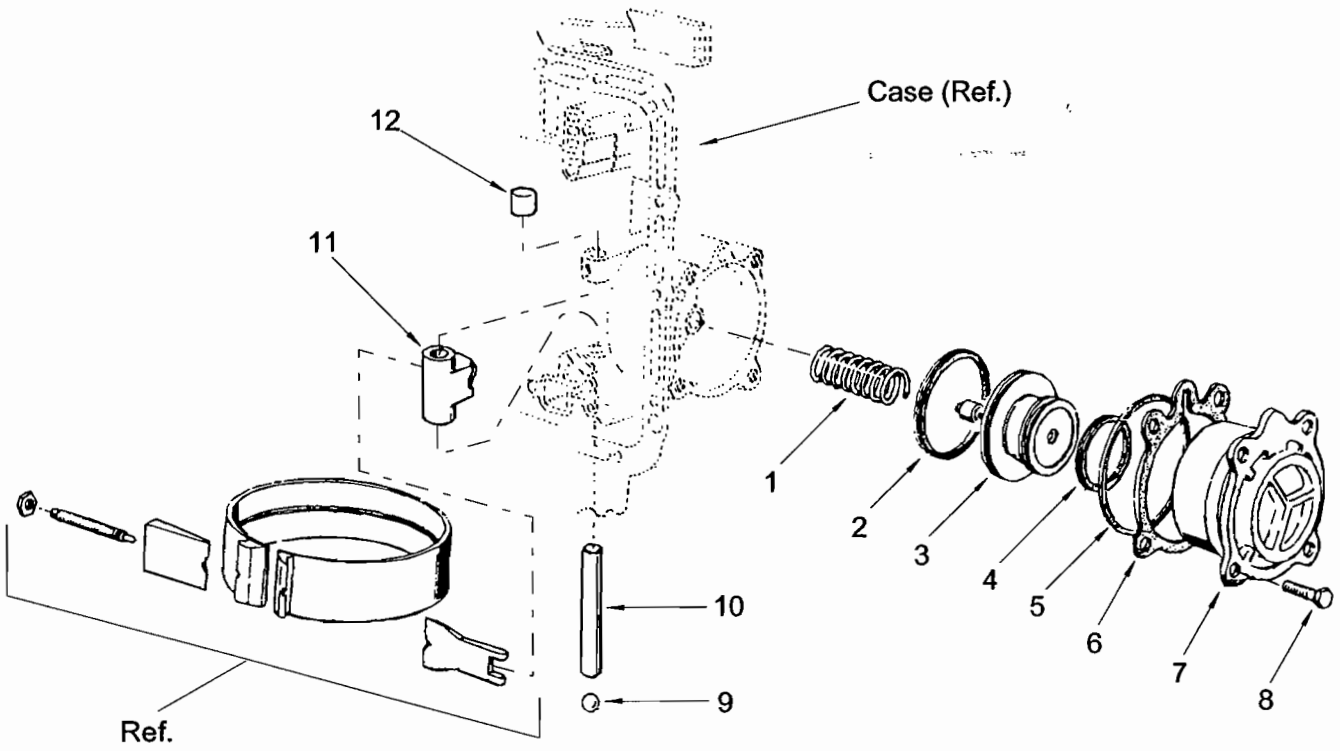


FIGURE 2
INTERMEDIATE SERVO AND BAND

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1		302314 302315 302316	C8SZ-TD028-B D1AZ-7D028-A D6OZ-7D028-A	Spring, Intermediate Band Servo (Yellow) Spring, Intermediate Band Servo (Brown) Spring, Intermediate Band Servo (Pink)		1
2		302317	D5TZ-7D024-B	Seal, Intermediate Band Servo Cover		1
3		302318	D5UZ-7D021-B	Piston Assy, Intermediate Band Servo		1
4		302319	C6AZ-7D025-A	Seal, Intermediate Brake Drum		1
5		302320	D5TZ-7D024-B	Seal, Intermediate Band Servo Cover		1
6		302321	D4AZ-7D026-A	Gasket, Inter. Band Servo Cover		1
7		302322	D3AZ-7D027-A	Cover, Intermediate Band Servo		1
8		Comm	57633-S2	HHCS, 5/16-18 x 0.75		4
9		302323	353079-S	Ball, 1/2"		1
10		302324	C6AZ-7D433-A	Shaft, Intermediate Band Actuating Lever		1
11		302325	C6AZ-7330-B	Lever, Intermediate Band Servo		1
12		302326	C7AZ-7E206-A	Retainer, Intermediate Band Servo Lever		1

FIGURE 3
VALVE BODY ASSEMBLY

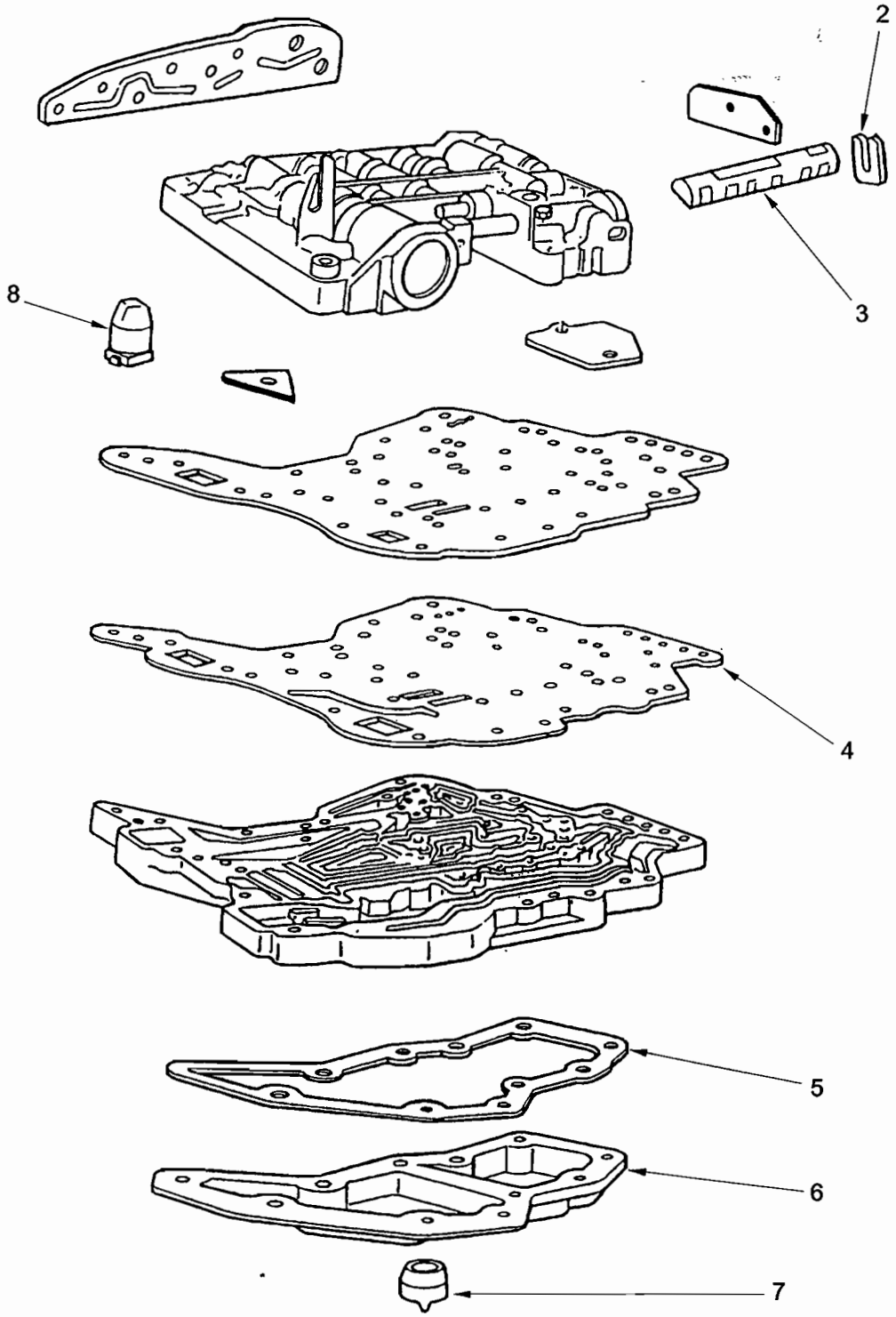


FIGURE 3
VALVE BODY ASSEMBLY

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1		302327	E0FP-7A100-BA or E0FP-7A100-AA	Valve Body, Main Control Assy (2-speed) (Includes items shown but not called out) or Valve Body, Main Control Assy (3-speed) (Includes items shown but not called out)		1 1
2		302328	C4AZ-7D227-A	Spacer, Throttle Pressure Valve		1
3		302329	E0TZ-7326-D	Rod, Gear Selector Valve		1
4		302330	6DAZ-7D100-A	Gasket, Valve Body Separator Plate		1
5		302331	C6AZ-7E062-A	Gasket, Oil Pan Screen		1
6		NW34532	D5AZ-7A098-B	Screen, Oil Pan (includes item #5)		1
7		320332	D3TZ-7A102-A	Tube, Lower Valve Body Suction		1
8		302333	D0AZ-7E387-A	Screen, Main Control Pump Inlet		1

FIGURE 4
THROTTLE AND MANUAL CONTROL LINKAGE

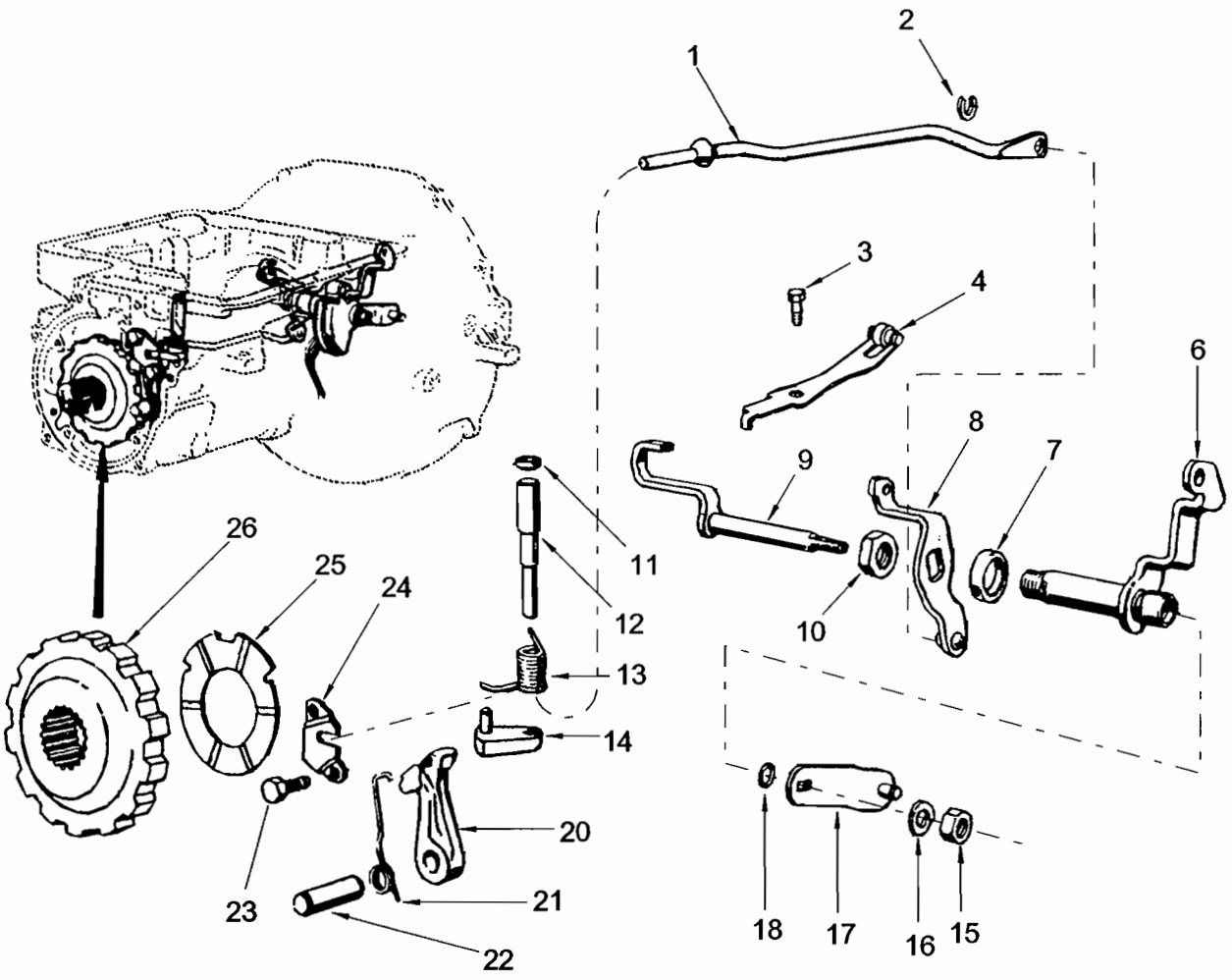


FIGURE 4
THROTTLE AND MANUAL CONTROL LINKAGE

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
1		302334	F0TZ-7D411-A	Rod, Parking Pawl Actuating (Includes item #24)		1
2		Comm	97411-S	Retainer		1
3		Comm	376562-S	Screw		1
4		302335	E0TZ-7A261-A	Spring, Manual Control Valve Detent Lever		1
5				NOT USED		1
6		302336	D2ZP-7A256-AB	Lever Assembly, Manual Control		1
7		302337	D5AZ-7B498-A	Seal Assy., Manual Control Lever		1
8		302338	E0TZ-7A115-A	Lever Assy., Manual Control Valve Detent		1
9		302339	D0AZ-7D261-B	Lever Assy., Downshift Detent Inner		1
10		Comm	33945-S	Nut		1
11		302340	EAA 6572-A	Cup, Parking Plate Shaft		1
12		302341	C6AZ-7D418-A	Shaft, Parking Plate		1
13		302342	C9AZ-7D417-A	Spring, Parking Brake Torsion		1
14		302343	C9AZ-7D414-A	Plate Assy (Includes item #13)		1
15		Comm	33798-S	Nut		1
16		Comm	34806-S7	Washer, Lock		1
17		302344	D0OZ-7A394-B	Lever, Downshift Control Outer		1
18		302345	386078-S	Seal		1
19				NOT USED		
20		302346	E0TZ-7A441-A	Pawl, Parking		1
21		302347	C6AZ-7D070-B	Spring, Parking Pawl Return		1
22		302348	C6AZ-7D071-A	Shaft, Parking Pawl Return		1
23		Comm	379058-S7-8	Screw and Washer		1
24		NSS	E0AP-7D419-BA	Plate (See item #1)		1
25		302349	D3TZ-7B368-A	Washer, Output Shaft Thrust Rear		1
26		302350	D6TZ-7A233-A	Gear, Output Shaft (Incl. item #25)		1

