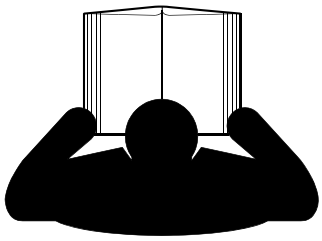
GROVE
by Manitowoc

CARRIER OPERATOR'S MANUAL

This manual has been prepared for and is considered part of -

TM500E-2

Crane Model Number



⚠DANGER

An untrained operator subjects himself and others to death or serious injury. Do not operate this crane unless:

- You are trained in the safe operation of this crane. Manitowoc is not responsible for qualifying personnel.
- You read, understand, and follow the safety and operating recommendations contained in the crane manufacturer's manuals and load charts, your employer's work rules, and applicable government regulations.
- You are sure that all safety signs, guards, and other safety features are in place and in proper condition.
- The Operator's Manual and Load Chart are in the holder provided on crane.

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by the addition of operational aids or warning devices. Indeed, you must guard against acquiring a false sense of security when using them. They are there to assist, not direct the operation. Operational aids or warning devices can be mechanical, electrical, electronic, or a combination thereof. They are subject to failure or misuse and should not be relied upon in place of good operating practices.

You are the only one who can be relied upon to assure the safety of yourself and those around you. Be a **professional** and follow the **rules of safety**.

Remember, failure to follow just one safety precaution could cause an accident that results in death or serious injury to personnel or damage to equipment. You are responsible for the safety of yourself and those around you.

Accidents

Following any accident or damage to equipment, the Manitowoc distributor must be immediately advised of the incident and consulted on necessary inspections and repairs. Should the distributor not be immediately available, contact should be made directly with Manitowoc Product Safety at the address below. The crane must not be returned to service until it is thoroughly inspected for any evidence of damage. All damaged parts must be repaired or replaced as authorized by your Manitowoc distributor and/or Manitowoc Crane Care.

If this crane becomes involved in a property damage and/or personal injury accident, **immediately** contact your Manitowoc distributor. If the distributor is unknown and/or cannot be reached, contact Product Safety at:

The Manitowoc Company, Inc.
1565 East Buchanan Trail
Shady Grove, PA 17256-0021

Phone:888-777-3378 (888-PSR.DEPT)
Fax:717-593-5152
E-mail:product.safety@manitowoc.com

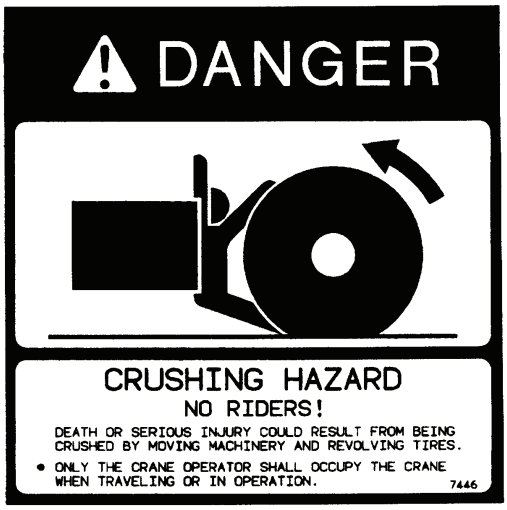
Operator's Information

You must **read** and **understand** this *Operator's Manual* and the *Load Chart* before operating your new crane. You must also **view** and **understand** the supplied safety video. This manual and *Load Chart* must be readily available to the operator at all times and must remain in the cab (if equipped) or operator's station while the crane is in use.

The *Operator's Manual* supplied with and considered part of your crane must be read and completely understood by each person responsible for assembly, disassembly, operation and maintenance of the crane.

No personnel shall be allowed to climb onto the crane or enter the crane cab or operator's station unless performance of their duties require them to do so, and then only with knowledge of the operator or other qualified person.

Allow **No One** other than the operator to be on the crane while the crane is operating or moving, unless they are seated in a two-man cab.



Do not remove the *Load Chart*, this *Operator's Manual*, or any decal from this crane.

Inspect the crane every day (before the start of each shift). Ensure that routine maintenance and lubrication are being dutifully performed. Don't operate a damaged or poorly maintained crane. You risk lives when operating faulty machinery - including your own.

If adjustments or repairs are necessary, the operator shall notify the next operator.

