DG681

Shop Manual

830E

DUMP TRUCK

SERIAL SUFFIX

AFE32-AS - AFE32-DH
AFE32-DN - AFE32-DR

KOMATSU®

FOREWORD

This Service Manual is written for use by the service technician and is designed to help the technician become fully knowledgeable of the truck and all its systems in order to keep it running and in production. All maintenance personnel should read and understand the materials in this manual before performing maintenance and/or operational checks on the truck. All safety notices, warnings and cautions should be understood and followed when accomplishing repairs on the truck.

The first section covers component descriptions, truck specifications and safe work practices, as well as other general information. The major portion of the manual pertains to disassembly, service and reassembly. Each major serviceable area is dealt with individually. For example: The disassembly, service and reassembly of the radiator group is discussed as a unit. The same is true of the engine and engine accessories, and so on through the entire mechanical detail of the truck. Disassembly should be carried only as far as necessary to accomplish needed repairs.

The illustrations used in this manual are, at times, typical of the component shown and may not necessarily depict a specific model.

This manual shows dimensioning of U.S. standard and metric (SI) units throughout and all references to "Right", "Left", "Front", or "Rear" are made with respect to the operator's normal seated position, unless specifically stated otherwise.

Standard torque requirements are shown in torque charts in the general information section and individual torques are provided in the text in bold face type, such as **100 ft.lbs. (135 N.m)** torque. All torque specifications have ± 10% tolerance unless otherwise specified.

A Product Identification plate is normally located on the truck 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. 830E). 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.

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

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

⚠ WARNING

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

⚠ CAUTION

"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.

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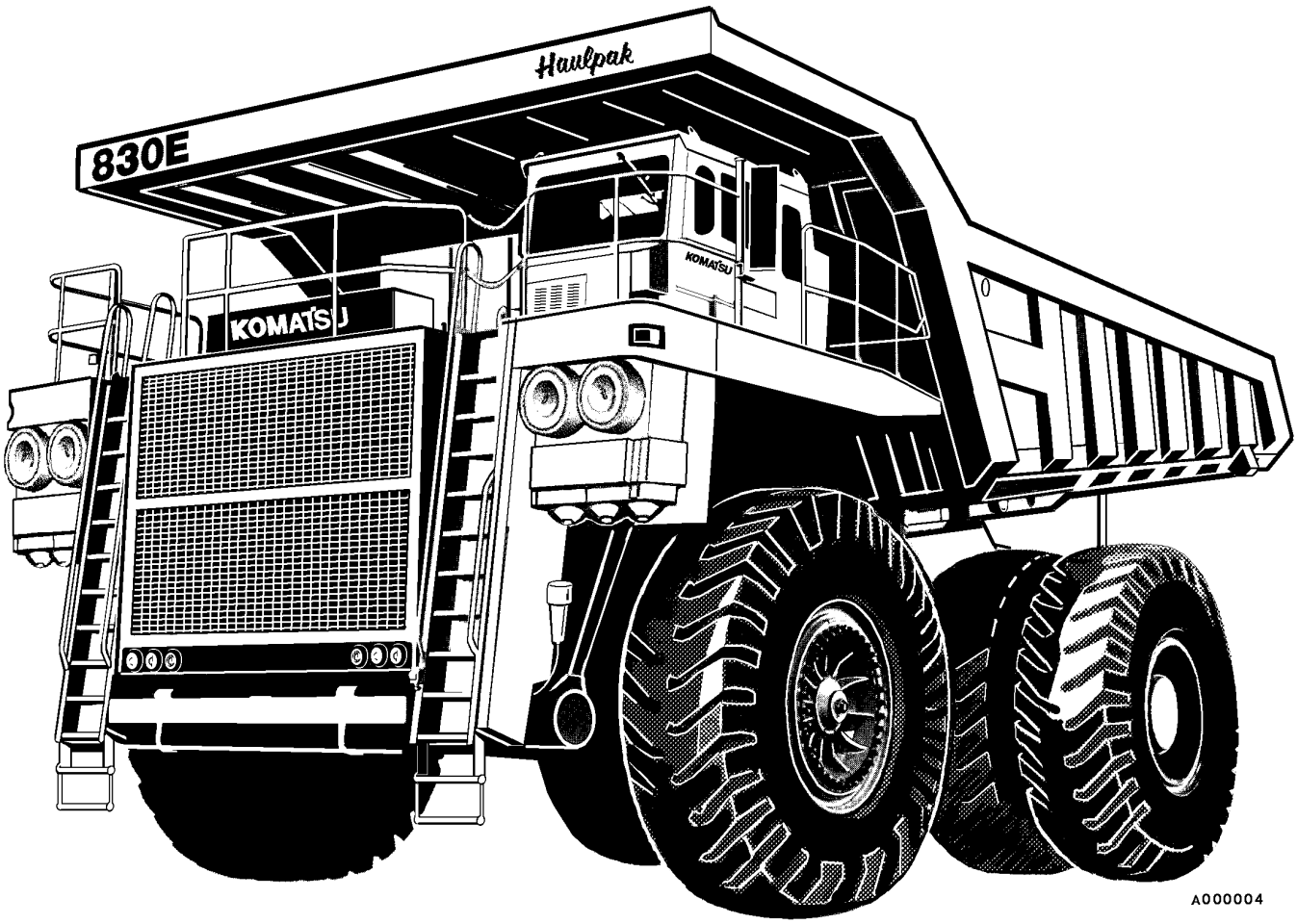

MODEL 830E HAULPAK® TRUCK

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NOTES

TRUCK COMPONENT DESCRIPTION

The Model 830E HAULPAK® Truck is an electric drive, off-highway, rear dump truck whose gross vehicle weight is 830,000 lbs. (240 ton nominal payload).

ENGINE

The Model 830E HAULPAK® Truck may be powered by either a Detroit Diesel 16V-149TIB diesel engine with rated brake power @ 2200 hp (1640 kW) @ 1900 RPM, a Detroit Diesel 20V-149TIB diesel engine with rated brake power @ 2500 hp (1750 kW) @ 1900 RPM, or an MTU 16V 396, diesel engine with rated brake power @ 2467 hp (1840 kW). The radiator, engine, alternator, and blower are mounted on a separate subframe to provide fast, easy removal and installation of the power module.

ALTERNATOR

The alternator is mounted in-line with the engine. The alternating current (AC) output of the alternator is rectified to direct current (DC) and sent to the wheel mounted DC drive traction motors.

BLOWER

The dual impeller, in-line blower supplies cooling air for the alternator, rectifiers, and both traction motors. The air is exhausted to atmosphere through the wheel motors.

WHEEL MOTORS

Traction motors located within each rear wheel structure receive electrical energy from the alternator. The two traction motors convert electrical energy back to mechanical energy through built-in gear trains within the wheel structure. The direction of the drive motors is controlled by a forward or reverse hand selector switch located on a console in the cab to the right side of the operator.

POWER STEERING

The HAULPAK® truck is equipped with a full time power steering system which provides positive steering control with a minimum of effort by the operator. The system includes a nitrogen-charged accumulator which automatically provides emergency power if the steering hydraulic pressure is reduced below an established minimum.

OPERATOR'S CAB

The HAULPAK® Operator's Cab has been engineered for operator comfort and to allow for efficient and safe operation of the truck. The cab contains an integrated ROPS and is fully insulated to reduce noise and vibration. The tinted safety-glass windshield and side windows provide excellent visibility. The seat is a comfortable, adjustable suspension seat, the steering wheel provides tilt and telescoping adjustments and controls are mounted within easy reach of the operator. The instrument panel provides the operator with instruments and gauges that are necessary to control and monitor the truck's operating systems and is marked with international symbols for easy identification of functions.

