Aircraft/Industrial

Tow Tractor

Service and Parts Manual

MODEL 60

Serial Number _____

Order Number 433814

NORTHWESTERN MOTOR COMPANY
1125 Starr Avenue
Eau Claire, WI 54703
715-835-3151
Fax 715-835-6625

CALIFORNIA

Proposition 65 Warning

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

The information contained in this manual is subject to change without notice.

IMPORTANT SAFETY NOTICE

There are numerous variations in procedures, techniques, tools, and parts for servicing tow tractors, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who does not follow the instructions provided in this manual must first make sure that they do not endanger their personal safety or tractor integrity by their choice of methods, tools, or parts.

Prior to starting any task, first read the WARNINGS or CAUTIONS included in the text for that task.

CAUTION is used in this manual to indicate hazards or unsafe practices which could result in equipment damage.

WARNING is used in this manual to indicate hazards or unsafe practices which could result in personal injury or death.

General Specifications

Rear-Wheel Drive, Two-Wheel Steer, Towing Tractor

The following specifications describe the standard configuration. Various options may alter these specifications.

Gross Weight (Standard) - - - - - - - - -6,300 lbs.
Drawbar Pull (Standard) - - - - - - - - -6,000 lbs.
Ground Clearance - - - - - - - - - - - - - - - 8"
Turning Radius - - - - - - - - - - - - - - 115.0"
Fuel Tank:
Capacity - - - - - - - - - - - - - 12.5 Gallons
Material - - - - - - - - - - - - - 18 Gauge Steel
Cooling System:
Capacity - - - - - - - - - - - - - - - - - 24 qts.
Pressure - - - - - - - - - - - - - - - - - - 14 psi
Rear Axle:
Make - - - - - - - - - - - - - - - - - Rockwell
Model - - - - - - - - - - - - - - - - - - TA267
Ratio - - - - - - - - - - - - 14.14:1 or 17.00:1
Alternator - - - - - - - - - - - - - - - - 66 amps
Battery - - - - - - - - 530 CCA (625 CCA diesel)

FLUIDS
Engine Oil - - - - - - - - - - - - - - - - - CD/SF
Trans. Fluid - - - - - - - - - - - ATF Dexron R2
Coolant - - - - 50-50 Water/Ethylene Glycol-Base
Brake Fluid - - - - - - - - - - - - - - - - DOT-3
Power Steering Fluid - - - - - - - - ATF Type A
Fuel (Diesel) - - - - - - - - - - - - -JP5-DF1-DF2
Fuel(Gasoline) - - - - - - - - - - - - - - -Unleaded

Engine Specifications

Make/Model	Perkins 4.236
Bore	3.875"
Stroke	5.00"
Displacement	236 Cu. In.
Number of Cylinders	4
Cycle	4-stroke
Compression Ratio	16:1
Combustion System	Direct Injection
Firing Order	1-3-4-2
Horsepower	80 @ 2600 RPM
Rotation	Clockwise Viewed from Front
Dry Weight	609 lbs.
Aspiration	natural
Governing	mechanical
Idle	650-750 RPM
High Idle	2860 RPM
Oil Capacity	8.00 Qts.

Make/Model	Ford CSG-649
Bore	4.00"
Stroke	3.98"
Displacement	300 Cu. In.
Number of Cylinders	6
Cycle	4
Compression Ratio	8:1
Firing Order	1-5-3-6-2-4
Rotation	Clockwise Viewed from Front
Dry Weight	473 Lbs.
HP	101 @ 2800 RPM.
Idle	500-550 RPM.
Oil Capacity	6 Qts.
Coolant Capacity, engine only	11 Qts.
Oil Pressure @ 2000 RPM	35-60
Fuel Pump Static Pressure	5-7
Thermostat, fully open	186 Deg.
Ignition Timing, BTDC	6 Deg.
Spark Plug Gap	0.045"

Make/Model	Isuzu 4BD1
Bore	102 mm
Stroke	118 mm
Displacement	3856 cc
Number of Cylinders	4
Cycle	4-stroke
Compression Ratio	17:1
Combustion System	Direct Injection
Firing Order	1-3-4-2
Injection Pump	Bosch A type
Dry Weight	325 kg
Aspiration	natural
Governing	mechanical
Oil Capacity	14.00 liters

Make/Model	Perkins 1004
Bore	3.937"
Stroke	5.00"
Displacement	243 Cu. In.
Number of Cylinders	4
Cycle	4-stroke
Compression Ratio	16.5:1
Combustion System	Direct Injection
Firing Order	1-3-4-2
Horsepower	80.5 @ 2200 RPM
Rotation	Clockwise Viewed from Front
Dry Weight	620 lbs.
Aspiration	natural
Governing	mechanical

Transmission Specifications

Make/Model	Chrysler
Type	Automatic w/ Torque Converter
Model	A-727 C Case
Oil Capacity	14.00 Qts.
Gear Ratio:	
1-Low	2.45:1
2-Second	1.45:1
D-Drive	1.00:1
R-Reverse	2.21:1
N-Neutral	

Make/Model	Ford C6
Type	Automatic w/ Torque Converter
Fluid Capacity	11.75 Qts.
Fluid Type	ATF Dexron R2
Gear Ratio:	
1-Low	2.46:1
2-Second	1.46:1
D-Drive	1.00:1
R-Reverse	2.18:1
N-Neutral	

Northwestern Motor Company, Inc.

Limited Warranty

Northwestern Motor Company (NMC) warrants to the original owner that all components of the tow tractor manufactured by NMC are free from defects in material and workmanship under normal use and service for 12 months or 1000 hours, whichever comes first, from the earlier of the date of delivery or first use of the equipment.

This warranty provides for any tow tractor component manufactured by NMC that fails because of defects in material or workmanship during the warranty period, without charge to the owner for parts or labor. The owner must provide prompt notice of the defect and allow reasonable time for replacement or repair.

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

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

The tow tractor must be maintained according to the instructions provided with it or this warranty may be considered void. Warranted components must be replaced with parts manufactured or approved by NMC and warranty repairs must be done by an NMC dealer authorized to make warranty repairs. Warranty determination will be made after NMC inspects the failed part.

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

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

This warranty is non-transferable.

TO OBTAIN WARRANTY SERVICE

Warranty service can be obtained from the NMC factory. Contact NMC at: Northwestern Motor Company, 1125 Starr Avenue, Eau Claire, WI 54703, 715/835-3151 (Fax 715/835-6625).

Northwestern Motor Company

Warranty Procedures for Tow Tractors

All tow tractor models are covered under NMC's new equipment warranty, which applies to all tow tractor components except those not manufactured by NMC. Components installed on the tow tractor but not manufactured by NMC are covered under the original manufacturer's warranty, if any.

A copy of the Warranty sheet along with several blank warranty claim forms are included with this package.

What is covered by warranty?

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

What is not covered by warranty?

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

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

Refer to the Warranty text for more specific conditions.

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

What to do when you receive a new unit.

- Make sure that you have received all equipment, including manuals and registration card. Return the registration card immediately.
- Inspect the unit for any transportation damage, including broken glass, leaks, or loose wires or belts.

What to do when you discover a possible warranty problem.

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

Important . . . !

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

What to do after warranty problem has been resolved.

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

What labor rate and time should be used?

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

This manual is available on CD-ROM.

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

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

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

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IMPORTANT!

There are numerous variations in procedures, techniques, tools, and parts for servicing the tractor, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who does not follow the instructions provided in this manual must first make sure that they do not endanger their personal safety or tractor integrity by their choice of methods, tools, or parts.

This manual describes processes which might require the use of chemicals, solvents, paints, or other commercially available material. Users of this manual should obtain the material safety data sheets (OSHA Form 20 or equivalent) from the manufacturers or suppliers of any materials to be used.

Know and follow the instructions provided by the manufacturer/supplier for the safe handling, use, storage, and disposal of these materials.

Prior to starting any task, first read the WARNINGS or CAUTIONS included in the text for that task.

INSTRUCTIONS FOR OPERATORS

Safety is everyone's business. Obey the rules of the road, be alert at all times, operate the vehicle defensively, stop at all intersections, be aware of all clearances, and obey special safety regulations.

1. When approaching other traffic, slow down, sound horn, and if vision is obstructed, keep right. Under all conditions, with a load or without, operate at a speed that will permit you to come to a stop safely.
2. Use special care when operating on inclines. Travel slowly and do not angle or turn.
3. Do not operate on excessive grades.
4. Tow the tractor only with the rear end picked up or with the drive shaft disconnected. Failure to do so will damage the transmission.
5. Maintain a safe distance from the edge of ramps and platforms.
6. Observe all traffic regulations including speed limits.
7. Under normal traffic conditions, keep to the right.
8. Maintain a safe distance from the vehicle ahead and always keep the tractor under control.
9. Conform to local traffic regulations when operating on public roads.
10. Never allow anyone to ride on the tractor with

you except in the passenger seat.

11. Avoid abrupt moves. Be a professional driver and HANDLE WITH CARE.
12. When towing loads, take extra care in securing and transporting the load.
13. Watch out for obstructions. Check overhead clearances.
14. If the tractor has to be parked on an incline, set the parking brake and chock the wheels.
15. Report accidents involving persons, building structures, and equipment to the proper authority.

INSTRUCTIONS FOR MAINTENANCE PERSONNEL

1. Before attempting to repair the tractor, read and understand the maintenance procedures.
2. Only qualified and authorized persons should be permitted to maintain, repair, adjust, and inspect the tractor.
3. Properly vent the work area.
4. Avoid fire hazards and have fire protection equipment present. Do not use open pans of fuel or flammable fluids for cleaning parts.
5. Brakes, steering mechanisms, warning devices, lights, safety guards, etc., should be inspected regularly and maintained in a safe operating condition.
6. Keep the tractor clean to lessen fire hazards and allow loose or defective parts to be better seen.
7. Before working on the tractor, make sure jacks and jack stands have a lifting capacity of at least 10,000 lbs.
8. Prevent water from entering into internal tractor parts. Before cleaning, be sure all openings are closed or covered.
9. Sparks or open flames in the maintenance area are dangerous. Explosive vapor can easily escape from a vehicle into the work area.
10. Never add engine oil from a jug or a bottle. The chance of contamination is too great. Use oil from a sealed container.
11. Keep unnecessary personnel away from tractor while it is running.
12. Only one person must control the engine.
13. Operate engine only from the driver's seat.
14. Properly dispose of all used fluids. If you do not know the proper disposal procedures, read the labels or ask your supervisor.

SECTION 1

INTRODUCTION AND DESCRIPTION OF TRACTOR

Contents

1.1 PURPOSE OF THIS MANUAL

This manual is meant to provide the information necessary to operate, maintain, and repair the aircraft towing tractor ("tractor") manufactured by **Northwestern Motor Company, Eau Claire, WI 54703, phone 715-835-3151.**

1.2 ARRANGEMENT OF THIS MANUAL

This manual is divided into ten Sections. Sections 1 through 9 are the introduction, specification, preventive maintenance, operation, and repair sections.

Section 10 is the Illustrated Parts Breakdown (IPB). The IPB shows all parts and part numbers necessary for support of the tractor. The IPB can be used for requisitioning and identifying parts. It is arranged in alphabetical order.

1.3 DESCRIPTION OF THE TRACTOR

The tractor is designed for towing aircraft but may also be used for towing other loads. Towing couplers may be attached to the front and/or rear of the tractor.

The tractor operates like most any automotive vehicle powered by an internal combustion engine. The major difference between this tractor and an automobile having a similar size engine is the higher gear ratio in the rear axle. The higher gear ratio allows great pulling (towing) ability. Maximum forward speed is between 12 and 18 MPH, depending on axle gear ratio.

1.3.1 Frame. The frame is a welded-steel one-piece unit, cross-braced to prevent misalignment. Ballast weight is on the frame over the rear axle. An adjustable driver's seat is on the left side of the tractor. A seat may also be provided on the passenger side.

1.3.2 Engine. A gasoline or diesel engine powers the rear wheels through a transmission, drive shaft, and rear axle assembly. The engine is a valve-in-head, four-cycle, liquid-cooled, pressure-lubricated, with crankcase ventilation.

1.3.3 Cooling System. The water pump on the front of the engine circulates coolant through the cylinder block, head, radiator, and oil cooler. A belt-driven cooling fan mounted on the water pump creates air flow through the radiator to reduce the temperature of the coolant as it passes through the radiator. To allow higher water temperatures without boil-over, the system is pressurized. If system pressure exceeds 14 PSI (due to excessive heat), a valve in the radiator fill cap will open to release the pressure.

To maintain proper engine operating temperature, a thermostat regulates water flow from the engine to the radiator. When coolant reaches 182°F, the thermostat begins to open, and is fully open at 192°F.

1.3.4 Transmission. The automatic transmission and torque converter housing are together in an aluminum casting. Gear selection is done by using a conveniently located manual shift lever. On most tractors, the lever has five detent positions; R (reverse), N (neutral), D (drive), 2 (second), and 1 (low). *There is no P (park) position.* The Allison transmission has an additional forward gear.

There is no P (park) position. The gear shift control is linked to the transmission by a cable. The transmission is cooled by hydraulic fluid circulated through a heat exchanger attached to the engine radiator.

1.3.5 Torque Converter. The torque converter is attached to the crankshaft with a flexible plate in between. Cooling is by circulating transmission fluid through the transmission heat exchanger.

1.3.6 Lubrication System. An oil pump draws oil through a strainer in the oil pan and circulates the oil through the engine. Before entering the engine, all the oil from the pump passes through the oil filter. Surplus oil drains back into the pan. Engine oil pressure is maintained by a spring-loaded pressure-relief valve in the oil pump.

The screw-on oil filter is mounted on the oil pump (or auxiliary cooler where provided). If the element becomes clogged, a relief valve in the filter permits oil to bypass the filter.

Engine oil flows through the oil cooler cavity to be cooled by coolant which flows through plates inside the oil cooler.

1.3.7 Fuel System. The fuel riser pump brings fuel from the fuel tank and delivers it to the carburetor or injection pump. LPG fuel systems do not use the fuel pump.

1.3.8 Governor. A variable-speed governor limits fuel flow. The governor is preset by the manufacturer.

1.3.9 Air Cleaner. The air cleaner is a dry element type and is located on the right front fender. It prevents dirt and other foreign materials from entering the engine.

1.3.10 Exhaust System. The exhaust system consists of an exhaust manifold, exhaust pipe, muffler and tail pipe. The exhaust manifold has large radius curves which permit exhaust gasses to leave the cylinders with a minimum of back pressure and power loss. All parts of the exhaust system are well supported with clamps and hangers.

1.3.11 Electrical System. The tractor uses a conventional 12-volt electrical system to supply power for the lights, horn, starter motor, ignition, and instruments. However, some tractors are built with a 24-volt system option. A standard battery and alternator is used.

1.3.11.1 Battery. The battery is a conventional 12-volt type with a positive cable and a negative ground cable. The cables have protective boots at the battery end.

1.3.11.2 Alternator. Electrical power is supplied by a belt-driven alternator mounted on the right front of the engine. It produces three-phase alternating current and voltage, rectified to DC by a full-wave rectifier bridge using six diodes. The alternator does not require a cutout relay.

1.3.11.3 Current Regulator. The current regulator is part of the alternator assembly. It determines output current according to load, such as headlights, rear lights, etc.

1.3.11.4 Starter. The starter motor is a gear-reduction type mounted on the automatic transmission housing at the rear of the engine. The starter motor is used to turn the engine fast enough to start the engine.

1.3.11.5 Lights and Accessories. Two head lights are on the front of the tractor. The stop/tail lights and rear backup lights are in the rear body. The backup lights can also be used as work lights (there is a separate switch for this purpose).

1.3.12 Instrument Panel. All driver instruments are conveniently located on the instrument panel (see Figure 1-1 below):

(a) Voltmeter

(b) Engine coolant temperature gauge.

(c) Oil pressure gauge.

(d) Transmission oil temperature gauge.

(e) Fuel gauge.

(f) Ignition switch.

(g) Hour meter

(h) Rear work light switch.

(i) Head and tail light switch.

1.3.13 Rear Axle. The rear axle assembly consists of the rear driving axle, differential, and a planetary hub at each rear wheel. The rear axle assembly is coupled to the transmission by a drive shaft and two universal joints.

1.3.14 Brake System.

1.3.14.1 Service Brake. The service brake is a typical automotive design using a brake master cylinder with hydraulic power booster, foot pedal, equalizer valve, tubing, etc. Disc brakes are on the front and rear. However, drum brakes are used on the rear of tractors equipped with optional dual wheels.

1.3.14.2 Parking Brake. The parking brake lever is on the operator's right. When pulled, the lever pulls a cable which applies pressure to brake bands which press against the parking brake drum or disk (attached to the transmission output shaft). The parking brake is com-

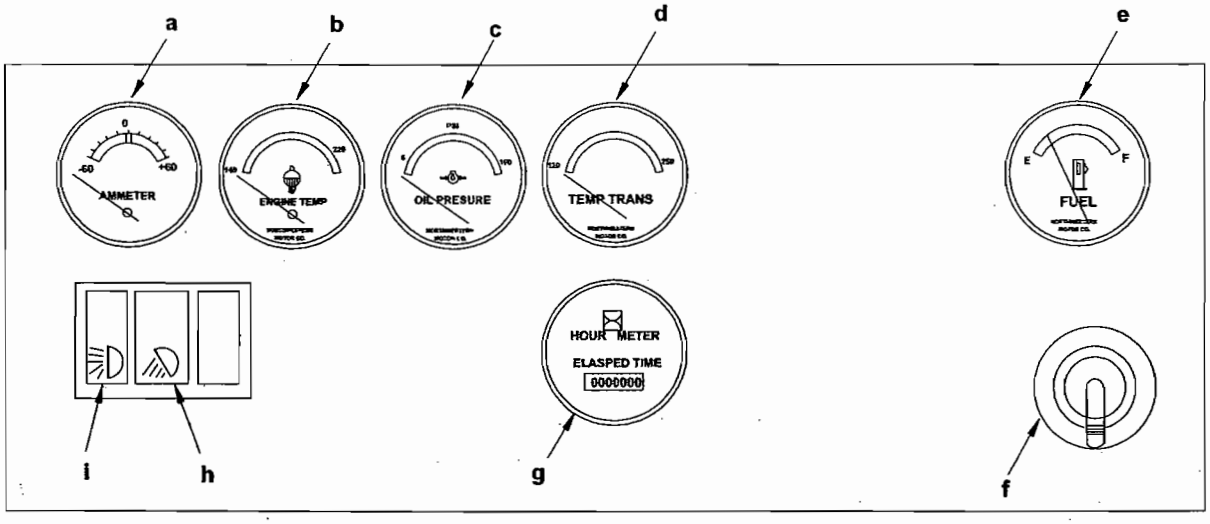
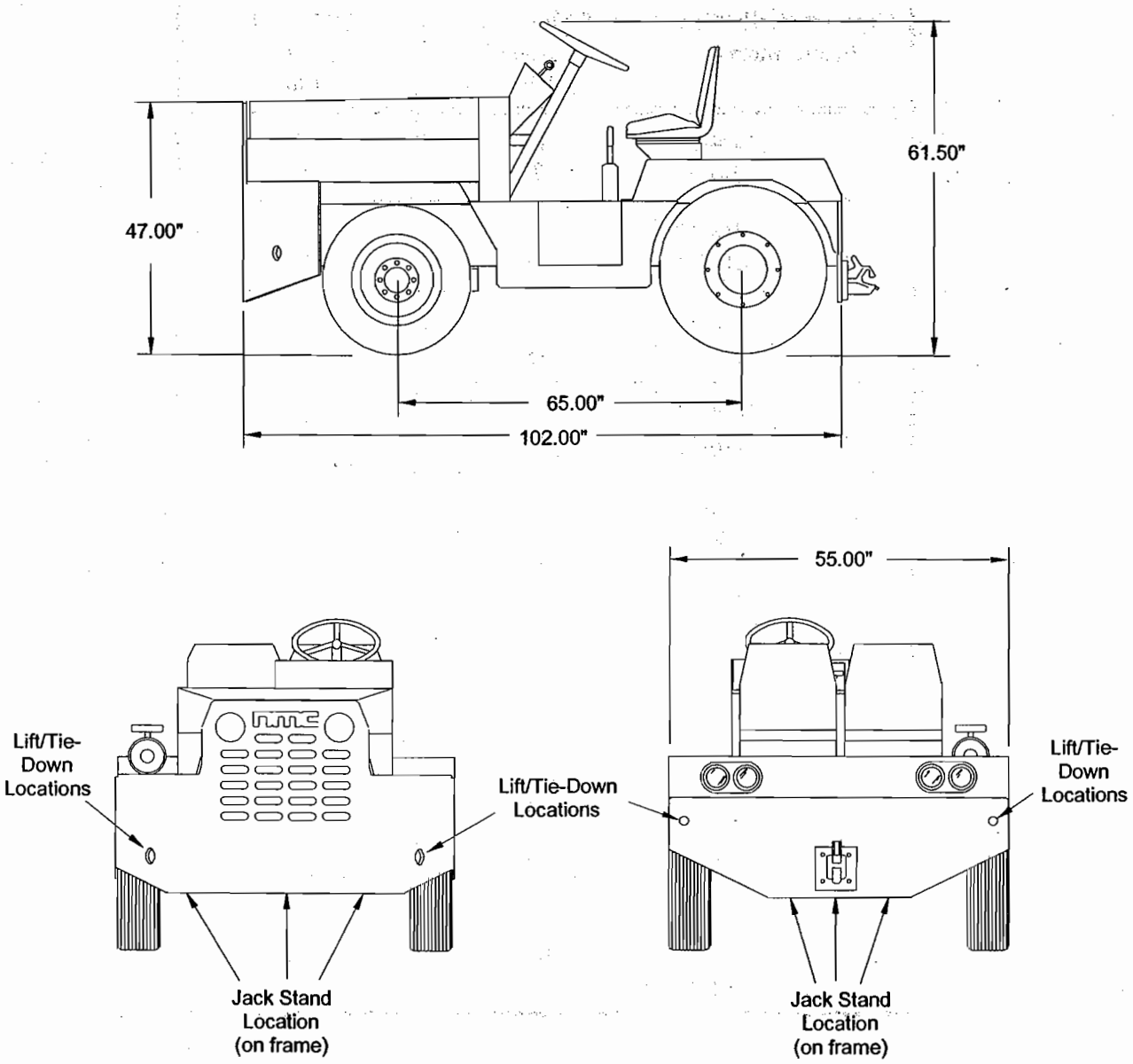


Figure 1-1. Instrument Panel.

pletely mechanical.

1.3.15 Steering System. The power-assisted front-wheel steering gear operates through a mechanical linkage (drag link, pitman arm and single tie rod). The tie rod is attached to knuckles on the front axle. The front axle assembly is spring-mounted.

The steering gear is a recirculating ballnut type. The power assist is activated by the belt-driven power steering hydraulic pump.



WARNING

Make sure jack and jack stands have the capacity for the weight of the tractor.

Lifts and jacks may be used on any point on the bottom edge of frame at the front and rear of tractor as shown above.

Figure 1-2. Tractor Dimensions.

Table 1-1. Standard Torque Specifications.

Capscrew Body Size Inches-thread	SAE Gr. 5 Torque ft/lb	SAE Gr. 8 Torque ft/lb
1/4-20	6	9
1/4-28	7	10
5/16-18	13	18
5/16-24	14	24
3/8-16	23	35
3/8-24	35	40
7/16-14	35	55
7/16-20	40	60
1/2-13	55	80
1/2-20	65	90
9/16-12	80	110
9/16-18	90	130
5/8-11	110	160
5/8-18	130	180
3/4-10	200	280
3/4-16	220	320
7/8-9	300	460
7/8-14	330	510
1-8	480	680
1-12	530	750

NOTES

Do not use these values if a different torque value is given for a specific procedure.

These values are for clean, dry, PLATED (or lubricated) threads. Increase torque 20% for unlubricated or unplated threads.

If the fastened part is aluminum, reduce torque 25%.

Fasteners should be replaced with the same or higher grade. If higher grade fasteners are used, they should be tightened to the strength of the original.

Locknuts: Tighten plastic-insert or crimped-steel-type lock nuts to approx. 50% of the dry torque shown (applied to the nut, not the screw head).

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Figure 1-3. Electrical System Schematic.

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SECTION 2

OPERATION

Contents

2.1 CHECK TRACTOR BEFORE OPERATING

Inspect the tractor for shipping damage. A thorough visual examination will usually reveal any damage that may have occurred in transit. Report damage to the proper authorities so that repairs and claims may be made.

The tractor is shipped with all fluids except fuel. As a precaution, however, check all fluid levels, brakes, electrical system, engine, steering, axles, and transmission as described in Section 3 and perform the prescribed lubrication.

2.2 CONTROLS AND INSTRUMENTS

Before driving the tractor, become familiar with all operating controls and instruments as described below. Then drive the tractor without a tow load until you can handle the vehicle properly.

2.2.1 Operator's Controls.

1. The **gasoline ignition switch** is a rotary type marked OFF, IGN (ignition), and START. **The diesel ignition switch** is a rotary type marked O (off), R (run), H (heat) and HS (heat/start).

2. The **head and tail light** toggle switch controls the two sealed beam headlights and the tail lights.

3. The **rear work light** toggle switch controls the rear work lights.

4. The **gear shift lever** is to the right of the driver. It permits selection of forward or reverse gears and a neutral position.

5. The **accelerator pedal** is to the right of the brake pedal and is connected by mechanical linkage to the fuel injection pump or carburetor.

6. The **park brake lever** is to the right of the driver. It must be pushed forward to disengage the park brake. Tension on the brake cable is changed by loosening or tightening the knob on top of the brake lever.

7. The **service brake pedal** is to the left of the accelerator pedal.

2.2.2 Instruments.

1. The engine **hourmeter** registers how many hours the engine has operated. It is sealed and can record 99999.9 hours before it returns to zero.

2. The **fuel gauge** shows the amount of fuel in the fuel tank. A sending unit in the tank is connected to the gauge. The gauge is marked **E and F** to indicate the relative quantity of fuel in the

tank. Keep the needle in the green part of the gauge.

3. The **oil pressure gauge** indicates oil pressure only (not oil level). It is marked **6 to 100** with intermediate index marks. If the gauge registers in the red area, stop the engine and troubleshoot the problem.

4. The **voltmeter** registers voltage across the battery terminals. The needle should be in the green area while the tractor is operating. If the needle registers in the red while the tractor is operating, this indicates that the battery is not being charged by the alternator. Stop the tractor and inspect the battery, cables, and alternator connections.

5. The **coolant temperature gauge** shows the coolant temperature in the engine's water jacket. The gauge needle should rise when the engine is started, then level out at between 150 and 200 as the engine warms up. If the needle goes into the red, stop the engine and check for a cooling system problem.

6. The **transmission oil temperature gauge** shows the temperature of the transmission fluid. Normal operating temperature is in the 120°F to 280°F range. If the needle goes into the red, stop the engine and troubleshoot the cause.

7. **Fuses** for all electrical circuits (except the optional cab) are located under the instrument panel in fuse blocks.

2.3 STARTING THE ENGINE

Several things affect engine start, such as battery power, starter motor performance, and oil viscosity.

Diesel engines need a cold-starting system if they are to start in cold conditions. The cold start system on the tractor engine is an intake air preheater that burns a small amount of fuel in the air intake manifold.

2.3.1 Starting the Engine (Cold).

1. Perform the daily service checks as shown on Table 3-1.
2. Apply the parking brake.
3. Place the gear shift lever in N (neutral) position.
4. Diesel only: Turn ignition switch to "IGN" and push in preheater switch for about 15 seconds, then let up the switch.
5. Turn ignition switch to "START" and crank starter for no more than 15 seconds.
6. Diesel only: If engine does not start after 15 seconds of cranking starter, press the preheater switch for 10 seconds and again crank starter for no more than 15 seconds.

Important! If the tractor will not start, allow the starter motor to cool before repeating the procedure. This will prevent battery drain and starter motor overheating.

7. After the engine is running smoothly, tap the accelerator pedal to reduce the fast idle speed. Allow engine to warm up for 2 minutes.
8. Observe instruments to be sure each is working. Do not operate engine if oil pressure fails to rise or if voltmeter does not show any charge.

2.3.2 Starting the Engine (Warm). Diesel only: Follow the cold start procedure, but do not use the preheater.

2.4 HARD STARTING

If the tractor fails to start in the normal way, the engine probably needs service. See Table 4-1, Engine Troubleshooting.

Note: Because it has an automatic transmission, the tractor cannot be started by towing or pushing.

⚠CAUTION When using a battery booster, observe proper polarity or you may damage the electrical system and battery.

A worn out or badly sulphated battery will produce numerous problems that cannot be corrected until the battery is replaced.

Always check battery condition and connections before condemning other tractor systems.

2.4.1 Jump Starting the Tractor. Cold weather reduces battery efficiency. For example, at 32°F, battery capacity is reduced to 65%, and at 0°F, capacity is reduced to 40%.

A 12-volt booster battery can be connected in parallel with battery on the tractor to aid in cold weather starting. Heavy duty jumper cables will supply significantly more current than cheap cables.

⚠WARNING Battery gas can explode. Keep sparks and flames away from batteries. Wear safety goggles. Do not lean over battery when making connections.

Always remove black (negative) battery clamp first and replace it last. Never let cable ends touch.

1. To jump start a tractor, make sure the two vehicles are not touching each other.
2. Loosen vent caps from BOTH batteries, if present.
3. In very cold weather, check for frozen electrolyte or no visible electrolyte. If either condition exists, warm the battery until it reaches a temperature of at least 40°F before attaching booster. This will reduce chance of battery rupture or explosion.

Note: Charging vehicle should not be running.

4. Connect the POSITIVE jumper cable clamps to the POSITIVE posts of the two batteries. Then connect the NEGATIVE jumper clamp to the good battery. Finally, place the other NEGATIVE jumper clamp on a solid unpainted metal bolt or bracket located on the disabled machine.

⚠WARNING Do not make the connection at the discharged battery because a spark is caused when attaching the clamp.

5. Start vehicle having the good battery, then crank starter of disabled vehicle. Do not overcrank.
6. Remove jumper cables in order applied.

2.5 DRIVING THE TRACTOR

When the engine is warmed up, the tractor is ready for work. Use lights as required.

1. Release parking brake and apply foot brake.
2. Place gear shift lever in proper speed range:

   D – No load or light load

   2 – (If equipped) Medium load

   1 – Heavy load or inclines

   R – Reverse

3. Release the foot brake and depress the accelerator pedal slowly and evenly. As the tractor starts to move and increase speed, the transmission will upshift automatically, unless you are in "1" or "R".

⚠CAUTION Do not shift from a forward gear (D, 2, or 1) to reverse (R) or from reverse to a forward gear unless the tractor is at a complete stop. Failure to do this will ruin the transmission and void the warranty.

4. When towing, allow tractor to decelerate by releasing accelerator pedal before applying foot brake. The transmission will downshift automatically.

⚠CAUTION Secure the towing pintle before moving the load.

5. When driving or towing, avoid the tendency to oversteer and turn too sharply. Allow enough clearance for the towed load.

2.6 SHUTTING DOWN THE TRACTOR

1. Bring tractor to a safe and complete stop and set parking brake.
2. Place gear shift lever in neutral (N).
3. Turn off all lights.
4. Turn off ignition switch.

Important! Always set the parking brake when parking the tractor. The automatic transmission does not have an internal parking lock.

2.7 EMERGENCY STOPPING

If the brakes fail, follow this procedure:

1. Downshift to next lower gear, unless already in "1."
2. Use parking brake to stop tractor by pulling on parking brake lever.

2.8 TOWING THE TRACTOR

⚠CAUTION Tow the tractor with the rear end picked up or with the drive shaft disconnected. Failure to do so will damage the transmission.

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

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

Failure to follow these instructions will cause transmission damage and will void the warranty.

SECTION 3

PREVENTIVE MAINTENANCE AND GUIDELINES FOR REPAIR

Contents Page

3.1 CHAPTER CONTENTS

This chapter provides a preventive maintenance schedule with the necessary procedures. Tools required are those normally available in any organizational tool shop.

Also, guidelines for repairing the tractor are located on the last two pages of this chapter. Before attempting to repair the tractor, be familiar with the information on these pages.

3.2 PERIODIC MAINTENANCE AND INSPECTION

Use the engine hour meter to keep track of when preventive maintenance is required.

Use Table 3.1 below to schedule your maintenance.

Note: Recommended service intervals are for normal operating conditions. Service MORE OFTEN if machine is operating under sandy, dusty, or wet conditions.

⚠CAUTION Neglecting maintenance can result in failures or permanent damage to tractor components and may void the warranty.

Table 3-1. Preventive Maintenance Schedule.

Component	Service Required	Paragraph Where Instructions are Located
Daily (Pre-Start-Up)		
Engine Cooling System	Check coolant level. Check for coolant leaks.	3.3.1 3.3.2
Engine Oil	Check level.	3.3.3
Engine Air Filter (if conditions are extremely dusty)	Inspect element and empty dust cap.	3.3.4
Transmission	Check for leaks.	3.3.5
Electrical System	Check lights.	3.3.6
Fuel System	Check for fuel leaks.	3.3.7
Brakes	Check brake pedal free play.	3.3.8
Wheels and Tires	Inspect condition and check pressure	3.3.9
Rear Axle	Check for leaks.	3.3.10

Table 3-1. Preventive Maintenance Schedule.

Component	Service Required	Paragraph Where Instructions are Located
Every 100 Operating Hours		
Engine Oil and Filter	Change.	3.4.1
Crankcase Air Cleaner	Clean.	3.4.2
Every 250 Operating Hours or 3 Months		
Spark Plugs	Change.	3.5.1
Ignition Timing	Check.	3.5.2
Breaker point distributor wick	Lubricate wick in center of cam.	3.5.3
Distributor cam	Lubricate.	3.5.3
Transmission	Check Oil	3.5.4
Grease Fittings	Lubricate	3.5.5
Driveshaft	Lubricate and inspect U-joints.	3.5.6
Steering, suspension, and front axle	Inspect.	3.5.6
Brakes	Inspect parking brake. Inspect system. Check master cylinder fluid level	3.5.7 3.5.7 3.5.7
Exhaust System	Inspect.	3.5.8
Every 500 Operating Hours or 6 Months		

Table 3-1. Preventive Maintenance Schedule.

Component	Service Required	Paragraph Where Instructions are Located
Perform 250-hour service		3.5
Engine Air Cleaner	Change element.	3.6.1
Belts	Check tension and condition. Install or adjust.	3.6.2 3.6.2
Axles	Check oil level.	3.6.3
Brakes	Inspect	3.6.4
Electrical System	Clean and inspect wiring, battery, and cables.	3.6.5
Every 1000 Operating Hours or 1 Year		
Perform 500-hour service		3.6
Transmission	Change oil and filter. Tighten mounting bolts. Adjust bands.	3.7.1.1 3.7.1.2 3.7.1.3
Axles	Change oil. Repack front wheel bearings.	3.7.2.1 3.7.2.2
Every 2500 Operating Hours or 2 Years		
Perform 500-hour service		3.6
Engine	Adjust valves.	3.8.1
Engine Cooling System	Change coolant.	3.8.2

3.3 DAILY SERVICE

3.3.1 Check Coolant Level. Raise engine hood and visually check level of coolant in coolant reservoir. If low, fill to FULL mark with a 50/50 mixture of clean, soft water and an ethylene glycol-base engine coolant (Fed. Spec. A-A-870).

3.3.2 Check for Coolant Leaks. After tractor has been parked overnight, check ground under engine for leaked coolant (green-colored). If found, try to locate exact source of the leak. If source is a loose hose, tighten hose clamp or replace hose if necessary. If radiator or water pump is leaking, report condition to a supervisor.

3.3.3 Check Engine Oil Level. With engine off and tractor parked on a flat surface, remove dipstick and read oil level. If low, add clean engine oil, MIL-L-46152, as required.

Use correct viscosity grade for the temperature range in which the tractor will be operating. Refer to Table 3-2 at the end of this section..

3.3.4 Empty Air Cleaner Dust Cup (If Conditions are Extremely Dusty). Remove retaining strap securing dust cup to canister. Remove dust cup. Remove wing nut securing filter element to canister. Remove and inspect element.

Clean out dust from canister and dust cup with a damp, lint-free cloth. Install element and dust cup. Replace element if necessary.

Note: Replace filter element immediately if sealing edges are damaged.

3.3.5 Inspect for Transmission Oil Leaks. After tractor has been parked overnight, check ground under tractor for evidence of oil leakage (red-colored fluid). Try to find exact source of any leak and report condition to your supervisor.

3.3.6 Check Lights. Check operation of all tractor lights. Replace any burned-out lights.

3.3.7 Check for Fuel Leaks. Raise engine cover and inspect fuel line connections for leaks. Be sure fuel lines are securely fastened by retaining clips.

3.3.8 Check Brake Pedal Free Play. Check brake pedal free play. There should be ample travel remaining when brakes are fully applied. The pedal should be firm with no spongy feeling. If free travel is excessive, but braking improves after "pumping" the pedal several times, there may be air in the brake lines. Report condition to your supervisor. Also see 8.3.

Excessive free travel may also be caused by worn brake linings, pads, or both.

3.3.9 Check Tire Condition and Pressure. Inspect tire for cuts, nails, stones in the tread or deterioration. Remove stones and other foreign material imbedded in the tires. If damaged, report condition to supervisor. Also see Section 9.

Inspect wheels for cracks and other damage. If damaged, report condition to supervisor.

Check air pressure using a proper gauge. Pressure should be 65 PSI max. Add air as required.

3.3.10 Check for Rear Axle Oil Leaks. After engine has been parked overnight, check ground under rear axle for spots of oil. Try to find the exact source of any leak and report condition to your supervisor.

3.4 EVERY 100 OPERATING HOURS

3.4.1 Change Engine Oil and Oil Filter.

1. Run engine until it is warm.
2. Stop engine, remove sump drain plug and O-ring. Drain lubricating oil from sump. Do not damage O-ring. Reinstall drain plug and O-ring. Tighten plug to 25 ft-lb.
3. Put tray under filter to catch oil spills.

4. Unscrew filter canister with a strap wrench or by hand. Make sure that adapter is secure in filter head. Discard used filter canister properly.
5. Clean filter head.
6. Add clean engine lubricating oil to new canister. Allow oil enough time to pass through filter element.
7. Lubricate top of canister seal with clean engine lubricating oil.
8. Screw on new canister until gasket on filter contacts base. Tighten at least 1/2 more turn by hand only. Do not use strap wrench.
9. Fill sump with 4 quarts of new, clean lubricating oil. Allow oil to drain down into engine for several minutes. Check oil level on dipstick. Add oil if necessary.
10. Start engine, check oil pressure gauge to make sure oil pressure is normal, check for leaks from filters. When engine has cooled, check oil level on dipstick. Add oil if necessary.

3.4.2 Clean Crankcase Inlet Air Cleaner.

1. Remove crankcase air cleaner from oil filler pipe.
2. Wash in kerosene.
3. Dry and re-oil with SAE 30 Engine Oil (more frequently in dusty conditions).

3.5 EVERY 250 OPERATING HOURS OR 3 MONTHS

3.5.1 Replace Spark Plugs.

1. Remove and replace plugs. Set plug gaps to. 035".
2. Install new gaskets when installing spark plugs.
3. Tighten plugs to 30 ft-lbs . torque.

3.5.2 Check Ignition Timing. The distributor must be correctly positioned to give proper ignition timing to obtain maximum engine performance. Check timing mark on vibration dampener. Mark with chalk if not readily visible.

1. Disconnect vacuum line at distributor. This will disable the vacuum advance mechanism.
2. Connect the three timing light leads as follows, or as per manufacturer's instructions:
   (a) Connect secondary lead of a timing light to No. 1 spark plug.
   (b) Connect red primary lead to positive battery terminal.
   (c) Connect black lead to negative battery terminal.
3. Start engine and set idle to 475-500 RPM with engine at normal operating temperature and transmission in neutral.
4. Using timing light, observe position of timing mark on vibration dampener or pulley and check against specifications. Ignition timing should be set at 4° BTDC.
5. Loosen distributor clamp screw and rotate distributor housing so specified timing mark and pointer are in alignment. (Moving distributor housing **against** shaft rotation advances timing and **with** shaft rotation retards timing.)
6. Tighten distributor clamp screw securely after timing has been set and recheck timing adjustment with timing light.
7. When spark timing is correct, reconnect vacuum line to distributor and remove timing light.

Note: If advance units are functioning, timing mark should move down on vibration dampener below the pointer as engine speed is increased.

3.5.3 Lubricate Distributor.

1. Remove distributor cap and rotor and oil wick in center of cam.
2. Wipe old grease from surface of breaker cam and apply a light film of clean distributor cam grease.

3.5.4 Check Transmission Oil.

For Allison transmission, Refer to Section 6

1. Bring transmission to normal operating temperature (about 180°F). Five minutes of driving, including frequent stops and starts, will usually produce normal fluid temperature.

Note: Use care to prevent entry of dirt and other foreign matter into transmission through filler tube.

2. Set gear selector to neutral (N) and withdraw transmission dipstick (located in engine compartment on driver's right) to check oil level.

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

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

3. Examine fluid for discoloration and a foul (burned) smell. This would indicate damaged bands or clutches. If oil has a milky look, water has entered the transmission. Air bubbles mean there is an air leak in the suction lines. Report any of these conditions to your supervisor.

4. Check level indicated on dipstick. Add fluid as needed to maintain level between "FULL" and "ADD" marks on the dipstick. **Use oil meeting specification Dexron R2.**

3.5.5 Lubricate Grease Fittings. At each oil change, apply a high-quality grease to all grease fittings. See Figure 3.1 for locations.

1. Wipe grease and dirt from fitting with a clean rag.

2. Using a grease gun, apply grease until clean grease oozes from between the mating parts.

3. Wipe off all excess grease.

3.5.6 Inspect Driveshaft, Steering, Suspension, and Front Axle Components. Repair information is in Section 7.

1. Inspect driveshaft by trying to move shaft sideways and up and down. If there is any movement in the U-joint, replace the U-joint. An indication of a worn U-joint is a regular squeak when the tractor is moving.

2. Using an appropriate torque wrench, check drive shaft bolt torque. Torque should be to 70 ft/lbs.

3. Inspect steering gear assembly, steering column assembly, drag link, pitman arm, and column support bracket for looseness; cracked, broken, or bent parts; and seal leaks. Replace all damaged parts.

4. Check front axle for worn, bent, cracked, or otherwise damaged parts. Replace all damaged parts.

5. Make sure pivoting members turn freely through complete turning radius.

6. Check knuckle bushings for wear.

   (a) Raise tractor until wheels are off ground. Support with safety stands.

   (b) Grab top of tire with both hands and move tire towards and away from the tractor. Grab bottom of tire and do the same. Any movement should be almost unnoticable (no more than 0.010-inch). If movement is excessive, replace all knuckle bushings. Lower tractor to ground.

7. Check tie rods for wear. Grab and try to move the tie rod tube in any direction. If any movement or looseness is felt, replace the ball joint assemblies.

8. Check tires for uneven wear patterns which might suggest axle misalignment or damage.

9. Check fastener torque according to values in Section 7 and Table 1-1.

10. Inspect hoses for softness, swelling, cracking, abrasion, etc. Inspect fittings for cracking or looseness.

11. Replace hoses and components that show signs of damage or deterioration.

12. Wipe off hoses and steering parts with a clean cloth to remove dirt and foreign materials.
13. Inspect steering pump oil level.
    (a) Clean steering pump filler cap, remove cap, and read oil level on dipstick.
    (b) Add oil if necessary (automatic transmission fluid type ATF, Dexron R2.
    (c) Replace filler cap.

3.5.7 Inspect Brakes.

3.5.7.1 Inspect Brake Lines. Access to brake lines can be obtained from the underside of the tractor. Check brake lines and hoses for leaks, deterioration, swelling, cuts, kinks and other damage. Report abnormal conditions to your supervisor.

3.5.7.2 Inspect Parking Brake and Clean Disc. Inspect all parts of the parking brake assembly for wear and damage, particularly brake pads. To change pads, refer to Section 8.

The parking brake may be adjusted by turning handle knob clockwise to tighten. Do not allow pads to "drag" on brake disk while brake is released.

Wipe off any dirt or oil from the parking brake disc using alcohol or other solvent approved for use on brakes.

3.5.7.3 Check Fluid Level in Brake Master Cylinder Reservoir. To access the master cylinder reservoir, remove access cover or open engine hood. Clean dirt from master cylinder cover and remove cap by raising the cap holders and snapping them over the ends of the cylinder.

If necessary, replenish with DOT 3 brake fluid (SAE J1703). If fluid level is often low, check all brake components for leaks. Report any abnormal condition to your supervisor.

Replace cap on top of cylinder and snap holders back into place.

3.5.8 Inspect Muffler, Exhaust, and Tail Pipe. With engine off and cool, check for loose mounting straps and fasteners. Check for damage such as rusted-through areas and report condition to supervisor.

3.6 EVERY 500 OPERATING HOURS OR 6 MONTHS

3.6.1 Replace Air Cleaner Element.
A dirty filter can restrict the air intake and reduce engine efficiency.

1. Remove retaining strap securing dust cup to canister and remove dust cup.
2. Remove wing nut securing filter element to canister and remove element.
3. Direct compressed air, **DO NOT EXCEED 30 PSI,** from the inside to the outside of element by inserting air nozzle inside element. Blow loose particles by holding nozzle at least 6" from element.
4. Clean inside of canister with a damp, lint-free cloth. Also clean dust cap and baffle.
5. Remove air cleaner inlet cap. Wash cap with water and wipe dry with a clean cloth.
6. Install element in canister and secure with wing nut. Install baffle in dust cap. Secure dust cap to canister by tightening retaining strap.
7. Install air cleaner inlet cap.
8. Check and tighten all air induction connections

before resuming operations.

3.6.2 Check Belt Tension And Condition.

⚠CAUTION Shut off and tag out tractor engine before checking drive belts.

1. To check deflection, press belt down with your thumb at center of longest free length. With moderate thumb pressure, deflection should be 3/8 inch.
2. If deflection is excessive and belt is in good condition, tighten belt by pivoting alternator or power steering pump. Replace belt if worn, cracked, or frayed.

3.6.2.1 Installing or Adjusting Belts. Adjust or install a belt by pivoting the alternator or power steering pump on its mounting brackets:

1. Loosen fasteners holding pump or alternator to their mounting brackets.
2. Change position of alternator or pump to give correct tension. Tighten fasteners.
3. Recheck belt tension.
4. If you installed a new belt, recheck belt tension after 25 hours of operation.

3.6.3 Check Rear Axle Oil Level. The rear axle has three fill plugs: one on the outside of each wheel end and one on the axle housing.

1. Park tractor on a level surface. Shut off engine and set parking brake.
2. Using a rag and wire brush, thoroughly clean dirt and rust from around fill plugs. The axle housing fill plug is the upper plug.
3. Check oil level in wheel ends, turn wheel so wheel end plug is horizontal to axle shaft.
4. Remove each fill plug and check oil level with a finger. Level should be to height of fill plug hole. Add oil, SAE 80W-85-140 as required.

3.6.4 Inspect Linings, Pads, Calipers, Wheel Cylinders, etc. See Section 8.

3.6.5 Clean and Inspect Wiring, Battery, and Cables.

1. Inspect all wiring and cable harnesses for loose connections, evidence of shorting (burned insulation or terminals) and frayed wires.
2. Check that retaining clips are secure.
3. Remove exterior dirt and grease by wiping with a cloth dampened with a general-purpose cleaner.
4. Allow parts to air dry after cleaning.

⚠CAUTION Disconnect the positive cable if charging battery in the vehicle.

5. When disconnecting the battery, first disconnect the negative cable, then disconnect the positive cable.
6. Remove cables from battery posts.
7. Inspect battery for evidence of electrolyte loss. Inspect case for cracks and leaks.
8. Check that posts are secure. If loose, replace battery. (Send battery to overhaul personnel for salvage.)
9. If corrosion or dirt is present, clean top of battery with a solution of clean warm water and baking soda. Scrub areas with a stiff bristle brush, being careful not to scatter corrosion residue. Wipe clean with a cloth moistened with baking soda in water.
10. Using a common wire-brush type battery tool, brush battery posts and inside of cable ends.
11. Reattach positive cable, then negative cable, to correct battery post.

3.7 EVERY 1000 OPERATING HOURS OR 1 YEAR

3.7.1 Transmission.

For Allison transmission, Refer to Section 6

3.7.1.1 Change Oil and Filter.

1. Raise tractor on jack stands or hoist.
2. Put a drain pan beneath transmission pan.
3. Loosen, but do not remove, the transmission pan capscrews.
4. Tap pan at one corner to break it loose. Allow fluid to drain. Remove capscrews and lower the pan.
5. Examine fluid for discoloration and a foul (burned) smell. This would indicate damaged bands or clutches. If oil has a milky look, water has entered the transmission. Air bubbles mean there is an air leak in the suction lines. Report any of these conditions to your supervisor.
6. Remove transmission filter retaining screws. Remove and discard filter.

Note: The torque converter does not drain when transmission pan is removed.

7. Install a new transmission filter on control valve body and secure with capscrews. Tighten to 150 in/lbs. torque.
8. Clean oil pan with solvent and dry it with compressed air.

Note: Use care to prevent entry of dirt and other foreign matter into transmission.

9. Install a new gasket on pan and install pan on transmission. Tighten pan capscrews to 150 in/lbs. torque.
10. Remove combined dipstick/filler cap from filler tube. Add **4 quarts** of type ATF DEXRON R2 transmission fluid.
11. Bring transmission to normal operating temperature (about 180°F). Five minutes of driving, including frequent stops and starts, will usually produce normal fluid temperature.
12. Set gear selector to neutral (N) and withdraw transmission dipstick (located in engine compartment on driver's right) to check oil level.

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

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

13. Check level indicated on dipstick. Add fluid as needed to maintain level between "FULL" and "ADD" marks on dipstick.

3.7.1.2 Tighten Mounting Bolts. Using a suitable torque wrench, check the torque of capscrews that secure transmission to tractor and engine. Torque specs are according to capscrew size. See Table 1-1.

3.7.1.3 Adjust Intermediate Band.

At every transmission oil change, adjust the intermediate band. Refer to Section 5.

3.7.2 Axles.

3.7.2.1 Change Rear Axle Oil. Refer to Section 9.

3.7.2.2 Repack Front Wheel Bearings. Refer to Section 7.

3.8 EVERY 2500 OPERATING HOURS OR 2 YEARS

3.8.1 Adjust Valves. Refer to Ford service manual supplied with this manual.

3.8.2 Change Coolant. To prevent internal corrosion in the radiator, oil cooler, and engine, the cooling system should be flushed out and filled with fresh coolant.

⚠WARNING Do not open radiator cap while engine is hot and system is under pressure.

1. Remove radiator fill cap. Place suitable catch pans under the radiator and engine drain plugs.
2. Drain radiator by opening tap at bottom of radiator.
3. Remove the drain plug from side of cylinder block to drain engine. Make sure drain hole is

not plugged.

4. Dispose of old coolant in an approved manner.
5. Flush system with clean water.
6. Install drain plugs and close radiator tap.
7. Remove one of the plugs from the thermostat housing to allow air to escape the engine. Fill radiator with a 50/50 mixture of clean, soft water and ethylene glycol-base engine coolant (Fed. Spec. A-A-870). Fill coolant reservoir to the recommended level.
8. Start engine. When engine reaches normal operating temperature, check coolant level in reservoir and fill as required.

3.9 GUIDELINES FOR REPAIRING THE TRACTOR

⚠WARNING BEFORE ATTEMPTING ANY REPAIRS on the tractor, know the safety precautions located in the front part of this manual.

The following are general instructions for the removal, disassembly, cleaning, inspection, reassembly, and installation of tractor components within the capabilities of the using organization. Common shop practices are not described. **Use the exploded views in Section 10.**

3.9.1 Special Tools. There are no special tools required for this tractor. Common automotive shop tools are all that is required to service the tractor.

3.9.2 Removal and Disassembly. Removal and disassembly should be performed using the exploded views in Chapter 10. Special instructions are noted in the appropriate text. Disassemble components only to the extent necessary to do repairs.

3.9.3 Cleaning. When cleaning, keep related parts together so reassembly in easier. Valves, pistons, sleeves and other internal parts that have close tolerance fits in mating bores should be cleaned individually to prevent surface scoring and marking. Special cleaning instructions are given where required.

3.9.3.1 Using Compressed Air. Use low-pressure compressed air to remove debris and dirt as necessary.

3.9.3.2 Frame, Engine, and Transmission.

⚠CAUTION Be sure all openings are closed or covered adequately before cleaning to prevent the entry of water into internal parts.

Structural parts are best cleaned using soap and water and suitable brushes. Steam cleaning may also be done before disassembly to remove heavy accumulations of grease, oil, and dirt from exterior of engine, transmission and rear axle assembly.

3.9.3.3 Metal Parts.

⚠CAUTION Reassemble and oil metal parts as soon as possible after cleaning. Parts that normally operate in oil can quickly corrode after cleaning unless a film of lubricating oil is applied.

Do not allow cleaned parts to remain more than two hours without reassembling or applying a film of oil.

Wash metal parts in an appropriate cleaning solvent. Allow to air dry. Do not use compressed air to dry parts. The moisture generally present in air systems may cause corrosion. Lubricate metal parts as soon as possible after cleaning.

3.9.3.4 Bearings. Wash bearings in a bearing washer or immerse in solvent and scrub clean with a soft brush. Remove all grease and oil from bearing recesses. Allow to air dry. Apply a thin film of lubricating oil to bearings and check for free movement between inner and outer race. Worn bearings must be replaced.

3.9.3.5 Gears. Clean gears using a soft bristle brush and cleaning solvent. Remove foreign matter from the gears.

3.9.4 Inspecting Parts. Inspect all parts visually for cracks, breaks, scratches, dents, bends, punctures, galling, wear, scoring, stripped threads, distortion and deformation. Give special attention to bearing surfaces, mating surfaces, gaskets and seals. Specific dimensional checks and tests are given where

required.

3.9.5 Repair and Replacement.

3.9.5.1 Structural Parts. Structural parts, enclosing, and supporting members may be repaired by welding, brazing and refinishing. Major repairs should be performed by overhaul facilities. Where repainting is required, the surface should first be suitably prepared and primed.

3.9.5.2 Wiring. Wiring should be repaired in accordance with standard automotive practices.

3.9.5.3 Gaskets and Seals. Gaskets, oil seals, preformed packing, and seals should be replaced instead of being cleaned and reused, unless otherwise specified by local directives. Replace any seals and packings that show any deterioration or damage.

Note: Use repair kits when available.

3.9.6 Reassembly and Installation. Unless otherwise specified, reassembly and installation are the reverse of removal and disassembly. Use the illustrations in Section 10 as a reference.

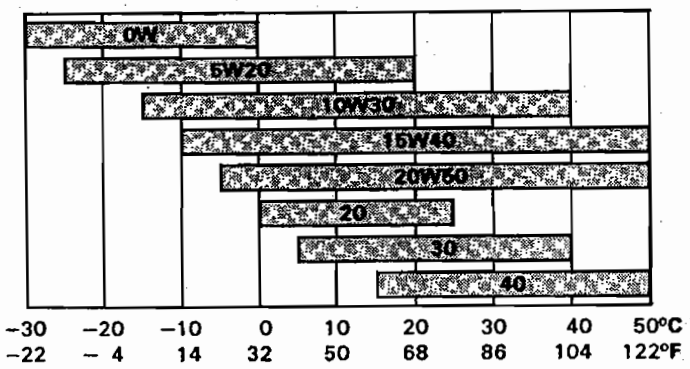


Table 3-2. Recommended Engine Oil Viscosity Grades.

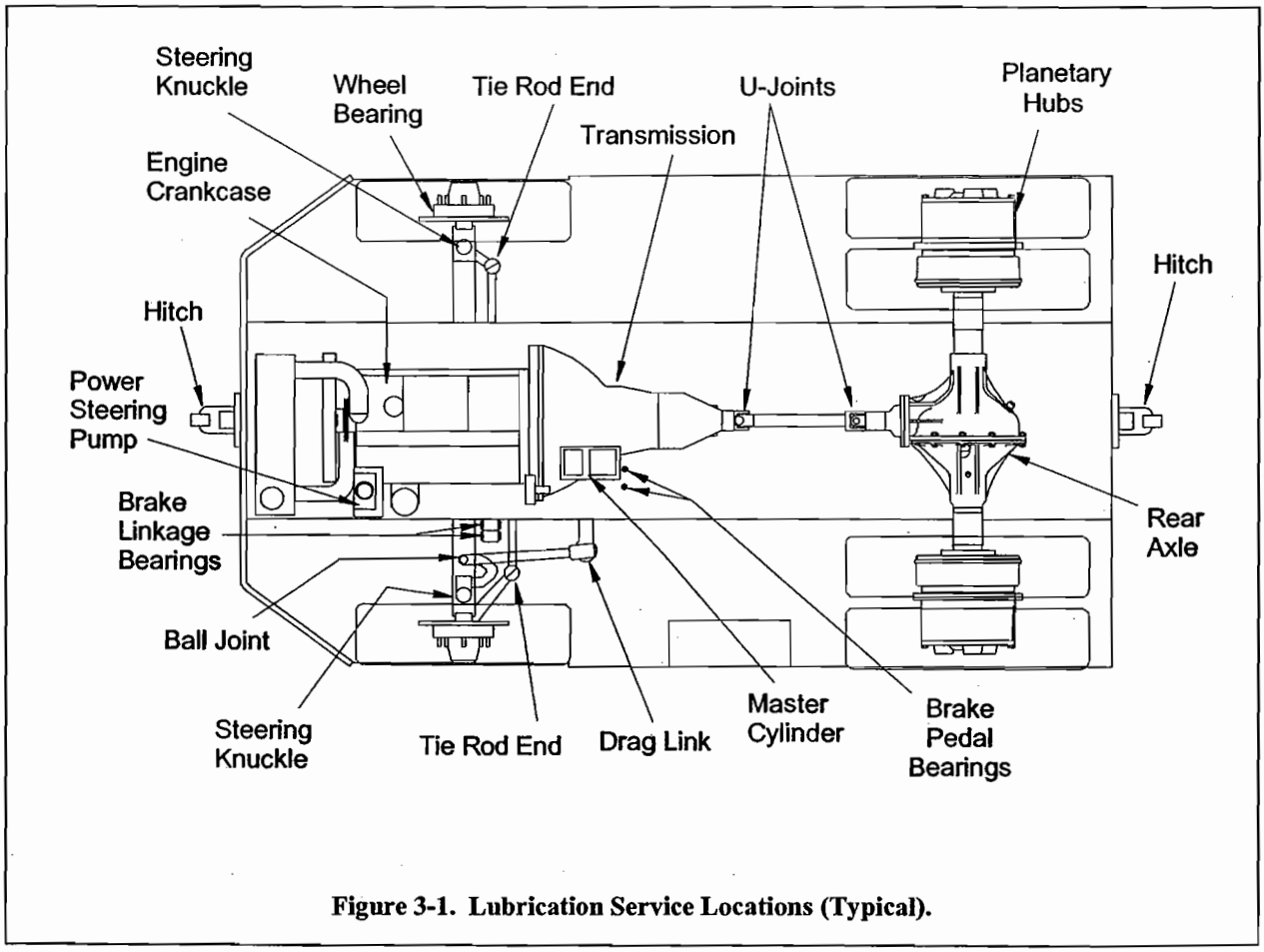
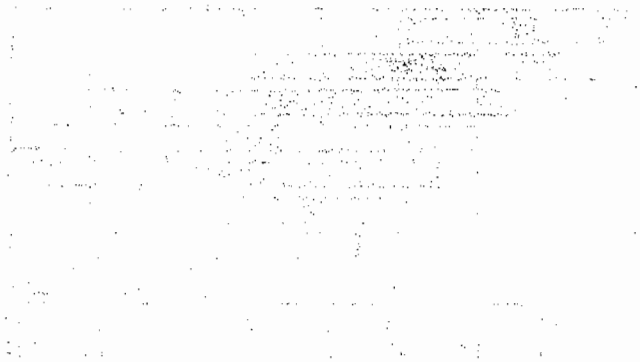


Figure 3-1. Lubrication Service Locations (Typical).



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SECTION 4

ENGINE

Contents

4.1 OVERVIEW

To get the best performance and the longest life from your engine, you must ensure that maintenance operations are done as indicated in Table 3-1. If the engine works in a very dusty environment or other adverse conditions, maintenance will have to be done more frequently. Replace filter elements and lubricating oil regularly to remove corrosive materials and compounds.

Ensure that adjustments and repairs are done by persons who have had the correct training.

The left and right sides of the engine are as when seated in the operator's seat.

Read the "Safety Precautions" in the front section of this manual.

4.2 ORDERING PARTS

If you need parts for your engine, you must provide the complete engine number, and tractor description, name, and serial number.

The engine number is stamped on a label fastened to the cylinder block.

4.3 BREAK-IN

Gradual new-engine break-in is not recommended because prolonged operation at light loads during the early life of the engine can cause excessive carbon build-up.

As soon as the engine is put into service and coolant temperature has reached at least 140°F, you can apply maximum load to the engine.

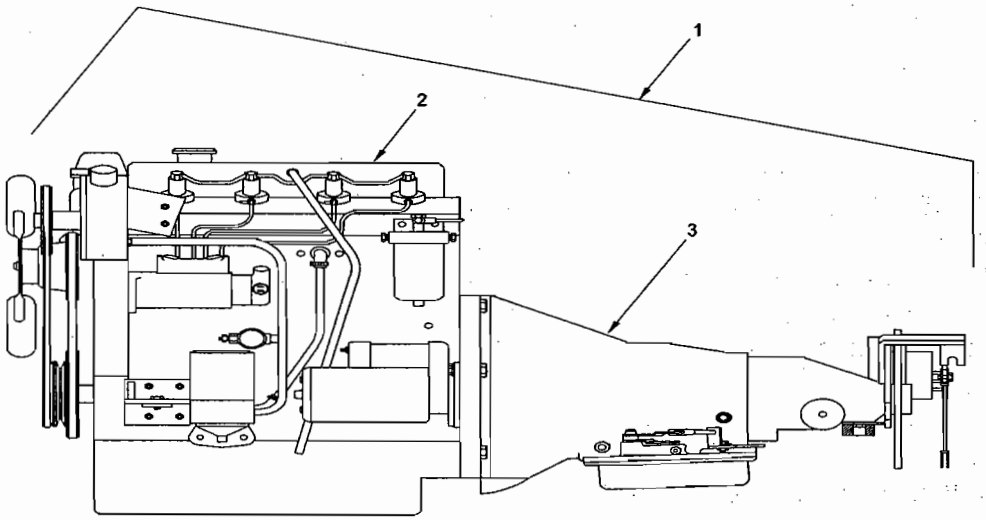
Do not operate the engine at high speeds without a load and do not overload the engine.

4.4 ADJUSTING ENGINE SPEED

Do not change the idle or maximum speed settings because this can damage the engine or transmission. Adjust speed only to the manufacturer's specifications. Engine warranty can be affected if the seals on the fuel injection pump (diesel) are broken during the warranty period by a person not approved by Perkins or Northwestern Motor Co.

4.5 ALTITUDE (DIESEL)

If the engine is to run at an altitude above 2,000 ft.,



fuel delivery can be adjusted to reduce fuel consumption and smoke. Northwestern Motor Company can advise as to fuel reduction necessary if details of engine application and ambient conditions are given. Changes to settings of the fuel injection pump must be made by authorized personnel.

4.6 REPAIR AND MAINTENANCE

Refer to the operator's manual supplied by the engine manufacturer (supplied with this manual) for instructions. More detailed "shop" manuals may be special-ordered from NMC or can be obtained from a local distributor.

4.7 RADIATOR

If a tractor radiator leaks, do not attempt to repair it by pouring any substance into the radiator. This will only be a temporary fix at best, and may damage the engine and water pump.

The recommended way to fix a radiator is to either replace it with a new one or take it to a qualified radiator repair facility.

4.7.1 Removal.

1. When engine is cool, remove transmission oil cooler from radiator.
2. Drain cooling system.
3. Disconnect upper and lower hoses. Replace if bulged, cracked, or leaky.
4. Remove radiator mounting fasteners and remove radiator.

4.7.2 Installation.

1. Install radiator and secure with fasteners.

2. Connect hoses. Use new clamps if old clamps are corroded or faulty.
3. Fill cooling system as described in 3.8.3.
4. Install transmission oil cooler assembly.
5. Start engine and check for leaks and proper operating temperature.

4.8 ENGINE/TRANSMISSION REMOVAL

The following is a general guide for removing the engine (or the engine and transmission together). The numerous available options make it necessary for the individual technician to determine the best course for removing the tow tractor engine.

1. Block rear wheels in both directions to prevent tractor from rolling when drive shaft is disconnected. **Do not apply parking brake.**
2. Remove engine hood, side panels, and access plates.
3. Raise front of tractor with suitable stands.
4. Shift transmission into neutral. Drain engine crankcase, cooling system, and transmission (Section 3).
5. Remove air cleaner and hose assemblies.
6. Disconnect battery cables.
7. Remove radiator (4.11).
8. Remove fan blade.
9. Tag and disconnect all wire harnesses to engine and transmission components.
10. Disconnect and cap fuel lines at required engine locations.
11. Disconnect accelerator linkage.
12. Disconnect exhaust pipe at the exhaust manifold. Tape over opening to prevent debris from entering engine.
13. Disconnect drive shaft from parking brake disc and tie out of the way.
14. Disconnect shift cable from transmission.
15. Disconnect and cap transmission fluid cooler lines.
16. Remove master cylinder/power booster. See Section 8.
17. Remove screws from hood support and slide back to allow clearance for removing engine/transmission assembly.
18. Loosen cable tension and disconnect parking brake cable from caliper and bracket.

⚠WARNING The engine and transmission assembly is large and heavy. Use proper slings and hoists for removal and installation.

19. Attach a suitable hoisting bracket to transmission and/or engine assembly for support and lifting.

Note: Steps 20-25 apply if it is possible to remove the engine without the transmission.

20. Remove converter drain plug access cover from lower end of converter housing. Matchmark torque converter with drive plate (for easier installation).
21. Remove converter-to-flywheel attaching nuts.
22. Remove converter housing-to-engine attaching bolts.
23. Lower tractor for easier engine removal, if necessary.
24. Remove engine mount capscrews.
25. Move engine away from transmission.

⚠CAUTION The driveplate (flywheel) will not support a load.

Note: Steps 26-29 apply if removing the transmission with the engine.

⚠CAUTION Before removing transmission support in the following step, support the transmission with a jack.

26. Remove capscrews securing transmission rubber mounts to rear crossmember. Remove capscrews mounting rear crossmember to frame. Remove crossmember.

27. Remove ground strap.
28. Remove two engine rubber mount capscrews.
29. Lower tractor for easier engine removal, if necessary.
30. Lift engine and transmission assembly upward slowly from tractor frame. It may be necessary to tilt front of engine upward so transmission clears fire wall.
31. Lower engine and transmission assembly onto a suitable support or repair stand.
32. To install engine assembly, reverse this procedure. Make sure plugs are secure and hoses are tight. Refill engine crankcase, cooling system, and transmission with recommended fluids and check for leaks.

4.9 ALTERNATOR

The alternator requires no special care except to keep the drive belt properly tensioned. It is not a user-repairable item.

If you suspect a problem with the alternator, most alternator problems can be traced to one of the following causes:

- Battery or battery connection fault.
- Loose, dirty, or corroded alternator connections.
- Broken wires to alternator.
- Slipping drive belt.

⚠CAUTION When welding on the tractor, disconnect the battery to prevent damage to the alternator.

SECTION 5

TRANSMISSION

Contents

5.1 INTRODUCTION

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

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

5.2 MALFUNCTIONS

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

You should always begin by checking engine performance, then fluid level and condition (5.4), and gearshift cable adjustment (5.5.1).

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

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

5.3 TOWING THE TRACTOR

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

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

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

Note: Failure to follow these instructions will void the warranty.

5.4 FLUID LEVEL AND CONDITION

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

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

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

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

5.5 TRANSMISSION ADJUSTMENTS

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

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

The intermediate band may need to be occasionally adjusted to compensate for normal wear. Adjust band at every transmission oil change.

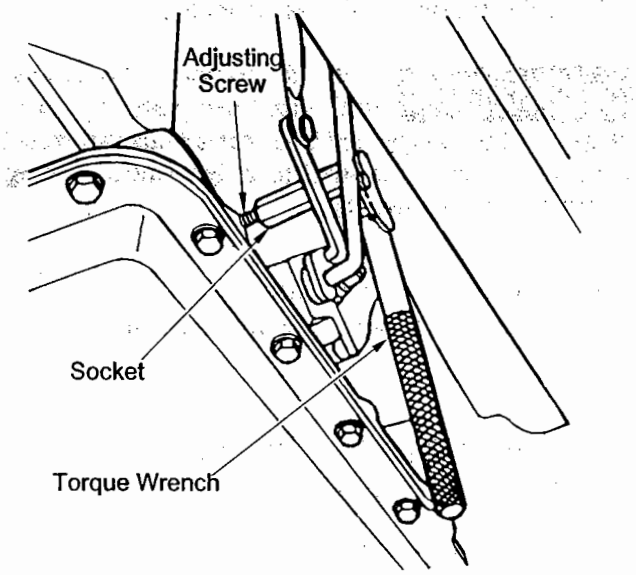
5.5.1 Gearshift Cable.

1. Disconnect the shift cable from the shift control on the transmission. (Driver's side of transmission).
2. Place gearshift lever on dash in N (neutral).
3. Move the control lever on transmission to the rearmost position detent. Move the control lever on transmission ahead 2 detents. This is neutral.
4. Adjust cable length by turning clevis in or out until clevis capscrew will slide through clevis and shift lever without movement of shift lever or control lever.
5. Move control lever through the entire shift range one position at a time, checking shift lever detent at each position.
6. Tighten the clevis lock nut. Install the clevis capscrew and a new self-locking nut. Tighten the nut firmly.

5.5.2 Intermediate Band Adjustment.

1. Raise tractor on jack stands or a hoist.

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



Adjusting the Intermediate Band

5.5.3 Neutral Start Switch.

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

5.5.3.1 Adjusting the Neutral Start Switch.

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

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

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

5.5.3.2 Replacing the Neutral Start Switch.

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

Note: Be sure the switch packing is properly installed to prevent oil leakage.

4. Add fluid to transmission if needed.

5.6 TRANSMISSION AND TORQUE CONVERTER REMOVAL

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

1. Put tractor on hoist, but do not raise at this time. Disconnect neutral switch wire at plug connector.
2. Raise tractor on hoist or stands.
3. Place drain pan under transmission fluid pan. Starting at rear of pan and working toward front, loosen attaching bolts and allow fluid to drain. Finally remove all of pan attaching bolts except two at front to allow fluid to further drain. With fluid drained, install two bolts on rear side of pan to temporarily hold it in place.
4. Remove converter drain plug access cover from lower end of converter housing. Matchmark torque converter with drive plate (for easier installation).
5. Remove converter-to-flywheel attaching nuts. Place a wrench on crankshaft pulley attaching bolt to turn converter to gain access to bump switch.
6. With wrench on crankshaft pulley attaching bolt, turn converter to gain access to converter drain plug. Place a drain pan under converter to catch fluid and remove plug. After fluid has been drained, re-install plug.
7. Disconnect park brake cable. Disconnect driveshaft from transmission park brake disk and slide shaft rearward from transmission. Install a seal installation tool in extension housing to prevent fluid leakage.
8. Disconnect downshift and manual linkage rods or cable controls from levers at transmission.
9. Disconnect oil cooler lines from transmission. Disconnect temperature sender wire.
10. Remove vacuum hose from vacuum diaphragm unit. Remove vacuum line from retaining clip.
11. Disconnect cable from terminal on starter motor. Remove the three attaching bolts and remove starter motor.
12. Remove transmission rear support and insulator assembly attaching bolts at bottom rear of transmission.
13. Raise transmission with transmission jack to take pressure off rear crossmember.
14. Remove bolts securing transmission crossmember to frame and remove crossmember.
15. Secure transmission to jack with safety chain.
16. Remove converter housing-to-engine attaching bolts.
17. Move transmission away from engine.

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

18. Lower transmission jack and move transmission and converter assembly from under vehicle.

5.7 TRANSMISSION AND TORQUE CONVERTER INSTALLATION

1. Tighten converter drain plug to 18-28 ft-lbs.
2. Position converter on transmission, making sure converter drive flats are fully engaged in pump gear.
3. With converter properly installed, place transmission on jack. Secure transmission to jack with chain and place under tractor.
4. Raise transmission to align with engine.
5. Rotate converter until studs, drain plug and matchmark are in alignment with flywheel.
6. The converter must rest squarely against flywheel. This indicates that converter pilot is not binding in engine crankshaft.Do not allow con-

verter drive flats to disengage from pump gear. Move converter and transmission assembly forward into position, using care not to damage the flywheel and converter pilot.

7. Install and tighten converter housing-to-engine attaching bolts to 40-50 ft-lbs.
8. Remove transmission jack safety chain from around transmission.
9. Position transmission support crossmember to frame side rails and tighten attaching bolts to torque specified in the Table 1-1.
10. Position transmission rear support and insulator assembly above crossmember and lower transmission into place. Install mounting bolts and tighten to torque specified in Table 1-1.
11. Remove jack.
12. Connect vacuum line to vacuum diaphragm making sure that line is in retaining clip.
13. Connect oil cooler lines to transmission.
14. Connect downshift and manual linkage rods or cable controls to their respective levers on the transmission. Refer to "Transmission" in Chapter 10.
15. Secure starter motor in place with attaching bolts. Connect cable to terminal on starter.
16. Install a new O-ring on lower end of transmission filler tube and insert tube in case.
17. Secure converter-to-flywheel attaching nuts and tighten them to 20-30 ft-lbs.
18. Install converter housing access cover and secure it with attaching bolts.
19. Slide driveshaft forward and connect it to transmission park brake drum. Connect park brake cable to park brake lever.
20. Adjust shift cable as required. Refer to 5.5.1.
21. Install new filter and pan gasket, and fill transmission with oil according to procedures under 5.4. Check for leaks.
22. Connect neutral switch wire to plug connector.
23. Connect temperature sender wire.
24. Connect the battery negative cable.
25. Lower tractor. Start engine and again check for leaks.

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SECTION 6

FUEL TANK

Contents

6.1 FUEL TANK

If excessive amounts of water appear in the water separator, the tank may be contaminated and will require removal and cleaning or replacement.

⚠WARNING Fuel vapors create fire and explosion hazards which can result in severe personal injury or death. Do not allow any open flame, smoking materials or other potential igniters near the fuel system.

Have a fire extinguisher handy and keep other personnel away from operation.

6.1.1 Removal and Disassembly.

1. Raise tractor on suitable jacks or hoist and block with jack stands.

⚠WARNING Disconnect the negative battery cable. An electrical arc at the sending unit can act as an igniter creating a fire and explosion hazard, which can result in personal injury or death.

2. Disconnect cables from battery and remove battery from tractor (to prevent a possible spark when removing tank and related components).
3. Place a suitable container beneath drain opening at bottom rear of tank.
4. Remove drain plug from fuel tank and drain tank.
5. Remove filler cap and cover filler hole to keep out debris. Support fuel tank and remove tank straps from tank supports.
6. Remove tank supports and lower tank to ground. Disconnect fuel sending wire and fuel hoses. Tank can now be removed from area for cleaning and inspection.

Important! Use care when handling the sending unit to prevent damaging it.

6.1.2 Cleaning and Inspection.

1. Install drain plug on bottom of tank.
2. Pour a detergent and water solution into tank.
3. Agitate mixture by rotating tank. Make sure solution contacts entire interior surfaces of tank.
4. Drain cleaning solution from tank. Rinse and repeat steps 1-4.
5. Flush interior of tank with clean water and allow to air dry.
6. Inspect filler cap and sending unit for corrosion and damage.
7. Inspect tank protectors for deterioration.
8. Inspect fuel tank for damage. Repair or replace tank as needed.
9. Check tank mounting straps for rust and corrosion.
10. Inspect elbows for damage.

6.1.3 Repair or Replacement.

⚠WARNING FUEL TANKS CAN BE LETHAL BOMBS CAPABLE OF INSTANTLY KILLING ANYONE NEARBY.

BEFORE SOLDERING OR BRAZING, clean the tank thoroughly. Fill tank with an inert gas such as carbon dioxide or nitrogen, OR COMPLETELY FILL WITH WATER.

1. Repair tank by soldering or brazing if needed. Re-prime and paint any repaired areas of tank.
2. Test any repair with wet soap lather. Place an air hose in tank and admit air. By holding a rag around hose where it enters, a mild pressure will be built up. If the repair is sound, no bubbles will appear.
3. Replace corroded or damaged cap or sending unit.
4. Replace protectors if they are damaged or deteriorated.
5. Replace straps if weakened by either of these conditions.
6. Replace damaged parts.
7. If there is any doubt as to the integrity of the tank, replace the tank.

6.1.4 Reassembly.

1. Install new gasket on sending unit opening on tank, then carefully lower sending unit into tank. **Do not use gasket cement.**
2. Secure sending unit with its hardware.
3. Temporarily tape or cover tank filler opening to prevent entry of dirt when installing tank.
4. Apply thread sealer to drain plug threads and install drain plug.

6.1.5 Installation.

1. When ready to install tank, place a quart of fuel in the tank, slosh around, and pour out.
2. Install hoses and sending unit wire.
3. Position tank under frame and raise into position.
4. Install tank supports and straps. Tighten mounting hardware to 30 ft./lbs. torque.
5. Install battery and connect battery cables.
6. Fill tank with fuel and check for leaks.

SECTION 7

STEERING AND FRONT SUSPENSION/AXLE

7.1 STEERING SYSTEM OVERVIEW

The power steering system on the tractor is a compact, efficient design. Like automotive systems, it uses oil under pressure to provide most of the turning force to the front wheels. The system uses a control valve and an engine-belt-driven oil pump to supply oil pressure to a hydraulic piston. The hydraulic piston and control valve are contained in the steering gear unit. A pitman arm/drag link combination attaches the steering gear unit to the left-hand steering arm on the front axle assembly. The control valve senses steering resistance or pressure and directs oil flow accordingly to assist steering.

Pressurized oil from the pump flows to the steering gear unit via the brake power boost assembly.

7.1.1 Problem Diagnosis. Most steering problems can be readily diagnosed by visual inspection. Problems internal to the pump, steering gear, or hoses may be identified by a system pressure test (see 7.3).

The following are the most likely causes of steering problems:

Slipping, oily, cracked, or glazed belt.

Low fluid level (check for leaks).

Air in system (see 7.2).

Worn, loose, or broken steering linkage.

Worn or broken pump or steering gear.

7.1.2 Before Servicing the Steering System. Before servicing, inspect and clean steering system components according to instructions in Chapter 3.

7.2 BLEEDING THE SYSTEM

Any time a hose, pump, or steering gear unit is removed, replaced, or opened, air in the system will have to be eliminated.

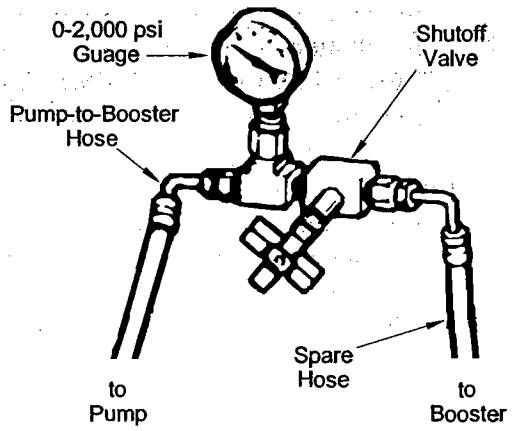
1. Fill power steering pump to proper level and let fluid stand for at least two minutes.
2. Start engine and run momentarily. Add power steering fluid if necessary.
3. Repeat above procedure until fluid level remains constant after running engine.
4. Raise front of vehicle so that wheels are off ground. Turn steering wheel back and forth, lightly contacting wheel stops. Add fluid if necessary.
5. Lower vehicle and turn wheels back and forth on ground. Check fluid level and refill as required.
6. If fluid is foamy, allow vehicle to stand for a few minutes with engine off. Repeat steps 1-6 as necessary.
7. Trapped air in system will cause fluid level in pump to rise when engine is off. Repeat steps above until this condition no longer occurs.