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

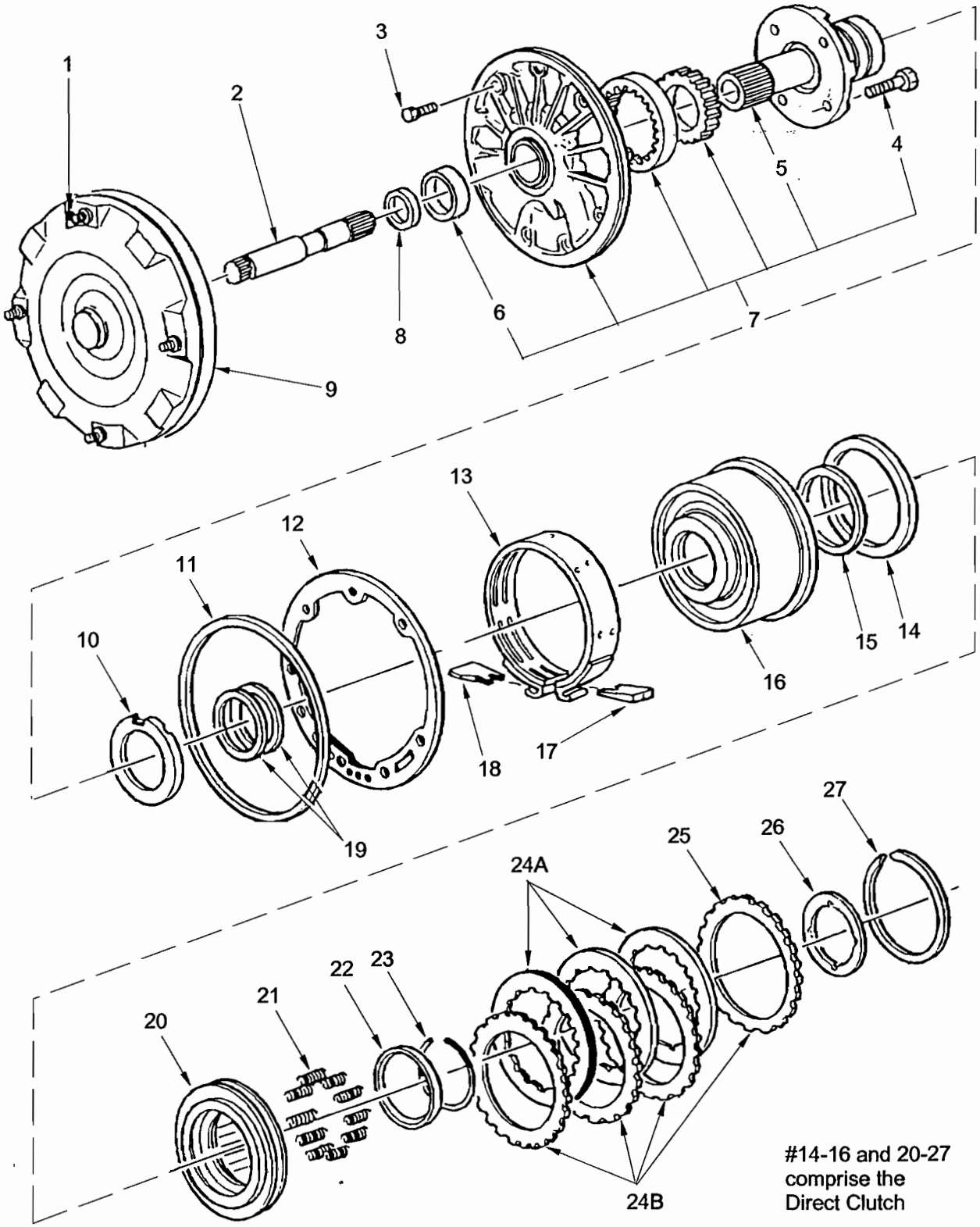


FIGURE 5
CLUTCHES, GEARS AND SHAFTS

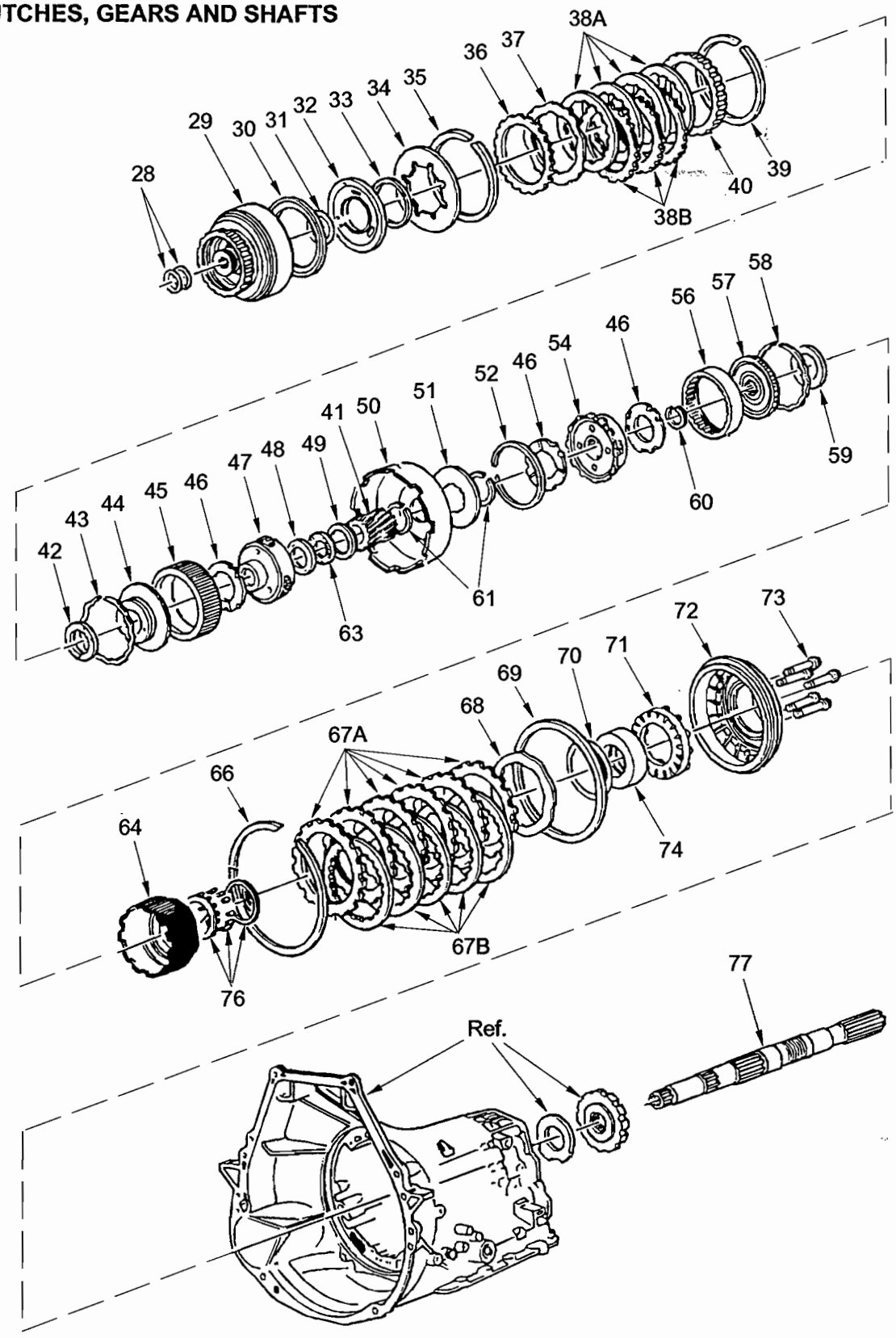


FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
1		302351	87650-S2	Plug, Dry Seal Tapered Thread, 1/8-27		1
2		302352	D2AZ-7017-A	Shaft, Input		1
3		Comm	58619-S2	HHCS, 5/16-18 x 1.25		7
4		Comm	20346-S8	HHCS, 5/16-18 x 0.75		5
5		302353	C9AZ-7A108-A	Support Assy., Front Pump		1
6		302354	C6AZ-7B258-A	Bushing, Front Oil Pump		1
7		302355	C8AZ-7A103-B	Pump Assembly, Front Oil		1
8		302356	C2AZ-7A248-A	Seal Assy., Front Oil Pump, Small		1
9		38792	E4TP-EA	Torque Converter Assembly		Ref
10		302357		Washer, Front Pump Support Thrust:		
			C6AZ-7D014-A	#1, 0.057" thick		1
			C6AZ-7D014-B	#2, 5/64" thick		1
			C6AZ-7D014-C	#3, 3/32" thick		1
			C6AZ-7D014-D	#4, 0.114 thick		1
			C6AZ-7D014-E	#5, 0.119 thick		1
11		300134	C6AZ-7A248-B	Seal Assy., Front Oil Pump, Large		1
12		302358	C6AZ-7A136-A	Gasket, Front Oil Pump to Case		1
13		302359	D9AZ-7D034-B	Band Assy, Intermediate Servo		1
14		302360	C8AZ-7A548-C	Seal, Direct Clutch Piston Oil		1
15		302361	C8AZ-7C099-A	Seal, Clutch Piston Oil		1
16		302362	C9AZ-7D044-A	Drum Assembly, Intermediate Brake (Incl. Item #15)		1
17		302363	C6AZ-7D430-C	Strut, Intermediate Band Anchor		1
18		302364	C6AZ-7D029-C	Strut, Intermediate Brake Band		1
19		302319	C6AZ-7D025-A	Seal, Interm. Band Servo Piston Cover		2
20		302365	C9AZ-7A262-B	Piston Assy, Direct Clutch		1
21		302366	C7ZZ-7B488-A	Spring, Direct Clutch Piston		10
22		302367	C6AZ-7A527-A	Retainer, Direct Clutch Piston Spring		1
23		302368	377136-S	Ring, Retaining		1
24A		302369	D6AZ-7B164-B	Plate, Direct Clutch, Internal (Friction)		A/R
24B		302370	C6AZ-7B442-A	Plate, Direct Clutch, External		A/R
25		302371	C6AZ-7B066-B	Plate, Clutch Pressure		1
26		302372	C6AZ-7C096-A	Washer, Thrust		1
27		NSS		Ring, Retaining (See item #39)		1
28		302373	E0AZ-7D019-A	Seal, Forward Clutch Cylinder		2

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
29		302374	E9AZ-7A360-A	Cylinder Assy., 8-Plate Clutch Forward (Includes item #34) Note: If replacing a 6-plate clutch, you must use an additional item #24A and B)		1
30		302375	D6AZ-7A548-A	Seal, Forward Clutch Piston Oil, Outer		1
31		302376	377130-S94	Seal, Forward Clutch Piston Oil, Inner		1
32		302377	D6AZ-7A262-A	Piston Assembly, Forward Clutch		1
33		302378	C6AZ-7D256-B	Ring, Forward Clutch Piston Spring		1
34		302379	D9AZ-7B070-A	Spring, Forward Clutch Piston Disc		1
35		302380	377127-S	Ring, Retainer, 6-21/32" x 0.076" thick		1
36		302381	C6AZ-7B066-A	Plate, Clutch Pressure (has triangle depression on front face)		1
37		302382	D6AZ-7E085-B	Spring, Clutch Pressure, Forward (4 teeth in 26-tooth bank)		1
38A 38B		302383 302370	C8AZ-7B164-H C6AZ-7B442-A	Plate, Front Clutch, Internal (Friction) Plate, Front Clutch, External (Steel)		A/R A/R
39		302384	 377126-S 377127-S 377128-S 377437-S 377444-S 386841-S 386842-S	Ring, Retaining (Select fit): 6-21/32" dia. x 0.062" thick 6-21/32" dia. 0.076" thick 6-21/32" dia. 0.090" thick 0.058" thick (forward clutch) 0.094" thick (forward clutch) 7-7/64" dia. x 0.112" thick 7-7/64" dia. x 0.130" thick		A/R
40		302385	C6AZ-7D066-B	Washer, Input Shell Thrust, 3-3/4" x 3/64"		1
41		302386	C6AZ-7D063-A	Gear Assembly, Sun (34 teeth)		1
42		302387	C9AZ-7D090-A	Washer, Froward Clutch Hub Thrust		1
43		302388	377132-S	Ring, Retaining, 4-21/32"		1
44		302389	D6AZ-7B067-A	Hub, Clutch, Forward Ring Gear, 4-1/2"		1
45		302390	D6AZ-7D392-A	Gear, Forward Ring		1
46		302391	C6AZ-7A166-A	Thrust Washer, Forward Planet Carrier		1
47		302392	D5AZ-7A398-A	Planet Assy, Forward		1
48		302393	C6AZ-7D236-A	Race, Sun Gear Thrust Bearing (Front)		1
49		302394	C6AZ-7D235-A	Race, Sun Gear Thrust Bearing (Rear)		1
50		302395	C6AZ-7D064-A	Shell, Input		1
51		302396	C6AZ-7D066-B	Washer, Input Shell Thrust, 3-3/4 x 3/64		1
52		302397	377155-S	Ring, Retaining, 5-7/32"		1
53				NOT USED		
54		302398	C6AZ-7D006-B	Planet Assembly, Reverse		1
55				NOT USED		

FIGURE 5
CLUTCHES, GEARS AND SHAFTS

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units Per Assy
56		302399	C6AZ-7A153-A	Gear Ring (74 teeth)		1
57		302400	C9AZ-7D164-A	Hub, Output Shaft		1
58		302388	377132-S	Ring, Retaining, 4-21/32"		1
59		302401	C9AZ-7D422-A	Thrust Washer, Output Shaft Hub		1
60		302402	387031-S5	Ring, Retaining, Copper, 5/64" thick		1
61		302403	377300-S	Ring, Retaining, 2"		2
62				NOT USED		
63		302404	C6AZ-7D234-A	Bearing Assembly, Sun Gear Thrust		1
64		302405	C6AZ-7B067-B	Hub, Clutch, Reverse, 5-1/2"		1
65				NOT USED		
66		302406	385044-S	Ring, Retaining, 7-1/8"		1
67A 67B		302407 302408	D6AZ-7B164-A C6AZ-7B442-B	Plate, Reverse Clutch, Internal (friction) Plate, Reverse Clutch, External (steel)		A/R A/R
68		302409	D8AZ-7E085-A	Spring, Clutch Pressure, Reverse, 6-7/8"		1
69		302410	C8AZ-7D403-A	Seal, Outer, Reverse Clutch Piston		1
70		302411	C7AZ-7D404-A	Seal, Inner, Reverse Clutch Piston		1
71		302412	D6AZ-7D406-A	Retainer and Spring, Reverse Clutch		1
72		302413	D8AZ-7D402-A	Piston Assembly, Reverse Clutch (Includes item #68)		1
73		302414	C6AZ-7D167-A	HHCS, Overrunning Clutch Case, 5/16-24 x 2.00		5
74		302415	C9AZ-7D171	Race, Inner, Overrunning Clutch		1
75				NOT USED		
76		302416	D0AZ-7A089-A	Clutch Assembly, Overrunning		1
77		302417	D6TZ-7060-A	Shaft, Output		1

FIGURE 6
FLYWHEEL AND OIL FILLER

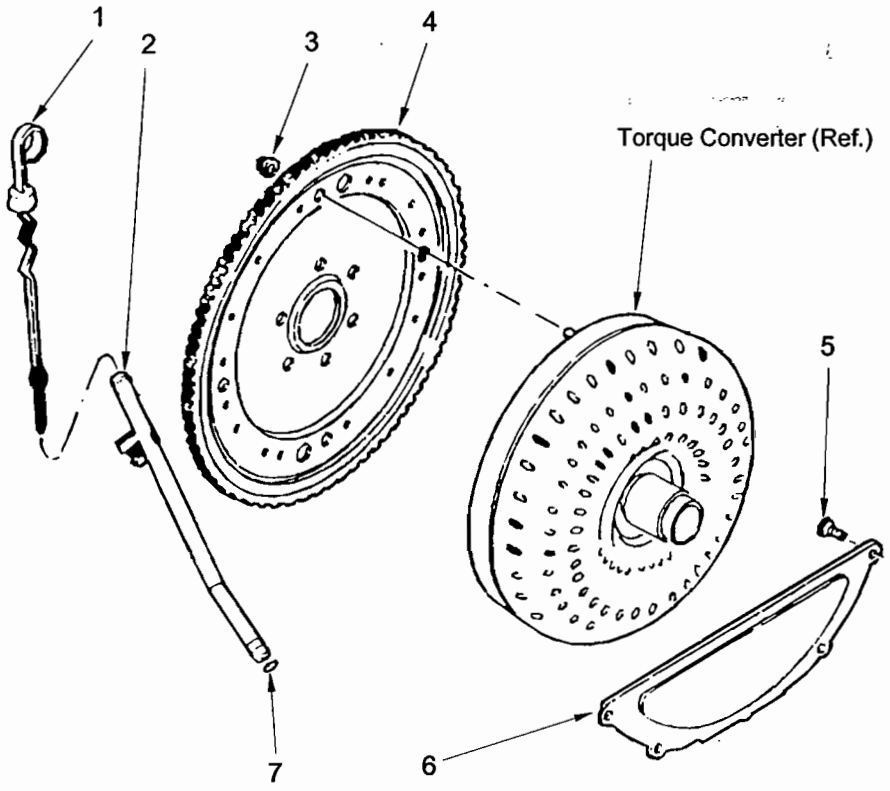


FIGURE 29F
FLYWHEEL AND OIL FILLER

Item	Airline Use	Wollard Part No.	Ford Part No.	Nomenclature	Eff	Units per Assy
1			Numerous types-Call with description.	Indicator, Oil Level		1
2				Tube Assembly, Oil Filler		1
3		Comm	378941-S7-8	Nut, Flywheel		4
4		302418	D5TZ-6375-A	Flywheel		1
5		Comm	57632-S2	HHCS		4
6		302419	D10Z-7986-A	Cover, Converter Housing		1
7		302420	87034-S94	Seal, Oil Filler Tube		1
8		302296	D0AZ-7034-B	Vent, Case		1

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C-6 TRANSMISSION SERVICE

Available: Ford C-6 Automatic Transmission Service Manual

Wollard P/N 302157

(Ford P/N PPD 194-296)

C-6 AUTOMATIC TRANSMISSION

Removal and installation procedures are included in the event the transmission must be replaced or sent to a specialized repair facility.

The Ford C6 transmission combines a torque converter with a two-speed, fully automatic unit for transmitting engine torque to the drive axle via a drive shaft. Maintenance is limited to changing the fluid and filter at the recommended service intervals and adjusting the linkage, intermediate band, and neutral start switch.

Malfunctions

Automatic transmission malfunctions may be caused by poor engine performance or improper transmission adjustments.

You should always begin by checking engine performance, then fluid level and condition, and gearshift cable adjustment.

If the problem exists after these checks and adjustments are completed, remove unit from service and refer the transmission to a transmission repair facility.

⚠CAUTION If you ever notice unusual noises such as gear noise or grinding, a buzz or whine, knocks, scraping, clicking, etc., remove the unit from service and refer it to a transmission repair facility.

Towing the Unit

⚠CAUTION Tow the unit with the rear end picked up or with the drive shaft disconnected or the transmission will be damaged.

IN AN EMERGENCY, the unit may be towed without lifting the wheels or disconnecting the drive shaft **IF:**

- Engine is running AND transmission is in neutral.
- Towing distance must be LESS THAN 1 MILE and travel speed LESS THAN 5 M.P.H.

Important! Failure to follow these instructions will void the warranty.

Fluid Level and Condition

1. Bring transmission to normal operating temperature (about 180°F). Five minutes of driving, including frequent stops and starts, will usually produce normal fluid temperature.
2. Set gear selector to neutral (N) and withdraw transmission dipstick to check oil level.

⚠CAUTION Always check oil level with unit on a level surface and WITH FLUID AT NORMAL OPERATING TEMPERATURE. DO NOT OVERFILL TRANSMISSION. Overfilling can result in transmission damage. It is easy to overfill the transmission. To avoid overfilling, add oil in small amounts and recheck level frequently.

3. Withdraw dipstick and examine fluid for discoloration and a foul (burned) smell. This would indicate damaged bands or clutches. If oil has a milky look, water has entered the transmission. Air bubbles mean there is an air leak in the suction lines. Report any of these conditions to your supervisor.
4. Check level indicated on dipstick. Add fluid as needed to maintain level between "FULL" and "ADD 1 PINT" marks on the dipstick. Use type Dexron R2.

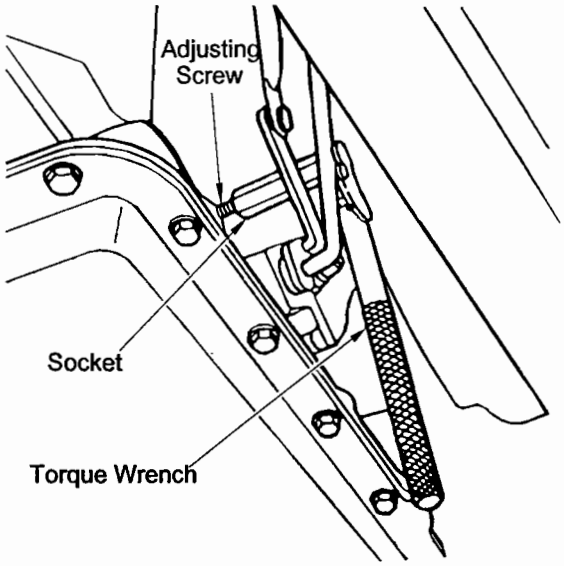
Transmission Adjustments

Most repair facilities can perform intermediate band and neutral start switch adjustments.

Intermediate Band Adjustment

⚠CAUTION When making band adjustments, FOLLOW SPECIFICATIONS EXACTLY. Failure to do so may cause serious damage to the transmission.

1. Raise unit on jack stands or a hoist.
2. Clean dirt from band adjusting screw. Remove and discard locknut.
3. Install a new locknut and tighten adjusting screw to 10 ft/lbs. torque.
4. Back off adjusting screw exactly 1 1/2 turns.
5. Hold adjusting screw from turning and tighten locknut to 35-40 ft/lbs.
6. Lower the unit.



Adjusting the Intermediate Band

Neutral Start Switch

The neutral start switch is a safety device that prevents the engine from starting if the transmission is in any shift position other than NEUTRAL.

Adjusting the Neutral Start Switch

Note: The neutral start switch may also be checked by attempting to start the engine with the gear shift lever in each shift position.

This switch is a combination unit located on the automatic transmission shifter shaft in the engine package.

1. Remove clevis pin holding shifter arm to cable clevis.
2. Connect a volt-ohm meter (on resistance range) or a continuity tester across both Red/Blue wires coming out of the switch.
3. Loosen hold-down bolts on switch and rotate switch until contact opens for the same throw of shifter arm either side of Neutral.
4. Retighten switch bolts and recheck adjustment.
5. Replace clevis pin.

Replacing the Neutral Start Switch

1. Remove neutral start switch from transmission case. Catch fluid in a clean container.
2. Move control lever to NEUTRAL position. Check to see that the switch operating lever finger is centered in switch opening in transmission case.
3. Install switch and tighten to 24 ft./lbs torque. Readjust switch.

Important! Be sure the switch packing is properly installed to prevent oil leakage.

