Chapter 1

GENERAL INFORMATION

1-1 PURPOSE OF EQUIPMENT.

The Flightline Tow Factors Model No. 3 (herein referred to as the vehicle), is designed for use in general towing operations in a flightline environment. It is designed for towing trailers and other wheeled loads. Pintle hooks in the front and rear of the vehicle are available for the attachment of loads.

1-2 GENERAL DESCRIPTION.

The vehicle is designed for high maneuverability, ease of operation and maximum flexibility in flightline towing operations. The vehicle is built in accordance with conventional design for automotive-type vehicles and is equipped with a diesel engine, three-speed automatic transmission, pneumatic tires and hydraulic brakes. See figure 1-1 for identification of major components. Power is provided by the six cylinder diesel engine which drives the rear axle through the transfer case, torque converter and transmission.

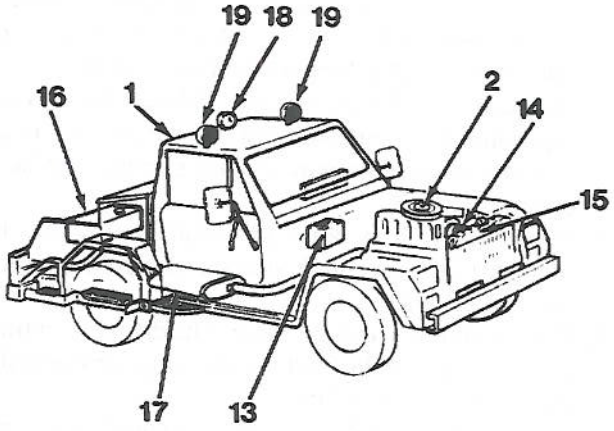
The operator's compartment seats three, and all controls and instruments necessary for vehicle operation are conveniently arranged in the cab. All instruments and controls are generally similar to the controls for any conventional piece of automotive equipment. The vehicle also has four pintle hooks, including one in front, and an extendable hitch assembly in the rear. An exterior tool box, a work light and ballast mounts are also located on the rear of the vehicle.

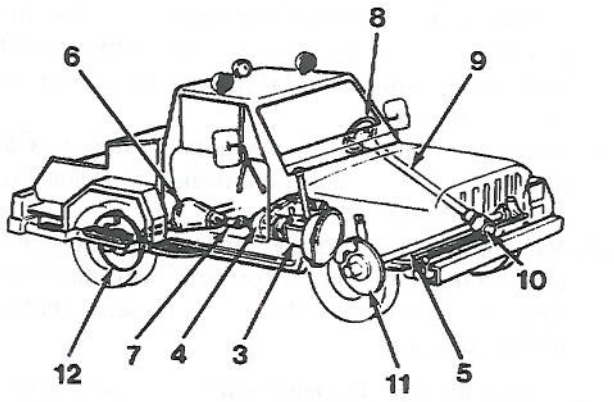
1-3 DETAILED DESCRIPTION.

The following items represent the major components and systems contained on this vehicle and are described here in detail.

1-3.1 ***Frame***. The frame is the foundation and structural center of the vehicle. In addition to carrying the load, it mounts and supports the power unit while maintaining correct relationship and alignment of the power train. This relationship assures normal functioning of the units and freedom from excessive wear, stress and strain. The frame is constructed of heavy-channel-steel side rails and crossmembers. The crossmembers maintain the proper positions of the side rails in direct relationship to each other, providing maximum resistance to torsional twists and strains.

1-3.2 ***Engine.*** The engine is a four-cycle, six-cylinder, in-line swirl combustion chamber diesel engine. Listed below are several features which





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1. Cab
2. Engine
3. Transmission
4. Transfer Case
5. Front Axle
6. Rear Axle
7. Propeller Shaft
8. Steering Wheel
9. Steering Column
10. Steering Gear
11. Front Disc Brakes
12. Rear Drum Brakes
13. Battery
14. Alternator
15. Radiator
16. Fuel Tank
17. Muffler
18. Work Light
19. Warning Lights

Figure 1-1. Major Components

contribute to its economy, durability and quiet operation.

(1) Spherical-Swirl Combustion Chamber. A spherical-swirl combustion chamber is connected by an eliptical opening to the main combustion chamber. Compressed air in the cylinder is introduced into the swirl chamber where fuel is sprayed at a right angle to the air stream. This contributes to rapid and effective combustion of the air/fuel mixture and to quiet operation, easy starting and fuel economy.

(2) Glow Plugs. Glow plugs are installed at each cylinder to promote quick starts under cold operating conditions.

(3) Replaceable Cylinder Liners. The dry-type cylinder liners are replaceable, improving serviceability and long engine life.

(4) Lubrication. A full-flow oil filter and large oil cooler extend intervals between oil changes and maintain proper oil temperature; oil jets cool the pistons.

(5) Piston Rings. The piston rings are hard chromium plated to improve wear resistance. The first piston ring is a full-keystone type which resists high temperature. Hood ring carriers are cast into the piston groove.

(6) Vibration Dampening. A rubber damper is attached to the end of the crankshaft to absorb torsional vibration.

(7) Vacuum Pump. A rotary-vane type pump generates vacuum for the power brake unit and other systems. The pump is driven on the same shaft as the alternator.

1-3.3 ***Transmission***. The automotive transmission used in the vehicle is a fully automatic, three-speed, hydraulically operated unit with a compound planetary gear system. A three-element torque converter is used for all applications. A manually operated gearshift linkage is used to select the desired gear range. The transmission case and converter housing consists of a one-piece aluminum casting. An aluminum adapter housing is used to connect the transmission to the transfer case. The shift points on this model vary with throttle opening. Listed below are transmission components and related assemblies.

(1) Torque Converter. The three-element torque converter consists of a front cover, impeller, turbine, stator and stator over-running clutch. The impeller is the driving member and is connected to the engine crankshaft through the front cover which is welded to the impeller. The turbine is the driven member and is splined to the transmission input shaft. The stator is the reaction member and is splined to the transmission reaction shaft.

