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Manual # 99904591

Material Handling Crane Operation & Safety

Revision Date 20120104

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Contents

Revisions iv

Introduction 5

Crane Component Identification 7
Appropriate Loader Applications 8

The Operator 11

Operator Qualifications 11
Operator Physical Condition 12
Operator Conduct 12
Knowledge & Abilities Required 13

Crane Operation 15

Operator Responsibilities 15
Daily Safety Inspections 16
Crane Transport 16
Work Site Planning 17
Material Handling Crane Controls 19
Engaging the PTO 19
Stabilizers 20
Hydraulic Swing-up Stabilizer Legs Controlled by Slewing Cylinder Piston Rod 22
Hydraulic Swing-up Stabilizer Legs Controlled by Connecting Rod 25
Unfolding the Loader 27
Unfolding a Z-Loader or Grab-Loader 28
Electrical Hazards 29
Safely Operating the Crane 31
Crane Capacity 35
Stowing the Loader 36
Stowing a Z-Loader or Grab-Loader without Top Seat Controls 37
Stowing a Z-Loader or Grab-Loader with Top Seat Controls 38
Direction Terminology 39

Crane Decals 41

Danger Decals 41
Decal Placement - Material Handling Cranes 42
Danger Decal Figures 43
Instructional Decals 46

Hand Signals 49

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Component Installation 51

Winch Safety 51
Winch Mount - Outer Boom 52
Winch Mount - Fly-Jib 53
Winch Mount - Inner Boom 55
Winch Installation on Boom System 57
Fly-Jib 59
Fly-Jib Safety 61

Wire Rope & Hooks 63

Wire Rope Inspection 63
Wire Rope Lubrication 64
Wire Rope Inspection & Replacement 64
Wire Rope Slings 66
Basic Hitches 67
Sling Loading 68
Hooks 68
Methods of Hook Inspection 69
Hook Testing 71

Capacity 73

Crane Capacity & Stability 73
Using the Capacity Placard 75
Crane Stability 77
Stability Chart - Crane Mounted Behind Cab 81
Stability Chart -Rear Mounted Crane 82

Maintenance 83

Crane Maintenance Precautions 83
Daily Maintenance 84
Recommended Oil & Grease 85
Grease Points 86
Greasing - Central Grease Point on Loader Base 87
Greasing Push Rods at the Inner and Outer Boom Cylinders 89
Greasing Boom System Sliding Surfaces 90
Bleeding Air from Cylinders 90
Repair 90
Chemical Safety 91

Crane Design 93

Loader Safety Factors 93
Hydraulic System Design 94
Load Moment Limitation 95
Heavy Duty Lifting - HDL 96
Hoses and Hydraulic Pipes 96

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General Reference 97

Inspection Checklist....97
Deficiency / Recommendation / Corrective Action Report....102
Turntable Bearing Thread Tightening Sequence....104
Turntable Bearing Inspection....105
Turntable Bearing Tilt Test....105
Thread Torque Charts....107

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Revisions

DATE	LOCATION	DESCRIPTION
20120104	THROUGHOUT	ECN 11628 - UPDATED STABILIZER WORDING, ELECTROCUTION HAZARD INFORMATION.

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CHAPTER 1

Introduction

This manual is designed for the loader operator. It is a supplement to the Instruction Manual, Technical Specifications, and Parts Manuals for each loader. It describes how to operate your loader in the safest possible manner, with examples of hazards and methods to avoid dangerous situations. It does not replace any government regulations, safety codes, or insurance carrier requirements. Operators and maintenance and test personnel must read and understand all safety procedures applicable to the equipment in use.

WARNING

READ YOUR MANUAL!! FAILURE TO READ, UNDERSTAND AND FOLLOW ANY SAFETY PROCEDURES APPLICABLE TO YOUR EQUIPMENT MAY RESULT IN EQUIPMENT DAMAGE, SERIOUS INJURY, OR DEATH.

Use caution and common sense while operating and maintaining the crane, and follow all safety procedures and regulations. Treat this equipment with respect and service it regularly. In addition to reading the manual, become familiar with government regulations, hazards, and the specific operation of your crane. Refer to ANSI/ASME B30.22, the standard for Articulating Boom Cranes, for more information on crane design and test criteria. (You may obtain this publication from ASME at *www.asme.org*.) Crane operators must also be familiar with OSHA 29CFR, Subpart N, Article 1926.550 and CAL-OSHA Title 8, Article 93 (California).

MODIFICATIONS

Modifications to your crane must be performed with IMT approved accessories, parts and optional equipment. If in doubt about the safety, compatibility, or appropriateness of any modifications, contact IMT prior to making those modifications. DO NOT alter or modify any safety device! All safety devices must be inspected, tested and maintained in proper working condition.

Note that decals regarding crane safety and operation are considered safety equipment. They must be maintained just as any other safety device. Decals must be kept clean and legible to the operator, operational personnel, and bystanders as specified in the decal section of this manual. DO NOT remove, disable, or disregard any safety device attached to your crane.

WARRANTY

Warranty of this unit will be void on any part of the unit subjected to misuse due to overloading, abuse, lack of maintenance and unauthorized modifications. No warranty - verbal, written or implied - other than the official, published IMT new machinery and equipment warranty will be valid with this unit.

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NOTICE TO THE OWNER / USER

If your equipment is involved in a property damage accident, contact your IMT distributor immediately and provide them with the details of the accident and the serial number of the equipment. If an accident involves personal injury, immediately notify your distributor and IMT's Technical Support at:

IOWA MOLD TOOLING CO., INC.
500 HWY 18 WEST
GARNER, IA 50438

641 - 923 - 3711

MANUAL STRUCTURE

Throughout this manual, three means are used to draw the attention of personnel. They are NOTEs, CAUTIONs and WARNINGs and are defined as follows:

NOTE

A NOTE is used to either convey additional information or to provide further emphasis for a previous point.

CAUTION

A CAUTION is used when there is the very strong possibility of damage to the equipment or premature equipment failure.

WARNING

A WARNING is used when there is the potential for personal injury or death.

This manual is divided into specific sections in order to keep similar subject matter under one heading. In some cases, a subject may be presented in more than one section of the manual. This redundancy is necessary in order to provide comprehensive information.

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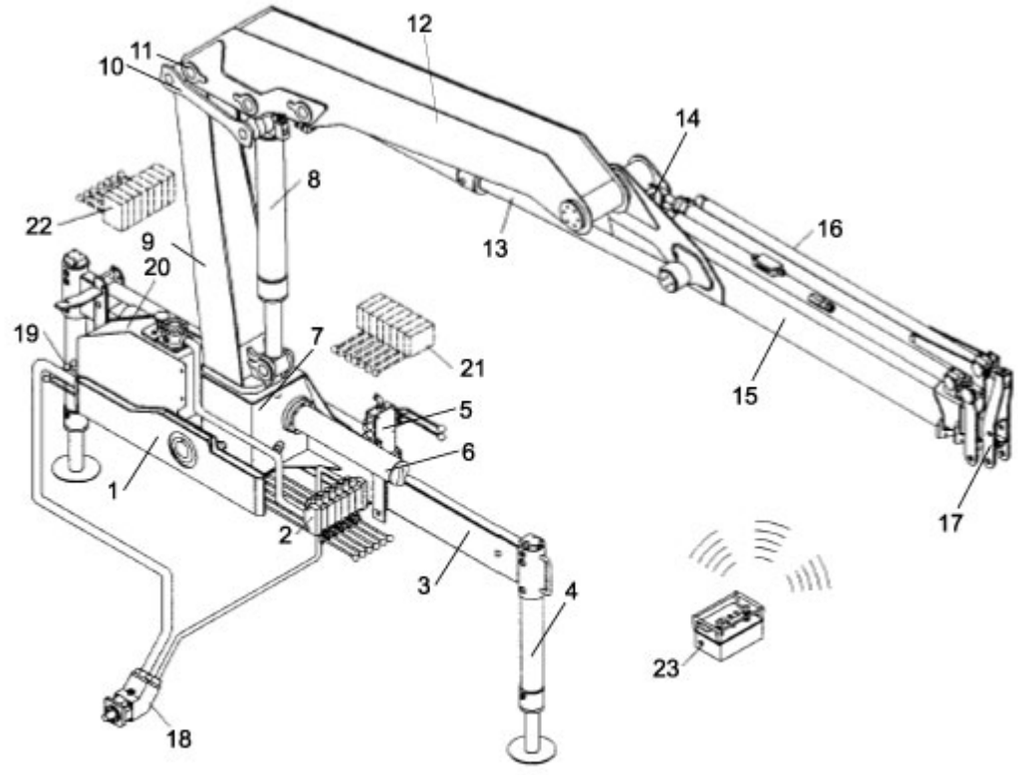
Crane Component Identification

Components of your crane have commonly understood names. By knowing the component names, you can communicate crane problems more clearly to maintenance and technical support staff.



LOADER SYSTEM COMPONENTS			
ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	SUSPENSION BRIDGE	13	OUTER CYLINDER
2	HYDRAULIC CONTROL VALVE	14	OUTER BOOM PIN
3	STABILIZER ARM	15	OUTER BOOM (JIB)
4	STABILIZERS	16	EXTENSION CYLINDER
5	CONTROL VALVE, STABILIZERS	17	EXTENSION BOOM
6	ROTATION SYSTEM CYLINDER	18	PUMP
7	BASE	19	DUAL CONTROL LEVERS
8	INNER BOOM CYLINDER	20	HYDRAULIC OIL TANK
9	MAST	21	STAND-UP CONTROLS ON BASE
10	LINK ARM, INNER BOOM	22	CONTROLS ON THE TOP SEAT/MAST
11	HINGE PIN	23	RADIO OR TETHERED REMOTE CONTROLS
12	INNER BOOM (MAIN BOOM)		

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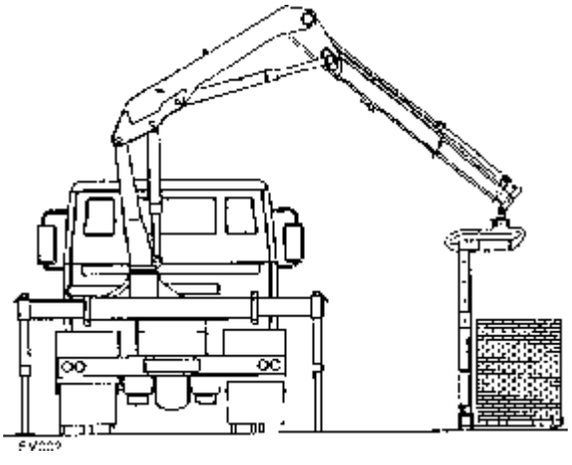
Your hydraulic loader is operated using a pump (18) connected to the hydraulic cylinders via the control valve (2). The pump builds hydraulic pressure which moves the loader when the control valves are moved. When operating the control valve, the cylinders are activated and the speed can be regulated. The oil flows in a closed system with the pump, valves, and hydraulic oil tank. Loaders can be operated from the control valves (2), dual levers (19), stand-up controls (21), top-seat controls (22) or using a radio or tethered remote (23).

NOTE: Your loader is designed to be truck-mounted. Stationary mount applications, on tractors, special purpose vehicles, etc. require a specific agreement with IMT for safe and appropriate installation.

Appropriate Loader Applications

Your IMT loader is used primarily for handling cargo. Using a sling, goods are lifted onto a truck body then unloaded at the destination. You can also use your loader with optional accessories which may increase the application possibilities. Available options include:

Pallet Fork / Stone Clamp - A pallet fork or stone clamp may be mounted on the hook suspension for handling wallboard or other building materials. A rotator may be mounted between the hook suspension and pallet fork to allow load rotation.



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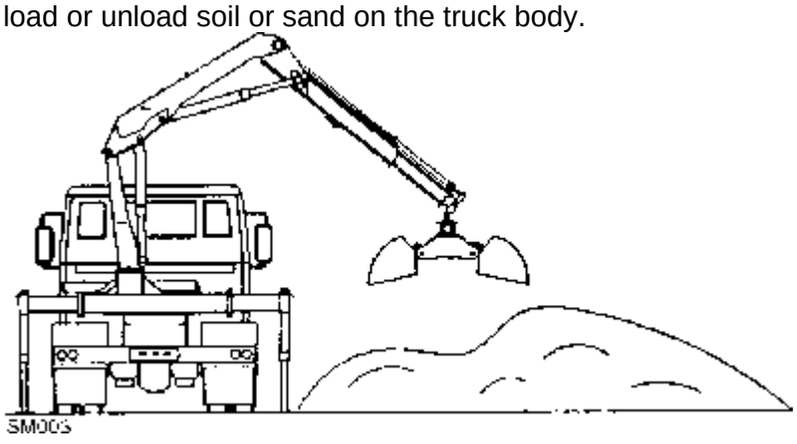
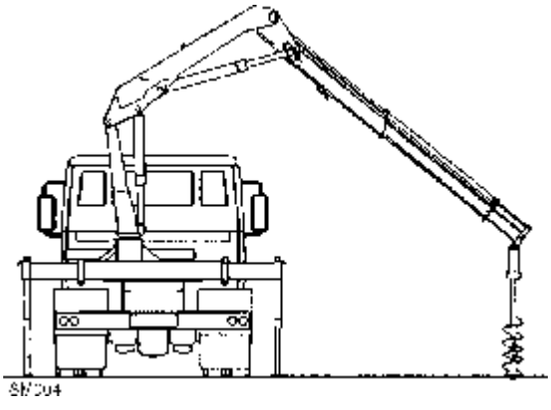
Sand Bucket - With a sand bucket mounted on the hook suspension, the loader can be used to load or unload soil or sand on the truck body.



Auger - A hydraulic auger mounted on the hook suspension can be used to drill holes (for stakes or poles) into the ground.



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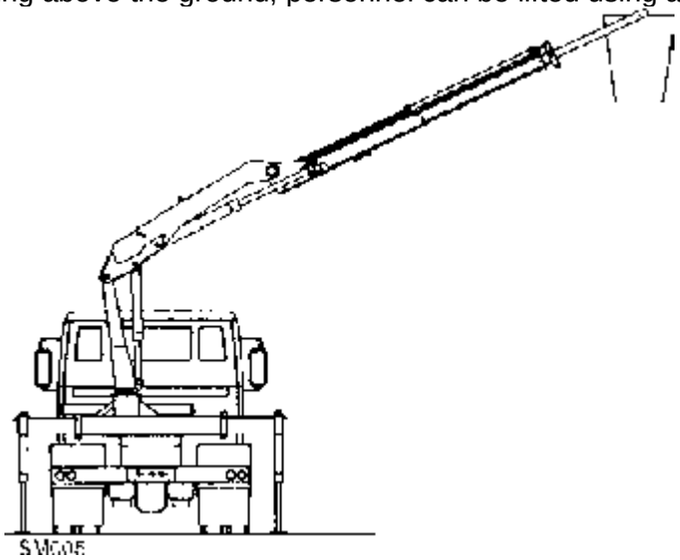
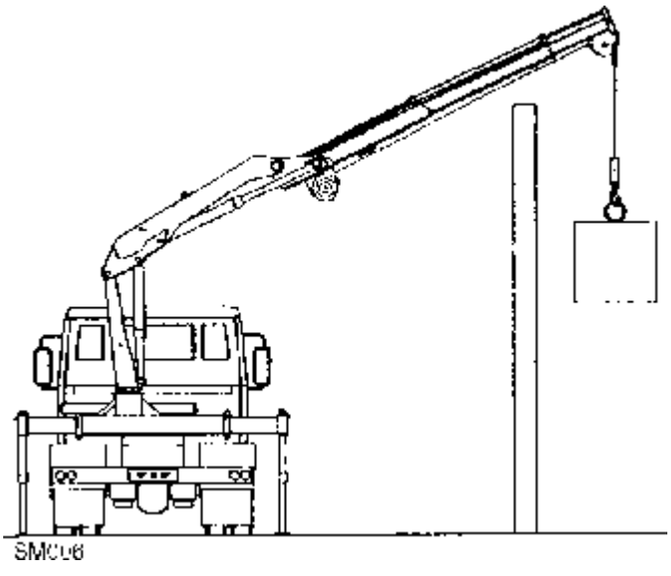
Personnel Basket - When working above the ground, personnel can be lifted using a personnel basket mounted on the loader.



Hydraulic Winch - With a hydraulic winch, loads can be lifted up and over obstacles.



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CHAPTER 2

The Operator

In This Chapter

Operator Qualifications.....11
Operator Physical Condition.....12
Operator Conduct.....12
Knowledge & Abilities Required 13

Operator Qualifications

Personnel permitted to operate a crane must have the following minimum qualifications:

1 Previously trained and experienced operating personnel.

2 Trainees under the direct supervision of a trained, experienced operator.

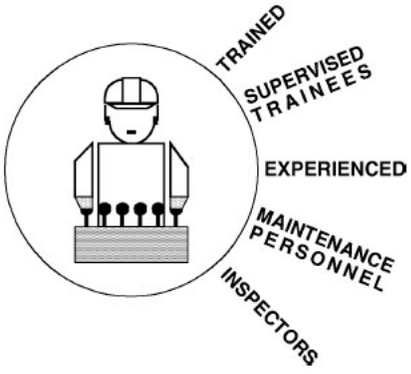
3 Maintenance and test personnel in the performance of their duties.

4 Supervisory personnel under the direct observation of a trained, experienced operator.

5 Crane inspectors.

WARNING

OPERATION OF A CRANE MUST NOT BE PERFORMED BY PERSONS UNDER THE INFLUENCE OF ALCOHOL, DRUGS, MEDICATIONS OR ANY CHEMICALS CAPABLE OF IMPAIRING THE ABILITIES OF THAT PERSON.



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Operator Physical Condition

Physical condition of all operators and trainees must conform to the following guidelines:

1 Good vision of at least 20/30 Snellen in one eye and 20/50 in the other, with or without the aid of corrective lenses.

2 Normal depth perception and field of vision (peripheral vision).

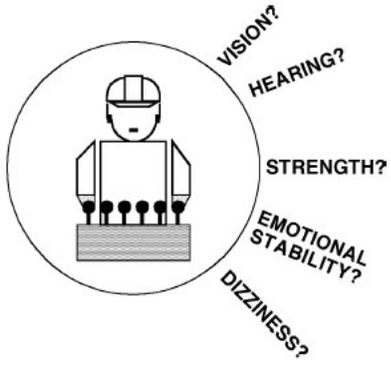
3 Ability to distinguish colors if color recognition or differentiation is required for safe operation.

4 Adequate hearing, with or without a hearing aid.

5 Sufficient strength, endurance, agility and coordination to meet equipment operation demands.

6 Emotionally stable.

7 Not subject to seizures, loss of physical control, dizziness or have physical limitations which could impair the ability to safely operate the crane.



Operator Conduct

1 The operator will not engage in any activity which can divert his attention from the operation of the crane.

2 The operator will relinquish control of the crane to another qualified operator if he is physically or mentally unfit.

3 The operator must respond to signals from a signal person or spotter during all lifts. If a signal person is not being utilized then the lift is the responsibility of the operator.

4 The operator will respond to a stop signal at any time, from anyone.

5 The operator will be held responsible for all operations under the operator's direct control. The operator, if in doubt about safety, must consult with his superior before making a lift.

6 Before leaving a crane unattended, the operator must:

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a) Land the load.

b) Disengage the main power source.

c) Set any locking devices.

d) Put all controls in the off or neutral position.

e) Secure the crane against accidental travel.

f) Stop the engine.

Knowledge & Abilities Required

1 The ability to read and understand all decals, placards, operation and safety manuals, and any information relevant to the proper and safe operation of this equipment.

2 Knowledge of any emergency procedures necessary to safe operation.

3 Evidence of, or demonstration of the proper and safe operation of the equipment.

4 Familiarization with all relevant safety codes and governmental regulations pertaining to the operation of this equipment.

5 The responsibility to recognize all maintenance requirements of the equipment being operated.

6 The familiarity with the equipment and all control functions associated with its operation.

7 Have read and understood the procedures for the operation of the equipment.

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CHAPTER 3

Crane Operation

In This Chapter

Operator Responsibilities 15
Daily Safety Inspections 16
Crane Transport 16
Work Site Planning 17
Material Handling Crane Controls 18
Engaging the PTO 19
Stabilizers 20
Hydraulic Swing-up Stabilizer Legs Controlled by Slewing Cylinder Piston Rod 22
Hydraulic Swing-up Stabilizer Legs Controlled by Connecting Rod 25
Unfolding the Loader 26
Unfolding a Z-Loader or Grab-Loader 28
Electrical Hazards 29
Safely Operating the Crane 31
Crane Capacity 35
Stowing the Loader 36
Stowing a Z-Loader or Grab-Loader without Top Seat Controls 37
Stowing a Z-Loader or Grab-Loader with Top Seat Controls 38
..... 38
Direction Terminology 39

Operator Responsibilities

The loader operator and maintenance staff are responsible for safe operation. They must make sure the loader is operated, inspected, and maintained so it can be used safely. Safety has been designed and manufactured into this equipment by the manufacturer, but only the people working with the crane can insure a safe work environment.

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Daily Safety Inspections

Use the following list as a guide when you are inspecting your unit at start-up and during operation, and log your inspection results using the Crane Log (IMT Manual No. 99900686) or the inspection checklist in the reference section of this manual:

1. Vehicle - Check oil level, battery, lights, brakes, and tires for inflation, pressure, cuts, and loose or missing wheel lugs.
2. Safety Accessories - Check for proper function, oil levels, leaks and malfunctions.
3. Hydraulic Oil Reservoir - Check for proper oil level, above the bottom of the reservoir within the screened area. Check for leaks and blockages.
4. Weldments - Check visually for damage, especially cracks or breaks in welds.
5. Cylinders - Check for leakage and scored rods.
6. Fasteners - Check pins, sheaves, nuts and bolts for breakage, excessive wear and tightness.
7. Hooks - Check for the presence of a safety catch, twists, cracks, or damage.
8. Ropes & Slings - Check for frayed edges, broken strands, kinks, flat spots, and end attachments.
9. Covers & Guards - Check for missing or improperly maintained covers and guards.
10. Remote Control - Check engine stop switch for function and corrosion.
11. Operation Placards and Safety Decals - Check for illegible or missing decals and placards. Refer to the Decal section of this manual for more information on the required decals.
12. Work Area - Check for hazards including powerlines, obstructions, etc.
13. Replace or repair any items as needed prior to equipment operation.

Crane Transport

Before transporting the crane, make sure:

1. The crane is stowed its stored position.
2. The stabilizers are securely stowed and NOT extended horizontally or vertically.
3. Hook and sheave assemblies are securely fastened to prevent swinging.
4. All loose accessories, tools and remote controls are securely stored in their respective compartments or fasteners.
5. The PTO is disengaged.
6. DO NOT release the parking brake until all of the above procedures are completed.

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7 DO NOT drive the carrier vehicle while a load is present on the hook.

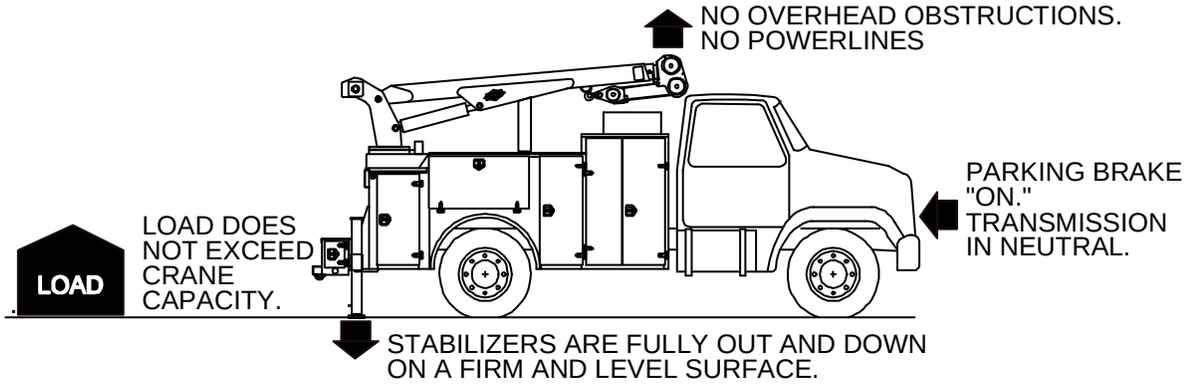
8 DO NOT drive the carrier vehicle with less than the proper tire inflation pressure.

