CEAM022602

Operation & Maintenance Manual

930E-4

DUMP TRUCK

SERIAL NUMBERS **A30873 - A30989**
Tier II

KOMATSU®

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STANDARD TIGHTENING TORQUES
For SAE Grade 5 and Grade 8 Cap screws

The following specifications apply to required assembly torques for all grade 5 and grade 8 cap screws.

- Cap screw threads and seats shall be lubricated when assembled.

  Unless 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, previous 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.
- In the following table under Cap Screw Size, the first number represents the shank diameter (in.). The second number represents threads per inch.

  Example: 7/16 - 20

  7/16 = shank diameter (7/16 inch (0.438 inch))

  20 = threads per inch

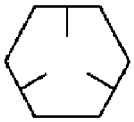


TABLE 2.
Standard Tightening Torque
for SAE Hex Head Cap Screw And Nut Assembly

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

1 ft. lb. = 0.138 kg·m = 1.356 N.m

Precautions With High Temperature Fluids

Immediately after truck operation, engine coolant, engine oil, and hydraulic oil are at high temperatures and are pressurized. If the cap is removed, the fluids are drained, the filters are replaced, etc., there is danger of serious burns. Allow heat and pressure to dissipate before performing such tasks and follow proper procedures as outlined in the service manual.


A0055050

To prevent hot coolant from spraying:

1. Stop the engine.
2. Wait for the coolant temperature to decrease.
3. Depress the pressure release button on the cap to vent cooling system pressure.
4. Turn the radiator cap slowly to release the pressure before removing.

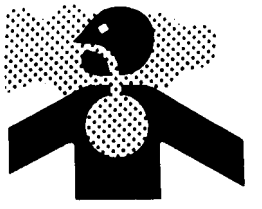
To prevent hot engine oil spray:

1. Stop the engine.
2. Wait for the oil temperature to cool down.
3. Turn the cap slowly to release the pressure before removing the cap.

Asbestos Dust Hazard Prevention

Asbestos dust is hazardous to your health when inhaled. If you handle materials containing asbestos fibers, follow the guidelines below:

- Never use compressed air for cleaning.
- Use water for cleaning to control dust.
- Operate the truck or perform tasks with the wind to your back whenever possible.
- Use an approved respirator when necessary.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Prevention Of Injury By Work Equipment

Never enter or put your hand, arm or any other part of your body between movable parts such as the dump body, chassis or cylinders. If the work equipment is operated, clearances will change and may lead to serious bodily injury or death.

Unauthorized Modification

Any modification made to this vehicle without authorization from Komatsu America Corp. can possibly create hazards.

Before making any modification, consult the authorized regional Komatsu America Corp. distributor. Komatsu will not be responsible for any injury or damage caused by any unauthorized modification.

ROPS Precautions

The ROPS is intended to protect the operator if the truck should roll over. It is designed not only to support the load of the truck, but also to absorb the energy of the impact.

- The Rollover Protection Structure (ROPS) must be properly installed before the truck is operated.
- ROPS installed on equipment manufactured and designed by Komatsu America Corp. fulfills all of the regulations and standards for all countries. If it is modified or repaired without authorization from Komatsu, or if it is damaged when the truck rolls over, the strength of the structure will be compromised and will not be able to fulfill its intended purpose. Optimum strength of the structure can only be achieved if it is repaired or modified as specified by Komatsu.
- When modifying or repairing the ROPS, always consult your nearest Komatsu distributor.
- Even with the ROPS installed, the operator must always use the seat belt when operating the truck.

TIRES

Handling Tires

If tires are not used under the specified conditions, they may overheat and burst, or be cut and burst by sharp stones on rough road surfaces. This may lead to serious injury or damage.

To maintain tire safety, always use the specified tires. Inflate the tires to the specified pressure. An abnormal level of heat is generated when the inflation pressure is too low.

The tire inflation pressure and permissible speeds are general values. The actual values may differ depending on the type of tire and the condition under which they are used. For details, please consult the tire manufacturer.

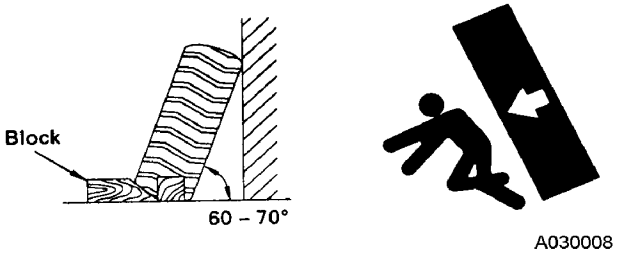
When tires become hot, a flammable gas is produced and may ignite. It is particularly dangerous if the tires become overheated while the tires are pressurized. If the gas generated inside the tire ignites, the internal pressure will suddenly rise and the tire will explode, resulting in danger to personnel in the area. Explosions differ from punctures or tire bursts because the destructive force is extremely large. Therefore, the following operations are strictly prohibited when the tire is pressurized:

- Welding the rim
- Welding near the wheel or tire
- Smoking or creating open flames

If the proper procedure for performing maintenance or replacement of the wheel or tire is not used, the wheel or tire may burst and cause serious injury or damage. When performing such maintenance, consult your authorized regional Komatsu distributor or the tire manufacturer.

