This manual is intended for the service mechanic who is seeking information about maintenance and service replacement parts. It contains a section on troubleshooting which will enable a qualified mechanic to locate and solve problems which may occur.

OPERATOR INSTRUCTIONS

This manual does not contain operation instructions. Operator Instructions in tag or booklet form are sent with each truck. Additional copies can be ordered if required. These booklets are for you and your personnel to insure years of safe, trouble-free operation of your Crown Lift Truck. For stockpicker operator instructions, refer to Crown publication, "You and Your Crown Stockpicker" (PF7568).

DRIVER TRAINING

Crown has available a complete series of Driver Training programs in two parts, concerning basic safety rules and operating characteristics of your stockpicker. To obtain this informative material, ask your Crown Dealer about "Its up to You" and "You and Your Stockpicker".

SERVICE TRAINING

Complete Service Training is available to the lift truck mechanic covering all Crown Lift Trucks, SCR systems, wire guidance, hydraulic and electrical systems. To obtain more information concerning service training, contact your Crown Dealer.

When ordering replacement parts from this manual, always specify, along with the part number, the model and serial number of the truck. This information will further enable us to give correct, fast and efficient service.

For Series SP capacities, technical information and dimensional specifications, please refer to the following sales literature:

SP Literature	SF4285
SP36 Specifications	SF4286
SP42 Specifications	SF4287
30SP48 Specifications	SF4288
15SP48 Specifications	SF4289

Copies of publications can be obtained from your Crown dealer or by writing to:

Crown Equipment Corporation
44 S. Washington Street
New Bremen, OH 45869

This manual is arranged according to major sections. The first part of the page number, found at the bottom of each page, denotes the section in which a particular form will be located. The front of the manual covers the written maintenance. The back covers the replacement parts. The sectional descriptions are as follows:

MAINTENANCE		REPLACEMENT PARTS	
SECTION	DESCRIPTION	SECTION	DESCRIPTION
M1	Lubrication and Adjustments	**1**	Basic Chassis or Power Unit
M2	Hydraulics	**2**	Hydraulic System and Components
M3	Drive Unit	**3**	Drive Unit and Components
M4	Electrical	**4**	Electrical Components
M5	Brake	**5**	Brake Assemblies and Brake Systems
M6	Steering	**6**	Steering System and Components
M7	Mast and Main Frame	**7**	Main Frame and Mast Assemblies
M8	Cylinder	**8**	Cylinders
M9	Platform	**9**	Platform Assembly
M10	Glossary	**10**	Accessories
		11	Specifications

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SP36, SP42

In the interest of safety and to ensure compliance with the OSHA Regulations, (Standards - 29 CFR), The control of hazardous energy (lockout/tagout) - 1910.147, Crown has developed guidelines for proper energy control when performing service and maintenance on the SP36, SP42. Before performing any service or maintenance on the SP36, SP42, review the appropriate sections in this service manual for additional procedures to be followed.

In addition, Crown recommends that all mechanics wear appropriate protective items, such as safety glasses, work gloves, and steel toed shoes, whenever performing service or maintenance work on Crown equipment.

BATTERY

SAFETY RULES

- Wear protective clothing, such as, rubber apron, gloves, boots and full-face shield when performing any maintenance on batteries. Do not allow electrolyte to come in contact with eyes, skin, clothing or floor. If electrolyte comes in contact with eyes, flush immediately and thoroughly with clean water. Obtain medical attention immediately. Should electrolyte be spilled on skin, rinse promptly with clean water and wash with soap. A baking soda solution (one pound to one gallon of water) will neutralize acid spilled on clothing, floor or any other surface. Apply solution until bubbling stops and rinse with clean water.
- Keep vent plugs firmly in place at all times except when adding water or taking hydrometer readings.
- Do not bring any type of flame, spark, etc., near the battery. Gas formed while the battery is charging, is highly explosive. This gas remains in the cells long after charging has stopped.
- Do not lay metallic or conductive objects on battery. Arcing will result.
- Do not allow dirt, cleaning solution or other foreign material to enter cells. Impurities in electrolyte has a neutralizing effect reducing available charge.
- If battery repair is planned, follow the battery manufacturer's instructions concerning repair practices and procedures.

BATTERY CARE

WARNING

Only qualified and experienced personnel should perform maintenance and repair on batteries.

- Make certain the charger being used matches the voltage and amperage of the truck battery. This voltage is listed on the truck serial plate.
- Before disconnecting or connecting batteries to a charger, make sure the charger is “OFF”. If an attempt is made to do this while the charger is “ON”, serious injury to you, the battery and charger could result.
- Never use a match or lighter. Battery fumes are explosive.
- Make certain battery used meets weight, size and voltage requirements of truck (refer to serial plate). NEVER operate truck with an undersized battery.

CHARGING

CAUTION

Never smoke or bring flame near the battery. Gas formed during charging is highly explosive and can cause serious injury.

Consult the charger manufacturer’s manual covering your charger for hints on operation and maintenance.

The following is a list of lubricants and maintenance products recommended when doing Planned Maintenance on Crown Lift Trucks.

Lubrication Identification Chart

Type of Lubricant		Part Number	Package Quantity
A	Gear Lube 80W-90 (Typical)	363506-001 363506-012	1 Quart (12) 1 Quart Cans
AA	Automatic Transmission Fluid (Multi-Purpose)	363503-001 363503-012	1 Quart (12) 1 Quart
AAA	Universal Hydraulic & Transmission Fluid	363513-001 363513-012	1 Quart (12) 1 Quart
AAAA	Synthetic Gear Oil 75W-90	363514-001 363514-012	1 Quart (12) 1 Quart
B	Grease (Multi-Purpose)	063002-034 063002-045	14.5 oz Cartridge (40) 14.5 oz Cartridges
BB(1)	Grease (Low Temperature)	063002-017 063002-046	14.5 oz Cartridge (40) 14.5 oz Cartridges
BBB	Food Grade Grease (Multi-Purpose)	363002-001 363002-030	14 oz Cartridge (30) 14 oz Cartridges
BBBB	Grease (Multi-Purpose) Premium	063002-025 063002-026	14.5 oz Cartridge 5 Gallon
C	Oil (SAE 40)		
CC	Engine Oil (10W30)	363500-001 363500-012	1 Quart (12) 1 Quart
D	Hydraulic Oil	363504-101 363504-106	1 Gallon (6) 1 Gallon
DD(1)	Hydraulic Oil (Low Temp)	363505-101 363505-106	1 Gallon (6) 1 Gallon
DDD	Hydraulic Oil - DTE24	063001-021	1 Gallon
E	Channel Grease	063002-024 063002-022	14.5 oz Cartridge 35 lb Pail
F	Gear Grease	063002-024 063002-022	14.5 oz Cartridge 35 lb Pail
G	Chain & Cable Lube	363107-001 363107-012	15 oz Can (12) 15 oz Cans
	Premium Chain & Cable Lube	363115-001 363115-012	12 oz Can (12) 12 oz Cans
H	Final Finish - Rubber & Vinyl Dressing	363129-001 363129-012	11 oz Can (12) 11 oz Cans

(1) Trucks operated in below freezing temperatures must use Low Temp Hydraulic Oil & Grease.

Crown 1987 PF7886-2 Rev. 1/11

INSPECTION CHART

INDEX	COMPONENT	HOURS				
		100	250	500	1000	2000
I-1	Battery and Connector	†				
I-2	Brake Lining			†		
I-3	Brake Operation	†				
I-4	Brake Switch	†				
I-5	Chain Anchors and Retainers	†				
I-6	Column Rollers		†			
I-7	Contactor Tips	†				
I-8	Electrical Connections	†				
I-9	Forks	†				
I-10	Horn	†				
I-11	Hydraulic Lines and Fittings	†				
I-12	Lift Chain			†		
I-13	Lift Cylinder(s)	†				
I-14	Limit Switch	†				
I-15	Motor Brushes — Lift		†			
I-16	Motor Brushes — Traction		†			
I-17	Motor Brushes — Power Steering		†			
I-18	Mechanical Disconnect and Cables	†				
I-19	Platform Gates	†				
I-20	Safety Belt	†				
I-21	Safety Lanyard	†				
I-22	Steering Assembly and Chain	†				
I-23	Stop Blocks and Mast Latches		†			
I-24	Tires, Load Wheels and Guide Wheels	†				
I-25	Travel Controls	†				

CHART 1-5

See Illustration 1-4 & 1-6 for Index Call-outs

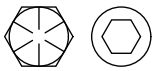
† - Denotes Inspect and (or) Adjust

M1.0 - 07.2 - 006

SAE Torque Values

It is important to tighten fasteners to the correct torque value. This section shows the standard torque values for the screws and bolts used in Crown lift trucks and vehicles. Special torque values in the maintenance and parts sections of this manual override the standard torque values in this section.

Grade

Grade Identification (on Head)	Specification	Bolt and Screw Size (in)
	SAE - Grade 2	1/4 through 1-1/2
	SAE - Grade 5	1/4 through 1-1/2
	SAE - Grade 8	1/4 through 1-1/2

NOTE: Even though a bolt head is unmarked, Crown uses nothing less than Grade 5 in all its bolted assemblies. Instances do occur when Grade 5 bolts are manufactured unmarked. When a fastener is replaced that is unmarked, replace the fastener with a Grade 5.

Fig. 1 (14916-02)

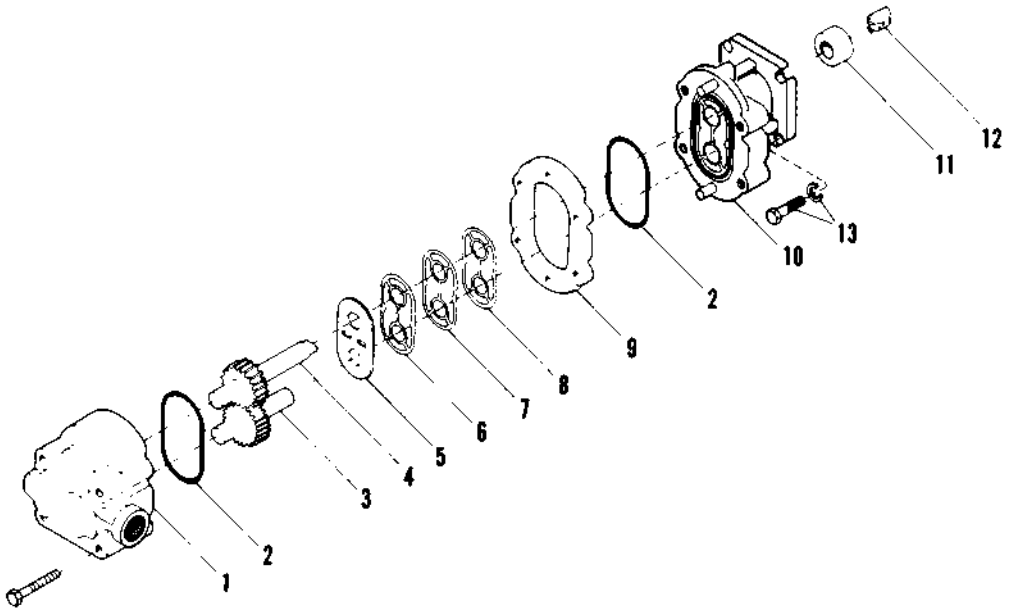


ILLUSTRATION 2.1-1

HYDRAULIC PUMP — PARKER HANNIFIN

Pump - Gear

Before the pump is removed or disassembled, check the following list of common troubles and remedies. It could save time, effort and money.

Preparation for Disassembly

The pump overhauling should be performed in a clean, dust-free location, using clean tools and equipment. Dirt or grit will damage the highly machined surfaces and will result in leakage or premature failure of the pump.

TROUBLE	PROBABLE CAUSE	REMEDY
1. Noisy Pump	a. Low oil supply b. Oil too heavy (i.e. viscous) c. Air leak in inlet line d. Partly blocked inlet line	a. Fill reservoir b. Change to proper viscosity c. Check plumbing d. Check for foreign object and/or clean
2. Foaming Oil	a. Pump cavitating b. Water in the oil	a. See 1a, 1b, 1c, 1d b. Check reservoir
3. Pump or oil overheating	a. Oil supply too thin b. Oil supply contaminated c. Pump cavitating d. Pump drive shaft excessively misaligned with pump driven shaft e. Pump drive shaft axially loaded by driving shaft (Prime Mover) f. System relief valve bypassing	a. Drain & fill with proper viscosity oil b. Drain, clean filter & fill with clean oil c. See 1a, 1b, 1c, 1d d. Check alignment e. Check for clearance at ends of shafts, for shaft misalignment or worn driving keys, keyways or splines. If pulley drive check for belt alignment f. Check relief valve setting (see 4c)
4. Low Flow	a. Pump cavitating b. Foaming oil c. Relief valve leaks or set too low d. Speed too low e. Oil too hot	a. See 1a, 1b, 1c, 1d b. See 2a, 2b c. Check relief valve for foreign particles d. Check prime mover speed e. Check temperature (see 3a, 3b, 3c, 3d & 3e)
5. Failure to build pressure	a. Defective relief valve b. Low oil supply	a. Check and reset or replace b. Fill reservoir

Next inspect the check valves (index 4 & 21). Raise the platform a couple of inches, disconnect the battery and loosen the hydraulic fitting from the "P1" port. If hydraulic oil flows out and the platform lowers the right check valve (index 21 [as shown in illustration 2.4-1]) is faulty. A certain amount of oil will always run out. It comes from the suction line between the pump and the check valve and should not be confused with oil under pressure. If the platform does not lower, repeat the same test method on the "P2" port. If this also proves negative, test both ports for check valve "O" ring leakage. Drain out as much of the hydraulic oil from the "PI" and "P2" port cavities as possible. Monitor the oil level for a minute or so to see if the oil level rises. If it does, lower the platform and remove both check valves and replace the "O" rings since it is impossible to futher isolate which check valve "O" ring is leaking.

If it is determined that all check valves are functioning properly, one or more of the external component valves are faulty. With the use of a test plug (f#92177), remove each valve and replace it with the test plug. Operate the system until the problem disappears. The valve you have out of the manifold body at that time is the faulty valve. The test plug will only fit the manual valve, relief valve and the "SV2" solenoid valve cavities in the body so the test procedure will have to be a process of elimination. If the test plug does not alleviate the problem when inserted into the "SV2", manual or relief valve cavities and, as tested previously, the check valves are working properly, the problem has to be in the "SV1" solenoid valve.

If the problem is a slow drift of the platform, replace the smaller "O" ring and back-up ring on the faulty valve. Re-install the valve and run operational test. If the problem persists, replace the component valve.

VALVE ASSEMBLY TROUBLE SHOOTING CHART

(REFER TO ILLUSTRATION 2.4-1)

TROUBLE	PROBABLE CAUSE	REMEDY
1. Oil present around manifold.	Defective "O" ring on the valves, fittings or plugs.	Replace "O" rings (index 11, 15, 19 or 29 [as required]) or replace "O" rings on plugs or fittings.
2. Platform will not raise (pump runs).	Relief valve stuck in the open position.	Replace relief valve.
	Solenoid valves or manual valve stuck in the open (free flow) position.	Actuate the valve(s) and try to dislodge the debris. Check to see that the valve (solenoid only) is not over tightened. (160 to 170 in. /lb. max.) If neither of the above two remedies work, replace valve.
3. No low speed raise, high speed raise works properly.	Check valve (index 4) stuck in the open position.	Actuate the lift button several times to try to dislodge the debris. If that doesn't work, replace check valve.
4. Platform will not raise capacity load.	Relief valve not adjusted correctly.	Readjust relief valve in accordance with chart 2.4-2.
5. Platform drifts down (t).	Defective "O" rings on check valves, solenoid valves manual valve or relief valve.	Replace "O" rings (index 5, 10, 14, 18, 22 or 28 [as required]) or back-up rings (index 9, 13, 17 or 27). Check valve cavity at "O" ring sealing area for nicks or rough surfaces.
	Debris caught in check valve (index 21) seats.	Actuate the valve(s) and try to dislodge the debris. If that doesn't work, replace valve.
6. Platform will not lower.	Solenoid coil failure.	Replace solenoid coil.
	Electrical malfunction.	Refer to "Electrical" section.

(t) = in excess of drift test.

CHART 2.4-3

Drive Unit Removal

NOTE

In most cases repair to the drive unit can be made with the drive unit in the power unit. However, should it be necessary to remove the complete drive unit from truck, the following procedure should be followed.

Elevate and block the power unit; the drive tire must be off floor.

Remove steering mechanism, control handle, etc. from top of drive unit.

SP ONLY. Disconnect brake line at base of mainframe. Drain brake fluid into container. Unclamp and unthread brake line from power unit. Trucks built October 1, 1986 and after (equipped with an electric brake assembly) hydraulic brake lines do not exist.

Disconnect motor cables from contactor panel; disconnect brake switch leads.

Attach a hoist to support plate at top of drive unit, near the thrust plate. Use caution not to damage brake linkage, if so equipped in the process.

Loosen and remove the (3) screws connecting the thrust plate to the power unit and carefully raise the drive unit until it is clear of the power unit.

NOTE

The drive unit should be taken to a clean work area if further disassembly is necessary. Make sure the vented fill plug is to the top side of unit if it is necessary to lay the drive unit down for transporting, etc.

Drive Unit Disassembly

The following disassembly and assembly procedure is a complete tear down and rebuild operation. Once the problem has been diagnosed the repair procedure can be used that covers the necessary repair.

LOWER HOUSING

Drain gear oil.

In order to separate the drive unit top from the drive unit bottom remove the six screws (item 17, Figure 0060S-01) securing the two drive unit sections together.

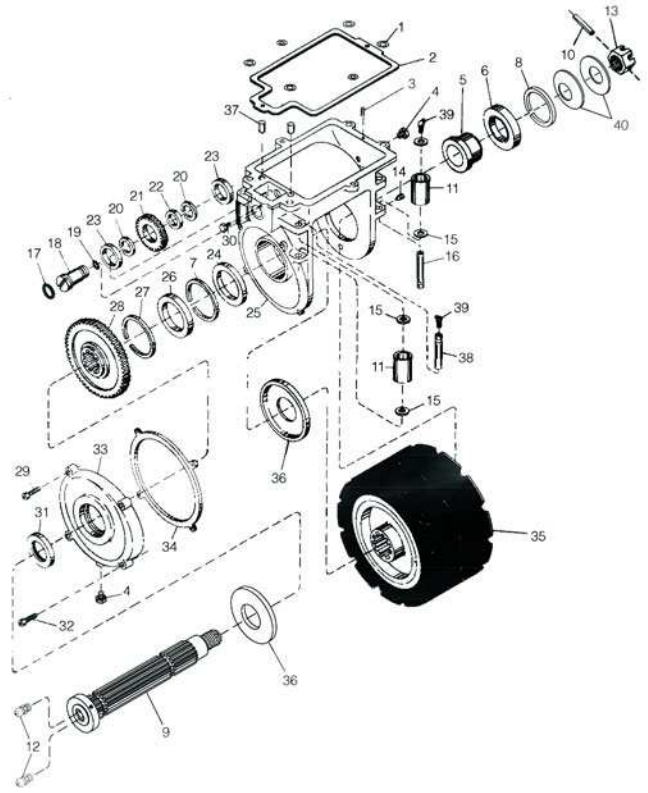


Figure 0357S-02

Remove the drive wheel axle (item 9, Figure 0357S-02). Remove the roll pin (item 10) locking the castle nut (item 13) to the end of the axle. Use a 1 1 /2 in. wrench and remove castle nut from axle. Pull axle from drive unit housing while stabilizing the drive tire.

Unfasten the four screws (item 32 & 29) and remove the cover (item 33) and the gasket (item 34).

Remove the retaining ring (item 27), access it through the slots in the face of the second reduction gear (item 28). Large retaining ring pliers with a locking ratchet such as a Waldes Truarc No. S-6700, Crown no. 092668, should be used (see Figure 3394).

Figure 3394

will cut off battery power when the disconnect handle is engaged. Cable tension should be checked by inspection of the disconnect spring located between the mast assembly and the rear wall of the power unit. The spring should be ½" [12.7 mm] from being fully compressed when properly adjusted. A turn buckle is used to adjust to this measurement, compensating for wear. See section 6 "Steering" for the compression tools to use when replacing cables.

GAGES

Hour Meter (TT)

The hour meter is used to accurately record a lift trucks "running time" in hours. This instrument serves as an aid in determining a lubrication and maintenance schedule.

Discharge Meter (V)

A discharge meter is used to monitor the lift trucks battery voltage while the key switch is in the "on" position. Observe the operation of the gage. Should the indicator needle drop into the red area, it is recommended that a specific gravity test be taken with a hydrometer to more accurately determine the battery condition. Depending on the test results, the battery should either be recharged or exchanged with a fully charged battery.

Discharge Meter/Lift Interrupt (BDI)

The discharge meter/lift interrupt is used to monitor the state of charge of the trucks battery. As the state of charge (specific gravity) falls below a predetermined level, the truck's lift contactor will drop-out, permitting no further lifting operations,

The discharge/lift interrupt meter shows the state of charge of the battery. The pointer will move from "F" full charge, towards "E" discharged red zone, as the battery is discharged. As the pointer moves to the yellow zone, the warning light in the gage will come on. This is a signal to the operator that 'he has approximately 5% battery capacity left before the truck's lift contactor will be locked out. If the truck continues to operate with a low battery, the pointer will move to the red zone. At this time, lift lock-out will occur, preventing battery damage caused by deep discharging.

