DG615

Operation & Maintenance Manual

210M

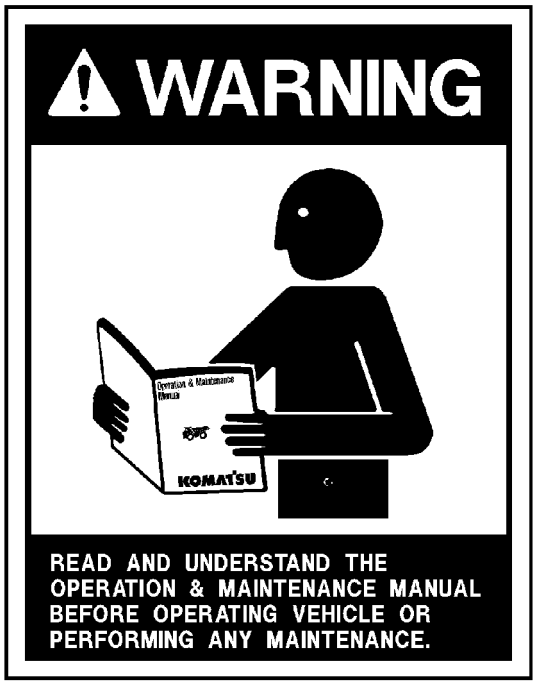
DUMP TRUCK

SERIAL SUFFIX **BFA40A thru BR**
23858 thru 24352

KOMATSU

⚠WARNING

Unsafe use of this machine may cause serious injury or death. Operators and maintenance personnel must read and understand this manual before operating or maintaining this machine.
This manual should be kept in or near the machine for reference, and periodically reviewed by all personnel who will come into contact with it.



This material is proprietary to Komatsu Mining Systems, Inc. and is not to be reproduced, used, or disclosed except in accordance with written authorization from Komatsu Mining Systems, Inc.

It is the policy of the Company to improve products whenever it is possible and practical to do so. The Company reserves the right to make changes or add improvements at any time without incurring any obligation to install such changes on products sold previously.

Because of continuous research and development, periodic revisions may be made to this publication. Customers should contact their local distributor for information on the latest revision.

CALIFORNIA
Proposition 65 Warning

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

210M

KOMATSU

FOREWORD

This handbook is intended to provide the HAULPAK® operator with the necessary information to allow for safe and efficient truck operation.

The HAULPAK® operator should be a qualified individual who has had proper training to achieve full production with the truck. An efficient, qualified operator can help insure long production life of the truck and avoid costly down time due to misuse of the unit and its systems. Training for both operators and maintenance personnel is recommended and is available upon request. Operator training is accomplished at the job site by qualified operator instructors. Maintenance training is provided both in the factory setting and in field schools. All requests for operator and/or maintenance training should be forwarded to the local HAULPAK® Distributor for action.

This handbook shows dimensioning of U.S. standard and metric (SI) units, and all references to "Right", "Left", "Front", or "Rear" are made with respect to the operator's normal seated position, unless specifically stated otherwise. Illustrations used in this handbook are typically representative and may not necessarily depict a specific model.

A Product Identification plate is normally located on the frame in front of the right side front wheel and designates the Truck Model Number, Product Identification Number (vehicle serial number), and Maximum G.V.W. (Gross Vehicle Weight) rating.

The HAULPAK® Model designation consists of three numbers and one letter (i.e. 210M). The three numbers represent the basic truck model. The letter "M" designates a Mechanical drive and the letter "E" designates an Electrical propulsion system.

The Product Identification Number (vehicle serial number) contains information which will identify the original manufacturing bill of material for this unit. This complete number will be necessary for proper ordering of many service parts and/or warranty consideration.

The Gross Vehicle Weight (GVW) is what determines the load on the drive train, frame, tires, and other components. The vehicle design and application guidelines are sensitive to the **total maximum Gross Vehicle Weight (GVW)** and this **means the total weight**: the Empty Vehicle Weight + the fuel/lubricants + the payload.

To determine allowable payload:
Service all lubricants for proper level and fill fuel tank of empty truck (which includes all accessories, body liners, tailgates, etc.) and then weigh truck.
Record this value and subtract from the GVW rating. The result is the allowable payload.
NOTE: Accumulations of mud, frozen material, etc. become a part of the GVW and reduces allowable payload. To maximize payload and to keep from exceeding the GVW rating, these accumulations should be removed as often as practical.

Exceeding the allowable payload will reduce expected life of truck components.

⚠WARNING

Unsafe use of this machine may cause serious injury or death. Operators and maintenance personnel must read this manual before operating or maintaining this machine. This manual should be kept in or near the machine for reference and periodically reviewed by all personnel who come in contact with it.

This* "ALERT" *symbol is used with the signal words,
"CAUTION", "DANGER", and* "WARNING" *in this manual to alert the reader to hazards arising from improper operating and maintenance practices.

"DANGER" ***identifies a specific potential hazard***
WHICH WILL RESULT
in either INJURY OR DEATH
if proper precautions are not taken.

"WARNING" ***identifies a specific potential hazard***
WHICH MAY RESULT
in either INJURY OR DEATH
if proper precautions are not taken.

"CAUTION" ***is used for general reminders of proper safety practices***
OR
to direct the reader's attention to avoid unsafe or improper practices which may result in damage to the equipment.

TABLE OF CONTENTS

SUBJECT **PAGE**

MODEL 210M HAULPAK® TRUCK

COMPONENT DESCRIPTION AND SPECIFICATIONS

ENGINE

The 210M HAULPAK® is powered by a Cummins KTTA–19C diesel engine. The truck is capable of speeds up to 35 MPH (56.7 km/h).

TRANSMISSION

The diesel engine drives a remote-mounted Allison CLT-6062 transmission incorporating a TC683 torque converter. The transmission has six speeds "Forward" and one "Reverse" and uses Allison Transmission Electronic Control (ATEC) for complete automatic shift sequencing. By moving the operator's Range Selector in the cab, the operator may select "R" for Reverse, "N" for Neutral or any one of six Forward driving ranges.

The Range Selector is an electronic-mechanical control unit. Each position (R,N,D,5,4,3,2,1) is selected by releasing a range locking mechanism on the lever and choosing the desired range. "D" will permit completely automatic up and down shifts through all six ranges. "5" will limit upshifts to 5th range only. "4" will limit upshifts to 4th range only. "3" will limit upshifts to 3rd range only. "2" will limit upshifts to 2nd range only. "1" is a first range hold position and no upshifts are permitted.

DYNAMIC RETARDING

Dynamic retarding is actuated by depressing the operator's retarder pedal which applies oil-cooled, rear mounted, wet disc brakes only; *the front brakes are not applied*.
Application of the retarder pedal may be fully modulated and should be used to slow the truck during normal truck operation, to control speed coming down a grade or to make non-emergency stops. Use of the retarder pedal saves wear on the front brakes and provides better steering control.

SERVICE BRAKE SYSTEM

The service brakes are controlled by an all hydraulic actuation system. Depressing the service brake pedal actuates front dry disc brakes and rear wet disc brakes.

Automatic Emergency Braking is provided if system pressure falls below a preset value. All functioning wheel brakes will be automatically applied by accumulators.

POWER STEERING

The HAULPAK® Truck is equipped with an orbital power steering system mounted under the cab floor with noise and vibration isolators. Emergency power to safely steer the truck while stopping is provided automatically by an accumulator.

INSTRUMENTS

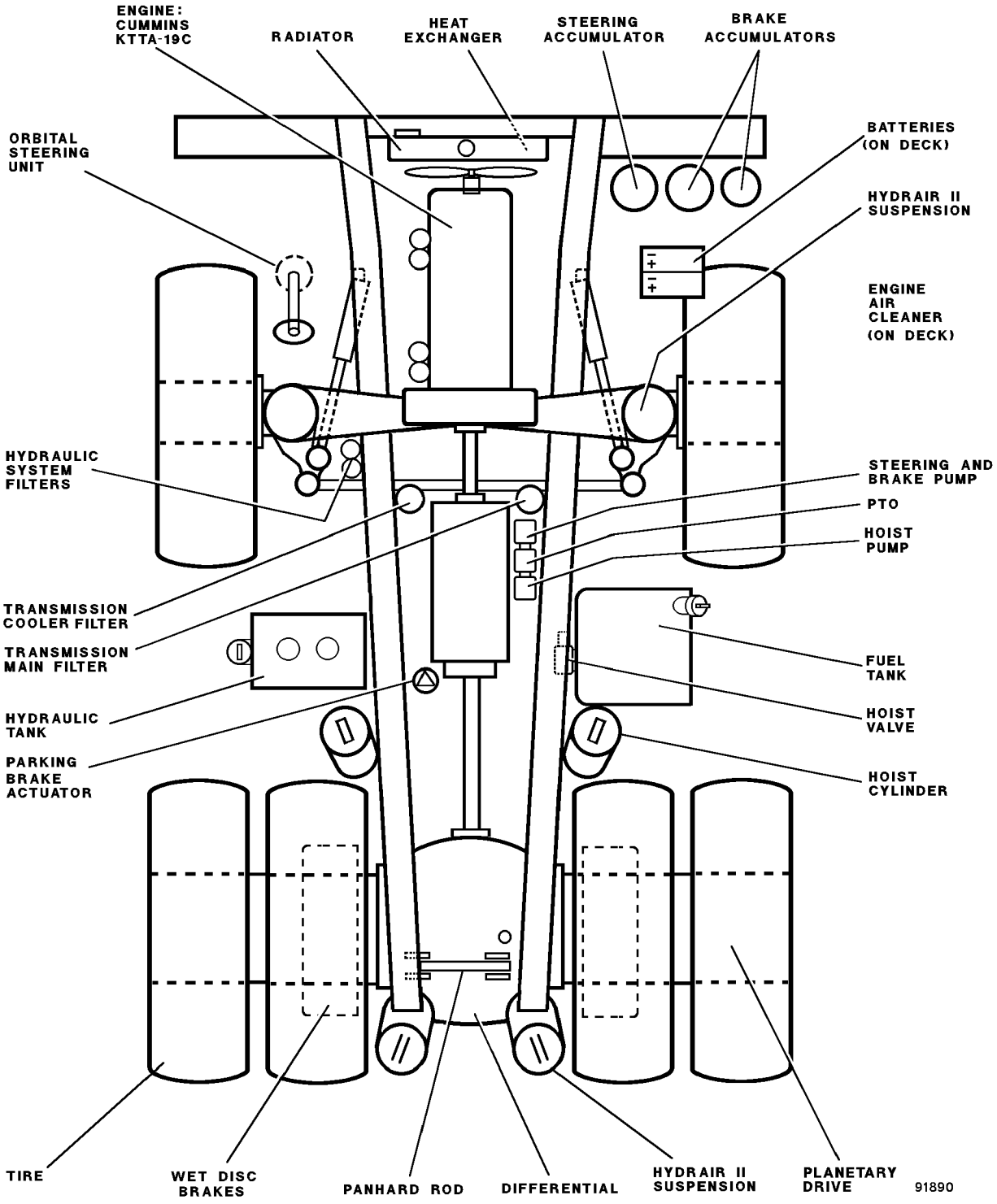
The instrument panel located in the cab provides the operator easy identification of all instruments and gauges which are necessary to control the truck and monitor the truck's operating systems.

SUSPENSION

HYDRAIR® II suspension cylinders located at each wheel provide a smooth and comfortable ride for the operator and dampens shock loads to the chassis during loading.

FINAL DRIVE

Planetary Final Drive has full floating axle shafts and a plug-in differential carrier assembly.



MODEL 210M HAULPAK® MAJOR COMPONENTS

The SPECIFICATIONS listed on these pages cover standard production. When optional equipment is selected, some of these specifications and/or capacities may change.

ENGINE

Cummins KTTA–19C
Number of Cylinders 6
Operating Cycle 4-Stroke
Rated Brake HP (SAE) 675 HP (504kW) @ 2100 RPM
Flywheel HP (SAE) . 641 HP (478kW) @ 2100 RPM
Maximum Torque:
. . . . . 1990 ft. lbs. (2698 N.m) @ 1400 RPM

TRANSMISSION ALLISON CLT-6062 w/ATEC

Torque Converter TC683
6 Speeds FORWARD . . . . . 1 REVERSE

SUSPENSION HYDRAIR® II

Stroke (Front & Rear) . . . . . 10.88 in. (276 mm)

FINAL DRIVE

Ratios:
Bevel Set (differential) 3.85:1
Planetary 5.70:1
Total Reduction 21.93:1
Maximum Speed . . . . . 35 MPH (56.7 km/h)

TIRES (Standard) 24.00-35, 36 PR(E-3)

Rating Ton-MPH (m/ton-km/h) 180 (262.8)

24 VDC ELECTRIC SYSTEM

Batteries . . . . . Two 12 Volt Batteries in Series
Capacity . . . . . 200 Ampere-Hour
Alternator . . . . . 24 Volt, 75 Amperes Output
Starter . . . . . DELCO-REMY
Lighting . . . . . 24 Volt-DC

HOIST SYSTEM

Tandem Pump Capacity:
Shaft End . . . . 94 gpm (355 l/min.) @ 2100 RPM
Cover End . . . . 80 gpm (303 l/min.) @ 2100 RPM
Relief Valve Pressure Setting . 2750 psi (18.9 MPa)
Hoist Cylinders . . . . 2 - Stage Hydraulic Cylinders
Filtration . . . . . Full-Flow, Remote-Mounted Filter
Return . . . . . Full Flow, 12 Micron - Absolute

SERVICE BRAKES

Actuation . . . . . All Hydraulic
Type:
(Front) Single Dry Disc with 2 Caliper Assy./Wheel
Total Braking Surface . . . 408 in.^{2} (2 632 cm^2)
(Rear) . . . . . Dual Wet Disc Brake Assemblies
Total Braking Surface . . 9020 in.^{2} (58 193 cm^2)

STEERING

Turning Circle . . . . . 69 ft. (21.0 m)
Pump Capacity . . . . . 22.7 gpm (85.9 lpm)
System Pressure . . . . . 2750 psi (19.0 MPa)

DUMP BODY CAPACITIES

PAYLOAD (Rated)	**55 Ton**	**(49.9 mt)**
Capacitiy:		
Struck	31.1 cu. yds.	(23.8 m^3)
Heaped @ 2:1 (SAE) . .	44.0 cu. yds.	(33.7 m^3)

BODY

Material [Yield Strength]	Thickness
Floor [125,000 psi (862 MPa)Steel]	0.75 in. (19 mm)
Front [90,000 psi (620 MPa)Steel]	0.50 in. (13 mm)
Sides [90,000 psi (620 MPa)Steel]	0.38 in. (10 mm)

SERVICE CAPACITIES

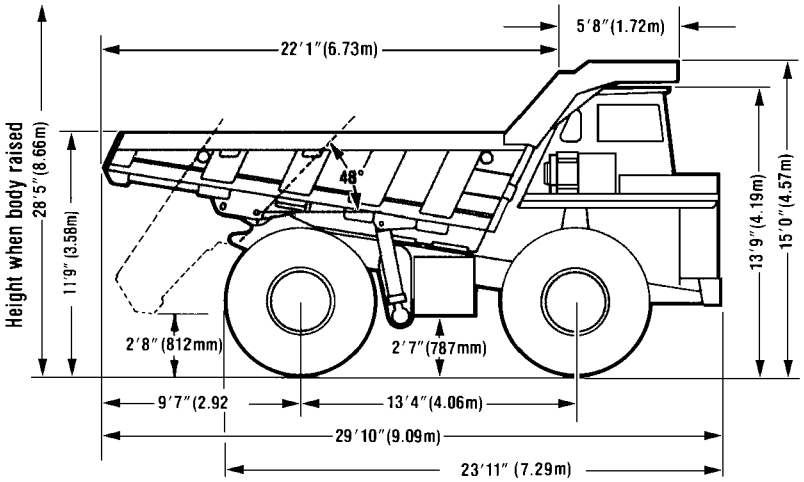
	U.S. Gallons	Liters
Engine Lube Oil:		
Cummins (incl. lube oil filters) . .	14.2	53.8
Cooling System	48	181.7
Fuel Tank	154	583.7
Hydraulic System (incl. tank)	144	545.0
Hydraulic Tank	95	359.6
Transmission	20	75.6
Final Drive	56	212.2
Front Spindle	1	3.8

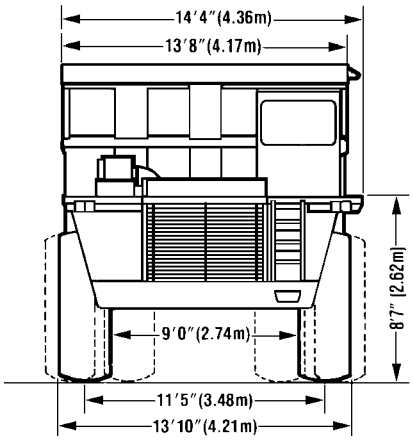
WEIGHT DISTRIBUTION

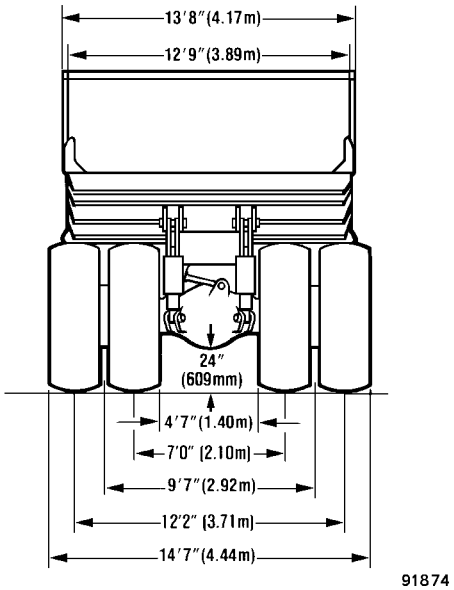
EMPTY - STANDARD	**Pounds**	**Kilograms**
Front Axle	44,390	20 135
Rear Axle	45,910	20 824
Total	90,300	40 959
LOADED	**Pounds**	**Kilograms**
Front Axle	66,700	30 255
Rear Axle	133,600	60 600
Total	200,300	90 855

MAXIMUM ALLOWABLE GVW 210,000 95 340

OVERALL TRUCK DIMENSIONS







GENERAL SAFETY

Safety records of most organizations will show that the greatest percentage of accidents are caused by unsafe acts of persons. The remainder are caused by unsafe mechanical or physical conditions. Report all unsafe conditions to the proper authority.

