DF Series 150 and 250 Transmissions (ANALOG)

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Funk Manufacturing Company
CTM147 (16JUL98)
LITHO IN U.S.A.
ENGLISH

Introduction

FOREWORD

Component Technical Manuals (CTM) are concise service guides for specific components. Component technical manuals are written as stand-alone manuals covering multiple machine applications.

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

Live with safety: Read the safety messages in the introduction of this manual and the cautions presented throughout the text of the manual.

This is the safety-alert symbol. When you see this symbol in the manual or on the machine, be alert to the potential for personal injury.

WARNING VEHICLE RUNAWAY HAZARD
Avoid serious or fatal injury. This transmission is not a braking system. Install it only if there is a braking system capable of stopping vehicle with dead engine, disengaged transmission, or loss of hydrostatic retardation. Otherwise, vehicle may roll freely, resulting in loss of control.

IMPORTANT: Important warns of possible damage to transmission.

NOTE: To make special mention of or to record in writing useful information about the transmission.

Use this component technical manual in conjunction with the machine technical manual. See the machine technical manual for information on component removal and installation, and gaining access to the components.

This manual is divided in three parts; general information, repair, and troubleshooting and tests:

• General information group offers component identification with specification information about the transmission.

• Repair groups contain necessary instructions to repair the component.

• Troubleshooting and test groups help you identify the majority of routine failures quickly and then allows you to perform certain tests.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable service equipment and tools, other materials needed to do the job, specifications, and torque values.

YZ,CTM147,IFC -19-05MAY98

Contents

All information, illustrations and specifications in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice.

CTM147-19-16JUL98

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YZ,WARN -19-10MAR98

HANDLE FLUIDS SAFELY—AVOID FIRES

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

TS227 -UN-23AUG88

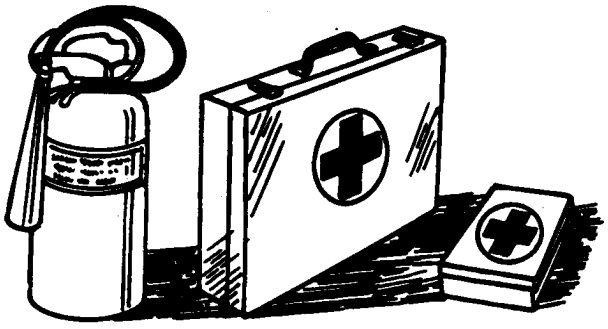
DX,FLAME -19-04JUN90

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

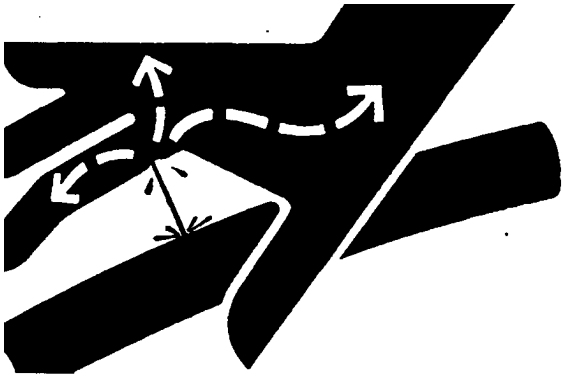
Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



TS291 -UN-23AUG88

DX,FIRE2 -19-03MAR93

AVOID HIGH-PRESSURE FLUIDS



X9811 -UN-23AUG88

Escaping fluid under pressure can penetrate the skin causing serious injury.

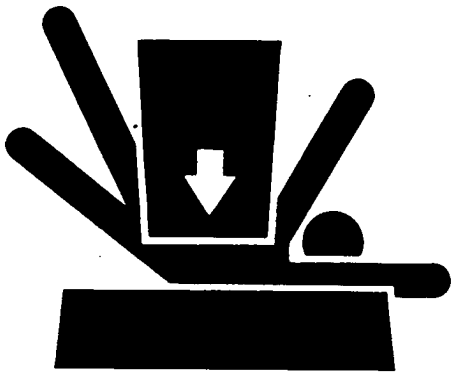
Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

DX,FLUID -19-03MAR93

SUPPORT MACHINE PROPERLY



TS229 -UN-23AUG88

Always lower the attachment or implement to the ground before you work on the machine. If you must work on a lifted machine or attachment, securely support the machine or attachment.

Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

DX,LOWER -19-04JUN90

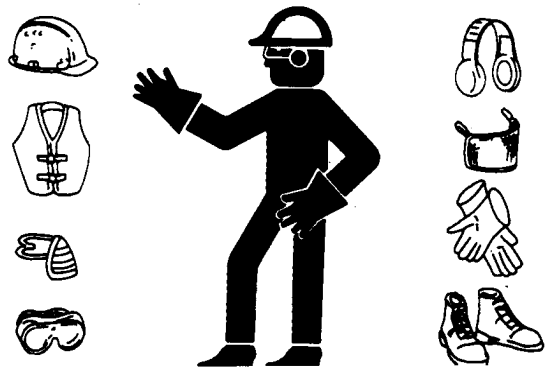
WEAR PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.



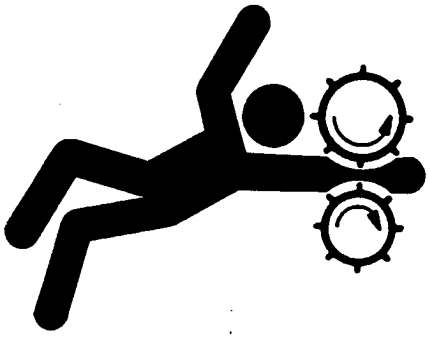
TS206 -UN-23AUG88

DX,WEAR -19-10SEP90

SERVICE MACHINES SAFELY

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.



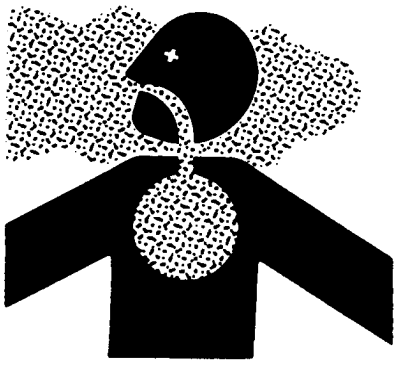
TS228 -UN-23AUG88

DX,LOOSE -19-04JUN90

WORK IN VENTILATED AREA

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.

If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

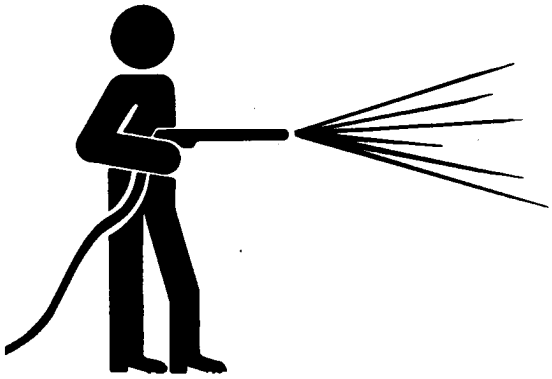


TS220 -UN-23AUG88

DX,AIR -19-04JUN90

WORK IN CLEAN AREA

Before starting a job:
- Clean work area and machine.
- Make sure you have all necessary tools to do your job.
- Have the right parts on hand.
- Read all instructions thoroughly; do not attempt shortcuts.



T6642EJ -UN-18OCT88

DX,CLEAN -19-04JUN90

REMOVE PAINT BEFORE WELDING OR HEATING

Avoid potentially toxic fumes and dust.

Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch.

Do all work outside or in a well ventilated area. Dispose of paint and solvent properly.

Remove paint before welding or heating:

- If you sand or grind paint, avoid breathing the dust. Wear an approved respirator.

- If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.

TS220 -UN-23AUG88

DX,PAINT -19-03MAR93

AVOID HEATING NEAR PRESSURIZED FLUID LINES

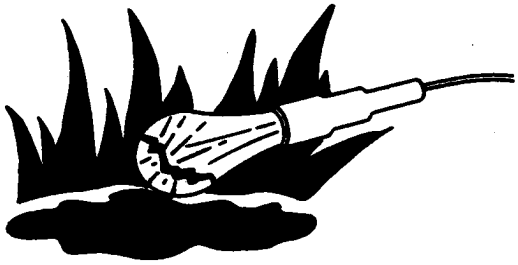
Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

TS953 -UN-15MAY90

DX,TORCH -19-03MAR93

ILLUMINATE WORK AREA SAFELY

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.



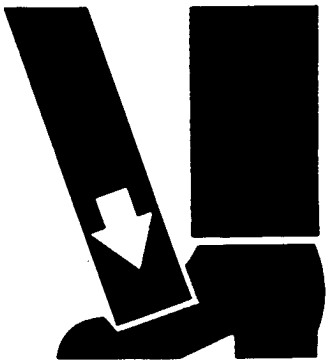
TS223 -UN-23AUG88

DX,LIGHT -19-04JUN90

USE PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.



TS226 -UN-23AUG88

DX,LIFT -19-04JUN90

PRACTICE SAFE MAINTENANCE

Understand service procedure before doing work. Keep area clean and dry.

Never lubricate, service, or adjust machine while it is moving. Keep hands, feet , and clothing from power-driven parts. Disengage all power and operate controls to relieve pressure. Lower equipment to the ground. Stop the engine. Remove the key. Allow machine to cool.

Securely support any machine elements that must be raised for service work.

Keep all parts in good condition and properly installed. Fix damage immediately. Replace worn or broken parts. Remove any buildup of grease, oil, or debris.

Disconnect battery ground cable (-) before making adjustments on electrical systems or welding on machine.

TS218 -UN-23AUG88

DX,SERV -19-03MAR93

USE PROPER TOOLS

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards.

Use power tools only to loosen threaded parts and fasteners.

For loosening and tightening hardware, use the correct size tools. DO NOT use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches.

Use only service parts meeting John Deere specifications.

TS779 -UN-08NOV89

DX,REPAIR -19-04JUN90

DISPOSE OF WASTE PROPERLY

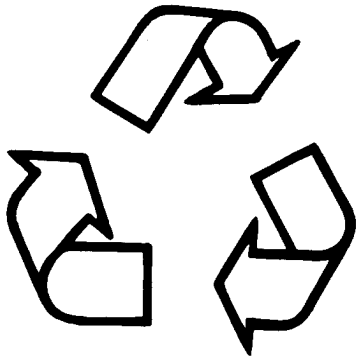
Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries.

Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them.

Do not pour waste onto the ground, down a drain, or into any water source.

Air conditioning refrigerants escaping into the air can damage the Earth's atmosphere. Government regulations may require a certified air conditioning service center to recover and recycle used air conditioning refrigerants.

Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.



TS1133 -UN-26NOV90

DX,DRAIN -19-03MAR93

LIVE WITH SAFETY

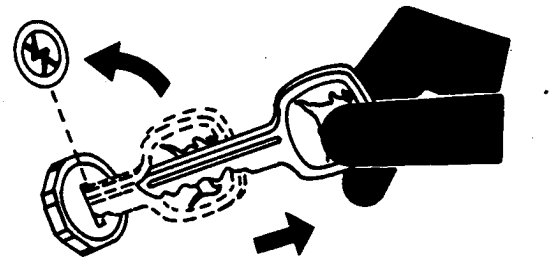
Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.

TS231 -19-07OCT88

DX,LIVE -19-15APR98

PARK MACHINE SAFELY

Before working on the machine:
- Lower all equipment to the ground.
- Stop the engine and remove the key.
- Disconnect the battery ground strap.
- Hang a “DO NOT OPERATE” tag in operator station.



TS230 -UN-24MAY89

DX,PARK -19-04JUN90

STAY CLEAR OF ROTATING DRIVELINES

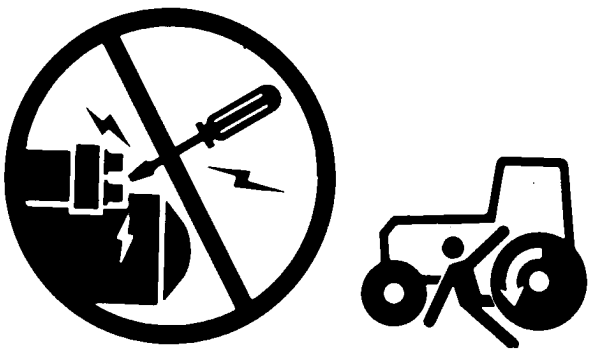
Entanglement in rotating driveline can cause serious injury or death.

Keep tractor master shield and driveline shields in place at all times. Make sure rotating shields turn freely.

Wear close fitting clothing. Stop the engine and be sure PTO driveline is stopped before making adjustments, connections, or cleaning out PTO driven equipment.

TS1644 -UN-22AUG95

DX,PTO -19-12SEP95



TS177 -UN-11JAN89

DX,BYPASS1 -19-10MAR98

SPECIFICATIONS

Item	Measurement	Specification
• DF-150	Weight	567 Kg (1250 lbs)
• DF-150	Input-to-Output	500 mm (19.69 in)
• DF-150	Rating (Depending on application)	Input power (maximum) - 142 kW (190 SAE hp)
		Input no load speed (maximum) - 3000 rpm
		Turbine torque (maximum) - 1288 N·m (950 lb-ft)
• DF-250	Weight	703 Kg (1550 lbs)
• DF-250	Input-to-Output	550 mm (21.65 in)
• DF-250	Rating (Depending on application)	Input power(maximum) - 224 kW (300 SAE hp)
		Input no load speed (maximum) - 3000 rpm
		Turbine torque (maximum) - 1898 N·m (1400 lb-ft)
• DF-150/250	Mountings Available	Engine
		Midship
		Remote
• DF-150/250	Torque Converters Available	298.5 mm (11.75 in)
		323.8 mm (12.75 in)
		355.6 mm (14.00 in)
• DF-150/250	Clutches	Fully modulated, oil cooled, multidisc, hydraulic actuated and self-adjusting.
• DF-150/250	Gearing	Constant mesh, in line, high contact ratio ground gears. Up to eight speeds forward and four speeds reverse.
• DF-150/250	Oil	Hydraulic transmission fluid.
• DF-150/250	Filter	Remote mounted spin-on type filter.

Continued on next page

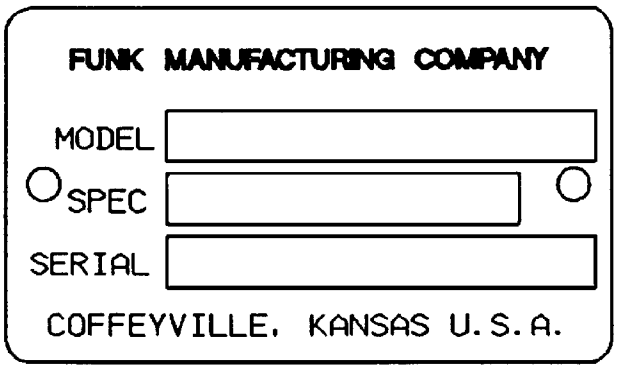
Item	Measurement	Specification
Transmission Operating Conditions	Maximum Input Speed	3000 rpm
	Test Input Speed	2000 rpm
	Minimum Operating Temperature	-40˚C (-40˚F)
	Maximum Continuous Operating Temperature	110˚C (230˚F)
	Maximum intermittent Operating Temperature	121˚C (250˚F)
	Normal Operating Temperature	38—93˚C (100—200˚F)
Pressures and Flows at Control Valve	Pump Pressure	1758—1965 kPa (255—285 psi)
	Pump Flow	87—102 L/min (23—27 gpm)
	Clutch Pressure	1655—1931 kPa (240—280 psi)
	Lube, In Pressure	138—414 kPa (20—60 psi)

Weights will vary depending on installed options.

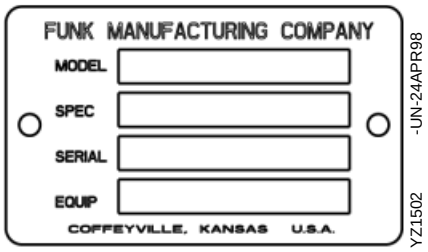
YZCTM147,10,SPC-19-05MAY98

IDENTIFICATION AND SERIAL NUMBER PLATES

The identification plate is located on the engine side and/or opposite engine side of the transmission main case housing. The exact location varies depending on installed options and model number. Earlier version of the DF series transmission had three lines of information. Later DF series transmission will have four lines of information on identification plate. All information on identification plate is needed when contacting FUNK concerning transmission.



-UN-01MAY98
YZ1503



-UN-24APR98
YZ1502

Contact:

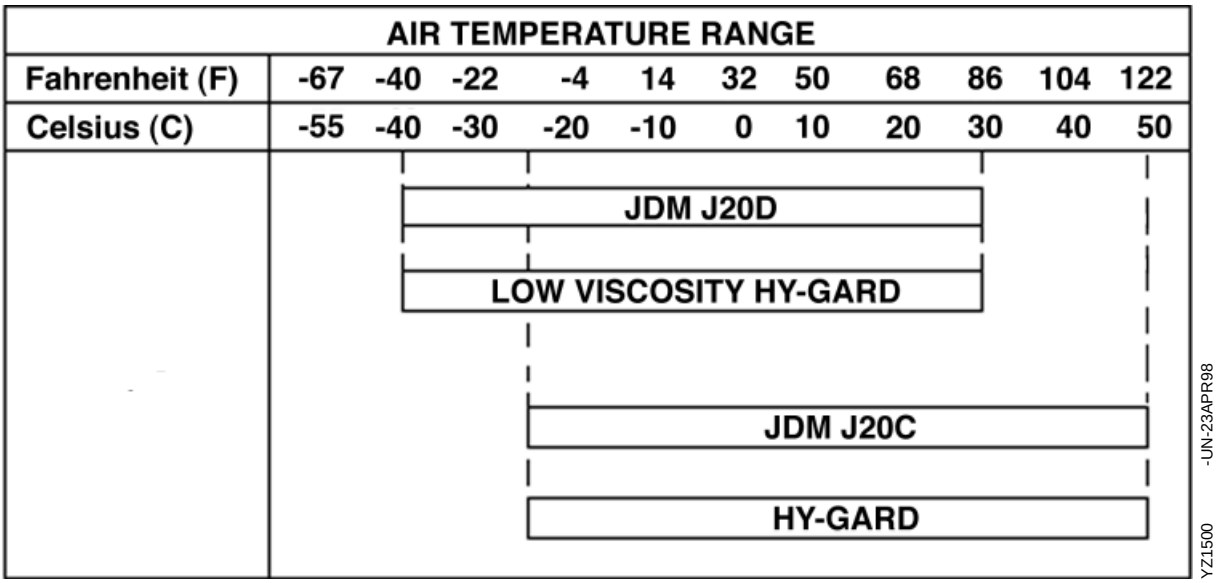
Funk Manufacturing Company
Attention: Parts Department
Industrial Park, Highway 169 North
P.O. Box 577
Coffeyville, Kansas 67337-0577
Telephone: Area Code (800)-844-1337
Ask for Parts Department
FAX:(316)-252-3253

YZ,CTM147,10,13-19-07MAY98

RECOMMENDED LUBRICANTS

AMBIENT AIR TEMPERATURE CHART

Select an oil viscosity, from the chart, based on the air temperature range expected between oil changes.



NOTE: The words "oil", "fluid" and "transmission fluid" are used in this manual to mean, HYDRAULIC TRANSMISSION FLUID, the operating and lubricating oil for this transmission.

Standard and Low viscosity HY-GARD® Transmission fluids are available through the John Deere dealer network worldwide. Other oils may be used if they meet one of the following:

John Deere Standard JDM J20 C
John Deere Standard JDM J20 D

Some fluids that contain the following additive packages have been shown to meet the specification requirements of J20 C and/or J20 D. Inclusion of the following additive packages does not constitute blanket approval of the oil for these applications.

Supplier	Additive
Chevron	Ornite OLOA 9725X
Lubrizol	Lubrizol 9990

HY-GARD is a registered trademark of Deere & Company.

YZ,CTM147,10,3 -19-05MAY98

COLD WEATHER STARTUP

Cold starts will sometimes cause the oil filter bypass signal to activate, indicating the oil is bypassing the filter. This should be an intermittent condition and should not continue after the transmission oil has reached 38˚ C (100˚ F) operating temperature.

IMPORTANT: Transmission oil should be warm before operating the transmission. If the transmission (converter out) oil temperature remains below the normal operating range after a reasonable warm-up period, stop the machine and warm the oil by stalling the torque converter.

If necessary to maintain the recommended oil temperature, operate the machine in a higher gear.

STALLING THE TORQUE CONVERTER:

NOTE: This procedure should not be used on 14 inch AAD torque converters.

• Park vehicle away from personnel and obstacles.

• Set brakes.

• Shift transmission to the highest gear.

IMPORTANT: Do not operate transmission at full governed engine rpm for more than 30 seconds. Do not allow converter out oil temperature to exceed 121˚C (250˚F).

• Run engine for a maximum of 30 seconds at full governed engine speed.

• Stop the stall procedure when oil temperature is in the normal operating range. Do not allow oil temperature to exceed 121˚C (250˚F) at anytime.

YZ,CTM54,10,19 -19-07MAY98

COLD WEATHER OPERATION

IMPORTANT: Viscosity grade selection is critical for cold weather operation of the transmission. Preheat and proper start-up procedures are required when operating transmission below the oil's MINIMUM critical temperature which is viscosity grade dependant.

NOTE: Refer to AIR TEMPERATURE RANGE chart for the MINIMUM transmission operating temperature viscosity grades.

PREHEAT TRANSMISSION FLUID WITH AUXILIARY SOURCE

• Preheat the transmission fluid to the MINIMUM temperature before operating.

ALTERNATE WARM-UP PROCEDURE:

• Operate transmission in neutral for approximately 20 minutes or until oil is warmed to the MINIMUM temperature.

HOT WEATHER OPERATION

Use higher viscosity grades (Refer to AIR TEMPERATURE RANGE chart) for:

• Ambient temperatures consistently above 30˚C (86˚F).

• Frequent stop-and-go driving in hot weather.

• High grade climbing in hot weather.

YZ,CTM147,10,3A-19-05MAY98

FILL THE TRANSMISSION WITH OIL

AFTER INSTALLING TRANSMISSION IN VEHICLE:

• Park machine on level surface.

• Engage parking brake, block wheels.

• Put transmission in neutral.

• Remove dipstick, the dipstick tube is the normal oil fill location.

• Begin filling operation by adding 19 liters (5 gal) of recommended oil.

• Start the engine, run at idle speed to fill the converter and oil lines.

• Check oil level on dip stick with engine running at idle speed.

IMPORTANT: Do not overfill transmission. This will cause overheating. Damage to the transmission will result.

• Fill transmission to the full mark on dipstick with engine running at idle speed.

• Check oil level again when the transmission has reached normal operating temperature 38—93˚C (100—200˚F).

YZ,CTM147,10,2 -19-05MAY98

CHECK AND SERVICE TRANSMISSION REGULARLY

Routine checks will help prevent down time. The operator can aid in preventative maintenance by reporting signs of leaks or malfunctions.

The transmission operates in and by oil, most of the maintenance is concerned with oil replenishment and oil cleanliness. The type of service and operating conditions shall determine the maintenance interval.

NOTE: Engage park brake before checking oil level.

OIL LEVEL

IMPORTANT: The DF series transmission should always be in the neutral position before starting the engine, or when the vehicle is parked and the engine is running.

CHECK THE OIL LEVEL DAILY

- Set parking brake.
- Put the gear selector lever in neutral position.
- Operate the engine at idle speed.
- Make sure the transmission oil temperature is at 38—93˚C (100—200˚F).
- Clean area around dipstick before removing.
- Keep oil level at the “FULL” mark on the dipstick.

YZ,CTM147,10,1 -19-05MAY98

INTERVALS FOR CHANGING TRANSMISSION OIL AND FILTERS

IMPORTANT: Change oil and filter after the first 50 hours of transmission operation. The oil and filter change intervals given here are for normal service conditions. If the transmission is to be operated in severe conditions contact the Funk Service Department for additional recommendations.

FIRST OIL AND FILTER CHANGE:

• Change oil and filter after first 50 hours of transmission operation.

ROUTINE OIL AND FILTER MAINTENANCE:

IMPORTANT: Some vehicles are equipped with devices to alert the operator when oil is bypassing the filter. Change the oil filter if a "Filter Bypass Signal" is indicated and the transmission is at normal operating temperature.

• Change oil filter anytime the transmission is at normal operating temperature and a "Filter Bypass Signal" is indicated.

• Change oil and filter anytime there are signs of contamination in the oil or the oil has a burnt odor.

• Change filter at every 500 hours, change filter and oil every 1000 hours of transmission operation.

YZ,CTM147,10,4 -19-05MAY98

OIL ANALYSIS

Oil analysis is best used by sampling at regular intervals to establish a baseline analysis for the oil and operation conditions present. Changes from this baseline may indicate unusual wear.

IMPORTANT: Change the oil and filter if an analysis of the used transmission oil indicates any of the following limits are exceeded.

• Glycol (Anti-freeze), must not exceed 0% by volume.

• Water, must not exceed 0.05% by volume.

• Viscosity increase at 38˚C (100˚F), not more than 40% over new oil value.

• Total Acid Number (TAN) per ASTM D664, limit of 3.0 over new lubricant value.

YZ,CTM54,10,20 -19-05MAY98

OIL TEMPERATURE WARNING SIGNAL

• If the oil temperature gauge, indicating the converter oil-out temperature, rises to 121˚C (250˚F) or the transmission oil temperature warning light comes on, stop the vehicle immediately. Shift to neutral and run the engine at 1000—1200 rpm.

IMPORTANT: Do not stop the engine when the transmission is overheating if the cooling system is known to be in working order.

• The transmission oil temperature should soon lower to the engine water temperature, or if an air-to-oil exchanger is used, the temperature should soon lower to ambient air temperature across the heat exchanger. If the temperature does not lower, trouble is indicated.

• Correct overheating problem before the vehicle is operated again.

YZ,CTM54,10,18 -19-05MAY98

TOWING THE VEHICLE

AVOID DAMAGE TO TRANSMISSION:

• Run engine at idle speed to lubricate the clutches.
— Do not exceed normal vehicle speeds while towing.

• If the engine cannot be run:
— Disconnect drive line from transmission

• If drive line can not be disconnected:
— Do not exceed 5 km/h (3 mph)
— Tow no further than 2 km (1 mile)

YZ,CTM54,10,17 -19-05MAY98

PUT TRANSMISSION IN STORAGE

This procedure applies to those transmissions and components that have been tested according to Funk Manufacturing test specifications and have had the oil drained from them prior to shipment.

The following actions will help protect the unit and component items from internal rust and corrosion damage for approximately one year, provided the transmissions are stored in a dry area:

• Seal all openings with moisture-proof covers or tape.

• Spray 113 mL (4 oz) of atomized NOX RUST® VCI No. 10 oil or an equivalent into oil drain hole. This fluid is covered and approved per (MIL-P-46002 and MIL-I-23310).

• Dip, spray, or brush all exposed unpainted surfaces with NOX RUST X-110 or an equivalent.

NOX RUST is a trademark of Daubert Chemical Company.

YZ,CTM147,10,5 -19-05MAY98

REMOVE TRANSMISSION FROM STORAGE

- Wash off all external grease with a safety solvent.
- Remove covers or tape from all openings.
- Drain transmission completely.
- Tag transmission to indicate it needs to be filled with oil after installing in vehicle.

YZ,CTM147,10,6 -19-10MAR98

INSTALL TRANSMISSION TO THE ENGINE

CAUTION: Vehicle runaway hazard. Avoid serious or fatal injury. This transmission is not a braking system. Install only if there is a braking system capable of stopping the vehicle with dead engine, disengaged transmission, or loss of hydrostatic retardation. Otherwise, vehicle may roll freely, resulting in loss of control.

1. Check engine crankshaft endplay, it should comply with engine manufactures tolerances.

2. Remove the flywheel housing access cover. Rotate the engine flywheel until one of the mounting holes for the drive plate is aligned with the flywheel housing access hole.

3. Support the transmission assembly so that it can be positioned directly in line with the engine crankshaft. Align the pilot sleeve with the flywheel pilot bore. Align one of the cap screw holes in the drive plate with one of the mounting holes in the flywheel.

IMPORTANT: If the transmission does not close up to the flywheel, do not proceed, Forcing the transmission up to the engine with the assembly bolts could preload the engine crankshaft and cause engine or transmission problems later, Remove the transmission and check previous assembly steps to determine the problem. Take corrective action before proceeding.

4. Push the transmission to the engine.

5. Fasten the transmission input housing (converter housing) to the engine flywheel housing.

6. Attach the drive plate to the flywheel. Install and hand tighten cap screws through the engine flywheel housing access hole. After all the cap screws have been installed, tighten to proper torque values.

IMPORTANT: Check the engine crankshaft endplay.

7. Check the engine crankshaft endplay. It should comply with the engine manufacturer's specifications. If end play is less than specified the crankshaft may have been preloaded at assembly with the transmission. The engine should not be run until the preload condition is corrected.

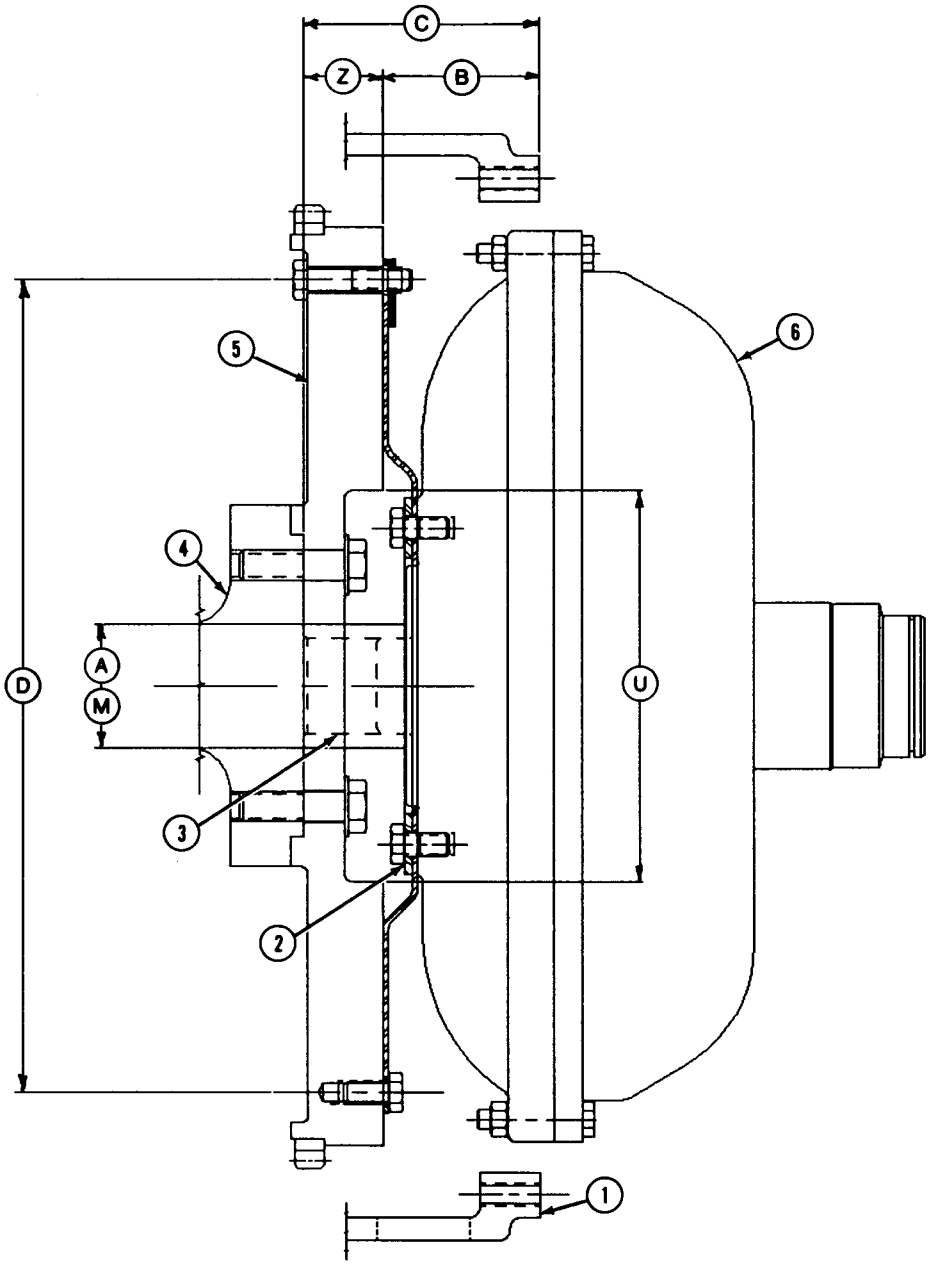
8. Install the flywheel access hole cover.

9. Connect all drive line, mechanical linkages, hydraulic lines and electronic connectors required by transmission.

10. Fill transmission with oil as described in this section of the manual.

YZ,CTM147,10,7 -19-05MAY98

CONVERTER-TO-ENGINE FLYWHEEL DIMENSIONS



1-Engine Flywheel Housing
2-Converter Drive Plate Group
3-Converter Pilot Sleeve
4-Engine Crank Shaft
5-Engine Flywheel
6-Converter Assembly
7-Housing Spacer (as required)
8-Flywheel End Stop
9-Flywheel Shoulder Stop
10-Pilot Sleeve End Stop
11-Pilot Sleeve Shoulder Stop

YZ,CTM147,10,37-19-05MAY98

ENGINE TO TORQUE CONVERTER SPECIFICATIONS

IMPORTANT: Engine to torque converter dimensions must be checked anytime the following has occurred:

CHECK THE ENGINE TO TORQUE CONVERTER SPECIFICATIONS ANYTIME:

- The engine has been changed.
- The engine flywheel has been changed.
- The engine flywheel housing has been changed.
- The torque converter has been replaced with a different part number.
- The drive plate has been replaced with a different part number.

SPECIAL FLYWHEEL APPLICATIONS
B= FLYWHEEL HOUSING FACE TO FLYWHEEL FACE

	Z+0.2 -0.2 mm (Z+0.01 -0.01 in.)	"B" REFERENCE	"R" MAXIMUM
STANDARD	46.2 mm (1.82 in)	53.3 mm (2.12 in)	31.7 mm (1.25 in)

See preceding page for drawing with installation dimensions.

Standard length pilot sleeves are setup for 2.046/2.048, 2.44/2.442 and 2.833/2.835 flywheel pilot bores and dimension "Z" 33.4 ± 0.2 mm (1.315 ± .01) from the flywheel drive plate mounting face to the flywheel pilot bore stop in the bottom of the pilot bore.

CHECK THE FOLLOWING ENGINE AND TRANSMISSION DIMENSIONS TO ASSURE PROPER INSTALLATION:

1. Dimension "U" 165.1 mm (6.50) minimum to clear the drive plate and converter assembly.

2. Check and determine the type of pilot sleeve that is being used in your application (end stop or shoulder stop).

3. Check dimension "Y" and "Z" on the flywheel depending on the type of pilot sleeve, measure dimension "Z" from flywheel drive plate mounting face to the flywheel pilot bore stop in the bottom of the pilot bore on dimension "Y" on the flywheel from flywheel drive plate mounting face to the flywheel pilot bore shoulder stop.

4. Place sleeve on the converter front cover pilot knob and push back to the converter front cover. Check dimension "Y" or "Z" on the converter drive plate pilot sleeve assembly depending on the type of pilot sleeve, or measure dimension "Y" from the drive plate mounting face that will be mounted to the flywheel out to the shoulder on the pilot sleeve.

5. The converter, drive plate and pilot assembly dimension "Z" or "Y" (step 4) should be .03 to .10 shorter than flywheel dimension "Z" or "Y" (step 3). The pilot sleeve is not preloaded between the converter assembly and flywheel.

6. Check the diameter of the flywheel pilot bore dimension "M" and converter pilot sleeve dimension "A" for a proper fit. There should be 0.01—0.07 mm (0.0005—0.003 in.) diametric clearance. Flywheels that do not fit within this tolerance will require a special sleeve to accurately pilot the converter assembly. If the above dimensions check out, the assembly can continue.

7. Check the engine crankshaft endplay. It should comply with the engine manufacturer's tolerance.

YZ,CTM147,10,32-19-05MAY98

SUGGESTED WRENCHING TORQUE FOR TAPERED PIPE THREAD

TAPERED PIPE THREAD WITH SEALANT CHART

Thread Size	N·m	lb-ft
1/16-27 UNF	15	10
1/8-27 UNF	20	15
1/4-18 UNF	25	20
3/8-18 UNF	35	25
1/2-14 UNF	45	35
3/4-14 UNF	60	45
1-11 1/2 UN	75	55
1-1/4-11 1/2 UN	95	70
1-1/2-11 1/2 UN	110	80
2-11 1/2 UN	130	95

TAPERED PIPE THREAD WITHOUT SEALANT CHART

Thread Size	N·m	lb-ft
1/16-27 UNF	20	15
1/8-27 UNF	25	20
1/4-18 UNF	35	25
3/8-18 UNF	45	35
1/2-14 UNF	60	45
3/4-14 UNF	75	55
1-11 1/2 UN	90	65
1-1/4-11 1/2 UN	110	80
1-1/2-11 1/2 UN	130	95
2-11 1/2 UN	160	120

SUGGESTED WRENCHING TORQUE FOR TAPERED PIPE THREAD charts meet Funk Engineering Procedures Manual Torque Specifications FEP 14.4.

CTM147,10,41 -19-05MAY98

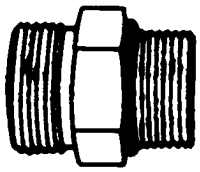
SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS

STRAIGHT FITTING

1. Inspect O-ring boss seat for dirt or defects.

2. Lubricate O-ring with petroleum jelly. Place electrical tape over threads to protect O-ring. Slide O-ring over tape and into O-ring groove of fitting. Remove tape.

3. Tighten fitting to torque value shown on chart.



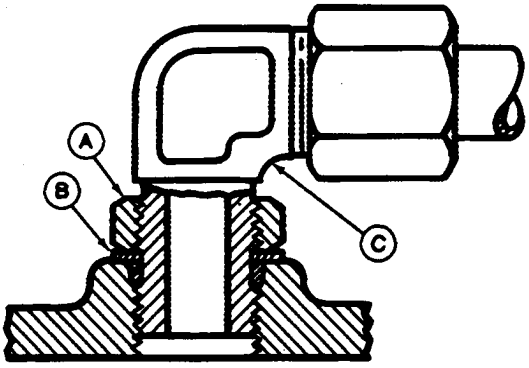
T6243AE -UN-18OCT88

ANGLE FITTING

1. Back-off lock nut (A) and back-up washer (B) completely to head-end (C) of fitting.

2. Turn fitting into threaded boss until back-up washer contacts face of boss.

3. Turn fitting head-end counterclockwise to proper index (maximum of one turn).



T6520AB -UN-18OCT88

NOTE: Do not allow hoses to twist when tightening fittings.

4. Hold fitting head-end with a wrench and tighten locknut and back-up washer to proper torque value.

STRAIGHT FITTING OR SPECIAL NUT TORQUE CHART

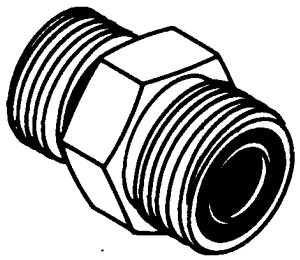
Thread Size	N·m	lb-ft
3/8-24 UNF	8	6
7/16-20 UNF	12	9
1/2-20 UNF	16	12
9/16-18 UNF	24	18
3/4-16 UNF	46	34
7/8-14 UNF	62	46
1-1/16-12 UN	102	75
1-3/16-12 UN	122	90
1-5/16-12 UN	142	105
1-5/8-12 UN	190	140
1-7/8-12 UN	217	160

NOTE: Torque tolerance is + 15% -20%.

SERVICE RECOMMENDATIONS FOR O-RING BOSS FITTINGS chart meets Funk Engineering Procedures Manual Torque Specifications FEP 14.3.

CTM147,10,40 -19-05MAY98

SERVICE RECOMMENDATIONS FOR FLAT FACE O-RING SEAL FITTINGS



T6243AD -UN-18OCT88

1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.

2. Inspect the O-ring. It must be free of damage or defects.

3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.

4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.

5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.

6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.

FLAT FACE O-RING SEAL FITTING TORQUE

Nominal Tube O.D. mm	Nominal Tube O.D. in.	Dash Size	Thread Size in.	Swivel Nut N·m	Swivel Nut lb-ft	Bulkhead Nut N·m	Bulkhead Nut lb-ft
6.35	0.250	-4	9/16-18	16	12	5.0	3.5
9.52	0.375	-6	11/16-16	24	18	9.0	6.5
12.70	0.500	-8	13/16-16	50	37	17.0	12.5
15.88	0.625	-10	1-14	69	51	17.0	12.5
19.05	0.750	-12	1 3/16-12	102	75	17.0	12.5
22.22	0.875	-14	1 3/16-12	102	75	17.0	12.5
25.40	1.000	-16	1 7/16-12	142	105	17.0	12.5
31.75	1.250	-20	1 11/16-12	190	140	17.0	12.5
38.10	1.500	-24	2-12	217	160	17.0	12.5

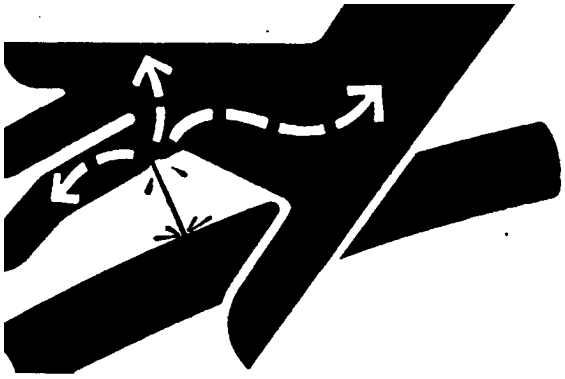
NOTE: Torque tolerance is +15 -20%.

04T,90,K67 -19-01AUG94

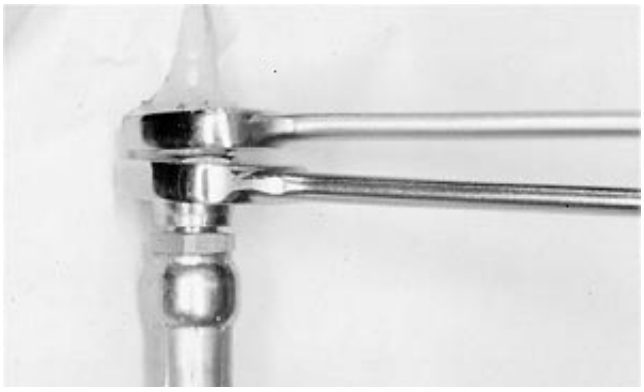
CHECK OIL LINES AND FITTINGS

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Avoid the hazard by relieving pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury may call the Deere & Company Medical Department in Moline, Illinois, or other knowledgeable medical source.



X9811 -UN-23AUG88



T85401 -UN-24JAN89

Check all oil lines, hoses, and fittings regularly for leaks or damage. Make sure all clamps are in position and tight. Make sure hoses are not twisted or touching moving machine parts. If abrasion or wear occurs, replace immediately.

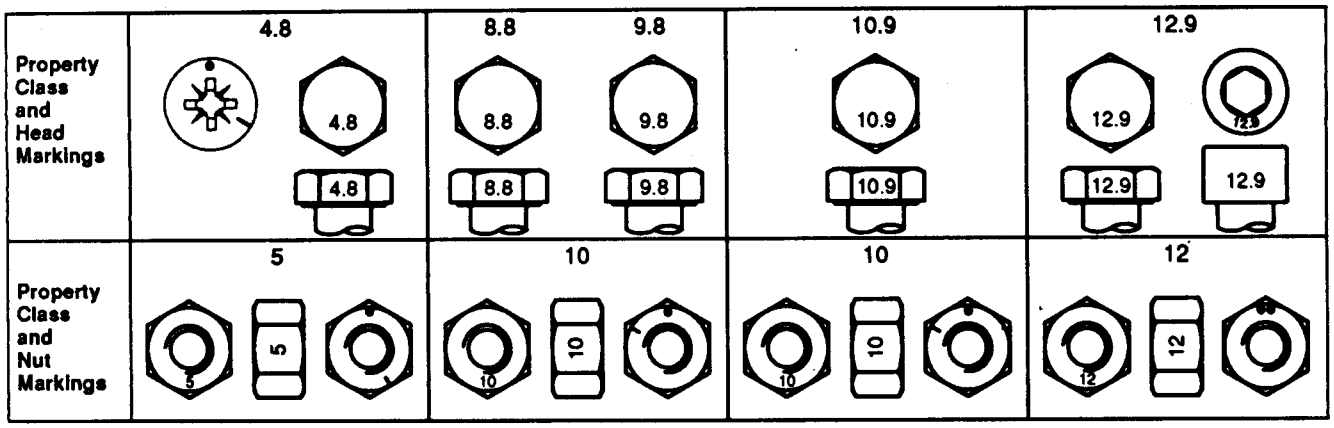
Tubing with dents may cause the oil to overheat. If you find tubing with dents, install new tubing immediately.

IMPORTANT: Tighten fittings as specified in torque chart.

When you tighten connections, use two wrenches to prevent bending or breaking tubing and fittings.

TX,90,DH1559 -19-01AUG94

METRIC BOLT AND CAP SCREW TORQUE VALUES



Applies to non-lubricated plain or zinc plated fasteners.

Size	Class 8.8		Class 10.9	
	N·m	lb-ft	N·m	lb-ft
M5	6.1	4.5	9.0	6.6
M6	10.4	7.7	15.3	11.3
M8	25	19	37	27
M10	50	37	73	54
M12	87	64	128	94
M14	139	102	204	150
M16	216	160	318	234
M20	435	321	620	457
M24	730	555	1072	790
M30	1450	1103	2129	1570
M36	2533	1927	3721	2744

NOTE: Torque tolerance is ± 20%

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

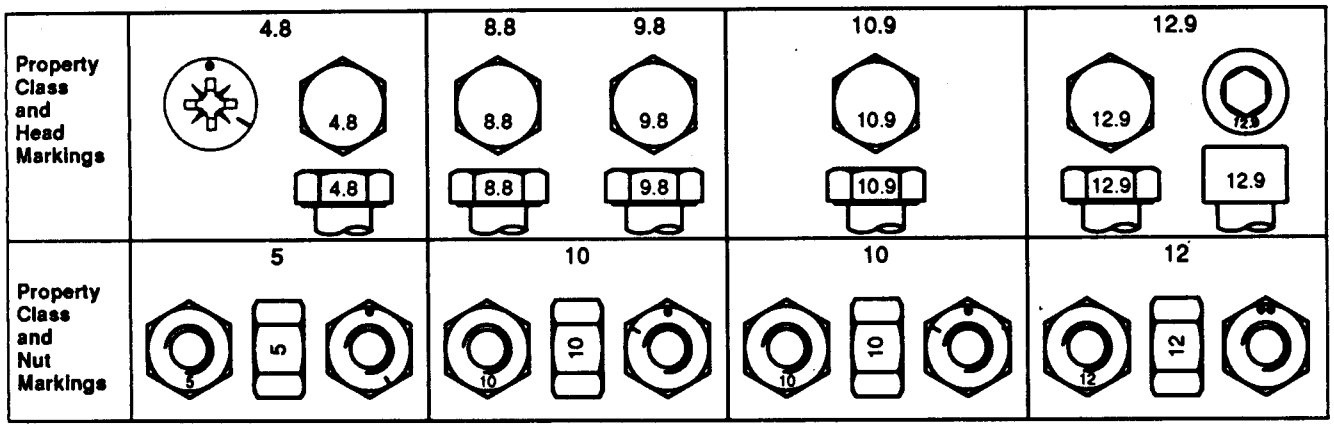
Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

METRIC BOLT AND CAP SCREW TORQUE VALUES chart meet Funk Engineering Procedures Manual Torque Specifications FEP 14.1.

CTM147,10,42 -19-07MAY98

UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES



TS1163 -19-04MAR91

Applies to non-lubricated plain or zinc plated fasteners.

Size	Grade 5		Grade 8	
	N·m	lb-ft	N·m	lb-ft
1/4-20	11.1	8.2	16	11.6
1/4-28	12.8	9.4	18	13.3
5/16-18	23	16.9	32	23.9
5/16-24	25	18.7	36	26.4
3/8-16	41	30	57	42
3/8-24	46	34	65	48
7/16-14	65	48	92	68
7/16-20	73	54	103	76
1/2-13	99	73	140	103
1/2-20	111	82	159	117
9/16-12	144	106	202	149
9/16-18	160	118	225	166
5/8-11	198	146	280	206
5/8-18	224	165	316	233
3/4-10	350	258	495	365
3/4-16	392	289	554	408
7/8-9	566	417	799	589
7/8-14	624	460	881	649
1-8	848	625	1199	884
1-12	928	684	1312	967

NOTE: Torque tolerance is ± 20%

DO NOT use these values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only. Check tightness of fasteners periodically.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical property class.

Fasteners should be replaced with the same or higher property class. If higher property class fasteners are used, these should only be tightened to the strength of the original.

Make sure fasteners threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

Tighten plastic insert or crimped steel-type lock nuts to approximately 50 percent of the dry torque shown in the chart, applied to the nut, not to the bolt head. Tighten toothed or serrated-type lock nuts to the full torque value.

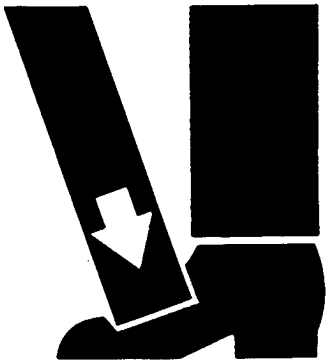
UNIFIED INCH BOLT AND CAP SCREW TORQUE VALUES chart meet Funk Engineering Procedures Manual Torque Specifications FEP 14.2.

CTM147,10,43 -19-07MAY98

USE PROPER LIFTING EQUIPMENT

Lifting heavy components incorrectly can cause severe injury or machine damage.

Follow recommended procedure for removal and installation of components in the manual.

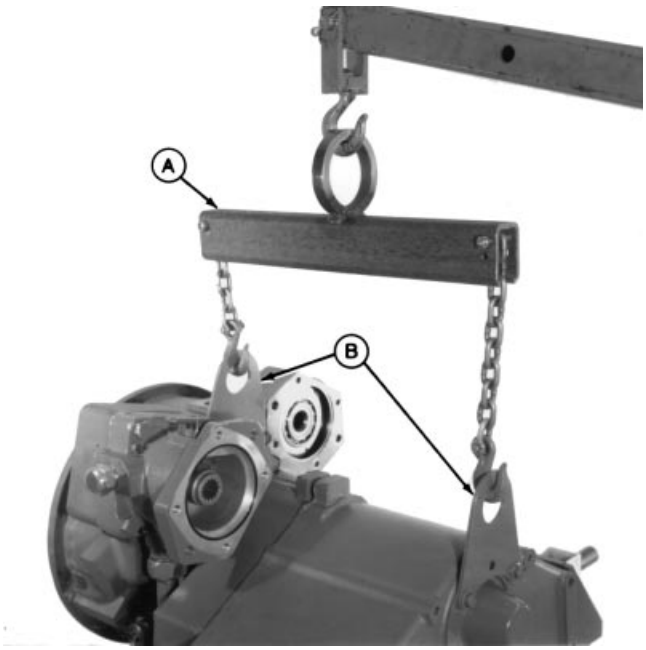


TS226 -UN-23AUG88

DX,LIFT -19-04JUN90

TRANSMISSION LIFTING PROCEDURE

Use a lift sling similar to (A). It should hold the transmission level without bending the lift hangers (B).



YZ545 -UN-14MAR98

YZ,CTM147,15,3 -19-05MAY98

TRANSMISSION REPAIR STAND

NOTE: The repair stand (A) used in this manual is OTC DIVISION part number 1735, capacity is 907 Kg (2000)lbs.

OTC Division
Sealed Power Corporation
655 Eisenhower Drive
Owatonna, Mn 55060

When any other stand is used, consult the Manufacturer's instructions for mounting.

Approximate dry weights:
Model DF150 = 545 Kg (1250 lbs).
Model DF250 = 703 Kg (1550 lbs).

YZ501 -UN-10MAR98

Actual weights depend on the options included.

YZ,CTM147,15,1 -19-05MAY98

MOUNTING DF SERIES TRANSMISSION TO REPAIR STAND

NOTE: See Group 99, "Special Tools" for Assembly Stand Plate drawings.

YZ687 -UN-20MAR98

YZ,CTM147,15,4 -19-05MAY98

CAUTION: Do not allow any part of the body to be under the transmission while it is being lifted or after it is suspended on the repair stand. Do not exceed maximum capacities for the repair stand. Use only high grade fasteners in good condition. Personal injury could result.

SAFETY PRECAUTIONS

• This stand should be used only by qualified service technicians familiar with this equipment.

• Fabricate transmission mounting adapters to specifications provided in fabricated tools, Group 99, of this manual.

• Use SAE Grade 8 or better cap screws to attach adapters or mount transmission.

• Make sure tapped holes in adapters and transmission are clean and not damaged.

• Minimum cap screw thread engagement should be equal to 1-1/2 screw diameters.

• Do not exceed the maximum capacity rating of stand.

• Be sure transmission is solidly mounted before releasing from lifting device.

• Never permit any part of the body to be positioned under a load being lifted or suspended. Accidental slippage may result in personal injury.

YZ,CTM147,15,2 -19-05MAY98

OTHER MATERIAL

Number	Name	Use
T43513*	LOCTITE® Thread Lock & Sealer (High Strength) #262	Impeller hub-to-impeller cap screws.
	LOCTITE® Thread Lock & Sealer (High Strength) #262	Drive plate and retainer ring-to-front cover cap screw.

LOCTITE is a trademark of the LOCTITE Corporation.

**John Deere part number reference.*

YZCTM147,20,OTH-19-05MAY98

SPECIFICATIONS

Item	Measurement	Specification
Impeller Hub-to-Impeller Cap Screws	Torque	31 N·m (23 lb-ft)
Front Cover-to-Impeller Cap Screws	Torque	35 N·m (26 lb-ft)
Drive Plates and Retainer Ring-to-Front Cover Cap Screws	Torque	40 N·m (30 lb-ft)

YZCTM147,20,SPC-19-05MAY98

REMOVE TORQUE CONVERTER AND DRIVE PLATE ASSEMBLY.

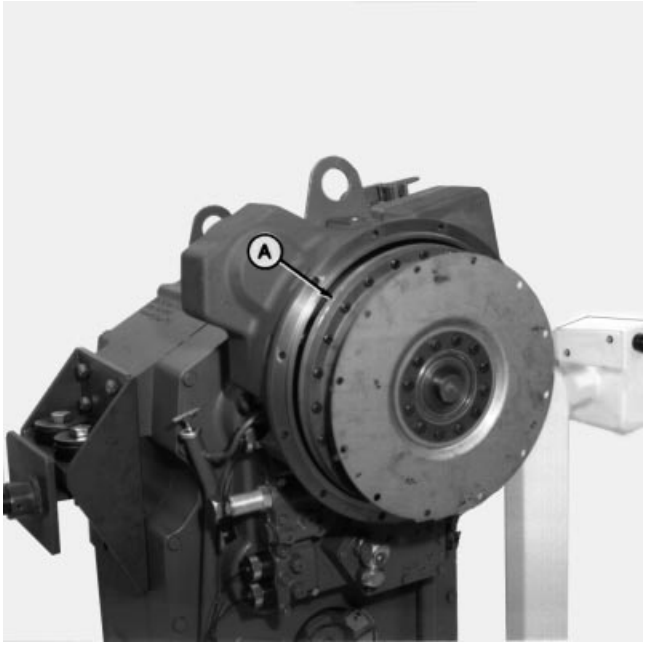
CAUTION: Torque converter assembly weighs approximately 32 Kg (70 lbs). Torque converter is not attached to transmission. Do not allow torque converter to fall out of transmission input housing. Personal injury could result.

1. Remove torque converter assembly (A) straight away from transmission input housing.

2. Drain oil through impeller hub, check for contaminates, dispose of oil properly.

3. Place torque converter assembly on work surface with drive plate assembly up.

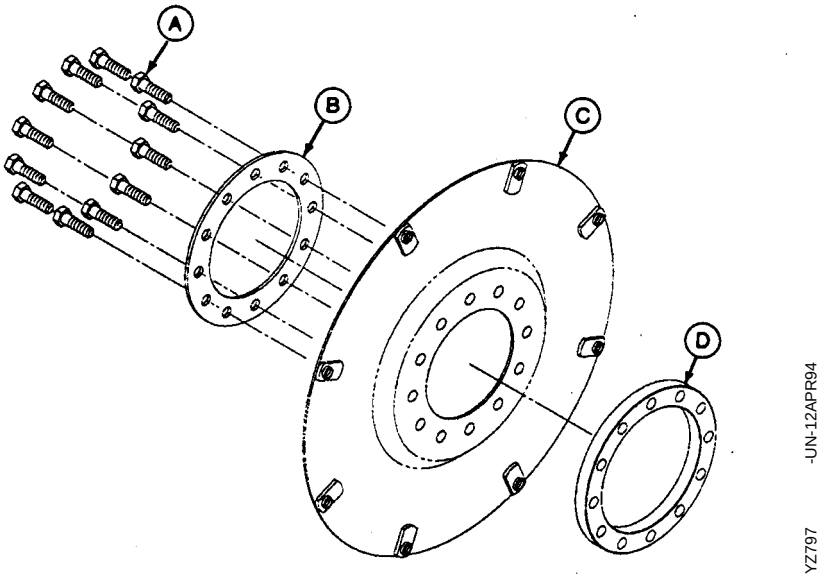
4. Place support blocks under torque converter impeller to prevent tipping.



