HTC- 8640/HTC- 8640HL Series - Master Keysheet
(F8 Prefix On Crane Serial Number)

AREA 00 GENERAL INFORMATION

AREA 01 RUBBER TIRE LOWER

SM01- 039- 005.00 Hydraulic Reservoir Filter Assembly, Recondition
SM01- 039- 008.00 Hydraulic Reservoir Filter Assembly, R & I
SM01- 043- 001.00 Solenoid Valves, General Recondition
SM01- 043- 003.00 Outrigger Solenoid Valve Stack, Recondition (Function)
SM01- 043- 004.00 Four Way Solenoid Valve, Recondition (Outrigger Directional/Remote Steering)
SM01- 043- 035.00 Four Way Directional Solenoid Valve, Recondition
SM01- 043- 036.00 Outrigger Directional Control Valve, R & I
SM01- 043- 045.00 Outrigger Directional Control Valve, R & I
SM01- 043- 046.00 Outrigger Function Control Valve, R & I
SM01- 043- 047.00 Fifth Outrigger Directional Control Valve, R & I
SM01- 044- 009.00 Jack Cylinder Lock Valve, Recondition (Bumper Outrigger)
SM01- 044- 018.00 Outrigger Lock Valve Cartridge, R & I
SM01- 044- 019.00 Fifth Outrigger Lock Valve, R & I
SM01- 044- 023.00 Outrigger Lock Valve Cartridge, R & I (5^{th} O.R. Integral)
SM01- 044- 027.00 Outrigger Lock Valve Cartridge, R & I And Recon.
SM01- 045- 014.00 Outrigger Beam Cylinder, Recondition (Gen 1 - Iowa Ind Hyd or Hyd Tech)
SM01- 045- 043.00 Outrigger Beam & Beam Cylinder, R & I
SM01- 045- 050.00 Outrigger Beam Cylinder, Recon.
SM01- 045- 054.00 Outrigger Beam Cylinder, Recondition (Gen 2 - Texas Hydraulics)
SM01- 045- 056.00 Outrigger Beam And Beam Cylinder, R & I
SM01- 046- 034.00 Jack Cylinder, Recondition (Main & Fifth Outrigger)
SM01- 046- 035.00 Jack Cylinder, R & I
SM01- 046- 036.00 Fifth Outrigger Jack Cylinder, R & I
SM01- 046- 044.00 Jack Cylinder, R & I
SM01- 046- 045.00 5^{th} Outrigger Jack Cylinder, R & I
SM01- 047- 011.00 Relief Valve, Recondition
SM01- 047- 029.00 Manifold Block Illustrated
SM01- 047- 030.00 Manifold Block Illustrated
SM01- 047- 034.00 Relief Valve, Recondition
SM01- 047- 035.00 Pick & Carry Manifold Block, Illustrated
SM01- 047- 038.00 Pick & Carry Manifold Block, Illustrated
SM01- 047- 048.00 P & C Manifold Block, Illustrated
SM01- 048- 023.00 Rotating Joint, R & I (Rectangular Collector Ring Cover)
SM01- 048- 026.00 Rotating Joint, Recondition
SM01- 048- 027.00 Rotating Joint, R & I (Round Collector Ring Cover)
SM01- 048- 037.00 Rotating Joint, R & I
SM01- 048- 038.00 Rotating Joint, Recon.
SM01- 050- 007.00 Transmission Oil Cooler, R & I
SM01- 050- 008.00 Transmission Oil Bypass Valve, R & I
SM01- 050- 009.00 Transmission Oil Bypass Valve, Recon.
SM01- 050- 012.00 Oil Cooler Fan Motor, R & I (Hydraulic Oil Cooler)
SM01- 050- 013.00 Hydraulic Oil Cooler, R & I
SM01- 053- 001.00 Remote Steer Motor, R & I
SM01- 053- 002.00 Remote Steer Motor, Recondition
SM01- 053- 003.00 Remote Steer Motor, R & I
SM01- 066- 024.00 Battery, R & I
SM01- 069- 009.00 Tires & Rims, R & I
SM01- 069- 016.00 Tire & Rim Inspection & Maintenance
SM01- 071- 004.00 Repair Of Components Made Of Fibrous Composite Materials
SM01- 071- 007.00 Engine Housing, R & I
SM01- 071- 008.00 Outrigger Lock Valve Cartridge, R & I
SM01- 071- 013.00 Engine Housing, R & I
SM01- 073- 001.00 Electronic Gauge, Troubleshooting (Interlink)
SM01- 073- 002.00 Electronic Gauges, Troubleshooting
SM01- 075- 040.00 Radiator, R & I
SM01- 075- 041.00 Alternator, R & I
SM01- 075- 042.00 Starter, R & I
SM01- 075- 043.00 Radiator Fan Clutch, R & I