7.3 SYSTEM PRESSURE TEST

A reduction in steering responsiveness may be caused by a faulty pump, relief valve, or internal leakage in the steering gear or power booster.

The relief valve is the least expensive and easiest power system component to replace or repair. The relief valve is located in the lower port on the steering pump. The relief valve may only require cleaning to work properly.

1. Check for proper belt tension and fluid level, and repair any power system fluid leaks.
2. Raise and set front of tractor onto jackstands so that front wheels are off the ground.
3. Disconnect pump-to-booster pressure hose at the power booster. Use rags to catch any fluid leakage.



4. Install a 0-2,000 PSI pressure gauge, shutoff valve, and extra hose between the pump pressure hose and the booster as shown in the figure. Gauge must be between shutoff valve and pump.
5. Open the shutoff valve.
6. Start engine and bleed system by turning wheels stop-to-stop. Check fluid level and refill as required. Allow system to reach operating temperature.
7. Pressure should read below 150 psi. If above 150 psi, check for hose restrictions. When corrected, proceed to step 8.
8. Turn the steering wheel all the way to one of the stops, then the other. If pressure rises to 1100-1200 PSI each time, the steering pump is OK. Turn engine off, remove test gauge, valve, and extra hose. Reconnect pressure hose to the booster and check fluid level.

If pressure exceeds 1200 PSI, replace the relief valve and re-test.

If pressure is below 1100 PSI, go to step 9.

⚠CAUTION Do not leave the shut-off valve closed for more than 5 seconds. Excessive heat may build up, damaging the power system components.

9. Slowly close the shut-off valve, then immediately open. If pressure is 1100-1200 PSI, the pump is OK. The cause of low pressure in step 8 may be a faulty steering gear or power booster.

   If pressure exceeds 1200 PSI, replace the relief valve and re-test.

   If pressure is below 1100 PSI, either the relief valve or pump is faulty.

10. Turn engine off, remove test gauge, valve, and extra hose. Reconnect pressure hose to the booster, check fluid level, and make necessary repairs.

The relief valve is the least expensive and easiest power system component to replace or repair. The relief valve is located in the lower port on the steering pump. The relief valve may only require cleaning to work properly.

7.4 STEERING GEAR ASSEMBLY

Maintenance of the power steering gear should be performed by qualified service personnel. If the steering gear does not operate properly, replace it or take it to a specialized repair shop.

7.4.1 Removal.

1. Loosen hose clamp at power steering pump and disconnect hose. Drain fluid into suitable container.
2. Remove steering column cover and pitman arm cover, if applicable.
3. Remove hose clamp and hose from return fitting at steering gear. Remove hose assembly, union and pressure fitting from steering gear.
4. Loosen pinch bolt on coupling on lower end of steering column.
5. Disconnect drag link at steering gear end.
6. Remove pitman arm nut and washer. Remove arm from steering gear.
7. Remove capscrews and washers securing steering gear to frame mounting bracket. Disconnect steering gear from coupling on column and remove from vehicle.

7.4.2 Installation.

1. Position steering gear assembly on frame bracket and engage gear shaft with coupling on lower end of steering column. Secure to bracket with capscrews and washers. Tighten capscrews to 45 ft./lbs.
2. Tighten pinch bolt on steering gear coupling.
3. Install hose assembly, union and pressure fitting. Connect hose assembly to power steering pump.
4. Connect hose to return fitting and power steering pump and secure with hose clamps.
5. Install pitman arm on gear shaft. Install hex nut and washer. Tighten hex nut to 80-120 ft./lbs.
6. Install drag link and grease the link.
7. Bleed the system according to 7.2.
8. Install steering column cover and pitman arm cover, if applicable.

7.5 POWER STEERING PUMP

Repair of the power steering pump is not recommended. If the pump does not function properly or leaks, replace the entire unit. If the cap is broken, cracked or leaks, replace the cap.

7.5.1 Removal.

1. Disconnect hoses at steering pump and secure in raised position to prevent drainage of fluid. Cap hose ends and pump connections to prevent

entry of contaminants.

2. Remove capscrews that allow power steering pump to pivot. Remove belt and pump.
3. Remove pulley from pump shaft.

⚠CAUTION Do not hammer pulley off shaft. This will damage the pump.

4. Remove capscrews and washers securing pump to pivot bracket.
5. Remove cap from pump.

7.5.2 Installation.

1. Position pump-to-pivot bracket with capscrews and washers.
2. Install pulley-to-pump shaft.
3. Install capscrews that allow pump to pivot.
4. Install belt and adjust tension to approx. 3/8" deflection.
5. Uncap hoses and pump connections. Connect hoses to pump. Tighten hose fittings to 30-40 ft./lbs.
6. Bleed system as described in 7.2.
7. Install cap on power steering pump.

7.6 STEERING COLUMN ASSEMBLY

7.6.1 Removal.

1. Disconnect external horn wire from under dash panel.
2. Remove rubber horn button from steering wheel by peeling it from plastic horn base.
3. Remove plastic horn base by turning and pulling it. Ease horn base off so spring and seat assembly don't pop out.
4. Remove nut and flat washer from top of steering column shaft. Hold your hand under steering wheel while removing wheel because two carbon brushes and a spring will fall out.
5. Remove steering wheel assembly. Wheel is keyed to serrations on steering shaft.
6. Remove nuts, washers, and U-bolt attaching steering column to dash assembly. Remove steering column assembly.
7. Remove cover plate.
8. Loosen pinch bolt on coupling at lower end of steering column assembly.
9. Place nut and washer on steering column shaft to prevent loss.

7.6.2 Installation.

1. Install cover plate.
2. Position steering column assembly to lower coupling on steering gear assembly.
3. Install U-bolt around steering column and attach to dash assembly with washers and nuts. Hand tighten nuts.
4. Check engagement of coupling and steering gear shaft. Tighten pinch bolt.
5. Tighten nuts on U-bolts to secure steering column.
6. Install steering wheel assembly on steering shaft. Tap into place on shaft serrations with a soft-faced hammer. Install nut and washer to secure steering wheel to column.
7. Insert plunger into counterbored hole in steering wheel. Install horn parts.
8. Connect external horn wire. Test operation of horn.
9. Install cover plate.

7.7 FRONT SUSPENSION

The front suspension is comprised of the leaf springs, hangers, brackets, and hardware needed to secure the springs to the axle and frame.

7.7.1 Removing the Leaf Springs.

1. Using a jack, raise the front of tractor. Support with appropriate jack stands.
2. Raise tractor far enough to relieve tension on

springs. Support axle with jack stands positioned so they will not interfere with spring removal.

3. Remove nuts, lock washers, U-bolts and spring plate.
4. Remove bolt, nut, and lock washer securing front of spring to frame.
5. Lower axle until there is enough clearance to remove spring.
6. Lower front of spring until rear of spring clears seating slot in rear spring hanger.

7.7.2 Cleaning and Inspection.

In order to properly inspect the condition of the springs, clean the spring assembly with solvent using a brush or a cloth dampened with solvent. Then inspect the leaves for cracks or breaks. Replace the spring assembly if damaged.

7.7.3 Installation.

1. Work rear of spring into seating slot in the rear spring mounting plate.
2. Align front of spring bushing bore with hole in frame and install spring front mounting hardware. Tighten nut to 135 ft./lbs. torque.
3. Install U-bolts over front axle and springs and install mounting plates, washers, and nuts. Torque nuts to 100 ft./lbs.
4. Remove jack stands and jack from beneath axle and frame.

7.8 FRONT AXLE ASSEMBLY

7.8.1 Removal.

1. Remove caliper retaining bolts holding caliper to mounting bracket and remove caliper. If necessary, loosen a bleeder to relieve pressure (This will necessitate bleeding the brakes later.). Place a block between the friction pads to secure the pistons..
2. Remove grease cap from hub.
3. Remove cotter pin, nut, and washer from wheel hub and pull off wheel hub and brake disk. Protect bearings from contamination.
4. Remove brake disc from wheel hub, if necessary, by removing socket head capscrews. Do not remove wheel studs unless replacement is necessary.
5. Remove cotter pins and locknuts securing lower steering arms to tie rod end assemblies. Remove tie rod. If tie rod ends need replacing, loosen jam nuts on tie rod and remove end assemblies.
6. Disassemble knuckles and push out the king pins.
7. Remove knuckles from axle weldment. Remove knuckle bushings and/or thrust bearings.
8. If necessary to remove tie rod and/or caliper brackets, remove the socket head capscrews.
9. Remove steering arm, if necessary.
10. Inspect hub bearings. Remove bearing cups, if necessary. Always replace cup and cone as a set.

7.8.2 Assembly.

1. Install new thrust bearings, bushings, and king pins into the knuckles and axle weldment.
2. Re-assemble king pins.
3. Install ball stud and secure with nut and cotter pin, if previously disassembled. Place loctite on socket head screw threads and tighten to 85 ft./lbs. torque.
4. If inner and outer bearings are to be replaced, install new cups into hub. **Make sure cups are seated well.**
5. Install wheel studs, if removed.
6. Grease inner cone and cup and install inner cone.
7. Install grease seal using a plug to place pressure evenly around seal. If you bend or otherwise damage seal, discard and use a new one.
8. Install brake disc on wheel hub, if removed. Tighten bolts to 105 ft/lbs (Brierton Axle)

9. Install tie rod assembly to tie rod arms. Adjust toe-in of front wheels according to 7.8.5. Tighten tie rod lock nuts to 20 ft./lbs. torque and insert cotter pins.

⚠CAUTION DO NOT OVERFILL with grease because too much grease can cause seal to fail or grease cap to pop loose after assembly.

NOTE

If the tie rod ball joints were replaced or adjusted in any way, check toe-in and adjust if necessary (Refer to 7.8.5).

Use MIL-G-10924D grease on the front axle.

10. Pump grease into hub cavity.
11. Use grease to lubricate the seal lip.
12. Install hub. Rotate hub while installing to spindle so seal doesn't roll under. As spindle goes into inner cone, try to feel that all parts are straight and properly seated on spindle bearing journal.
13. Grease outer cone and place over spindle and into cup.
14. Assemble washer and nut to spindle. Tighten nut to 10-15 ft./lbs. torque. **Rotate hub while tightening nut.**
15. Back off nut until it just becomes loose.
16. While rotating hub, retighten nut to finger tight. Line up cotter pin hole in spindle with slot in nut. Check hub for excessive end play. Excessive end play indicates that nut is too loose. Hub should rotate freely, but if hub binds or if you can feel the bearings, it means that the nut is too tight. Readjust nut if needed.
17. Insert cotter pin and bend to lock it on nut. Fill grease cap with grease and snap into place.
18. Check seal for a turned-under lip. Rotate hub and check for any indication of misalignment or roughness. If either is noted, disassemble hub and check inner cups for any small nicks or other damage. If damaged, the hub must be replaced.
19. Using a C-clamp (surface that contacts pad MUST be clean.) on each piston, force pistons into caliper to allow caliper to fit over disc.
20. Reassemble brake caliper to caliper bracket using retaining bolts. Tighten bolts to 105 ft/lbs. torque (Brierton axle).
21. Lube all grease fittings with MIL-G-10924D grease.

7.8.3 Installation.

1. Position axle under tractor and raise axle using an axle jack.
2. Install U-bolts over front axle and springs and install mounting plates, washers, and nuts. Torque nuts to 70 ft./lbs.
3. Untie brake lines from frame and unplug lines. Connect brake lines and bleed the brakes (see 8.3).
4. Install front wheels and tighten mounting nuts to 90 ft./lbs. torque.
5. Remove jack stands and jack.

⚠WARNING Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

7.8.4 Toe-In Adjustment. Toe-in is a condition in which the front of the tires are closer together than the back. This is used to compensate for the natural tendency of road-to-tire friction to force the wheels apart. If the wheels were set parallel (no toe-in), steering linkage wear would allow the wheels to actually toe-out. By setting a certain amount of toe-in, the wheels will be nearly parallel in actual use.

An improper toe-in can grind off tire tread in a short period of driving. Toe-in should be checked using a toe gauge or trammel.

1. Jack up each front wheel and chalk a band near center of tire while spinning the wheel.
2. Use a sharp-nosed scriber to form a thin line near the center of the chalk band while spinning the wheel. Keep the line THIN.
3. Lower wheels to floor. Roll tractor forward until wheels have made one complete turn. Wheels should point straight ahead. This will impart a rearward thrust to the wheels and will provide an accurate toe-in reading.
4. Move toe-in gauge to behind wheels. Set pointers exactly on scribed lines. Top of pointers should be as near the center of the spindle height as possible.
5. Carefully remove gauge without altering pointer setting. Align one pointer with scribe mark on the front of one of the tires. Check distance between the other pointer and scribe mark on other tire. The distance will indicate amount of toe-in or toe-out present.
6. Loosen tie rod jam nuts and rotate tube to obtain 0.15 + or - .030 (5/32 + or - 5/16) toe-in.
7. Tighten jam nuts to secure adjustment.

7.9 REPACKING WHEEL BEARINGS

1. To provide adequate working space under tractor, raise front of tractor with jack and support tractor with appropriate jack stands. Position jack so it does not interfere with work.
2. Remove front wheel and tire assemblies (see 9.4.1).
3. Remove center cap from hub.
4. Remove cotter pin, spindle nut, and washer from spindle.
5. Remove hub. Outer wheel bearing cone will slide out of hub. Inspect outer bearing cone and cup. Remove bearing cone and cup if they appear damaged in any way. (Always replace cup and cone as a set.)

Note: Always replace grease seals.

6. Remove grease seal. Inspect inner bearing cone and cup. Remove bearing cone and cup if they appear damaged in any way. (Always replace cup and cone as a set.)
7. Using a clean rag, wipe old grease from spindle, hub, and bearings.
8. Install new outer bearing cup, if removed.
9. Install new inner bearing cup, if removed.
10. Install new grease seal, if removed, using a plug to place pressure evenly around seal. If you bend or otherwise damage seal, discard and use a new one.

⚠CAUTION DO NOT OVERFILL with grease because too much grease can cause seal to fail or grease cap to pop loose after assembly.

11. Spread grease inside hub cavity.
12. Use grease to lubricate the seal lip.
13. Install hub. Rotate hub while installing to spindle so seal doesn't roll under. As spindle goes into inner cone, try to feel that all parts are straight and properly seated on spindle bearing journal.
14. Grease outer cone and place over spindle and into cup.
15. Assemble washer and nut to spindle. Tighten nut to 10-15 ft./lbs. torque. **Rotate hub while tightening nut.**
16. Back off nut until it just becomes loose.
17. While rotating hub, retighten nut to finger tight. Line up cotter pin hole in spindle with slot in nut. Check hub for excessive end play. Excessive end play indicates that nut is too loose. Hub should rotate freely, but if hub binds or if you can feel the bearings, it means that the nut is too tight. Readjust nut if needed.
18. Insert cotter pin and bend to lock it on nut. Fill grease cap with grease and snap into place.
19. Check seal for a turned-under lip. Check hub for any indication of roughness which might indicate misalignment. If roughness is noted, disassemble hub and check inner cup for any small nick. If a nick is found, the hub must be replaced.
20. Lube all grease fittings with MIL-G-10924D grease, if not already done.

21. Install front wheels and tighten mounting nuts to 90 ft./lbs. torque.
22. Remove jack stands and jack.

⚠WARNING Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

7.10 DRAG LINK

The drag link is a rod that connects the steering gear unit pitman arm to the left-hand front axle knuckle.

7.10.1 Removal.

1. Remove cotter pins from ends of drag link.
2. Unscrew drag link plugs enough to free pitman arm and steering arm. Remove drag link.

7.10.2 Installation.

1. Position drag link so openings in ends engage balls on pitman arm and steering arm.
2. Tighten plugs until plugs are flush with ends of tube.
3. Align holes in ends of drag link tube with holes in plugs and install cotter pins to secure.

SECTION 8

BRAKES

8.1 BRAKE SYSTEM DESCRIPTION

The brake system consists of individual hydraulically actuated brake units on the front and rear wheels, a hydraulically assisted master cylinder, a power booster unit with accumulator, an equalizing valve, a check valve, and the necessary coated steel tubing and spiral-wrapped flex hoses.

The **front and rear brakes** are non-adjustable, sliding caliper-type disc brakes.

The optional dual-wheel rear axle has brakes that are the self-adjusting, expanding, shoe-type. Adjustment occurs when the brake pedal is pushed.

The **master cylinder** has a brake fluid reservoir and a mechanically actuated piston that pressurizes the system when the brake pedal is applied.

The **power booster** unit provides a power assist to operate the dual master cylinder system.

The **equalizing valve** proportions the brake fluid between the front and rear wheel cylinders to provide braking force at each wheel.

The **check valve** in the rear brake circuit slows down the shoe return, thus preventing the rear wheel cylinders from collapsing and introducing air into the system when the brakes are released.

⚠WARNING The brakes must work when needed. Perform all brake work thoroughly and to the highest standards. Refuse to do any "half-way" jobs.

Any brake service other than periodic inspection or bleeding should be performed only by personnel specially trained in brake service.

⚠WARNING Never place brake system rubber parts in contact with gasoline, diesel fuel, or any type of cleaner other than an approved type.

Never touch rubber parts with oily or gasoline-soaked fingers. Wash hands with soap and water before handling parts.

Important! Clean brake system rubber parts in clean, denatured (isopropyl) alcohol, approved brake cleaning solution, or brake fluid.

⚠WARNING Be careful with alcohol. It is very flammable.

⚠CAUTION Compressed air used to service brake components must be oil-free or rubber parts may be damaged.

8.2 BRAKE SYSTEM INSPECTION (EVERY 500 OPERATING HOURS)

Important! Do not handle the brake linings with grease or oil on hands. The linings can become contaminated and will have to be discarded.

Periodic brake inspections are a must for safe and efficient brake operation. Your inspection should be thorough.

8.2.1 Front and Rear Disc and Pads.

1. Set parking brake. Using a jack, raise tractor high enough off floor to provide adequate working space underneath the frame. Support tractor with safety stands. Be sure that positioning of safety stands does not interfere with work task.
2. Remove front and rear wheels. For drum-type rear brakes, also see 8.2.2.
3. Check friction pad wear.

Note: There are four pads in each front caliper, two pads in each rear caliper.

4. Pads should be replaced if any pad has 1/8 inch or less friction material remaining.
5. Inspect brake disc for rust, scoring, ridges, and distortion. Light rust is not harmful. Disc should be free of excessive or heavy scoring, but some scoring is natural. If scoring is deeper than .080-in., replace both discs.

   Any cracks require disc replacement. If warpage is detected or disc is worn to .400-in., replace disc.

⚠WARNING Do not hone the discs. Honed or heavily worn discs may result in brake failure.

6. Clean up minor roughness with an emery cloth.
7. If brake disc has heavy scoring, ridges, or blue

heat spots, machining the disc may eliminate these problems.

8. Maximum friction surface lateral runout (side-to-side wobble) allowed is 0.030" total.
9. Replace disc if wear or distortion exceeds these values.
10. Mount wheel and tire assemblies on axle and secure with lug nuts. Tighten gradually in an alternating pattern:

- 1/2" lug nuts (front) to 90 ft/lbs. torque
- 9/16" lug nuts (rear) to 130 ft/lbs torque.

11. Remove safety stands and jack from beneath tractor.

⚠CAUTION Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

12. Run unit and check wheels after one hour.

8.2.2 Wheel Cylinders and Brake Shoe/Drum Assemblies.

Used in the optional dual-wheel axle.

1. Pull the rear wheel and drum assemblies (Refer to 8.6).
2. Use a dry bristle brush or a clean lint-free cloth to remove lining dust from shoes, backing plate, springs, drum, and wheel cylinder.
3. Examine wheel cylinder for evidence of leakage, cracks in housing, and deterioration of rubber cups. Repair or replace wheel cylinder as needed. (Refer to 8.6.)
4. Inspect brake drums for scoring, heat checking, out-of-round condition, or concave, convex, or bellmouth condition. Drum must be free of grease, oil, scoring, cracking, or uneven wear.
5. Replace drum if inside surface is rough or ragged or if depth of scoring exceeds 0.010" (0.3 mm). If heat cracks are visible or can be felt with a finger nail, replace drum (See 8.6).
6. Inspect lining thickness. If less than 1/8 inch, replace shoe and lining assemblies and turn drums (Refer to 8.6).
7. Inspect retracting springs, shoe hold-downs, automatic adjusting device, and shoe contact pads on backing plate. Backing plate and shoe anchors must be tight.
8. Replace backing plate assembly if damaged.
9. Mount wheel and tire assemblies on axle and secure with lug nuts. Tighten gradually in an alternating pattern 9/16" lug nuts (rear) to 130 ft/lbs torque.
10. Remove safety stands and jack from beneath tractor.

⚠CAUTION Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

11. Run unit and check wheels after one hour.

8.2.3 Stoplight Switch. Check switch operation according to 8.12.

8.2.4 Power Booster/Master Cylinder. Check for hydraulic fluid leaks and service if necessary. Check accumulator reserve charge retention as described in 8.10.

8.2.5 Road Test. After performing the above checks and any necessary repairs, drive the tractor to test brake action. The tractor should stop quickly and smoothly with no tendency to dive or pull to one side.

8.3 BLEEDING THE BRAKES

Bleeding the brakes means removing air from the brake system. Air in the system causes a springy or spongy feel when braking.

Bleeding consists of pumping fresh fluid throughout the system. This forces air out through the wheel cylinder or caliper bleeder valves.

Note: Bleeding the brakes requires two persons, one to open and close the bleeder valves, and one to depress and hold the brake pedal when directed.

1. Clean master cylinder filler cover and remove

cover. Fill master cylinder reservoir to within 1/4" (6 mm) from top of reservoir. Replace cover.

2. Clean all wheel cylinder and caliper bleeder screws.
3. If the bleeder screw is not at the top of the caliper, remove screws holding caliper to front axle weldment and rotate caliper to top of rotor. This will allow trapped air to escape.
4. Brake bleeding should start with wheel cylinder farthest from master cylinder. Place one end of a length of brake bleeder hose onto the bleeder screw. Place free end of hose in a clear jar partially filled with clean brake fluid. **The hose end must be submerged in the fluid during the procedure.**
5. Depress brake pedal several times and hold it down, maintaining moderate pressure. While depressing brake pedal, open bleeder screw and allow fluid and air to flow into jar. When pedal reaches floor, tighten bleeder screw. Release brake pedal and pump brake several times.

Important! Do not let reservoir run empty. If you let the reservoir run empty, air will enter the system and you will have to begin the procedure all over again.

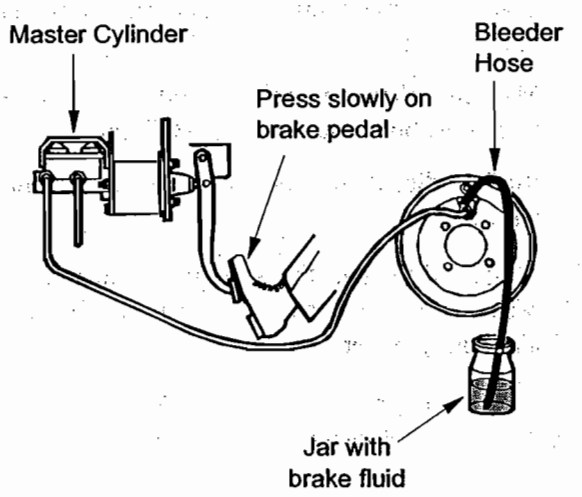


Figure 8-1. Typical Setup for Bleeding Air from Brake System.

6. Again, hold brake pedal down with moderate force. Open bleeder screw and allow fluid and air to flow into jar. Continue this process until only clean brake fluid with no air enters container.
7. When no bubbles are evident in fluid entering jar from bleeder screw, close bleeder screw. Make sure screw is tight but not overtightened. Discard used fluid.
8. Check fluid level in master cylinder reservoir and add fluid if necessary.
9. Replace caliper to original position.
10. Repeat bleeding process at each of the remaining wheels.
11. After all four brakes have been bled, fill reservoir and install cover on master cylinder.

8.4 FRONT BRAKES

The brake assemblies must be removed as complete assemblies. They cannot be disassembled while

mounted on the front axle.

Note: There is no adjustment for caliper-type brakes.

8.4.1 Friction Pad Removal and Installation (Front).

⚠CAUTION Never mix new and used pads in the brake assembly.

1. Set parking brake. Using a jack, raise tractor high enough off floor to provide adequate working space underneath the frame. Support tractor with jack stands. Be sure that positioning of jack stands does not interfere with work task.
2. Remove wheel.
3. Remove dirt and grease from disc and caliper components by wiping them with a cloth dampened with clean brake fluid or isopropyl alcohol.
4. Remove the retaining bolts holding caliper to axle and remove caliper. If necessary, loosen a bleeder to relieve pressure (This will necessitate bleeding the brakes later.).
5. Remove the capscrews securing the caliper halves and separate the halves.
6. Remove the screws holding pads in place and remove pads.
7. Check pistons for leakage, corrosion, and gumming. If necessary, disassemble and service the caliper (See 8.4.3).
8. Using a C-clamp (surface that contacts pad MUST be clean.) on each piston, force pistons into caliper to allow caliper to fit over disc.
9. Install new pads and assemble caliper.
10. Reassemble brake caliper to caliper bracket. Insert retaining bolts and reinstall cotter pins. Tighten bolts to 60 ft./lbs. torque (PDI axle) or 105 ft/lbs. torque (Brierton axle).
11. Check that the caliper and pads are centered over (parallel to) the disc.

⚠WARNING Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

12. Install wheel assembly and tighten 1/2" lug nuts (front) to 90 ft./lbs. torque. Remove safety stands and lower tractor.
13. If air was allowed to enter the hydraulic system, bleed brakes according to 8.3.
14. Pump brake pedal to force pads against disc. Check fluid reservoir and bring to correct level.
15. Road test the tractor to test brake action. The tractor should stop quickly and smoothly with no tendency to dive or pull to one side.

8.4.2 Disc Replacement (Front).

Refer to Chapter 7, paragraph 7.8.

- Inspect disc according to 8.2.1.

⚠WARNING Do not hone the front discs. Honed or heavily worn discs may result in brake failure.

8.4.3 Caliper Repair (Front).

8.4.3.1 Removal.

1. Using a jack, raise tractor high enough off floor to provide adequate working space underneath the frame. Support tractor with safety stands. Be sure that positioning of safety stands does not interfere with work task.

2. Remove front wheel.
3. Remove brake line from caliper and plug line end to prevent entry of contaminants. Some brake fluid will spill from line when removing.
4. Remove screws holding caliper to axle weldment and remove caliper.
5. Inspect disc and friction pads according to 8.2.1.
6. Inspect caliper housing for evidence of fluid leakage. If present, caliper must be disassembled, inspected, and repaired or replaced.

8.4.3.2 Disassembly.

1. Remove the four capscrews securing caliper halves and separate the halves.

⚠WARNING The piston can be ejected with considerable force if high pressure compressed air is used. Use only low-pressure compressed air for piston removal.

Keep fingers clear because piston can come out very fast. Turn caliper away from face and body. Cover assembly with heavy shield cloth.

2. Apply low-pressure compressed air to brake housing inlet port to force piston from housing.
3. Remove O-ring from piston and discard O-ring.
4. Remove seat inserts, sleeves, and bleeders from housing only if replacement of these components is necessary.

8.4.3.3 Cleaning and Inspection.

1. Remove dirt and grease from disc and caliper components by wiping them with a cloth dampened with clean brake fluid or isopropyl alcohol. Allow parts to air dry before assembling.
2. Use low-pressure compressed air to blow out the brake line inlet in the housing to make sure it is not clogged.
3. Inspect piston for worn plating, scoring, scratches and corrosion. Replace piston if damaged.
4. Check housing for cracks, thread damage and other damage. Clean up damaged thread. Replace housing if damaged.
5. Check seat inserts for damage. Replace if defective.

8.4.3.4 Assembly.

1. If removed, install seat inserts, and sleeve and bleeder screws in housing.
2. Install new O-rings on pistons and insert piston assembly in housing. If necessary, use C-clamp to compress piston enough to allow pad installation.
3. Install brake pads.
4. Install secondary plate and spacers.

8.4.3.5 Installation.

1. Connect brake line to housing assembly.
2. Bleed brake system as described in 8.3.
3. Install caliper according to 8.4.1.

8.5 REAR BRAKES (STANDARD SINGLE-WHEEL AXLE)

8.5.1 Friction Pad and Caliper Service (Rear).

1. Remove 2/3 of the brake fluid from the master cylinder.
2. Raise the rear end of the vehicle and place on secure jack stands.
3. Remove rear wheels.
4. Position C-clamp as shown and tighten until the

piston bottoms in the bore.

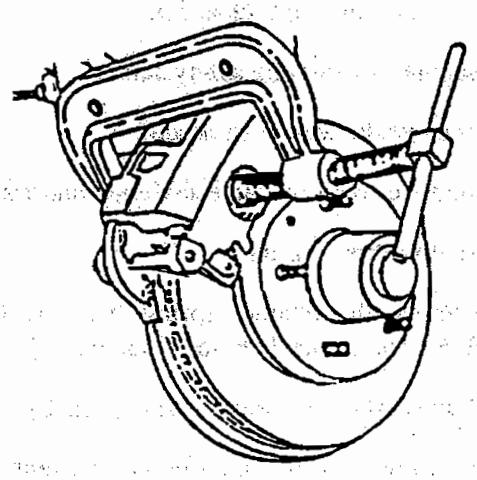


Figure 8.2. C-Clamp Placement.

5. Remove the two allen head bolts from the caliper and mount bracket.
6. Lift caliper from the rotor and mounting bracket. Hang caliper from the frame rail with wire hook.
7. Remove inboard shoe and lining and shoe retainer spring.
8. Dislodge and remove outboard shoe and lining.
9. Remove sleeves and rubber bushings from the caliper and discard.
10. Examine caliper in area of piston and boot for evidence of leakage. Check boot for cuts, cracks, or other damage. If leakage or damage is noted, the caliper should be removed for overhaul or replacement.
11. Inspect mounting bolts for corrosion. Use new bolts if corroded. Do not attempt to polish away corrosion.
12. Lubricate new bushings and sleeves with silicone grease and install in the caliper mounting holes.

Important! Be sure the caliper piston is bottomed in its bore.

13. Install shoe retainer spring on the inboard shoe as shown in Figure 8-3.

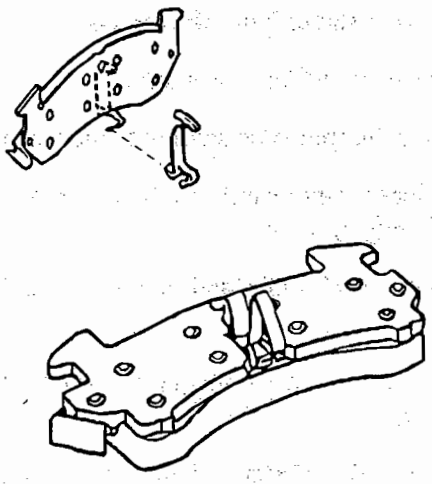


Figure 8-3. Shoe Retainer Spring.

14. Install inboard shoe in the caliper with spring in the piston recess.
15. Install outboard shoe in the caliper.
16. Install caliper with shoes in place over the rotor and in the mounting bracket.
17. Coat the two allen head bolt heads with silicone grease. Put locktite 242 thread locker on the threaded portion.
18. Install the two allen head bolts and torque to 35 ft.lbs.
19. After both sides are replaced, depress the brake pedal several times to seat the pads.
20. Position 12" channel lock pliers across the outboard shoe tabs and caliper ears and clinch shoe to caliper. Be sure to clinch both tabs on each shoe.
21. If calipers were replaced, bleed the calipers.
22. Refill the master cylinder.
23. Replace wheels and tires and tighten lugs to 90 ft/lbs. (front) using a criss-cross pattern.
24. Remove from jack stands.
25. Road test the vehicle.

8.5.2 Disc Replacement (Rear). To remove the rear wheel brake disc, you need to remove the rear wheel

and hub:

1. Raise rear of tractor until tires clear floor and position jack stands beneath rear axle.
2. Remove the wheel/tire assembly.
3. Remove cotter pin, axle shaft nut, and washer.
4. Use puller to remove hub and disc. Leave bearing assembly on shaft.
5. Push out wheel studs and remove disc from hub.
6. Follow same inspection and repair procedure as for front disc.
7. Install new wheel studs if the old ones have been pressed out.
8. Install hub and disk onto shaft.
9. Install washer and axle nut. Tighten to 400-450 ft/lbs. torque. Install cotter pin.

⚠CAUTION Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

10. Install wheel and tire assembly. Tighten 9/16 lug nuts (rear) to 130 ft./lbs. torque. Remove jack stand and lower tractor.

8.6 REAR BRAKES (OPTIONAL DUAL-WHEEL AXLE)

The Rockwell FSH brake is a floating-shoe hydraulic type. It can be removed as a complete assembly or be partially disassembled while mounted on the axle housing.

8.6.1 Adjustment. There is no adjustment for this brake.

8.6.2 Rear Drum Brake Removal and Disassembly.

1. Park the tractor in a service facility.
2. Place blocks in front of front wheels. Raise rear of tractor until tires clear floor.
3. Support tractor with safety stands.
4. Remove the wheel/tire assembly.
5. Remove cotter pin, axle shaft nut, and washer.
6. Remove brake drum.
7. Remove the retainer spring (item 1, **Brake, Rear,** Dual Wheel Option, Chapter 10).
8. Remove the shoe return spring (item 2).
9. Push down on the shoe retainers (item 21) so that the retainer rods (item 16) can be reached with pliers. Hold the retainers so that they do not twist while you rotate the rods 1/4 turn. Remove the rods, springs, and clips.
10. Remove the brake shoes.
11. If wheel cylinder removal is necessary, disconnect the hydraulic line and remove the attaching capscrews.

Note: If the wheel cylinder is leaking or has failed, it is better to install a new one rather than repair the old one. The time and cost involved to recondition a cylinder is usually greater than its replacement cost.

8.6.3 Cleaning and Inspection. Refer to 8.2.

8.6.4 Rear Drum Brake Assembly and Installation.

1. Before assembly, apply a thin layer of brake lubricant to the following parts:
   (a) Push rod ends of shoes and cylinder.
   (b) Surfaces of shoe support pads on backing plate assembly and ends of shoe webs that slide against anchor bracket.
2. If removed, position wheel cylinder, install capscrews and lock washers, and tighten to 25-35 ft./lbs. torque. Connect the hydraulic line. Tighten tube fitting firmly. **Do not overtighten.**

⚠CAUTION Do not overtighten brake tube fittings. Overtightening may crack the fitting or damage the seat in the cylinder fitting. Refer to paragraph 8.9.

3. Position shoe and lining assemblies so that the push rod ends of the shoes are engaged with the wheel cylinders.
4. Assemble the retainer rods, springs, and retainers. Lock the rods by pushing down on the retainers while you twist the nails 1/4-turn with pliers.
5. To assemble the shoe return spring, put one hook in position in a brake shoe. Pull the spring open to install the opposite hook in the other shoe.
6. Install the retainer spring into the shoes.
7. Install the hub and drum.
8. Install the washer and axle shaft nut. Tighten nut to 400-450 ft/lbs torque. Install cotter pin.
9. If hydraulic line to wheel cylinder was removed, bleed brake system. Refer to paragraph 8.3.

⚠CAUTION Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

10. Install wheel and tire assembly. Tighten 9/16 lug nuts to 130 ft./lbs. torque. Remove jack stand and lower tractor.

8.7 EQUALIZER VALVE

The equalizer valve reduces the hydraulic pressure to the front disk brakes and maintains high pressure to the rear drum brakes.

Check the equalizer valve for leakage whenever the brakes are serviced. If there is evidence of leakage, replace the equalizer valve.

8.8 CHECK VALVE

The check valve maintains a slight pressure in the rear brake system to prevent the entry of air into the system past the wheel cylinder cups when the pedal is released and fluid returns to the master cylinder from the wheel cylinder.

The check valve is non-repairable. If air is frequently being drawn into the brake system, as evidenced by spongy brakes, replace the check valve.

8.9 BRAKE LINES AND FITTINGS

⚠WARNING Failure of a brake line or fitting can result in a serious accident and possible personal injury. Always replace lines that are questionable.

Check the brake metallic lines and hoses for leaks whenever servicing the brakes. Check the lines for signs of deterioration, cuts, kinks and other damage. Replace any line that is questionable.

Brake fittings are either the *inverted flare* or *pipe*

type.

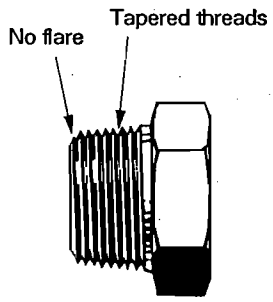


Figure 8-1. Pipe Fitting (Typical).

The **pipe fitting** (Figure 8-1) uses a tapered thread that produces leakproof joints. Pipe threads will leak if under-torqued or over-torqued.

Use a good pipe dope such as teflon tape on pipe threads. Do not put dope on the first two threads from the end. Always put dope on the male thread, never on the female thread.

After firm **hand** tightening, give the fitting 2-1/2 to 3 additional turns. This will lock the threads. Tightening beyond this point will be of no value and could even split the fitting.

Flare fittings (Figure 8-2) are designed especially for high-pressure application.

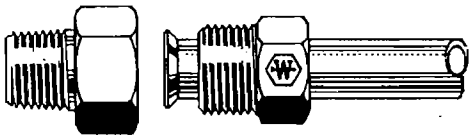


Figure 8-2. Inverted Flare Fitting (Typical).

To properly tighten an inverted flare fitting:

(a) Align the tubing with the fitting.

(b) Shove the flare against the fitting seat and run up the nut finger-tight.

(c) Using a flare wrench, bring the nut up solidly. You will feel a firm metal-to-metal contact. At this point, give the nut an additional 1/6 turn.

8.10 POWER BOOSTER/MASTER CYLINDER ASSEMBLY

A hydraulically operated unit called a "power booster" supplies the power-assist to the master cylinder, much like the vacuum booster found in most automobiles. The power steering pump provides the hydraulic pressure. The master cylinder is mounted on the end of the power booster.

An accumulator is filled with brake fluid each time the brakes are applied. If the power steering pump fails for some reason, the accumulator will provide around three power-assisted stops. Brakes can also be operated with no power assist, but will require much

firmer pedal pressure.

Check accumulator reserve charge retention as follows:

1. With engine running at medium rpm, holding steering to stop or hold brake with 100 lb. minimum brake pedal force for 5 seconds (maximum) and turn engine off.
2. Several minutes later, depress brake pedal (engine off). You should be able to make two power-assisted applications. If this cannot be done, repair or replace the booster.

Brake Booster Noise

Normal hydro-boost brake units will produce certain noises. The following noises usually occur during high pedal efforts and quick pedal release:

Above-normal pedal pressure may cause the booster to hiss. Loud hissing sounds at or below normal pedal effort indicates a possible problem.

Clunk, chatter, or clicking noises may be heard when the brake pedal is quickly released from hard pedal efforts.

If you notice booster noise (hydraulic system at normal operating temperature) during low brake pedal effort or with no pedal effort at idle, the booster may be faulty.

8.10.1 Removal.

1. With engine off, depress brake pedal several times to discharge accumulator.
2. Remove deck plate (located to right of operator's seat).
   (a) Disconnect parking brake cable from parking brake lever.
   (b) Remove round head screws from both brake access plates and remove access plates.
   (c) Remove deck plate fasteners and deck plate.
3. Disconnect brake pedal linkage from power booster by removing linkage locknuts and capscrews.
4. Place rags under booster and master cylinder assembly. Disconnect all hoses and pipes from booster and master cylinder.
5. Plug hoses, pipes, and booster ports to prevent entry of dirt, water or other contaminants.
6. Remove hardware securing power booster to bracket and remove booster assembly.

⚠CAUTION Do not carry brake booster by the accumulator section. The booster should never be dropped on the accumulator.

Do not expose accumulator to excessive heat, fire or incineration.

⚠WARNING The accumulator contains high pressure gas and must be handled with care. Do not apply heat. Do not attempt to service the accumulator.

8.10.2 Repair. Repair of the power booster/master cylinder assembly is not recommended. If faulty, replace entire unit.

8.10.3 Installation.

1. Position power booster assembly on bracket and secure booster with its mounting hardware. Tighten capscrews to 30 ft./lbs. torque.
2. Bleed air from master cylinder.
   (a) Fill reservoir with DOT 3 brake fluid.
   (b) Using two plastic or rubber tubes, each approx. 5 inches long, place one end of each tube into one of the master cylinder ports and place other end in reservoir.
   (c) Move booster piston back and forth until no more bubbles appear.
   (d) Remove tubes and connect brake lines to master cylinder.
3. Connect brake lines to master cylinder and tighten.
4. Connect fittings to power booster and tighten.

5. Bleed air from Hydro-boost unit as follows:
   (a) Fill pump reservoir.
   (b) Crank engine for several seconds with coil wire or fuel pump wire disconnected. DO NOT START ENGINE.
   (c) Check fluid level and add if necessary.
   (d) Start engine.
   (e) Turn wheels, lock-to-lock, twice.
   (f) Stop engine.
   (g) Discharge accumulator by depressing brake pedal five times.
   (h) Repeat steps (a) through (g).
   (i) If foaming occurs, stop engine and wait for 1 hour for foam to dissipate.
   (j) Repeat steps (a) through (g).
6. Re-connect pedal linkage. Tighten locknuts to 70 ft./lbs. torque.
7. Adjust brake pedal free travel. Refer to 8.11.
8. Bleed brake system. Refer to 8.3.
9. Road test the tractor.

8.11 BRAKE PEDAL ADJUSTMENT

The brake pedal should have about 3/8" free travel before resistance is felt (linkage begins to push booster piston).

1. Remove cover plate.
2. Disconnect upper end of turnbuckle and turn in or out to decrease or increase pedal travel.
3. Reconnect turnbuckle and check pedal free travel. Repeat step 2 if necessary.
4. Reinstall cover plate.

8.12 STOPLIGHT SWITCH

The stoplight switch is actuated by hydraulic pressure. It is located on the side of the brake fluid reservoir.

Check switch operation by inspecting brake lights while brake is being applied. Lights should come on with very mild pressure on the brake pedal.

If one light does not come on, check for a burned-out bulb or a poor electrical connection. If both lights do not come on, check the fuses.

If bulbs, fuses, and connections are good, check the stop light switch: Unplug the two wires from the switch and test for 12VDC. Voltage should be present. If not, the problem is in the wiring. If voltage is present, the switch is not working and should be replaced.

If care is taken, a new switch may be installed without allowing air into the brake system. To replace the switch, unscrew the switch from the hydraulic fitting. Apply a very small amount of pressure on the brake pedal, just enough to cause brake fluid to fill the opening in the hydraulic fitting, then install the new switch. Plug in the wires and re-check the brake light operation.

If brakes feel spongy after replacing the stoplight switch, bleed the brakes according to paragraph 8.3.

8.13 PARKING BRAKE (CHRYSLER TRANSMISSION)

Used on Chrysler Transmission

The following procedures describe how to replace the brake pads and perform other maintenance essential for keeping the parking brake in good working order.

Refer to the "Parking Brake" exploded view in Chapter 10 when disassembling the brake.

8.13.1 Removing Caliper and Pads.

1. Block the wheels.
2. Disconnect brake cable from caliper.
3. Remove mounting capscrews and locknuts. Remove caliper.

8.13.2 Disassembling, Inspecting, and Lubricating the Caliper.

1. Remove the center bolt from the caliper. The pads and compression spring will fall out. Don't lose the compression spring. It prevents the pads from rattling during operation.

2. Remove the two capscrews and washers securing lever to cam.
3. Remove cotter pin, castle nut, and flat washer. Pull lever and cam off stud.
4. Remove, clean, and inspect actuating pins for damage or wear. Replace if necessary.
5. Apply a fresh coating of grease (MIL-G-10924) to actuating pins and reinstall (flat ends against pads).
6. Clean and inspect cam surface for wear or damage and replace if necessary.
7. Apply a fresh coating of grease (MIL-G-10924) to surface of cam that meets actuating pins and the hole in the center of the cam.
8. Clean and grease the large flat washer.
9. Reinstall the two capscrews and washers securing lever to cam.
10. Reinstall cam and lever assembly, flat washer, and castle nut. Tighten castle nut hand-tight and install cotter pin through nut and threaded rod.
11. Reinstall center bolt and washer into caliper and through two new pads and compression spring. Tighten bolt to 25 ft./lbs. torque.

8.13.3 Installation and Adjustment.

Note: If the parking brake disc appears severely scored, out-of-round, or otherwise damaged, it must be replaced. Minimum allowable parking disc thickness is 0.375-in.

1. Install caliper assembly, mounting capscrews, and locknuts. Tighten locknuts to 120 ft./lbs. torque.
2. Adjust the parking brake.
   (a) Remove the cotter pin.
   (b) Tighten the castle nut until pads just touch the disc.
   (c) Back off castle nut one full turn to provide running clearance. Install cotter pin.
3. Install brake cable to caliper. Adjust cable length using the adjusting knob on the parking brake handle.
4. The park brake may be adjusted by turning handle knob clockwise as is necessary to tighten calipers enough to hold tractor but not enough to allow pads to "drag" on brake disk.

8.14 PARKING BRAKE (FORD TRANSMISSION)

Used on Ford Transmission

8.14.1 Removing Brake Shoes and Pads.

1. Block wheels, release park brake and loosen park brake cable by turning handle counterclockwise.
2. Raise rear wheels of tractor using a hoist and jack stands to allow enough room under tractor for the work task.
3. Disconnect park brake cable from parking brake lever.
4. Remove driveshaft mounting capscrews and slide driveshaft back and away from park brake assembly.
5. Remove capscrews from park brake cover and remove cover.
6. Remove springs holding brake shoes in assembly and remove shoes and pads together.

8.14.2 Inspecting and Lubricating Brake Assembly. Inspect all parts of parking brake assembly for wear and damage, particularly brake pads and linkage. Lubricate all moving parts. Be careful to keep brake shoes and pads clean and free of grease, oil and gasoline.

8.14.3 Repair and Replacement. Replace all parts which are worn excessively or damaged brake drum for scoring and replace if drum has excessive grooving.

8.14.4 Reassembly.

1. Position brake shoes in drum and fasten with springs.
2. Put cover over brake assembly and fasten with attaching capscrews.
3. Slide driveshaft forward and attach to park brake assembly.
4. Turn knob on park brake handle out as far as possible without removing it.

8.15 TROUBLESHOOTING

Use Table 8-1 for assistance in diagnosing brake problems.

8.15.1 Power System Test. To determine if the pump and booster are operating properly, perform the following test:

1. With engine off, depress and release brake pedal four times to deplete all hydraulic pressure in booster.
2. Depress pedal and hold with light pressure, then start engine.
3. If power section is operating properly, the pedal will fall slightly and then hold. Less pressure will be needed to hold pedal down to this position. You may now wish to perform the leak test.
4. If the power system is not operating properly, check pump fluid level. If OK, check drive belt tension and condition and repair as necessary. If OK, check pump flow and relief pressure (see Section 7) and replace pump if necessary. If all tests and checks are OK, replace the booster.

8.15.2 Hydraulic Leak Test.

1. First perform the ***Power System Test.***
2. Thoroughly clean all hydraulic system (steering and braking) components.
3. With hydraulic system at normal operating temperature and engine at medium idle speed, apply heavy brake pedal force (100 lbs. maximum) for no more than 5 seconds at a time.
4. Check booster, master cylinder, pump, steering gear, and all hose fittings for leaks. Perform repairs as required.
5. If no leaks are found, depress and release brake pedal several times, then hold with medium pressure (25 to 35 lbs.)

- If pedal does not fall away, hydraulic brake system is not leaking.
- If pedal falls away, the hydraulic brake system is leaking. Check for external leakage at wheel cylinders, calipers, and brake lines and hoses.
- If there is no external leak, there may be an internal leak, such as in the master cylinder.

Table 8-1. Brake System Troubleshooting.

Problem	Possible Cause	Correction
No Pedal -- No Brakes	Broken line, hose, or other leak.	Repair source of leak.
	Air in system.	Repair source of air entry and bleed system.
	Lining and/or pads worn.	Replace lining and/or pads.
	Master cylinder leaking internally.	Replace master cylinder.
	Low fluid level in master cylinder.	Fill reservoir and bleed system.
	Brake linkage disconnected.	Re-connect.
	Rear brakes not adjusted.	Repair or replace adjusters and adjust.
	Caliper seal or piston damage.	Repair or replace caliper.
Spongy Pedal	Air in system.	Repair source of air entry and bleed system.
	Shoes not centered on drum.	Adjust anchors to center shoes.
	Drums worn or turned too thin.	Replace drums.
	Soft hose.	Replace hose.
	Shoe lining wrong thickness.	Install correct lining.
	Cracked brake drum.	Replace drum.
	Brake shoes distorted.	Replace shoes.
	Insufficient brake fluid.	Bleed system and fill with fluid.
Brakes Fade	Poor lining and/or pads.	Use proper lining and/or pads.
	Excessive use of brakes.	Reduce speed or use lower gear.
	Poor brake fluid.	Flush system and install heavy-duty fluid.
	Improper drum-to-lining contact.	adjust shoes or grind to correct radius.
	Thin brake drums.	Install new drums.
	Dragging brakes.	Adjust or repair cause of dragging.
	Riding the brake pedal.	Keep foot off brake pedal unless needed.
	Excessively thin rotors.	Replace rotors.

Table 8-1. Brake System Troubleshooting.

Problem	Possible Cause	Correction
Hard Pedal (Excessive Foot Pressure Required)	Incorrect rear brake lining.	Install proper lining.
	Lining contaminated with grease or brake fluid.	Replace or reline shoes. Repair source of fluid.
	Shoes not centered.	Center shoes.
	Primary and secondary shoes reversed.	Install shoes in correct location.
	Brake linkage binding.	Free linkage and lubricate.
	Master or wheel cylinder pistons frozen.	Rebuild or replace cylinder.
	Seized caliper pistons.	Repair or replace.
	Linings hard and glazed.	Sand lining with medium grit sandpaper.
	Lining ground to wrong radius.	Grind to correct radius.
	Heat checked or blued rotor.	Recondition or replace rotor.
	Brake line or hose clogged or kinked.	Replace line or hose.
	Power booster unit defective.	Replace power booster.
	Power steering pump belt defective or slipping.	Replace belt or tighten.
	No hydraulic fluid in power steering pump reservoir.	Add hydraulic fluid.
Brakes Grab (One or More Wheels)	Grease or brake fluid on lining and/or pads.	Replace lining and/or pads.
	Lining charred.	If mild, sand. If severe, replace.
	Lining loose on shoe.	Replace.
	Loose wheel bearings.	Adjust bearings.
	Defective wheel bearing.	Replace bearings.
	Loose brake backing plate.	Torque fasteners.
	Defective drum.	Turn both drums.
	Sand or dirt in brake shoe assembly.	Disassemble and clean. Repair as required.
	Wrong lining type or size.	Install correct lining.
	Primary and secondary linings or shoes reversed.	Install correctly.
	Loose caliper.	Torque fasteners.
	Defective power booster.	Repair or replace.

Table 8-1. Brake System Troubleshooting.

Problem	Possible Cause	Correction
Brakes Pull Tractor to One Side	One wheel grabbing.	See "Brakes Grabbing"
	Shoes not centered or adjusted properly.	Center and adjust lining-to-drum clearance.
	Different lining on one side or shoes reversed on one side.	Replace lining or install shoes in proper position.
	Sagged, weak, or broken suspension.	Repair or replace axle.
	Uneven tire pressure.	Use same pressure on both sides.
	Front axle damaged.	Repair or replace axle.
	Plugged line or hose.	Clean or replace.
	Caliper or backing plate loose.	Tighten fasteners to proper torque specs.
Brakes Drag	Parking brake adjusted too tight.	Adjust properly.
	Clogged hose or line.	Clean or replace.
	Master cylinder reservoir cap vent clogged.	Open vent in cap.
	Brake pedal not fully releasing.	Adjust pedal release.
	Insufficient pedal free travel.	Adjust pedal free travel.
	Brakes adjusted too tight.	Adjust correctly.
	Brakes not centered on drum.	Center shoes.
	Master cylinder or wheel cylinder cups soft and sticky.	Repair or replace cylinders. Flush system.
	Loose wheel bearing.	Adjust bearings.
	Parking brake fails to release.	Clean and lubricate parking brake linkage.
	Shoe retracting springs weak or broken.	Replace springs.
	Out-of-round drum.	Turn drums.
	Defective power booster.	Repair or replace booster.
	Seized caliper piston(s).	Repair or replace caliper.
	Thin rotor.	Replace rotor.
	Loose caliper bolts.	Tighten to proper torque specifications.

Table 8-1. Brake System Troubleshooting.

Problem	Possible Cause	Correction
Brakes Chatter	Weak or broken shoe retracting springs.	Replace springs.
	Loose backing plate.	Tighten fasteners.
	Loose or damaged wheel bearings.	Adjust or replace bearings
	Drums tapered or barrel-shaped.	Turn drum in pairs, or replace.
	Bent shoes.	Replace.
	Dust on lining or lining glazed.	Sand with medium grit sandpaper and clean.
	Drum damper spring missing.	Install damper spring.
	Grease or fluid on linings.	Replace shoe and lining assembly.
	Shoes not adjusted properly.	Center and adjust shoes.
	Incorrect pads.	Install correct pads.
	Damaged pads.	Replace pads.
Brakes Squeal	Glazed or charged lining and/or pads.	Sand or replace linings and/or pads.
	Dust or metal particles imbedded in lining.	Sand lining with medium grit sandpaper and clean.
	Lining rivets loose.	Replace shoes.
	Wrong lining.	Replace with correct shoe and lining assemblies.
	Shoe hold-downs weak or broken.	Replace hold-downs.
	Drum damper spring missing.	Install damper spring.
	Shoes improperly adjusted.	Adjust shoes.
	Shoes bent.	Replace shoes.
	Bent backing plate.	Replace backing plate.
	Shoe retracting springs weak or broken.	Replace springs.
	Drum too thin.	Replace drum.
	Lining saturated with grease or brake fluid.	Replace shoe and lining assemblies.
"Nervous" Pedal (Pedal Moves Rapidly Up and Down When Applying Brakes)	Excessive disc distortion.	Machine or replace disc.
	Brake drums out-of-round.	Turn or replace drums.
	Loose wheel bearings.	Adjust to remove play.
	Drums loose.	Tighten wheel lugs.
	Rear axle bent.	Replace axle.

SECTION 9

REAR AXLE, DRIVE SHAFT, AND WHEELS

9.1 CHANGING AXLE OIL

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

1. Remove rear wheels according to 9.4.1.
2. Using a rag and wire brush, thoroughly clean dirt and rust from around the drain plugs (item 20 and 67), fill plugs (item 15 and 72), and axle breather (item 4).
3. Remove, clean, and reinstall drive axle breather. Replace if corroded.
4. Place catch pans under drain plugs.
5. Remove drain plugs. Inspect and remove metal particles from plugs. Normally, these particles are very fine. If they appear to be irregular or of a large size, there may be damage inside the axle. Notify your supervisor of this condition.
6. When oil has drained, apply a non-hardening sealing compound (like Permatex #51 or equivalent) to drain plugs and install plugs.
7. Remove fill plugs and fill with oil (SAE 80W-85-140, MIL-L-2105) to level of plug hole.
8. Apply a non-hardening sealing compound (like Permatex #51 or equivalent) to fill plugs and install plugs.
9. Install wheels according to 9.4.6.

9.2 REAR AXLE

9.2.1 Removal. If you need to disassemble or replace

the axle, first remove axle from tractor.

1. Remove rear wheels according to 9.4.1.
2. Remove pipe clamps holding exhaust pipe and tail pipe to frame. Disconnect and remove exhaust components as necessary.
3. Remove U-bolts securing rear universal joint to input yoke of differential and swing drive shaft out of the way. Tape bearing to universal joint spider to prevent losing bearings.
4. Remove calipers according to 8.5.1.
5. (Drum-brake axles only) Disconnect brake lines from wheel cylinders and remove hardware securing tee to differential housing. Plug lines to prevent system contamination. Move brake lines and secure to frame to prevent damage to lines.
6. Drain axle lubricant according to 9.1.
7. Position an axle jack or other mobile lifting device under axle and raise it enough to relieve tension.
8. Remove the frame-to-axle capscrews and lower the axle.
9. Raise tractor until axle can be moved from under tractor. If sufficient clearance cannot be obtained at the rear, slide unit out side of tractor.

Note: Do not attempt to clean assembled units using steam or by dipping in solvent. These methods will result in premature axle failure. Complete disassembly is necessary for thorough cleaning.

9.2.2 Disassembly of Reduction Gear Case.

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

1. Remove axle according to 9.2.1.
2. Remove input shaft lock nut and washer (item 47 and 48).
3. Remove yoke (item 49).
4. Remove oil seal (item 51).
5. Remove the 15 capscrews, washers, and nuts (item 61, 53, and 52).
6. Remove the gear case cover (item 60).
7. Remove driven gear (item 70) from pinion shaft (item 34) by straightening the locking washer (item 41), locknuts (item 43), and thrust washer (item 40).
8. Remove snap ring (item 58) bearings (items 55 and 57) and input shaft (item 56).
9. If removal from the carrier assembly (item 14) is required, remove the six locknuts and washers (item 69 and 68).
10. If pinion or pinion cage removal is desired, refer to 9.2.8.1.
11. Clean, inspect, and repair components according to 9.2.4 and 9.2.3.

9.2.3 Assembly of Reduction Gear Case.

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

Install components in reverse of disassembly.

- Install a new oil seal (item 51)
- Lubricate seal and bearings with oil.
- If the pinion cage gasket (item 33) seal was broken, install a new gasket and coat cage flange contact surfaces with Permatex #51 sealing compound or equivalent.
- Observe the following torque specifications:
  - (a) Item 65: 35-50 ft/lbs.
  - (b) Item 52 and 61: 40-55 ft/lbs.
  - (c) Item 69: 110-145 ft/lbs.
  - (d) Item 47: 250 ft/lbs.

9.2.4 Cleaning and Inspection. Thorough cleaning and visual inspection of parts for indications of wear or stress is necessary to eliminate costly and avoidable axle failures.

Clean parts in a suitable solvent such as P-D-680 or equivalent. Parts should be thoroughly dried immedi-

ately after cleaning. Use soft, lintless absorbent paper towels or wiping rags free of dirt, lapping compound, metal filings, or contaminated oil.

Immediately after cleaning, coat parts with a light film of oil to protect from corrosion and then reassemble. If parts are to be stored for any length of time, they should be treated with a good rust preventive and wrapped in special paper or other material designed to prevent corrosion.

Note: Do not clean bearings in gasoline. Never place ground and polished surfaces in a hot cleaning solution tank.

1. Inspect all bearing cups and cones, including those not removed from parts of the carrier. Replace if pitted or damaged in any way.
2. Remove parts needing replacement with a suitable puller. Avoid use of hammers and drifts as they can easily mutilate or distort axle parts.
3. Inspect gears for wear or damage. Gears that are pitted, galled, worn, or broken through the case hardening should be replaced.

Note: When necessary to replace either the bevel pinion or gear, replace the gears as a set. These gears are matched to assure quietness and satisfactory service.

4. Inspect differential assembly for:
   (a) Pitted, scored or worn thrust washers, spiders, differential gears or wear surfaces.

Note: Replace thrust washers in sets because using old and new washers together can result in premature failure.

Note: Replace differential pinions and side gears as sets.

   (b) Wear or damage to differential gear teeth.
   (c) Spider trunnions for looseness in differential case bores.
5. Check bevel pinion end for indications of brinelling caused by worn splines. Replace parts if pinion or shaft splines are worn, permitting the pinion to move on the shaft.
6. Inspect axle shafts for indications of torsional fractures and runout. Total runout should not exceed .005".

9.2.5 Repair. Replace all worn or damaged parts. Replace hex nuts with rounded corners, all lock washers, oil seals, and gaskets.

9.2.6 Disassembly of Wheel End.

Item numbers refer to the **AXLE–Rear (Wheel End)** illustration in Chapter 10.

If you want to remove the axle assembly from the vehicle, follow the axle removal procedures under 9.2.1.

1. Remove the wheels according to 9.4.1.
2. Remove calipers according to 8.5.1.
3. (Drum-brake axles only) Disconnect brake lines from wheel cylinders and remove hardware securing tee to differential housing. Plug lines

to prevent system contamination. Move brake lines and secure to frame to prevent damage to lines.

4. Remove the cotter pin, axle nut, and washer (item 16, 1, and 2).
5. Using a suitable puller, pull the hub/rotor assembly (item 3 and 4) from the axle shaft (item 17).
6. Place an oil catch pan under the axle end.
7. Remove capscrews and washers (item 6 and 7).
8. Remove oil seal retainer (item 8). Shims (item 9) and bearing retainer (item 10) will also come off.
9. Pull axle shaft from carrier assembly. Bearings (items 12 and 13) are on the shaft.
10. Remove bearings using an appropriate bearing puller, if replacement is required.
11. Clean, inspect, and repair components according to 9.2.4 and 9.2.3.

9.2.7 Reassembly of Wheel End.

Item numbers refer to the **AXLE–Rear (Wheel End)** illustration in Chapter 10.

Install components in reverse of disassembly.

- Install a new oil seal (item 15) and lubricate seal with oil.
- If removed, install bearings onto axle and housing using an approved method.
- Pack bearings with grease.
- If installing a new axle shaft, check for end play after installing items 6-17. Add or remove shims until there is "zero" end play after installing capscrews (item 6). Then remove a .003" shim to obtain correct preload.
- Apply Permatex #51 sealing compound or equivalent to bearing retainer (item 8).
- Observe the following torque specifications:
  (a) Axle shaft nut (item 1): 400 ft/lbs. then tighten to insert cotter pin.
  (b) Bearing retainer (item 6): 50 ft/lbs.
- Install calipers according to 8.5.1. Bleed brakes if any brake lines were disconnected.
- Install wheels according to 9.4.6.
- Fill carrier assembly with oil according to 9.1.
- If removed, install axle according to 9.2.10.

9.2.8 Disassembly of Differential Carrier.

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

1. Remove axle from vehicle according to 9.2.1.
2. Remove reduction gear case from axle carrier according to 9.2.2, steps 5, 6, 7, and 9.
3. Remove capscrews, nuts, and washers (item 16, 1, and 2) from carrier halves.
4. Separate the carrier halves (items 3 and 14).
5. Remove the differential and gear assembly.

9.2.8.1 Disassembly of Differential and Pinion.

1. If original alignment marks are not clear, mark differential case halves (items 7 and 10) with a punch or chisel before disassembling.
2. Cut lock wire, remove bolts or capscrews, and

separate the case halves.

3. Remove the spider, pinions, side gears, and thrust washers.
4. If desired, separate gear (item 8) from case by removing the attaching capscrews, washers, and nuts.
5. If necessary, remove bearing cones and cups (item 11 and 12) using a suitable puller.
6. If pinion removal is necessary, do not attempt to drive pinion with a drift or the pinion will be damaged. Remove pinion and cage together using puller screws in holes provided.
   (a) After removing pinion and cage, tap shaft from cage (item 39) using a soft mallet or press the shaft from the cage.
   (b) Remove outer bearing and spacer from cage.
7. Clean, inspect, and repair components according to 9.2.4 and 9.2.3.

9.2.8.2 Disassembly and Assembly of the Pinion.

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

If the pinion-pinion cage assembly is to be disassembled, follow the procedures below. If it is not to be disassembled, skip to 9.2.9.

When a new pinion cage is required, use new bearings (item 35 and 36). A shim pack (item 37) should be obtained.

1. Disassemble and inspect the pinion and pinion cage parts.
2. If removed, install new bearing (item 32) and bearing cone (item 35) to drive pinion shaft. Press new bearings firmly against drive pinion shoulders using a suitable sleeve.
3. Install bearing snap ring (item 31) and squeeze ring into pinion shaft groove with pliers.
4. If a new cone was installed onto pinion shaft, press a new inner cup into the pinion bearing cage firmly against cage shoulder.
5. If a new outer cone is to be installed onto pinion shaft, press a outer new cup into the pinion bearing cage firmly against cage shoulder.
6. Lubricate pinion and cage bearings and cups with light machine oil.
7. Install new dowel (item 38) into bearing cage, if removed
8. Place bearing cage assembly over drive pinion and bearing cone assembly.
9. Position spacer or spacer combination over pinion shaft.
10. Check bearing rotating torque.
    (a) Install thrust washer (item 40) over pinion shaft.
    (b) Install and secure inner pinion nut (item 43) to 300 ft/lbs.
    (c) Wrap a soft wire around outside of pinion cage and pull wire with a pound scale. Rotating torque should be between 12 and 18 ft/lbs.
    (d) To adjust torque, remove pinion nut and remove or add shim, then re-check torque.

    To increase torque, use less shim. To decrease torque, use more shim.
11. When rotating torque is correct, install pinion and cage into axle housing.
12. If not already done, install thrust washer (item 40).
13. If not already done, install and secure inner pinion nut (item 43) to 300 ft/lbs.
14. Install lock plate (item 41) and bend tab flat over inner nut.
15. Install outer pinion nut (item 43) and tighten to 300 ft/lbs.
16. Bend lock plate tab flat over outer nut.
17. Install assembly into axle housing.

9.2.9 Reassembly of Differential.

Item numbers refer to the **AXLE–Rear** illustration in Chapter 10.

1. If pinion cage was removed, install pinion-pinion cage assembly.
   (a) Coat cage flange contact surfaces with Permatex #51 sealing compound or equiva-

lent.

(b) Install new gasket (item 33) on face of pinion cage.

(c) Position cage asembly over studs and tap into position with a soft mallet.

(d) Install the reduction gear case according to 9.2.3.

1. If disassembled, attach bevel gear (item 8) to case half (item 7) using capscrews, washers, and nuts. Tighten to 60-75 ft/lbs. torque.
2. Lubricate differential case inner walls and all internal parts with clean axle oil.
3. Install thrust washers, side gears, differential pinions, and spider (items 24-28) in bevel gear-case assembly.
4. Align match marks and position differential case plain half (item 10) onto flange half (item 7). Draw together using four washers and cap-screws, equally spaced.
5. Check for free rotation of differential gears and correct if necessary.
6. Install remaining washers and capscrews and tighten to 85-115 ft/lbs. If lock wire was not used, apply Loctite No. 277 or equivalent to threads prior to assembly.
7. If bearings (items 11 and 12) are to be replaced, press new cones squarely and firmly on differential case halves. Press new cups into carrier halves.
8. If removed, install thrust block and pin (item 22 and 23) into carrier plain half.
9. Coat carrier flanges with a non-hardening sealing compound (like Permatex #51 or equivalent).
10. Using a new gasket, assemble carrier halves together. Make sure mounting pads are in the same position and level with each other. Secure halves with capscrews, lock washers, and nuts. Tighten to 65-85 ft/lbs.

Note: There is no shim pack or shims necessary for adjusting bevel gears or differential bearing pre-load because housing and gears are machined within limits that impose the correct pre-load and gear lash when unit is assembled.

11. Install reduction gear case according to 9.2.2.

9.2.10 Installation of Axle.

1. Position rear axle under tractor and raise axle into position.
2. Install capscrews and secure axle to frame using original fasteners if undamaged. Refer to standard torque specification chart at the front of this manual.
3. Apply a non-hardening sealing compound (like Permatex #51 or equivalent) to drain plugs (carrier case and reduction gear case) and install plugs.
4. Remove fill plugs (carrier case and reduction gear case) and fill with oil (SAE 80W-85-140, MIL-L-2105) to level of plug hole. Recheck after 1/2 hour.
5. Apply a non-hardening sealing compound (like

Permatex #51 or equivalent) to fill plugs and install plugs.

6. Install calipers according to 8.5.1. Bleed brakes as described in 8.3, if any lines were opened.
7. Connect rear universal joint to axle yoke. Tighten U-bolt nuts to 70 ft./lbs.
8. Install exhaust system.
9. Install wheels according to 9.4.6.

9.3 DRIVE SHAFT

The drive shaft transmits torque from the transmission to the rear axle assembly. Universal joints at each end of the drive shaft compensate for any angular misalignment between the transmission and the rear axle.

Repair of the drive shaft assembly is limited to replacing universal joints, the slip joint components, or the complete drive shaft.

9.3.1 Removal.

1. Remove four capscrews securing front yoke to transmission.
2. Remove nuts and lock washers from "U" bolts securing rear spider to yoke on differential.
3. Remove "U" bolts and carefully strike the yoke to push the drive shaft slip joint together. Remove drive shaft assembly from tractor. Be careful not to allow bearing caps to fall off spider.

9.3.2 Installation.

1. Install drive shaft assembly on transmission and secure with capscrews and lock washers. Tighten capscrews to 70 ft./lbs.
2. Position slip yoke on differential gear case yoke and loosely install "U" bolts. Remove tape securing bearings to yoke and tighten "U" bolt nuts to 70 ft./lbs.
3. Grease universal joints with a high-quality grease (MIL-G-10924).

9.3.3 Universal Joint Repair.

9.3.3.1 Removal–Flange Yoke End.

1. Match mark the flange yoke bearing caps and spider to ensure that bearings are assembled on same spider journals.
2. Remove retaining ring clips securing bearing caps to flange yoke and separate flange yoke from drive shaft.
3. Support drive shaft in a way that will allow bearings to be pressed from yoke without interference.
4. Using a short piece of pipe or a solid rod (about same diameter as bearing cap) and a hydraulic press, press a bearing cap until spider bottoms on yoke.
5. Use a hammer to tap loosened bearing cap from yoke.
6. Turn drive shaft over and repeat steps 4 and 5 to remove remaining bearing cap.

9.3.3.2 Removal–Slip Yoke End.

1. Loosen slip yoke dust cap and remove slip yoke from drive shaft.
2. Remove retaining rings securing bearing caps in slip yoke.
3. Repeat previous steps 3-6 under `Flange Yoke End' to disassemble universal joint.

9.3.3.3 Assembly–Slip Yoke End.

1. Clean and inspect yokes for damage and replace if necessary.
2. Apply automotive grease to new needle bearings to retain them in caps.
3. Start one of the caps into slip yoke bearing bore.

⚠CAUTION Protect bearings before installation and handle carefully during installation to prevent entry of dirt or other foreign matter into bearings.

4. Pack grease passage in spider with automotive type grease before installation.
5. Install new seals on spider journals.
6. Install spider in yoke and start one journal into bearing cap assembled to yoke. Be careful to not dislodge needle bearings.

7. Start remaining bearing cap into remaining yoke bore and start journal into that bearing. Do not dislodge needle bearings in either bearing.

8. Using either a press or bench vise, carefully push bearing caps into bores and onto bearing journals. If substantial resistance is encountered, a needle bearing may have been dislodged and is impeding progress. Carefully remove bearing caps and make sure bearings are in place. If a bearing is damaged, replace it with a new one.

9. Continue pressing on one side until retaining ring groove is exposed. Install retaining ring. Turn yoke over and press the other bearing into its bore. Install the retaining ring.

10. Install remaining seals and bearings on spider journals. Tape these bearings to yoke to prevent them from falling off spider.

11. Loosely assemble dust cap. Lubricate splines on drive shaft and insert shaft into slip yoke, insuring that front and rear yokes are aligned.

12. Lubricate slip joint through grease fitting before installing drive shaft on tractor.

9.3.3.4 Assembly–Flange Yoke End.

1. Apply automotive grease to needle bearings to retain them in cap.

2. Pack grease passage in spider with automotive-type grease before installation.

3. Slide two bearing assemblies onto spider journals 180 deg. apart. Use match marks to get correct bearing on correct journal.

4. Position spider and bearing assembly on flange yoke and secure bearing assemblies with retaining ring clips.

5. Install remaining two bearing assemblies on spider journals and position flange assembly on drive shaft. Install retaining rings.

9.4 WHEELS AND TIRES

The front and rear wheels are similar in maintenance, cleaning, and inspection.

9.4.1 Removal.

1. Move tractor to a level surface. Shut off engine and set parking brake.

2. Using a jack, overhead crane, or some other suitable lifting device (minimum 5 ton), raise end of tractor. Before tires leave the ground, loosen the lug nuts. Then continue raising the tractor until the tire comes off the ground. See Chapter 1 for safety stand locations.

3. Place safety stands under tractor to support it while wheel is off.

4. Remove lug nuts, valve stem bracket (rear wheels), and tire and wheel assembly.

9.4.2 Disassembly.

1. Let air out of tire and remove valve core.

⚠CAUTION Use proper tire removal tools to prevent possible damage to the tire bead.

⚠WARNING If a bead breaker slips, it can fly off with enough force to cause serious injury.

2. Remove tire from wheel using standard safety equipment, tire changing equipment, and safety practices.

3. Remove valve stem, if damaged or defective.

9.4.3 Inspection and Cleaning.

1. Wash dirt and grease from wheels and tires with soap and water and a soft bristle brush or a clean cloth. Rinse with clean water and allow to air dry.

⚠CAUTION Do not use cleaning solvent on tires. Solvents cause deterioration of the rubber.

2. Inspect tire for uneven wear. Replace any badly

worn tire.

3. Inspect tire for cuts, nails, stones in tread, or deterioration. If damage is severe, replace tire.

4. Inspect wheels for cracks and other damage. If damaged, replace wheel.

9.4.4 Repair.

⚠CAUTION Never mix rim parts of different manufacturers or different sizes. Do not use damaged parts.

1. Remove stones and other foreign material imbedded in tires.

2. Repair punctures or cuts if possible.

3. Remove nicks, burrs, and rust from wheels. Clean rim sealing area with coarse steel wool. Repaint wheel if necessary.

9.4.5 Assembly.

1. If removed, install a new valve stem in wheel.

2. Mount tire on wheel using standard safety equipment, tire changing equipment, and safety practices. To help get tire on, always use an approved rubber lubricant or use a small amount of soapy water for lubricating tire bead.

⚠WARNING Do not attempt to use extremely high air pressure to seat a tire bead. If a tire cannot be seated using normal pressure, contact the manufacturer for advice.

⚠WARNING Make sure no one is in the blow-out trajectory area. Always stand to one side when inflating tires.

3. Install valve core and place entire assembly in restraining device and inflate tire to 60 PSI. Make sure bead has seated all around and on both sides.

4. Inspect tire and wheel components while still in restraining device to make sure they are properly seated. If further adjustment is necessary, first deflate tire and remove valve core. Check for leaks. If none are detected, install valve cap.

9.4.6 Installation.

⚠CAUTION Do not lean or rest your body or repair equipment against the restraining device while the wheel/tire is in the device.

⚠WARNING Never inflate tires with air from systems using alcohol evaporators.

1. Assemble valve stems, if not already done.

⚠CAUTION Do not start lug nuts with power tools or cross threading may result.

2. Mount wheel and tire assembly on axle and secure with lug nuts. Tighten gradually in an alternating pattern:

- **1/2" lug nuts (front): 90 ft/lbs. torque**
- **9/16" lug nuts (rear): 130 ft/lbs torque.**

3. Remove safety stand and jack from beneath tractor.

⚠CAUTION Always recheck lug nut torque one hour after mounting wheel and tire assembly. Failure to do so may result in loose wheels and/or broken wheel studs.

4. Run unit and check wheels after one hour and periodically thereafter to be sure wheels are set.

9.5 REAR SUSPENSION

9.5.1 Removal.

1. Move tractor to a level surface. Shut off engine and set parking brake.

2. Place axle jack under axle. Raise slightly.

3. Remove nut and washers from axle plate.

4. Lower axle.

5. Remove front spring bolts.

6. Remove top shackle bolts.

7. Tip front of spring forward, down, and out.

9.5.2 Installation. Install in reverse of removal sequence. Refer to Table 1.1 for torque specifications.

CHAPTER 10

ILLUSTRATED PARTS BREAKDOWN

Contents

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

This Chapter 10 part list is effective on all model 60 tow tractors ser. #97-C-1785 and on.

This chapter contains the Illustrated parts breakdown (IPB) for the tow tractor manufactured by **Northwestern Motor Company, Inc.** of Eau Claire, WI, 54702. Any part in listed this IPB can be obtained from NMC by calling 715-835-3151.

NOTE

Returned parts will be assessed a restocking charge.

NOTE

Parts obtained from sources other than Northwestern Motor Company (NMC) will not be covered under the NMC warranty. Damage to the tow tractor caused by the use of non-NMC parts will not be warranted by NMC.

Abbreviations Used in the IPB

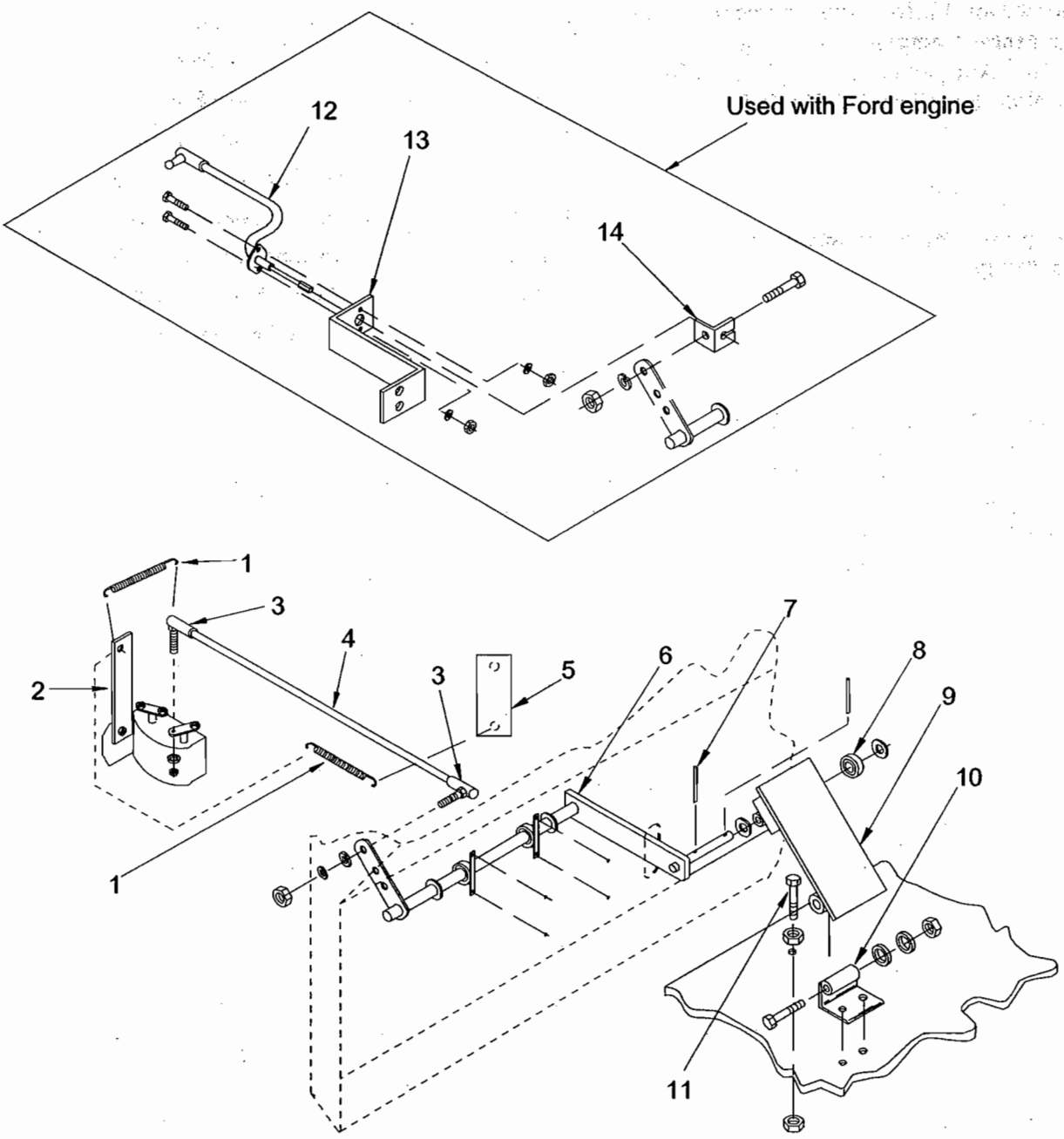
A/R- - - - - - - - - - - - - - - - As Required
COMM - - - - - - - - - - - - - - Common item
NS - - - - - - - - - - - - - - - - - Not Shown
NSS - - - - - - - - - - - - Not Sold Separately
HHCS - - - - - - - - - Hex Head Cap Screw
PHMS - - - - - - - - Pan Head Machine Screw
RHMS - - - - - - - Round Head Machine Screw
THMS - - - - - - - Truss Head Machine Screw
SHCS- - - - - - - - - Socket Head Cap Screw
REF - - - - - - - - - - listed for reference only
L.H. - - - - - - - - - - - - - - - - Left Hand
R.H. - - - - - - - - - - - - - - - - Right Hand

All capscrews and bolts are zinc plated, grade 5, unless otherwise stated.