DYNAMIC RETARDING

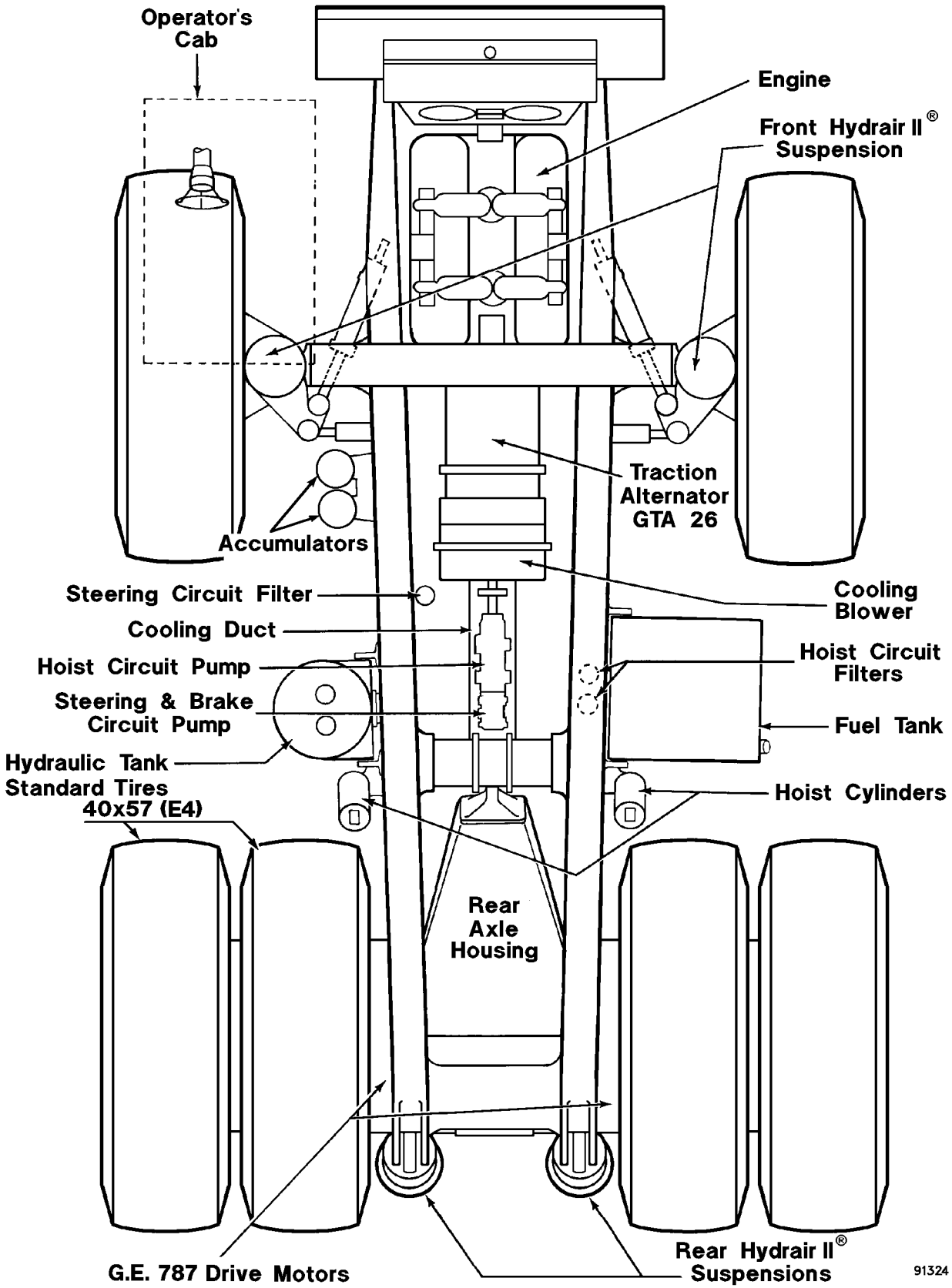
Dynamic retarding is used to slow the truck during normal operation or control speed coming down a grade. The dynamic retarding ability of the DC electric system is controlled by the operator by depressing the foot operated retarder pedal and/or setting the RSC (Retarder Speed Control) on the instrument panel. Dynamic Retarding is automatically activated if truck exceeds the overspeed setting.

BRAKE SYSTEM

The braking system consists of an all hydraulic actuation system. Depressing the brake pedal actuates wheel-speed single disc front brakes and armature-speed dual disc rear brakes. The brakes can also be activated by operating a switch on the instrument panel. The brakes will be applied automatically if system pressure decreases below a preset minimum.

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.



830E HAULPAK® MAJOR COMPONENTS

SPECIFICATIONS

These specifications are for the standard basic 830E HAULPAK® Truck. Customer Options may change this listing.

ENGINES -

MTU 16V 396 TE44

Number of Cylinders 16
Operating Cycle . . . . . 4- Cycle
Rated Brake HP . 2467 HP (1840kW) @ 1900 RPM
Flywheel HP . . . 2292 HP (1709kW) @ 1900 RPM
Weight (Dry) . . . . . 13,690 pounds (6210 kg)

DDC 16V-149TIB

Number of Cylinders 16
Operating Cycle 2-Stroke
Rated Brake HP . 2200 HP (1640kW) @ 1900 RPM
Flywheel HP . . . 2054 HP (1532kW) @ 1900 RPM
Weight (Dry) . . . . . 11,210 pounds (5085 kg)

DDC 20V-149TIB

Number of Cylinders 20
Operating Cycle 2-Stroke
Rated Brake HP . 2500 HP (1750kW) @ 1900 RPM
Flywheel HP . . . 2334 HP (1635kW) @ 1900 RPM
(Weight (Dry) . . . . . 15,210 pounds (6899 kg)

ELECTRIC DRIVE SYSTEM - STATEX III

(AC/DC Current)
Alternator . . . . . General Electric GTA - 26
Dual Impeller, In-Line Blower 9000 cfm (255 m^3/min)
Motorized Wheels . . . . . General Electric 787
Ratio 28.125:1
Maximum Speed* . . . . . 35.3 MPH (56.9 km/h)
(*w/40.00-57 Tires and 28.125:1 gear train)

DYNAMIC RETARDING

Extended Range Retarding With Fully Blown
18-Resistor Grids and Reverse Retarding Standard
Maximum Rating . . . . . 4000 HP (2983 kW)

TIRES

Rock Service, Deep Tread . . . . . (E-4) Tubeless
Standard Tire . . . . . 40.00 - 57, 68 Ply Rating
(w/787 Wheelmotor)
Separable Tire Rims *
5 Piece New Generation™ Rims *
Rims* are interchangeable with different positions on the truck, but due to improved design for greater load support, rims are not interchangeable with other manufacturer's rims.
Rim Size
29 in. (737 mm) X 57 in. (1448 mm) X 5 in. (127 mm)

24 VDC ELECTRIC SYSTEM

Batteries . . . . . Two 12 Volt Batteries in Series
. 220 Ampere-Hour Capacity w/Disconnect Switch
Alternator (DDC eng.) 24 Volt, 175 Ampere Output
Generator (MTU supplied) 24 V, 100 Amp. Nominal
Lighting . . . . . 24 Volt

SERVICE CAPACITIES

	U.S. Gallons	(Liters)
MTU Crankcase *	55.0	210.0
Detroit Diesel Crankcase *	52.5	198.7
* Includes Lube Oil Filters		
Cooling System		
MTU	152	575
DDC (2200) HP	135	511
DDC (2500) HP	160	625
Fuel	1000	3785
Hydraulic System	250	947
Wheel Motor Gear Box (each)	10.5	39.7

AIR SYSTEM

Compressor . . . . . MTU supplied
Compressor (DDC only) . . . . B-W TU-FLO 501
Capacity . . . . . 12 cfm (0.34 m^3/min)
Starter with Interlock . Varies with Customer Option
Main Tank Capacity . . . . . 15 $ft.^3$ (425 liters)

HYDRAULIC SYSTEMS

Pumps
Hoist . . . . . Tandem Gear Pumps
Rated @ . . . 230 GPM (870 l/min.) @ 1900 RPM
Steering . . Radial Piston-Pressure Compensating
(also Brake) . 65 GPM (246 l/min.) @ 1900 RPM
System Relief Pressures
Hoist/Steering . . . . . 2500 psi (17.2 MPa)
Brakes . . . . . 3500 psi (24.1 MPa)
Hoist Cylinders (2) 3-Stage
Tank (Vertical/Cylindrical) . . . . . Non-Pressurized
Filtration Remote-mounted, Replaceable, Elements
Suction . . . . . Single, Full Flow, 100 Mesh
Hoist & Steering Full Flow, 7 Micron, High Pressure

STEERING (w / Accumulators)

Turning Circle - Front Wheel Track . 93 ft. (28.35 m)
Full Time Power Steering . . . . . Twin Cylinders
Automatic Emergency Steering . . . . . Standard

SERVICE BRAKES

Actuation . . . . . All Hydraulic
Front . . . . . Wheel Speed, Single Disc
Inboard Mounted . . . . . 3 Calipers
Disc Diameter, O.D. . . . . 47.75 in. (1213 mm)
Rear . . . . . Armature Speed, Dual Disc
Disc Diameter, O.D. . . . . 25.00 in. (63.5 cm)
Emergency Brake-Automatically Applied Standard
Wheel Brake Lock . . . . Manual Switch on Panel
(Loading and Dumping)

DISC PARKING BRAKE

Each Rear Wheel . . . . . Single Caliper
Spring Applied . . . . . Hydraulically Released

DUMP BODY CAPACITIES AND DIMENSIONS

Standard, Heaped @ 2:1 (SAE) 171 yd^3 (130.7 m^3)
Loading Height Empty . . . . . 20 ft. 1 in. (6.12 m)
Optional Heaped @ 2:1 (SAE) . 160 yd^3 (122.3 m^3)
Loading Height Empty . . . . . 19 ft. 6 in. (5.97 m)
Dumping Angle . . . . . 45°
Non-heated Body w/Exhaust Mufflers . . Standard

WEIGHT DISTRIBUTION

(w/Detroit Diesel 16V-149TIB)