Radiator Fan Clutch, Troubleshooting
SM01- 075- 044.00 Radiator Fan Clutch, Recondition
SM01- 076- 025.00 Collector Ring, R & I (Rectangular Cover)
SM01- 076- 028.00 Collector Ring, Recondition (Rectangular Cover)
SM01- 076- 030.00 Collector Ring, Recondition (Round Cover)
SM01- 076- 039.00 Collector Ring, R & I (Round Cover)
SM01- 076- 042.00 Collector Ring, R & I
SM01- 076- 043.00 Collector Ring, Recon.
SM01- 076- 044.00 Collector Ring, Recon.
SM01- 076- 052.00 Collector Ring, Recon (With Air Swivel)
SM01- 076- 053.00 Collector Ring, Recon. (38 Rings W/Air Swivel)
SM01- 076- 056.00 Collector Ring, Recon. (43 Rings W/Air Swivel)
SM01- 076- 059.00 Collector Ring, Recon. (32 Rings)
SM01- 076- 063.00 Collector Ring, Recon. (34 Rings)
SM01- 076- 073.00 Collector Ring, R & I
SM01- 077- 008.00 Starter, R & I (CAT C10/C11)
SM01- 077- 009.00 Alternator, R & I (CAT C10)
SM01- 077- 010.00 Radiator, R & I
SM01- 077- 011.00 Alternator, R & I (CAT C11)
SM01- 077- 012.00 Radiator, R & I
SM01- 077- 023.00 Alternator, R & I
SM01- 077- 036.00 Radiator & Changed Air Cooler, R & I (G2)
SM01- 079- 013.00 Lower Hydraulic Components, R & I
SM01- 079- 035.00 Lower Hydraulic Components, R & I
SM01- 079- 036.00 Lower Hydraulic Components, R & I
SM01- 079- 049.00 Lower Hydraulic Components, R & I (Suction, Pressure, & Return Lines)
SM01- 079- 080.00 Lower Hydraulic Components, R & I (Suction, Pressure, & Return Lines)
SM01- 080- 008.00 Pump Disconnect, Recondition
SM01- 080- 042.00 Pump Disconnect, R & I
SM01- 080- 043.00 Main Hydraulic Pump, R & I
SM01- 081- 014.00 Hydraulic Pump, Recondition (Multi Section Commercial- Intertech)
SM01- 081- 036.00 Radiator Fan Motor, Recon.
SM01- 081- 037.00 Hydraulic Pump, Recon. (Multiple Section Aluminum)
SM01- 081- 038.00 Hydraulic Pump, R & I (Tandem 4 Section)
SM01- 081- 039.00 Hydraulic Pump, R & I (Pick & Carry 2 Section)
SM01- 081- 040.00 Hydraulic Pump, R & I (Tandem 4 Section)
SM01- 081- 041.00 Hydraulic Pump, R & I (Pick & Carry 2 Section)
SM01- 081- 042.00 Radiator Fan Motor, R & I
SM01- 081- 043.00 Radiator Fan Motor, R & I
SM01- 081- 046.00 Hydraulic Gear Pump/Motor, Recon. - Aluminum (Radiator Fan Motor)