The following safety rules are provided as a guide for the HAULPAK® operator. However, local conditions and regulations may add many more to this list.

SAFETY IS THINKING AHEAD

Prevention is the best safety program. Prevent a potential accident by knowing the employer's safety requirements, all necessary job site regulations as well as use and care of the safety equipment on the HAULPAK® Truck. Only qualified operators or technicians should attempt to operate the HAULPAK® Truck.

Safe practices start before the operator gets to the equipment!

1. Wear the proper clothing. Loose fitting clothing, unbuttoned sleeves and jackets, jewelry, etc., can catch on a protrusion and cause a potential hazard.
2. Always use the personal safety equipment provided for the operator such as hard hat, safety shoes, safety glasses or goggles. There are some conditions when protective hearing devices should also be worn for operator safety.
3. When walking to and from the truck, maintain a safe distance from all machines even if the operator is visible.

At The Truck - Ground Level Inspection

4. Before operating truck, a careful visual inspection should be completed. Report any items that need attention to the proper authority.
   a. Visually inspect all headlights, worklights, clearance lights, and taillights for damage and be certain lenses are clean. Good visibility may prevent an accident.
   b. Visually inspect entire truck for oil or coolant leaks, and loose nuts and bolts, especially at the load carrying areas, such as: wheels, suspensions, steering, and brakes.

⚠WARNING

If engine has been running, allow coolant to cool before removing the fill cap or draining radiator.

Any operating fluid, such as hydraulic oil, or engine coolant escaping under pressure, can have sufficient force to enter a person's body by penetrating the skin and cause serious injury and possibly death, if proper medical treatment by a physician who is *familiar with this type of injury is not received immediately.*

c. When checking coolant in radiator, relieve pressure before removing radiator cap.

⚠WARNING

Do not stand in front of rim and locking ring when inflating tire.

d. Check tires for cuts, damage or ‘‘bubbles’’. Check tires for proper inflation. If tire is warm from operation, **allow tire to cool before adjusting tire pressure**. If inflation is needed, use an air chuck with extension hose clipped on the tire inflation valve to allow service from behind the tread of the tire and away from front of wheel.

e. Clean ladder and handrails of any foreign material such as ice, snow, mud or oil.

f. Upon completion of an exterior inspection of the truck, clean mud, grease, or snow from shoes before climbing access ladder.

Preparing For Operation

⚠WARNING

Always mount and dismount facing the truck. Never attempt to mount or dismount the truck while it is in motion.

5. Always use handrails and ladder when mounting or dismounting from the truck.
6. Check the deck areas for debris, loose hardware or tools.
7. Become familiar with all protective equipment devices on the truck and insure that these items (anti-skid material, grab bars, seat belts, etc.) are securely in place.
8. Read and understand the contents of this handbook. Read the sections pertaining to safety and operating instructions with special attention. Become thoroughly acquainted with all gauges, instruments and controls before attempting operation of the truck.
   Read and understand **WARNING** and **CAUTION** decals in the operator’s cab.
9. Keep all unauthorized reading material out of truck cab.
10. Do not carry tools and supplies or allow trash to accumulate in cab of truck.

11. Insure steering wheel, horn, controls and pedals are free of any oil, grease or mud.

12. Insure headlights, worklights and taillights are in proper working order.

13. Insure windshield and all cab windows are clean and unbroken. Good visibility may prevent an accident.

14. Check operation of windshield wiper, condition of wiper blades, and check windshield washer reservoir for fluid level.

15. Be familiar with all steering and brake system controls and warning devices, road speeds and loading capabilities, before operating the truck.

Truck Operation

16. DO NOT leave truck unattended while engine is running.

17. **WEAR SEAT BELTS AT ALL TIMES.** Only authorized persons are allowed to ride in truck. Riders should be in cab only.

18. Do not allow anyone to ride on decks or steps of truck.

19. Do not allow anyone to get on or off truck while it is in motion.

20. Do not move truck into or out of a building without a signal person present.

21. Know and obey the hand signal communications between operator and spotter. When other machines and personnel are present, the operator should move in and out of buildings, loading areas and through traffic, under the direction of a signal person. **Courtesy at all times is a safety precaution!**

22. Report immediately to supervisor any conditions on haul road, pit or dump area that may present an operating hazard.

23. Check for flat tires periodically during shift. If truck has been run on a ‘‘flat’’, **it must not be parked in a building until the tire cools.**

    If tire must be changed, do not stand in front of rim and locking ring when inflating tire mounted on the machine. Observers should not be permitted in the area and should be kept away from the side of such tires.

24. Always have parking brake applied when the truck is parked and unattended.

25. When parking, park a safe distance from other vehicles as determined by supervisor.

26. Keep serviceable fire fighting equipment at hand. Report used extinguishers for replacement or refilling.

⚠WARNING

Tire and rim assembly may expode if subjected to excessive heat. Personnel should move to a remote or protected location if sensing excessively hot brakes, smell of burning rubber or evidence of fire near tire and wheel area.

If the truck must be approached, such as to fight a fire, those personnel should do so only while facing the tread area of the tire (front or back), unless protected by use of large heavy equipment as a shield. Stay at least 50 ft. (15 m) from the tread of the tire.

In the event of fire in the tire and wheel area (including brake fires), stay away from the truck at least 8 hours or until the tire and wheel are cool.

27. Stay alert at all times! In the event of an emergency, be prepared to react quickly and avoid accidents. If an emergency arises, know where to get prompt assistance.

WHEN REPAIRS ARE NECESSARY

1. Only qualified maintenance personnel who understand the systems being repaired should accomplish repairs.
2. Many components on the HAULPAK® Truck are large and heavy. Insure that lifting equipment - hoists, slings, chains, lifting eyes - are of adequate capacity to handle the lift.
3. DO NOT WORK under a suspended load. Do not work under raised body unless body safety cables, props, or pins are in place to hold the body in up position.
4. Do not repair or service truck while engine is running, except when adjustments can only be made under such conditions. **Keep a safe distance from moving parts.**
5. When servicing air conditioning system with refrigerant (Freon), wear a face shield and cold resistant gloves for protection against freezing. Be certain to follow all current requirements for handling and recapturing freon gas.
6. Follow package directions carefully when using cleaning solvents.
7. If an auxiliary battery assist is needed, first use one cable to connect the 24V positive (+) post of the disabled truck batteries to the 24V positive (+) post of the auxiliary assist. Use second cable to connect the 24V negative (-) post of the auxililary assist battery to a **frame ground (-)** on the disabled truck *away from the battery*.

8. Always disconnect the positive and negative battery cables of the vehicle before doing any welding on the unit. Failure to do so may seriously damage the battery and electrical equipment. Disconnect battery charging alternator lead wire and isolate electronic control components before making welding repairs. It is not necessary to disconnect or remove any control circuit cards on electric drive HAULPAK® Trucks or any of the "AID" circuit control cards.

   Always fasten the welding machine ground (-) lead to the piece being welded; **grounding clamp MUST BE ATTACHED AS NEAR AS POSSIBLE to the weld area**. Never allow welding current to pass through ball bearings, roller bearings, suspensions, or hydraulic cylinders. Always avoid laying welding cables over or near the vehicle electrical harnesses. Welding voltage could be induced into the electrical harness and possibly cause damage to components.

9. If truck is to be towed for any reason, use a rigid tow bar. Check truck cab for decal recommending special towing precautions. (Also refer to Towing Procedure in OPERATING INSTRUCTIONS.)

10. Drain, clean and ventilate fuel tanks and/or hydraulic tanks before making any welding repairs.

⚠WARNING

Any operating fluid, such as hydraulic oil or brake fluid escaping under pressure, can have sufficient force to enter a person's body by penetrating the skin. Serious injury and possibly death may result if proper medical treatment by a physician familiar with this injury is not received immediately.

11. Relieve pressure in lines or hoses before making any disconnects.

12. After adjustments or repairs, replace all shields, screens and clamps.

13. Tire Care:

⚠WARNING

Do not stand in front of rim and locking ring when inflating tire mounted on the machine. Observers should not be permitted in the area and should be kept away from the side of such tires.

Do not weld or apply heat on the rim assembly with the tire mounted on the rim. Resulting gases inside the tire may ignite, causing explosion of tire and rim.

14. Only a qualified operator or experienced maintenance personnel who are also qualified in operation should move the truck under its own power in the repair facility or during road testing after repairs are complete.

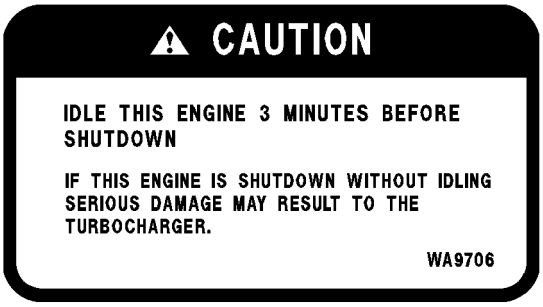
NOTES

WARNINGS AND CAUTIONS

The following paragraphs give an explanation of the Warning, Caution, Danger and Service Instruction plates and decals attached to the truck. The plates and decals listed here are typical of this model HAULPAK®, but because of customer options, individual trucks may have plates and decals that are different from those shown here.

The plates and decals must be kept clean and legible. If any decal or plate becomes worn or unable to be read, it should be replaced with a new one. Order replacements by the part number shown at the bottom of the plate or decal.

Engine idle decal WA9706 is located in the cab, above the windshield. The operator is cautioned that damage can occur to the turbocharger if the engine is not properly idled for three minutes before shutdown. These instructions are very important.



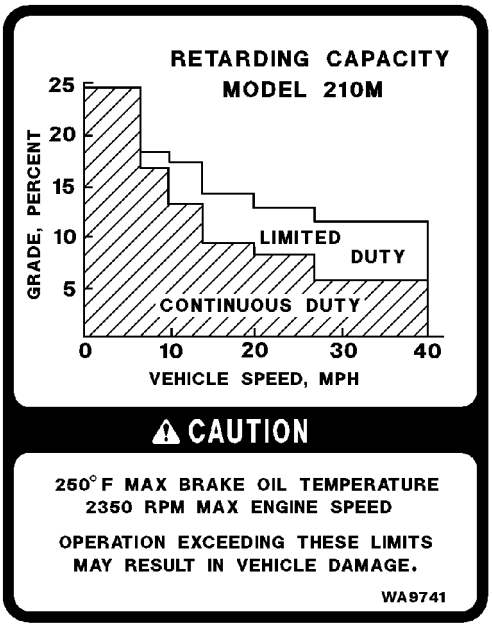
The WA9721 towing "Caution" decal is located to the right of operator, above the windshield. Do not tow the truck without first removing the sun gears and sun shafts from the planetary drive. If these parts are not removed, damage to the transmission and/or final drive will result when the truck is towed. Refer to the service manual, Section "G", Planetary Drive, for instructions.

Do not tow the truck faster than 5 MPH (8 KPH).

WA9741Caution decal is located inside the cab above the windshield. It cautions the operator that the maximum brake oil temperature is 250°F (121°C) and maximum engine speed is 2350 RPM. Exceeding these limits may result in vehicle damage. The graph provides speed guide lines to be used to maintain these limits when descending various grades with a loaded truck.

When descending a grade and applying the retarder pedal, the operator should observe *both the Tachometer and the Brake Oil Temperature Gauge*. The engine RPM must be maintained at 1650 – 2350 RPM (green area on tachometer) and the Brake Oil Temperature must be maintained below 250°F (121°C).

If the operator observes that either of these values are about to be exceeded, the operator should immediately move the transmission range selector to the next lower range and apply the service brakes until the truck is slowed to a speed which will permit the transmission to downshift to the gear range selected.



The welding "Caution" plate WA9713 is located in the cab above the windshield. These instructions MUST be followed when welding is done on the truck to avoid damage to the ATEC components.

⚠ CAUTION

PRIOR TO WELDING ON TRUCK

1) DISCONNECT BATTERY CONNECTIONS
2) DISCONNECT PLUGS TO ELECTRONIC CONTROL UNIT (ECU)
3) COVER ATEC COMPONENTS AND WIRING FOR PROTECTION FROM HOT SPARKS.
4) DO NOT CONNECT WELDING CABLES TO ATEC COMPONENTS
5) DO NOT WELD ON ATEC COMPONENTS
6) REMOVE THE ATEC COMPONENTS IF WELDING IS TO BE DONE WITHIN 10 IN. OF COMPONENTS.

WA9713

. . . . . .

A ROPS/FOPS Warning plate is located on the right side of the cab above the windshield. It specifies that the structure as manufactured meets SAE specifications and warns that these specifications may be impaired if subjected to any modifications or damage.

WA9779 Caution decal is located in the cab on the back of the sunvisor and specifies that during first four hours of operation, the **Truck Speed SHOULD NOT Exceed** 25 MPH (40 KPH) in order to properly break-in the oil brake seals.

⚠ CAUTION

BREAK-IN PROCEDURE FOR OIL BRAKE SEALS

VEHICLE SPEED MUST NOT EXCEED 25 MPH DURING THE FIRST 4 HOURS OF OPERATION WHILE IN MOTION

WA9779

. . . . . .

On the right side of the operator's instument panel is a series of three Warnings.

The Warning on the left specifies that wheel brake lock is **not to be used for parking**. If engine is not running, brake pressure may bleed down allowing brakes to be released. It should be used only at the shovel or dump, or for emergency.

⚠ WARNING	⚠ WARNING	⚠ WARNING
MANUAL BRAKE APPLY. NO PARK! USE FOR EMERGENCY AND/OR SHOVEL AND DUMP ONLY. SYSTEM WILL BLEED DOWN RELEASING BRAKES.	DO NOT OPERATE MACHINE IF ANY OF THE RED WARNING LIGHTS ARE ON.	SLIPPERY ROAD CONTROL. REDUCES FRONT WHEEL BRAKING. REDUCING BRAKING ASSIST IN STEERING CONTROL ON SLIPPERY ROAD CONDITIONS.

ROPS/FOPS Nº. YA1169 MACHINE MODEL CFA25 AND BFA40 AS INSTALLED BY THE MANUFACTURER ON THIS DUMPER WITH EMPTY WEIGHT LESS THAN 40900 kg. AND WEIGHT WITHOUT BODY LESS THAN 31300 kg. THIS ROLLOVER PROTECTIVE STRUCTURE AND FALLING OBJECT PROTECTIVE STRUCTURE MEETS THE PERFORMANCE REQUIREMENTS OF SAE-J1040, SAE-J231, AND SAE-J1164.

⚠ WARNING THE PROTECTION OFFERED MAY BE IMPAIRED IF SUBJECTED TO ANY MODIFICATIONS OR DAMAGE. TO MAINTAIN MANUFACTURERS CERTIFICATION, ANY REPAIR OR ALTERATION ON THIS STRUCTURE MUST HAVE WRITTEN APPROVAL.