YZ502 -UN-10MAR98

YZ,CTM147,20,3 -19-05MAY98

DISASSEMBLE AND ASSEMBLE DRIVE PLATE GROUP



YZ797 -UN-12APR94

A—Cap screw (12 used)
B—Ring
C—Drive plate assembly
D—Ring

Ring (D) is used only with the 11.75 converter.

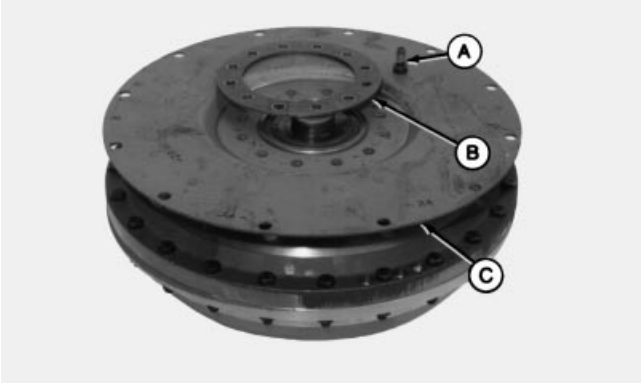
YZ,CTM147,20,38-19-05MAY98

DISASSEMBLE DRIVE PLATE GROUP

1. Remove 12 cap screws (A).

2. Remove ring (B) and drive plate assembly (C).

3. Inspect for wear or damage. Look closely at drive plate (C) for signs of fatigue, cracks or elongated bolt holes.

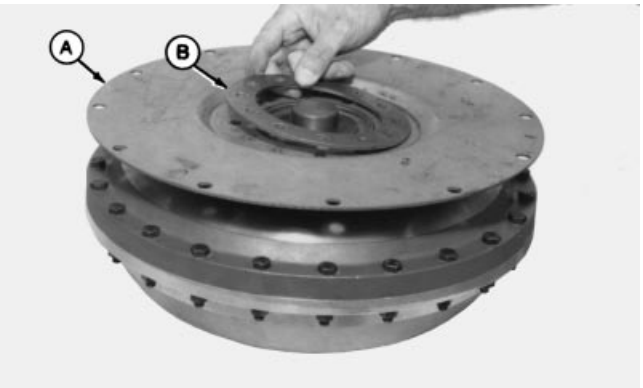


YZ503 -UN-10MAR98

YZ,CTM147,20,4 -19-05MAY98

ASSEMBLE DRIVE PLATE GROUP

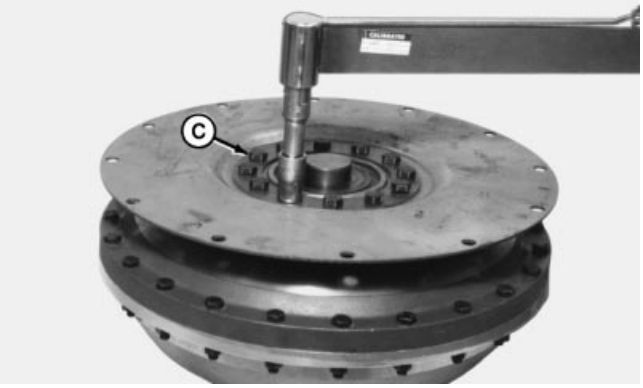
1. Install drive plate assembly (A) and ring (B).



-UN-14MAR98
YZ538

2. Install cap screws (C) and tighten evenly. Alternating front to rear and side to side.

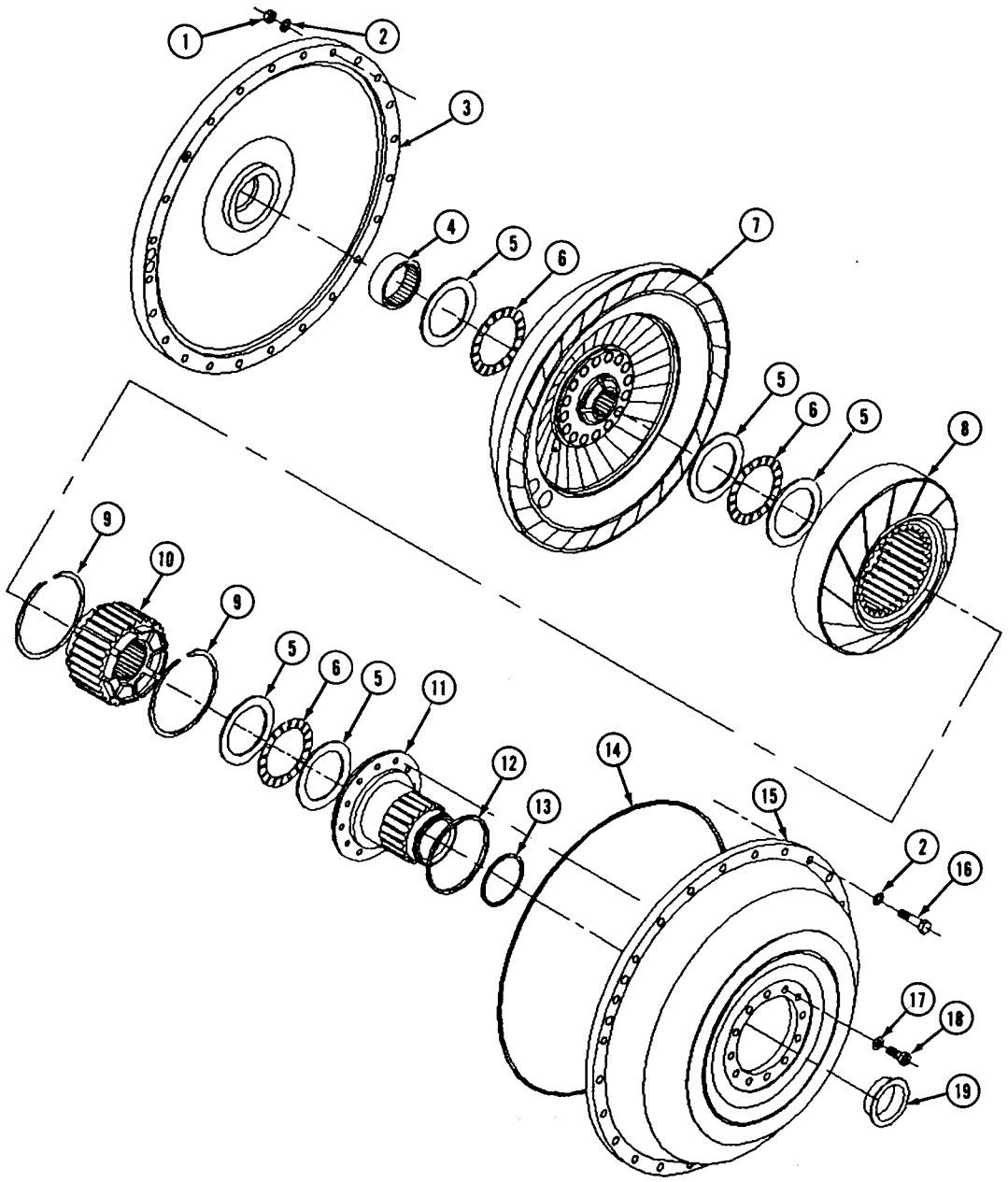
3. Tighten to 40 N·m (30 lb-ft).



-UN-14MAR98
YZ539

YZ,CTM147,20,26-19-05MAY98

DISASSEMBLE AND ASSEMBLE 12.75 INCH TORQUE CONVERTER WITH FIXED STATOR

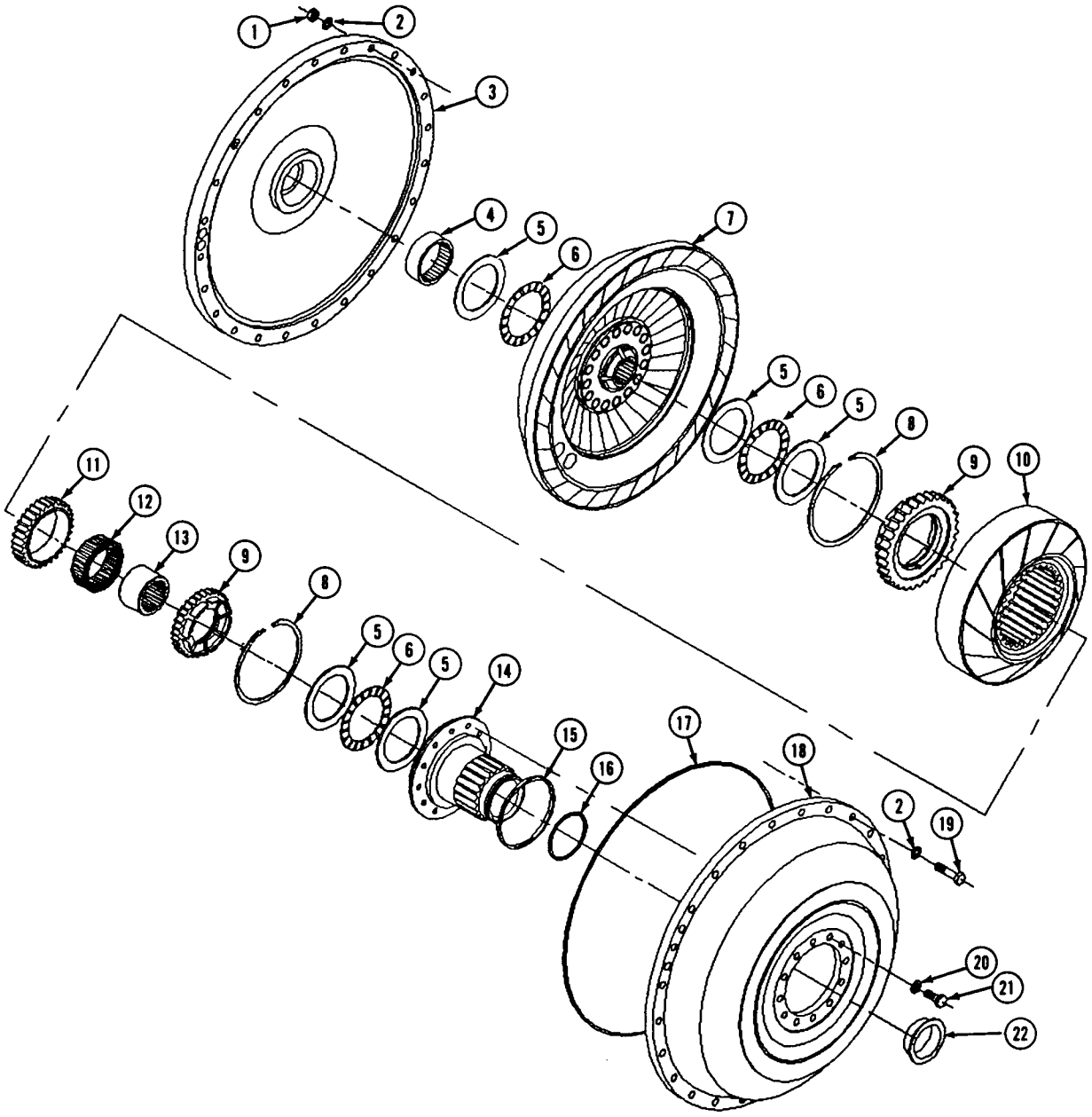


YZ541 -UN-25OCT93

1—Hex nut (24 used)
2—Flat washer (24 used)
3—Front cover
4—Bearing
5—Thrust washer (5 used)
6—Needle thrust washer (3 used)
7—Turbine assembly
8—Converter stator
9—Retainer ring (2 used)
10—Fixed stator hub
11—Impeller hub
12—O-ring
13—Seal ring
14—Gasket O-ring
15—Converter impeller
16—Cap screw (24 used)
17—Washer (12 used)
18—Cap screw (12 used)
19—Shipping plug

YZ,CTM147,20,28-19-05MAY98

DISASSEMBLE AND ASSEMBLE 12.75 INCH TORQUE CONVERTER WITH FREE STATOR



1—Hex nut (24 used)
2—Flat washer (24 used)
3—Front cover
4—Bearing
5—Thrust washer (5 used)
6—Needle thrust washer (3 used)
7—Turbine assembly
8—Retainer ring (2 used)
9—Clutch retainer (2 used)
10—Converter stator
11—Outer clutch race
12—Sprag clutch assembly
13—Inner clutch race
14—Impeller hub
15—O-ring
16—Seal ring
17—Gasket O-ring
18—Converter impeller
19—Cap screw (24 used)
20—Washer (12 used)
21—Cap screw (12 used)
22—Shipping plug

YZ,CTM147,20,27-19-05MAY98

REMOVE FRONT COVER

IMPORTANT: Note from which side of the converter the cap screws are installed and the arrangement of flat washers. They must be installed the same when reassembled.

1. Remove 24 cap screws, hex nuts and flat washers (A).

IMPORTANT: Do not use pry bars to remove front cover (B), damage to aluminum impeller casting could result.

2. Lift front cover (B) and remove.

3. Remove O-ring gasket (C).

YZ504 -UN-10MAR98

YZ,CTM147,20,5 -19-06MAY98

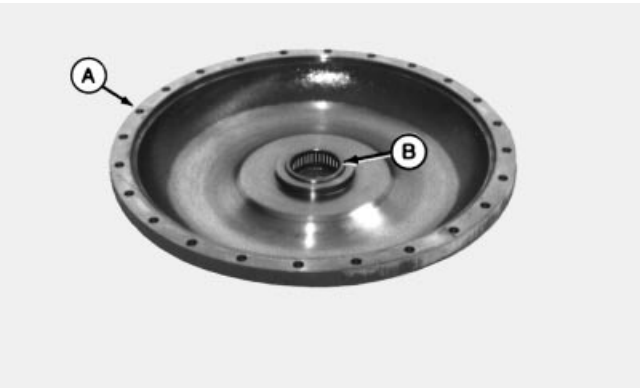
REMOVE AND INSTALL BEARING IN FRONT COVER

1. Position front cover (A) with the bearing up.

2. Block front cover to prevent tipping.

3. Remove bearing (B).

4. Install new bearing.



YZ505 -UN-10MAR98

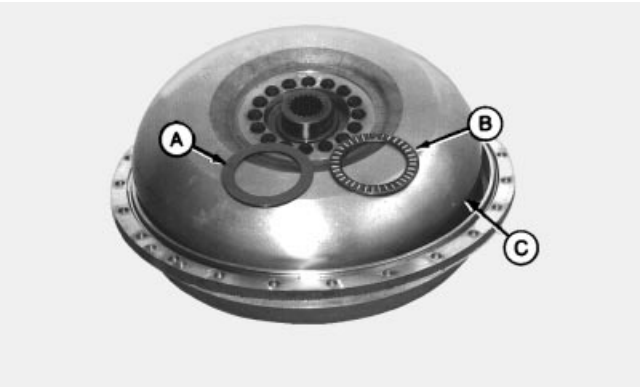
YZ,CTM147,20,6 -19-05MAY98

REMOVE TURBINE ASSEMBLY

1. Remove thrust washer (A).

2. Remove needle thrust bearing (B).

3. Remove turbine assembly (C) and inspect .



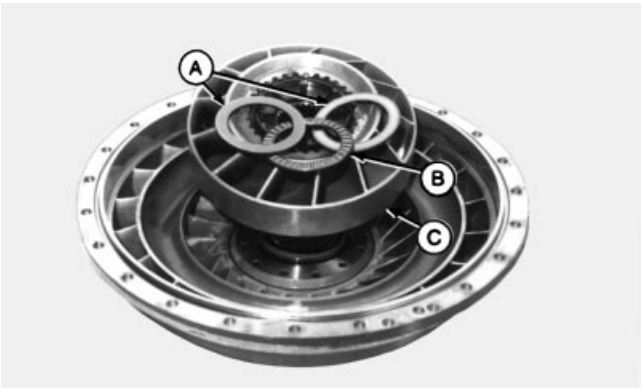
YZ506 -UN-10MAR98

YZ,CTM147,20,7 -19-05MAY98

REMOVE STATOR ASSEMBLY

1. Remove two thrust washers (A) and one needle thrust bearing (B).

2. Remove stator assembly (C).

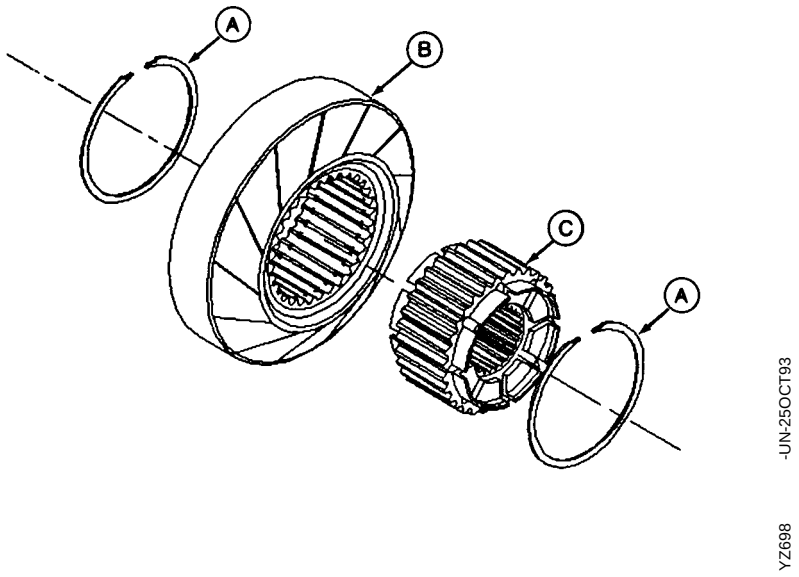


YZ,CTM147,20,8 -19-05MAY98

THE CONVERTER ASSEMBLY MAY CONTAIN EITHER A “FREE STATOR ASSEMBLY” OR A “FIXED STATOR ASSEMBLY” DEPENDING ON APPLICATION. THIS MANUAL ILLUSTRATES AND DESCRIBES BOTH STATOR TYPES.

YZ,CTM147,20,9 -19-05MAY98

DISASSEMBLE AND ASSEMBLE FIXED STATOR ASSEMBLY

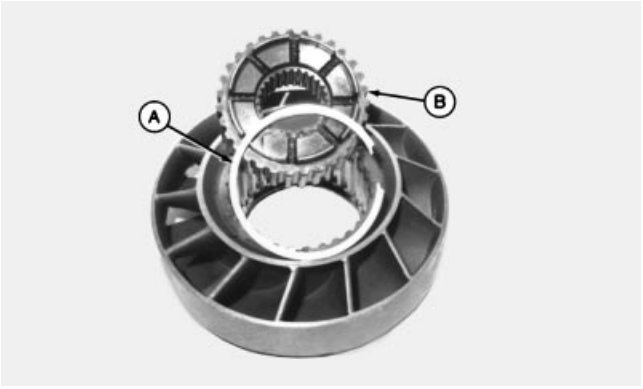


A—Retaining ring (2) **B—Stator** **C—Fixed stator hub**

YZ,CTM147,20,35-19-05MAY98

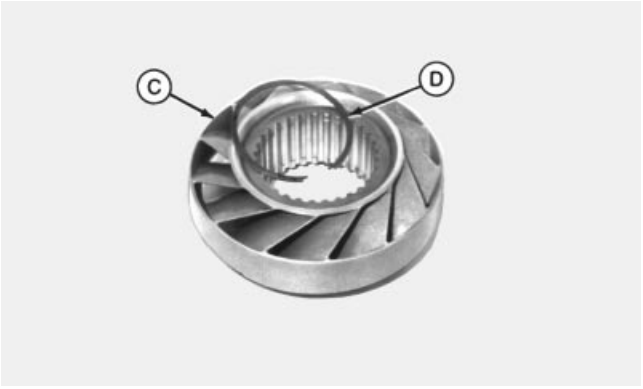
DISASSEMBLE FIXED STATOR ASSEMBLY

1. Remove retainer ring (A).
2. Remove fixed stator hub (B).



-UN-10MAR98
YZ508

3. Turn stator (C) over.
4. Remove retainer ring (D).
5. Inspect parts for wear or damage.



-UN-10MAR98
YZ509

YZ,CTM147,20,10-19-05MAY98

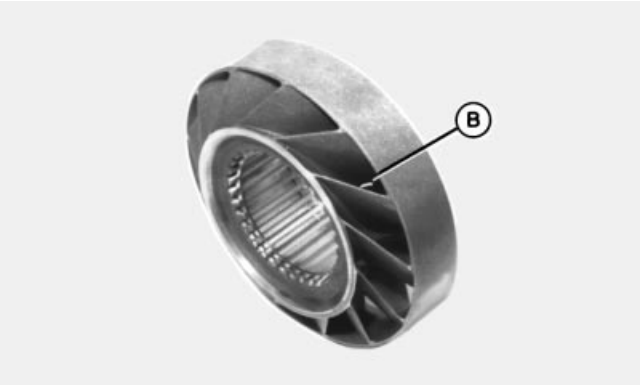
STATOR FRONT AND BACK SIDE IDENTIFICATION

IMPORTANT: Do not assemble stator wrong. The torque converter will not work properly and damage will occur.

NOTE: Throughout the assembly process of the torque converter the stator "FRONT" and "BACK" sides will be referred to. The stator casting is not marked, it must be identified by the characteristics of the cast vanes.

The "FRONT" of the stator casting is identified by the vanes being thicker (A) on this side.

-UN-10MAR98
YZ510



-UN-10MAR98
YZ511

The "BACK" of the stator casting is identified by the vanes being thinner (B) on this side.

YZ,CTM147,20,11-19-05MAY98

ASSEMBLE FIXED STATOR ASSEMBLY

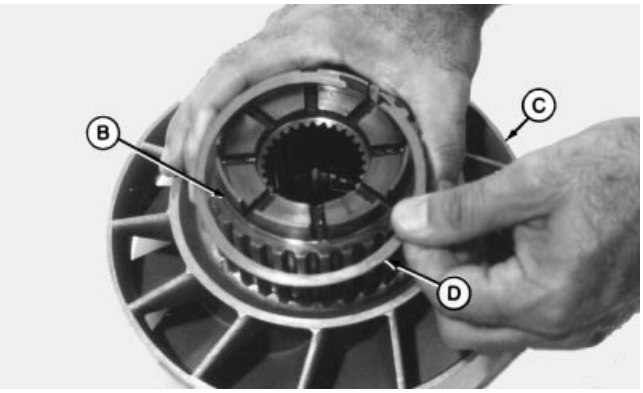
CAUTION: Wear eye protection when installing or removing retaining rings.

1. Position stator with back side up.
2. Install retaining ring (A) in groove.

3. Turn stator over.

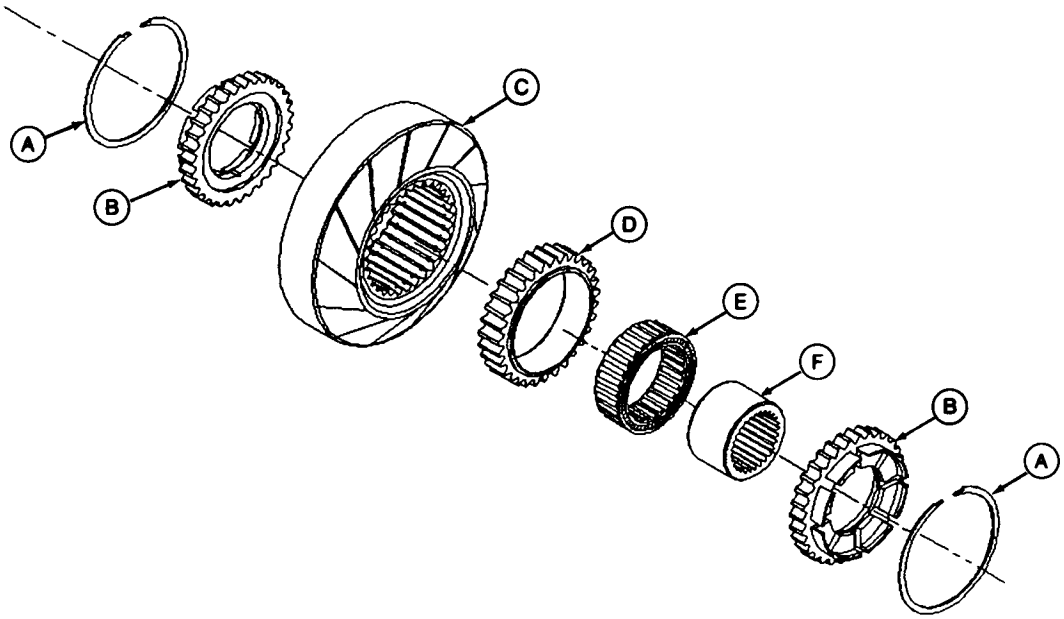
NOTE: Stator hub (B) may be installed with either side up.

4. Install fixed stator hub (B) into stator (C).
5. Install retaining ring (D) into groove.



YZ,CTM147,20,12-19-05MAY98

DISASSEMBLE AND ASSEMBLE FREE STATOR ASSEMBLY



-UN-03DEC93
YZ736

A—Retaining ring (2)
B—Clutch retainer (2)
C—Stator
D—Outer clutch race
E—Clutch sprag assembly
F—Inner clutch race

YZ,CTM147,20,34-19-05MAY98

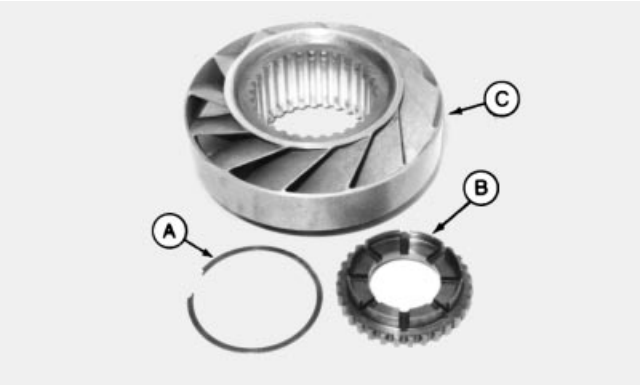
DISASSEMBLE FREE STATOR ASSEMBLY

1. Remove retaining ring (A) from stator (C).
2. Remove clutch retainer (B).
3. Remove inner clutch race (F).
4. Remove sprag clutch assembly (E).
5. Remove outer clutch race (D).

YZ514 -UN-10MAR98

NOTE: Clutch retainer (B) will slide out of stator when turned over.

6. Turn stator (C) over.
7. Remove retaining ring (A).
8. Remove clutch retainer (B).
9. Inspect parts for wear or damage.



YZ515 -UN-10MAR98

YZ,CTM147,20,13-19-05MAY98

ASSEMBLE FREE STATOR ASSEMBLY

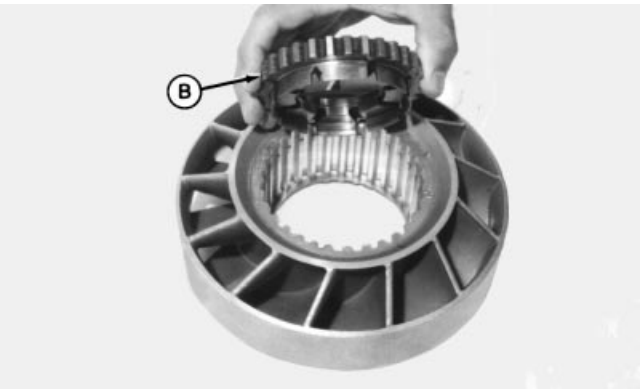
1. Position stator with “BACK” side up.

2. Install retaining ring (A) into groove.

YZ512 -UN-10MAR98

3. Turn stator, position “FRONT” side up.

4. Install clutch retainer (B) with slotted face down.



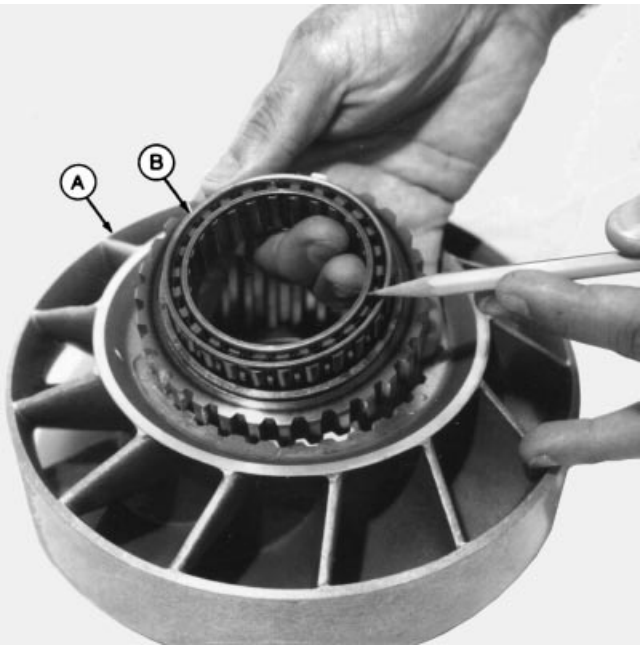
YZ517 -UN-12MAR98

YZ,CTM147,20,14-19-05MAY98

5. Position stator (A) “FRONT” side up.

6. Lubricate all clutch parts with clean transmission fluid.

IMPORTANT: Install outer cage flange of sprag clutch up. Stator must freewheel counter-clockwise viewed from front side.



-UN-12MAR98
YZ518

NOTE: Cage flange is up.

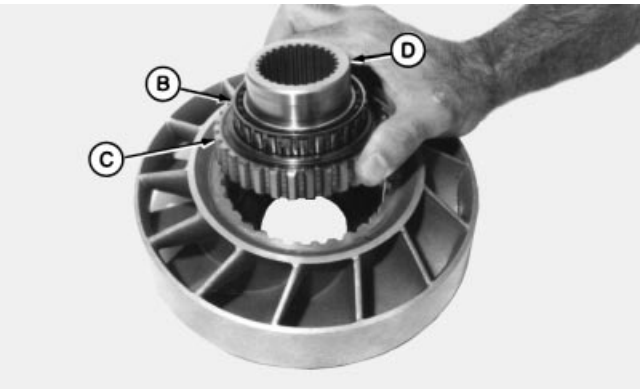
7. Install sprag clutch (B) to about one half its depth into the outer clutch race (C).

8. Install inner clutch race (D) to about one half its depth into the sprag clutch (B).

9. Push all parts together.

10. Install assembled parts into stator.

11. Compare the assembly to the “free stator clutch assembly” photograph.

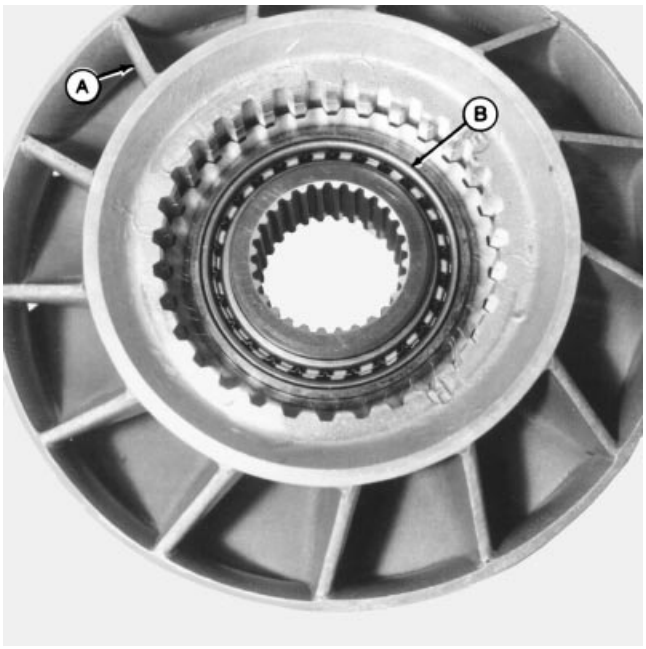


-UN-20MAR98
YZ688

YZ,CTM147,20,15-19-05MAY98

FREE STATOR CLUTCH ASSEMBLY

IMPORTANT: The photo shows how the stator and sprag clutch will look if properly assembled, the thick vanes (A) indicating the stator front is up. The cage flange of the sprag clutch assembly (B) is up.

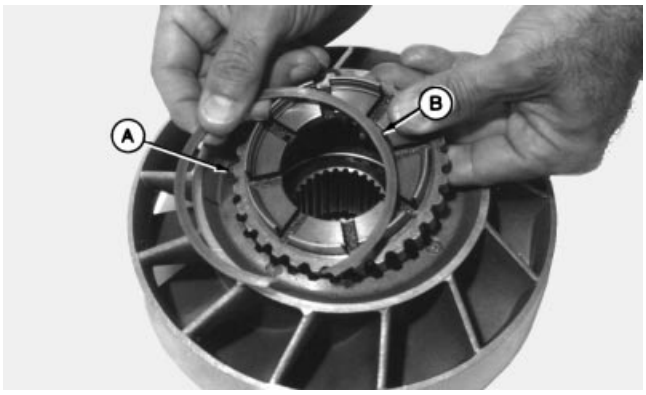


YZ519 -UN-12MAR98

YZ,CTM147,20,16-19-05MAY98

12. Install clutch retainer (A) slotted face up.

13. Install retainer ring (B) into groove.

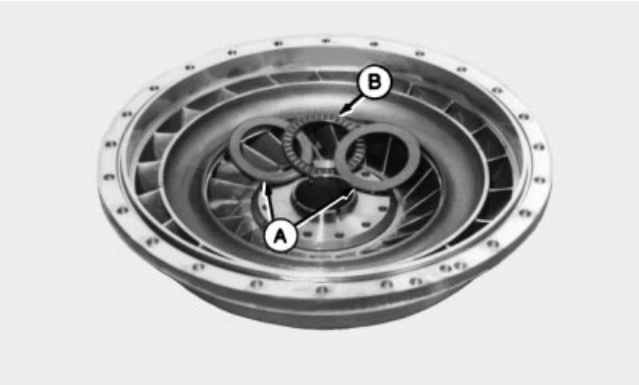


YZ520 -UN-12MAR98

YZ,CTM147,20,17-19-05MAY98

DISASSEMBLE CONVERTER IMPELLER

1. Remove two thrust washers (A) and one needle thrust bearing (B).

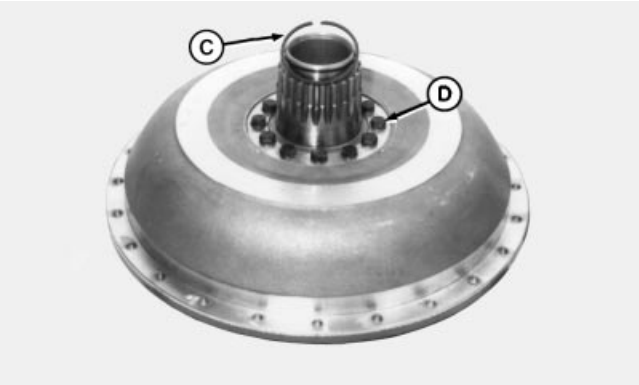


YZ521 -UN-12MAR98

2. Turn impeller over.

3. Remove seal ring (C).

4. Remove twelve cap screws (D) and washers.



YZ522 -UN-12MAR98

5. Turn impeller over.

6. Remove impeller hub (E) and 0-ring (F).

7. Inspect splines, seal and bearing surfaces.

YZ523 -UN-12MAR98

YZ,CTM147,20,18-19-05MAY98

ASSEMBLE CONVERTER IMPELLER AND HUB

1. Lubricate O-ring (A) with clean transmission fluid.

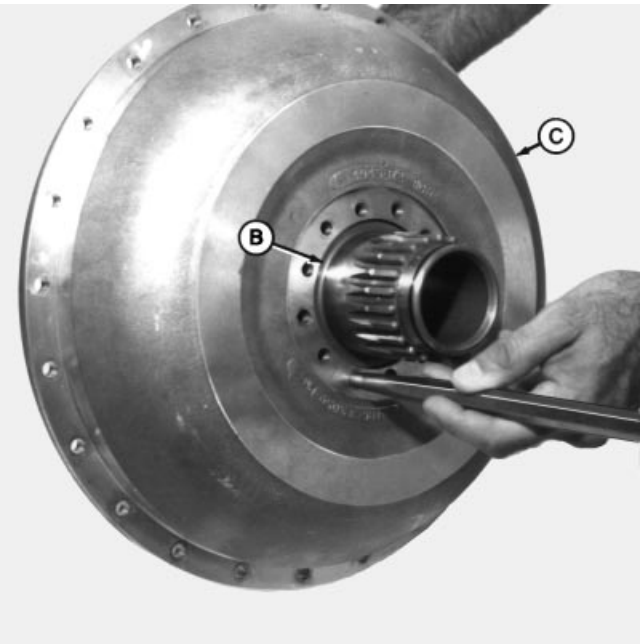
2. Install O-ring (A) into groove on impeller hub (B).

-UN-12MAR98
YZ524

3. Install impeller hub (B) into impeller (C).

NOTE: There are two bolt hole patterns in the impeller hub. Be certain all holes are aligned.

4. Align holes in impeller hub (B) with holes in impeller (C).



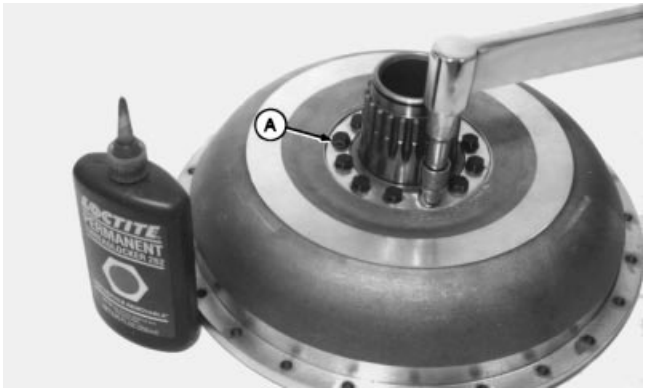
-UN-12MAR98
YZ525

YZ,CTM147,20,19-19-05MAY98

5. Apply a small drop of LOCTITE® #262 to cap screws.

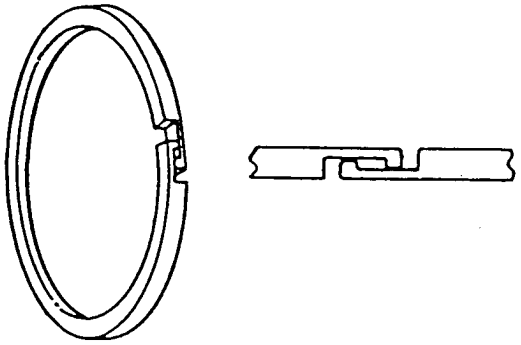
6. Install 12 cap screws and washers (A).

7. Tighten cap screws to 31 N·m (23 lb-ft).



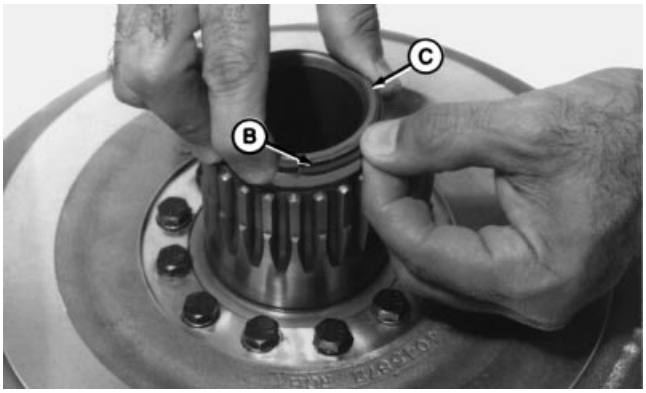
-UN-12MAR98
YZ526

IMPORTANT: Seal ring ends must be hooked together.



-UN-25OCT93
YZ527

8. Install seal ring (B) into groove on impeller hub (C) and lock ends.



-UN-12MAR98
YZ528

LOCTITE is a trademark of the LOCTITE Corporation.

YZ,CTM147,20,20-19-05MAY98

ASSEMBLE STATOR TO IMPELLER

1. Position impeller with vanes up.

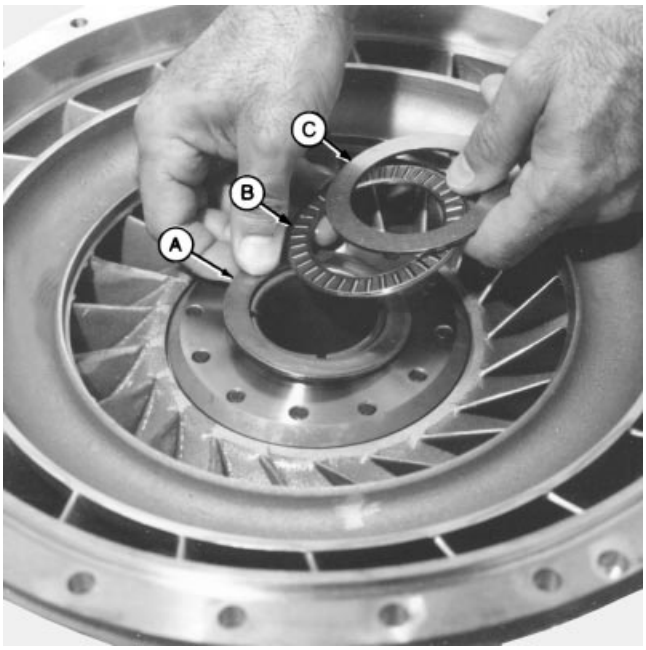
2. Lubricate one needle thrust bearing and two thrust washers with clean transmission fluid.

3. Install new thrust washer (A) onto impeller hub.

4. Install new needle thrust bearing (B) onto thrust washer.

5. Install new thrust washer (C) onto thrust bearing.

NOTE: Thrust washers (A) and (C) are identical parts.

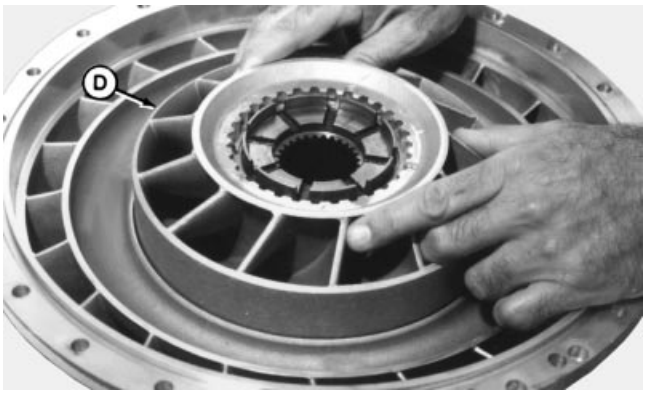


YZ529 -UN-12MAR98

6. Install stator assembly (D) with front side up (refer to STATOR FRONT AND BACK SIDE IDENTIFICATION in this group).

NOTE: If Stator is installed improperly it will not turn freely on thrust bearing.

7. Rotate stator assembly several turns to be sure it is properly seated on the thrust bearings.



YZ530 -UN-12MAR98

YZ,CTM147,20,21-19-05MAY98

ASSEMBLE TURBINE TO STATOR

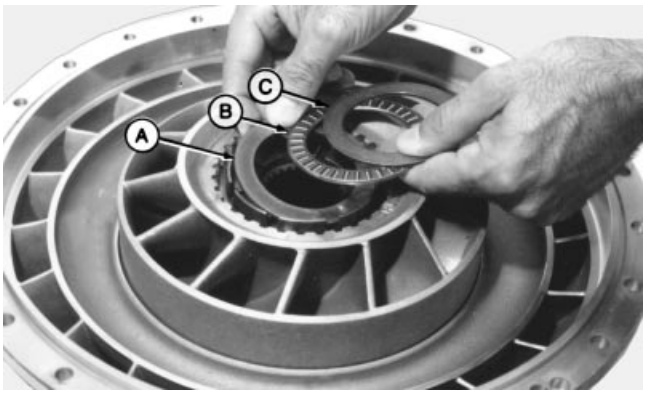
1. Lubricate needle thrust bearing and thrust washers with clean transmission fluid.

2. Install new thrust washer (A).

3. Install new needle thrust bearing (B).

4. Install new thrust washer (C).

NOTE: Thrust washers (A) and (C) are identical parts.



-UN-12MAR98
YZ531

5. Install turbine assembly (D).

6. Rotate turbine assembly several turns to be sure it is properly seated on the thrust bearings.

-UN-12MAR98
YZ532

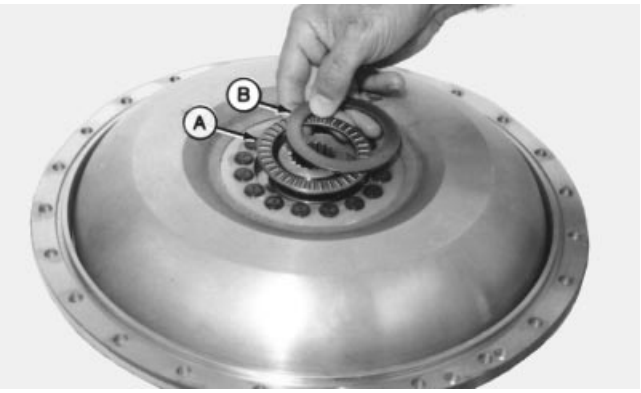
YZ,CTM147,20,22-19-05MAY98

ASSEMBLE FRONT COVER TO TURBINE AND IMPELLER

1. Lubricate needle thrust bearing and thrust washer with clean transmission fluid.

2. Install new needle thrust bearing (A).

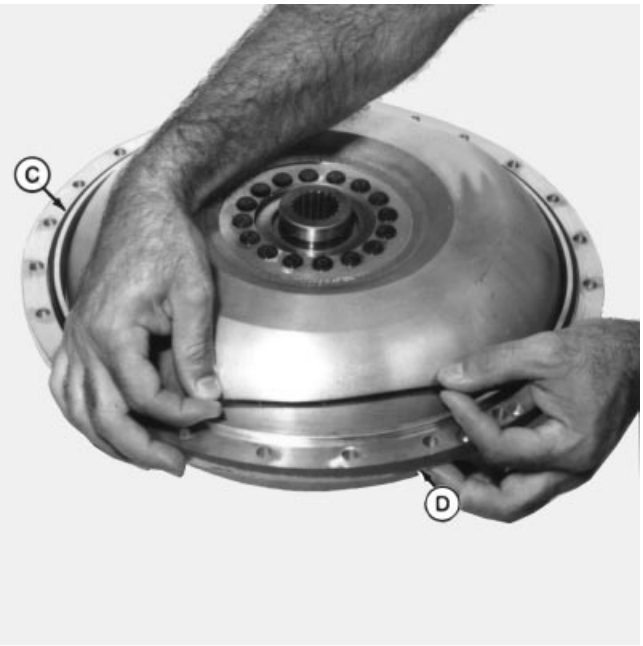
3. Install new thrust washer (B).



-UN-12MAR98
YZ533

4. Lubricate new gasket O-ring (C) with clean transmission fluid.

5. Install new gasket O-ring (C), in groove in impeller (D). Be certain the gasket O-ring is not twisted and is laying flat in the groove.



-UN-12MAR98
YZ534

YZ,CTM147,20,23-19-05MAY98

6. Install front cover (A), the mating surfaces meet evenly without binding. Align cap screw holes.

YZ535 -UN-12MAR98

7. Install cap screws (B) from same direction as originally installed.

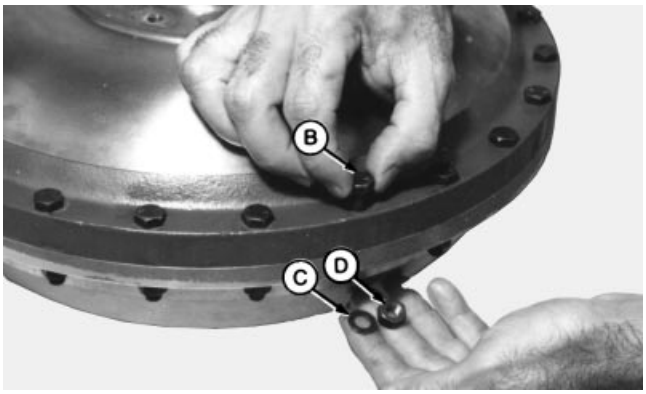
NOTE: The cap screws are usually installed from the front cover side.

8. Install flat washers (C) the same as originally installed.

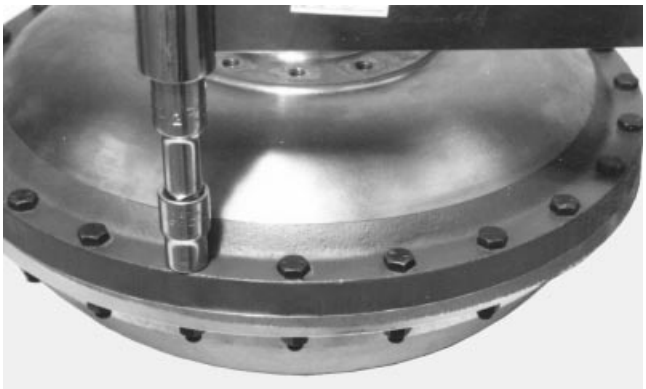
NOTE: The flat washers may be found installed on either or both sides of the converter. They are usually under the hex nut on the turbine side of the converter.

9. Install hex nuts (D).

10. Tighten cap screws to 35 N·m (26 lb-ft), alternating front to rear and side to side.



YZ536 -UN-12MAR98



YZ537 -UN-12MAR98

YZ,CTM147,20,24-19-05MAY98

OTHER MATERIAL

Number	Name	Use
T43513*	LOCTITE® Thread Lock & Sealer (High Strength) #262	On spring plunger and oil seal.

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**John Deere part number reference.*

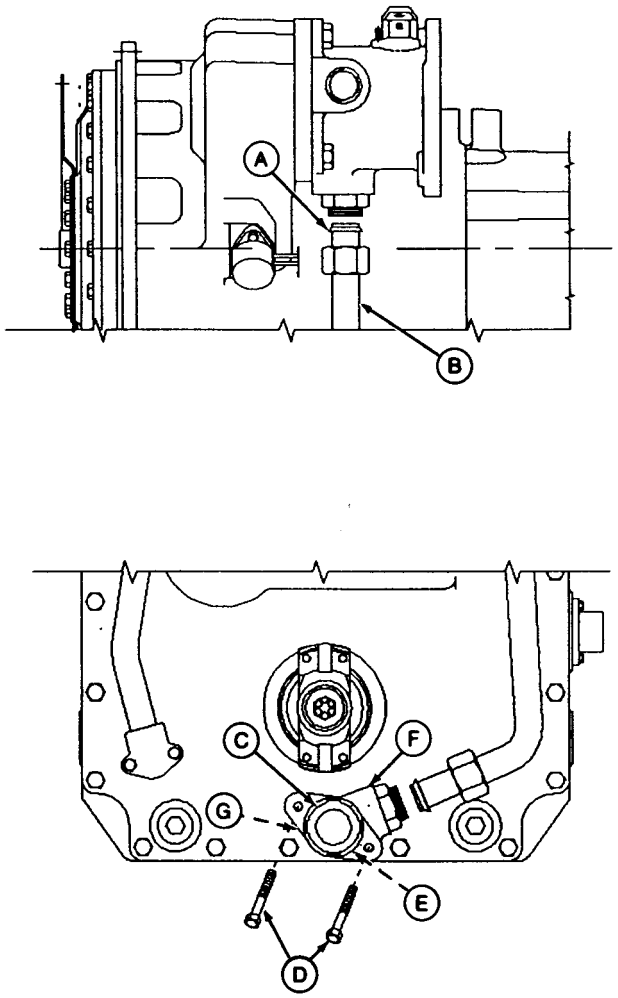
YZCTM147,25,OTH-19-05MAY98

SPECIFICATIONS

Item	Measurement	Specification
Charge pump-to-front cover cap screws.	Torque	115 N·m (85 lb-ft)
Suction Manifold-to-Front Cover cap screws.	Torque	25 N·m (18 lb-ft)

YZCTM147,25,SPC-19-05MAY98

DISASSEMBLE SUCTION TUBE GROUP



A—O-ring fitting (2 used)
B—Suction tube
C—Suction screen assembly
D—Cap screw (2 used)
E—Gasket
F—Suction manifold
G—O-ring

YZ,CTM147,25,14-19-05MAY98

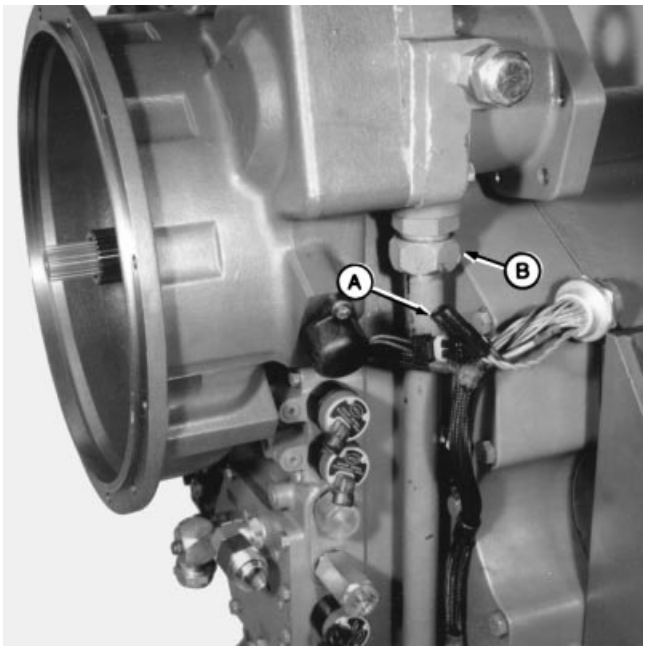
REMOVE SUCTION TUBE ASSEMBLY

IMPORTANT: All oil should be drained from transmission before beginning disassembly.

1. Remove wire harness connector (A) from magnetic pickup.

2. Loosen connector bracket and move connector out of the way.

3. Loosen nut (B) on suction tube.



YZ,CTM147,25,1 -19-05MAY98

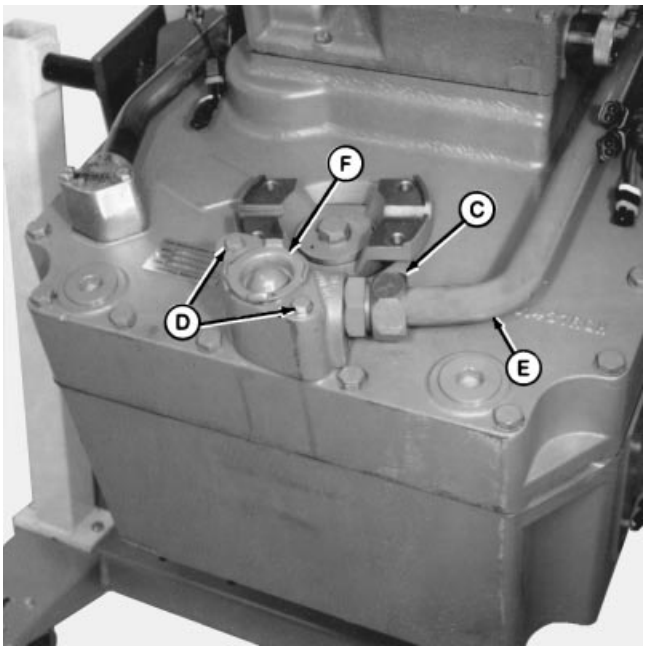
4. Remove suction screen assembly (F). Clean and inspect.

5. Loosen nut (C) connecting tube to suction manifold.

6. Remove two cap screws (D) from suction manifold.

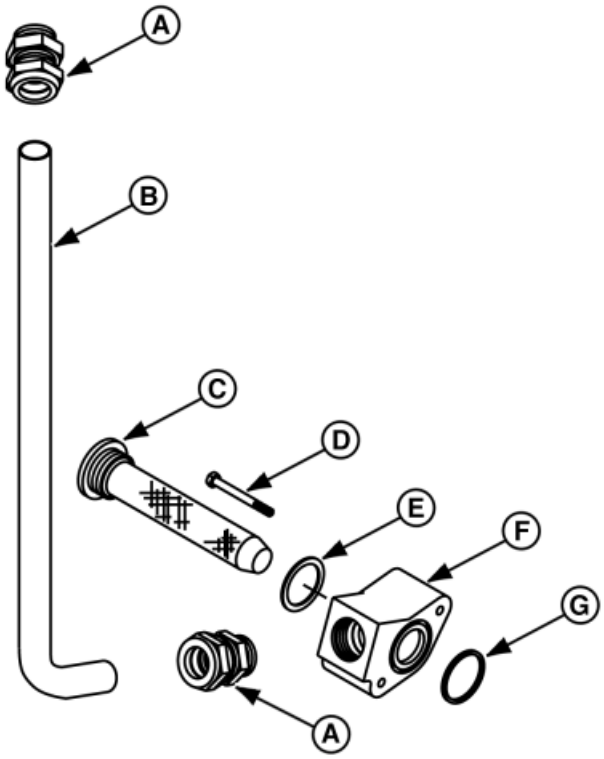
7. Remove suction manifold and O-ring in groove on back of manifold.