Storing Tires After Removal

- As a basic rule, store the tires in a warehouse in which unauthorized persons cannot enter. If the tires are stored outside, always erect a fence around the tires and put up “No Entry” signs and other warning signs that even young children can understand.
- Stand the tire on level ground and block it securely so that it cannot roll or fall over.
- If the tire falls over, flee the area quickly. The tires for dump trucks are extremely heavy. Never attempt to hold or support the tire. Attempting to hold or support a tire may lead to serious injury.



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⚠WARNING

Voltages in excess of 1500 VDC may be present. Any measurement and/or protective equipment used must be rated at 2000 VDC minimum.

Verify functionality of the measurement equipment using site-approved procedures both before and after performing control group measurements.

Failure to observe these precautions may result in death or serious personal injury.

4. Measure voltage on all capacitors as described in Failure of the Discharge System on page 30-21. Discharge any capacitors that show voltage.
5. If all capacitors read discharged, verify that the meter is functioning correctly using site-approved procedures. If so, proceed to Short Isolated Capacitor Terminals on page 30-24.

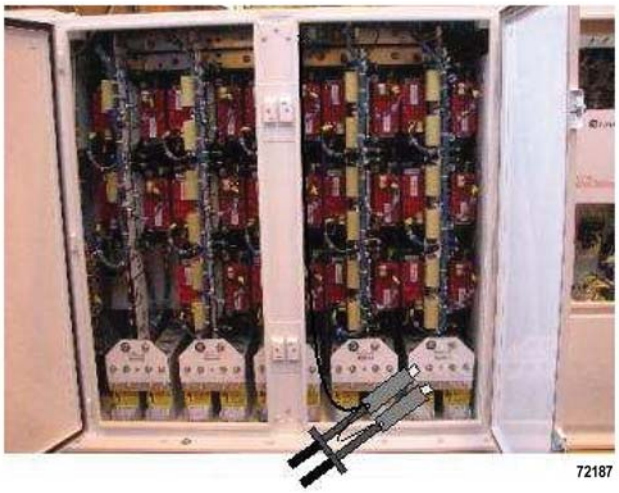
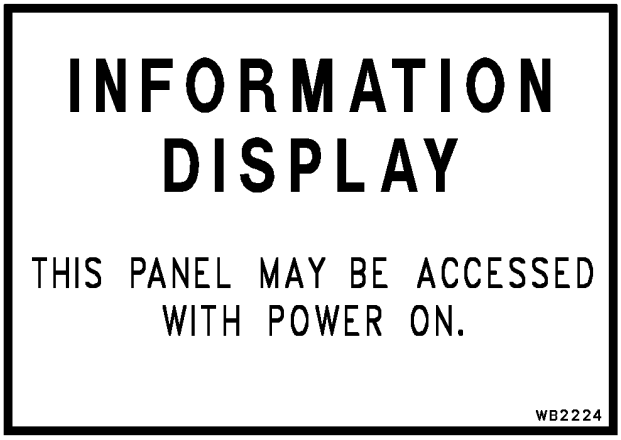


FIGURE 20-10. APPLICATION OF GROUNDING STICKS TO CAPACITOR TERMINALS

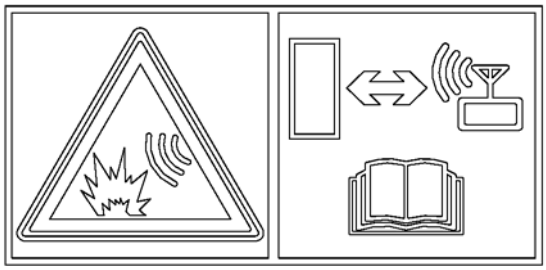
INFORMATION DISPLAY

This information decal is placed on the left door of the control cabinet.



WIRELESS SIGNALS

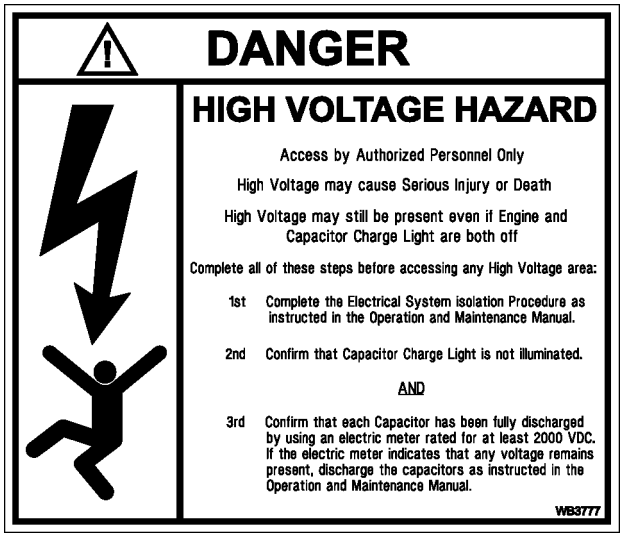
Wireless signals from the truck's KOMTRAX Plus system can interfere with other wireless signals in the area. This interference can cause a malfunction in a blast zone resulting in an unintended detonation. Know the locations of blast zones in the area and keep a safe distance to avoid unintentional blasts. Operating frequency of KOMTRAX Plus is 148 MHz to 150 MHz.

