

TM 9-2320-312-24-1

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

**TRUCK, TRACTOR, YARD TYPE:
46,662 GVWR, DED, 4 X 2, M878A2
(NSN 2320-01-452-5579)**



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HEADQUARTERS, DEPARTMENT OF THE ARMY

December 2003

TECHNICAL MANUAL
TM 9-2320-312-24-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 17 December 2003

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MAINTENANCE MANUAL

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46,662 GVWR, DED, 4 X 2, M878A2
(NSN 2320-01-452-5579)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (*Recommended Changes to Equipment Technical Publications*), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <http://aeps.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter, DA Form 2028 direct to: AMSTA-LC-CI/TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is: TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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VOLUME 3

Group 070 - Transmission
 Group 080 - Front Axle (includes front axle steering components and front service brakes)
 Group 090 - Rear Axle (includes rear service brakes)
 Group 110 - Steering
 Group 120 - Propshaft
 Group 140 - Cab and Sheet Metal
 Group 150 - Air Piping and Brake
 Group 160 - Miscellaneous
 Group 170 - Electrical

HOW TO USE THIS MANUAL

NOTE

If at any time you are unsure how to use this manual or you cannot locate the information you need, notify your supervisor.

INTRODUCTION

1. This manual is designed to help you perform Unit, Direct Support, and General Support Maintenance on the M878A2 Yard Tractor.
2. The *Repair Parts and Special Tools List (RPSTL)*, TM 9-2320-312-24P, is to be used in conjunction with this manual, to locate and obtain the repair parts and special tools needed to maintain this equipment.
3. This manual consists of three volumes: Volume 1 contains maintenance and troubleshooting for yard tractor components NOT covered in the Commercial Service Manuals. Volumes 2 and 3 are a compilation of Commercial off-the-Shelf (COTS) Service Manuals.
4. A *Table of Contents* at the front of Volume 1 lists the contents of all volumes of this publication. Each volume also contains a *Table of Contents* for that particular volume.
5. Volume 1 is written in work package format, in accordance with MIL-STD-40051A:
 - a. Chapters divide the manual into major categories of information (e.g. *Introductory Information with Theory of Operation, Troubleshooting Procedures, Unit Maintenance, Direct Support Maintenance, General Support Maintenance, and Supporting Information*).
 - b. Each Chapter is divided into work packages, which are identified by a 6-digit number (e.g. 0001 00, 0002 00, etc.) located on the upper right-hand corner of each page. The work package page number (e.g. 0001 00-1, 0001 00-2, etc.) is located centered at the bottom of each page.
 - c. If a Change Package is issued to this manual, added work packages use the 5th and 6th digits of their number to indicate new material. For instance, work packages inserted between WP 0001 00 and WP 0002 00 are numbered WP 0001 01, WP 0001 02, etc.
6. Volumes 2 and 3 are provided in commercial format.
7. Scan through all volumes of this manual to become familiar with their organization and contents before attempting to maintain the equipment.

ORGANIZATION OF MATERIAL

1. Maintenance procedures in each volume are sequenced in accordance with the following major assembly groups, as outlined in the Maintenance Allocation Chart (MAC) in Volume 1:
 - a. Group 020—engine
 - b. Group 040—fuel
 - c. Group 050—exhaust
 - d. Group 060—cooling
 - e. Group 070—transmission
 - f. Group 080—front axle (includes front axle steering components and front service brakes)
 - g. Group 090—rear axle (includes rear service brakes)
 - h. Group 110—steering
 - i. Group 115—frame
 - j. Group 120—propshaft
 - k. Group 140—cab and sheet metal
 - l. Group 150—air piping and brake

ORGANIZATION OF MATERIAL - CONTINUED

- m. Group 160—miscellaneous
 - n. Group 170—electrical
 - o. Group 180—power take-off (PTO)
 - p. Group 190—oil piping (all fluid lines except air)
2. In the Commercial Service Manuals, troubleshooting is located in the same section as the maintenance procedures for that assembly group. For instance, engine troubleshooting is located within Group 020; transmission troubleshooting is located within Group 070.
 3. In the work package-formatted material, troubleshooting for ALL assembly group components is located in work package 0006 00. However, the Troubleshooting Symptom Index in WP 0005 00 contains a listing of ALL troubleshooting procedures, to include those contained in the Commercial Service Manuals.

