

Shop Manual

860E-1KT

DUMP TRUCK

SERIAL NUMBERS

A30036 & UP

KOMATSU®

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Drive system fault code table, part 2	CEN40042-00
50 L3A DSP A: Active current reference at limit	3
51 L1A DSP A: Braking chopper controller at limit.....	4
52 L3C DSP A: Phase unbalance too large	5
53 L3A DSP A: Pulse block by DSP software.....	6
54 L3C DSP A: U/F Card defective.....	7
55 L3C DSP A: Difference in current of phase U overlimit.....	8
56 L3C DSP A: Difference in current of phase W over limit.....	9
60 L3C DSP B: Initialization fault detected by DSP	10
61 L3C DSP B: SW-Watchdog.....	11
62 L3C DSP B: Initialization fault detected by CPU	12
63 L1B DSP B: SW-Traco triggered.....	13
64 L1B DSP B: SW-Traco full	14
65 L3C DSP B: Time slice overflow T1	15
66 L3C DSP B: Time slice overflow T2	15
67 L3C DSP B: Time slice overflow T3	15
68 L3C DSP B: Time slice overflow T4	15
69 L1A DSP B: Communication HSCX data from DSP A missing.....	16
70 L1A DSP B: Communication HSCX data from DSP T missing	17
71 L3C DSP B: Current offset during pulse block	18
72 L3C DSP B: Current offset during no pulse block.....	19
73 L3A DSP B: Overcurrent fault	20
74 L3C DSP B: Current transducer defective phase V	21
75 L3C DSP B: Current transducer defective phase W	22
78 L1A DSP B: Modulation software fault	23
79 L3A DSP B: Active current controller at limit.....	24
80 L3A DSP B: Active current reference at limit	25
81 L1A DSP B: Braking chopper controller at limit.....	26
82 L3C DSP B: Phase unbalance too large	27
83 L3A DSP B: Pulse block by DSP software.....	28
84 L3C DSP B: U/F Card defective.....	29
85 L3C DSP B: Difference in current of phase V over limit.....	30
86 L3C DSP B: Difference in current of phase W over limit.....	31
90 L3C DSP T: Initialization fault detected by DSP	32
91 L3C DSP T: SW-Watchdog	33
92 L3C DSP T: Initialization fault detected by CPU.....	34
93 L1B DSP T: SW-Traco triggered	35
94 L1B DSP T: SW-Traco full	36
95 L3C DSP T: Time slice overflow T1	37
96 L3C DSP T: Time slice overflow T2.....	37
97 L3C DSP T: Time slice overflow T3.....	37
98 L3C DSP T: Time slice overflow T4.....	37
99 L1A DSP T: Communication HSCX data from DSP A missing	38



NON-OEM PARTS IN CRITICAL SYSTEMS

For safety reasons, Komatsu America Corp. strongly recommends against the use of non-OEM replacement parts in critical systems of all Komatsu equipment. Critical systems include but are not limited to steering, braking and operator safety systems.

Replacement parts manufactured and supplied by unauthorized sources may not be designed, manufactured or assembled to Komatsu's design specifications; accordingly, use of such parts may compromise the safe operation of Komatsu products and place the operator and others in danger should the part fail.

Komatsu is also aware of repair companies that will rework or modify an OEM part for reuse in critical systems. Komatsu does not generally authorize such repairs or modifications for the same reasons as noted above.

Use of non-OEM parts places full responsibility for the safe performance of the Komatsu product on the supplier and user. Komatsu will not in any case accept responsibility for the failure or performance of non-OEM parts in its products, including any damages or personal injury resulting from such use.

Precautions for performing repairs

NOTE: Only qualified maintenance personnel who understand the systems being repaired should attempt repairs. Only a qualified operator should move the truck under its own power in the repair facility or during road testing after repairs are complete.

- Many components on the Komatsu truck are large and heavy. Ensure that lifting equipment (hoists, slings, chains, and lifting eyes) are of adequate capacity to handle the load.
- Do not work under a suspended load. Do not work under a raised body unless body retention sling, props or pins are in place to hold the body in the raised position.
- Do not repair the truck while the engine is running, except when adjustments can only be made under such conditions. Keep a safe distance from moving parts.
- When servicing any air conditioning system with refrigerant, wear a face shield and cold resistant gloves for protection against freezing. Follow all current regulations for handling and recycling refrigerants. Refer to Testing and adjusting section **Cab air conditioning**.
- Follow package directions carefully when using cleaning solvents.
- If an auxiliary battery assist is needed, refer to Jump Starting With Booster Cables or Jump Starting With Receptacles earlier in this section.
- If the truck must be towed, use a rigid tow bar. Check the truck frame for a decal recommending special towing precautions. Also refer to the towing instructions in Index and foreword section **Operating instructions**.
- Relieve hydraulic pressure before disconnecting any lines or hoses. Hydraulic oil escaping under pressure can have sufficient force to enter a person's body by penetrating the skin, resulting in serious injury and possibly death.
- After adjustments or repairs, replace all shields, screens and clamps.

Engine shutdown procedure after AC drive system failure

Normal operation of the drive system at shutdown will leave the system safe to maintain. However, in the event of a system failure, performing the following procedure prior to any maintenance activities will ensure that no hazardous voltages are present in the AC drive system.

1. Before shutting down the engine, verify the status of all the drive system status lights on the status indicator panel.

If any drive system warning messages are displayed, DO NOT attempt to open any cabinets, disconnect any cables, or reach inside the retarder grid cabinet without a trained drive system technician present - even if engine is off. Only qualified personnel, specifically trained for servicing the AC drive system, must perform this service.
2. If there are no drive system warning messages, follow all of the instructions for "Safe Parking Procedures."
3. After the engine has stopped, open the access panel at the left front side of the control cabinet. Verify that the green link voltage light is illuminated and the DC bus voltage gauge reads 0.0 V. Notify qualified drive system maintenance personnel if the green link voltage light remains off longer than five minutes after engine shutdown.
4. Locate the alternator cutoff switch in the front access panel on the left side of the main control cabinet. Place the CUTOFF switch in the ON position. This will prevent the alternator from re-energizing and creating system voltage until the switch is returned to the previous position.
5. Ensure both battery disconnect switches are in the OFF position. Verify that the battery disconnects are functioning.
6. Leave the drive system in the rest mode until the truck is to be moved.

Conversion tables

Common conversion multipliers

Table 14: English to metric

From	To	Multiply by
inch (in.)	millimeter (mm)	25.40
inch (in.)	centimeter (cm)	2.54
foot (ft)	meter (m)	0.3048
yard (yd)	meter (m)	0.914
mile (mi)	kilometer (km)	1.61
square inch (in. ²)	square centimeter (cm ²)	6.45
square foot (ft ²)	square centimeter (cm ²)	929
cubic inch (in. ³)	cubic centimeter (cm ³)	16.39
cubic inch (in. ³)	liter (l)	0.016
cubic foot (ft ³)	cubic meter (m ³)	0.028
cubic foot (ft ³)	liter (l)	28.317
ounce (oz)	gram (g)	28.350
fluid ounce (fl oz)	milliliter (ml)	29.573
pound (lb) - mass	kilogram (kg)	0.454
pound (lb) - force	Newton (N)	4.448
inch pound (in lb)	Newton meter (Nm)	0.113
foot pound (ft lb)	Newton meter (Nm)	1.356
foot pound (ft lb)	kilogram meter (kgm)	0.138
pounds/square inch (psi)	kilopascal (kPa)	6.895
pounds/square inch (psi)	megapascal (MPa)	0.007
pounds/square inch (psi)	kilograms/square centimeter (kg/cm ²)	0.0704
short ton	kilogram (kg)	907.2
short ton	metric ton	0.0907
quart (qt)	liter (l)	0.946
U.S gallon (gal)	liter (l)	3.785
horsepower (HP)	kilowatt (kw)	0.745

Table 15: Metric to English

From	To	Multiply by
millimeter (mm)	inch (in.)	0.0394
centimeter (cm)	inch (in.)	0.3937
meter (m)	foot (ft)	3.2808
meter (m)	yard (yd)	1.0936
kilometer (km)	mile (mi)	0.6210
square centimeter (cm ²)	square inch (in. ²)	0.1550
square centimeter (cm ²)	square foot (ft ²)	0.001
cubic centimeter (cm ³)	cubic inch (in. ³)	0.061
liter (l)	cubic inch (in. ³)	61.02
cubic meter (m ³)	cubic foot (ft ³)	35.314
liter (l)	cubic foot (ft ³)	0.0353
gram (g)	ounce (oz)	0.0353
milliliter (ml)	fluid ounce (fl oz)	0.0338
kilogram (kg)	pound (lb) - mass	2.2046
Newton (N)	pound (lb) - force	0.2248
Newton meter (Nm)	inch pound (in lb)	8.85
Newton meter (Nm)	foot pound (ft lb)	0.7376
kilogram meter (kgm)	foot pound (ft lb)	7.2329
kilopascal (kPa)	pounds/square inch (psi)	0.1450
megapascal (MPa)	pounds/square inch (psi)	145.038
kilograms/square centimeter (kg/cm ²)	pounds/square inch (psi)	14.2231
kilogram (kg)	short ton	0.0011
metric ton	short ton	1.1023
liter (l)	quart (qt)	1.0567
liter (l)	U.S gallon (gal)	0.2642
kilowatt (kw)	horsepower (HP)	1.3410

Trolley operating instructions

The instructions provided here are specifically for trolley use. General operating instructions outlined earlier in this chapter apply.

If a haul truck is unable to get on trolley, the operator will continue up the ramp in the diesel mode, and contact the supervisor immediately describing the problem encountered.

Operating in trolley line mode

Only trucks that are loaded will travel on the trolley line. Trucks operating on trolley will have a faster speed than when operating on diesel. Because of the faster speed, all safety and warning recommendations must be followed very closely.

All recommendations for diesel operation apply for trolley operation with the addition of the following recommendations:

1. Loaded trucks operating on diesel will not be as fast as loaded trucks that are on trolley.
2. If there is something in the path of a truck while on trolley, and it is necessary to go around it, the truck will have to drop off the trolley and use diesel power. After driving around the object, the truck can return to trolley.



Always keep the pantographs stowed in the lowered position when not in use on trolley. Never drive near or under the trolley lines with raised pantographs unless the truck is properly aligned with the trolley line. If this procedure is not followed, pantograph and line damage will occur.

3. Trolley-assist is to be used for loaded uphill haul only. Trucks must have the dump body at least half loaded, or more, before going uphill on trolley. Empty trucks are not to go uphill on trolley.

Getting on line

When operating a trolley truck, follow the procedure listed below to get on the trolley line.

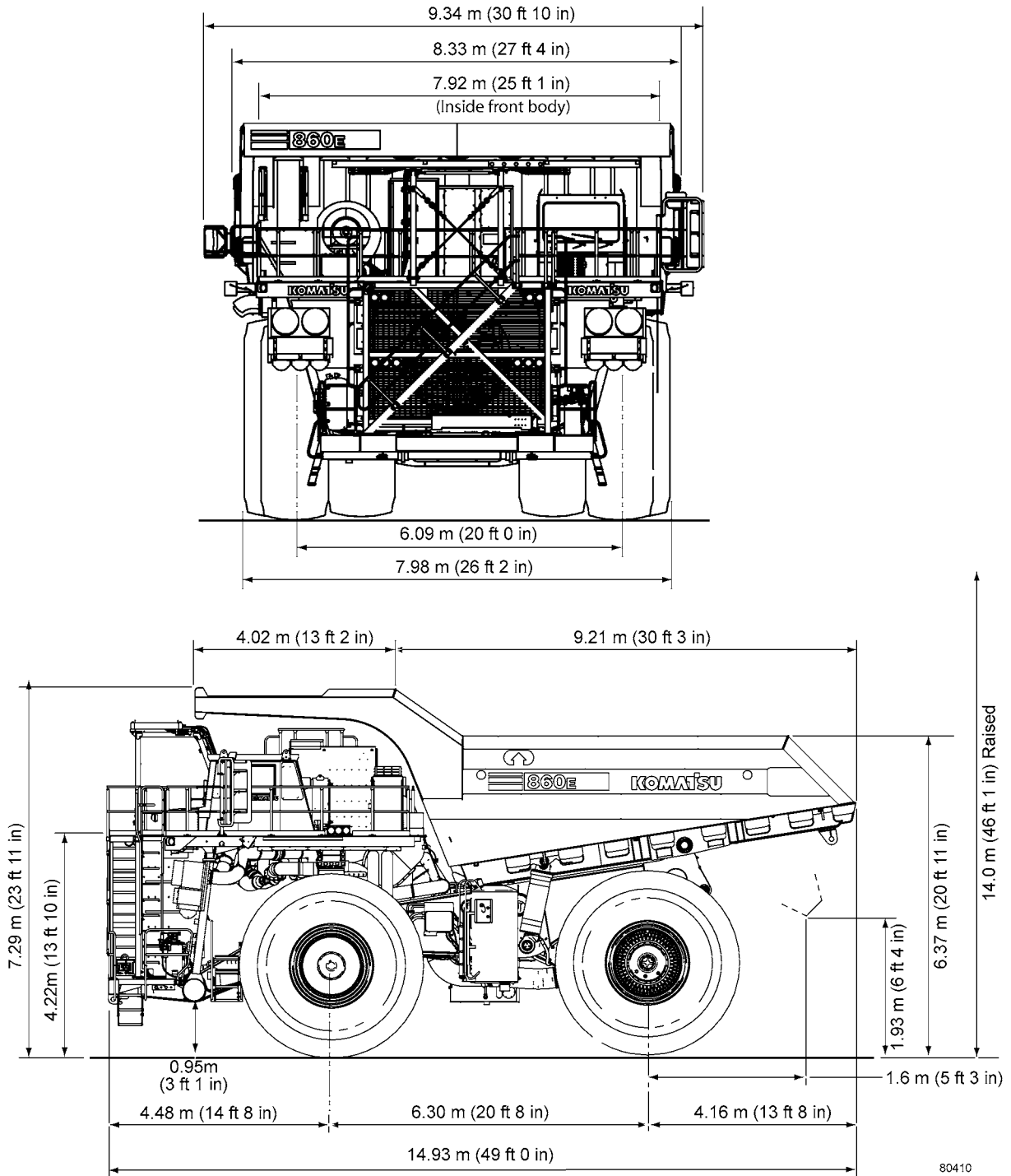
1. Move the directional control lever to the T position to prepare for trolley operation.
2. Approach the trolley line equipped portion of the haul road at 8 - 16 kph (5 - 10 mph) to allow for smooth transition into trolley assist propulsion. If speed of the truck (in diesel mode) is below 8 kph (5 mph), the trolley system will not start the trolley sequence. Increase speed to 8 - 16 kph (5 - 10 mph). Sufficient distance must be allowed between trucks to prevent overloading of the trolley line electrical supply system and/or conductors and trucks being rejected from the trolley line.
3. Align the truck with the entrance area of the trolley line system when entering the overhead cables for trolley. The operator should center the truck pantographs with the cables as he enters the trolley pick up area.

NOTE: The center of operation is approximately the center of the truck cab with the left overhead power cable.

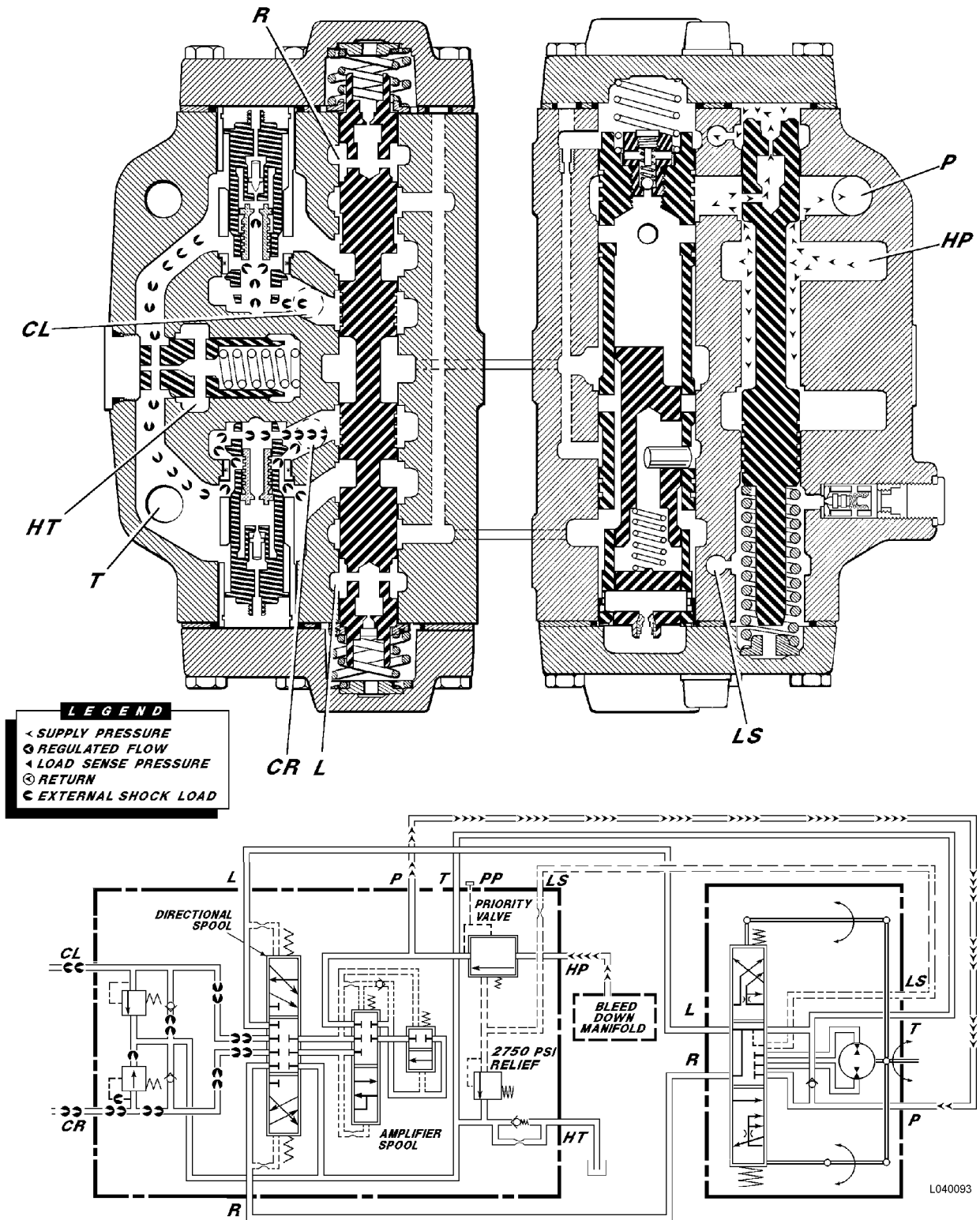
4. With accelerator pedal still fully depressed, press the pantograph raise switch and hold for 0.5 seconds or longer. The pantograph will then raise to contact the overhead cables. The "Pantograph Up" light on the Status Monitor Panel will illuminate.
5. After the pantograph is in contact with the cables for two seconds, and the voltage is within limits, the trolley sequence will complete and the wheel motor power will switch to the overhead power cables. The Status Monitor Panel indicator light for "Pantograph Energized" should illuminate. The engine speed will decrease to the low idle setting.

NOTE: If the drive system detects low voltage on the overhead power lines, the pantograph will lower and a fault message will be issued.

Specification drawing



NOTES



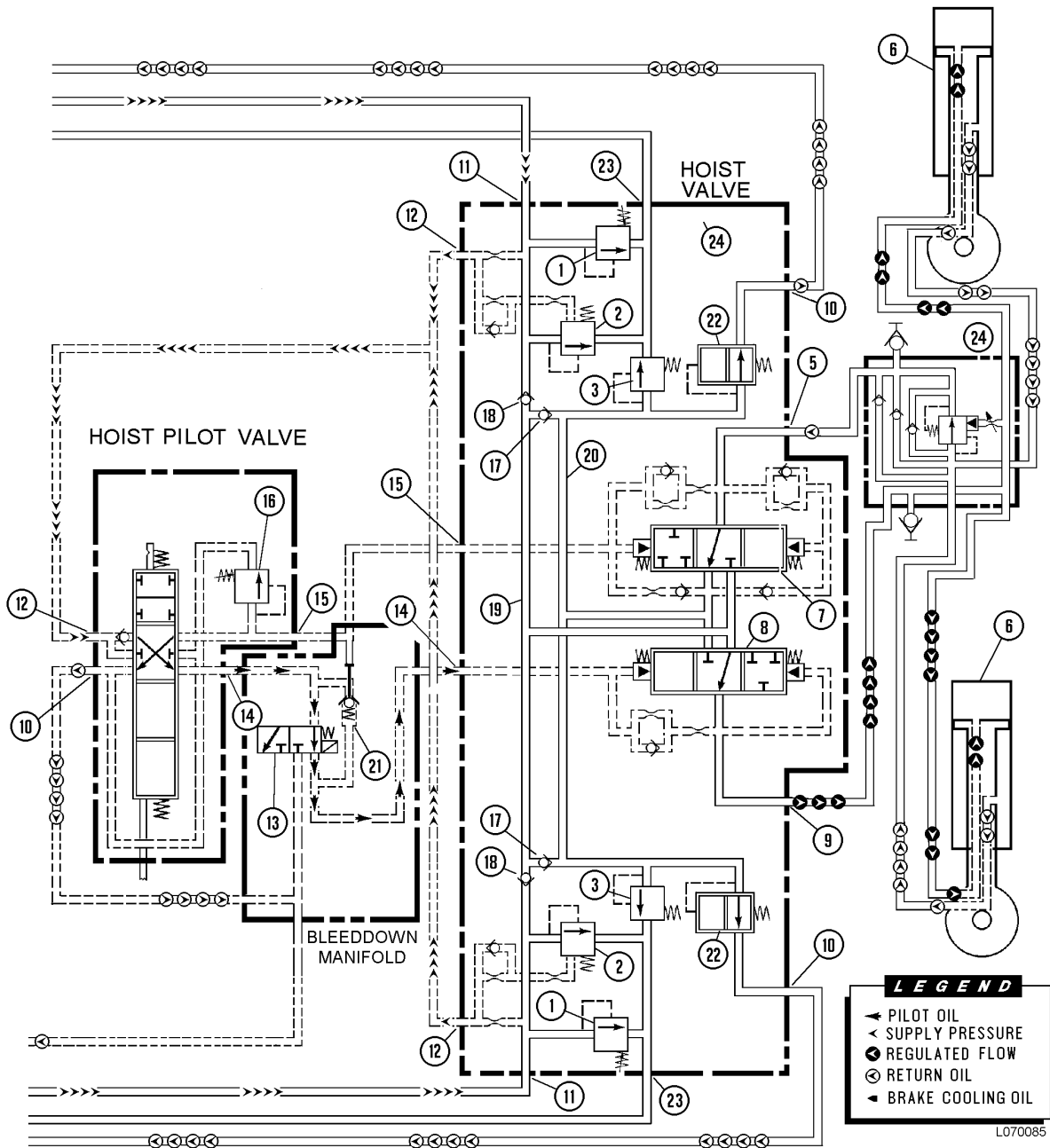


FIGURE 10-6. POWER UP POSITION

- | | | |
|---|---|--|
| 1. Hoist Relief Valve (2,500 psi) | 9. Head End Work Port | 17. Anti-Void Check Valve |
| 2. Flow Control Valve | 10. Tank Return Port | 18. Load Check Valve |
| 3. Secondary Low Pressure Valve (250 psi) | 11. Supply Port | 19. High Pressure Passage |
| 4. Snubber Valve | 12. Pilot Supply Port | 20. Low Pressure Passage |
| 5. Rod End Work Port | 13. Hoist Limit Solenoid | 21. Pilot Operated Check Valve |
| 6. Hoist Cylinders | 14. Raise Pilot Port | 22. Primary Low Pressure Relief Valve (26 psi) |
| 7. Rod End Spool | 15. Down Pilot Port | 23. Brake Cooling Circuit Port |
| 8. Head End Spool | 16. Power Down Relief Valve (1,500 psi) | 24. Overcenter Manifold |

- **Directional control lever in F, R, or N**

The parking brake solenoid is energized. The oil flow is routed from parking brake solenoid valve (15) to the front and rear parking brake relay valves.

NOTE: The front parking brake relay valve is located in the brake cabinet, the rear parking brake relay valve is in the rear axle housing.

- The parking brake circuit is protected against accidental application by monitoring a wheel motor speed sensor to determine the truck ground speed. The parking brake will not apply until the truck is virtually stopped. This eliminates parking brake damage and will extend brake adjustment intervals. If the key switch is turned OFF, the parking brake will not apply until the truck speed is less than 0.5 kph (1/3 mph).

NOTE: Do not leave the truck if it is moving. Ensure that the parking brake will hold the truck stationary before leaving the cab.

If a loss of oil supply pressure occurs at the brake manifold while the directional control lever in F, R, or N, the parking brake solenoid will still be energized. The supply circuit that lost pressure is still open to the parking brake relay valves. To prevent parking brake pressure oil from returning to the supply circuit, three check valves are in the parking brake circuit which traps the oil, holding the parking brake in the released position.

NOTE: Normal internal leakage in the parking brake solenoid may allow leakage of the trapped oil to return to tank and eventually will allow parking brake application.

If 24 volt power to the parking brake solenoid is interrupted, the parking brake will apply at any truck speed. The spring in the solenoid will cause it to shift, opening a path for the oil pressure in the parking brake line and the relay valve lines to return to tank, and the springs in the parking brake will apply the brake. The parking brake switches will change state, and the interface module will indicate that a parking brake applied condition exists when not commanded and will indicate a fault. When this occurs, the propulsion system will also disengage.

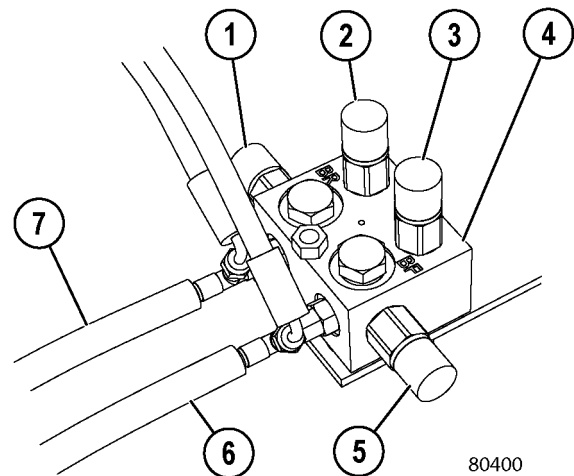


FIGURE 10-4. REAR AXLE JUNCTION BLOCK

1. Pressure Switch (Park Brake Release) 1425 psi
2. Pressure Switch (Park Brake Applied) 75 psi
3. Pressure Switch (Park Brake Applied) 75 psi
4. Junction Block (Parking Brake Circuits)
5. Pressure Switch (Park Brake Release) 1425 psi
6. Hose
7. Hose

Relay board 4 (RB4)

- 1 - Steering Pressure Bleeddown Timer Module card
- 1 - Bleed Down Light (green): This light is illuminated when the bleed down solenoid is being energized. The bleed down timer will energize the solenoid for 90 seconds after the key switch is turned OFF.
- 3 - 12.5 amp circuit breakers (CB20, CB21, CB22)
- 4 - Relays
 - Parking Brake Failure Relay (K1)
 - Engine Cranking Oil Pressure Interlock Relay (K2)
 - Horn Relay (K3)
 - Body-Up Relay (K4)

Relay board 5 (RB5)

- 1 - Light Display Module card
- 1 - Lights Control Light (green): This light is illuminated when 24 volts is being supplied to the battery terminal of the light switch.
- 5 - 12.5 amp circuit breakers (CB23, CB24, CB25, CB26, CB27)
- 4 - Relays
 - Left Low Beam Relay (K1)
 - Right Low Beam Relay (K2)
 - Left High Beam Relay (K3)
 - Right High Beam Relay (K4)

Relay board 6 (RB6)

- Backup Horn Relay (K1)
- Engine Run/Ignition Relay (K2)
- Propel Inhibit(K3)
- Park Brake Release (K4)
- Ignition On (K5)
- Spare Relay (K6)
- Starter Lockout (K7)
- Park Brake Control (K8)

Relay board 7 (RB7)

- Bleed Down Power Supply Relay (K1)
- Truck Moving Relay (K2)
- Brake Lock Hold Relay (K3)
- Engine Run Relay (K4)
- Auto Lube Solenoid Relay (K5)
- HID Light Relay (K6)
- Park Brake Switch Relay (K7)
- Auto Lube Relay (K8)

Relay board 8 (RB8)

- Full Load Signal to PSC Relay (K1)
- 70% Load Signal to PSC Relay (K2)
- Spare Relay (K3)
- Payload Power Relay (K4)
- Spare Relay (K5)
- PLMIII Red Lights Relay (K6)
- PLMIII Amber Lights Relay (K7)
- PLMIII Green Lights Relay (K8)

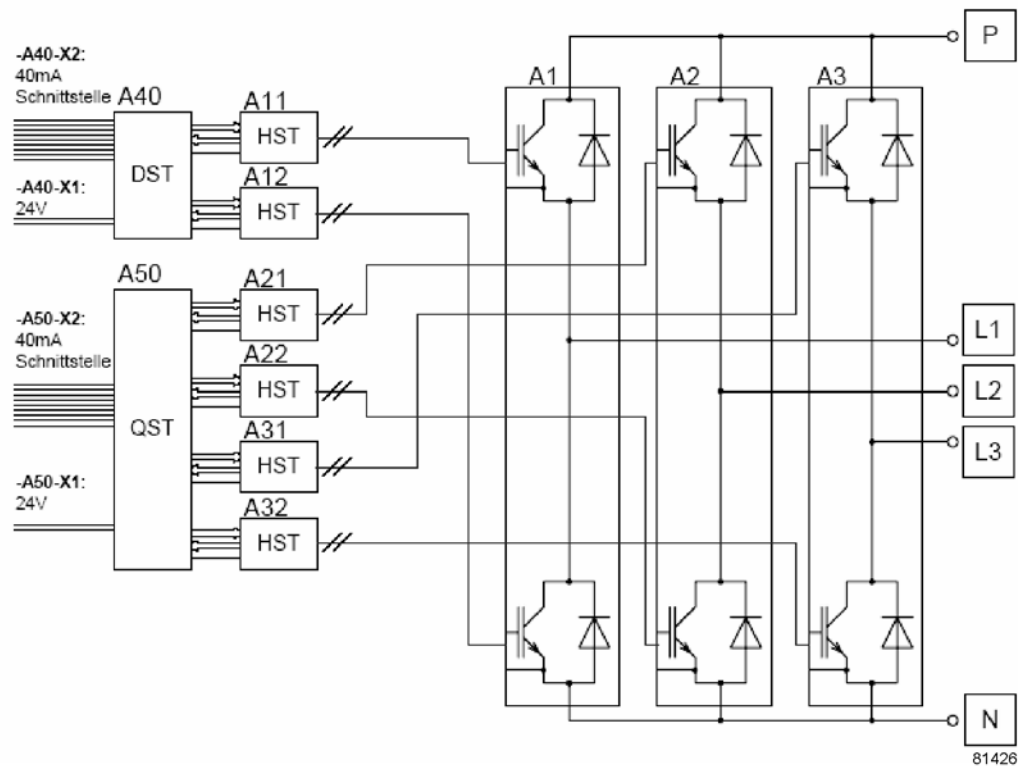


FIGURE 10-5. INTERNAL CIRCUIT DIAGRAM

Free-wheeling diode for low-inductance bus bars



81446

FIGURE 10-43. FREE-WHEELING DIODE FOR LOW-INDUCTANCE BUS BARS, FRONT VIEW

Contactor (grid box and main blower motor)



81046

FIGURE 10-44. CONTACTORS K105 AND K103, FRONT VIEW (LOCATED ON REAR SIDE OF CONTROL CABINET IN UPPER RIGHT DOOR)

Technical Data

150A, AC-3, DC coil: 23-26 VDC

Auxiliary contacts: 4 pole, 1 NO/1 NC low-level contact

Internal circuit diagram

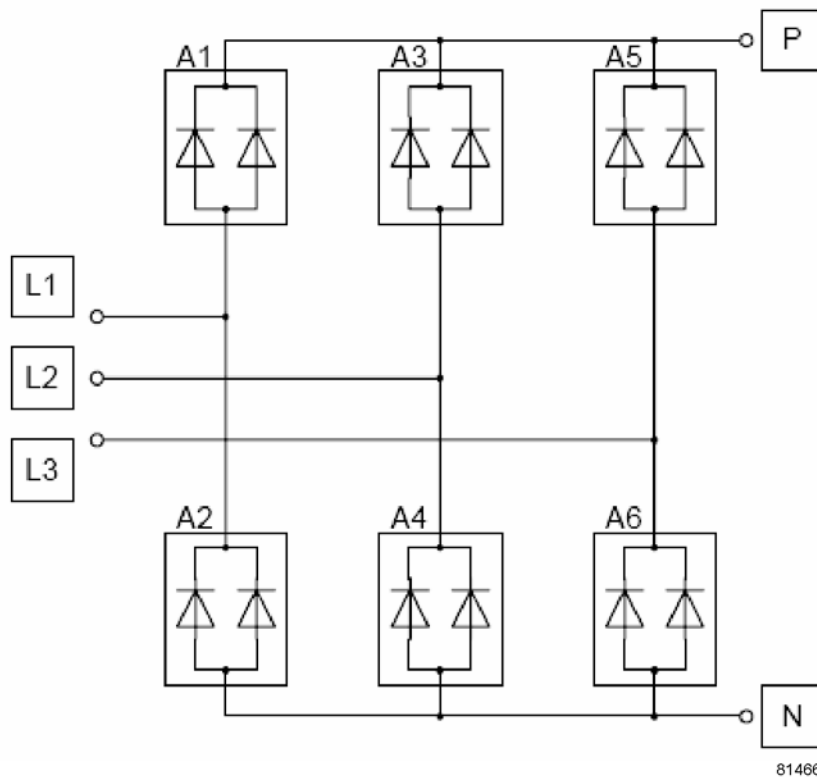


FIGURE 10-84. INTERNAL CIRCUIT DIAGRAM

SiBAS®32 card interchangeability

While each SiBAS®32 card has a specific part number, not every card is functionally unique. Below is a list of the groups of cards that are interchangeable with some modification to the card's rack and front plug coding pins. These coding pins are small plastic tabs that can be manipulated with needle nose pliers. The coding pins' purpose is to prevent plugging the card and/or front plug into the wrong position.