(2) Clutch-Band-Gear System. The transmission contains multiple disc clutches, two bands and actuating servos, an over-running clutch and two planetary gear sets, all of which combine to provide one reverse and three forward gear ranges. The planetary gear sets are connected by a common sun gear. The sun gear is interconnected to the multiple disc clutches through the driving shell which is splined to the sun gear and front clutch retainer.

(3) Hydraulic System. The hydraulic system consists of a single oil pump, a valve body containing the pressure-regulating shift control valves, a governor valve assembly, two bands and actuating servos and an accumulator.

1-3.4 ***Brakes***. The vehicle is equipped with single-piston, low-drag, floating caliper front disc brakes. Listed below are features of the brake system.

(1) The brake caliper slides on pivot bolts installed in the support shield and bracket assembly.

(2) The rear drum brakes have linkage-operated adjusters.

(3) A dual-reservoir master cylinder that provides separate hydraulic systems for the front and rear brake is used.

(4) A three-function combination valve is used. The valve consists of a one-piece housing containing a front brake metering valve, pressure differential warning valve and rear brake proportioning valve.

(5) The power brake unit is a 9-1/2 inch single diaphragm power unit.

(6) The vacuum pump is mounted on the rear cover of the alternator. It produces vacuum for the power brakes and other components.

1-3.5 ***Steering System***. The power steering system forms a closed system consisting of a power steering gear, a hydraulic pump and interconnecting hoses. The system fluid supply is contained in a reservoir mounted on the pump. Fluid from the pump is supplied to the gear through the interconnecting pressure and return hoses. The pump is operated by a drive belt mounted on pulleys attached to the pump shaft and engine crankshaft.

The vehicle uses a steering gear with a variable ratio gear that has a 16:1 ratio on center and a 13:1 ratio at full lock. A vane-type power steering pump with a combination flow control/relief valve is used.

The valve is calibrated to open at 1500 psi. The power steering gear is designed to operate manually if a system malfunction should ever occur. This feature provides the driver with continued steering control of the vehicle. In this condition, the gear operates like a manual steering gear; hydraulic fluid is bypassed through the gear valve body to allow manual operation.

1-3.6 ***Electrical System***. The vehicle is equipped with a 12-volt battery containing low-antimony/lead compound plates. In addition to helping reduce overall vehicle weight, they require less frequent electrolyte inspections, have a decreased self-discharge rate from local action and have a longer shelf life. Electrolyte level inspections are required only at the beginning of each winter season and every 15,000 miles.

The negative ground alternator used has an internally mounted integrated circuit voltage regulator that is sealed in plastic. The voltage regulator is attached to the brush holder assembly. A rotor assembly is supported by ball bearings in the front and rear covers. The rotor shaft extends through the rear cover to drive an externally mounted vacuum pump that is attached to the rear cover. The alternator is a rotating-field, three-phase AC alternator with 60-ampere output.

Refer to figure FO-1, Wiring Diagram, for wiring reference. The vehicle has a main wiring harness connector located at the left upper corner of the dash panel. This connector is made up of the engine forward lamp harness at the engine compartment side and the fuse and instrument panel harness at the passenger compartment side.

The connector can be removed from the dash panel by removing the center bolt from the engine compartment side and the two attaching screws from the driver's side. Be careful not to bend the male spade terminals when removing or installing the connector. The center of the connector is filled with a non-conductive grease to prevent corrosion of the terminals.

The wiring for the lighting system is color coded for easy tracing. The switch for the lighting system has a 24-ampere circuit breaker. The upper and lower headlamp beams are controlled by a foot switch located on the floorboard.

The vehicle is equipped with a rectangular, single headlamp system. Both lamps contain two elements: one low beam and one high beam.

The vehicle also contains backup lamps, a dome lamp, instrument cluster lamps, parking and directional lamps, rear directional lamps, stop lamps, taillamps and a four-way emergency flasher.

Fuses protecting the vehicle electrical system are located in the fuse panel and bulkhead connector, located on the passenger compartment side of the dash panel. They are attached to the main harness connector.

The horn system includes horn, horn relay, steering column wiring harness and horn contact.

1-3.7 ***Cooling System***. The vehicle's cooling system regulates engine operating temperature by allowing the engine to reach normal operating temperature as soon as possible, maintaining normal operating temperature and preventing engine overheating. The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant through the system.

1-3.8 ***Fuel System***. In the vehicle's fuel system, fuel is drawn from the tank by the feed pump and delivered through the water separator and fuel filter to the injection pump. The injection pump feeds fuel through the nozzles to the combustion chambers. Listed below are features of the fuel system.

(1) The filter overflow valve maintains specified fuel pressure and prevents excessive fuel temperature.
(2) Any excess fuel to the nozzles or to the filter overflow valve bypasses the nozzles or valves and returns to the fuel tank.
(3) A mechanical governor controls engine speed.

1-3.9 ***Exhaust System***. The vehicle's exhaust system consists of exhaust manifold, front exhaust pipe, muffler, tailpipe and spark arrestor.

The exhaust system must be properly aligned to prevent stress, leakage and chassis contact. If the system contacts any body panel, it may amplify objectionable noise.

1-3.10 ***Air System***. The air system is designed to produce positive air pressure between 100-125 psi, using a belt-driven air compressor. The air compressor mounts to a bracket assembly attached to the engine block. Power to the air compressor is provided by a belt and pulley from the crankshaft. An ider pulley mounted to the water pump assembly is used to direct and apply belt tension to the pulley attached to the air compressor. Two air tanks located under the vehicle hold equal pressure supplied by the air compressor. Maximum air pressure is regulated by an adjustable air governor assembly, which is designed to unload air pressure from the compressor when pressure exceeds the adjustable limit of 100 to 125 psi. Air pressure is indicated on an air pressure gauge mounted under the dashboard. If pressure drops below a preset limit, a buzzer sounds, alerting an operator of a drop in air pressure.

The air compressor receives air through an air filter. Compressed air is supplied to one side of the governor and to the alcohol injector. The alcohol injector injects an alcohol vapor into the pressurized air. This prohibits air from freezing which can cause component failure.