CONTROL CABLES

Control Cable Tension Device

(Refer to illustration 4-2)

The control cables which are routed through the mast pulleys are kept properly seated in these pulleys by means of a tension device located at the base of the main frame. To obtain the proper cable tension, adjust the spring so there is 8" [203mm] of extension on the spring (14" [356mm] overall). This will be equal to approximately 19 Ibs. [8.6 kg.] of pull. Fasten the cable ties around the end of the cable grip to help prevent cable slippage (See illustration).

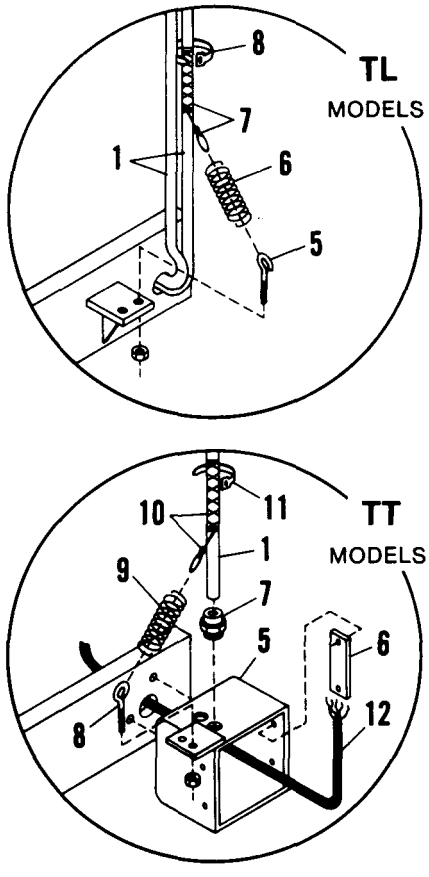


ILLUSTRATION 4-2

DISCHARGE METER/LIFT INTERRUPT (BDI)

The Discharge Indicator shows the state-of-charge in the battery. During regular operation, the pointer in the gage will move from “F”, green zone - full charge, towards “E”, red zone - discharged. As the pointer moves into the solid yellow zone, the “reserve warning light”, located in the discharge indicator, will begin to flash. This is a warning to the operator to recharge or change to a fully charged battery. If the truck is continued in operation without recharge or replacement of battery, the pointer will move into the red zone of the gage. Should this occur the lift contactor will drop-out and prevent any lifting operations, thus preventing battery damage.

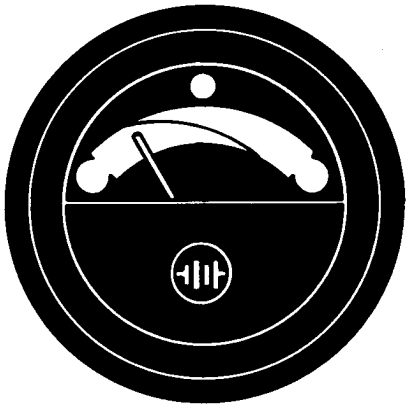
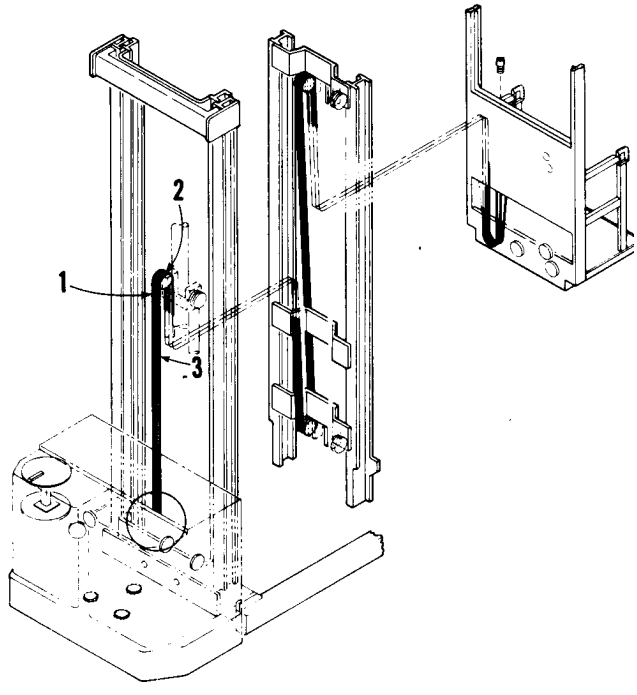


ILLUSTRATION 4.0-17



Control Cables

CONTROL CABLE TENSION DEVICE

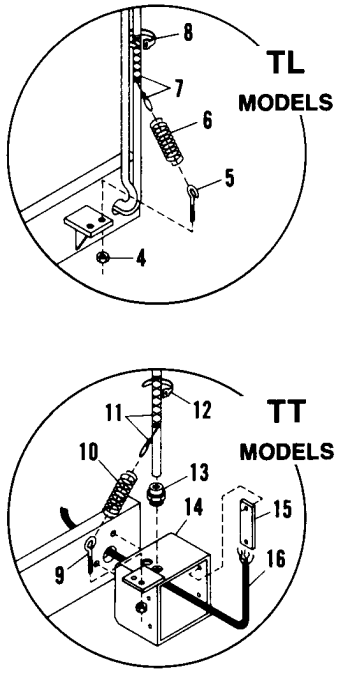
(Refer to Illustration 4.0-18)

The control cables which are routed through the mast pulleys are kept properly seated in these pulleys by means of a tension device located at the base of the main frame. To obtain the proper cable tension, adjust the spring so there is 8“ [203 mm] of extension on the spring (14” [356 mm] overall). This will be equal to approximately 19 lbs. [8.6 kg.] of pull. Fasten cable ties around the end of the cable grip to help prevent cable slippage (See Illustration).

CABLE ROUTING

(Refer to Illustration 4.0-18)

Cables are routed through the mast assembly as shown. Signals carried by each cable are listed in the Illustration.



1 Carries signals between SCR contactor panel and platform.

2 Carries all miscellaneous signals between platform and power unit.

3 Present on wire guide trucks only. Carries signals for wire guidance systems.

ILLUSTRATION 4.0-18

EMERGENCY DISCONNECT SWITCH — EDS

The Emergency Disconnect Switch is located in the control module assembly, above the raise and lower buttons. This switch is actuated by a button in the control module. Depressing the button removes power from the emergency disconnect contactor coil, which opens its contact and the latching contacts around the switch contact. This removes power from the power steering, lift, traction and control circuit. To power the truck back up, EDS must be released and the keyswitch cycled OFF, START and back to ON. This switch requires no adjustment.

TOW SWITCH — EMS-1

This toggle switch is located on the top flange of the power unit electrical panel on SP36 series trucks and on the pump contactor panel of SP42 and SP48 series trucks. When the truck becomes disabled and must be towed to the maintenance area, the Tow Switch must be used to release the electric brake.

When EMS-1 is in the “Tow” position, traction is disabled. Before placing truck back in service, the Tow Switch must be placed in the “DRIVE” position to allow normal truck and brake operation. This switch requires no adjustment.

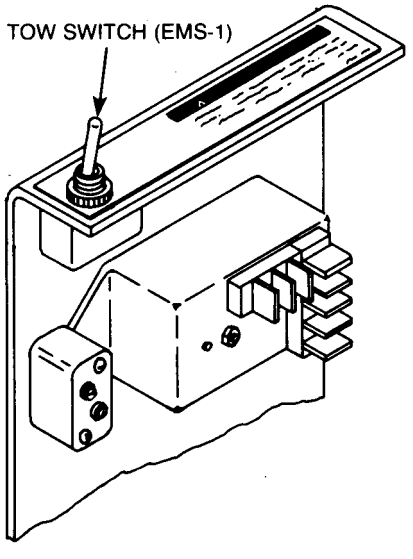


ILLUSTRATION 4.0-10

FORWARD SWITCH — FS

The Forward Switch is located inside the control module assembly, left of the raise and lower buttons. When the twist grip is rotated away from the operator, the actuator arm of FS contacts a cam lobe, closing the normally open contacts which completes the circuit to energize the forward contactor. For adjustment of this switch, refer to the Control Module Assembly section.

GUIDANCE SWITCH — GUS

The Guidance Switch is a toggle switch located in the panel above the control module assembly of the operator compartment. This switch is present only on trucks with a wire guidance system. Placing this switch in the “MANUAL” mode will cause the steering of the truck to be controlled by the operator. Placing the switch in the “AUTOMATIC” mode will, provided wire guidance is acquired, steer the truck automatically. Refer to the Wire Guidance section of the Service Manual for more detailed description. Adjustment of this switch is not required.

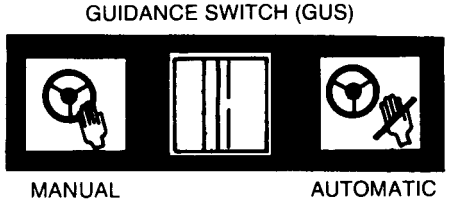


ILLUSTRATION 4.0-11

HORN SWITCH — HNS

The Horn Switch is located inside the control module assembly of the operator compartment, below the raise and lower buttons. When the horn button is depressed, the normally open contact of HNS closes and the horn will sound. This switch requires no adjustment.

KEYSWITCH — KYS

The keyswitch, located in the control module assembly of the operator compartment, is a key operated, three position, spring return to center switch. In the “OFF” position, all electrical controls are disabled. Turning this switch to the “START” position energizes a latching circuit and allows the keyswitch to be returned to the “ON” position. When the latching circuit is energized and the keyswitch is in the “ON” position, electrical power is available for electrical controls. KYS has a mechanical restriction which requires the key to be returned to “OFF” from the “ON” position before it can be turned to the “START” position. This switch requires no adjustment.

1A CUTOUT SWITCH — LMS-1

LMS-1 limit switch is mounted on the platform, between the platform and mast. When the platform exceeds a height of 24 inches, the actuating arm of LMS-1 loses contact with a tripper baron the mast. This action reduces maximum traction speed by opening the 1 A and accelerator circuits and closes a circuit limiting traction speed to 2.5 mph. A contact of this switch also cuts out second speed lower on trucks equipped with dual speed raise.

30SP48

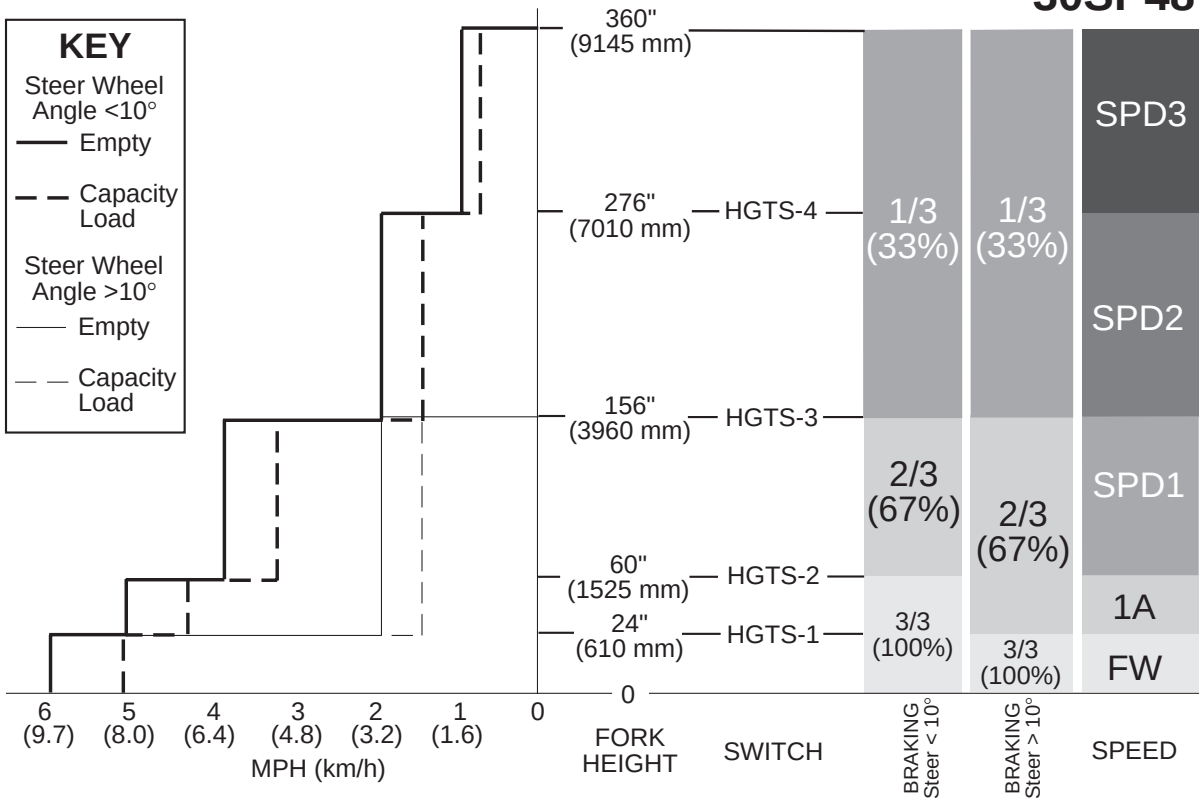


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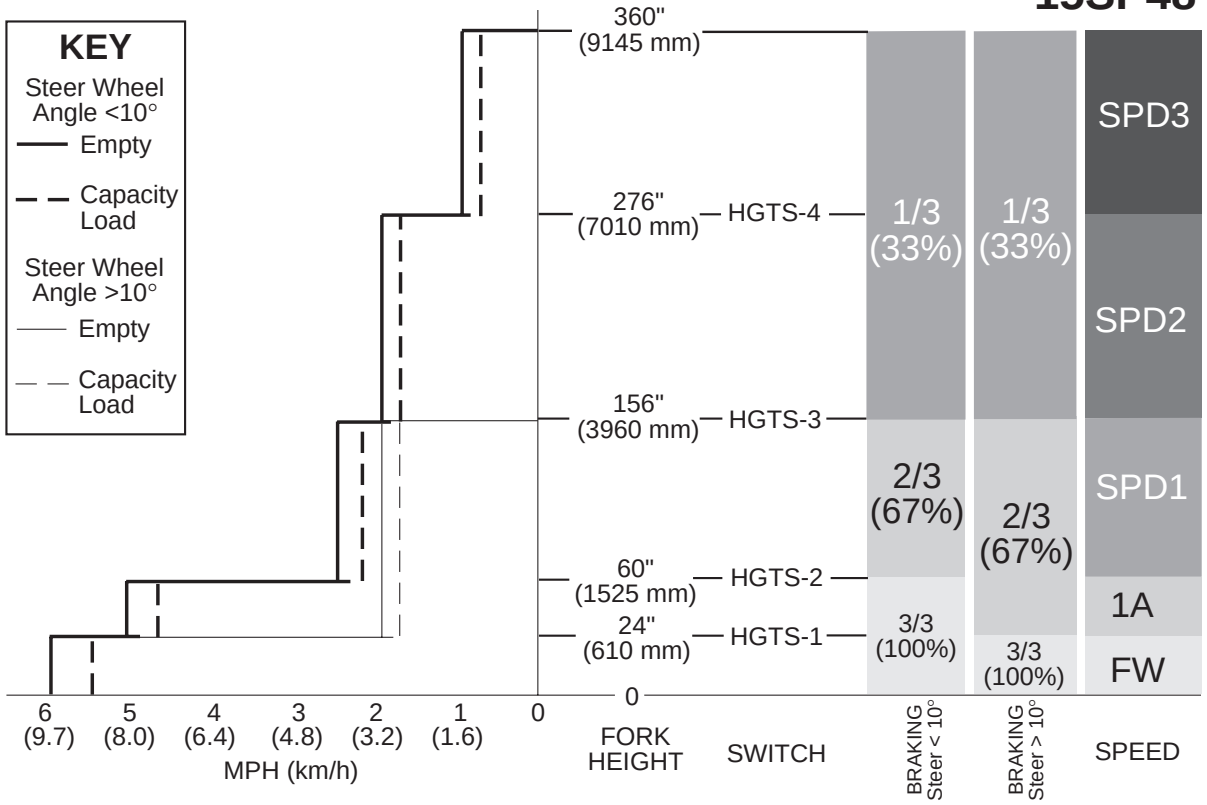
ILLUSTRATION 4.0-3

15SP48

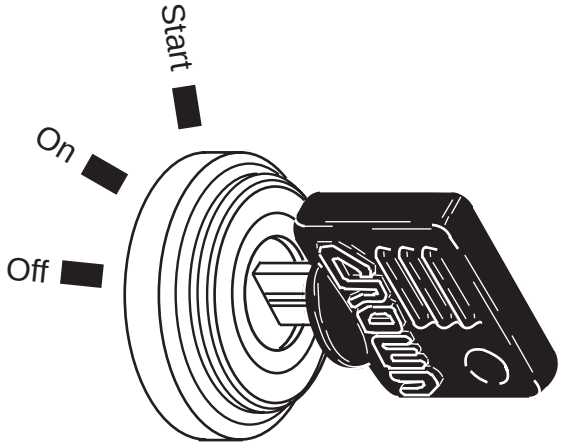


0477

ILLUSTRATION 4.0-4

KYS
KEYSWITCH

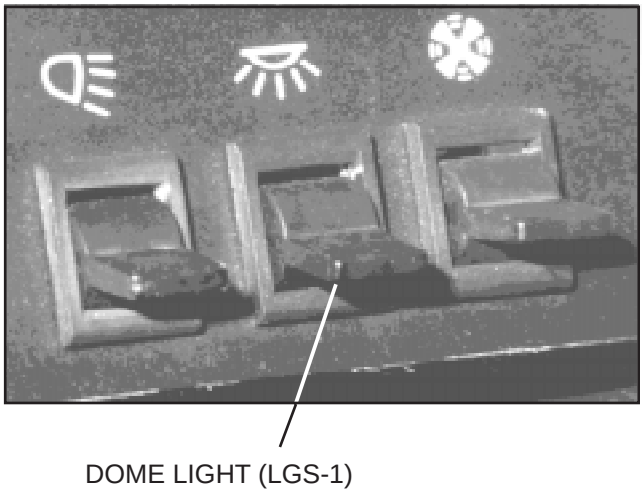
The keyswitch, located in the control module assembly of the operator compartment, is a key operated, three position, spring return to center switch. In the "OFF" position, all electrical controls are disabled. Turning this switch to the "START" position energizes a latching circuit and allows the keyswitch to be returned to the "ON" position. When the latching circuit is energized and the keyswitch is in the "ON" position, electrical power is available for electrical controls. KYS has a mechanical restriction which requires the key to be returned to "OFF" from the "ON" position before it can be turned to the "START" position. This switch requires no adjustment.



0134 ILLUSTRATION 4.0-14

LGS-1
DOME LIGHT SWITCH

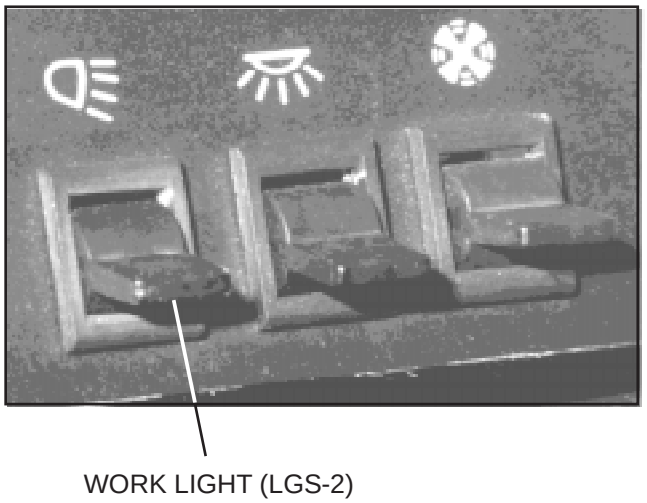
LGS-1 is located in the Switch and Indicator Panel above the platform control module. When this toggle switch is placed in the "up" position, the dome lights will illuminate. This switch does not require adjustment.



0135P ILLUSTRATION 4.0-15

LGS-2
WORK LIGHT SWITCH

LGS-2 is located in the Switch and Indicator Panel above the platform control module. When this toggle switch is placed in the "up" position, the work lights will illuminate. This switch does not require adjustment.