Because the cards are manufactured to not require changing these coding pins, the variant identification portion of the part number is incremented to indicate default coding.

Example:

6FH9387-3CY60 differs from 6FH9387-3CY61 because the coding pins are set to match position C027 in the SiBAS®32 rack

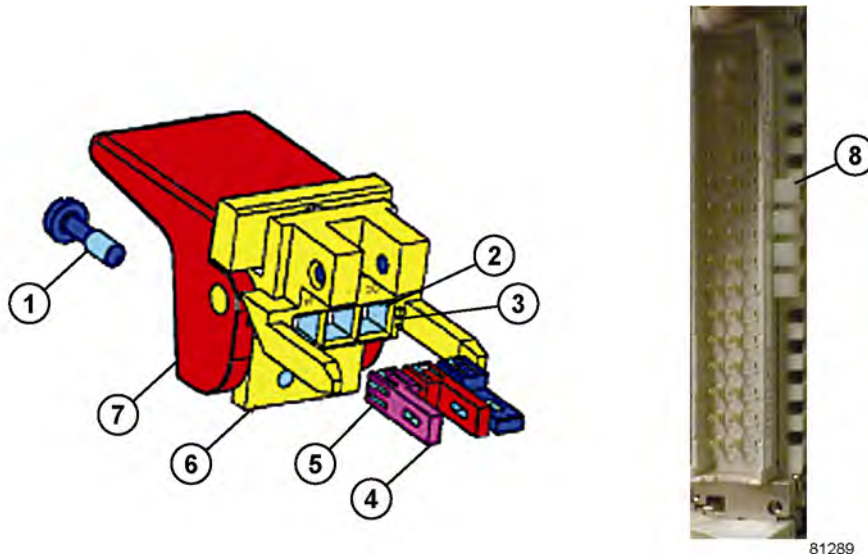


FIGURE 10-7. SiBAS®32 CARD MOUNTING TAB AND FRONT PLUG SHOWING THE CODING PINS

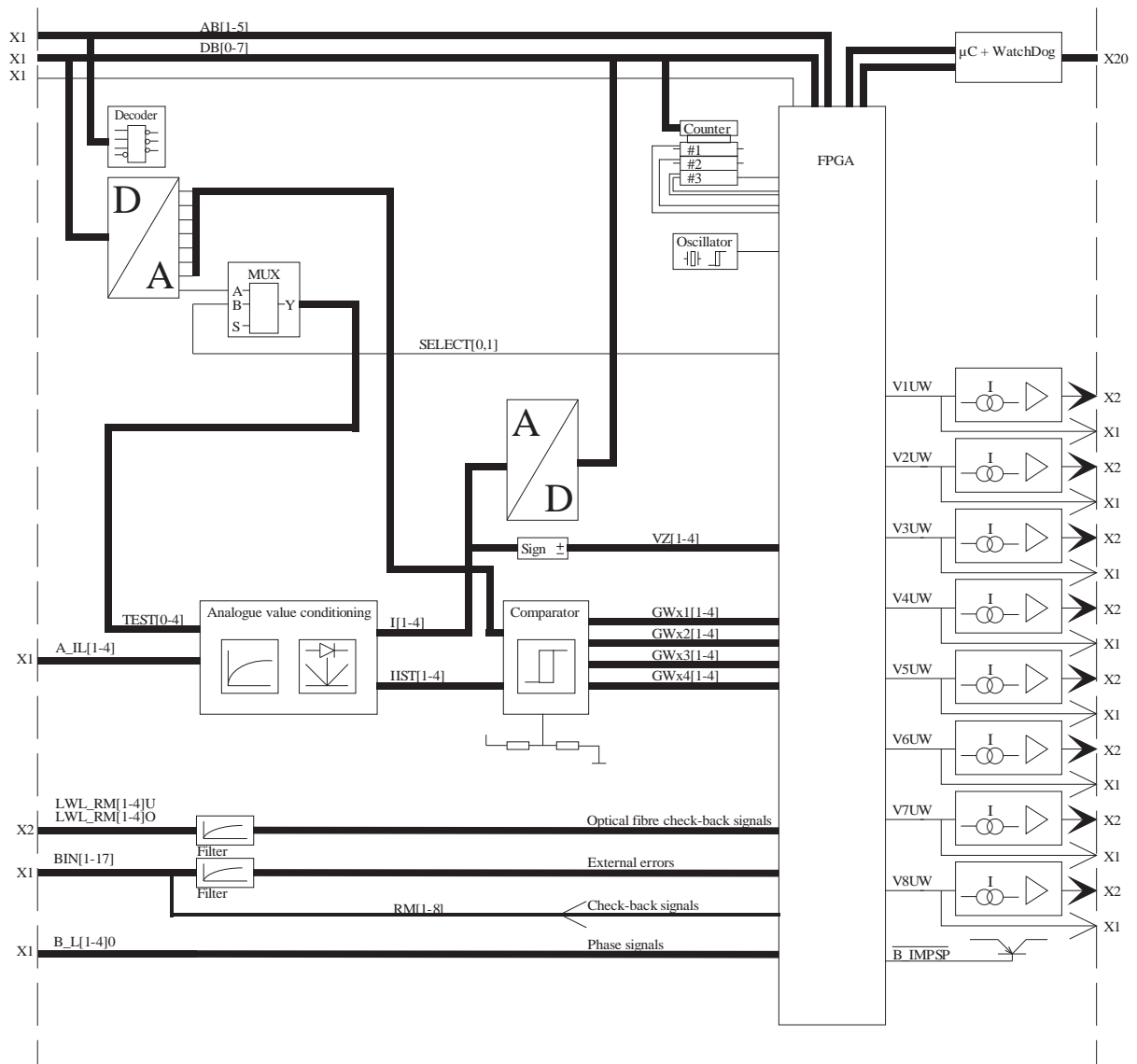
- | | |
|---------------------|---------------------------|
| 1. Fixing screw | 5. Coding bolt |
| 2. Coding chamber | 6. End piece |
| 3. Marker points | 7. Ejector |
| 4. Coding bolt nose | 8. Front plug coding pins |

The mounting tab coding pins are rotated to mate with the corresponding pins in the rack. The front plug coding pins are added/removed to match the harness connector.

Front panel

TRACO 50-pin female connector		DX2 harness (optional)
Pin	Description	
1	Ground (M)	1
2	Selectable DAC CH0	2
3	Selectable DAC CH1	3
4	Selectable DAC CH2	4
5	Selectable DAC CH3	5
6	Selectable DAC CH4	6
7	Selectable DAC CH5	7
8	Selectable DAC CH6	8
9	Selectable DAC CH7	9
10	N/C	N/C
11	N/C	N/C
12	Current U Motor A1 AOUT00	12
13	Current W Motor A1 AOUT01	13
14	Current Chopper A AOUT02	14
15	Current Chopper B AOUT03	15
16	Current V Motor B1 AOUT04	16
17	Ground (M)	N/C
18	Ground (M)	N/C
19	Current W Motor B1 AOUT05	19
20	Current Chopper C AOUT06	20
21	Current Chopper D AOUT07	21
23	Current U Alternator AOUT09	10
24	Current U ST module AOUT10	23
25	Current V ST module AOUT11	25
26	Current W ST Module AOUT12	24
27	DC link Voltage B AOUT13	17
28	Voltage AC in Alternator AOUT14	11
29	Voltage ST out module AOUT15	18
30	N/C	N/C
31	N/C	N/C
32	IO Trig TRACO	22
33	Ground (M)	N/C
34	Ground (M)	N/C
35	Feedback A101 Upper IGBT	N/C
36	Feedback A101 Lower IGBT	N/C
37	Feedback A102 Upper IGBT	N/C
38	Feedback A102 Lower IGBT	N/C
39	Feedback A103 Upper IGBT	N/C
40	Feedback A103 Lower IGBT	N/C
41	Feedback Chop A A104 L1 IGBT	N/C
42	Feedback A201 Upper IGBT	N/C
43	Feedback A201 Lower IGBT	N/C
44	Feedback A202 Upper IGBT	N/C
45	Feedback A202 Lower IGBT	N/C
46	Feedback A203 Upper IGBT	N/C
47	Feedback A203 Lower IGBT	N/C
48	Feedback Chop A A104L1 IGBT	N/C
49	Feedback A101 Upper L2 IGBT	N/C
50	Ground (M)	N/C

Technical data



81405

FIGURE 10-33. G055, G063, G071 AND G079 BLOCK DIAGRAM

Technical data

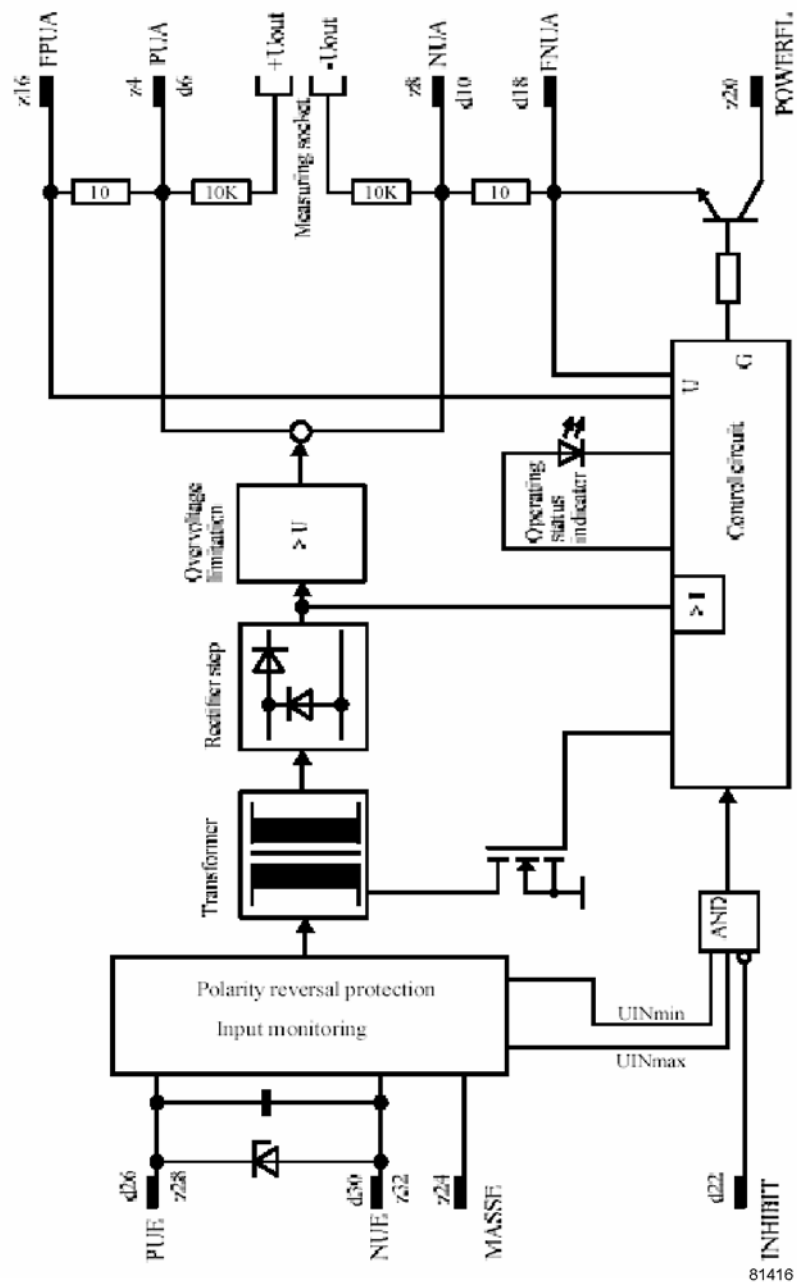


FIGURE 10-45. C153 BLOCK DIAGRAM

Truck model				860E-1				
Check item		Measurement conditions		Unit	Standard value for new truck	Permissible value		
Operating force and stroke	Accelerator pedal	Operating force	<ul style="list-style-type: none"> Point at 150 mm (6 in.) from fulcrum of pedal 	<ul style="list-style-type: none"> Starting to depress 	N (lb)	29.3 + 13.0/-0 (6.6 + 2.9/-0)	29.3 + 13.0/-0 (6.6 + 2.9/-0)	
				<ul style="list-style-type: none"> Full 		58.7 + 0/-13.3 (13.2 + 0/-3.0)	58.7 + 0/-13.3 (13.2 + 0/-3.0)	
		Stroke	<ul style="list-style-type: none"> Starting to depress to Full 	mm (in.)	45 ± 5 (1.8 ± 0.2)	45 ± 5 (1.8 ± 0.2)		
	Brake pedal	Operating force	<ul style="list-style-type: none"> Retarding 		N (lb)	44.5 ± 4.0 (10.0 ± 0.9)	44.5 ± 4.0 (10.0 ± 0.9)	
			<ul style="list-style-type: none"> Braking 			300.5 ± 189.5 (67.55 ± 42.6)	300.5 ± 189.5 (67.55 ± 42.6)	
		Stroke	<ul style="list-style-type: none"> Retarding 		Deg	17.5 ± 1.0	17.5 ± 1.0	
			<ul style="list-style-type: none"> Braking 			17.5 ± 1.0	17.5 ± 1.0	
	Directional control lever	Operating force	<ul style="list-style-type: none"> Measuring point: Center of grip 		N (lb)	Max. 29.4 (Max. 6.61)	Max. 29.4 (Max. 6.61)	
		Stroke			mm (in.)	24.5 ± 1 (0.96 ± 0.04)	24.5 ± 2 (0.96 ± 0.08)	
	Hoist lever	Operating force	Float to Raise	<ul style="list-style-type: none"> Measuring point: Center of grip 	<ul style="list-style-type: none"> Initial 	N (lb)	Max. 35.3 (Max. 7.94)	Max. 35.3 (Max. 7.94)
					<ul style="list-style-type: none"> Full 		Max. 24.5 (Max. 5.51)	Max. 24.5 (Max. 5.51)
			Must return smoothly when engine speed is at high idle.					
			Raise to Hold		<ul style="list-style-type: none"> Initial 		Max. 35.3 (Max. 7.94)	Max. 35.3 (Max. 7.94)
					<ul style="list-style-type: none"> Full 		Max. 24.5 (Max. 5.51)	Max. 24.5 (Max. 5.51)
Hold to Raise			<ul style="list-style-type: none"> Initial 		Max. 35.3 (Max. 7.94)		Max. 35.3 (Max. 7.94)	
			<ul style="list-style-type: none"> Full 		Max. 24.5 (Max. 5.51)		Max. 24.5 (Max. 5.51)	
Hold to Lower			<ul style="list-style-type: none"> Initial 		Max. 35.3 (Max. 7.94)		Max. 35.3 (Max. 7.94)	
		<ul style="list-style-type: none"> Full 	Max. 24.5 (Max. 5.51)	Max. 24.5 (Max. 5.51)				
Lower to Float		Must return smoothly when engine speed is at high idle.						
Stroke	Raise to Hold	<ul style="list-style-type: none"> Measuring point: Center of grip 		mm (in.)	44.8 ± 1.9 (1.76 ± 0.08)	44.8 ± 1.9 (1.76 ± 0.08)		
	Hold to Lower							

Recovering and recycling refrigerant

Recycled refrigerant has been extracted from a mobile air conditioning system using a recovery unit. The refrigerant is cleaned by the recovery unit as it passes through filters located on the unit that meet specifications stipulated by Society of Automotive Engineers, SAE J2099. The refrigerant that has passed through the filtering process has only been cleaned of contaminants that are associated with mobile systems. Therefore, recycled refrigerant from mobile systems is only acceptable for reuse in mobile systems.

Reclaimed refrigerant has been filtered through a more thorough filtering process and has been processed to the same standards of purity as virgin refrigerant. Because of this, reclaimed refrigerant is acceptable for use in all systems, not just mobile. The reclaiming equipment used for this process is expensive, and therefore, not common among normal maintenance shops. Equipment such as this is more commonly found in air conditioning specialty shops.

CAUTION

Always use new, recycled, or reclaimed refrigerant when charging a system. Failure to adhere to this recommendation may result in premature wear or damage to air conditioning system components and poor cooling performance.

If not enough refrigerant is charged into the system, cooling ability will be diminished. If too much refrigerant is charged into the system, the system will operate at higher pressures and, in some cases, may damage system components. Exceeding the specified refrigerant charge will not provide better cooling.

If an incorrect charge is suspected, recover the refrigerant from the system, and charge the system with the correct operating weight of 3.4 kg (7.4 lb). This is not only the recommended procedure, but it is also the best way to ensure that the system is operating with the proper charge and providing optimum cooling. Using the sight glass to determine the charge is not an accurate method.

IMPORTANT

An unclear sight glass on R-134a systems can indicate that the system may be low on refrigerant. However, the sight glass should not be used as a gauge for charging the system. Charging the system must be done with a scale to ensure the proper amount of refrigerant has been added.

Two basic, readily available containers are used to store R-134a: the 14 kg (30 lb) or 28 kg (60 lb) bulk canisters (Figure 30-8). Always read the container label to verify the contents are correct for the system being serviced. Note the containers for R-134a are painted light blue.

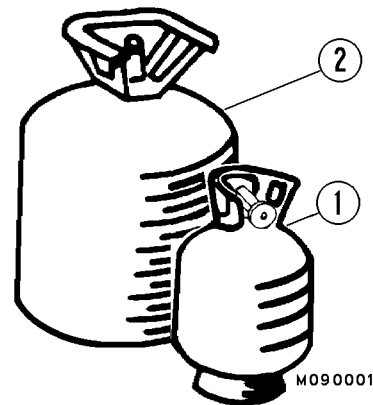


FIGURE 30-8. R-134a CONTAINERS

1. 14 kg (30 lb) Canister 2. 28 kg (60 lb) Canister

4. Check the pressure again by repeating Step 2. If necessary, repeat the adjustment procedure until the correct pressure is obtained.

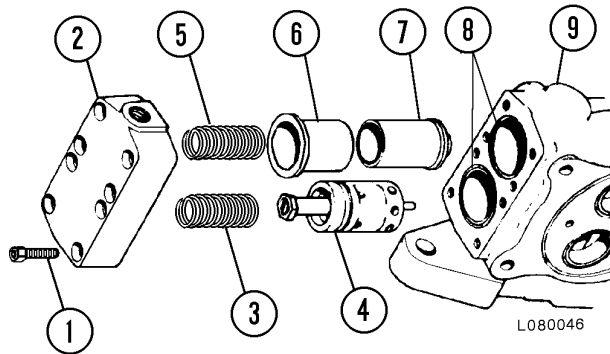


FIGURE 30-6. INLET SECTION

- | | |
|----------------------|---------------------------------|
| 1. Capscrew | 6. Sleeve |
| 2. Inlet Cover | 7. Secondary Low Pressure Valve |
| 3. Spring | 8. O-rings |
| 4. Main Relief Valve | 9. Inlet Valve Body |
| 5. Spring | |

NOTE: Front and rear inlet sections are identical.

Power down relief pressure test

NOTE: The hoist system power down relief valve is located on the hoist pilot valve in the hydraulic brake cabinet behind the cab.

1. Start the engine and operate at low idle. Allow the accumulators to fill and the steering/brake pump to unload.
2. With the body resting on the frame, move the hoist control lever to the LOWER position.
 - Pressure at the overcenter manifold test port "TPD" should be $10\,340 \pm 517$ kPa ($1,500 \pm 75$ psi).

** Record on Data Sheet*

3. If power down relief pressure is not within specifications, adjust the relief valve as follows:
 - a. Remove the cap from power down relief valve (2, Figure 30-7).
 - b. To increase the power down relief pressure, turn the adjusting screw inward (clockwise). To decrease the power down relief pressure, turn the adjusting screw outward (counterclockwise).

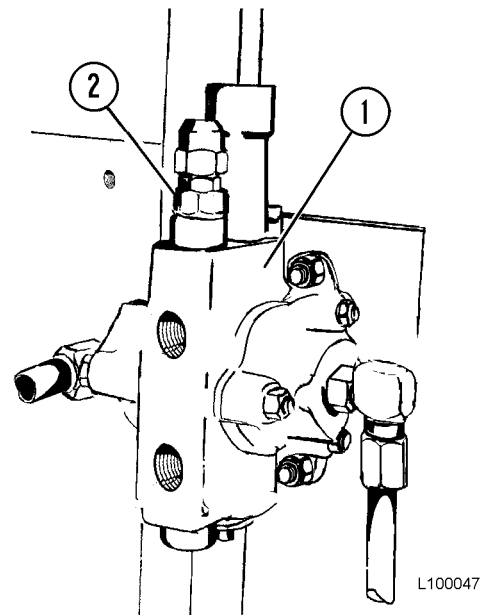
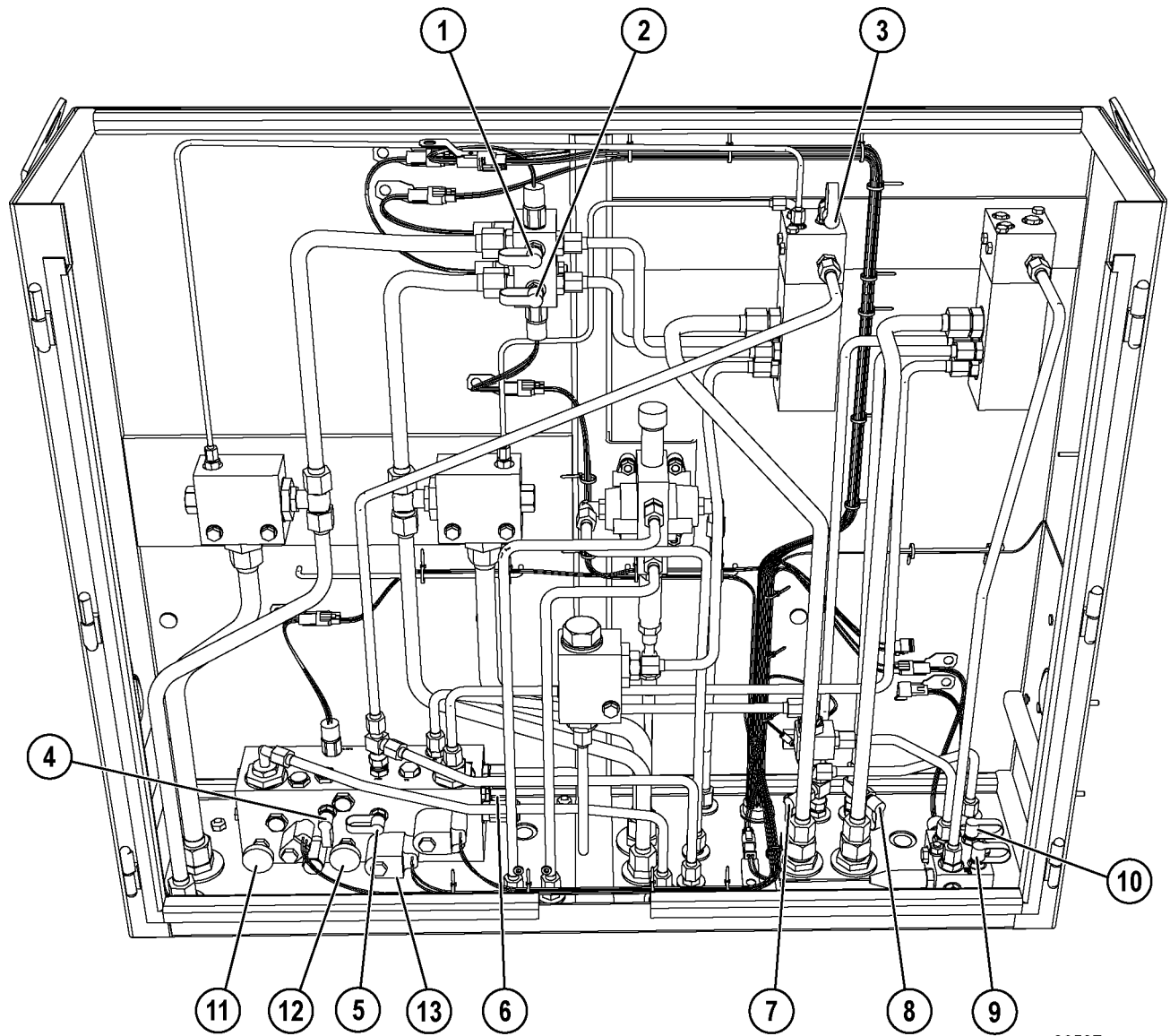


FIGURE 30-7. HOIST PILOT VALVE

1. Spool Housing
2. Power Down Relief Valve



80597

FIGURE 30-1. HYDRAULIC BRAKE CABINET

- | | |
|---|--|
| 1. RFPB Test Port (Right Front Park Brake) | 8. RFSB Test Port (Right Front Service Brake) |
| 2. LFPB Test Port (Left Front Park Brake) | 9. Front Brake Pressure Test Port (BF) |
| 3. FPBP Test Port (Front Park Brake Pressure) | 10. Rear Brake Pressure Test Port (BR) |
| 4. Low Accumulator Pressure Test Port (LAP1) | 11. Accumulator Bleed Down Valve (Rear Brake) |
| 5. Parking Brake Release Pressure (PK2) | 12. Accumulator Bleed Down Valve (Front Brake) |
| 6. Brake Lock Apply Pressure Test Port (PP3) | 13. Brake Lock Solenoid |
| 7. LFSB Test Port (Left Front Service Brake) | |

Parking brake bleeding procedure

1. Securely block the wheels to prevent the truck from rolling away.
2. Open bleed down valves (1, Figure 30-4) and (2) to depressurize the brake accumulators.
3. To verify that the brake accumulators are depressurized, turn the key switch ON, but do not start the engine. Press the brake lock switch and apply the service brake pedal. The service brake light should not come on.
4. Close the accumulator bleed down valves.
5. Open the rear axle housing hatch.
6. Start the engine and allow the steering system to fully charge (pump unloads). Then move the directional control lever to NEUTRAL to disengage the parking brake.
7. Connect a clear plastic hose to the bleeder valve at the top of the parking brake. Place the other end of hose into a container.
8. Slowly open the bleeder valve and allow hydraulic oil to run until it is clear and free of bubbles. Close the bleeder valve securely.
9. Repeat Steps 5 and 6 for the other parking brake.
10. Shut off the engine. Remove the bleed equipment and close the rear axle housing hatch.

Parking brake leakage test

This leakage test can be used at any time to test for parking brake piston leakage. It can also be used during the brake assembly process, before the brake assembly is installed in the rear wheel hubs.