Air is supplied to the left-hand air tank from the alcohol injector. Two outlet pressure hoses are connected to the left-hand air tank. One hose connects to the other side of the air governor, and the other hose connects to the right-hand air tank. Heater and drain valve assemblies are attached to each tank. The heater is activated by the HEATER ON/OFF switch located on the dashboard. The drain valve is removed to drain fluids from both tanks.

Three outlet hoses are attached to the right-hand air tank. Two of the three hoses connect to the right front and rear shutoff valves and gladhand couplings. The third outlet hose connects to a tee and supplies air to the air pressure gauge and the input side of the air valve, located under the dashboard. Air preceeds through the output side of the air valve and is supplied through the left front and rear gladhand couplings.

1-3.11 ***Winterization System***. The winterization system is used to prevent coolant, oil, and battery from freezing during extreme cold weather conditions. The system receives power from an external 115 VAC power source. External power is plugged into a male outlet mounted to the front of the vehicle. Each component receives power through a fused junction box rated at 20 amperes.

Thermostats control power to the cooler and oil heaters. When temperature exceeds the preset limit of each thermostat, it opens preventing the heater(s) from operating. The battery warmer contains no thermostat and remains on constantly as long as power is applied to the system.

Chapter 2

SPECIAL TOOLS AND TEST EQUIPMENT

2-1. GENERAL.

Certain tools and test equipment are required to perform overhaul and test procedures outlined in Chapters 4 and 5. Table 2-1 lists special tools and test equipment by part numbers and by index numbers (referring to figure 2-1), describes their functions and indicates the area of the manual in which they are used. Figure 2-1 contains illustrations of all special tools and equipment listed in Table 2-1.

Table 2-1. Special Tools and Test Equipment

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-2619-01	5-85, 5-87	Slide Hammer	5-5.3.3a
J-3837-2	2-1 (14)	Pilot Studs Tool	5-5.2.9d
J-4245	2-1 (40)	Snap Ring Pliers	5-5.4.4b,e
J-5223-4	2-1 (28)	Gauge Arbor	5-5.6.3d
J-5223-20	2-1 (25)	Gauge Block	5-5.6.3d
J-5223-24	2-1 (23)	Clamps	5-5.6.3d
J-5223-25	2-1 (27)	Discs	5-5.6.3d
J-5223-27	2-1 (26)	Gauge Block Plunger	5-5.6.3d
J-5223-29	2-1 (24)	Bolt	5-5.6.3d
J-5864	2-1 (21)	Dial Indicator Support Rod	5-5.2.9a
J-6221	2-1 (42)	Remover/Installer	5-5.4.4b,e
J-6585-1	2-1 (49)	Slide Hammer Tool	5-5.2.9a
J-6632	2-1 (44)	Puller Tool	5-5.4.4a
J-6893	N.I.	Lockring Remover	4-4.15b 5-5.7.7a,d
J-7004-3	2-1 (50)	Slide Hammer Bolts Tool	5-5.2.8a 5-5.2.9a
J-7079-2	2-1 (51)	Driver Handle	5-5.6.3d
J-7624	2-1 (45)	Spanner Wrench	5-5.4.4e
J-7818	2-1 (5)	Installer	5-5.3.3b
J-8001	2-1 (20)	Dial Indicator	5-5.2.9a 5-5.6.3d
J-8092	2-1 (52)	Driver Handle (Figs. 5-86, 5-88)	5-5.3.3b 5-5.2.8d 5-5.2.9a,d 5-5.4.4b,e
J-8614-01	2-1 (7)	Remover Tool	5-5.3.3a
J-8614-02,03	2-1 (33)	Remover Tools	5-5.6.3a
J-8842	2-1 (46)	Seal Remover	5-5.4.8b
J-21104-01	2-1 (53)	Weatherstrip Remover	5-5.9.7a
J-21177-01	2-1 (34)	Brakeshoe-to-Drum Clearance Gauge	4-4.5b
J-21232	2-1 (38)	Puller Tool	5-5.4.1a
J-21232-01	2-1 (19)	Steering Wheel Puller	5-5.10.24
J-21551	2-1 (43)	Remover/Installer	5-5.4.4b

N.I. = NOT ILLUSTRATED

Table 2-1. Special Tools and Test Equipment-Continued

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-21552	2-1 (41)	Arbor Tool	5-5.4.4b,e
J-7539-01A			
J-21553	2-1 (40)	Installer	5-5.4.4e
J-22904	2-1 (35)	Installer	5-5.7.6d
J-23600	2-1 (8)	Tension Gauge	4-4.3
			5.5.1.10d
J-23653	2-1 (37)	Compressor Tool	5-5.4.2a,d
		-	5-5.10.24a
J-23653-4	2-1 (54)	Metric Forcing Screw	5-5.4.2a
J-23709	2-1 (36)	Metering Valve Tool	4-4.5c
J-24026	2-1 (18)	Holding Fixture	5-5.2.4b,e
			5-5.2.6a,d
			5-5.2.8a
			5-5.2.9a,d
J-24037	2-1 (16)	Bushing Removal Tool	5-5.2.9a
J-24038	2-1 (11)	Bushing Installer Tool	5-5.2.9d
J-24039	2-1 (10)	Bushing Remover/Installer Tool	5-5.2.8d
J-24040	2-1 (12)	Bushing Installer Tool	5-5.2.8d
J-24041	2-1 (17)	Bushing Removal Tool	5-5.2.8a
J-24042	2-1 (15)	Compressor Tool	5-5.2.8a,d
J-24043	2-1 (9)	Support Stand	5-5.2.6a
J-24055	2-1 (13)	Remover/Installer Tool	5-5.2.9a
J-24385-01	2-1 (29)	Spreader Tool	5-5.6.3a
J-24433	2-1 (22)	Installer Sleeve	5-5.6.3d
J-25033	5-114	Installer	5-5.4.7d
			5-5.4.8e
J-25034	5-113	Remover	5-5.4.7a
			5-5.4.8b
J-25070	2-1 (47)	Electric Heat Gun	5-5.10.9d
J-25101	2-1 (32)	Installer	5-5.6.3d
J-25122	N.I.	Driver Handle	5-5.6.3d
J-25157	N.I.	Installer	5-5.6.3d
J-25194	N.I.	Locknut Installer	5-5.4.4e
J-25359-C	2-1 (48)	Torx Bit Tool	5-5.9.9a,d
			5-5.9.6a,d
			5-5.9.14a,d
			5-5.10.4a,d
			5-5.10.8a,d
J-26941	5-87	Remover Tool	5-5.3.3b
J-28648	2-1 (31)	Installer	5-5.6.3d
J-29162	2-1 (3)	Installer	5-5.3.3b
J-29184A			
J-29163	2-1 (1)	Installer	5-5.3.3b
J-29167	2-1 (6)	Installer	5-5.3.3b
J-29168	5-86	Drive Handle	5-5.3.3b

