Yale Europe

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Workshop Manual

ERC/ERP 15/18/18X TCE
(ERC/ERP 030/035/040 TCE)

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4.5 OVERHAUL

4.5.1 ELECTRIC MOTOR PRECAUTIONS

1. ALWAYS disconnect the battery at the connector before commencing work on the truck. DO NOT pull the cables attached to the connectors.

2. ALWAYS refer to the applicable procedures when undertaking maintenance and overhaul operations.

3. NEVER guess or assume polarity or connections of the truck wiring. NEVER use 'trial and error' techniques.

4. ALWAYS refer to the truck wiring diagram (See Electrical Section).

5. MOTOR MAINTENANCE

5.1 CLEANING

Remove loose dust using a regulated supply of clean compressed air. Degrease components using a suitable solvent applied with a lint free cloth or soft bristle brush. Allow the components to dry before inspection.

5.2 ARMATURE

(a) Examine the armature core for indications of local overheating (caused by shorted circuits) and signs of chafing against the field windings (indicating armature shaft distortion or excessive wearing of bearings).

(b) Inspect the commutator for scoring, pitting, wearing of the brush track and thrown solder. Excessive pitting or blackening indicates a winding defect.

5.3 FIELD WINDINGS

Inspect the windings for indications of chafing or damaged insulation (Indicates a distorted armature or worn bearings). Renew if defective.

NOTE: If required, the field windings can be given an extra coating of insulating varnish. Red glycol can be used if a class H polyurethane varnish is not available. Ensure the varnish does not contact the brush gear, pole shoe faces and end head sets.

5.4 BEARINGS

Examine the armature bearings for excessive wear, pitting, discolouration and rough running. Renew if defective.

5.5. BRUSH HOLDERS & COMMUTATOR END BRACKETS

Check the insulation resistance between the brush holders and the commutator end bracket, using a 100 volt insulation tester. Minimum acceptable value 1 megaohm.

5.6. BRUSH SPRINGS

Check the brush spring force. It will be necessary to remove the motors from the installed position on the truck to check all brushes on each of the three motors. However, it is possible to arrive at a satisfactory conclusion through sample testing of the accessible brushes without removal of the motors as visual confirmation is possible through comparison with the readings obtained as above. Renew the springs if the force is below the value stated in the SPECIFICATIONS. (See Fig. 1).

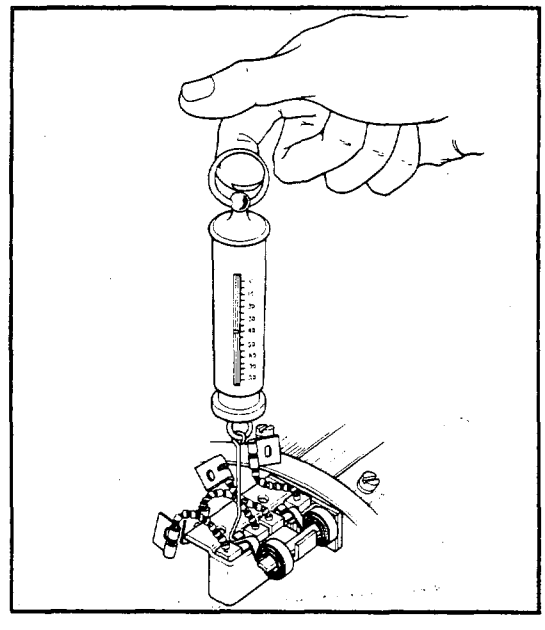


Fig.1.

5.7. BRUSHES - RENEWAL (Motor Removed From Truck)

TO REMOVE

1. Clean the motor externally, using a lint free cloth dampened in a cleaning solvent (Yale Part No 296318300).

2. Remove the brush gear cover to gain access to the brushes.

3. Remove the screws securing the brush leads. Lift the brush springs and withdraw the brushes from their holders.

NOTE: Excessive deformation during the above procedure can lead to the needle bearing inner ring becoming deformed.

