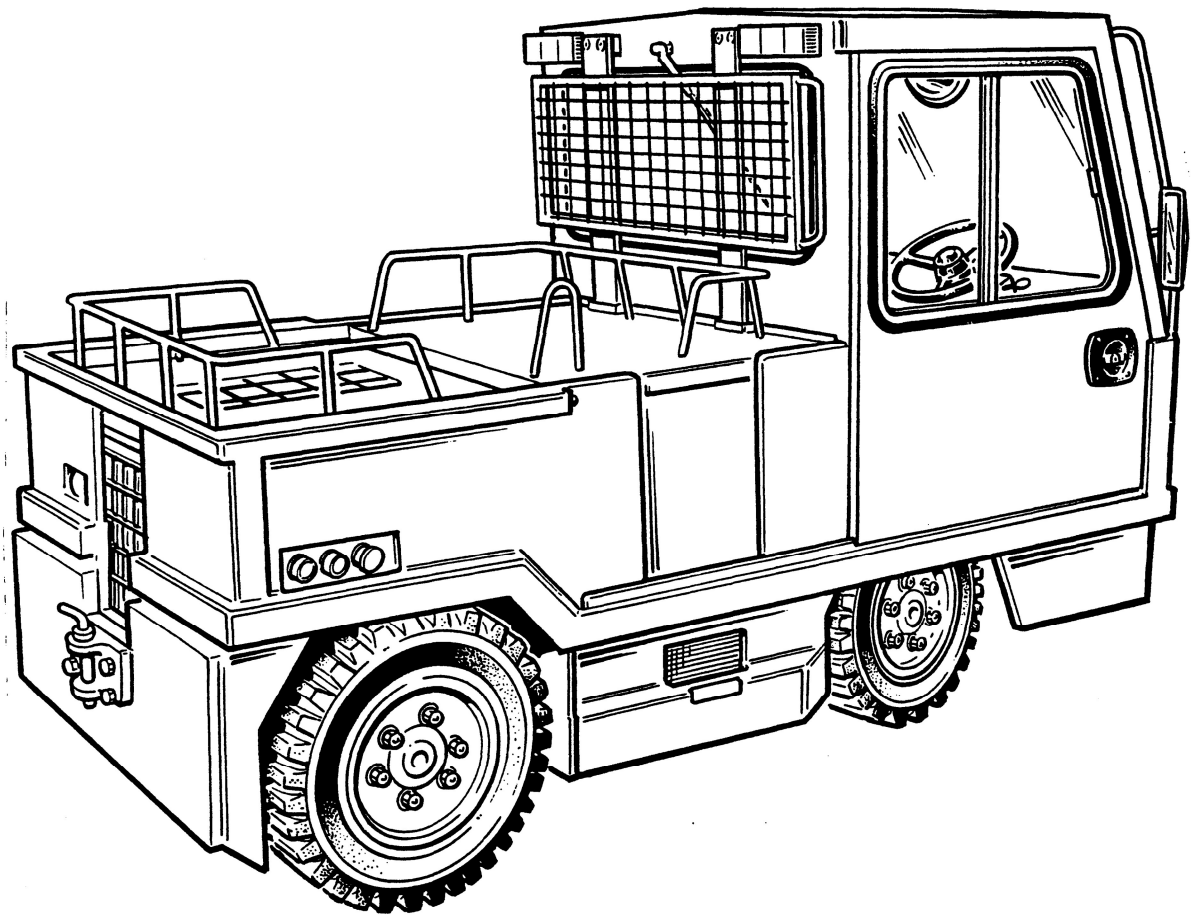
# Service Training

OM PIMESPO

## Electric towtractor
## T 200
## Type 370





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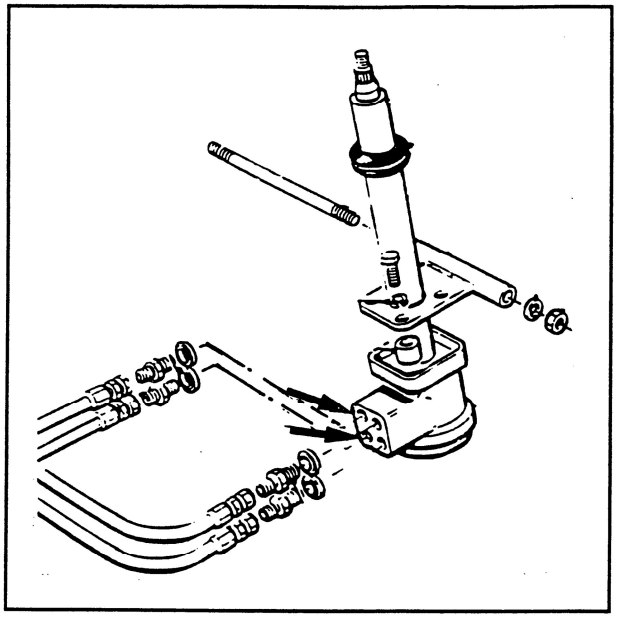


### 3.4.2.1 STEERING COLUMN - REFITTING

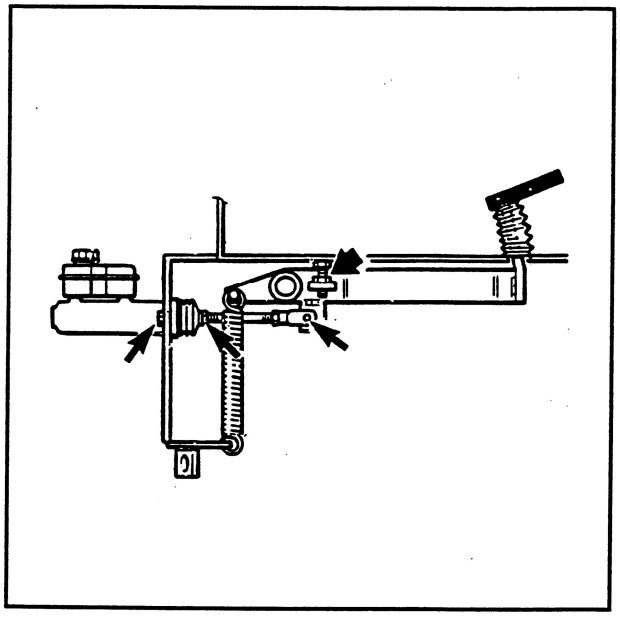
Replacing the steering column and valve is the opposite procedure to that for removal. The following points should be noted:-

- Wheel nuts should be torqued to 215 Nm.
- Check the level of fluid in the reservoir after completion. Refer to 'recommended lubricants' section.
- Check for leaks and correct steering operation.

### 3.5.2.1 MASTER CYLINDER - REMOVAL

Procedure:-

- Park the vehicle in a suitable working area.
- Apply the handbrake, turn off the key switch and disconnect the battery.
- Chock the drive wheels to prevent accidental movement of the tractor.
- Release the handbrake.
- Place a suitable drip tray underneath the master cylinder.
- Ensure that the cylinder is clean before attempting to remove any pipes.
- Disconnect all pipes from the cylinder and plug them to prevent ingress of dirt.
- Remove the spring pin from the brake pedal clevis fork.
- Remove the fixing bolts and nuts retaining the master cylinder to the chassis.
- Remove the push-rod from the master cylinder.