9 DO NOT drive the carrier vehicle in areas where the vertical clearance is not known.

10 DO NOT allow personnel to ride on the equipment during transport.

11 DO NOT attempt to operate the vehicle or equipment without a signal person if visibility is limited.

Work Site Planning



Lift safety depends on work site preparation. Plan your lifts carefully. Consider:

- Powerlines
- Bystanders
- Overhead obstructions
- Solid surface support

Determine the weight of the load to be lifted. Use the crane capacity chart to make sure all lifts are performed within the rated capacity of the crane. Position the carrier vehicle with these capacities in mind and avoid any overhead obstructions which can impair the lift.

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WARNING

VISIBILITY IS CRITICAL! Park the vehicle so the operator can see all of the working area!

DANGER

AVOID POWERLINES! Read and understand the Electrical Hazard section of this manual before attempting any crane operations near powerlines.

Position the carrier vehicle so that when the crane is fully extended it can't contact electrically charged lines or apparatus. Ten feet (3.05 meters) is the minimum distance that any portion of the crane, loadline or load can be to electrical lines carrying up to 50,000 Volts. Add a minimum of 12 inches (30.5 centimeters) to that distance for every additional 30,000 Volts or less.

In windy conditions, allow extra space for powerline and loadline sway and deflection. Provide additional clearance between the crane and electrical lines. If the powerline or apparatus voltage is not known, contact the electrical utility prior to the lift.

If a lift is impossible to perform within the minimum distance between electrical source and crane, ask the power company to de-energize the powerlines or apparatus before any lift is attempted.

Use a qualified signal person or spotter when working near electrical sources, even if the powerline has been de-energized.

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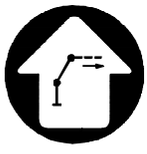
Material Handling Crane Controls

Your crane can be operated with a radio remote, with dual control levers located on the crane, with controls located at the base or mast, or with top seat controls. Any of these control levers will be marked with symbols with the following functions.

CRANE CONTROL GRAPHICS				
ROTATION RIGHT	BOOM DOWN	OUTER BOOM UP	 EXTENSION OUT	ROTATE LOADER RIGHT
RIGHT STABILIZER ARM EXTEND	RIGHT STABILIZER LEG DOWN	FLY-JIB, EXTENSION OUT	FLY-JIB, JIB UP	WINCH DOWN

Engaging the PTO

1 Apply the vehicle parking brake.

2 Switch the change-over valve, if any, to “loader”.

3 Engage the PTO at low revolutions.

4 Regulate the engine RPM using the hand accelerator so the oil flow from the hydraulic pump corresponds to the recommended pump flow for the loader. With a cold temperature start, allow the oil to circulate for a few minutes before starting operation.

Starting up:

a Pull out the emergency stop button – remember both sides of the loader, if necessary.

b Push the green button once. The “RUN” diode is lit and the safety system is activated.

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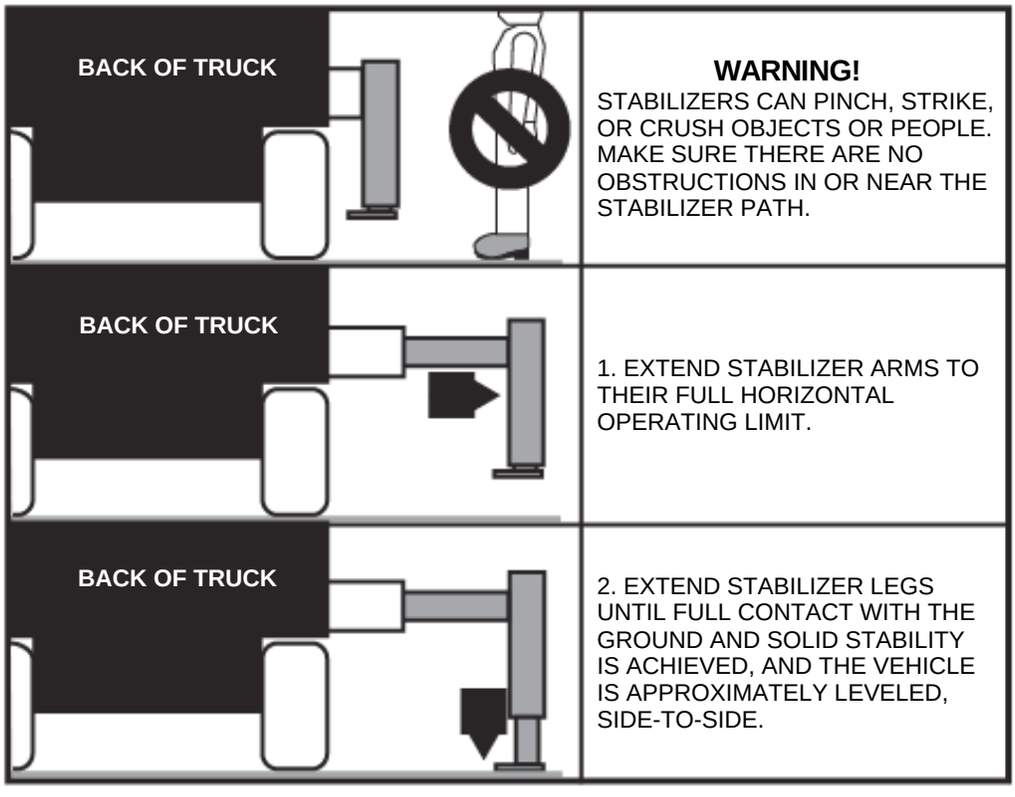
Stabilizers

Stabilizer legs can break through soft ground and cause vehicle and loader instability. The ground surface where loader operation takes place must be sufficiently firm to absorb the pressure from the stabilizer legs. If the ground is too soft, reinforce the stabilizer legs with iron plates. Stabilizers must be extended and locked before unfolding the boom system.

WARNING! Stabilizers can cause serious injury! Avoid hitting people when extending stabilizer arms, crushing people or equipment when lowering stabilizer legs, or pinching people when retracting stabilizers.



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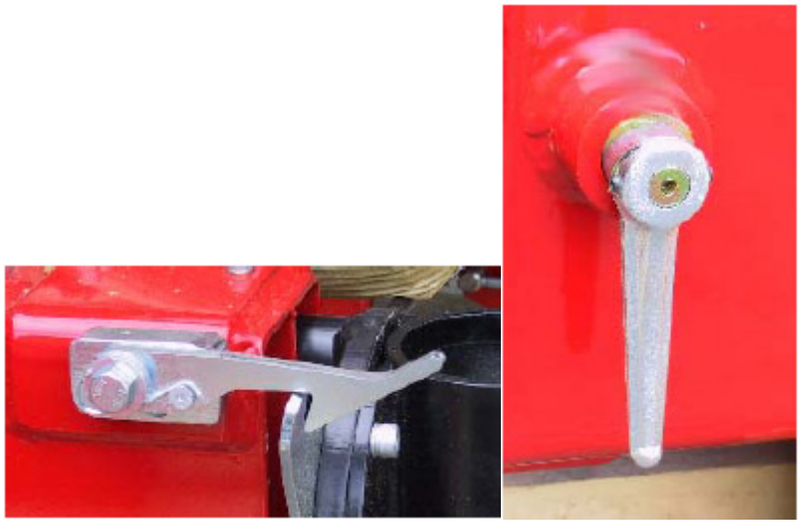
STABILIZER SET-UP

1 The loader operates best when positioned as close to level as possible. Park the vehicle in the most level spot if lifting a load on an inclined surface.

2 Make sure that the ground is not slippery to avoid vehicle and loader skidding during loader operation. Chock wheels if needed.

3 Push the yellow button twice and the “FUNC” and “F5” diodes are lit. After 2 seconds the diodes are turned off, but the stabilizer function remains activated. Release the stabilizer lock and the safety lock and extend the stabilizer arm completely, and lock them again.



NOTE

On certain loader models the stabilizers are operated using the radio remote control. See the IRC Instruction Manual.

4 Lower the stabilizer legs until the vehicle chassis has been lifted a maximum of 1-1/2" (4 cm). Never lift the vehicle to a point where the wheels lose contact with the ground, because the stabilizers will have to absorb both the total weight of the vehicle and the load. If the vehicle transmission is in "Park", the parking brake is on, and the wheels do not have sufficient contact with the ground, the vehicle will easily skid during loader operation. This can damage the stabilizers.

5 During loader operation, the stabilizers may have to be adjusted slightly in order to let the weight of the load be absorbed by the vehicle’s suspension. The stabilizers are not designed to support this excessive load.

6 With manual pull-out stabilizers, make sure the arm locking pin is secure.

DANGER! AVOID SERIOUS INJURY! Stay clear of moving stabilizers! Do not extend stabilizer arms or legs during loader operation.

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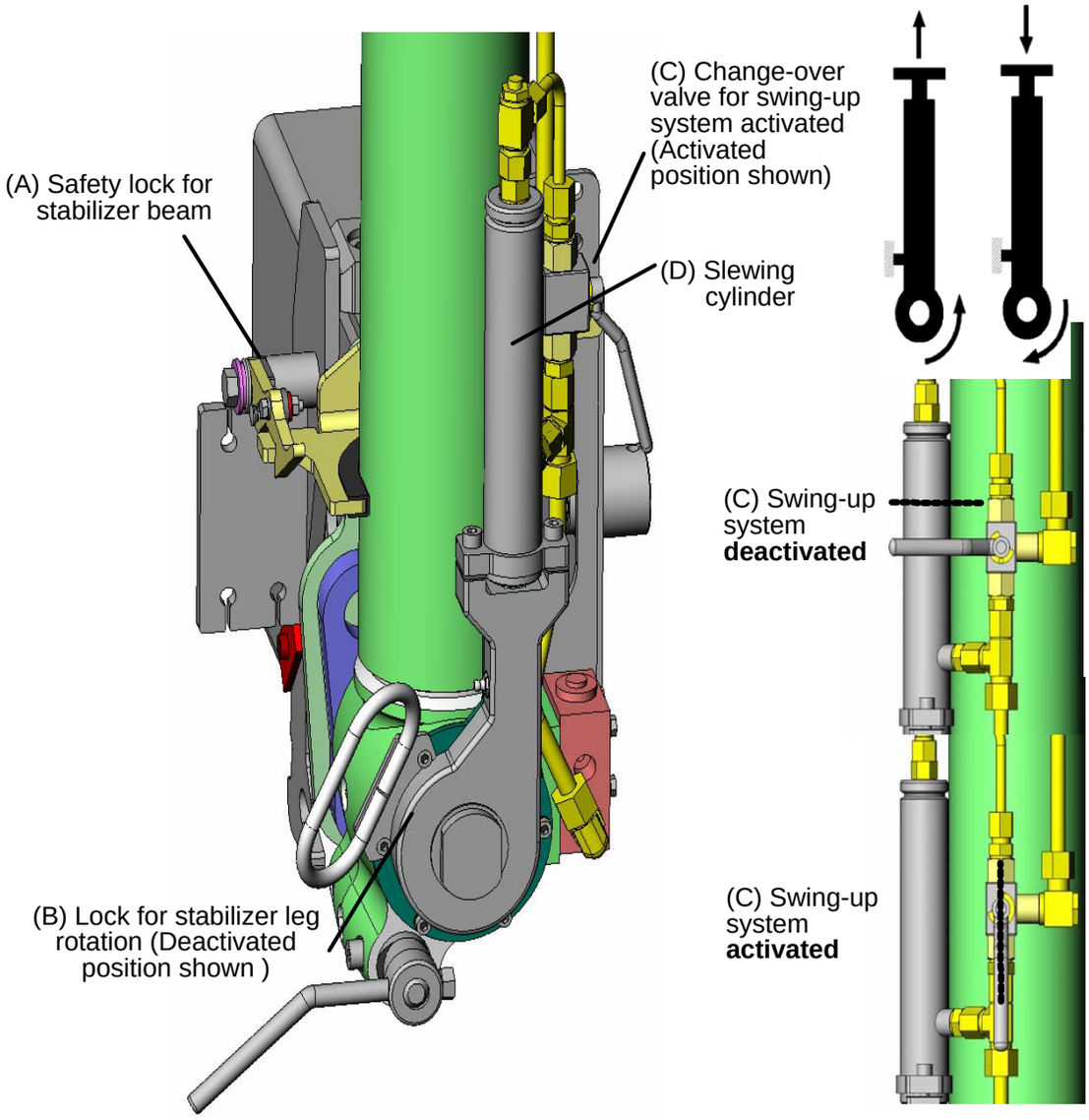
Hydraulic Swing-up Stabilizer Legs Controlled by Slewing Cylinder Piston Rod

One model of swing-up stabilizers legs uses the piston rod (D) of the slewing cylinder to swing the stabilizer leg when the swinging system is activated with the change-over valve (C). In case of a swing-up movement of 180°, the piston of the stabilizer leg moves approximately 1" (25 mm) and the stabilizer leg must be extended at least 1" (25 mm) to be able to swing completely down.



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CAUTION

Keep at least 5' (1.5 m) from the rotation area of the stabilizer leg when the stabilizer leg swings up or down or when the stabilizer beam is extended.

Always activate the stabilizer leg rotation lock (B) when the stabilizer beam is retracted, extended, and swung down.

Swing the stabilizer leg up against the stop and keep a safe distance from the rotation area of the stabilizer leg before deactivating the lock (B) for stabilizer leg rotation.

If the vehicle is parked on an incline of more than 5 degrees in the direction of travel of the vehicle, the stabilizer leg cannot swing down automatically from the stowing position. However, it may be positioned manually.

WARNING

Avoid stabilizer leg swing! Fully extend the piston rod.

SWINGING THE STABILIZER LEG DOWN FROM STOWED POSITION:

1 Before extending the stabilizer beam, be sure the piston rod is completely extended from the rotation cylinder (D) so the stabilizer leg is completely swung up against the stop in the stowed position. Activate the swing-up system by turning the change-over valve (C) into the vertical position. Carefully operate the "stabilizer-down" movement (the stabilizer leg is swung up), until you are certain that the stabilizer leg is completely swung up.

2 Make sure that the stabilizer leg is in a position where it is extended at least 1.2" (30 mm). If it is not extended, deactivate the swing-up system (change-over valve (C) is turned into horizontal position), and extend the stabilizer leg at least 1.2" (30 mm).

3 Lock the rotation lock for the stabilizer leg (B).

4 Release the stabilizer lock and the safety lock (A), and extend the beam completely. Keep a safe distance to the rotation area of the stabilizer leg! If the stabilizer leg swings away from the stop in its stowing position, or if the stabilizer leg is swung down by mistake without the lock (B) being deactivated, you must repeat the procedure in step 1. Otherwise there is a risk of the stabilizer leg swinging down at uncontrolled speed, when the lock is released (B).

5 Release the stabilizer leg rotation lock (B) so the stabilizer leg can swing down. Maintain a safe distance to the rotation area of the stabilizer leg!

6 Make sure that the swing-up system is activated (change-over valve (C) in vertical position).

7 Carefully activate the ”stabilizer leg – up” function, and the stabilizer leg swings down.

8 When the stabilizer leg is completely swung down, lock it by the lock (B).

9 Deactivate the swing-up system by turning the change-over valve (C) into horizontal position.

10 Lower the stabilizer leg until the vehicle is correctly supported.

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SWINGING UP THE STABILIZER LEG INTO THE STOWED POSITION:

1 Swing up the stabilizer leg completely and then extend the stabilizer cylinder a little bit again to release the oil pressure. A blocked pressure may make it difficult to swing down the stabilizer leg completely.

2 Release the stabilizer leg rotation lock (B).

3 Activate the swing-up system (C) (change-over valve in vertical position).

4 Carefully operate the ”stabilizer leg – down” function, and the stabilizer leg swings up.

5 When the stabilizer leg is completely swung up against stop in its stowing position, lock it in place (B).

6 Retract the stabilizer beam and lock the stabilizer lock and the safety lock (A).

7 Deactivate the swing-up system by turning the change-over valve (C) into horizontal position.

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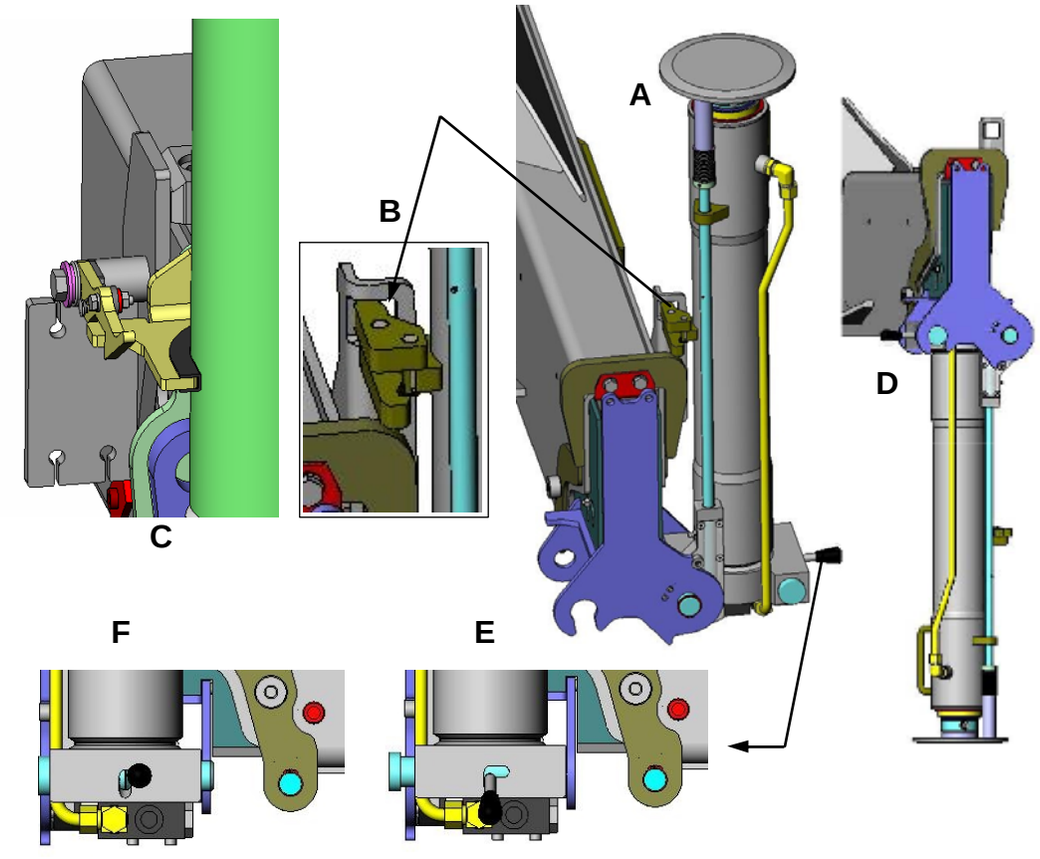
Hydraulic Swing-up Stabilizer Legs Controlled by Connecting Rod

This swing-up system is activated using a connecting rod which contacts the footplate of the stabilizer leg when the stabilizer leg is in swing-up position. The swing-up and swing-down movements of the stabilizer leg takes place at the same time the "stabilizer - up" or "stabilizer - down" movement is activated.



SWINGING DOWN THE STABILIZER LEG FROM STOWED POSITION:

1 In the stowed position (A) the stabilizer leg is fixed in a bracket (B). Before extending the stabilizer beam, you must ensure that the stabilizer leg is completely swung up against stop in the stowed position, and that the rod of the swing-up system is in contact with the footplate.

2 Unlock the safety lock (C) and extend the stabilizer beam. Keep a safe distance from rotation area of the stabilizer leg!

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3 Unlock the lock for rotation of the stabilizer leg – position (E) so that it is possible to swing down the stabilizer leg. Keep a safe distance to the rotation area of the stabilizer leg! If you try to swing down the stabilizer leg without unlocking this lock, you must repeat the procedure in step 1. Otherwise there is a risk of the stabilizer leg swinging down too fast after deactivating the lock (E).

4 Carefully operate the ”stabilizer leg – down” function. The stabilizer leg will swing down.

5 When the stabilizer leg is completely swung down, lock the rotation stabilizer leg lock – position (F).

6 Lower the stabilizer leg until the vehicle is correctly supported.

SWINGING UP THE STABILIZER LEG INTO STOWED POSITION:

1 Raise the stabilizer leg slightly until the footplate no longer touches the surface.

2 Unlock the lock for rotation of the stabilizer leg - position (E).

3 Raise the stabilizer leg – the last bit very slowly – until the rod of the swing-up system is in contact with the footplate.

4 Carefully activate the ”stabilizer leg – up” function, and the stabilizer leg swings up.

5 When the stabilizer leg is completely swung up against stop in stowing position, activate the lock for rotation of the stabilizer leg – position (F).

6 Retract the stabilizer beam and activate the safety lock (C).

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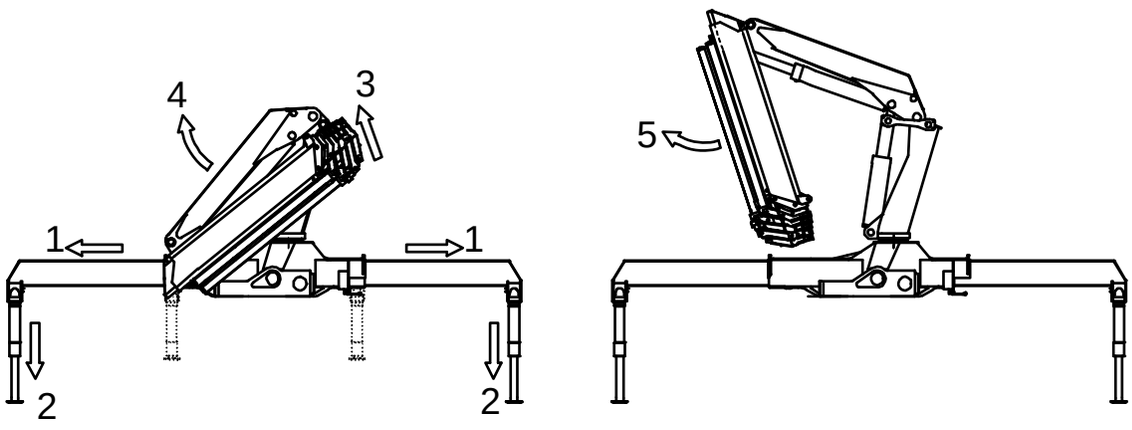
Unfolding the Loader



1 Extend the stabilizer arms completely. This also goes for the separate traverse (if any).

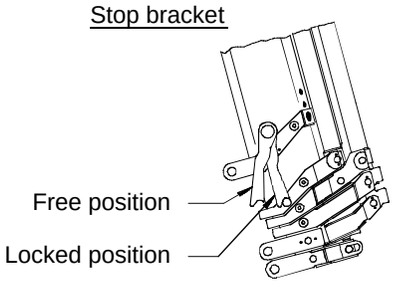
2 Lower the stabilizer legs according to the ***Stabilizer section.*** (see "Stabilizers" on page 20) Lower auxiliary stabilizer if applicable.

NOTE

The outer boom must be raised (the “outer boom down” movement of the lever), so that the outer boom is released from the bracket.

3 Raise the inner boom, which releases it from the bracket. Raise the inner boom slightly above horizontal so that the outer boom can be moved freely downwards.

4 Raise the outer boom until it is free of the base.



NOTE:

In case of loaders equipped with stop bracket on the outer boom, extend the outer boom extension slightly until the stop bracket is released.

