This manual is intended for the service mechanic who is seeking information about maintenance and service replacement parts. It contains a section on trouble shooting 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 rider pallet truck operator instructions, refer to Crown publication, "You and Your Crown Rider Pallet Truck" (PF-3072).

DRIVER TRAINING

Crown has available a complete series of Driver Training programs, in two parts concerning basic safety rules and operating characteristics of your rider pallet truck. To obtain this informative information ask your Crown Dealer about "Its up to You" and "You and Your Rider Pallet Truck".

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.

REPLACEMENT PARTS

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 Rider Pallet Truck capacities, technical information and dimensional specifications, please refer to the following sales literature:

Literature	
PC Specifications	SF-4283
PE Specifications	SF-4282
PR Specifications	SF-4284

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

Crown Controls Corporation
40-44 S. Washington Street
New Bremen, OH 45869

An index for this manual is located on the following pages. The 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. These sections are indicated by a black bar at the right hand edge of the page. The higher the number of the section, the farther down the page it is located. The front of the manual covers the written maintenance. The back covers the replacement parts. The sectional descriptions are as follows:

MAINTENANCE

SECTION	DESCRIPTION
M1	Lubrication and Adjustments
M2	Hydraulics
M3	Drive Unit
M4	Electrical
M5	Brake
M6	Steering
M7	Mast and Main Frame
M8	Cylinder
M9	Platform
M10	Glossary

REPLACEMENT PARTS

SECTION	DESCRIPTION
1	Basic Chassis or Power Unit
2	Hydraulic System and Components
3	Drive Unit and Components
4	Electrical Components
5	Brake Assemblies and Brake Systems
6	Steering System and Components
7	Main Frame and Mast Assemblies
8	Cylinders
9	Platform Assembly
10	Accessories

Crown 1988 PF-8036

Printed in U.S.A.

Alternate Lubricants & Fluids Chart			
Type of Lubricant		Product Name	Manufacturer/ Distributor
L	Metal Assembly Spray	Dow Corning	Dow Corning
M	Silicon Grease (Clear)	Dow Corning 111 Compound	Dow Corning
N	Brake & Parts Cleaner	Crown	Crown
	Low VOC Brake & Parts Cleaner	Crown	Crown
	Non-Flammable Brake & Parts Cleaner	Crown	Crown
O	Penetrating Lubricant	Crown	Crown
P	Premium Formula Multi-Purpose Grease	Crown	Crown
Q	White Lithium Grease	Crown	Crown
R	Choke & Carburetor Cleaner	Crown	Crown
S	Contact Cleaner	Crown	Crown
T	Electrical Connector Oxidation & Corrosion Inhibitor	Nye Grease	NYE Lubricants
U	Battery Cleaner	Crown	Crown
V	Battery Protector	Crown	Crown
W	Food Grade Machinery Lubricant	Crown	Crown
X	Food Grade Silicone Spray	Crown	Crown
Y	Extended Life Coolant		

Hydraulic System

The hydraulic system is supplied its power by a gear type pump which provides the pressure for lift to the cylinder through a combination valve. Pressure is limited by a relief valve to limit the maximum load that can be lifted.

Lowering is controlled by the solenoid section of the combination valve and a flow control valve to provide a controlled lowering speed.

A strainer is in the suction line to filter the hydraulic oil before it goes into the pump. The pump, lower solenoid, relief valve and flow control are all a part of an integral hydraulic unit.

Hydraulic schematic of standard pallet truck model is shown in Figure 6357-01.

Hydraulic System - General

1. To check hydraulic fluid level, remove the breather cap from the reservoir and insert a clean dowel. With the lift fully lowered and on a level floor, it should be no lower than one half inch from the breather hole. Approximate capacity of the hydraulic system is three quarts. Use only a good grade hydraulic oil (063001-001) or equal.

NOTE

Do not use hydraulic brake fluid.

2. Occasionally, a slight creep of the fork assembly may occur. This may be due to internal leakage in the lift cylinder packing but it can also be caused by leakage in the solenoid or check valve. To seat these valves properly when this occurs, raise and lower the forks to flush out any foreign material from the valve seat.
3. A thorough check of the system for leaks should be conducted if abnormal oil losses occur. The hydraulic system is designed to eliminate mechanical damage even if fittings become loose.
4. Great care and cleanliness should be exercised in the disassembly and assembly of any hydraulic cylinder. Wipe all surfaces clean of dirt and oil before attempting disassembly. Care should be taken when removing the ram as nicks will damage the packings. Whenever new packings are required, new wiper rings should also be installed.
5. Disassembly - To remove the cylinder cap, turn counterclockwise utilizing a spanner wrench with 3/16 inch pins and unscrew it from the cylinder tube. See Figure 16889. Replace packings and seals, clean and lubricate inside ram assembly and reassemble.
6. Assembly - After packings, seals, bushings, etc. are in place, install the cap. See Figure 16889. Apply thread locking adhesive (061004-005) to threads of cap. Screw the cap clockwise until the cap is tight with the top of the cylinder tube.

CAUTION

Care should be taken when inserting the cylinder cap, to prevent threads and sharp edges from damaging new seals and packings.

Hydraulic Seals

The seals used in the cylinders are made from an extremely tough, hard polyurethane material which can be deformed temporarily to allow for installation without permanent damage.

3. GEARS (item 7) — Inspect the gears for any signs of galling or metal build-upon the side faces of the gears as well as on the outside diameter of the teeth. If these conditions exist, the gears must be replaced. When replacing gears, always replace both gears as a set.
4. OIL SEAL (item 14) — Check the oil seal rubber for wear, cracks, chips or any other condition that would cause the seal to lose its sealing ability. Should any of these conditions exist, Crown recommends seal replacement. To replace the seal, pry out the old seal being careful not to damage the stator oil seal bore. Locate and squarely press in the new seal "lip first".
5. NEEDLE BEARINGS (item 5) — With the use of a new shaft (idler or drive) or a metal rod ground to a dimension of .5000''/.4997" (12.700 mm/12.692mm) in diameter, inserted into the bearing bores, check for excessive bearing to shaft clearance in the stator bearings as well as the gear housing bearings. Although replacement bearings are available, Crown recommends the replacement of the entire stator and (or) gear housing because bearing wear or damage usually damages the bearing bores.
6. STATOR (item 12) — Inspect the innerface of the stator for signs of scoring, excessive wear or metal build-up. If a slight metal build-up is evident, the stator face can be lapped smooth with the use of a solvent soaked crocus cloth (280 or 320 grit) placed on a flat surface. Care should be taken to remove only enough material to clean up the build-ups. A stator having a scored or worn innerface should be replaced.
7. GEAR HOUSING (item 3) — Inspect the gear housing's gear pocket face and wall for scoring or excessive wear. If either of the conditions exist, the housing should be replaced.
8. KEYS (item 8) — Check the keys for any cracks or shear marks and replace if necessary.

Pump Reassembly

Begin the reassembly by placing the shim (item 4) in position on the innerface of stator (item 12). A thin film of hydraulic oil will help maintain the location of the shim. If a new shim is being installed, make sure the shim's color corresponds to the color of the shim removed during disassembly. Preassemble the idler and drive gear assemblies by installing the keys (item 8), gears (item 7) and retaining rings (item 6) onto their respective shafts (items 9 and 10).