1. Remove the dust cap on diagnostic coupler (1, Figure 30-3) on the brake backplate.

2. Remove the capnut on parking brake pressure port "P". Attach a hydraulic pressure test device to the fitting.
3. Slowly apply pressure to bleed air from the piston cavity.
4. Cycle the piston to full stroke ten times by applying 2 070 kPa (300 psi) of hydraulic pressure. Observe the piston for leakage.
5. Minor oil seepage (non-measurable) is permissible. If the leakage is greater, disassemble the piston assembly and determine the cause.
- 6.

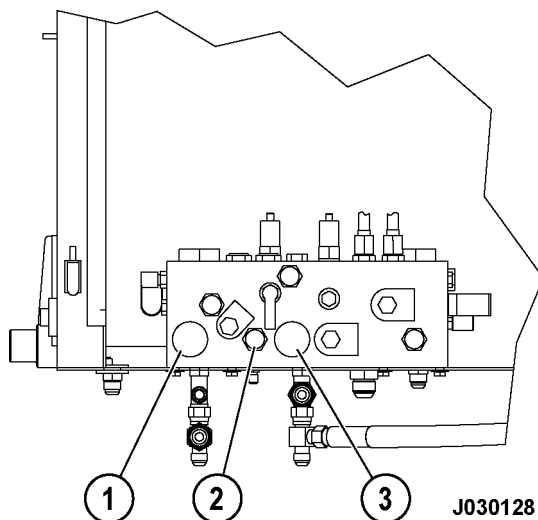


FIGURE 30-4. BRAKE MANIFOLD

1. Accumulator Bleed Down Valve (Rear Brake)
2. Automatic Apply Valve
3. Accumulator Bleed Down Valve (Front Brake)

4. Make sure that outlet valves (3) and inlet valve (4) are closed (turned completely clockwise).
5. Turn the swivel nut (small hex) on the charging valve three full turns counterclockwise to unseat the valve.
6. Attach charging valve adapters (2) to each suspension charging valve stem.
7. Turn "T" handle valves (1) clockwise. This will depress the core of the charging valve and open the gas chamber of the suspension.
8. Open both outlet valves (3).

NOTE: By selective opening and closing of outlet valves (3), and inlet valve (4), suspensions may be charged separately or together.

Removing the charging kit

1. Close both outlet valves (3).
2. Turn "T" handles (1) counterclockwise to release the charging valve cores.
3. Remove charging valve adapters (2) from the charging valves.
4. Tighten the swivel nut (small hex) on the charging valve. If a new charging valve is being used, tighten the swivel nut to **15 Nm (11 ft lb)**, then loosen and retighten the swivel nut to **15 Nm (11 ft lb)**. Loosen the swivel nut again and retighten to **6 Nm (50 in lb)**. Install the valve cap finger-tight.
5. Install the charging valve caps and protective covers on both suspensions.

Support blocks for oiling and charging dimensions

Before starting the oiling and charging procedures, supports should be fabricated to maintain the correct exposed piston rod extensions.



Nitrogen charging support blocks for the rear suspension are no longer necessary. However, oiling blocks are necessary to properly set the oiling height.

Exposed piston rod extensions are specified for both oil level and nitrogen charging for Hydrair II suspensions. These dimensions are listed in the tables below. Measure the dimensions from the face of the cylinder gland to the machined surface on the spindle at the front suspension. At the rear suspension, measure from the face of the bearing retainer to the flat machined surface on the piston.

Support blocks may be made in various forms. Mild steel materials are recommended. Square stock or pipe segments at least 25 mm (1 in.) may be used. The blocks must be capable of supporting the weight of the truck during oiling and charging procedures while avoiding contact with plated surfaces and seals on the suspension. Refer to Figure 30-10 for front suspension support block placement and Figure 30-13 for rear support block placement.

Table 2: FRONT SUSPENSION DIMENSIONS (EMPTY)		
OILING HEIGHT	CHARGING HEIGHT	CHARGING PRESSURE
25.4 mm (1.0 in.)	229 mm (9.01 in.)	*3 365 kPa (488 psi)
* Charging pressures are for reference only and may vary depending on body weights.		

DUMP TRUCK

860E

Machine model	Serial number
860E-1K	A30003 and up
860E-1KT	A30003 and up

30 Testing and adjusting KOMTRAX Plus

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KOMTRAX Plus controller checkout procedure

Necessary equipment

- Checkout procedure
- System schematic
- Laptop personal computer (PC)
- *VHMS Technical Analysis Toolbox* software
- *VHMS Setting Tool* software
- Tera Term Pro software
- Serial cable (RS232)
(male DB9 connector on one end, female connector on the other end)

NOTE: Before performing this procedure, the interface module must be fully functional and the KOMTRAX Plus controller must be initialized and fully functional.

Preliminary

1. Turn the key switch to the OFF position to stop the engine. Verify that the seven segment LED display on the KOMTRAX Plus controller is off.
2. Turn the key switch to the ON position, but DO NOT start the engine.
3. Allow the KOMTRAX Plus controller to boot up. Watch the red, two digit LED display on the KOMTRAX Plus controller to show a circular sequence of seven flashing segments on each digit. After a short time the two digit display should start counting up from 00 - 99 at a rate of ten numbers per second.
4. Attach the KOMTRAX Plus serial cable to the truck's KOMTRAX Plus diagnostic port (2, Figure 30-3) and the other end to the laptop PC's serial port.
5. Double-click on the *VHMS Technical Analysis Tool Box* icon on the laptop PC's desktop.
6. Enter the appropriate User Name and Password and click the [OK] button.
7. Check for any active fault codes. If any are found, these circuits should be analyzed to determine the cause of the fault and they must be repaired before continuing.

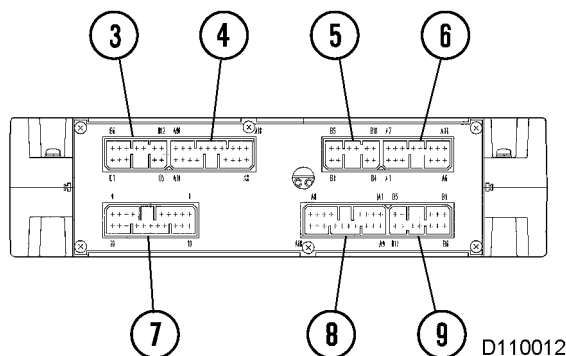
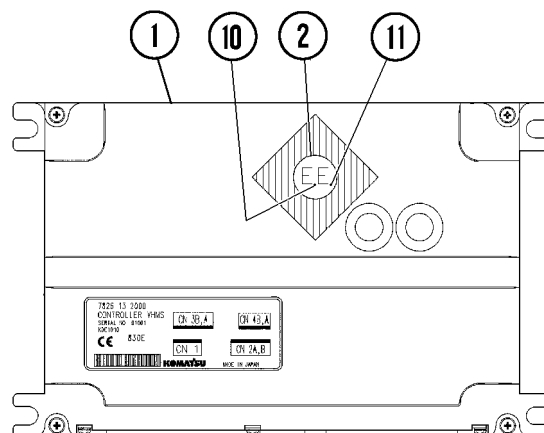


FIGURE 30-1. KOMTRAX PLUS CONTROLLER

- | | |
|----------------------------|-------------------|
| 1. KOMTRAX Plus Controller | 6. Connector CN4A |
| 2. LED Display | 7. Connector CN1 |
| 3. Connector CN3B | 8. Connector CN2A |
| 4. Connector CN3A | 9. Connector CN2B |
| 5. Connector CN4B | 10. PLM III Light |
| | 11. OrbComm Light |

Abbreviations

ABIN.....	Binary Output Contactor Drive (SIBAS® 32 board)
AC	Alternating Current
A/D	Analog / Digital
ADC	Analog-Digital Converter
AIF	Analog Interface (SIBAS® 32 board)
APRS	Automatic Power Reduction System
BCD	Binary Coded Decimal Code
BOD	Brake Over Device
BRAM.....	Battery RAM
CPU	Central Processing Unit
DAC	Digital-Analog Converter
DC.....	Diagnosis Code or Direct Current
DSP.....	Digital Signal Processing Unit (SIBAS® 32 board)
EBIN.....	Input Converter Binary (SIBAS® 32 board)
EPROM.....	Erasable PROM
ESD.....	Electrostatic Sensitive Device
ESH.....	Power Start-up Unit (SIBAS® 32 board)
ETM	Input Temperature Sensor PT100 (SIBAS® 32 board)
FB	Function Block
FP	Function Package
FPGA	Field Programmable Gate Array
GW.....	Grenzwerti = threshold/limit
GTO	Gate Turnoff Thyristor
HSCX	High Speed Computer Interface
IO	Input/Output module (SIBAS® 32 board)
INV	Inverter
INVM.....	Inverter Module
IPM.....	Inverter Protection Module (Crowbar)
LCA	Logic Cell Array
LED	Light-Emitting Diode
MC	Microcomputer
NMI	Non-Maskable Interrupt
PCB.....	Printed Circuit Board
PROM	Programmable Read-Only Memory
PSU.....	Power Start-up Unit (SIBAS® 32 board)

Before a record file can be read with an editor, recording must be terminated.

Example	
Set Record Create	Starts recording
Set Record Stop	Terminates recording

"Set DIN-Bus"

**Not used in the IGBT haul truck project.

"Set TCN"

**Not used in the IGBT haul truck project.

"Set Timeout"

Changes the timeout.

Options

0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.50
3.00
3.50
4.00

The timeout of the monitor, i.e., the maximum waiting time of the customer monitor for a response of the target computer before an error message ("Timeout") is sent, can be changed by selecting a multiplication factor. The timeout (ca. 2 seconds) set after start-up of the program is multiplied by the factor selected.

"Set Wait"

Setting of the waiting time for automated test applications which run with monitor batch files.

Options

1 Second
2 Seconds
5 Seconds
10 Seconds
20 Seconds
50 Seconds

"Set Color"

Sets the color of text in the Edit line.

Options

1)	"Text"	:Command refers to text
	"Background"	:Command refers to text background
2)	"/Blue"	
	"/Green"	
	"/Red"	
	"/Yellow"	
	"/Black"	
	"/White"	
	"/Magenta"	

Basic setting: yellow background, black text

E.g.,	"Set Color Background/ Red"	→Red background
	"Set Color Text /Black"	→Black text

NOTE: The colors for the window background, menu lines, etc., can be set by means of the Windows system control.

3. Call the Customer Monitor.
4. Press the BOOT button on the DSP (recessed black push button at the bottom) and the RESET button on the DSP and keep them pressed.
5. Call the command Hardw. BOOT DSP and enter the full file name for the loading module of the operating system.
e.g.:
Hardw. BOOT DSP /OS: C:\SIBAS32\CUSTOMON.250\OSSI0128.LOC

The file selector key [F1] can be used to help enter the file name.

After the command has been initiated, a dialog box BOOT DSP appears which must not yet be acknowledged! If there are several Signal Processing Units in the SIBAS® 32 control unit, you must decide beforehand which Signal Processing Unit is to be booted.

6. With the BOOT button still pressed, release the RESET button on the DSP.

Consequence:

Display location	Message
7-segment display DSP	1 (DSP in BOOT mode)

7. Release the BOOT button on the DSP.
8. Confirm the BOOT DSP dialog box.

Consequences:

Display location	Message
7-segment display DSP	L (Loader is being loaded into the RAM of the DSP)
7-segment display DSP	(Operating system deletion is running)
7-segment display DSP	0 (Operating system loading is running)
Message on the PC	Erasing Flash Memory!
Message on the PC	Loading Code!

9. Wait until loading is completed and the RESET has been carried out.

Display location	Message
Message on the PC	Flash Memory programmed!
Message on the PC	Reset Detected!

10. The Customer Monitor now enables further operations on the booted DSP, e.g., loading of project-specific software by means of Hardw. Flash User Program or return to operations on the Central Processing Unit by means of Hardw. ZR.

DSP56303 (monitor and CPU operating system as of V2.0), ADSP and ICM (monitor and CPU operating system as of V2.30 at any one time) modules

The above modules have no RESET or BOOT buttons that the user has to press. BOOT and RESET are executed by the operating system of the CPU.

1. Plug the programming jumper into the front panel of the Signal Processing Unit.
2. Plug the connecting cable into the service interface of the Central Processing Unit and switch the Central Processing Unit to *Monitor Only* mode.

NOTE: The BCD switch of the Central Processing Unit must not be in the 1 position!

3. Call the Customer Monitor.

Events Menu

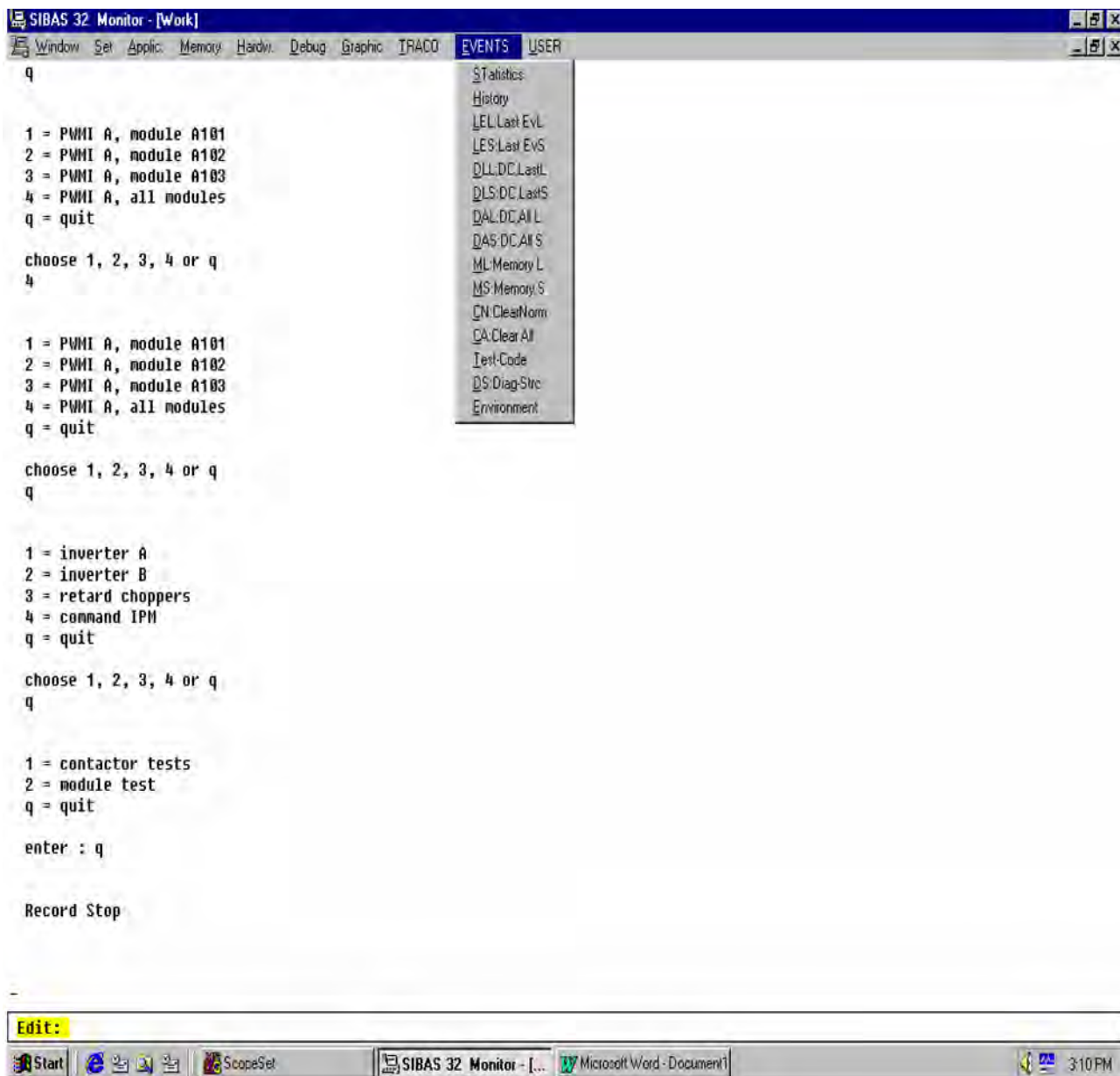


FIGURE 30-12. OUTPUT ON DAQ 0

81488

```

Enter Item Number : 1

Date / Time.....: 07-19-2006 16:53:48
Vehicle number.....: 0
Data valid since.....: 07-19-2006 16:14:15

Engine Operating Hours.....: 0 h 0 min
TCU ON-time.....: 0 h 0 min
Truck in motion hours.....: 0 h 0 min

Clear operating data?
Clear by 'y'
Ignore by every other input

```

|

81506

FIGURE 30-29. OPERATING TIME DATA

To prevent clearing the data accidentally, dumpbody override switch must be held while "y" is pressed.

Energy Usage data

Displays the DC-link energy consumed from the engine/alternator as well as the Retard power dissipated in the grid box. These values are maintained when new software is loaded, but not if the CPU card if changed.

```

Enter Item Number : 2

Date / Time.....: 07-19-2006 16:55:22
Vehicle number.....: 0
Data valid since.....: 07-19-2006 16:14:23

DC-link energy consumed.....: 0.0 kWh
Retard power dissipated.....: 0.0 kWh

```

```

Clear energy data?
Clear by 'y'
Ignore by every other input

```

|

81507

FIGURE 30-30. ENERGY USAGE DATA

To prevent clearing the data accidentally, dumpbody override switch must be held while "y" is pressed.

IV: Vehic-ID

This sets the vehicle number which is displayed in the state intern and long listing of a fault code, a number up to 99999 is acceptable.

IU: Vehic ID

```
Current vehicle identifier : 99999
New vehicle identifier    : 2000
```

81531

FIGURE 30-53. VEHICLE ID

Commands

This menu allows the customer to perform certain commands that are sometimes necessary in the troubleshooting process.

Commands

Commands:

=====

```
1 = Reset inhibits
2 = Discharge DC-link
3 = Fire crowbar
4 = Limp mode commands
q = Exit menu
```

```
Enter Item Number : |
```

81532

FIGURE 30-54. COMMANDS

4. Select Hardw. -DSP-INV_A, -Enter.
5. Select Hardw. -Flash -User Code File, -Enter.

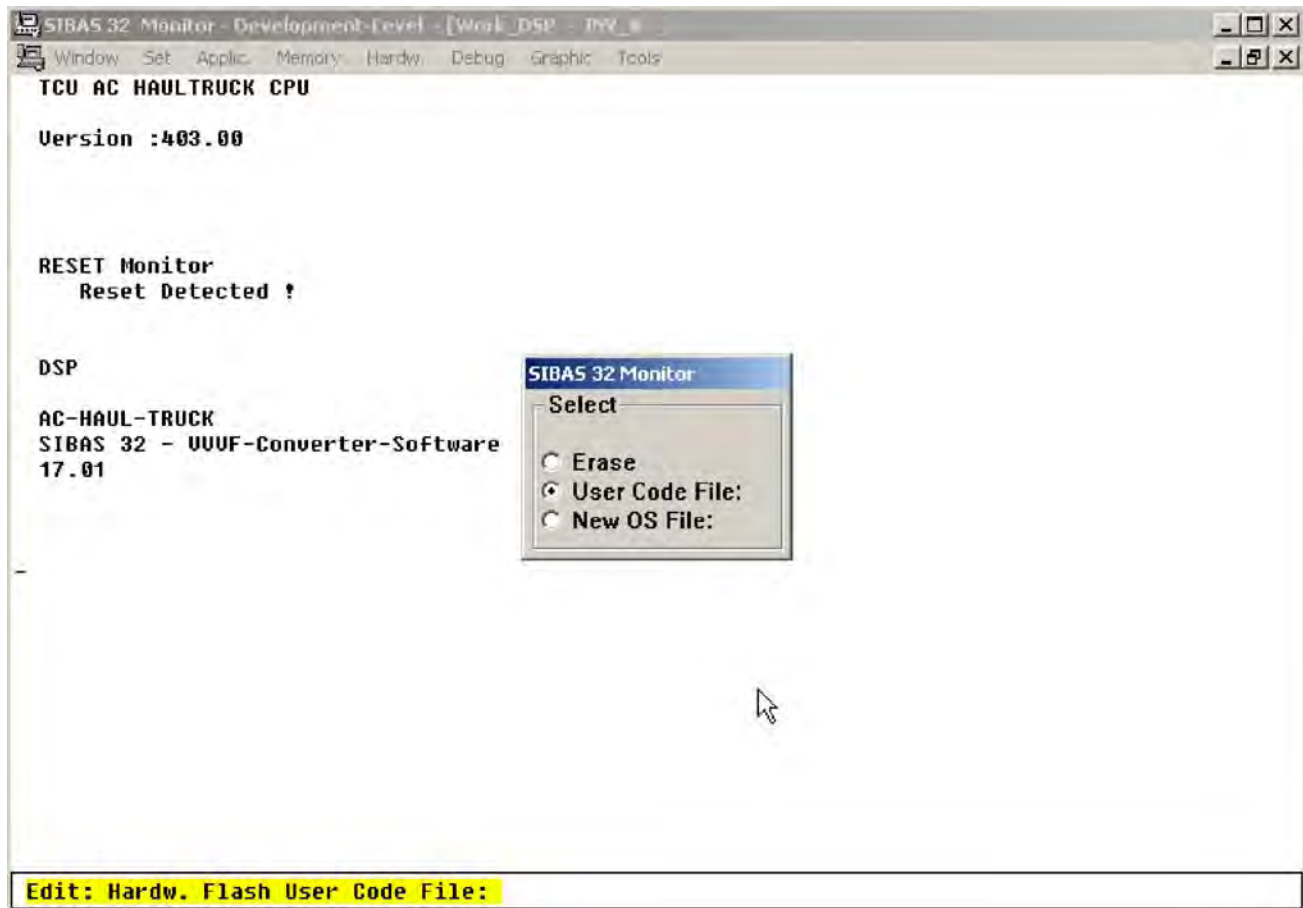


FIGURE 30-8. FLASH SUB MENU

81452

Hoist limit switch adjustment

1. Raise the body so that the hoist cylinders are within 152 mm (6 in.) of maximum travel.
2. Adjust the hoist limit switch to achieve an air gap (dimension "A", Figure 30-2) of 12.70 to 14.30 mm (0.50 to 0.56 in.) between the sensing area and actuator arm (3). Tighten the cap screws.
3. The actuator arm will be lined up across from the proximity switch when it is activated.
4. Check the operation of the proximity switch to verify that the hoist cylinders stop before reaching maximum cylinder stroke. If the cylinders extend to full stroke, adjust the proximity switch as necessary to prevent full cylinder extension.

Service

For both proximity switches, keep the sensing area clean and free of metallic dust and other debris that may damage or inhibit operation of the switch. If the switch is damaged or not functioning, the switch must be replaced.

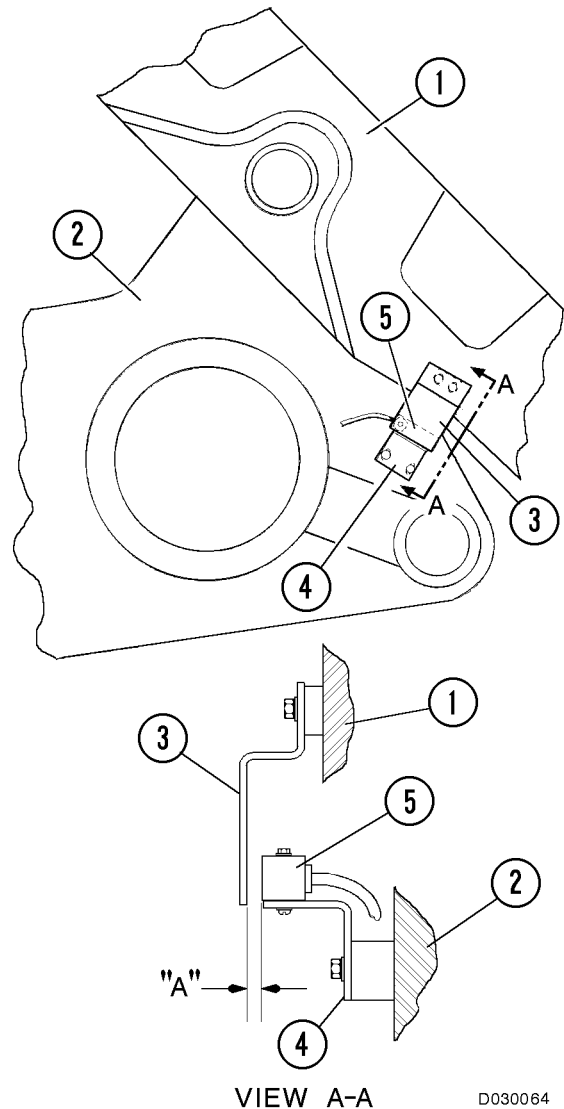


FIGURE 30-2. HOIST LIMIT SWITCH

- | | |
|-----------------|--------------------------|
| 1. Body | 4. Switch Mounting Plate |
| 2. Frame | 5. Hoist Limit Switch |
| 3. Actuator Arm | |

FUSE BLOCK #1

Location	Amps	Devices protected	Circuit
1	15	A/C, Heater Blower Motor	12H
2	10	Windshield Washer / Wiper	63
3	5	Instrument Panel Gauges	712G
4	10	Key Switch Power	712P
5	10	Hoist Limit Switch	712H
6	15	Turn Signal / Clearance Lights	712T
7	10	Engine Options	712E
8	10	AID Module and Indicator Lights	12M
9	10	Engine Start Failure	712SF
10	10	Engine Shutters	712R
11	10	Auxiliary Control Cabinet Dome Lights	712A
12	10	Operator Seat	712DS
13	15	Drive System Power	71P
14	10	Auto Lube	68ES
17	10	Brake Circuits	71bc
18	5	Payload Meter Module	712PL
19	5	Interface Module Power	87
20	5	KOMTRAX Plus Power	71VHM
21	5	Dispatch System Power	712MM
22	5	Dash Switch Power	49B
23	1	Selector Switch	71SS

Fault Code A014: Payload meter checksum computation has failed

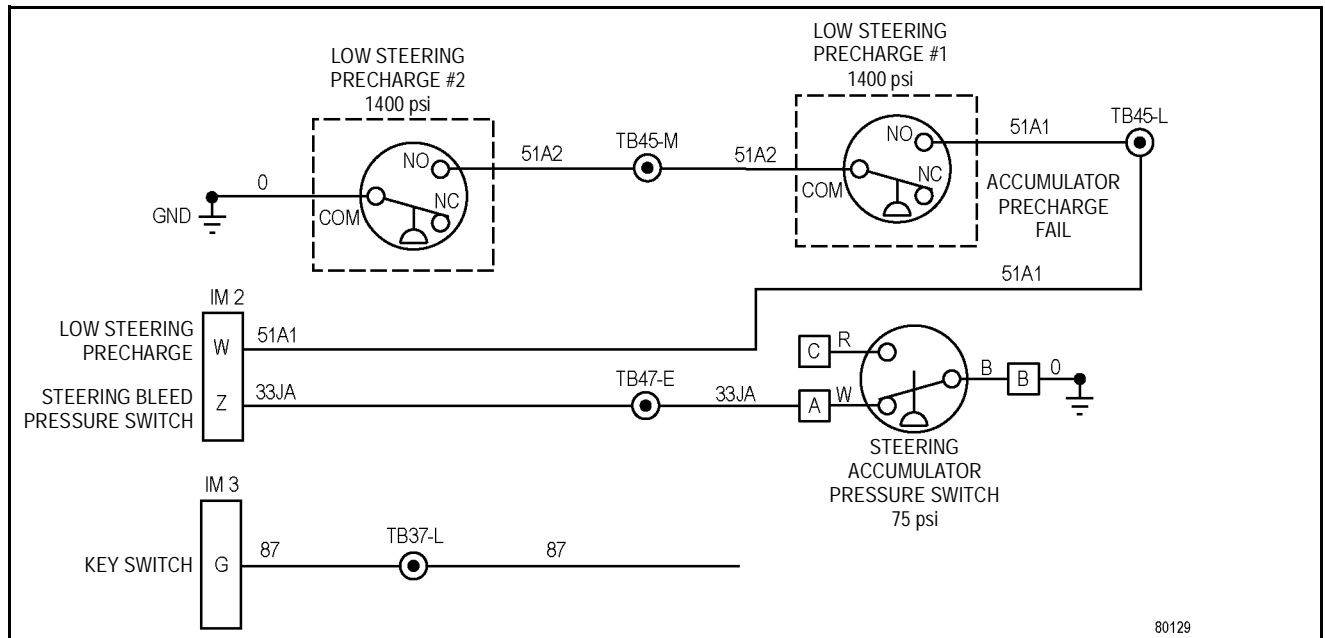
Operator Action	None
Fault Code	A014
Description	Payload meter checksum computation has failed.
Fault Conditions	PLM reports a checksum failure.
Operator Alerting System Response	Lamp or Buzzer: None - Maintenance Item Display Fault Description: PLM CHECKSUM FAIL Display Fault Code: A014
Resulting Problem(s)	Payload and haul cycle data is bad.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
1. This fault is totally contained within the payload meter.	
Parameter	Expected State and/or Related Fault(s)
Payload Meter	

Related circuit diagram

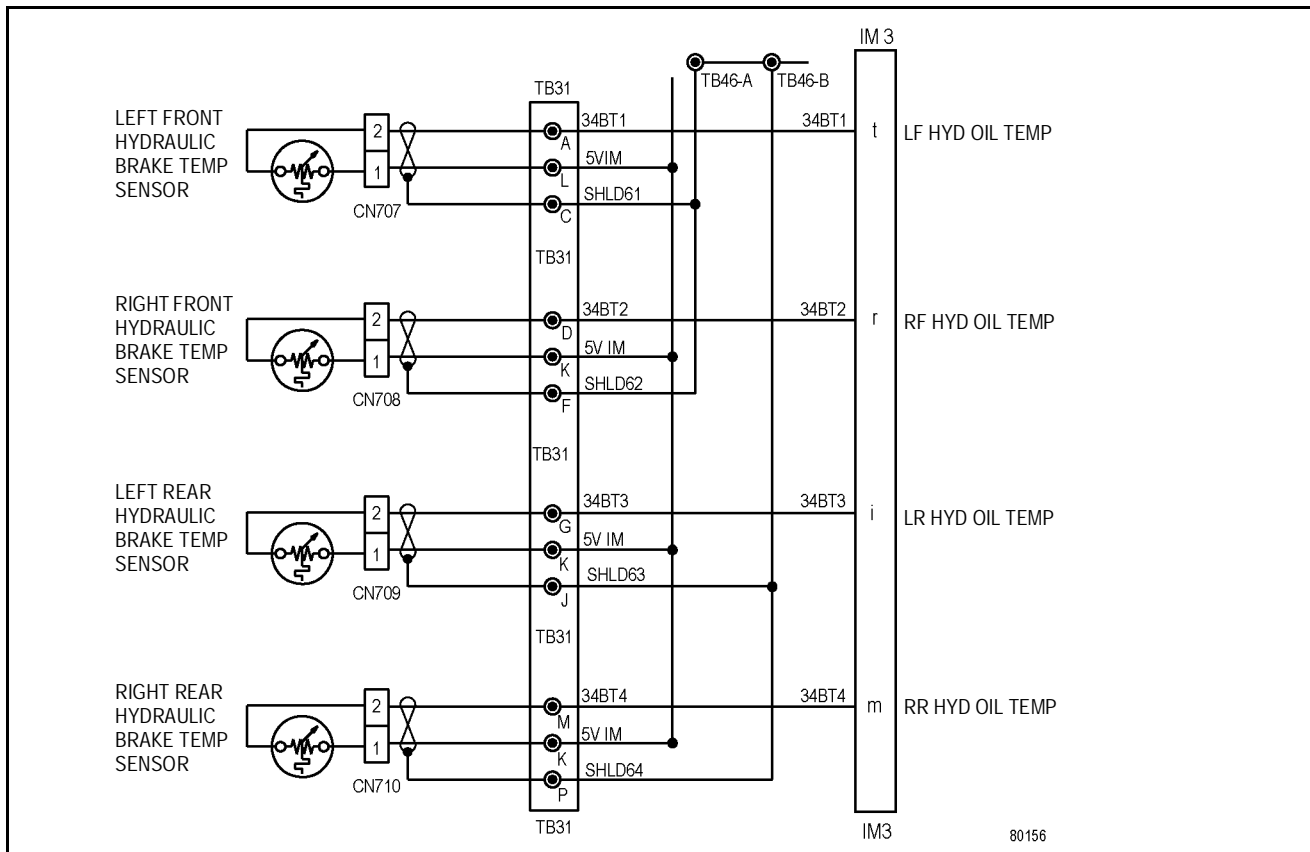
None.