8. Remove suction tube (E).



YZ,CTM147,25,12-19-05MAY98

ASSEMBLE SUCTION TUBE GROUP



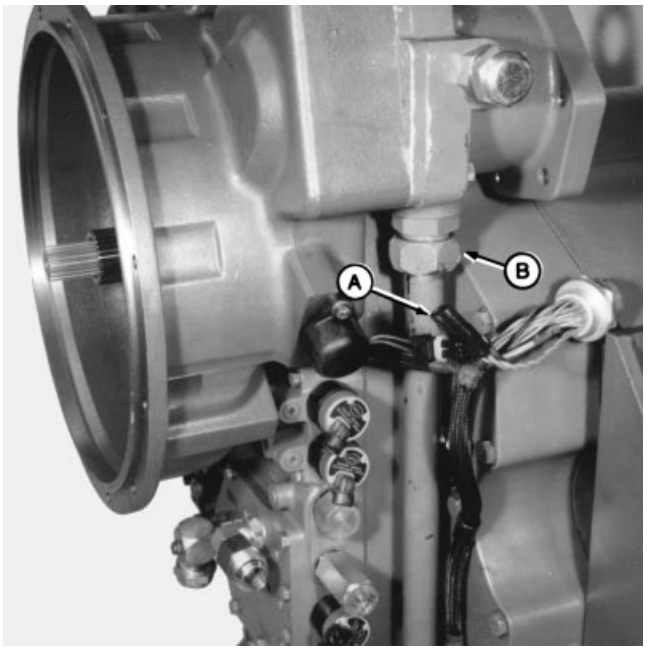
A—O-ring fitting (2 used)
B—Suction tube
C—Suction screen assembly
D—Cap screw (2 used)
E—Gasket
F—Suction manifold
G—O-ring

YZ,CTM147,25,19-19-05MAY98

INSTALL SUCTION TUBE

IMPORTANT: There must not be any suction leaks. Use care assembling and installing the suction tube. A leak may cause the transmission to not operate properly or the charge pump to fail.

1. Place suction tube (E) into fitting on charge pump.



2. Install O-ring on back side of suction manifold.

3. Start one cap screw (D) into suction manifold.

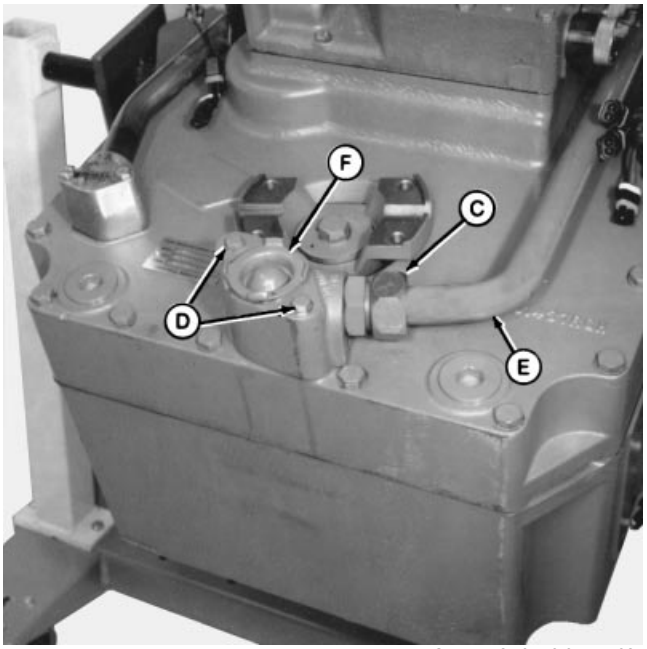
4. Position suction tube (E) into suction manifold.

5. Install and tighten cap screws (D) to 25 N·m (18 lb-ft).

6. Tighten nuts (B) and (C) at both ends of suction tube (E) to 190 N·m (140 lb-ft).

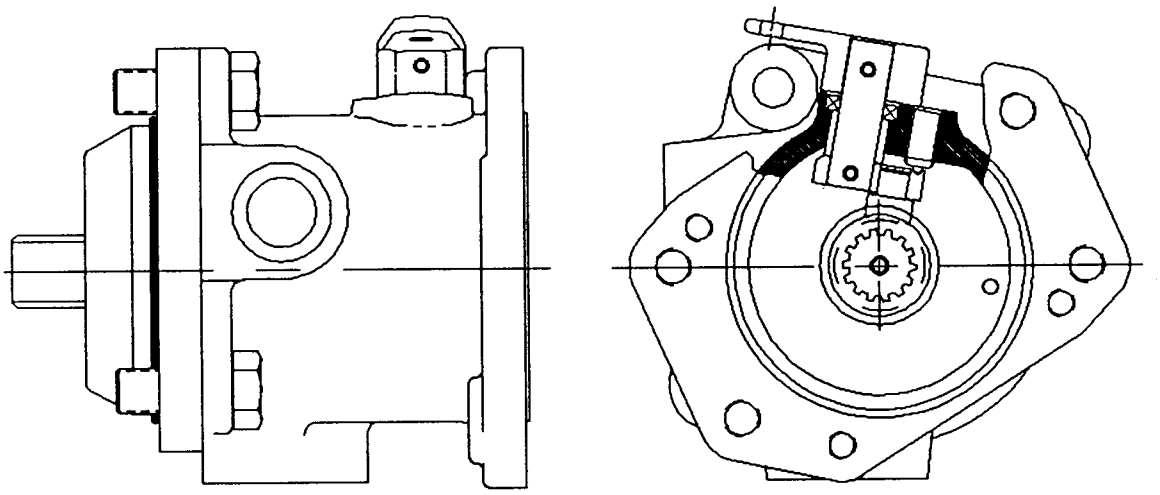
7. Install suction screen assembly (F).

8. Connect wiring harness (A) to magnetic pickup.



YZ,CTM147,25,9 -19-05MAY98

CHARGE PUMP GROUP



YZ701 -UN-25OCT93

THE CHARGE PUMP IS NOT REPAIRABLE. THE PUMP MUST BE REPLACED IF FOUND DEFECTIVE. THE AUXILIARY PUMP DRIVE DISCONNECT PARTS MAY BE SERVICED.

YZ,CTM147,25,4 -19-05MAY98

REMOVE CHARGE PUMP GROUP

NOTE: Transmission is shown with the front cover down.

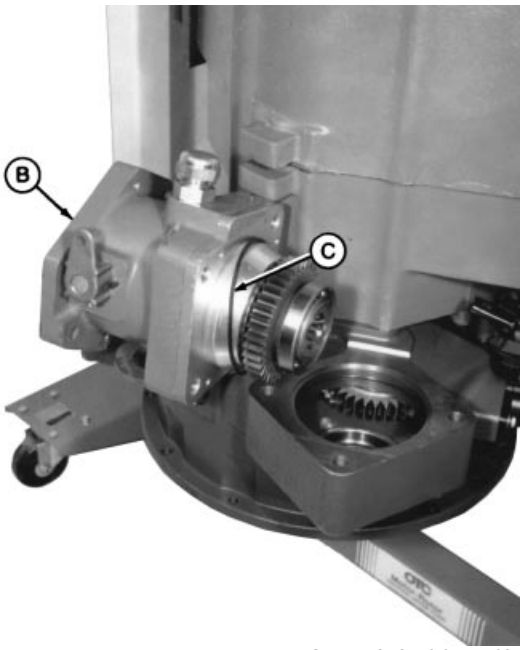
1. Remove three cap screws (A).

CAUTION: The driven gear and support bearings will usually stay with the charge pump when removed from front cover. Do not allow these parts to fall from the charge pump, personal injury or damage could result.

NOTE: The driven gear and support bearings are considered part of the Front Cover Group, but they will usually come out with the charge pump when it is removed. For information concerning these parts see Group 30 (Front Cover) in this manual.

2. Remove charge pump (B) from front cover.

3. Remove O-ring (C).

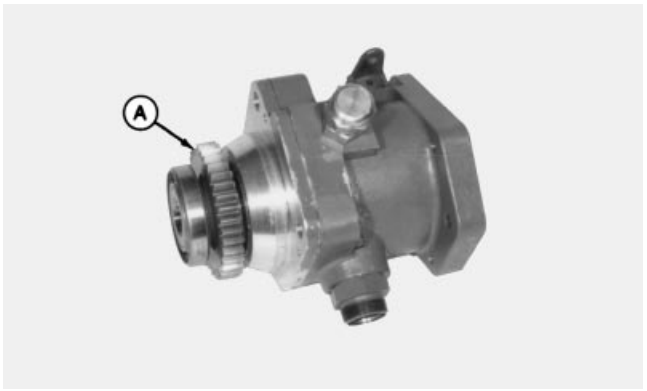


YZ,CTM147,25,2 -19-05MAY98

REMOVE DRIVEN GEAR AND BEARING ASSEMBLY

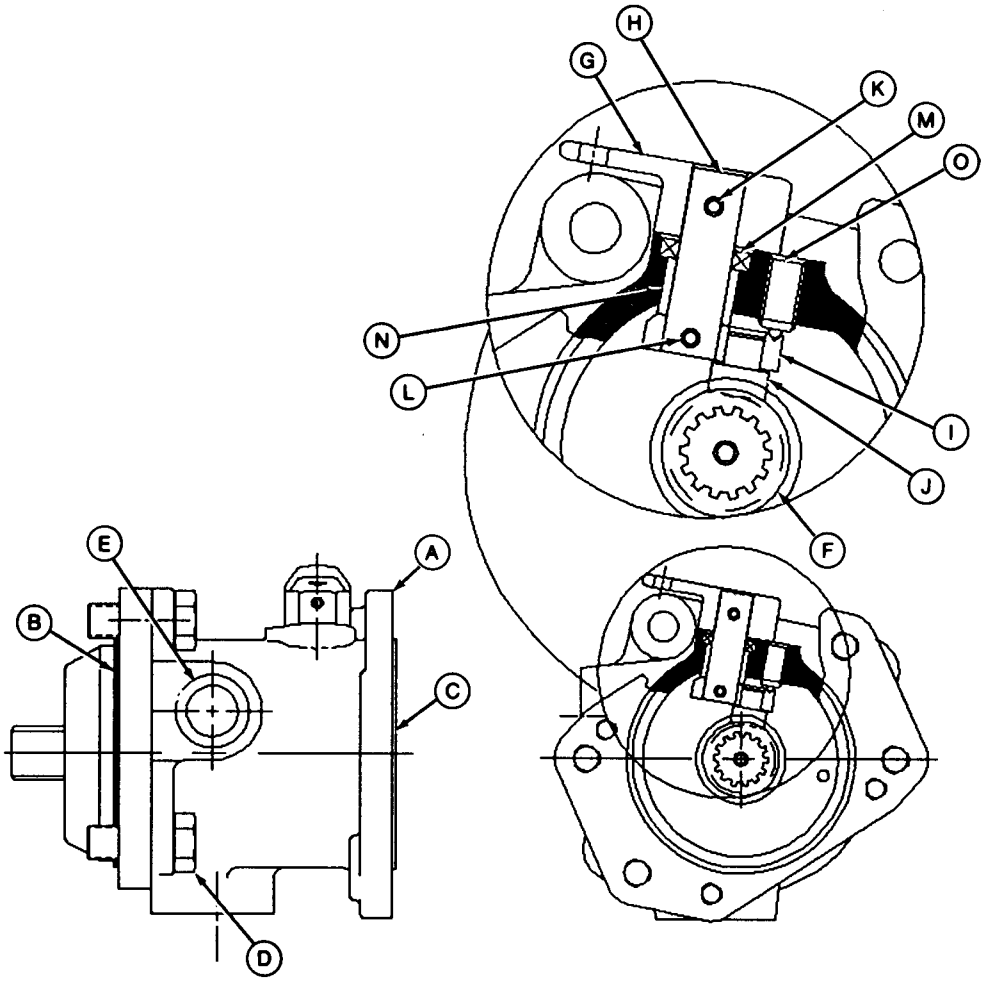
1. Remove driven gear and bearing assembly (A) from charge pump.

2. Inspect for wear and damage.



YZ,CTM147,25,3 -19-05MAY98

DISASSEMBLE AND ASSEMBLE CHARGE PUMP GROUP WITH AUXILIARY PUMP DRIVE DISCONNECT



YZ702 -UN-25OCT93

A—Oil pump
B—O-ring
C—Shipping plug
D—Cap screw
E—Shipping plug
F—Disconnect sleeve
G—Disconnect shift arm
H—Disconnect lever shaft
I—Detent shift block
J—Disconnect fork
K—Roll pin
L—Roll pin
M—Oil seal
N—Inner ring bearing
O—Spring Plunger

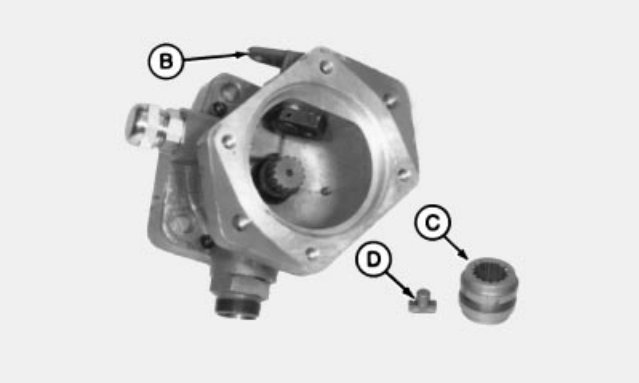
YZ,CTM147,25,11-19-05MAY98

DISASSEMBLE AUXILIARY PUMP DRIVE DISCONNECT

NOTE: Depending on the application, the charge pump may be equipped with a mechanical disconnect to disengage the auxiliary pump drive.

1. Rotate disconnect shift arm (B) counter clockwise, remove disconnect sleeve (C) and disconnect fork (D).

2. Inspect pump shaft, disconnect sleeve and disconnect fork for wear and damage.



-UN-19MAR98
YZ587

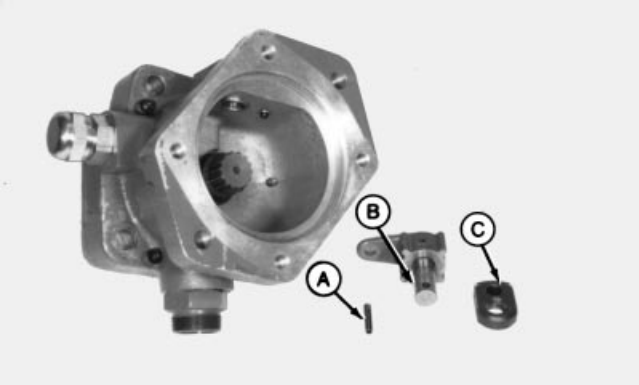
YZ,CTM147,25,15-19-05MAY98

3. Drive roll pin (A) through disconnect lever shaft (B) and detent shift block (C).

4. Remove detent shift block (C) from disconnect lever shaft (B).

5. Remove disconnect lever shaft (B) from charge pump.

6. Inspect parts for wear or damage.



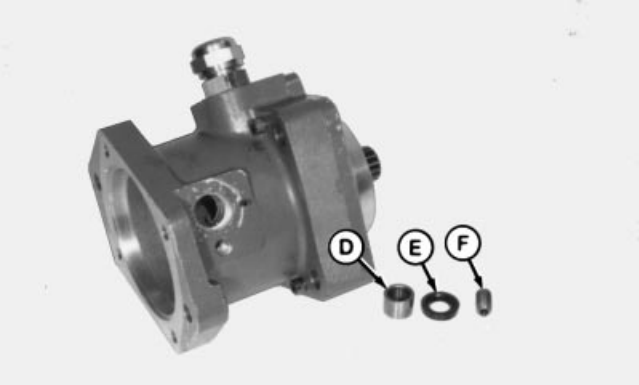
-UN-19MAR98
YZ588

7. Remove oil seal (E).

8. Remove inner ring bearing (D).

9. Remove spring plunger (F).

10. Inspect parts for wear and damage.



-UN-19MAR98
YZ589

YZCTM147,25,15A-19-05MAY98

ASSEMBLE AUXILIARY PUMP DRIVE DISCONNECT

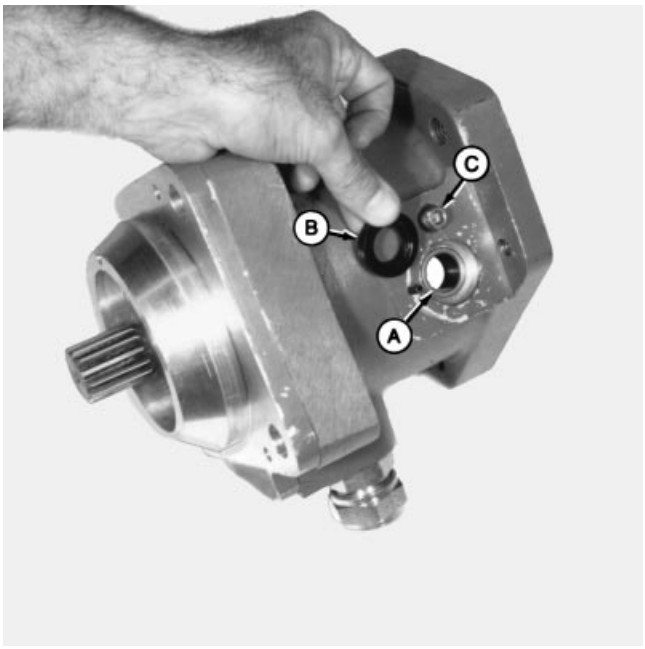
1. Install inner ring bearing (A).

2. Apply LOCTITE® #262 to outside diameter of oil seal (B).

3. Install oil seal (B).

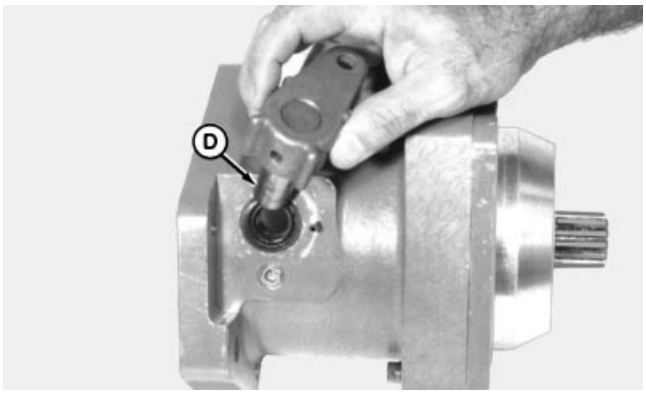
4. Apply LOCTITE® #262 to threads of spring plunger (C).

5. Install spring plunger (C) into charge pump.



YZ590 -UN-19MAR98

6. Install disconnect lever shaft (D) through inner ring bearing (A).

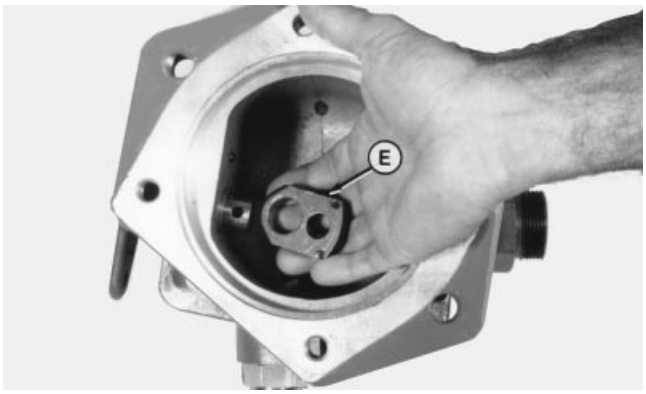


YZ600 -UN-19MAR98

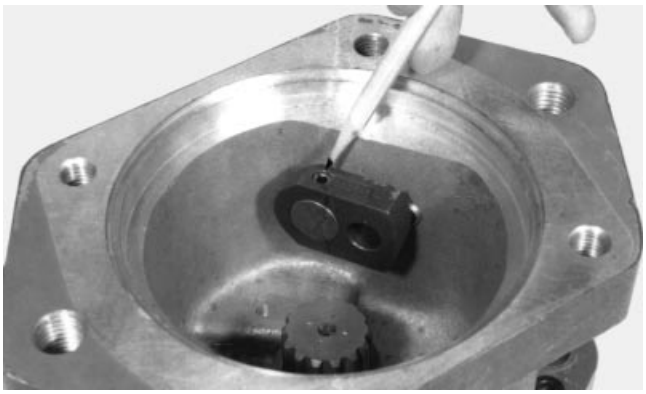
YZ,CTM147,25,5 -19-05MAY98

NOTE: Detent shift block (E) has depressions in one side of the block. The side with the depressions will go toward the spring plunger.

7. Install detent shift block (E) onto disconnect lever shaft.



8. Install roll pin.



YZ,CTM147,25,13-19-05MAY98

NOTE: Adjust spring plunger to hold shift block at the detent until manually shifted.

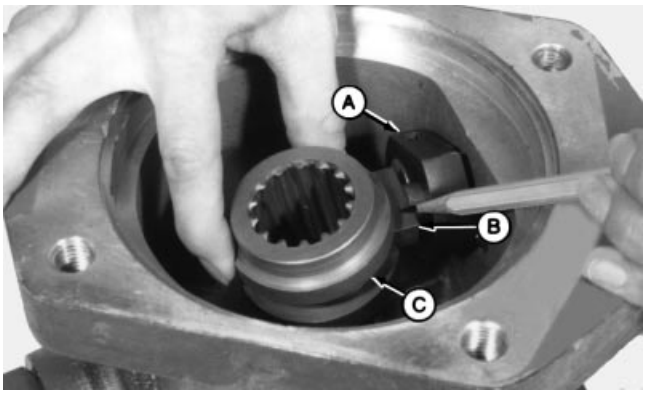
9. Rotate disconnect shift arm (A) toward charge pump opening.

10. Install disconnect fork (B) into detent shift block.

NOTE: Hold disconnect fork against detent shift block while installing disconnect sleeve groove against detent shift block and onto end of splined shaft.

11. Install disconnect sleeve (C).

12. Rotate disconnect shift arm (A) away from pump opening to hold sleeve on pump shaft.



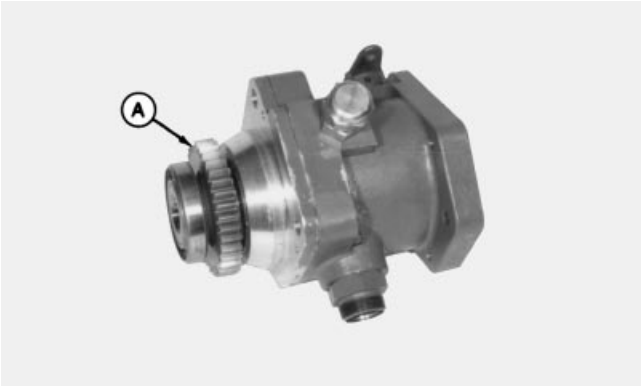
CTM147,25,13A -19-05MAY98

INSTALL DRIVEN GEAR AND BEARING ASSEMBLY (CHARGE PUMP)

NOTE: Refer to Group 30 (Front Cover) for information on disassembling and assembling driven gear assembly (A).

NOTE: Driven gear and bearing assembly is a slip fit into the charge pump. Driven gear and bearing assembly can be install into the front cover first.

• Install driven gear assembly (A) onto charge pump.



YZ586 -UN-19MAR98

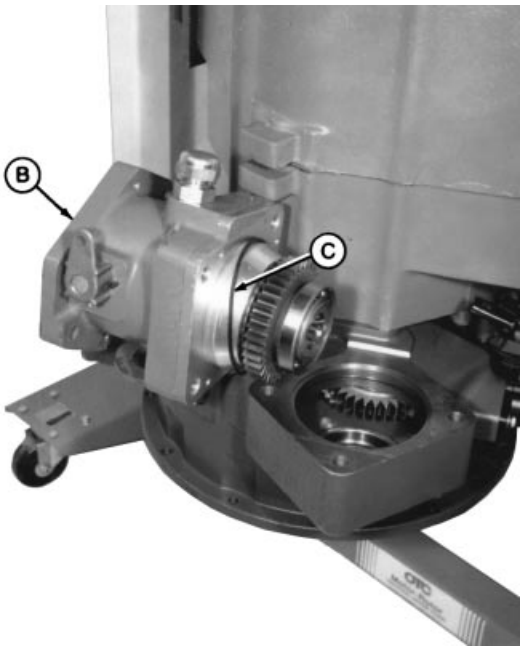
YZ,CTM147,25,7 -19-06MAY98

INSTALL CHARGE PUMP TO FRONT COVER

1. Lubricate O-ring (C) install onto charge pump (B).

NOTE: The driven gear on the charge pump must mesh with the idler gear. Refer to Group 30, Front Cover (install driven gear assemblies).

2. Install charge pump (B) into front cover.



3. Install three cap screws (A) through charge pump into front cover.

4. Tighten cap screws to 115 N·m (85 lb-ft).

YZ,CTM147,25,8 -19-05MAY98

OTHER MATERIAL

Number	Name	Use
....	LOCTITE #620	Oil seal
	Grease	O-ring
	Transmission fluid	All moving parts

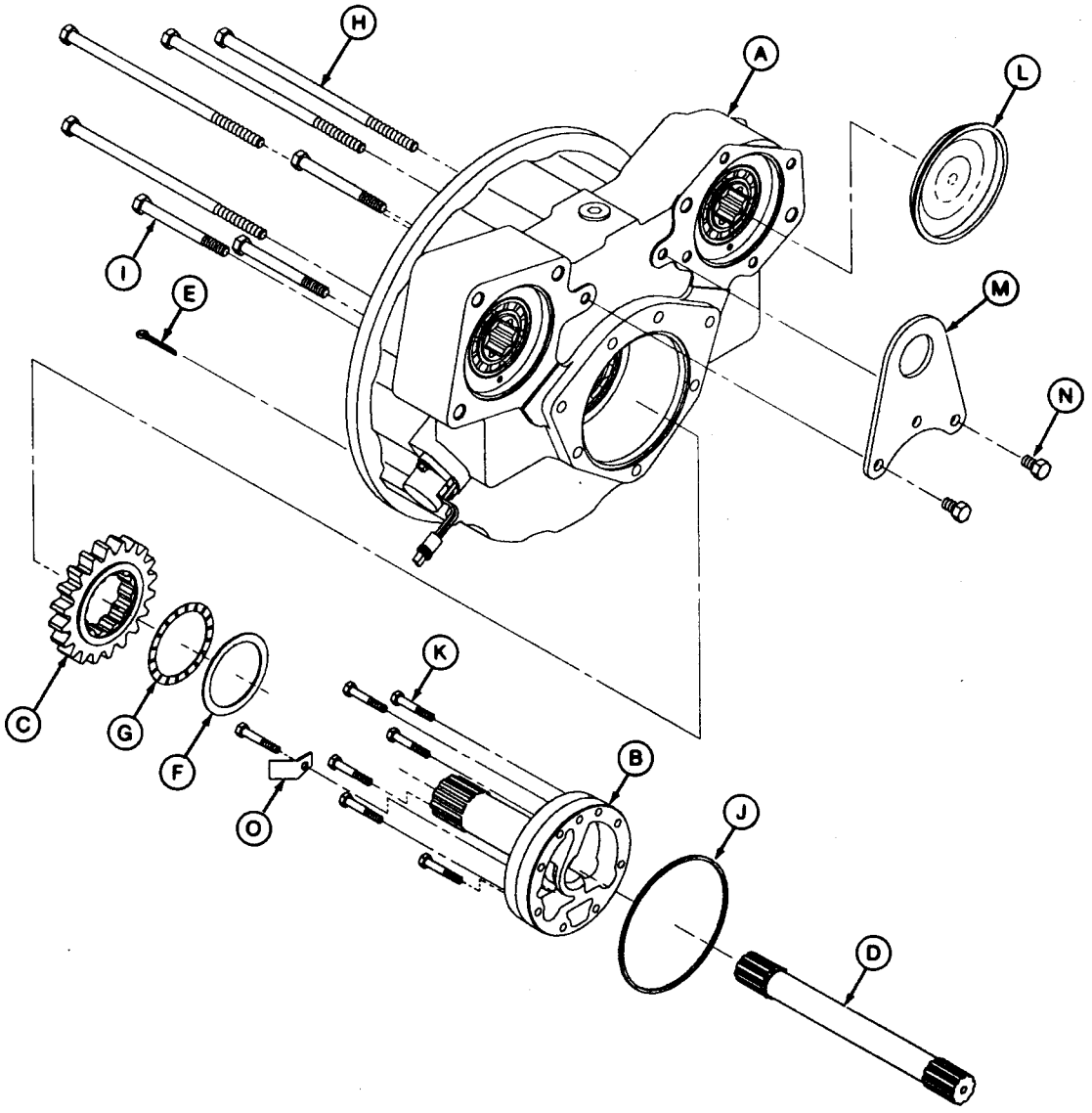
YZCTM147,30,OTH-19-05MAY98

SPECIFICATIONS

Item	Measurement	Specification
Stator Support Tube-to-Main Case Front Housing Cap Screws.	Torque	37 N·m (27 lb-ft)
Magnetic Pickup-to-Main Case Front Housing Cap Screws.	Torque	10 N·m (8 lb-ft)
Front Cover Assembly-to-Main Case Front Housing Cap Screws.	Torque	87 N·m (64 lb-ft)

YZCTM147,30,SPC-19-05MAY98

DISASSEMBLE FRONT COVER GROUP



YZ703 -UN-25OCT93

A—Input housing (SAE 3)
B—Stator support tube
C—Gear, 43T
D—Converter input shaft
E—Cotter pin
F—Thrust race
G—Needle bearing
H—Hex cap screw, 12x280mm (4 used)
I—Hex cap screw, 12x172mm (3 used)
J—O-ring
K—Hex cap screw, 8x50mm (7 used)
L—Shipping plug
M—Lift hanger
N—Cap screw (2 used)
O—Deflector

YZ,CTM147,30,26-19-05MAY98

REMOVE FRONT COVER AND INPUT ASSEMBLY

1. Position transmission with front cover up.

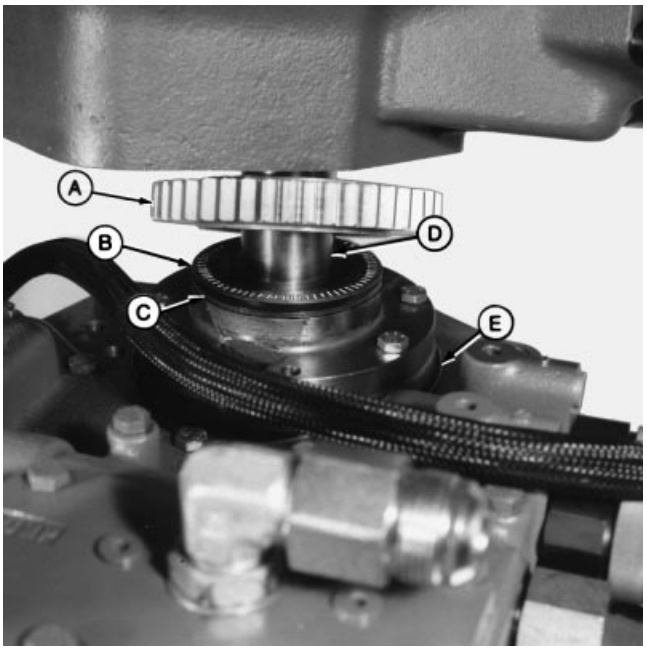
2. Remove seven bolts (A).

YZ,CTM147,30,1 -19-05MAY98

3. Install lifting device.

YZ,CTM147,30,23-19-05MAY98

4. Lift front cover carefully from transmission. The 43 tooth gear (A), needle thrust bearing (B), thrust race (C), stator tube (D), and O-ring (E) should stay with transmission.



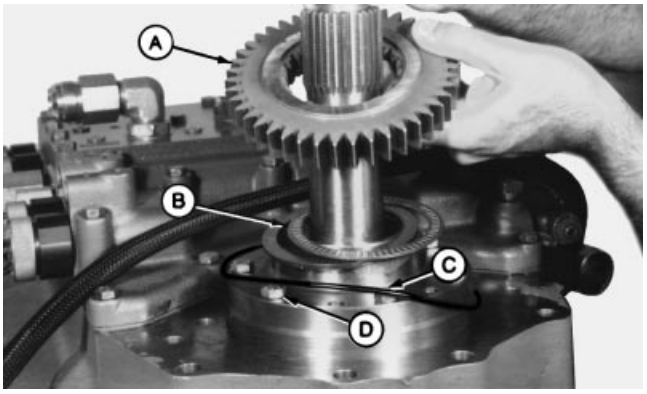
YZ,CTM147,30,24-19-05MAY98

5. Remove 43 tooth gear (A).

6. Remove needle bearing and thrust race (B).

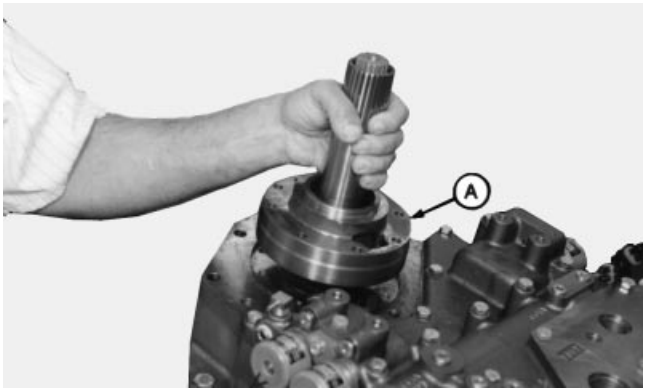
7. Remove O-ring (C).

8. Remove seven bolts (D) and deflector (not shown).

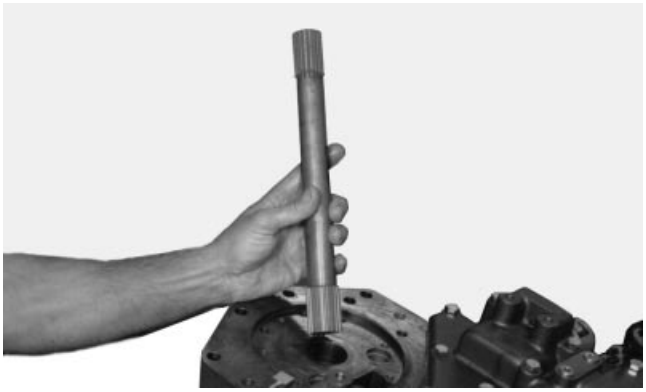


YZ,CTM147,30,12-19-05MAY98

9. Remove stator support tube (A).

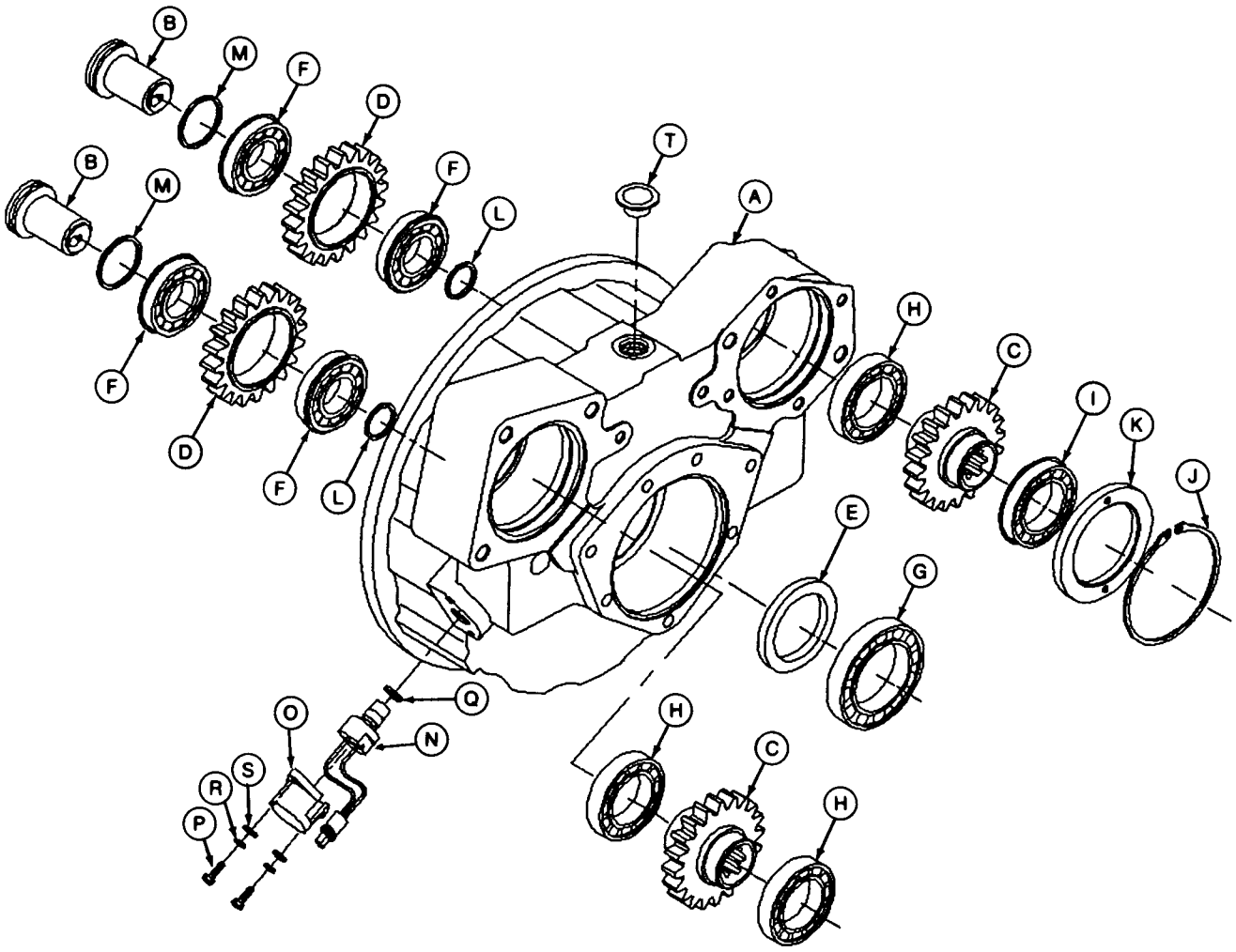


10. Remove converter input shaft.



YZ,CTM147,30,29-19-05MAY98

DISASSEMBLE INPUT ASSEMBLY



YZ7704 -UN-25OCT93

A—Input housing
B—Idler shaft (2 used)
C—Driven gear (2 used)
D—Idler gear (2 used)
E—Oil seal
F—Bearing (4 used)
G—Ball bearing
H—Bearing (3 used)
I—Bearing
J—Snap ring
K—Bearing spacer
L—O-ring (2 used)
M—O-ring (2 used)
N—Magnetic pickup sensor
O—Magnetic pickup cover
P—Hex cap screw (2 used)
Q—O-ring
R—Lock washer (2 used)
S—Washer (2 used)
T—Hex socket plug

YZ,CTM147,30,27-19-05MAY98

DISASSEMBLE FRONT COVER

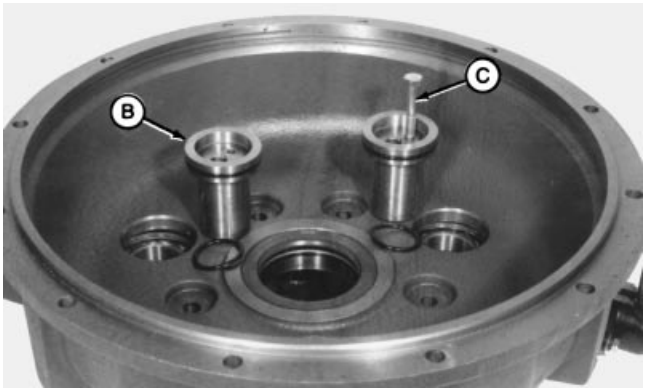
1. Position front cover assembly (A) converter side up.

2. Install a bolt (C) into threaded hole in idler shaft (B). Use this bolt to pull idler shafts, the shafts are a slip fit in their bores

3. Remove two idler shafts (B).

4. Remove two O-rings from bottom of idler shaft bores.

5. Inspect idler shaft for wear or damage.



YZ,CTM147,30,2 -19-05MAY98

6. Use a driving tool to remove oil seal and bearing from front cover.

YZ,CTM147,30,3 -19-05MAY98

REMOVE AND DISASSEMBLE DRIVEN GEARS

1. Position front cover to have pump ports and driven gear assemblies up.

2. Remove driven gear assembly (A) from charge pump side.

3. Remove snap ring (B) from groove in auxiliary pump side bore .

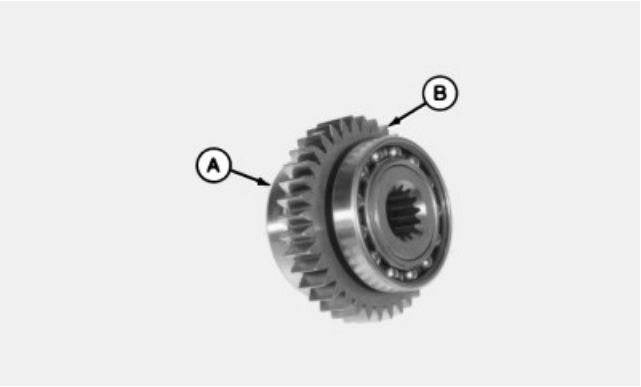
4. Remove spacer and driven gear assembly (C).

YZ551 -UN-14MAR98

YZ,CTM147,30,4 -19-05MAY98

5. Use puller to remove bearings (A) from gear (B).

6. Inspect bearings and gears.



YZ554 -UN-14MAR98

YZ,CTM147,30,7 -19-05MAY98

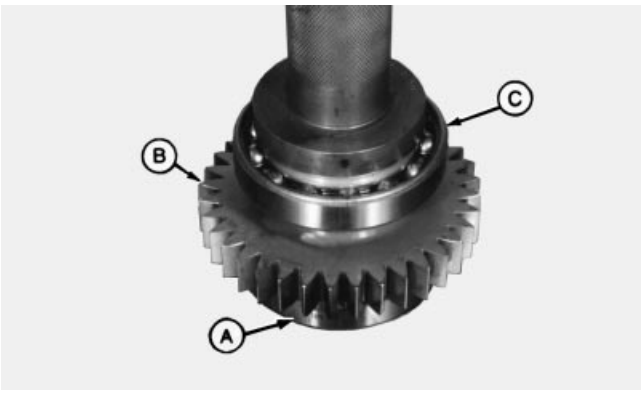
ASSEMBLE DRIVEN GEARS AND BEARINGS (CHARGE PUMP SIDE)

IMPORTANT: Use press tool that bears on the inner race of the bearing.

1. Press bearing (A) onto driven gear (B).

2. Turn gear over and press bearing (C) onto gear.

NOTE: Auxiliary pump port driven gear assembly will have one bearing with a snap ring. Install this bearing with snap ring down.



YZ555 -UN-14MAR98

YZ,CTM147,30,8 -19-05MAY98

REMOVE IDLER GEARS AND DISASSEMBLE

1. Remove idler gears through front cover pump ports.

YZ556 -UN-14MAR98

2. Remove snap ring (A) from top bearing.

3. Support gear so that the bottom bearing is free to come out when the top bearing is pressed through.

4. Press top bearing through idler gear, removing both bearings.

5. Inspect bearings and gears for wear or damage.

YZ557 -UN-14MAR98

YZ,CTM147,30,9 -19-05MAY98

ASSEMBLE IDLER GEARS

NOTE: Both idler gears assemble the same. Install bearing into the idler gear correctly. Snap ring side of bearing to the outside of the gear.

1. Use a press and bearing installation tool to install bearings into idler gear.

YZ,CTM147,30,10-19-05MAY98

REMOVE MAGNETIC PICKUP

1. Remove two cap screws, two lock washers and two flat washers (A).

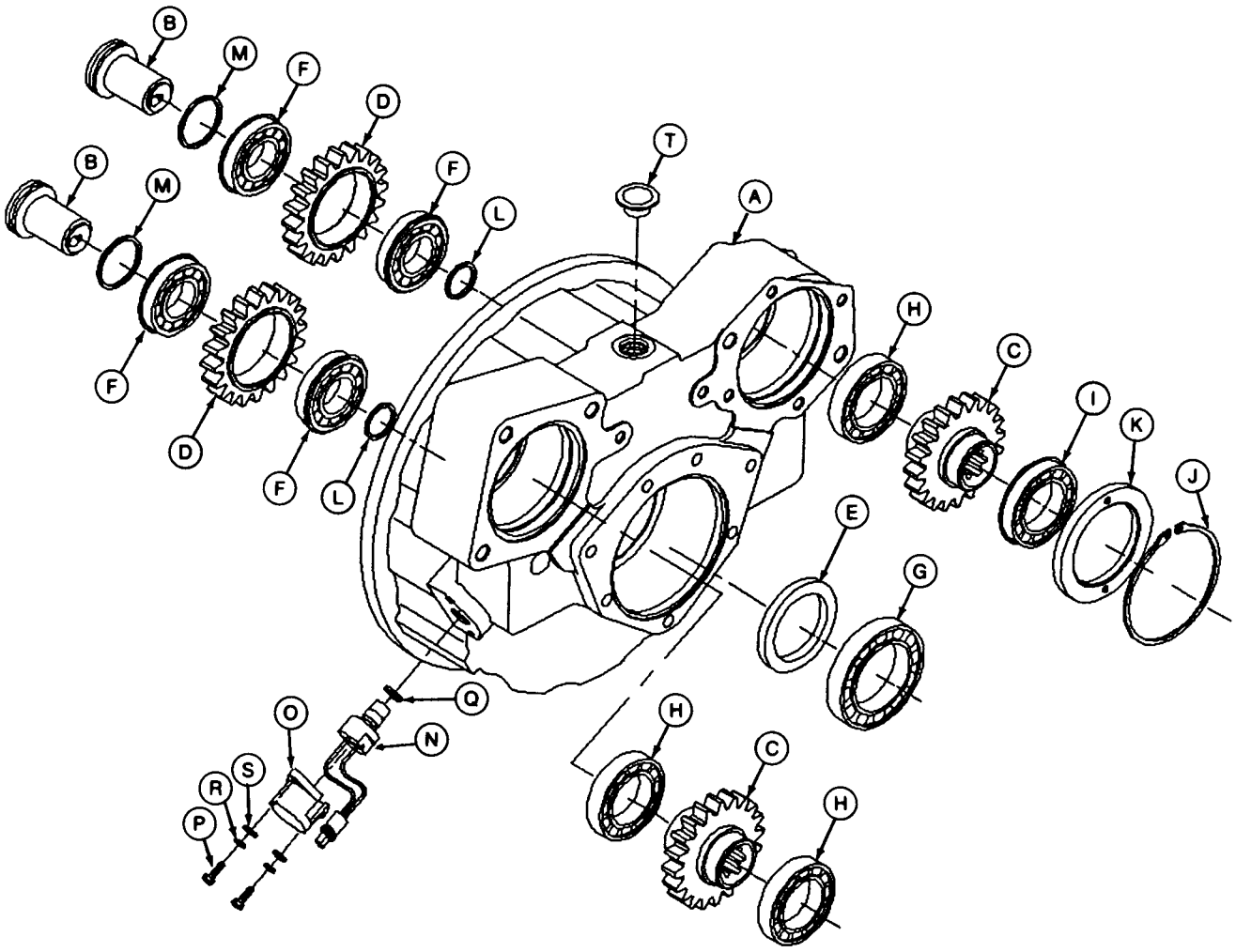
2. Remove magnetic pickup cover (B).

3. Remove magnetic pickup sensor with O-ring (C).

NOTE: Install magnetic pickup after installing driven gears.

YZ,CTM147,30,11-19-05MAY98

ASSEMBLE INPUT ASSEMBLY



YZ7704 -UN-25OCT93

A—Input housing
B—Idler shaft (2 used)
C—Driven gear (2 used)
D—Idler gear (2 used)
E—Oil seal
F—Bearing (4 used)
G—Ball bearing
H—Bearing (3 used)
I—Bearing
J—Snap ring
K—Bearing spacer
L—O-ring (2 used)
M—O-ring (2 used)
N—Magnetic pickup sensor
O—Magnetic pickup cover
P—Hex cap screw (2 used)
Q—O-ring
R—Lock washer (2 used)
S—Washer (2 used)
T—Hex socket plug

YZ,CTM147,30,30-19-05MAY98

INSTALL OIL SEAL AND BALL BEARING

1. Position input housing with converter side up.

2. Install new oil seal.

NOTE: If outside diameter of oil seal is not already coated with a sealer apply LOCTITE® #620.

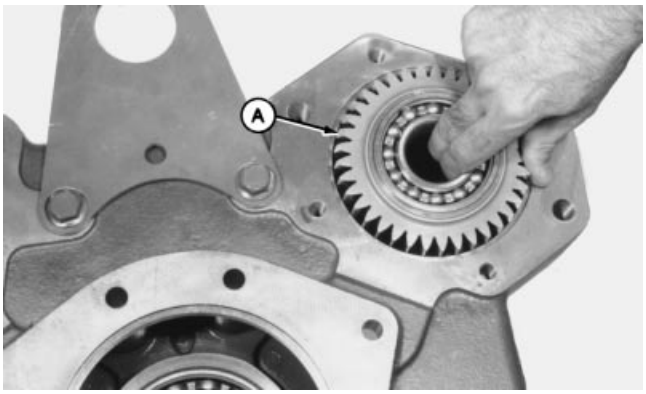
3. Position input housing with converter side down.

4. Install new ball bearing (D) into front cover.

YZ,CTM147,30,14-19-05MAY98

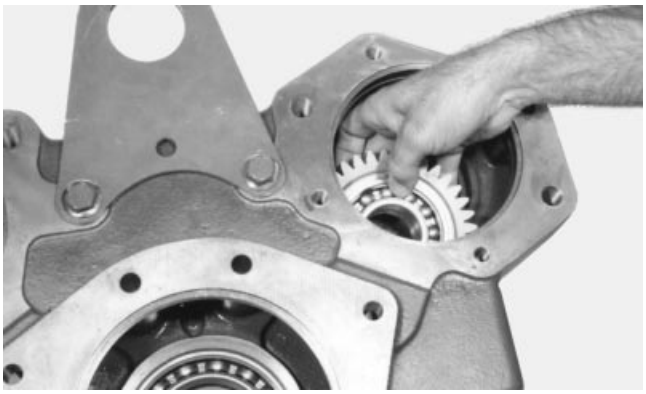
INSTALL IDLER GEARS AND BEARING ASSEMBLIES

1. Place idler gear assembly (A) into auxiliary pump port of the front cover.



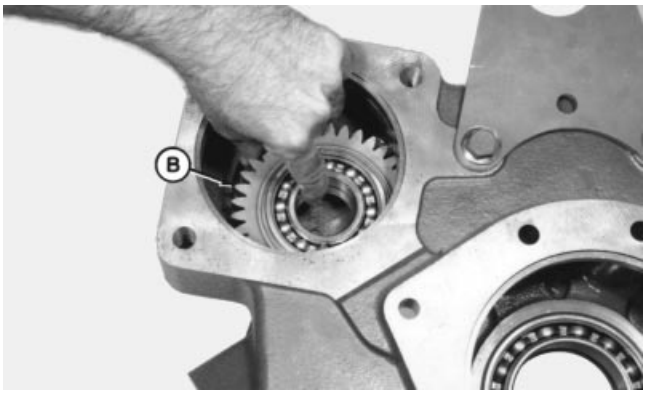
YZ567 -UN-14MAR98

2. Position idler gear assembly into its cavity beside auxiliary pump port.



YZ568 -UN-14MAR98

3. Install idler gear assembly (B) into charge pump port and place into cavity.



YZ569 -UN-14MAR98

YZ,CTM147,30,15-19-05MAY98

INSTALL IDLER SHAFTS

NOTE: Thru hole in idler shaft must line up with bolt hole in input housing. Use a bolt to guide the alignment while installing.

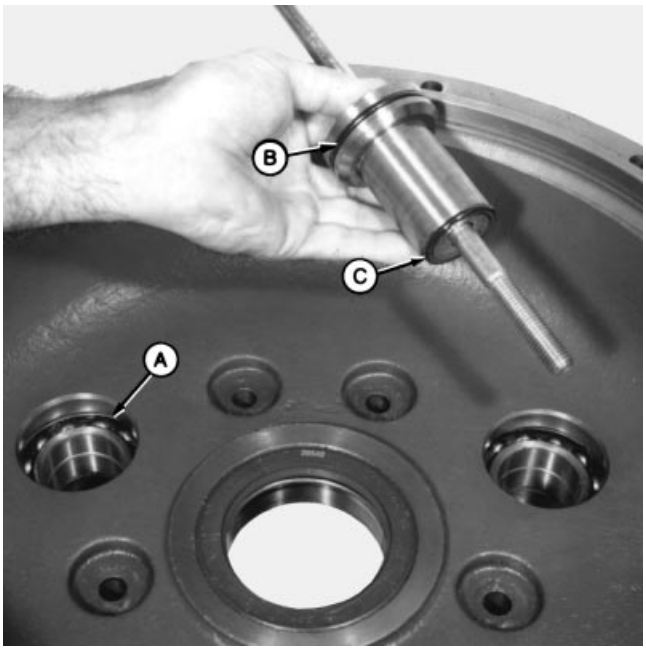
1. Align bearing bore of idler gear assemblies (A) with input housing shaft bore.

2. Lubricate O-ring (B) with grease and install in groove on shaft.

3. Use grease to hold O-ring (C) to the bottom of the idler shaft during installation.

ALTERNATE O-RING INSTALLATION PROCEDURE

3a. Position O-ring (C) at the bottom of the shaft bore in the input housing.



YZ570 -UN-14MAR98

YZ,CTM147,30,16-19-05MAY98

4. Use bolt to align thru hole in idler shaft with threaded hole in the input cover.

5. Push idler shaft (D) through idler gear assembly into input housing.

6. Install the other idler shaft in this same manner.

YZ,CTM147,30,17-19-05MAY98

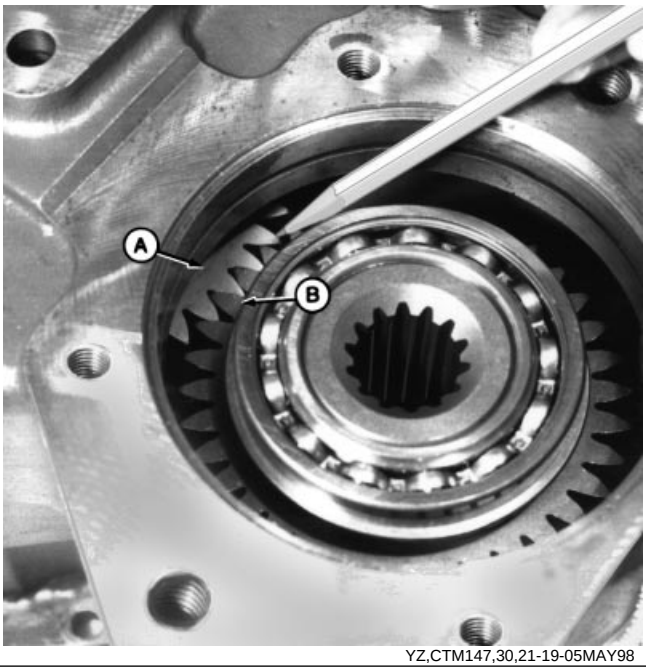
INSTALL DRIVEN GEAR ASSEMBLY (AUXILIARY PUMP PORT SIDE)

1. Install driven gear assembly with the snap ring up.

YZ578 -UN-14MAR98

2. Rotate idler gear (A) to align teeth with driven gear (B).

3. Push idler gear bearing into bore in input housing.



YZ579 -UN-14MAR98

YZ,CTM147,30,21-19-05MAY98

4. Install bearing spacer (C).

-UN-14MAR98
YZ580

CAUTION: Wear eye protection when installing snap rings.