(e) Using tool "K" press on the inner ring of the tapered roller bearing (See Figure 7.Item 5).

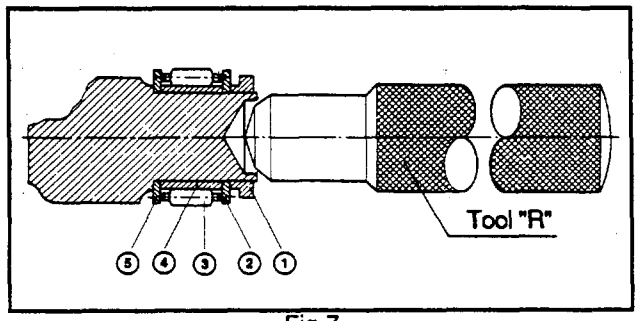


Fig.7.

6.4.2.2 PRE-ASSEMBLE GEAR SHAFT (See Fig.8.)

(a) Smear the edges of the 5 wheel studs (10) with Loctite 242 and press them into the gear shaft flange.

(b) Push the nilos ring (9) up the stop position on the shaft.

(c) Using tool "K" press on the inner ring of the tapered roller bearing.

(d) Coat the hollow spaces on the bearing inner ring between the rollers and the cage with grease. Do the same to the sealing edge of the nilos ring. Use Shell Alvania R3.

REMARK:

Other grease of the same specification may also be used.

6.4.2.3 PRE-ASSEMBLE BEARING HOUSING (See Fig.8.)

(a) Smear the outside diameter of the shaft oil seal (6) with Loctite 574 and using tool "F" plate it in the correct position i.e. the open side of the ring facing towards the transmission.

(b) Place both outer rings of tapered roller bearings (5 and 7) in the housing.

(c) Smear the seating faces of the gamma ring (8) with Loctite 242 and press it onto the bearing housing.

6.4.2.4 ASSEMBLE GEAR SHAFT AND SATELLITE CARRIER - PRE-STRESS BEARING (See Fig.8.)

(a) Place the pre-assembled gear shaft into the bearing housing.

(b) Place the pre-assembled satellite carrier (3) onto the gear shaft.

NOTE: In the case of Transmission "V" (different tyres) washer (4) must also be put into position.

Assemble them together using the washer, threaded bolt and hexagon bolt from tool "L" adjust until the bearing play = O.

(c) Pre-stress bearing to 500 Nm.

Using a torque spanner pre-stress the gear shaft and the satellite carrier with the aid of tool "L".

TIGHTENING TORQUE 10 Nm - 10%

Rotate the gear shaft in both directions several times, ca. 10 to 20 revolutions, so that the rollers of the tapered roller bearing become aligned.

Check that the tightening torque is still 10 Nm + /- 10%.

(d) Determine shim thickness "X".

Place the dial indicator gauge on the end face of the satellite carrier and set to "O".

(e) Unscrew tool "L" and remove.

(f) Position the required thickness "X" of shims (2).

(g) Smear the pinch bolt with Loctite 242 and put it in position using tool "N".