### 3.5.2.2 MASTER CYLINDER - REFITTING

The procedure for refitting the master cylinder is the opposite to that for removal, noting the following points:-

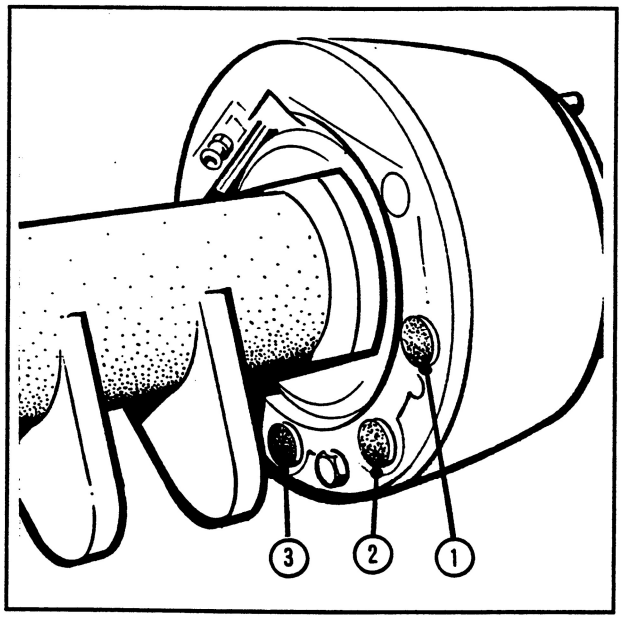
- Removed nyloc nuts should be discarded and replaced with new ones.
- Nuts should be torqued to 28 Nm.
- The footbrake will now require adjustment. See appropriate section.
- The system will now require bleeding. See appropriate section.
- The linings should now be checked for correct adjustment. See appropriate section.

### 3.5.5 BRAKE DRUM AND LININGS - REMOVAL AND INSPECTION

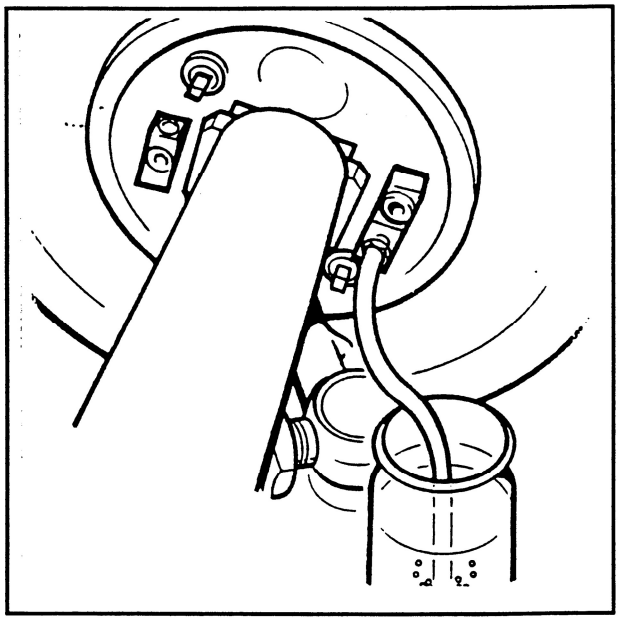
Procedure:-

- Apply the parking brake, turn off the key switch and disconnect the battery.
- Chock the steer wheels securely and release the handbrake.
- Slacken the drive wheel nuts, but do not remove.
- Using suitable lifting equipment, raise the drive wheel clear of the ground and securely chock the chassis to prevent accidental lowering of the tractor.
- Remove the wheel nuts and the wheel assembly.
- Holes are provided in the backplate to allow access to the starwheel adjusters and also for inspection of the linings. The holes are normally fitted with rubber plugs and these must be replaced after any inspection or adjustment has been carried out.

KEYCODE
1 Inspection of linings
2 Starwheel adjuster
3 Starwheel adjuster




- Brake shoes should not be allowed to wear below 2mm thickness at any point.



