ROUGH TERRAIN CRANE

OPERATOR'S MANUAL

ZOOMLION

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ZRT850 Rough Terrain Crane Operator’s Manual

Edition 1 April 2018

To Users

Zoomlion appreciates your selection of the ZOOMLION Rough Terrain Crane for your application.

No one should operate the crane unless they read and understand the information in this manual. This manual contains the instructions and data on the safety and operation of the rough terrain crane. When you follow the instructions in this manual, your crane can operate at MAXIMUM EFFICIENCY. The operator must keep this manual in the cab of the crane.

If there is anything in the manual that is not clear or you do not understand, please contact our service technician. We (Zoomlion) are NOT responsible for damages from an operator who does not obey the instructions in the *OPERATOR'S MANUAL*.

The *OPERATOR'S MANUAL* is an important part of the crane. If the crane becomes the property of a different person, make sure that the manual stays in the cab of the crane.

The data (data, specifications, illustrations) in this manual is for cranes in production at the time of this manual's publication. We reserve the right to make changes to this manual at any time, without obligation.

The manual has been translated to be best of our knowledge. Zoomlion assumes no liability for translation errors. The Chinese version of the *OPERATOR'S MANUAL* is solely applicable for factual accuracy.

Thank you!

Mobile Crane Branch Company of Zoomlion Heavy Industry Science and Technology Co., Ltd.

Safety Instructions

DANGER, WARNING, CAUTION and NOTICE labels are on signs and decals, and as you read this manual to show important instructions. In this manual, the labels follow the paragraph or item they apply to. The markers are as follows:

DANGER	Refers to a dangerous situation which, if you do not prevent, will cause death or injury.
WARNING	Refers to a possible dangerous situation which, if you do not prevent, could cause death or injury.
CAUTION	Refers to a possible dangerous situation which, if you do not prevent, may cause light or moderate injury.
NOTICE	Refers to a situation which, if you do not prevent, may cause property or equipment damage.

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Chapter 1 Foreword

CHAPTER 1 FOREWORD

The owner of this crane must know federal, state and local rules. When your equipment is in operation, the area must be safe for employees and non-employees. Do not cause damage to other equipment or local structures while you operate this crane. The rules change by location and this manual does not give that data.

ZOOMLION makes manuals for different construction and industrial equipment. It is policy to include applicable national consensus, industry standards and safety data with the manuals. Use these data to give applicable training to personnel who are to operate, do the maintenance and supervise the equipment correctly and safely.

We make equipment for heavy-duty labor. Do the periodic inspections regularly because the equipment wears. This prevents accidents, decreases downtime and helps equipment work satisfactorily. The goal of these inspections is to find worn, cracked, damaged parts and loose or missing fasteners before they cause a problem.

Correct training and inspection procedures are necessary to prevent injury to persons, property damage and high maintenance costs.

Read and understand the data that comes with this crane. Help is available from the distributors of your ZOOMLION crane and from the ZOOMLION Mobile Crane Branch Company.

This manual contains the instructions and data on the operation, maintenance, lubrication, and adjustments of the Rough Terrain Crane. Do not operate the crane before you understand the data in this manual.

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Rough Terrain Crane Operator'S Manual

Chapter 2 Nomenclature

Chapter 2 NOMENCLATURE

To aid in understanding the contents of this manual, refer to the figure below. Each numbered term can represent several components of the same main part.

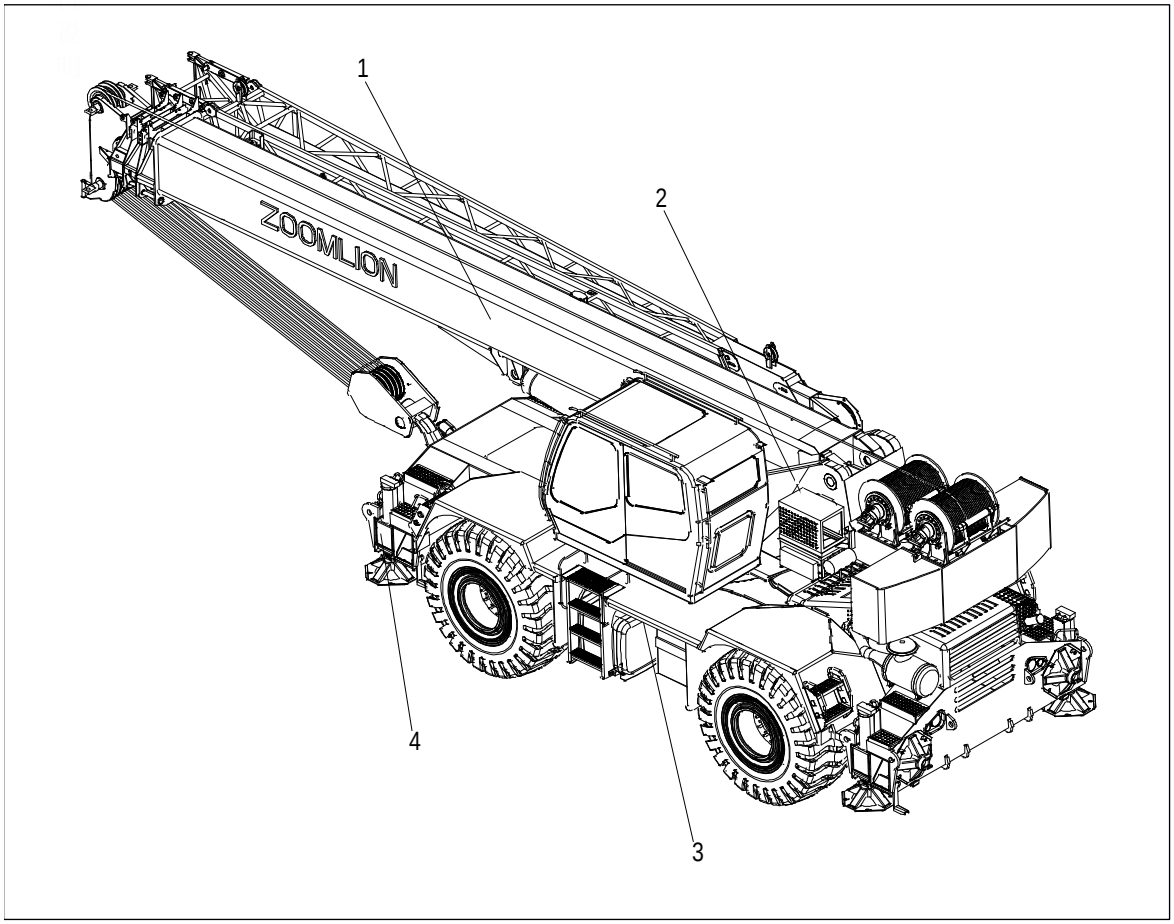

Figure 2-1 Main components of crane

Pos.	Description	Illustration
1	Boom system	Main boom assy., jib assy., telescoping mechanism, main and auxiliary hooks, hoist rope
2	Swing system	Superstructure, counterweight, main and auxiliary winches, swing bearing, swing reducer, derricking cylinder, cab, air conditioner and cab heater
3	Chassis	Power system, drive system, steering system, air intake system, exhaust system, cooling system, fuel supply system, chassis frame assy. and vehicle body system
4	Outriggers	Outrigger beams, outrigger jacks, cylinders and outrigger floats

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Chapter 3 Introduction

CHAPTER 3 INTRODUCTION

3.1 CRANE PERIODIC INSPECTION CHECKLIST

This inspection checklist provides supplementary data to facilitate the correct operation and maintenance of the crane.

Table 3-1 Crane Periodic Inspection Checklist

COMPONENT INSPECTED	INSPECTION CODE	FUNCTION	ADJUSTING CONDITION	MAINTENANCE CONDITION	COMPONENT INSPECTED	INSPECTION CODE	FUNCTION	ADJUSTING CONDITION	MAINTENANCE CONDITION

3.2 MAINTENANCE LOG

Table 3-2 Maintenance Log

ITEM	ADJUSTING CONDITION	DATE

3.3 ABOUT THIS MANUAL

General

The data (data, specifications, illustrations) in this manual is for cranes in production at the time of this manual's publication. We reserve the right to make changes to this manual at any time, without obligation.

This manual contains the instructions to move and operate the crane in the field. Follow the operation and maintenance procedures to make sure that your machine operates at MAXIMUM EFFICIENCY. Use the CRANE PERIODIC INSPECTION CHECKLIST. Keep a maintenance log to monitor all maintenance work on the machine.

An example of a *Maintenance Log and Crane Periodic Inspection Checklist* is at the beginning of this section.

Again, we at Zoomlion appreciate your selection of our crane. User safety is most important. To complete on-site tasks safely, operators must be responsible. Obey the instructions that follow:

- **Comply** – with Occupational Safety and Health Administration (OSHA), Federal, State, and Local Regulations.
- **Read, Understand, and Follow** – the instructions in this and other manuals and documents that come with the crane.
- **Use Good, Safe Work Practices** – in a common sense way.
- **Only have trained operators** – directed by informed and knowledgeable job-site supervisors.
- **Do not use this crane** – before the portable fire extinguisher, installed in the cab, agrees with local fire protection rules.

Note:

OSHA prohibits the alteration or modification of this crane without written manufacturer's approval. Use only factory approved parts to service or repair the crane.

The operator must comply with the requirements that apply, as follows:

- OSHA 1926:1412 (Inspections)
- OSHA 1926.1413 (Wire rope – inspection)
- OSHA 1926.1414 (Wire rope – selection and installation criteria)
- OSHA 1926:1417 (Operation)
- OSHA 1926:1418 (Authority to stop operation)
- OSHA 1926:1422 (Signals – hand signal chart)
- OSHA 1926:1423 (Fall protection).

Speak with us if special data is necessary for the maintenance or operation of your crane. Send your machine model and a serial number to make sure that you receive the correct data.

If there is anything in this manual that is not clear or which you think is necessary, write to the address that follows:

Zoomlion Heavy Industry Science and Technology Co., Ltd.
Quantang Industrial Park, 2nd Yuanda Road,
Changsha, Hunan Province, China, 410131
You can also speak to us by telephone at 400-800-1680.
Thank You!

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Rough Terrain Crane Operator'S Manual

Chapter 4 Safety

CHAPTER 4 SAFETY

4.1 SAFETY SYMBOL

The safety symbol, used on the Danger, Warning, and Caution labels, tells personnel of possible death, injury, or property damage. Obey all safety data that follows this symbol to prevent dangerous conditions.

DANGER	Refers to a dangerous situation which, if you do not prevent, will cause death or injury.
WARNING	Refers to a possible dangerous situation which, if you do not prevent, could cause death or injury.
CAUTION	Refers to a possible dangerous situation which, if you do not prevent, may cause light or moderate injury.
NOTICE	Refers to a situation which, if you do not prevent, may cause property or equipment damage.

4.2 HAZARD CLASSIFICATION

Hazard classification is a system to show different classes of possible injury levels. A safety symbol and a signal word show how dangerous the level of possible injury can be.

A signal word without a safety symbol refers to property damage, protection devices, or important data. You will find this system used in this manual and on signs on the crane to help find and prevent dangerous situations.

4.3 SAFETY

This section contains the safety rules that you must follow. You must read and understand the *Operator's Manual*. It contains the instructions for the specified machine.

All personnel must be safe at the work location.

The safety rules are as follows:

4.3.1 MOVING PERSONNEL

Do not use the crane to move personnel.

4.3.2 OPERATOR'S RESPONSIBILITIES

A. Read and understand the *Operator's Manual*.

B. The operator must always think about the safety of all personnel in the area.

C. Only personnel who show that they can safely control a crane can operate the crane.

D. Comply with the requirements, that apply, as follows:

(1) Occupational Safety and Health Administration (OSHA) standards.

(2) American National Standards Institute (ANSI).
(3) European Committee for standardization (CEN).
(4) China National Standards GB/T3811.

E. Make sure that all the mechanical functions of the crane can operate.
F. Make sure that the system operating gauges and indicators, and warning signals function.
G. Keep all the glazed surfaces, instruments, windows, and lights clean.
H. Remove all oil, grease, mud, ice, and snow from walkway surfaces.
I. Read and understand all Decals and Warnings.
J. Keep all tools and other necessary items in the toolbox.
K. Do not lift a load without the *Load Ratings* in the cab.
L. Read and understand the *Load Ratings.*
M. Make sure that the load to lift is less than the capacity of the crane.
N. Be in good physical condition and free from effects of alcohol, drugs and medications. Be sure to not decrease vision, hearing, or reaction time.
O. Keep personnel, equipment and material that are not necessary for your task at the job-site out of the area.
P. The operator must know the hand signals.
Q. When the view of the operator is blocked or if the task is in a dangerous area, use signal personnel to give directions.
R. If a signal person is necessary, the operator must obey only the signals from the approved signal person. You must obey the STOP signal from all personnel in the area.
S. Keep a fully charged fire extinguisher and first aid kit in the cab at all times. The operator must know how to use the fire extinguisher and how to apply the items in the first aid kit.
T. Look for the movement of other equipment, trucks, and personnel at the job-site.
U. Personnel must stay off the crane platform while the crane is in operation.
V. All personnel must be in a safe area before you move the hook, boom, load, or outriggers.
W. Stop and start the movement of the load smoothly and move at a speed that keeps the load in your control.
X. Keep a minimum of three full wraps of wire rope on the drum.
Y. Use the tag lines to keep the load in control.
Z. Keep the load near the ground.
AA. Use the shortest boom possible.
BB. If a load is off the ground or the crane is on, you must stay in the cab.
CC. Always use outriggers as the *Load Ratings* and *Operator's Manual* tells.

4.3.3 SIGNAL PERSONNEL RESPONSIBILITIES

A. Use and understand all standard hand signals.
B. Help the operator to operate safely and satisfactorily. Keep safe all personnel and property.
C. Understand the work you must do.
D. Stay where you can see the full operation and where personnel can see you.

4.3.4 RESPONSIBILITIES OF ALL CREW MEMBERS

A. Correct the conditions and procedures that are not safe.
B. Obey WARNING signs.
C. Do your work safely and do not make dangerous conditions.
D. Know and understand correct procedures for crane erection and rigging.
E. Tell the operator and the signal person of dangerous conditions (power lines / cables, work surface that is not stable etc.).

4.3.5 MANAGEMENT RESPONSIBILITIES

A. The operator must be competent, in good physical condition and have applicable licenses.
B. The operator, signal person, and riggers must receive training in correct crane operation.
C. The operator and the signal person must know all standard hand signals.
D. Have a supervisor at the job-site to be responsible for safety.
E. Give crew members the safety instructions and tell them to report conditions that are not safe to the supervisors.
F. Supply the operator with accurate data on the load that they have to lift.
G. Make sure that all personnel know applicable OSHA, ANSI B30.5 and EN 13000 requirements and the instructions in manuals.

4.3.6 PLANNING THE JOB

A. Understand the work that you must do.
B. Think of all possible dangerous conditions / risks at the job-site.
C. Know the type of personnel that is necessary.
D. Give the tasks to personnel.
E. Know the weight of the load that you must lift.
F. Find the lift-radius, boom angle, and the rated lift limits of the crane.
G. Tell the signal person how to communicate with the operator.
H. Use equipment which does the work safely.
I. Make a decision on how to safely move equipment to the job-site.
J. Find gas lines, power lines and structures.
K. Make sure that the work surface can hold the crane and load.
L. Find out how to rig the load.

M. If necessary, make the special safety precautions.
N. Know the weather conditions.
O. Keep equipment that is not necessary away from the job-site.
P. Set the crane to use the shortest possible boom and radius.

4.3.7 OPERATOR SAFETY CHECK

A. Safety related items must be in position.
B. Look at the crane logbook for maintenance and inspection records.
C. Make sure to complete necessary repairs.
D. Examine the wire rope for damage (kinks, broken wires etc.).
E. Make sure that all crane modifications are approved.
F. Do an inspection for air and hydraulic oil leaks.
G. Examine the control positions before you start the engine.
H. After you start the engine, examine all the instruments and indicators for the correct values.
I. Do a test on the controls.
J. Examine the brakes.
K. Lift and hold a load 2 inch (50 mm) off of the work surface to examine the load brakes.

4.3.8 OPERATOR AIDS CHECK

A. Anti-Two Block devices
B. Boom angle indicator
C. Backup alarms
D. Swing lockout device
E. Rated capacity indicator (RCI)
F. 3rd wrap indicator.

4.3.9 OPERATION OVERLOAD PREVENTION

A. Know the weight of the load.
B. Decrease radius at the start of the lift to let the load radius increase during lift.
C. Know the weight of the hook and rigging.
D. Know the boom length, jib length, and the area where you have to move the load.
E. Use next lower rated capacity when working at the boom length or radius between the figures on the lift chart.
F. Do not lift a load until you know if the load is less than the capacity limit of the crane.
G. Only operate with the recommended counterweights.
H. Do not lift the load if winds are dangerous. If necessary, lower the boom.
I. See the *Load Ratings* for possible restrictions.
J. Avoid side loading.
K. Do not let the load or other objects hit the boom.
L. Release the load slowly, be sure the boom does not tighten against back stops.

M. Put the boom point directly above the load.
N. Be sure that the load hangs freely.

4.3.10 OPERATION SETUP

A. Be sure the load-bearing surface can hold the weight of the crane and load.
B. Make each crane level, examine frequently, and re-level them when necessary.
C. Assemble barricades to keep personnel out of the load move radius.

4.3.11 POWER LINE SAFETY

A. Find power lines in the area before you start a task. Follow national and local regulations when you operate around power lines.
B. Do not remove the material from below power lines if the boom or crane can touch the lines.
C. Do not let the crane or load touch electrical lines. Do not go near the minimum permitted clearance for operation of a crane near electrical lines.
D. If you touch the electrical lines, stay on the crane until the boom moves off the lines or until the power line current is off. If you must move from the crane, JUMP, DO NOT STEP OFF. Jump with feet together.
E. Keep all personnel off the crane if it touches power lines.
F. Use a signal person when you operate around power lines.

4.3.12 SLIP AND FALL PREVENTION

A. Make sure that you stop the crane before you move on and off the equipment. Do not jump.
B. Do not use the controls and the steering wheel as hand holds.
C. Keep the equipment clean and dry.
D. Replace all broken ladders.
E. Keep the non-slip surfaces in good condition.
F. Wear a safety harness when you climb the counterweight and attach the harness in the necessary points. Do not walk on the boom!

4.3.13 TRAVEL

A. Be careful when you move cranes on or off the job-site.
B. Look for personnel, power lines, low or narrow clearance, bridge or road load limits, steep hills, or rough terrain.
C. Correctly stow the boom before you move the crane.
D. Inflate the tires to the specified pressure.
E. Move slowly and prevent sudden movement.
F. Wear seat belt correctly when you move the crane.
G. Make sure that the travel surface can hold the weight of the crane and load.
H. Always use the park brake when you park the crane.

4.3.14 SAFETY SIGN MAINTENANCE

During the daily inspection, make sure that the decals show and are in good condition. Replace all missing or damaged safety signs. The safety of the operator is always important.

Use a weak soap and water to clean the safety signs. Do not use solvent-based cleaners. Solvents can cause damage to the safety sign material.

The graphics, on the pages that follow, give an example of each safety decal and its location.

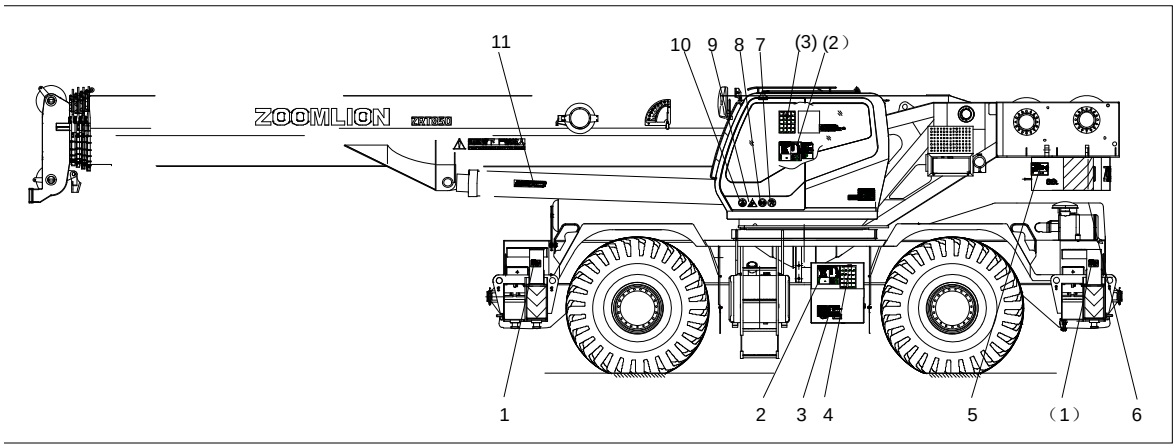
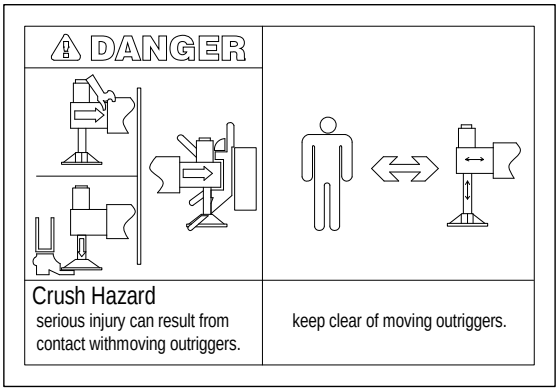
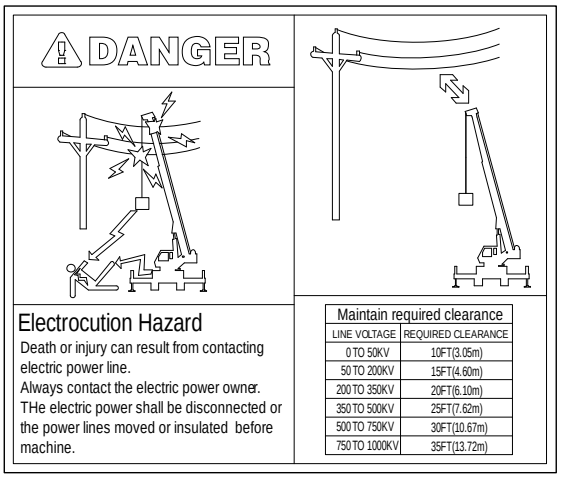


Figure 4-1 Overall view of the Safety Signs on the Left-Hand Side of the Crane

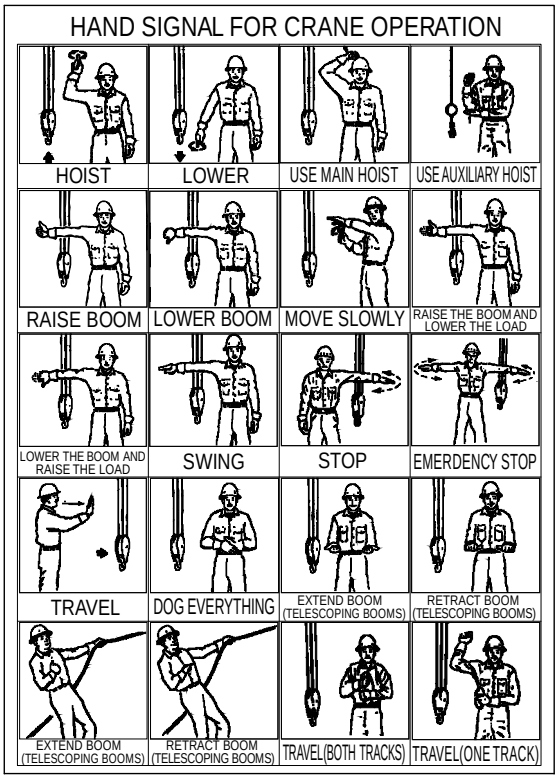
1. Danger – Crush Hazard



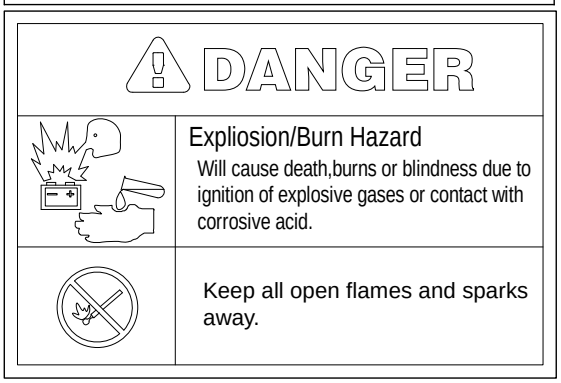
2. Danger – Electrocution Hazard



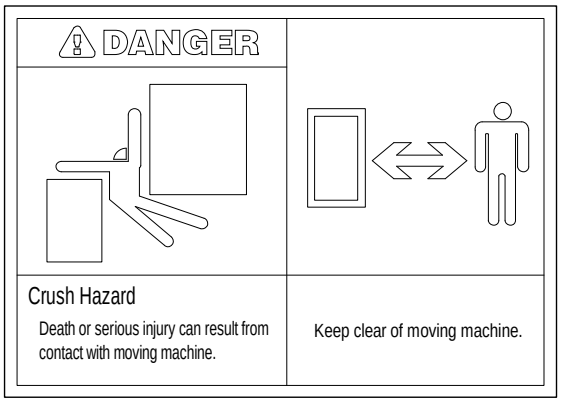
3. Hand Signals for Crane Operation



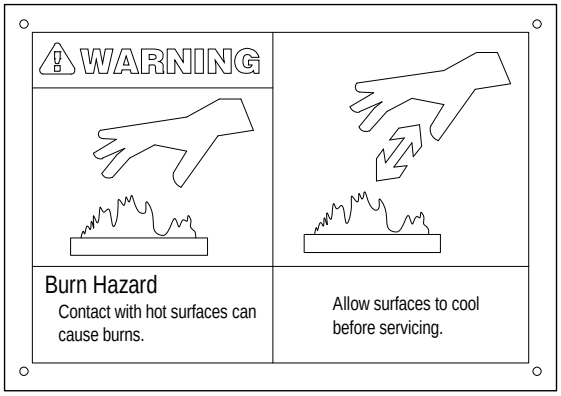
4. Danger – Explosion / Burn Hazard



5. Danger – Crush Hazard



6. Danger – Burn Hazard

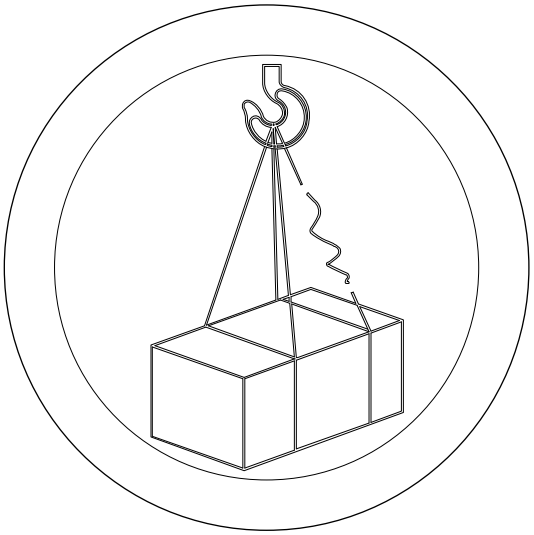


7. Prohibited – No Thoroughfare

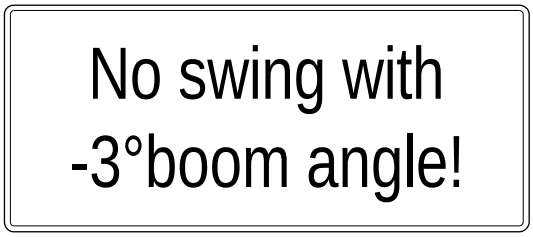
8. **Prohibited – No Access / Only Authorized Personnel**

9. **CAUTION – Risk of Falling**

10. **CAUTION – Swinging Load**



11. **No Swing with -3° boom angle**



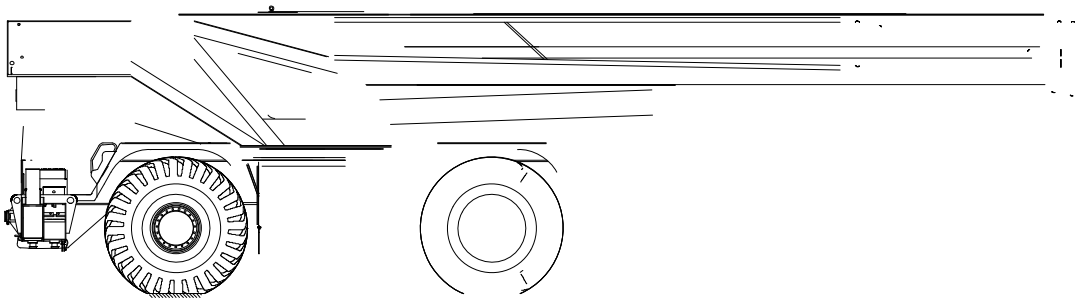
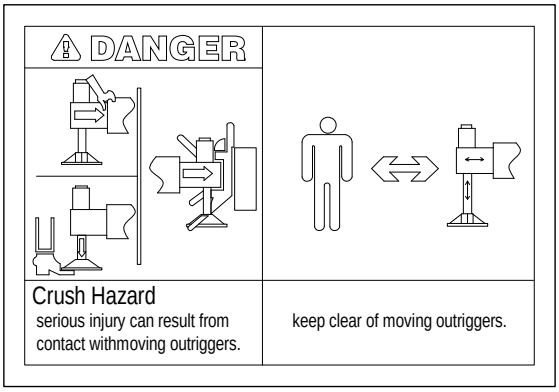
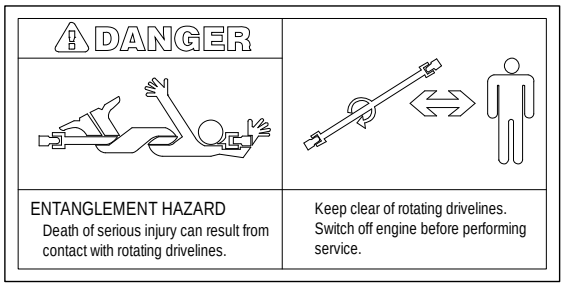


Figure 4-2 Overall view of the Safety Signs on the Right-Hand Side of the Crane

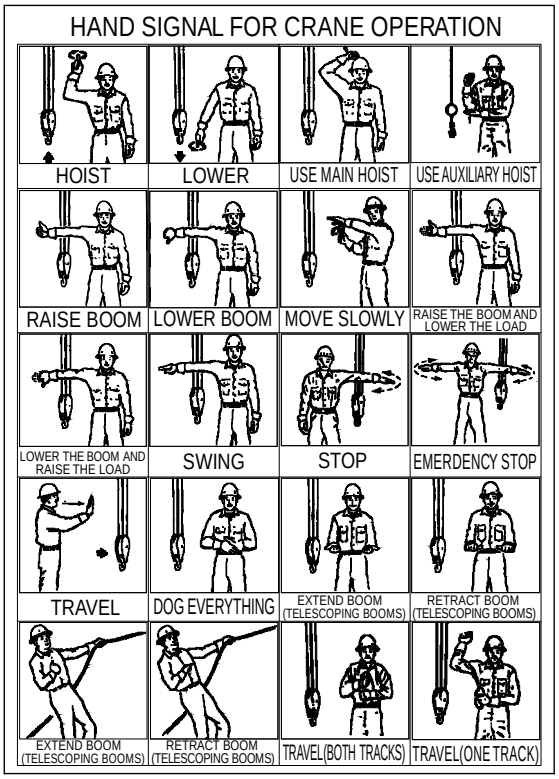
1. **Danger – Crush Hazard**



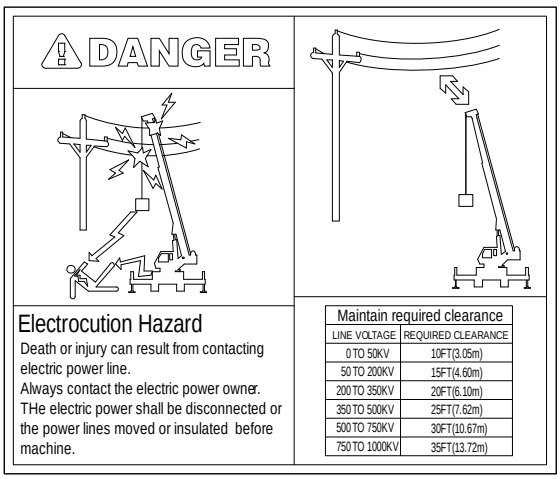
2. Entanglement Hazard



3. Hand Signals for Crane Operation



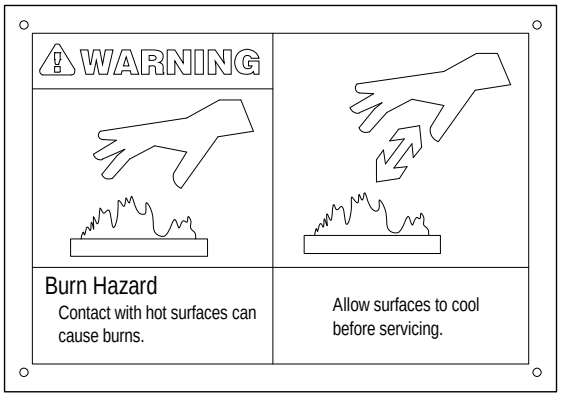
4. Danger – Electrocution Hazard



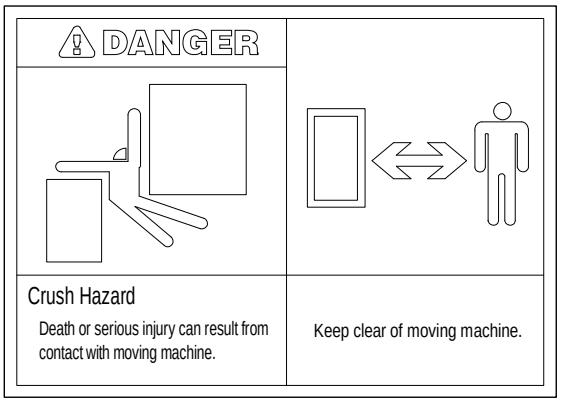
5. **Keep All Open Flames and Sparks Away – RH Only**

6. **No Walk – RH Only**

7. **Danger – Burn Hazard**

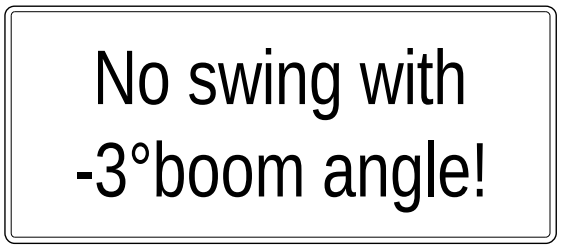


8. Danger – Crush Hazard



9. Be Careful in the Working Radius – RH Only

10. No Swing with -3° boom angle



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Rough Terrain Crane Operator'S Manual

Chapter 5 Operating conditions and points for attention

CHAPTER 5 OPERATING CONDITIONS AND POINTS FOR ATTENTION

5.1 OPERATING CONDITIONS

A. Always use the correct light diesel fuel and engine oil. Make your selection on the lowest ambient temperature where you are to do the work. Refer to the table below for more data on diesel and engine oil. Obey the *Engine Manual* if the data in this table is incorrect.

Table 5-1 Data on Diesel Fuel and Engine Oil

ENGINE EMISSION	OIL BRAND	SPECIFICATION
According to guidelines per US EPA Tier 3 Emission Standards	Sulfur content < 15 PPM, according to US EPA 2007 regulations	CH – 4 stage, API classification
According to guidelines per EURO Stage III A Emission Standards.	Sulfur content < 15 PPM, according to EN 590 regulations.	CH – 4 stage, API classification

WARNING

- **The fuel sulfur content must be less than 15 PPM to obey US EPA Tier 3 Emission Standards.**
- **The fuel sulfur content must be less than 15 PPM to obey EURO stage III A Emission Standards.**
- **Do not use fuel which is mixed with lubricants or accredited additives.**

B. All mechanical components are in a break-in state during initial crane operation (less than 100 operating hours). You must follow the below instructions during this time period:
- The working load and working speed must not be too high.
- The maximum lift capacity should not be larger than 80% of the rate one.
- Do not operate the crane at a speed that is more than the maximum limits.

C. Make sure that you do all of the work on level ground that is hard. The ground must hold more than the load bearing capacity (permissible ground pressure ≥ 507.6 psi (3.5 MPa)). Use material (such as wooden timbers) below the outrigger floats if the work area is soft or not flat.

D. Before you operate a crane that uses the outriggers for support, make sure that the wheels do not touch the ground. Before you use On tires lifts, make sure that you align the crane wheels to the middle.

E. Do not operate the crane if the temperature at the job-site is more than -4°F to 104°F (-20°C to +40°C).

F. If wind speed is greater than the permissible value of 45 ft/s (13.8 m/s), while the crane is in operation, do the tasks that follow:

- Stop the work (safely lower the load)
- Retract the boom
- Correctly stow the boom.

