SM KEYSHEET AND GENERAL INFORMATION

Link-Belt CRANES

DATE 10/21/20
PAGE 1

ORDER NO.- S3C001 MODEL - ATC-3210 SERIAL NO. - S3L1-6826

DISTRIBUTOR: MARDIAN EQUIPMENT CO., INC.
CARRIER ENG:
MODEL- CUMMINS QSX15 T3
S/N- 79744324
OPERATION- 4915540
PARTS- NONE
UPPER ENGINE:
MODEL- CUMMINS QSB6.7 T4F
S/N- 73693681
OPERATION- 4332780
PARTS- NONE

O/M BOOK- 1362092118
ADDENDUMS - NONE
TECH BULLETINS - NONE
MISCELLANEOUS - HOIST ROPE CAUTION

SALES ORDER: 26826
MAIN TRANS:
MODEL- ZF 12-AS-3041
S/N- 00952261
OPERATION- NONE
PARTS- NONE
AUX TRANS:
MODEL- KESSLER VG2600
S/N- 536071
OPERATION- NONE
PARTS- NONE
AEM: BOOK- MC-1407
VIDEO- DVD-CR

SM CODE DESCRIPTION

SM00 GENERAL INFORMATION
****
SM00-000-000.00 HOW TO USE THIS MANUAL, S

SM01 RUBBER TIRE LOWER
****
SM01-069-018.00 TIRE & RIM, R & I
SM01-069-019.00 TIRE & RIM, INSP & MAINT

SM07 UPPER HYDRAULICS & AIR
****
SM07-008-169.00 SINGLE AXIS ELECTRONIC CO
SM07-008-170.00 SINGLE AXIS ELECTRONIC CO

SM09 TUBULAR BOOM
****
SM09-001-002.00 REPAIRING DAMAGED TUBE BO

SM17 HYDRAULIC BOOM
****
SM17-001-053.00 HYDRAULIC BOOM INSPECTION
SM17-001-087.00 6 SECTION BOOM, RECON
SM17-002-055.00 BOOM TELESCOPE CYLINDER,
SM17-002-069.00 BOOM LATCHING CYLINDER, R
SM17-002-086.00 BOOM PINNING CYLINDER, RE
SM17-002-097.00 BOOM TELE COUNTERBALANCE
SM17-002-098.00 BOOM PINNING CYLINDER, R
SM17-002-099.00 BOOM LATCHING CYLINDER, R
SM17-002-100.00 BOOM TELESCOPE CYLINDER M
SM17-002-131.00 TELE CYLINDER LENGTH ENCO
SM17-002-134.00 HOSE & CABLE REEL, R & I
SM17-002-154.00 HOSE & ELECTRICAL REEL AS

SM CODE DESCRIPTION

SM17 HYDRAULIC BOOM
****
SM17-003-047.00 BOOM HOIST CYLINDER, R &
SM17-003-049.00 BOOM HOIST HOLDING VALVE,
SM17-003-050.00 BOOM HOIST HOLDING VALVE,
SM17-003-053.00 BOOM HOIST CYLINDER, RECO
SM17-009-010.00 7 SHEAVE BOOM HEAD MACHIN

SM18 SPECIAL ATTACHMENTS
****
SM18-007-024.00 REELING DRUM, R & I
SM18-007-038.00 REELING DRUM, TROUBLESHOO

How To Use This Manual, General Service Instructions, And Safety Procedures

The following information is provided to help guide the user of this manual. An explanation of how this manual is organized, as well as general information and safety considerations which should be understood when performing any service or maintenance procedure, is given. This information is general in nature and should supplement any of the specific procedures in this manual along with a constant awareness of safety and common sense.

How To Use This Manual

This Service Manual is a collection of written procedures which are used to service and maintain a specific crane model. The index, which is called a "Keysheet", is used to organize the procedures within this manual and serve as a Table Of Contents as well. Each procedure, in this manual, is written so that it can stand alone and typically covers only one procedure. Procedures are given a numerical designation, or "SM Code" Number, (Example: SM01—005—034.00) which is unique to that procedure and that procedure only. The following is a listing of the general area definitions which are designated by the first digits in the SM Code Number sequence:

General Area Descriptions

SM01 — Rubber Tire Lower
SM02 — Crawler Lower
SM03 — Upper Revolving Frame & Machinery
SM04 — Vertical Shafts
SM05 — Horizontal Shafts
SM06 — Upper Engine
SM07 — Hydraulic Power Supply
SM08 — Angle Boom
SM09 — Tubular Boom
SM10 — Tagline Winder
SM11 — Fairleader
SM12 — Shovel Attachment
SM13 — Trench Hoe, Logger & Scrapper Attachment & Prop Handler
SM14 — Cab & House Assembly
SM15 — Rotascope Attachment (Discontinued)
SM16 — Wire Rope Requirements
SM17 — Hydraulic Boom And Attachments
SM18 — Special Attachments
SM19 — Diesel Pile Hammer (Discontinued)
SM20 — Tower, Climbing Assembly, Traveling Base & Gantry (Discontinued)
SM21 — Log Skidder (Discontinued)
SM22 — Hydraulic Hammer (Discontinued)

The procedures in this manual are collated by SM Code Number sequence. Use the Keysheet in the front of this manual, the general area descriptions shown previously, and the SM Code title shown on the Keysheet to find the specific procedure required to service the crane.