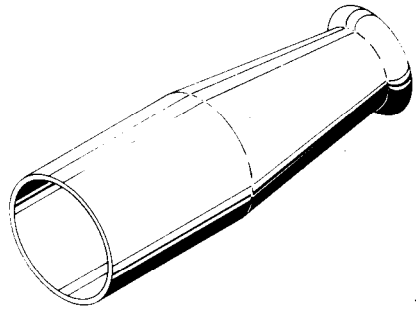

ILLUSTRATION 2.1-25

The drive shaft should be installed with the use of a sleeved tool, similar to the tool shown in Illustration 2.1-25. Insert the tool through the new oil seal being careful not to damage the seal's rubber lip. Once in position, introduce the tang end of the drive shaft into the sleeve bore and slide the shaft to a position where the side of the gear is in contact with the stator innerface. Carefully extract the sleeved tool.

insert the idler gear shaft into its respective bore after aligning and meshing the gear teeth properly. Once both shafts are in position, check to make sure the shim is free of the gear teeth. Replace the two (2) dowel pins (item 11) and after aligning the scribed match marks, carefully slide the gear housing in place and install screws. If for some reason the scribe marks are not visible, a check to assure proper asembly is as follows:

> Hold the pump in a position where you are viewing the outside face of the gear housing (screw heads should be visible). Rotate the pump to a position where the idler shaft is directly below the drive shaft. From that position, the 1/2" (12.7mm) NPTF port should be on your left side.

After you are sure of the positioning, finger tighten the eight (8) assembly screws and check to see that the drive shaft rotates freely. If it does, the screws can be tightened to a torque reading of between 8 and 10 ft. lb.(11 and 13.5 Nm). Again check to see that the shaft turns freely. Before mating the pump assembly to the motor, lubricate the drive shaft tang and the coupling (item 15) with "Moly" grease (Crown No. 63002-11).

M2.1 - 12 - 012

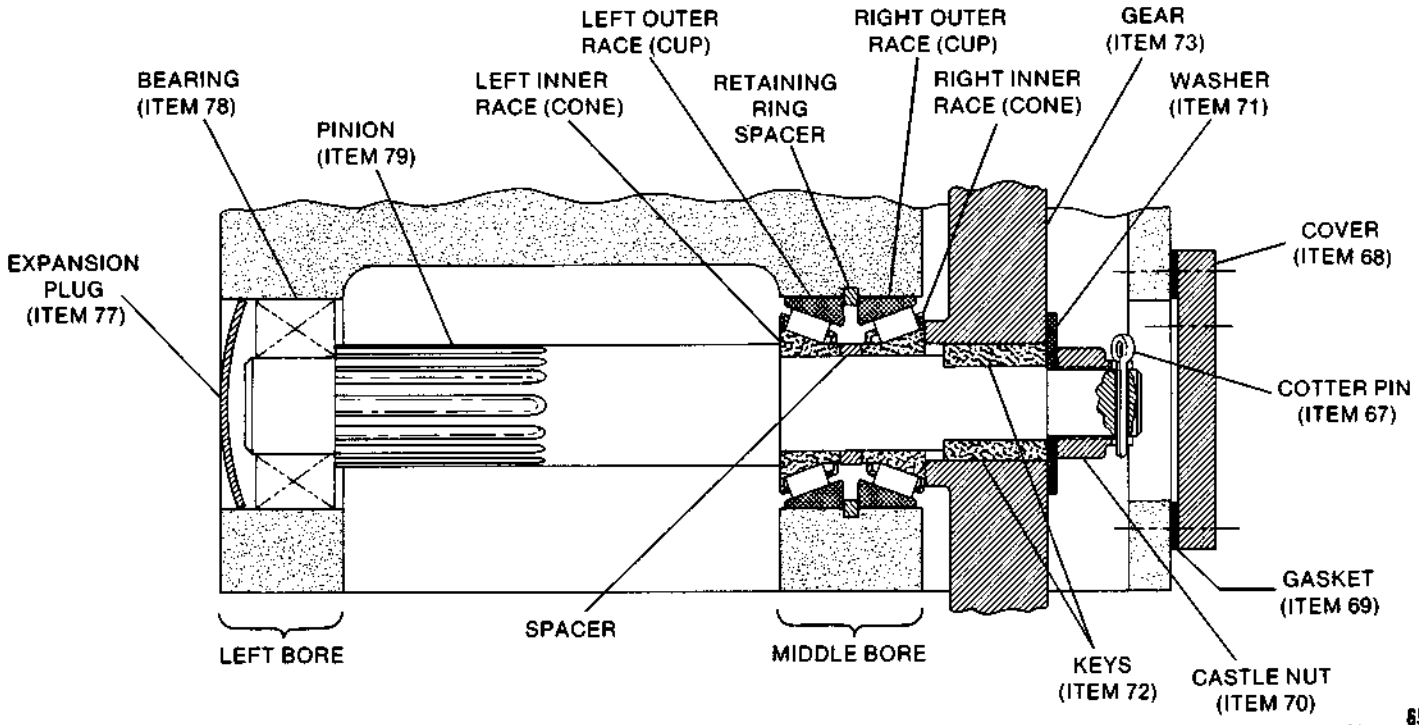

ILLUSTRATION 3-5

With the upper housing (item 62) in the same relative position as the housing in Illustration 3-4, install the lower grommet (item 23) into the neck of the housing. Preassemble the key (item 82) and the gear (item 83) onto the motor (item 81). After the components are in position, insert the retaining ring (item 84) into its groove on the end of the motor shaft. Apply a light film of multi-purpose grease (Crown No. 63002-7) to the face of the motor and stick the gasket (item 47) onto the greased mounting face. Insert the complete motor assembly into the housing and secure the fasteners. (Note: Two bolts fasten from the inside of the housing – two bolts fasten from the outside). Grease the motor shaft and its bore and install the oil seal (item 64).

With the use of an arbor press, force the left outer race of bearing (item 74) into the middle pinion bore (see Illustration 3-5). The bearing (item 74) includes two inner bearing races [cones], two outer bearing races [cups], a spacer and a retaining ring spacer. After the outer race has been pressed slightly past the groove, install the retaining ring spacer. Next, slide the pinion (item 79) through the left bore and then install the inner race and the spacer onto the end of the pinion shaft prior to the shaft entering the middle bore. Move the pinion shaft through the middle bore to a position where the right inner race, right outer race and the gear (item 73) can be installed. Once installed, force the pinion completely in and insert the two keys (item 72) into the gear. Slide the bearing (item 78) and the expansion plug (item 77) in place on the left bore before installing the washer (item 71) and the castle nut (item 70) on the end of the pinion shaft,