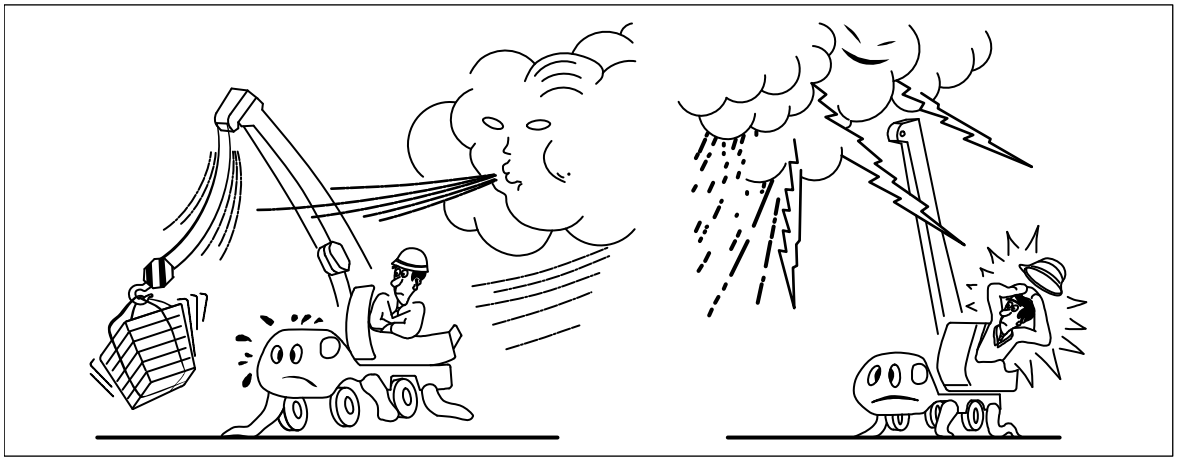


Table 5-1 Storm, Thunder and Lightning

To make an estimate of the wind speed, use the table that follows:

Table 5-2 Wind Force

WIND FORCE		WIND SPEED		EFFECT OF THE WIND ON THE LAND
BEAUFORT SCALE	DESCRIPTION	M/S	FT-IN/S	
0	Calm	0 – 8″	0 – 0.2	No wind, smoke rises vertically
1	Light Air	1′-4″– 4′-7″	0.4 – 1.4	Wind direction shown by smoke drift but not by wind vanes
2	Light Breeze	5′-3″– 9′-10″	1.6 – 3	Wind felt on face, leaves rustle, vanes move by wind
3	Gentle Breeze	11′-2″– 17′-5″	3.4 – 5.3	Leaves and small twigs in constant motion, wind extends light flag
4	Moderate Breeze	18′-1″– 25′-7″	5.5 – 7.8	Small branches move
5	Fresh Breeze	26′-3″– 34′-9″	8 – 10.6	Small trees in leaf begin to sway

WIND FORCE		WIND SPEED		EFFECT OF THE WIND ON THE LAND
BEAUFORT SCALE	DESCRIPTION	M/S	FT-IN/S	
6	Strong Wind	35′-5″– 45′-0″	10.8 – 13.7	Large branches in motion; difficult to use umbrellas, whistling heard in telegraph wires
7	Near Gale	45′-7″– 55′-9″	13.9 – 17	Whole trees in motion, difficult to walk against the wind
8	Gale	56′-5″– 67′-7″	17.2 – 20.6	Breaks twigs off trees, impedes progress
9	Strong Gale	68′-3″– 80′-5″	20.8 – 24.5	Slight structural damage (roof tiles and chimney covers, etc. blown off)
10	Storm	81′-0″– 92′-10″	24.7 – 28.3	Trees uprooted, considerable damage occurs

G. Do not operate the crane unless the conditions are safe.

5.2 PRE-DEPARTURE CHECKS (TO JOB-SITE)

5.2.1 VEHICLE CHECKS (PRIOR TO ENGINE START)

A. Do a check of the level of coolant and add more if below the cold engine level.
B. Do a check of the fuel level and make sure that you have more than is necessary to complete the task.
C. Make sure that the parts in the steering and brake systems are flexible, safe, and reliable.
D. Make sure that the parts that follow are tight:
   - Bolts in universal joints for steering axles
   - Front and rear axles mounting bolts
   - Wheel bolts
   - Drive shaft mounting bolts
   - Engine and transmission mounting bolts.
E. Examine all tires for the correct pressure.
F. Examine the items that follow for damage:
   - Condition of tires
   - Door locks
   - Doors
   - Windows
   - Each crane control mechanism.
G. Examine the fittings of oil pipes and water pipes for leakage.
H. Examine the battery terminals for too much corrosion and make sure that the power wires are tight.
I. Examine the level of the battery electrolyte (adjust as necessary).
J. Examine the air filter indicator. If the indicator is red, clean or replace the filter element.

The air filter system must be clean prior to starting the engine.

K. Examine the air filter assembly. Clean the contamination from the bottom of the air filter.
L. Turn the ignition switch to stage "I" and examine the functions of the items that follow:
   - Instrument panel
   - Switches
   - All lights
   - Turn signals
   - Wipers
   - Miscellaneous displays.
M. Adjust the mirrors for clear vision to the rear.

5.2.2 GENERAL CHECKS AT VEHICLE START UP

CAUTION

- **Before you start the vehicle on a steep slope or a muddy road, engage the 4-wheel drive and move the transmission selection lever into "F1" position.**
- **Do not turn the power supply OFF while the engine is ON. If you turn the power supply OFF, the electrical system does not operate and you remove the data from the ECU.**

A. Examine the controls and instruments.
   (1) Examine the transmission oil pressure gauge.
   The transmission oil pressure must be between 240 PSI (1.7 MPa) – 310 PSI (2.1 MPa).
   (2) Examine the engine coolant temperature.
   After the engine has the time to warm-up, the pointer must point to the green range (between 158°F (70°C) and 203°F (95°C).
   (3) Make sure that the transmission gears shift correctly. Refer to Table 6-3 in Chapter 6.
   (4) Make sure that the 360° superstructure lock moves correctly and the control light illuminates.
B. Make sure that each indicator operates.
C. Make sure that the generator operates.
D. Make sure that the park brake is not ON.
E. Move the transmission selection lever to the "F1" position and slowly increase the speed.

5.2.3 MOVE THE CRANE TO THE JOB-SITE

DANGER

Do not let the vehicle move forward when the transmission is in neutral.

WARNING

Do not operate a vehicle if a warning indicator illuminates. Stop the vehicle and have it repaired.

A. If a warning indicator illuminates, decrease your speed immediately and stop at a safe location for maintenance checks.
B. Do not skip a gear when you move through the gear cycle.
C. Stop the vehicle if there are unusual conditions with the items in the below list:
   - Steering
   - Braking

- Sounds or smells
- Vibrations
- Sudden speed increase or decrease.

If you cannot find or correct the problem, send the vehicle for repair.

D. Examine the following instruments for functions:

CAUTION

Stop the engine if the engine oil pressure low indicator illuminates.

CAUTION

The engine oil pressure low indicator illuminates if the engine oil filter screen is dirty. If this occurs, examine the engine oil pressure. If it is in the correct pressure range, examine and clean the engine oil filter screen.

(1) Engine oil pressure low indicator:

(a) Not illuminated.

(b) When the engine runs at idle, the minimum oil pressure is 55.1 psi (0.38 MPa). When the engine runs without a load, the minimum oil pressure is 10 psi (0.069 MPa). If the pressure is less than the minimum value, the indicator illuminates. If this occurs, stop the engine. Measure the level of the oil in the engine and examine for leaks. If the oil level is at the correct level and there are no leaks, it is an unserviceable lubricating system. Send the crane to the factory for repair.

(2) Engine coolant temperature gauge:

(a) The coolant temperature must be between 158°F and 203°F (70°C and 95°C). Do not move the crane at high speed when the coolant temperature is less than 158°F (70°C).

(b) Do not operate the engine at high speeds without a load for extended periods of time.

CAUTION

Do not move the crane at high speeds with a heavy load until the engine coolant temperature is a minimum 158°F (70°C).

(c) When the coolant temperature is in the yellow area, between 203°F and 212°F (95°C – 100°C), the engine is too hot. Park the crane. Operate the engine at a RPM immediately above idle to help cool the engine. Or, as you move, put the transmission in a lower gear range to decrease the load on the engine.

CAUTION

Do not stop the engine immediately when the engine coolant temperature is above the maximum limit. If you stop the engine, the coolant temperature increases suddenly and damage to the engine occurs. Operate the engine at a RPM immediately above idle to help decrease the coolant temperature.

(d) When the coolant temperature gauge points to the red area, between 212° F and 248° F (100° C - 120° C) continuously, it shows that the engine is above limits. If you stop the engine, the coolant temperature increases suddenly and damage to the engine occurs. Operate the engine at a RPM immediately above idle to help decrease the coolant temperature.

(e) When the coolant temperature goes back to the green or yellow area, do the items that follow:

- Examine the engine area for leaks.
- Examine the function of the thermostat.
- Examine the coolant level.
- Examine the fan belt for damage.
- Make sure that the fan belt is not too loose.

CAUTION

Do not add a large quantity of cold water to the engine if the engine coolant temperature is above the maximum limit. This can kill or blind you and cause damage to the engine.

(3) Low engine coolant:

CAUTION

Use soft water, e. g. tap water, for coolant. Do not use hard water (river water).

Do not add a large quantity of cold water too quickly. When it is necessary to add cold water, put the water in slowly. Follow the below instructions to add coolant:

- Put together water, antifreeze and/or anti-rust fluid in the correct ratio.
- Loosen the cap to the coolant tank with a wet rag to release the pressure in the tank. After you release the pressure, continue to remove the cap. The fluid released is hot and pressurized and can cause burns or blindness. Always keep your face away from the cap on the coolant tank.
- Add the water mix to the applicable coolant tank fill-line and then install the cap.

CAUTION

Do not operate the engine continuously at high speeds without a load.

CAUTION

Do not bypass gears when you move to a lower gear.

Slow the crane down before you change to a lower gear.

E. Do the items that follow before you go down a long hill slope:
- Make sure that the brake system can stop the crane before you go onto the slope.
- Put the transmission in the "F1" position before you go down the slope.

F. Know the below data while you steer the crane:
- When you go into a corner, put the transmission in a lower gear and apply a small quantity of pressure on the brakes.
- The steering wheel has a mechanical limit. Do not continue to turn the wheel when at the limit. Do not keep the wheel at the limit for long periods of time.

G. If the engine stops because the fuel tank is empty, air can go into the fuel system. When this occurs, you remove the air from the fuel lines.

H. When you move the crane between locations, only one person is approved to be in the cab.

5.2.4 CRANE MOVEMENT IN OFF-ROAD CONDITIONS

When the rear axle is in the mud (no traction) or on rough terrain, follow these steps:
- Put the transmission in the "F1" position. This applies more torque to the drive system.
- Put the vehicle in the 4-wheel drive mode.
- Tow the vehicle or put rigid materials, e.g. pieces of wood or iron plates, below the wheels.

5.2.5 PARK THE VEHICLE

A. When you park the vehicle, follow the instructions below:
- In bad weather condition (rain, snow, ice) or on a slope, make sure that there is a lot of clearance in front and to the aft of the vehicle.
- Put the park switch to the "P" position and put the chocks against the wheels.
- Put the transmission in the neutral position.

B. Before you stop the engine, do the items that follow:
- Push the accelerator pedal 2 or 3 times to increase the engine RPM. This makes the oil flow into each part of the engine.
- Let the engine idle while you monitor the coolant temperature.
- Stop the engine, when the coolant temperature is in the correct range.
- Put the battery master switch to the OFF position.

CAUTION

Make sure that the hazard indicator illuminates when the vehicle is parked on the road at night.

5.2.6 EMERGENCY STOP ON THE ROADWAY

If the crane malfunctions on the roadway, do the items that follow:

- Set the hazard lights to ON and put the safety triangles in position.
- Set the park brake if you stop because of a drive train (drive shaft, axle) failure or you make an emergency stop on a slope. Put the chocks on the wheels.
- Examine the vehicle to find the part that caused the malfunction. Be careful of the road conditions while you move around the vehicle.
- If you cannot repair the vehicle, tell the servicing and repair facility.

5.2.7 PREPARE THE CRANE FOR OPERATION

A. Examine the items that follow:
   - Engine oil for correct level and make sure that it is clean
   - Coolant for correct level
   - Fuel tank for correct level
   - Hydraulic oil tank for correct level.

B. Start the engine and examine for noises and vibrations that are not usual.

C. If necessary, engage the PTO.

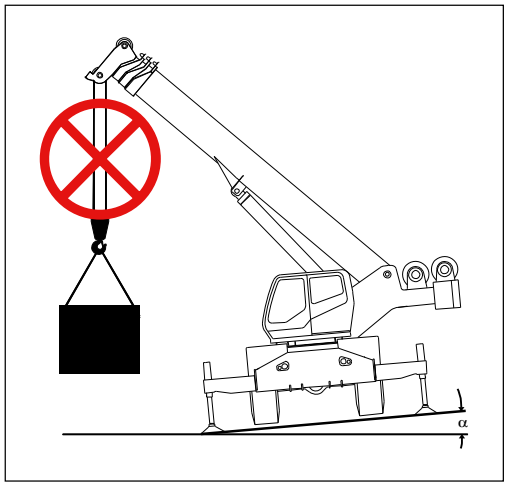
5.2.8 WHEN THE CRANE IS IN OPERATION

A. Personnel must stay away from the area below the boom.

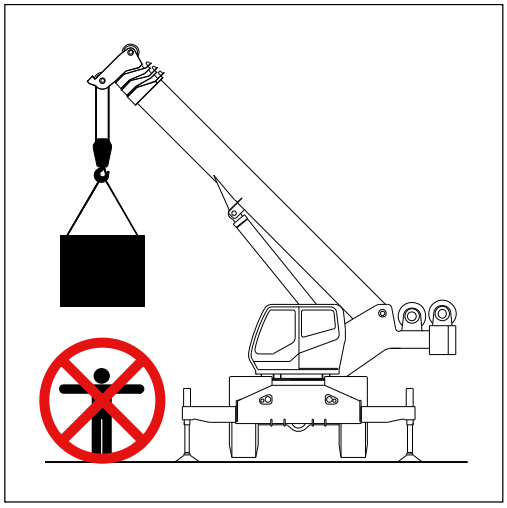
B. Do not let personnel on the superstructure while you operate the crane.

C. Personnel must stay away from the reach of the boom.

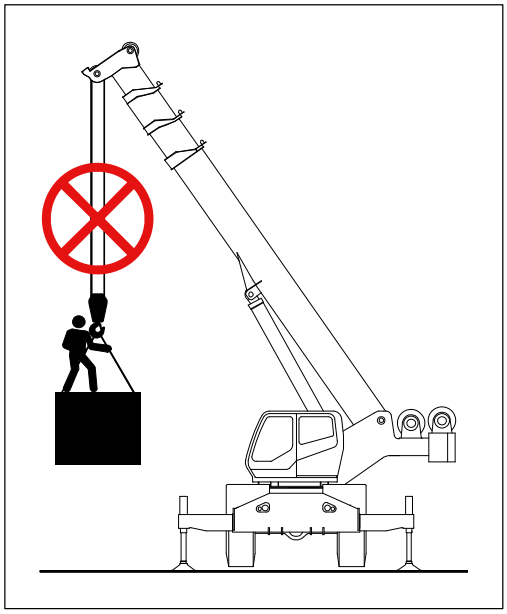
D. The crane, with extended outriggers, must be on the ground with a slope of less than 1°.



E. Do not move a load above personnel.

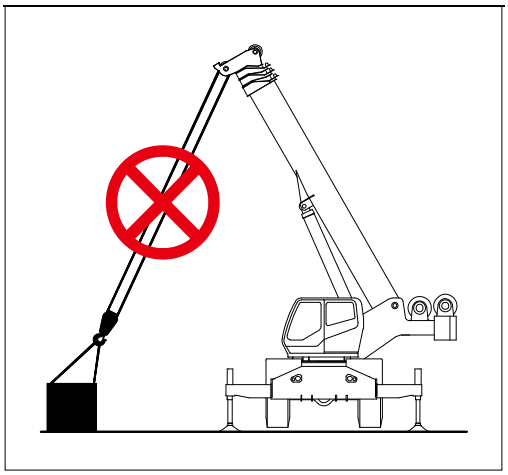


F. Do not move personnel on the load or other equipment used to lift.

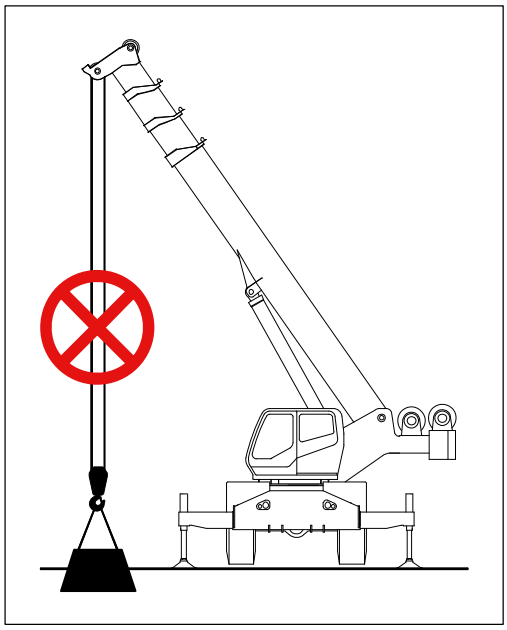


G. Do not use the crane for the tasks that follow:

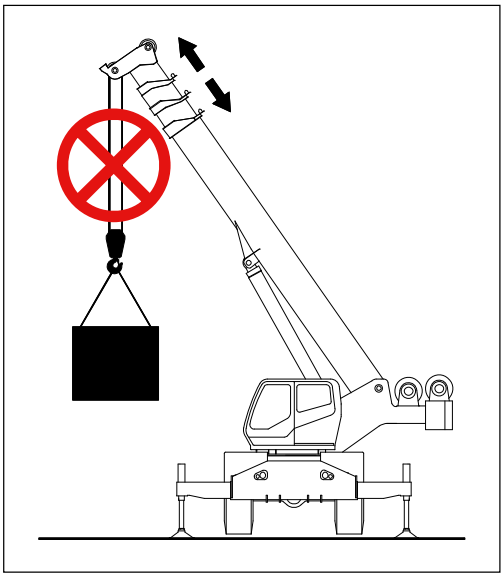
- Lift a load that is above the capacity of the crane
- Pull a load at an angle
- Lift a load that is not in balance.



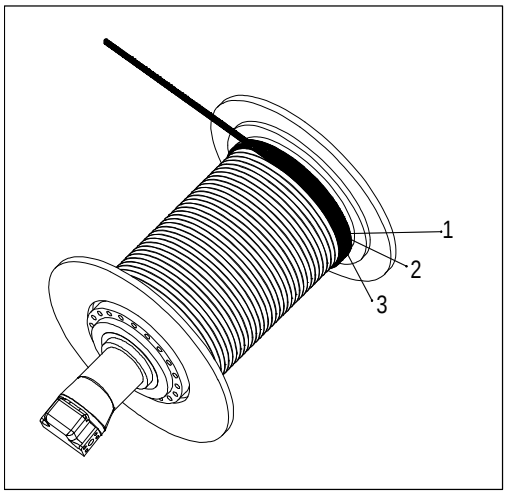
H. Do not try to lift a load that is buried or frozen on the ground.



I. Do not extend / retract the boom with a suspended load.

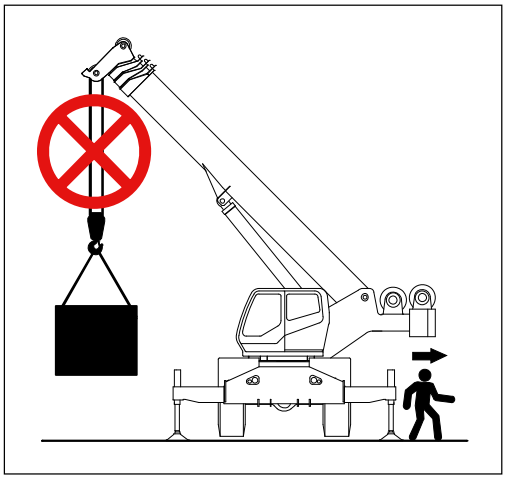


J. Keep no less than 3 wraps of wire rope on the drum.

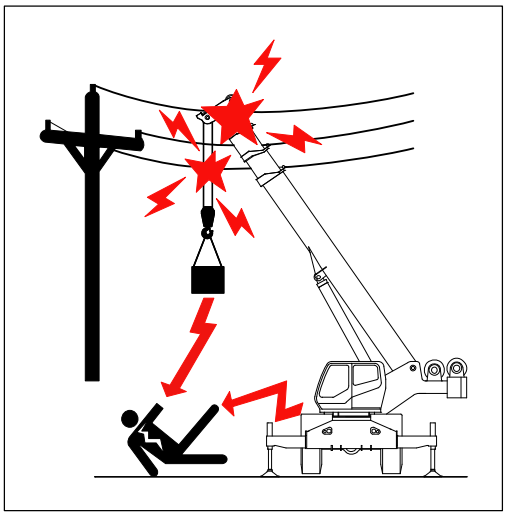


K. When the load is off the ground, do not adjust the hoist mechanism brake.

L. When the load is off the ground, the operator must stay in the cab.



M. When the job-site is near live power lines, you must keep a safe distance.



N. When the load is off the ground, move the load in a slow and smooth direction.

O. Constantly monitor the system gauges and indicators, when the crane is in operation. If you find a malfunction, stop the operation.

P. A noise sounds when the load is at 90% of the capacity of the crane. When this occurs, be careful as you continue to lift.

Q. If the crane was changed, do not operate the crane until approved personnel examine the changed part.

WARNING

Stop the operation or do not start to lift a load, if one of the items that follow occurs:

- **An overload or if the weight of the load is unknown.**
- **The load lift moves out of position, the rigging becomes too loose or the load is out of balance.**
- **The protective material between the edges of load and wire rope is missing.**
- **The light level at the job-site goes below a safe work condition.**
- **Equipment malfunction or damage to the crane that decreases the safe operation of the crane.**

ZOOMLION

Rough Terrain Crane Operator'S Manual

Chapter 6 Controls and instruments

CHAPTER 6 CONTROLS AND INSTRUMENTS

This part of the chapter is to show you the controls and instruments on the crane. This is only a small part of the data that you must know before you can safely operate the crane. Do not operate the crane until you are trained in all the other sections of this manual.

6.1 UPPER CONTROLS AND INSTRUMENTS

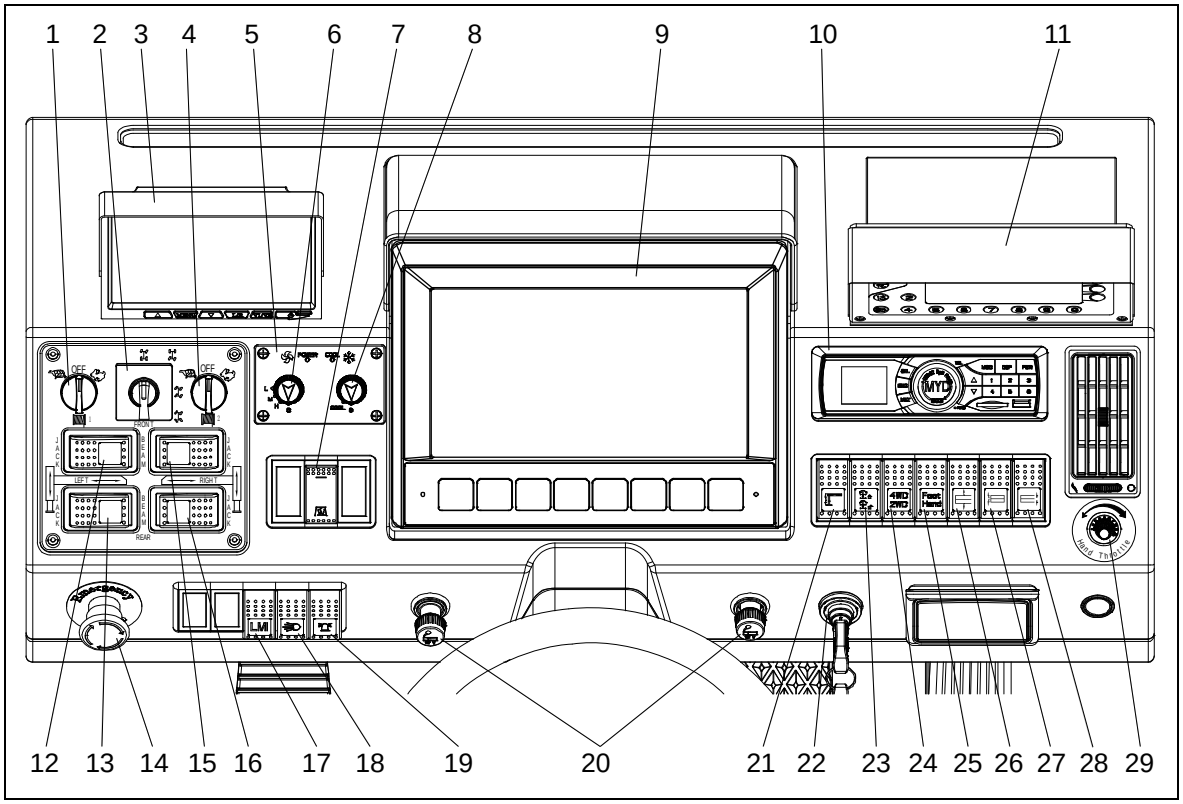


Figure 6-1 Upper Controls and Instruments

POS.	DESCRIPTION	POS.	DESCRIPTION
1	High / Low Speed Select Switch for Main Winch	16	Right Rear Outrigger Switch
2	Steering Switch	17	Set-up Switch
3	Camera Display	18	Work Light Switch
4	High / Low Speed Select Switch for Auxiliary Winch	19	Rotating Beacon Switch
5	Air Conditioner Control Panel	20	Cigarette Lighter
6	A/C Fan Speed / Master Switch	21	Outrigger Extend / Retract Master Switch
7	Cab Heater Power Switch	22	Ignition Switch
8	Cab Cooler Power Switch	23	Swing Lock Switch
9	Monitor	24	2-Wheel / 4-Wheel Drive Switch
10	Media player	25	Hand / Foot Throttle Select Switch
11	Load Moment Indicator (LMI) Display	26	Counterweight Cylinders Extend / Retract Switch
12	Left Front Outrigger Switch	27	Left Counterweight Cylinder Extend / Retract Switch
13	Left Rear Outrigger Switch	28	Right Counterweight Cylinder Extend / Retract Switch
14	Emergency Stop Button	29	Hand Throttle
15	Right Front Outrigger Switch		

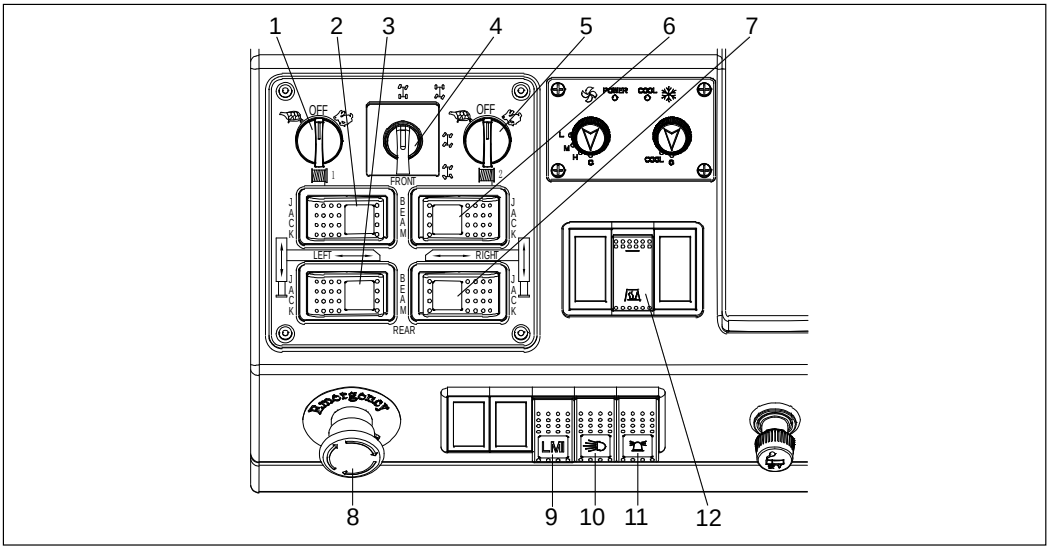


Figure 6-2 Left Dash

1. **HIGH / LOW SPEED SELECT SWITCH FOR MAIN WINCH –** Sets the main winch speed to OFF, LOW or HIGH.
2. **LEFT FRONT OUTRIGGER SWITCH –** Used to select the outrigger cylinder (jack or beam) to be extended / retracted with the **OUTRIGGER EXTEND / RETRACT MASTER SWITCH (21)** (Refer to Figure 6-1.).
3. **LEFT REAR OUTRIGGER SWITCH –** Used to select the outrigger cylinder (jack or beam) to be extended / retracted with the **OUTRIGGER EXTEND / RETRACT MASTER SWITCH (21)** (Refer to Figure 6-1.).

   CAUTION

   You can set the steering switch from crab or 4-wheel steer to 2-wheel steer only when the axles are in the center position.

   Be careful when the upperstructure is not in the travel position. The steering is opposite when the boom is in the rear position.

4. **STEERING SWITCH –** The 4 modes are as follows:

   2-wheel steer (front wheel) 2-wheel steer (rear wheel) Crab steer 4-wheel steer
5. **HIGH / LOW SPEED SELECT SWITCH FOR AUXILIARY WINCH –** Sets the auxiliary winch speed to OFF, LOW or HIGH.
6. **RIGHT FRONT OUTRIGGER SWITCH –** Used to select the outrigger cylinder (jack or beam) to be extended / retracted with the **OUTRIGGER EXTEND / RETRACT MASTER SWITCH (21)** (Refer to Figure 6-1.).
7. **RIGHT REAR OUTRIGGER SWITCH –** Used to select the outrigger cylinder (jack or beam) to be extended / retracted with the **OUTRIGGER EXTEND / RETRACT MASTER SWITCH (21)** (Refer to Figure 6-1.).
8. **EMERGENCY STOP BUTTON –** In an emergency, push this button to immediately STOP all crane functions. Turn the button clockwise to release the button.
9. **SET-UP SWITCH –** Push down to bypass the switch-off after the LMI sounds the alarm and switches off the movements. (If the crane is equipped with HIRSMANN LMI, the set-up switch should be fitted. If the crane is equipped with GREER LMI, the set-up switch should not be fitted.)
10. **WORK LIGHTS SWITCH –** Push down to turn on the headlights and boom work lights, up to turn off.
11. **ROTATING BEACON SWITCH –** Push down to turn on the rotating beacons, turn signals and boom head lamp.
12. **CAB HEATER POWER SWITCH –** Used to turn on the cab heater. The controls to adjust heat are on the **AIR CONDITIONER CONTROL PANEL (5)** (Refer to Figure 6-1.).

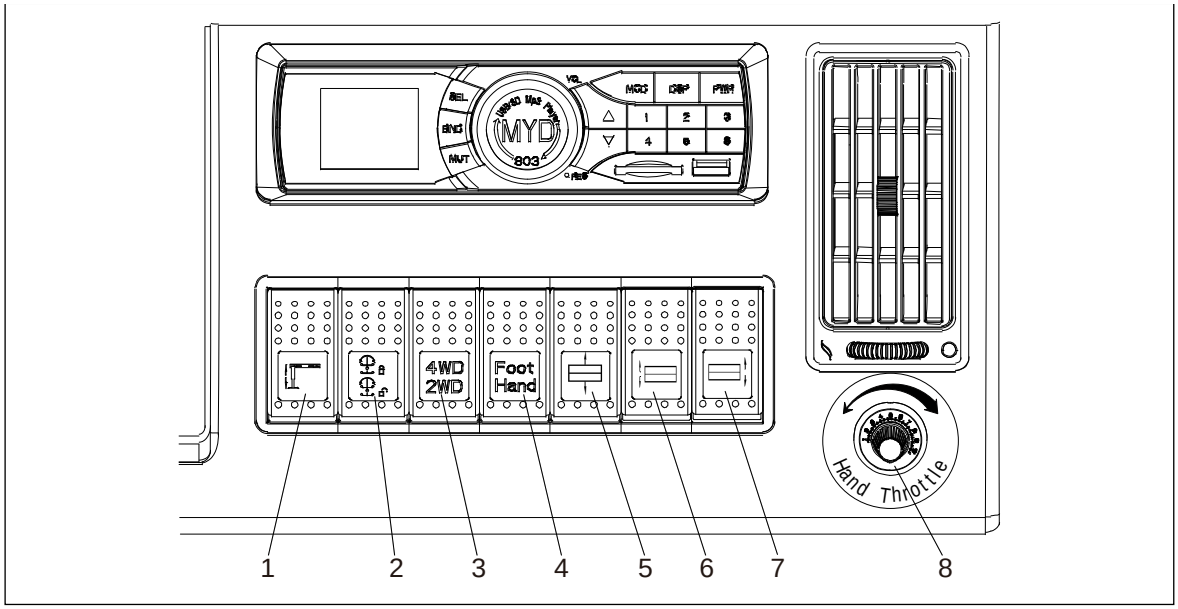


Figure 6-3 Right Dash

1. **OUTRIGGER EXTEND / RETRACT MASTER SWITCH –** Used with switches (12, 13, 15, 16) (Refer to Figure 6-1.) to extend and retract the outrigger beams or jacks. Push down to retract, up to extend.

   CAUTION

   You must set the swing lock switch to LOCK, when the boom is in the travel position.

2. **SWING LOCK SWITCH –** Push down to disengage swing lock, up to engage.

   CAUTION

   Do not use this switch until you stop the crane.

3. **2-WHEEL / 4-WHEEL DRIVE SWITCH –** Push up to engage 2-wheel drive, down to engage 4-wheel drive.
4. **HAND / FOOT THROTTLE SELECT SWITCH –** Push up to select foot throttle, down to select hand throttle.
5. **COUNTERWEIGHT CYLINDERS EXTEND / RETRACT SWITCH –** Push up to retract both counterweight cylinders, down to extend.
6. **LEFT COUNTERWEIGHT CYLINDER EXTEND / RETRACT SWITCH –** Push up to retract the left counterweight cylinder, down to extend.
7. **RIGHT COUNTERWEIGHT CYLINDER EXTEND / RETRACT SWITCH –** Push up to retract the right counterweight cylinder, down to extend.
8. **HAND THROTTLE –** Rotate to control the throttle (used with switch 25 in Figure 6-1).

6.1.1 AIR CONDITIONER CONTROL PANEL

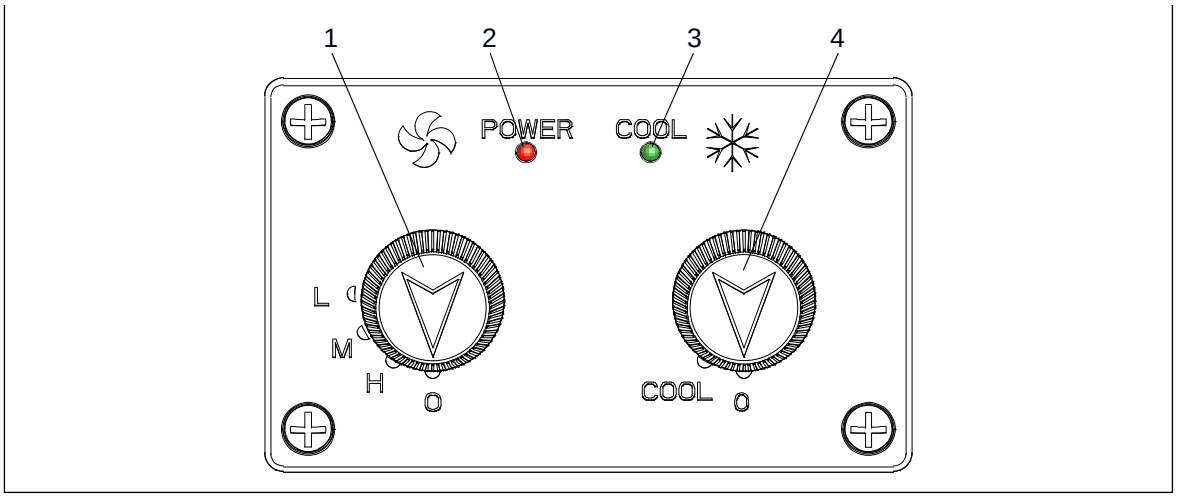


Figure 6-4 Air Conditioner Control Panel

FUNCTIONS

1. **A/C FAN SPEED / MASTER SWITCH –** Used to control the fan blower modes: OFF, HI, MID, LOW.
2. **FAN POWER INDICATOR**
3. **COOL MODE INDICATOR**
4. **CAB COOLER POWER SWITCH –** Refrigeration ON / OFF. Starts or stops the function of the compressor.

Table 6-1 Air Conditioner Maintenance Requirements

ITEM	REQUIREMENTS	MAINTENANCE INTERVAL
Condenser fan motor	Examine and repair.	Every quarter
Evaporator fan motor	Examine and repair.	Every quarter
Condenser	Examine and clean.	Every month or increase the maintenance frequency according to the working conditions
Evaporator	Examine and clean.	Every quarter or increase the maintenance frequency according to the working conditions
Electromagnetic clutch	Make sure that it operates smoothly and is clean.	Every quarter
Connector	Make sure that the connector is set in place.	Every month

A. Component Location

- Evaporator – In the cab
- Condenser – On the left side of the superstructure
- Condenser fan – On the left side of the superstructure.

B. Operating Methods:

Cab Temperature Control Functions:

(1) Refrigeration

The first time you use the COOL function, do the items that follow:

- Start the engine.
- Set the A/C FAN SPEED / MASTER SWITCH (1) to blow air.
  RESULT – Fan power indicator (red) illuminates.
- Set the CAB COOLER POWER SWITCH (3) to position COOL.
  RESULT – Cool mode indicator (green) illuminates.
- Turn the A/C FAN SPEED / MASTER SWITCH (1) counter-clockwise to 3 fan speed (HI, MID, LOW) to get the desired temperature.

(2) A/C FAN SPEED / MASTER SWITCH – Used to change between the 4 fan speeds (OFF, HI, MID, LOW).

When the switch is set to blow air, the fan power indicator (red) illuminates.

Note:

The switch is the master power to the COOL function and must be ON (HI, MID, LOW) for the COOL function to operate.

(3) HEAT Mode

Turn on the A/C FAN SPEED / MASTER SWITCH after the engine is started:

- Set the A/C FAN SPEED / MASTER SWITCH to blow air.
  RESULT – The fan power indicator (red) illuminates.
- Push down the HEATER POWER SWITCH.
  RESULT – The heater is ON.
- Turn the A/C FAN SPEED / MASTER SWITCH (1) counter-clockwise between 3 fan speeds (HI, MID, LOW) to get the desired temperature.