NOTE

Because most customers can obtain fasteners locally, they are not included with any order unless you specifically request them.

ACCELERATOR



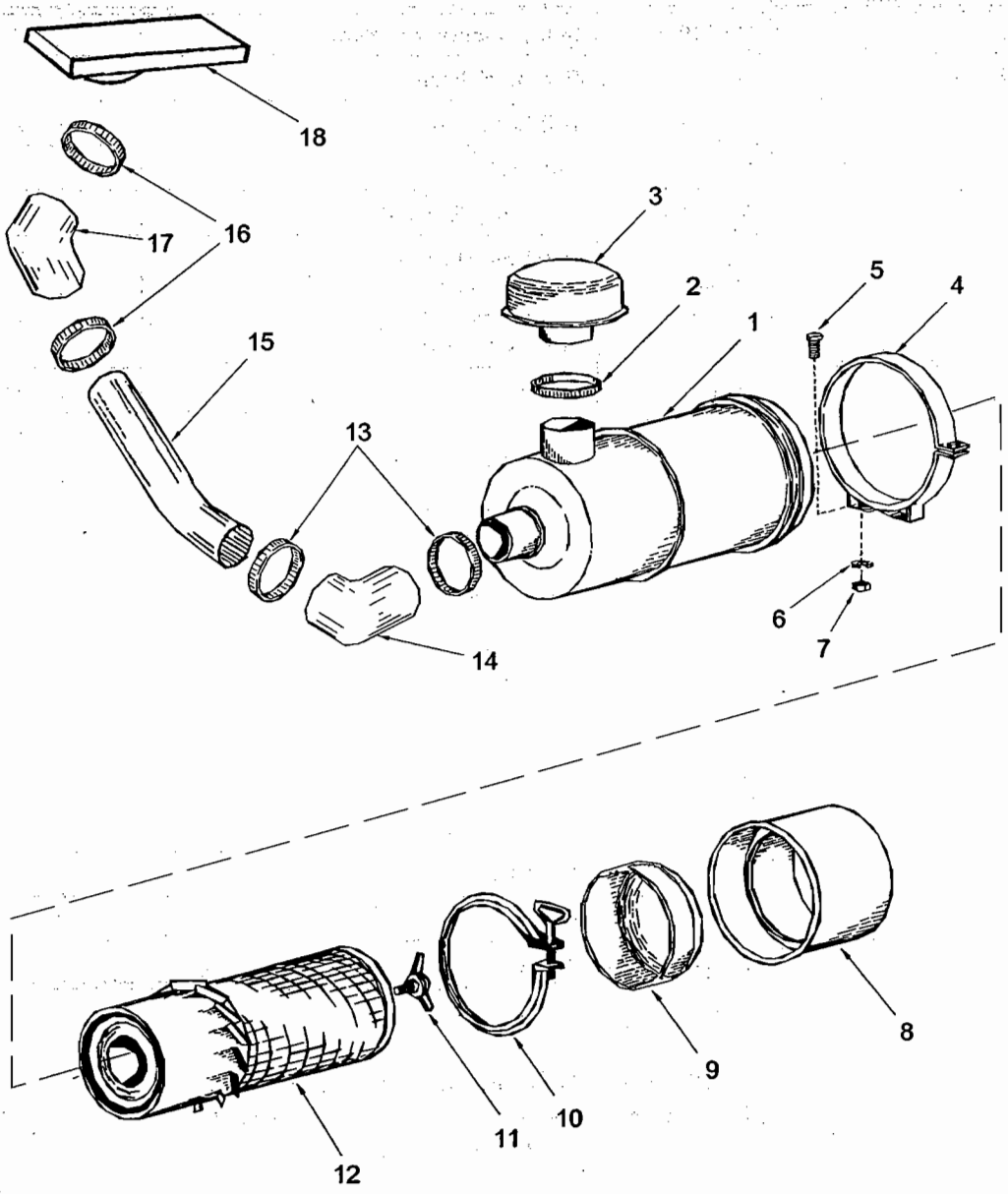
ACCELERATOR

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW21911	Spring, Carburetor Return		2
2		NW35406	Bar, Accel. Return		1
3		F101863	Ball Joint, 1/4-28		2
4		NW32392	Accelerator Rod		1
5		NW36134	Bar, Spring Return Bracket		1
6		37562 Comm Comm Comm	Accelerator Linkage HHCS, 1/4-20 x 0.75 Lock Washer, 1/4 Hex Nut, 1/4-20		1 4 4 4
7		F01005	Cotter Pin		2
8		NW14718 Comm	Bearing Flat Washer, 5/16		1 2
9		37616 Comm Comm Comm	Accelerator Pedal HHCS, 1/4-20 x 3.50 Lock Nut, 1/4-20 Flat Washer, 1/4		1 1 1 2
10		NW22971 Comm Comm Comm Comm	Accelerator Pedal Bracket HHCS, 1/4-20 x 1.00 Flat Washer, 1/4 Lock Washer, 1/4 Hex Nut, 1/4-20		1 2 2 2 2
11		Comm Comm	HHCS, 3/8-16 x 3.50 Hex Nut, 3/8-16		1 2
12		NW34282	Accelerator Cable		1
13		NW34165	Bracket		1
14		NW34296	Bracket, Pivot		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

AIR CLEANER

with Ford engine



AIR CLEANER

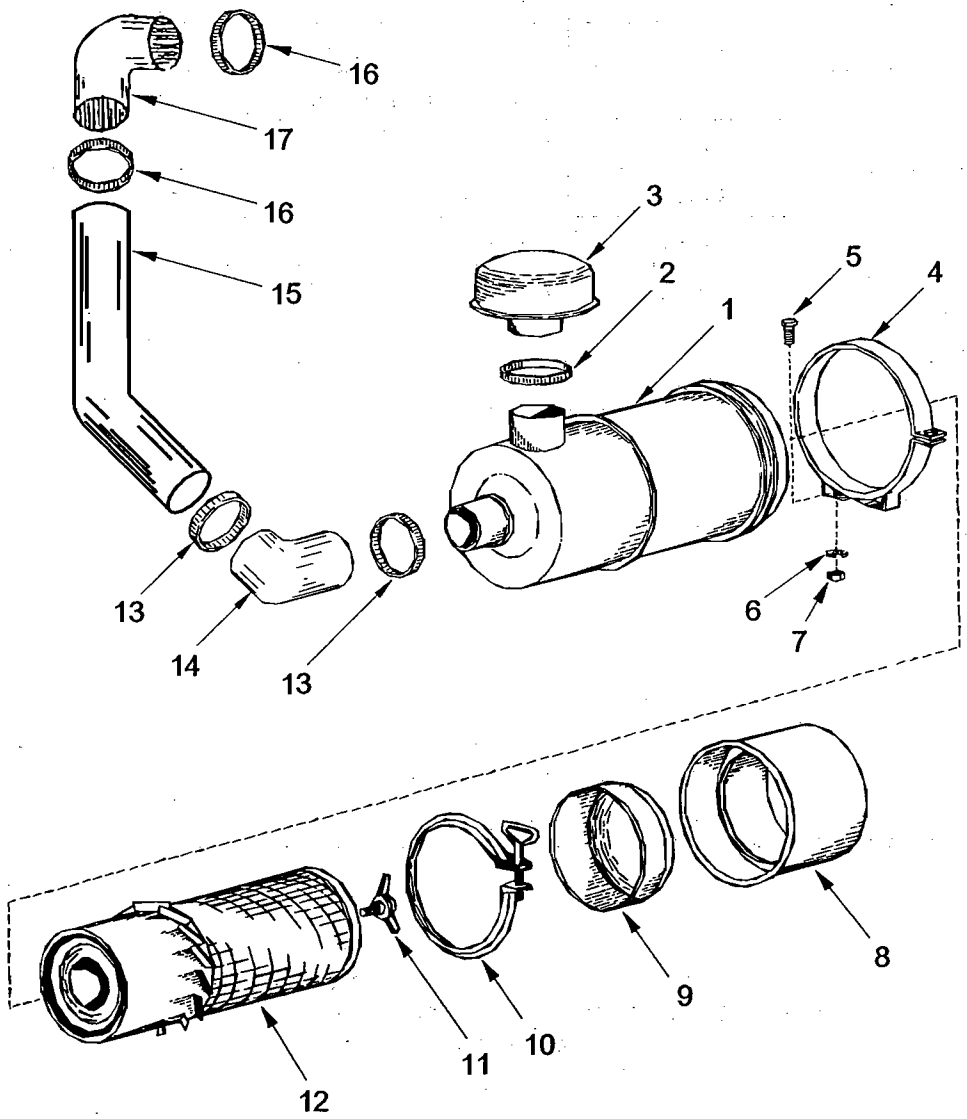
with Ford engine

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		F102351	Air Cleaner Assembly (incl. items 8-12)		1
2		NSS	Clamp		Ref
3		39052	Hat, 2.50" (includes item 2)		1
4		F102489	Mounting Band		2
5		Comm	HHCS, 5/16-18 x 1.00		4
6		Comm	Lock Washer, 5/16		4
7		Comm	Hex Nut, 5/16-18		4
8		37851	Cup		Ref
9		37850	Baffle		Ref
10		37849	Clamp		Ref
11		NW35916	Wing Nut		Ref
12		NW29951	Filter Element		Ref
13		NW33101	T-Bolt Clamp, 2.25"		2
14		NW36784	Elbow, 45 Deg., 2.25"		1
15		38589	Tube, Air Intake		1
16		NW33103	T-Bolt Clamp, 3.00"		2
17		37488	Elbow, 45 Deg., 3.00"		1
18		NW35358	Air Horn		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

AIR CLEANER

for Perkins 4.236 engine



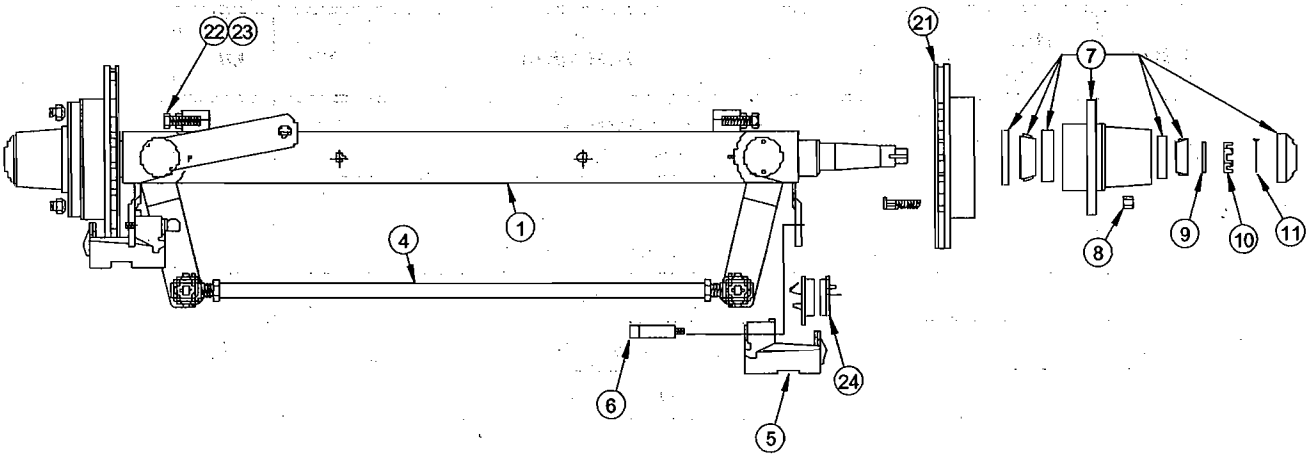
AIR CLEANER

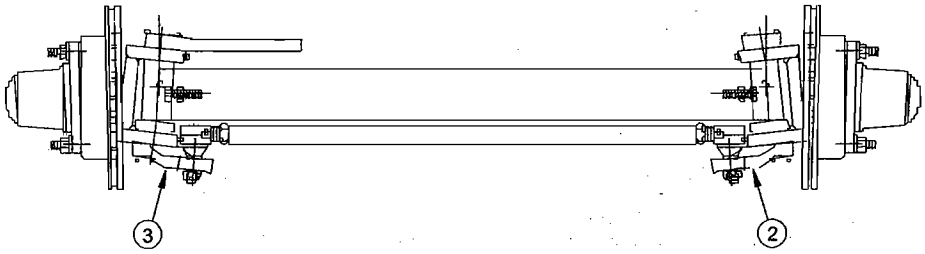
for Perkins 4.236 engine

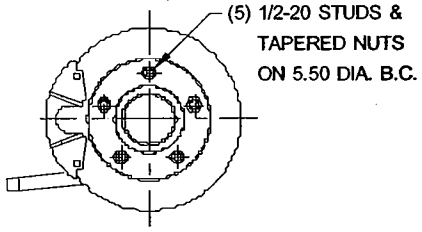
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW29952	Air Cleaner Assembly (Incl. items 8-12)		1
2		NSS	Clamp		1
3		38594	Hat, 3.00 (Includes item 2)		1
4		F104049	Mounting Band Assembly		2
5		Comm	HHCS, 5/16-18 x 1.00		4
6		Comm	Lock Washer, 5/16		4
7		Comm	Hex Nut, 5/16-18		4
8		37851	Cup		1
9		37850	Baffle		1
10		37849	Clamp		1
11		NW35916	Wing Nut		1
12		NW29951	Filter Element		1
13		NW33103	T-bolt Clamp, 3.00		2
14		NW30064	Elbow, 3.00", 90 Deg.		1
15		NW32112	Tube, Air Intake		1
16		NW33101	T-bolt Clamp, 2.25		2
17		F102348	Elbow, 2.25", 90 Deg.		1

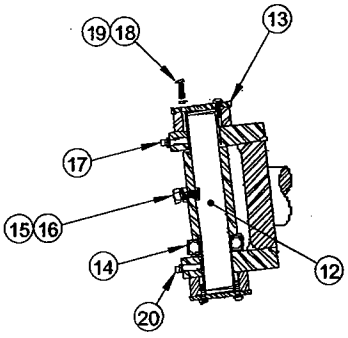
AXLE

Front Axle









AXLE

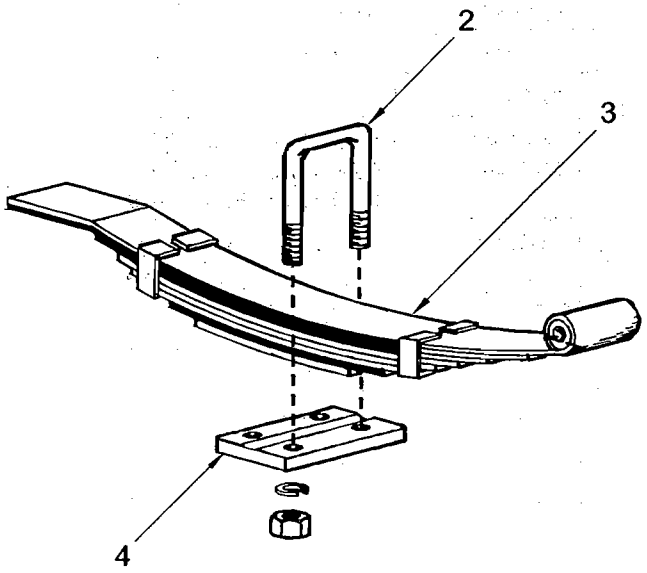
Front Axle

Item	Owner Use	NMC Part No.	Vendor Part No. (Brierton)	Description	Eff	Qty
		41678		Axle Assembly		1
1		42471	03-30487	Axle Weldment		1
2		42472	03-30485	Knuckle Weldment, R.H.		1
3		42473	03-30486	Knuckle Weldment, L.H.		1
4		42474	02-20389	Tie Rod Tube Assembly		1
5		41822 41823	06-61460R 06-61460L	Caliper, Disc Brake, R.H. Caliper, Disc Brake, L.H. **See Brakes - Front Caliper**		1 1
6		41829	06-61460A	Screw, Caliper Mounting		4
7		42475	02-20322	Hub Assembly, #623 920154 8		2
8		Comm		Nut, 1/2-20 UNF Tapered Hex		10
9		NW36545	06-13108	Spindle Washer		2
10		NW36162	321415140	Castle Nut, 1-14		2
11		Comm		Cotter Pin, 3/16 x 2.00		2
12		42476	06-60555	King Pin, KB289		2
13		42477	06-60547	King Pin, Cap, Std		4
14		41527	06-60744	Bearing, Thrust		2
15		Comm		HHCS, 5/16-18 x .75 Lg.		2
16		Comm		Nut, 5/16-18, Hex Jam		2
17		41526	06-61376	King Pin Cap Gasket		4
18		41524	06-61080	Screw, #10-24 x 5/8 Lg.		8
19		Comm		Washer, #10 Lock		8
20		Comm		Grease Zerk		4
21		42478	06-61459	Rotor, 10.75 Dia.		2
22		Comm		Nut, 1/2-13 Hex Jam		2
23		Comm		HHCS, 1/2-13 UNC x 1.75 Lg.		2
24		41830	06-61460B	Brake Pad Kit		2

Bendix MKD159

AXLE

Front Spring



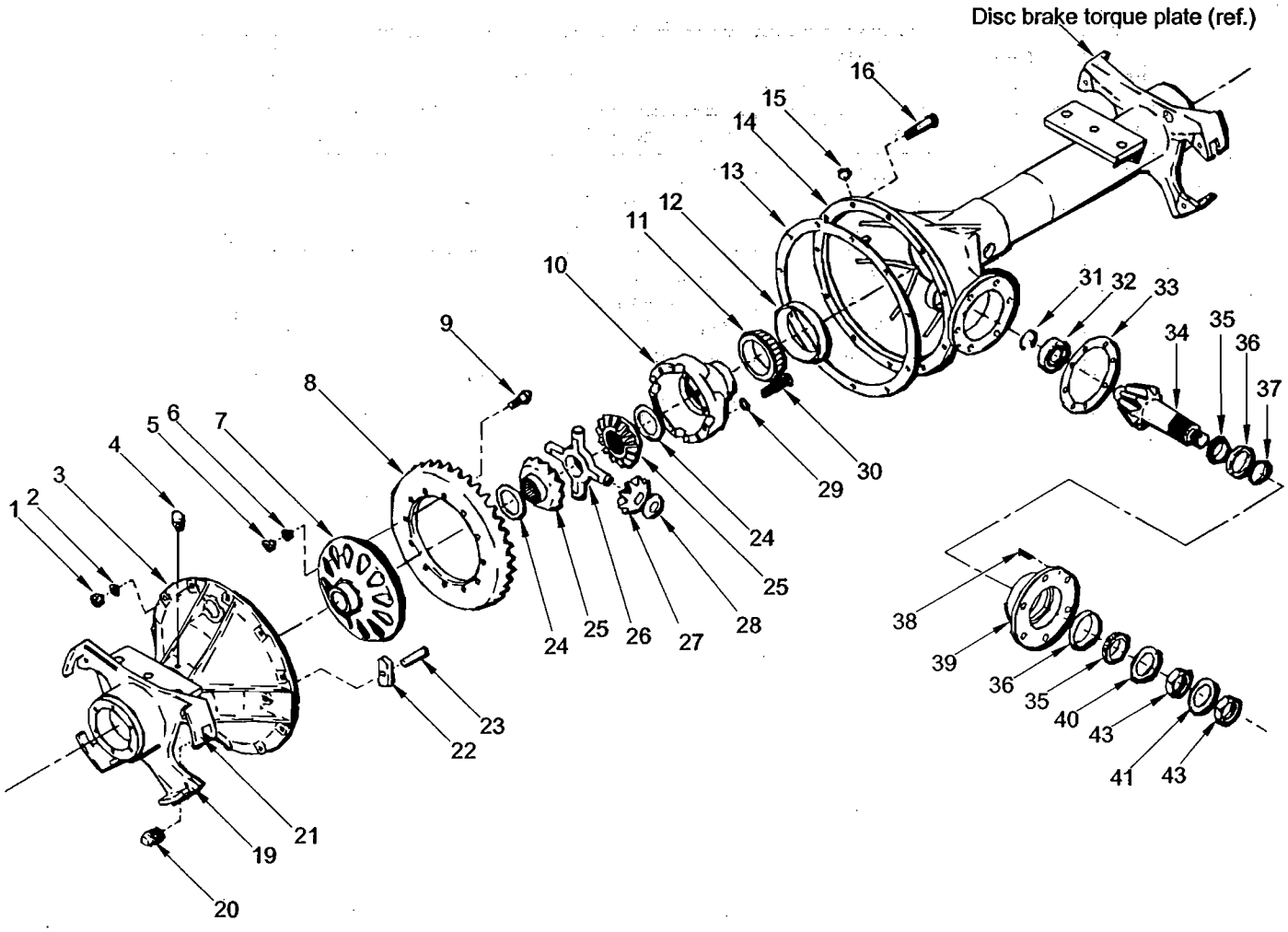
AXLE

Front Spring

Item	Owner Use	NMC Part No.	Description	Eff	Qty
NS		NW32136	Hanger, Spring (See FRAME)		Ref
2		NW18585	U-Bolt		4
		Comm	Lockwasher, 9/16		8
		Comm	Nut, Hex, 9/16-18		8
3		40036	Spring, Front		2
		Comm	HHCS, 5/8-11 x 4.00		2
		Comm	Lockwasher, 5/8		2
		Comm	Nut, Hex, 5/8-11		2
4		NW33675	Plate, U-Bolt		2

NOTE: Always check OPTIONS before ordering parts.
Most options will replace or modify one of the standard assemblies.

AXLE–Rear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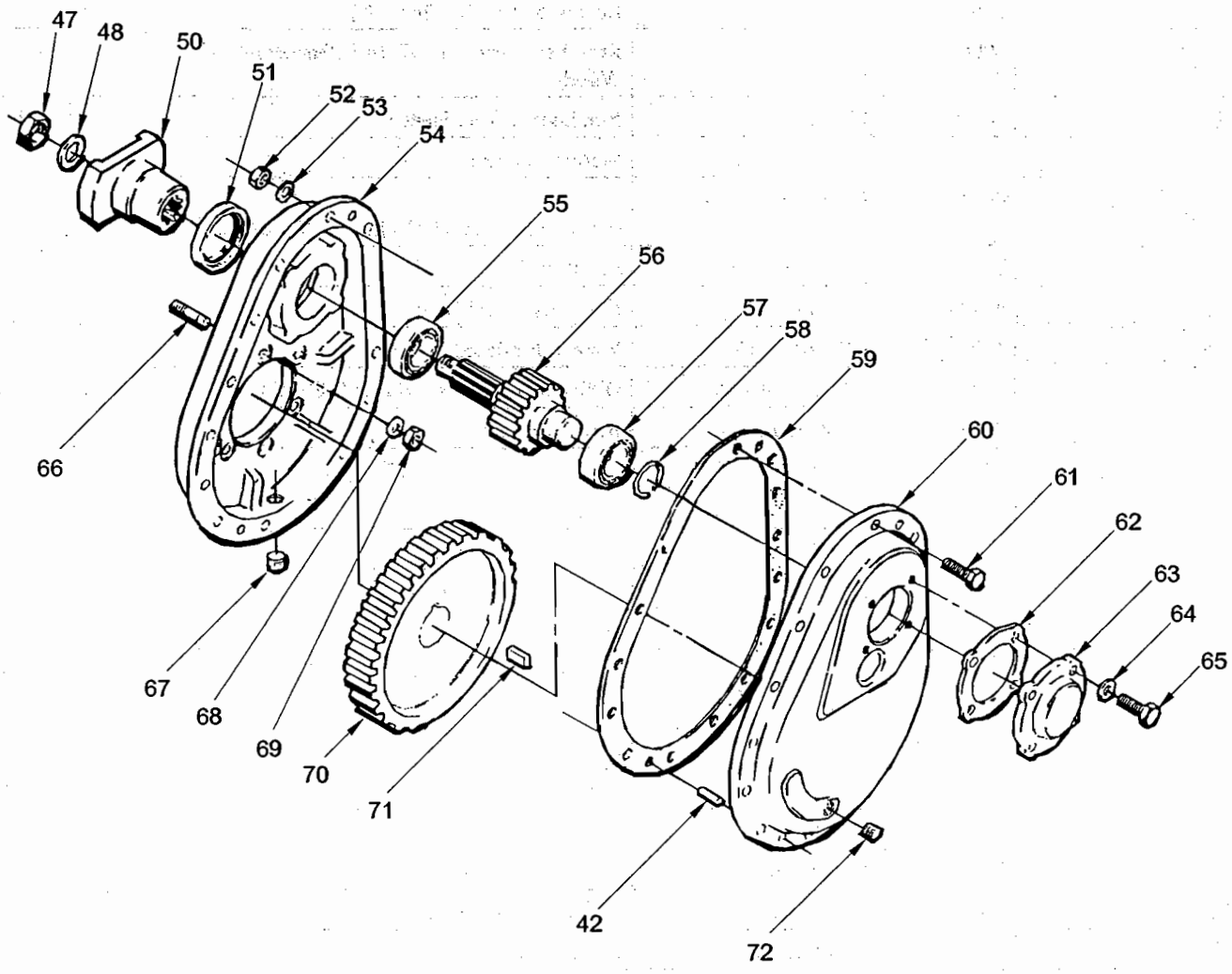
AXLE–Rear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AXLE–Rear

Item	Owner Use	NMC Part No.	Rockwell Part No.	Description	Eff	Qty
		38680		Rear Axle Assy, TA 267, 14:1		1
		39060		Rear Axle Assy, TA 267, 14:1 (Optional–Dual Wheels)		1
1		NW15196	NL-17-1	Nut, Lock, Carrier Flange		11
2		NW15197	1229-E-1513	Washer, Hardened		11
3		40033	B28-3800-X-570	Carrier Assy., Plain Half (Incl. 12, 20, 22, 23)		1
4		39936	A-1199-C-1043	Breather, Oil		1
5		NW15196	NL-17-1	Nut, Lock, Bevel Gear		12
6		NW15197	1229-E-1513	Washer, Hardened		12
7		40034	A1-3235-N-1262	Differential Case Assy (Incl. 10, 29, 30)		1
8		39937	A-40370-1	Bevel Gear Assy.		1
9		37163	15-X-776	Capscrew, Diff. Case To Bev. Gr.		12
10		NSS		Case, Diff. Plain		1
11		NW15249	3984	Cone, Diff. Case Bearing		2
12		NW15248	3920	Cup, Diff. Case Bearing		2
13		NW15199	2208-H-112	Gasket		1
14		39938	A-86-3800-D-654	Carrier Assy., Pinion Half (Incl. 12, 15)		1
15		F100752	P-112	Plug, 3/4"		1
16		37164	S-1714-1	Capscrew		11
17-19				NOT USED		
20		37176	1250-S-123	Plug, Magnetic, Case Cover		1
21			A26-3816-J-556	Tube, Carrier Cover		1
22		NW15204	2297-S-175	Thrust Block-bevel Gear		1
23		NW15203	1246-D-134	Pin, Thrust Block		1
24		NW15247	1229-V-412	Thrust Washer, Side Gear		2
25		NW15246	2234-K-427	Gear, Diff. Side		2
26		NW15243	3278-T-72	Spider, Diff.		1
27		NW15242	2233-M-429	Pinion, Diff.		4
28		NW15244	1229-U-1061	Thrust Washer, Diff. Pinion		4
29		F102522	1229-C-1511	Washer, Diff. Case		8
30		NW15240	S-2822-1	Capscrew		8
31		NW15236	1229-Y-1299	Lock Ring, Bevel Pinion		1
32		NW15237	1228-E-83	Bearing, Bevel Pinion, Rear		1
33		NW15231	2808-F-942	Gasket, Pinion Bearing Cage		1
34		NSS		Pinion, Bevel		1
35		NW15232	HM-803149	Cone, Bevel Pinion Gear		2
36		NW15233	HM-803110	Cup, Bevel Pinion Gear		2

AXLE–Rear

Item	Owner Use	NMC Part No.	Rockwell Part No.	Description	Eff	Qty
37			S2203A6969	Shim Pack		Ref
		F102431		Spacer, Bevel Pinion, .445		AR
		F102432		Spacer, .446		AR
		F102433		Spacer, .447		AR
		F102434		Spacer, .448		AR
		F102435		Spacer, .449		AR
		F102436		Spacer, .450		AR
		F102437		Spacer, .451		AR
		F102438		Spacer, .452		AR
		F102439		Spacer, .453		AR
		F102440		Spacer, .454		AR
		F102441		Spacer, .455		AR
		F102442		Spacer, .456		AR
		F102443		Spacer, .457		AR
		F102444		Spacer, .458		AR
		F102445		Spacer, .459		AR
		F102446		Spacer, .460		AR
		F102447		Spacer, .461		AR
		F102448		Spacer, .462		AR
		F102449		Spacer, .463		AR
		F102450		Spacer, .464		AR
		F102451		Spacer, .465		AR
		F102452		Spacer, .466		AR
		F102453		Spacer, .467		AR
		F102454		Spacer, .468		AR
		F102455		Spacer, .469		AR
		F102456		Spacer, .470		AR
		F102457		Spacer, .471		AR
		F102458		Spacer, .472		AR
		F102459		Spacer, .473		AR
		F102460		Spacer, .474		AR
		F102461		Spacer, .475		AR
38		NW15230	1246-C-211	Dowel, Bevel Pinion Cage		1
39		37180	A1-3226-C-679	Cage, Bevel Pinion Bearing (Incl. 36, 38)		1
40		NW15227	1229-G-813	Washer, Thrust, Bevel Pinion Bearing		1
41		37168	1229-H-528	Lock, Bevel Pinion Nut		1
42		37169	1846-C-159	Dowel, Case Cover		2
43		NW15161	1227-M-117	Nut, Bevel Pinion		2
44-46				NOT USED		
47		NW15137	1227-G-943	Nut, Input Shaft		1
48		NW15138	1829-T-592	Washer, Input Shaft Nut		1
49		NW23707		Yoke		1
50				NOT USED		
51		37171	A-1805-R-96	Oil Seal, Input Shaft		1
52		NW15146	N-16-1	Nut, Case & Cover		15
53		NW15142	WA-16	Lock Washer, Case & Cover		15
54		39940	A7-3875-A-651	Case, Reduction (Incl. 42, 51, 59, 60)		1
55		NW15155	1228-K-375	Bearing, Input Shaft, Front		1
56		39941	3892-X-5172	Gear, Input		1

AXLE–Rear

Item	Owner Use	NMC Part No.	Rockwell Part No.	Description	Eff	Qty
57		39942	1228-T-1216	Bearing, Input Shaft, Rear		1
58		NW15156	1854-M-169	Snap Ring		1
59		37172	2808-X-622	Gasket, Case & Cover		1
60		NSS		Cover, Reduction Case		1
61		NW15148	S-1612-1	Bolt, Case & Cover		15
62		NW15143	2808-C-913	Gasket, Input Shaft Cover		1
63		39943	3266-A-1171	Cover, Input Shaft		1
64		NW15142	WA-16	Lock Washer		4
65		39944	S-268-2	Capscrew		4
66		37174	4-X-834	Stud		6
67		NW15134	1250-U-125	Plug, Magnetic		1
68		NW15167	1229-Y-1507	Washer, Hardened		6
69		NW15166	NL-19-1	Nut, Lock		6
70		39945	3892-Y-5173	Gear, Driven		1
71		37175	16-X-71	Key, Driven Gear		1
72		37167	1250-S-123	Plug, 1/2"		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

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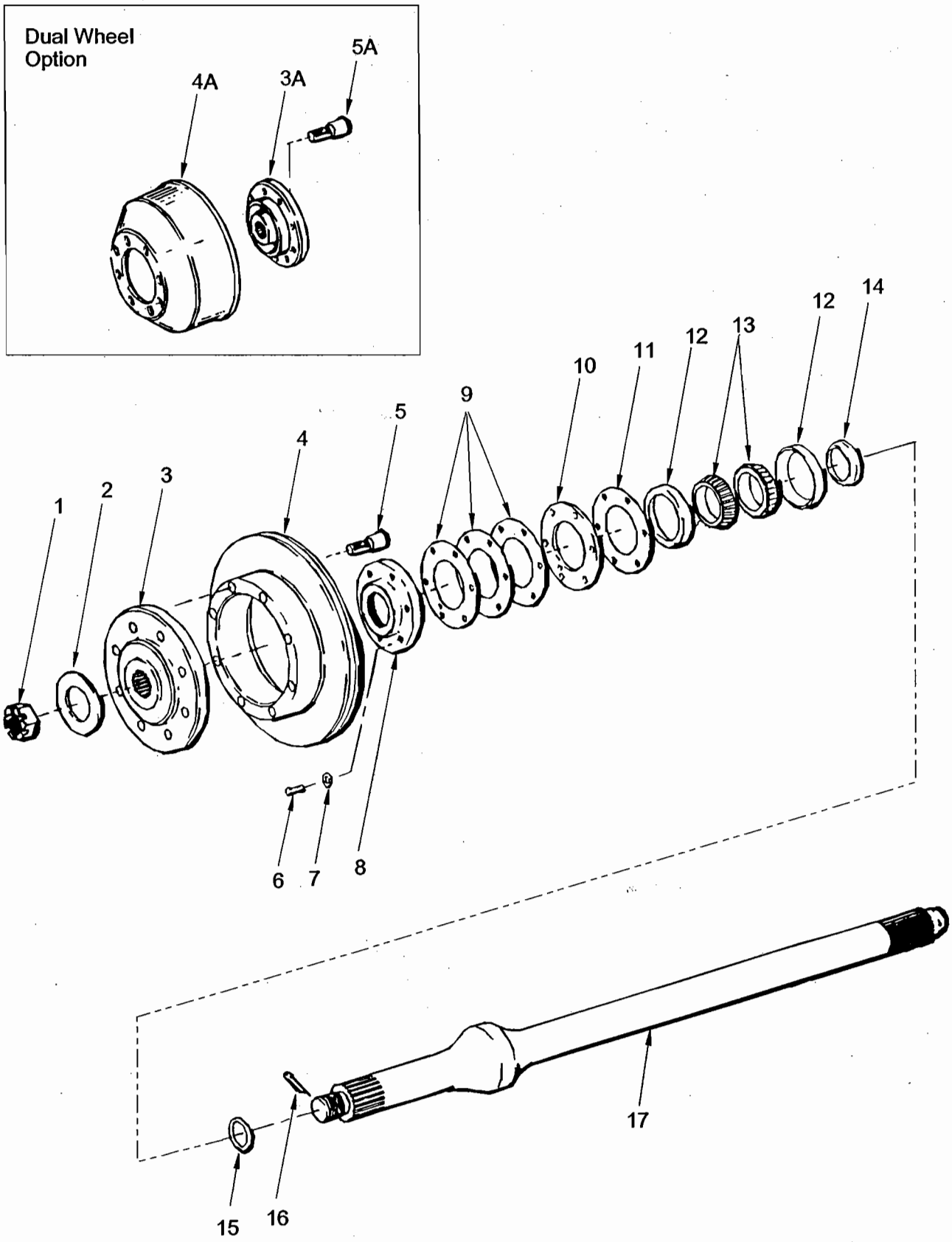
AXLE–Rear (Wheel End)

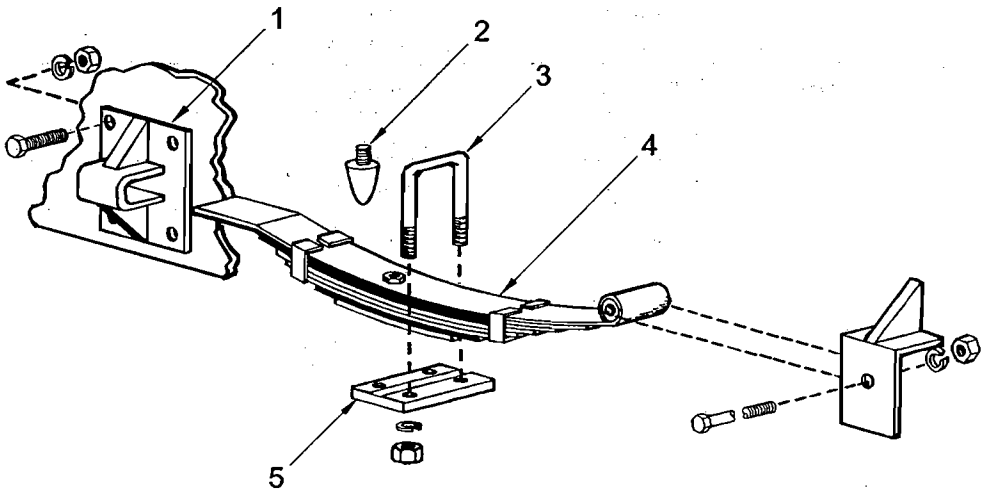


AXLE-Rear (Wheel End)

Item	Owner Use	NMC Part No.	Rockwell Part No.	Description	Eff	Qty
1		NW15174	1227-B-496	Nut, Axle Drive Shaft		2
2		NW15175	1829-U-775	Washer		2
3 3A		37156 40312	311-G-1021 311-W-465	Hub, Wheel Hub, Wheel		2 2
4 4A		37157 NW23221	3218-C-1069 3819-T-540	Rotor, Disk Brake Drum, Brake		2 2
5 5A		37158 NW15171	20-X-2077 20-X-2165	Stud, Wheel Stud, Wheel		16 16
6		39946	S-2610-2	Capscrew		12
7		NW15142	WA-16	Washer		12
8		NW15177	A-1805-N-560	Retainer, Oil Seal		2
9		NW15183 NW15184 NW15185	2803-S-2099 2803-T-2100 2803-U-2101	Shim, .003 Shim, .005 Shim, .010		10 8 6
10		NW15182	1244-A-261	Retainer, Bearing		2
11		NW15181	2808-V-672	Gasket		2
12		NW15186	18720	Cup, Bearing		4
13		NW15187	18790	Cone, Bearing		4
14		NW15188	1874-E-187	Collar, Spacer		2
15		37159	3780-C-185	O-ring		2
16		NW15173	K-2418	Cotter Pin		2
17		39947 37161	A-3202-X-9150 A-3202-Z-9152	Shaft, Axle, Short (incl. item 14) Shaft, Axle, Long (incl. item 14)		1 1

AXLE

Rear Spring



AXLE

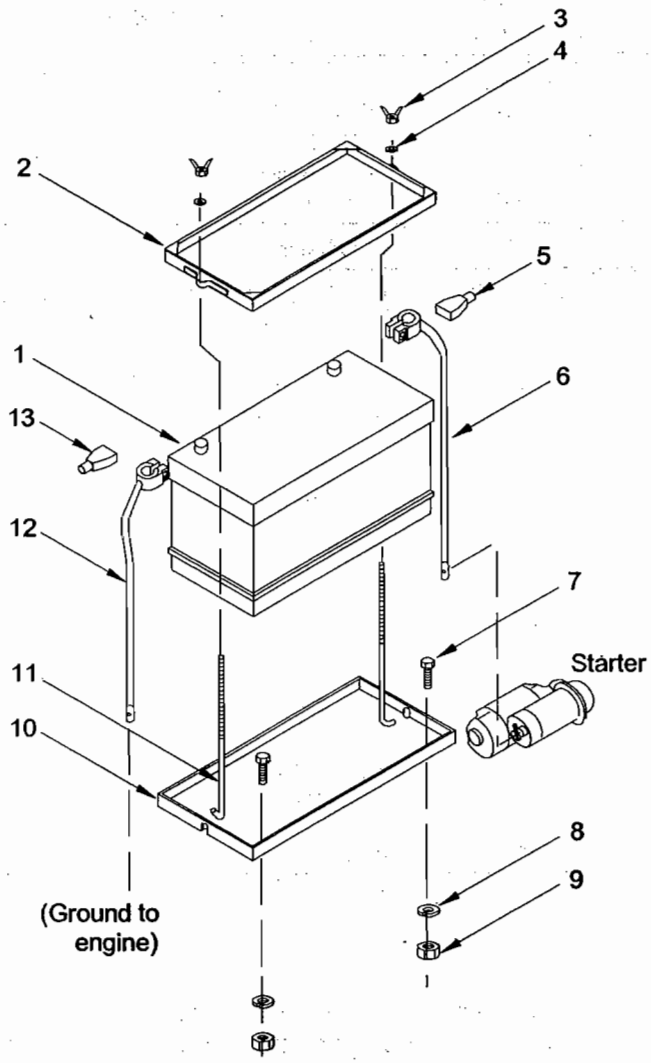
Rear Spring

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW35667	Rear Spring Hanger		2
		F18701	HHCS, 1/2-13 x 2.00 (if used)		1
		F100358	HHCS, 1/2-13 x 1.75		8
		F15973	Lock Washer, 1/2		8
		F16825	Hex Nut, 1/2-13		8
2		1000798	Axle Bumper		2
3		NW25840	U-Bolt, 5/8-18 x 2.75 x 9.00 (used on tractors with single wheels)		4
		NW29997	U-Bolt, 5/8-18 x 2.12 x 8.00 (used on tractors with dual wheels)		4
		Comm	Hex Nut, 5/8-18		8
		Comm	Lock Washer, 5/8		8
4		NW30070	Rear Spring		2
		F100407	HHCS, 5/8-11 x 5.50		2
		F16829	Lock Washer, 5/8		2
		F100002	Hex Nut, 5/8-11		2
5		NW36813	Rear Spring Plate, LH (used on tractors with single wheels)		1
			or		
		NW35659	Rear Spring Plate, LH (used on tractors with dual wheels)		1
		NW23116	Rear Spring Plate, RH		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

920-1584 KIT

BATTERY



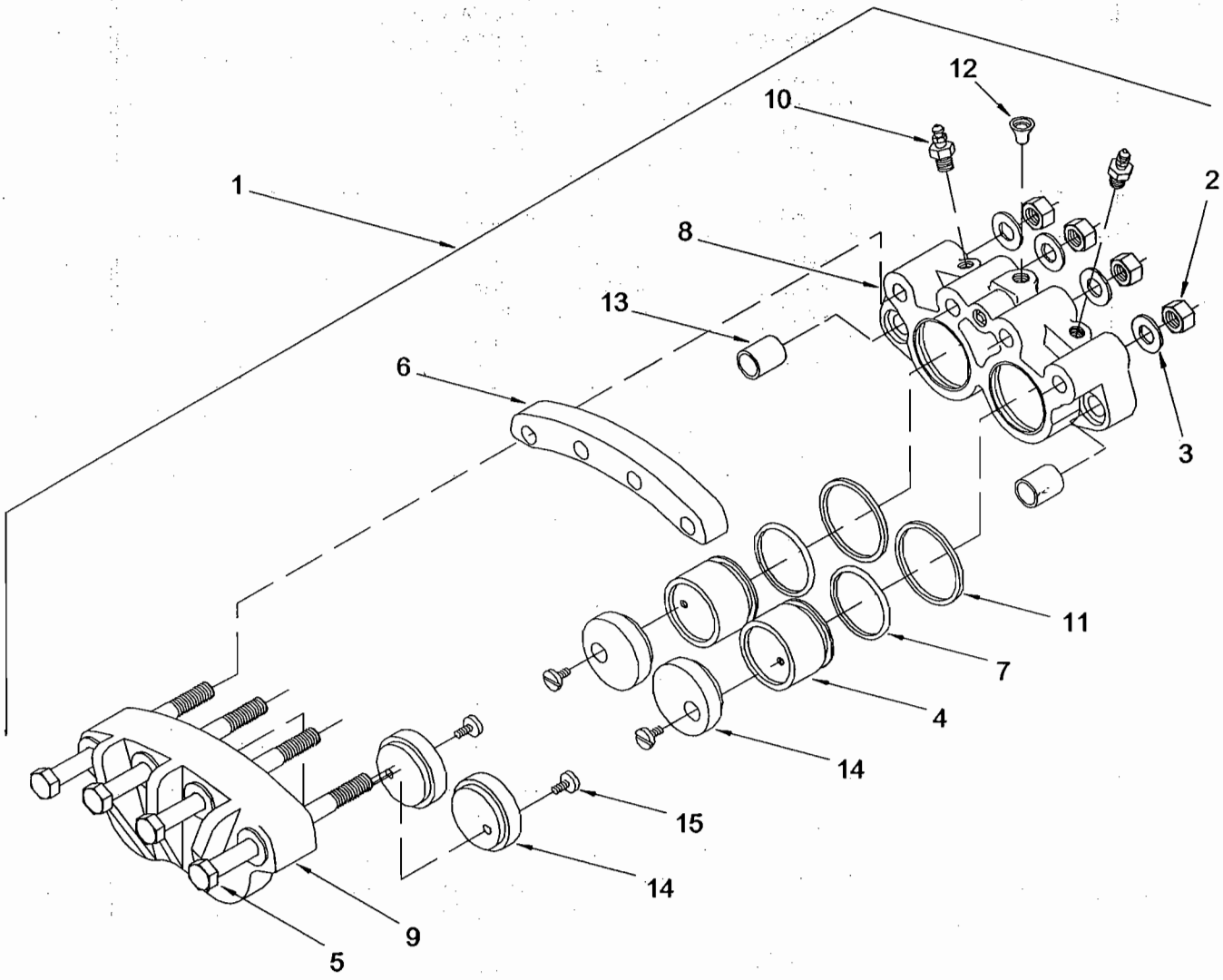
BATTERY

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW25811 F104445 SWIH3033	Battery, 12V, 530 CCA Battery, 12V, 625 CCA, Optional Battery, 12V, 825 CCA, Optional		s1
2		F103934	Battery Hold-down		1
3		Comm	Wing Nut, 5/16-18		2
4		Comm	Flat Washer, 5/16		2
5		F100930	Battery Cable Boot, Red		1
6		NW36147 NW35691 NW32334 NW30043 NW32137	Bat. Cable, Red, 24.00" Bat. Cable, Red, 30.00" Bat. Cable, Red, 58.00" Bat. Cable, Red, 40.00" Bat. Cable, Red, 48.00"		1
7		Comm	HHCS, 3/8-16 x 1.00		2
8		Comm	Lock Washer, 3/8		2
9		Comm	Hex Nut, 3/8-16		2
10		NW29866	Battery Base		1
11		NW22821	J-Bolt, 5/16-18		2
12		NW34294 NW10515BA NW17269	Bat. Cable, Black, 40.00" Bat. Cable, Black, 30.00" Bat. Cable, Black, 18.00"		1
13		F100931	Battery Boot, Black		1
NS		NW23098	Battery Box		1
NS		F102162	Cable, Starter, 4 Ga. x 36" (Ford engine)		1
NS		NW34601 NW34602	The following are used on models with battery mounted under fender: Angle, Bat. Mnt., Rear Angle, Bat. Mnt., Front		1 1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

BRAKES

Caliper (Front)



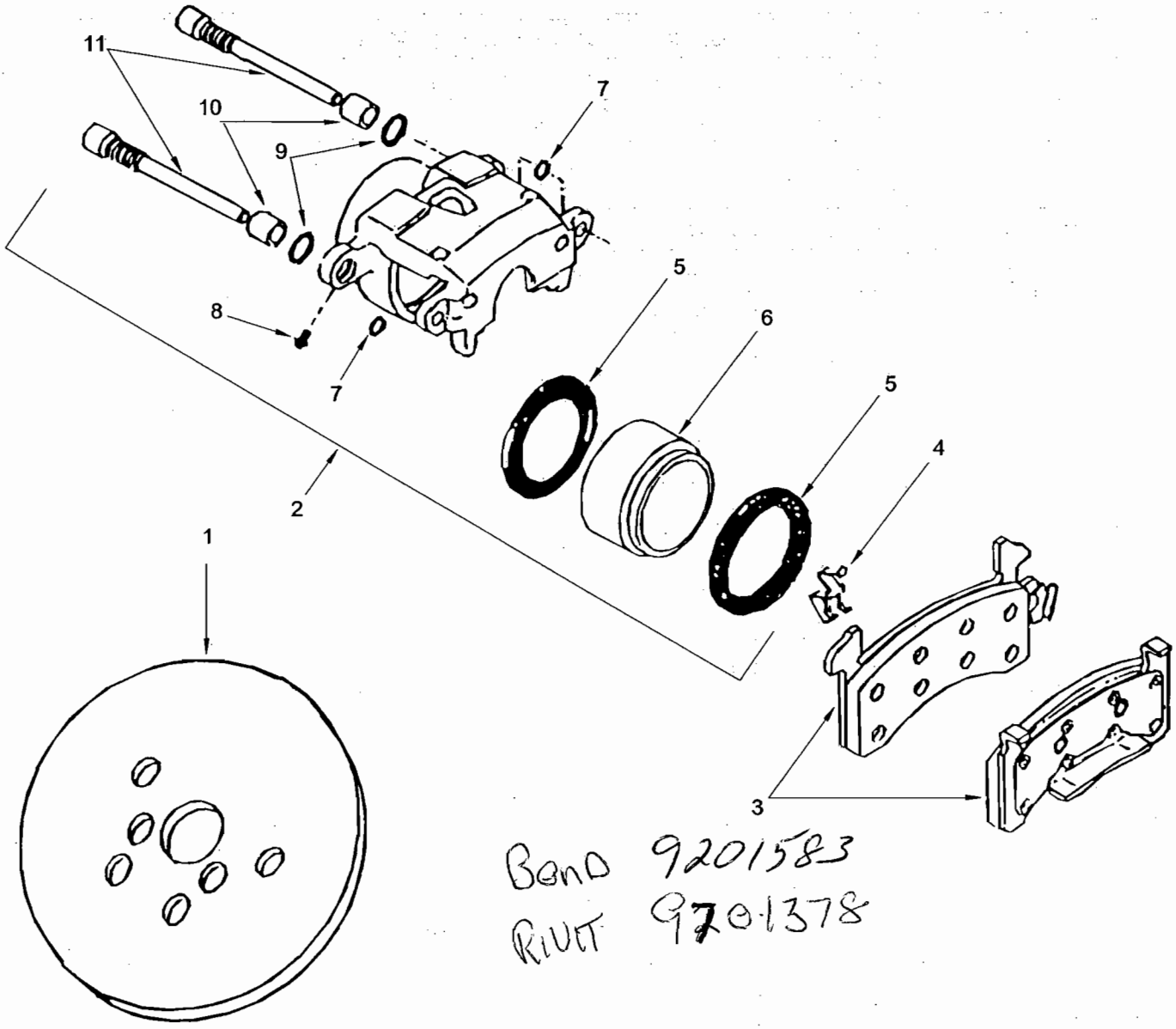
BRAKES
Caliper (Front)

Item	Owner Use	NMC Part No.	Vendor Part No.	Description	Eff	Qty
1		41221	0733-0208	Caliper Assembly (Tol-O-Matic, Inc.)		Ref
2		NW35988	0720-1008	Nut, Spirolock Flange		4
3		NW35989	0720-1011	Flat Washer		4
4		41222	0720-9007	Brake Piston Assembly (incl. items 11, 14, and 15)		2
5		NW35987	0724-1105	HHCS, 3/8-24 x 3.75, Gr. 8		4
6		41223	0733-1023	Spacer		1
7		41590	0760-1009	O-Ring		2
8		37385	0733-1279	Housing, Live Side		1
9		39912	0733-9000	Housing Subassembly, Dead Side (incl. items 14 and 15)		1
10		NW34768	0740-1002	Bleeder Screw		2
11		41589	0733-1227	Seal, Square		2
12		41224	0733-1280	Plug, Vinyl, 1/8 NPT		1
13		41115	0733-1280	Bushing, Bronze		2
14		NW34769	0720-1024	Brake Puck Kit (4)		1
15		NW35243	0720-1026	Puck Mounting Screw		4

Brake Pads 41830

BRAKES

Caliper (Rear)



Bond 9201583
Rivet 9201378

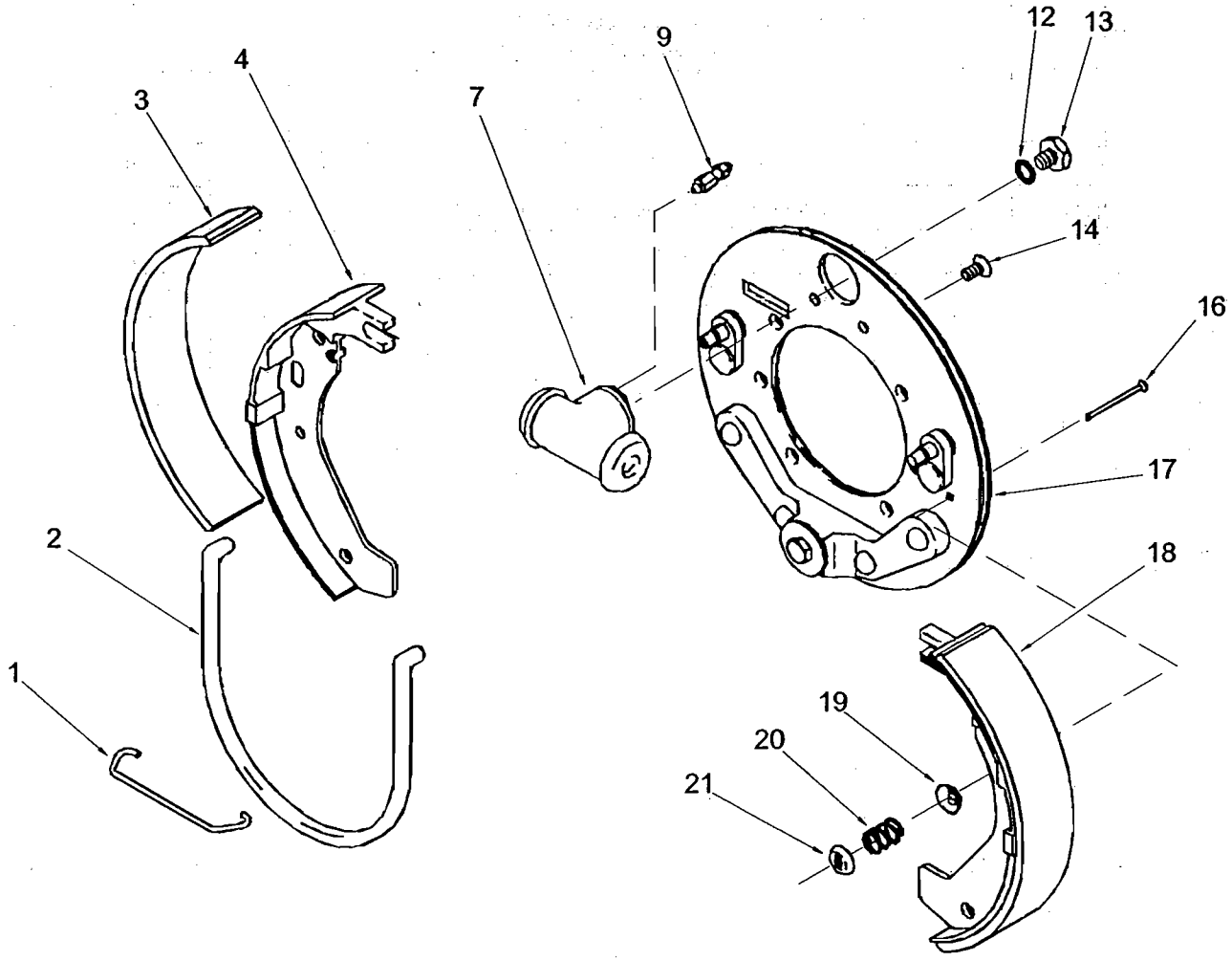
BRAKES
Caliper (Rear)

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW33717	Brake Disk		1
2		NW33718 NW34585	Caliper Assembly, LH Caliper Assembly, RH		1 1
3		NW36648	Kit, Shoe & Lining, 1 RH and 1 LH (will service both calipers)		1
4		NW36649	Retainer, Spring		1
5		NW36650	Kit, Seal, (Inc. Boot & O-Ring)		1
6		NW36651	Piston		1
7		NW36652	O-Ring		2
8		NW36653	Bleeder Screw		1
9		NW36654	O-Ring		2
10		NW36655	Bushing, Steel		2
11		NW36656	Bolt, Caliper Anchor		2

Note: The quantities are for one wheel assembly, except for item #3.

BRAKES
Drum (Rear)

Used with Dual Wheel Option

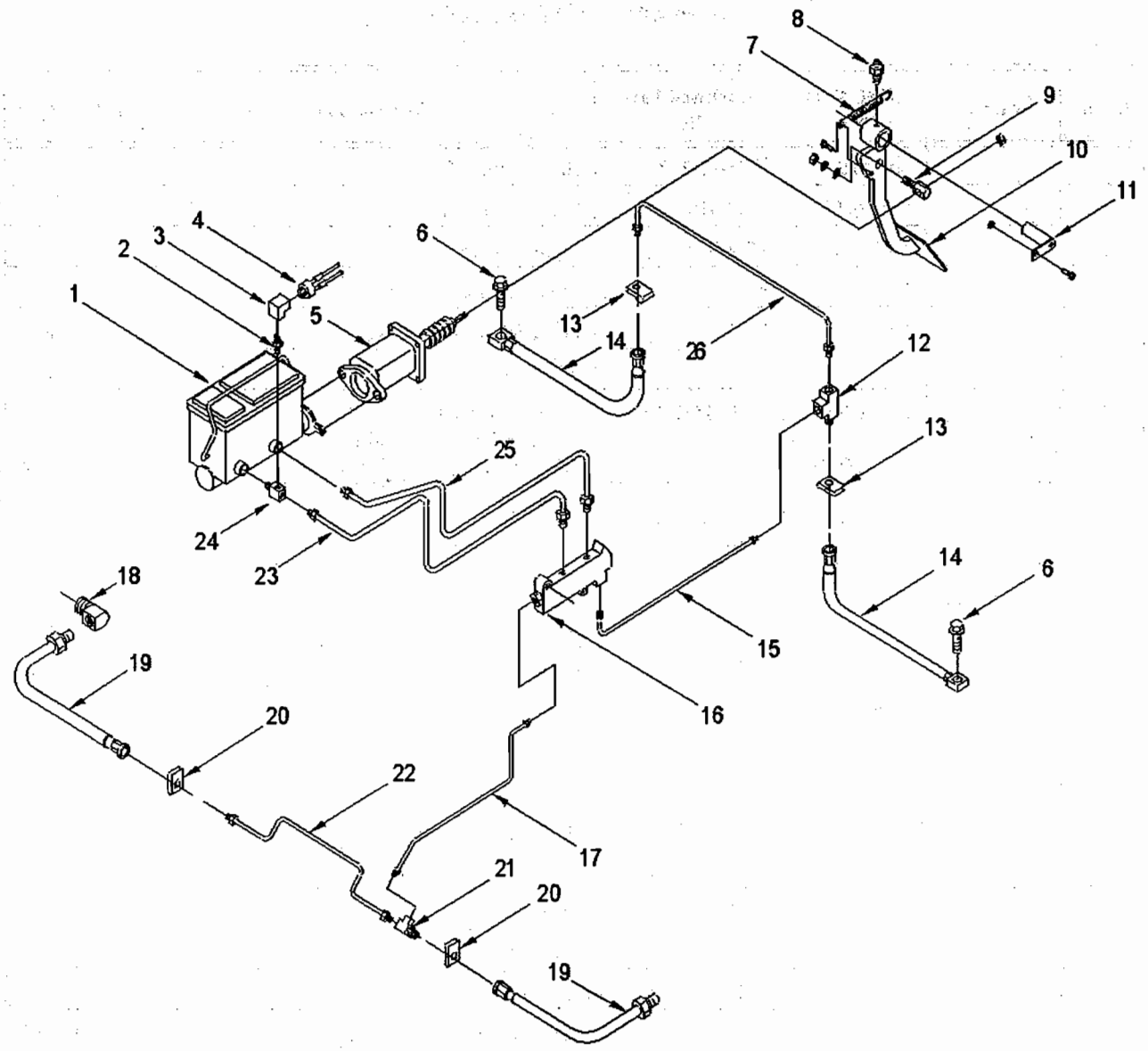


BRAKES
Drum (Rear)

Used with Dual Wheel Option

Item	Owner Use	NMC Part No.	Rockwell Part No.	Description	Eff	Qty
		NW36292	FSH-12-270	Brake Assembly		2
1		NW36293	1718D108	Spring, Retainer		1
2		NW36294	1718Q121	Spring, Return		1
3		NSS	NSS	Lining, Brake (see item 18)		Ref
4		NSS	NSS	Shoe, Brake (see item 18)		Ref
5-6				NOT USED		
7		NW36296 NW36697	A15-3261N40	Cylinder Assembly, Wheel (includes item 9, 12, and 13) Kit, Wheel Cylinder Repair		1 Ref
8				NOT USED		
9		NW36299	1199H1334Z	Screw, Bleeder		Ref
10-11				NOT USED		
12			2208V204	Gasket		Ref
13			1779D56	Coupling, Inlet		Ref
14		37390	10X626	Capscrew		2
15				NOT USED		
16			1779W49	Rod, Anti-Rattle		2
17		NW36297	A6-3736K479	Backing Plate Assembly		2
18		NW36295	A5-3722N300	Shoe, Brake and Lining Assembly		2
19			1807A1	Retainer		4
20			2858M91	Spring		2
21			1807A1	Retainer		4
		NW36298		Shoe Hold-Down Assembly (includes items 16, 19, 20 and 21)		Ref

BRAKES–Hydraulic Tubes, Hoses, and Connections



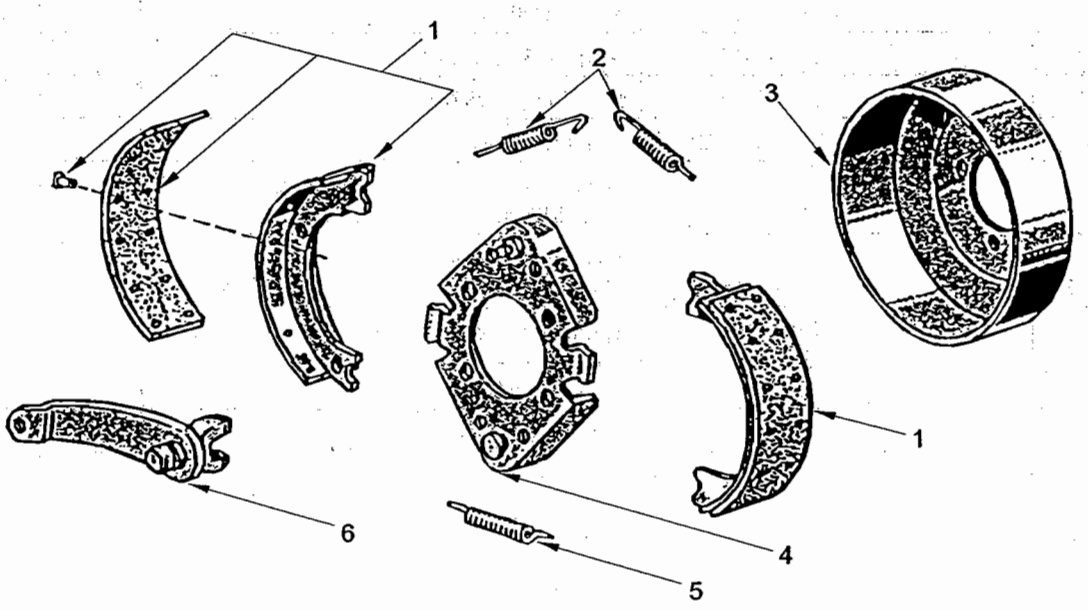
NOTE: Always check OPTIONS before ordering parts.
Most options will replace or modify one of the standard assemblies.

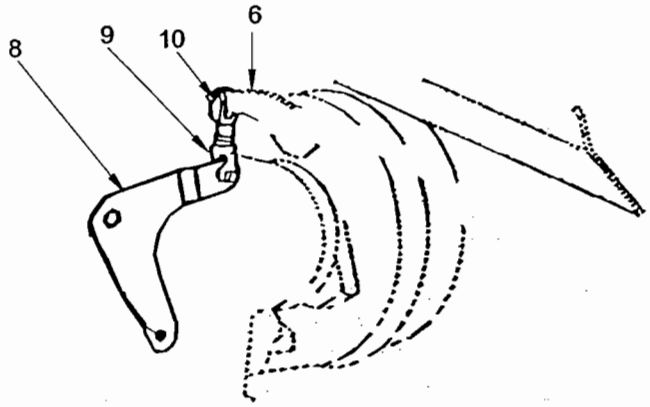
BRAKES
Hydraulic Tubes, Hoses, and Connections

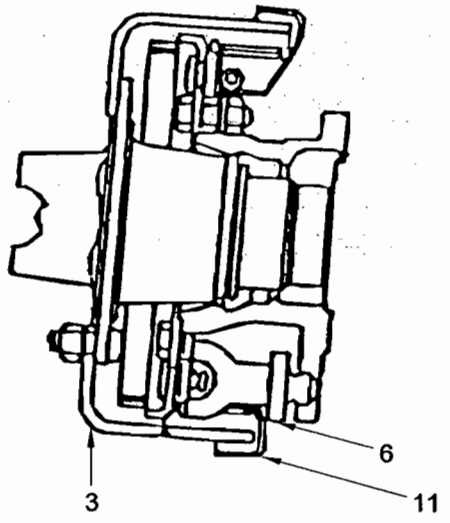
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW30198	Master Cylinder		Ref
2		NW36465	Adapter, 3/16 x 1/8 NPT		1
3		NW36466	Ell, 90 Deg., 1/8 NPT		1
4		NW10370EB	Stop Light Switch		1
5		NW30201 F103925	Power Booster Nut, M10 x 1.5P, Gr. 8.8 metric		Ref 1
6 NS		NW33560 NW33559	Banjo Bolt, Metric Copper Washer		2 4
7		F104435 Comm Comm	Spring, Extension HHCS, 3/8-16 x 1.25 Hex Nut, 3/8-16		1 1 1
8		F10722	Grease Zerk, 1/4-28, 90-Deg.		1
9		NW29715	Connector		1
10		37498	Pedal Assembly		1
11		NW29876 Comm Comm Comm Comm	Shaft Assembly HHCS, 5/16-18 x 1.25 Flat Washer, 5/16 Lock Washer, 5/16 Hex Nut, 5/16-18		1 1 1 1 1
12		F100728	Tee		1
13		NW22778	Clip, Brake Line		4
14		NW33518	Brake Line, Rear		2
15		NW36817	Brake Line, Valve/Rear Tee		1
16		F101573 Comm Comm Comm Comm	Equalizer Valve HHCS, 5/16-18 x 2.25 Lock Washer, 5/16 Flat Washer, 5/16 Hex Nut, 5/16-18		1 2 2 2 2
17		NW29882	Brake Line, Valve/Front Tee		1
19		NW24019	Brake Hose, Front		2
20		NW22778	Clip, Brake Line		2
21		F100728	Tee, Run, 3/16		1
22		NW22729	Brake Line, Front Crossover		1
23		NW29870	Brake Line, Cylinder/Valve, Front Port		1
24		NW36464	Tee, Adapter		1
25		NW29869	Brake Line, Cylinder/Valve, Rear Port		1
26		NW36812	Brake Line, Rear Crossover		1

BRAKES
Parking Brake

(Used on units with Ford C-6 transmission)







BRAKES

Parking Brake

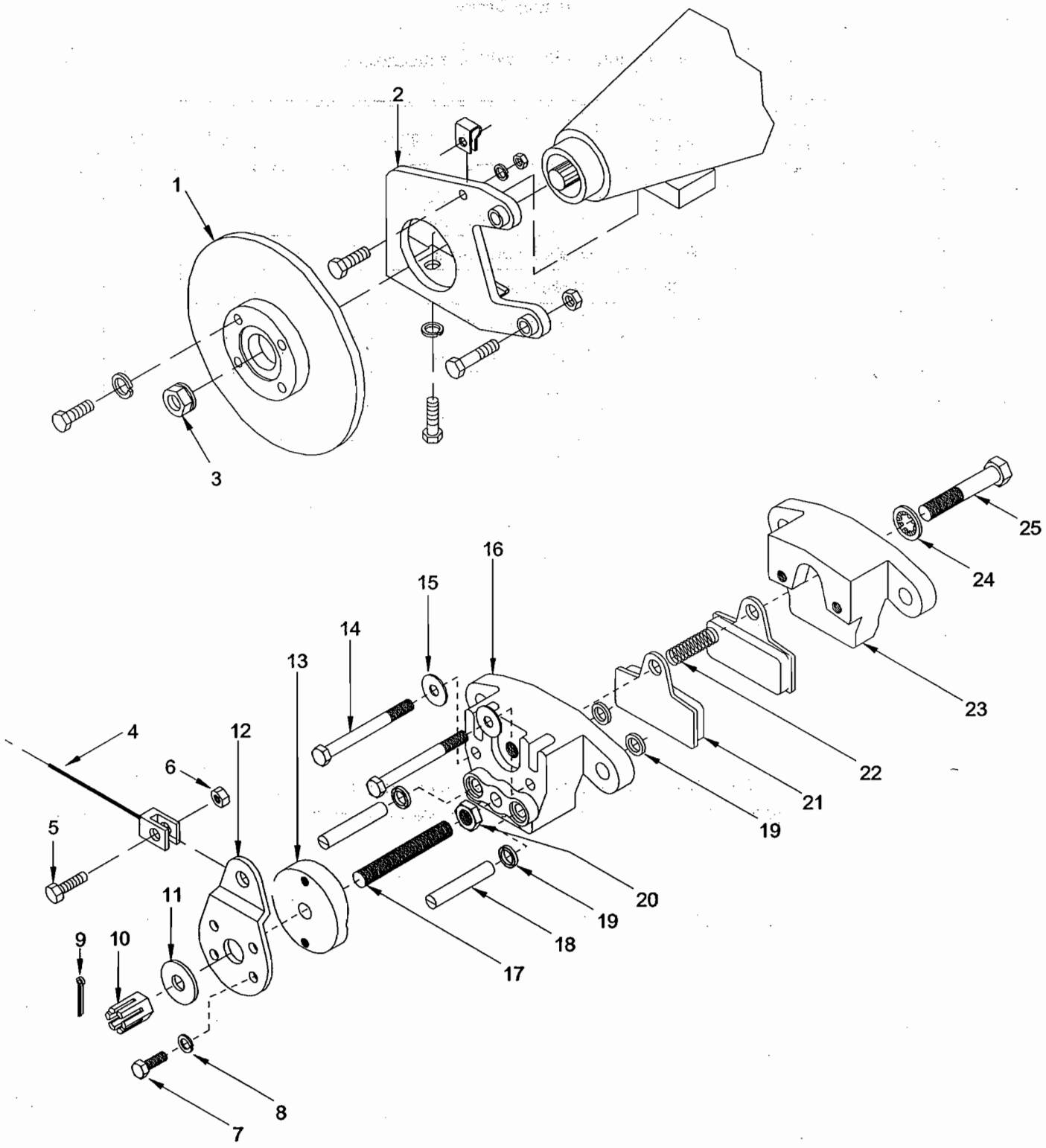
Used on units with Ford C-6 transmission

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		NW34879	Park Brake Assembly, C6		1
1		NW34880	Band & Lining Assembly		2
2		NW34881	Brake Release Spring		2
3		NW34882	Brake Drum		1
4		NW34883	Brake Support Plate		1
5		NW34884	Brake Adjusting Spring		1
6		NW34885	Brake Cam		1
7		NW34886	Cable Support Bracket		1
8		NW34887	Bell Crank		1
9		NW34888	Clevis		1
10		NW34889	Clevis		1
11		NW34890	Brake Drum Shield		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

BRAKES–Parking Brake

Used on units with Chrysler A727 transmission



BRAKES

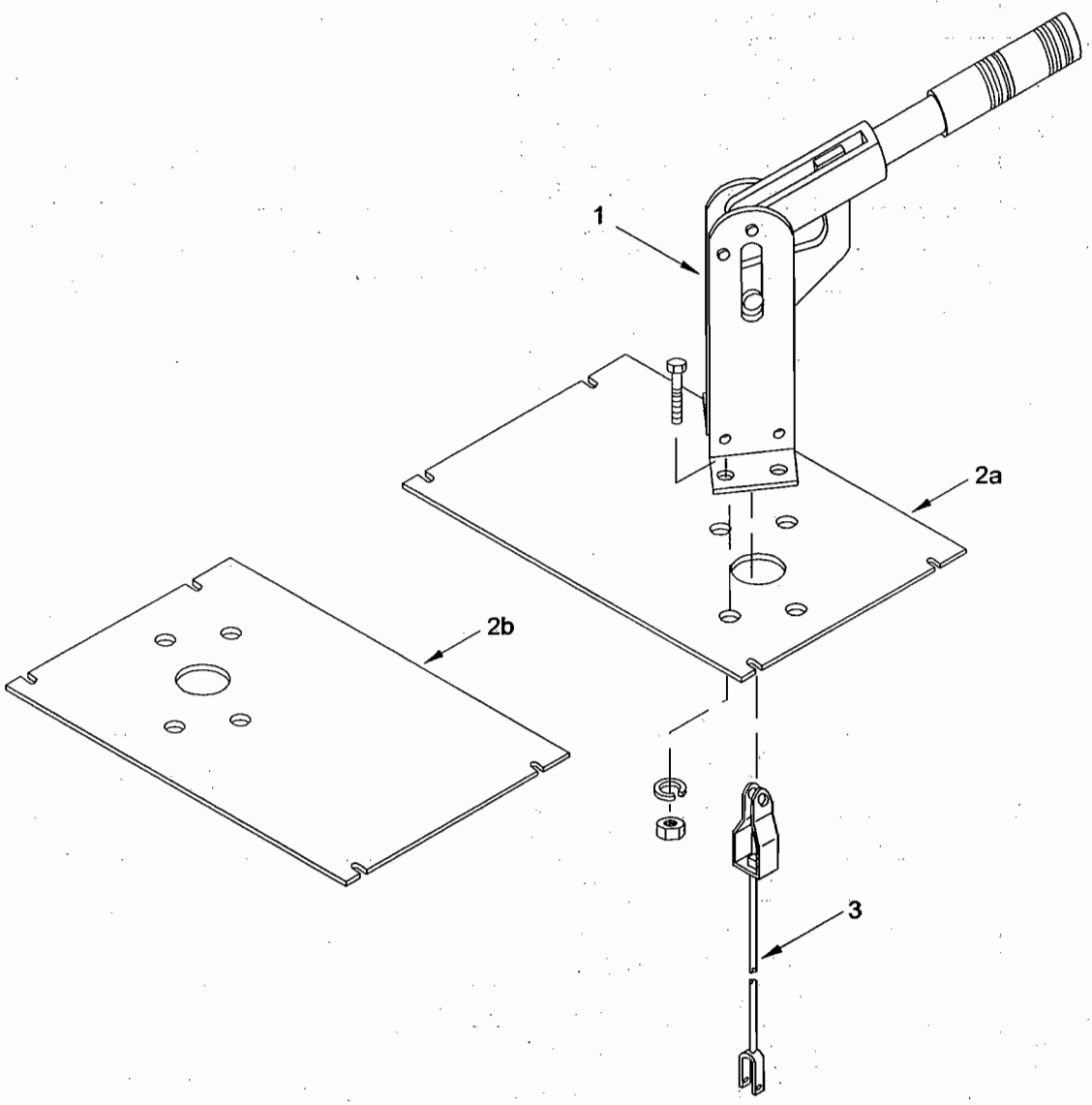
Parking Brake

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW32016 COMM COMM	Brake Disk HHCS, 5/8-11 x 4.00 Lock Nut, 5/8-11, Elastic		1 2 2
2		34875 F101146 COMM COMM	Bracket, Parking Brake Clip, Insulated, 1.25" Lock Washer, 7/16 HHCS, 7/16-14 x 1.25		1 1 2 2
3		NW31963	Nut, Trans. Output Shaft		1
4		NW31807	Park Brake Cable		Ref
5		COMM	HHCS, 5/16-18 x 1.25		1
6		COMM	Lock Nut, 5/16-18, Elastic		1
		NW35764	Caliper Assembly, Park Brake (includes items 11-29)		1
7		NW36272	HHCS, M8 x 1.25 x 20mm		4
8		NW36273	Lock Washer, 3/8		4
9		NW36270	Cotter Pin		1
10		NW36271	Castle Nut, M14 x 2.00		1
11		COMM	Flat Washer, 5/8		1
12		37539	Actuating Lever		1
13		NW35990	Cam		1
14		NW36276	HHCS		2
15		COMM	Flat Washer, 7/16		2
16		NW36278	Housing, Live Side		1
17		NW36279	Stud		1
18		NW36280	Actuating Pin		2
19		NW36281	Wiper Seal		4
20		NW36282	Jam Nut		1
21		NW35765	Brake Pads (2 per set)		1
22		NW36283	Compression Spring		1
23		NW36284	Housing, Dead Side		1
24		NW36285	Washer		1
25		NW36286	HHCS, M14 x 2 x 90mm		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

BRAKES

Parking Brake Lever



BRAKES

Parking Brake Lever

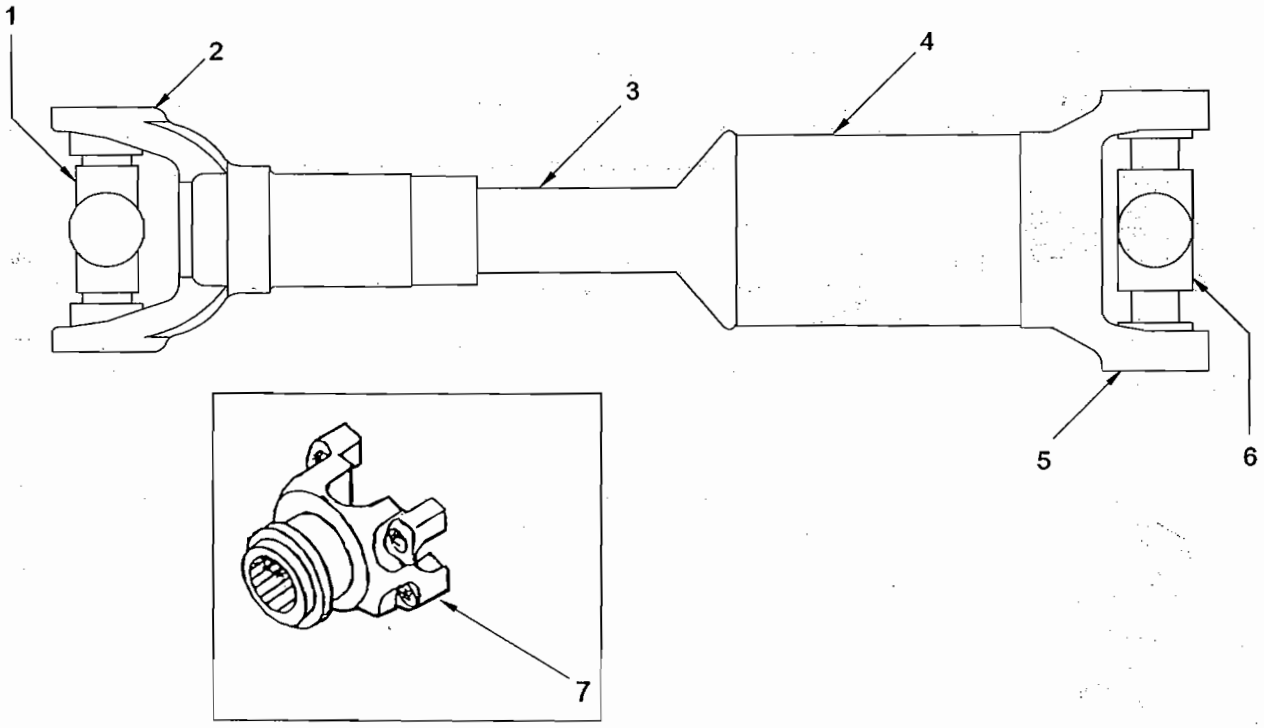
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW22767	Park Brake Lever		1
		Comm	HHCS 5/16-18 x 0.75		4
		Comm	Lock Washer, 5/16		4
		Comm	Hex Nut, 5/16-18		4
2a		NW32055	Park Brake Plate (Ford) or		1
		NW36595	Park Brake Plate (Perkins)		1
		Comm	HHCS, 5/16-18 x 1.25		4
		Comm	Lock Washer, 5/16		4
		Comm	Flat Washer, 5/16		4
		F100030	Tinnerman Nut, 5/16, J-Type		4
2b			NOT USED		
3		NW32273	Park Brake Cable Assembly		1
		Comm	HHCS, 5/16-18 x 1.25		1
		Comm	HHCS, 7/16-14 x 1.25		2
		Comm	Lock Washer, 7/16		2
		F14476	Nut, 5/16 Elastic Stop		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

DECALS and PLATES

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		NW24357	Plate, Serial #		1
		38714	Decal, Wollard, White (Optional)		3
		38713	Decal, Wollard, Black		1
		NW32170	Decal (Northwestern)		3
		42536	Decal, NMC Logo 1.75"		2
		37244	Decal (NMC) (Optional)		3
		1018145	Decal, Fan Warning		1
		40329	Decal, Lug Nut Torque		4
		40518	Tag, Wheel Torque		1
		NW35561	Plate, Warning (Engage Park Brake)		1
		NW30247	Plate, Ignition		1
		38963	Plate, Switch Data (on overhead guard) (Optional)		1
		38867	Plate, Switch Data (on dash)		1
		NW17237	Plate, Warning (Parking brake not to be used as service brake. . .)		1
		153768	Decal, Diesel Fuel Only (with diesel engine)		1
		41472	Decal, Diesel Exhaust Warning		1
		37302	Decal, Power Great Lakes (with Perkins engine)		1
		NW36180	Decal, Caution, Munitions (Optional)		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

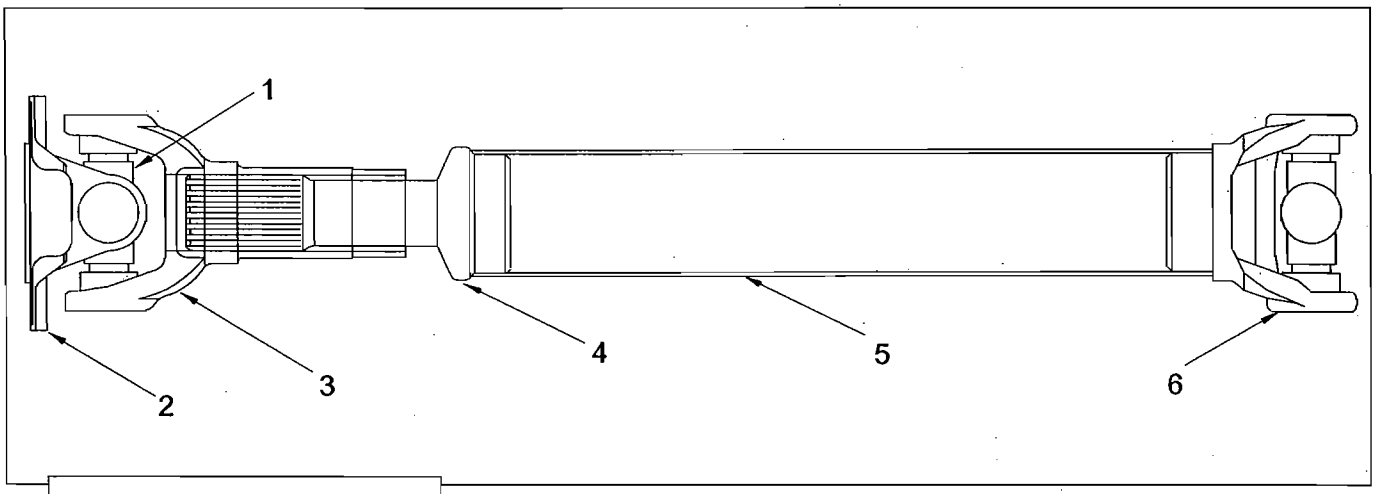


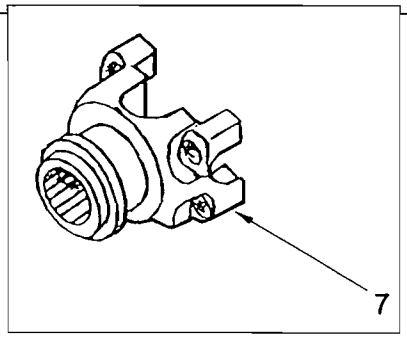
DRIVESHAFT

Rockwell TA267 Axle / C-6 Transmission

Item	Owner Use	NMC Part No.	Dana Part No.	Description	Eff	Qty
		NW36083		Driveshaft Assembly (incl. items 1-6)		1
1		NW32783	5-178	U-Joint		1
2		NW32794	3-3-598KX	Tube Yoke		1
3		38298	3-40-1611	Slip Tube Shaft		1
4		RF 90585		Tubing		1
5		NW35885	3-28-97	Tube Yoke		1
6		NW33731	5-160X	U-Joint		1
7		NW23707		End Yoke		1
NS		SWGF103		Grease Zerk, 1/8-28, Straight		Ref
NS		NW23706		U-Bolt Kit		2

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.





