



## ***SERVICE MANUAL***

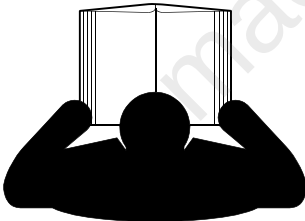
### ***TMS9000E***

### ***PRELIMINARY***

#### **NOTICE**

The crane serial number is the only method your distributor or the factory has of providing you with correct parts and service information.

The crane serial number is stamped on the top of the outrigger box. ***Always furnish crane serial number*** when ordering parts or communicating service problems with your distributor or the factory.

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <div data-bbox="717 1130 1218 1205"> <b>WARNING</b></div> <p><b>To prevent death or serious injury:</b></p> <ul style="list-style-type: none"><li>• Avoid unsafe operation and maintenance.</li><li>• This crane must be operated and maintained by trained and experienced personnel. Manitowoc is not responsible for qualifying these personnel.</li><li>• Do not operate or work on this crane without first reading and understanding Operator's Manual and Rating Plate supplied with crane.</li><li>• Store Operator's Manual in holder provided on crane.</li><li>• Attach laminated Capacity Charts supplied with crane to chain in operator's cab.</li><li>• If Operator's Manual or Capacity Charts are missing from cab, contact your distributor for new ones.</li></ul> |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| Designation | Lubricating point                    | Type of lubrication               | Designation according to DIN 51502      | Specification Classification | Lubricant type Viscosityrange |
|-------------|--------------------------------------|-----------------------------------|-----------------------------------------|------------------------------|-------------------------------|
| <b>M</b>    | Lubricating points (lubricating oil) | Oil can, high pressure squirt gun | As for <b>A</b> (diesel engine)         |                              |                               |
| <b>V</b>    | Open-running gear wheels             | Adhesive lubrication              | GROVE part no. 00 554 205 <sup>2)</sup> |                              |                               |
| <b>W</b>    | Mounting screws, bushings, etc.      |                                   | GROVE part no. 01 573 046 <sup>2)</sup> |                              |                               |
| <b>Y</b>    | Boom locking pin                     | Grease gun                        | GROVE part no. 03 325 216 <sup>2)</sup> |                              |                               |

## 6.2

### Process materials

### 6.2.1

#### Fuel

The diesel fuels that may be used and their respective specifications may be found in the engine operating manual.

### 6.2.2

#### Engine coolant and mixtures

The specifications and mixture ratios may be found in the engine operating manual.

### 6.2.3

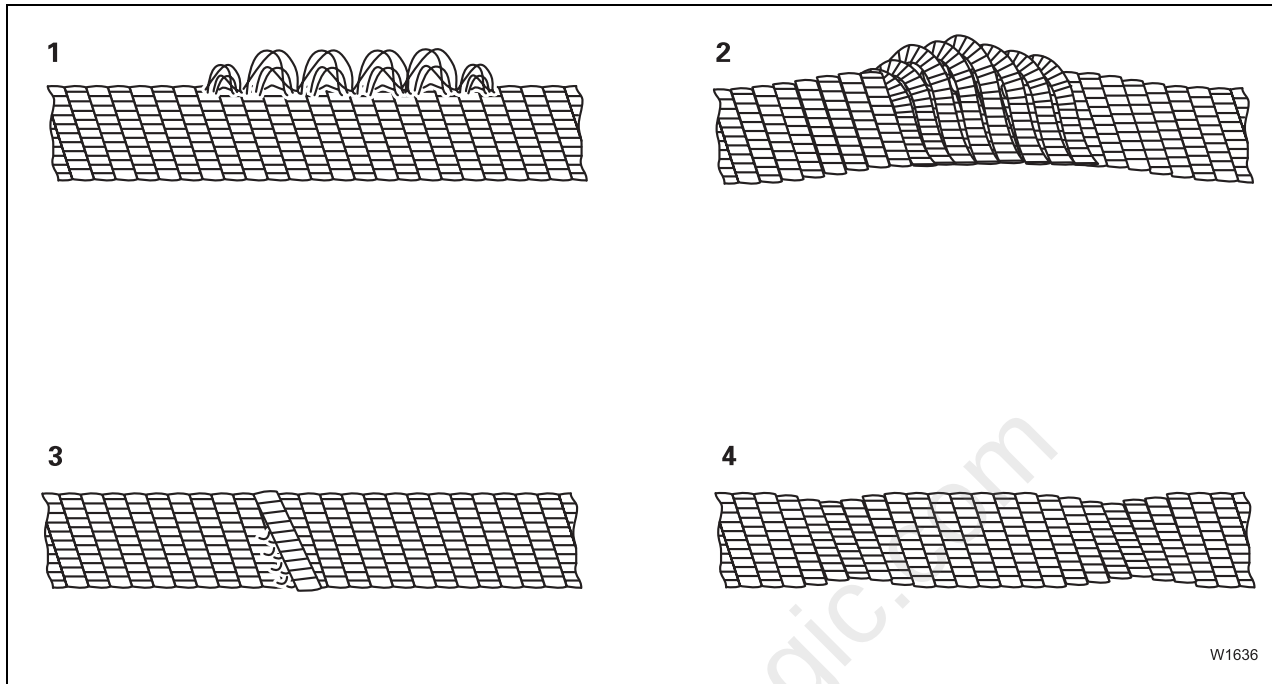
#### Windscreen washing system admixtures