⚠ CAUTION

- **Do not disassemble an A/C system that is in the Warranty Period without consent from the A/C manufacturer.**
- **Examine the condition and tension of the compressor belt at a regular interval. If necessary, adjust the tension on the belt.**
- **You must clean the condenser at a regular interval.**
- **You must use the same type of refrigerant and compressor oil to complete the repairs on the A/C.**
- **Set the FAN mode to HI when you first start to cool the cab.**
- **Do not repair the A/C system with the parts that are not supplied by the manufacturer.**
- **When you use the A/C function where it is cool and has a high level of humidity, examine the evaporator frequently. In these conditions, the evaporator freezes and causes a blockage for the air that goes through it.**
- **If you operate the crane in a cold area or in winter, set the A/C system to ON for 10 minutes each month.**

⚠ CAUTION

- **Make sure that the A/C is in the OFF mode when the engine is OFF or at idle speed for a long time. The battery drains in these conditions.**
- **When you move the crane for a long distance at low speed, with the A/C in the ON mode, put the transmission in a low gear. This increases the engine RPM and decreases the load on the transmission.**
- **Set the A/C to the OFF position when you do one of the items that follow:**
  - **Start the crane quickly**
  - **Move up a long hill slope.**
- **Make sure that the refrigerant in the A/C system is at the correct level at regular intervals.**

- **If there are unusual vibrations, noises or smells during operation, stop and examine the crane immediately. Do not operate the crane that has a malfunction.**
- **Keep the surface of the condenser clean. When you clean the condenser, do not use the steam.**
- **Before you disassemble the A/C system, correctly remove the refrigerant.**
- **Do not disassemble the A/C system in an area with high humidity.**

6.1.2 MEDIA PLAYER

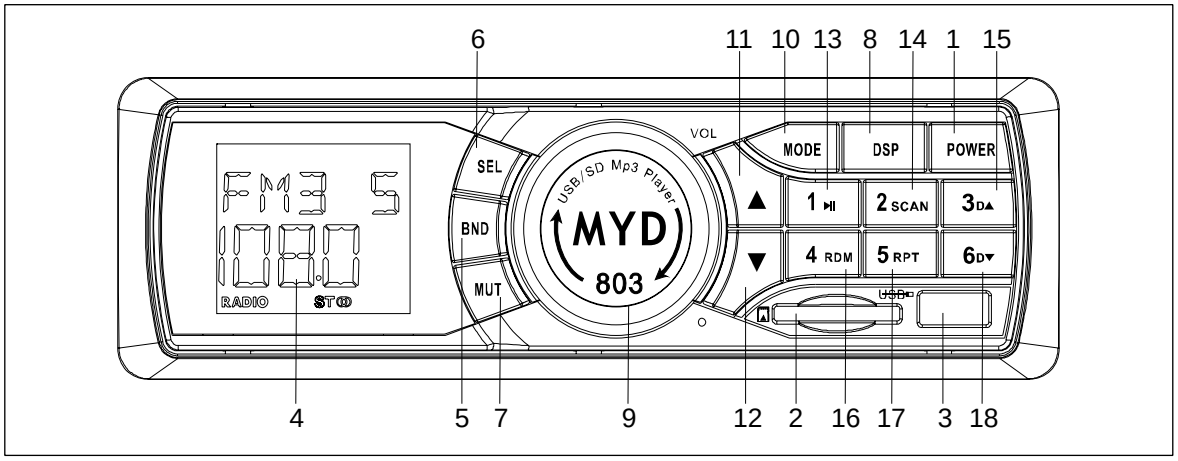


Figure 6-5 Media Player

1. **POWER button** **Power source**
2. **SD card slot**
3. **USB port**
4. **Display**
5. **BND button** **Band control**
6. **SEL button** **Sound effect selection**
7. **MUT button** **Mute**
8. **DSP button** **Time set**

   Pressed and released:

   Display the time.

   Keep it pressed for 3 seconds:

   Use the buttons ▲ or ▼ to set time.
9. **Rotary switch** **Control**
10. **MODE button** **Changeover RADIO / SD / USB**
11. **▲ button** **Low-frequency scan (receive) / skip previous**
12. **▼ button** **High-frequency scan (receive) / skip next**
13. **1 ⏯ – Preset button 1 (receive) / pause (play)**
14. **2 SCAN – Preset button 2 (receive) / 10 second browse (play)**

15. 3 – Preset button 3 (receive) / select the previous file (play)

16. 4 RDM – Preset button 4 (receive) / play at random (play)

17. 5 RPT – Preset button 5 (receive) / repeat (play)

18. 6 – Preset button 6 (receive) / select the next file (play)

Note:

For the detailed information, please refer to the attached *Operating Instructions for Media Player.*

CAUTION

Set the ignition switch to the "I" position, when you use the media player with the engine in the "OFF" position.

6.2 CONTROLS AND INSTRUMENTS

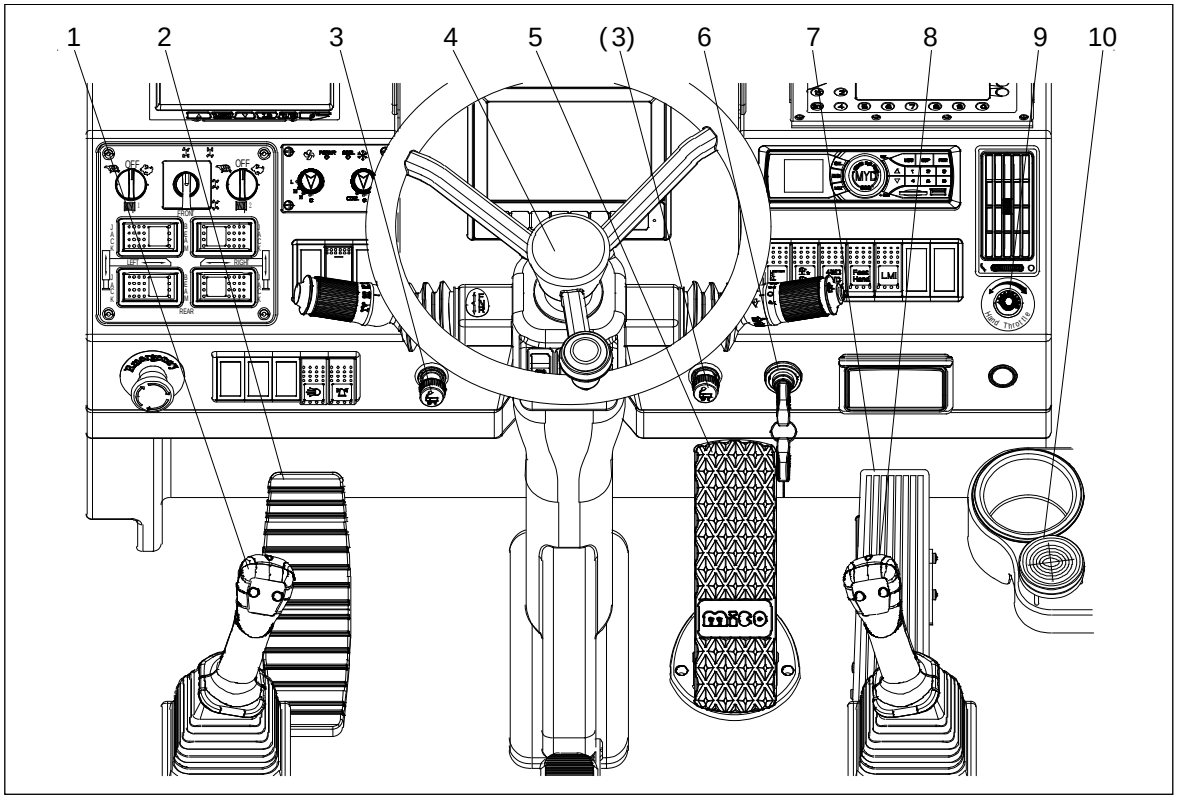


Figure 6-6 Controls and Instruments

POS.	DESCRIPTION	POS.	DESCRIPTION
1	Left Joystick	6	Ignition Switch
2	Boom Extend / Retract Pedal	7	Throttle Pedal
3	Cigarette Lighter	8	Right Joystick
4	Steering Wheel and Combination Switches	9	Hand Throttle
5	Brake Pedal	10	Bubble Level

6.2.1 LEFT JOYSTICK

Refer to Figure 6-7.

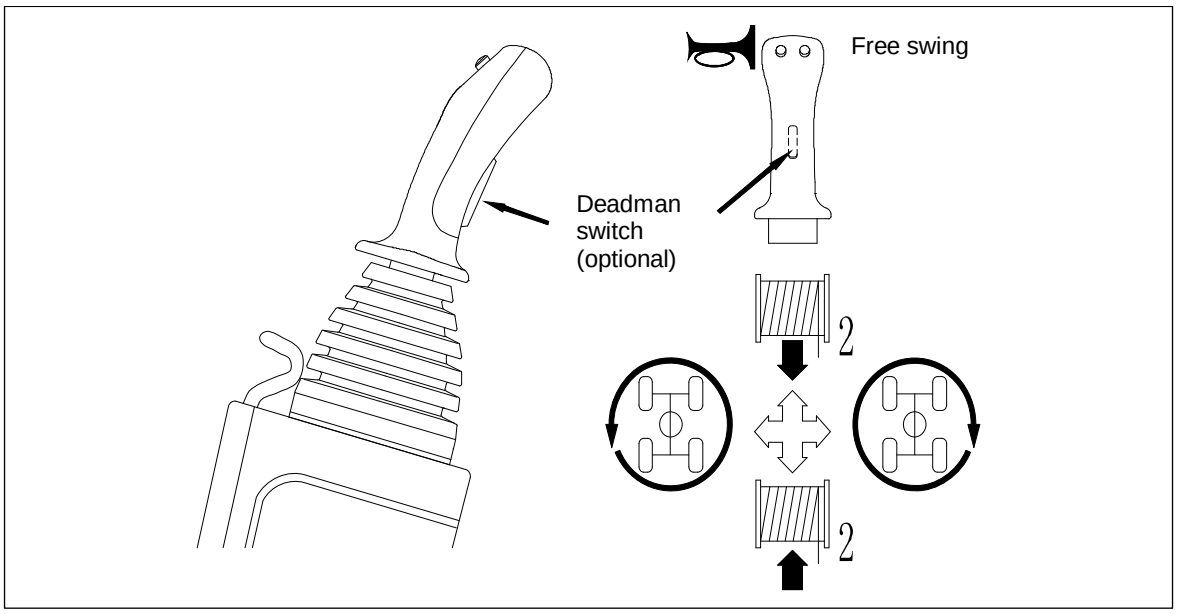


Figure 6-7 Left Joystick

1. **SWING / AUXILIARY WINCH CONTROL –** Move the joystick forward to reel-off the auxiliary winch rope. Move the joystick rearward to spool-up the auxiliary winch rope. Move the joystick to the left to move the boom to the left side. Move the joystick to the right to move the boom to the right side.
2. **HORN –** Push and hold to make a sound. (Located on the left side of the joystick)
3. **FREE SWING –** Push to activate the FREE SWING function. Push again to release this function. (Located on the right side of the joystick)

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on the left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

6.2.2 BOOM EXTEND / RETRACT PEDAL

Refer to Figure 6-8.

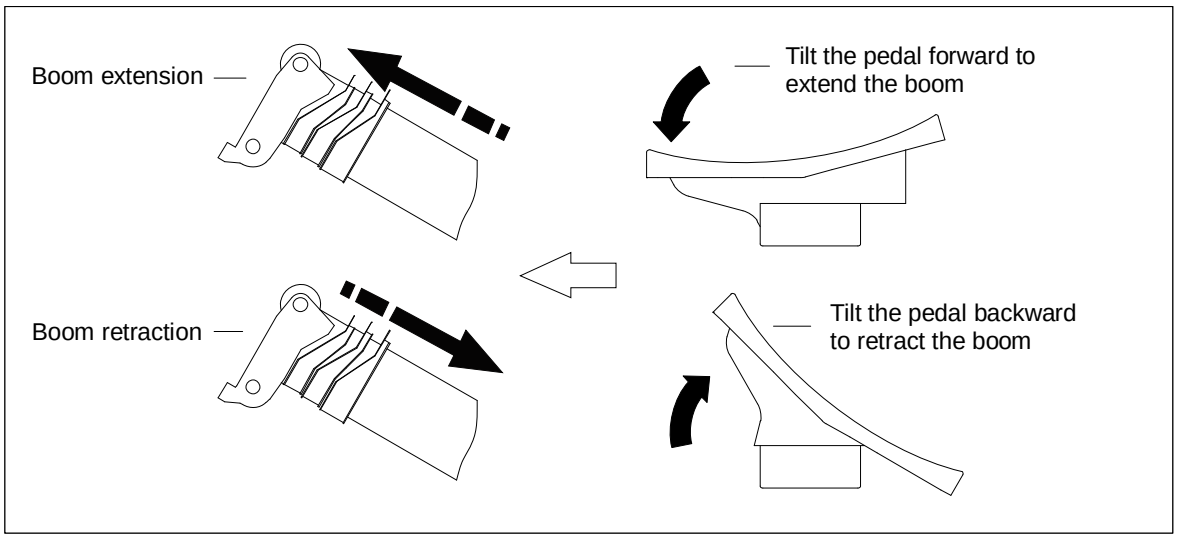


Figure 6-8 Boom Extend / Retract Pedal

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on the left or right joystick) for the boom extend / retract pedal commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the boom extend / retract pedal commands to operate the crane.

6.2.3 CIGARETTE LIGHTER

Push-in the cigarette lighter for 3 to 5 seconds. Pull it out to use it. After you use it, put it in its initial position.

Note:

Set the ignition switch to the "I" position, when you use the cigarette lighter with the engine in the OFF position.

6.2.4 STEERING WHEEL AND COMBINATION SWITCHES

6.2.4.1 STEERING WHEEL

A. The crane has a hydraulic booster system which makes it easy to turn the crane in all conditions.

CAUTION

DO NOT adjust the steering column while you move the crane. This can kill you.

B. You can adjust the steering wheel height and inclination when you push the pedal at the bottom of the steering column. Lock the steering column after adjustment.

6.2.4.2 COMBINATION SWITCHES

Refer to Figure 6-9.

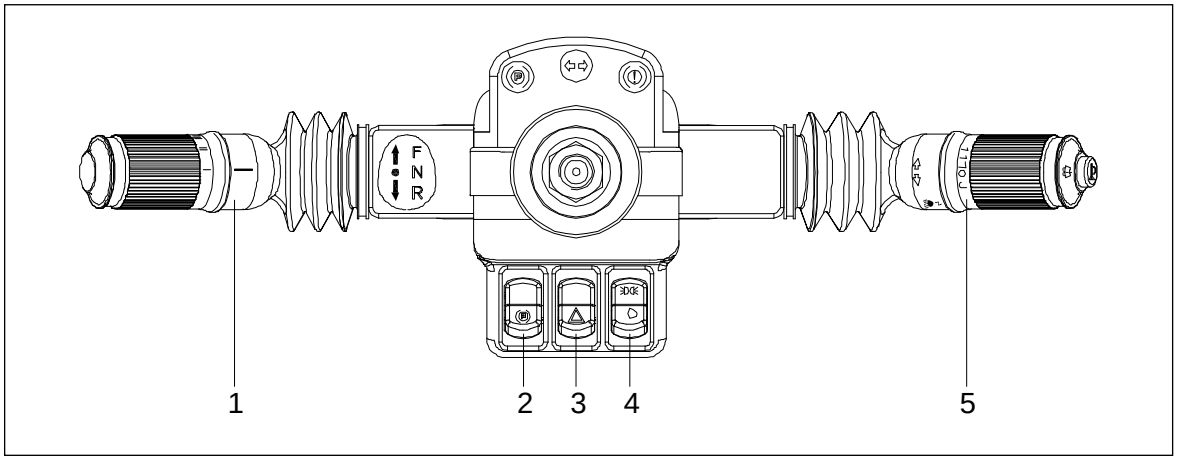


Figure 6-9 Combination Switches

1. **GEAR SELECTOR –** Use to control the transmission gear selection. Pull in the direction of the operator for reverse. Push in the direction of the dash for forward. Turn the handle to set the speed. Refer to Figure 6-10.

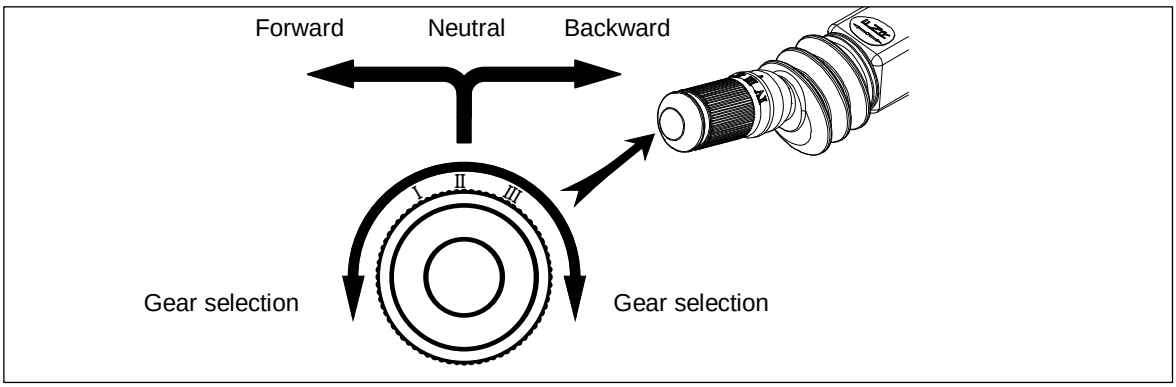


Figure 6-10 Gear Selector

2. **PARK BRAKE SWITCH –** Set the switch to the "P" position when the crane is in the correct position to operate.

   Note:

   If you park the crane on a slope, you must put the chocks before and behind the wheels.

3. **HAZARD LIGHTS SWITCH –** Push-in to set the hazard lights to ON. The indicator illuminates (flashes).
4. **CORNER MARKER LIGHTS / LOW BEAM LIGHTS SWITCH –** Push the switch up, to turn ON the corner marker lights. Push the switch down, illuminate the low beam lights.
5. **WIPER CONTROL –** Windshield wiper operation (4-speed settings: J – Timed Interval (Intermittent), I – Low Speed, II – High Speed, O – OFF). Push the button, on the end of the handle, to spray washer fluid onto the window. Push in the direction of the dash for the left turn signal. Pull in the direction of the operator for the right turn signal. Refer to Figure 6-11.

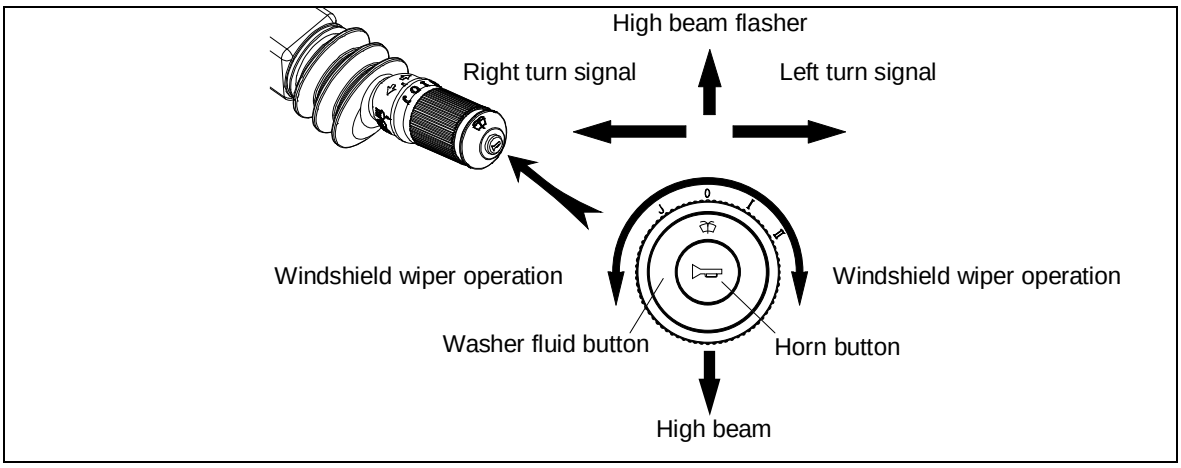


Figure 6-11 Wiper Control

CAUTION

The spray of washer fluid stops after 15 seconds or if the washer fluid tank is empty. Do not operate the wipers on hot sunny days unless you spray the window with wiper fluid. When the temperature is below freezing, make sure that the wiper blades are not stuck to the window before you set the wipers to ON.

6.2.5 BRAKE PEDAL

Push the brake pedal to decelerate or stop the crane.

6.2.6 IGNITION SWITCH

Refer to Figure 6-12.

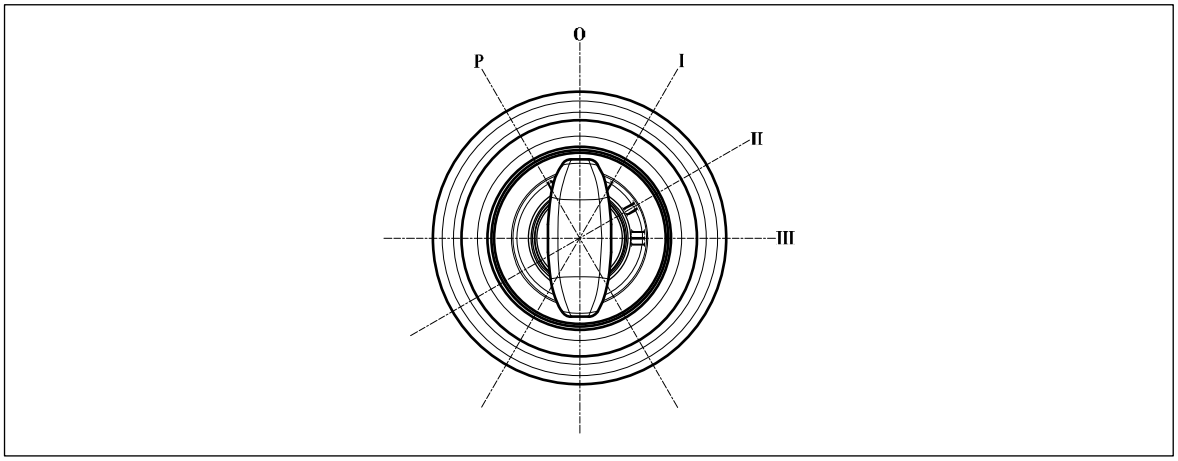


Figure 6-12 Ignition Switch

The 4 positions of the switch are as follows:

- "I" – All circuits, this does not include the starter, are ON.
- "II" – Not used.
- "III" – A temporary position, use it to operate the starter
- "O" – All circuits are OFF.

Note:

Make sure that you release the ignition ("III" position) after the engine starts.

CAUTION

You cannot remove the key from the ignition until the switch is in the "O" position (OFF).

6.2.7 THROTTLE PEDAL

Push the pedal to increase the engine RPM, release the pedal to decrease it. The movement of the items that follow can increase or decrease as the speed of the engine changes:

- Boom swing
- Increase or decrease the angle of the boom
- Extend or retract the boom
- Hoist movements (raise or lower a load).

6.2.8 HAND THROTTLE

You can use the hand throttle after you push down the hand / foot throttle select switch.

6.2.9 BUBBLE LEVEL

You use this to make sure that the crane is level.

6.2.10 RIGHT JOYSTICK

Refer to Figure 6-13.

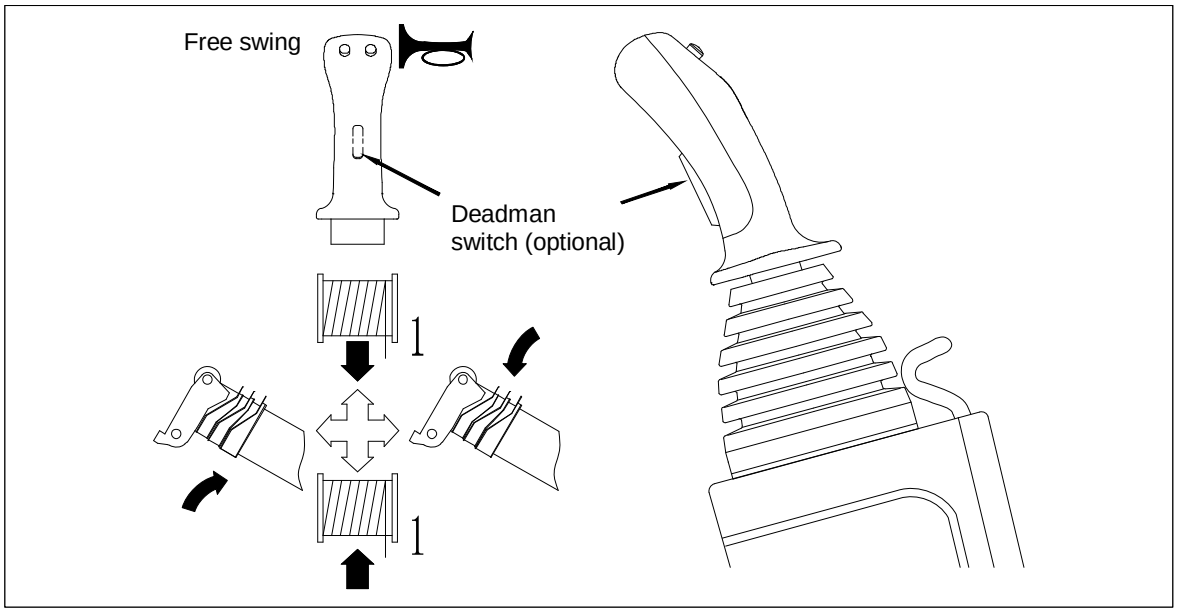


Figure 6-13 Right Joystick

1. **BOOM HOIST / MAIN WINCH CONTROL –** Move the joystick forward to reel-off main winch rope. Move the joystick rearward to spool-up main winch rope. Move the joystick left to lift the boom. Move the joystick right to lower the boom.
2. **HORN –** Push and hold-in to make a sound. (Located on the right side of the joystick).
3. **FREE SWING –** Push to activate the FREE SWING function. Push again to release this function. (Located on the left side of the joystick)

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on the left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

6.3 MONITOR

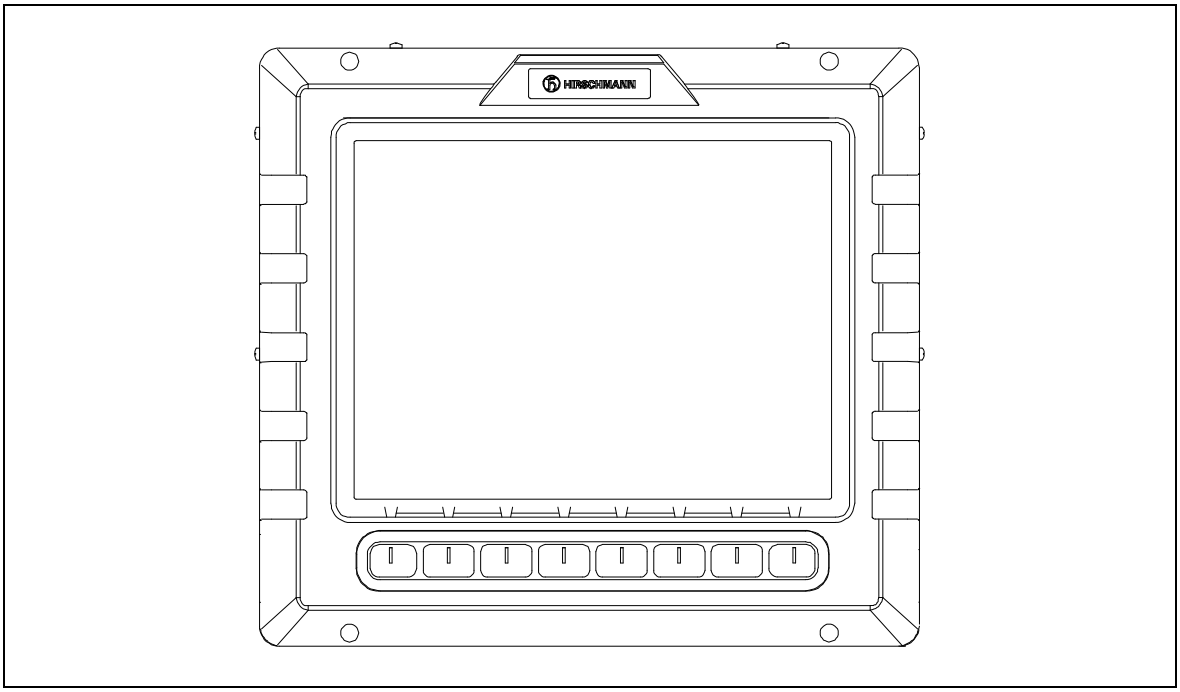


Figure 6-14 Overall View

Figure 6-15 System Start-up

After you turn on the power supply:

A. The computer system boots up. Refer to Figure 6-15.

B. The Work Mode Screen (when the park brake is ON) or Travel Mode Screen (when the park brake is OFF) appears on the monitor. Refer to Figures 6-16 and 6-17 respectively.

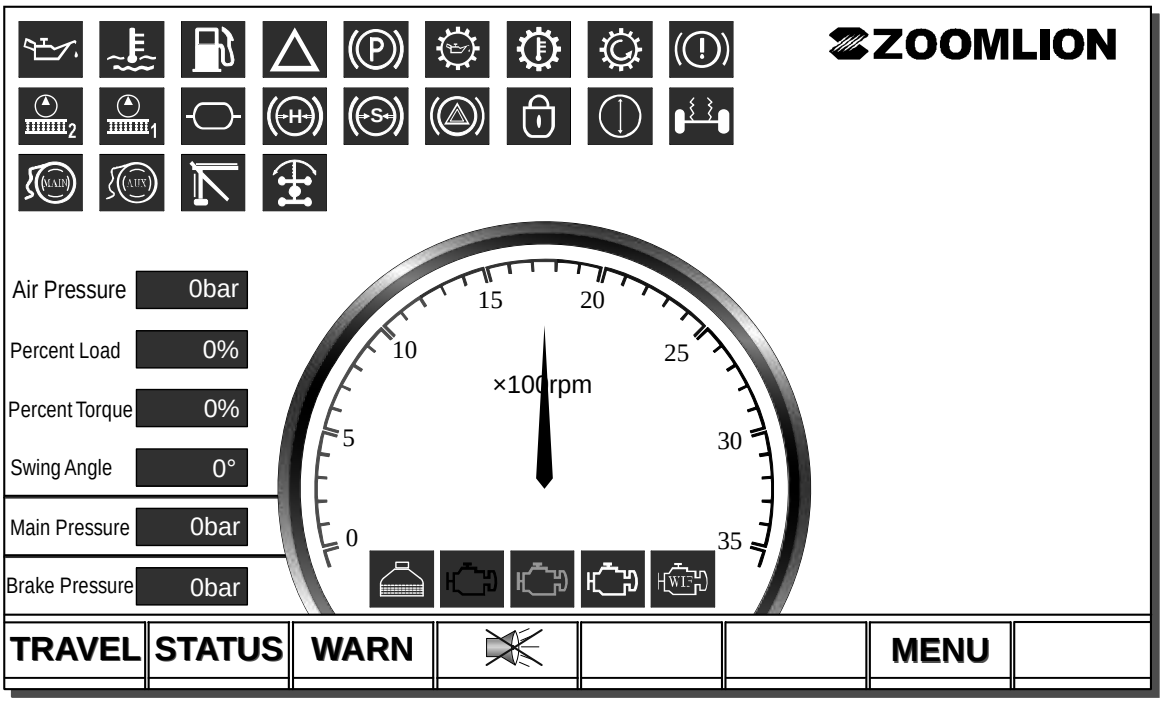


Figure 6-16 Work Mode

Under the Work Mode Screen, the virtual tachometer will be displayed on the screen. For its function, refer to Table 6-2.

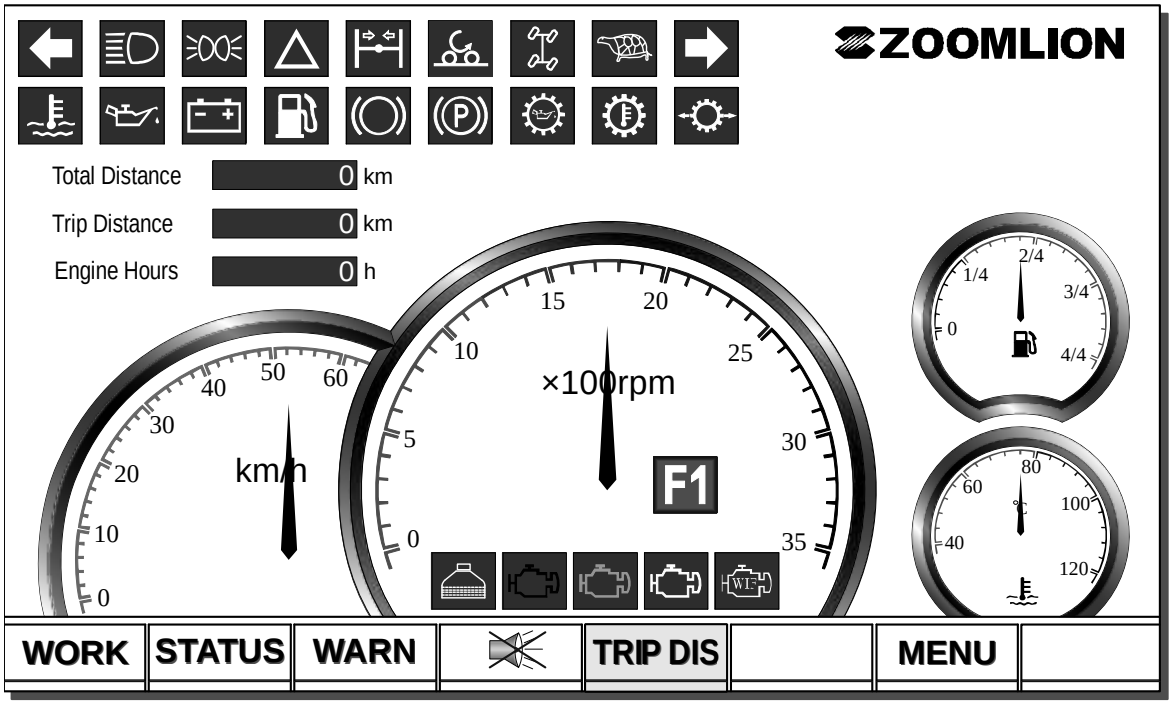


Figure 6-17 Travel Mode

Trip Distance is the crane travel distance from the departure place to the destination. Press the function key "TRIP DIS" to begin to record the travel distance. At this time, the key turns to grey. Press the key again to finish the travel distance recording and the key turns to green.

Under the Travel Mode Screen, the virtual gauges such as odometer, tachometer, fuel gauge and engine coolant temperature gauge will be displayed on the screen. For their functions, refer to Table 6-2.

Under any screen, the function keys at the bottom are available for switching among various screens.

For the functions of the symbols displayed on the screen, please refer to Table 6-3.

Table 6-2 Gauges

DESCRIPTION	FUNCTION
Tachometer	Displays engine speed (RPM).
Odometer	Displays the speed of the crane in kilometers per hour (km/h) when the crane is moving.
Engine coolant temperature gauge	Displays the engine coolant temperature in degrees Celsius (°C). YELLOW – normal range RED – the engine has a large load on it.
Fuel gauge	Displays, as a percent full, the amount of fuel in the tank.

CAUTION

The engine should not operate for a long interval if the coolant temperature gauge is in the red area. Decrease the speed of the engine or decrease the load on the engine. If the temperature does not go down, stop the crane and examine the engine coolant system. The engine can be damaged, if you cannot find a solution to the problem.

CAUTION

Always use clean fuel.

WARNING

Before you stop the engine, operate the engine at idle for several minutes. This helps the engine coolant temperature to be stable.

CAUTION

Do not move the crane when the "ENGINE OIL PRESSURE LOW" INDICATOR illuminates. Stop the engine to prevent damage to the engine.

Table 6-3 Indicators – Universal Symbol Identification

INDICATOR SYMBOL	DESCRIPTION	FUNCTION
	ENGINE COOLANT LOW INDICATOR	**Illuminates:** Shows that the engine coolant level is low.
	ENGINE OIL PRESSURE LOW INDICATOR	**Illuminates:** Shows that the engine oil pressure is low or the oil filter element is dirty. Stop the engine immediately to prevent damage.
	ENGINE COOLANT TEMPERATURE HIGH INDICATOR	**Illuminates:** Shows that the engine coolant temperature is high. Examine the coolant temperature gauge and find the cause of the out-of-tolerance indication. Do the steps to decrease the coolant temperature.
	FUEL RESERVE LOW INDICATOR	**Illuminates:** Shows that the fuel reserve is lower than the permitted value (1/4 of the total).
	LEFT TURN SIGNAL	**Flashes:** The crane moves to the left.
	RIGHT TURN SIGNAL	**Flashes:** The crane moves to the right.
	HIGH PRESSURE FILTER DIRTY INDICATOR	**Illuminates:** Shows that the high pressure filter is dirty.
	CHARGE MONITORING INDICATOR	**Illuminates:** Shows that the battery voltage is low.
	CORNER MARKER LIGHTS INDICATOR	**Illuminates:** The corner marker lights are ON.
	LOW BEAM INDICATOR	**Illuminates:** The low beam lights are ON.
	HIGH BEAM INDICATOR	**Illuminates:** The high beam lights are ON.
	FAULTY OUTRIGGER OPERATION INDICATOR	**Illuminates:** Shows that the outrigger system has a malfunction.

