GROVE®

OPERATOR'S AND SAFETY HANDBOOK

TMS900E

CARRIER

(SINGLE ECM ENGINE)

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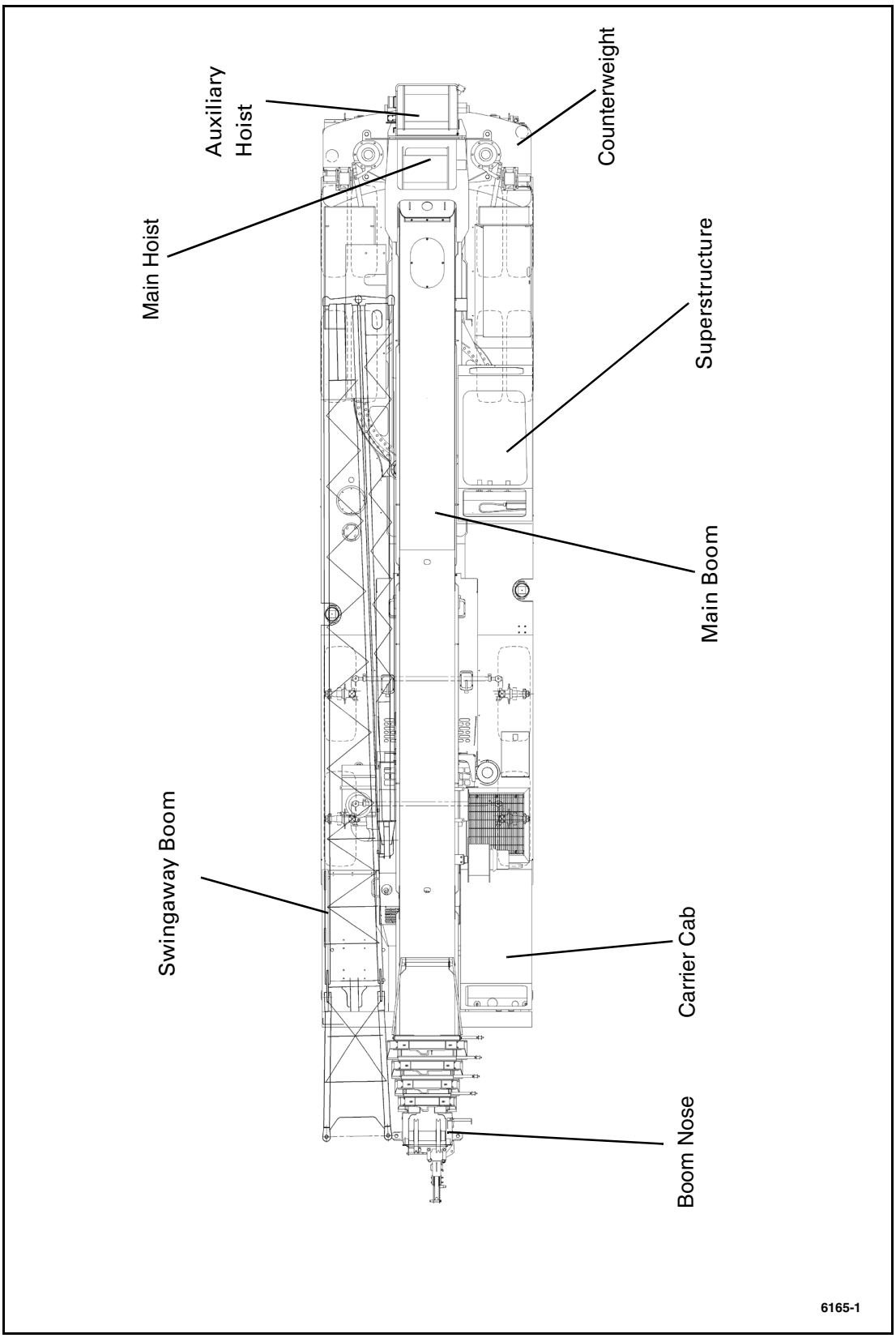


Basic Nomenclature (Sheet 2 of 3)

For detailed information concerning the operation and maintenance of the safe load indicating system installed on the crane, see the manufacturer's manual supplied with the crane.