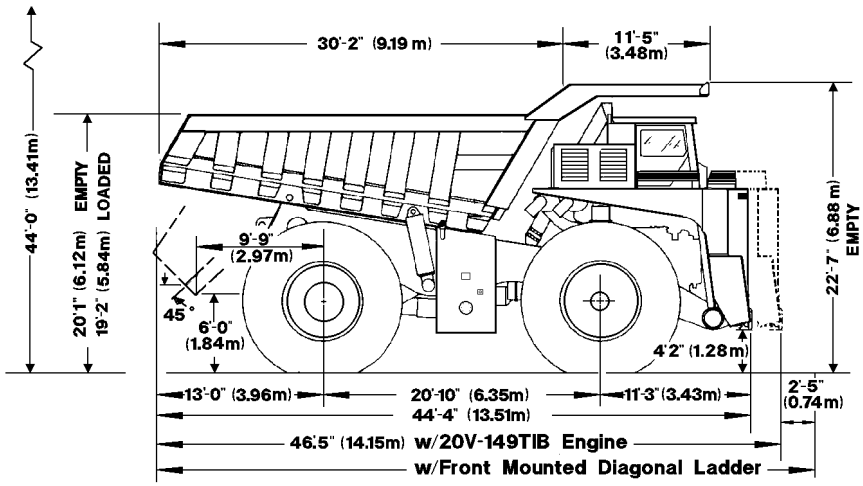
Empty Vehicle	**Pounds**	**(Kilograms)**
Front Axle	153,800	(69 763)
Rear Axle	179,100	(81 239)
Total	332,900	(151 002)

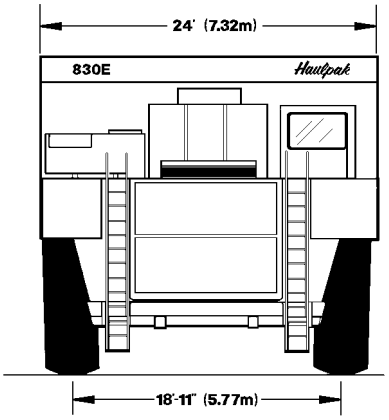
Loaded Vehicle	**Pounds**	**(Kilograms)**
Front Axle	269,750	(122 359)
Rear Axle	560,250	(245 129)
Total *	830,000	(376 485)

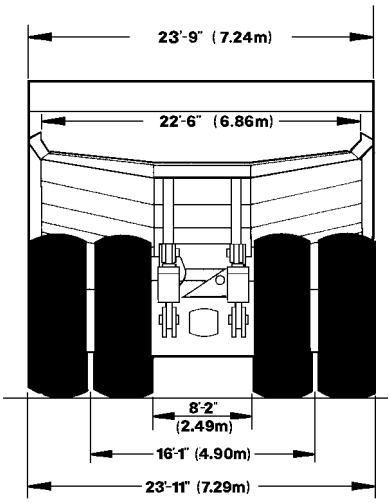
Added Weight for:

Detroit Diesel 20V-149TIB 2500 HP (1750kW) engine .	7,025	(3 186)
Front Mounted Diagonal Ladder.	1,368	(621.5)

* Not To Exceed 830,000 lbs. (376 485 kg) including options, fuel and payload.







OVERALL TRUCK DIMENSIONS

(Empty with Standard Body)

Length	44 ft. 4 in.	(13.51 m)
Width	24 ft.	(7.32 m)
Height With Canopy	22 ft. 7 in.	(6.88 m)
Height With Dump Body Up . .	44 ft.	(13.41 m)
Turning Circle (On Front Track)	93.0 ft.	(28.35 m)

GENERAL SAFETY AND OPERATION

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. Potential accidents can be prevented 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®.

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.

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, use coolant level sight gauge (if equipped). If necessary to remove radiator cap, shut down engine, and relieve coolant 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.

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.

3. Check tires for cuts, damage or "bubbles". Check tires for proper inflation before beginning shift and periodically during shift. 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.

⚠WARNING

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

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 hand rails and ladder when mounting or dismounting from the truck. Clean your shoes, ladder, and hand rails of all accumulations, such as ice, snow, oil, or mud before climbing.

⚠WARNING

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

6. Check the deck areas for debris, loose hardware or tools. 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.

7. Read and understand the contents of the Operator's Handbook. Give particular attention to safety material and operating instructions.
   Read and understand CAUTION and WARNING decals in the operator's cab.
8. Become thoroughly acquainted with all gauges, instruments and controls. Be familiar with all brake and steering system controls and warning devices, road speeds, and loading capabilities, before operating the truck.
9. Keep all unauthorized reading material out of truck cab.
10. 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.
11. Insure steering wheel, 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 windshield washer reservoir for fluid level.
15. Insure adequate ventilation before start-up if the truck is in an enclosure.
    Exhaust fumes are dangerous!

ENGINE START-UP SAFETY PRACTICES

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 Selector Switch is in "**N**eutral" before starting.
3. If truck is equipped with auxiliary cold weather heater system(s), do not attempt to start engine while heaters are in operation.
   Damage to coolant heaters will result.

NOTE: If truck is equipped with HMS control system, refer to Operator Handbook for starting procedures

4. The keyswitch 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. With Selector Switch in "**N**eutral", rotate keyswitch fully clockwise to "Start" position and hold this position until engine starts. "Start" position is spring loaded to return to "Run" when key is released.

   NOTE: If truck is equipped with the Cummins Engine Prelube System, a noticeable time delay will occur (while engine lube oil passages are being filled) before starter engagement and engine cranking will begin. The colder the engine oil temperature, the longer the time delay will be. In addition, if truck is also equipped with Engine Starting Aid for cold weather starting, the Engine Prelube System should be engaged FIRST for 5-10 seconds, or until starter is engaged, BEFORE activating the Engine Starting Aid.

⚠WARNING

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

If truck is equipped with optional Engine Starting Aid and ambient temperature is below 50°F (10°C), turn the keyswitch to the "Start" position, and while cranking engine, move the Engine Starting Aid switch to the "On" position for three (3) seconds **MAXIMUM**; then release Engine Starting Aid. If engine does not start, wait at least fifteen (15) seconds before repeating the procedure.

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

AFTER ENGINE HAS STARTED

1. Become thoroughly familiar with steering and emergency controls. After engine has started and low pressure and warning systems are normal, 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 from the operator's cab of the service brake, parking brake, and brake lock (also emergency brake, if equipped). With the engine running and with the hydraulic circuit fully charged, activate each circuit individually. If any application or release of any brake circuit appears sluggish or improper, or if warning alarms are activated 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 hydraulic 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 leave truck unattended while engine is running. Shut down engine before getting out of cab.

SAFETY PRECAUTIONS DURING TRUCK OPERATION

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.

⚠CAUTION

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.

Operating truck with stalled or free spinning wheel motors may cause serious damage to wheel motors! If truck does not begin to move within 10 seconds after depressing throttle pedal (Selector Switch in a drive position), release throttle pedal and allow wheels to regain traction before accelerating engine again.

At the beginning of each shift, check the **automatic** emergency steering for proper operation. This can be accomplished as follows:

- With engine running and steering system fully charged, no red warning lights or buzzer should be "on" (HMS trucks should have no warnings displayed.).
- Shut down engine and leave keyswitch in "Run" position (leave HMS "On").
- Turn steering wheel one full turn left and right; if front wheels turn, system is operating properly. Restart engine.

*NOTE: **Automatic** Emergency Steering ability is limited by the capacity of the steering accumulators. This function is intended to allow the operator only enough time to steer the HAULPAK® to a safe stop during an emergency situation.*

1. WEAR SEAT BELTS AT ALL TIMES! Operate the truck only while properly seated with seat belt fastened. Keep hands and feet inside the cab compartment while truck is in operation.
2. Do not allow unauthorized personnel to ride in the truck. Only authorized persons are allowed to ride in truck cab, and they should have seat belts fastened. Do not allow anyone to get on or off truck while it is in motion, or to ride on the deck or the ladder of the truck.

3. Do not move truck into or out of a building without a signal person present. 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 signalman. Courtesy at all times is a safety precaution!
   Always look to the rear before backing the truck. Watch for and obey ground spotter's hand signals before making any reverse movements. Sound the warning horn (3 blasts). Spotter should have a clear view of the total area at the rear of the truck.
4. Check gauges and instruments frequently during operation for proper readings.
5. DO NOT leave truck unattended while engine is running. Do not allow engine to run at "Idle" for extended periods of time. When parking, always apply parking brake, and park a safe distance from other vehicles, as determined by supervisor.
6. Report immediately to supervisor any conditions on haul road, pit or dump area that may present an operating hazard.
7. Observe all regulations pertaining to the job site's traffic pattern. Be alert to any unusual traffic pattern. Obey the spotter's signals.
8. 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.
9. Check parking brake periodically during shift. Use parking brake **ONLY** for parking. Do not use park brake for loading / dumping.
   Do not attempt to apply parking brake while truck is moving!

Do not use "Brake Lock" or "Emergency Brake" (if equipped) for parking.

