TM 10-3930-675-10

TECHNICAL MANUAL

OPERATOR'S MANUAL

FOR

ROUGH TERRAIN CONTAINER HANDLER (RTCH): RT 240; 53,000 LB CAPACITY; 4 X 4 (NSN 3930-01-473-3998)

Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 2001

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Date of issue for original manual is:

Original 1 July 2001

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 20 AND TOTAL NUMBER OF WORK PACKAGES IS 20 CONSISTING OF THE FOLLOWING:

Page/WP No.	*Change No.
Cover (Back Blank)	0
A (B Blank)	0
a to g (h Blank)	0
i to iv	0
WP 0001 00 to 0020 00	0
Index-1 to Index-4	0

* Zero in this column indicates an original page or work package.

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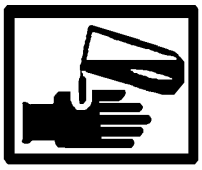
WARNING SUMMARY

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

BIOLOGICAL - abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.



CHEMICAL - drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.

ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.

EYE PROTECTION - person with goggles shows that the material will injure the eyes.

FIRE - flame shows that a material may ignite and cause burns.

FLYING PARTICLES - arrows bouncing off face with face shield shows that particles flying through the air will harm face.

HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.

HOT AREA - hand over object radiating heat shows that part is hot and can burn.

RADIOACTIVE - identifies a material that emits radioactive energy and can injure human tissue or organs.

VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.

FOR INFORMATION ON FIRST AID, REFER TO FM 21-11.

WARNING

CARBON MONOXIDE (EXHAUST GASES) CAN KILL!

- Carbon monoxide is a colorless, odorless, deadly poison which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air containing carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and coma. Permanent brain damage or death can result from severe exposure.
- Carbon monoxide occurs in exhaust fumes of internal combustion engines. Carbon monoxide can become dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to ensure safety of personnel when engine of truck is operated.

1. DO NOT operate truck engine in enclosed areas.
2. DO NOT idle truck engine without adequate ventilation.
3. DO NOT drive truck with inspection plates or cover plates removed.
4. BE ALERT for exhaust poisoning symptoms. They are:
   - Headache
   - Dizziness
   - Sleepiness
   - Loss of muscular control
5. If you see another person with exhaust poisoning symptoms:
   - Remove person from area.
   - Expose to fresh air.
   - Keep person warm.
   - Do not permit physical exercise.
   - Administer cardiopulmonary resuscitation (CPR), if necessary.
   - Notify a medic.
6. BE AWARE. The field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning.

The Best Defense Against Carbon Monoxide Poisoning Is Good Ventilation!


WARNING

BATTERIES

- To avoid injury, eye protection and acid-resistant gloves must be worn when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment, and injury to personnel.
- Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel.

a. **Eyes.** Flush with cold water for no less than 15 minutes and seek medical attention immediately.

b. **Skin.** Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.

c. **Internal.** If corrosion or electrolyte is ingested, drink large amounts of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Seek medical attention immediately.

d. **Clothing/Equipment.** Wash area with large amounts of cold water. Neutralize acid with baking soda or household ammonia.

WARNING

COMPRESSED AIR

Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

WARNING

DIESEL FUEL HANDLING

- DO NOT smoke or permit any open flame in area of truck while you are servicing diesel fuel system. Be sure hose nozzle is grounded against filler tube during refueling to prevent static electricity. Failure to follow this warning may result in injury to personnel or equipment damage.
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.
- Operating personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.


WARNING

DRY CLEANING SOLVENT


Dry cleaning solvent P-D-680 type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical help. If solvent contact eyes, wash your eyes and get medical aid immediately.

WARNING

FIRE EXTINGUISHER

Discharging large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after the discharge event. If at all possible, discharge fire extinguisher from outside the cab. Ventilate cab thoroughly prior to reentry.

WARNING

HAZARDOUS WASTE DISPOSAL

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, transmission fluid, lubricants, battery acids or batteries, and CARC paint, consult your unit/local hazardous waste disposal center or safety office for local regulatory guidance. If further information is needed, please contact The Army Environmental Hotline at 1-800-872-3845.

WARNING

INFRARED (IR) LIGHTS

DO NOT look directly at IR source without eye protection and maintain a minimum of 12 inches from energized IR lights to prevent possible eye discomfort or damage.

WARNING

NBC EXPOSURE

If NBC exposure is suspected, all air cleaner media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

IF NBC EXPOSURE IS SUSPECTED ALL AIR FILTER MEDIA WILL BE HANDLED BY PERSONNEL WEARING FULL NBC PROTECTIVE EQUIPMENT. SEE OPERATOR/ MAINTENANCE MANUAL.

7690-01-114-3702

To order this NBC decal use:

National Stock Number (NSN) - 7690-01-114-3702
Part Number (PN) - 12296626
Commercial and Government Entity Code (CAGEC) - 19207

WARNING

OPERATION SAFETY

- DO NOT allow riders on the truck. Failure to follow this warning may result in serious injury or death to personnel.
- BE ALERT for personnel in the area while operating truck. Always check to ensure area is clear of personnel and obstructions before moving. Failure to follow this warning may result in serious injury or death to personnel or damage to equipment
- ALL FOUR corners of the tophandler must be in contact with the container when locking or releasing the twistlocks. In addition, during release, all four corners of the container must be resting firmly on the surface supporting it. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- If the indicator lamps for the overload system are inoperative, the RTCH must not be operated. Safe operation may be affected if the truck is used when the indicator lamps are defective. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- NEVER operate the RTCH or move the load near a power line or overhead wires. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- Truck must not be driven when container load is in fully raised position. Truck is less stable when traveling with the load in a raised position. Maintain proper transport mode load height and position when driving to prevent forward tipping. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- Never leave the operator's position without applying the parking brake. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- Never use starting fluid or spray to aid in starting the engine. Failure to follow this warning may result in death or injury to personnel or damage to equipment.
- Always use a ground guide when driving RTCH up or down ramps in preparation for highway, marine or air transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

WARNING

PRESSURIZED COOLING SYSTEM

- DO NOT service cooling system unless engine has been allowed to cool down. DO NOT remove radiator cap. Add coolant only to expansion tank. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury.

WARNING

SLAVE STARTING

- When slave starting truck, use NATO slave cable that DOES NOT have loose or missing insulation.
- DO NOT proceed if suitable cable is not available.
- DO NOT use civilian-type jumper cables.

WARNING

WORK SAFETY

- Ether is highly flammable and explosive. DO NOT perform ether quick-start system checks or inspections while smoking or near fire, flame or sparks. Failure to follow this warning may cause a fire and explosion, causing serious injury or death to personnel.
- Avoid breathing cold start system fluid vapors. Wear goggles and fuel-resistant gloves when handling fluid. Failure to follow this warning may cause serious injury or death to personnel.

- Lifting cables, chains, hooks, and slings used for lifting truck must be in good condition and of suitable capacity. Failure to follow this warning may result in injury or death to personnel and damage to equipment.

- Improper use of lifting equipment and improper attachment of cables to vehicle can result in serious personnel injury and equipment damage. Observe all standard rules of safety.

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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 1 July 2001

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ROUGH TERRAIN CONTAINER HANDLER (RTCH): RT 240; 53,000 LB CAPACITY; 4 X 4 (NSN 3930-01-473-3998)

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.

Table of Contents

Table of Contents - Continued

HOW TO USE THIS MANUAL

INTRODUCTION

1. This manual is designed to help you operate the RT 240 Rough Terrain Container Handler (RTCH) and perform operator troubleshooting and maintenance on the equipment.

2. This manual is written in Work Package format:

    a. Chapters divide the manual into major categories of information (e.g., *Introductory Information with Theory of Operation, Operating Instructions, Operator Troubleshooting, Operator Maintenance Instructions,* 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 5^{th} and 6^{th} 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.

3. Scan thru this manual to become familiar with its organization and contents before attempting to operate or maintain the equipment.

CONTENTS OF THIS MANUAL

1. A *Warning Summary* is located at the beginning of this manual. Become familiar with these warnings before operating or performing operator troubleshooting or maintenance on the vehicle.

2. A *Table of Contents*, located in the front of the manual, lists all Chapters and Work Packages in the publication.

    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, *Operating Instructions*, explains and illustrates all operator controls and indicators, and describes how to perform all operating procedures for the RTCH: *Operation Under Usual Conditions, Operation Under Unusual Conditions*, as well as *Preparation of Transport*.

5. Chapter 3 covers all *Operator Troubleshooting*. WP 0010 00 contains a *Troubleshooting Symptom Index*. If the RTCH malfunctions, this index should always be consulted to locate the appropriate troubleshooting procedure.

6. Chapter 4 deals with *Operator Maintenance*: Major areas covered are *Preventive Maintenance Checks and Services (PMCS)* and operator level maintenance tasks.

7. Chapter 5 includes *Supporting Information: References, Components of End Item (COEI) and Basic Issue Items (BII) Lists*; and *Expendable and Durable Items List*. Of particular interest is WP 0020 00, *Error Codes*. This contains an explanation of the error code display that is shown when the RTCH experiences a mechanical malfunction and provides a complete list and explanation of all error codes resident on the vehicle.

FEATURES OF THIS MANUAL

1. WARNINGs, CAUTIONs, NOTEs, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

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

CAUTION

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

NOTE

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

2. Statements and words of particular interest may be printed in CAPITAL LETTERS to create emphasis.
3. Within a procedural step, reference may be made to another Work Package in this manual or to another manual. These references indicate where you should look for more complete information.
   a. If you are told: "If red band is showing, service air cleaner as soon as possible (WP 0014 00)", go to Work Package 0014 00 in this manual for instructions on servicing the air cleaner.
   b. If you are told: "Stow M1000 trailer loading ramps (TM 9-2330-381-14)", go to TM 9-2330-381-14, which is listed in the *References* Work Package, for complete information on stowing the M1000 loading ramps. Use the *Table of Contents* or alphabetical *Index* in TM 9-2330-381-14 to find procedures to use the M1000 loading ramps.
4. 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; whichever method is easier for the soldier.
5. Numbers located at lower right corner of art (e.g. 350-001; 350-002, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
6. Dashed leader lines used in illustrations indicate that called out items are not visible in the view depicted (i.e. they are located within the structure).
7. 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.

NOTE

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

CHAPTER 1
INTRODUCTORY INFORMATION WITH THEORY OF OPERATION

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GENERAL INFORMATION 0001 00

SCOPE

1. **Type of Manual.** This manual is for use in operating and performing operator maintenance on the Rough Terrain Container Handler (RTCH), RT 240.

2. **Equipment Name and Model Number.** Rough Terrain Container Handler (RTCH): RT 240, 53,000 lb capacity, 4 X 4.

3. **Purpose of Equipment.** The RTCH-RT 240 is designed to lift and stack 20 and 40 ft International Standard Organization (ISO) containers, loaded to a gross weight of 53,000 lb (24,062 kg).

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for the equipment 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 truck 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-AC-NML, Rock Island, Illinois 61299-7630. We'll send you a reply.

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. 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.

OZONE DEPLETING SUBSTANCES

Listing to be provided by requiring activity.

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 TM 10-3930-675-20.

WARRANTY INFORMATION

The vehicles are warranted by Kalmar RT in accordance with TB 10-3930-675-14. Warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your Organizational Maintenance shop.

LIST OF ABBREVIATIONS/ACRONYMS

NOTE

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

ABBREVIATION/ACRONYMS	DEFINITION
AAL	Additional Authorization List
BII	Basic Issue Items
C	Centigrade or Celsius
CAN-BUS	Controller Area Network-BUS
CID	Cubic Inch Displacement
cm	Centimeter
COEI	Components of End Item
ECM	Electronic Control Module
ECS	Electronic Control System
GCWR	Gross Combination Weight Rating
GVWR	Gross Vehicle Weight Rating
IAW	In Accordance With
IETM	Interactive Electronic Technical Manual
ISO	International Organization for Standardization
kg	Kilogram
km	Kilometer
kPa	Kilopascal
kph	Kilometers per Hour
kW	Kilowatt
l	Liter
lb-ft	Pound Foot
LC	Load Center
lph	Liters per Hour
mm	Millimeter
NATO	North Atlantic Treaty Organization
Nm	Newton Meter
OALH	Overall Lowered Height
OEM	Original Equipment Manufacturer
PMCS	Preventive Maintenance Checks and Services
RTCH	Rough Terrain Container Handler
SPORT	Soldiers' Portable On-System Repair Tool

EQUIPMENT DESCRIPTION AND DATA 0002 00

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

1. **Characteristics.**

   a. The Rough Terrain Container Handler (RTCH)-RT 240 is designed to lift, move, stack or unstack 20 and 40 ft by 8 ft wide ISO containers.

   b. The RTCH-RT 240 has a lift capacity of 53,000 lb (24,062 kg) and operates on hard and/or unimproved surfaces, to include beach operations.

   c. The RTCH-RT 240 can be utilized as a forklift with an operator-installed forklift kit.

2. **Capabilities and Features.**

   a. **Capabilities.**

      (1) Container handling capabilities:

      - Stack or unstack 8 ft high ISO containers stacked three (3) high with a gross weight of 53,000 lb (24,062 kg) in the first row.
      - Stack or unstack 8 ft high ISO containers stacked three (3) high with a gross weight of 27,500 lb (12,485 kg) in the second row.
      - Stack or unstack 4.3 ft high ISO containers stacked seven (7) high.
      - Container tophandler adjusts to 20 ft or 40 ft ISO container lengths.
      - Container tophandler oscillates 7° left and right.
      - Container tophandler rotates 195° clockwise and 105° counterclockwise.
      - Container tophandler tilts 8° forward and 12° to the rear.
      - Container tophandler side shifts ± 15 in (± 400 mm) from the center on each side.

      (2) Forklift kit is operator-installed and attaches to the tophandler. The fork tines are adjustable from 24 in (61 cm) center-to-center to 81.5 in (207 cm) center-to-center. Lift capacity is 44,000 lb (19,976 kg).

      (3) Maximum speed of RTCH is 23 mph (37 kph) on level ground with NO LOAD; maximum speed on level ground LOADED is 15 mph (24 kph).

      (4) Maximum fording depth is 60 in (1.52 m).

      (5) Operation in temperatures from -25°F (-32°C) to +125°F (+52°C), and to -40°F (-40°C) with arctic kit installed.

   b. **Features.**

      (1) Electronically-controlled 400 hp, six-cylinder turbocharged engine.

      (2) Electronic semi-automatic shift controlled transmission with 4 ranges forward and 3 reverse. Operator selects range and ECM controls shift points.

      (3) The drive axles provide traction for two- or four-wheel drive.

      (4) Limited slip differentials and multi-disc-wet brakes are an integral part of the axle assemblies. Multi-disc-wet brakes are hydraulically cooled to prevent overheating. Accumulators store energy for the emergency braking system.

      (5) The steering system is capable of two-wheel, four-wheel, crab, and emergency modes of operation.

      (6) The parking brake is hydraulically released and spring-applied by disc brake assemblies mounted on the front and rear differentials.

      (7) The operator’s cab has a fully adjustable operator’s seat, fresh air (filtered) ventilation system, and heater/defroster/air conditioning systems.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - CONTINUED

(8) Operator's controls include: adjustable steering wheel; accelerator and brake pedals; transmission range selector; steering mode selection rocker switches; and a single joystick control for all boom, tophandler, and forklift operations.

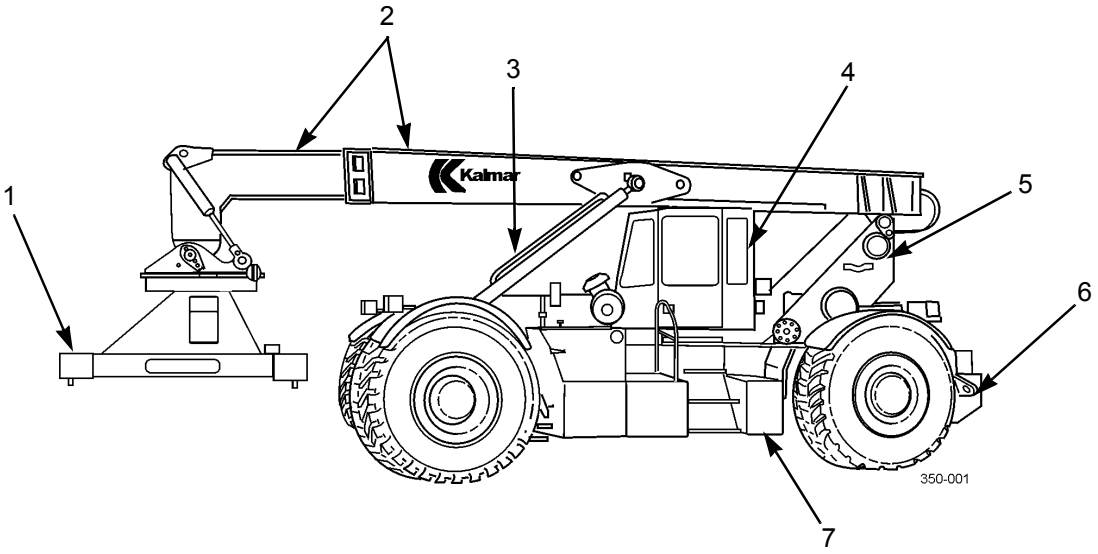
c. **Transport Modes.**

NOTE

Refer to WP 0007 00 for detailed instructions to prepare the RTCH for transport.

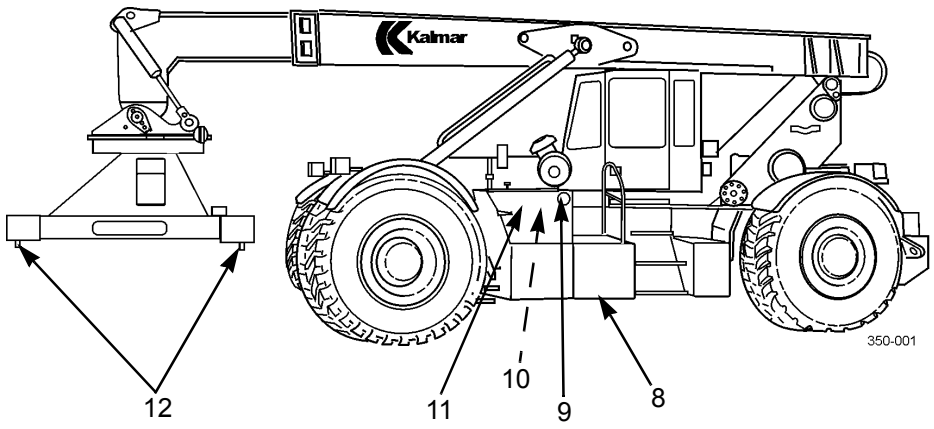
- Self Deployment
- Highway Transport
- Rail Transport
- Marine Transport
- Air Transport

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



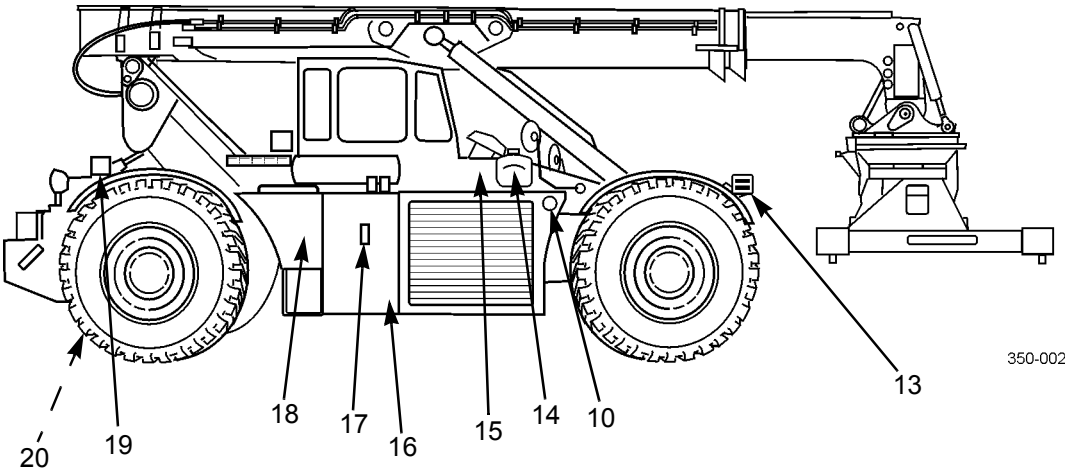
KEY	COMPONENT	DESCRIPTION
1	Tophandler	Electro-hydraulically operated 20-40 ft tophandler. Capable of sideshifting, rotation, forward/rear tilting, left/right tilting, and load position leveling and locking. Also interfaces with forklift attachment.
2	Boom Assembly	Electro-hydraulically operated heavy duty steel boom designed for moving, lifting, and stacking 20-40 ft ISO containers.
3	Boom Lift Cylinders	Electro-hydraulically operated cylinders raise, lower, and support the boom assembly.
4	Operator's Cab	Contains all driving and container handling controls as well as heating, air conditioning, and filtered ventilation system controls. During air transport operations the cab is moved to the left side of the chassis, then lowered and secured in place.
5	Boom Support	Rear support and pivot point for the boom to include an unlocking device that allows the boom assembly to be lowered into the transport position.
6	Frame	A heavy-duty steel construction with tie-downs, towing lugs, and pintle hook.
7	Remote Hydraulic Control Compartment	Location of selected hydraulic remote controls. Also access to hydraulic system test and AOAP sampling ports.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



KEY	COMPONENT	DESCRIPTION
8	Dolly Wheels Storage Compartment	Storage location for the tophandler air transport dolly wheels.
9	Master Battery Switch	ON/OFF control of electrical power from batteries to vehicle electrical system.
10	Slave Receptacle	Provides an electrical connection for slave starting. A receptacle is located on each side of the truck.
11	Battery Compartment	Stores four 12-volt batteries and required cabling. Batteries are accessible from the side and/or the top.
12	Twistlocks	Electro-hydraulically operated and monitored ISO twistlocks, located at each corner of the tophandler. Also utilized to attach forklift attachment to tophandler.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



KEY	COMPONENT	DESCRIPTION
13	Front Service and Blackout Lights	Headlight, blackout drive light, and composite turn signal with blackout markers.
14	Coolant Expansion Tank	Contains cooling system overflow. Provides means to visually check coolant level and add coolant to system.
15	Engine Compartment	Houses the six-cylinder turbocharged diesel engine that supplies power for the automotive, electrical, and hydraulic systems.
16	Hydraulic Reservoir	Stores and vents system hydraulic oil.
17	Hydraulic Reservoir Sight Gage	Visual indicator of hydraulic oil level. If oil is NOT visible in sight gage with boom completely lowered and tophandler retracted, do not start engine.
18	Fuel Tank	Stores fuel supply for vehicle.
19	Rear Service and Blackout Lights	Composite tail, stop, and blackout markers; turn signals; and backup lights.
20	Bogie Wheels	Distribute weight equally between bogie wheels and rear axle for air transportability.

EQUIPMENT DATA

Engine:

Manufacturer	Cummins
Model	QSM 11
Horsepower @ 2150 rpm	400 hp (298 kW)
Torque @ 1200 rpm	1450 lb-ft (1966 Nm)
Cylinders	6
Displacement	661 CID (10.8 liters)
Weight	2070 lb (940 kg)
Fuel System	Fully electronic
Cooling System, Thermostat Range	180°- 200°F (82°- 93°C)

Transmission:

Manufacturer	ZF-Hydromedia
Model	4 WG-260
Type	4 forward and 3 reverse speeds
Range Selection	Automatic, electronically-controlled

Axles:

Manufacturer	Kessler
Model:	
Front	LT102PL341/528NLB4650
Rear	LT102PL341/528NLB4460
Weight:	
Front	8379 lb (3804 kg)
Rear	5733 lb (2602 kg)

Tires:

Front and Rear:	
Manufacturer	Bridgestone
Size	29.5 R 35 XRB
Inflation	85 psi (586 kPa)
Weight	2315 lb (1050 kg)
Bogie Wheels (Transport Operations):	
Manufacturer	Michelin
Size	355/65 R 15 XZM
Inflation	85 psi (586 kPa)
Dolly Wheels (Tophandler Transport):	
Manufacturer	Michelin
Size	225/75 R 10 XZR
Inflation	85 psi (586 kPa)

Dimensions:

Length:	
Tophandler Lateral	37.7 ft (11.5 m)
Tophandler Longitudinal	49.2 ft (15.0 m)
Height:	
Operational w/ Boom Level	13.1 ft (4.0 m)
Highway Transport Mode	9.8 ft (3.0 m)
Width, Tophandler Longitudinal	12 ft (3650 mm)

EQUIPMENT DATA - CONTINUED

Weights:

GVWR . . . . . 118,000 lb (53,572 kg)
GVWR w/ Forklift Kit . . . . . 128,400 lb (58,294 kg)

Capacities:

Fuel Tank . . . . . 103 gal. (390 l)
Cooling System . . . . . 23.7 gal. (90.1 l)
Cooling Engine Only . . . . . 3.4 gal. (12.9 l)
Hydraulic Oil Reservoir . . . . . 180 gal. (680 l)
Engine Crankcase w/Filter . . . . . 38.6 qt (36.5 l)
Transmission w/Filter . . . . . 36 qt (34 l)

Electrical System:

Type . . . . . 24 volt, negative ground
Batteries:
  Quantity 4
  Voltage . . . . . 12 volt

Miscellaneous:

Maximum Lifting Capacity:
  First Stacking Row . . . . . 53,000 lb (24,062 kg)
  Second Stacking Row . . . . . 27,500 lb (12,485 kg)
Maximum Lift Height . . . . . 33 ft (10.06 m)
Maximum Lifting Capacity, w/Forklift Kit
  First Stacking Row . . . . . 44,000 lb (19,976 kg)
  Second Stacking Row . . . . . 24,600 lb (11,168 kg)
Maximum Lift Height, w/Forklift Kit . . . . . 21.8 ft (6.65 m)
Forklift Kit, Fork Tines Center-to-Center Range . . . . . 24-81.5 in (61-207 cm)
Maximum Forward Reach (Boom Level) . . . . . 20.6 ft (6.28 m)
Curb-to-Curb Turning Circle:
  Four-Wheel Steering . . . . . 65 ft (19.8 m)
Ground Clearance . . . . . 18 in (45.7 cm)
Fording Depth . . . . . 60 in (1.5 m)
Maximum Travel Speeds:
  Empty . . . . . 23 mph (37 kph)
  Loaded . . . . . 15 mph (24 kph)

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THEORY OF OPERATION 0003 00

INTRODUCTION

1. The RTCH-RT 240 consists of the following major components and functional systems: drive train, fuel system, exhaust system, cooling system, electrical and electronic systems, steering and brake systems, hydraulic system, cab system, and lifting boom with tophandler. A forklift kit may be added as required.
2. This work package explains how the components and systems of the RT 240 work together. A functional description is provided for each major component and system.

DRIVE TRAIN

1. The engine is a six-cylinder turbocharged diesel which supplies power to the transmission. The engine cooling system is pressurized and includes a thermostat, controlled bypass, and coolant recovery bottle. Engine lubrication is pressurized and a full-flow filter continuously cleans oil.
2. The transmission is a semi-automatic electronically-controlled unit. The operator electronically selects range of gears and the transmission ECM controls shift points up to the highest selected gear. A shift inhibitor circuit controls down-shifts in forward and reverse gears. The transmission can be manually or electronically shifted through 4 forward and 3 reverse gears. A torque converter provides interface to the engine.
3. The drive shafts transmit rotation of the transmission output to the front and rear axles. Connections at both ends are made through universal joints to compensate for any misalinements due to operating on uneven surfaces.
4. The front and rear axles are identical in operating principles. Both axles are hydraulically steered with planetary wheel ends and wet-disc brakes. The rear axle oscillates above and below horizontal to allow for operation on uneven surfaces.

FUEL SYSTEM

1. Fuel to power the engine is pumped from the fuel tank by an engine-mounted fuel pump to the electronically controlled fuel injector nozzles.
2. The engine electronic control module manages, monitors, and stores key engine functions, to include engine idle speed, limits maximum engine speed, and engine diagnostic data.
3. The engine-mounted fuel/water separator is a spin-on replaceable type with drain.

EXHAUST SYSTEM

The exhaust system removes exhaust gases from the engine through the exhaust manifold and turbocharger. The gases flow into exhaust pipes and muffler to the atmosphere along the right side and to the rear of the operator's cab.

COOLING SYSTEM

1. The cooling system consists of an engine-mounted circulating pump, 180°- 200°F (82°- 93°C) thermostat, oil cooler/ after cooler manifolds, a radiator, engine-mounted coolant filter, and hydraulically-driven cooling fan.
2. The cooling system cools the engine by means of circulating pressurized ethylene glycol-based coolant through the engine and radiator.

ELECTRICAL SYSTEM

1. The system voltage is 24 volts. Four 12-volt batteries, connected in series/parallel configuration and charged by an alternator across electronic rectifying and voltage stabilization circuits, provide the voltage.
2. The negative and positive poles are both connected across the master battery switch. The negative pole is connected to the chassis.
3. NATO slave-starting receptacles are provided.

STEERING SYSTEM

1. The electro-hydraulic steering system provides three modes of steering control; two-wheel steer, four-wheel steer, and crab steer.
2. The variable rate steering system utilizes two front and two rear hydraulic steer cylinders and electronic wheel position sensors connected to an electronic control module to maintain direction and control. The variable rate system allows the system to change or adjust to different modes of operation.
3. An emergency steering pump is provided in the event the engine is inoperative. If the engine quits while operating the RTCH, the emergency steering pump provides sufficient hydraulic pressure to control the truck until it is brought to a safe stop.

BRAKE SYSTEM

1. The brakes are totally enclosed within the front and rear drive axle housings, next to the wheel ends.
2. The brake system is a wet brake system that is comprised of three separate hydraulic circuits: service brake circuit, cooling circuit, and parking brake circuit.
3. The brake system also includes six pressurized accumulators that provide adequate stored energy to stop the RTCH in the event of engine shutdown.
4. The service brake circuit is applied by depressing either the left or right floor-mounted hydraulic brake pedals. Brake pressure is applied to eight cylinders per side within the front axle and one cylinder per side in the rear axle.
5. The brake system cooling circuit cools the brake disks using oil pumped from the main hydraulic system through brake chambers during operation.
6. The parking brake assemblies are mounted at the input flanges of the front and rear axles. The brakes are applied by spring pressure and released hydraulically. A warning buzzer sounds if driver leaves seat without applying the parking brakes. In the event of an emergency the parking brake may be utilized to stop the truck.

HYDRAULIC SYSTEM

The RTCH hydraulic system is comprised of the following major components that provide hydraulic power to operate and control the container tophandler, boom, steering, and brake systems. In addition the hydraulic system is used to place the cab and bogie wheels into transport mode.

1. Three variable piston-type hydraulic pumps are driven by the transmission power take-off (PTO). The pumps provide hydraulics for the steering system and tophandler.
2. One double vane-type pump is driven by the transmission PTO. It provides hydraulics for the boom cylinders, service, and parking brake systems.
3. One single-vane pump is driven by the engine. It provides hydraulics for a cooling fan.
4. Main valves control the main hydraulics. The valves are controlled by an electro-hydraulic servo system from the joystick control in the operator’s cab.
5. High-pressure oil filters clean hydraulic oil before returning oil to the reservoir. Breather filters allow venting of the hydraulic reservoir.
6. Hydraulic system oil cooler and fan maintain and control hydraulic oil temperature. The cooling fan is powered by hydraulics from an engine-driven hydraulic pump.
7. Emergency systems: one ground-driven hydraulic pump maintains steering control in the event of engine failure; a 24-volt electric hydraulic pump provides power to lower boom and release the twist locks in the event of engine failure. The electric pump also provides a means to place the operator’s cab into the transport mode.

CAB SYSTEM

1. The operator's cab is a sound and weather insulated unit that provides the operator with the systems to control and monitor both standard automotive functions and container handling functions. The following components or systems are also contained within the cab:
   a. Adjustable steering column and adjustable suspension seat.
   b. Heater, air conditioning, and filtered ventilation system.
   c. Portable fire extinguisher and rifle mount.
2. The air conditioning unit is part of the cab heater and is mounted at the front of the cab.
   a. It consists of an evaporator coil, blower motor, control valves, and air ducts.
   b. The system is turned on by operating the air conditioning control switch on the instrument panel.
   c. A three-speed blower switch controls air flow.
   d. Operating the temperature control switch controls refrigerant flow thru the evaporator coil to maintain an even cab temperature.

ELECTRONIC SYSTEM

The RT 240 is equipped with several electronic modules, all connected using CAN-BUS technology. The modules can be diagnosed using the IETM and OEM testing equipment. They assist in the operation of major systems such as engine, transmission shifting, steering mode and wheel position, the safe working load control, and many related functions that require data input to operate correctly for the intended uses of the RT 240.

LIFTING BOOM AND TOPHANDLER

The lifting boom and tophandler is an electro-hydraulic operated heavy-duty telescoping boom and spreader assembly, designed to lift, move, and stack/unstack 20-40 ft (6.1-12.2 m) ISO containers. The operator joystick provides complete control of the lifting boom and tophandler during container handling operations. The boom provides lifting/lowering, extending/retracting operations. The tophandler or spreader provides for sideshifting, rotation, forward/rear tilting, left/right tilting, and load leveling and locking operations. The tophandler also provides interface capability with a forklift attachment.

FORKLIFT KIT

The forklift kit is attached to the tophandler twistlocks and two hydraulic hose quick disconnects. Forklift operation is controlled from the tophandler joystick to include adjustable fork tines. The fork tines and vertical support beams fold under the forklift framework for transport.

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CHAPTER 2
OPERATING INSTRUCTIONS

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DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

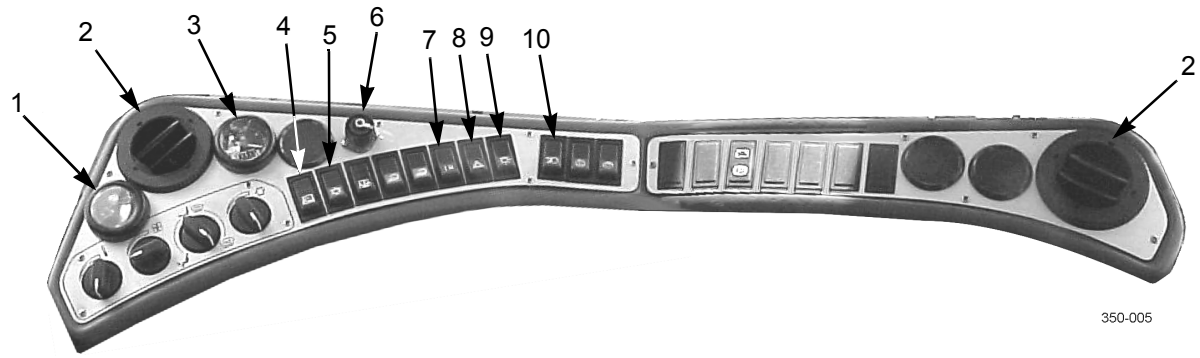
0004 00

GENERAL

Do not attempt to operate the RTCH-RT 240 until becoming familiar with the location and use of all controls and indicators. This work package describes all operator controls and indicators.

INSTRUMENT PANEL

1. **Gage and Switch Panel.**

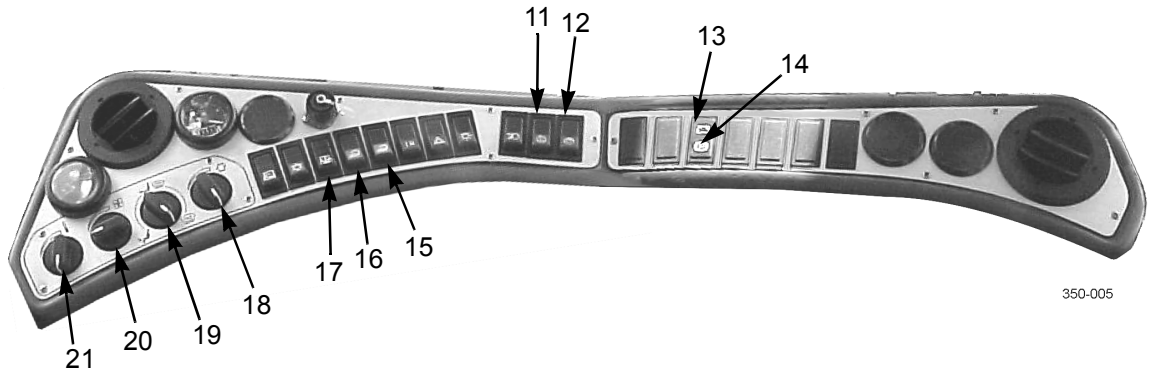


KEY	CONTROL OR INDICATOR	FUNCTION
1	Fuel Gage	Indicates amount of fuel in fuel tank when ignition switch is on.
2	Air Vents	Vents air into cab from heater/ventilator/defroster and air conditioner. Louvered openings are adjustable.
3	Hour Meter	Records hours of vehicle operation.
4	Cab Air Circulation Control Switch	Two-position rocker switch provides selection of recirculated air or fresh air within the cab.
5	Air Conditioning Control Switch	ON/OFF rocker switch controls cab air conditioning operation.
6	12-Volt Utility Plug	Supplies 12-volt power to operate utilities.
7	IR Light Switch	ON/OFF rocker switch controls operation of infrared lights.
8	Hazard Warning Light Switch	ON/OFF rocker switch controls hazard warning lights.
9	Service Light Switch	ON/OFF rocker switch controls headlights and taillights.
10	Blackout Drive/Marker Light Switch	ON/OFF rocker switch controls blackout drive/marker light.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED

0004 00

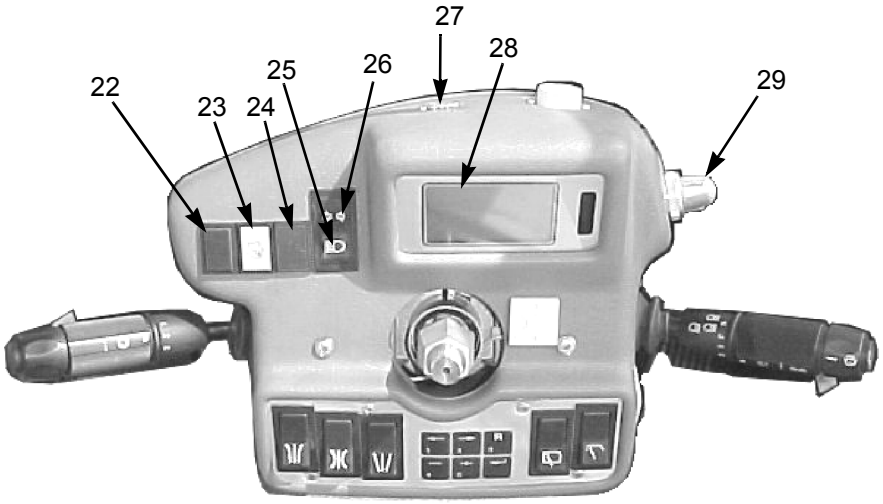
INSTRUMENT PANEL - CONTINUED



KEY	CONTROL OR INDICATOR	FUNCTION
11	Ether Injector Switch	Spring-loaded rocker switch is used to inject a metered amount of ether while engine cranking during cold weather starting.
12	Auxiliary Pump Switch	Spring-loaded rocker switch is used in the event of an engine failure or shut down, to lower the boom, unlock twistlocks, and raise/retract the boom. The auxiliary pump is also utilized to reposition the operator's cab for transport.
13	Alternator Charging Lamp	Red light comes ON when alternator fails to operate properly.
14	Parking Brake Indicator Light	Red light comes ON when parking brake is set.
15	Tophandler Work Light Switch	ON/OFF rocker switch controls tophandler work lights.
16	Boom Work Light Switch	ON/OFF rocker switch controls boom work lights.
17	Arctic Heater Switch (if equipped)	ON/OFF rocker switch operates arctic heater, if equipped.
18	Air Conditioner Temperature Control Switch	Switch rotates to control air conditioner output within the cab. Rotate switch clockwise to decrease temperature.
19	Heater and Defroster Selection Switch	Three-position switch selects air flow direction to windshield, operator or both.
20	Fan Switch	Switch rotates to control heater/air conditioner fan speed. Rotate switch clockwise to increase fan speed.
21	Heater Temperature Control Switch	Switch rotates to control heater output within the cab. Rotate switch clockwise to increase temperature.

INSTRUMENT PANEL - CONTINUED

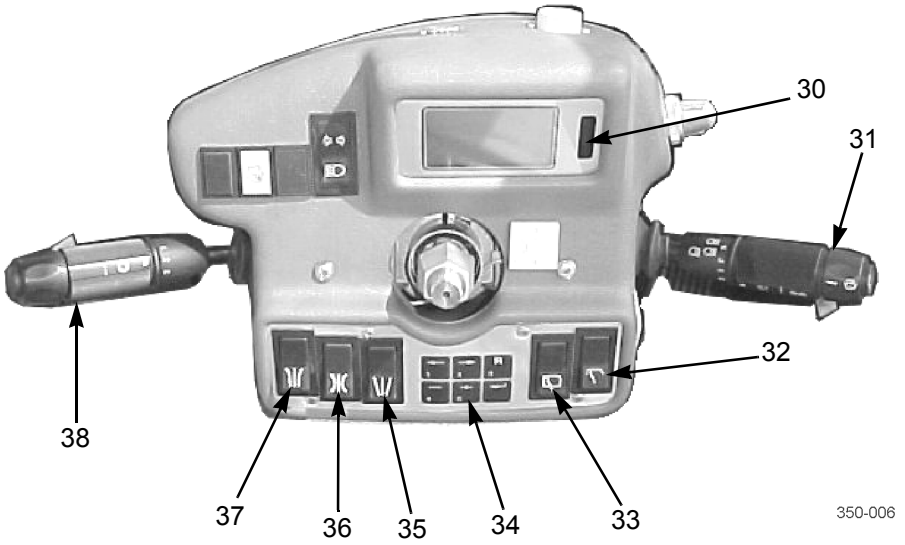
2. **Steering Column Switches and Controls.**



350-006

KEY	CONTROL OR INDICATOR	FUNCTION
22	Twistlocks LOCKED Indicator Light	GREEN indicator light is lit when twistlocks are locked.
23	Twistlocks ALINEMENT Indicator Light	YELLOW indicator light is lit during twistlock alinement.
24	Twistlocks UNLOCKED Indicator Light	RED indicator light is lit when twistlocks are unlocked.
25	High Beam Indicator Light	Indicator light is BLUE when headlight high beams are on.
26	Turn Signal Indicator Lights	Left/right directional arrow flashes GREEN whenever turn signal lights are flashing. Both arrows flash when hazard warning light switch is on.
27	Diagnostic Connector	Connection point for SPORT diagnostic computer or commercial laptop computer.
28	Electronic Control System (ECS) Display Screen	Provides vehicle and container handling operational information, including an OVERLOAD indicator. Displays system error codes (WP 0020 00) and operational and service menus. Refer to subparagraph *ECS Display Screens* on page 0004 00-6 for additional information.
29	Ignition Switch	Operates gages/switches/sending units, instrument panel lights, and engine starting.

INSTRUMENT PANEL - CONTINUED

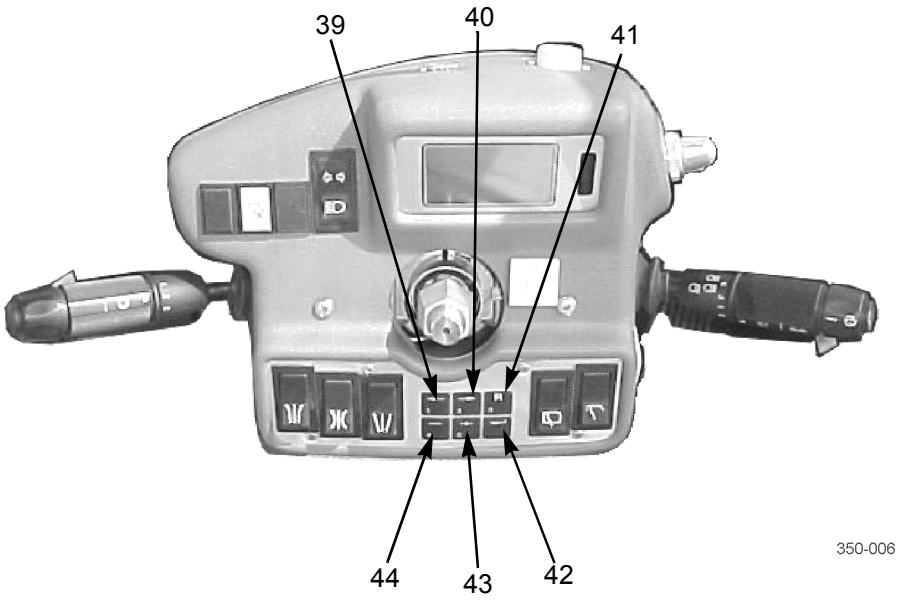


KEY	CONTROL OR INDICATOR	FUNCTION
30	Warning Indicator Light	Red light flashes to notify operator that an abnormal condition or system malfunction has occurred. Operator must refer to ECS display screen for further information. Systems tied to indicator light are: Engine — low oil pressure Engine — high coolant temperature Transmission — high temperature Transmission — low oil pressure Steering — angle error ECM — computer errors Sensors — signal problems Overload System — Overload condition
31	Accessory Control Lever	Provides controls for vehicle lights, turn signals, windshield wiper and washer, and horn.
32	Roof Window Wiper Switch	ON/OFF rocker switch controls roof window wiper motor.
33	Rear Window Wiper Switch	ON/OFF rocker switch controls rear window wiper motor.
34	Electronic Control System (ECS) Menu Selection Buttons	Six buttons are used to access ECS menus, scroll between menus, view error codes, and reset systems. Refer to subparagraph *ECS Menu Selection Buttons* on page 0004 00-5 for additional information.
35	Crab Steering Switch	ON/OFF rocker switch selects crab steering mode of operation.
36	Four-Wheel Steering Switch	ON/OFF rocker switch selects four-wheel steering mode of operation.
37	Two-Wheel Steering Switch	ON/OFF rocker switch selects two-wheel steering mode of operation.
38	Transmission Control Lever	Used to manually select transmission gear range and vehicle direction.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

INSTRUMENT PANEL - CONTINUED

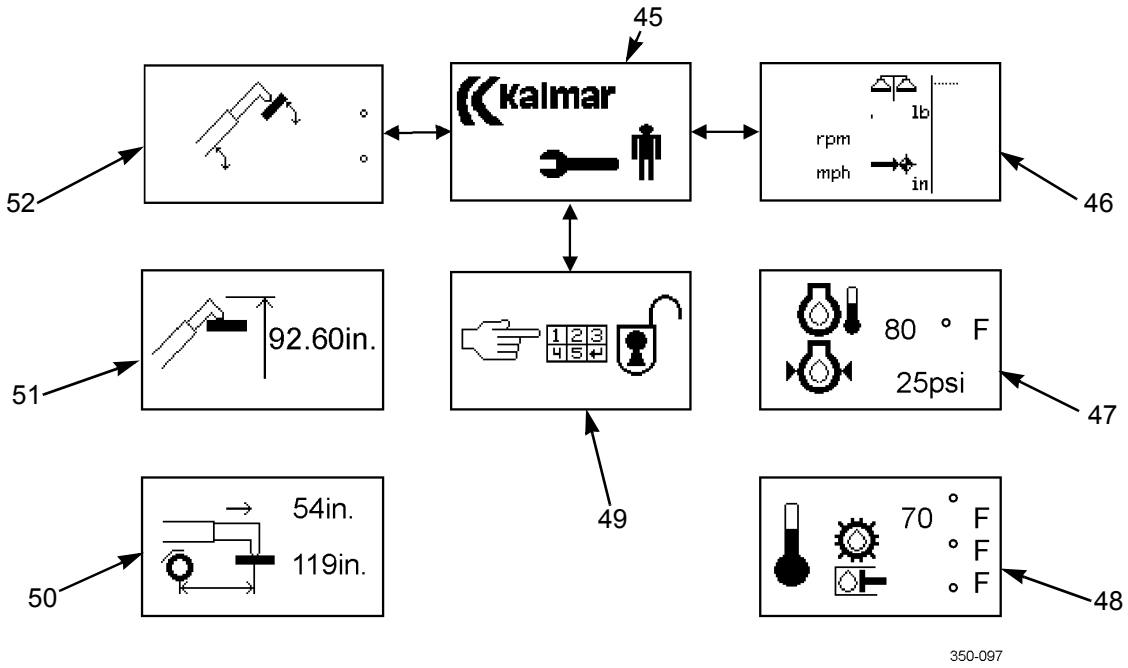
3. **ECS Menu Selection Buttons.**



KEY	CONTROL OR INDICATOR	FUNCTION
39	Left Arrow Button	Press to scroll backward through menus on ECS display screen.
40	Right Arrow Button	Press to scroll forward through menus on ECS display screen.
41	Error Message Reset "R" Button	Used to reset the ECS display screen.
42	ENTER Button	Used by maintenance personnel when setting up and calibrating vehicle monitoring systems.
43	Value Increase "+" Button	Used by maintenance personnel when setting up and calibrating vehicle monitoring systems.
44	Value Decrease "-" Button	Used by maintenance personnel when setting up and calibrating vehicle monitoring systems.