0136P ILLUSTRATION 4.0-16

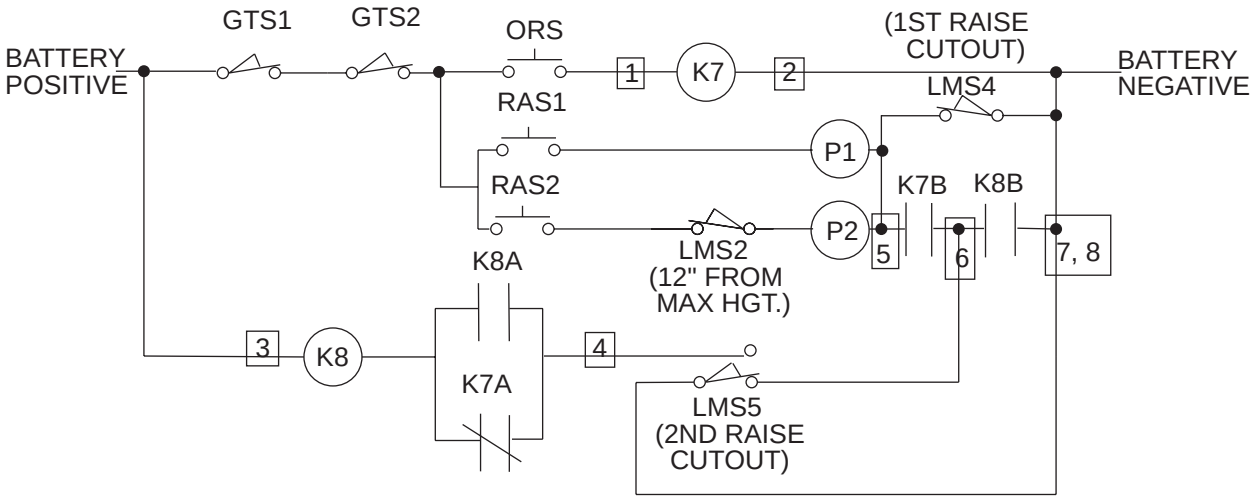
LGS-3
SPOTLIGHT SWITCH

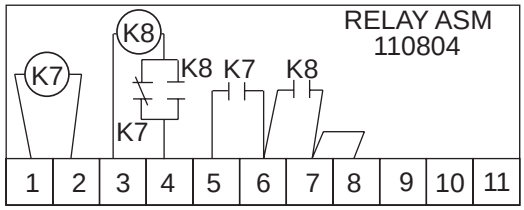
Trucks equipped with spotlights will have a rocker switch located in the left hand console of the overhead guard. Changing the rocker position of this switch will illuminate the spotlights. This switch does not require adjustment.

0137P ILLUSTRATION 4.0-17

K7 & K8
OVERRIDE DUAL RELAY

K7 and K8 are located on the door panel. On trucks with 2 raise cutouts w/ override, K7 works with the 1st cutout with override and K8 works with the 2nd cutout w/ override.





078614

1538

ILLUSTRATION 4.0-7

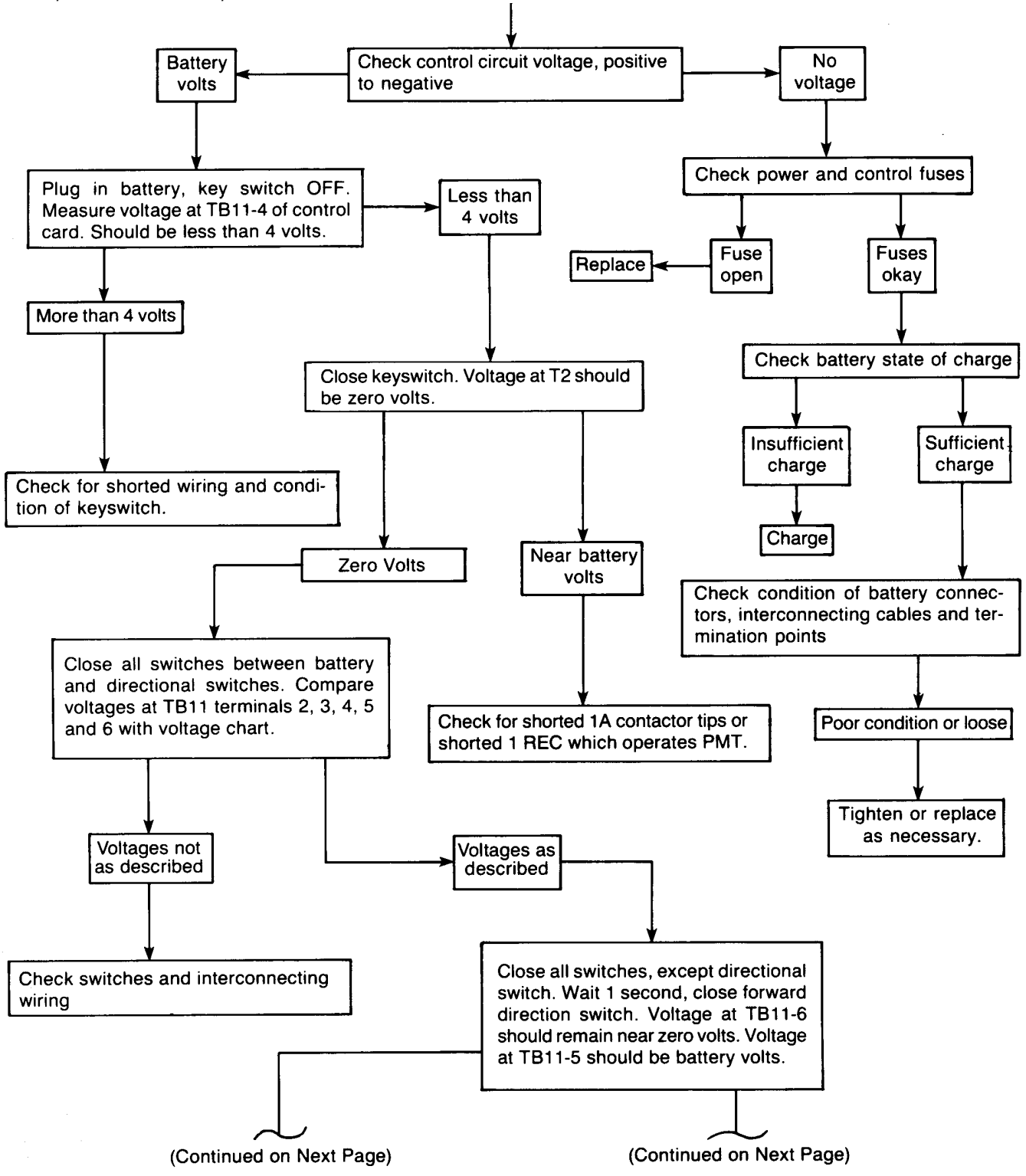
M4.0 - 07.3 - 103

CAUTION

Make certain correct control card is in use. Refer to parts breakdown and chart in TUNE-UP section for type and part number card required.

TROUBLESHOOTING FLOWCHART BY SYMPTOM

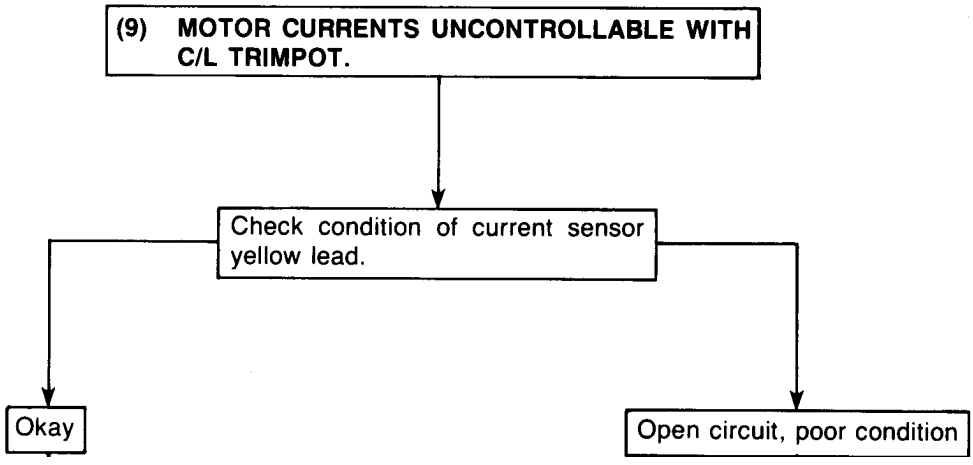
DIRECTIONAL CONTRACTORS DO NOT OPERATE (1)



M4.2 - 07.2 - 404

CAUTION

Make certain correct control card is in use. Refer to parts breakdown and chart in TUNE-UP section for type and part number card required.



M4.2 - 07.2 - 414

SYSTEM OPERATION

To operate in the Automatic mode, proceed as follows:

1. Start the truck and drive it in the Manual mode to the entrance of a guided aisle.
2. Prior to attempting guidance of a wire guidance equipped truck raise the platform or forks to a height of 6 to 12 inches. Failure to do so may result in masking of the Sensor Input Signal, and prevent proper guidance.
3. Approach the guidepath, steer the truck to intersect the guidepath at an approach angle of 20 degrees or less.

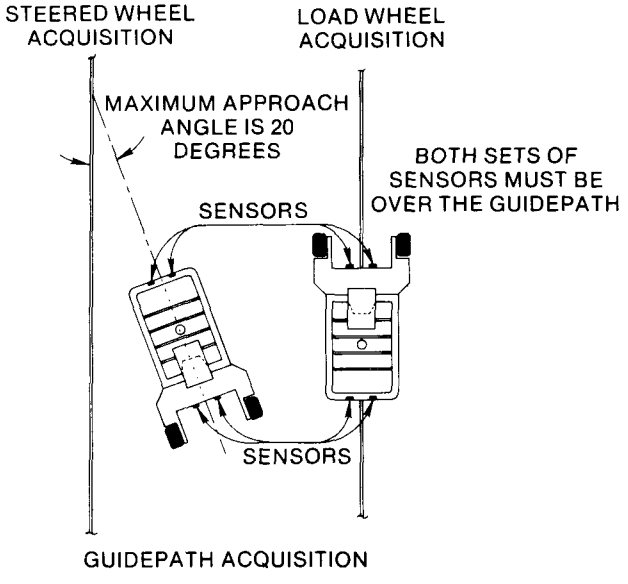


ILLUSTRATION 4.3-52

NOTE

The approach angle of the vehicle must not be more than 20 degrees when acquiring the wire in the steered wheel direction. When acquiring the wire in the load wheel direction, both sets of sensors must be centered over the guidepath. If the truck approaches the guidepath at too great an angle, or too high a speed, the wire guidance system will not acquire the wire.

4. Switch to the automatic mode near the entrance of the aisle. The red and green lights on the indicator panel will be on to indicate the Acquisition mode of operation. The wire guidance system switches to the automatic mode of operation when sufficient input signal is received from the guidepath. At this time, the red light goes out, the green light will remain on, and a one-half second tone is sounded, indicating that Automatic guidance has begun.
5. Accelerate slowly when changing the direction of travel in the automatic mode. The system should be allowed two truck lengths of travel to insure proper centering before driving at high speed.

An alarm indicates mode changes and also alerts the operator if the truck goes off the guidepath. There are three alarm modes: a half *second tone,* a *three second alarm,* and a *continuous alarm.*

The *half second tone* indicates that acquisition has been accomplished and the system is in the automatic mode. The red light goes out and the green light remains on when acquisition is obtained.

The *three second alarm* alerts the driver that the system has lost acquisition while entering the automatic mode of operation. For example: when in the Acquisition mode, if the truck should acquire the wire and then overshoot it due to going too fast or attempting acquisition at too great an angle, a three second alarm will sound. Manual steering control is returned to the operator during a three second alarm. The operator remains in control of the vehicle steering until acquisition is regained. During a three second alarm, both the red and green lights are on. When acquisition is regained, the red light will go out and the green light will remain on.

A *continuous alarm* sounds if guidance is lost after the system has been in the automatic mode longer than seven seconds. For example: a continuous alarm sounds when the truck travels beyond the wire at the end of a guided aisle. In this case, both the red and green lights are on and manual steering is returned to the operator. To clear a continuous alarm, the operator must select the Manual mode of operation to reset the system. The system can not return to the Automatic mode until the continuous alarm has been reset.

STEERING COMMAND GENERATION

Illustration 4.3-77 provides a comparison of the signals on the servo amplifier board with respect to the behavior of the truck.

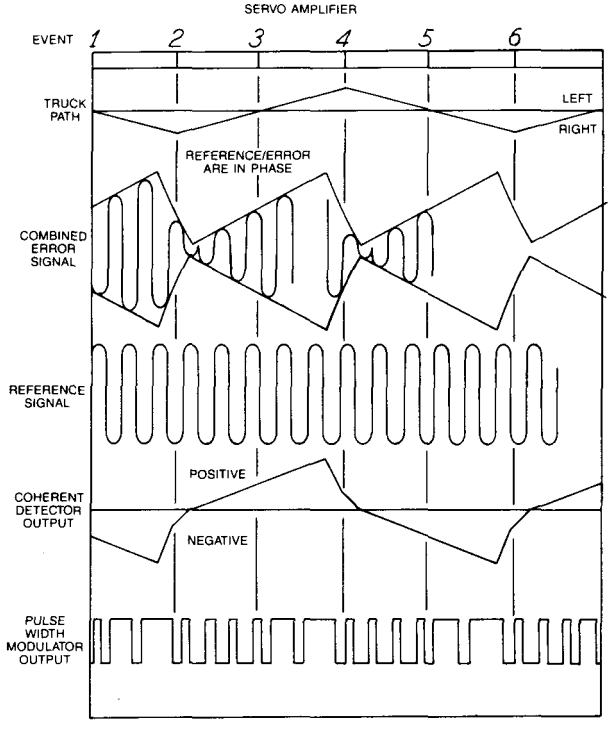


ILLUSTRATION 4.3-77

TRUCK PATH

This illustrates the path of the steered wheel sensors with respect to the guidepath as the truck travels along the wire.

COMBINED ERROR AMPLITUDE

The combined error amplitude signal represents the error signal input to the servo circuit board from the sensor amplifier.

REFERENCE SIGNAL

This signal is representative of the reference input to the coherent detector. The reference signal is constant in terms of phase and amplitude. In the coherent detector, the reference signal is compared with the error signal, and a varying DC output is generated.

COHERENT DETECTOR OUTPUT

The output of the coherent detector is a DC voltage varying above and below analog ground. The coherent detector output will be a negative DC level when the reference and error inputs are out of phase, and a positive DC level when the reference and error signals are in phase.

PULSE WIDTH MODULATOR OUTPUT

The output of the pulse width modulator is a series of pulses that vary in width as the coherent detector DC output varies above or below the analog ground reference. Increasing the output level of the coherent detector increases the pulse width, which increases the current flow through the servo motor.

Bi-Directional Travel Steering Description

Bi-directional steering is accomplished in the guidance system by using two essentially identical sets of sensors and input circuits and then using these inputs to generate the steering commands.

Reverse guidance is guidance in the load wheel direction of travel. During reverse guidance, both sets of sensors are used to generate the error signal. The reference signal is still generated by the steered wheel sensors and associated circuitry.

During operation, with both sets of sensors over the wire, the sensor outputs are applied to the summing amplifier inputs. Two outputs are generated by each set of summing amplifiers, R + L, from the simple addition of the left and right sensor inputs, and R-L from the algebraic addition of the left and right sensor inputs. R + L from the steered wheel sensors is used to generate the AGC signal for the steered wheel sensor circuits, and also to generate the reference signal. R + L from the load wheel sensors is used only to generate the AGC signal for the load wheel sensor circuits. Right minus Left, or R-L, from both steered wheel and load wheel sensor circuits is applied to the angle sensing circuit to be used to generate the error signal for REVERSE guidance only.

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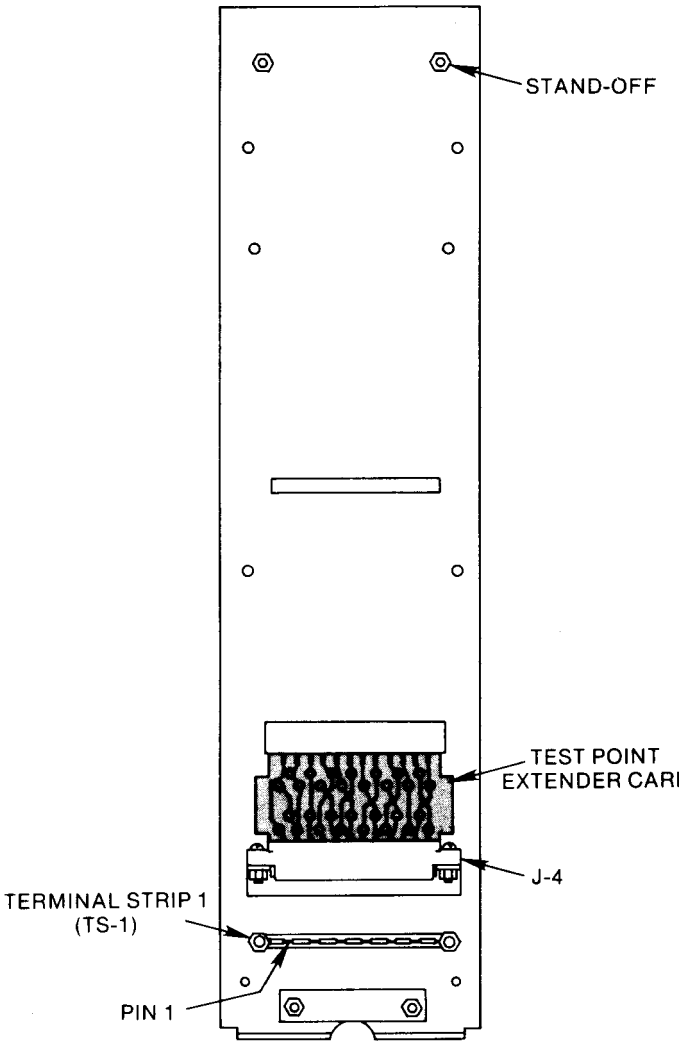
Refer to the sensor amplifier servicing block diagram and the wiring diagram for the truck being serviced.

1. Disconnect the truck battery.
2. Remove the sensor amplifier cover.
3. Remove the sensor amplifier board.
4. Insert the test point extender card into edge connector J-4. Insert the sensor amplifier board into the extender card.

CAUTION

If the sensor amplifier board was held in place with screws, cover the stand-offs with non-conductive tape prior to inserting the sensor amplifier board into the extender card. Failure to do so will result in destruction of the sensor amplifier board.

5. Reconnect the truck battery.



SENSOR AMPLIFIER BACKPLATE

ILLUSTRATION 4.3-57

Check the sensor inputs:

Set the voltmeter to measure AC millivolts. Center the sensors over a working guidepath and measure the sensor input levels between test points 1, 2, 3 and 4 and ground. (Negative battery is used as ground. The common test lead should be connected to the upper lead of the large capacitor located in the lower right hand section of the PC board.)

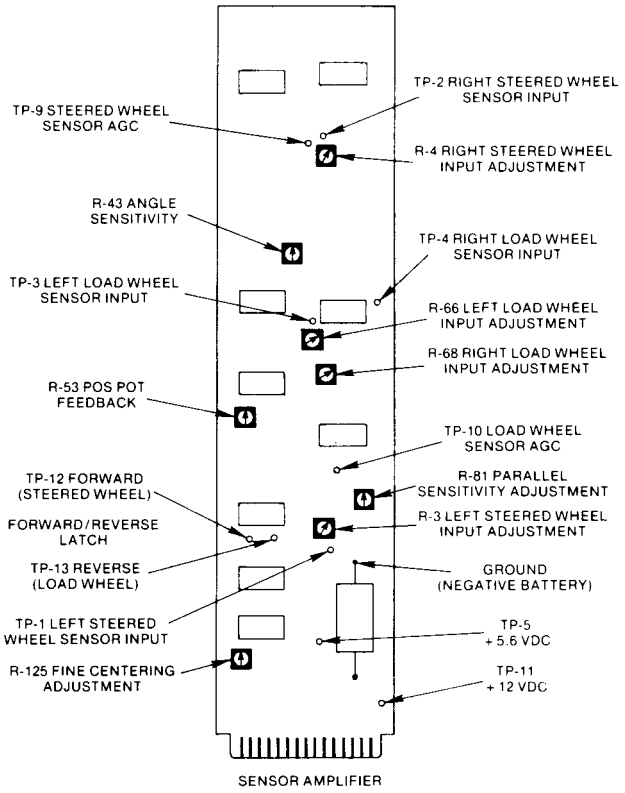


ILLUSTRATION 4.3-58

The voltage at test points 1, 2, 3 and 4 should be 135 mVac when the sensors are perfectly centered. A measurement of plus or minus 30 mVac is acceptable for this check.

If the sensor input levels are good, check the Reference signal output. If the sensor input levels are 0 Vac, check the power supply output at test point 11 for 12 V dc. If 12 volts is available, the sensor assembly, or the wiring harness from the sensor assembly is probably open. Perform a visual inspection of the sensor wiring and continuity checks as required to find the open circuit. If 12 volts is not available at TP-11, check the input voltage at edge connector pin M or on the terminal strip. Refer to the wiring diagram, the input at edge connector pin M will be either 24 or 30 V dc.

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The collector is the case of the transistor. The base is always on the left and the emitter is always on the right.

It is also necessary to check the condition of the diodes, CR-1 through 5. Each diode has two leads, the Anode and the Cathode.

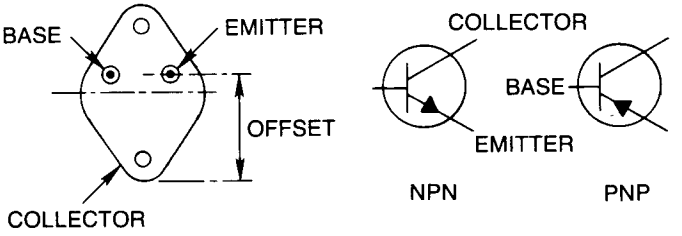


ILLUSTRATION 4.3-93

SET UP THE MULTIMETER:

1. Connect the black (Negative) lead to the common jack of the meter.
2. Connect the red (Positive) lead to the V-Kohms-NS jack of the meter.
3. Turn the Multimeter ON.
4. DC-AC pushbutton to “DC”.
5. V-Kohms-NS pushbutton to “K ohms”.
6. Scale Select pushbutton to “2”.