10. Check brake lock performance periodically for safe loading and dump operation.
11. Proceed slowly on rough terrain to avoid deep ruts or large obstacles. Avoid traveling close to soft edges and the edge of fill area.
12. Truck operation requires concentrated effort by the driver. Avoid distractions of any kind while operating the truck.
13. Keep serviceable fire fighting equipment at hand. If extinguisher is discharged, report the occurrence, so the used unit can be refilled or replaced.

⚠WARNING

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

14. 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.

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 similar pattern.
5. When being loaded, operator should stay in truck cab. Place Selector Switch in "Neutral" and apply brake lock with engine running.

⚠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 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.
   Cab doors should remain closed at all times if truck is in motion or unattended.
2. Obey all road signs. Operate truck so it is under control at all times. Govern truck speed by the road conditions, weather and visibility. Report haul road conditions immediately. Muddy or icy roads, pot holes or other obstructions can present hazards.
3. When backing the truck, give back-up signal (three blasts on the horn); when starting forward, two blasts on the horn. Sound these alarms each time the truck is moved forward or backward.
4. Use extreme caution when approaching a haul road intersection. Maintain a safe distance from oncoming vehicles.
5. 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 driving on a down grade, this distance should not be less than 100 ft. (30 m).
6. Do not stop or park on a haul road unless unavoidable. If you must stop, move truck to a safe place, apply parking brake, block wheels securely, shut down engine and notify maintenance personnel for assistance.
7. 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.
8. 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. Always dim headlights when meeting oncoming vehicles.
9. If the "Emergency Steering" light and/or "Low Brake Pressure Warning" light (*if equipped*) illuminate during operation, steer the truck **immediately** to a safe stopping area, away from other traffic, if possible. Refer to item 6 above.
10. The Statex III w/Fuel Enhancement system monitors wheel motor, ambient, and static exciter temperatures. If any one of these values is outside the limits established, the Statex III controls will cause the engine to increase to 1650 RPM.
    (Normal engine RPM for haul road/retarding operation is 1250 RPM.)
11. When maximum truck speed is reached, haul trucks equipped with Statex III w/Fuel Enhancement system will experience a DECREASE in engine RPM.
    NOTE: This is different from trucks equipped with Statex II or Statex III without Fuel Enhancement, which increase RPM upon reaching speed limit.
12. Check tires for proper inflation periodically during shift. If truck has been run on a "flat", or under-inflated tire, **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. Make sure area is clear of persons and obstructions, including overhead utility lines. Carefully maneuver truck into dump position. Obey signals directed by the spotter, if present.
2. Avoid unstable areas. Stay a safe distance from edge of dump area. **Position truck on a solid, level surface before dumping**.

⚠DANGER

As body raises, the truck Center of Gravity (CG) will move. Truck must be on level surface to prevent tipping / rolling!

3. When in dump position, apply Brake Lock and move Selector Switch to the "**N**eutral" position.

To Raise dump body:

⚠WARNING

The dumping of very large rocks (10% of payload, or greater) or sticky material (loads that do not flow freely from the body) may allow the material to move too fast and cause the body to move RAPIDLY and SUDDENLY. This sudden movement may jolt the truck violently and cause possible injury to the operator, and/or damage to the hoist cylinders, frame, and/or body hinge pins. If it is necessary to dump this kind of material, refer to the CAUTION in the following procedure:

4. Pull the lever 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. Refer to the CAUTION below.

⚠CAUTION

If dumping very large rocks or sticky material as described in WARNING above, slowly accelerate engine RPM to raise body. When the material starts to move, release hoist lever to "HOLD" position. If material does not continue moving and clear body, repeat this procedure until material has cleared body.

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 of hoist cylinder reaches full extension.
8. After material being dumped clears body, lower body to frame.

To Lower Body:

Move hoist lever 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 the rear of the body and the body cannot be lowered, shift Selector Switch to "Forward", release Brake Lock, depress Override button and drive forward to clear material. Stop, shift Selector Switch to "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 Selector Switch to "Forward", 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.
Do not tow the truck any faster than 5 MPH (8 kph).

A disabled machine may be towed after the following MINIMUM precautions have been taken.

1. Shut down engine.
2. If truck is equipped, install hydraulic connections for steering and dumping between towing and towed vehicles. Check towed vehicle for braking system.
3. Inspect tow bar for adequacy (approximately 1.5 times the gross vehicle weight of truck being towed).
4. Determine that towing vehicle has adequate capacity to both move and stop the towed truck under all conditions.
5. Protect both operators in the event of tow bar failure.
6. Block disabled truck to prevent movement while attaching tow bar.
7. Release disabled truck brakes and remove blocking.
8. Sudden movement may cause tow bar failure. Smooth and gradual truck movement is preferred.
9. Minimize tow angle at all times - NEVER EXCEED 30°. The towed truck must be steered in the direction of the tow bar.

WHEN REPAIRS ARE NECESSARY

1. Only qualified maintenance personnel, who understand the systems being repaired, should accomplish repairs.
2. If truck is to be towed for any reason, use a rigid tow bar. Refer to **TOWING** procedure.
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.
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.
6. Follow package directions carefully when using cleaning solvents.
7. If an auxiliary battery assist is needed, hook up positive (+) leads of the auxiliary battery cables to the positive (+) posts of both truck batteries. Connect the negative (-) lead to the auxiliary battery and then connect cable to a frame ground on the disabled truck away from the battery.
8. Disconnect batteries (or battery disconnect switch, if so equipped), battery charging alternator, and plug-in cards before making welding repairs. When welding, the ground connections must be as close as possible to weld area. Welding current must not pass through any bearings.
9. Many components on the *HAULPAK*® are large and heavy. Insure that lifting equipment (hoists, slings, chains, lifting eyes) are of adequate capacity to handle the lift.
10. Relieve pressure in lines or hoses by shutting engine down, activating the system to relieve accumulator pressure, and place all system controls in neutral before making the disconnects.

⚠WARNING

Any operating fluid, such as hydraulic oil, 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. Drain, clean and ventilate fuel tanks and/or hydraulic tanks before making any welding repairs on these structures.
12. After adjustments or repairs, replace all shields, screens and clamps.
13. Tire Care:
    Mounting and demounting a multi-piece tire and rim assembly can be extremely dangerous. An incorrect assembly can blow apart leading to extensive property damage, severe injury, or even death for anyone in its trajectory path.

    Before servicing tire and rim assemblies, read all available publications on proper tire handling and safety instructions.

⚠WARNING

Do not stand in front of rim and locking ring when inflating/deflating tire mounted on vehicle. Inflate ONLY to tire manufacturer's recommendation.

- Use an air chuck with extension hose clipped on the tire inflation valve to allow service from behind the tread of the tire.
- 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.
- When jacking a vehicle, DO NOT rely entirely on vehicle braking system; use chocks to block the wheels on opposite side from jack.
- DO NOT remove any rim or wheel mounting hardware, such as nuts or clamps, before COMPLETELY exhausting all air from the tire, or both tires on a dual assembly.
- DO NOT reuse cracked, damaged, or worn rim parts. Replace with new parts.
- DO NOT mix/assemble rim parts of different designs. If in doubt of compatibility, consult rim manufacturer.
- DO NOT use a steel hammer to aid assembly. Use soft mallets only.

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

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 flares at night.

SHUTDOWN PROCEDURE

The following procedure (1. - 4.) should be followed at each engine shutdown.

1. Stop truck. Reduce engine RPM to low idle. Place Selector Switch in "**N**eutral" and apply parking brake.
2. Allow engine to cool gradually by running at low idle for 3 to 5 minutes.

   NOTE: If truck is equipped with HMS control system, refer to Operator Handbook for shutdown procedure.

3. With truck stopped and engine cooled down, turn keyswitch counterclockwise to "Off" for normal shutdown of engines equipped with electronic engine controls (MTU, Detroit Diesel w/ DDEC, or Cummins w/Centry™ Fuel Control).
   If engine does not shutdown with keyswitch, use engine shutdown switch (*) and hold switch down until engine stops.
   * For 445E - 685E, this is the Engine Shutdown Switch on center console (see "Operator Controls" in Operator Handbook).
   * For 830E, this is the instrument panel Emergency Engine Shutdown switch (see "Instruments and Indicators" in Operator Handbook).
4. With keyswitch "Off", and engine stopped, 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.

NOTE: A switch is located at lower left front of truck for ground level engine shutdown.

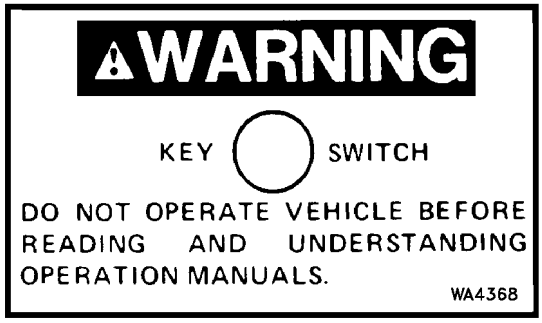
5. Close and lock all windows, remove key from keyswitch and lock cab to prevent possible unauthorized truck operation. Dismount truck properly.