INSTRUMENT PANEL - CONTINUED

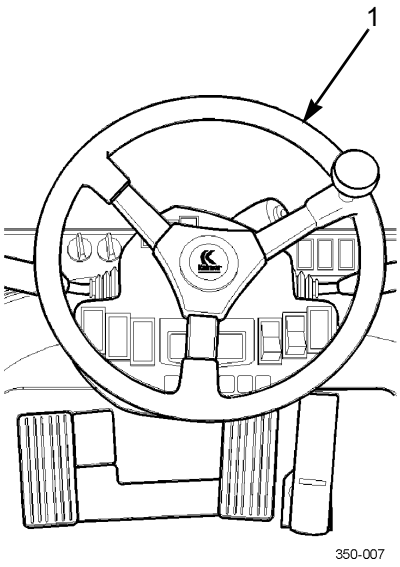
4. **ECS Display Screens.**

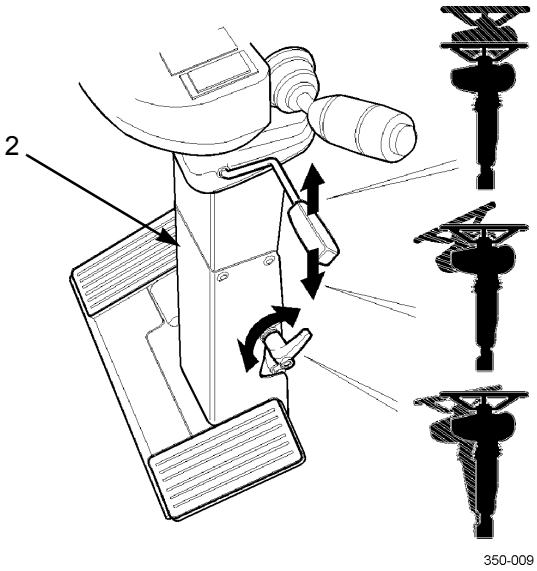


KEY	CONTROL OR INDICATOR	FUNCTION
45	ECS Icon Screen	Starting screen for menu selection.
46	Operational Screen	Displays the following data: (a) Transmission direction and gear range (b) Load weight (c) Engine RPMs (d) Truck mph (e) Center of gravity offset inches or centimeters
47	Engine Monitoring Screen	Displays engine oil pressure and temperature.
48	Temperature Monitoring Screen	Displays outside ambient, transmission, and hydraulic system temperatures.
49	Service and Maintenance Access Screen	Displays screens that are utilized by maintenance personnel for fault identification, setup, and calibration procedures.
50	Boom Extension Screen	Display of boom extension, in inches or centimeters.
51	Boom Height Screen	Display of boom height, in inches or centimeters.
52	Boom and Tophandler Lift Angle Screen	Display of boom and tophandler lift angles, in degrees.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

STEERING WHEEL AND STEERING COLUMN CONTROLS

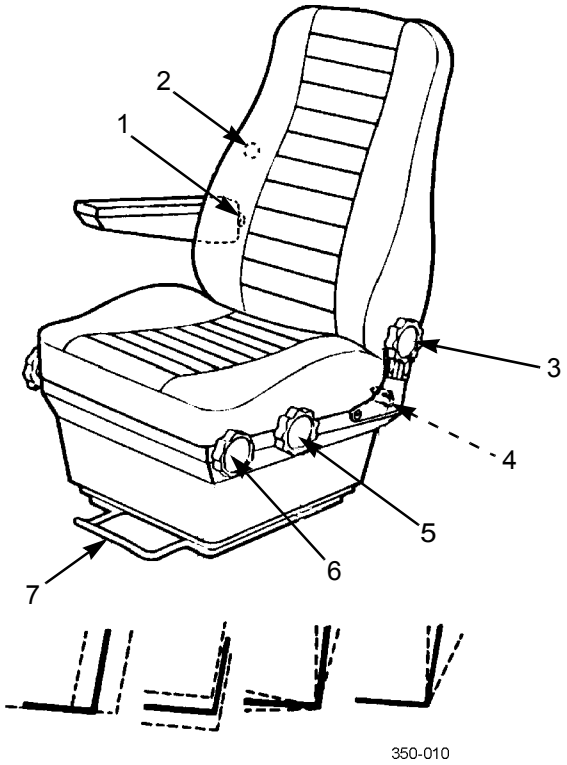




KEY	CONTROL OR INDICATOR	FUNCTION
1	Steering Wheel	Controls vehicle direction of travel. Turn steering wheel clockwise to turn right and counterclockwise to turn left.
2	Adjustable Steering Column	Upper control handle adjusts steering wheel height and angle. Lower control handle adjusts steering column tilt position.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

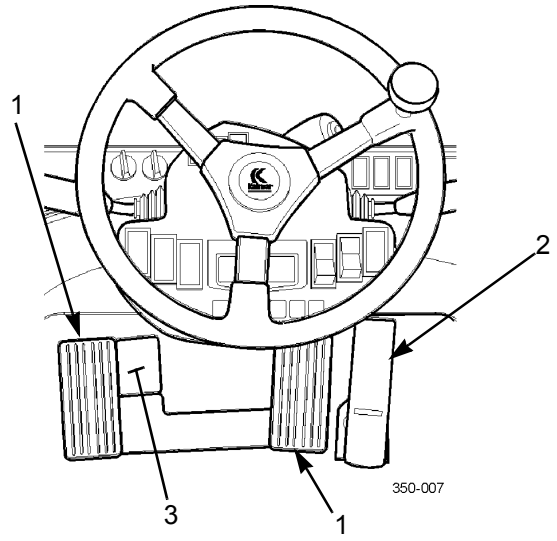
SEAT CONTROLS

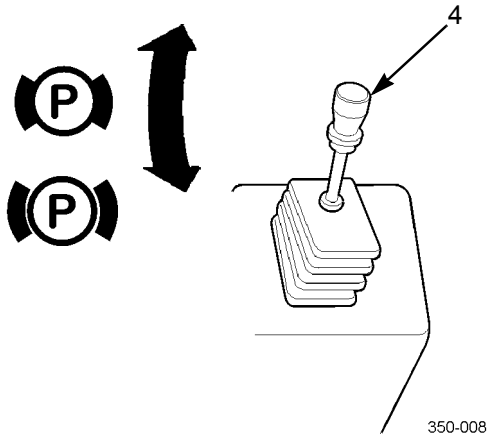


KEY	CONTROL OR INDICATOR	FUNCTION
1	Armrest Tilt Adjustment	Turn adjusting knob until desired armrest tilt is achieved.
2	Lumbar Adjustment Knob	Rotate knob forward to increase and rearward to decrease lumbar support.
3	Backrest Tilt Adjustment	Turn adjusting knob until desired backrest tilt is achieved.
4	Seat Cushioning Adjustment Lever	Three-position lever adjusts for desired amount of springing: NORMAL — lever pulled out. Use in normal operation. RESTRICTED — lever pushed half way in. Use when operating on rough surfaces. LOCKED — lever pushed in fully. Use when springing is not required.
5	Seat Tilt Adjustment Knob	Turn adjusting knob until desired seat tilt is achieved.
6	Seat Height Adjustment Knob	Turn adjusting knob until desired height is achieved.
7	Fore and Aft Seat Adjustment Lever	Lift adjusting lever and move seat forward or rearward.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

ACCELERATOR AND BRAKE CONTROLS

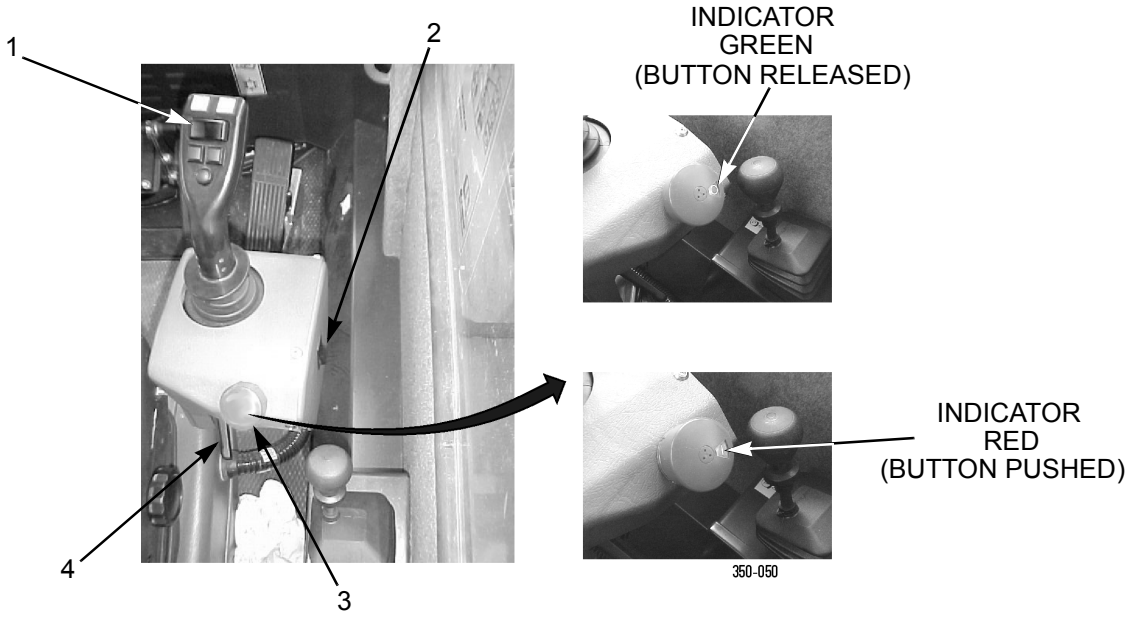




KEY	CONTROL OR INDICATOR	FUNCTION
1	Service Brake Pedals	Depress to apply service brakes and illuminate brake lights.
2	Accelerator Pedal	Depress to increase engine speed; release to decrease engine speed. Pedal is electrically linked to the engine control module.
3	Transmission Disconnect Brake Pedal	Depress to release transmission internal clutch. This allows the operator to increase engine RPMs, thereby accelerating hydraulic functions.
4	Parking Brake Lever	Push lever forward to apply; raise release lever and pull to the rear to release. The parking brake may also be utilized as an emergency brake. After emergency application using parking brake, notify Organizational Maintenance to replace parking brake pads.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

BOOM AND TOPHANDLER CONTROLS



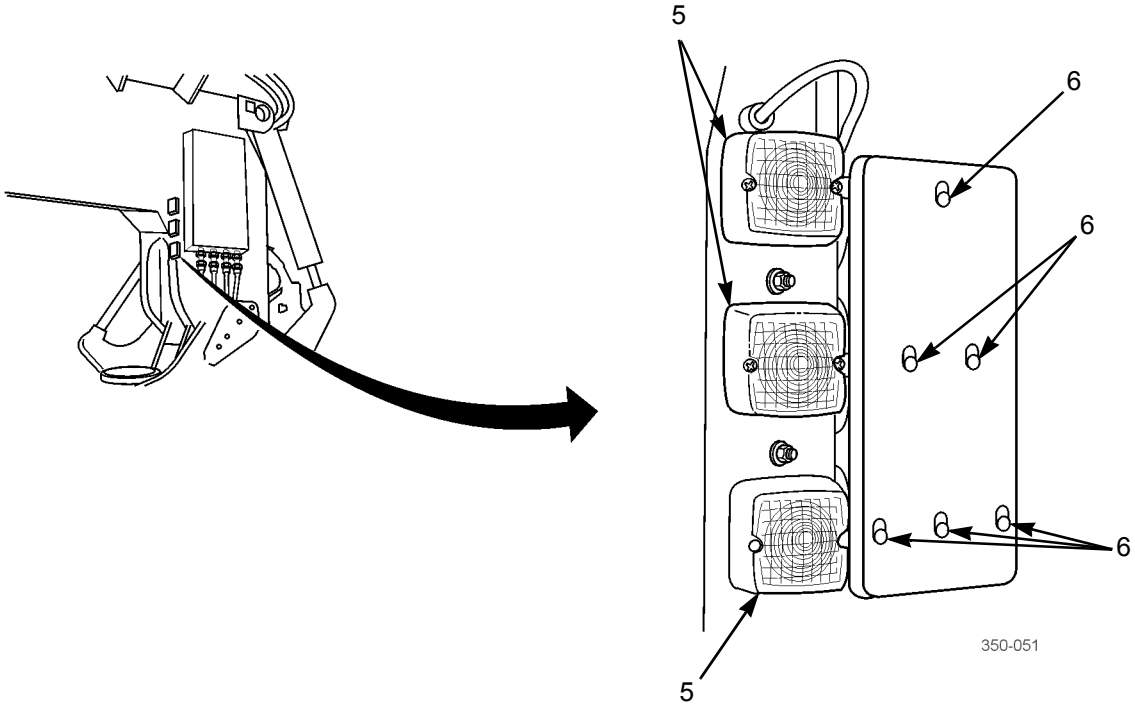
NOTE

Refer to *Operation Under Usual Conditions*, WP 0005 00, for detailed instruction on joystick operations.

KEY	CONTROL OR INDICATOR	FUNCTION
1	Joystick	Provides the following electro-hydraulic controls: (a) Raises and lowers boom. (b) Extends and retracts boom. (c) Locks and unlocks twistlocks. (d) Extends and retracts tophandler spreader for 20/40 ft containers. (e) Tilts and oscillates tophandler. (f) Locks container in position, when tilted or oscillated. (g) Slews left and right. (h) Sideshifts left and right. (i) Straight lifting control.
2	Override Switch	Allows the operator to retract and lower the boom after an OVERLOAD lockout. Provides twistlock override in the event of incorrect twistlock alinement.
3	Emergency Stop Button	Push button to stop all hydraulic functions to the boom and tophandler. When button is pushed, indicator on button shows red. Pull button to release. When released, indicator on button shows green.
4	Joystick Positioning Lever	Raise to release lever and adjust joystick position. Lower lever to lock joystick in position.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

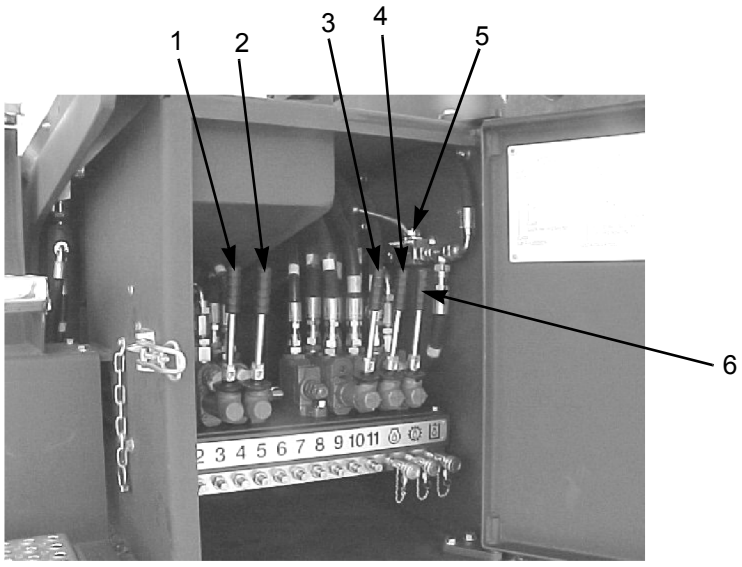
BOOM AND TOPHANDLER CONTROLS - CONTINUED



KEY	CONTROL OR INDICATOR	FUNCTION
5	Twistlock Indicator Lights	RED: twistlocks UNLOCKED YELLOW: twistlock ALINING GREEN: twistlocks LOCKED
6	Twistlock Indicator Lights (IR)	Single IR light: twistlocks UNLOCKED Two IR lights: twistlock ALINING Three IR lights: twistlocks LOCKED

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS - CONTINUED **0004 00**

REMOTE HYDRAULIC CONTROLS



350-058

KEY	CONTROL OR INDICATOR	FUNCTION
1	Cab Lift/Lower Lever	Used to move cab to transport position. Pull lever to raise cab. Push lever to lower cab.
2	Cab Side Movement Lever	Used to move cab to transport position. Pull lever to move cab to the left. Push lever to move cab to the right.
3	Locking Pins Lever	Pull lever to hydraulically extend/install boom support locking pins. Push lever to hydraulically retract locking pins.
4	Folding Boom Support Lever	Pull lever to hydraulically raise boom support. Push lever to hydraulically lower boom support.
5	Shutoff Valve #5	Supplies constant pressure to bogie wheels during air transport.
6	Bogie Wheels Lever	Used to lower and raise bogie wheels. Pull lever to raise bogie wheels. Push lever to lower bogie wheels.

OPERATION UNDER USUAL CONDITIONS 0005 00

GENERAL

WARNING

This vehicle has been designed to operate safely and efficiently within the limits specified in this TM. Operation beyond these limits is prohibited in accordance with AR 70-1 without written approval from: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-DSA-CS, Warren, MI 48397-5000.

NOTE

If an error code appears on driver's ECS display screen during operation, refer to WP 0020 00 for further information.

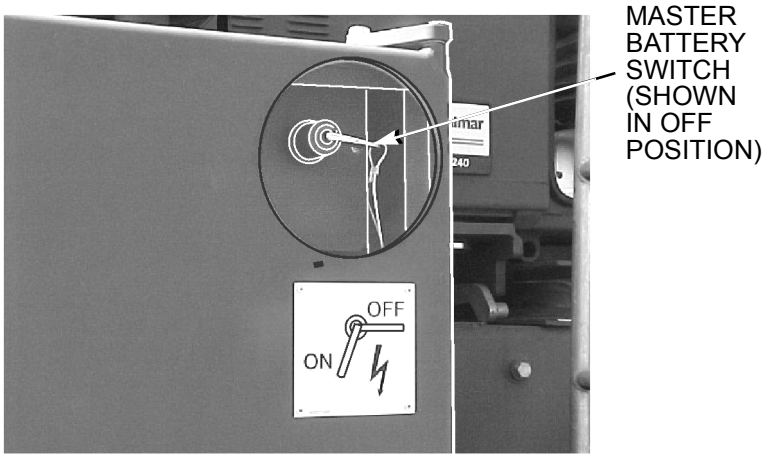
This section contains instructions for safely operating the RTCH-RT 240 under usual conditions. Unusual conditions are defined and described in WP 0006 00.

INITIAL ADJUSTMENTS, DAILY CHECKS, AND SELF-TEST

NOTE

Refer to WP 0004 00 for location and operation of controls.

1. Place master battery switch to ON.



350-048

2. Perform *Before* operation Preventive Maintenance Checks and Services (PMCS) (WP 0012 00 and WP 0013 00).
3. Occupy and adjust seat.
4. Close cab door.
5. Adjust position of joystick.
6. Adjust left and right exterior mirrors and interior rearview mirror as required.
7. Adjust steering wheel and column.
8. Fasten seat belt.

START ENGINE

NOTE

Refer to WP 0004 00 for location and operation of instrument panel indicators and controls.

1. Ensure that parking brake is applied.
2. Place transmission shift control lever to Neutral (N).
3. Ensure that all accessory switches and controls are in the OFF position.

CAUTION

DO NOT operate the starter motor for more than 30 seconds at a time. After 30 seconds, allow starter motor to cool for at least two minutes before attempting to start engine again. Excessive heating of starter motor may result in damage or early starter failure.

4. Turn ignition switch to ON position. System warning lights will illuminate briefly, then go out.
5. If ambient temperature is below 32°F (0°C), press ether injector switch on instrument panel.

NOTE

Start the engine with throttle in the IDLE position. It is not necessary to press the throttle to start a computer-controlled engine.

6. Turn ignition switch to START and allow the engine to start and run at idle speed.
7. Increase the engine speed (RPMs) slowly to provide adequate lubrication to the bearings and allow the oil pressure to stabilize.
8. Run engine at idle speed for 3 to 5 minutes before operating with a load.
9. Monitor fuel gage and indicators for any signs of abnormal temperatures or pressures. Shut down engine at first sign of a problem.

OPERATE TRANSMISSION

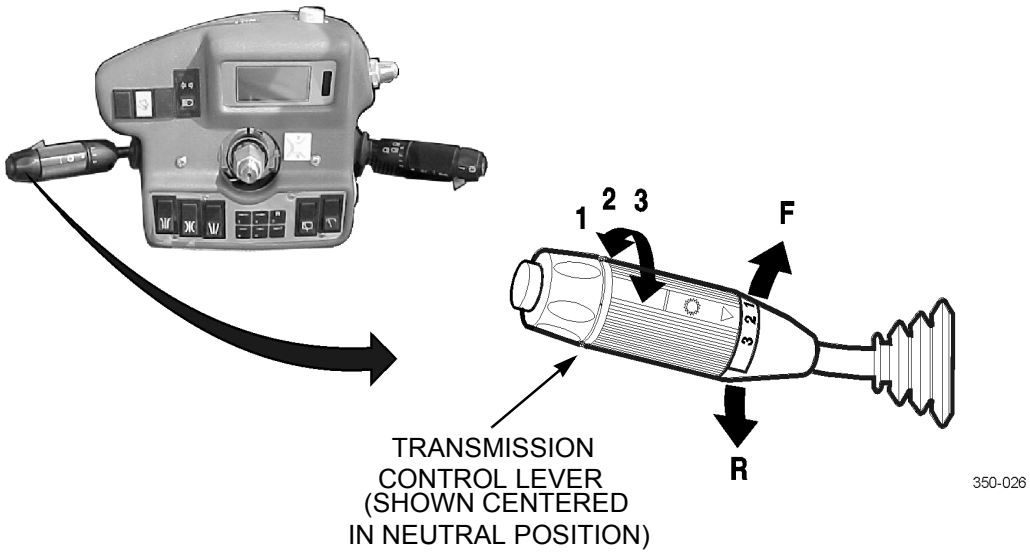
1. Transmission Ranges.

a. **Forward (F).** When placed in Forward (F), the transmission starts out in 1st gear and automatically progresses to the 4th gear. Automatic gear changing can be limited, by rotating the gear selection lever to 3rd, 2nd or 1st gear. The current gear selection and direction will be displayed on the driver's ECS display screen.

b. **Neutral (N).** This is the normal transmission position when the vehicle is not in use. Use N when starting the engine, checking accessories, and for extended periods of idling. An N will be displayed on the driver's ECS display screen when transmission is in the neutral position.

c. **Reverse (R).** When placed in Reverse (R), the truck moves rearward; the transmission starts out in 1st gear and automatically progresses to the 3rd reverse gear. The current gear selection and direction will be displayed on the driver's ECS display screen.

OPERATE TRANSMISSION - CONTINUED



2. **Operation.**

CAUTION

ALWAYS bring the truck to a complete STOP before changing from forward to reverse to prevent possible damage to the transmission.

NOTE

When a lower transmission range or gear is selected, the transmission may not downshift until vehicle speed is reduced.

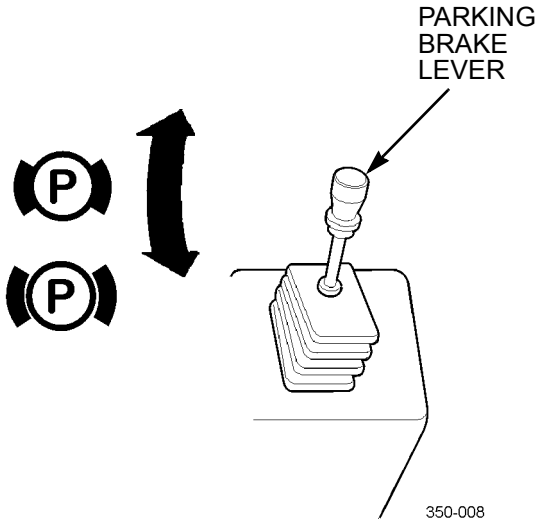
a. Depress and hold brake pedal.
b. Release parking brake.
c. Select direction and gear range with transmission control lever.
d. Release brake pedal and begin to move truck.
e. As required, select a specific forward or reverse gear for the load.

OPERATE PARKING BRAKE

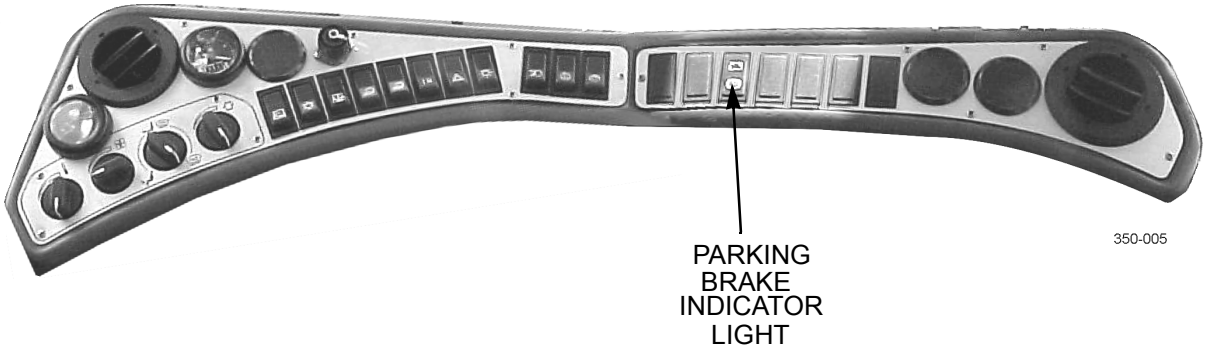
WARNING

Never leave the operator's position without applying the parking brake. Failure to follow this warning may result in death or injury to personnel or damage to equipment.

1. Push the parking brake lever forward to engage the parking brakes at front and rear axles. Raise release lever and pull the lever rearward to release the parking brakes.



2. A RED indicator light will illuminate on the instrument panel when the parking brake is applied.



3. A buzzer will sound if the driver attempts to leave the driver's seat without first applying the parking brake.

4. After one emergency application using parking brake, notify Organizational Maintenance to replace parking brake pads.

STEERING

1. **Steering Modes.**

   a. The RT 240 RTCH can be operated in any of three steering modes: two-wheel, four-wheel or crab steering, as selected by the steering mode selection switches or by transmission direction and gear range selection.

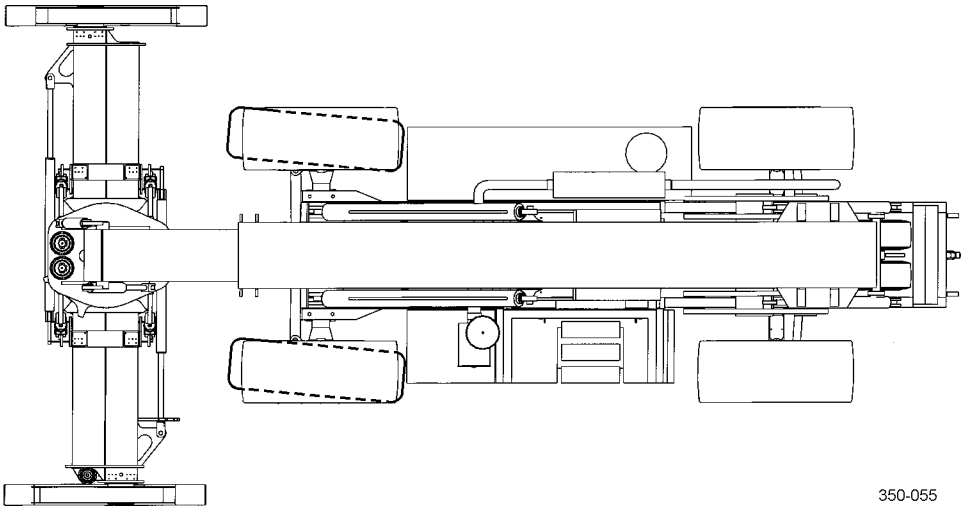
   b. Always bring the vehicle to a complete stop before switching from one mode of steering to another.

   c. Emergency steering is provided by the emergency ground-driven steering pump. If the engine quits during operation, this pump provides sufficient hydraulic pressure to control the truck until it is brought to a safe stop.

	Steering programs			
Gear Lever	Forward	Four	Crab	Manual, Emergency Mode
F3	2-3-4	1-2-3	2	2
F2	2-3	1-2	1-2	1
F1	2	1	1	1
R1	2	1	1	1
R2	2	1-2	1	1
R3	2-3	1-2-3	1	2
	2WD	4WD	4WD	4WD

350-057

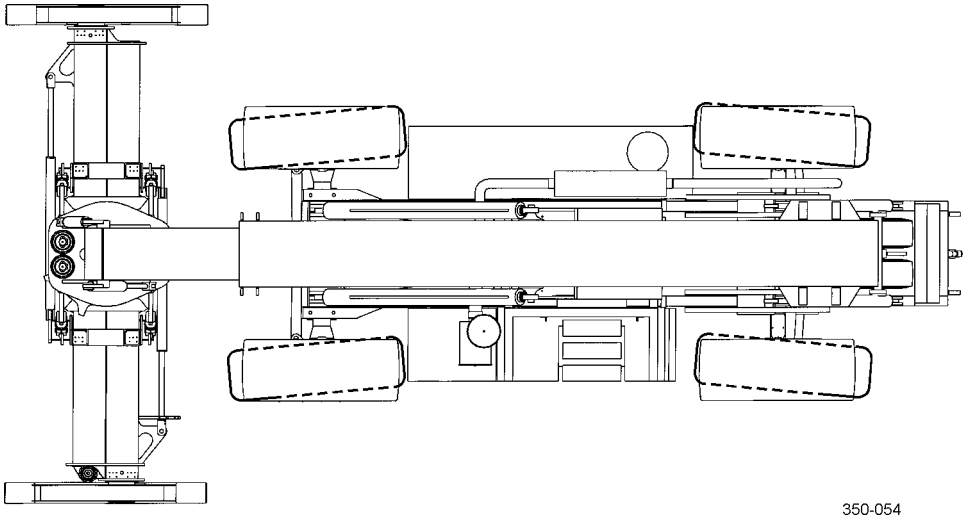
2. **Two-Wheel Steering.** Press the two-wheel steering selection switch on the steering column. Front wheels will steer in the direction the steering wheel is turned; the rear wheels will remain in the forward position.



350-055

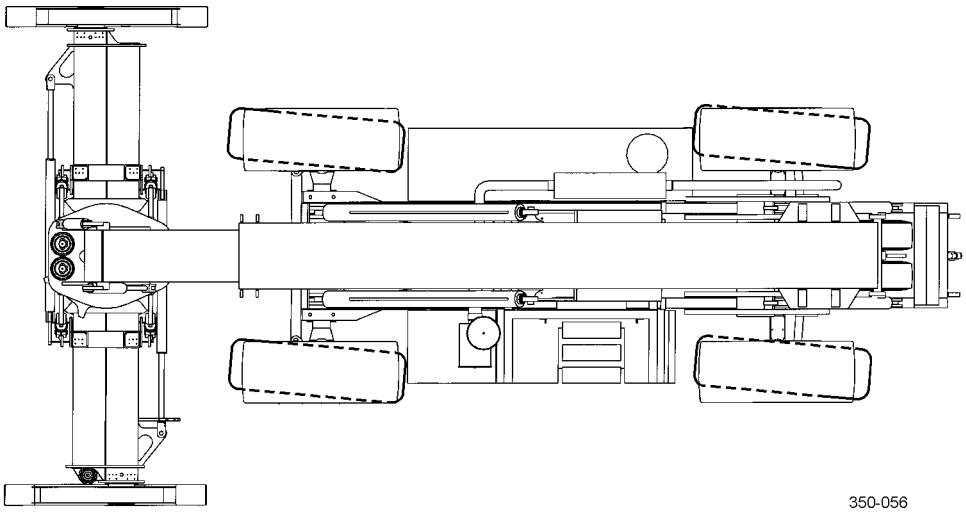
STEERING - CONTINUED

3. **Four-Wheel Steering.** Press the four-wheel steering selection switch on the steering column. Front wheels will steer in the direction the steering wheel is turned; the rear wheels will steer in the opposite direction. This steering mode allows for an extremely short turning radius. It also enables the rear wheels to follow in the tracks of the front wheels, thereby increasing traction in mud and snow conditions.



350-054

4. **Crab Steering.** Press the crab steering selection switch on the steering column. All wheels will steer in the same direction. This steering mode permits sideways movement, for better positioning of the truck during transport and moving the truck within tight quarters.



350-056

DRIVING TIPS

WARNING

- DO NOT allow riders on the truck. Failure to follow this warning may result in serious injury or death to personnel.
- Truck must not be driven when container load is in fully raised position. Truck is less stable when traveling with the load in a raised position. Always position the bottom of the load just above the driver's field of view, with the boom fully retracted. Failure to follow this warning may result in serious injury or death to personnel.
- BE ALERT for personnel in area while operating truck. Always check to ensure area is clear of personnel and obstructions before moving. Failure to follow this warning may result in serious injury or death to personnel.

CAUTION

The governed engine speed is 2100 RPMs. If engine is allowed to exceed governed speed, serious engine or transmission damage may result.

1. **Check Fuel Gage, Indicators, and ECS Display Screen Frequently.** If indicators show an abnormal reading or warning light comes on, bring the truck to a safe stop, shut down engine, and investigate cause.
2. **Avoid Over Steering.** Become familiar with steering characteristics of truck before attempting maneuvers in limited space.
3. **Avoid Hard Braking.** Become familiar with the braking characteristics of the truck with and without a load.
4. **Field of View.** When driving without a load, position the tophandler above your field of view, with the boom fully retracted. When driving with a load, position the bottom of the load above your field of view, with the boom fully retracted.

DRIVING

NOTE

Refer to WP 0004 00 for location and operation of controls.

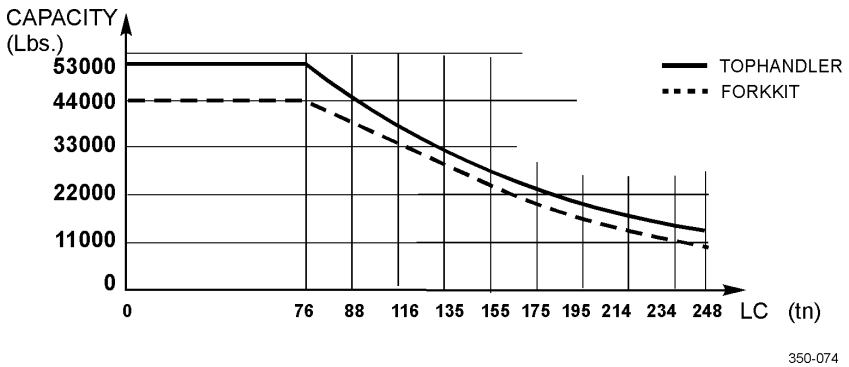
1. Perform initial seat and steering column adjustments.
2. Perform daily checks and self-tests (WP 0013 00).
3. Start engine and allow it to come up to operating temperature.
4. Raise tophandler to driving position.
5. With engine at idle, apply service brakes.
6. Select steering mode of operation by first straightening wheels, then pressing desired steering selection switch.
7. Move transmission control lever to desired direction, F or R, and select gear range.
8. Release parking brake lever and depress accelerator pedal to control truck speed.
9. Engage oscillation and tilt locks before driving with a load.

OPERATE LIFTING BOOM AND TOPHANDLER

NOTE

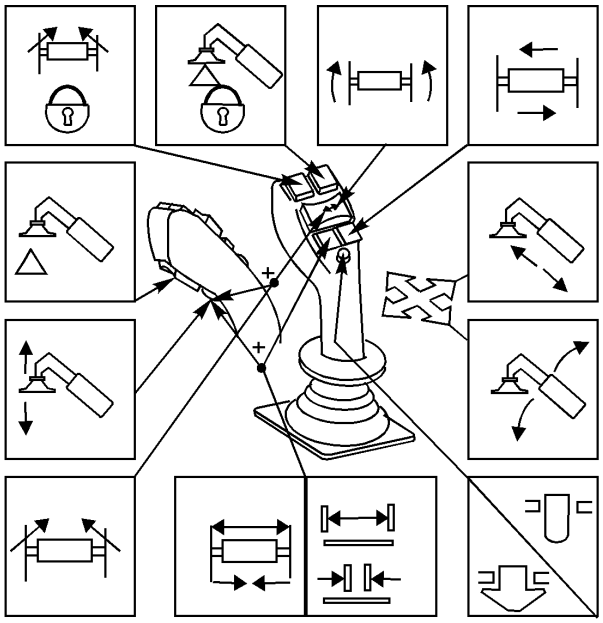
- Do NOT perform container handling procedures while in blackout mode. Blackout mode is to be used only when driving. In blackout mode, oscillation and tilt lock/unlock buttons do not illuminate. However, these buttons will light up in service mode or when IR lights are on.
- Refer to *Operation Under Unusual Conditions*, WP 0006 00, for instructions on emergency lowering of the boom, in the event of engine shutdown.

1. **General.**
   a. It is essential that the operator know how to safely perform every container handling operation of which the RT 240 RTCH is capable.
   b. The following information will provide the operator with instructions to perform container handling operations using the joystick to maneuver the lifting boom, tophandler, and forklift kit.
   c. The RT 240 tophandler is designed to move, stack, and unstack 20 ft and 40 ft ISO containers.
   d. With the forklift kit installed to the tophandler, the tophandler spreader controls will open and close the fork tines.
   e. The RT 240 ECU continuously monitors the boom angle, boom extension, and pressure in the hydraulic lift cylinders. From this data the computer calculates the actual load. This information is compared to the allowed load at the current position. When 100% capacity is reached, the system cuts off and will not allow any more movement, except to retract. When the load is moved into a safe operating range, the control of the system is returned to the operator controls (joystick).
   f. During lifting operations, do not exceed maximum lifting capability. The following chart indicates lift capacity in relation to boom extension. Note that as the boom is extended, the lift capacity is reduced.



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

2. **Joystick Operation.** The following buttons and switches on the joystick are used, individually or in conjunction with each other, to fully control all container handling operations. The following decal, located on the cab's right-side window, summarizes all joystick functions.



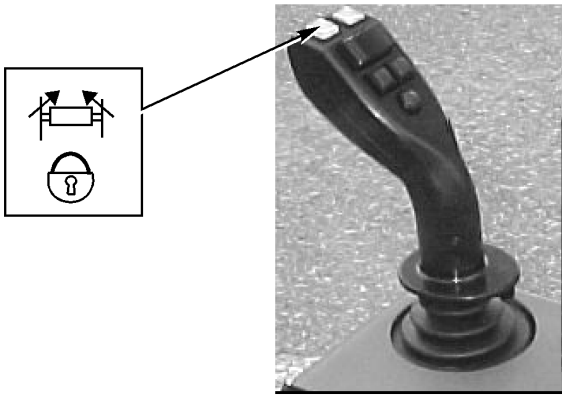
a. **Oscillation Lock/Unlock Button.**

NOTE

Button illuminates when lock is engaged.

(1) Press to engage lock, securing load position.

(2) Press to release lock, allowing load to float.



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

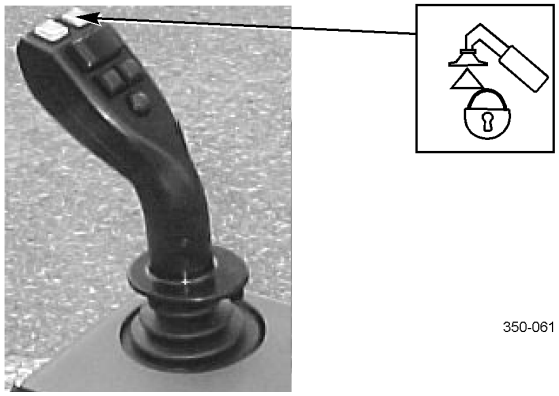
b. **Tilt Lock/Unlock Button.**

NOTE

Button illuminates when lock is engaged.

(1) Press to engage lock, securing load position.

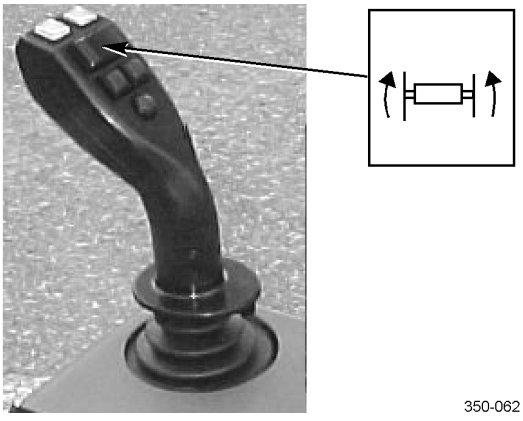
(2) Press to release lock, allowing load to float.



c. **Rotation Control Rocker Switch.**

(1) Press left side of rocker switch to rotate load clockwise.

(2) Press right side of rocker switch to rotate load counterclockwise.

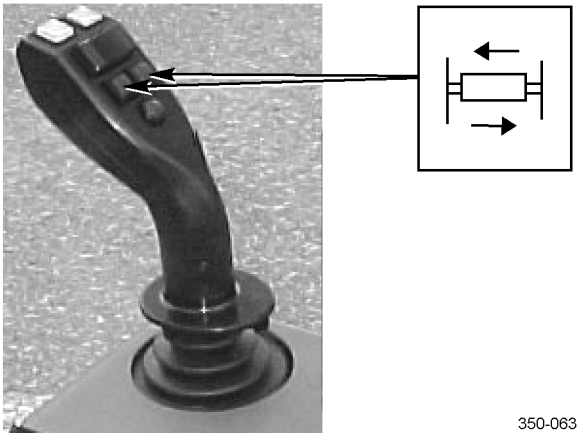


OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

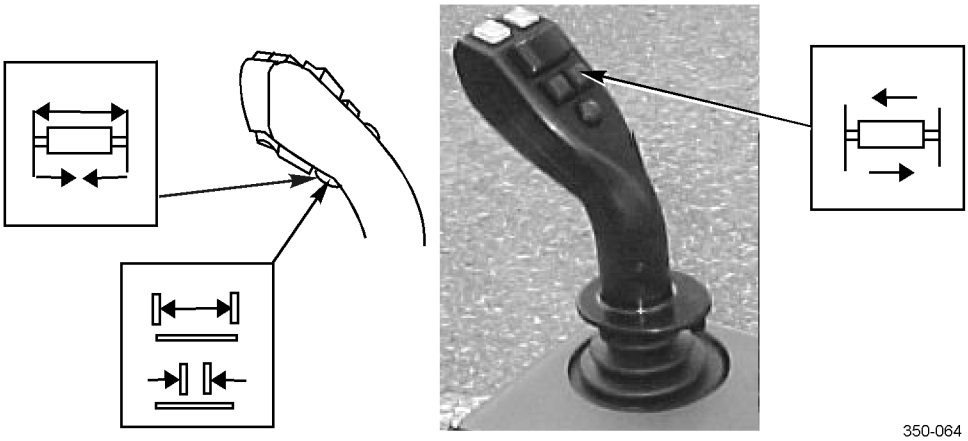
d. **Tophandler and Forklift Sideshift Buttons.**

(1) Press right button to shift load to the right.

(2) Press left button to shift load to the left.

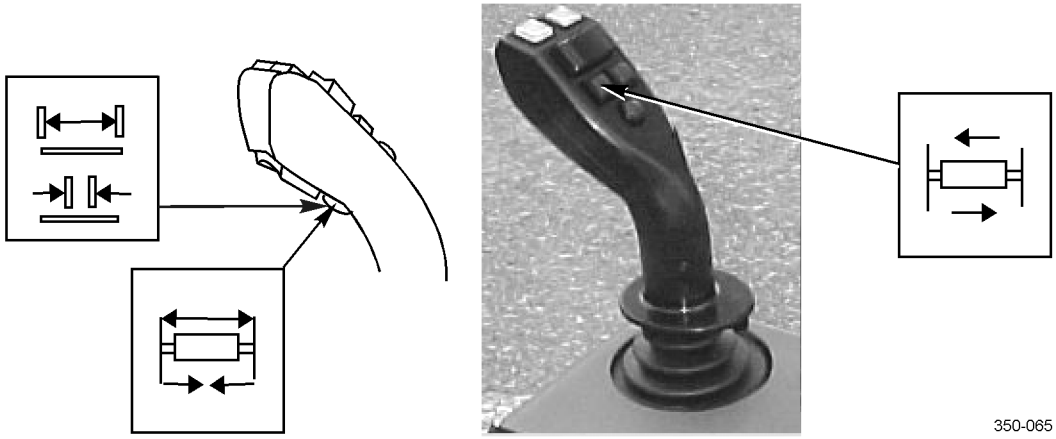


(3) Press right button and multiple function trigger button to widen tophandler from 20 to 40 ft or to open forklift tines, if forklift kit is installed.



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

(4) Press left button and multiple function trigger button to close tophandler from 40 to 20 ft or to close forklift tines, if forklift kit is installed.



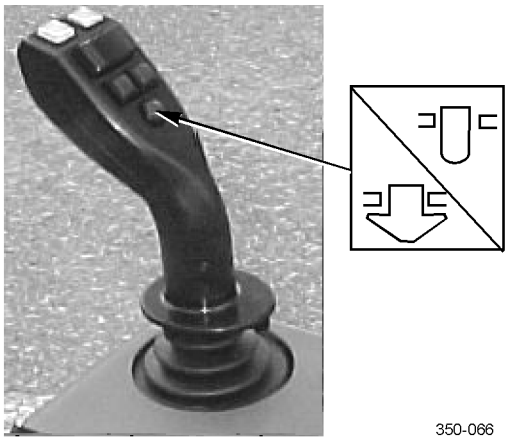
e. **Twistlock Lock/Unlock Button.**

NOTE

- When twistlocks are locked, GREEN indicator light on steering column inside cab and at end of boom will illuminate. Three IR lights at end of boom also illuminate, when operating in blackout mode.
- When twistlocks are unlocked, RED indicator light on steering column inside cab and at end of boom will illuminate. Single IR light at end of boom also illuminates, when operating in blackout mode.
- Pressing twistlock lock/unlock button and override switch at the same time will lock out or disable boom lifting and lowering operation; twistlock indicator light will turn off. To reactivate boom, momentarily press twistlock lock/unlock button and override switch at the same time.

(1) Press button to lock twistlocks, securing load.

(2) Press button to unlock twistlocks, releasing load.



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

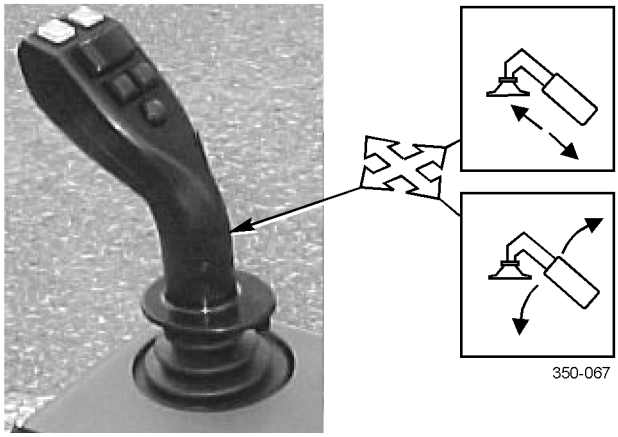
f. **Boom Control Handle (Joystick).**

(1) Move control handle forward to lower boom.

(2) Move control handle back to raise boom.

(3) Move control handle right to extend boom.

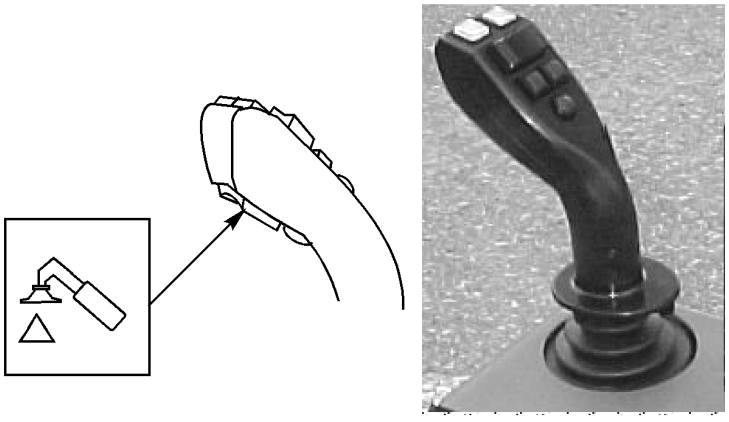
(4) Move control handle left to retract boom.



g. **Tilt Control Rocker Switch.**

(1) Press bottom of rocker switch to tilt bottom of load out.

(2) Press top of rocker switch to tilt bottom of load in.

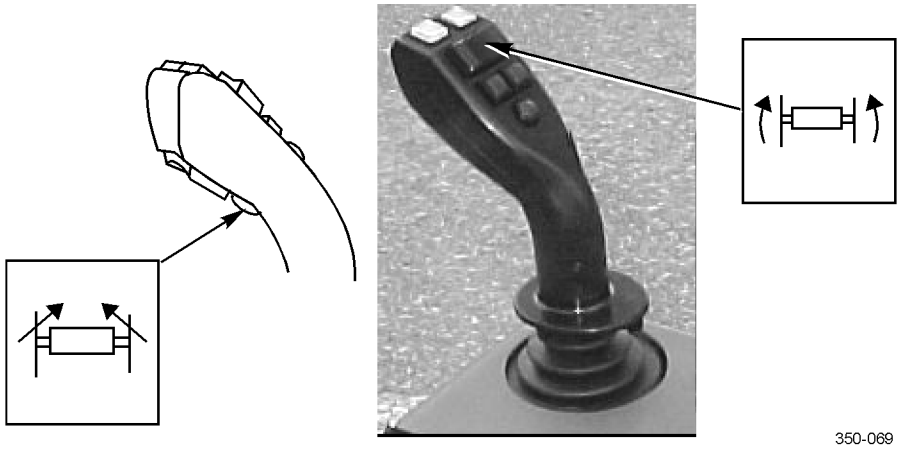


OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

h. **Oscillation Controls Switches.**

(1) Press multiple function trigger button and right side of rotation control rocker switch to raise left side of load.

(2) Press multiple function trigger button and left side of rotation control rocker switch to raise right side of load.

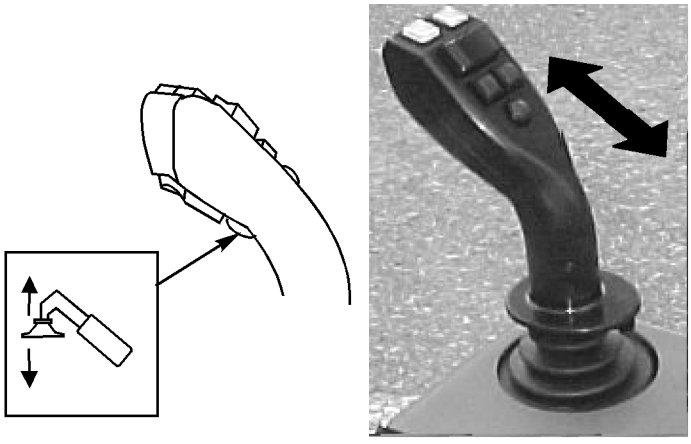


350-069

i. **Straight Lift/Lower Controls.**

(1) Move control handle back while pressing multiple function trigger button to raise and extend boom.

(2) Move control handle forward while pressing multiple function trigger button to lower and retract boom.