Two-Blocking

Two-blocking occurs when the load block (hook block, headache ball, rigging, etc.) comes into physical contact with the boom (boom nose, sheaves, jib, etc.). Two-blocking can cause hoist lines (wire rope) rigging, reeving, and other components to become highly stressed and overloaded in which case the wire rope may fail allowing the load, block, etc. to free fall.

Two-blocking is more likely to occur when both the main and auxiliary hoist lines are reeved over the main boom nose and boom extension/jib nose respectively. An operator, concentrating on the specific line being used, may telescope or lower the boom allowing the other hoist line attachment to contact the boom or boom extension/jib nose, thus causing damage to the sheaves, or causing the wire rope to fail, dropping the lifting device to the ground and possibly injuring personnel working below.

Caution must be used when lowering or extending the boom. Let out load line(s) simultaneously to prevent two-blocking the boom tip(s) and the hook block, etc. The closer the load is carried to the boom nose the more important it becomes to simultaneously let out wire rope as the boom is lowered. Keep load handling devices a minimum of 42 in (107 cm) below the boom nose at all times.

Two-blocking can be prevented. Operator awareness of the hazards of two-blocking is the most important factor in preventing this condition. An anti two-block system is intended to assist the operator in preventing dangerous two-block conditions. It is not a replacement for operator awareness and competence.

To avoid death or serious injury, keep load handling devices away from boom/jib tip when extending or lowering the boom and when hoisting up.

This crane should have a functional ANTI-TWO-BLOCK and CONTROL LOCK-OUT system. Test daily for proper operation.

Do not pass loads or boom over ground personnel.

Barricade the area where the crane is working and keep all unnecessary personnel out of that area. DO NOT allow personnel to be under the load or boom.

Never pass loads, load handling devices, or the crane boom over people on the ground.

Never operate the crane with less than two wraps of wire rope on the hoist drum.

Never interfere with the proper functioning of operational aids or warning devices.

When checking and maintaining batteries exercise the following procedures and precautions:

- Disconnect the batteries.
- Wear safety glasses when servicing batteries.
- Do not short across the battery posts to check charge. Short circuit, spark, or flame could cause battery explosion.
- Maintain battery electrolyte at the proper level. Check the electrolyte with a flashlight.
- If applicable to your crane, check battery test indicator on maintenance-free batteries.
- Do not break a live circuit at the battery terminal. Disconnect the ground battery cable first when removing a battery and connect it last when installing a battery.
- Check battery condition only with proper test equipment. Batteries shall not be charged except in an open, well-ventilated area that is free of flame, smoking, sparks, and fire.

Engine

Be careful when checking the engine coolant level. The fluid may be hot and under pressure. Shut down the engine and allow the radiator time to cool before removing the radiator cap.

Shut down the engine and disconnect the battery before performing maintenance. If unable to do so for the task required, keep hands clear of the engine fan and other moving parts while performing maintenance.

Be careful of hot surfaces and hot fluids when performing maintenance on or around the engine.

Work Practices

Crane Access

You must take every precaution to ensure you do not slip and/or fall off the crane. Falling from any elevation could result in serious injury or death.

BRAKE PEDAL

The brake pedal (37) is located on the cab floor, to the left of the foot throttle and is used to apply the service brakes.

CLUTCH PEDAL

The clutch pedal (52) is located on the left side of the cab floor. It is used to engage or disengage the clutch.

TRANSMISSION SHIFT LEVER

The transmission shift lever (40) is located on the right side of the cab. It is used to shift the transmission gears.

TRANSMISSION RANGE CONTROL BUTTON

The transmission range control button (39) is located on the shift lever knob. It provides for high and low range shifting.

TRAILING BOOM TRAILER EMERGENCY BRAKE CONTROL (OPTIONAL)

The TRAILING BOOM (TRAILER EMERGENCY) brake control (11) is a push-pull type air valve located on the right side of the front console. The control is used to set and release the brakes on the trailing boom trailer.

SUSPENSION CONTROL

The SUSPENSION control (34) is a lever operated air valve located on the right side console. When positioned to INFLATE, the suspension air bags are inflated. When positioned to DEFLATE, the suspension air bags are deflated.

The suspension air bags should be inflated at all times except when on outriggers or in a pick and carry mode.

SUSPENSION DEFLATED INDICATOR

The SUSPENSION DEFLATED indicator (33) is located on the right side console above the suspension control lever. The amber indicator illuminates when the air is removed from the suspension air bags. It is controlled by four pressure switches connected in series.