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Unfolding a Z-Loader or Grab-Loader

Extend the stabilizer arms completely. Lower the stabilizer legs according to the ***Stabilizer section.*** (see "Stabilizers" on page 20)

UNFOLD SO MAIN BOOM IS ***ALMOST*** VERTICAL

1 Raise the main boom into an almost vertical position as shown.

CAUTION

Main boom MUST NOT be in a completely vertical position. Loader will not unfold correctly.

2 Raise the jib to a nearly vertical position.

3 Carefully lower the inner boom until the outer boom is positioned at the angle shown.

4 Lower the jib exceeding the breakover angle. Handle the loader carefully to avoid shocking or bouncing around the breakover angle of the jib.

OR

1 Move the jib away from the main boom. Lower until it forms an angle as shown.

2 Lower the main boom below horizontal as shown until the tool in the hook suspension touches the surface and the boom is released.

3 Raise the main boom and *simultaneously*

4 Lower the jib exceeding the dead-point.

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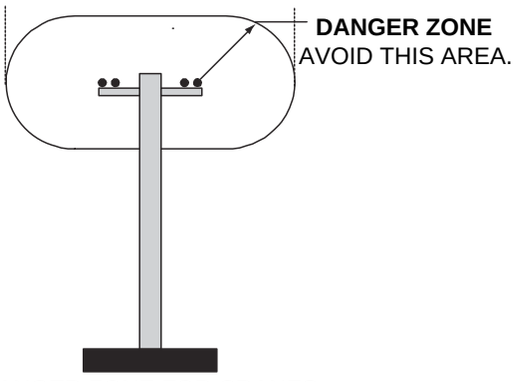
Electrical Hazards

Always operate the crane so that no part of the crane or load enters the minimum clearance distance for a powerline, called the "Danger Zone".



DANGER ZONE FOR CRANES OPERATING NEAR ELECTRICAL POWERLINES

NOTE

THE DANGER ZONE OF A PARTICULAR POWERLINE IS BASED UPON ITS VOLTAGE. HIGH VOLTAGE LEVELS INCREASE THE DANGER ZONE.

REQUIRED CLEARANCE OF CRANES FROM ELECTRICAL TRANSMISSION LINES		
	VOLTAGE (Volts)	MINIMUM CLEARANCE REQUIRED (Danger Zone) Feet (meters)
OPERATION NEAR HIGH VOLTAGE POWERLINES	From 0 to 350,000	20' (6.10)
	Above 350,000 or unknown	50' (15.24)
OPERATION IN TRANSIT WITH NO LOAD AND BOOM OR MAST LOWERED	From 0 to 750	4' (0.22)
	From 750 to 5,000	6' (0.83)
	From 5,000 to 345,000	10' (3.05)
	From 345,000 to 750,000	16' (4.87)
	From 750,000 to 1,000,000	20' (8.10)

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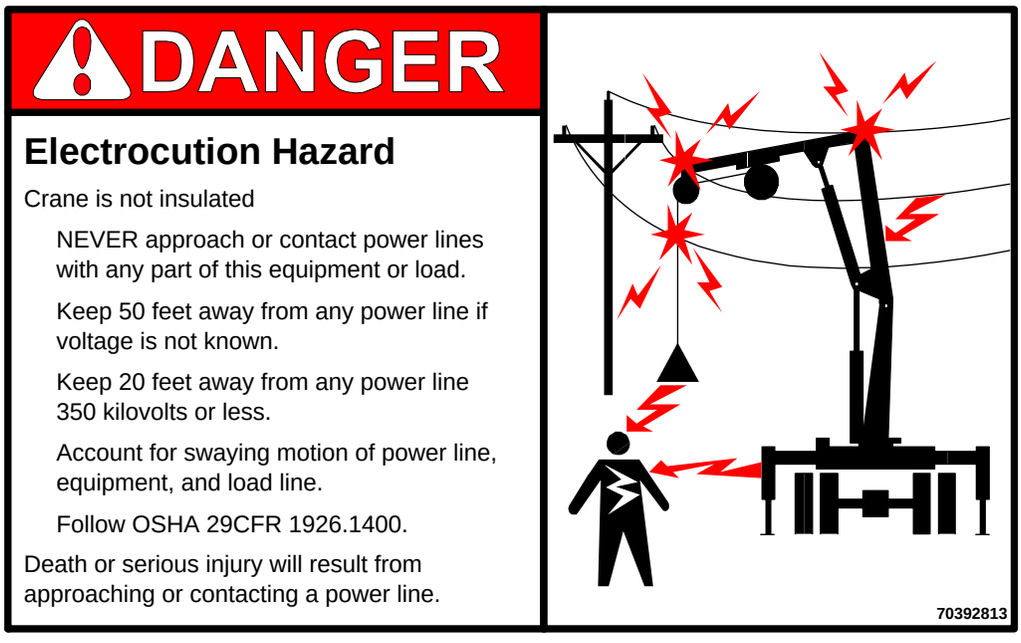

WARNING

When working near powerlines, any change in conditions or the job site can be dangerous. For maximum safety during work near powerlines, adhere to these guidelines:

- During windy conditions, allow additional clearance.
- Do not rely on cage-type boom guards, insulating links, or proximity warning devices for safety. Adhere to the required distances listed in table titled *REQUIRED CLEARANCE OF CRANES FROM ELECTRICAL TRANSMISSION LINES*.
- Contact the utility company before beginning work near powerlines.
- Always assume overhead lines to be energized.
- Avoid transporting a crane over uneven terrain.
- When using rope to steady a load or restrain spinning of the load, be aware that rope will also conduct electricity, especially if wet or damp.
- Reduce operating speed when in close proximity to powerlines in order to allow the operator more reaction time.
- Always use a qualified signal person or spotter to observe the clearance when a crane, load or crane attachments is within a boom's length of the limits in the *REQUIRED CLEARANCE* table, even if the powerline has been de-energized. An operator is not in the best position to judge powerline-to-crane distances. Use a spotter.
- When working near an energized powerline, erect a barrier on the ground which is readily identifiable as a "Danger Zone." This zone must conform to the requirements of the *REQUIRED CLEARANCE* table.

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IF ELECTRICAL CONTACT OCCURS:

1. Shut off all power.
2. Break contact of any person in contact with a live conductor by using rubber hose, dry rope, or dry wood. DO NOT attempt this unless you are certain that all power is off.
3. Call 911 or the local emergency service.
4. Administer first aid.
5. Avoid the area around the crane, as high voltage traveling through a crane will charge the ground.

ELECTRICAL CONTACT FOLLOW-UP:

1. Inspect and repair any equipment affected by electrical contact.
2. Replace any wire rope which has had high voltage contact.

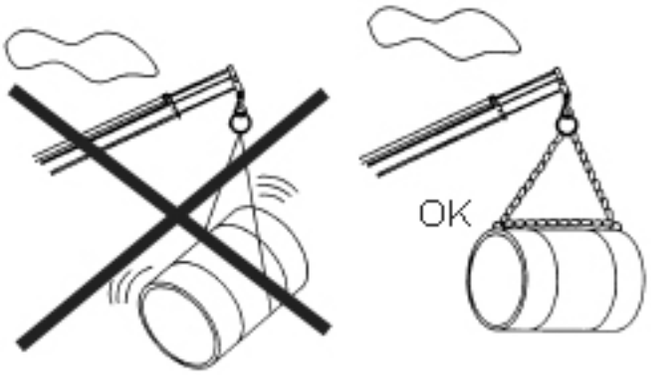
Safely Operating the Crane

PRIOR TO LIFTING A LOAD

1. Read and understand all safety and operating decals before operating the crane.
2. Be sure the carrier vehicle's transmission is in neutral and the parking brake is on before engaging the PTO.
3. Wear a hard hat and goggles or safety glasses during operation.
4. Avoid work around powerlines. See ***Crane Operation Near Powerlines*** (see "Electrical Hazards" on page 29).

LOAD SET-UP

1. Set-up stabilizers per ***Stabilizers*** (see "Stabilizers" on page 20) section.
2. Carefully attach lifting gear to the load so there is no risk of it falling. Keep load balanced when lifting, using a yoke if needed.



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3 Secure all unneeded manual boom extensions before operating the crane.

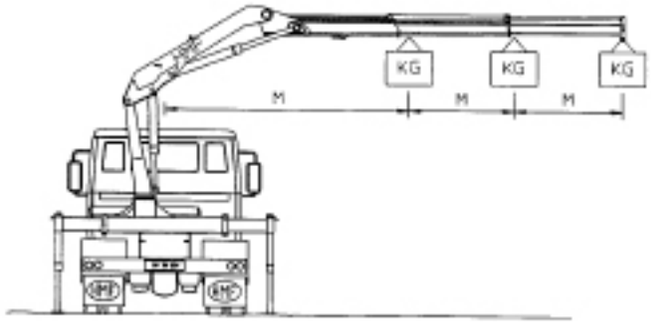
4 Know the position of the booms at all times while operating the crane. Keep all unnecessary personnel away from the loader and working radius. Be sure there are no areas with an obstructed view or obstacles.

5 Eliminate swing by positioning the boom tip directly over the center of the load before lifting.

6 Check the safety of the load by first lifting the load barely off the ground.

CAPACITY

1 Do not exceed the rated capacity as noted on the lifting capacity diagram. The load moment is highest when the boom is slightly above horizontal, as noted on the capacity chart.



2 Avoid vehicle instability. Do not incline the loader beyond 5 degrees when operating the loader at full capacity. Use caution when operating in reduced stability areas, such as over the vehicle cab.

3 With loader attachments (grab, rotator, fork, etc.) the total weight of the attachments must not exceed the lifting capacity at maximum reach.

DURING THE LIFT

1 Do not operate the stabilizers when the loader is working.

2 Operate the control valves smoothly. Avoid jerking the valves or the load.

3 Use any extension booms in their proper sequence, largest to smallest.

4 DO NOT stand directly in line with the boom travel, when releasing manual extension boom pins, to avoid injury if the boom slides unexpectedly.

5 Know the position of the booms at all times while operating the crane.

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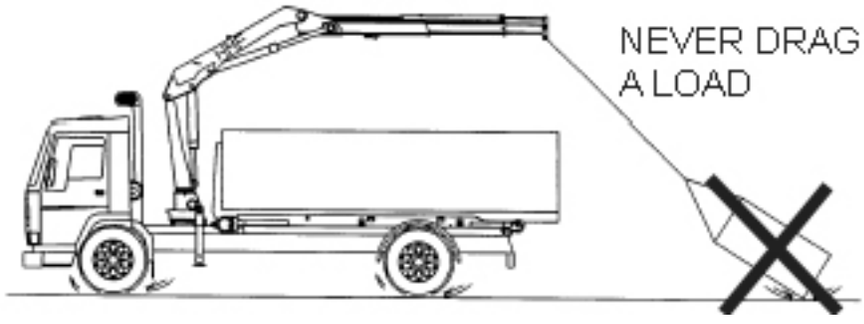
6 Never drag a load or bounce the boom. Oscillation during loading increases loader stress and could damage the loader.



7 Never leave the loader when it is loaded, or walk under a suspended load.

8 When lifting a load, keep it as close to the ground as possible.

9 Stop all crane operation at a signal from anyone.

10 When you rotate the crane, the load may change from being supported by the stabilizers to the vehicle suspension. Be cautious as you rotate the crane, because the springs on the carrier vehicle will respond differently to the load than the tires will.

11 When a cylinder is in its most extreme position, the control valve lever must be immediately released to the neutral position to prevent the oil from overheating.

OVERLOAD

1 If the load is extended enough to exceed the lifting capacity, movement which continues to increase the load moment will be stopped. See the RCL Safety System Instruction Manual for more information. The inner boom will slowly begin to sink. To stop this movement, bring the load in towards the mast using the "extension retract" function.

2 The load indicator dial shows the load moment pressure. When the load moment increases, the indicator approaches the red Danger Overload zone. When the indicator reaches the red zone, the loader is 100% loaded. The load must not be increased.

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EMERGENCY STOP

1 To immediately stop the loader during loader operation, release the control lever and push the stop button into the locked position. This will interrupt the power supply and stop movement.

AFTER LOADER OPERATION

1 Raise stabilizer legs and retract stabilizer beams.

2 Secure stabilizer beams with locking devices.

3 Stow the crane when not in use. If the boom is parked on the truck body, stow it in a bracket to prevent side-to-side movement.

4 Disengage the PTO/pump.

MANUAL EXTENSIONS

1 Never exceed the manual extension load limits noted on the capacity chart. The loader lifting capacity is reduced by the weight of the manual extensions, accessory, or load-handling device.

2 Pull out manual extensions with the boom as close to a horizontal position as possible. If the boom is tipped downward, extensions may slide out too fast, break through the stops, and cause injury.

3 Engage the lock pins for manual extensions.

4 The overload system protects manual extensions ONLY when all hydraulic extensions are fully extended.

5 If manual extensions are used with hydraulic extensions not fully extended, do not exceed the maximum permissible load indicated on the capacity chart for the extension in question.

6 If not all extensions are required for a lift, use the extension(s) with the largest box profile.

FLY-JIBS

1 Do not exceed the rated capacity when using a fly-jib.

2 Follow the rules noted above for manual extensions when using a manual extension with a fly-jib.

3 Whenever the fly-jib is mounted on the boom, connect the hydraulic quick-release couplings properly to avoid excess cylinder pressure and incorrect or dangerous movements.

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Crane Capacity

The IMT crane is designed to lift specific loads. These loads are defined on the capacity placard mounted near the operator's station and on the crane. Exceeding the limits presented on the capacity placard will create severe safety hazards and will shorten the life of the crane. The operator and other concerned personnel must know the load capacity of the crane and the weight of the load being lifted!

The capacity chart for each model is located in the specific crane technical specifications manual and on placards on the crane and body.

WARNING

NEVER EXCEED THE CRANE'S RATED LOAD CAPACITIES. DOING SO WILL CAUSE STRUCTURAL DAMAGE AND DAMAGE TO WINCHES AND CABLES WHICH CAN LEAD TO DEATH OR SERIOUS INJURY.

NOTE

CAPACITY PLACARDS ARE INTENTIONALLY LOCATED NEAR THE OPERATOR TO ASSURE READY REFERENCE IN DETERMINING WHEN A LOAD CAN OR CANNOT BE HANDLED.

LOAD LIMIT INFORMATION ON THE CAPACITY PLACARD IS FORMULATED ON 85% OF TIPPING. TIPPING REFERS TO THE CRANE ACTUALLY TIPPING WITH ITS OPPOSITE STABILIZER AND TIRES HAVING BROKEN CONTACT WITH THE SURFACE.

Prior to lifting a load:

1. Determine the weight of the load.
2. Determine the weight of any load handling devices.
3. Add the weight of the load and the weight of the load handling devices. The sum is the total weight of the load being lifted.
4. Determine the distance from the centerline of crane rotation to the centerline of the load being lifted.
5. Determine the distance from the centerline of crane rotation to the centerline of where the load is to be moved to.
6. The actual distance used should be figured as the larger of items 4 and 5 above.

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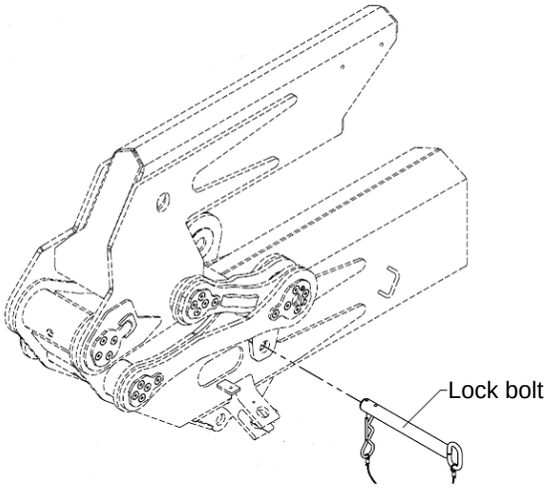
Stowing the Loader

Reverse the procedure defined in ***Unfolding the Loader*** (on page 26). If the boom is parked on the truck platform, stow it in the boom support to prevent it from swinging out during transport. Make sure the total height does not exceed 13'-1" (4000 mm).

If a fly-jib is attached to the loader and it remains attached after loader operation, secure the lock bolt pin to prevent the fly-jib extensions from sliding out in case of hydraulic system leakage.



CAUTION:

Be sure that both the stabilizer lock and safety lock are in place and properly secured to prevent the stabilizer arm from extending by itself during transport.

If the loader is equipped with swing-up stabilizer legs they must also be secured in position before driving off. Before the vehicle is started, disengage the PTO and turn off the pump.

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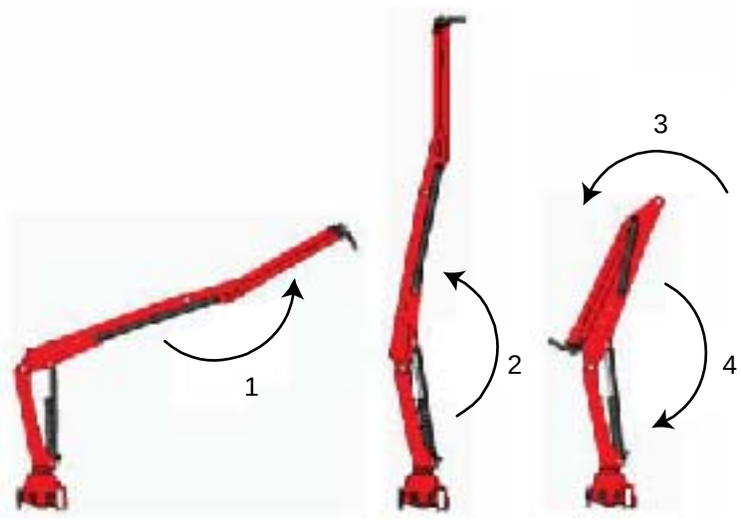
Stowing a Z-Loader or Grab-Loader without Top Seat Controls



1 Raise the jib as high as possible.

2 Raise the main boom just enough so the jib exceeds the breakover angle due to its own weight.

CAUTION

DO NOT raise the main boom into a completely vertical position. Handle the loader carefully to avoid shock movements around the dead-point of the jib.

3 Lower the jib against the main boom.

4 Rotate the loader. Lower the main boom into the stowing bracket.

WARNING

DO NOT USE THIS PROCEDURE IF THE Z-LOADER HAS TOP-SEAT OPERATOR CONTROLS

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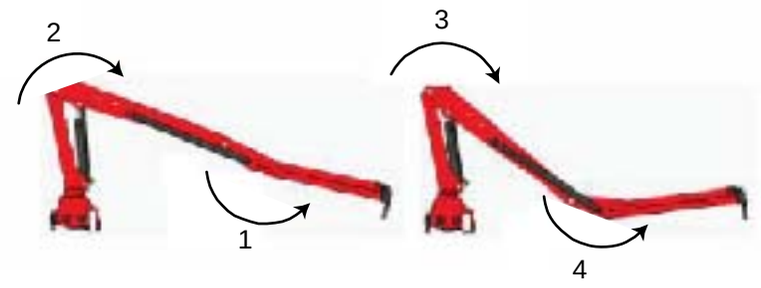
Stowing a Z-Loader or Grab-Loader with Top Seat Controls



1 Raise the jib as high up as possible.

2 Lower the main boom until the tool in the hook suspension touches the surface and the boom system is released.

3 Simultaneously lower the main boom and raise the jib. This moves the jib until it exceeds the breakover angle.

CAUTION

Handle the loader carefully to avoid shocking or bouncing around the breakover angle of the jib.

4 Raise the jib against the main boom. Rotate the loader and lower the main boom into the stowing bracket.

See the ***Crane Capacity & Stability Section*** (see "Crane Capacity & Stability" on page 73) for more information on capacity, stability and performing a stability test.

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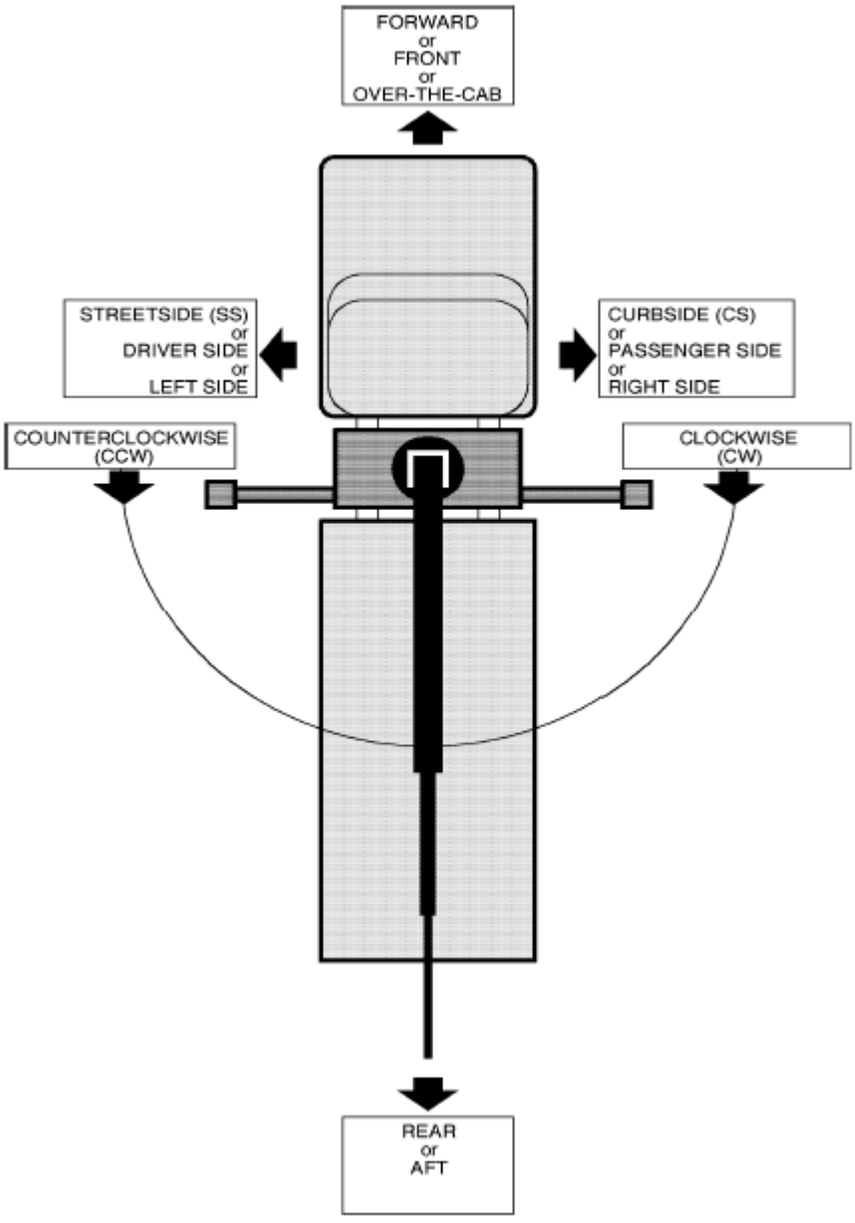
Direction Terminology

Various terms may be used to describe directions associated with crane operation. Illustrated here are some of those terms and their variations.



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CHAPTER 4

Crane Decals

In This Chapter

Danger Decals.....41
Decal Placement - Material Handling Cranes 42
Danger Decal Figures 43
Instructional Decals.....46

Danger Decals

All operators must familiarize themselves with the “DANGER” decals shown in this section. Your equipment may have additional safety decals that are not described here. Any safety decals affixed to your equipment must be identified, read and understood.

The materials and adhesives used in the production of these decals were designed for maximum durability, adhesion and legibility. Nevertheless, if a decal (including capacity chart) becomes damaged or illegible, replace it at your earliest opportunity. If a crane is repaired or repainted, replace all decals before the crane is put back into service. Individual decals as well as complete decal kits are available from IMT.