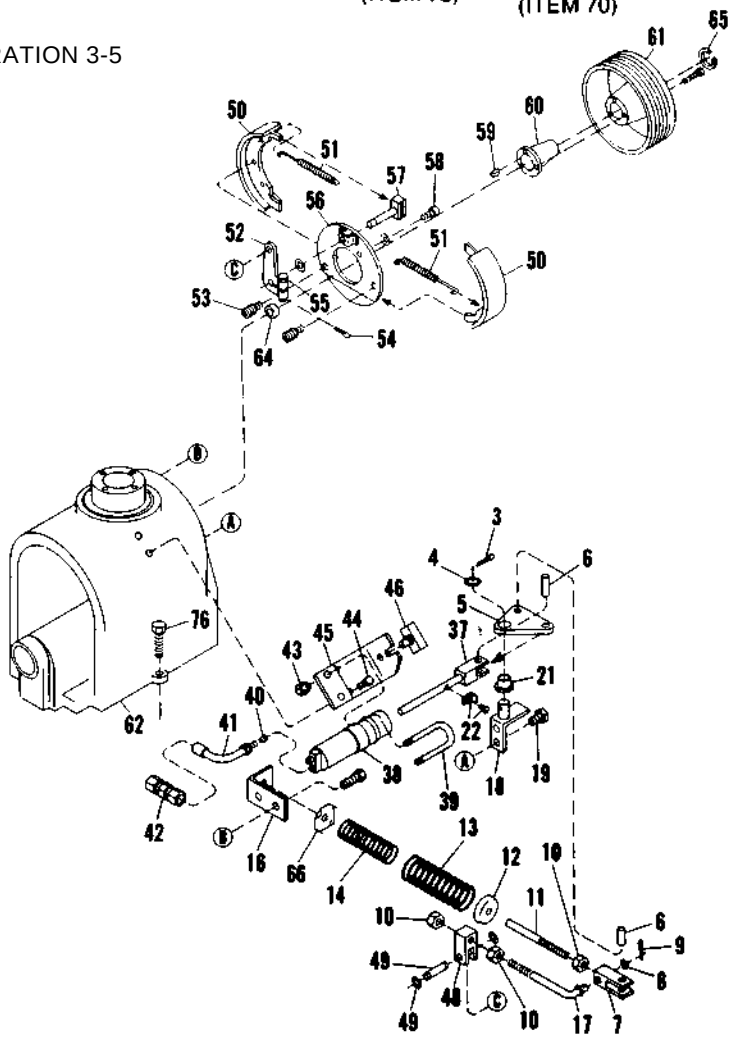

ILLUSTRATION 3-6

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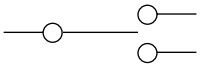
M3.0 - 12 - 002

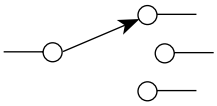
Maintained Contact Switches Operator Actuated

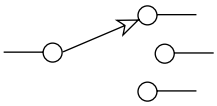

Normally Open

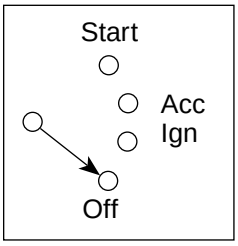

Normally Closed


Center Off


Double Throw


Multiple Pole
Break Before Make


Multiple Pole
Make Before Break



Key
Switch

Momentary Contact Switches Mechanically Operator Actuated


Normally Open


Held Closed

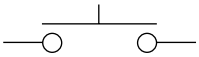

Held Open

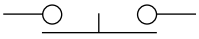

Normally Closed

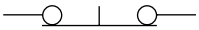

Double Throw

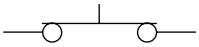

2 Circuit

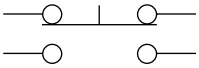
Momentary Contact Switches Operator Actuated

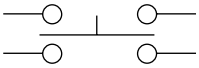

Normally Open

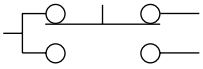

Held Open


Normally Closed


Held Closed


2 Circuit


Center Off


Double Throw

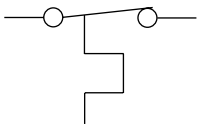
Momentary Contact Switches Mechanically Actuated