NOTE

Any other setting will give you erroneous readings, always use the 2 K ohm scale.

NOTE

All resistance readings are taken with a fluke 8020A digital multi-meter. Using a different model multi-meter will work, however, the readings obtained will probably be different.

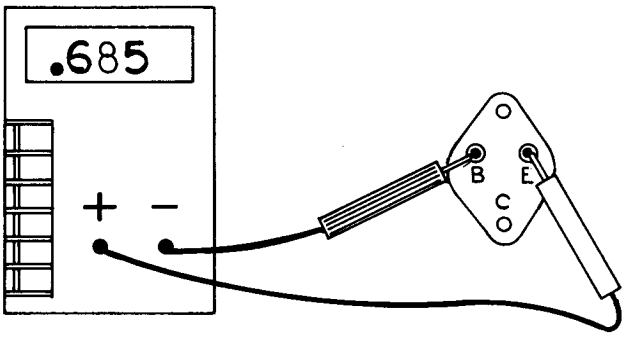
CHECK Q1 AND Q2

NOTE

The stated resistance should be correct within plus or minus 10 percent. Transistors with resistances outside the stated tolerance should be replaced, along with the other transistor of the pair.

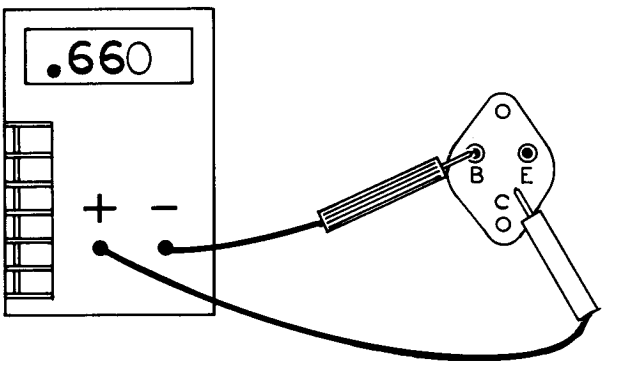
Connect the negative, (Black), lead to the Base. Connect the positive, (Red), lead to the Emitter.

THE METER INDICATION SHOULD BE .685 K OHMS (685 OHMS).



Connect the positive, (Red), lead to the collector.

THE METER INDICATION SHOULD BE .660 K OHMS (660 OHMS).



POSITION POTENTIOMETER

The Position Potentiometer provides an input signal to the wire guidance system which indicates the direction and distance the steered wheel is turned from the straight ahead position.

The Position Potentiometer is mounted to the drive unit sprocket and support assembly.

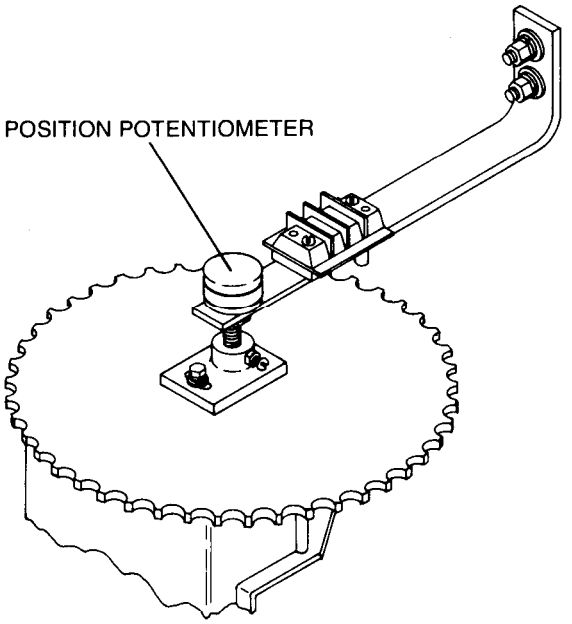


ILLUSTRATION 4.3-120

This section covers troubleshooting and repair of the Position Potentiometer. Alignment of the Position Potentiometer is covered in the Alignment Section of this manual.

Signal Inputs and Outputs

The Position Potentiometer receives two (2) signals from the sensor amplifier board pins H and F, R + L and inverted R + L. These signals are 1.85 VAC in amplitude when measured with a meter. Since these signals are 180° out of phase with each other, when added together, they will cancel each other when the potentiometer wiper arm is at the center of resistance. The point where the signal cancellation occurs is called the NULL point. The result of the added signal, the wiper arm, is connected to the sensor amplifier board, pin 6. This signal will vary from a few millivolts with the steered wheel pointing straight ahead to approximately 1.85 VAC with the wheel at right or left lock.

POSITION POTENTIOMETER OPERATION

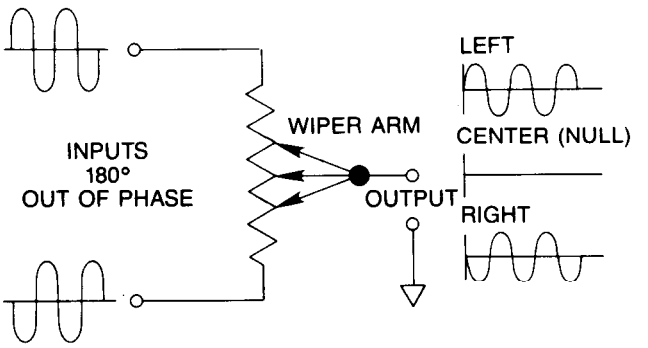


ILLUSTRATION 4.3-121

Troubleshooting

Typical problem symptoms of a position potentiometer are:

- The steered wheel turns to the right or left lock position upon acquisition of the guidepath in the automatic mode of operation.
- The truck guides off center. (Could also result from misadjustment).
- The truck leaves the wire to the right or left.
- The truck jerks back and forth on the wire as it guides.

TOOLS AND EQUIPMENT REQUIRED:

1. Fluke 8022B Digital Multimeter, (or equivalent).
2. Clip on test leads.
3. Test point extension board (Crown No. 100378).
4. Common hand tools.

TROUBLESHOOTING PROCEDURE:

1. Turn the steered wheel, to a straight ahead position.
2. Disconnect the truck battery.
3. Carefully inspect the position potentiometer mounting hardware and associated wiring. Replace any wires that are nicked or broken.
4. Check connections on TB12. Tighten if necessary.
5. Set up the multimeter to measure resistance by:
   a. Place the AC/DC select pushbutton to DC.
   b. Place the MA/V/K ohm pushbutton to the K ohm position.
   c. Place the scale select pushbutton to the 20 K ohm scale.
6. Remove the sensor amplifier board from J-4.

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MANUAL MODE VERIFICATION

Place the system in the Manual mode and check for the following indications:

a. The RED indicator light should be on.
b. The truck should have power steering.
c. There should be no indication of binding, dragging, or lag inthesteering assembly. The steered wheel should turn smoothly from lock to lock.

PRIMARY ALIGNMENT

The primary alignment procedure is performed in the automatic mode.

NOTE

Steered wheel guidance, (alignment steps 1 through 6), must be completed prior to attempting load wheel guidance. If the system is not guiding correctly in the steered wheel direction, it will not guide correctly in the load wheel direction.

STEP 1: POSITION THE TRUCK

žCenter the steered wheel sensors over the guidepath with the steered wheel pointing straight ahead.

STEP 2: VERIFY STEERED WHEEL SENSOR POSITION AND CONDITION

žVisually check the position of the steered wheel sensors. The sensors should be equally distant from the guidepath side to side and at an equal height from the floor. Optimum sensor height from the floor is 3¾ to 4¼ inches (93.8 mm to 106.3 mm).

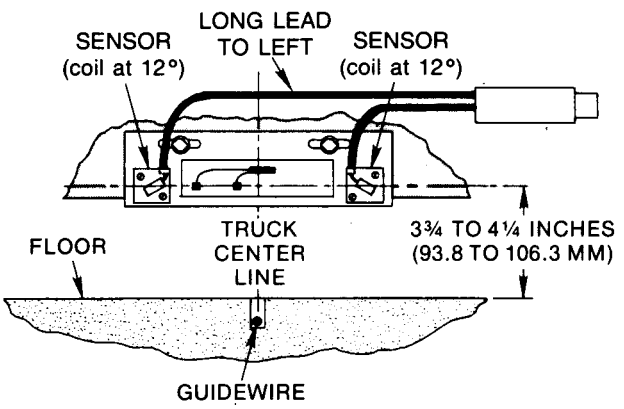


ILLUSTRATION 4.3-62

Refer to Illustration 4.3-62. If the sensors are not positioned as shown, due to damage to the sensor mount or other cause, correct the problem before continuing. The truck cannot be aligned if the sensors are not correctly positioned.

STEP 3: BALANCE THE STEERED WHEEL SENSOR INPUTS

·Set the digital voltmeter to measure a 200 mVac signal.
žMeasure the voltage between TP-1 and Ground on the Sensor Amplifier Board. (See Illustration 4.3-63).
Ž Adjust potentiometer R-3 so that the voltage level at TP-1 is 135 mVac Plus or minus .5 mVac.

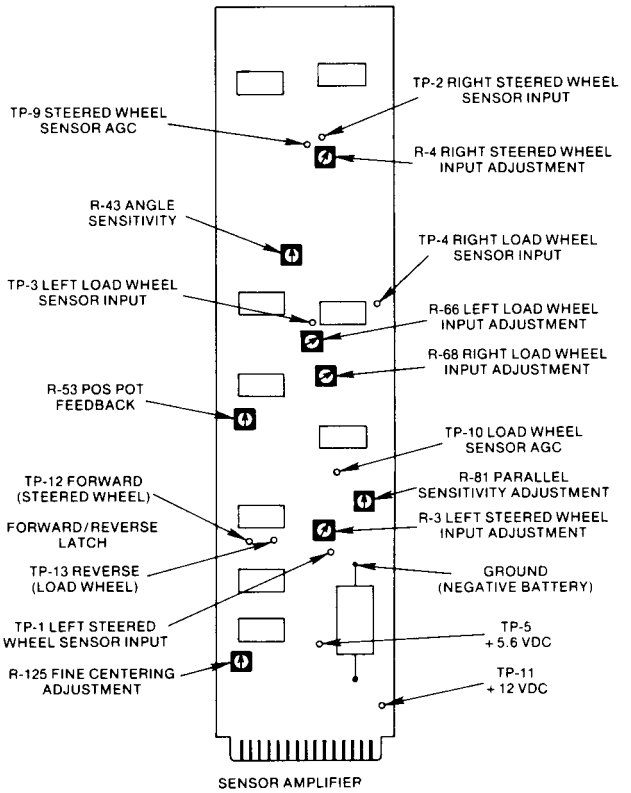
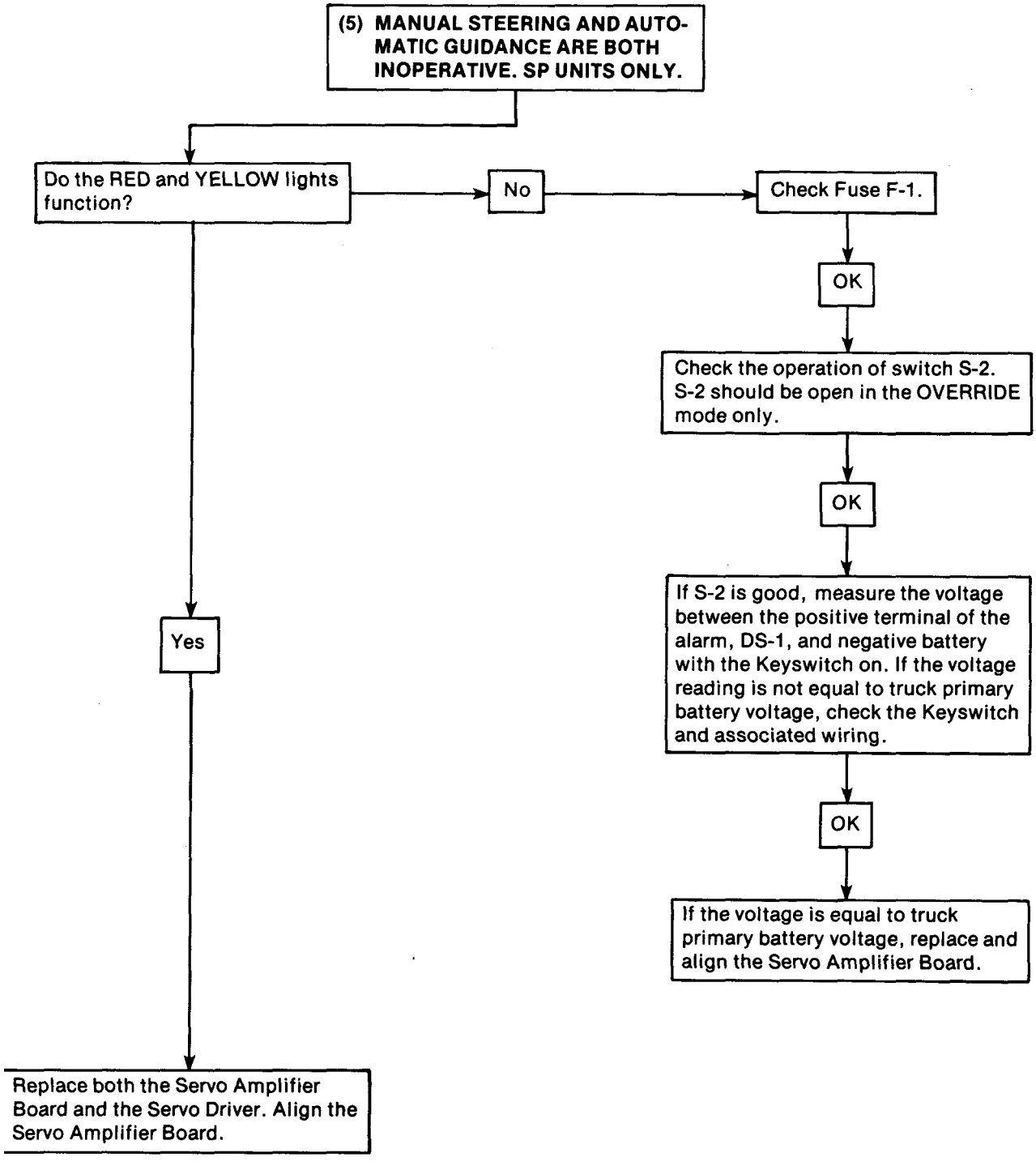


ILLUSTRATION 4.3-63

NOTE

135 mVac is the optimum setting. Permissible tolerance is from 125 to 150 mVac. All four sensors must have the same input for correct guidance. For example; if TP-1 is set at 140 mVac, TP-2, 3, and 4, must be set at 140 mVac.

žMeasure the voltage between TP-2 and ground on the Sensor Amplifier board. (See Illustration 4.3-63).
žAdjust potentiometer R-4 so that the voltage level at TP-2 is 135 mVac PIUS or minus .5 mVac.


(5) MANUAL STEERING AND AUTOMATIC GUIDANCE ARE BOTH INOPERATIVE. SP UNITS ONLY.
Do the RED and YELLOW lights function?
No
Check Fuse F-1.
OK
Check the operation of switch S-2. S-2 should be open in the OVERRIDE mode only.
OK
If S-2 is good, measure the voltage between the positive terminal of the alarm, DS-1, and negative battery with the Keyswitch on. If the voltage reading is not equal to truck primary battery voltage, check the Keyswitch and associated wiring.
OK
If the voltage is equal to truck primary battery voltage, replace and align the Servo Amplifier Board.
Yes
Replace both the Servo Amplifier Board and the Servo Driver. Align the Servo Amplifier Board.

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SENSOR ERROR AMPLITUDE

Sensor error amplitude is a function of sensor position with respect to the guidepath. At event 1, 3 and 5, the sensors are centered on the guidepath and sensor error is minimum. Sensor phase reverses as the sensors cross the wire, in effect, telling the system circuitry the direction to steer the truck. Sensor error phase reverses at events 3 and 5.

POSITION POTENTIOMETER ERROR AMPLITUDE

Position Potentiometer error amplitude is a function of the amount, in degrees, that the steered wheel is turned either left or right of straight ahead. Normally, the wheel corrects equally left and right, resulting in a Position Potentiometer error amplitude that remains fixed between corrections. Position Potentiometer error phase shifts 180 degrees at the time of correction. Between events 1 and 2, the error is in phase with the sensor error. Just prior to event 2, the steering correction occurs, and the steered wheel turns left. The Position Potentiometer wiper crosses the null at event 2, reversing the phase of the Position Potentiometer error.

COMBINED ERROR AMPLITUDE

Combined Error Amplitude is generated by combining sensor error with position Potentiometer error. Since both of these sources of error vary in phase and amplitude, the resultant signal will vary in terms of phase and amplitude. Between events 1 and 2 the truck is to the right of the guidepath and the steered wheel is turned such that the sensor error is increasing in amplitude. Under these conditions, the error signals are in phase, and additive. The combined error signal causes a steering correction at the point where the error amplitude overcomes the resistance of the truck steering system. Due to the inherent lag of the steering system the steered wheel turns at a point after the error signal is at maximum.

At event 2, the position potentiometer error reverses phase with respect to the sensor error, and the two signals subtract from each other. The combined error decreases rapidly to a point where there is insufficient amplitude to cause further steering correction. This will prevent overcorrection. At event 3, the sensors cross the guidepath and sensor error phase shifts 180 degrees, and becomes additive with position potentiometer error. Between events 3 and 4, the combined error increases to the point that another steering correction occurs, at event 4. Note that the error signals described are dynamic errors, resulting from truck and steered wheel movement. A fixed error, caused by incorrect sensor balancing, or improper position potentiometer adjustment, will result in a constant offset left or right of the guidepath.

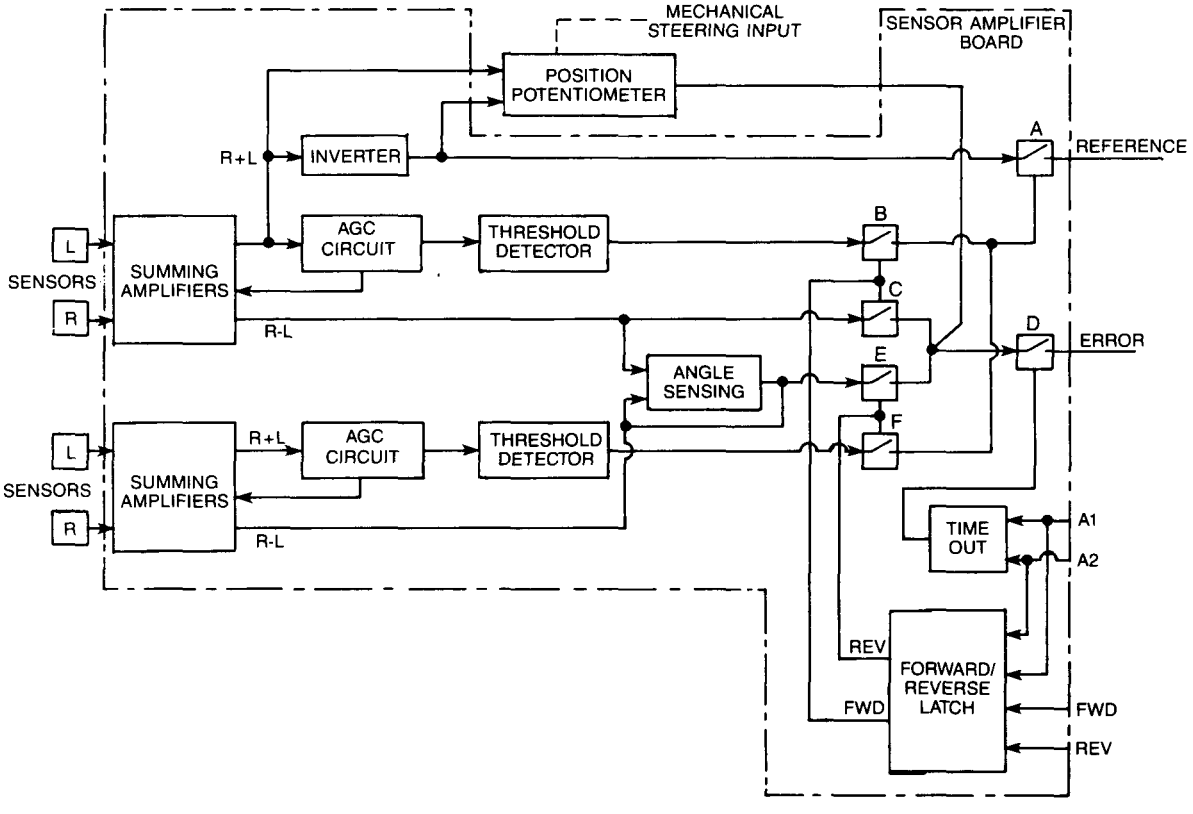


ILLUSTRATION 4.3-75

Intermittent Breaks in the Guidewire:

If the guidewire has an intermittent break, (one that comes and goes), the following procedure applies:

1. Stand at a point approximately half way down the length of the guidewire with the radio positioned for receiving the tone from the test board.

2. Have an operator drive a lift truck down each aisle in the Manual Mode.

CAUTION

Extreme care must be exercised when driving a lift truck down a guided aisle in *the manual mode. Failure to do so will result in damage to the lift truck and/or warehouse racking.*

3. If a sudden loud tone, or loss of tone is experienced, check the floor at the location that the truck just passed over. The break will be found at a crack or an expansion joint close to that location.