Dresser Haulpak Division
Peoria Illinois U.S.A.

TZ5575

The center Warning specifies that if any of the red lights on the instrument panel are "ON" (during truck operation), the truck should not be operated. The switch in this panel is a manual test switch to check all indicator lights for operation.

The Warning on the right specifies that when the slippery road control is in use, braking power to the front wheels is reduced. *The Slippery Road switch will not be present on Haulpak® Trucks with rear oil-cooled disc brakes.*

. . . . . .

WA6488 instruction decal is applied to the right side window of the cab. It identifies the various symbols that may appear on the instrument panel and gauges. Refer to Operator and Instrument Controls, for description of function or control being identified by symbol.

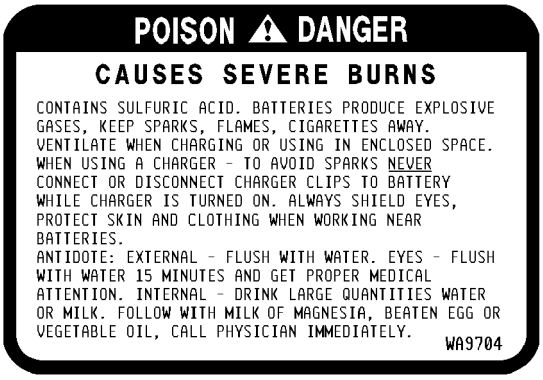
. . . . . .

WA9702 decal is located on top of the battery box cover. The battery box is mounted on top of the right deck structure. This decal informs the technician that **the truck electrical system is Negative Ground**. If the batteries are removed, proper polarity must be maintained at installation. Always disconnect ground last.

. . . . . .

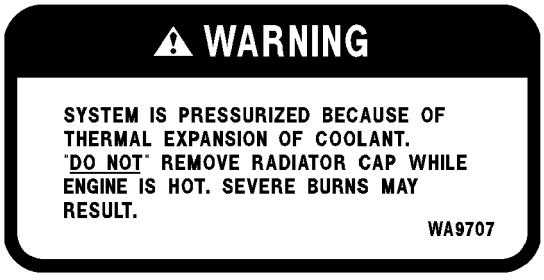
Attached to the exterior of the battery compartment is danger plate WA9704. This plate stresses the need to keep from making any sparks near the battery. When getting a battery assist from one truck to another, all switches must be "Off" prior to making any connections. Be certain to maintain correct polarity. Connect one lead of booster cable to 24V positive (+) post of battery needing assist, and other lead of the booster cable to the 24V positive (+) post of auxiliary battery. Connect one lead of second booster cable to 24V negative (-) post of auxiliary battery and then connect other lead of the booster cable to a good frame ground on the disabled truck away from the battery needing assist. This procedure will avoid the possibility of causing sparks near the battery where explosive gases may be present.

Sulfuric acid is corrosive and toxic. Use proper safety gear, goggles, rubber gloves and rubber apron when handling and servicing batteries.



. . . . . .

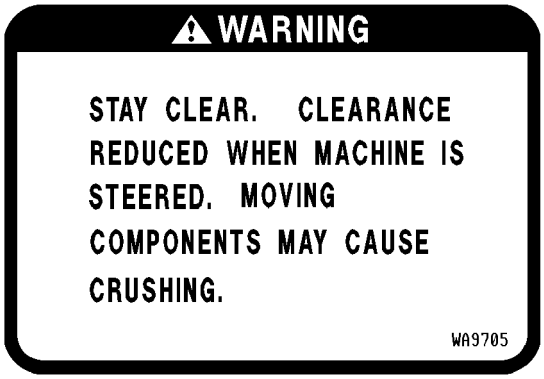
Warning plate WA9707 is mounted on top of the radiator grille near the radiator cap. **Radiator pressure must be released** (refer to Radiator, Section "C"), **before removing the radiator cap** after engine has been running. The engine cooling system is controlled by thermostats which keep coolant temperature between 160°- 190°F (71°- 88°C) during operation. Hot coolant may be expelled from the radiator resulting in serious scalding and burning if pressure is not released prior to removal of cap.



. . . . . .

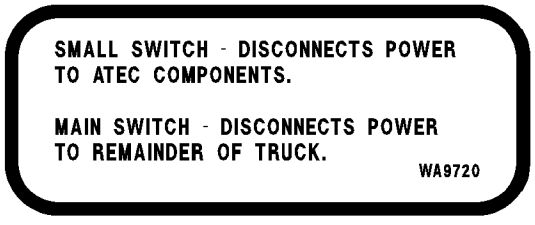
Decal WA9722 is located on the engine air cleaner which is on the deck above the right front wheel. Refer to the service manual, Section "C" for air cleaner service.

Warning plates WA9705 are mounted on the frame in front of and to the rear of both front tires. Technicians making adjustments are warned that the clearances change when the truck is steered. Serious injury by crushing may occur if care is not taken.

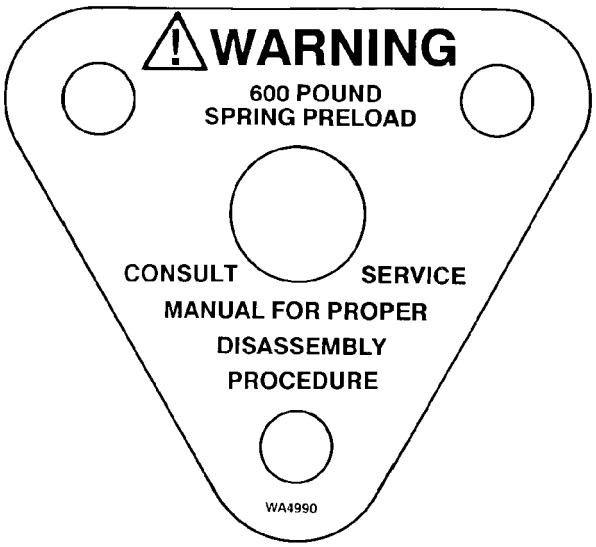


Instructional decal WA9720 is located on a switch box on the left side of the engine. The small toggle switch on top of the box disconnects *both the 24 VDC and 12 VDC from the ATEC system*. The large "T" handle on the face of the switch box disconnects ALL electrical power to the truck *except* the ATEC system when pulled out and rotated either direction from the horizontal position.

When disconnecting batteries, be certain that the ATEC disconnect switch is "OFF" **before** physically removing battery cables. Additionally, do not turn ATEC switch "ON" before all battery connections are secure.

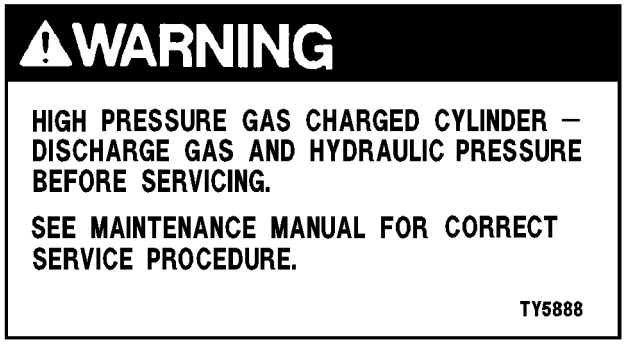


WA4990 Warning plate is located on the top of the parking brake actuator. It warns that the unit contains a spring with a preloaded force of 600 lb. (270 kg). Refer to the service manual, Parking Brake, Section "J" for service instructions. Serious injury may result if proper procedures are not followed.

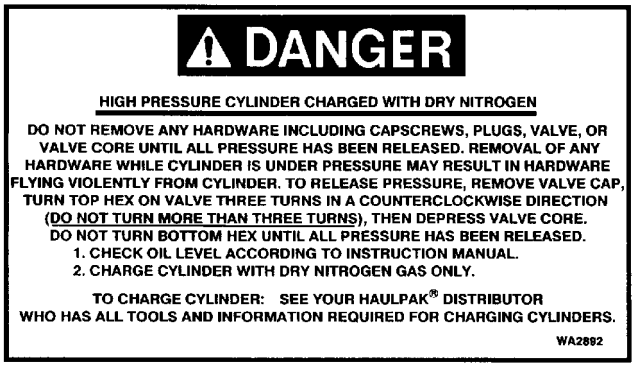


WA9712 Warning plate is attached to both the hydraulic and fuel tank. For the safety of technicians who may be working on the truck with the body in the raised position, they are warned to make sure safety pin (body-up retaining pin) is in position.

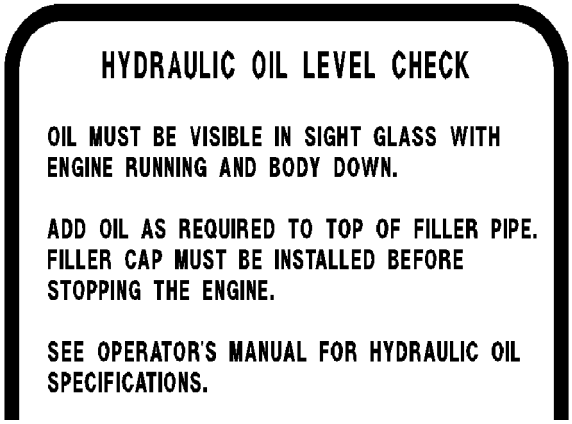
TY5888 Warning decal is applied to the Steering accumulator and both Brake accumulators to warn servicing personnel of both high gas pressure and hydraulic pressure. Be certain pressures are released before disconnecting any lines or disassembly of the cylinders. Refer to the service manual, Sections "J" and "L" for accumulator bleeddown instructions.



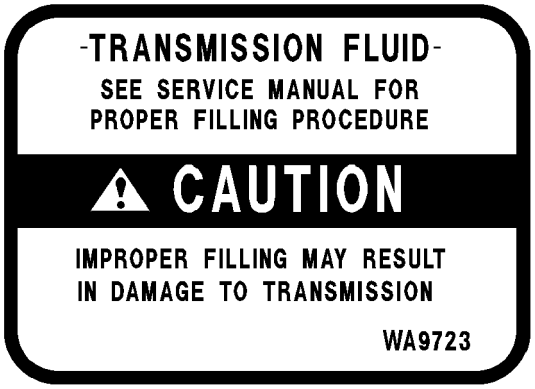
Danger plate WA2892 is attached to each suspension cylinder as well as steering and brake accumulators. This plate contains instructions for releasing internal pressure prior to disconnecting any hydraulic lines or hardware.



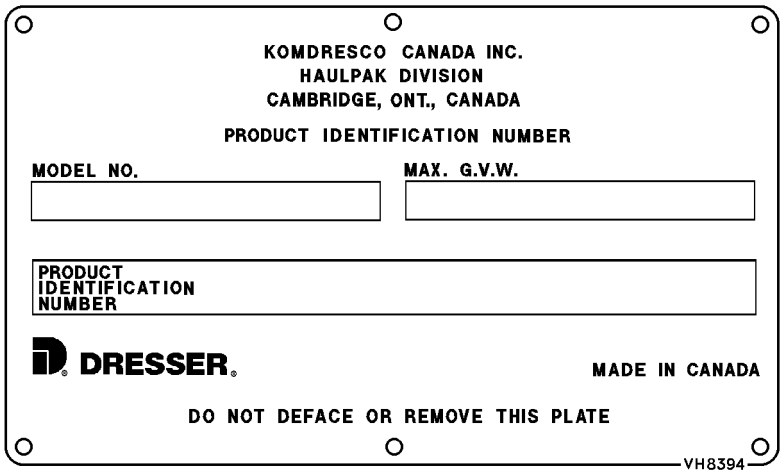
WA9719 hydraulic oil level check decal is located on the hydraulic tank. The information given on this decal provides the proper method of filling the hydraulic tank. If the steps are not followed closely, possible damage to hydraulic components may occur or possible injury to the technician servicing the truck.



WA9723 decal is located above the transmission fill tube on front side of the hydraulic tank. It cautions the servicing technician to refer to the service manual for proper filling instructions to avoid serious damage to the transmission.



VH8394 Identification plate is located on the right side of the main frame, just in front of the front wheel. Refer to serial number on this plate whenever reporting truck conditions.

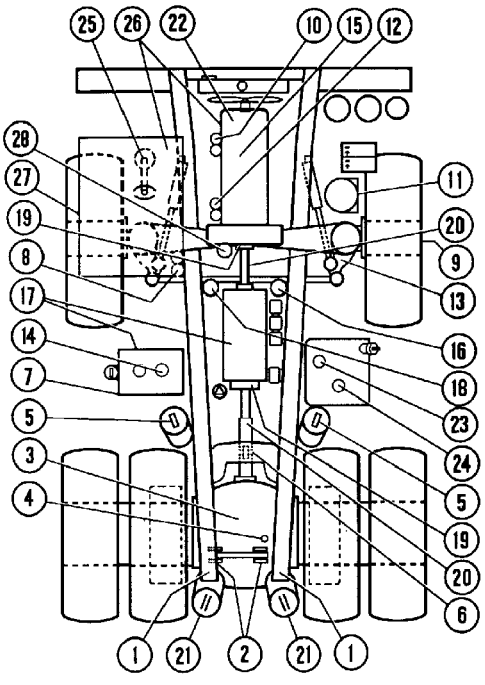


WA8875 Lubrication Chart is mounted on the front of the right front deck support. Refer to this chart for lubrication specifications and lubrication intervals.

LUBRICATION CHART

LUBRICATION SPECIFICATIONS				
LUBE KEY	TYPE LUBRICANT	-65°F TO -25°F	-25°F TO +32°F	+32°F TO +90°F	ABOVE 90°F
A	ENGINE OIL	SEE ENG. MANUAL*	SEE ENG. MANUAL*	SEE ENG. MANUAL	SEE ENG. MANUAL
AA	LUBRICATING OIL	SAE 10W	SAE 10W	SAE 10W	SAE 10W
B	MULTI-PURPOSE GREASE	MIL-G-10924B	MIL-G-10924B	MIL-G-10924B	MIL-G-10924B
C	MULTI-PURPOSE GEAR OIL	MIL-L-2105C SAE 75W	MIL-L-2105C SAE 80W-90	MIL-L-2105C SAE 80W-90	MIL-L-2105C SAE 85W-140
D	HYDRAULIC OIL C-4	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W
E	MOLYBDENUM DISULPHIDE GREASE -3% MIN	#0	#1	#2	#2

DESCRIPTION	SYM.	PTS.	LUBE KEY	10 HR	100 HR	250 HR	1000 HR
BODY HINGE PINS	1	2	E	GREASE			
PANHARD ROD	2	2	E	GREASE			
FINAL DRIVE	3	**	C		CHECK		CHANGE
FINAL DRIVE BREATHER	4	**			CLEAN		
HOIST CYLINDER PIVOTS	5	4	E	GREASE			
FINAL DRIVE PIVOT PIN	6	1	E	GREASE			
HYDRAULIC TANK	7	1	D	CHECK			CHANGE
HYDRAULIC FILTER	8	2				CHANGE	
FRONT WHEEL BEARINGS	9	2	C		CHECK		
FUEL FILTERS	10	2				CHANGE	
ENGINE AIR CLEANER	11	1		CHECK			
ENGINE LUBE FILTERS	12	2				CHANGE	
STEERING BALL STUD/PIVOT	13	6	E	GREASE			
HYDRAULIC TANK BREATHER	14	2			CHECK		CHANGE
ENGINE CRANKCASE OIL	15	1	A	CHECK		CHANGE	
TRANSMISSION OIL FILTER	16	1					CHANGE
TRANSMISSION OIL	17	1	D		CHECK		CHANGE
TRANSMISSION COOLER FILTER	18	1					CHANGE
U-JOINT CROSSES	19	4	B		GREASE		
U-JOINT SLIP SPLINE	20	2	E		GREASE		
SUSPENSION BEARINGS	21	4	E	GREASE			
ENGINE CRANKCASE BREATHER	22	4					CLEAN
FUEL TANK BREATHER	23	1					CLEAN
FUEL TANK – H20 & SEDIMENT	24	1			DRAIN		
STEERING COLUMN BEARINGS	25	2	B		GREASE		
THROTTLE CABLE LINK	26	2	AA		OIL		
CAB DOOR HINGE	27	3	AA		OIL		
ENGINE BY-PASS FILTER	28	1				CHANGE	

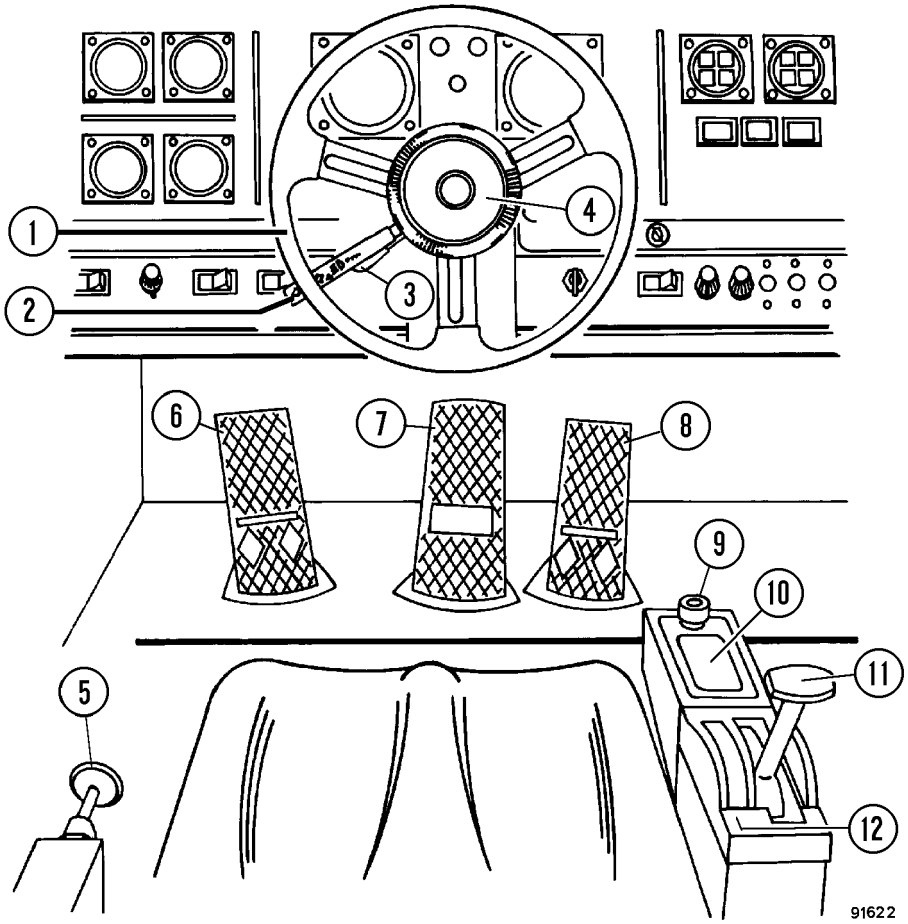


* AUXILIARY HEATERS REQUIRED BELOW -10° F.