TIGHTENING TORQUE MA = 80 Nm

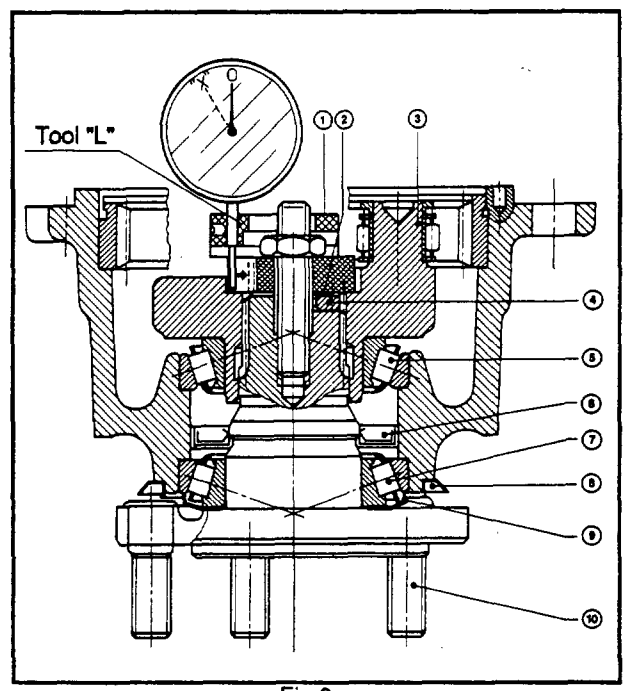


Fig.8.

(d) Install steer axle assembly into truck frame (Installation is the reversal of removal procedure).

NOTE: Ensure that correct torque is applied to flange bolts.

NOTE: Grease nipple must be aligned in a horizontal plane with reference to truck centre line.

Tightening torque 86 Nm 63 lbs ft

(e) INSTALL TRAIL WHEEL

NOTE: Ensure that correct torque is applied to wheel bolts.

Tightening torque 140 Nm 103 lbs ft

(f) TORQUE ARM WELDMENT

Install drive key and torque arm.

NOTE: Ensure that correct torque is applied to slotted nut, back off to nearest split pin hole.

Tightening torque 68 Nm 50 lbs ft Max.

(g) INSTALLATION OF BELLCRANK

Shim to achieve a clean entry into interlink.

NOTE: Tighten nyloc locknut sufficiently to remove any vertical movement in bellcrank.

(h) INSTALLATION OF INTERLINK

NOTE: Tighten nyloc locknut sufficiently to remove any vertical movement.

4.6 POWER STEER ROD END - INSTALLATION

NOTE: Torque nyloc locknut to 210 Nm 155 lbs ft.

4.6.1 SETTING PROCEDURE FOR STEERING ANGLES

(a) Turn steer wheel to full lock position. Power steer cylinder will be in closed position.

(b) Adjust piston rod end to obtain a dimension of 74 mm, See Fig 3.

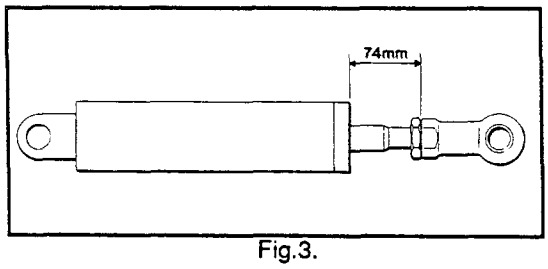


Fig.3.

4.7 INTERUPTOR WELDMENT AND WHEEL DETECTION BOARD - INSTALLATION

For sequence of assembly see fig.2.

SETTING PROCEDURE

(a) Turn steer wheel to straight ahead position.

(b) Install interruptor and wheel detection board, ensure interruptor cam plate is central to steer tyre, and that the detection board is perfectly flat.

NOTE: Torque securing bolt should operate steer wheel from LH/RH locks, and in each position, check that the optical interruptor switches are blanked off.

(c) Install main interface board.

NOTE: Before connecting the interface plugs (three in number) and after subsequent disconnection, the pins must be sprayed with electrolube 2 GAX contact treatment grease, Yale Part No 258345000.

(d) Connect battery and check interruptor switches for correct operation.

(e) Install remaining covers.

1. ELECTRICAL SYSTEM

The truck power source is a 36 volt lead acid traction battery, this provides power for the drive, hoist and power steer functions.

2. TRACTION SYSTEM

The truck is driven by two reversible electric motors driving independent transmission units. The motors are controlled by a General Electric EV100 Traction Controller.

The controller provides smooth speed control combined with electrical plug braking.