350-070

OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

j. **Override Switch.**

NOTE

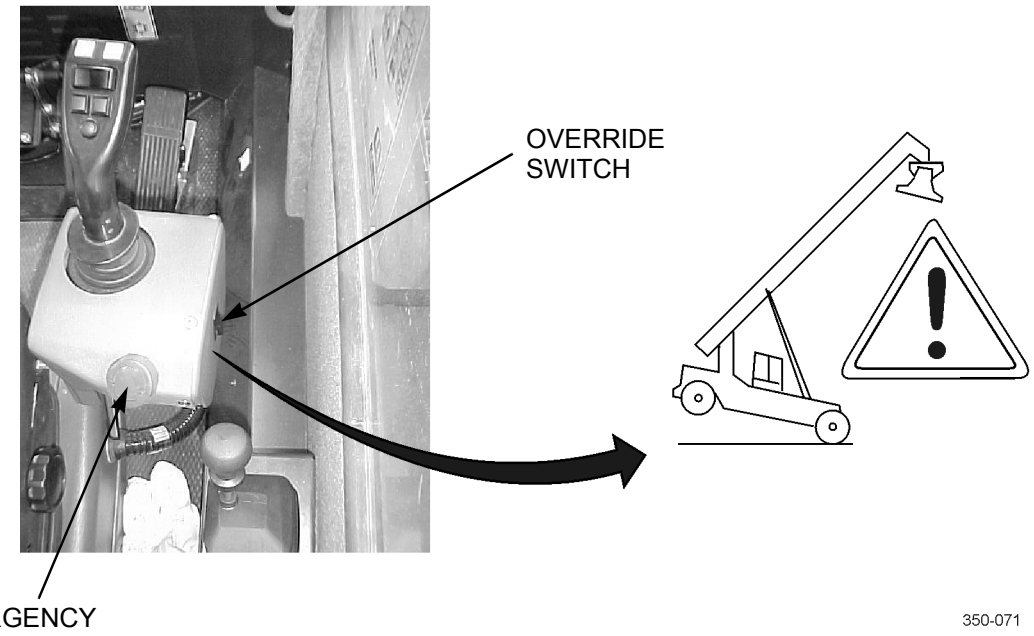
Pressing twistlock lock/unlock button and override switch at the same time will lock out or disable boom lifting and lowering operation; twistlock indicator light will turn off. To reactivate boom, momentarily press twistlock lock/unlock button and override switch at the same time.

(1) Move control handle forward and left while pressing the override switch to retract and lower the boom in an override condition.

(2) Press override switch to activate hydraulic system while engine RPMs are below 600.

(3) Press override switch to override an ECS detected fault.

(4) Press override switch to override twistlocks alinement, locked or unlocked signals.



k. **Emergency Stop Button.**

(1) Press button to stop all boom and tophandler hydraulic functions.

NOTE

Be sure to release emergency stop button when resuming normal operation. If emergency stop button is left activated, error codes may appear on ECS driver's display screen.

(2) Pull button to release emergency stop button.

3. **Container Lifting.**

WARNING

NEVER operate the RTCH or move the load near a power line or overhead wires. Failure to follow this warning may result in death or injury to personnel or damage to equipment.

OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

NOTE

During lifting operation, do not exceed the maximum lifting capacity.

a. Adjust the tophandler spreader width (20-40 ft) for the container to be lifted.

b. Position the truck as close to the container as possible. Adjust the tophandler to the container by rotating, sideshifting or moving the boom as necessary.

c. Fully lower the tophandler while alining the twistlocks with the container locking holes.

d. Check that the YELLOW alinement indicator light is on. This indicates the twistlocks are engaged in the locking holes of the container.

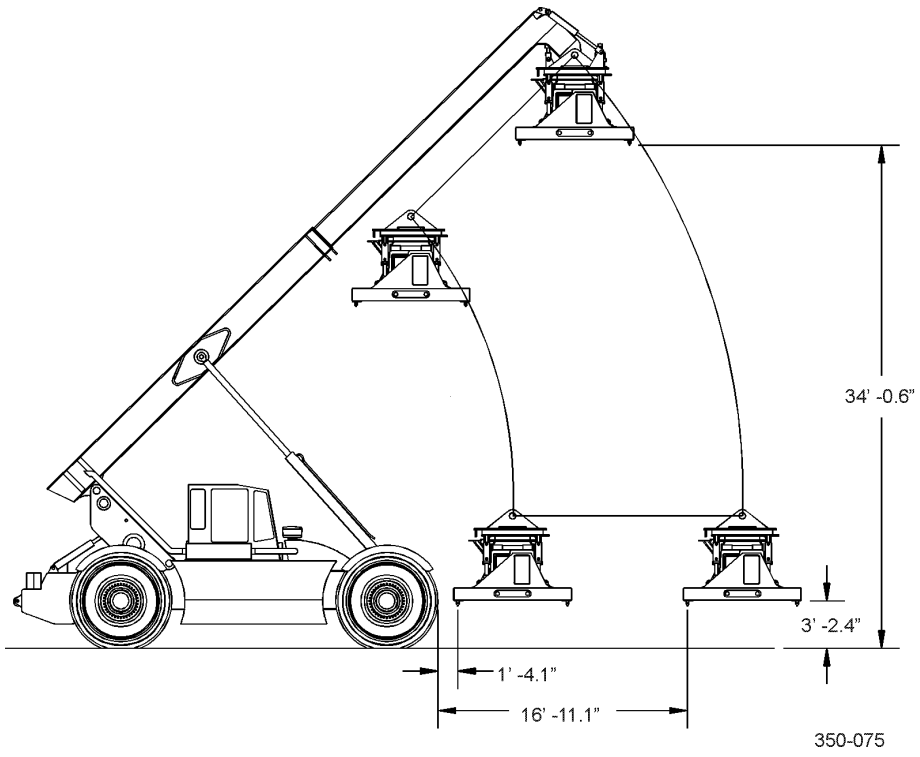
e. Lock the twistlocks. Check that the GREEN lock indicator light is on.

f. Lift the load. When load is lifted, the YELLOW alinement indicator light will go out.

g. Engage oscillation and tilt locks before driving with a load over rough terrain.

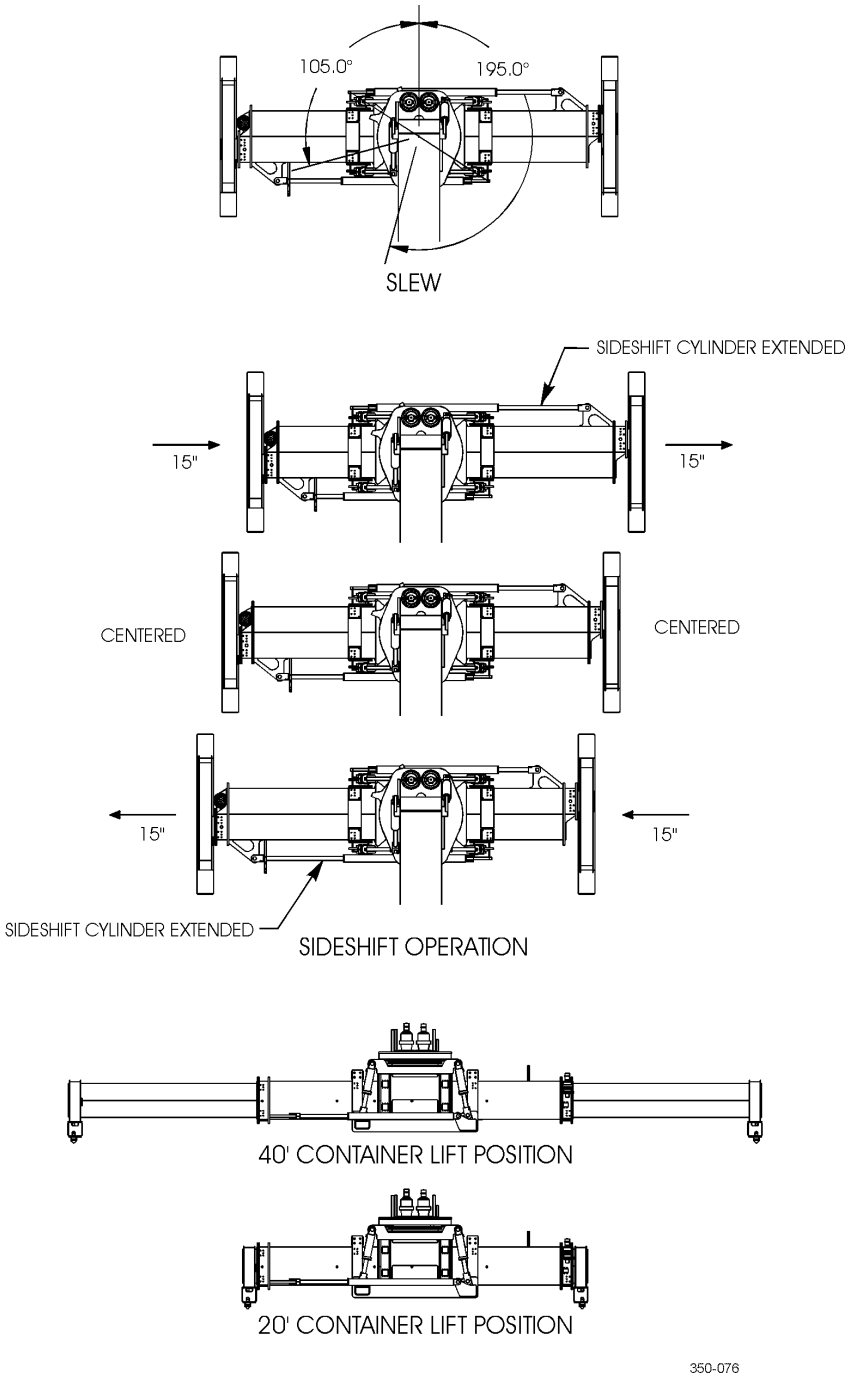
4. **Tophandler Positioning.**

a. **Tophandler Operational Envelope.**



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

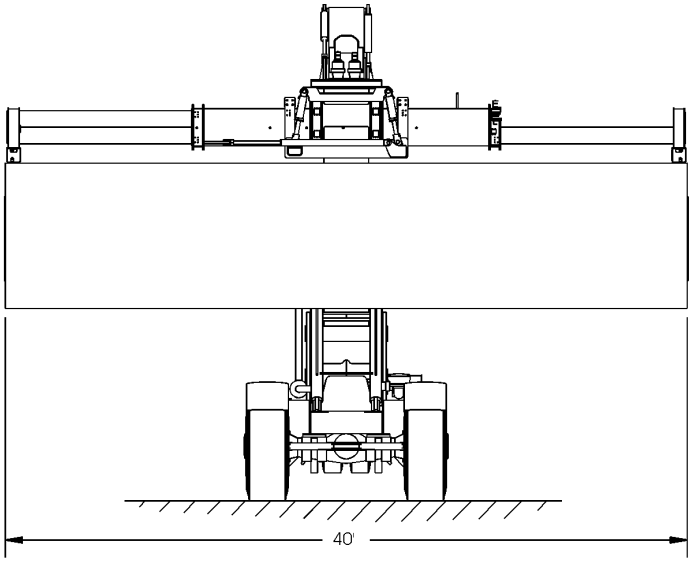
b. **Tophandler Shifting and Rotating Positions.**

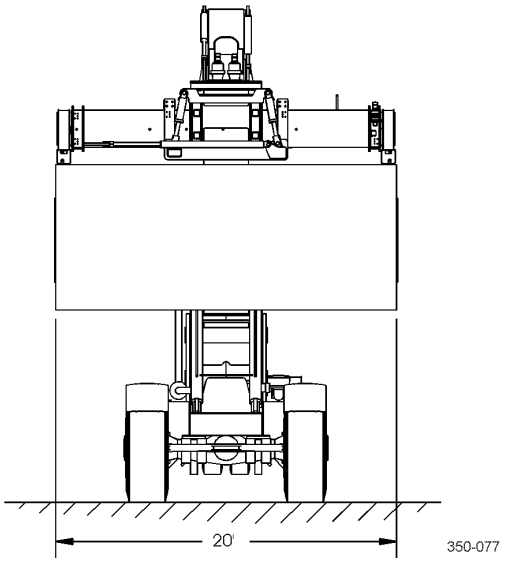


OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

5. **Container Positioning.**

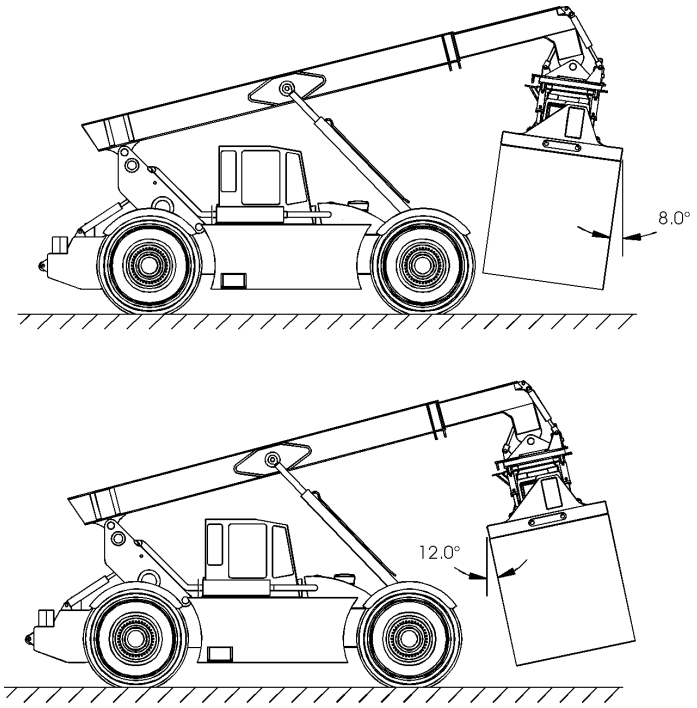
   a. **Lifting and Centering 20 ft or 40 ft Containers.**



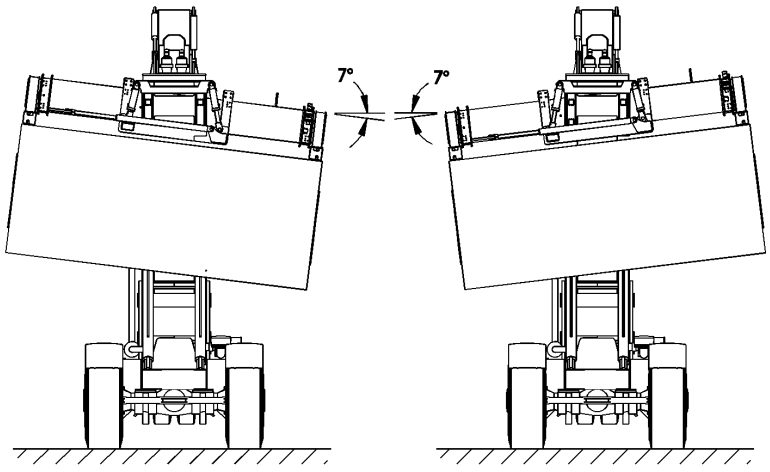


OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

b. **Container Oscillation and Tilt Angles.**



TILT ANGLES

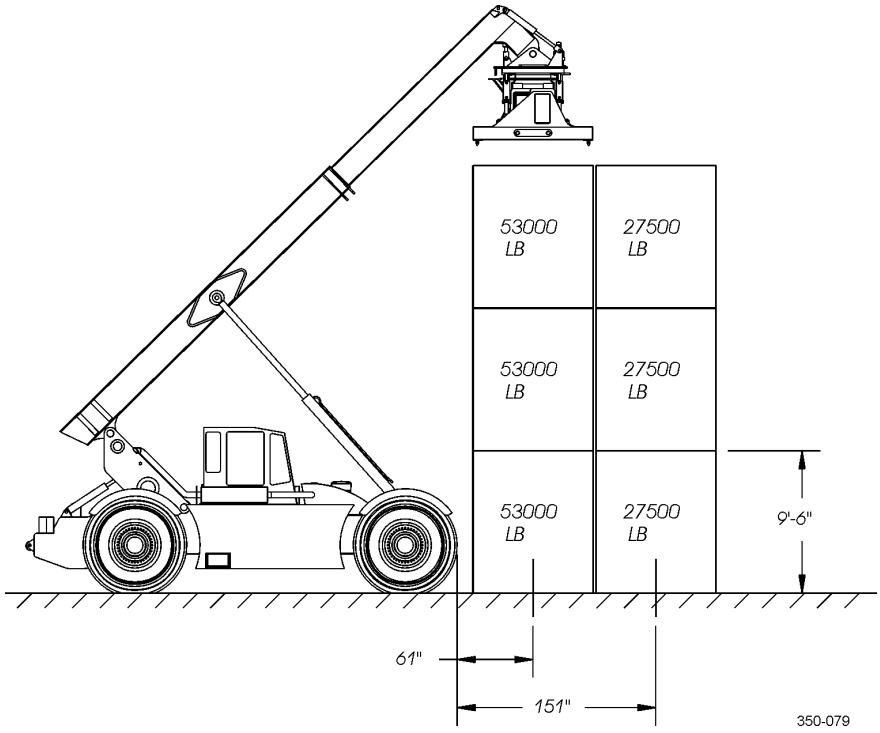


OSCILLATION ANGLES

350-078

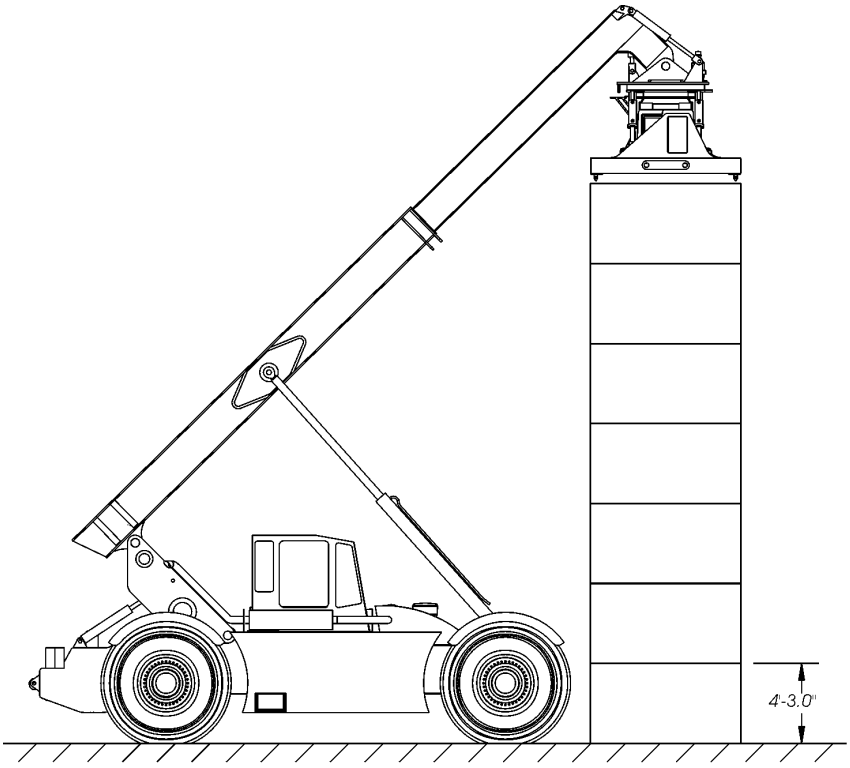
OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

c. **Container Reach and Load Range in Row One (53,000 lb) and in Row Two (27,500 lb).**



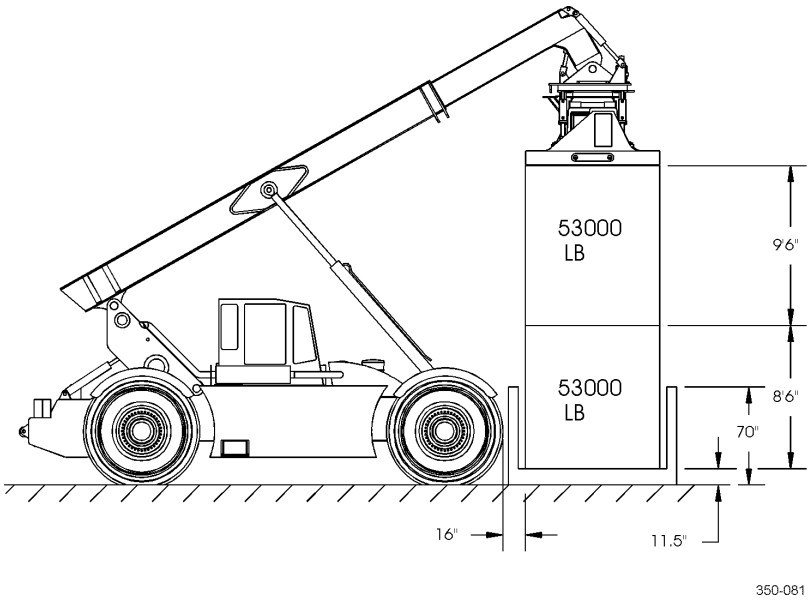
OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

d. **Stacking of 4 ft 3 in Containers Seven (7) High.**



OPERATE LIFTING BOOM AND TOPHANDLER - CONTINUED

e. **Deep Well Container Lifting/Stacking.**



OPERATE HEATER AND DEFROSTER

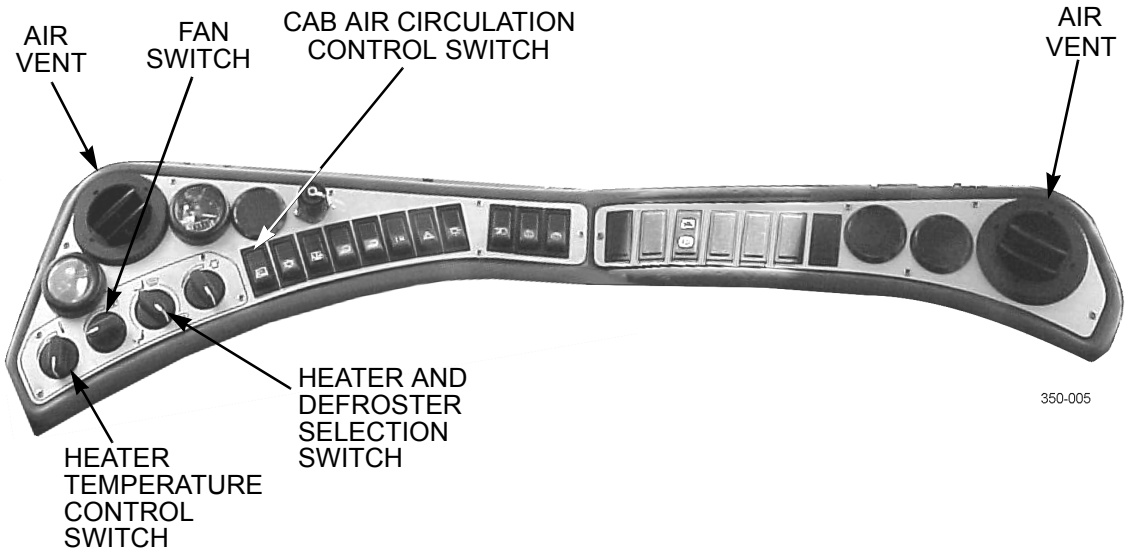
1. Start engine and bring truck to normal operating temperature.
2. Rotate heater and defroster selection switch clockwise to desired position, to select air flow direction to windshield, operator or both.
3. Rotate heater temperature control switch clockwise to desired position, to control heater output within the cab.
4. Rotate fan switch clockwise to adjust fan speed from low to high.
5. Press cab air circulation control switch to select either of two options, recirculated or fresh air within the cab.

NOTE

Air vents are located at each rear corner of cab, as well as on instrument panel.

6. Control air flow as needed by adjusting louvered openings of air vents.

OPERATE HEATER AND DEFROSTER - CONTINUED



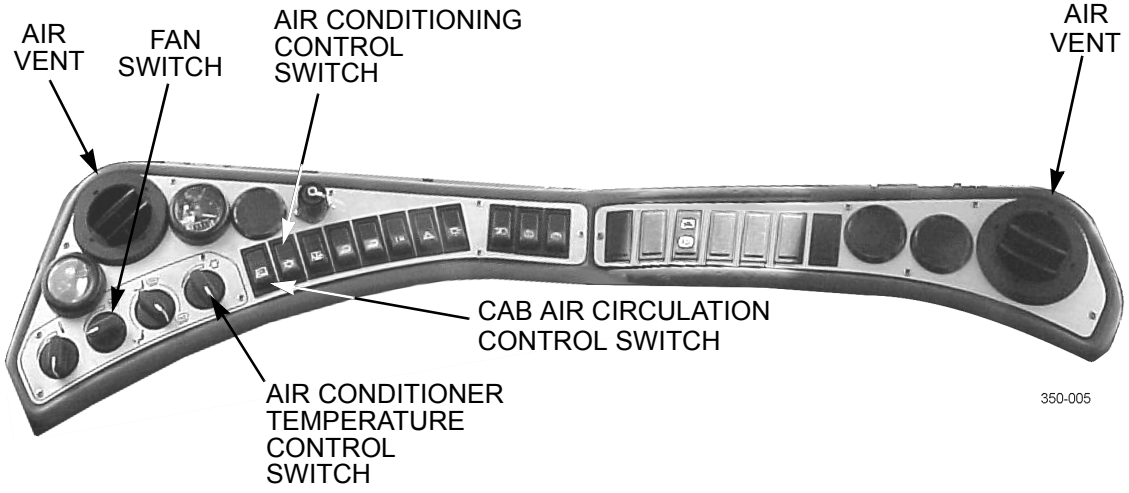
OPERATE AIR CONDITIONER

1. Start engine and bring truck to normal operating temperature.
2. Press air conditioning control switch to the ON position.
3. Rotate air conditioner temperature control switch clockwise to desired position, to control air conditioner output within the cab.
4. Rotate fan switch clockwise to adjust fan speed from low to high.
5. Press cab air circulation control switch to select either of two options, recirculated or fresh air within the cab.

NOTE

Air vents are located at each rear corner of cab, as well as on instrument panel.

6. Control air flow as needed by adjusting louvered openings of air vents.

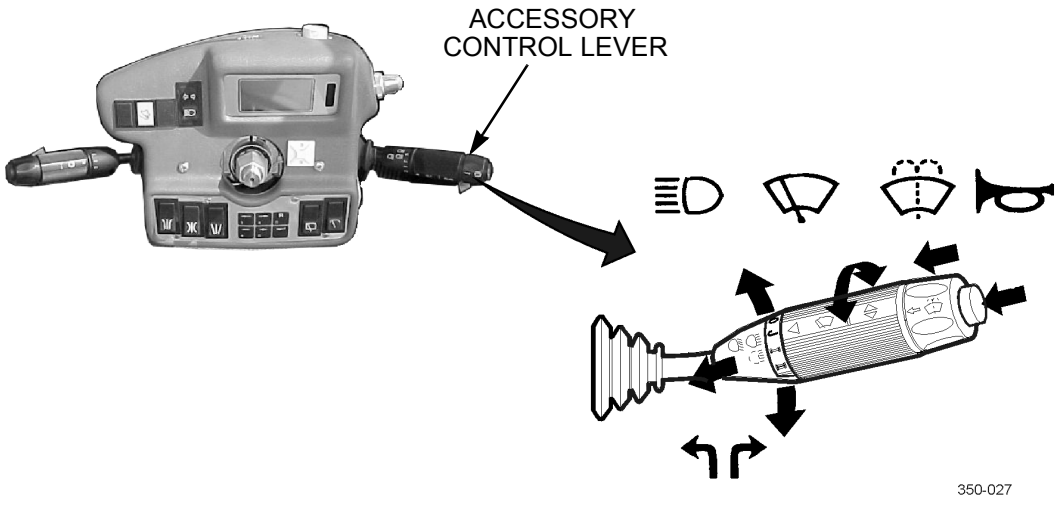


OPERATE LIGHTS, HORN, AND FRONT WINDSHIELD WIPER/WASHER

NOTE

If the engine is not running, ignition switch must be in ON position for the lights and horn to work.

1. Place ignition switch to the ON position.
2. Move accessory control lever FORWARD for LEFT directional signal and REARWARD for RIGHT directional signal.
3. Lift up on accessory control lever to FLASH headlights.
4. Push down on accessory control lever for headlight HIGH BEAM.
5. Press button at the end of the accessory control lever for HORN operation.
6. Rotate accessory control lever knob for windshield wiper and push for windshield washer functions.



SHUT DOWN ENGINE

1. Apply the parking brake.
2. Retract and fully lower boom.
3. Place transmission control lever in Neutral (N).
4. Allow the engine to run for 1/2-1 minute at idle.

CAUTION

Never turn master battery switch to OFF when the engine is running. Damage to voltage regulator may result.

5. Stop the engine by turning ignition switch to 0 position.
6. If the truck will not be used for a longer period, place master battery switch to OFF.

OPERATE PORTABLE FIRE EXTINGUISHER

WARNING

Discharging large quantities of dry chemical fire extinguisher in cab may result in temporary breathing difficulty during and immediately after the discharge event. If at all possible, discharge fire extinguisher from outside the cab. Ventilate cab thoroughly prior to reentry.

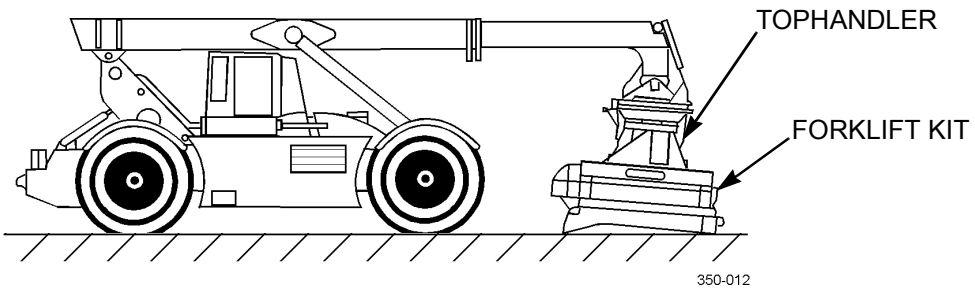
NOTE

This is a type B or C fire extinguisher. Use on oil and electrical fires only.

1. Remove fire extinguisher from bracket located to the right rear of the operator's seat.
2. Hold fire extinguisher upright. Point nozzle toward base of fire and pull safety pin.
3. Squeeze lever, discharging chemical at base of fire. Use a side-to-side motion to spread the chemical.
4. After using fire extinguisher, notify Organizational Maintenance.

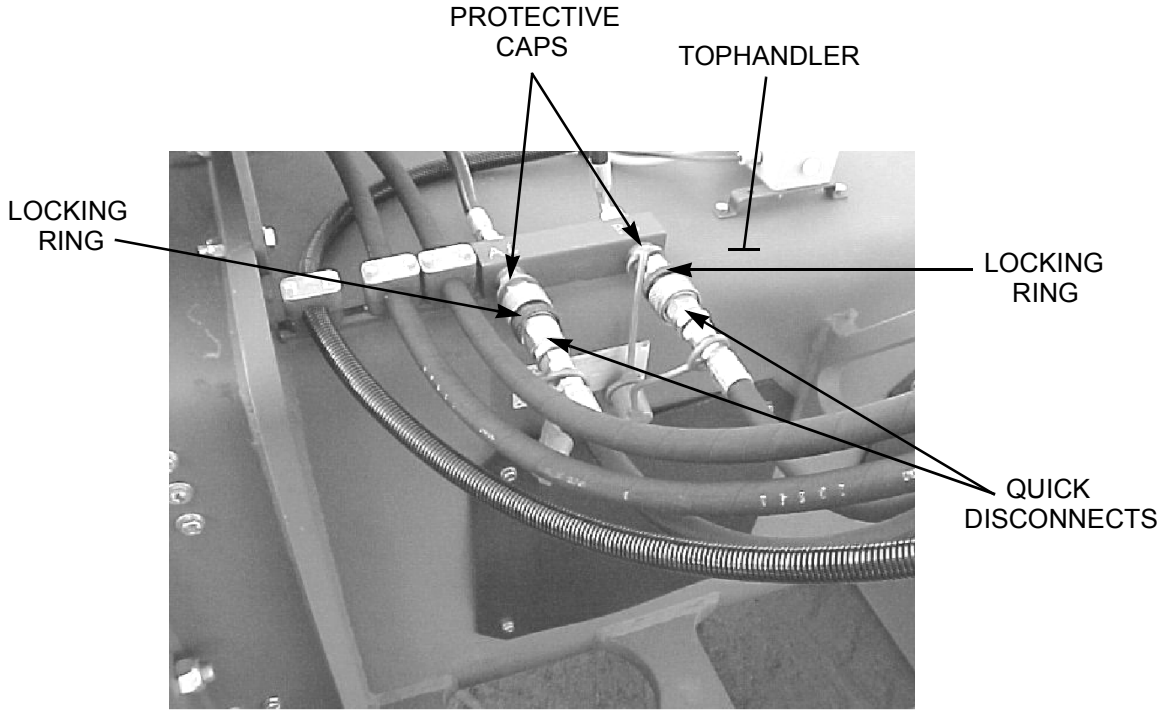
FORKLIFT KIT INSTALLATION

1. **General.**
   a. The forklift kit attaches to the tophandler twistlocks and hydraulic system. The forklift is attached with the kit in a folded configuration.
   b. The procedure requires two personnel: one person in the cab operating the joystick controls; one person installing/removing retaining pins, connecting the hydraulic quick disconnect hoses, and ground guiding the operator.
2. **Installing Forklift Kit.**
   a. Position tophandler directly over and level with forklift kit.
   b. Lower tophandler onto forklift kit and secure with twistlocks.



FORKLIFT KIT INSTALLATION - CONTINUED

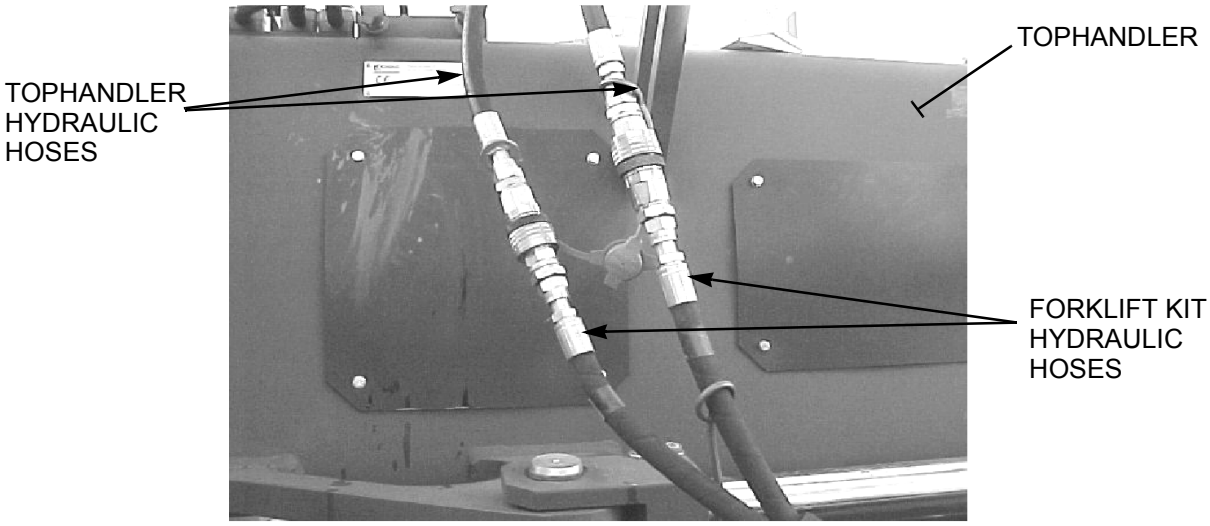
c. Release locking rings to disconnect two hydraulic hose quick disconnects, located on top left side of the tophandler. Install protective caps on connectors.



350-013

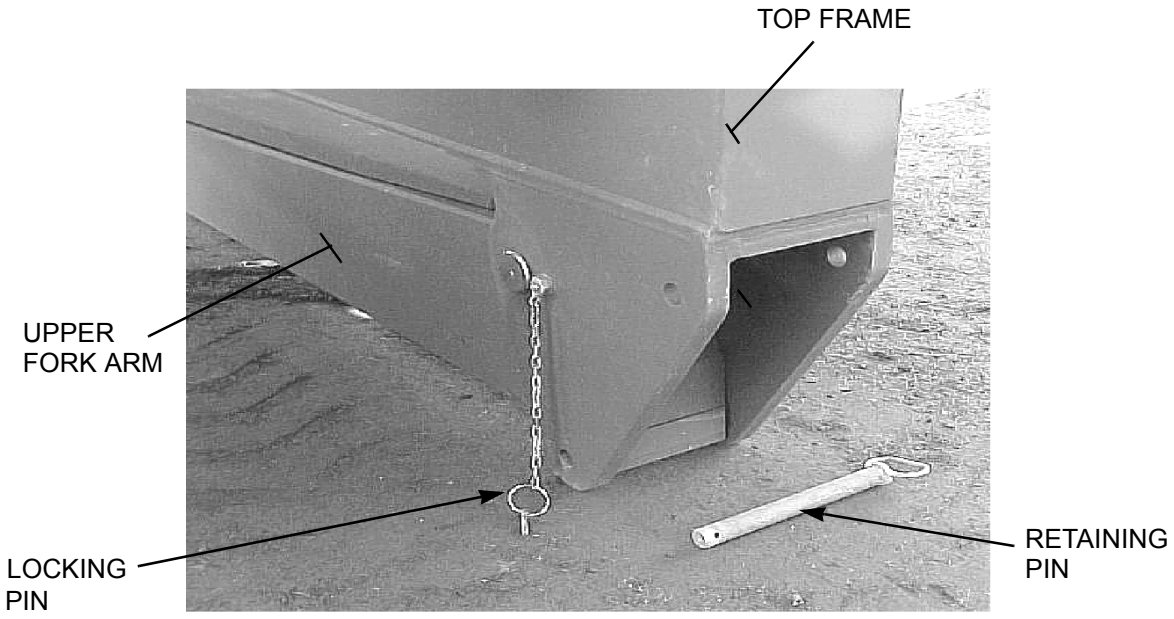
FORKLIFT KIT INSTALLATION - CONTINUED

d. Remove protective caps from forklift kit hydraulic hose connectors. Connect the two forklift kit hydraulic hose quick disconnects to the hydraulic hose quick disconnects that were disconnected from the tophandler.



350-014

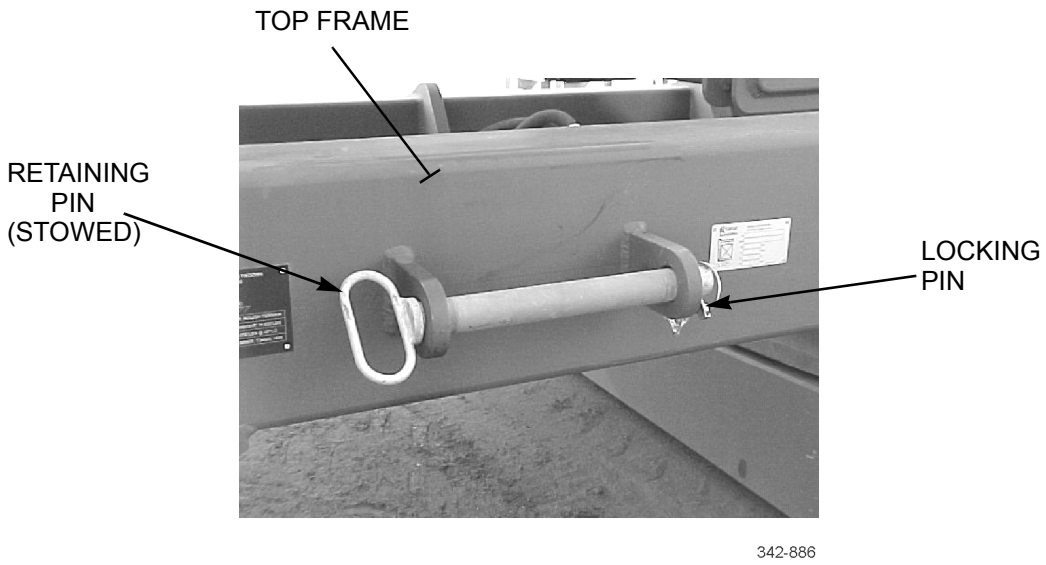
e. Remove two locking pins and retaining pins that secure upper fork arms to the top frame.



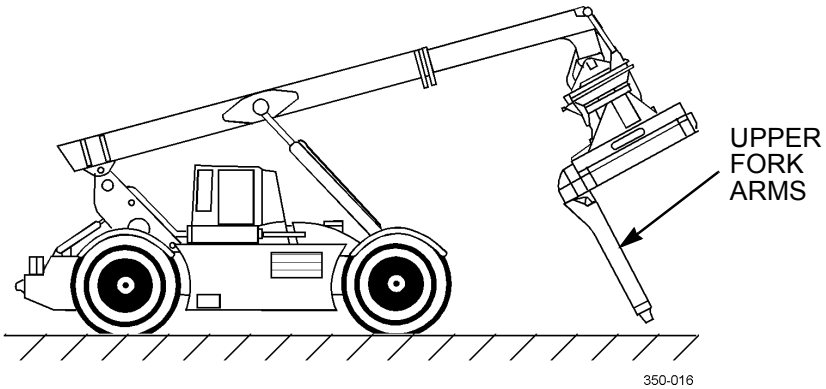
350-015

FORKLIFT KIT INSTALLATION - CONTINUED

f. Stow retaining pins on forklift kit top frame.



g. Slowly tilt the tophandler/forklift kit to the full rearward position while raising the boom. This will allow the upper fork arms to unfold downward.

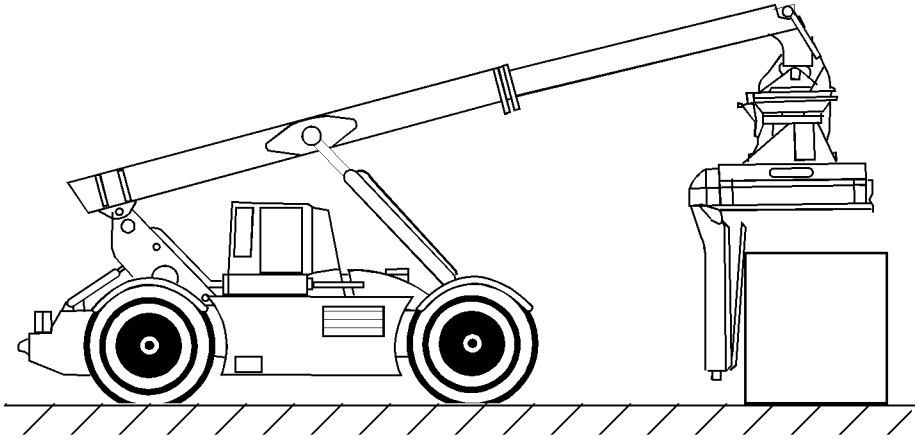


FORKLIFT KIT INSTALLATION - CONTINUED

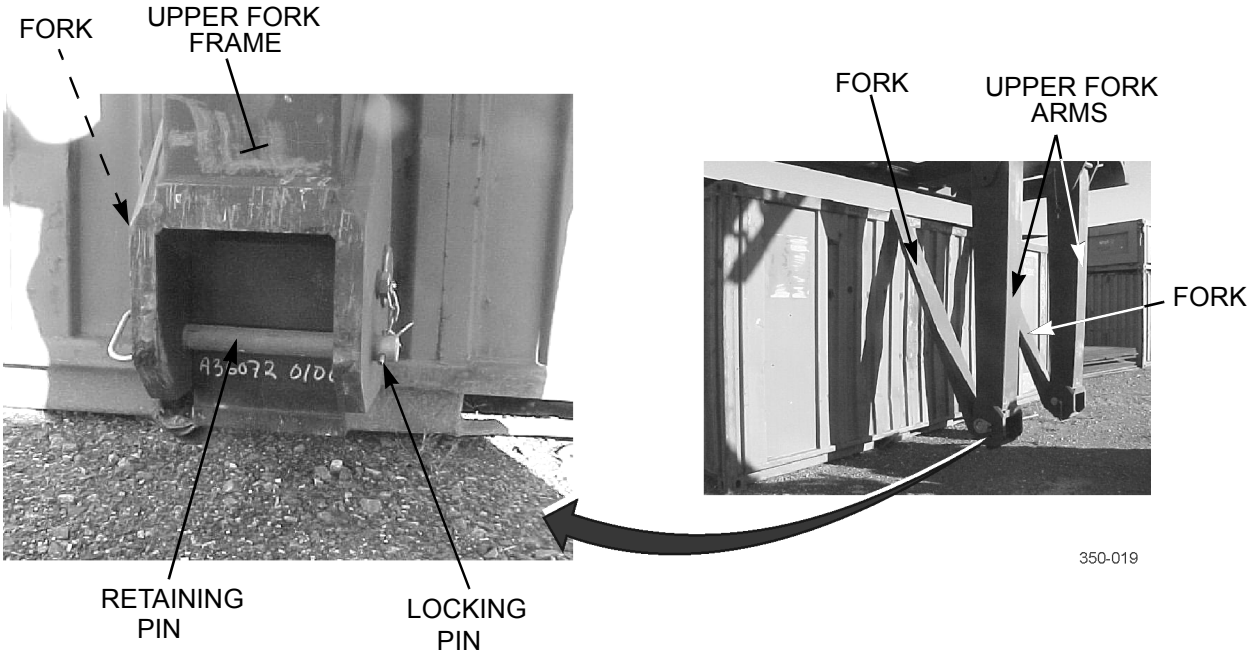
NOTE

The following step requires a structure such as an ISO container or a loading dock to complete the unfolding of the lower forks.

h. Retract the boom and position the truck in front of an ISO container or loading dock.



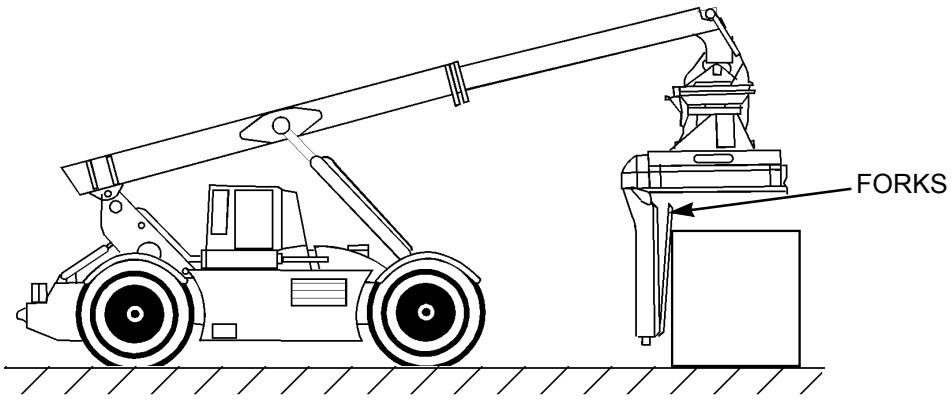
i. Remove two locking pins and retaining pins that secure forks to upper fork arms.



FORKLIFT KIT INSTALLATION - CONTINUED

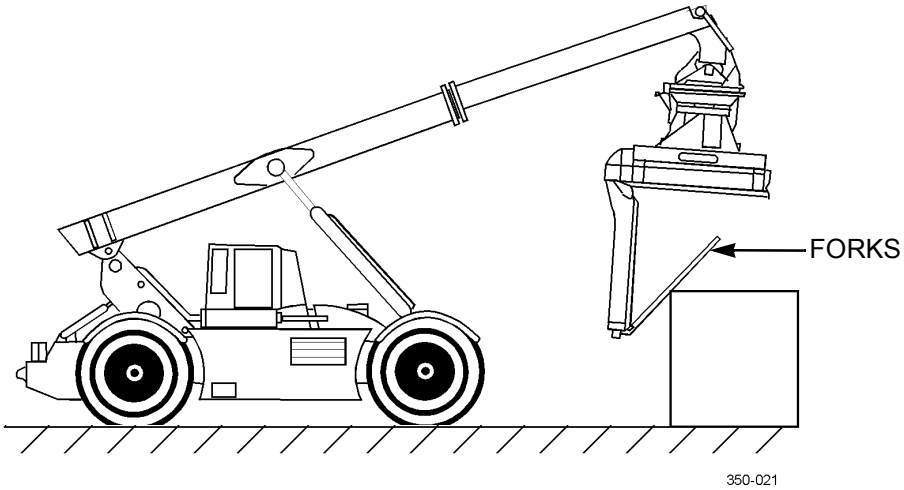
j. Raise the boom until the forks are even with sides of the container or vertical wall of the loading dock.

k. Extend the boom until the forks are close to the vertical surface.



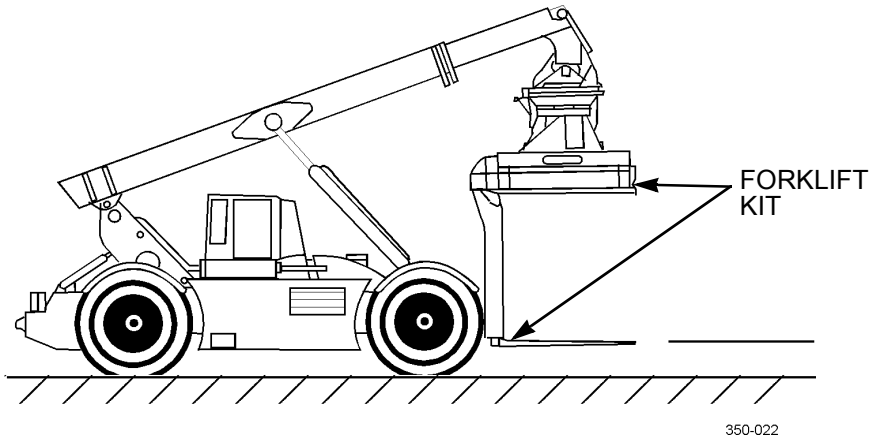
l. Place transmission in Neutral (N).

m. Slowly tilt the tophandler/forklift kit forward, then raise the boom. This will allow the RTCH to move rearward and the forks to fold out to the horizontal position.