5. Install snap ring into groove.

-UN-14MAR98
YZ581

YZ,CTM147,30,22-19-05MAY98

INSTALL MAGNETIC PICKUP

1. Lubricate O-ring.

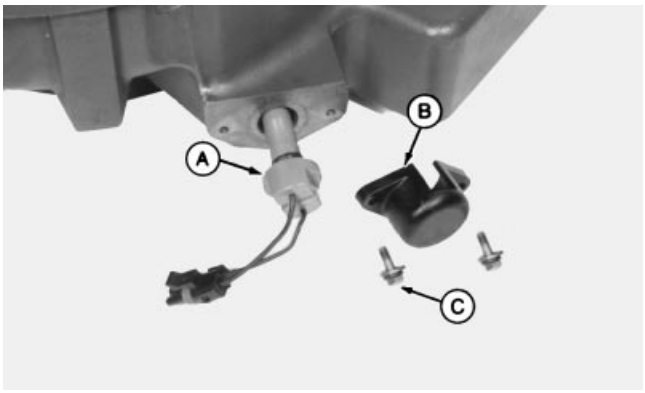
2. Install new O-ring in groove on magnetic pickup sensor (A).

3. Push magnetic pickup sensor into front cover.

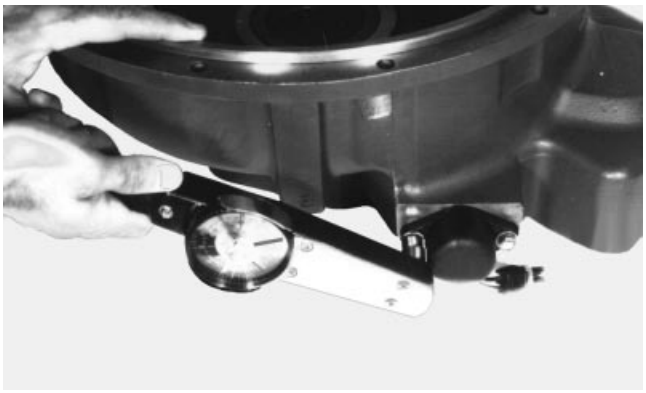
4. Install magnetic pickup cover (B).

5. Install cap screws and lock washers (C).

6. Tighten cap screws to 10 N·m (8 lb-ft).



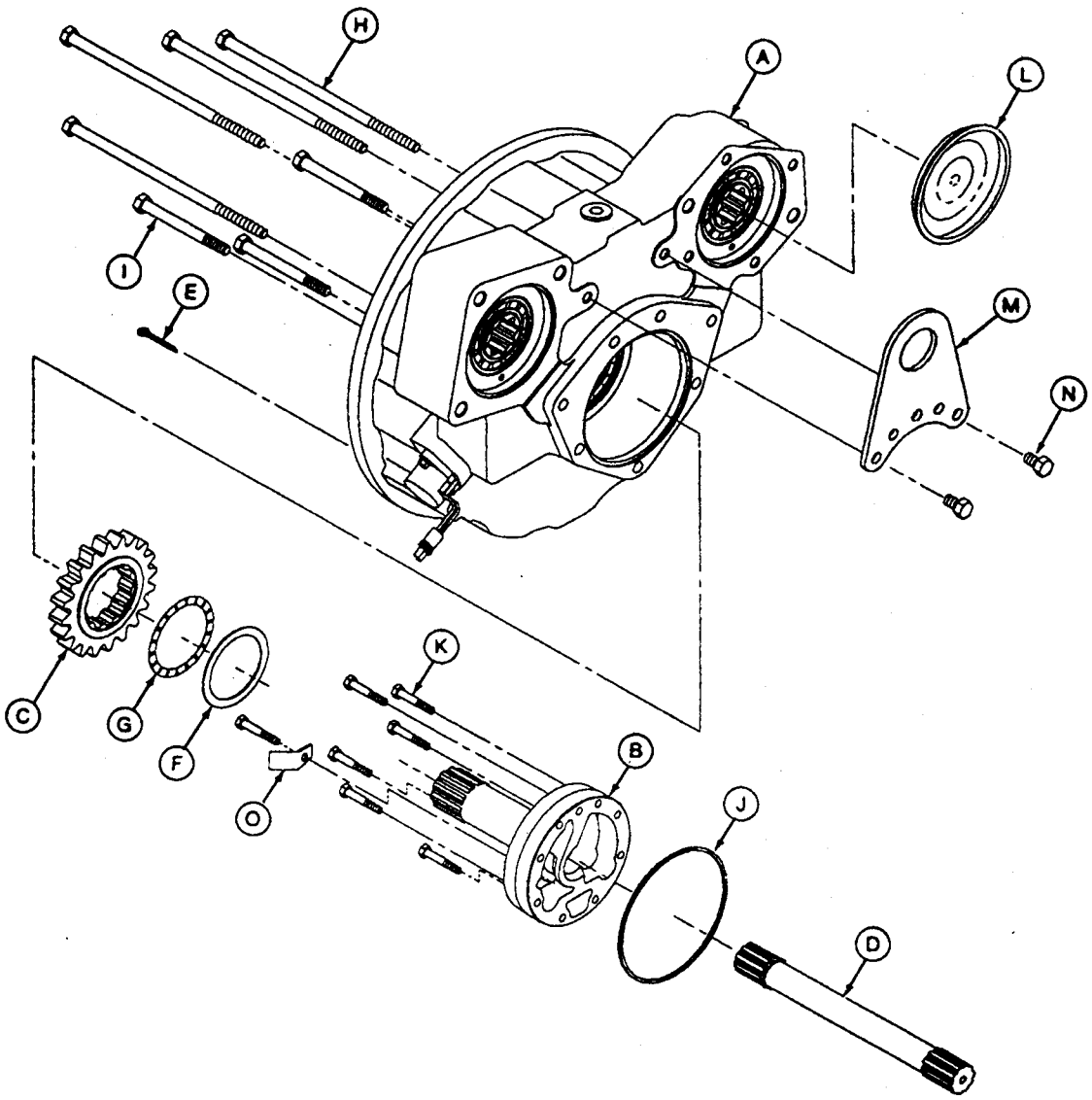
-UN-14MAR98
YZ563



-UN-14MAR98
YZ564

YZ,CTM147,30,13-19-05MAY98

ASSEMBLE FRONT COVER GROUP



-UN-12APR94

YZ806

A—Input housing (SAE 3)
B—Stator support tube
C—Gear, 43T
D—Converter input shaft
E—Cotter pin
F—Thrust race
G—Needle bearing
H—Hex cap screw, 12x280mm (4 used)
I—Hex cap screw, 12x172mm (3 used)
J—O-ring
K—Hex cap screw, 8x50mm (7 used)
L—Shipping plug
M—Lift hanger
N—Cap screw (2 used)
O—Deflector

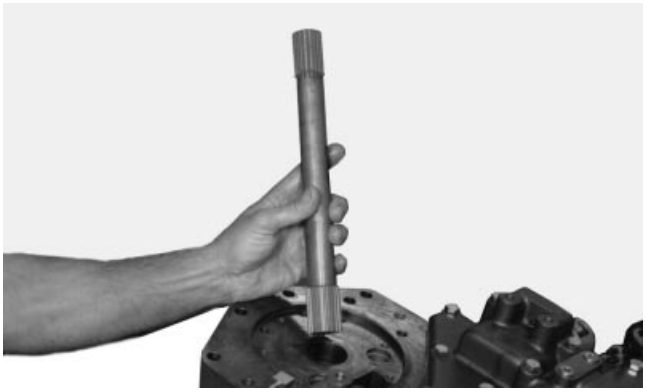
YZ,CTM147,30,31-19-05MAY98

ASSEMBLE CONVERTER INPUT SHAFT AND STATOR TUBE

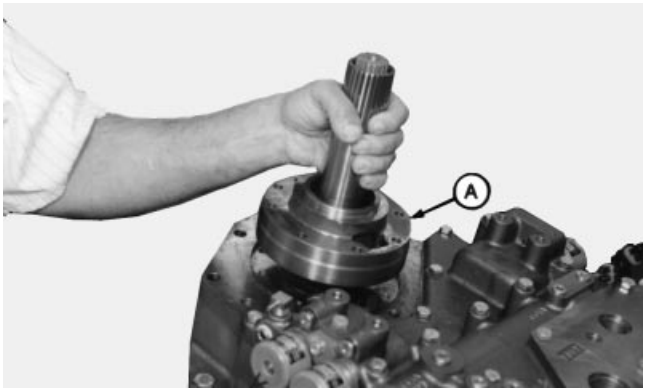
IMPORTANT: Install ridged spline of converter input shaft toward converter.

1. Install converter input shaft.

NOTE: The splined end with ridge must be installed up (toward converter).



2. Place stator support tube (A) over converter input shaft.



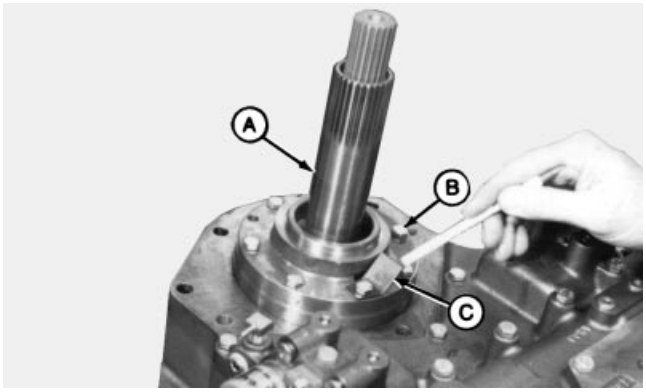
YZ,CTM147,30,28-19-05MAY98

3. Align the oil passage and bolt holes in stator support tube (A) with oil passage and bolt holes in the front housing.

IMPORTANT: Deflector (C) must be in place and installed correctly to properly direct oil flow. It also must not interfere with installing the input housing over the stator tube.

4. Install cap screws (B) and deflector (C).

5. Tighten cap screws to 37 N·m (27 lb-ft).

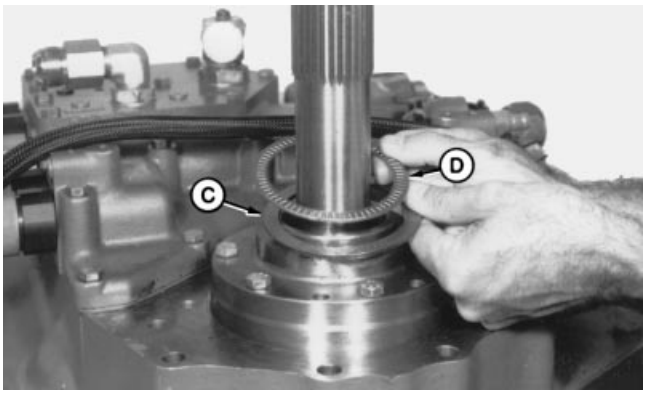


YZ,CTM147,30,18-19-05MAY98

6. Lubricate all parts with clean transmission fluid.

7. Install new thrust race (C).

8. Install new needle thrust bearing (D).

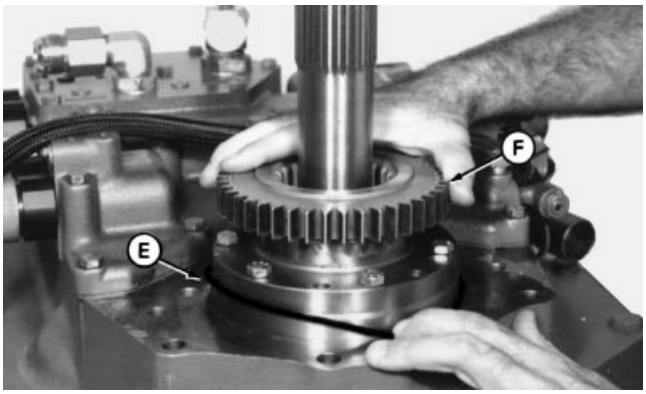


-UN-14MAR98
YZ575

9. Install new O-ring (E) flat against front housing.

10. Install 43 tooth gear (F).

11. Rotate gear to be sure it is centered and seated on bearings.



-UN-14MAR98
YZ576

YZ,CTM147,30,19-19-05MAY98

INSTALL FRONT COVER ASSEMBLY TO MAIN CASE FRONT HOUSING

1. Install lifting device, make sure the input housing assembly hangs level.

NOTE: Be sure main case front housing is level before attempting to install input housing assembly.

2. Lower input housing assembly carefully over stator tube and gear.

NOTE: Be sure the input housing goes down completely and sits flat on the front housing.

3. Install seven cap screws (A).

YZ730 -UN-20MAR98

4. Tighten cap screws to 87 N·m (64 lb-ft)

YZ729 -UN-20MAR98

YZ,CTM147,30,25-19-05MAY98

SPECIFICATIONS

Item	Measurement	Specification
Control Valve-to-Front Housing Cap Screw	Torque	37 N·m (27 lb-ft)
Valve Clamp-to-Valve Housing Cap Screw	Torque	10.4 N·m (7.5 lb-ft)

YZCTM147,35,SPC-19-05MAY98

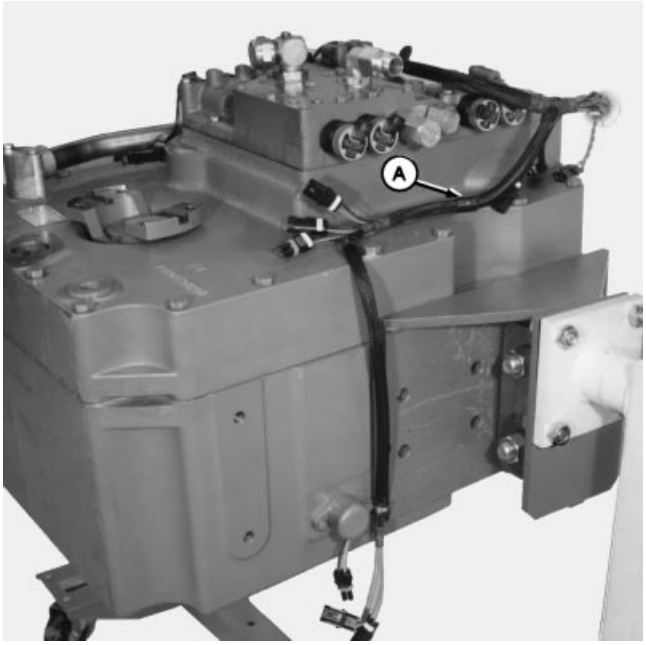
REMOVE AND INSTALL WIRING HARNESS

REMOVE WIRING HARNESS

1. Tag all connectors relative to proportional valves.
2. Disconnect all electrical connectors.
3. Remove bracket (A) and harness.
4. Inspect wiring and connectors.

INSTALL WIRING HARNESS

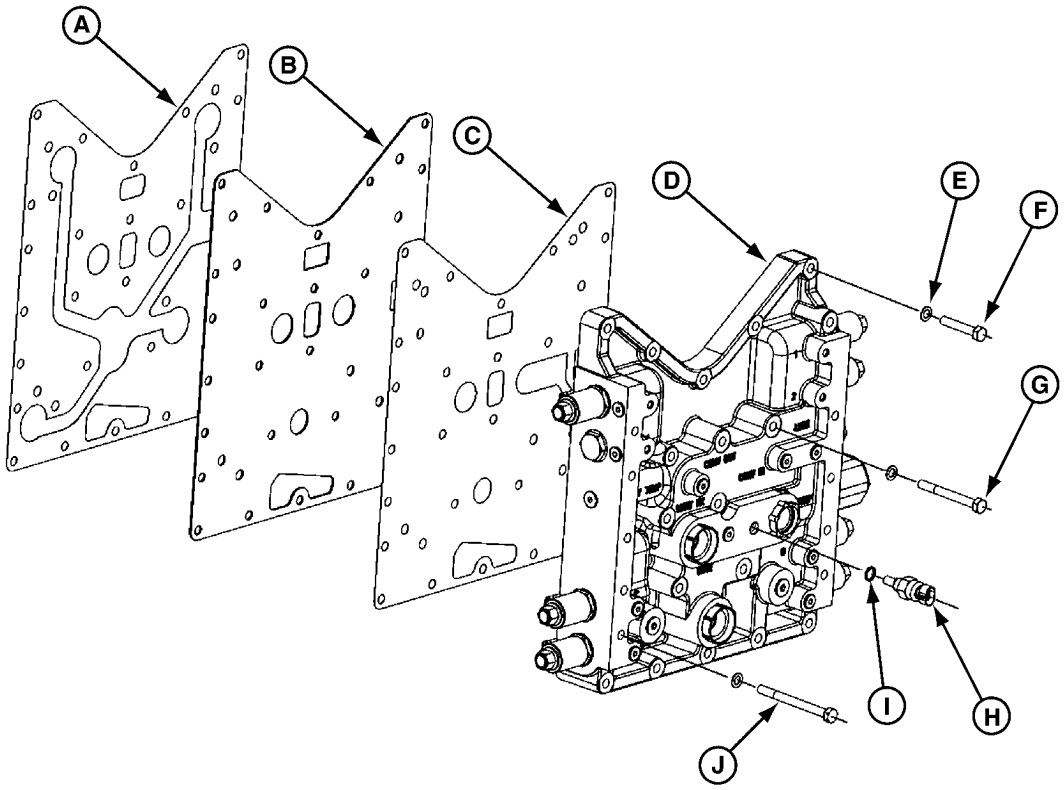
1. Install bracket (A) and harness.
2. Connect all electrical connectors.



YZ596 -UN-19MAR98

YZ,CTM147,35,1 -19-05MAY98

REMOVE CONTROL VALVE GROUP



YZ713A -UN-10MAR98

A—Gasket
B—Plate
C—Gasket
D—Valve Assembly
E—Flat Washer (27 used)
F—Cap screw M8x45 10.9 (5 used)
G—Cap screw M8x75 10.9 (13 used)
H—Temperature Sender
I—O-ring
J—Cap screw M8x90 10.9 (9 used)

1. Tag and disconnect all electrical leads to control valve.
2. Remove cap screws (F), (G) and (J).
3. Remove valve assembly (D).
4. Remove gasket (C).
5. Remove plate (B).
6. Remove gasket (A).

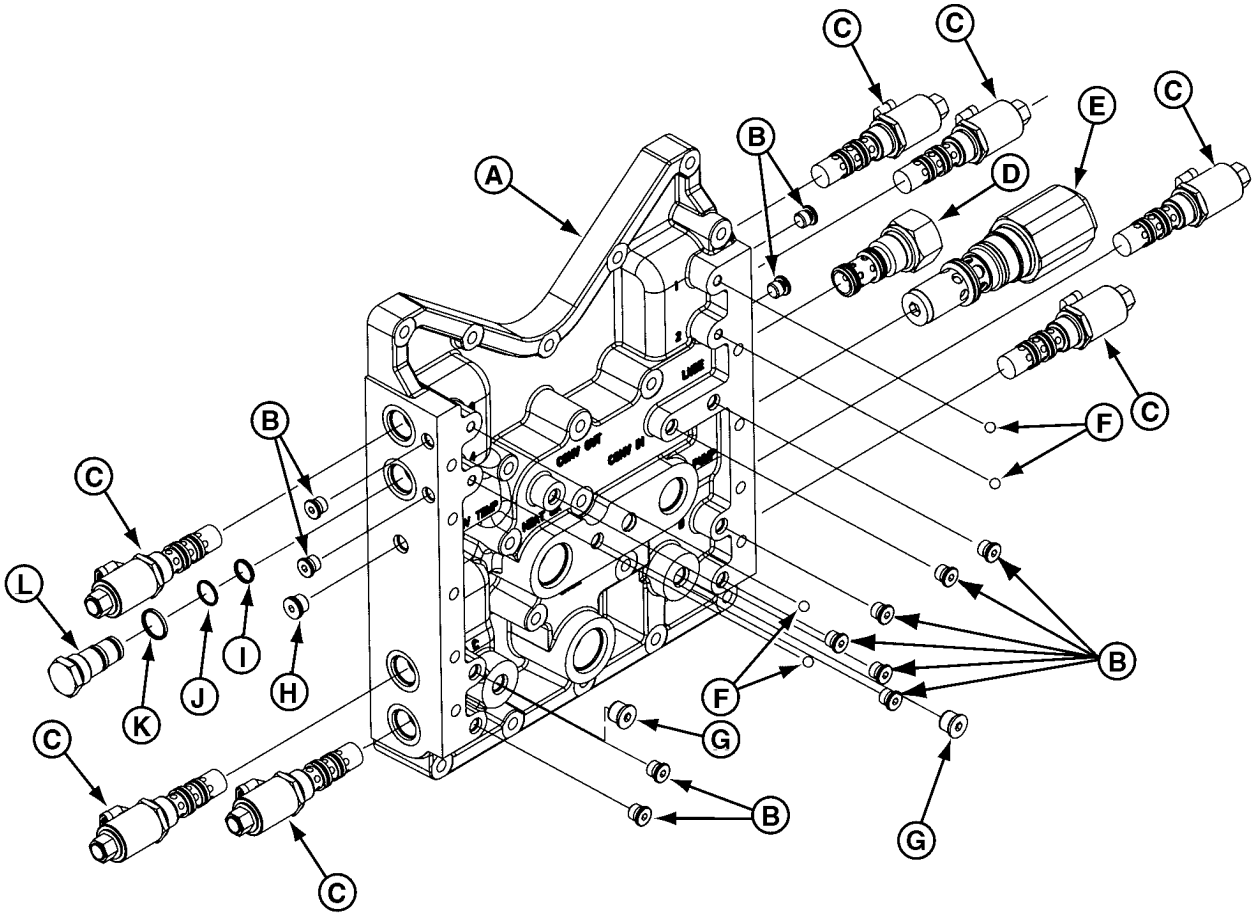
YZ,CTM147,35,6 -19-05MAY98

DISASSEMBLE AND ASSEMBLE CONTROL VALVE

THE CARTRIDGE TYPE VALVES USED IN THIS ASSEMBLY ARE NOT USER REPAIRABLE. ANY VALVE FOUND TO BE DEFECTIVE MUST BE REPLACED AS A UNIT.

IMPORTANT: Cartridge valves require a O-rings. When assembling valves grease all O-rings. Use only new O-rings. Install new O-rings onto cartridge type valve.

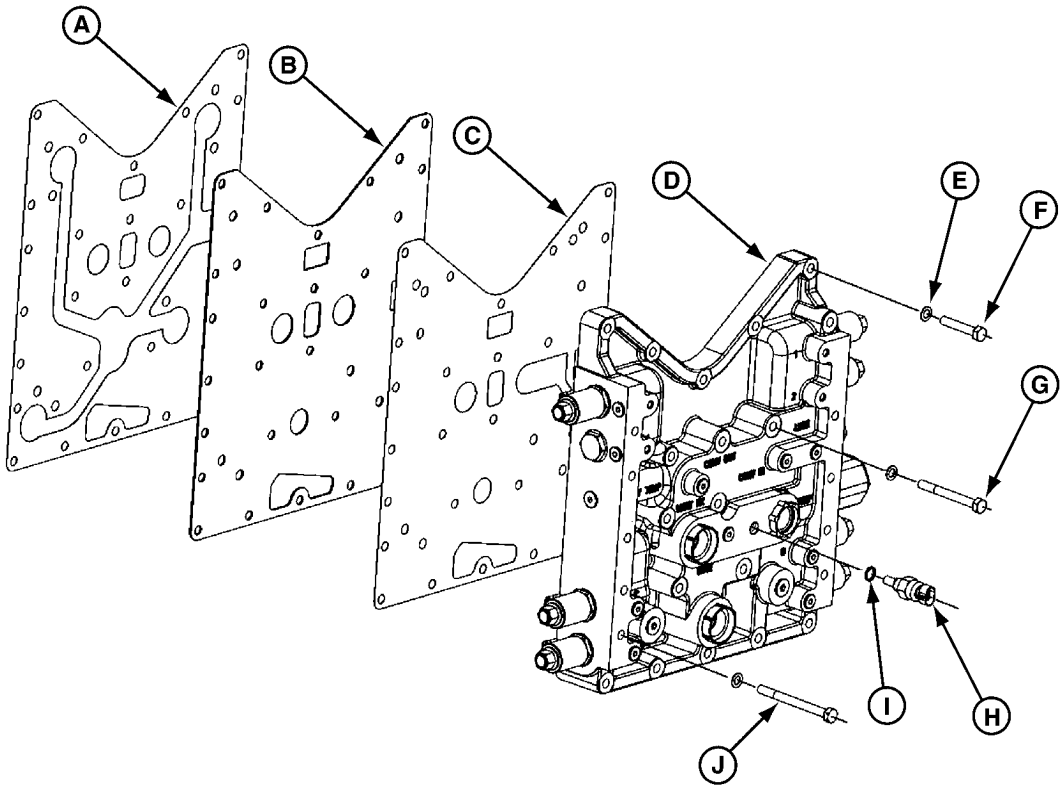
USE THE DRAWINGS PROVIDED AS GUIDES FOR FURTHER DISASSEMBLY AND ASSEMBLY OF THE CONTROL VALVE.



A—Valve Housing
B—Hex Socket Plug 7/16-20 (12 used)
C—Proportional 12 or 24 Volt Valve (7 used)
D—90 Relief Valve
E—Main Regulator Assembly
F—Steel Ball 9/32 (4 used)
G—Hex Socket Plug 9/16-18 (2 used)
H—Plug
I—O-ring
J—O-ring
K—O-ring
L—Proportional Solenoid Plug

YZ,CTM147,35,7 -19-05MAY98

INSTALL CONTROL VALVE GROUP



YZ713A -UN-10MAR98

A—Gasket
B—Plate
C—Gasket
D—Valve Assembly
E—Flat Washer (27 used)
F—Cap screw M8x45 10.9 (5 used)
G—Cap screw M8x75 10.9 (13 used)
H—Temperature Sender
I—O-ring
J—Cap screw M8x90 10.9 (9 used)

IMPORTANT: The gaskets and metal plate must be installed so that the large oil return slot aligns with the slot in the transmission front cover.

1. Install gasket (A).

2. Install plate (B).

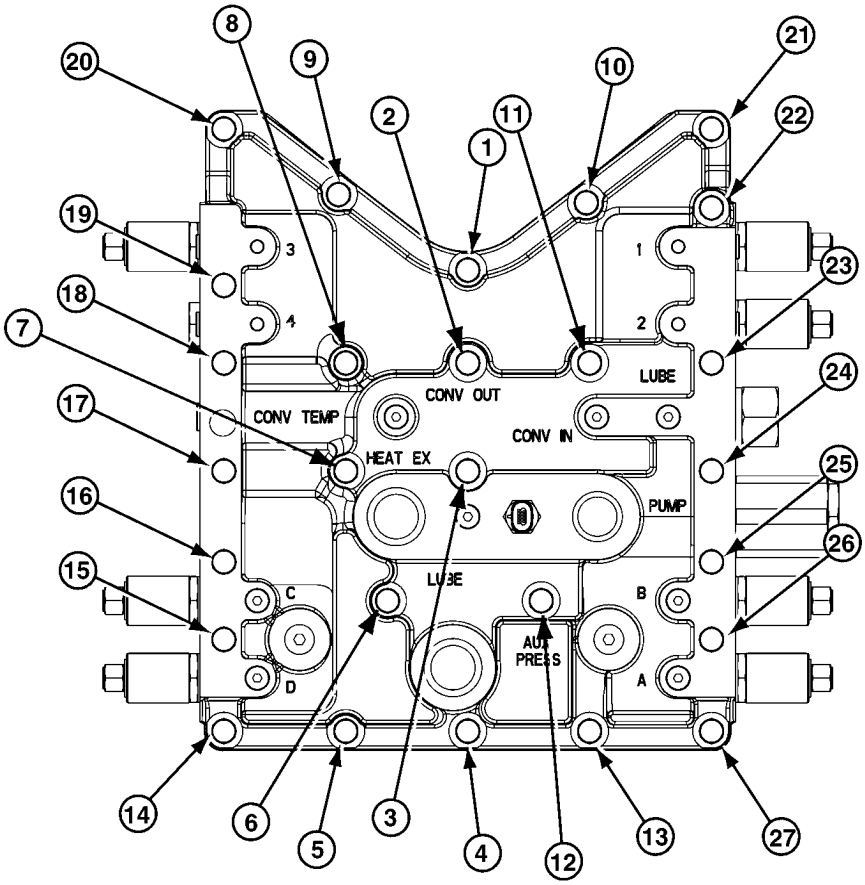
3. Install gasket (C).

4. Install valve assembly (D).

5. Install cap screws (F), (G) and (J) and washers (E). Observe tightening sequence and torque specifications given in this section.

YZ,CTM147,35,12-19-06MAY98

CAP SCREW TIGHTENING SEQUENCE AND TORQUE SPECIFICATIONS



YZ735A -UN-10MAR98

Tighten cap screws in rotational sequence represented by call outs.

1. First rotational sequence tighten all cap screws to 40 N·m (30 lb-ft).

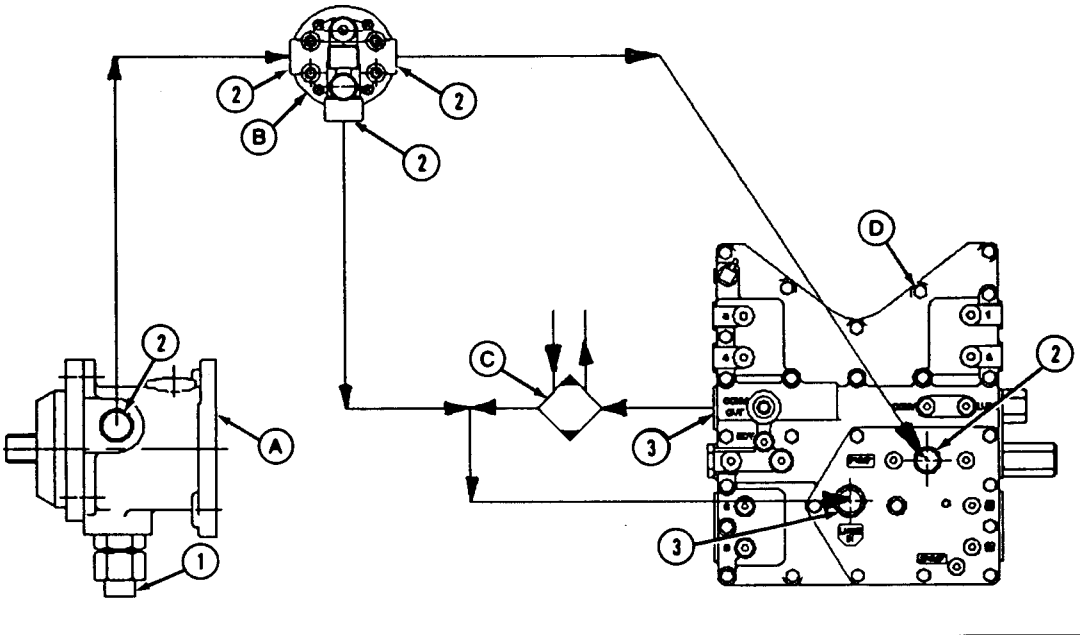
2. Repeat step 1.

CONTROL VALVE CAP SCREW TORQUE SPECIFICATIONS.....40 N·m (30 lb-ft)

YZ,CTM147,35,10-19-05MAY98

PIPING DIAGRAM, CONVERTER DRIVEN TRANSMISSION, (WITHOUT WET BRAKE)

NOTE: Piping diagram for converter driven or direct drive DF series transmission without wet brake option (Digital Valve Shown).



A—Charge pump 91 lpm (24gpm) at 2100 engine rpm.

B—Remote mount filter with bypass warning switch.

C—Heat exchanger Maximum allowable pressure drop with converter 69 kPa (10psi) with direct drive 345 kPa (50 psi).

D—Main control valve for transmission

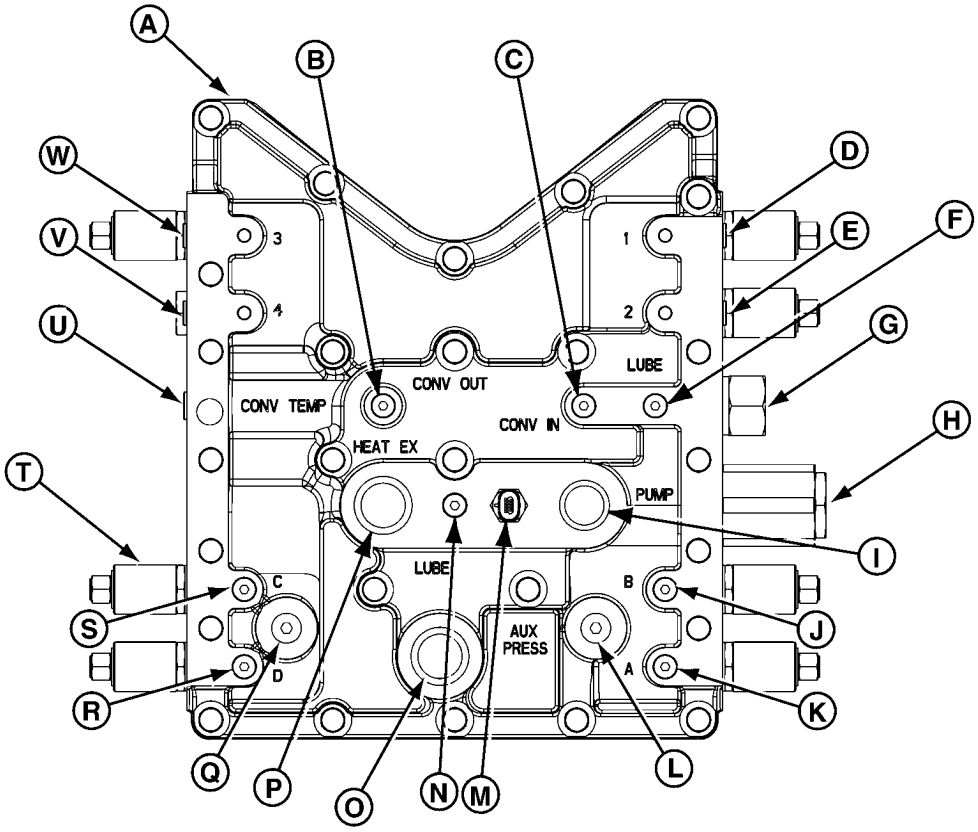
1—Transmission sump suction

2— 1 1/16-12UNC-2B JIC thd port.

3— 1 5/16-12UNC-2B JIC thd port.

YZ,CTM147,35,4 -19-05MAY98

PRESSURE AND TEMPERATURE CHECK PORTS (WITHOUT WET BRAKE)



A—Valve Housing
B—Converter Out Pressure Check Port
C—Converter In Pressure Check Port
D—Clutch 1 Pressure Check Port
E—Clutch 2 Pressure Check Port
F—Lube Pressure Check Port
G—Converter Relief
H—Pressure Regulator
I—Pump In Port
J—Clutch B Check Port
K—Clutch A Check Port
L—Auxiliary Pressure Source
M—Temperature Sensor
N—System Pressure Check Port
O—Lube In Port
P—Oil Out To Heat Exchanger
Q—Auxiliary Pressure Source
R—Clutch D Check Port
S—Clutch C Check Port
T—Solenoid Assembly
U—Converter Out Temperature
V—Clutch 4 Check Port
W—Clutch 3 Check Port

OPERATING CONDITIONS:

- Engine speed at 2000 rpm
- Transmission temperature range at 38—93˚C (100˚—200˚F).
- Pump flow 87—102 L/min (23—27 gpm) at 1655—1931 kPa (255—280 psi).

PORT PRESSURES:

In neutral

- Converter in 60—115 psi (see footnote)
- Converter out 40—90 psi
- Lube 40—60 psi

In gear

- Lube 20—40 psi

In neutral, “Converter In” pressure should always be higher than Lube pressure.

YZ,CTM147,35,8 -19-05MAY98

PRESSURE AND TEMPERATURE CHECK PORTS (WITHOUT WET BRAKE) continued

Following is identification of ports as they are marked on the valve body casting.

Ports marked 1, 2, 3 and 4 are Direction Clutch Ports.

- 1 and 2 are forward clutches.
- 3 and 4 are reverse clutches.

Ports marked A, B, C and D are Speed Clutch Ports.

NOTE: All check ports are 7/16-20 UNF SAE O-ring, unless otherwise specified.

YZ,CTM147,35,3 -19-05MAY98

OTHER MATERIAL

Number	Name	Use
	LOCTITE® Thread Lock & Sealer (High Strength) #262	Piston-to-Shift Fork Cap Screws.
	Transmission Fluid	All moving parts.

LOCTITE is a trademark of the LOCTITE Corporation.

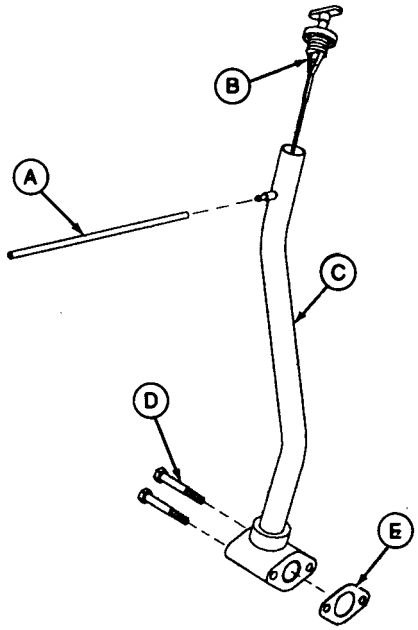
YZCTM147,40,OTH-19-07MAY98

SPECIFICATIONS

Item	Measurement	Specification
Dipstick Tube Assembly-to-Front Housing Cap Screws.	Torque	25 N·m (18 lb-ft)
Front Housing-to-Rear Housing Cap Screws.	Torque	87 N·m (64 lb-ft)
Main Case Front Housing.	Weight	120 Kg (265 lbs.)
Cylinder Housing Cap Screws.	Torque	25 N·m (18 lb-ft)
Capscrew-to-Piston	Torque	25 N·m (18 lb-ft)
Solenoid Capscrews	Torque	25 N·m (18 lb-ft)
Thin Stop Nut-to-Coil on Output Disconnect Group.	Torque	5 N·m (50 lb-in)
Ground Driven Pump-to-Front Housing Capscrews.	Torque	87 N·m (64 lb-ft)

YZCTM147,40,SPC-19-01APR98

REMOVE AND INSTALL DIPSTICK ASSEMBLY



YZ712 -UN-05NOV93

A—1/4 I.D. Hose
B—Dipstick
C—Dipstick tube assembly
D—Cap screw (2 used)
E—Dipstick gasket

REMOVE DIPSTICK TUBE

1. Remove 1/4 inch hose (A) from valve and dipstick tube assembly (C).

2. Remove two cap screws (D) from dipstick tube assembly.

3. Remove dipstick tube assembly.

4. Remove gasket.

INSTALL DIPSTICK TUBE

1. Install new gasket (E).

2. Install two cap screws (D) in dipstick tube assembly.

3. Install 1/4 inch hose (A) from valve to dipstick tube assembly (C).

4. Tighten cap screws (D) to 25 N·m (18 lb-ft).

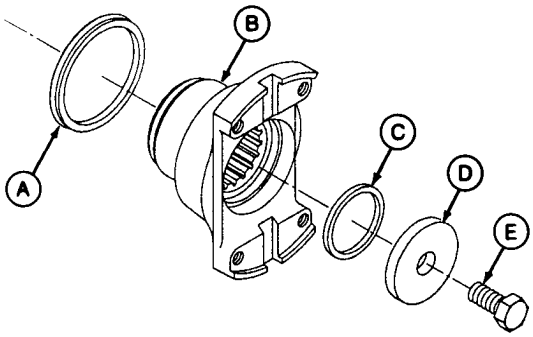
YZ,CTM147,40,13-19-05MAY98

REMOVE OUTPUT YOKE

1. Remove cap screw (E), washer (D), O-ring (C).

2. Remove yoke (B) and V-ring seal (A).

A—V-ring seal
B—Yoke
C—O-ring
D—Yoke washer
E—Cap screw



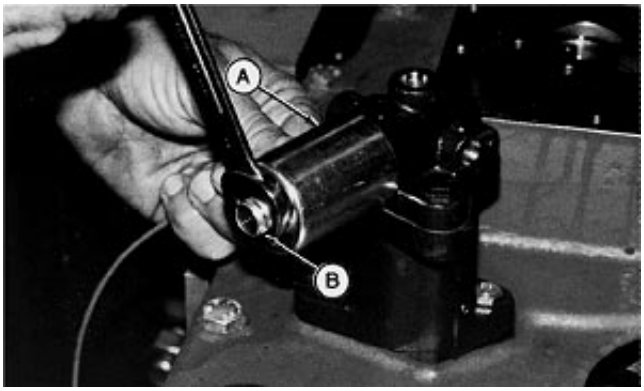
-UN-05NOV93
YZ722

YZ,CTM147,40,1 -19-05MAY98

REMOVE INTERNAL DISCONNECT

1. Remove thin stop nut (B).

2. Remove pin and coil assembly (A).

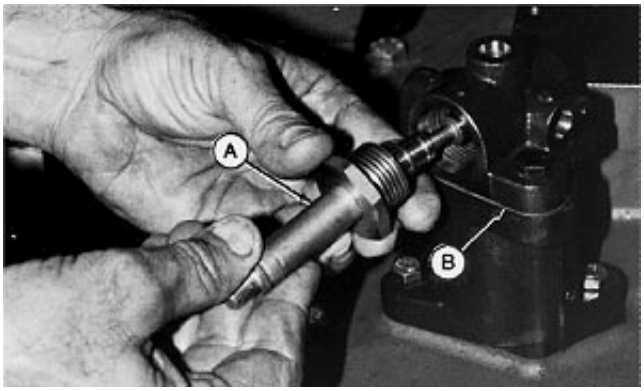


-UN-13DEC93
YZ751

YZ,CTM147,40,17-19-05MAY98

NOTE: Behind the core assembly (A) inside of the solenoid cap (B) you will find solenoid spool, solenoid plunger, and spring solenoid.

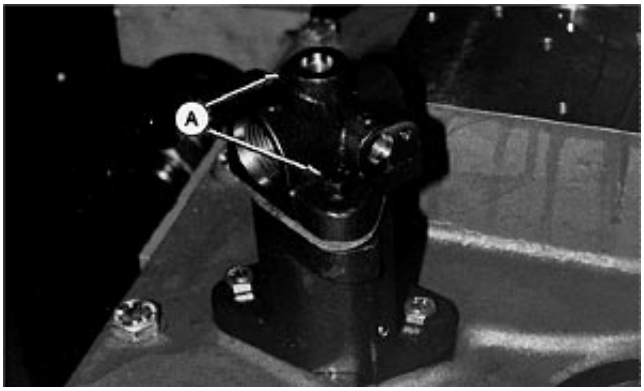
3. Remove core assembly (A).



-UN-13DEC93
YZ755

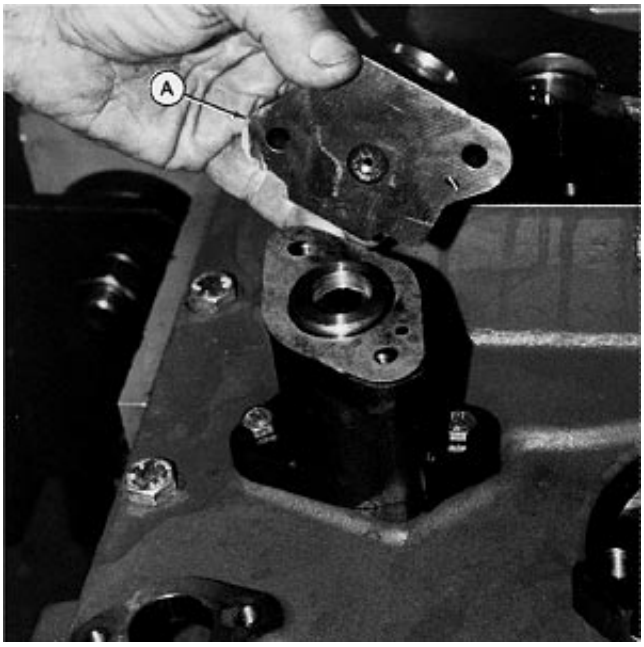
YZ,CTM147,40,19-19-05MAY98

4. Remove cap screws (A).



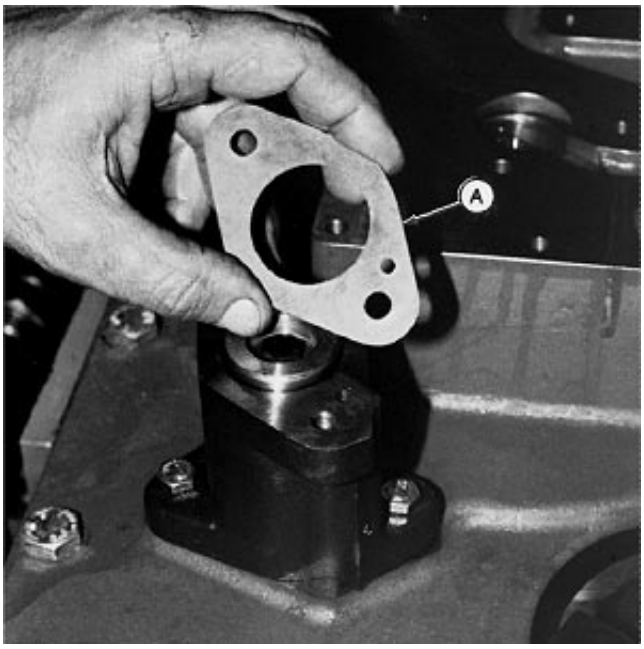
YZ,CTM147,40,20-19-05MAY98

5. Remove solenoid cap.(A).



YZ,CTM147,40,21-19-05MAY98

6. Remove gasket (A).

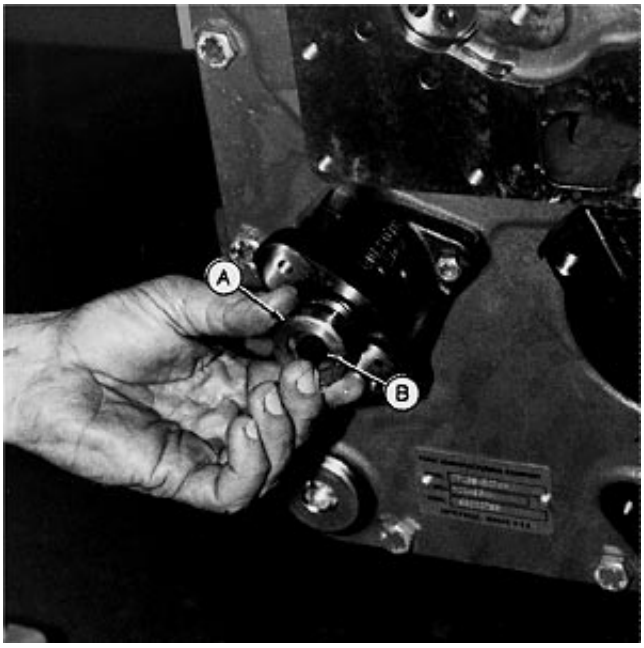


YZ761 -UN-13DEC93

YZ,CTM147,40,22-19-05MAY98

7. Remove cap screw (B).

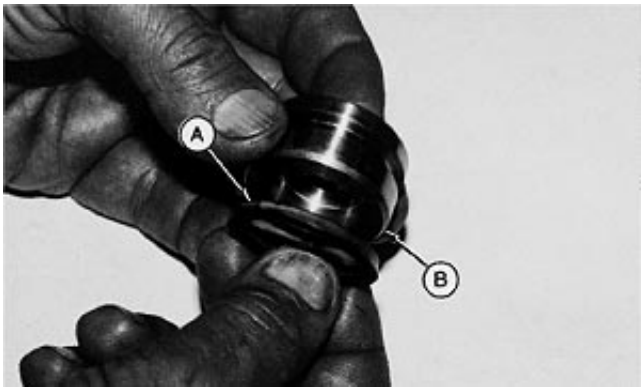
8. Remove piston (A).



YZ764 -UN-13DEC93

YZ,CTM147,40,23-19-05MAY98

9. Remove lip seal (A) from piston (B).



YZ,CTM147,40,24-19-05MAY98

10. Remove disconnect return spring (A).

11. Remove cap screws.

YZ,CTM147,40,25-19-05MAY98

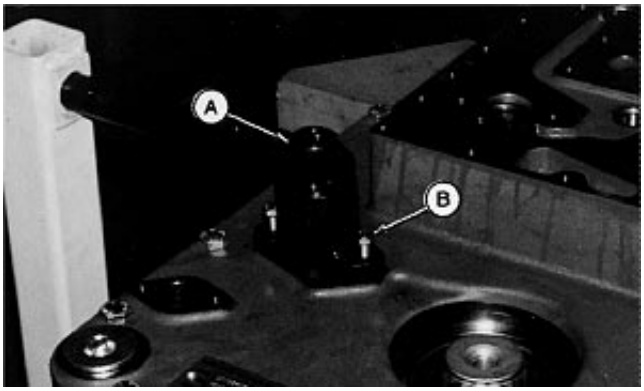
12. Remove cylinder housing.

YZ769 -UN-13DEC93

YZ,CTM147,40,26-19-05MAY98

INSTALL INTERNAL DISCONNECT

1. Install cylinder housing (A) and cap screw (B).



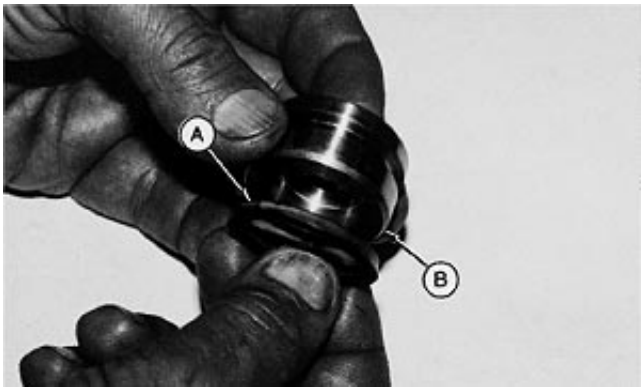
2. Tighten cap screws 25 N·m (18 lb-ft.)

YZ,CTM147,40,27-19-05MAY98

3. Install disconnect return spring (A).

YZ767 -UN-13DEC93

4. Install lip seal (A) onto piston (B).



YZ766 -UN-13DEC93

YZ,CTM147,40,28-19-05MAY98

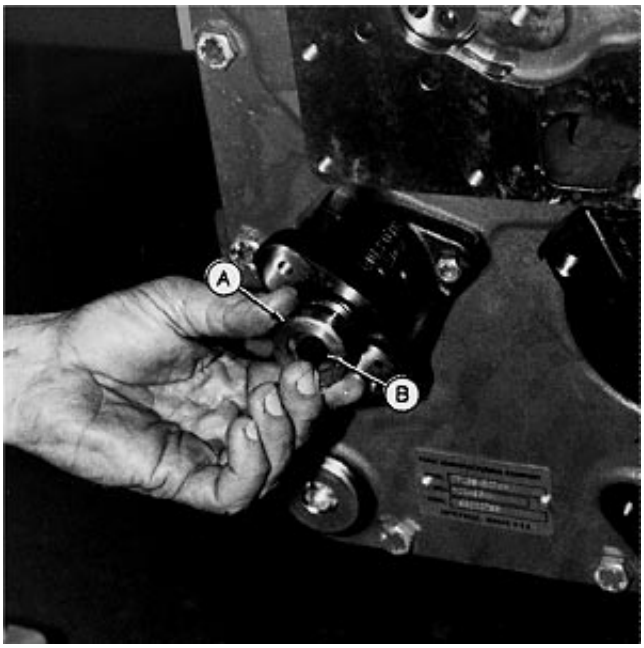
5. Apply LOCTITE® #262 to cap screw (B).

6. Place cap screw (B) into piston (A).

NOTE: Cap screw is held away from shift fork assembly by disconnect return spring. Push piston and cap screw into cylinder housing to start cap screw threads.

7. Install cap screw.

8. Tighten cap screw 25 N·m (18 lb-ft.).



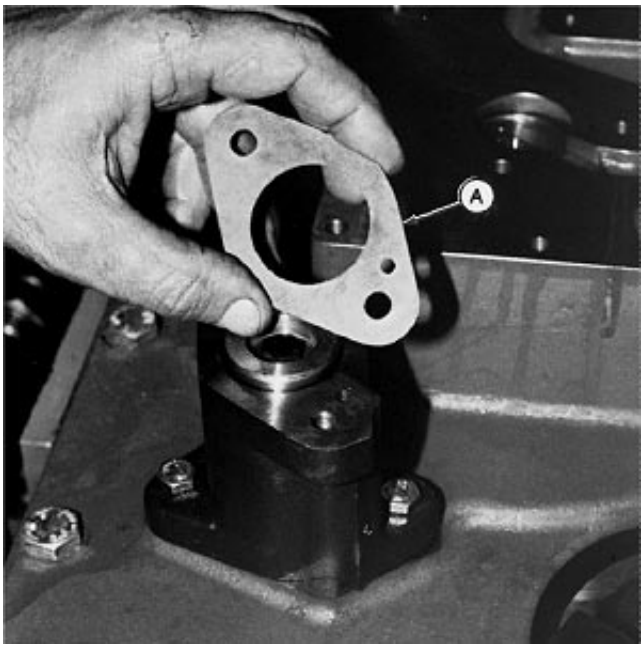
YZ764 -UN-13DEC93

LOCTITE is a trademark of the LOCTITE Corporation.

YZ,CTM147,40,29-19-05MAY98

NOTE: Place small hole in gasket over small hole in cylinder housing.

9. Install gasket (A).

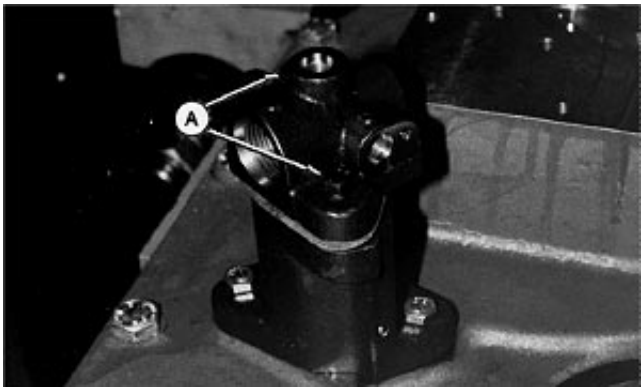


YZ761 -UN-13DEC93

YZ,CTM147,40,30-19-05MAY98

10. Install solenoid cap.

11. Install cap screws (A) and tighten to 25 N·m (18 lb-ft.).

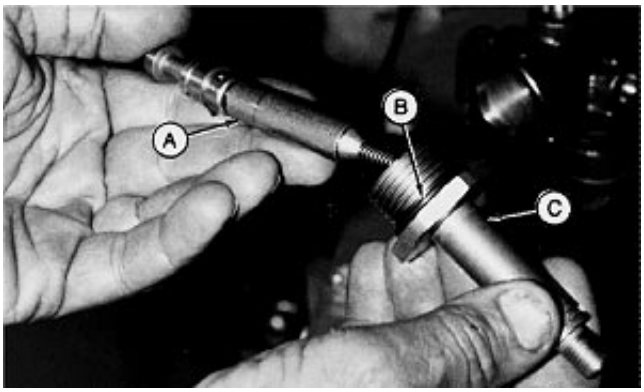


YZ,CTM147,40,33-19-05MAY98

12. Place solenoid plunger assembly (A) into core assembly (B).

13. Install core assembly and plunger assembly into solenoid cap.

14. Tighten core assembly.

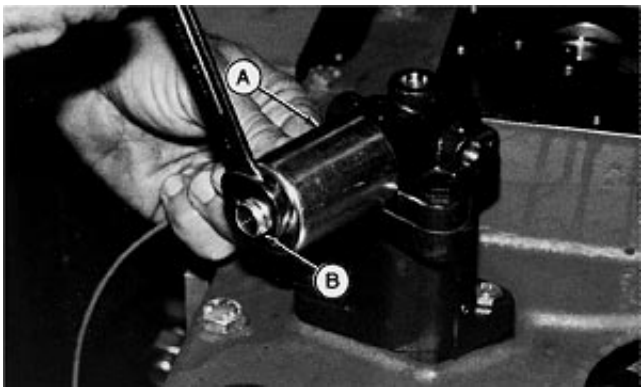


YZ,CTM147,40,31-19-05MAY98

15. Place pin and coil assembly (A) onto core assembly.

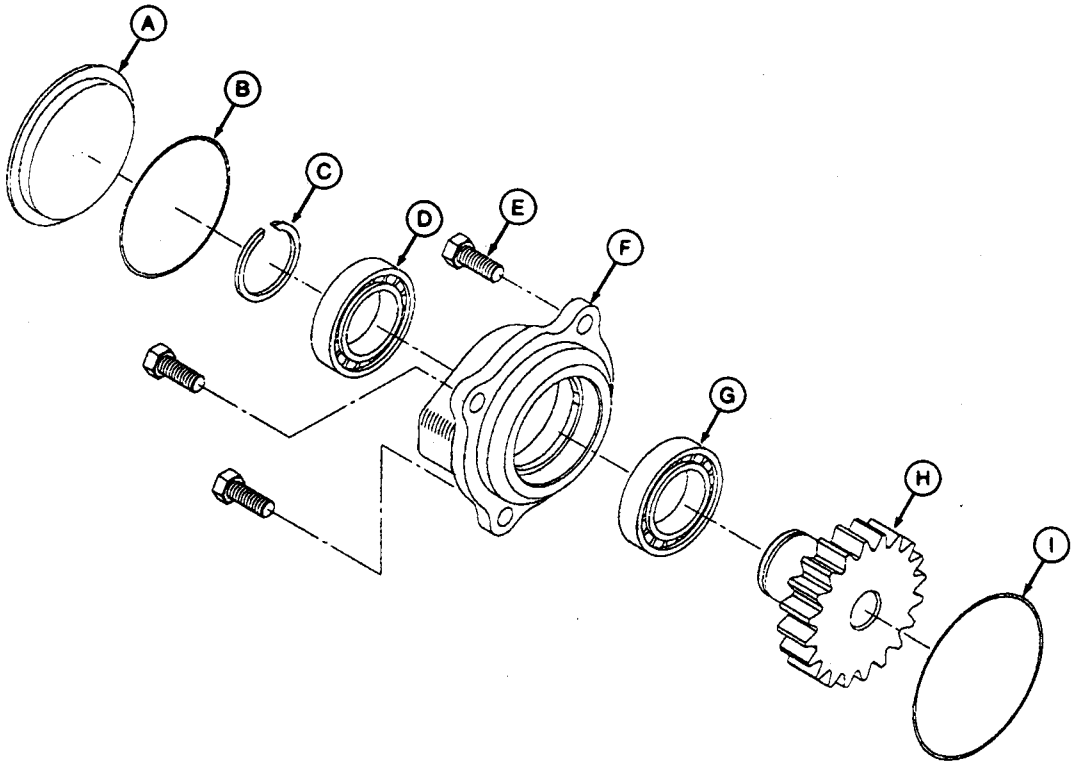
16. Install thin stop nut.