Commercial cleansers and antifreeze may be added to the windscreen washing water. Observe the application instructions on the package.

### 6.2.4

#### Fuel for crane cab heating system

You should use either the fuel specified in section 6.2.1 or EL heating oil as heating fuel for the crane cab.



| Damage                                   | Description                                                                                                                                                                | Cause                                                                                         | Replacement                                                                                                        |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Loop formation (1)</b>                | Outer layer wires in the form of hair pins are protruding from the rope on the side opposite the sheave.                                                                   | General wear due to aging of the rope or subsequent damage resulting from damage to the rope. | <b>Immediately</b> replace hoist rope if the rope structure has been substantially altered by the loop formations. |
| <b>Loosening of wires or strands (2)</b> | Outer wires or strands have become loose. Only the inner strands continue to bear the load.                                                                                | Corrosion or abrasion.                                                                        | Replace hoist rope <b>immediately</b> .                                                                            |
|                                          |                                                                                                                                                                            | Other causes.                                                                                 | The number of broken wires determines when the rope must be replaced.                                              |
| <b>Knot formation (3)</b>                | Repeatedly occurring knot-like thickening of rope; core often protrudes. The strands bear on each other at thin points resulting in increased occurrence of wire breakage. | General wear due to aging of the rope or subsequent damage resulting from damage to the rope. | Determine number of broken wires; if serious knot formation occurs, replace rope <b>immediately</b> .              |
| <b>Constriction (4)</b>                  | Diameter reduction over short sections.                                                                                                                                    | General wear caused by ageing of the rope.                                                    | Replace hoist rope <b>immediately</b> if serious constriction.                                                     |

**12.6****Transmission Shift Air System****12.6.1****Description**

The shift air system controls the selection of the transmission ranges and is comprised of an air valve, air regulator, air filter range control valve, a range shift cylinder, and the necessary connecting piping.

The range control valve is located on the shift lever in the cab, and the other valves and cylinders are mounted on the transmission.

**12.6.2****Theory Of Operation**

The range control valve has two positions HIGH (button up) and LOW (button down). There are two air lines connected between it and the air valve. One of these is the supply line from the regulator, while the other is the air return to the air valve.

When the range control valve is in the LOW position, air is exiting the range control valve and enters the slave air valve where it shifts the piston. This allows the air from the regulator to exit the bottom port of the air valve, enter the low range air port of the auxiliary shift cylinder, and shift the low speed gear.

When the range control valve is in the HIGH position, air is prevented from exiting the range control valve. This allows the air entering the slave air valve from the regulator, to move the piston routing the air out of the valve to the high range port of the auxiliary shift cylinder. This moves the shift bar shifting the high speed gear.