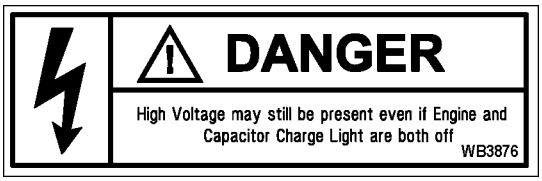


HIGH VOLTAGE

A high voltage danger decal is attached to the door of the rear hatch cover. **High voltage may be present!** Only authorized personnel should access this rear housing.

These danger decals are mounted on all the AC drive control housings and cabinets. **High voltage may be present!** Only authorized personnel should access this component.



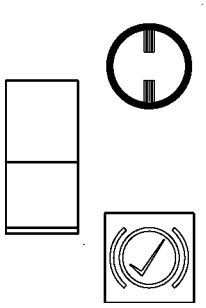


OPERATION

The static brake test utilizes a momentary switch and a check light located in the overhead display panel.

Brake Test Switch

The brake test switch is used to initiate a brake test. Press on the momentary switch to enter the brake test mode. If certain conditions are met, the operator can enter a brake test sequence.



Brake Check Light

The amber light is used to indicate when the truck is in the brake test mode. When illuminated, a brake test is ready. When flashing, the brake test is at the validation point, or the retard system test is finished.

Description

The operator can choose which brake test to perform, and will set the truck controls based on the settings in Table 1. The drive system will detect the position of the directional control lever, and will prepare for the appropriate test. The operator will then press the brake test switch.

If the brake check light is illuminated solid after pressing the brake test switch, the system is in brake test mode and is ready for the chosen test to be initiated by the operator. After testing, the operator will then determine if the truck passed the brake tests, and if it is safe for operation.

If the brake check light does not illuminate immediately after pressing the brake test switch, there is most likely a problem with the setup. Refer to the setup conditions and take action to prepare the truck for a brake test.

If there is a problem with the truck setup, the DID panel will display the problem.

For example if the engine is off:

ERROR Entering Brake Test
Engine not running

If the Truck is loaded:

ERROR Entering Brake Test
Truck is NOT Empty

If all of the conditions are correct, except the brakes are not set correctly, an error message will be displayed. For example, if the service brake and parking brake are both applied together:

ERROR Entering Brake Test
Set Brakes for Test

Brake Test Exit Criteria

Numerous conditions can occur which may interrupt a brake test, including the following:

- Any of the setup conditions becoming false
- Drive system fault which restricts the LINK or Propel mode
- Truck Speed greater than 3.2 kph (2.0 mph)
- Drive system at torque level for more than 30 seconds
- Brake test requested, but not initiated by the operator within 60 seconds after pressing the brake test switch

Table 1: BRAKE TEST SETTINGS

Test Type	Wheel Brake Lock	Service Brake Pedal	Directional Control Lever
Service Brake	OFF	FULLY APPLIED	NEUTRAL
Parking Brake	OFF	RELEASED	PARK
Retard Test	OFF	RELEASED	PARK

8. The parking brakes must be released before towing. To release the parking brake, follow the steps below to install a special wiring harness to release the parking brakes.
   a. Ensure switch (1) is in the OFF position.
   b. Connect one lead of the special wiring harness to the 24VDC bus bar terminal on the side wall in the auxiliary control cabinet for the 24V supply.
   c. Disconnect the truck wiring harness from parking brake solenoid (2, Figure 30-8). Connect special wiring harness (3, Figure 30-9) to the parking brake solenoid. Attach short lead (2) to ground.
   d. WIth the window lowered, place the end of the special wiring harness inside the cab so the operator can control switch (1).
9. When ready to tow the disabled truck, remove blocking from the wheels.
10. The operator in the disabled truck should now move switch (1) to the ON position. This will release the parking brakes.
11. Tow the disabled truck. Sudden movement may cause tow bar failure. Smooth, gradual truck movement is preferred. Do not tow the truck any faster than 8 kph (5 mph).

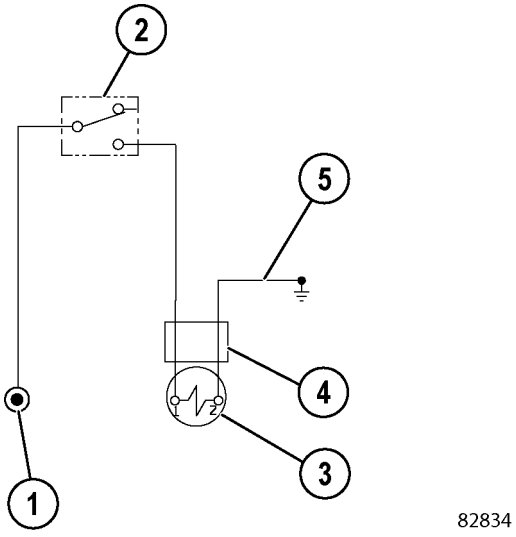


FIGURE 30-1. PARKING BRAKE HARNESS

1. 24VDC Bus Bar
2. Switch (ON/OFF)
3. Park Brake Solenoid
4. Connector
5. Ground Wire

12. Minimize the tow angle at all times. **Never exceed 30 degrees.** The towed truck must be steered in the direction of the tow bar.
13. When the desired location has been reached, the operator in the towed vehicle is to apply the service brakes, then turn switch (1) to the OFF position. This will apply the parking brakes.
14. Block the wheels to prevent roll-away.
15. Shut down the engine in the pulling vehicle. Disconnect the hydraulic hoses.
16. Disconnect special wiring harness (3) from the truck. Connect the truck wiring harness back to the parking brake solenoid.
17. Disconnect the tow bar.