17. Tighten to 5 N·m (50 lb-in).



YZ,CTM147,40,32-19-05MAY98

DISASSEMBLE AND ASSEMBLE GROUND DRIVEN PUMP

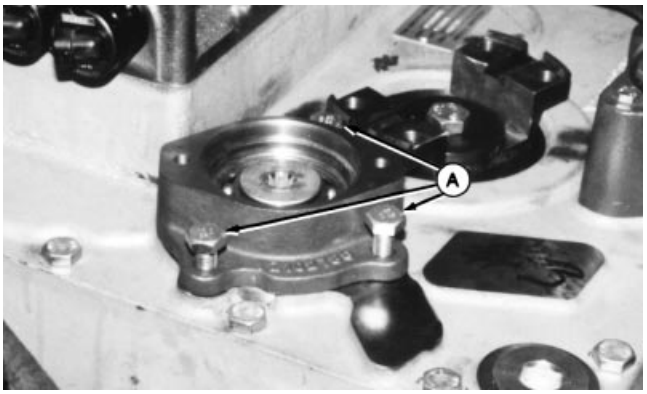


YZ800 -UN-12APR94

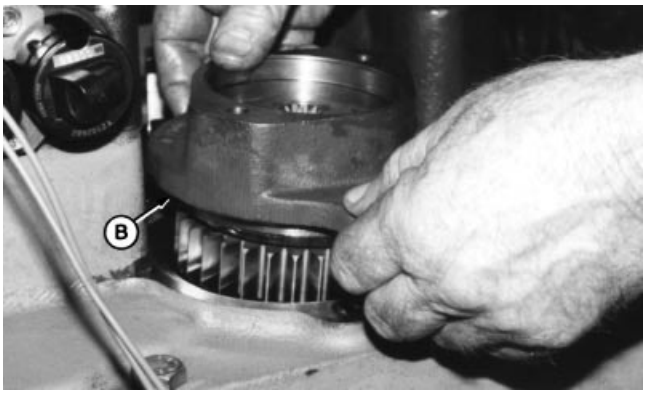
A—Shipping Plug
B—O-ring
C—External Retaining Ring
D—Bearing
E—Hex Cap Screw (3)
F—Adapter
G—Bearing
H—Gear
I—O-ring

YZ,CTM147,40,34-19-05MAY98

1. Remove three cap screws (A).



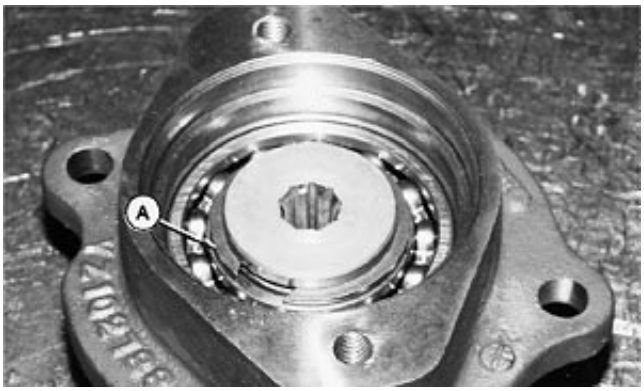
2. Remove ground driven pump assembly (B).



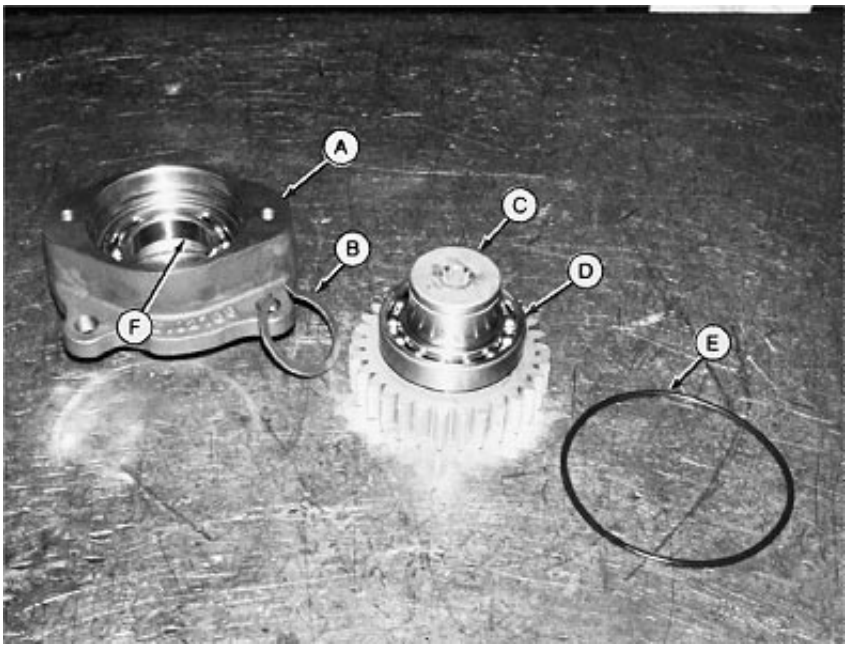
YZ,CTM147,40,35-19-05MAY98

DISASSEMBLE GROUND DRIVEN PUMP

1. Remove external retaining ring (A).



YZ,CTM147,40,36-19-05MAY98



Disassemble Ground Driven Pump

1. Press Gear (C) from Adapter (A).

2. Remove bearings from gear (C) and from adapter (A).

3. Discard bearings (D) and (F).

Assemble Ground Driven Pump

1. Install new bearing (D) onto gear (C).

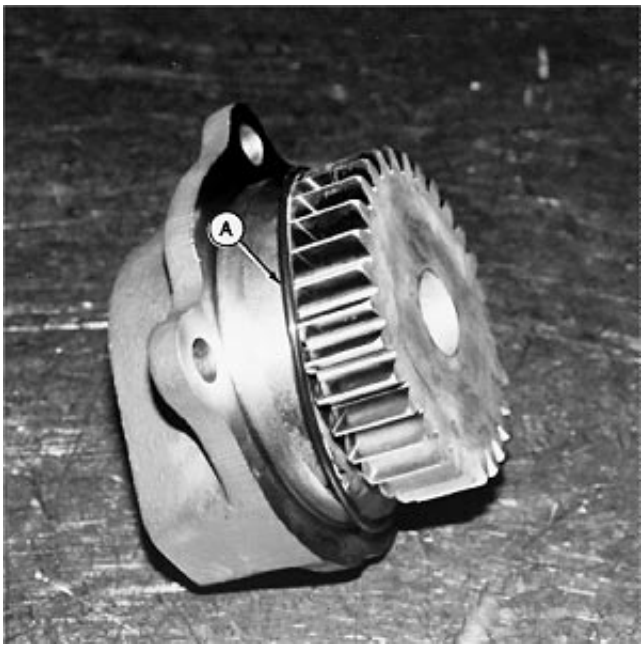
2. Press gear (C) and bearing (D) into adapter (A).

3. Start bearing (F) onto gear (C) and press bearing into adapter (A).

4. Install external retaining ring (B) into groove in gear (C).

YZ,CTM147,40,37-19-06MAY98

5. Install O-ring (A) onto ground pump assembly.



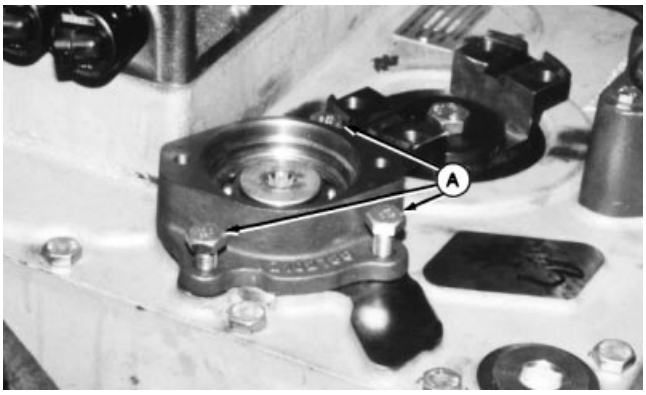
YZ,CTM147,40,38-19-05MAY98

INSTALL GROUND DRIVEN PUMP

1. Install ground driven pump onto main case front housing.

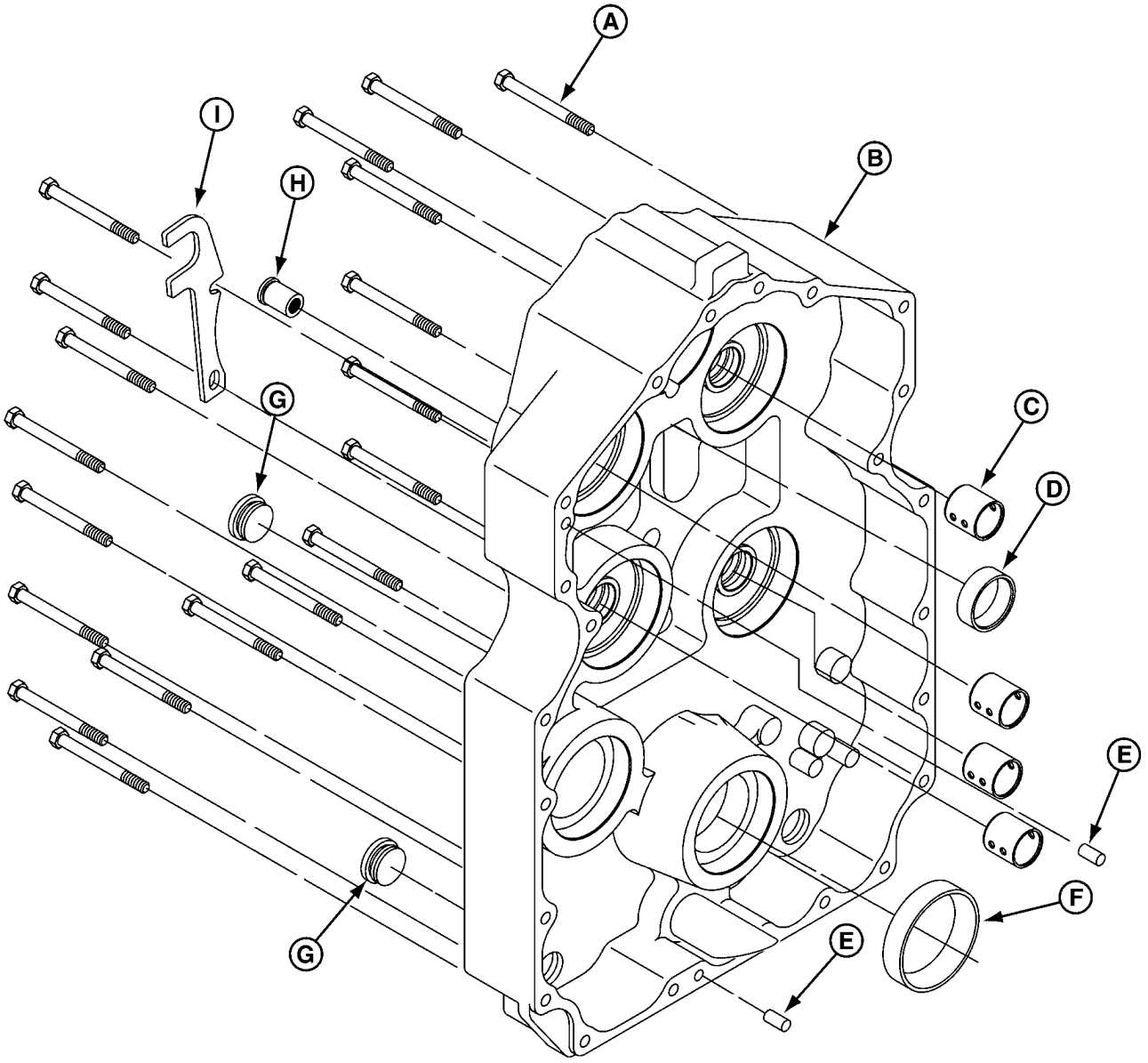
2. Install cap screws (A).

3. Torque cap screws to 87 N·m (64 lb-ft).



YZ,CTM147,40,39-19-05MAY98

DISASSEMBLE AND ASSEMBLE FRONT HOUSING



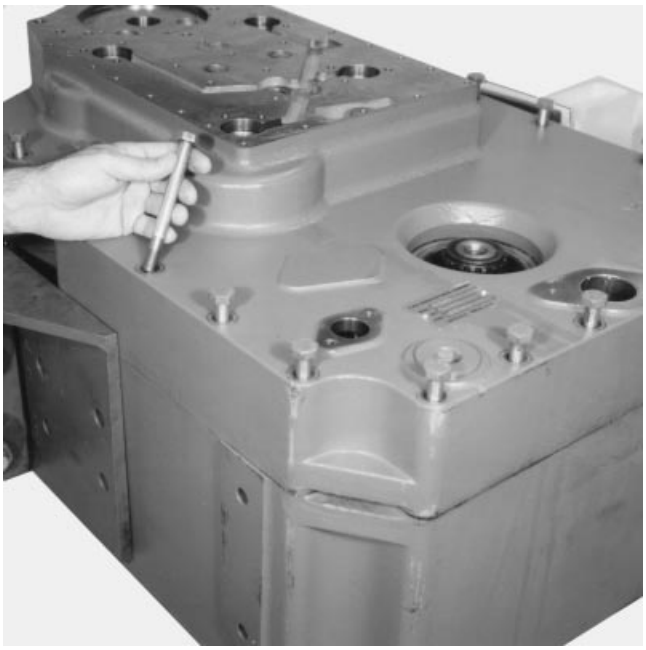
YZ718A -UN-13MAR98

A—Hex cap screws 12x120mm (18 used)
B—Front Housing (DF250)
C—Bore Sleeve (4 used)
D—Input Bushing
E—Dowel Pin (2 used)
F—Bearing Cup
G—Plug with O-ring (2 used)
H—Lube Relief Valve Assembly
I—Bracket

YZ,CTM147,40,18-19-05MAY98

REMOVE FRONT HOUSING

1. Remove cap screws from front housing.

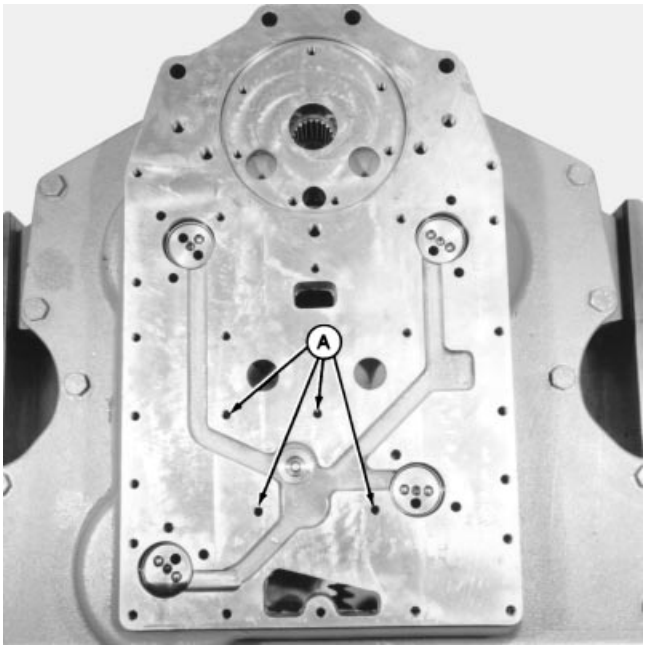


YZ604 -UN-19MAR98

YZ,CTM147,40,2 -19-05MAY98

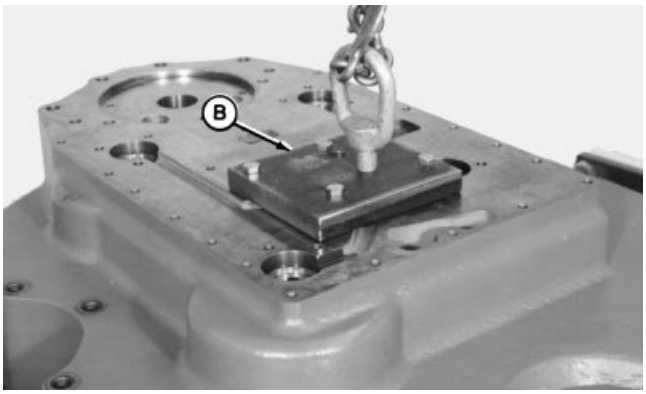
NOTE: See group 99 for special tools.

1. Use four threaded holes (A) in front housing to attach lifting tool.



NOTE: Use only high grade fasteners for holding the lifting tool to the front cover.

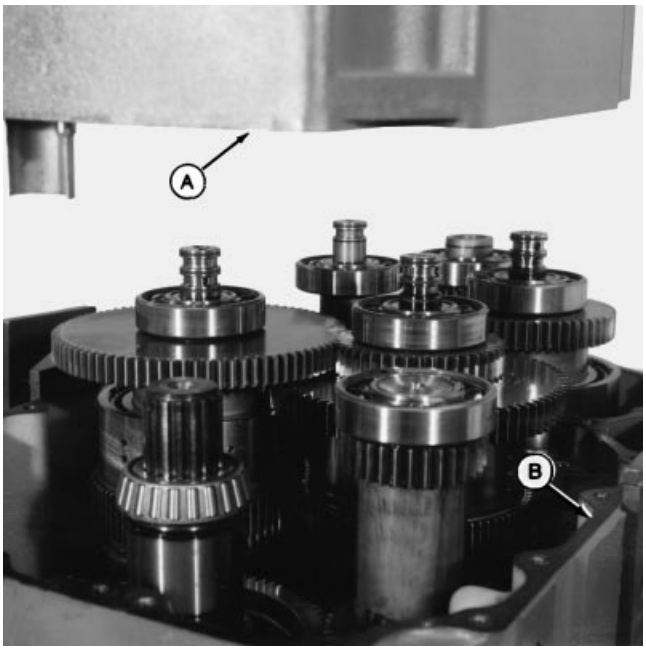
2. Attach lifting tool (B) onto front housing.



YZ,CTM147,40,3 -19-05MAY98

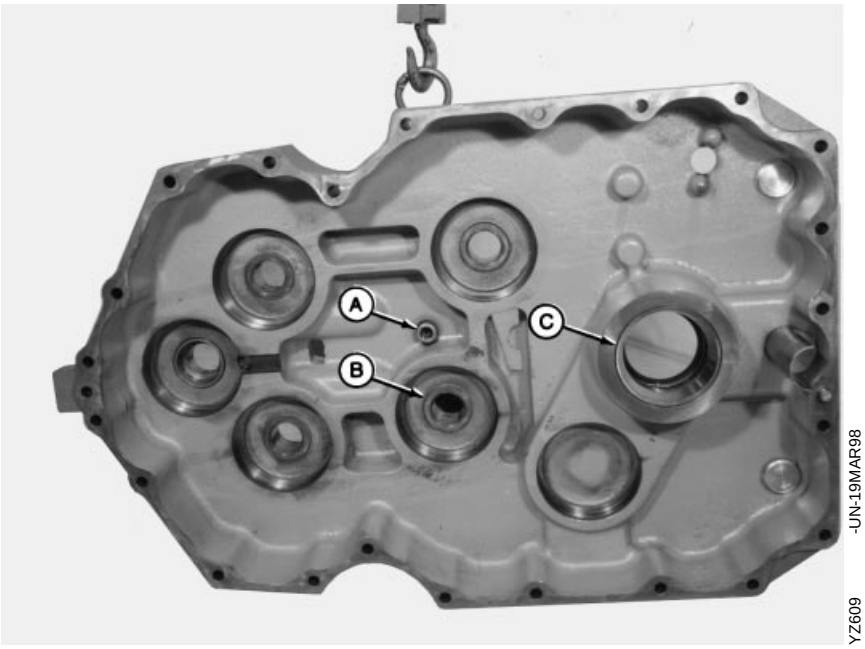
CAUTION: Front housing weight is approximately 265 lbs.

3. Lift front housing (A) from rear housing (B).



YZ,CTM147,40,4 -19-05MAY98

DISASSEMBLE FRONT HOUSING



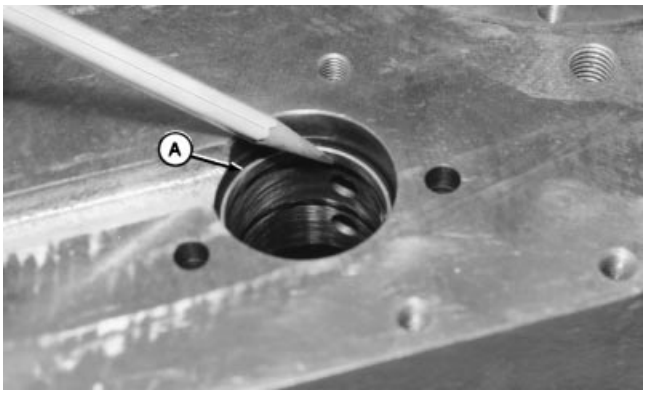
A—Lube relief valve **B—Bore sleeve (4)** **C—Bearing cup**

YZ,CTM147,40,11-19-10MAR98

REMOVE BORE SLEEVES

1. Inspect bore sleeves (A) for wear or damage.

NOTE: When removing bore sleeves from the DF 150 Series Transmission you must pull sleeves. The front housing of the DF 150 Series Transmission has a shoulder in the bore.



YZ610 -UN-19MAR98

NOTE: See group 99, special tools.

2. Remove bore sleeves from front side of front housing.

YZ611 -UN-19MAR98

YZ,CTM147,40,5 -19-05MAY98

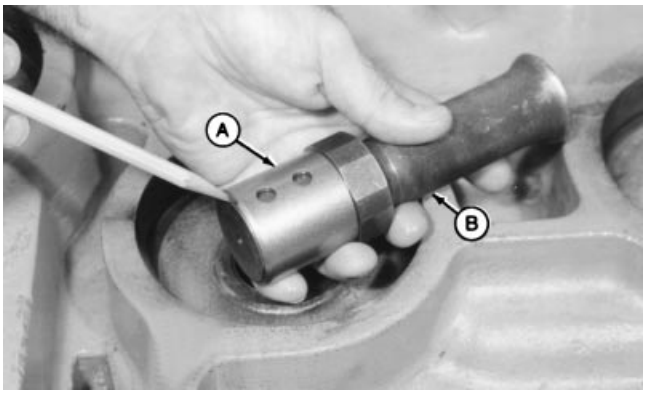
INSTALL BORE SLEEVES

1. Position front housing with bearing bore side up.

IMPORTANT: Install bore sleeves with the internal chamfer up.

2. Place bore sleeve (A) onto driving tool (B) with outside diameter chamfer of bore sleeve to end of tool.

NOTE: See group 99, special tools.



3. Install bore sleeve flush with shoulder.

YZ,CTM147,40,6 -19-05MAY98

REMOVE LUBE RELIEF VALVE

1. Position front housing with bearing bore side up.

2. Remove lube relief valve (A).

NOTE: See group 99, special tools.

-UN-19MAR98
YZ616

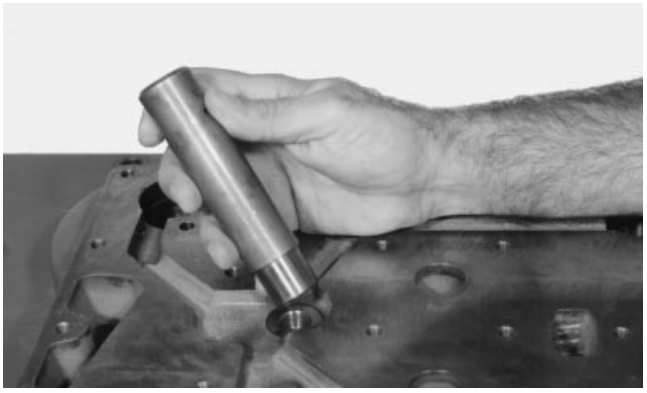
YZ,CTM147,40,7 -19-05MAY98

INSTALL LUBE RELIEF VALVE

1. Position front housing with bearing bore side down.

2. Install new lube relief valve (A).

NOTE: See group 99, special tools.

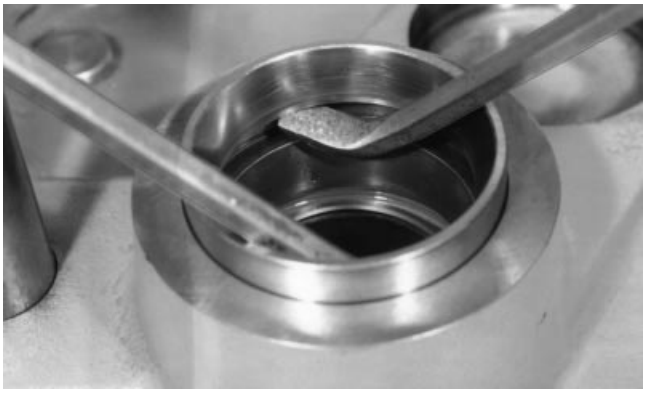


-UN-19MAR98
YZ612

YZ,CTM147,40,8 -19-05MAY98

REMOVE BEARING CUP

1. Remove bearing cup.



-UN-19MAR98
YZ620

YZ,CTM147,40,9 -19-05MAY98

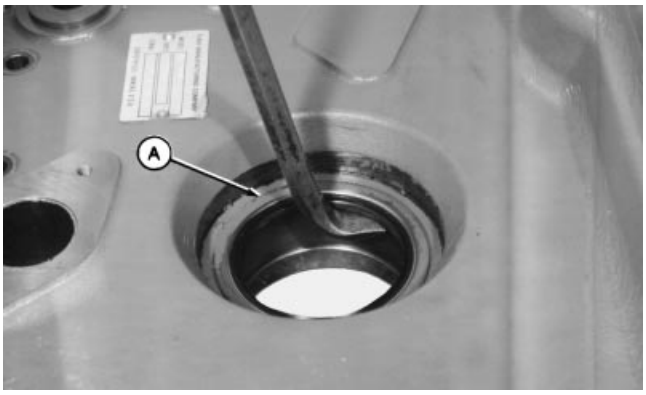
INSTALL BEARING CUP

1. Install new bearing cup (A).

YZ,CTM147,40,10-19-05MAY98

REMOVE OIL SEAL

1. Remove oil seal (A).

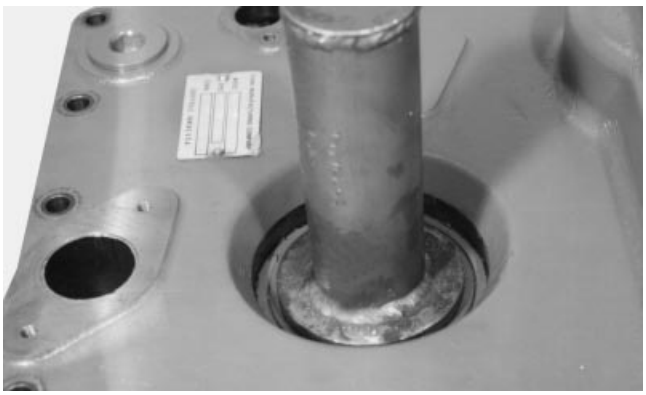


YZ,CTM147,40,12-19-05MAY98

INSTALL OIL SEAL

NOTE: Apply LOCTITE #242 or equivalent to outside diameter of oil seal before installation.

1. Install new oil seal flush with shoulder.



YZ,CTM147,40,14-19-05MAY98

INSTALL FRONT HOUSING TO REAR HOUSING

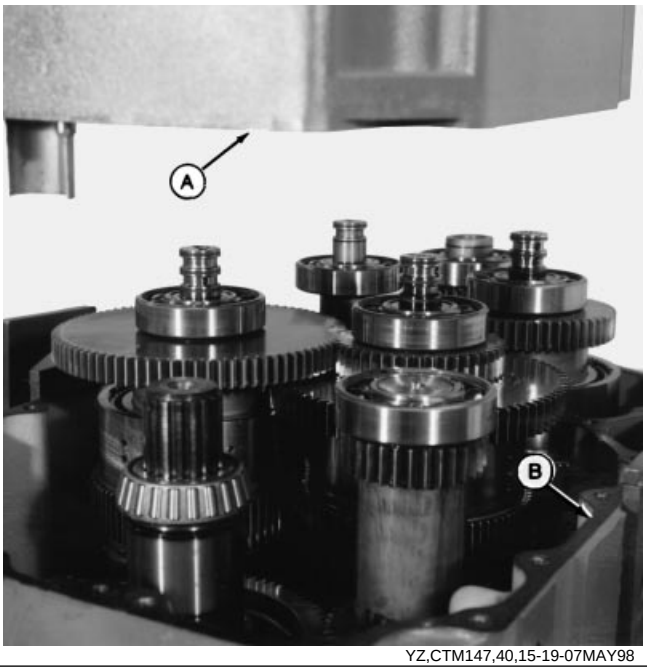
IMPORTANT: When installing front housing to rear housing use guide pins to help align housings and to protect seal rings during installation. Check for dowel pins before installing (Refer to DISASSEMBLE AND ASSEMBLE FRONT HOUSING for dowel pins hole location).

1. Attach lift tool to front housing.

NOTE: Refer to remove front housing for information on attaching lifting tool.

2. Install new gasket onto rear housing.

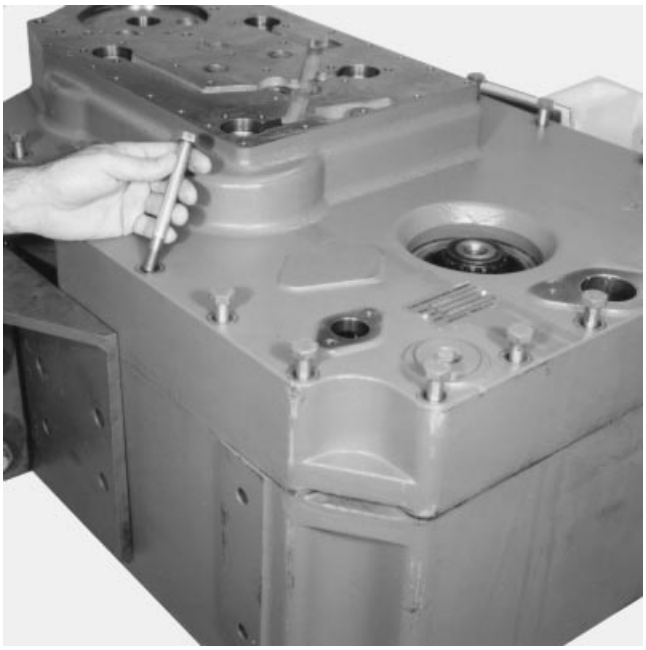
3. Install front housing (A) to rear housing (B).



YZ,CTM147,40,15-19-07MAY98

4. Install cap screws.

5. Tighten cap screws to 87 N·m (64 lb-ft).



YZ604 -UN-19MAR98

YZ,CTM147,40,16-19-05MAY98

SPECIFICATIONS

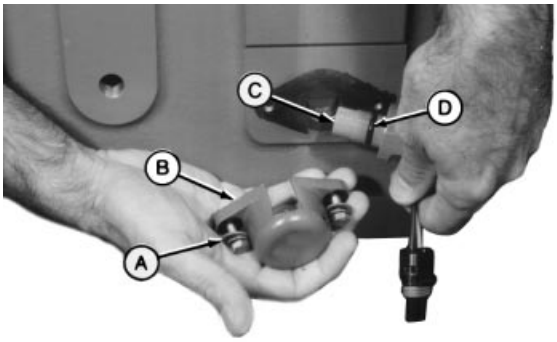
Item	Measurement	Specification
Output Group without Internal Disconnect.	Weight	30 Kg (65 lbs.)
Clutch Stages less Output Stage.	Weight	272 Kg (600 lbs.)
Oil Trough-to-Rear Housing Cap Screws.	Torque	25 N·m (18 lb-ft)
Clutch Assemblies	Clutch, Separator Plate Clearance	2.79 mm—5.59mm (.110—.220 in)

YZCTM147,45,SPC-19-05MAY98

REMOVE MAGNETIC PICKUP FROM REAR HOUSING

1. Remove cap screws and washers (A).
2. Remove cover (B), note position of cut out in cover.
3. Pull out magnetic sensor (C) with O-ring (D).

A—Cap screws and washers
B—Cover
C—Magnetic sensor
D—O-ring

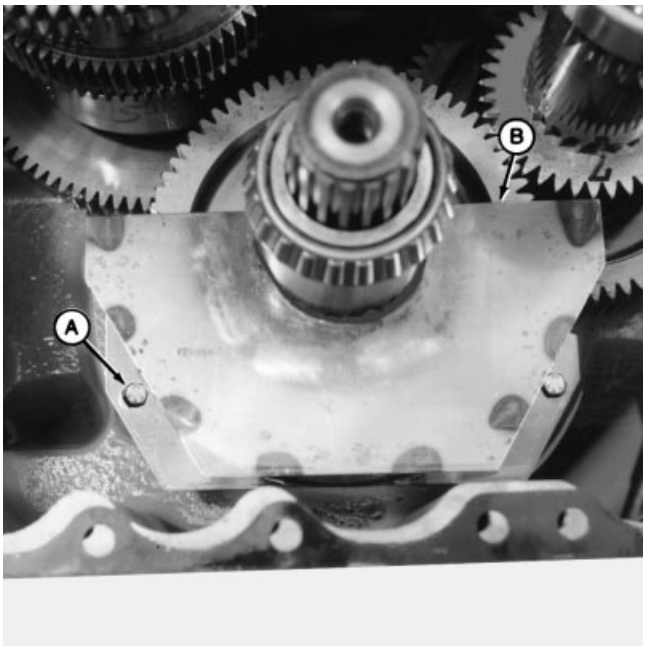


YZ654 -UN-19MAR98

YZ,CTM147,45,3 -19-05MAY98

REMOVE OUTPUT GROUP

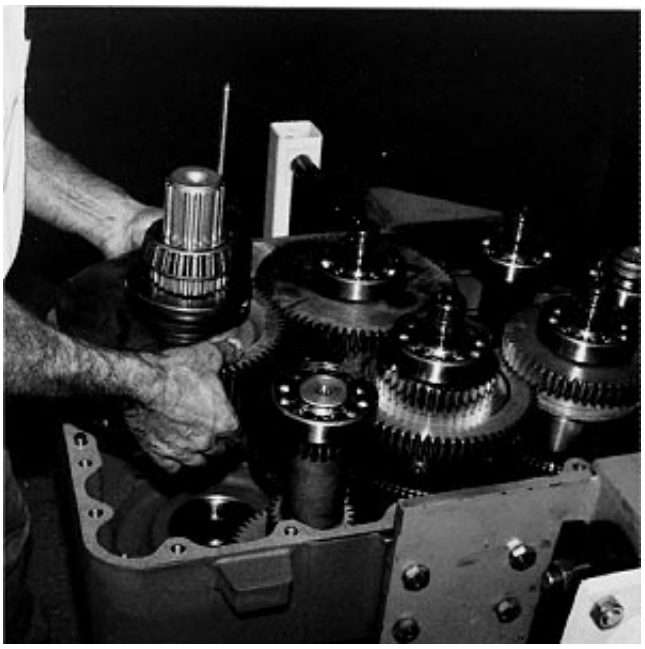
1. Remove two cap screws (A) from oil trough assembly (B).



YZ,CTM147,45,1 -19-06MAY98

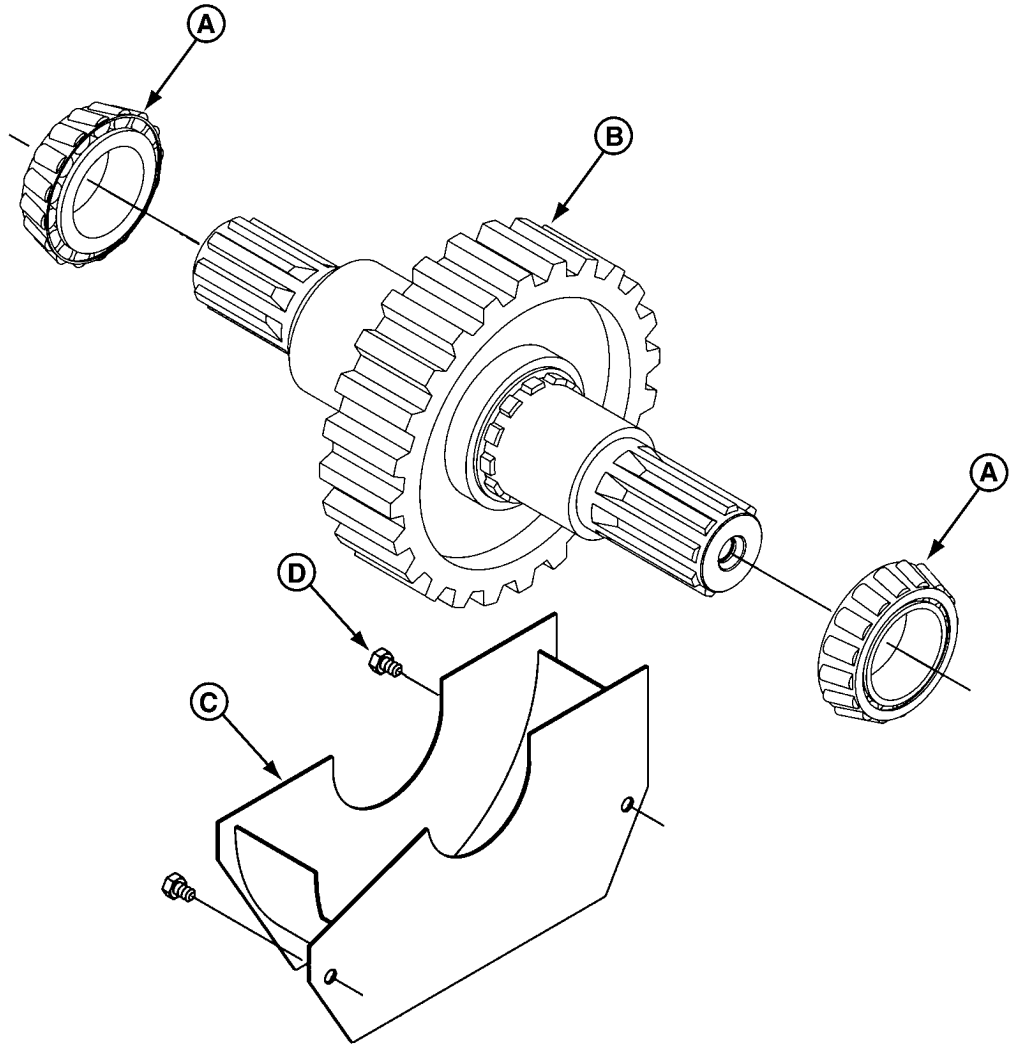
CAUTION: Approximate weight of output group is 75 lbs.

2. Remove output group and oil trough.



YZ,CTM147,45,2 -19-06MAY98

DISASSEMBLE OUTPUT GROUP (NO DISCONNECT) AND OIL TROUGH



YZ796A -UN-12MAR98

A—Bearing cone (2 used)

B—Seventh stage output shaft gear assembly

C—Oil Trough Assembly

D—Cap Screw M8x12 8.8 (2 used)

NOTE: Oil trough can only be removed or installed with output group.

IMPORTANT: Do not attempt to remove gear from shaft. This is a permanent assembly. Damage to parts will result.

Disassemble Output Group

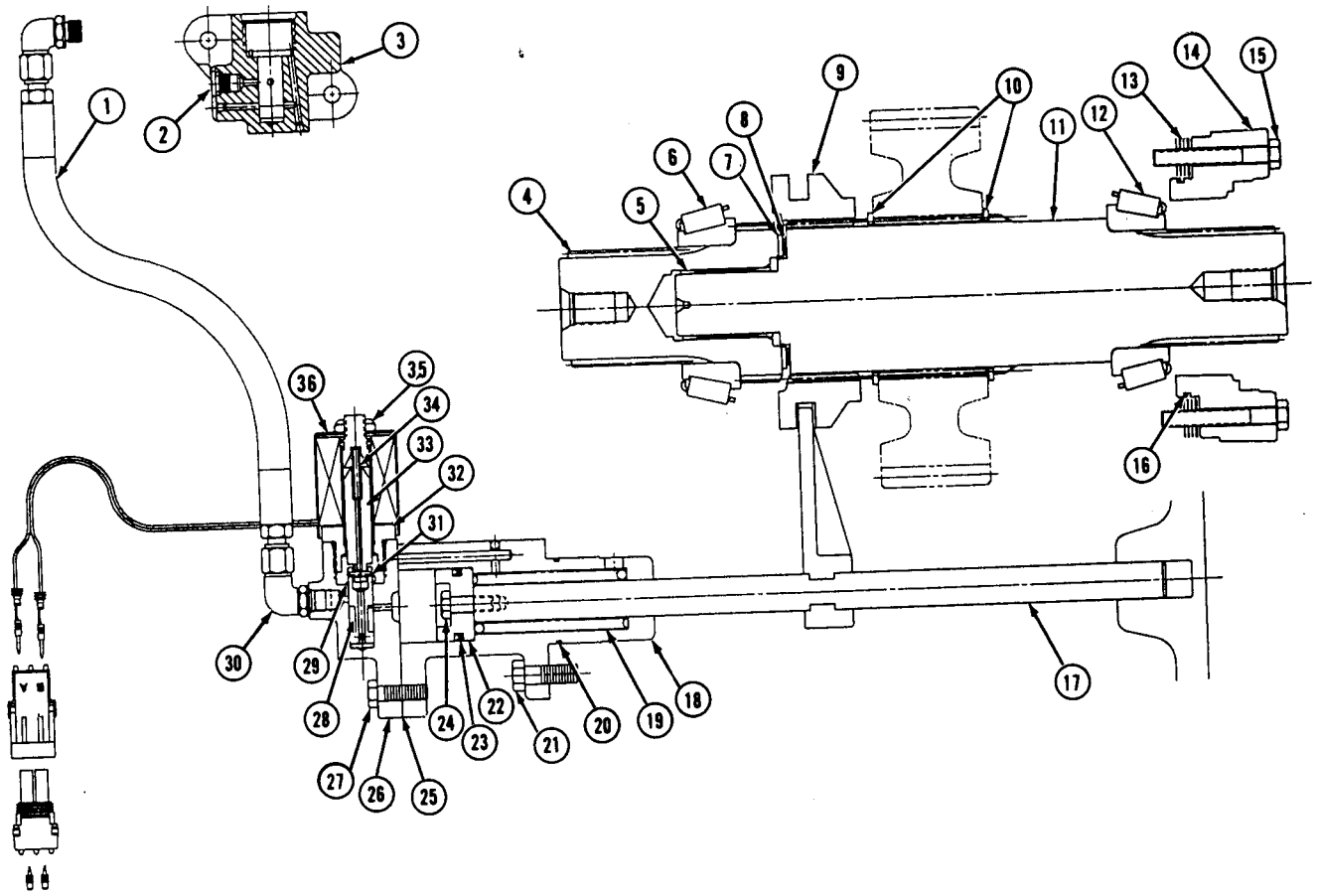
1. Remove bearing cones (A).

Assemble Output Group

1. Install new bearing cones (A).

YZ,CTM147,45,13-19-05MAY98

DISASSEMBLE AND ASSEMBLE OUTPUT GROUP (WITH INTERNAL DISCONNECT)



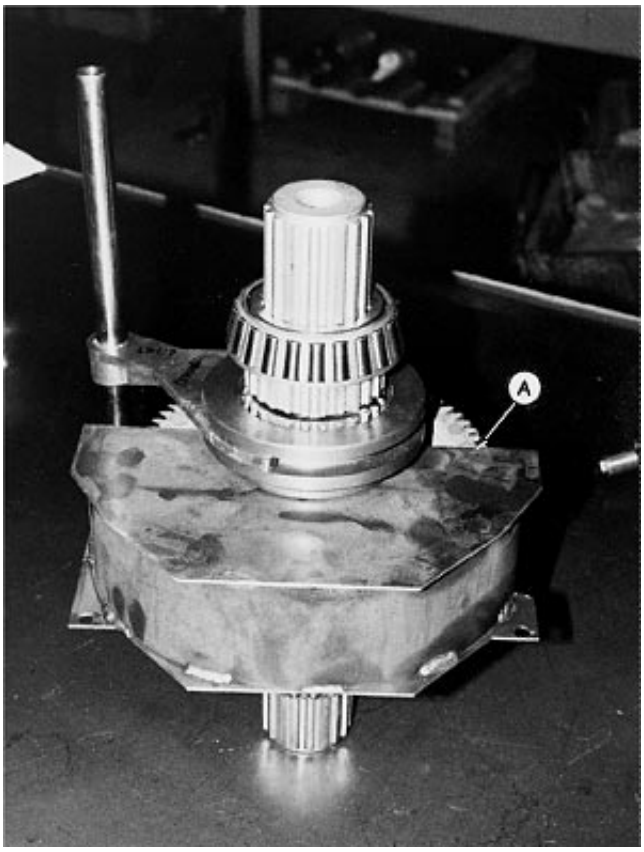
YZ717 -UN-05NOV93

1—Hose
2—Standard thread O-ring plug
3—Solenoid cap
4—Output disconnect shaft
5—Bushing
6—Bearing cone
7—Thrust bearing
8—Thrust race
9—Shift collar
10—Snap ring (external)
11—Seventh stage output shaft
12—Bearing cone
13—Shims (.18mm, .51mm, .13mm)
14—Bearing retainer
15—Cap screw (6 used)
16—O-ring
17—Shift fork assembly
18—Cylinder housing
19—Disconnect retainer spring
20—O-ring
21—Cap screw m8x25
22—Piston
23—Lip seal
24—Cap screw m8x20
25—Gasket
26—Solenoid cap
27—Cap screw (2 used)
28—Solenoid spool
29—Snap ring
30—90 JIC fitting
31—Roll pin
32—Core assembly
33—Solenoid plunger
34—Solenoid spring
35—Thin stop nut
36—Pin and coil 12 or 24 volt assembly

YZ,CTM147,45,41-19-05MAY98

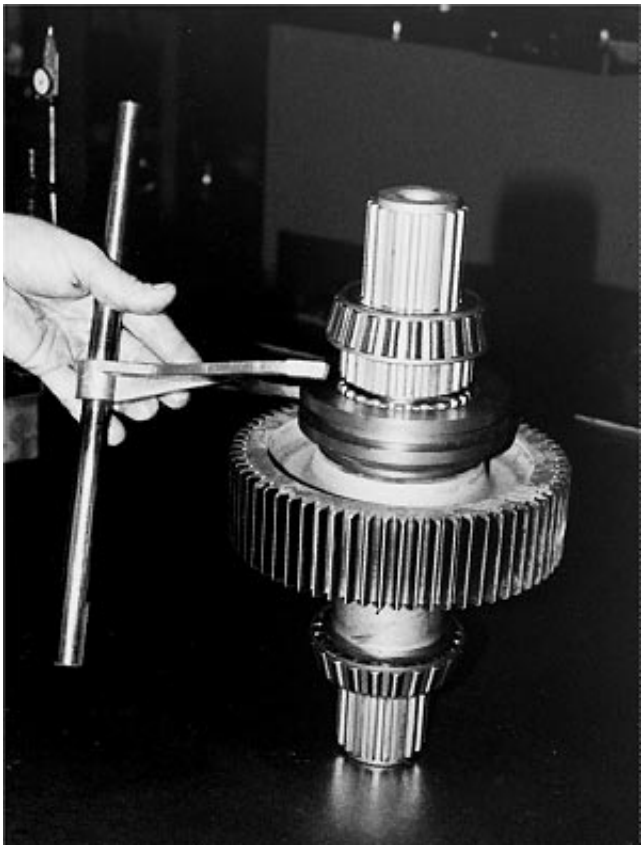
DISASSEMBLE OUTPUT GROUP WITH INTERNAL DISCONNECT

1. Remove oil trough (A).



YZ782 -UN-13DEC93

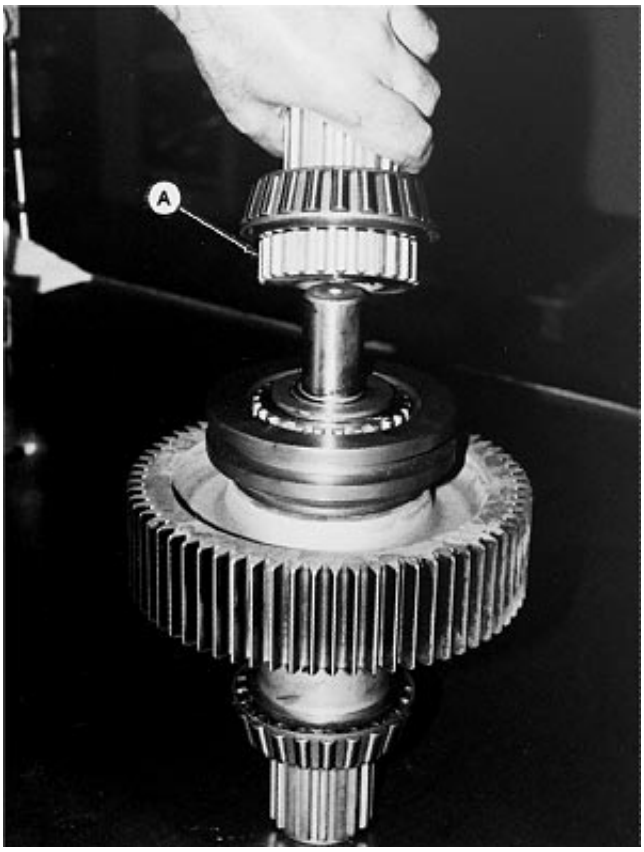
2. Remove shift fork.



YZ784 -UN-13DEC93

YZ,CTM147,45,8 -19-05MAY98

3. Remove output disconnect shaft (A).



YZ,CTM147,45,9 -19-05MAY98

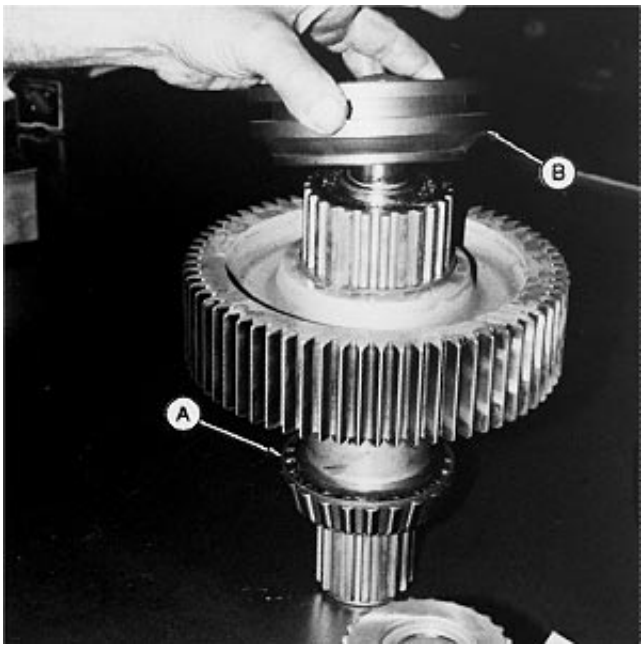
4. Remove thrust race (B).

5. Remove thrust bearing (A).

YZ,CTM147,45,10-19-05MAY98

6. Remove shift collar (B).

7. Remove bearing cone (A).



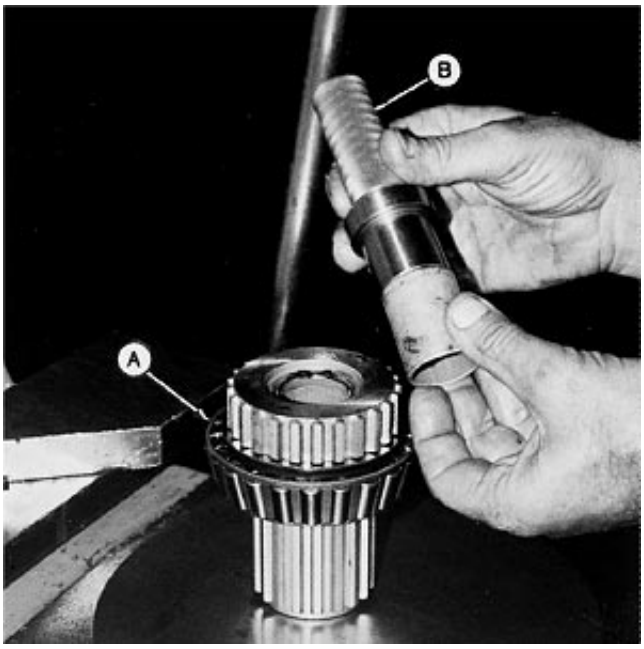
YZ788 -UN-13DEC93

YZ,CTM147,45,11-19-05MAY98

ASSEMBLE OUTPUT GROUP WITH INTERNAL DISCONNECT

NOTE: See group 99 for special tool (B).

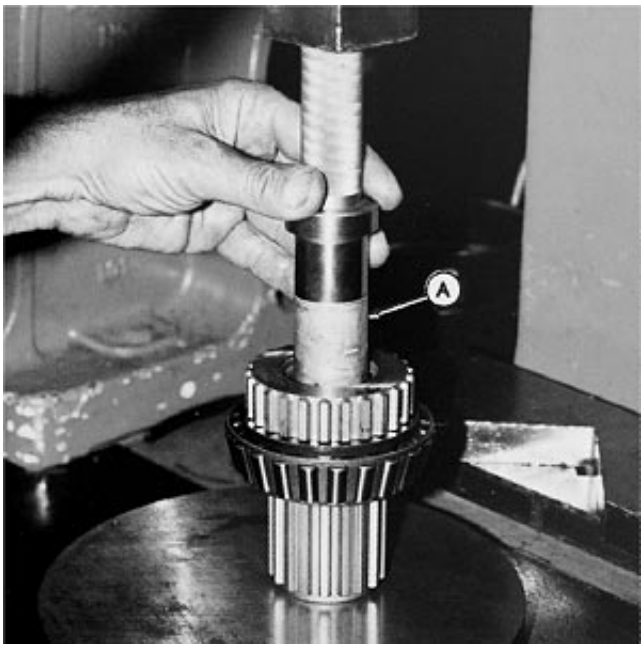
1. Install bearing cone (A).