AREA 03 UPPER REVOLVING FRAME

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SM03- 001- 067.00 Upper Revolving Frame & Turntable Bearing, R & I
SM03- 001- 072.00 Upper Revolving Frame & Turntable Bearting, R & I
SM03- 003- 013.00 Main Counterweight, R & I
SM03- 003- 016.00 Fixed Counterweight, R & I
SM03- 010- 025.00 Counterweight Removal Cylinder, Recon.
SM03- 010- 037.00 Counterweight Removal Cylinder, R & I
SM03- 010- 038.00 Counterweight Removal Control Valve, R & I

AREA 04 VERTICAL SHAFTS

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SM04- 005- 022.00 Swing Brake Assembly, Recondition
SM04- 010- 026.00 Swing Reduction Unit, R & I
SM04- 010- 027.00 Swing Speed Reducer, Recondition
SM04- 010- 032.00 Swing Reduction Unit & Brake, R & I
SM04- 010- 033.00 Swing Reduction Unit W/Brake, Recon.

AREA 05 HORIZONTAL SHAFTS

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SM05- 006- 018.00 Winch, R & I (Generation 1 - w/Remote Drum Rotation Indicator)
SM05- 006- 019.00 Winch, Recondition
SM05- 006- 020.00 Winch Troubleshooting
SM05- 006- 031.00 Winch, R & I
SM05- 006- 032.00 Winch, R & I (Generation 2 - w/Drum Rotation Indicator Integral to Winch Motor)
SM05- 006- 039.00 Winch Assy, R & I
SM05- 010- 006.00 Drum Rotation Indicator, R & I And Troubleshooting
SM05- 018- 001.00 Winch Roller, Recondition (Steel Roller)
SM05- 018- 004.00 Winch Roller, Recondition (Nylon Roller)

AREA 06 UPPER ENGINE

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SM06- 008- 009.00 Throttle Treadle Assembly, R & I
SM06- 008- 010.00 Throttle Treadle Assembly, Recondition
SM06- 025- 004.00 Diesel Cab Heater, R & I (Generation 1)
SM06- 025- 005.00 Diesel Cab Heater, Recondition & Troubleshooting (Generation 1)
SM06- 025- 007.00 Hydraulic Cab Heater, R & I
SM06- 025- 008.00 Hydraulic Cab Heater, Recondition
SM06- 025- 009.00 Hydraulic Heater - Troubleshooting
SM06- 025- 017.00 Diesel Cab Heater, R & I (Generation 2)
SM06- 025- 018.00 Diesel Cab Heater, Recondition & Troubleshooting (Generation 2)
SM06- 025- 019.00 Operator's Cab Water Heater, R & I
SM06- 025- 022.00 A/C Coil And Heater Core, Illustrated
SM06- 025- 023.00 Upper Cab A/C Coil & Heater Core, R & I
SM06- 025- 024.00 Upper Cab Heater Water Swivel, R & I & Recon.
SM06- 025- 026.00 Diesel Coolant Heater, Troubleshooting & Recon.
SM06- 025- 029.00 Diesel Coolant Heater, R & I
SM06- 047- 000.00 Electrical System Wire Identification Code
SM06- 047- 105.00 Electrical System Schematic Diagram (Generation 1)
SM06- 047- 106.00 Electrical System Schematic Diagram (Generation 2)
SM06- 047- 109.00 Electrical System Schematic Diagram (Generation 3)