Wire Guidepath Repair Procedure:

TOOLS AND EQUIPMENT REQUIRED:

1. Rosin Core Solder 60/40
2. Soldering Iron, 40 Watt
3. Electric Drill
4. 3/8 inch Masonry Drill Bit
5. 1/8 inch Chisel
6. 16 Ga., Stranded Wire
7. 1/8 inch Shrink Tubing
8. G.E. Sealproof, Silicon Sealant
9. Small Putty Knife
10. Epoxy, Concresive 1001-LPL

PROCEDURE: (Refer to Illustration 4.3-117)

1. Drill a 3/8" hole into the cement, 1" deep, at the location of the break.

2. Going under the wire, chisel back 8" of guidewire on both sides of the break.

NOTE:

If the chisel is placed under the wire and epoxy, at the bottom of the floorcut, the epoxy and guide-wire should curl up and be accessible.

3. Cut the wire back approximately 4" from the break.

4. Clean off all of the epoxy and strip off the insulation 1/2" back on the wires.

5. Place shrink tubing over each piece of wire and push to the back of the wire.

6. Take a piece of wire, approximately 11" long, and strip back the insulation 1/2" on either end.

7. Twist the jumper wire and the guidewire together at each end and solder.

8. Place shrink tubing over the solder joints and apply heat to shrink it in place.

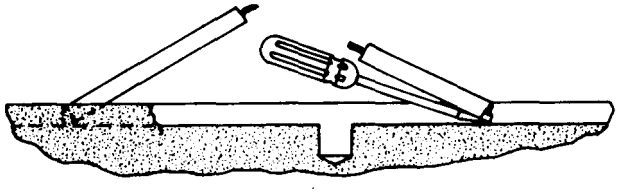
9. Lay the wire into the guidepath and push a small loop into the 3/8" hole drilled earlier.

10. Fill the portion of the guidepath which contains the loop, and 2 inches on either side of the loop, with G.E. Sealproof, (Silicon Sealant). Use a putty knife to smooth it over.

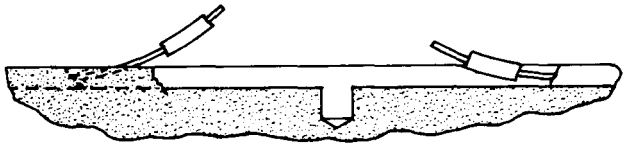
11. Fill the rest of the exposed guidepath with the Concresive 1001-LPL Epoxy, and use a putty knife to smooth it over.

12. Test the guidepath continuity.

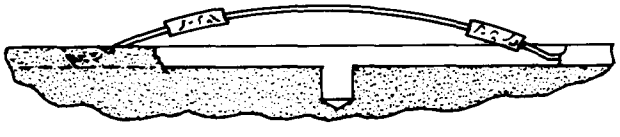
Steps 1 and 2: Drill a 3/8" hole and chisel back the Guidewire 8" on each side.



Steps 3, 4 and 5: Cut the wire back 4" from the break. Strip 1/4" of insulation off of each wire, and place shrink tubing on the wires, and slide it to the back.



Steps 6, 7 and 8: Insert jumper wire, solder connections, and shrink tubing over the solder joints.



Steps 9, 10 and 11: Lay the wire in the guidepath. Push a loop into the hole. Fill the hole and 2" on either side with Silicon Sealant. Fill the Guidepath with Epoxy.

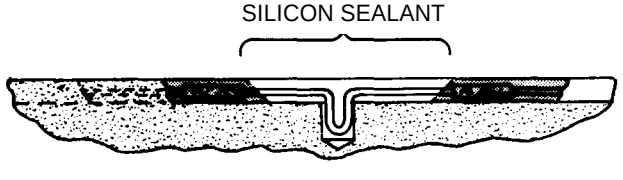


ILLUSTRATION 4.3-117

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SENSOR AMPLIFIER CIRCUIT BOARD

The Sensor Amplifier circuit board provides the signals used to steer the truck during operation in the Automatic mode of operation. The following functions are performed on the sensor amp board: determination of direction of truck travel, determination of truck position with respect to the guidepath, generation of the Reference signal, and generation and selection of the Error signal.

Sensor amplifier circuit boards have built in power supplies which operate from a 24 to 30 V dc input from the truck battery. Truck battery voltage variations are taken care of by the insertion of a series dropping resistor, or a combination of a series dropping resistor and a Zener diode, located in the wiring harness. There are different types of 'sensor amplifier boards. Consult the Parts Breakdown in the Parts Breakdown section of this manual.

The sensor amplifier circuit board is used during the Automatic mode of system operation. Power is supplied to the board, and the circuitry is operating, whenever power is applied to the system. Inputs to the board are positive 24 V dc from the truck via the wiring harness, truck negative battery, forward and reverse from the truck contactor (A-1 and A-2), position potentiometer feedback, and the steered wheel and load wheel sensor inputs.

Outputs from the board are positive 12 volts to the sensor assemblies, negative battery to the sensor assemblies, position potentiometer input, and the reference and error signals to the servo circuit board.

A chart listing the voltages and signal levels appearing at the edge connector pins is provided later.

The following list of tools and equipment are required to troubleshoot the sensor amplifier printed circuit board:

1. A digital multimeter (FLUKE 8022 or equivalent).
2. Common hand tools.
3. Wiring Diagram.
4. A functioning line driver and guidepath.
5. Test Point Extension Board.

All voltage measurements concerned with the wire guidance system were taken with a Fluke 8022B Digital Multimeter. Frequencies included with the millivolt A.C. readings require the following steps to be taken if a Fluke 8022B is not used. These steps will indicate whether voltages listed need to be adjusted up or down for meter being used.

NOTE

Do not use analog meter when checking voltages from Position Potentiometer as this can damage the potentiometer.

Balance sensors up or down as necessary to obtain exactly 2 Vdc from the AGC circuit (TP-9) on the sensor amplifier board. Measure voltage (millivolt A. C.) at sensor inputs (TP-1 and TP-2 of sensor amplifier board). Compare the reading on the meter with the voltage reading on the servicing block diagram. Divide the reading on the meter by the voltage on the block diagram. Multiply all A.C. voltages on the block diagram by the result of the division. These are the readings you should obtain with meter being used.

EXAMPLE: Sensor input level at TP-1 and TP-2 when AGC circuit (TP-9) is 2 v.d.c. is 142 m.v.a.c. with meter being used. Block diagram voltage level for these points is 135 m.v. a.c. What should voltage reading be at J4-7 (reference signal).

	142 m.v.a.c. meter reading
divided by	135 m.v.a.c. block diagram
equals	1.05
	1.8 v.a.c. ref. block diagram reading
times	1.05
equals	1.89 v.a.c. with meter being used.

Troubleshooting on the sensor amplifier board is limited to checking the inputs and outputs. A board that fails the check out procedure must be replaced.

Symptoms of a faulty sensor amplifier board are a failure to acquire the guidepath, guidance in only one direction of travel, or complete failure to guide. A complete guide to troubleshooting the system is found in the troubleshooting section. If the sensor amplifier board is suspected, the easiest way to isolate the problem is to replace the board with a “known good” sensor amplifier board.

If the problem still exists after changing out the board, or if another board is not available, perform the following procedure to isolate the problem to a faulty circuit. The procedure will give a good indication of whether or not the correct inputs and outputs are present, however, passing all the checks does not completely rule out the sensor amplifier board as the source of the problem.

NOTE

Designations for test points located on the sensor amplifier board are prefixed by the letters TP. All other points are referenced to the actual location in the circuit. Points where voltage may be checked on terminal strip 1 are designated as follows: terminal strip 1, terminal 4. Edge connector and test point extender card pins are designated: edge connector pin 3. Pins on the test point extender card are direct extensions of the edge connector pins.

It is important to make certain that the measurement is being made at the correct point in the circuitry.

MOTOR & GEARBOX ASSEMBLY

Removal

1. Disconnect truck battery.
2. Remove outer rim of the handwheel assembly by removing the three socket head cap screws from the rim. Push the button on the handweel and pull rim off.
3. Remove the cover from the steering backplate assembly.
4. Remove drive chain from around gearbox sprocket.
5. Disconnect connector CA8.
6. Hold motor and gearbox assembly while removing two mounting bolts from gearbox. Lift assembly from backplate.

Disassembly

1. Remove three screws holding gearbox to motor.
2. Pull motor and gearbox apart.

NOTE

Further disassembly of the gearbox is not necessary since replaceable components are not present.

3. Mark the motor end heads and stator by scribing a mark for proper assembly. Remove brushes.
4. Remove two thru-screws from motor drive end and remove drive end head. Note the number and placement of flat and wave washers for proper assembly.
5. Pull armature from remaining assembly. Separate stator and brush holder/end cap.

Assembly

Reverse the disassembly procedures to assemble. Make certain woodruff key is in position in motor shaft.

Installation

Reverse the Removal procedures to install.

Motor Inspection

Inspect motor for clean, tight connections and tight mounting bolts. Check associated wiring for worn, cracked or frayed insulation.

Check motors for shorts between terminals and motor frame with VOM on R x 10,000 ohm scale. A reading of less than 50,000 ohms should be isolated and corrected before placing unit in operation.

Brush Inspection

Remove motor from truck. Clean commutator end of motor and remove four brush holder caps. Pull brush assemblies from motor and inspect spring for heat discoloration which may affect spring quality.

Inspect brushes for cleanliness, uneven wear and signs of overheating. Brushes that are chipped, broken or oil soaked must be replaced.

NOTE

If any brush is in a condition that merits replacement, the complete brush set should be replaced. Do not replace just one or two brushes.

Clean brushes with a clean, dry cloth. Check each brush for free movement in its holder. Inspect brush holders for damage and tightness in end head.

Measure brush length (shortest portion). Replace brushes which have worn to 5/16".

Commutator Inspection

Commutator inspection can be performed through the brush holder when brush is removed. A commutator in good condition will be smooth, polished, dark-brownish in color. The commutator should not be rough, pitted, scored or have signs of burning and heavy arcing between the commutator bars.

Deep burned sections on the commutator bars indicates an open or short circuit in the armature windings. Excessive wear or burning on one or more bars indicates a loose commutator bar. Check for loose bars by lightly tapping all of the bars with a wooden dowel. A contrasting dull thud or vibration indicates a loose bar. In either case, the armature must be replaced.

When this motor is operated for extended periods of time beyond maximum ratings, permanent damage can occur through demagnetization of the fields.

INSPECTION AND REPAIR

Problems within the handwheel may include:

- The beveled gear, (item #16), used to drive the tachometer getting mashed.
- The clutch dogs, (item #7), getting mushroomed, and not making a proper mechanical connection during Override.
- The steel balls, (item #3), and compression spring, (item #4), inside the handwheel pin housing getting marred or distorted causing difficulty when changing modes.

Inspect the clutch dogs, (item #7), for a smooth taper. If the ends are mushroomed at all, replace them.

Inspect the inside of the handwheel pin housing, (item #6), and the outer surface of the hub isolator, (item #1 2), for scratches or excessive wear. If worn excessively, replace them.

Inspect the steel balls (item #3), and compression springs, (item #4), that came out of the handwheel pin housing. The springs should not be deformed in any way. If they are, replace them.

ASSEMBLY PROCEDURE:

1. Insert the Compression Springs, (item #4), and the steel balls, (item #3), into the handwheel pin housing, (item #6).

NOTE

A special tool is required to compress the springs and steel balls prior to inserting the handwheel hub isolator.

2. Hold the compression springs and steel balls in place and insert the hub isolator, (item #12), into the handwheel pin housing, (item #6).

CAUTION

Care must be taken so that the springs and balls are seated properly inside the pin housing assembly so that they do not get ruined as the hub isolator is installed. Damage to the springs and balls will cause failure of the handwheel assembly.

3. Install a thrust washer, (item #2), on the clutch hub, (item #22), and then insert the clutch hub through the center of the hub isolator, (item #12).
4. Turn the assembly over and insert a thrust washer, (item #2), over the end of the clutch hub.
5. Install the chain sprocket, (item #20) on the end of the clutch hub insuring that the woodruff key mates properly.
6. Install the retaining ring, (item #21), on the end of the clutch hub to secure the sprocket.
7. Install the handwheel assembly back on the steering shaft of the truck using the installation prints of the truck being serviced as a guide. Tighten the handwheel securely.
8. Install the drive chain around the sprocket of the handwheel.
9. Install the tachometer assembly on the isolator arm.
10. Replace the backplate assembly cover in accordance with the installation drawings for the truck being serviced.
11. Replace the outer rim of the handwheel and tighten the three socket head cap screws holding the rim in place.
12. Reconnect the truck battery.

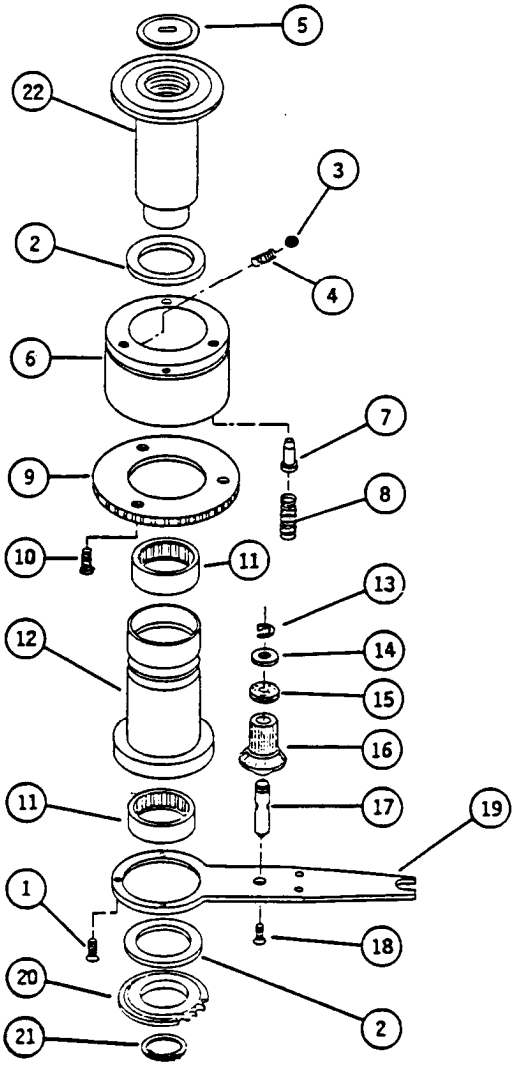
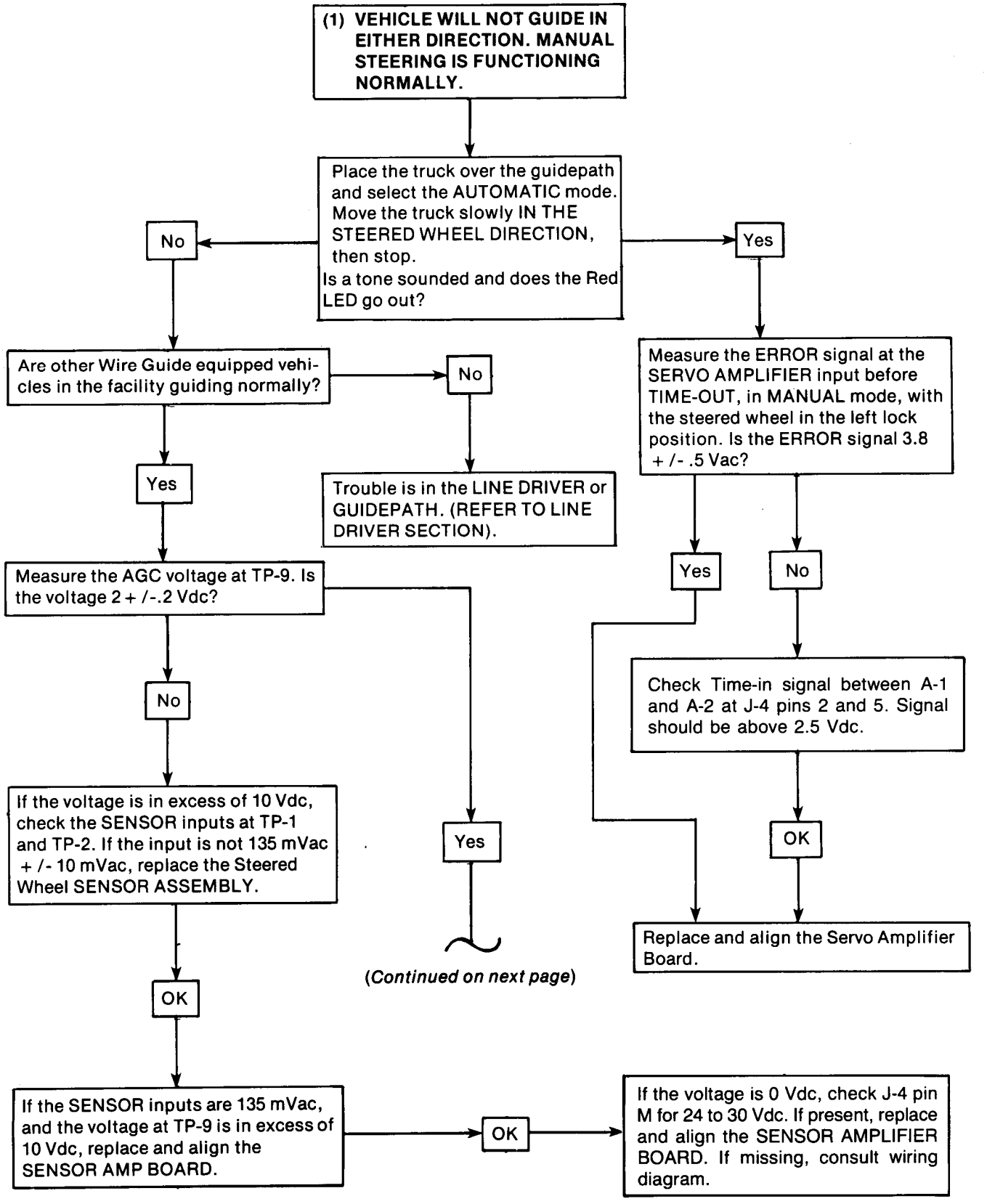


ILLUSTRATION 4.3-102



(Continued on next page)

SUPPRESSOR

A visual inspection for cracked or broken potting material is necessary. Cracked or broken potting material indicates a faulty suppressor.

SPRING

Contact Spring

Free length should be between 0.31 to 0.32 inches (7.9 -8.13 mm). This spring should be replaced if signs of overheating or corrosion are present.

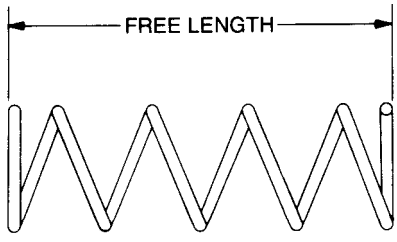


ILLUSTRATION 4.4-3

Spiral Return Spring

A visual inspection of this spring is necessary. A spring which shows signs of corrosion should be replaced. If spring is questionable, compare to new spring and replace as necessary.

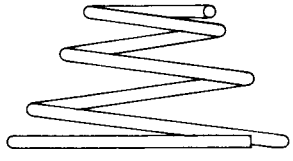


ILLUSTRATION 4.4-4

Component Replacement

Refer to parts breakdown in Illustration 4.4-2 when replacing parts.

CONTACT REPLACEMENT

To replace the fixed contacts (Index 14), proceed as follows:

1. Remove screws (Index 18).
2. Remove screws (Index 22) and bridge guides, flatwashers and lockwashers (Index 19, 20, 21.
3. Lift lockwasher (Index 15) from contacts.
4. Remove contact. Position replacement contact on contactor assembly and assemble bridge guide, flatwasher, lockwasher and screw. Do not tighten screw.
5. Assemble lockwasher and screw (Index 15, 18) in contact.
6. Tighten screws to 10 inch lbs. torque (1.15 Newton meters).

To replace movable contact (Index 26), proceed as follows:

1. Remove locknut, lockwasher and flatwashers (Index 29, 30, 31, 32) from armature assembly (Index 9).
2. Lift spring insulator and spring (Index 27, 28) from armature.
3. Remove movable contact (Index 26) from armature and install replacement contact.
4. Install spring, spring insulator, fiber flatwasher, flatwasher, lockwasher and locknut (Index 27,28,29,30, 31, 32) on armature.
5. Tighten locknut to 20 inch lbs. torque (2.3 Newton meters),

COIL REPLACEMENT (Index 3)

1. Remove four (4) hex/torx screws (Index 5).

CAUTION

Do not loosen or remove four(4) screws on frame (Index 6) near contact tips. These maintain a factory setting for core stroke.

2. Slide base frame, "O' ring and coil (Index 1,2, 3) from contactor frame. Note position of coil connections for reassembly.
3. Slide coil from base frame and install replacement coil.
4. Assemble base frame to contactor frame, positioning coil connections as noted at disassembly, with hex/torx screws. Tighten screws to 20 inch lbs. torque (2.3 Newton meters).