A = ALTERNATE
N.I. = NOT ILLUSTRATED

Table 2-1. Special Tools and Test Equipment-Continued

Tool Equipment No.	Figure No.	Nomenclature	Use And Application (Paragraph)
J-29169	2-1 (4)	Installer	5-5.3.3b
J-29170	5-88	Remover	5-5.3.3b
J-29174	2-1 (2)	Installer	5-5.3.3b
J-29369-1	5-85	Remover	5-5.3.3a
J-29721	2-1 (30)	Removal Tool	5-5.6.3d
J-57914-010	2-1 (55)	Socket Wrench	5-5.1.21b
J-57916-432	N.I.	Special Wrench	5-5.1.21b
J-57920-032	2-1 (56)	Delivery Valve Extractor Tool	5-5.1.21b
J-57921-012	2-1 (58)	Tappet Insert Tool	5-5.1.21b
J-57921-210	2-1 (57)	Tappet Holder Tool	5-5.1.21b
J-57921-412	2-1 (59)	Plunger Insert Tool	5-5.1.21b
J-57926-511	2-1 (60)	Extractor Tool	5-5.1.21b
J-57931-210	2-1 (62)	Tappet Holder Tool	5-5.1.21b
J-57931-612	2-1 (61)	Tappet Clamps	5-5.1.21b
9969Z7000	2-1 (63)	Removal Tool	5-5.1.22b
9969Z7001	2-1 (64)	Removal Tool	5-5.1.22b
99590Z7000	N.I.	Installer	5-5.1.29e
99600Z7000	2-1 (65)	Puller Tool	5-5.1.29b,e
00624Z7000	2-1 (66)	Split Collar Tool	5-5.1.23b,e
99665Z7000	2-1 (67)	Valve Seat Tool	5-5.1.22e
99665Z7001	2-1 (68)	Valve Seat Tool	5-5.1.22e
99674Z7000	2-1 (69)	Valve Stem Seal Replacer Tool	5-5.1.23e
99724Z5000	2-1 (70)	Removal Tool	5-5.1.16a,e

A = ALTERNATE
N.I. = NOT ILLUSTRATED

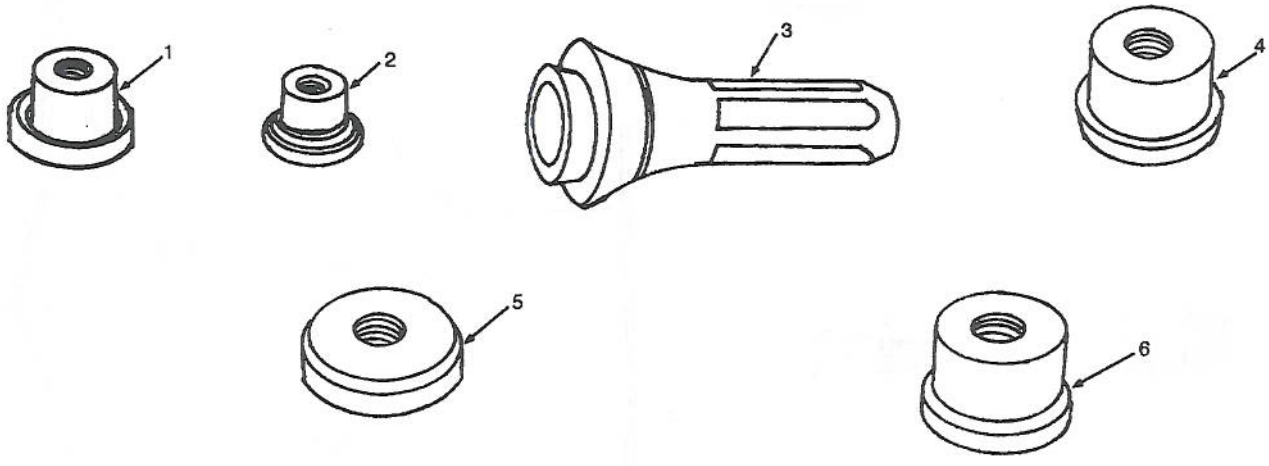


Figure 2-1. Special Tools (Sheet 1 of 7)