YZ789 -UN-13DEC93

YZ,CTM147,45,12-19-05MAY98

2. Press sleeve (A) into output disconnect shaft.

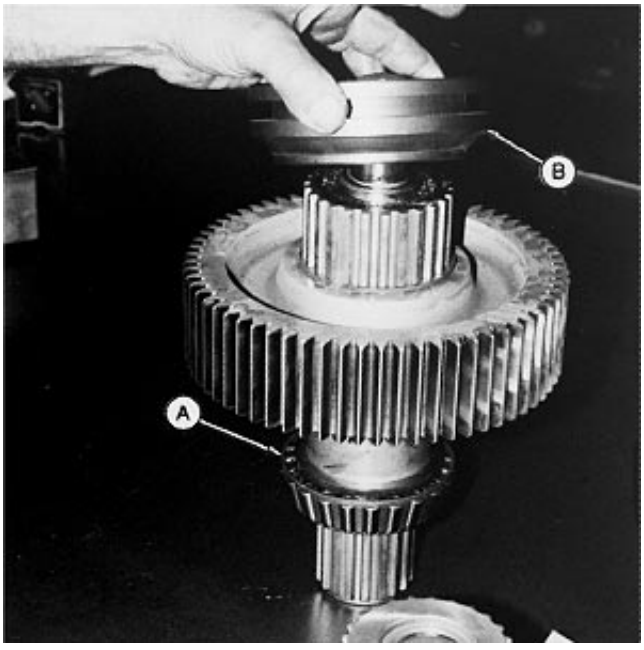


YZ790 -UN-13DEC93

YZ,CTM147,45,44-19-05MAY98

3. Install new bearing cone (A).

4. Install shift collar (B).



YZ788 -UN-13DEC93

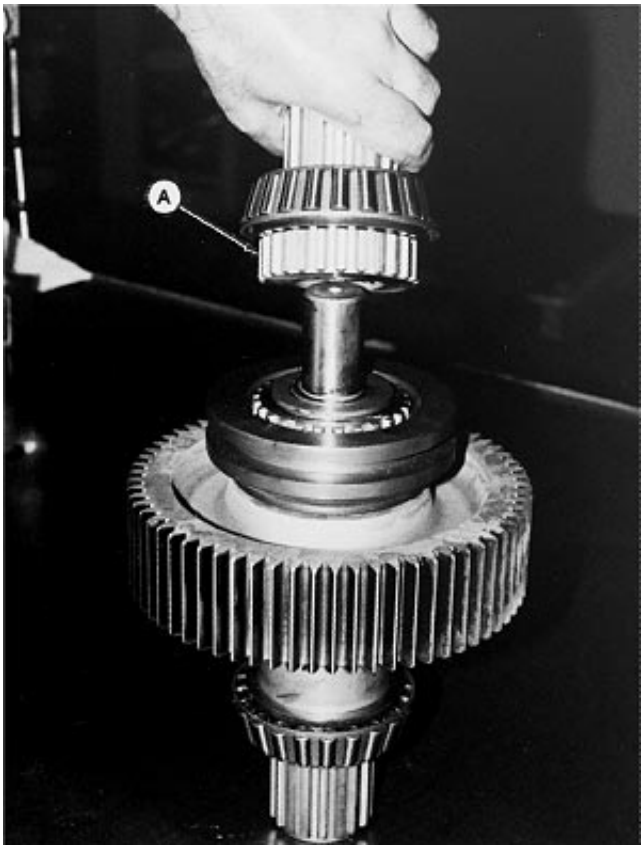
YZ,CTM147,45,45-19-05MAY98

5. Install new thrust bearing (A).

6. Install new thrust race (B)

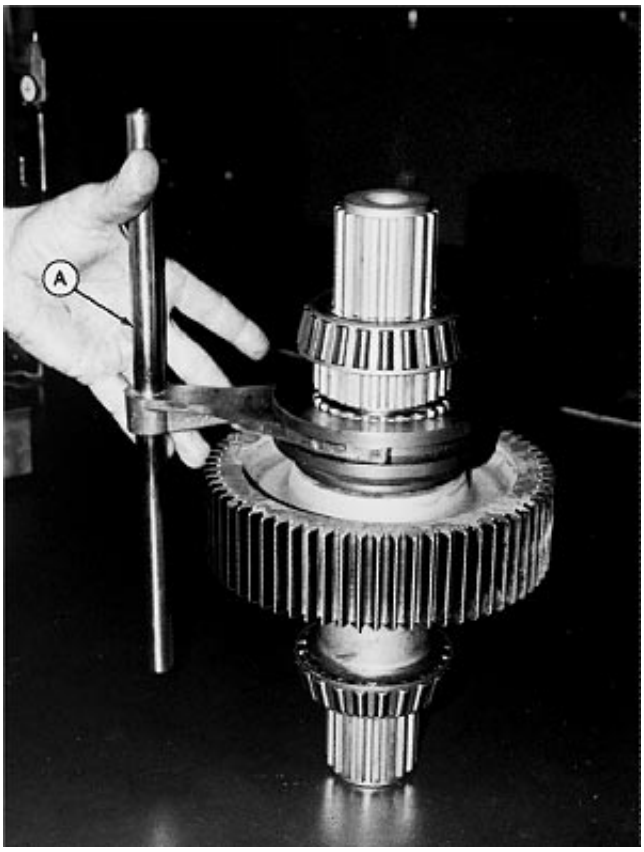
YZ,CTM147,45,46-19-05MAY98

7. Install output disconnect shaft (A).



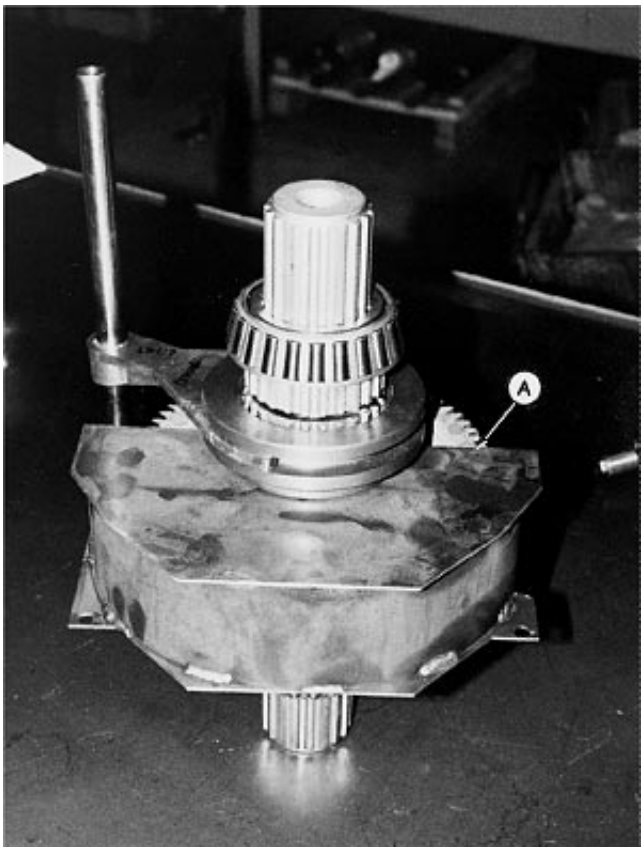
YZ,CTM147,45,47-19-05MAY98

8. Install shift fork assembly (A) with threaded end up.



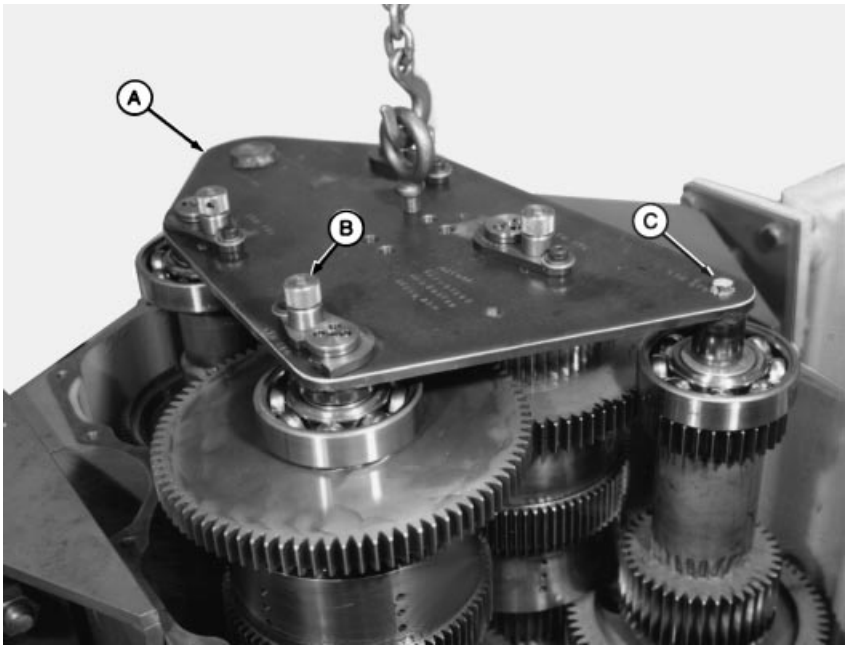
YZ,CTM147,45,48-19-05MAY98

9. Install oil trough (A) with bolt holes down.



YZ,CTM147,45,49-19-05MAY98

REMOVE ALL CLUTCH STAGE ASSEMBLIES



CAUTION: Approximate weight of all clutch stage assemblies is 600 lbs.

IMPORTANT: Lift all clutch stage assemblies at one time using lift tool.

NOTE: See group 99 for special tools.

1. Install lift tool (A).
2. Lock holders (B) into place.
3. Install bolt (C) into sixth stage assembly.
4. Lift all clutch stage assemblies from rear housing.

YZ,CTM147,45,5 -19-05MAY98

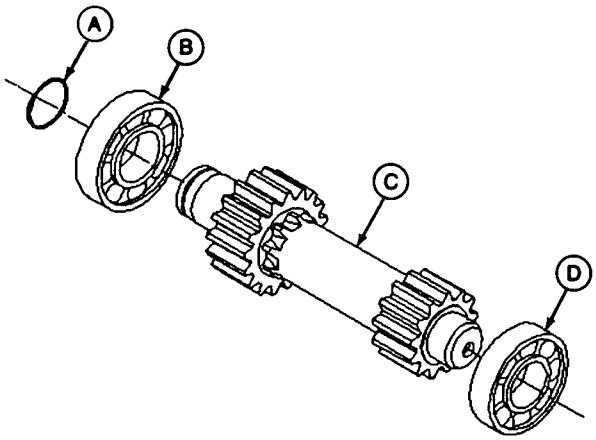
5. Place stages on work table.

CAUTION: Place clutch stage assemblies in center of work table to prevent personal injury.

6. Remove lift tool from clutch stage assemblies.

YZ,CTM147,45,6 -19-05MAY98

FIRST STAGE SHAFT ASSEMBLY



-UN-25OCT93

YZ706

A—Seal ring **B—Bearing** **C—First stage shaft assembly** **D—Bearing**

DISASSEMBLE FIRST STAGE ASSEMBLY

1. Remove and discard Seal Ring (A).
2. Remove and discard Bearing (B).
3. Remove and discard Bearing (D).
4. Inspect first stage shaft assembly (C).

ASSEMBLE FIRST STAGE ASSEMBLY

NOTE: Press only on inner race of bearing.

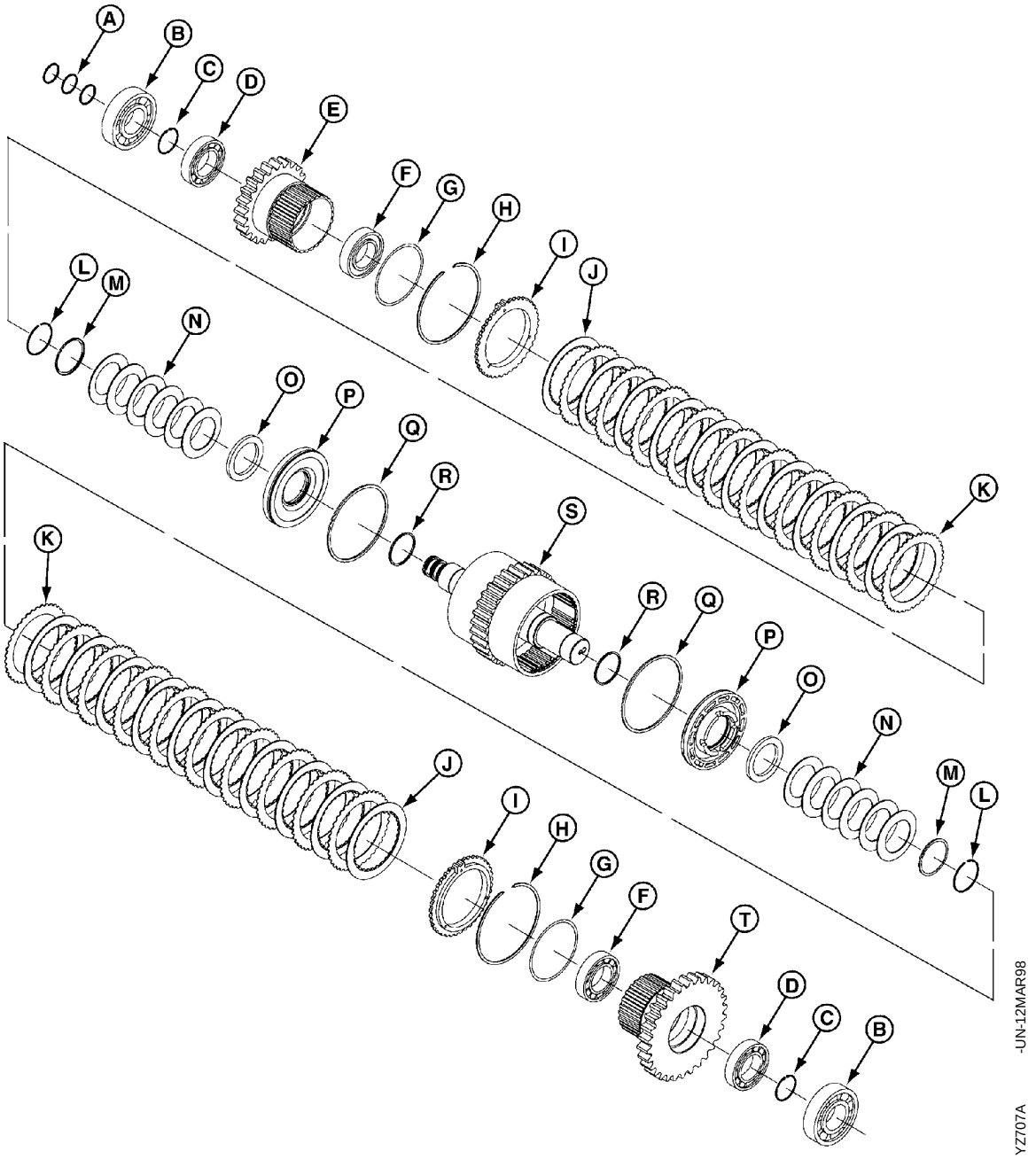
1. Install new bearing (B).
2. Install new bearing (D).

NOTE: Refer to Sizing Seal Rings in this group.

3. Install new seal ring (A).

YZ,CTM147,45,17-19-05MAY98

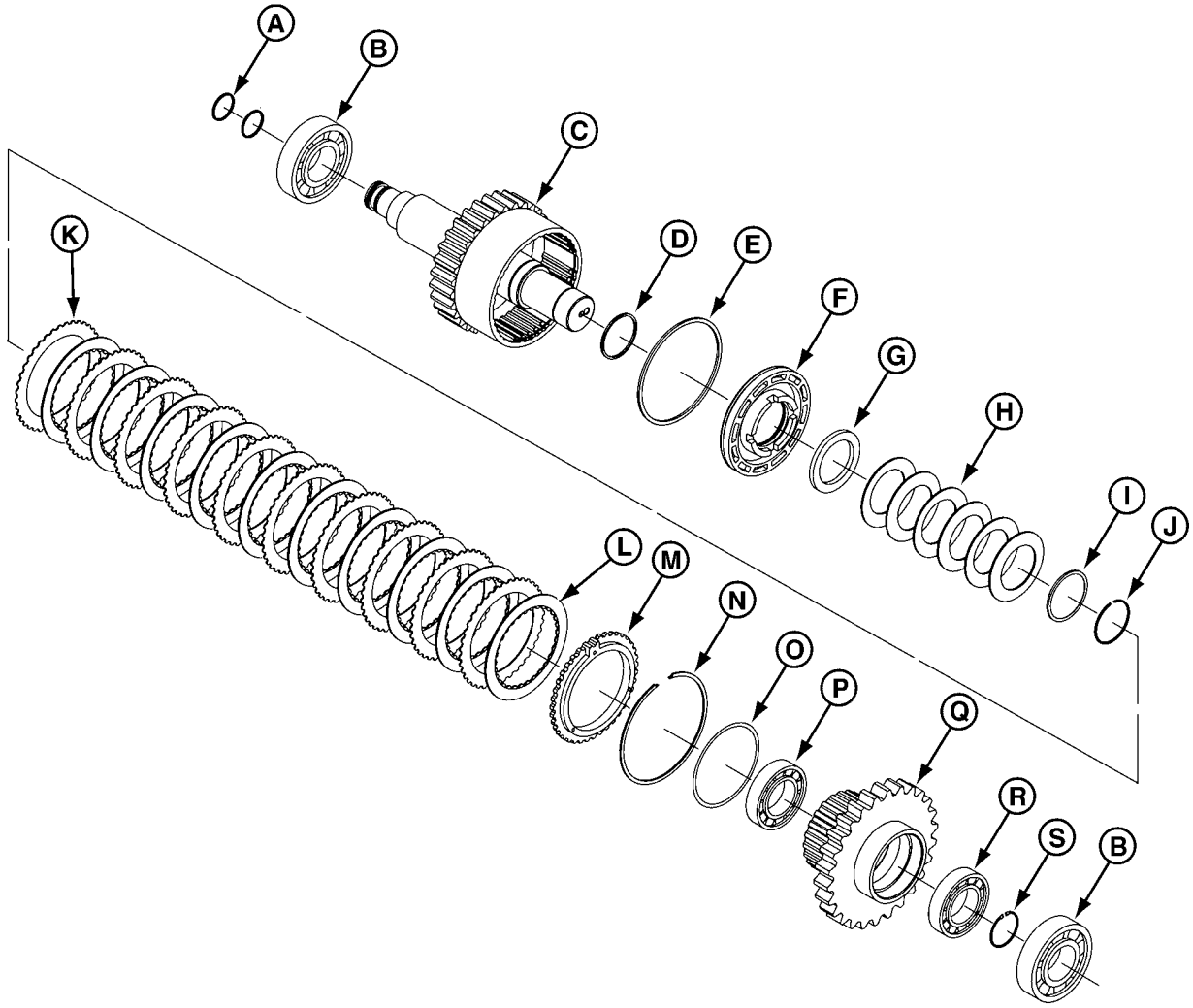
SECOND STAGE CLUTCH ASSEMBLY (DF150)



A—Seal Ring (3 used)
B—Ball Bearing (2 used)
C—Retaining Ring (2 used)
D—Bearing (2 used)
E—Clutch Gear
F—Bearing (2 used)
G—O-ring (2 used)
H—Snap ring (2 used)
I—Clutch Plate Retainer (2 used)
J—Clutch Plate (20 used)
K—Clutch Separator Plate (20 used)
L—Retainer Ring (2 used)
M—Snap Ring Retainer (2 used)
N—Clutch Return Spring (12 used)
O—Lube Shutoff Washer (2 used)
P—Clutch Piston (2 used)
Q—Piston Outer Seal (2 used)
R—O-ring (2 used)
S—2nd Stage Shaft Assembly
T—Clutch Gear

YZ,CTM147,45,16-19-05MAY98

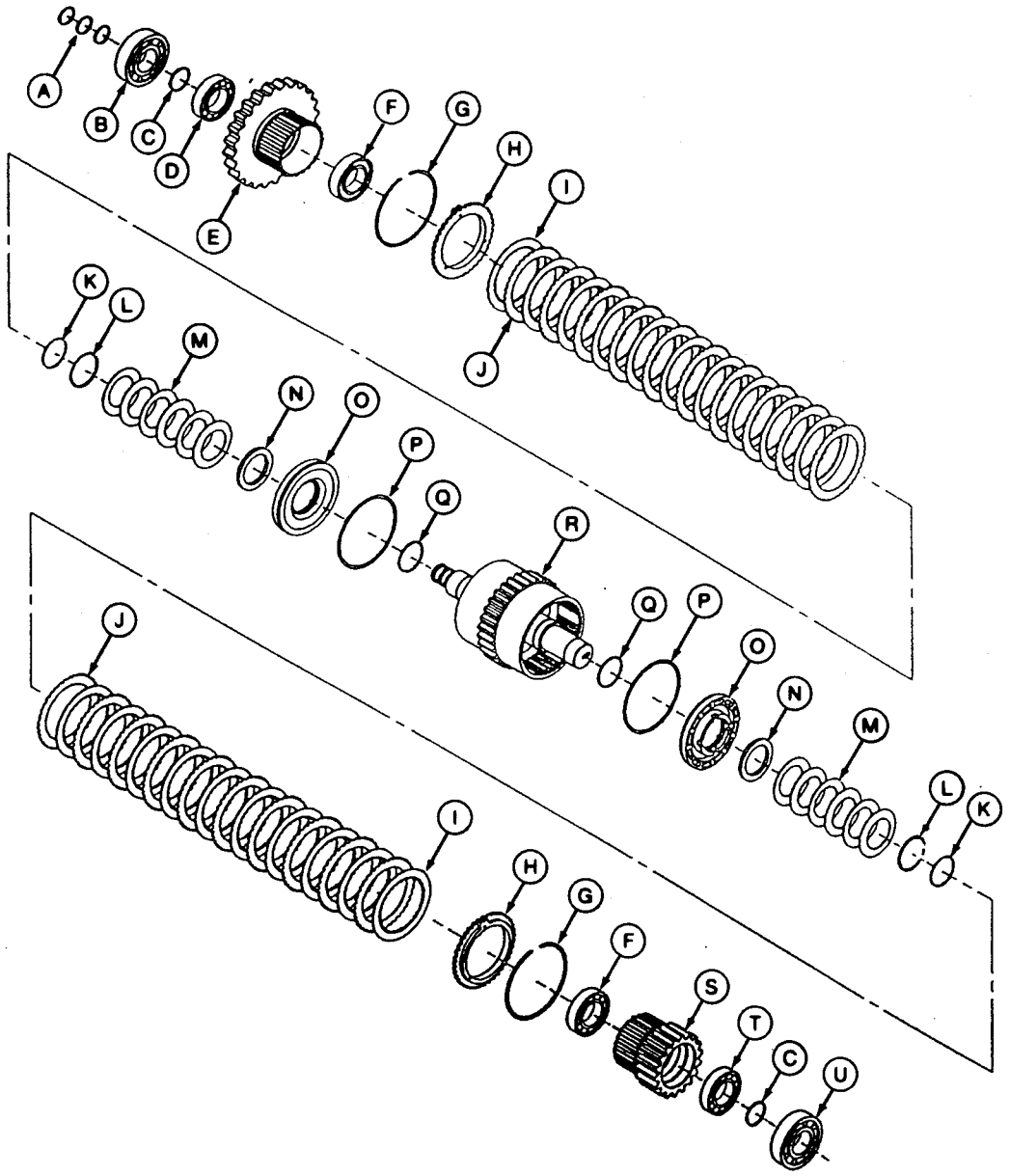
THIRD STAGE CLUTCH ASSEMBLY (DF150)



A-Seal Ring (2 used)
B-Ball Bearing (2 used)
C-3rd Stage Shaft Assembly
D-O-ring
E-Piston Outer Seal
F-Clutch Piston
G-Lube Shutoff Washer
H-Clutch Return Spring (6 used)
I-Snap Ring Retainer
J-Retaining Ring
K-Clutch Separator Plate (10 used)
L-Clutch Plate (10 used)
M-Clutch Plate Retainer
N-Snap Ring
O-O-ring
P-Bearing
Q-Clutch Gear
R-Bearing
S-Retaining Ring

YZ,CTM147,45,38-19-05MAY98

FOURTH STAGE CLUTCH ASSEMBLY

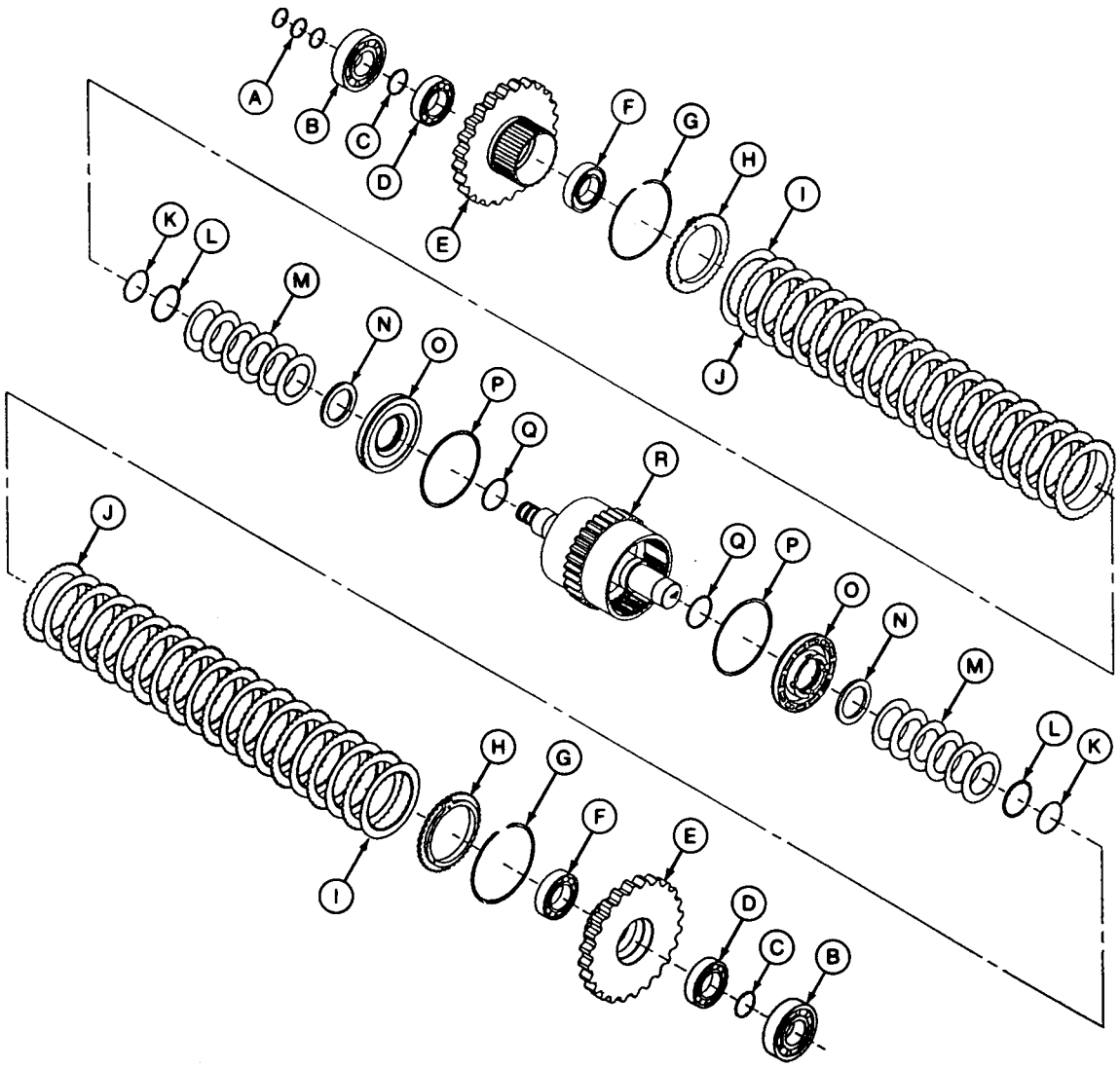


YZ716 -UN-05NOV93

A—Seal ring (3 used)
B—Bearing
C—Snap ring (2 used)
D—Bearing
E—4th clutch assembly gear
F—Bearing (2 used)
G—Snap ring (2 used)
H—Clutch plate retainer
I—Clutch plate (DF-150 20 used)
I—Clutch plate (DF-250 22 used)
J—Clutch separator plates (DF-150 20 used)
J—Clutch separator plates (DF-250 22 used)
K—Retaining ring (2 used)
L—Snap ring retainer (2 used)
M—Clutch retainer spring (12 used)
N—Lube shutoff piston (2 used)
O—Clutch piston (2 used)
P—Piston outer seal (2 used)
Q—O-ring
R—4th and 5th stage shaft assembly
S—38th clutch gear
T—Bearing
U—Bearing

YZ,CTM147,45,40-19-05MAY98

FIFTH STAGE CLUTCH ASSEMBLY



A—Seal ring (3 used)
B—Bearing (2 used)
C—Snap ring (2 used)
D—Bearing (2 used)
E—75 tooth clutch gear (2 used)
F—Bearing (2 used)
G—Snap ring (2 used)
H—Clutch plate retainer (2 used)
I—Clutch plate (DF-150 20 used)
I—Clutch plate (DF-250 22 used)
J—Clutch separator plate (DF-150 20 used)
J—Clutch separator plate (DF-250 22 used)
K—Retaining ring (2 used)
L—Snap ring retainer (2 used)
M—Clutch retainer spring (12 used)
N—Lube shutoff washer (2 used)
O—Clutch piston (2 used)
P—Outer piston seal (2 used)
Q—O-ring (2 used)
R—4th and 5th stage shaft assembly

YZ,CTM147,45,39-19-05MAY98

DISASSEMBLE CLUTCH STAGE ASSEMBLY

All clutch stage assemblies in the DF series transmission assemble and disassemble in the same manner. In this manual we show the disassembly and assembly of the second stage clutch.

YZ638 -UN-19MAR98

1. Remove three teflon seal rings.

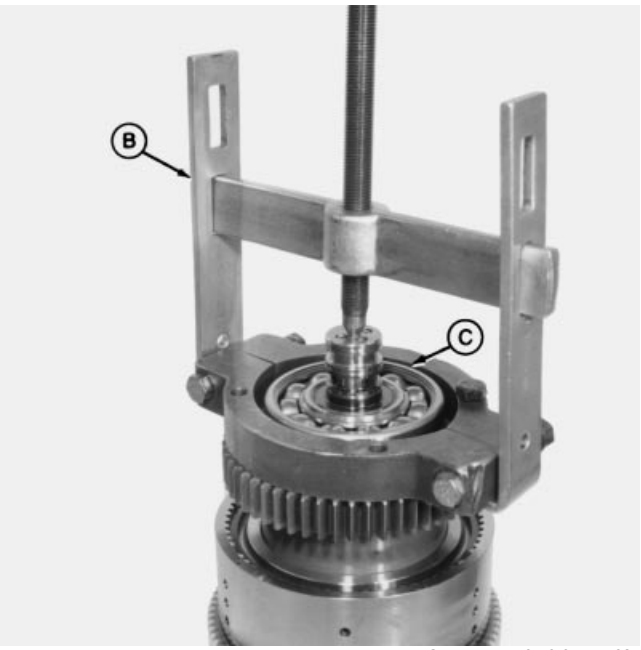
YZ639 -UN-19MAR98

YZ,CTM147,45,18-19-05MAY98

2. Install bearing removal tool (A).

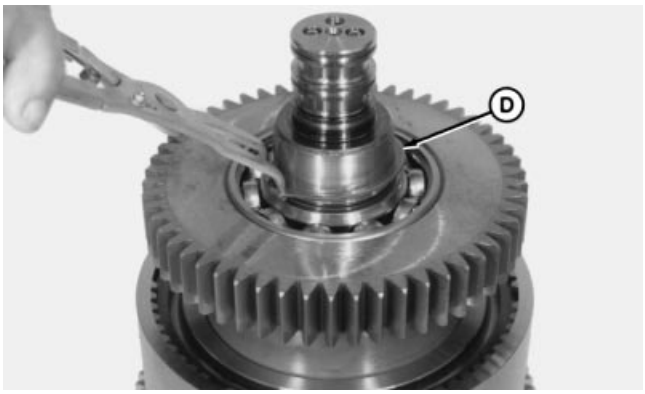
3. Install gear puller (B) onto bearing removal tool.

4. Remove bearing (C) from shaft assembly.



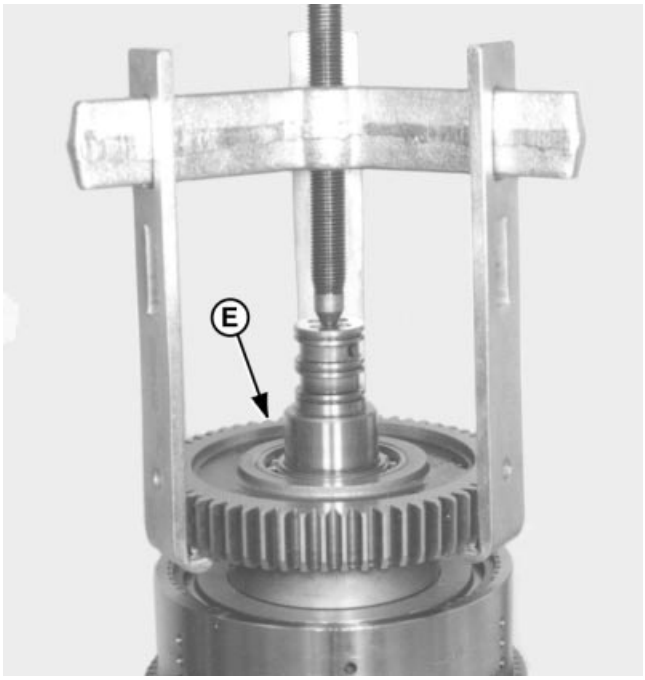
YZ,CTM147,45,19-19-05MAY98

5. Remove snap ring (D) from shaft assembly.



YZ642 -UN-19MAR98

6. Install gear puller.
7. Remove clutch gear (E).



YZ404A -UN-12MAR98

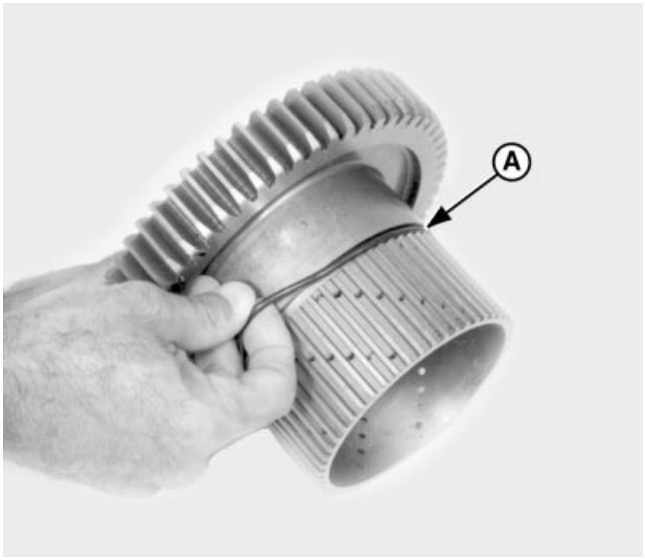
YZ,CTM147,45,20-19-05MAY98

8. Remove bearing (A).

CTM147,45,20A -19-05MAY98

9. Remove o-ring (A).

10. Inspect for wear and damage.



CTM147,45,20B -19-05MAY98

CAUTION: Wear eye protection when removing snap ring.

11. Remove snap ring (A).

YZ644 -UN-19MAR98

YZ,CTM147,45,21-19-05MAY98

12. Turn shaft assembly over. Remove all clutch and separator plates.

YZ645 -UN-19MAR98

YZ,CTM147,45,15-19-05MAY98

13. Turn shaft assembly over.
14. Install puller.
15. Remove ball bearing and discard bearing.

YZ647 -UN-19MAR98

YZ,CTM147,45,22-19-05MAY98

16. Place shaft assembly on press.

17. Use press tool (B) to compress clutch return springs.

NOTE: See group 99 for special tools.

18. Remove snap ring (C).

YZ,CTM147,45,23-19-05MAY98

IMPORTANT: Pay attention to the assembly of the clutch return springs. They must be reassembled in the same way.

19. Lift out snap ring, retaining ring, and clutch return springs.

20. Remove lube shutoff washer.

YZ,CTM147,45,24-19-05MAY98

CAUTION: Wear eye protection when removing piston from cylinder.

21. Apply air pressure through oil passage to force piston from shaft assembly.

YZ652 -UN-19MAR98

22. Remove piston from cylinder.

23. Remove O-ring and piston outer seal from piston.

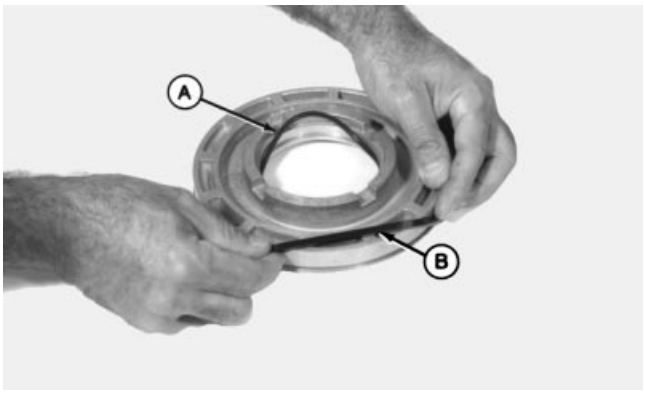
24. Inspect all parts.

YZ653 -UN-19MAR98

YZ,CTM147,45,25-19-05MAY98

ASSEMBLE CLUTCH STAGE ASSEMBLY

1. Install new O-ring (A).
2. Install new piston outer seal (B).



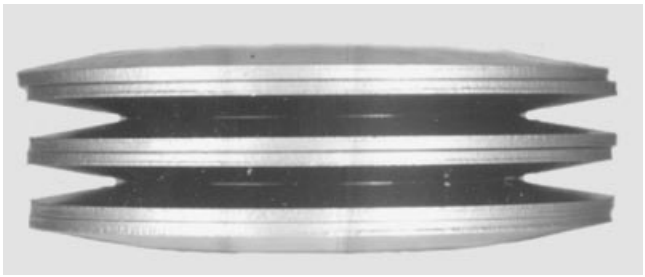
YZ655 -UN-19MAR98

3. Install clutch piston (C).
4. Install lube shutoff washer (D).

YZ656 -UN-19MAR98

YZ,CTM147,45,26-19-05MAY98

IMPORTANT: Install clutch return springs (A) correctly. Use the photograph as a guide.



-UN-20MAR97
YZ853

5. Install clutch return springs (A).

-UN-19MAR98
YZ657

6. Place press tool (B) over shaft.

7. Place snap ring retainer (C) and retaining ring (D) over shaft.

-UN-19MAR98
YZ659

YZ,CTM147,45,27-19-05MAY98

8. Compress clutch return springs.

9. Install retaining ring (E).

10. Release pressure on clutch return springs slowly, be sure snap ring retainer is properly positioned.

YZ,CTM147,45,28-19-10MAR98

NOTE: Clutch separator plates are all steel with external spline teeth. Clutch plates have a lining material on the face and internal spline teeth. Lubricate and install one plate at a time. First install a clutch separator plate then a clutch plate. Continue until all plates are installed.

11. Install clutch separator plate (A).

12. Install clutch plate (B).

Repeat steps 11 and 12 until all plates are installed.

YZ,CTM147,45,29-19-05MAY98

13. Install clutch plate retainer (A).

CAUTION: Wear eye protection when installing snap ring.

14. Install snap ring (B).

YZ,CTM147,45,30-19-05MAY98

IMPORTANT: Clutch plate splines must be aligned before installing bearings on shaft assembly to avoid clutch plate damage.

15. Use gear and hub assembly to align clutch plates and separator plates.

16. After aligning clutch plates remove gear and hub assembly.

YZ664 -UN-19MAR98

IMPORTANT: Seal side of bearing goes toward the clutch plates.

17. Install new bearing with seal side of bearing toward clutch plates.

YZ665 -UN-19MAR98

YZ,CTM147,45,31-19-05MAY98

18. Press bearing, seal side down, until bearing contacts shoulder of shaft.

YZ666 -UN-20MAR98

19. Install hub and gear assembly (A).

20. Place new bearing (B) on shaft, start bearing into the gear and hub assembly.

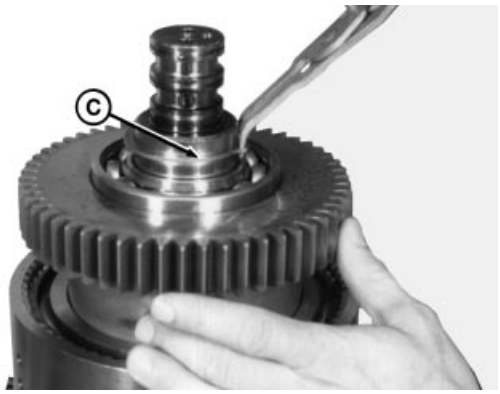
IMPORTANT: Start bearing into gear and hub. DO NOT press bearing below snap ring groove in shaft. Pressing bearing too far into gear will preload bearing. This will cause the bearing to fail.

21. PARTIALLY install bearing into gear and hub assembly.

YZ667 -UN-19MAR98

YZ,CTM147,45,32-19-05MAY98

22. Position snap ring (C) on top of bearing.



23. Place press tool on top of snap ring.

24. Press only on snap ring. Press until snap ring slips into snap ring groove.

NOTE: Check clutch gear for end play. It must have at least .25 mm (.010 in) end play.

YZ,CTM147,45,33-19-05MAY98

25. Install new outer bearing (D).

YZ,CTM147,45,34-19-05MAY98

SIZING SEAL RINGS

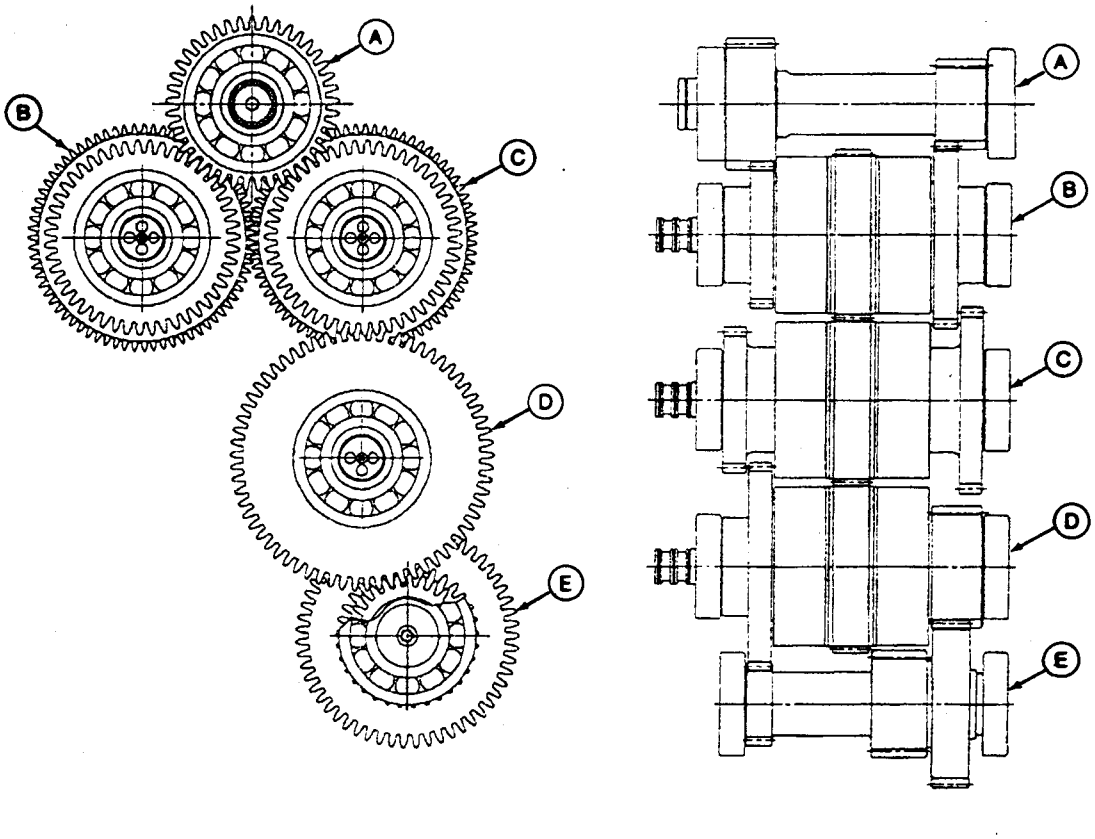
IMPORTANT: Always use new seal rings. The seal rings must be sized to fit the shaft groove tightly to avoid damage during installation of front housing. Check and size seal rings before installation of front housing.

1. Twist seal ring into a tight circle, approximately 3/4 inch in diameter.

2. Install three seal rings in the ring grooves in the shaft assembly.

YZ,CTM147,45,35-19-06MAY98

INSTALL STAGE ASSEMBLIES INTO REAR HOUSING



DF150, 4 speeds forward, 4 reverse

A-First stage shaft assemble
B-Third stage clutch assemble
C-Second stage clutch assemble
D-Fourth stage clutch assemble
E-Sixth stage shaft assemble

IMPORTANT: During assembly notice 4 holes in end of shafts on 2nd and 3rd stages. Three holes in end of 4th stage shaft. When working on a DF-150 four speed forward and four speeds reverse transmission, be sure second and third stage clutch assemblies are in proper arrangement. These two clutch assemblies can be installed backwards. Output shaft cannot be rotated if 2nd and 3rd clutch assemblies are installed into the transmission in a reverse order.

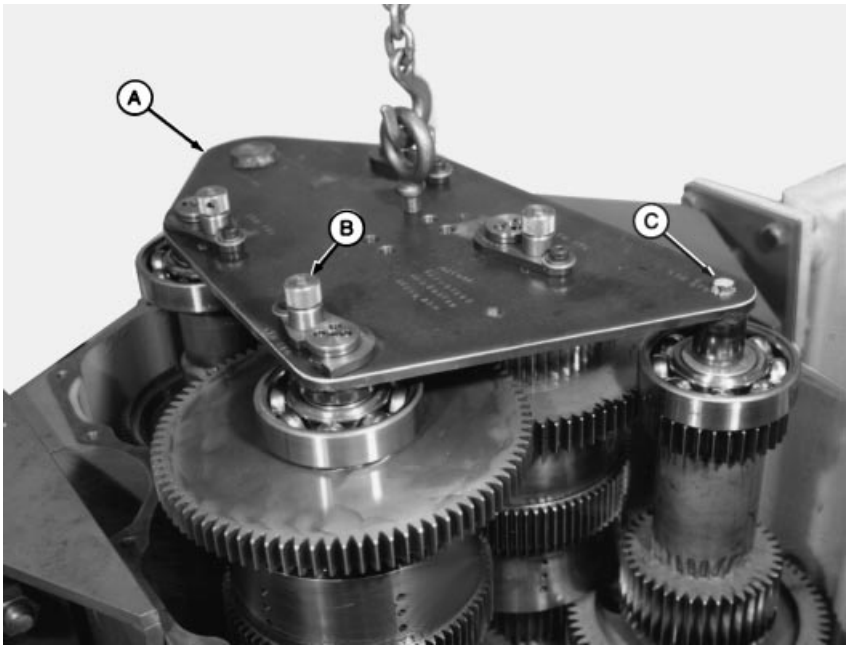
YZ,CTM147,45,50-19-05MAY98

1. Arrange stage assemblies.
2. Install lifting tool.

YZ,CTM147,45,36-19-05MAY98

3. Secure all stage assemblies to lifting tool.

YZ,CTM147,45,14-19-05MAY98



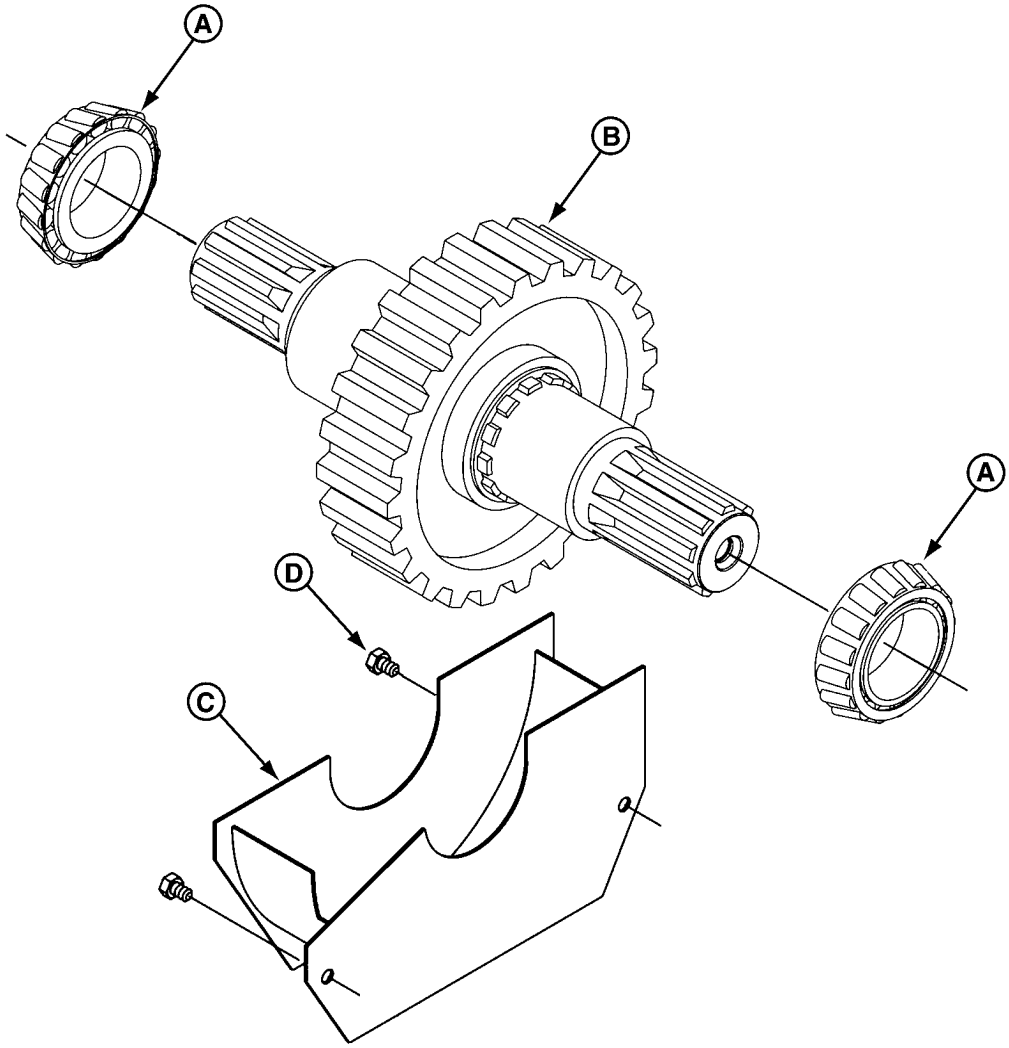
4. Install stage assemblies.

5. Move locks (B) away from shaft grooves and remove bolt (C) from lifting tool (A).

6. Remove lifting tool carefully from stage assemblies to avoid damage to seal rings.

YZ,CTM147,45,37-19-05MAY98

INSTALL OUTPUT GROUP (NO DISCONNECT) AND OIL TROUGH



YZ796A -UN-12MAR98

A—Bearing cone (2 used)

B—Seventh stage output shaft gear assembly

C—Oil Trough Assembly

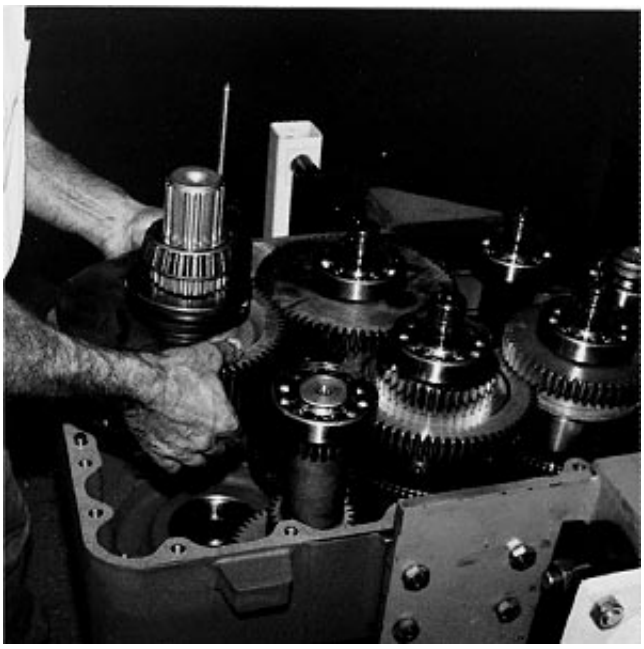
D—Cap Screw M8x12 8.8 (2 used)

CTM147,45,42A -19-05MAY98

INSTALL OUTPUT GROUP AND OIL TROUGH

NOTE: Be sure new bearing cup has been installed in main case rear housing. Oil bearing cup before installing seventh stage assembly. See group 50 (remove bearing cup).