Operator's Qualifications

Qualified person is defined as one who by reason of knowledge, training and experience is thoroughly familiar with crane operations and the hazards involved. Such a person shall meet the operator qualifications specified in Occupational Safety and

- Sometimes the sensing portion of the proximity devices becomes confused by complex or differing arrays of power lines and power sources.

Do not depend on grounding. Grounding of a crane affords little or no protection from electrical hazards. The effectiveness of grounding is limited by the size of the conductor (wire) used, the condition of the ground, the magnitude of the voltage and current present, and numerous other factors.

Electrical Contact

If the crane should come in contact with an energized power source, you must:

1. Stay in the crane cab. **Don't panic**.
2. Immediately warn personnel in the vicinity to stay away.
3. Attempt to move the crane away from the contacted power source using the crane's controls which are likely to remain functional.
4. Stay in the crane until the power company has been contacted and the power source has been de-energized. **No one** must attempt to come close to the crane or load until the power has been turned off.

Only as a last resort should an operator attempt to leave the crane upon contacting a power source. If it is absolutely necessary to leave the operator's station, **jump completely clear of the crane. Do not step off.** Hop away with both feet together. **Do not** walk or run.

Following any contact with an energized electrical source, the Manitowoc distributor must be immediately advised of the incident and consulted on necessary inspections and repairs. Thoroughly inspect the wire rope and all points of contact on the crane. Should the distributor not be immediately available, contact Manitowoc Crane Care. The crane must not be returned to service until it is thoroughly inspected for any evidence of damage and all damaged parts are repaired or replaced as authorized by your Manitowoc distributor or Manitowoc Crane Care.

Special Operating Conditions and Equipment

Never operate the crane during an electrical thunderstorm.

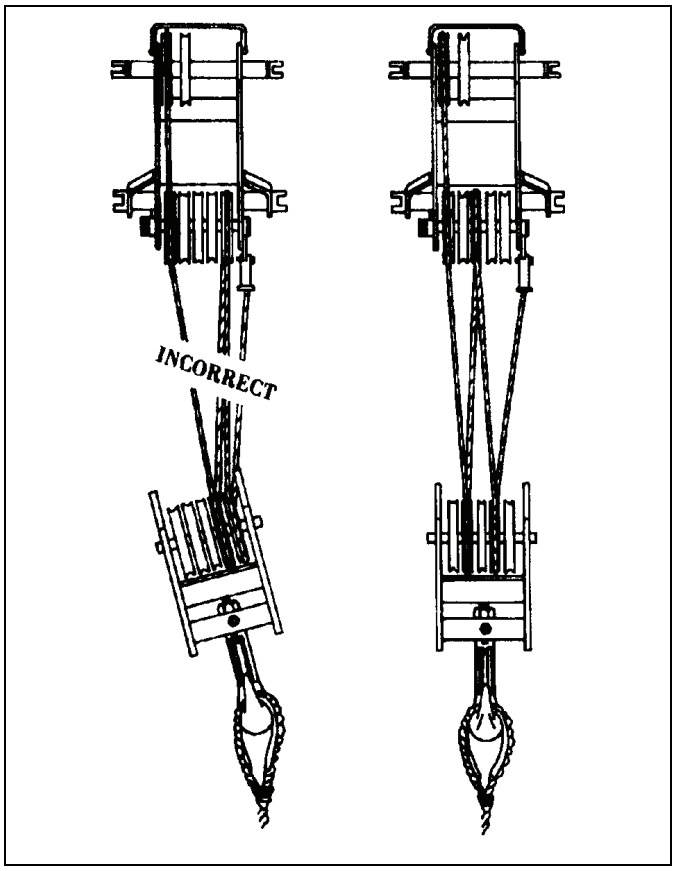
When operating near transmitter/communication towers where an electrical charge can be induced into the crane or load:

- The transmitter shall be deenergized OR,
- Tests shall be made to determine if an electrical charge will be induced into the crane or load.
- The crane must be provided an electrical ground.
- If taglines are used, they must be non-conductive.
- Every precaution must be taken to dissipate induced voltages. Consult a qualified RF (radio frequency) Consultant. Also refer to local, state, and federal codes and regulations.

When operating cranes equipped with electromagnets, you must take additional precautions. Permit no one to touch the magnet or load. Alert personnel by sounding a warning signal when moving a load. Do not allow the cover of the electromagnet power supply to be open during operation or at any time the electrical system is activated. Shut down the crane completely and open the magnet controls switch prior to connecting or disconnecting magnet leads. Use only a non-conductive device when positioning a load. Lower the magnet to the stowing area and shut off power before leaving the operator's cab (if equipped) or operator's station.