Throughout this manual, reference is made to the left, right, front, and rear, pertaining to directions and locations. These reference directions are relative to the operator, sitting in the operator's seat, with the upper directly over the front of the carrier, unless otherwise stated. (Crawler mounted cranes: upper over the front of the crane with travel motors to the rear.)

Danger, warning, and caution captions as well as special notes are used throughout this manual and on the crane to emphasize important and critical instructions. **If any instruction, caution, warning, or danger labels, decals, or plates become lost, damaged, or unreadable, they must be replaced.** Information contained on such labels, decals, and plates is important and failure to follow the information they contain could result in an accident. Replacement labels, decals, and plates can be ordered through a Link-Belt Distributor. For the purpose of this manual, danger, warning, and caution captions and notes are defined as follows:

DANGER

An operating procedure, practice, etc. which, if not correctly followed, may result in severe personal injury, dismemberment, or loss of life.

WARNING

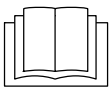
An operating procedure, practice, etc. which, if not correctly followed, may result in personal injury.

CAUTION

An operating procedure, practice, etc. which, if not correctly followed, may result in damage to, or destruction of, equipment or property.

NOTES

Note: An operating procedure step, condition, etc. which is essential in order for the process to be completed properly.



This symbol may appear in manuals or on a label on the crane to alert personnel that additional instructions are included in the crane Operator's Manual.

Figure 1
Keep hands and tools clear of moving parts.

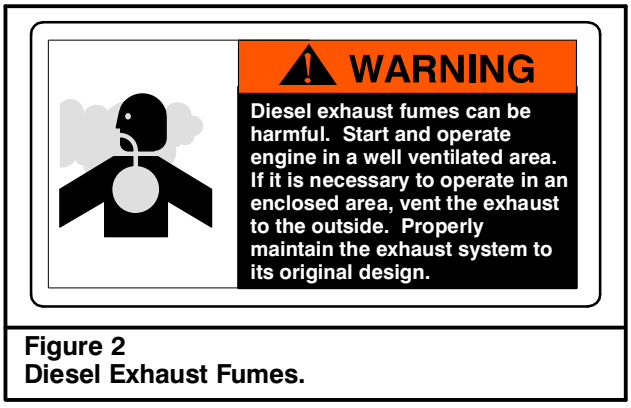


Figure 2
Diesel Exhaust Fumes.

Service Safety And Set Up Guidelines

The following is a list of safety and set up considerations which may apply to any service or maintenance procedure. Review the entire list and understand the type of things you must consider to perform a safe service procedure and then apply these guidelines to each specific service or maintenance procedure.

DANGER

Do not operate the crane unless you are qualified. Unauthorized operation by untrained personnel could result in an accident. Crane operation is to be performed by a certified operator only.

Service Safety

1. Read and understand the service or maintenance procedure to be performed before beginning work. By reading the procedure ahead of time, you can be sure to have the replacement parts and tools on hand that are required to complete the job.
2. Wear protective gear to prevent injury; hard hat, safety glasses, gloves, steel toed shoes, etc.

Figure 3
Pinch Point Label

3. First aid supplies and a fire extinguisher should be on the job site to assist in an unexpected situation. The location of these items should be known to all as well as access to a telephone for emergencies.
4. Work in a clean, dry, firm, level area whenever possible. Choosing the correct work site can make a big difference on how well the job goes.
5. Use caution around flammable materials. Be aware of all the materials in the work area which are a threat. Also make others aware of volatile materials; post signs if necessary.
6. Release all trapped pressure in air and hydraulic circuits before disconnecting any line or component. Shutdown the crane, exhaust all pressure from the crane's air reservoir(s) and work the hydraulic control levers back and forth before servicing the crane.
7. Do not disconnect any hydraulic line from a crane which has its attachment in the air. Trapped pressure may be all that is suspending it. Disconnecting a line could release the trapped pressure, causing the attachment to fall. Lower the attachment to the ground or on to its rest before servicing the crane.
8. Do not work on a crane which is in motion. Fans, belts, gear trains, etc. can catch an unexpecting person and quickly dismember them.
9. Do not climb on the attachment or other hard to reach areas. If the steps and/or ladders which are installed on the crane do not provide adequate access to the area of the crane which needs servicing, use a step ladder or other approved device.
10. Pinch points exists between the upper and lower frames. Death or dismemberment may result from personnel caught in these points. Learn where these pinch points are and stay clear of the rotating upper frame.

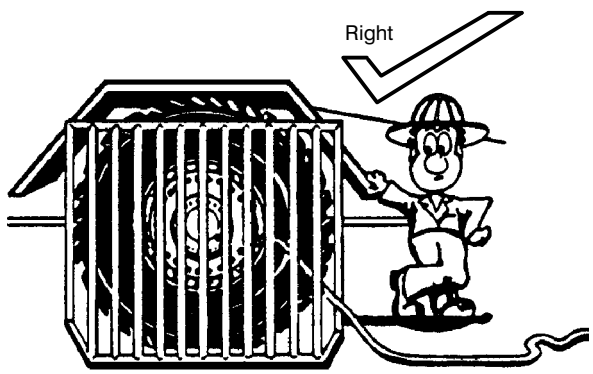


Figure 4
Use a guard when inflating tires.