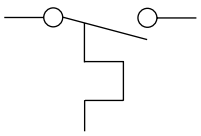

Normally Open


Normally Open
Held Closed

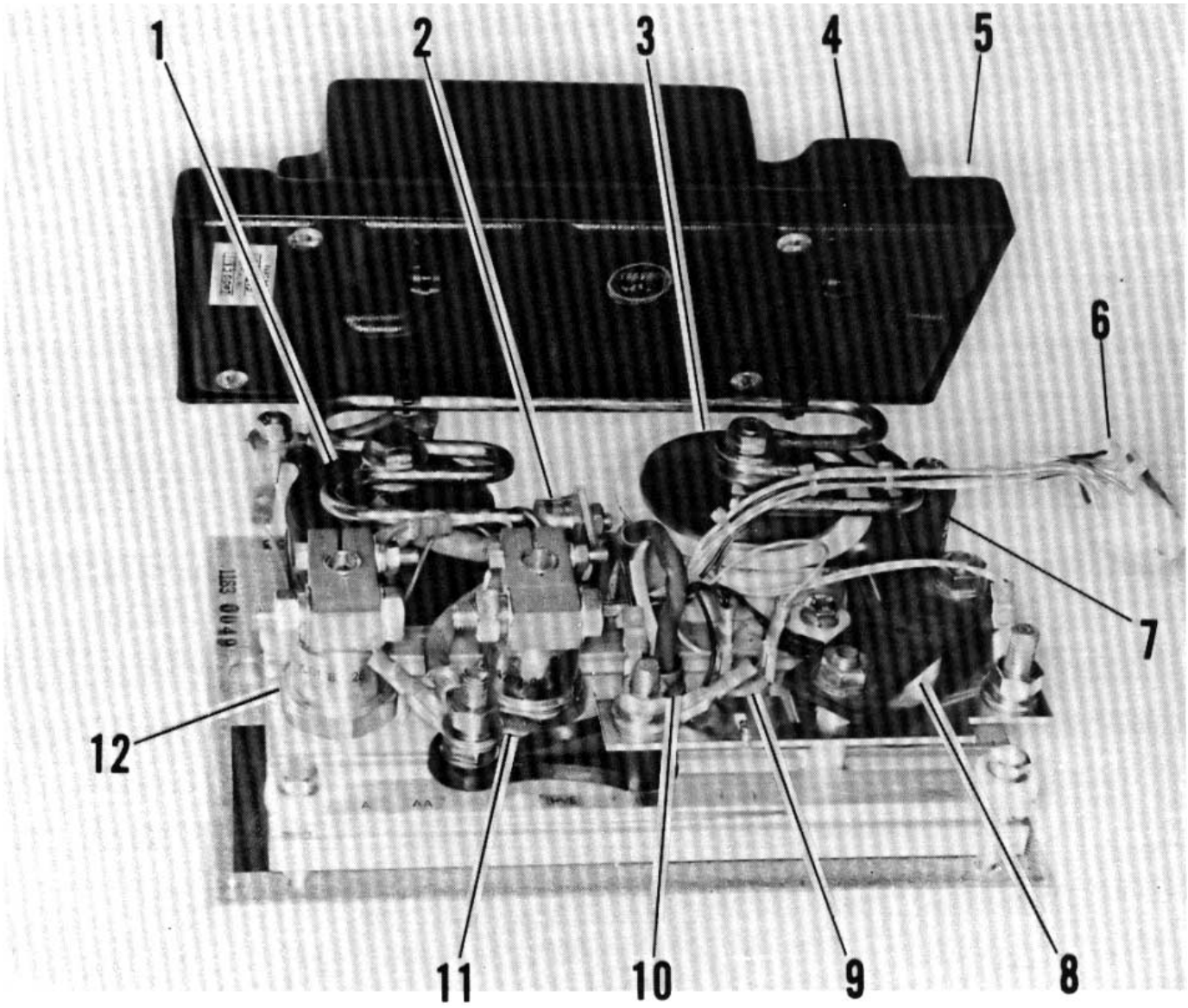

Normally Closed
Held Open


Normally Closed


Open On Rise


Close On Rise

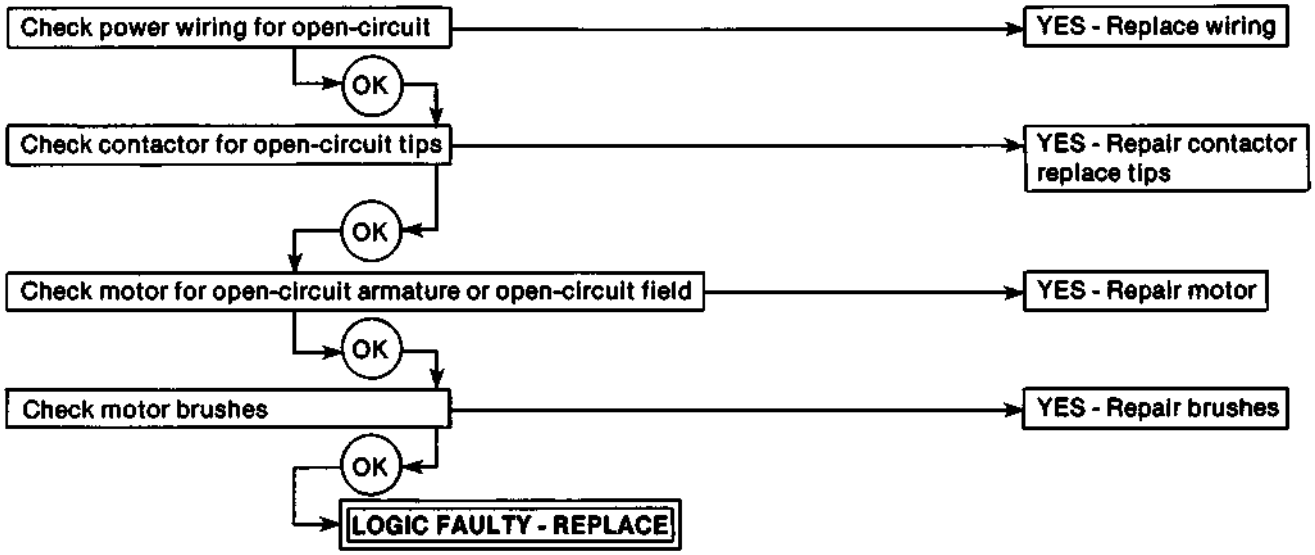
TYPICAL PHYSICAL ARRANGEMENT AND IDENTIFICATION OF COMPONENTS
(Refer to wiring diagram furnished with truck for precise arrangement of components.)



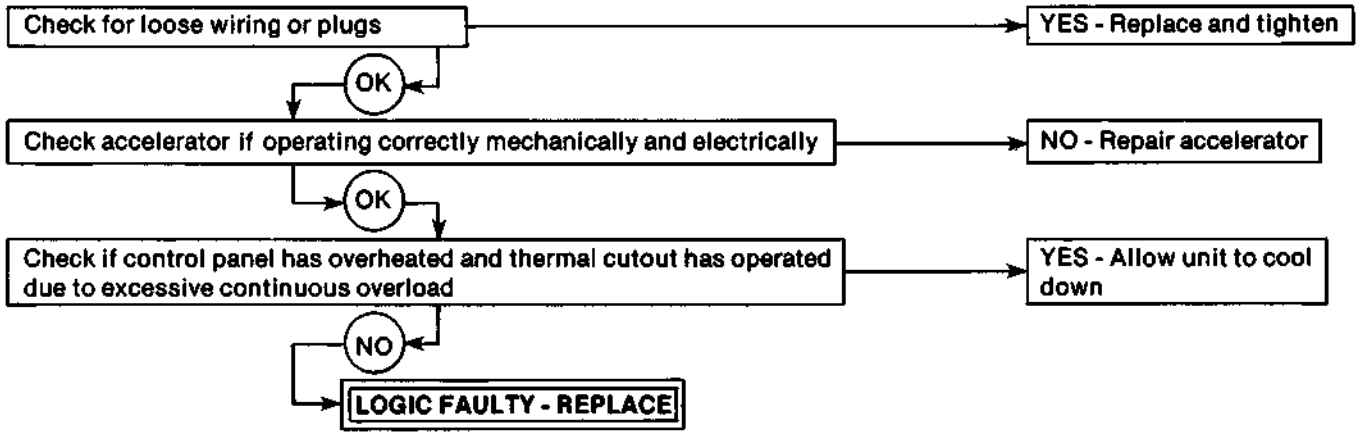
(1) Coil (L1)
(2) Resonant Charging SCR (SCR-3)
(3) Commutating Capacitor (C1)
(4) Logic (Control Card)
(5) JC1
(6) PC1
(7) Resistor
(8) Main SCR (SCR-1)
(9) Thermal Protector
(10) Turn-off SCR (SCR-2)
(11) Flyback Diode (D1)
(12) Plugging Diode (D2)

ILLUSTRATION 18

(4) DIRECTION CONTACTOR CLOSES - FAULT DETECTOR CIRCUIT OPENS DIRECTION CONTACTOR
NO SUDDEN MOVEMENT - NO ARCING AT CONTACTOR



(5) TRUCK MOVES SLOWLY - WILL NOT ACCELERATE



(*Continued on Next Page*)

Static Return to Off:

The clamp and sequence circuit takes inputs from the key, direction, foot, handbrake and seat switches (where fitted) and ensures that the contactors will not energize if the incorrect sequence is selected. It incorporates a static return to off time delay. This circuit also feeds inhibit signals to the oscillators to stop them from oscillating and allow them to start up in the correct sequence.

Over-temperature Protection:

The controllers include a thermal switch which measures the temperature of the main heat sink. At 85 degrees C the switch comes into the circuit to reduce current limit to a value = 2/3 of current limit.

Bypass Operation (1A Control):

Bypass operation is included by connecting a bypass contactor into the circuit. Bypass operation under current limit conditions is normally inhibited unless the motor voltage is approximately 300/. of battery voitage. Adjustments are provided for bypass over-current drop out and bypass pull in delay (variable over the range 0-10 seconds).

1A Plugglng Holdoff:

This built-in feature is designed to prevent 1A closure any-time during plugging.

Fault Detector Circuit:

The fauit detector circuit is designed to cause the direction contactors to de-energize if the main current carrying SCR has not been turned off within a pre-set period of time. As the controller never goes to a fuii-on condition except when using bypass, the fauit detector circuit is always in operation. The fauit detector circuit will aiso detect any condition which creates a short circuit across the main SCR inciuding a weided bypass contactor, and in these conditions the forward or reverse contactor is prevented from closing.

Contactor Coil Suppression:

Coil suppression circuits for the forward, reverse, and bypass contractors are inciuded in the logic circuit. ADDITIONAL SUPPRESSION SHOULD NOT BE FITTED TO THE CONTACTORS. Additional optionai contractors such as pump are suppressed externally to the logic unit.

Reverse Battery Protection:

Reverse connection of the battery will not damage the controller and the directional contactors will not energize.

MAINTENANCE INSTRUCTIONS

General

The SCR control, like all electrical apparatus, does have some thermal losses. The semiconductor junctions have finite temperature limits above which these devices may be damaged. For these reasons, normal maintenance should guard against any action which will expose the components to excessive heat, such as steam cleaning; or which will reduce the heat dissipating ability of the control, such as restricting air flow.

The following DOS and DON'TS should be observed:

(1) Any controls that will be used in ambients of 100° F (40° C) or over should be brought to the attention of Crown.

(2) All external components having inductive colls must be fiitered. Refer to Crown for specifications.

(3) The control should not be steam cleaned. in dusty areas, use low pressure air to blow off the control. in oily or greasy areas, a mild solution of detergent or denatured alcohol can be used to wash off the control and then blow completely dry with low pressure air. The control can also be cleaned with Freon TF degreaser.

(4) Terminal boards and other exposed SCR control parts should be kept free of dirt and paint which might change the effective resistance between points.

(5) The truck should not be plugged when the truck is jacked up and the drive wheels are in a free wheeling position. This can create excessive voltages that can be harmful to the control.

Tune Up

Cards are factory adjusted and should not require further adjustments. The card is supplied with single turn potentiometer adjustments and are marked with "diai" settings.