In addition to the range control button, a LO-LO button is incorporated to select two extra low gears.

| SYMPTOM                                 | PROBABLE CAUSE                                               | SOLUTION                                                                                                         |
|-----------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 3. Automatic adjusters are not working. | a Adjusting pawl installed backwards.                        | Remove and properly install pawl.                                                                                |
|                                         | b Pawl is collapsed or missing.                              | Replace spring.                                                                                                  |
|                                         | c Bolt is frozen in adjusting sleeve.                        | Free-up or replace the bolt.                                                                                     |
|                                         | d Detent is damaged allowing the bolt to rotate with sleeve. | Replace damaged detent.                                                                                          |
|                                         | e Double lip seals are not installed correctly.              | Remove and correctly install seals.                                                                              |
| 4. Spring brake is not holding.         | a Power spring is not fully released. (uncaged).             | Turn caging bolt fully counterclockwise until stop is reached.                                                   |
|                                         | b Brakes are out of adjustment.                              | Readjust the brakes.                                                                                             |
|                                         | c Hold-off air is not releasing fully.                       | Check for faulty air system components.                                                                          |
|                                         | d Power spring is broken.                                    | Replace spring brake actuator.                                                                                   |
| 5. Brake is dragging.                   | a Low spring brake hold-off air pressure 482 kPa (70 psi).   | Check for minimum spring brake pressure 482 kPa (70 psi). Check for proper functioning of air system components. |
|                                         | b Improper connection of the service line at spring brake.   | Check and connect line to proper port.                                                                           |
|                                         | c Leaking lines or spring brake seals.                       | Tighten connections on air lines or replace spring brake unit seals.                                             |

### SPRING BRAKE ACTUATOR

The upper part of the brake air chamber containing the large spring is not serviceable; however, the lower part of the assembly is serviceable.



#### Death or injury could occur

Spring brake unit is powerful enough to cause parts to fly apart with enough force to cause personal injury. The spring brake must be caged before removing or servicing brakes. Uncage the spring brake before returning the crane to service.

### Manually Caging the Spring Brake

1. Remove the caging bolt and washer from its storage hole on the outside of the brake chamber.
2. Remove the dust cap from the bolt hole in the top of the chamber.

4. Check that all wheels turn freely.
5. Simulate a full air leak by opening the drain valve in one of the two secondary reservoirs.
6. The Low Air Pressure indicator and warning buzzer should come on when the air pressure in the secondary system drops below 517 kPa/5.1 bar (75 +/- 5 psi). Air pressure in the primary system should not drop below 689 kPa/6.8 bar (100 psi).
7. Continue draining the secondary reservoirs to zero (0) psi.
8. Apply the service brakes.
9. All four rear axle brakes should apply. The brake lights on the rear of the crane should illuminate.
10. On units equipped with trailing boom, the trailer supply line should not be evacuated.
11. Release the service brakes.

**Emergency Brake Application**

1. If necessary, start the engine and charge air system to governor cut-out pressure.
2. Turn engine off and allow the air pressure to stabilize for one minute.
3. Release the park brakes by pushing the yellow knob on the front console.
4. Check that all wheels turn freely.
5. Simulate a full air leak by opening the drain valve in one of the two secondary reservoirs.
6. Slowly drain the primary reservoirs.
7. The yellow knob should automatically “pop” out when the pressure decreases below 138kPa/1.3bar to 207 kPa/2.0 bar (20 to 30 psi).
8. On units equipped with trailing boom, the trailer emergency supply line should be exhausted between 138 to 310 kPa/1.3 to 3.1 bar (20 to 45 psi).