SPRING REPLACEMENT

Spiral Return Spring (Index 7)

1. Remove fixed and movable contacts as described in Contact Replacement.
2. Remove upper insulator (Index 13). Remove four (4) torx screws (Index 12) from mounting plate (Index 11). Lift mounting plate and lower insulator (Index 10) from contactor assembly.
3. Lift armature (Index 9) from contactor assembly and slide spring (Index 7) out sideways.
4. Install replacement spring and assemble armature, lower insulator and mounting plate. Tighten torx screws to 20 inch lbs. (2.3 Newton meters). Make certain armature moves freely in guides.
5. Position upper insulator (Index 13) on mounting plate and assemble fixed and movable contacts as described in Contact Replacement. Make certain movable contact moves freely.

Contact Spring (Index 27)

1. Remove movable contact as described in Contact Replacement up to spring removal.
2. Remove spring and install replacement spring.
3. Assemble as described in Contact Replacement, Movable Contact.

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Adjustments

Components which are adjustable are contained within the directional and speed control compartment.

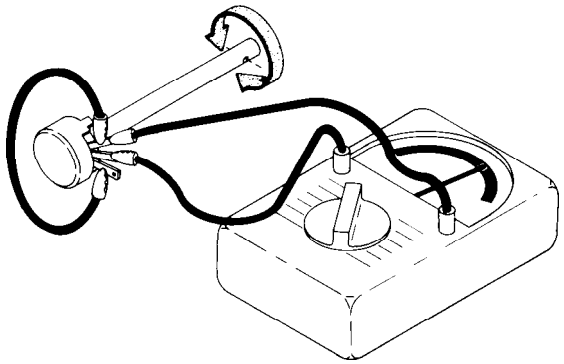
DIRECTIONAL SWITCHES (FS & RS)

1. With twist grip in neutral position, turn adjustment screws on both directional switches, slowly, clockwise until switch actuates.
2. Turn both screws 1/2 turn counter-clockwise.
3. Connect ohmmeter between the center terminal and either end terminal of the potentiometer. Disconnect lead from potentiometer at TB101-17.
4. Slowly turn twist grip until a directional switch actuates (signified by a “click”).
5. Record reading shown on meter.
6. Turn twist grip in opposite direction from neutral, slowly, until other directional switch actuates.
7. Record reading shown on meter. Compare two readings. The values should be within 250 ohms. If difference is in excess of 250 ohms, turn adjusting screw on actuator arm of switch that corresponds to the highest reading, counter-clockwise until readings at actuation are within 250 ohms.
8. Secure adjustments with thread locking adhesive (Crown no. 061004-014).

ACCELERATOR POTENTIOMETER (POT-1)

When a new potentiometer is being installed, the potentiometer can be approximately adjusted before meshing gear teeth.

1. Attach jumper between outside terminals of potentiometer.
2. Connect leads of ohmmeter between either outside terminal and center terminal of potentiometer.



0271S ILLUSTRATION 4.5-3

3. Rotate the potentiometer shaft to obtain the highest ohmmeter reading (approximately 5000 ohms).

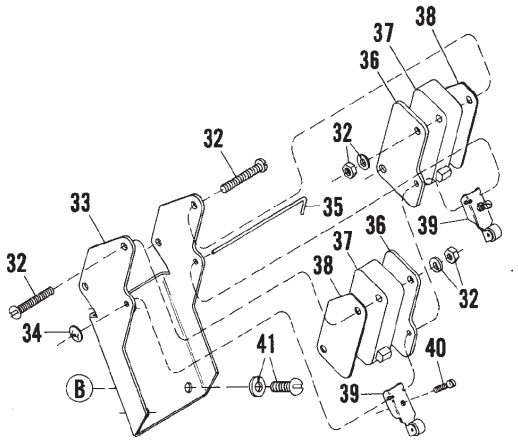
To fine adjust the potentiometer, make certain potentiometer terminals will not contact any part of the assembly when gear teeth are meshed. If terminals will contact assembly, loosen potentiometer locknut and rotate potentiometer until terminals are centered in opening. Secure in this position with locknut. Mesh gear teeth, tighten screws on mounting bracket and proceed with the following instructions.

1. Loosen potentiometer locknut.
2. Rotate potentiometer back and forth to obtain the highest resistance reading (approximately 5000 ohms).
3. Secure adjustment with locknut.
4. Rotate twist grip from stop to stop. Resistance reading must not jump from zero ohms to infinite resistance throughout entire rotation. If resistance does jump, adjust potentiometer slightly.

Component Replacement

FS AND RS (Refer to Illustration 4.5-4)

1. Remove three (3) screws and lockwashers (Index 41).
2. Move switch and bracket assembly over top of cams and out.
3. Remove switch mounting bolts (Index 32) of switch to be replaced.
4. Transfer wires to replacement switch and tighten screws to within 55-65 inch ounces (388-459 mm).
5. Assemble switch, insulator and spacer as shown in Illustration 4.5-4. Secure in place with screws, lock washers and nuts.
6. Move switch and bracket assembly under cam, on top of posts and secure in place.
7. Adjust both switches as described in Adjustments.



1342S ILLUSTRATION 4.5-4

2. A bleed valve is located at the end of the slave cylinder (item 43) mounted on the drive unit, refer to illustration 5-1. Attach a drain hose to the bleed valve for the purpose of catching and reusing the excess fluid. A clear line is preferred so you can see air bubbles flow through the line.
3. Attach the pressure bleeder to the brake reservoir.

CAUTION

Do not apply more than 50 P.S.I. to avoid damage and possible rupture of the reservoir.

4. 'With the brake pedal in the raised position, open the valve on the pressure bleeder. Open the bleed valve on the slave cylinder approximately 1/2 turn counterclockwise.
5. Close the bleed valve after all of the air has been forced out of the system and there is a steady flow of brake fluid out of the drain line, (this may take between 2 and 3 minutes).
6. Check and refill the brake reservoir if necessary.

If a pressure bleeder is not available, the following procedure can be used:

1. Check the brake reservoir for proper fluid level and inspect the system to be sure all connection are tight.
2. A bleed valve is located at the end of the slave cylinder (item 43) mounted on the drive unit, refer to illustration 5-1. Attach a drain hose to the bleed valve for the purpose of catching and reusing excess fluid.
3. Open the bleed valve on the slave cylinder approximately 1/2 turn counterclockwise.
4. Pump the brake pedal, open the bleed valve until the pedal stops at the bottom of its travel, then close the valve. Repeat this procedure until a steady stream of brake fluid flows out of the drain line without any signs of entrapped air, (this may take bet ween 2 and 3 minutes).

CAUTION

Do not allow the fluid in the brake reservoir to drain so low as to draw air into the system.

Fluid Level

Brake fluid is added to the reservoir mounted on the steering box, on the back side of the platform. The reservoir should be filled to ½" (12.7 mm) to 3A" (19mm) from the top. Use Dow Corning Q2-1141 Silicone Brake Fluid or equal.

Brake Lines

Exercise care to avoid kinking any brake lines. Permanent damage to the line will result if this occurs.

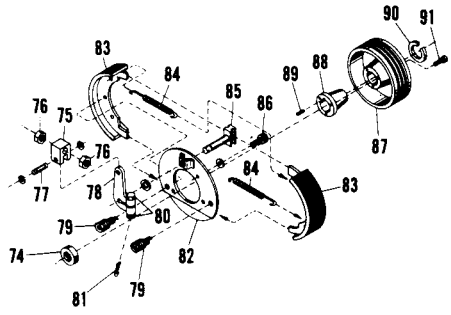


ILLUSTRATION 5-2

Lining Replacement

(Refer to illustration 5-2)

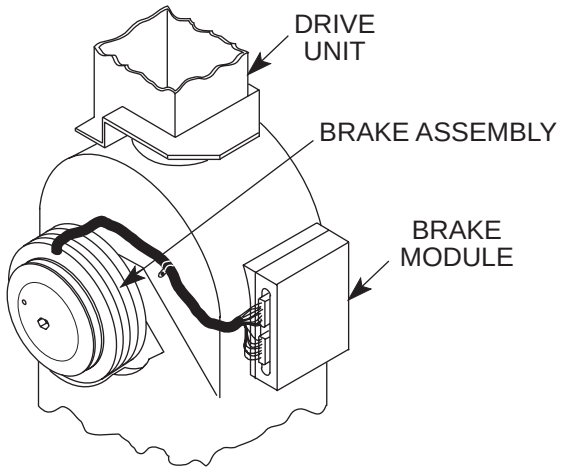
1. Raise the rear of the truck until the drive wheel is off of the floor then place hardwood blocks below the deck skirts to maintain the elevation.
2. Unlatch and open the door assemblies to a position where they will not obstruct the work to be performed.
3. Unfasten the screws (item 91) and remove the retaining ring (item 90) from the brake drum. Depress the brake pedal and remove the brake drum (item 87).
4. Inspect the condition of the drum, especially for grooves on the inside of the drum caused by worn linings.
5. Remove the two springs (item 84) which connects the brake shoes (item 83) together. Next, remove the two springs (item 79) which holds the shoes to the backing plate (item 82) and remove the old shoes.
6. Place the new linings in position and attach the springs (items 84 & 79).

NOTE

Position the brake springs (item 84) so that the long hooks are not connected to the same shoe.

7. Depress the brake pedal and reinstall the brake drum. Attach the retaining ring and secure the screws. These screws are to be tightened to a torque reading of between 8 to 10 fl./lb. (11 to 14nm).

The brake system consists of an electric brake and a brake module mounted to the drive unit.



0103

ILLUSTRATION 1

When the operator depresses the brake pedal, a switch (BRS) located below the platform is reset. Switch contacts close thereby allowing power to be supplied to the brake. The brake is then electromagnetically released. When the operator releases the pedal, the brake magnets are de-energized. Springs force armatures within the brake to compress the brake pads against the rotor applying the brake.

Depending on the truck steer angle and platform height, one of three levels of brake force will be applied. The applied braking force is controlled by the brake module through switches located on the mast, platform and steering sprocket. These three levels of braking force are listed in the charts.

The brake contains two armatures, inner and outer, which are controlled by two electro-magnets. When 33% of full braking is required, the module allows only the inner magnet coil to be de-energized. Springs force the inner armature to compress the pads against the rotor while the outer armature remains electromagnetically attracted to the magnet. Thus 33% of full braking occurs. When 67% of full braking is required, only the outer armature is used for braking and at 100%, both armatures are used.

When in a reduced braking mode, the inner or outer brake (depending on braking level required) remains released for 4 - 8 seconds after brakes are requested. This time is referred to as time out. Time out allows the truck to stop in a reduced braking mode then applies full brakes to reduce heat build up in the brake and conserve truck battery life.

MODEL SP36

Fork Height in.	Fork Height mm	Braking Force
0 To 24	0 To 610	100%
24 To 60	610 To 1525	67%
60 To Full Ht.	1525 To Full Ht.	33%

MODEL SP42

Steer Angle Less Than 10 Degrees From Straight Ahead Travel		
Fork Height in.	Fork Height mm	Braking Force
0 To 24	0 To 610	100%
24 To 60	610 To 1525	100%
60 To 120	1525 To 3050	67%
120 To Full Ht.	3050 To Full Ht.	33%
Steer Angle More Than 10 Degrees From Straight Ahead Travel		
0 To 24	0 To 610	100%
24 To 60	610 To 1525	67%
60 To 120	1525 To 3050	67%
120 To Full Ht.	3050 To Full Ht.	33%

MODEL SP48

Steer Angle Less Than 10 Degrees From Straight Ahead Travel		
Fork Height in.	Fork Height mm	Braking Force
0 To 24	0 To 610	100%
24 To 60	610 To 1525	100%
60 To 156	1525 To 3960	67%
156 To Full Ht.	3960 To Full Ht.	33%
Steer Angle More Than 10 Degrees From Straight Ahead Travel		
0 To 24	0 To 610	100%
24 To 60	610 To 1525	67%
60 To 156	1525 To 3960	67%
156 To Full Ht.	3960 To Full Ht.	33%

STEERING

Crown Stockpickers are available with either a power assisted steering system ora manual steering system. Steering on your truck is accomplished by rotating the steering wheel which is located on the platform. A steering gearbox, connected to the steering wheel, is geared to improve the operators mechanical advantage when turning. The larger output gear is fitted with a chain sprocket and a roller chain which, in turn, is secured to the steering cables by connecting links. The steering cables are routed over the mast by means of cable pulleys. The left hand cable is routed into the power unit while the right hand cable is attached to a cable tightening turnbuckle prior to its entry into the power unit. From this point on, the cable routing changes, depending on the steering system your truck is equipped with (power or manual).

Power Unit Steering Routing

A. POWER STEERING

Inside the power unit, the steering cables (item 24 & 28) connect to a roller chain (item 27) by means of connecting links (item 26). The roller chain is routed around a pair of idler sprockets (item 23) before it is routed around a drive sprocket (item 20) coupled to the torque generator (item 9). A roller chain (item 29) connects the drive unit to the upper torque generator sprocket (item 2).

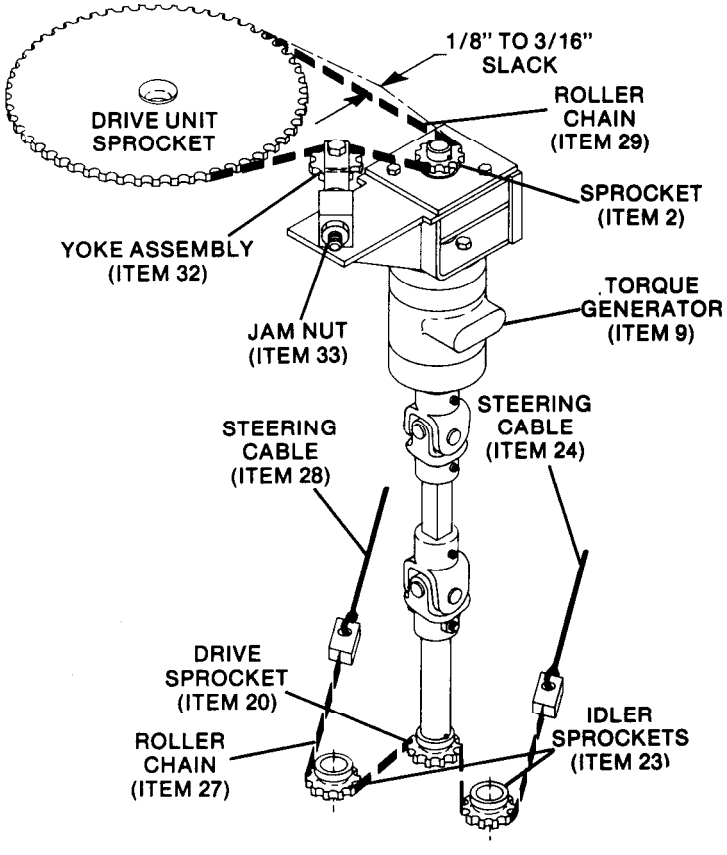


ILLUSTRATION 6-1

B. MANUAL STEERING

(Refer to illustration 6-2)

Inside the power unit, the left steering cable (item 24) is routed around four pulleys and then around the top of the drive unit. From that point, the cable is routed over four more pulleys where it then leaves the power unit and connects to the lower portion of the cable adjusting turnbuckle (item 23).

Steering Adjustments

A. CABLE

Periodic adjustment of the steering cable tension is necessary due to wear and stretch. The adjustment is made by turning the cable adjusting turnbuckle which is located on the right steering cable, near the back wall of the power unit. Cable tension can be checked by using a Pacific Scientific Co. Model #T5-2002-104-00 Cable Tensiometer or equal. A reading of between 25 and 45 on the scale is satisfactory. If a tensiometer is unavailable, adjust the cables only enough to take up the slack and eliminate any play in the steering wheel.

NOTE

Do not overtighten the cables as this will cause excessive wear, stretch, and significantly shorten the life of the cable as well as possibly damaging other steering mechanism components.

B. CHAIN (POWER STEERING UNITS ONLY)

(Refer to illustration 6-1)

To adjust the chain tension on the roller chain (item 29) which connects the top of the drive unit to the torque generator (item 9), the yokeassembly (item 32) must be moved either in or out. This is accomplished by either tightening or loosening the jam nuts (item 33) located on the yoke assembly. The chain should be adjusted so that the section of chain nearest the back wall of the power unit has approximately 1/8' to 3/16' slack (bow) while the section of chain at the yoke assembly is tight (see illustration 6-l). When the correct adjustment is achieved, lock the jam nuts.

M6.0-07.2-002

TORQUE GENERATOR

The torque generator used in this unit consists of two elements in one housing; the gerotor (hydraulic motor) and the companion control valve. The two elements are interconnected by drive links to provide an emergency direct through drive in the event of a hydraulic failure.

The turning effort, (torque) is provided by the gerotor mechanism which consists of an inner star and outer ring. The inner star has six teeth which orbit in a fixed outer ring with seven lobes. The orbiting effect is created by hydraulic pressure from the control valve to the chambers between the inner star and outer ring lobes and is transformed into a steady circular shaft motion through a double ended splined drive to the power end shaft. This creates a high torque at low R.P.M. The control shaft operates at the same speed as the output shaft. The control valve consists of three basic components: the valvebody, control sleeve, and control spool. There are no external lubrication points on the torque generator. The hydraulic motor and valve mechanism are lubricated on the inside by the hydraulic fluid passing through it.

Repairs to be made on the torque generator should be done in a clean area, and during disassembly the parts should be laid out and inspected, then assembled without any foreign material entering unit. All parts should be cleaned with a degreasing solution and air dried before assembly. Do not wipe any parts with rag or shop towel. A small piece of lint could cause a malfunction of the gerotor or valve mechanism.

Disassembly

Before loosening cap bolts scribe a line parallel to the center line of the unit from the power end housing to the control end cap to assist in orientating the parts for reassembly. Note position of power end and control end shaft keyways. Drain oil from unit by rotating the control shaft several times. Place unit in a soft jawed vise with the power end shaft up. Remove the key from the keyway. Now remove the seven socket head cap screws that secure the power end housing to the control housing. Lift off the power end housing and shaft assembly from the upper wear plate. Slide the power end shaft out of the housing and discard the shaft “O” Ring seal. Note position of the seal washer. Remove the power end drive from the gerotor set. Then remove the gerotor set and wear plates from the control housing and lay these parts out on the bench for inspection. Lift out the control end drive from the center of the control spool in the control housing. Now relocate the unit in the vise to a horizontal position and remove the key from the shaft keyway. Inspect and clean the control end shaft. Carefully remove the four socket head cap screws that secure the control end cap to the control housing. Slip off the control end cap and remove the static “O” Ring, shaft “O” Ring seal and seal washer from the control end cap. Now pull the control spool and sleeve out of the control housing. Carefully note the position of the centering springs and push the cross pin from the sleeve. Slide the control spool out of the control sleeve and remove the centering springs. If spool and sleeve are frozen in the control housing, discard the entire control valve assembly and replace. *DO NOT replace or interchange control spool, control sleeve or control housing separately as these parts should be replaced in matched assemblies.*

Careful inspection of all parts is essential for proper operation after assembly. The centering springs should be checked for abnormal wear or deformation. Check the gerotor wear plates for wear or scoring. A certain amount of polishing due to the rubbing action on the wear plates may occur and should not be taken for wear. If heavy wear is evident, wear plates should be replaced. These parts are precision matched to a fine finish and flatness which prevents high pressure leakage in this area. Inspect the control spool, control sleeve and control housing for scoring or uneven wear. These three pieces are select fit during original assembly and any undue wear or damage to any one part makes it mandatory that they all be replaced as a matched set. Inspect edges of cross pin holes in control sleeve and tapered holes in the control spool for burns or interruptions. These must be removed for proper valve operation. Check cross pin for snug fit in control sleeve, if not, replace. Inspect the stub shafts of the power end shaft and control spool for coupling wear and broken-out keyways. If wear is severe replace part. Severe coupling wear generally indicates misalignment.

Assembly

Insert the control spool into the control sleeve so that the spring slots will line up. *DO NOT* force these two together. Due to a very close fit, it may be necessary to insert the spool from the opposite end. Install the two sets of centering springs back-to-back in the spring slots with the notched ends of the springs away from the shoulder of the spool. Center springs in slot so they do not stick out beyond the sleeve. Now insert cross pin. Carefully insert the control sleeve into the bore of the control housing the same procedure used to assemble the spool and sleeve. Place new “O” Ring seals in the static “O” Ring seal groove and the shaft “O” Ring seal counter- bore of the control end cap. You will notice that the proper size “O” Ring appears to be too large and must be pushed in place. Place the seal washer in the counterbore adjacent to the seal. Install the control end cap over the shaft of the control spool with a twisting motion to prevent damage to the seal. Care should be taken to prevent the control spool and

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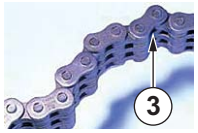
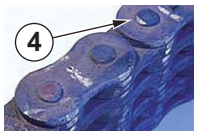
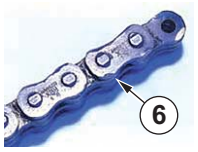
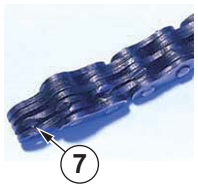
M6.3–11–001

Lift Chain Inspection			
Damage Example	**Damage and Symptom**	**Cause**	**Solution**
	**Rigid joints** • The lift chain joints do not return to the extended position easily.	• Insufficient lubrication	1. Replace the lift chain. 2. Increase the frequency of the planned maintenance intervals.
	**Turned lift chain pins** • One or more chain pins (4) turned.	• Insufficient lubrication **Note:** Turned chain pins are a result of rigid joints.	1. Replace the lift chain. 2. Increase the frequency of the planned maintenance intervals.
	**Loose lift chain pins** • One or more chain pins (5) are protruding.	• Insufficient lubrication **Note:** Loose chain pins are a result of rigid joints.	1. Replace the lift chain. 2. Increase the frequency of the planned maintenance intervals.
	**Too much outer wear** • The outer plates (6) are worn down.	• The lift chain is not aligned correctly and is operating against mast sections or at the side of the pulley. • The lift chains tension is not equal.	1. Measure the width of the wear zone and calculate the percentage of wear in relation to the overall width of the plate. • If the wear is greater than or equal to 5% of the full width, replace the lift chain. Correct the alignment of the lift components and pulleys after replacing. • If the wear is less than 5% of the full width, correct the alignment of the lift components and the pulleys.
	**Nicks or distortion** • Parts of the lift chain have nicks (7) or are distorted.	• The lift chain hits against parts of the mast.	1. Remove the cause of the nicks or distortion. 2. Replace the lift chain.
Images and technical information provided with the permission of Rexnord Kette GmbH • www.rexnord.com Figures 28009, 28010, 28011, 28012, 28013, 28014, 28015, 28016, 28017, 28018, 28019, and 28020 are used in this table.			