DRIVESHAFT

Perkins 4.236 Engine/A727 Transmission

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		37151	Driveshaft (incl. items 1-6)		1
1		NW32783 SWGF103	U-Joint Kit Grease Zerk, 1/8-28, Straight		2 Ref
2		NW32782	Flange		1
3		NW32794	Slip Yoke		1
4		37191	Tube Shaft		1
5		NW33888	Tubing		1
6		NW34521	Tube Yoke		1
7		NW23707	End Yoke		1
NS		NW23706	U-Bolt Kit		2

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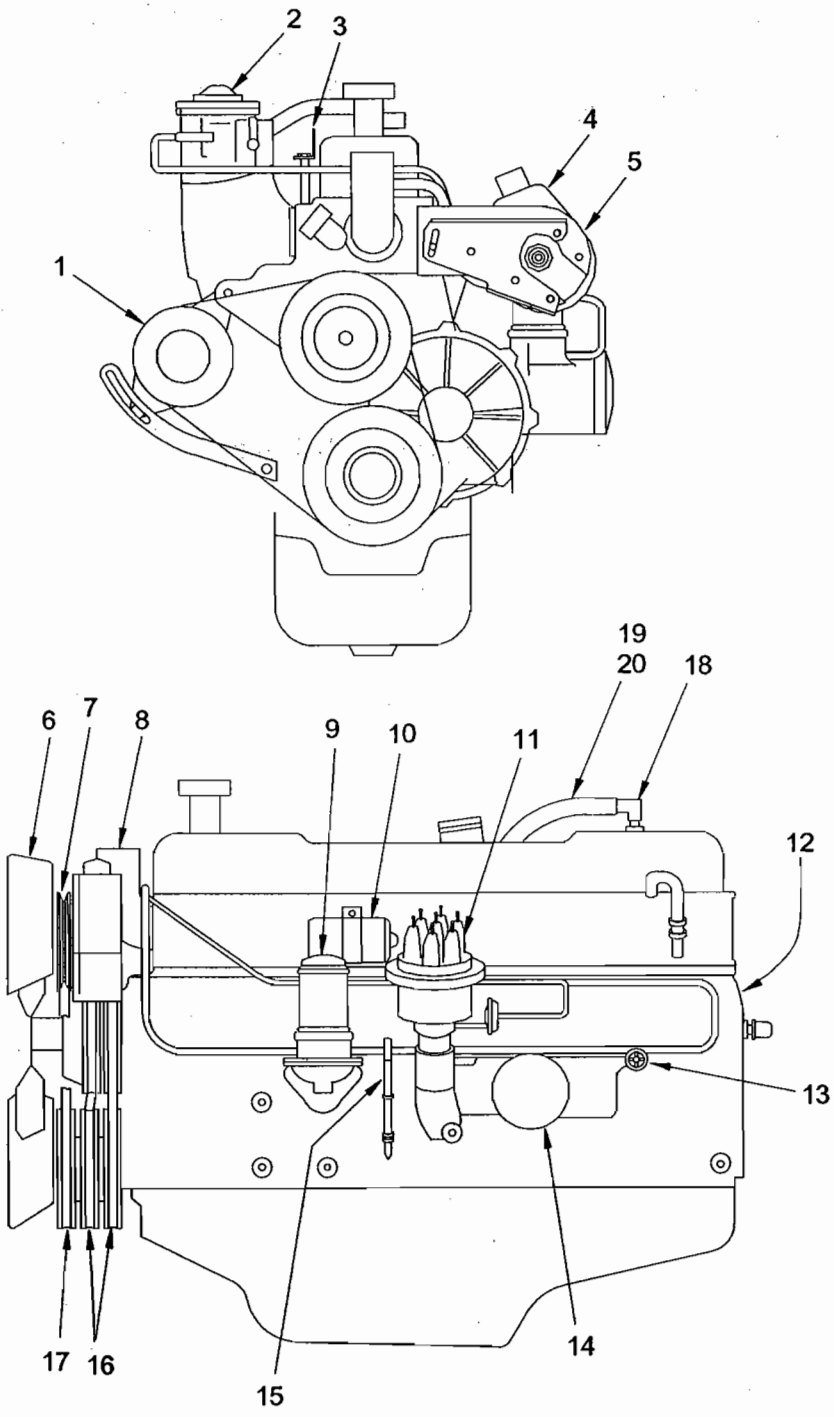
ENGINE
Ford 300 c.i.d.

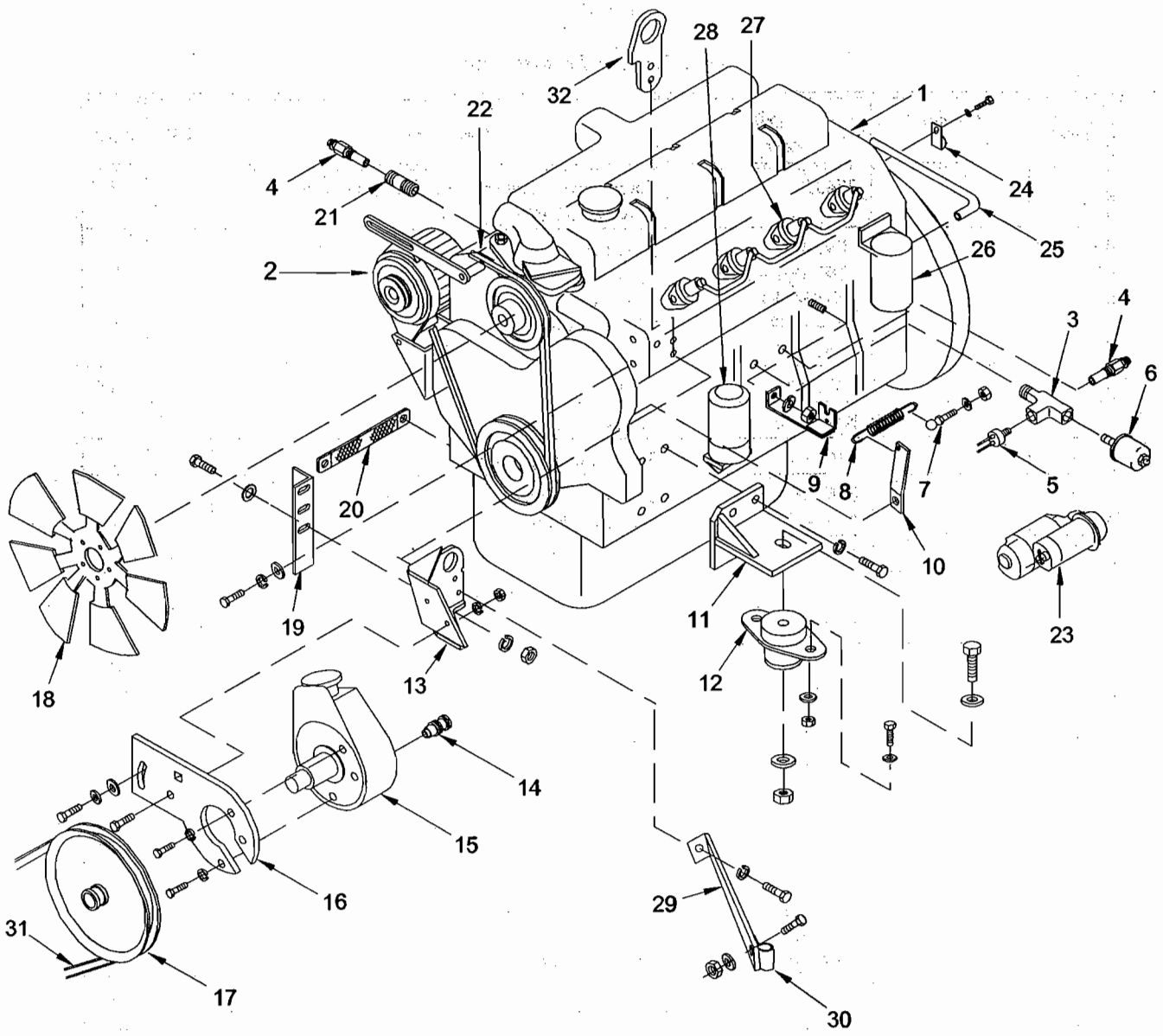


NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

ENGINE

Ford 300/C-6 Transmission

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		37435	Engine w/C6 Transmission (Includes all items listed in this table)		1
1		NW34692 DEL001000190 NW34691 NW29982 NW34472	Alternator Diode Assembly Pulley, Dual Spacer, Alt. Spacer, Alt., 3/4 x 1/8 W x 1 5/8L		1 Ref 1 1 1
2		NW34701	Carburetor		Ref
3		NW34295	Bracket, Accelerator		1
4		F102526	Power Steering Pump		1
5		NW34674 NW34236	Bracket, PS Pump Plate, PS Pump		1 1
6		38736	Fan, 16" Puller		Ref
7		NW23994	Pulley, Steering Pump		1
8		NW34524	Thermostat		Ref
9		NW36072 NW34523	Fuel Pump Element, Fuel Filter		Ref Ref
10		NW34525	Starter		Ref
11		NW34528	Rotor		Ref
12		F101526 F010907	Sender, Water Temp. Reducer, Bushing, 3/8 NPT to 1/8		1 1
13		F101527 37689 F100661 F100671 NW21649	Sender, Oil Pressure Fitting, Pipe, Nipple, 1/8-27 w/Hex Fitting, Pipe, Tee, 1/8 NPT Fitting, Pipe, 1/4 x 1/8 Bushing Switch, Pressure		1 1 1 1 1
14		NW34522	Element, Oil Filter		Ref
15		NW34529	Dipstick		Ref
16		39227	V Belt, Alternator		1
17		F101903	V Belt, Power Steering		1
18		NW34533	Valve, PCV		Ref
19		F101617	Hose, 1/2" ID Vacuum, Low Pressure, 20"		Ref
20		F101156	Clamp, Hose, #12, 11/16 -- 1.25		Ref
NS		F101137 F104343	Clip, Insulated, 0.19 ID Clip, Insulated, 0.75 ID		1 1
NS		2.3554	Block Heater (Optional)		Ref
NS		NW34526	Spark Plug Set		Ref
NS		NW34527	Wire Set, Spark Plug		Ref



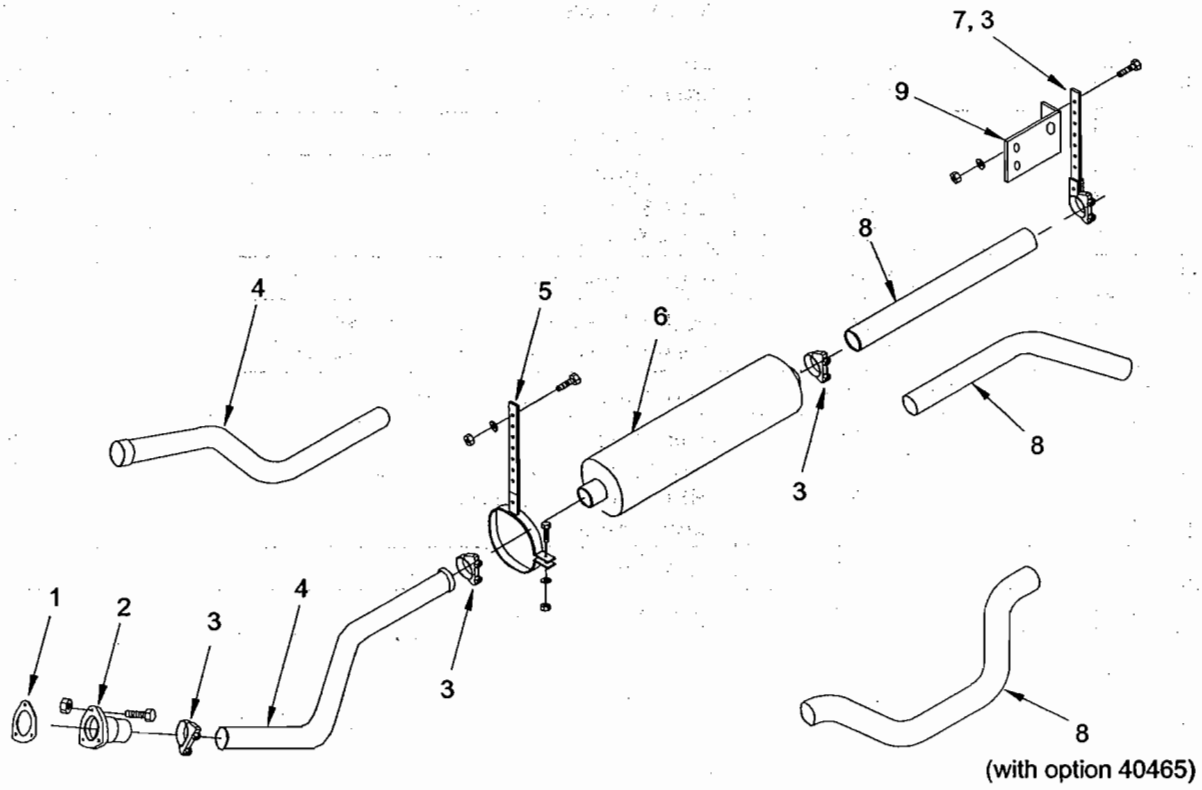
ENGINE–Perkins 4.236

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		38060 34572 39096	Engine, Perkins 4.236/Chrysler A727 trans., or Engine, Perkins 4.236/Ford C-6 trans., or Engine, Perkins 4.236T/Ford C-6 trans.		1
2		NW31859 39511	Alternator Alternator Fan		Ref Ref
3		F100661	Tee, Street, 1/8		1
4		F101526	Sender, Water or Oil Temp.		2
5		F101527	Sender, Oil Pressure		1
6		NW21649	Switch, Pressure		1
7		38690	Stud, Ball, 1/4-20		1
8		NW21911	Spring		1

ENGINE–Perkins 4.236

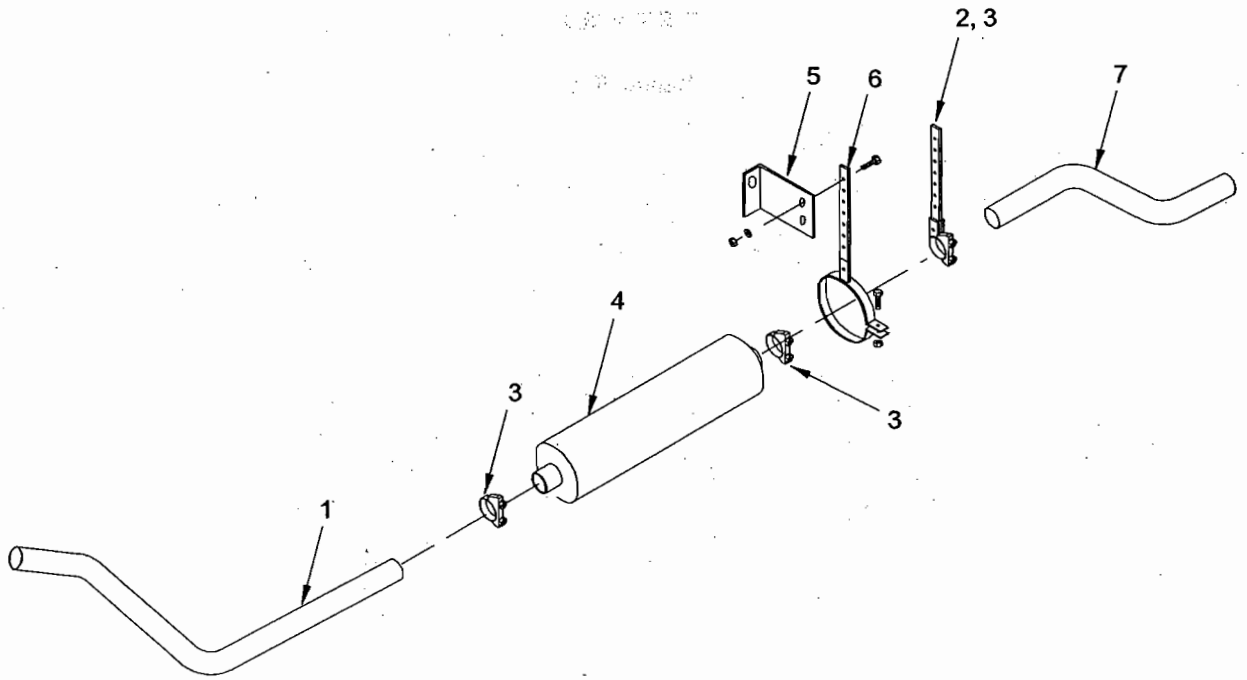
9		NW34413	Bracket, Throttle Cable		1
10		NW35406	Bar, Accelerator		1
11		37575 NW31398 Comm	Mount, Engine HHCS, 7/16-20 x 1.25 Lock Washer, 7/16		2 8 8
12		38634	Mount, Engine, Rubber		2
13		37740 41489	Bracket, PS Pump (thru Ser. #97-C-1854) Bracket, PS Pump (Ser. #97-C-1855 and on)		1 1
14		NW33586	Valve, Control, Power Steering		1
15		F102526 Comm NW31646 Comm	Pump, Power Steering HHCS, M10 x 1.5 x 25mm DN 933 HHCS, 10mm x 30mm GR 8 Lock Washer, 7/16		1 2 1 3
16		38657	Bracket, PS Pump		1
17		NW23994	Pulley, Steering Pump		1
18		37678	Fan, 16" Puller		1
19		38656 41486	Angle, PS Pump (thru Ser. #97-C-1854) Angle, PS Pump (Ser. #97-C-1855 and on)		1 1
20		NW10518FB	Strap, Ground		Ref
21		F100780	Reducer, Bushing, 1/2 NPT to 1/8		1
22		37748	V-belt, Alternator		1
23		37742 NW31858	Starter (for engine 38060) Starter (for all other Perkins engines)		Ref Ref
NS		F103957	Glow Plug		Ref
24		F101137	Clip, Insulated, 3/16		1
25		NW31787	Line, Fuel Return		15"
26		NW31852	Kit, Fuel Filter Element		Ref
27		37892 37893	Fuel Injector w/Nozzle Nozzle		Ref Ref
28		NW31851	Element, Oil Filter		Ref
29		39981	Bracket, Dipstick		1
30		F101115	Clip, Dipstick Bracket		1
31		NW36707	V-belt, Power Steering		1
32		41435	Lifting Eye		Ref
NS		39580 NW31786 NW27618 40709	Fuel/Water Separator Pipe, 90-Deg. Hose, Fuel, 15" Kit, Glass Bowl w/O-rings		Ref 2 2 Ref
NS		37679	Line, Fuel to Fuel Pump		2"
NS		NW31787 F104343 Comm Comm	Line, Fuel Return Clip HHCS, 5/16-18 x 0.75 Lock Washer, 5/16		15" 1 1 1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.



EXHAUST ASSEMBLY (Perkins 4.236 Engine)

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		36822111	Exhaust Gasket		1
2		NW31805	Exhaust Flange		1
		Comm	HHCS, 38-24 x 1.50		3
		Comm	Hex Nut, 3/8-24		3
3		NW18217	Exhaust Pipe Clamp		4
4		37872	Exhaust Pipe		1
5		NW17079	Muffler Hanger		1
		Comm	HHCS, 1/4-20 x 1.50		1
		Comm	Lock Washer, 1/4		1
		Comm	Hex Nut, 1/4-20		1
		Comm	HHCS, 3/8-16 x 1.00		1
		Comm	Lock Washer, 3/8		1
		Comm	Hex Nut, 3/8-16		1
6		NW21196	Muffler, Spark Arrestor		1
7		NW23112	Pipe Strap		1
		Comm	Lock Washer, 3/8		1
		Comm	Hex Nut, 3/8-16		1
8		40711	Tail Pipe (Model 100)		Ref
		NW27784	Tail Pipe (Model 60)		1
		39230	Tail Pipe (with rear spring option #40465)		Ref
9		NW	Angle Bracket		2



EXHAUST ASSEMBLY

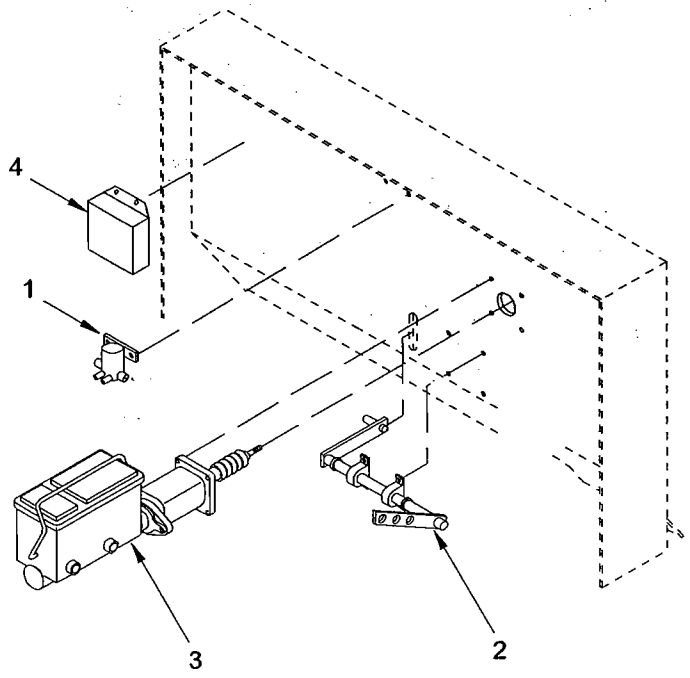
Ford 300 Engine

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34247 38136	Exhaust Pipe Exhaust Pipe, Stainless Steel, Optional		1 1
2		NW26335	Hanger, Tail Pipe		1
3		NW18217	Clamp, 2.00"		3
4		NW21196 38135	Muffler, Spark Arrestor Muffler, Stainless Steel, Optional	s	1 1
5		NW27929 Comm Comm Comm	Angle Bracket HHCS, 5/16-18 x 1.00 Lock Washer, 5/16 Hex Nut, 5/16-18		2 1 1 1
6		NW17079 Comm Comm	Muffler Hanger HHCS, 1/4-20 x 1.25 Hex Nut, 1/4-20		1 1 1
7		NW27784 38137	Tail Pipe Tail Pipe, Stainless Steel, Optional		1 1

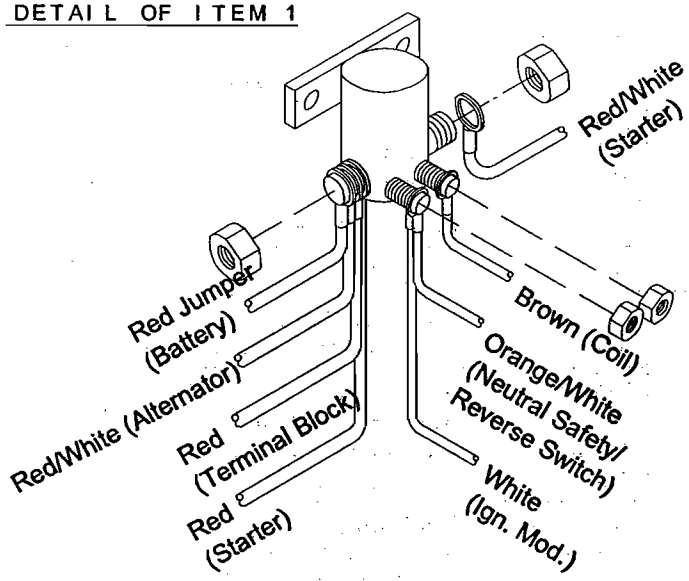
NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

FIREWALL

Engine Side



DETAIL OF ITEM 1



FIREWALL

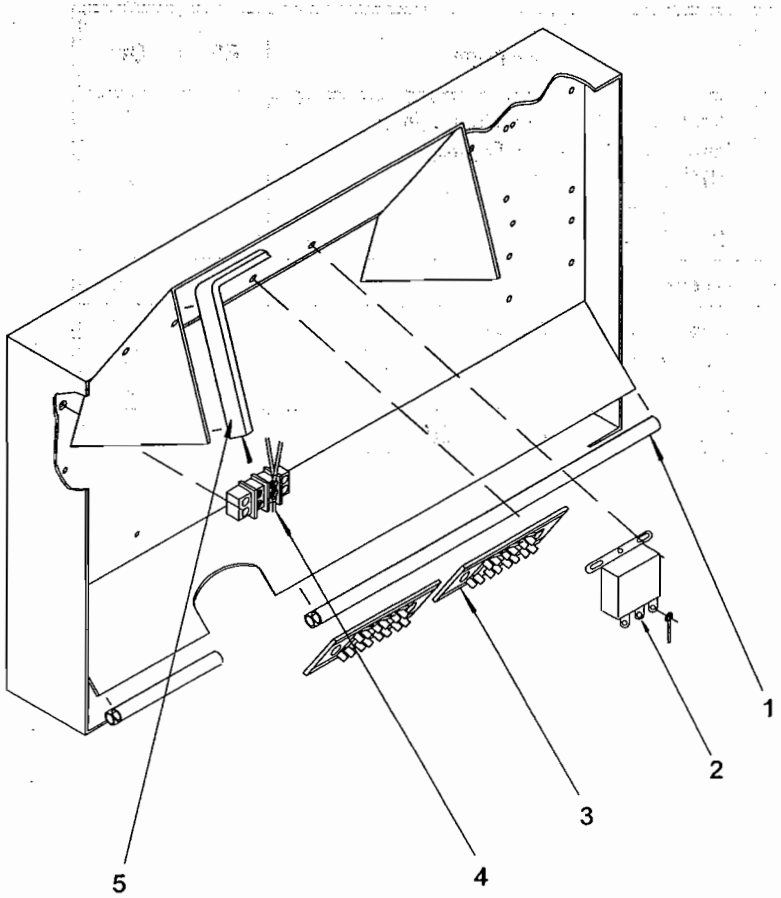
Engine Side

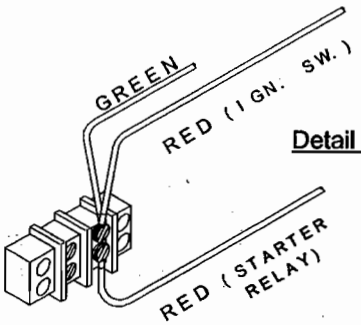
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		F102160	Starter Relay (Perkins 4.236 Engine)		1
		37487	Starter Relay (Ford 300 Engine)		1
		Comm	HHCS, 1/4-20 x 0.75		2
		Comm	Lock Washer, 1/4		2
		Comm	Hex Nut, 1/4-20		2
2		37562	Accelerator Linkage		Ref
3		F104286	Master Cyl./Power Booster		Ref
		NW30198	Master Cylinder		Ref
		NW30201	Power Booster		Ref
4		41342	Module, Ignition (Ford 300 Engine)		Ref

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

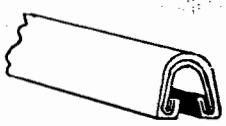
FIREWALL

Driver's Side





Detail of item 4



F101603 Rubber Trim

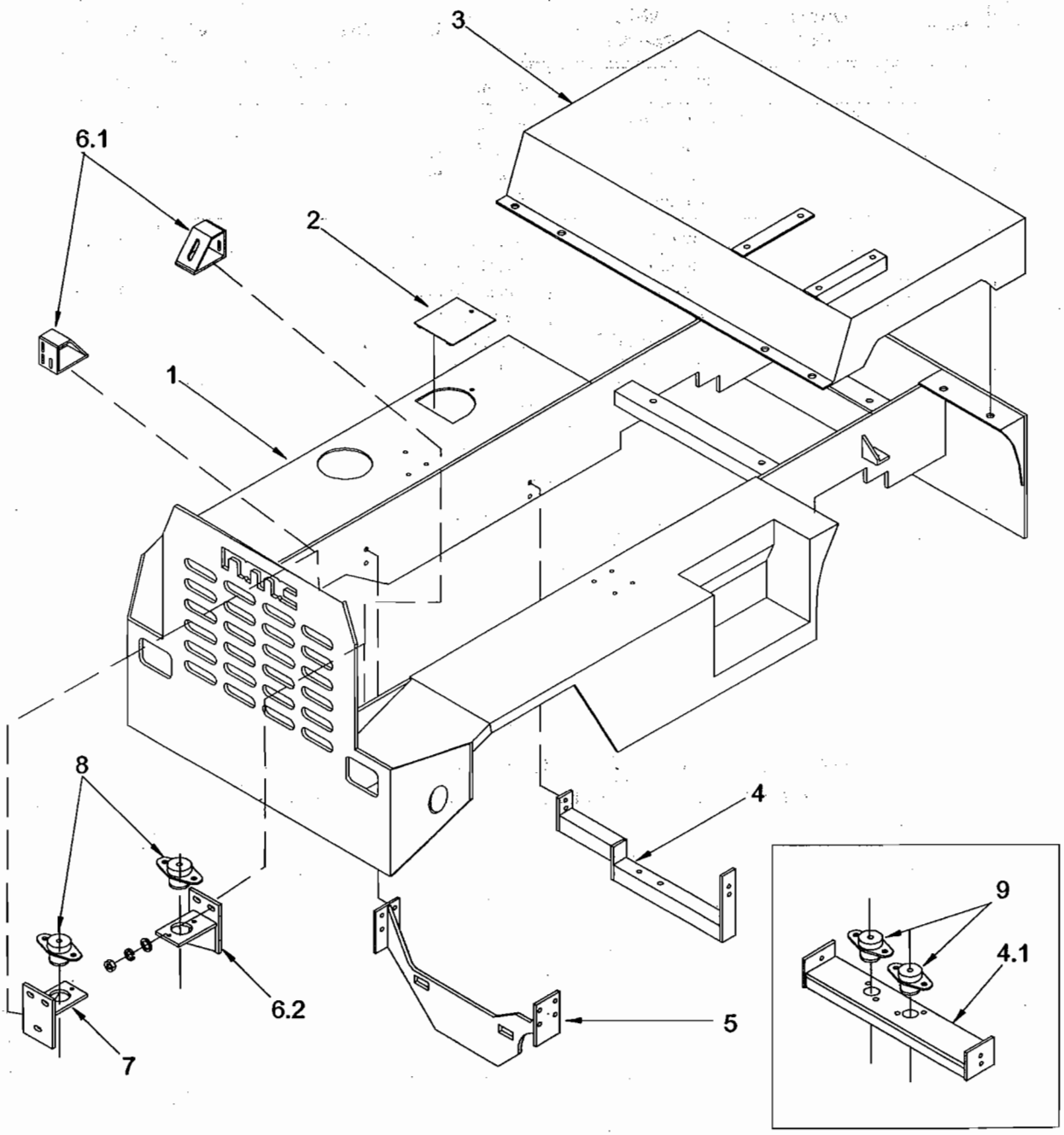
FIREWALL

Driver's Side

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		F102416	Sealant		37"
2		NW23700	Horn Relay		1
		Comm	HHCS, 1/4-20 x 0.75		2
		Comm	Lock Washer, 5/16		2
		Comm	Hex Nut, 1/4-20		2
3		NW23360	Fuse Panel		2
		Comm	RHMS, #8-32 x 0.50		4
		Comm	Lock Washer, #8		4
		Comm	Hex Nut, #8-32		4
		NW10526C20	Fuse, #20		2
		NW10526C10	Fuse, #10		6
4		37681	Terminal Block		1
		Comm	RHMS, #10-32 x 0.75		2
		Comm	Lock Washer, #10 Reg.		2
		Comm	Hex Nut, #10-32		2
5		F101603	Rubber Trim		38"

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

FRAME

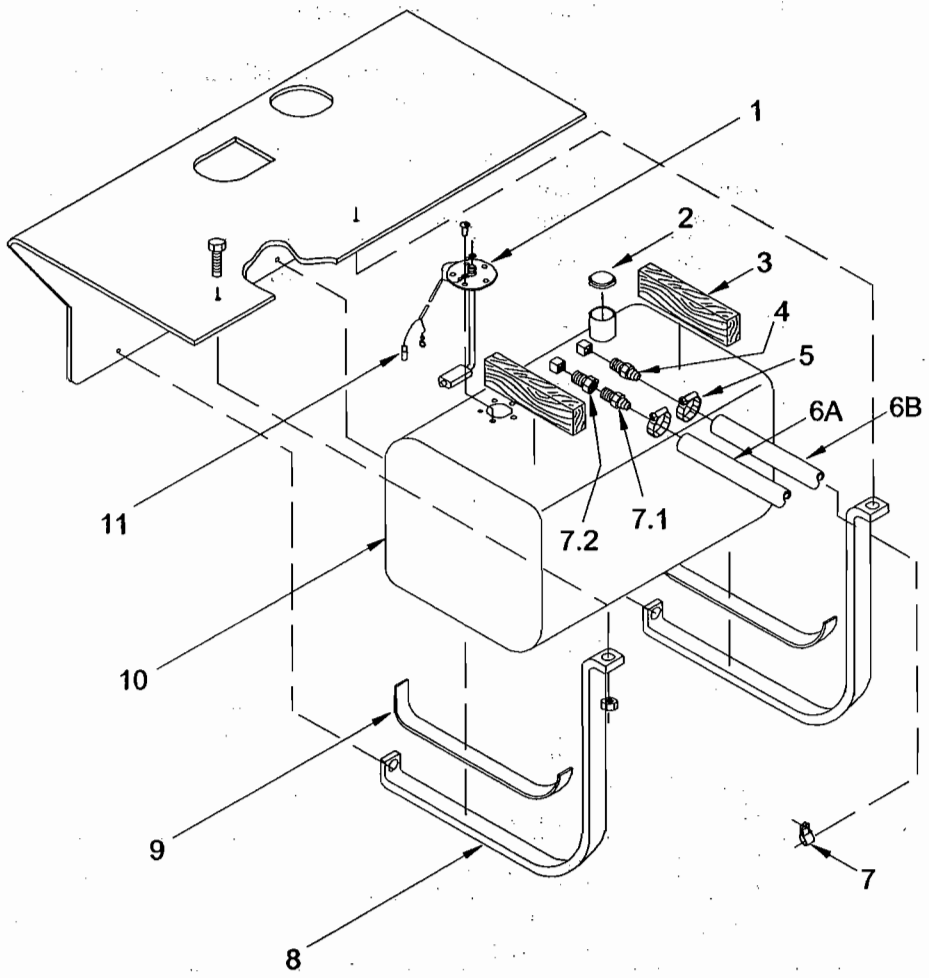


FRAME

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		38700	Frame Assembly		1
		or	or		
		38780	Frame Assembly (with dual rear wheels)		1
2		NW27756	Cover, Sending Unit (Not used on LPG units with		1
		or	battery mounted under fender.)		
			or		
		39092	Cover, Sending Unit (Used on LPG units with battery mounted under fender.)		1
		Comm	HHCS, 5/16-18 x 0.75		1
		Comm	Lock Washer		1
		Comm	Nut, Tinnerman, 5/16-18		1
3		NW31584	Rear Body (standard)		1
		or	or		
		NW36914	Rear Body (with dual wheels)		1
		Comm	HHCS, 3/8-16 x 1.25		8
		Comm	Lock Washer, 3/8		8
		Comm	Flat Washer, 3/8		16
		Comm	Hex Nut, 3/8-16		8
		NW23697	Plate, Counterweight, 1.5 x 24 x 30"		4
		NW23752	Counterweight, 1 x 27 x 52"		3
		38858	Counterweight, 1 x 26 x 52"		1
4		NW34205	Transmission Support (Ford C-6 Trans.)		1
		Comm	HHCS, 1/2-13 x 1.75		4
		Comm	Lock Washer, 1/2		4
		Comm	Hex Nut, 1/2-13		4
4.1		39915	Transmission Support (Chrysler A727 Trans.)		1
		Comm	HHCS, 1/2-13 x 1.75		4
		Comm	Lock Washer, 1/2		4
		Comm	Hex Nut, 1/2-13		4
5		NW32136	Spring Hanger		1
		Comm	HHCS, 1/2-13 x 1.75		4
		Comm	Lock Washer, 1/2		4
		Comm	Hex Nut, 1/2-13		4
6.1		NW34191	Motor Mount, Engine/Frame (Ford)		2
6.2		38001	Motor Mount, Engine/Frame, LH (Perkins)		1
7		37980	Motor Mount, Engine/Frame, RH (Perkins)		1
8		38634	Engine Mount, Rubber (Perkins)		2
9		39059	Insulator Mount (Chrysler A727 Trans.)		2
NS		39050	Engine Mount, Rubber, LH		1
		39049	Engine Mount, Rubber, RH		1
NS		37795	Radiator Mount (Perkins)		1
		38987	Spacer, Radiator Mount		2

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

FUEL TANK

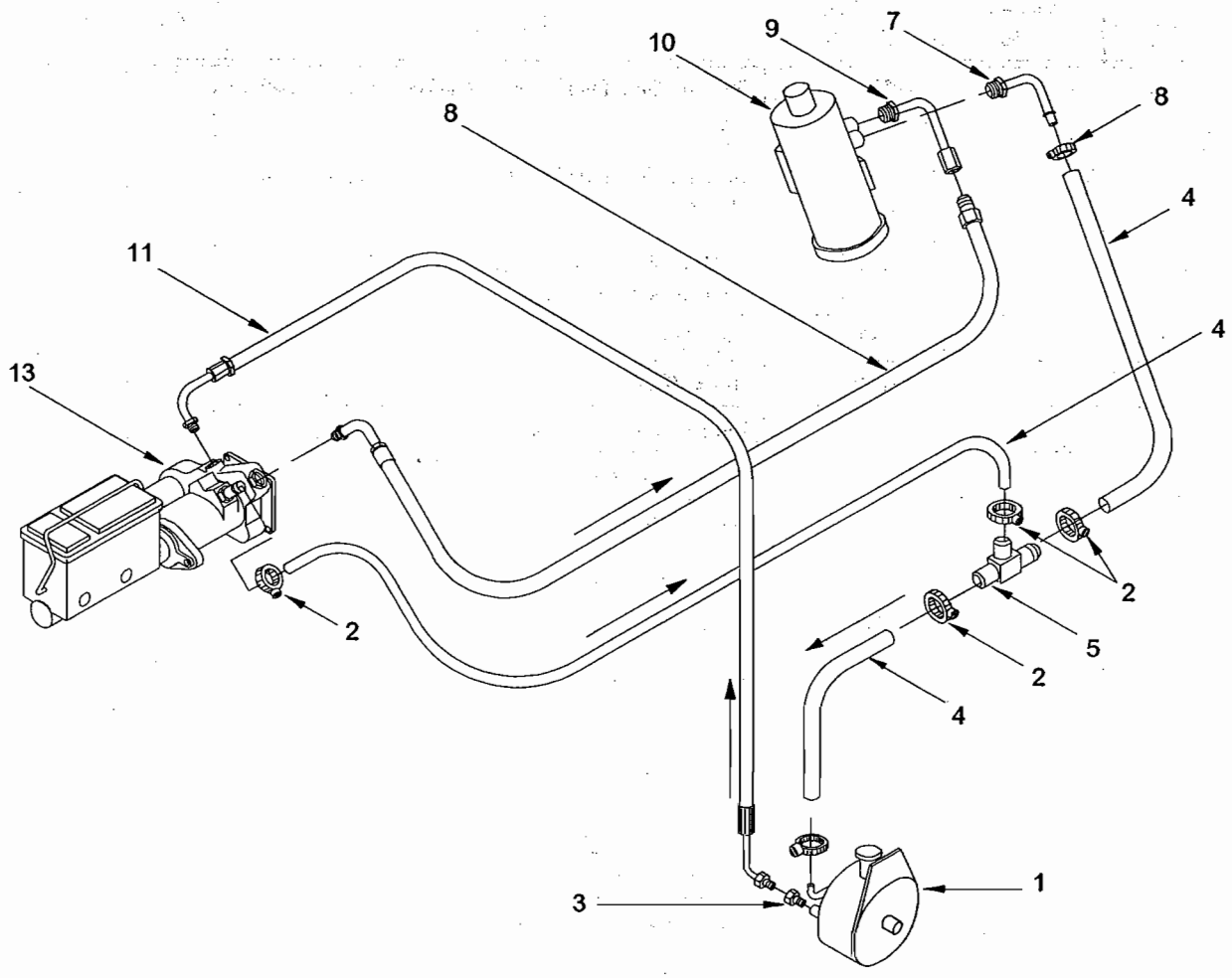


FUEL TANK

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		41534	Sending Unit, Fuel Level, w/Gasket (used with tank # 40450)		1
			or		
		41535	Sending Unit, Fuel Level, w/Gasket (used with tank # NW36193)		1
		Comm	RHMS, #10-32 x 3/8, Brass		5
		Comm	Flat Washer, SAE, .188		5
2		37833	Cap, Tank		1
3		NW22982	Block, Spacer		2
4		NW36198	Fitting, Hose, 5/16 x 1/4 NPT		1
5		F101150	Hose Clamp, #4 (.25 - .62)		A/R
6A		37548	Tube, Fuel Return, 3/16" (Cummins)		1
			or		
		NW36196	Tube, Fuel Return, 5/16", 9.50" (Perkins 4.236)		1
6B		NW31841	Hose (Ford engine), 5/8" x 58"		1
			or		
		NW26540	Hose, 5/16 ID (Suction, diesel engines)		A/R
7		F101125	Clip, Insul.		2
7.1		37549	Fitting, 3/16 (Cummins)		1
			or		
		NW36198	Fitting, Hose, 5/16 Hose x 1/4 NPT (Perkins)		1
7.2		F100671	Adapter (Cummins)		1
8		NW36960	Fuel Tank Strap (used with tank # 40450)		2
			or		
		NW22966	Fuel Tank Strap (used with tank # NW36193)		2
		Comm	Hex Nut, 3/8-16, Jam		2
		Comm	HHCS, 3/8-16 x 7/8		2
		F102221	RHMS, 3/8-16 x 2.50		2
9		NW23237	Tank Protection Strip		2
10		40450	Fuel Tank, 20.7-gal.		1
			or		
		NW36193	Fuel Tank, 12.5-gal		1
11		NW22788	Harness, Fuel Tank		Ref

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

HYDRAULIC POWER SYSTEM

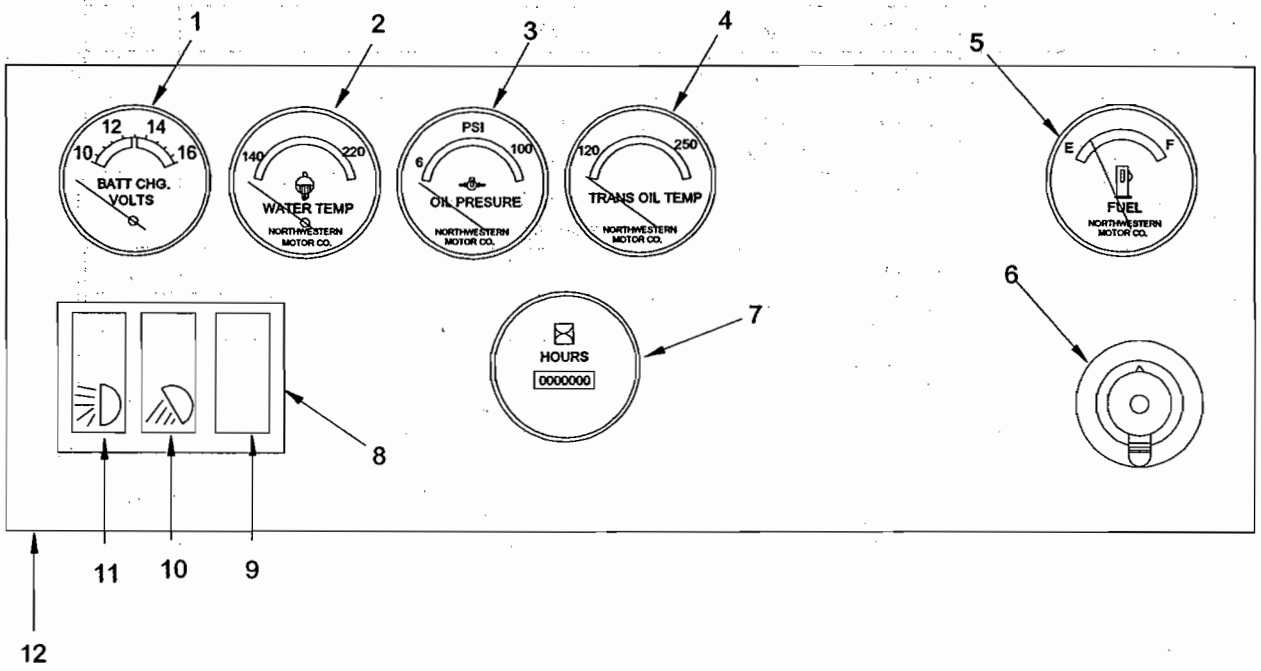


HYDRAULIC POWER SYSTEM

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		F102526	Power Steering Pump		1
2		F100979	Hose Clamp, #6 (3/8-7/8)		6
3		NW33586	Relief Valve		1
4		NW29878	Hose, 3/8 x 21", Tee - Pump (Used with Ford engine)		1
4		NW34570	Hose, 3/8 x 32", Tee - Pump (Used with diesel engines.)		1
5		F104418	Tee, Union		1
6		NW29964	Hose Assy, 12", Tee - Str. Gear		1
7		NW26800	Elbow		1
8		NW29966	Hose Assy, 30.50", Str. Gear-Booster		1
9		NW26799	Elbow		2
10		NW23510	Steering Gear (See Steering Column)		Ref
11		NW29965 37695	Hose Assy, 29", Pump - Booster (Used with Ford engines.) or, Hose Assy, 27", Pump - Booster (Used with diesel engines.)		1 1
12		NW29879 NW29878	Hose Assy, 3/8 x 25", Tee - Booster (Used with Ford engines.) Hose Assy, 3/8 x 21", Tee - Booster (Used with diesel engines.)		1 1
13		F104286	Master Cylinder/Power Booster		1
NS		F101146	Clip, Insulated, 1.25" ID		2

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

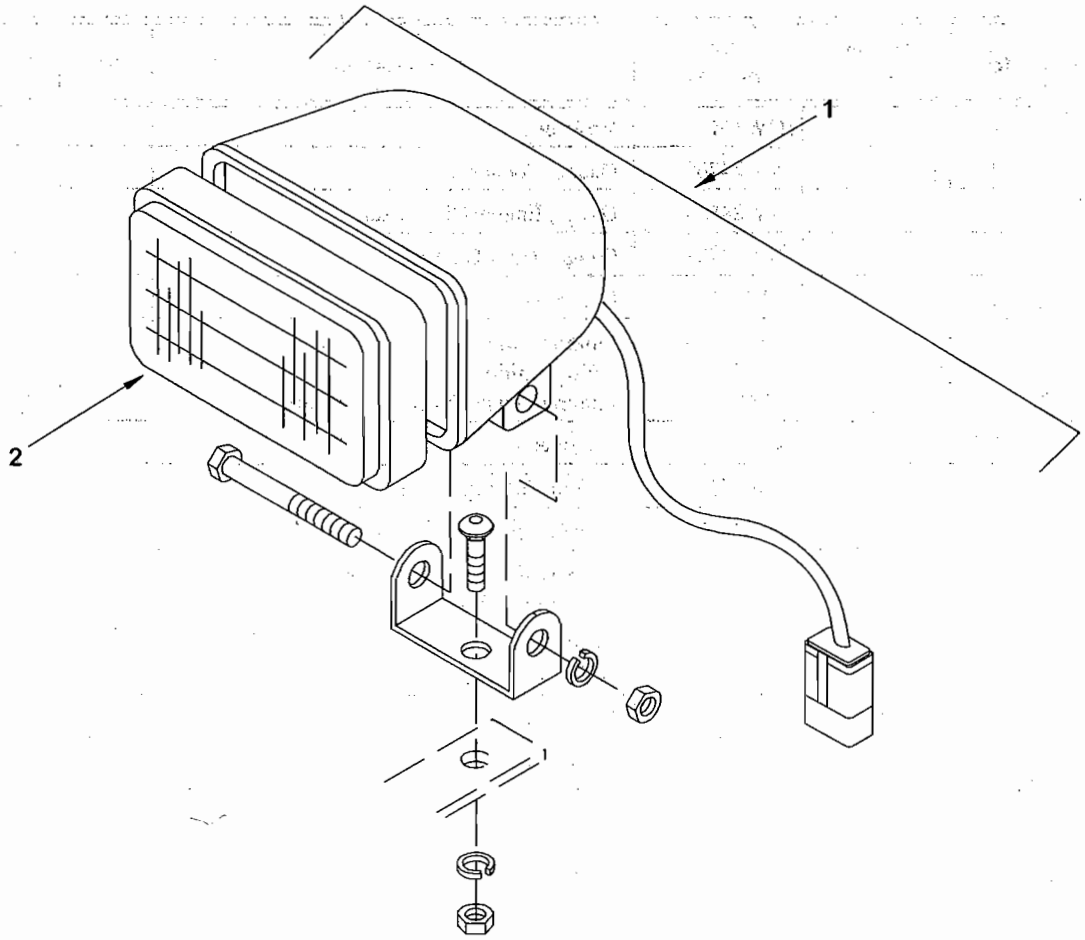
INSTRUMENT PANEL



INSTRUMENT PANEL

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW36129	Voltmeter		1
2		NW24700	Gauge, Coolant Temp.		1
3		NW24699	Gauge, Engine Oil Pressure		1
4		NW24701	Gauge, Trans Oil Temp.		1
5		NW24702	Gauge, Fuel		1
6		NW31860 NW30247 37844	Ignition Switch Disc, Ignition Ignition Switch, Keyed (Optional)		1 1 Ref
7		41434	Hourmeter		1
8		NW35380	Switch Housing, 3-frame		1
9		NW35379	Switch, Blank		1
10		NW34176 NW35383	Work Light Switch (Vendor #511-001) Work Light Insert, Green		1 1
11		NW35376 NW35386	Head/Tail Light Switch Head/Tail Light Insert, Green		1 1
12		NW36128	Instrument Panel Plate		1
NS NS		37654 NW36767	Bulb, Replacement for switches Bulb, Replacement for dash		Ref Ref

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

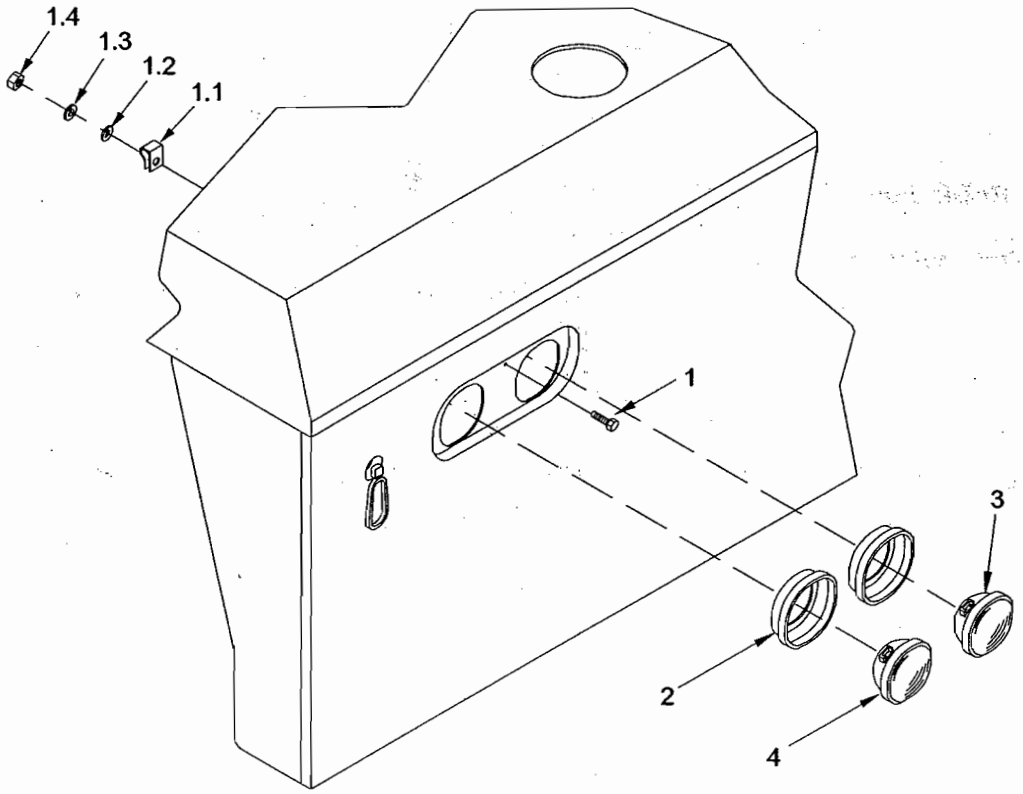


LIGHTS

Headlight

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		38684	Headlight Assembly		2
2		NW29958	Lamp, Replacement, 12V		A/R

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.



LIGHTS

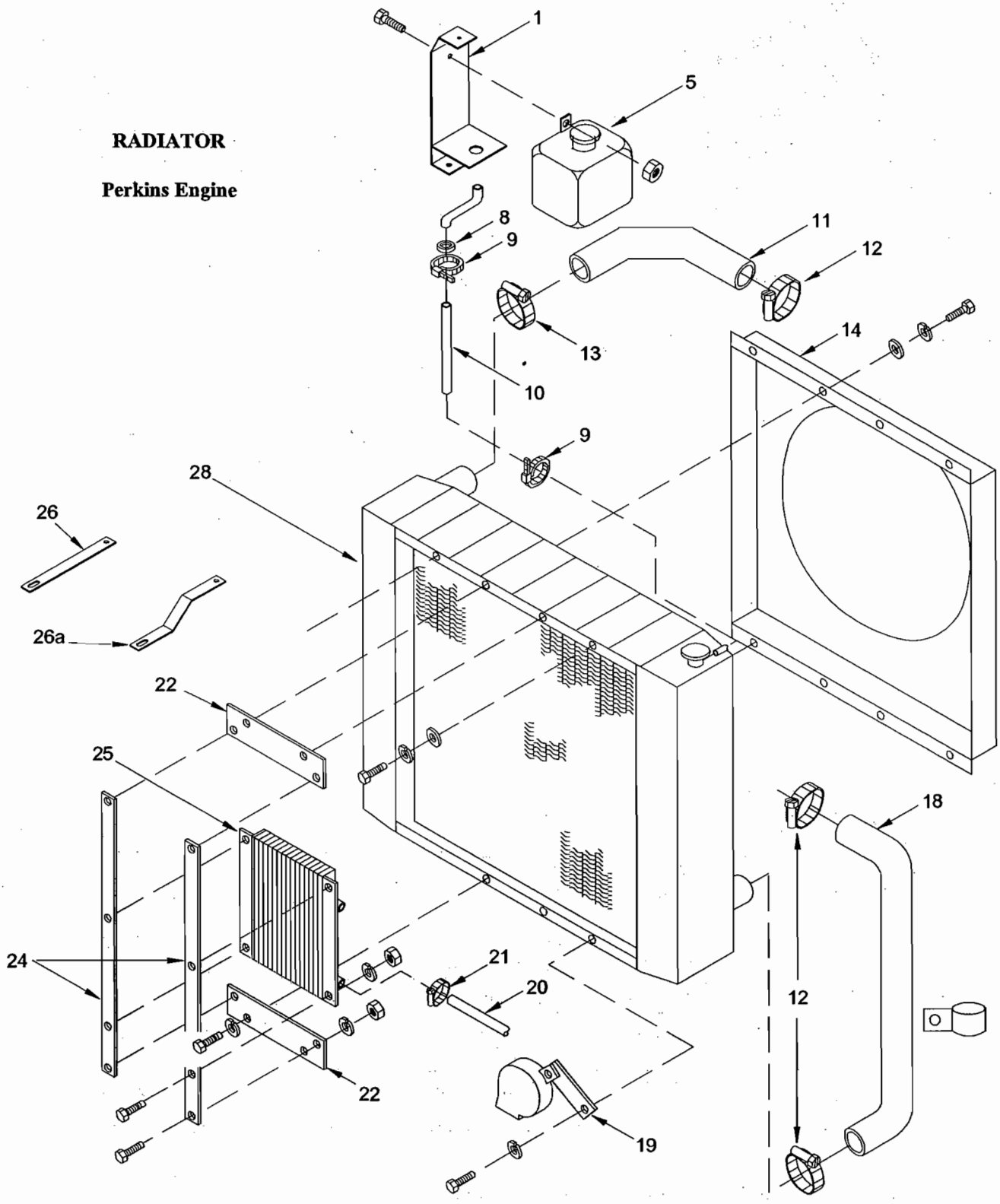
Rear

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34546 Comm Comm Comm Comm	THMS, 1/4-20 x 0.75 Clip, Insulated Flat Washer, 1/4 Lock Washer, 1/4 Hex Nut, 1/4-20		2 2 2 2 2
2		NW35843	Rubber Seal		4
3		NW35842	Back-up/Work Light Assy, 2-wire, Clear		2
4		NW35844	Tail/Stop Light Assy, 3-wire, Red		2

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

RADIATOR

Perkins Engine



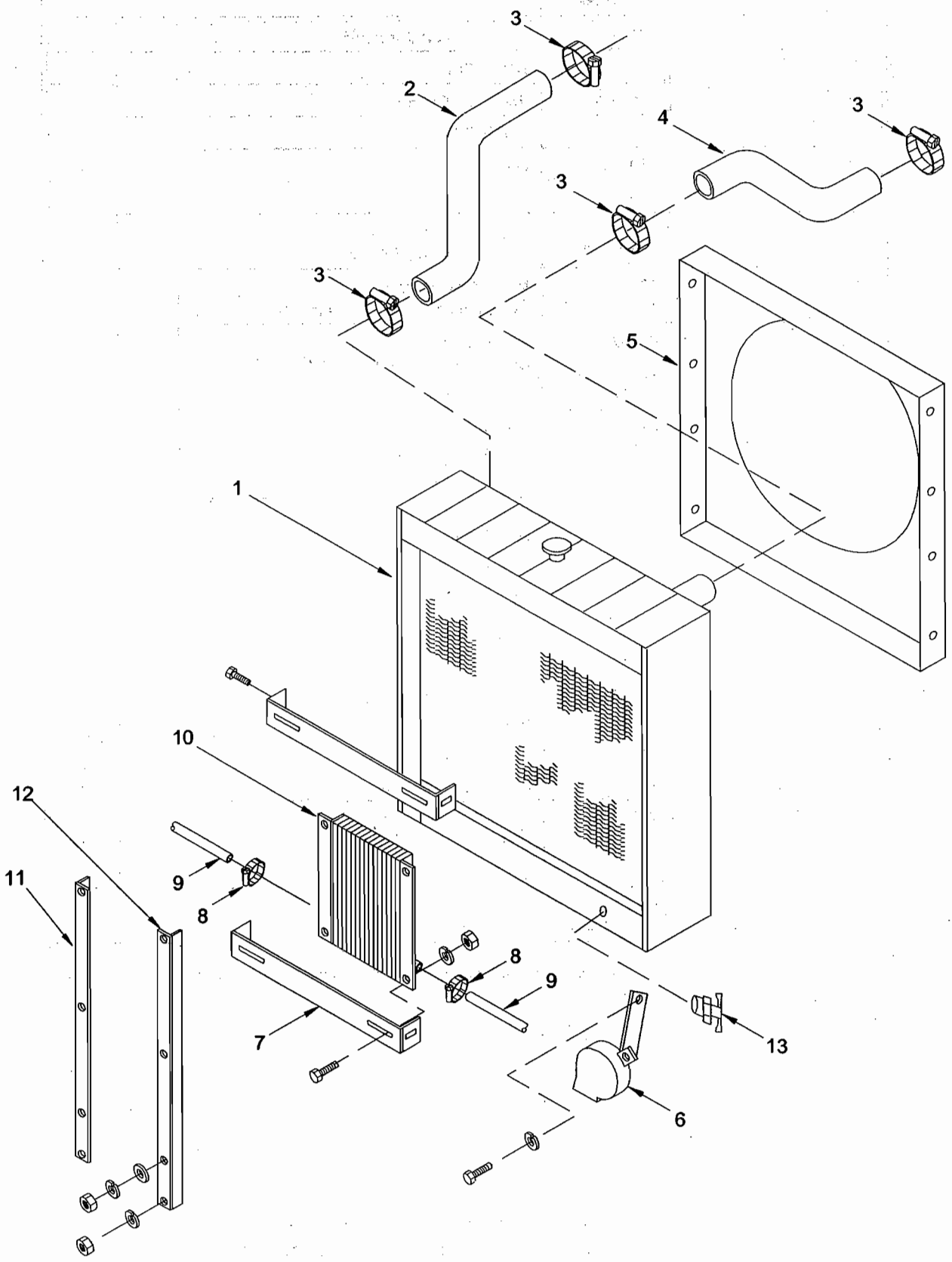
RADIATOR (Perkins engine)

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		37255	Bracket, Coolant Reservoir		1
2-4			NOT USED		
5		F101582	Reservoir, Overflow		1
6-7			NOT USED		
8		F101745	Grommet		1
9		F101661	Tie Strap		2
10		NW31849 NW36097	Hose, Recovery, Vinyl, 55" Clip, Retaining, Res Hose		1 3
11		37625 38345	Hose, Radiator, Upper Hose, Radiator, 2 x 17 (Perkins 1004)		1 1
12		F100937 F101140	Clamp, Hose, #28 Clamp, Hose, #32 (Perkins 1004)		3 4
13		F101122	Clamp, Hose, #24		1
14		42533 1018145	Shroud, Fan Decal, Warn., Fan/Belts		1 1
15-17			NOT USED		
18		37720 38344 F101680	Hose, Radiator, Lower Hose, Radiator, 2 x 9.5 (Perkins 1004) Clip, Insulated, 1.75 Dia.		1 1 1
19		152864	Horn		1
20		F101679	Hose, 3/8"		A/R
21		F100979	Clamp, Hose, #6		4
22		39484	Plate, Oil Cooler		2
23			NOT USED		
24		37676	Strap, Mount, Oil Cooler		2
25		37655	Cooler, Oil, Transmission		1
26 26a		38801 38989	Angle, Mounting Bracket Bracket, Radiator Upper		1 1
27			NOT USED		
28		37576 NW17243	Radiator, w/Cap Radiator Cap		1 Ref

NOTE: Always check OPTIONS before ordering parts.
Most options will replace or modify one of the standard assemblies.