11. If working in a confined area, be sure to provide adequate ventilation when running the engine(s), using toxic solvents, welding, or any other operation which contaminates the fresh air supply.
12. Post a sign in the operator's cab to alert others that the crane is under service. Starting the crane while it is being serviced could severely injure someone. Crane damage could also occur if systems are operated prematurely. Imagine starting the engine(s) before the oil is replaced.
13. Secure access panels, doors, and machinery hoods when in the open position to ensure they do not fall or slam shut due to wind or accidental disruption.
14. Crane parts may be heavy. Always use an appropriate lifting device to support work. Do not attempt to lift an object without knowing its weight. Get help if necessary.
15. Always use a safety rim cage when inflating or deflating tires. Worn or misassembled parts can "explode" from the assembly causing serious injury. Use a safety rim cage, clip on air chuck, and stand aside when inflating or deflating tires.

Crane Set Up And Disassembly

1. Properly park the crane as described in the Operator's Manual. Park the crane in an area which provides the most comfortable working conditions. However, do not park the crane where it will be an obstruction or an intrusion to traffic, coworkers, or to the public. Keep in mind that a major service procedure, or a repair part which requires a long lead time, could have the crane disabled for an extended period of time.
2. Keep in mind the mess which is sometimes caused by a crane under repair. Oil or other fluid leaks should be contained or prevented. Consider your responsibility of maintaining a safe clean work area and a healthy environment for all.

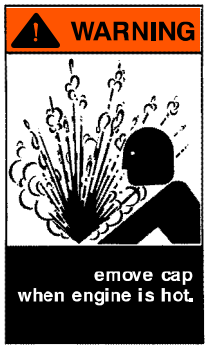


Figure 5
Allow engine to cool before removing the radiator cap.

3. If the crane is equipped with outriggers, it may be safer as well as an advantage to raise and level the crane on outriggers to provide easier access to areas underneath. Do not work under a crane that is improperly supported.
4. Shutdown the engine(s) per the instructions given in the Operator's Manual.
5. Post a sign in the operator's cab to alert others that the crane is being serviced.
6. Engines, transmissions, hydraulic systems, etc. generate extreme heat during operation. Temperatures can reach levels which may cause serious burns. Allow the crane to cool before attempting to service it.

WARNING

Engine coolant is hot. Failure to allow engine(s) to sufficiently cool before draining coolant could result in severe burns or other personal injury. Allow the engine(s) and radiator(s) to cool before draining coolant from the radiator(s).

7. Pressure is generated inside the engine's cooling system due to the heat transfer process from the engine(s) to the radiator(s). Do not attempt to open or drain the radiator(s) until it/they has/have had sufficient time to cool. Disconnecting hoses before the engine(s) and radiator(s) has/have cooled is even more dangerous. Wait until the engine(s) and radiator(s) have cooled and then drain the radiator(s) before disconnecting any hoses. Properly store or dispose of used coolant.

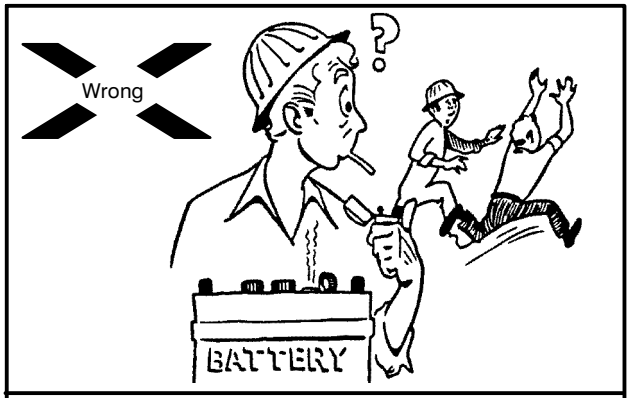


Figure 6
Do not use an open flame near the battery.

WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

8. Thoroughly clean the area of the crane which is to be serviced. Dirt or other contamination could enter the hydraulic, air, lubricating system, etc. and cause immediate and/or long term problems. Cleaning the service area not only prevents contamination problems but it also makes working on the crane easier and sometimes problems are more recognizable.
9. Before beginning any removal or disassembly procedure, take a moment to observe critical features of the assembly which may greatly simplify the installation or assembly process. Label electrical, hydraulic, air, or other connections. Index mark pump, motor, and valve sections. Lightly spray paint or count the threads of adjustment screws. Simple steps such as these can minimize the effort needed to put the crane back in service.

WARNING

Hydraulic oil is under pressure and may be hot. A sudden release of hot oil could cause severe burns and/or other serious injury. Shutdown the engine(s) and exhaust all trapped hydraulic pressure from the system before removing any line or component.

10. Hydraulic systems, while operating, are under high pressure. Even after the crane is shutdown these pressures can remain trapped in the hydraulic lines and system components. Some hydraulic systems utilize an air pressurized reservoir which maintains pressure on the system after the crane is shutdown. It is critical that all residual pressure, which is trapped in the system, be neutralized before disconnecting any line or hydraulic component. Use the following techniques to exhaust trapped hydraulic pressure from the system:
    a. Lower the attachment to the boom rest, onto blocking, or onto the ground and shutdown the engine(s).
    b. Open the drain valves on the air system reservoir(s), if equipped, to bleed the air system pressure.
    c. Relieve any residual or precharge pressure by pushing the button on the pressure relief valve, on the hydraulic reservoir, if equipped. Otherwise, loosen the filler cap 1/4 turn.
    d. Turn the ignition switch to the **ON POSITION**, but **DO NOT START THE ENGINE.**
    e. Operate the steering control(s) back and forth repeatedly until steering becomes hard. (On cranes equipped with emergency steering system, it will take several rotations of steering wheel before steering becomes hard.)
    f. Work the crane control levers and outrigger switches, if equipped, back and forth several times.
    g. Turn ignition switch to the **OFF POSITION.**
    h. When pressure is fully relieved, close the drain valves on the air system reservoir(s), if equipped.

