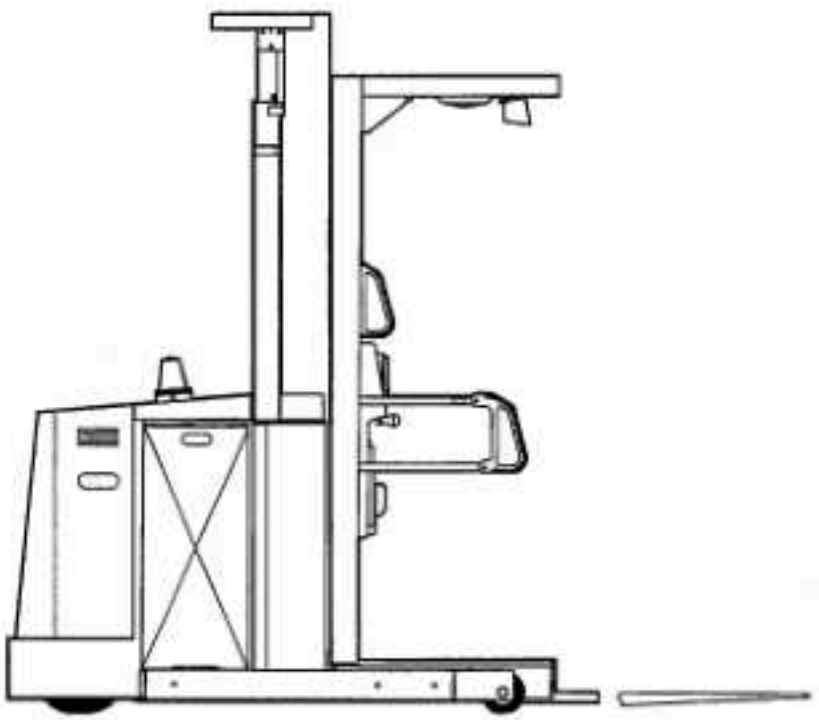
SM-613
NOS 15
SERVICE MANUAL



CLARK Technical Publications
Lexington, KY
40508

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STEERING SYSTEM (ST)

Section 1	Pages 1-5	Steering System (General Information)
Section 2	Pages 1	Steering System (Maintenance)
Section 3	Pages 1-3	Steer Cable (Wire Rope) (Replacement and Adjustments) & Reccommended Assembly
Section 4	Pages 1-2	Steer Cable Adjustments

LOAD CARRIER (LC)

Section 1	Pages 1	Mast Maintenance and Repair (General Information)
Section 2	Pages 1-3	Mast Maintenance and Repair (Lift Chain and Sheaves)
Section 2	Pages 1-2	Mast Maintenance and Repair (Roller Bearings)
Section 4	Pages 1-2	Mast and Platform Removal
Section 5	Pages 1-5	Mast and Platform Installation

BODY AND FRAME (BF)

OPTIONAL EQUIPMENT (OE)

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BASIC ELECTRICAL THEORY

Commonly Used Terms

Anode - Positive or Incoming terminal of a semi-conductor device through which current flows into the device.

Average Current - On a pulsed system, the effective value of current that performs work. Average current can be read with a conventional D.C. Meter.

Cathode - Negative or Discharge terminal of a semi-conductor.

Charging Transformer - A transformer which supplied voltage to the oil filled capacitor used to turn off the SCR.

Controlled Reversing (Plugging) - The ability of the control to bring the truck to a smooth stop.

Diode - A semi-conductor consisting of an anode and a cathode. A diode will pass current easily in the direction from anode to cathode and block the flow of current in the other direction.

Filtering - The use of devices such as capacitors or small diodes to remove from a circuit the spikes of voltage which may be generated by switching of contactors or other circuit operations.

Frequency Modulation - The method of obtaining adjustable speed control by varying the number of pulses per second.

Gate - The control element of an SCR. A small signal applied to this element will cause the SCR to conduct large amounts of current between anode and cathode.

Heat Sink - A mounting device for a semi-conductor designed to dissipate any heat generated within the semi-conductor.

Module - A small sub-panel, epoxy encapsulated, containing the controls circuit electronic components such as resistors, capacitors, etc.

Oscillator - A device composed of a small transistor and a resistor capacitor network used to generate pulses.

Potentiometer - A small variable resistor.

Pulse - Electrical energy which flows for a brief interval of time.

Pulse Width Modulation - The method of obtaining adjustable speed control by varying the width of current pulses.

Semi-Conductor - Any of a family of solid state electronic devices such as diodes, transistors, SCR's, etc.

Silicon Controlled Rectifier (SCR) - A semi-conductor rectifier used as a latching switch; i.e., it may assume either a conducting or nonconducting state (on, off).

Static Timer - A timing device utilizing electronic components.