FORKLIFT KIT INSTALLATION - CONTINUED

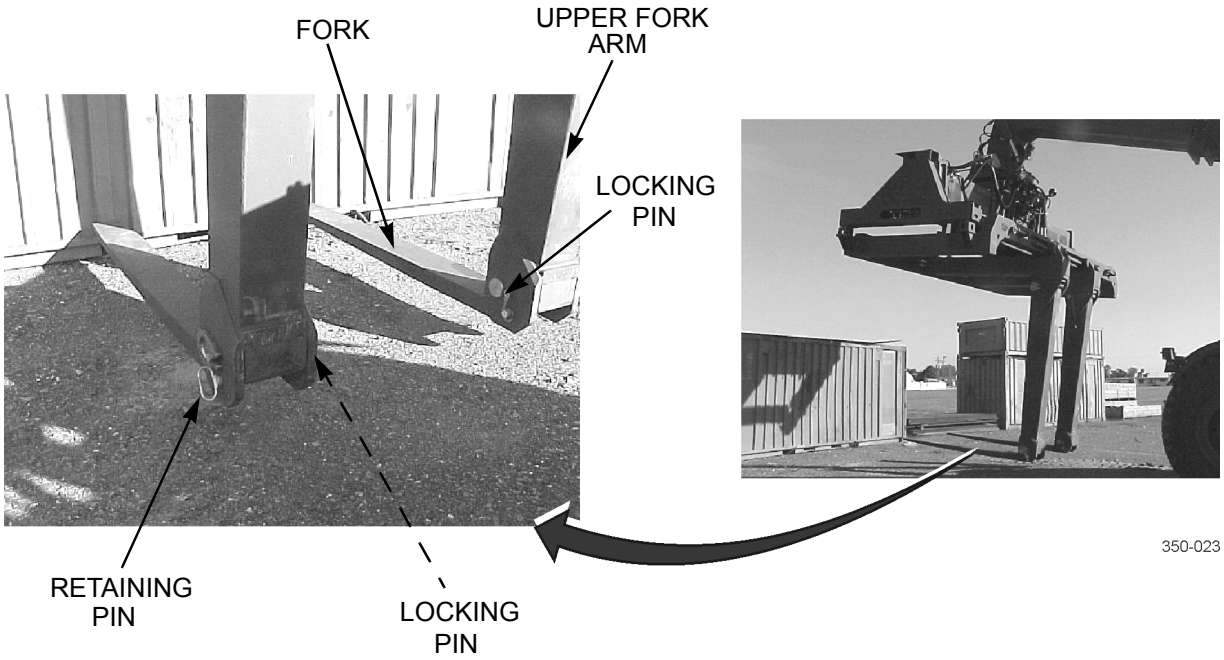
n. Retract the boom and level the forklift kit using the joystick tilt control.



NOTE

Retaining pins should be installed from the outside.

o. Install retaining pins and locking pins to secure forks to upper fork arms.



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OPERATION UNDER UNUSUAL CONDITIONS 0006 00

GENERAL

WARNING

This vehicle has been designed to operate safely and efficiently within the limits specified in this TM. Operation beyond these limits is prohibited in accordance with AR 70-1 without written approval from: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-DSA-CS, Warren, MI. 48397-5000.

This section contains instructions for safely operating the RTCH-RT 240 under unusual conditions. In addition to normal preventive maintenance, special care must be taken to keep the truck operational in extreme temperatures and other environmental conditions.

SLAVE STARTING

WARNING

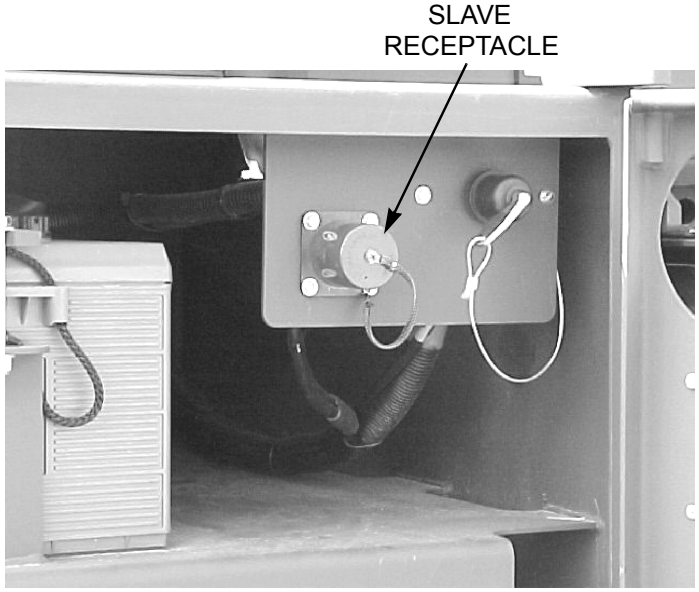
- When slave starting truck, use NATO slave cable that does NOT have loose or missing insulation.
- DO NOT proceed if suitable cable is not available.
- DO NOT use civilian-type jumper cables.

The RT 240 is equipped with a 24 volt, negative ground electrical system. The truck has two slave receptacles. One receptacle is located on the left side of the truck within the battery box. The other receptacle is located on the right side of the truck to the rear of the right front tire.

NOTE

Ensure that both RTCH and booster vehicle are equipped with serviceable NATO slave receptacles.

1. Connect slave cable to booster vehicle slave receptacle.



350-049

LEFT SIDE OF TRUCK

SLAVE STARTING - CONTINUED

2. Connect other end of slave cable to disabled vehicle slave receptacle.
3. Ensure disabled vehicle's master battery switch is in the ON position.
4. Start booster vehicle and run at a speed just above idle.
5. Wait approximately five minutes, then start disabled vehicle. If vehicle fails to start, notify Organizational Maintenance.
6. After starting disabled vehicle, return booster vehicle to idle.
7. Remove the slave cable from disabled vehicle, then from booster vehicle.

TOWING

WARNING

DO NOT tow at speeds over 5 mph (8 kph).

CAUTION

DO NOT attempt to start the RTCH-RT 240 by towing. Any attempt to start the engine by towing will cause damage to the transmission.

NOTE

- The preferred method for towing a disabled RTCH is with another RTCH, if one is available.
- The truck must ONLY be towed a short distance and at slow speeds. Distance towed and speed may not exceed 15 miles at 5 mph (25 km at 8 kph). If it is absolutely necessary to move the truck more than 15 miles (24 km), it must be transported.
- Because the engine is not running during towing, the following vehicle systems will NOT function properly.
  a. Steering control will be greatly reduced.
  b. Service brakes will not function.
  c. Parking brakes will not release.
  d. Transmission lubrication will be insufficient.

1. Chock wheels of disabled RTCH.
2. Place transmission in neutral.
3. Apply parking brakes.
4. Turn ignition on.
5. Use auxiliary pump to power hydraulics to fully lower and retract boom. Turn tophandler to longitudinal position, so as not to obstruct traffic while being towed.
6. Turn ignition off.
7. Release parking brakes.
8. Have Organizational Maintenance cage parking brakes.
9. Connect a medium-duty tow bar with standard clevises to rear towing lugs of towing vehicle, another RTCH.

WARNING

Carefully move towing vehicle into position. Always use a ground guide and any device necessary to lift tow bar into position without standing directly between vehicles. Failure to follow this warning may result in equipment damage or injury or death to personnel.

10. Position towing vehicle directly behind the disabled RTCH. Connect tow bar to rear towing lugs of RTCH to be towed.

TOWING - CONTINUED

NOTE

Master battery switch and ignition of towed RTCH must be on to power computer to maintain correct wheel alinement during towing.

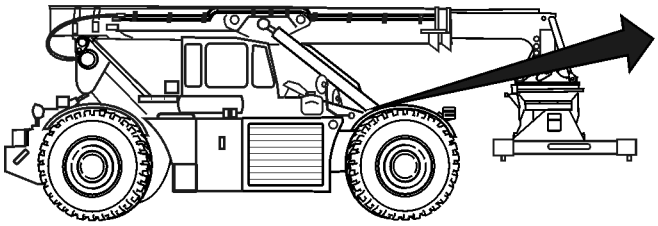
11. Turn on ignition and master battery switch of vehicle being towed. Place vehicle in two-wheel steer.
12. Remove and secure wheel chocks. Ensure that all personnel and equipment are clear. Proceed to tow with caution.

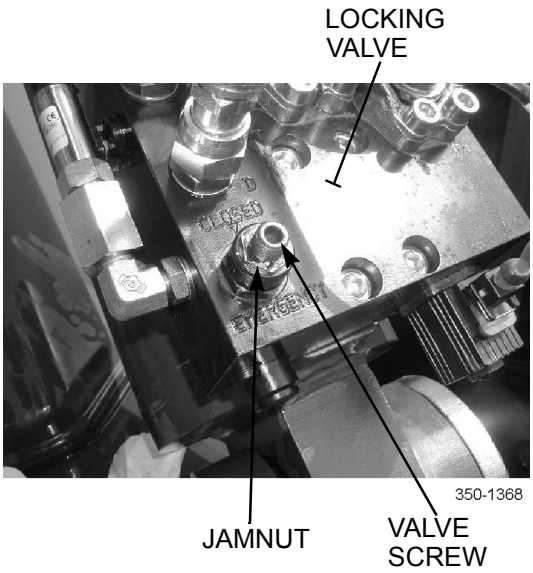
EMERGENCY LOWERING OF THE BOOM

NOTE

- Use the following procedures to lower the boom if the engine fails during RTCH operation.
- Boom movement during emergency lowering will be slow. This is normal.

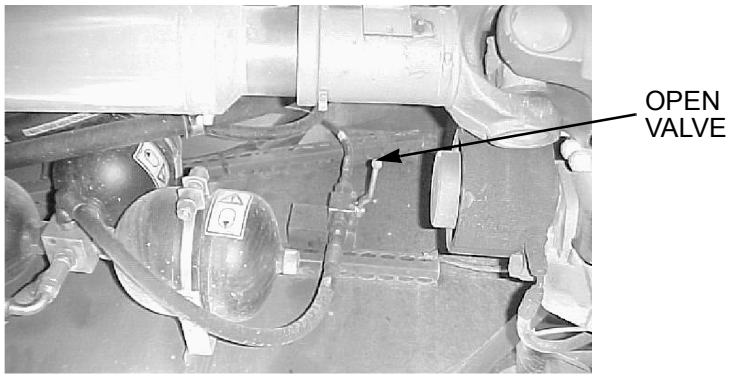
1. **Lower Boom (Retracted and Unloaded).**
   a. Loosen emergency lowering valve jamnuts on both left and right lift cylinder locking valves.
   b. Turn both left and right emergency lowering valve screws counterclockwise three turns.
   c. Turn left emergency lowering valve screw an additional three counterclockwise turns.
   d. Turn right emergency lowering valve screw an additional three counterclockwise turns.
   e. When boom is full lowered, close both left and right emergency lowering valve screws by turning them clockwise until tight. Tighten both left and right jamnuts.





EMERGENCY LOWERING OF THE BOOM - CONTINUED

2. **Lower Boom (Extended or Loaded With a Container).**
   a. Open valve located under vehicle, on right frame forward of right-rear tire.



350-098

   b. Turn vehicle ignition on.
   c. Press auxiliary pump switch on instrument panel on. It will run for four minutes, then pause for two minutes, then restart, if necessary.
   d. Use joystick to lower and retract the boom.

OPERATE IN EXTREME COLD

1. **General.**
   a. Extreme cold causes many problems:
      (1) Lubricants thicken or congeal.
      (2) Batteries may freeze or lose their electrical efficiency.
      (3) Fuel may not readily atomize for combustion.
      (4) Various materials will become hard, brittle, and easily damaged.
      (5) The cooling system requires adequate protection from extreme cold.
      (6) Fuels, lubricants, and antifreeze compounds require special storage, handling, and use.
   b. Refer to FM 9-207 for additional information.

NOTE

Notify Organizational Maintenance to prepare vehicle for arctic operation.

   c. Vehicles assigned to arctic regions are equipped with an auxiliary arctic heater to enable easier starting by providing preheating of engine cooling system.
   d. When starting out in extreme cold, follow these procedures:
      (1) Be careful when you first start your vehicle. Use cold weather starting procedure and allow engine time to reach operating temperature range of 180-200°F (82-93°C). Be alert that tires may be frozen to ground.
      (2) Start driving very slowly for about 100 yards (91.4 m). If a problem is noted, notify Organizational Maintenance as required.
   e. When parking, follow these procedures:

OPERATE IN EXTREME COLD - CONTINUED

(1) If vehicle will be parked for a short period, park in a sheltered area out of wind. If shelter is not available, park vehicle so right side, where radiator is located, does not face into the wind.

(2) If vehicle will be parked for a long shutdown period, try to park on high ground and use planks or brush to make a raised and relatively dry surface. Keep tires out of snow, water, ice, and mud, if possible.

(3) Clean snow, ice, and mud from vehicle as soon as possible after shutdown.

(4) If vehicle will be parked for a long period of time, have Organizational Maintenance remove and store batteries. Fill fuel tank to guard against condensation and drain any accumulated water from air reservoirs and fuel filters.

(5) Ensure tires are properly inflated.

2. **Operate Arctic Heater (If Equipped).**

WARNING

DO NOT operate arctic heater in a confined area. Always ensure there is adequate fresh air ventilation. Failure to follow this warning may cause death due to carbon monoxide poisoning.

NOTE

- Arctic heater is used to provide engine preheating for engine startup in extreme cold, in temperatures below -25°F (-32°C). When heater is required to preheat engine coolant and engine block before startup, it should be turned on 3/4 hour before engine is started.
- Operating instructions for the arctic heater will be provided with the arctic heater installation kit.

OPERATE IN EXTREME HEAT

1. **General.** During very hot weather, driving procedures may require altering to prevent vehicle overheating. Avoid continuous high engine RPMs, and continuous operation in soft terrain.

2. **Driving Vehicle.**

   a. Check water temperature display and stop if temperature is unusually high. Allow vehicle to cool down.

   b. Check cooling system, air cleaner, air cleaner restriction indicator, engine oil level, and radiator fins frequently. Perform necessary services and notify Organizational Maintenance of any unusual readings or problems.

   c. Notify Organizational Maintenance to shorten differential oil change interval.

3. **Parking Vehicle.**

   a. Park vehicle under cover, if possible. If shelter is not available, cover vehicle with tarpaulins. If there aren't enough tarps to cover entire vehicle, arrange tarps around engine compartment and over radiator to keep sand and dust out. Cover window glass to protect against sand blasting.

   b. Ensure all tires are inflated to proper pressure.

   c. Check frequently for rust. Clean and lubricate vehicle to help prevent deterioration.

OPERATE IN MUD OR SOFT SURFACES

1. Before entering mud or other soft surfaces, check conditions and select appropriate transmission gear range. Use four-wheel drive as required. Enter soft area at a medium speed for gear range selected.

OPERATE IN MUD OR SOFT SURFACES - CONTINUED

2. Maintain steady pressure on accelerator pedal to keep vehicle rolling until solid ground is reached. Do not accelerate to point where wheels spin, if possible.
3. If vehicle gets stuck, try to pull out slowly in a low gear. Boards, brush, or similar materials may be placed under tires to provide traction.
4. Notify Organizational Maintenance to clean and inspect propeller shafts for proper lubrication.

OPERATE IN SANDY OR DUSTY CONDITIONS

1. Maintain steady, even movement with transmission in lower gears. Use four-wheel drive as required. Try to keep vehicle rolling without straining engine and powertrain. If vehicle gets stuck, notify Organizational Maintenance.
2. If vehicle bogs down after tire pressure has been reduced, place boards, brush, canvas, or similar materials under and in front of tires after shoveling a clear path ahead of each tire. This should improve traction.
3. If these efforts fail and it becomes evident that vehicle will not free itself, have another vehicle tow stuck vehicle.
4. Whenever operating in sandy or dusty areas, you should:
   a. Service engine air cleaner and cab air filter more frequently.
   b. Make sure each tire has a valve cap.
   c. Check engine and transmission temperature and engine oil pressure frequently.
   d. If vehicle overheats, stop and find out why. Service or notify Organizational Maintenance, as necessary.
   e. Make sure engine oil filler tube and transmission fluid filler tube are cleaned before dipsticks are removed to check fluid levels. Clean accumulations of sand and dirt from around fluid filler locations before checking or adding fluids.
   f. Clean spouts of fuel containers and areas around filler caps on fuel tanks before adding fuel. Under extremely sandy or dusty conditions, filter fuel when filling tanks.
   g. Cover window glass to protect against sand blasting.
   h. Notify Organizational Maintenance to clean, inspect, and lubricate propeller shafts more frequently.

OPERATE IN WOODS OR ON ROCKY TERRAIN

Ensure vehicle can clear any obstructions and try to avoid low hanging tree limbs which might cause damage.

OPERATE ON SNOW AND ICE

1. **Driving.**
   a. Accelerate slowly to avoid spinning tires.
   b. Drive at slower speeds.
   c. Give signals sooner.
   d. Apply brakes sooner to give early warning of intention to stop. This will also help to avoid skidding.
   e. Maintain double the normal distance from the vehicle ahead.
   f. Keep windshields, windows, mirrors, and lights clean and free of snow and ice. Use defroster to help keep glass free of snow and ice.
   g. If a difficult stretch of road approaches, stop and inspect it carefully before driving on it. Select transmission gear range that best suits road condition. Use four-wheel drive as required.
2. **Stopping.**
   a. Ease up on accelerator, leaving vehicle in gear.

OPERATE ON SNOW AND ICE - CONTINUED

b. Apply service brakes lightly and evenly. DO NOT pump service brake pedal.

c. Always avoid sudden braking.

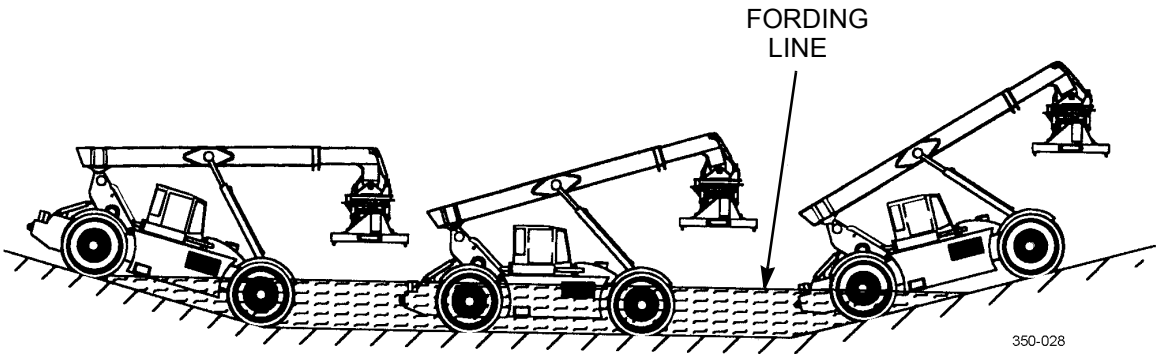
3. **Parking.** If parking on icy, slushy, wet or muddy surfaces, place boards, brush or other materials that will provide traction underneath tires. This will guard against tires freezing to the ground or becoming pocketed in ice, and will provide some traction when vehicle is started and moving again.

FORDING

1. **General.**

   a. Maximum fording depth is 60 in (1.5 m).

   b. Check water depth in several places, thereby allowing for inconsistency of bottom. Ensure that bottom of stream is hard enough to be forded, without exceeding maximum fording depth. Do not attempt to ford even the narrowest stream that is more than 60 in (1.5 m) deep.



2. **Before Fording.**

   a. Ensure engine is operating properly and all indicators are indicating normal operating pressures and temperatures.

   b. Lubricate unpainted surfaces to guard against rust and deterioration.

3. **During Fording.**

   a. Place transmission in lower gear ranges and enter water slowly.

   b. Ford at speeds of 3-4 mph (5-6 kph).

4. **After Fording.**

   a. Allow engine to run for awhile to drive out any accumulated water.

   b. Drain and dry any area where water has accumulated.

   c. Check all fluids for signs of contamination and for proper levels.

   d. Lubricate all grease fittings below water line.

   e. If truck has operated in salt water, rinse the entire vehicle with fresh water as soon as possible.

   f. Notify Organizational Maintenance to remove drain plug from engine flywheel housing and check for signs of water.

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NOTE

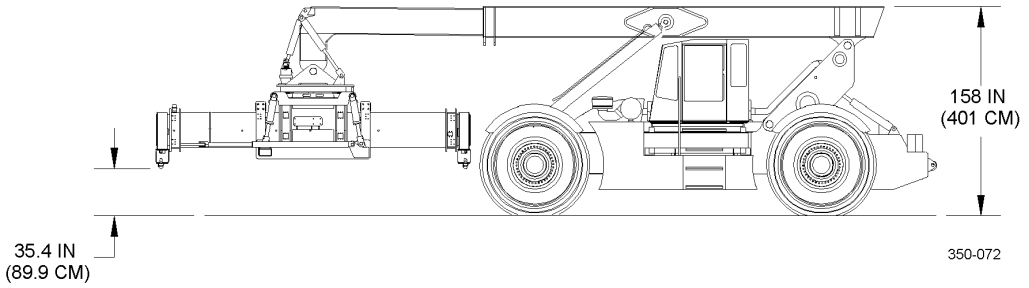
In order to prepare the RTCH-RT 240 for transport, all procedures, except for *Self Deployment*, require that the boom support be lowered. The boom support cannot be lowered unless the cab has first been placed in transport position (to the left and fully lowered).

SELF DEPLOYMENT

NOTE

- The RTCH may be deployed with forklift kit attached only when moving between remote areas, NOT on highways or streets. Forklift kit may also only be deployed with tophandler oriented in normal operational position, NOT longitudinal position. With forklift kit attached, overall lowered height of vehicle is increased by 3 ft (0.9 m). This makes the lowered height (with clearance under forklift kit) approximately 193 in (490 cm). This height is acceptable for movement between remote areas, but not for highway and/or street movement, due to overhead wires and structures.
- Refer to data plate on forklift kit for rail or trailer transport instructions.
- Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.

1. Extend boom.
2. Rotate tophandler 90° clockwise to longitudinal position.
3. Position boom in horizontal position. Load control display should read 0° and OALH should read 160 in.
4. Retract boom until tophandler is in close proximity to front tires.
5. Select two-wheel steer mode.
6. Turn on lights and flashers, as required.



PLACING CAB IN TRANSPORT POSITION

NOTE

Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.

1. **Move Cab to Transport Position.**

NOTE

If RTCH cab is being moved to transport position in order to perform maintenance, it may not be possible to run engine. Auxiliary pump will operate without engine running.

PLACING CAB IN TRANSPORT POSITION - CONTINUED

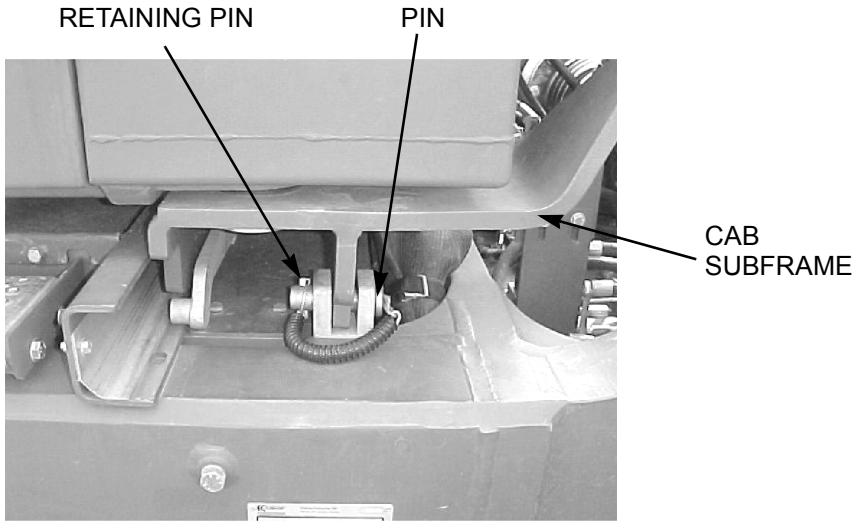
a. Run RTCH engine at idle.

NOTE

Skip step b if RTCH cab is being moved to transport position in order to perform maintenance or if boom support is not going to be lowered.

b. If boom support is to be lowered, remove retaining pin from boom support locking pin extension on each side of boom support.

c. Release cab by removing two retaining pins and pins from cab subframe.



CAB IN OPERATIONAL POSITION 350-089

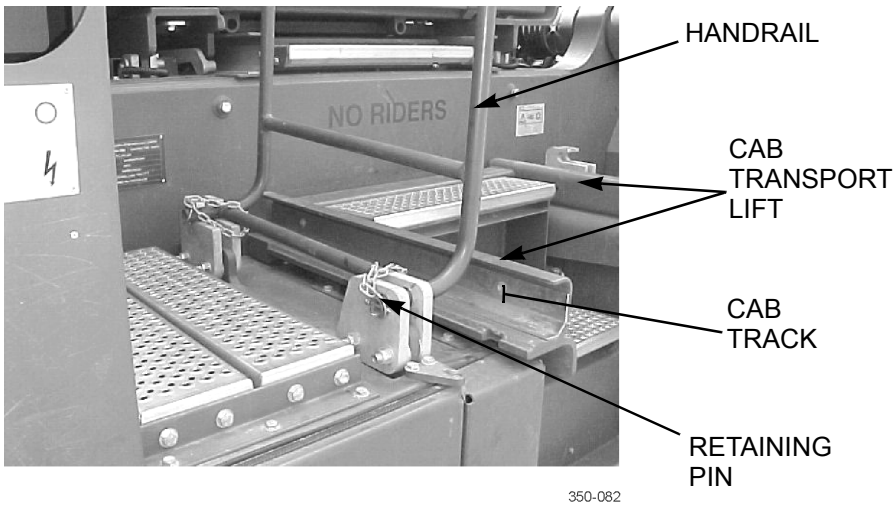
d. Remove two retaining pins and remove handrail.

PLACING CAB IN TRANSPORT POSITION - CONTINUED

e. Push auxiliary pump switch on instrument panel inside cab to start auxiliary pump.

f. Open door of remote hydraulic control compartment.

g. Pull cab lift/lower lever to raise cab transport lift until cab track is level with current cab position.

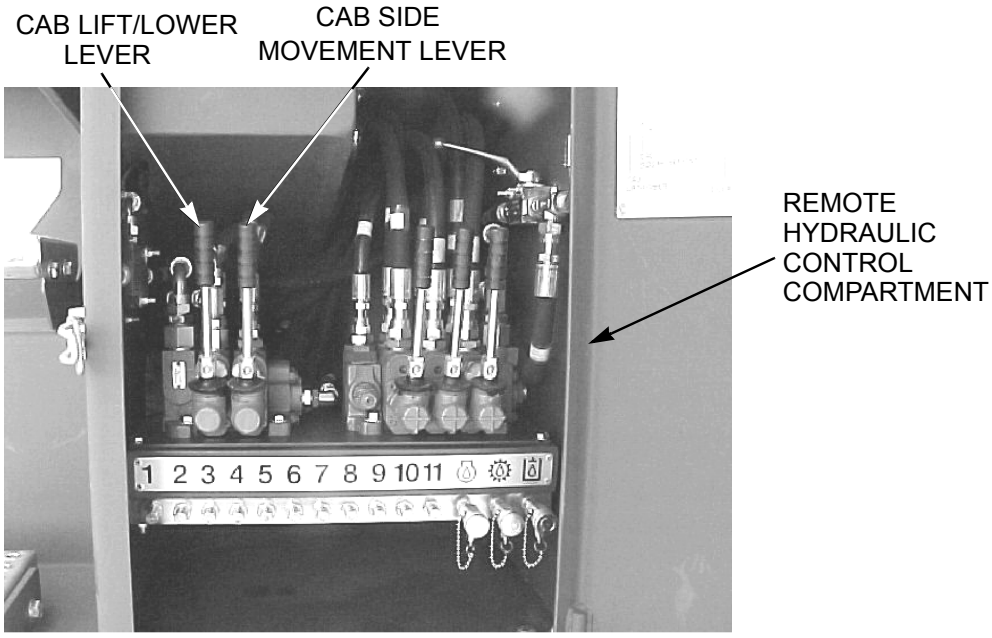


350-082

h. Pull cab side movement lever until cab has moved all the way to the left and safety locks drop into place on cab track.

i. Slowly push cab lift/lower lever and lower cab to transport height.

j. Push cab side movement lever to move cab slightly to the right, so that cab securing pins can be installed. Close and latch door of remote hydraulic control compartment.



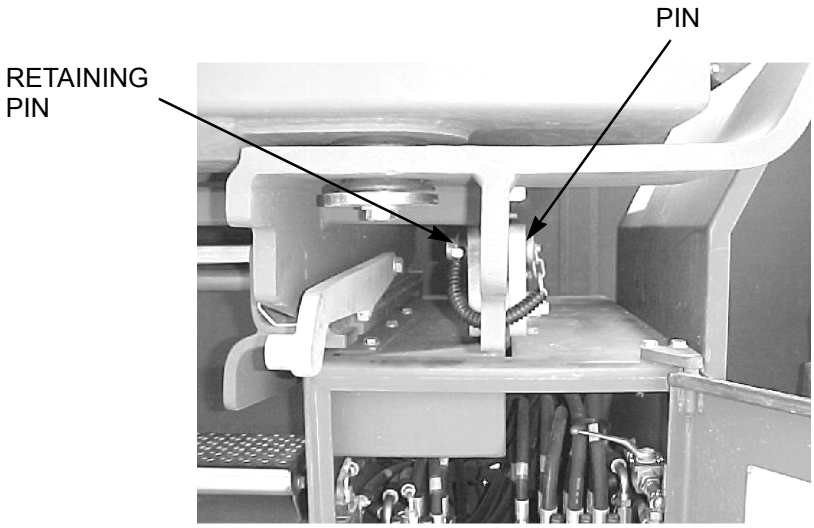
350-843

PLACING CAB IN TRANSPORT POSITION - CONTINUED

NOTE

Pins should be installed from the rear. Install rearmost pin first.

k. Install two pins and retaining pins to secure cab in transport position.



CAB IN TRANSPORT POSITION 350-083

l. Reinstall handrail, now configured as a ladder, on cab in transport position. Secure with two retaining pins.

m. Push auxiliary pump switch on instrument panel inside cab to turn off pump.

350-842

2. **Return Cab to Operational Position.**

a. Run RTCH engine at idle.

PLACING CAB IN TRANSPORT POSITION - CONTINUED

b. Push auxiliary pump switch on instrument panel inside cab to start auxiliary pump.
c. Remove two retaining pins and remove ladder.
d. Open door of remote hydraulic control compartment.
e. Release cab by removing two retaining pins and pins from cab.
f. Pull side movement lever to move cab free of frame lock.
g. Pull cab lift/lower lever until cab is fully raised.
h. Push cab side movement lever until cab has moved all the way to center position.
i. Push cab lift/lower lever to lower cab transport lift.

NOTE

- Cab side movement lever may need to be operated to move cab slightly side-to-side, to enable installation of pins.
- Pins should be installed from the rear. Install rearmost pin first.

j. Lock cab in operational position by installing two pins and retaining pins to cab subframe.
k. Close and latch door of remote hydraulic control compartment.
l. Push auxiliary pump switch on instrument panel inside cab to turn off pump.
m. Install handrail on cab with two retaining pins.

PLACING BOOM SUPPORT IN TRANSPORT POSITION

CAUTION

To ensure tophandler does not contact underside of boom, exercise tilt function and lock tophandler in tilted position while rotating tophandler. Failure to do so may damage tophandler and/or boom.

NOTE

- Boom must be raised to 19° and extended to 110 in (2794 mm) as shown on ECS display screen.
- Tophandler must be rotated 90° to longitudinal position.

1. **Fold Boom Support.**
   a. If not previously removed, remove retaining pin from boom support locking pin extension on each side of boom support.

   b. Run RTCH engine at idle.
   c. Open door of remote hydraulic control compartment.

CAUTION

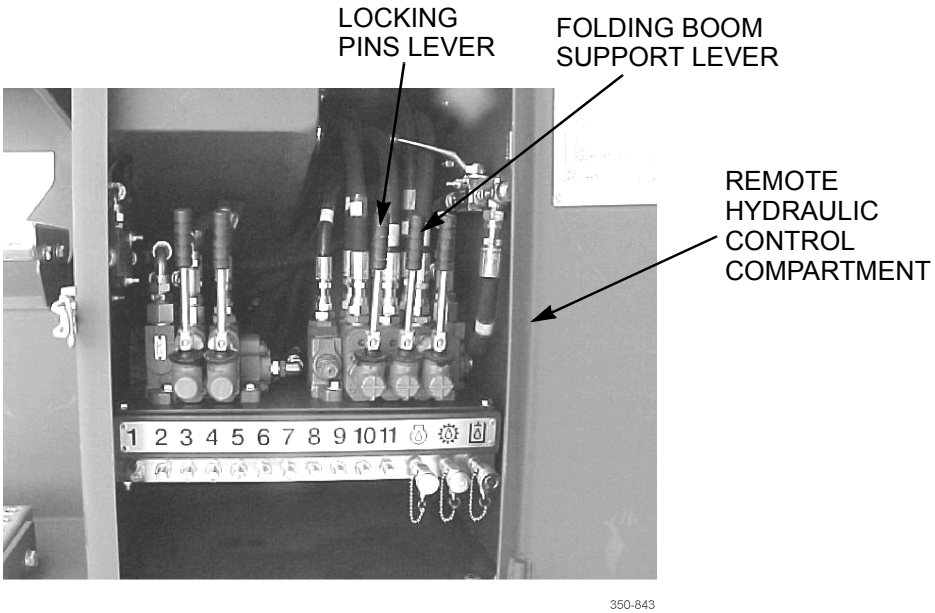
DO NOT operate locking pins lever and folding boom support lever at the same time. If levers are operated at the same time, boom support locking pin extensions may shear.

NOTE

- If the hydraulic function for boom support locking pins, boom folding or bogie wheel lowering are not working, it may be necessary to reposition cab closer to the frame.
- Left and right boom support locking pins may not retract at the same time; keep pushing locking pins lever until they both retract. Locking pins may also be difficult to retract; work locking pins lever back and forth several times to get both pins retracted.

   d. Raise boom folding cylinders to aid in releasing boom support locking pins.
   e. Push locking pins lever to retract boom support locking pins.

PLACING BOOM SUPPORT IN TRANSPORT POSITION - CONTINUED



CAUTION

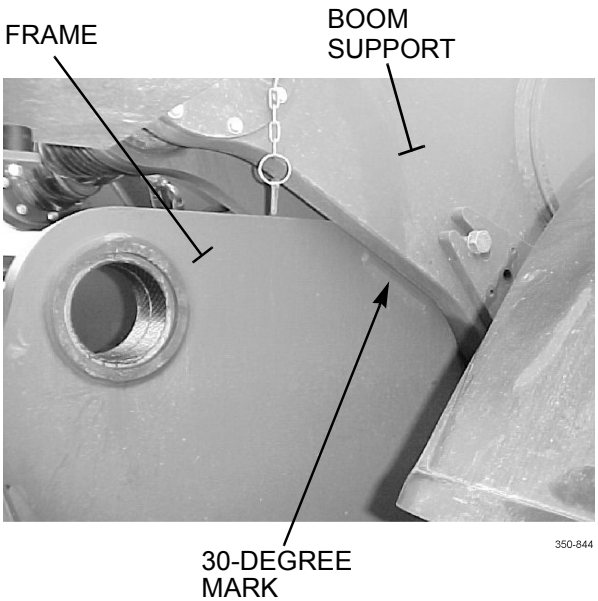
Ensure locking pins are fully retracted to avoid damaging them.

f. Visually inspect both sides to ensure left and right boom support locking pins have retracted.

g. Push folding boom support lever to fold boom support:

(1) For highway or rail transport, lower boom support until it will not fold any more.

(2) For air transport, lower boom support to 30-degree mark on frame.



PLACING BOOM SUPPORT IN TRANSPORT POSITION - CONTINUED

h. Pull locking pins lever to extend boom support locking pins. Install retaining pins to secure in locked position.

i. Close and latch door of remote hydraulic control compartment.

2. **Raise Boom Support.**

a. Run RTCH engine at idle.

b. Remove retaining pins from boom support locking pin extensions.

c. Open door of remote hydraulic control compartment.

d. Push locking pins lever to retract boom support locking pins.

e. Pull folding boom support lever to raise boom support to upright position.

CAUTION

DO NOT operate locking pins lever and folding boom support lever at the same time. If levers are operated at the same time, boom support locking pin extensions may shear.

NOTE

Left and right boom support locking pins may not extend at the same time; keep pulling locking pins lever until they both extend. Locking pins may also be difficult to extend; work locking pins lever back and forth several times to get both pins extended. It may also be necessary to raise the boom folding cylinders to aid in releasing boom support locking pins.

f. Pull locking pins lever to extend boom support locking pins.

g. Install retaining pin in left and right boom support locking pin extensions.

h. Close and latch door of remote hydraulic control compartment.

HIGHWAY TRANSPORT

NOTE

Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.

1. **Load RTCH on M1000 Trailer.**

a. Remove tophandler (TM 10-3930-675-20).

b. Lower loading ramps on M1000 trailer and place in outside (full wide) position (TM 9-2330-381-14).

c. Start RTCH engine and position vehicle facing forward and in line with trailer ramps.

WARNING

Always use a ground guide when driving RTCH up trailer ramps in preparation for highway transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

d. Slowly drive RTCH up loading ramps and onto M1000 trailer. Stop RTCH when directed to do so by ground guide.

e. Move cab to transport position (refer to *Placing Cab in Transport Position*).

f. Fold boom support (refer to *Placing Boom Support in Transport Position*).

g. Ensure boom is fully retracted and lowered.

h. Shut down RTCH engine.

HIGHWAY TRANSPORT - CONTINUED

i. Secure RTCH to trailer IAW tie-down instructions on RTCH data plate and on M1000 trailer.

j. Stow M1000 trailer loading ramps (TM 9-2330-381-14).

2. **Unload RTCH from M1000 Trailer.**

a. Remove tie-downs from RTCH and trailer.

b. Start RTCH engine.

c. Raise boom support (refer to *Placing Boom Support in Transport Position*).

d. Return cab to operational position (refer to *Placing Cab in Transport Position*).

e. Lower loading ramps on M1000 trailer and place in outside (full wide) position (TM 9-2330-381-14).

WARNING

Always use a ground guide when driving RTCH down trailer ramps. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

f. Slowly back RTCH down trailer ramps.

g. Stow M1000 trailer loading ramps (TM 9-2330-381-14).

h. Install tophandler (TM 10-3930-675-20).

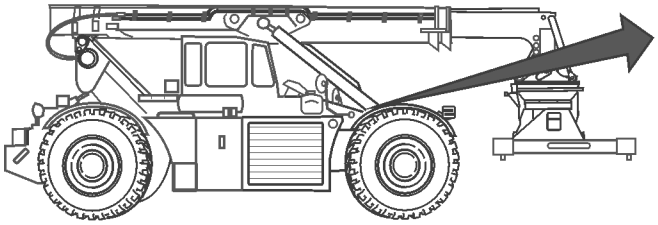
i. Shut down RTCH engine.

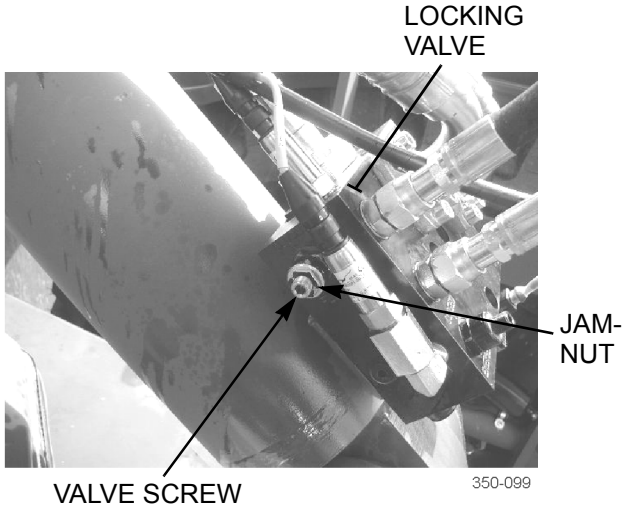
RAIL TRANSPORT

NOTE

Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.

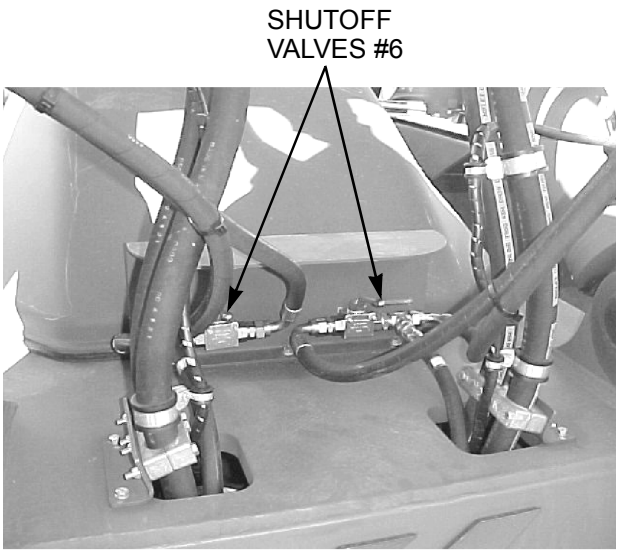
1. **Load RTCH on Rail Flatcar.**
   a. Drive RTCH, with tophandler attached, onto rail flatcar (MIL-STD-1366C).
   b. Raise boom to 19° as shown on ECS display screen.
   c. Extend boom to 96.5 in (2450 mm) as shown on ECS display screen.
   d. Move cab to transport position (refer to *Placing Cab in Transport Position*).
   e. Fold boom support (refer to *Placing Boom Support in Transport Position*).
   f. Rotate tophandler 90° clockwise to longitudinal position.
   g. Lower and retract boom until tophandler is located as close to vehicle front wheels as possible.
   h. Place shoring (4 X 4, 6 X 6, etc.) under tophandler.
   i. Lower tophandler onto shoring. Ensure tophandler leveling cylinders fully collapse when tophandler is lowered.
   j. Shut down RTCH engine.
   k. At side of locking valve at base of each lift cylinder, loosen float valve jamnut and turn float valve screw five turns counterclockwise. Retighten jamnut to prevent loss.





RAIL TRANSPORT - CONTINUED

l. Open both shutoff valves #6 slowly and at the same time.



350-091

m. Secure RTCH to rail flatcar IAW tie-down instructions on RTCH data plate and on rail flatcar.

2. **Unload RTCH from Rail Flatcar.**

a. Remove tie-downs from RTCH and rail flatcar.

b. Close both shutoff valves #6.

c. At side of locking valve at base of each lift cylinder, loosen float valve jamnut and turn float valve clockwise until tight. Retighten jamnut.

d. Start RTCH engine.

e. Raise tophandler slightly and remove shoring.

f. Raise and extend boom until extended to 110 in (2794 mm) and height is approximately 13 ft (4 m).

g. Raise boom support (refer to *Placing Boom Support in Transport Position*).

h. Return cab to operational position (refer to *Placing Cab in Transport Position*).

i. Lower and retract boom.

j. Rotate tophandler 90° counterclockwise to place in operational position.

k. Drive RTCH from rail flatcar (MIL-STD-1366C).

MARINE TRANSPORT

1. **Load RTCH On Ship.**

NOTE

- Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.
- Perform steps a through d if ship is equipped with RO/RO (rollon/rolloff) capabilities.

a. Start RTCH engine and rotate tophandler 90° clockwise to longitudinal position.

MARINE TRANSPORT - CONTINUED

b. Place boom in elevated position to clear door or bulkhead entry of ship.

WARNING

Always use a ground guide and do not exceed 1 mph (1.6 kph) when driving RTCH up ramps in preparation for marine transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

c. Back RTCH up ramp at door or bulkhead entry of ship. As vehicle approaches ship, lower boom to horizontal full-down position.

d. Shut down RTCH engine.

NOTE

- Perform steps e through h for LCU 1646, 2000, and LSV.
- If the RTCH were required to be transported on a Comet Class vessel, it could be moved from one area of the ship to another by moving the boom support to the lowered (transport) position. This would reduce the RTCH height to less than the 147 in (373 cm) bulkhead openings within a Comet Class vessel.

e. Move cab and boom support to transport position (refer to *Placing Cab in Transport Position* and *Placing Boom Support in Transport Position*).

f. Rotate tophandler 90° clockwise to longitudinal position.

WARNING

Always use a ground guide and do not exceed 1 mph (1.6 kph) when driving RTCH up ramps in preparation for marine transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

g. Back RTCH up ramp at door or bulkhead entry of ship. As vehicle approaches ship, lower boom to horizontal full-down position.

h. Shut down RTCH engine.

2. **Unload RTCH From Ship.**

NOTE

Perform steps a through e for LCU 1646, 2000, and LSV only.

a. Start RTCH engine.

WARNING

Always use a ground guide and do not exceed 1 mph (1.6 kph) when driving RTCH down ramps after marine transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

b. Drive RTCH out vehicle ramp at door or bulkhead entry of ship.

c. Rotate tophandler 90° counterclockwise to operational position.

d. Shut down RTCH engine.

e. Return cab and boom support to operational position (refer to *Placing Cab in Transport Position* and *Placing Boom Support in Transport Position*).

MARINE TRANSPORT - CONTINUED

NOTE

Perform steps f through h for ships equipped with RO/RO capabilities.

f. Start RTCH engine.

WARNING

Always use a ground guide and do not exceed 1 mph (1.6 kph) when driving RTCH down ramps after marine transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

g. Drive RTCH out vehicle ramp at door or bulkhead entry of ship.

h. Shut down RTCH engine.

AIR TRANSPORT

NOTE

- Refer to WP 0002 00, 0004 00, and 0005 00 for the location and operation of RTCH controls, indicators, and components.
- Fuel tank must be drained to ¼ tank or less.

1. **Load RTCH on C-5 Aircraft.**

a. Start RTCH engine.

WARNING

Always use a ground guide and do not exceed 1 mph (1.6 kph) when driving RTCH up ramps in preparation for air transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

NOTE

Ensure RTCH is properly alined with aircraft. Once dolly wheels are installed on tophandler, RTCH is difficult to steer.

b. Position RTCH in line with and facing aircraft loading ramp, as close as possible to aircraft.

c. Move cab to transport position (refer to *Placing Cab in Transport Position*).

d. Raise boom to 19° and extend boom to 110 in (2794 mm) as shown on ECS display screen.

CAUTION

To ensure tophandler does not contact underside of boom, exercise tilt function and lock tophandler in tilted position while rotating tophandler. Failure to do so may damage tophandler and/or boom.

e. Rotate tophandler 90° counterclockwise to longitudinal position. Ensure tophandler is centered with RTCH.

f. Fold boom support (refer to *Placing Boom Support in Transport Position*).

g. Lower tophandler until approximately 18 in (45.7 cm) off the ground.

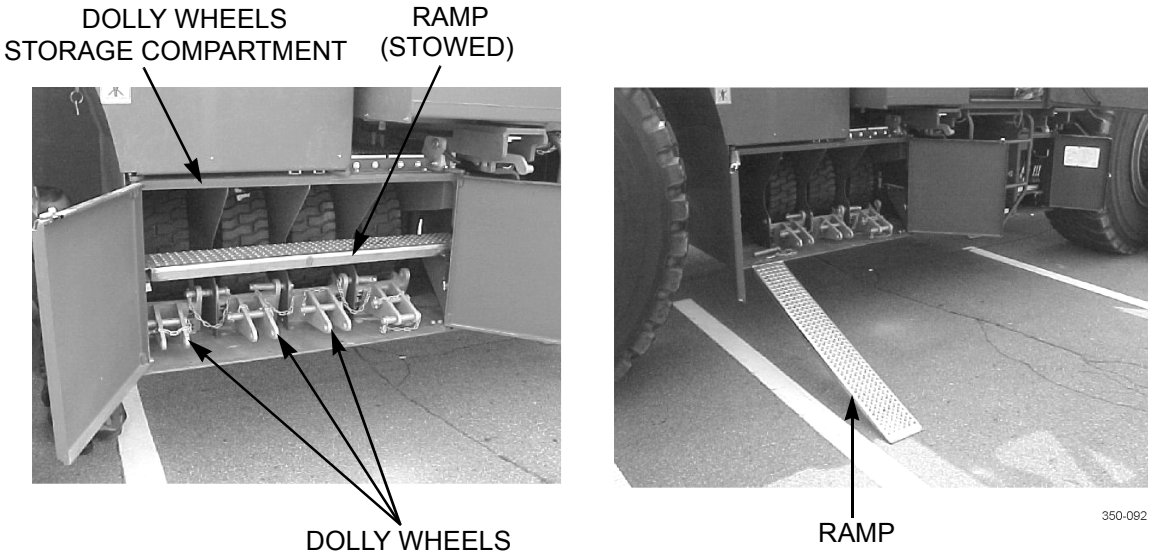
WARNING

Ensure that tabs on ramp are engaged into ramp seat holes in dolly wheels storage compartment. Failure to secure ramp properly may cause ramp to fall under weight of dolly wheel, causing injury to personnel.

AIR TRANSPORT - CONTINUED

h. Open dolly wheels storage compartment. Remove ramp from stowage and position against storage compartment.

i. Remove dolly wheels from storage compartment, using ramp.



NOTE

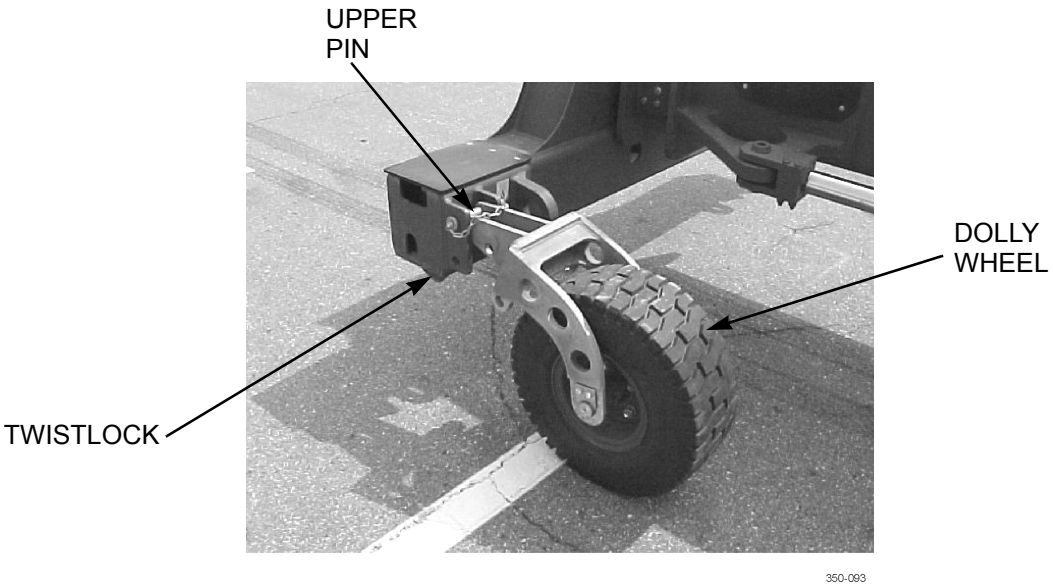
When installed, front and rear dolly wheels are turned toward each other.

j. Install each dolly wheel to tophandler:

(1) Place dolly wheel so that tire will be under the twistlock when wheel is lifted.