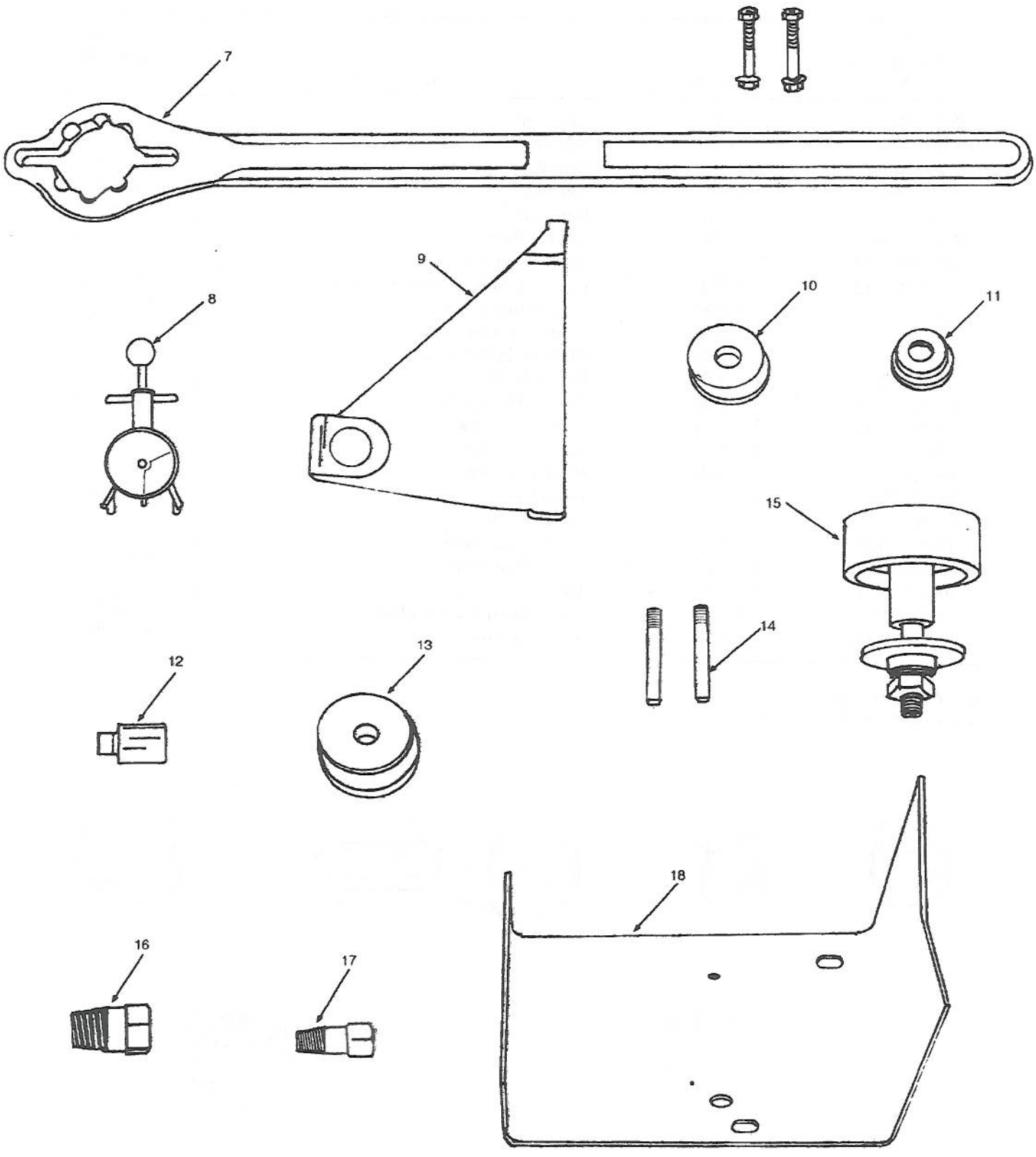


Figure 2-1. Special Tools (Sheet 2 of 7)

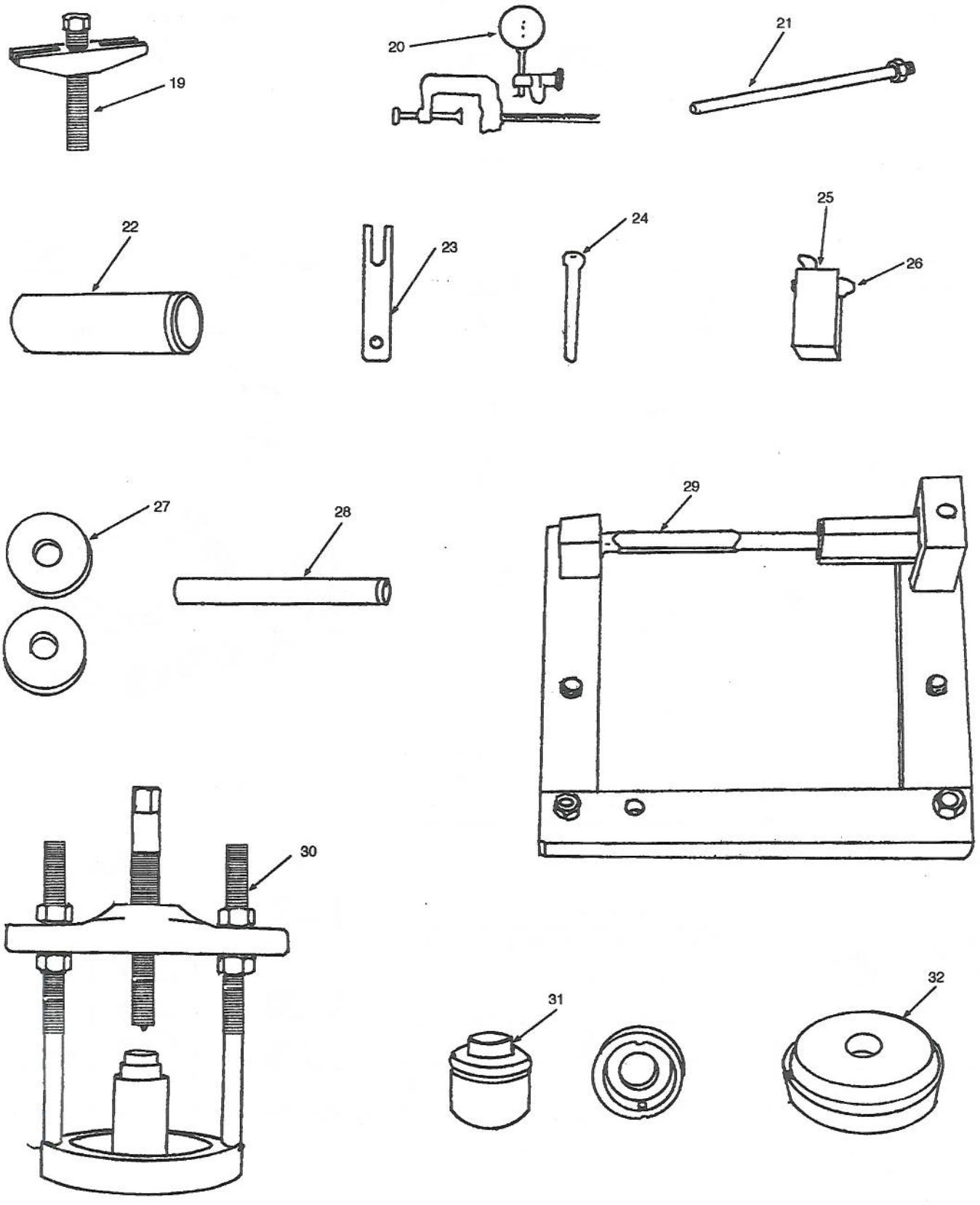


Figure 2-1. Special Tools (Sheet 3 of 7)