INDICATOR SYMBOL	DESCRIPTION	FUNCTION
	TRANSMISSION OIL PRESSURE LOW INDICATOR	**Illuminates:** Shows that the transmission oil pressure is low.
	TRANSMISSION OIL TEMPERATURE HIGH INDICATOR	**Illuminates:** Shows that the transmission oil temperature is high.
	RETURN-LINE FILTER DIRTY INDICATOR 1	**Illuminates:** The hydraulic oil return-line filter 1 is dirty. Replace the filter element.
	RETURN-LINE FILTER DIRTY INDICATOR 2	**Illuminates:** The hydraulic oil return-line filter 2 is dirty. Replace the filter element.
	FREE SWING INDICATOR	**Illuminates:** Shows that the swing function is ON.
	SERVICE BRAKE INDICATOR	**Illuminates:** The service brake is ON.
	PARK BRAKE INDICATOR	**Illuminates:** The park brake is ON.
	SWING LOCKOUT DEVICE PRESSURE LOW INDICATOR (OPTIONAL)	**Illuminates:** Shows that the pressure in the swing lockout device is low.
	EMERGENCY BRAKE SYSTEM PRESSURE LOW INDICATOR	**Illuminates:** Shows that the pressure in the emergency brake system is low. Use the service brake system to bring the crane to a stop.
	SERVICE BRAKE SYSTEM PRESSURE LOW INDICATOR	**Illuminates:** Shows that the pressure in the service brake system is low. **DO NOT** move the crane.
	PARK BRAKE SYSTEM PRESSURE LOW INDICATOR	**Illuminates:** Shows that the pressure in the park brake system is low. **DO NOT** move the crane.
	CLUTCH DISENGAGING INDICATOR	**Illuminates:** The park brake is ON or the brake pressure is low.

INDICATOR SYMBOL	DESCRIPTION	FUNCTION
	PTO INDICATOR (OPTIONAL)	**Illuminates:** Shows that the PTO is engaged.
	AXLE CENTERED INDICATOR	**Illuminates:** Shows that the rear axle is centered.
	SUPERSTRUCTURE POSITION INDICATOR	**Illuminates:** Shows that the superstructure is in the initial position.
	MAIN WINCH APPROACHING LOWER LIMIT INDICATOR	**Illuminates:** Shows that the main winch is near the minimum wire rope wrap limit (3 turns on the drum).
	AUXILIARY WINCH APPROACHING LOWER LIMIT INDICATOR	**Illuminates:** Shows that the auxiliary winch is near the minimum wire rope wrap limit (3 turns on the drum).
	2-WHEEL DRIVE INDICATOR	**Illuminates:** Shows that the crane is in the 2-wheel-drive mode.
	4-WHEEL DRIVE INDICATOR	**Illuminates:** Shows that the crane is in the 4-wheel-drive mode.
	AXLE SUSPENSION LOCKED INDICATOR	**Illuminates:** Shows that the axle suspension is locked.
	AXLE SUSPENSION UNLOCKED INDICATOR	**Illuminates:** Shows that the axle suspension is not in the locked position.
	SWING LOCK INDICATOR	**Illuminates:** Shows that the swing lock is engaged.
	SWING UNLOCK INDICATOR	**Illuminates:** Shows that the swing lock is NOT engaged.
N0	NEUTRAL 0 POSITION INDICATOR	**Illuminates:** Shows that the transmission is in the "N0" position.
N1	NEUTRAL 1 POSITION INDICATOR	**Illuminates:** Shows that the transmission is in the "N1" position.

INDICATOR SYMBOL	DESCRIPTION	FUNCTION
N2	NEUTRAL 2 POSITION INDICATOR	**Illuminates:** Shows that the transmission is in the "N2" position.
F1	FORWARD SPEEDS INDICATOR	**Illuminates:** Shows that the gear selector is in the forward direction.
R1	REVERSE SPEEDS INDICATOR	**Illuminates:** Shows that the gear selector is in the reverse direction.
	CRAB-STEER INDICATOR	**Illuminates:** Shows that the "Crab steer" steering program is switched to ON.
	4-WHEEL STEER INDICATOR	**Illuminates:** Shows that the "4-wheel steer" steering program is switched to ON.
	2-WHEEL STEER (FRONT WHEEL) INDICATOR	**Illuminates:** Shows that the "2-wheel steer (front wheel)" steering program is switched to ON.
	2-WHEEL STEER (REAR WHEEL) INDICATOR	**Illuminates:** Shows that the "2-wheel steer (rear wheel)" steering program is switched to ON.
	ENGINE STOP INDICATOR (RED)	**Illuminates:** The ECU detects a serious failure and you must stop the engine immediately.
	ENGINE WARNING INDICATOR (AMBER)	**Illuminates:** Shows that the ECU detects a common failure.
	WAIT TO START INDICATOR (WHITE)	**Illuminates:** Shows that the engine is cool and the glow plugs must have time to heat up properly to start the engine. Shows that the glow plugs are hot enough, the light goes out.
	WATER IN FUEL INDICATOR	**Illuminates:** Shows that the fuel contains water.

INDICATOR SYMBOL	DESCRIPTION	FUNCTION
	HAZARD LIGHTS INDICATOR	**Illuminates:** Shows that the crane is in operation and the hazard lights are ON.
	HIGH-SPEED INDICATOR	**Illuminates:** Shows that the transmission high-low speed valve is connected.
	LOW-SPEED INDICATOR	**Illuminates:** Shows that the transmission high-low speed valve is disconnected.
	SEAT OCCUPIED INDICATOR (OPTIONAL)	**Illuminates:** The seat is occupied.

Note: Some of the above symbol functions are optional.

When the crane is equipped with the deadman switch on the seat, the left & right joysticks and the boom extend / retract pedal are operational during traveling. Be careful not to touch them!

6.3.1 VEHICLE STATUS

Under the Travel Mode Screen or Work Mode Screen, press the function key "STATUS" to enter the Vehicle Status Screen. You can consult the basic information about the vehicle.

Press the key "BACK" to return to the Travel Mode Screen or Work Mode Screen. Press the key "MENU" to enter the Main Menu Screen. Press the key "HOME" to return to the Travel Mode Screen.

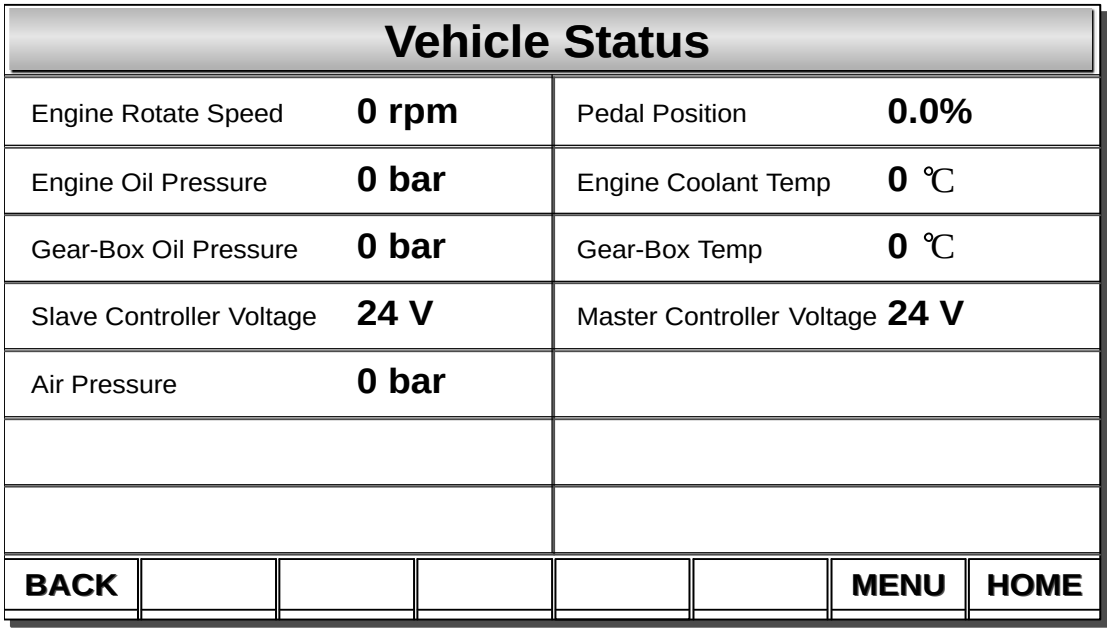


Figure 6-18 Vehicle Status

6.3.2 SYSTEM WARNING

Under the Travel Mode Screen or Work Mode Screen, press the function key "WARN" to enter the System Warning Screen. You can consult the current warning information about the vehicle. Remedy the malfunctions immediately according the displayed information.

Press the key "BACK" to return to the System Warning Screen. Press the key "MENU" to enter the Main Menu Screen. Press the key "HOME" to return to the Travel Mode Screen.

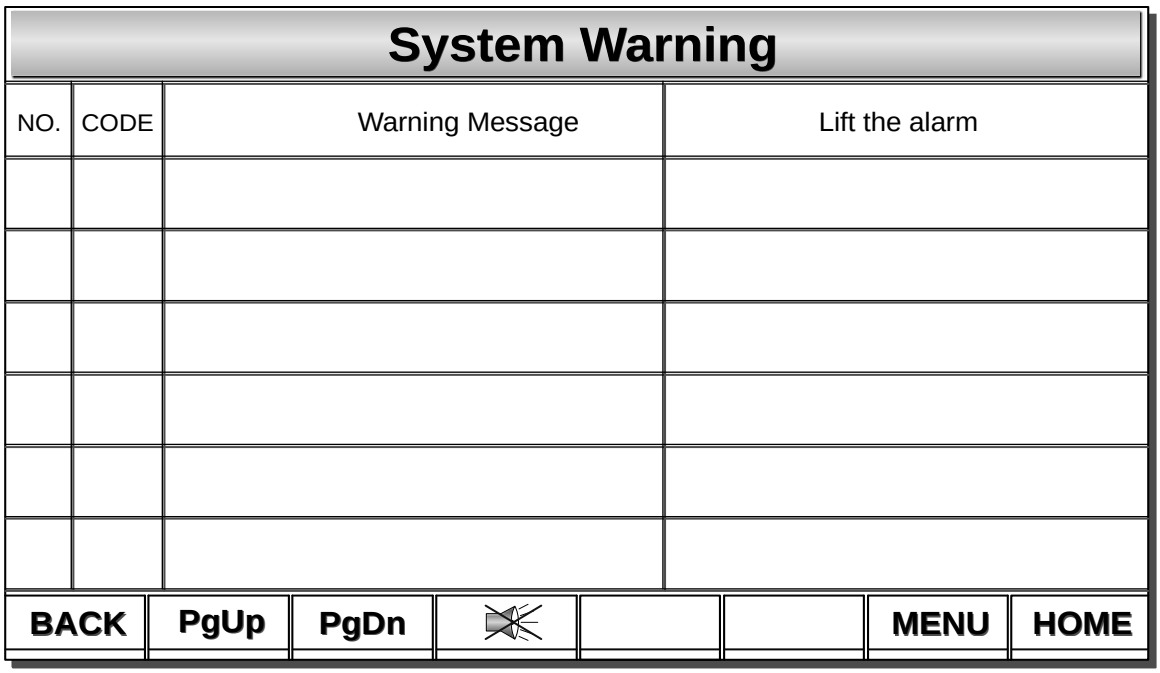


Figure 6-19 System Warning

6.3.3 MAIN MENU

Under the Travel Mode Screen or Work Mode Screen, press the function key "MENU" to enter the Main Menu Screen. Press the relevant function keys to move the cursor left and right to select the items as follows: Monitoring, Real-time Warning, Parameter Settings, Maintenance, 简体中文(Chinese), Information and Password etc. And then press the key "ENTER" to enter the required screen.

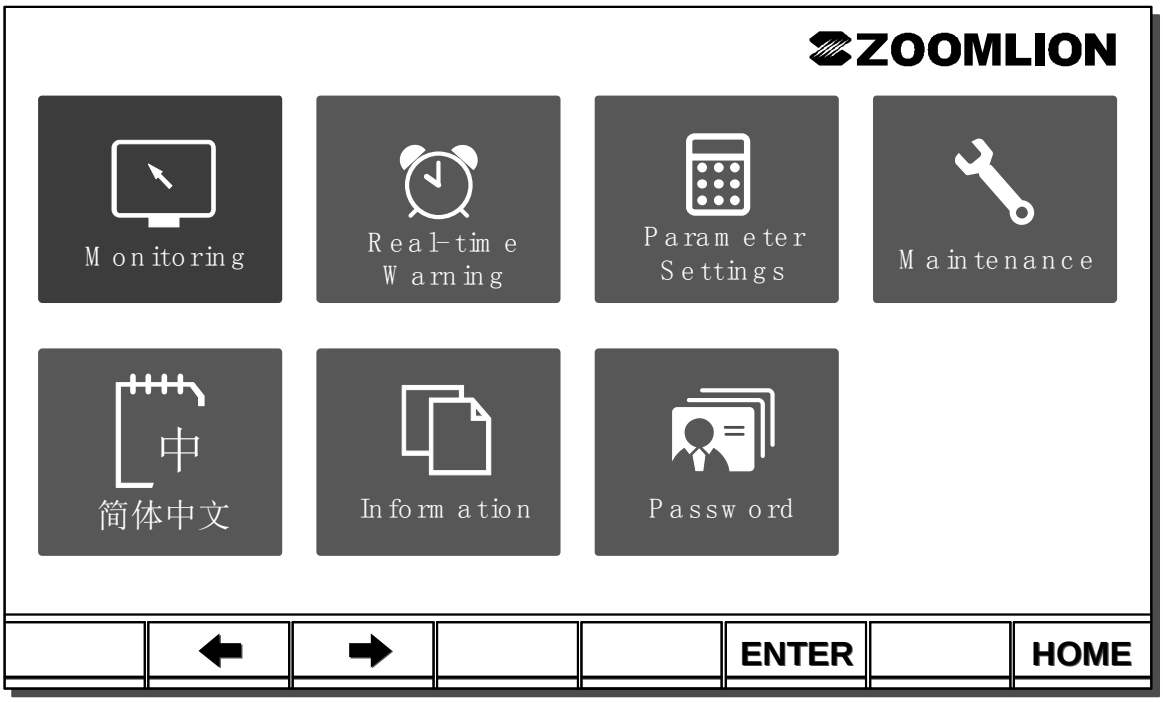


Figure 6-20 Main Menu

6.3.3.1 LANGUAGE SWITCHING

The monitor can display all the information in English or Chinese mode.

How to switch between the English mode and the Chinese mode:

A. Switch to the English mode

In the Chinese mode, under Travel Mode Screen or Work Mode Screen, press "主菜单" (MENU) to enter the Main Menu Screen.

Under Main Menu Screen, press ← or → to move the cursor left or right to select the "English" item (Refer to Figure 6-21), and press "确认" (ENTER). The monitor will display all the information in English. Refer to Figure 6-22.

B. Switch to the Chinese mode

In the English mode, under Travel Mode Screen or Work Mode Screen, press "MENU" to enter Main Menu Screen.

Under the Main Menu Screen, press ← or → to move the cursor left or right to select the "简体中文" (Chinese) item, refer to Figure 6-22, and press "ENTER". The monitor will display all the information in Chinese mode. Refer to Figure 6-21.

Figure 6-21 Main Menu (Chinese Mode)

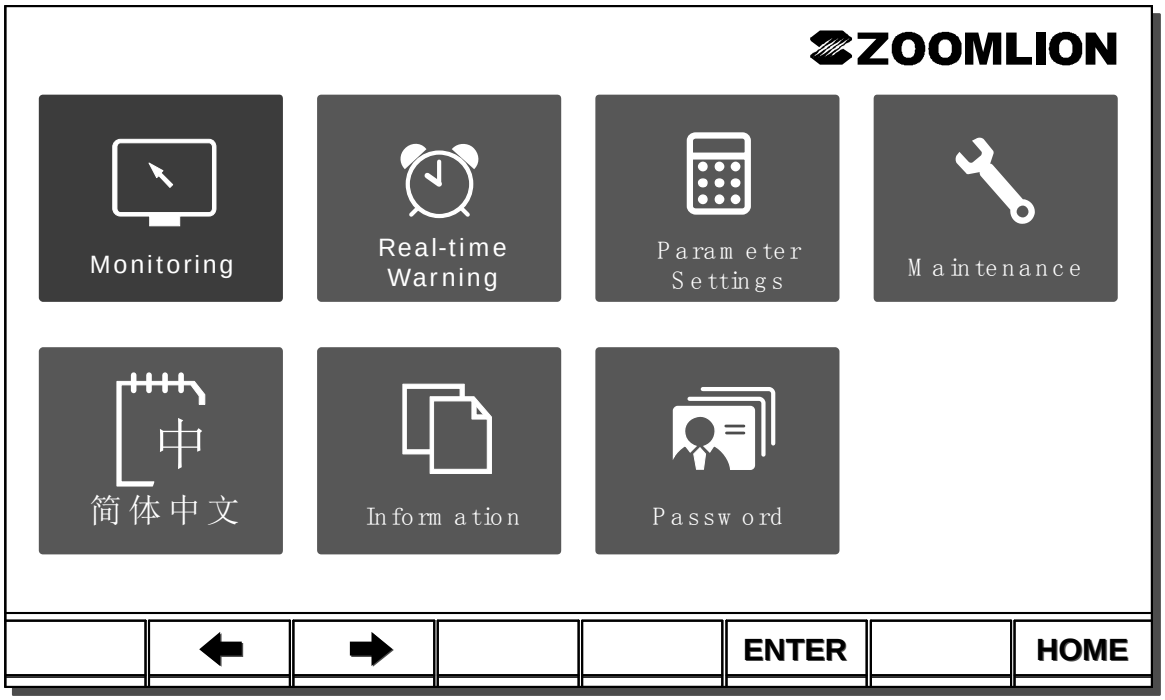


Figure 6-22 Main Menu (English Mode)

6.3.3.2 MONITORING

In the Monitoring Screen, move the cursor left / right and press the key "ENTER" to select the items as follows: Travel Mode, Work Mode, Vehicle Status and Bus Status. Refer to Figure 6-23.

Press the key "BACK" or "MENU" to return to the Main Menu Screen. Press the key "HOME" to enter the Travel Mode Screen.

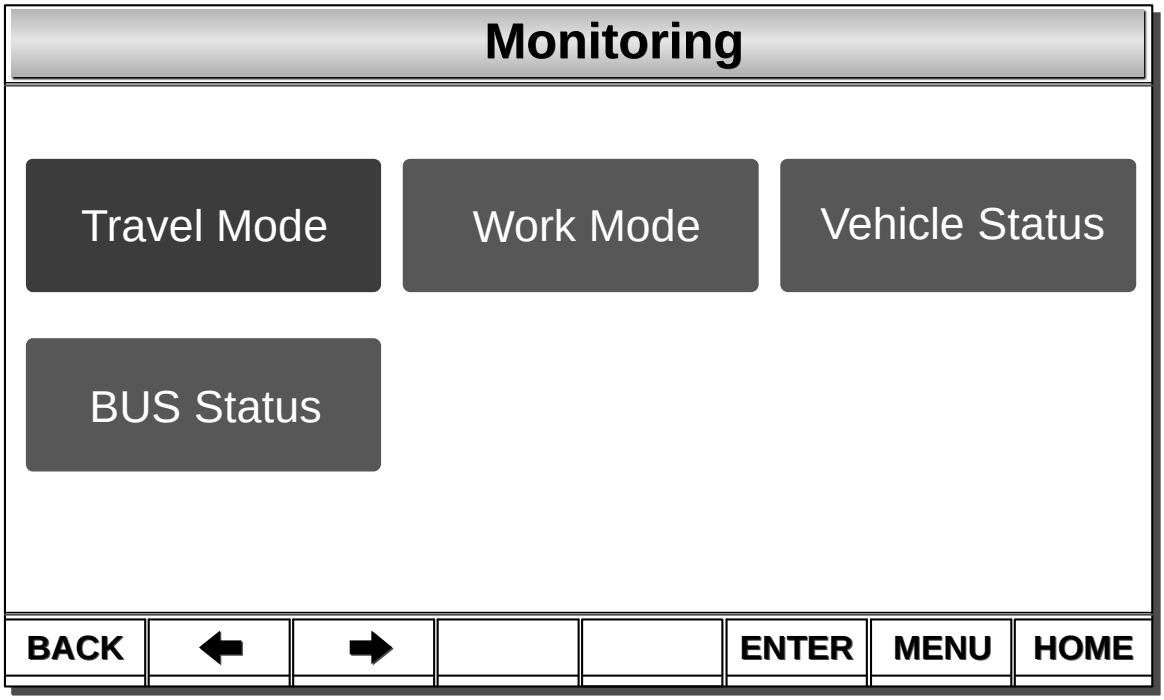


Figure 6-23 Monitoring

A. Travel Mode: move the cursor to select the icon "Travel Mode" and press the key "ENTER" to enter the Travel Mode Screen. Refer to Figure 6-17.

B. Work Mode: move the cursor to select the icon "Work Mode" and press the key "ENTER" to enter the Work Mode Screen. Refer to Figure 6-16.

C. Vehicle Status: move the cursor to select the icon "Vehicle Status" and press the key "ENTER" to enter the Vehicle Status Screen. Refer to Figure 6-18.

D. Bus Status: move the cursor to select the icon "Bus Status" and press the key "ENTER" to enter the Bus Status Screen. Refer to Figure 6-24. If the communication between the controllers is unsuccessful, it means that the network signal between the controllers is disconnected.

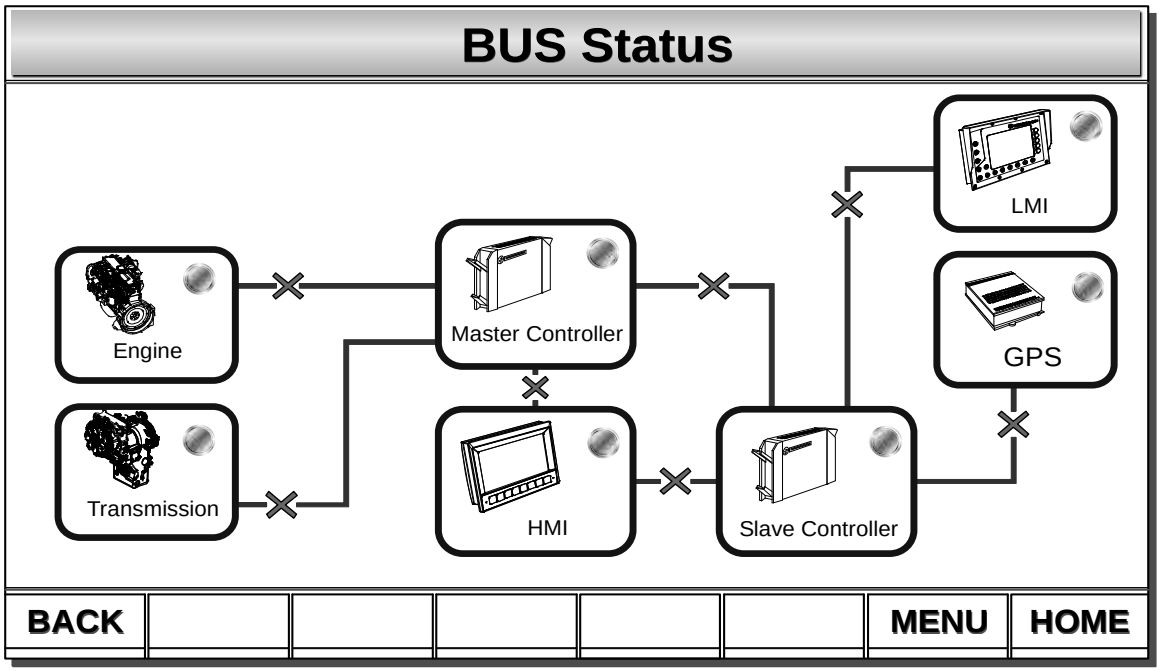


Figure 6-24 Bus Status

6.3.3.3 REAL-TIME WARNING

In the Real-time Warning Screen, move the cursor left / right and press the key "ENTER" to select the items as follows: System Warning, Engine Warning and Transmission Warning. Refer to Figure 6-25.

Press the key "BACK" or "MENU" to return to the Main Menu Screen. Press the key "HOME" to enter the Travel Mode Screen.

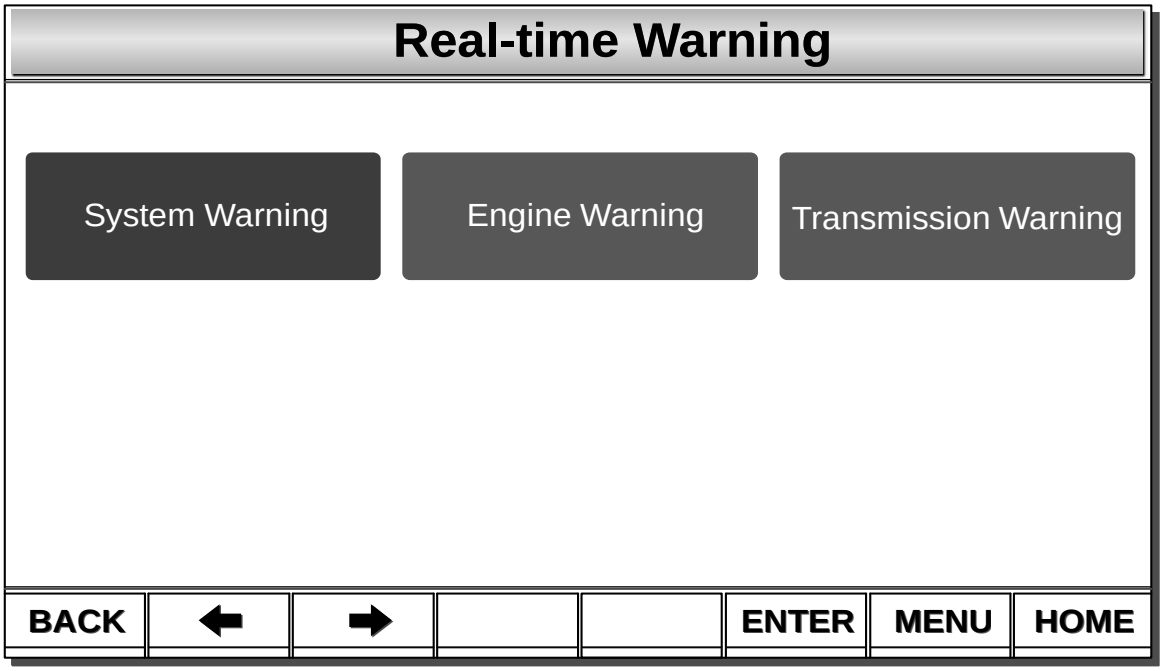


Figure 6-25 Real-time Warning

A. System Warning: move the cursor to select the icon "System Warning" and press the key "ENTER" to enter the System Warning Screen. Refer to Figure 6-19.

B. Engine Warning: move the cursor to select the icon "Engine Warning" and press the key "ENTER" to enter the Engine Warning Screen. Refer to Figure 6-26.

C. Transmission Warning: move the cursor to select the icon "Transmission Warning" and press the key "ENTER" to enter the Transmission Warning Screen. Refer to Figure 6-27.

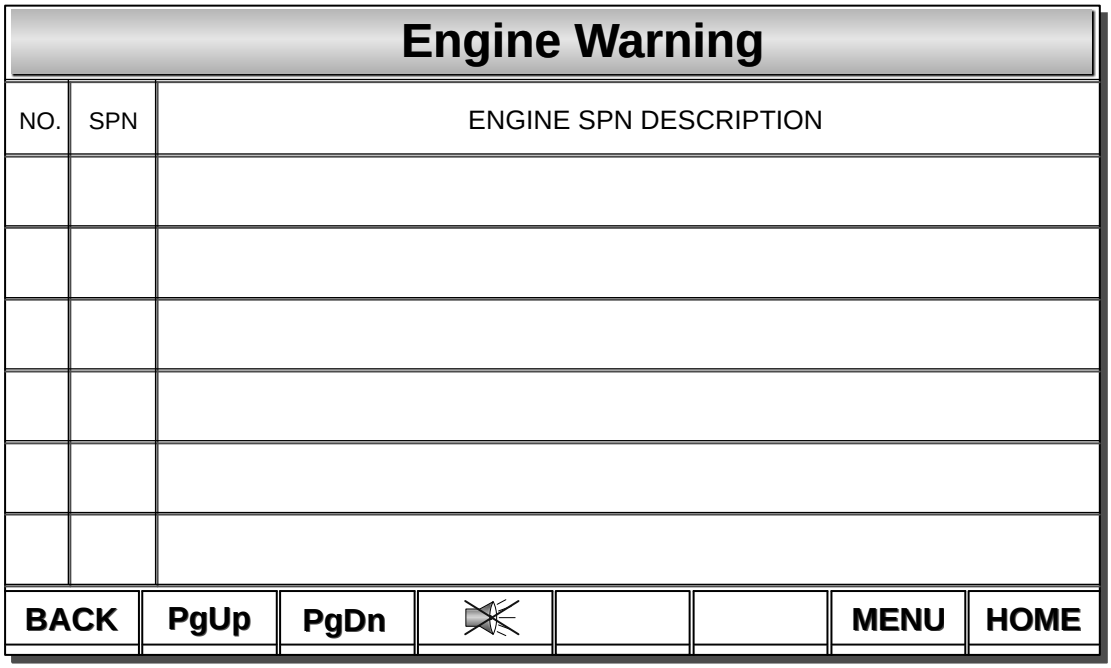


Figure 6-26 Engine Warning

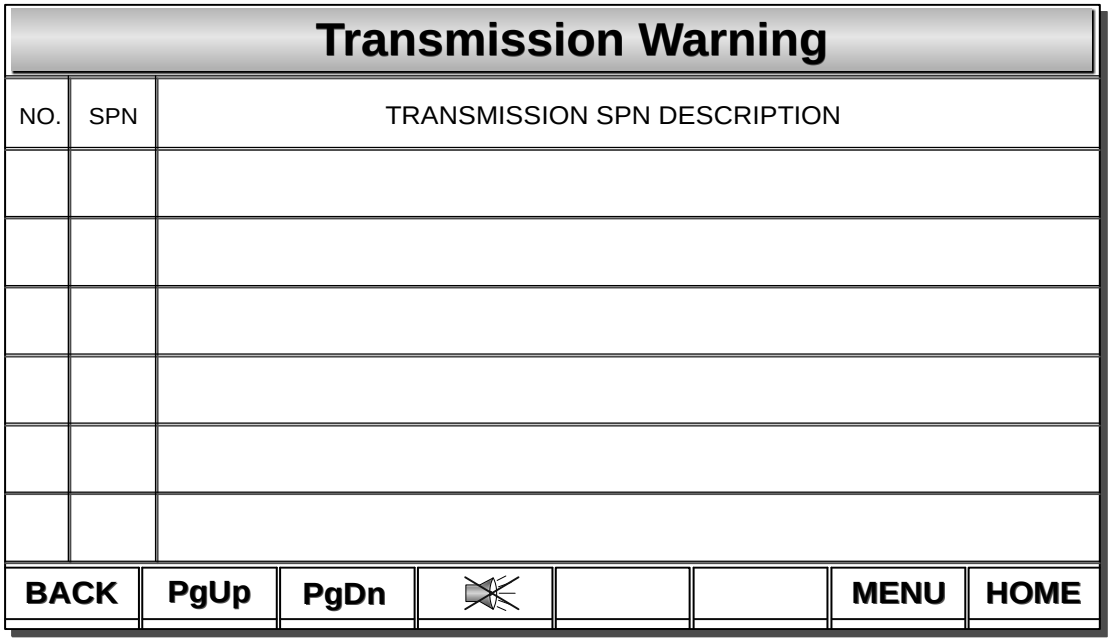


Figure 6-27 Transmission Warning

6.3.3.4 PARAMETER SETTINGS

In the Parameter Settings Screen, you can adjust the brightness of the monitor. Refer to Figure 6-28.

Press the key "BACK" or "MENU" to return to the Main Menu Screen. Press the key "HOME" to enter the Travel Mode Screen.

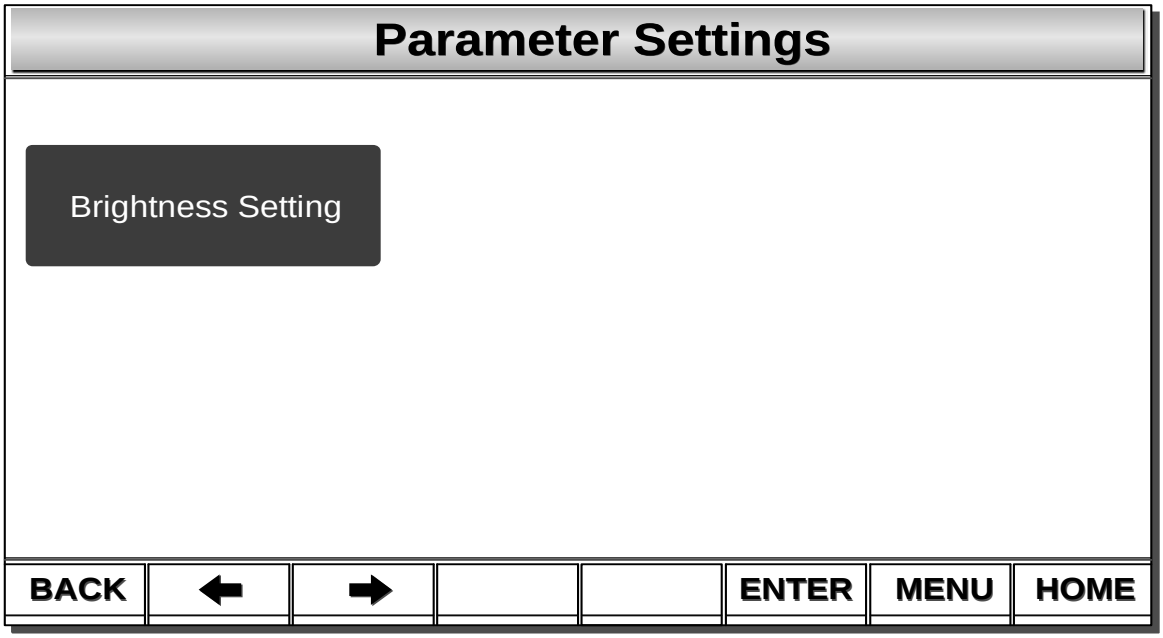


Figure 6-28 Parameter Settings

Brightness Setting: press the key "ENTER" to enter the Brightness Setting Screen. Press the function keys "+" and "-" to adjust the brightness. Refer to Figure 6-29.

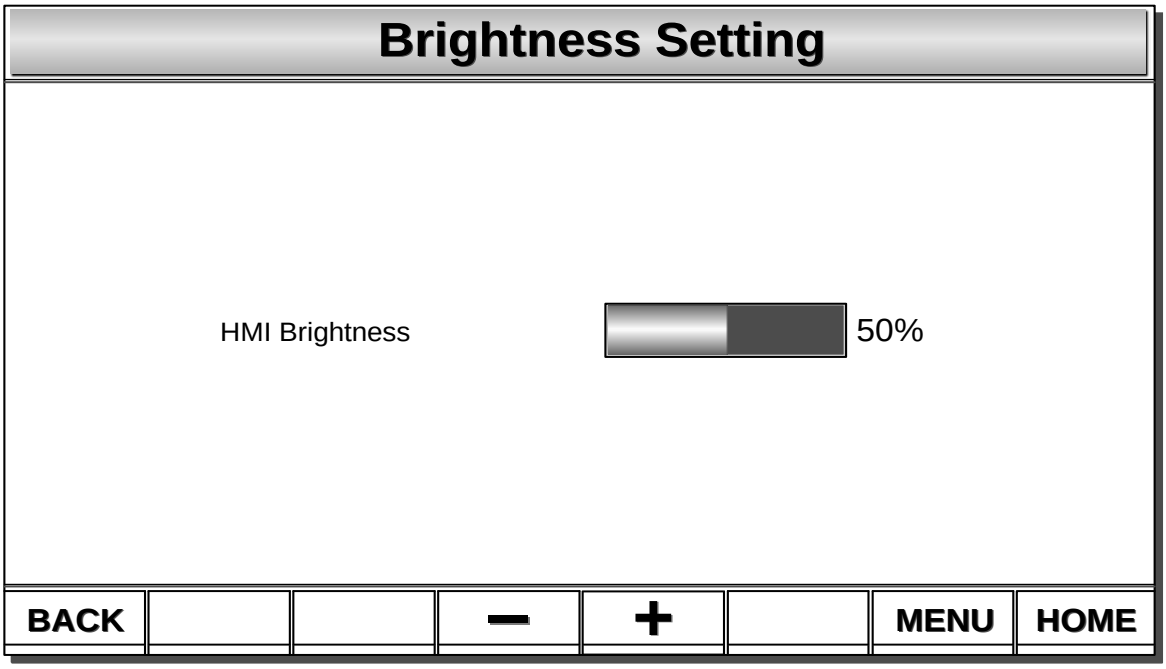


Figure 6-29 Brightness Setting

6.3.3.5 Maintenance

In the Maintenance Screen, move the cursor left / right and press the key "ENTER" to select the items as follows: Engine Diagnostic, Error Diagnostic and GPS Temporary Unlock. Refer to Figure 6-30.

Press the key "BACK" or "MENU" to return to the Main Menu Screen. Press the key "HOME" to enter the Travel Mode Screen.