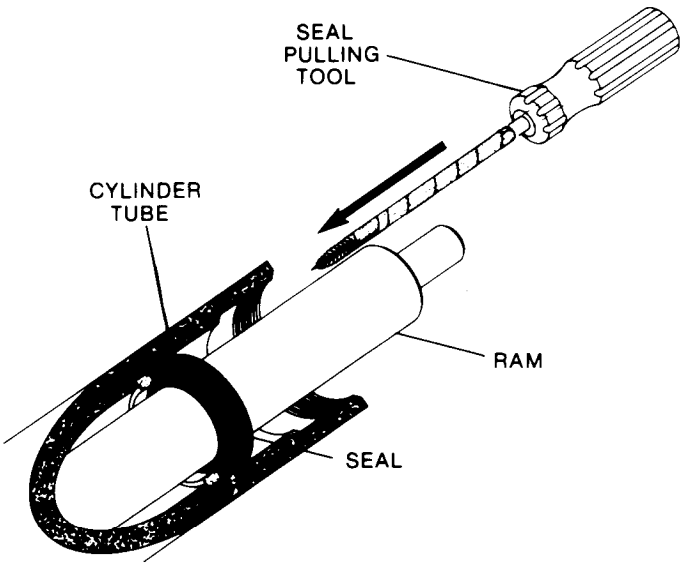


ILLUSTRATION 8-3

NOTE

Extreme care should be taken to prevent damage to cylinder wall and ram assembly.

At this time, the wiper ring should also be removed since packings and wiper rings should always be replaced in pairs. Thoroughly clean the area where the seals seat. Any burrs, dirt or seal debris must be removed before re-installing new seals.

CAUTION

Close inspection of seal seating critical areas should be made before the new seal is installed (SEE ILLUSTRATION 8-4 AND 8-9), Your seal failure may not have been caused by a worn seal, *but rather, by burrs, nicks and dirt located on the seal seating area, causing the seal to deform and lose its sealing ability.*

Seal Installation - General

Tools used to install hydraulic seals should be of soft metal or suitable plastic, free of burrs and sharp edges. Screwdrivers and other similar tools should not be used as they may damage the sealing edges.

The area in contact with the seal should be free of burrs, sharp edges and nicks.

If necessary to force seal over sharp edges, slots or undercuts, protective devices should be used.

Light lubrication should be applied to the seal and installation groove prior to installation. The same oil as will be used later in the cylinder should be applied.

Rod U-Cup Installation

A. SMALL U-CUP

1. Installation Tools

a. A groove alignment plug (SEE ILLUSTRATION 8-4) is needed which should be flush with groove edge. Any metal or plastic material which is smooth and lubricated may be used.

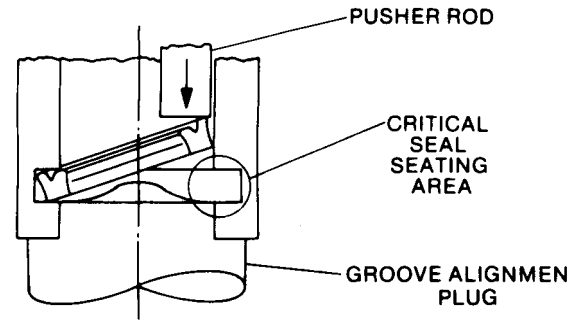


ILLUSTRATION 8-4

b. A soft metal or plastic pusher rod is needed.

2. Installation Procedure
Squeeze U-cup together and insert end into bore first. When lower end is engaged in installation groove, release U-cup and force upper end downward using pusher rod until U-cup snaps into groove.

B. LARGE U-CUP

1. Installation Tool
An installation tool made of any soft metal or hard plastic machined smooth and free of burrs with a fixed steel pin (PIN 1) and two movable pins (PINS 2 & 3) is required for this installation method. (SEE ILLUSTRATION 8-5).

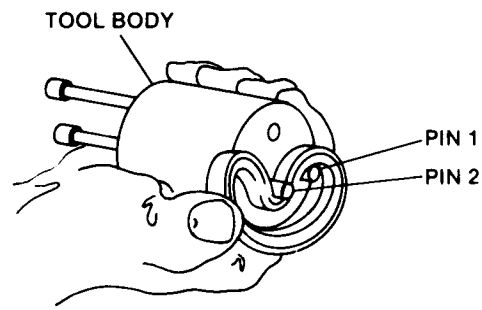
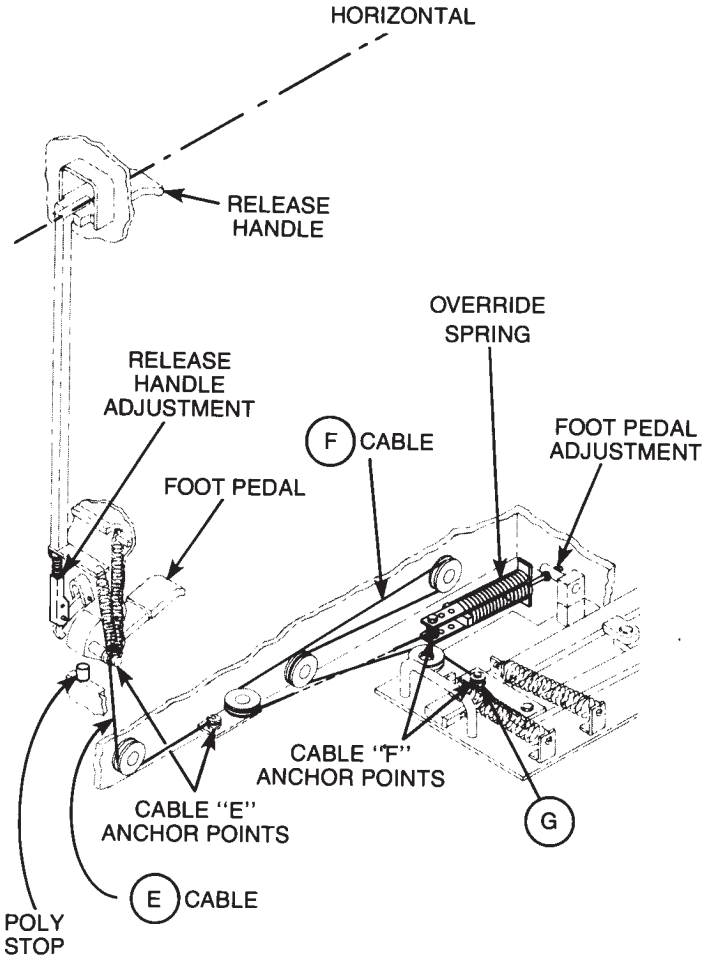


ILLUSTRATION 8-5

M8.0-07.2-003

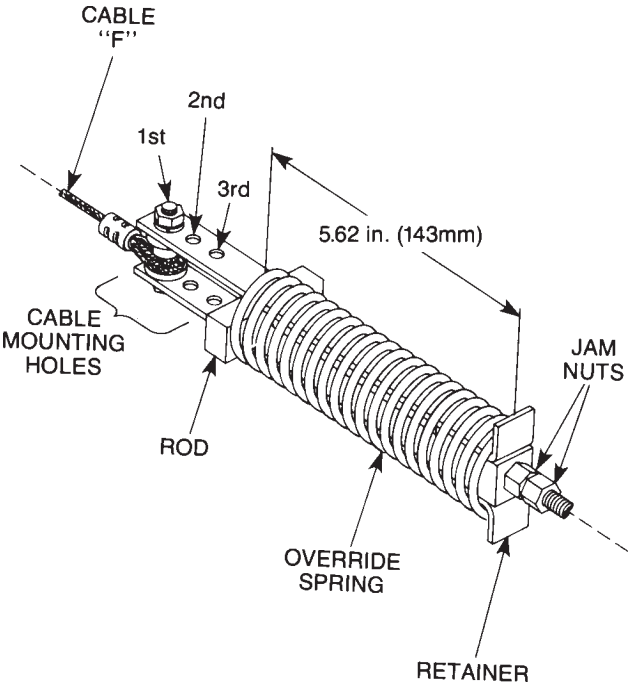


2944S ILLUSTRATION 9-3

The foot pedal position, in the released position, can be adjusted somewhat to make sure it latches properly. During normal operation a slightly lower, released pedal position may develop that could make a pedal latch impossible. To adjust pedal height slightly, loosen the jam nuts and turn nut clockwise until pedal height and operation is correct. The adjustment must be made from beneath the floor of the platform. Be sure platform is blocked securely with hardwood blocks before performing work under platform. If correct pedal height can not be achieved, through this adjustment, component parts have worn and replacement is recommended.

Should cable “E” or “F”, springs, pulleys, etc. need replacement the pallet grab can be removed from the floor of the platform by removing the two hex socket head bolts near the rear of the platform with a 3/8 in. hex key wrench. Hold the pallet grab in position until both bolts are removed. The grab can be rotated down on the “L” shaped mounting bracket at the opposite end of the grab. Be careful that the grab does not slip from this bracket at this point. Remove cotter pin, flatwasher and cable from point “G”. The pallet grab can now be moved to a suitable work area.

When reassembling pallet grab the override spring, in the grab released position should measure 5.63 in. (143mm) overall length. Refer to Illustration 9-4.



2945S ILLUSTRATION 9-4

Attach cable “F” preferably to the 1st hole in the end of the retainer. If the cable has stretched slightly or a replacement cable has been installed, the 2nd or 3rd hole can be used to maintain the proper spring length and cable tension etc. Two cables are used in the pallet grab mechanism, referred to as cable “E” and “F”. Cable “E” is the shorter of the two (approximately 14.5 in. [368mm] overall length) and cable “F” is the longer cable (approximately 53 in. [1346mm] overall length). Refer to Illustration 9-3 for cable connections, routing, etc.

A poly stop is located at the rear of the right arm and should be inspected for wear, damage, etc. The stop is secured in position with two bolts for simple installation or removal as necessary. Be sure all springs, retainers, rollers, etc. are positioned and working properly before installing mounting plate with associated parts to the underside of the platform.

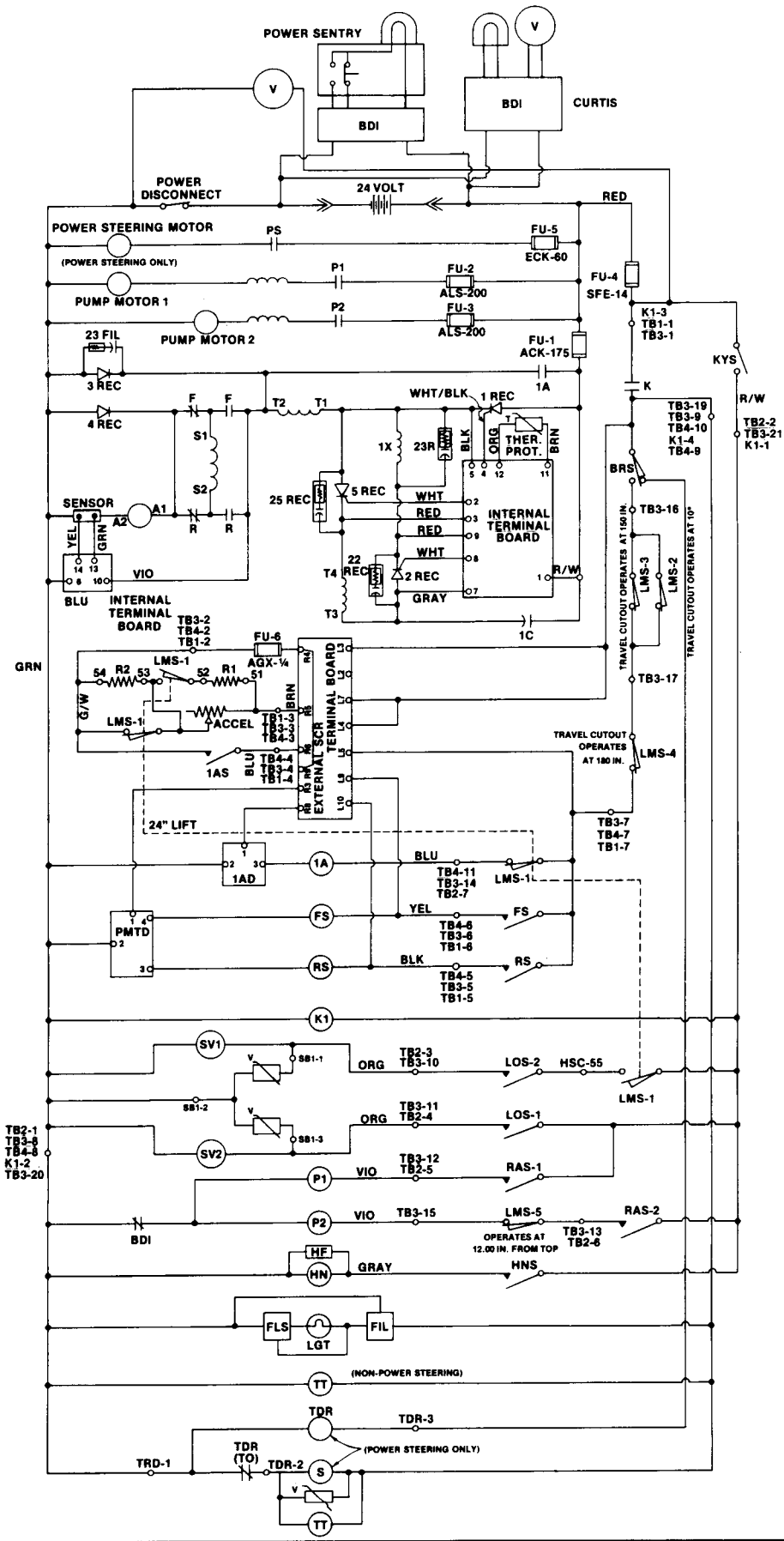
GLOSSARY, cont'd.

Component	Description	Diagram	Parts Breakdown
Suppressors			
SB1	Suppressor No. 1	DIA -07.3-103 (A-2)	2.4-07.3-003 (25)
SB2	Suppressor No. 2	DIA -07.3-013 (B-4)	4.8-07.3-002 (15)
		DIA -07.3-103 (A-2)	
SB3	Suppressor No. 3	DIA -07.3-013 (B-3)	3-12-005(36)
		DIA -07.3-103 (A-3)	
SB4	Suppressor No. 4	DIA -07.3-013 (C-3)	5.1-07.2-002(11)
		DIA -07.3-204 (A-2)	
Switches			
BRS	Brake Switch	DIA -07.3-013 (C-3)	5.1-07.2-002 (1)
		DIA -07.3-204 (A-2)	
CHS	Chain Slack Switch	DIA -07.3-013 (C-3)	9-07.2-100 (3)
		DIA -07.3-204 (A-2)	
EDS	Emergency Disconnect Switch	DIA -07.3-013 (C-2)	4.6-07.3-003 (47)
		DIA -07.3-204 (A-4)	
EMS-1	Tow-Switch	DIA -07.3-013 (C-3)	4.3-07.3-004 (11)
		DIA -07.3-103 (A-4)	
FS	Forward Switch	DIA -07.3-013 (B-2)	4.6-07.3-003 (37)
		DIA -07.3-204 (A-3)	
GTS-1	Gate Switch No. 1	DIA -07.3-013 (C-2)	9-07.2-015 (35)
		DIA -07.3-204 (A-2)	
GTS-2	Gate Switch No. 2	DIA -07.3-013 (C-2)	9-07.2-015 (35)
		DIA -07.3-204 (A-2)	
GTS-3	Gate Switch No. 3	DIA -07.3-013 (B-2)	9-07.2-015 (35)
		DIA -07.3-204 (B-2)	
GTS-4	Gate Switch No. 4	DIA -07.3-013 (B-2)	9-07.2-015 (35)
		DIA -07.3-204 (B-2)	
GUS	Guidance Switch	DIA -07.3-013 (B-2)	4.6-07.3-003 (81)
		DIA -07.4-601 (A-4)	
HNS	Horn Switch	DIA -07.3-013 (B-4)	4.6-07.3-003 (60)
		DIA -07.3-204 (A-2)	
KYS	Key Switch	DIA -07.3-013 (C-2)	4.6-07.3-003 (31)
		DIA -07.3-204 (A-4)	
LMS-1	1A Cutout Switch	DIA -07.3-013 (B-2,C-4)	4.8-07.2-258 (C)
		DIA -07.3-204 (C-4)	9-07.2-100 (14)
LMS-2	Traction Cutout Switch	DIA -07.3-013 (C-2)	4.8-07.2-258 (B)
		DIA -07.3-103 (B-1)	
LMS-3	Steering Restriction Switch	DIA -07.3-013 (C-2)	4.8-07.2-258 (B)
		DIA -07.3-103 (A-1)	
LMS-4	Steering Restriction Switch	DIA -07.3-013 (C-2)	4.8-07.2-258 (A)
		DIA -07.3-103 (A-1)	6.6-07.3-009 (51)
LMS-5	Second Speed Raise Cutout Switch	DIA -07.3-013 (B-3)	4.8-07.2-258 (B)
		DIA -07.3-103 (B-1)	
LMS-6	Limited Speed Switch	DIA -07.3-013 (B-2)	
		DIA -07.3-103 (B-1)	
LOS-1	Lower Switch	DIA -07.3-013 (B-3)	4.6-07.3-003 (60)
		DIA -07.3-204 (A-3)	
LOS-2	Lower Switch	DIA -07.3-013 (B-4)	4.6-07.3-003 (65)
		DIA -07.3-204 (A-3)	