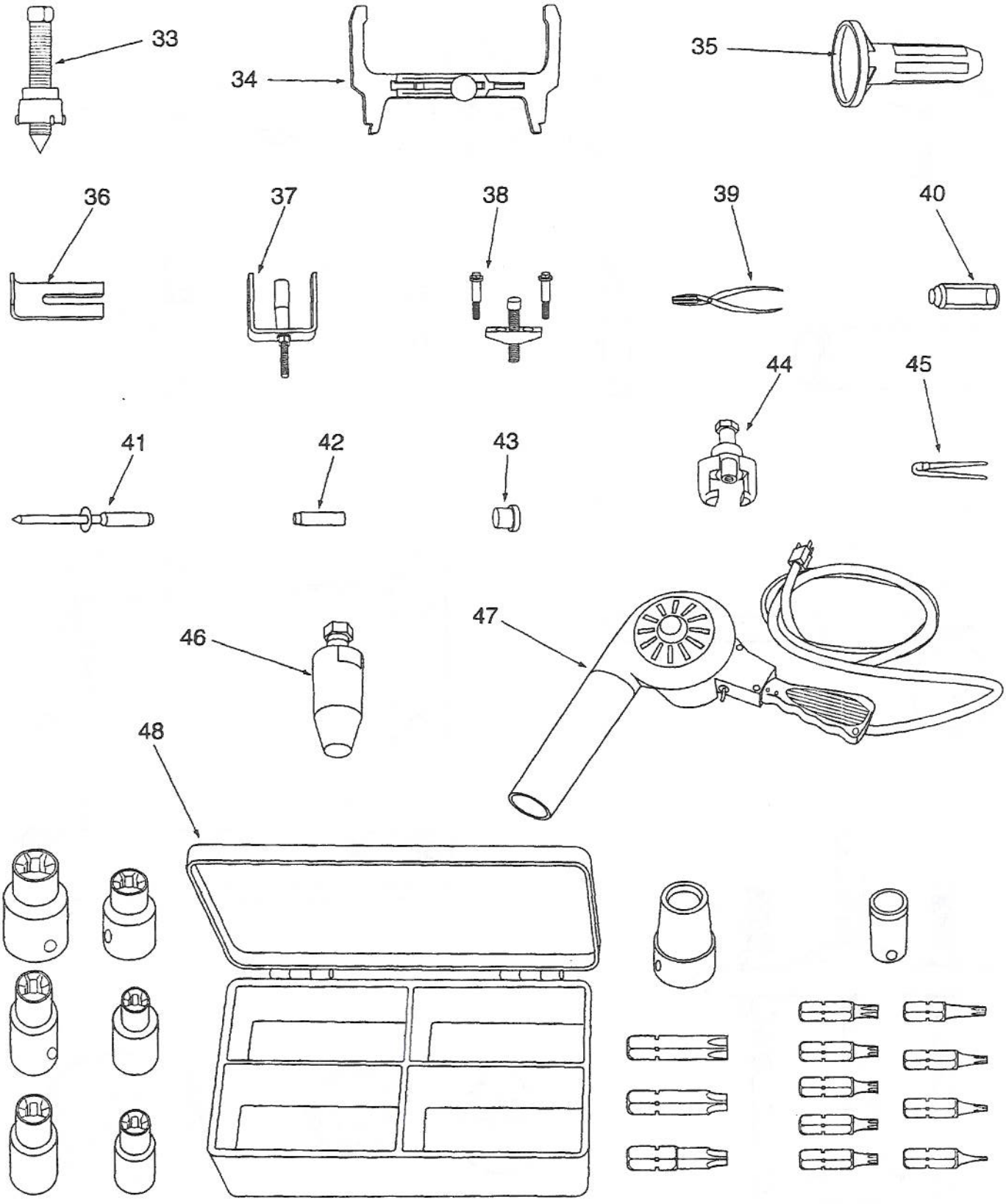
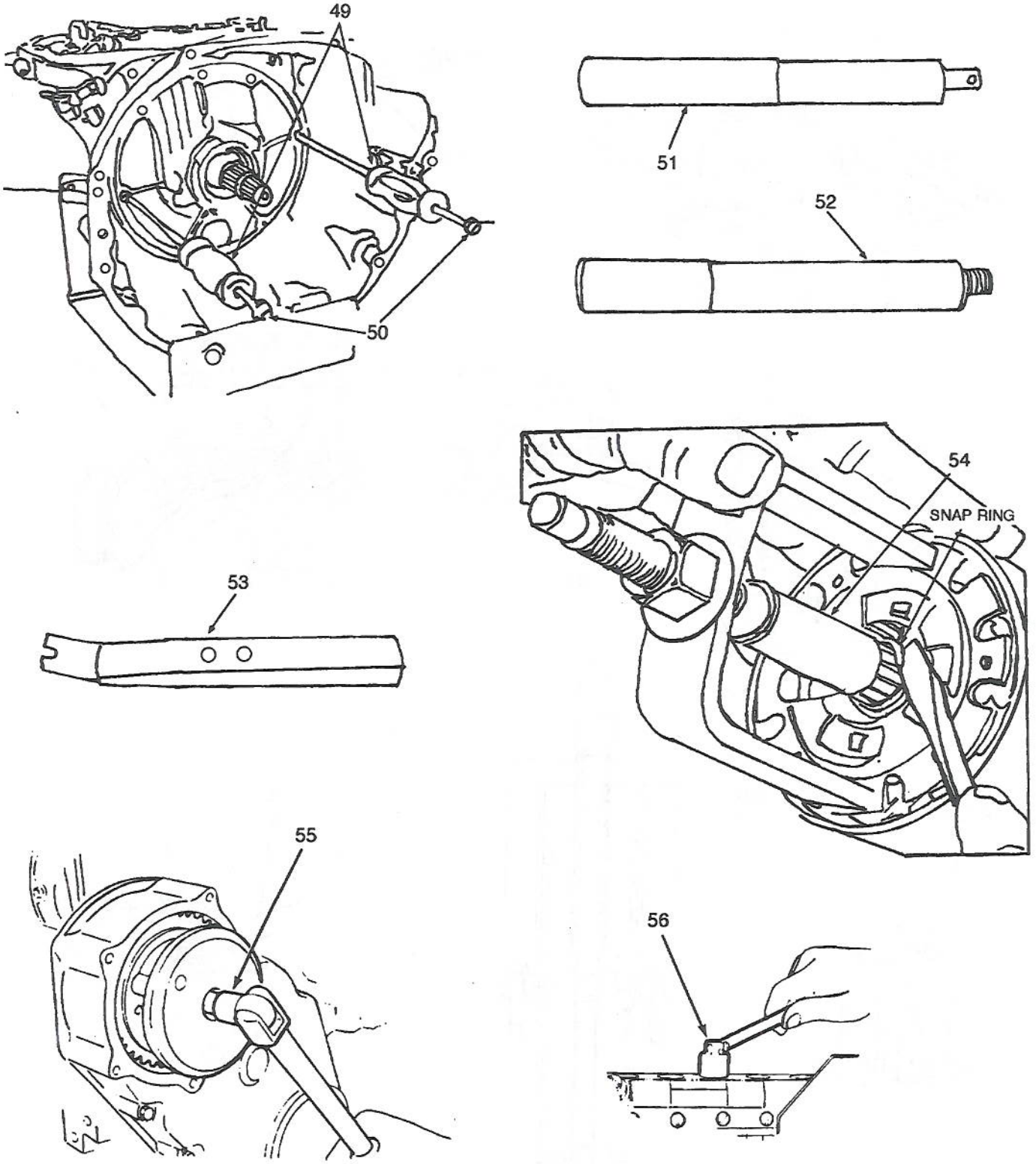