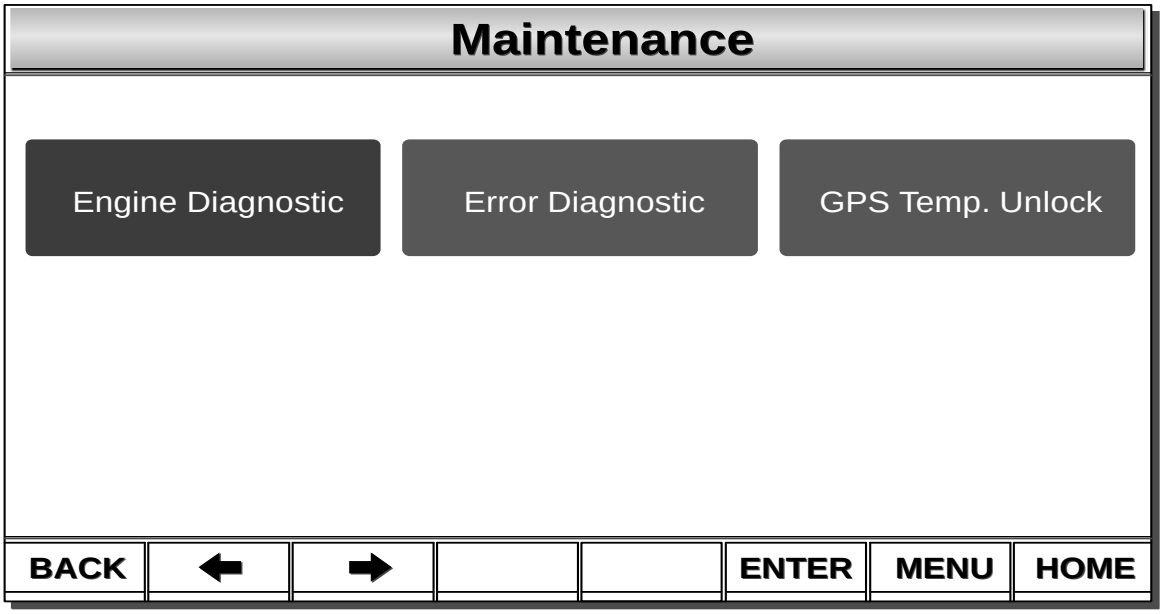


Figure 6-30 Maintenance

A. Engine Diagnostic: move the cursor to select the icon "Engine Diagnostic" and press the key "ENTER" to enter the Engine Diagnostic Screen. Refer to Figure 6-31.

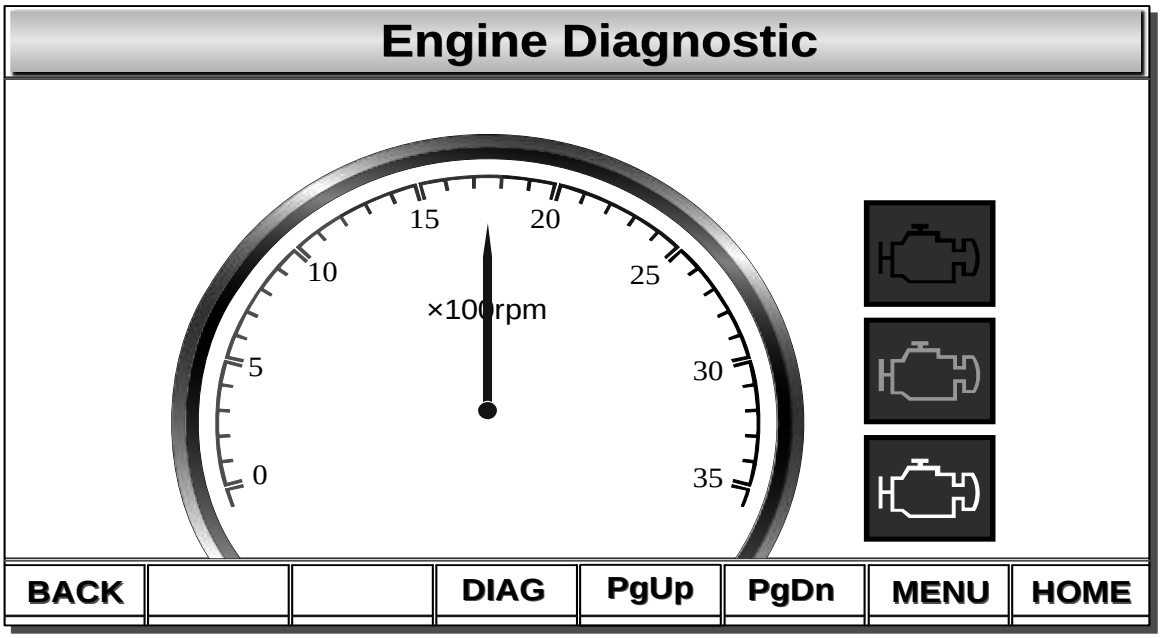


Figure 6-31 Engine Diagnostic

B. Error Diagnostic: move the cursor to select the icon "Error Diagnostic" and press the key "ENTER" to enter the Error Diagnostic Screen. Refer to Figure 6-32 and Figure 6-33. There are 2 pages of the error diagnostic information. Press the keys "PgUp" and "PgDn" to consult the diagnostic information.

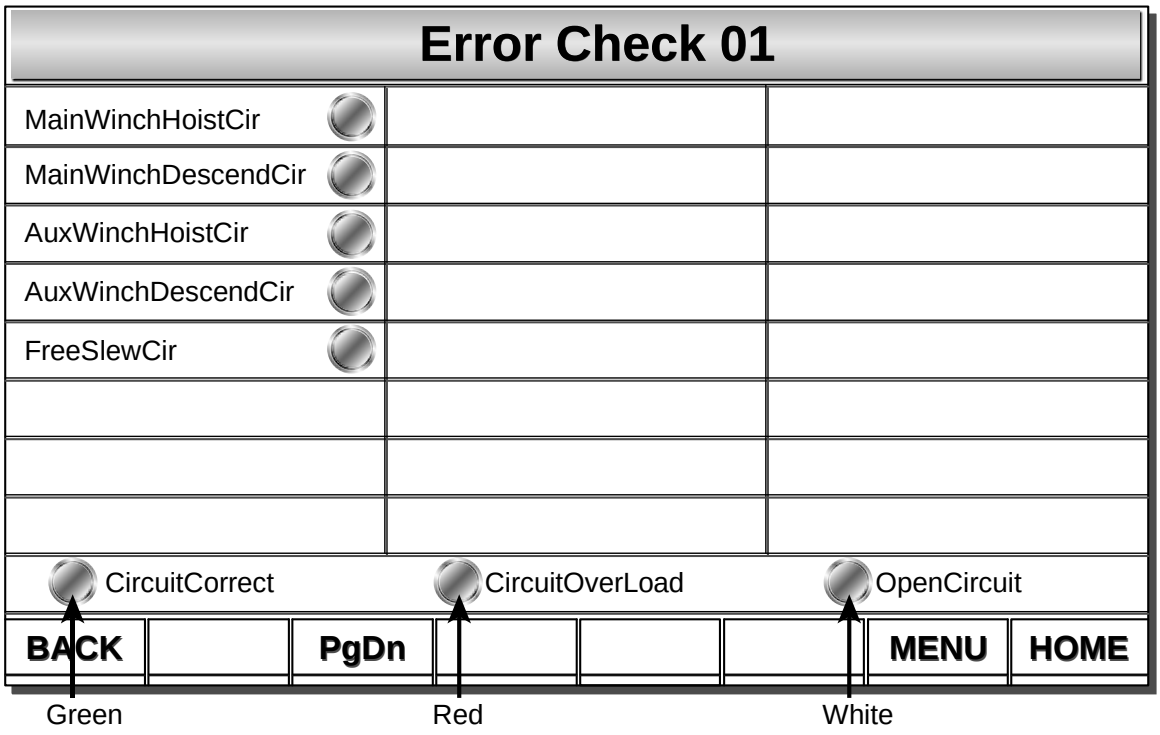


Figure 6-32 Error Diagnostic 1

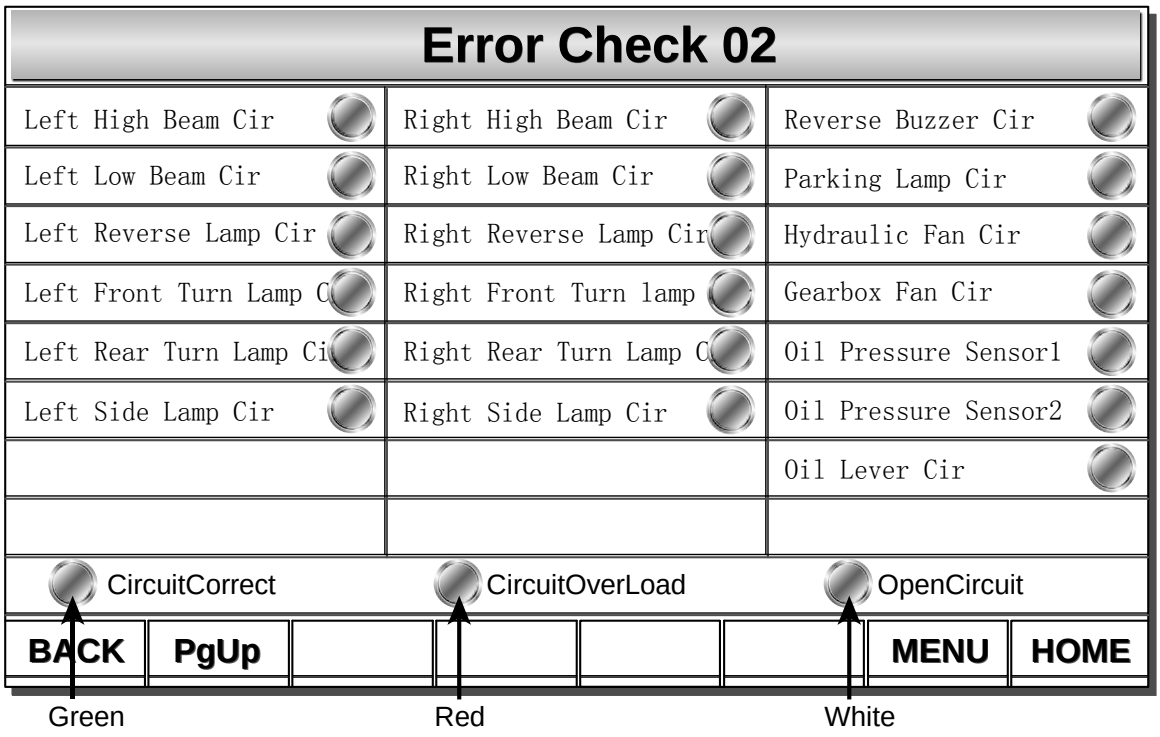


Figure 6-33 Error Diagnostic 2

C. GPS Temporary Unlock: move the cursor to select the icon "GPS Temp. Unlock" and press the key "ENTER" to enter the GPS Temporary Unlock Screen. Enter the temporary password to unlock the GPS temporarily.

6.3.3.6 INFORMATION

In the Information Screen, move the cursor left / right and press the key "ENTER" to select the items as follows: System History Warning, Engine History Warning, Transmission History Warning and About (about the vehicle basic parameters). Refer to Figure 6-34.

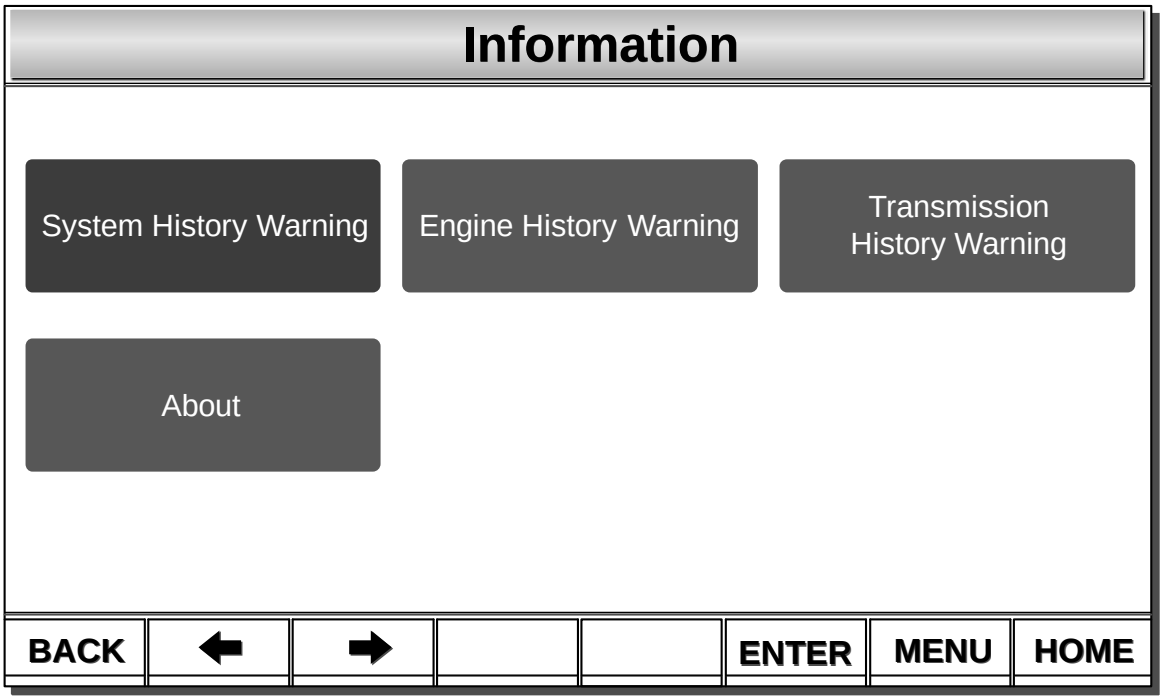


Figure 6-34 Information

A. System History Warning: move the cursor to select the icon "System History Warning" and press the key "ENTER" to enter the System History Warning Screen to consult the historical system defects. Refer to Figure 6-35.
B. Engine History Warning: move the cursor to select the icon "Engine History Warning" and press the key "ENTER" to enter the Engine History Warning Screen to consult the historical engine defects. Refer to Figure 6-36.
C. Transmission History Warning: move the cursor to select the icon "Transmission History Warning" and press the key "ENTER" to enter the Transmission History Warning Screen to consult the historical transmission defects. Refer to Figure 6-37.
D. About: move the cursor to select the icon "About" and press the key "ENTER" to enter the About Screen to consult the basic information about the crane. Refer to Figure 6-38.

System History Warning

NO.	CODE	Warning message	occurrence time	disappearance time
0				
1				
2				
3				
4				
5				

BACK	PgUp	PgDn				MENU	HOME

Figure 6-35 System History Warning

Engine History Warning

NO.	ENGINE_SPN	occurrence time	disappearance time
0			
1			
2			
3			
4			
5			

BACK	PgUp	PgDn				MENU	HOME

Figure 6-36 Engine History Warning

Transmission History Warning

NO.	TRANS._SPN	occurrence time	disappearance time
0			
1			
2			
3			
4			
5			

BACK	PgUp	PgDn				MENU	HOME

Figure 6-37 Transmission History Warning

About

Manufacture Date：

Serve Num.：

Slave Box Num.：

Master Box Num.：

Slave Controller Program Edition：

Master Controller Program Edition：

HMI Program Edition：

BACK						MENU	HOME

Figure 6-38 About

6.3.3.7 PASSWORD

In the Main Menu Screen, move the cursor to select the icon "Password" and press the key "ENTER" to enter the Password Screen. Refer to Figure 6-39.

Enter the correct passwords to consult more information.

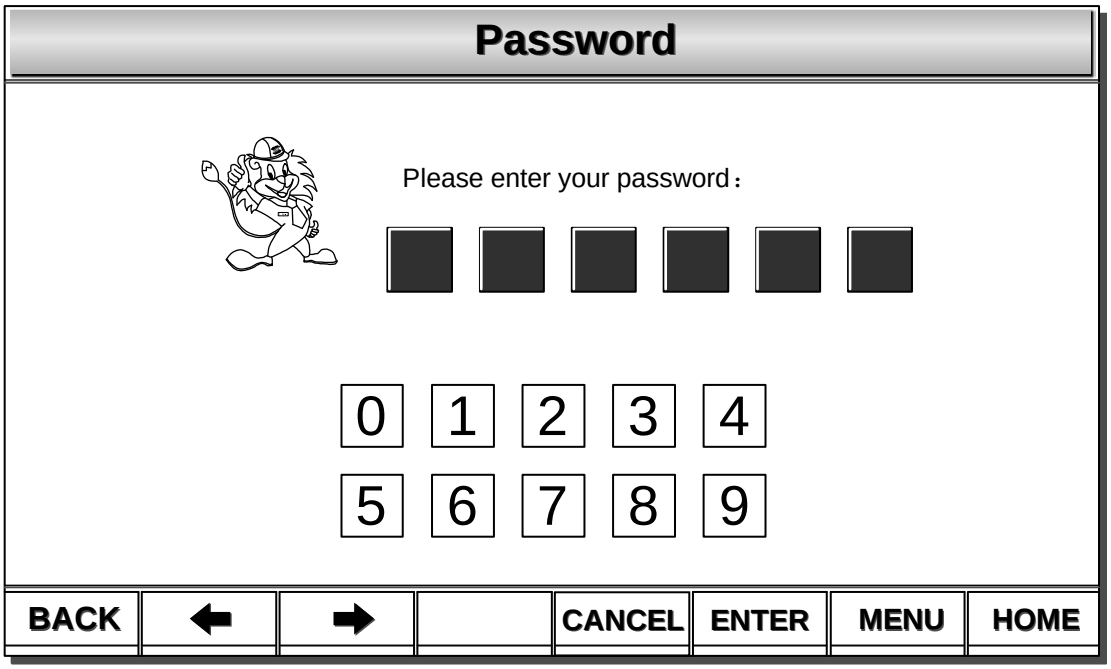


Figure 6-39 Password

Note: The password is only available for the authorized service technician.

All screens (except the Travel Mode Screen and Work Mode Screen) have a function key "HOME". You can press the key "HOME" to return to the Travel Mode Screen.

6.4 VEHICLE CAMERA

Figure 6-40 Camera Display

Manual Video Control: After the vehicle is powered on, press the ⏻ button to turn on the power supply of the camera display. The display will show the vision of the camera after 5 seconds.

a) ⏻ button Power supply
b) V1/V2 button Switch between video 1 and video 2
c) L/R button Switch between mirror image and non-mirror image
d) MENU button Enter the brightness, contrast and color adjustment setting screen
e) ▲ button Increase the brightness, contrast or adjust the color
f) ▼ button Decrease the brightness, contrast or adjust the color

ZOOMLION

Rough Terrain Crane Operator'S Manual

Chapter 7 Operating Instructions

CHAPTER 7 OPERATING INSTRUCTIONS

7.1 SAFETY EQUIPMENT

A. Anti-two block system

Examine the anti-two block switches on the boom, the jib and auxiliary sheave heads for damage. Make sure that the switch weights operate correctly and they are on the lift cable in the correct positions. Examine the electrical equipment and wires that attach to the cable reel. Do an inspection of the wires along the length of the cable. Look for indications of wear, damage or incorrect installation. Make sure that the tension on the spring-loaded cable reel is correct and that the reel turns freely.

Note:

When you do a check of the anti-two block switch function, you must move the anti-two block weight with the hook block.

B. Load moment indicator

When the actual load is near the rated one, it sends out acoustic sound. You can only do safe crane movements that are on the screen at this time. Move the load into a permitted condition to stop alarms and continue correct crane operation. For details, please refer to technical documents for load moment indicator.

C. Emergency stop

(1) You can find the emergency stop button on the lower left side of the dash.

(2) When you push the button, all crane operations immediately STOP (including the engine). Turn the button clockwise to release it and continue usual crane operation.

(3) Only use the EMERGENCY STOP BUTTON in a clear emergency!

D. 3rd wrap

When there are only 3 wraps of wire rope remaining on the winch, the winch (main or auxiliary) does not reel off. When this occurs, you can only do "Boom Retract" and "Winch up" operations.

E. Deadman switches on the joysticks (optional)

For the crane with deadman switches on the joysticks:

(1) This switch sends or stops all command signals that go through the left & right joysticks and the boom extend / retract pedal.

(2) This prevents the crane movements if you accidentally touch one of the joysticks or push the boom extend / retract pedal.

F. Deadman switch on the seat (optional)

For the crane with a deadman switch on the seat:

(1) Sit on the seat to activate the deadman switch. The indicator "Seat occupied"  illuminates.

(2) This switch sends or stops all command signals that go through the left & right joysticks and the boom extend / retract pedal.

(3) You can operate the functions of the left & right joysticks and the boom extend / retract pedal only when the seat is occupied and the indicator illuminates.

CAUTION

When the crane is equipped with the deadman switch on the seat, the left & right joysticks and the boom extend / retract pedal are operational during traveling. Be careful not to touch them!

7.2 STARTING THE ENGINE

A. After you do an inspection, start the engine.

B. If the temperature is above 32°F (0°C), use the steps that follow to start the engine:

- Move the gear selector to the neutral position.
- Turn the park brake switch to the "P" position.
- Turn the ignition switch to the "I" position.
- Turn the ignition switch to the "III" position to start the engine.

C. Release the ignition switch after the engine starts. If the engine stops during the start-up procedure, make sure that the engine comes to a full stop before you try to start it again.

D. If you cannot start the engine in less than a maximum of 15 seconds, wait for 2 minutes. Then try to start the engine again.

E. After the engine starts, examine the indicators and gauges. If one of the indicators or gauges shows you an out of tolerance indication, turn the engine OFF. Correct the malfunctions before you start the engine again.

F. Do not increase the engine RPMs to a high level before the engine gets to the correct operating temperature.

7.3 AFTER THE ENGINE STARTS

A. When the engine is ON, examine the indicators and gauges, (at frequent intervals), to find an indication of an out of range condition. Also, listen for sounds that are not usual.

B. When you operate the engine at idle speed for a long period of time, the battery can lose power. If necessary, increase the engine idle speed to keep the battery fully charged. This is important when you start the engine.

C. When it is necessary to stop the engine, operate it at idle speed (with no load on the engine) for minimum of 5 minutes. This lets the engine coolant temperature decrease gradually before the engine stops.

Note:

This cool down period is very important for a crane with a turbocharged engine. This is because the turbocharged engine makes more heat than an engine that does not have a turbocharger.

If more data about the engine is necessary, look in the technical documents for engine.

7.4 COLD WEATHER STARTING

If you operate the crane in very low temperature areas, the engine is hard to start. The optional flame starting device is very important for the normal engine start. Please speak with the Zoomlion Service Department if you select a flame starting device for your crane.

7.5 MOVE AND PARK THE CRANE

7.5.1 MOVE THE CRANE

WARNING

Make sure that the crane has sufficient brake pressure before you try to move the crane. A dangerous condition occurs if the crane starts to move and you cannot stop it.

After you prepare the crane for driving, use the steps below to start the vehicle:

A. Depress the brake pedal.
B. Deactivate the park brake.
C. Move the gear selector to the "F1" position.
D. Release the brake pedal gradually and start to drive.

7.5.2 PARK THE CRANE

A. Gradually push the brake pedal and move the gear selector to the "F1" position.
B. When the crane is at a slow speed, push the brake pedal to stop the crane.
C. Turn the park brake switch to the "P" position and move the gear selector to the "N" position.

CAUTION

When the crane is in the "Crab steer" or "4-wheel steer" mode, make sure that you center the axles before you stop.

D. When it is necessary to stop the engine, operate the engine at idle speed (with no load on the engine) for minimum of 5 minutes. This lets the engine coolant temperature decrease gradually before the engine stops.
E. Do not turn the ignition switch to the "0" position at this time. Stop the engine and keep

electrical power applied to the engine for 30 seconds to let the engine data transfer to the ECU. Turn the ignition switch to the "0" position and remove the key from the ignition.

CAUTION

Do not keep the battery master switch in the "ON" position after you park the crane. This will cause the battery to drain, circuit breakdown or accident.

F. When you park the crane on a slope, you must put chocks before and behind the wheels.

G. To prevent an accident when you park the crane in the dark, you must turn "ON" the hazard lights.

CAUTION

You can use the battery to turn "ON" the hazard lights even if the engine is OFF.

7.6 ECONOMICAL DRIVING

You can decrease fuel use and extend the life of the tires if you follow these points:

- Develop good driving habits.
- Only idle the engine at a high speed when it is necessary. Make sure that the gear selector is always at a high gear. When more engine power is necessary, increase the engine RPM speed.
- Do not move the throttle or brake pedal quickly.
- Do not turn the crane sharply.
- Do not start to move the crane quickly.
- The most efficient speed to move the crane is at 3/4 of the maximum.
- When you move the crane, keep the engine coolant temperature between 70°C and 95°C (158°F – 203°F).

CAUTION

When the engine coolant temperature is too low or too high, the performance of the engine decreases.

- Always make sure that the tires have the correct pressure.

CAUTION

If the tire pressure is too low, the tires wear incorrectly and they increase the fuel consumption.

- Keep the operation of the air conditioner system at a minimum.
- Always use the correct type of fuel and engine lubricants. `
- Keep to the preventive maintenance schedule.

7.7 STEERING OPERATION

A. The crane has a hydraulic booster system which makes it easy to turn the crane in all conditions.

B. You can adjust the steering wheel height and inclination when you push the pedal at the bottom of the steering column.

C. When you move the crane, follow these points:

- Look around before you turn the steering wheel. Turn the steering wheel after you make sure that it is safe to move.
- When necessary, set the transmission to a lower gear to decrease the speed of the crane as you turn.
- Decrease the speed slowly while you turn the steering wheel in the same direction as the turn.
- If you over-steer, decrease the speed slowly while you turn the steering wheel in the opposite direction of the turn.

Do not turn the steering wheel quickly in one direction unless it is an emergency. Make your turns smoothly to keep the crane laterally stable. When you complete the turn, lightly and immediately turn the steering wheel to the neutral position to prevent an unstable condition.

- Decrease the speed of the vehicle and move down one transmission gear if you have a sharp turn.

7.8 BRAKING OPERATION

A. Service Brake

When it is necessary to stop the crane, follow these items:

- Start to apply the service brake in a sufficient amount of time to let you bring the crane to a full stop.
- Adjust the pressure on the brake pedal according to the weight and speed of the crane.
- When the crane is at a slow speed, push and hold the pedal down to fully stop the crane.

B. Emergency Brake

(1) In an emergency, push the brake pedal quickly and fully stop the crane

immediately. For a short interval of time, you can have a hard time with the control of the crane. You must use caution.

CAUTION

When you make many hard brake stops, the tire and the brake linings wear prematurely.

Use more caution when the roads are wet or frozen.

Note:

If the brake system pressure low indicator illuminate, stop the crane immediately. The crane may have a leak in the hydraulic oil system. Contact the repair facility.

(2) The crane has dual-circuit brake system. If one circuit of the system has a malfunction, the other one can stop the crane.

WARNING

If the tire blows out suddenly during the move, do not push the brake pedal immediately. Hold the steering wheel tightly with two hands, decrease the speed, and move the crane to a safe area.

7.9 TRANSMISSION OPERATION

The transmission is hydraulically driven and power shifted. To step through the gears in the transmission, follow these points:

A. The transmission has two drive modes: 2-wheel drive and 4-wheel drive. The 4-wheel drive is a manual shift mode. Usually you use the 1st gear position when you start to move the crane. The 2-wheel drive is an automatic shift mode. Usually you use the low gear positions when you start to move the crane.

B. If it is necessary to manually shift the transmission, the gear selector must be in the 4-wheel-drive mode.

C. When you hear an unusual noise in the transmission or it is hard to move the steering wheel, stop the crane immediately. Correct the malfunction if you can refer to the technical documents for transmission.

D. When you park the crane, move the gear selector to the "N" position.

E. To measure the quantity of oil in the transmission, park the crane and operate the engine at idle speed.

CAUTION

The transmission oil must be at the correct operating temperature between 180°F and 194.4°F (82.2°C and 93.3°C).

When the oil temperature is more than 250°F (121.1°C), stop the crane immediately. To decrease the temperature, move the gear selector to the "N" position, and decrease the engine RPM between 1000 r/min. and 1200 r/min. In this way, the oil temperature can decrease in a short interval of time immediately.
DO NOT stop the engine when the transmission oil temperature is too high.

DO NOT move the crane when the transmission oil pressure is lower than 240 psi.

DO NOT move the crane with the gear selector in the "N" position.

7.10 TOWING

When the crane is in-tow, do not make sudden changes in speed. This can damage the tow coupling.

If the engine cannot operate, do not tow the crane.

To prepare the crane to be towed, do the items that follow:

- Operate the engine at idle (keeps the transmission oil in motion).
- Disconnect the propeller shaft of the front axle.
- Disconnect the propeller shaft of the rear axle.

7.11 OUTRIGGER OPERATION

The outrigger switches and bubble level indicator are in the cab. The outrigger switches control the movements for all the outriggers. Refer to Figure 7-1.

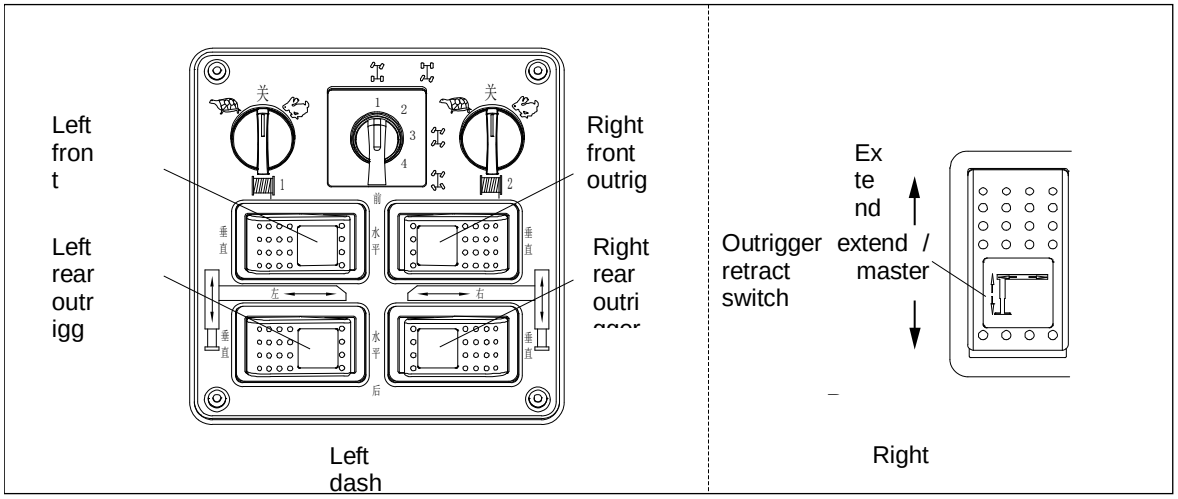


Figure 7-1 Outrigger Switches

WARNING

(1) Make sure that the LMI is set to match the outrigger configuration. It is dangerous to set the LMI incorrectly.

(2) Make sure that you do all of the work on level ground that is hard. The ground must hold more than the load bearing capacity (permissible ground pressure ≥ 507.6 psi (3.5 MPa)). Use material (such as wooden timbers) below the outrigger floats if the work area is soft or not flat.

7.11.1 EXTEND THE OUTRIGGER

A. Remove the outrigger beam retaining pins.

B. Extend the outrigger beams.

(1) Push and hold the outrigger switch (or switches) to the "BEAM" position.

(2) Push and hold the outrigger extend / retract master switch to the "EXTEND" position.

(3) After the outrigger beam (or beams) moves (or move) to the "FULLY" or "INTERMEDIATELY" mark (or marks), release the outrigger switch (or switches) or the master switch.

CAUTION

When you extend the outrigger beam, you can operate one outrigger switch or more at one time.

C. After the 4 outrigger beams extend to the correct positions, extend the outrigger jacks.
   (1) Push and hold the 2 front (or 2 rear) outrigger switches to the "JACK" position.
   (2) Push and hold the outrigger extend / retract master switch to the "EXTEND" position.
   (3) After the 4 outriggers hold the weight of the crane (wheels off the ground), release the outrigger switches or the master switch.

CAUTION

When you extend the outrigger jacks, you should extend the 2 front (or 2 rear) outrigger jacks simultaneously. However, when you level the crane, you can just operate one jack.

When you operate the outrigger jacks, the maximum permitted deviation from the horizontal position of the crane is ± 1°.

D. Make the crane level.
   (1) Look at the bubble level to tell if the crane is at level.
   (2) If the bubble level does not show a level indication, you can move each outrigger to make the crane level. Refer to step C.

   For example:

   If the crane is low on the right front, do the steps that follow:
   (1) Push and hold the right front outrigger switch to the "JACK" position.
   (2) Push and hold the outrigger extend / retract master switch to the "EXTEND" position at the same time.
   (3) Monitor the bubble level. When the bubble is at the correct position, release the master switch or the outrigger switch.

E. Install the outrigger beam retaining pins.

7.11.2 RETRACT THE OUTRIGGER

WARNING

Retract the boom and attach it to the support before you retract the outriggers.

A. Remove the outrigger beam retaining pins.
B. Retract the outrigger jacks.
   (1) Push and hold the 2 front (or 2 rear) outrigger switches to the "JACK" position.
   (2) Push and hold the outrigger extend / retract master switch to the "RETRACT" position at the same time.
   (3) After the outrigger jacks fully retract, release the master switch or the outrigger switches.
   (4) Do above steps until all outrigger jacks are retracted.

CAUTION

When you retract the outrigger jacks, you should retract the 2 front (or 2 rear) outrigger jacks simultaneously.

When you operate the outrigger jacks, the maximum permitted deviation from the horizontal position of the crane is ± 1°.

C. Retract the outrigger beams.

(1) Push and hold the outrigger switch (or switches) to the "BEAM" position.

(2) Push and hold the outrigger extend / retract master switch to the "RETRACT" position at the same time.

(3) After the outrigger beam (or beams) fully retracts (or retract), release the outrigger switch (or switches) or the master switch.

(4) Do above steps until all outrigger beams are retracted.

CAUTION

When you retract the outrigger beam, you can operate one outrigger switch or more at one time.

D. Install the outrigger beam retaining pins.

7.11.3 INSTALL AND REMOVE THE OUTRIGGER FLOATS

A. Installation

Before you extend the outriggers, remove the socket pins from the outrigger floats and pull out the outrigger floats. When the holes align with the vertical cylinders, install the socket pins.

B. Removal

After you fully retract the outriggers, remove the socket pins and push in the outrigger floats until they are in the correct positions. Install the socket pins.

CAUTION

- **Before you move the outriggers, make sure that there is clearance to prevent injury to personnel or damage to the crane and other objects.**
- **Do not move the outriggers if you have a load off the ground.**
- **You can adjust the speed (slow or fast) of the outrigger movement (extend or retract) by the engine RPM (increase or decrease).**
- **Make sure that you install the outrigger floats before you move the outriggers.**
- **Make sure that you remove the retaining pins before you extend or retract the outrigger beams. After the outrigger beams are in position (fully extended, intermediately extended or fully retracted), install the retaining pins.**

- **Before you extend or retract the outrigger beams, make sure that the floats are clear from all objects.**
- **Make sure that all the tires are off the ground (crane weight held up by the outriggers) before you start to lift a load.**
- **When the crane is on a level area, examine the bubble indicator. The bubble shows in the middle of the indicator. If not, adjust the nuts below the indicator.**

7.12 HOIST OPERATION

The hoist mechanism includes these components:

- Hydraulic motor
- Winch reducer
- Brake
- Rope guider
- Anti-two block system
- 3rd wrap
- Hoist rope
- Main hook
- Auxiliary hook, etc.

The hoist mechanism includes two parts:

- Main winch
- Auxiliary winch.

There are two joysticks in the cab. Refer to Figure 7-2.

- The left joystick on the left side of the seat controls the auxiliary winch.
- The right joystick on the right side of the seat controls the main winch.

Note:

Always refer to the "Lift Chart" and the "Lift Height Chart" before you start to lift a load.

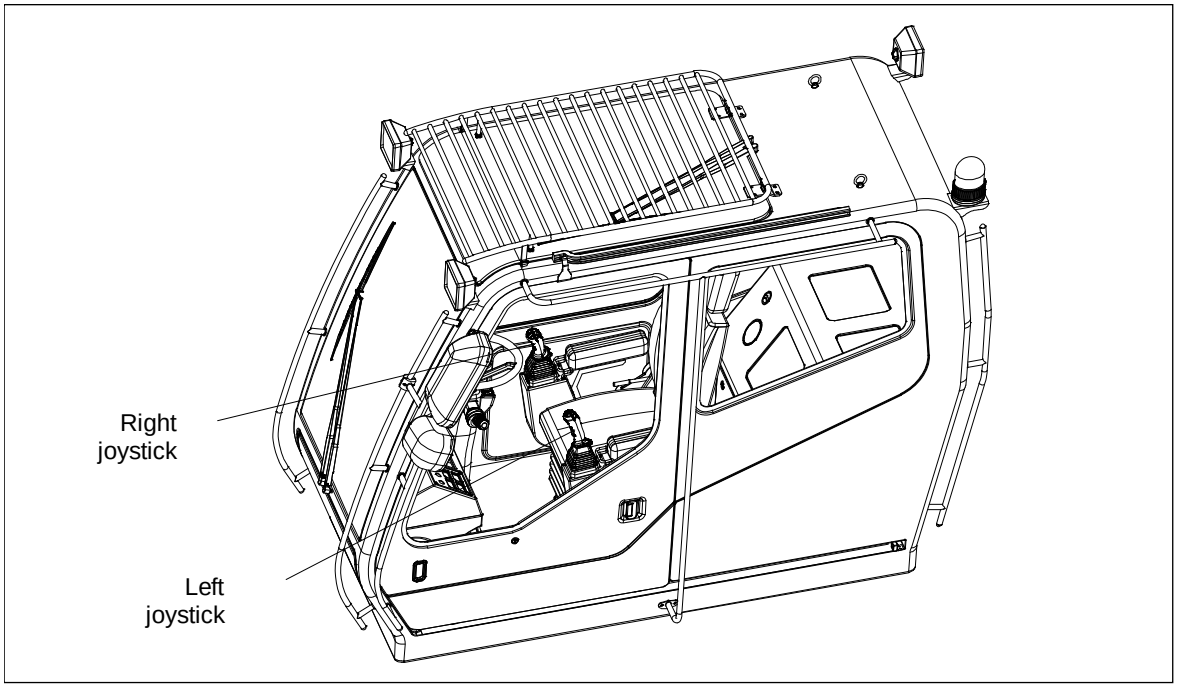


Figure 7-2 Left and Right Joysticks

CAUTION

- **For the crane with deadman switches on the joysticks:**
  You must push in the deadman switch (on left or right joystick) for the joystick commands to operate the crane.
- **For the crane with a deadman switch on the seat:**
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

7.12.1 LIFT CHART AND LIFT HEIGHT CHART

A. Lift Chart

How to look up rated lift capacity:

(1) Use the Lift Height Chart to find out the boom length and load radius.