CONTENTS OF VOLUME I (WORK PACKAGE-FORMATTED MANUAL)

1. A *Warning Summary* is located at the beginning of this volume. Become familiar with these warnings before performing troubleshooting or maintenance on the vehicle.
2. A *Table of Contents*, located in the front of this volume, lists all chapters and work packages in the publication, as well as the contents of Volumes 2 and 3.
 - a. The *Table of Contents* also provides *Reporting Errors and Recommending Improvements* information and DA Form 2028 addresses, for the submittal of corrections to this manual.
 - b. If you cannot find what you are looking for in the *Table of Contents*, refer to the alphabetical *Index* at the back of the manual.
3. Chapter 1, *Introductory Information with Theory of Information*, provides general information on the manual and the equipment.
4. Chapter 2, *Troubleshooting Procedures*, contains troubleshooting.
5. Chapter 3 covers all *Unit Maintenance*.
6. Chapter 4 covers all *Direct Support Maintenance*.
7. Chapter 5 covers all *General Support Maintenance*.
8. Chapter 6 covers *Supporting Information: References, Maintenance Allocation Chart (MAC) Introduction, Maintenance Allocation Chart (MAC), Expendable and Durable Items List, and Tool Identification List*.
9. There are electrical system *Foldouts* at the back of Volume 1.

CONTENTS OF VOLUMES 2 AND 3 (COMMERCIAL SERVICE MANUALS)

1. Volume 2 contains Group 020—engine.
2. Volume 3 contains:
 - a. Group 070—transmission.
 - b. Group 080—front axle
 - c. Group 090—rear axle
 - d. Group 110—steering
 - e. Group 120—propshaft
 - f. Group 140—cab and sheet metal
 - g. Group 150—air piping and brake
 - h. Group 160—miscellaneous

FEATURES OF VOLUME I (WORK PACKAGE-FORMATTED MANUAL)

1. Because the major assembly groupings used in this manual do not correspond to military function group codes (FGC) and are unfamiliar to the soldier, maintenance tasks in Volume I include in their initial setups the following information:
 - a. MAC Reference (e.g., MAC Group 160)
 - b. RPSTL Reference (e.g., RPSTL Group 160, Figure 003)

This information will assist the user to locate appropriate MAC guidance and repair parts for the component being maintained.

2. WARNINGS, CAUTIONS, NOTES, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

A WARNING indicates a hazard that may result in death or serious injury.

CAUTION

A CAUTION is a reminder of safety practices or directs attention to usage practices that may cause damage to equipment.

NOTE

A NOTE is a statement containing information that will make the procedures easier to perform.

3. Statements and words of particular interest may be printed in CAPITAL LETTERS to create emphasis.
4. Within a procedural step, reference may be made to another work package in this volume of the manual or to another volume of this manual or another manual. These references indicate where you should look for more complete information.
 - a. If you are told: "Fill hydraulic reservoir (WP 0129 00)", go to work package 0129 00 in Volume 1 of this manual for instructions on filling the hydraulic reservoir.
 - b. If you are told: "Raise fifth wheel (TM 9-2320-312-10)", go to TM 9-2320-312-10 for complete instructions on raising the fifth wheel. Use the *Table of Contents* or alphabetical *Index* in TM 9-2320-312-10 to find the procedure.
 - c. If you are told "Repair transmission torque converter (Group 070 Commercial Service Manuals)", go to Group 070 in the Commercial Service Manuals (Volume 3) to find the procedure.
5. Illustrations are placed after, and as close to, the procedural steps to which they apply. Callouts placed on the art may be text or numbers, or both.
6. Numbers located at the lower right corner of the art (e.g. 376-001, 376-002, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
7. Dasher leader lines used in illustrations indicate that called-out items are not visible in the view depicted (i.e. they are located within or behind the structure). In Lubrication Charts (WP 0008 00, *Unit PMCS Introduction*) and in *Unit PMCS* (WP 0009 00), dashed leader lines indicate a lubrication that is required on both sides of the equipment.
8. Technical instructions include metric units as well as standard units. For your reference, a *Metric Conversion Chart* is located on the inside back cover of the manual.