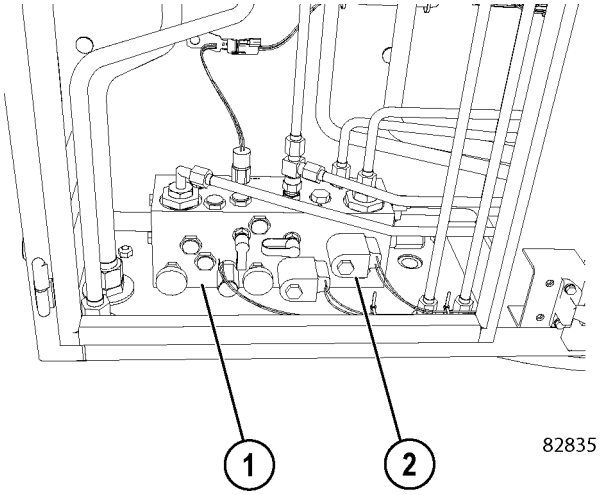


FIGURE 30-2. BRAKE CABINET

1. Brake Manifold
2. Parking Brake Solenoid

OVERHEAD PANEL AND DISPLAYS

The components described below are located on the overhead panel. Refer to Figure 32-1.

Speakers

Speakers (9, Figure 32-1) for the radio/CD player are located at the far left and right of the overhead panel.

Warning Alarm Buzzer

A warning alarm buzzer (10) will sound when activated by any one of several truck functions. Refer to Instrument Panel and Indicator Lights in this section for a detailed description of functions and indicators that will activate this alarm.

Radio/CD Player

This panel will normally contain a radio/CD player (11). Refer to Section 70 for a complete description of the radio/CD player and its functions. Individual customers may use this area for other purposes, such as a two-way communications radio.

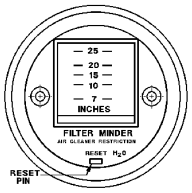
Warning Indicator Light Dimmer Control

Dimmer control (12) below the radio/CD player permits the operator to adjust the brightness of the warning indicator lights.

Status/Warning Indicator Light Panel

Status/ warning indicator panel (13) contains an array of indicator lights to provide the operator with important status messages concerning selected truck functions. Refer to Instrument Panel and Indicator Lights in this section for a detailed description of these indicators.

Air Cleaner Restriction Gauges



Air cleaner restriction gauges (14) provide a continuous reading of the maximum air cleaner restriction reached during operation. The air cleaner(s) should be serviced when the gauge(s) shows the maximum recommended restriction of 25 inches of H_2O vacuum.

NOTE: After service, push the reset button on the face of the gauge to return the gauge to zero.

Key Switch

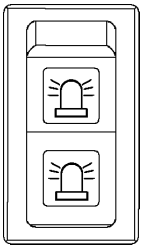
Key switch (1, Figure 32-8) is a four-position switch (ACC, OFF, RUN, START). The ACC position is not currently used.

When the switch is rotated one position clockwise, it is in the RUN position and all electrical circuits (except START are activated).

1. With the directional control lever in PARK, rotate key switch 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.
2. After the engine has started, place rest switch (6, Figure 32-8) in the OFF position to deactivate the rest mode of operation.

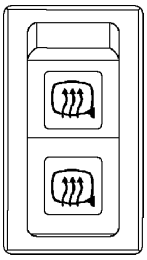
NOTE: The electric cranking motors have a 30 second time limit. If the 30 second limit is reached, cranking will be prohibited for two minutes. After two minutes, cranking will be allowed. If the 30 second limit is reached seven consecutive times, the key switch must be turned to the OFF position. This will allow the interface module to power down and reset, which requires seven minutes to complete.

Rotating Beacon Light Switch (optional)



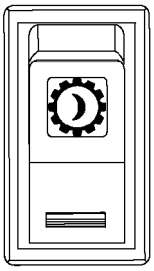
Switch (4, Figure 32-8) controls the operation of the rotating beacon light.

Heated Mirror Switch (optional)



Switch (5, Figure 32-8) controls the operation of the heated mirrors.

AC Drive System Rest Switch



Rest switch (6, Figure 32-8) is a rocker switch with a locking device for the OFF position. A small tab must be pushed to unlock the switch before it can be depressed to the ON position. When in the ON position, an amber lamp in the switch will illuminate.

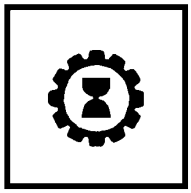
The switch should be in the ON position to de-energize the AC drive system whenever the engine is to be shutdown or the truck will be parked for a length of time with the engine running. The directional control lever must be in PARK or NEUTRAL and the vehicle not moving to enable this function. This will allow the engine to continue running while the AC drive system is de-energized.

Amber indicator light (B6, Figure 32-9) in the overhead panel will illuminate when the rest mode is activated.