Related circuit diagram

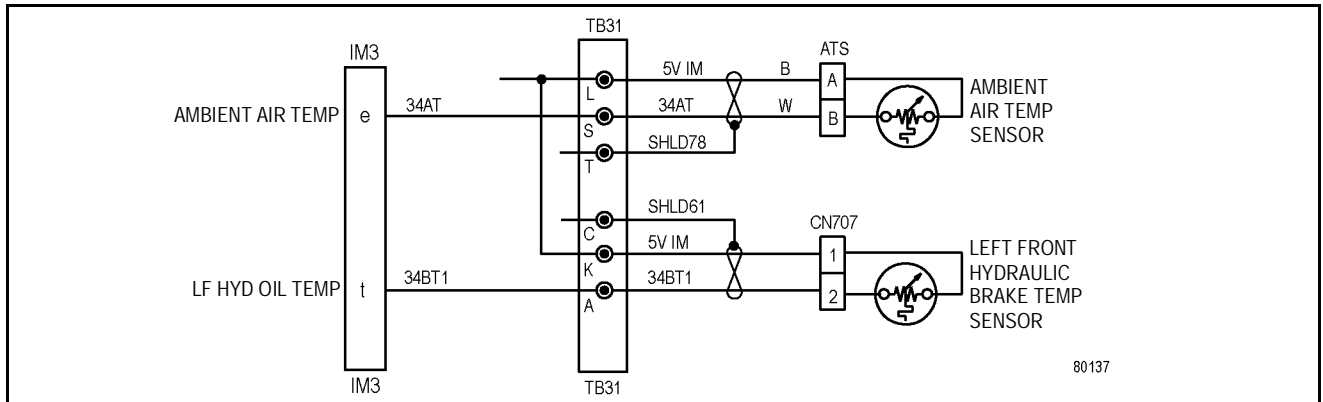


80129

Related circuit diagram



Related circuit diagram



Fault Code A195: Right front hydraulic oil temperature is high

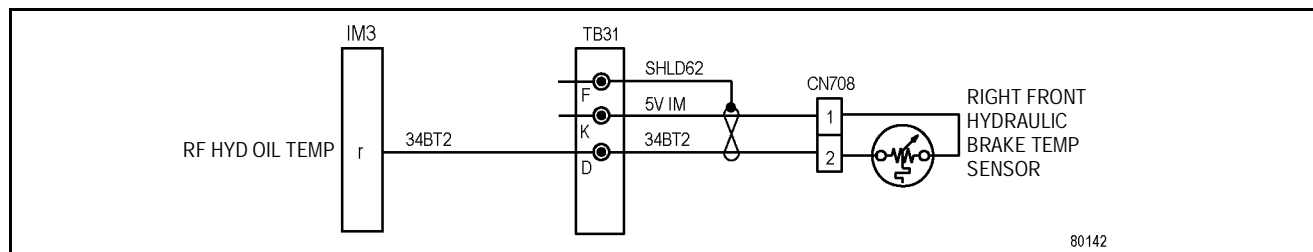
Operator Action	Stop; Park; Run Engine
Fault Code	A195
Description	Right Front Hydraulic Oil Temperature is high
Fault Conditions	Sets at 120°C (248°F) (4.13 volts) after 5 seconds. Resets at 103°C (217°F) (3.78 volts) after 5 seconds or at steering bleed.
Operator Alerting System Response	Sound Buzzer Flash IM Warning indicator Display Operator Action: STOP: PARK: RUN ENG Display Fault Description: HOT HYD OIL RF Display Fault Code: A195
Resulting Problem(s)	Excessively hot oil can cause equipment damage and even reduce service brake effectiveness.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

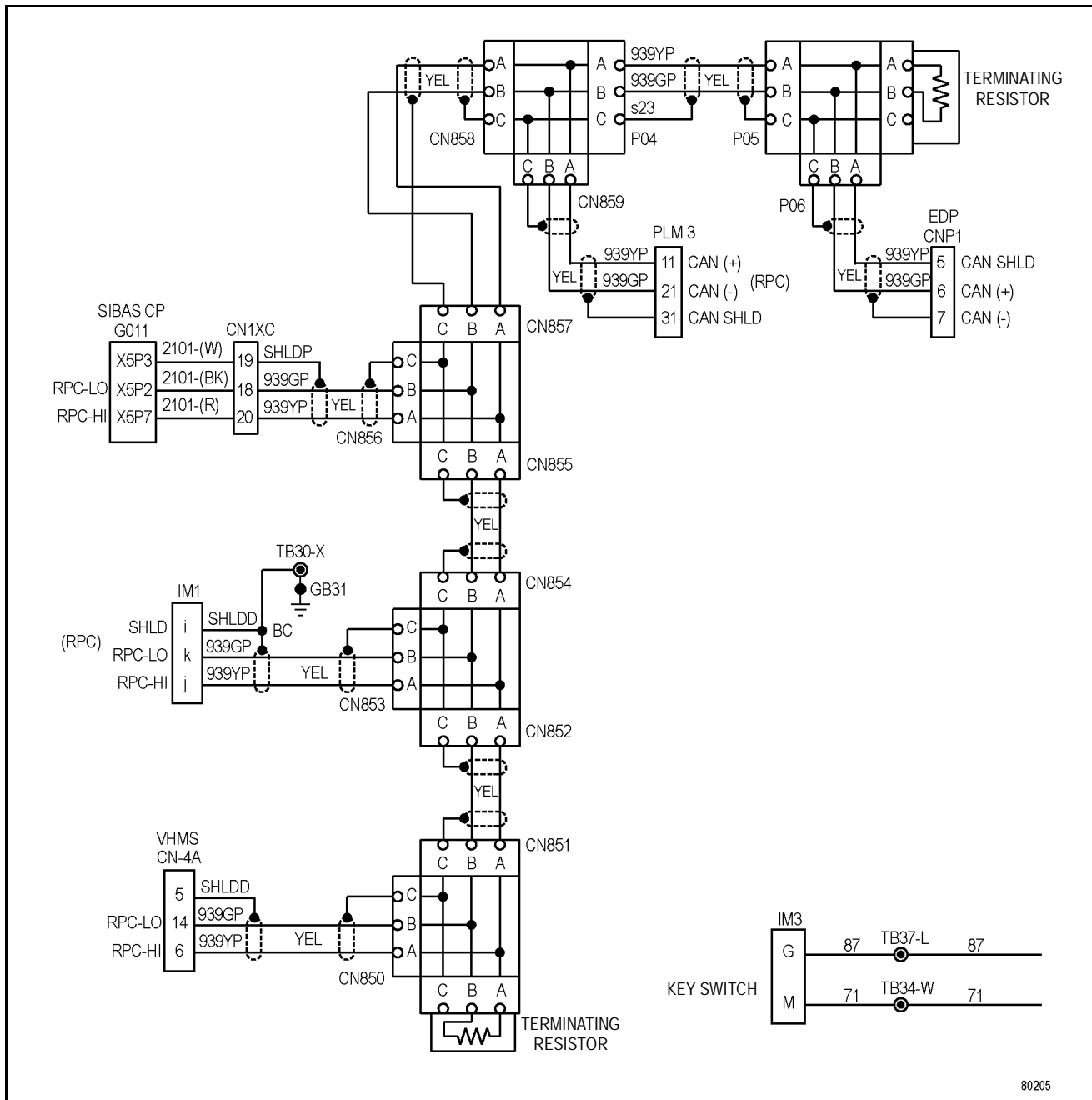
Parameter	Expected State and/or Related Fault(s)
Hydraulic Oil Temperature - Right Front (IM 3r)	0.016 Volt to 4.89 Volt: Good Readings <0.016 Volt or >4.89 Volt: Defective Sensor or Circuit Fault(s): A169, A173
Steering Bleed Valve	0: steering bleed valve is off 1: steering bleed valve is on

Related circuit diagram



Park Brake Solenoid (IM 1E)	Status - Open Load: Unexpected. Troubleshoot. Status - Normal: Expected. No Problem. Status - Shorted to Ground: Expected if shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the setpoint of the engine oil pressure switch. Otherwise unexpected and must troubleshoot. Status - Overload: Unexpected. Troubleshoot. 0: shifter is not in the forward, neutral, or reverse positions or the engine oil pressure is below the setpoint of the engine oil pressure switch and either the speed of the truck has been 0.8kph or less for 1 second or the service brakes are applied 1: shifter is in the forward, neutral, or reverse positions and the engine oil pressure is above the setpoint of the engine oil pressure switch Fault(s): A216, A351
--------------------------------	--

Related circuit diagram



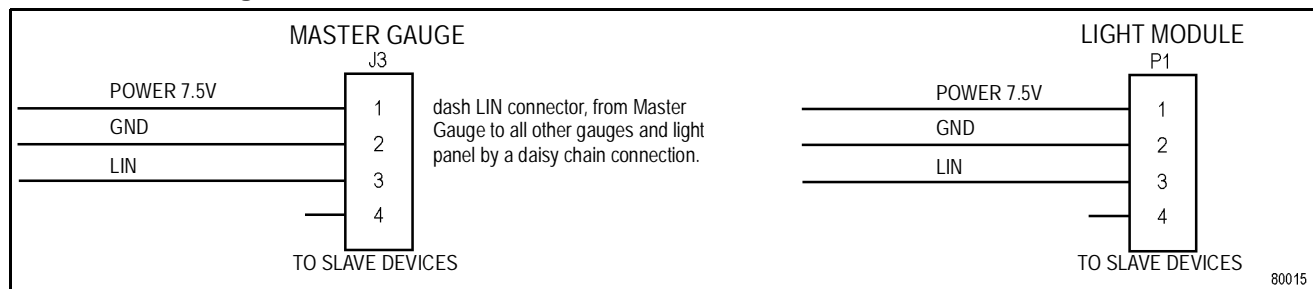
80205

Fault Code A248: Status module within the dash display panel is defective

Operator Action	Go to Shop
Fault Code	A248
Description	Status module within the dash display panel is defective.
Fault Conditions	Sets if dash reports a status module fault. Resets if dash clears the fault or steering bleed comes on.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: STATUS MODULE FLT Display Fault Code: A248
Resulting Problem(s)	Proper operation will be difficult without status information.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

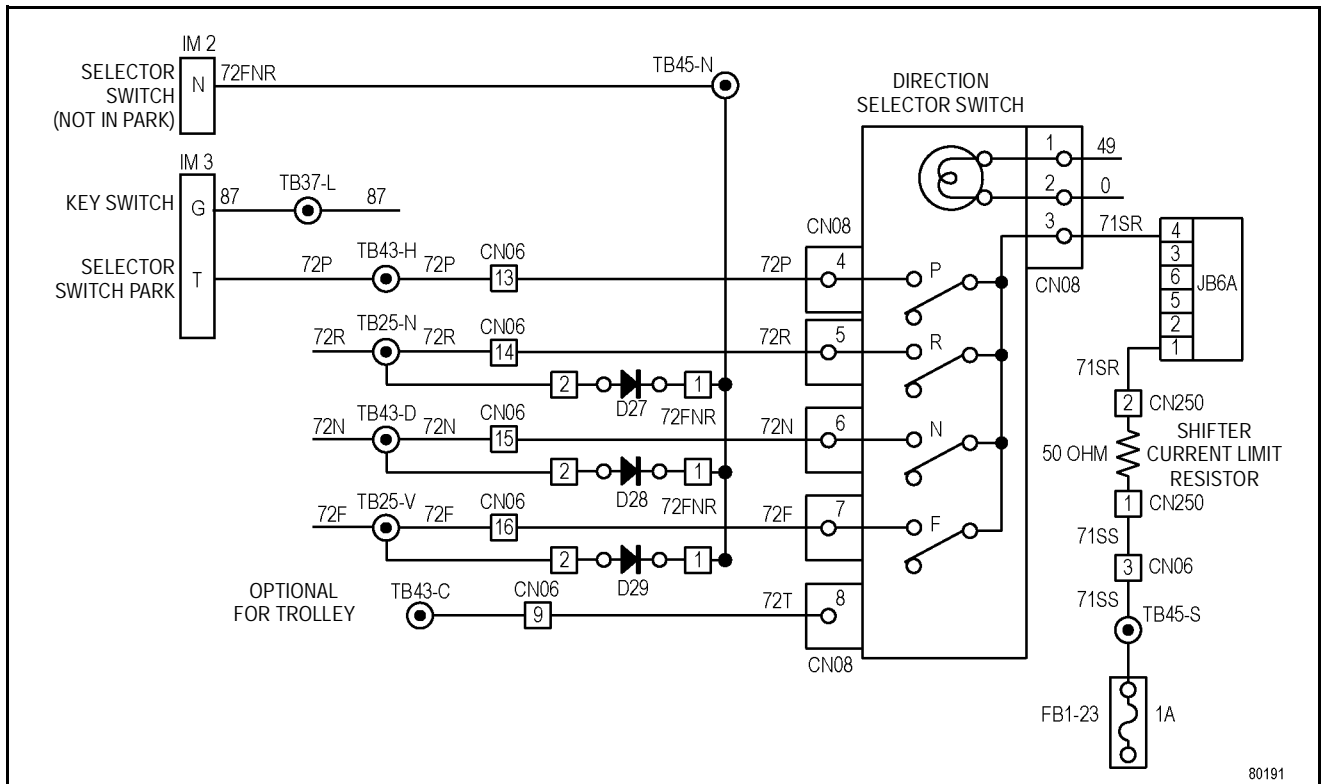
Table	
1. Except for being masked by the steering bleed process, this fault is entirely contained within the dash display panel. The panel and communication to it must be working in order for IM to be aware of the fault. Therefore the only diagnostic effort is to check the status module and wiring within the panel and replace if necessary.	
Parameter	Expected State and/or Related Fault(s)
Steering Bleed Valve	0: steering bleed valve is off 1: steering bleed valve is on

Related circuit diagram



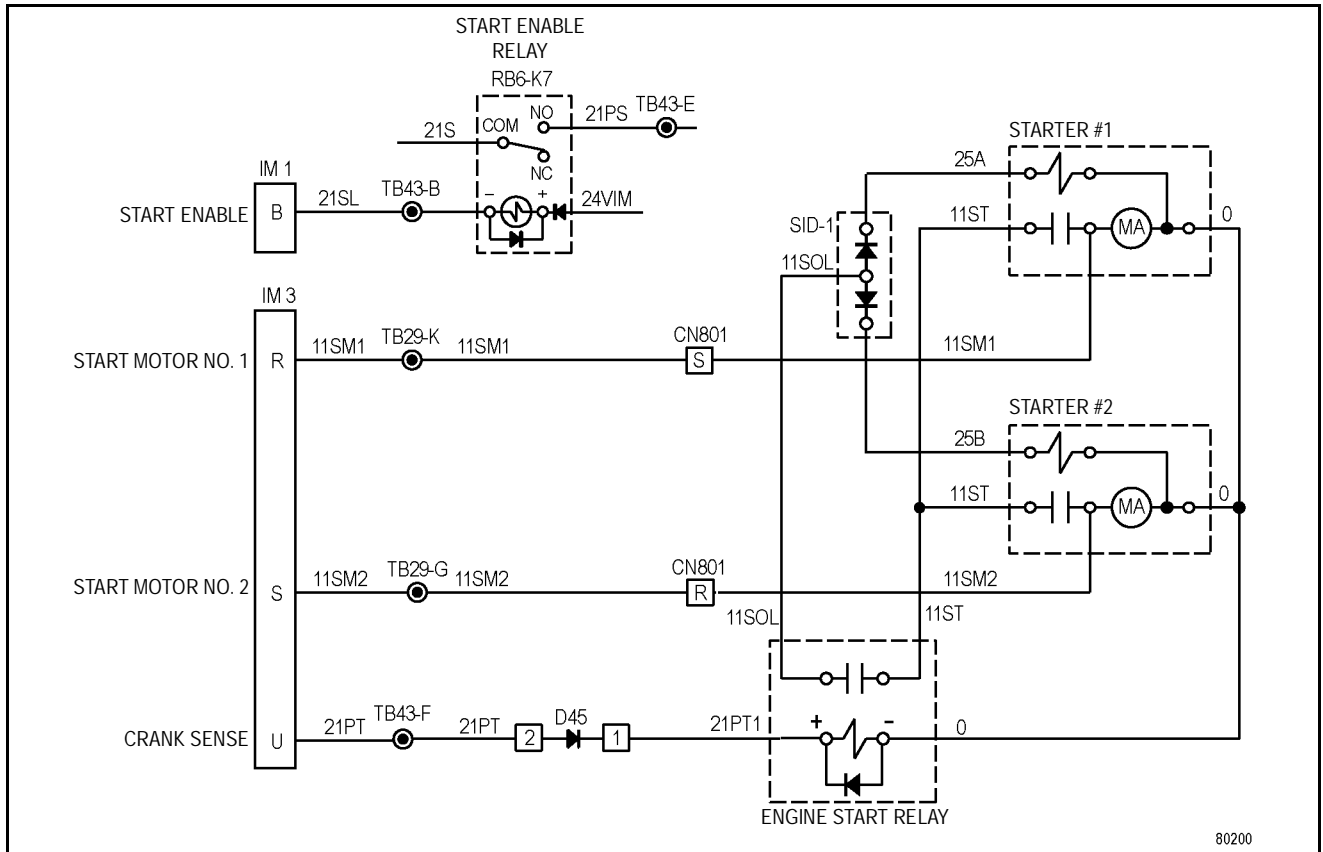
NOTES

Related circuit diagram



80191

Related circuit diagram

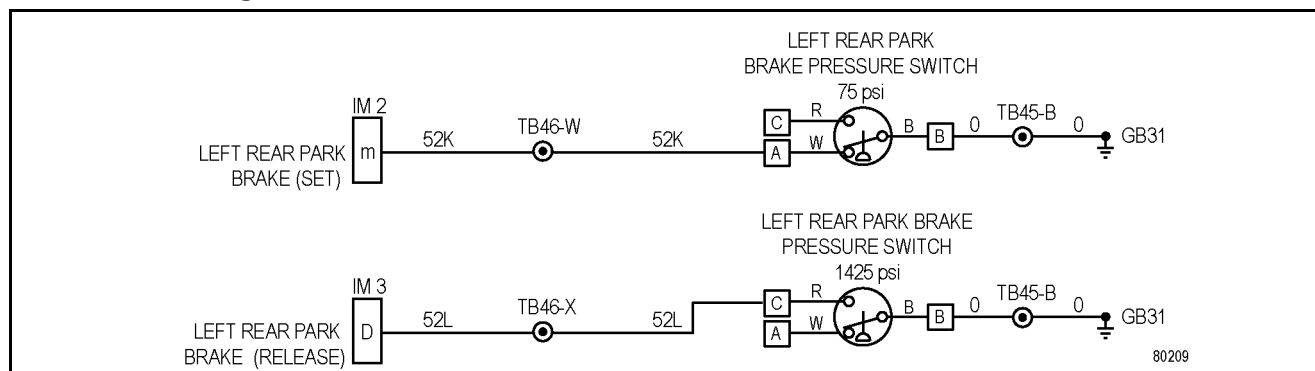


Fault Code A302: The left rear park brake is not releasing

Operator Action	None
Fault Code	A302
Description	The left rear park brake is not releasing.
Fault Conditions	A Park Brake Not Released When Expected fault has been recorded and the left rear park brake set pressure switch is closed or the left rear park brake release pressure switch is open.
Operator Alerting System Response	Repair Lamp Display Fault Description: LR PB NOT RELEASING Display Fault Code: A302
Resulting Problem(s)	Brakes not released can damage the brakes and drive system.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
<p>1. This fault's logic contains more than one parameter, each of which may have its own related fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).</p> <p>2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.</p> <p>3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.</p>	
Parameter	Expected State and/or Related Fault(s)
Left Rear Park Brake Set (IM 2m)	0: parking brake pressure switch indicating low pressure and an applied parking brake 1: parking brake pressure switch indicating higher pressure and an unapplied parking brake Fault(s): A214, A298
Left Rear Park Brake Released (IM 3D)	0: parking brake pressure switch indicating high pressure and a released parking brake 1: parking brake pressure switch indicating low pressure and an applied parking brake Fault(s): A214, A298

Related circuit diagram

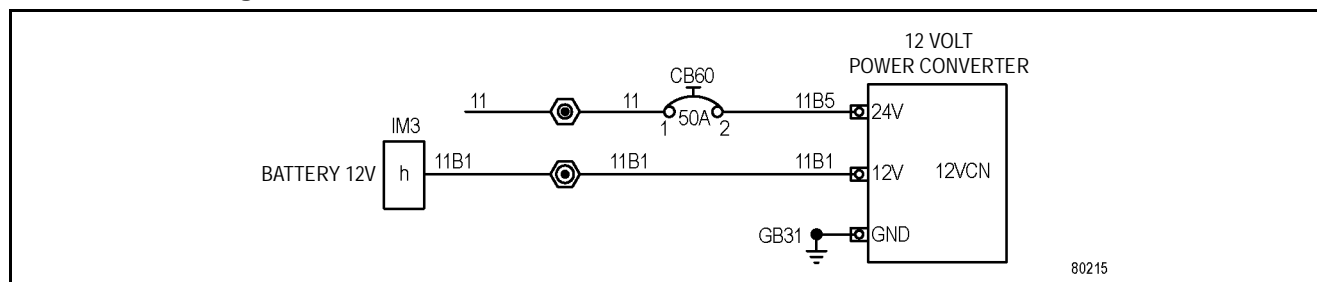


Fault Code A313: (A30004 & Up) DCDC converter 12 volt circuit sensing is producing high readings

Operator Action	None
Fault Code	A313
Description	The DCDC Converter 12 volt circuit sensing is producing high readings.
Fault Conditions	Sets if voltage at 12 volt input rises to 16.1 volts for 3 seconds. Resets if voltage at 12 volt input drops to 15.5 volts for 3 seconds.
Operator Alerting System Response	Repair Lamp Display Fault Description: DCDC 12V SENSE HIGH Display Fault Code: A313
Resulting Problem(s)	Monitoring is lost for the 12 volt battery tap circuit.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table	
1. The primary correction for this fault is to correct any external wiring to the 12 volt input.	
Parameter	Expected State and/or Related Fault(s)
DCDC Converter 12 Volt (IM 3h)	0.2 volts to 16.1 volts: Normal measurement range. <0.2 or >16.1: Bad sensing circuit or external connection.

Related circuit diagram



Fault Code A356: Overload on output 1M

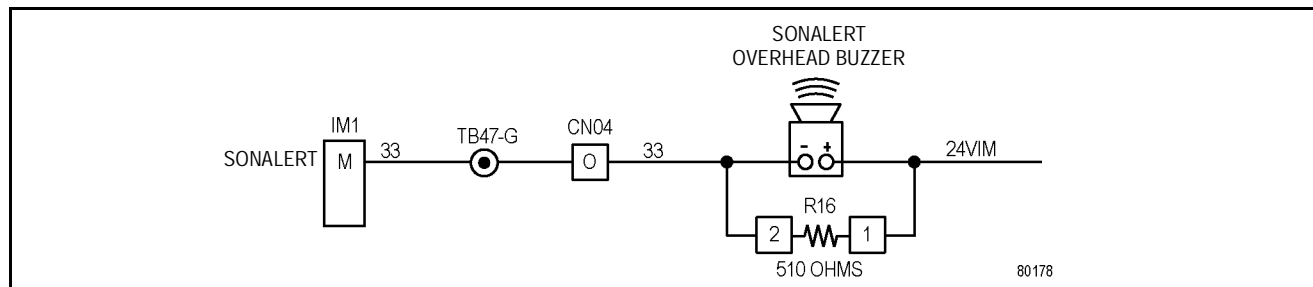
Operator Action	Go to shop now
Fault Code	A356
Description	Overload on output 1M.
Fault Conditions	Sets if driver chip detects overcurrent or over temp on output 1M. Output is turned off when overload is detected. Resets at power down.
Operator Alerting System Response	Sound Buzzer Flash IM Warning Indicator Display Operator Action: GO TO SHOP NOW Display Fault Description: SONALERT IM FAULT Display Fault Code: A356
Resulting Problem(s)	The sonalert with the display cannot be driven.
Related Information	A laptop running "IM Realtime Data Monitor" software may be required to resolve this fault.

Table

1. This fault's logic contains just one parameter, which may have additional fault code(s). This fault may be resolved by resolving the parameter(s) active fault code(s). Refer to the Troubleshooting Instructions for the active parameter fault(s).
2. If there are no active parameter fault codes, then based on the truck's setup while this fault is active, determine which of the parameters in the Table is not shown in its expected state on the IM Realtime Data Monitor program. Refer to the schematic to identify which item(s) may be causing the parameter(s) to be in the unexpected state. Troubleshoot these items.
3. If this fault is not currently active or if no parameters are currently in the unexpected state and the malfunction is still unresolved, then check each of the parameters in the Table for proper functionality. Troubleshoot all item(s) related to the parameter(s) which are found to be malfunctioning.

Parameter	Expected State and/or Related Fault(s)
Sonalert (IM 1M)	Status - Open Load: Unexpected. Troubleshoot. Status - Normal: Expected. No problem. Status - Shorted to Ground: Unexpected. Troubleshoot. Status - Overload: Unexpected. Troubleshoot. 0: No faults are active that require buzzer operation. 1: One or more faults are active that require buzzer action. Fault(s): A251

Related circuit diagram



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Level 1: Warning

Level 1 is used for any event classified as a warning message. These events do not have immediate influence on truck operation, but service is required soon. As the failure may influence the truck operation, if the event persists, service is required as soon as it is convenient. Level 1 events will reset automatically.

Level 1 event classification:

- L1a–Warning: There is no protection reaction, but a message is logged to indicate a possible problem if the event is logged multiple times or stays active for a long period of time.
- L1–Notification: The purpose of this event is just to log an occurrence for information.

Level 2: Minor purposes.

Level 2 is used for any event which causes the drive system to reduce propel power or completely inhibit propel. Retard remains unaffected.

- L2a–The event will reset automatically: This type of event will reset automatically when the conditions are no longer true and the truck is stopped. Propel is affected only while the fault is active. For example: 364 L2a EXT: ENGINE DERATE PROTECTION ACTIVE.
- L2b–The event can be reset by the operator reset button Until the event is reset, propel is inhibited. The event can only be reset once it is no longer active. Retard is not affected.
- L2c–Power reduction: The event causes a reduction of propel torque by a certain percentage. When the event is no longer active, full propel torque is automatically restored.

Level 3: Severe

Level 3 is used for any event that causes the drive system to reduce retard power or completely inhibit retard. Propel is completely inhibited. When this level of event occurs, the service brakes may be required to stop the truck.

- L3a–The event will reset automatically: While the event is active, the affected inverter will be pulse blocked for a certain period of time. Once the event goes inactive, the pulse block is removed.
- L3b–The event can be reset by the operator reset button This event causes the affected inverter to be pulse blocked. Only after resetting the event will the pulse block be removed assuming the event is no longer active.
- L3c–The event can be reset only by cycling 24V power: This event causes the affected inverter to be pulse blocked. Only after cycling 24V power is the pulse block removed.
- L3d–The fault can be reset only by maintenance personnel: This event causes all inverters to be pulse blocked immediately. This event will also cause a total lock to be logged. To reset, maintenance personnel must reset by a service PC or the reset button inside the diagnostic box on the Inverter cabinet.