| SYMPTOM                                                                   | PROBABLE CAUSE                                          | SOLUTION                                                                                                                       |
|---------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1 Slow or erratic operation of outrigger extension cylinders. (Continued) | k Bent cylinder rod.                                    | k Replace piston rod and seals.                                                                                                |
|                                                                           | l Excessive material on outrigger beams.                | l Clean outrigger beams.                                                                                                       |
|                                                                           | m Binding outrigger beam.                               | m Repair or replace outrigger beam.                                                                                            |
|                                                                           | n Damaged outrigger valve.                              | n Repair or replace valve.                                                                                                     |
|                                                                           | o Damaged valve coil.                                   | o Replace coil.                                                                                                                |
|                                                                           | p Main hydraulic pump cavitation.                       | p Replace or tighten hose or fittings.                                                                                         |
|                                                                           | q Partially shifted hydraulic selector spool.           | q Disassemble, clean, and polish spool and valve housing with very fine emery cloth.                                           |
|                                                                           | r Insufficient voltage for operation of solenoid valve. | r Solenoids require a minimum of 9.5 volts to energize. Check outrigger wiring and electrical swivel coupling collector rings. |
|                                                                           | s Damaged piston seals.                                 | s Replace all cylinder seals.                                                                                                  |
|                                                                           | t Worn or damaged hydraulic pump section.               | t Repair or replace pump section.                                                                                              |
|                                                                           | u Scored cylinder barrel.                               | u Repair or replace barrel.                                                                                                    |
| 2. Sticking spool.                                                        | v Cracked or damaged piston.                            | v Replace piston and all cylinder seals.                                                                                       |
|                                                                           | w Piston loose on piston rod.                           | w Replace all cylinder seals and torque piston locknut.                                                                        |
|                                                                           | a Dirt in system.                                       | a Change oil and flush system.                                                                                                 |
|                                                                           | b Distortion caused by tie bolts being over torqued.    | b Retorque tie bolts.                                                                                                          |
|                                                                           | c Flow in excess of valve rating.                       | c Limit flow through valve to that recommended. Check pump output and cylinder rating.                                         |
|                                                                           | d Pressure in excess of valve rating.                   | d Check relief valve setting or pump compensation and adjust or replace as necessary.                                          |
|                                                                           | e Electrical failure.                                   | e Check wiring and solenoids.                                                                                                  |

5. Turn the ignition switch(es) to RUN (1). Using a multimeter, check for 24 volts on the “I” post of ignition switch(es). If there is not 24 volts (but the head lights, tail lights, marker lights, dome light, work light, or gauge lights and panel lights will come on), suspect the ignition switch(es) and the power circuit to it starting at the ignition switch(es) fuse (F1). Repair or replace circuit, switch, or fuse as needed.
6. If the batteries, fuses, ignition switch(es), and power circuit to the ignition switch check out, do one of the following:
  - a. If you hear no noise when you try to turn the starter, troubleshoot the start circuit (ignition switch, electric shifter, neutral start switch and wiring from ignition switch to starter relay). Make repairs as needed.
  - b. If the engine still won't start, and you hear no noise or just a single click, suspect the starter. Troubleshoot the start circuit from the starter relay through the starter solenoid to the starter motor and ground. Make repairs as needed. If the starter solenoid or the starter motor is faulty, replace the starter.
  - c. If the starter engages but can't turn the engine (and the lights dim, signaling power drain during start attempt), check the starter's feed circuit from the batteries for resistance. If the resistance is high, make repairs. If the circuit checks out, replace the starter. If the engine still won't start, suspect a seized engine.
  - d. If the starter turns the engine, but it still won't start, suspect a faulty engine control system. Refer to the engine manual for further instructions.
  - e. If the engine starts, then shuts down, suspect a faulty engine control system. Refer to the engine manual for further instructions.



If the starter won't disengage during running, verify the starter is mounted properly so its gear won't mesh with the engine's flywheel when not trying to start engine. Troubleshoot the starter relay and ignition switch for closed contacts. If these components check out, replace the starter.

#### 20.2.4

#### Troubleshooting Engine Charging Problems

1. Verify battery terminals are connected and clean and all wires in the charging system are in good repair and are connected properly.
2. Verify the alternator belt is properly installed and is under proper tension.
3. Verify the batteries put out 24 volts minimum. Charge battery as needed so the battery can supply a minimum excitation voltage to the engine's charging system.
4. Verify there is a minimum of 24 volts at the alternator from the batteries, and that the alternator is properly grounded.
5. Replace the alternator if the other conditions check out.
6. Refer to the engine manual for further instructions.

# Full Version Available

## Grove TMS9000E Truck Crane Service Manual

Grove TMS9000E truck crane service manual with repair procedures, adjustments and troubleshooting for the main systems. Instant PDF download.

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