WARNING

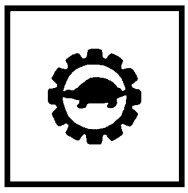
Activation of the rest switch alone DOES NOT completely ensure that the drive system is safe to work on. Refer to Section 20, Safety, for more information on servicing an AC drive truck. Check all "link-on" or "link energized" indicator lights to verify that the AC drive system is de-engergized before performing any maintenance on the drive system. DO NOT activate the rest switch while the truck is moving! The truck may unintentionally enter the rest mode after stopping.

C6. Propel System Not Ready



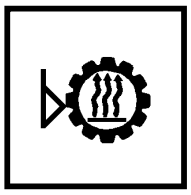
This amber indicator light functions during start-up much like the hourglass icon on a computer screen. This light indicates the computer is in the process of performing the self-diagnostics and set-up functions at start-up. Propulsion will not be available at this time.

D6. Reduced Propulsion



This amber indicator light illuminates if the full AC drive system performance in propulsion is not available. At this time, the only event that should activate this light is the use of “limp home” mode. This mode of operation requires a technician to enable.

E6. Retard At Continuous Level

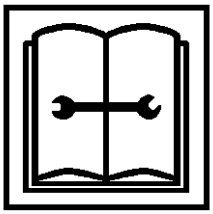


When the drive system detects that any of its components has reached maximum temperature, this amber indicator light will flash for 15 seconds, then illuminate steadily when the retarding performace is limited to the continuous level. The operator should control the speed of the truck in accordance to the “continuous speeds” on the grade/ speed chart.

D7. Brake Test Light

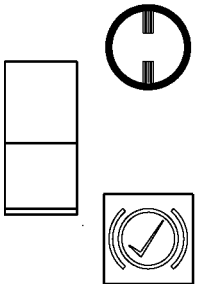
This amber indicator light indicates when the truck is in the brake test mode. When illuminated, a brake test is ready. When flashing, the brake test is at the validation point, or the retard system test is finished.

E7. Maintenance Monitor



This amber indicator light will illuminate if a “repair” fault is detected, which must be corrected after the operator’s shift is done.

8. Brake Test Switch



This switch is used to initiate a brake test. Press the momentary switch to enter the brake test mode. If certain conditions are met, the operator can enter a brake test sequence.

FUSE BLOCK #2

Location	Amps	Devices protected	Circuit
1	15	Engine Service Lights	11SL
2	15	Cab Dome, Fog, Ladder Lights, Beacon, Hour Meter	11L
3	15	Hazard Lights	46
4	10	Interface Module	11INT
5	10	VHMS & Orbcomm Controllers Power	85
6	20	Modular Mining Hub	11M
7	15	Display Module	11DISP
8	10	Interface Module Power 2	11IM2
9	15	Reserve Oil System Pump	11ORS
10	15	Reserve Oil System Control Module	11RCNT
11	20	Hydraulic Bleed Down Power	11BD
12	10	Engine Load Module Power	11EM
13	10	Key Switch Power	11KS
17	20	Engine ECM Power	11E1
18	20	Engine ECM Power	11E2
19	20	Engine ECM Power	11E3
20	20	Engine ECM Power	11E4

FUSE BLOCK #3

Location	Amps	Devices protected	Circuit
1	15	Cab Drive System Power	71P
2	10	Auto Lube Pump Power	68ES
3	15	Interface Module (GE Power)	71IM
4	20	Operator Seat Power	71OS
17	10	12V Auxiliary Power Outlets	67C
18	20	R.H. Cab Window Switch	67R
19	20	L.H. Cab Window Switch	67P

10 HOUR (DAILY) INSPECTIONS (Cont.)

Truck Serial Number_____ **Site Unit Number**_____ **Date**_____

Hourmeter_____ **Name of Service Technician**_____

	TASK	COMMENTS	CHECKED	INITIALS
7.	COOLING AIR DUCTWORK - Inspect the ductwork from the blower to the rear axle. Make sure that the ductwork is secure, undamaged and unrestricted.			
8.	AIR INTAKE PIPING - Check all mounting hardware, joints and connections. Make sure that there are no air leaks and all hardware is properly tightened.			
9.	AIR CLEANERS - Check the air cleaner restriction gauges in the operator cab. The air cleaners should be serviced if the gauges show a maximum restriction of 25 inches of H_2O vacuum. Refer to Section C5 in the shop manual for servicing instructions. Empty the air cleaner dust caps. After service, push the reset button on face of gauges to return the gauges to zero.			
11.	CAB AIR FILTER - In extremely dusty conditions, check this filter daily and service as frequently as required. See the 250 Hour Lubrication and Maintenance Checks for the cleaning procedure.			
12.	WASHER FLUID - Check the level of washer fluid in the bottle behind the cab. Fill as needed.			
10.	FUEL TANK - 1. Check the quick fill fuel receivers for excessive wear, leaks and mud buildup. 2. Check the vent on top of the fuel tank for mud buildup or any other obstructions. Clean if necessary. See the 1000 Hour Lubrication and Maintenance Checks for cleaning instructions.			

SYSTEM COMPONENTS

Filter

Filter assembly (21, Figure 42-2) mounted on the grease reservoir filters the grease prior to refilling the reservoir from the shop supply. A bypass indicator alerts service personnel when the filter requires replacement.

Hydraulic Motor and Pump

Rotary hydraulic pump (3 & 9, Figure 42-1) is a fully hydraulically operated grease pump. An integrated pump control manifold is incorporated with the motor to control input flow and pressure.