Figure 2-1. Special Tools (Sheet 4 of 7)



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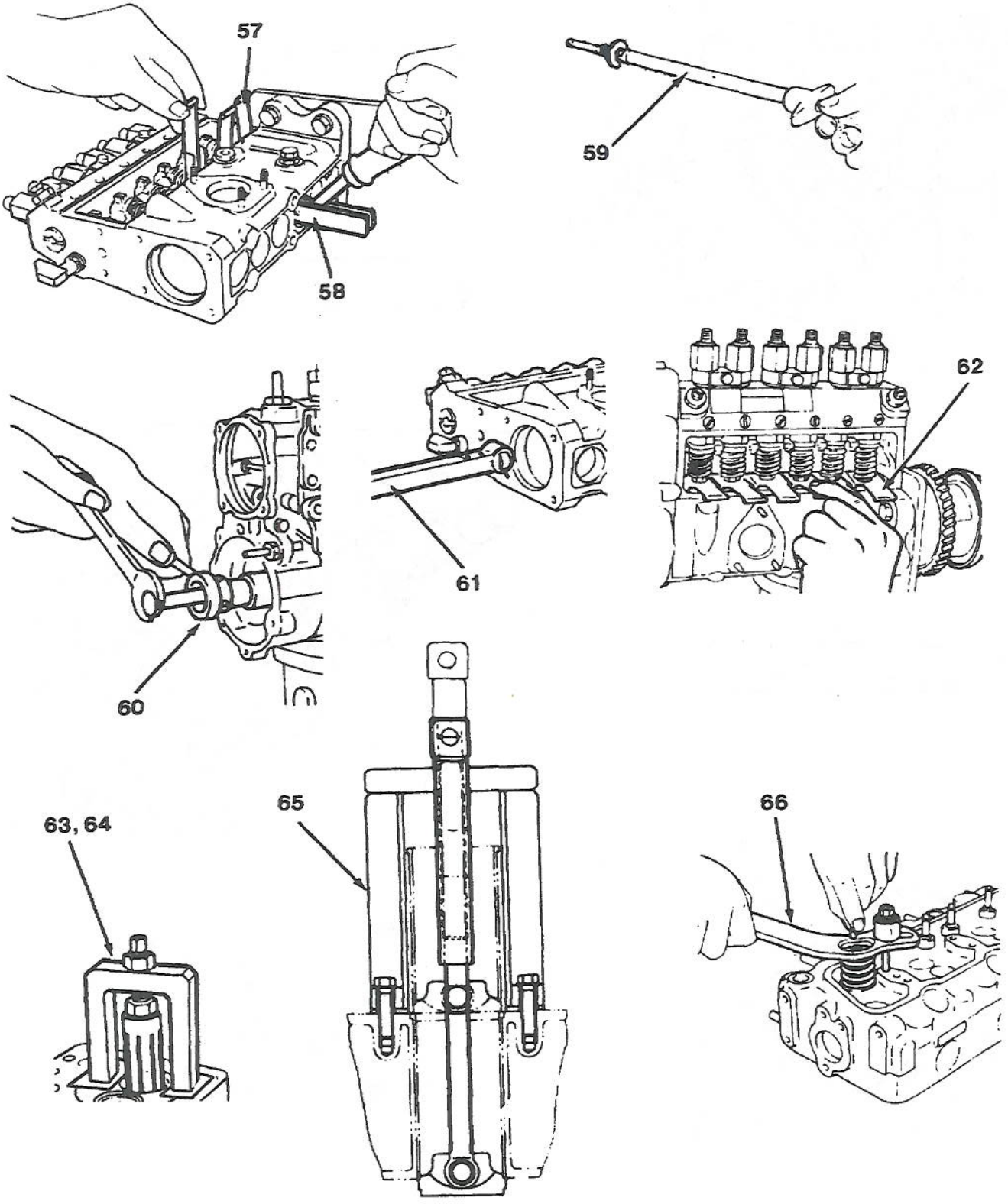

Figure 2-1. Special Tools (Sheet 6 of 7)