PERSONNEL HANDLING

The American Society of Mechanical Engineers issued a new American National Standard entitled, *Personnel Lifting Systems, ASME B30.23-2005*. This standard provides, "lifting and lowering of personnel using ASME B30 Standard hoisting equipment shall be undertaken only in circumstances when it is not possible to accomplish the task by less hazardous means. Unless all of the applicable requirements of this volume are met, the lifting or lowering of personnel using ASME B30 Standard equipment is prohibited." This new



Lifting

Use enough parts of line for all lifts and check all lines, slings, and chains for correct attachment. To obtain maximum lifting capacities, the hook block must be set up with enough parts of line. Too few parts of line can result in failure of the wire rope or hoist. **No less than three wraps** of wire rope should remain on the hoist drum. When slings, ties, hooks, etc., are used, make certain they are correctly positioned and secured before raising or lowering the loads.

Be sure the rigging is adequate before lifting. Use tag lines when possible to position and restrain loads. Personnel using tag lines should be on the ground.

Be sure good rigging practices are being used. Refuse to use any poorly maintained or damaged equipment. Never wrap the hoist cable around a load.

If using a clam bucket, do not exceed 80% of the crane's capacity.

Make certain the boom tip is centered directly over the load before lifting.

Ensure that all slings, ties, and hooks are correctly placed and secured before raising or lowering the load.

Be sure the load is well secured and attached to the hook with rigging of proper size and in good condition.

Check the hoist brake by raising the load a few inches, stopping the hoist and holding the load. Be sure the hoist brake is working correctly before continuing the lift.

When lowering a load always slow down the load's descent before stopping the hoist. Do not attempt to change speeds on multiple-speed hoists while the hoist is in motion.

Watch the path of the boom and load when swinging. Avoid lowering or swinging the boom and load into ground personnel, equipment, or other objects.

Lift one load at a time. Do not lift two or more separately rigged loads at one time, even if the loads are within the crane's rated capacity.

Never leave the crane with a load suspended. Should it become necessary to leave the crane, lower the load to the ground and stop the engine before leaving the operator's station.

Remember, all rigging equipment must be considered as part of the load. Lifting capacities vary with working areas. If applicable, permissible working areas are listed in the *Load Chart*. When swinging from one working area to another, ensure *Load Chart* capacities are not exceeded. Know your crane!

Stop the hook block from swinging when unhooking a load.

Swinging rapidly can cause the load to swing out and increase the load radius. Swing the load slowly. Swing with caution and keep the load lines vertical.

Look before swinging your crane. Even though the original setup may have been checked, situations do change.

Never swing or lower the boom into the carrier cab (if applicable).

Never push or pull loads with the crane's boom; never drag a load.

Do not subject crane to side loading. A side load can tip the crane or cause it to fail structurally.