On mistuned cards, turn pots P4 and P3 fully clockwise and pots P0, P1, P2, P5 and P6 fully counterclockwise. Then set each pot to the setting for the particular truck as listed in chart.

M4.2 - 06.5 - 107

If power components are believed to be faulty, or in need of replacement, refer to Power Component Test and Replacement.

By using the appropriate troubleshooting aids (based on failure symptom), truck wiring diagram, and information provided in this manual; most problems should be easily detected and corrected.

WARNING

Drive wheels must be clear of the floor and free to rotate during all of the following checks unless otherwise specified. Care must be taken whenever doing "live" checks. At all other times disconnect the battery and discharge the commutation capacitor.

Voltage Readings

The readings in Chart 2 are in reference to battery negative. When making the voltage checks, make certain the meter probe is making good contact to the pin in the connector to ensure an accurate reading.

WARNING

Drive wheels must be clear of the floor and free to rotate during all of the following checks. Care must be taken when doing these "live" checks to prevent possible personal injury.

When powering-up the truck check the voltage across SCR-1. With the keyswitch closed a voltage reading above 7 vdc should be present. if voltage is less than 7 volts, check for a short circuit across SCR-1 (e.g. welded 1A contactor tips, shorted SCR-1 etc.).

TERMINAL	I/O DESCRIPTION	CONDITION	VOLTAGE
CA7-1	NOT USED		
CA7-2	High speed switch input	-Keyswitch on	approx. 5
		—HSS depressed	0
CA7-3	1A circuit common	—Direction selected	Battery volts
		—HSS depressed	Less than 2
CA7-4	Accelerator input	-Keyswitch on	Between 2 & 5
		—Maximum speed requested	0*
CA7-5	Direction contactor common	-Keyswitch on	0
		—Direction selected	Less than 2
CA7-6	Forward sense	—Forward selected	Battery volts
		—Reverse selected	Less than 2
CA7-7	1A sense	—Direction selected	Battery volts
		-Keyswitch on	0
CA7-8	Reverse sense	—Reverse selected	Battery volts
		—Forward selected	Less than 2
CA7-9	NOT USED		
CA7-10	Jumpered to CA7-15	-Keyswitch on	0
		—Direction selected	Battery volts
CA7-11	Power input	-Keyswitch on	Battery volts
CA7-12	NOT USED		
CA7-13	1A power	-Keyswitch on	0
		—Direction selected	Battery volts
CA7-14	NOT USED		
CA7-15	Jumpered to CA7-10	—Keyswitch on	0
		—Direction selected	Battery volts

* Make certain voltage drops as twist grip is turned toward maximum speed.

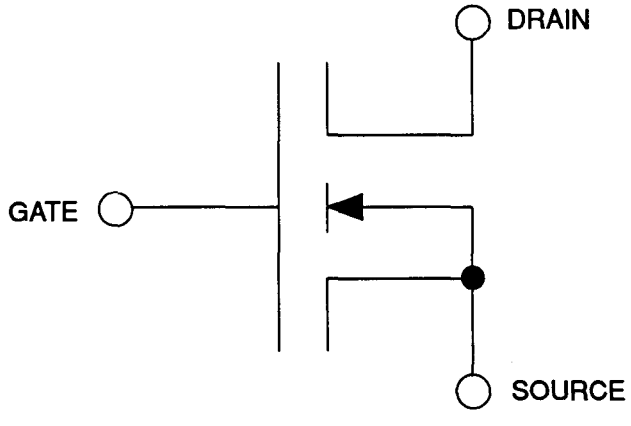
CHART 2

TRANSISTOR (MOSFET) CONTROLLER

The Transistor Control is a solid state electronic speed control which enables the energy from a fixed voltage DC source to be fed to an electric motor smoothly and without the power losses associated with other means of speed control.

The operation of the system consists of switching the full battery voltage to the traction motor for very short periods of time. The motor does not respond to the individual voltage pulses but rotates at a speed corresponding to the average voltage which is determined by the pulse width. The pulse frequency is constant and the pulse width duty cycle is set by the truck accelerator (twist grip). Therefore the average motor voltage can be varied anywhere from zero up to battery voltage, smoothly and with minimal energy losses. The battery voltage pulses are made possible by a device known as a Metal Oxide Semiconductor Field Effect Transistor (MOSFET). This is simply a solid state switch that is capable of handling high currents.

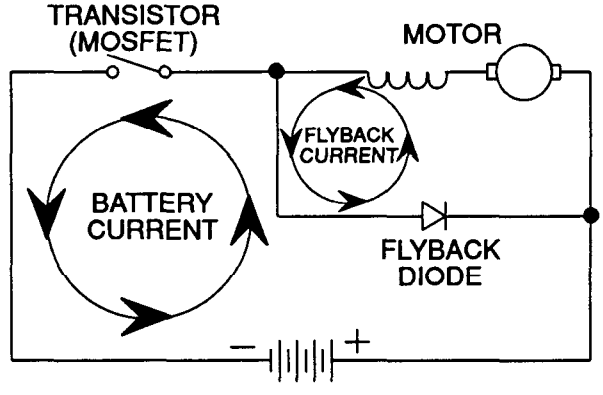
The MOSFET is a three terminal device (Illustration 4.2-1). The two main terminals which are called the SOURCE and the DRAIN, carry the working current. The third electrode, known as the GATE, is the switching electrode.



0284 **ILLUSTRATION 4.2-1**

Normally the transistor is non-conducting (open circuit). However, if a positive voltage is applied to the anode with respect to the source and then a gate signal is applied to the gate electrode, the transistor will switch to a conducting state (short circuit). Thetransistorwill continue to conduct as long as the gate signal is present. The gate's "on" time is set by the accelerator (twist grip) position, and is supplied by the electronics in the controller. At slow speeds the transistor "on" times are short in duration and the "off" times are long in comparison. This allows little current to flow through the motor and consequently the motor output shaft rotates slowly. As the transistor "on" times become longer the motor output shaft will turn at a speed proportional to the increased current.

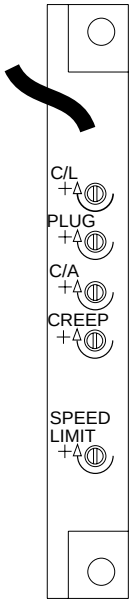
During the transistor "on" times, the current flowing in the motor windings sets up a magnetic field. During the "off" times, the magnetic field set up by the motor windings, collapses and induces a voltage in the windings. This voltage would be wasted under normal conditions, however, a diode (flyback diode, Illustration 4.2-2) is placed around the motor which routes the induced voltage of the collapsing magnetic field back through the motor.



0285-01 **ILLUSTRATION 4.2-2**

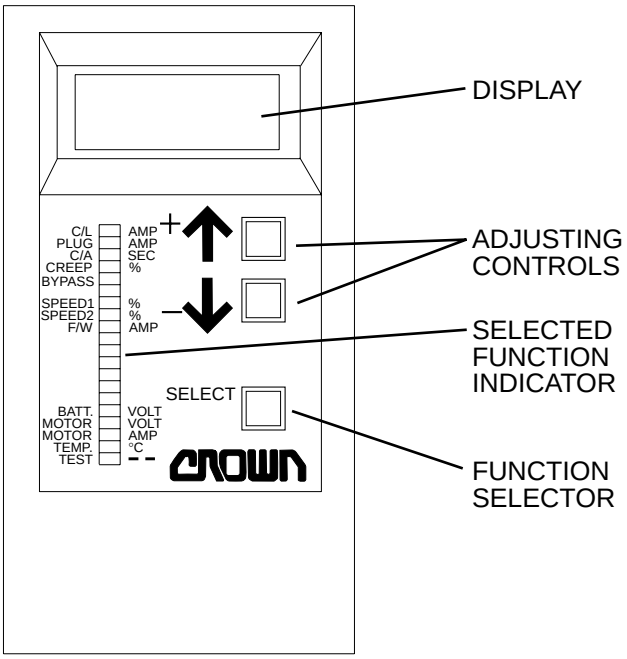
SEVCON TRANSISTOR CONTROL

The Sevcon Transistor Control can be tuned up using two different units. One unit is a set of potentiometers (110769). This unit is plugged into the controller and the corresponding features adjusted by turning the potentiometers.