(2) Use the Lift chart to find out the rated lift capacity.

Note:

Use the boom angle to find out the rated lift capacity if you lift a load with jib assembled at the main boom head.

For example:

Use Figure 7-3 to find out the rated lift capacity if the outrigger beams are fully extended and the crane is working with the main boom.

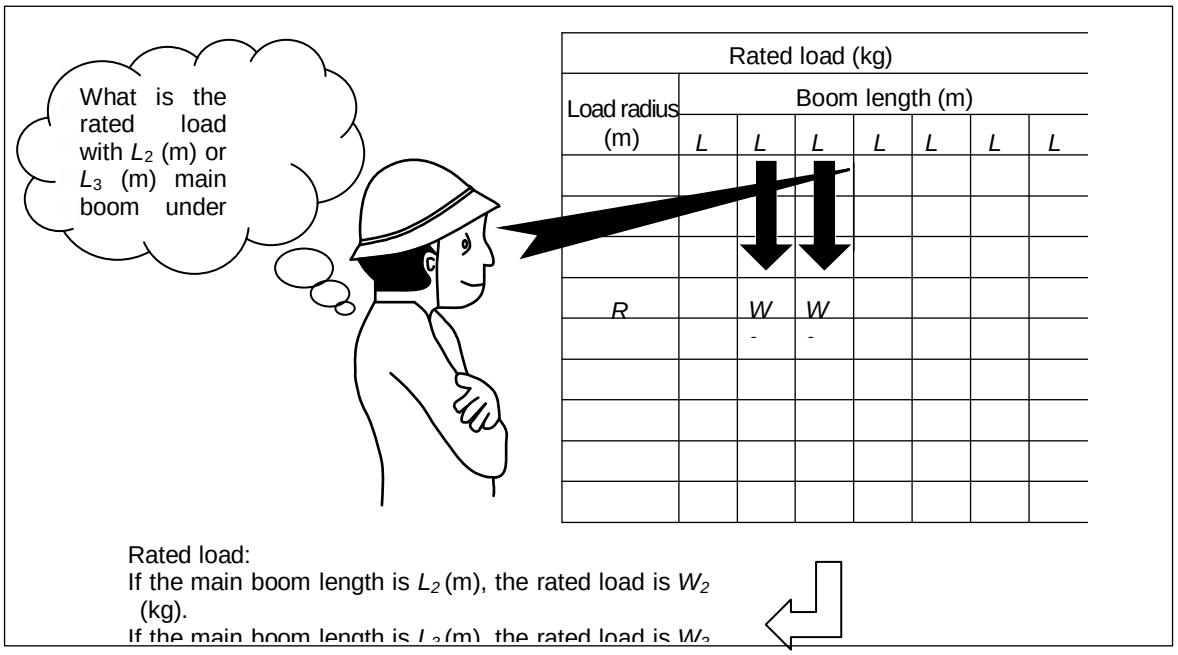


Figure 7-3 Rated Load

CAUTION

Use working conditions to find the rated lift capacity.

B. Lift height chart

Refer to Figure 7-4.

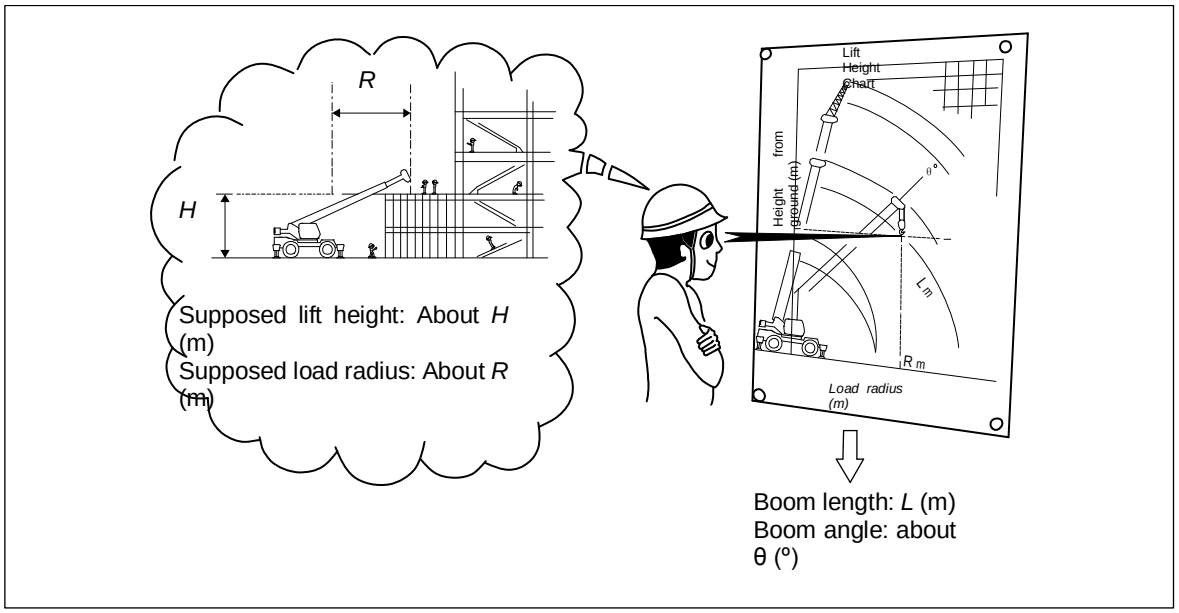


Figure 7-4 Lift Height

CAUTION

The data in the lifting height chart does not include the bend of the main boom.

C. Load radius

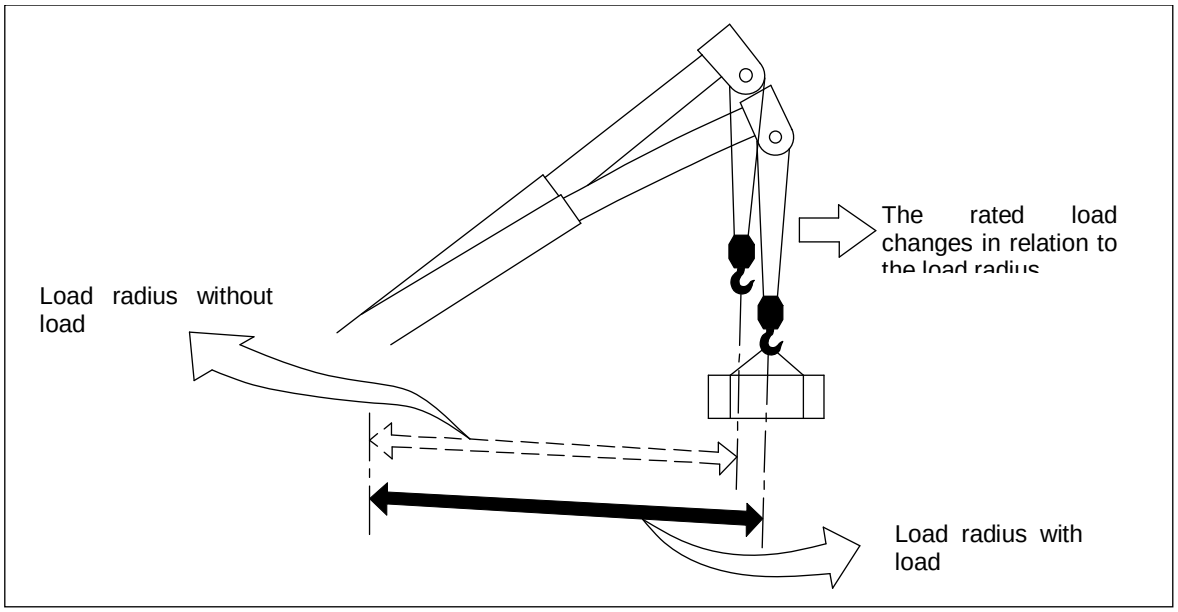


Figure 7-5 Load radius

(1) The balance valve in the hoist mechanism makes sure that the movement of the hoist is stable. It also makes the load stop at the necessary location.

(2) When you increase the boom length and height, you must increase the length of the hoist rope. You can change the line parts to get a longer rope. You must install the anti-two block weight before you change the parts.

7.12.2 MAIN WINCH

The right joystick controls the main winch. Push the joystick forward to reel-off to move the load down. Pull it to the rear to spool-up to move the load up. Refer to Figure 7-6.

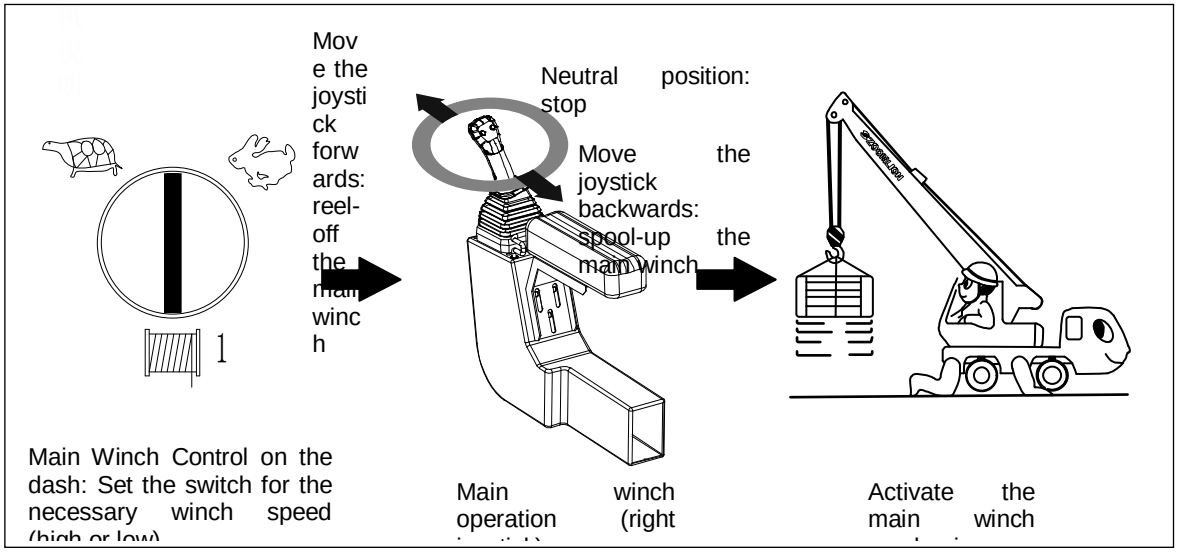


Figure 7-6 Main Winch – Right Joystick

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

If the end of the boom is not directly above the load lift point when you lift a load, do the steps that follow:

A. Push the FREE SWING button. The FREE SWING indicator illuminates and the free swing is active.
B. Let the boom automatically align the end of the boom above the load.
C. Push the FREE SWING button again to disengage free swing. The FREE SWING indicator goes off.

The Main Winch Control is on the dash. Set it for the necessary winch speed (high or low).

7.12.3 AUXILIARY WINCH

The left joystick controls the auxiliary winch. Push the joystick forward to reel-off to move the load down. Pull it to the rear to spool-up to move the load up. Refer to Figure 7-7.

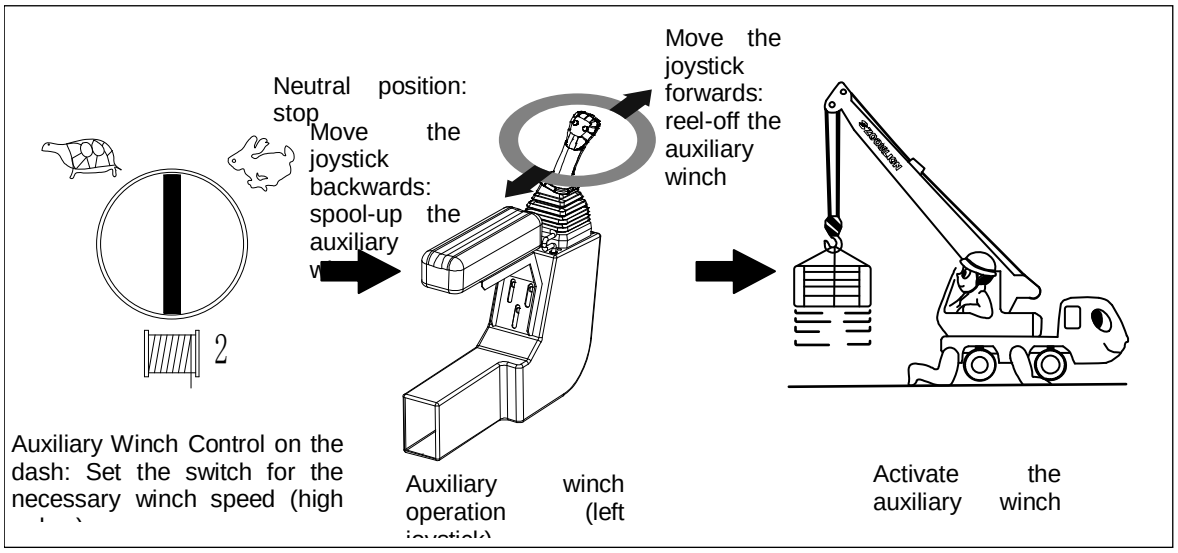


Figure 7-7 Auxiliary Winch – Left Joystick

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

Note:

(a) After you complete the movement, move the joystick to the neutral position slowly to stop the movements.

(b) The two winches (main and auxiliary) have a speed selector switch. You can set a slow or high speed for the winch movements (reel-off or spool-up). The speed at which you move the load increases or decreases by the pressure put on the throttle pedal. When you increase the engine idle speed, the load moves more quickly.

(c) The joystick travel distance is the third procedure to adjust how fast the winch moves. When you push the joystick a short distance, the winch moves are slow. When you push the joystick fully forward, the winch moves are fast. You have the same results when you pull back on the joystick.

Note:

The speed adjustments operate the same for the left and right joysticks.

(d) When the main or auxiliary winch is in the "spool up" mode and the hook block touches the anti-two block weight, the items below occur:

- A warning noise sounds.
- A warning light illuminates.

When the warning occurs, the function of the items below stop:

- Winch "spool up"
- Boom extension
- Boom "derrick down".

(e) When the crane sensor senses that the load weight is more than the load weight in the system, the items below occur:

- A warning noise sounds.
- A warning light illuminates.

When the warning occurs, the function of the items below stop:

- Winch "spool up"
- Boom extension
- Boom "derrick down".

(f) When the sensor senses that the main or auxiliary winch has 3 wraps of wire-rope on it, the "reel off" function stops.

(g) If necessary, this switch-off can be bypassed by the bypass key switch in cab. When the maintenance personnel repair or check out the functions on the crane, they can turn the bypass key switch.

(h) Do bypassed movement with maximum precaution and minimum speed.

Do not use the bypass key switch when you do usual crane operations.

- **Choose the correct line parts for the boom length and load weights. If the hook turns because of the rope, put the load on the ground. Do not lift the load until the rope is straight.**
- **When you lift a load to a height that is more than usual, monitor the number of wire-rope wraps remaining on the winch. If the load is lowered down a hole that is deep, monitor the wire-rope. Keep a minimum of 3 wraps of rope on the winch while you operate the crane.**
- **Lift the load vertically. Do not try to lift the load diagonally. Do not pull a load across the ground.**
- **Monitor the area as you lift a load. Do not move a load unless the conditions are safe.**

- **Do not derrick the boom up and extend the boom at the same time if:**
  - **The crane has a part of the load weight**
  - **The crane connects to a load on the ground.**
- **Do not change quickly between reel-off and spool-up. Let the winch stop before you continue to move the hook.**
- **Make sure that the sling has sufficient strength to hold the crane.**
- **Do not use the crane to lift personnel.**

7.12.4 HOIST LINE REEVING

A. Before you start to change the wire-rope line parts, fully retract the boom and move it to the front of the crane.

B. Change the wire-rope line parts as follows:

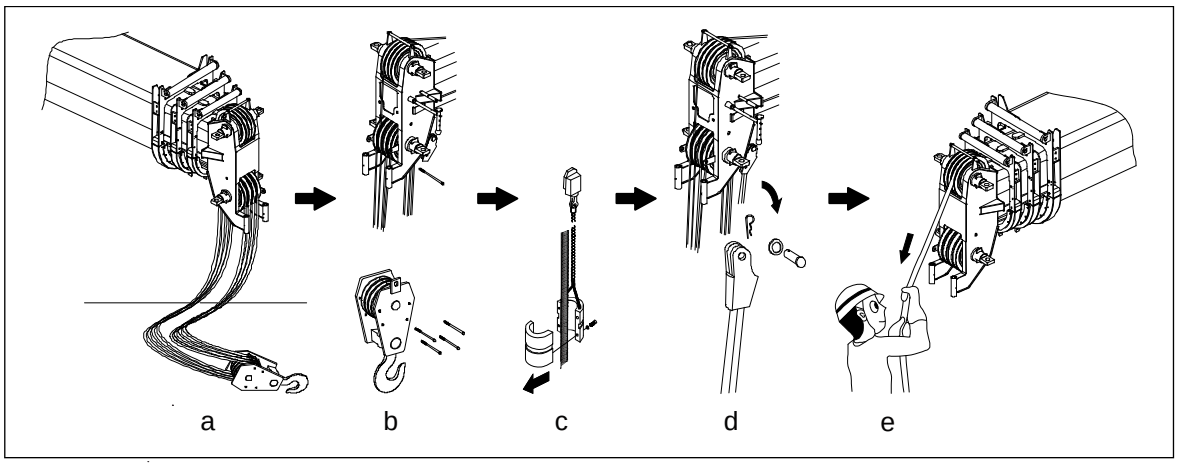


Figure 7-8 Hoist Line Reeving

(1) Derrick the boom down to put the hook on the ground.

(2) Remove the pins on the hookblock and boom head to let the wire rope unreeve.

(3) Remove the anti-two block weight.

(4) Remove the wedge and socket assembly (beckett).

Note:

Dead end the rope on the hook block for an odd number of line parts. Dead end the rope on the boom head for an even number of line parts.

(5) Change the line parts.

Note:

(a) You must change the location of the anti-two block weight if you have a different number of wire-rope wraps. Refer to Figure 7-9.

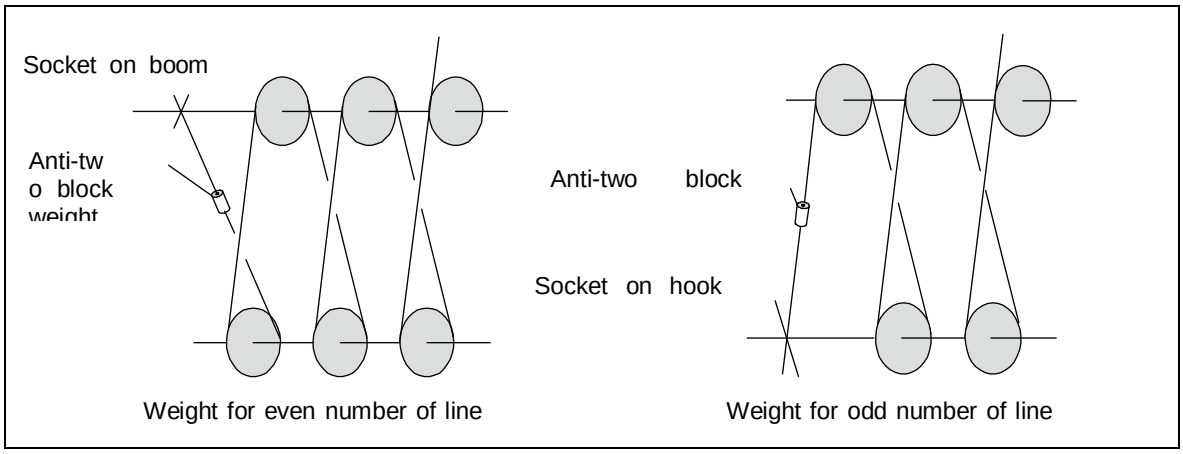


Figure 7-9 Even and Odd Line Parts

(b) Put the wire-rope on the winch spool smoothly and in sequence.

(c) Install the socket and wire-rope clamp. Refer to Figure 7-10.

(d) Do not install the wire rope clamp on the live side of the wire rope.

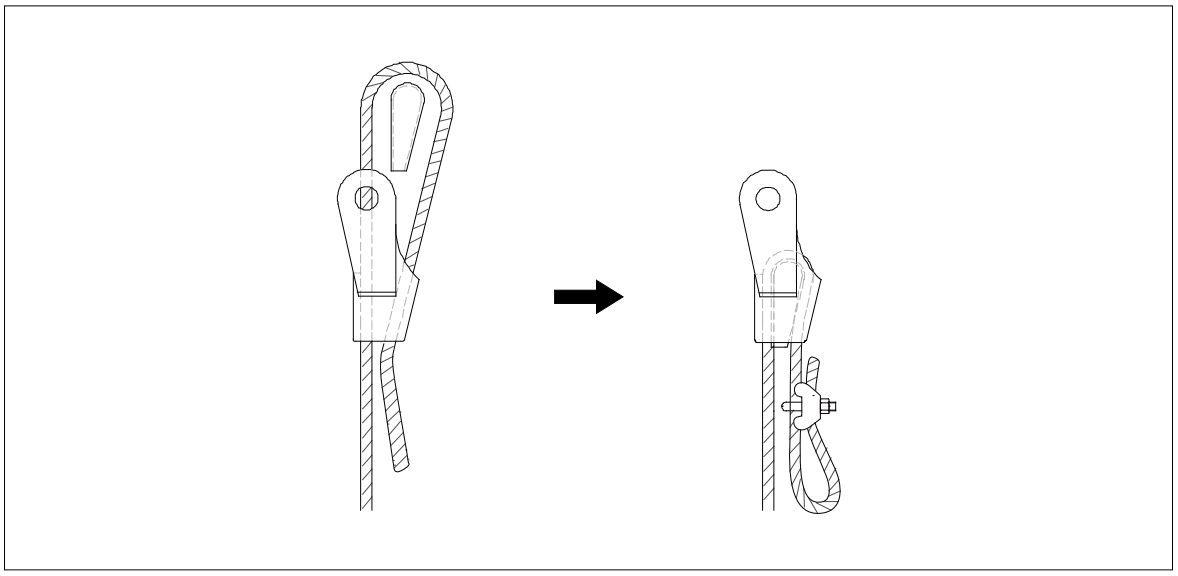


Figure 7-10 Rope Clamp

7.13 MAIN BOOM EXTEND / RETRACT FUNCTION OPERATION

A. The boom has four parts to it: a basic boom and four telescopic sections. The basic boom attaches to the superstructure with a pivot connection. The four telescopic sections move together to increase the length / range of the boom.

B. To extend and retract the boom, a telescoping mechanism is attached in the boom structure. The components of the telescoping mechanism are as follows:

- Telescopic cylinder
- Boom extension wire-rope
- Boom retraction wire-rope.

C. The figure below shows the telescoping principle:

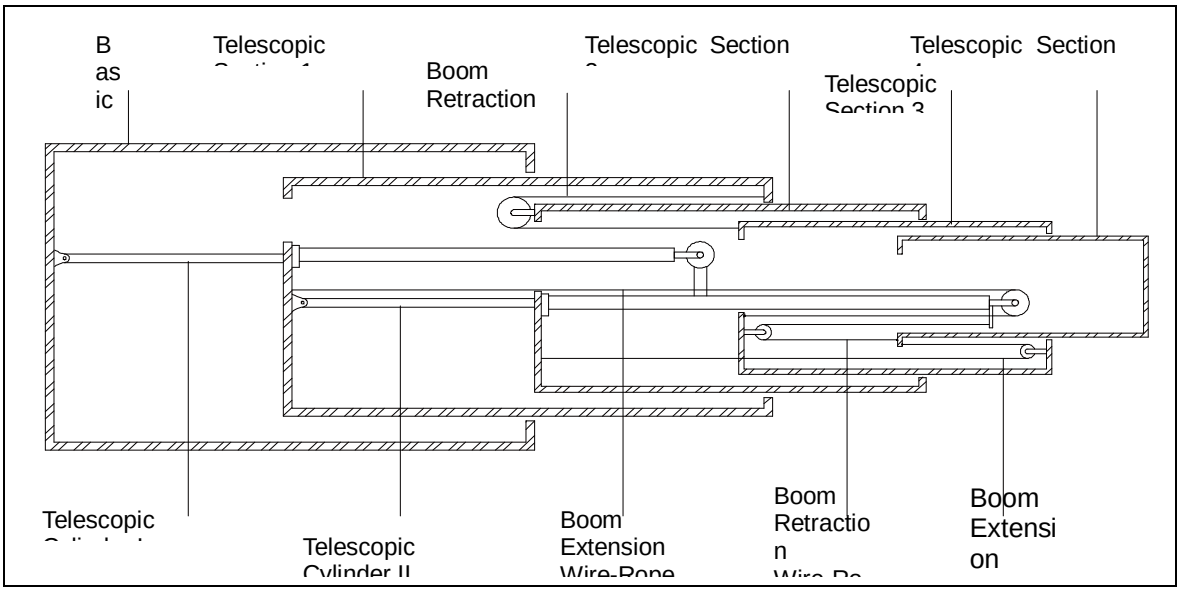


Figure 7-11 Telescoping Principle

D. The balance valve, in the hydraulic system, helps the telescoping components move smoothly. When the boom is set the correct length, the valve causes a blockage of the hydraulic oil flow out of the cylinder. This helps to lock the boom in position.

E. The length detector (in the main boom, on the left side) measures the boom length and transmits the data to the load moment indicator. The boom length data is calculated then the boom configuration shows on the screen.

7.13.1 OPERATE – EXTEND THE BOOM

A. Pull the PTO handle up to the engage position.

B. The boom extend / retract pedal controls the telescoping movements. Refer to Figure 7-12.

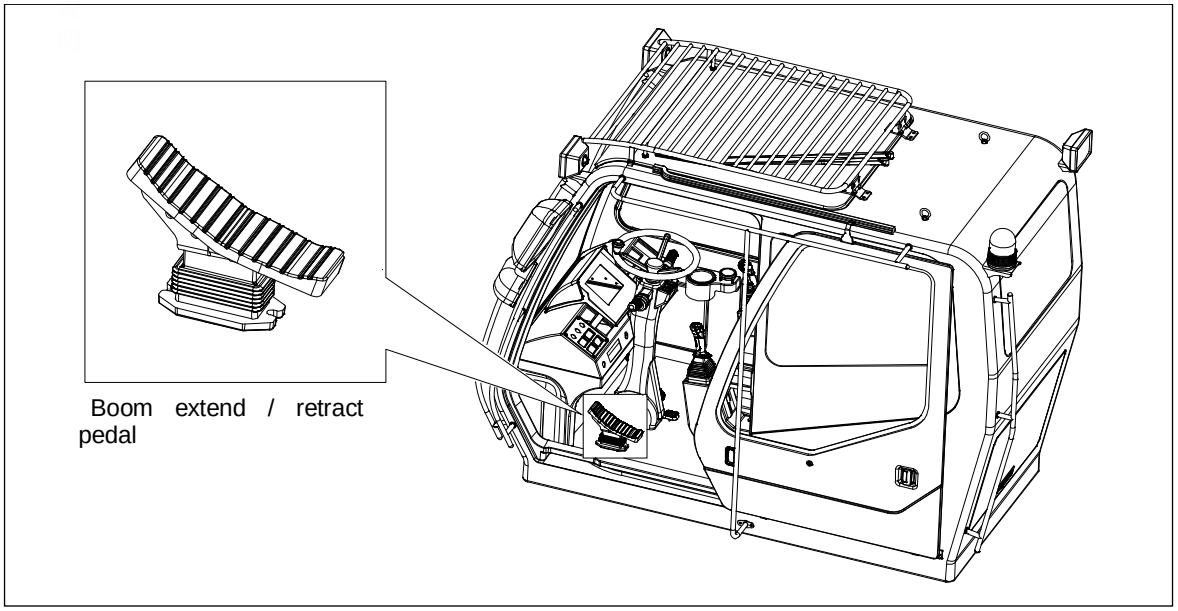


Figure 7-12 Boom Extend / Retract Pedal

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the boom extend / retract pedal commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the boom extend / retract pedal commands to operate the crane.

C. When you tilt the pedal forward, the telescopic sections 1, 2 and 3 move out at the same time. Refer to Figure 7-13.

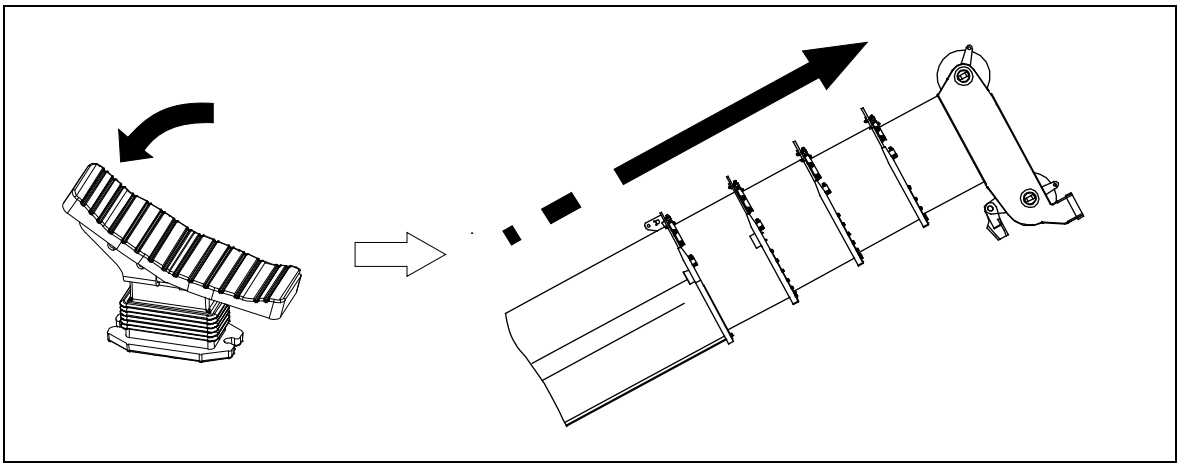


Figure 7-13 Telescopic Sections – Extend

D. Release the pedal slowly to the neutral position to stop the telescoping movement. The boom stops at that point.

CAUTION

When you extend the boom and the hook block touches the anti-two block weight, the items below occur:

- **A warning noise sounds**
- **A warning light illuminates.**

When the warning occurs, the function of the items below, stop:

- **Winch spool-up**
- **Boom extension**
- **Derrick boom down.**

If you must extend the boom more, use the reel-off function (push the right joystick forward) to lower the hook block.

The crane has a bypass key switch that prevents the warning indications. When the maintenance personnel repair or check out the functions on the crane, they can turn the bypass key switch.

7.13.2 OPERATE – RETRACT THE BOOM

A. Tilt the pedal backward to retract the telescopic sections 1, 2 and 3. Refer to Figure 7-14.

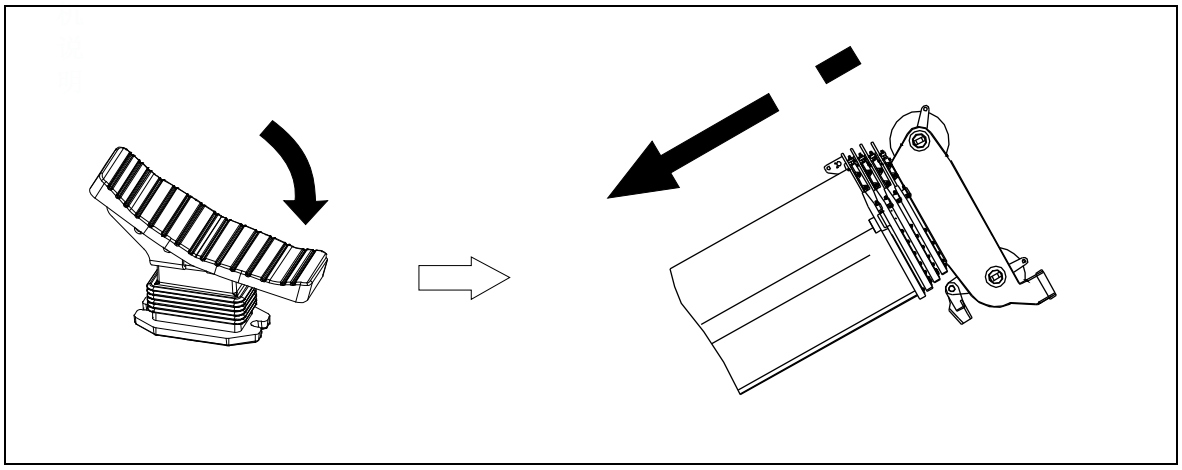


Figure 7-14 Telescopic Sections – Retract

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the boom extend / retract pedal commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the boom extend / retract pedal commands to operate the crane.

B. Release the pedal slowly to the neutral position to stop the telescoping movement. The boom stops at that point.

CAUTION

- **When you extend and retract the boom, the hook block moves up and down. Make sure that you adjust the length of the hoist wire-rope when you adjust the length of the boom. Do not extend the boom too quickly.**
- **The speed of the extend and retract movements changes by:**
  - **The extend / retract pedal – how far you tilt it**
  - **Throttle pedal – increase or decrease the engine RPMs.**
- **When the boom is fully retracted, it can be two seconds before the boom starts to move.**
- **Lift the load vertically. Do not try to lift the load diagonally. Do not pull a load across the ground.**
- **Do not use the bypass key switch when you do usual crane operations.**

- **An extended boom can retract a short distance if the boom is extended for a long period of time. The items that follow are the possible causes for the movement:**
  - **A change in the hydraulic oil temperature**
  - **A change in the angle of the boom**
  - **Lubrication status.**

  Solutions:
  - **Make sure that the hydraulic oil temperature does not increase too high.**
  - **Extend the boom to the correct length.**
  - **Do not extend / retract the boom with a suspended load.**

7.14 DERRICKING OPERATION (OPERATE – BOOM DERRICK)

A. To move the boom up or down (derricking), the hydraulic oil is pumped in or vented out of the derricking cylinder.

B. The boom angle (boom derricking) is adjusted from -2° – 80°, by the derricking cylinder. When the boom is in the front at a -2° angle, jib assembly, line parts change and boom head parts maintenance can be carried out easily.

C. The derricking cylinder has a balance valve. The balance valve, in the hydraulic system, helps the derricking components move smoothly. When the boom is set at the correct length, the valve stops the hydraulic oil flow out of the derricking cylinder. This helps to lock the boom in position.

D. The right joystick controls the derricking movements. Refer to Figure 7-15.

E. The speed of the derricking up / down movements change by:
- Joystick – how far you move the joystick left or right
- Throttle pedal – increase or decrease the engine RPMs.

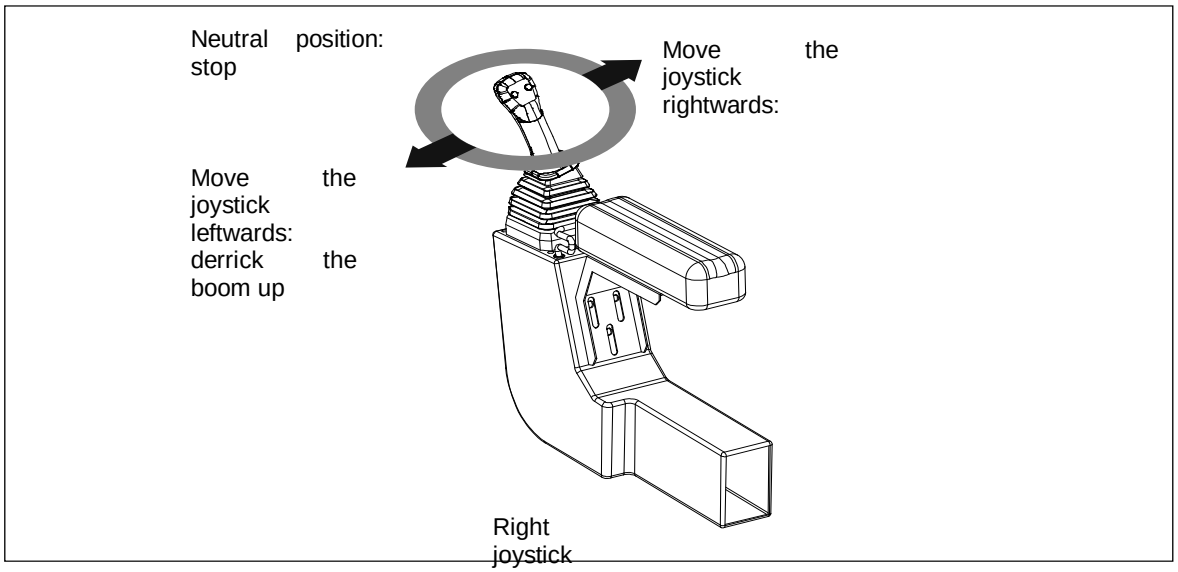


Figure 7-15 Derricking Operation

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

F. The boom angle indicator and the angle detector attach to the side of the main boom. Refer to Figure 7-16. The operator can see the angle indicator from the cab of the crane. The angle detector is an electronic device that sends the boom angle data to the LMI (Load Moment Indicator). The boom angle shows on the display screen.