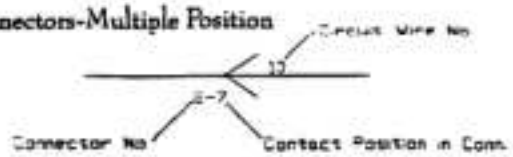
Transistor - A semi-conductor device which will carry varying amounts of current depending on the applied control signal.

P.M.C. - A stepless transistorized motor controller utilizing a high power semi-conductor MOSFET transistor switch.

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ELECTRICAL SCHEMATIC AND WIRING (LEGEND)

Connectors-Multiple Position

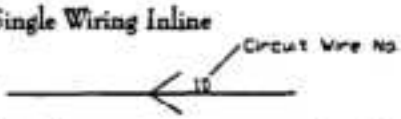


J (Socket Or Cap Half)

P(Plug Half)

J & P Refer to the Construction of the Connector Housing Halves

Connectors- Single Wiring Inline



Single Wire Inline Connectors are not numbered

J (Socket Half)

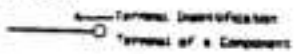
P (Plug Half)

J & P Refer to the Connectors of the metal contacts

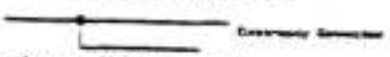
Connector Application

No.	J	P	Applications
1	X		Chassis Electrical Panel Harness
1		X	Mast Electric Cable
2	X		Mast Electric Cable
2		X	Chassis Electric Panel Harness
3	X		Chassis Electric Panel Harness
3		X	Mast Height and Limit Switch Harness
4	X		Platform Electric Panel Harness
4		X	Travel Control Harness-Lower
5	X		Travel Control Harness-Upper (Handle)
5		X	Platform Electric Panel Harness
6	X		Mast Electric Cable
6		X	Platform Electric Panel Harness
7	X		Platform Electric Panel Harness
7		X	Mast Electric Cable
8	X		Lift/Lower Control PCB
8		X	Chassis Electric Panel Harness
9	X		Lift/Lower Control PCB
9		X	Chassis Electric Panel Harness

Connections-General



Terminal of a Component

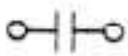


Electrically Connected



Wires Crossing-No Connection

Relay and Contactor Contacts

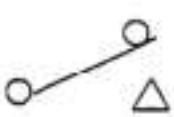


Normally Open



Normally Closed

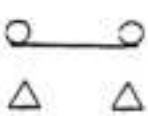
Switch Contacts



Maintained Contact

Momentary Contact

Typical of single Make Switches



Maintained Contact

Momentary Contact

Typical of Double Make Switches

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Main Table of Contents

TROUBLESHOOTING

Troubleshooting Electrical Problems

Sometimes, things we cannot see are difficult to understand. Such is the case with electricity. But, we can certainly see the results of electricity at work. In electric forklift drive control systems, when electricity is able to "flow" properly, the traction motor runs and the forklift operates properly. When that electrical flow is interrupted strange things can happen. Components do not work or work intermittently, fuses blow and in extreme cases, wires can become so hot they could cause the insulation to break down and melt.

This section will guide you through basic electrical troubleshooting. As with any other aspect of service work, it takes time and patience to develop skills. But, if you take your time, read the Service Manual and the Training Manual carefully and follow the steps recommended by CLARK , you will be able to troubleshoot and repair even complicated and involved problems.

The Logic of Electrical Troubleshooting

For some technicians, electrical problems are what they like to work on the least. It's easier to fix a problem that can bee "seen" as some electrical problems can be elusive. However, if you take your time to carefully analyze the problem and outline some logical steps to solve it, you will find that most electrical problems are pretty basic. Remember for current to work, you need a Battery or a Source for electrical power, a Load such as a motor or contactor and Continuity, which means wires and conductors that are free of resistance. If any of these factors are missing, the circuit is broken and current will not flow.

Troubleshooting Procedure

It's helpful to have a routine procedure or approach when troubleshooting a problem, a method with which you are familiar and that gives you the most information with minimum time and effort. A general rule of thumb when performing electrical troubleshooting is to: ***"Do the easiest and quickest checks first."***

This approach means looking for the obvious things first, such as damage to wires or buss bars, **excessive corrosion** on wires and connectors. Fuses should be checked with a VOM meter. **Don't** trust your eyes on this check! A fuse that may "look good" may be blown. After this step, you should begin developing a sound "plan attack" before going any further on the forklift. Some of the most frustrating and confusing electrical problems are made more difficult with a haphazard and random troubleshooting approach. It's important that the checks you make will give you the answers you need. If you test the wrong component, use the wrong test equipment or forget to calibrate a meter, you may get incorrect or useless information.

Don't forget, there is a time to **"walk away from the problem"**. When that "time" occurs is different for each person but the important point to remember is that it is very easy to become confused when troubleshooting electrical problems. If, after 30 to 45 minutes, you have not reached a solution to an electrical problem, it's usually a good idea to take a break and walk away from the problem to think about it for a few minutes. This is when you need to go over your "plan of attack" and find out exactly what you know about the problem you are working on.

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