(2) Install upper pin from outside of tophandler. Lock pin in position with retaining pin.

(3) Remove lower pin from dolly wheel and set aside.

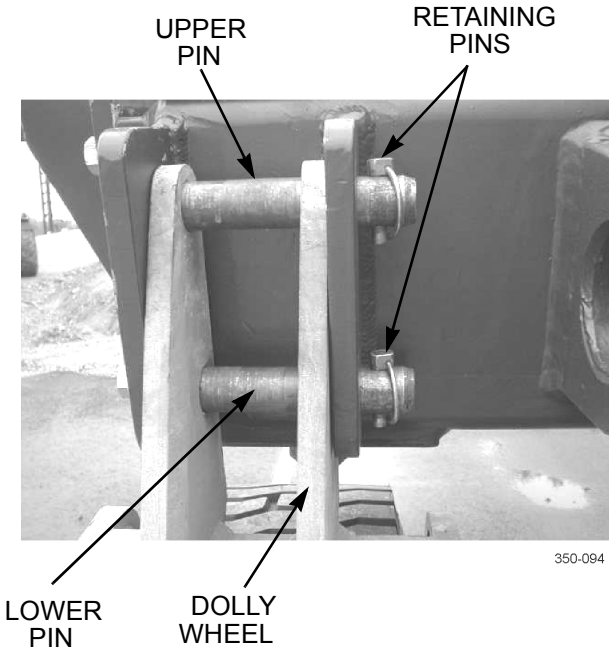


AIR TRANSPORT - CONTINUED

k. Stow ramp in dolly wheels storage compartment. Secure ramp with straps.

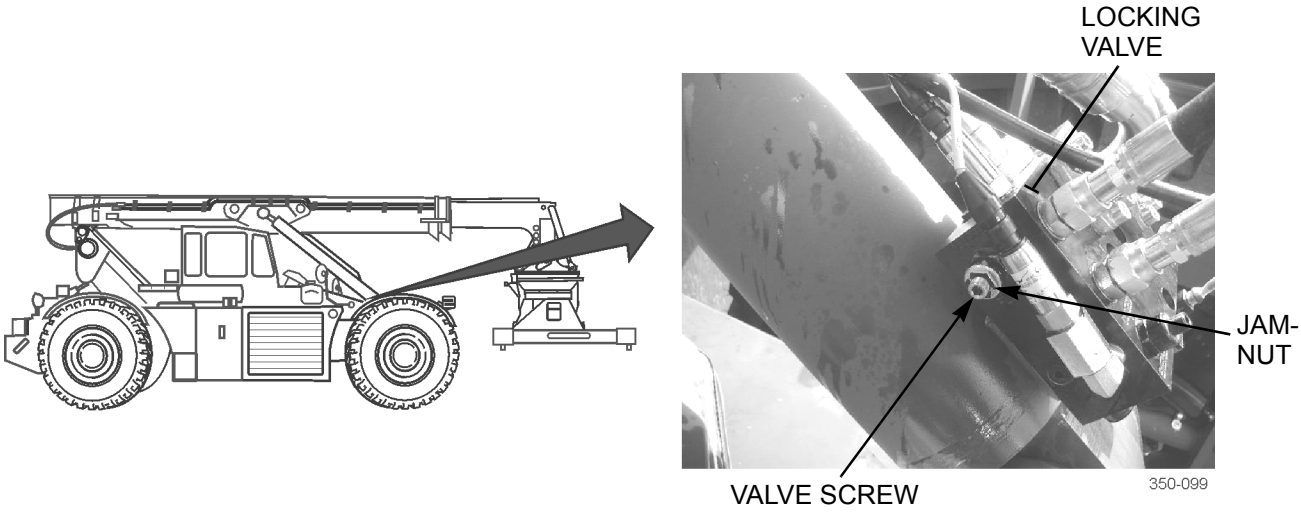
l. Raise tophandler so that dolly wheels are off the ground approximately 2 ft (0.6 m).

m. Install lower pin in lower hole of each dolly wheel. Lock pin in position with retaining pin.



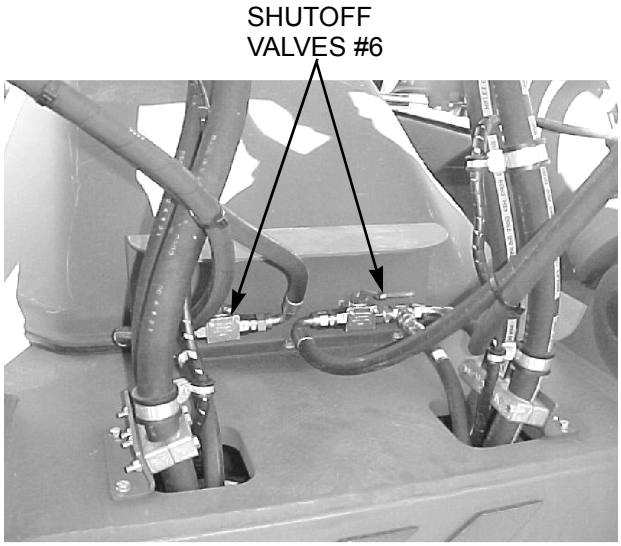
n. Lower tophandler until all four dolly wheels are resting on ground.

o. At side of locking valve at base of each lift cylinder, loosen float valve jamnut and turn float valve screw five turns counterclockwise. Retighten jamnut to prevent loss.



AIR TRANSPORT - CONTINUED

p. At front of vehicle, open both shutoff valves #6 slowly and at the same time. Tophandler should now be resting on dolly wheels, in floating position.



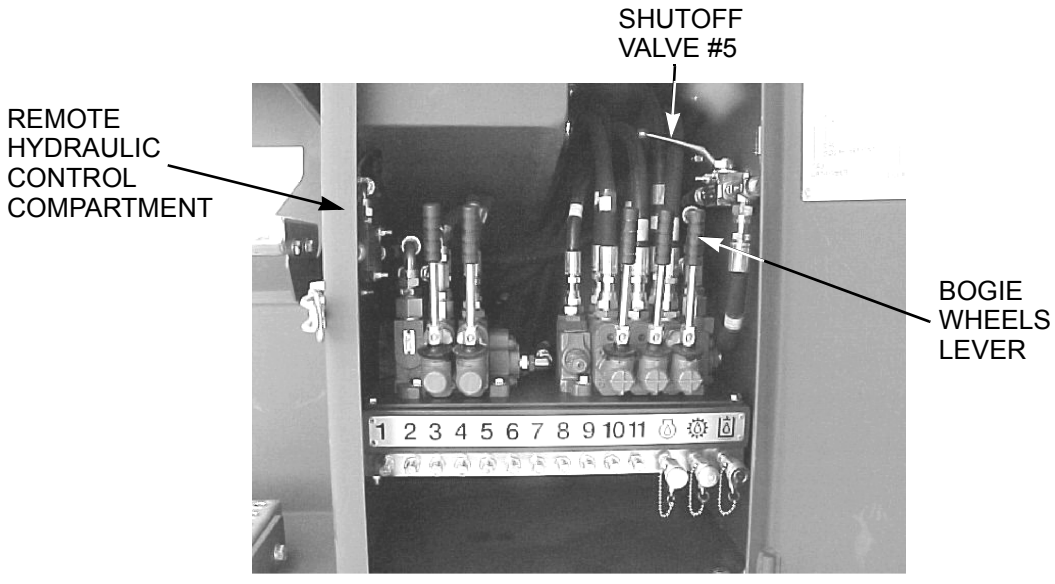
350-091

q. Open remote hydraulic control compartment.

NOTE

Raise bogie wheels only enough to allow bogie wheels retaining collar to be unlocked.

r. Slowly pull bogie wheels lever to raise bogie wheels.



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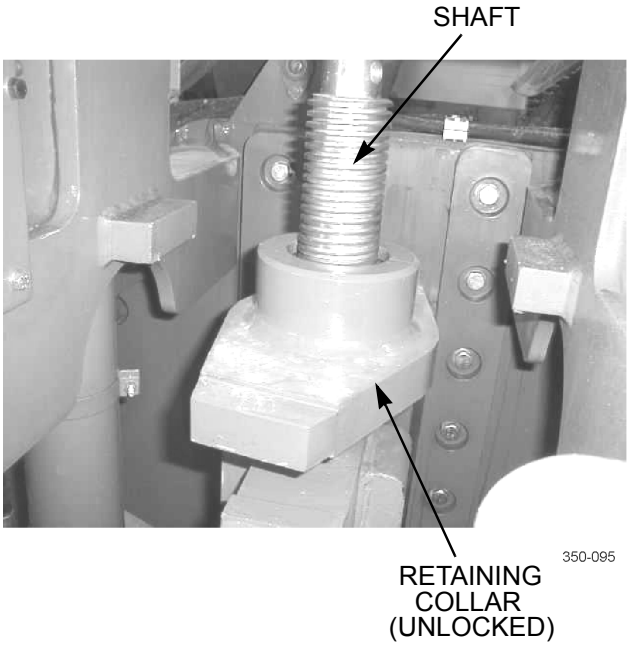
AIR TRANSPORT - CONTINUED

s. Turn bogie wheels retaining collar ¼ turn clockwise to unlock bogie wheels. If retaining collar is still tight, use handle stowed forward of bogie wheels to rotate shaft.



t. Push bogie wheels lever to lower bogie wheels; ensure wheels are lowered sufficiently to apply ground pressure.

u. Open shutoff valve #5 inside remote hydraulic control compartment by turning handle 90° counterclockwise. Bogie wheels will lower further and apply correct amount of ground pressure.

WARNING

Always use a ground guide (load master) and do not exceed 1 mph (1.6 kph) speed when driving RTCH up ramps in preparation for air transport. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

CAUTION

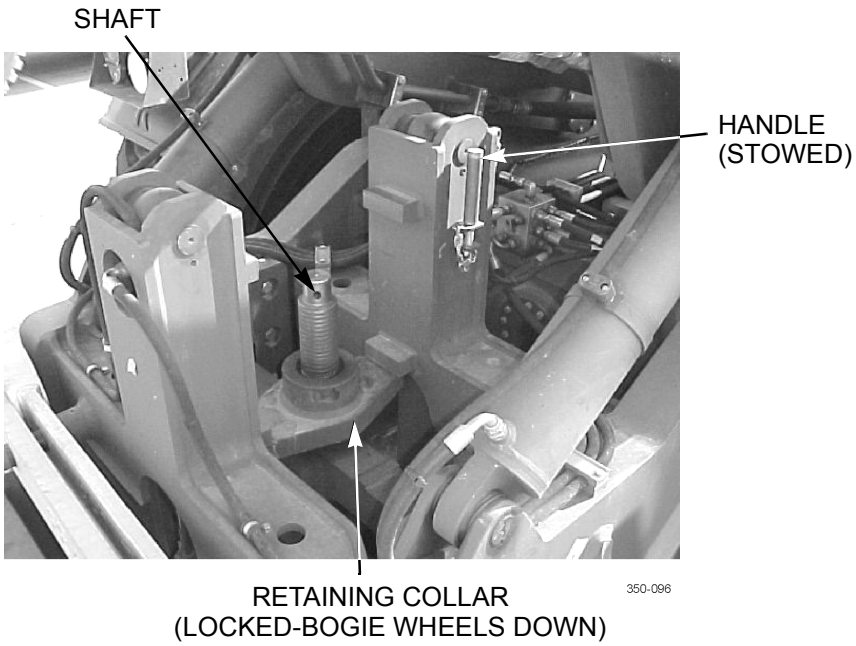
Oversteering will damage dolly and bogie wheels.

v. Using first gear and two-wheel steering mode, slowly drive RTCH forward up ramps and position inside aircraft. DO NOT exceed 1 mph (1.6 kph) speed. Only slight steering corrections (no more than ¼ turn of steering wheel) are allowed during loading.

w. Lower boom support to the maximum onto the frame (refer to *Placing Boom Support in Transport Position*).

AIR TRANSPORT - CONTINUED

x. Rotate bogie wheels retaining collar ¼ turn clockwise to lock bogie wheels in position. It may be necessary to screw shaft down to take up slack in bogie wheels lock.



y. Close shutoff valve #5 by turning handle 90° clockwise.

z. Shut down RTCH engine.

aa. Tie boom to RTCH frame.

ab. Secure RTCH to tiedown locations inside aircraft IAW tiedown instructions on RTCH data plate and on aircraft.

2. **Unload RTCH from C-5 Aircraft.**

a. Remove all tiedowns.

b. Open shutoff valve #5 inside remote hydraulic control compartment by turning handle 90° counterclockwise.

c. Rotate bogie wheels retaining collar ¼ turn clockwise to unlock bogie wheels.

d. Raise boom support to 30° mark on frame (refer to *Placing Boom Support in Transport Position*).

WARNING

Always use a ground guide (load master) and do not exceed 1 mph (1.6 kph) when backing RTCH down aircraft ramps. Failure to use a ground guide may result in an accident, causing death or injury to personnel or damage to equipment.

CAUTION

Oversteering will damage dolly and bogie wheels.

e. Using two-wheel steering mode, slowly back RTCH down ramps. DO NOT exceed 1 mph (1.6 kph) speed. Only slight steering corrections (no more than ¼ turn of steering wheel) are allowed during unloading.

f. Inside remote hydraulic control compartment, close shutoff valve #5.

g. Inside remote hydraulic control compartment, pull bogie wheels lever to fully raise bogie wheels.

AIR TRANSPORT - CONTINUED

h. Turn bogie wheels retaining collar ¼ turn clockwise to lock bogie wheels in stowed position.

i. At front of vehicle, close both shutoff valves #6.

j. At side of locking valve at base of each lift cylinder, loosen float valve jamnut and turn float valve clockwise until tight. Retighten jamnut.

k. Remove dolly wheels from tophandler:

(1) Remove two retaining pins and lower and upper pin from each dolly wheel. Remove dolly wheel from tophandler.

(2) Reinstall lower and upper pin in dolly wheel and secure with retaining pins.

WARNING

Ensure that tabs on ramp are engaged into ramp seat holes in dolly wheels storage compartment. Failure to secure ramp properly may cause ramp to fall under weight of dolly wheel, causing injury to personnel.

l. Using ramp, stow dolly wheels in dolly wheels storage compartment. Stow ramp inside storage compartment and secure with straps.

m. Raise boom to approximately 13 ft (4 m) height.

n. Raise boom support (refer to *Placing Boom Support in Transport Position*).

o. Retract and lower boom.

CAUTION

To ensure tophandler does not contact underside of boom, exercise tilt function and lock tophandler in tilted position while rotating tophandler. Failure to do so may damage tophandler and/or boom.

p. Rotate tophandler 90° clockwise to operational position.

q. Return cab to operational position (refer to *Placing Cab in Transport Position*).

r. Shut down RTCH engine.

s. Fill fuel tank (WP 0015 00).

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STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE 0008 00

INTRODUCTION

a. This work package shows the location for stowage of equipment and material required to be carried on the RTCH-RT 240.

b. This work package also includes illustrations showing the location of all decals, data plates, and stencils.

STOWAGE GUIDE

NOTE

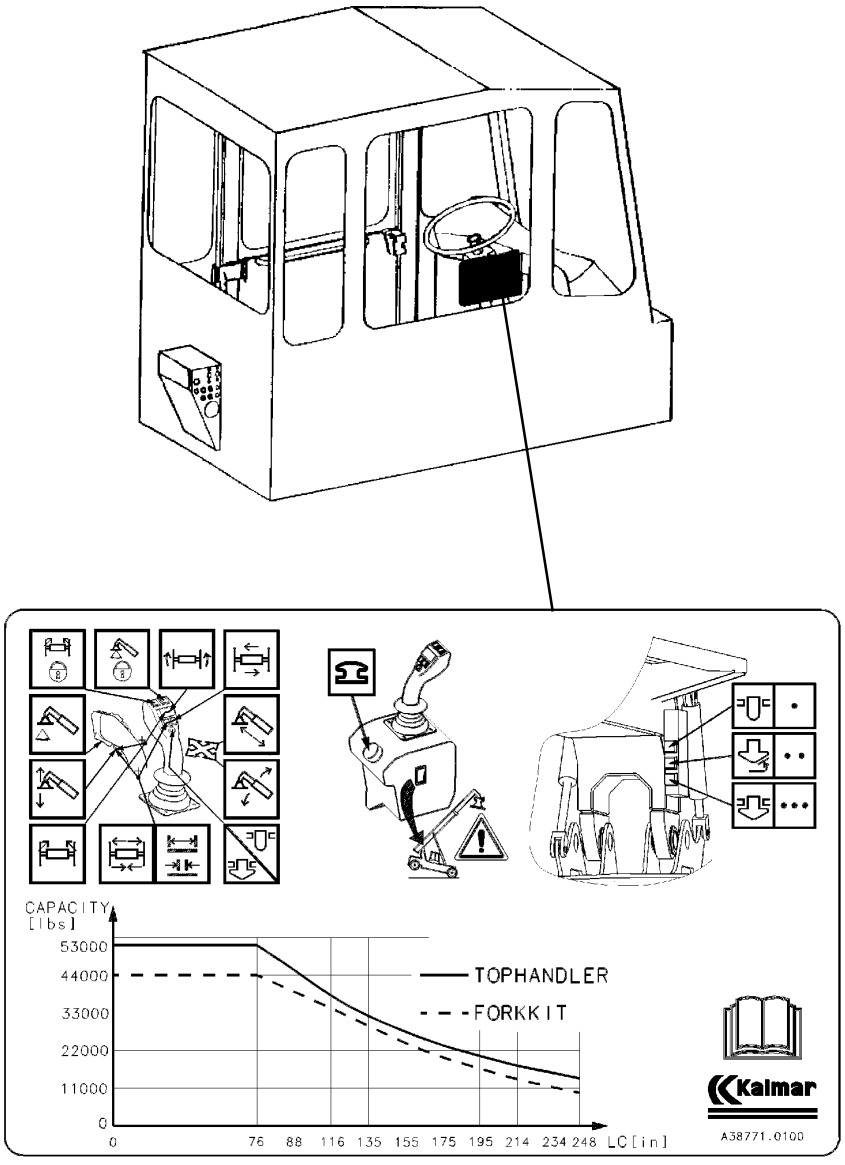
Items listed in Table 1 below are illustrated in WP 0017 00, *Components of End Item (COEI) and Basic Issue Items (BII) Lists*.

Table 1. Stowage Guide.

ITEM	NOMENCLATURE	QTY	STOWAGE LOCATION
1	Extinguisher, Fire	1	Mount in bracket inside cab.
2	Ladder/Handrail	1	During normal operation, mount as a handrail on left side of stairs on left side of vehicle. May be mounted as a ladder on left, right, front or rear of vehicle.
3	Ramp, Dolly Wheels	1	Stow inside dolly wheels storage compartment.
4	Toolkit	1	Stow inside cab.
5	Wheel, Dolly	4	Stow inside dolly wheels storage compartment.

STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CAB DECALS



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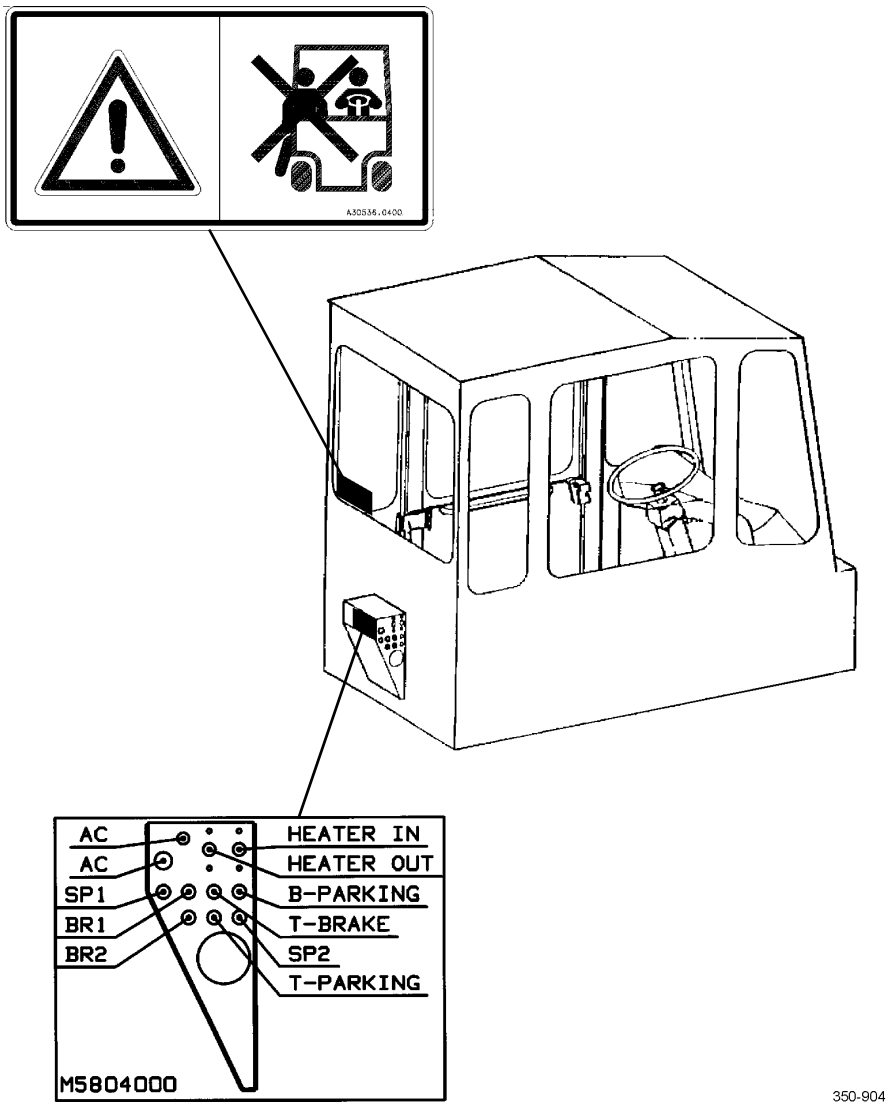
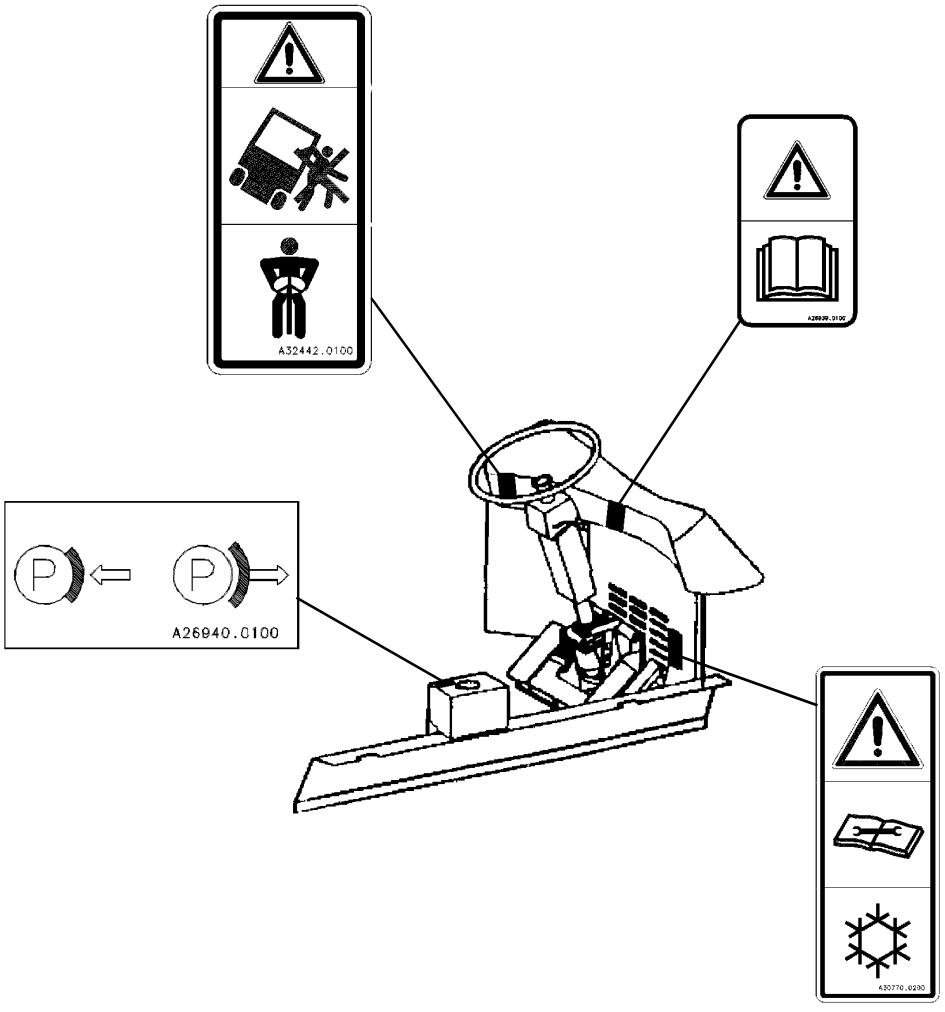
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CAB DECALS - CONTINUED



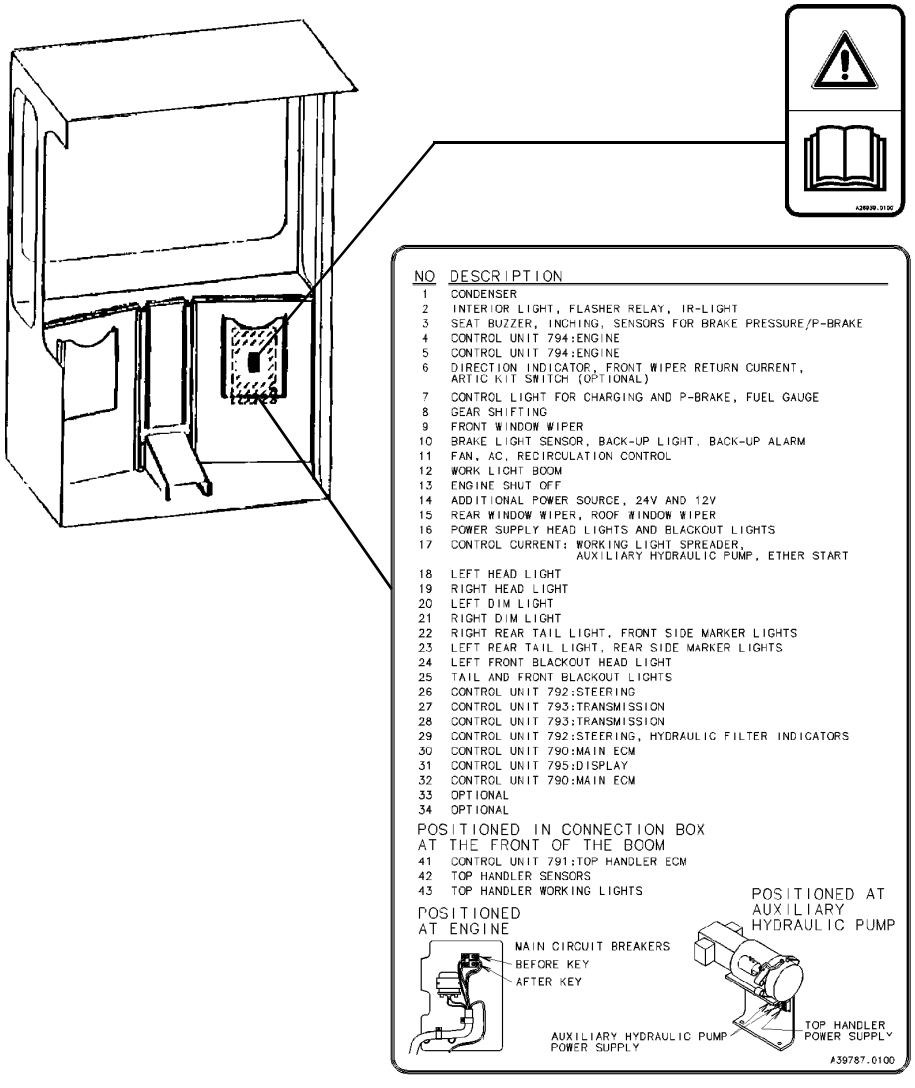
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CAB DECALS - CONTINUED



STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED 0008 00

CAB DECALS - CONTINUED



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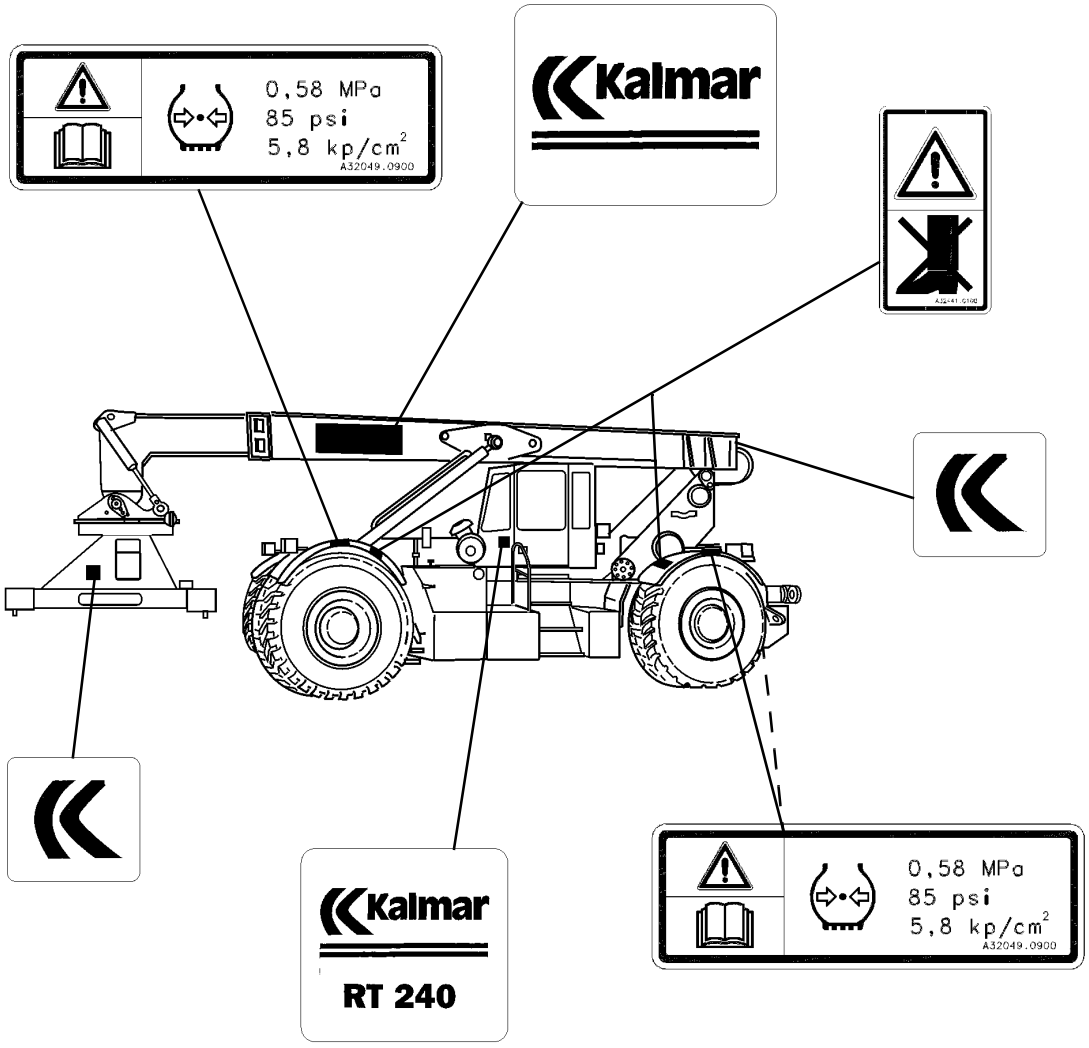
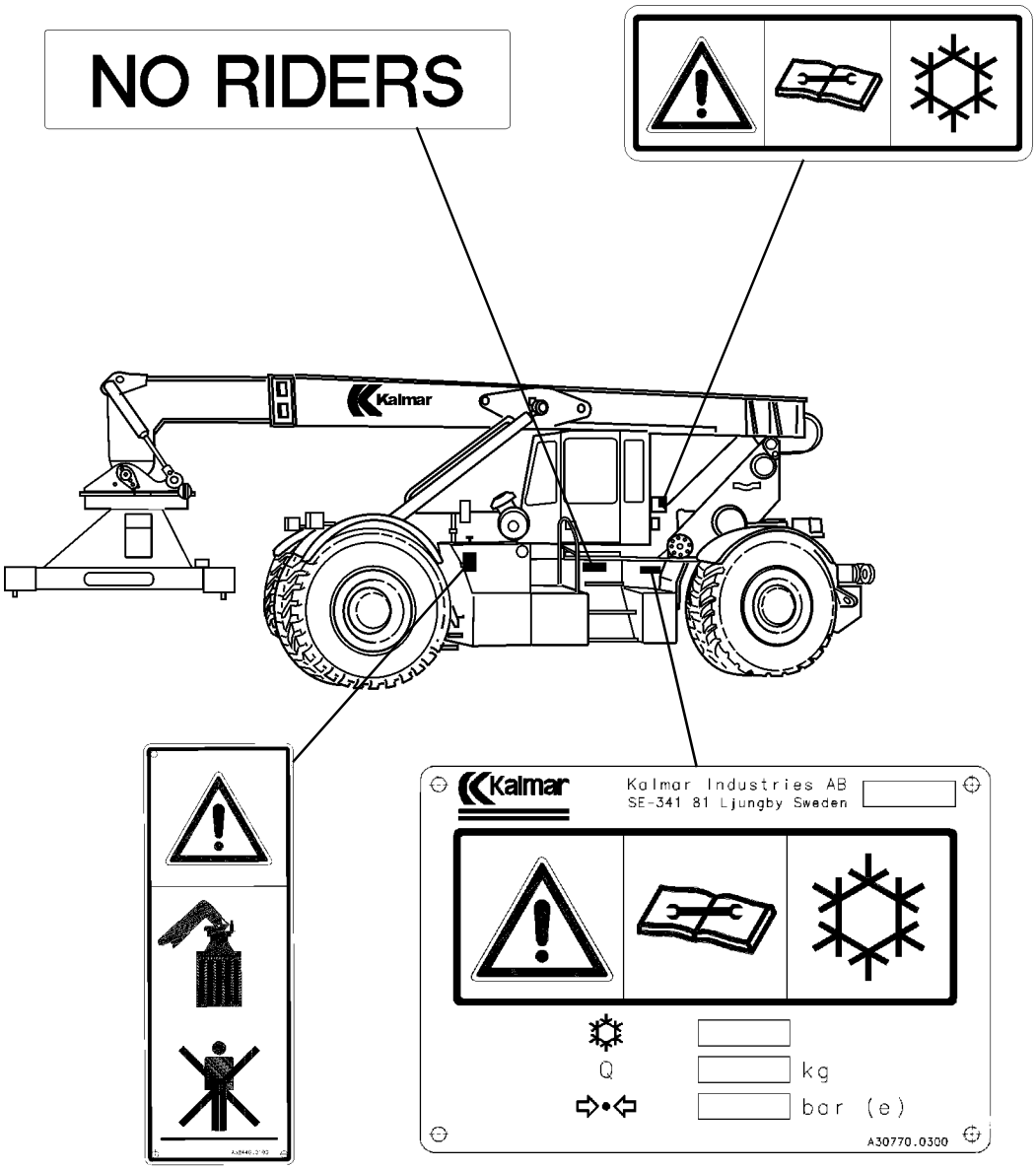
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS



STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



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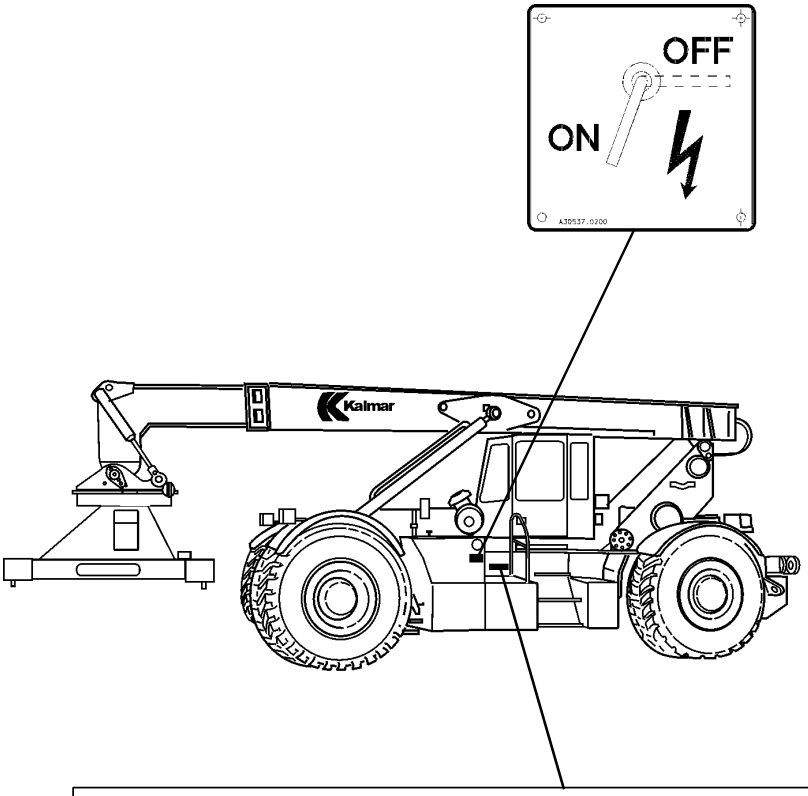
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED 0008 00

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED

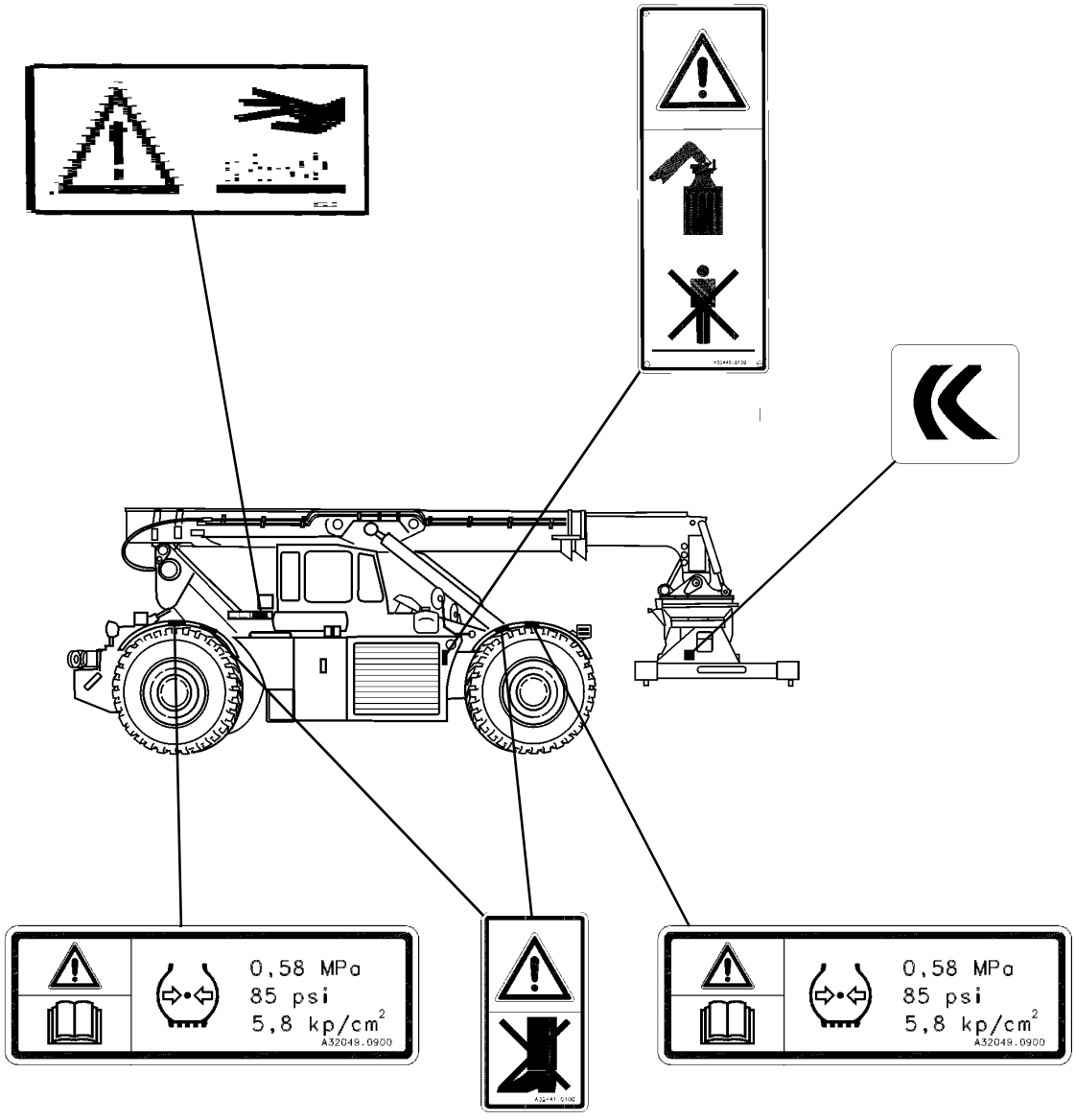


CONTAINER HANDLER: ROUGH TERRAIN: 53,000 POUND CAPACITY; AT 48 INCH LOAD CENTER			
MODEL: TRA24055S3M	SERIAL NO:	MFD:	CONTRACTOR: 1NWY2
CAPACITY: 53,000 LBS	GVW: 118,500 LBS	SHIPPING WT: 118,000 LBS	
NSN: 3930-01-473-3998	REGISTRATION NO:	WARRANTY EXP:	
MFD BY: KALMAR RT CENTER LLC	INSPECTED BY:	DATE: AUG 2000	
DATE SHIPPED:	DATE IN SERVICE:	INSPECTED BY:	
OPERATIONAL HEIGHT: 157.5 IN	WIDTH: 143.7 IN	OPERATIONAL CUBE: 7630 FT^3	
FOR INFORMATION CONTACT: KALMAR RT CENTER, SAN ANTONIO, TX 1-800-232-1236			

350-918

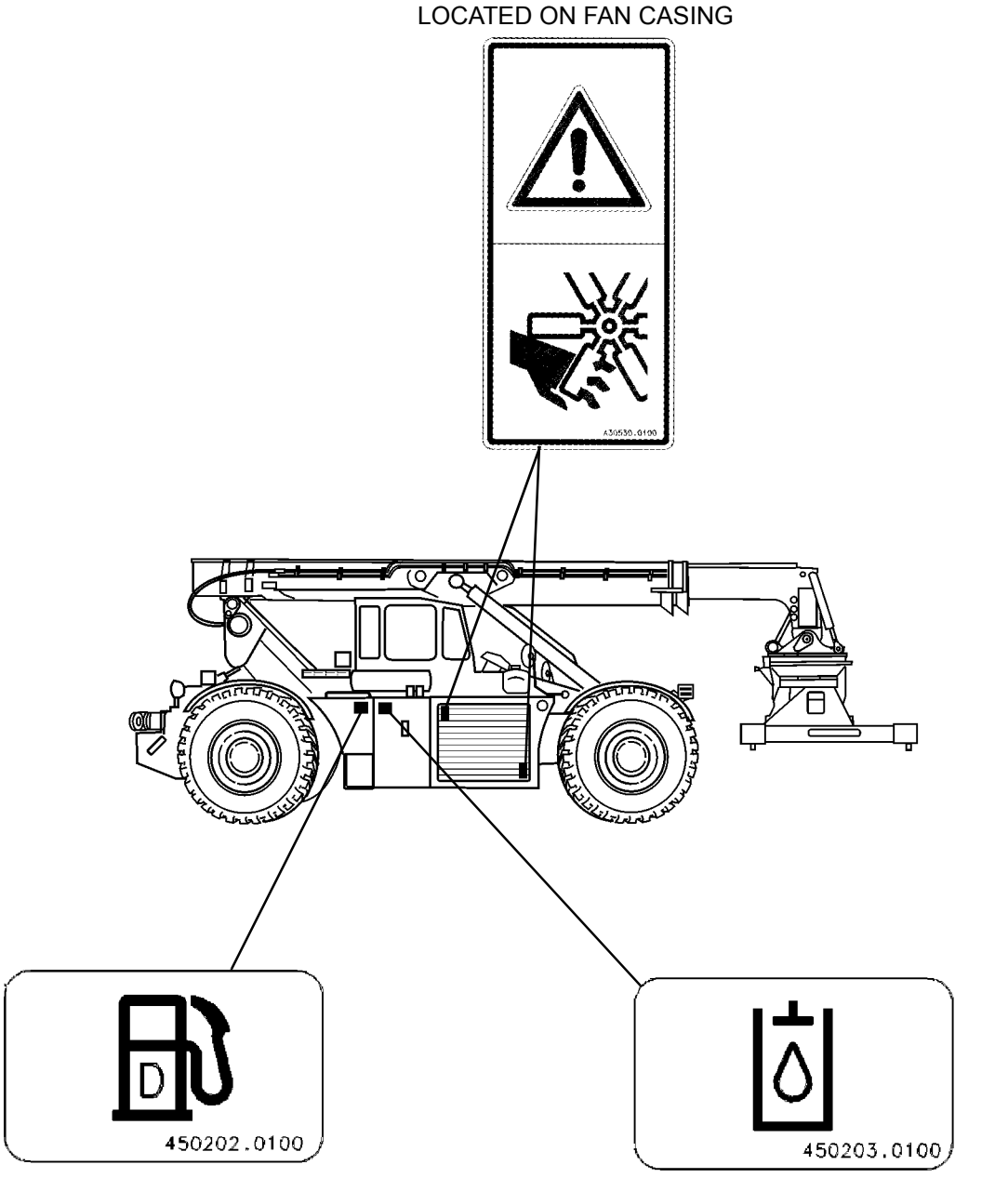
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



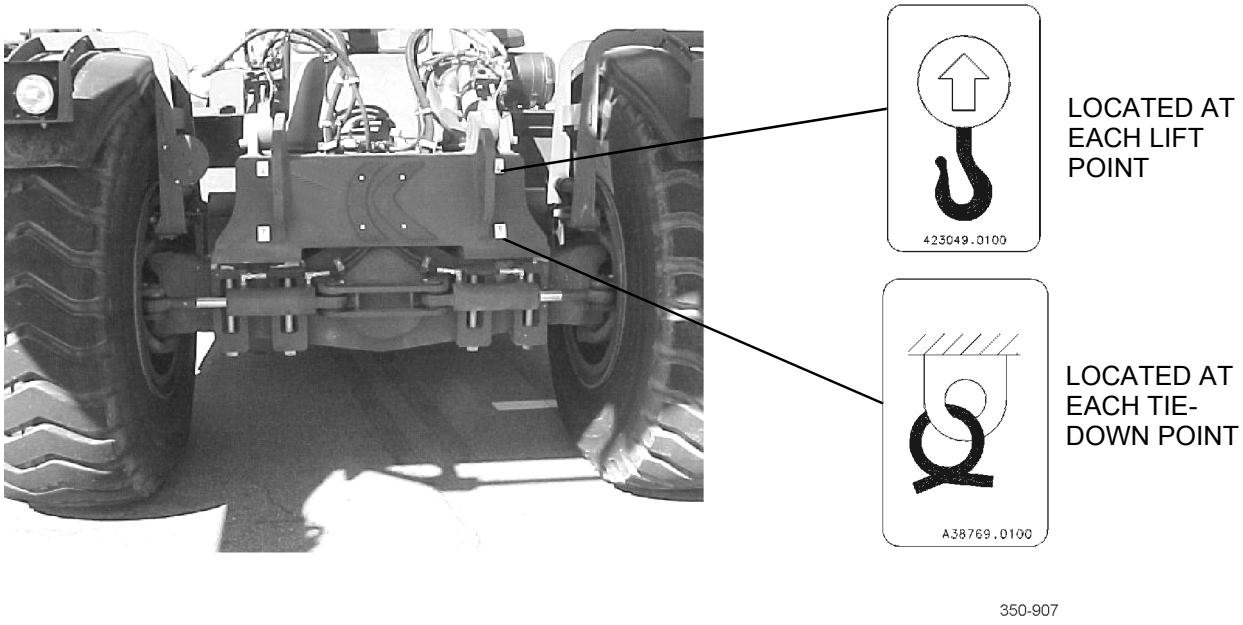
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



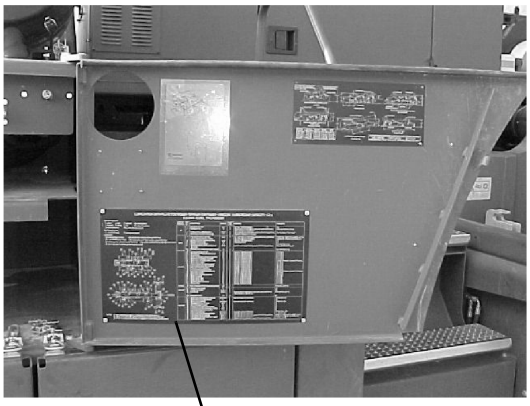
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



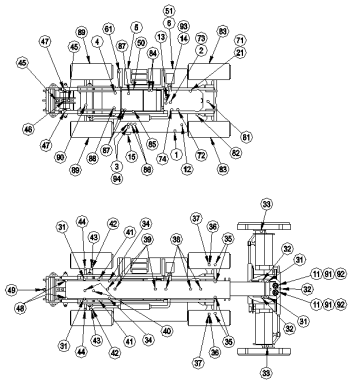
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