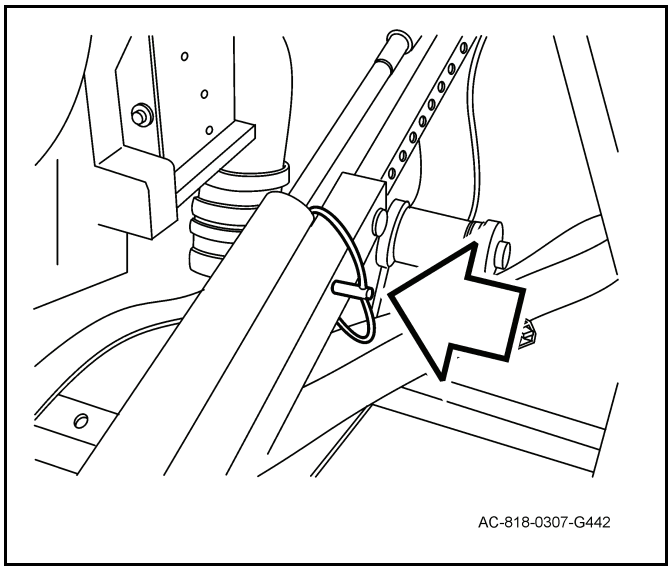


Figure 8

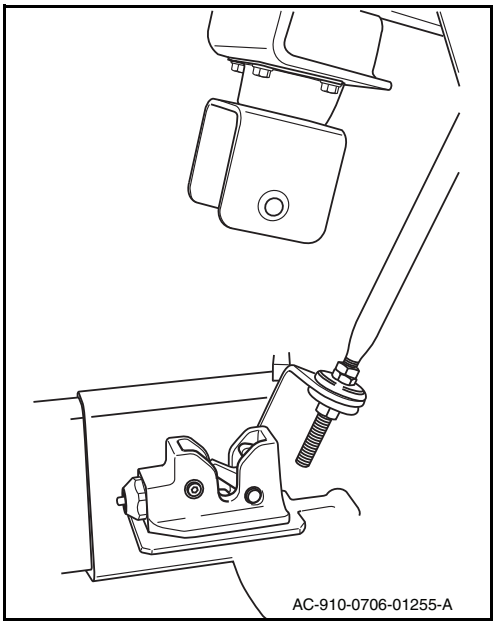


Figure 9

CAUTION

Remove the pump handle when not in use. It may stick out and could cause injury to passersby.

To stop the cab in a partially tilted position while raising the cab, stop pumping and place the flow valve selector in the HOLD position. Install the safety pin in the cab tilt lock tube wherever the holes line up.

Velocity fuses are incorporated into the cab tilt cylinder ports to control the cab's free fall past the midpoint (top) when raising and lowering the cab. The fuses also act as a safety valve to prevent the cab from falling unchecked in the event of a hydraulic system failure.

⚠ DANGER

Never rely on the hydraulic pressure to hold the cab in a partially open position. Always use the safety pin in the cab tilt lock tube to prevent serious personal injury or death.

Lowering the Cab

Remove the safety lock pin. It may be necessary to remove weight from the pin by operating the cab jack pump. Do not use excessive force on either pin or pump, pin should be free to turn in order to remove it. Place the selector lever on the hydraulic pump to the LOWER (pull circuit) position. Insert the pump handle into the pump and operate the handle in an up and down motion. The hydraulic cylinders then lower the cab until the midpoint (top) is reached. Once the cab has reached midpoint, stop pumping and the cab will free fall rearward to the fully lowered position. When the cab is lowered, the crossbars of the cab brackets will automatically engage the hydraulic cab latches. The weight of the cab then triggers the hydraulic latches to lock. This will be evident when the pins in the hydraulic latches retract into the latch body.

CAUTION

Remove the pump handle when not in use. It may stick out and could cause injury to passersby.

Tether straps are installed on some suspension-type seats. Tether straps help secure the seat to the floor and are intended to restrain the seat and safety belt in case of an accident or sudden stop.

The tethers are not adjustable.

Operating the Safety Belt

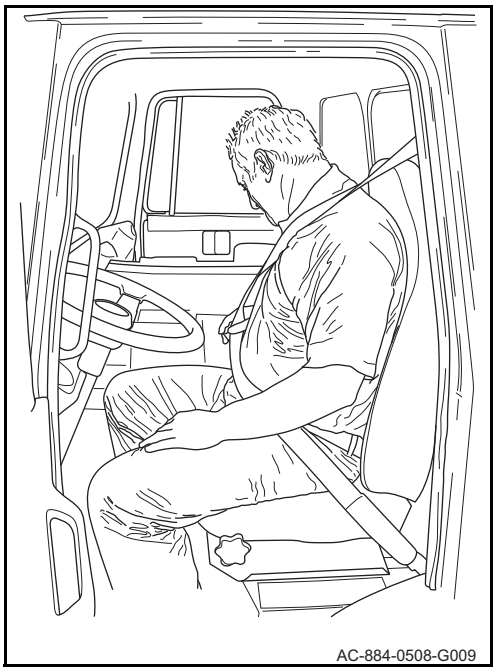


Figure 21

To fasten the safety belt, pull the belt out from the retractor and insert the latch into the buckle. Verify proper lock of the latch by pulling on the latch.

Adjust the slack by pulling on the top part of the belt until the lower part, or the part that crosses the lap, is snugly adjusted. Release the top part and let the retractor pull the belt in.

The lap portion of the safety belt should be worn low across the pelvic region (hip bone) and adjusted snugly. Never adjust the lap belt across the abdomen. A push button on the buckle is used to release the safety belt latch by pushing in the button release on the buckle.