- Unscrew the bleed nipple approximately ¾ of a turn and depress the brake pedal fully.
- Allow the pedal to return without assistance.
- Repeat the operation with a pause between each stroke to allow the master cylinder time to re-charge. Check the master cylinder frequently to ensure that the level does not drop too low.
- Continue pumping until the fluid entering the jar is free of bubbles. When this occurs, on the last stroke tighten the bleed screw while the pedal is still depressed.
- Disconnect the pipe and fit the protective cap.
- Do not use old fluid expelled from the system to replenish the master cylinder.
- Repeat the above procedure on all the wheel cylinders, leaving the one nearest to the master cylinder until last.
- With the operation complete, top up the master cylinder to the correct level and replace the cap.
- Slacken the pressure switch, remove the spacer and re-clip it to the pipe for future use.
- Adjust the brake shoes.
- Test the braking system for correct operation.

### 3.6.8 DIRECTION SELECTION STAGE 2 - RELAY CONTACT FUNCTIONS

As explained in Stage 1, a direction relay can only be energised provided that a direction contactor is NOT closed.

Each direction relay has four sets of contacts. Their functions are as follows:-

Set 1

The first set (RL1-4 for the forward relay, RL2-1 for the reverse) are "self-hold" contacts, as mentioned in the Stage 1. They provide a negative to hold the coil energised even if the original negative feed via RS1 (or RS2) is removed.

Set 2

When relay contacts RL1-3 (or RL2-2 for reverse) change-over, they provide a positive feed from fuse FS3 through diode D21, resistor R1, R9, C19 and R35 to the base of transistor Q5. This causes Q5 to turn on and the "TOFF" LED to illuminate. This reduces the gate voltage on field effect transistor Q4 via D20 and R37, causing it to turn on. The "INIT" LED will illuminate.

Q4 now provides a battery positive to the thyristor chopper circuit at T1 PRI, taken from the armature circuit via pin S7, diode D31, Q4 (source to drain), pin R13, external resistor R6, pin R17 and pin S4.

Provided that SCR1 is not conducting, current will flow from T1 PRI through diode D4, pin S9, relay contact RL2-3 and pin S1 to Con 1 coil.

### 3.6.12 OVERSPEED LIMITING

While in normal driving mode, the maximum speed is monitored by the overspeed circuit on the Regen and Inching board, using the voltage generated by the tachometer. The point at which speed limiting occurs can be set using potentiometer 5 on the Regen and Inching board.

At the preset point, control is taken away from the driver and speed limiting commences in three stages:-

- At the set speed, the firing of pulses to SCR 1 will be inhibited.
- If the speed should continue to increase (if travelling down a gradient, for example), the drive system will be configured for regen braking.
- Any further increase in speed will cause current to flow in the regen and inching bias winding. Pulsing will recommence in regen braking mode. The tractor speed will be limited from any further increase since the bias current will adjust to maintain this downhill speed.

When the tractor speed reduces below the threshold level once more, the system will revert to normal driver control.

### 3.6.13 REGENERATIVE ELECTRICAL BRAKING

When regen braking is required, both the positive and the negative supplies to the direction relays are provided by the Regen and Inching board. Relay RLB on the board directs the negative coil feeds to two transistors which are controlled by logic that responds to the tachometer input signal.

Two modes of braking are available, selectable by a link on the board. With link 127 set in position "Foot off", regen braking will occur as soon as the traction pedal is fully released. With the link set away from the "Foot off" position, the tractor will freewheel when the traction pedal is released and regen braking will commence when the footbrake switch is actuated.

During regenerative braking:-

Con 8 will de-energise thereby introducing the 7 ohm resistor into the motor circuit to limit the braking power.

The opposite direction contactor to that used for traction will be energised.

Relay RLT energises to select the Regen and Inching transductor. A current is passed through the bias winding to enable pulsing. The current value (braking power) for the regen braking can be set using potentiometer 1 on the Regen and Inching board.

The Regen and Inching board also replaces the positive supply previously obtained from MS1.

Automatic regen braking will cease when the traction pedal is depressed again (MS1 actuated) or the tacho output drops below a preset level (just before standstill).