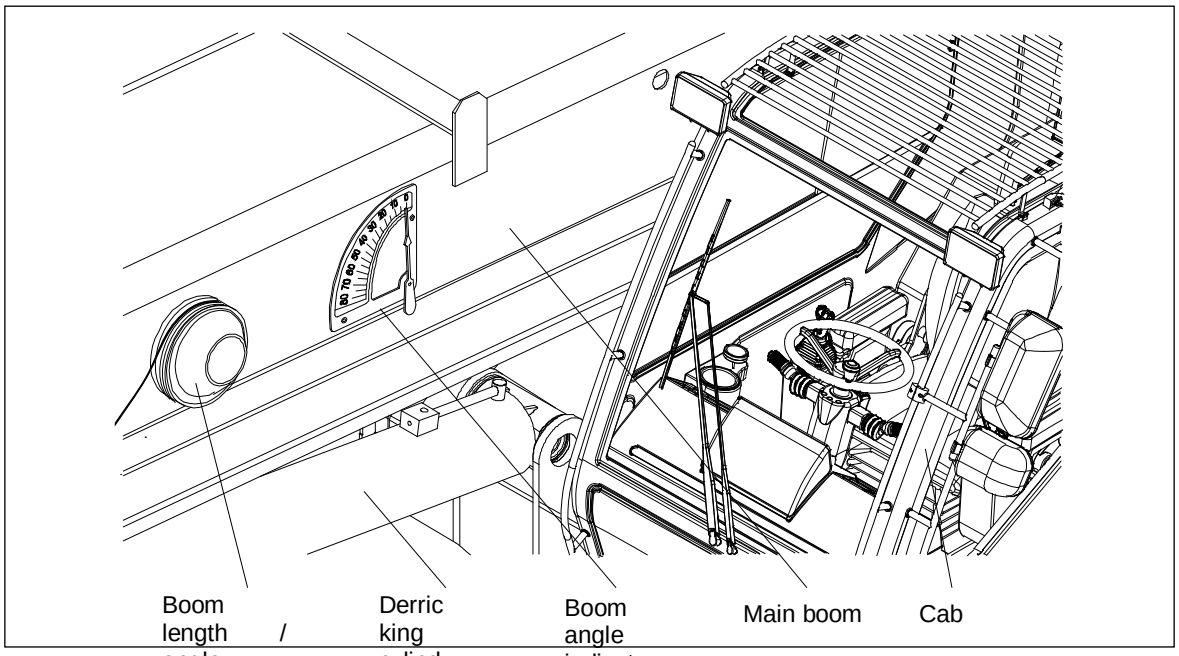


Figure 7-16 Boom Angle Indicator / Detector

WARNING

Do all derricking movements smoothly. You can cause damage to the crane if you move the load up or down with quick stops.

You can cause a dangerous condition if you try to lift a heavy load with the boom at a low angle. Make sure that you follow the *Load Ratings*.

7.15 SWING OPERATION

7.15.1 SWING MECHANISM

The superstructure, which includes the cab, moves around a full 360° range by the swing mechanism. The components that make up the swing mechanism are as follows:

- Hydraulic Motor
- Planetary Gear Reducer
- Swing Bearing
- Swing Lockout Device.

Refer to Figure 7-17.

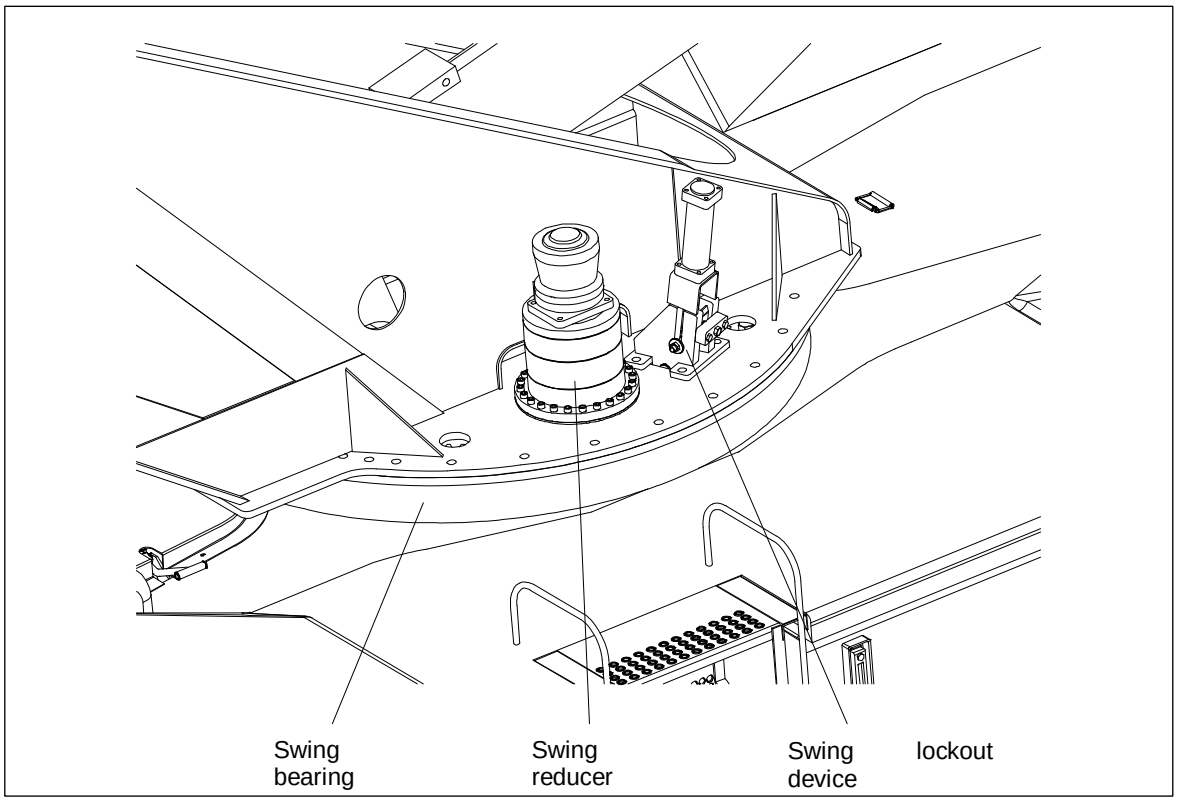


Figure 7-17 Swing Mechanism

7.15.2 SWING LOCKOUT DEVICE

The swing lockout device attaches on the right side of the superstructure. It can lock the superstructure in the 360° range. You use the swing lock switch (on the cab dash panel) to engage or disengage the swing lockout device. When the swing lock switch is in the LOCK position, the superstructure cannot move left or right. Refer to Figure 7-18.

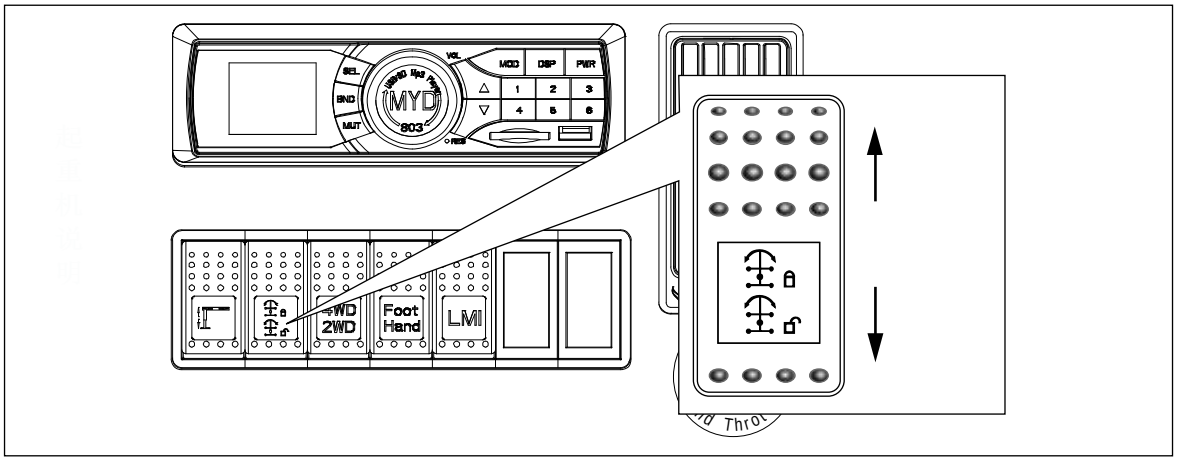


Figure 7-18 Swing Lock Switch

CAUTION

When you turn the crane, your view to the rear and side can be blocked. Be careful. Make sure that job-site personnel and equipment are clear from the area of swing. Send out a short warning sound (horn) before you swing the crane.

7.15.3 OPERATE – SWING DURING A LIFT

A. Disengage the swing lockout device with the swing lock switch. The swing lock indicator changes on the LMI. Refer to Figure 7-19.

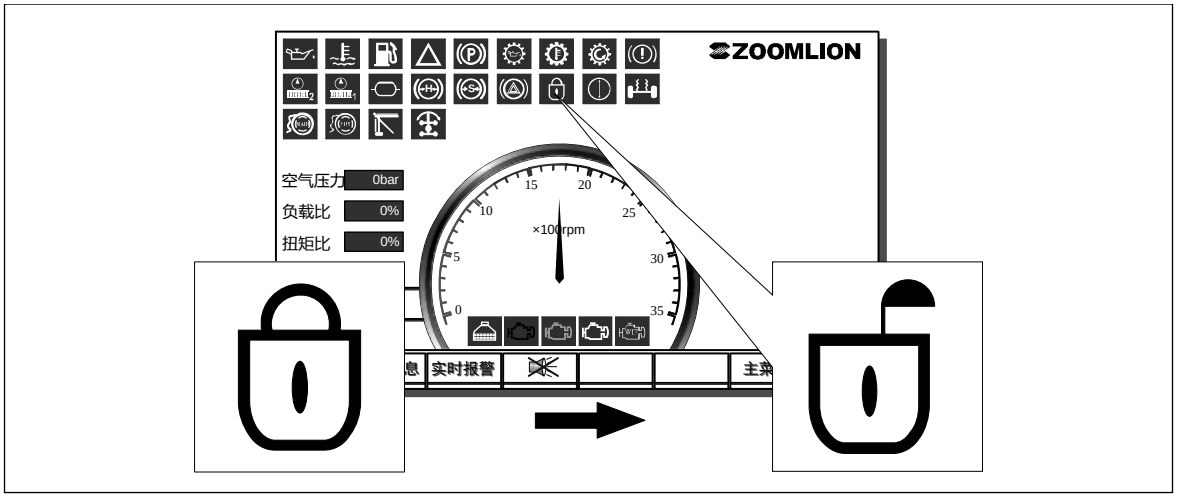


Figure 7-19 Unlock Indicator

B. To swing the superstructure, push the left joystick to the left or right. The deadman switch must be activated to use this function. The speed of the swing movement changes by:

- Joystick – how far you move the joystick left or right
- Throttle pedal – increase or decrease the engine RPMs.

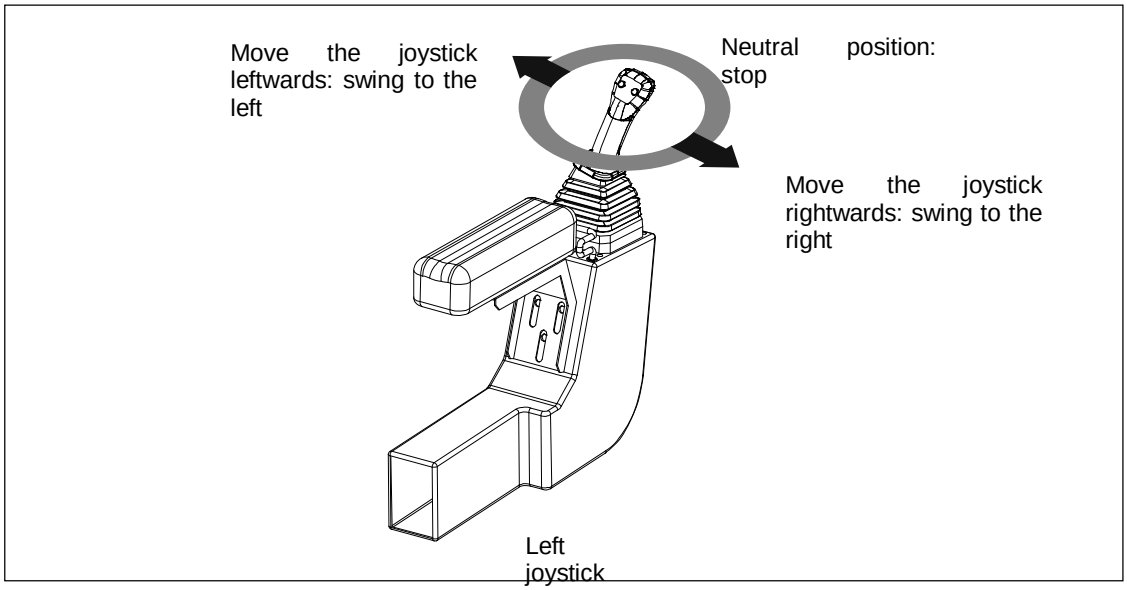


Figure 7-20 Swing Operation

Note:

- For the crane with deadman switches on the joysticks:
  You must push in the deadman switch (on left or right joystick) for the joystick commands to operate the crane.
- For the crane with a deadman switch on the seat:
  You must sit on the seat until the indicator illuminates for the joystick commands to operate the crane.

CAUTION

- **Make sure that you do not make fast movements or suddenly stop the turn.**
- **When you operate a new crane, make sure that you do a check of the Maintenance Log. The swing bearing bolts must be examined after 500 hours of operation. And then do the above-mentioned check every 1000 hours of operation.**
  - **The torque on the bolts must be 700 lbs·ft (950 N·m).**
- **The crane can turn with a load above the ground. Do not try to lift the load diagonally. Do not pull a load across the ground.**
- **Make sure that the outriggers are in the correct positions according to the *Load Ratings* before you swing the superstructure with a load on the boom.**
- **Monitor the area as you move a load. Do not move a load unless the conditions are safe.**
- **Before you swing the superstructure, make sure that the swing lockout device is in the UNLOCK position. When crane movements stop, lock the superstructure and make sure the swing lock indicator illuminates.**

7.16 MULTIFUNCTIONS

A. The crane can do two operations or more at the same time. This increases the quantity of work that the crane can do.

B. Before you start, make sure that you examine or do the items that follow:

- The hydraulic system works correctly and gives a sufficient flow for multifunctioning.
- Do not move the joysticks to their limit positions.
- Easy and smooth movements are necessary when you do an operation for multifunctioning.
- Make sure that you increase the engine RPMs.
- Monitor the area as you operate. Do not move a load unless the conditions are safe.

CAUTION

You can only use crane movements that operate at the same time when there is no load (or when you lift the load away from the ground).

C. Extend or Retract the Boom + Main Winch

You can extend or retract the boom and move the main hook up or down at the same time. To do this, push the boom extend / retract pedal and push or pull the right joystick. Refer to Figure 7-21.

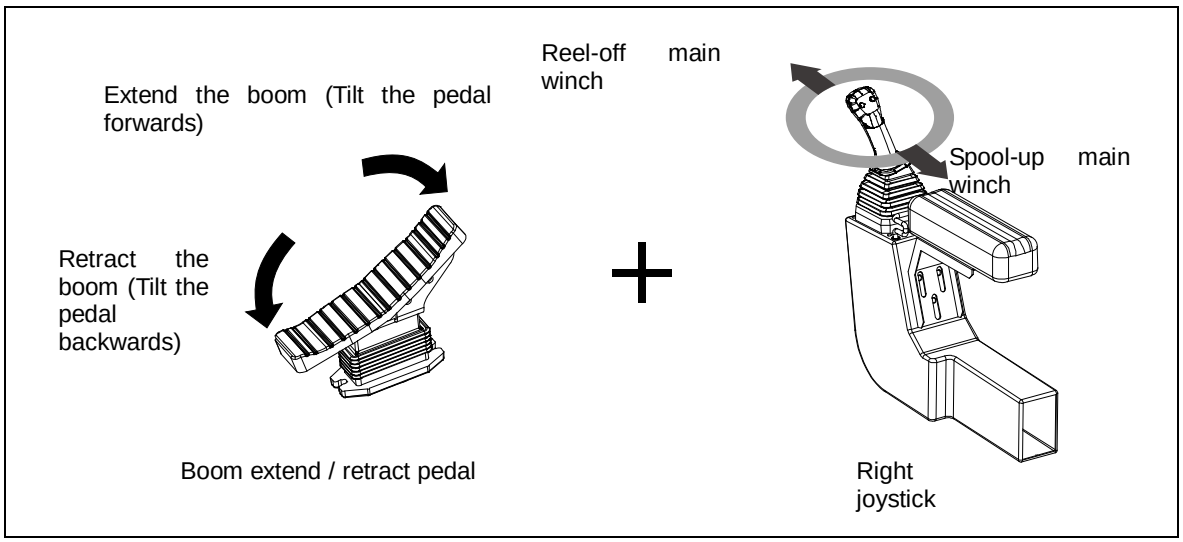


Figure 7-21 Extend or Retract the Boom + Main Winch

D. Auxiliary Winch + Main Winch

To move auxiliary winch and main winch at the same time, push or pull the left and right joysticks. The auxiliary hook and main hook move up and/or down. Refer to Figure 7-22.

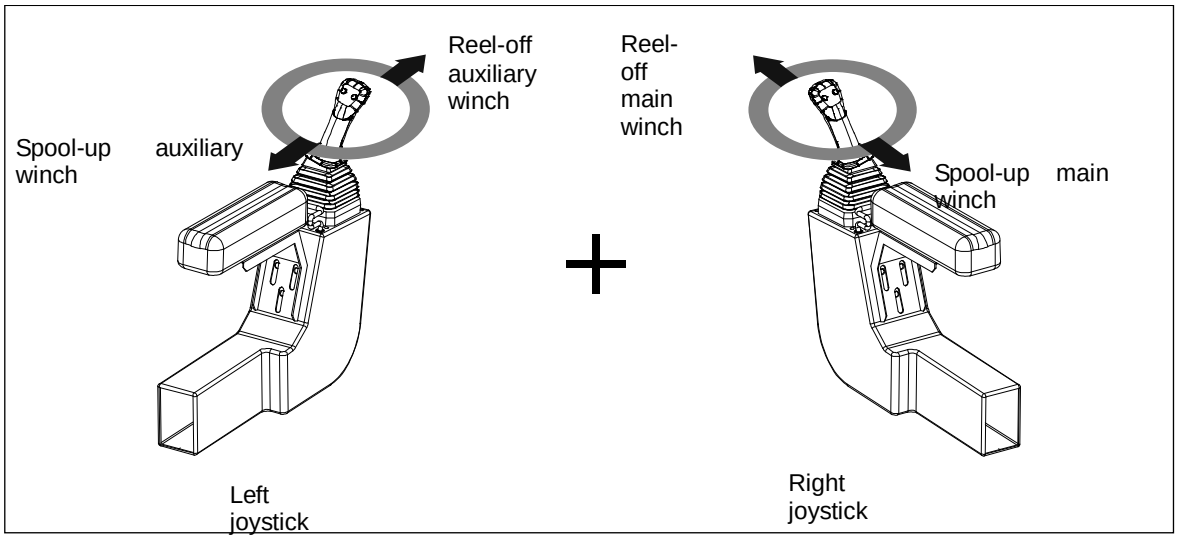


Figure 7-22 Auxiliary Winch + Main Winch

E. Extend or Retract the Boom + Derrick

You can extend or retract the boom and derrick the boom up or down at the same time. To do this, push the boom extend / retract pedal and move the right joystick left or right. The boom extends or retracts and the boom moves up or down. Refer to Figure 7-23.

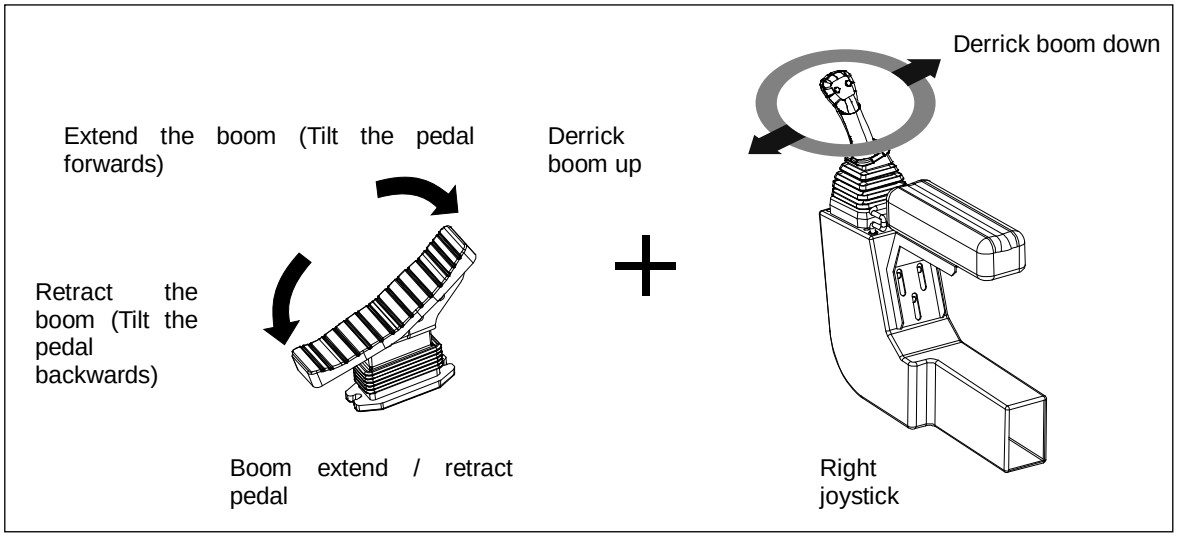


Figure 7-23 Extend or Retract the Boom + Derrick

F. Auxiliary Winch + Derrick

You can move the auxiliary hook up or down and derrick the boom up or down at the same time. To do this, push or pull the left joystick and move the right joystick left or right. Refer to Figure 7-24.

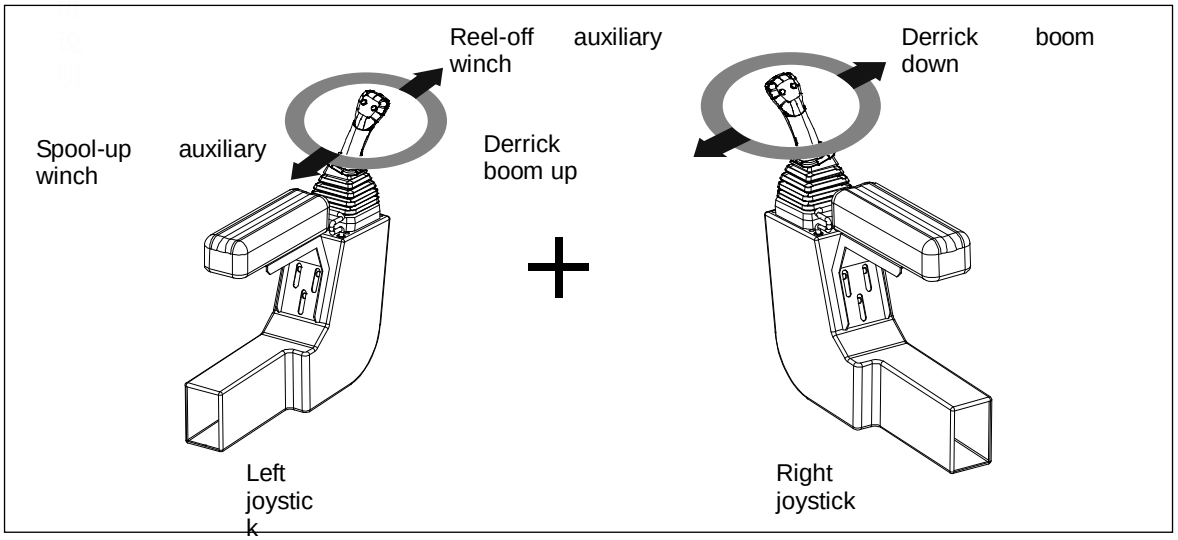


Figure 7-24 Auxiliary Winch + Derrick

G. Swing + Derrick

You can swing the superstructure to the left or right and derrick the boom up or down at the same time. To do this, move the left joystick left or right and move the right joystick left or right. Refer to Figure 7-25.

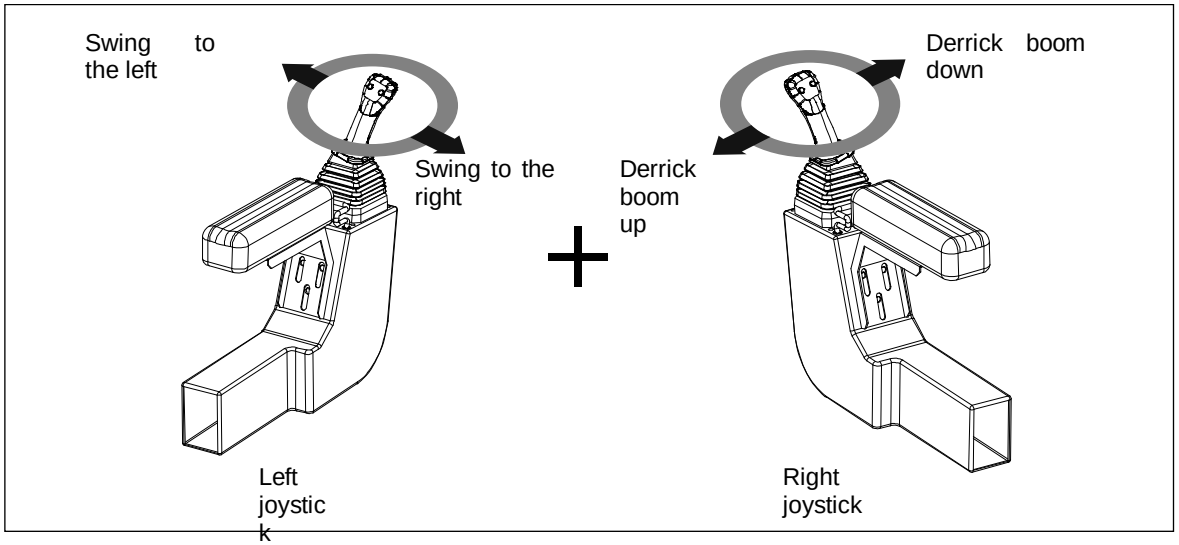


Figure 7-25 Swing + Derrick

CAUTION

When you lift the load, it moves. Be careful not to touch the outriggers with the load.

H. Swing + Main Winch

You can swing the superstructure to the left or right and move the main hook up or down at the same time. To do this, move the left joystick left or right and push or pull the right joystick. Refer to Figure 7-26.

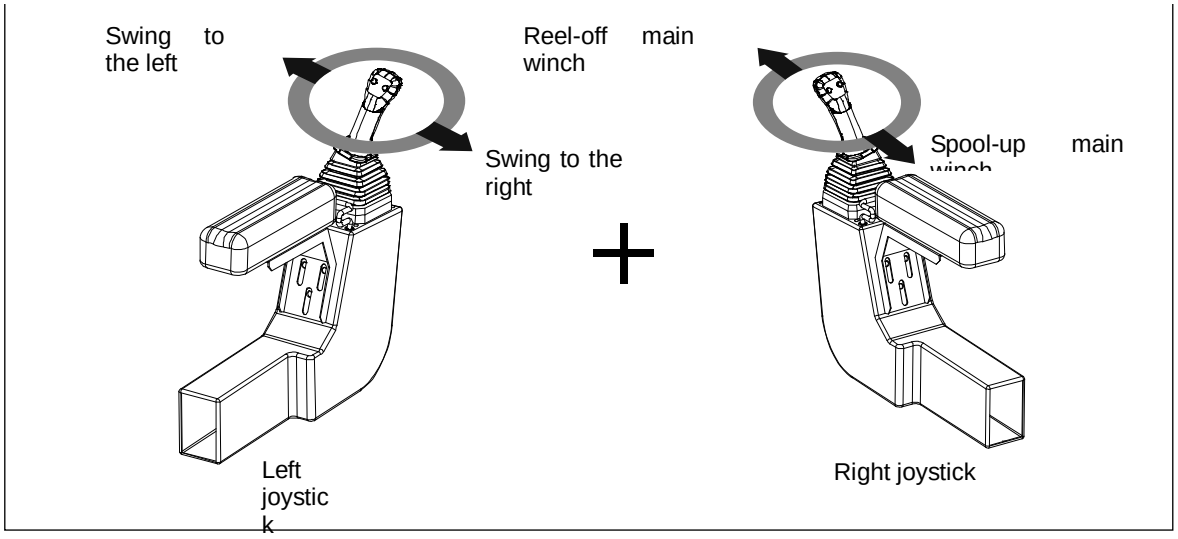


Figure 7-26 Swing + Main Winch

I. Derrick + Main Winch

(1) You can derrick the boom and move the main hook up or down at the same time. For this type of move, it is necessary for the operator to move the joystick in two adjacent directions. For example, to move the boom and main hook down, push the right joystick up and to the right (1:30 clock position). Refer to Figure 7-27. The other movements on the right joystick are as follows:

(2) Push up and to the left (10:30 clock position) – the boom moves up and the main hook moves down.

(3) Pull aft and to the right (4:30 clock position) – the boom moves down and the main hook moves up.

(4) Pull aft and to the left (7:30 clock position) – the boom moves up and the main hook moves up.

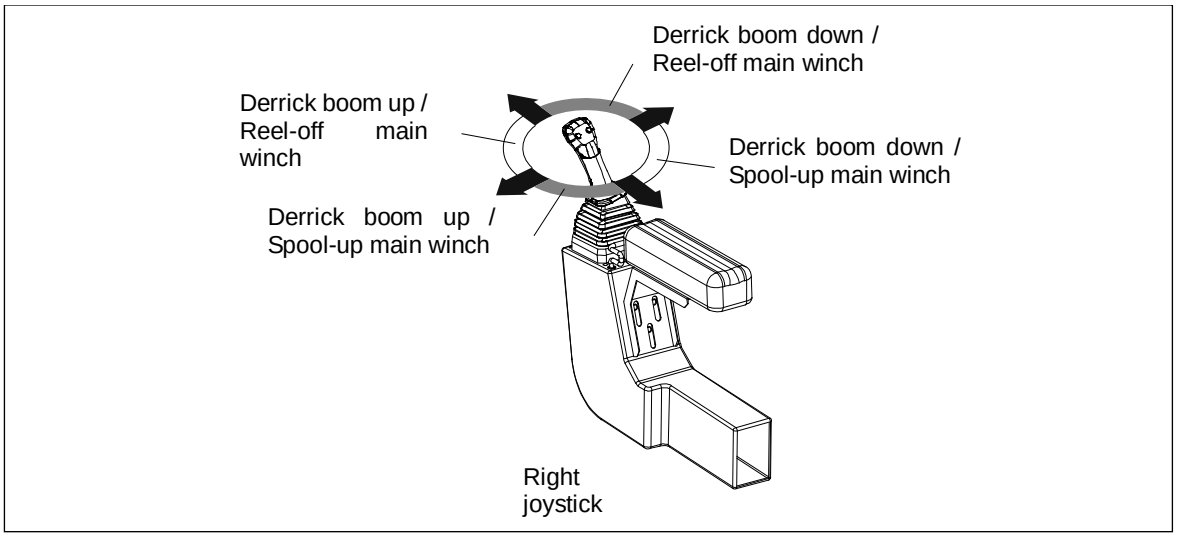


Figure 7-27 Derrick + Main Winch

J. Swing + Auxiliary Winch

(1) You can swing the superstructure to the left or right and move the auxiliary hook up or down at the same time. For this type of move, it is necessary for the operator to move the joystick in two adjacent directions. For example, to swing the superstructure to the right and move the auxiliary hook down, push the left joystick up and to the right (1:30 clock position). Refer to Figure 7-28. The other movements on the left joystick are as follows:

(2) Push up and to the left (10:30 clock position) – the superstructure swings to the left the auxiliary hook moves down.

(3) Pull aft and to the right (4:30 clock position) – the superstructure swings to the right and the auxiliary hook moves up.

(4) Pull aft and to the left (7:30 clock position) – the superstructure swings to the left and the auxiliary hook moves up.

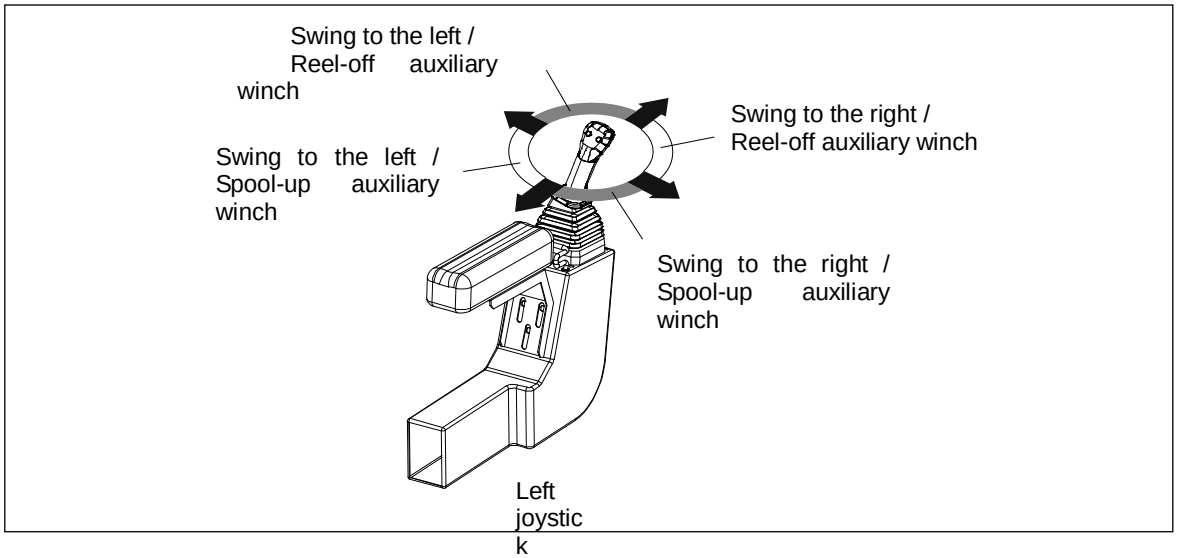


Figure 7-28 Swing + Auxiliary Winch

K. Extend or Retract the Boom + Swing

You can extend or retract the boom and swing the superstructure to the left or right at the same time. To do this, push the boom extend / retract pedal and move the left joystick left or right. Refer to Figure 7-29.

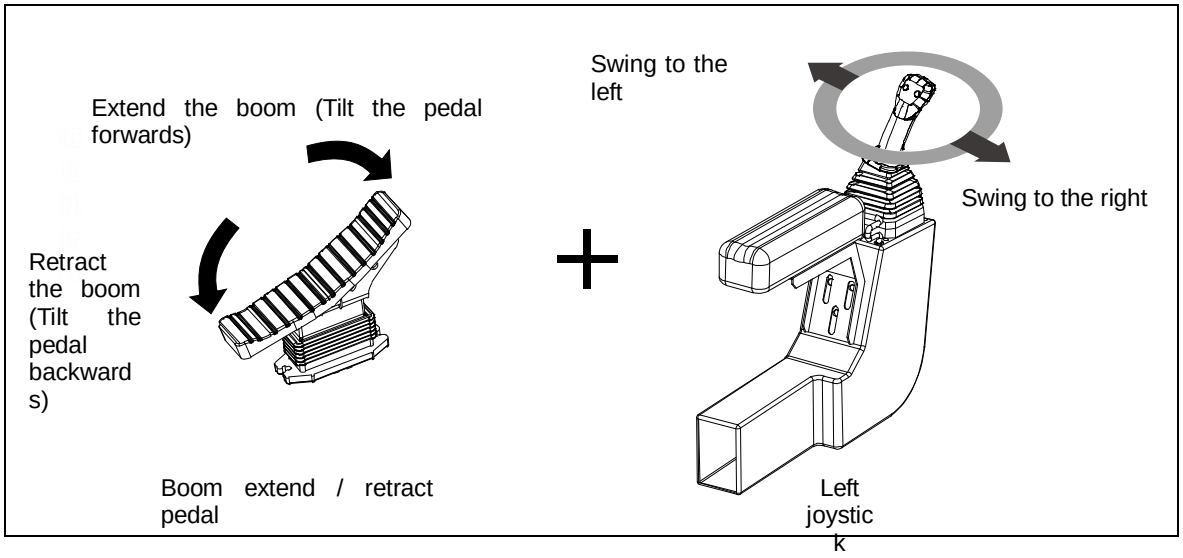


Figure 7-29 Extend or Retract the Boom + Swing

Note:

To add a third or fourth multifunction operation, lightly apply the correct controls. If you do another operation, some or all of the crane functions in operation can decrease. Carefully make smooth crane operations.

7.17 JIB OPERATION

A. The crane has a 2-section jib. Section 1 is a quadrilateral lattice structure and section 2 is a triangle lattice structure.

B. The jib section 2 is secured into jib section 1, and the whole jib is secured onto the right side of main boom via moveable pins during traveling. Meanwhile, the jib section 2 can also be secured onto the right side of main boom independently.

WARNING

You cannot use the jib when you lift a load if the outriggers are not in the correct positions.