WARNING

Air lines may contain high pressure. Opening lines and fittings before relieving air pressure may result in serious injury. Shutdown the engine(s) and drain the air system reservoir(s) before opening any line or fitting.

11. Air system circuits, like hydraulic circuits, contain high pressures also. Although the threat of a hot working fluid does not exist, highly pressurized lines and components can possibly "fly off" if lines are disconnected before the system pressure is relieved. Open the drain valve on the air system reservoir(s) to exhaust system pressure before working on the crane.

WARNING

Use care not to cause sparks at the battery terminals while disconnecting or connecting the battery. Battery gasses are volatile and could be ignited by a spark or flame causing the battery to explode. Keep the area around the battery well ventilated and disconnect the negative side of the battery first, with the ignition switch "OFF", to minimize hazard.

Battery posts, terminals, and related accessories contain lead and lead compounds. Eating or smoking with lead residue on hands may cause lead poisoning. Wash hands after handling lead products.

12. When working on electrical circuits, disconnect the battery to minimize shock, burn, spark, or other hazard. When disconnecting the battery, confirm that the ignition switch is in the "OFF" position. Disconnect the negative side of the battery first to minimize the potential for sparks at the battery. Battery gases which are exposed to such sparks, could cause an explosion. Likewise when connecting the battery, confirm that the ignition switch is in the "OFF" position and install the positive cable(s), first and the negative connection(s) last.
13. It is a good practice when disassembling hydraulic components to lay the parts out in the order that they were disassembled. Keeping the parts in this order during disassembly, cleaning, and inspection will aid in the assembly process.

Welding

1. When making repairs which require welding, disconnect any electronic equipment (such as rated capacity limiters and engine computers) to prevent damage to them. Use the battery disconnect switch(es), if equipped.
2. Be aware of systems adjacent to areas being welded. Residual heat from the welding process could cause damage to other components. Heat may also vaporize materials which may become toxic or volatile.
3. Remove paint from areas to be welded to prevent toxic fumes.
4. The grounding connection should be within 3 feet (*1 m*) of the welded parts.
5. Connect the ground to the lower, if welding on the lower, or to the upper if welding on the upper. Electrical current through the turntable bearing could cause an arc which could damage it.
6. Do not position the ground connection where seals or bearing, as in transmissions or valves, will be between it and the welded parts.
7. Remove any flammable materials from the area.
8. Use the appropriate setting on the welder for the size of the welding operation. Do not use more than 200 Volts continuously.

Cleaning And Inspection

WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

1. All components should be thoroughly cleaned with an approved cleaning solvent, air dried and carefully inspected for damage, wear and corrosion.
2. All Loctite® or other sealant residue should be removed from threads of hardware and parts that are going to be reused.
3. All "soft parts", such as seals, gaskets, back up rings, and o-rings, should be replaced.
4. Replacement of bearings and bushings is generally a good preventive maintenance measure. Even though a bearing or bushing seems to be intact and is functioning properly, its life span is limited. Replacing a simple bearing or bushing while the opportunity is at hand could save a complete component failure later.
5. In the event of severe defects, contact factory personnel for directions whether to repair or replace any major component.

Crane Assembly

1. Loosely assemble parts to ensure all parts are in place and fasteners started before beginning torquing procedure. Always use a cross torquing sequence to ensure even and uniform installation.

WARNING

Lubricants, sealants, joint and thread locking compounds, etc. can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all manufacturer's recommendations concerning these products.

Figure 7
Proper disposal is important.

2. Unless otherwise stated, torque all fasteners per the instructions given in SM Code Area 18—000.
3. When installing hydraulic hoses, lines, and fittings, use two wrenches to ensure the hoses and lines are not twisted. One wrench must be on the male fitting, the other wrench on the female fitting.
4. Unless otherwise stated, torque all hydraulic fittings per the instructions given in SM Code Area 07—018.
5. Check all fluid levels before returning the crane to service; hydraulic reservoir oil level, transmission fluid level, engine(s) oil level, etc. Add oil as required. See Operator's Manual and/or engine(s) manufacturer's manual(s) for correct type of fluids and procedures.
6. Always replace guards, grilles, and other types of protective shields. Also, be sure that any systems which were disconnected such as load indicating systems, anti-two block devices, control cables, etc. are functioning properly before returning the crane to service.
7. Start the appropriate engine and let it idle for five minutes. Inspect the connections on the hydraulic, air, transmission, etc. lines for leaks. Repair if needed.
8. Check that all hydraulic, air, and electrical functions are operating normally before returning the crane to service.
9. After crane is assembled, refer to the Operator's Manual for any periodic type of adjustments which may have been affected by the service procedure.
10. Properly dispose of any used oils, solvents, cleaners, etc.

Tire And Rim, R & I

This procedure covers the removal and installation of the Tire And Rim. Read and thoroughly understand "Tire And Rim, Inspection And Maintenance" in SM Keysheet Area 01—069 prior to performing any tire or rim service.

WARNING

Servicing tire and rim assemblies can be extremely dangerous. Tire or rim failure can cause serious injury or death. For your protection, do not attempt to service any tire and rim assembly without proper training. Always use a restraining device, such as a rim cage, when deflating or inflating tires.