NOTE: The pump crankcase oil level must be maintained to the level of the pipe plug (17, Figure 42-2) or use the dip stick. If necessary, refill with 10W-30 motor oil.

⚠WARNING

Hydraulic oil supply inlet pressure must not exceed 24 132 kPa (3,500 psi). Exceeding the rated pressure may result in damage to the system components and personal injury.

Grease Reservoir

Reservoir (12, Figure 42-1) has an approximate capacity of 41 kg (90 lb) of grease. When the grease supply is replenished by filling the system at the service center, the grease is passed through the filter to remove contaminants before it flows into the reservoir.

Pressure Reducing Valve

Pressure reducing valve (4, Figure 42-1), located on the manifold, reduces the hydraulic supply pressure (from the truck steering circuit) to a suitable operating pressure for the hydraulic motor used to drive the lubricant pump. **The pressure control valve has been factory adjusted and the setting should not be disturbed unless grease output pressure is outside the recommendations.**

A pressure gauge can be installed where pipe plug (8, Figure 42-1) is located. The pressure gauge will indicate hydraulic oil pressure to the inlet of the hydraulic motor. Normal pressure is 2241 - 2413 kPa (325 - 350 psi).

Flow Control Valve

Flow control valve (10, Figure 42-1) mounted on the manifold, controls the amount of oil flow to the hydraulic motor. **The flow control valve has been factory adjusted and the setting should not be disturbed.**

Solenoid Valve

Solenoid valve (5, Figure 42-1), when energized, allows oil to flow to the hydraulic motor.

Vent Valve

With vent valve (7, Figure 42-1) closed, the pump continues to operate until maximum grease pressure is achieved. As this occurs, the vent valve opens and allows the grease pressure to drop to zero, so the injectors can recharge for their next output cycle.

Lubrication Cycle Timer

The solid state lubrication cycle timer provides a 24 VDC timed-interval signal to energize solenoid valve (3, Figure 42-3) providing oil flow to operate the grease pump motor. This timer is mounted in the Electrical Interface Cabinet.

Over Pressure Cut Off Switch

Pressure switch (18, Figure 42-2) is a normally open switch set at 20 684 kPa (3,000 psi). This switch de-energizes the pump solenoid relay if the grease line pressure reaches the switch pressure setting, turning off the motor and pump.

Grease Pressure Failure Switch

Pressure switch (24, Figure 42-2) is a normally open switch set at 13 789 kPa (2,000 psi). If the appropriate grease pressure is not achieved during the normal pump cycle, the warning system will be activated, illuminating the warning lamp in the overhead display to notify the operator a problem exists in the lube system.

Injectors

Each injector (23, Figure 42-2) delivers a controlled amount of pressurized lubricant to a designated lube point. Refer to Figure 42-2 for locations.

Relief Valve (unloader valve)

Relief valve (14, Figure 42-3) protects the pump from high pressures. This relief valve is set at 27 580 kPa (4,000 psi).

TROUBLE	POSSIBLE CAUSES	SUGGESTED CORRECTIVE ACTION
Pump Pressure Builds Very Slowly Or Not At All	No signal at solenoid.	Check timer.
Controller Does Not Operate	No electric power to controller.	Turn on electric power to pump. “POWER” LED should light, “PUMP ON” LED should light when “MANUAL LUBE” is pressed.
“PUMP ON” LED Lights, But Load Connected To Terminals 3 & 4 Will Not Energize	Printed circuit board failure.	Remove and replace.
Load Connected To Terminals 3 & 4 Energized, But “PUMP ON” LED Does Not Light	Failure of the printed circuit board or keypad.	Remove and replace.
Bearing Points Excessively Lubricated	Controller memory mode is OFF.	Switch controller memory mode to ON.
	Injector output adjustment setting too high.	Readjust to lower setting.
Bearing Points Are Not Sufficiently Lubricated	Timer/controller cycle time setting too low.	Set to longer cycle time or reevaluate lube requirements.
	Injector output adjustment setting too low.	Readjust injector output setting.
	Timer/controller cycle time setting does not deliver lubricant often enough.	Set to shorter cycle time or reevaluate lube requirements.
	System too large for pump output.	Calculate system requirements per planning manual.

INTRODUCTION

Payload Meter III (PLMIII) measures, displays and records the weight of material being carried by an off-highway truck. The system generally consists of a payload meter, a gauge display, deck-mounted lights, and sensors. The primary sensors are four suspension pressures and an inclinometer. Other inputs include a body up signal, brake lock signal, and speed.

Data Summary

5208 haul cycles can be stored in memory. The following information is recorded for each haul cycle:

- Payload
- Operator ID number (0000-9999)
- Distance traveled loaded and empty
- The amount of time spent empty run/stop, loading, loaded run/stop, and dumping
- Maximum speed loaded and empty with time of day
- Average speed loaded and empty
- Empty carry-back load
- Haul-cycle, loading, dumping start time of day.
- Peak positive and peak negative frame torque with time of day
- Peak sprung load with time of day
- Tire ton-mph for each front and average per rear tires

The payload meter stores lifetime data that cannot be erased. This data includes:

- Top 5 maximum payloads and time stamps.
- Top 5 positive and negative frame torque and time stamps
- Top 5 maximum speeds and time stamps

Data Gathering

Windows 95/98/NT software is available to download, store and view payload and fault information. The PC software will download an entire truck fleet into one Paradox database file. Users can query the database by date, time, truck type and truck number to produce reports, graphs and export the data. The software can export the data in '.CSV' format that can be easily imported into most spreadsheet applications. The Windows software is not compatible with the Payload Meter II system.