The following figures show examples of the safety decals used on IMT cranes, along with an explanation of their purpose, location, and the normal quantity used on each crane.

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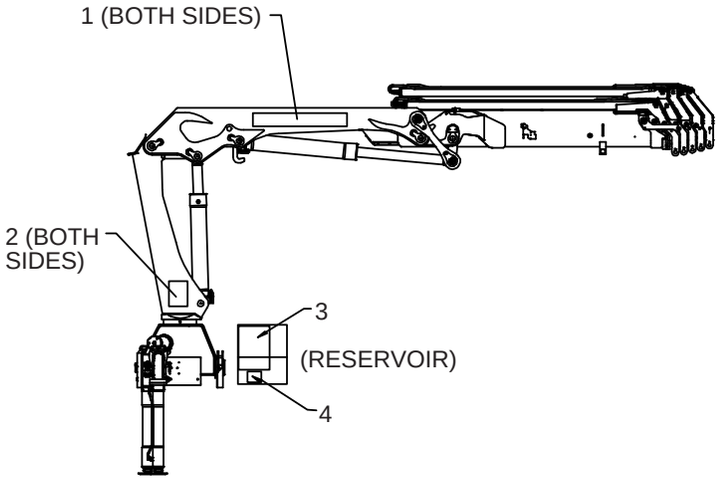
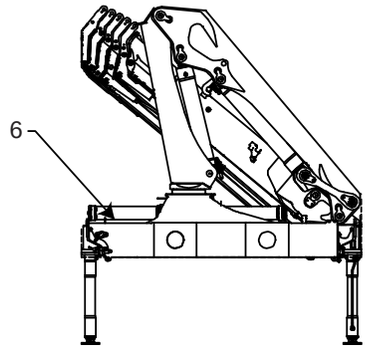
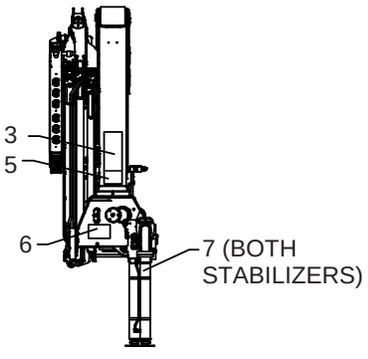
Decal Placement - Material Handling Cranes







ITEM	PART #	DESCRIPTION	QUANTITY
1.	VARIES BY MODEL	DECAL-MODEL IDENTIFICATION	2
2.	VARIES BY MODEL	DECAL-CAPACITY CHART	2
3.	70396918 OR 70396919	DECAL-DANGER ARTICULATED (VERSION USED DEPENDS ON SPACE)	2
4.	70394189	DECAL-OIL RESERVOIR	1
5.	VARIES BY MODEL	DECAL-GREASE POINTS	1
6.	70391583	DECAL-SET-UP/STOW INSTRUCTIONS	2
7.	70392864	DECAL-WARNING, STABILIZER, STAND CLEAR	2
8.	70392865	DECAL-DANGER ELECTRICAL HAZARD	4REF
9.	70392868	DECAL-WARNING LOADLINE	4REF
10.	70392891	DECAL-DANGER DRIVELINE	1REF

NOTE: ITEMS 8, 9, AND 10 ARE INCLUDED WITH EACH CRANE TO BE POSTED ON THE CARRIER VEHICLE. PLACE #8 AND #9 ON ALL FOUR SIDES OF THE CARRIER VEHICLE, AND PLACE #10 AT OR NEAR THE DRIVELINE.

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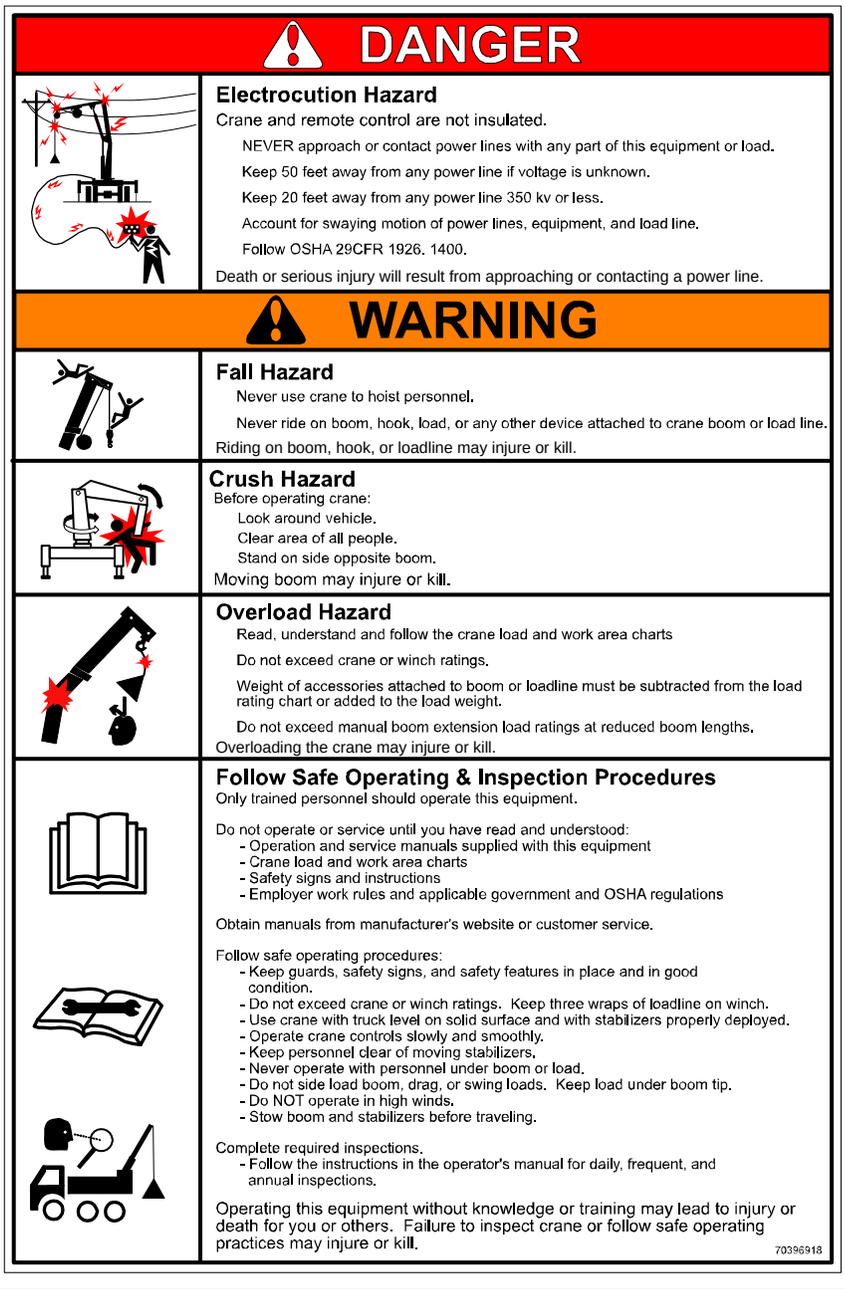
Danger Decal Figures

Safe Operation			
Part #	Function	Placement	Quantity
70396918 or 70396919	To inform the operator and other personnel in the work area of the hazards associated with crane operation, correct operation methods, and how to avoid hazards.	At operating stations.	2



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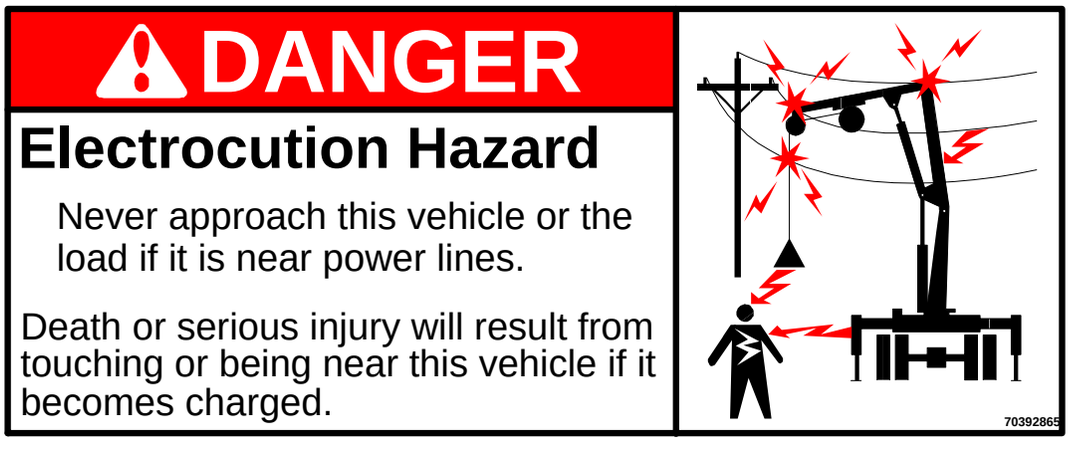
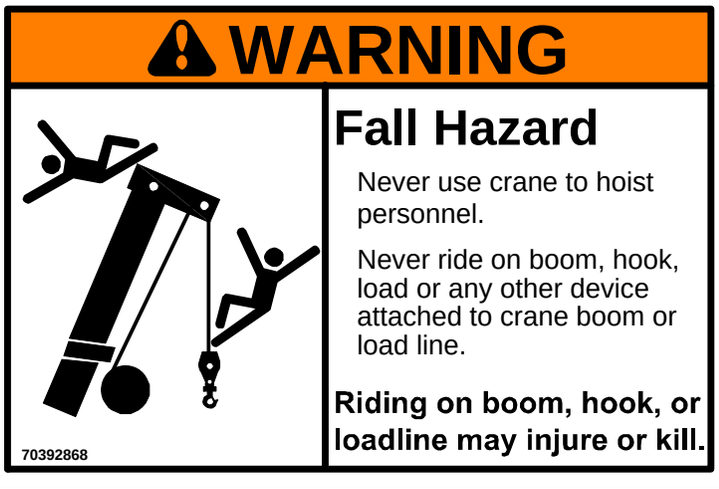
Electrocution Hazard

Part #	Function	Placement	Quantity
70392865	To inform the operator and other personnel in the work area of the hazard associated with contact or proximity to electrical lines, the possible consequences should the hazard occur, and how to avoid the hazard.	On all four sides of the carrier vehicle.	4



Riding on Boom, Hook or Loadline Hazard

Part #	Function	Placement	Quantity
70392868	To inform personnel in the work area of the possible consequences of riding on the boom, boom hook, the load or winch loadline, and how to avoid the hazard.	On all four sides of the vehicle.	4



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Stabilizer Foot Crushing Hazard				
Part #	Function	Placement	Quantity	Sample
70392864	To inform the operator and other personnel in the work area of the hazard associated with the operation of the stabilizers, the possible consequences should the hazard occur, and how to avoid the hazard.	On each stabilizer.	2	
Rotating Driveline Hazard				
Part #	Function	Placement	Quantity	Sample
70392891	To inform personnel of the hazard associated with servicing an operating driveline or PTO, the possible consequences should the hazard occur, and how to avoid the hazard.	At or near the driveline.	1	

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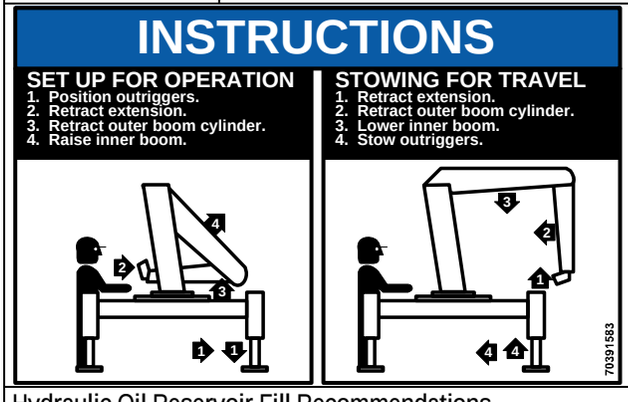
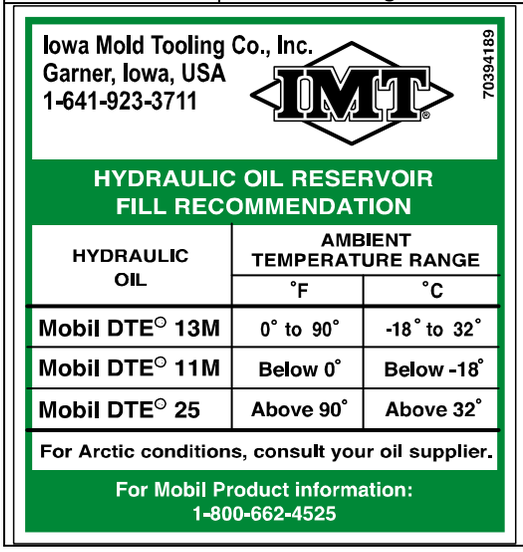
Instructional Decals

Decals in this section are instructional decals which may be affixed to your crane. Some are relevant to maintenance while others focus on operation. They are provided here as reference to help you understand their purpose and placement.

Set-up / Stow Instructions			
Part #	Function	Placement	Quantity
70391583	To provide the operator with sequential steps to be taken in the set-up and storing of a figure-4 folding crane.	On figure-4 folding cranes, at or near the operator's station.	1



Hydraulic Oil Reservoir Fill Recommendations			
Part #	Function	Placement	Quantity
70394189	To inform operator and maintenance personnel of the recommended hydraulic oil to be used under differing climatic conditions.	On or near hydraulic oil reservoir.	1



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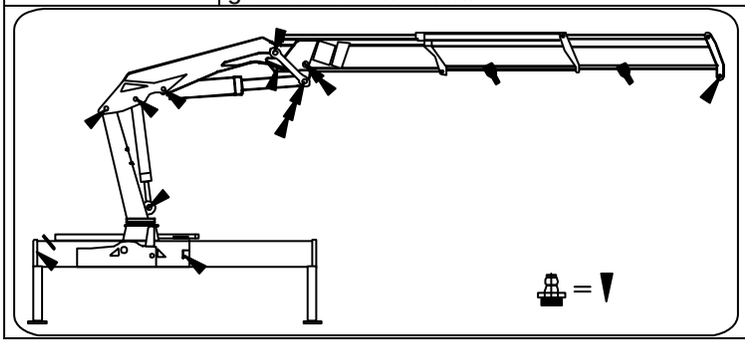
Grease Points			
Part #	Function	Placement	Quantity
Varies by model	To show the areas of the loader that require grease or lubrication.	At or near control station.	1



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CHAPTER 5

Hand Signals

Hand signals can be used to communicate between crane operators and assistants when the job site noise level is too high to communicate in other ways.

Signals to the operator shall follow ASME B30.5 standards, unless voice communication is utilized. Signals shall be discernible or audible at all times. No response by the operator is to be made unless the signal is clearly understood.

For operations not covered by the ASME hand signals, additions to or modifications may be made. These special signals must be agreed upon by the operator and signal person before the crane is operated.

If verbal instructions are required rather than hand signals, all crane motions must be stopped before doing so. Figure includes an illustration of the hand signal, the operation associated with the signal, and a description of the signal. The operator and signal person must review these signals and agree to their use before implementation. For complete hand signal information, refer to ASME/ANSI B30.5 - Mobile and Locomotive Cranes, published by the American Society of Mechanical Engineers.

The hand signals presented by The American Society of Mechanical Engineers have been accepted by the Occupational Safety and Health Administration (OSHA).

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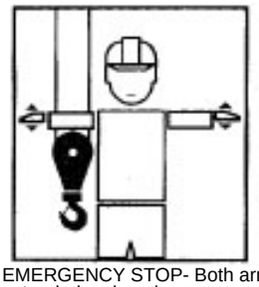
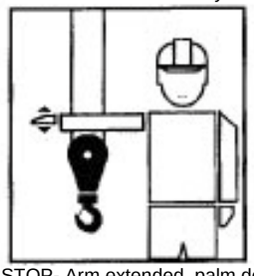
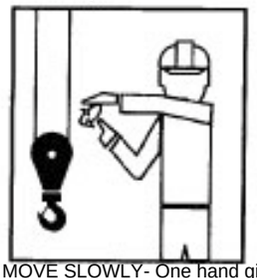


EMERGENCY STOP- Both arms extended, palms down, move arms back and forth horizontally.



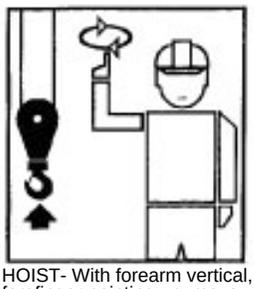
STOP- Arm extended, palm down, move arm back and forth horizontally.



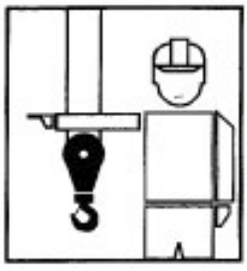
MOVE SLOWLY- One hand gives any motion signal; place other hand motionless in front of that hand. (Hoist slowly shown.)

USE MAIN HOIST- Tap fist on head; then use regular signals.

EXTEND BOOM- (Telescoping Booms) One Hand Signal. One fist in front of chest with thumb tapping chest.

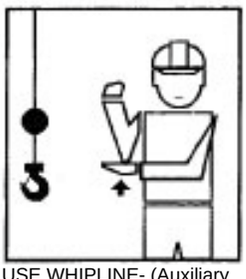


HOIST- With forearm vertical, forefinger pointing up, move hand in small horizontal circles.

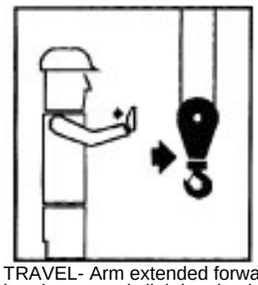


SWING - Arm extended, point with finger in direction of boom swing.

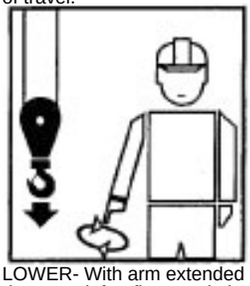
EXTEND BOOM- (Telescoping Booms) Both fists in front of body with thumb pointing outward.



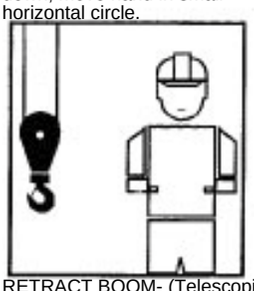
USE WHIPLINE- (Auxiliary Hoist) - Tap elbow with one hand; then use regular signals.



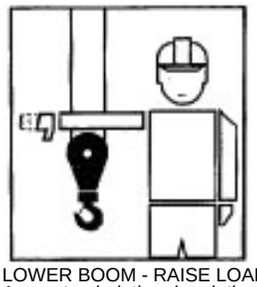
TRAVEL- Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



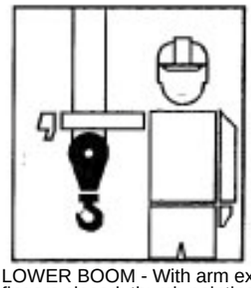
LOWER- With arm extended downward, forefinger pointing down, move hand in small horizontal circle.



RETRACT BOOM- (Telescoping Booms) Both fists in front of body with thumbs pointing inward.

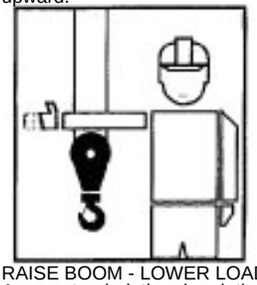


LOWER BOOM - RAISE LOAD Arm extended, thumb pointing down, flex fingers in and out until desired movement is completed.



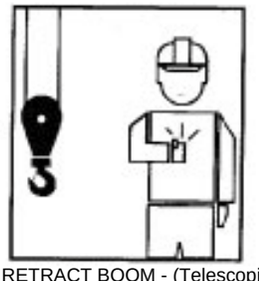
LOWER BOOM - With arm extended, fingers closed, thumb pointing downward.

RAISE BOOM - With arm extended, fingers closed, thumb pointing upward.



RAISE BOOM - LOWER LOAD Arms extended, thumb pointing up flex fingers in and out until desired movement is completed.

DOG EVERYTHING - Clasp hands in front of body.



RETRACT BOOM - (Telescopic Booms) - One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

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CHAPTER 6

Component Installation

In This Chapter

Winch Safety 51
Winch Mount - Outer Boom 51
Winch Mount - Fly-Jib 52
Winch Mount - Inner Boom 54
Winch Installation on Boom System 56
Fly-Jib 58
Fly-Jib Safety 61

Winch Safety

- The loader safety system prevents the loader and winch system from being overloaded, but the operator is ultimately responsible for safe loader / winch operation.
- Do not try to lift a load that exceeds the winch hook capacity, noted with a label on the swivel hook. The label indicates the maximum wire stress on the wire.
- Operate the winch slowly and smoothly. Ensure the wire is correctly wound.
- Do not sideload the winch. Only lift vertically with the winch.
- Never drag a load across a surface. The winch is designed for vertical lifts.
- Keep the wire taut when working with a winch. Stop the winch down movement as soon as the load is placed on the surface.
- Always operate the winch up movement carefully when the hook reaches the hoist stop.
- Do not operate the winch quickly when working with a load hanging on a long winch cable. Do not swing the load on the winch cable.
- Raise and lower the winch cable slowly when working in high positions with loader and Fly-Jib, if any.
- Extend the outer boom extensions to the position where the winch is required, prior to using the winch. Do not extend loader and fly-jib extensions with a load on the winch cable.
- If the safety system stops the loader or winch function, immediately investigate the cause.

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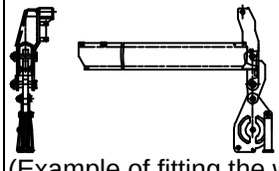
Winch Mount - Outer Boom

Your winch may be mounted on the outer boom.

WINCH COMPONENTS	
ITEM	DESCRIPTION
1 - Winch	Depending on the loader size, three winch types are used with a mean wire pull of 3085 lb (1400 kg), 4410 lb (2000 kg), or 5730 lb (2600 kg) respectively.
2 - Wire	The wire is torsion free. Two standard wire types are used with a diameter of 0.4" (10 mm) or 0.47" (12 mm) respectively. NOTE: Do not use another wire diameter, as there are grooves in the winch drum surface.
3 - Wire pulley	At the end of the outer boom next to the loader hook suspension, the wire runs over a wire pulley with a hoist stop bracket (item #4) which is the stop for the swivel hook.  (Example of fitting the wire pulley on the boom system)
4 - Hoist stop bracket	
5 - Swivel hook	A swivel hook is attached to the wire. The hook also functions as a counterweight, keeping the wire taut in case of high boom position. The swivel hook is marked with the maximum permissible wire load.

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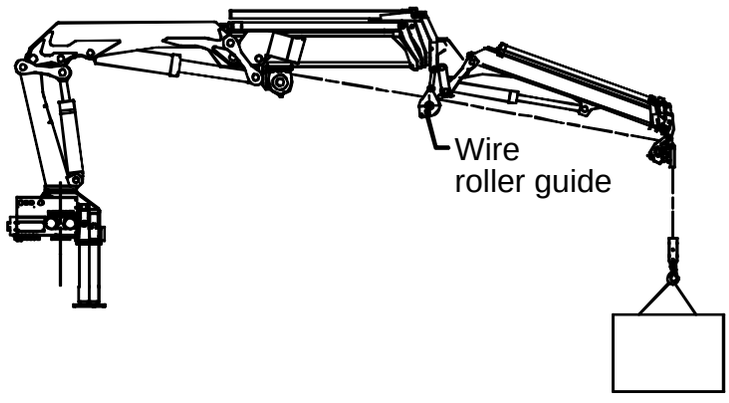
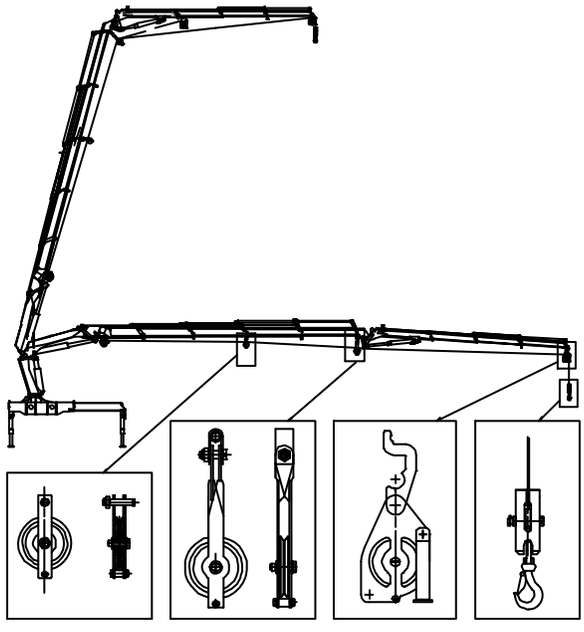
Winch Mount - Fly-Jib



If a fly-jib is attached to the outer boom, the wire is kept close to the outer boom extension via a wire roller guide.