27 L1B SYS: Regular inhibit fault active

Description	As long as this event is active, it means a regular inhibit of Inverter A, B, ST or field regulator is active. A regular inhibit can be reset by the operator reset button. This event is logged to indicate the system still has a regular inhibit active, though the event which caused the regular inhibit may not be active.
Threshold(s)	Refer to the event logged at the same time as this event for help in determining the cause.
Detection by	CPU (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Event logged causing Inverter A regular inhibit • Event logged causing Inverter B regular inhibit • Event logged causing Inverter ST regular inhibit • Event logged causing field regulator regular inhibit
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (limp mode is possible).
Action to repair	<ul style="list-style-type: none"> • Check which other logged events caused the regular inhibit. • Follow the instruction for the event which caused regular inhibit.
Operator displayed code	S5
Notes	This fault doesn't cause direct protection.
Protection reactions	<ul style="list-style-type: none"> • Warning

DUMP TRUCK

860E 960E

Machine model	Serial number
860E-1K	A30003 and up
860E-1KT	A30003 and up
960E-1K	A50003 and up

40 Troubleshooting

Drive system fault code table, Part 2

50 L3A DSP A: Active current reference at limit	3
51 L1A DSP A: Braking chopper controller at limit	4
52 L3C DSP A: Phase unbalance too large	5
53 L3A DSP A: Pulse block by DSP software	6
54 L3C DSP A: U/F Card defective	7
55 L3C DSP A: Difference in current of phase U over limit	8
56 L3C DSP A: Difference in current of phase W over limit	9
60 L3C DSP B: Initialization fault detected by DSP	10
61 L3C DSP B: SW-Watchdog	11
62 L3C DSP B: Initialization fault detected by CPU	12
63 L1B DSP B: SW-Traco triggered	13
64 L1B DSP B: SW-Traco full	14
65 L3C DSP B: Time slice overflow T1	15
66 L3C DSP B: Time slice overflow T2	15
67 L3C DSP B: Time slice overflow T3	15
68 L3C DSP B: Time slice overflow T4	15

72 L3C DSP B: Current offset during no pulse block

Description	A measured motor phase current for INVB is less than 25A while the paired phase is greater than 100A for 200 ms. This event is logged to indicate a low reading on an INVB motor current transducer. When the inverter is switching, if one of the paired phases is greater than 100A, then the other paired phase must be above 25A to avoid logging this event. The pairings are V/V1, W/W1 of INVB.
Threshold(s)	INVB motor current <<25A (phase V1/V/W1/W) while other paired phase is >>100A (phase V/V1/W/W1).
Detection by	DSP B (G027), T4 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective motor B current transducer for phase V, V1, W, or W1 • Defective U/F card (L063) • Defective DPS B card (G027) • Defective bad power component (IGBT module shorted)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (limp mode is possible). • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace the current sensor according to event 74–77. • Replace defective U/F card (L063). • Replace defective DSP B card (G027). • Replace the defective IGBT module (A201 or A203).
Operator displayed code	S18
Notes	Event 74 to 77 indicates the exact phase having problem.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Main Inverter Temporary Pulse Block • Main Inverter Permanent Pulse Block • Limp Mode

95 L3C DSP T: Time slice overflow T1**96 L3C DSP T: Time slice overflow T2****97 L3C DSP T: Time slice overflow T3****98 L3C DSP T: Time slice overflow T4**

Description	The processing of one time slice of the DSP T-software did not terminate within the allowed time.
Threshold(s)	
Detection by	DSP T (G035), G1~G4 time slice
Possible reasons	<ul style="list-style-type: none"> • Incorrect software for DSP T (G035) • Defective DSP T card (G035)
Action to reset	<ul style="list-style-type: none"> • Switch off/on TCU • Reset by service person via laptop.
Action to repair	<ul style="list-style-type: none"> • Reload DSP T software. • Replace DSP T card (G035). • Consult with KOMATSU.
Operator displayed code	S23
Notes	
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • ST Inverter Temporary Pulse Block • ST Inverter Permanent Pulse Block

114 L3C DSP T: U/F Card defective

Description	Offset or amplification of a U/F card channel is out of the admissible range from the reference value during internal calibration.
Threshold(s)	Offset is >>10% or amplification is >>18%.
Detection by	DSP T (G035), T4 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective U/F card (L071) • Defective DSP T card (G035)
Action to reset	<ul style="list-style-type: none"> • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace U/F card (L071). • Replace DSP T card (G035)*.
Operator displayed code	S27
Notes	*Software needs to be reloaded if DSP T card is replaced.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • ST Inverter Temporary Pulse Block • ST Inverter Permanent Pulse Block

135 L3C IO: CPU Reset triggered

Description	CPU reset performed by monitor or recessed red push button on CPU card (G011).
Threshold(s)	
Detection by	I/O card (G043), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Push button (red) on the front panel of CPU card (G011) was pressed. • Reset command is active via monitor program. • Defective CPU card (G011). • Defective SiBAS backplane wiring.
Action to reset	<ul style="list-style-type: none"> • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Check push button on the front panel of CPU card (G011). • Replace defective CPU card (G011). • Consult with KOMATSU before replacing SiBAS backplane.
Operator displayed code	S42
Notes	This event normally only logs when the recessed red pushbutton on the CPU card is pressed, since this interrupts normal software operation.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • Field Regulator Inhibit • Turn On Choppers • Main Inverter Temporary Pulse Block • ST Inverter Temporary Pulse Block • Total Block

186 L3C UWSA1: Configuration failure

Description	At least one of the following configuration errors is active: <ul style="list-style-type: none"> • FPGA version monitor module. • DC Bus regulator is in CPU software. • Switching frequency monitor module. • Peak current counter monitor module.
Threshold(s)	
Detection by	CPU card (G011), T8 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective UWSA1 card (G055) • Incorrect CPU software (G011)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (For limp mode). • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace defective UWSA1 card (G055). • Load correct CPU software. • Consult with KOMATSU.
Operator displayed code	S60
Notes	
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Main Inverter Permanent Pulse Block • Limp Mode

214 L3C UWSB1: GW Comparator faulty during start-up test

Description	A hardware comparator on the UWSB1 card failed during the comparator test during SIBAS® initialization. Hardware comparator on UWSB1 card include: <ul style="list-style-type: none"> • Bus voltage sensor B (U32) • Motor B phase current V and W (U201 & U203).
Threshold(s)	
Detection by	CPU card (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective UWSB1 card (G063) • Incorrect FPGA for UWSB1 card (G063) • Incorrect CPU software
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (Limp mode may be available). • Switch off/on ignition. • Reset by service person via laptop.
Action to repair	<ul style="list-style-type: none"> • Replace defective UWSB1 card (G063) • Load correct software for CPU
Operator displayed code	S70
Notes	If the comparator for the DC bus voltage sensor B fails, the start-up sequence will not start (operation is not available). If the comparator for either current sensor fails, a permanent inhibit occurs for inverter B.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • Field Regulator Inhibit • Main Inverter Temporary Pulse Block • Main Inverter Permanent Pulse Block • ST Inverter Temporary Pulse Block • Limp Mode

246 L3C UWSA2: Configuration failure

Description	At least one of the following configuration errors is active: <ul style="list-style-type: none"> • FPGA version monitor module • Switching frequency monitor module • Peak current counter monitor module
Threshold(s)	
Detection by	CPU card (G011), T8 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective UWSA2 card (G071) • Incorrect CPU software (G011)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (For limp mode). • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace defective UWSA2 card (G071). • Load correct CPU software. • Consult with KOMATSU.
Operator displayed code	S80
Notes	
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Main Inverter Permanent Pulse Block • Limp Mode

278 L3A UWSB2: Peak current protection active

Description	One of inverter B2 output current exceeds the limit (GW4). Currents monitored include: <ul style="list-style-type: none"> • Inverter B phase V1 (U202) • Inverter B phase W1 (U204)
Threshold(s)	Current >>2150A
Detection by	UWSB2 card (G079), T1 time slice
Possible reasons	<ul style="list-style-type: none"> • Bad/abnormal road condition • Power cable wiring problem on motor B • Defective current transducer for inverter B (U202, U204) • Defective U/F card (L063) • Defective analog interface card (L079) • Defective UWSB2 card (G079) • Defective IGBT module of inverter B (A201, A202, A203) • Defective motor B
Action to reset	<ul style="list-style-type: none"> • Automatic reset 2 seconds after current <<1900A (GW2).
Action to repair	<ul style="list-style-type: none"> • Sporadic events are admissible and do not require corrective action. • Check power cable connections on motor B. • Replace defective current transducer (U202, U204). • Replace U/F card (L063). • Replace defective analog interface card (L079). • Replace UWSB2 card (G079). • Replace defective IGBT module (A201, A202, A203). • Replace defective motor B.
Operator displayed code	W35
Notes	Inverter B is shutoff for 2 seconds and motor B torque is reduced by 80% for 3 seconds.
Protection reactions	<ul style="list-style-type: none"> • Power Reduction • Propel Inhibit • Main Inverter Temporary Pulse Block

305 L1A UWSST: ADC Faulty

Description	The conversion time for an AD converter on the ST inverter protection card (UWSST) G087 card is exceeded.
Threshold(s)	Conversion time >40 μ s.
Detection by	CPU card (G011), T3 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective UWSST card (G087) • Incorrect CPU software (G011)
Action to reset	<ul style="list-style-type: none"> • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace defective UWSST card (G087). • Load correct CPU software (G011).
Operator displayed code	S100
Notes	
Protection reactions	<ul style="list-style-type: none"> • Warning

342 L1A ETM: ADC Failure for ETM3

Description	The conversion time for the AD converter on the ETM3 card (G143) was exceeded. This card measures various temperature sensors in the drive system.
Threshold(s)	Conversion time >>40 μs.
Detection by	CPU (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective I/O card (G055)
Action to reset	<ul style="list-style-type: none"> • Switch off/on ignition.
Action to repair	<ul style="list-style-type: none"> • Replace defective I/O card (G055).
Operator displayed code	W48
Notes	The temperatures are set at 300°C or 83°C and may cause other faults when ADC is faulty.
Protection reactions	<ul style="list-style-type: none"> • Warning

364 L2A EXT: Engine derate protection active

Description	The engine OK feedback signal is not active for more than 2 seconds while the system's bus voltage is more than 900V. The output from the engine used for this is the same pin that causes the red engine light to activate. A relay is normally added because the drive system is expecting the input to be 24V when everything is OK.
Threshold(s)	Input not seen for >>2 seconds with precharging finished (bus voltage >>900V)
Detection by	CPU (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • If red engine light is on, problem with engine (e.g., low coolant) • Wiring problem for engine derate signal into drive system • Defective digital input card (G111)
Action to reset	<ul style="list-style-type: none"> • Automatically reset (once input is active)
Action to repair	<ul style="list-style-type: none"> • Have engine service person check the engine fault and fix the problem. • Check wiring problem from engine derate signal into drive system. • Replace digital input card (G111) if input is 24V but fault is still active.
Operator displayed code	S122
Notes	While this event is active, propel and engine testing is blocked. Retard is still possible.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit

388 L2B BEF: CB113 Tripped

Description	CB113 feedback indicates it is open over 200 ms.
Threshold(s)	
Detection by	CPU (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Circuit breaker CB113 has tripped from an overload • Power cabling problem after CB113 • Defective filter capacitor at the output of CB113 (C31) • Defective circuit breaker (CB113) • Defective digital input card (G119) • Defective water pump or inner radiator motor (M05, M06)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button.
Action to repair	<ul style="list-style-type: none"> • Locate the reason for causing CB113 overload. • Check the power cabling after CB113. • Replace defective capacitor at output of CB113 (C31). • Replace defective circuit breaker (CB113). • Replace digital input card (G119) if SIBAS[®] doesn't read the correct input. • Replace water pump motor (M05). • Replace inner radiator (M06).
Operator displayed code	S136
Notes	This event only causes a propel and engine test inhibits, but if CB113 has really tripped, a water pressure event code will log as well as blocking all inverter operation.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Engine Self-Load Test Inhibit

404 L3A IUW: DC Link voltage out of range retard

Description	The DC bus voltage is out of the admissible range in retard. The voltage measured by DC link voltage sensor A (U31) is used unless there is an active fault affecting this sensor, in which case the measured voltage from sensor B (U32) is used.
Threshold(s)	Measured voltage <<775V or >>2175V.
Detection by	CPU (G011), T4 time slice
Possible reasons	<ul style="list-style-type: none"> • Open/short circuit at field regulator output to the main alternator field • Defective rotating diode(s) inside main alternator • Wiring problem for field regulator control power or command • Defective main rectifier (A1) • Power cabling problem from main alternator to main rectifier • Defective field regulator (A107) • Short circuit inside power section of drive system • Bus voltage control issue • Defective I/O card (G043)
Action to reset	<ul style="list-style-type: none"> • Automatic reset.
Action to repair	<ul style="list-style-type: none"> • Check ohm value at the output of contactor K111 (alternator field). Value should be 7–8 ohms. • Replace blown fuse (FU107) feeding 24V to field regulator (A107). • Check rotating diodes inside rear of alternator and main rectifier (A1). • Do off-line test of field regulator to confirm operation. • Check for short circuit on power section of drive system (failed IGBT module). • Consult with KOMATSU about bus control issue. • Replace defective I/O card (G043).
Operator displayed code	S150
Notes	While this event is active, retard is inhibited.
Protection reactions	<ul style="list-style-type: none"> • Retard Inhibit

422 L3C IUW: ST Inverter failure

Description	The measured output rms current of the ST inverter is not within the limits during operation. The minimum of the three measured rms currents is compared to the threshold value after the ST inverter is outputting a frequency above 70 Hz.
Threshold(s)	A table with expected current values based on the ST output frequency is used. A frequency of 70Hz–120 Hz relates to 24A–80A.
Detection by	CPU (G011), T4 time slice
Possible reasons	<ul style="list-style-type: none"> • Defective ST output current transducer(s) (U301, U302, U303) • Wiring problem for the grid blower motor, main blower motor, ST output, or transformer • Defective grid blower motor • Defective main blower motor • Defective U/F card (L071) • Defective DSP card (G035)
Action to reset	<ul style="list-style-type: none"> • Reset by service person via laptop. • Switch ignition off/on.
Action to repair	<ul style="list-style-type: none"> • Replace defective ST output current transducer(s) (U301, U302, U303). • Check cabling to grid blower motor, main blower motor, ST output, and transformer (check for crossed connections to different transformer taps, etc.). • Replace defective grid blower motor. • Replace defective main blower motor. • Replace defective U/F card (L071). • Defective DSP card (G035).
Operator displayed code	S160
Notes	Inverter A and B are blocked immediately when event occurs. inverter A, B, and ST are permanently inhibited if active longer then 5 seconds.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • Main Inverter Temporary Pulse Block • Main Inverter Permanent Pulse Block • ST Inverter Permanent Pulse Block

440 L3C SIV: Start-up sequence can't pass due to K103/K105 failure

Description	During the start-up sequence, the testing of contactors K103 and K105 failed. These are the AC grid blower output contactors. During this step, each contactor is closed, and the feedback is verified. If the feedback from K103 and/or K105 does not indicate the contactor is closed when commanded, this event is logged, and the start-up sequence stops.
Threshold(s)	Status of K103 and/or K105 does not match the command.
Detection by	CPU (G011), T6 time slice
Possible reasons	<ul style="list-style-type: none"> • Wiring problem from SIBAS® to K103 and/or K105 • Defective digital input card (G119) • Defective contactor K103 and/or K105 • Defective digital output card (C019)
Action to reset	<ul style="list-style-type: none"> • Switch ignition off/on.
Action to repair	<ul style="list-style-type: none"> • Check wiring for K103 and K05 command feedback. • Replace contactor K103 and/or K105 if status doesn't change with command. Visually verify contactor(s) are closed. • Replace digital input card (G119) if SIBAS® doesn't read the correct input. • Replace digital output card (C019) if command doesn't show at the pin of the output card.
Operator displayed code	S170
Notes	Until the start-up sequence is completed, there is no operation possible.
Protection reactions	<ul style="list-style-type: none"> • Propel Inhibit • Retard Inhibit • Engine Self-Load Test Inhibit • Field Regulator Inhibit • Main Inverter Temporary Pulse Block • ST Inverter Temporary Pulse Block

457 L2C TMP: IGBT Module A102 temperature > APRS limit

Description	<p>Temperature reading from the IGBT module A102 is below the low limit for more then 1 second.</p> <p>IGBT module has a temperature sensor attached to the bottom side of the heat sink. This sensor is a separate part from the IGBT module and attaches via a peel and stick adhesive backing.</p> <p>The sensor is an RTD type with the characteristic of 100 ohms at 0°C.</p>
Threshold(s)	At least one measured temperature >>64°C.
Detection by	CPU (G011), T7 time slice
Possible reasons	<ul style="list-style-type: none"> • Ambient temperature is too high, system only rated to +55°C • Wiring problem from SIBAS® to IGBT module temperature sensor(s) • Defective temperature sensor (PT201, PT202, PT203) • ST output frequency is not high enough • Defective temperature sensor interface card (G143) • Defective system coolant pump (M05) • Defective drive system radiator • Defective I/O interface card (G043)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (limp mode A is possible). • Automatic reset (when temperature <<62°C)
Action to repair	<ul style="list-style-type: none"> • Check/repair wiring from SIBAS® to IGBT module temperature sensor(s) (PT201, PT202, PT203). • Replace temperature sensor (PT201, PT202, PT203). • Check if ST is running at maximum frequency. • Replace temperature sensor interface card (G143). • Replace defective system coolant pump (M05). • Replace defective drive system radiator. • Replace defective I/O card (G043).
Operator displayed code	W102
Notes	<ul style="list-style-type: none"> • While this event is active, maximum motor B torque is reduced by 25%.
Protection reactions	<ul style="list-style-type: none"> • Warning

475 L2C TMP: Wheel motor A, DE bearing temperature > warning limit

Description	Wheel motor A drive end (DE) bearing temperature is above the warning limit for more than 1 second (grid side of truck). In each motor there are two RTD type temperature probes extending into the motor's DE and NDE bearing. This RTD type sensor has the characteristics of 100 ohms at 0°C.
Threshold(s)	Measured temperature >>100°C.
Detection by	CPU (G011), T7 time slice
Possible reasons	<ul style="list-style-type: none"> • Ambient temperature is too high, system only rated to +55°C • Wiring problem from SIBAS® to motor A DE bearing temperature sensor • Broken air duct for wheel motor A cooling • Defective motor A DE bearing temperature sensor • Defective temperature sensor interface card (L163) • Planetary gears on grid side overheating • Motor A DE bearing needs grease added (follow maintenance intervals and procedure for correct type/amount of grease) • Defective I/O card (G043) • Defective motor A DE bearing
Action to reset	<ul style="list-style-type: none"> • Automatic reset (when temperature <<90°C).
Action to repair	<ul style="list-style-type: none"> • Check/repair wiring from SIBAS® to motor A DE bearing temperature sensor. • Check air duct from main blower to wheel motor A inlet. • Replace defective wheel motor A DE bearing temperature sensor. • Replace temperature input card (L163). • Measure planetary gear temperatures; refer to truck manufacturer documentation for limits. • Add grease based on maintenance interval and procedure guidelines. • Replace defective I/O card (G043). • Replace defective bearing; requires motor A removal and rebuild.
Operator displayed code	W104
Notes	While this event is active, maximum motor A torque is reduced by 25%.
Protection reactions	<ul style="list-style-type: none"> • Power Reduction

493 L1A TMP: Cooling water delta T too high

Description	The difference between system coolant entering and leaving the inverter sections is higher than the allowed design limitation while the ST inverter is operating.
Threshold(s)	Difference of temperatures >>8°C.
Detection by	CPU (G011), T7 time slice
Possible reasons	<ul style="list-style-type: none"> • Ambient temperature is too high, system only rated to +55°C • Wiring problem from SIBAS® to coolant inlet temperature sensor • Wiring problem from SIBAS® to coolant outlet temperature sensor • Defective temperature sensor (PT4) • Defective temperature sensor (PT5) • ST output frequency is not high enough • Defective temperature sensor interface card (L155) • Defective system coolant pump (M05) • Defective drive system radiator • Defective I/O interface card (G043)
Action to reset	<ul style="list-style-type: none"> • Automatic reset (when temperature <<55°C).
Action to repair	<ul style="list-style-type: none"> • Check/repair wiring from SIBAS® to coolant inlet/outlet temperature sensor(s) (PT4, PT5). • Replace temperature sensor(s) (PT4, PT5). • Check if ST is running at maximum frequency. • Replace temperature sensor interface card (L155). • Replace defective system coolant pump (M05). • Replace defective drive system radiator. • Replace defective I/O card (G043).
Operator displayed code	S190
Notes	
Protection reactions	<ul style="list-style-type: none"> • Warning

554 L2C TMP: Inverter B module temperature > APRS limit

Description	At least one temperature reading from the inverter B IGBT module is above the automatic power reduction (APRS) limit for more than 1 second. Each IGBT module has a temperature sensor attached to the bottom side of the heat sink. This sensor is a separate part from the IGBT module and attaches via a peel and stick adhesive backing. This RTD type sensor has the characteristics of 100 ohms at 0°C.
Threshold(s)	At least one measured temperature >>64°C.
Detection by	CPU (G011), T7 time slice
Possible reasons	<ul style="list-style-type: none"> • Ambient temperature is too high, system only rated to +55°C • Wiring problem from SIBAS® to IGBT module temperature sensor(s) • Defective temperature sensor (PT201, PT202, PT203) • ST output frequency is not high enough • Defective temperature sensor interface card (G143) • Defective system coolant pump (M05) • Defective drive system radiator • Defective I/O interface card (G043)
Action to reset	<ul style="list-style-type: none"> • Press operator reset button (limp mode A is possible). • Automatic reset (when temperature <<62°C).
Action to repair	<ul style="list-style-type: none"> • Check/repair wiring from SIBAS® to IGBT module temperature sensor(s) (PT201, PT202, PT203). • Replace temperature sensor (PT201, PT202, PT203). • Check if ST is running at maximum frequency. • Replace temperature sensor interface card (G143). • Replace defective system coolant pump (M05). • Replace defective drive system radiator. • Replace defective I/O card (G043).
Operator displayed code	W102
Notes	While this event is active, maximum motor B torque is reduced by 25%.
Protection reactions	<ul style="list-style-type: none"> • Warning

NOTES

Replacement of air conditioning system components



Never use any lubricant or joint compound to lubricate or seal any A/C connections.

Hoses and fittings

When replacing hoses, use the same type and ID hose you removed. When hoses or fittings are shielded or clamped to prevent vibration damage, ensure that these are in position or secured.

Lines

Always use two wrenches when disconnecting or connecting A/C fittings attached to metal lines. Copper and aluminum tubing can kink or break very easily. When grommets or clamps are used to prevent line vibration, ensure that these are in place and secure.



It is important to always torque fittings to the proper torque. Failure to do this may result in improper contact between mating parts and leakage may occur. Refer to the following torque chart for tightening specifications.

Fitting Size	Torque
6	14 - 20 N·m (10 - 15 ft lb)
8	33 - 39 N·m (24 - 29 ft lb)
10	36 - 42 N·m (26 - 31 ft lb)
12	41 - 47 N·m (30 - 35 ft lb)

Installation torque for the single M10 or 3/8 in. capscrews securing the inlet and outlet fittings onto the compressor ports is **15 - 34 N·m (11 - 25 ft lb)**.

Expansion valve

When removing the expansion valve from the system, remove the insulation, clean the area and disconnect the line from the receiver-drier. Detach the capillary (bulb) and external equalizer tube (if present) from their mounting locations. Remove the expansion valve from the evaporator inlet. Expansion valve service is limited to cleaning or replacing the filter screen. If this is not the problem, replace the valve. Secure the capillary and equalizer, if used, to clean surfaces and replace or attach any insulating material.

Receiver-drier

The receiver-drier can not be serviced or repaired. It must be replaced whenever the system is opened for any service. The receiver-drier has a pressure switch to control the clutch, and should be removed and installed onto the new unit.

Thermostat

A thermostat can be stuck open or closed due to contact point wear or fusion. The thermostat temperature sensing element (capillary tube) may be broken or kinked closed and therefore unable to sense evaporator temperature.

When thermostat contact points are stuck open or the sensing element can not sense temperature in the evaporator, the clutch will not engage (no A/C system operation). Causes are a loss of charge in the capillary tube or a kink, burned thermostat contact or just no contact. When troubleshooting, bypass the thermostat by hot wiring the clutch coil with a fused lead. If the clutch engages, replace the thermostat.

Thermostat contact points may be fused (burned) closed and the clutch will not disengage. Causes are a faulty switch that could be due to fatigue. The thermostat must be replaced. When the clutch will not disengage you may also note that condensate has frozen on the evaporator fins and blocked air flow. There will also be below normal pressure on the low side of the system. Side effects can be compressor damage caused by oil accumulation (refrigeration oil tends to accumulate at the coldest spot inside the system) and lower than normal suction pressure that can starve the compressor of oil.

⚠ DANGER

When inflating tires, always use a safety cage. Never inflate a tire until the lock ring is securely in place. Do not stand in front of or over the lock ring during inflation procedures. Never overinflate a tire. Refer to tire manufacturers recommendations.

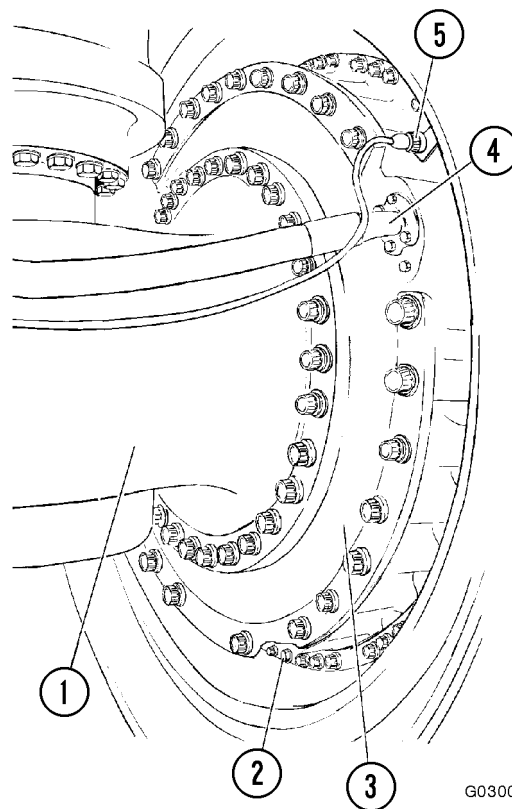
- 12. Place the tire and wheel assembly in a safety cage. Remove the valve core from the valve stem and inflate the tire to seat the beads of the tire and the O-ring as specified by the tire manufacturer.
- 13. If the beads of the tire and O-ring do not seat within one minute, raise the tire slightly and tap bead seat band (6). This will help the air pressure to push the tire bead out into position.
- 14. As soon as the seating has been accomplished, install the valve core and inflate the tire to the recommended tire pressure.

Removal and installation of front wheel hub and spindle

The following instructions will cover the complete removal, installation, disassembly, assembly and bearing adjustment of the front wheel hub and spindle. If only brake service is to be performed, refer to Disassembly and assembly section **Brake system**.

⚠ WARNING

Do not loosen or disconnect any hydraulic line or component until the engine is stopped, the key switch is OFF for 90 seconds, and the brake accumulators are depressurized.



G030019

FIGURE 50-10. FRONT WHEEL & SPINDLE REMOVAL

- 1. Spindle
- 2. Brake Oil Drain Plug
- 3. Disc Brake Housing
- 4. Brake Cooling Line
- 5. Speed Sensor Connector

6. The hardened washers used in this application could be punched during the manufacturing process. Therefore, they must be assembled with the punch lip away from head of the mounting cap screws to prevent damage to the fillet between cap screw head and shank. Refer to Figure 50-21.
7. Install the lubricated mounting hardware for Group 1, Figure 50-22. Tighten each cap screw to **542 N·m (400 ft lb)**.

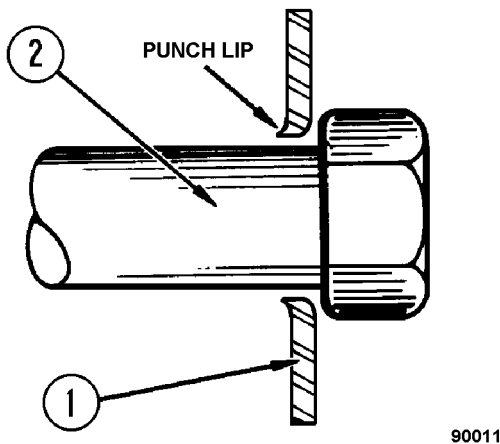


FIGURE 50-21. MOUNTING HARDWARE

1. Washer
2. Capscrew

⚠ IMPORTANT ⚠

Install and tighten all of the hardware in a group before proceeding to the next group in the tightening sequence. Remove the guide pins that were installed in step 6 when installing the hardware for Groups 3 and 4.

8. Repeat steps 4 - 7 for each remaining group in the tightening sequence. Refer to Figure 50-22.
9. After all of the hardware in all of the groups has been installed and tightened to **542 N·m (400 ft lb)**, move back to Group 1. Increase the torque on each cap screw in Group 1 to **2 006 N·m (1,480 ft lb)**. Repeat this step for each remaining group in the tightening sequence.

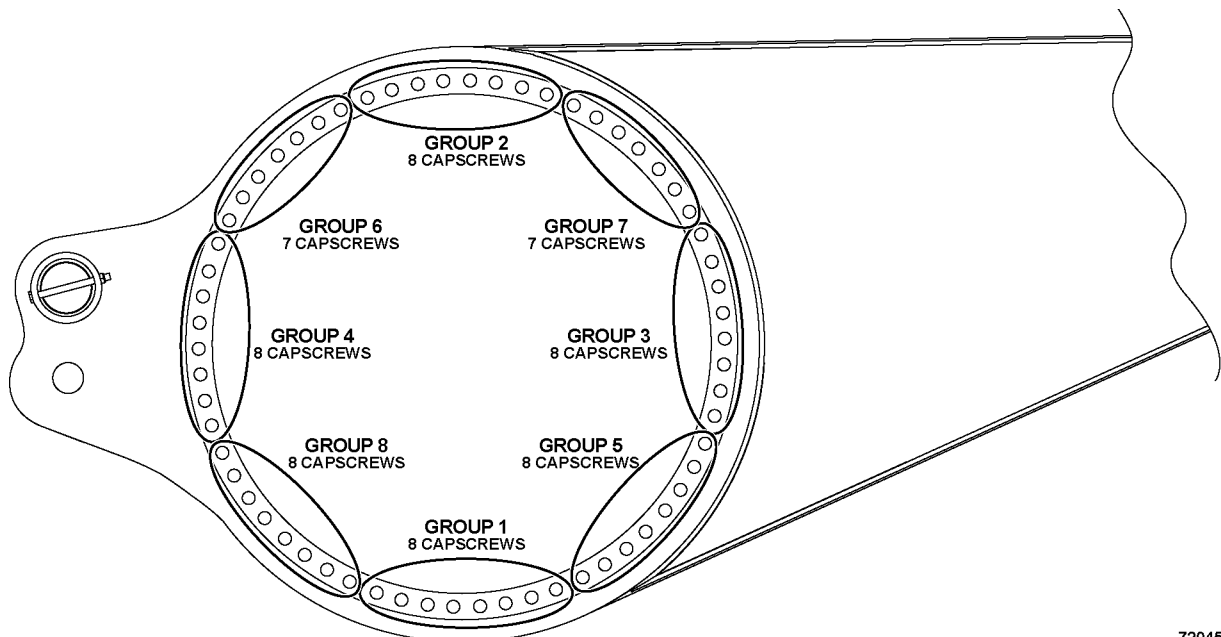


FIGURE 50-22. WHEEL MOTOR MOUNTING HARDWARE INSTALLATION SEQUENCE

72045

9. After bearing (2, Figure 50-47) has cooled, lubricate the bearing and race with clean wheel motor oil.
10. Remove the three cap screws that are holding hub adaptor and spacer to tool (3, Figure 50-48). This will allow stud from hub (1) to go through hub adapter. Leave spacer and tool attached to brake housing.
11. Attach lifting slings and a hoist to hub (1). The weight of the hub is approximately 2210 kg (4872 lb).
12. Carefully lift hub (1, Figure 50-48) and install onto the spindle and bearing.
13. Apply Three Bond (TB1374) thread locker to studs (2).
14. Install 36 nuts and tighten to **1 196 ± 176 N·m (882 ± 130 ft lb)**.