CRANING CONTROLS AND INDICATORS

SWING BRAKE ON INDICATOR (OPTIONAL)

The SWING BRAKE ON indicator (30) is located at the top of the front console. The red indicator illuminates to warn the operator that the swing brake release pressure is not enough to hold the swing brake disengaged during trailing boom operation. In addition to illuminating the SWING BRAKE ON indicator, the pressure switch also energizes a warning buzzer.

During cold weather operation, it is recommended that a cold engine be started from the carrier cab with the clutch disengaged.

To start the engine, position the ignition switch to START. If the engine does not start within 30 seconds, allow the starter to cool at least two minutes and repeat the procedure.

Idling The Engine

Idling the engine unnecessarily for long periods of time wastes fuel and fouls injector nozzles. Unburned fuel causes carbon formation; oil dilution; formation of lacquer or gummy deposits on the valves, pistons and rings; and rapid accumulation of sludge in the engine.

When prolonged engine idling is necessary, maintain at least 800 rpm.

Racing The Engine

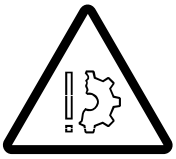
NEVER race the engine during the warm-up period. NEVER operate the engine beyond governed speed (as might occur in downhill operation or downshifting). Engine bearings, pistons, and valves may be damaged if these precautions are not taken.

Shutdown Procedure

1. Allow the engine to operate at fast idle speed for approximately five minutes to avoid high internal heat rise and allow for heat dissipation.

2. Position the ignition switch to OFF.

IF AN OVERHEATING CONDITION NECESSITATES AN EMERGENCY SHUTDOWN, USE CAUTION WHEN CHECKING THE RADIATOR. WHEN LOOSENING THE RADIATOR CAP TO RELIEVE PRESSURE, USE A HEAVY CLOTH OR GLOVES. ALLOW THE ENGINE TO COOL BEFORE REMOVING THE CAP FROM THE RADIATOR.



CORRECT THE PROBLEM THAT CAUSED THE EMERGENCY SHUTDOWN BEFORE ATTEMPTING A RESTART OF THE ENGINE.

3. When necessary to use brakes to reduce crane speed on a downgrade, use on-and-off application to minimize heat and wear. Do not hold a continuous brake application or slide the wheels.

4. When driving on slippery pavement or under icy conditions, alternately and smoothly apply and release the brakes to prevent skidding.

5. Keep the tires properly inflated. Improperly inflated tires can reduce the efficiency of the brakes.

6. After driving through water, dry the brakes by applying them lightly while maintaining a slow forward speed with an assured clear distance ahead until brake performance returns to normal.

IF LOW PRESSURE OCCURS AND THE BUZZER SOUNDS DURING OPERATION, STOP IMMEDIATELY AND DETERMINE THE CAUSE OF AIR LOSS. DOWNSHIFT, USE THE ENGINE AS A BRAKE, AND MAKE THE FINAL STOP USING A SINGLE BRAKE PEDAL MOVEMENT TO AVOID EXCESSIVE LOSS OF AIR AND CONSEQUENT SUDDEN ENGAGEMENT OF THE AUTOMATIC SPRING BRAKES.

7. Regularly check the air pressure gauge indication. System air pressure should never be allowed to fall below 45 psi (310 kPa/3.1 bar). If both systems drop below 45 psi (310 kPa/3.1 bar), the automatic spring brakes will actuate. Normal operating pressure range is 105 to 120 psi (724 to 827kPa/7.24 to 8.27 bar).

If the pressure drops below 2 psi (14 kPa/0.14 bar) per minute with the engine stopped, have the air system checked for leaks.

ENSURE THE BRAKES ARE RELEASED BEFORE MAKING ANY ATTEMPT TO DRIVE OR DRIVE TRAIN DAMAGE WILL RESULT. THE PARKING BRAKE IS TO BE USED FOR PARKING ONLY. DO NOT USE THE PARKING BRAKE FOR STOPPING THE CRANE EXCEPT IN CASE OF AN EMERGENCY, AS A SEVERE SUDDEN STOP WILL OCCUR.

8. Parking brakes are controlled by a readily identified push-pull knob on the dash panel. To apply the parking brake, pull the knob out. To release the parking brake, push the knob in.