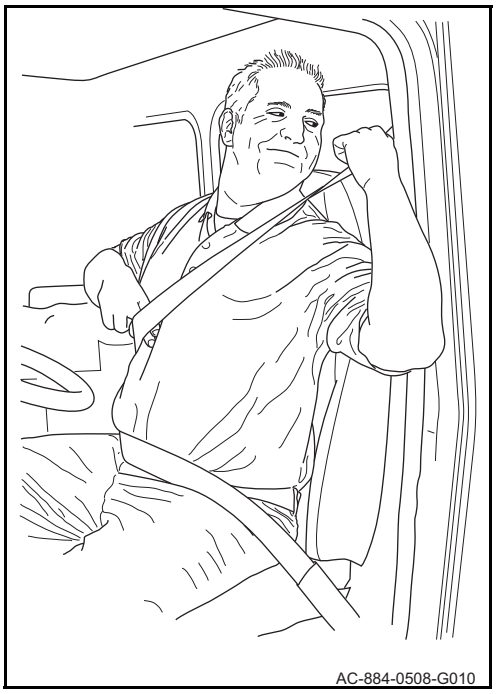


Figure 22

If a Komfort Latch is used on the safety belt, always adjust the belt so that there is a maximum of 1 in. (25 mm) of slack between the belt and chest (about two fingers' width). If a larger slack is allowed, in the event of a collision, the effectiveness of the safety belt is decreased. Operation of the clip is described in Komfort Latch Operation.

Make sure the safety belt is completely retracted and out of the way when not in use.

Inspection

Check the belts, buckles, latch plates, retractors, anchors and guide loops to ensure that they are working properly. Look for loose/damaged parts (without disassembling) that could keep the restraint system from working properly. If the safety belt, retractor and hardware were in use during a collision, they must be replaced. The restraint system anchoring fasteners must be replaced if necessary. If there is any doubt about the restraint system's effectiveness, replace the entire safety belt assembly.

⚠ WARNING

Failure to take necessary action when the Stop Engine telltale is on can result in automatic engine shutdown and loss of power steering assist. Crane crash can occur causing serious personal injury or death.

NOTICE

Failure to observe correct precautions when the Stop Engine telltale lights up solidly could result in serious damage to the engine and/or other components.

Fuel Level

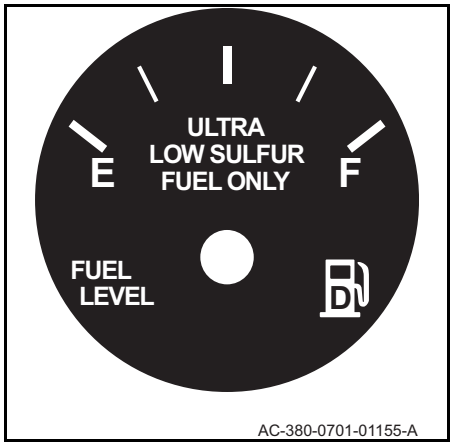


Figure 43

The gauge is connected to a sending unit in the fuel tank via the gateway module on the right-side frame rail.

Figure 44

If the fuel level is depleted to a specific level, the Low Fuel telltale will illuminate. An alarm will sound to indicate that the fuel level is low.

CAUTION

Use ultra low sulfur diesel fuel only. Using a diesel fuel that is not ultra low sulfur will damage the diesel particulate filter and can damage the other emission system components.

Note: Ultra low sulfur diesel is not required with the Export Engine Option.

Reserve Pressure "A" & "B"

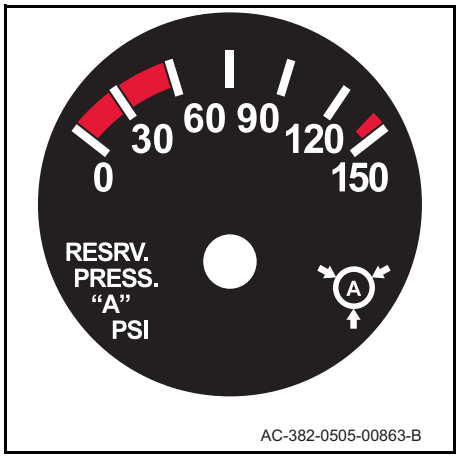


Figure 45

Note: The wiper motor contains a built-in protective thermal switch that will shut down the motor if it is overloaded. The continued operation of the wipers over a dry windshield for an extended period may overload the wiper motor sufficiently to trip the thermal switch.