FIGURE 50-48.

- 1. Hub
- 2. Stud
- 3. Tool

15. Remove tool (3) at three places from between the hub adaptor and the brake assembly.
16. Heat outer bearing (1, Figure 50-49) to $90 \pm 10^\circ\text{C}$ ($194 \pm 50^\circ\text{F}$).
17. Attach lift eyes to outer bearing (1). Attach lifting chains and a hoist to the lift eyes. The inner bearing weighs approximately 140 kg (309 lb).
18. Lift the bearing over the outer bearing race in the hub. Lower the bearing into the outer bearing race. After the bearing has cooled, lubricate bearing and race with clean wheel motor oil.
19. Attach two lift eyes (M16 x 2.00) to retainer (1, Figure 50-50). Attach lifting chains and a hoist to the lift eyes and lift the retainer onto the bearing. The retainer weighs approximately 95 kg (209 lb).
20. Install seven cap screws (2). Leave an open hole in between each cap screw. Alternately tighten the cap screws just enough to secure the bearing in place.

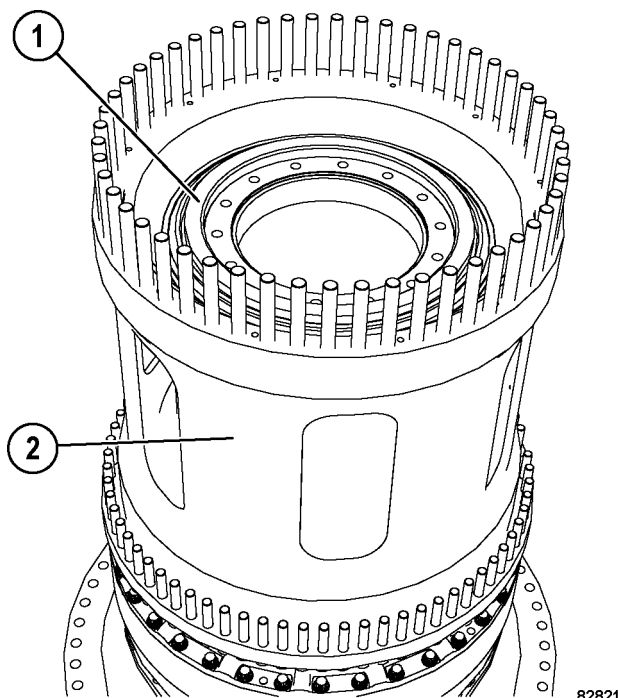
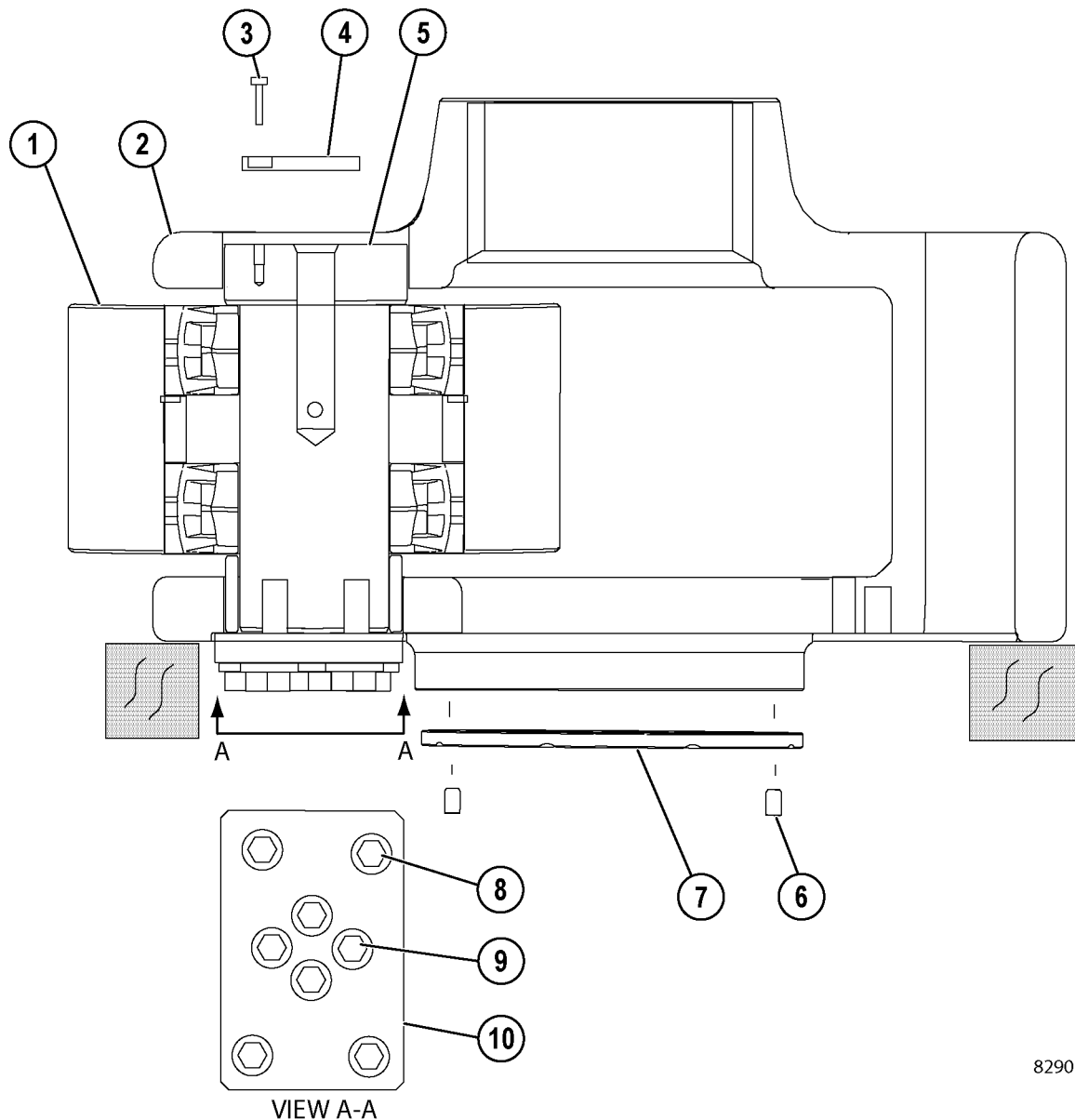


FIGURE 50-49.

- 1. Outer Bearing
- 2. Hub

- 12. Insert cooled shaft into the carrier and through the bearings. Each shaft must be installed with the cap screw holes lined up with the reference lines as shown in Figure 50-80.
- 13. Once shaft is fully inserted into carrier, install all four cap screws (9) with flat washers through holder (10) and into shaft (5). Rotate shaft as necessary to line up holes. Do not tighten cap screws (9) at this time.
- 14. Apply Three Bond (TB1374) to cap screws (8) and install with flatwashers through the holder and into the carrier. Rotate the holder as necessary to line up holes. Tighten capscrews (8) to **550 ± 60 Nm (405 ± 45 ft lb)**.
- 15. While rotating gear (1), tighten cap screws (9) in even increments. The gear must be rotated 20 times during the tightening process. Tighten cap screws (9) to a final torque of **550 ± 60 Nm (405 ± 45 ft lb)**.



82901

FIGURE 50-79. CARRIER

- | | | |
|--------------|------------------|----------------------------|
| 1. Gear | 5. Shaft | 8. Cap Screw & Flat Washer |
| 2. Carrier | 6. Pin | 9. Cap Screw & Flat Washer |
| 3. Cap Screw | 7. Thrust Washer | 10. Holder |
| 4. Plate | | |

7. Install sleeve packing seal (10). Refer to Details "A" and "B" in Figure 50-12 and install O-rings (22) and (24) and backup rings (21) and (23) in the grooves of sleeve (9).
8. Apply a light film of oil to the sleeve seals. Carefully push sleeves (9) into their respective bores in the valve body until the flange at the base of each sleeve contacts the valve body.
9. Preassemble regulator spool (12) as follows:
 - a. Insert spool springs (11) into the spool bore.
 - b. Insert reaction plungers (8) into the spool bores and springs.
10. Install the regulator spool assemblies into their respective sleeve bores. The spherical end must be inserted toward the spring seat. Push them into the bore until contact is made with the lower spring seat.
11. Install sleeve retainer plug packing (4) in the valve body.
12. Verify that spring seats (13) and (15) are positioned properly in regulator springs (14) and that reaction plunger (8) slides smoothly in its bore. Install retaining plug (5) in the valve body counterbore.
13. Position sleeve retainer (6) on the valve body. Install four cap screws and washers (7). Tighten the cap screws evenly to properly seat plug (5) in the counterbore. Then tighten the cap screws to a final torque of **16 - 17 Nm (140 - 150 in lb)**.
14. Tighten two cap screws (3) that hold manifold body (1) to valve body (2) to **20 - 21 Nm (180 - 190 in lb)**.
15. Install plugs (19) in the manifold body ports. Tighten the larger plugs to **31 - 34 Nm (275 - 300 in lb)**. Tighten the smaller plugs (installed in the "TC1" and "TC2" ports) to **10 - 11 Nm (90 - 100 in lb)**.

Removal and installation of brake manifold

Removal

NOTE: If the brake manifold is leaking oil, an O-ring or cartridge can be replaced without removing the manifold from the truck. Refer to "Disassembly and assembly of brake manifold".



Before disconnecting pressure lines, replacing components in the hydraulic circuits, or installing test gauges, always bleed down the steering and brake accumulators.

1. Shut down the truck. For the proper shutdown procedure, refer to Index and foreword section **Operating instructions**.
2. Open bleed down valves (1, Figure 50-13) and (2) to depressurize the brake accumulators.
3. To verify that the brake accumulators are depressurized, press the brake lock switch (key switch ON, engine off) and applying the service brake pedal. The service brake light should not come on.
4. Close the bleed down valves by rotating them clockwise.

NOTE: If the manifold must be removed from the truck, disconnect only the hydraulic lines and wires that are necessary to allow removal.

5. Disconnect and plug all necessary lines and ports to prevent possible contamination.
6. Remove the mounting hardware and move the brake manifold to a clean work area for disassembly.

Floating ring seal assembly and installation

Failures are usually caused by combinations of factors rather than one single cause, but many failures have one common denominator: **assembly error!**

Floating ring seals should **always** be installed in **matched** pairs; that is, two *new* rings or two rings *that have previously run together*. Never assemble one new ring and one used ring, or two used rings that have not previously run together.

ALWAYS USE NEW TORIC RINGS!

1. Inspect the seal surfaces and mounting cavities for rough tool marks or nicks that may damage rubber seal rings. Hone them smooth and clean, if required.
2. Remove any oil, dust, protective coating or other foreign matter from the metal seal rings, the toric rings, and both the housing and seal ring ramps. Use tri-chloroethane #111, which is a non-petroleum based, rapid drying solvent that leaves no film. Allow the surfaces to dry completely. Use clean, lint-free material such as Micro-Wipes # 05310 for cleaning and wiping.

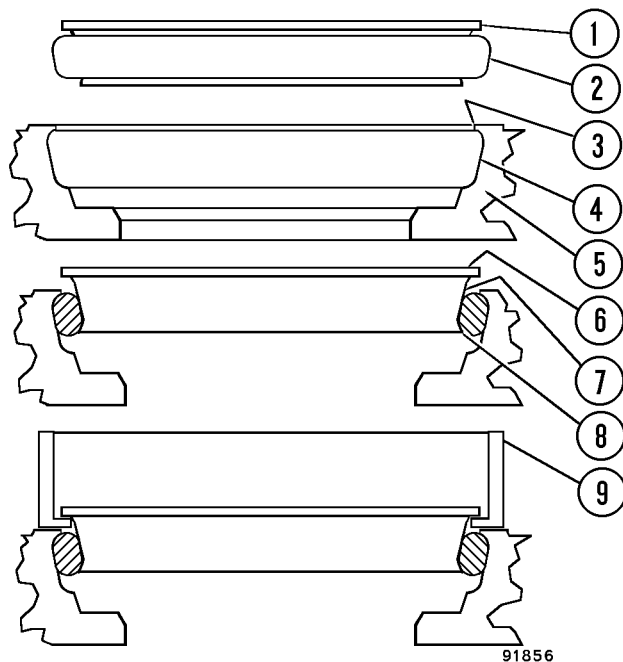


FIGURE 50-33. SEAL TERMINOLOGY

- | | |
|-------------------------|---------------------------|
| 1. Seal Ring | 5. Seal Ring Housing |
| 2. Rubber Toric | 6. Seal Ring Face |
| 3. Housing Retainer Lip | 7. Seal Ring Ramp |
| 4. Housing Ramp | 8. Seal Ring Retainer Lip |

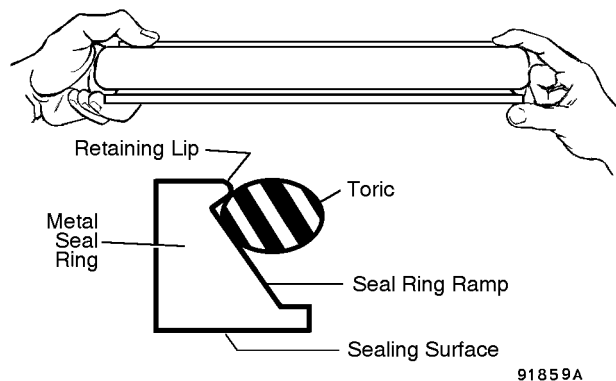


When using tri-chloroethane or any solvent, avoid prolonged skin contact. Use solvents only in well ventilated areas and use approved respirators to avoid breathing fumes. Do not use near open flame, welding operations or other heated surfaces exceeding 482°C (900°F). Do not smoke around solvents.

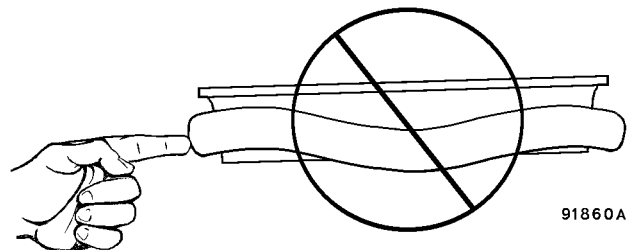
Both ramps must be dry. Use clean, lint-free cloths or lint-free paper towels for wiping.

NOTE: Oil from adjacent bearing installations or seal ring face lubrication must not get on the ramp or toric until after both seal rings are together in their final assembled position.

3. Install the rubber toric on the seal ring. *Make sure that it is STRAIGHT!* Make sure that the toric ring is not twisted and that it is seated against the retaining lip of the seal ring ramp. Use the flash line as a reference guide to eliminate twist. The flash line must be straight and uniform around the toric ring.



NOTE: Handle the seal carefully. Nicks and scratches on the seal ring face can cause leaks.



11. Position the steering control unit so that housing (1, Figure 50-11) is horizontal. Slowly guide lubricated spool assembly (2) with fitted parts into the bore using light turning movements.

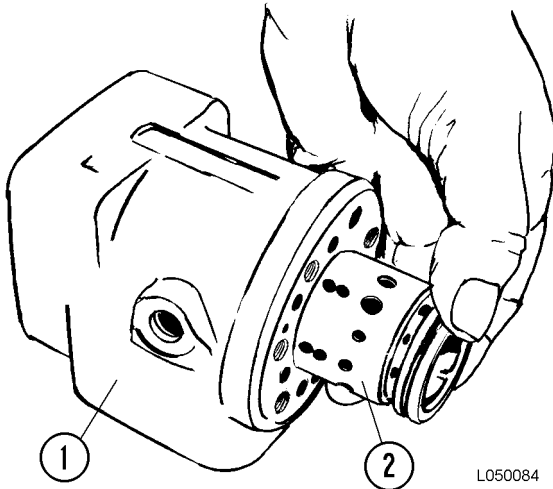


FIGURE 50-11. SPOOL INSTALLATION

1. Housing
2. Spool Assembly

▲ IMPORTANT ▲

The cross pin must remain horizontal when the spool and sleeve are pushed into the bore to prevent the pin from dropping out of the spool.

12. Install check ball (2, Figure 50-12) in hole (1). Install and lightly tighten the threaded bushing.
13. Lubricate O-ring (3) with Vaseline and install it in the groove of housing (4).
14. Install distribution plate (15, Figure 50-6) so that the plate holes match the corresponding holes in the housing.
15. Guide cardan shaft (11) down into the bore with the slot in the cardan shaft aligned with cross pin (9).

16. Position the inner gear wheel onto the cardan shaft. It may be necessary to rotate the gear slightly to find the matching splines on the cardan shaft. Splines are machined to ensure proper alignment of the cardan shaft and inner gear wheel.
17. Lubricate O-rings (17) and (18) on both sides of the outer gear wheel with Vaseline and install them.
18. Align the outer gear wheel bolt holes with the tapped holes in the housing and the match marks.
19. Align cover (19), using the match marks as a reference. Install cap screws (23) and washers (20).
20. Install cap screw with pin (22) into the proper hole.
21. Install the end cover. Install and tighten the cap screws with washers hand-tight in a criss-cross pattern.

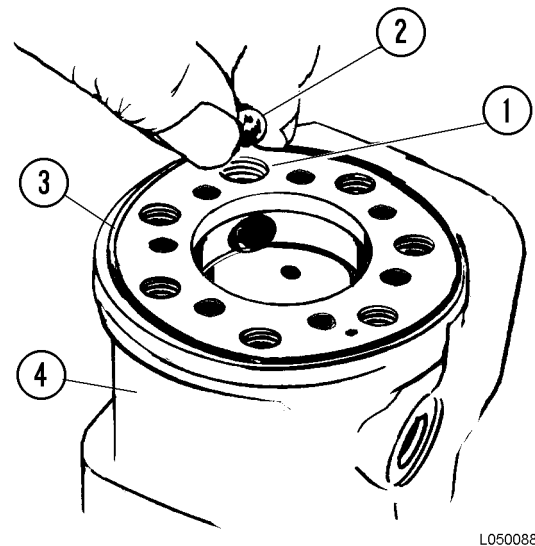
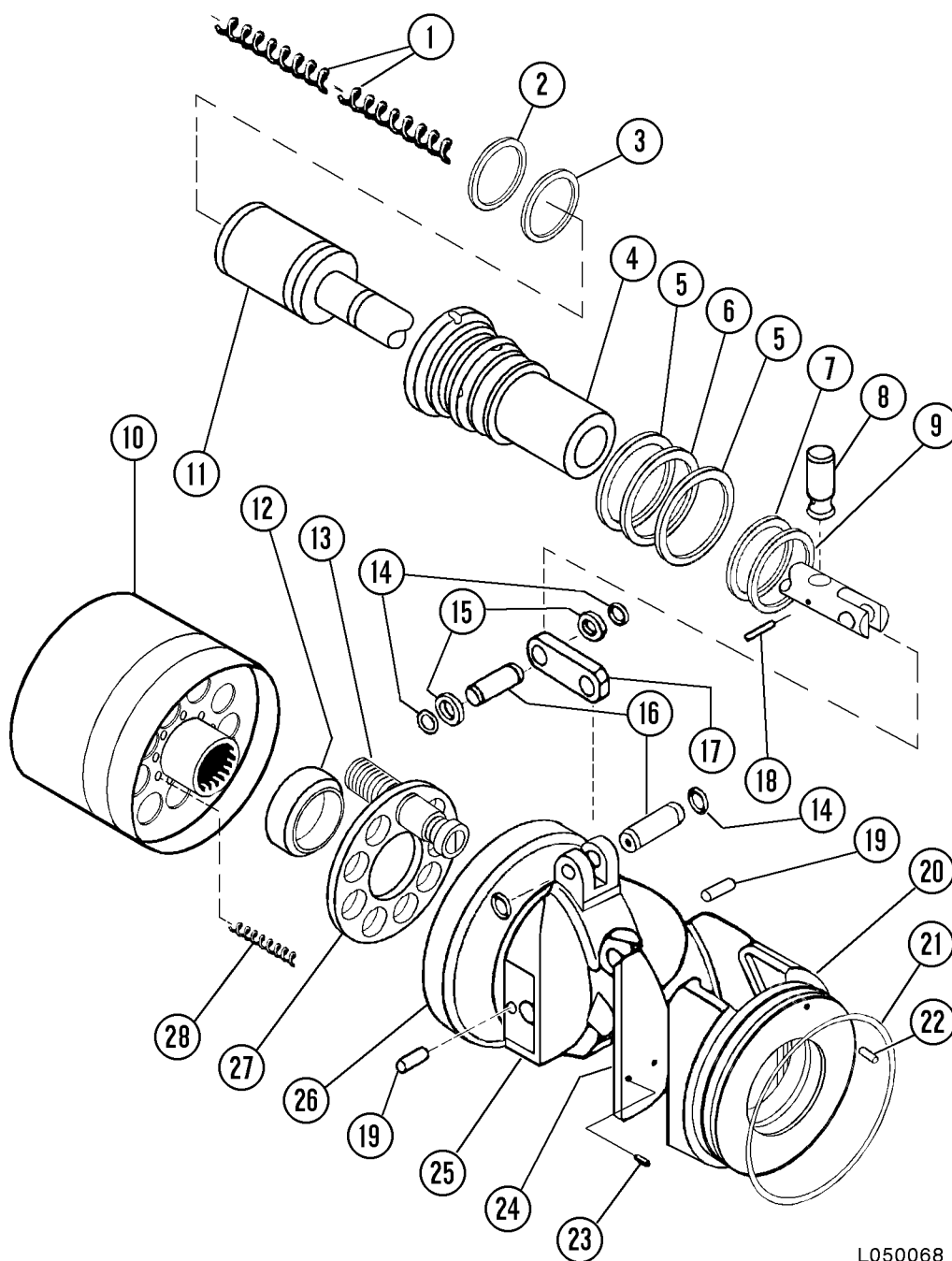


FIGURE 50-12. CHECK BALL INSTALLATION

- | | |
|---------------|------------|
| 1. Hole | 3. O-ring |
| 2. Check Ball | 4. Housing |



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FIGURE 50-27. PUMP ROTATING GROUP

- | | | | |
|------------------------|--------------------------|------------------|----------------------|
| 1. Bias Control Spring | 8. Stop Pin | 15. Washer | 22. Roll Pin |
| 2. Seal | 9. Backup Ring | 16. Pin | 23. Roll Pin |
| 3. Piston Ring | 10. Cylinder Barrel | 17. Control Link | 24. Saddle Bearing |
| 4. Sleeve | 11. Control Piston | 18. Pin | 25. Swashblock |
| 5. Backup Ring | 12. Fulcrum Ball | 19. Dowel Pin | 26. Cylinder Bearing |
| 6. O-ring | 13. Piston Shoe Assembly | 20. Saddle | 27. Retainer |
| 7. O-ring | 14. Retaining Ring | 21. O-ring | 28. Retainer Spring |

Removal and installation of front suspension

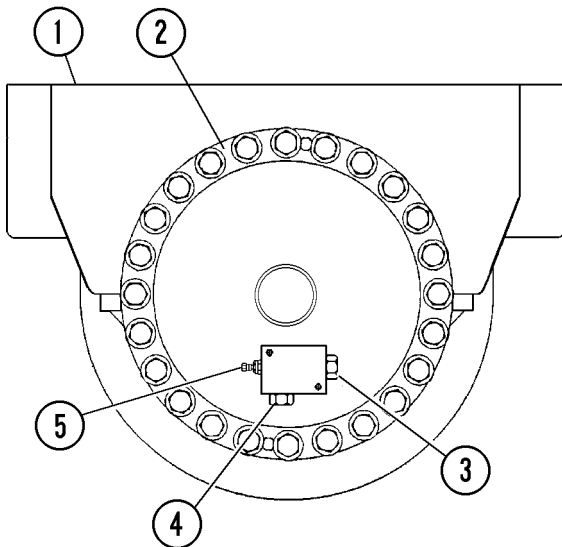
Hydrair® II suspensions are hydro-pneumatic components containing oil and nitrogen gas. The oil and gas in the four suspensions carry the gross truck weight less wheels, spindles and rear axle assembly.

The front suspension cylinders consist of two basic components: a suspension housing attached to the truck frame and a suspension rod attached to the front spindle.

Check valves and orifice dampening holes control suspension travel to provide good ride qualities on haul roads under loaded and empty conditions.

The front suspension rods also act as kingpins for steering the truck.

The suspension cylinder requires only normal care when handling as a unit. However, after being disassembled, these parts must be handled carefully to prevent damage to the machined surfaces. Surfaces are machined to extremely close tolerances and are precisely fitted. All parts must be completely clean during assembly.



H020026

FIGURE 50-1. SUSPENSION CHARGING VALVE

- | | |
|-------------------------|-------------------|
| 1. Suspension Housing | 4. Vent Plug |
| 2. Cap Structure | 5. Charging Valve |
| 3. Pressure Sensor Port | |

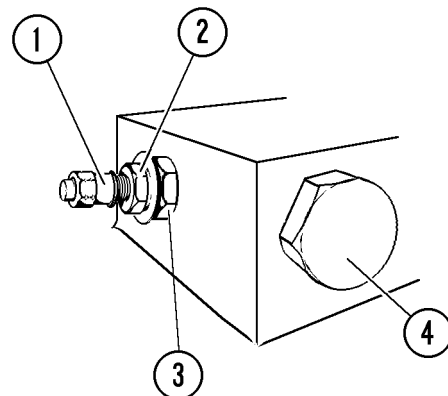
Removal

1. Remove the front tire and rim. Refer to Disassembly and assembly section **Tires, spindles and rear axle**.
2. Remove the front wheel hub and spindle. Refer to Disassembly and assembly section **Tires, spindles and rear axle**.
3. Remove the boot clamp and boot from the front suspension.

⚠ DANGER

Wear a face mask or goggles. Make sure that only the swivel nut turns. Turning the entire charging valve assembly may result in the valve assembly being forced out of the suspension by the gas pressure inside.

4. Discharge the nitrogen pressure from the suspension as follows:
 - a. Remove the cap from charging valve (5, Figure 50-1).
 - b. Turn charging valve swivel nut (small hex) (2, Figure 50-2) counterclockwise three full turns to unseat the valve seal. Do not turn more than three turns. Do not turn charging valve body (large hex) (3).
 - c. Depress the valve stem until all nitrogen pressure has been relieved.
5. After all nitrogen pressure has been relieved, loosen valve body (3) and remove the charging valve assembly. Discard the O-ring seal.



H020027

FIGURE 50-2. CHARGING VALVE

- | | |
|---------------------------|------------------------------------|
| 1. Valve Cap | 3. Charging Valve Body (Large Hex) |
| 2. Swivel Nut (Small Hex) | 4. Vent Plug |

DUMP TRUCK

860E

Machine model	Serial number
860E-1K	A30003 and up
860E-1KT	A30003 and up

50 Disassembly and assembly

Hoist circuit

Removal and installation of hoist pump	3
Disassembly and assembly of hoist pump	5
Removal and installation of hoist valve	13
Disassembly and assembly of hoist valve	14
Overcenter valve manifold service	21
Removal and installation of hoist pilot valve	22
Disassembly and assembly of hoist pilot valve	23
Removal and installation of hoist cylinders	25
Disassembly and assembly of hoist cylinders	27

Assembly of rear spool section

1. Discard all O-rings and backup rings. Clean all parts in solvent and blow dry with compressed air.
2. Inspect all springs for breaks and distortion. Inspect the poppet seating surfaces for nicks and excessive wear. All seats must be sharp and free of nicks.
3. Inspect all bores and surfaces of sliding parts for nicks, scores and excessive wear.
4. Inspect all poppets in their respective bore for proper fit. Poppets should move freely through a complete revolution without binding.
5. Lubricate O-rings (4, Figure 50-24), (5) and (10) with clean hydraulic oil. Install the O-rings in spool housing (13). Install poppet (18). Install spool cover (19) and secure it with the cap screws. Tighten the cap screws to **81 Nm (60 ft lb)**.
6. Install spring (11) in spool assembly (20). Install spring seat (2). Apply Loctite to the threads of spool end (15). Install the spool end and tighten it to **34 Nm (25 ft lb)**. Install restrictor poppet (21). Apply Dri-loc #204 to the threads of plug (3). Install and tighten the plug to **20 Nm (15 ft lb)**.

NOTE: Poppets (12), (21) and (22) may be color coded and must be installed in their original location.

7. Repeat Step 6 for the opposite end of spool assembly (20). Ensure that spring (16) is blue. A poppet and plug are not installed in the lower end.
8. Lubricate the spool assembly and carefully install it in the spool housing (See Figure 50-25). Make sure that "V" groove (1) in spool assembly (2) is positioned **up** as noted.
9. Install spring (11, Figure 50-24) in the top (grooved) end of remaining spool assembly (14). Install spring seat (2). Apply Loctite to the threads of spool end (15). Install spool end and tighten it to **34 Nm (25 ft lb)**. Install red restrictor poppet (12). Apply Dri-loc #204 to the threads of plug (3). Install and tighten the plug to **20 Nm (15 ft lb)**.
10. Repeat Step 9 for the bottom end of spool assembly (14). Ensure that spring (16) is blue.
11. Lubricate the assembled spool and install it in the spool housing (See Figure 50-25). Make sure that "V" groove (1) in spool assembly (2) is positioned **up** as noted.