RADIATOR

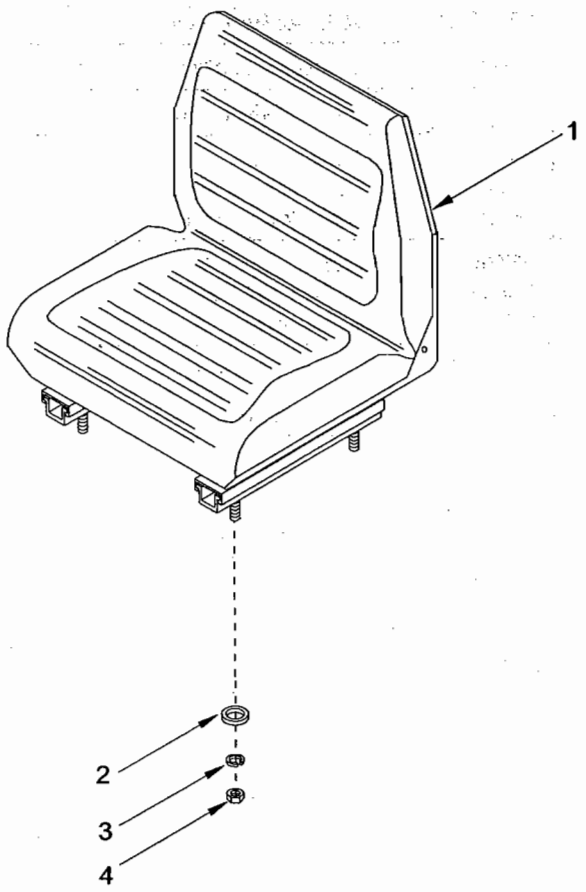
Ford Engine



RADIATOR Ford Engine

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34161	Radiator		1
2		NW37625	Radiator Hose, Lower		1
3		F100937	Hose Clamp, #28 (1.31 - 2.25)		4
4		NW35291	Upper Radiator Hose		1
5		NW34275 Comm Comm	Fan Shroud HHCS, 5/16-18 x 0.75 Lock Washer, 5/16		1 8 8
6		152864 Comm Comm	Horn HHCS, 5/16-18 x 0.75 Lock Washer, 5/16		1 1 1
7		NW34371	Oil Cooler Mounting		2
8		F100979	Hose Clamp, #6 (0.44 - 0.78)		4
9		NW27605 NW34584	Hose, Trans. Oil, 82" Hose, 3/8 x 96"		1 1
10		37655	Transmission Oil Cooler, 8.00"		1
11		NW34273	Radiator Angle, RH		1
12		NW34274	Radiator Angle, LH		1
13		F100669	Drain Cock		1
NS		F101146	Clip, Insulated, 1.25 ID		2

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

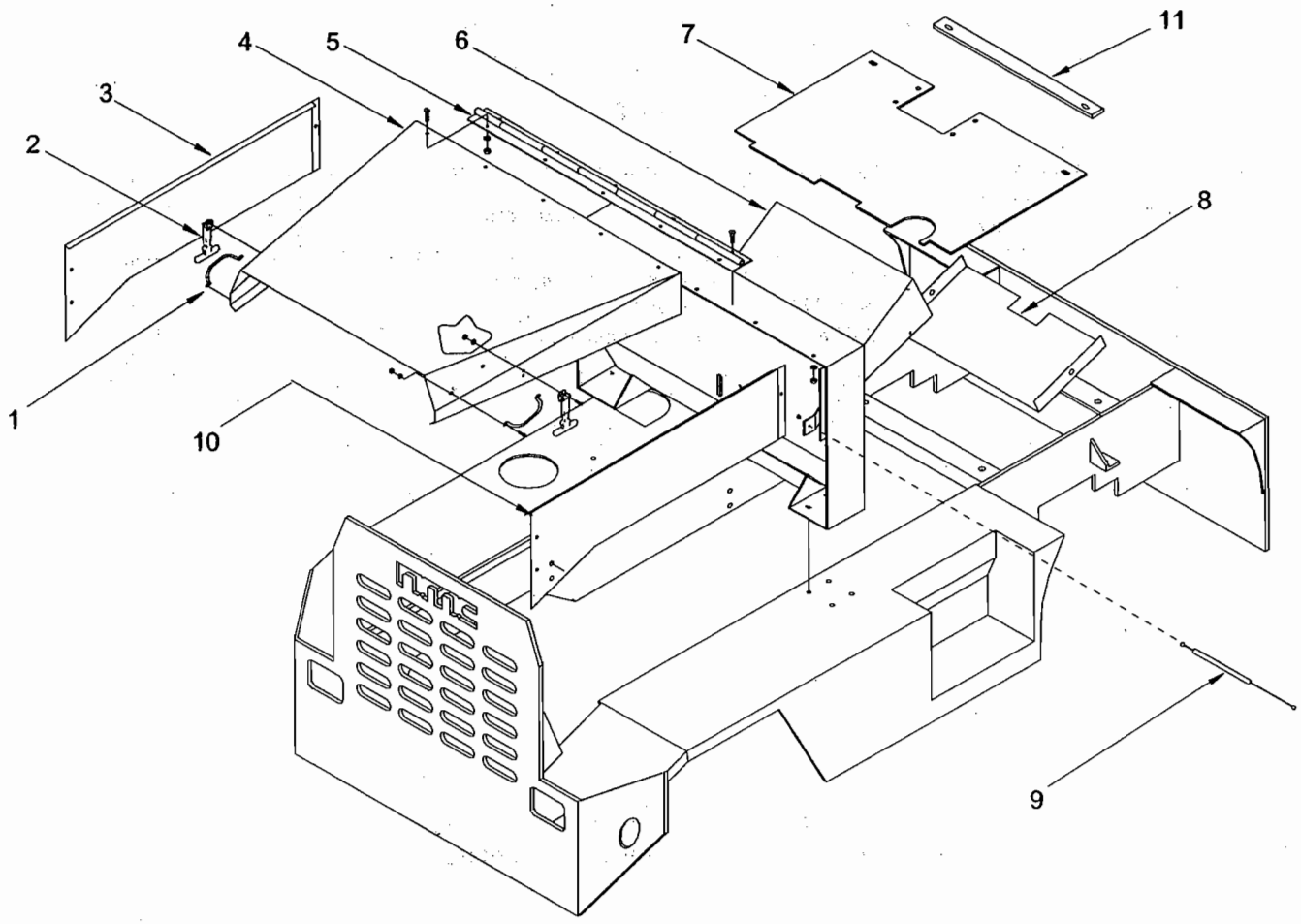

1
2
3
4

SEAT

Item	Owner Use	Part No.	Description	Eff	Qty
1		NW23843 NW34728 38138	Seat Assembly W/slide Seat Belt Armrest (Optional)		1 1 Ref
2		F9549	Flat Washer, 5/16		4
3		F9546	Lock Washer, 5/16		4
4		F9547	Hex Nut, 5/16-18		4

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

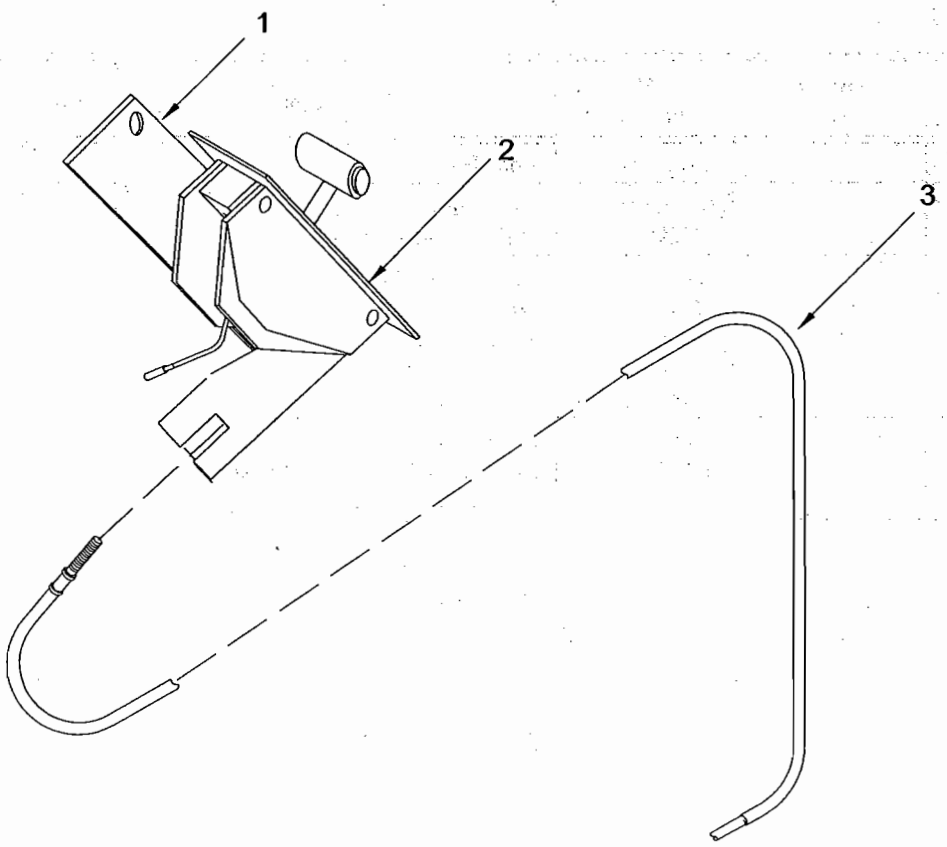
SHEET METAL



NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

SHEET METAL

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34658	Hood Handle		2
2		NW22814 40290	Latch, Flex Draw PHMS 10-32 x 0.50		2 8
3		38688 Comm Comm Comm Comm	Panel, Right Side HHCS, 5/16-18 x 1.00 Flat Washer, 5/16 Lock Washer Hex Nut, 5/16-18		1 2 2 2 2
4		38686 39093	Hood Assembly, or Hood Assembly (Used when battery is mounted under fender.)		1 Ref
5		37604 NW34546 Comm Comm Comm	Hood Hinge THMS, 1/4-20 x 0.75 Lock Washer, 1/4 Flat Washer, 1/4 Hex Nut, 1/4-20		1 10 10 10 10
6		37605 39033 40700 Comm Comm Comm Comm	Rear Hood Support, or Rear Hood Support (Used with air conditioning.), or Rear Hood Support (Used with Isuzu engine.) HHCS, 3/8-16 x 1.00 Flat Washer Lock Washer Hex Nut, 3/8-16		1 Ref Ref 8 8 8 8
7		NW36864 NW34206 NW30399 Comm Comm Comm Comm	Floor Plate (with Ford engine), or Floor Plate (with Perkins engine) Seal, Neoprene HHCS, 3/8-16 x 1.25 Lock Washer Flat Washer Hex Nut, 3/8-16		1 1 2 2 2 4 2
8		NW35229 F101603 Comm Comm	Wire Cover Trim, Rubber, 3.75" Screw, #10-16 Flat Washer		1 1 3 3
9		NW35891 NW35714 NW35715	Shock, Gas, 90 Psi Stud, Ball Clip		2 4 4
10		42127 Comm Comm Comm Comm	Panel, Left Side HHCS, 5/16-18 x 1.00 Flat Washer, 5/16 Lock Washer Hex Nut, 5/16-18		1 2 2 2 2
11		40404	Plate, Filler Floor		1
NS		NW23065	Screw, Hood Bumper		2
NS		NW23066	Bumper, Hood Bumper		2



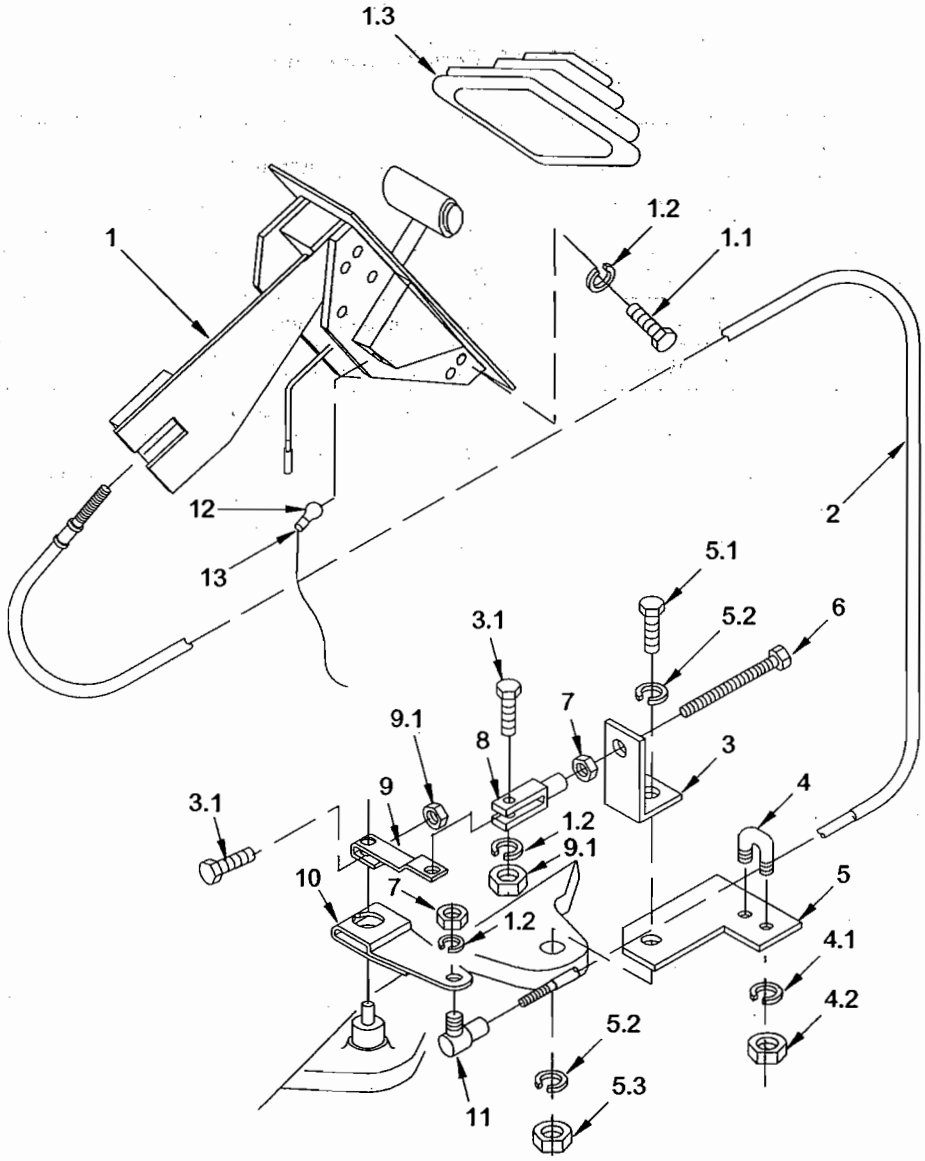
NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

SHIFTER Ford Transmission

Item	Owner Use	Part No.	Description	Eff	Qty
1		NW35228	Spacer		1
2		37417	Shifter		1
3		NW31669	Transmission Shift Cable		1
4		NW34238	Bracket, Kickdown Plate		1
5		37667	Bar, Kickdown Adjustment		1
6		NW31669	Transmission Shift Cable		1

SHIFTER and LINKAGE

for Chrysler A727 Transmission



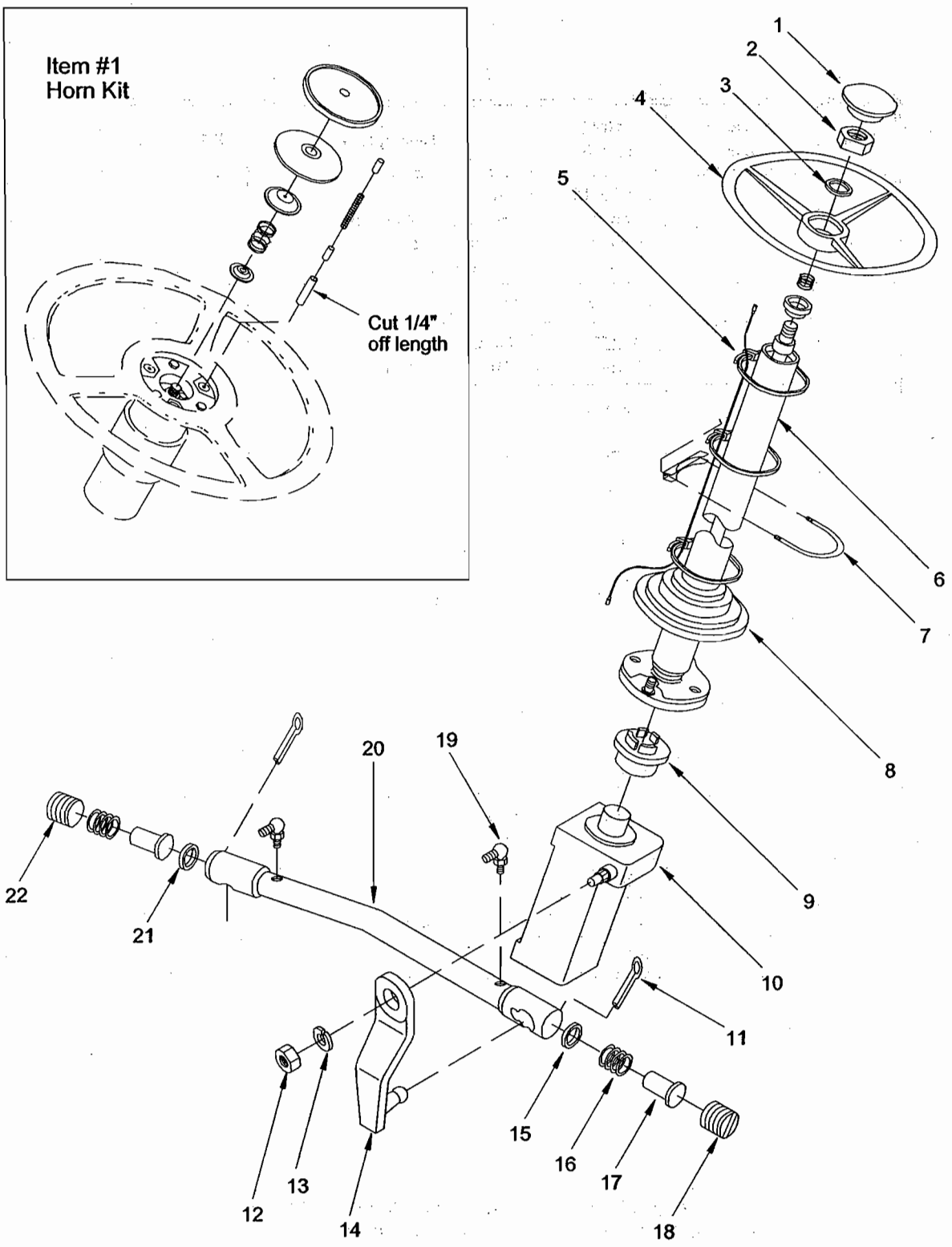
SHIFTER and LINKAGE

Chrysler A727 Transmission

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW35314	Shifter		1
1.1		Comm	HHCS, 1/4-20 x 0.50		4
1.2		Comm	Lock Washer, 1/4		5
1.3		40368	Boot Assembly		1
2		F101614	Shift Cable		1
3		NW25903	Bracket, Trans		1
3.1		Comm	HHCS, 1/4-20 x 1.00		2
4		F101865	U-Bolt		1
4.1		Comm	Lock Washer, 5/16		2
4.2		Comm	Hex Nut, 5/16-18		2
5		NW30904	Bracket, Shift Cable		1
5.1		F100403	HHCS, 1/2-13 x 1.50		1
5.2		Comm	Lock Washer, 1/2		2
5.3		Comm	Hex Nut, 1/2-13		1
6		NW29461	HHCS, 1/4-28 x 3.00		1
7		Comm	Hex Nut, 1/4-28		2
8		NW24149	Yoke End		1
9		NW16578	Throttle Lever		1
9.1		Comm	Lock Nut, Nylon, 1/4-20		2
10		NW21814	Shift Lever		1
11		F101863	Ball Joint		1
		Comm	Hex Nut, 1/4-28		2
12		40369	Lamp		Ref
13		40370	Socket Assembly		Ref
NS		40371	Lens		Ref

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

STEERING



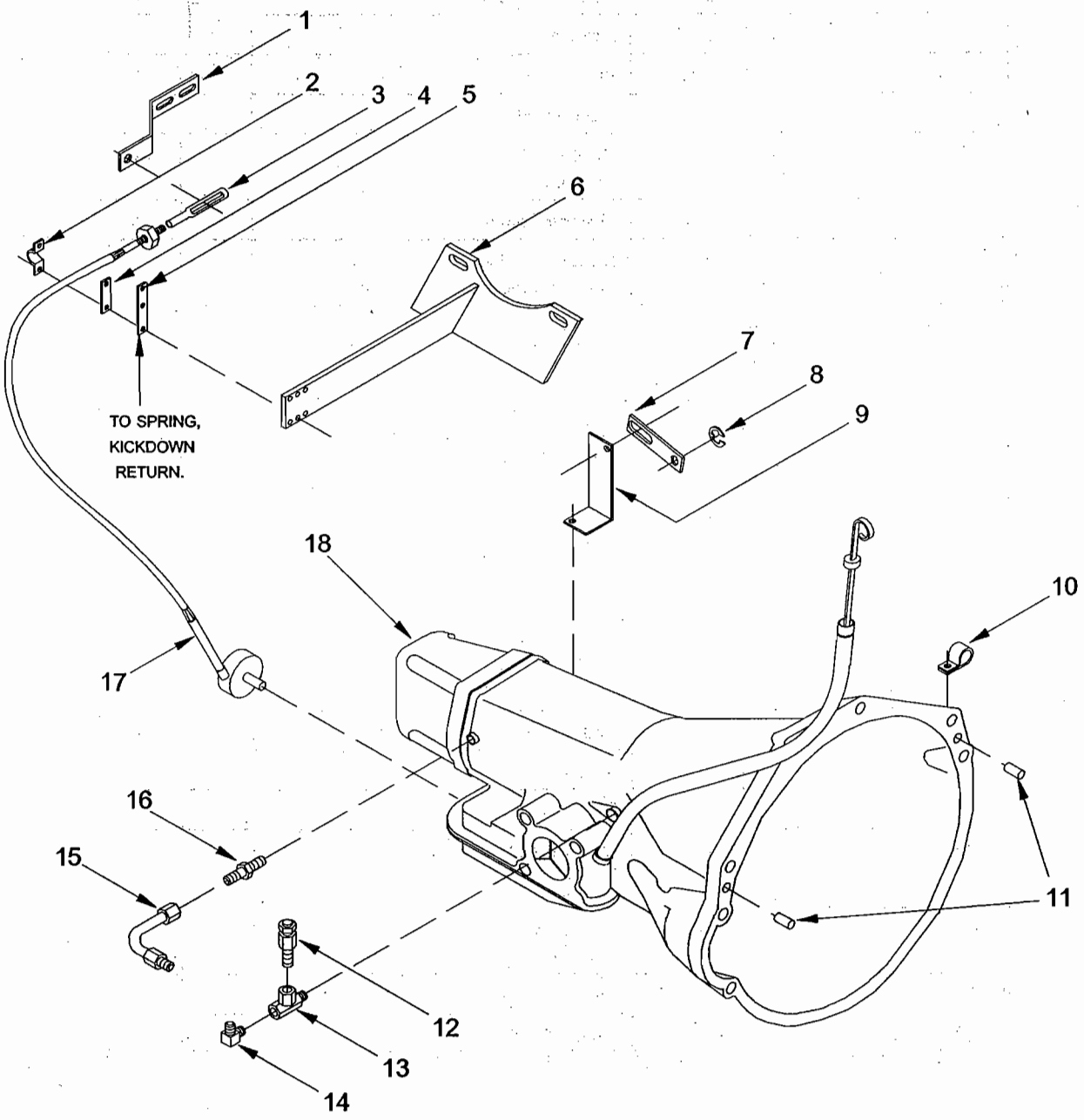
Item 14 appears different on some models. The part number shown on the following page is correct.

STEERING

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34686 F100843	Horn Button Kit Connector, 2-Way		1 1
2		NW23027	Hex Nut		1
3		NW23028	Flat Washer		1
4		NW34684	Steering Wheel		1
5		NW26372 F101661	Horn Wire Tie Strap		Ref 2
6		NW23511	Steering Column		1
7		NW35441 F100075	Bracket, U-Bolt Lock Washer, Int. Shakeproof		1 2
8		NW30946	Steering Column Boot		1
9		NW23913	Coupling Assembly		1
10		NW23510 40998 40997 NW34403	Steering Gear Assembly HHCS, 7/16-14 x 2.25, Gr. 8 HHCS, 7/16-14 x 1.75, Gr. 8 Lock Washer, SAE Hardened, 7/16		1 1 2 3
11		F02547	Cotter Pin, 1/8 x 2.00		2
12		NW23017	Hex Nut, 7/8 UNF, Jam		1
13		NW23033	Lock Washer, 7/8		1
14		NW36173 Comm Comm	Pitman Arm HHCS, 1/2-13 x 3.00 Hex Nut, 1/2-13		1 2 2
15		37829	Ball Seat, Flat		1
16		37828	Spring, Seat		2
17		37827	Ball Seat		2
18		37826	Drag Link Plug, Cupped		1
19		F09217	Grease Zerk, 1/8, 90 Deg.		2
20		NW29931	Drag Link (incl. items 15-18 and 21-22)		1
21		37830	Ball Seat, Cupped		1
22		37831	Drag Link Plug, Flat		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

TRANSMISSION–Ford C-6



TRANSMISSION–Ford C-6

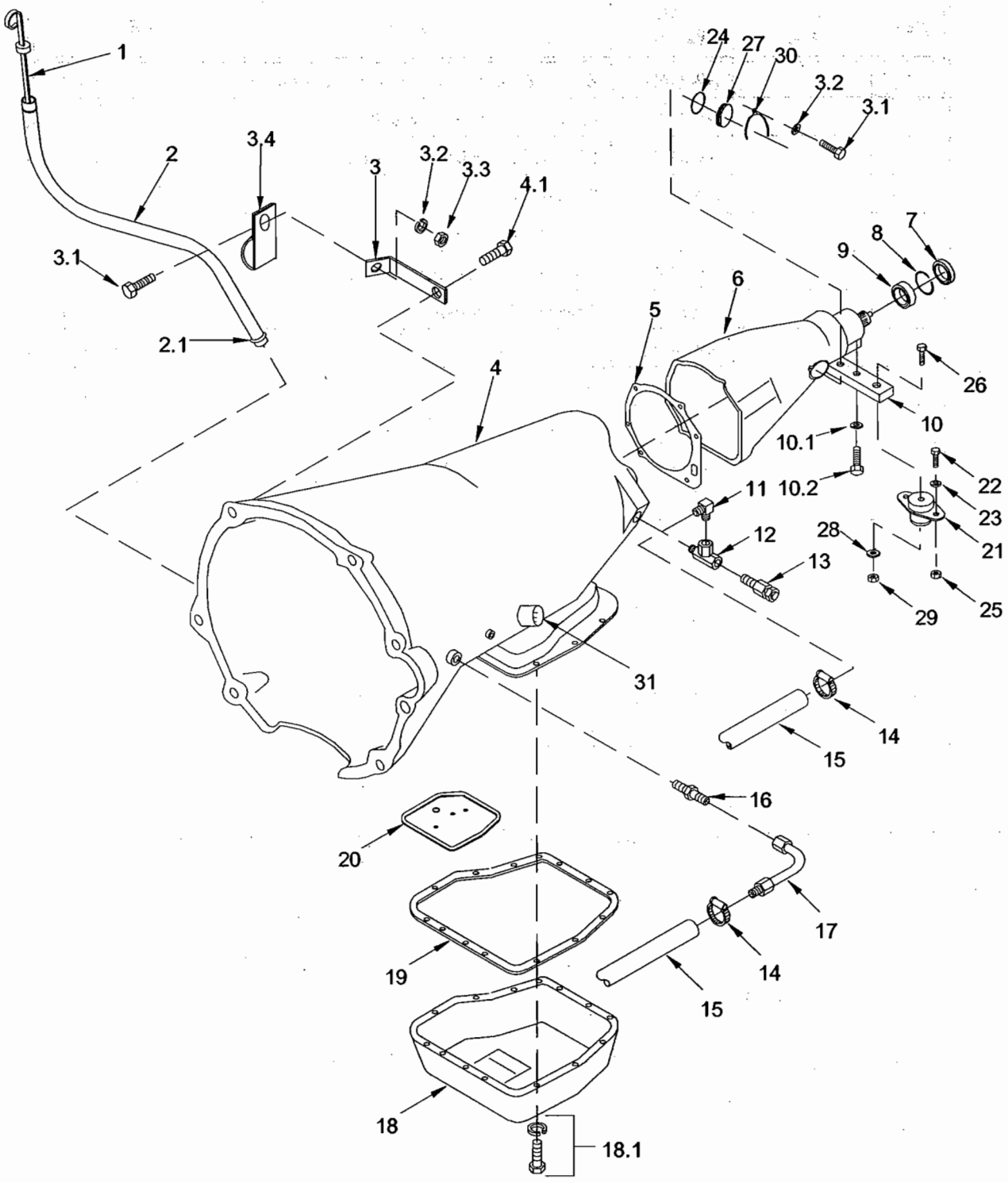
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34690	Bar, Modulator Actuating (with Perkins engine)		1
2		NW34731	Clip, Cable Mounting (with Perkins engine)		1
3		NW34718	Kit, Slip Link (with Perkins engine)		1
4		NW34733	Shim (Perkins)		1
5		39925	Bracket, Spring Return		1
6		NW34687	Bracket, Modulator (with Perkins engine)		1
7		NW34238	Bracket, Kickdown Adj.		1
8		NW34551	Clip, "E", 1/4" Shaft		1
9		37667	Bar, Bracket, Kickdown (Model 100)		1
10		F101146	Clip, Insulated, 1.25 ID (Model 100 and 140)		1
11		F100444	Pin, Dowel (with Perkins engine)		2
12		NW30236	Sender, Temperature		1
13		NW34729	Tee, Male Run (2092-4-4S)		1
14		NW34736	Ell, 1/4 NPT x 3/8 Hose		1
15		F104402	Ell, 90-Deg.		1
16		NW34732	Adapter, Pipe to Flare (2021-4-6S)		1
17		NW34717	Cable, Modulator (with Perkins engine)		1
18		NW34441	Transmission Assembly, C-6		1

Also see Ford C-6 Transmission Service and Parts information, located at the end of this manual.

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

TRANSMISSION

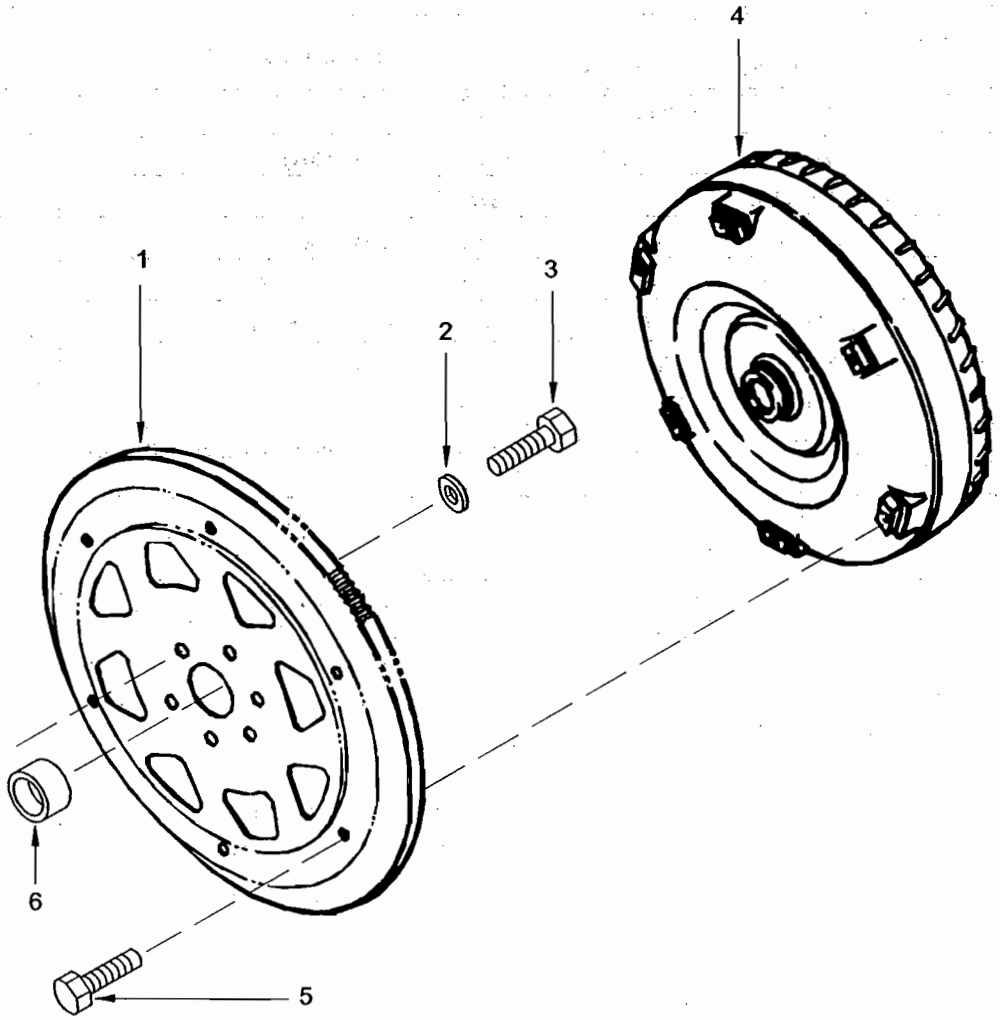
Chrysler A727



NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.

TRANSMISSION Chrysler A727

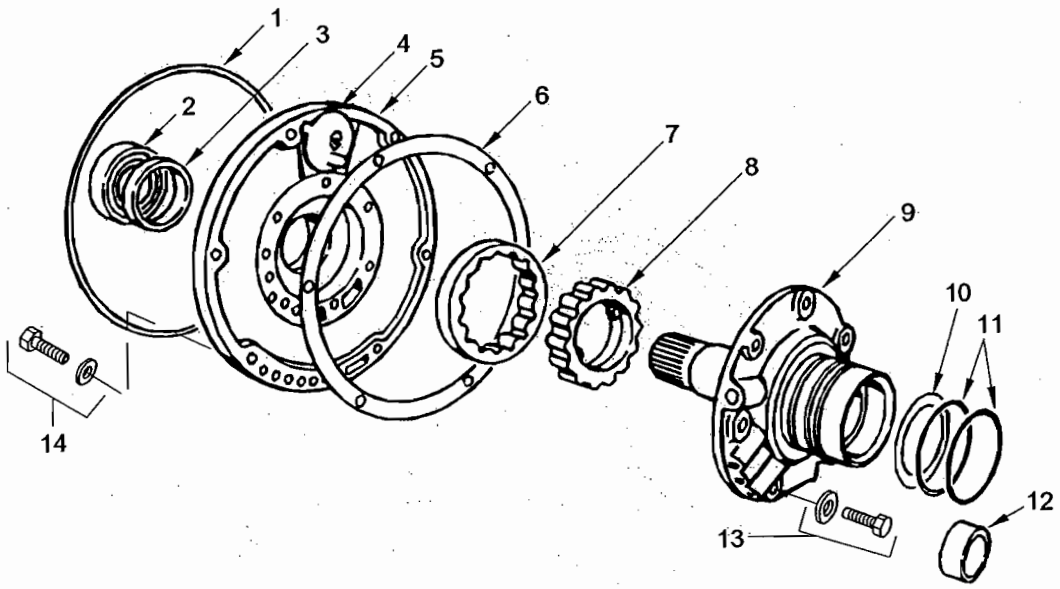
Item	Owner Use	NMC Part No.	Vendor Part No.	Description (CAGE Code)	Eff	Qty
1		37803	53003661	Dipstick, Trans		1
2		37802	53002009	Dipstick Tube (12204)		1
2.1		NW15325		Seal, Oil Filler		1
3		37804		Dipstick Tube Bracket		1
3.1		F100306	Comm	HHCS, 5/16-18 x 0.75 (96906)		1
3.2		F09546	Comm	Lock Washer, 5/16 (96906)		1
3.3		F09547	Comm	Hex Nut, 5/16 (96906)		1
3.4		F104343	COV1311	Clip, Insul. (75272)		1
4		39514	5SE02120	Transmission Assembly (Includes all items listed on this page)		1
4.1		F100350	Comm	HHCS, 7/16-14 x 1.25		1
5		39545	2466954	Gasket (12204)		1
6		39546	4471596	Extension, Short (12204)		1
7		NW32659	4412507	Oil Seal (12204)		1
8		NW32630	4412508	Snap Ring (12204)		1
9		NW32660	4130537	Bearing (12204)		1
10		39063		Plate, Trans. Mount		1
10.1		F18486	Comm	Lock Washer, 7/16 (96906)		2
10.2		F100342	Comm	HHCS, 7/16-14 x 1.50 (96906)		2
11		NW34736		Ell, 1/4 NPT x 3/8 Hose, Brass		1
12		NW34729	2092-4-4S	Tee, Int/Ext Pipe (01276)		1
13		NW30236	02023-00	Temperature Sender (16476)		1
14		F100974	Comm	Clamp, Hose, #6		Ref
15		NW27506		Hose		Ref
16		NW34732	2021-4-6S	Fitting, Pipe to 37 Deg. Flare (01276)		1
17		F104402		Ell, 90-Deg.		1
18		38673	4428462	Oil Pan (12204)		1
18.1		38195	6023 355	HHCS w/Washer		14
19		NW15316	2464324	Gasket (12204)		1
20		NW14990	3515996	Filter Screen, Trans. (12204)		1
21		39059	51508-1	Mount, Trans, Rubber (Tech. Prod.)		2
22		F100312	Comm	HHCS, 3/8-16 x 1.25 (96906)		8
23		F9669	Comm	Flat Washer, 3/8 (96906)		8
24		NW19561	6025752	O-Ring (12204)		Ref
25		37744	Comm	Nylock Nut, 3/8 x 16		8
26		F100333	Comm	HHCS, 1/2-13 x 3.50		2
27		NW16999	2659464	Plug (12204)		Ref
28		NW14597	Comm	Flat Washer, 9/16		2
29		37745	Comm	Nylock Nut, 1/2-13		4
30		19562	2892899	Clamp		Ref
31		NW17444	3747361	Neutral Safety Switch (72582)		Ref
NS		37780 38732	4428472 9417361	Dust Shield (12204) Self Tap Machine Screw (12204)		Ref3



TRANSMISSION–Torque Converter

Chrysler A727

Item	Owner Use	NMC Part No.	Vendor Part No.	Description (CAGE Code)	Eff	Qty
1		37751	PE3917784	Drive Plate / Ring Gear (Power Great Lakes)		1
2		39600	33117127	Washer, Hardened (12204)		8
3		37781	6033439	HHCS, 3/8-24 x 7/16, Special Head (12204)		8
4		NW36911	203-10817	Torque Convertor (75958)		1
5		NW17585	1949424	Special Screw, Conv. Drive Plate (12204)		6
6		37434		Bushing, Torque Convertor (44185)		1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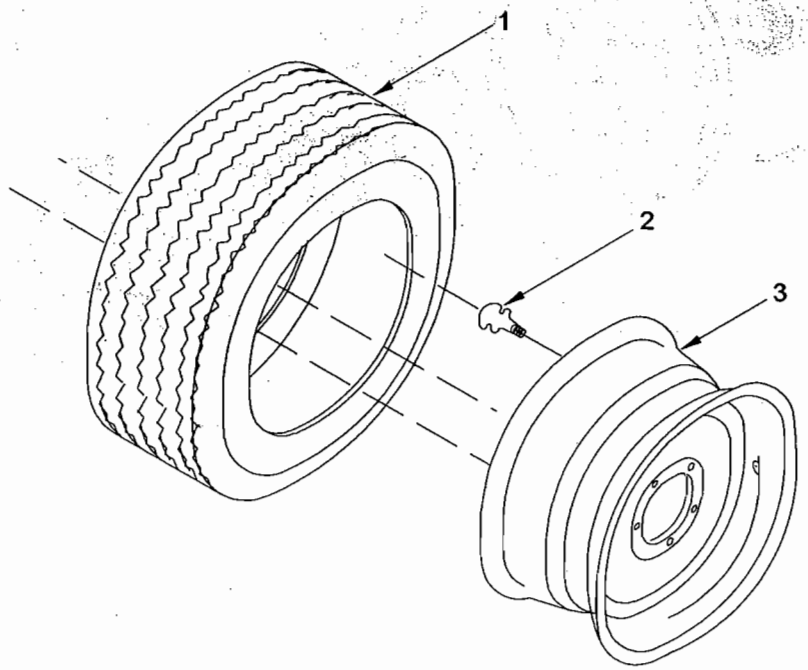
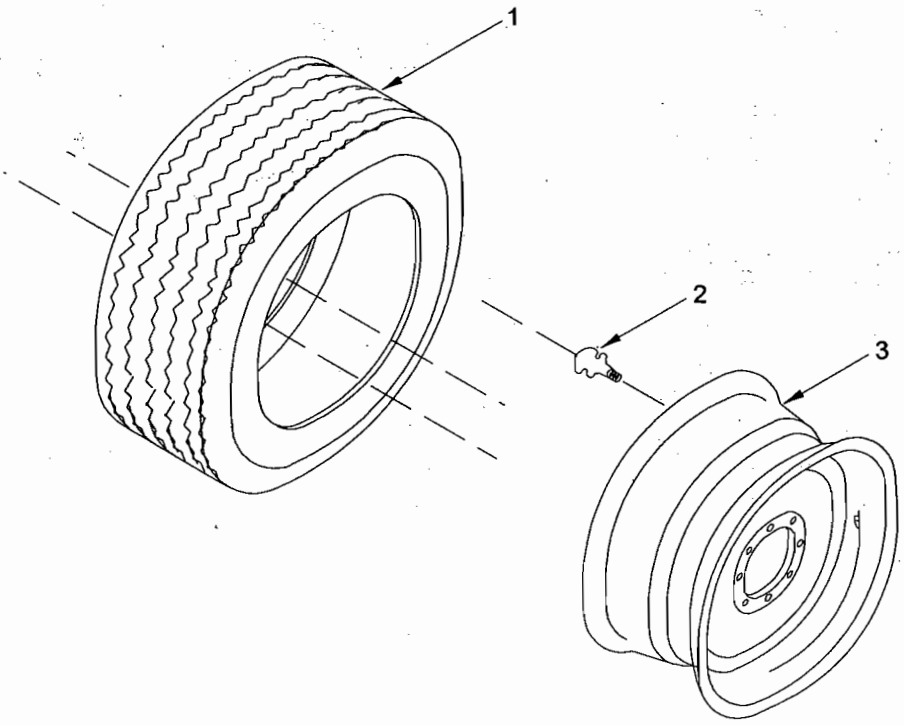


WHEELS and TIRES Front

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW31614	Tire, ST175/80R13		2
2		NW22984	Valve Stem		2
3		NW26256 NW17242	Wheel, 4.5 x 13 Nut, Lug, 1/2-20, 90-deg.		2 10

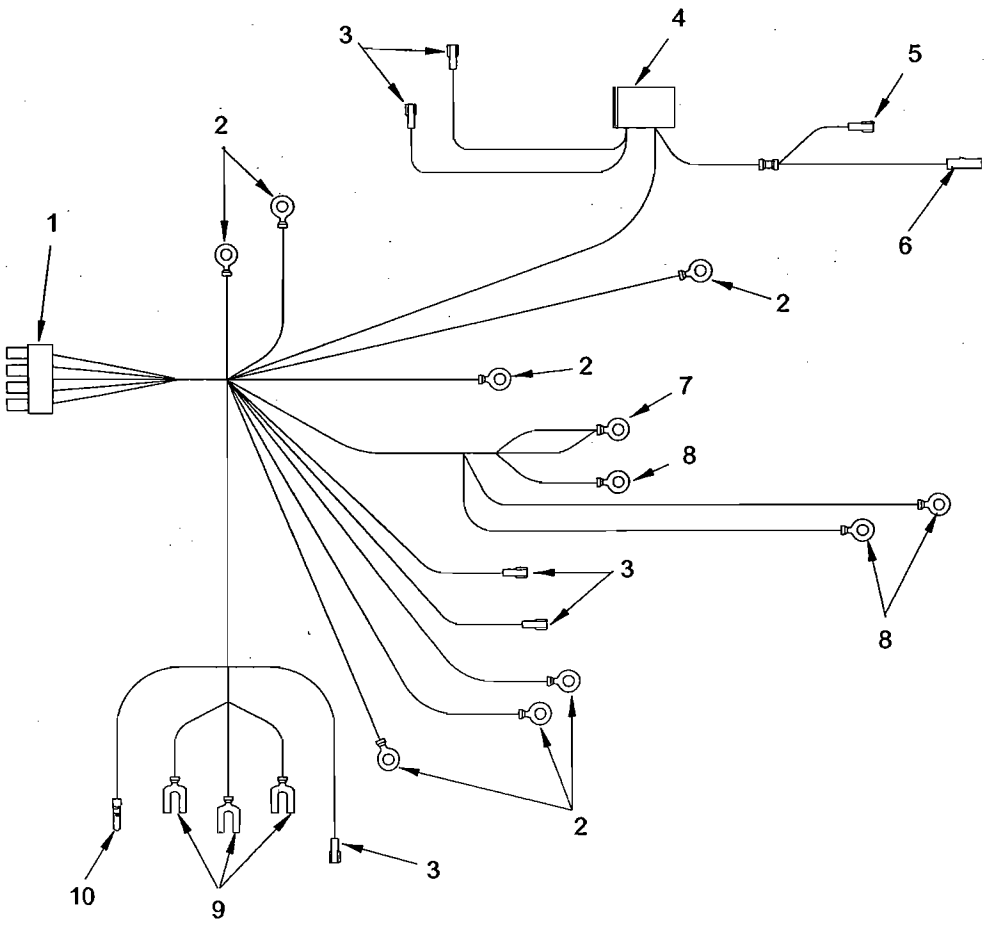
NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.



WHEELS and TIRES Rear

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34564 41055 40434	Tire, 8.75-16.50 LT, 8-ply Tire, Snow, 8.75-16.50, 8-ply (Optional) Tire, Solid (Optional)		2 Ref Ref
2		NW18775	Valve Stem		2
3		NW36693 NW36842	Wheel, 6.75 x 16.5 Wheel Nut, 9/16-18		2 16

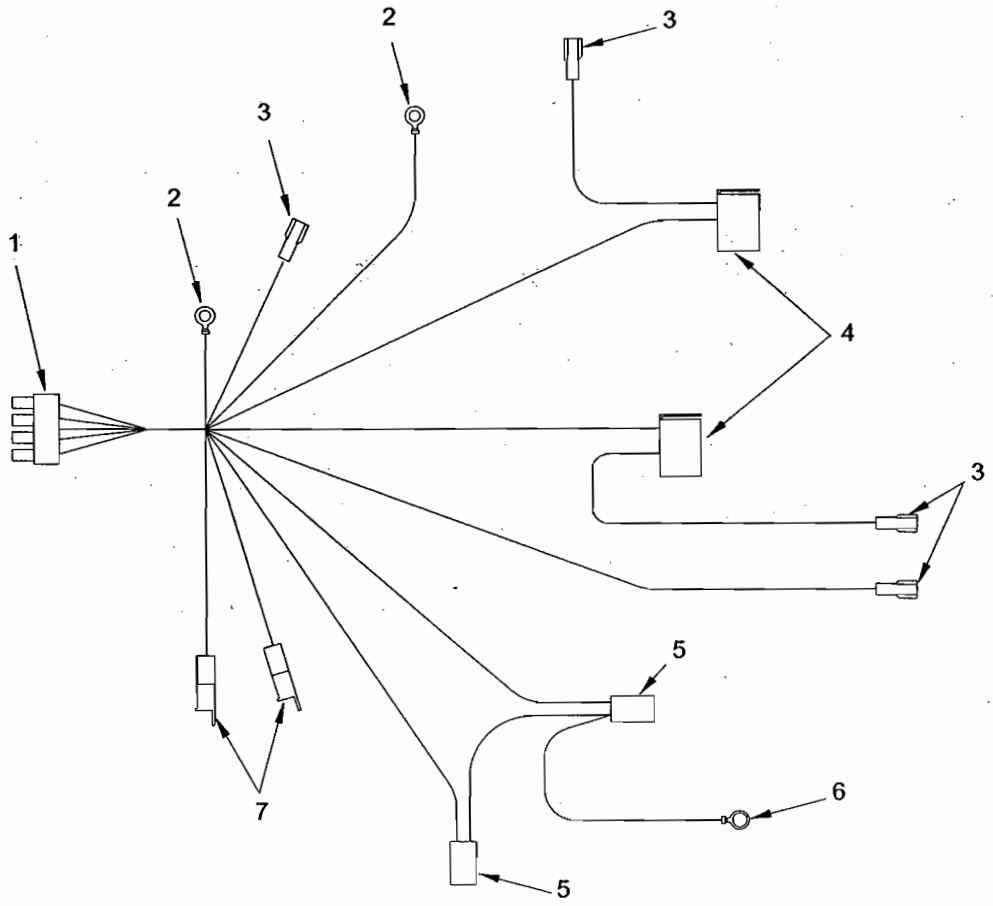
NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.



WIRING HARNESS

Dash I

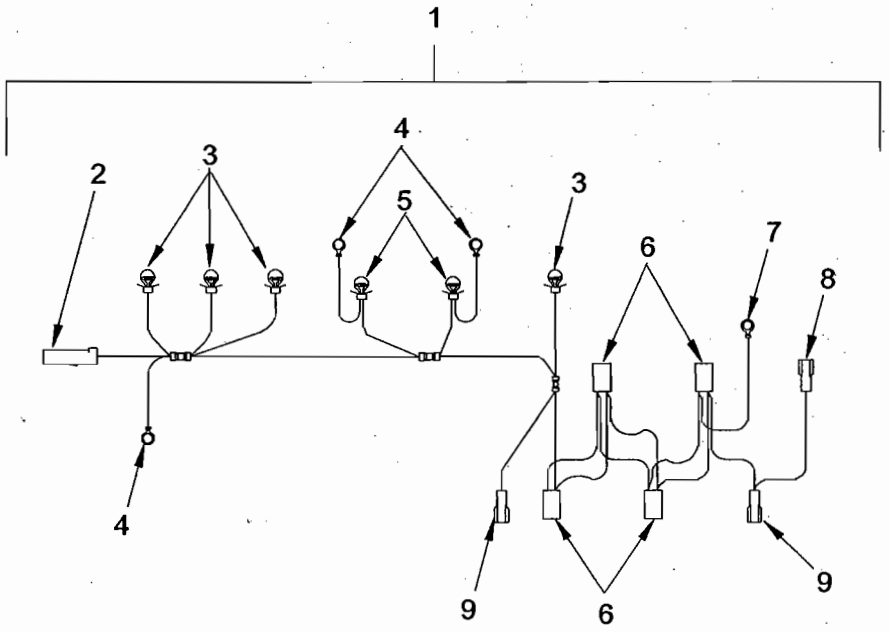
Item	Owner Use	NMC Part No.	Description	Eff	Qty
		37730	Dash Harness I		1
1		1-480708-0 350547-1	Housing Connector		1 11
2		31503	#10 Ring		7
3		31513	Terminal		5
4		37408 37049	Connector, Switch Terminal, Female Blade		1 3
5		31512	Terminal, Male		1
6		38001 31031	Connector Terminal		1 1
7		31501	#10 Ring		1
8		32501	#10 Ring		3
9		31525	#10 Fork		3
10		31561	Bullet		1



WIRING HARNESS

Dash II

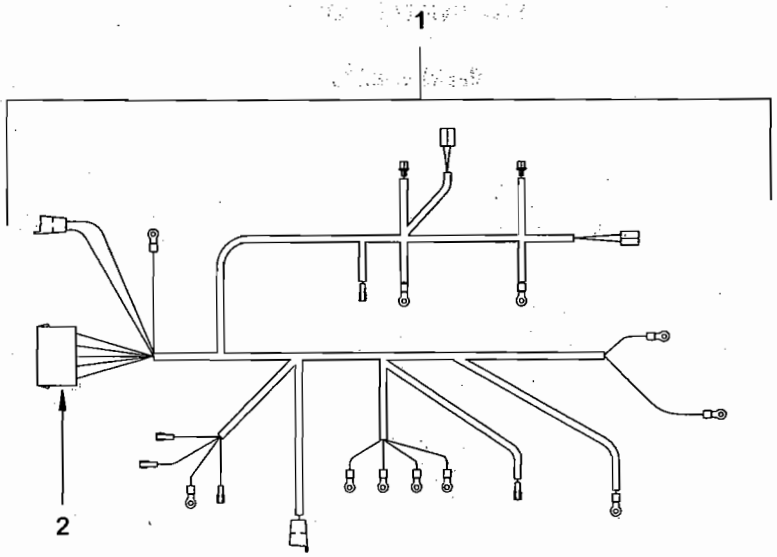
Item	Owner Use	NMC Part No.	Description	Eff	Qty
		37731	Dash Harness II		1
1		1-480708-0 350547-1	Housing Connector		1 10
2		31503	#10 Ring		2
3		31513	Terminal		4
4		37408 37049	Connector, Switch Terminal, Female Blade		2 2
5		37409 37049 37410	Connector, Light Terminal, Female Blade Terminal, Female Blade		2 3 1
6		31504	1/4 Ring		1
7		31513 38000	Terminal Connector		2 2



WIRING HARNESS

Gauge and Switch Lights

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		37729	Harness, Gauge and Lights Switch		1
2		38001 31031	Connector Terminal		1 1
3		F101597	Light Bulb		4
4		31503	#10 Ring Terminal		3
5		NW33538	Light Assembly		2
6		37409 37049	Connector, Light Terminal, Female		4 8
7		37049	Terminal, Female		1
8		31512	Terminal		1
9		31513	Terminal		2



ENGINE HARNESS

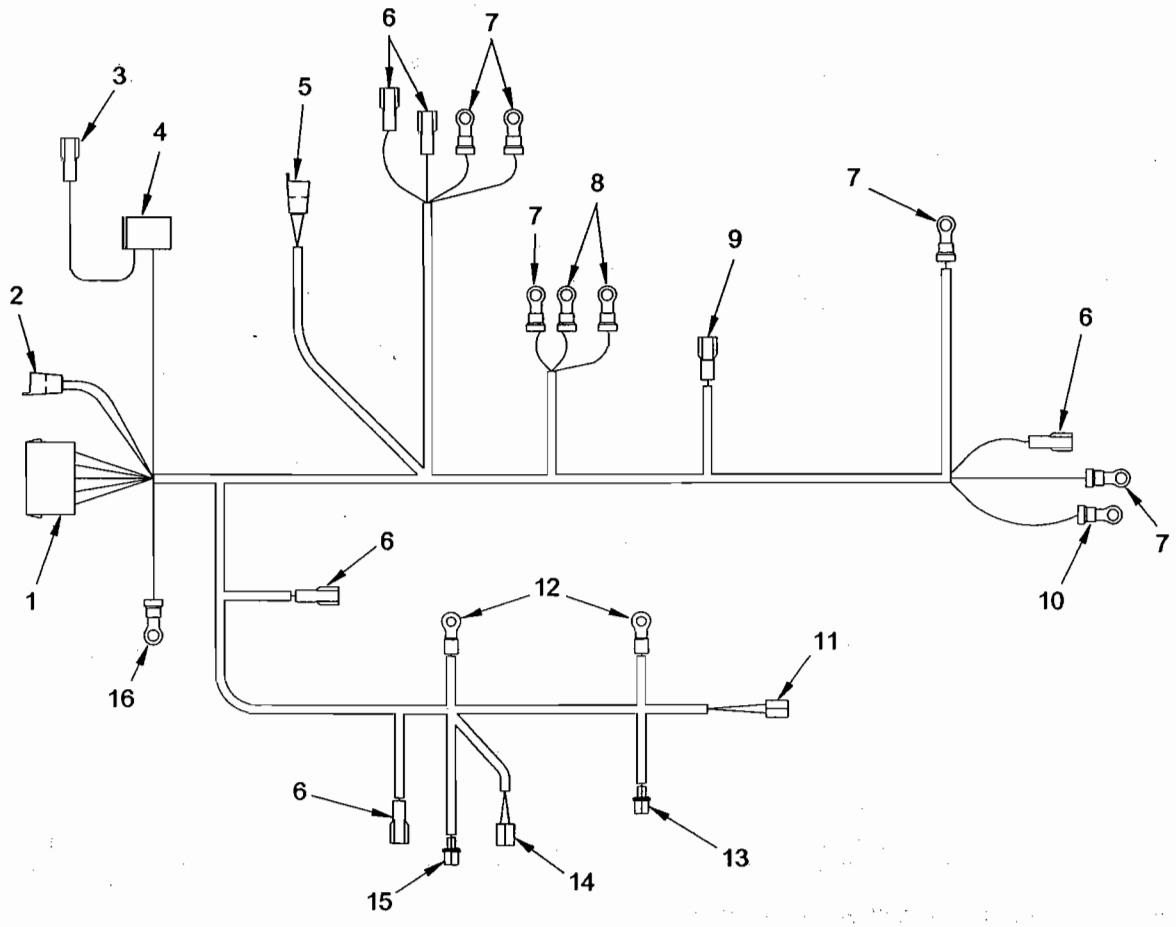
Ford 300

Item	Owner Use	NMC Part No.	Vendor Part No.	Description	Eff	Qty
1		37832		Engine Harness		1
2		F101562 F100929	1-480709-0 350550-1	12-Way Connector Terminal		1 11

Note: Other harness parts are available if required.

ENGINE HARNESS

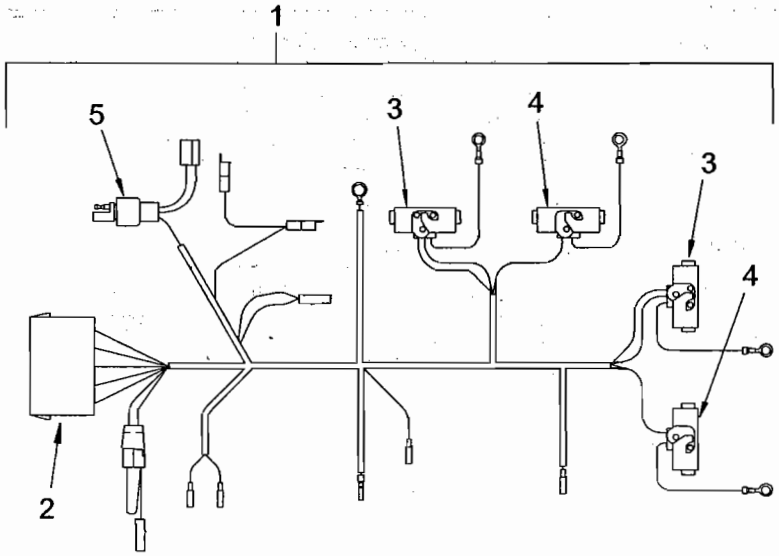
Perkins 4.236



WIRING HARNESS

Perkins 4.236 Engine

Item	Owner Use	NMC Part No.	Vendor Part No.	Description (CAGE Code)	Eff	Qty
		37819		Harness, Engine		1
1		F101562 F100929	1-480709-0 350550-1	12-way Connector (1Z829) Terminal (1Z829)		1 11
2		F101550 F101552	38002 31030	Connector, Female (58961) Terminal (58961)		1 2
3		F103621	32515	Terminal (58961)		1
4		37408 37049	SSH-0100 42100-2	Connector, Switch (Adv. Tech.) Terminal, Female Blade (1Z829)		1 2
5		F101550 F101552	38002 31030	Connector, Female (58961) Terminal (58961)		1 2
6		F102204	31513	Terminal (58961)		5
7		F100846	31503	#10 Ring (58961)		4
8		F103622	33503	5/16 Ring (58961)		2
9		F103621	32512	Terminal, 3/8 Female (58961)		1
10		F101553	32504	5/16 Ring (58961)		1
11		F101551 F101927	38003 31031	Connector (58961) Terminal (58961)		1 2
12		F101850	31504	1/4 Ring (58961)		2
13		37640 37308 37310	38043 31035 39001	Connector, Tower Half (58961) Terminal, Female (58961) Cable Seal (58961)		1 1 1
14		F101551 F101927	38003 31031	Connector (58961) Terminal (58961)		1 1
15		37640 37308 37310	38043 31035 39001	Connector, Tower Half (58961) Terminal, Female (58961) Cable Seal (58961)		1 1 1
16		F104429	33501	#10 Ring (58961)		1

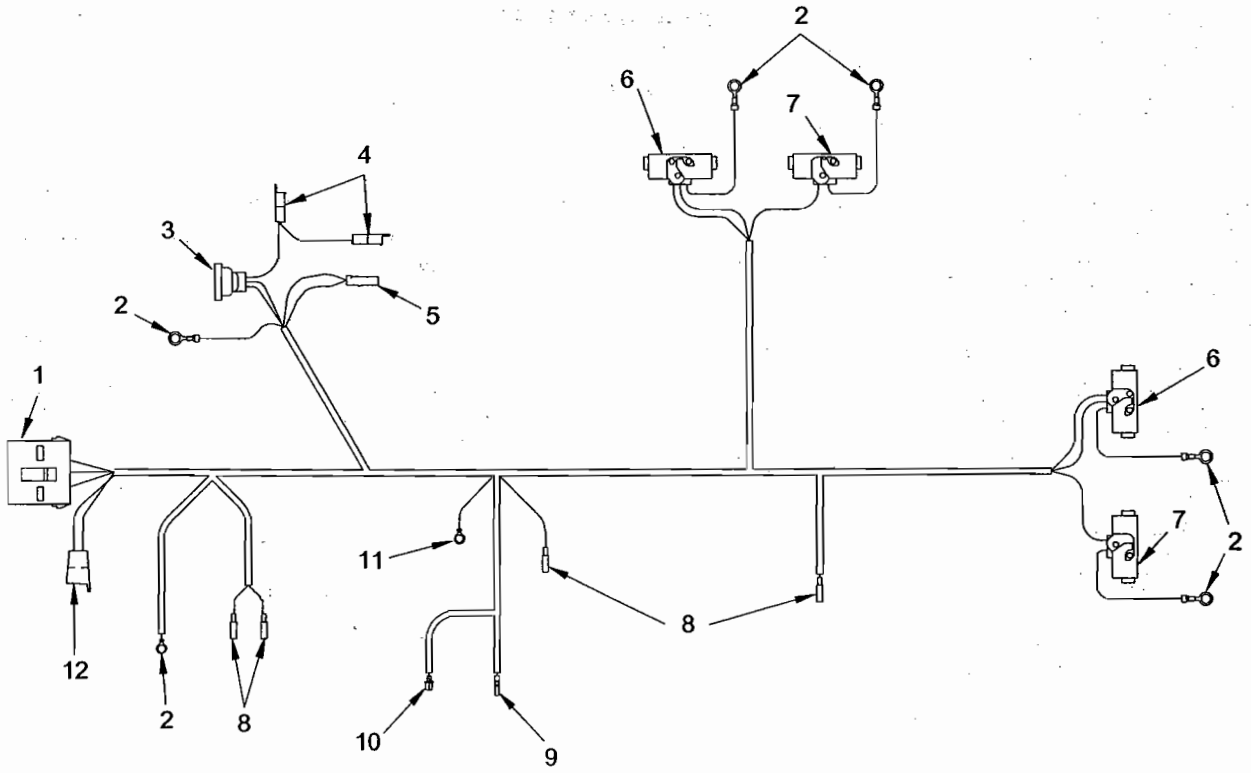


REAR HARNESS

(models with Ford 300 Engine/C6 Transmission)

Item	Owner Use	NMC Part No.	Vendor Part No.	Description	Eff	Qty
1		NW36429		Rear Harness		1
2		F101562 F100929	1-480709-0 350550-1	12-way Connector Terminal		1 10
3		NW35616	93170-001	Light Connection		2
4		NW35615	93169-001	Light Connection		2
5		37540		Connector		1

Note: Other harness parts are available if required.



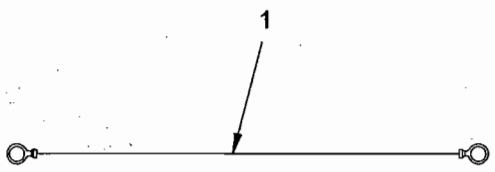
REAR HARNESS

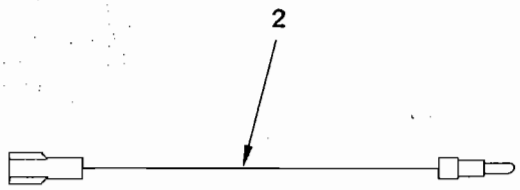
(used with Perkins 4.236 engine)

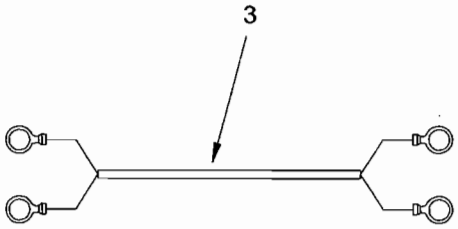
Item	Owner Use	NMC Part No.	Vendor Part No.	Description (CAGE Code)	Eff	Qty
		NW36818		Harness, Rear		1
1		F101562 F100929	1-480709-0 350550-1	Connector (1Z829) Terminal (1Z829)		1 10
2		F100846	31503	#10 Ring Terminal (58961)		6
3		NW19242		Connector		1
4		F100548 F101552	38000 31030	Terminal Body (58961) Terminal (58961)		2 2
5		F104341 F101549	31760 38001	Butt Connector (58961) Terminal Body (58961)		1 1
6		NW35616	93170-001	Harness, Light Wire (80019)		2
7		NW35615	39018-001	Harness, Light Wire (80019)		2
8		F101890	31568	Bullet Connector (58961)		4
9		F100527	31561	Bullet Connector (58961)		1
10		37640 37308 37309	38043 31035 39000	Connector (58961) Terminal, Female (58961) Seal (58961)		1 2 2
11		F101772	31505	5/16 Ring Terminal (58961)		1
12		F101550 F101552	38002 31030	Terminal Body (58961) Terminal (58961)		1 2

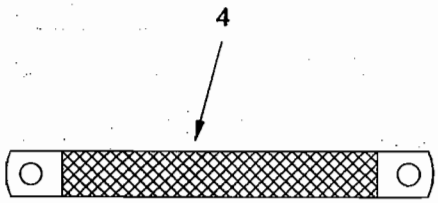
WIRING HARNESSES

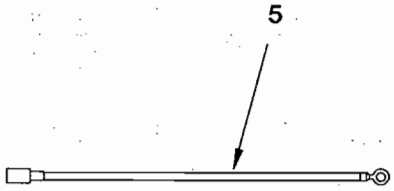
Various

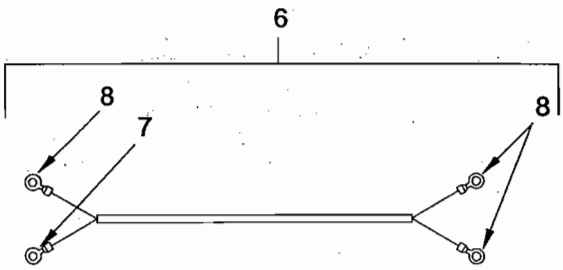


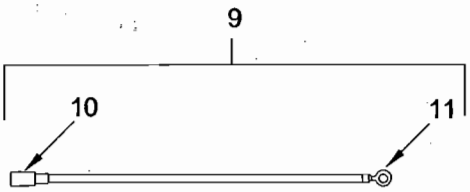


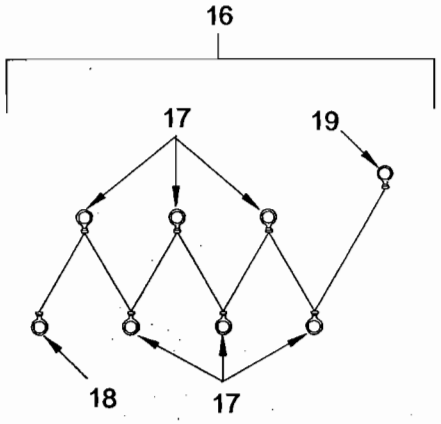


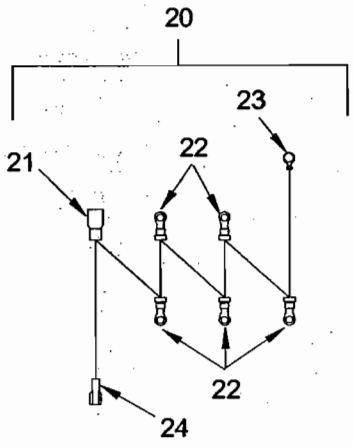












WIRING HARNESSES

Various

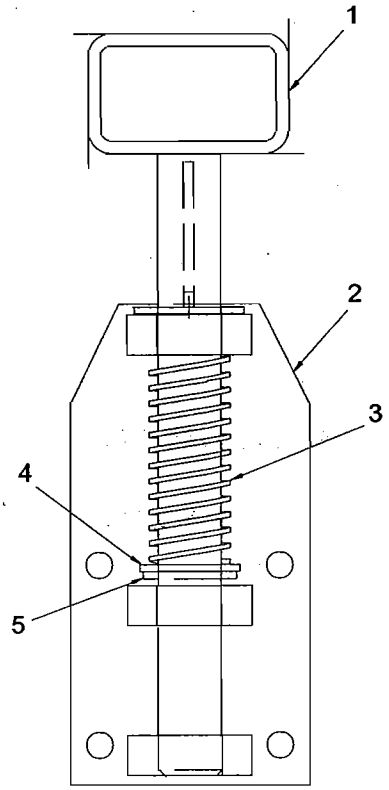
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		37732	Wire Assembly, Green, Terminal Block		1
2		NW26372 F6059 F100522 F100527 F102204	Wire Assembly Wire, 14 Ga. Red Loom Terminal, Bullet Terminal, Female Insulated		1 17" 15" 1 1
3		NW22788	Harness, Fuel Tank		1
4		NW10518FB	Strap, Ground		1
5		NW36825 2.3478 F101792 F102369 F102008	Harness, Starter (Ford) Conduit .25 Flexgaurd Wire, 12 Ga. Red/White Terminal, Female Terminal		1 33" 33" 1 1
6		NW31776	Harness, Starter (Perkins)		1
7		F103623	Terminal		3
8		F104429	Terminal		1
9		NW31845	Wire, Ground to Inj. Pump (Perkins)		1
10		F102204	Terminal		1
11		F101772	Terminal		1
12-15			NOT USED		1
16		NW35413	Harness, Dash Panel Jumper		1
17		32502	#10 Ring		6
18		31503	#10 Ring		1
19		31504	1/4 Ring		1
20		NW35412	Harness, Gauge Jumper		1
21		32515	Terminal		1
22		32502	#10 Ring		5
23		31503	#10 Ring		1
24		31513	Terminal		1

NOTE: Always check OPTIONS before ordering parts. Most options will replace or modify one of the standard assemblies.


nmc
NORTHWESTERN
MOTOR CO., INC.

Hitch, 1-1/2" Pin

Option #39138

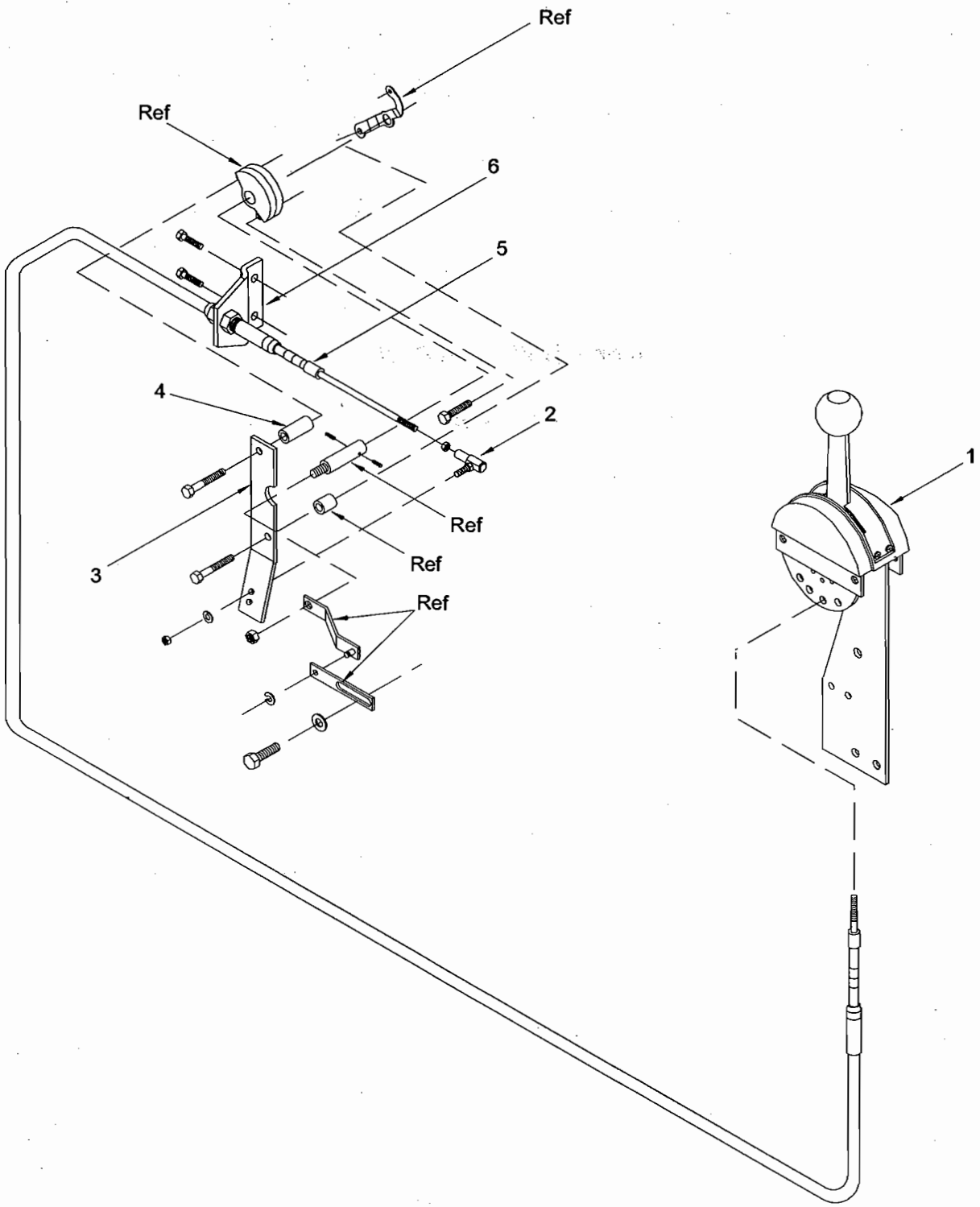


Hitch

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		39138	Hitch (incl. items 1-5)		1
1	9200366	39140	Pin Assembly		1
2		39139	Hitch Weldment		1
3	9200365	39141	Spring		1
4		39487	Washer		1
5		SWXRP202	Pin		1

Morse Shifter on Dash

Option #40672


Ref
Ref
6
5
4
2
1
Ref
Ref
3
Ref

Morse Shifter on Dash

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		NW34591	Shift Control Assembly (with U-Bolts)		1
2		F101863 NW34593	Ball Joint, 1/4-28 Ball Joint, 5/16-24		1 1
3		38647	Plate, Shift Arm Extension		1
4		38648	Spacer, 1-1/2"		1
5		NW34592	Cable, Transmission Shift		1
6		NW36794	Bracket, Shift Cable		1

Delete from standard:

37417	Shifter, C-6
NW31669	Cable, Shift
NW34343	Kit, Connector, C-6 Transmission

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Wiring through Ignition

Option #41762

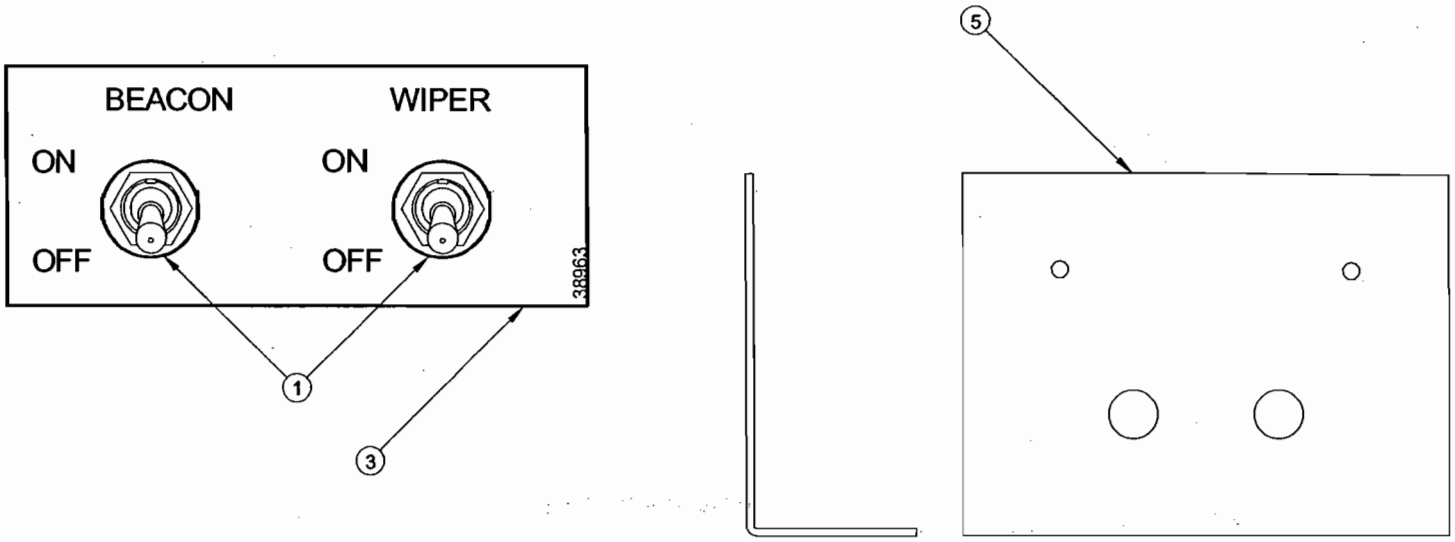
Option Wiring Through Ignition

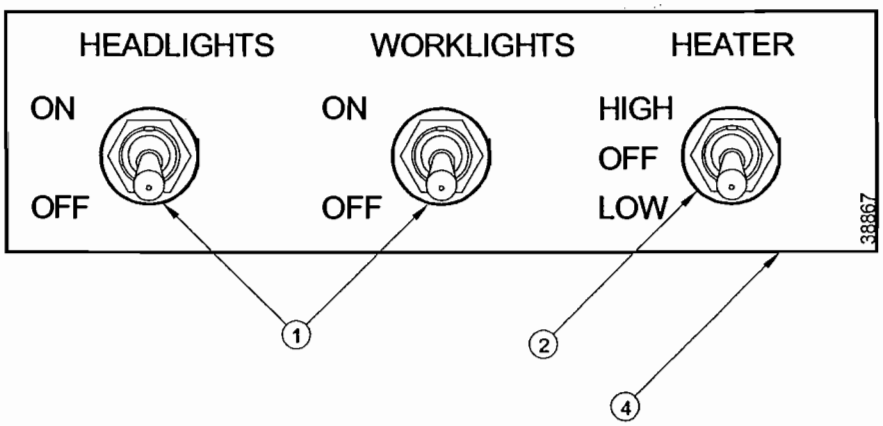
Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		39892	Solenoid, 12V Continuous		1
2		39893	Harness, Ignition, Solenoid		1

Toggle Switch

Military Spec.

Option # 42116

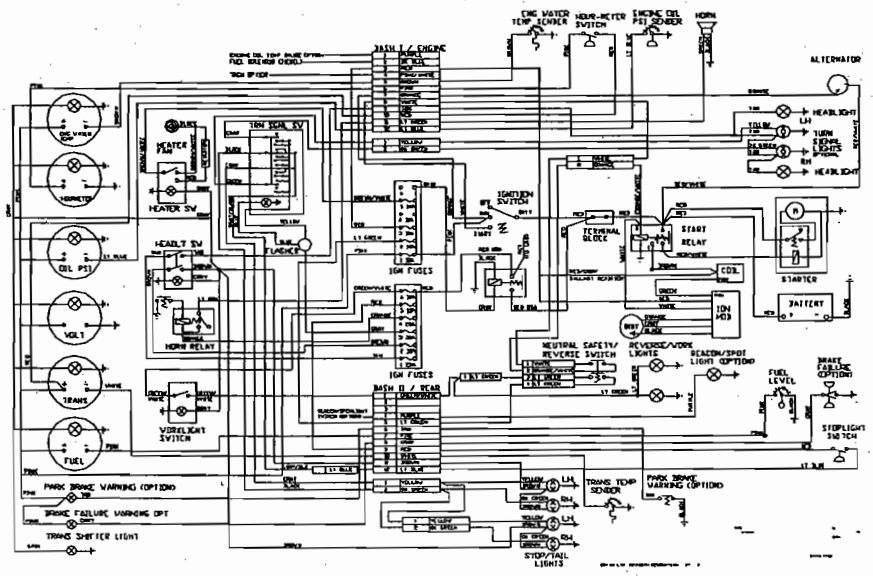




TOGGLE SWITCHES

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		42116	Military Spec. Toggle Switches		1
1		38863	Switch, Toggle, SPDT, MS3505		4
2		38864	Switch, Toggle, DPST, MS3505		1
3		38963	Plate, Data, Switch		1
4		38867	Plate, Data, Switch		1
5		38964	Bracket, Switch, 14 Ga.		1
NS		38862	Plate, Instrument Panel		1
NS		38886	Harness I Dash, Airline		1
NS		38887	Harness II Dash, Airline		1
NS		38888	Harness, Gauge Lights, Airline		1
NS		42868	Harness, O/H Gaurd		1
NS	9203328	41789	Resistor Assy., Heater		1

ELECTRICAL SCHEMATIC 38115



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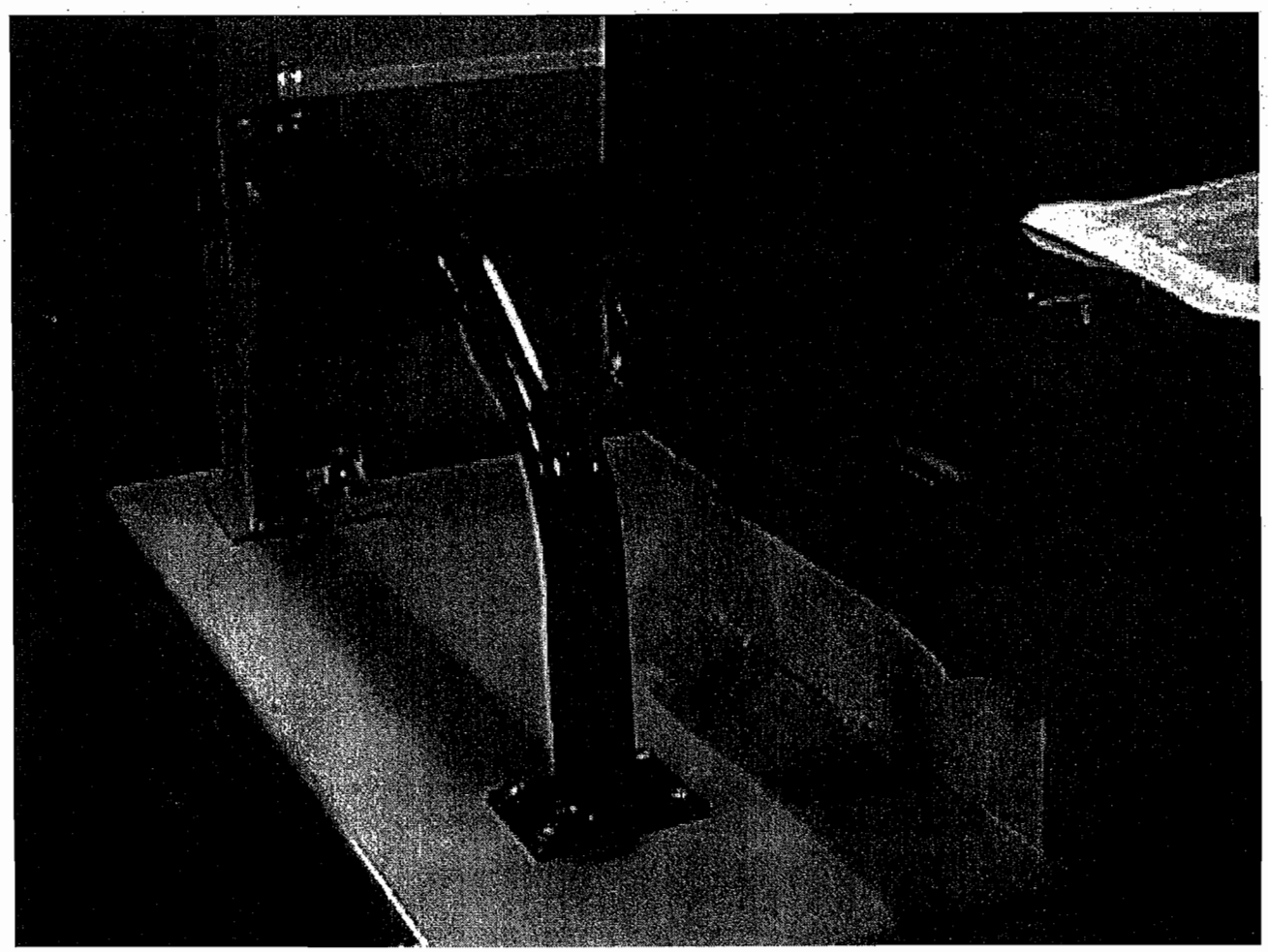
Hip Guards

Option #42459

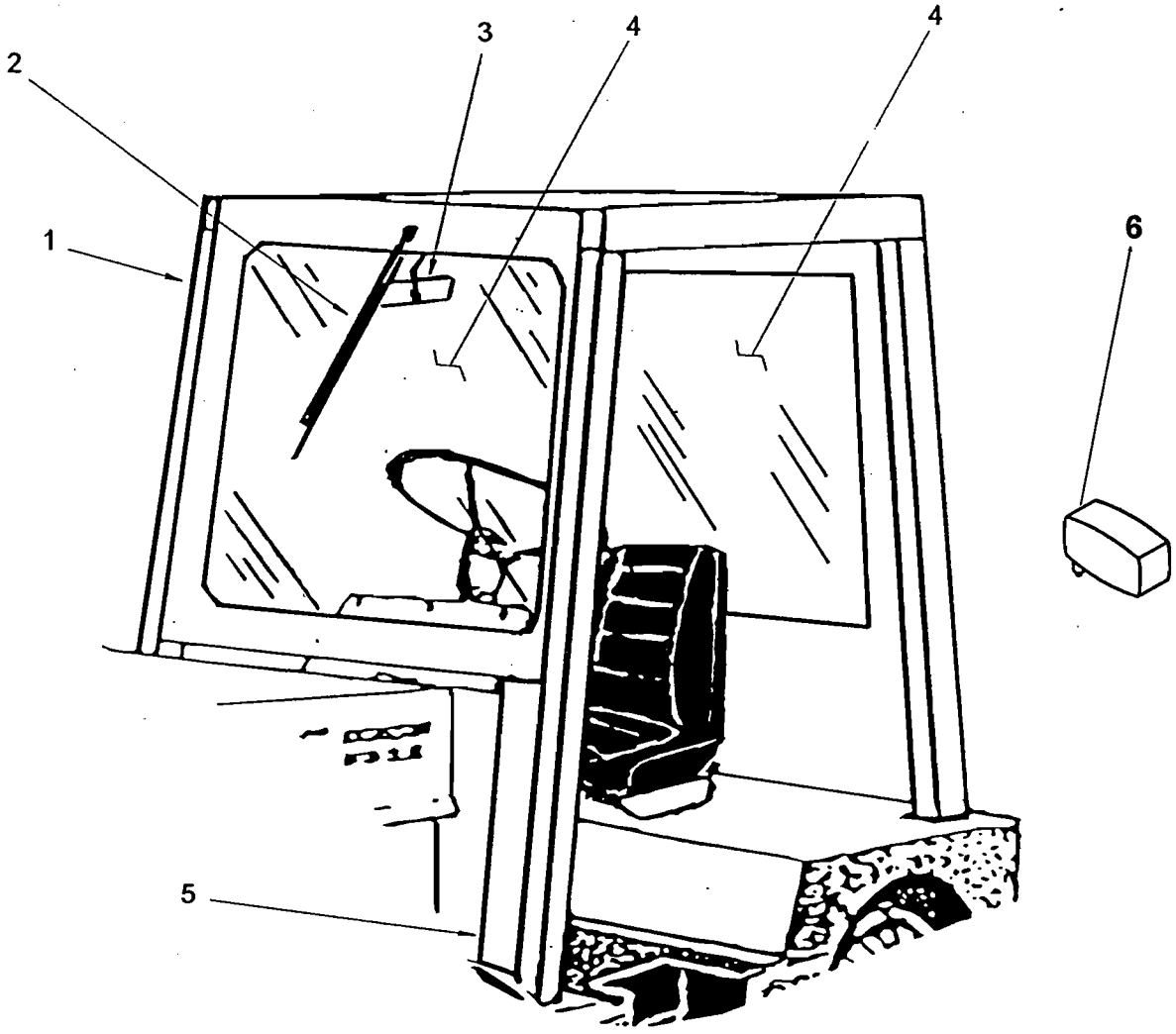


Option Guard Weldment

Item	Owner Use	NMC Part No.	Description	Eff	Qty
		42459	Option Hip Guards		
1		40576	Guard Weldment, Hip, RH		1
2		42461	Guard Weldment, Hip, LH		1

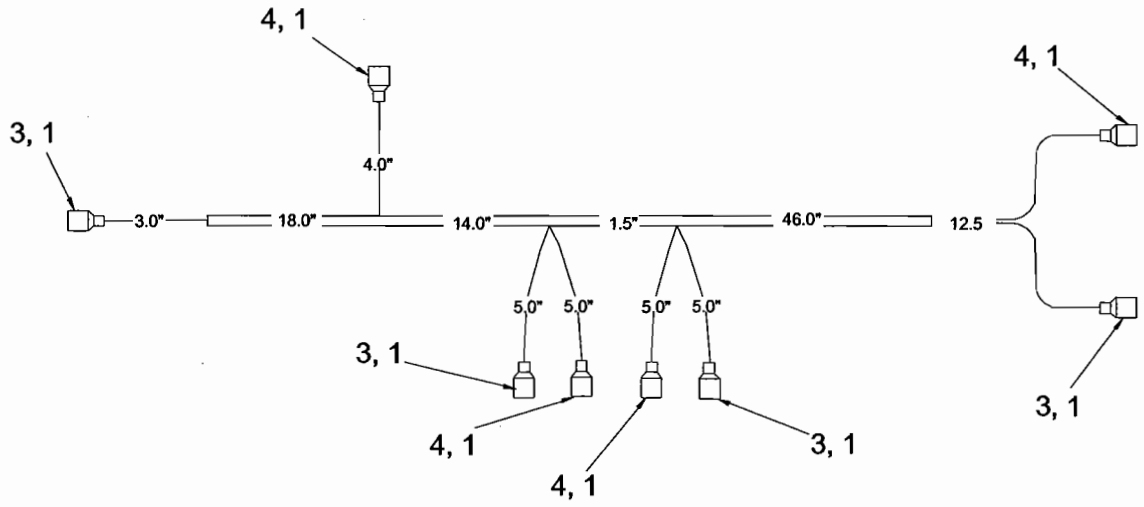
Econo Cab

Option #42522



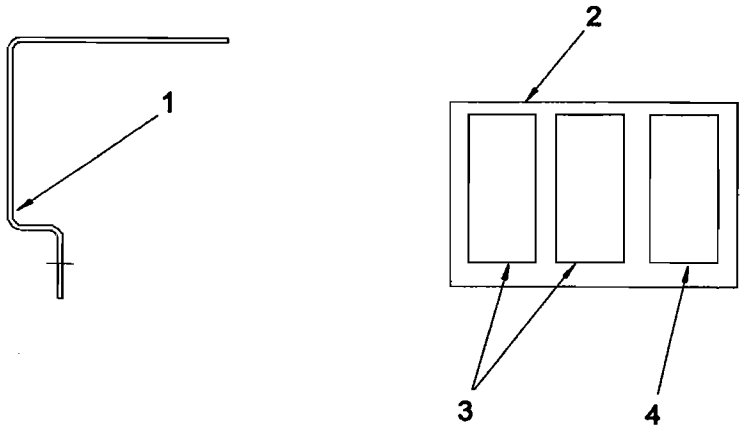
Cab Option

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		42504 NW034853	Guard Weldment Gasket, Cab Mounting		1 81"
2		NW36120 NW33315 NW33314	Motor, Wiper, Cab Arm, Wiper Blade, Wiper		1 1 1
3		NW33318	Mirror, Inside		1
4		NW35932 37711	Window Seal, Window		2 274"
NS		40166	Panel,RH, Overhead Guard		1
NS		40167	Panel, LH, Overhead Guard		1
5		NW34579	Seal, Rubber Trim		47"
6		40559	Domelight		1
NS		42517	Brkt Wldmt, Beacon		1



Cab Harness

Item	Owner Use	NMC Part No.	Description	Eff	Qty
0		38965	Harness, OH Guard, Electrical		1
1		F102204	Terminal, Female, 16 Ga.		8
2			NOT USED		
3		F9794	Wire, Red, 16 Ga.		103"
4		F103622	Wire, Lt. Blue, 16 Ga.		86"



Cab Electrical

Item	Owner Use	NMC Part No.	Description	Eff	Qty
1		40049	Bracket, Switch, Cab		1
2		NW35380	Frame, 3-Switch		1
3		NW34176 NW35384 NW36552	Switch Assembly, Rocker Insert, Switch Beacon, Green Insert, Switch, Wiper		2 1 1
4		NW35379	Blank, Switch		1
NS NS		NW10526C20 NW36843	Fuse, 20A Clip, Insluated, 5/16 ID		2 4

Canvas Doors

Option #42525

Canvas Door Kit for Cab

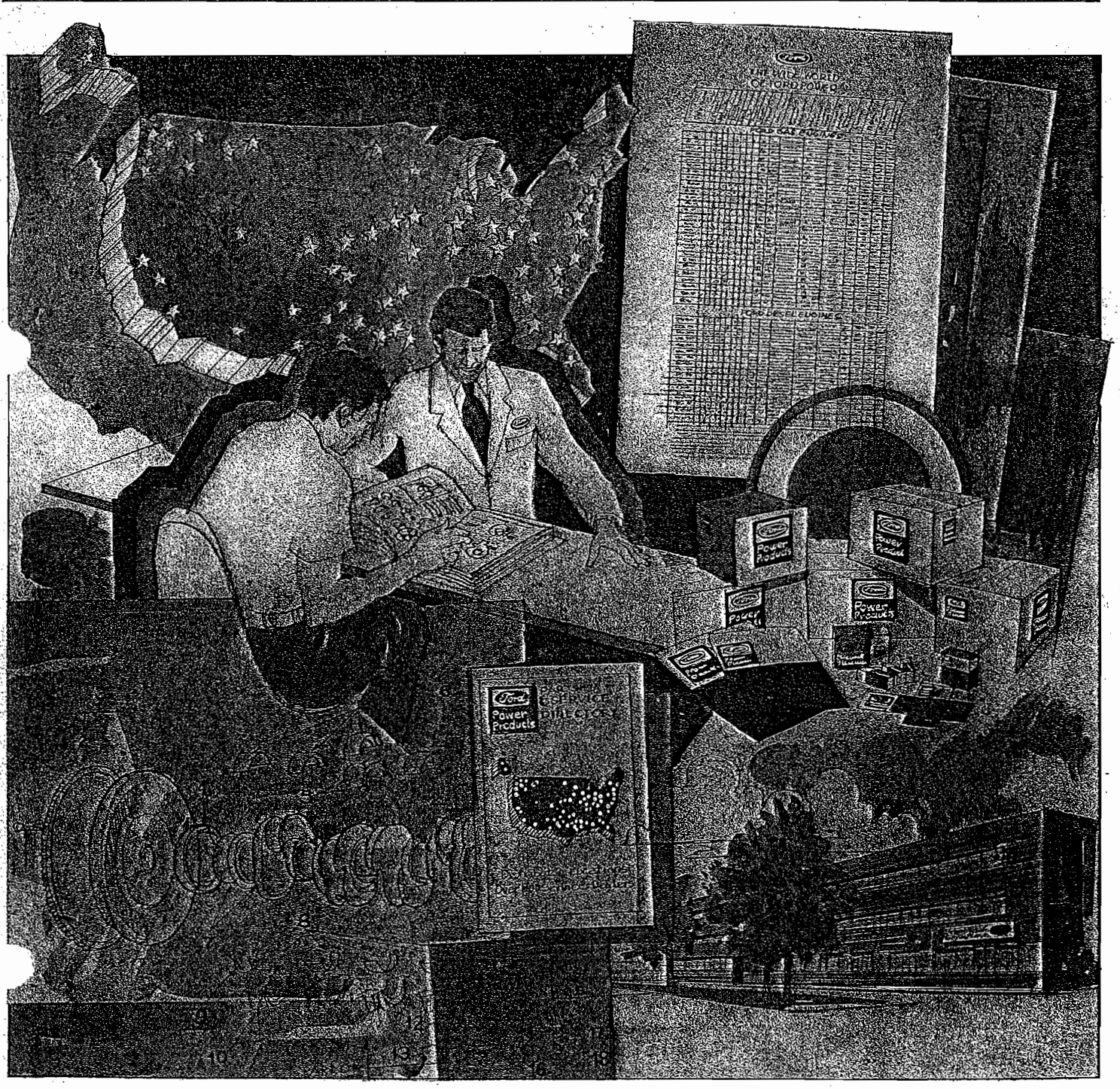
Item	Owner Use	NMC Part No.	Description	Eff	Qty
		42525	Kit, Canvas Doors (incl. Doors, Strap, Snap, Rivets, and Instruction Sheet for each door)		1
1		40425	Door, RH		Ref
2		40426	Door, LH		Ref
3		40460 42523 42524	Plate, 43", Canvas Door Retainer Plate, 42.75", Canvas Door Retainer Plate, 51.75", Canvas Door Retainer		2 2 2

Ford

Power Products

PARTS LIST

CSG-649 & CSG-649P
300 C.I.D.
GASOLINE ENGINE
AND POWER UNIT



GENERAL INFORMATION

This Ford Power Products Division parts catalog has been prepared to assist you, the owner, in identifying the correct replacement parts for your Ford industrial engine.