WARNINGS AND CAUTIONS

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

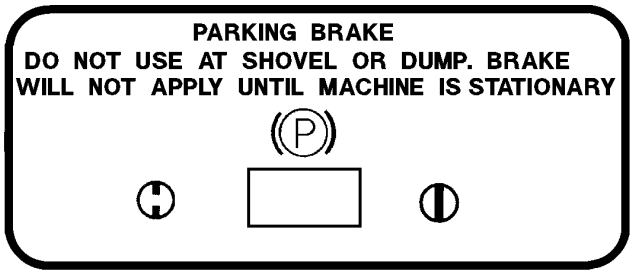
The plates and decals must be kept clean and legible. If any decal or plate becomes unable to be read or damaged, it should be replaced with a new one.

A warning plate is mounted around the key switch on the instrument panel. The warning stresses the importance of reading the operator's manual before operation.

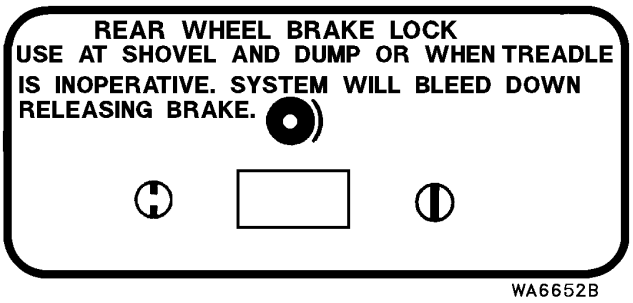


A warning plate is mounted directly over the parking brake switch. The plate stresses the parking brake is not to be used while the truck is being loaded at a shovel or when parked at a dump.

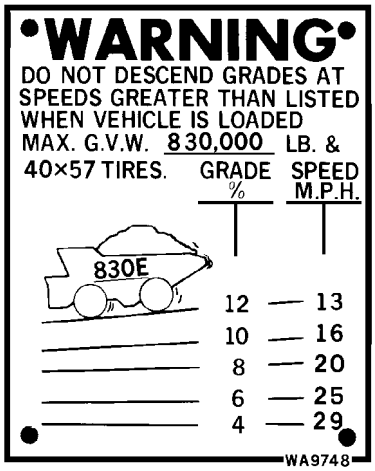
The truck must be completely stopped before applying the parking brake or damage may occur to parking brake. The parking brake is **not** designed to stop a moving truck.



A warning plate over the "Rear Wheel Brake Lock" switch stresses the use of this brake for use during truck loading while parked at a shovel or during dumping. If an emergency occurs where the brake treadle valve does not operate, apply this brake to stop the truck. Do not use this brake as a parking brake when leaving the truck as the hydraulic system will eventually bleed down, releasing the Brake Lock.

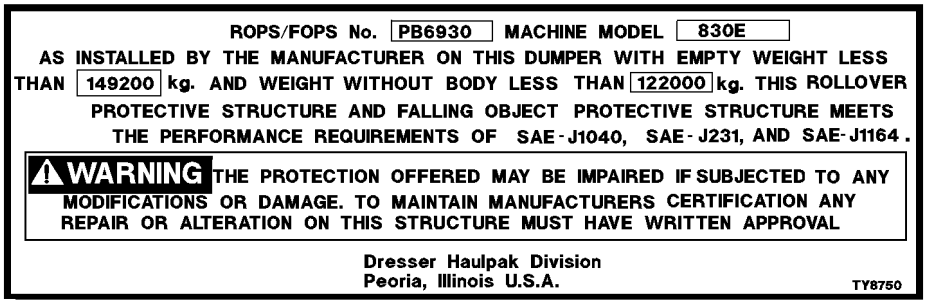


A plate located on the instrument panel in the operator's cab lists maximum speeds when descending various grades with a loaded truck.



MAXIMUM ALLOWABLE TRUCK SPEED IS 30.1 MPH (48.4 km/h)

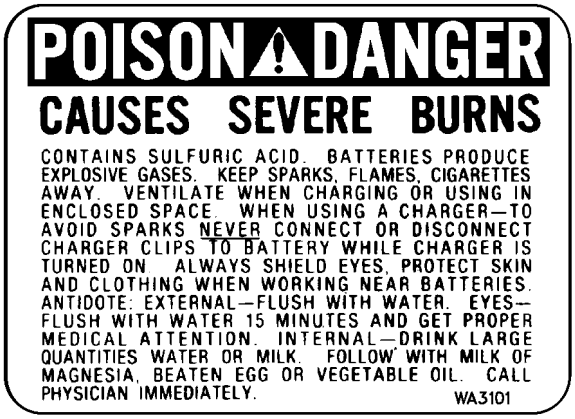
A plate attached to the right rear corner of the cab states the Rollover Protective Structure and Falling Object Protective Structure meets various SAE performance requirements.



⚠WARNING ***Do not make modifications to this structure or attempt to repair damage without written approval from the Manufacturer. Unauthorized repairs will void certification.***

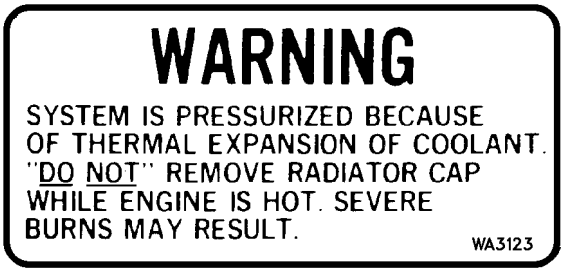
Attached to the exterior of the battery compartment is a danger plate. This plate stresses the need to keep from making any sparks near the battery. When another battery or 24VDC power source is used for auxiliary power, all switches must be "Off" prior to making any connections. When connecting auxiliary power cables, positively maintain correct polarity; connect the positive (+) posts together and then connect the negative (-) lead of the auxiliary power cable to a good frame ground. **Do not connect to the negative posts of the truck battery or near the battery box.** This hookup completes the circuit but minimizes danger of sparks near the batteries.

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



A warning plate is mounted on top of the radiator surge tank cover near the radiator cap.

The engine cooling system is pressurized by the truck air system when the key switch is turned “On”. **Always turn the key switch off and allow the engine to cool before removing radiator cap.** Unless the pressure is first released, removing the radiator cap after the engine has been running for a time will result in the hot coolant being expelled from the radiator. **Serious scalding and burning can result.**



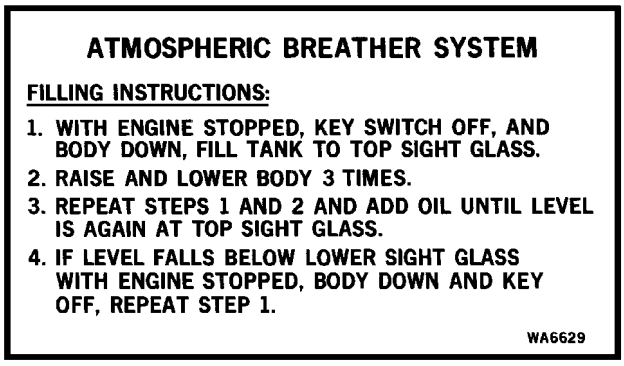
Warning plates are mounted on the frame just in front of and to the rear of the front tires. Technicians making adjustments while the truck is being steered are warned the clearances change when the truck is steered and could cause serious injury.

A plate on the side of the hydraulic tank furnishes instructions for filling the hydraulic tank.

Keep the system open to the atmosphere only as long as absolutely necessary to lessen chances of system contamination.

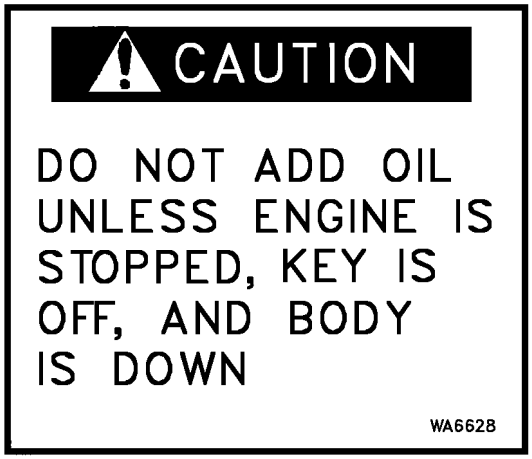
Service the tank with clean Type C-4 hydraulic oil.

All oil being put into the hydraulic tank should be filtered through 3 micron filters.

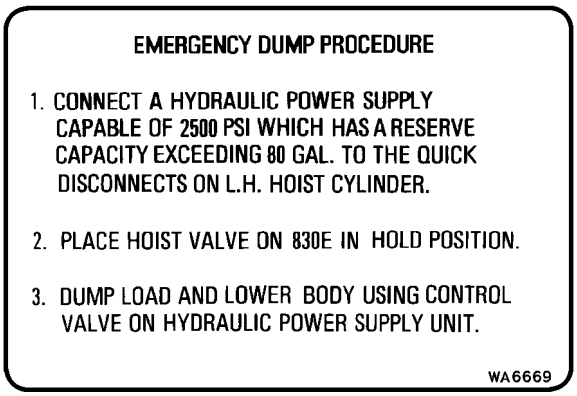


A caution decal is attached below the hydraulic tank oil level sight gauge. Check level with body down, engine stopped, and key switch “Off”.