The electric windshield washer is also operated by the Windshield Wiper/Washer switch. Depress and hold the rocker switch to operate the washer. Release the switch to stop.

Cruise Control

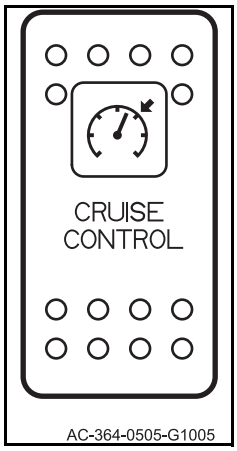


Figure 72

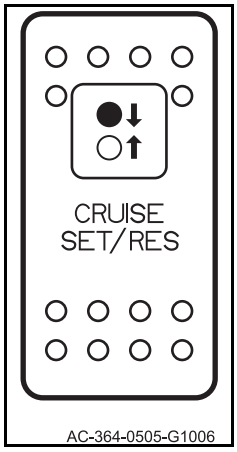


Figure 73

The Cruise Control switches are located on the center switch panel.

To engage the cruise control and set the crane speed:

1. Set the cruise control ON/OFF switch to the ON position.
2. When the desired crane speed has been reached, move the SET/RES switch to the SET position.
3. If the crane speed needs to be increased, push the SET/RES switch upward to accelerate the crane. The crane speed will increase as long as the switch is held. Release the switch when the desired speed has been reached.
4. To reduce the crane speed, push the SET/RES switch downward to decelerate the crane. The crane speed will decrease as long as the switch is held. Release the switch when the desired speed has been reached.

Note: As an option, some cranes may be equipped with Base PTO Mode. Base PTO Mode allows the crane to be operated with the cruise control engaged below 30 mph. This feature is a function of the electronic engine control unit. Refer to the engine manufacturer's operator's manual for more information.

Note: The Cruise Control switches may be used to control more functions than just the cruise control. Ensure that you are familiar with the operating characteristics of the crane and any additional functions the Cruise Control switches have control over.

Engine Diagnostic Active Regeneration

Figure 74

This switch enables the operator to start manual exhaust regeneration. (Despite its label, this switch is not involved in engine diagnostics.)

Note: The Engine Diagnostic Active Regeneration Switch is not used with the Export Engine Option.

Cold weather operation does require changes in operating practices, maintenance procedures, lubrication and fuel. Additions to the crane, such as heated fuel filters, fuel tank heater, engine block heater, etc., can make winter operation easier. Contact your Manitowoc dealer for the correct accessories and installation information.

If satisfactory engine temperature is not maintained, increased engine wear will result in higher maintenance cost. Accessories should be designed to be easily disconnected when switching to driving in warmer weather so they do not affect the operation of the engine.

Recommendations for cold weather operations:

- When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity.
- When the temperature is below freezing, make sure the concentration of antifreeze in the coolant is sufficient to prevent freezing.
- During cold weather, give more attention to the condition of the batteries. Test them frequently to ensure sufficient power for starting. A dead battery may freeze.
- Fuel cloud point is the temperature at which wax crystals become visible in the fuel. The cloud point is generally at a higher temperature than the pour point of the fuel. To keep the fuel filter from clogging with wax crystals, the cloud point should be below the lowest ambient temperature at which the engine will be expected to operate.

To prevent wear and possible damage to the engine when it is cold, gradually bring it up to operating temperature before operating at high engine speeds or full load. After starting and before moving the crane, run the engine at 800 - 1000 RPM for three to five minutes. Operate at partial engine load until the coolant temperature reaches 165°F (75°C).

Engine Block Heater

An electric engine block heater can be installed for keeping the coolant hot when the crane is parked. The heater is mounted through the side of the engine block with the heater coils in the coolant jacket. The heater does not interfere with normal operation and can be permanently installed.

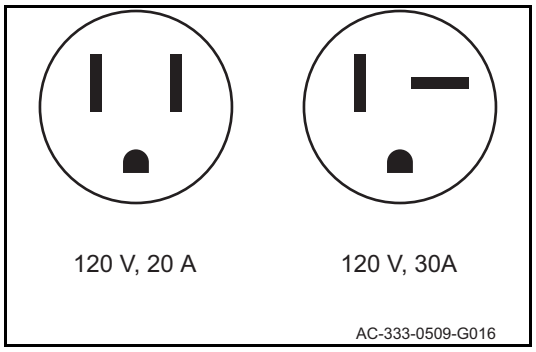


Figure 92

The engine block heater runs on 120 V and has an easily accessible plug, typically located around the grille area. The plug will hook up to a normal extension cable. Your engine may be equipped with a 20 amp or 30 amp power receptacle.