The catalog is divided into major sections which correspond to specific areas of the engine, such as cylinder block, cylinder head, crankshaft, oil pump, water pump, etc. Each of these sections is made up of illustrations followed by text for identifying detail parts.

ILLUSTRATIONS

The illustrations show typical assemblies but may not in all cases show the shape or details of parts required. However, the purpose of the illustrations is to identify parts through visual and descriptive assistance. Illustrations are located at the beginning of each section or immediately adjacent to the applicable text. Parts are identified on each illustration by reference numbers. Find the reference number of the part desired and locate it in the parts list reference column. As you will note, only the year, part name description and quantity are shown. When ordering replacement parts for your engine it will be necessary to contact your local Ford Power Products Distributor.

PARTS INFORMATION

Each listing contains illustrations, reference number, the effective year range, part name including description, and the quantity required to assist in identifying the correct part.

SYMBOLS IN YEAR COLUMN

81 Parts used commencing with initial production of engines are indicated by only the year in which production commenced.

81/92 Parts used for a period of years and then discontinued are indicated in the year column by a commencing and finishing year.

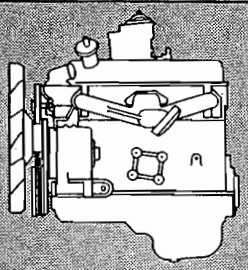
81/ Parts still used in current production are indicated by the commencing year followed by a slant (/).

NOTE: The description and specifications contained in this manual were in effect at the time the book was released for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design, without notice and without incurring obligation.

WE'VE GOT THE POWER!

GASOLINE ENGINES

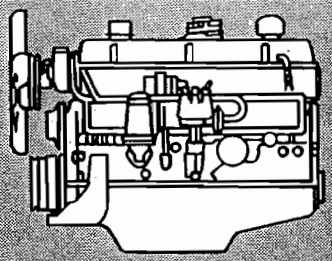
Ford's gasoline engines, ranging from the 1.1 liter (67 CID) to the 7.5 liter (460 CID), have for decades, provided power for all types of industrial, agricultural, construction and marine equipment.



1.1L (67 CID) to 7.5L (460 CID)

DRY FUEL (LPG & NATURAL GAS) ENGINES

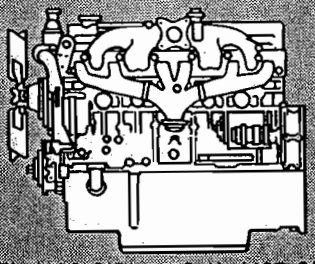
For over 15 years, thousands of Ford engines have been run on dry fuel in sweepers, forklift trucks, generator sets and irrigation equipment. Ford offers dry fuel engines in 1.1, 1.3, 1.6, 2.3, 4.9 6.1, 7.0 and 7.5 liter displacements.



1.1L (67 CID) to 7.5L (460 CID)

DIESEL ENGINES

Ford diesels range from a 2.7 liter to a 8.1 liter engine. Ford offers diesel engines for vehicles, generator sets, agricultural, industrial and construction equipment.



2.7L (168 CID) to 8.1L (495 CID)

PARTS & SERVICE SUPPORT

There are 65 Ford Power Products Distributor locations in the U.S. alone. A nationwide network of service support, plus many Ford Parts & Service outlets worldwide. For over 50 years, we've proven that Ford's got the power!

Ford Power Products

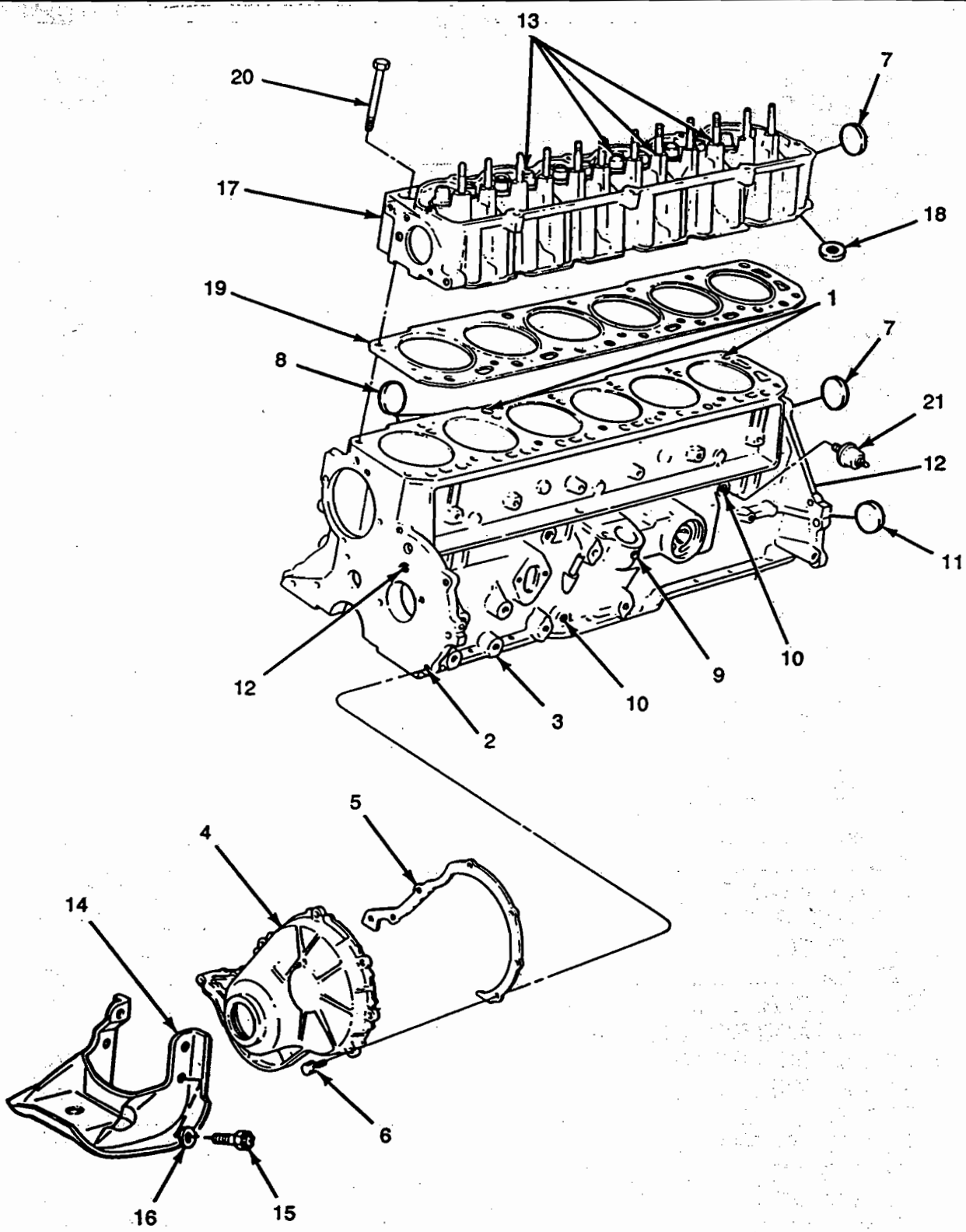
CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

Ford Power Products

INDEX

Ford Power Products

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

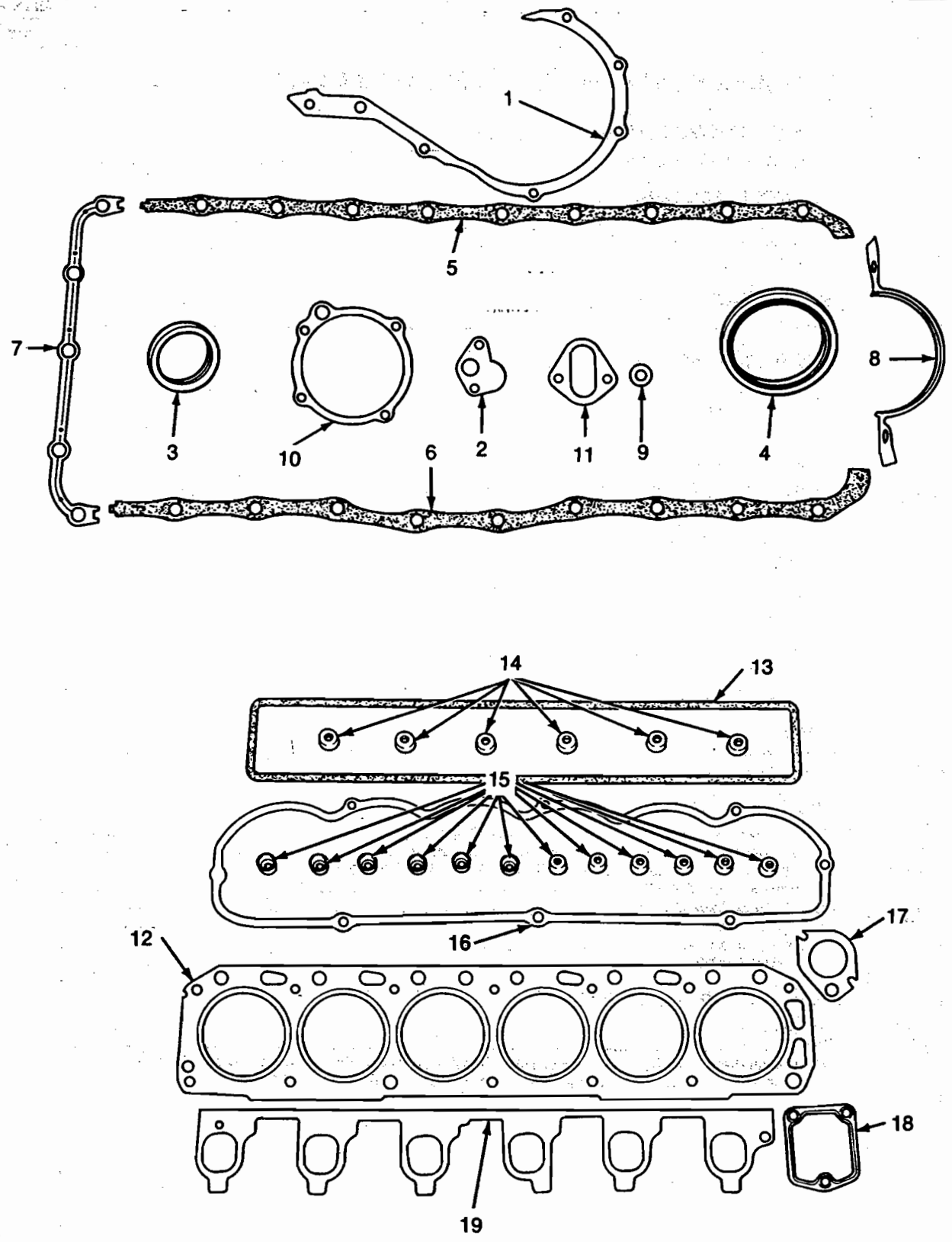


CYLINDER BLOCK, HEAD AND RELATED PARTS — TYPICAL IE-31A

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

Ford Power Products

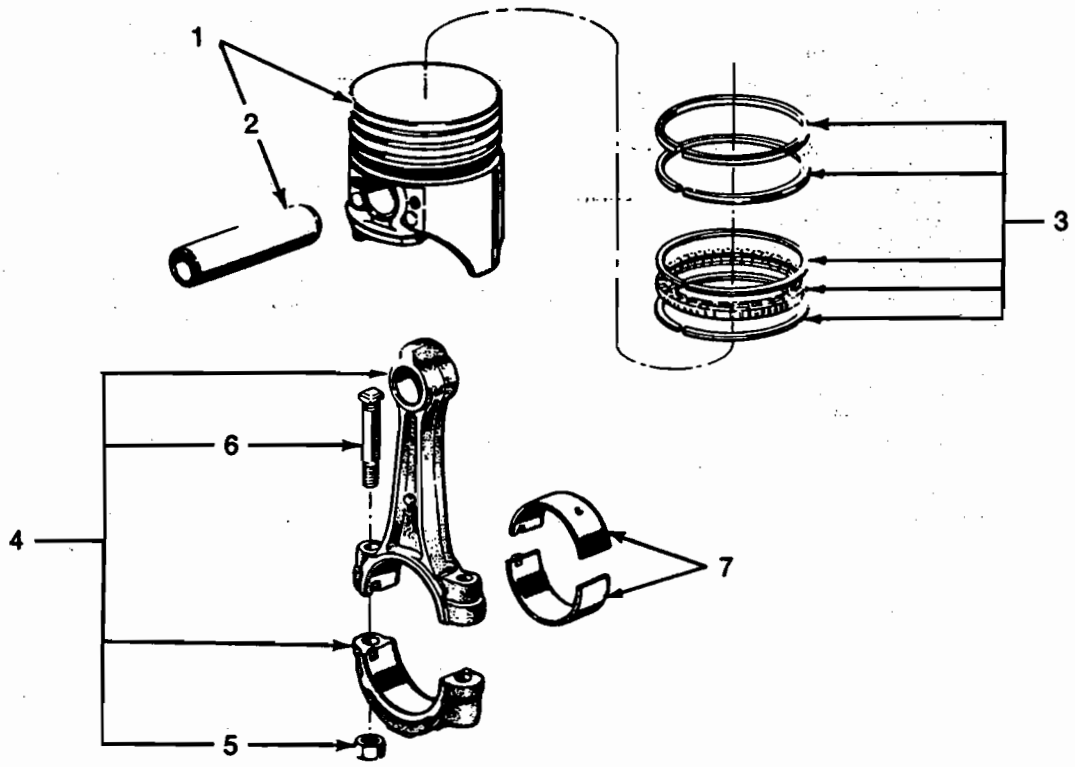
REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		CYLINDER BLOCK, HEAD AND RELATED PARTS	
		DOWEL - CYLINDER HEAD TO BLOCK	
1	70/	Dowel - Cylinder Head to Block - 1/2 Diameter	2
		CYLINDER ASSEMBLY	
		INCLUDES CYLINDER BLOCK WITH ALL INTERNAL PARTS OF THE ENGINE - DOES NOT INCLUDE OIL PAN, OIL PUMP, CYLINDER HEAD OR CYLINDER FRONT COVER	
2	70/	Cylinder Assembly	1
		BLOCK ASSEMBLY - CYLINDER	
3	70/	Block	1
		COVER ASSEMBLY - CYLINDER FRONT	
4	70/	Cover Assembly - Use E6DZ-6700-A Seal	1
5	70/	Gasket - Front Cover	1
6	70/	Bolt - 5/16-18 x .875	6
		PLUG - ENGINE	
7	70/	Standard - 2.078 OD - Rear Of Block And Cylinder Head	2
	70/	.060 O/S - Rear Of Block And Cylinder Head	A/R
8	70/	Standard - 1.625 OD - Clean Out Holes In Block	5
	70/	.060 Oversize - Clean Out Holes In Block	A/R
9	70/	Standard - .259 OD - Distributor Oil Access Hole In Block	1
	70/	.060 O/S - Distributor Oil Access Hole In Block	A/R
10	70/	1/4 NPT	1
11	70/	Plug - Standard - Camshaft Rear Bearing	1
	70/	Plug - .060 OS - Camshaft Rear Bearing	A/R
12	70/	3/8 NPT	3
13	70/	3/4 NPT - Core Holes In Top Of Cylinder Head	4
		SUPPORT - ENGINE FRONT	
14	70/	Support	1
15	70/	Bolt - 7/16-14 x .875	4
16	70/	Washer - 7/16 Flat	4
		HEAD ASSEMBLY - CYLINDER	
17	70/	* Cylinder Head Less Valves - With Exhaust Valve Seat Inserts	1
	70/	* Cylinder Head Complete - With Exhaust Valve Seat Inserts	1
	70/84	Cylinder Head Less Valves - Necessary To Use D0AZ-6A529-A Nuts (Rocker Arm Stud) On Units Built Prior To 1978	1
	85/	Cylinder Head Less Valves	1
18	70/	Valve Seat Inserts	6
19	70/	Gasket - Cylinder Head	1
20	70/	Bolt - 7/16-14 x 3.94	14
		SENDING UNIT - OIL PRESSURE	
21	70/86	Sending Unit	1
	87/	Sending Unit	1
		* On Engines Built Prior To 1985 - It Is Necessary To Change The Water Outlet Connection, Rocker Arms, Rocker Arm Cover, Rocker Arm Fulcrum Guide, Rocker Arm Fulcrum Seat Etc.	



ENGINE GASKET SETS — TYPICAL IE-32

Ford Power Products

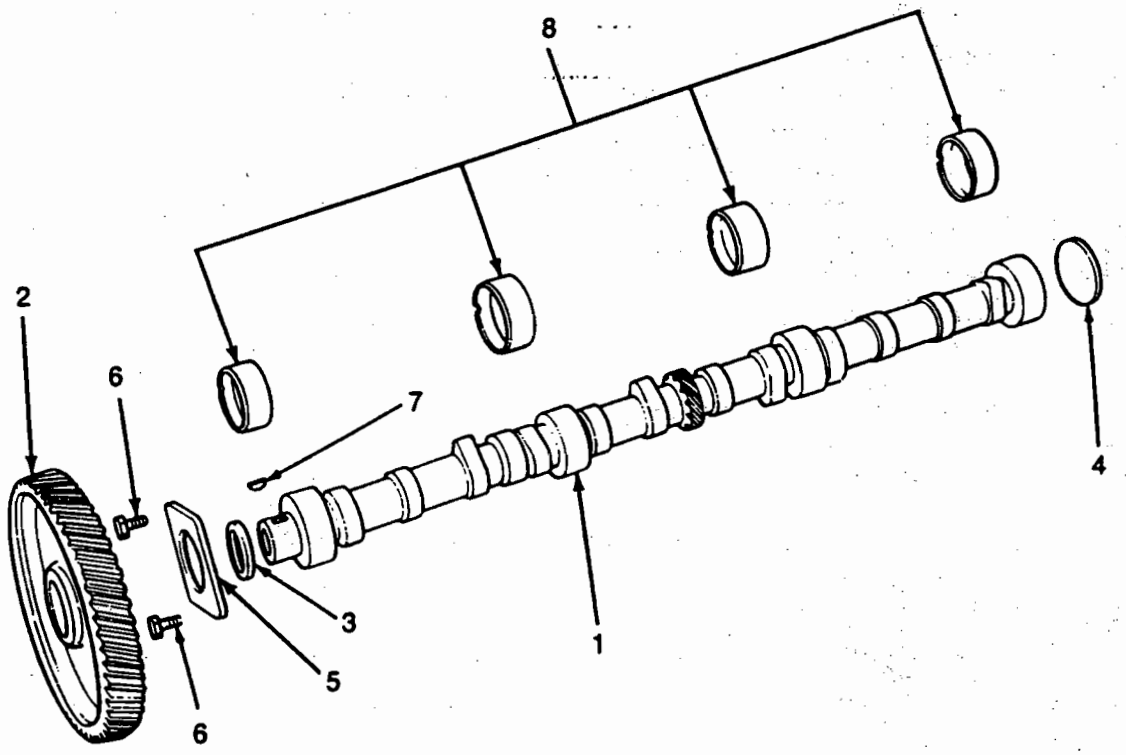
REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		GASKET SETS - ENGINE	
		GASKET SET - LOWER	
	70/85	Gasket Set	1
		CONSISTS OF:	
1		Gasket - Front Cover	1
2		Gasket - Oil Pump Inlet	1
		Gasket - Oil Pump Inlet	1
3		Oil Seal - Front Cover - Rear Entry	1
4		Seal - Crankshaft Rear	1
5		Gasket - Oil Pan - Right	1
6		Gasket - Oil Pan - Left	1
7		Seal - Oil Pan - Front	1
8		Seal - Oil Pan - Rear	1
9		Gasket - Oil Pan Drain Plug	1
10		Gasket - Water Pump Mounting	1
11		Gasket - Fuel Pump	1
	85/87	Gasket Set	1
		CONSISTS OF:	
1		Gasket - Front Cover	1
2		Gasket - Oil Pump Inlet	1
3		Oil Seal - Front Cover - Front Entry	1
4		Seal - Crankshaft Rear	1
5		Gasket - Oil Pan - Right	1
6		Gasket - Oil Pan - Left	1
7		Seal - Oil Pan - Front	1
8		Seal - Oil Pan - Rear	1
9		Gasket - Oil Pan Drain Plug	1
11		Gasket - Fuel Pump	1
	88/	Gasket Set - One Piece Pan Gasket	1
		CONSISTS OF:	
1		Gasket - Front Cover	1
2		Gasket - Oil Pump Inlet	1
3		Oil Seal - Front Cover - Front Entry	1
4		Seal - Crankshaft Rear	1
5		Gasket - Oil Pan - One Piece	1
9		Gasket - Oil Pan Drain Plug	1
11		Gasket - Fuel Pump	1
		GASKET SET - VALVE GRIND	
	70/87	Gasket Set	1
		CONSISTS OF:	
12		Gasket - Cylinder Head	1
13		Gasket - Push Rod Cover	1
14		Grommet - Push Rod Cover Bolt	6
15		Seal - Valve Stem	6
		Seal - Valve Stem	12
16		Gasket - Rocker Arm Cover	1
17		Gasket - Water Connector	1
18		Gasket - Manifold	1
19		Gasket - Intake Manifold	1
	88/	Gasket Set	1
		CONSISTS OF:	
12		Gasket - Cylinder Head	1
13		Gasket - Push Rod Cover	1
14		Grommet - Push Rod Cover Bolt	6
15		Seal - Valve Stem	12
16		Gasket - Rocker Arm Cover	1
17		Gasket - Water Outlet Connection - LO Fan	1
19		Gasket - Intake Manifold	1



PISTON, CONNECTING ROD AND RELATED PARTS — TYPICAL IE-33

Ford Power Products

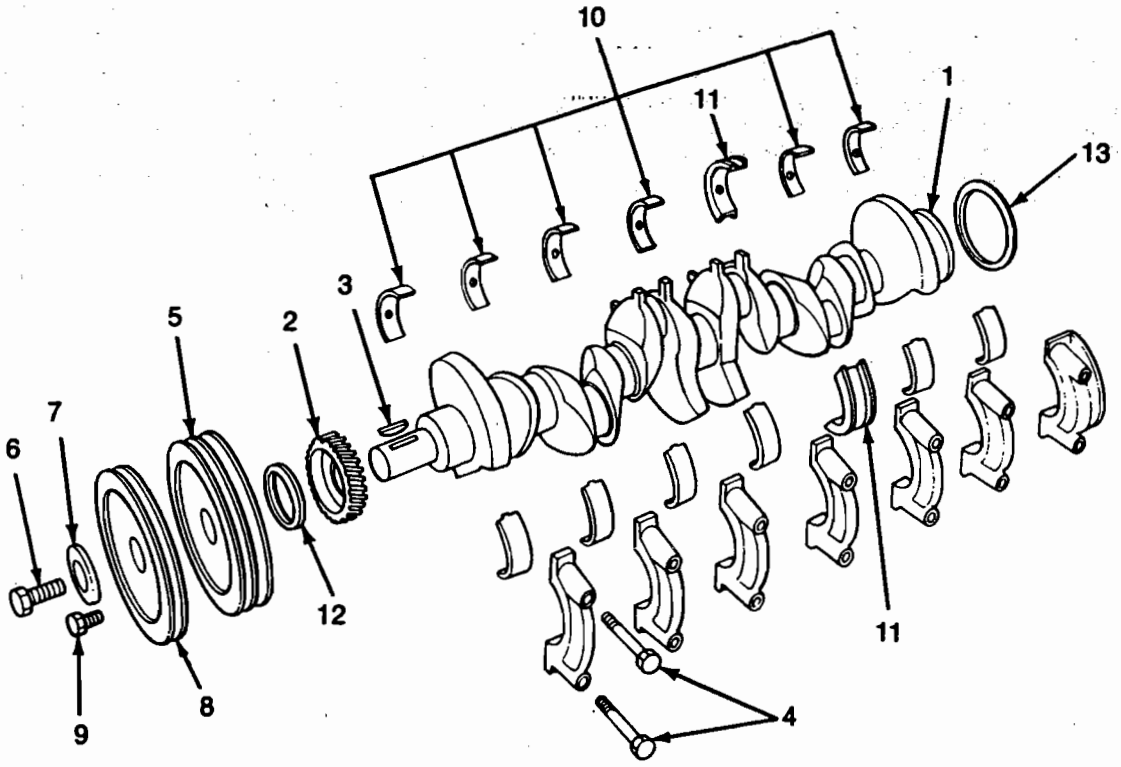
REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		PISTON, CONNECTING ROD AND RELATED PARTS	
		PISTON ASSEMBLY	
		INCLUDES FITTED PIN	
1	73/	Piston - Standard	6
	73/	Piston - .003 O/S	A/R
	73/	Piston - .020 O/S	A/R
	73/	Piston - .030 O/S	A/R
	73/	Piston - .040 O/S	A/R
		PIN - PISTON	
2	70/	Pin - 3.17 Long - .975 OD	6
		RING SET - PISTON PARTIAL	
		CONSISTS OF NECESSARY RINGS TO RE-RING 2 PISTONS	
3	70/73	Ring Set - Standard	3
	70/73	Ring Set - .020 O/S	A/R
	70/73	Ring Set - .030 O/S	A/R
	70/73	Ring Set - .040 O/S	A/R
	73/	Ring Set - Standard	3
	73/	Ring Set - .020 O/S	A/R
	73/	Ring Set - .030 O/S	A/R
	73/	Ring Set - .040 O/S	A/R
		CONNECTING ROD ASSEMBLIES	
4	70/	Rod Assembly - Connecting	6
5	70/	Nut - 3/8-24	12
6	70/	Bolt - Connecting Rod	12
		BEARING SET - CONNECTING ROD - UPPER AND LOWER	
7	70/	Bearing - Standard	12
	70/	Bearing - .001 U/S	A/R
	70/	Bearing - .002 U/S	A/R
	70/	Bearing - .010 U/S	A/R
	70/	Bearing - .020 U/S	A/R
	70/	Bearing - .030 U/S	A/R



CAMSHAFT, GEAR, BEARINGS AND RELATED PARTS — TYPICAL IE-34

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		CAMSHAFT, GEAR, BEARINGS AND RELATED PARTS	
1	70/	Camshaft Assembly - Less Gear	1
2	70/	* Gear Set - With Phenolic Tooth Cam Gear	1
	70/	Gear - Camshaft - Steel Tooth Gear - Not Interchangeable With Phenolic Gear	1
3	70/	Spacer - Cam Gear - 1-1/2 OD - 1-1/4 ID	1
4	70/	Plug - Standard - Camshaft Rear Bearing	1
	70/	Plug - .060 OS - Camshaft Rear Bearing	A/R
5	70/	Plate - Cam Thrust - 1-5/8 ID - 13/64 Thick	1
6	70/	Bolt - Bracket To Block - 5/16-18 x .75	2
7	70/	Key - Gear To Camshaft - 3/16 x 3/4	1
8	70/85	Camshaft Bearing - Standard	4
	70/85	Camshaft Bearing - .015 U/S	A/R
	85/	Camshaft Bearing - Front And Rear - Standard	2
	85/	Camshaft Bearing - Front And Rear - .015 U/S	A/R
	85/	Camshaft Bearing - Front And Rear Intermediate - Standard	2
	85/	Camshaft Bearing - Front And Rear Intermediate - .015 U/S	A/R
		* Includes Camshaft Gear And Crankshaft Gear - Necessary To Replace As A Set	



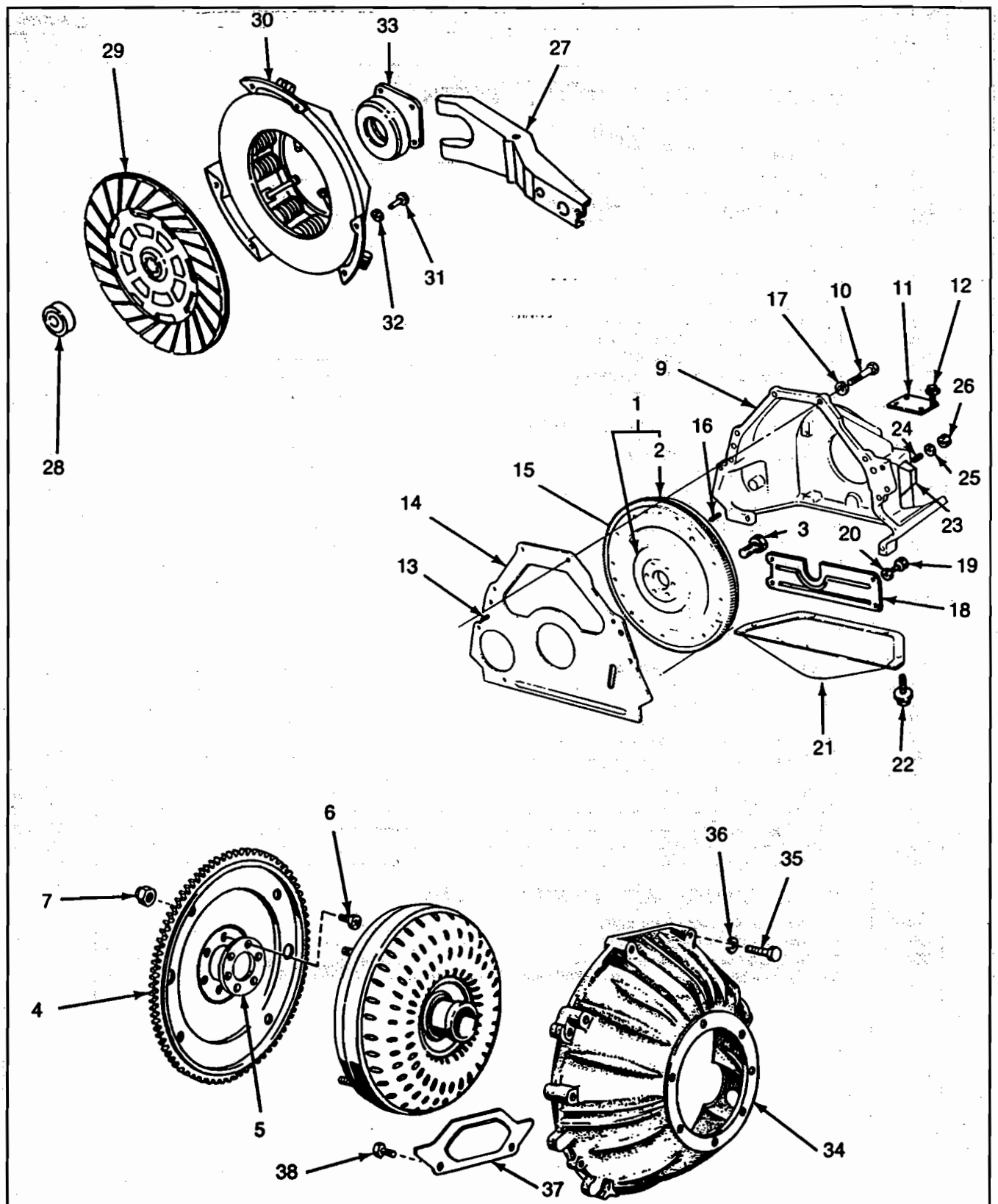
CRANKSHAFT AND RELATED PARTS — TYPICAL IE-35

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		CRANKSHAFT AND RELATED PARTS	
		CRANKSHAFT ASSEMBLY	
1	70/	Crankshaft	1
2	70/	* Gear Set - With Phenolic Tooth Cam Gear	1
	70/	Gear - Crankshaft - Use With Steel Cam Gear	1
3	70/	Key - Gear To Crankshaft - 3/16 x 1-3/4	1
4	70/	Bolt - 7/16-14 x 3.18	14
		PULLEY - CRANKSHAFT	
		INCLUDES DAMPER	
5	70/	Pulley - Crankshaft - Double Sheave	1
6	70/	Bolt - 5/8-18 x 1-3/4 - Pulley To Crankshaft	1
7	70/	Washer - Crankshaft Pulley Retaining	1
8	70/	Pulley Assembly - Crankshaft Outer - Double Sheave	1
9	70/	Bolt - 3/8-16 x 1.12 - Self Locking	3
		BEARINGS - CRANKSHAFT MAIN	
10	70/	Main Bearing - Lower - Standard	6
	70/	Main Bearing - .001 U/S	A/R
	70/	Main Bearing - .002 U/S	A/R
	70/	Main Bearing - .010 U/S	A/R
	70/	Main Bearing - .020 U/S	A/R
	70/	Main Bearing - .030 U/S	A/R
	70/	Main Bearing - Upper - Standard	6
	70/	Main Bearing - .001 U/S	A/R
	70/	Main Bearing - .002 U/S	A/R
	70/	Main Bearing - .010 U/S	A/R
	70/	Main Bearing - .020 U/S	A/R
	70/	Main Bearing - .030 U/S	A/R
11	70/	Thrust Bearing - Upper - Standard	1
	70/	Thrust Bearing - .001 U/S	A/R
	70/	Thrust Bearing - .002 U/S	A/R
	70/	Thrust Bearing - .010 U/S	A/R
	70/	Thrust Bearing - .020 U/S	A/R
	70/	Thrust Bearing - .030 U/S	A/R
	70/	Thrust Bearing - Lower - Standard	1
	70/	Thrust Bearing - .001 U/S	A/R
	70/	Thrust Bearing - .002 U/S	A/R
	70/	Thrust Bearing - .010 U/S	A/R
	70/	Thrust Bearing - .020 U/S	A/R
	70/	Thrust Bearing - .030 U/S	A/R
		SEALS - CRANKSHAFT - FRONT AND REAR	
12	70/85	Oil Seal - Front Cover - Rear Entry	1
	85/	Oil Seal - Front Cover - Front Entry	1
13	70/	Oil Seal - Crankshaft - Rear	1

* Includes Camshaft Gear And Crankshaft Gear - Necessary To Replace As A Set

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

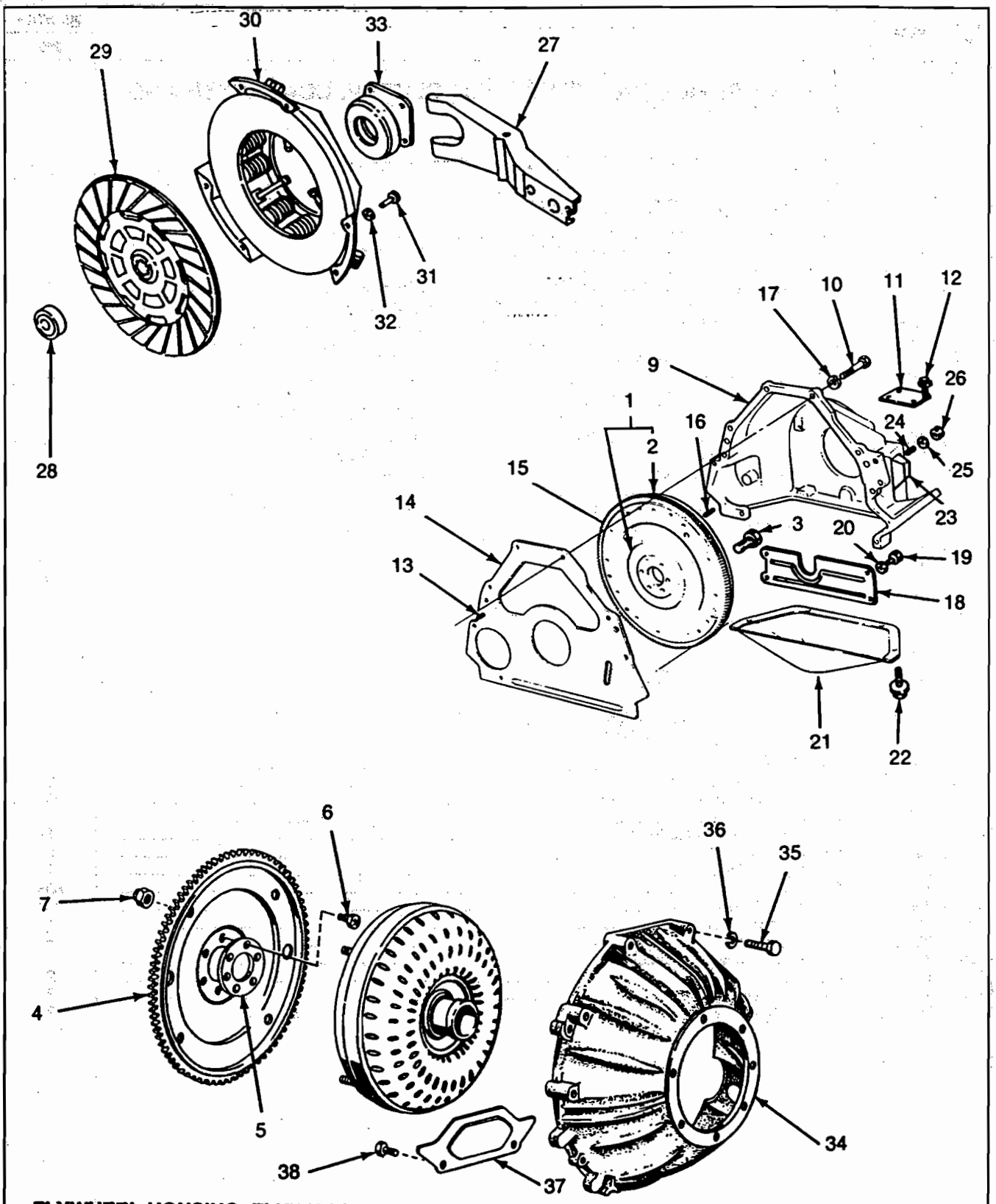


FLYWHEEL HOUSING, FLYWHEEL, CLUTCH, CONVERTER AND RELATED PARTS — TYPICAL

IE-36A

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		FLYWHEEL HOUSING, FLYWHEEL, CLUTCH, CONVERTER AND RELATED PARTS	
		CLUTCH ASSEMBLY 12 INCH H.D. - 1-3/8 - 10 SPLINE	
		FLYWHEEL AND RING GEAR ASSEMBLY	
1	70/	Flywheel And Ring Gear - 180 Tooth - For 12 Inch Clutch	1
2	70/	Ring Gear - Flywheel - 184 Tooth - For C5TZ-B, C5JZ-A And C5JZ-B Flywheels	1
	80/	Ring Gear - Flywheel - 180 Teeth - For D8TZ-C And E5TZ-G Flywheels	1
3	70/	Bolt - 7/16-20 x 1.62 Hex - Flywheel To Crankshaft - For E5TZ-G Flywheel	6
4	70/80	Flywheel And Ring Gear - 164 Tooth - For Converter	1
5	70/80	Plate - Flywheel Reinforcing	1
6	70/80	Bolt - 7/16-20 x .83 - Flywheel To Crankshaft - For C5TZ-T Flywheel	6
7	70/80	Nut - Attach Converter To Flywheel	4
		HOUSING - FLYWHEEL - WITH FEET AND FLYWHEEL ASSEMBLY	
1	70/	Flywheel And Ring Gear - 184 Tooth - For 10 Inch Over Center Clutch	1
	70/	Flywheel And Ring Gear - 184 Tooth - For 11-1/2 Inch Over Center Clutch	1
2	70/	Ring Gear - Flywheel - 184 Tooth - For C5TZ-B, C5JZ-A And C5JZ-B Flywheels	1
3	70/	Bolt - 7/16-20 x 1.045 - Flywheel To Crankshaft For C5JZ-A And C5JZ-B Flywheels	6
9	70/	Housing - Flywheel - SAE 4	1
	70/	Housing - Flywheel - SAE 3	1
10	70/	Bolt - 7/16-14 x 1.00 - Self Locking	A/R
	70/	Bolt - 7/16-14 x 1.50	A/R
11	70/	Cover - Inspection Hole	1
12	70/	Screw And Washer - 5/16-18 x .75	4
13	70/	Dowel - 1/2 x 1.00	1
14	70/	Plate - Rear Engine	1
15	70/	Adapter - Pilot Bearing To Flywheel	1
16	70/	Bolt - 3/8-16 x 1.00 Self-Locking	3
		HOUSING - CLUTCH - AND RELEASE LEVER FOUR AND FIVE SPEED TRANSMISSION	
9	70/	Housing Assembly - Clutch	1
10	70/	Bolt - 7/16-14 x 3.75	6
	70/	Bolt - 7/16-14 x 1.00 - Self Locking	A/R
13	70/	Dowel - 1/2 x 1.00	1
14	70/	Plate Assembly - Engine Rear	1
17	70/	Washer - 7/16 Lock	6
18	70/	Dust Cover - Front	1
19	70/	Bolt - 3/8-16 x 1.00	A/R
20	70/	Washer - 3/8 Lock	A/R
21	70/	Cover - Lower Dust	1
22	70/	Bolt - 5/16-18 x .50	5
23	70/	Dust Seal - Clutch Release Lever	1
24	70/	Stud - 9/16-12-18 x 2.56	2
25	70/	Washer - 9/16 Lock	2
26	70/	Nut - 9/16-18 Lock	2

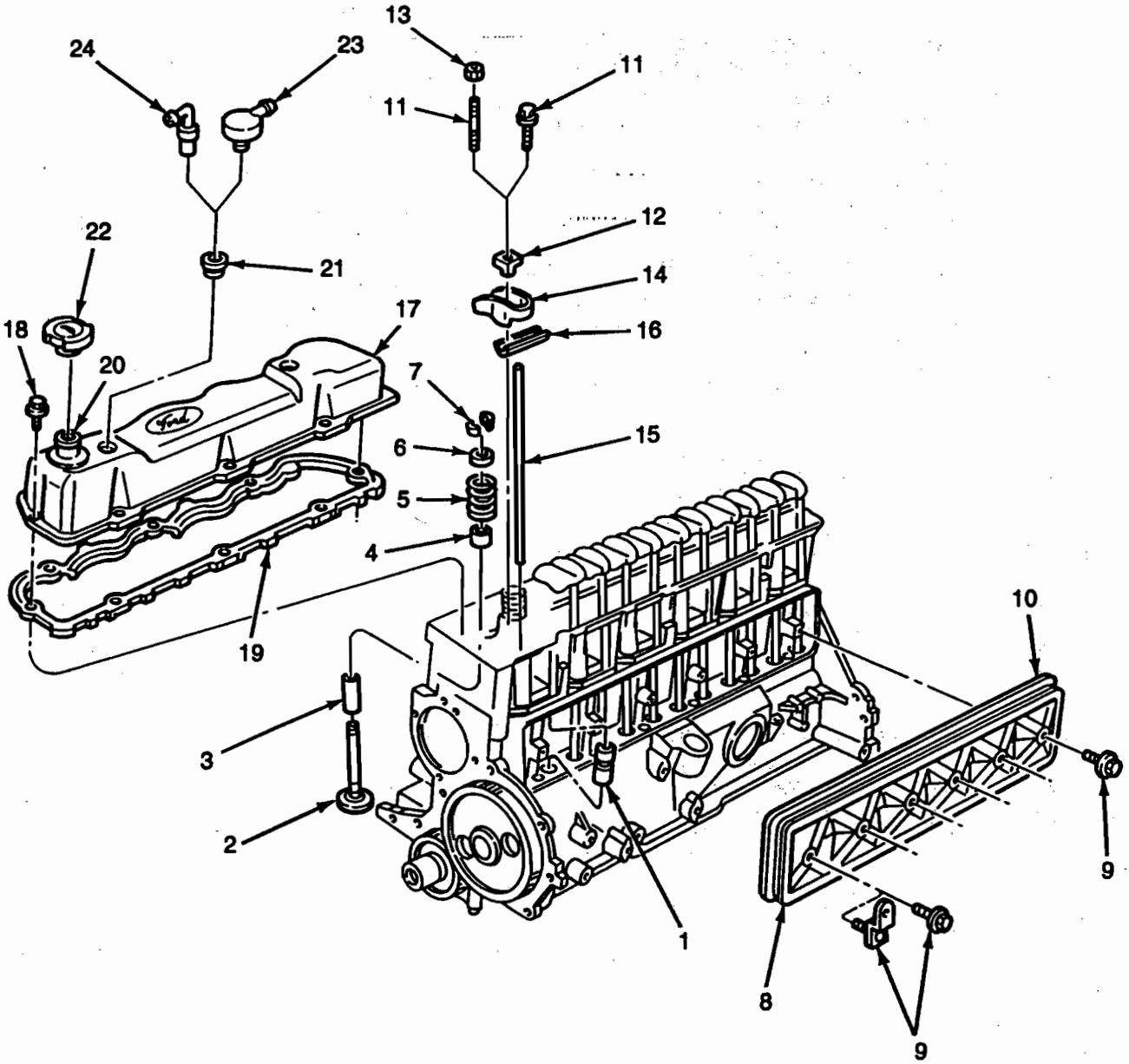
CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



FLYWHEEL HOUSING, FLYWHEEL, CLUTCH, CONVERTER AND RELATED PARTS — TYPICAL

IE-36A

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		FLYWHEEL HOUSING, FLYWHEEL, CLUTCH, CONVERTER AND RELATED PARTS (Cont'd)	
		HOUSING - CLUTCH - AND RELEASE LEVER FOUR AND FIVE SPEED TRANSMISSION (Cont'd)	
27	70/	Lever - Clutch Release	1
28	70/	Bearing - Ball - Pilot - 1.85 OD x .98 ID x .47 Wide	1
	70/	Bearing - Bronze - Pilot - 1.85 OD x .987 ID x .58 Wide	1
29	70/	Disc Assembly - Clutch - 12 Inch	1
30	70/	Plate And Cover Assembly - Clutch Pressure - 12 Inch	1
31	70/	Bolt - 5/16-18 x .92	6
32	70/	Washer - 5/16 Lock	6
		CLUTCH ASSEMBLY 12 INCH H.D. - 1-3/8 - 10 SPLINE	
29	70/	Disc Assembly - Clutch - 12 Inch	1
30	70/	Plate And Cover Assembly - Clutch Pressure - 12 Inch	1
31	70/	Bolt - 5/16-18 x .92	6
32	70/	Washer - 5/16 Lock	6
33	70/	Bearing And Hub Assembly - Clutch Release	1
		BEARING - CLUTCH PILOT	
15	70/	Adapter - Pilot Bearing To Flywheel	1
16	70/	Bolt - 3/8-16 x 1.00 Self-Locking	3
26	70/82	Bearing - Ball - Pilot - 1.85 OD x .98 ID x .47 Wide	1
	70/	Bearing - Bronze - Pilot - 1.85 OD x .987 ID x .58 Wide	1
		CONVERTER HOUSING AND REAR ENGINE PLATE	
14	70/80	Plate - Engine Rear	1
34	70/80	Converter Housing - Not Serviced	1
35	70/80	Bolt - 7/16-14 x 2.50	6
36	70/80	Washer - 7/16 Lock	6
37	70/80	Cover - Front Dust	1
38	70/80	Bolt - 5/16-18 x .50	3
		REAR ENGINE PLATE AND FRONT DUST COVER	
10	70/	Bolt - 7/16-14 x 1.00 - Self Locking	3
14	70/	Plate Assembly - Engine Rear	1
18	70/	Dust Cover - Front	1
19	70/	Bolt - 3/8-16 x .75	1
20	70/	Washer - 3/8 Lock	2

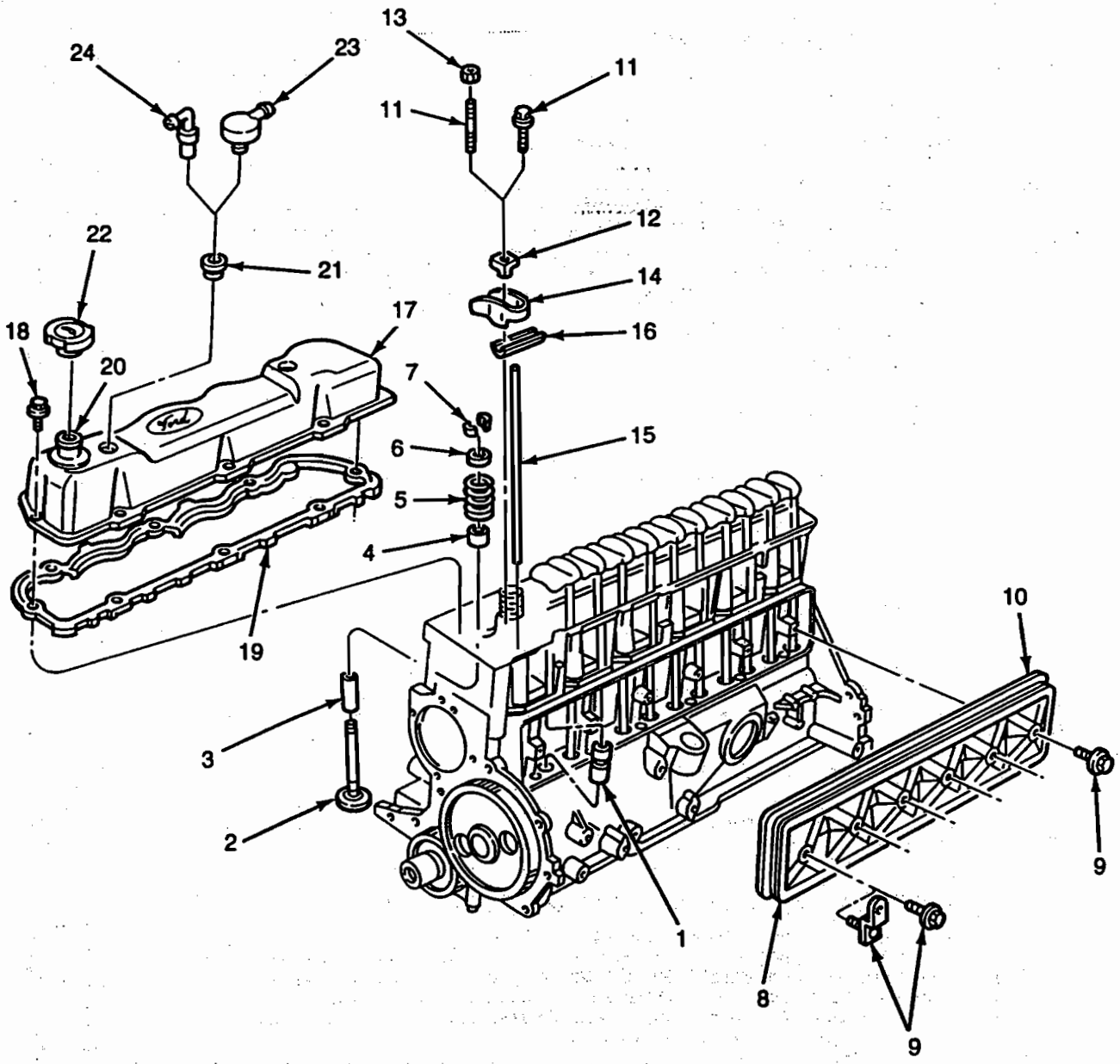


VALVES, PUSH RODS, ROCKER ARM COVER AND RELATED PARTS — TYPICAL

IE-582

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		VALVES, PUSH RODS, ROCKER ARM COVER AND RELATED PARTS	
		TAPPET ASSEMBLY - VALVE	
1	70/	Tappet	12
		VALVE	
2	70/84	Valve - Exhaust Standard .3419 Stem Diameter	6
	70/84	Valve - Exhaust .015 O/S	A/R
	70/84	Valve - Exhaust .030 O/S	A/R
	85/	Valve - Exhaust Standard .341 Stem Diameter	6
	70/84	Valve - Intake Standard .3419 Stem Diameter	6
	70/84	Valve - Intake .015 O/S	A/R
	70/84	Valve - Intake .030 O/S	A/R
	85/	Valve - Intake Standard .341 Stem Diameter	6
		BUSHING - VALVE GUIDE	
3	70/	Bushing - Intake	A/R
	70/	Bushing - Exhaust	A/R
		SEAL - VALVE STEM	
4	70/91	Seal - Valve Stem	12
	92/	Seal - Valve Stem - Intake	6
	92/	Seal - Valve Stem - Exhaust	6
		RETAINERS, LOCKS AND SPRINGS - VALVE	
5	70/83	Valve Spring - Intake	6
	70/83	Valve Spring - Exhaust	6
	84	Valve Spring - Exhaust	6
	84	Valve Spring - Intake	6
	85/	Valve Spring - Intake	6
	85/	Valve Spring - Exhaust	6
6	70/	Retainer - Valve Spring - Exhaust - Rotator	6
	70/	Retainer - Valve Spring - Intake	6
7	70/	Lock Key	24
		COVER - VALVE PUSH ROD	
8	70/	Cover - Push Rod	1
9	70/	Bolt And Grommet Assembly	A/R
	70/	Bolt, Grommet And Retainer Assembly	A/R
10	70/	Gasket - Push Rod Cover	1
		ROCKER ARMS, PUSH RODS AND RELATED PARTS	
11	70/78	Stud - Valve Rocker Arm Support - 3/8-24 x 2-5/8 - .3717	12
	70/78	Stud - Valve Rocker Arm Support .006 O/S	A/R
	70/78	Stud - Valve Rocker Arm Support .010 O/S - Not Serviced	A/R
	78/84	Stud - Valve Rocker Arm Support 5/16-24 x 2-39/64	12
	78/84	Stud - Valve Rocker Arm Support .010 O/S - Not Serviced	A/R
	85/	Bolt - Valve Rocker Arm Support - 5/16-18 x 1.40	12
12	70/84	Seat - Rocker Arm Fulcrum	12
	85/	Seat - Rocker Arm Fulcrum	12
13	70/78	Nut - Rocker Arm Stud - 3/8-24	12
	78/84	Nut - Rocker Arm Stud - 5/16-24	12
14	70/84	Arm - Valve Rocker	12
	85/	Arm - Valve Rocker	12
15	70/	Rod - Valve Push - 10.16 Long	12
	70/	Rod - Valve Push - .060 U/S	A/R

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

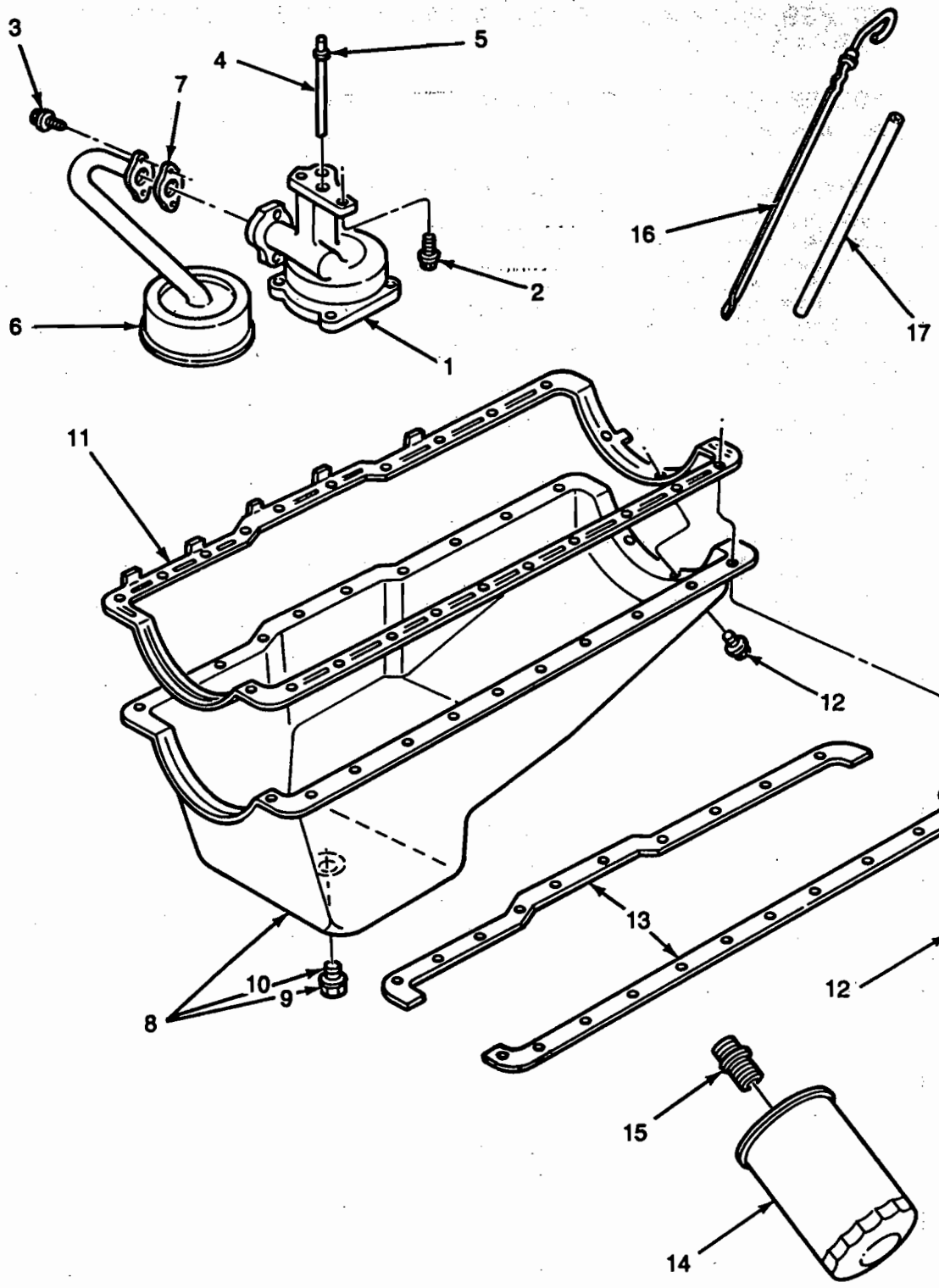


VALVES, PUSH RODS, ROCKER ARM COVER AND RELATED PARTS — TYPICAL

IE-582

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		VALVES, PUSH RODS, ROCKER ARM COVER AND RELATED PARTS (Cont'd)	
		ROCKER ARMS, PUSH RODS AND RELATED PARTS (Cont'd)	
15	70/	Rod - Valve Push - .060 O/S	A/R
16	85/	Guide - Rocker Arm Fulcrum	12
		COVER - ROCKER ARM - AND RELATED PARTS	
17	70/83	Cover - Rocker Arm	1
	84	Cover - Rocker Arm - Not Serviced	1
	85/86	Cover - Rocker Arm	1
	87	Cover - Rocker Arm - Not Serviced	1
	88/	Cover - Rocker Arm	1
18	70/84	Bolt - 5/16-18 x .62 - Not Serviced	8
	85/	Bolt - 1/4-20 x .65	8
19	70/87	Gasket - Rocker Arm Cover	1
	88/	Gasket - Rocker Arm Cover	1
		PIPE - OIL FILLER AND BREATHER CAP	
20	70/84	Pipe - Oil Filler	1
21	70/84	Retainer	1
	85/	Retainer	2
22	70/84	Cap - Oil Filler	1
	70/83	Cap - Open System	1
	84	Cap And Filter Assembly	1
	85/	Cap - Oil Filler	1
23	85/	Filter Assembly - Crankcase Vent Tube	1
24	70/	PCV Valve And Elbow Connector	1
	70/	PCV Valve	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

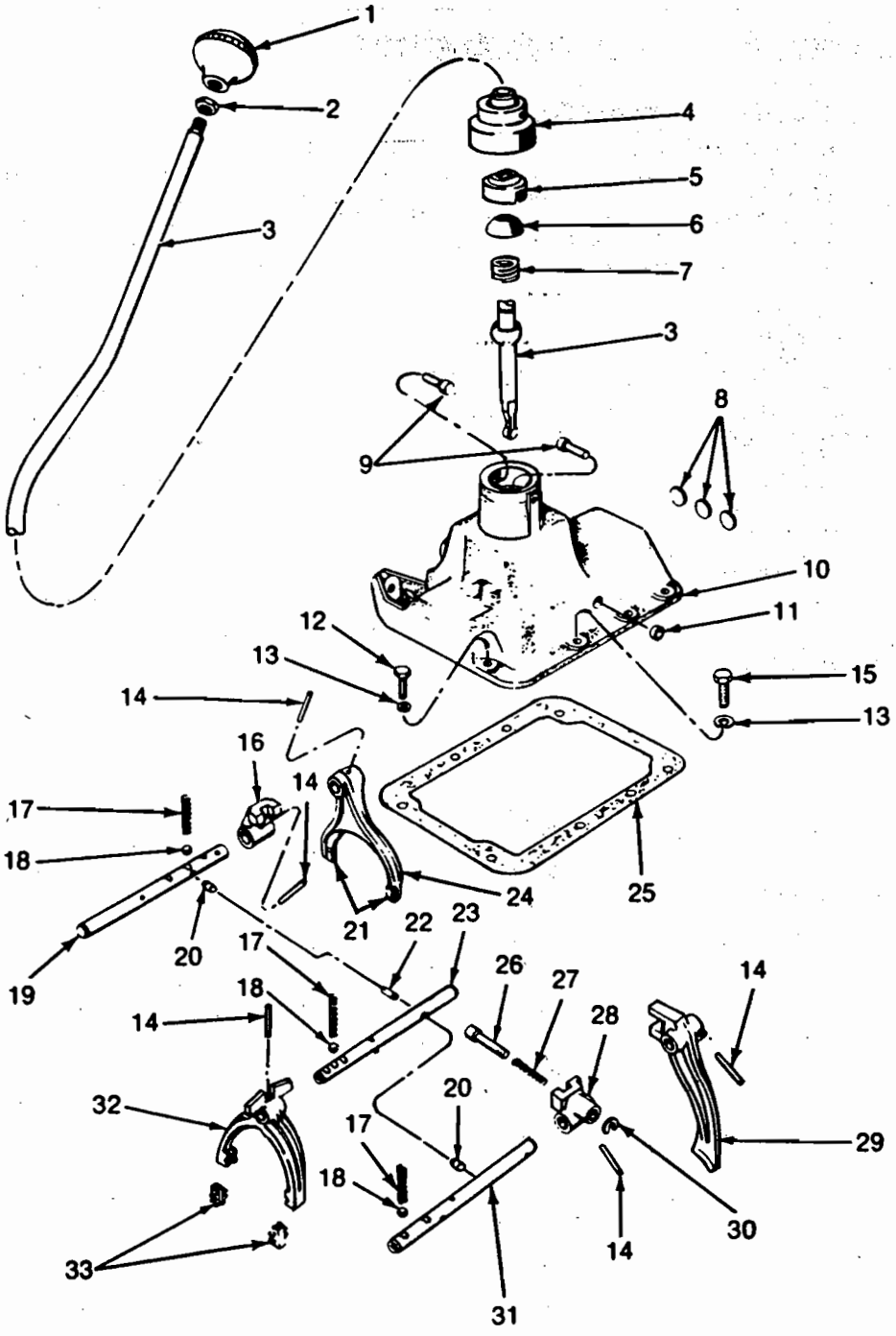


OIL PUMP, OIL PAN AND RELATED PARTS — TYPICAL IE-583

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		OIL PUMP, OIL PAN AND RELATED PARTS	
		PUMP ASSEMBLY - ENGINE OIL	
1	70/	Pump Assembly - Less Screen And Tube	1
2	70/	Bolt - 5/16-18 x .875	2
3	70/	Bolt - 5/16-18 x .875	2
4	70/	Shaft Assembly - Pump Intermediate - 4.52 Long - With Retainer	1
5	70/	Ring - Pump Intermediate, Shaft Retainer	1
6	70/	Screen, Tube And Cover Assembly	1
7	70/	Gasket - Oil Pump Inlet	1
		PAN - ENGINE OIL	
8	70/	Pan - Engine Oil	1
9	70/	Plug - Oil Pan Drain - Includes Gasket	1
10	70/	Gasket - Oil Pan Drain Plug	1
11	70/87	Gasket Set	1
		CONSISTS OF:	
		Gasket - Oil Pan Drain Plug	1
		Seal - Oil Pan - Front	1
		Seal - Oil Pan - Rear	1
		Gasket - Oil Pan - Right	1
		Gasket - Oil Pan - Left	1
	88/	Gasket - Oil Pan - One Piece	1
12	70/	* Bolt - 5/16-18 x .875	25
	70/	• Bolt - 5/16-18 x .625	25
13	70/	Reinforcement Rail - Right	1
	70/	Reinforcement Rail - Left	1
		FILTER - ENGINE OIL	
14	70/	Filter	1
15	70/	Insert - Oil Filter Adapter	1
		INDICATOR - ENGINE OIL LEVEL	
16	70/	Indicator - Oil Level - 12.52 Top Of Shield To Full	1
17	79/	Tube - Oil Level Indicator	1

* With Reinforcement Rails
• Without Reinforcement Rails

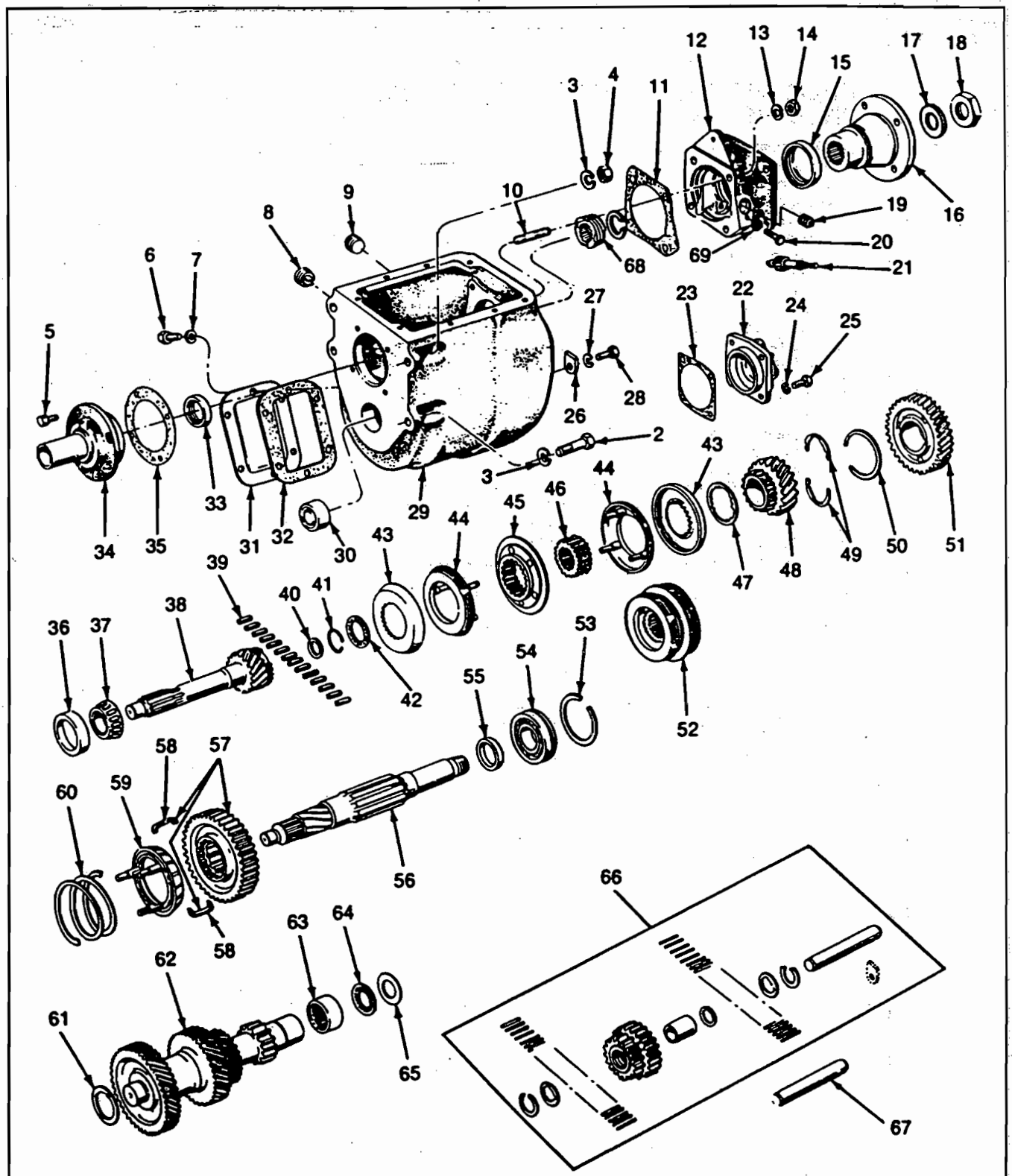


GEAR SHIFT MECHANISM — 4-SPEED HELICAL (NEW PROCESS 435) — TYPICAL IE-39

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		GEAR SHIFT MECHANISM - 4 SPEED CENTER SHIFT - NEW PROCESS 435	
1	70/	Ball Assembly - Gearshift Lever	1
2	70/	Nut - 3/8-24 Hex Jam	1
3	70/	Lever Assembly - Gearshift - Power Unit	1
	70/	Lever Assembly - Gearshift	1
4	70/	Boot - Gearshift Lever To Housing	1
5	70/	Cap - Shift Lever	1
6	70/	Seat - Gearshift Spring	1
7	70/	Spring - Gearshift Lever	1
8	70/	Plug - 3/4	3
9	70/	Trunnion - Cover - 1-3/16 Long, 5/16 Dia. One End, 1/4 Dia. Other End	2
10	70/	Housing - Gearshift	1
11	70/	Plug - 3/8 Cup	1
12	70/	Bolt - 3/8-16 x .75	6
13	70/	Washer - 3/8 Lock	6
14	70/	Pin - Shifter Interlock - 1 Long, 3/16 OD - Chamfer On One End Only	5
15	70/	Bolt - Housing To Case - 3/8-16 x 1.125	2
16	70/	Gate - First And Second Gearshifter Shaft	1
17	70/	Spring - Gearshifter Shaft Poppet - 7 Active Coils - 23/64 OD, 1 Long	3
18	70/	Ball - Shifter Shaft Poppet - 3/8	3
19	70/	Shaft - First And Second Gearshifter - 8.15 Long, .6213 Diameter	1
20	70/	Plunger - Shifter Shaft Interlock -.599 Long, .374 Dia.- Rounded Ends	2
21	70/	Insert - First And Second Gearshifter Fork - 3/4 Long, 5/16 Wide, 1/4 Thick - Nylon	2
22	70/	Gearshifter Shaft Interlock - 3/16 OD, 33/64 Long	1
23	70/	Shaft - Third And Fourth Gearshifter - 8.63 Long, .6213 Diameter	1
24	70/	Fork - First And Second Gearshifter - Includes Nylon Inserts	1
25	70/	Gasket - Gearshift Housing - 10.69 Long, 8/32 Wide, (8) Bolt Holes	1
26	70/	Plunger - Shifter Shaft Interlock - Reverse Shift Lug	1
27	70/	Spring - Reverse Shift Lug - 1/2 OD, 1-9/16 Free Length	1
28	70/	Gate - Gearshift Reverse - Front	1
29	70/	Arm - Gearshift, Reverse Fork	1
30	70/	Washer - Reverse Shift Lug Plunger - "C" Type - 5/8 Wide, 7/32 Opening, 1/16 Thick - Not Serviced	1
31	70/	Shaft - Reverse Gearshift - 8.69 Long, .6213 Diameter	1
32	70/	Fork - Third And Fourth Gearshifter - Includes Inserts	1
33	70/	Insert - Third And Fourth Gearshifter Forks, 3/4 Long, 1/2 Overall Width	2