2.1 THE MAJOR COMPONENTS OF THE SYSTEM

1. GE-EV100 Power unit and logic PCB.
2. Sevcon Accelerator unit.
3. Yale Interface printed circuit board.
4. Yale Steer angle detection Board.
5. Direction, Bypass and plugging equalisation Contacts.

2.1.1 EV100 CONTROLLER

The EV100 controller contains all the power components for the for the pulse control system and the fail safe system.

2.1.2 ACCELERATOR UNIT

The Sevcon accelerator unit is of a sealed construction and no maintenance is required.

2.1.3 INTERFACE PCB

THE interface PCB contains all switching devices for the direction power steer by pass and armature cross contacts. Stabilized supply devices. Relays for the key switch pulse reduction and handbrake. Warning buzzer, also connected by a ribbon type cable is the steer angle detection PCB.

2.1.4 STEER ANGLE DETECTION PCB

The steer angle detection board contains 4 infa red OPTO interruptors set at 60 degrees and 90 degrees to detect steer wheel angle. The detection board is mounted above the steer axle, mounted on the steer axle is a steel cam plate which interrupts the infa red light, when the steer angle attains 60 degrees. This is detected by the interface board and turns off one drive motor, when the steering is turned to full lock, i.e. 90 degrees this reverses the previously stopped motor. At 60 degrees of lock the by-pass contactor is inhibited to prevent full speed operation at 90 degrees by-pass is inhibited and the pulse is reduced. The switching of the motors gives a differential effect when the truck is being steered between 60 degrees and 90 degrees, when the truck is being steered between 0 degrees - 60 degrees by-pass is enabled and pulse reduction is inhibited to give full speed. The control is operative on right and left hand steer locks and in forward and reverse direction.

COMPONENT LOCATION

POWER UNIT
CONTACTOR PANEL
INTERFACE PCB

REPLACEMENT OF EV-100 COMPONENTS

When replacing stud semiconductors such as 3REC and 4REC it is not necessary to torque these devices to a specific value.

The use of a heat-transfer grease (part number 295359000) is recommended.

When replacing module semiconductors such as 1REC, 2REC or 5REC

(1) Remove all module connections. (As required).
(2) Remove module by backing out the two screws at the top device sides.
(3) Clean the insulator surface with a clean rag and isopropyl alcohol.
(4) Inspect the insulator surface for tears or cracks. If defective, replace. Wipe a light layer of machine oil on the base and smooth the insulator into position.

NOTE: Insulator not required for 2REC and 5REC.

(5) Coat insulator with a light coat of heat-transfer grease.
(6) Set new module on insulator and start screws back into base. Be sure to use the original screws and washers. Run screws into base "finger tight".
Check that the bottom of the module is flat against the insulator or base.
Alternately tighten the two screws by 1/4 turn until firm.
(7) Replace all connections removed in step 1.

Capacitor

(1) Remove nuts from capacitor connections and remove wires.
(2) Remove hold down brackets and lift out.
(3) Reverse procedure to replace capacitor.