** SEE MANUAL

WA8875

OPERATOR CONTROLS AND EQUIPMENT



OPERATOR CONTROLS

1. Steering Wheel
2. Turn Signals and Dimmer Switch
3. Steering Wheel Tilt Lever
4. Horn/Telescope Adj.
5. Hoist Control
6. Retarder Pedal
7. Service Brake Pedal
8. Throttle Pedal
9. Cigarette Lighter
10. Ash Tray
11. Range Selector
12. DO NOT SHIFT Light

Not Shown - HAZARD Flasher Switch below Steering Wheel

(1) STEERING COLUMN AND CONTROLS

The steering column will tilt up and down and telescope in and out to provide a comfortable drive position for the operator, or move up and away for easy entry and exit.

(2) DIMMER SWITCH AND TURN SIGNALS

The dimmer switch is located in the turn signal lever. If headlights are on low beam, pulling the lever toward the steering wheel will change headlights to high beam. Pulling the lever again changes headlights back to low beam.

Turn signals lights are activated by moving the lever "up" to activate right turn lights, and moving the lever "down" for left turn lights.

(3) TILT LEVER

Adjust the tilt of the steering wheel by pulling the Tilt Lever toward the steering wheel and moving the wheel to the desired angle. Releasing the lever will lock the wheel in the desired location.

(4) HORN AND TELESCOPING ADJUSTMENT

The horn is activated by depressing the center "button". Operation of the horn should be verified before starting engine or moving truck.

The steering wheel adjustment may be moved "in" or "out" (telescoped) by rotating the housing around the horn button **counterclockwise to unlock** the adjustment. After selecting the desired position, rotate the housing **clockwise to lock** the adjustment.

HAZARD FLASHER SWITCH

Not shown in the illustration is the "HAZARD" flasher switch. It is located below the steering wheel, approximately in the "seven O' clock" position. Pulling the switch out activates all turn signal lights, causing all lights to flash simultaneously. These should be used to mark the truck when necessary to park an inoperative truck at the side of the road or other unusual parking place.

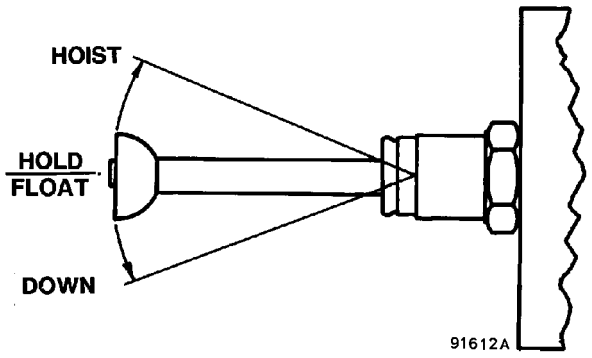
(5) HOIST CONTROL LEVER

The hoist control lever is a three-position hand operated switch located to the left of the operator seat.

A push button in the center of the control knob must be depressed to unlock the lever from the neutral position.

Pulling the lever up actuates the hoist circuit causing body to raise. Hold lever in hoist position until load is dumped. Releasing the lever from the hoist position will place the body in a hold position.

To lower body, move the hoist lever to the "Down" position and release. Releasing the lever, places the hoist control valve in the "Float" position allowing the body to return to the frame.



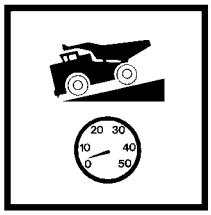
(6) RETARDER PEDAL

The Retarder Pedal is the *left* pedal of the three pedals and should be used by the operator to slow the truck during normal operation and to maintain a safe productive speed while decending grades. *When the retarder pedal is activated, only the rear oil-cooled brakes are applied;* the front brakes are not applied. The amount of retarding is controlled by how far the operator depresses the pedal and with full application may be used for non-emergency stops.

Retarder Operation

The operator should use the retarder pedal instead of the service brake pedal for slowing the truck and for non-emergency stops whenever speed and load conditions permit. Using the retarder saves front brake wear and provides better steering control.

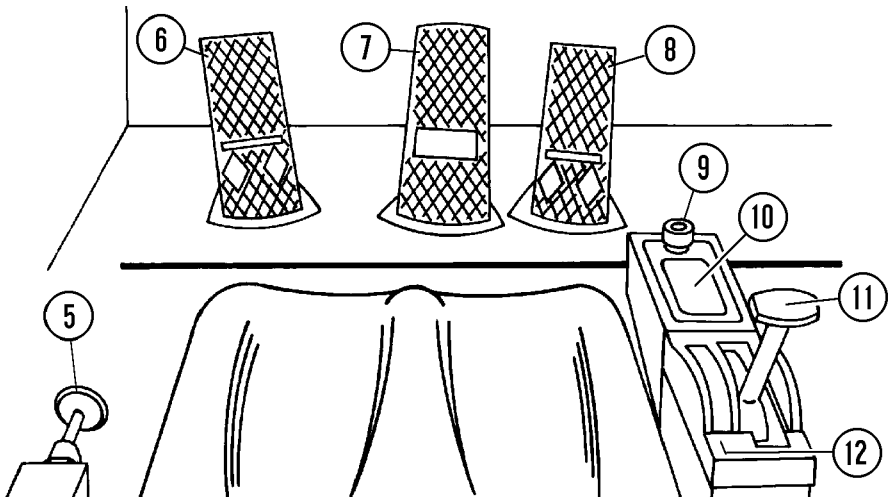
When approaching a descending grade, the operator should slow the truck and select the proper transmission gear range to maintain an engine speed of 1650 – 2350 RPM (green area on tachometer) and the brake oil temperature below 250^{O}F (121^{O}C) during retarder operation. Refer to the Grade/Speed decal in the cab above the windshield.



When descending a grade, the operator should apply the retarder pedal and observe *both the Tachometer and the Brake Oil Temperature Gauge*. **The engine RPM must be maintained at 1650 – 2350 RPM (green area on tachometer) and the Brake Oil Temperature must be maintained below 250^{O}F (121^{O}C).**

If the operator observes that **either** the maximum engine speed of 2350 RPM **or** the Brake Oil Temperature of 250^{O}F (121^{O}C) are about to be exceeded, the operator should immediately move the transmission range selector to the next lower range and apply the service brakes until the truck is slowed to a speed which will permit the transmission to downshift to the gear range selected. Continue this procedure to downshift to the required gear range to maintain engine speed at 1650 – 2350 RPM and brake oil temperature below 250^{O}F (121^{O}C). The service brakes should be used only long enough to slow the truck to allow the transmission to downshift. When the proper gear range is attained, continue using the retarder to maintain a safe, productive speed.

If brake oil temperature exceeds 250^{O}F (121^{O}C), the *Brake Oil Temperature Warning light will turn on.* **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and run engine at high idle. Continue to run engine at high idle until Brake Oil Temperature Warning light turns off and brake oil temperature cools to below 250^{O}F (121^{O}C). If temperature does not return to this range within a few minutes, report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.



(7) SERVICE BRAKE PEDAL

The Service Brake Pedal is the *middle* pedal of the three pedals. It controls a dual hydraulic valve, which applies both the front dry disc brakes and the rear wet disc brakes. The service brakes should be used to slow or stop the truck whenever safety and/or truck speed/load conditions exceeds the capability of the retarder.

(8) THROTTLE PEDAL

The Throttle Pedal is the *right* pedal of the three pedals. The operator increases engine RPM by depressing the throttle pedal. Engine RPM is decreased by releasing the pedal.

(9) LIGHTER

Used for lighting cigars/cigarettes. Always use CAUTION with smoking materials.

(10) ASH TRAY

Used for extinguishing and depositing smoking materials. DO NOT use for flammable materials such as paper wrappers. Be certain that all fire ash is extinguished.

(11) RANGE SELECTOR

The lever-type range selector has eight positions (**R, N, D, 5, 4, 3, 2** and **1**). To change positions, release the range holding mechanism on the lever and move lever to the desired range.

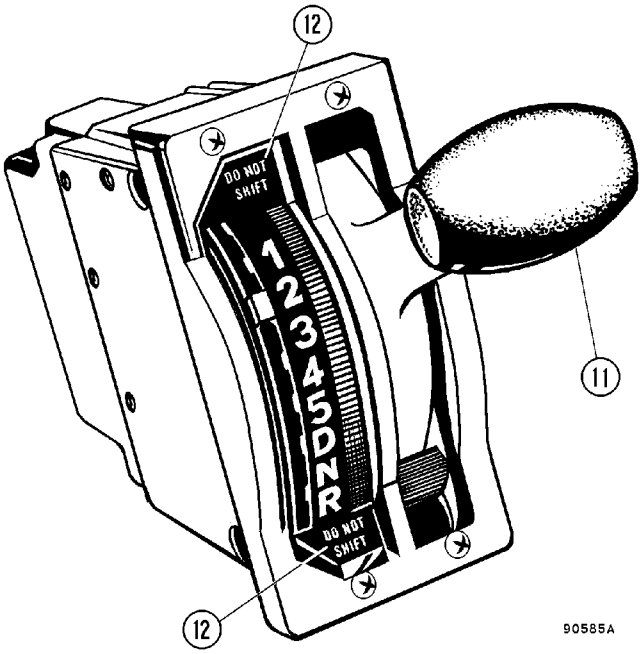
"N" NEUTRAL - used when starting engine. The truck cannot be started unless the Range Selector is in NEUTRAL position.

"R" REVERSE - use this position to back the truck. **Completely stop** the truck before shifting from FORWARD to REVERSE or vice-versa. The Reverse Warning Horn is activated when this gear is selected.

"D" DRIVE - position. The transmission will shift to first gear and as truck speed increases, the transmission will automatically upshift through each gear to sixth gear operation. As the truck slows down, the transmission will automatically downshift to the correct gear.

5, 4, 3, 2 - positions. Road and load conditions sometimes make it desirable to limit the automatic shifting to a lower range. These positions provide greater engine braking on grades. The transmission will not shift above the highest gear selected. When conditions improve, select position D for full range operation.

1 - Use this gear when pulling through mud and deep snow, or when maneuvering in tight spaces, when driving up or down steep grades where maximum driving power and maximum engine braking is needed.



NOTE: As engine and ground speed increases, the transmission will automatically UPSHIFT to the gear range required up to the highest range selected. However, DOWNSHIFTS will not occur, regardless of gear range selected, until engine and ground speed are reduced to match the next lower gear range requirements.

(12) DO NOT SHIFT LIGHT

This light comes on anytime the on-board computer finds a potentially serious problem in the system. The computer will cause the transmission to lock- in-gear and also to disengage the lockup clutch. These actions by the computer reduces the possibility of damage to the truck and transmission. The hold-in- gear feature prevents upshifts and downshifts when a problem is detected in the operation of the transmission. The hold-in-gear circuit permits the transmission to continue to operate in the gear it was in at the time the DO NOT SHIFT light and buzzer came "On". Selection of a different gear range will have no effect on the transmission. The hold-in-gear circuit is released when the engine is shut-off. If the problem causing the DO NOT SHIFT light is still present when the engine is restarted, the transmission will be in " Neutral" and will remain in "Neutral" until the probem is corrected.

RESET PROCEDURE - When the DO NOT SHIFT LIGHT and/or CHECK TRANS light (on instrument panel) comes "On", the system can be reset. To reset, bring the vehicle to a stop at a safe location and shutdown engine. Wait about 10 seconds and restart engine. If the problem is temporary, the DO NOT SHIFT (12) and CHECK TRANS lights will not come back "On" and the truck can be operated in a normal manner. If the problem causing the DO NOT SHIFT light is still present when the engine is restarted or comes again in operation, notify maintenance personnel.

OPERATOR SEAT

The operator's seat provides a fully adjustable cushioned ride for the driver's comfort and ease of operation. The seat is independently mounted from the cab for easy maintenance and repair.

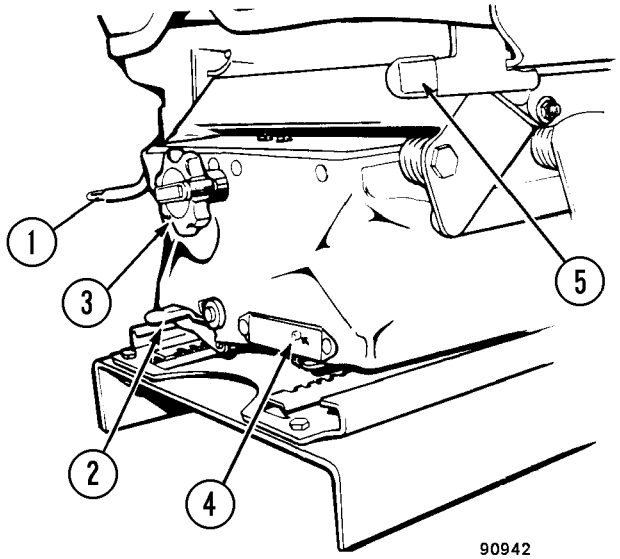
Adjustment

The following adjustments must be made while sitting in the seat.

1. To adjust fore/aft location of seat:

   a. Raise adjustment lever "Lift to Slide" (2, Seat Adjustment).

   b. Move seat backward or forward as desired.



SEAT ADJUSTMENT

1. Height Adjust Lever
2. Fore/Aft Adjust Lever
3. Weight Adjust Knob
4. Weight Indicator
5. Cushion Tilt latch lever

2. To adjust seat height:

   a. Depress the "Height Adjust " lever (1).

   b. Adjust seat assembly to desired height.

3. To adjust weight:

   a. Turn knob "Weight Adjust" (3).

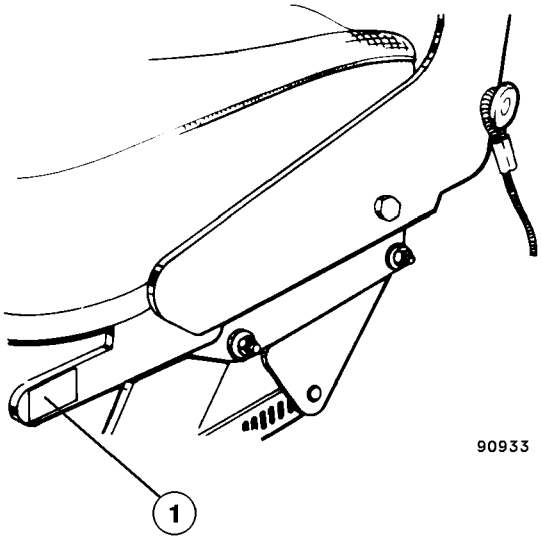
   b. Moving knob clockwise decreases cushioning effect of seat and turning counterclockwise increases cushioning effect.

   c. Proper adjustment results in Weight Indicator (4) being flush with seat base while operator is seated.