Removal

1. Stabilize the crane for service as follows:
   a. Lower, detach, and secure load, as required.
   b. Fully retract and position the boom, as required.
   c. Engage the swing park brake or travel swing lock, as required.
   d. Properly shutdown the upper engine.
   e. Park the crane out of the way on a firm and level surface.
   f. Apply the park brake and/or properly block the tires.

Refer to Figure 1.

   g. Remove the caps (1) only from the tire and rim assembly (3) being removed.
   h. Loosen each of the lug nuts (4) one-half turn on the tire and rim assembly (3) being removed.
   i. Level the crane on fully extended outriggers.
   j. Properly shutdown the carrier engine.

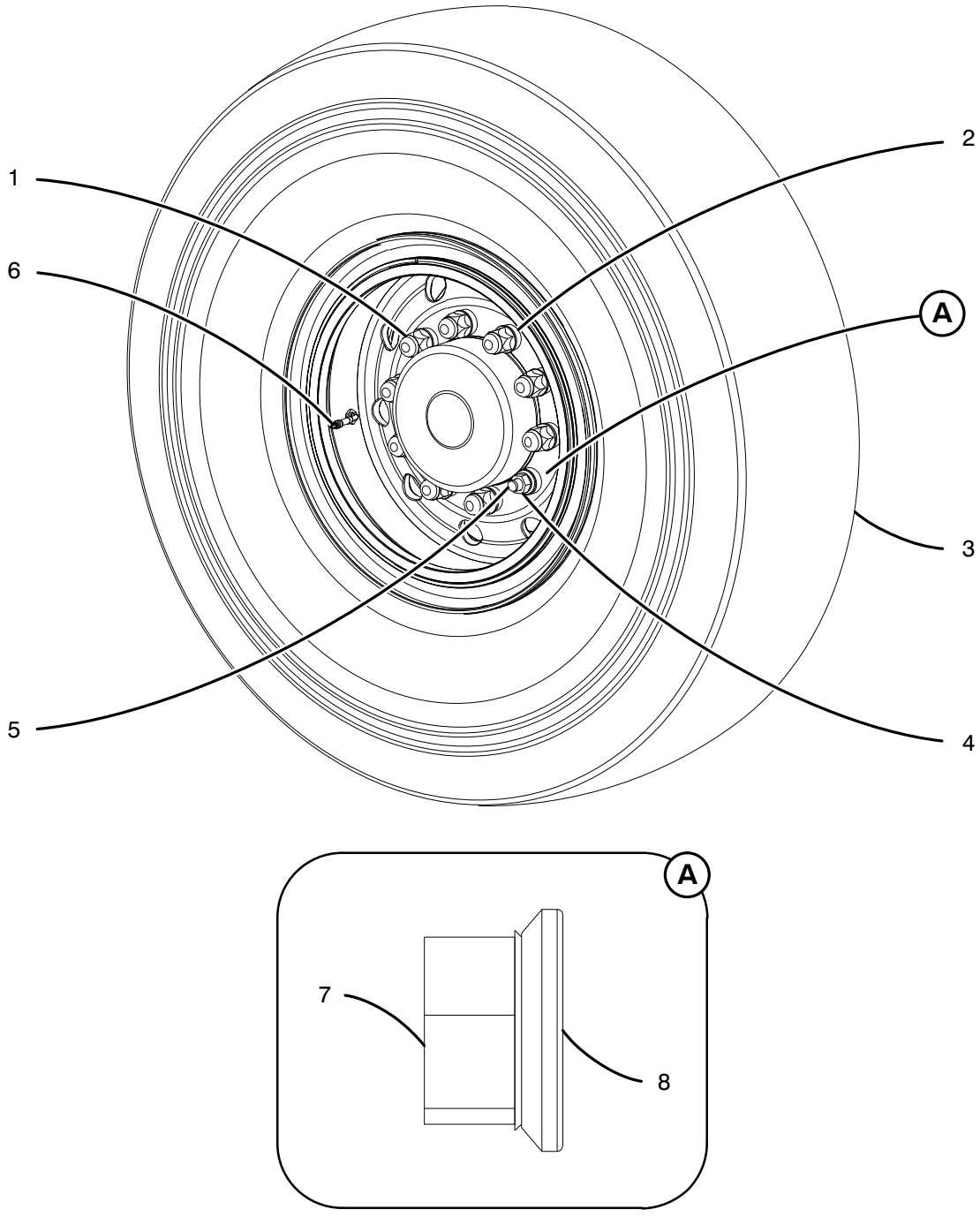
WARNING

A pressurized tire and rim assembly can explode and separate violently. This violent separation can cause serious injury or death. Always contain the tire and rim assembly in a restraining device, such as a rim cage, whenever deflating or inflating tires.

2. Position a restraining device, such as a rim cage, in front of the tire and rim assembly (3) being removed.
3. Remove the core from the valve stem (6). Allow all air to exhaust from the tire.

   Note: Refer to Table A for tire and rim assembly weights.

4. Use an adequate lifting device to support the tire and rim assembly (3).
5. Remove the lug nuts (4) and washers (2).
6. Carefully remove the tire and rim assembly (3) from the studs (5).