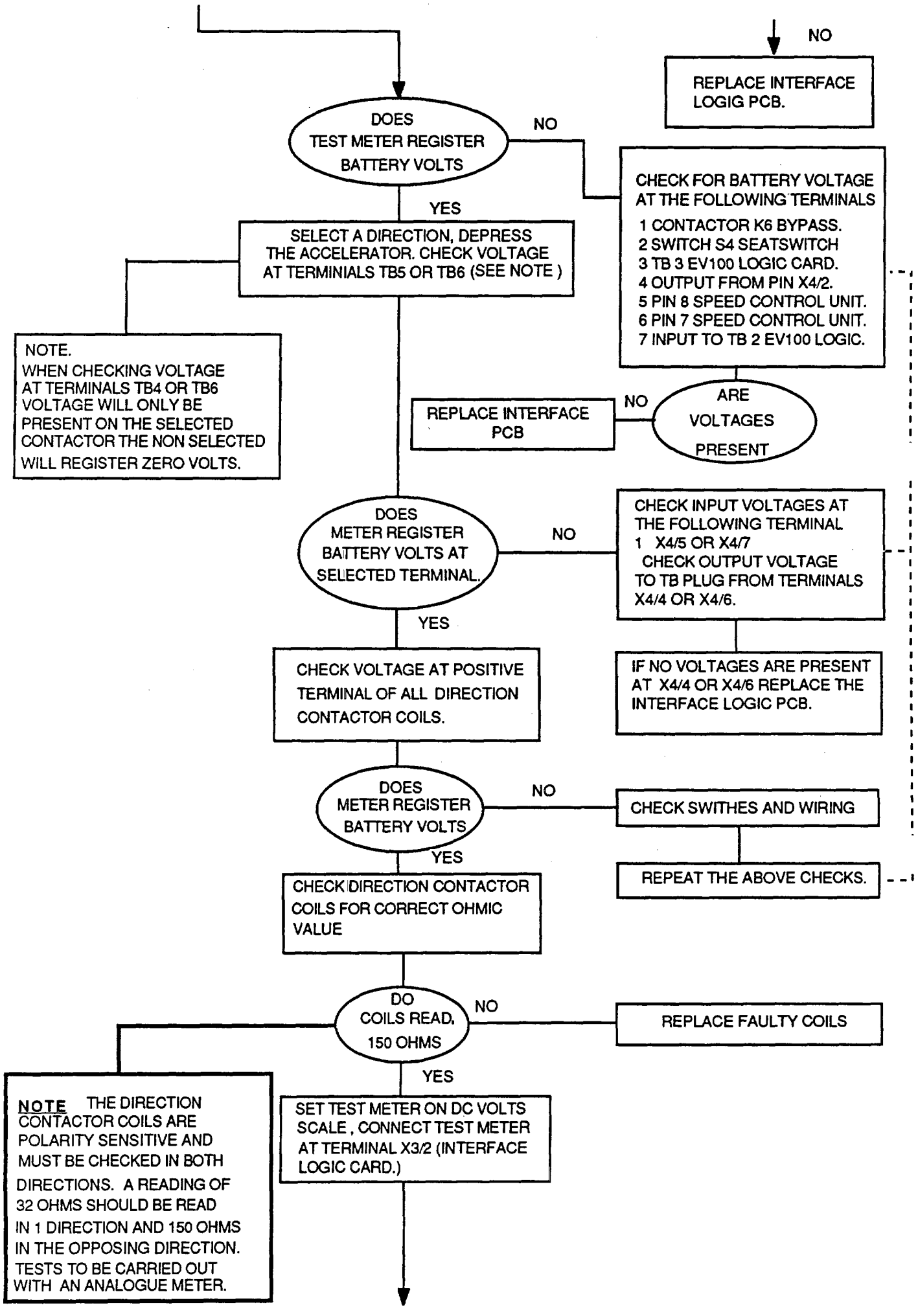
22REC, 23REC and 25REC

(1) Remove mounting screws and lift out.