CHAPTER 1
INTRODUCTORY INFORMATION WITH
THEORY OF OPERATION

GENERAL INFORMATION

0001 00**SCOPE**

1. **Type of Manual.** This manual is for use in performing troubleshooting and Unit, Direct Support, and General Support Maintenance on the M878A2 Yard Tractor.
2. **Equipment Name and Model Number.** Truck, Tractor, Yard Type: 46,662 GVWR, DED, 4 X 2, M878A2.
3. **Purpose of Equipment.** The M878A2 is a 4 X 2 tractor used to move ("spot") trailers within a terminal yard environment. It is also used in roll-on/roll-off (RO/RO) naval operations. Use of this vehicle on a public road or highway is NOT authorized.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, *Functional User's Manual for the Army Maintenance Management System (TAMMS)*, as contained in the Maintenance Management Update.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs)

If your tractor needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF Form 368 (*Product Quality Deficiency Report*). Mail it to us at: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CIP-WT, Rock Island, Illinois 61299-7630. We'll send you a reply.

HAND RECEIPT MANUALS

This manual has a companion document with a TM number followed by "-HR" (which stands for Hand Receipt). TM 9-2320-312-10-HR consists of preprinted hand receipts that list end item related equipment (i.e., COEI, BII, and AAL) that must be accounted for. As an aid to property accountability, additional HR manuals may be requisitioned through normal publication channels.

CORROSION PREVENTION AND CONTROL (CPC)

1. Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.
2. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.
3. If a corrosion problem is identified, it can be reported using SF Form 368 (*Product Quality Deficiency Report*). Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA Pam 738-750.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For destruction of Army materiel to prevent enemy use, refer to TM 750-244-6.

PREPARATION FOR STORAGE OR SHIPMENT

For preparation for storage or shipment procedures, refer to WP 0133 00.

WARRANTY INFORMATION

The M878A2 Yard Tractor is warranted by Crane Carrier Corporation in accordance with TB 9-2320-312-14. Warranty starts on the date found in block 23, DA Form 2408-9, *Equipment Control Log*. Report all defects in material or workmanship to your supervisor, who will take appropriate action.

GENERAL INFORMATION - CONTINUED**0001 00****NOMENCLATURE CROSS-REFERENCE LIST**

COMMON NAME	OFFICIAL NOMENCLATURE
Differential Assembly	Drive Head (Rear Axle Assembly)
Dipstick	Oil Level Gauge
Engine Coolant	Antifreeze, Ethylene Glycol Mixture
Gladhand	Quick Disconnect Coupling
In Place (Installed)	In Situ
Wheel Bearing Adjustment	Hub End Float (Rear Axle Assembly)

LIST OF ABBREVIATIONS**NOTE**

Refer to ASME Y14.38-1999 for standard abbreviations.

ABBREVIATION	DEFINITION
AAL	Additional Authorization List
BII	Basic Issue Items
C	Centigrade or Celsius
CCC	Crane Carrier Corporation
cfm	Cubic Feet per Minute
cm	Centimeter
COEI	Components of End Item
ECM	Electronic Control Module
ECU	Electronic Control Unit
F	Fahrenheit
GVWR	Gross Vehicle Weight Rating
HEUI	Hydraulic Electronic Unit Injector
IAP	Injection Actuation Pressure
kg	Kilogram
km	Kilometer
kPa	Kilopascal
kph	Kilometers per Hour
L	Liter
lb-ft	Pound Foot
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
lph	Liters per Hour
mm	Millimeter
Nm	Newton Meter
PMCS	Preventive Maintenance Checks and Services
RO/RO	Roll-On/Roll-Off
SPORT	Soldier's Portable On-System Repair Tool

END OF WORK PACKAGE

EQUIPMENT DESCRIPTION AND DATA

0002 00***EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES*****1. Characteristics.**