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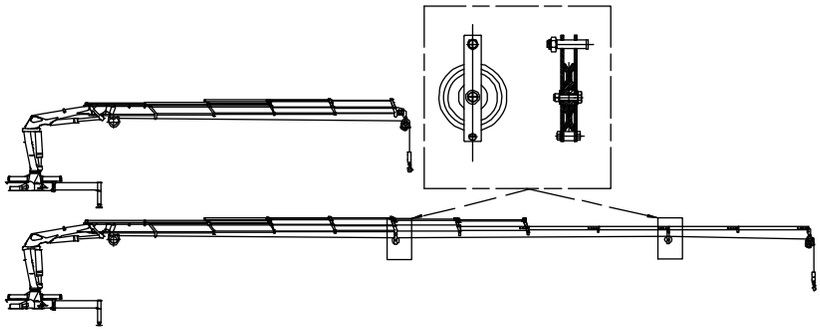
If the loader/fly-jib has several hydraulic extensions, wire roller guides are used to keep the wire as close to the outer boom extensions as possible.



Depending on loader type, it is necessary to use a wire roller guide for approximately every 4th hydraulic extension / manual extension.

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Winch Mount - Inner Boom

A winch system can also be mounted on the inner boom.

WINCH COMPONENTS	
ITEM	DESCRIPTION
1 - Winch	The winch bracket with winch is mounted on the inner boom.
2 - Fixed Wire Roller Guide	The wire roller guide is mounted to the outer boom. It has both a positively and negatively loaded wire sheave. Negative load on the wire occurs when the outer boom has loader movements above the horizontal, when the inner boom is in a horizontal position.
3 - Movable Wire Roller Guide	To keep the wire close to the outer boom extensions, the wire roller guide is mounted in one of the extensions.
4 - Fixed Wire Roller Guide	The wire roller guide is fixed to the Fly-Jib link arm system and has both a positively and a negatively loaded wire sheave. Negative load on the wire occurs when the Fly-Jib has movements above horizontal in relation to the outer boom.
5 - Movable Wire Roller Guide	To keep the wire close to the fly-jib, a wire roller guide is fitted in one of the extensions.
6 - Wire Pulley	At the end of the jib extensions next to the hook suspension of the loader, the wire runs over a wire pulley with a hoist stop bracket, which makes out the stop for the swivel hook.
7 - Wire	The wire is torsion free. Two standard wire types are used with a diameter of 0.4" (10 mm) or 0.47" (12 mm) respectively. NOTE: Do not use another wire diameter, as there are grooves in the winch drum surface.
8 - Swivel hook	A swivel hook is attached to the wire. The hook also functions as a counterweight, keeping the wire taut in case of high boom position. The swivel hook is marked with the maximum permissible wire load.

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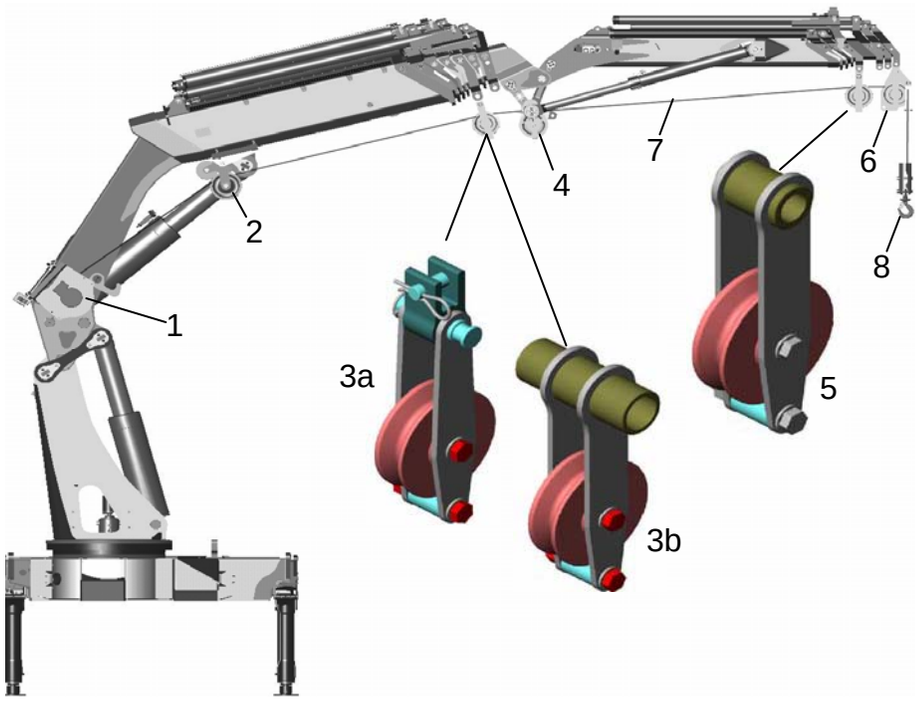

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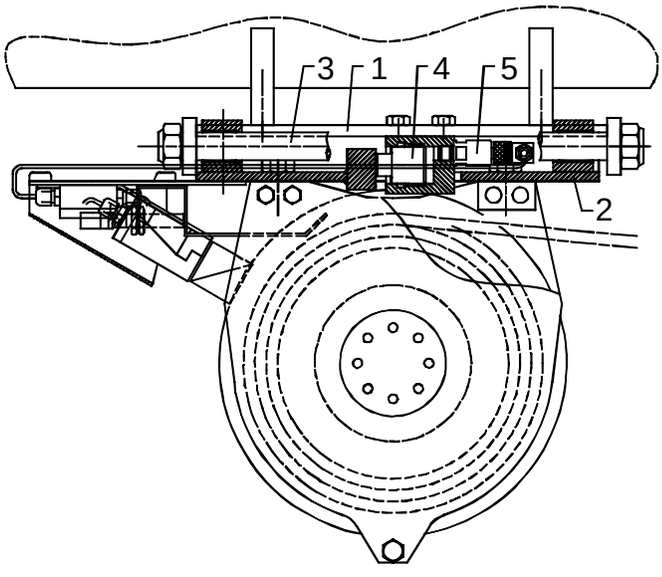
Winch Installation on Boom System

The winch is mounted onto a winch bracket. The winch bracket design varies based on the loader type.

Bracket designs include:

- a fixed bracket (item 1) which is welded onto the outer boom of the loader,
- a movable bracket (item 2) which can be displaced a bit in the longitudinal direction of the outer boom in relation to the fixed bracket,



There are two axles (item 3), on which the movable bracket can be displaced, and a cylinder (item 4), fitted between the two brackets. The tractive effort from the wire is led via the movable bracket directly onto the cylinder. The oil pressure in the cylinder is thus constantly proportional to the wire pull.

A pressure transducer (item 5) is fitted in the cylinder, which converts the hydraulic pressure in the cylinder into electric voltage. The voltage variation, which is proportional to the wire pull, is thus the control signal for the safety system. For more information, see the Instruction Manual – RCL Safety System.

On some winch types, a conical wire roller (item 6) prevents lopsided winding of the wire along the flange of the cable drum. On some winch types, a wire rope pressure drum (item 7) is mounted on the back of the winch. The wire rope pressure drum activates a sensor when there are 3 winds of cable left on the cable drum (the safety system stops the ease movement) and

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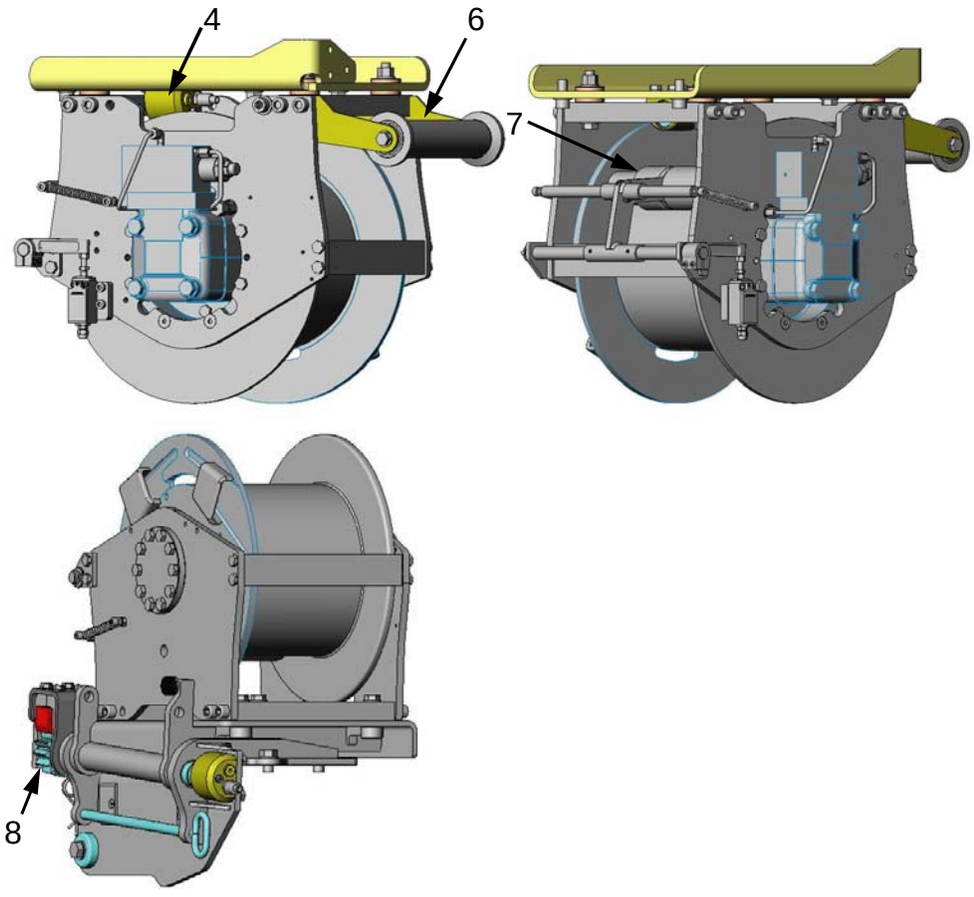
ensures correct wire winding. A winch which is mounted on the inner boom can have a swing-up stowing bracket, swinging up from the side till on top of the inner boom (item 8).



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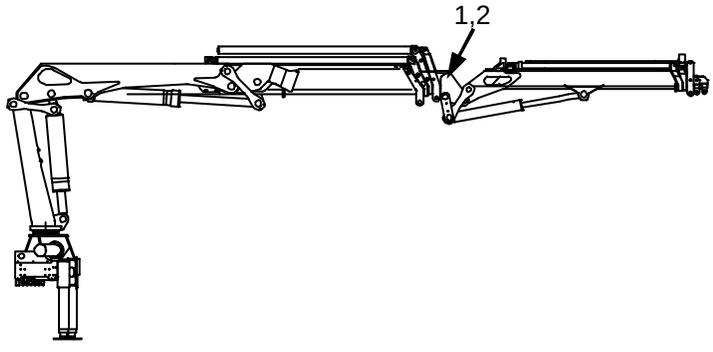
Fly-Jib

The detachable Fly-Jib is mounted at the end of the outer boom extensions. There are hydraulic quick-release couplings and an electric plug and socket-outlet (positions 1,2) which must be removed and re-fitted with mounted or dismounted.



The Fly-Jib is protected against an overload condition by the RCL Safety System in the entire lifting area. See the Instruction Manual – RCL Safety System.

CAUTION

The load limits indicated on the lifting capacity diagram of the manual extensions must never be exceeded.

- When the Fly-Jib is removed from the loader, cap all quick-release couplings with dust caps to keep dirt from the hydraulic system. (See Figure 1.)

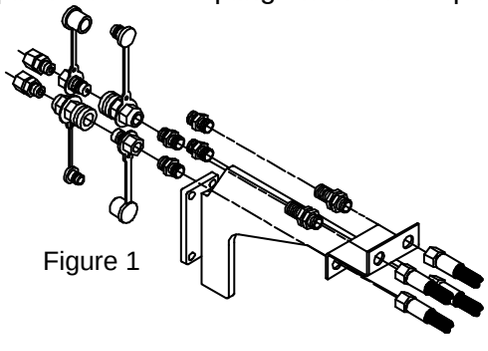


Figure 1

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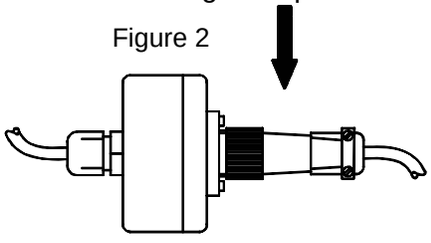
- When using the fly-jib to lift a load, plug the electric plug into the plug box. (See Figure 2.) When the fly-jib is dismounted, carefully fit the dummy plug in the socket on the loader, otherwise the safety system will indicate an error. Avoid damaging the plug when mounting and dismounting. Keep the dummy plug in the vehicle cab when not in use.

Figure 2

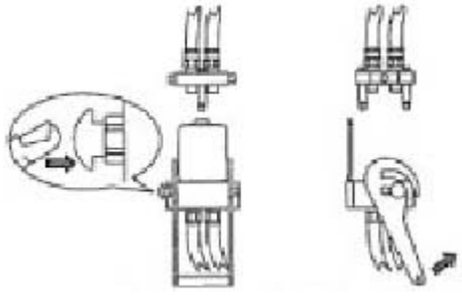
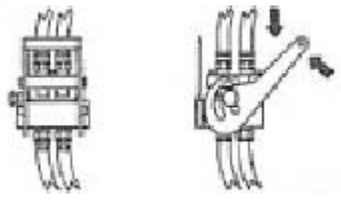
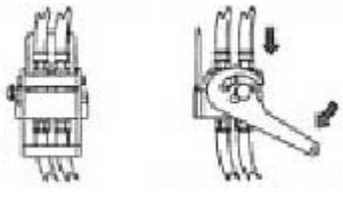


- When the Fly-Jib is mounted, fit the lock bolt with a pin.
- Always operate the loader smoothly when working with a Fly-Jib, especially during crane rotation.
- On some loaders, all hydraulic connections are connected and disconnected through a multi-coupling system.

NOTE

Depressurize the hydraulic system before connection and disconnection.

Connection Instructions

1.	Remove the dust cap. Hold down the lock knob while lifting the lever.	
2.	Push the movable part against the fixed part. Move the locking pins against the curved slot in the lever.	
3.	Push the lever completely down against stop.	

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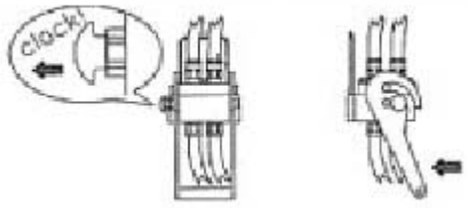
4.	The correct connection has been obtained when the lock knob pops out.	

Disconnection

1 Hold down the lock knob.

2 Lift the lever till the locking pins are free of the curved slot in the lever.

3 Pull out the movable part from the fixed part.

4 Put on the dust cap.

NOTE

Clean fixed and moving parts before assembly.

Fly-Jib Safety

- When the Fly-Jib is mounted, make sure the lock bolt is correctly pinned.
- Never exceed the load limits indicated on the lifting capacity diagram of the manual extensions.
- The Fly-Jib increases the loader’s extended reach considerably. The loader must be operated slowly and smoothly.
- Lower the load carefully when working in high positions with loader and Fly-Jib. The load moment is increased suddenly and very fast, and can easily lead to serious overloading/instability.
- Always rotate movement carefully, especially when moving a heavy load at a long reach.

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CHAPTER 7

Wire Rope & Hooks

In This Chapter

Wire Rope Inspection 63
Wire Rope Lubrication 64
Wire Rope Inspection & Replacement 64
Wire Rope Slings 66
Basic Hitches 67
Sling Loading 68
Hooks 68
Methods of Hook Inspection 69
Hook Testing 71

Wire Rope Inspection

OSHA requires regular inspections and permanent, signed record-keeping on wire rope inspections. These inspections help the crane operator determine whether the rope can be safely used. Inspection criteria, including number and location of broken wires, wear and elongation, have been established by OSHA, ANSI, ASME and similar organizations.

WIRE ROPE INSPECTION CRITERIA

1. INSPECTOR - The wire rope inspector must keep written reports of the rope condition on file at the work site and must have the authority to order wire rope replacements and keep unsafe wire rope from being used.
2. PERIODS OF INSPECTION - Set up inspection periods for each material hoist wire rope. Determine inspection frequency by considering environment, degree of hazard to materials, frequency of operation and the frequency with which the wire rope is subjected to its capacity limits. Inspect at least every 30 days.
3. METHODS OF INSPECTION - To inspect, unwind the working length of the wire rope from the hoist drum. Thoroughly inspect the rope sections that pass over sheaves, drums or contact saddles or which make opposing turns. Inspect the rope close to the end attachments. DO NOT open the rope for inspection.
4. USED WIRE ROPE - Thoroughly inspect used wire rope prior to installation.
5. IDLE EQUIPMENT - Inspect wire rope on idle equipment prior to operation.

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DAILY INSPECTION: Inspect for kinking (sharp bends), crushing, unstranding, birdcaging, core protrusion, rope diameter loss, rope strand unevenness, general corrosion, broken or cut strands, heat damage, and integrity of end attachments.

MONTHLY INSPECTION: Each month, inspect the entire length of the rope, the wire rope eye, and the sheaves, drums and other apparatus with which the rope makes contact.

When a wire rope has been removed from service because it is no longer suitable for use, it must not be re-used on another application. Every wire rope user should understand that each type of fitting attached to a wire rope has a specific efficiency rating which can reduce the working load of the rope assembly or rope system, and this must be given due consideration in determining the capacity of a wire rope system.

Wire Rope Lubrication

Wire rope used on IMT cranes does not have continuous lubrication replenishment. Use open gear lubricant to protect the wire rope on your crane. The areas of rope which experience the most wear are located over sheaves or are otherwise hidden, and these areas require the most rope lubrication.

Lubricate the wire rope using ChainMate™ Chain and Wire Rope lubricant, Vitalife® 400, or equivalent. To lubricate the rope:

1 Clean dirt, dust, and foreign matter from the rope.

2 Apply ChainMate lubricant or equivalent, penetrating the strands of the rope. Apply according to the lubricant specifications.

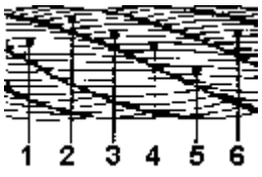
3 Apply lubricant heavily to portions which encounter bending such as at the sheave and winch.

Wire Rope Inspection & Replacement

Wire rope with any of the deficiencies shown below shall be removed and replaced immediately.

a Corrosion can be cause for replacement. Any development of corrosion must be noted and monitored closely.

b When there are either three broken wires in one strand or a total of six broken wires in all strands in any one rope lay.



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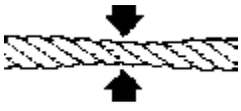
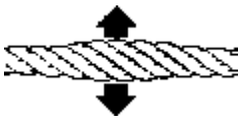
c When flat spots on the outer wires appear and those outside wires are less than 2/3 the thickness of the unworn outer wire.

d When there is a decrease of diameter indicating a core failure.

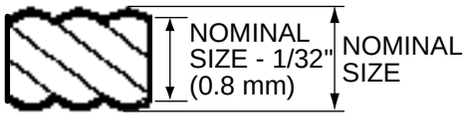


e When kinking, crushing, birdcaging or other distortion occurs.



f When there is noticeable heat damage (discoloration) of the rope by any means.

g When the diameter is reduced from nominal size by 1/32" (0.8 mm) or more.



h If a broken wire protrudes or loops out from the core of the rope.

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Wire Rope Slings

Rated load (rated capacity) of a wire rope sling is based on the nominal, or catalog strength of the wire rope used in the sling, and factors which affect the overall strength of the sling. These factors include attachment or splicing efficiency, the number of parts of rope in the sling, type of hitch (straight, choker, basket), diameter around which the body of the sling is bent, and the diameter of hook over which the eye of the sling is rigged.

Rated load of a sling is different for each of the three basic methods of rigging. These rated loads are available from your wire rope sling supplier and may be indicated on a tag attached to the sling at the time it is fabricated.

WARNING

A HAND-TUCKED EYE SPLICE CAN UNLAY (UNRAVEL) AND FAIL IF THE SLING IS ALLOWED TO ROTATE DURING USE.

- Never shock load a sling. There is no practical way to estimate the actual force applied by shock loading. The rated load of a wire rope sling can easily be exceeded by a sudden application of force, and damage can occur to the sling. The sudden release of a load can also damage a sling.
- Protect the body of a wire rope sling using corner protectors, blocking or padding against damage by sharp edges or corners of a load being lifted. Sharp bends that distort the sling body damage the wire rope and reduce its strength.
- Any angle other than vertical at which a sling is rigged increases the loading on the sling.
- Visually inspect a sling before each lift or usage to determine if it is capable of safely making the intended lift in the same method as inspecting a wire rope.
- If a sling is found to be deficient, the eyes must be cut, or other end attachments or fittings removed to prevent further use, and the sling body discarded.
- Never use a sling eye over a hook or pin with a body diameter larger than the natural width of the eye. Never force an eye onto a hook. The eye should always be used on a hook or pin with at least the diameter of the rope.

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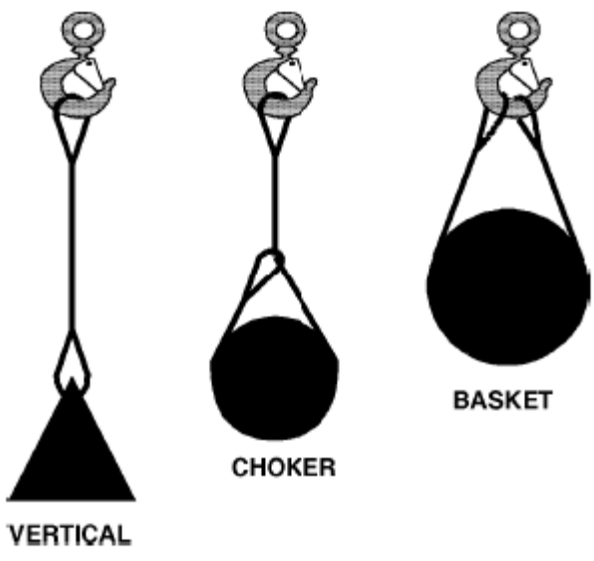
Basic Hitches

VERTICAL or straight attachment, is simply the using of a sling to connect a lifting hook to the load. Full rated load of the sling may be used, but never exceeded. A tagline should be used on such a lift to prevent rotation which can damage the sling. A sling with a hand-tucked splice can unlay and fail if the sling is allowed to rotate.

CHOKER hitches reduce lifting capability of a sling, since this method of rigging affects the ability of the wire rope components to adjust during the lift, places angular loading on the body of the sling, and creates a small diameter bend in the sling body at the choke point.