POTENTIOMETER UNIT
110769
0287 ILLUSTRATION 1

The second unit is a hand held calibrator (111930). This unit is also plugged into the controller and the corresponding features adjusted by incrementing or decrementing the value with keys on the hand held. Once settings are made, the units can be disconnected. The calibration values are saved by the controller as changes are made.

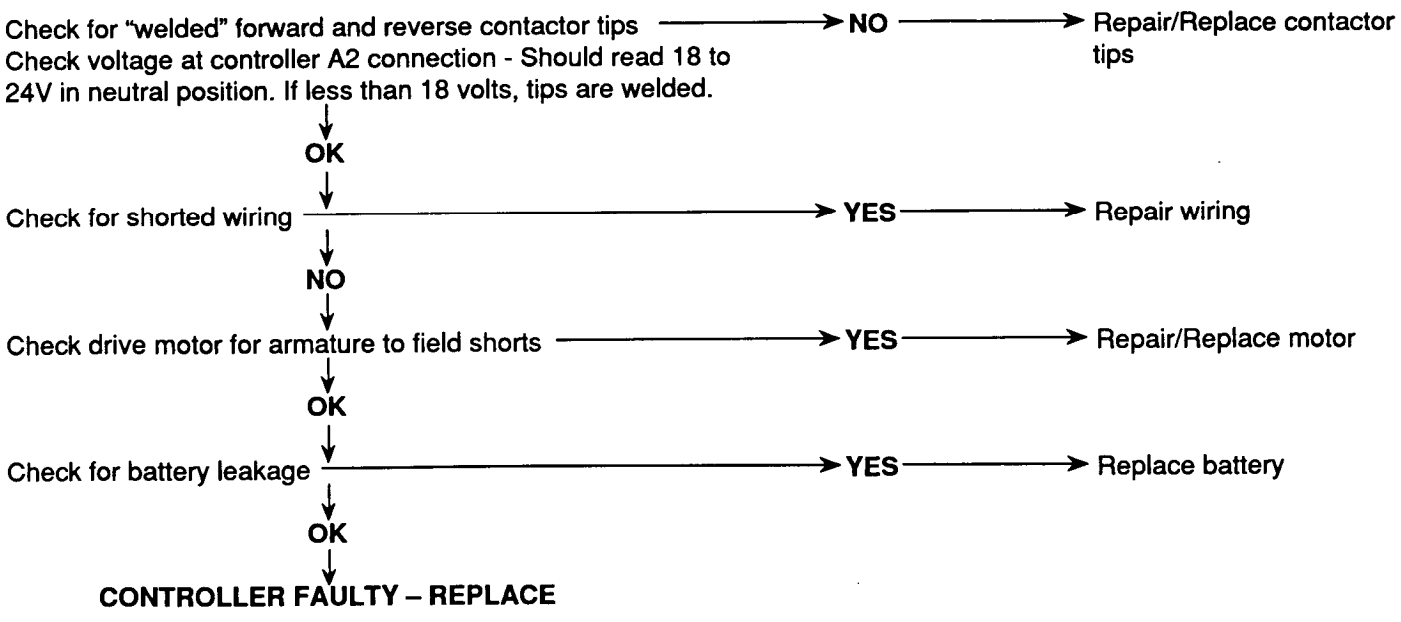


HAND HELD UNIT
111930
0288-01 ILLUSTRATION 2

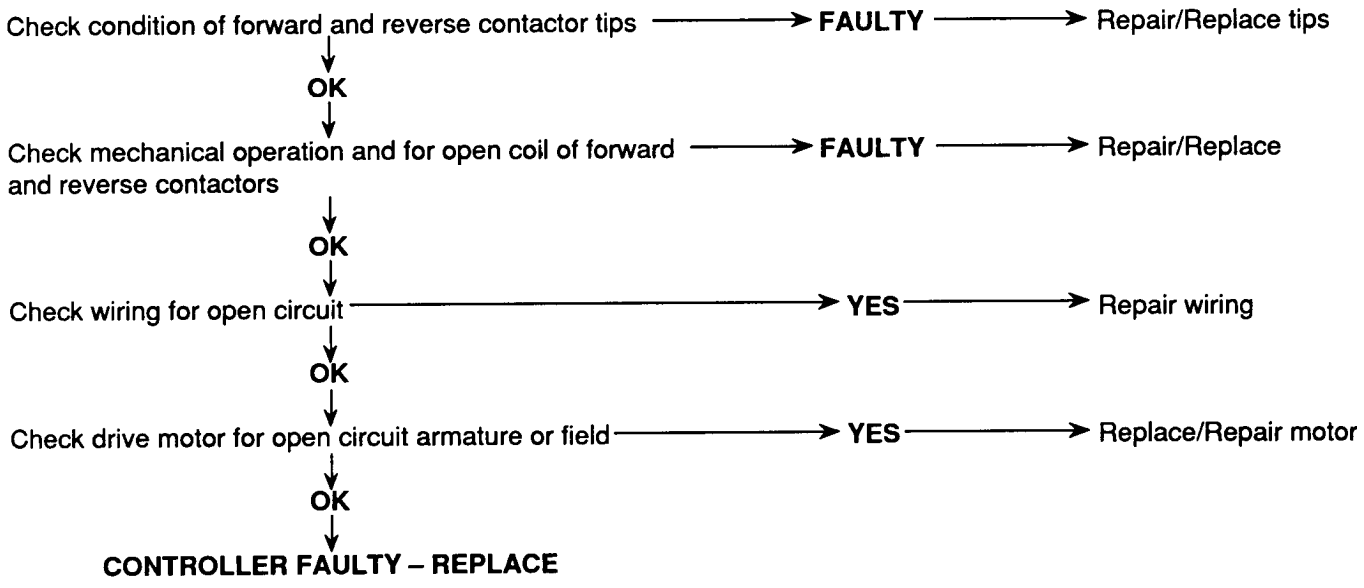
With either unit, the values set are stored immediately by the controller and the controller monitors the input for any changes. With the potentiometers, any time this unit is plugged in, the values of the potentiometers are stored immediately. So the control cannot be tuned up with the hand held and then the potentiometers plugged back in without losing the values set by the hand held unless the potentiometer settings are identical to the changes made by the hand held.

When the hand held is plugged in and a feature selected, the value of that function will be displayed. If the value is not changed with the hand held, no change to the setting will occur.

4 FLASHES - DIRECTIONAL CONTACTOR WELDED



5 FLASHES - DIRECTIONAL CONTACTOR NOT CLOSED OR MOTOR HAS OPEN CIRCUIT



Assembly

(Refer to Illustration 4-21 for exploded view and parts index).

Before assembly all parts should be cleaned and inspected for wear and replaced if required. The assembly is performed in the reverse order from the disassembly with the following precautions required:

1. Force the small end of the spiral spring over the small diameter on the armature assembly. (See illustration 4-22).

2. Reassemble the armature parts 5 to 15 and tighten the 10-32 nut to 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

3. Locate the projections on the magnet frame in the indentations on top of the coil with frame oriented as in Illustration 4-21.