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



TRANSMISSION ASSEMBLY — 1
GASKET SET — 70
KIT — SMALL PARTS REPAIR — 71
KIT — BEARING AND GASKET (OVERHAUL) — 72

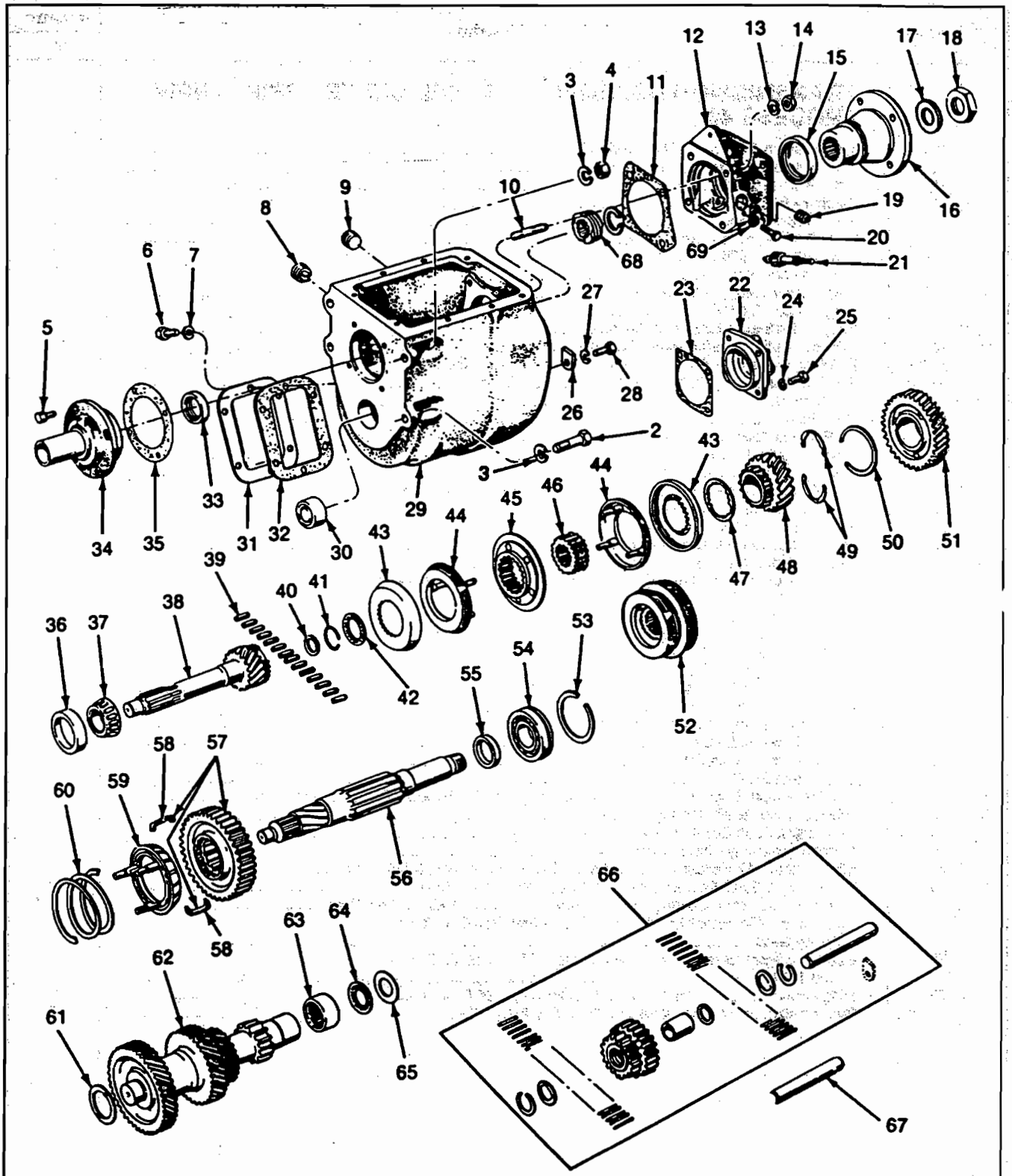
IE-40

TRANSMISSION — 4-SPEED SYNCHRO. HELICAL GEAR (NEW PROCESS 435) — TYPICAL

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		TRANSMISSION ASSEMBLY - 4 SPEED CENTER SHIFT - NEW PROCESS 435	
1	70/80	Transmission Assembly - Not Serviced	1
	80/	Transmission Assembly - Not Serviced	1
2	70/	Bolt - 9/16-12 x 2.00	2
3	70/	Washer - 9/16 Lock	4
4	70/	Nut - 9/16-18 Lock	2
5	70/	Bolt - 5/16-18 x .75 - Not Serviced	4
6	70/	Bolt - 3/8-16 x .625	6
7	70/	Washer - 3/8 Lock	6
8	70/	Plug - Drain - Magnetic - 3/4 NPT	1
9	70/	Plug - Filler - 3/4 NPT	1
10	70/	Stud - 1/2-13-20 x 1.75 - Not Serviced	4
11	70/	Gasket - Output Shaft Bearing Retainer	1
12	70/83	Retainer Assembly - Output Shaft Bearing - D7HT-DA And E0HT-AFA	1
	83/	Retainer Assembly - Output Shaft Bearing - E4HT-CA	1
13	70/	Washer - 1/2 Lock	4
14	70/	Nut - 1/2-20	4
15	70/	Oil Seal - Output Shaft Bearing Retainer - 3-1/4 OD, 2-1/2 ID, 1/2 Thick	1
16	70/	Flange - Output	1
17	70/	Washer - Output Shaft - 1.75 OD, 1 ID, .156 Thick	1
18	70/	Nut - Output Shaft - 1.20 Hex Lock, 1-1/2 Across Flats, 1-20 Thread	1
19	70/	Adapter - Speedometer Gear	1
20	70/	Bolt - 1/4-20 x .625	1
21	70/	Gear - Speedometer Driven - 15 Teeth	1
22	70/	Cap - Countershaft Rear Bearing	1
23	70/	Gasket - Countershaft Rear Bearing Cap - 3.19 ID, 1/64 Thick, (4) .41 Bolt Holes	1
24	70/	Washer - 3/8 Lock	4
25	70/	Bolt - 3/8-16 x .75	4
26	70/	Plate - Countershaft And Reverse Idler Shaft Lock - 7/8 Wide, 1/8 Thick, 1-1/8 Overall Length	1
27	70/	Washer - 3/8 Lock	1
28	70/	Bolt - Lock Plate To Case - 3/8-16 x .625 - Not Serviced	1
29	70/	Case - Transmission	1
30	70/	Bearing Assembly - Countershaft Front Radial - 1.8755 OD, 1.50 ID, 1 Thick	1
31	70/	Cover - Power Take Off	1
32	70/	Gasket - Power Take Off Cover	1
33	70/	Seal - Input Shaft	1
34	70/	Retainer - Input Bearing - 4-11/32 Overall Length, 5.124 Flange OD, 2.8428 Flange ID	1
35	70/	Gasket - Input Shaft Bearing Retainer	2
36	70/	Cup - Input Shaft Bearing - 2.8443 OD, .7812 Wide	1
37	70/	Bearing Assembly - Input Shaft	1
38	70/	Shaft - Input - 17 Helical Teeth, 24 Clutch Teeth - 10 Splines, 9-3/8 Long	1
39	70/	Roller - Input Shaft Pilot Bearing - .2811 OD, .678 Long - Set Of 14	14
40	70/	Spacer - Input Shaft Bearing To Inner Race - 1.543 OD, 1.25 ID, .062 Thick	1
41	70/	Snap Ring - Pilot Roller Bearing Retainer - 1.685 Free OD, .093 Dia., Spring Steel	1
42	70/	Bearing - Synchronizer Clutch Gear Thrust - 27 Rollers, 2.171 OD, .156 Thick	1
43	70/	Ring - Synchronizer Third And Fourth Outer Stop - 24 Splines	2
44	70/80	Synchronizer Inner Stop - 4.65 OD, Third And Fourth Gear	2

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



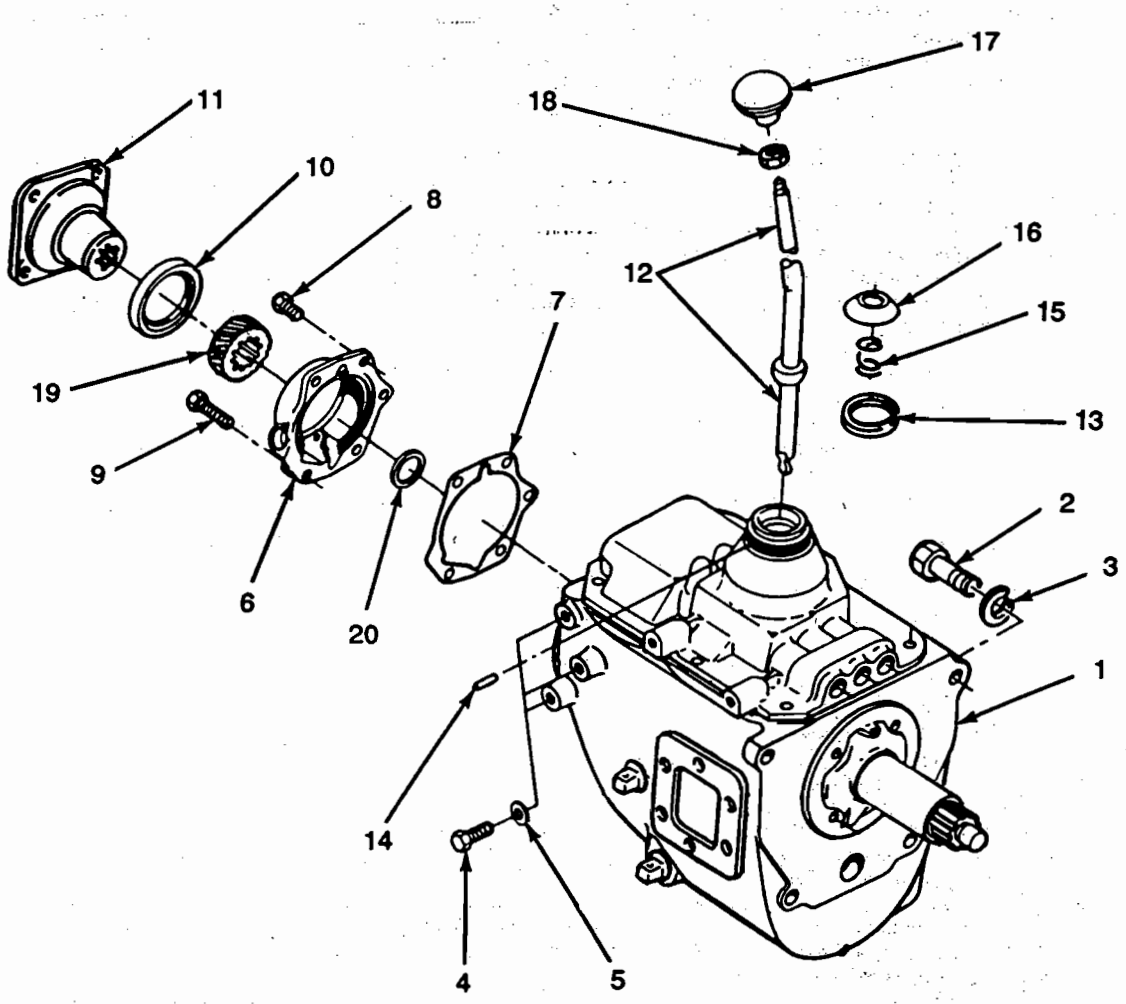
TRANSMISSION ASSEMBLY — 1
GASKET SET — 70
KIT — SMALL PARTS REPAIR — 71
KIT — BEARING AND GASKET (OVERHAUL) — 72

IE-40

TRANSMISSION — 4-SPEED SYNCHRO. HELICAL GEAR (NEW PROCESS 435) — TYPICAL

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		TRANSMISSION ASSEMBLY - 4 SPEED CENTER SHIFT - NEW PROCESS 435 (Cont'd)	
45	70/77	Sleeve - Synchronizer Sliding - 24 Teeth - Before 6-77	1
	77/	Sleeve - Synchronizer Sliding - 24 Teeth - After 6-77	1
46	70/	Hub - Third And Fourth Gear Synchronizer Clutch - 24 External Teeth, 35 Internal Splines, Includes (1) C4TZ-7C096-C Bearing	1
47	70/	Shim - Synchronizer To Output Shaft And Third Speed Idler Gear - .010 Thick	A/R
	70/	Shim - Synchronizer To Output Shaft And Third Speed Idler Gear - .015 Thick	A/R
48	70/80	Gear - Output Shaft Third Speed Idler - 23 Helical Teeth, 24 Spur Teeth, 3.723 OD, 1.714 Overall Thickness - D7HT-DA	1
	80/	Gear - Output Shaft Third Speed Idler - 24 Helical Teeth, 24 Spur Teeth, 3.75 OD, 1.703 Thick - E0HT-AFA & E4HT-CA	1
49	70/	Ring - Output Shaft Second Speed Gear Split Retaining - 1.809 ID, 2.333 OD, .0745 Thick	2
50	70/	Snap Ring - Output Second Speed Rear - 3.43 OD, 3.053 ID, .065 Thick	1
51	70/	Gear - Output Shaft Second Speed - 33 Helical Teeth, 27 Clutch Teeth, 5.105 OD, 2.1268 ID	1
52	70/	Synchronizer Assembly - Third And Fourth Speed	1
53	70/	Snap Ring - Output Shaft Bearing Retainer - .097 Thick	1
54	70/	Bearing - Output Shaft Rear - 3.543 OD, 1.574 ID, .905 Wide	1
55	70/	Spacer - Output Shaft To Bearing - 2.25 OD, .338 Wide	1
56	70/	Shaft - Output - 13.59 Long, 10 Splines, 35 Serrations Both Ends, Includes (1) Each C5TZ-7119-A Washer And 371887-S Nut	1
57	70/	Gear - Low And Reverse Sliding - 37 Spur Teeth, 27 Clutch Teeth, 10 Splines, 6.417 OD, Includes (2) C5TZ-7E082-A Springs And (1) C4TZ-7100-J Gear	1
58	70/	Spring - Sliding Gear Tension	2
59	70/	Ring - Synchronizer Inner Stop And Clutch Pin - 5.0597 OD	1
60	70/	Spring - Synchronizer Blocking - 4 ID, 4.88 Free Length, 2-1/2 Active Coils, .46 x .225 Wide, Spring Steel	1
61	70/	Washer - Countershaft Cluster Gear Thrust - Front 2.75 OD, 1.90 ID, .062 Thick, 4 Oil Grooves	1
62	70/80	Gear - Countershaft Cluster - 11.30 Long, 43-35-25 Helical Teeth, 14 Spur Teeth - D7HT-DA	1
	80/	Gear - Countershaft Cluster - 43-34-25 Helical Teeth - 14 Spur Teeth - E0HT-AFA & E4HT-CA	1
63	70/	Bearing Assembly - Countershaft Rear - 2.3755 OD, 2.00 ID, 1 Wide	1
64	70/	Bearing - Countershaft Thrust Rear - 2.3755 OD, 38 Rollers, .078 Thick	1
65	70/	Washer - Countershaft Cluster Gear Thrust Rear - 1.917 OD, 1.257 ID, .031 Thick	1
66	70/	Gear - Reverse Idler - 17-21 Teeth, 3.893 OD, 1.481 ID, With Bearing	1
67	70/	Shaft - Reverse Idler Gear - 5-11/32 Long, .9877 Diameter	1
68	70/	Gear - Speedometer Drive - 5 Teeth	1
69	70/	Washer - 1/4 Lock	1
70	70/	Gasket Set	1
71	70/	Kit - Small Parts Repair	1
72	70/	Kit - Bearing And Gasket - Overhaul	1

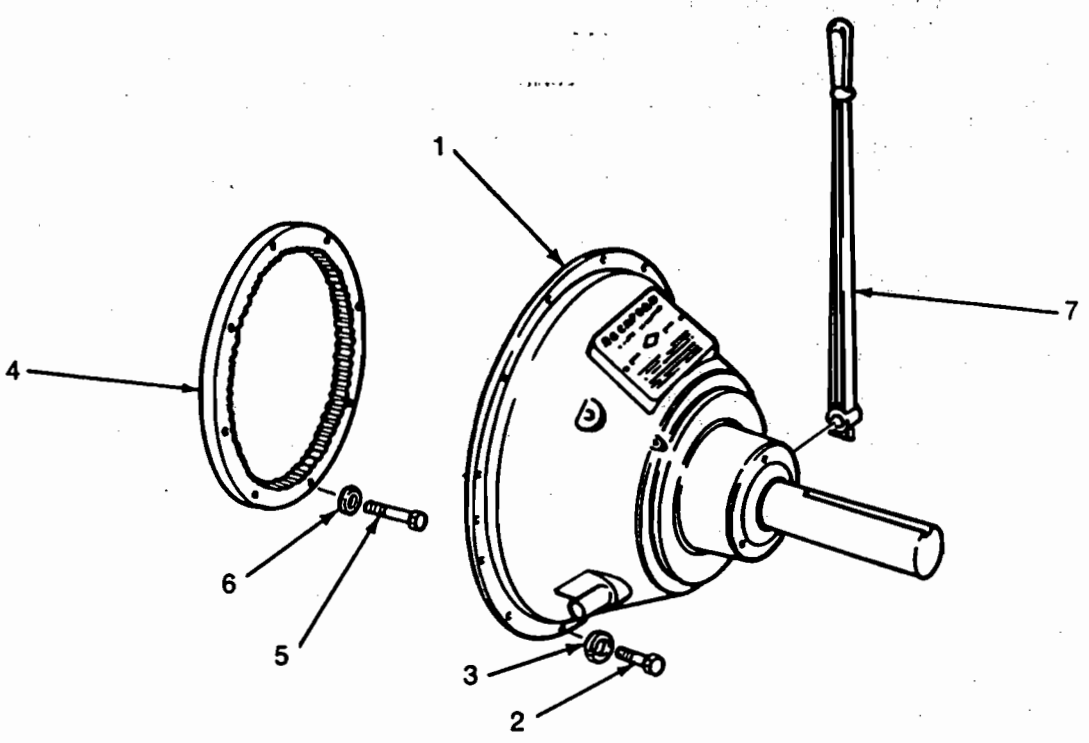


TRANSMISSION ASSEMBLY (4-SPEED HELICAL) WARNER GEAR T18 — TYPICAL

IE-584

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		TRANSMISSION ASSEMBLY - 4 SPEED CENTER SHIFT - WARNER T-18	
1	73/	* Transmission Assembly	1
2	73/	● Bolt - 9/16-12 x 2.00	2
3	73/	● Washer - 9/16 Lock	2
4	73/	★ Bolt - 3/8-16 x .625	3
5	73/	★ Washer - 3/8 Lock	3
6	73/	Retainer - Transmission Bearing	1
7	73/	Gasket - Transmission Bearing Retainer	1
8	73/	Bolt - 3/8-16 x 1.00 - HI Fan	4
9	73/	Bolt - 3/8-16 x 1.75	1
10	73/	Retainer - Rear Transmission Grease	1
11	73/	Flange - Output	1
12	73/	Lever - Gear Shift	1
13	73/	Gasket - Shift Lever Cap	1
14	73/	Trunnion - Shift Lever	1
15	73/	Spring - Shift Lever	1
16	73/		
17	73/	Ball Shift Lever	1
18	73/	Nut - 3/8-24 Hex Jam	1
19	73/	Gear - Speedometer Drive	1
20	73/	Spacer - Speedometer Drive Gear	1
		TRANSMISSION ASSEMBLY - FMX AUTOMATIC	
		■ Transmission Assembly - Not Serviced	1
		■ Transmission Assembly - Not Serviced	1
		* Order Transmission Service Parts From The Industrial Power Products Distributor In Your Area	
		● Attach Transmission To Clutch Housing	
		★ Plug Unused Holes In Transmission	
		■ To Order Transmission Service Parts, Refer To The FPSD Light Truck, F100/500 Series, 73/79 Parts Book, Section A70.2	

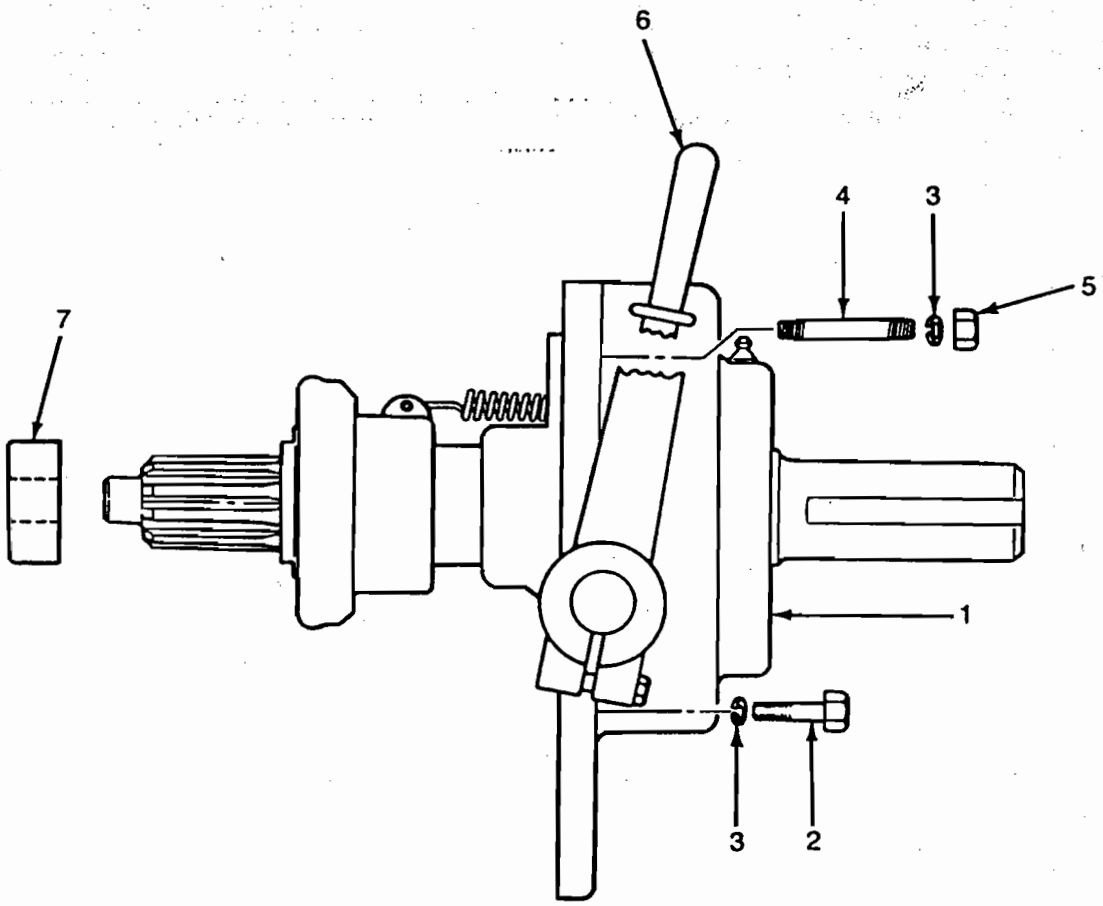


POWER TAKE-OFF ASSEMBLY H.D. OVERCENTER CLUTCH — TYPICAL

IE-42

Ford Power Products

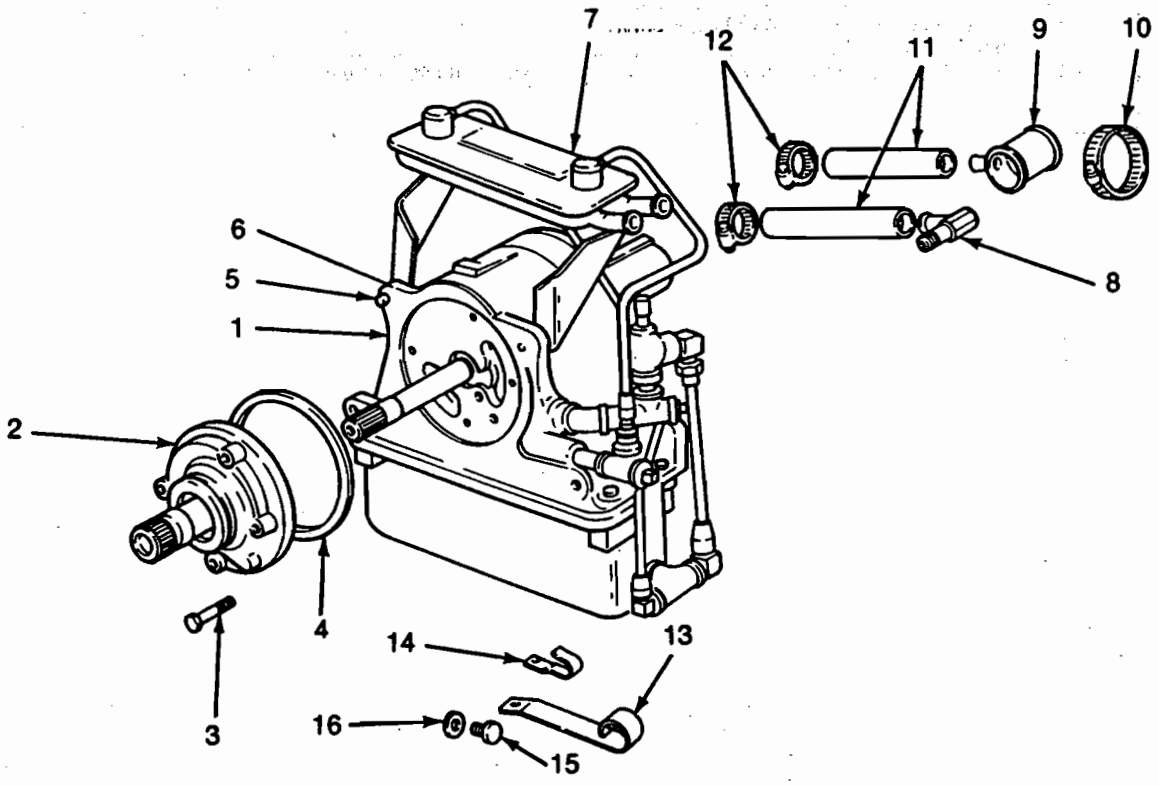
REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		POWER TAKE-OFF ASSEMBLY - ROCKFORD WITH 11-1/2 INCH OVER-CENTER CLUTCH - FOR SPEEDS NOT EXCEEDING 2800 RPM	
1	70/	* Power Take-Off - 11.5 Inch O.C. Clutch	1
2	70/	Bolt - 3/8-16 x 1.00	12
3	70/	Washer - 3/8 Lock	12
4	70/	Drive Ring	1
5	70/	Bolt - 3/8-16 x 2.00	8
6	70/	Washer - 3/8 Flat - Hardened	8
7	70/	Handle - PTO	1
		* Order Power Take-Off Service Parts From The Industrial Power Products Distributor In Your Area	



POWER TAKE-OFF ASSEMBLY H.D. SPRING LOADED CLUTCH — TYPICAL IE-43C

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		POWER TAKE-OFF ASSEMBLY - FUNK H.D. FOR SPRING LOADED CLUTCH (F-10-101)	
1	70/82	* Power Take-Off Assembly - Does Not Include Handle - Use Only With C5TZ-7600-B Pilot Bearing - Not Serviced	1
	83/	* Power Take-Off Assembly - Does Not Include Handle - Use Only With B8C-10095-A Pilot Bearing	1
2	70/	Bolt - 9/16-12 x 2.00	2
3	70/	Washer - 9/16 Lock	4
4	70/	Stud - 9/16-12-18 x 2.56	2
5	70/	Nut - 9/16-18 Lock	2
6	70/	Handle - PTO	1
7	70/82	Bearing - Ball - Pilot - 1.85 OD x .98 ID x .47 Wide	1
	83/	Bearing - Ball - Pilot	1
		* Order Power Take-Off Service Parts From The Industrial Power Products Distributor In Your Area	

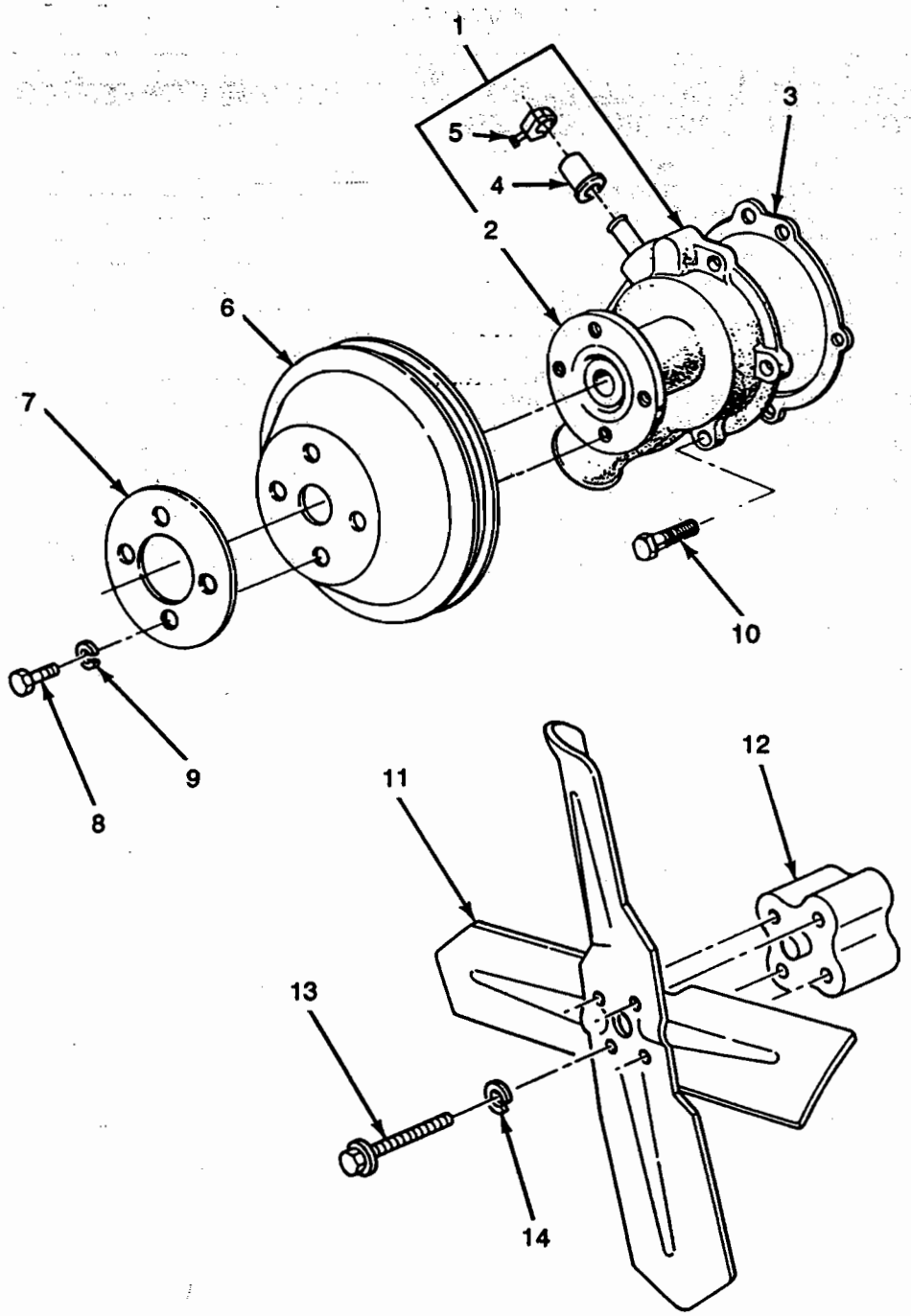


POWER TAKE-OFF ASSEMBLY — TORQUE CONVERTER TYPE PUMP AND OIL COOLER — TYPICAL IE-44

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		POWER TAKE-OFF ASSEMBLY - FUNK, TORQUE CONVERTER TYPE, PUMP AND OIL COOLER	
1	78/80	* P.T.O Assembly - Not Serviced	1
2	70/80	Pump Assembly - Front - Not Serviced	1
3	70/80	Bolt - 5/16-18 x 2.00 - Not Serviced	4
4	70/80	Gasket - Pump	1
5	70/80	Bolt - 7/16-14 x 1.50	4
6	70/80	Washer - 7/16 Lock	4
7	70/80	Cooler - Transmission Oil - Not Serviced	1
8	70/80	Elbow - 90 Degree - 3/8 NPT To 5/8 Hose	1
9	70/80	Tee - Water Return	1
10	70/80	Clamp - Radiator Hose	2
11	70/80	Hose - Oil Cooler Water - Outlet - Not Serviced	1
	70/80	Hose - Oil Cooler Water - Inlet - Not Serviced	1
12	70/80	Clamp - Cooler Hose	4
13	70/80	Bracket - Hose	3
14	70/80	Clip	2
15	70/80	Bolt - 7/16-14 x .625	2
16	70/80	Washer - 7/16 Lock	2

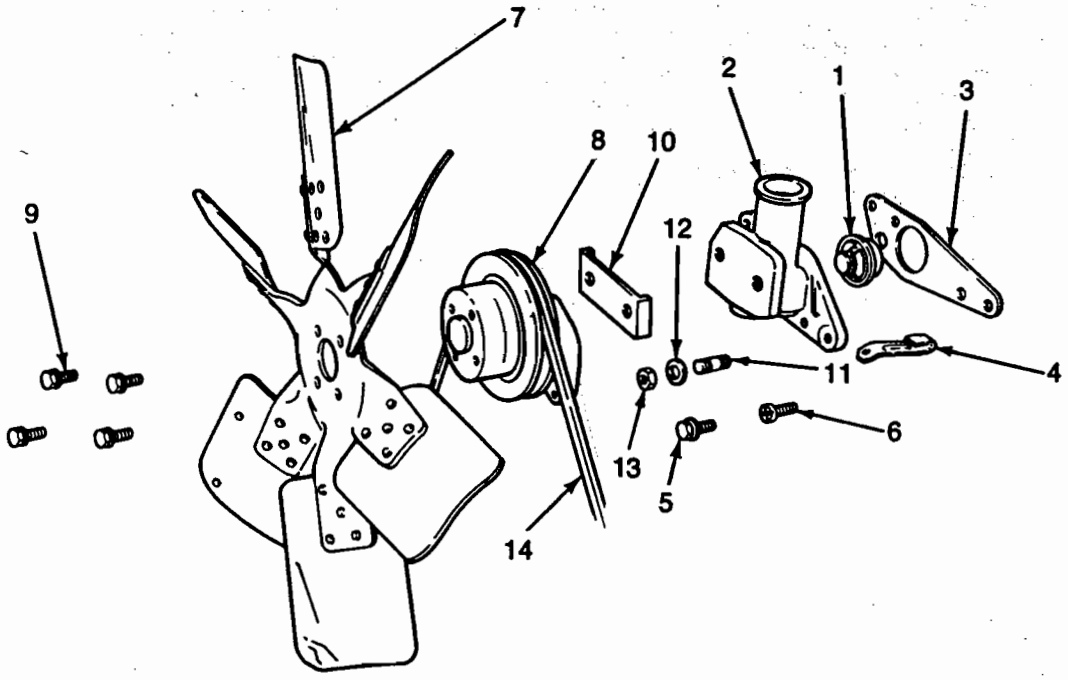
* Order Power Take-Off Service Parts From The Industrial Power Products Distributor In Your Area



WATER PUMP AND RELATED PARTS — TYPICAL IE-585

Ford Power Products

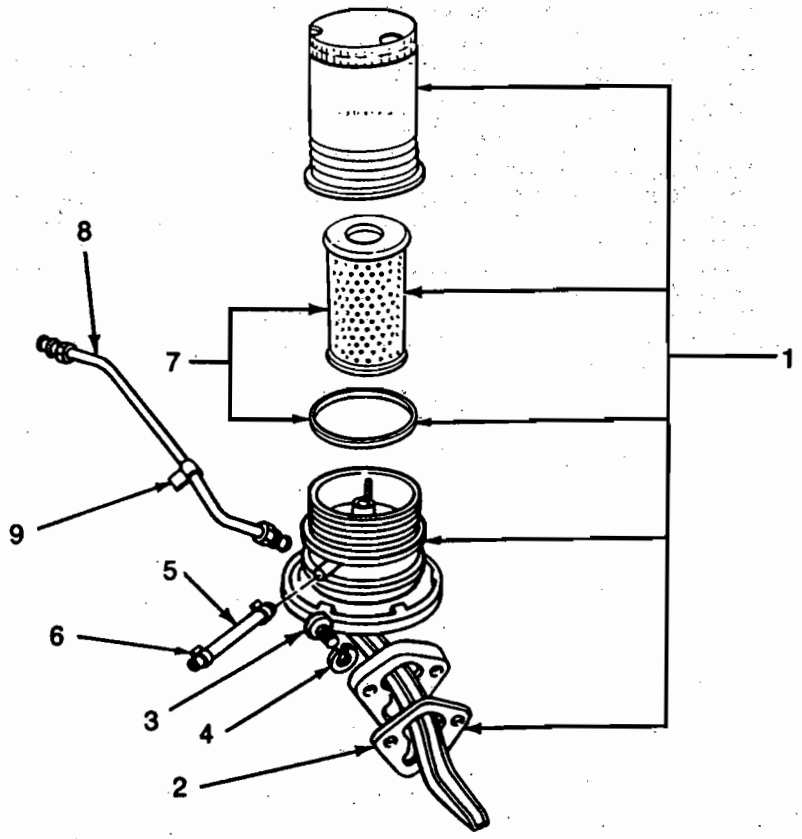
REF. NO.	YEAR	DESCRIPTION	QUANTITY 300
		WATER PUMP AND RELATED PARTS	
1	70/90	Pump	1
	90/	Pump	1
2	70/90	Hub	1
3	70/	Gasket - Water Pump Mounting	1
4	70/	Cap - Heater Tube	1
5	70/	Clamp - Heater Tube Cap	1
6	70/90	Pulley - Single Sheave	1
	90/	Pulley - Double Sheave	1
	90/	Pulley - Triple Sheave	1
7	70/90	Clamping Ring	1
8	70/	Bolt - 5/16-24 x .687	4
9	70/	Washer - 5/16 Lock	4
10	70/	Bolt - 5/16-18 x .875	4
11	70/	Fan - 4 Blade - 18.00 Inch - Suction	1
	70/	Fan - 6 Blade - 18.50 Inch - Suction	1
	70/	Fan - 6 Blade - 18.50 Inch - Pusher	1
12	70/90	Spacer - 1.75	1
	90/	Spacer - 2.18	1
13	70/90	Bolt And Washer - 5/16-24 x 2.75	
	90/	Bolt - 5/16-24 x 3.00	4
14	90/	Washer - 5/16 Lock	4



THERMOSTAT, FAN AND RELATED PARTS — TYPICAL IE-46

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		THERMOSTAT, FAN AND RELATED PARTS	
		THERMOSTAT AND WATER OUTLET CONNECTION	
1	70/	Thermostat - 160°F	1
2	70/	Connection - Water Outlet - HI Fan	1
	70/	Connection - Water Outlet - LO Fan	1
3	70/	Gasket - Water Outlet Connection - HI Fan	1
	70/	Gasket - Water Outlet Connection - LO Fan	1
4	70/	Bracket - Fuel Pump To Carburetor Tube	1
5	70/	Bolt - 5/16-18 x .875	2
6	70/	Bolt - 3/8-18 x 1.00 - HI Fan	2
		FAN ASSEMBLY - HI MOUNT	
7	70/	Fan - 5 Blade - 17.00 Inch - Suction	1
	70/	Fan - 6 Blade - 18.50 Inch - Suction	1
	70/	Fan - 6 Blade - 18.50 Inch - Pusher	1
8	70/	Bracket And Pulley Assembly	1
9	70/	Screw And Washer - 5/16-18 x 7/8	4
10	70/	Guide - Fan Bracket	1
11	70/	Stud - 7/16-14-20 x 1.88	2
12	70/	Washer - 7/16 Flat	2
13	70/	Nut - 7/16-20 Hex Lock	2
14	70/	Belt - Fan 1/2 x 40.40	1

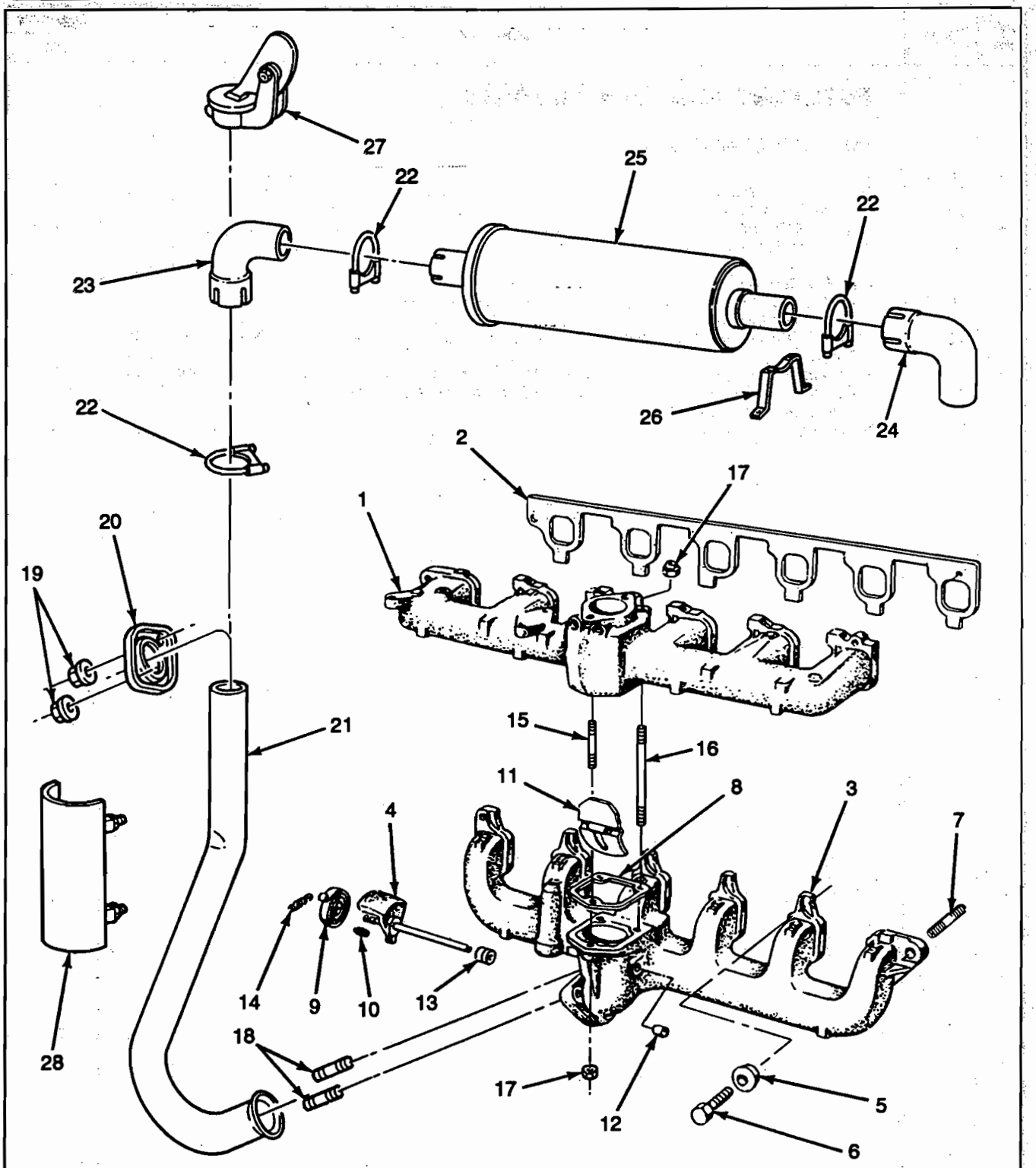


FUEL PUMP AND RELATED PARTS — TYPICAL IE-47

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		FUEL PUMP AND RELATED PARTS	
		PUMP ASSEMBLY - FUEL	
1	70/	Pump	1
2	70/	Gasket - Fuel Pump	1
3	70/	Bolt - 5/16-18 x 1.25	2
4	70/	Washer - 5/16 Lock	2
5	70/	Hose - Fuel Tube Connector	1
6	70/	Clamp - Hose	2
7	70/	Fuel Filter Element	1
8	70/76	Fuel Line - Fuel Pump To Carburetor - Used With Mechanical Governor - Holley 1904 Carburetor	1
	70/76	Fuel Line - Fuel Pump To Carburetor - Used Without Mechanical Governor Holley 1904 Carburetor - Not Serviced	1
	76/	Fuel Line - Fuel Pump To Carburetor - Used Without Mechanical Governor Holley 1940 Carburetor	1
	76/	Fuel Line - Fuel Pump To Carburetor - Used With Mechanical Governor - Holley 1940 Carburetor	1
9	70/76	Strap - Bundling	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



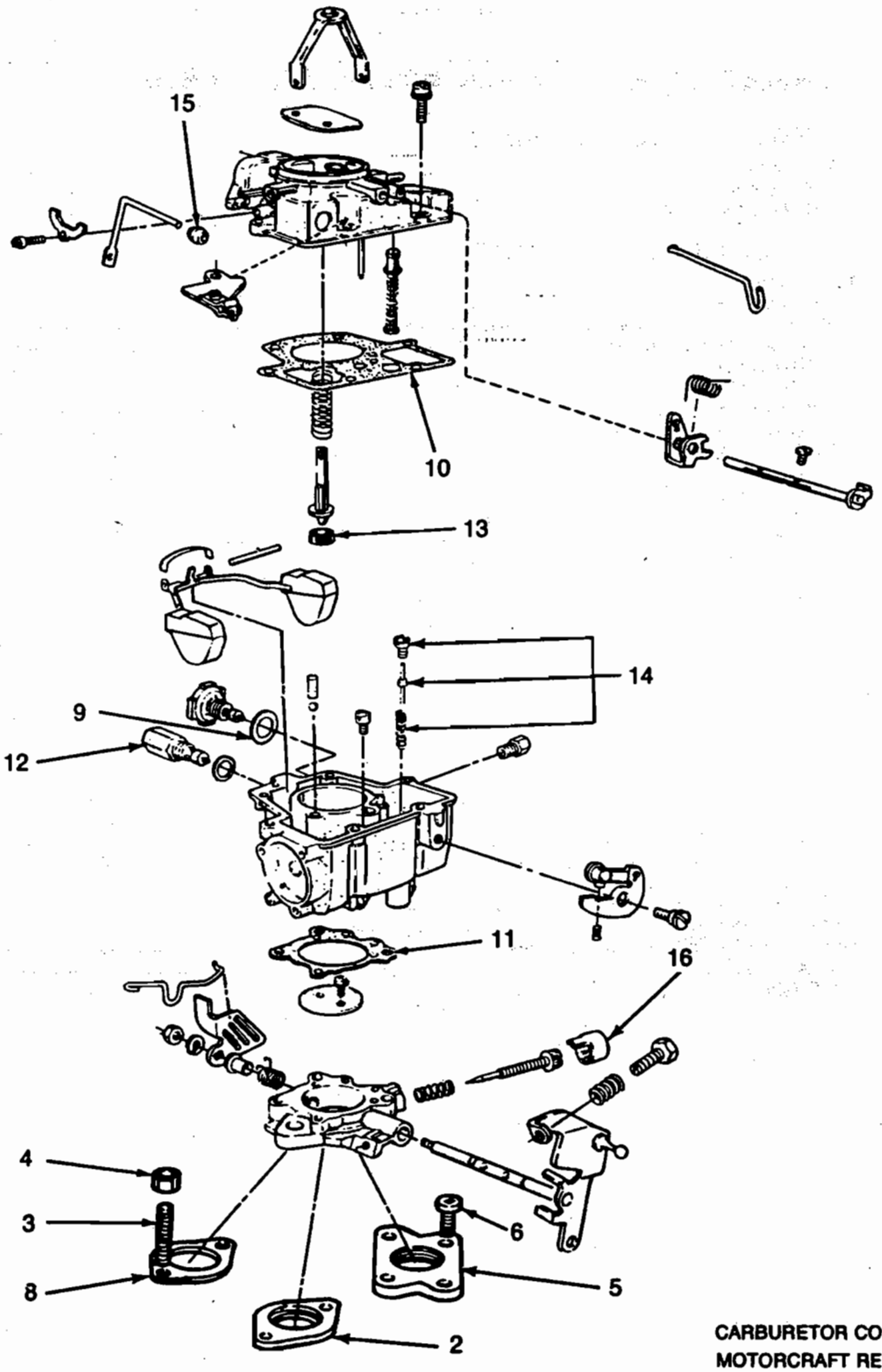
MANIFOLD, EXHAUST SYSTEM AND RELATED PARTS — TYPICAL

IE-586

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		MANIFOLD,EXHAUST SYSTEM AND RELATED PARTS	
		MANIFOLD ASSEMBLY - INTAKE	
1	70/76	Manifold Assembly	1
	76/	Manifold Assembly	1
2	70/	Gasket - Intake Manifold	1
		MANIFOLD ASSEMBLY - EXHAUST	
3	70/83	Manifold Assembly	1
	84/	Manifold Assembly	1
4	70/	Shaft And Counterweight Assembly - Exhaust Control Valve	1
5	70/	Clamp - Intake And Exhaust Manifold	A/R
6	70/	Bolt - 3/8-16 x 1.312	A/R
7	70/	Stud - 3/8-16 x 2.42	A/R
8	70/74	Gasket - Manifold	1
9	70/	Spring - Exhaust Control Valve	1
10	70/	Stop - Exhaust Control Valve Spring	1
11	70/	Valve - Exhaust Control	1
12	70/	Bushing - Exhaust Control Valve	1
	70/	Bushing - Exhaust Control Valve - .010 O/S	A/R
13	70/	Bushing - Exhaust Control Valve	1
14	70/	Spring - Exhaust Control Valve Tension	1
15	70/	Stud - 3/8-16-24 x 2.25	1
16	70/	Stud - 3/8-16-24 x 4.75	2
17	70/	Nut - 3/8-24	3
		EXHAUST PIPE, MUFFLER AND RELATED PARTS	
18	84/	Stud - 7/16-14 x 2.18	2
19	84/	Nut 7/16-14	2
20	84/	Flange - Exhaust Pipe	1
21	84/	Pipe - Exhaust - Underhood Muffler	1
	84/	Pipe - Exhaust - Hood Top Muffler	1
	84/	Pipe - Exhaust - Low Mounted Muffler	1
22	84/	Clamp - Exhaust Pipe	A/R
23	84/	Pipe - Inlet Extension - Hood Top Muffler	1
24	84/	Elbow - Exhaust Outlet - Hood Top Muffler	1
25	84/	Muffler - Underhood	1
	84/	Muffler - Hood Top	1
	84/	Muffler - Low Mount	1
26	84/	Support - Exhaust Outlet - Hood Top Muffler	1
27	70/	Rain Cap	1
28	91/	Heat Shield	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



CARBURETOR COMPLETE — 1
MOTORCRAFT REPAIR KIT — 7

CARBURETOR AND RELATED PARTS — TYPICAL

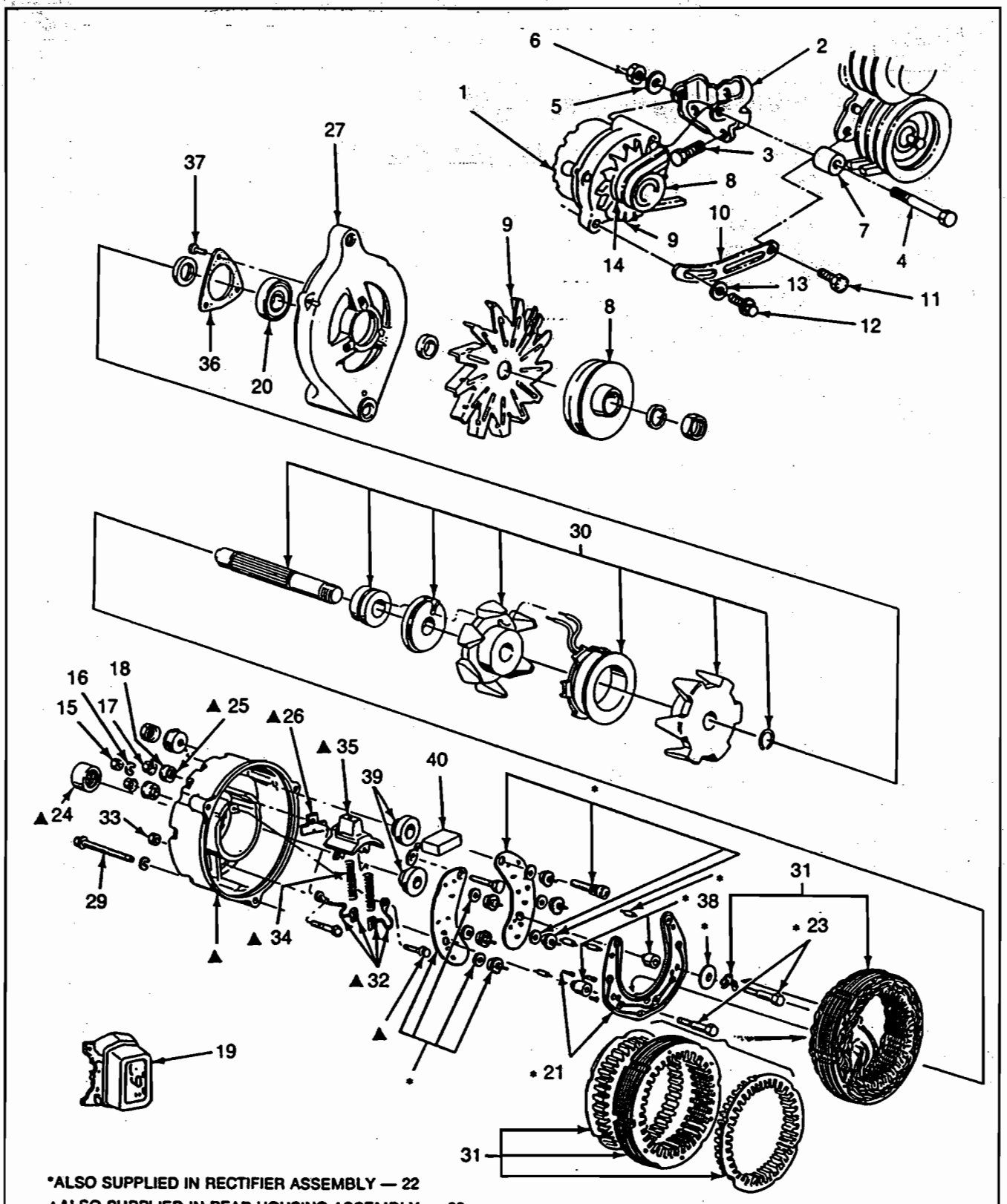
IE-49

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		CARBURETOR AND RELATED PARTS	
		CARBURETOR ASSEMBLY - WITH MECHANICAL GOVERNOR	
1	70/76	Carburetor Assembly - Holley 1904 - Not Serviced	1
	76/	Carburetor Assembly - Holley 1940	1
2	70/76	Spacer - Carburetor To Intake Manifold	1
3	70/	Stud - 3/8-16-24 x 1.30	2
4	70/	Nut - 3/8-24 Hex	2
5	70/76	Adapter - Carburetor	1
	76/	Adapter - Carburetor	1
6	70/76	Screw - 3/8-16 x 1.0 - Not Serviced	2
	76/	Screw - 3/8-16 x .88	2
8	70/	Gasket - Carburetor To Adapter And Adapter To Manifold	A/R
		CARBURETOR ASSEMBLY - WITHOUT MECHANICAL GOVERNOR	
1	70/76	Carburetor Assembly - Holley 1904 - Not Serviced	1
	76/	Carburetor Assembly - Holley 1940	1
2	70/76	Spacer - Carburetor To Intake Manifold	1
	76/	Spacer - Carburetor To Intake Manifold	
3	70/	Stud - 3/8-16-24 X 1.62	2
4	70/	Nut - 3/8-24 Hex	2
		CARBURETOR REPAIR KIT	
7	70/76	Kit - Repair	1
	76/	Kit - Repair	1
		CONSISTS OF:	
8		Gasket - Carburetor Flange	7
9		Gasket - Spark Valve	1
10		Gasket - Fuel Bowl To Body	1
11		Gasket - Throttle Body	3
12		Needle and Seat Assy.	1
13		Cup - Pump Piston	1
14		Power Valve	1
15		Seal - Pump Rod	1
16		Cap - Idle Limiter	1
17		Gasket - Thermo Housing Plate - Not Illustrated	1
18		Gasket - Choke Cover - Not Illustrated	1

Power Products

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



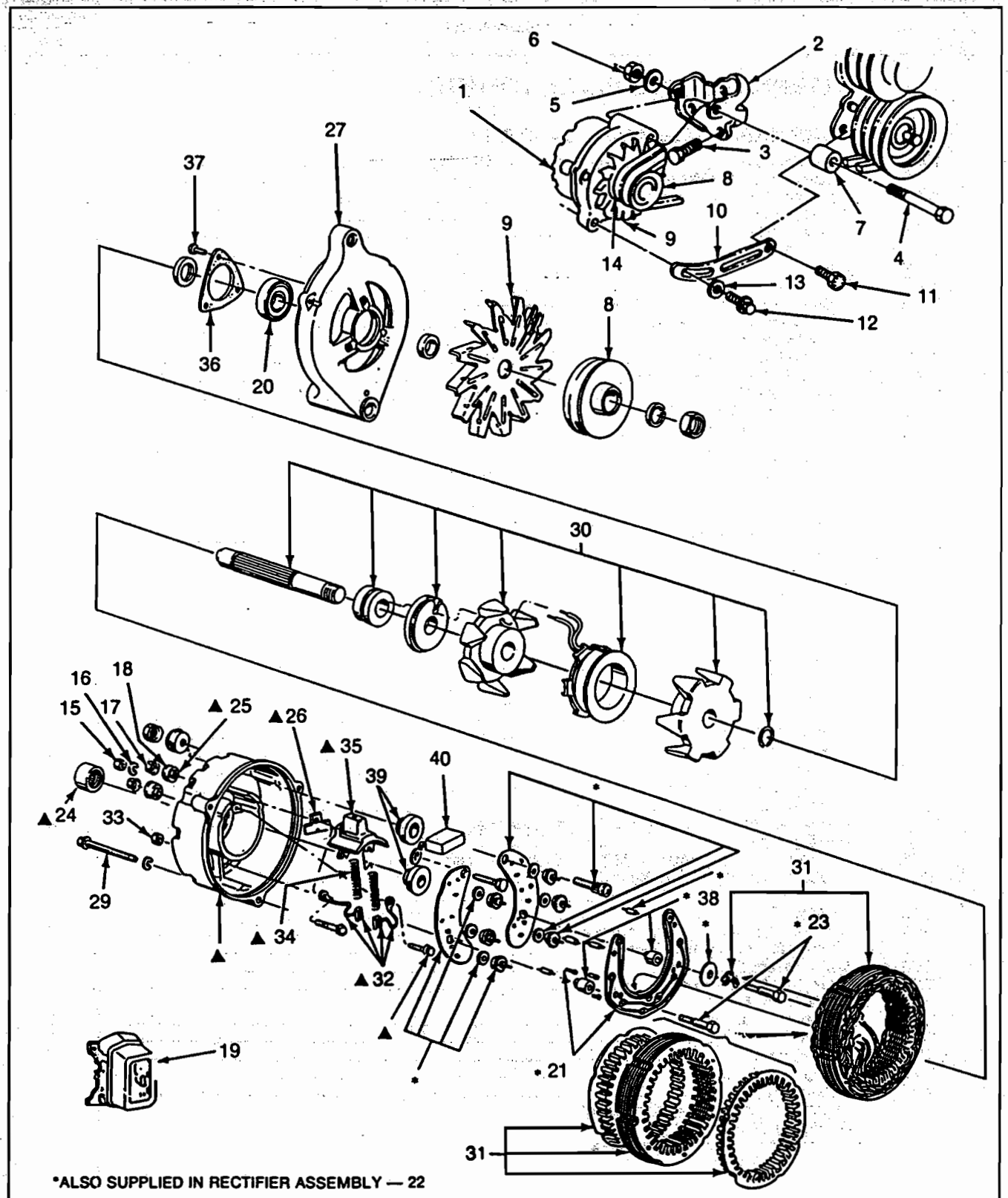
*ALSO SUPPLIED IN RECTIFIER ASSEMBLY — 22

▲ALSO SUPPLIED IN REAR HOUSING ASSEMBLY — 28

ALTERNATOR AND RELATED PARTS — TYPICAL IE-443

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		ALTERNATOR AND RELATED PARTS	
		ALTERNATOR ASSEMBLY - 12V 42 AMP	
1	70/75	Alternator Assembly - Not Serviced - Replaced By D7AZ-C	1
2	70/75	Bracket - Alternator Mounting	1
3	70/75	Bolt - 3/8-16 x 3/4 Locking	1
4	70/75	* Bolt - 7/16-14 x 4.25	1
5	70/75	* Washer - 7/16 Lock	1
6	70/75	* Nut - 7/16-14	1
7	70/75	* Spacer	1
8	70/75	Pulley - Alternator	1
	70/75	Pulley - Alternator - Use With Mechanical Governor	1
9	70/75	Fan - Alternator	1
10	70/75	Arm - Adjusting	1
11	70/75	Bolt - 5/16-18 x 1.625	1
12	70/75	● Bolt - 3/8-16 x 1.12 - Self Locking	1
13	70/75	● Washer - 3/8 Flat	1
14	70/75	Belt - Drive - 15/32 x 41.31	1
15	70/75	★ Nut - 10-32 Hex	3
16	70/75	★ Washer - No. 10 Lock	3
17	70/75	★ Nut - 1/4-20	1
18	70/75	★ Washer - 1/4 Lock	1
19	70/75	Voltage Regulator	1
20	70/75	Bearing - Front	1
21	70/75	Board Kit - Printed Circuit	1
		CONSISTS OF:	
	70/75	Washer	2
	70/75	Nut - 10-24	2
	70/75	Screw	2
	70/75	Board Assy.	1
	70/75	Ring	9
22	70/75	Rectifier Assembly	1
		CONSISTS OF:	
	70/75	Washer	2
	70/75	Nut - No.10-24	2
	70/75	Nut - 1/4-20	2
	70/75	Screw - No.10-24 x 1 37/64	2
	70/75	Insulator	1
	70/75	Insulator - Diode Plate	1
	70/75	Rectifier	1
23	70/75	Screw - No. 10-24 x 1-37/64 - Not Serviced Seperately	2
24	70/75	Bearing - Rear	1
25	70/75	Insulator - Terminal - White - 9/32 ID x 5/8 OD x 1/4 Thick	1
26	70/75	Insulator - Terminal - 1/16 x 3/4 x 1	1
27	70/75	Housing - Front	1
28	70/75	Housing - Rear	1
29	70/75	Bolt - Hex Washer Head - No. 10-24 x 2-1/8	3
30	70/75	Rotor Assembly - Includes Stop Ring	1
31	70/75	Stator Assembly	1
32	70/75	Brush And Terminal Set	1
		CONSISTS OF:	
	70/75	Brush And Terminal	1
	70/75	Brush And Terminal	1
33	70/75	Nut - 10-24	1
34	70/75	Spring - Brush	2
35	70/75	Holder - Brush	1
		* Attach Alternator To Mounting Bracket	
		● Attach Arm To Alternator	
		★ Attach Wires To Alternator Terminals	

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



*ALSO SUPPLIED IN RECTIFIER ASSEMBLY — 22

▲ALSO SUPPLIED IN REAR HOUSING ASSEMBLY — 28

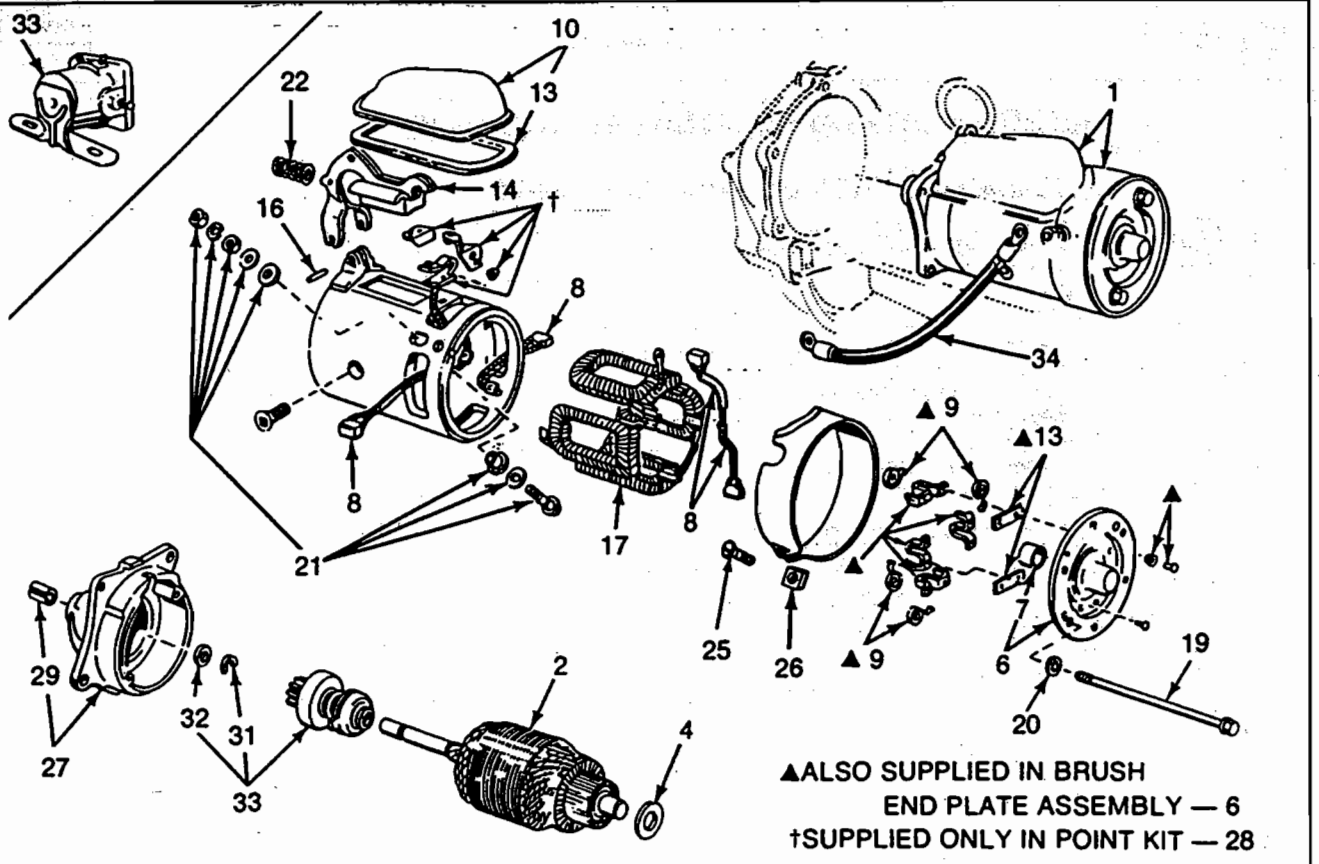
ALTERNATOR AND RELATED PARTS — TYPICAL IE-443

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		ALTERNATOR AND RELATED PARTS (Cont'd)	
		ALTERNATOR ASSEMBLY - 12V 42 AMP (Cont'd)	
36	70/75	Retainer - Front Bearing	1
37	70/75	Screw No. 10-32 x 3/8 - Not Serviced	3
38	70/75	Insulator Kit - Terminal	1
		CONSISTS OF:	
	70/75	Insulator - Terminal	1
	70/75	Insulator - Diode Plate	1
	70/75	Insulator - Diode Plate	1
39	70/75	Insulator Kit - Battery Terminal	1
		CONSISTS OF:	
	70/75	Insulator - Terminal	1
	70/75	Insulator - Diode Plate	1
40	70/75	Capacitor - Radio	1
		ALTERNATOR - MOTOROLA - 12V - 37 AMP	
1	75/	Alternator And Regulator - 37 Amp. - Less Pulley	1
2	75/	Bracket - Alternator Mounting	1
3	75/	† Bolt - 3/8-16 x 3/4 Locking	3
4	75/	† Bolt - 7/16-14 X 4.25	1
6	75/	† Nut - 7/16-14	1
8	75/	Pulley - Alternator - Double Sheave	1
	75/	Pulley - Alternator - Triple Sheave	1
10	75/	Arm - Adjusting	1
11	75/	♠ Bolt - 5/16-18 x 1.625	1
12	75/	♣ Bolt - 3/8-16 x 1.12 - Self Locking	1
13	75/	Washer - 3/8 Flat	1
14	75/	★ Belt - Drive - 15/32 x 41.31	2
19	75/	Regulator - Voltage	1

★ Must Be A Matched Set
† Attach Alternator To Mounting Bracket
♠ Attach Adjusting Arm Thru Front Cover To Block
Attach Adjusting Arm To Alternator

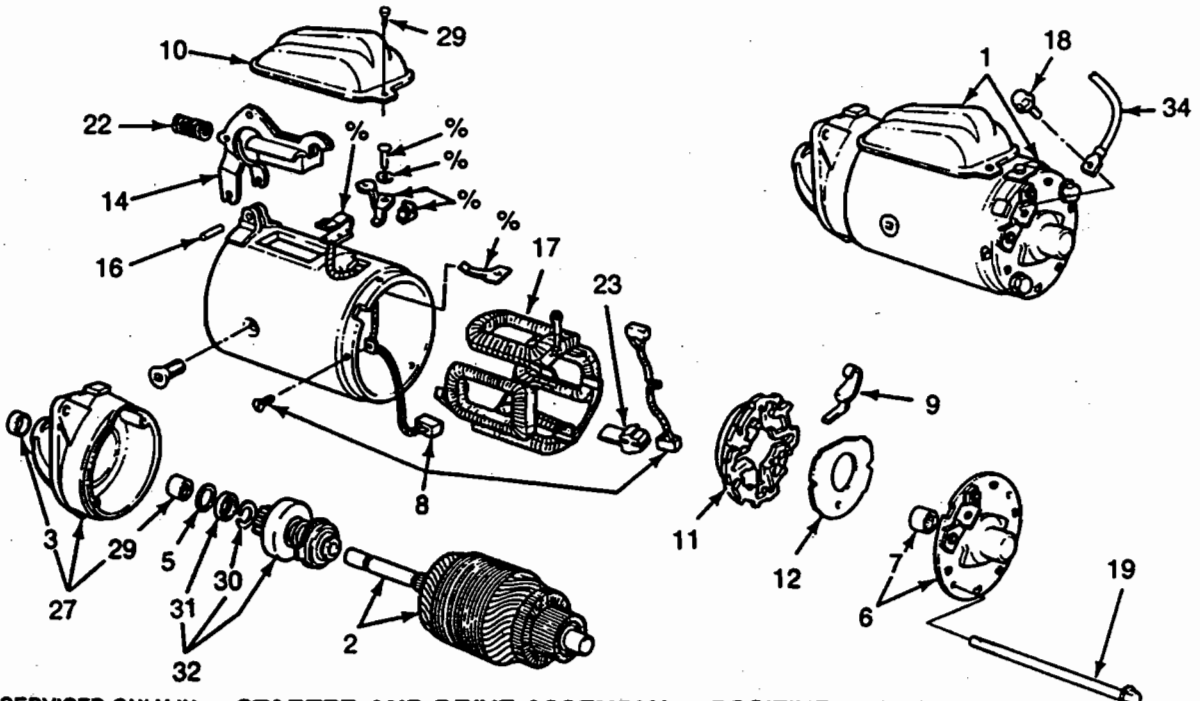
Ford Power Products

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



▲ALSO SUPPLIED IN BRUSH END PLATE ASSEMBLY — 6
†SUPPLIED ONLY IN POINT KIT — 28

STARTER AND DRIVE ASSEMBLY — POSITIVE ENGAGEMENT — TYPICAL



%SERVICED ONLY IN CONTACT POINT KIT — 28

STARTER AND DRIVE ASSEMBLY — POSITIVE ENGAGEMENT ALL W/REAR CABLE ATTACHMENT — TYPICAL

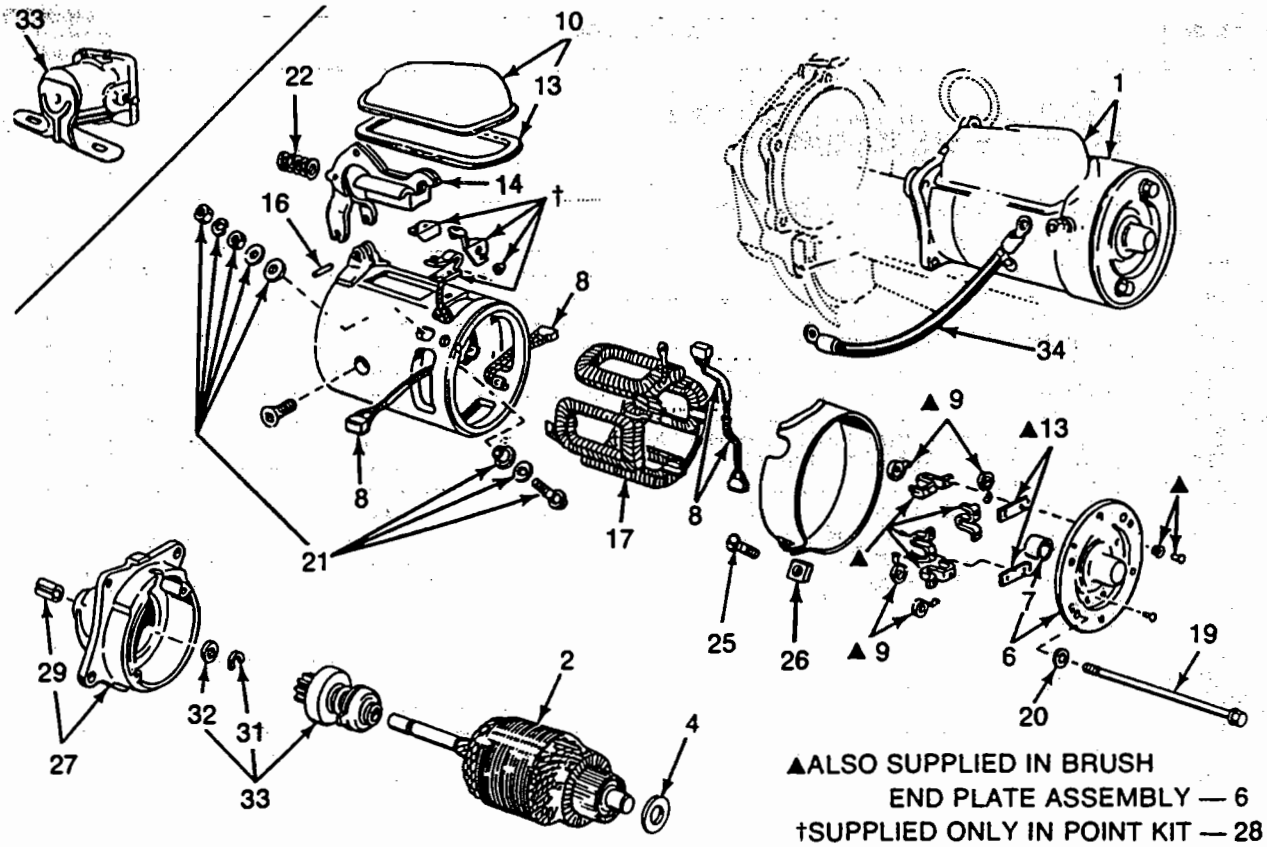
IE-444A

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		STARTER AND RELATED PARTS POSITIVE ENGAGEMENT	
		STARTER AND DRIVE ASSEMBLY	
1	70/77	Starter Motor - 12V - Not Serviced	1
	77/81	Starter Motor - 12V - Not Serviced	1
	81/83	Starter Motor - 12V	1
	83/84	Starter Motor - 12V - Not Serviced	1
	84/92	Starter Motor - 12V - Not Serviced	1
2	70/83	Armature	1
	83/84	Armature	1
	84/92	Armature	1
3	70/77	Seal - Drive End Housing - Not Serviced Seperately	1
4	70/77	Washer - Armature Thrust - Not Serviced	1
5	70/92	Washer - Drive Thrust	1
8	70/77	Plate And Bushing - Brush End	1
	77/83	Plate And Bushing - Brush End	1
	83/92	Plate And Bushing - Brush End	1
7	70/92	Bushing - Brush End Plate	1
8	70/77	Brush Set	1
		CONSISTS OF:	
	70/77	Instruction Sheet	1
	70/77	Brush Set	1
	70/77	Screw	1
	70/77	Brush	1
	70/77	Brush	1
	77/83	Brush Set	1
		CONSISTS OF:	
	77/83	Instruction Sheet	1
	77/83	Screw	2
	77/83	Brush	1
	77/83	Brush	1
	83/92	Brush Set	1
9	70/77	Spring - Brush - Not Serviced	4
	77/92	Spring - Brush	4
10	70/81	Cover - Plunger	1
	81/83	Cover - Plunger	1
	83/92	Cover - Plunger	1
11	77/83	Holder - Brush	1
	83/84	Holder - Brush	1
	84/92	Holder - Brush	1
12	77/83	Insulator - Brush Holder	1
	83/92	Insulator - Brush Holder	1
13	70/77	Gasket - Plunger Cover	1
14	70/77	Lever - Drive	1
	77/81	Lever - Drive	1
	81/83	Lever - Drive	1
	83/92	Lever - Drive - Includes Pin	1
16	77/81	Pin - Lever to Housing - Not Serviced	1
	81/83	Pin - Lever to Housing	1
	70/77	Pin - Lever to Housing - Not Serviced	1
17	70/77	Coil - Field - Complete	1
	77/83	Coil - Field - Complete	1
	83/84	Coil - Field - Complete	1
	84/92	Coil - Field - Complete	1
18	77/92	Screw And Washer - Cable To Plate	1
19	70/83	Bolt - Thru	2
	83/84	Bolt - Thru	2
	84/92	Bolt - Thru	2