4. To adjust seat cushion:

a. Raise "Cushion Tilt Latch" lever (1, Seat Tilt Latch) on left side of seat.

b. When lever is unlatched, choose between two different positions.



SEAT TILT LATCH
1. Cushion Tilt latch lever

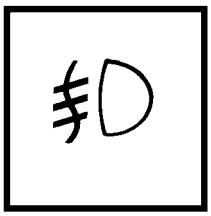
NOTES

INSTRUMENTS AND INDICATORS

INSTRUMENT PANEL

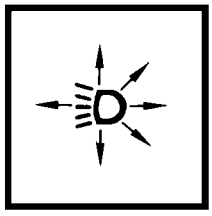
The operator must understand the function and operation of each instrument and control. This knowledge is essential for proper and safe operation of the machine. Items that are marked **(OPTIONAL)** may not apply to this truck.

(1) FOG LIGHTS (OPTIONAL)



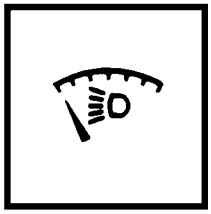
The fog lights are an optional piece of equipment, useful in heavy rain and foggy conditions. When present, the switch has two positions, "On" and "Off".

(2) LIGHTS- ALL



The instrument panel lights and the head lights are controlled by a three position switch. Moving the switch from the "Off" position to the second position completes the circuit from battery to the instrument panel lights and taillights. Moving the switch to the third position completes the circuit to the head lights in addition to the panel and tail lights.

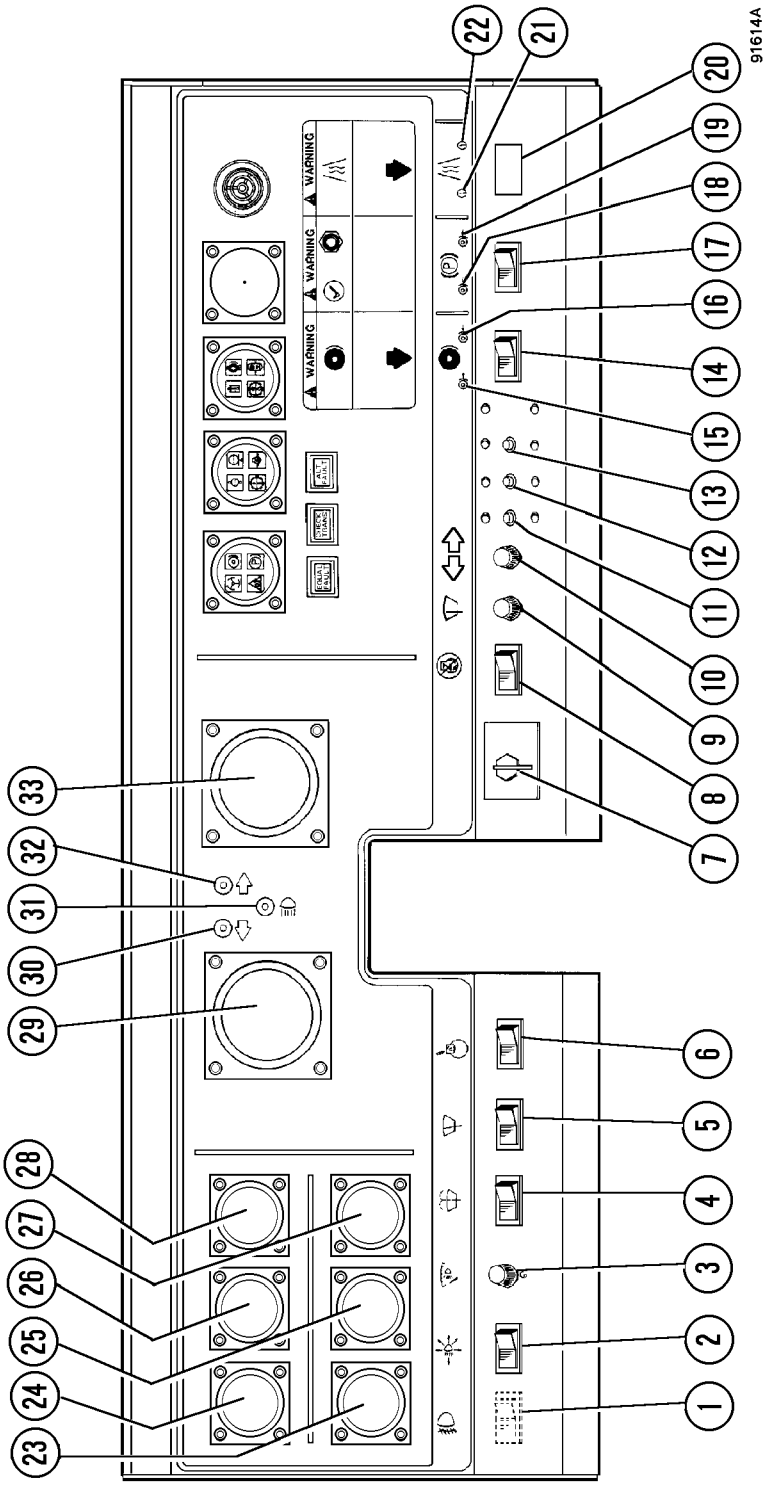
(3) LIGHTS - INSTRUMENT PANEL



The panel light dimmer control is a rheostat which allows the operator to vary the brightness of the instrument panel lights.

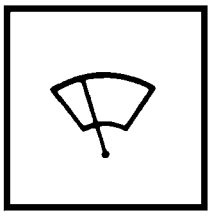
(4) WINDSHIELD WASHER

The windshield washer switch, when held in the "On" position, directs water from the reservoir (located in the cab to the left of the passenger seatbox) to the windshield for cleaning purposes. Wipers (5) should be operating when washer is activated. This switch is spring loaded to the "Off" position. The windshield washer has a 2 qt. (2 l) plastic container.



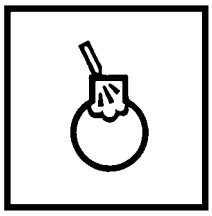
INSTRUMENT PANEL

(5) WINDSHIELD WIPER



The windshield wiper control switch is a three position rocker switch. Moving the switch from "Off" to the second position places the wiper in the low or slow cycle. Pushing the switch to the third position places the wiper motor in high or fast cycle.

(6) ENGINE STARTING AID



The ether starting aid is used for cold weather starting and is controlled by a switch, spring-loaded to the "Off" position. When the switch is held in the "On" position, the ether is injected into the engine intake manifold to aid in cold weather starting. In cold weather, below 50^{o}F (10^{o}C), turn the keyswitch (7) to the "Start" position. Push the cold weather starting switch to the "On" position for **three seconds while cranking**, then release. If engine does not start, wait thirty seconds before repeating the procedure.

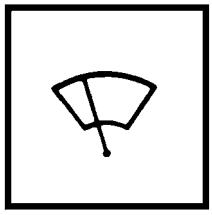
(7) KEYSWITCH

The key switch is a three position ("Off", "Run", "Start") switch. When it is moved to the "Run" position, the switch activates the accessory circuits. When moved to the "Start" position, the engine's starting system is activated. After engine start, allow the switch to return to the spring-loaded "Run" position.

(8) ENGINE SHUT DOWN

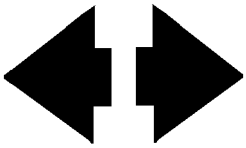
The engine shutdown switch is a spring return rocker switch that is connected to the engine shutdown solenoid. In order for this switch to work, the keyswitch must be in the "Run" position. The engine shutdown switch must be depressed until the engine comes to a complete stop. When the switch is held closed, fuel to the engine is shut off.

(9) WINDSHIELD WIPER FUSE HOLDER



This is a 15 amp.- dual element, time delay (slow blow) type fuse. Replacement with any other type is not recommended.

(10) TURN SIGNAL FUSE HOLDER



This is a 15 amp.- dual element, time delay (slow blow) type fuse. Replacement with any other type is not recommended.

(11) CIRCUIT BREAKER

5 amp circuit breaker protects the warning cluster and the sound alarm from overloads. If a malfunction occurs, the breaker will open to protect the circuit from overcurrent condition. The circuit breaker can be reset manually by pushing the red reset button.

(12) CIRCUIT BREAKER

15 amp circuit breaker protects the steering bleeddown timer from overloads. If a malfunction in the circuitry occurs, the breaker will open the circuit. The circuit breaker can be reset manually by pushing the red reset button.

(13) CIRCUIT BREAKER

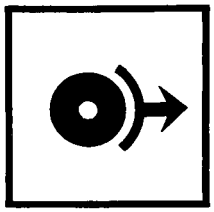
30 amp circuit breaker protects the heater blower motor and the air conditioning system from overloads. The circuit breaker can be reset manually by pushing the red reset button.

⚠WARNING ***Promptly report to maintenance personnel any burnt out fuses or circuit breakers that need repeated resetting. These may be indications of serious problems that may result in fire or damage to components if neglected.***

(14) BRAKE LOCK

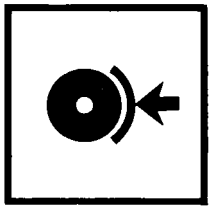
The brake lock switch actuates the hydraulic brakes on the rear of the truck. Apply the brake lock switch while truck is being loaded. When pulling into the shovel or dump area, **do not apply the brake lock switch until truck is completely stopped**.

(15) and (18) BRAKE OFF



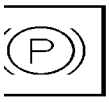
When the Brake Lock switch (14) or Parking Brake switch (17) is in this position, the brake is off.

(16) and (19) BRAKE ON



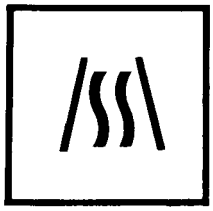
When the Brake Lock switch (14) or Parking Brake switch (17) is in this position, the brake is on.

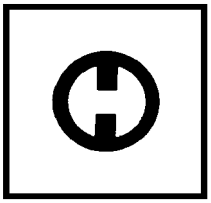
(17) PARKING BRAKE

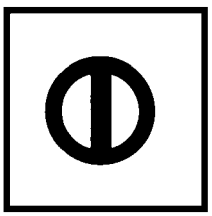


To apply parking brake, move control to "On". To release, move switch to the "Off" position. The parking brake is spring applied and hydraulically released. When the parking brake is actuated, an indicator light (42) will be illuminated on the instrument panel. The parking brake can only be applied with the keyswitch in the "Run" position and the transmission range selector in the NEUTRAL position. The parking brake is automatically applied when the engine is shut-down and hydraulic pressure is bled down.

(20) SLIPPERY ROAD SWITCH **(21) SWITCH OPEN** **(22) SWITCH CLOSED**

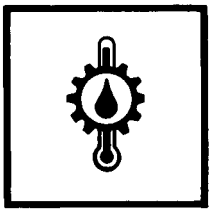






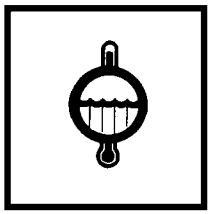
(Not used on 140M/210M HAULPAK® with Rear Wet Disc Brakes)

(23) TRANSMISSION TEMPERATURE



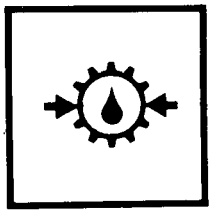
The transmission temperature gauge indicates the temperature of the transmission oil during operation. Maximum operating oil temperature is 250^{o}F (121^{o}C). If oil temperature exceeds this maximum, *CHECK TRANS light (35)* will turn on. **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and run engine at high idle. Continue to run engine at high idle until transmission oil temperature cools to below 250^{o}F (121^{o}C). If temperature does not return to this range within a few minutes, report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(24) WATER TEMPERATURE



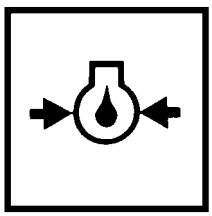
The engine water temperature gauge indicates the temperature of the coolant in the engine's cooling system. The temperature range after engine warm-up and truck operating under normal conditions, should be 165^{o} to 195^{o}F (74^{o} to 91^{o}C). If water temperature exceeds 200^{o}F (93^{o}C), *Coolant Temperature light (43)* will turn on. **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and shut down engine. Report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(25) TRANSMISSION OIL PRESSURE



The transmission oil pressure gauge indicates main pressure in the transmission clutch apply circuit. Normal operating pressure after warm-up should be 170 to 210 psi (1172-1448 kPa). If transmission oil pressure falls below this range with engine operating at 800 RPM or higher, bring the truck to a complete stop safely away from traffic, move transmission range selector to "Neutral", apply the parking brake, and shut down engine. Report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(26) ENGINE OIL PRESSURE

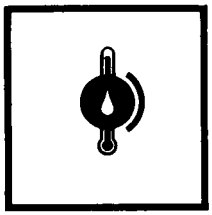


The engine oil pressure gauge indicates engine lube oil pressure. Normal operating pressure after engine warm-up should be:

Low idle;	20 psi (138 kPa),
Rated speed;	45 to 70 psi (310 to 483 kPa).

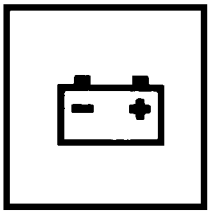
If engine oil pressure falls below 6 psi (41 kPa), *Engine Oil Pressure light (46)* will turn on. **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and shut down engine. Report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(27) BRAKE OIL TEMPERATURE



The brake oil temperature gauge indicates the temperature of the rear brake cooling oil during operation. Maximum operating oil temperature is 250^{o}F (121^{o}C). If oil temperature exceeds this maximum, *Brake Oil Temperature Warning light (48)* will turn on. **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and run engine at high idle. Continue to run engine at high idle until Brake Oil Temperature Warning light turns off and brake oil temperature cools to below 250^{o}F (121^{o}C). If temperature does not return to this range within a few minutes, report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(28) VOLTMETER

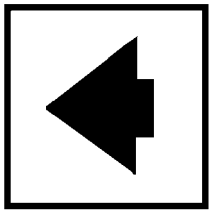


The voltmeter indicates the output voltage of the battery charging alternator. Normal indicated voltage at high idle is 27 – 28 volts. When the key switch is "On" and engine is not running, the voltmeter indicates battery voltage.

(29) SPEEDOMETER

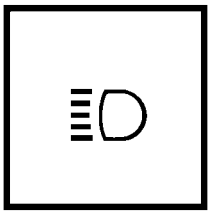
The speedometer indicates the truck speed in miles per hour (MPH) and kilometers per hour (km/h).

(30) LEFT TURN INDICATOR (Red Light)



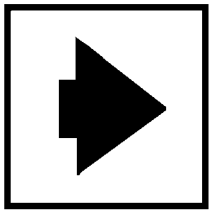
This light flashes to indicate that the left turn signal lights on the truck have been activated. It will also flash simultaneously with right turn signal indicator (32) when "Hazard" switch (on steering column) is On.

(31) HIGH BEAM INDICATOR (Blue Light)



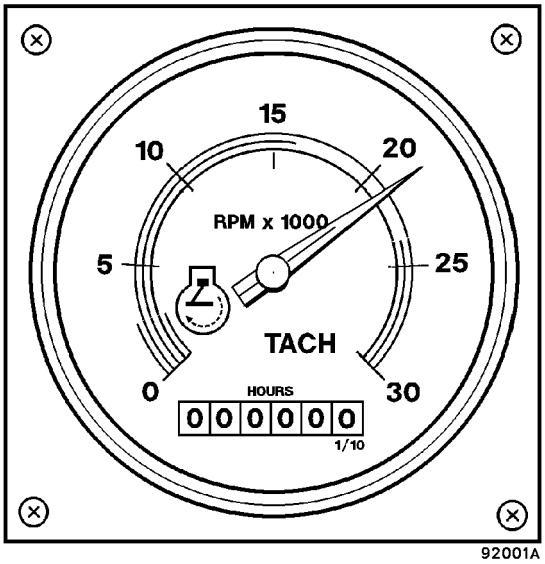
The high beam indicator light, when lit, indicates that the truck headlights are on "High" beam. To switch headlights to "High" or "Low" beam, pull lever-operated dimmer switch (turn signal lever) and release.