4. Add fluid to transmission if needed.

Transmission and Torque Converter Removal

⚠CAUTION **The drive plate (flywheel) will not support a load. None of the weight of the transmission must be allowed to rest on the drive plate during removal or installation.**

⚠CAUTION **The transmission and torque converter must be removed and installed as an assembly to prevent damage to the front bushing or front oil seal.**

1. Remove the engine/transmission assembly.
2. Shift transmission into NEUTRAL. Place drain pan under transmission fluid pan. Starting at rear of pan and working toward front, loosen attaching bolts and allow fluid to drain. Finally remove all of pan attaching bolts except two at front to allow fluid to further drain. With fluid drained, install two bolts on rear side of pan to temporarily hold it in place.
3. Remove converter drain plug access cover from lower end of converter housing. Matchmark torque converter with drive plate (for easier installation).

⚠CAUTION **Do not attempt to rotate the drive plate or torque converter by prying or using force or you will damage the drive plate.**

4. Remove converter-to-flywheel attaching nuts. Place a wrench on crankshaft pulley attaching bolt to turn converter to gain access to bump switch.
5. With wrench on crankshaft pulley attaching bolt, turn converter to gain access to converter drain plug. Place a drain pan under converter to catch fluid and remove plug. After fluid has been drained, re-install plug.
6. Remove capscrew and self-locking nut securing transmission shift cable to shift lever on transmission.
7. Remove all hardware securing transmission shift cable to transmission and free the cable.
8. Disconnect hydraulic lines at transmission.
9. Disconnect park brake cable. Disconnect driveshaft and slide shaft rearward from transmission. Install a seal installation tool in extension housing to prevent fluid leakage.
10. Remove vacuum hose from vacuum diaphragm unit. Remove vacuum line from retaining clip.
11. Remove transmission rear support and insulator assembly attaching bolts at bottom rear of transmission.

12. Raise transmission with transmission jack to take pressure off rear crossmember.
13. Secure transmission to jack with safety chain.
14. Remove converter housing-to-engine attaching bolts.
15. Move transmission away from engine.
16. Lower transmission jack and move transmission and converter assembly from under vehicle.

Note: This manual does not cover transmission disassembly. Disassembly must be done by specialized personnel.

Transmission/Torque Converter Installation

⚠CAUTION The transmission must be installed as an assembly, or the front pump bushing and oil seal will be damaged.

Do not allow the weight of the transmission to rest on the drive plate during installation. The drive plate will not support a load.

1. Tighten converter drain plug to 18-28 ft-lbs.
2. Position converter on transmission, making sure converter drive flats are fully engaged in pump gear.
3. With converter properly installed, place transmission on jack. Secure transmission to jack with chain and place under tractor.
4. Raise transmission to align with engine.
5. Rotate converter until studs, drain plug and matchmark are in alignment with flywheel.
6. The converter must rest squarely against flywheel. This indicates that converter pilot is not binding in engine crankshaft.Do not allow converter drive flats to disengage from pump gear. Move converter and transmission assembly forward into position, using care not to damage the flywheel and converter pilot.
7. Install and tighten converter housing-to-engine attaching bolts to 40-50 ft-lbs.
8. Remove transmission jack safety chain from around transmission.
9. Position transmission support crossmember to frame side rails and tighten attaching bolts.
10. Position transmission rear support and insulator assembly above crossmember and lower transmission into place. Install mounting bolts and tighten.

11. Remove jack.
12. Connect vacuum line to vacuum diaphragm making sure that line is in retaining clip.
13. Connect oil cooler lines to transmission.
14. Connect downshift and manual linkage rods or cable controls to their respective levers on the transmission.
15. Secure converter-to-flywheel attaching nuts and tighten them to 20-30 ft-lbs.
16. Install converter housing access cover and secure it with attaching bolts.
17. Install new filter and pan gasket, and fill transmission with oil.
18. Connect neutral switch wire to plug connector.
19. Connect temperature sender wire.
20. Connect oil cooler lines to transmission and install oil filler tube.
21. Install dust shield in front of converter assembly.
22. Install engine/transmission assembly into the unit.
23. Connect the battery negative cable.
24. Place gear shift lever in neutral position. Install gear shift cable.
25. Connect wires to neutral starting switch and temperature sending unit.
26. Install park brake cable.
27. Adjust shift cable as required.
28. Start engine and again check for leaks.

Tires, Rear Mud/Snow

Option #305161

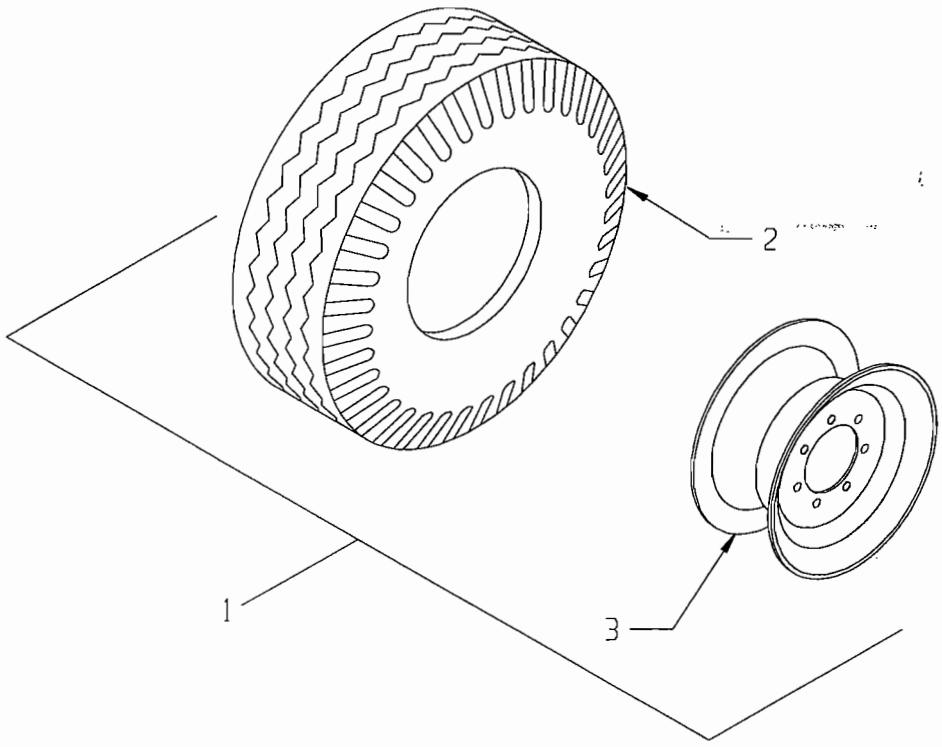
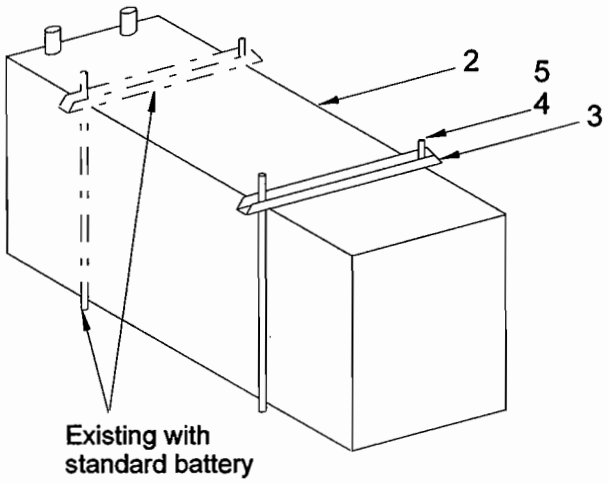


Fig Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	305161		Option, Tires, Rear Mud/Snow		Ref
1	16776.3		Wheel/Tire Assy, P225/75R15 Mud/Snow		2
2		1.8412	P225/75R15, Max Load 2540 lbs (Kelly)		1
3		1.7941	Wheel 15x6, 5-Bolt 5.5 (American Racing)		1

HEAVY DUTY BATTERY OPTION
OPTION #20097



HEAVY DUTY BATTERY

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
		20097		4D Battery Option		Ref
1				Not Used		
2		2.3555	904D-12V	Battery, 930 CCA (Deka)		1
3		19911		Battery Strap		1
4		19916		Bolt		2
5		3.3340		Nut, Lock, 1/4-20		2

Battery Side Covers

Option #20101

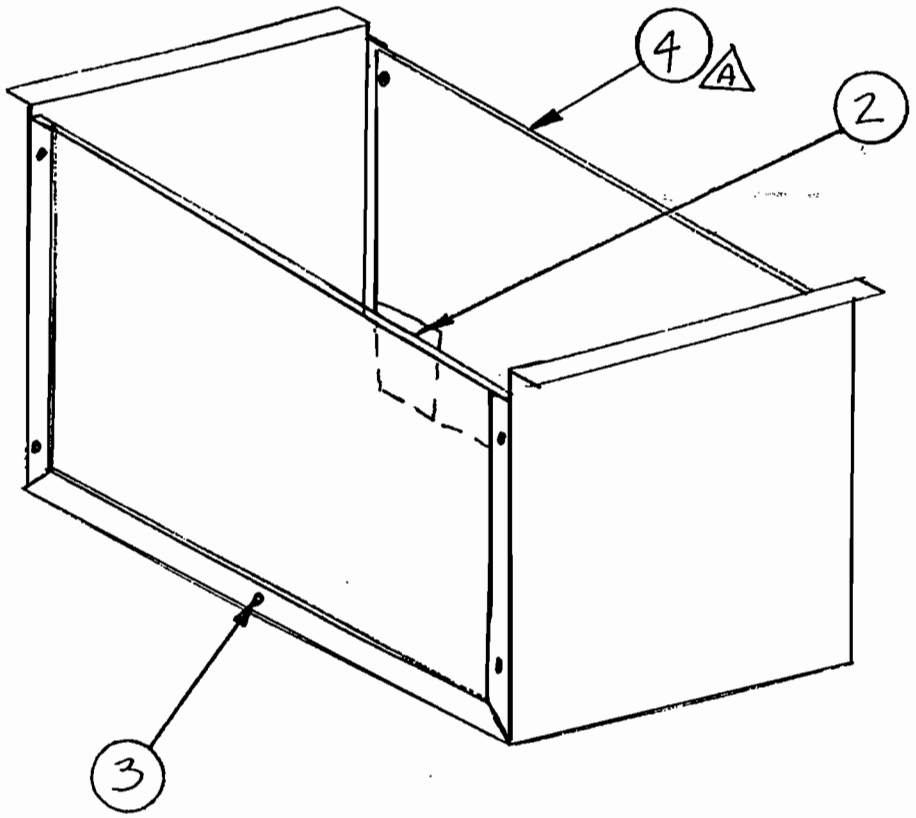
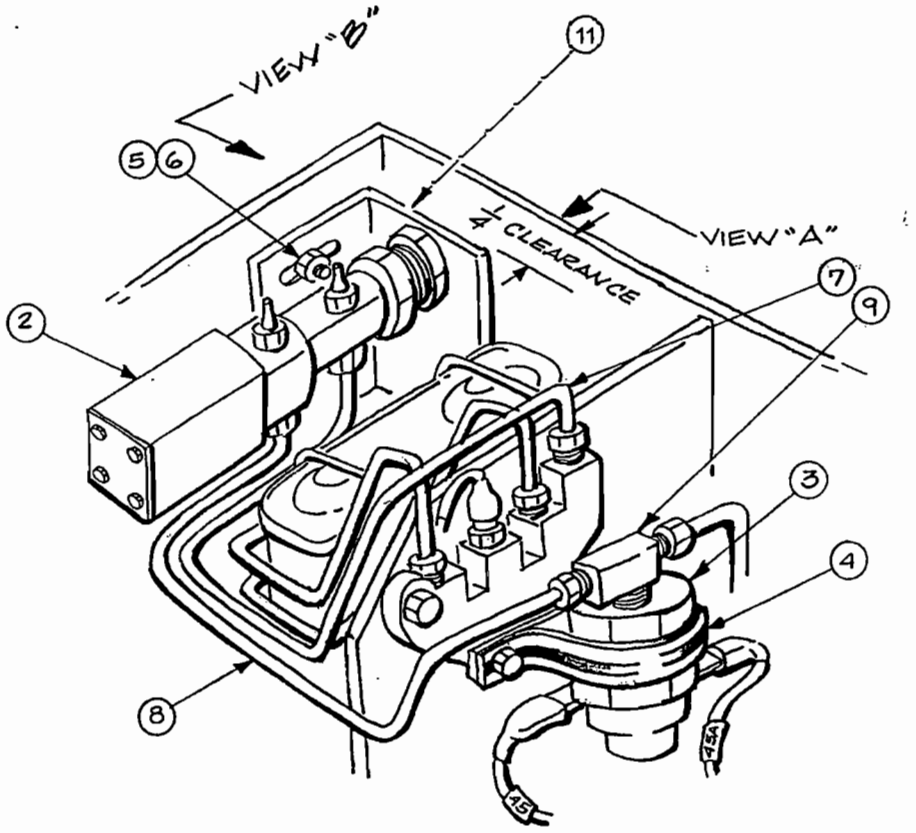
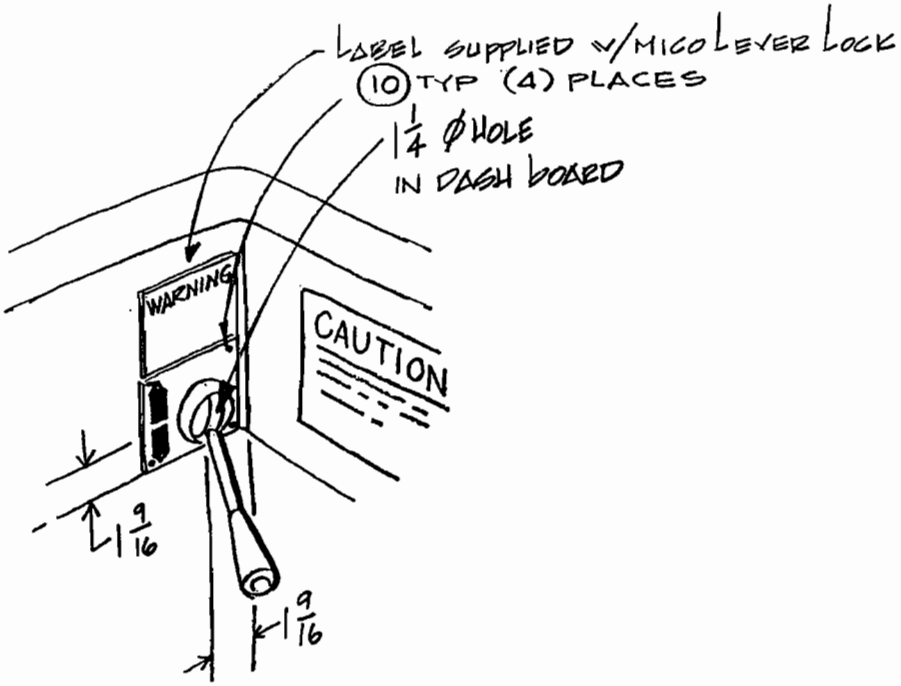


Fig Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	20101		Optional, Battery Side Covers		Ref
2	20102		Side, Battery Box, RH		1
3	Comm		Pop Rivet, AL #10 x 1/4 Grip		10
4	20202		Side, Battery Box, LH		1

Mico Brake

Option #20014


VIEW "B"
11
5
6
1/4 CLEARANCE
VIEW "A"
7
9
2
3
4
8
45A
45


LABEL SUPPLIED W/MICO LEVER LOCK
10 TYP (4) PLACES
1/4 Ø HOLE
IN DASH BOARD
WARNING
CAUTION
9/16
9/16

VIEW "A"

Item	Wollard Part No.	Vendor Part No.	Description	Eff	Units Per Assy
	20014		Optional, Mico Lever Lock		Ref
2	1.8832		Mico Lever Lock (Mico)		1
3	2.3305		Switch, Press, 600 (Mico)		1
4	3.3354		Clamp, Adel		1
5			Capscrew R Head		2
6			Nut, Hex Hd		2
7	9.1571		Tube Brake, 3/16 x .028		24
8	9.1571		Tube Brake, 3/16 x .028		24
9	3.3353		Ftg, Hyd, Adapter, Tee		1
10			Rivet		4
11	305440		Brkt, Micro Lock Mnt		1
NS	302123		Nut, Fuseholder		6

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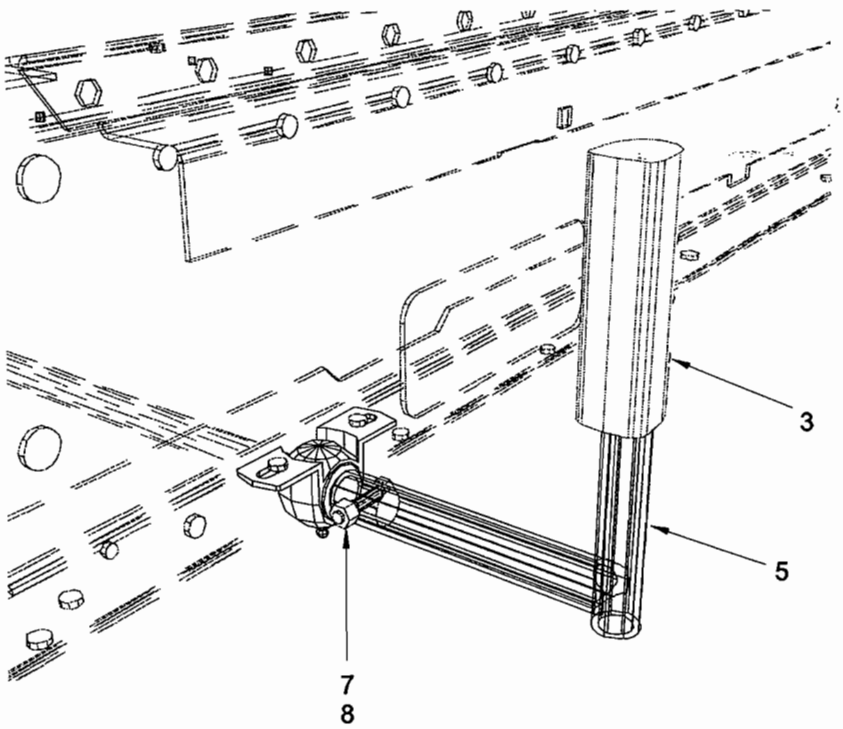
FULL WIDTH FRONT BUMPER
OPTION #20659

FULL WIDTH FRONT BUMPER

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20659		Full Width Front Bumper		Opt
2		20660		Bracket, Bumper		1
3		20658		Retainer, Bumper		1
4		20665		Bumper		1
5		Comm		HHCS, 3/8-16 x 2.00		3
6		Comm		Washer, Lock, 3/8		3

If a drawing is required, please call Wollard.