1. Cap
2. Washer
3. Tire And Rim Assembly
4. Lug Nut
5. Stud
6. Valve Stem
7. Hex
8. Flange

Figure 1
Tire And Rim Assembly

Rim Material/Tire Size	Tire Manufacturer	Weight
Steel Wheel 525 / 80 R25	Bridgestone	790 lb (*358kg*)
Steel Wheel 445 / 95 R25	Bridgestone	690 lb (*313kg*)
Aluminum Wheel 525 / 80 R25	Michelin	615 lb (*279kg*)
Aluminum Wheel 445 / 95 R25	Michelin	539 lb (*245kg*)
Aluminum Wheel 445 / 95 R25	Michelin	225 lb (*102kg*)
Aluminum Wheel 525 / 80 R25	Bridgestone	640 lb (*290kg*)
Aluminum Wheel 445 / 95 R25	Bridgestone	560 lb (*254kg*)

Table A
Tire and Rim Weights

Cleaning And Inspection

WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

1. All components should be thoroughly cleaned with an approved cleaning solvent, air dried, and carefully inspected.
2. All Loctite®, Permatex®, or other sealant residue should be removed from threads of hardware and the mounting surfaces of parts that are going to be reused. Prior to applying new thread locking compounds or sealants, clean threads and surfaces with Loctite® 7070 Cleaner to ensure best performance of products.
3. Inspect all parts for damage, wear, and corrosion; replace as required. Refer to "Tire And Rim, Inspection And Maintenance" in SM Keysheet Area 01—069.
4. In the event of severe defects, contact factory personnel for directions whether to repair or replace any major component.

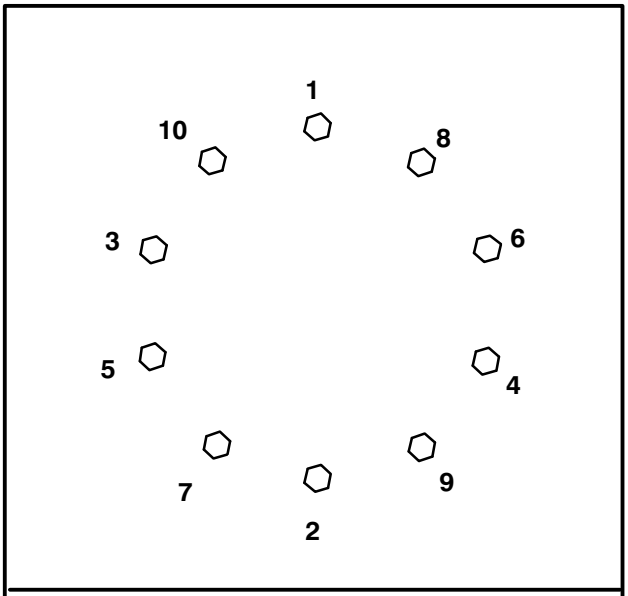


Figure 2
Lug Nut Torque Sequence

Installation

WARNING

Lubricants, sealants, joint and thread locking compounds, etc. can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all manufacturer's recommendations concerning these products.

Refer to Figure 1.

Note: Refer to Table A for tire and rim assembly weights.

1. Use an adequate lifting device to position the tire and rim assembly (3) on the studs (5). Ensure the valve stem (6) is facing out.
2. Install the washers (2) on the studs (5).
3. If installing previously used lug nuts (4), apply two drops of oil between the flange (8) and hex (7) of each lug nut (4). Refer to Figure 1, Detail A.
4. Install and hand tighten two opposing lug nuts (4).
5. Install all remaining lug nuts (4). Using a criss-cross pattern, tighten the lug nuts (4) to an initial torque of 225—250 ft lb (*305—339Nm*). Refer to Figure 2 for the proper torquing sequence.
6. Tighten the lug nuts (4) to a final torque of 450—500 ft lb (*610—678Nm*).
7. Install the core in the valve stem (6) on the tire and rim assembly (3).

WARNING

A pressurized tire and rim assembly can explode and separate violently. This violent separation can cause serious injury or death. Always contain the tire and rim assembly in a restraining device, such as a rim cage, whenever deflating or inflating tires.

8. Position a restraining device, such as a rim cage, in front of the tire and rim assembly (3).
9. Properly inflate the tire and rim assembly (3). Correct tire pressures are listed on the Gross Axle Rating Plate and/or in the Crane Rating Manual, as applicable. Refer to "Tire And Rim, Inspection And Maintenance" in SM Keysheet Area 01—069 for additional information.
10. Ensure proper wheel alignment. Refer to SM Keysheet Area 01—006 for correct alignment and adjustment procedures.
11. Complete the installation by road testing the crane. Drive the crane approximately 1 mile (*1.6km*), then retorque the lug nuts (4) to 450—500 ft lb (*610—678Nm*). Refer to Figure 2 for the proper torquing sequence. Install the caps (1). After approximately 50—100 miles (*80—160km*), retorque the lug nuts (4) again. Check the lug nut (4) torque every 50 hours of operation thereafter.

Tire & Rim, Inspection & Maintenance

(Aluminum Wheels)

⚠ WARNING

Servicing tire and rim assemblies can be extremely dangerous. Tire or rim failure can cause serious injury or death. Do not attempt to service any tire and rim assembly without proper training.

This document is general in nature and is not to be used in place of proper training. The intent is to provide a basic understanding and guideline for tire and rim inspection and maintenance for aluminum wheels. Because of the general nature of this document, information contained in specific removal and installation procedures in SM Keysheet Area 01–069 take precidence. Information for this document has been compiled from several different resources, including documents produced by Hutchinson Worldwide, Alcoa Wheel Products, and Bridgestone Firestone North American Tire.