(32) RIGHT TURN INDICATOR (Red Light)



This light flashes to indicate that the right turn signal lights on the truck have been activated. It will also flash simultaneously with left turn signal indicator (30) when "Hazard" switch is On.

(33) TACHOMETER and HOURMETER



This gauge includes an Hourmeter to register engine hours of operation and a Tachometer which registers engine speed in hundreds of Revolutions Per Minute (RPM).

Adjusted Engine Speeds are:

Low Idle – 700 ± 25 RPM.
High Idle, No load – 2450 RPM
Governed Speed – 2100 RPM

Retarder Operation

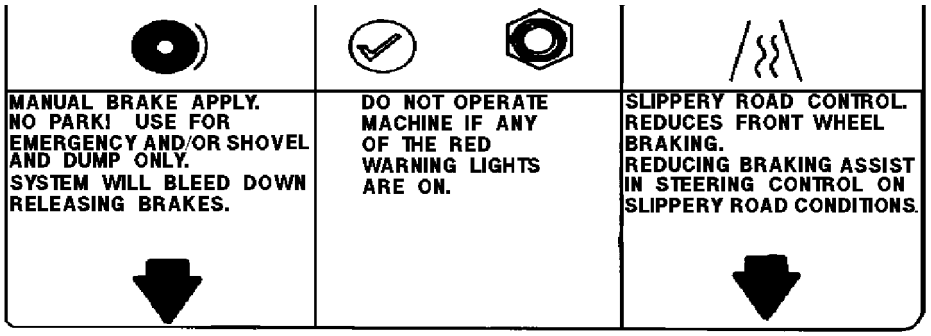
When approaching a descending grade, the operator should slow the truck and select the proper transmission gear range to maintain an engine speed of 1650 – 2350 RPM (green area on tachometer) and the brake oil temperature below 250^{O}F (121^{O}C) during retarder operation. Refer to the Grade/Speed decal in the cab above the windshield.

When descending a grade, the operator should apply the retarder pedal and observe *both the Tachometer and the Brake Oil Temperature Gauge* (27). **The engine RPM must be maintained at 1650 – 2350 RPM (green area on tachometer) and the Brake Oil Temperature must be maintained below 250^{O}F (121^{O}C).**

If the operator observes that **either** the maximum engine speed of 2350 RPM **or** the Brake Oil Temperature of 250^{O}F (121^{O}C) are about to be exceeded, the operator should immediately move the transmission range selector to the next lower range and apply the service brakes until the truck is slowed to a speed which will permit the transmission to downshift to the gear range selected. Continue this procedure to downshift to the required gear range to maintain engine speed at 1650 – 2350 RPM and brake oil temperature below 250^{O}F (121^{O}C). The service brakes should be used only long enough to slow the truck to allow the transmission to downshift. When the proper gear range is attained, continue using the retarder to maintain a safe, productive speed.

If brake oil temperature exceeds 250^{O}F (121^{O}C), the *Brake Oil Temperature Warning light (48) will turn on.* **As quickly as safety will permit,** bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and run engine at high idle. Continue to run engine at high idle until Brake Oil Temperature Warning light turns off and brake oil temperature cools to below 250^{O}F (121^{O}C). If temperature does not return to this range within a few minutes, report the condition **immediately** to maintenance personnel and wait for further instructions before moving truck.

(34) EQUAL FAULT LIGHT



INSTRUMENT PANEL WARNING INDICATORS

The charge condition of the two 12 Volt batteries is monitored to make sure that both batteries are being charged equally. The Equal Fault Light will illuminate if more than a 0.85 volt variance between the two batteries is detected.

(35) CHECK TRANS LIGHT

The ATEC system has a built in computer that monitors various functions and performances. When the computer senses that the system is not performing properly, the CHECK TRANS light comes "On" to warn and alert the operator that a problem has occurred and that the vehicle should be serviced as soon as possible. The CHECK TRANS light will come "On" when the ignition is turned "On". After about two seconds, the light will go "Off". This provides a light bulb check and a system check.

In cold weather, when the transmission oil is below -10^{o}F (-23^{o}C), the DO NOT SHIFT lights on the range selector and the CHECK TRANS light will stay on after the engine is started. The transmission will stay in NEUTRAL, regardless of which range is selected until the oil is warmer than -10^{o}F (-23^{o}C). When the transmission oil warms up, the CHECK TRANS and DO NOT SHIFT lights will turn off and the transmission will operate in first gear or reverse only. At 20^{o}F (-7^{o}C), the transmission may be operated safely in all ranges.

If the transmission oil temperature reaches 250°F (121°C), the CHECK TRANS indicator light will come "On". The ECU (Electronic Control Unit) will inhibit operation of the truck in higher gears.

SUMP OIL TEMPERATURE	DO NOT SHIFT LIGHT	CHECK TRANS LIGHT	TRUCK OPERATION
-10 F(-24 C) AND BELOW	ON	ON	NEUTRAL ONLY
-9 F(-22 C) to +19 F(-7 C)	OFF	OFF	NEUTRAL, FIRST & REVERSE ONLY
+20 F(-7 C) AND ABOVE	OFF	OFF	FULL OPERATION IN ALL RANGES

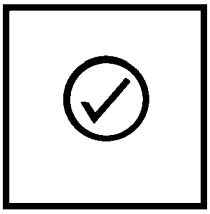
90589

NOTE: The Transmission Temperature Gauge (23) indicates the converter temperature. The ECU senses oil temperature in the sump. **The two temperatures may be different.**

(36) ALT FAULT LIGHT

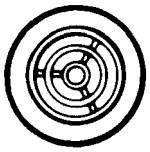
This light will illuminate if the alternator output exceeds 30 VDC or battery voltage is less than 24 VDC or if voltage for each battery differs more than 0.75 V.

(37) LAMP TEST SWITCH



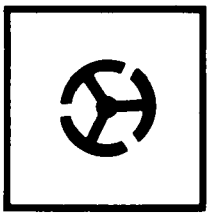
The lamp test switch is provided for the operator to test the warning and indicator lights before engine start-up. The key switch is turned to the "Run" position and the lamp test push button switch is depressed to the "On" position. This action will complete a circuit to the warning and indicator lights.

(38) ALARM HORN



The alarm horn is a signaling device used to alert the operator of a malfunction within a system. The alarm horn will sound if low steering pressure and/or low brake pressure is detected. When the alarm horn sounds during operation, a warning light will come "On". The warning light (39 or 41) will be the operator's visual aid in determining which system is malfunctioning.

(39) EMERGENCY STEERING



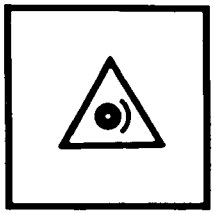
The Emergency Steering Light, when actuated, indicates that the steering circuit pressure is decreasing and is below 1800 psi (12.4 MPa).

⚠WARNING ***If the light comes "On", stop the truck immediately and have the system checked. Do not attempt further operation until malfunction is located and corrected.***

(40) BRAKE LOCK

The Brake Lock light is on only when the brake lock switch has been activated by the operator. The light indicates that only the rear brakes have been applied. The brake lock switch is to be used only at the shovel or dump area.

(41) LOW BRAKE PRESSURE WARNING LIGHT



This light indicates a malfunction within the hydraulic brake circuit. The low brake pressure warning light indicates that the hydraulic pressure in the brake system is decreasing and is below 2000 psi (13.8 MPa).

⚠WARNING

If this light comes "On" when the brake pedal is depressed or comes "On" continuously, bring truck to a safe stop as soon as possible out of way of traffic. Move transmission range selector to Neutral, shut engine down, apply parking brake and call maintenance personnel to correct problem.

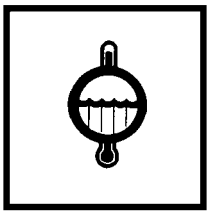
⚠WARNING

When the pressure drops to 1650 psi (11.4 MPa), all brakes will automatically be fully applied to stop the truck.

(42) PARKING BRAKE

The Parking Brake light indicates that the parking brake switch has been moved to the "On" position or that the park brake is "On". **Do not use the parking brake while loading or dumping.**

(43) COOLANT TEMPERATURE LIGHT

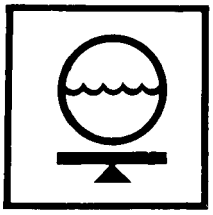


This warning light indicates the engine coolant temperature has exceeded 200^{o}F (93^{o}C).

⚠WARNING

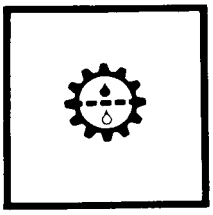
If light comes On, bring truck to a safe stop as soon as possible out of way of traffic. Move transmission range selector to Neutral, shut engine down, apply parking brake and call maintenance personnel to correct problem.

(44) COOLANT LEVEL



This light indicates the coolant level in the radiator is low. If light comes On, bring truck to a safe stop as soon as possible out of way of traffic and call maintenance personnel to correct problem. Have coolant level checked.

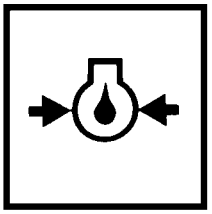
(45) TRANSMISSION MAIN FILTER



The Transmission Main Filter warning light alerts the operator that oil passing through the filter elements is being restricted. The transmission electronic control system monitors the data supplied by the transmission filter differential pressure switch. When filter restriction is detected, transmission operation is limited to **1st**, **N**eutral, or **R**everse ranges, until the restriction is eliminated.

Cold transmission oil will produce a temporary oil restriction, but normal transmission operation will be restored as oil temperature rises to an acceptable operating temperature. If normal transmission operation is not restored as oil temperature rises, then transmission filter elements are likely clogged and service is required.

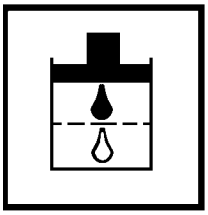
(46) ENGINE OIL PRESSURE



The Engine Oil Pressure Warning light will come "On" indicating engine oil pressure is below normal operating range.

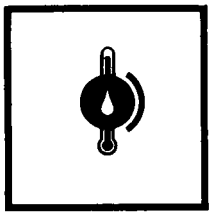
If light comes On, bring truck to a safe stop as soon as possible out of way of traffic. Shut engine down immediately and call maintenance personnel to correct problem. Serious damage may result to engine if operated without sufficient lubricating oil pressure.

(47) HYDRAULIC OIL FILTER



The Hydraulic Oil Filter warning light indicates that the oil passing through the filter elements is being restricted. Due to cold oil, the light may come on at startup and remain lit until the hydraulic oil is warm. Occasionally, during operation the light may flicker on and off; but when the light comes on and remains on, the filters should be changed as soon as possible.

(48) BRAKE OIL TEMPERATURE

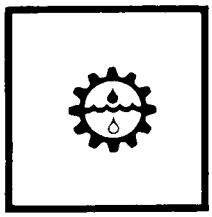


Brake Oil Temperature Warning light will turn on if the brake oil temperature exceeds 250^{o}F (121^{o}C).

⚠WARNING

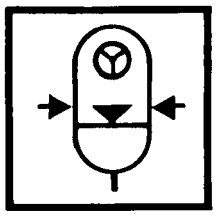
As quickly as safety will permit, bring the truck to a complete stop away from traffic, move transmission range selector to "Neutral", apply the parking brake, and run engine at high idle. Continue to run engine at high idle until Brake Oil Temperature Warning light turns off and brake oil temperature cools to below 250^{o}F (121^{o}C). If temperature does not return to this range within a *few minutes, report the condition immediately to maintenance personnel and wait for further instructions before moving truck.*

(49) TRANSMISSION COOLER FILTER



The transmission Cooler Filter light alerts the operator that oil passing through the elements in the filter assembly is being restricted. Due to cold oil, the warning light may come on at startup and remain lit until the oil is warm. Occasionally, during operation the warning light may flicker on and off; but when the light comes on and remains on, the filters should be changed as soon as possible.

(50) LOW ACCUMULATOR PRECHARGE WARNING LIGHT



The Low Accumulator Precharge Warning light indicates a low steering accumulator nitrogen precharge. If the nitrogen precharge within the accumulators falls below 850 psi (5.9 MPa) the warning light will illuminate.

⚠WARNING

Stop the truck. Do not attempt further operation until the accumulator has been recharged to 1050 ± 25 psi (7.2- *7.5 MPa).*

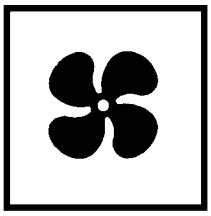
(51) Reserved for future accessories.

(52) Reserved for future accessories.

(53) Reserved for future accessories.

(54) Reserved for future accessories.

(55) FAN



The fan switch controls the heater/air condition three-speed blower motor. The speeds are High, Medium, and Low.

(56) TEMPERATURE CONTROL KNOB

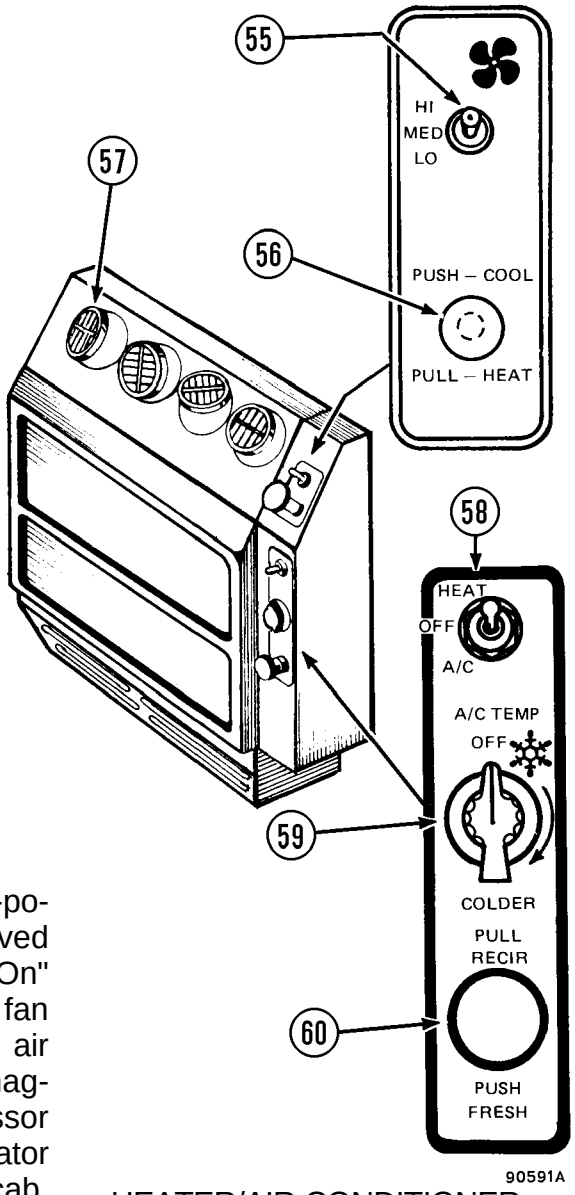
The push/pull knob controls the amount of hot water that will flow through the heater core to heat the air as it passes through the core and circulates throughout the cab.

(57) LOUVERS

The louvers can be rotated or adjusted to direct the flow of air to any part of the cab for the operator's comfort.

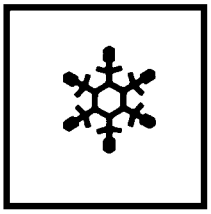
(58) HEATER/AIR CONDITIONER SWITCH

The heater/air conditioner switch is a three-position toggle switch. When the switch is moved to the "Heat" position, the blower motor is "On" and can be controlled by the three-position fan switch (55). If the switch is moved to the air conditioning position, the compressor magnetic clutch is turned "On" and the compressor will deliver R-12 refrigerant to the evaporator coil in the heater/air conditioner unit in the cab.



HEATER/AIR CONDITIONER

(59) AIR CONDITIONING TEMPERATURE CONTROL



The thermostatic switch controls the temperature of the air entering the truck cab. The control is set by the operator as desired.

(60) INSIDE/OUTSIDE AIR CONTROL KNOB

The inside/outside air control knob is connected to a vent, which allows either outside or inside air to be circulated through the heater assembly. Pulling the knob out permits inside air to be recirculated through the heater. Pushing the knob all the way in permits outside air to be circulated through the heater assembly.

OPERATING INSTRUCTIONS

PREPARING FOR OPERATION

The safest trucks are those which have been properly prepared for operation. At the beginning of each shift, a careful check of the truck should be made before the operator attempts engine start-up.

1. When walking to and from the truck, BE ALERT, remain a safe distance from all other machines even if the operator is visible.
2. Check for any oil or coolant leaks. When checking coolant in radiator, relieve pressure slowly before removing radiator cap.