MANUAL CONTROL, RH REAR
OPTION #300781



MANUAL CONTROL, RH REAR

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		300781		RH Rear Manual Control		Opt.
2				Not Used		
3		1.0495		Grip, Handle		1
4				Not Used		
5		300782		Control Handle		1
6				Not Used		
7		3.3375		HHCS, 1/4-20 x 1-3/8, Gr. 8		1
8		Comm		Nut, Lock, 1/4-20		1

Belt Emergency Stop

Option #304904

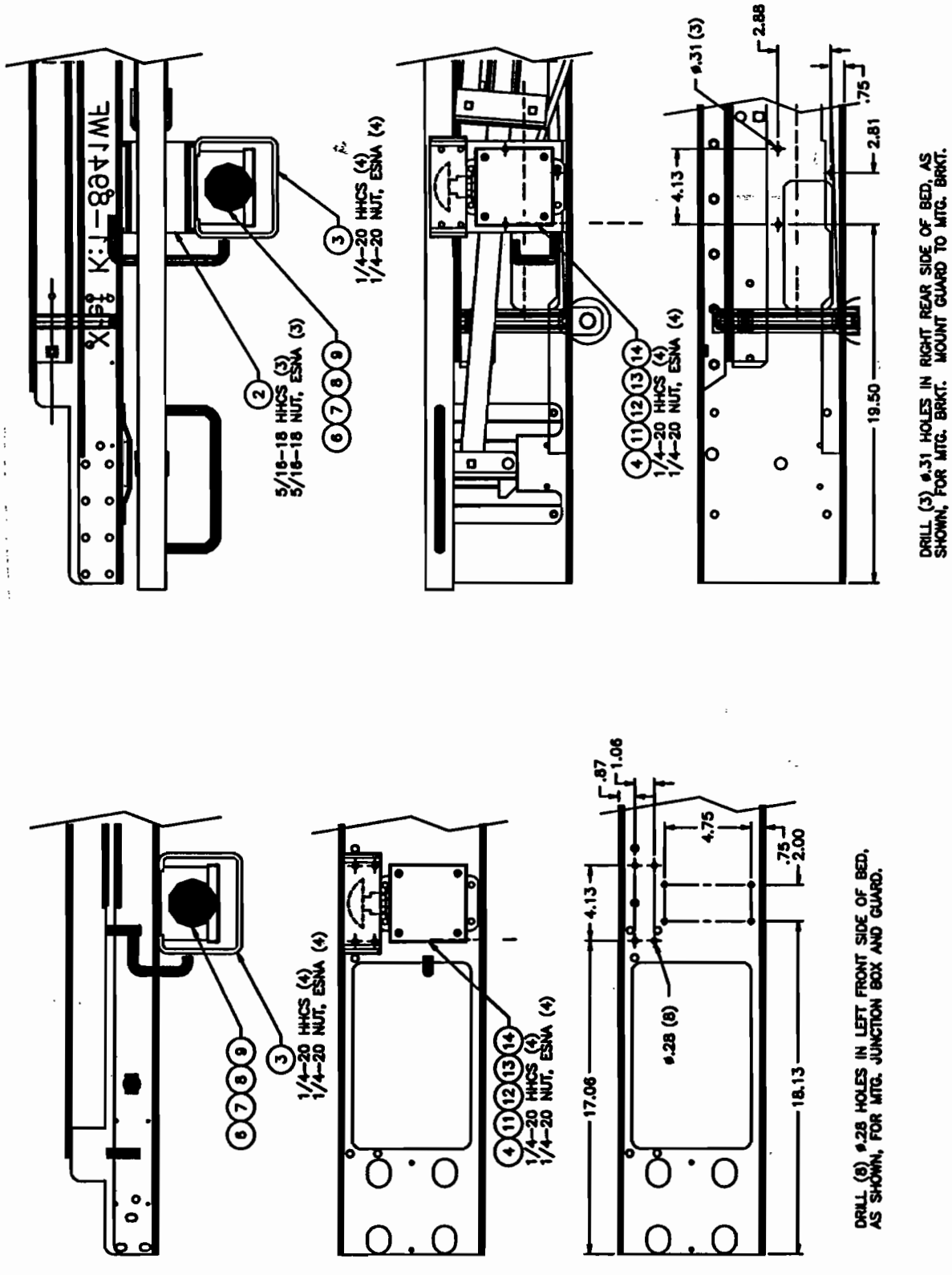

5/16–18 HHCS (3)
5/16–18 NUT, ESNA (3)
1/4–20 HHCS (4)
1/4–20 NUT, ESNA (4)
1/4–20 HHCS (4)
1/4–20 NUT, ESNA (4)
ø.31 (3)
2.88
.75
2.81
4.13
19.50
DRILL (3) ø.31 HOLES IN RIGHT REAR SIDE OF BED, AS SHOWN, FOR MTG. BRKT. MOUNT GUARD TO MTG. BRKT.
1/4–20 HHCS (4)
1/4–20 NUT, ESNA (4)
1/4–20 HHCS (4)
1/4–20 NUT, ESNA (4)
.87
1.06
4.75
.75
2.00
4.13
ø.28 (8)
17.06
18.13
DRILL (8) ø.28 HOLES IN LEFT FRONT SIDE OF BED, AS SHOWN, FOR MTG. JUNCTION BOX AND GUARD.

Fig Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
	304904		Optional, Belt Emergency Stop		Ref
2	304905		Brkt, Emergency Stop Mounting		1
3	20191		Guard, Emergency Stop		2
4	304965		Box, Junction, Modified		2
5	2.3692		Button, Emergency, Jumbo (DS Electric Supply)		2
6	2.3693		Switch, Oper Push/Pull (DS Electric Supply)		2
7	2.3691		Block, Contact, SPNC(DS Electric Supply)		2
8	2.3694		Plate, Legend, Push/Pull		2
9	2.0177		Connector, Cord		2
10	2.3695		Wire 16/2 SO 600V		72
11	2.3442		Nut, 1/2 Electric Seal		2
12	2.0500		Nut, Lock Conduit		2

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Towing Provisions

Option #20165

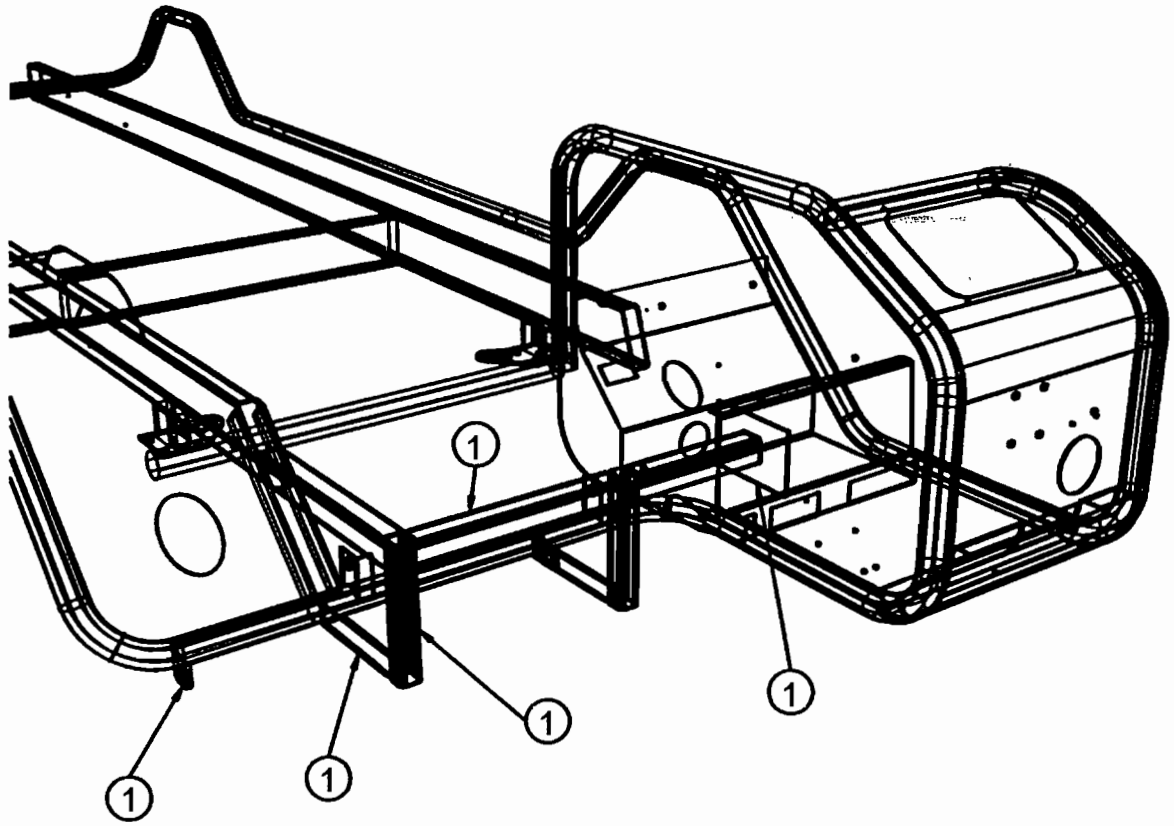
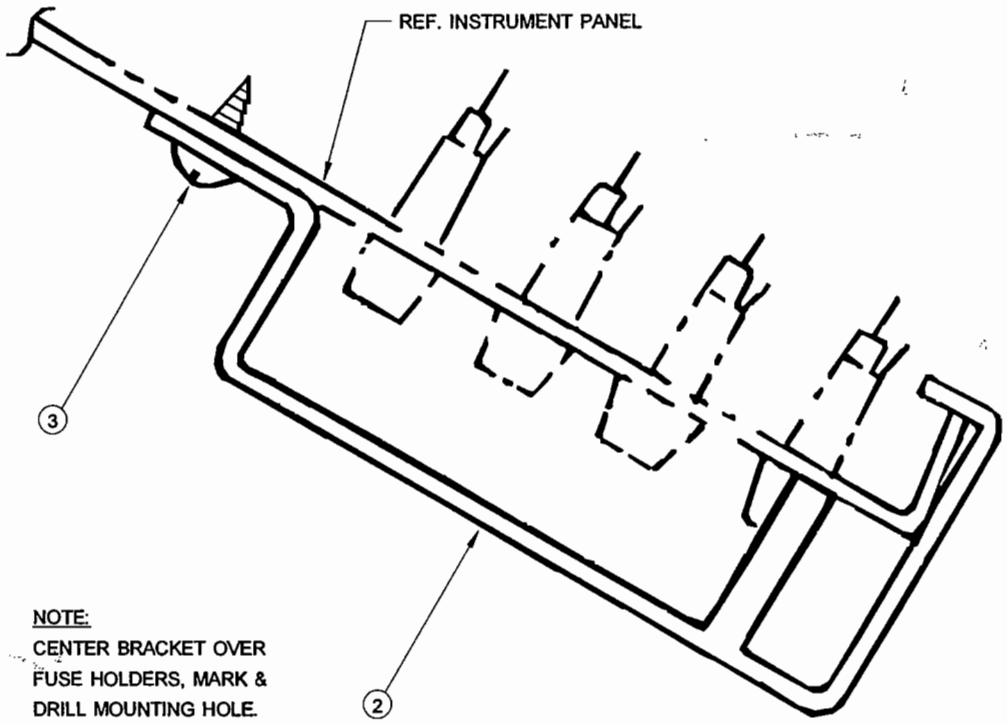


Fig Item	NMC-Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units Per Assy
1	20165		Option, Towing Provisions		Ref

FUSE COVER
OPTION #20099

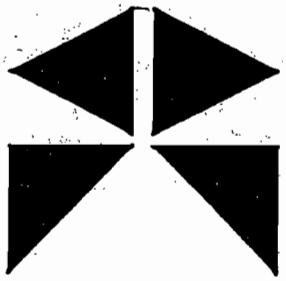


FUSE COVER

Item	Airline Use	Wollard Part No.	Vendor Part No.	Nomenclature	Eff	Units per Assy
1		20099		Option, Fuse Cover		1
2		20100		Bracket, Fuse Cover		1
3		Comm		Pan Head Screw, Stl., #8 x 1/2" lg.		1

CONTINENTAL MODEL TMD27 WITH STANADYNE

ILLUSTRATED PARTS CATALOG



WIS·CON TOTAL POWER CORP.

LIT10255

WARRANTY STATEMENTS
MAINTENANCE AND EMISSIONS COMPONENTS
TMD27 / TMDT27 *ONLY*

(ADDENDUM TO: LIT10169, LIT10175, LIT10180 & TTP10148)

NOTICE

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any non-road engine repair establishment or individual, however, warranty repairs must be performed by a dealer or service center authorized by Wis-Con Total Power Corp. Settings and procedures must be performed per this manual. The use of parts that are not equivalent in performance and durability to authorized parts may impair the effectiveness of the emission control system and have a bearing on the outcome of a warranty claim.

WARRANTY PROVISIONS - EMISSIONS COMPONENTS

Wis-Con Total Power warrants that our certified engines are designed, built and equipped to conform at the time of sale with all applicable E.P.A. regulations and are free from defects in materials and workmanship which would cause the engine to fail to conform with applicable regulations for its warranty period. The warranty period for emission related components is 3,000 hours or five years of use, whichever occurs first.

WIS·CON TOTAL POWER CORP.
Visit our web site at: http://www.totalpower.com

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B-4053 Chaudfontaine (Liege)
Belgium
Phone: (32) (43) 675320
FAX: (32) (43) 677987

SERVICE FACILITIES

WIS-CON TOTAL POWER Distributors and Service Centers, located throughout the U.S. and foreign countries, have been carefully selected to insure complete and efficient repair and inspection service to owners of WIS-CON TOTAL POWER Engines. These service centers, equipped and staffed for complete engine repair, also stock engine parts to facilitate immediate delivery for the complete line of WIS-CON TOTAL POWER Engines.

Order parts from the WIS-CON TOTAL POWER Distributor or Service Center in your locality. Refer to the Yellow Pages of the Telephone Directory under ENGINES, or write to WIS-CON TOTAL POWER for a free copy of a list of authorized Distributors and Service Centers. Do not order parts from WIS-CON TOTAL POWER in Memphis, TN.

The MODEL, SPECIFICATION and SERIAL NUMBER of your engine must be given when ordering parts. The MODEL and SPECIFICATION number are on the name plate. The SERIAL NUMBER is stamped either on the crankcase or the engine's identification tag.

Copy the MODEL, SPECIFICATION and SERIAL NUMBER in the spaces provided below so that it will be available when ordering parts.

MODEL	SPECIFICATION

SERIAL NUMBER

To insure prompt and accurate service, the following information must also be given:

1. State EXACTLY the quantity of each part and part number.
2. State definitely whether parts are to be shipped by express, freight or parcel post.
3. State exact mailing address.

INTRODUCTION

This catalog is designed to identify Continental parts.

When ordering parts, it is always advisable to list the engine model, specification number and serial number. With this information, we can check your order for any incorrect part numbers.

Use your "Customer Specification" to insure proper part number and nomenclature identification.

WIS-CON TOTAL POWER reserves the right to modify, alter and improve engines and parts. Part numbers and the structure of parts may change from those shown in this catalog.

Table of Contents

NOTES

ENGINE SERVICE KITS

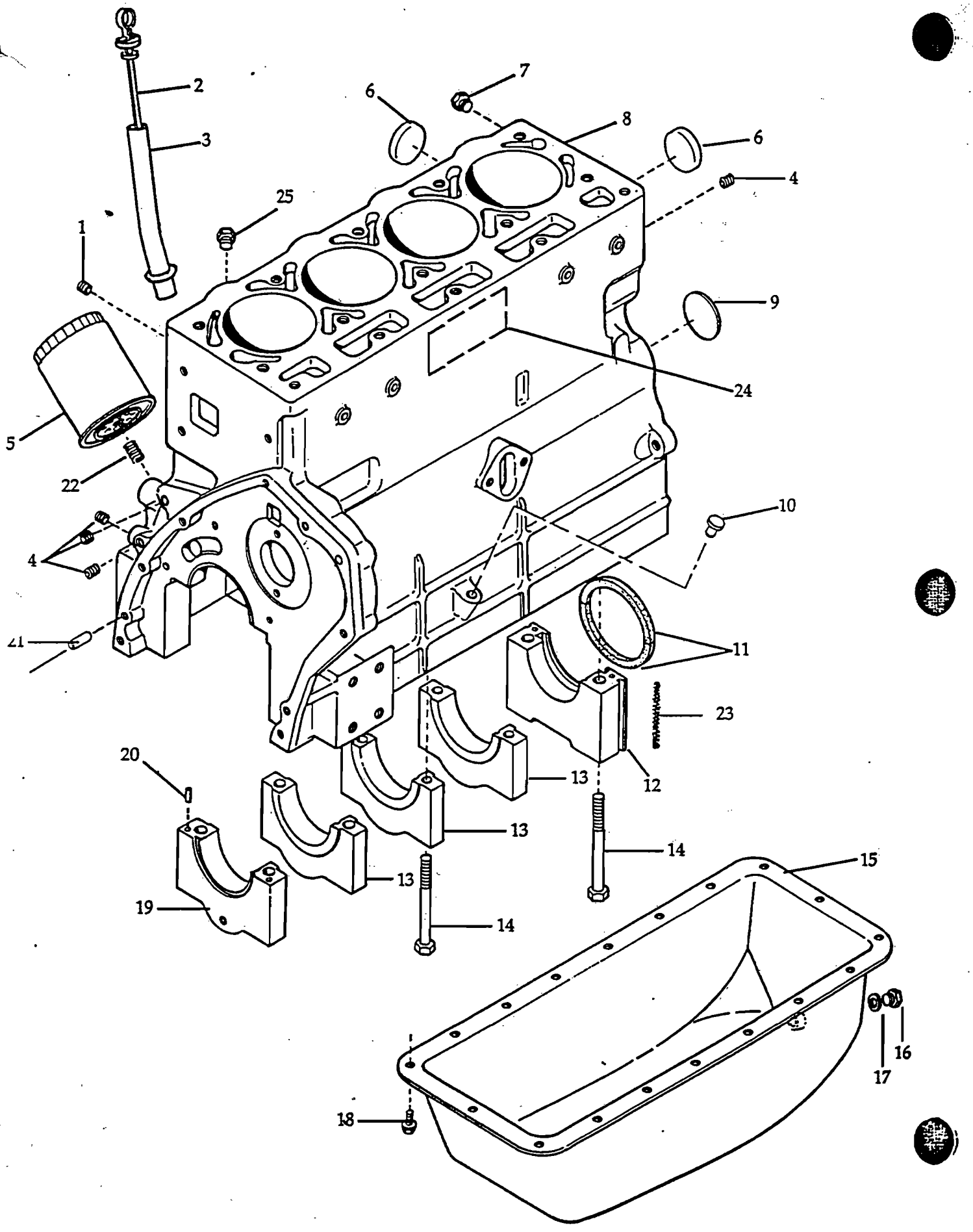
KIT NUMBER	DESCRIPTION
TMD20T00201	Ring Set (single piston)
TMD27A05031E	Piston, Pin & Retaining Rings
TMD20T00203 [a]	Nozzle Holder & Tip Assembly with Heat Shield
TMD20T00204 [a]	Nozzle Tip with Heat Shield
TMD27U01006 [a]	Gasket Set, Top End
TMD27U02002 [a]	Gasket Set, Front End
TM20T00102	Bearing Set, Connecting Rod (single rod)
TM27T00102	Bearing Kit, Crankshaft (engine set)
TM27T00107 [a]	Kit, Oil Pan Gasket & Rear Bearing Sealing
TM27T01001 [a]	Water Pump Repair Kit
NOT AVAILABLE	Cam Bushing

NOTE: [a] See Page #35 for Components

ENGINE SERVICE INFORMATION

PART NUMBER	DESCRIPTION
TTP10148	Repair Manual & Operators Guide
X10058	Wiring Diagram
TTP00086	Handbook, Preventive Maintenance