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General Notes

- Safety is serious business. Do not attempt to service any tire and rim assembly without proper training.
- Safety and service information is readily available. Tire, rim, and service equipment manufacturers offer service manuals and other valuable training materials. Stay up to date on proper procedures, and keep current instructional materials on hand in the shop at all times. Study safety and service information and use it on the job.
- Proper equipment is important. Always have the recommended tools and equipment on hand and use them according to the manufacturer's instructions.
- Check tire inflation pressure daily when tires are cold. The tire inflation pressure for normal highway travel is listed on the Gross Axle Weight Rating plate. The tire inflation pressure for pick and carry operation is listed in the Crane Rating Manual.
- Tires can lose 1 psi (*6.9kPa*) of tire pressure per month under normal conditions. Additionally, tires can lose another 1 psi (*6.9kPa*) for every 10° F (*12° C*) temperature drop.
- Inspect tires daily for any debris that may be wedged in the tread. Check for nails, screws, glass, or any other foreign object that may penetrate the tire and permit air to leak from the tires. Check the side walls and treads for cuts, bulges, and other damage. Check for, and remove, any debris that may be wedged between the tires in dual tire applications. If internal damage to a tire is suspected, demount and check it thoroughly. Make all necessary repairs or replace as required.
- Inspect tires for adequate tread depth. Always replace tires when the wear indicator is showing or tire cord/fabric is exposed. Because tires may wear unevenly, it may be necessary to replace them before the wear indicator appears across the entire tread.
- It is not always possible to predict the useful life of a tire or rim. Tire and rim assemblies used in extreme conditions can wear at a more rapid pace. Older tires and rims, and those used in extreme conditions, should be checked more frequently.
- When replacing tires, all tires should be of the same manufacturer, size, type, load rating, and construction. Do not mix bias-belted and radial tires. Refer to the tire manufacturer and follow all recommendations regarding tire inspection and replacement.

- Always use a restraining device, such as a rim cage, whenever deflating or inflating tires, and stand clear.
- Always remove the valve core to exhaust all air pressure from the tire before demounting it from the rim or removing the lug nuts.
- After deflating a tire, run a piece of wire through the valve stem to ensure it is not clogged and that the tire is completely deflated. Ice may form as the air leaves the tire, or foreign material may clog the stem.
- Do not inflate a tire that has been run flat or extremely under inflated. Demount the tire, and inspect it and the rim for damage.
- When inflating a tire, always use a clip-on air chuck or threaded straight chuck and a remote valve with pressure gauge. Ensure the air hose is long enough to permit the person inflating the tire to stand clear of the restraining device.
- Inflate tires, 10 psi (*68kPa*) at a time, checking for proper tire to rim fit and assembly during inflation. Once it is determined that the tire and rim are properly assembled, inflate the tire to fully seat the tire bead.
- The crane should not be road driven with the tires inflated to the pick and carry pressures. Travel on tires inflated to pick and carry pressures is limited. Refer to the Crane Rating Manual for complete pick and carry restrictions.
- Correct installation of tire and rim assemblies is critical. Refer to SM Keysheet Area 01–069 for correct removal and installation procedures.
- Lug nut torque is one of the most important operations in tire and rim maintenance. Refer to Table A for recommended torque values for typical lug nuts. If a specific torque value is listed in the tire and rim removal and installation procedure, always adhere to that value.
- When tightening lug nuts, always follow a criss-cross pattern. Some common lug nut torque sequences are shown in Figure 7.
- Lug nut torque values should be checked every 10 hours, for the first 50 hours of operation, after a tire and rim assembly is installed. Tighten any lug nuts, as required, to the recommended torque value. Check the lug nut torque every 50 hours of operation thereafter.
- Rims should not be altered. Welding, brazing, or any other heat application in an attempt to repair or straighten a rim is not allowed. Rims should not be painted or otherwise coated in any way that may interfere with the mounting surfaces. Rims that show any signs of alteration should be immediately removed from service and scrapped.
- It is not often that a properly maintained tire will "blow out" during normal driving. More commonly, if inflation pressure is lost, it will be gradual. However, if a blowout or sudden tire failure does occur, the following information should be helpful:
  - When the failure occurs, you may hear a loud noise, feel a vibration, and/or the crane may pull toward the side of the failed tire.
  - Do not abruptly brake or turn.
  - Slowly remove your foot from the accelerator, hold the steering wheel firmly, and steer to maintain your lane position.
  - Once the crane has slowed, apply the brakes gently.
  - Gradually pull over to the shoulder, as far off the road as safely possible, and come to a complete stop.

Inspection

Heat Damage

WARNING

Excessive heat from fire, brake malfunction, wheel bearing failure, tire failure, or other sources may weaken the metal and cause the tire and rim assembly to separate explosively. An exploding tire and rim assembly can cause serious injury or death. Immediately and permanently remove from service any tire and rim assembly that has been exposed to excessive heat.

Inspect for exposure to excessive heat. A tire or rim that has been subjected to excessive heat may appear charred or burned.

A rim that has been exposed to excessive heat may appear to be in good condition if it has been cleaned. Do not use any tire or rim that has been overheated regardless of appearance. Even if a rim does not appear to be obviously burned, inspect labels, tire bead, and brake drum for evidence of charring, melting, blistering, or burning.

A rim may discolor from excessive heat. It can appear a dull grayish color and will not polish to a bright finish as a typical rim would.

Any rim run with a flat tire longer than the time necessary to immediately pull off the road should be checked for excessive heat damage.

A blistered, charred, blackened, or cracked-looking OEM decal may indicate that the rim has been exposed to excessive heat.

Inspect all axle end components for signs of exposure to excessive heat. Pay particular attention to brake drums (or discs) and studs. If these components show signs of over-heating, the tire & rim assembly should be replaced.