BASKET hitches distribute a load equally between the two legs of a sling, within limitations imposed by the angles at which legs are rigged to the load.



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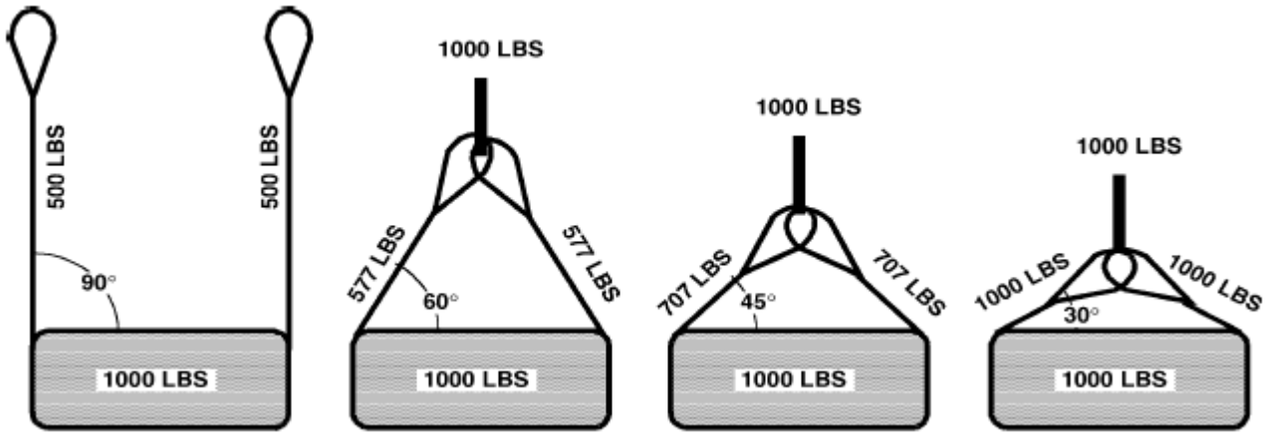
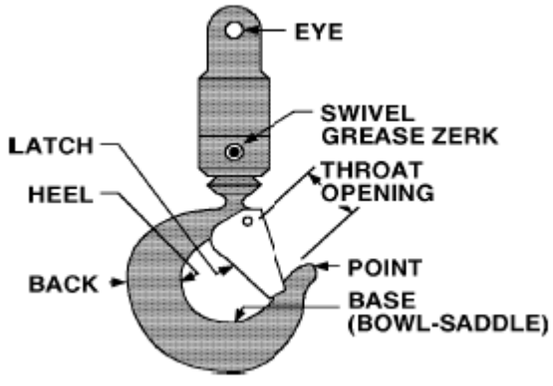
Sling Loading

Sling angle (angle of loading) is the angle measured between a horizontal line and the sling leg or body. This angle is very important and can have a dramatic effect on the rated load of the sling. When this angle decreases, the load on each leg increases. This principle applies whether one sling is used with legs at an angle in a basket hitch, or for multi-leg bridle slings. Horizontal sling angles of less than 30° shall not be used. See figure.



Hooks

Crane hooks are designed and manufactured to lift specific loads. Hooks are rated for loads held in direct tension, rather than shock loaded, loaded on the hook tip, bent, etc. Hooks are designed to permanently deform before failing, and they should be periodically inspected and tested.



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LATCHES

Use a hook equipped with a latch except when a latch is impractical or dangerous. The latch is used to retain such items as slings and chains under slack conditions. Latches do not support loads, and should not be crowded by oversized rope or stiff riggings. The load should be seated on the “bowl-saddle” before lifting.

HOOK SWIVELS

Hook swivels prevent a load from twisting caused by a natural tendency for wire rope to unwind under load. These swivels, usually a part of the hook, are fitted with bearings to provide for rotation. Regular lubrication of the swivel bearings is extremely important and is normally applied by way of a grease zerk located on the swivel.

CAUTION

THE CRIMPING EFFECT OF WEDGE SOCKETS CAN REDUCE THE SAFE WORKING LIMIT OF A LINE BY AS MUCH AS 30%

Methods of Hook Inspection

Inspections and record keeping requirements for hooks are determined by the kind of equipment the hooks are used on. When the inspection requirements for hooks are specified in regulations applicable to your equipment, those regulations will take precedence over the information presented here.

NEW AND REPAIRED HOOKS

NEW AND REPAIRED HOOKSPrior to initial use, inspect all new and repaired hooks shall to assure compliance with the items listed in the HOOK INSPECTION CHECKLIST.

HOOKS IN REGULAR USE

Inspect hooks in regular use with the FREQUENT or PERIODIC method as described below.

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HOOKS NOT IN REGULAR USE

Hooks not in regular use should be inspected before they are returned to service. See HOOK INSPECTION CHECKLIST.

REQUIREMENTS	FREQUENT INSPECTION	PERIODIC INSPECTION
MEANS	Visual examination by the operator or designated person.	Visual inspections by an appointed person.
RECORDS	Records of the inspection are not required.	Records of apparent external hook conditions should be created to provide the basis for continuing hook evaluation.
NORMAL SERVICE (Less than 85% of rated load except for isolated instances.)	Monthly	Yearly
HEAVY SERVICE (85% to 100% of rated load on a regular basis.)	Weekly to Monthly	Yearly, unless hook conditions indicate a need for detailed inspection.
SEVERE SERVICE (85% to 100% of rated load regularly and under environmental conditions which are unfavorable, harmful, or detrimental to the hook.)	Daily to Weekly	Quarterly, as above, unless detailed inspection shows a need for non-destructive testing.
SPECIAL or INFREQUENT SERVICE	As authorized by a qualified person, and before and after each period of service, with record of the operation retained.	As authorized by a qualified person, before the first period of service, and as directed by the qualified person for any subsequent operation.

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HOOK INSPECTION CHECKLIST	
CHECK FOR:	**REASON TO REMOVE HOOK FROM SERVICE (See Note 1)**
DISTORTION (Bending / Twisting	A bend or twist exceeding 10 degrees from the plane of the unbent hook.
DISTORTION (Increased throat opening)	HOOK WITHOUT LATCH: An increase in throat opening exceeding 15 degrees (or as recommended by the manufacturer) HOOK WITH LATCH: An increase of the dimension between a fully-opened latch and the tip section of the hook exceeding 8 percent (or as recommended by the manufacturer)
WEAR	If wear exceeds 10 percent of the original section dimension (or as recommended by the manufacturer)
CRACKS, NICKS, GOUGES	Cracks, nicks, and gouges must be repaired by a designated repair person by grinding longitudinally following the contour of the hook, provided that no dimension is reduced by more than 10 percent of its original value. (Or as recommended by the manufacturer.) (A qualified person may authorize continued use if the reduced area is not critical.)
LATCH (Engagement / Damage / Malfunction)	If a latch becomes inoperative because of wear or deformation and is required for the service involved, it must be replaced or repaired before being put back into service. If the latch fails to fully close the throat opening, the hook shall be removed from service or wired shut until repaired.
HOOK ATTACHMENTS & SECURING MEANS	If any indication of distortion, wear, cracks, nicks, or gouges are present unless a qualified person authorizes their use. (Or as recommended by the manufacturer.)
NOTE: **1** Hooks having any of the deficiencies listed shall be removed from service unless a qualified person approves their continued use and initiates corrective action. Hooks approved for continued use shall be subjected to periodic inspection.	

Hook Testing

Hooks should be tested at least once a year by magnaflux test, X-ray, or other qualified method.

Intermittent tests can be conducted using the readily available, though less accurate, oil stain method, as follows:

1 Immerse hook into lube oil.

2 Wipe hook dry.

3 White-wash hook surface.

4 Inspect hook for seepage of white-wash into fractures.

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CHAPTER 8

Capacity

In This Chapter

Crane Capacity & Stability....73
Using the Capacity Placard....75
Crane Stability....77
Stability Chart - Crane Mounted Behind Cab....80
Stability Chart -Rear Mounted Crane....82

Crane Capacity & Stability

Crane Capacity

The IMT crane is designed to lift specific loads. These loads are defined on the capacity placard mounted near the operator's station, on the crane, and in the Technical Specifications manual for your crane model. Exceeding the limits presented on the capacity placard will create severe safety hazards and will shorten the life of the crane. The operator and other concerned personnel must know the load capacity of the crane and the weight of the load being lifted!

WARNING

NEVER EXCEED THE CRANE'S RATED LOAD CAPACITIES. DOING SO WILL CAUSE STRUCTURAL DAMAGE AND DAMAGE TO WINCHES AND CABLES WHICH CAN LEAD TO DEATH OR SERIOUS INJURY.

NOTE

CAPACITY PLACARDS ARE INTENTIONALLY LOCATED NEAR THE OPERATOR TO ASSURE READY REFERENCE IN DETERMINING WHEN A LOAD CAN OR CANNOT BE HANDLED.

LOAD LIMIT INFORMATION ON THE CAPACITY PLACARD IS FORMULATED ON 85% OF THE BALANCE POINT (TIPPING POINT) FOR A SPECIFIC TRUCK AND CRANE COMBINATION.

All load ratings are dependent upon compliance with the following:

1 The unit has been correctly installed on a factory approved truck.

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2 A satisfactory stability test has been performed and the results are available to the operator.

3 The intended operation is to be carried out on level, solid footing with proper stabilizer placement.

Each stated capacity is directly related to the radius of a given operation. The radius is measured from the load line to the centerline of rotation on the horizontal plane.

Stability Ratings

Capacity ratings project unit stability to no more than 85% of tipping, provided:

1 The vehicle on which the unit is mounted complies with factory requirements.

2 Factory installation instructions are followed when the unit is mounted on a vehicle.

3 Counterweight sufficient to supplement vehicle weight has been installed and meets factory specifications.

4 Tires are properly inflated, and tire inflation pressures meet requirements as stated in appropriate tire load limit charts.

5 The stabilizers are in use, making proper contact with firm, level footing.

6 Any load handling devices have been added to the weight being lifted.

7 Extreme wind velocities are not present.

8 The crane is operated in a smooth and controlled manner.

9 Any required counterweights have been added.

WARNING

THE MINIMUM CURB WEIGHTS SHOWN IN THE SPECIFICATIONS SECTION OF THE CRANE PARTS AND SPECIFICATIONS MANUAL DO NOT ENSURE THE UNIT WILL BE STABLE. ACTUAL STABILITY RATINGS WILL BE OBTAINED FROM THE INITIAL START-UP AND TESTING PROCEDURES.

Required axle weights for the crane mounted on a chassis meeting the minimum chassis specifications are shown in the specifications section of the crane parts manual.

CAUTION

STABILITY FACTORS DO NOT TAKE THE FRONT AXLE LOAD RATING INTO CONSIDERATION. DUE TO THE CAPACITY RATING OF THE FRONT AXLE, THE LOADING 75° EITHER SIDE OF THE CENTERLINE OVER THE CAB MUST BE SEVERELY RESTRICTED.

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Using the Capacity Placard

Perform the following steps before a load is lifted:

1 Determine the weight of the load.

2 Determine the weight of any load handling devices.

3 Add the weight of the load and the weight of the load handling devices. The sum will be the total weight of the load being lifted.

4 Determine the distance from the centerline of crane rotation to the centerline of the load being lifted.

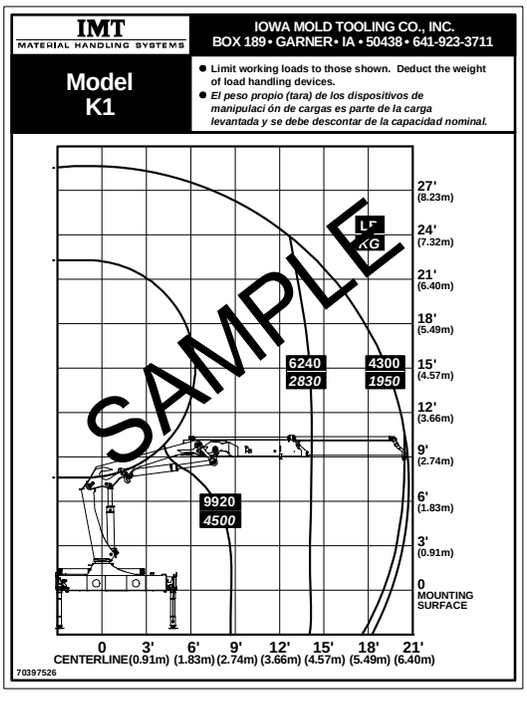
5 Determine the distance from the centerline of crane rotation to the centerline of where the load is to be moved to.

6 The actual distance used should be figured as the larger of items 4 and 5 above.

7 Refer to the crane's capacity placard and determine the range or angle at which the lift will be accomplished.

8 Refer to the capacity of that range to be certain the load being lifted does not exceed the crane's capacity within that range. If using a manual extension or fly-jib, look for the chart showing that application.

9 If a winch is used for the lift, make certain the load does not exceed the winch or winch line capacity.



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Crane Stability

Every IMT factory-installed crane includes a completed stability chart. Any installer other than IMT also has the responsibility to complete a stability chart. Cranes are tested for stability to 85% of "tipping" based on the balance point for a specific truck and crane combination. The Stability Test is per SAE J765a.

Figures entered on the stability chart are for a specific truck and crane combination. If the crane or vehicle are modified or replaced with another, it is necessary to recalculate stability. By referring to the stability chart for your crane/chassis combination, it is possible to determine the loads permitted in the derated load range of your crane.

CAUTION

The percentages given in the gray area of the stability chart are based on actual vehicle stability and do not take front axle rating into consideration. Due to the capacity rating of the front axle, the loading 75° to either side of the centerline over the cab must be severely restricted.

Determine the stability of your truck and crane combination per the following procedure:

1 Use ***Stability Chart - Crane Mounted Behind Cab*** (on page 80) for cranes mounted directly behind the chassis cab, and use ***Stability Chart -Rear Mounted Crane*** (on page 82) for cranes mounted at the rear of the chassis.

2 On the appropriate figure, fill out items A through L.

3 Perform the stability test on a flat hard surface. Ideally this surface will be concrete, but asphalt or hard-packed gravel are acceptable. Only authorized testing personnel may be in or near the test area. Per SAE J765a, the area must be within 1% of level.

4 Position and lower the stabilizers until the weight of the crane has been removed from the truck springs.

5 Extend the crane to full horizontal position, centered over the rear of the truck.

6 From the capacity placard, determine the rated load at the maximum horizontal reach. Place a weight equal to 118% of that rated load at the maximum horizontal reach (L). Keep the load close to the ground to avoid excessive tipping.

L =	ft.

7 Slowly start rotating the load counterclockwise. Through every 5° increment, check whether all vehicle tires remain in contact with the test surface.

NOTE: To make it easier to visualize degrees, compare the rotation to numbered positions on a clock face. As a point of reference, the rear center of the truck is the 0° (12 o'clock) position, and the front center is the 180° (6 o'clock) position.

CLOCK/DEGREE COMPARISONS

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CLOCK POSITION	DEGREES (°)
1	30
2	60
3	90
4	120
5	150
6	180
7	150
8	120
9	90
10	60
11	30
12	0

8 If at any point through the rotation cycle, any one of the vehicle tires starts to break contact with the test surface, stop the rotation and note the position of the crane (X°). This is the balance point which determines 85% of tipping for the rated load.

X° =

9 After the balance point has been reached, retract the extension boom until all tires are in full contact with the test surface again.

10 Continue rotating the boom after stability has been regained. Again, watch all vehicle tires for a point of instability. If a point of instability re-occurs (one of the vehicle tires breaks contact with the test surface), retract the extension boom until stability is regained.

11 Repeat this cycle through a full 180°.

12 At the end of the 180° arc, physically measure the existing horizontal distance from the centerline of rotation to the centerline of the load (K).

K =	ft.

13 To determine the percent of full capacity in the derated zone, divide the remaining horizontal distance (K) by the original maximum horizontal distance (L). Multiply this figure by 100.

K / L x 100 =	%

14 Enter the derated percent of full capacity (Z%) obtained in step 13 on the appropriate figure (***Stability Chart - Crane Mounted Behind Cab*** (on page 80) or ***Stability Chart -Rear Mounted Crane*** (on page 82)). In the derated zone, each individual capacity on the capacity chart must be multiplied by the derated percent of full capacity (Z%). The reduced capacities must maintain 85% of tipping in the derated zone.

15 If the crane is a side mount, repeat the stability test by rotating the crane clockwise through 180° of arc to find X_1°, Y_1° and Z_1°.

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X_1° =
Y_1° =
Z_1° =

16 The figures obtained indicate the stability range of the particular truck and crane combination only. If either the truck or crane is changes or modified, the stability calculations must be repeated.

17 Rotate the crane at least 5 times to using the completed figure to ensure the rating is accurate.

18 Be sure all information has been recorded on the appropriate figure., and in the service manual.

19 Record the total length of time to test the crane (total crane test and inspection time should approximate 4 hours per SAE J765a (1979).

Total hours:

When applicable, this stability test conforms to SAE J765a, ANSI B30.15 and USAS B30.5.

LIFTING IN THE DERATED ZONE

If it is absolutely necessary to perform a lift within the derated load capacity zones (Y or Y1), proceed as follows:

1 Determine the distance from centerline of rotation to the centerline of the load being lifted.

2 Determine the distance from centerline of rotation to the centerline of where the load is to be moved to.

3 The actual distance used should be figured as the larger of items 1 and 2 above.

4 Refer to the crane's capacity placard and determine within which range the lift will be accomplished.

5 Refer to the capacity of that range and multiply that figure by the derated capacity percentage (Z or Z1).

6 Make certain that the weight of the load plus any load handling devices does not exceed that figure.

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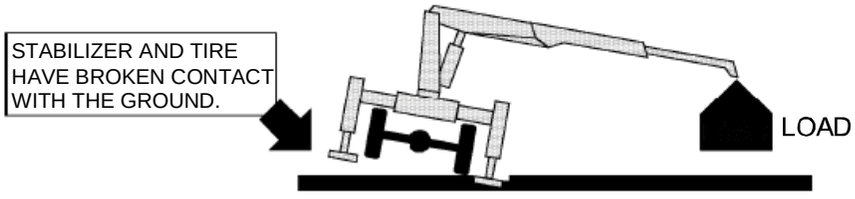
EXAMPLE

If Z% = 70% and crane capacity at the desired range = 2000 lb, then:

.70 x 2000 lb = 1400 lb

Thus, even though the crane is rated for 2000 lb at that particular range, by making the lift within the derated load capacity zone the load must not exceed 1400 lb.



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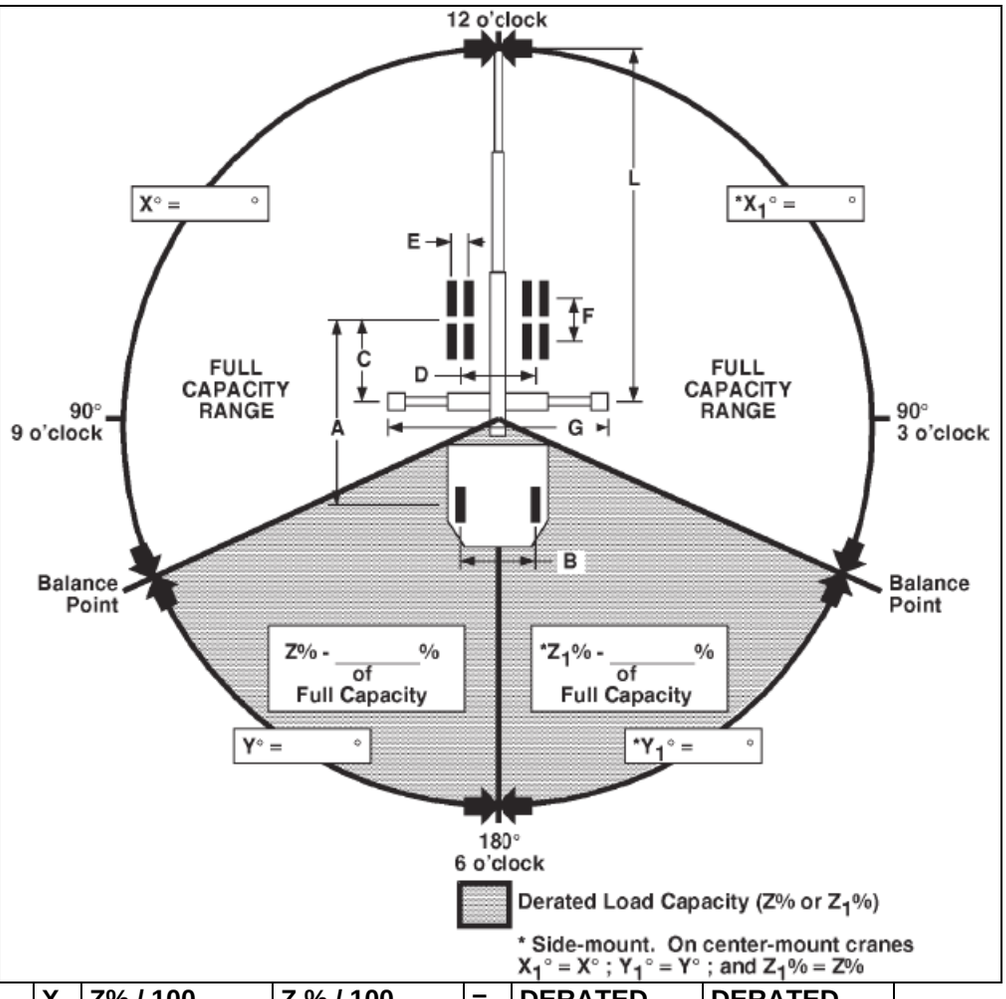
Stability Chart - Crane Mounted Behind Cab

BOOM IN STORED POSITION (no payload) ACTUAL WEIGHTS	
FRONT AXLE (lb)	
REAR AXLE (lb)	
TOTAL (lb)	

LEGEND
Z% OR Z_1% = 100 x K / L
Y° = 180° - X°
Y_1° = 180° - X_1°

DIMENSIONAL DATA	
A (in):	
B (in):	
C (in):	
D (in):	
E (in):	
F (in):	
G (in):	
L (ft):	
X° (°)	
Y° (°)	
Z%(%)	



REACH (per capacity chart)	FULL RATED LOAD	X	Z% / 100	Z_1% / 100	=	DERATED LOAD FOR Z%	DERATED LOAD FOR Z_1%
		X			=		
		X			=		
		X			=		
		X			=		

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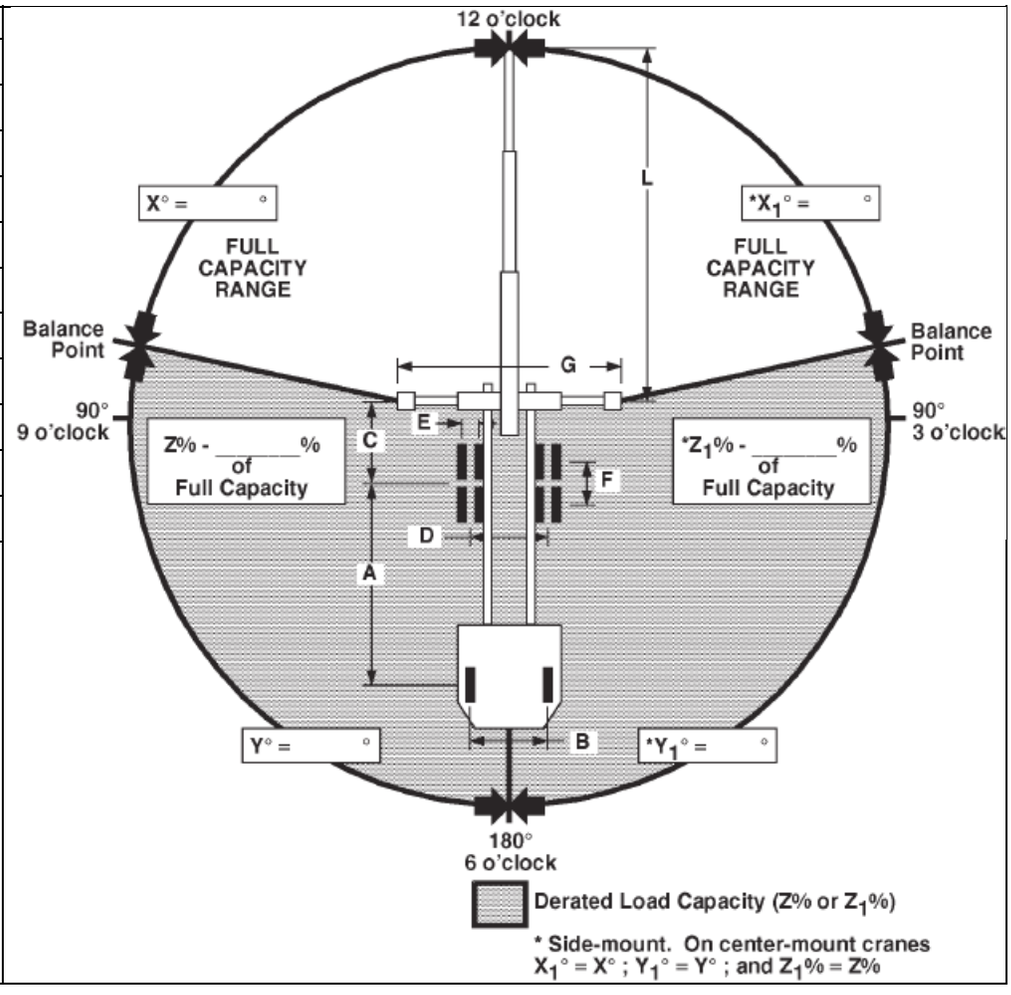
Stability Chart -Rear Mounted Crane

BOOM IN STORED POSITION (no payload) ACTUAL WEIGHTS	
FRONT AXLE (lb)	
REAR AXLE (lb)	
TOTAL (lb)	

LEGEND
Z% OR Z_1% = 100 x K / L
Y° = 180° - X°
Y_1° = 180° - X_1°

DIMENSIONAL DATA	
A (in):	
B (in):	
C (in):	
D (in):	
E (in):	
F (in):	
G (in):	
L (ft):	
X° (°)	
Y° (°)	
Z%(%)	



REACH (per capacity chart)	FULL RATED LOAD	X	Z% / 100	Z_1% / 100	=	DERATED LOAD FOR Z%	DERATED LOAD FOR Z_1%
		X			=		
		X			=		
		X			=		
		X			=		

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CHAPTER 9

Maintenance

In This Chapter

Crane Maintenance Precautions 83
Daily Maintenance 84
Recommended Oil & Grease 85
Grease Points 86
Greasing - Central Grease Point on Loader Base 87
Greasing Push Rods at the Inner and Outer Boom Cylinders 88
Greasing Boom System Sliding Surfaces 90
Bleeding Air from Cylinders 90
Repair 90
Chemical Safety 91

Crane Maintenance Precautions

Proper and regular maintenance of the crane is a very important safety factor. As in the operation of the crane, there are also precautions to take during crane maintenance. Before beginning any maintenance, familiarize yourself with the maintenance sections of any manuals for the equipment being repaired. Before starting work:

1 Place the crane in an area where other equipment is not operating and where there is no through traffic.

2 Make certain the carrier vehicle's parking brake is set. Use wheel chocks to prevent vehicle movement.

3 Position the crane in its stowed position if possible or with the boom lowered to the ground so that any booms will be prevented from collapsing during maintenance.