AREA 07 HYDRAULIC POWER SUPPLY

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SM07- 000- 000.00 Hydraulic Schematic Diagram Symbol Legend
SM07- 000- 127.00 Hydraulic System Schematic Diagram
SM07- 001- 024.00 Pilot Control Accumulator, R & I
SM07- 001- 027.00 Pilot Control Accumulator, R & I
SM07- 002- 032.00 Relief Valve, Recon. (Upper A/C)
SM07- 003- 006.00 Solenoid Valves, General Recondition
SM07- 004- 007.00 Upper Hydraulic Components, R & I
SM07- 004- 009.00 Upper Hydraulic Components, R & I
SM07- 004- 042.00 Upper Hydraulic Components, R & I (Upper Frame)
SM07- 004- 043.00 Upper Hydraulic Components, R & I (Two Winch Plumbing)
SM07- 004- 044.00 Upper Hydraulic Components, R & I (Single Winch Plumbing)
SM07- 004- 047.00 Upper Hydraulic Components, R & I (Single Winch Plumbing With Linde Motor)
SM07- 004- 048.00 Upper Hydraulic Components, R & I (Two Winch Plumbing With Linde Motor)
SM07- 004- 079.00 Upper Hydraulic Components, R & I (Cab Floor)
SM07- 005- 052.00 Hydraulic Gear Pump Assembly, Recondition (Hydraulic Heater)
SM07- 005- 061.00 Hydraulic Heater Gear Pump, R & I (Upper w/o A/C)
SM07- 005- 062.00 Hydraulic Heater Gear Pump, R & I (Upper w/Air Conditioning)
SM07- 006- 034.00 Swing Motor, Recondition
SM07- 006- 050.00 Winch Motor, R & I (Generation 1 - w/Remote Drum Rotation Indicator)
SM07- 006- 056.00 Hydraulic Motor, Recondition - Winch (Rexroth 63 Series)
SM07- 006- 059.00 Hydraulic Motor, Recondition (Hydraulic Heater)
SM07- 006- 075.00 Swing Motor & Brake, R & I

SM17- 002- 027.00 Boom Telescope Counterbalance Valve, R & I
SM17- 003- 013.00 Boom Hoist Cylinder, Recondition
SM17- 003- 014.00 Boom Hoist Counterbalance Valve, R & I (Block Mounted)
SM17- 003- 015.00 Boom Hoist Counterbalance Valve, Recondition (Block Mounted)
SM17- 003- 021.00 Boom Hoist Cylinder, R & I
SM17- 003- 034.00 Boom Hoist Cylinder, R & I (w/Integral Counterbalance Valve)
SM17- 003- 035.00 Boom Hoist Counterbalance Valves, R & I (Case Mounted)
SM17- 009- 006.00 Four Sheave Head Machinery, Recondition

AREA 18 SPECIAL ATTACHMENTS

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SM18- 000- 001.00 Capscrew Torques
SM18- 000- 002.00 Bearing, Gear, Shaft, & Housing Inspection
SM18- 000- 003.00 Crane System Schematics
SM18- 007- 003.00 Reeling Drum, R & I
SM18- 007- 004.00 Reeling Drum, Recondition
SM18- 018- 001.00 Air Conditioning Service Precautions
SM18- 018- 002.00 Air Conditioning Hydraulic Drive Motor, R & I (Upper)
SM18- 018- 003.00 Air Conditioning Hydraulic Drive Motor, Recondition (Upper)
SM18- 018- 004.00 Air Conditioning Compressor, Recondition (Carrier & Upper)
SM18- 018- 006.00 Air Conditioning Compressor, R & I (Upper)
SM18- 018- 007.00 Air Conditioning Compressor, R & I (Carrier)
SM18- 018- 012.00 Air Conditioning Compressor, R & I (Carrier)
SM18- 018- 013.00 Air Conditioning Compressor, R & I (Upper)
SM18- 018- 014.00 Air Conditioning Hydraulic Drive Motor, R & I (Upper)
SM18- 018- 015.00 Air Conditioning Hydraulic Drive Motor, Recon.
SM18- 018- 016.00 Air Conditioning Compressor, R & I (Carrier CAT C- 11)
SM18- 018- 017.00 Air Conditioning Compressor, R & I (Carrier)

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

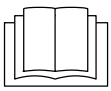
An operating procedure, practice, etc. which, if not correctly followed, may result in personal injury.

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.