CRANKCASE, BEARING CAPS AND OIL FILTER



CRANKCASE, BEARING CAPS AND OIL FILTER

ITEM		PART NO.	DESCRIPTION	QTY
1		26XX00110	Plug, crankcase (3/8" pipe)	1
2		TM27L00426	Rod & cap, oil gauge	1
3		TM27L00311	Tube, oil filler	1
4		26XX00137A	Plug, crankcase (1/4" pipe)	4
5		F600L03750	Filter - oil, full flow	1
6		X13304	Plug, cup, crankcase core hole, right side & rear	5
7		26XX26129	Plug, hex head, crankcase (1/8" pipe)	1
8	a,c	TMD27A610601R	Short block (Service "R" Assembly)	1
—	b,c	TMD27A610803S	Long block (Service "S" Assembly)	1
9		X02208	Plug, expansion, crankcase at rear cam bearing	1
10		X07663	Plug, crankcase, left side, oil gauge rod hole	1
11	d	TM27L00513	Seal, oil, rear crankshaft	2
12		TM27B00500	Cap & filler block, rear bearing	1
13		TMD27B00403	Cap, crankshaft bearing, intermediate	3
14		XM32018	Screw, bearing cap to crankcase	10
15		TM27B05021	Pan, oil (includes items 16 & 17)	1
16		F400B00282	Plug, oil pan drain	1
17		X14583	Washer, oil pan drain plug	1
18		XM32077	Screw & washer, oil pan to crankcase	18
19		TMD27B00402	Cap, crankshaft, front bearing	1
20		TM27B00322	Dowel - bushing, bearing cap, front & rear	4
21		X17025	Pin, dowel, gear cover to crankcase	2
22		TM27L00202	Adapter, oil filter	1
23	e	X07840	Insert - Curing, Rear Bearing cap - side	2
24		———	Nameplate (normal location)	1
25		26XX26167	Plug - Hex Hd (1/4" Pipe)	1

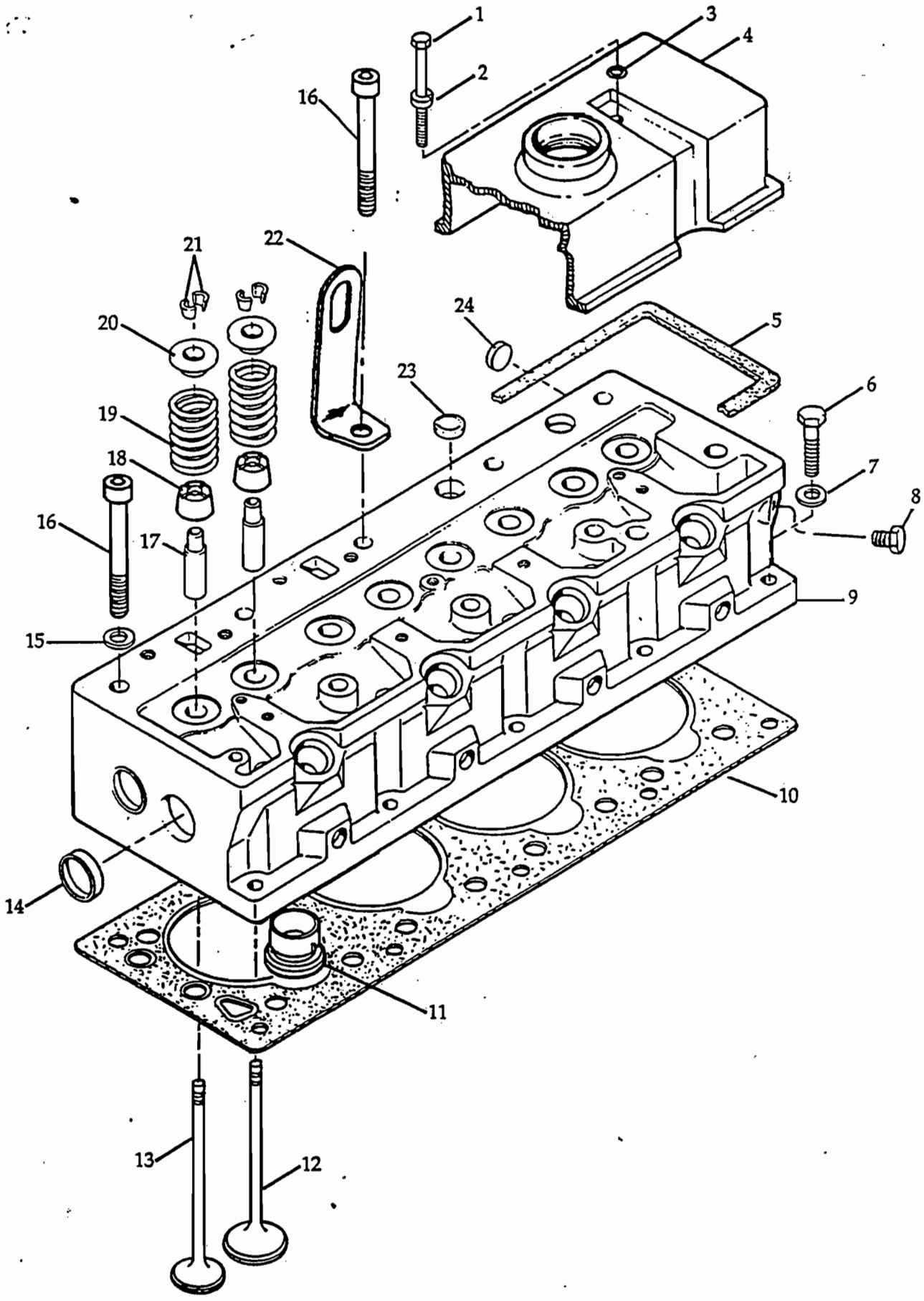
NOTE:

[a] Typically includes crankcase assembly, bearing caps, tappets, camshaft, main and rod bearings, crankshaft assembly, oil slinger — crankshaft, pistons, piston pins, piston rings, connecting rods, thrust plate, cam gear, crankshaft gear, injection pump driver gear, cover-fuel pump hole, oil pump assembly w/inlet tube assembly, lifting bracket, miscellaneous hardware and service gasket set.

[b] Typically includes all items in short block service "R" assembly (Note [a]) plus cylin der head (includes valve train), rocker arm shaft assembly, push rods, cylinder head cover, oil filler cap, gear cover assembly and oil pan assembly.

[c] Use the "R" & "S" assembly part numbers shown on your "Customer Specification" if different from part numbers listed here.

CYLINDER HEAD, COVER AND VALVES

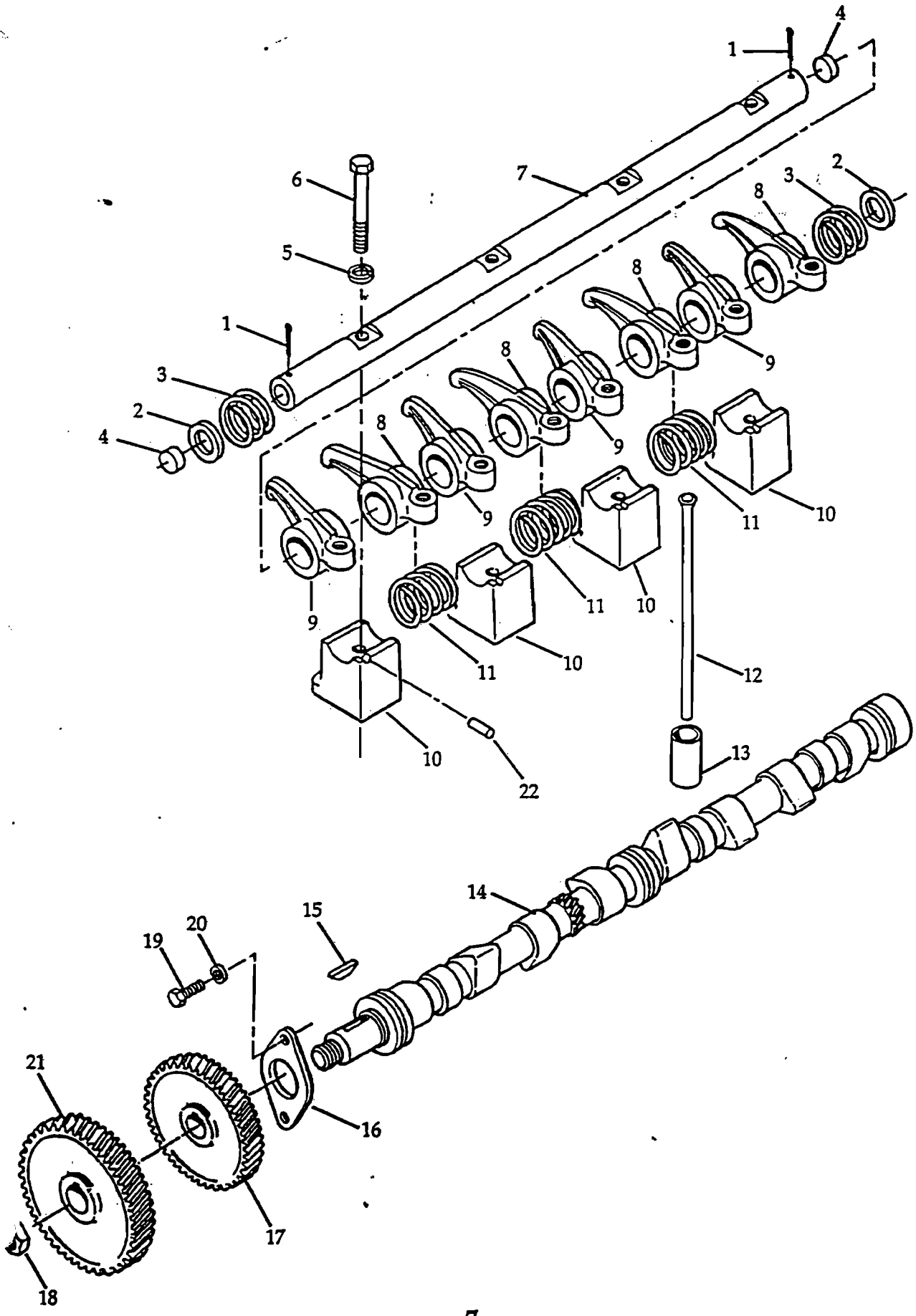


CYLINDER HEAD, COVER AND VALVES

ITEM		PART NO.	DESCRIPTION	QTY
1		XM32072	Screw, cylinder head cover to cylinder head	3
2	[a]	X14596	Washer, plain, cylinder head cover to cylinder head	3
3	[a]	XM39000	O-ring, cylinder head cover to cylinder head	3
4		TM27A00610	Cover, cylinder head	1
5	[a]	TM27A00502	Gasket, cylinder head cover	1
6		XM32021	Screw, cylinder head to crankcase	5
7		X14141	Washer, plain, cylinder head to crankcase	5
8		26XX26129	Plug, cylinder head, oil gallery	1
9		TMD27A06031	Head, cylinder, service (includes items 11-14, 17-21, 23, 24 and manifold studs)	1
10	[a]	TMD27A00614	Gasket, cylinder head	1
11		TMD27A00500	Insert, combustion chamber	4
12		TMD27I00502	Valve, intake	4
13		TMD27I00501	Valve, exhaust	4
14		X02583	Plug, cup, cylinder head, front & rear	4
15		XM37003	Washer, cylinder head to crankcase	9
16	[b]	XM32134	Screw, socket head, cylinder head to crankcase	10
17		TM27I00316	Guide, valve stem, intake & exhaust	8
18		TMD27I00401	Guard, valve stem oil, intake & exhaust	8
19		TM27I00309	Spring, valve, intake & exhaust	8
20		TM27I00300	Retainer, valve spring, intake & exhaust	8
21		CVT03234	Lock, valve spring retainer, intake & exhaust	16
22	[b]	TM27Z00402	Bracket, lifting, cylinder head #2 to crankcase	1
23		X07689	Plug, cup, cylinder head top	2
24		X07606	Plug, cross drill holes, cylinder head	4
—		X06226	Label, fan, warning; cylinder head cover - top front	1

NOTE: [a] Included in Top End Gasket Set TMD27U01006.
[b] On older model engines, see Service Bulletin #90-391, 90-403 & Newsletter C89-15 concerning lifting bracket & head bolt changes & torques.

CAMSHAFT AND ROCKER ARM



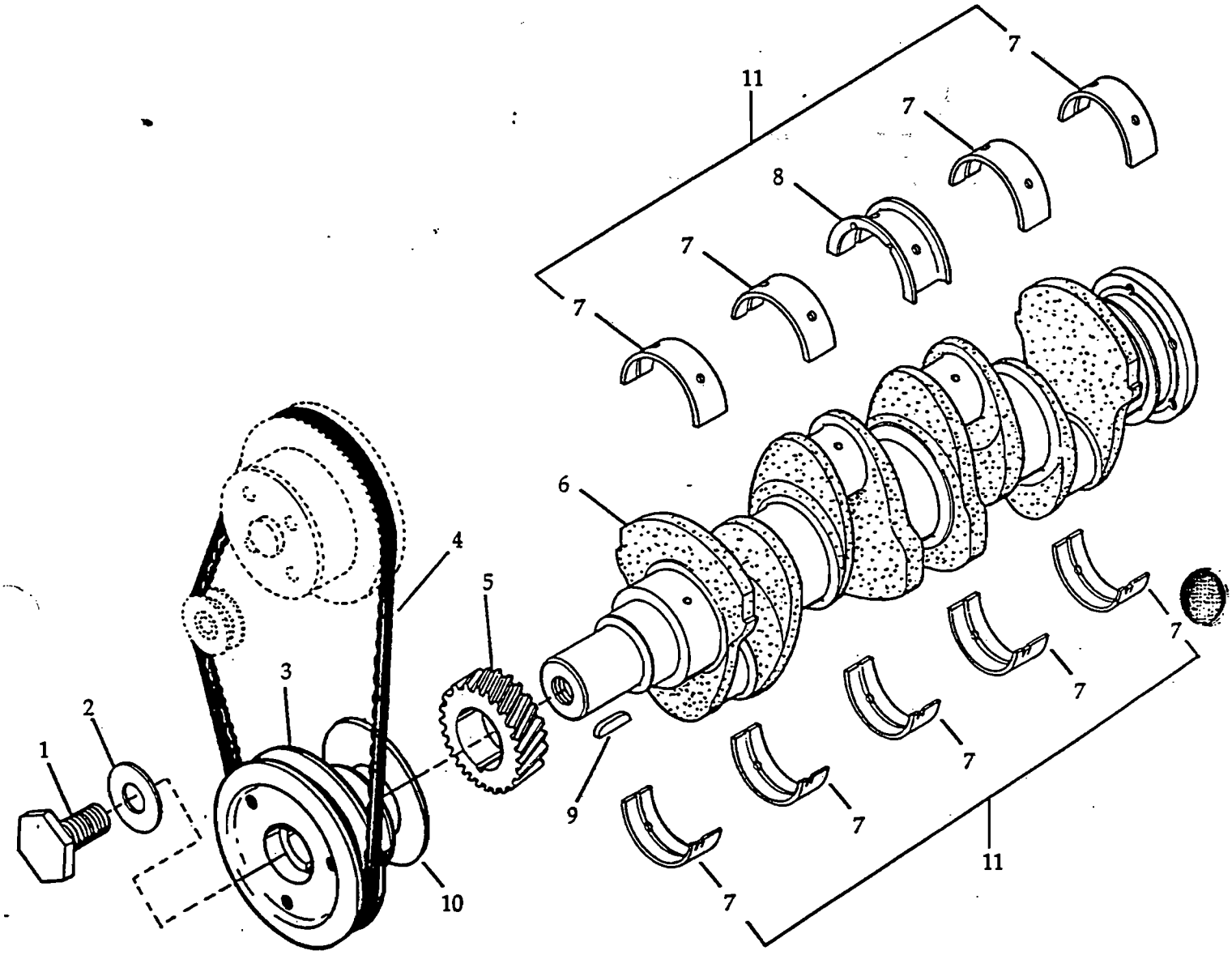
CAMSHAFT AND ROCKER ARM

ITEM		PART NO.	DESCRIPTION	QTY
1		X00623	Pin-cotter, rocker shaft-ends	2
2		X14589	Washer, plain, rocker shaft-ends	2
3		TM27I00313	Spring, rocker shaft-ends	2
4		X07815	Plug, rocker shaft-ends	2
5		XM37005	Washer, flat, rocker arm shaft to cylinder head	4
6		XM32031	Screw, rocker arm shaft to cylinder head	4
7	[a]	TM27I05162	Shaft, rocker arm, w/ plugs (includes item 4)	1
8		TM27I05150	Arm assembly, rocker, intake	4
9		TM27I05140	Arm assembly, rocker, exhaust	4
10		TM27I00314	Support, rocker arm shaft	4
11		TM27I00303	Spring, rocker arm shaft	3
12		TM27I00403	Rod, push	8
13		TM27I00305	Tappet, valve	8
14		TMD27I00402	Camshaft	1
15		X00599D	Key, cam gear to camshaft	1
16		F400I00246	Plate, camshaft thrust	1
17		TMD27H00402	Gear, injection pump	1
18		X18498	Nut, cam gear to crankshaft	1
19		XM32019	Screw, thrust plate to crankcase	2
20		XM37012	Washer, lock, thrust plate to crankcase	2
21	[b]	TMD27H00506	Gear, camshaft (Nitempered 21°)	1
22		X17066	Pin, grooved, front support to shaft	1

NOTE: [a] TM27I05164 Complete Rocker Arm Shaft Assembly (includes items 1-6, 8-11 & 22).

[b] SEE: SPB# 83-340 Rev. Sept. 1992.