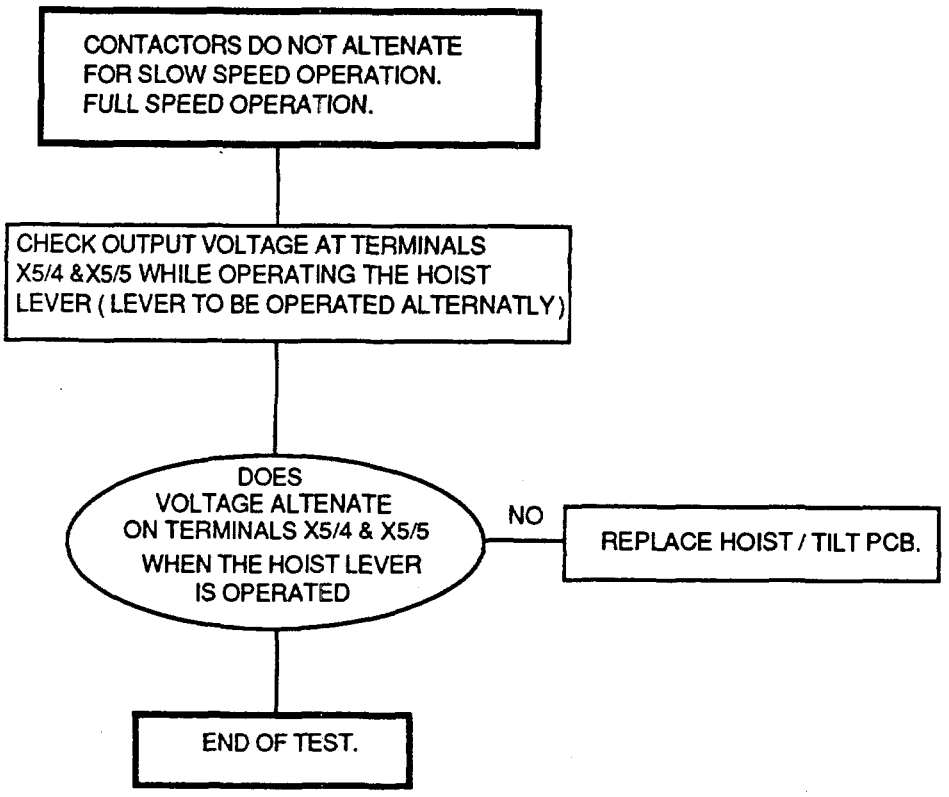
NOTE: When replacing these devices, use the original hardware in the same holes, as the inserts are used for electrical connections.

Reactor/Choke

(1) Disconnect all leads to the reactor.
(2) Remove the two mounting bolts and lift out.
(3) Set new reactor on SCR base and start screws back into base. Be sure to use the original screws and washers, run screws into base "finger tight".
Check that the bottom of the reactor is flat against the base.
Alternately tighten the two screws by 1/4 turn until firm.
(4) Replace all connections removed in step 1.


NO
REPLACE INTERFACE LOGIG PCB.
DOES TEST METER REGISTER BATTERY VOLTS
NO
YES
CHECK FOR BATTERY VOLTAGE AT THE FOLLOWING TERMINALS
1 CONTACTOR K6 BYPASS.
2 SWITCH S4 SEATSWITCH
3 TB 3 EV100 LOGIC CARD.
4 OUTPUT FROM PIN X4/2.
5 PIN 8 SPEED CONTROL UNIT.
6 PIN 7 SPEED CONTROL UNIT.
7 INPUT TO TB 2 EV100 LOGIC.
SELECT A DIRECTION, DEPRESS THE ACCELERATOR. CHECK VOLTAGE AT TERMINIALS TB5 OR TB6 (SEE NOTE)
NOTE.
WHEN CHECKING VOLTAGE AT TERMINALS TB4 OR TB6 VOLTAGE WILL ONLY BE PRESENT ON THE SELECTED CONTACTOR THE NON SELECTED WILL REGISTER ZERO VOLTS.
ARE VOLTAGES PRESENT
NO
REPLACE INTERFACE PCB
DOES METER REGISTER BATTERY VOLTS AT SELECTED TERMINAL.
NO
CHECK INPUT VOLTAGES AT THE FOLLOWING TERMINAL
1 X4/5 OR X4/7
CHECK OUTPUT VOLTAGE TO TB PLUG FROM TERMINALS X4/4 OR X4/6.
YES
CHECK VOLTAGE AT POSITIVE TERMINAL OF ALL DIRECTION CONTACTOR COILS.
IF NO VOLTAGES ARE PRESENT AT X4/4 OR X4/6 REPLACE THE INTERFACE LOGIC PCB.
DOES METER REGISTER BATTERY VOLTS
NO
CHECK SWITHES AND WIRING
YES
REPEAT THE ABOVE CHECKS.
CHECK DIRECTION CONTACTOR COILS FOR CORRECT OHMIC VALUE
DO COILS READ. 150 OHMS
NO
REPLACE FAULTY COILS
YES
NOTE THE DIRECTION CONTACTOR COILS ARE POLARITY SENSITIVE AND MUST BE CHECKED IN BOTH DIRECTIONS. A READING OF 32 OHMS SHOULD BE READ IN 1 DIRECTION AND 150 OHMS IN THE OPPOSING DIRECTION. TESTS TO BE CARRIED OUT WITH AN ANALOGUE METER.
SET TEST METER ON DC VOLTS SCALE , CONNECT TEST METER AT TERMINAL X3/2 (INTERFACE LOGIC CARD.)