⚠WARNING

If engine has been running, allow coolant to cool, before removing the fill cap or draining radiator. Serious burns may result if coolant is not allowed to cool.

3. Check tires for cuts, damage or "bubbles". Check tires for low pressure periodically during shift. If truck has been run on a "flat", **the tire must be cooled before parking truck inside**.
4. Visually inspect all headlights, worklights and taillights and safety equipment for external damage from rocks or misuse. Make sure lenses are clean.
5. Always use handrails and ladder when mounting or dismounting the truck. Clean ladder and handrails of any foreign material, such as ice, snow, oil and mud.

⚠CAUTION

Always mount and dismount the truck facing the truck. Never attempt to mount or dismount the truck while it is in motion.

6. Dirt or trash buildup, specifically in the operator's cab, should be cleared. Do not carry tools or supplies in cab of truck or on the deck.
7. Insure steering wheel, controls and pedals are free of any oil, grease or mud.
8. Insure adequate ventilation before start-up if the truck is in an enclosure. Exhaust fumes are dangerous!

ENGINE START-UP SAFETY PRACTICES

Safety rules must be observed upon engine start-up.

1. Insure all personnel are clear of truck before starting engine. Always sound the horn as a warning before actuating any operational controls.

2. Check and insure Transmission Range Selector is in "**N**eutral" before starting.

3. Do not attempt to start engine while cold weather starting heater (if equipped) is in operation. Damage to coolant heaters will result, due to lack of circulation.

4. The key switch is a three position (Off, Run, Start) switch. When switch is rotated one position clockwise, it is in the "run" position and all electrical circuits (except "start") are activated. Rotate key switch fully clockwise to "start" position (Transmission Range Selector in "**N**eutral") and hold this position until engine starts. "Start" position is spring loaded to return to "run" when key is released.

⚠WARNING

Starting fluid is extremely volatile and flammable! Use with extreme care.

   If truck is equipped with optional Engine Starting Aid for cold weather starting and ambient temperature is below 50^{o}F (10^{o}C), turn the key switch to the "start" position and while rotating engine, move the Engine Starting Aid switch to the "On" position for three seconds; then release Engine Starting Aid. If engine does not start, wait at least fifteen seconds before repeating the procedure.

   Do not crank an electric starter for more than 30 seconds. Allow two minutes for cooling before attempting to start engine again. *Severe damage to starter motor can result from overheating*.

5. The truck cannot be push started. Transmission lube and control systems are inoperative when engine is not running. See towing decal in Operator's Cab.

6. When getting a battery assist from one truck to another, all switches must be "Off" prior to making any connections. Be certain to maintain correct polarity. Connect one lead of booster cable to 24V positive (+) post of battery needing assist, and other lead of the booster cable to the 24V positive (+) post of auxiliary battery. Connect one lead of second booster cable to 24V negative (-) post of auxiliary battery and then connect other lead of the booster cable to a good frame ground on the disabled truck away from the battery needing assist. This procedure will avoid the possibility of causing sparks near the battery where explosive gases may be present.

NOTE: HAULPAK® Trucks are generally equipped with two 12 volt batteries connected in series to provide 24 volt output. Be sure to maintain correct voltage and polarity when connecting booster cables. Damage to electrical components may result if voltage and polarity are not correct.

AFTER ENGINE HAS STARTED

1. Become thoroughly familiar with steering and emergency controls. Test the truck steering in extreme right and left directions. If the steering system is not operating properly, shut engine down immediately. Determine the steering system problem and have repairs made before resuming operation.

2. Operate each of the truck's brake circuits at least twice prior to operating and moving the truck. These circuits include individual activation of the service brake, parking brake, brake lock (and emergency brake if equipped) from the operator's cab.

   Activate each circuit individually with the engine running and with hydraulic circuit (air circuit if truck is equipped with air/hydraulic brakes) fully charged.

   If any application or release of any brake circuit does not appear proper or if sluggishness is apparent on application or release, shut the engine down and notify maintenance personnel. Do not operate truck until brake circuit in question is fully operational.

3. Check gauges, warning lights and instruments before moving the truck to insure proper system operation and proper instrument functioning. Give special attention to braking and steering circuit warning lights. If warning lights come on, shut down the engine immediately and determine the cause.

4. Insure headlights, worklights and taillights are in proper working order. Good visibility may prevent an accident. Check operation of windshield wiper.

5. When truck body is in dump position, do not allow anyone beneath it unless body-up retaining pin or cable is in place.

6. Do not use the fire extinguisher for any purpose other than putting out a fire! If extinguisher is discharged, report the occurrence so the used unit can be refilled or replaced.

7. Do not allow unauthorized personnel to ride in the truck. Do not allow anyone to ride on the ladder or on the deck of the truck.

8. Do not leave truck unattended while engine is running. Shut down engine before getting out of cab.

MACHINE OPERATION SAFETY PRECAUTIONS

After the truck engine is started and all systems are functioning properly, the operator must follow all local safety rules to insure safe machine operation.

⚠WARNING

If any of the red warning lights come "On" or if any gauge reads in the red area during truck operation, a malfunction is indicated. Stop truck as soon as safety permits, shut down engine if problem indicates and have problem corrected before resuming truck operation.

1. Always sound the warning horn before moving the truck. When backing the truck, give back-up signal (three blasts on air horn); when starting forward, two blasts on air horn. These signals must be given each time the truck is moved forward or backward. Look to the rear before backing the truck. Watch for and obey ground spotter's hand signals before making any reverse movements. Spotter should have a clear view of the total area at the rear of the truck.
2. Operate the truck only while properly seated with seat belt fastened. Keep hands and feet inside the cab compartment while truck is in operation.
3. Check gauges and instruments frequently during operation for proper readings.
4. Observe all regulations pertaining to the job site's traffic pattern. Be alert to any unusual traffic pattern. Obey the spotter's signals.
5. Match the truck speed to haul road conditions and slow the truck in any congested area. Keep a firm grip on steering wheel at all times.
6. Do not allow engine to run at "Idle" for extended periods of time.
7. Check parking brake periodically during working shift. **Use parking brake for parking only.** *Do not attempt to apply parking brake while truck is moving!*
8. Check brake lock performance periodically for safe loading and dump operation.
9. Proceed slowly on rough terrain to avoid deep ruts or large obstacles. Avoid traveling close to soft edges and the edge of fill area.
10. Truck operation requires concentrated effort by the driver. Avoid distractions of any kind while operating the truck.

LOADING

1. Pull into the loading area with caution. Remain at a safe distance while truck ahead is being loaded.
2. Do not drive over unprotected power cables.
3. When approaching or leaving a loading area, watch out for other vehicles and for personnel working in the area.
4. When pulling in under a loader or shovel, follow "Spotter" or "Shovel Operator" signals. The truck operator may speed up loading operations by observing the location and loading cycle of the truck being loaded ahead, then follow a similiar pattern.
5. Operator should remain in truck cab with engine running while truck is being loaded. Place Transmission Range Selector in "**N**eutral" and apply Brake Lock.

⚠WARNING

If operator must leave truck cab during loading, engine must be shut down and parking brake applied. DO NOT use brake lock or emergency brake (if equipped) for parking. Remain far enough away from truck to avoid being struck by flying material.

6. When truck is loaded, pull away from shovel as quickly as possible, but with extreme caution.

HAULING

1. Always stay alert! If unfamiliar with the road, drive with extreme caution.
2. Govern truck speed by the road conditions, weather and visibility.
3. Operate truck so it is under control at all times.
4. Use extreme caution when approaching a haul road intersection. Maintain a safe distance from oncoming vehicles.
5. Obey all road signs.
6. Always dim headlights when meeting oncoming vehicles.
7. Maintain a safe distance when following another vehicle. Never approach another vehicle from the rear, in the same lane, closer than 50 ft. (15 m). When operating on a down grade, this distance should be no closer than 100 ft. (30 m).
8. Before starting up or down a grade, maintain a speed that will insure safe driving and provide effective retarding under all conditions. Refer to Grade/Speed decal in operator's cab.

9. When operating truck in darkness or when visibility is poor, do not move truck unless headlights are on. Do not back truck if back-up horn or lights are inoperative.

10. When backing the truck, give back-up signal (three blasts on air horn); when starting forward, two blasts on air horn. These signals must be given each time the truck is moved forward or backward.

11. Do not stop or park on a haul road unless unavoidable. If you must stop, move truck to a safe place, apply parking brake, shut down engine, block wheels securely and notify maintenance personnel for assistance.

12. If the "Emergency Steering" light and/or "Low Brake Pressure Warning" light (*if equipped*) come on during operation, steer the truck **immediately** to a safe stopping area, away from other traffic if possible. Refer to item 11 above.

13. Report haul road conditions immediately. Muddy or icy roads, pot holes or other obstructions can present hazards.

14. Cab doors should remain closed at all times while truck is in motion or unattended.

15. Check for flat tires periodically during shift. If truck has been run on a "flat", **it must not be parked in a building until the tire cools**.

PASSING

1. Do not pass another truck on a hill or blind curve!

2. Before passing, make sure the road ahead is clear. If a disabled truck is blocking your lane, slow down and pass with extreme caution.

3. Use only the areas designated for passing.

DUMPING

1. Pull into dump area with extreme caution.
2. Carefully maneuver truck into dump position. Obey signals directed by the spotter, if present.
3. When in dump position, apply Brake Lock and move Transmission Range Selector to the "**N**eutral" position

To Raise dump body:

4. Pull the lever (depress the hoist switch release button, if equipped) to the rear to actuate hoist circuit. Releasing the lever anywhere during "hoist up" will place the body in "hold" at that position.
5. Raise engine RPM to accelerate hoist speed.
6. Reduce engine RPM as last stage of hoist cylinder begins to extend and let engine go to low idle as last stage reaches half-extension.
7. Release hoist lever as last stage reaches full extension.
8. After material being dumped clears body, lower body to frame.

To Lower Body:

Move hoist lever (depress the hoist switch release button, if equipped) forward to "down" position and release. Releasing the lever places hoist control valve in the "float" position allowing the body to return to frame.

NOTE: If dumped material builds up at body tailgate and body cannot be lowered, shift Transmission Range Selector to "D" (Drive), release Brake Lock, and drive forward to clear material. Stop, shift Transmission Range Selector to "N" (Neutral), apply Brake Lock and lower body.

⚠CAUTION

The HAULPAK™ is not to be moved with the dump *body raised except for emergency moves only. Failure to lower body before moving truck may cause damage to hoist cylinders, frame and/or body hinge pins.*

9. With body returned to frame, move Transmission Range Selector to "D" (Drive), release Brake Lock, and leave dump area carefully.

TOWING

Prior to towing a truck, many factors must be carefully considered. Serious personal injury and/or significant property damage may result if important safety practices, procedures and preparation for moving heavy equipment are not observed.

⚠CAUTION ***Both right and left planetary sun gears/drive axles should be removed before any towing. Refer to Section "G" in the Service Manual for these instructions. Extensive secondary damage can occur to final drive components and/or transmission, if truck is towed without first removing sun gears/drive axles.***

ALWAYS TOW A DISABLED VEHICLE FROM THE FRONT! A disabled machine may be towed after the following MINIMUM precautions have been taken.

1. Shut down engine.
2. Refer to operator's cab for towing decal for any special instructions.
3. If truck is equipped, install hydraulic connections for steering and dumping between towing and towed vehicles.
4. Be certain tow bar capacity is approximately equal to 1.5 times the gross vehicle weight of vehicle being towed.
5. Determine that towing vehicle has adequate capacity to both move and stop the towed truck under all conditions.
6. Protect both operators in the event of tow bar failure.
7. Block disabled truck to prevent movement while attaching tow bar.
8. Release disabled truck brakes and remove blocking.

⚠WARNING **Do not tow the truck any faster than 5 MPH (8 kph).**

9. Sudden movement may cause tow bar failure. Smooth and gradual truck movement is preferred.
10. Minimize tow angle at all times - NEVER EXCEED 30^{o}. The towed truck must be steered in the direction of the tow bar.

SAFE PARKING PROCEDURES

The operator must continue the use of safety precautions when preparing for parking and engine shutdown.

In the event that the equipment is being worked in consecutive shifts, any questionable truck performance the operator may have noticed must be checked by maintenance personnel before the truck is released to another operator.

1. The truck should be parked on level ground, if at all possible. If parking must be done on a grade, the truck should be positioned at right angles to the grade.
2. The parking brake must be applied and/or chocks placed fore/aft of wheels so that the truck cannot roll. Each truck should be parked at a reasonable distance from another.
3. Haul roads are not safe parking areas. In an emergency, pick the safest spot most visible to other machines in the area. If the truck becomes disabled where traffic is heavy, mark the truck with warning flags in daylight or with flares at night.

SHUTDOWN PROCEDURE

The following sequence of shutdown procedure is important and should be followed at each shutdown.

1. Stop truck, reduce engine RPM to low idle. Place Transmission Range Selector in "**N**eutral" and apply parking brake.
2. Allow engine to cool gradually by running at low idle for 3 to 5 minutes.
3. Hold engine shutdown switch until engine stops. After engine has stopped, turn key switch "Off" and wait at least 90 seconds. Insure steering circuit is completely bled down by turning steering wheel back and forth several times. No front wheel movement will occur when hydraulic pressure is relieved.
4. Close and lock all windows, remove key from key switch and lock cab to prevent possible unauthorized truck operation. Dismount truck properly.

NOTES

LUBRICATION AND SERVICE

Preventive Maintenance will contribute to the long life and dependability of the HAULPAK® truck and its components. The use of proper lubricants and the performance of checks and adjustments at recommended intervals is most important. **The service intervals presented here are** in hours of operation and are **recommended intervals in lieu of an oil analysis program which may determine different intervals.** However, if truck is being operated under extreme conditions, some or all of the intervals may need to be shortened and the service performed more frequently.

Refer to manufacturer's service manual when servicing the engine or any components of the Allison transmission system.

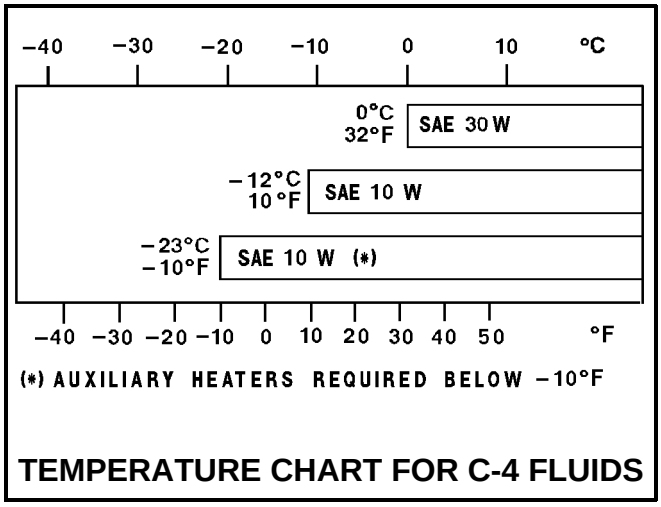
Lubrication requirements are referenced to the lube key found in the Truck Lubrication Specifications Chart. For detailed service requirements for specific components, refer to the service manual section for that component (i.e. Section "G" for Final Drive, Section "H" for Suspensions, etc.).

140M SERVICE CAPACITIES		
	Gallons	**Liters**
Cooling System	38	144.0
Crankcase – Cummins (includes lube oil filters)	9.0	34.0
Hydraulic System (includes tank)	144	5451
Hydraulic Tank	95	3601
Fuel Tank	130	492.0
Final Drive	43	162.8
Front Spindle	1	3.8
Transmission (Sump, Filters, Lines, etc.)	22	83.4

210M SERVICE CAPACITIES		
	Gallons	**Liters**
Cooling System	48	181.7
Crankcase – Cummins (includes lube oil filters)	14.2	53.8
Hydraulic System (includes tank)	144	5451
Hydraulic Tank	95	3601
Fuel Tank	154	583.7
Final Drive	56	212.2
Front Spindle	1	3.8
Transmission (Sump, Filters, Lines, etc.)	22	83.4

COOLING SYSTEM ANTI–FREEZE RECOMMENDATIONS Ethylene Glycol Permanent Type Anti-Freeze		
Percentage of Anti-Freeze	**Protection to:**	
	°F	**°C**
10	+ 23	-5
20	+ 16	-9
25	+ 11	-11
30	+ 4	-16
35	-3	-19
40	-12	-24
45	-23	-30
50	-34	-36
55	-48	-44
60	-62	-52

Use only antifreeze that is compatible with engine as specified by engine manufacturer.