Dimension Checks

⚠ WARNING

Rims that have been subjected to high pressure tire and rim separation or excessive heat damage may no longer have sufficient dimension and contour to retain the tire bead while under pressure. An exploding tire and rim assembly can cause serious injury or death. Immediately and permanently remove from service any tire and rim assembly that has been exposed to high pressure separation or excessive heat.

⚠ WARNING

A tire and rim assembly that has been run flat or has other physical damage may no longer have sufficient dimension and contour to retain the tire bead while under pressure. Rims that lack proper dimension and contour can lead to explosive separation of the tire and rim, causing serious injury or death. Any tire and rim assembly that has been in service must be inspected prior to mounting. Follow dimension check procedures described in this section during each inspection.

Open Side Circumference Check

Ball Tape Method (Preferred, Most Accurate)

The ball tape method is the preferred, and most accurate, method for checking circumference.

Measure the circumference of the bead seat on the open side with a ball tape. The circumference of the bead seat on the open side of the rim should be checked at each tire change. The open side is the side opposite the disc face. In the case of center flange wide base rims, or rims with insets less than 3 in (*7.62cm*), both rim flanges should be checked. All rims should be inspected prior to mounting. If the circumference of the bead seat does not match the required dimension, immediately and permanently remove the rim from service.

Carpenter Square Method (For Dual Or Disc Faced Rims Only)

Check all rims at each tire change for proper contour of the open side of the rim. Place the long leg of a carpenters square across the center of the disc side of the rim. Extend the short leg across both rim flanges. Repeat this process at four equidistant points around the rim. The short leg should touch both rim flanges at each point. If a distance greater than 0.030 in (*0.76mm*) feeler gauge appears between the short leg and the rim flange, the rim should be removed from service and scrapped.

Rolling Method (Least Accurate)

If a ball tape or carpenters square is unavailable, roll the unmounted rim, without a tire, a minimum of 10 ft (*3.05m*) over a smooth, flat, level, clean surface such as asphalt or concrete pavement. Any deviation from rolling in a straight line is an indication of a potential lack of proper dimension and contour, in which case, remove the rim from service until it can be properly checked with a ball tape or carpenter square.

Tire wear or ride problem

If experiencing tire wear or vibrations, it may be helpful to check radial run out:

- Remove the tire and rim assembly from the crane. Refer to SM Keysheet Area 01–069 for the correct procedure.
- Demount the tire from the rim. Refer to “Mounting/Demounting Tubeless Tires” in this document.
- Install the rim on the crane without the tire. Follow proper installation procedures to assure the rim is well centered on the hub. Refer to SM Keysheet Area 01–069 for the correct procedure.

  Note: Aluminum rims should be tested for radial run out only at the bead seat surface.

- Place dial indicators to trace the bead seats of the rim. Refer to Figure 1.
- Rotate the rim noting the amount of variation shown on the dial indicators. A total indicator reading of 0.040 in (*1.02mm*) or less is acceptable. A reading outside these parameters requires the rim be removed from service and scrapped.
- If the rim is acceptable, mount the tire on the rim. Refer to “Mounting/Demounting Tubeless Tires” in this document.
- Install the tire and rim assembly on the crane. Refer to SM Keysheet Area 01–069 for the correct procedure.

Figure 1
Dial Indicator Check For Radial Run Out

Tire wear and vibrations can also be caused by improperly seated tires. Inspect the tire for proper seating on the rim. If the tire beads are not seated properly:

- Remove the tire and rim assembly from the crane. Refer to SM Keysheet Area 01–069 for the correct procedure.
- Ensure the tire has been sufficiently deflated to break the bead seats.
- Adequately lubricate the bead seats, and properly seat the tire beads.
- Install the tire and rim assembly on the crane. Refer to SM Keysheet Area 01–069 for the correct procedure.
- Inflate the tire to the proper tire inflation pressure. Refer to the Gross Axle Weight Rating plate and/or the Crane Rating Manual for correct pressure.

Cracked Rims

WARNING

Cracked or damaged rims may fail or come off the crane. Rims that fail or come off the crane while it is moving can cause serious injury or death. Immediately and permanently remove cracked or damaged rims from service.

Visually inspect rims for cracks or damage at regular intervals. Immediately remove from service any rim with known or suspected damage.

Inspect the areas around the hand holes, stud holes, valve stem, and bead seat for cracks. Cracks from stud hole to hand hole are usually caused by improper torquing, excessive loading, or insufficient mounting flange support by the hub or brake drum. Cracks from stud hole to stud hole usually result from an undersized diameter of rim support surface, support surface is not flat, incorrect attachment parts, and insufficient torque.

Check the entire rim area for nicks, gouges, and cracks. Loss of air may be caused by cracks in areas around the valve stem hole.

Corrosion

WARNING

The use of liquid tire balancers or sealants with aluminum rims may cause extremely rapid corrosion of the rim surface. Rims with major corrosion are unsuitable for use. Remove from service any rim that shows signs of excess corrosion.

Certain environments can lead to corrosion. Some of the more common corrosives are: salt, magnesium chloride and calcium chloride compounds used for snow removal, and highly alkaline materials. If the air used to fill tubeless tires, or the tire itself, is not dry, the areas of the rim under the tire can corrode rapidly.

Bead seat and valve stem corrosion often are caused by entrapped moisture. Mild corrosion should be removed thoroughly with a wire brush and the rim protected with a non-water-based tire lubricant. Remove any rim with major corrosion from service.