FAULT FINDING - SPLIT VOLTAGE


CONTACTORS DO NOT ALTENATE
FOR SLOW SPEED OPERATION.
FULL SPEED OPERATION.
CHECK OUTPUT VOLTAGE AT TERMINALS
X5/4 &X5/5 WHILE OPERATING THE HOIST
LEVER (LEVER TO BE OPERATED ALTERNATLY)
DOES
VOLTAGE ALTENATE
ON TERMINALS X5/4 & X5/5
WHEN THE HOIST LEVER
IS OPERATED
NO
REPLACE HOIST / TILT PCB.
END OF TEST.

SECTION H

HYDRAULIC SYSTEM **PAGE**

SECTION I

MAST CONNECTING PARTS **PAGE**

2 With master key switch OFF depress and release accelerator pedal several times and check for freedom of movement and full travel.

3 Operate parking brake and ensure that braking power is available.

4 With master key swithc ON check the following for correct functioning:-

a) Direction control lever.

b) Hoist control lever.

c)Tilt control lever.

d)Third function control lever - if attachment is fitted.

e) Horn button.

f) Check footbrake and parking brake.

g) On completion of checks switch master key switch OFF and apply parkihg brake.

2.4 HYDRAULIC OIL TANK

1 When a low level is indicated on the dipstick, examine the truck for evidence of oil leakage. Report any defects to appropriate authority before topping up the tank with clean hydraulic fluid.

2.5 TYRES

1 Inspect the tyres for wear and damge. Remove stones, swarf, etc. from tyre tread.

2 Check tyre pressures (ERP only):

9.5 bar on all models 138 lbs ft in sq

WARNING: INFLATE TYRES TO CORRECT PRESSURES TO MAINTAIN TRUCK STABILITY. ALWAYS USE A SAFETY CAGE OR RESTRAINING DEVICE WHEN INFLATING TYRES FITTED TO WHEELS WITH SPLIT RIMS.BEFORE INFLATING THE TYRES ALWAYS ENSURE THE RETAINER RINGS ARE CORRECTLY SEATED.

3. SPECIFICATIONS

COUNTERWEIGHTS

TRUCK MODEL	WEIGHT
ERC/P 030 TCE	695 Kg
ERC/P 035 TCE	695 Kg

TIGHTENING TORQUES

Counterweight Bolts = 405 Nm / 300 lbs ft
Overhead Guard Bolts:-
Front Legs = 135 Nm / 100 lbs ft
Rear Legs = 470 Nm / 350 lbs ft

4. MAINTENANCE

4.1 DAILY INSPECTION

1. Inspect the truck for evidence of damage, fracture, wear or leaks.Rectify as necessary.

4.2 EVERY 200 HOURS OR 1 MONTH

1. Inspect all attaching and fixing parts for security.

2. Thoroughly wash or steam clean the truck.

4.3 EVERY 1000 HOURS OR 6 MONTHS

Visually inspect all load structures such as mast channels, fork carriage, overhead guard, frame weld joints etc., for cracks, fractures or damage.

WARNING: DO NOT OPEPRATE THE TRUCK WITH ANY CRACKED, FRACTURED OR DAMAGED STRUCTURES.