4 Place all controls in the "OFF" position and disable any means of starting the carrier vehicle or powering the crane.

5 Disconnect the PTO.

6 Secure sheaves and/or load blocks so they will not swing or fall during maintenance.

7 Relieve the hydraulic oil pressure from all circuits before disconnecting any hydraulic fittings or components.

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Replace any parts with only factory approved replacements.

BEFORE RETURNING THE CRANE TO SERVICE

1. Replace all shrouds, guards and safety devices which may have been removed during maintenance.
2. Remove all trapped air in the hydraulic system to prevent erratic operation.
3. Make certain all controls are free of grease and oil.
4. Make certain all decals are present and legible.
5. DO NOT return to the worksite until all repairs are proven to be in proper working condition.

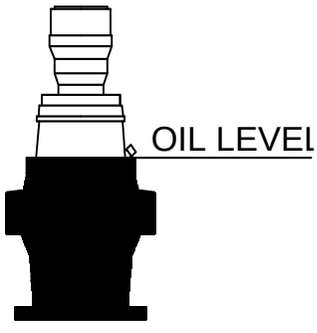
GENERAL PRECAUTIONS

1. DO NOT wear loose clothing while working near machinery.
2. ALWAYS wear safety hat and safety glasses or goggles.
3. DO NOT place your hands near operating gear trains.
4. ALWAYS know where you are and what is happening around you.
5. DO NOT place yourself close to hot hydraulic fluid leaks, which will cause serious burns and injuries.
6. REVIEW all maintenance procedures before attempting.
7. NEVER perform maintenance procedures when unnecessary personnel are in the vicinity.

Daily Maintenance

Daily or weekly, depending on frequency of loader application, complete the following maintenance steps:

1. Check the oil level in tank. The oil must be visible in the oil level glass of the tank when the loader is folded. If the loader is equipped with a planetary gear, check the oil level in it.



2. Make sure that any defects, damage or leaks are repaired by an authorized IMT service center as soon as they are discovered.
3. Check that loader is safely mounted to the truck.

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4 Slide blocks and bushings reduce friction and are naturally subject to wear and tear. Replace slide blocks if too much free play is found in the boom system. Replace bushings before the metal components physically touch each other.

5 Check all hoses for defects and kinks.

6 Check that hooks, wire ropes, straps and the like are in good working order.

7 Check all lock pins and bolts for wear and tear.

CAUTION

If the loader is not folded after use, make sure that all cylinders are completely retracted at least once a day. This maintains the protective oil coating on the piston rods and prevents corrosion on the chromium surfaces. Additional lubrication may be required if the loader is not used regularly.

Recommended Oil & Grease

Crane lubrication requirements are important for both maintenance and safety. By reducing friction on pins and gears the crane will be more reliable and safer to operate. Different lubricants are required for different sections of your crane. Contact your lubricant supplier for specific product information. Grease your crane per the following lubrication specifications and intervals.

APPLICATION POINT	LUBRICATION PRODUCT	APPLICATION METHOD	INTERVAL
Pinion & Drive Gear Rotation Brake Turntable Bearing (rotate while greasing) Cylinder Pins Boom Hinge Pins Boom Rollers	Shell Alvania 2EP or Shell Retinax "A" or Mobilith AW2 or equivalent	Hand Grease Gun or Pneumatic Pressure Gun	Weekly
Planetary Gear	Mobilube HD 80W90 or equivalent	Fill to Check Plug	Monthly

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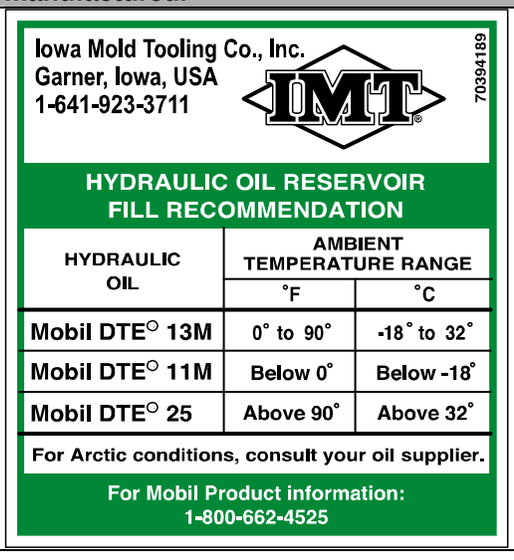
Hydraulic Oil Specifications

The hydraulic oil for your loader must be ISO VG32, low pour, anti-wear hydraulic oil. IMT recommends SAE oil based on the following temperature ranges:

SAE DESIGNATION	TEMPERATURE RANGE	NOTE: Mobil DTE meets these specifications and is the hydraulic oil used when the crane is manufactured.
5W-20	-10 to 180° F (-23 to 82° C)	
10W	+10 to 180° F (-12 to 82° C)	
10W-30	+10 to 210° F (-12 to 99° C)	



Grease Points

Maintaining a lubrication schedule will vary dependent on climatic conditions and the frequency of crane use. The lubrication chart shown in this section is intended to reflect crane lubrication requirements for units under normal working frequencies and normal weather conditions. Periods of heavy use and severe weather conditions will require more frequent lubrication.

Lubrication Point	Frequency
Mast / planetary gear	After 50 hours of operation / 1 month (whichever occurs first)
Pinion ball bearings	After 50 hours of operation / 1 month (whichever occurs first)
Base bearings	After 20 hours of operation / 1 week (whichever occurs first) (Rotate between stops during greasing)
Extension system / slide blocks	After 50 hours of operation / 1 month (whichever occurs first)
Guide rail on extension cylinders	After 50 hours of operation / 1 month (whichever occurs first)
Pins / bolts	After 50 hours of operation / 1 month (whichever occurs first)
Stabilizer arms	As required
Control valves and rod connections	Oil spray as required

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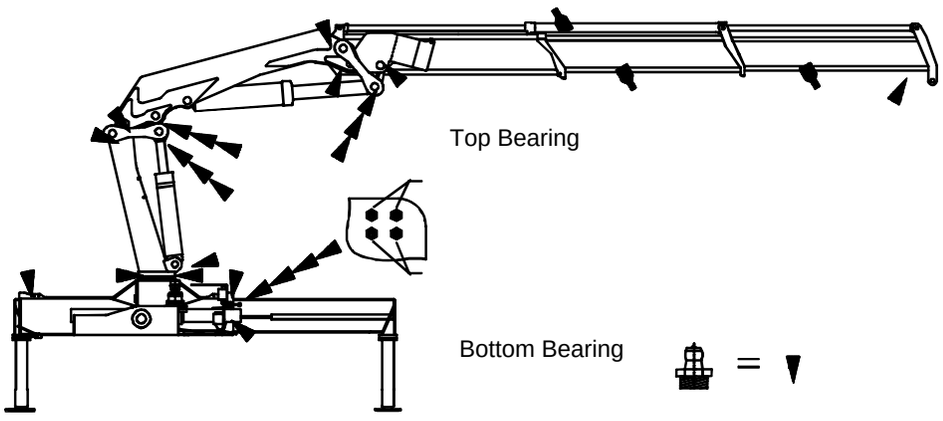


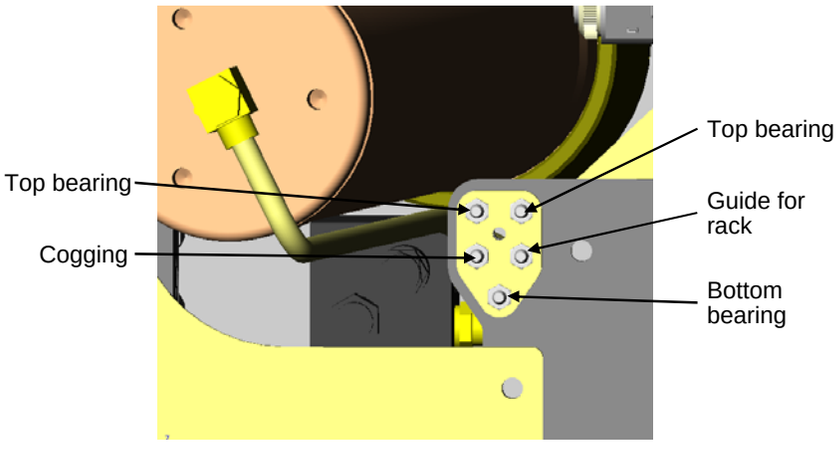
Each loader is marked with a lubrication decal similar to the graphic shown. Rotate the loader between stops several times within the whole rotation area while lubricating the base bearings. Lubricate telescopic extensions and the planetary gear with special grease.

Greasing - Central Grease Point on Loader Base

This greasing information applies to the following loader models:

- 13/88SL & DL
- 14/98SL & DL
- 15/105SL & DL
- 17/117SL & DL
- 18/124SL & DL
- 20/138SL & DL
- 22/153SL & DL
- 24/169SL & DL

The base includes a central grease point where rotation system moving parts can be lubricated. The central grease point located on the cross beam of the base as shown.



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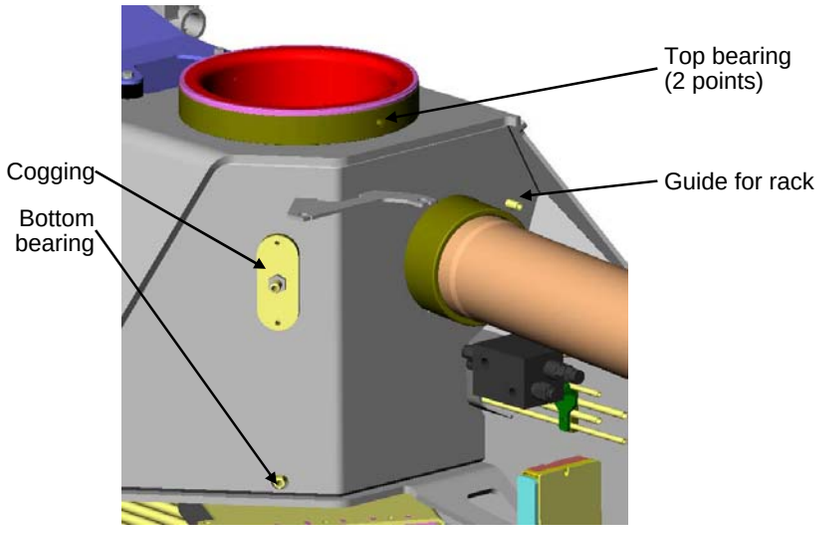
Rotate the loader between stops while greasing at the grease points indicated. Lubricate the cogging twice. Lubricate the loader after 50 hours of operation or as a minimum every month. Additional lubrication is required when the loader has not been used for an extended period of time. See figure to locate the central grease points on the base.



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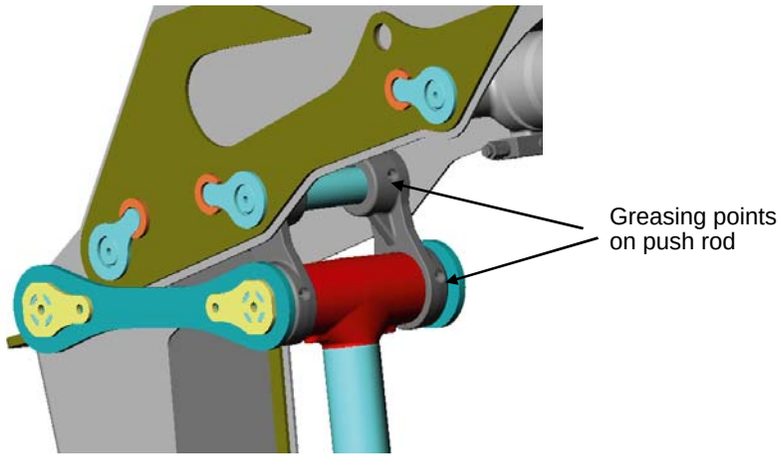
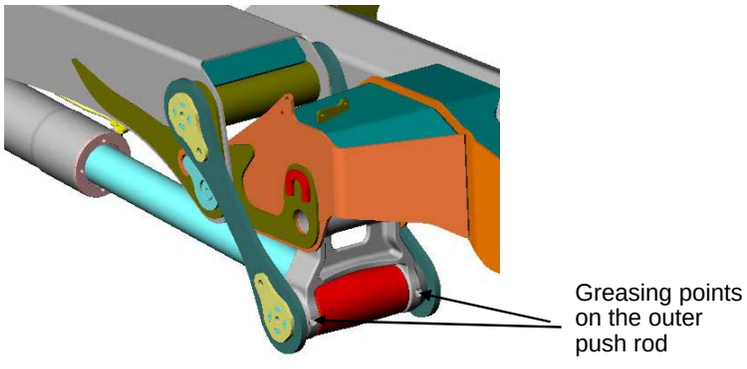
Greasing Push Rods at the Inner and Outer Boom Cylinders

Grease the boom cylinder push rods after 250 hours of operation or every three months.



Grease Points on Inner Push Rods at Inner Boom Cylinder



Grease Points on Outer Push Rod at Outer Boom Cylinder

NOTE: Single link models only have a push rod at the outer boom cylinder.

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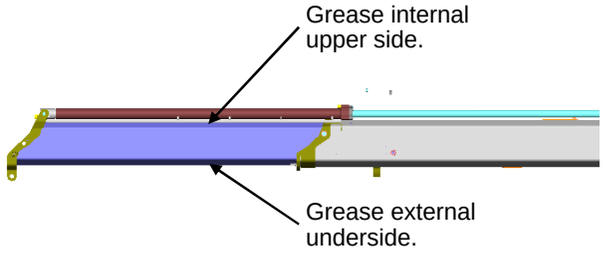
Greasing Boom System Sliding Surfaces

Grease the boom system on all surfaces with bearing slide blocks - the bottom of the external extension booms, and the top of the internal extension booms. Grease booms after 100 hours of operation or at least once a month, and grease when the loader has not been used for an extended period of time.



Bleeding Air from Cylinders

If for some reason air has entered into the hydraulic system, bleed the air from the cylinders using the following steps:

1. Raise and lower each stabilizer leg twice.
2. Extend and retract the inner boom cylinder twice.
3. Extend and retract the outer boom cylinder twice with the inner boom pointing downwards and twice with the inner boom pointing upwards.
4. Extend and retract the extension cylinder twice with the outer boom cylinder pointing almost vertically upwards and twice with the outer boom cylinder pointing almost vertically downwards.

Repair

If you discover defects, damage or leaks, repair them as soon as possible. Use an authorized IMT dealer for service and repairs. Repairs to the hydraulic system must only be made by an authorized service point.

When you order spare parts for your loader, please state:

- Loader type
- Loader serial number

This information can be found in this instruction manual or stamped into the metal plate on the back side of the loader mast.

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Chemical Safety

Many chemicals are available for cleaning and lubricating your equipment. Prior to opening or using any chemical for cleaning, lubrication, or other procedure, READ THE LABEL.

Labels on chemical containers list important information on health, safety, and the product itself. This information can save you from serious injury or even DEATH. Some of this information may be the scientific or common name of the chemical, which is useful when describing poisoning conditions to a poison control center or doctor. The label also describes chemical properties such as flammability, combustibility, explosiveness, or corrosiveness. This information can save your life.

The label also provides advisories in how the product is to be used, such as, “Use only in a well-ventilated area”, “Keep away from heat”, or “Avoid contact with skin”. Always follow these and other warnings and instructions, and refer to the container for first aid instructions.

These warnings and advisories may also be posted in the area where chemicals are stored or used.

Chemicals and their containers have specific handling, storage, and disposal requirements. If these requirements aren't noted on the container, acquire the information from the chemical distributor or responsible governmental agency.

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CHAPTER 10

Crane Design

In This Chapter

Loader Safety Factors 93
Hydraulic System Design 94
Load Moment Limitation 95
Heavy Duty Lifting - HDL 96
Hoses and Hydraulic Pipes 96

Loader Safety Factors

Loader Structure Design & Test

This loader was designed to ensure bearing parts will last the lifetime of the product. During design and testing, the loader completed a long-term stress test corresponding as much as possible to actual operation. All loaders complete a quality control test during production to ensure they meet the design standards.

Safety in Control Circuits

Built-in electrohydraulic control circuits safety features include:

1 An adjustable main-relief valve in the inlet section of the valve block, factory pre-set to the maximum pressure so the loader's lifting capacity is limited to the maximum permissible load. The pressure setting must not exceed the maximum permissible load and should always be sealed.

2 Port-relief valves in the control valve sections of the individual circuits which limit the hydraulic pressure to the individual cylinders, and minimize impact on the loader's structure which might occur from sudden movements.

3 The boom, jib, and extension cylinders with load holding valves with the following main functions:

1. If the loader is overloaded and the pressure in the cylinders is too high, the load holding valve will open in order to relieve internal cylinder pressure.
2. In case of hose rupture, the load holding valve blocks the oil so that it cannot flow out of the cylinder, so the boom is maintained in position and the load is prevented from falling.
3. The load holding valves ensure that during mounting, the load is maintained in position for a length of time, even if the control valve is worn.

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4. The load holding valves maintain the boom system in position if the operator tries to lower the boom system while the loader stands still and the hydraulic pump is stopped.

4 A piloted check-valve is fitted to each stabilizer leg to maintain the stabilizer cylinder in position in case of hose rupture. This device prevents the vehicle from overturning.

5 The hydraulic system forms part of a load moment limitation system (LMB) which ensures that the permissible load moment is never exceeded, irrespective of the operator's actions. For further information, please see the individual loader instruction manual.

6 An emergency stop button is placed near each control station.

7 The operator is warned with a red light when the stress on the loader has reached 90% of the maximum permissible load.

8 The fully extended position of the stabilizer beams is clearly marked.

9 All controls are ensured against unintentional operation of the control levers by means of safety guards etc.

10 If a load is moved into an area (for instance over the driver's cab) where the vehicle becomes unstable, the slewing movement is interrupted either mechanically or by means of an extended load moment limitation system. An extended load moment limitation system ensures that the loader can only be loaded with a limited load moment in this unstable area, so that the vehicle's stability is maintained. When working in this area with a reduced load moment, the operator is warned via a yellow light.

11 If the loader is equipped with stand-up controls where the operator operates the loader standing on the base, a safety system automatically interrupts the slewing movement so that the boom system cannot be moved over the operator.

12 Many movable parts are shielded to protect the operator from injury.

13 If the loader is operated from a top seat (mounted on the column), the slewing system is equipped with a double load holding valve as security in case of hose rupture.

Hydraulic System Design

The loader valve block is a "stack" type, as it is made up of a number of separate control valves. This ensures great flexibility and low maintenance costs. A main relief valve is fitted in the inlet section of the valve block to ensure that the oil pressure in the pump line does not exceed the permissible limit. This valve is adjustable and must always remain sealed. Port relief valves are mounted at the ports of the individual control valves in order to limit the pressure in the individual circuits. Normally the port relief valves are pre-set and cannot be adjusted.

The inner boom, outer boom and extension cylinders are mounted with load holding valves which:

1 Protect cylinders against excessive pressure

2 Reduce the lowering speed of the boom

3 Maintain the boom in position during operations where a fixed boom position is required.

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4 Lock the boom and maintain the load in position in case of hose or pipe rupture.

The stabilizer cylinders are equipped with a piloted check valve, which locks the cylinder in case of damage to the hydraulic system.

CAUTION

The main relief valve, the load holding valves, the dump valve and the external relief valve are sealed. If these seals are broken or removed, the IMT warranty will automatically be void. Check seals regularly and replace if damaged.

Any modification or alteration to the hydraulic system must be in accordance to specific agreement with IMT. Hydraulic system maintenance should always take place at an authorized IMT service point.

Load Moment Limitation

The loader is equipped with a load moment limitation system (LMB) which prevents the maximum permissible load moment from being exceeded, in spite of operator error.

However, the LMB-system does not necessarily ensure sufficient vehicle stability. Before working with the loader, the operator must always make sure that the vehicle is stable in the entire rotation area of the loader.

If the loader is equipped with an EVS-system (Electronic Vehicle Stability), the stability of the vehicle is ensured in the entire working area, because the system is constantly checking the vehicle, and immediately stopping the load moment increasing movement in case of instability, irrespective of the operator's doings. The LMB-system is described in the Instruction Manual - RCL Safety System. Be familiar with this manual.

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Heavy Duty Lifting - HDL

If the loader is equipped with a Heavy Duty Lifting (HDL) system, an increased lifting capacity is available at reduced speed.