Add oil per filling instructions if oil level is below top of sight glass.



An emergency dump procedure decal plate is located on the frame near the left hoist cylinder which provides the operator or technician with the proper hook-up procedure for dumping a loaded, disabled truck.



Warning plates are attached to both the hydraulic and fuel tank to alert technicians **not to work** on the truck **with the body in the raised position** unless body-up retention device (pin) is in position.

A warning plate is attached to the frame above the hydraulic system (APU) quick disconnect fittings to alert technicians that high pressure hydraulic oil is present during operation. Care must be taken when it is necessary to open the hydraulic system. There is always a chance of residual pressure being present. Open fittings slowly to allow any pressure to bleed off before removing any connections.

⚠WARNING

Any operating fluid, such as hydraulic oil, 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.

A warning plate is located above the hydraulic system (APU) quick disconnect fittings in front of the hydraulic tank which provides instructions to the operator or technician for towing a disabled truck. This plate specifies the requirements for an auxillary source of supply for hydraulic oil and the proper hookup.

TEST
STEERING AND BRAKE SYSTEM OPERATION
BEFORE TOWING.

⚠ WARNING

EMERGENCY TOWING PROCEDURE

1. ENGINE MUST BE STOPPED AND ACCUMULATOR DISCHARGED.
2. EXTERNAL SUPPLY MUST BE ABLE TO MAINTAIN 3000 PSI AND HAVE A MIN. CAPACITY OF 20 GAL.
3. CONNECT EXTERNAL SUPPLY TO THE .75 INCH SUPPLY AND 1.00 RETURN QUICK DISCONNECTS.
4. CHECK OPERATION OF STEERING AND BRAKES.
5. PROCEED WITH TOWING OPERATION.

WA6670

High Voltage Danger Plates and Caution Plates are attached to the doors of the Electrical Control Cabinet. The High Voltage Plate is also attached to the blown grid housing, extended range housing, rectifier housing, inlet duct structure and rear hatch cover.

⚠DANGER

HIGH VOLTAGE

WA3108

CAUTION

PRIOR TO WELDING ON TRUCK DISCONNECT PLUG IN CARDS AND DISCONNECT LEAD WIRE ON BATTERY CHARGING ALT.

WA2987

A wheel motor oil level decal is attached to the gear cover on both electric wheel motors. This decal stresses the fact that the truck must be on a level surface and parked for 20 minutes prior to checking the oil level. This is necessary in order to get an accurate reading.

CHECK OIL LEVEL ONLY AFTER TRUCK HAS BEEN PARKED FOR 20 MINUTES

TB2464

Warning and Danger plates are located inside the door of the brake system cabinet behind the cab.

This plate alerts technicians to read the warning labels attached to the accumulators prior to releasing internal nitrogen pressure or disconnecting any hydraulic lines or hardware.

⚠DANGER

HIGH PRESSURE CYLINDER

READ WARNING LABEL MOUNTED ON ACCUMULATOR BEFORE LOOSENING OR DISASSEMBLING ANY PARTS

WA4328

This plate warns the technician to stop the engine, turn off the key switch, and open the drain valves on all three accumulators to bleed the hydraulic pressure before loosening or disconnecting a brake line.

⚠WARNING

HIGH PRESSURE

DO NOT LOOSEN OR DISCONNECT ANY HYDRAULIC BRAKE LINE OR COMPONENT UNTIL ENGINE IS STOPPED, KEY SWITCH IS OFF AND DRAIN VALVES ON ACCUMULATORS ARE OPENED.

WA4329

A Danger plate is attached to each suspension and the steering accumulator. The plate contains instructions for releasing internal pressure before disconnecting any hydraulic lines or hardware.

⚠ DANGER

HIGH PRESSURE CYLINDER CHARGED WITH DRY NITROGEN

DO NOT REMOVE ANY HARDWARE INCLUDING CAPSCREWS, PLUGS, VALVE, OR VALVE CORE UNTIL ALL PRESSURE HAS BEEN RELEASED. REMOVAL OF ANY HARDWARE WHILE CYLINDER IS UNDER PRESSURE MAY RESULT IN HARDWARE FLYING VIOLENTLY FROM CYLINDER. TO RELEASE PRESSURE, REMOVE VALVE CAP, TURN TOP HEX ON VALVE THREE TURNS IN A COUNTERCLOCKWISE DIRECTION (DO NOT TURN MORE THAN THREE TURNS), THEN DEPRESS VALVE CORE. DO NOT TURN BOTTOM HEX UNTIL ALL PRESSURE HAS BEEN RELEASED.

1. CHECK OIL LEVEL ACCORDING TO INSTRUCTION MANUAL.

2. CHARGE CYLINDER WITH DRY NITROGEN GAS ONLY.

TO CHARGE CYLINDER: SEE YOUR HAULPAK® DISTRIBUTOR WHO HAS ALL TOOLS AND INFORMATION REQUIRED FOR CHARGING CYLINDERS.

WA2892

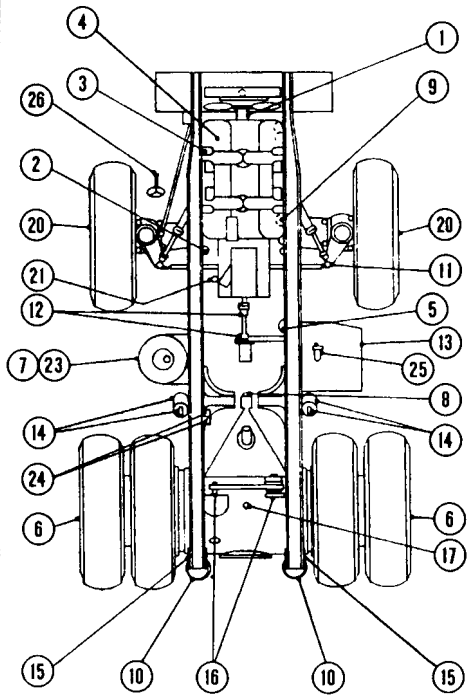
The Lubrication Chart is located on the right hand side of the radiator grille and is for reference. Refer to the "Lubrication Section" in this manual for more complete lubrication instructions.

LUBRICATION CHART

LUBRICATION SPECIFICATIONS

LUBE KEY	DESCRIPTION	-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
B	LUBRICATING OIL	SAE 10W	SAE 10W	SAE 10W	SAE 10W
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	TYPE C-3 OIL	SAE 10W ***	SAE 10W ***	SAE 10W	SAE 30W
E	MOLYBDENUM DISULPHIDE GREASE -3% MIN	#0	#2	#2	#2
F	MULTI-PURPOSE GREASE NLGI	#0	#0	#0	#0

SYM.	DESCRIPTION	PTS.	LUBE KEY	10 HR	50 HR	100 HR	250 HR	500 HR	1000 HR	2000 HR	5000 HR
1	FAN DRIVE	1	SEE ENGINE MANUAL								
2	AIR STARTERS	1	E						GREASE		
3	CRANKCASE	1	A	CHECK			CHANGE				
	CRANKCASE BREATHERS	1							WASH DRY		
4	FUEL FILTER	1		DRAIN			CHANGE				
5	FUEL STRAINER	1		DRAIN			CHANGE				
6	MOTORIZED WHEEL GEAR CASE	2	C	SEE GENERAL ELECTRIC PLANNED MAINTENANCE MANUAL AND SPECIFIC MOTORIZED WHEEL SERVICE MANUAL							
	SPEED SENSOR	2	E								
7	HYDRAULIC OIL RESERVOIR	1	D		CHECK				CHANGE *		
8	FINAL DRIVE PIVOT PIN	1	E		GREASE						
9	ENGINE LUBE OIL FILTERS	4				CHANGE					
10	REAR SUSPENSION BALL JOINTS	4	E			GREASE					
11	STEERING LINKAGE BALL JOINTS	6	E				GREASE				
12	HYDRAULIC PUMP DRIVE SHAFT	2	F			GREASE					
13	FUEL TANK	1				DRAIN H20 & SEDIMENT					
14	HOIST CYLINDER BALL JOINTS	4	E			GREASE					
15	BODY HINGE PINS	2	E			GREASE					
16	ANTI-SWAY BAR	2	E			GREASE					
17	REAR AXLE AIR BREATHER	2						CHANGE CLEAN			
18											
19											
20	FRONT WHEEL BEARINGS	2	**			CHECK					CHANGE
21	AIR SYSTEM LUBRICATOR	1	D				REFILL -				
22	SEAT ADJ. STUD & SLIDE RAILS	4	E						GREASE		
23	HYDRAULIC STRAINER	1							CLEAN		
24	HYDRAULIC FILTERS	1						CHANGE			
25	FUEL TANK BREATHER	1							CLEAN		
26	STEERING COLUMN	1	E			GREASE					
27											
28											