LUBRICATION DATA PLATE FOR ROUGH TERRAIN CONTAINER HANDLER: 53,000 POUND CAPACITY: 4 X 4
KALMAR MODEL TRA24055S3M

SERVICE FUNCTIONS
S - CHECK A - ADD G - GREASE AR - AS REQUIRED
C - CHANGE D - DRAIN F - FILL CS - COLLECT SAMPLE
IB - INITIAL BREAK IN FTLG - FILL TO LEVEL GAUGE
MAINTENANCE LEVEL
C - OPERATOR/CREW O - UNIT MAINTENANCE
LUBRICANTS
GAA - GREASE (MIL-G-10924) EO - ENGINE OIL, OE/HDO-15/40 (MIL-PREF-2104)
ANT - ANTIFREEZE (MIL-A-46153) LEO- ENGINE OIL, LOW TEMP, OE/HDO-10 (MIL-PREF-2104)
HO - HYDRAULIC OIL, OE/HDO-10 (MIL-PREF-2104) AHO - ARTIC LUBRICATING OIL, OEA (MIL-PREF-46167)
GO - GEAR OIL, MULTIPURPOSE GO-80W/140 (MIL-L-2105)



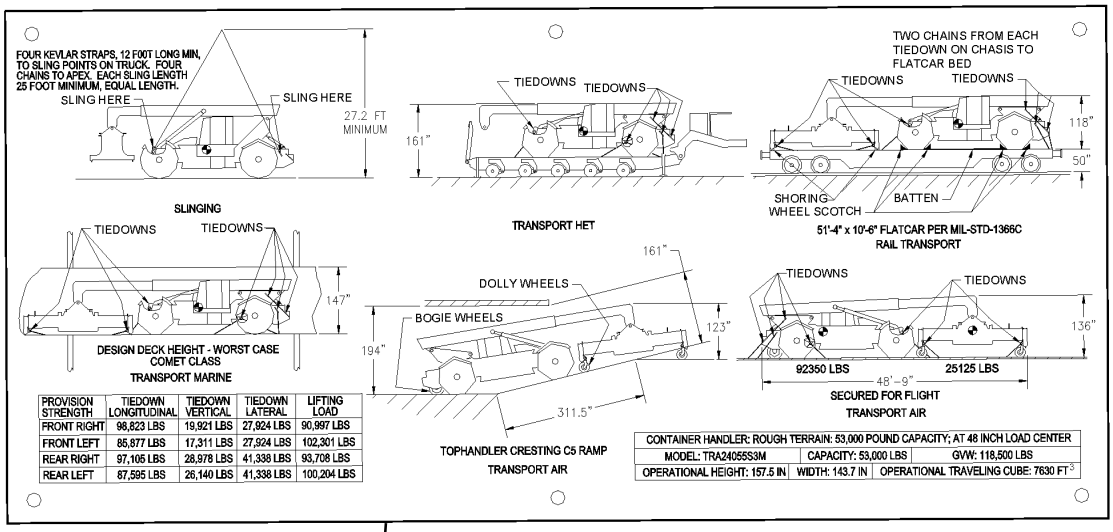
SERVICE INTERVAL	REF NO	DESCRIPTION	SERVICE	MAINT LEVEL	REMARKS	COMMENTS
AR	1	RADIATOR FILL CAP	D, F	O	ANT (ALL TEMPERATURES)	N3
	2	ENGINE OIL FILL	A	C	EO (0°F/-18°C TO 120°F/49°C), LEO (-20°F/-29°C TO 40°F/4°C) LHO (-70°F/-57°C TO 40°F/4°C)	FULL ON DIPSTICK, N2, N3
	3	HYDRAULIC OIL RESERVOIR FILL	A, D, F	C	HO (-10°F/-23°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	180 GAL/680 L, FTLG, N2, N3
	4	WINDSHIELD WASHER RESERVOIR	F	C	SOLVENT, WINDSHIELD WASHER	
	5	AUXILIARY CONTROL COMPARTMENT ACCESS DOOR AND HINGES	A	C	HO (-10°F/-23°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	N3
	6	COMPARTMENT DOORS AND HINGES	A	C	HO (-10°F/-23°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	N3
DAILY	11	TOPHANDLER GEAR MOTORS, SIGHT GAUGES AND FILL TUBES	S, A	C	HO (-10°F/-23°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C) GO (-40°F/-40°C TO 120°F/49°C)	UPPER FILL TUBE & FTLG UPPER, N2, N3 LOWER FILL TUBE & FTLG LOWER, N3
	12	ENGINE COOLANT EXPANSION TANK	S, A	C	ANT (ALL TEMPERATURES)	N3
	13	ENGINE OIL LEVEL GAUGE	S	C		FILL PER ITEM 2, N3
	14	TRANSMISSION OIL LEVEL GAUGE AND FILL TUBE	S, A	C	HO (0°F/-18°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	FULL ON DIPSTICK, N2, N3
	15	HYDRAULIC OIL RESERVOIR SIGHT GAUGE	S	C		FILL PER ITEM 3, N3
WEEKLY	21	PRIMARY FUEL FILTER	D	C	DRAIN MOISTURE	N3
200 HRS	31	BOOM PIVOT PIN	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	32	TOPHANDLER PINION AND RING GEAR	G	O	GAA (ALL TEMPERATURES)	4 FITTINGS, N3
	33	CHAIN WHEEL	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	34	BOOM LOCK PINS	G	C	GAA (ALL TEMPERATURES)	BRUSH GREASE ON PIN
	35	FRONT AXLE STEERING CYLINDER	G	C	GAA (ALL TEMPERATURES)	4 FITTINGS
	36	FRONT AXLE STEERING KNUCKLE PIN	G	C	GAA (ALL TEMPERATURES)	2 UPPER FITTINGS, 1 LOWER FITTING EA
	37	FRONT AXLE U-JOINT	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	38	FRONT PROPELLER SHAFT U-JOINTS	G	C	GAA (ALL TEMPERATURES)	3 FITTINGS
	39	REAR PROPELLER SHAFT U-JOINTS	G	C	GAA (ALL TEMPERATURES)	3 FITTINGS
	40	REAR AXLE PIVOT BEARING	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	41	BOOM SUPPORT PIVOT PINS	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	42	REAR AXLE STEERING KNUCKLE PIN	G	C	GAA (ALL TEMPERATURES)	2 UPPER FITTINGS, 1 LOWER FITTING EA
	43	REAR AXLE U-JOINT	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	44	REAR AXLE STEERING CYLINDER	G	C	GAA (ALL TEMPERATURES)	4 FITTINGS
	45	BOGIE CYLINDER	G	C	GAA (ALL TEMPERATURES)	4 FITTINGS
	46	BOGIE LOCK SCREW	G	C	GAA (ALL TEMPERATURES)	1 FITTING
	47	BOGIE WHEEL AXLE	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	48	BOOM FOLDING CYLINDERS	G	C	GAA (ALL TEMPERATURES)	4 FITTINGS
	49	PINTLE HOOK	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	50	CAB DOOR HINGES	G	C	GAA (ALL TEMPERATURES)	2 FITTINGS
	51	TOPHANDLER DOLLY WHEELS	G	C	GAA (ALL TEMPERATURES)	4 FITTINGS
90 DAYS	61	ENG, TRANS & HYD SYS SAMPLING VALVES	CS	O		3 VALVES, AOAP, N3
300 HRS	71	PRIMARY FUEL FILTER	IB, C	O		N3
	72	ENGINE OIL FILTER	IB, D, F	O		N3
	73	ENGINE OIL	IB, D, F	C	EO (0°F/-18°C TO 120°F/49°C), LEO (-20°F/-29°C TO 40°F/4°C) LHO (-70°F/-57°C TO 40°F/4°C)	38.6 QT/36.5 L, N2, N3
	74	COOLANT FILTER	IB, C	O		N3
1000 HRS	81	FRONT AXLE DIFFERENTIAL HOUSING	S, D, F	O	GO (-40°F/-40°C TO 120°F/49°C)	15.9 GAL/60 L, N3
	82	FRONT BRAKE COOLING FILTER	IB, C	O		N3
	83	FRONT AXLE HUB END	S, D, F	O	GO (-40°F/-40°C TO 120°F/49°C)	2.6 GAL/10 L, N3
	84	TRANSMISSION OIL FILTERS	IB, C	O		N3
	85	PILOT PRESSURE FILTER	IB, C	O		N3
	86	HYDRAULIC OIL BREATHER FILTERS	C	O		N3
	87	HYDRAULIC SYSTEM PRESSURE FILTERS	IB, C	O		N3
	88	REAR BRAKE COOLING FILTER	IB, C	O		N3
	89	REAR AXLE HUB END	S, D, F	O	GO (-40°F/-40°C TO 120°F/49°C)	2.77 GAL/10.5 L, N3
	90	REAR AXLE DIFFERENTIAL HOUSING	S, D, F	O	GO (-40°F/-40°C TO 120°F/49°C)	11.1 GAL/42 L, N3
	91	TOPHANDLER MOTOR BRAKE	D, F	O	HO (-10°F/-23°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	UPPER FILL TUBE & FTLG UPPER, N2, N3
	92	TOPHANDLER MOTOR PLANETARY GEAR	D, F	O	GO (-40°F/-40°C TO 120°F/49°C)	LOWER FILL TUBE & FTLG LOWER, N3
	93	TRANSMISSION FLUID	IB, D, F	O	HO (0°F/-18°C TO 120°F/49°C), AHO (-70°F/-57°C TO 40°F/4°C)	30 QT/28 L, N2, N3
	94	HYDRAULIC RETURN FILTERS	IB, C	O		N3

NOTES: N1: SEE LUBRICATION ORDER: LO 10-3930-675-12 FOR INITIAL BREAK-IN.
N2: REFER TO FM 9-207 FOR LUBRICATION INSTRUCTIONS IN COLD WEATHER.
N3: REFER TO LUBRICATION ORDER; LO 10-3930-675-12 FOR SPECIAL INSTRUCTIONS.

350-908

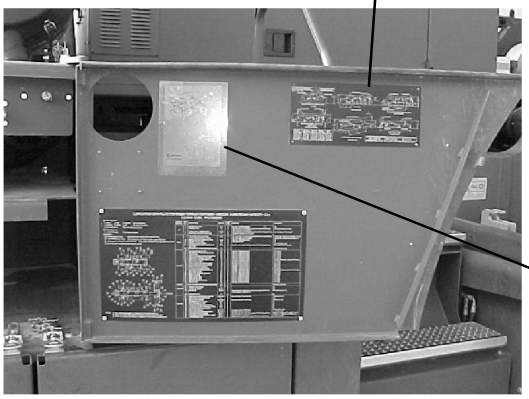
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED 0008 00

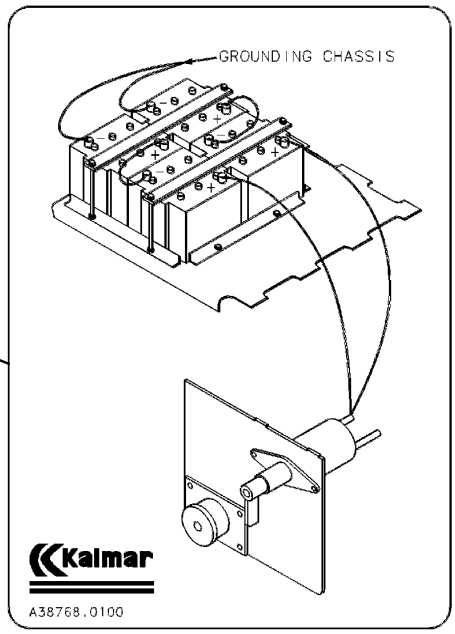
CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



PROVISION STRENGTH	TIEDOWN LONGITUDINAL	TIEDOWN VERTICAL	TIEDOWN LATERAL	LIFTING LOAD
FRONT RIGHT	98,823 LBS	19,921 LBS	27,924 LBS	90,997 LBS
FRONT LEFT	86,877 LBS	17,311 LBS	27,924 LBS	102,301 LBS
REAR RIGHT	97,105 LBS	28,978 LBS	41,338 LBS	93,708 LBS
REAR LEFT	87,595 LBS	26,140 LBS	41,338 LBS	100,204 LBS

CONTAINER HANDLER: ROUGH TERRAIN: 53,000 POUND CAPACITY; AT 48 INCH LOAD CENTER		
MODEL: TRA24055S3M	CAPACITY: 53,000 LBS	GVW: 118,500 LBS
OPERATIONAL HEIGHT: 157.5 IN	WIDTH: 143.7 IN	OPERATIONAL TRAVELING CUBE: 7630 FT³





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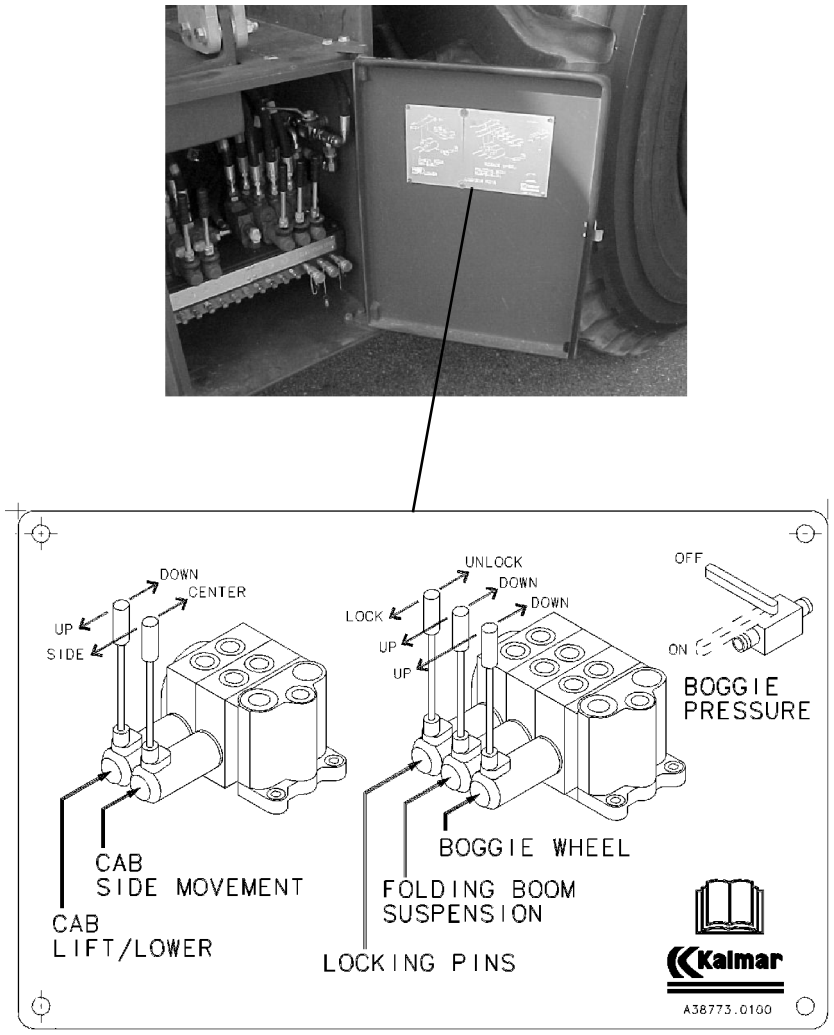
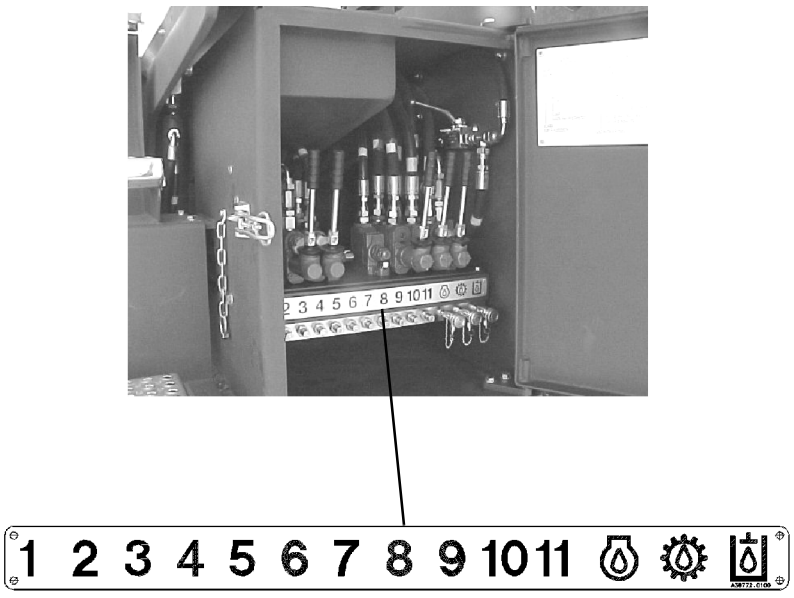
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



350-102

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



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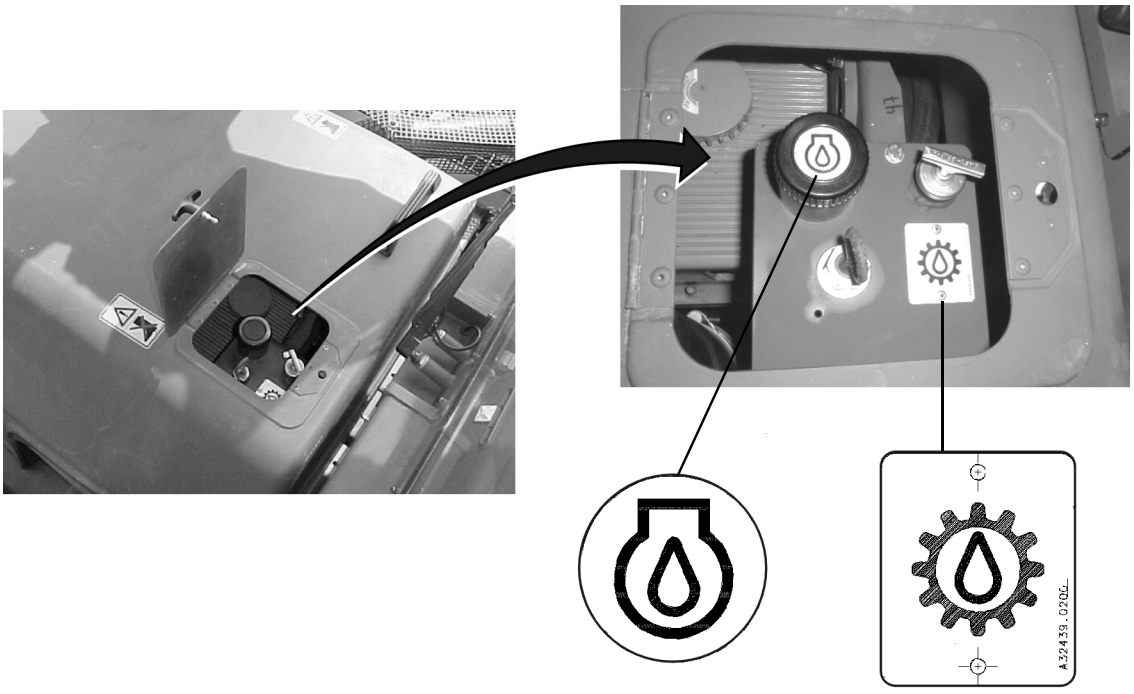
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



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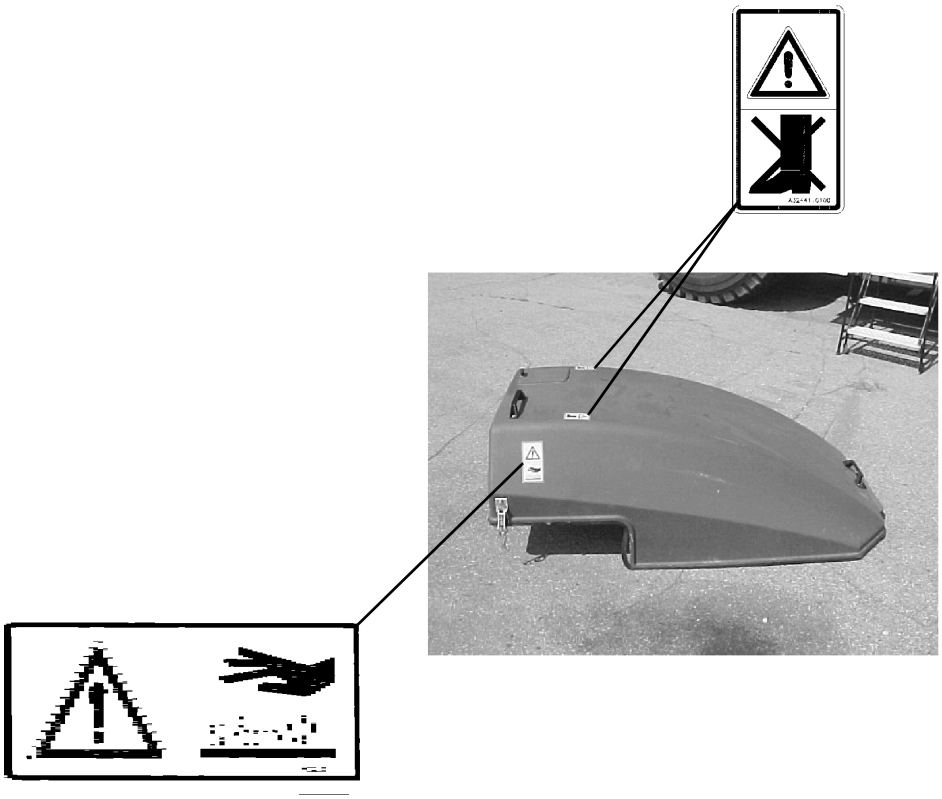
STOWAGE AND DECAL, DATA PLATE, AND STENCIL GUIDE - CONTINUED **0008 00**

CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



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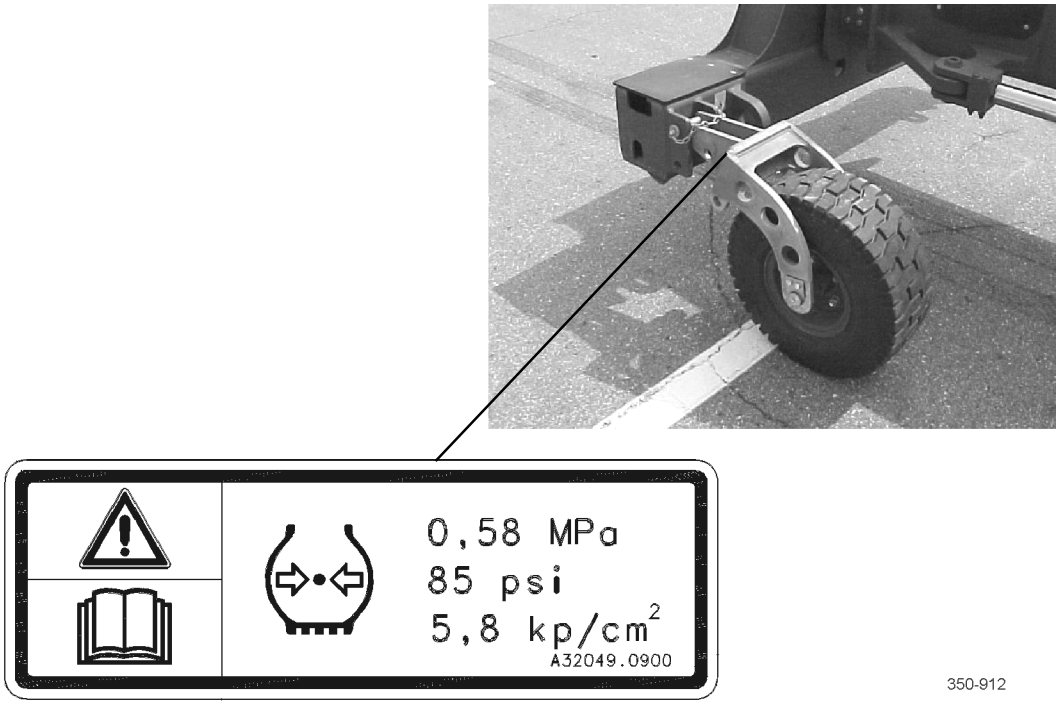
CHASSIS DECALS, PLATES, AND STENCILS - CONTINUED



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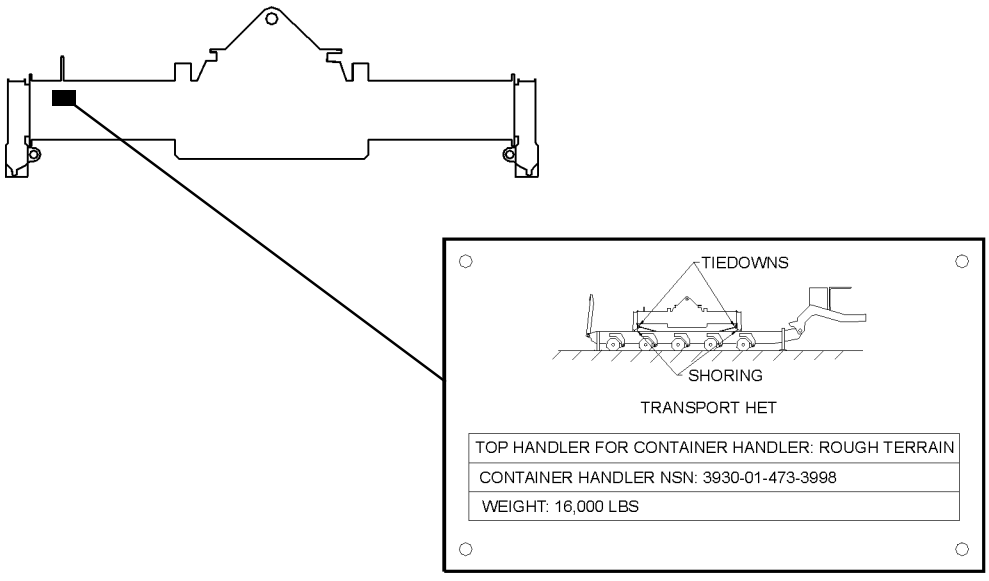
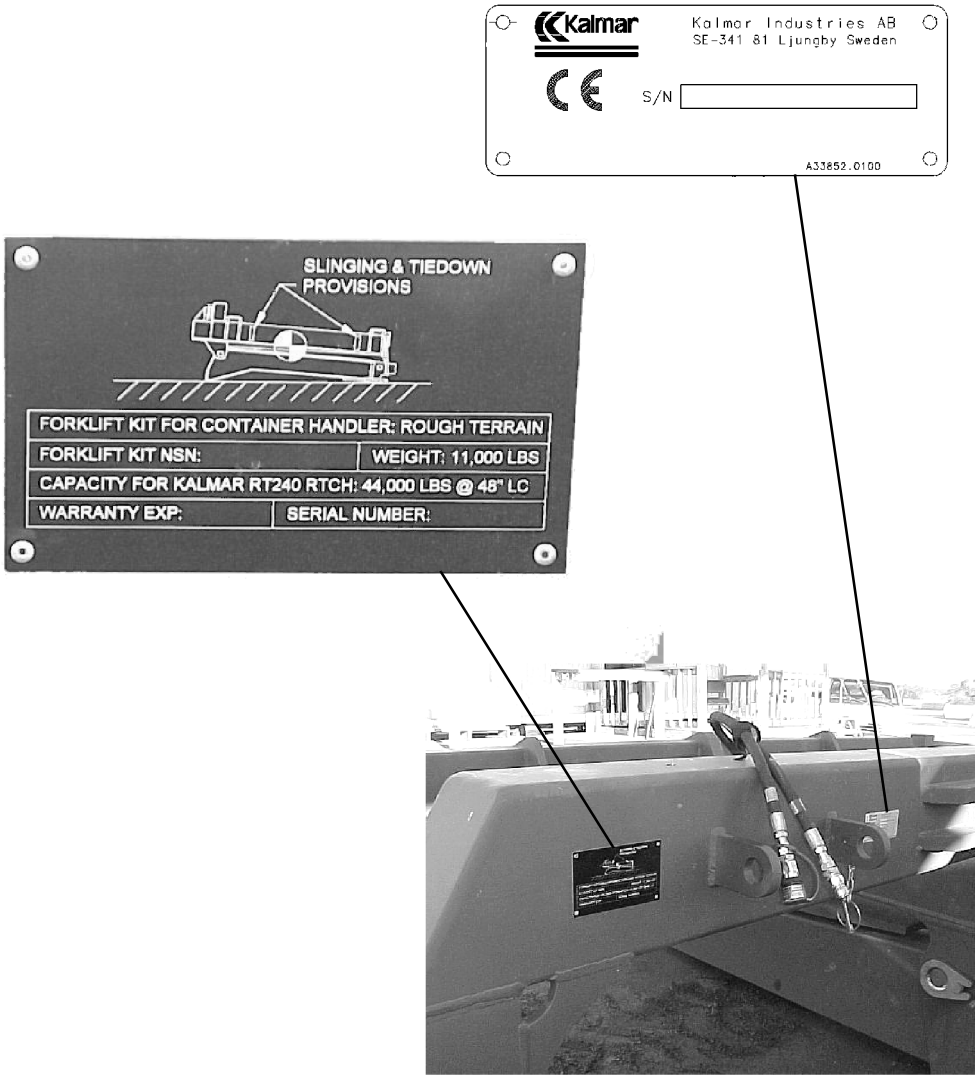


350-1136

FORKLIFT PLATES



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CHAPTER 3
OPERATOR TROUBLESHOOTING

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TROUBLESHOOTING INSTRUCTIONS 0009 00

GENERAL

NOTE

If an error code appears on driver's ECS display screen during operation, refer to WP 0020 00 for further information.

1. This chapter provides information for identifying and correcting malfunctions which may develop while operating the RTCH-RT 240.
2. The Troubleshooting Symptom Index in WP 0010 00 lists common malfunctions which may occur and refers you to the proper page in WP 0011 00, Table 1 for a troubleshooting procedure.
3. The Troubleshooting Symptom Index cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by the listed corrective actions, notify your supervisor.
4. If you are unsure of the location of an item mentioned in troubleshooting, refer to WP 0002 00 or WP 0004 00.
5. Before performing troubleshooting, read and follow all safety instructions found in the Warning Summary at the front of this manual.
6. When troubleshooting a malfunction:
   a. Locate the symptom or symptoms in WP 0010 00 that best describe the malfunction.
   b. Turn to the page in WP 0011 00, Table 1 where the troubleshooting procedures for the malfunction in question are described. Headings at the top of each page show how each troubleshooting procedure is organized: SYMPTOM, MALFUNCTION, and CORRECTIVE ACTION.
   c. Perform each step in the order listed until the malfunction is corrected. DO NOT perform any maintenance task unless the troubleshooting procedure tells you to do so.

EXPLANATION OF COLUMNS

The columns in WP 0011 00, Table 1 are defined as follows:

1. **SYMPTOM.** Indicates fault that has occurred in system/equipment.
2. **MALFUNCTION.** Indicates probable cause for fault symptom.
3. **CORRECTIVE ACTION.** Indicates procedure to correct the problem.

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TROUBLESHOOTING SYMPTOM INDEX 0010 00

NOTE

Whenever ECS display screen indicates a fault code, shut down engine, then restart engine. If fault code persists, notify Organizational Maintenance.

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Table 1. Troubleshooting Procedures.

ENGINE WILL NOT START

SYMPTOM

Engine will not crank or cranks slowly.

MALFUNCTION

Ensure master battery switch is in ON position.

CORRECTIVE ACTION

Turn master battery switch to ON position.

Check for loose or disconnected battery cables.

CORRECTIVE ACTION

If cables or connectors are loose, broken or disconnected notify Organizational Maintenance.

Battery charging error code indicates low voltage.

Batteries low or discharged.

CORRECTIVE ACTION

Attempt to slave start vehicle (WP 0006 00) and notify Organizational Maintenance.

Engine cranks but will not start.

Fuel tank is empty or low on fuel.

CORRECTIVE ACTION

Fill fuel tank (WP 0015 00).

Fuel/water separator contains water or is clogged.

CORRECTIVE ACTION

Drain fuel/water separator (*Weekly* PMCS, WP 0013 00).

ECS display screen indicates engine fault code(s).

Notify Organizational Maintenance.

ENGINE STARTS BUT WILL NOT KEEP RUNNING

SYMPTOM

Engine stops running after starting.

MALFUNCTION

Fuel tank is empty or low on fuel.

CORRECTIVE ACTION

Fill fuel tank (WP 0015 00).

Fuel/water separator contains water or is clogged.

CORRECTIVE ACTION

Drain fuel/water separator (*Weekly* PMCS, WP 0013 00).

Table 1. Troubleshooting Procedures - Continued.

ENGINE STARTS BUT WILL NOT KEEP RUNNING - CONTINUED

MALFUNCTION

Check fuel lines, connections, and filters for leakage or damage.

CORRECTIVE ACTION

Notify Organizational Maintenance.

ECS display screen indicates engine fault code(s).

CORRECTIVE ACTION

Notify Organizational Maintenance.

ENGINE RUNS ROUGH

SYMPTOM

Rough idling and misfires.

MALFUNCTION

Check for white or blue smoke, indicating engine is cold.

CORRECTIVE ACTION

Allow engine reach normal operating temperature of 180°F to 200°F (82°C to 93°C).

Fuel/water separator contains water or is clogged.

CORRECTIVE ACTION

Drain fuel/water separator (*Weekly* PMCS, WP 0013 00).

Check fuel lines, connections, and filters for leakage or damage.

CORRECTIVE ACTION

Notify Organizational Maintenance.

ECS display screen indicates engine fault code(s).

CORRECTIVE ACTION

Notify Organizational Maintenance.

ENGINE LOW ON POWER

SYMPTOM

Engine will not run at normal operating range of 1800 to 2100 RPMs.

MALFUNCTION

Air cleaner is clogged or restricted.

CORRECTIVE ACTION

Service air cleaner assembly (WP 0014 00).

Check fuel lines, connections, and filters for leakage or damage.

CORRECTIVE ACTION

Notify Organizational Maintenance.

Table 1. Troubleshooting Procedures - Continued.

ENGINE LOW ON POWER - CONTINUED

MALFUNCTION

Check for overfull engine oil level.

CORRECTIVE ACTION

Notify Organizational Maintenance.

ECS display screen indicates engine fault code(s).

CORRECTIVE ACTION

Notify Organizational Maintenance.

ENGINE OVERHEATS

WARNING

DO NOT service cooling system unless engine has been allowed to cool down. DO NOT remove radiator cap. Add coolant only to expansion tank. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.

SYMPTOM

Engine temperature exceeds 200ºF (93ºC).

MALFUNCTION

Check for low coolant level in the expansion tank.

CORRECTIVE ACTION

If low, add appropriate amount of coolant to the expansion tank (*After* PMCS, WP 0013 00).

Check cooling system for loose or leaking lines, hoses, and fittings.

CORRECTIVE ACTION

Notify Organizational Maintenance.

Check for obstructions and trash buildup on radiator fins and grille.

CORRECTIVE ACTION

If radiator fins and grille are obstructed, clean and remove obstructions.

Check for overfull engine oil level.

CORRECTIVE ACTION

Notify Organizational Maintenance.

ECS display screen indicates engine fault code(s).

CORRECTIVE ACTION

Notify Organizational Maintenance.

Table 1. Troubleshooting Procedures - Continued.

LOW ENGINE OIL PRESSURE

SYMPTOM

Engine oil pressure at idle is below 10 psi (70 kPa) and/or below 30 psi (207 kPa) at 1200 rpm.

MALFUNCTION

Check for low engine oil level.

CORRECTIVE ACTION

If oil level is low, add engine oil as required (*Before* PMCS, WP 0013 00).

Check for external oil leaks.

CORRECTIVE ACTION

If oil leaks are found, notify Organizational Maintenance.

ECS display screen indicates engine fault code(s).

CORRECTIVE ACTION

Notify Organizational Maintenance.

SLOW OR NO TRANSMISSION FUNCTIONS

SYMPTOM

Truck will not move in forward or reverse direction.

MALFUNCTION

Check to ensure parking brake is released.

CORRECTIVE ACTION

Release parking brake.

Check if transmission oil level is low.

CORRECTIVE ACTION

If transmission oil level is low, add oil as required (*After* PMCS, WP 0013 00).

ECS display screen indicates transmission fault code(s).

CORRECTIVE ACTION

Shut down engine and restart. If failure persists, notify Organizational Maintenance.

Transmission will not upshift or downshift properly.

Check if transmission oil level is low.

CORRECTIVE ACTION

If transmission oil level is low, add oil as required (*After* PMCS, WP 0013 00).

ECS display screen indicates transmission fault code(s).

CORRECTIVE ACTION

Shut down engine and restart. If failure persists, notify Organizational Maintenance.

Table 1. Troubleshooting Procedures - Continued.

ERRATIC OR NO STEERING CONTROL

SYMPTOM

Steering system not responding to steering wheel movement.

MALFUNCTION

Ensure vehicle is in 2-wheel steer.

CORRECTIVE ACTION

Place vehicle in 2-wheel steer. Recheck steering.

Hydraulic system oil level is low.

CORRECTIVE ACTION

If hydraulic system reservoir oil level is low, add oil as required (*Before* PMCS, WP 0013 00).

ECS display screen indicates steering system fault code(s).

CORRECTIVE ACTION

Shut down engine and restart. If failure persists, notify Organizational Maintenance.

Steering system not responding to two, four or crab steering selection modes.

ECS display screen indicates steering system fault code(s).

CORRECTIVE ACTION

Shut down engine and restart. If failure persists, notify Organizational Maintenance.

POOR OR ERRATIC BRAKING CONTROL

SYMPTOM

Brakes will not hold truck and/or brakes operate erratically.

MALFUNCTION

There are obstructions or trash building under brake pedal.

CORRECTIVE ACTION

Remove obstructions or trash.

ECS display screen indicates brake system fault code(s).

CORRECTIVE ACTION

Shut down engine and restart. If failure persists, notify Organizational Maintenance.

Parking brake will not hold truck.

CORRECTIVE ACTION

Chock vehicles wheels. Notify Organizational Maintenance.

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CHAPTER 4
OPERATOR MAINTENANCE INSTRUCTIONS

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PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION 0012 00

GENERAL

To ensure that the RTCH-RT 240 is ready for operation at all times, it must be inspected on a regular basis so that defects may be found and corrected before they result in serious damage, equipment failure, or injury to personnel. Table 1 in WP 0013 00 contains systematic instructions on inspections, adjustments, and corrections to be performed by the operator/crew to keep your equipment in good operating condition and ready for its primary mission.

EXPLANATION OF TABLE ENTRIES

1. **Item Number (Item No.) Column.** Numbers in this column are for reference. When completing DA Form 5988-E *(Equipment Inspection and Maintenance Worksheet)*, include the item number for the check/service indicating a fault. Item numbers also appear in the order that you must perform checks and services for the interval listed.
2. **Interval Column.** This column tells you when you must perform the procedure in the procedure column.
   a. *Before* procedures must be done immediately before you operate the truck.
   b. *During* procedures must be done while you are operating the truck.
   c. *After* procedures must be done immediately after you have operated the truck.
   d. *Weekly* procedures must be done once each week.
   e. *Monthly* procedures must be done once each month.
3. **Location, Item to Check/Service Column.** This column provides the location and item to be checked or serviced. The item location is underlined.

NOTE

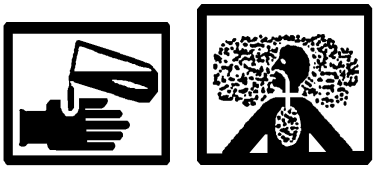
The WARNINGs and CAUTIONs appearing in your PMCS table should always be observed. WARNINGs and CAUTIONs appear before applicable procedures. You must observe these WARNINGs to prevent serious injury to yourself and others, and CAUTIONs to prevent your equipment from being damaged.

4. **Procedure Column.** This column gives the procedure you must perform to check or service the item listed in the Item to Check/Service column to know if the equipment is ready or available for its intended mission or for operation. You must perform the procedure at the time stated in the interval column.
5. **Not Fully Mission Capable If: Column.** Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you perform check/service procedures that show faults listed in this column, the equipment is not mission-capable. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

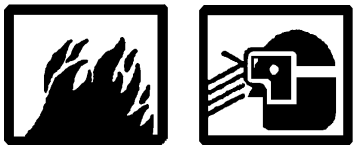
GENERAL PMCS PROCEDURES

1. Always perform PMCS in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry. If the truck does not perform as required, refer to the appropriate troubleshooting procedure in Chapter 3.
2. If anything looks wrong and you can't fix it, write it on your DA Form 5988-E. If you find something seriously wrong, IMMEDIATELY report it to your supervisor.
3. Before performing preventive maintenance, read all the checks required for the applicable interval and prepare all the tools you need to make all the checks. You'll always need a rag (Item 12, WP 0019 00) or two.

GENERAL PMCS PROCEDURES - CONTINUED



WARNING



Dry cleaning solvent P-D-680 Type III is toxic and flammable. Wear protective goggles and gloves and use only in a well-ventilated area. Avoid contact with skin, eyes, and clothes and do not breathe vapors. Do not use near open flame or excessive heat. The solvent's flash point is 200°F (94°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical help. If solvent contacts eyes, wash your eyes and get medical aid immediately.

a. **Keep It Clean.** Dirt, grease, oil, and debris get in the way and may cover up a serious problem. Clean as you work and as needed. Use dry cleaning solvent (Item 13, WP 0019 00) on all metal surfaces. Use detergent (Item 3, WP 0019 00) and water when you clean rubber, plastic, and painted surfaces.

b. **Rust and Corrosion.** Check metal parts for rust and corrosion. If any bare metal or corrosion exists, clean and apply a light coat of lubricating oil (Item 10, WP 0019 00). Report it to your supervisor.

c. **Bolts, Nuts, and Screws.** Check bolts, nuts, and screws for obvious looseness, missing, bent, or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal, or rust around bolt heads. If you find one you think is loose, tighten it.

d. **Welds.** Look for loose or chipped paint, rust, or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.

e. **Electric Wires and Connectors.** Look for cracked or broken insulation, bare wires, and loose or broken connectors. Tighten loose connectors and ensure that the wires are in good condition.

f. **Hoses and Fluid Lines.** Look for wear, damage, and signs of leaks. Ensure that clamps and fittings are tight. Wet spots indicate leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, report it to your supervisor.

g. **Fluid Leakage.** It is necessary for you to know how fluid leakage affects the status of your truck. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your truck. Learn and be familiar with them, and remember - when in doubt, notify your supervisor.

CAUTION

Operation is allowable with Class I and Class II leakage. WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR. When operating with Class I or Class II leaks, check fluid levels more frequently. Class III leaks must be reported immediately to your supervisor. Failure to do this will result in damage to vehicle and/or components.

Leakage Definitions for PMCS

Class I	Leakage indicated by wetness or discoloration, but not great enough to form drops.
Class II	Leakage great enough to form drops, but not enough to cause drops to drip from the item being checked/inspected.
Class III	Leakage great enough to form drops that fall from the item being checked/inspected.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			NOTE • Review all WARNINGs, CAUTIONs, and NOTEs before performing PMCS and operating the RTCH-RT 240. • Perform all PMCS checks if: a. You are the assigned operator but have not operated the truck since the last weekly checks. b. You are operating the truck for the first time. • At 100 hours of operation, notify Organizational Maintenance to perform 100-hour initial checks and services.	
		FRONT AND LEFT SIDE		
1	Before	**Overall View**	a. Check under truck for evidence of fluid leakages such as oil, coolant or hydraulic fluid.	a. Class III oil, coolant or hydraulic leaks are evident. Any fuel leaks are evident.
			b. Visually check for damaged tires. Check for missing or signs of loose lug nuts.	b. A tire with major damage that would impair operation or missing lug nuts are found.
2	Before	**Hydraulic Cylinders**	Check hydraulic cylinders behind staircase, hydraulic hoses, lines, and fittings for damage and leaks.	Class III leaks are evident.
3	Before	**Remote Hydraulic Control Compartment**	a. Open compartment door and visually check hydraulic controls, valves, and lines for signs of leakage.	a. Class III leaks are evident.
			b. Check compartment door, door hinge, and retaining latch for damage.	
4	Before	**Cab Exterior**	a. Check for damage to cab door, steps, and handrail.	
			NOTE Operation of vehicle with damaged or missing windshield, wiper arms/blades may violate AR 385-55.	
			b. Check for damage to cab glass (front, top, sides, and rear), windshield wiper blades, and arms.	b. Damage that would interfere with visibility or impair safe operation is evident.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
4 (Con't)	**Before**	**Cab Exterior**	c. Check for damage to the rear of cab, windshield washer reservoir, horn, air conditioning system components, and hydraulic lines and cylinders.	c. Class III leaks are evident.
5	**Before**	**Boom Support Locking Pin**	Ensure that boom support locking pin is present and extension is locked by retaining pin in extended position.	Boom support locking pin is missing, extension is not locked in extended position or is damaged.
				
		REAR AND RIGHT SIDE		
6	**Before**	**Overall View**	a. Check under truck for evidence of fluid leakages such as oil, coolant or hydraulic fluid.	a. Class III oil, coolant or hydraulic leaks are found. Any fuel leaks are found.
			b. Visually check for damaged tires. Check for missing or signs of loose lug nuts.	b. A tire with major damage that would impair operation or missing lug nuts are found.
7	**Before**	**Hydraulic Cylinders**	Check hydraulic cylinders, hoses, lines, and fittings for damage and leaks.	Class III leaks are evident.
8	**Before**	**Boom Support Locking Pin**	Ensure that boom support locking pin is present and extension is locked in extended position.	Boom support locking pin is missing, extension is not locked in extended position or is damaged.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

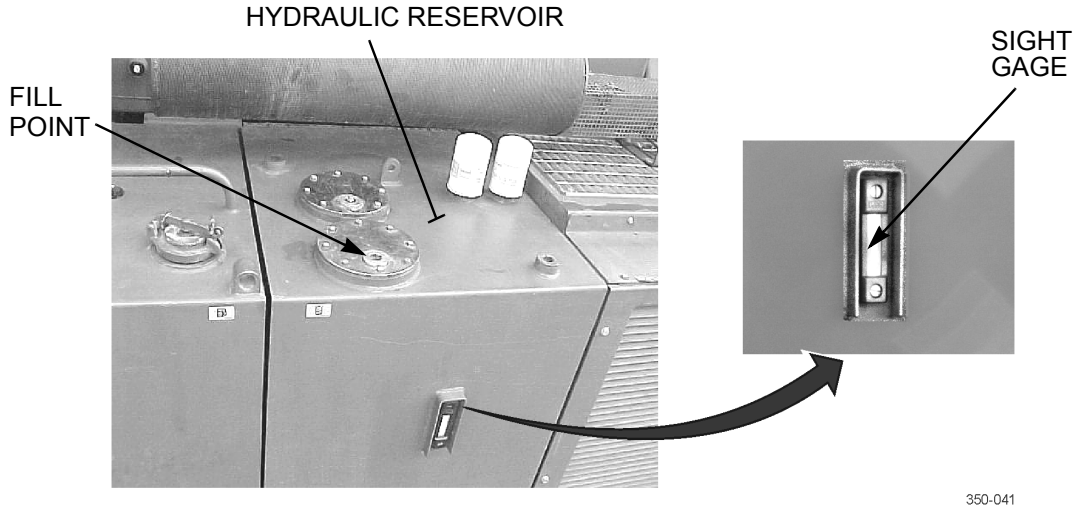
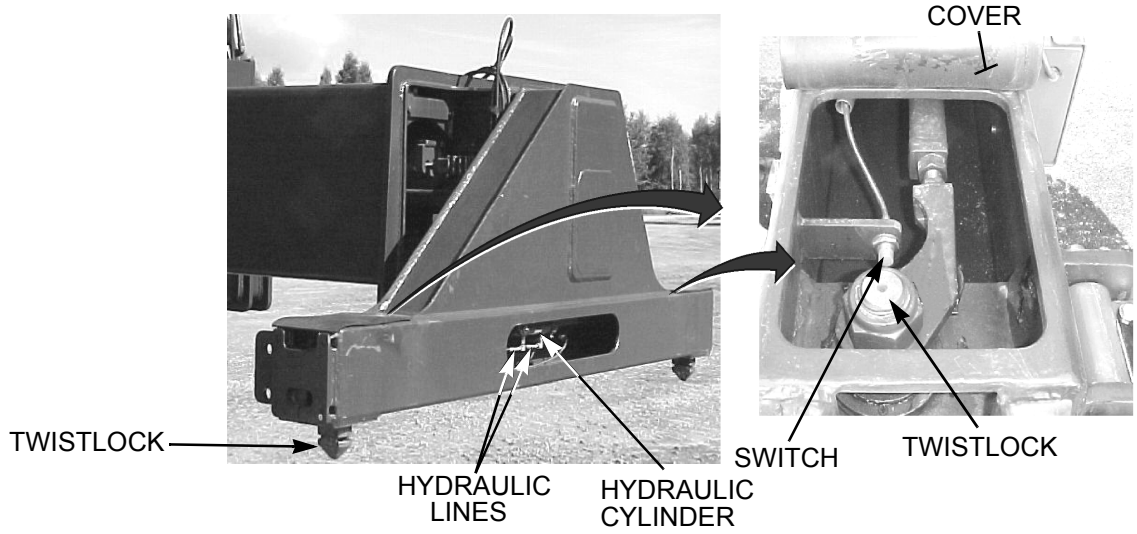
ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
9	**Before**	**Hydraulic Reservoir and Sight Gage**	a. Check for damage and leaks.	a. Class III leaks are evident.
			NOTE Boom must be fully lowered and retracted and truck on level ground before checking hydraulic oil level in reservoir. Engine should be stopped at least five minutes.	
			b. Check hydraulic oil in oil level sight gage. If hydraulic oil is visible in sight gage, level is okay. If level is low, add oil IAW instructions in LO 10-3930-675-12.	b. Hydraulic oil level is below sight gage.
				
		LIFTING BOOM AND TOP-HANDLER		
10	**Before**	**Boom Hydraulics**	Check hydraulic cylinders, hoses, lines, and fittings for damage and leaks.	Class III leaks are evident.
11	**Before**	**Tophandler Hydraulics**	Check hydraulic cylinders, hoses, lines, and fittings for damage and leaks.	Class III leaks are evident.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
12	**Before**	**Twistlocks**	Visually check all twistlocks, hydraulic cylinders, electrical wiring, and switches for signs of damage.	Damage that would impair operation is evident. Class III leaks are evident.



			NOTE To ensure an accurate reading, vehicle must be parked on level ground.	
13	**Before**	**Engine Oil Level**	Check engine oil level on dipstick. Maintain oil level within cross hatched area at end of dipstick. If level is low, add oil IAW LO 10-3930-675-12.	