Be sure that any supply circuits are adequately protected against short or open wiring conditions that may occur to the block heater wiring circuit.

Cold Weather Shielding

Today's electronically controlled engines are designed to operate in cold temperature environments without winter fronts, shutters or any other type of cold weather shielding. Manitowoc does not recommend the use of such devices. Higher exhaust temperatures, power loss, excessive fan usage and reductions in fuel economy can result from improper use of cold weather shielding.

Engine Operation

General

Proper operation, driving techniques and maintenance are key factors in obtaining the maximum life and economy from a modern turbocharged diesel engine. This section has operational information about the components that make up the engine. For the best operation economy, see *Fuel Economy*.

When operating on a level highway or cruising, hold the engine speed at approximately 75 to 85 percent of governed speed (1400 to 1600 RPM for large displacement engines) to achieve power and economical fuel consumption.

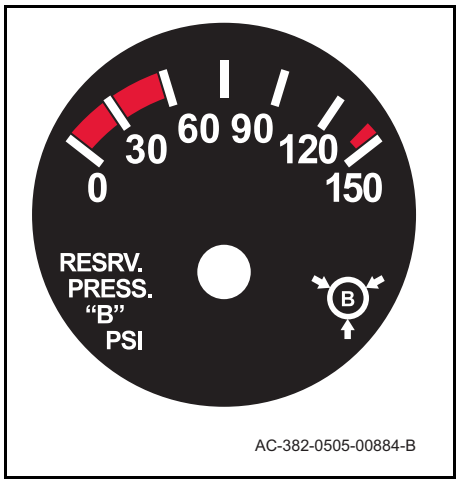


Figure 101

Manitowoc cranes are designed to meet or exceed all applicable federal brake standards and regulations. They use a dual-circuit, compressed air system. It consists of two independent brake systems that use a single set of brake controls. Each circuit is supplied by its own compressed air tank which is protected by a check valve. Both air tanks receive compressed air from the same supply tank (wet tank) and are charged with equal pressure. The two circuits are interconnected for the parking brake system by means of a double check valve.

Air pressure in the two circuits is monitored by two gauges in the main instrument cluster. The two gauges should register equal or nearly equal pressure. By observing the gauges, the operator is forewarned in the event of a pressure drop in either or both of the circuits, and also may readily identify the specific circuit.

Before operating the crane, check the air gauges which indicate air pressure. They should not register less than 105 psi (725 kPa). Maximum pressure at any time should not exceed 150 psi (1035 kPa).

Both circuits are plumbed into a dual brake valve, which simultaneously applies front and rear axle service brakes during each brake application. In the event of a failure in either one of the circuits, the other circuit becomes the emergency circuit for applying the brakes.

An important feature of the brake system is that an automatic spring brake application does not take place as a result of an air loss in only one of the two circuits. In this case, brake control remains in the foot brake valve. For each air pressure system, there is a warning telltale in the telltale warning panel connected to a low pressure switch that comes on if air pressure goes below 70 psi +/- 6 psi (485 kPa) in either system. At the same time, the buzzer will sound and the main warning telltale will illuminate. This pressure drop warns the operator to make a manual emergency stop before an automatic emergency stop is made.

Brake System Controls

The air compressor, governor, pressure regulator valve and reservoirs are control devices. Their function is to build up, maintain and control air pressure in the reservoirs. This is so that pressure is held constant between the minimum and maximum range established for air brake operation.

The brake valve, quick release valve, brake chambers, and slack adjusters are application devices. They distribute the air pressure and convert its energy into the mechanical force necessary to apply or release the brakes.

Foot Brake Valve

The foot brake valve is directly connected to the brake pedal. The valve gives a progressive output against the pedal travel. This allows better control of the pressure in the first half of the pedal travel. In the last half of the pedal travel, the pressure output increase is faster.

The foot brake valve applies the service brakes, incorporating both the primary and secondary air systems. The primary system controls the rear brakes and the secondary system controls the front brakes. The foot brake valve receives air from the compressed air tanks. Air pressure is then delivered to the wheel brake chambers as required by the amount of pressure exerted on the foot brake pedal. The brake chamber force then applies the wheel brakes.