### 3.6.14.3 CHOPPER CIRCUIT 'ON'

With the armature rotating due to the movement of the tractor and the series field excited by the initialising current, a small voltage will be developed across it. This will cause current flow supplementing the initialising current through a loop comprising armature, field, chopper circuit, D5, TDR2 and TDR1.

As the field current increases, so the armature excitation will increase. The circulating current increases rapidly to a high value.

KEYCODE

1 Diode D1
2 Contactor Con 8
3 Regenerative braking resistor 7 ohm 1kW
4 Diode D2
5 Transductor TDR2
6 Transductor TDR1
7 Traction motor armature
8 Reverse contactor Con 2
9 Forward contactor Con 1
10 Regen diode D5
11 Trapping diode D3
12 Thyristor SCR2
13 Thyristor SCR1
14 Negative line contactor Con 3B
15 Battery 80 volt
16 Main fuse FS1 - 500 amps
17 Positive line contactor Con 3A
18 Traction motor field
19 Field divert resistor
20 Field divert contactor Con 4
21 Field divert resistor
22 Field divert contactor Con 5

### 3.6.17.2.1 INTERCONNECTING PRINTED CIRCUIT BOARD MULTI PIN CONNECTOR DETAILS

| 36 WAY MAIN TRUCK LOOM CONNECTOR | | | | | |
|---|---|---|---|---|---|
| PIN | COLOUR | TO | PIN | COLOUR | TO |
| 1 | BK | SEAT SWITCH | 19 | G-O | REVERSING SWITCH RS2 |
| 2 | GY-BN | INDICATOR LAMP | 20 | | |
| 3 | Y-GY | CONVERTER 2 +VE | 21 | PK | KEYSWITCH |
| 4 | G-BN | HANDBRAKE SWITCH | 22 | B-O | HOUR METER +VE FOR CURTIS 804 |
| 5 | R-W | CON 6 | 23 | G-BN | SEAT SWITCH |
| 6 | | | 24 | | SPEED CONTROL |
| 7 | R-Y | SAFETY ISOLATOR | 25 | Y-PK | INDICATOR LAMP |
| 8 | | | 26 | | |
| 9 | G-PK | REVERSING SWITCH RS1 | 27 | Y-BN | R & I BOARD |
| 10 | R-W | HANDBRAKE SWITCH | 28 | | SPEED CONTROL |
| 11 | Y-W | REVERSING SWITCH RS1 | 29 | | |
| 12 | | | 30 | | |
| 13 | B-G | REVERSING SWITCH RS2 | 31 | | |
| 14 | | | 32 | | |
| 15 | R-V | REMOTE INCHING CONTROL | 33 | | |
| 16 | R-V | REVERSING SWITCH RS1 & RS2 | 34 | BK | CURTIS 804 BDI |
| 17 | | | 35 | | |
| 18 | | | 36 | | |

| 9 WAY THYRISTOR AND HEAT SINK CONNECTOR | | |
|---|---|---|
| PIN | COLOUR | TO |
| 1 | BK-GY | HEAT SINK |
| 2 | - | |
| 3 | - | |
| 4 | G | SCR1 ANODE |
| 5 | W | SCR1 GATE |
| 6 | GY | SCR2 GATE |
| 7 | BK-B | HEAT SINK |
| 8 | BK-W | HEATSINK |
| 9 | BN-V | SCR2 ANODE |

| 20 WAY RESISTOR CONNECTOR | | | | | |
|---|---|---|---|---|---|
| PIN | COLOUR | TO | PIN | COLOUR | TO |
| 1 | R-BN | R5 | 11 | | |
| 2 | G | R3 | 12 | | |
| 3 | | | 13 | W-PK | R6 |
| 4 | GY | R3 | 14 | BK-PK | R9 |
| 5 | | | 15 | PK | R9 |
| 6 | BK-B | R10 | 16 | Y-PK | R10 |
| 7 | BK-W | R8 | 17 | W-O | R6 |
| 8 | V-BN | R7 | 18 | | |
| 9 | BK-G | R8 | 19 | R-GY | R7 |
| 10 | R-W | R5 | 20 | | |