When the loader reaches its normal lifting capacity limit, the HDL-system will automatically activate, irrespective of the operator’s doings, and the oil flow to the control valve will be reduced to approximately 20% of the normal oil flow. At the same time the loader lifting capacity is increased by approximately 10% in the entire working area of the loader.

When the HDL-system is activated, the operator will be able to continue extending the load without interruption at reduced speed.

If the load moment is reduced to the permitted load limits again, the HDL-system will increase the oil flow to normal and the working speed will increase again.

The HDL-system will only disconnect automatically when all control levers have been released into neutral position *at the same time* as the load moment has been reduced to the permitted load limit.

See the section titled "Heavy Duty Lifting, HDL" in the RCL Safety System Instruction Manual.

Hoses and Hydraulic Pipes

The hoses comply with the DIN 20 022 2SN standards.

The pipes are manufactured in St.35.4C-NBK.

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CHAPTER 11

General Reference

In This Chapter

Inspection Checklist 97
Deficiency / Recommendation / Corrective Action Report 102
Turntable Bearing Thread Tightening Sequence 104
Turntable Bearing Inspection 105
Turntable Bearing Tilt Test 106
Thread Torque Charts 107

Inspection Checklist

NOTICE:

The user of this form is responsible for determining that these inspections satisfy all applicable regulatory requirements.

OWNER/COMPANY:	TYPE OF INSPECTION (circle one):			
CONTACT PERSON:	DAILY	MONTHLY	QUARTERLY	ANNUAL
CRANE MAKE & MODEL:	DATE INSPECTED:			
CRANE SERIAL NUMBER:	HOURMETER READING (if applicable):			
UNIT I.D. NUMBER:	INSPECTED BY (print):			
LOCATION OF UNIT:	SIGNATURE OF INSPECTOR:			

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TYPE OF INSPECTION
NOTES:
Daily and monthly inspections are to be performed by a “competent person”, who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Quarterly and annual inspections are to be performed by a “qualified person” who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

One hour of normal crane operation assumes 20 complete cycles per hour. If operation exceeds 20 cycles per hour, inspection frequency should be increased accordingly.

Consult Operator / Service Manual for additional inspection items, service bulletins and other information.

Before inspecting and operating crane, crane must be set up away from power lines and leveled with stabilizers fully extended.

DAILY (D): Before each shift of operation, those items designated with a (D) must be inspected.

MONTHLY (M): Monthly inspections or 100 hours of normal operation (which ever comes first) includes all daily inspections plus items designated with an (M). This inspection must be recorded and retained for a minimum of 3 months.

QUARTERLY (Q): Every three to four months or 300 hours of normal operation (which ever comes first) includes all daily and monthly inspection items plus items designated with a (Q). This inspection must be documented, maintained, and retained for a minimum of 12 months, by the employer that conducts the inspection.

ANNUAL (A): Each year or 1200 hours of normal operation (which ever comes first) includes all items on this form which encompasses daily, monthly and quarterly inspections plus those items designated by (A). This inspection must be documented, maintained, and retained for a minimum of 12 months, by the employer that conducts the inspection.

INSPECTION CHECKLIST STATUS KEY:

S = Satisfactory	X = Deficient (NOTE: If a deficiency is found, an immediate determination must be made as to whether the deficiency constitutes a safety hazard and must be corrected prior to operation.)
R = Recommendation (Should be considered for corrective action)	
NA = Not Applicable	

FREQUENCY	ITEM	KEY	INSPECTION DESCRIPTION	STATUS (S,R,X,NA)
D	1	Labels	All load charts, safety & warning labels, and control labels are present and legible.	
D	2	Crane	Check all safety devices for proper operation.	
D	3	Controls	Control mechanisms for proper operation of all functions, leaks and cracks.	
D	4	Station	Control and operator's station for dirt, contamination by lubricants, and foreign material.	
D	5	Hydraulic System	Hydraulic system (hoses, tubes, fittings) for leakage and proper oil level.	
D	6	Hook	Presence and proper operation of hook safety latches.	
D	7	Wire Rope	Inspect for apparent deficiencies per applicable requirements and manufacturer’s specifications.	
D	8	Pins	Proper engagement of all connecting pins and pin retaining devices.	

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FREQUENCY	ITEM	KEY	INSPECTION DESCRIPTION	STATUS (S,R,X,NA)
D	9	General	Overall observation of crane for damaged or missing parts, cracked welds, and presence of safety covers.	
D	10	Operation	During operation, observe crane for abnormal performance, unusual wear (loose pins, wire rope damage, etc.). If observed, discontinue use and determine cause and severity of hazard.	
D	11	Remote Ctrl	Operate remote control devices to check for proper operation.	
D	12	Electrical	Operate all lights, alarms, etc. to check for proper operation.	
D	13	Anti Two-Block or Two-Block Damage Prevention	Operate anti two-block or two-block damage prevention device to check for proper operation.	
D	14	Tires	Check tires (when in use) for proper inflation and condition.	
D	15	Ground Conditions	Check ground conditions around the equipment for proper support, watching for ground settling under and around stabilizers and supporting foundations, ground water accumulation, or similar conditions.	
D	16	Level	Check the equipment for level position within the tolerances specified by the equipment manufacturer’s recommendations, both before each shift and after each move and setup.	
D	17	Operator cab windows	Check windows for cracks, breaks, or other deficiencies which would hamper the operator's view.	
D	18	Rails, rail stops, rail clamps and supporting surfaces	Check rails, rail stops, rail clamps and supporting surfaces when the equipment has rail traveling.	
D	19	Safety devices	Check safety devices and operational aids for proper operation.	
D	20	Electrical	Check electrical apparatus for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation.	
D	21		Other	
D	22		Other	
M	23	Daily	All daily inspection items.	
M	24	Cylinders	Visual inspection of cylinders for leakage at rod, fittings, and welds. Damage to rod and case.	
M	25	Valves	Holding valves for proper operation.	
M	26	Valves	Control valves for leaks at fittings and between stations.	
M	27	Valves	Control valve linkages for wear, smoothness of operation, and tightness of fasteners. Relief valve for proper pressure settings.	
M	28	General	Bent, broken, or significantly rusted/corroded parts.	
M	29	Electrical	Electrical apparatus for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation. Electrical systems for presence of dirt, moisture, and frayed wires.	
M	30	Structure	All structural members for damage.	
M	31	Welds	All welds for breaks and cracks.	
M	32	Pins	All pins for proper installation and condition.	
M	33	Hardware	All bolts, fasteners and retaining rings for tightness, wear and corrosion.	
M	34	Wear Pads	Presence of wear pads.	
M	35	Pump & Motor	Hydraulic pumps and motors for leakage at fittings, seals, and between sections. Check tightness of mounting bolts.	
M	36	PTO	Transmission/PTO for leakage, abnormal vibration & noise, alignment, and mounting bolt torque.	

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FREQUENCY	ITEM	KEY	INSPECTION DESCRIPTION	STATUS (S,R,X,NA)
M	37	Hyd Fluid	Quality of hydraulic fluid and presence of water.	
M	38	Hyd Lines	Hoses & tubes for leakage, abrasion damage, blistering, cracking, deterioration, fitting leakage, and secured properly.	
M	39	Hook	Load hook for abnormal throat distance, twist, wear, and cracks.	
M	40	Wire Rope	Condition of load line.	
M	41	Manual	Presence of operator's manual with unit.	
M	42		Other	
M	43		Other	
Q	44	Daily	All daily inspection items.	
Q	45	Monthly	All monthly inspection items.	
Q	46	Rotation Sys	Rotation bearing for proper torque of all mounting bolts.	
Q	47	Hardware	Base mounting bolts for proper torque.	
Q	48	Structure	All structural members for deformation, cracks and corrosion.	
	49		• Base	
	50		• Stabilizer beams and legs	
	51		• Mast	
	52		• Inner Boom	
	53		• Outer Boom	
	54		• Extension(s)	
	55		• Jib boom	
	56		• Jib extension(s)	
	57		• Other	
Q	58	Hardware	Pins, bearing, shafts, gears, rollers, and locking devices for wear, cracks, corrosion and distortion.	
	59		• Rotation bearing(s)	
	60		• Inner boom pivot pin(s) and retainer(s)	
	61		• Outer boom pivot pin(s) and retainer(s)	
	62		• Inner boom cylinder pin(s) and retainer(s)	
	63		• Outer boom cylinder pin(s) and retainer(s)	
	64		• Extension cylinder pin(s) and retainer(s)	
	65		• Jib boom pin(s) and retainer(s)	
	66		• Jib cylinder pin(s) and retainer(s)	
	67		• Jib extension cylinder pin(s) and retainer(s)	
	68		• Boom tip attachment	
	69		• Other	
Q	70	Hyd Lines	Hoses, fittings and tubing for proper routing, leakage, blistering, deformation and excessive abrasion.	
	71		• Pressure line(s) from pump to control valve	
	72		• Return line(s) from control valve to reservoir	
	73		• Suction line(s) from reservoir to pump	
	74		• Pressure line(s) from control valve to each function	
	75		• Load holding valve pipe(s) and hose(s)	
	76		• Other	
Q	77	Pumps & Motors	Pumps and Motors for loose bolts/fasteners, leaks, noise, vibration, loss of performance, heating & excess pressure.	
	78		• Winch motor(s)	
	79		• Rotation motor(s)	
	80		• Other	
Q	81	Valves	Hydraulic valves for cracks, spool return to neutral, sticking spools, proper relief valve setting, relief valve failure.	

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FREQUENCY	ITEM	KEY	INSPECTION DESCRIPTION	STATUS (S,R,X,NA)
	82		• Main control valve	
	83		• Load holding valve(s)	
	84		• Stabilizer or auxiliary control valve(s)	
	85		• Other	
	86		• Other	
Q	87	Cylinders	Hydraulic cylinders for drifting, rod seal leakage and leakage at welds. Rods for nicks, scores and dents. Case for damage. Case and rod ends for damage and abnormal wear.	
	88		• Stabilizer cylinder(s)	
	89		• Inner boom cylinder(s)	
	90		• Outer boom cylinder(s)	
	91		• Extension cylinder(s)	
	92		• Rotation cylinder(s)	
	93		• Jib lift cylinder(s)	
	94		• Jib extension cylinder(s)	
	95		• Other	
Q	96	Winch	Winch, sheaves and drums for damage, abnormal wear, abrasions and other irregularities.	
Q	97	Hyd Filters	Hydraulic filters for replacement per maintenance schedule.	
A	98	Daily	All daily inspection items.	
A	99	Monthly	All monthly inspection items.	
A	100	Quarterly	All quarterly inspection items.	
A	101	Hyd Sys	Hydraulic fluid change per maintenance schedule.	
A	102	Controls	Control valve calibration for correct pressure & relief valve settings.	
A	103	Valves	Safety valve calibration for correct pressure & relief valve settings.	
A	104	Valves	Valves for failure to maintain correct settings.	
A	105	Rotation Sys	Rotation drive system for proper backlash clearance & abnormal wear, deformation and cracks.	
A	106	Lubrication	Gear oil change in rotation drive system per maintenance schedule.	
A	107	Hardware	Check tightness of all fasteners and bolts, using torque specifications on component drawings or torque chart.	
A	108	Wear Pads	Wear pads for excessive wear.	
A	109	Loadline	Loadline for proper attachment to drum.	

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Deficiency / Recommendation / Corrective Action Report

DATE:	OWNER:	UNIT I.D. NUMBER:

GUIDELINES

a A deficiency (X) may constitute a hazard. Deficiency must be corrected and/or faulty parts replaced before resuming operation.

b Recommendations (R) should be considered for corrective actions. Corrective action for a particular recommendation depends on the facts in each situation.

c Corrective actions (CA), repairs, adjustments, parts replacement, etc. are to be performed by a qualified person in accordance with all manufacturer's recommendations, specifications and requirements.

NOTE: Deficiencies (X) listed must be followed by the corresponding corrective action taken (CA).

X = DEFICIENCY R = RECOMMENDATION CA = CORRECTIVE ACTION TAKEN

X,R,CA	ITEM #	EXPLANATION	DATE CORRECTED

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X,R,CA	ITEM #	EXPLANATION	DATE CORRECTED

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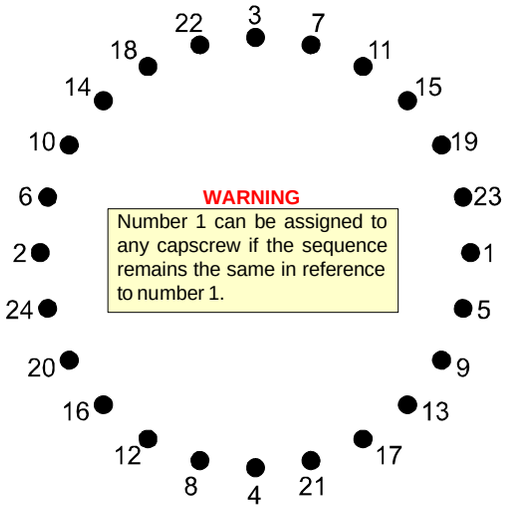
Turntable Bearing Thread Tightening Sequence

Refer to the turntable bearing thread tightening diagram below for proper tightening/torquing sequence of the turntable bearing to the crane base and crane mast. The total quantity of cap screws varies dependent on crane model.



TIGHTENING PROCEDURE

1 Refer to the Torque Data Chart to determine the proper torque value to apply to the size of capscrew used.

2 Follow the tightening sequence shown in the diagram. Note that the quantity of capscrews may differ from the diagram, but the sequence must follow the criss-cross pattern as shown in the diagram.

3 Torque all capscrews to approximately 40% of the specified torque value, by following the sequence.

(EXAMPLE: .40 x 265 FT-LB = 106 FT-LB)

(EXAMPLE-METRIC: .40 x 36 KG-M = 14.4 KG-M)

4 Repeat Step 3, but torquing all capscrews to 75% of the specified torque value. Continue to follow the tightening sequence.

(EXAMPLE: .75 x 265 FT-LB = 199 FT-LB)

(EXAMPLE-METRIC: .75 x 36 KG-M = 27 KG-M)

5 Using the proper sequence, torque all capscrews to the listed torque value as determined from the Torque Data Chart.

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Turntable Bearing Inspection

Turntable bearings may experience wear. One of the following conditions may indicate turntable bearing wear:

1. Metal particles present in the bearing lubricant.
2. Increased drive power required to rotate the crane.
3. Noise emitting from the bearing during rotation.
4. Rough rotation.
5. Uneven or excessive wear between the pinion gear and turntable gear.

If one or more of the above conditions exists, further inspection may be required. Limits are measured in “TILT” which is dependent on the internal clearances of the bearing. TILT is the most practical determination of a bearings' internal clearance once mounted on a crane. You can measure the tilt using the ***Turntable Bearing Tilt Test.***

Turntable Bearing Tilt Test

1. Place crane in vertical position.
2. Set a dial indicator at 0 on the pinion cover plate at back side of mast.
3. Lower crane to the horizontal position.
4. Check and record the dial indicator change. It should not exceed the tilt measurement noted in the chart below.
5. Return the crane to the vertical position. The dial indicator should return to 0.

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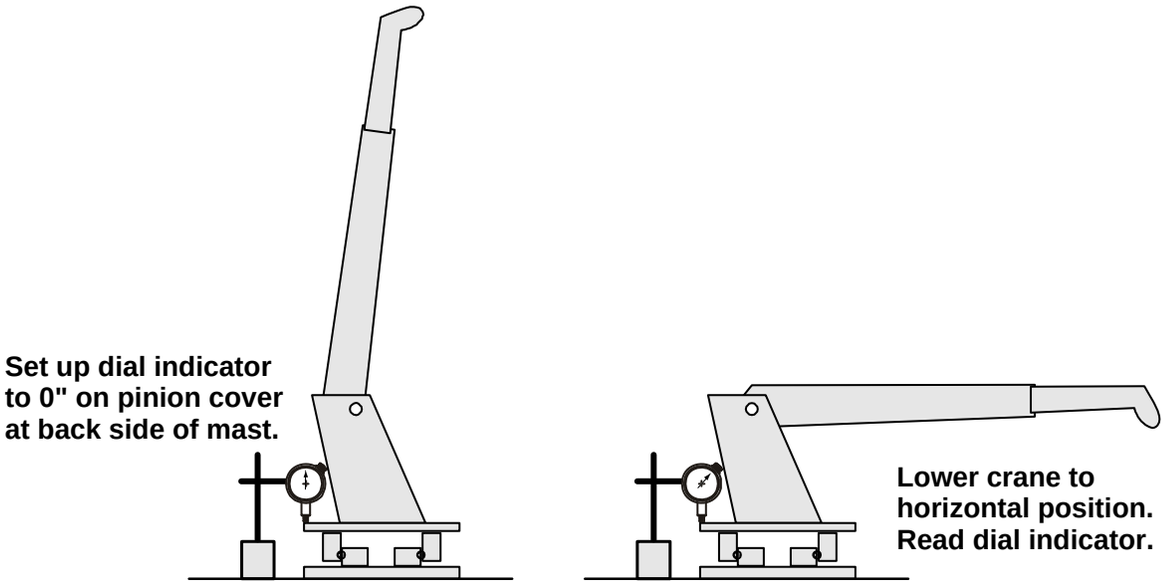

COMPARISON CHART - MEASURED TILT DIMENSION PER CRANE MODEL					
NOTE: The tilt dimensions listed in this chart are service guidelines and do not, in themselves, require that the bearing be inspected. If there is reason to suspect an excess of bearing wear **AND** the measured tilt dimension exceeds the dimension listed, remove the bearing for inspection.					
IMT Crane, Loader or Tirehand Model	1007 1014/1014A 1015 2015/2020 2109 2820 3000 3016/3020 3203i 3816/3820 4004i 421/425 4300 5005i 5016/5020 6006i 6016/6020 6022 5525 / 6025 / 6625 EZ Hauler I, II EZ Hauler 3000 / 5500	5200 5200R 5217 5800 7020 7025 7200 7415 8025 9000	16000-I, II, III 32018 32027 32030 T30 T40	23516 14K160TH COMMANDER IV	1221R 1225R 8000L 9800 12916 13031 13034 14000 15000 18000 20017 8000L H1200 H1200RR T50
Ball Dia. (Ref)	.875" (22 mm)	1.00" (25 mm)	1.18 - 1.25" (30-32 mm)	1.5” (38 mm)	1.75" (44 mm)
Tilt Dim.	.060" (1.524 mm)	.070" (1.778 mm)	.075" (1.905 mm)	.085” (2.159 mm)	.090" (2.286 mm)

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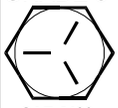
Thread Torque Charts

FINE THREAD BOLTS (ENGLISH)					
SIZE	BOLT DIA.	GRADE 5  SAE J429 GRADE 5		GRADE 8 SAE J429 GRADE 8	
(DIA-TPI)	(INCHES)	PLAIN	PLATED	PLAIN	PLATED
		(FT-LB)	(FT-LB)	(FT-LB)	(FT-LB)
5/16-24	0.3125	19	14	27	20
3/8-24	0.375	35	26	49	35
7/16-20	0.4375	55	41	78	58
1/2-20	0.5	90	64	120	90
9/16-18	0.5625	120	90	170	130
5/8-18	0.625	170	130	240	180
3/4-16	0.75	300	225	420	315
7/8-11	0.875	445	325	670	500
1-12	1	645	485	995	745
1 1/8-12	1.125	890	670	1445	1085
1 1/4-12	1.25	1240	930	2010	1510
1 3/8-12	1.375	1675	1255	2710	2035
1 1/2-12	1.5	2195	1645	3560	2670

COARSE THREAD BOLTS (ENGLISH)					
SIZE	BOLT DIA.	GRADE 5 SAE J429 GRADE 5		GRADE 8 SAE J429 GRADE 8	
(DIA-TPI)	(INCHES)	PLAIN	PLATED	PLAIN	PLATED
		(FT-LB)	(FT-LB)	(FT-LB)	(FT-LB)
5/16-18	0.3125	17	13	25	18
3/8-16	0.375	31	23	44	33
7/16-14	0.4375	49	37	70	52
1/2-13	0.5	75	57	105	80
9/16-12	0.5625	110	82	155	115
5/8-11	0.625	150	115	220	160
3/4-10	0.75	265	200	375	280
7/8-9	0.875	395	295	605	455
1-8	1	590	445	910	680
1 1/8-7	1.125	795	595	1290	965
1 1/4-7	1.25	1120	840	1815	1360
1 3/8-6	1.375	1470	1100	2380	1780
1 1/2-6	1.5	1950	1460	3160	2370

NOTES

1 Tightening torques provided are midrange.

2 Consult bolt manufacturer's particular specifications, when provided.

3 Use flat washers of equal strength.

4 All torque measurements are given in foot-pounds.

5 Torque values specified are for bolts with residual oils or no special lubricants applied. If special lubricants of high stress ability, such as Never-Seez compound graphite and oil, molybdenum disulphide, colloidal copper or white lead are applied, multiply the torque values in the charts by the factor .90. The use of Loctite does not affect the torque values listed above.

WARNING

Anytime a gear-bearing bolt is removed, it must be replaced with a new bolt of the identical grade and size. Once a bolt has been torqued to 75% of its proof load and then removed, the torque coefficient may no longer be the same as when the bolt was new thus giving indeterminate clamp loads after torquing. Failure to replace gear-bearing bolts may result in bolt failure due to metal fatigue causing death or serious injury.

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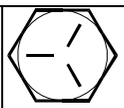
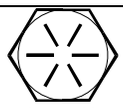
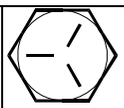
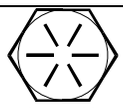
FINE THREAD TORQUE CHART (METRIC)					
TIGHTENING TORQUE					
SIZE (DIA-TPI)	BOLT DIA. (INCHES)	 SAE J429 GRADE 5		 SAE J429 GRADE 8	
		PLAIN (KG-M)	PLATED (KG-M)	PLAIN (KG-M)	PLATED (KG-M)
5/16-24	0.3125	3	2	4	3
3/8-24	0.375	5	4	7	5
7/16-20	0.4375	8	6	11	8
1/2-20	0.5	12	9	17	12
9/16-18	0.5625	17	12	24	18
5/8-18	0.625	24	18	33	25
3/4-16	0.75	41	31	58	44
7/8-11	0.875	62	45	93	69
1-12	1	89	67	138	103
1 1/8-12	1.125	123	93	200	150
1 1/4-12	1.25	171	129	278	209
1 3/8-12	1.375	232	174	375	281
1 1/2-12	1.5	304	228	492	369

COARSE THREAD TORQUE CHART (METRIC)					
TIGHTENING TORQUE					
SIZE (DIA-TPI)	BOLT DIA (INCHES)	 SAE J429 GRADE 5		 SAE J429 GRADE 8	
		PLAIN (KG-M)	PLATED (KG-M)	PLAIN (KG-M)	PLATED (KG-M)
5/16-18	0.3125	2	2	3	2
3/8-16	0.375	4	3	6	5
7/16-14	0.4375	7	5	10	7
1/2-13	0.5	10	8	15	11
9/16-12	0.5625	15	11	21	16
5/8-11	0.625	21	16	30	22
3/4-10	0.75	37	28	52	39
7/8-9	0.875	55	41	84	63
1-8	1	82	62	126	94
1 1/8-7	1.125	110	82	178	133
1 1/4-7	1.25	155	116	251	188
1 3/8-6	1.375	203	152	329	246
1 1/2-6	1.5	270	210	438	328

NOTES

1 Tightening torques provided are midrange.

2 Consult bolt manufacturer's particular specifications, when provided.

3 Use flat washers of equal strength.

4 All torque measurements are given in kilogram-meters.

5 Torque values specified are for bolts with residual oils or no special lubricants applied. If special lubricants of high stress ability, such as Never-Seez compound graphite and oil, molybdenum disulphide, colloidal copper or white lead are applied, multiply the torque values in the charts by the factor .90. The use of Loctite does not affect the torque values listed above.

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