CRANKSHAFT AND PULLEY

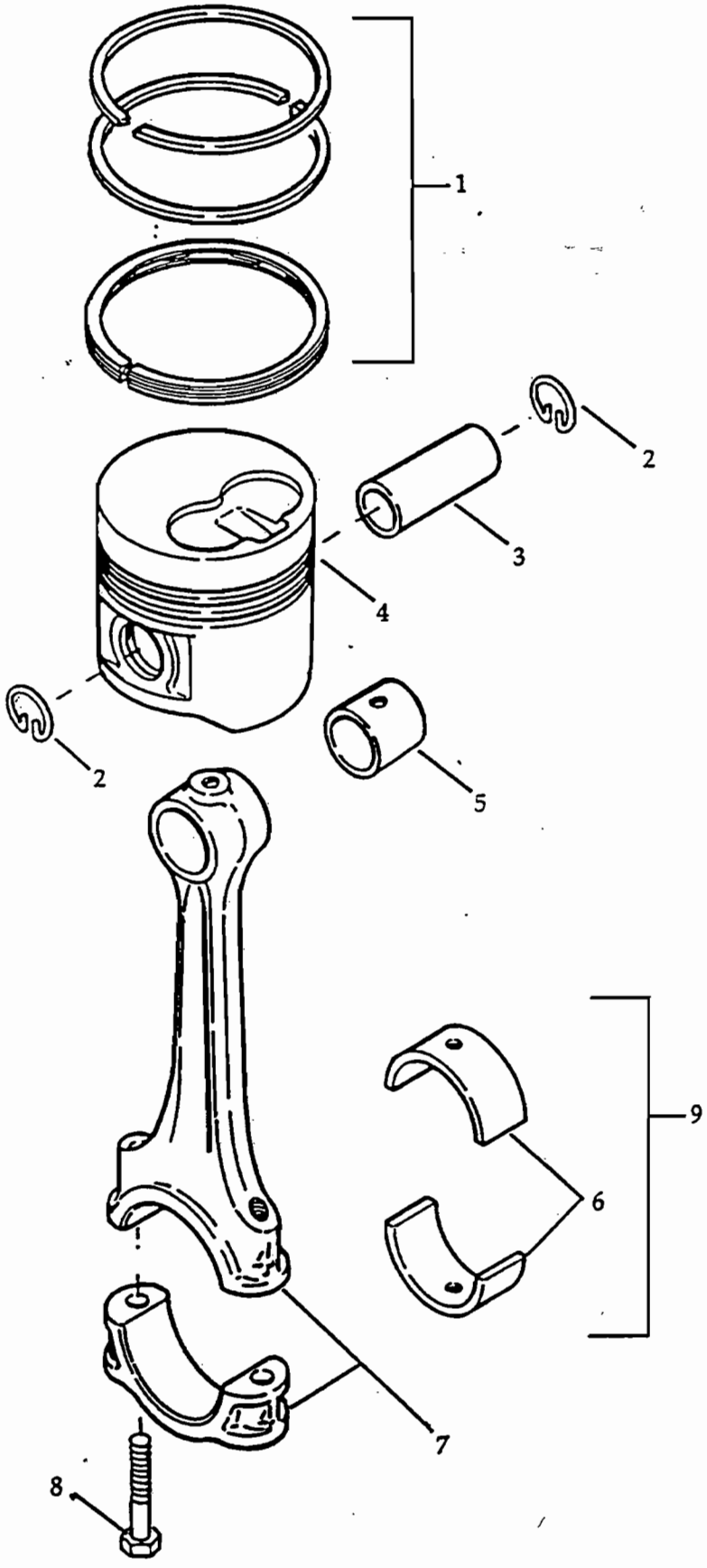


CRANKSHAFT AND PULLEY

ITEM		PART NO.	DESCRIPTION	QTY
1		XM32064	Screw, crankshaft pulley to crankshaft	1
2		XM37014	Washer, plain, crankshaft pulley to crankshaft	1
3		TM27C00401	Pulley, crankshaft (w/PTO machining)	1
4		X27019504	Belt, water pump/alternator drive	1
5		TM27H00409	Gear, crankshaft (Nitempered 21°)	1
6		TMD27C00300	Crankshaft	1
7	[a]	———	Bearing, crankshaft, front, intermediate & rear, upper & lower	9
8	[a]	———	Bearing, crankshaft, thrust, center upper	1
9		X00666	Key, crankshaft gear & pulley to crankshaft	1
10	[c]	TM27C00408	Slinger, oil	1
11	[b]	TM27T00102	Bearing kit, crankshaft (includes items 7 & 8)	1

NOTE: [a] Included in item 11.
[b] Crankshaft Bearing Kits are serviced in Standard and 0.25mm, 0.50mm, 0.75mm and 1.00mm oversizes.
[c] SEE: SPB #93-429.

PISTON AND CONNECTING RODS

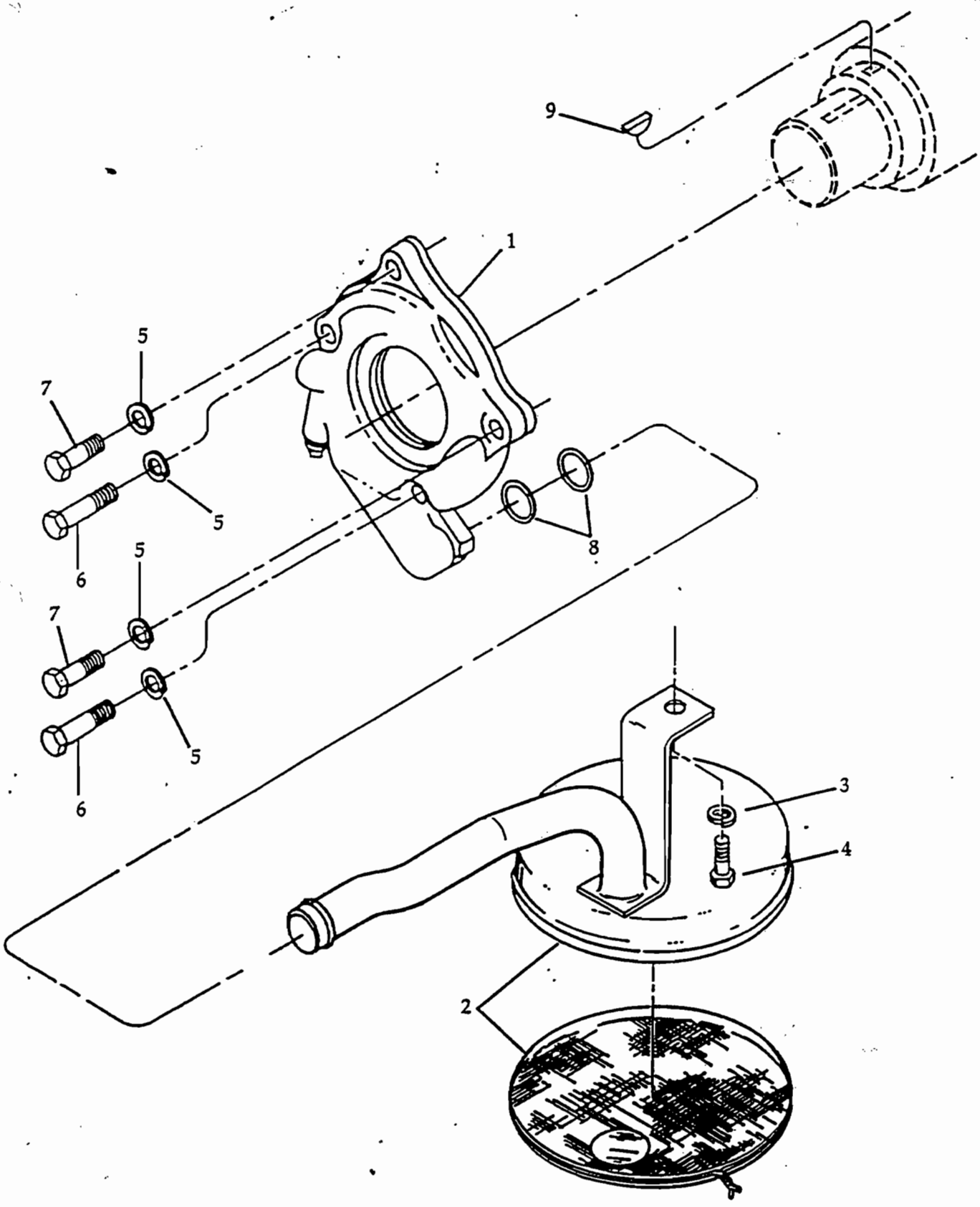


PISTON AND CONNECTING RODS

ITEM		PART NO.	DESCRIPTION	QTY
1	[a]	TMD20T00201	Ring set (single piston)	4
2		K800A00203	Ring, retaining, piston pin	8
3		TMD27A00300	Pin, piston	4
4	[b]	TMD27A05031E	Piston (includes items 2 & 3)	4
5		TM27G00303	Bushing, piston pin	4
6	[c]	————	Bearing, connecting rod, upper & lower	8
7		TMD27D03001	Rod assembly, connecting (includes items 5 & 8)	4
8		Z145D00300	Bolt, connecting rod	8
9	[d]	TM20T00102	Bearing set, connecting rod (single rod, includes item 6)	4

NOTE:
[a] Piston Ring Sets are serviced in Standard and oversized 0.50mm, 0.75mm & 1.00mm.
[b] Pistons are serviced in Standard and oversized 0.50mm, 0.75mm & 1.00mm.
[c] Included in item 9.
[d] Connecting Rod Bearings are serviced in standard and undersized 0.25mm, 0.50mm, 0.75mm & 1.00mm.

OIL PUMP

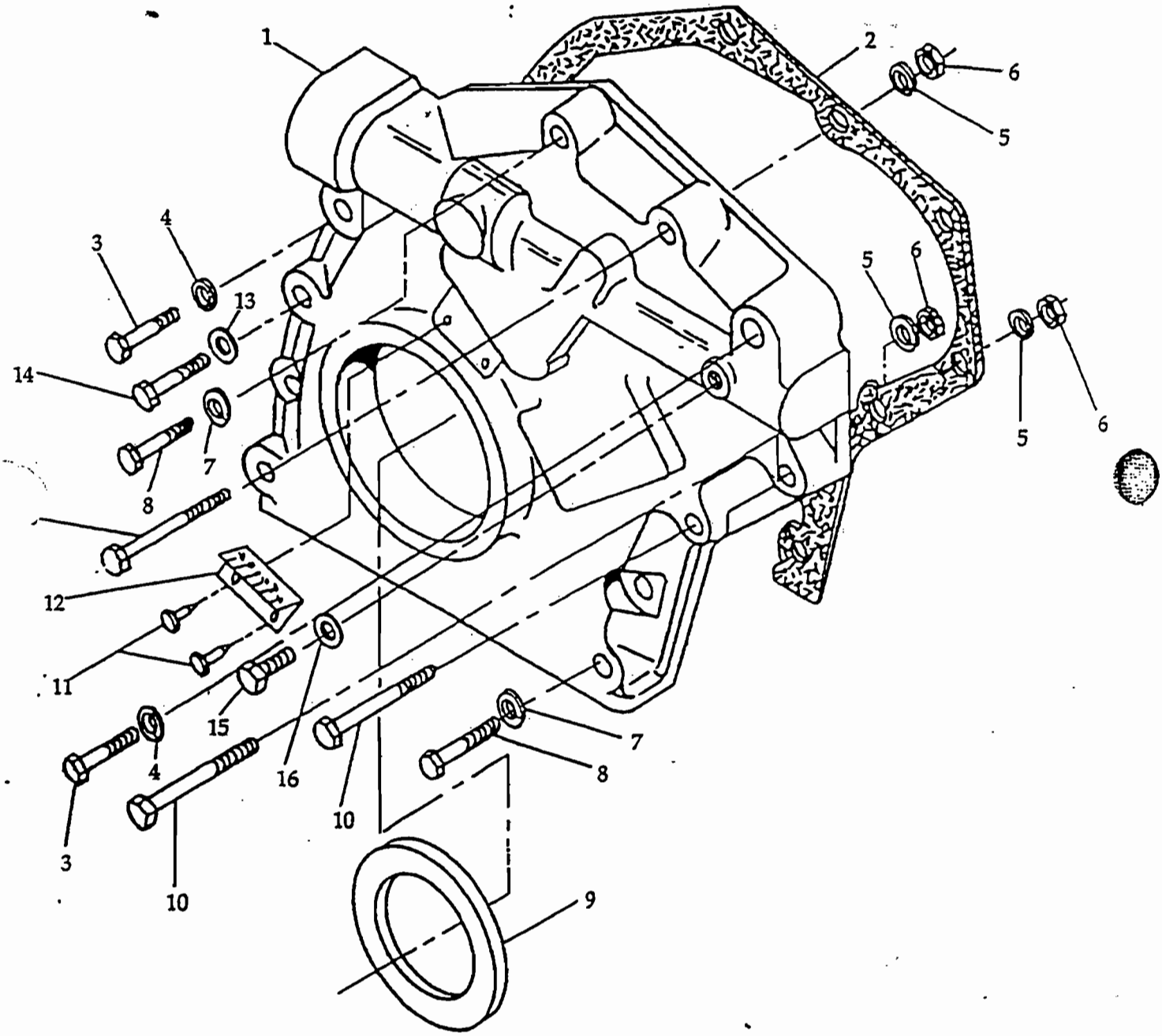


OIL PUMP

ITEM		PART NO.	DESCRIPTION	QTY
1	[a,b]	TM27L06050	Pump assembly, oil (complete)	1
2	[b]	TM27L05180	Tube assembly, oil pump inlet	1
3		XM37001	Washer, lock, tube to center bearing cap	1
4		XM32052	Screw, tube to center bearing cap	1
5		XM37002	Lock washer	4
6		XM32041	Screw	2
7		XM32039	Screw, oil pump to crankcase	2
8		X01673	Seal, O-ring, oil pump inlet tube	2
9		X00692	Key, oil pump drive, crankcase	1

NOTE: [a] Oil Pump components are <u>not</u> serviced separately.
[b] Engines built prior to S/N 88096321, see Service Bulletin # 88-379 & Newsletter C89-6 concerning Oil Pump & Inlet Tube assembly changes.

GEAR COVER

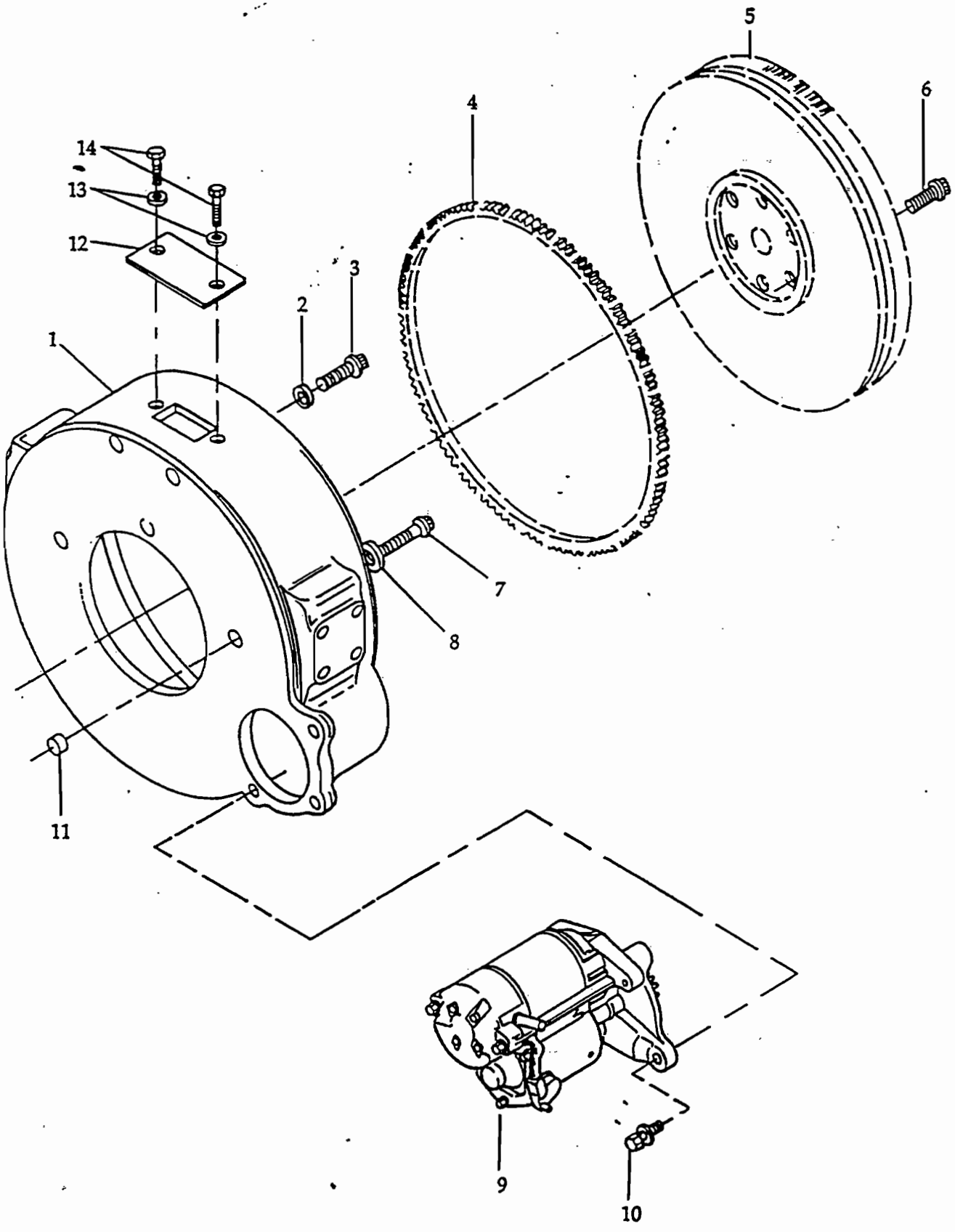


GEAR COVER

ITEM		PART NO.	DESCRIPTION	QTY
1		TMD27B05141	Cover assembly gear (includes items 9, 11, 12, 15, & 16)	1
2	[a]	TM27B00517	Gasket, gear cover	1
3		XM32115	Screw, gear cover to crankcase, upper right & left	2
4		XM37001	Washer, lock, gear cover to crankcase, upper right & left	2
5		XM37001	Washer, lock, gear cover thru crankcase to adapter	3
6		XM35000	Nut, hex, gear cover thru crankcase to adapter	3
7		XM37001	Washer, gear cover to crankcase	3
8		XM32026	Screw, gear cover to crankcase	3
9	[a]	X07845	Seal, crankshaft oil	1
10		XM32068	Screw, gear cover thru crankcase	3
11		X13012	Rivet, timing pointer to gear cover	2
12		TM27B00416	Timing pointer plate	1
13		X14134	Washer, gear cover to crankcase-right center	1
14		XM32026	Screw, gear cover to crankcase-right center	1
15		XM32019	Screw, timing hole plug	1
16		X14590	Washer, plain, timing pointer hole plug screw	1

NOTE: [a] Included in Front End Gasket Set TMD27U02002.