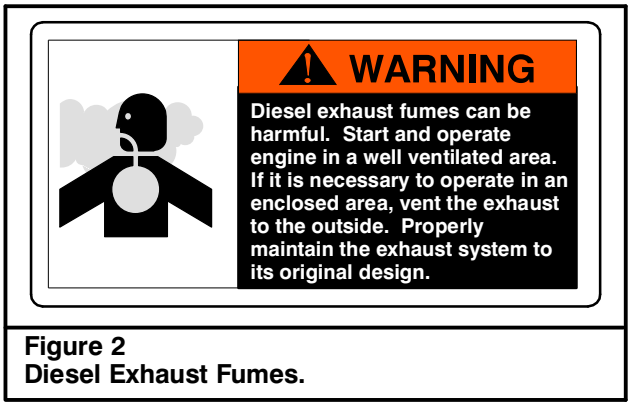


Figure 2
Diesel Exhaust Fumes.

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.

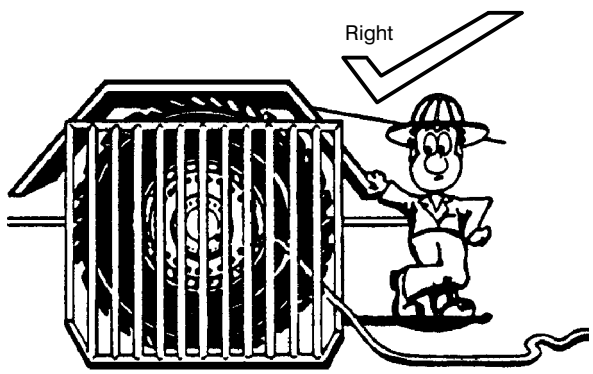


Figure 4
Use a guard when inflating tires.

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.

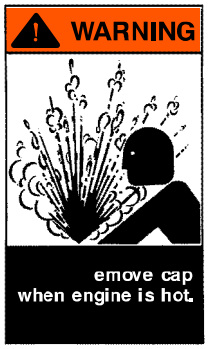


Figure 5
Allow engine to cool before removing the radiator cap.

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.

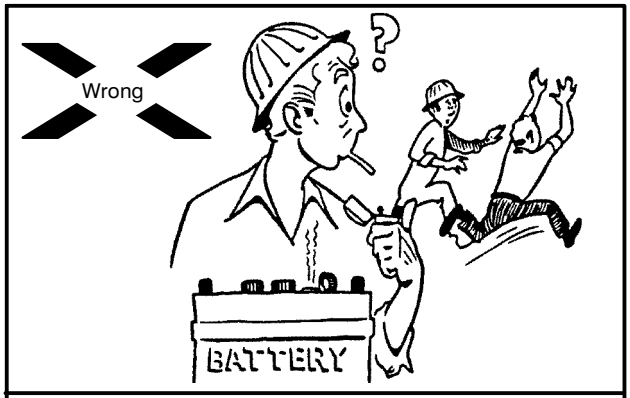


Figure 6
Do not use an open flame near the battery.