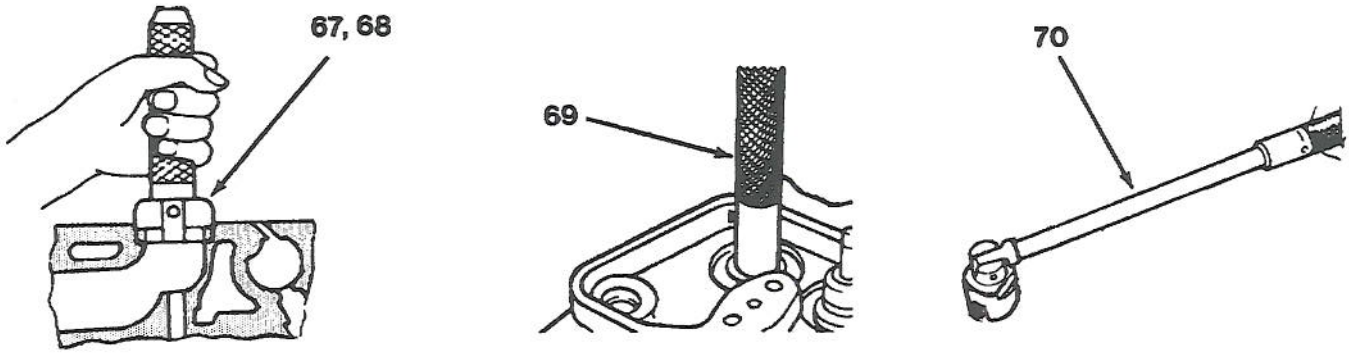

Figure 2-1. Special Tools (Sheet 7 of 7)

Chapter 3

PREPARATION FOR USE

3-1 GENERAL.

The purpose of this chapter is to provide the information required to prepare a vehicle for use or to determine that the vehicle is in satisfactory condition for operation.

3-2 PRELIMINARY INSPECTION.

When a new or reconditioned vehicle is first received by the using organization, it is necessary to determine that the vehicle is in satisfactory condition and will operate properly when first placed into service. The following procedures should be observed prior to placing a vehicle in service for the first time.

3-2.1 ***Visual Inspection***. Visually inspect the vehicle upon receipt for obvious damage, such as broken, cracked, dented or missing parts. Carefully check pintle hooks in particular for secure mounting and proper operation.

3-2.2 ***Item Check***. Check the following items for proper quantity:

(1) Check engine coolant level with engine at normal operating temperature, as follows:

CAUTION

Remove the radiator cap only for testing or when filling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system, which may cause damage by corrosion.

(a) Check that engine coolant level is between the FULL and ADD marks on the coolant recovery bottle.
(b) Add coolant to recovery bottle only if coolant level is below ADD mark.
(e) If ambient temperature is below 32°F, also check level of antifreeze protection by testing coolant with a hydrometer.

(2) Check fuel level.
(3) Check engine oil level.
(4) Check the automatic transmission fluid, as follows:

NOTE

Transmission fluid should be checked while transmission is at normal operating temperature. This occurs after the equivalent of at least 15 miles of highway driving. At normal operating temperature, the gauge end of the dipstick will be too hot to hold comfortably.

(a) Bring transmission fluid up to normal operating temperature.
(b) Place vehicle on level surface.
(c) Run engine at idle speed.
(d) Apply parking brake .
(e) Move gearshift lever through all positions, leaving it in NEUTRAL.
(f) Remove dipstick, located in fill tube at right rear of engine near dash panel, and wipe clean.
(g) Insert dipstick until cap seats.
(h) Remove dipstick and note reading. Fluid level should be between ADD and FILL marks.

CAUTION

Do not overfill. Overfilling can cause foaming which can lead to overheating, fluid oxidation or varnish formation. These conditions can cause interference with normal valve, clutch and servo operation. Foaming can also cause fluid to escape from the transmission vent where it may be mistaken for a leak.

(i) If fluid level is at or below ADD mark, add sufficient fluid to raise level to ADD mark.

(5) Check brake master cylinder as follows:
(a) Clean tops of covers and surrounding area.
(b) Remove covers.
(c) Fluid should be 1/4 inch below rim of each cell.
(d) If low, add brake fluid as required and install cover.

(6) Check battery electrolyte level and add water as follows:

WARNING

Battery fluid contains sulphuric acid. When servicing batteries, wear eye protection (face shield), acid resistant rubber apron and gloves. Keep flames/sparks away from the vent and filler cap openings.

CAUTION

Do not spill battery acid on the vehicle's painted surfaces. If acid contacts any painted surface, flush immediately with water.

(a) Lift battery cell caps and check each filler well. Fluid level should be above battery plates to the bottom of the filler well ring.
(b) Add distilled water or drinking water free of high mineral content, if required.
(c) Check battery charge using hydrometer.

(7) Drain the water separator.
(8) Drain the air reservoir.
(9) Check drive belt tension. Check belts that drive the fan, air pump, alternator and power steering pump. Use tension gauge to check belt tension, as described in paragraph 5-5.1.10.
(10) Check tire pressure, as described in paragraph 4-4.15.
(11) Check windshield washer fluid level.
(12) Check power steering pump fluid level. Fluid level may be checked with fluid hot or cold. If below FULL HOT or FULL COLD marking on dipstick attached to reservoir cap, add fluid.

3-3 SWITCHES, GAGES AND LIGHTS.

Check switches, gauges and lights for proper operation, as follows:

(1) Start engine and check temperature gauges, oil pressure gauge, air pressure gauge, ammeter and fuel level gauge.
(2) Turn on all light switches and check for proper operation of lights, exterior and interior.
(3) Check operation of horn by depressing center button in steering wheel.

3-4 OPERATIONAL CHECK.

Refer to Operation and Operator Maintenance Instructions Manual, and check operation of engine, transmission and brakes. Check that the parking brake will prevent truck motion with transmission in gear and engine at full stall speed.

3-5 LUBRICATION.

Check service records for indication of last periodic maintenance performed. Refer to Chapter 4 for proper vehicle lubrication and lubricant specifications.