FLYWHEEL, HOUSING AND STARTER

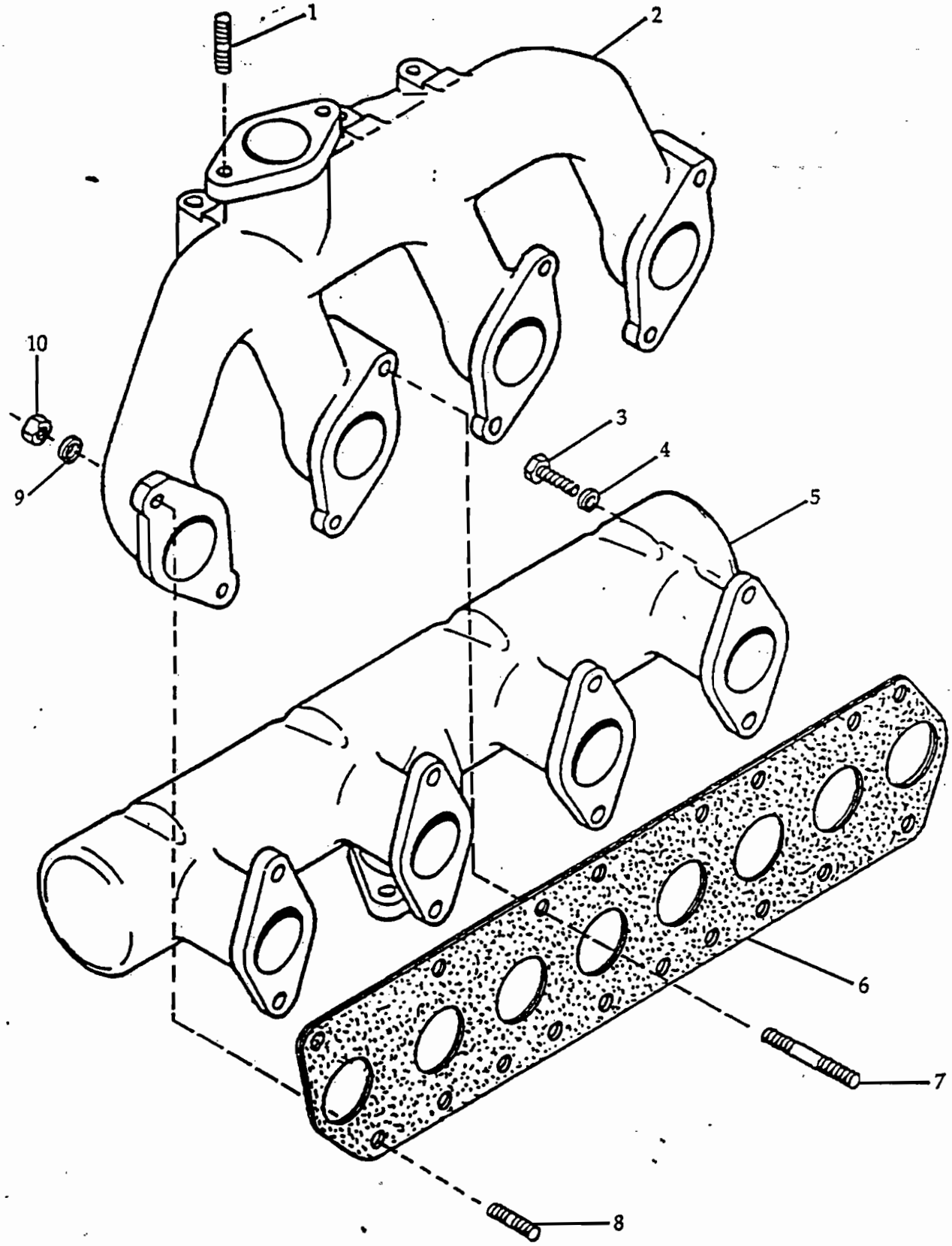


FLYWHEEL, HOUSING AND STARTER

ITEM		PART NO.	DESCRIPTION	QTY
1		TM27B06072	Housing, flywheel (includes items 12-14)	1
2		X14323	Washer, plain, housing to crankcase, center & upper	3
3		XM32086	Screw, flanged, housing to crankcase, center & upper	3
4	[a]	———	Gear, ring	1
5	[a]	———	Flywheel assembly (includes item 4)	1
6		XM32036	Screw, flywheel to crankcase	6
7		XM32021	Screw, housing to crankcase at dowel	2
8		X14141	Washer, housing to crankcase at dowel	2
9	[b]	TMD27M00504	Starter (Nippondenso)	1
10		X03979	Screw & washer, starter to flywheel housing	2
11		X07005	Dowel, ring, flywheel housing to crankcase	2
12		TM27B00304	Cover, timing hole	1
13		X00202B	Washer, lock, cover to housing	2
14		X03236	Screw, cover to housing	2

NOTE: [a] See your "Customer Specification" to determine Flywheel Assembly part number, then see Service Bulletin #91-416 for Ring Gear part number.
[b] See accessories section at rear of this manual for service parts.

INTAKE AND EXHAUST MANIFOLD

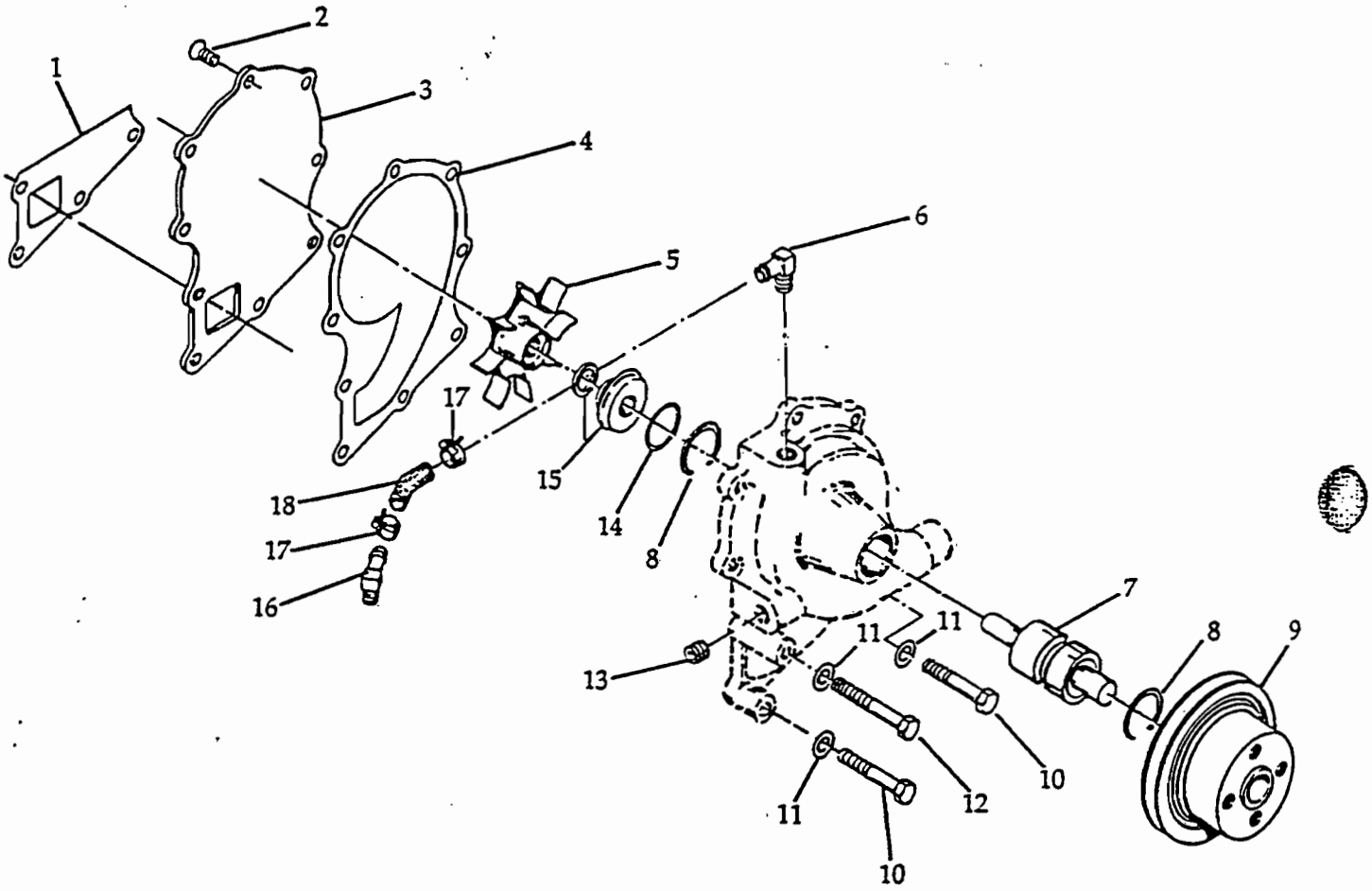


INTAKE AND EXHAUST

ITEM		PART NO.	DESCRIPTION	QTY
1		XM32048	Stud, exhaust outlet flange	2
2		TMD27E00501	Manifold, exhaust	1
3		XM32039	Screw, intake manifold to cylinder head	8
4		XM37005	Washer, flat, intake manifold to cylinder head	8
5		TMD27F00601	Manifold, intake	1
6	[a]	TM27E00503	Gasket, manifold, intake & exhaust	1
7		XM32050	Stud, exhaust manifold to cylinder head (M8 X 80)	2
8		XM32022	Stud, exhaust manifold to cylinder head (M8 X 40)	6
9		XM37005	Washer, flat exhaust manifold to cylinder head	8
10		24XXM35002	Nut, exhaust manifold to cylinder	8
—		X06234	Label-Ether Warning, affix to intake manifold-top between intake flange & front end	1

NOTE: [a] Included in Top End Gasket Set TMD27U01006.

WATER PUMP ASSEMBLY



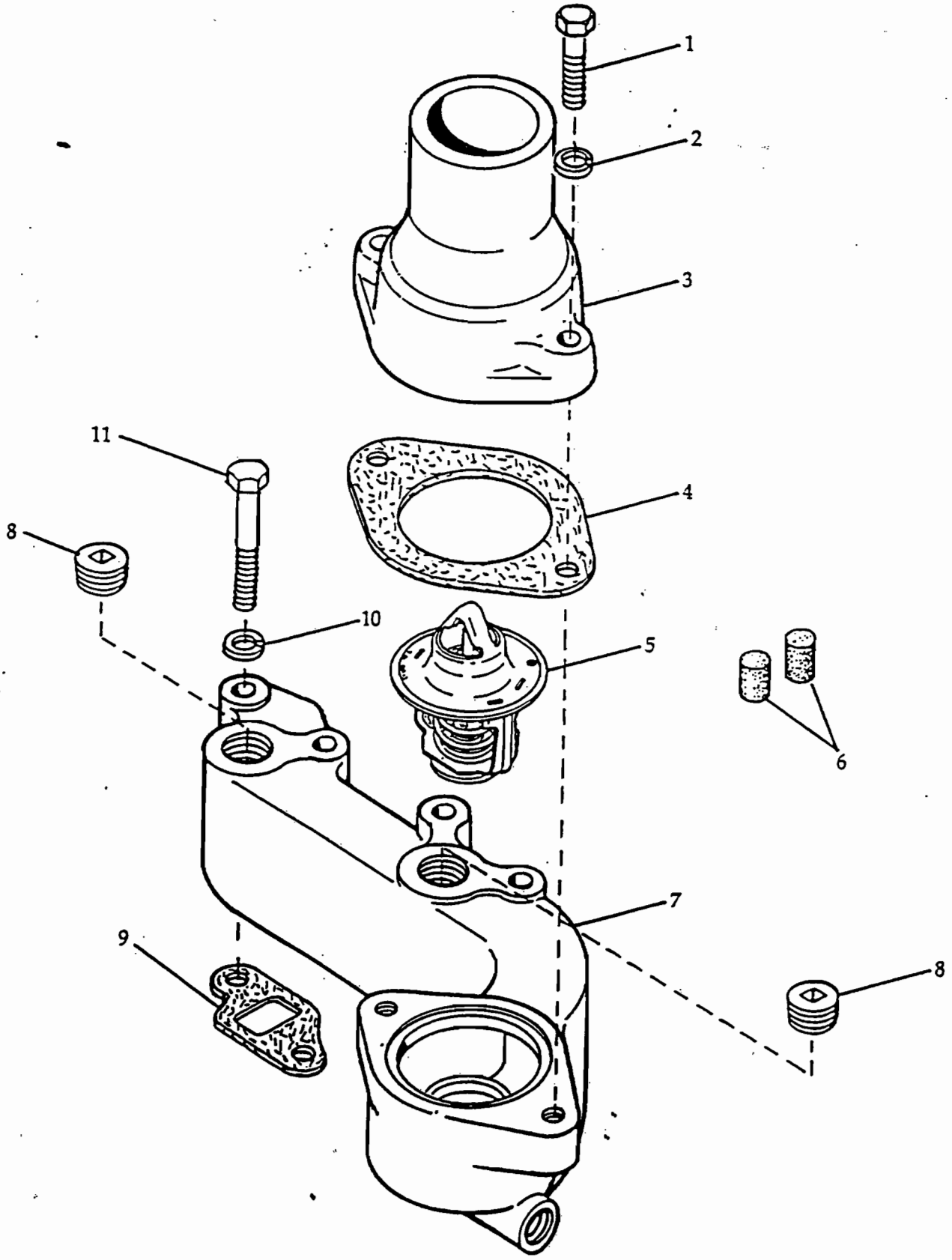
WATER PUMP ASSEMBLY

ITEM		PART NO.	DESCRIPTION	QTY
—		TM27K06015	Pump assembly, water, complete (includes items 2-5, 7-9, & 13-15)	1
—		TM27K06012	Pump assembly, water, for service, complete (includes items 1-5, 7, 8 & 13-15)	1
1	a,b	TM27K00301	Gasket, water pump to crankcase	1
2		XM32106	Screw, backplate to water pump	6
3		TM27K00405	Plate, water pump back	1
4	b	TM27K00403	Gasket, water pump back plate	1
5	b	TM27K00418	Impeller, water pump	1
6		X26176	Elbow, hose, water pump body	1
7	b	TM27K00306	Shaft & bearing assembly	1
8	b	X07047	Ring, snap, shaft & bearing	2
9	c	TM27K00406	Pulley, water pump	1
10		XM32011	Screw, water pump to crankcase	2
11		XM37001	Washer, lock, water pump to crankcase	3
12		XM32108	Screw, water pump & alternator strap to crankcase	1
13		X26166	Plug, water pump body, side	1
14	b	K600K00220	Gasket, water pump seal	1
15	b	OA200K03040	Seal & Seat assembly	1
16		X26176	Elbow, water by-pass, water header	1
17		X02376	Clamp, hose, water by-pass hose	2
18		TM27K00309	Hose, water by-pass	1

NOTE:
[a] Included in Front End Gasket Set TMD27U02002.
[b] Included in Water Pump Repair Kit TM27T01001.
[c] Water Pump Pulley Installation Instructions, Form X30078, packaged with service pump and water pump repair kit, must be followed when assembling pulley to pump.

Wollard
Water Pump
AW35973

WATER HEADER AND THERMOSTAT

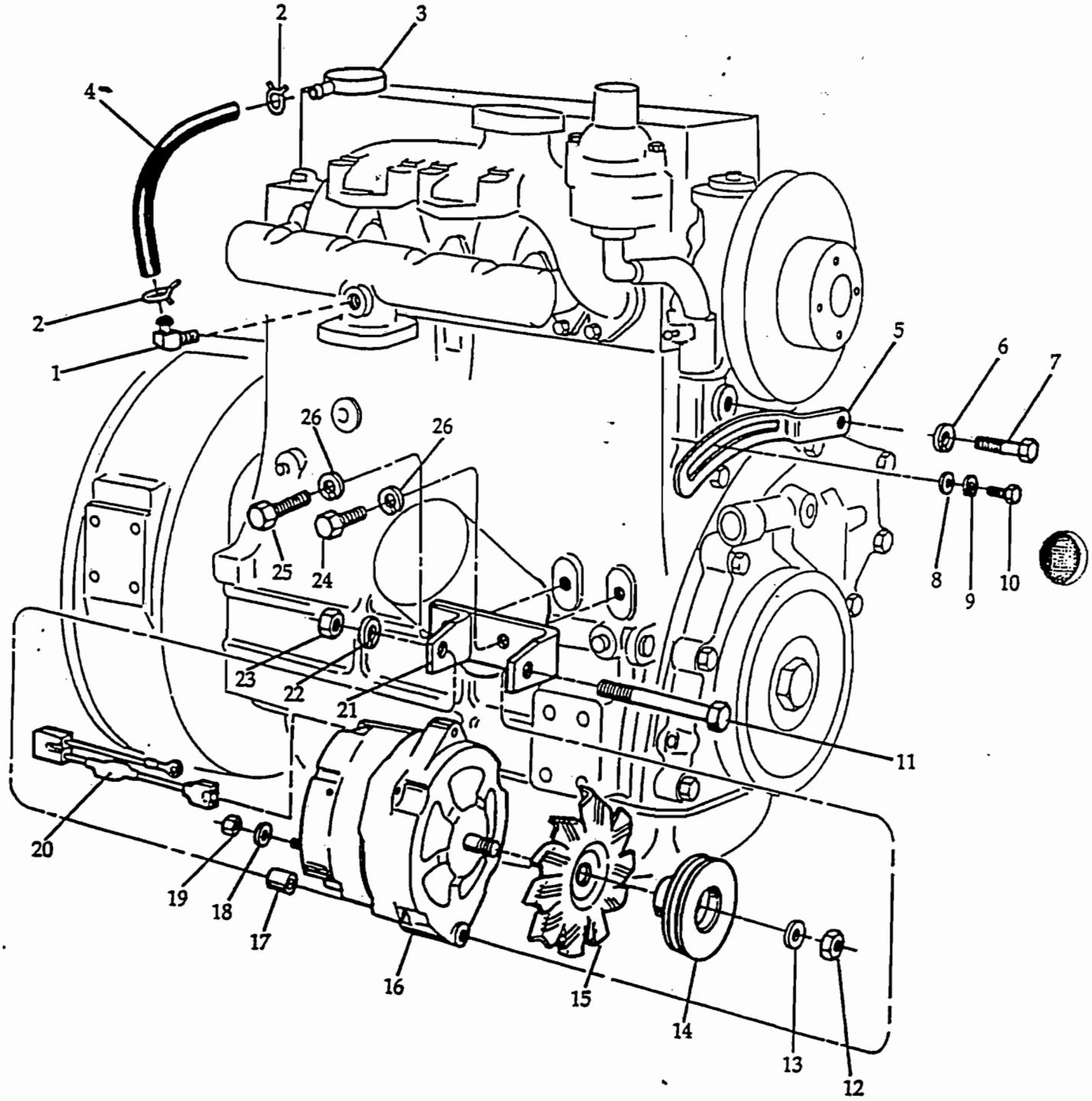


WATER HEADER AND THERMOSTAT

ITEM		PART NO.	DESCRIPTION	QTY
1		XM32039	Screw, water outlet elbow to water header	2
2		XM37002	Washer, lock, water outlet elbow	2
3		TM27K00404	Elbow, water outlet	1
4	[a]	X07854	Gasket, water outlet elbow	1
5		TM27K00402	Thermostat	1
6	[b]	X05695	Conditioner, coolant	2
7		TM27K00503	Header, water outlet	1
8		26XX00101B	Plug, water header, top	2
9	[a]	TM27K00202	Gasket, water outlet header	2
10		XM37002	Washer, lock, water header to cylinder head	4
11		XM32038	Screw, water header to cylinder head	4

NOTE: [a] Included in Top End Gasket Set TMD27U01006.
[b] Replinish anytime cooling system is serviced.