1. Install seventh stage assembly into main case rear housing.



YZ780 -UN-13DEC93

YZ,CTM147,45,42-19-05MAY98

2. Install two cap screws (A).

3. Tighten cap screws (A) to 25 N·m (18 lb-ft).

YZ778 -UN-13DEC93

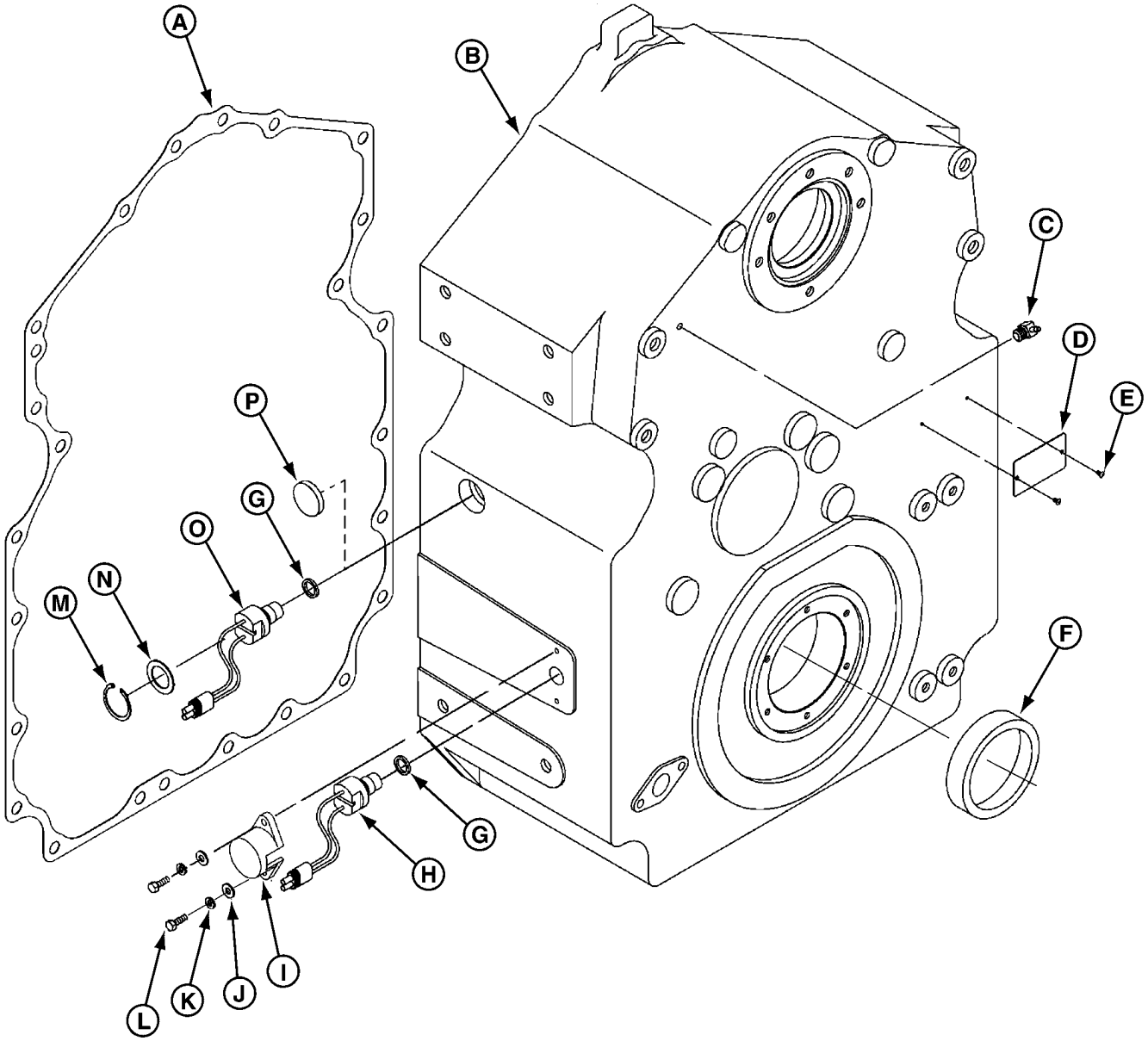
YZ,CTM147,45,43-19-06MAY98

SPECIFICATIONS

Item	Measurement	Specification
Lift Hanger and Cover-to-Main Case Rear Housing Cap screw.	Torque	87 N·m (64 lb-ft)
Bearing Retainer-to-Main Case Rear Housing cap screws.	Torque	25 N·m (18 lb-ft)
Yoke-to-Output Shaft cap screw.	Torque	215 N·m (159 lb-ft)
Output Shaft.	End play	0± .051 mm (0± .002 inch)

YZCTM147,50,SPC-19-05MAY98

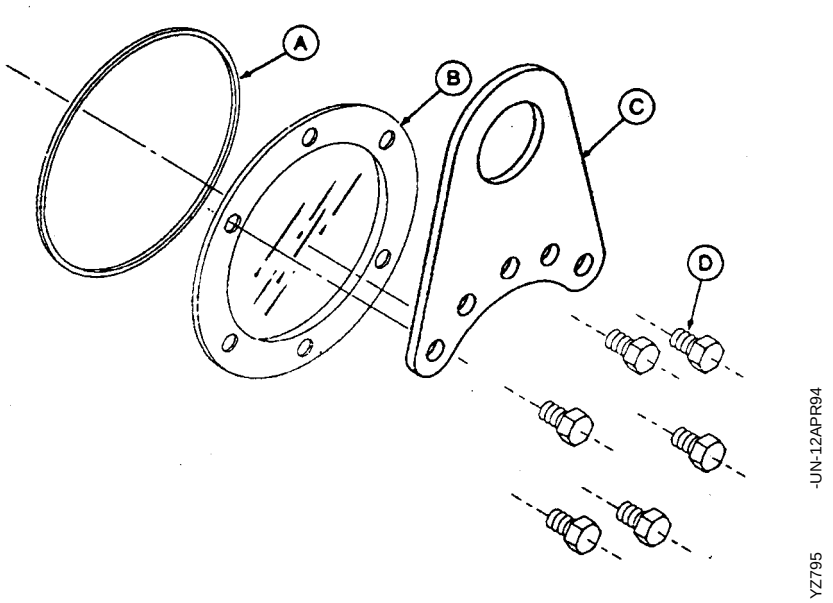
REAR HOUSING COMPONENT IDENTIFICATION (DF250)



A—Gasket
B—Rear Housing (DF 250)
C—Elbow
D—Identification Plate
E—Drive Screw (2 used)
F—Bearing Cup
G—O-ring (2 used)
H—Magnetic Pickup Sensor
I—Cover
J—Washer (2 used)
K—Lock Washer (2 used)
L—Cap Screw M6x20 8.8 (2 used)
M—Snap Ring
N—Flat Washer
O—Magnetic Pickup Sensor
P—Plug (If Magnetic Pickup Sensor Not Used)

YZ,CTM147,50,14-19-05MAY98

FIRST STAGE COVER GROUP

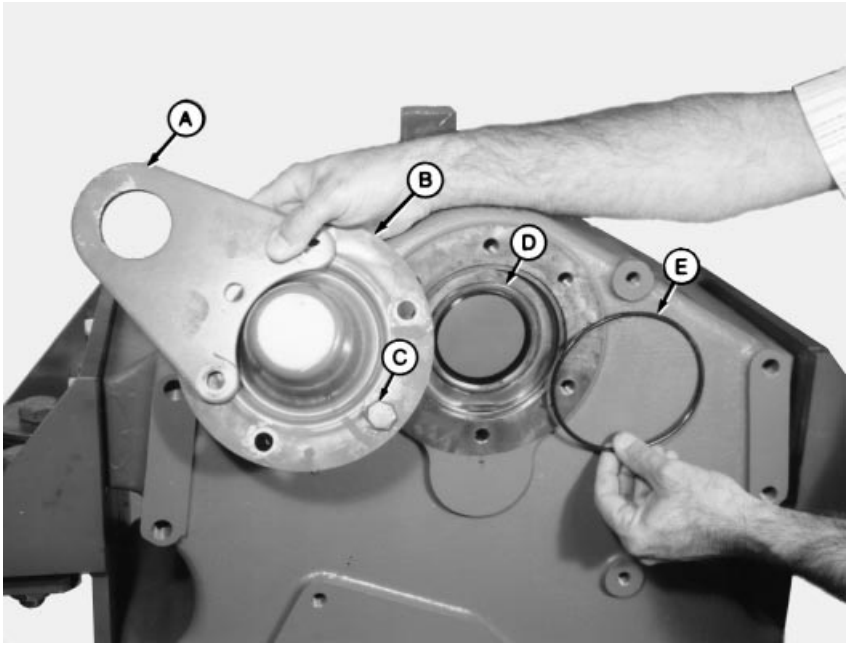


A—O-ring **B—First stage cover** **C—Lift hanger** **D—Cap screw (6 used)**

YZ,CTM147,50,15-19-05MAY98

REMOVE FIRST STAGE COVER GROUP

1. Remove cap screws (C).



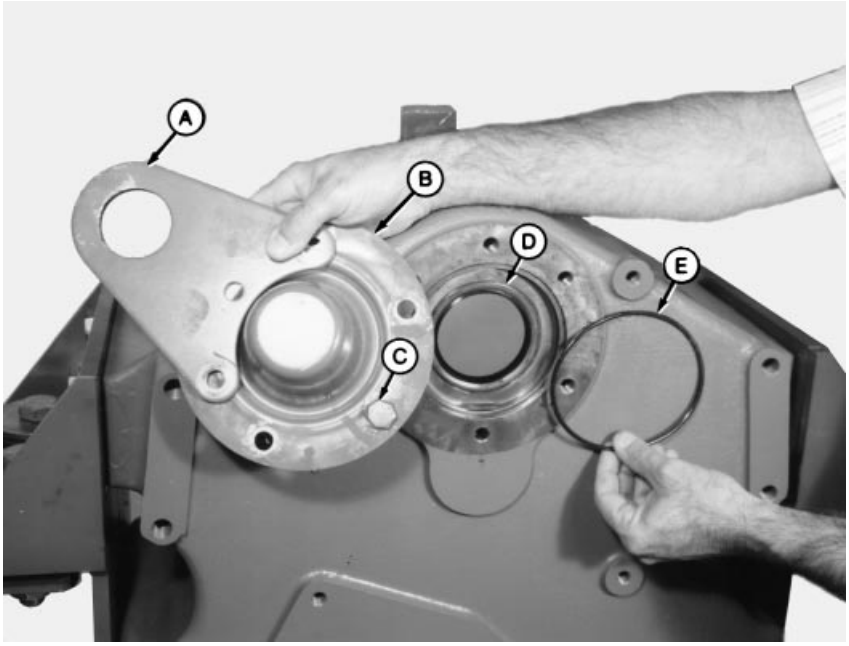
A—Lift hanger
B—Cover
C—Cap screw (5)
D—Oil seal
E—O-ring

2. Remove lift hanger (A), cover (B) and O-ring (E).

3. Remove oil seal (D).

YZ,CTM147,50,1 -19-05MAY98

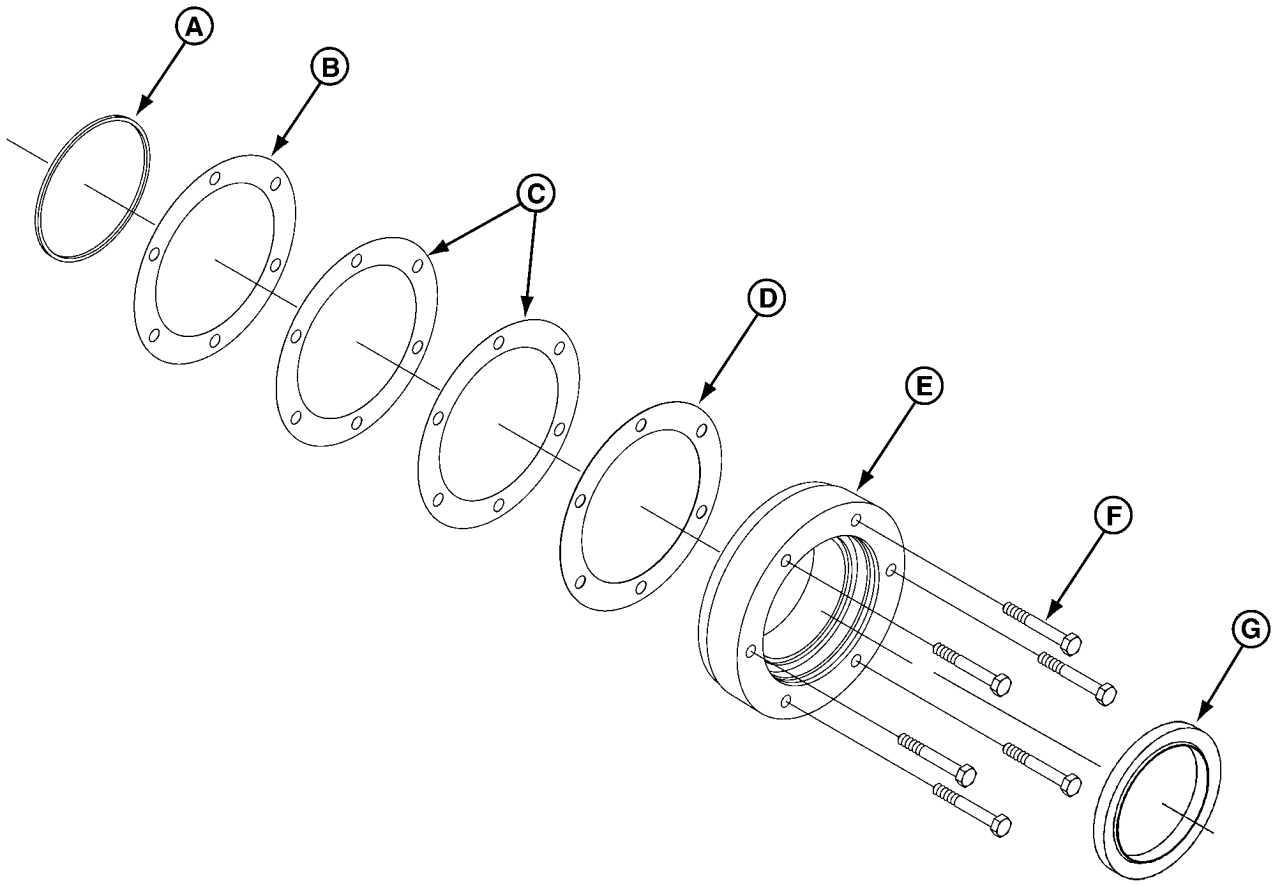
INSTALL FIRST STAGE COVER GROUP



1. Install new oil seal (D).
2. Install new O-ring (E).
3. Align cover (B) with bolt hole pattern in rear housing.
4. Install cap screws (C).
5. Install lift hanger (A) over cover (B).
6. Tighten cap screws to 87 N·m (64 lb-ft).

YZ,CTM147,50,2 -19-05MAY98

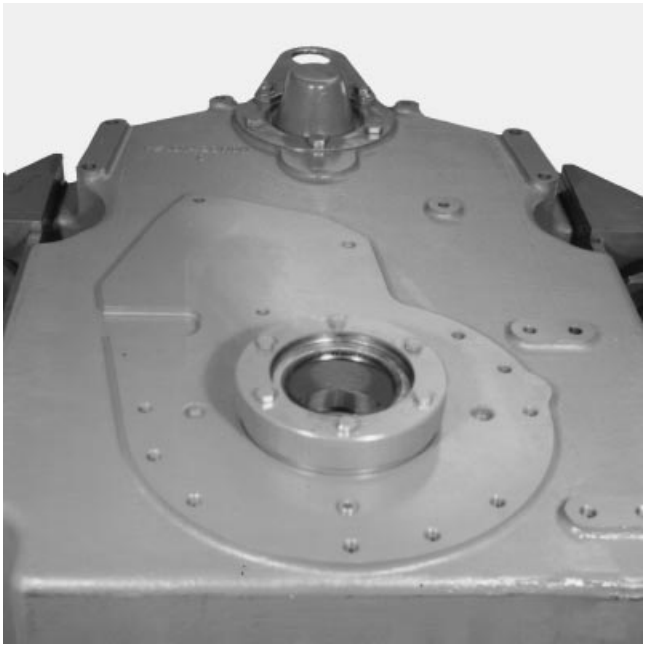
REMOVE BEARING RETAINER



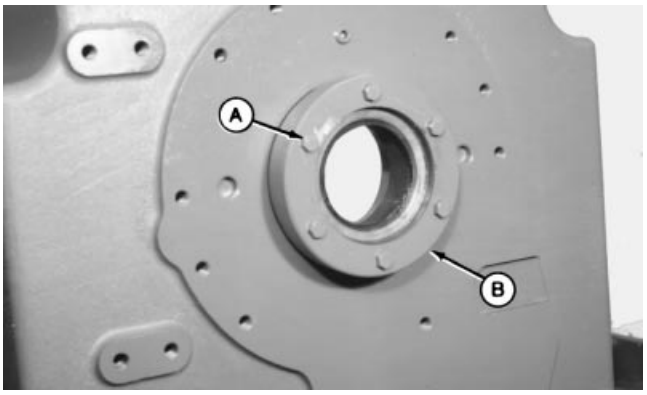
A—O-ring
B—.51 shim (as required)
C—.18 shim (as required)
D—.13 shim (as required)
E—Bearing retainer
F—Cap screw M8x60 8.8 (6 used)
G—Oil seal

YZ,CTM147,50,17-19-05MAY98

1. Position rear housing with bearing retainer up.



-UN-20MAR98
YZ677



-UN-19MAR98
YZ631

2. Remove cap screws (A) from bearing retainer (B).

YZ,CTM147,50,13-19-06MAY98

IMPORTANT: Keep shims together for reassembly.

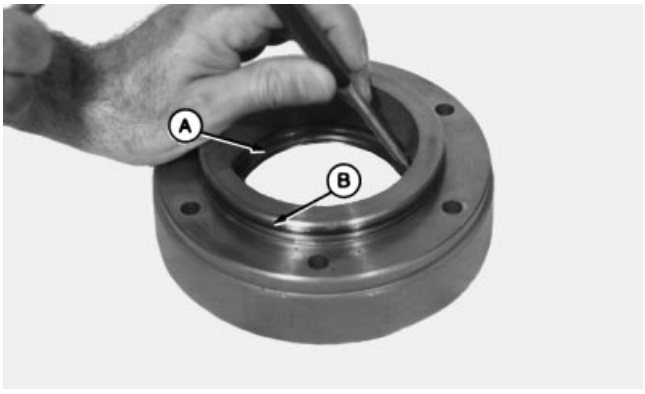
3. Remove bearing retainer and shims.

YZ632 -UN-19MAR98

YZ,CTM147,50,18-19-05MAY98

DISASSEMBLE BEARING RETAINER

• Remove oil seal (A) and O-ring (B).



YZ635 -UN-19MAR98

YZ,CTM147,50,6 -19-05MAY98

ASSEMBLE BEARING RETAINER

1. Install new oil seal.

2. Install new O-ring (A).

YZ,CTM147,50,7 -19-05MAY98

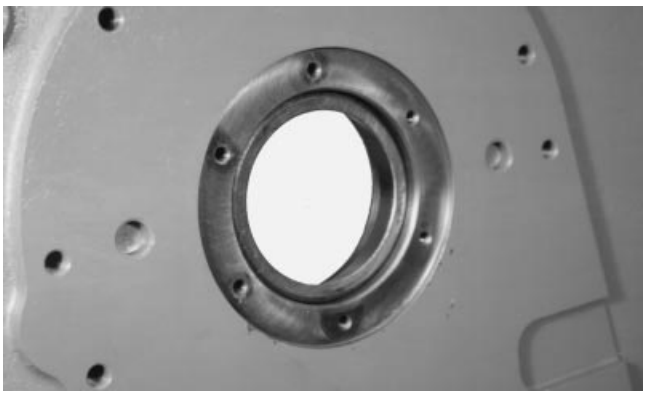
REMOVE AND INSTALL BEARING CUP (REAR HOUSING)

1. Remove bearing cup.

YZ,CTM147,50,4 -19-05MAY98

NOTE: Install bearing cup 1/4 inch past rear housing bore surface. Rear housing bore is a light fit for setting end play of the seventh stage assembly.

2. Install new bearing cup into rear housing 1/4 inch past flush.



YZ,CTM147,50,5 -19-05MAY98

INSTALL BEARING RETAINER (PRELIMINARY INSTALLATION, PRIOR TO SETTING BEARING END PLAY OUTPUT SHAFT)

NOTE: Use all original shims and one additional .010 shim onto bearing retainer for setting end play of the output seventh stage.

1. Place shims on bearing retainer.

2. Install bearing retainer with shims.

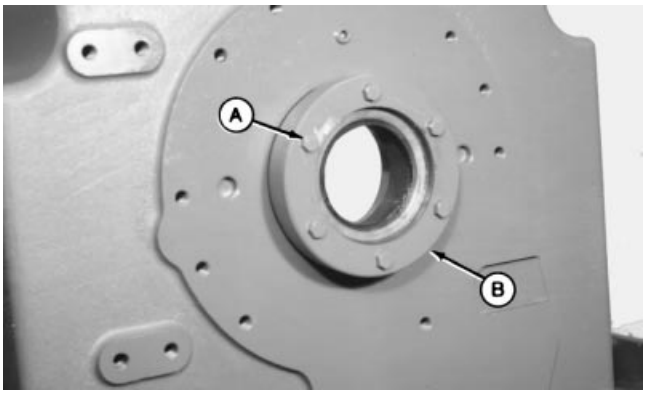
-UN-19MAR98 YZ632

3. Install cap screws (A) through bearing retainer (B) into rear housing.

4. Tighten cap screws but do not tighten to final torque.

NOTE: Refer to group 45 to install gear ratio group into rear housing.

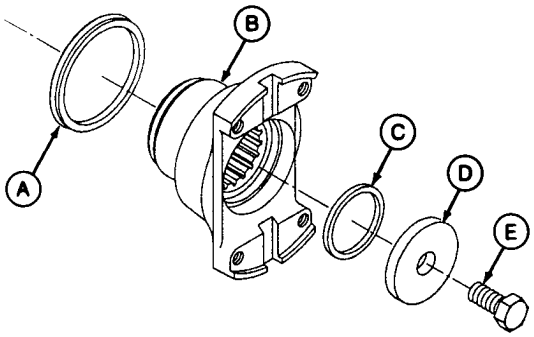
NOTE: Refer to group 40 to install front housing to rear housing.



-UN-19MAR98 YZ631

YZ,CTM147,50,8 -19-06MAY98

SETTING END PLAY OF OUTPUT GROUP



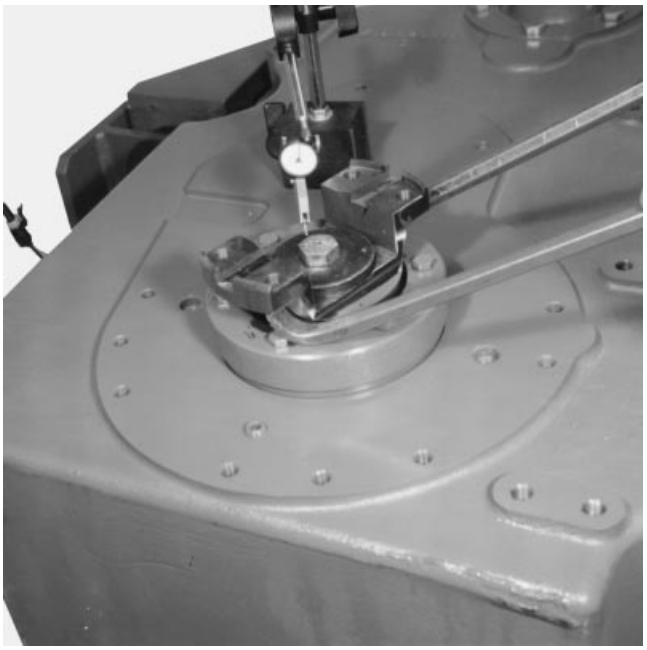
-UN-05NOV93
YZ722

INSTALL OUTPUT YOKE

1. Install yoke (B) with V-ring seal (A) onto splined output shaft.

2. Install O-ring (C), washer (D) and cap screw (E).

3. Tighten cap screw 215 N·m (159 lb-ft).



-UN-20MAR98
YZ680

IMPORTANT: Check and reset output shaft end play whenever new parts are installed. Set End play at a 0 ± .002.

Check end play

IMPORTANT: Check end play with dial indicator on cap screw.

4. Place dial indicator on cap screw.

5. Use pry bars under yoke to check end play.

A—V-ring seal
B—Yoke
C—O-ring
D—Yoke washer
E—Cap screw

YZ,CTM147,50,9 -19-05MAY98

6. Remove cap screw, washer and yoke from seventh stage shaft.

7. Remove bolts from bearing retainer.

8. Remove bearing retainer from rear housing.

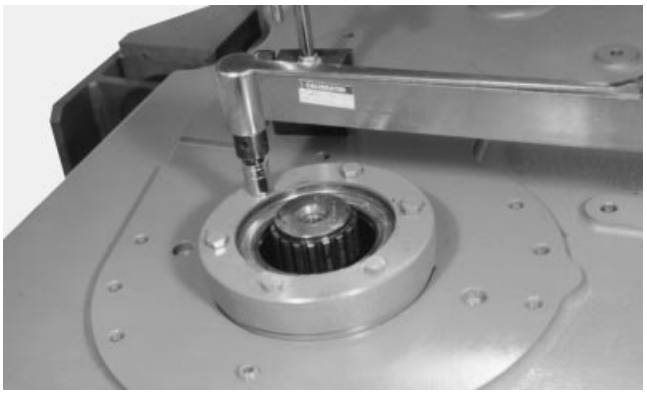
9. Remove or install correct amount of shims to reach a 0 ± .002 amount of end play.

YZ,CTM147,50,10-19-05MAY98

10. Align bearing retainer bolt holes with bolt hole circle in the rear housing.

11. Install cap screws.

12. Tighten cap screws to 25 N·m (18 lb-ft).



13. Install yoke, O-ring, washer and cap screw.

YZ,CTM147,50,11-19-05MAY98

14. Tighten cap screw to 215 N·m (159 lb-ft).

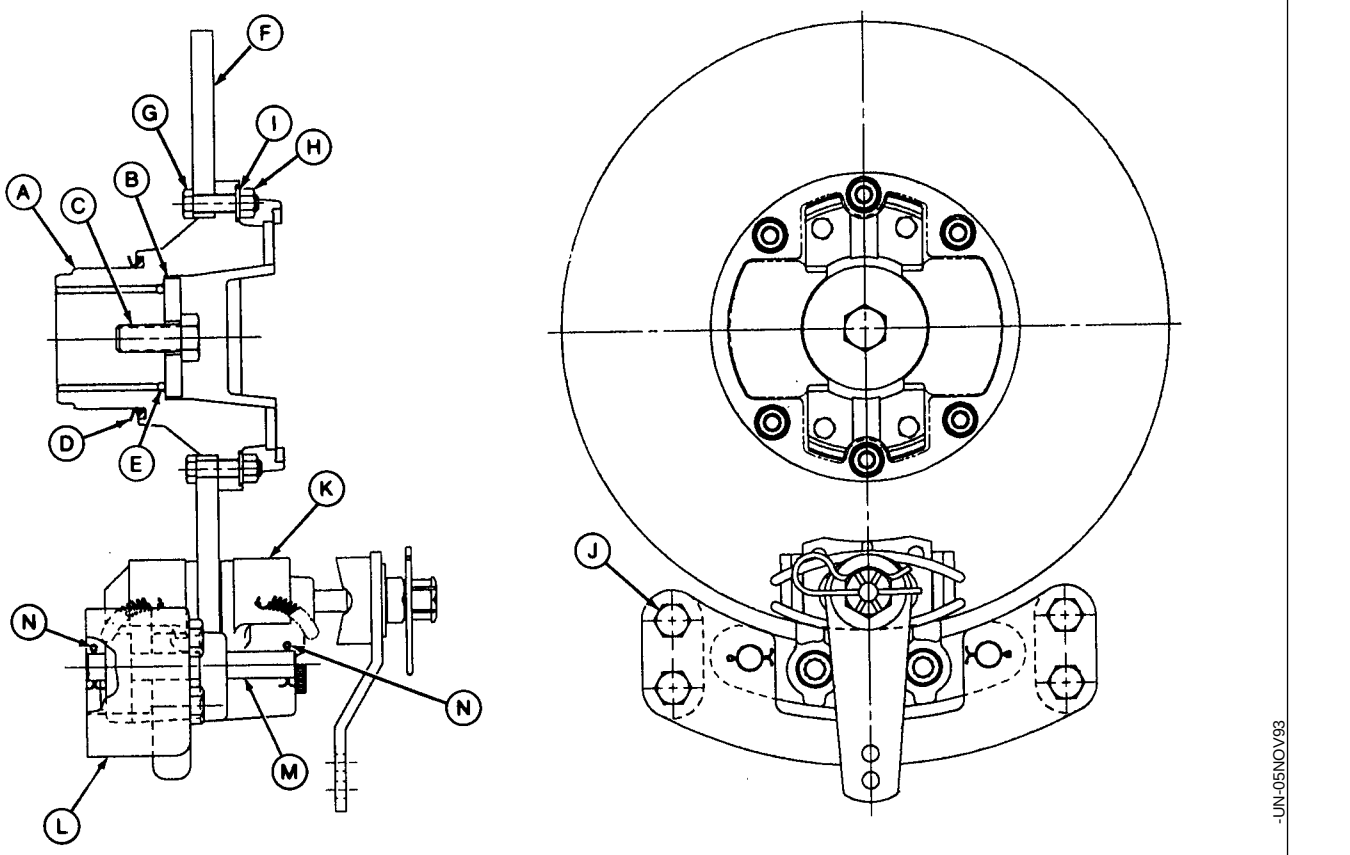
YZ,CTM147,50,12-19-05MAY98

SPECIFICATIONS

Item	Measurement	Specification
Disk Brake-to-Yoke Cap Screw.	Torque	48 N·m (36 lb-ft)
Yoke Flange-to-Output Shaft Cap Screw.	Torque	215 N·m (159 lb-ft)
Caliper Assembly-to-Brake Bracket Cap Screw.	Torque	87 N·m (64 lb-ft)

YZCTM147,55,SPC-19-05MAY98

DISC BRAKE GROUP



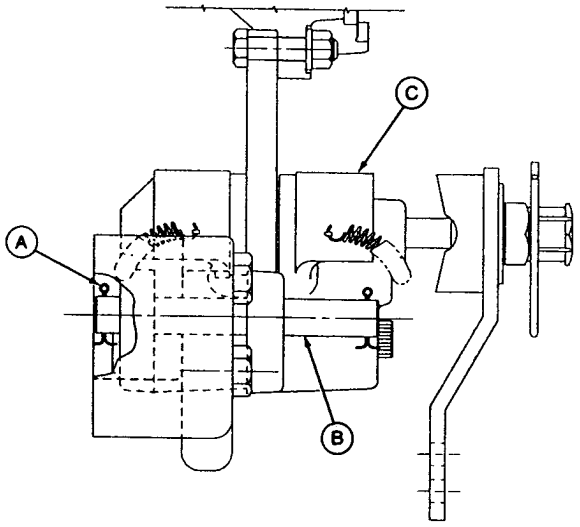
YZ723 -UN-05NOV93

A—Yoke flange
B—Yoke washer
C—Cap screw
D—V-ring seal
E—O-ring
F—Brake disc
G—Cap screw (6 used)
H—Hex nut (6 used)
I—Lock washer (6 used)
J—Cap screw (6 used)
K—Caliper assembly
L—Brake bracket
M—Mount pin (2 used)
N—Cotter pin (4 used)

YZ,CTM147,55,1 -19-05MAY98

DISASSEMBLE DISC BRAKE

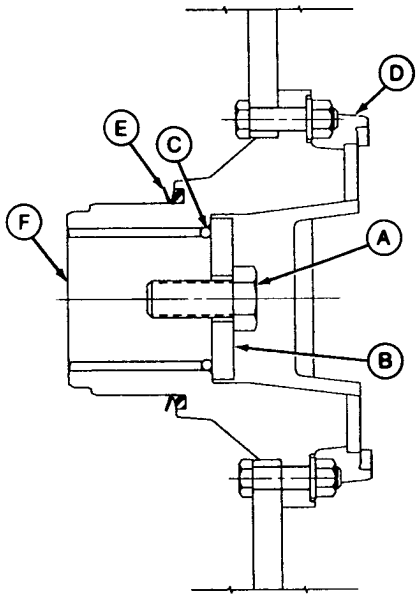
1. Remove Cotter pin (A) two places.
2. Remove two mount pins (B).
3. Remove caliper assembly (C) from brake bracket.



YZ724 -UN-05NOV93

YZ,CTM147,55,2 -19-05MAY98

4. Remove cap screw (A).
5. Remove yoke washer (B) and O-ring (C).
6. Remove yoke flange with brake disc (D) from output shaft (F).



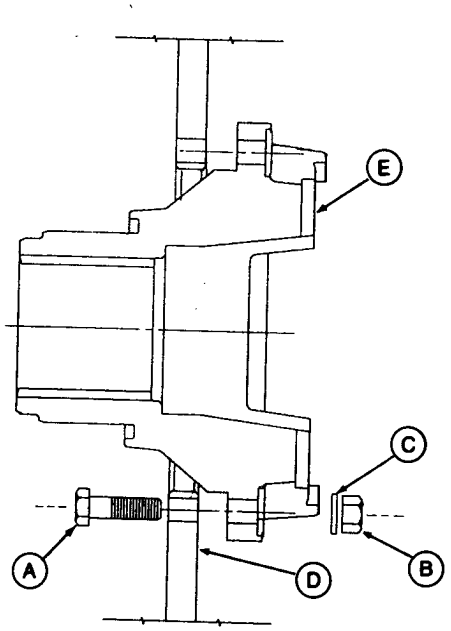
YZ725 -UN-05NOV93

YZ,CTM147,55,3 -19-05MAY98

7. Remove cap screw (A), Hex nut (B) and lock washer (C) six places.

8. Remove brake disc (D) from yoke flange (E).

9. Inspect brake disc and yoke flange splines for wear or damage.



YZ726 -UN-05NOV93

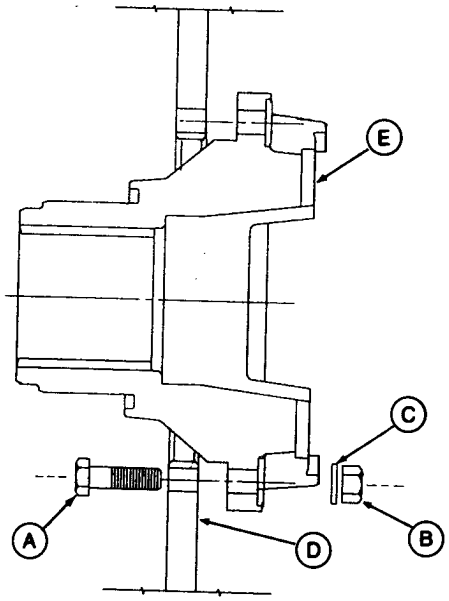
YZ,CTM147,55,4 -19-05MAY98

ASSEMBLE DISC BRAKE

1. Install brake disc (D) to yoke flange (E).

2. Install cap screw (A), Hex nut (B) and lock washer (C) six places.

3. Tighten cap screw to 87 N·m (64 lb ft).

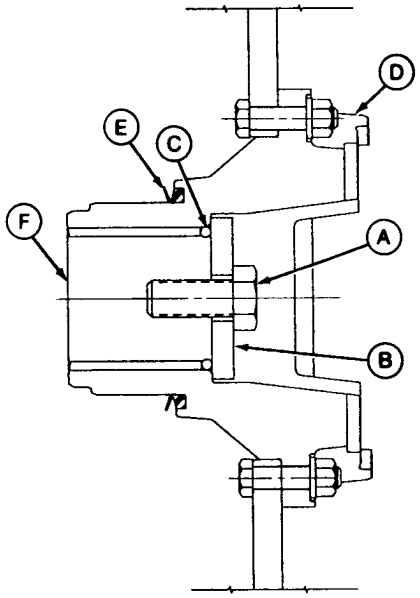


YZ726 -UN-05NOV93

4. Install yoke flange with brake disc (D) on output shaft.

5. Install O-ring (C) yoke washer (B) and cap screw (A).

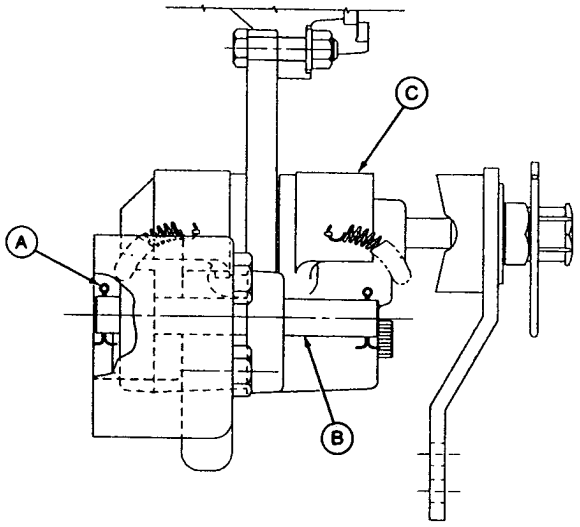
6. Tighten cap screw to 215 N·m (159 lb-ft).



YZ725 -UN-05NOV93

YZ,CTM147,55,5 -19-05MAY98

7. Install caliper assembly (C) on brake bracket.
8. Tighten cap screws 87 N·m (64 lb ft).
9. Install mount pins (B) two places.
10. Install new cotter pins (A) two places.



YZ724 -UN-05NOV93

YZ,CTM147,55,6 -19-05MAY98

GROUP 99

IMPORTANT: The special tools listed below are required to properly service the transmission.

SPECIAL TOOLS USED IN THIS MANUAL:

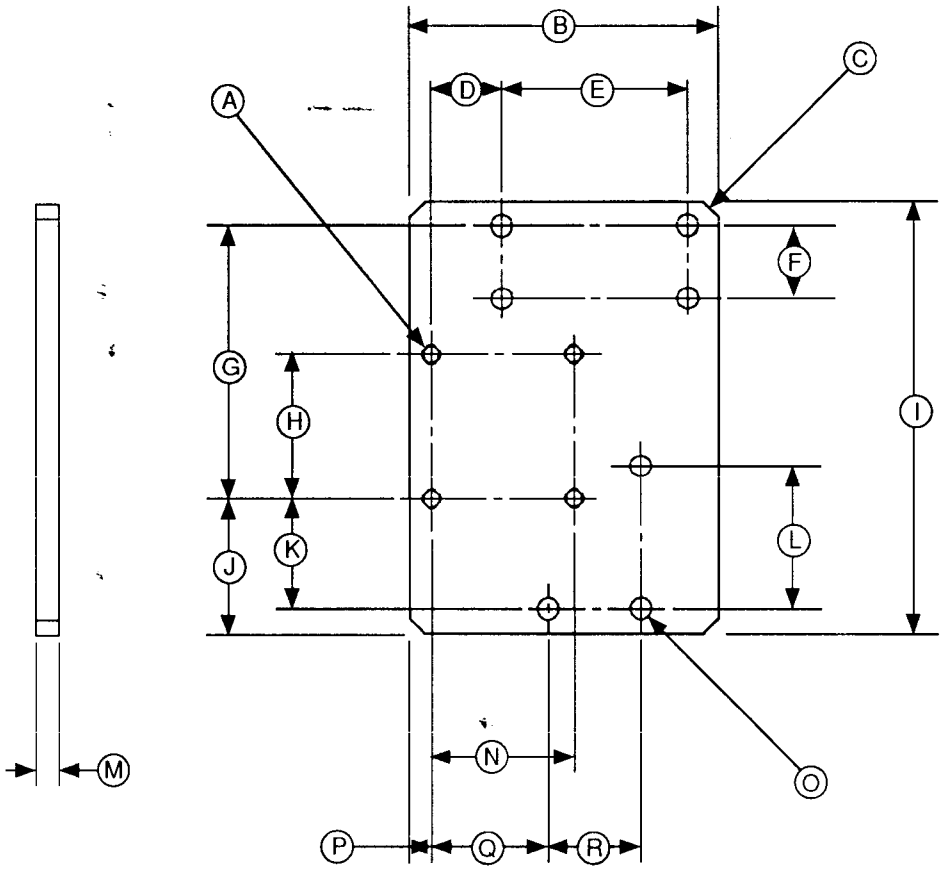
Clutch Stage Lifting tool.
Bore Sleeve removal tool.
Bore Sleeve installation tool.
Transmission Repair Stand.
Transmission Stand Mounting Brackets.
Clutch Return Spring Compression tool.
Front Housing Lifting tool.
Front Housing Relief Valve tool.

Contact FUNK Manufacturing for measured drawings.

Funk Manufacturing Company
Industrial Park, Highway 169 North
P.O. Box 577
Coffeyville, Kansas 67337-0577
Telephone: (316)-252-3400 or 800-844-1377
FAX: (316)-252-3252

YZ,CTM147,99,1 -19-05MAY98

ASSEMBLY STAND PLATE



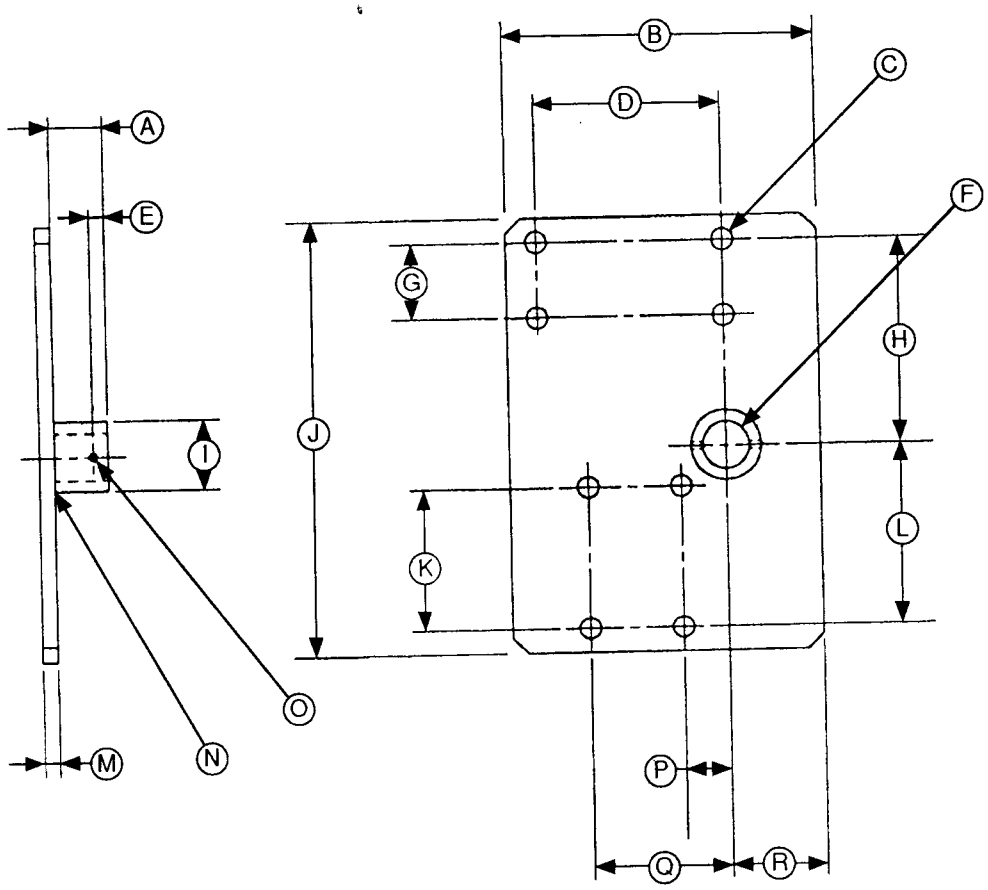
YZ807 -UN-28APR94

A—4X 17/32 Drill Through 5/8-11 UNC-2B Tap through
B—9.968 in. (253.187mm)
C—4x 1/2 x 45˚
D—2.31 in. (58.67mm)
E—5.984 in. (151.993mm)
F—2.362 in. (59.994mm)
G—8.79 in. (223.26mm)
H—4.625 in. (117.475mm)
I—13.875 in. (98.425mm)
J—4.31 in. (109.47mm)
K—3.52 in. (89.40mm)
L—4.528 in. (115.011mm)
M—.75 in. (19.05mm)
N—4.625 in. (117.475mm)
O—7x 11/16 Drill Through
P—.69 in. (17.52mm)
Q—3.77 in. (95.75mm)
R— 2.992 in. (75.996mm)

For use with OTC stand P/N 1735

YZ,CTM147,99,2 -19-05MAY98

ASSEMBLY STAND PLATE



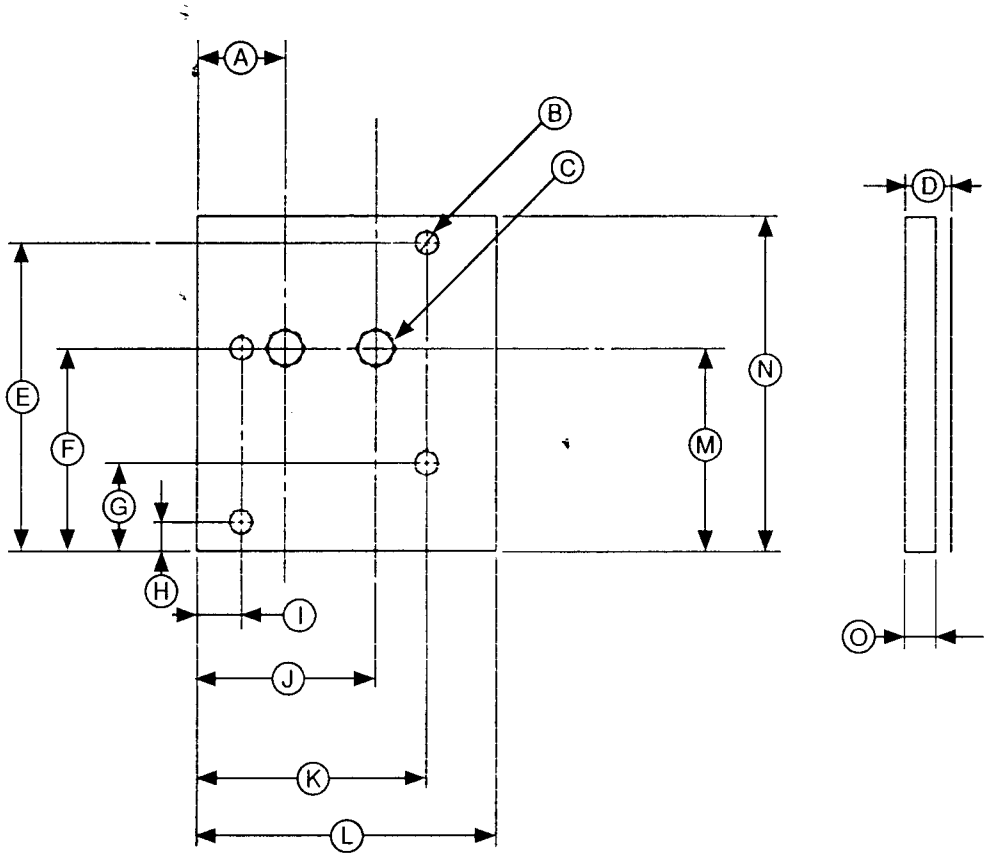
YZ808 -UN-09JUN94

A—1.75 in. (44.45mm)
B—9.96 in. (252.98mm)
C—8X 11/16 Drill Through
D—5.984 in. (151.993mm)
E—.5 in. (12.7mm)
F—1.500—1.505 in. (38.1—38.227mm)
G—2.362 in. (59.994mm)
H—6.48 in. (164.59mm)
I—2.25 in. (57.15mm)
J—13.875 in. (352.425mm)
K—4.528 in. (115.011mm)
L—5.84 in. (148.33mm)
M—.5 in. (12.7mm)
N—.25 (6.35) radius in corner
O—17/64 Drill Through as Shown
P—1.46 in. (37.08mm)
Q—2.992 in. (75.996mm)
R— 3.00 in. (76.2mm)

For use with OTC stand P/N 1735

YZ,CTM147,99,3 -19-05MAY98

FRONT COVER LIFTING TOOL



A-1.42 in. (36.05mm)
B-4X .38 in. (9.52mm)
C-17/32 Drill Through 5/8-11 UNC
D-.75 in. maximum (19.05mm)
E-4.99 in. (126.7mm)
F-3.29 in. (83.6mm)
G-1.44 in. (36.5mm)
H-.47 in. (12mm)
I-.71 in. (18.11mm)
J-2.88 in. (73.17mm)
K-3.70 in. (94.01mm)
L-4.83 in. (122.78mm)
M-3.29 in. (83.6mm)
N-5.43 in. (138mm)
O-.50 in. minimum (12.7mm)
P-1.46 in. (37.08mm)
Q-2.992 in. (75.996mm)
R- 3.00 in. (76.2mm)

NOTE: Used for lifting main case front housing.

YZ,CTM147,99,4 -19-05MAY98

SUCTION LEAK TEST

Some indications of a suction leak includes:
• Erratic oil pressure. Look for rapid fluctuation of gauges.
• Pump and filter hoses jumping.
• Excessive air entrainment in the transmission oil.
• A long prime time (time elapsed from engine start to an indication of pump pressure).

1. Fill to normal level with transmission fluid.

NOTE: See PRESSURE AND TEMPERATURE CHECK PORTS (group 35) for port location.

2. Install a 21 bar (2068 kPa) (300psi) pressure gauge in the pressure port.

3. Start the engine.

4. See if there is an indication of erratic oil pressure.

5. If any of the above conditions are corrected by this procedure, a suction leak exists.

NOTE: Check suction tube fitting.

IMPORTANT: Drain the transmission to the correct level after the test. Failure to do so will result in poor performance and over heating.

6. Drain the transmission to proper level.

YZ,CTM147,100,2-19-05MAY98

SOLENOID VALVE OPERATION

Before troubleshooting the electric circuit of the valve, the chart shows what solenoids are charged when that gear is selected.

DF SERIES EIGHT SPEEDS FORWARD AND FOUR REVERSE

	DF 8/4
Gear Engage	**Solenoid Charged**
F 8th	2 and D
F 7th	1 and D
F 6th	2 and B
F 5th	1 and B
F 4th	2 and C
F 3rd	1 and C
F 2nd	2 and A
F 1st	1 and A
Neutral	
R 1st	3 and A
R 2nd	3 and C
R 3rd	3 and B
R 4th	3 and D

DF SERIES FOUR SPEEDS FORWARD AND FOUR REVERSE

	DF 4/4
Gear Engage	**Solenoid Charged**
F 4th	2 and B
F 3rd	1 and B
F 2nd	2 and A
F 1st	1 and A
Neutral	
R 1st	3 and A
R 2nd	4 and A
R 3rd	3 and B
R 4th	4 and B

YZ,CTM147,100,4-19-05MAY98

CLUTCH SOLENOID VOLTAGE REQUIREMENTS

NOMINAL VOLTAGE	12V	24V
ALLOWABLE VOLTAGE	10—14V	20—28V
CURRENT DRAW	1 AMPS	.6 AMP
CURRENT DRAW MAX.	1.2 AMPS	.7 AMPS
RESISTANCE	14 OHMS ± 3%	53 OHMS ± 3%

** This coil must be used with a Funk approved electronic control module.*

All checks must be made at the valve.

YZ,CTM147,100,6-19-10MAR98

TEST SOLENOIDS

IMPORTANT: If a solenoid is removed from the valve, it must be installed in the same location.

NOTE: To determine the defective clutch is simply a matter of elimination. For example, if the gear selected uses solenoids 1 and A, and low pressure is indicated, select another clutch that uses one of those solenoids. If pressure is good, then the solenoid or clutch not selected is the one that is bad.

To confirm that this is the faulty circuit, select another clutch that uses this solenoid, to assure that the discrepancy is actually in this solenoid or clutch.

1. Select solenoids 1 and A.

If low pressure exists, then solenoid or clutch 1 or A is defective.

2. Select solenoids 2 and A.

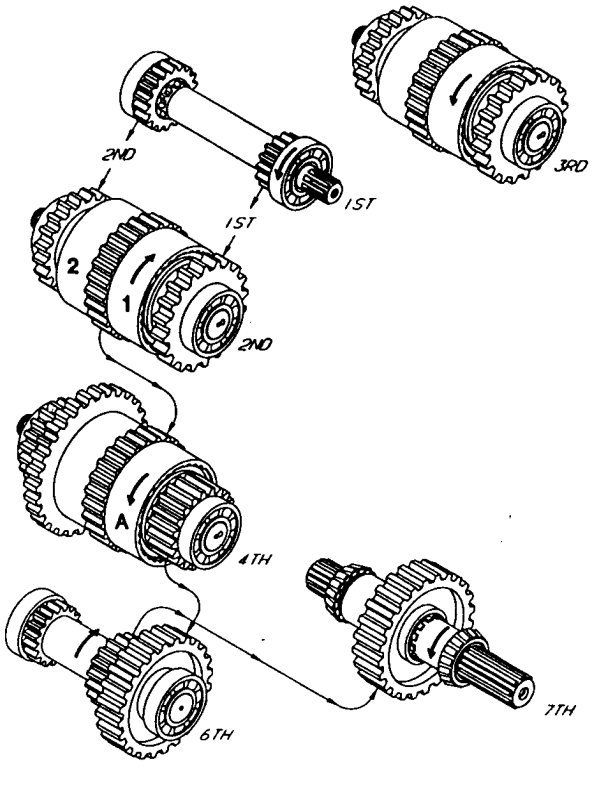
If pressure is OK, then solenoid or clutch 1 is defective.

3. Select solenoids 1 and B.

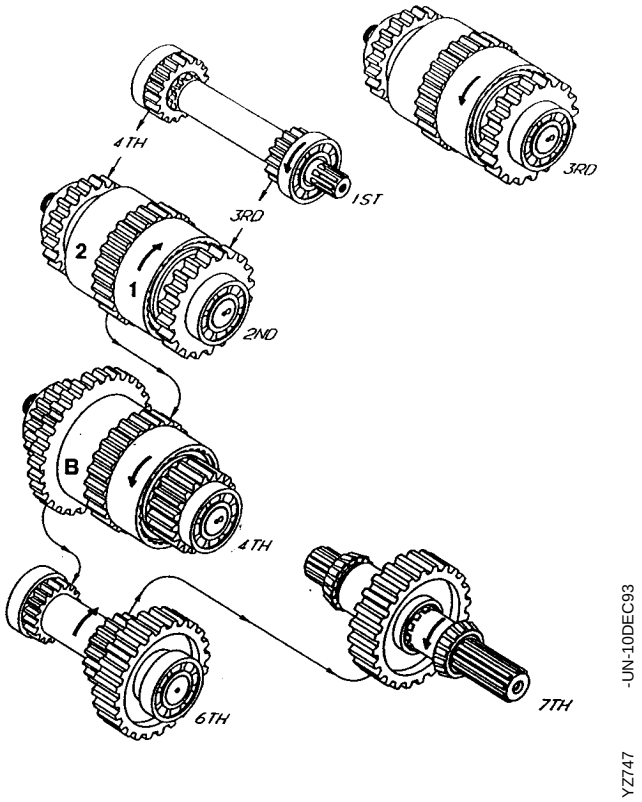
If low pressure exists, then this confirms solenoid or clutch 1 is defective.