4. Add the armature and movable-contact assembly.

5. Properly seat the stationary contacts in the slots of the molded stationary-contact support and add the two contact spacers.

6. Tighten the four long bolts with 14 to 18 inch-pounds torque (1.6 to 2.0 Newton meters).

ILLUSTRATION 4-22

MAINTENANCE AND INSPECTION OF PARTS

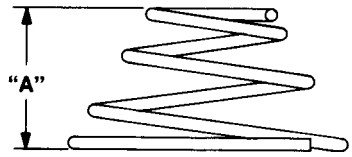
Contacts

Contacts must be replaced before they have worn through contact button to the base copper material.

Spiral Return Spring

The free length should be between the limits shown in the table and should be replaced if it shows signs of corrosion.

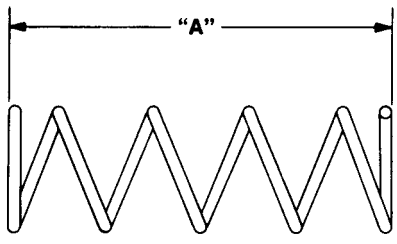
Contactor	Free Length "A" in inches (mm)
79567 79771 79772	0.73 to 0.79 (18.5 to 20.1)
83872 83872	0.67 to 0.73 (17.3 to 18.5)



Contact Spring

The free length should be between the limits shown in the table and should be replaced if it showns signs of having been overheated or of corrosion.

Contactor	Free Length "A" in inches (mm)
79567, 79771 79772, 83872	0.38 to 0.40 (9.6 to 10)



coils

⚠ CAUTION ⚠

The coils have voltage suppression cast integral with the coil. If a test voltage is applied in the wrong direction or if the coil is connected back wards, permanent damage may result. Observe the polarity mark on the coil during maintenance.

If the contactor fails to operate, measure the voltage being applied to the coil terminals. The coils on the contactor have been designed to actuate the contactor on reduced battery voltage and with approximately three volts drop in the electronic circuit so that all contractors should operate at or below 65 percent of rated battery voltage. Replace the coil if the contactor does not operate to the full stroke on 65 percent voltage or if the coil shows signs of being overheated.

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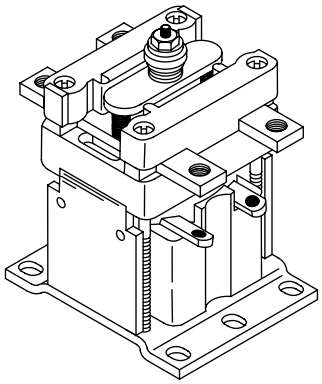
M4.4 - 11 - 023

Crown has tested and applied these contactors according to the requirements of our vehicle. No modifications or changes should be made in the layout, physical arrangement or electrical connections without written permission from Crown. The information contained in this section pertains to the contactors listed below.

Contactor	Voltage
106109-003	36
126209-002	36



7769 ILLUSTRATION 1

WARNING

Before any inspection, adjustments, servicing, parts replacement or any other act is performed requiring physical contact with the electrical working components or wiring of these contactors; disconnect battery, raise traction wheels clear of floor and place hardwood blocks under truck frame.

Inspection

The following information is intended to assist during periods of normal maintenance and to provide checks for maintaining adjustments. As these devices are tested and adjusted at the factory, they should normally not require further adjustments. However, if factory adjustments are tampered with or otherwise changed, the checks contained in the following information may be made.

CONTACTS

In normal operation, the contacts may become blackened, discolored, and roughened. This will not interfere with proper operation and cleaning is not necessary. The contacts should be replaced if the silver contact facing is completely eroded through to the backing material. The silver contact facing may transfer to either the moving or stationary contact and cause buildup on one contact. This can be expected under certain conditions and does not require contact dressing or filing. It is recommended that contacts always be replaced in mating pairs.

COILS

Remove coil from circuit by removing wires from terminals, including suppressor. Coil resistance should be as follows:

Coil	Voltage	Resistance
112222	36/48	28.2 to 36.2 ohms
126240	36	55 to 65 ohms

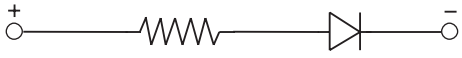
CONTACT AND SPIRAL RETURN SPRINGS

These springs should be replaced if signs of corrosion or discoloration from overheating are present.

0282 ILLUSTRATION 2

SUPPRESSORS

104497 Suppressor: This suppressor is a resistor-diode network. When meter, on R x 10K scale, is attached with polarity shown in Illustration 3, a meter reading of less than 5,000 ohms should be realized. Reverse meter leads. Meter should indicate infinite resistance.



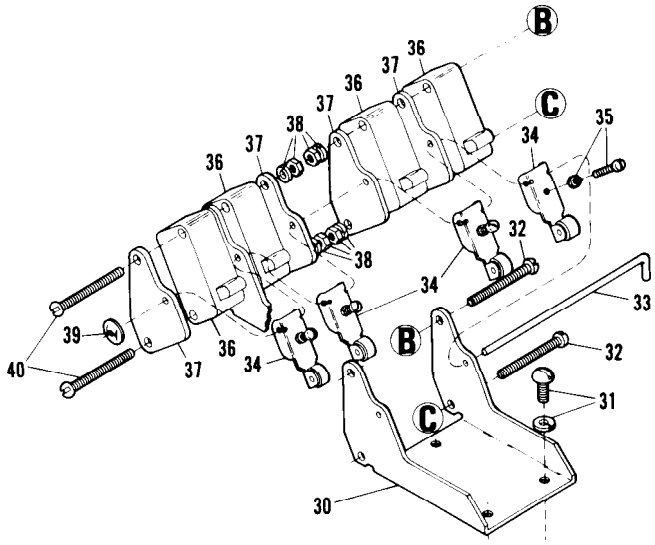
0280 ILLUSTRATION 3

Component Replacement

Remove covers from top and bottom of control pod.

DIRECTIONAL, SPEED, 1A SWITCHES AND ACTUATORS

Remove three mounting screws from switch and bracket assembly. Arrange wires in control pod to permit switch and bracket assembly to be moved out from under cam through top of control pod.



0272S ILLUSTRATION 2

Locate switch to be replaced and disconnect wires, noting location for proper installation. Remove appropriate mounting screws and slide switch from assembly. Position replacement switch and slide into assembly, securing in place with mounting screws. Connect wires as noted at disassembly and tighten electrical connection screws 390-460 Nmm (55-65 inch ounces).

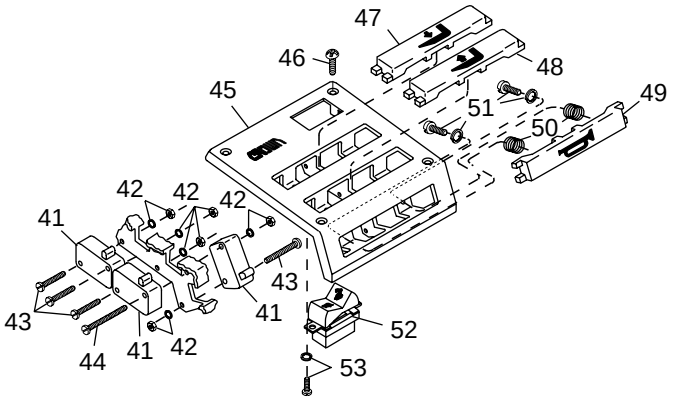
Locate actuator arm in question. Remove speed nut (39) (Illustration 2) and slide rod (33) out until actuator in question can be removed. Remove adjusting screw from arm being replaced and install in replacement arm. Slide rod into switch bracket, aligning actuators so rod goes through pivot point. Install speed nut.