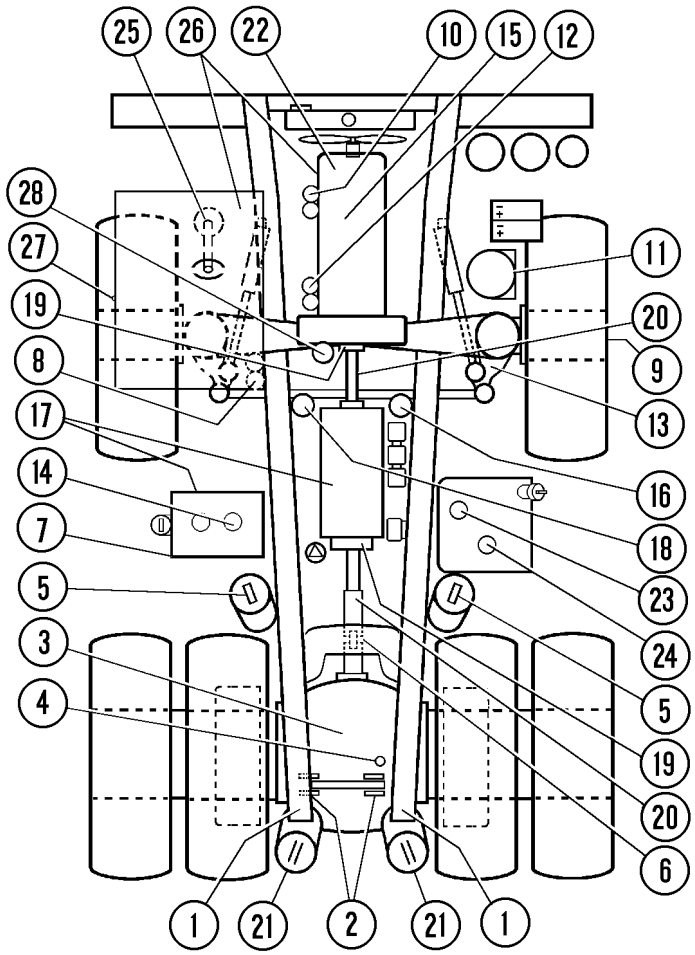


TEMPERATURE CHART FOR C-4 FLUIDS

LUBRICATION CHART

LUBRICATION SPECIFICATIONS					
LUBE KEY	TYPE LUBRICANT	-65°F TO -25°F	-25°F TO + 32°F	+ 32°F T0 + 90°F	ABOVE 90°F
A	ENGINE OIL	SEE ENG. MANUAL*	SEE ENG. MANUAL*	SEE ENG. MANUAL	SEE ENG. MANUAL
AA	LUBRICATING OIL	SAE 10W	SAE 10W	SAE 10W	SAE 10W
B	MULTI-PURPOSE GREASE	MIL-G-10924B	MIL-G-10924B	MIL-G-10924B	MIL-G-10924B
C	MULTI-PURPOSE GEAR OIL	MIL-L-2105C SAE 75W	MIL-L-2105C SAE 80W-90	MIL-L-2105C SAE 80W-90	MIL-L-2105C SAE 85W-140
D	HYDRAULIC OIL C-4	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W	MIL-L-2104D SAE 10W
E	MOLYBDENUM DISULPHIDE GREASE -3% MIN	# 0	# 1	# 2	# 2

DESCRIPTION	SYM.	PTS.	LUBE KEY	10 HR		100 HR	250 HR		1000 HR	
BODY HINGE PINS	1	2	E	GREASE						
PANHARD ROD	2	2	E	GREASE						
FINAL DRIVE	3	* *	C			CHECK			CHANGE	
FINAL DRIVE BREATHER	4	* *				CLEAN				
HOIST CYLINDER PIVOTS	5	4	E	GREASE						
FINAL DRIVE PIVOT PIN	6	1	E	GREASE						
HYDRAULIC TANK	7	1	D	CHECK					CHANGE	
HYDRAULIC FILTER	8	2					CHANGE			
FRONT WHEEL BEARINGS	9	2	C			CHECK				
FUEL FILTERS	10	2					CHANGE			
ENGINE AIR CLEANER	11	1		CHECK						
ENGINE LUBE FILTERS	12	2					CHANGE			
STEERING BALL STUD/PIVOT	13	6	E	GREASE						
HYDRAULIC TANK BREATHER	14	2				CHECK			CHANGE	
ENGINE CRANKCASE OIL	15	1	A	CHECK			CHANGE			
TRANSMISSION OIL FILTER	16	1							CHANGE	
TRANSMISSION OIL	17	1	D			CHECK			CHANGE	
TRANSMISSION COOLER FILTER	18	1							CHANGE	
U-JOINT CROSSES	19	4	B			GREASE				
U-JOINT SLIP SPLINE	20	2	E			GREASE				
SUSPENSION BEARINGS	21	4	E	GREASE						
ENGINE CRANKCASE BREATHER	22	4							CLEAN	
FUEL TANK BREATHER	23	1							CLEAN	
FUEL TANK – H20 & SEDIMENT	24	1				DRAIN				
STEERING COLUMN BEARINGS	25	2	B			GREASE				
THROTTLE CABLE LINK	26	2	AA			OIL				
CAB DOOR HINGE	27	3	AA			OIL				
ENGINE BY-PASS FILTER	28	1					CHANGE			



* AUXILIARY HEATERS REQUIRED BELOW -10° F.

** SEE MANUAL

WA8875

10 HOUR (DAILY) INSPECTION

Prior to each operating shift, a "walk around" inspection should be performed. Check the truck for general condition. Look for evidence of hydraulic leaks; check all lights and mirrors for clean and unbroken lenses; check operator's cab for clean and unbroken glass; check frame, sheet metal and body for cracks. Notify the proper maintenance authority if any discrepancies are found. Give particular attention to the following:

CHECK ALL FLUID LEVELS

a. **Engine oil** –

NOTE: Refer to engine manufacturer service manual for oil recommendations.

b. **Radiator** – Check coolant level and fill with proper mixture as shown in Cooling System Recommendation Chart.

c. **Battery** – Check electrolyte level and add water if necessary.

d. **Hydraulic tank** – Check oil level in tank, add if necessary. Lube key "D", C-4 hydraulic fluid.

NOTE: Check hydraulic oil level with truck level, engine idling, body down, and oil warm. Oil should be visible in sight glass.
DO NOT OVERFILL.

e. **Transmission** – Check oil level. If necessary, add oil. Lube key "D", C-4 hydraulic fluid.

NOTE: Check transmission oil level with truck level, engine running, oil at operating temperature, and transmission in neutral. Oil level should be not more than half full in sight glass or just trickle from top (full) petcock (or should be just below the FULL mark). **DO NOT OVERFILL.**

f. **Fuel Tank** – Fill as required.

g. **Final drive** – Check oil level in sight glass. Truck should be on level surface; oil should fill sight glass.

AIR CLEANERS

a. **Check service indicator**. If indicator shows red, replace with clean filters. Reset indicator by pressing button on top of indicator.

b. **Empty air cleaner dust cups**. See Section "C" of the service manual. Remove and empty air cleaner dust cups.

Truck Serial Number _____

Site Unit Number _____

Date:_____Hour Meter_____

Serviceperson Name_____

COMMENTS	√'d	INITIALS

10 HOUR (DAILY) INSPECTION
(continued)

DRIVE BELTS

a. Check **alternator and fan belts** for proper tension and condition.

b. Inspect for alignment.

ENGINE AND TURBOCHARGERS

Inspect for leaks, vibrations or odd noises.

TIRES

IMPORTANT! After each wheel mounting operation, recheck wheel mounting capscrew tightness after about five hours operation. Check again at the end of the shift and then periodically until all capscrews hold at the prescribed* 300 ft.lbs. (407 N.m) *torque. This requirement is prescribed for both front and rear wheels.

a. Inspect for proper inflation and wear.

b. Inspect for debris embedded in cuts or tread.

CHECK TORQUE ON FRONT SPINDLE RETAINING NUT

The splined nut holding the spindle onto the front Hydrair piston must be checked for looseness. During delivery of a new truck, the torque on these splined nuts must be tightened to **1100 ± 100 ft.lbs. (1491 ± 135 N.m)** torque. After the truck has hauled one load, tighten splined nuts again. Continue to check torque after each shift until this torque is maintained. ***This procedure must be followed each time a splined nut is removed during servicing of the truck***.

LUBRICATION

a. **Panhard Rod** – Grease pins and bushings at grease fittings. Lube Key "E". (2 pts.)

b. **Final Drive Pivot Pin** – Grease bushing at grease fitting. Lube Key "E". (1 pt.)

c. **Body Hinge Pins** – Grease pins and bushings at grease fittings. Lube Key "E". (2 pts.)

d. **Hoist Cylinder Pivots** – Grease pins and bushings at grease fittings. Lube Key "E". (4 pts.)

e. **Steering Ball Studs/Pivot and Tie Rod** – Grease bearings and pins at grease fittings . Lube Key "E". (6 pts.)

f. **Suspension Bearings** – Grease pins and bushings at grease fittings. Lube Key "E". (4 pts.)

COMMENTS	√'d	INITIALS

100 HOUR LUBRICATION AND MAINTENANCE CHECKS

NOTE: 10 Hour service should be included with the following:

Truck Serial Number _____
Site Unit Number _____
Date:_____Hour Meter_____
Serviceperson Name_____

CAB

a. **Steering Column Linkage** – Use hand gun and lubricate with grease. Lube Key "E". (2 pts.)

b. **Cab Door Hinges** – Oil hinges as necessary. Lube Key "AA" (SAE 10W). Check door & windows for proper operation, correct as required.

c. **Cab Air Filter** – Clean or replace.

d. **Cab Mounts** – Check rubber cab mounts, replace as required.

e. **Outside Mirrors And Lights** – Check for damage and operation, repair as required.

f. **Instrument Panel** – Check instruments for proper operation. Verify operation of all lights and warning devices. Check alternator charging rate. Correct as required.

FRONT WHEEL –

Check front wheel bearing oil level. Lube Key "C".

NOTE: To check oil in front wheel hub, rotate wheel hub until one fill/drain hole is horizontal, and the other is "up", add lube oil as required.

THROTTLE CABLE LINKAGE –

Oil linkage with SAE 10W oil (Lube Key "AA").

BRAKES –

Check hydraulic brake control valve, brake calipers, brake pads, hoses and tubes for leaks or wear, repair as required.

U-JOINTS/DRIVE SHAFTS –

Use hand gun and lubricate at grease fittings on the cross and bearing assemblies and splines. Lube Key "E" (6 pts.).

FUEL TANK –

Drain water and sediment from fuel tank.

HYDRAULIC TANK BREATHER –

Remove spin-on breathers and check breathers for cleanliness. Replace as necessary.

COMMENTS	√'d	INITIALS

100 HOUR LUBRICATION AND MAINTENANCE CHECKS (continued)

FINAL DRIVE –

Check oil level. Add oil as required. Lube Key "C".

FINAL DRIVE BREATHER –

Remove and clean.

REAR HYDRAIR SUSPENSION –

Grease bearings. Lube Key "E". (4 pts.).

SUSPENSIONS –

Check suspension cylinders for leaks (more than 50% of dirt ring washed away). Check for proper extension. Refer to service manual, Section "H" if servicing is required.

COMMENTS	√'d	INITIALS

250 HOUR LUBRICATION AND MAINTENANCE CHECKS

NOTE: 10 Hour and 100 Hour service should be included with the following:

Truck Serial Number _____
Site Unit Number _____
Date:_____Hour Meter_____
Serviceperson Name_____

ENGINE

a. **Crankcase Oil** – Change engine oil (use Lube Key "A" on Lubrication and Specification chart) and corrosion filters.

b. **Lube Oil Filters** – Change.

c. **By- Pass Filter** – Change.

d. **Other EngineChecks –**

- Remove primary air filters if indicator shows RED. Clean or replace as required.
- Change safety filter when green dot disappears from wing nut on safety element. If safety element is disturbed, replace O-ring seal.
- Check air filter cover gasket, replace as required.
- Check radiator, water pump, hoses and pipes for leaks, replace or repair as required.
- Check cooling system for correct coolant mixture. Add mixture as required.
- Check exhaust manifolds, gaskets, pipes & exhaust box for leaks, repair as required.
- Check lubrication hoses and pipes for leaks, replace or repair as required.

FUEL FILTER AND STRAINER -

Change filter and strainer element.

HYDRAULIC FILTERS -

Change filter element(s). [1 - 140M; 2 - 210M]

OTHER CHECKS AND ADJUSTMENTS -

Check hydraulic tank, lines, valves and cylinders for leaks and/or wear, repair as required.

Check orbitrol steering control unit for binding, steering column for excess play, hoses and tubes for wear or leaks, steering cylinders for excessive play or leaks, repair as required.

Check parking brake actuator, hoses and tubes for leaks or wear, repair as required.

Check parking brake adjustments (lining and linkage), adjust/repair as required.

COMMENTS	√'d	INITIALS

NOTES

1000 HOUR LUBRICATION AND MAINTENANCE CHECKS

NOTE: All 10, 100, and 250 hour service points should be included with the following:

Truck Serial Number _____
Site Unit Number _____
Date:_____Hour Meter_____
Serviceperson Name_____

ENGINE -

Remove and clean breather elements.

Check engine mounts, repair as required.

Adjust/replace fuel injectors as required.

Adjust intake and exhaust valves as required (Cummins recommends 1500 hours).

FUEL TANK -

Remove breather and clean in solvent. Dry with air pressure.

Drain water and sediment from fuel tank.

TRANSMISSION -

Remove and clean magnetic plug and drain transmission oil.
Remove and clean sump strainer.
Remove, clean, oil and replace breather.

Refill transmission oil. Lube Key "D".

TRANSMISSION FILTERS -

Change transmission oil and oil cooler filter elements.

HYDRAULIC TANK -

Drain hydraulic oil. Remove, clean magnetic plug. Change filter elements. Refill with oil. Use Lube Key "D", C-4 hydraulic fluid.

HYDRAULIC TANK BREATHER -

Install new breather.

FINAL DRIVE -

Change final drive oil. Lube Key "C". Fill final drive housing at rear fill plug until oil level is at bottom of fill hole. Oil must flow from center housing out to both planetaries; add oil until level is maintained at bottom of hole. Allow approximately 15 minutes for proper fill.
NOTE: Long, high speed runs and high operating temperature may require a more frequent change interval.

COMMENTS	√'d	INITIALS

1000 HOUR LUBRICATION AND MAINTENANCE CHECKS (continued)

OTHER CHECKS AND ADJUSTMENTS -

Check and record hydraulic pressures:

- Steering pressure RH and LH – 2750 psi (19.0 MPa).
- Hoist up pressure – 2750 psi (19.0 MPa).
- Hoist down pressure – 1000 psi (6.9 MPa).
- Hoist valve pilot pressure – 125 psi (0.9 MPa).
- Brake pressure - all wheels.
- Correct hydraulic pressure as required.

- Check Rear Oil Brake Disc Wear (Use tool installed; Refer to service manual, Section "J", Rear Wet Disc Brakes)

Check steering and brake accumulator precharge pressure – 1050 psi (7.2 MPa).

NOTE: ***SERVICE ACCUMULATORS WITH DRY NITROGEN ONLY.***

COMMENTS	√'d	INITIALS

NOTE: For specific checkout procedures or additional information, refer to service manual.

5000 HOUR LUBRICATION AND MAINTENANCE CHECKS

NOTE: All 10, 100, 250, and 1000 hour service points should be included with the following:

Truck Serial Number _____
Site Unit Number _____
Date:_____Hour Meter_____
Serviceperson Name_____

FRONT WHEELS -

Drain oil and check bearing preload as covered in Section "G" of the Service Manual. Use Lube Key "C".

AIR CLEANER -

Clean the Donaclone Tubes in the pre-cleaner section of the air filter. Use low pressure cold water or low pressure air to clean tubes.

NOTE: Do not use a hot pressure washer or high pressure air to clean tubes because pre-cleaner tubes will distort.

STEERING CONTROL FILTER -

Change in-line filter at orbitrol steering control unit inlet line.

RADIATOR -

Clean cooling system with a quality cleaning compound. Flush with water. Refill system with anti-freeze and water solution. Check Cooling System Recommendation Chart for correct mixture.
Maintain cooling system according to engine manufacturer's recommendations.

COMMENTS	√'d	INITIALS

NOTE: For additional or more specific information, refer to service manual.

NOTES

Komatsu Mining Systems, Inc.
Peoria Operations, P.O. Box 240
Peoria, IL 61650-0240

Printed in U.S.A. 040398


KOMATSU