YZ,CTM147,100,3-19-05MAY98

4-4 DF POWER FLOW FORWARD SPEEDS



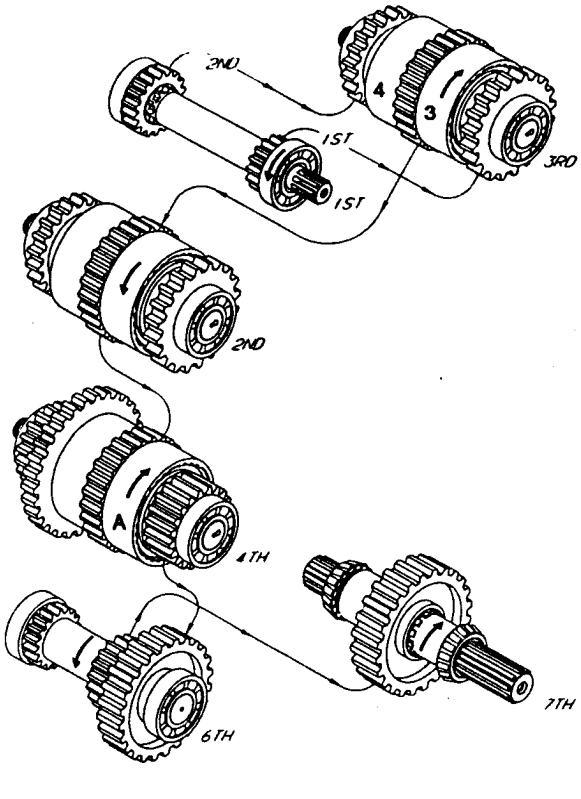
1st Gear - 1A, 2nd Gear - 2A



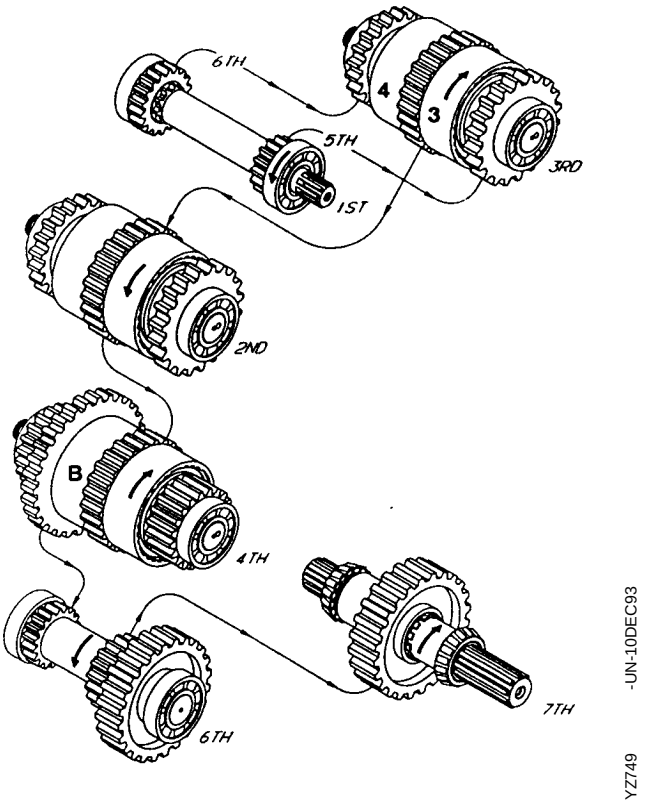
3rd Gear - 1B, 4th Gear - 2B

YZCTM147,100,10-19-05MAY98

4-4 DF POWER FLOW REVERSE SPEEDS



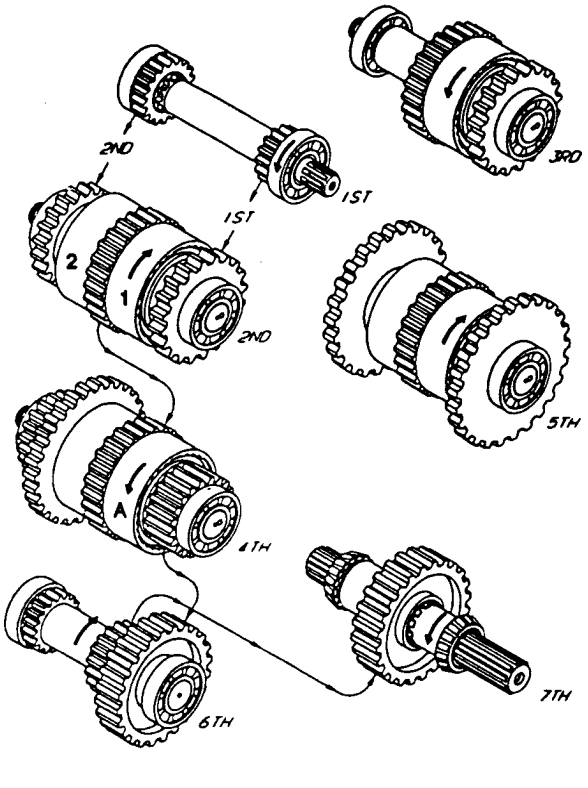
R1 Gear - 3A, R2 Gear - 4A



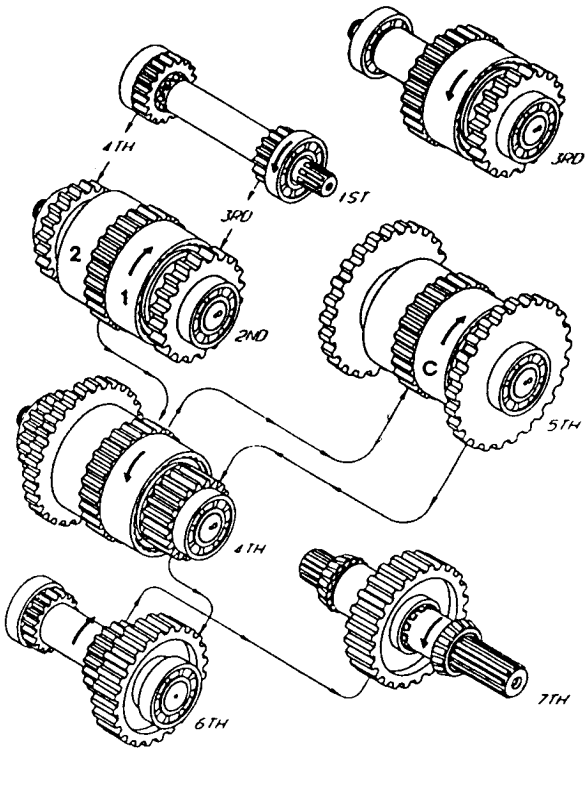
R3 Gear - 3B, R4 Gear - 4B

YZCTM147,100,11-19-05MAY98

8-4 DF POWER FLOW FORWARD SPEEDS



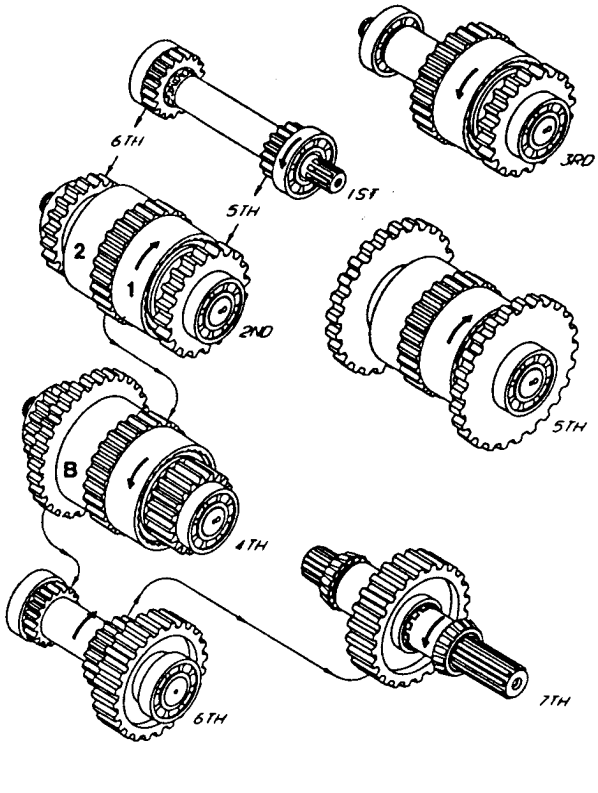
1st Gear - 1A, 2nd Gear - 2A



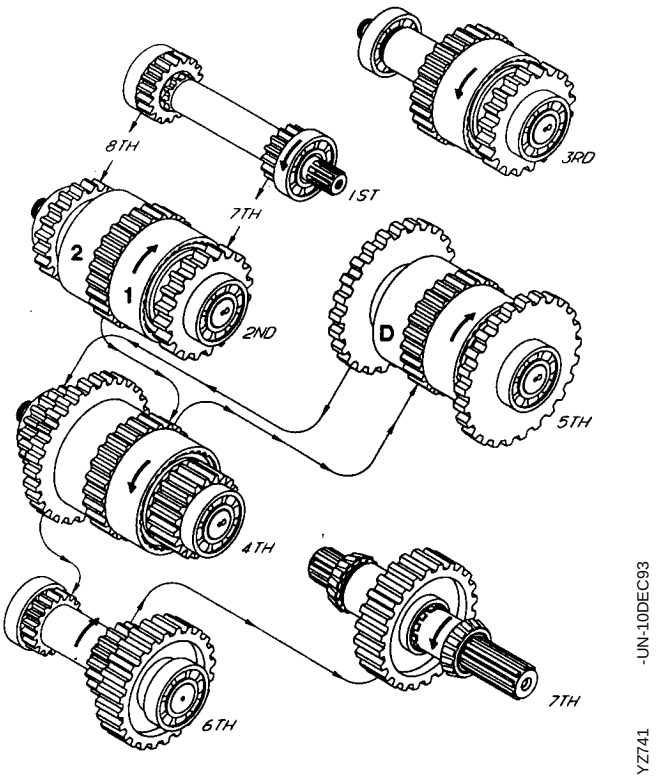
3rd Gear - 1C, 4th Gear - 2C

YZCTM147,100,12-19-05MAY98

8-4 DF POWER FLOW FORWARD SPEEDS (CONTINUED)



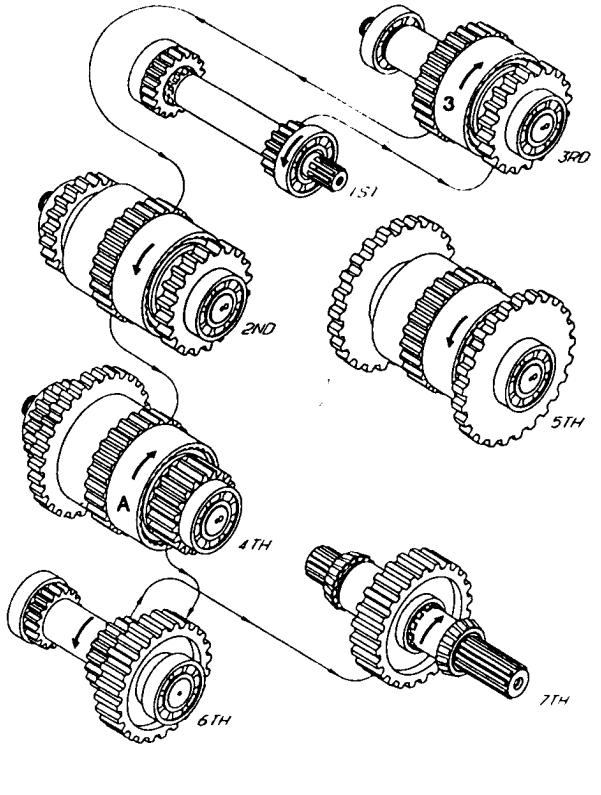
5th Gear - 1B, 6th Gear - 2B



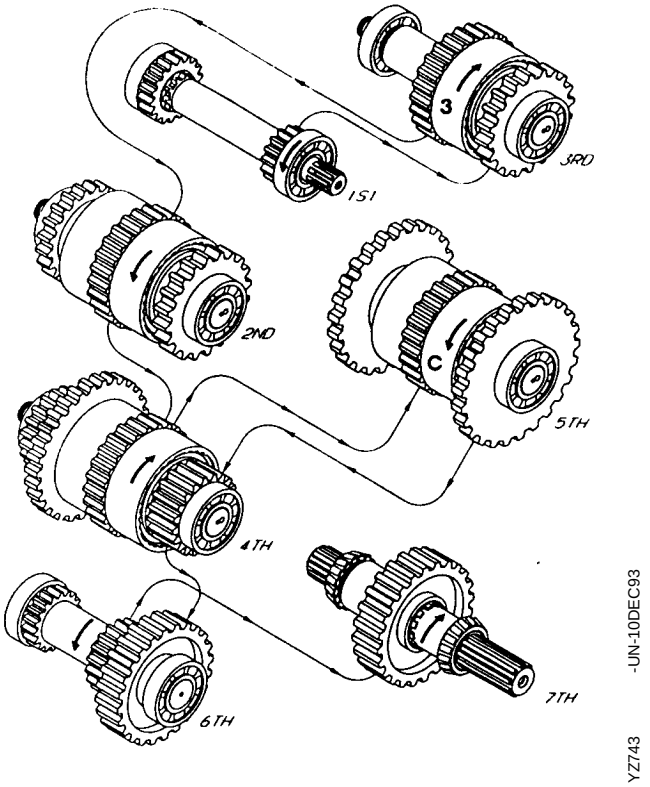
7th Gear - 1D, 8th Gear - 2D

YZCTM147,100,13-19-05MAY98

8-4 DF POWER FLOW REVERSE SPEEDS



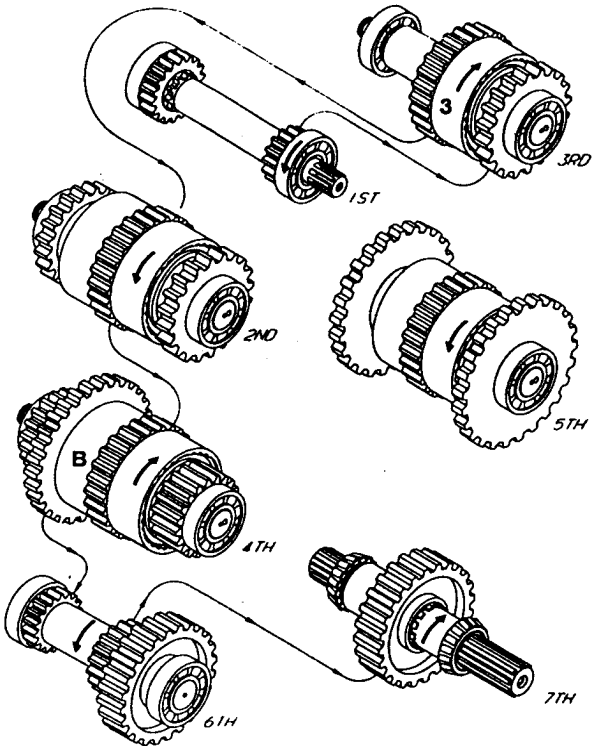
R1 Gear - 3A



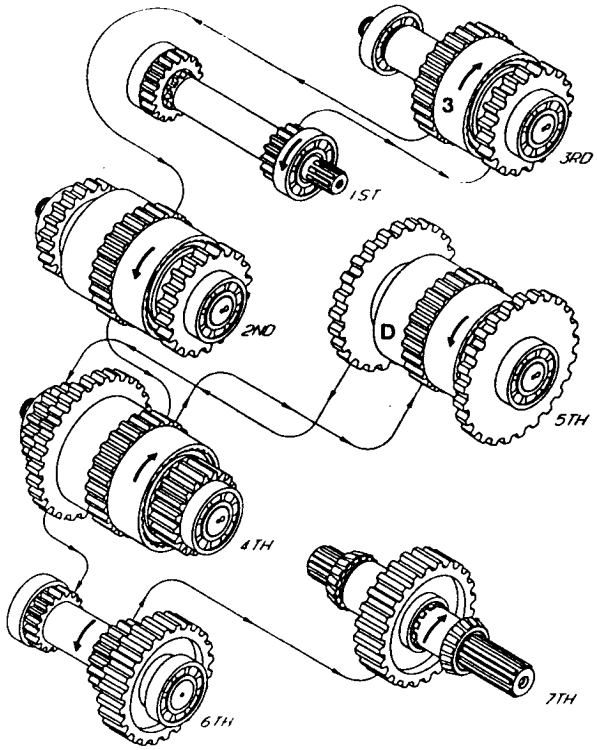
R2 Gear - 3C

YZCTM147,100,14-19-05MAY98

8-4 DF POWER FLOW REVERSE SPEEDS (CONTINUED)



R3 Gear - 3B



R4 Gear - 3D

YZCTM147,100,15-19-05MAY98

TROUBLESHOOT TRANSMISSION SYSTEM MALFUNCTIONS

Symptom	Problem	Solution
Erratic oil pressure.	Low oil level.	Add oil to proper level.
	Suction tube fitting	Replace O-ring fitting.
	Suction manifold O-ring not sealing.	Replace O-ring.
	Foreign object in suction port.	Remove object and check for other contamination.
Excessive oil pressure.	Sticking main regulator valve.	Replace main regulator valve.
	Faulty spring.	Replace main regulator valve.
Low oil pressure in all gears.	Sticking main regulator valve.	Replace main regulator valve.
	Control valve body gasket leaking.	Replace gaskets.
	Charge pump defective.	Replace pump.
	Internal disconnect seal damage or installed incorrectly.	Replace seal and install correctly.
	Faulty main regulator valve.	Replace regulator assembly.
	Control valve body cracked.	Replace control valve body.
Low pressure in one gear but all right in other gears.	Contaminated proportional solenoid.	Replace proportional solenoid. *Check suction screen for contamination.
	Broken wire to one solenoid, or dirty connection.	Repair wire.
	Broken seal ring on input end of clutch assembly.	Replace seal ring.
	Bore sleeve worn.	Replace bore sleeves.
	Outer or inner piston seal leaking.	Replace seals.
Transmission System Pressure is Low (One or Two Gears)	Failed transmission control valve	Inspect transmission control valve for external leakage, Remove control valve. Inspect or replace gasket (See group 35)
	Leakage in clutch piston or seal ring.	Air check to confirm leak.

Continued on next page

Symptom	Problem	Solution
	Solenoid valve malfunction	Check for a transmission fault code on monitor, then check solenoids using monitor diagnostics.
Filter or filter oil lines blow out.	Hose bends too sharp.	Reroute hoses.
	Defective hose.	Replace hose.
	Main regulator valve faulty.	Change valve and change filter and oil.
	System plumbing incorrect.	Correct plumbing.
	Filter O-ring faulty.	Replace filter
Foaming Oil	Incorrect type of oil	Change oil
	High oil level	Transmission overfilled or hydraulic pump seal leaking.
	Low oil level	Add oil (See Group 10)
	Air leak on suction side of pump	Check oil pickup tube on inside of transmission.
Blows oil out of breather or dipstick tube.	Transmission over filled with oil.	Establish proper oil level. Check front seal on auxiliary driven hydraulic pump if equipped.
Oil leaking from engine flywheel and/or weep hole in transmission bell housing.	Converter seal ring damaged.	Remove transmission and install new seal ring on converter hub.
	Converter front cover seal leaking.	Replace seal.
	Converter hub seal or O-ring damaged.	Replace seal.
	Converter not properly positioned within bell housing, causing converter and seal to leak.	Check engine flywheel offset dimensions and converter pilot bushing length against vehicle manufacture standards.
Vehicle will not move	Fault code problem	Check fault codes to define problem.
	Voltage to wrong solenoids on control valve. (See schematic.)	Check wiring and connecters.
	Converter damage.	Rebuild converter.

Continued on next page

Symptom	Problem	Solution
	No voltage to all solenoids.	Check wiring, controller and connecters.
	Voltage to more than two solenoids.	Check wiring and controller.
	Proportional solenoid stuck.	Replace solenoid.
	Failed shift switch	Check that basic display window shows correct gear when shift switch is moved.
	Check Inching Pedal.	Replace Switch or wiring.
Low or no converter pressure (Converter in pressure).	Converter bypass valve defective.	Replace converter bypass valve.
	Converter hub seal ring not sealing.	Replace seal ring.
	Check converter offset dimension.	Correct offset dimension.
Excessive noise.	Charge pump defective.	Replace pump.
	Excessive backlash in gear train.	Replace bearings and inspect for defective gears.
	Auxiliary driven pump bad.	Remove pump and check for noise.
	Worn parts or damage in transmission	Remove transmission suction screen. Inspect for metal particles.
	Low or no lube	Do converter-out and lube pressure test.
Machine “Creeps” In Neutral	Warped disks and plates in clutch pack of transmission.	Check transmission
	Control valve leakage	Do transmission leakage test
	Plugged screen on solenoid valve	Remove solenoid valve and clean.
Transmission Clutch Slippage	Low oil level	Add oil (See Group 10)
	Wrong oil grade	Change oil (See Group 10)
	Restricted transmission pump suction screen.	Remove and clean screen (See Group 25)
	Leak in transmission control valve or gasket	Remove valve and inspect gaskets (See Group 35).

Continued on next page

Symptom	Problem	Solution
	Low transmission pump flow due to worn pump	Do transmission pump flow test.
	Stuck solenoid valve	Check wiring to solenoid valve.
		Remove and inspect solenoid valve.
Transmission overheating.	Converter stalling.	Shift to lower gear.
	Oil level too high.	Establish proper oil level. Check front seal on auxiliary driven hydraulic pump if equipped.
	Engine overheating.	Check engine coolant.
	Water lines defective on heat exchanger.	Replace lines.
	Heat exchanger dirty.	Clean heat exchanger.
	Clutch slipping.	Check clutch pressure.
Transmission pressure checks okay, but has no power and possibly overheating.	Converter sprag clutch damaged or installed wrong.	Disassemble and inspect converter.
	Converter relief valve broken.	Replace relief valve.

YZ,CTM147,100,1-19-05MAY98

POWERSHIFT TROUBLESHOOTING-INTERNAL DISCONNECT MODELS ONLY

Symptom	Problem	Solution
Four wheel drive will not engage.	Solenoid stuck open. Voltage applied all the time.	Repair or replace solenoid. Check wiring diagram and connecters.
	Damaged or missing disconnect retainer spring.	Replace or install disconnect retainer spring.
	Bleed port blocked.	Check for proper installation of gasket and solenoid cap or contamination.
Four wheel drive will not disengage.	No power to solenoid, solenoid inoperative.	Check for electric power to solenoid - check wiring and connecters if O.K., replace solenoid.
	Check valve installed backwards.	Install check valve properly.

YZ,CTM147,100,9-19-05MAY98

TROUBLE SHOOTING INTRODUCTION

This introduction is written to initiate an understanding of a strategy which can be used toward solving problems in the drive line system. The preferred technique used in solving problems is to exchange components. However, a very important element necessary to the timely and successful conclusion of this activity is the selection of the malfunctioning component. An understanding of the total system and an elimination process leading to the component is absolutely necessary before starting the exchange activity. The transmission system as installed consists of the following components linked together to form a functioning system.

- Cab shift handle
- Wiring harness
- Transmission control unit (TCU)
- Magnetic pickups
- Temperature sensor
- Inching pedal (Application Dependent)
- Gear/Diagnostic indicator
- Transmission control valve
- Transmission hydraulic system (pump, relief valves, lines, etc.)
- Transmission mechanical system (clutches, gears, shafts, seals, etc.)

The most desirable strategy in a trouble shooting plan is to reduce the random exchange of components by carefully analyzing the symptoms and then conducting tests which will help determine which of the elements in the system is likely to be the problem. The technician should use the above list as a guide in locating the problem.

As a result of being a new component and unfamiliar to most people, the TCU is usually the first component which is targeted for exchange. However, the malfunction of an TCU is extremely rare and therefore, it should be the last component considered for replacement. In fact the TCU has an internal ability to diagnose itself and the connections which are attached to it. This information can be very helpful in indicating the problem area. Therefore, if the TCU is responding to commands and not giving diagnostics which indicate and internal problem, the likelihood of the problem being internal to the TCU is very remote.

CTM114,105,1 -19-05MAY98

THEORY OF OPERATION

The purpose of the Transmission Control Unit (TCU) is to control the functions of the transmission. Upshifting, downshifting, control of the proportional solenoids and capability to communicate with a panel mounted gear/diagnostic indicator are the main functions. The transmission's performance is determined by the various inputs to the TCU. Based upon these inputs, the TCU commands the transmission so that maximum performance can be achieved under the present operating conditions. All functions of the TCU are under software control. Park Brake Solenoid function is connected to the TCU, however it is not controlled by the TCU or software.

Operation begins when the vehicle's ignition is switched to the on position, supplying electrical power to the TCU and related system components from the vehicle's power source. The TCU now begins monitoring all inputs and outputs. If a known conflict in inputs or a fault condition is detected, the TCU will command the transmission to stay in neutral regardless of the shift lever position. A flashing error code will be displayed on the gear/diagnostic indicator, and will remain displayed until the error has been resolved and the shift lever cycled back through the neutral or park position.

If no error conditions are detected, based upon a combination of inputs from the shift lever and other applicable inputs, the TCU will select the proper transmission gear and command the transmission to shift to this gear. The gear/diagnostic indicator will now show the actual transmission gear.

The TCU Module uses electrohydraulic valves to control the operation of the transmission. The solenoids controlling the transmission clutches (solenoids A through D & 1 through 4) are driven by a signal that produces proportional pressure/flow changes. During modulation, the solenoids are started out with a low duty cycle and ramped up to full on. The initial duty cycle is dependent upon several factors and is not a preset value. The process of modulating these clutches greatly enhances shift quality.

CTM114,105,2 -19-05MAY98

SYSTEM COMPONENTS

Required components:

1. Transmission Control Unit (TCU)
2. Engine Speed Magnetic Pickup Sensor (Input speed)
3. Cylinder Magnetic Pickup Sensor (MPU)
4. Output Speed Magnetic Pickup Sensor (MPU)
5. Shift Lever
6. Temperature Sensor
7. Gear/Diagnostic Indicator
8. Inching Pedal (Optional)
9. Park Pressure
10. Proportional Valves

CTM114,105,4 -19-05MAY98

COMPONENT FUNCTIONS

Basic Components

1. Transmission Control Unit (TCU)

FUNCTION

The TCU is the “brain” of the system. It is responsible for the logic, computation, and decision making processes of the transmission based on calculations. How the TCU performs is determined by software programmed into the TCU’s memory. This software is developed to meet the requirements of the vehicle manufacturer, and is based on a vehicle performance analysis. It is application specific, therefore TCUs from different vehicles are not interchangeable. TCUs can only be interchanged on vehicles which are identical in all ways (same engine/drivetrain combination, same wiring, same shift lever, same vehicle voltage, etc.)

MOUNTING

The TCU must be mounted inside the vehicle cab or other enclosed area which will not exceed ambient temperature range (-40˚C to +85˚C). It must be mounted to ensure good electrical grounding between the TCU and the vehicle chassis, although a ground wire from battery negative to the TCU is required. It must not be mounted by any method which would isolate the TCU from the vehicle chassis. If rubber mounted for shock protection, a grounding strap must be utilized to ensure proper grounding.

IMPORTANT: Do not weld on vehicle with battery and TCU connected, “WARRANTY WILL BE VOID”.

NOTE: The only way to adequately protect the TCU from damage caused by high voltage and amperage is to completely remove all three wiring harness connectors (J1, J2 and J3) and any ground strap from the TCU prior to welding. Disconnection the battery supply alone is not sufficient to protect the TCU from ground voltage feeding back through the wiring harness.

CTM114,105,5 -19-05MAY98

2. Engine speed magnetic pickup (input speed)

CONNECTOR PINOUTS

SIGNAL DESCRIPTION	TCU PIN
ENGINE MPU	J1-B1
ENGINE MPU GND	J1-C2

The engine speed magnetic pickup reads engine RPM by measuring the number of pulses per minute generated from the teeth of the charge pump idler gear, which is in mesh with the input gear.

Input RPM is calculated by pulses per minute divided by the number of teeth on the input gear.

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3. Cylinder Magnetic Pickup Sensor (MPU)

CONNECTOR PINOUTS

SIGNAL DESCRIPTION	TCU PIN
CYLINDER MPU	J1-B2
CYLINDER MPU GND	J1-C2

The cylinder speed magnetic pickup reads cylinder RPM by measuring the number of pulses per minute generated from the teeth of the cylinder gear.

Cylinder RPM is calculated by pulses per minute divided by the number of teeth on the cylinder gear.

CTM114,105,7 -19-05MAY98

4. Output Speed Magnetic Pickup Sensor (MPU)

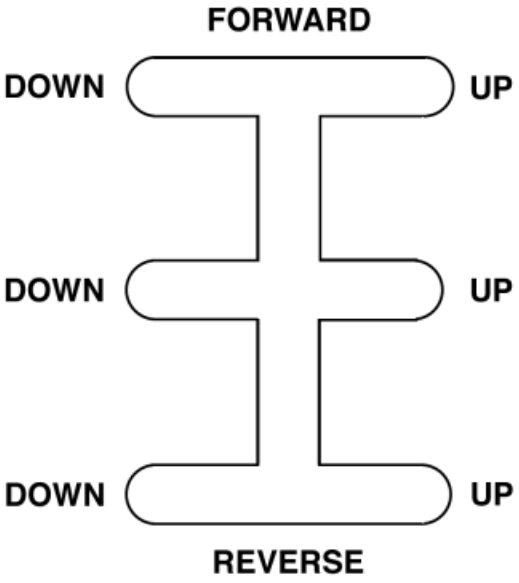
CONNECTOR PINOUTS

SIGNAL DESCRIPTION	TCU PIN
OUTPUT MPU	J1-A3
OUTPUT MPU GND	J1-C2

The output speed magnetic pickup reads output RPM by measuring the number of pulses per minute generated from the teeth of the sixth stage gear. The sixth stage gear is on the same shaft as the sixth stage pinion which drives the output gear.

CTM114,105,8 -19-05MAY98

5. Bump Shift Handle



The shift handle is a “Bump” handle which operates in an “I” pattern with a horizontal bar in the middle. Neutral position is in the middle of the pattern along the horizontal bar. The handle can be moved right to request a higher pre-selected gear or left to request a lower pre-selected gear.

The handle can be moved forward to request a forward gear or moved back to request a reverse gear. The release ring under the handle knob must be pulled up to release the neutral lock.

The handle can be moved back to the neutral position at anytime without moving the release ring under the handle knob.

When in the forward or reverse position the handle can be “Bumped” to the right to request an up shift or to the left to request a down shift.

CTM114,105,9 -19-05MAY98

6. Calibration

Reasons to Calibrate

• **Matches Transmission Control Unit (TCU) to Transmission.** Default clutch fill and hold values are placed in the TCU at the factory. Calibration changes these values to match a particular transmission.

• **Reduces Impact Of Manufacturing Tolerances.** Since the clutch fill and hold values are for a particular transmission, adjustments for differences in parts due to manufacturing tolerances are automatic.

• **Provides For Consistency Between Machines.** The calibration routine makes sure each transmission clutch starts from the same spot just prior to clutch engagement.

• **When to Calibrate?** If solenoid valve assemblies are changed. After repairs involving transmission clutches. If TCU is replaced. If shift Quality deteriorates.

CTM114,105,34 -19-05MAY98

CLUTCH CALIBRATION FOUR FORWARD SPEEDS AND FOUR REVERSE

For Funk Analog Valve DF150 or DF250 Series Transmissions Four Forward Speeds and Four Reverse.

NOTE: Attempting to calibrate with sump temperature below minimum calibration temperature (120˚F for converter drives and 90 ˚F for most direct drives) will trigger the "warm-up" mode. This mode will show "---" on the display as the transmission warms to the minimum calibration temperature at which time the calibration process will automatically begin. Temperatures below 50˚F will result in "sump temperature too cold" error 100.

1.Bring the transmission oil temperature up to 140˚ to 160˚F (60˚ to 71˚C) for optimum calibration.

2. With the vehicle ignition off, apply the park brake.

3. Plug a jumper plug (which connects pin A to pin B) in the calibration plug (s16) on the vehicle harness.

NOTE: Any errors that appear during calibration will cause the procedure to terminate, and you will have to start the calibration over from the beginning.

4. Power up the TCU by turning on the vehicle ignition. The display should show "CAL".

5. Start and hold the engine speed at 1600 RPM. The engine governor must hold the engine speed ± 50 RPM.

6. Move the shift handle to the Forward position.

7. During the first few seconds of the calibration process, the display will show "---" while testing the cylinder speed and response.

8. At this time the Clutch calibration process starts.

a. Directional and Speed Clutch Holds. The display will show **C1H, C2H, C3H, C4H, CAH,** and **CBH** while acquiring the respective "hold" level of each clutch.

b. Directional and Speed Clutch Fills. The display will show **C1F, C2F, C3F, C4F, CAF,** and **CBF** while acquiring the respective "fill" level of each clutch.

9. The display will show **END** when the routine is finished. At that time move the shift handle back to the Neutral position.

10. Shut the vehicle's ignition OFF, which will power down the TCU.

11. Remove the jumper plug from the calibration plug (S16).

The calibration is complete.

CTM114,105,34A -19-05MAY98

CLUTCH CALIBRATION EIGHT FORWARD SPEEDS AND FOUR REVERSE

For Funk Analog Valve DF150 or DF250 Series Transmissions Eight Forward Speeds and Four Reverse.

NOTE: Attempting to calibrate with sump temperature below minimum calibration temperature (120˚F for converter drives and 90 ˚F for most direct drives) will trigger the "warm-up" mode. This mode will show "---" on the display as the transmission warms to the minimum calibration temperature at which time the calibration process will automatically begin. Temperatures below 50˚F will result in "sump temperature too cold" error 100.

1.Bring the transmission oil temperature up to 140˚ to 160˚F (60˚ to 71˚C) for optimum calibration.

2. With the vehicle ignition off, apply the park brake.

3. Plug a jumper plug (which connects pin A to pin B) in the calibration plug (s16) on the vehicle harness.

NOTE: Any errors that appear during calibration will cause the procedure to terminate, and you will have to start the calibration over from the beginning.

4. Power up the TCU by turning on the vehicle ignition. The display should show "CAL".

5. Start and hold the engine speed at 1600 RPM. The engine governor must hold the engine speed ± 50 RPM.

6. Move the shift handle to the Forward position.

7. During the first few seconds of the calibration process, the display will show "---" while testing the cylinder speed and response.

8. At this time the Clutch calibration process starts.

a. Directional and Speed Clutch Holds. The display will show **C1H, C2H, C3H, CAH, CBH, CCH** and **CDH** while acquiring the respective "hold" time of each clutch.

b. Directional and Speed Clutch Fills. The display will show **C1F, C2F, C3F, CAF, CBF, CCF** and **CDF** while acquiring the respective "fill" time of each clutch.

9. The display will show **END** when the routine is finished. At that time move the shift handle back to the Neutral position.

10. Shut the vehicle's ignition OFF, which will power down the TCU.

11. Remove the jumper plug from the calibration plug (S16).

The calibration is complete.

CTM114,105,34B -19-05MAY98

7. Gear/diagnostic indicator

CONNECTOR PINOUTS

SIGNAL DESCRIPTION	CONNECTOR AND PIN	TCU PIN
+12V/+24V	S5-A	J3-A1
GROUND	S5-B	J2-F1
CCD BUS+	S5-C	J2-E2
CCD BUS-	S5-D	J2-E3

NOTE: Mounting requires a 2 inch diameter hole with 88.9 mm (3.5 in) clearance behind the front face.

CTM114,105,11 -19-05MAY98

8. Inching Pedal (Application Dependent)

CONNECTOR PINOUT

SIGNAL DESCRIPTION	CONNECTOR AND PIN	TCU PIN
VAGND	T11-A	J1-G1
VAREF	T11-B	J1-F2
ANALOG INPUT	T11-C	J1-F3
TOC INPUT (TOP OF CLUTCH)	T11-D	J1-K3
NOT BOC INPUT (BOTTOM OF CLUTCH)	T11-E	J1-K2
+24V	T11-F	J2-F2

The inching pedal provides the operator with a device for controlling modulation of the transmission clutches when desired. With the pedal fully depressed, the transmission remains in neutral regardless of shift lever position. Releasing the inching pedal engages the transmission. The more the pedal is released, the more the clutches engage causing the vehicle to 'inch'. When the pedal is fully released, the transmission clutches are fully engaged. This gives a 'foot clutch' type of performance to the vehicle.

The normally closed set of contacts of a switch mechanically linked to the pedal, provides the "NOT BOTTOM OF CLUTCH" input signal to the TCU. These contacts open when the pedal is fully depressed (input is passive), and are closed in all other positions of the pedal (input is active).

The 'inching' signal is a 5 volt D.C. (Direct Current) voltage supplied to a 5K ohm potentiometer by the TCU. It is this voltage that the potentiometer alters, relative to pedal position, and feeds back a voltage measurement telling the TCU the relative movement of the inching pedal. It is then compared against the original reference to determine pedal movement. A percentage of modulation is used to modulate the transmission clutches.

CTM114,105,12 -19-21APR98

9. Park Pressure

This switches provides an input to the TCU by simply switching vehicle voltage on or off to the TCU input. The input is active at the TCU pin when vehicle voltage is present (logic level 1), and is passive when no voltage is present (logic level 0).

a. Park brake

CONNECTOR PINOUTS

SIGNAL DESCRIPTION	TCU PIN
PARK PRESS	J2-B3

The input to the TCU is supplied by a pressure switch mounted in the park brake housing. The park brake input allows the TCU to detect when the park brake is applied, and prohibits the transmission from engaging in any gear.

The park brake pressure switch supplies a passive input to the TCU when the park brake is released, and an active input when the brake is applied.

CTM114,105,15 -19-05MAY98

10. Torque Converter (Optional)

The torque converter lock up clutch provides the capability to a torque converter to run as a direct drive without any slippage. The lockup is accomplished by a clutch in the torque converter which locks the impeller to the turbine. The clutch is applied by a hydraulic piston. Return force on the piston is provided by the converter pressure at the front of the piston. Hydraulic pressure to apply the clutch is supplied through a proportional valve mounted on the back of the transmission. Supply oil at system pressure, comes from a port in the main valve body through a hose connected to the torque converter lockup valve manifold. Apply pressure to the clutch is transferred from the proportional valve to the rotating input shaft and runs down a hole in the shaft to the torque converter at the front of the transmission. The Torque Converter Lockup is controlled by the TCU.

CTM114,105,15A -19-05MAY98

SYSTEM REQUIREMENTS

Voltage

The TCU and gear/diagnostic indicator can be 12 or 24 volt depending upon application.

CTM114,105,16 -19-05MAY98

CONNECTOR PINOUTS

J1 CONNECTOR

A	B	C	D	E	F	G	H	J	K	
OUT MPU	FREQ4 IN	TEMP SENSE	R STEER INPUT	LOAD IN	INCH ANALOG INPUT		BIT D (down-shift)	ENG BIT	TOC	3
GND1	CYL MPU	MPU GND	R STEER V REF	LOAD HI	INCH VAREF		BIT E (up-shift)	REV	NOT BOC	2
MAIN BAT1	ENG MPU	FFLOW IN	TEMP GND	R STEER GND	LOAD LOW	INCH VAGND		FORWARD	NOT PARK	1

- Metric-pack 150 series 30 way sealed P2S connector
- Packard part number: 12034398
- Terminals: 12103881
- Tighten Connector to TCU 0.8—1.5 N·m (7.1—13.3 in-lb)

CTM114,105,35 -19-01APR98

J2 CONNECTOR

A	B	C	D	E	F	
BIT C	PARK	DISC-IN VSENSE	RS232 TxD	CCD BUS-	+12/24 OUT	3
BIT B	START PARK/START	CALIBRATE		C CCD BUS+	+12/24 OUT	2
NEU HFWD	BIT A	AUTO		C RS232 RxD	-GND	1

- Metric-pack 150 series 18 way sealed P2S connector
- Packard part number: 12040921
- Terminals: 12103881
- Tighten Connector to TCU 0.8—1.5 N·m (7.1—13.3 in-lb)

CTM114,105,36 -19-02APR98

J3 CONNECTOR

A	B	C	D	E	F	G	H	J	K	
SOL 1	SOL 2 GND	SOL 4	SOL A GND	SOL C	SOL D GND	TC LOCK	DIS GND	F PTO		3
GND 2	SOL 2	SOL 3 GND	SOL A	SOL B GND	SOL D	SOL E GND	DIS OUT	R PTO GND		2
MAIN BAT 2	SOL 1 GND	SOL 3	SOL 4 GND	SOL B	SOL C GND	SOL E	TCLOC GND	R PTO	F PTO GND	1

- Metric-pack 150 series 30 way sealed P2S connector
- Packard part number: 12048455
- Terminals: 12103881
- Tighten Connector to TCU 0.8—1.5 N·m (7.1—13.3 in-lb)

CTM114,105,37 -19-01APR98

10. FUNCTION OF PROPORTIONAL VALVES

The proportional valve is analog pilot operated. It has a main spool that is forced in one direction by a spring and clutch pressure. In this position the valve is off, meaning that system pressure is shut off from the clutch actuation line and the clutch actuation line is open to sump to insure that there is 0 PSI in the clutch.

To apply pressure to the clutch, the spool must be moved against the spring and clutch pressure. This shuts off the opening from the clutch to the sump and opens the system pressure to the clutch. The pressure then forces the clutch piston against the friction plates and applies the clutch.

In a proportional valve the main spool is able to be forced part way open to provide a partial pressure to the clutch. In this position the system pressure is partially open to the clutch while the clutch is also partially open to sump. As the system pressure is open more, the opening to sump is shut off more, creating a higher and higher pressure in the clutch.

The pilot section is the part of the valve that forces the spool open against the spring. It is a sealed chamber into which the main spool slides in and out of like a hydraulic cylinder. There are two openings into this chamber. One is a small hole which allows oil into the chamber from system pressure. The other hole allows the oil to flow out of the chamber. At this point the pressure in the pilot section is near 0 PSI and is not enough force to move the spool against the spring.

The large hole is able to be shut off by a small Poppet that is normally held away from the hole by the oil exiting the cavity. It is forced shut against the outlet hole when the electric solenoid is turned on. This allows pressure to build up in the pilot section. As the pressure builds up it forces the main spool against the spring and clutch pressure on the other end and brings the valve on.

In an Analog valve the Poppet in the pilot section can be controlled to any position between open and closed. The Poppet is controlled to an intermediate position by a variable magnetic force from the solenoid coil. In this position it is equally opposed by the pressure in the cavity acting on the ball.

A variable force from the coil is created with a Pulse Width Modulated (PWM) signal at a constant voltage. The PWM signal is a voltage that cycles in the form of a square wave. The “duty cycle” of the signal is the length of time that the voltage is on compared to the length of time that it is on and off combined. For example, a duty cycle of 25% at a frequency of 50 cycles per second, (a 20 millisecond cycle time) would give full voltage for 5 milliseconds and 0 volts for 15 milliseconds.
In an analog valve the frequency used is high enough that the coil then averages out the variable amperage to some intermediate value. This amperage varies with the duty cycle of the PWM signal, and controls the position of the Poppet. If the Poppet is partially closed, the pressure in the pilot section is at an intermediate pressure between 0 PSI and system pressure, This moves the main spool to a position where the spring force and clutch pressure increases to match it, holding the main spool in a partially displaced position that provides a proportional pressure to the clutch.

CTM114,105,39 -19-16APR98

PROPORTIONAL VALVES

CONNECTOR PINOUT

SIGNAL DESCRIPTION	CONNECTOR AND PIN	TCU PIN
SOLENOID 1	J6-2	J3-A3
SOLENOID 1 GND	J6-1	J3-B1
SOLENOID 2	J6-3	J3-B2
SOLENOID 2 GND	J6-15	J3-B3
SOLENOID 3	J6-4	J3-C1
SOLENOID 3 GND	J6-19	J3-C2
SOLENOID 4	J6-5	J3-C3
SOLENOID 4 GND	J6-6	J3-D1
SOLENOID A	J6-10	J3-D2
SOLENOID A GND	J6-17	J3-D3
SOLENOID B	J6-12	J3-E1
SOLENOID B GND	J6-11	J3-E2
SOLENOID C	J6-23	J3-E3
SOLENOID C GND	J6-22	J3-F1
SOLENOID D	J6-8	J3-F2
SOLENOID D GND	J6-7	J3-F3

DF Series Transmission Eight Speeds Forward and Four Reverse

GEAR ENGAGED	SOLENOID CHARGED
F 8th	2 and D
F 7th	1 and D
F 6th	2 and B
F 5th	1 and B
F 4th	2 and C
F 3rd	1 and C
F 2nd	2 and A
F 1st	1 and A
Neutral	
R 1st	3 and A
R 2nd	3 and C
R 3rd	3 and B
R 4th	3 and D

DF Series Transmission Four Speeds Forward and Four Reverse

GEAR ENGAGED	SOLENOID CHARGED
F 4th	2 and B
F 3rd	1 and B
F 2nd	2 and A
F 1st	1 and A
Neutral	
R 1st	3 and A
R 2nd	4 and A
R 3rd	3 and B
R 4th	4 and B

CTM114,105,38 -19-05MAY98

SYSTEM ERRORS

The TCU has the ability to detect various discrepancies.

Possible errors are:

- Pinched or broken wiring
- Shorted or open coils
- Bad connections
- Shorted wiring (to either ground or vehicle voltage.)
- Illogical input from the handle
- Magnetic pickup sensor failures

All errors are neutral recoverable, unless the condition causing the error prevents the TCU from detecting a legal neutral condition. After a neutral recovery, the shift lever may be placed back into a legal forward or reverse position. If the condition causing the error still exist, the error will again be detected and displayed.

CAUTION: How the TCU handles errors depends upon what type and which error has occurred. The TCU can immediately shift the transmission to neutral in the event of an error. The transmission will remain in neutral until the error has been resolved and the shift lever cycled to neutral and back to the desired position.

The TCU retains the last eight non-repeating error codes in nonvolatile memory in the order in which they have occurred. These codes are available for future retrieval to aid in the diagnosing of the system.

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ANALOG ERROR CODES

NOTE: The Following is a list of the errors that are detectable.

Diagnostic Code: 20

Error Type: Driver 1 cannot get up to requested current.

Error: Open or short to ground in Solenoid 1 circuit from output pin J3-A3 to return pin J3-B1.

Diagnostic Code: 21

Error Type: Driver 2 cannot get up to requested current.

Error: Open or short to ground in Solenoid 2 circuit from output pin J3-B2 to return pin J3-B3.

Diagnostic Code: 22

Error Type: Driver 3 cannot get up to requested current.

Error: Open or short to ground in Solenoid 3 circuit from output pin J3-C1 to return pin J3-C2.

Diagnostic Code: 23

Error Type: Driver 4 cannot get up to requested current.

Error: Open or short to ground in Solenoid 4 circuit from output pin J3-C3 to return pin J3-D1.

Diagnostic Code: 24

Error Type: Driver 5 cannot get up to requested current.

Error: Open or short to ground in Solenoid A circuit from output pin J3-D2 to return pin J3-D3.

Diagnostic Code: 25

Error Type: Driver 6 cannot get up to requested current.

Error: Open or short to ground in Solenoid B circuit from output pin J3-E1 to return pin J3-E2.

Diagnostic Code: 26

Error Type: Driver 7 cannot get up to requested current.

Error: Open or short to ground in Solenoid C circuit from output pin J3-E3 to return pin J3-F1.

Diagnostic Code: 27

Error Type: Driver 8 cannot get up to requested current.

Error: Open or short to ground in Solenoid D circuit from output pin J3-F2 to return pin J3-F3.

Diagnostic Code: 28

Error Type: Driver 9 cannot get up to requested current.

Error: Open or short to ground in circuit from output pin J3-G1 to return pin J3-G2.

Diagnostic Code: 29

Error Type: Driver 10 cannot get up to requested current.

Error: Open or short to ground in Torque Converter Lock Up circuit from output pin J3-G3 to return pin J3-H1.

Diagnostic Code: 30

Error Type: Driver 1 cannot get down to requested current.

Error: Short to positive in Solenoid 1 circuit from output pin J3-A3 to return pin J3-B1.

Diagnostic Code: 31

Error Type: Driver 2 cannot get down to requested current.

Error: Short to positive in Solenoid 2 circuit from output pin J3-B2 to return pin J3-B3.

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Diagnostic Code: 32

Error Type: Driver 3 cannot get down to requested current.

Error: Short to positive in Solenoid 3 circuit from output pin J3-C1 to return pin J3-C2.

Diagnostic Code: 33

Error Type: Driver 4 cannot get down to requested current.

Error: Short to positive in Solenoid 4 circuit from output pin J3-C3 to return pin J3-D1.

Diagnostic Code: 34

Error Type: Driver 5 cannot get down to requested current.

Error: Short to positive in Solenoid A circuit from output pin J3-D2 to return pin J3-D3.

Diagnostic Code: 35

Error Type: Driver 6 cannot get down to requested current.

Error: Short to positive in Solenoid B circuit from output pin J3-E1 to return pin J3-E2.

Diagnostic Code: 36

Error Type: Driver 7 cannot get down to requested current.

Error: Short to positive in Solenoid C circuit from output pin J3-E3 to return pin J3-F1.

Diagnostic Code: 37

Error Type: Driver 8 cannot get down to requested current.

Error: Short to positive in Solenoid D circuit from output pin J3-F2 to return pin J3-F3.

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Diagnostic Code: 38

Error Type: Driver 9 cannot get down to requested current.

Error: Short to positive in circuit from output pin J3-G1 to return pin J3-G2.

Diagnostic Code: 39

Error Type: Driver 10 cannot get down to requested current.

Error: Short to positive in Torque Converter Lock Up circuit from output pin J3-G3 to return pin J3-H1.

Diagnostic Code: 40

Error: Request for an undefined shift being made.

Diagnostic Code: 41

Error: TCU has not seen a legal Neutral (input pin J2-A1) since initial power up of system.

Diagnostic Code: 42

Error Type: Bottom of Clutch input on J1-K2 is passive.

Error: Application does not utilize inching. Input at J1-K2 must be connected to system voltage.

Diagnostic Code: 43

Error: NOT PARK (input pin J1-K1) and PARK (input pin J2-B3) are both passive at TCU.

Legal conditions are: 1 NOT PARK active and PARK passive.

Legal conditions are: 2 NOT PARK passive and PARK active.

Diagnostic Code: 44

Error: NOT PARK (input pin J1-K1) and NEUTRAL (input pin J2-A1) are both passive at TCU.

Legal conditions are: 1 NOT PARK active and NEUTRAL passive.

Legal conditions are: 2 NOT PARK passive and NEUTRAL active.

Diagnostic Code: 45

Error: PARK (input pin J2-B3) is active but NEUTRAL (input pin J2-A1) is passive at TCU.

Diagnostic Code: 46

Error: NOT PARK (input pin J1-K1) passive and FORWARD (input pin J1-J1) active at TCU.

Legal conditions are: 1 NOT PARK and FORWARD both active.

Legal conditions are: 2 NOT PARK and FORWARD both passive.

Diagnostic Code: 47

Error: NOT PARK (input pin J1-K1) passive and REVERSE (input pin J1-J2) active at TCU.

Legal conditions are: 1 NOT PARK and REVERSE both active.

Legal conditions are: 2 NOT PARK and REVERSE both passive.

Diagnostic Code: 48

Error: NOT PARK (input pin J1-K1) and PARK (input pin J2-B3) are both active at TCU.

Legal conditions are: 1 NOT PARK active and PARK passive.

Legal conditions are: 2 NOT PARK passive and PARK active.

Diagnostic Code: 49

Error: Handle signal is park but PARK PRESSURE (input pin J2-B3) is passive at TCU.

Diagnostic Code: 50

Error: UPSHIFT (input pin J1-H2) and DOWNSHIFT (input pin J1-H3) are both active at TCU.

Diagnostic Code: 51

Error: FORWARD (input pin J1-J1) and REVERSE (input pin J1-J2) are both active at TCU.

Diagnostic Code: 52

Error: FORWARD (input pin J1-J1) and NEUTRAL (input pin J2-A1) and REVERSE (input J1-J2) are all passive at TCU.

Diagnostic Code: 54

Error: Program variable REQUIRED GEAR has taken on an invalid value.

Diagnostic Code: 56

Error: NEUTRAL (input pin J2-A1) and FORWARD (input pin J1-J1) are both active at TCU.

Legal conditions are: 1 NEUTRAL active and FORWARD passive.

Legal conditions are: 2 NEUTRAL passive and FORWARD active.

Diagnostic Code: 57

Error: NEUTRAL (input pin J2-A1) and REVERSE (input pin J1-J2) are both active at TCU.

Legal conditions are: 1 NEUTRAL active and REVERSE passive.

Legal conditions are: 2 NEUTRAL passive and REVERSE active.

Diagnostic Code: 58

Error: START (input pin J2-B2) went active at TCU disabling internal solenoid power.

Diagnostic Code: 59

Error: Invalid 5 bit selector code.

Diagnostic Code: 60

Error Type: Valve driver supply voltage (TCU pin J3-A1) too low.

Error: Must be above 8 volts on a 12 volt system or above 17 volts on a 24 volt system.

Diagnostic Code: 80

Error: Engine MPU signal (input pin J1-B1) missing or frequency is too low.

Diagnostic Code: 82

Error: Output MPU (input pin J1-A3) signal missing or frequency is too low.

Diagnostic Code: 84

Error: **Illegal or undefined vehicle mode code.**

Diagnostic Code: **85**

Error: **PARK (input pin J2-B3) is active but NEUTRAL (input pin J2-A1) is passive at TCU.**

Diagnostic Code: **86**

Error: **Inching pedal TOP OF CLUTCH signal (input pin J1-K3) is closed but BOTTOM OF CLUTCH (input pin J1-K2) is open.**

Diagnostic Code: **87**

Error: **PARK (input pin J2-B3) and FORWARD (input pin J1-J1) are both active at TCU.**

Diagnostic Code: **88**

Error: **PARK (input pin J2-B3) and REVERSE (input pin J1-J2) are both active at TCU.**

Diagnostic Code: **89**

Error: **PARK (input pin J2-B3) and NOT PARK (input pin J1-K1) are both passive at TCU.**

Diagnostic Code: **90**

Error: **PARK (input pin J2-B3) and NOT PARK (input pin J1-K1) are both active at TCU.**

Diagnostic Code: 91

Error: Seat switch (input pin J2-C3) and NEUTRAL (input pin J2-A1) are both passive at TCU.

Diagnostic Code: 92

Error: Engine speed is at or near manufacturers warranty void level.

Diagnostic Code: 93

Error: CARRIER CAB and UPPER CAB inputs are both active at TCU.

Diagnostic Code: 94

Error: CARRIER CAB and UPPER CAB inputs are both passive at TCU.

Diagnostic Code: 95

Error Code: Handle code not neutral.

Error: NEUTRAL (input pin J2-A1) is passive while switching cab modes.

Diagnostic Code: 96

Error: Upper cab mode selected but transmission gear is not a legal gear range for upper cab mode.

Diagnostic Code: 97

Error: Upper cab mode selected but FORWARD NEUTRAL and REVERSE inputs are all passive at TCU.

Diagnostic Code: 98

Error: WHEELS-UP (input pin J1-H1) and WHEELS-DOWN (input pin J1-H2) are both active.

Diagnostic Code: 99

Error: Attempt to change wheels-up wheels-down mode while in an out-of-neutral condition.

Diagnostic Code: 100

Error: Sump temperature (input on J1-C3) is too low for calibration.

Diagnostic Code: 101

Error: Engine speed is too high for calibration.

Diagnostic Code: 102

Error: Engine speed is too low for calibration.

Diagnostic Code: 103

Error: Output speed detected during calibration.

Diagnostic Code: 104

Error: No cylinder speed detected during calibration.

Diagnostic Code: 105

Error: Incorrect forward cylinder speed ratio during calibration.

Diagnostic Code: 106

Error: Incorrect reverse cylinder speed ratio during calibration.

Diagnostic Code: 107

Error: Cylinder speed will not drop below the start count speed.

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Diagnostic Code: 108

Error: Holding clutch pressure exceeds 90 psi.

Diagnostic Code: 109

Error: Clutch 1 fast fill time exceeds 300 ms.

Diagnostic Code: 110

Error: Clutch 2 fast fill time exceeds 300 ms.

Diagnostic Code: 111

Error: Clutch 3 fast fill time exceeds 300 ms.

Diagnostic Code: 112

Error: Clutch 4 fast fill time exceeds 300 ms.

Diagnostic Code: 113

Error: Clutch A fast fill time exceeds 300 ms.

Diagnostic Code: 114

Error: Clutch B fast fill time exceeds 300 ms.

Diagnostic Code: 115

Error: Clutch C fast fill time exceeds 300 ms.

Diagnostic Code: 116

Error: Clutch D fast fill time exceeds 300 ms.

Diagnostic Code: 117

Error: Clutch hold pressure is above 90 psi.

Diagnostic Code: 118

Error: Clutch R fast fill time exceeds 300 ms.

Diagnostic Code: 119

Error: Clutch L fast fill time exceeds 300 ms.

Diagnostic Code: 120

Error: Clutch M fast fill time exceeds 300 ms.

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Diagnostic Code: 121

Error: Clutch H fast fill time exceeds 300 ms.

Diagnostic Code: 126

Error: Cylinder deceleration time is inconsistent.

Diagnostic Code: 127

Error: Attempt to calibrate with PARK (input pin J2-B3) input passive at TCU.

Diagnostic Code: 144

Error: Low air pressure.

Diagnostic Code: 145

Error: Analog inching voltage is too low.

Diagnostic Code: 146

Error: Temperature sensor circuit (J1-C3) SENSE or J1-D1 GROUND) shorted or open.

Diagnostic Code: 147

Error: Analog input (J1-D3) shorted or open.

Diagnostic Code: 148

Error: Analog inching voltage (J1-F3) is too high.

Diagnostic Code: 149

Error: Vehicle system voltage (j3-A1) is too high.

Diagnostic Code: 150

Error: Transmission temperature (J1-C3) is too high.

Diagnostic Code: 154

Error: Engine MPU circuit (J1-B1) open.

Diagnostic Code: 155

Error: Output MPU circuit (J1-A3) open.

Diagnostic Code: 160

Error: Cannot get shift constants from eeprom.

Diagnostic Code: 161

Error: Group one enable low should be high.

Diagnostic Code: 162

Error: Group two enable low should be high.

Diagnostic Code: 163

Error: Group three enable low should be high.

Diagnostic Code: 164

Error: Pointer in capcom20 gets too big.

Diagnostic Code: 165

Error: Safety FET A failed OFF.

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Diagnostic Code: 166

Error: Safety FET A failed ON.

Diagnostic Code: 167

Error: Safety FET B failed OFF.

Diagnostic Code: 168

Error: Safety FET B failed ON.

Diagnostic Code: 169

Error: Safety FET C failed OFF.

Diagnostic Code: 170

Error: Safety FET C failed ON.

Diagnostic Code: 171

Error: Group one enable high should be low.

Diagnostic Code: 172

Error: Group two enable high should be low.

Diagnostic Code: 173

Error: Group three enable high should be low.

Diagnostic Code: 174

Error: EEprom check sum error.

Diagnostic Code: 175

Error Code: Driver 11 cannot get up to requested current.

Error: Open or short to ground in circuit from output pin J3-H2 to return pin J3-H3.

Diagnostic Code: 176

Error Code: Driver 12 cannot get up to requested current.

Error: Open or short to ground in circuit from output pin J3-J1 to return pin J3-J2.

Diagnostic Code: 177

Error Code: Driver 13 cannot get up to requested current.

Error: Open or short to ground in circuit from output pin J3-J3 to return pin J3-K1.

Diagnostic Code: 178

Error Code: Driver 11 cannot get down to requested current.

Error: Short to positive in circuit from output pin J3-H2 to return pin J3-H3.

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Diagnostic Code: 179

Error Code: Driver 12 cannot get down to requested current.

Error: Short to positive in circuit from output pin J3-J1 to return pin J3-K1.

Diagnostic Code: 180

Error Code: Driver 13 cannot get down to requested current.

Error: Short to positive in circuit from output pin J3-J3 to return pin J3-K1.

Diagnostic Code: 198

Error: CCD communications link failure between master TCU and slave TCU on (CCD BUS- (J2-E3)) and (CCD BUS+ (J2-B2).

Diagnostic Code: 199

Error: This is a non-functional base TCU. No application specific software has been programmed into it.

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GLOSSARY

Analog: A signal which has a continuous range of possible voltages.

Digital: A signal which consists of only two voltage levels—usually 0 volts and +5 volts. On/Off type signals are also considered to be digital.

Active: The high voltage (+12V / +24V) state of a digital input. Dependent upon vehicle system voltage.

Actual Gear: The actual physical gear of the transmission, regardless of shift lever position or controller operation.

Bus: Serial communications link which interconnects intelligent electronic modules.

Come-Home: A hardware function which allows limited vehicle motion in the event of failure of certain components.

Commanded Gear: The gear selected by the combination of the shift lever position and the state of the Forward, Reverse, Neutral, and Not Neutral inputs. The 'destination' gear.

Current Gear: The gear the controller is currently attempting to drive the transmission into by the application of commands to the valves.

Downshift Inhibit: The prohibiting of downshifting, by the TCU, to prevent harsh and abrupt shifts or possible over speed conditions of the engine. The downshift will be inhibited until the current speed ratio will permit the shift to take place.

Fault: An abnormal condition which results in a perceived performance change or in a loss of function which may result in performance loss or system damage.

Intershift Pause Time: The minimum time delay between shifts. A value preprogrammed into the TCU.

Neutral Recoverable: The process where a detected fault is maintained and displayed by the TCU until the shift lever is cycled to neutral (park on some systems) and the TCU detects the proper combination of inputs for a legal neutral (park) condition, at which time the displayed fault will be cleared. The fault code will still be maintained in TCU memory for future recall.

Next Gear: The next gear the controller plans to enter. The next gear will become the current gear if no faults are detected and all conditions for entering the neat gear are met.

Nonvolatile Memory: Memory that retains its data even though power to the system has been removed.

Passive: The low voltage (0V) state of a digital input.

Previous Direction: The direction of vehicle motion before a shuttle shift is initiated.

Previous Gear: The previous current gear.

Sequence Shift: The type of shift which consists of shifting from a gear to an adjacent gear.

Sequential Shifting: Multiple sequence shifts with no delay between shifts other than the programmed intershift pause time.

Shuttle Shift: A shift to a gear in the opposite direction of vehicle travel made by moving the shift lever between the Forward and Reverse positions.

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ABBREVIATIONS USED IN TCU GROUP

TCU: Transmission Control Unit

PMW: Pulse Width Modulated

MPU: Magnetic Pickup Sensor

GND: Ground

RPM: Revolutions Per Minute

REV: Reverse

FOR: Forward

NEU: Neutral

P: Park

DC: Direct Current

TOC: Top of Clutch

BOC: Bottom of Clutch

V: Volt

CYL: Cylinder

ENG: Engine

TEMP: Temperature

CAN: Control Area Network

SOL: Solenoid

POT: Potentiometer

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