5. OVERHAUL

5.1 OVERHEAD CANOPY GUARD - REMOVE AND INSTALL (FIG 2.)

TO REMOVE:

1. Attach suitable overhead lifting equipment to the overhead canopy guard. Tension the lifitng equipment to take up the chain slack.

2. Remove two bolts securing the canopy guard to the front of the truck frame.

3. Unscrew and remove two bolts and washers securing canopy guard to the counterweight.

4. Raise the canopy guard from the truck and lower onto a level working surface.

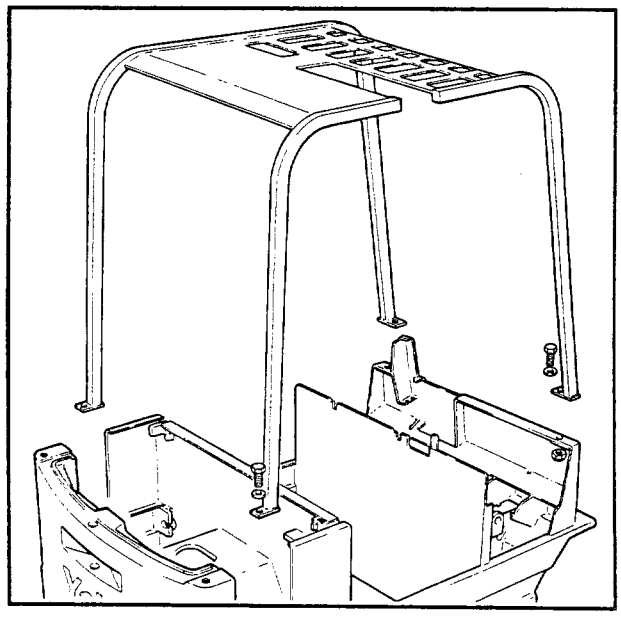


Fig.2.

	at base of cylinder.		valve if defective.
5.	Worn hoist cylinder seals.	5.	Renew seals.
6.	Defective pump.	6.	Renew pump.
7.	Incorrect hoist control valve spool setting.	7.	Adjust or renew valve as necessary.
8.	Electrical fault.	8. (a) (b)	Refer to electrical section. Check flip-flop module operation. Check fast lift switch on control valve.

5.3 FAULT HOIST CYLINDER WILL NOT LOWER OR LOWERS SLOWLY

Possible cause:		Remedy:	
1.	Lack of lubrication.	1.	Check mast channels, lubricate as necessary.
2.	Defective control valve.	2.	Check and renew, if necessary, valve in hoist cylinder inlet connection.
3.	Restriction in hose to hoist cylinder.	3.	Check and clear hoses, as necessary.
4.	Rollers defective or incorrect clearances.	4.	Check and renew or adjust the rollers as necessary.
5.	Defective hoist cylinder seals.	5.	Renew cylinder seals or cylinder.

6. FAULT DIAGNOSIS - Tilt System

6.1 FAULT TILT CYLINDER WILL NOT OPERATE IN EITHER DIRECTION

Possible cause:		Remedy:	
1.	Battery discharged.	1.	Check and recharge battery.
2.	Hydraulic fluid starvation.	2.	Check fluid level in tank and/or check for fluid leaks.
3.	Incorrectly adjusted tilt spool stops.	3.	Adjust stops.
4.	Defective relief valve in control valve.	4.	Check relief valve, renew as necessary.
5.	Worn or damaged control levers.	5.	Renew defective parts.
6.	Restrictions in hoses to tilt cylinders.	6.	Check and clear hoses.
7.	Defective pump motor.	7.	Check: Contactors, continuity of control harness and contactor coils, electrical supply to contactors and motor, coupling between pump and motor.
8.	Defective hoist pump.	8.	Renew pump.
9.	Electrical system fault.	9.	Refer to Electrical Section.