- a. The M878A2 Yard Tractor moves (“spots”) trailers in a terminal yard environment and in roll-on/roll-off (RO/RO) marine operations. Use of this vehicle on a public road or highway is NOT authorized.
- b. The M878A2 has a Gross Vehicle Weight Rating (GVWR) of 46,662 lb (21,185 kg).
- c. A hydraulically-controlled fifth wheel can be raised or lowered 32 in (81 cm), has a 70,000 lb (31,780 kg) vertical load capacity, and is compatible with a two-inch kingpin.
- d. A cab-controlled, air-operated latching cylinder unlocks fifth wheel coupler jaws from inside the cab.

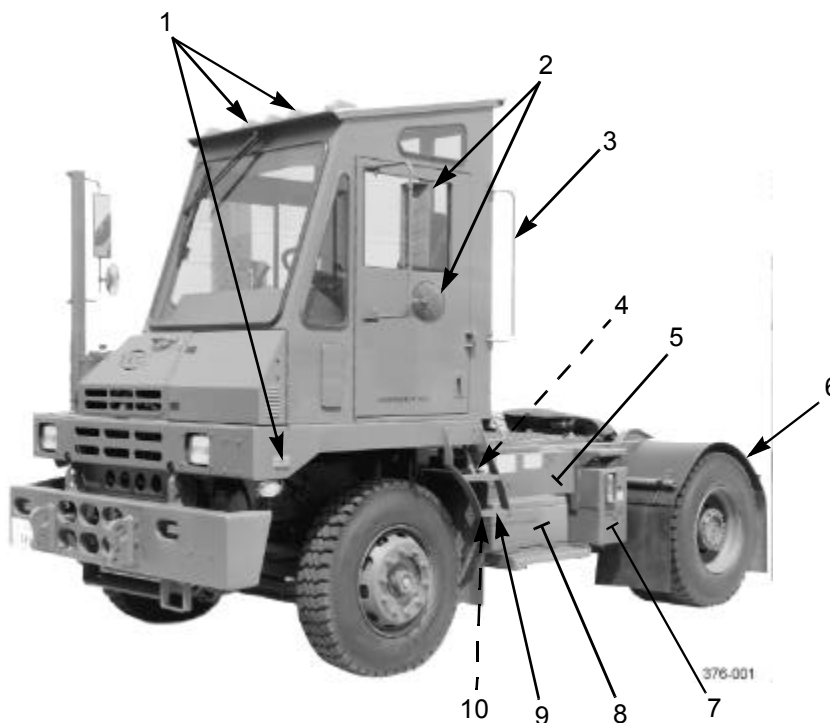
2. Capabilities and Features.

- a. The M878A2 has a wheelbase of 122.00 in (309.88 cm) and an overall length of 205.75 in (522.61 cm).
- b. The maximum speed of the M878A2 is 21 mph (34 kph). Maximum speed while towing is 15 mph (24 kph).
- c. The M878A2 is equipped with an instrument panel-mounted speedometer and tachometer that register vehicle forward speed and engine speed.
- d. The M878A2 has the following capabilities and features:
 - (1) Caterpillar 7.2L, electronically-controlled, turbocharged, 275 horsepower diesel engine;
 - (2) MD3560P Allison transmission with four (4) forward speeds, neutral, and reverse;
 - (3) Spicer 1710 propshaft;
 - (4) Eaton E-1460I front steering axle;
 - (5) Dana D90-14-2S single rear axle with dual wheels;
 - (6) front and rear air-activated s-cam brakes; rear axle spring-loaded parking brakes;
 - (7) Sheppard power steering gear;
 - (8) air conditioning system;
 - (9) backup lights and alarm;
 - (10) 45-degree cab tilt system;
 - (11) cab sliding rear door; and
 - (12) KBI 40 kJ Ultra Capacitor starting system.
- e. A fire extinguisher and an M16 rifle mount are located behind the driver’s seat inside the cab.
- f. An auxiliary arctic heater (TM 9-2320-312-10) is available for installation if tractor is to operate in temperatures below -25°F (-32°C).
- g. If installation of an auxiliary radio is desired, wiring is available behind the access panel located inside the cab above the sun visor.