Engine Brake

Do not keep a foot lightly on the clutch pedal or the throttle pedal. This will cause the engine brake not to come on.

By energizing the engine brake, the power producing diesel engine, in effect, becomes a power absorbing air compressor. To retard a crane on a downgrade using the Engine Brake, the operator selects a gear which will provide a balance between engine speed and road speed, then engages the engine brake. If the engine speed exceeds maximum rated rpm for a desired speed, a lower gear can be selected or intermittent use of the service brakes can be made. This selection of a lower gear will generally allow complete control of the crane by the engine brake, leaving the service brakes in reserve to be used for emergency stops. With the engine brake turned on, the engine brake will not be energized until the momentum is driving the engine.

LUBE SYMBOL CHART

Symbol	Description
EP-OGL	Open Gear Lubricant, CEPLATTYN 300 Spray, NLGI Class 1-2
RO-PAG	Refrigerant Oil (Polyalkylene Glycol)
R-134a	HFC Refrigerant (Hydrofluorocarbon)
	High-Lub SW 2 Spray, Oil Base, NLGI Grade 2-1

The following describe the lubrication points and gives the lube type, lube interval, lube amount and application of each. Each lubrication point is numbered, and this number corresponds to the index number shown on the Lubrication Diagram.

THE FOLLOWING LUBE INTERVALS ARE TO BE USED AS A GUIDELINE ONLY. ACTUAL LUBE INTERVALS SHOULD BE FORMULATED BY THE OPERATOR TO CORRESPOND ACCORDINGLY TO CONDITIONS SUCH AS CONTINUOUS DUTY CYCLES AND/OR HAZARDOUS ENVIRONMENTS.

Carrier Lubrication

1. Engine Crankcase.

Lube Type - EO - 15W40
Lube Interval - Check fluid level every 10 hours or daily; drain, fill and replace filter every 250 hours.
Lube Amount - Capacity - 38.8 quarts (36.7 liters)
Application - Fill to full mark on dipstick.

2. Engine Cooling System.

Lube Type - AFC
Lube Interval - Check coolant level every 10 hours or daily; drain and refill cooling system every 2000 hours or 12 months.
Lube Amount - Capacity - 52 quarts (49.2 liters)
Application - Fill radiator to bottom of filler neck with AFC. Run engine through two (2) thermal cycles. Check coolant level and refill as required.

3. Transmission.

Lube Type - SGL-5
Lube Interval - Check fluid level and fill every 500 hours, 6 months or 9,000 miles (14,484 km); Drain, fill, and replace filter every 50,000 mi (80,450 km) or 2 years.
Lube Amount - Capacity - 20 quarts (19 liters)
Application - Through fill pipe to oil level mark on dipstick.

72. Upper Wear Pads - Outer Mid.

Lube Type - EP-MPG
Lube Interval - 500 hours or 6 months
Lube Amount - Until grease extrudes
Application - 2 grease fittings; extend boom for entry through access hole in center mid section.

73. Upper Wear Pads - Fly.

Lube Type - EP-MPG
Lube Interval - 500 hours or 6 months
Lube Amount - Until grease extrudes
Application - 2 grease fittings; extend boom for entry through access hole in outer mid section.

74. Telescopic Slide Faces.

Lube Type - EP-MPG
Lube Interval - 500 hours or 6 months
Lube Amount - Thoroughly coat all areas the wear pads move on.
Application - By brush; 8 places

Should boom chatter or rubbing noises in the boom occur, it will be necessary to lubricate the telescopic slide faces. By adding an extension adapter to a grease gun, the wear pads and wear areas can be reached through the lubrication access holes in the side of the boom and through the access hole in the boom nose between the sheaves.

75. Derricking Cylinder Pivot Pin.

Lube Type - EP-MPG
Lube Interval - 100 hours or monthly
Lube Amount - Until grease extrudes
Application - 2 grease fittings

76. 10 M Section Pivot Pin.

Lube Type - EP-MPG
Lube Interval - 100 hours or monthly
Lube Amount - Until grease extrudes
Application - 2 grease fittings

77. Hookblock Sheaves.

Lube Type - EP-MPG
Lube Interval - 250 hours or 3 months
Lube Amount - Until grease extrudes
Application - 1 grease fitting