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

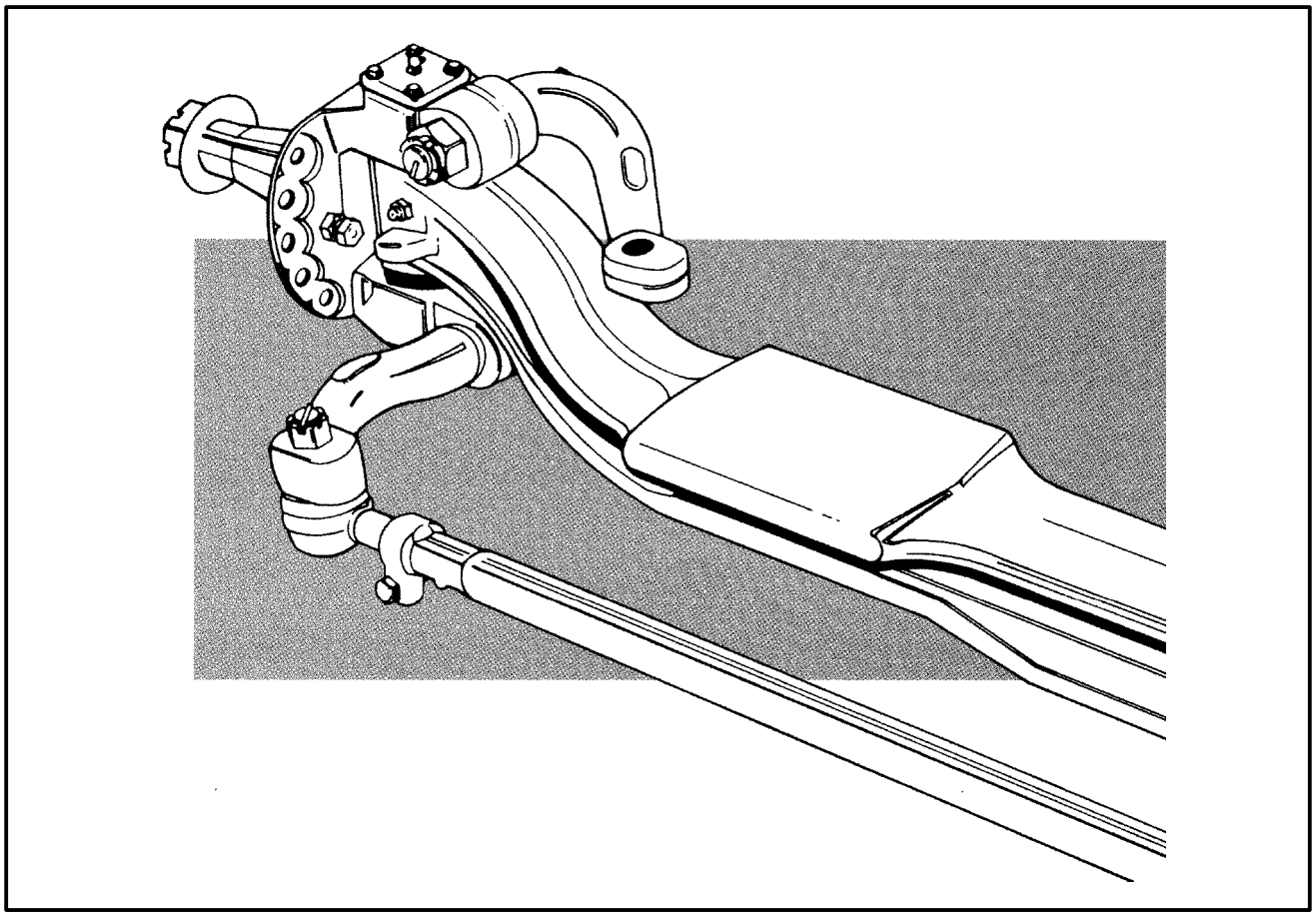
1. Loosely assemble parts to ensure all parts are in place and fasteners started before beginning torquing procedure. Always use a cross torquing sequence to ensure even and uniform installation.

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.



Front Steer Axle, Recondition

This procedure covers the recondition of the front steer axle. For removal and installation procedures, see SM Keysheet Area 1–4.

The following pages are taken directly from Dana® Spicer® Service Manual AXSM–0037 dated March 1992. Axle models 12F3/F4, 13F3/F5, 18F3, 20F4, 22T2/T5, and 24T2/T5 are covered by this information. Pay particular attention to Section 1 of this procedure to correctly identify the specific axle being serviced. Proper identification of the axle is crucial to obtain the correct information to follow from the charted specifications included in this procedure.

Based on the specific application of this axle, Link–Belt literature will supersede any discrepancies in operation, lubrication, maintenance, or service, implied by the axle manufacturer. Any concerns regarding such inconsistencies should be reviewed with a Link–Belt distributor.

If parts are hard to disassemble and assemble, do not use a hammer unless it has a soft face, do not force parts together, they must be free to turn and not bind.

It is a good practice when disassembling complex 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.

⚠ 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.

Thoroughly clean the exterior surface of the axle before beginning the disassembly process.