It is important that each payload meter be configured for each truck using the PC software. The information for frame serial number and truck number is used by the database program to organize the payload data. In addition, the payload meter must be configured to make calculations for the proper truck model. Improper configuration can lead to data loss and inaccurate payload calculations.

Haul Cycle Data

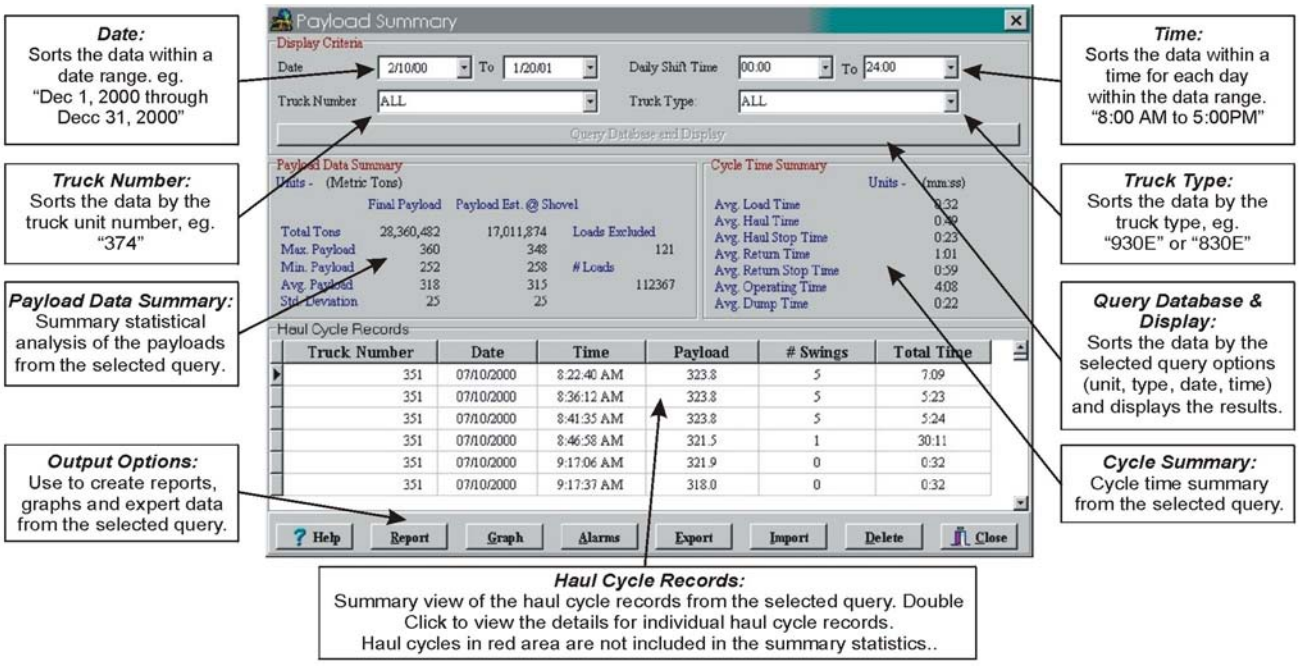
The following information is recorded for each haul cycle:

Table 1: HAUL CYCLE DATA

Data	Unit	Remark
Truck #	alpha-numeric	Up to 22 characters can be stored in this field to identify the truck. Typically this field will be just the truck number.
Haul Cycle Start Date/Time	seconds	Number of seconds from 1/1/70 to the start of the haul cycle, haul cycle starts when the meter transitions from dumping to empty state after the previous haul cycle, download program converts seconds into date and time for display
Payload	tons	Stored as metric, download program allows for conversion to short or long tons.
Number of Swingloads	number	The number of swingloads detected by the payload meter
Operator ID	number	This is a 4 digit number that can be entered by the operator at the start of the shift.
Warning Flags	alpha	Each letter represents a particular warning message about the haul cycle, details are located on page 19.
Carry-back load	tons	The difference between the latest empty tare and the clean truck tare
Empty haul time	seconds	Number of seconds in the tare_zone and empty states with the truck moving
Empty stop time	seconds	Number of seconds in the tare_zone and empty states with the truck stopped
Loading time	seconds	Number of seconds in the loading state
Loaded haul time	seconds	Number of seconds in the maneuvering, final_zone and loaded states with the truck moving
Loaded stop time	seconds	Number of seconds in the maneuvering, final_zone and loaded states with the truck stopped
Dumping time	seconds	Number of seconds in the dumping state
Loading start time	seconds	Number of seconds from the start of the haul cycle to when the meter transitions from empty to loading state
Dump start time	seconds	Number of seconds from the start of the haul cycle to the time when the meter switches from loaded to dumping state
Loaded haul distance	m	Distance traveled while loaded
Empty haul distance	m	Distance traveled while empty
Loaded max speed	km/h	Maximum speed recorded while the truck is loaded
Loaded max speed time	seconds	Number of seconds from the start of the haul cycle to the time when the max speed occurred
Empty max speed	km/h	Maximum speed recorded while the truck is empty
Empty max speed time	seconds	Number of seconds from the start of the haul cycle to the time when the max speed occurred
Peak positive frame torque	ton-meter	Positive frame torque is measured as the frame twists in the clockwise direction as viewed from the operator’s seat.
Peak frame torque time	seconds	Number of seconds from the start of the haul cycle to the peak torque, download program converts to time for display
Peak negative frame torque	ton-meter	Negative frame torque is measured as the frame twists in the counter-clockwise direction as viewed from the operator's seat.
Peak frame torque time	seconds	Number of seconds from the start of the haul cycle to the peak torque, download program converts to time for display
Peak sprung load	tons	Peak dynamic load calculation
Peak sprung load time	seconds	Number of seconds from the start of the haul cycle to the peak instantaneous load calculation
Front-left tire-ton-km/h	t-km/h	Tire ton-km/h for haul cycle
Front-right tire-ton-km/h	t-km/h	Tire ton-km/h for haul cycle
Average rear tire-ton-km/h	t-km/h	Tire ton-km/h for haul cycle
Truck Frame Serial Number	alpha	The truck serial number from the nameplate on the truck frame
Reserved 1-10	number	These values are internal calculations used in the continued development of the PLMIII system and should be ignored