Slide switch and bracket assembly onto mounting posts in control pod and secure in place with mounting screws. Perform switch adjustment procedures.

Install covers.

LIFT, LOWER, HIGH SPEED CUTOUT, HORN SWITCHES AND BUTTONS

Locate switch to be replaced and disconnect electrical wires, noting location for proper installation (Illustration 3). Remove mounting screws and replace switch. Secure in place with mounting screws and connect electrical wires as noted at disassembly. Tighten electrical connection screws 390-460 Nmm (55-65 inch ounces).



0273 ILLUSTRATION 3

Locate button to be replaced and remove two spring retaining screws (51). Work springs out of assembly. Remove corresponding switch mounting screws and move switch aside. Remove button from cover. Position replacement button so symbol on button is correct and insert in cover.

Compress springs and insert in spring recess in back of button and under bracket for spring retaining screw. Install spring retaining screws. Position switch and secure in place with mounting screws.

Install covers.

SAFETY REVERSING SWITCH AND BUTTON ASSEMBLY (Not Applicable on PC, TR Trucks)

Remove mounting screws from safety reversing switch (Illustration 4) and lift from control pod. Disconnect electrical wires and install on replacement switch. Position replacement switch in control pod and secure in place with mounting screws.

When the PMT circuit prevents F or R from closing, the PMT circuit can be reset only by opening the Key switch.

Static Return To Off

This built-in feature of the control requires the driver to return the directional control to neutral anytime he leaves the vehicle and returns. If the seat switch or key switch is opened, the control will shut off and cannot be restarted until returned to neutral. A time delay is built into the seat switch input, .75 second, to allow momentary opening of the seat switch if a bump is encountered.

Coil Drive Modules

These modules are located typically on the contactor portion of the control. They are the power devices that operate F, R and 1A contactor coils. These modules pick up or drop out these coils on command from the control card. All modules are equipped with reverse battery protection in that if the battery is connected incorrectly, none of the contactors controlled can be closed electrically.

Thermal Protector (TP)

This temperature sensitive device is mounted in the 1 REC heat sink. If the 1 REC temperature exceeds design limits, the thermal protector will lower the maximum current limit and not allow 1 REC to exceed its temperature limits. Even at a reduced current limit, the vehicle will normally be able to reach sufficient speed for full 1A operation, thereby allowing the panel to cool. As the panel cools, the thermal protector will automatically return the control to full power.

Filters

Hash filters and varistors prevent damage to the control circuit that can be caused by voltage spikes (Momentary surges when circuits are made or broken) from contactors, solenoids, etc.

Low Voltage

Batteries under load, particularly if undersized or more than 80 percent discharged, will produce low voltages at the SCR control terminals. The EV-1* control is designed for use down to 50 percent of the nominal battery volts. Low battery volts may cause the control to not operate correctly but the PMT should open the F or R contactor in the event of a commutation failure.

Oscillator Card Changes

Card 1C3645	Volts	FW	Features See Following								
			1	2	3	4	5	6	7	8	9
OSC1A3	24-48	YES	X	X	X	X	X				NOTE 1
1B3	24-48	NO	X	X	X	X	X				NOTE 1
1C3	24-48	YES				X*	X				YES
1D3	24-48	NO				X*	X				YES
1H3	24-48	NO						X			YES
1H9	24-48	NO						X	X	X	NO
2H9	24-48	NO						X	X	X	NO
3H9	24-48	NO						X	X	X	NO
4H9	24-48	NO						X	X	X	NO
5H9	24-48	NO						X	X		NOTE 2

* Only on cards up to Rev. B-2 (See card nameplate)

NOTE 1 - Can replace any card, however, requires group 1 thermal protector as described in feature 2.

NOTE 2 - Can replace any card, however, requires jumper between R4 on control card and battery negative.

M4.2 - EV1 - 005

Hour Meter Module (IC3645CPM1HMB1) **26 REC**

Check individual diode circuits with continuity light or Simpson. (See Chart 4.)

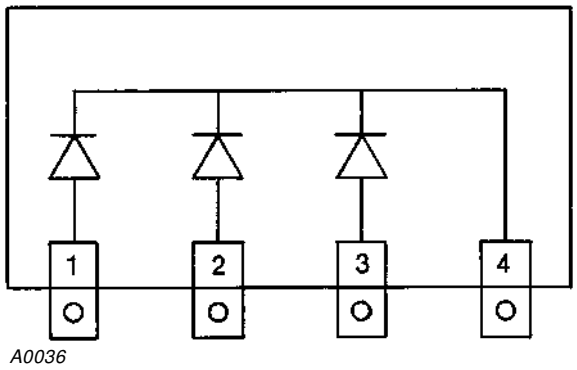


ILLUSTRATION 22

Rectifier

When checking diodes, *disconnect battery and discharge capacitor 1C* to prevent burning out the ohmmeter. When replacing rectifiers, refer to Replacement Procedures.

3 and 4 REC:

Disconnect one lead or flexible connection, 3 and 4 REC are diodes with about 7 to 12 ohms in the conducting direction (+ ⟶|— –) measured on the RX1 scale, and 50,000 ohms or higher, in the non-conducting direction (– ⟶|— +) measured on the RX 10,000 scale.

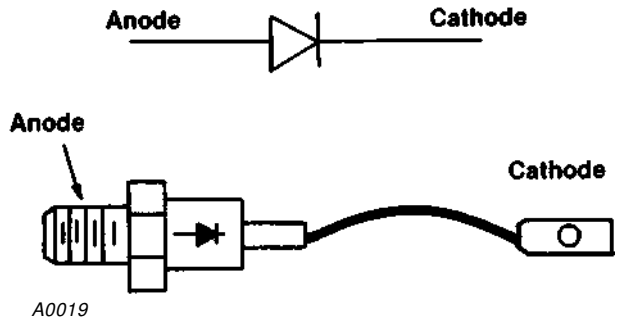


ILLUSTRATION 23

Thermal Protector (TP)

Remove both connections from TP and with a VOM read less than 200 ohms terminal to terminal, if heat sink is at room temperature. Set VOM to highest ohm scale and check pins to heat sink, reading should be infinity.

Filter Block (HF) 22 REC, 25 REC, 23 FIL, etc.

To check, disconnect all wires from filter block. With VOM on RX 10,000 scale, touch the lead to the filter terminals to charge the filter. After a few seconds, reverse the meter leads and touch the filter terminals. The VOM needle will deflect and return to infinity. If this capacitor action is not observed, replace the filter block.

NOTE

If system has symtoms to indicate 22 REC or 25 REC to be defective, interchange 22 REC and 25 REC and try again. If problem is corrected, 25 REC was marginal and should be replaced. If problem is not corrected replace both filters with known good filters.

VOM METER CHECKS

Check	Positive (Red) Meter Lead	Negative (Black) Meter Lead	Meter Scale	Reading
1	1	4	R × 1	7-12 ohms
2	4	1	R × 10,000	Infinity
3	2	4	R × 1	7-12 ohms
4	4	2	R × 10,000	Infinity
5	3	4	R × 1	7-12 ohms
6	4	3	R × 10,000	Infinity

NOTE: When using meter with positive and negative DC switch, be sure meter is set to + DC for check 1, 3 and 5. Meter switch can be reversed to - DC without changing leads for checks 2, 4 and 6.

CONTINUITY LIGHT CHECK

	Positive Lead	Negative Lead	Light Should
1	1	4	Light
2	4	1	Not Light
3	2	4	Light
4	4	2	Not Light
5	3	4	Light
6	4	3	Not Light

CHART 4