EQUIPMENT DESCRIPTION AND DATA - CONTINUED

0002 00

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

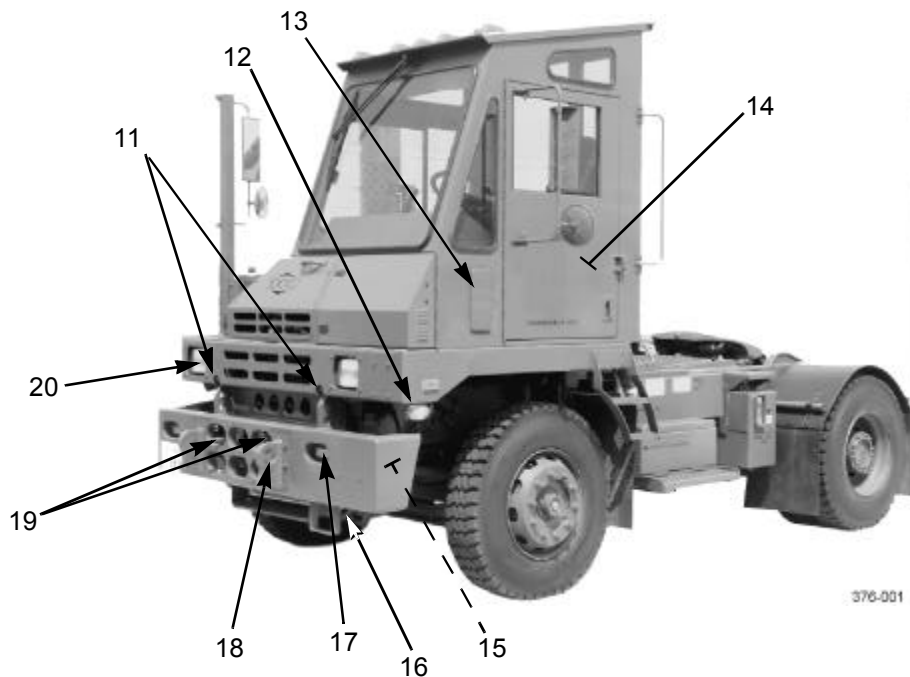


KEY	COMPONENT	DESCRIPTION
1	Marker Clearance Lights	Indicates outline of tractor.
2	Side Mirror and Spotter Mirror	Provide driver with a view to the rear of both sides of tractor and trailer, if towing.
3	Grabhandles	Provide a handhold for personnel climbing on tractor.
4	Slave Receptacle	Receptacle for NATO slave cable to slave start tractor.
5	Cab Tilt Controls	Includes pump, pump controls, and safety prop release cable used to operate cab tilt system.
6	Fender	Prevents water and debris from spraying.
7	Hydraulic Reservoir	Stores hydraulic fluid for operation of power steering system and fifth wheel lift. Contains sight gauge to determine level of fluid in reservoir.
8	Battery Box and Steps	Box holds vehicle batteries, capacitor(s), and 25A ignition system circuit breaker. Steps provide access to rear platform and cab.
9	Steps	Use only in an emergency to exit cab through side door.
10	Battery Disconnect Switch	Cuts off battery power from all vehicle electrical systems. Push in for ON. Pull out for OFF. Normally, leave switch in ON position. Place in OFF position under the following circumstances: • in the event of an accident or other emergency, to prevent fire • for long-term (over 30 days) storage • to perform electrical system maintenance