- Fit the new cable inner to the clevis on the accelerator pedal linkage, and the outer to the linkage bracket. At this stage do not connect the cable at the transductor end.
- Check and adjust if necessary the pedal stop screw to obtain 19mm.
- Check and adjust if necessary the link to obtain 65mm.
- Check and adjust if necessary the cable outer to obtain 20mm.
- After completing all adjustments ensure all locknuts are tightened.
- Remove the cover from the transductor, this is situated behind the handbrake lever between the driver and passenger seats.
- If necessary adjust the cable outer at the transductor end to position the microswitch operating roller centrally in the recess of the cam.
- At the transductor end, connect the cable inner to the clevis pin and secure with locknut. Ensure the spring is between the clevis and cable outer.
- Adjust the cable locknuts at the transductor end to position the microswitch operating roller centrally in the recess on the cam. Check the operation of the accelerator. Ensure that the microswitch operates when the cam is rotated. Check and adjust as necessary to ensure that the cam does not rotate past the white dot. See arrow on transductor.
- Replace all items removed and check the vehicle for correct accelerator operation.

### 3.6.29.1 BATTERY DISCHARGE INDICATOR AND HOUR METER FAULT FINDING

FAULT ANALYSIS
Battery Discharge Indicator will not reset
Battery Discharge Indicator always resets to full charge after a break in the battery line.
No Discharge. BDI does not run down.
Reduced Performance Circuit.
LEDs do not light.
Hour Meter.
No display.
Hour glass icon does not flash.
Hour glass icon always flashes.

### 3.6.29.2 FAULT FINDING

NOTE: The same safety procedures apply in the Battery Discharge Indicator and Hour Meter fault finding that are applied for the main truck fault finding.

### 3.6.29.3 BATTERY DISCHARGE INDICATOR WILL NOT RESET

Ensure there is no voltage leak across the relevant terminals, by 1) removing fuse FS4. 2) replace the fuse FS4, and measure the voltage across the instrument at connector pin 16 and pin 3. It must be above 2.09 volts per cell. If it is and the indicator does not reset to show a fully charged battery, then replace the BDI and hour meter.

### 3.6.29.4 BATTERY DISCHARGE INDICATOR ALWAYS RESETS TO FULL CHARGE AFTER A BREAK IN THE BATTERY LINE

If the voltage of the batteries is below 2.09 volts per cell and the indicator did not formerly display fully charged, it should not reset to fully charged after a break in the battery line. If this occurs, the instruments memory cell is faulty and the BDI and hour meter should be replaced.

This will not affect the discharge function of the instrument if it is always connected to a fully charged battery and allowed to monitor its discharge without a break in the battery line.

NOTE: All battery discharge indicators are supplied with a full reading in the memory. When the instrument is first connected to the truck it will always show a full charge. It is either resetting to show full charge because the battery is fully charged, or if the battery is not fully charged it is repeating the stored information in the memory which is a full reading.

### 3.6.29.5 NO DISCHARGE - BATTERY DISCHARGE INDICATOR WILL NOT RUN DOWN

The battery discharge indicator monitors loaded battery voltage. If the instrument is connected to a partially discharge battery, it will not show a discharge reading until it recognises the loaded voltages of the battery. A working time of at least 30 minutes is required for the battery discharge indicator to run down from fully to completely discharged.

To verify that the instrument will run down, measure across pin 16 and pin 3. A voltage of less than 2.0 volts per cell is required to lower the battery discharge indicator from a full battery charged reading.

### 3.6.29.6 REDUCED PERFORMANCE CIRCUIT

The reduced performance circuit function is not used on this model of tractor. When the battery condition drops to the appropriate level the 2 LEDs will flash to indicate that the battery should be changed but no circuit interrupt function will occur.