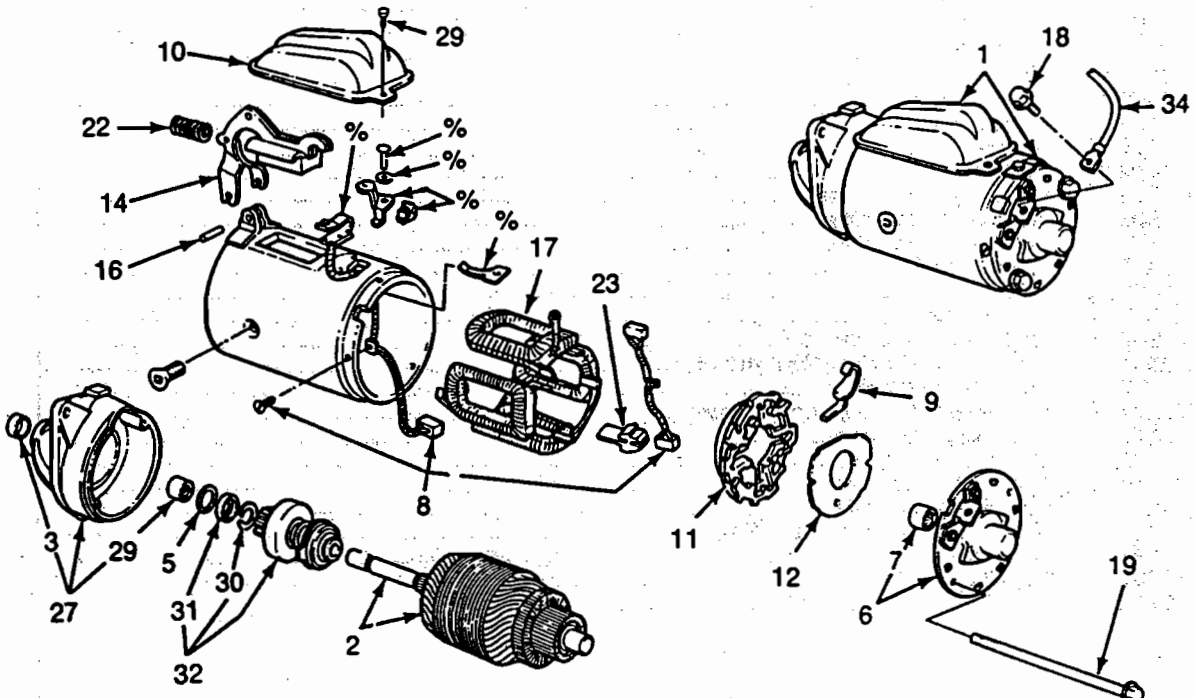
Ford Power Products

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



▲ALSO SUPPLIED IN BRUSH END PLATE ASSEMBLY — 6
†SUPPLIED ONLY IN POINT KIT — 28

STARTER AND DRIVE ASSEMBLY — POSITIVE ENGAGEMENT — TYPICAL



%SERVICED ONLY IN CONTACT POINT KIT — 28

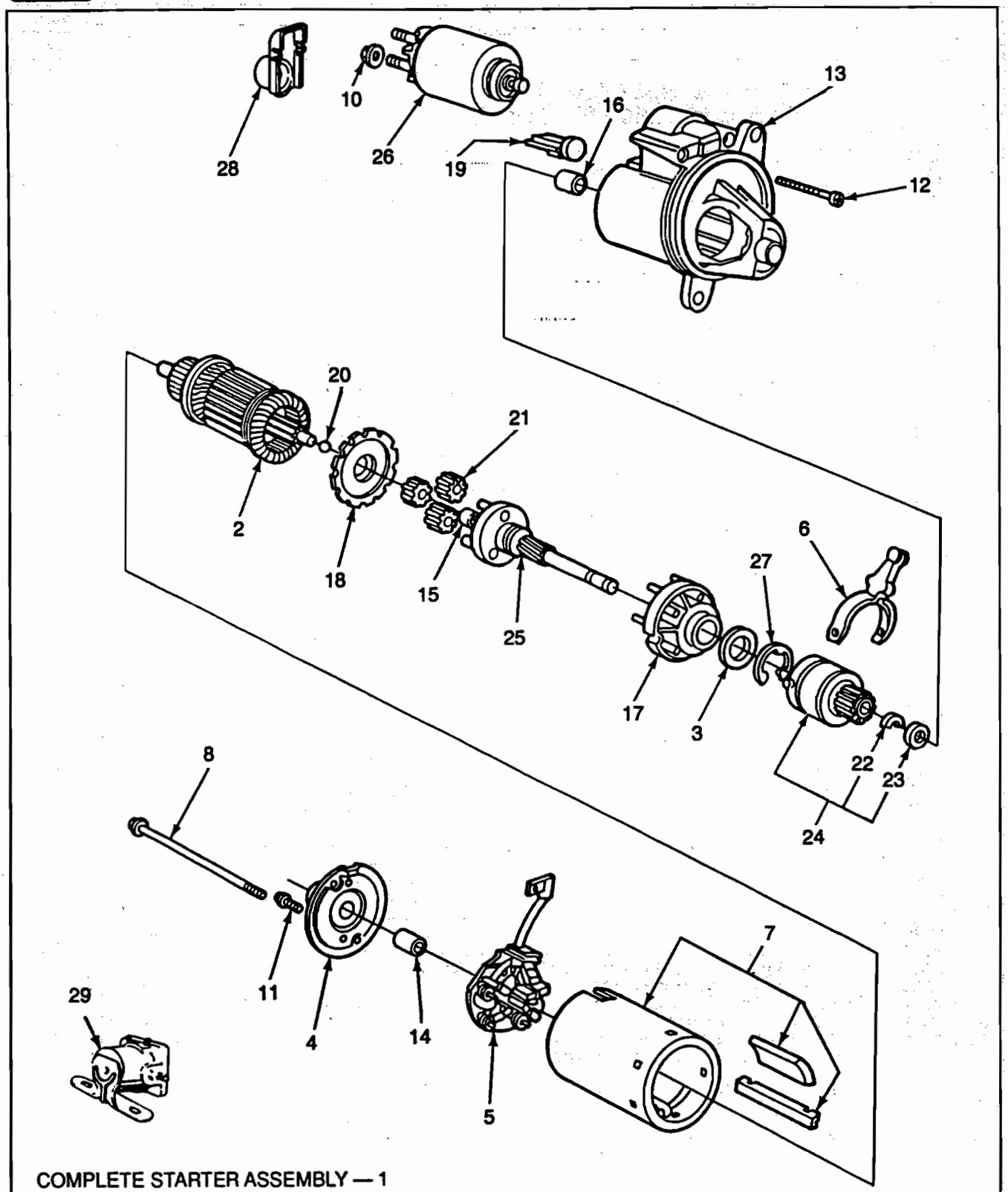
STARTER AND DRIVE ASSEMBLY — POSITIVE ENGAGEMENT ALL W/REAR CABLE ATTACHMENT — TYPICAL

IE-444A

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		STARTER AND RELATED PARTS POSITIVE ENGAGEMENT (Cont'd)	
20	70/77	Washer - 1/4 Lock	2
21	70/77	Field Terminal Kit - Not Serviced	1
22	70/83	Spring - Plunger Return	1
	83/92	Spring - Plunger Return	1
23	77/83	Grommet	1
	83/84	Grommet	1
	84/92	Grommet	1
25	70/77	Screw - Round Head 10-32 x 1.625 - Not Serviced	1
26	70/77	Nut - Square - 10-32 - Not Serviced	1
27	70/81	Housing Kit - Drive End	1
		CONSISTS OF:	
	70/81	Instruction Sheet	1
	70/81	Ring - Drive Stop	1
	70/81	Retainer	1
	70/81	Washer - Drive Thrust	1
	70/81	Lubricant	1
	70/81	Housing	1
	70/81	Seal - Drive End Housing - Not Serviced Seperately	1
	81/83	Housing - Assy. - Includes Bearing	1
	83/92	Housing - Assy. - Includes Bearing	1
28	70/77	Point Kit - Contact	1
		CONSISTS OF:	
	70/77	Instruction Sheet	1
	70/77	Screw	1
	70/77	Insulator	1
	70/77	Spring	1
	70/77	Post	1
	70/77	Insulator	1
	77/83	Point Kit - Contact	1
		CONSISTS OF:	
	77/83	Rivet	1
	77/83	Rivet	1
	77/83	Insulator	1
	77/83	Terminal	1
	77/83	Spring	1
	77/83	Post	1
	77/83	Insulator	1
	83/92	Point Kit - Contact	1
		CONSISTS OF:	
	83/92	Rivet	1
	83/92	Rivet	1
	83/92	Insulator	1
	83/92	Terminal	1
	83/92	Spring	1
	83/92	Post	1
	83/92	Insulator	1
29	83/92	Retainer Assy. - Cover (Screw) - No. 10 Self Tapping - Not Serviced	1
	77/83	Retainer Assy. - Cover (Screw) - 10-32 x 5/8	1
30	70/92	Ring - Drive Stop	1
31	70/92	Retainer - Drive Stop Ring	1
32	70/83	Drive Assembly - Includes Attaching Parts	1
	83/92	Drive Assembly - Includes Attaching Parts	1
		RELAY - STARTER	
33	70/92	Relay - Starter	1
34	70/92	Cable - Relay To Starter	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



COMPLETE STARTER ASSEMBLY — 1
ATTACHING KIT — 9

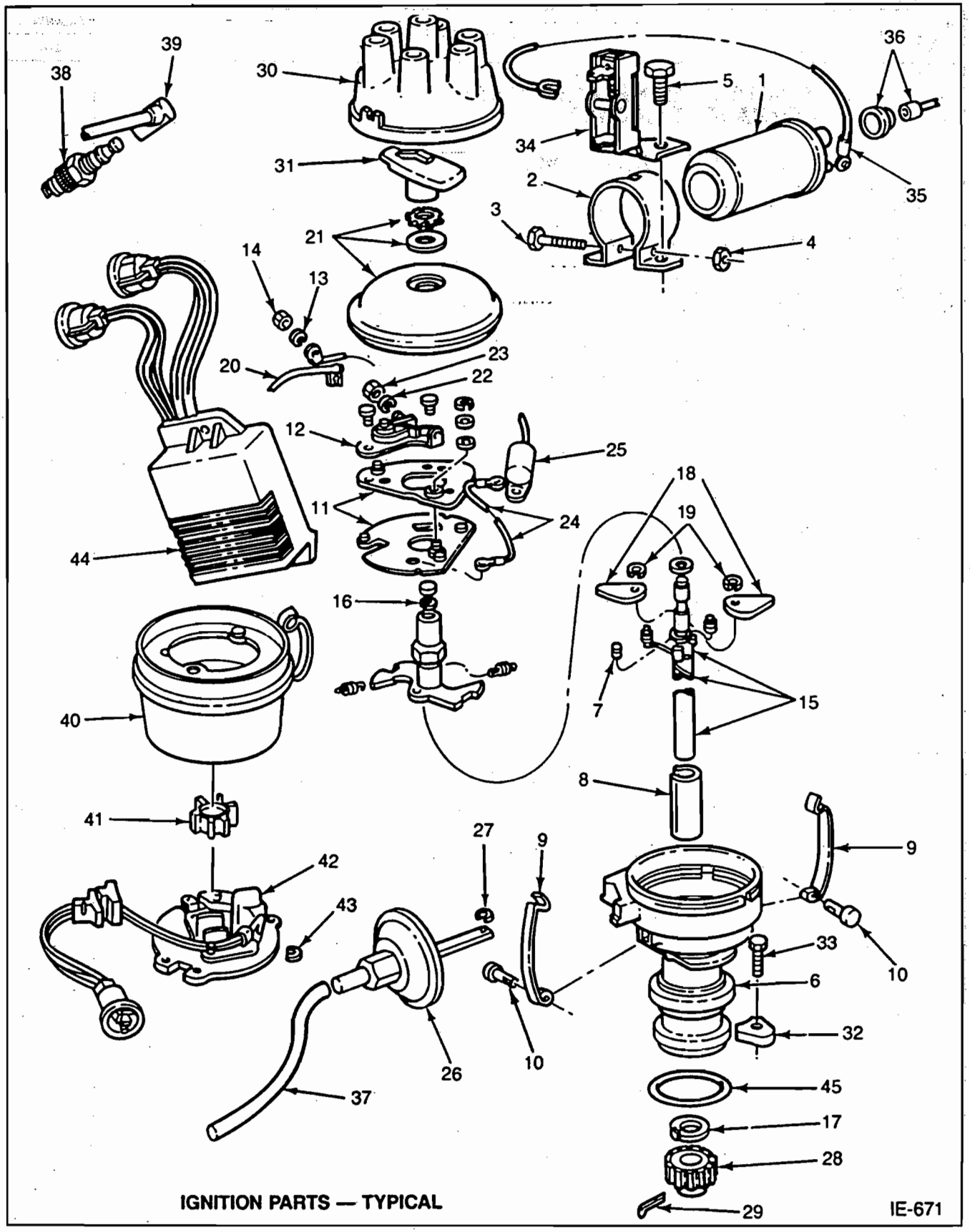
IE-540A

STARTER AND DRIVE ASSEMBLY — PERMANENT MAGNET — TYPICAL

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		STARTER AND RELATED PARTS PERMANENT MAGNET	
		STARTER AND DRIVE ASSEMBLY	
1	92/	Starter	1
2	92/	Armature	1
3	92/	Washer	1
4	92/	Plate And Bearing - Brush End	1
5	92/	Holder - Brush - Includes Brushes	1
6	92/	Lever	1
7	92/	Frame And Magnet Assembly	1
8	92/	Bolt - Thru	2
9	92/	Kit - Attaching	1
		CONSISTS OF:	
10		Nut And Washer - M8	1
11		Screw - M5 x 10.40mm - Serviced In Kit Only	2
12		Screw - M6 x 35.3mm - Serviced In Kit Only	2
13	92/	Housing - Drive End - Includes Bearing	1
14	92/	Bearing	1
15	92/	Bearing - Planet	3
16	92/	Bearing - Drive End Housing	1
17	92/	Gear - Stationary	1
18	92/	Retainer - Gear	1
19	92/	Seal	1
20	92/	Ball - Armature Thrust	1
21	92/	Gear Assembly - Planet - Includes Bearing	3
22	92/	Ring - Drive Stop	1
23	92/	Retainer - Drive Stop Ring	1
24	92/	Drive Assembly - Includes Ring And Retainer	1
25	92/	Shaft Assembly - Output	1
26	92/	Solenoid	1
27	92/	Ring - Retaining	1
28	92/	Cover - Solenoid Terminal	1
		RELAY - STARTER	
29	92/	Relay - Starter	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

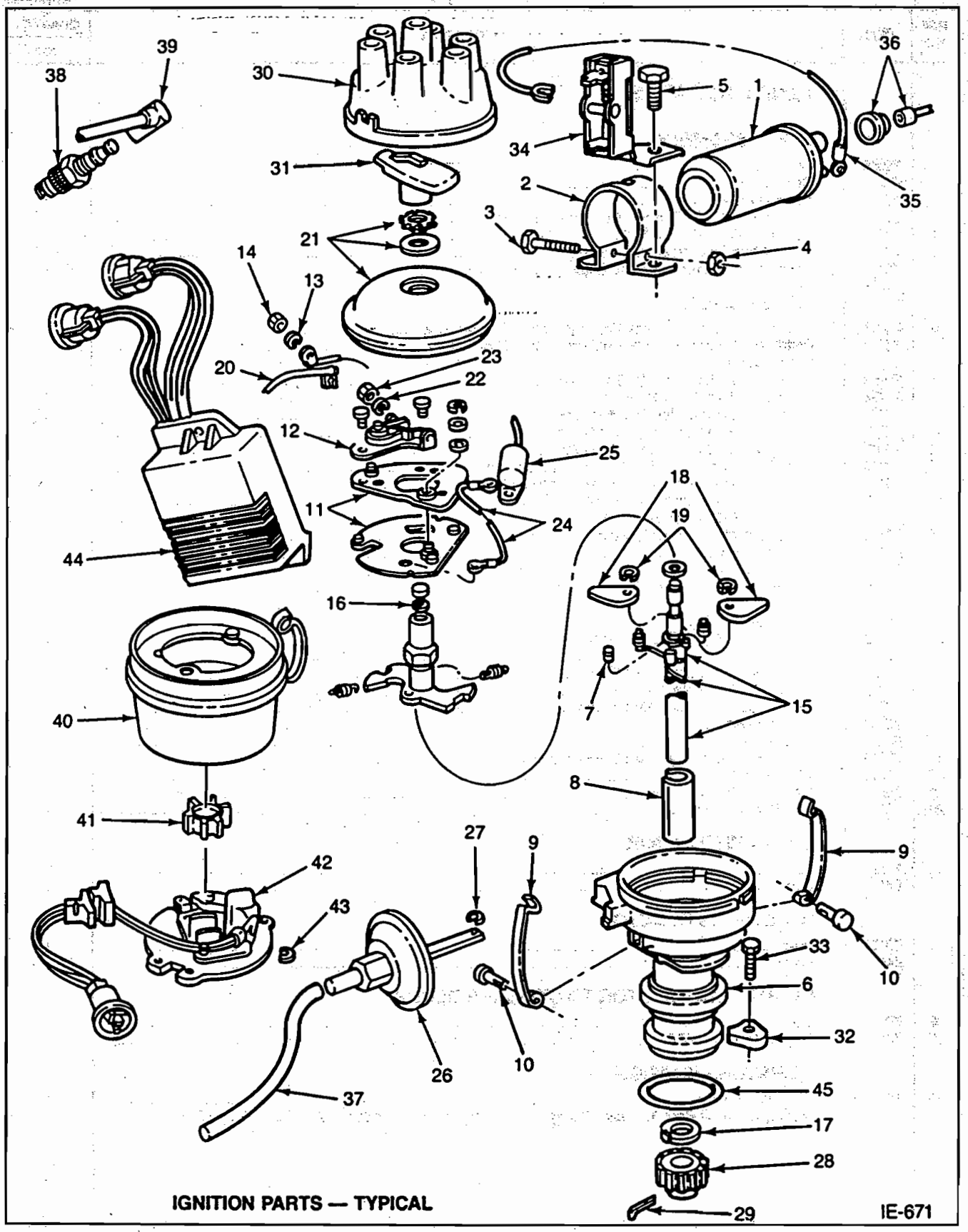


IGNITION PARTS — TYPICAL

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		IGNITION PARTS	
		COIL ASSEMBLY	
1	70/85	Coil	1
	86/	Coil	1
2	70/	Strap - Coil Mounting	1
3	70/	Bolt - 8-32 x 1.75 - Strap To Coil - Not Serviced	1
4	70/	Nut - No.8-32 - Strap to Coil	1
5	70/	Stud - Strap To Engine - 3/8-16-16 x 1.99	A/R
	70/	Screw And Washer - Strap To Engine - 3/8-16 x .75	1
		DISTRIBUTOR	
6	70/86	* Distributor Assembly - Less Cap And Rotor - Conventional	1
	86/	Distributor Assembly - Less Cap And Rotor - Breakerless	1
		CONSISTS OF:	
7	70/83	Sleeve - Shaft Plate - Not Serviced	1
8	70/83	Bushing - Distributor Housing	1
9	70/83	Clamp - Terminal Housing Hold Down	2
10	70/83	Rivet - Terminal Housing Hold Down Clamp	2
11	70/83	Plate Assembly - Breaker - Less Points	1
12	70/83	Point Set Assembly - Breaker Arm And Contact	1
	84/86	Point Set Assembly - Breaker Arm And Contact	1
13	70/83	Washer - No. 6 Lock - Not Serviced	1
14	70/83	Nut - No. 6-32 - Not Serviced	1
15	70/83	Shaft Assembly - Not Serviced	1
	84/	Shaft Assembly	1
16	70/	Retainer - Cam	1
17	70/83	Washer - Gear Thrust - Not Serviced	1
18	70/83	Weight Assembly - Distributor	2
19	70/83	Washer - "C" Type	2
20	70/83	Wire Assembly - Plate Terminal	1
21	70/83	Dust Cover	1
22	70/83	Washer - No. 6 Lock - Not Serviced	1
23	70/83	Nut - No. 6-32 - Not Serviced	1
24	70/83	Wire Assembly - Breaker Ground	1
25	70/83	Condenser	1
	84/	Condenser	1
26	70/83	Diaphragm Assembly - Distributor - Not Serviced	1
27	70/83	Washer - "C" Type	1
28	70/	Gear - Distributor Driven	1
29	70/	Pin - Driven Gear	1
		CAP - DISTRIBUTOR	
30	70/83	Cap	1
	84/	Cap	1
		ROTOR - DISTRIBUTOR	
31	70/83	Rotor	1
	84/	Rotor	1
		CLAMP - DISTRIBUTOR TO CYLINDER BLOCK	
32	70/	Clamp	1
33	70/	Bolt - 5/16 - 18 x .875	1
		RESISTOR - IGNITION	
34	70/	Resistor - Ignition	1

* On Engines Built Prior To 1984 - Necessary To Add Cap, Rotor, Adapter And Spark Plug Wires

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

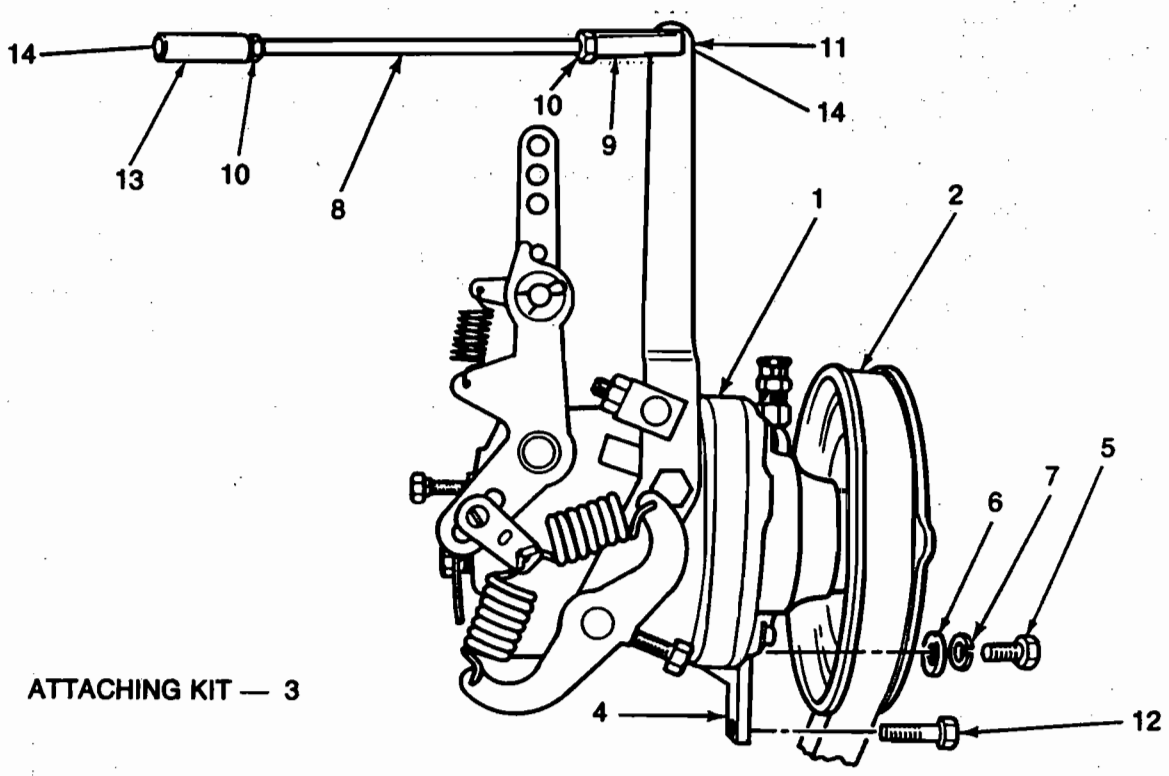


IGNITION PARTS — TYPICAL

IE-671

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		IGNITION PARTS (Cont'd)	
		RESISTOR - IGNITION (Cont'd)	
35	70/	Wire - Coil To Resistor - Not Serviced	1
36	70/	Wire Assembly - Coil To Distributor - High Tension - Not Serviced Separately	1
		HOSE - DISTRIBUTOR VACUUM	
37	70/	Hose - Distributor Vacuum - Cut To Length	1
		SPARK PLUG - ASSEMBLY	
38	70/85	Spark Plug	6
	86/	Spark Plug	6
39	70/83	Wire Set - Spark Plug	1
	84/	Wire Set - Spark Plug	1
		IGNITION COMPONENTS - MISCELLANEOUS	
40	84/	Adapter - Cap To Distributor	1
41	86/	Armature	1
42	86/	Stator Assembly	1
43	86/	Washer - "C" Type	1
44	86/	Module - Ignition	1
	86/	Wire Assembly - Ignition Module	1
45	70/	"O" Ring - Not Serviced	1



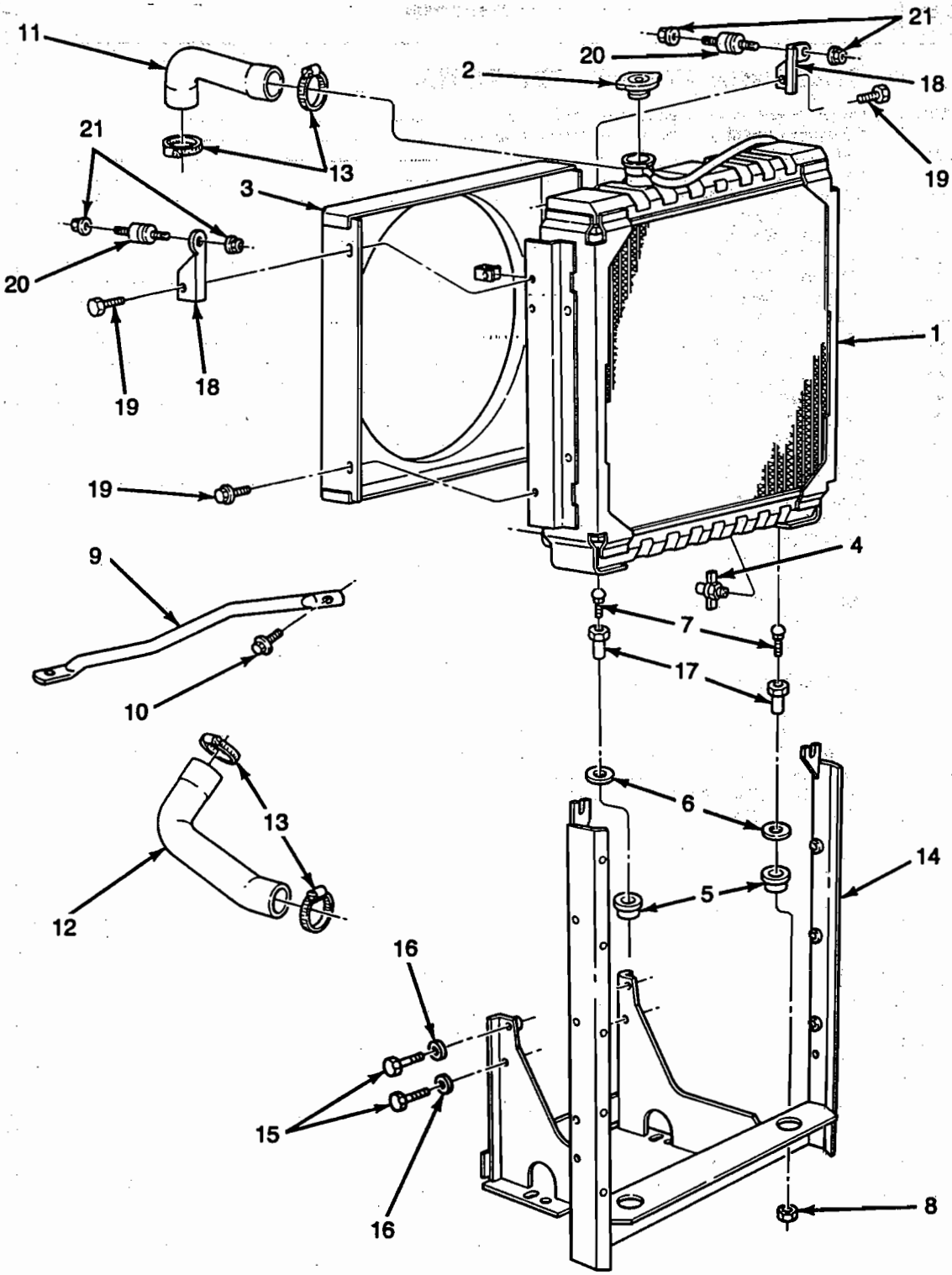
ATTACHING KIT — 3

MECHANICAL GOVERNOR AND RELATED PARTS — TYPICAL IE-53A

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		GOVERNOR AND RELATED PARTS	
1	70/90	Governor Assembly - Mechanical - Variable Speed	1
	91/	Governor Assembly - Mechanical - Variable Speed	1
2	70/90	Belt - 3/8 x 25.625	1
	91/	Belt - 15/32 x 50.00	1
3	70/90	Kit - Governor Attaching	1
		CONSISTS OF:	
4	70/90	Bracket - Governor Mount	1
5	70/90	* Bolt - 3/8-24 x 1.0	3
6	70/90	* Washer - 3/8 Flat	3
7	70/90	* Washer - 3/8 Lock	4
8	70/90	Rod - Throttle	1
9	70/90	Ball Joint - 1/4-28	1
10	70/90	Nut - 1/4-28	2
11	70/90	Washer - 1/4 Lock	1
12	70/90	Bolt - 3/8-16 x 1.25	1
13	70/90	Ball Joint - 1/4-28	1
14	70/90	Nut - 1/4-28	2
4	91/	Bracket - Governor Mount	1
5	91/	* Bolt - 3/8-24 x 1.0	3
6	91/	* Washer - 3/8 Flat	3
7	91/	* Washer - 3/8 Lock	3
8	91/	Rod - Throttle	1
9	91/	Ball Joint - 1/4-28	1
10	91/	Nut - 1/4-28	2
12	91/	Bolt - 3/8-16 x 1.25	1
13	91/	Ball Joint - 1/4-28	1
14	91/	Nut - 1/4-28	2
		GOVERNOR - VELOCITY - NOT ILLUSTRATED	
15	78/	Governor Kit - 2800 To 3400 RPM	1
	78/	Governor Kit - 3400 To 3800 RPM - Not Serviced	1
	78/	Governor Kit - 2000 To 2800 RPM	1
16	78/	Fuel Line	1
17	78/	Hose - Distributor Vacuum - Cut To Length	1
		* Governor To Bracket	

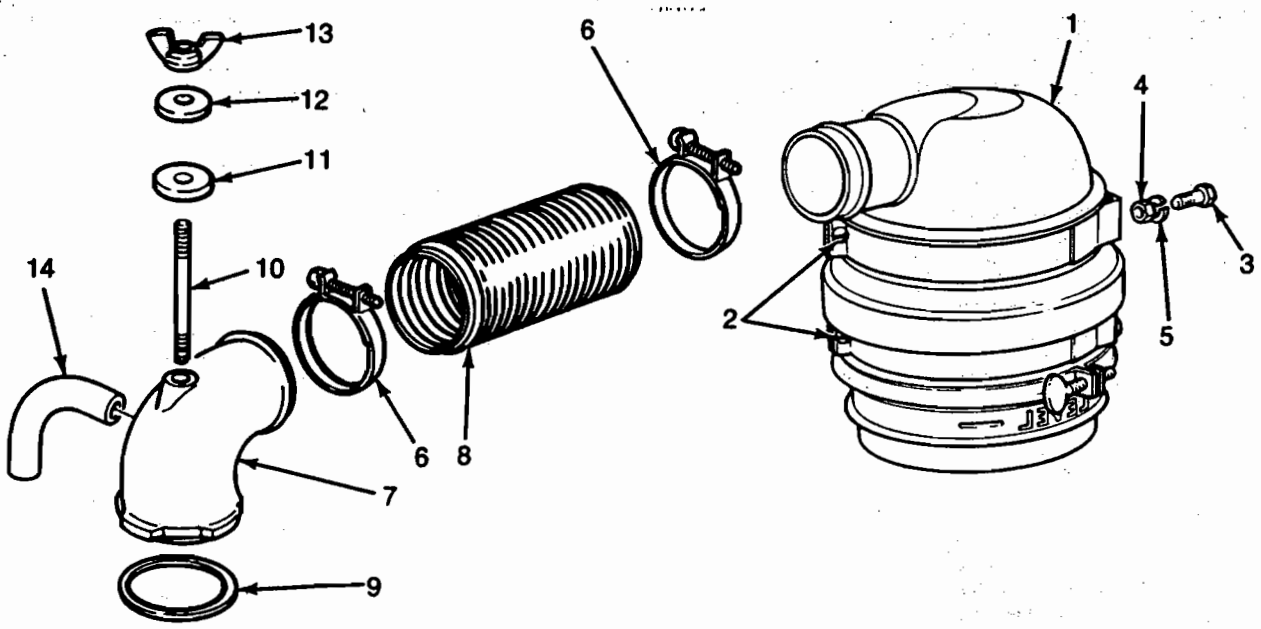
CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



RADIATOR, RADIATOR SUPPORT AND RELATED PARTS, TYPICAL IE-587

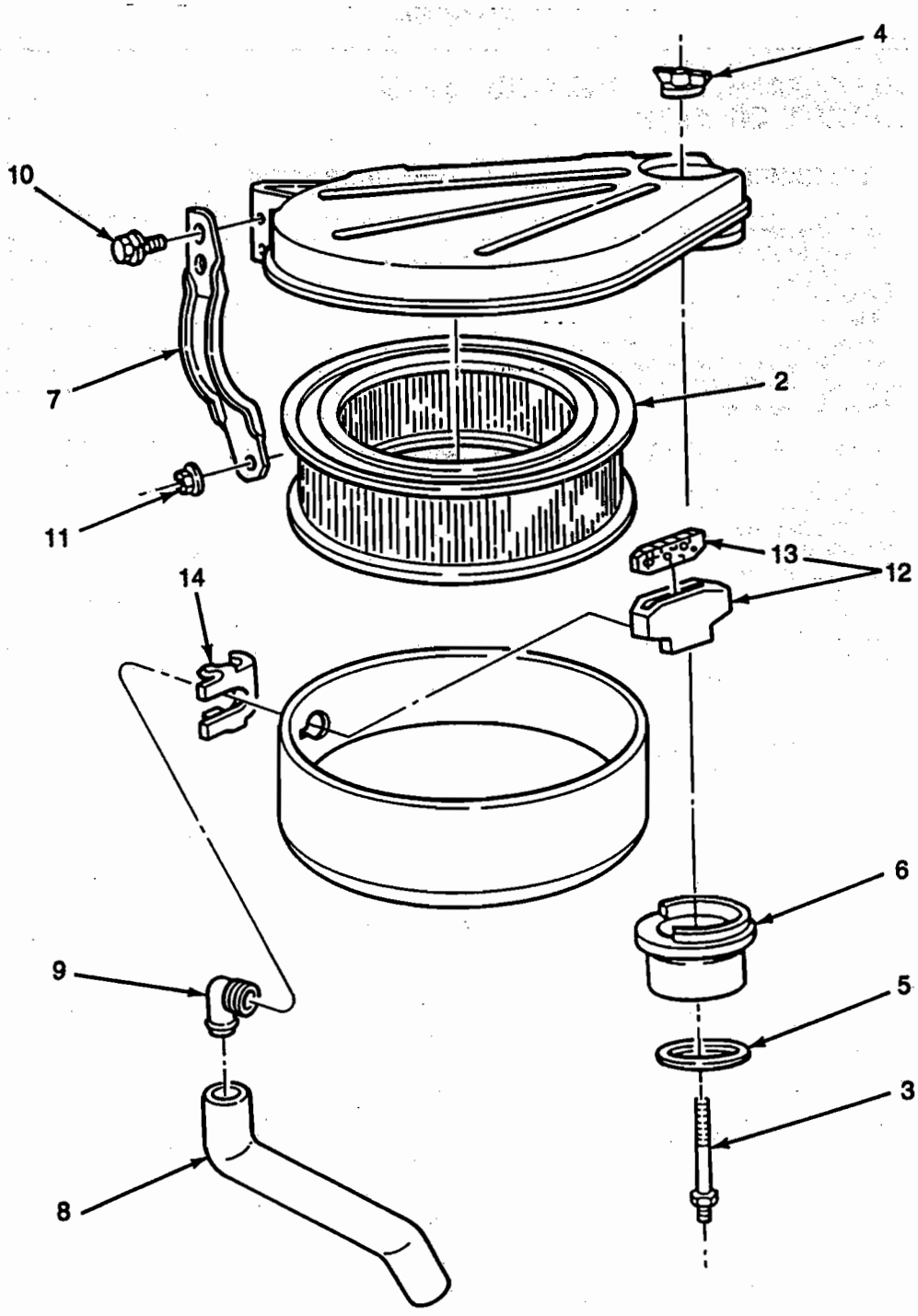
Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		RADIATOR, RADIATOR SUPPORT AND RELATED PARTS	
1	70/88	Radiator Assembly	1
	88/90	Radiator Assembly	1
	91/	Radiator Assembly	1
2	70/88	Cap - Radiator - 7 PSI	1
	88/	Cap - Radiator - 7 PSI	1
3	70/90	Shroud Assembly - Suction Fan	1
	70/90	Shroud Assembly - Pusher Fan	1
	91/	Shroud Assembly - Fan	1
4	70/	Drain Cock	1
5	70/90	Insulator - Oblong	2
	70/90	Insulator - Round	2
	91/	Insulator	2
6	70/90	Washer - 7/16 Flat	2
	91/	Washer - .75 x 2.0 x .12	2
7	88/90	Bolt - 7/16-14 x 1.75 - Carriage	2
	91/	Bolt - 7/16-14 x 1.0 - Carriage	2
8	70/90	Nut - 7/16-14 Locking	2
9	70/90	Brace - Radiator - Left	1
	70/90	Brace - Radiator - Right	1
10	70/90	Bolt - 1/4-20 x .50	2
11	70/88	Hose - Radiator Upper	1
	88/90	Hose - Radiator Upper	1
	91/	Hose - Radiator Upper	1
12	70/90	Hose - Radiator Lower	1
	91/	Hose - Radiator Lower	1
13	70/	Clamp - Radiator Hose	4
14	70/90	Support - Front Engine And Radiator	1
	91/	Support - Front Engine And Radiator	1
15	70/	Bolt - 7/16-14 x .875	3
	70/	Bolt - 7/16-14 x 1.50	1
16	70/	Washer - 7/16 Flat	4
17	91/	Pin - Support - Radiator Lower	2
18	91/	Support - Radiator Upper - Right	1
	91/	Support - Radiator Upper - Left	1
19	91/	Bolt - Washer Head - 3/8-16 x .75	4
20	91/	Stud - Insulator - Upper Radiator Support	2
21	91/	Nut And Washer - M8	4



AIR CLEANER AND RELATED PARTS — REMOTE OIL BATH — TYPICAL IE-441A

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		AIR CLEANER AND RELATED PARTS REMOTE OIL BATH	
		AIR CLEANER - USE WITH HOLLEY 1904 CARBURETOR	
1	70/76	Air Cleaner	1
2	70/76	Clamp - Mounting Bracket	2
3	70/76	Bolt - 5/16-24 x .625	4
4	70/76	Nut - 5/16-24	4
5	70/76	Washer - 5/16 Lock	4
6	70/76	Clamp	2
7	70/76	Air Horn - Does Not Include Clamp	1
	70/76	Clamp - Air Horn To Carburetor	1
6	70/76	Hose - Air Horn To Air Cleaner	1
9	70/76	Gasket - Air Horn To Carburetor	1
		AIR CLEANER - USE WITH HOLLEY 1940 CARBURETOR	
1	76/	Air Cleaner	1
2	76/	Clamp - Mounting Bracket	2
3	76/	Bolt - 5/16-24 x .625	4
4	76/	Nut - 5/16-24	4
5	76/	Washer - 5/16 Lock	4
6	76/	Clamp	2
7	76/	Air Horn	1
8	76/	Hose - Air Horn To Air Cleaner	1
9	76/	Gasket - Air Horn To Carburetor	1
10	76/	Stud - 1/4-20-20 x 3.13	1
11	76/	Seal	1
12	76/	Washer - 5/16 Flat	1
13	76/	Nut - 1/4-20 Wing	1
14	76/	Hose - Crankcase Vent	1



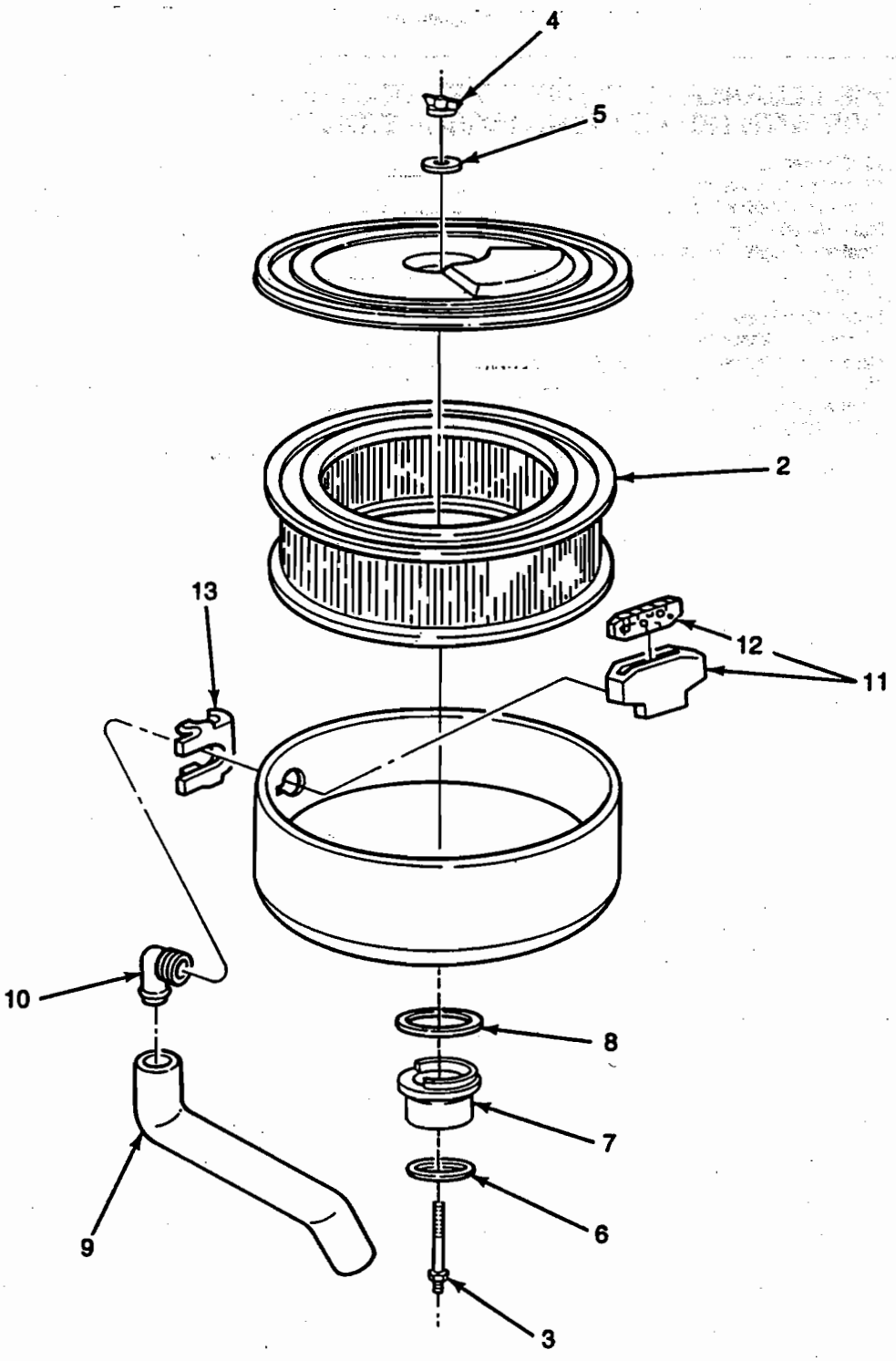
1 — COMPLETE AIR CLEANER ASSEMBLY

AIR CLEANER AND RELATED PARTS — DRY HAT TYPE — TYPICAL

IE-588

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		AIR CLEANER - DRY HAT TYPE - TEAR DROP USE WITH HOLLEY 1940 CARBURETOR	
1	76/	Air Cleaner	1
2	76/	Element - Air Cleaner	1
3	76/	Stud - 1/4-20-20 x 3.50	1
4	76/	Nut - 1/4-20 Wing	1
5	76/	Gasket - Adapter To Carburetor	1
6	76/	Adapter	1
7	76/	Bracket	1
8	76/	Hose - Crankcase Vent	1
9	76/	Elbow - Crankcase Vent Hose	1
10	76/	Screw And Washer - 5/16-18 x .75	1
11	76/	Nut - 3/8-16	1
12	76/	Filter Assembly	1
		CONSISTS OF:	
13	76/	Filter	1
14	76/	Retainer	1



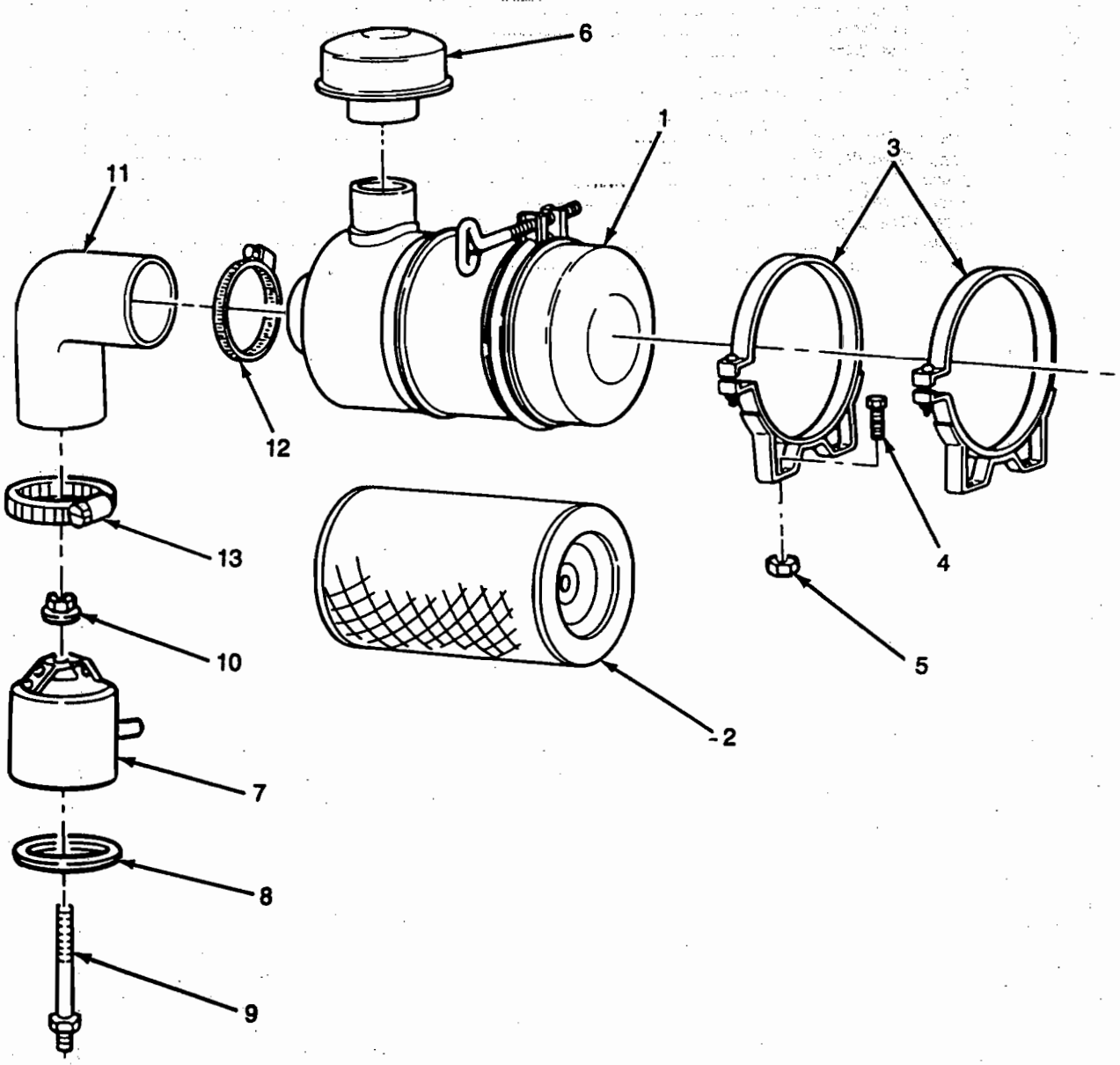
1 — COMPLETE AIR CLEANER ASSEMBLY

AIR CLEANER AND RELATED PARTS — DRY HAT TYPE — TYPICAL

IE-589

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		AIR CLEANER - DRY HAT TYPE - ROUND USE WITH HOLLEY 1940 CARBURETOR	
1	79/	Air Cleaner	1
2	79/	Element - Air Cleaner	1
3	79/	Stud - 1/4-20-20 x 2.375	1
4	79/	Nut - 1/4-20 Wing	1
5	79/	Grommet	1
6	79/	Gasket - Adapter To Carburetor	1
7	79/	Adapter	1
8	79/	Gasket - Air Cleaner To Adapter	1
9	79/	Hose - Crankcase Vent	1
10	79/	Elbow - Crankcase Vent Hose	1
11	79/	Filter Assembly	1
		CONSISTS OF:	
12	79/	Filter	1
13	79/	Retainer	1

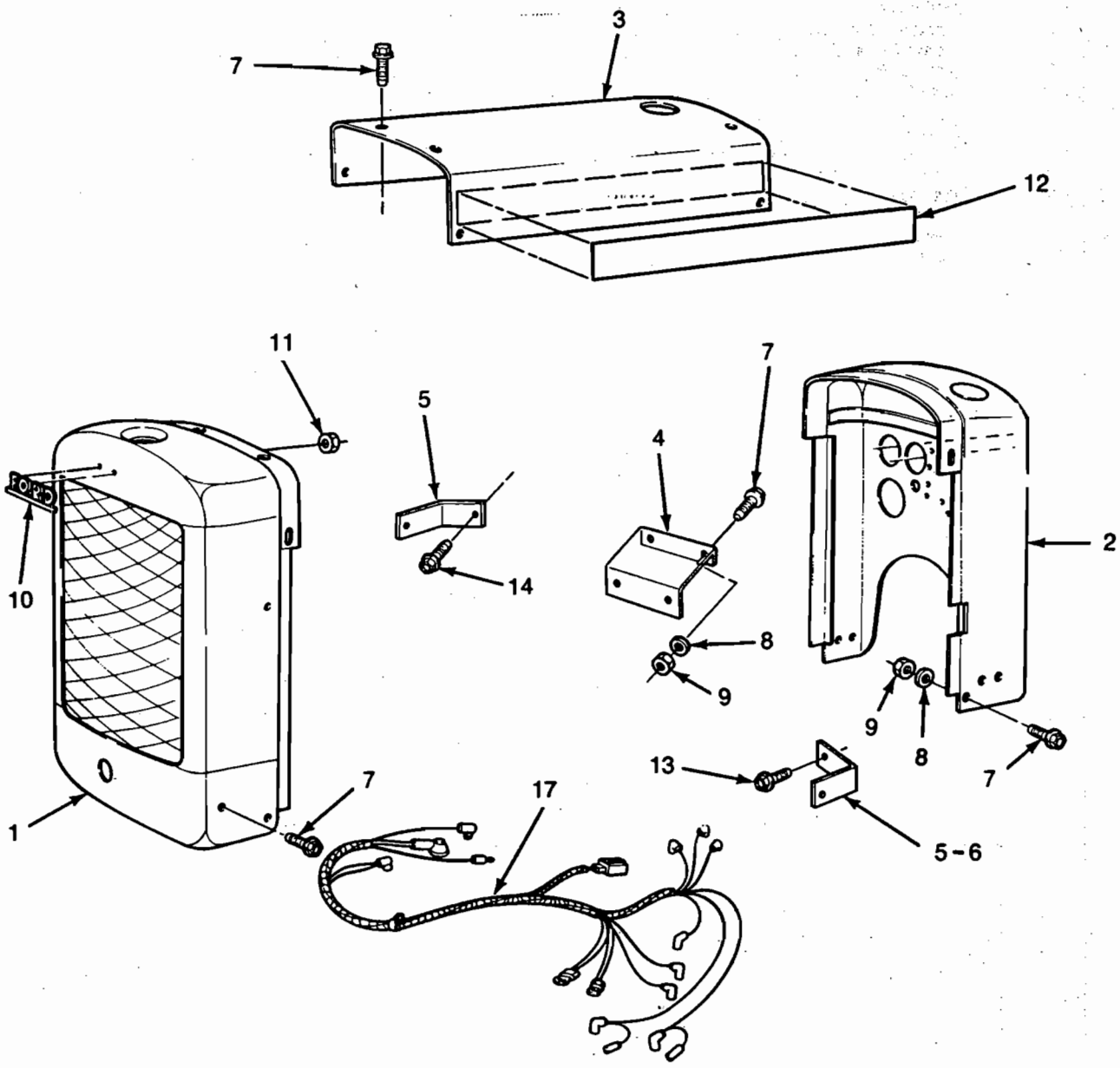


AIR CLEANER AND RELATED PARTS — DRY REMOTE TYPE — TYPICAL IE-560

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY
			300
		AIR CLEANER - DRY REMOTE TYPE USE WITH HOLLEY 1940 CARBURETOR	
1	91/	Air Cleaner	1
2	91/	Element - Air Cleaner	1
3	91/	Clamp Assembly	2
4	91/	Bolt - 5/16-18 x .75	4
5	91/	Nut - 5/16-18 - Washer Head	4
6	91/	Cap - Air Inlet	1
7	91/	Air Horn	1
8	91/	Gasket - Air Horn To Carburetor	1
9	91/	Stud - 1/4-20-20 x 3.13	1
10	91/	Nut - 1/4 x 20	1
11	91/	Hose	1
12	91/	Clamp	1
13	91/	Clamp	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

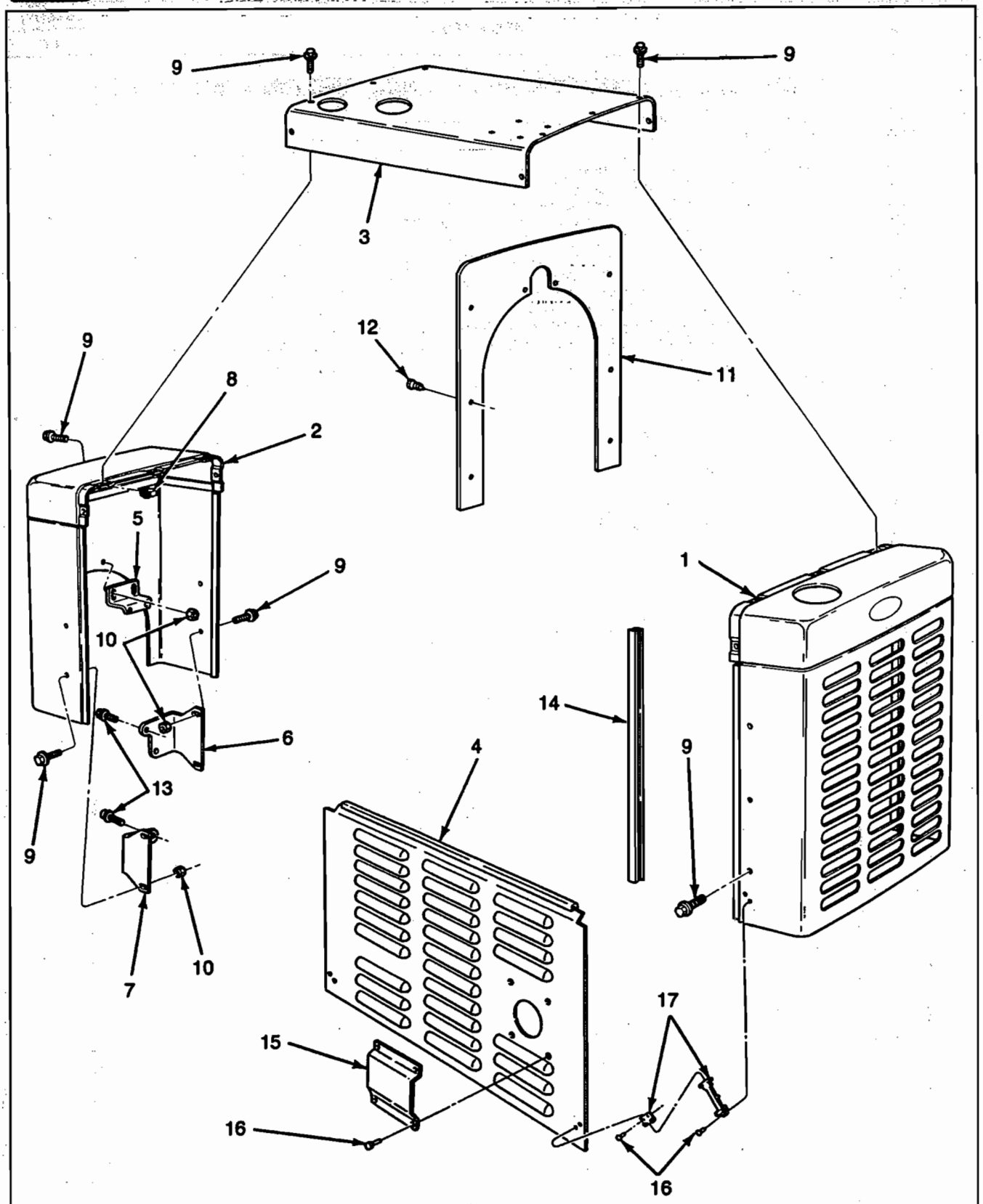


FRONT SHELL, HOOD TOP, REAR PANEL AND RELATED PARTS — TYPICAL IE-417D

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		FRONT SHELL, HOOD TOP, REAR PANEL, AND RELATED PARTS	
1	70/90	Shell - Radiator - Not Serviced	1
2	70/90	Panel - Rear	1
3	70/90	Hood Top	1
4	70/90	Bracket - (For Use With Clutch Housing)	1
	70/90	Bracket - (For Use With SAE Housing)	1
	70/80	Bracket - (For Use With Converter Housing) - Not Serviced	1
	70/90	Bracket - (For Use With Models Less Housings) - Not Serviced	1
5	70/90	Bracket - (For Use With SAE Housing)	2
	70/80	Bracket - RH (For Use With Converter Housing) - Not Serviced	1
	70/90	Bracket - RH (For Use With Models Less Housing) - Not Serviced	1
	70/90	Bracket - RH (For Use With Clutch Housing)	1
6	70/90	Bracket - LH (For Use With Clutch Housing)	1
	70/80	Bracket - LH (For Use With Converter Housing) - Not Serviced	1
	70/90	Bracket - LH (For Use With Models Less Housing) - Not Serviced	1
7	70/90	Bolt - 5/16-24 x .88	A/R
	70/90	Bolt - 5/16-24 x .50	2
8	70/90	Washer - 5/16 Lock	A/R
9	70/90	Nut - 5/16-24	A/R
10	70/80	Emblem - Ford	1
11	70/80	Nut - Speed	4
12	70/90	Stripe - Front Shell Identification	2
13	70/90	Bolt - 5/16-18 x .625	1
14	70/90	Bolt - 3/8-16 x 1.12 - Self Locking	1
15	70/90	Side Panel - Right - Not Illustrated	1
16	70/90	Side Panel - Left - Not Illustrated	1
		WIRING HARNESS	
17	70/75	Harness - Main Wiring - Motorcraft Alternator - Not Serviced	1
	75/85	Harness - Main Wiring - Motorola Alternator	1
	86/90	Harness - Main Wiring - Motorola Alternator	1

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

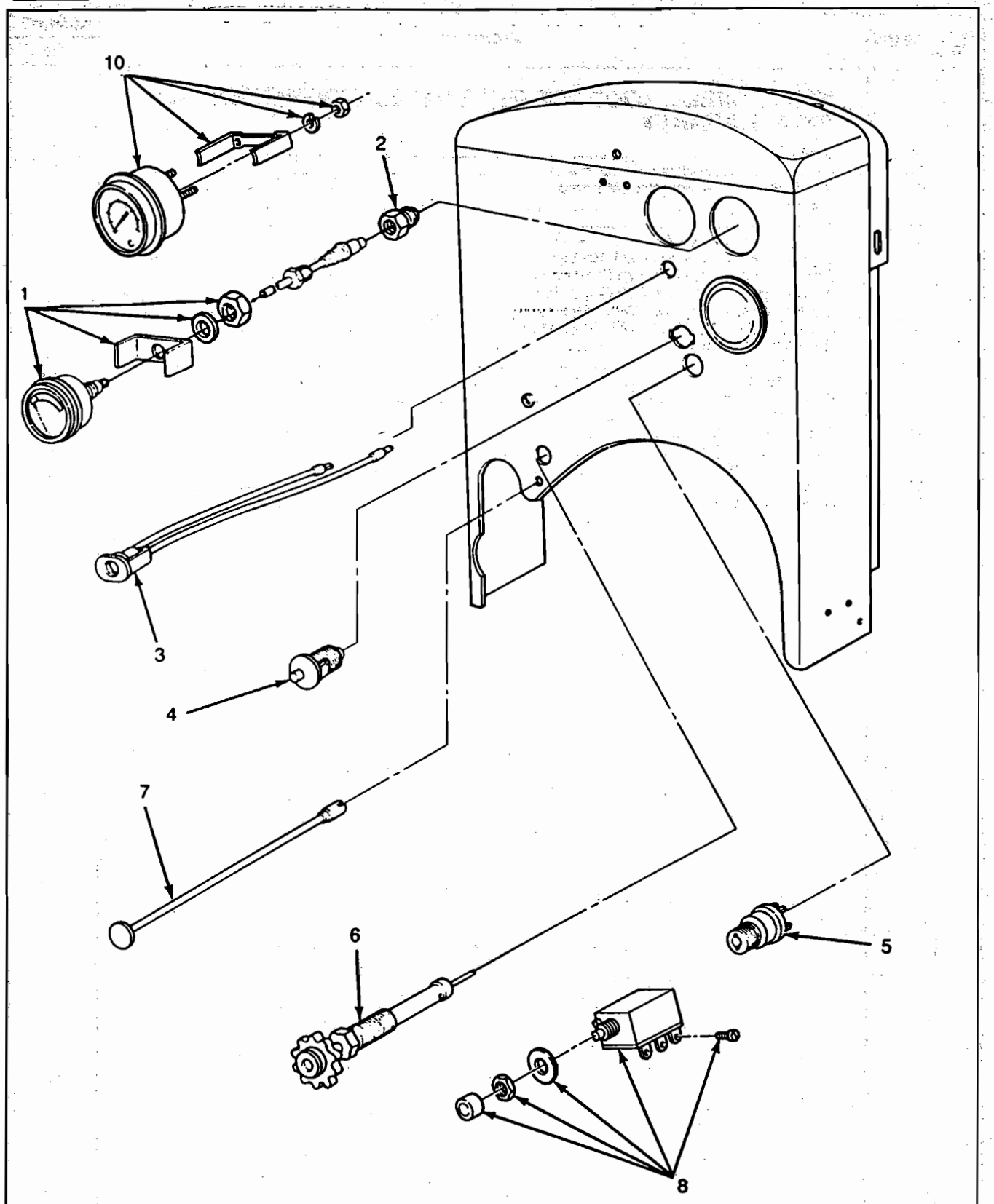


FRONT SHELL, HOOD TOP, REAR PANEL, SIDE PANELS AND RELATED PARTS — TYPICAL IE-561

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY
			300
		FRONT SHELL, HOOD TOP, REAR PANEL, SIDE PANELS AND RELATED PARTS	
1	91/	Shell - Radiator	1
2	91/	Panel - Rear - Rear Mounted Instruments	1
	91/	Panel - Rear - Side Mounted Instruments	1
3	91/	Hood Top	1
4	91/	Panel - Side	2
5	91/	Bracket - Center - Use With Clutch Housing	1
	91/	Bracket - Center - Use With SAE Housing	1
6	91/	Bracket - Rear - Left - Use With SAE Housing	1
	91/	Bracket - Rear - Left - Use With Clutch Housing	1
7	91/	Bracket - Rear - Right - Use With SAE Housing	1
	91/	Bracket - Rear - Right - Use With Clutch Housing	1
8	91/	Nut - 5/16-18 - U Type	10
9	91/	Bolt - 5/16-18 x .75	22
10	91/	Nut - 5/16-18	6
11	91/	Baffle - Radiator	1
12	91/	Pin - Push - 1/4 x .80	8
13	91/	Bolt - 7/16-14 x 1.00	A/R
14	91/	Damper - Side Panel	4
15	91/	Cover - Alternator	1
16	91/	Rivet	20
17	91/	Latch - Side Panel	4

CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT

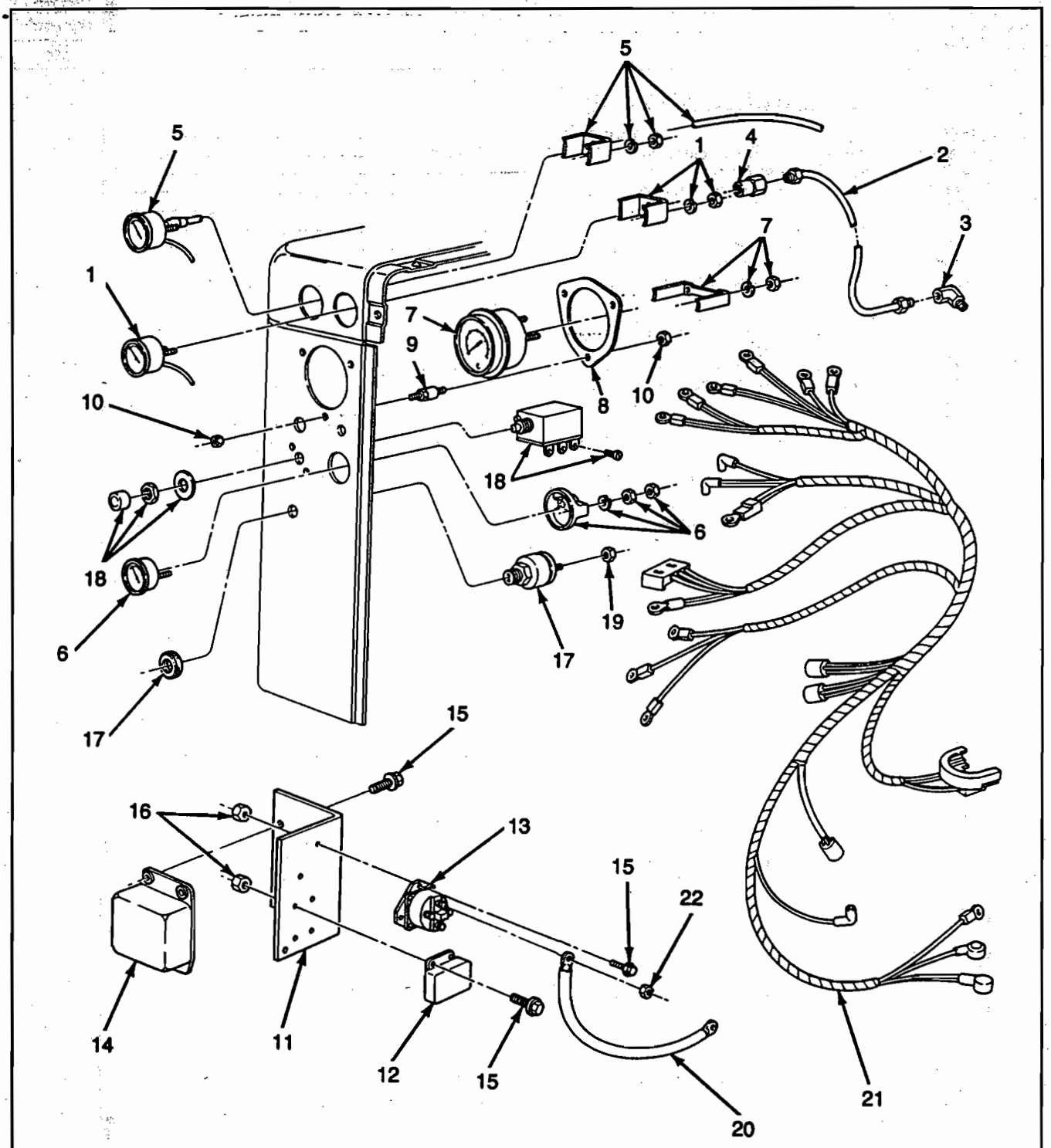


INSTRUMENTS AND GAUGES — TYPICAL IE-440A

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		INSTRUMENTS AND GAUGES	
1	74/90	Gauge - Water Temperature - Includes Adapter	1
2	74/86	Adapter - Water Temperature Gauge - Use With D8JL-A Gauge	1
3	74/90	Light - Alternator Warning	1
	74/90	Light - Low Oil Pressure Warning	1
4	74/85	Button - Starter	1
5	74/85	Switch - Ignition	1
	86/90	Switch - Ignition And Start	1
6	74/90	Cable - Throttle Control	1
7	74/90	Cable - Choke Control	1
		INSTRUMENTS AND GAUGES - SAFETY	
1	86/90	Gauge - Water Temperature	1
3	86/90	Light - Alternator Warning	1
	86/90	Light - Low Oil Pressure Warning	1
5	86/90	Switch - Ignition And Start	1
8	86/90	Switch - Magnetic Safety	1
9	86/90	Wire Assembly - Oil Light To Magnetic Safety Switch - Not Illustrated	1
		TACHOMETER / HOURMETER - ELECTRICAL	
10	83/90	Meter - Tachometer And Hour	1
11	83/90	Wiring Assembly - Not Illustrated	1

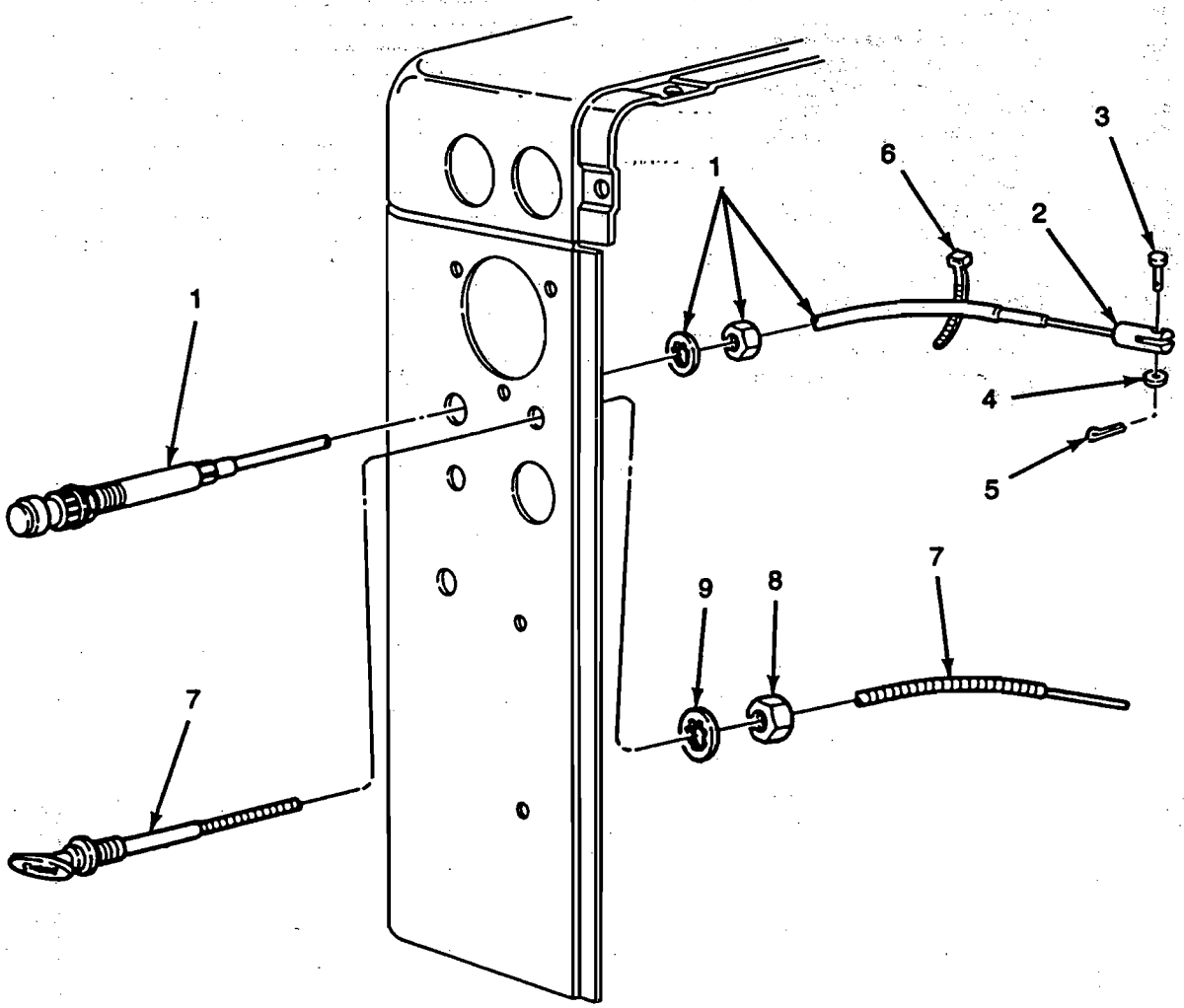
CSG 649 AND CSG 649P
300 CID
GASOLINE ENGINES AND POWER UNIT



INSTRUMENTS AND GAUGES — TYPICAL IE-562

Ford Power Products

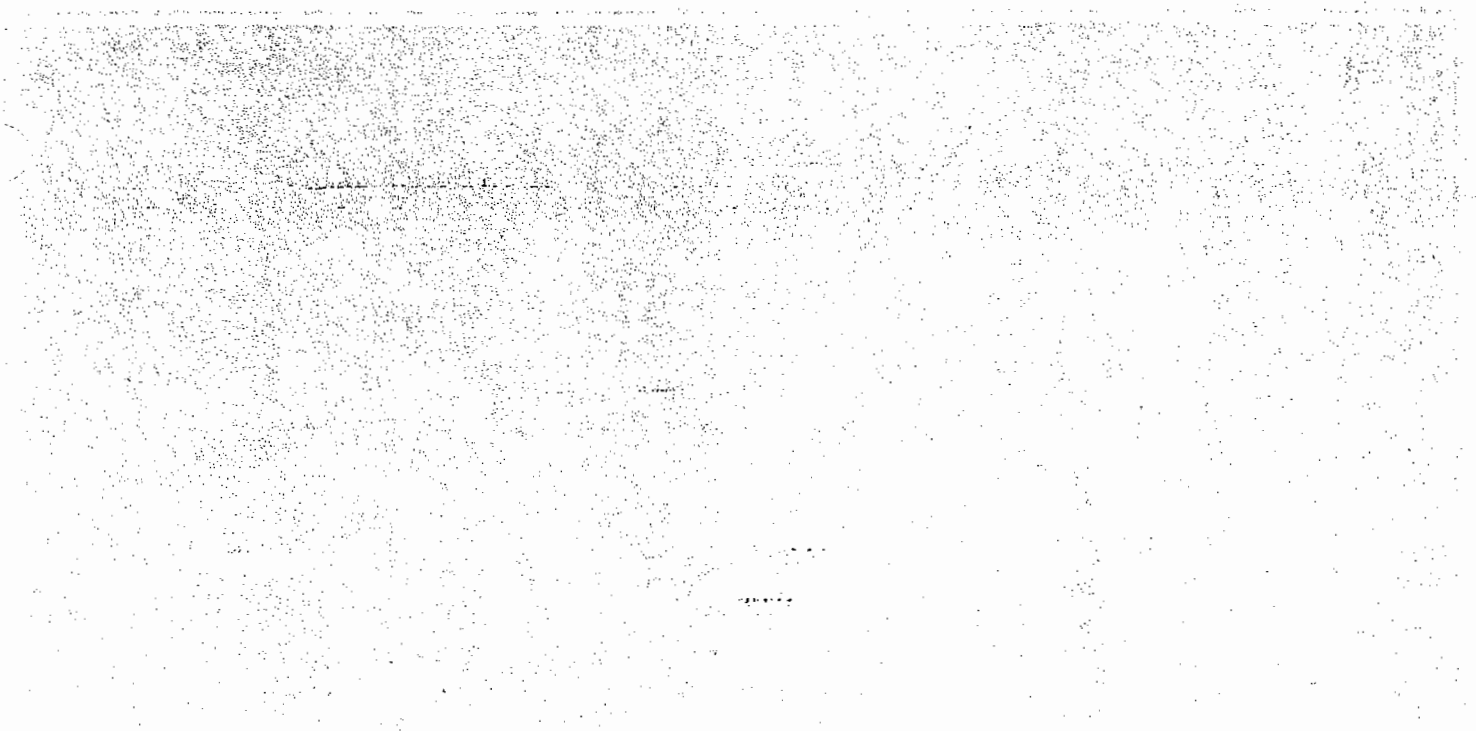
REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		INSTRUMENTS AND GAUGES	
1	91/	Gauge - Oil Pressure	1
2	91/	Tube-Oil Pressure	1
3	91/	Elbow 90 Deg. 1/8 Tube To 1/8 Pipe	1
4	91/	Bushing - Reducer - 1/4 To 1/8	1
5	91/	Gauge - Water Temperature	1
6	91/	Voltmeter	1
7	91/	Meter - Tachometer And Hour	1
8	91/	Plate - Tachometer Adapter	1
9	91/	Damper - Tachometer Vibration	3
10	91/	Nut And Washer - No. 8-32	6
11	91/	Bracket - Alternator Voltage Regulator	1
12	91/	Regulator - Voltage	1
13	91/	Relay - Starter	1
14	91/	Module - Ignition	1
15	91/	Bolt - 1/4-20 x .75	8
16	91/	Nut - 1/4-20 Lock	5
17	91/	Switch - Ignition And Start	1
18	91/	Switch - Magnetic Safety	1
19	91/	Nut - No.10-32	1
20	91/	Cable - Relay To Starter	1
21	91/	Harness - Wiring - 37A Alternator	1
22	91/	Nut And Washer - 5/16-18	2

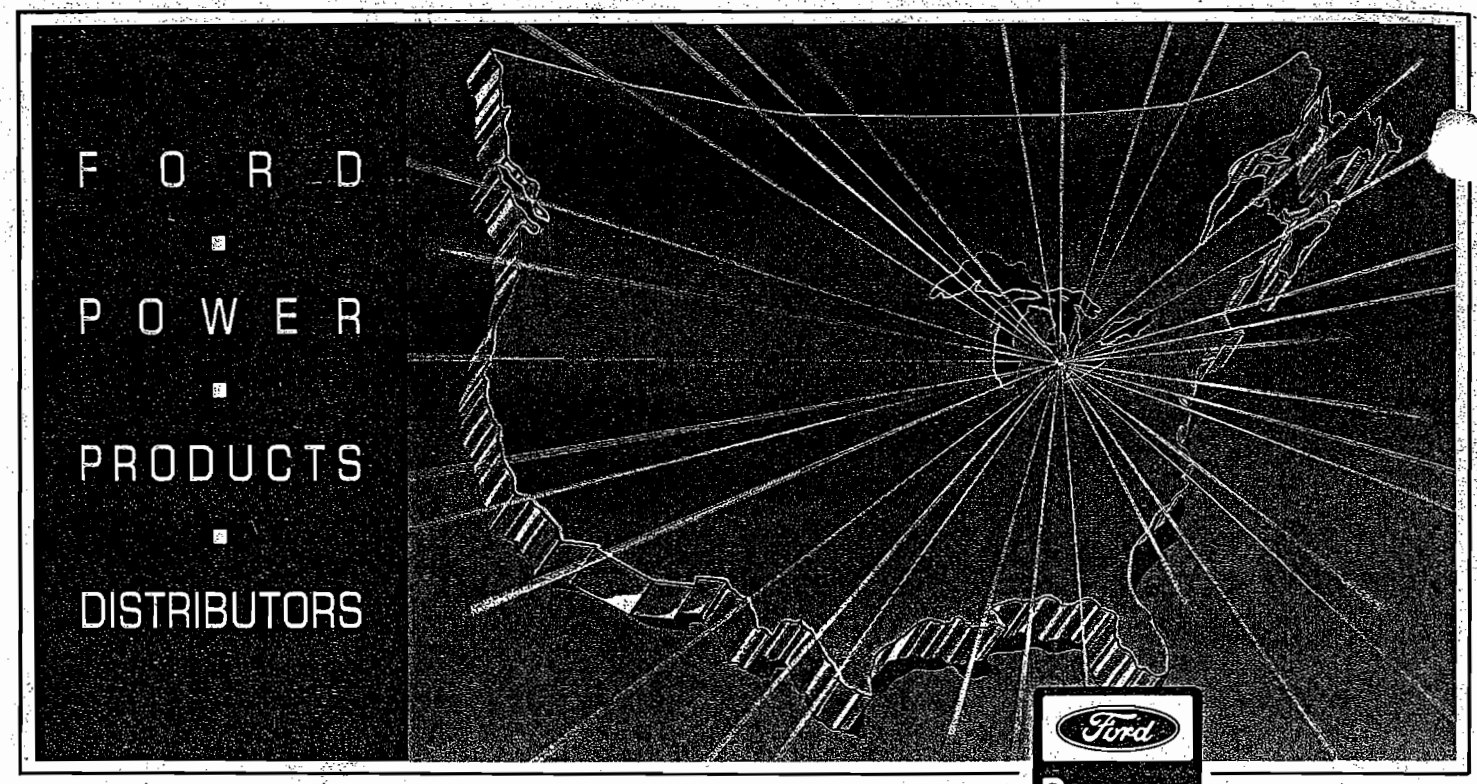


THROTTLE AND CHOKE CONTROLS — TYPICAL IE-563

Ford Power Products

REF NO.	YEAR	DESCRIPTION	QUANTITY 300
		THROTTLE AND CHOKE CONTROLS	
1	91/	Cable - Throttle Control - Includes Nut And Washer	1
2	91/	Clevis	1
3	91/	Pin - Clevis - 1/4 x 13/16	1
4	91/	Washer - 1/4 Flat	1
5	91/	Pin - Cotter - 1/16 x .75	1
6	91/	Strap - Bundling	1
7	91/	Cable - Choke Control	1
8	91/	Nut - 9/16-18 Lock	1
9	91/	Washer - 9/16 Lock	1





Ford
Power Products

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Geometric Results Incorporated
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