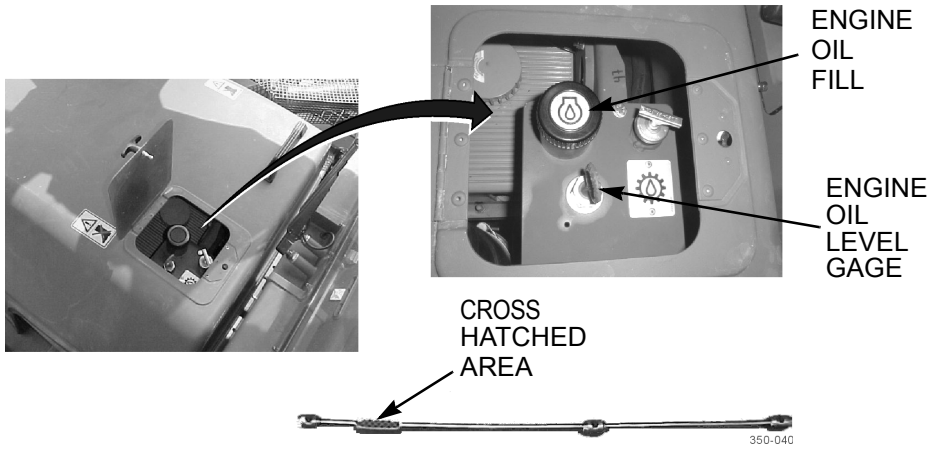


Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			NOTE Perform the following checks if forklift kit is to be used.	
14	Before	Forklift Kit	a. Ensure all retaining and locking pins are present and properly secured.	a. Retaining or locking pins are missing.
			b. Inspect hydraulic hoses and quick disconnects for dirt, damage, and proper operation.	b. Hydraulic hoses or quick disconnects are damaged.
		CAB INTERIOR		
			NOTE Refer to WP 0004 00 for the location of all gages, switches, and indicator lights.	
15	Before	Instrument Panel	Check for damaged gages, switches, indicator, and warning lights.	Any warning indicator is broken or unreadable.
16	Before	Fire Extinguisher	a. Check for missing or damaged fire extinguisher.	a. Fire extinguisher is missing or damaged.
			b. Check gage for proper pressure reading.	b. Pressure gage needle is in recharge area.
			c. Check for damaged or missing seal.	c. Seal is broken or missing.
17	Before	Seat and Seat Belt	Check seat and seat belt for damage and proper operation.	Seat belt is damaged.
18	Before	Steering Wheel and Column	Check steering wheel and column for damage and proper operation (tilt and height adjustments).	
19	During	Engine Startup	a. Start engine. Verify that all indicator and warning lights operate properly on ECS display screen.	a. Engine will not start. Warning lights remain ON.
			b. Check air cleaner restriction indicator. If red band is showing, service air cleaner as soon as possible (WP 0014 00).	b. Red band is showing.
			c. Check operating lights (brake lights, turn signals, etc.).	c. Brake lights and turn signals do not operate.
20	During	Hydraulic Controls	a. Perform a functional check of all lifting boom and tophandler operations.	a. Any system or function is not operating properly.

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ITEM NO.	INTERVAL	LOCATION ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
20 (Con't)	**During**	**Hydraulic Controls**	b. Ensure red twistlock indicator light at end of boom is lit.	b. Twistlock indicator light is not lit.
21	**During**	**Instrument Panel**	a. With RTCH fully warmed up, monitor indicators and warning lights on ECS display screen. Check that engine oil pressure and temperature and transmission and hydraulic system and engine coolant temperatures register within normal ranges: • Engine oil pressure—15-35 psi (103-241 kPa) • Engine oil temperature—195-240°F (91-116°C) • Transmission temperature—175-220°F (79-104°C) • Hydraulic oil temperature—below 160°F (71°C) • Coolant temperature—175-210°F (79-99°C)	a. ECS display screen indicates an abnormal reading.
			b. Ensure alternator charging lamp is not lit.	b. Alternator charging lamp remains lit.
			c. Monitor all lifting boom and tophandler functions on the ECS display screens.	c. Loss of ECS display functions occurs.
22	**During**	**Brakes**	a. Check service brakes for pulling, grabbing or reduced braking ability.	a. Brakes pull, grab or exhibit unsafe operation.
			b. Check parking brake operation with engine idling and transmission in high range.	b. Parking brake will not hold truck.
23	**During**	**Steering**	Check for smooth, controlled steering without pulling or drifting. Check two-wheel, four-wheel, and crab modes of steering operation.	Steering is erratic or will not change modes of operation.
24	**During**	**Drive Train**	Check for unusual noise or vibration from engine, transmission, drive shafts, axles, and wheels.	
25	**During**	**Overall Leakage**	Be alert for evidence of fluid leakage.	Class III oil, coolant or hydraulic leaks are evident. Any fuel leaks are evident.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
		FRONT AND LEFT SIDE		
26	**After**	**Overall View**	a. Check under truck for evidence of fluid leakages such as oil, coolant or hydraulic fluid.	a. Class III oil, coolant or hydraulic leaks are evident. Any fuel leaks are evident.
			b. Visually check for damaged tires. Check for missing or signs of loose lug nuts.	b. A tire with major damage that would impair operation or missing lug nuts are found.
27	**After**	**Left-Front Fender and Lights**	a. Check fender and mirror for damage or missing parts.	
			b. Check all light assemblies for damage.	b. Damage to lights that would impair their operation is evident.
28	**After**	**Battery Storage Compartment**	a. Open battery storage compartment door and visually check batteries, battery cables, and master battery switch for damage.	a. Damage or missing parts that would impair operation is evident.
			b. Check storage compartment door, door hinge, and retaining latch for damage.	
		REAR AND RIGHT SIDE		
29	**After**	**Overall View**	a. Check under truck for evidence of fluid leakages such as oil, coolant or hydraulic fluid.	a. Class III oil, coolant or hydraulic leaks are evident. Any fuel leaks are evident.
			b. Visually check for damaged tires. Check for missing or signs of loose lug nuts.	b. A tire with major damage that would impair operation or missing lug nuts are found.
30	**After**	**Rear Fenders, Lights, and Backup Alarm**	a. Check rear fenders for damage or missing parts.	
			b. Check all light assemblies and backup alarm for damage.	b. Lights or backup alarm is damaged.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
31	**After**	**Folding Step and Ladder**	Check for damage or missing parts.	
32	**After**	**Hydraulic Reservoir and Sight Gage**	a. Check for damage and leaks.	a. Class III leaks are evident.
			NOTE Boom must be fully lowered and retracted, and truck on level ground before checking hydraulic oil level in reservoir. Engine should be stopped at least five minutes.	
			b. Check hydraulic oil in the oil level sight gage. If hydraulic oil is visible in sight gage, level is okay. If level is low, add oil IAW LO 10-3930-675-12.	b. Hydraulic oil level is below sight gage.

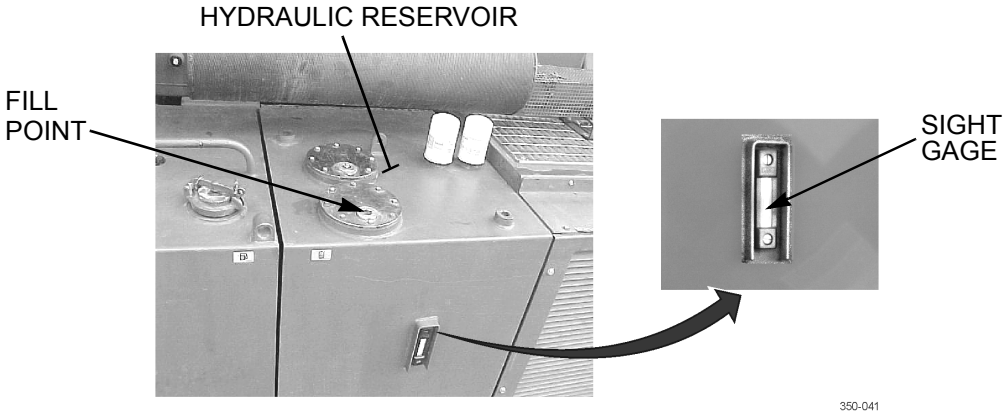


Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
33	After	Fuel Tank and Filler Cap	**WARNING** DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel.	
			Check fuel tank, filler cap, and cap seal for damage or leakage.	Any damage or leakage is evident.

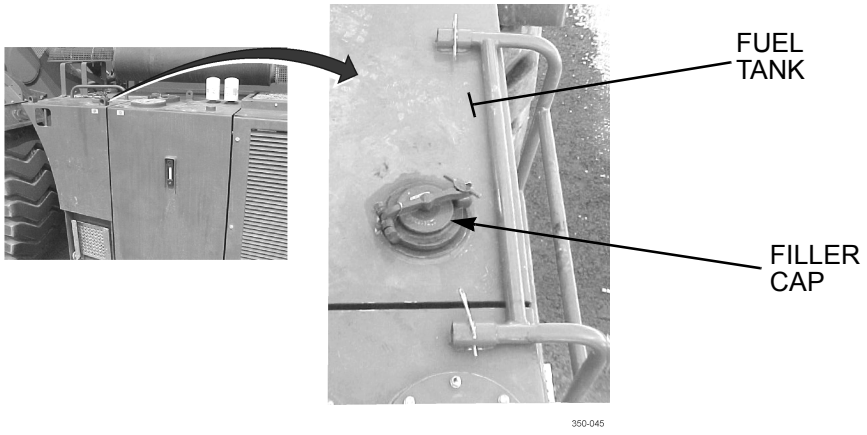


Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

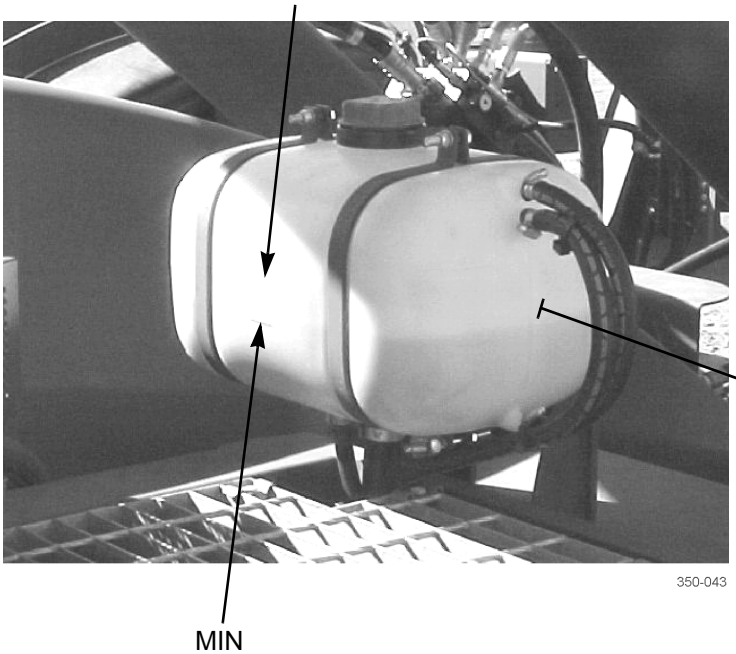
ITEM NO.	INTERVAL	LOCATION ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
			 **WARNING**  • DO NOT service cooling system unless engine has been allowed to cool down. DO NOT remove radiator cap. Add coolant only to expansion tank. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns. • Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury.	
			a. Visually check radiator for leaks, damage or obstructions. Remove any obstructions.	a. Class III leaks are evident.
			b. Check coolant level in expansion tank. Level should be between the MIN and MAX lines on tank. Add coolant as required.	
				

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

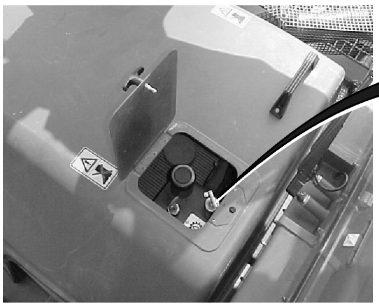
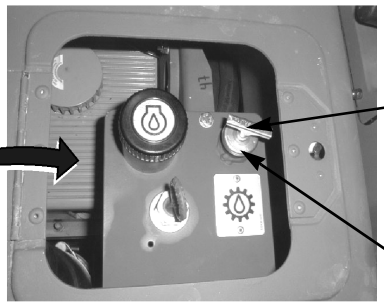
ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
34	After	Right-Front Fender and Lights	a. Check fender and mirror for damage or missing parts.	
			b. Check all light assemblies for damage and proper operation.	b. Lights are damaged.
35	After	Transmission Oil Level	With engine idling, transmission selector lever in N, parking brake set, and engine at operating temperature [coolant temperature of 180°F (82°C) minimum], remove transmission dipstick. Level as indicated on dipstick should be maintained within two indicator marks at end of dipstick. If level is low, add transmission fluid IAW LO 10-3930-675-12.	
			   350-899	
36	After	Engine Oil Level	**NOTE** To ensure an accurate reading, vehicle must be parked on level ground. Wait 10 minutes after shutting down engine to allow oil to drain into crankcase. Check engine oil level on dipstick. Maintain oil level within cross hatched area at end of dipstick. If level is low, add oil IAW LO 10-3930-675-12.	

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

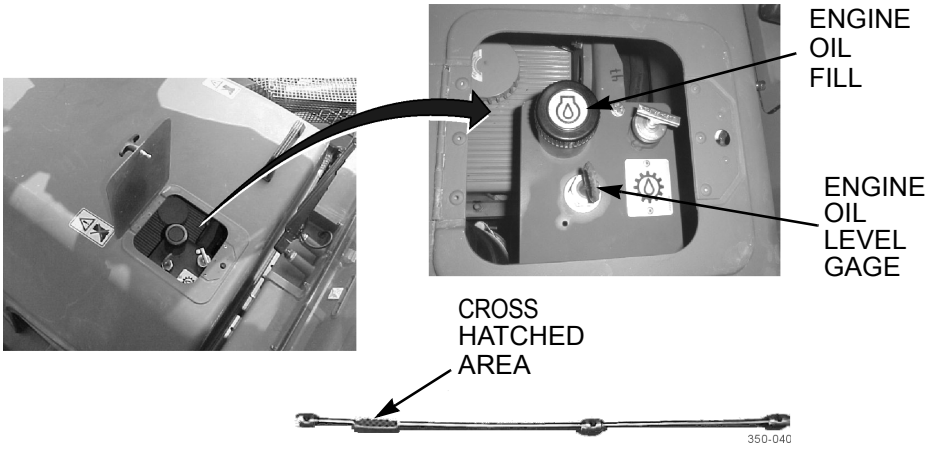
ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
37 (Con't)	**After**	**Engine Oil Level**		
				
		LIFTING BOOM AND TOPHANDLER		
37	**After**	**Boom Hydraulics**	a. Check hydraulic cylinders for damage and leaks.	a. Class III leaks are evident.
			b. Check hydraulic hoses, lines, and fittings for damage and leaks.	b. Class III leaks are evident.
38	**After**	**Boom Lights**	Check all light assemblies for damage or missing parts.	Damage to lights that would impair night operation. Twist-lock indicator lights are damaged.
39	**After**	**Tophandler Hydraulics**	a. Check hydraulic cylinders for damage and leaks.	a. Class III leaks are evident.
			b. Check hydraulic hoses, lines, and fittings for damage and leaks.	b. Class III leaks are evident.
40	**After**	**Tophandler Lights**	Check all light assemblies for damage or missing parts.	Damage to work lights that would impair night operation.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

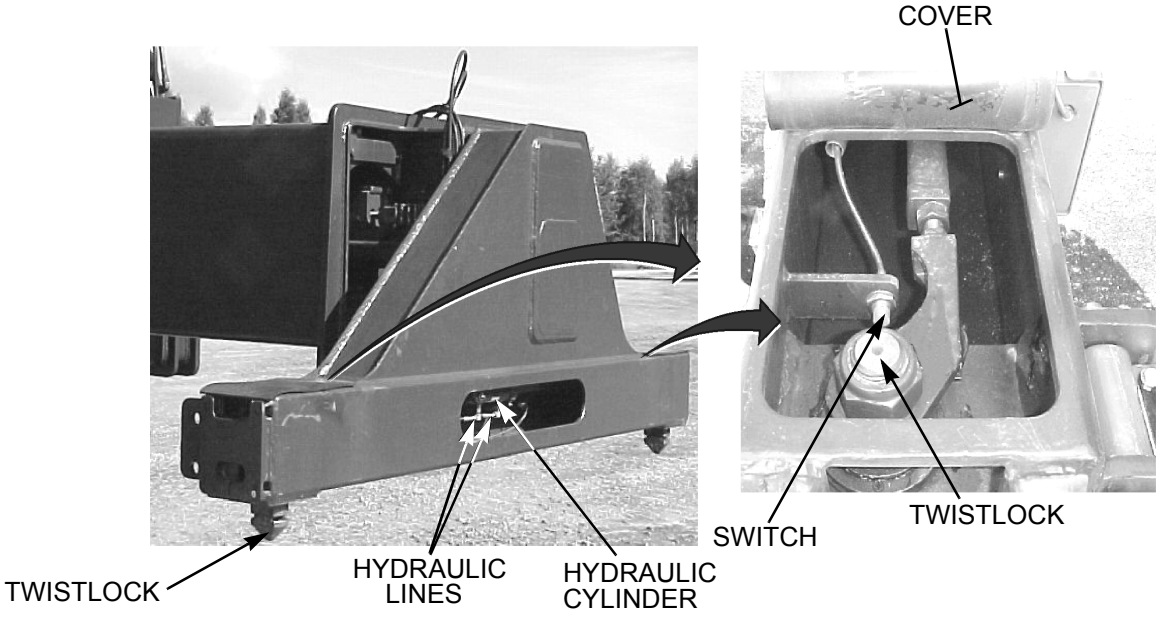
ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
41	**After**	**Twistlocks**	Visually check all twistlocks, hydraulic cylinders, electrical wiring, and switches for signs of damage.	Damage that would impair operation is evident. Class III leaks are evident.
				
			NOTE Perform the following checks if forklift kit was used.	
42	**After**	**Forklift Kit**	a. Check for damage or leaks to lines, fittings, and hydraulic cylinders. b. Check for cracks or other damage to forks. c. Inspect fork positioning shaft for dirt or damage.	a. Class III leaks are evident.
43	**Weekly**	**Air Cleaner Assembly**	**WARNING** If NBC exposure is suspected, all air cleaner media should be handled by personnel wearing protective equipment. Consult your NBC officer or NBC NCO for appropriate handling or disposal procedures.	
			Remove cover and service air cleaner assembly as required (WP 0014 00).	

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
44	Weekly	Drive Belts	a. Check for loose, missing, broken, frayed or cracked alternator belt.	a. Belt is loose or damaged.
			b. Check for loose, missing, broken, frayed or cracked air conditioner drive belts.	b. Belts are loose or damaged.
				
45	Weekly	Fuel/Water Separator	 **WARNING** DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to vehicle and injury or death to personnel. **NOTE** Ensure that a suitable container is used to catch draining fluid.	

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

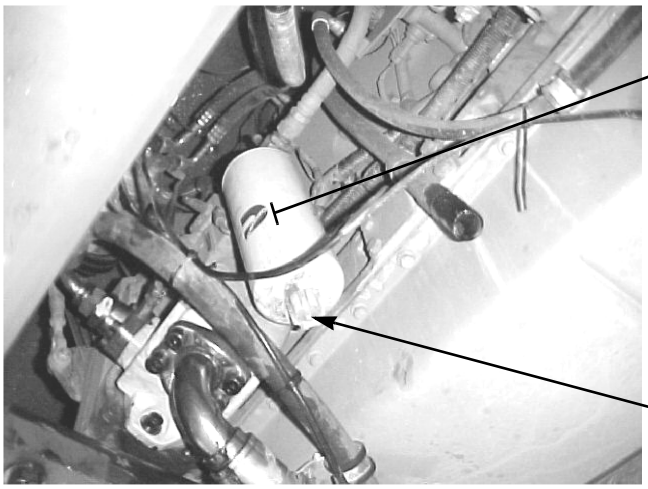
ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
46 (Con't)	**Weekly**	**Fuel/Water Separator**	Turn drain knob counterclockwise and drain all water from fuel/water separator. Turn knob clockwise to close.	
			 350-046	
46	**Weekly**	**Ether Quick-Start System**	 **WARNING** Ether is highly flammable and explosive. DO NOT perform ether quick-start system checks or inspections while smoking or near fire, flame or sparks. Failure to follow this warning may cause a fire or explosion, causing serious injury or death to personnel.	
			Check for loose connections and damage to lines, fittings, and canister. Be alert for odor of leaking ether.	Damage is noted.

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
47	Weekly	Batteries	  **WARNING**  To avoid eye injury, eye protection is required when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry, such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment, and injury to personnel. **CAUTION** To reduce battery damage, do not remove batteries from vehicle battery compartment unless the compartment is corroded (greenish/white powder). DO NOT jerk or pull on battery cables during visual inspection. Battery replacement will be performed by Organizational Maintenance.	
			a. Remove battery compartment cover. Check battery compartment for damaged or missing batteries.	a. Damage is noted.
			b. Check for damaged or missing battery filler caps.	b. Damage is noted.
			c. Check level of distilled water in battery cells. Fluid level should be to bottom of split ring.	c. Fluid level is low.
			d. Check for missing, broken, split or frayed cables.	d. Battery cables are damaged.
			e. Check for damaged terminal posts.	e. Damage is noted.
			f. Check for rust, corrosion, and cleanliness.	

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
48	Weekly	Wheels and Tires	**WARNING** Operating the truck with an underinflated or defective tire may lead to tire failure and loss of steering control. Damage to equipment or injury to personnel may result. **NOTE** If tire pressure is below 30 psi (207 kPa), do NOT inflate. Notify Organizational Maintenance.	
			a. Check pressure in tires and adjust as required to 85 psi (586 kPa).	
			b. Check if all wheel lug nuts are tight.	b. Lug nuts are loose.
49	Weekly	Dolly Wheels Storage Compartment	Check dolly wheels storage compartment doors, door hinges, and retaining latch for damage.	
50	Weekly	Dolly and Bogie Wheels	a. Check for presence and general condition of four air transport dolly wheels in dolly wheels storage compartment. Ensure that dolly wheel tires are inflated to 85 psi (586 kPa).	a. Dolly wheels are missing or damaged, if required for air transport.
			b. Lower and visually check bogie wheels and tires for damage. Ensure that tires are inflated to 85 psi (586 kPa).	b. Damage that would impair operation is evident, if required for air transport.
51	Weekly	Cab	Check operation and general condition of doors, windows, and storage compartments.	
52	Weekly	Exhaust System	Check exhaust system for corrosion, looseness or damage.	Exhaust system damage is noted.
53	Weekly	Air Conditioner	Check air conditioner operation. Operate for at least five minutes to help prevent drying and cracking of tubing seals and reduce refrigerant leaks in the system.	

Table 1. Preventive Maintenance Checks and Services (PMCS) for RTCH-RT 240 - Continued.

ITEM NO.	INTERVAL	LOCATION / ITEM TO CHECK/ SERVICE	PROCEDURE	NOT FULLY MISSION CAPABLE IF:
54	**Weekly**	**Tophandler Hydraulics**	Check level of oil in upper and lower sight gages of tophandler hydraulic slewing motors and sight gage of tophandler hydraulic spreader motor (LO 10-3930-675-12).	Hydraulic oil is not visible in sight gage(s).
55	**Monthly**	**IR Lights**	Use night vision goggles to check operation of all vehicle IR lights.	
56	**Monthly**	**Arctic Heater (If Equipped)**	Operate arctic heater for approximately five minutes, to prevent heater's water pump and burner motor from seizing.	
57	**Monthly**	**Slave Receptacles**	Check for damage to slave receptacle on each side of vehicle.	
58	**Monthly**	**Cab and Boom Support**	Place cab and boom support in transport position (WP 0007 00) to check for proper operation.	

ENGINE AIR CLEANER SERVICING 0014 00

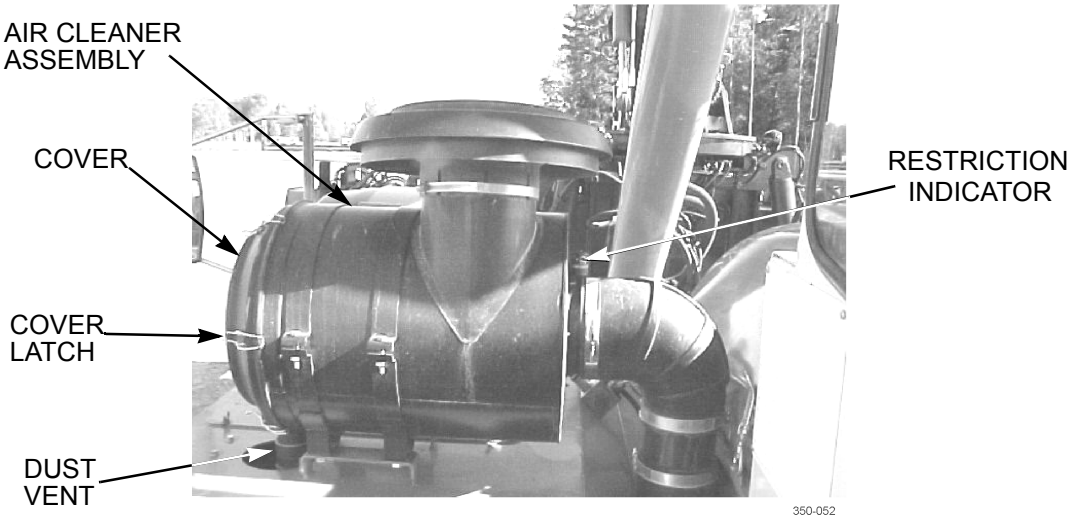
WARNING

If NBC exposure is suspected, all engine air cleaner air filter media should be handled by personnel wearing protective equipment. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.

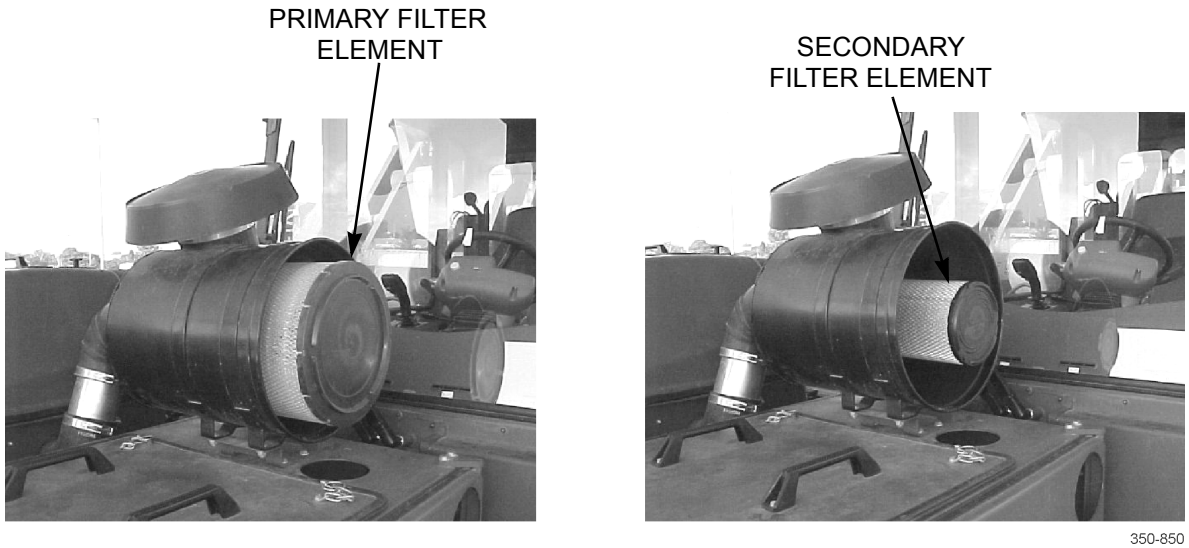
NOTE

Dust vent may be squeezed 2-3 times while engine is running to evacuate dust from air cleaner.

1. Wipe exterior of air cleaner assembly clean with a damp rag.
2. Release six latches and remove cover. Clean inside of cover with a clean, damp rag.



3. Remove primary (outer) and secondary (inner) filter elements from housing.



4. Clean inside of housing with a clean, damp rag.

WARNING

Compressed air used for cleaning purposes should never exceed 30 psi (207 kPa). Wear protective clothing (goggles/shield, gloves, etc.) and use caution to avoid injury to personnel.

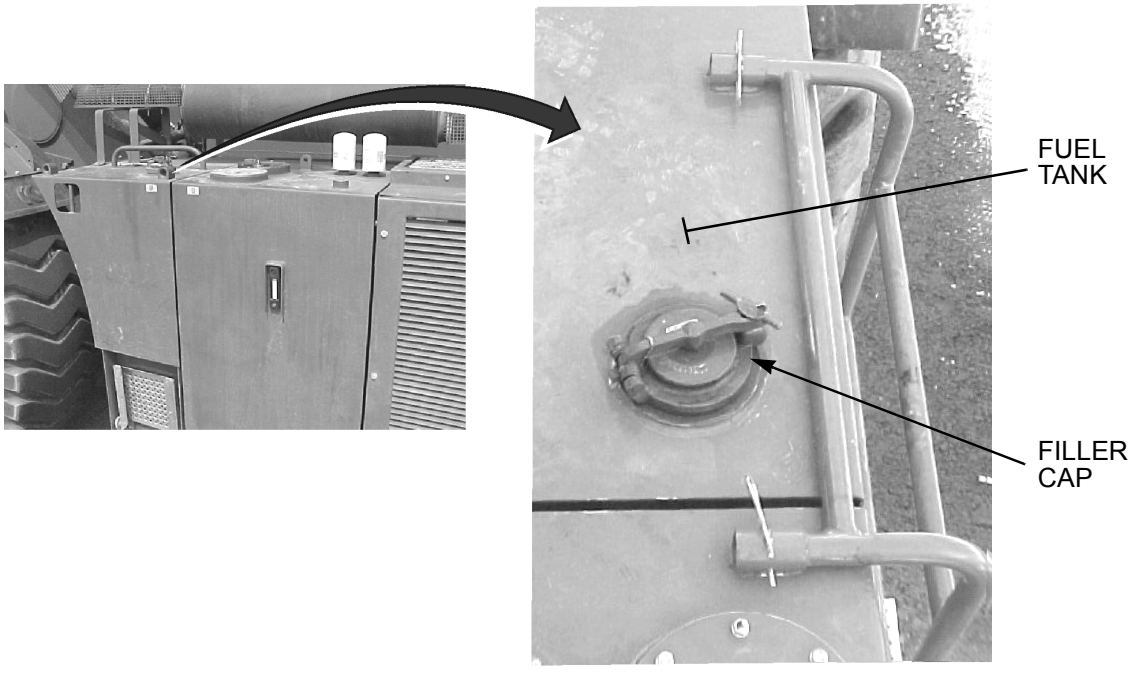
5. Use compressed air, directed from the outside (clean air side) toward the inside, to remove dust and dirt from primary and secondary filter elements.
6. After cleaning with compressed air, inspect primary and secondary filter elements for tears or other damage. Replace with new filter elements, if damaged.
7. Install secondary filter element and seat inside housing. Install primary filter element.
8. Install cover on housing and secure with six latches.
9. Reset air cleaner restriction indicator.

REFUELING PROCEDURES 0015 00

WARNING

- DO NOT smoke or permit any open flame in area of truck while you are servicing diesel fuel system. Be sure hose nozzle is grounded against filler tube during refueling to prevent static electricity. Failure to follow this warning may result in injury to personnel or equipment damage.
- Operating personnel must wear fuel-resistant gloves when handling fuels. If exposed to fuel, promptly wash exposed skin and change fuel-soaked clothing.
- Place portable fire extinguisher within reach prior to refueling.
- DO NOT overfill tank. If fuel starts foaming from fuel tank, stop immediately to avoid fuel spillage.
- Failure to follow these warnings could result in injury or death to personnel.

1. Shut down engine.
2. Wipe off dirt on and around filler cap.
3. Unlatch filler cap and open.
4. Refuel tank. Level of fuel should come approximately half-way up filter screen. DO NOT overfill tank.
5. Close filler cap and latch.



350-045

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CHAPTER 5
SUPPORTING INFORMATION

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REFERENCES 0016 00

SCOPE

This work package lists all forms, field manuals, technical manuals, and other publications referenced in this manual and which apply to the operation of the RTCH-RT 240.

PUBLICATION INDEXES

The following indexes should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual.

Consolidated Index of Army Publications and Blank Forms . . . . . .DA Pam 25-30

Functional User's Manual for the Army Maintenance Management System . . . . . .DA Pam 738-750

U.S. Army Equipment Index of Modification Work Orders . . . . . .DA Pam 750-10

FORMS

Refer to DA Pam 738-750, *The Army Maintenance Management System (TAMMS)*, for instructions on the use of maintenance forms.

Equipment Inspection and Maintenance Worksheet . . . . . .DA Form 5988-E

Product Quality Deficiency Report . . . . . SF Form 368

Recommended Changes to Equipment Technical Publications . . . . . .DA Form 2028-2

Recommended Changes to Publications and Blank Forms. . . . . DA Form 2028

FIELD MANUALS

Basic Cold Weather Manual . . . . . .FM 31-70

Camouflage . . . . . .FM 5-20

Cold Weather Operations . . . . . .FM 9-207

Desert Operations . . . . . .FM 90-3

Driver Selection/Training . . . . . .FM 21-300

First Aid for Soldiers. . . . . .FM 21-11

Manual for the Wheeled Vehicle Driver . . . . . .FM 21-305

NBC Contamination Avoidance . . . . . .FM 3-3

NBC Decontamination . . . . . .FM 3-5

NBC Protection . . . . . .FM 3-4

Northern Operations . . . . . .FM 31-71

Vehicle Recovery Operations . . . . . .FM 20-22

REFERENCES - CONTINUED **0016 00**

TECHNICAL MANUALS

Care, Maintenance, Repair, and Inspection of Pneumatic Tires and Inner Tubes. . . . . TM 9-2620-200-14
Destruction of Army Materiel to Prevent Enemy Use . . . . . TM 750-244-6
Operator's, Unit, Direct, and General Support Maintenance Manual for Trailers, M1000 HET . . . . . TM 9-2330-381-14
Operator's, Unit, Intermediate Direct Support, and Intermediate General Support Maintenance Manual for Lead-Acid Storage Batteries . . . . . TM 9-6140-200-14

TECHNICAL BULLETINS

Warranty Bulletin for RTCH-RT 240 . . . . . TB 10-3930-675-14

OTHER PUBLICATIONS

Abbreviations and Acronyms . . . . . ASME Y14.38-1999
Army Medical Department Expendable/Durable Items . . . . . CTA 8-100
Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items) . . . . . CTA 50-970
Prevention of Motor Vehicle Accidents . . . . . AR 385-55
Transportability Criteria MIL-STD-1366D

COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS 0017 00

SCOPE

This work package lists COEI and BII for the RTCH-RT 240, to help you inventory items required for safe and efficient operation.

GENERAL

The COEI and BII information is divided into the following lists:

1. **Table 1, Components of End Item List.** This listing is for informational purposes only and is not authority to requisition replacements. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.
2. **Table 2, Basic Issue Items List.** These are the minimum essential items required to place the truck in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the truck during operation and whenever it is transferred between property accounts. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of end item. Illustrations are furnished to assist you in identifying the items.

EXPLANATION OF COLUMNS

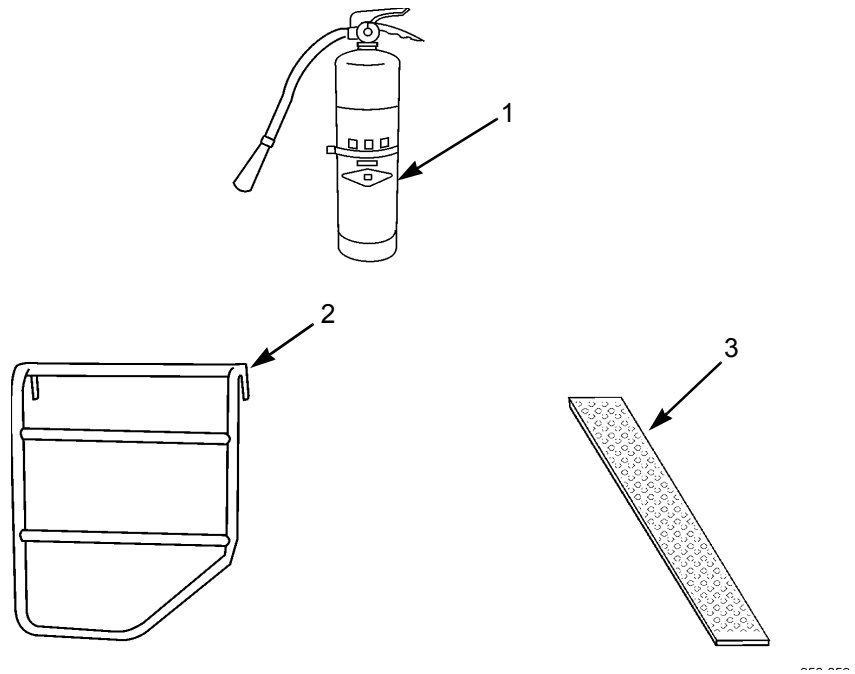
Below is an explanation of columns found in the tabular listings:

1. **Column (1) - Illustration Number (Illus Number).** This column indicates the number of the illustration that shows the item.
2. **Column (2) - National Stock Number.** Indicates the National Stock Number (NSN) assigned to the item and will be used for requisitioning purposes.
3. **Column (3) - Description, CAGEC, and Part Number.** Indicates the Federal item name (in all capital letters) and, if required, a minimum description in parentheses to identify and locate the item. The entry for each item ends with the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.
4. **Column (4) - Usable on Code.** Indicates a code if the item needed is not the same for different models of equipment. Usable on Code is not applicable to the RTCH-RT 240.
5. **Column (5) - Unit of Measure (U/M).** Indicates how the item is issued for the National Stock Number shown in Column (2).
6. **Column (6) - Quantity Required (Qty/Rqd).** Indicates the quantity of the item required.

Table 1. Components of End Item List.

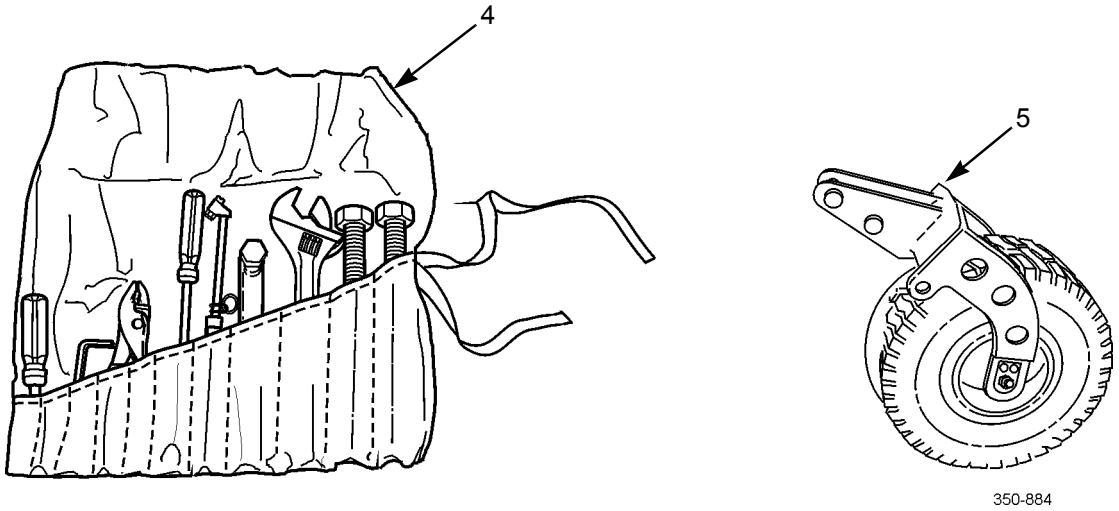
There are currently no COEI assigned.

Table 2. Basic Issue Items List.



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/M	(6) QTY RQD
1		EXTINGUISHER, FIRE (1NWY2) 12J1057		EA	1
2		LADDER/HANDRAIL (1NWY2) A36453.0100		EA	1
3		RAMP, DOLLY WHEELS (1NWY2) A36296.0100		EA	1

Table 2. Basic Issue Items List - Continued.



(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION, CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/M	(6) QTY RQD
4		TOOLKIT: (1NWY2) 12J1035			
	4910-00-204-3170	• Gage, Tire Pressure: 10-160 psi (27783) 7188BH		EA	1
	5120-00-224-4659	• Key, Socket Head, 1/4 Inch (74445) 57026		EA	1
	5120-00-223-7397	• Pliers, Slip Joint (56161) 10510983		EA	1
		• Pouch, Tool (1NWY2) 12J1068		EA	1
		• Screw, Jacking (1NWY2) 12J1029		EA	2
	5210-00-240-8716	• Screwdriver, Cross Tip (80204) B107.15TY2DEASZ1		EA	1
	5120-00-237-6985	• Screwdriver, Flat Tip (56161) 10510988		EA	1
		• Tool, Hydraulic Reservoir (1NWYZ) 12J1028		EA	1
	5120-00-264-3796	• Wrench, Adjustable (96508) D712		EA	1
5		WHEEL, DOLLY (1NWY2) A38709.0100		EA	4

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ADDITIONAL AUTHORIZATION LIST (AAL) 0018 00

SCOPE

This work package lists additional items that you are authorized for the support of the RTCH-RT 240.

GENERAL

This list identifies items that do not have to accompany the truck and that do not have to be turned in with it. These items are authorized to you by CTA, MTOE TDA or JTA.

EXPLANATION OF COLUMNS

1. **Column (1) - National Stock Number.** Indicates the National Stock Number (NSN) assigned to the item and will be used for requisitioning purposes.
2. **Column (2) - Description, CAGEC, and Part Number.** Indicates the Federal item name (in all capital letters) followed by a minimum description when needed. The entry for each item ends with the Commercial and Government Entity Code (CAGEC) in parentheses followed by the part number.
3. **Column (3) - Usable on Code.** Indicates a code if the item needed is not the same for different models of equipment. Usable on Code is not applicable for the RTCH-RT 240.
4. **Column (4) - Unit of Measure (U/M).** Indicates how the item is issued for the National Stock Number shown in Column (1).
5. **Column (5) - Qty Recm.** Indicates the quantity recommended.

Table 1. Additional Authorization List.

(1) NATIONAL STOCK NUMBER	(2) DESCRIPTION, CAGEC, AND PART NUMBER	(3) USABLE ON CODE	(4) U/M	(5) QTY RECM
3930-01-479-1624	KIT, FORKLIFT A36522.0100 (1NWY2)		EA	1

EXPENDABLE AND DURABLE ITEMS LIST 0019 00

SCOPE

This work package lists expendable and durable items you will need to operate and maintain the RTCH-RT 240. This listing is for informational purposes only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, *Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items)*, or CTA 8-100, *Army Medical Department Expendable/Durable Items*.

EXPLANATION OF COLUMNS

1. **Column (1) - Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the item [e.g., Use antifreeze (Item 1, WP 0019 00)].
2. **Column (2) - Level.** This column identifies the lowest level of maintenance that requires the listed item.

   C - Operator/Crew
3. **Column (3) - National Stock Number.** This is the National Stock Number assigned to the item which you can use to requisition it.
4. **Column (4) - Description, CAGEC, and Part Number.** This provides the other information you need to identify the item.
5. **Column (5) - Unit of Measure (U/M).** This column shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Table 1. Expendable and Durable Items List.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
1	C		ANTIFREEZE: Permanent Ethylene Glycol, Inhibited, Heavy-Duty (81349) MILA46153	
		6850-01-181-7929	1 Gallon Can	GAL
		6850-00-181-7933	5 Gallon Container	GAL
2	C	6850-00-926-2275	CLEANING COMPOUND: Windshield (81348), O-C-1901	PT
3	C		DETERGENT: General Purpose, Liquid (81348) P-D-220	
		7930-00-282-9699	1 Gallon Can	GAL
4	C		FUEL DIESEL: DF-2 Grade (81348) VVF800GRADEDF2RE	
		9140-00-286-5295	5 Gallon Can	GAL
		9140-00-286-5296	55 Gallon Drum, 16 Gage	GAL
5	C		FUEL: Diesel, Winter (81348) VVF800GRADEDF1W1	
		9140-00-286-5287	5 Gallon Can	GAL
		9140-00-286-5288	55 Gallon Drum, 16 Gage	GAL
6	C	9130-01-031-5816	FUEL, TURBINE: Aviation (81349) MILT83133 GR JP8	GAL
7	C		GREASE: Automotive and Artillery GAA (81349) MIL-G-10924	
		9150-01-197-7688	1-1/4 Ounce Tube	OZ
		9150-01-197-7693	14 Ounce Cartridge	OZ
		9150-01-197-7690	2-1/4 Pound Can	LB
		9150-01-197-7609	6-1/2 Pound Can	LB
		9150-01-197-7692	35 Pound Pail	LB
8	C		OIL: Lubricating GO 85W/140 (81349) MIL-L-2105	
		9150-01-048-4591	1 Quart Can	QT
		9150-01-035-5395	5 Gallon Can	GAL
		9150-01-035-5396	55 Gallon Drum	GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
9	C		OIL: Lubricating, Arctic, OEA (81349) MIL-L-46167	
		9150-00-402-4478	1 Quart Can	QT
		9150-00-402-2372	5 Gallon Drum	GAL
		9150-00-491-7197	55 Gallon Drum	GAL
10	C		OIL: Lubricating, OE/HDO 10 (81349) MIL-L-2104	
		9150-00-189-6727	1 Quart Can	QT
		9150-00-186-6668	5 Gallon Can	GAL
		9150-00-191-2772	55 Gallon Drum	GAL
11	C		OIL: Lubricating, OE/HDO 15W/40 (81349) MIL-L-2104	
		9150-01-152-4117	1 Quart Can	QT
		9150-01-152-4118	5 Gallon Can	GAL
		9150-01-152-4119	55 Gallon Drum	GAL
12	C		RAG: Wiping (64067) 7920-00-205-1711	
		7920-00-205-1711	50 Pound Bale	LB
13	C		SOLVENT: Dry Cleaning, Type III (81348) P-D-680	
		6650-01-377-1808	1 Quart Can	QT
		6850-01-331-3349	5 Gallon Can	GAL
		6850-01-331-3350	55 Gallon Drum	GAL

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ERROR CODES 0020 00

ERROR CODE TABLE

1. The attached error code table (Table 4) identifies error codes resident on the RTCH's on-board computer. These error codes are visible to both the driver and the maintainer and address very specific equipment conditions on the vehicle.
2. This error code listing also addresses required ***driver actions*** based on the category and type of error identified.

EXPLANATION OF ERROR CODE DISPLAY

NOTE

There are three kinds of information in the Electronic Control System (ECS) display.

1. Icons in the ***left lower corner*** of the display describe what the driver should do. Table 1 defines each of the three driver actions.

Table 1. Driver Action Icons.

ICON	DESCRIPTON
	S***TOP VEHICLE IMMEDIATELY in a safe way.*** Can be a safety issue. Machine performance may be restricted. Read operator's manual for instructions. Contact maintenance personnel.
	***WARNING - DEGRADED OPERATION, stop vehicle in a safe way***. Read operator's manual for instructions. Contact maintenance personnel. Confirm that error message is acknowledged by pressing RESET button. Error will appear every three minutes as long as error is active. It can be reset every time it shows.
	***INFORMATION/MAINTENANCE action is needed.*** Error code shows once when vehicle starts up. Acknowledge error message by pressing RESET. These error codes may be de-activated for driver, so that they only show when maintenance personnel activate them.

2. Icons in the ***center*** of the display identify the type of fault. Table 2 describes the five fault types used in the display.

Table 2. Type of Fault Icons.

ICON	DESCRIPTON		ICON	DESCRIPTION
	Sensor			Lever
	Valve			Temperature
	Pressure			

EXPLANATION OF ERROR CODE DISPLAY - CONTINUED

3. Icons in the ***right*** of the display identify what function or vehicle system the fault is related to. Table 3 lists the various functions or vehicle systems used in the display.

Table 3. Function Icons.

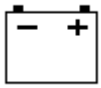
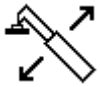
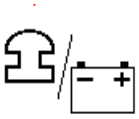
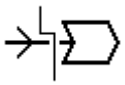
ICON	DESCRIPTON		ICON	DESCRIPTION
	Battery			Twistlock
	Forklift kit			Up/Down
	Emergency stop or battery			In/Out
	Rotation			Transmission
	Hydraulic filter			Fan
	Communication			Engine

Table 3. Function Icons - Continued.

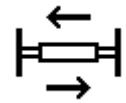
ICON	DESCRIPTON		ICON	DESCRIPTION
	Sideshifting			No overload protection
	Oscillation (leveling)			Brake
	Spreading			Tilt
	Steering			

Table 4. Error Codes.

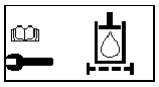
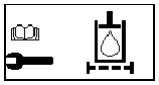
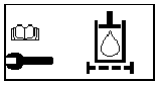
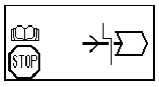
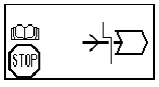
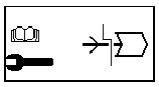
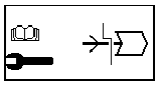
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
1		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Lifting/lowering boom** Hydraulic filter clogged.	None
2		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Steering** Hydraulic filter clogged.	None
3		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Tophandler attachment** Hydraulic filter clogged.	None
4		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Return filter** Hydraulic filter clogged.	None
105		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **ECU 790 not responding** Circuit breaker tripped. Cable defective. ECU 790 defective.	Operating system not responding. Boom and tophandler may not work.
106		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **ECU 791 not responding** Circuit breaker tripped. Cable defective. ECU 791 defective.	Operating system not responding. Boom and tophandler may not work.
107		**Press RESET** Finish mission. Notify maintenance.	**Information/Maintenance** **Communication, cable segment 1 between ECU 795 and 791** Cable between ECU 795 - 791 interrupted or short circuited.	No redundancy in ECS system of boom, display, and tophandler function.
108		**Press RESET** Finish mission. Notify maintenance.	**Information/Maintenance** **Communication, cable segment 2 between ECU 791 and 790** Cable between ECU 791 - 790 interrupted or short circuited.	No redundancy in ECS system of boom, display, and tophandler function.