EQUIPMENT DESCRIPTION AND DATA - CONTINUED

0002 00

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED

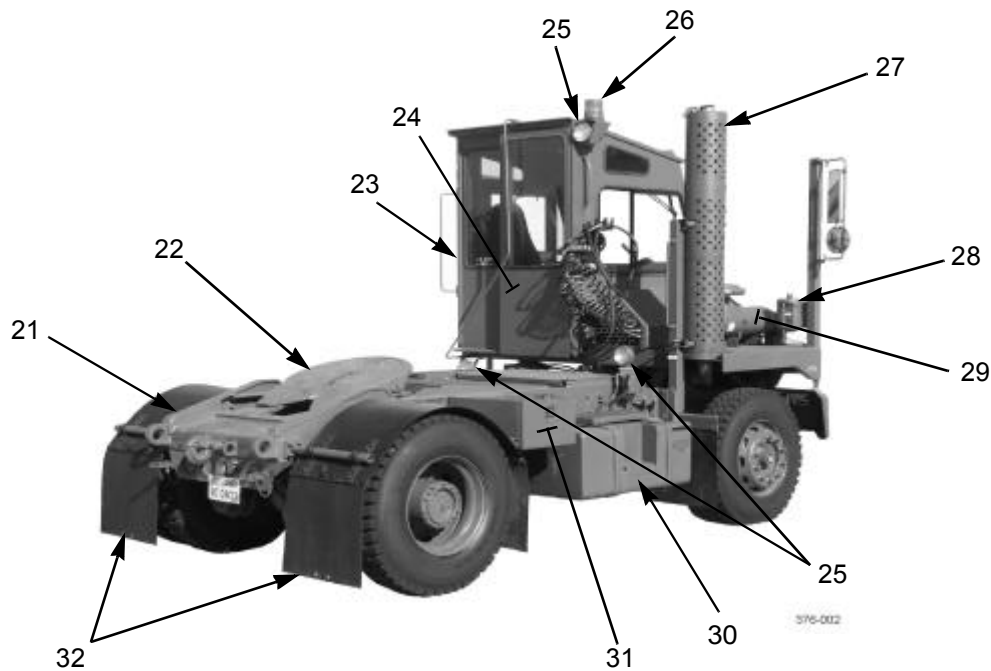


KEY	COMPONENT	DESCRIPTION
11	Cab Pivots	Front cab pivots allow for forward tilting of cab.
12	Auxiliary Lights	Assist visibility when turning, during night or low light operating conditions.
13	Cab Side Vent	Provides ventilation inside cab. Opens and closes from inside cab.
14	Side Door	To be used only in an emergency. Use rear sliding door under normal circumstances.
15	Windshield Washer Reservoir and Pump	Reservoir and pump supplies windshield washer fluid to windshield.
16	Tiedown Points	Used to tie tractor down when being shipped.
17	Turn Signals	When turned on, flash to indicate direction tractor is turning.
18	Lift and Tow Points	Provide attachment point for lifting and towing devices. Topmost eyes are for lifting; middle and bottommost eyes are for towing tractor.
19	Front Gladhands	Provide service and emergency air connections when tractor is towed from the front.
20	Headlights	Include high and low beam.

EQUIPMENT DESCRIPTION AND DATA - CONTINUED

0002 00

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



KEY	COMPONENT	DESCRIPTION
21	Ramp	Sloped surface serves as an approach to fifth wheel and facilitates trailer coupling to tractor.
22	Fifth Wheel	Adjustable-height coupling device for trailers with two-inch kingpins. Adjusts from a lowered height of 48 in (122 cm) to a fully raised height of 80 in (203 cm), as measured from top of fifth wheel plate to the ground.
23	Cab	Provides weatherproof enclosure for driver and driver controls.
24	Rear Door	Slides open to allow driver access into cab.
25	Floodlights	Illuminate area to rear of cab, specifically the fifth wheel/kingpin coupling. When floodlight switch is turned to REV, all floodlights also serve as backup lights, when tractor is in R (Reverse).
26	Strobe Warning Light	Flashes to alert other vehicles of presence of tractor.
27	Exhaust Muffler	Deadens noise of engine exhaust.
28	Coolant Overflow Bottle	Contains cooling system overflow. Provides means for operator to visually check coolant level and add coolant to system.
29	Engine Air Cleaner	Filters incoming air to engine intake manifold.
30	Fuel Tank and Steps	Stores fuel supply for vehicle. Steps mounted to tank provide access to cab and rear platform.
31	Stowage Compartment	Provide stowage for BII items and other items.
32	Mudflaps	Prevent water and debris from spraying. Mudflaps may be hooked up out of the way to prevent their damage, when negotiating steep ramps during RO/RO operations.