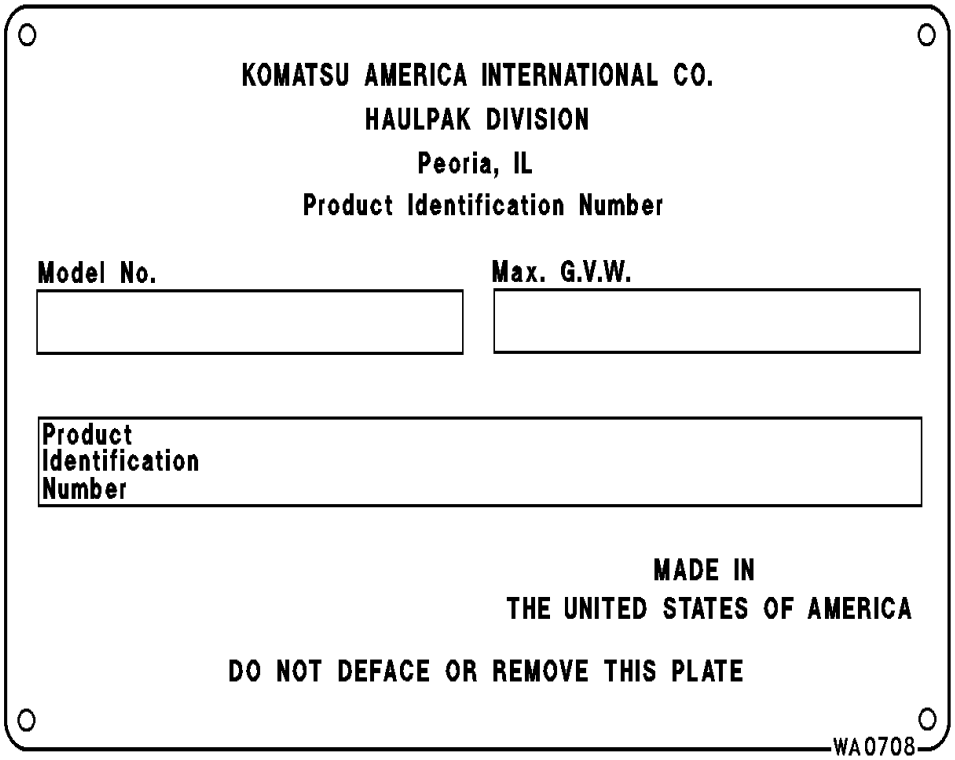


* 1000 HR INTERVAL CAN BE EXTENDED TO 5000 HR PROVIDED HYDRAULIC OIL SAMPLING AND ANALYSIS IS CONDUCTED EVERY 250 HR.
** DO NOT USE OTHER THAN SAE 80W-90 FOR FRONT WHEEL BEARINGS.
*** AUXILIARY HEATERS REQUIRED BELOW -10° F.

ITEM 22 NOT SHOWN

WA8867

A Product Identification plate is located on the frame in front of the right side front wheel and gives the Model Number, Maximum G.V.W. and Product Identification Number.



STANDARD TORQUE CHARTS AND CONVERSION TABLES

This manual provides U.S. standard and metric (SI) units for most specifications.

References throughout the manual to standard torques or other standard values will be to one of the following charts or tables. For values not shown in these charts or tables, standard conversion factors for most commonly used measurements are provided in Table XIII.

Standard torque values are not to be used when “turn-of-the-nut” tightening procedures are recommended.

INDEX OF TABLES

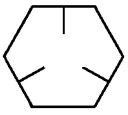
EFFECT OF SPECIAL LUBRICANTS On Fasteners and Standard Torque Values

Komatsu does not recommend the use of special friction-reducing lubricants, such as Copper Coat, Never-Seez®, and other similar products, on the threads of standard fasteners where standard torque values are applied. The use of special friction-reducing lubricants will significantly alter the clamping force during the tightening process.

If special friction-reducing lubricants are used, excessive stress and possible breakage of the fasteners may result.

When the torque tables specify “lubricated threads” for the standard torque values listed, these standard torque values are to be used with simple lithium base chassis grease (multi-purpose EP NLGI) or a rust-preventive grease (see list, page A5-2) on the threads and seats unless specified otherwise.

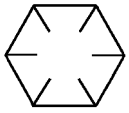
Verify threads and tapped holes are free of burrs and other imperfections before installing hardware.



Grade 5

TABLE I. -STANDARD TORQUE CHART
SAE HEX HEAD CAPSCREW AND NUT ASSEMBLY
(LUBRICATED THREADS) - TOLERANCES ±10%

Grade 8



Cap-screw Thread Size	TORQUE - GRADE 5			TORQUE - GRADE 8			Cap-screw Thread Size	TORQUE - GRADE 5			TORQUE - GRADE 8		
	ft lbs	kg•m	N•m	ft lbs	kg•m	N•m		ft lbs	kg•m	N•m	ft lbs	kg•m	N•m
1/4-20	7	0.97	9.5	10	1.38	13.6	3/4-16	235	32.5	319	335	46.3	454
1/4-28	8	1.11	10.8	11	1.52	14.9	7/8-9	350	48.4	475	500	69.2	678
5/16-18	15	2.07	20.3	21	2.90	28	7/8-14	375	51.9	508	530	73.3	719
5/16-24	16	2.21	22	22	3.04	30	1.0-8	525	72.6	712	750	103.7	1017
3/8-16	25	3.46	34	35	4.84	47	1.0-12	560	77.4	759	790	109.3	1071
3/8-24	30	4.15	41	40	5.5	54	1.0-14	570	78.8	773	800	110.6	1085
7/16-14	40	5.5	54	58	8.0	79	1 1/8-7	650	89.9	881	1050	145	1424
7/16-20	45	6.2	61	62	8.57	84	1 1/8-12	700	96.8	949	1140	158	1546
1/2-13	65	9	88	90	12.4	122	1 1/4-7	910	125.9	1234	1480	205	2007
1/2-20	70	9.7	95	95	13.1	129	1 1/4-12	975	134.8	1322	1580	219	2142
9/16-12	90	12.4	122	125	17.3	169	1 3/8-6	1200	166	1627	1940	268	2630
9/16-18	95	13.1	129	135	18.7	183	1 3/8-12	1310	181	1776	2120	293	2874
5/8-11	125	17.3	169	175	24.2	237	1 1/2-6	1580	219	2142	2560	354	3471
5/8-18	135	18.7	183	190	26.2	258	1 1/2-12	1700	235	2305	2770	383	3756
3/4-10	220	30.4	298	310	42.8	420							

1 ft lbs = 0.138 kg•m = 1.356 N•m

STANDARD ASSEMBLY TORQUES For 12-Point, Grade 9 Capscrews (SAE)

The following specifications apply to required assembly torques for all 12-point, grade 9 (170,000 psi minimum tensile) capscrews.

- Capscrew threads and seats shall be lubricated when assembled.

NOTE: Unless the instructions specifically recommend otherwise, these standard torque values are to be used with simple lithium base chassis grease (multi-purpose EP NLGI) or a rust preventive grease (see list, this page) on the threads.

- Torques are calculated to give a clamping force of approximately 75% of proof load.
- The maximum torque tolerance shall be ±10% of the torque value shown.

TABLE II. STANDARD ASSEMBLY TORQUE for 12-Point, Grade 9 Cap screws

CAPSCREW SIZE*	TORQUE ft lbs	TORQUE N•m	TORQUE kg•m
0.250 - 20	12	16	1.7
0.312 - 18	24	33	3.3
0.375 - 16	42	57	5.8
0.438 -14	70	95	9.7
0.500 -13	105	142	14.5
0.562 - 12	150	203	20.7
0.625 - 11	205	278	28.3
0.750 - 10	360	488	49.7
0.875 - 9	575	780	79.4
1.000 - 8	860	1166	119
1.000 - 12	915	1240	126
1.125 - 7	1230	1670	170
1.125 - 12	1330	1800	184
1.250 - 7	1715	2325	237
1.250 - 12	1840	2495	254
1.375 - 6	2270	3080	313
1.375 - 12	2475	3355	342
1.500 - 6	2980	4040	411
1.500 - 12	3225	4375	445

* Shank Diameter (in.) - Threads per inch

This table represents standard values only. Do not use these values to replace torque values which are specified in assembly instructions.

STANDARD ASSEMBLY TORQUES For Class 10.9 Capscrews & Class 10 Nuts

The following specifications apply to required assembly torques for all metric Class 10.9 finished hexagon head capscrews and Class 10 nuts.

- Capscrew threads and seats shall not be lubricated when assembled. These specifications are based on all capscrews, nuts, and hardened washers being phosphate and oil coated.

NOTE: If zinc-plated hardware is used, each piece must be lubricated with simple lithium base chassis grease (multi-purpose EP NLGI) or a rust preventive grease (see list, this page) to achieve the same clamping forces provided below.

- Torques are calculated to give a clamping force of approximately 75% of proof load.
- The maximum torque tolerance shall be within ±10% of the torque value shown.