NOTE: Spool assemblies (14, Figure 50-24) and (20) are physically interchangeable. Ensure that spool assembly (14) is installed toward the base port of the spool housing.

12. If used, install O-ring (2, Figure 50-23) and backup ring (3) on restrictor poppet (1). Install the poppet in the spool housing as shown in Figure 50-24.
13. Install new O-rings (4, Figure 50-24), (5) and (10).
14. Install a new O-ring (and backup ring, if used) on poppet (6). Make sure that small steel ball (7) is installed in the poppet. Install the poppet in spool cover (1).
15. Position spool cover (1) over spool housing (13). Install and tighten the cap screws to **81 Nm (60 ft lb)**.

NOTE: The cover must be positioned according to the match marks that were made during disassembly. Do not reverse the cover position.

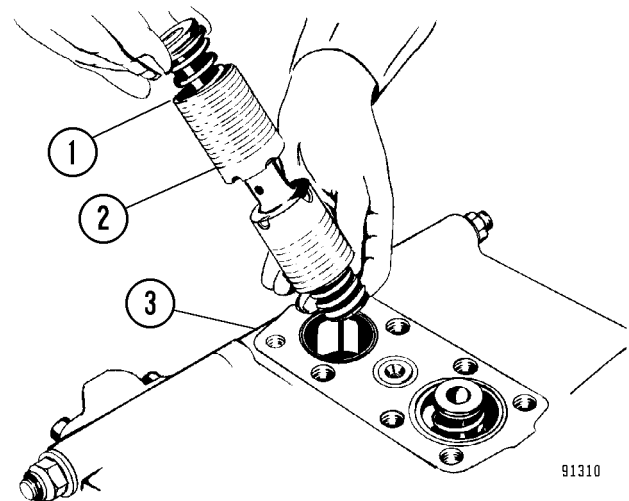


FIGURE 50-25. SPOOL INSTALLATION

- | | |
|-------------------|-----------------------------|
| 1. "V" Groove | 3. Work Ports Spool Section |
| 2. Spool Assembly | |

Removal and installation of operator cab

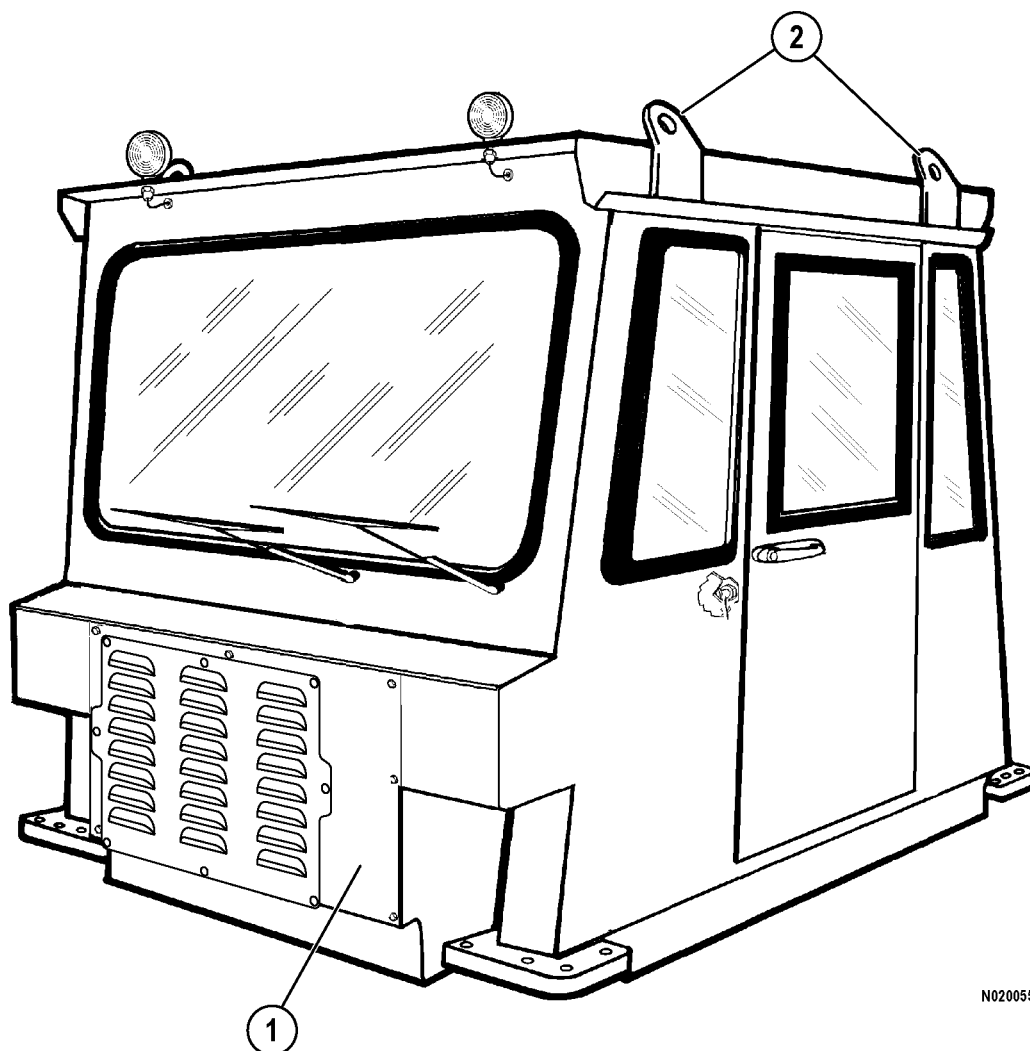
WARNING

DO NOT attempt to modify or repair damage to the ROPS structure. The protection offered may be impaired if subjected to any modifications or damage. To maintain manufacturers certification, any repair or alteration on this structure, including installation of a non-standard seat, or relocation of seat must have prior written approval.

NOTE: Prior to cab removal or repair procedures, it may be necessary to remove the body to provide clearance for lifting equipment to be used. If body removal is not required, the body should be raised and the safety cables installed at the rear of the truck.

WARNING

Do not attempt to work in the deck area until the body safety cables have been installed.



N020055

FIGURE 50-1. CAB ASSEMBLY (FRONT VIEW)

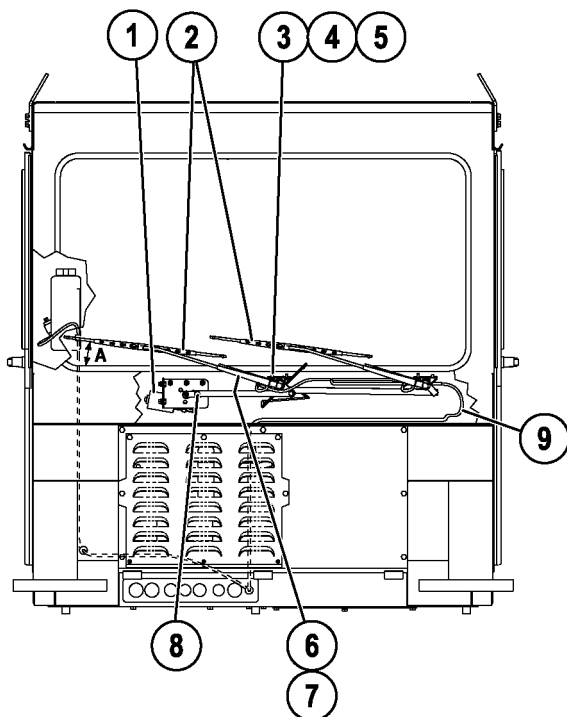
1. Access Cover

2. Lifting Eyes

Removal and installation of windshield wiper linkage

Removal

1. Remove the wiper arms. Refer to "Removal and installation of windshield wiper arm".
2. Remove retainer (8, Figure 50-25), and disconnect the wiper linkage from wiper motor drive arm (6).
3. Remove nut (6, Figure 50-24) and washer (5) from each wiper shaft.
4. Remove cap screws (3, Figure 50-25), lock washers (4) and flat washers (5).
5. Remove wiper assembly from cab.



N030028

FIGURE 50-25. PARK POSITION

- | | |
|-----------------------|--------------------------|
| A. Park Position (7°) | 5. Flat Washer |
| 1. Wiper Motor | 6. Wiper Motor Drive Arm |
| 2. Wiper Blade | 7. Nozzle |
| 3. Cap Screw | 8. Retainer |
| 4. Lock Washer | 9. Hose |

Installation

1. Place the wiper assembly into position in the wiper compartment.
2. Install cap screws (3, Figure 50-25), lock washers (4) and flat washers (5). Tighten cap screws.
3. Install washer (5, Figure 50-24) and nut (6) on each wiper shaft. Tighten the nut to **18-20 Nm (160-177 in lbs)**.



Do not overtighten the nut. The threads on the wiper shafts are easily stripped when improperly tightened.

4. Install cap (4) over nut (6).
5. Align the linkage and attach it to wiper motor drive arm (6, Figure 50-25) using retainer (8).

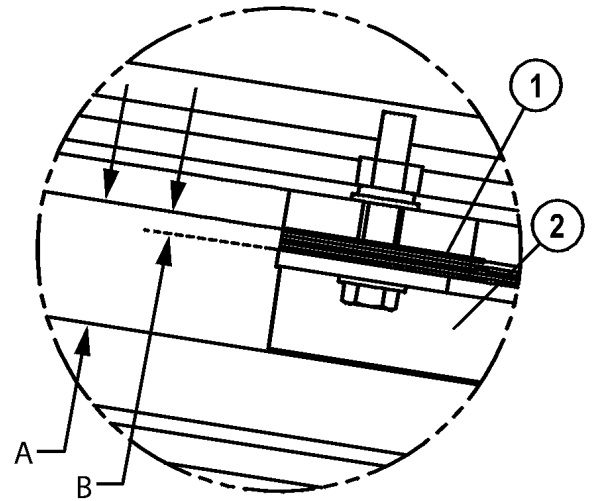
NOTE: When the motor is parked, the drive arm will be in the 3 o'clock position as shown in Figure 50-25.

6. Install the wiper arms. Refer to "Removal and installation of windshield wiper arm".
7. Verify that the wipers operate properly and park in the proper position.

5. Divide measurement "B" by the shim thickness of 1.5 mm (0.06 in.) to determine the number of shims required for each position.
6. Assemble a shim pack for each body pad location as determined in the previous step. On the rear most body pad mounting location (4, Figure 50-8), remove one shim from the calculation.

NOTE: Using half shims is allowed if necessary. Half shims must be installed at the top of the stack.

7. Install the body pads and shims at each location using mounting hardware shown in (Figure 50-5). Tighten nuts (6) to **88 N·m (65 ft lb)** torque.



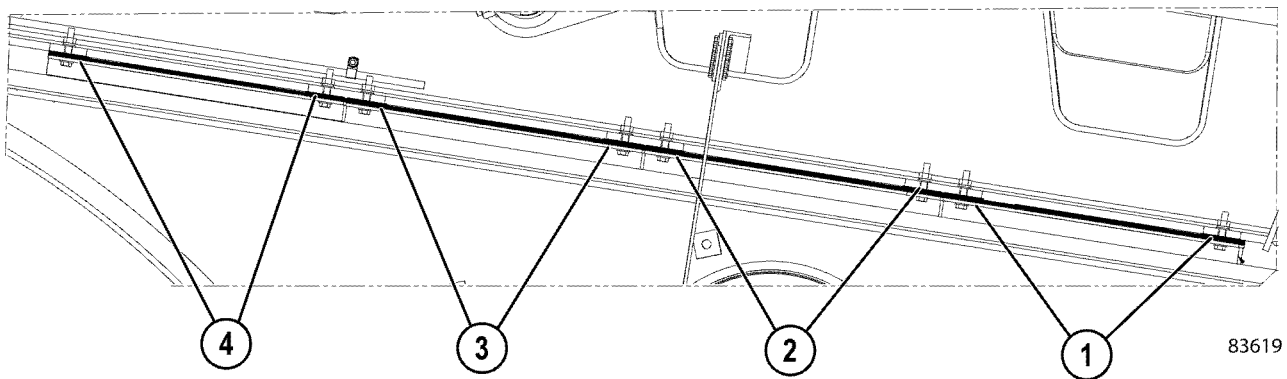
DETAIL - D

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FIGURE 50-7. MEASUREMENT DETAILS

1. Shim

2. Body Pad



83619

FIGURE 50-8. BODY PAD LOCATIONS

1. Body Pad Position 1

3. Body Pad Position 3

2. Body Pad Position 2

4. Body Pad Position 4

Storage

The motors must be stored in a dry area that is not susceptible to vibration. Preferably the ambient temperature should not exceed 25°C (77°F) or fall below -10°C (14°F). If these bearing temperatures are adhered to, a bearing regreasing has to be done prior to commissioning after a storage period of greater than **2 years**.

*NOTE: If the motors are stored between 25°C (77°F) and 80°C (176 F) or between -40°C (-40°F) and -10°C (14°F), a bearing regreasing has to be done prior to commissioning after a storage period greater than **6 months**.*

NOTE: The ambient temperature may not exceed 80°C (176°F) or fall below -40°C (-40°F).



The transport lock must be fitted if vibrations cannot be ruled out.

Under no circumstances must the motor be allowed to rotate, even a negligible amount, while the transport lock is fitted, as this could damage both the transport lock and parts of the motor.

Storage of new motors

- The motors should remain on the pallet in the condition in which they were delivered.
- If the transport packaging is used to store the motors for a period of up to 6 months, its condition must be checked (with respect to damage in transit or during handling, etc.).
- If the motors are to be stored for longer than 6 months, long-term packaging must be provided.
- Long-term packaging can be used for up to 2 years. The motors must be packed by appropriately qualified personnel in accordance with recognized guidelines, as well as local conditions.
- The corrosion protection on bright installation surfaces must be inspected and replaced if necessary.
- Please consult Komatsu if the motors are to be stored for longer than 2 years.
- The rotor of the stored motor must be turned by hand once every 2 years. The packaging and the transport locks must be removed for this purpose.
- After rotating the rotor shaft a few turns, remount the transport lock with the rotor in a different position. Then pack the motor again properly.

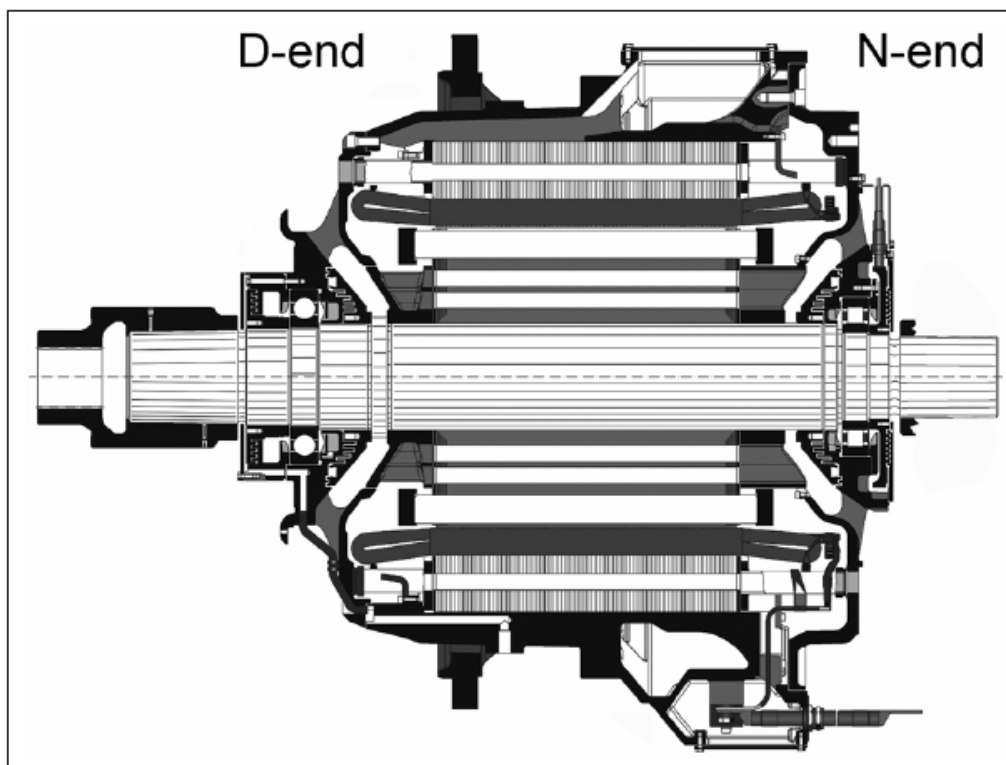


FIGURE 50-3. LONGITUDINAL SECTION THROUGH THE MOTOR

Assembling the rubber seals and the air baffles

NOTE: Assembly sequence:

Air baffles (2 and 4) (N-end and D-end)

Rubber seals (3) (N-end and D-end)

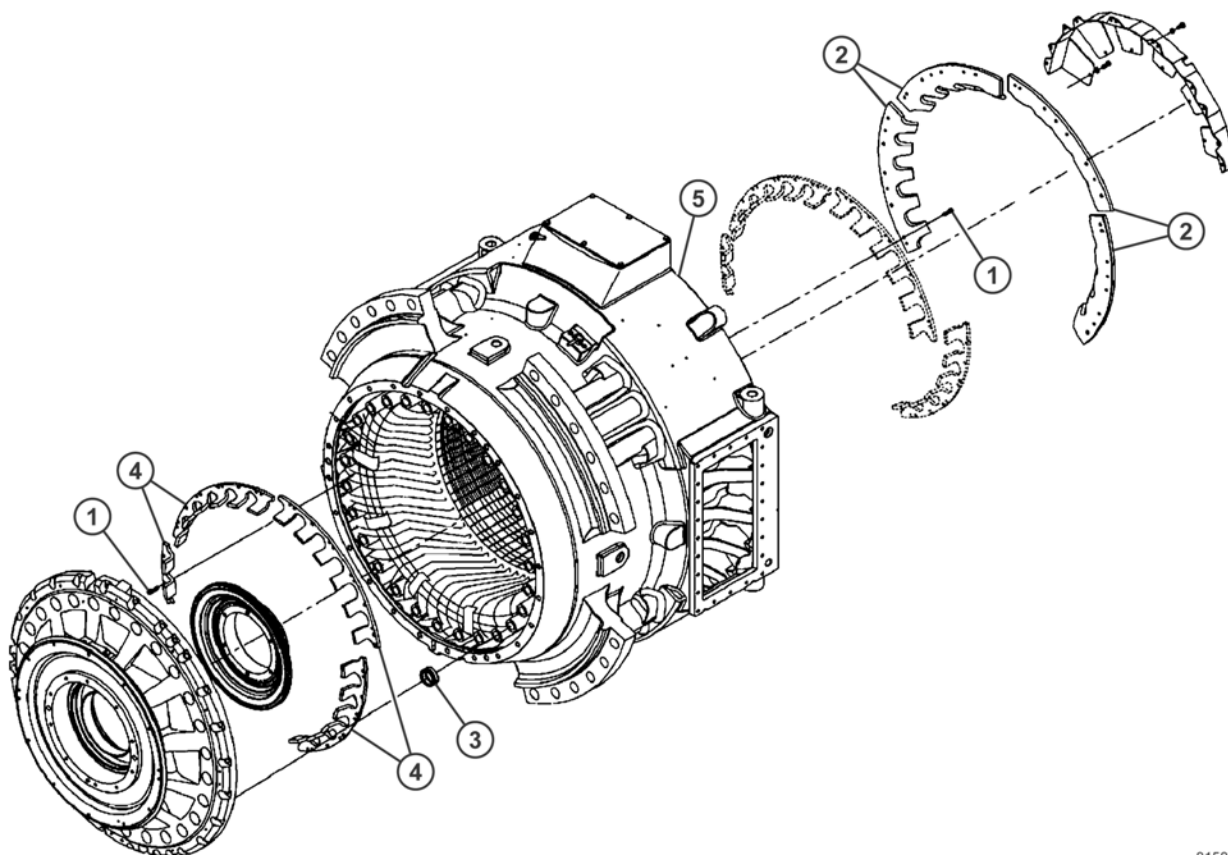
1. Remove all sealant residue from the surfaces of the stator frame and the air baffles. Then clean with cleaning agent (Loctite® 7063™).

NOTE: The drying time must always be observed.

2. Apply a zigzag bead of sealant (Loctite®518™) to the surfaces of the stator frame (5) and the air baffles (2 and 4) (N-end and D-end). Use a sufficient quantity to completely coat all surfaces, so that sealant (Loctite® 7471™) is evenly pressed out at the edges when the air baffles are assembled.

3. Apply activator (Loctite® 518™) to the threads of the screws (1), then coat threads with Loctite® 243™.
4. Arrange the individual air baffles (2 and 4) (N-end and D-end) in the correct positions as marked at the time of dismantling.
5. Insert the screws (1) and tighten to 20 Nm (14.8 ft-lb).
6. Assemble the rubber seals:

NOTE: All dismantled rubber seals must always be replaced.



81582

FIGURE 50-16. ASSEMBLING THE RUBBER SEALS AND THE AIR BAFFLES

- | | |
|-----------------------|-----------------------|
| 1. Screw | 4. Air Baffle (D-End) |
| 2. Air Baffle (N-End) | 5. Stator Frame |
| 3. Rubber Seal | |

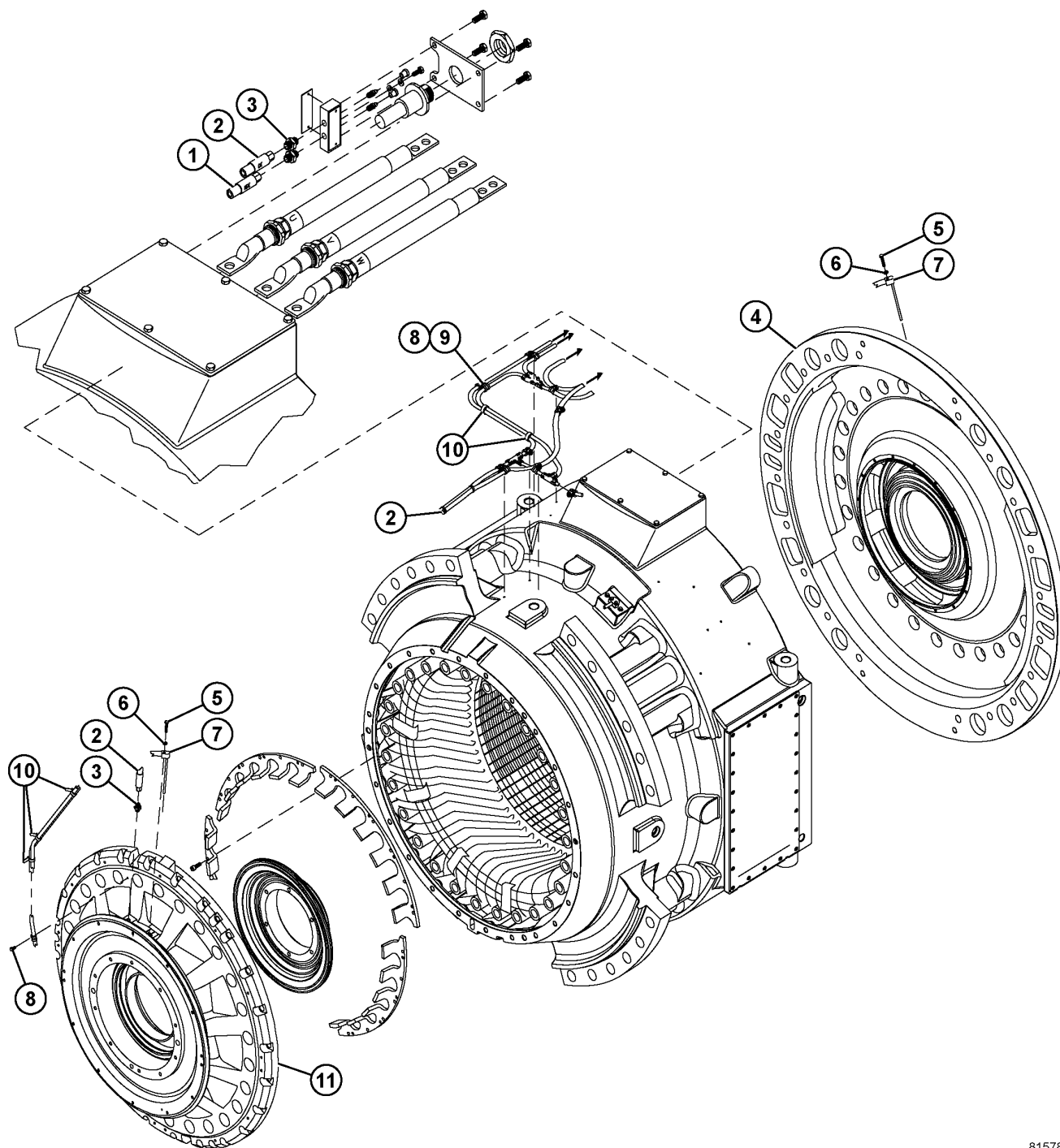


FIGURE 50-31. ASSEMBLING THE BUILT-ON ACCESSORIES (D- AND N-END)

81578

- | | | |
|---------------------|-----------------------|--------------------|
| 1. Lubricant Hose | 5. Screw | 9. Clip |
| 2. Lubricant Hose | 6. Washer | 10. Cable Tie |
| 3. Screw Connection | 7. Temperature Sensor | 11. Bearing Shield |
| 4. Bearing Shield | 8. Screw | |

Removal and installation of power module

General

The radiator, engine and alternator assemblies are mounted on a roller equipped subframe which is contained within the truck's main frame. This arrangement, referred to as a "power module", permits removal and installation of these components with a minimum amount of disconnect by utilizing the "roll in/roll out" feature.

Although the instructions in this section are primarily based upon the "rollout" method for major component removal, the radiator and fan may be removed as separate items. Optional equipment may also be installed on the truck, requiring additional removal and installation steps not listed.

The procedures outlined in this section of the manual are general instructions for power module removal and installation. It may be necessary to perform some procedures in a different order or use different methods for component removal and installation, depending on the lifting equipment available. Prior to removal or repair procedures, it may be necessary to remove the body to provide clearance for lifting equipment to be used. If body removal is not required, the body should be raised and secured with the body up retention cable or sling.

Read and observe the following instructions before attempting any repairs.



- ***Do not attempt to work in the deck area until the body up retention cable or sling has been installed.***
- ***Do not step on or use any power cable as a handhold when the engine is running.***
- ***Do not open any control cabinet doors or covers, and do not touch the retarding grid elements, until all shutdown procedures have been completed.***
- ***All removal, repair and installation of propulsion system electrical components and cables must be performed by an electrical maintenance technician who is properly trained to service the system.***
- ***In the event of a propulsion system malfunction, a qualified technician must inspect the truck and verify that dangerous voltage levels are not present in the propulsion system before repairs are started.***

Preparation

1. Park the truck on level ground and chock the rear wheels to prevent truck movement.
2. Shut down the truck. For the proper shutdown procedure, refer to Index and foreword section **Operating instructions**.
3. Tag or mark all hydraulic lines, fuel lines and electrical connections to ensure correct hookup at the time of power module installation. Plug all ports and cover all hose fittings or connections when disconnected to prevent dirt or foreign material from entering.
4. It is not necessary to remove the radiator prior to removal of the power module. However, the coolant must be drained and the piping to the brake cooling heat exchanger removed.

If removal of the radiator is desired or only repair of the radiator is necessary, refer to "Removal and installation of radiator" in this section.

Disassembly

⚠ IMPORTANT ⚠

To aid in removal of the tubes, clean the radiator prior to disassembly. Heating the seals with hot water helps to loosen the grip on the tubes. Cleaning the radiator prior to disassembly also reduces the risk of internal contamination. After cleaning, spray lubricating oil at the top end of the tubes.

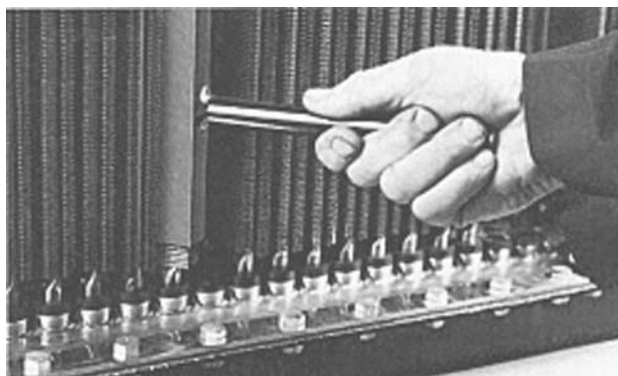


FIGURE 50-22. BREAKER TOOL (XA2307)

1. Start at the top row of tubes. Use breaker tool (XA2307) to loosen the tube to be removed. When using the breaker tool, position it at the top or bottom of the tube. Never position it in the middle of the tube or damage may result. Use the breaker tool to lightly twist the tube back and forth within the seals to loosen the grip. Refer to Figure 50-22.

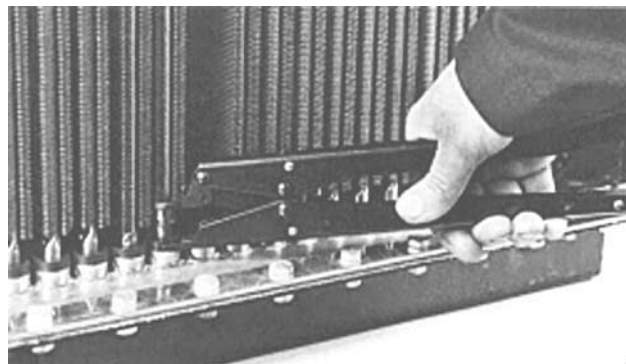


FIGURE 50-23. INSTALLATION TOOL (VJ6567)

2. After the tube is loose, position installation tool (VJ6567) at the bottom of the tube to be removed. Refer to Figure 50-23. The upper jaw of the installation tool should be positioned just below the rectangular section of the tube. The bottom jaw should rest on the seal. Squeeze the installation tool just enough to allow the bottom of the tube to be removed from the bottom seal.

NOTE: To ease in the removal of tubes, use the breaker tool and installation tool simultaneously.