DATA ANALYSIS

PAYLOAD SUMMARY FORM



The data analysis tools allow the user to monitor the performance of the payload systems across the fleet. Analysis begins when the "View Payload Data" button is pressed. This starts an "all trucks, all dates, all times" query of the database and displays the results in the Payload Summary Form.

The user can change the query by changing the dates, times, or trucks to include in the query for display.

Haul cycles in the data grid box at the bottom can be double-clicked to display the detailed results of that haul.

Creating a Query

The program defaults to show all trucks, all types, all dates and all times for the initial query. The display can be narrowed by selecting which trucks or types to view and for what dates and times.

The query items are added in the "AND" condition. If the user selects a truck # and date range, the query will sort the data for that truck number AND the date range.

Sorting on Truck Unit Number

The truck unit number is the truck unit number entered into the payload meter when it was configured at installation. The query can be set to look for all trucks or one particular truck number. When the program begins, it searches through the database for all the unique truck numbers and creates a list to select from.

Choosing one particular truck number will limit the data in the displays, summaries and reports to the one selected truck. To create reports for truck number 374, select 374 from the pull-down menu and hit the "Query Database and Display" button.

Sorting on Truck Type

The truck type is the size of the truck from the family of Komatsu trucks. This allows the user to quickly view results from different types of trucks on the property. For example, a separate report can be generated for 830E and 930E trucks.

If RDM is pressed once, RANDOM FOLDER/PLST will appear and the RDM icon will turn on. Then the display returns to its default. In iPod mode, the display will read SHUFFLE TRACKS.

If RDM is pressed a second time, RANDOM USB will appear and the RDM icon will remain turned on. Then the display returns to its default. In iPod mode, the display will read SHUFFLE ALBUMS.

If RDM is pressed a third time, RANDOM OFF will appear and the RDM icon will turn off. Then the display returns to its default. In iPod mode, the display will read SHUFFLE OFF.

If the PAUSE/PLAY button is pressed, the radio will display PAUSE (if RPT or RDM are currently selected the icon will remain on). If pressed again, it will go back to the previous display and continue playing the CD/USB/iPod.

When a USB stick is connected and DEVICE NOT SUPPORTED appears on the display, the USB stick is not supported by the receiver and a different USB stick will have to be used.

AUX Input Displays

When using an external device connected through the auxiliary inputs, pressing the “i Title/Menu” button will have no effect.

When a device is connected via the aux input, the radio will display FRONT AUX as long as it is kept in this mode. If AUX is selected by pressing the SRC button and no device is connected, the radio will select the rear auxiliary input, and display REAR AUX as long as it is kept in this mode.

CLOCK/ALARM Button

In any mode, pressing the CLOCK/ALARM button, the display will show the time for 3 seconds. If you press and hold the CLOCK/ALARM button, the display will show the alarm set time for 3 seconds and a beep will be heard.

Front Auxiliary Mode

In front auxiliary mode, an external device such as an iPod or MP3 player can be used via the auxiliary input jack on the front of the receiver. To use an external device, connect the device via the auxiliary input jack.

Front auxiliary mode will not be available if no device is connected to the auxiliary input jack on the front of the receiver.

Rear Auxiliary Mode

In rear auxiliary mode, the radio can play an external device that is connected via the auxiliary input radio lines. To enable rear auxiliary mode, press the SRC button until the display shows REAR AUX.

Adjusting the Receiver Audio Settings

To adjust the bass, middle, treble, fade, balance and auto EQ, press and release the ON/AUDIO knob. Each time the knob is pressed, the radio will advance to the next setting and BASS, MIDDLE,TREBLE, FADE, BALANCE or AUTO EQ will appear on the display.

BASS: Rotate the ON/AUDIO knob clockwise to increase the bass and counterclockwise to decrease it. The display will show BASS and its level from - 6 to +6.

MIDDLE: Rotate the ON/AUDIO knob clockwise to increase the middle sound and counterclockwise to decrease it. The display will show MIDDLE and its level from -6 to +6.