Table 4. Error Codes - Continued.

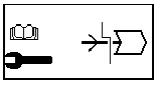
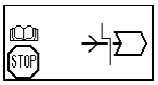
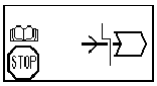
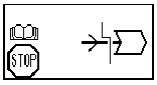
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
109		**Press RESET** Finish mission. Notify maintenance.	**Information/Maintenance** **Communication, cable segment 3 between ECU 790 and 795** Cable between ECU 790 - 795 interrupted or short circuited.	No redundancy in ECS system of boom, display, and tophandler function.
110		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Communication, ECU 792 - steering computer not responding** Circuit breaker tripped. Cable defective. ECU 792 defective.	Steering may not function properly.
111		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Communication, ECU 793 - transmission computer not responding** Circuit breaker tripped. Cable defective. ECU 793 defective.	Transmission may not function properly.
112		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **ECU 794 - engine computer not responding** Circuit breaker tripped. Cable defective. ECU 794 defective.	Engine may not function properly.
118		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **No pressure/signal - both brake systems** Circuit breaker tripped. Hydraulic failure.	Brakes may not function properly.
119		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **No pressure - brake circuit 1** Hydraulic failure.	Only half brake capability available.

Table 4. Error Codes - Continued.

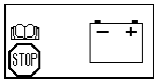
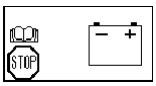
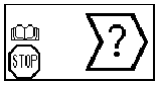
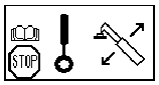
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
120		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **No pressure - brake circuit 2** Hydraulic failure.	Only half brake capability available.
121		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Supply voltage - ECU 790** Emergency stop engaged. Circuit breaker tripped. Cable defective.	Operating system and boom function not working.
122		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Supply voltage - CAN 790** Circuit breaker tripped. Cable defective.	Operating system and boom function not working.
123		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Ref. voltages 10V- ECU 790** Circuit breaker tripped. Cable defective.	Operating system and boom function not working.
125		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Memory fault, check ECU 790** Circuit breaker tripped. Cable defective.	None if code clears. Operating system and boom function not working.
126		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Signal for lifting/lowering, out of range** Cable defective. Short circuit. Potentiometer in joystick not functioning.	Lift/lower does not function properly (hydraulic stops).

Table 4. Error Codes - Continued.

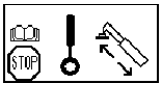
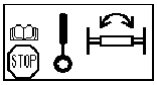
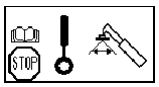
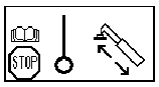
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
127		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Signal for boom in/out, out of range** Cable defective. Short circuit. Potentiometer in joystick not functioning.	Boom in/out does not function properly (hydraulic stops).
128		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Signal for slewing, out of range** Cable defective. Short circuit. Potentiometer in joystick not functioning.	Slewing does not function properly (hydraulic stops).
129		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Signal for tilt in/out of range** Cable defective. Short circuit. Potentiometer in joystick not functioning.	Tilt does not function properly (hydraulic stops).
130		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** Overload protection error Error codes 131 - 136 or 210 have been active.	No overload protection system. Reduced hydraulic speed.
131		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom sensor- boom length out of range or no signal change when boom is moving** Cable defective. Short circuit. Potentiometer damaged. Hydraulic failure.	No overload protection system. Reduced hydraulic speed.

Table 4. Error Codes - Continued.

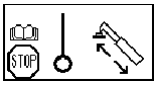
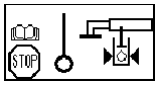
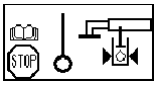
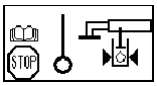
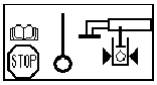
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
132		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom sensor- boom angle out of range or no signal change when lowering/lifting boom** Sensor bracket or lever damaged. Cable defective. Short circuit. Potentiometer damaged. Hydraulic failure.	No overload protection system. Reduced hydraulic speed.
133		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Left lift cylinder pressure sensor - signal out of range** Cable defective. Short circuit. Pressure sensor defective.	No overload protection system. Reduced hydraulic speed.
134		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Right lift cylinder pressure sensor - signal out of range** Cable defective. Short circuit. Pressure sensor defective.	No overload protection system. Reduced hydraulic speed.
135		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Left lift cylinder return pressure sensor - signal out of range** Cable defective. Short circuit. Pressure sensor defective.	No overload protection system. Reduced hydraulic speed.
136		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Right lift cylinder return pressure sensor - signal out of range** Cable defective. Short circuit. Pressure sensor defective.	No overload protection system. Reduced hydraulic speed.

Table 4. Error Codes - Continued.

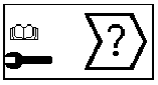
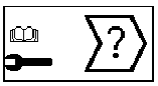
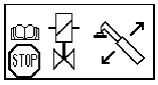
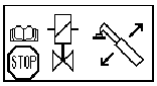
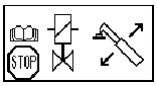
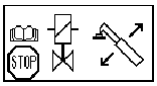
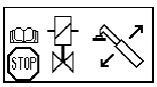
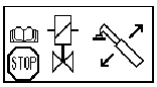
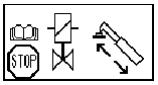
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE CATEGORY/ EXPLANATION	VEHICLE LIMITATIONS
141		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Information/Maintenance** **Communication fault - ECU 790** Computer hardware fault.	Possible ECU malfunction. Other codes will also show.
142		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Information/Maintenance** **Communication fault - ECU 790** Computer hardware fault.	Possible ECU malfunction. Other codes will also show.
151		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Locking valve, broken circuit** Cable to valve defective.	Boom cannot be lowered with joystick. Emergency lowering is necessary.
152		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Locking valve, short circuit** Cable to valve defective.	Boom cannot be lowered with joystick. Emergency lowering is necessary.
154		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Lifting valve, broken circuit** Cable to valve defective.	Lifting is impossible.
155		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Lifting valve, short circuit** Cable to valve defective.	Uncontrolled self-lifting may occur.
157		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Lowering valve, broken circuit** Cable to valve defective.	Boom cannot be lowered with joystick. Emergency lowering is necessary.
158		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Lowering valve, short circuit** Cable to valve defective.	Boom cannot be lowered with joystick. Emergency lowering is necessary. Uncontrolled self-lifting may occur.
160		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom in valve, broken circuit** Cable to valve defective.	Boom cannot be retracted.

Table 4. Error Codes - Continued.

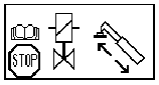
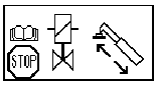
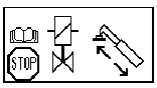
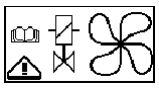
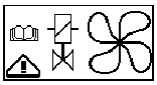
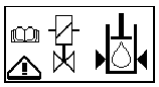
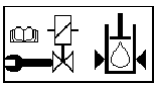
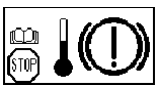
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
161		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom in valve, short circuit** Cable to valve defective.	Boom cannot be retracted. Uncontrolled self-retraction may occur.
163		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom out valve, broken circuit** Cable to valve defective.	Boom cannot be extended.
164		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Boom out valve, short circuit** Cable to valve defective.	Boom cannot be extended. Uncontrolled self-extension may occur.
166		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Cooling fan valve - broken circuit** Cable to valve defective.	Cooling fan will run at full speed. No fording activities possible.
167		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Cooling fan valve - short circuit** Cable to valve defective.	Cooling fan may run at any speed. No fording activities possible. Overheating may occur.
169		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Emergency hydraulic valve - broken circuit** Cable to valve defective.	No hydraulic emergency operation is possible.
172		**Press RESET** Finish mission. Notify maintenance.	**Information/Maintenance** **Pump turn off valve - broken circuit** Cable defective.	May be difficult to start because of engaged pumps.
191		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Temperature in front wheel end above 203°F (95°C)** Cable defective. No cooling.	Brakes may overheat at front axle.

Table 4. Error Codes - Continued.

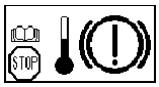
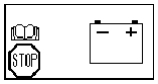
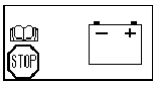
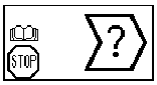
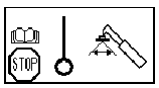
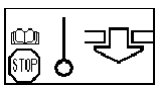
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
192		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Temperature in rear wheel end above 203°F (95°C)** Cable defective. No cooling.	Brakes may overheat at rear axle.
201		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Supply voltage - ECU 791** Emergency stop engaged. Circuit breaker tripped. Cable defective.	Tophandler not working.
202		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Supply voltage - CAN 791** Circuit breaker tripped. Cable defective.	Operating system and tophandler not working.
203		**Stop Vehicle** Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Ref. voltages 10V- 791** Circuit breaker tripped. Cable defective.	Operating system not working.
205		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Memory fault - check ECU 791** Circuit breaker tripped. Cable defective.	None if code clears. Operating system and tophandler not working.
210		**Stop Vehicle** Press RESET. Put load down safely. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Tilt angle sensor - signal out of range** Potentiometer damaged. Cable defective. Short circuit.	Generate error code 130.
212		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Logical error - left twistlock** Short circuit. Signal from both 7204L and 7205L.	Both locked and unlocked twistlock at the same time. Safe operation is not possible.

Table 4. Error Codes - Continued.

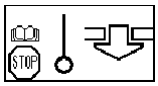
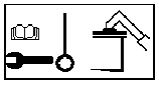
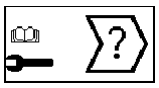
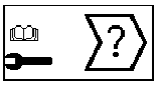
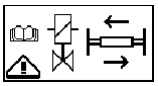
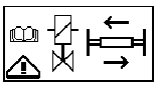
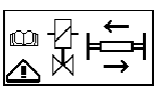
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
213		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Logical error - right twistlock** Short circuit. Signal from both 7204R and 7205R.	Both locked and unlocked twistlock at the same time. Safe operation is not possible.
214		**Stop Vehicle** Press RESET. Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Logical error - forklift sensors** Cable defective. Signal from 7206-1 or 7206-2.	Operation of forklift is not possible.
220		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **One pulse signal to the steering wheel interrupted** Clock 1. Clock 2. Cables defective. Steering column sensor defective.	Stop vehicle by switching to neutral. Steering system will operate but is not redundant. The steering computer uses non interrupted signal to steer the vehicle.
221		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Information/Maintenance** **Communication fault -ECU 791, connector 2** Computer hardware fault.	Possible ECU malfunction. Other codes will also show.
225		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Left sideshift - open circuit** Cable to valve defective.	Left sideshift is not possible.
226		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Left sideshift - short circuit** Cable to valve defective.	Uncontrolled left sideshift may occur.
228		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Right sideshift - open circuit** Cable to valve defective.	Right sideshift is not possible.

Table 4. Error Codes - Continued.

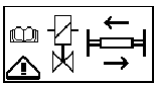
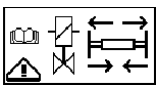
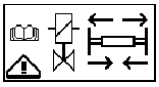
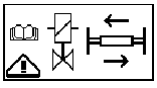
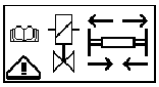
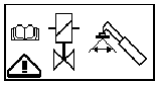
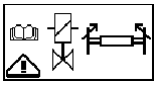
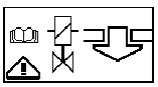
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
229		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Right sideshift - short circuit** Cable to valve defective.	Uncontrolled right sideshift may occur.
231		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **20-40 valve - open circuit** Cable to valve defective.	Spreading from 20 - 40 ft is not possible.
232		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **20-40 valve - short circuit** Cable to valve defective.	Spreading from 20 - 40 ft is not possible.
234		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **40-20 valve - open circuit** Cable to valve defective.	Spreading from 40 - 20 ft is not possible.
235		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **40-20 valve - short circuit** Cable to valve defective.	Spreading from 20 - 40 ft is not possible.
237		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Active tilt valve - open circuit** Cable to valve defective.	Tophandler locked, not automatically leveled.
240		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Active pile slope - open circuit** Cable to valve defective.	Tophandler locked, not free oscillated.
243		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Twistlock valve lock - open circuit** Cable to valve defective.	Impossible to lock twistlock.

Table 4. Error Codes - Continued.

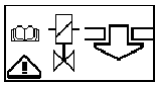
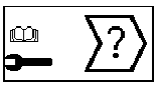
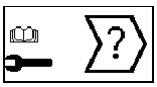
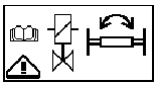
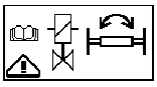
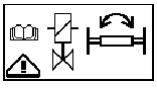
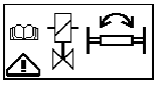
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
246		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Twistlock valve unlock - open circuit** Cable to valve defective.	Impossible to unlock twistlock.
250		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Information/Maintenance** **Communication fault - ECU 791, connector 3** Computer hardware fault.	Possible ECU malfunction. Other codes will also show.
251		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Information/Maintenance** **Communication fault -ECU 791, connector 3** Computer hardware fault.	Possible ECU malfunction. Other codes will also show.
255		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Slewing clockwise valve - open circuit** Cable to valve defective.	Slewing clockwise is not possible.
256		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Slewing clockwise valve - short circuit** Cable to valve defective.	Uncontrolled slewing may occur.
258		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Slewing counterclockwise valve - open circuit** Cable to valve defective.	Slewing clockwise is not possible.
259		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Slewing counterclockwise valve - short circuit** Cable to valve defective.	Uncontrolled slewing may occur.

Table 4. Error Codes - Continued.

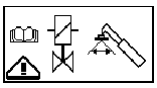
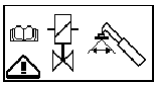
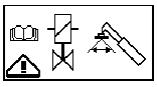
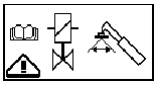
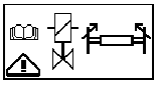
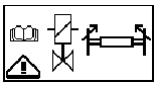
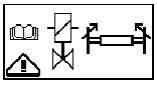
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
261		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Tilt out valve - open circuit** Cable to valve defective.	Tilt out is not possible.
262		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Tilt out valve - short circuit** Cable to valve defective.	Uncontrolled tilt may occur.
264		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Tilt in valve - open circuit** Cable to valve defective.	Tilt in is not possible.
265		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Tilt in valve - short circuit** Cable to valve defective.	Uncontrolled tilt may occur.
267		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Right oscillation valve - open circuit** Cable to valve defective.	Right oscillation (leveling) is not possible.
268		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Right oscillation valve - short circuit** Cable to valve defective.	Uncontrolled oscillation (leveling) may occur.
270		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Left oscillation valve - open circuit** Cable to valve defective.	Left oscillation (leveling) is not possible.

Table 4. Error Codes - Continued.

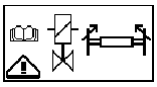
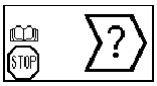
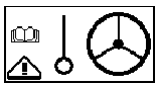
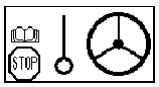
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
271		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Left oscillation valve - short circuit** Cable to valve defective.	Uncontrolled oscillation (leveling) may occur.
300		**Stop Vehicle** Shut engine off for 30 seconds then start vehicle. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Steering system malfunction** Steering computer - hardware error (EPROM, watchdog, reference voltages, etc.)	No steering and driving functions are available.
301 302 303 304 305 306 307 308		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **One track of actual value potentiometer out of range (e.g. cable interrupted)** Wheel 1, track 1. Wheel 2, track 1. Wheel 3, track 1. Wheel 4, track 1. Wheel 1, track 2. Wheel 2, track 2. Wheel 3, track 2. Wheel 4, track 2.	Stop vehicle by switching to neutral. Steering system will operate but is not redundant.
309 310 311 312		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Both tracks of actual value potentiometer out of range** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	Stop vehicle by switching to neutral. The faulty wheel is locked immediately. Other wheels remain operational.

Table 4. Error Codes - Continued.

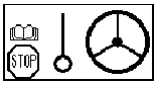
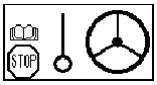
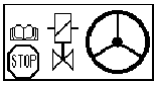
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
313 314 315 316		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Deviation between two potentiometer tracks, but both inside tolerance range** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	Stop vehicle by switching to neutral. Steering system will operate but is not redundant.
317 318 319 320		**Stop Vehicle** Check wheel for blockage. If blocked, remove blockage and press RESET. If not blocked, notify maintenance.	**Stop Vehicle Immediately** **Steering deviation between set point and actual value (tracking error)** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	Stop vehicle by switching to neutral. Steering remains active and tries to close up to set point. System will be active as soon as deviating wheel has closed up.
321 322 323 324		**Stop Vehicle** Notify maintenance.	**Stop Vehicle Immediately** **Wheel alinement values out of range** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	This error prohibits driving after steering calibration if calibration was not successful or calibration values are out of range.
325 326 327 328		**Stop Vehicle** Notify maintenance.	**Stop Vehicle Immediately** **Break in cable to proportional valve** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	Stop vehicle by switching to neutral. Steering computer cannot control wheel with broken cable. Faulty wheel has to be alined by manual operation of valve.

Table 4. Error Codes - Continued.

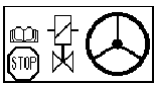
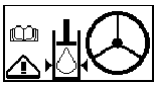
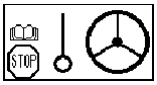
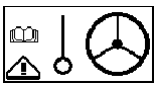
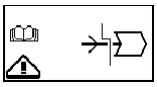
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
329 330 331 332		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Cable to proportional valve - short circuit** Wheel 1. Wheel 2. Wheel 3. Wheel 4.	Stop vehicle by switching to neutral. Steering computer cannot control wheel with broken cable. Faulty wheel has to be alined by manual operation of valve.
340		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Supply pressure below 1450 psi (100 bar)** Leaking hydraulics.	Stop vehicle by switching to neutral. Steering system will operate in a degraded mode.
341		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Steering wheel signals inconsistent (e.g. two incremental counters deviating)** Cables defective. Steering column sensor defective.	Stop vehicle by switching to neutral. Steering system will operate but is not redundant. Steering computer uses one of two counters to steer vehicle.
342 343		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **One pulse signal to steering wheel interrupted** Cables defective. Steering column sensor defective.	Stop vehicle by switching to neutral. Steering system will operate but is not redundant. Steering computer uses non interrupted signal to steer vehicle.
344		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Both pulse signals to steering wheel interrupted** Cables defective. Steering column sensor defective.	Stop vehicle by switching to neutral. Steering system will not operate.
345		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **No CAN communication to display** Cable defective.	Error codes from steering ECU will not show. Steering function is operational.

Table 4. Error Codes - Continued.

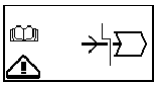
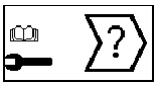
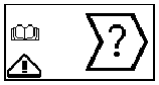
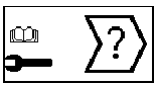
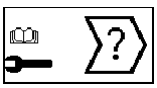
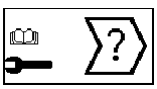
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
346		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **No CAN communication to transmission** Cables defective.	It is not possible to change from 2WD to 4WD or vice versa. The whole steering system remains operational, but steering features dependant on driving speed are not available. To keep vehicle in full operation, steering program selection is allowed at this time.
347		**Select Steering Mode**	**Information/Maintenance** **No valid steering program selected**	None
401		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital output short circuit - *"Enable driving"* (no neutral gear from steering ECU)** Cables defective.	Transmission will not go into neutral automatically.
404		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, front wheel steering"*** Cables defective.	Control lamp at steering selection switch is not working.
405		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, four wheel steering"*** Cables defective.	Control lamp at steering selection switch is not working.
406		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, crab steering"*** Cables defective.	Control lamp at steering selection switch is not working.

Table 4. Error Codes - Continued.

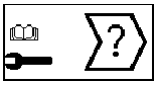
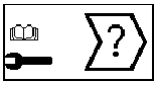
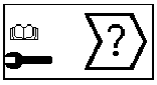
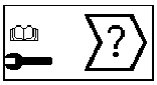
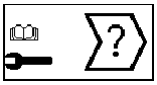
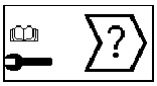
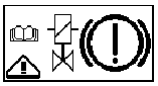
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
408		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, unlocked twist-lock"*** Cables defective.	Control lamp at steering column is not working.
409		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, locked twist-lock"*** Cables defective.	Control lamp at steering column is not working.
410		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Control lamp, alinement"*** Cables defective.	Control lamp at steering column is not working.
411		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Auxiliary hydraulic pump"*** Cables defective.	Cab cannot be moved. No emergency operation of boom or tophandler available.
412		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Ether start kit"*** Cables defective.	Ether start not working.
413		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital output short circuit - *"Oil supply valve, boom folding"*** Cables defective.	Boom cannot be folded.
414		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital output short circuit - *"Drive axle cooling, bypass valves"*** Cables defective.	Brakes may be overheated. Error codes 191 and 192 will show if brakes have overheated.

Table 4. Error Codes - Continued.

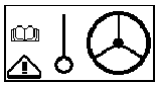
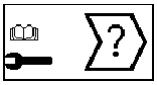
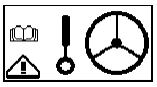
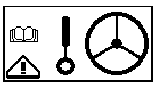
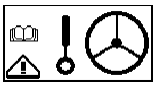
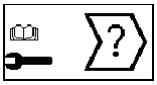
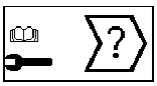
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
416		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital input not read correctly -*"Steering pressure"*** Cables defective.	A steering pressure failure cannot be detected, error code 340.
417		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Auxiliary hydraulic pump switch"*** Cables defective.	Auxiliary hydraulic pump cannot be started.
418		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital input not read correctly -*"Front wheel steering switch"*** Cables defective.	2WD cannot be selected.
419		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital input not read correctly -*"Four wheel steering switch"*** Cables defective.	4WD cannot be selected.
420		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital input not read correctly -*"Crab steering switch"*** Cables defective.	Crab steering cannot be selected.
422		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Sensor, cab in transport position"*** Cables defective. Steering computer damaged.	Boom folding is not possible.
423		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Ether start switch"*** Cables defective. Steering computer damaged.	Ether injection is not possible.

Table 4. Error Codes - Continued.

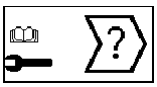
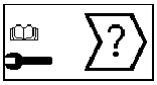
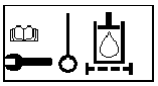
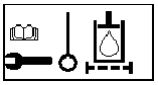
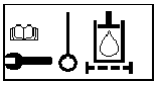
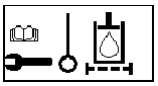
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
426		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Digital input not read correctly -*"Fording level switch"*** Cables defective. Steering computer damaged.	Fording operations are not possible.
427		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Tophandler working light switch"*** Cables defective. Steering computer damaged.	Working lights on tophandler do not function.
432		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Hydraulic filter indication (lift/ lower, boom in/out)"*** Cables defective. Steering computer damaged.	None
433		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Hydraulic filter indication, steering"*** Cables defective. Steering computer damaged.	None.
434		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Hydraulic filter indication, tophandler"*** Cables defective. Steering computer damaged.	None.
435		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Digital input not read correctly -*"Hydraulic filter indication, return oil"*** Cables defective. Steering computer damaged.	None.

Table 4. Error Codes - Continued.

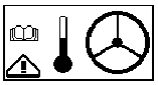
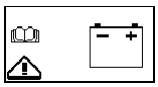
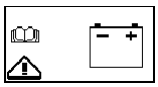
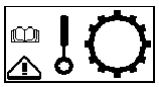
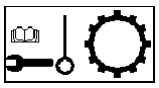
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
450		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Ambient temperature too high** Temperature sensor defective. ECU 792 defective.	None.
451		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Supply voltage too high** Alternator defective.	Stop vehicle by switching to neutral.
452		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Supply voltage too low** Power supply off. Alternator defective.	Stop vehicle by switching to neutral.
618		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Logical error at direction select signal - transmission ECU detected a wrong signal combination for the direction** Cables defective. Shift lever defective.	Stop vehicle by switching to neutral.
622		**Press RESET** If error shows again, notify maintenance. Finish mission.	**Information/Maintenance** **Logical error at axle connection - feedback axle connection measured by transmission ECU and output signal action connection do not match** Cables defective. Switch defective. Mechanical error.	When shifting from 2WD to 4WD or vice versa, engage forward drive and immediately return to neutral. Turn the ignition switch off for at least 30 seconds, then turn switch back on.
637		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage or open circuit at transmission sump temperature sensor input - voltage too high** Cables defective. Sensor defective. Connector pin broken.	None

Table 4. Error Codes - Continued.

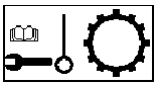
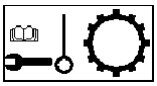
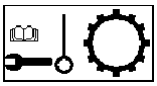
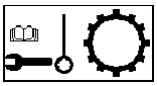
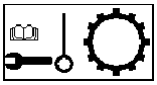
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
638		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to ground at transmission sump temperature sensor input - voltage too low** Cables defective. Sensor defective. Connector pin broken.	None
639		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage or open circuit at converter output temperature sensor input - voltage too high** Cables defective. Sensor defective. Connector pin broken.	None
640		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage or open circuit at converter output temperature sensor input - voltage too low** Cables defective. Sensor defective. Connector pin broken.	None
649		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage or open circuit at engine speed input - transmission ECU measures a voltage higher than 7.0V at speed input pin** Cables defective. Sensor defective. Connector pin broken.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control)
650		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to ground at engine speed input - transmission ECU measures a voltage less than 0.45V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control)

Table 4. Error Codes - Continued.

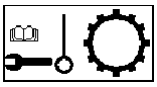
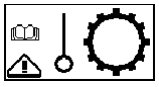
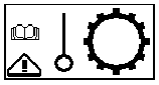
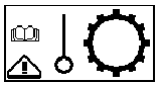
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
651		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Logical error at engine speed input - transmission ECU measures engine speed over a threshold and the next moment the measured speed is zero** Cables defective. Sensor defective. Wrong size sensor gap.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control)
652		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to battery voltage or open circuit at turbine speed input - transmission ECU measures a voltage higher than 7.0V at speed input pin** Cables defective. Sensor defective. Wrong size sensor gap.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at output speed, transmission ECU shifts to neutral. Limp home.
653		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to ground at turbine speed input - transmission ECU measures a voltage less than 0.45V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at output speed, transmission ECU shifts to neutral. Limp home.
654		**Press RESET** Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Logical error at turbine speed input - transmission ECU measures turbine speed over a threshold and at the next moment the measured speed is zero** Cables defective. Sensor defective. Wrong size sensor gap.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at output speed, transmission ECU shifts to neutral. Limp home.

Table 4. Error Codes - Continued.

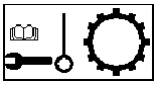
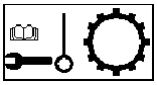
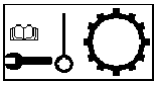
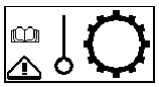
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
655		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage or open circuit at internal speed input - transmission ECU measures a voltage higher than 7.0V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control)
656		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to ground at internal speed input - transmission ECU measures a voltage less than 0.45V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control)
657		**Press RESET** Finish mission. Notify maintenance.	**Information/Maintenance** **Logical error at internal speed input - transmission ECU measures internal speed over a threshold and at the next moment the measured speed is zero** Cables defective. Sensor defective. Wrong size sensor gap.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at output speed, transmission ECU shifts to neutral. Limp home.
658		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to battery voltage or open circuit at output speed input - transmission ECU measures a voltage higher than 12.5V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at turbine speed, transmission ECU shifts to neutral. Limp home.

Table 4. Error Codes - Continued.

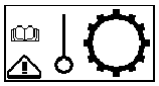
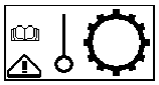
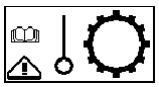
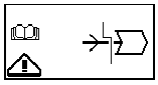
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
659		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to battery voltage at output speed input - transmission ECU measures a voltage less than 1.0V at speed input pin** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at turbine speed, transmission ECU shifts to neutral. Limp home.
660		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Logical error at output speed input - transmission ECU measures internal speed over a threshold and at the next moment the measured speed is zero** Cables defective. Sensor defective.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at turbine speed, transmission ECU shifts to neutral. Limp home.
662		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Output speed does not fit other speed signals. If transmission is not in neutral and shifting has finished, transmission ECU measures output speed as zero and turbine or internal speed as not equal to zero** Cables defective. Sensor defective. Wrong size sensor gap.	Gearshift quality is reduced due to another control mode. (Operating mode: substitute clutch control) If there is also a failure at turbine speed, transmission ECU shifts to neutral. Limp home.
684		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Time-out of CAN message from display computer** Cable defective. Defective display computer.	Error codes from transmission ECU will not show.

Table 4. Error Codes - Continued.

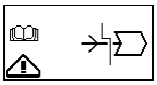
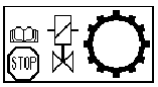
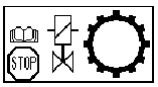
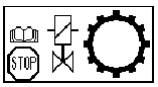
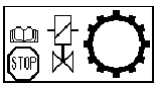
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
685		**Finish Mission** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Time-out of CAN message from display computer** Cable defective. Defective steering computer.	Error codes from transmission ECU will not show.
713		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch K1 - measured resistance value of valve is out of limit, voltage at K1 valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
714		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch K1 - measured resistance value of valve is out of limit, voltage at K1 valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
715		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch K1 - measured resistance value of valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
716		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch K2 - measured resistance value of valve is out of limit, voltage at K2 valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.

Table 4. Error Codes - Continued.

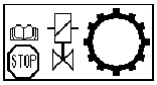
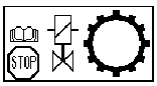
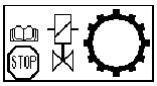
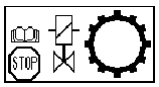
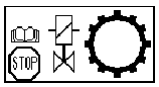
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
717		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch K2 - measured resistance value of valve is out of limit, voltage at K2 valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
718		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch K2 - measured resistance value of valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
719		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch K3 - measured resistance value of valve is out of limit, voltage at K3 valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
720		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch K3 - measured resistance value of valve is out of limit, voltage at K3 valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
721		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch K3 - measured resistance value of valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.

Table 4. Error Codes - Continued.

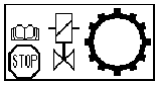
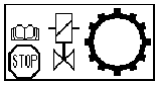
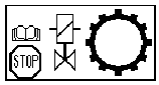
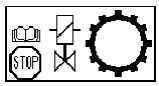
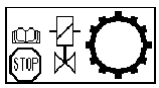
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
729		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch K4 - measured resistance value of valve is out of limit, voltage at K4 valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
730		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch K4 - measured resistance value of valve is out of limit, voltage at K4 valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
731		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch K4 - measured resistance value of valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
732		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch KV - measured resistance value of valve is out of limit, voltage at KV valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
733		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch KV - measured resistance value of valve is out of limit, voltage at KV valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.

Table 4. Error Codes - Continued.

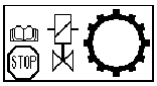
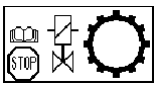
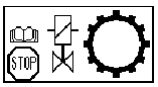
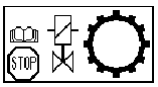
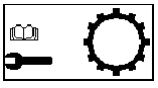
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
734		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch KV - measured resistance value of the valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
735		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to battery voltage at clutch KR - measured resistance value of valve is out of limit, voltage at KR valve is too high** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
736		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Short circuit to ground at clutch KR - measured resistance value of valve is out of limit, voltage at KR valve is too low** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
737		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Open circuit at clutch KR - measured resistance value of valve is out of limit** Cables defective. Regulator defective.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
745		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to ground at relay reverse warning alarm - transmission ECU detected a wrong voltage at output pin that looks like a short circuit to battery voltage** Cables defective. Backup alarm device defective.	None

Table 4. Error Codes - Continued.

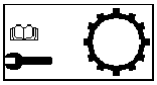
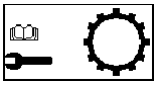
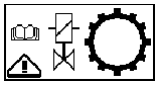
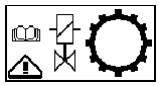
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
746		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Short circuit to battery voltage at relay reverse warning alarm - transmission ECU detected a wrong voltage at output pin that looks like a short circuit to battery voltage** Cables defective. Backup alarm device defective.	None
747		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Open circuit at relay reverse warning alarm - transmission ECU detected a wrong voltage at output pin that looks like an open circuit for this output pin** Cables defective. Backup alarm device defective.	None
761		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to ground at axle connection solenoid - transmission ECU detected a wrong voltage at output pin that looks like a short circuit to vehicle ground** Cables defective. Axle connection solenoid defective.	Switching from 2WD to 4WD is impossible.
762		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Short circuit to battery voltage axle connection solenoid - transmission ECU detected a wrong voltage at output pin that looks like a short circuit to battery voltage** Cables defective. Axle connection solenoid defective.	Switching from 2WD to 4WD is impossible.

Table 4. Error Codes - Continued.

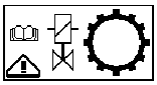
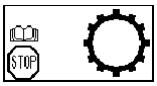
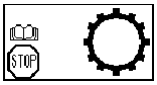
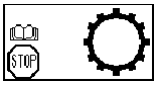
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
763		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Open circuit at axle connection solenoid - transmission ECU detected a wrong voltage at output pin that looks like an open circuit for this output pin** Cables defective. Axle connection solenoid defective.	Switching from 2WD to 4WD is impossible.
777		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch K1 - transmission ECU calculates a differential speed at closed clutch K1. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap. Defective clutch.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
778		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch K2 - transmission ECU calculates a differential speed at closed clutch K2. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap. Defective clutch.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
779		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch K3 - transmission ECU calculates a differential speed at closed clutch K3. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap Defective clutch.	ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.

Table 4. Error Codes - Continued.

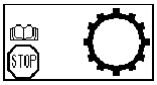
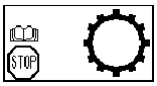
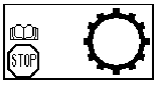
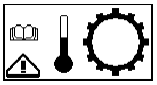
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
780		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch K4 - transmission ECU calculates a differential speed at closed clutch K4. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap Defective clutch.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
781		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch KV - transmission ECU calculates a differential speed at closed clutch KV. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap Defective clutch.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
782		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Slippage at clutch KR - transmission ECU calculates a differential speed at closed clutch KR. If this calculated value is outside of range, ECU interprets this as a slipping clutch** Low pressure. Sensor defective. Wrong size sensor gap Defective clutch.	Transmission ECU shifts to neutral. Limp home. If there is also a failure at another clutch, ECU shifts to neutral. ECU will shut down.
783		**Stop Vehicle** Check oil level. Allow transmission to cool down. Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Overheated sump - transmission ECU measured temperature in oil sump that is over 212°F (100°C)** Low oil level. Temperature sensor defective.	None

Table 4. Error Codes - Continued.

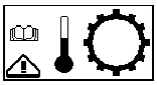
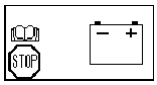
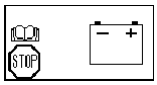
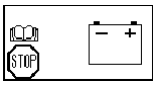
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
786		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Oil filter differential pressure - transmission ECU measured a voltage at differential pressure switch out of allowable range** Oil filter polluted. Cable/connector defective. Differential switch defective.	None
795		**Stop Vehicle** Check oil level. Allow transmission to cool down. Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Overheated converter output - ECU measured oil temperature at converter output that is over 248°F (120°C)** Low oil level. Temperature sensor defective.	None
811		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Low power at battery - measured voltage at power supply is lower than 18V** Defective cable. Defective battery. Defective connector.	Transmission ECU shifts to neutral. ECU will shut down.
812		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **High power at battery - measured voltage at power supply is higher than 32.5V** Defective cable. Defective battery. Defective connector.	Transmission ECU shifts to neutral. ECU will shut down.
813		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Error at shift valve power supply (VPS1)** Defective cable. Defective connector. ECU defective.	ECU shifts to neutral. ECU will shut down.

Table 4. Error Codes - Continued.

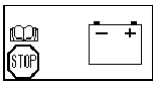
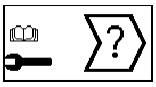
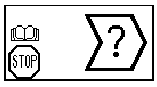
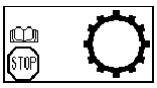
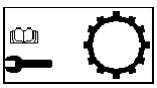
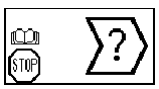
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
814		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Error at shift valve power supply (VPS2)** Defective cable. Defective connector. ECU defective.	ECU shifts to neutral. ECU will shut down.
841		**Finish Mission** Notify maintenance.	**Information/Maintenance** **General EEPROM fault - ECU cannot read memory** ECU defective.	None
843		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Application error** ECU defective.	Transmission stays in neutral. ECU will shut down.
845		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Clutch failure - AEB was not able to adjust clutch filling parameters** Clutch defective.	Transmission stays in neutral. ECU will shut down.
846		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Clutch adjustment data lost - ECU was not able to read correct adjustment parameters** Interference during data saving process.	None
1111		**Engine Will Not Start - Notify Maintenance**	**Stop Vehicle Immediately** **ECM internal internal memory error** Hardware defective. Internal microprocessor communication failure.	Engine will not start.

Table 4. Error Codes - Continued.

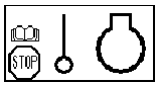
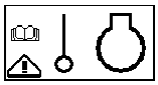
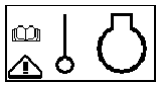
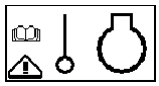
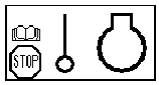
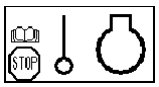
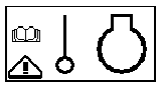
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1115		**Stop Vehicle** Shut engine off for 30 seconds, then turn engine on. If code clears, resume mission, then notify maintenance. If code remains, notify maintenance.	**Stop Vehicle Immediately** **No engine speed signal detected at both engine position sensor circuits**	Engine will shut down and will not start.
1121		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **No engine speed signal detected at one engine position sensor circuit**	None
1122		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **High voltage detected at intake manifold pressure sensor circuit**	Reduced engine power output.
1123		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Low voltage detected at intake manifold pressure sensor circuit**	Reduced engine power output.
1131		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **High voltage detected at throttle position sensor circuit**	Severe power and speed loss. Limp home power only.
1132		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Low voltage detected at throttle position sensor circuit**	Severe power and speed loss. Limp home power only.
1135		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **High voltage detected at oil pressure sensor circuit**	Oil pressure warning not working.

Table 4. Error Codes - Continued.

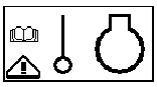
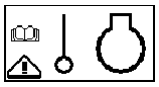
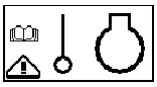
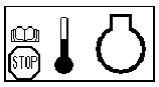
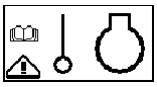
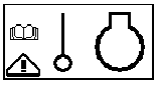
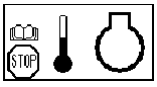
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1141		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Low voltage detected at oil pressure sensor circuit**	Oil pressure warning not working.
1143		**Stop Vehicle** Check oil level. Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Oil pressure signal indicates low oil pressure**	Reduced power and speed.
1144		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **High voltage detected at coolant temperature circuit**	Temperature warning not functioning.
1145		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Low voltage detected at coolant temperature circuit**	Temperature warning not functioning.
1151		**Stop Vehicle** Check coolant level. If error remains, notify maintenance.	**Stop Vehicle Immediately** **Coolant temperature signal indicated coolant temperature above critical threshold**	Reduced power and speed.
1153		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **High voltage detected at intake manifold temperature sensor circuit**	Possible white smoke. No engine protection for intake manifold temperature.
1154		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Low voltage detected at intake manifold temperature sensor circuit**	Possible white smoke. No engine protection for intake manifold temperature.
1155		**Stop Vehicle** Check coolant level. If error remains, notify maintenance.	**Stop Vehicle Immediately** **Intake manifold temperature signal indicated coolant temperature above critical threshold**	Reduced power and speed.

Table 4. Error Codes - Continued.

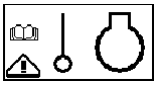
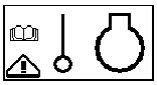
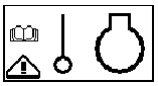
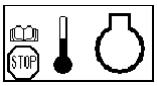
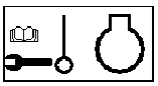
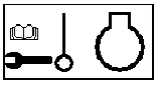
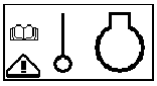
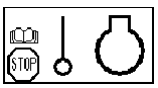
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1187		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Low voltage detected on ECM voltage supply line to some sensors**	Engine will run degraded. No protection for oil pressure.
1212		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **High voltage detected at oil temperature sensor circuit**	No engine protection for oil temperature.
1213		**Stop Vehicle** Press RESET. If error shows again, notify maintenance. Finish mission.	**Warning - Degraded Operation** **Low voltage detected at oil temperature sensor circuit**	No engine protection for oil temperature.
1214		**Stop Vehicle** Check oil level. Press RESET. If error remains, notify maintenance. Finish mission.	**Stop Vehicle Immediately** **Oil pressure signal indicates temperature above critical threshold**	Reduced power and speed.
1221		**Finish Mission** Notify maintenance.	**Information/Maintenance** **High voltage detected at ambient air pressure sensor circuit**	Reduced power and speed.
1222		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Low voltage detected at ambient air pressure sensor circuit**	Reduced power and speed.
1227		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **High voltage detected on ECM voltage supply line to some sensors**	Engine will run degraded. No protection for oil pressure.
1234		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Engine speed signal indicates engine speed greater than 2730 rpm**	Fuel shutoff valve is closed until engine speed drops. Fuel shutoff valve will open when engine speed falls below 2184 rpm.

Table 4. Error Codes - Continued.

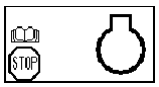
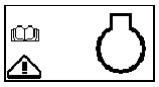
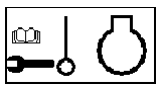
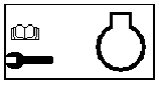
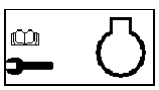
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1254		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Less than 6V detected at fuel shutoff driver** Excessive current draw. Power supply faulty.	ECM turns off FSO supply voltage. Engine will shut down.
1255		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Externally supplied voltage detected going to fuel shutoff supply circuit**	No performance limitations. Fuel shutoff valve stays open.
1285		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Information from multi-plexed device not received by ECM or received too late**	At least one multiplexed device will not operate properly.
1286		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Only a portion of information from multiplexed device received by ECM**	At least one multiplexed device will not operate properly.
1287		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Stop Vehicle Immediately** **Data error received while multi-plexing throttle pedal and IVS**	The engine will only idle.
1295		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Ambient air pressure sensor circuit error detected by ECM**	Engine is degraded to no air setting.
1311		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #1 when voltage is turned OFF**	Injector for cylinder #1 turned off.
1312		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #5 when voltage is turned OFF**	Injector for cylinder #5 turned off.

Table 4. Error Codes - Continued.

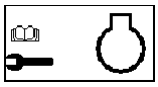
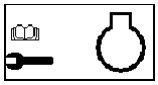
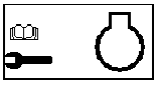
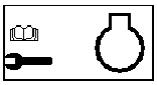
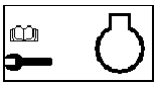
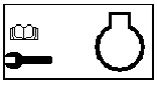
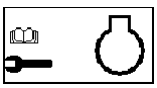
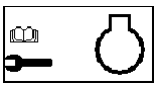
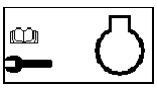
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1313		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #3 when voltage is turned OFF**	Injector for cylinder #3 turned off.
1314		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #6 when voltage is turned OFF**	Injector for cylinder #6 turned off.
1315		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #2 when voltage is turned OFF**	Injector for cylinder #2 turned off.
1321		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Current detected at injector for cylinder #4 when voltage is turned OFF**	Injector for cylinder #4 turned off.
1322		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #1 when voltage is turned ON**	Injector for cylinder #1 turned off.
1323		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #5 when voltage is turned ON**	Injector for cylinder #5 turned off.
1324		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #3 when voltage is turned ON**	Injector for cylinder #3 turned off.
1325		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #6 when the voltage is turned ON**	Injector for cylinder #6 turned off.
1331		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #2 when voltage is turned ON**	Injector for cylinder #2 turned off.

Table 4. Error Codes - Continued.

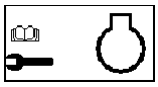
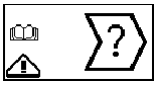
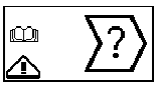
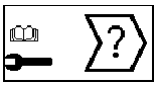
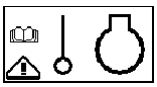
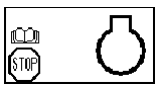
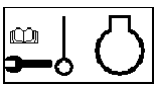
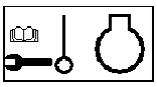
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1332		**Finish Mission** Notify maintenance.	**Information/Maintenance** **No current detected at injector for cylinder #4 when voltage is turned ON**	Injector for cylinder #4 turned off.
1341		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Severe loss of data from ECM**	No noticeable performance effects possible. Possibility of engine stopping or difficulty in starting engine.
1343		**Stop Vehicle** Shut engine off/on. If code clears, resume mission. If code remains, notify maintenance.	**Warning - Degraded Operation** **Microprocessor communication error inside ECM**	No noticeable performance effects possible. May encounter severe loss of power.
1346		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Software error in ECM**	Possibly too short of time for ECM to power down, less than 30 seconds.
1352		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Low voltage detected at sensor** Faulty power supply.	Engine is degraded to no air setting.
1415		**Stop Vehicle** Check oil level. Press RESET. If error remains, notify maintenance. Finish mission.	**Stop Vehicle Immediately** **Oil pressure signal indicates below critical threshold**	Reduced power and speed.
1419		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Error in intake manifold pressure sensor signal detected by ECM**	Engine is degraded to no air setting.
1431		**Finish mission** Notify maintenance.	**Information/Maintenance** **Both idle validation off-idle and on-idle signals indicate the same voltage reading**	None

Table 4. Error Codes - Continued.

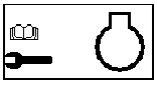
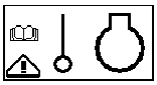
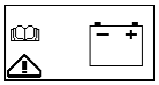
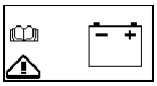
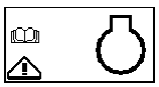
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1432		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Idle validation switch voltages are opposite (complimentary) but disagree with a valid throttle position sensor**	Engine will only idle.
1433		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Intake manifold pressure sensor voltage indicates a high pressure reading**	Engine is degraded to no air setting.
1434		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Battery voltage too low or insufficient amount of time for battery power to ECM for powering down after key off**	No noticeable performance effects possible. Possibility of engine stopping or difficulty in starting engine.
1435		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **ECM detects error in oil pressure sensor signal sensor**	None. No engine protection for oil pressure.
1441		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Battery voltage below normal operating level**	No noticeable performance effects possible. Possibility of rough idle.
1442		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Battery voltage above normal operating level**	None
1443		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Low voltage detected on ECM voltage supply line to throttle**	Engine will only idle.
1474		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Low voltage detected on starter lockout relay circuit when energized or voltage detected when circuit de-energized**	None

Table 4. Error Codes - Continued.

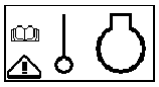
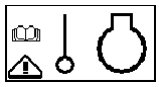
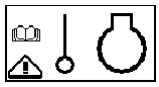
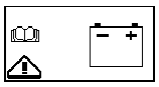
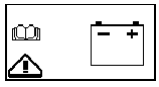
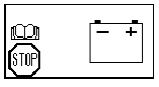
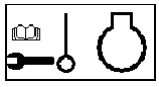
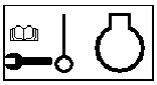
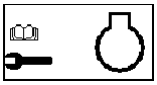
ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1551 IVS		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **No voltage detected simultaneously on both idle validation off-idle and on-idle circuits**	Engine will only idle.
1581		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **High voltage detected at fuel inlet pressure sensor circuit**	None
1582		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Low voltage detected at fuel inlet pressure sensor circuit**	None
1583		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Out-of-range low voltage detected at fuel inlet pressure sensor circuit**	None
1596		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Battery voltage above normal operating range**	None
1597		**Stop Vehicle** Press RESET. Finish mission. Notify maintenance.	**Warning - Degraded Operation** **Battery voltage below normal operating range**	None
1598		**Stop Vehicle** Abort mission. Notify maintenance.	**Stop Vehicle Immediately** **Very low battery voltage - critical level**	None
1697		**Finish Mission** Notify maintenance.	**Information/Maintenance** **High voltage detected at ECM internal temperature sensor circuit**	None

Table 4. Error Codes - Continued.

ERROR CODE	DISPLAY LAYOUT	DRIVER ACTION	ERROR CODE EXPLANATION	VEHICLE LIMITATIONS
1698		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Low voltage detected at ECM internal temperature sensor circuit**	None
1951		**Finish Mission** Notify maintenance.	**Information/Maintenance** **Power imbalance between cylinders detected by ECM**	Engine may rough idle or misfire.
1999		**Stop Vehicle** Press RESET. Check all errors that show. Notify maintenance.	**Stop Vehicle Immediately** **More than 6 errors active on the J1939 bus to the display**	None

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By Order of the Secretary of the Army:

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Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: 1 July 2002

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AMSTA-LC-CI/TECH PUBS, TACOM-RI
1 Rock Island Arsenal
Rock Island, IL 61299-7630

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125th Transportation Company
ATTN: Motor SGT (SGT Wilson)
Ft. Riley, KA 78665-4000

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 10-3930-675-10	1 July 2001	Operator's Manual for Rough Terrain Container Handler (RTCH-RT 240)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
	0017 00-2				2	Part number supplied for item 2 is incorrect.

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Johnny Wilson, E-5, MOTOR SGT	DSN 867-7967	

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THE METRIC SYSTEM AND EQUIVALENTS

Linear Measure

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

Weights

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Pounds
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

Liquid Measure

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

Square Measure

1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches
1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet
1 Sq Kilometer = 1,000,000 Sq Meters = 0.0386 Sq Miles

Cubic Measure

1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches
1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet

Temperature

5/9 (°F - 32) = °C
212° Fahrenheit is equivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5 C° +32 = F°

APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621