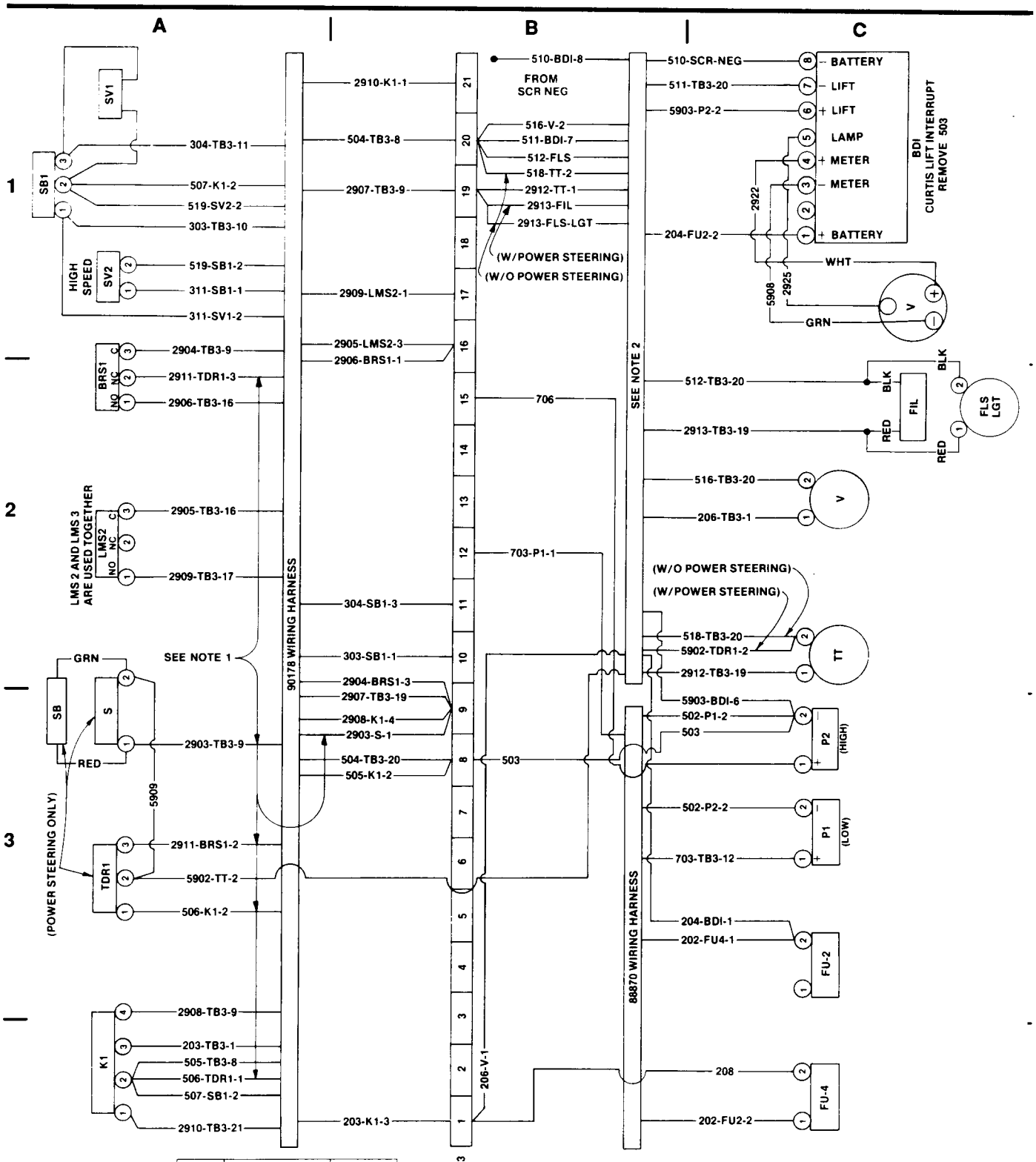
MISCELLANEOUS

Name	Location	Function	Diagram	Parts Breakdown
BDI	Power Unit	Battery Discharge Interrupt	DIA - 07.3 - 083 (B-1)	4.3 - 07.3 - 100 (12)
1AD	P.U. SCR	1A Driver	DIA - 07.3 - 082 (C-2)	4.1 - 07.3 - 008 (14)
DB1	Platform	Diode Block Override	DIA - 07.3 - 088 (B-4)	
HSC1	P.U. SCR	Limited Speed Module	DIA - 07.3 - 082 (A-2)	4.1 - 07.3 - 008 (24)
HSC2	P.U. SCR	Limited Speed Module	DIA - 07.3 - 082 (B-2)	4.1 - 07.3 - 008 (23)
HSC3	P.U. SCR	Limited Speed Module	DIA - 07.3 - 082 (B-2)	4.1 - 07.3 - 008 (26)
PMTD	P.U. SCR	Pulse Monitor Trip Driver	DIA - 07.3 - 082 (C-2)	4.1 - 07.3 - 008 (14)
POT1	Platform	Traction Potentiometer	DIA - 07.3 - 073 (B-2)	4.6 - 07.3 - 007 (30)
POT2	Power Unit	Wire Guide Position Pot.	DIA - 07.3 - 094 (B-3)	6.6 - 07.3 - 013 (44)
TDR	Power Unit	Time Delay Relay	DIA - 07.3 - 072 (A-3) DIA - 07.3 - 080 (A-3)	4.8 - 07.3 - 002 (4)
TT	Power Unit	Hour Meter	DIA - 07.3 - 083 (A-3)	1 - 07.3 - 017 (39)
PS1	Platform	Work Light Voltage	DIA - 07.3 - 077 (B-2)	4.9 - 07.2 - 052 (6)
PS2	Platform	Dome Light Converter	DIA - 07.3 - 077 (A-2)	4.9 - 07.2 - 052 (7)
FAN	Platform	Operator Fan	DIA - 07.3 - 077 (B-2)	4.9 - 07.2 - 052 (27)
RES1	Platform	Resistor Fan Low	DIA - 07.3 - 077 (B-3)	4.9 - 07.2 - 052 (30)
RES2	Power Unit	F.W. Resistor	DIA - 07.3 - 095 (B-2)	4.2 - 07.3 - 100 (14)
PS	Power Unit	Power Steering Solenoid	DIA - 07.3 - 080 (A-2)	4.8 - 07.3 - 002 (18)
V1	Platform	Discharge Indicator	DIA - 07.3 - 073 (A-3)	9 - 07.2 - 019 (7)
V2	Platform	BDI Indicator	DIA - 07.3 - 073 (A-2)	4.9 - 05.1 - 051 (1)

M10 - 07.3 - 019



88933 C
88935 C



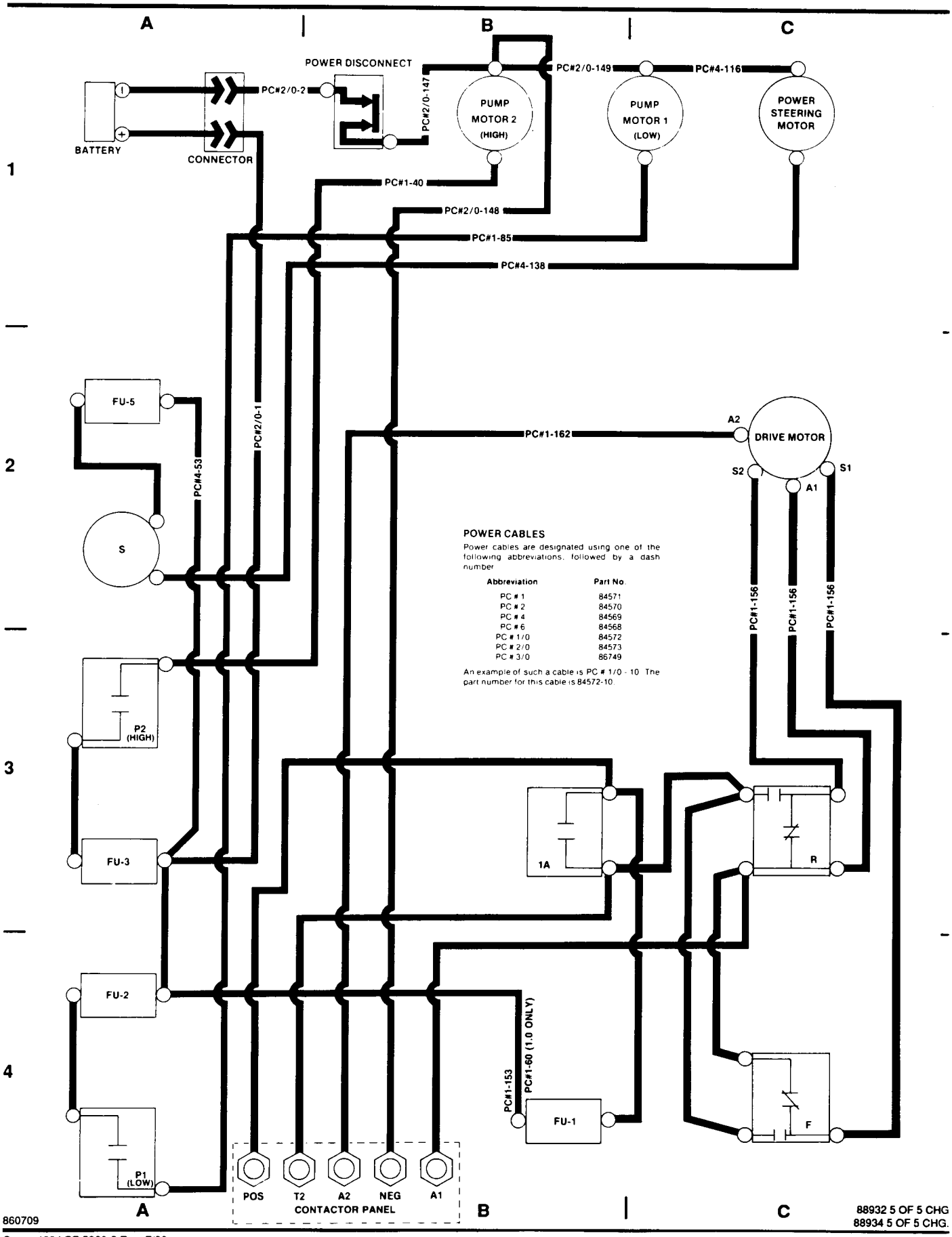
CODE	COLOR	EXAMPLE
0**	BLACK	003
1**	BROWN	109
2**	RED	207
3**	ORANGE	310
4**	YELLOW	403
5**	GREEN	517
6**	BLUE	606
7**	VIOLET	706
8**	GRAY	801
9**	WHITE	902
29**	RED STRIPE	2923
59**	GREEN STRIPE	5911

NOTE 1:
THESE LEADS ARE NOT USED ON UNITS EQUIPPED WITH MANUAL STEERING AND ARE TO BE CAPPED WITH 62020-2 INSULATOR CAPS.

NOTE 2:
88869 WIRNG HARNESS (W/POWER STEERING) (W/CURTIS BDI)
100624 WIRNG HARNESS (W/POWER STEERING) (W/O CURTIS BDI)
88931 WIRNG HARNESS (W/O POWER STEERING) (W/CURTIS BDI)
100623 WIRNG HARNESS (W/O POWER STEERING) (W/O CURTIS BDI)

860709

88932 1 OF 5 CHG
88934 1 OF 5 CHG



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88932 5 OF 5 CHG
88934 5 OF 5 CHG.

This electrical diagram index for the SP42 Stockpicker lists the diagrams with portion of truck covered by each diagram.

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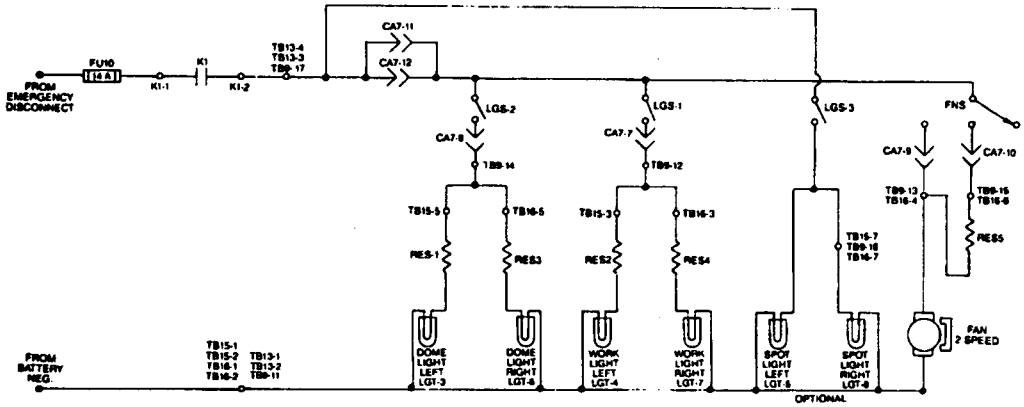
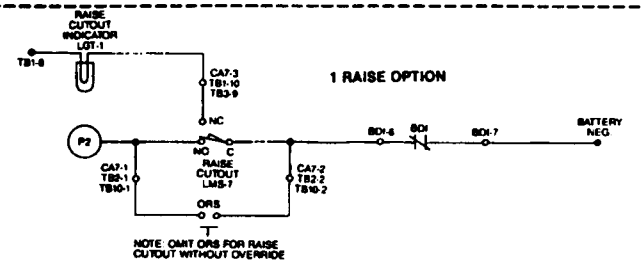
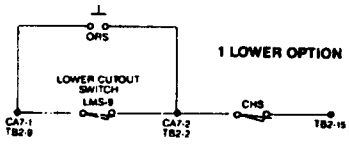
DIA - 07.3 - 045

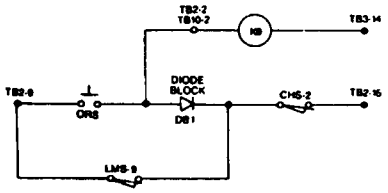
A | B | C 2213S

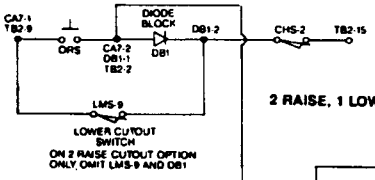
SCHEMATIC WIRING DIAGRAM - PART 2

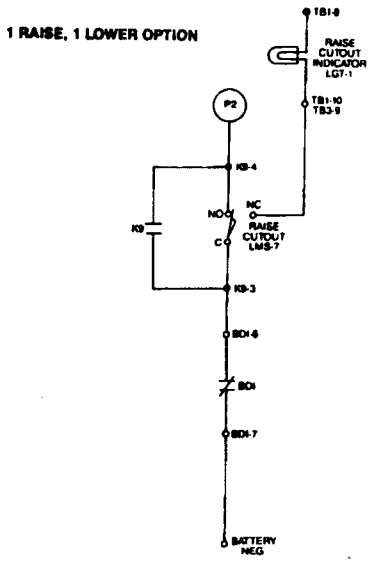


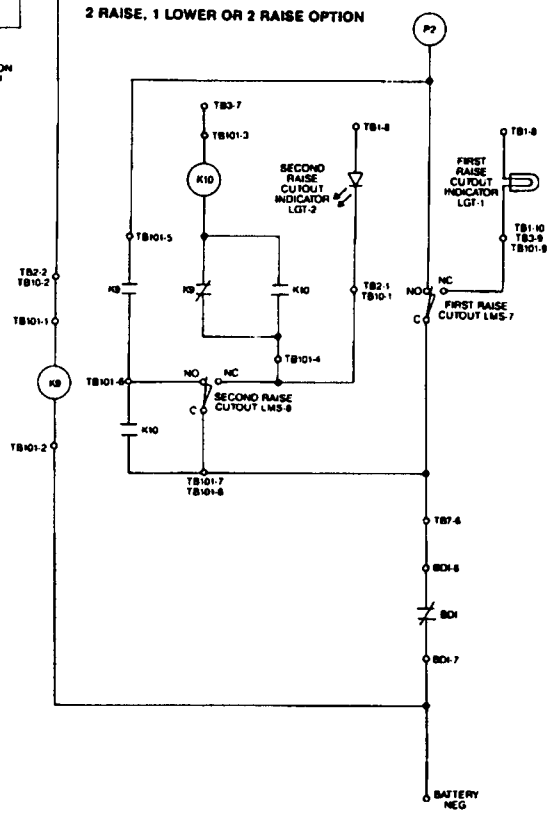






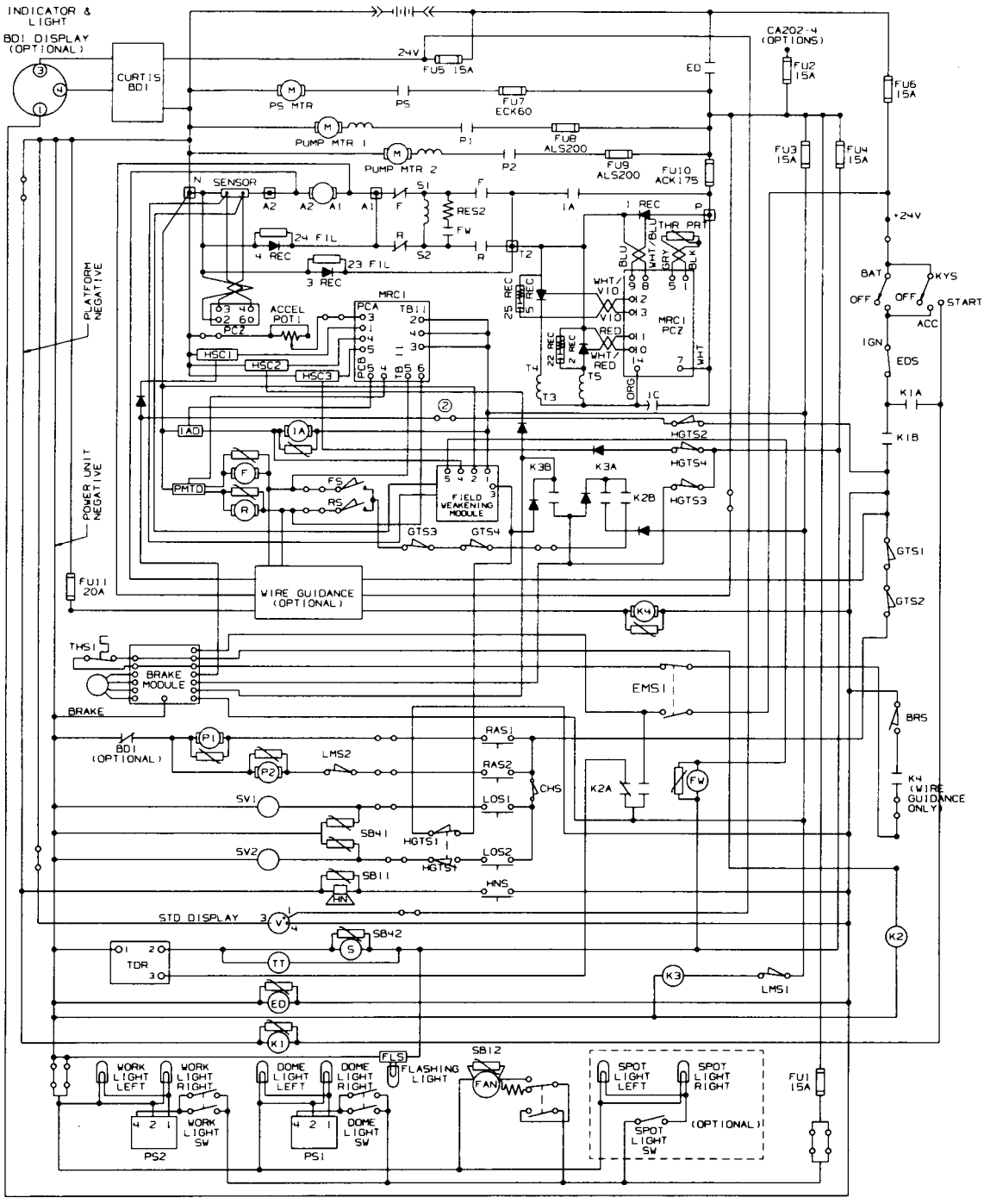






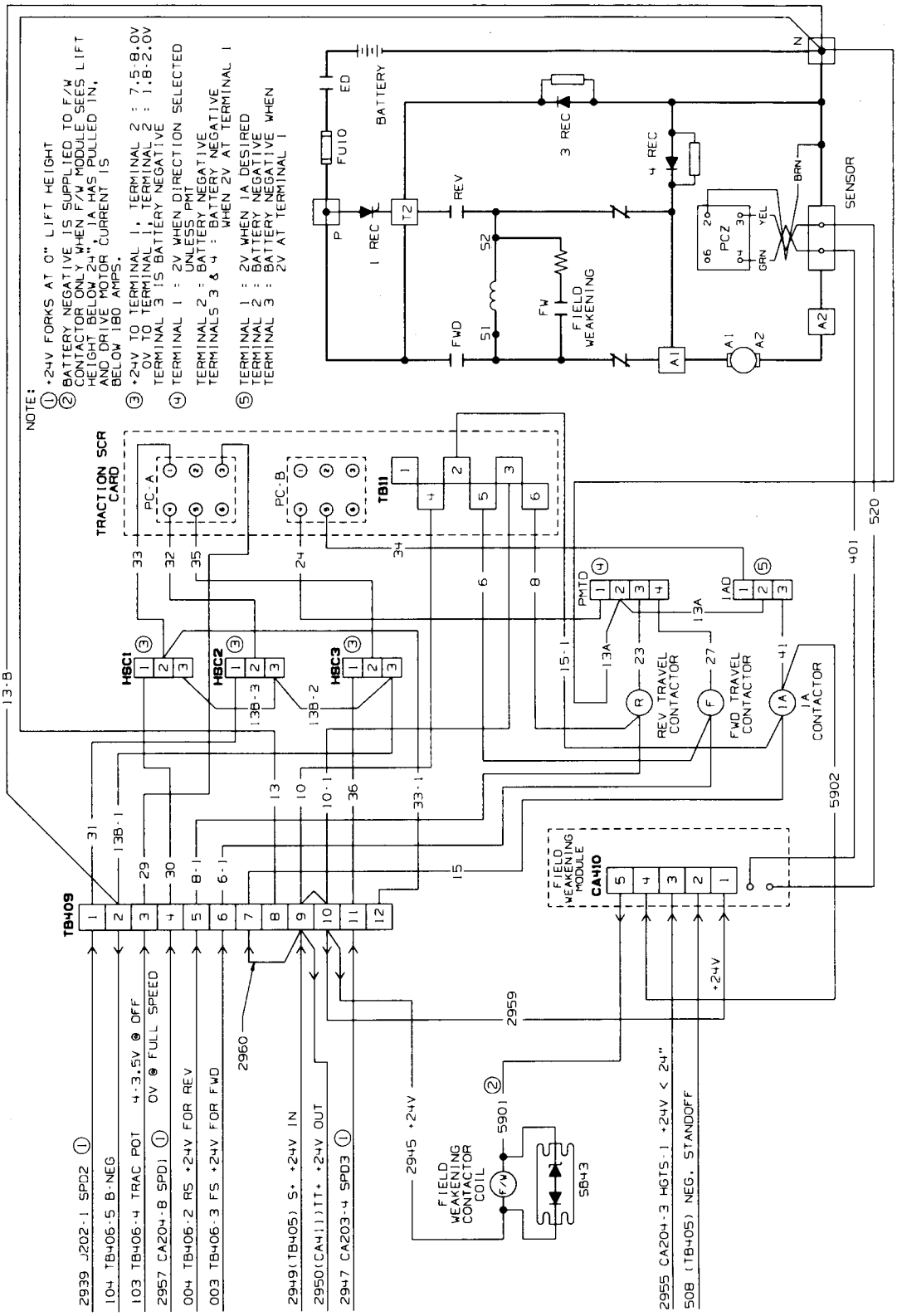
A | B | C

SCHEMATIC



DIA - 07.3 - 072

TRACTION PANEL - SCR



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