ALTERNATOR AND PCV SYSTEM

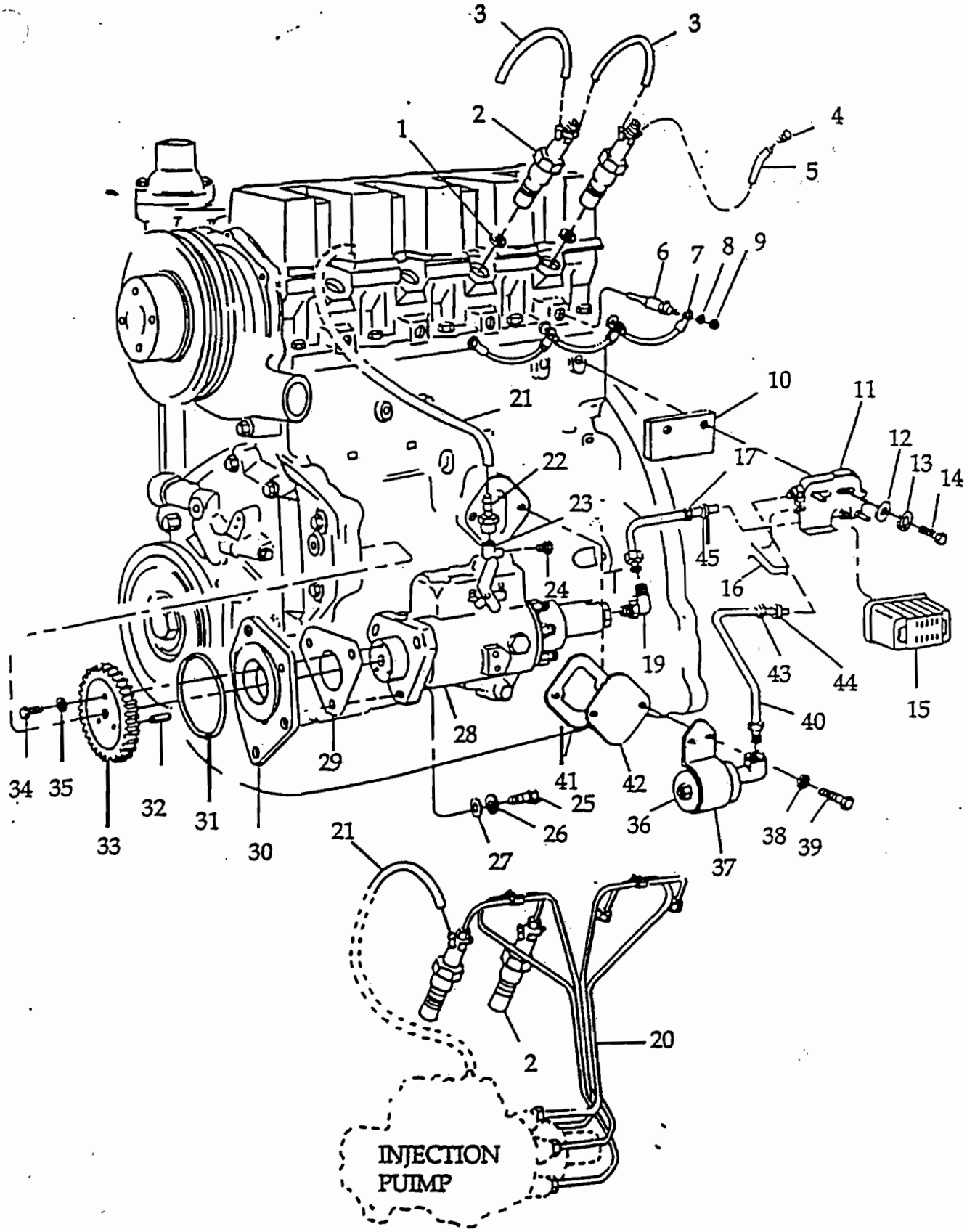


ALTERNATOR AND PCV SYSTEM

ITEM	PART NO.	DESCRIPTION	QTY
1	X26136	Elbow, intake manifold	1
2	X02751	Clamp, hose	2
3	TM27L00412	Cap, oil filler, top of cylinder head cover	1
4	X08253200	Hose, elbow to oil filler cap	1
5	TM27M00301	Strap, adjusting, alternator	1
6	———	Washer, lock (see item 11, page 22)	1
7	———	Screw (see item 12, page 22)	1
8	X14141	Washer, plain, adjusting strap to alternator	1
9	XM37002	Washer, lock, adjusting strap to alternator	1
10		Screw, adjusting strap to alternator (art of Alternator)	1
11	XM32007	Screw, alternator to bracket	1
12	———	Nut, pulley & fan to alternator (part of alternator)	1
13	———	Washer, pulley & fan to alternator (part of alternator)	1
14		Pulley, alternator (Part of Alternator)	1
15		Fan, alternator pulley	1
16	[a] 10120067	Alt. MCI 63AMP (includes items 12, 13,14,15,18 & 19)	1
17	X14234	Spacer, alternator to bracket, rear	1
18		Washer, lock, alternator battery terminal (Part of Alt.)	1
19		Nut, alternator battery terminal (Part of Alt.)	1
20	F401M00332	Harness, alternator	1
21	TM27M00411	Bracket, alternator	1
22	15XXM37001	Washer, lock, alternator to bracket	1
23	XM35000	Nut, alternator to bracket	1
24	XM32045	Screw, alternator bracket to crankcase	1
25	XM32046	Screw, alternator bracket to crankcase	1
26	XM37008	Washer, lock, alternator bracket to crankcase	2
—	X06163	Decal, warning label (apply to alternator)	1

NOTE: [a] Alternator See SPB #92-419.

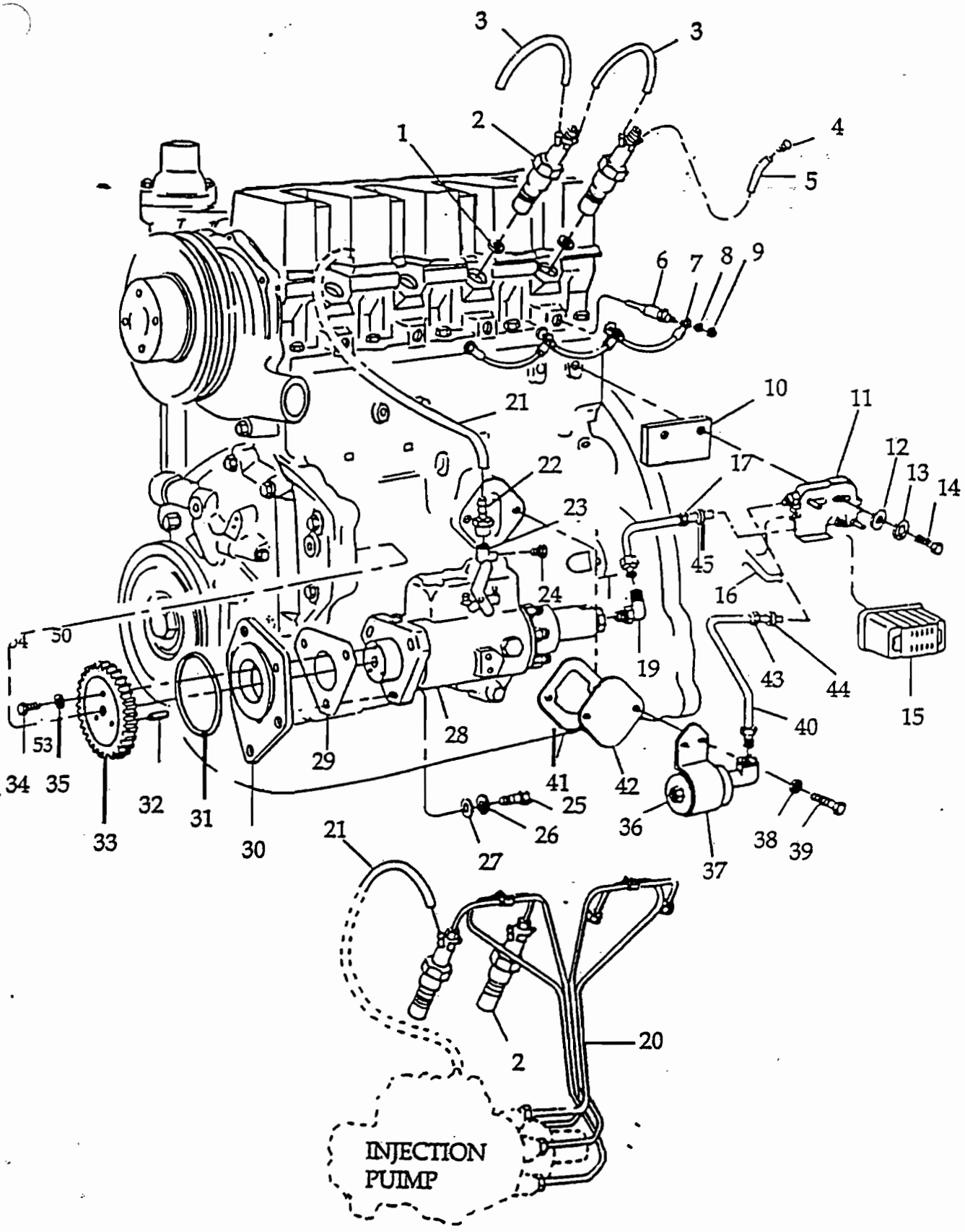
INJECTOR PUMP, FUEL FILTER, ELECTRIC FUEL PUMP
INJECTOR NOZZLES & LINES



INJECTOR PUMP, FUEL FILTER, ELECTRIC FUEL PUMP
INJECTOR NOZZLES & LINES

1		TMD27F00301	Shield, heat injector 4
2		TMD20T00203	Kit - Nozzle & holder assembly (incl: heat shield) 4
		TMD20T00204	Kit - Nozzle assembly (service) (incl: heat shield) 4
3		XM38003054	Hose, fuel 1 to 2, 2 to 3 & 3 to 4 3
4		X26138	Plug, #4 leak-off hose 1
5		XM38003020	Hose, fuel, #4 leak-off end 1
6		TMD27F00268	Plug, glow 4
7		LW00203042	Wire assembly, between glow plugs 3
8		13XX00200B	Washer, lock, wire to glow plug 4
9		13XXM35004	Nut, wire to flow plug 4
10		TMD20F00401	Base, fuel filter 1
11		TMD20F00300	Adapter, fuel filter to crankcase 1
12		X14472	Washer, base thru adapter to crankcase 2
13		XM37001	Washer, lock, base thru adapter to crankcase 2
14		XM32023	Screw, base thru adapter to crankcase 2
15		TMD20F00400	Element, fuel filter 1
16		TMD20F00301	Clamp, fuel filter 2
17		X12644	Nut, filter to injection pump tube (part of Item #18)
18		TMD27F03100	Tube assembly, fuel filter to inj. pump 1
19		X26162	Elbow, injection pump inlet 1
20		TMD27F05140	Tube set, fuel inj. (4 lines) incl. clamps 1
21		XM38003110	Hose, fuel, #1 leak-off to injection pump 1
22		X26175	Adapter, hose, tee at injection pump leak-off 1
23		X12671	Tee, injection pump return 1
24		26XX26129	Plug, tee to injection pump leak-off (if used) 1
25		XM32037	Screw, adapter to injection pump 3
26		XM32012	Washer, lock, adapter to injection pump 3
27		XM27005	Washer, flat, adapter to injection pump 3
28		TMD27F00230	Pump, diesel, fuel injection (SDS/MD4179) 1
29	*	TMD27B00300	Gasket, injection pump to adapter 1
30	*	TMD27B00404	Adapter, injection pump to crankcase 1
31	*	X07837	O-ring, adapter to crankcase 1
32		TMD27F00200	Pin, gear to injection pump 1
33		TMD27H00403	Gear, injection pump driven 1
34		X22132	Screw, gear to injection pump 3
35		X00202B	Washer, lock, gear to injection pump 3

INJECTOR PUMP, FUEL FILTER, ELECTRIC FUEL PUMP
INJECTOR NOZZLES & LINES



INJECTOR PUMP, FUEL FILTER, ELECTRIC FUEL PUMP
INJECTOR NOZZLES & LINES

ITEM	PART NO.	DESCRIPTION	QTY
36	TMD20F00506	Pump, fuel, electric	1
37	TMD20F00304	Clamp, fuel pump	1
38	XM37002	Washer, fuel pump to crankcase	1
39	XM32105	Screw, fuel pump to crankcase	1
40	TMD27F04110	Tube assembly, fuel pump to filter	1
41	X07861	Gasket, fuel pump	1
42	F600B00234	Cover, fuel pump hole	1
43	X12645	Sleeve, fuel pump to filter tube (Part of Item #40)	
44	X12644	Nut, fuel pump to filter tube (Part of Item #40)	
45	X12645	Sleeve, filter to injection pump tube (Part of Item #18)	

NOTE: [a] For injection pump adapter to crankcase attaching hardware (See Gear Cover Parts Group, Index Nos. 5, 6 & 10).

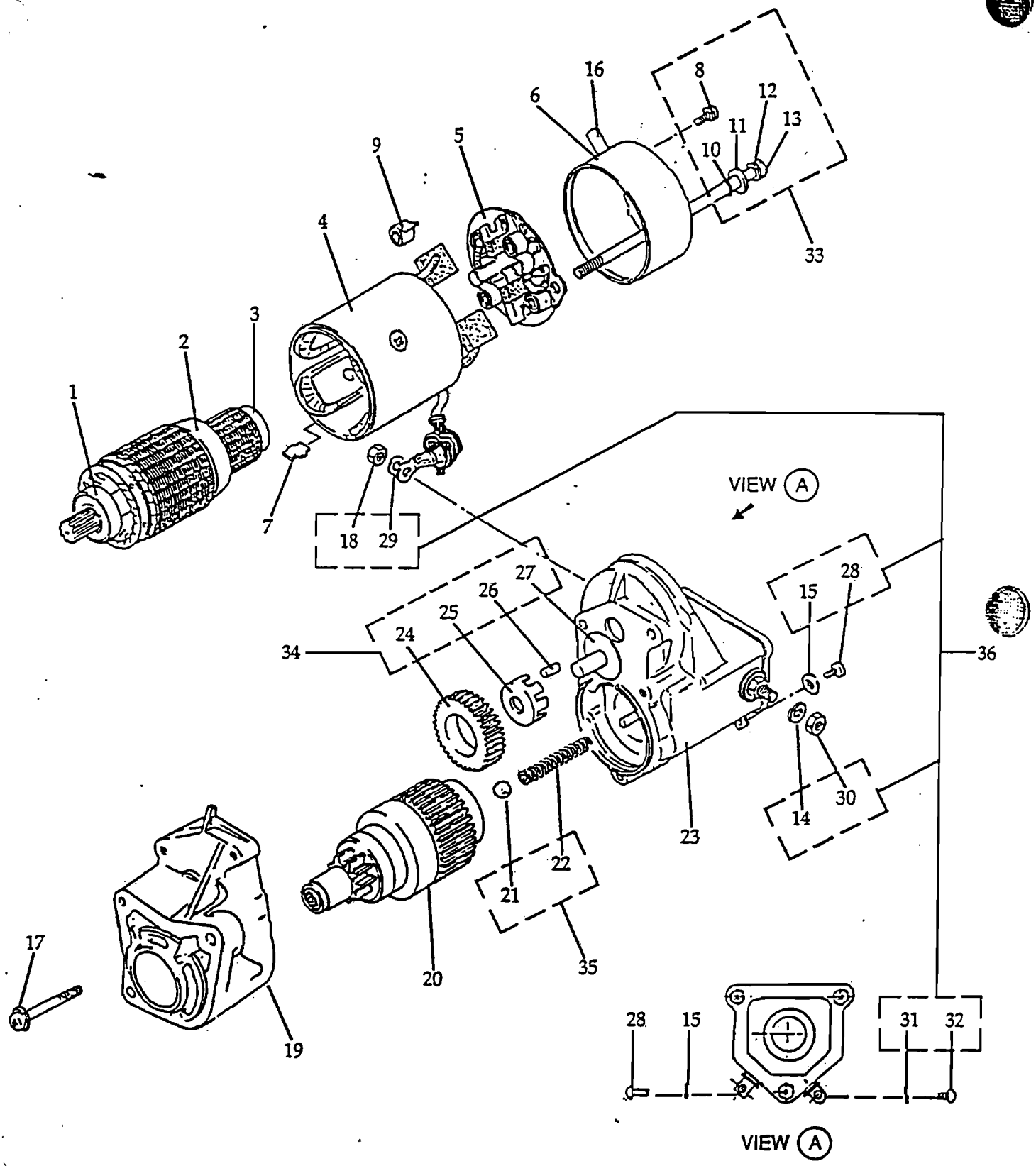
NOTES

Accessories Section

SERVICE PARTS LISTS

- Starter

TMD27M00504 STARTER



TMD27M00504 STARTER
(NIPPONDENSO P/N: 128000-1780)

ITEM		PART NO.	DESCRIPTION	QTY
1		10120018	Bearing, ball (drive end)	1
2	a	———	Armature assembly	1
3		10120019	Bearing, ball (dommutator end)	1
4	a	———	Yoke assembly, starter	1
5	a	———	Brush holder assembly, starter	1
6	a	———	Frame, starter end	1
7		10120021	Plate, lock	1
8	a,b	———	Screw w/washer	2
9	a	———	Spring, brush spiral	4
10	a,b	———	"O"-ring	2
11	a,b	———	Washer	2
12	a,b	———	Washer, spring	2
13	a,b	———	Bolt, through	2
14	a,e	———	Washer, spring	1
15	a,e	———	Washer, toothed	1
16		10120020	Cover, vent	1
17		10120030	Screw w/washer	3
18	a,e	———	Nut, hex	1
19	a	10120029	Housing assembly, starter	1
20		10120023	Clutch sub-assembly	1
21	a,d	———	Ball, steel	1
22	a,d	———	Spring, compression coil	1
23		10120026	Switch assembly, magnetic	1
24	a,c	———	Pinion, starter	1
25	a,c	———	Retainer	1
26	a,c	———	Roller, clutch	5
27	a,c	———	Washer	1
28	a,e	———	Screw, pan head (cross recess)	1
29	a,e	———	Washer, wave	1
30	a,e	———	Nut, hex	1
31	a,e	———	Washer, spring	1
32	a,e	———	Screw, pan head (cross recess)	1
33		10120022	Starter kit, hardware (includes items 8 & 10-13)	1
34		10120024	Starter kit (includes items 24-27)	1
35		10120025	Starter kit (includes items 21 & 22)	3
36		10120028	Starter kit, hardware (includes items 14, 15, 18 & 28-32)	1

NOTE:
[a] Not serviced separately.
[b] Included in item 33.
[c] Included in item 34.
[d] Included in item 35.
[e] Included in item 36.

ENGINE SERVICE KITS COMPONENTS

KIT NUMBER	PART NUMBER	DESCRIPTION	QTY
TMD20T00203	TMD20F03090	KCO - Nozzle ASM	1
	TMD27F00301	Shield Heat	1
TMD20T00204	TMD20F00403	KCO - Tip	1
	TMD2700301	Shield Heat	1
TMD27U01006	TMD27A00613	Gasket - Cyl Head	1
	TM27A00502	Gasket Head Cover	1
	X14596	Washer - Plain	3
	XM39000	O-Ring	3
	TM27E00502	Gasket - Manifold	1
	TM27K00202	Gasket - Water Outlet Header	2
	X07854	Gasket - Water Outlet Elbow	1
	TM27F00206	Gasket - Carburetor	1
	TM27F00308	Gasket - Carburetor	1
	X14192	Washer - Copper	2
	F401M00219	Gasket Dist.	1
	TTP10121	TM/TMD Cyl Hd. Torque Chart	1
TMD27U02002	TM27B00517	Gasket - G/C	1
	TM27K00301	Gasket - Water Pump	1
	X07845	Seal - Oil	1
	TM27L00513	Seal - Oil	2
	TMD27B00300	Gasket - Injection Pump	1
	X07837	O-Ring	1
TM27T00107	TM27B00305	Syringe	1
	X07818	Gasket Form-RTV	1
	X07840	Insert Cure	2
	X30194	Sheet - Instruction	1
TM27T01001	TM27K00306	Bearing and Shaft Water Pump	1
	X07047	Ring - Snap	2
	OA200K03040	Seal - Water Pump	1
	K600K00220	Gasket - Water Pump Seal	1
	TM27K00403	Gasket - Water Pump	1
	TM27K00301	Gasket - Water Pump	1
	TM27K00418	Impeller Water Pump	1
	X30078	Sheet - Instruction	1