TABLE III. STANDARD ASSEMBLY TORQUE for Metric Class 10.9 Cap screws & Class 10 Nuts

CAPSCREW SIZE*	TORQUE N•m	TORQUE ft lbs	TORQUE kg•m
M6 x1	12	9	1.22
M8 x 1.25	30	22	3.06
M10 x 1.5	55	40	5.61
M12 x 1.75	95	70	9.69
M14 x 2	155	114	15.81
M16 x 2	240	177	24.48
M20 x 2.25	465	343	47.43
M24 x 3	800	590	81.6
M30 x 3.5	1600	1180	163.2
M36 x 4	2750	2028	280.5

* Shank Diameter (mm) - Threads per millimeter

This table represents standard values only. Do not use these values to replace torque values which are specified in assembly instructions.

Suggested* Sources for Rust Preventive Grease:

- American Anti-Rust Grease #3-X from Standard Oil Company (also American Oil Co.)
- Gulf Norust #3 from Gulf Oil Company.
- Mobilarma 355, Product No. 66705 from Mobil Oil Corporation.
- Rust Ban 326 from Humble Oil Company.
- Rustolene B Grease from Sinclair Oil Co.
- Rust Preventive Grease - Code 312 from the Southwest Grease and Oil Company.

NOTE: This list represents the current engineering approved sources for use in Komatsu manufacture. It is not exclusive. Other products may meet the same specifications of this list.

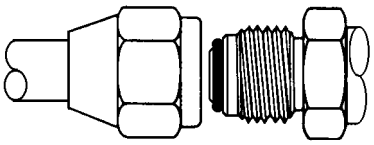


TABLE IV.
TORQUE CHART FOR JIC 37° SWIVEL NUTS
WITH OR WITHOUT O-RING SEALS

SIZE CODE	TUBE SIZE (O.D.)	THREADS UNF-2B	TORQUE ft lbs
– 2	0.125	0.312 – 24	4 ±1
– 3	0.188	0.375 – 24	8 ±3
– 4	0.250	0.438 – 20	12 ±3
– 5	0.312	0.500 – 20	15 ±3
– 6	0.375	0.562 – 18	18 ±5
– 8	0.500	0.750 – 16	30 ±5
– 10	0.625	0.875 – 14	40 ±5
– 12	0.750	1.062 – 12	55 ±5
– 14	0.875	1.188 – 12	65 ±5
– 16	1.000	1.312 – 12	80 ±5
– 20	1.250	1.625 – 12	100 ±10
– 24	1.500	1.875 – 12	120 ±10
– 32	2.000	2.500 – 12	230 ±20

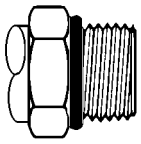


TABLE VI.
TORQUE CHART FOR
O-RING BOSS FITTINGS

SIZE CODE	TUBE SIZE (O.D.)	THREADS UNF-2B	TORQUE ft lbs
– 2	0.125	0.312 – 24	4 ±2
– 3	0.188	0.375 – 24	5 ±2
– 4	0.250	0.438 – 20	8 ±3
– 5	0.312	0.500 – 20	10 ±3
– 6	0.375	0.562 – 18	13 ±3
– 8	0.500	0.750 – 16	24 ±5
– 10	0.625	0.875 – 14	32 ±5
– 12	0.750	1.062 – 12	48 ±5
– 14	0.875	1.188 – 12	54 ±5
– 16	1.000	1.312 – 12	72 ±5
– 20	1.250	1.625 – 12	80 ±5
– 24	1.500	1.875 – 12	80 ±5
– 32	2.000	2.500 – 12	96 ±10

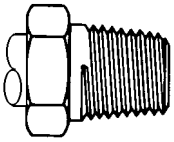


TABLE V.
TORQUE CHART FOR
PIPE THREAD FITTINGS

SIZE CODE	PIPE THREAD SIZE	WITH SEALANT ft lbs	WITHOUT SEALANT ft lbs
– 2	0.125 – 27	15 ±3	20 ±5
– 4	0.250 – 18	20 ±5	25 ±5
– 6	0.375 – 18	25 ±5	35 ±5
– 8	0.500 – 14	35 ±5	45 ±5
– 12	0.750 – 14	45 ±5	55 ±5
– 16	1.000 – 11.50	55 ±5	65 ±5
– 20	1.250 – 11.50	70 ±5	80 ±5
– 24	1.500 – 11.50	80 ±5	95 ±10
– 32	2.000 – 11.50	95 ±10	120 ±10

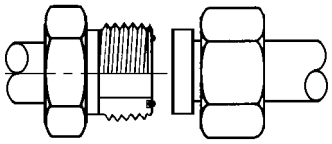


TABLE VII.
TORQUE CHART FOR
O-RING FACE SEAL FITTINGS

SIZE CODE	TUBE SIZE (O.D.)	THREADS UNF-2B	TORQUE ft lbs
– 4	0.250	0.438 – 20	11 ±1
– 6	0.375	0.562 – 18	18 ±2
– 8	0.500	0.750 – 16	35 ±4
– 10	0.625	0.875 – 14	51 ±5
– 12	0.750	1.062 – 12	71 ±7
– 16	1.000	1.312 – 12	98 ±6
– 20	1.250	1.625 – 12	132 ±7
– 24	1.500	1.875 – 12	165 ±15

TABLE VIII. TORQUE CONVERSIONS
Foot Pounds (ft lbs) to Newton-meters (N•m)

ft lbs	0	1	2	3	4	5	6	7	8	9
0	(N·m)	1.36	2.71	4.07	5.42	6.78	8.14	9.49	10.85	12.20
10	13.56	14.91	16.27	17.63	18.98	20.34	21.69	23.05	24.40	25.76
20	27.12	28.47	29.83	31.18	32.54	33.90	35.25	36.61	37.96	39.32
30	40.67	42.03	43.39	44.74	46.10	47.45	48.81	50.17	51.52	52.87
40	54.23	55.59	56.94	58.30	59.66	60.01	62.37	63.72	65.08	66.44
50	67.79	69.15	70.50	71.86	73.21	74.57	75.93	77.28	78.64	80.00
60	81.35	82.70	84.06	85.42	86.77	88.13	89.48	90.84	92.20	93.55
70	94.91	96.26	97.62	98.97	100.33	101.69	103.04	104.40	105.75	107.11
80	108.47	109.82	111.18	112.53	113.89	115.24	116.60	117.96	119.31	120.67
90	122.03	123.38	124.74	126.09	127.45	128.80	130.16	131.51	132.87	134.23
See NOTE on page A5-5 regarding Table usage										

TABLE IX. TORQUE CONVERSIONS
Foot Pounds (ft lbs) to kilogram-meters (kg•m)

ft lbs	0	1	2	3	4	5	6	7	8	9
0	(kg.m)	0.138	0.277	0.415	0.553	0.692	0.830	0.968	1.106	1.245
10	1.38	1.52	1.66	1.80	1.94	2.07	2.21	2.35	2.49	2.63
20	2.77	2.90	3.04	3.18	3.32	3.46	3.60	3.73	3.87	4.01
30	4.15	4.29	4.43	4.56	4.70	4.84	4.98	5.12	5.26	5.39
40	5.53	5.67	5.81	5.95	6.09	6.22	6.36	6.50	6.64	6.78
50	6.92	7.05	7.19	7.33	7.47	7.61	7.74	7.88	8.02	8.16
60	8.30	8.44	8.57	8.71	8.85	8.99	9.13	9.27	9.40	9.54
70	9.68	9.82	9.96	10.10	10.23	10.37	10.51	10.65	10.79	10.93
80	11.06	11.20	11.34	11.48	11.62	11.76	11.89	12.03	12.17	12.30
90	12.45	12.59	12.72	12.86	13.00	13.14	13.28	13.42	13.55	13.69
See NOTE on page A5-5 regarding Table usage										

TABLE X. PRESSURE CONVERSIONS
Pounds/square inch (psi) To Kilopascals (kPa)
Formula: psi x 6.895 = kPa

psi	0	1	2	3	4	5	6	7	8	9
0	(kPa)	6.895	13.79	20.68	27.58	34.47	41.37	48.26	55.16	62.05
10	68.95	75.84	82.74	89.63	96.53	103.42	110.32	117.21	124.1	131.0
20	137.9	144.8	151.7	158.6	165.5	172.4	179.3	186.2	193.1	200.0
30	206.8	213.7	220.6	227.5	234.4	241.3	248.2	255.1	262.0	268.9
40	275.8	282.7	289.6	296.5	303.4	310.3	317.2	324.1	331.0	337.9
50	344.7	351.6	358.5	365.4	372.3	379.2	386.1	393.0	399.9	406.8
60	413.7	420.6	427.5	434.4	441.3	448.2	455.1	462.0	468.9	475.8
70	482.6	489.5	496.4	503.3	510.2	517.1	524.0	530.9	537.8	544.7
80	551.6	558.5	565.4	572.3	579.2	586.1	593.0	599.9	606.8	613.7
90	620.5	627.4	634.3	641.2	648.1	655.0	661.9	668.8	675.7	682.6
See NOTE on page A5-5 regarding Table usage										