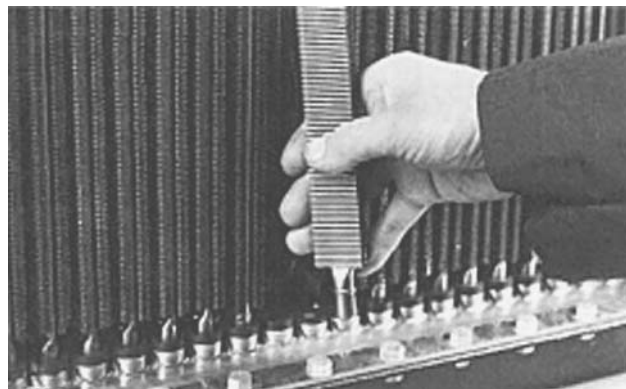


FIGURE 50-24. ANGLING TUBE DURING

3. Pull the tube from the top seal while simultaneously twisting the tube. Angle the tube only far enough to clear the radiator. Refer to Figure 50-24. Removing the tube at an excessive angle may cause damage to the tube.
4. Remove all the top tubes before removing the bottom tubes. After all of the tubes are removed, use pliers to remove the seals from the tanks. Discard all seals. New seals must be used for assembly.

3. Install three pusher bolts (4) in hub bushing (5). Tighten the pusher bolts evenly to remove the bushing and square key from the motor shaft.
4. Remove the impeller from the motor shaft.

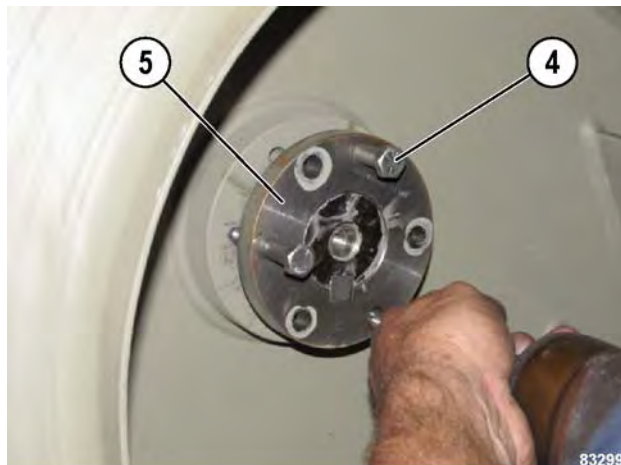


FIGURE 50-28. REMOVING THE HUB BUSHING

4. Pusher Bolts 5. Hub Bushing

5. Draw a match mark across bearing housing (6) and the motor housing for later installation.
6. Remove three inner capscrews (7) and four outer capscrews (8). Remove bearing housing (6).

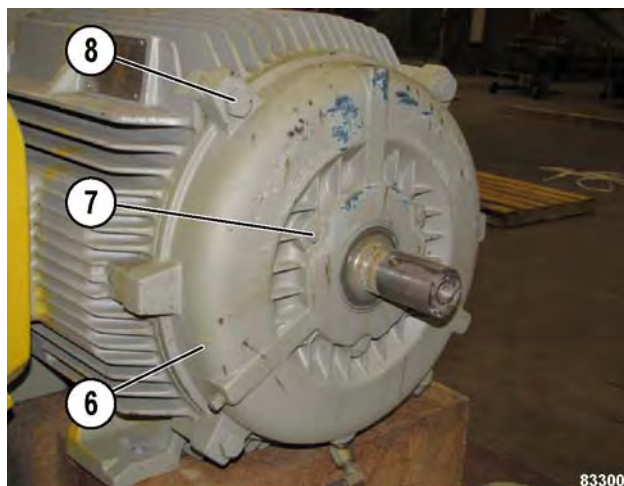


FIGURE 50-29. REMOVING THE BEARING HOUSING

6. Bearing Housing 8. Outer Capscrew
7. Inner Capscrew

7. Repeat Steps 1 - 6 for the impeller and bearing housing on the other end of the motor.
8. Attach a puller to bearing (9) and remove it from the motor shaft. Repeat for the bearing on the other end of the motor.

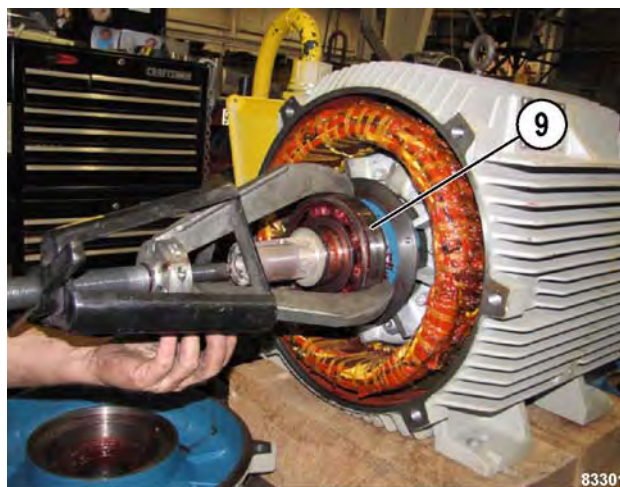


FIGURE 50-30. REMOVING THE BEARINGS

9. Bearing

9. Install lifting device (10) and a suitable hoist on the motor shaft. Remove rotor (11) from the motor housing and set it on wood blocks.

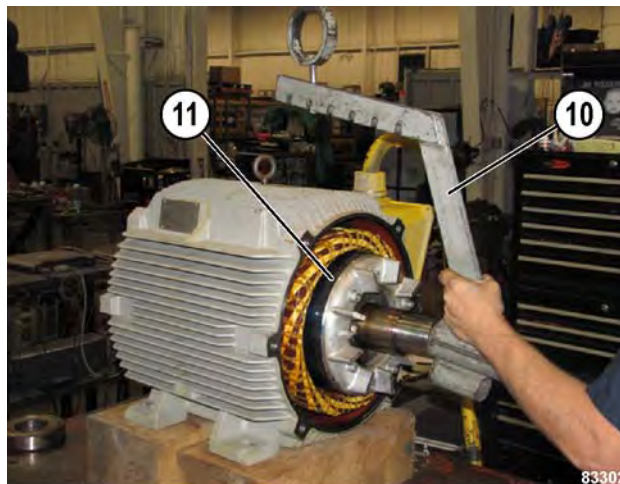


FIGURE 50-31. REMOVING THE ROTOR

10. Lifting Device 11. Rotor

- 6. Attach a suitable lifting chain and hoist to the bearing housing. Install the bearing housing on the motor shaft.



FIGURE 50-19. LIFTING THE BEARING HOUSING

- 9. Attach a suitable lifting chain and hoist to the bearing housing. Install the bearing housing on the motor shaft.



FIGURE 50-21. LIFTING THE BEARING HOUSING

- 7. Ensure that the match marks on bearing housing (3) and the motor housing are aligned.
- 8. Install three inner capscrews (4) that hold the thrust plate in place against the bearing, then install four outer capscrews (5) that secure the bearing housing to the motor housing.

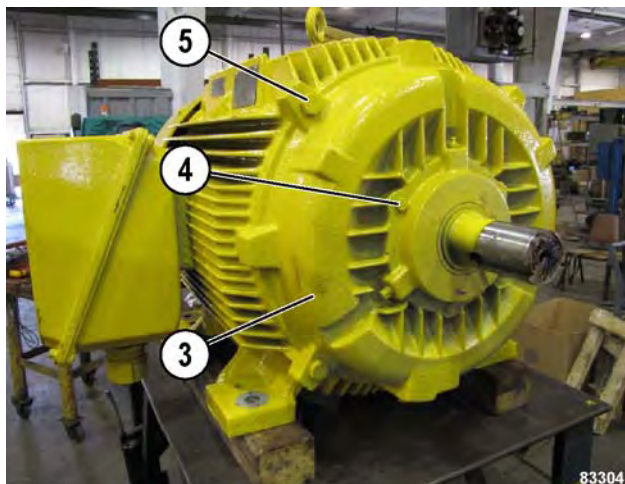


FIGURE 50-20. INSTALLING THE BEARING HOUSING (DRIVE END)

- 3. Bearing Housing
- 4. Outer Capscrew

- 5. Inner Capscrew

- 10. Ensure that the match marks on bearing housing (6) and the motor housing are aligned.
- 11. Install three inner capscrews (7) that hold the thrust plate in place against the bearing, then install four outer capscrews (8) that secure the bearing housing to the motor housing.

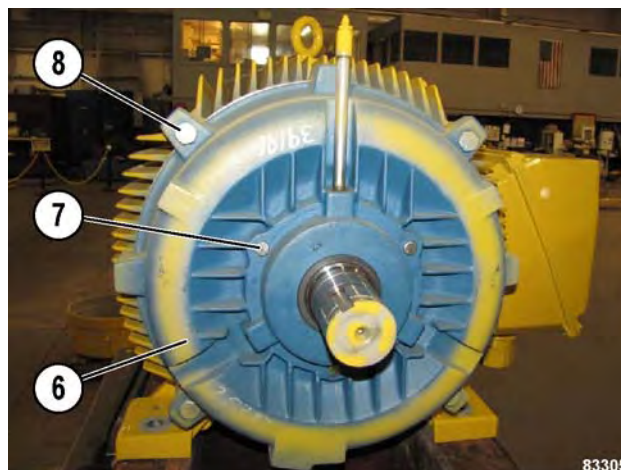


FIGURE 50-22. INSTALLING THE BEARING HOUSING (NON-DRIVE END)

- 6. Bearing Housing
- 7. Outer Capscrew

- 8. Inner Capscrew

DUMP TRUCK

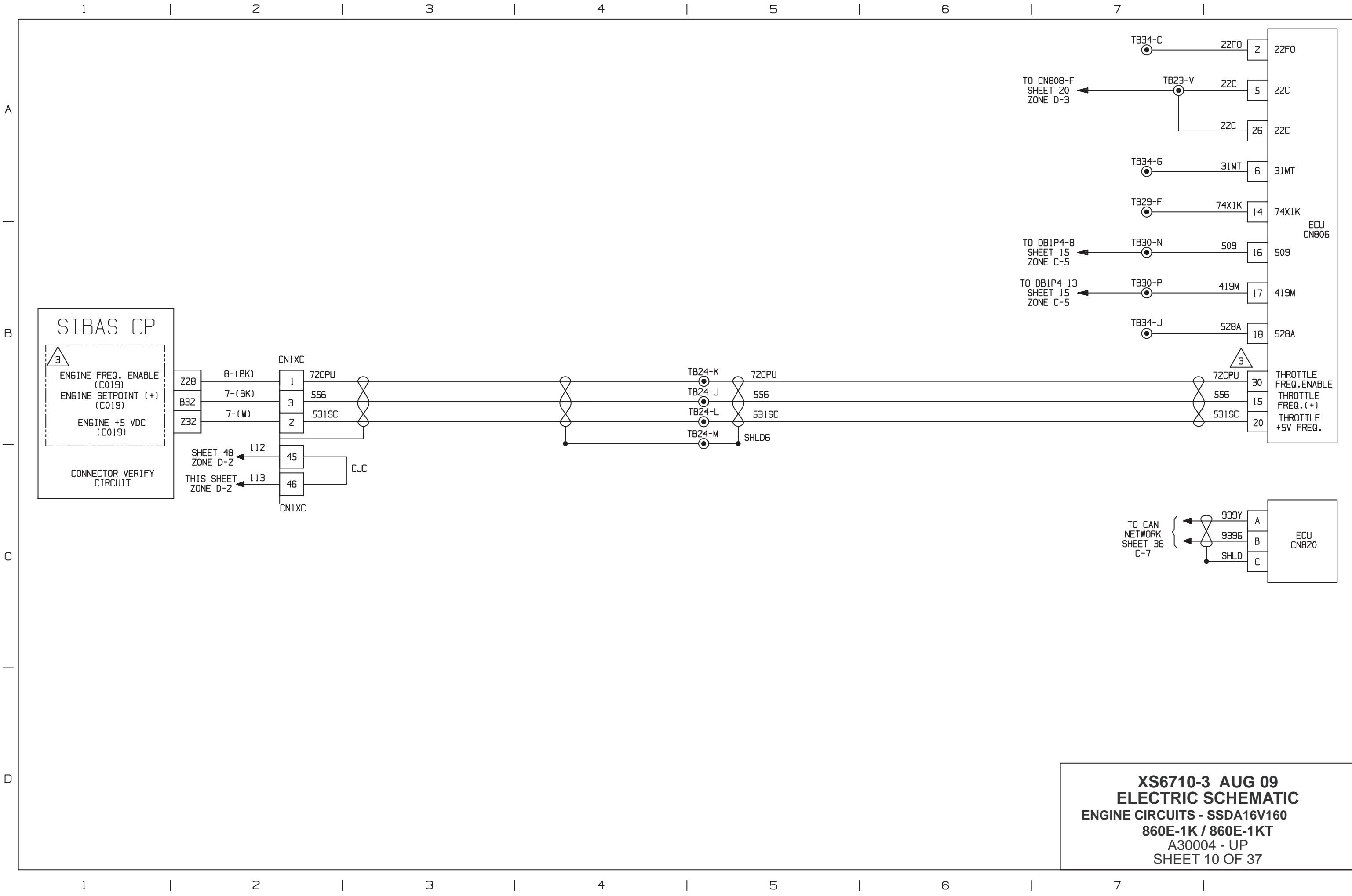
860E

Machine model	Serial number
860E-1K	A30003 and up
860E-1KT	A30003 and up

90 Diagrams and drawings

Hydraulic circuit diagrams

Steering, hoist and brake cooling hydraulic circuit diagram.....	EM1374
Brake hydraulic circuit diagram.....	EM6298



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ELECTRIC SCHEMATIC
ENGINE CIRCUITS - SSSA16V160
860E-1K / 860E-1KT
 A30004 - UP
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A

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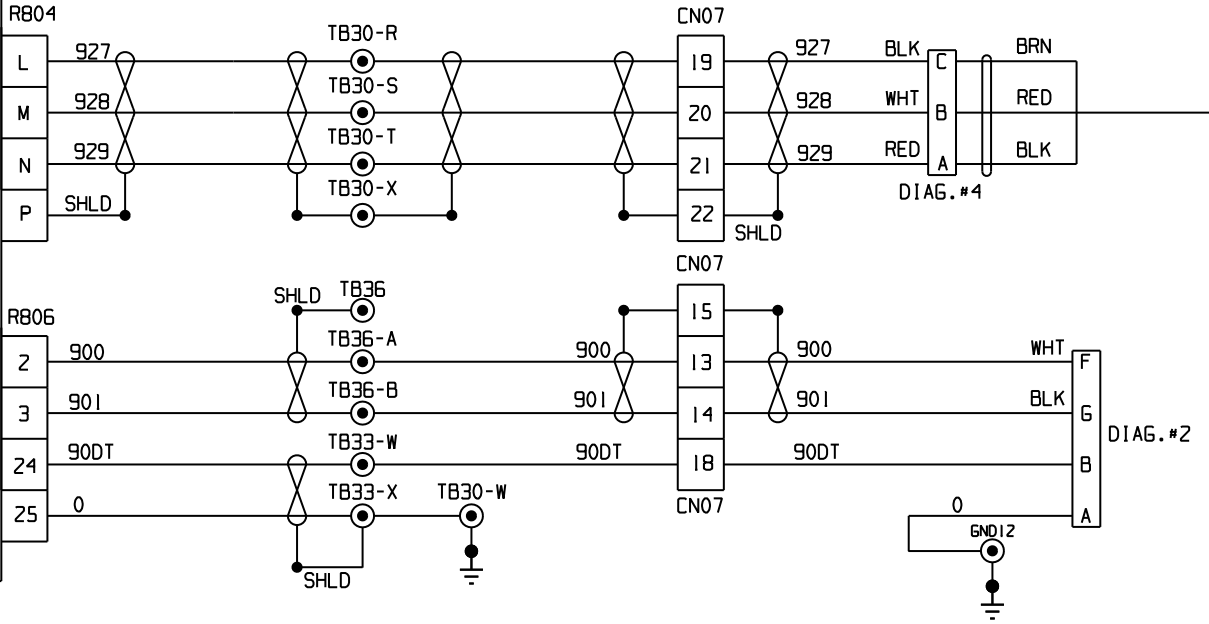
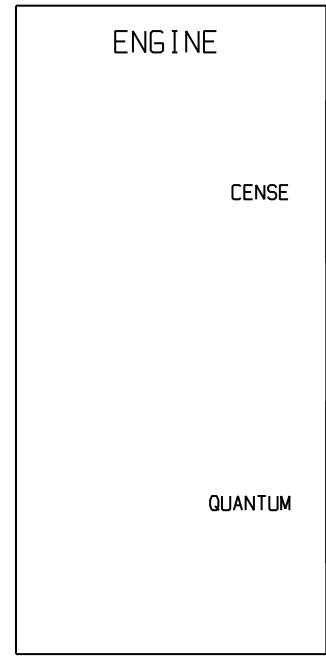
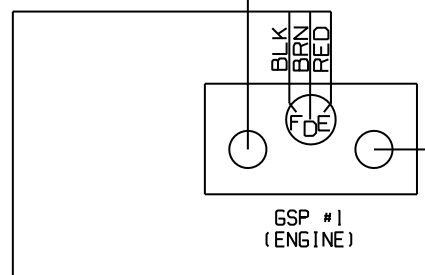
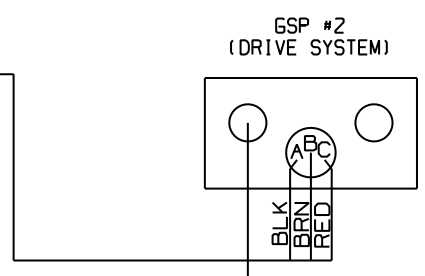
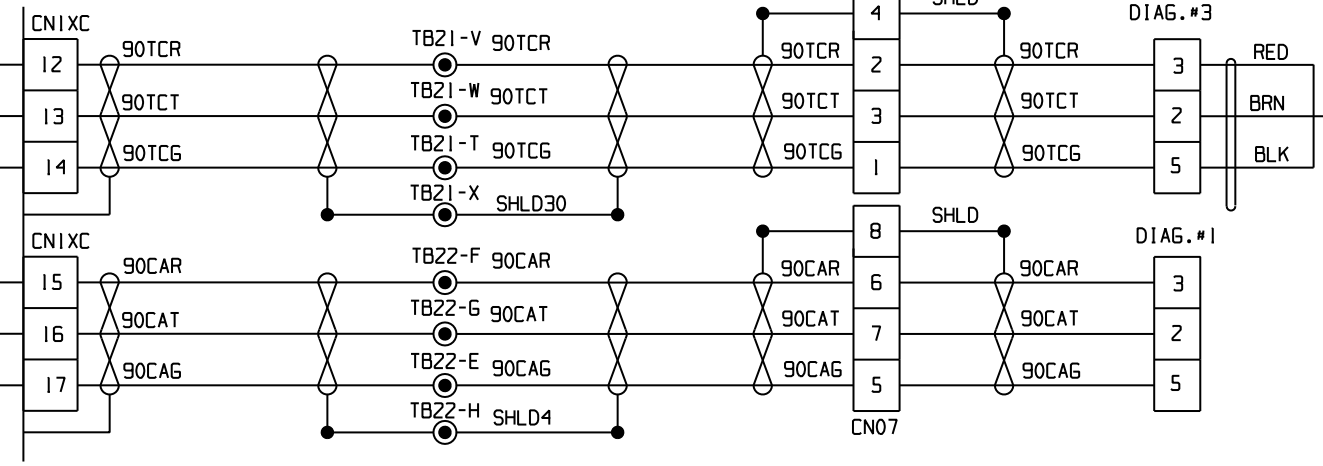
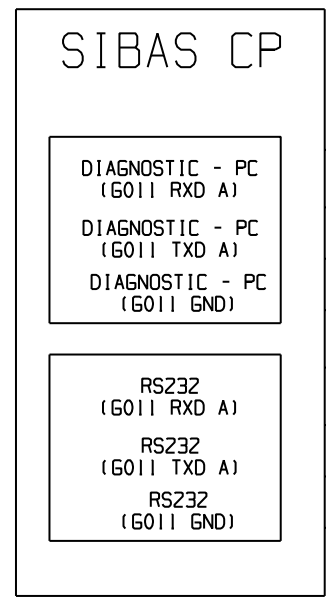
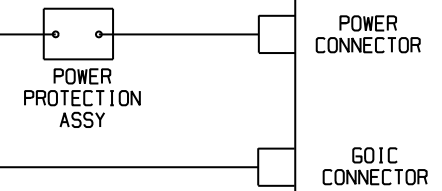
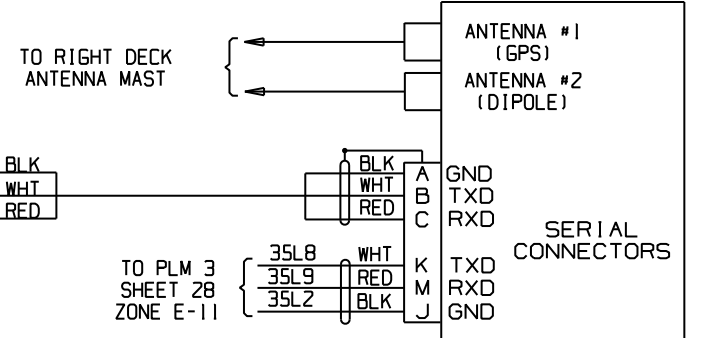
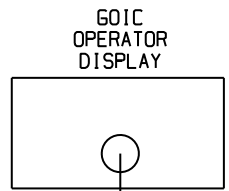
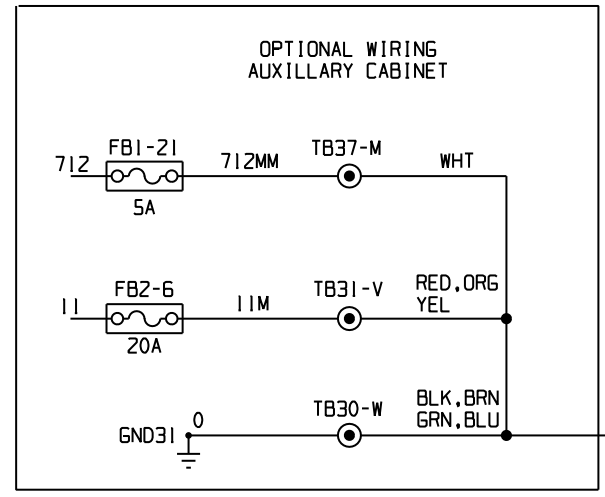
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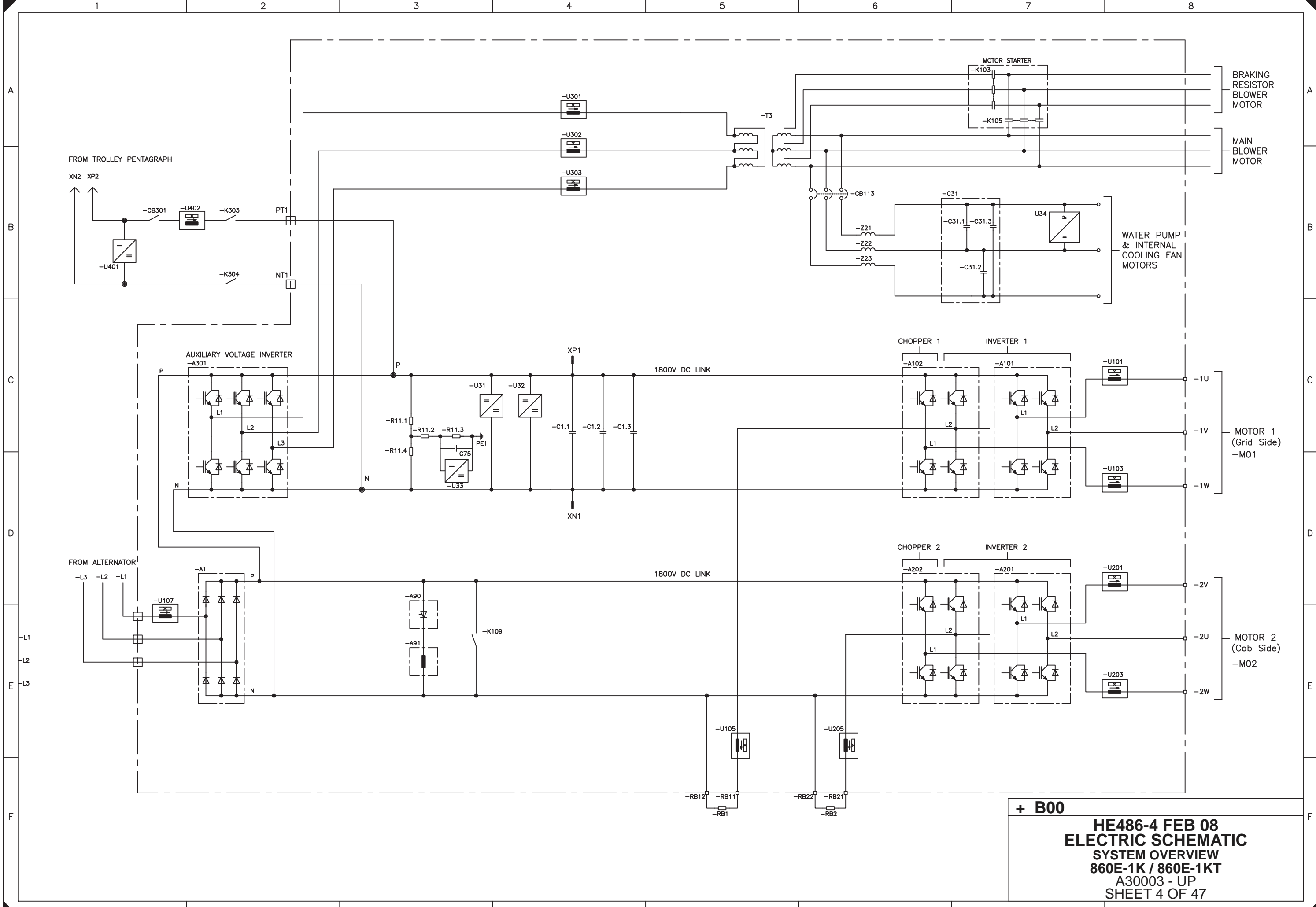
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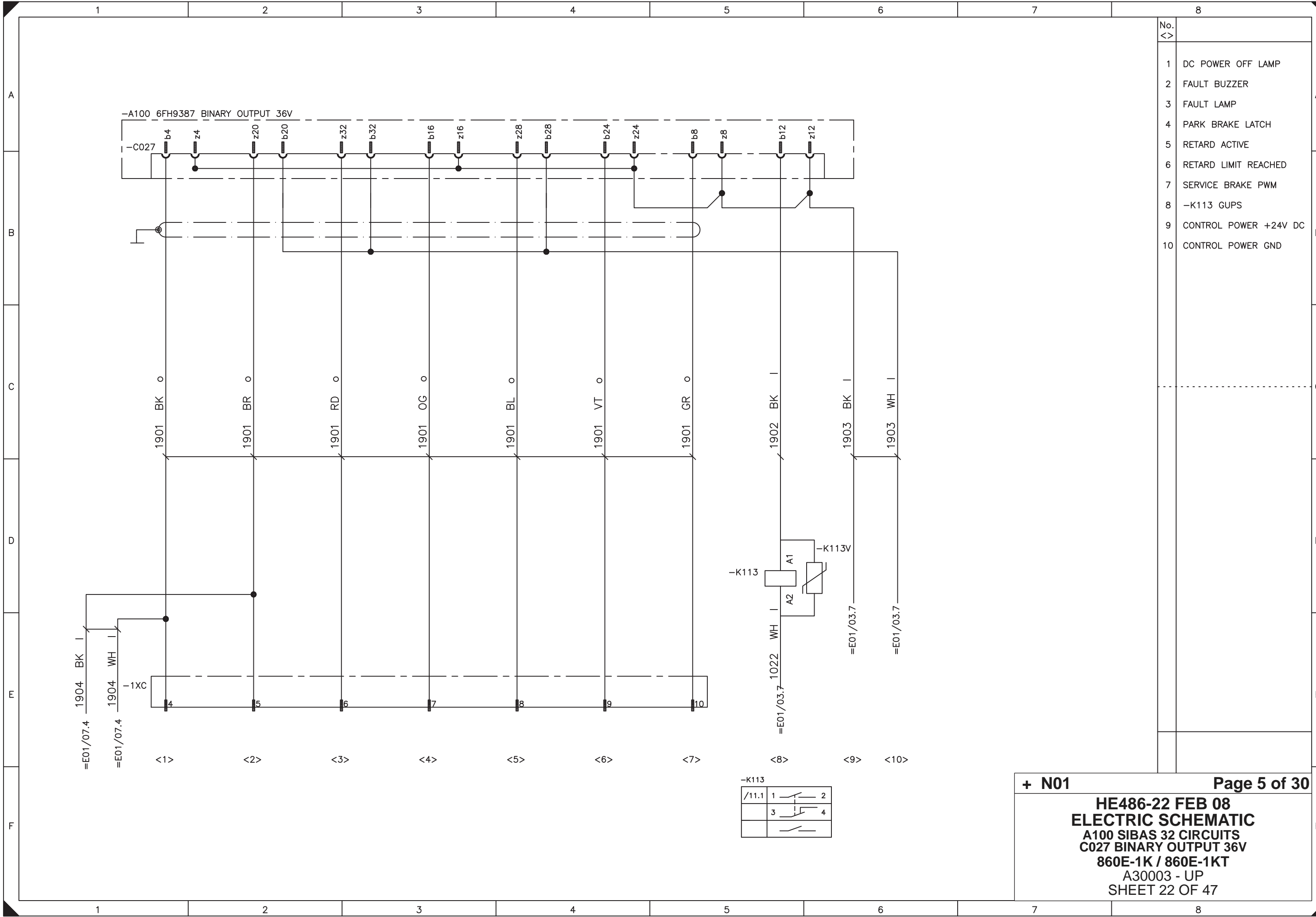
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XS6728-0 SEPT 08
ELECTRIC SCHEMATIC
DIAG. PORTS/DISPATCH SYSTEM
860E-1K / 860E-1KT
A30004 - UP
SHEET 28 OF 37



+ B00
HE486-4 FEB 08
ELECTRIC SCHEMATIC
SYSTEM OVERVIEW
860E-1K / 860E-1KT
A30003 - UP
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No.	<>
1	DC POWER OFF LAMP
2	FAULT BUZZER
3	FAULT LAMP
4	PARK BRAKE LATCH
5	RETARD ACTIVE
6	RETARD LIMIT REACHED
7	SERVICE BRAKE PWM
8	-K113 GUPS
9	CONTROL POWER +24V DC
10	CONTROL POWER GND

+ N01 **Page 5 of 30**

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ELECTRIC SCHEMATIC
 A100 SIBAS 32 CIRCUITS
 C027 BINARY OUTPUT 36V
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