7.17.1 ASSEMBLE THE JIB

A. You can assemble the jib at an angle of 0°, 15° or 30° to the telescopic boom according to working requirements.

B. Assemble the jib (Take 0° offset for example.).

C. Take out the auxiliary hook from the hook holder before jib assembly. Refer to Figure 7-30.

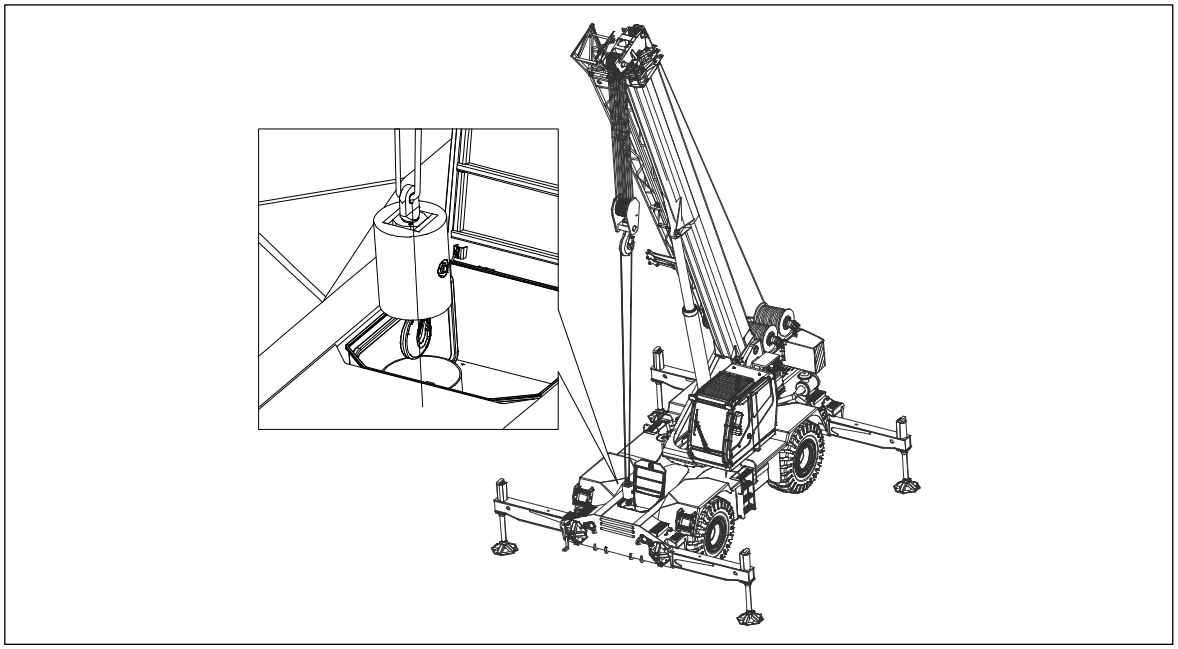


Figure 7-30 Take Out the Auxiliary Hook

D. Extend the outriggers and make the crane level. Refer to Figure 7-31.

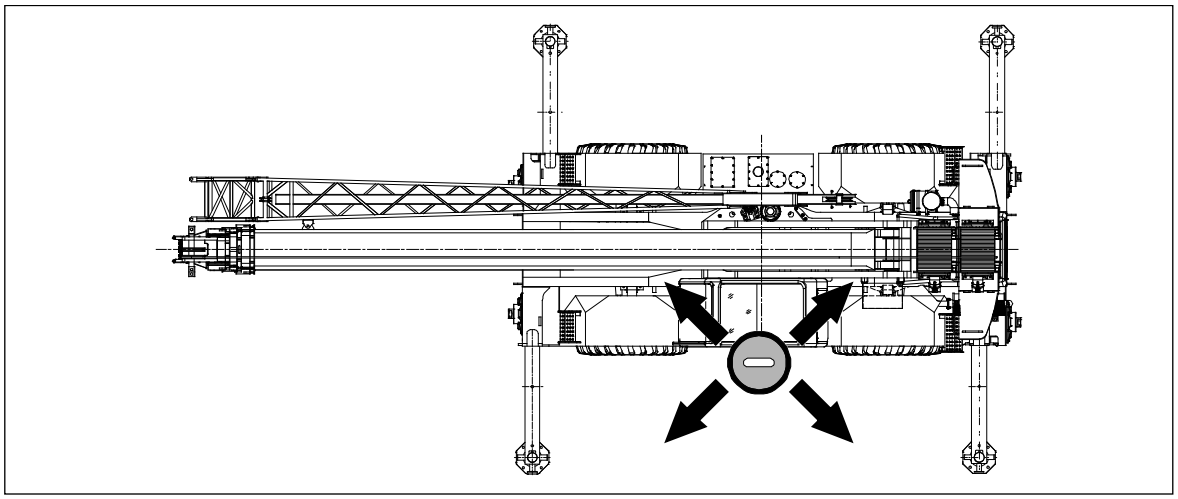


Figure 7-31 Make the Crane Level

E. Fully retract the boom, move the boom to the front of the crane and position it to -2°. Refer to Figure 7-32.

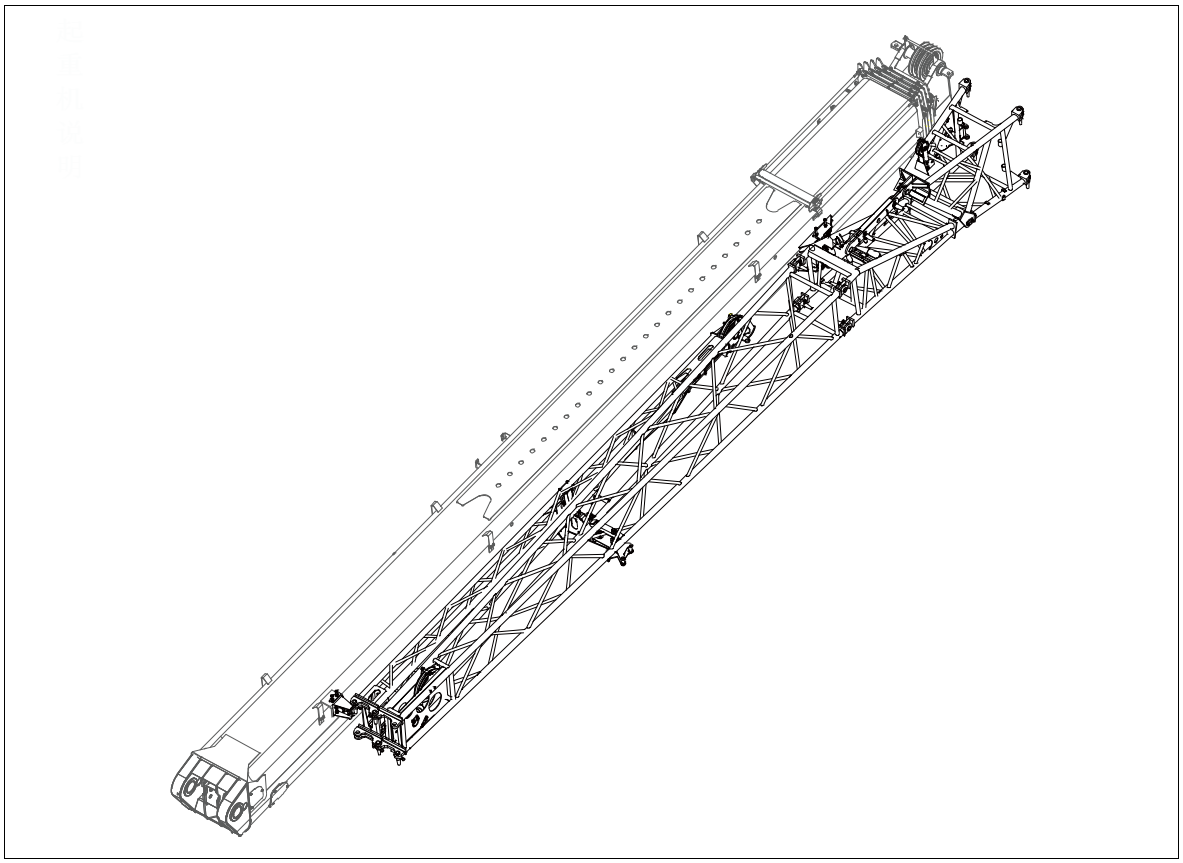


Figure 7-32 Jib assembly

F. Adjust the limit bolt at the left side of boom head (viewed from the traveling direction) to keep 1- 2 mm clearance between its end face and the bearing block at the boom head. After that, tighten the locknut. Refer to Figure 7-33.

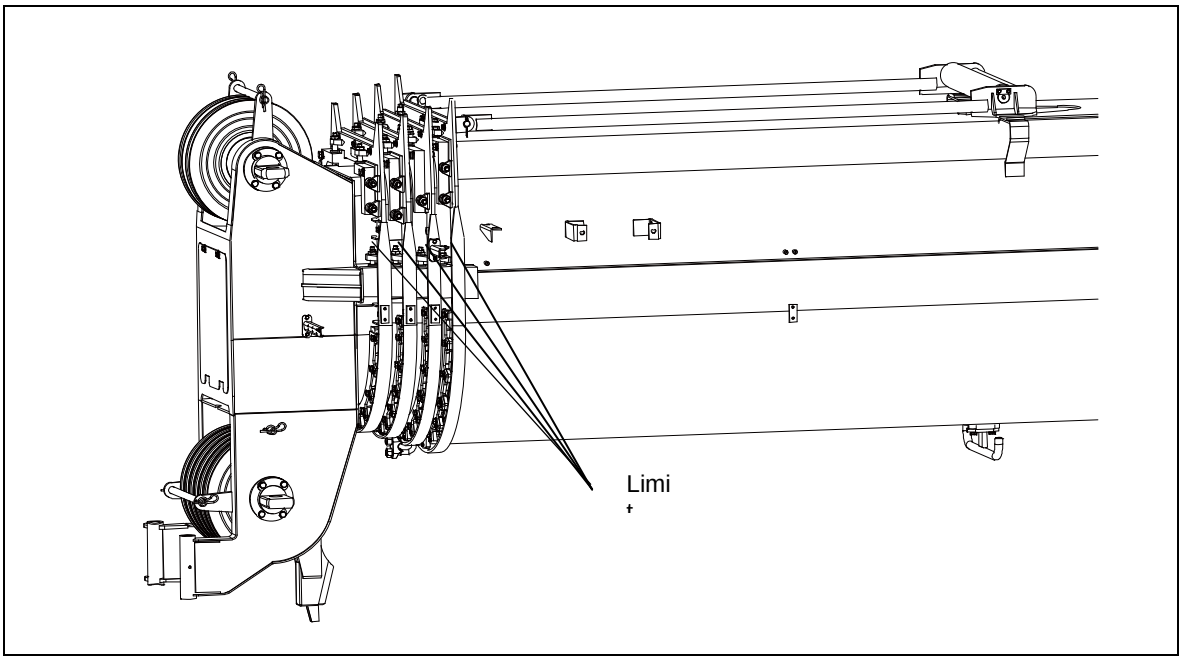


Figure 7-33 Adjust the limit bolt

G. Use the jib section 1. Remove the pin and extend the folding bracket. And secure it with the removed pin. Refer to Figure 7-34.

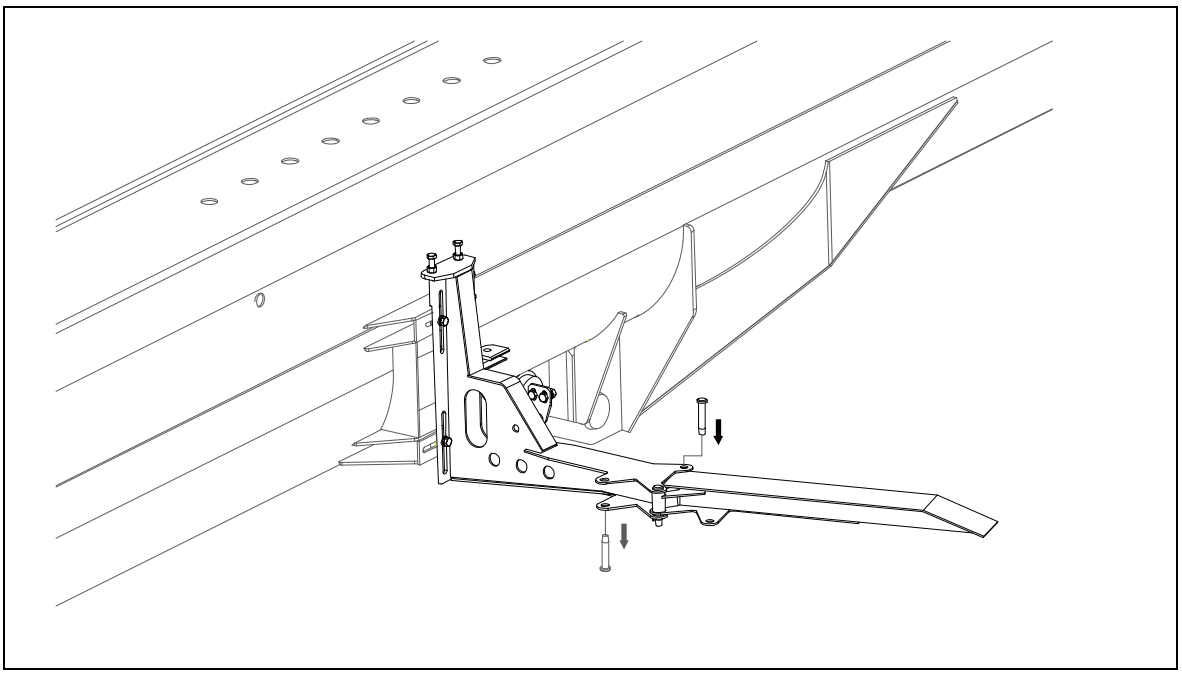


Figure 7-34 Extend the folding bracket

H. Extend the bracket and remove the pins I and II. Refer to Figure 7-35.

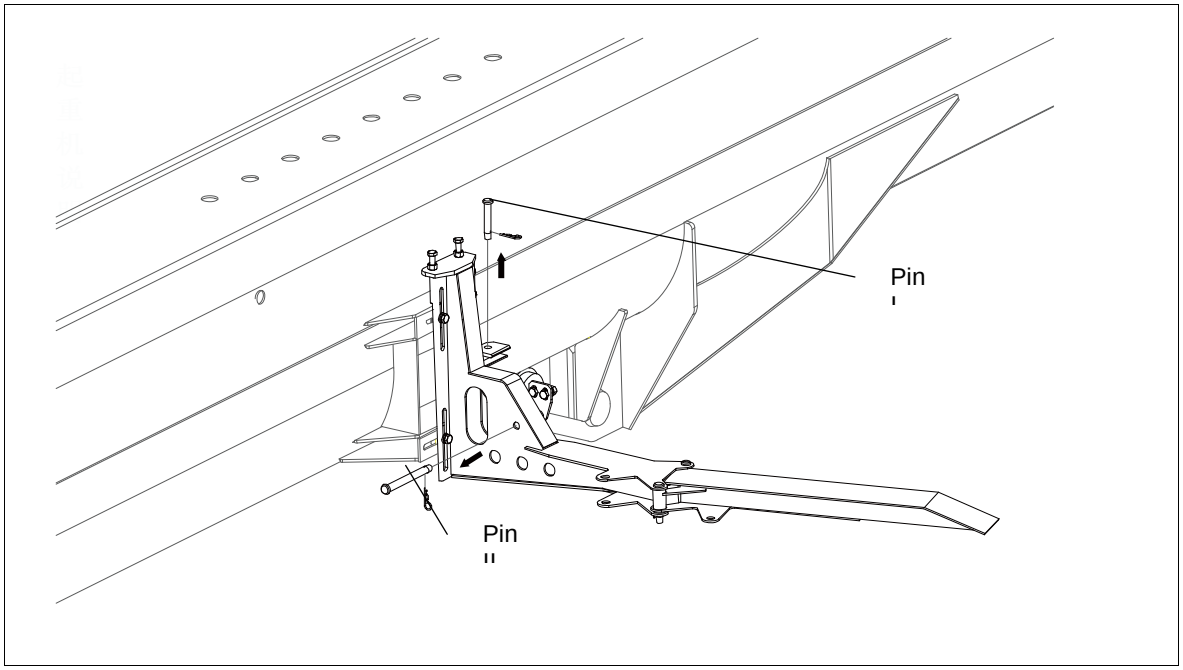


Figure 7-35 Pins I and II removal

I. Remove the Pin III. Refer to Figure 7-36.

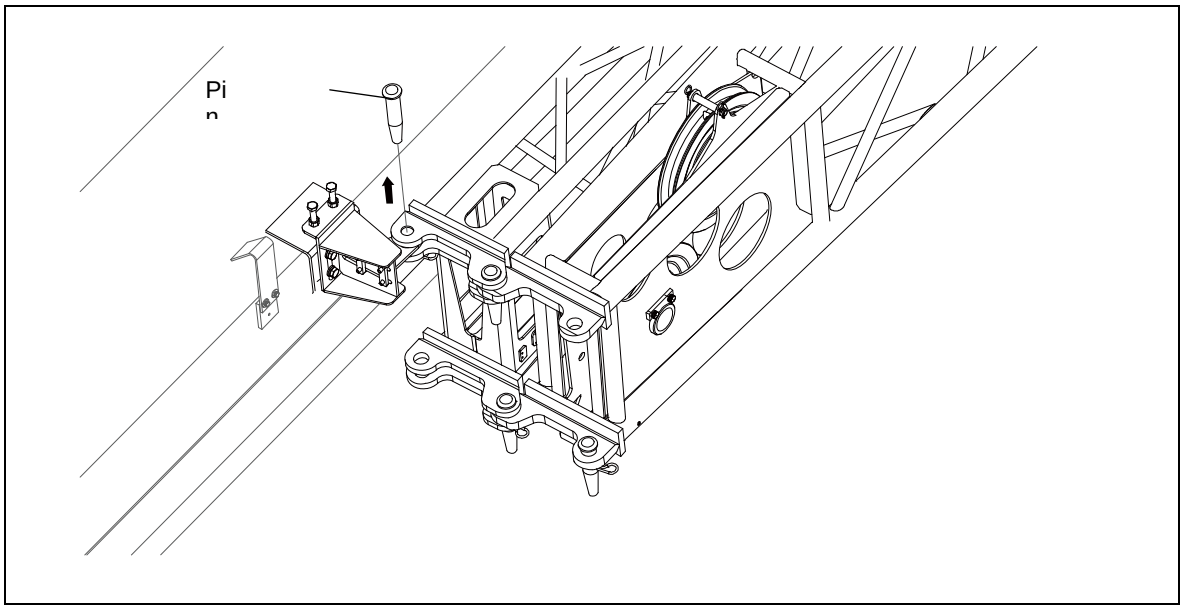


Figure 7-36 Pins III removal

J. Move front of the jib away from the main boom (jib pivots at pin IV). Refer to Figure 7-37.

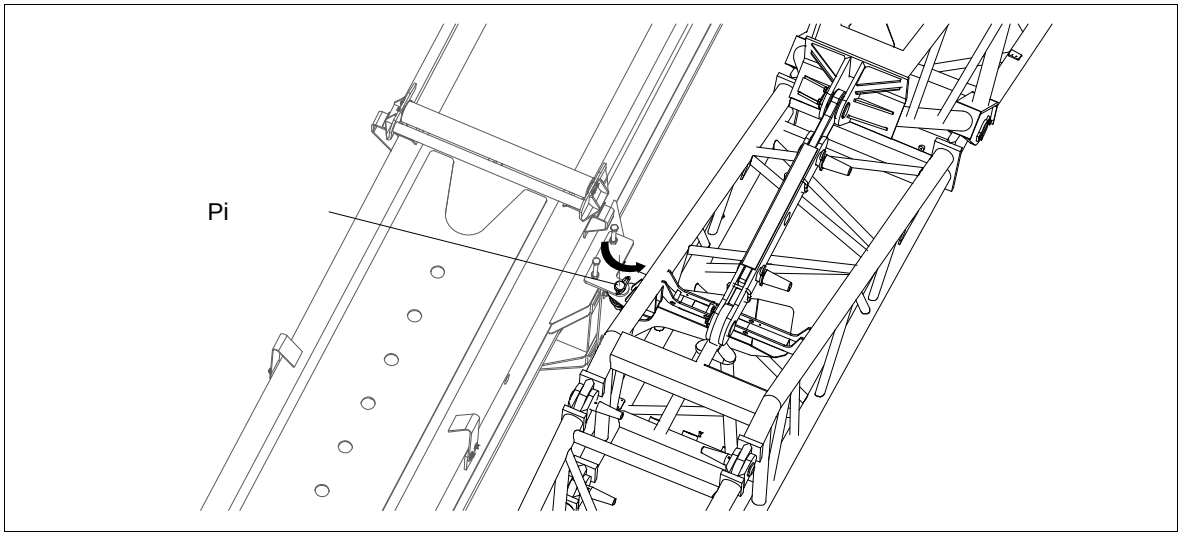


Figure 7-37 Move front of the jib away from the main boom

K. Align the end of the jib with the connection points on the end of the boom. Install pin V and the retaining clip. Refer to Figure 7-38.

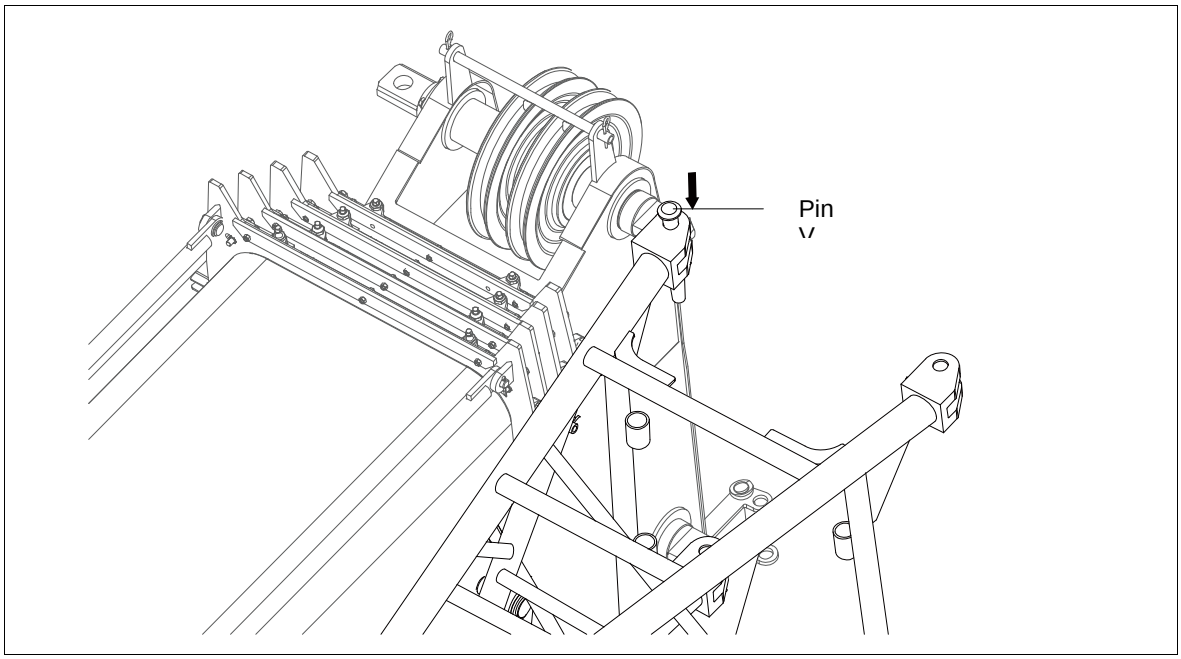


Figure 7-38 Pin V Installation

L. Remove the pin IV. Refer to Figure 7-39.

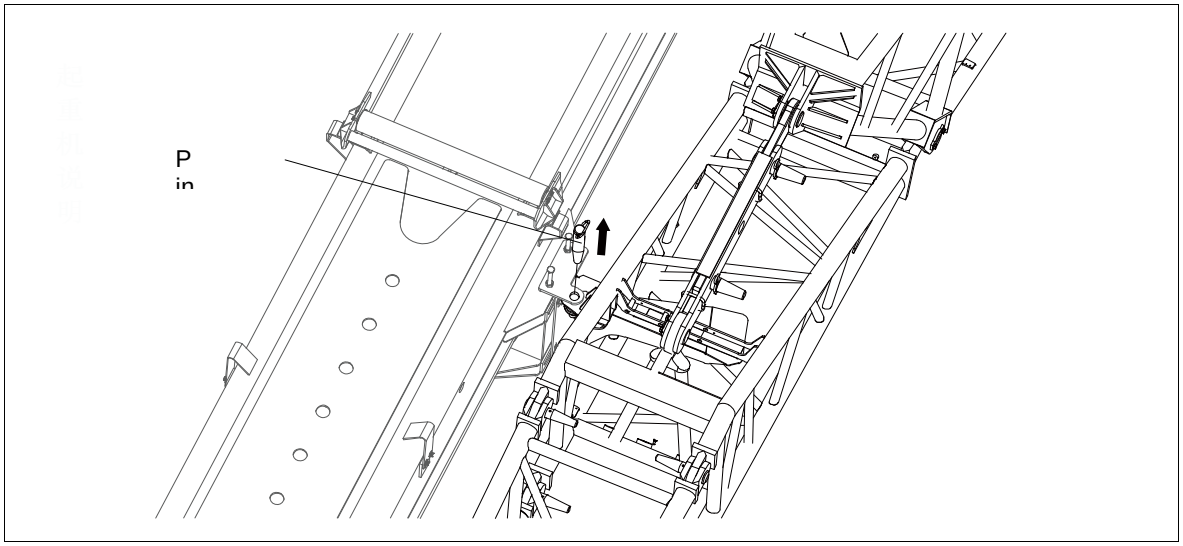


Figure 7-39 Pin IV removal

M. Move the jib (pivots on pin V) to the front of the main boom. Refer to Figure 7-40.

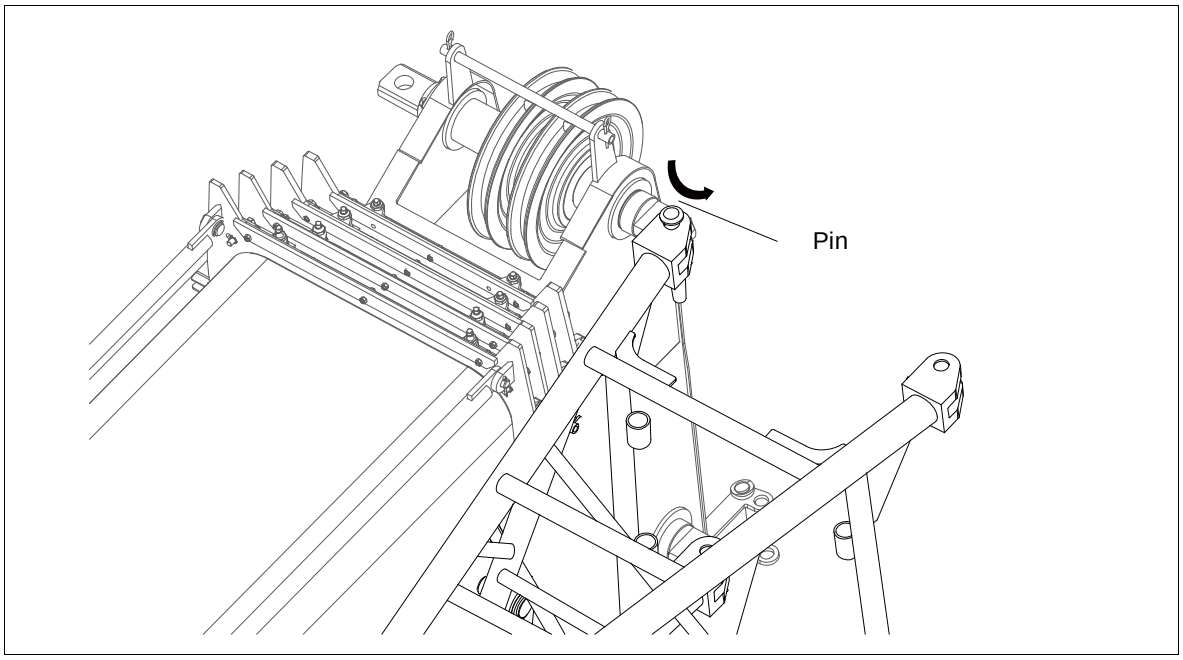


Figure 7-40 Move the jib

N. Align the end of the jib with connection points on the main boom. Install the pin VI and the retaining clip. Refer to Figure 7-41.

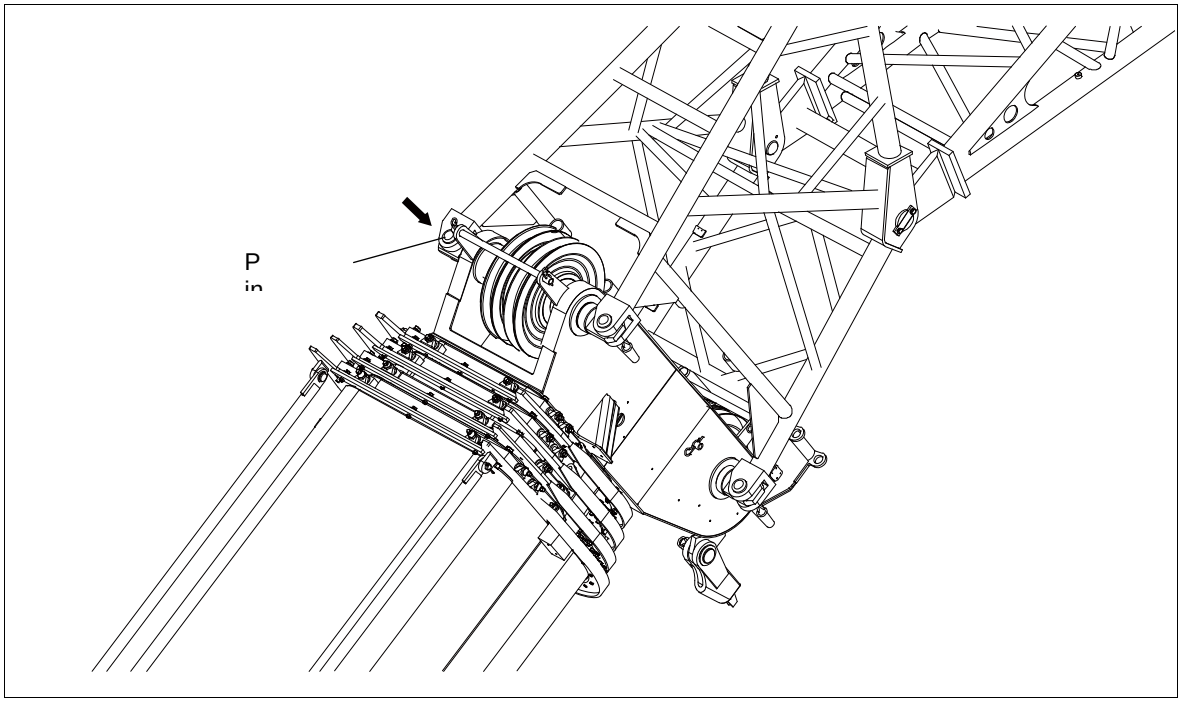


Figure 7-41 Pin VI installation

O. Use the jib section 2. Remove the Pin VII connecting the jib sections 1 and 2 and the retaining clip. Refer to Figure 7-42.

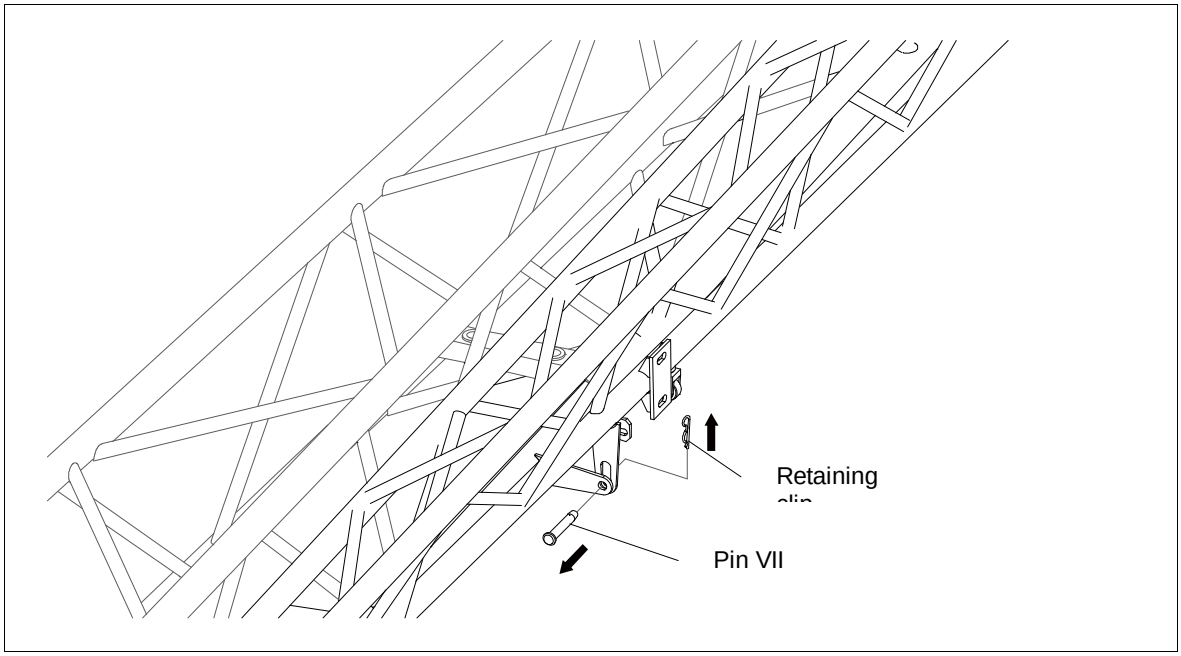


Figure 7-42 Pin VII removal

P. Move the jib section II (pivots on pin VIII) to the front of the jib section 1. Refer to Figure 7-43.

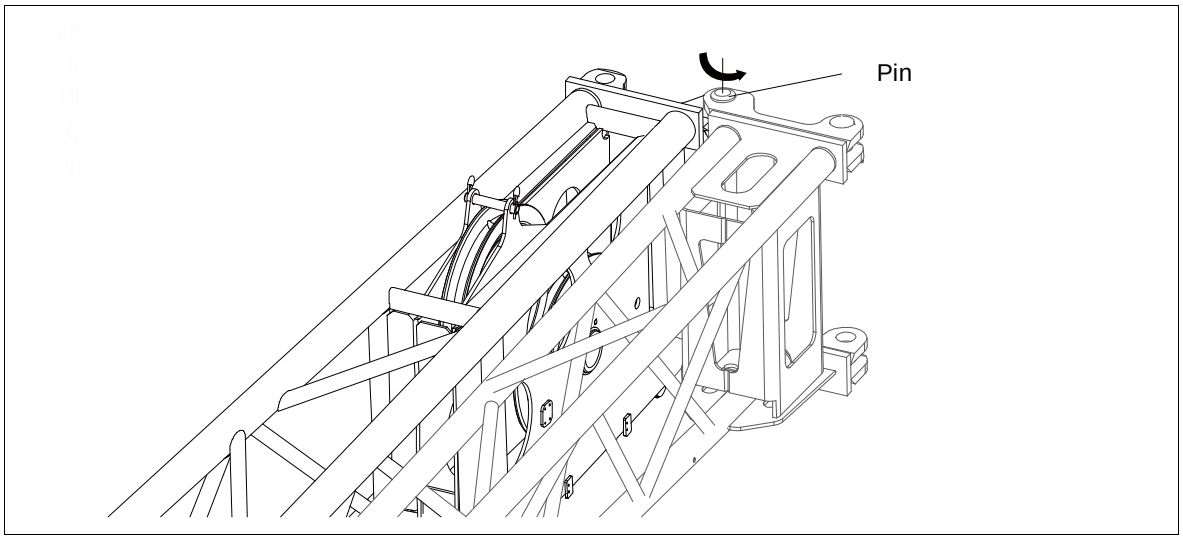


Figure 7-43 Move the jib section 2

Q. Align the end of the jib section 2 with connection points on the jib section 1. Install the pin IX and the retaining clip. Refer to Figure 7-44.

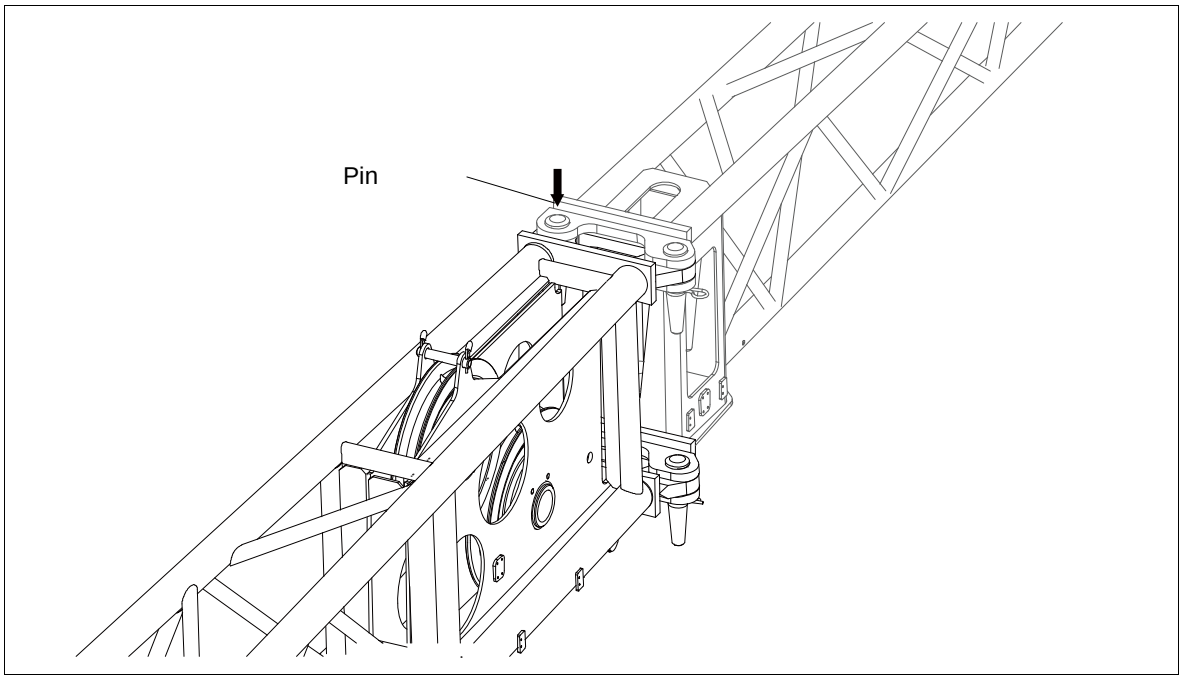


Figure 7-44 Pin IX installation

R. Reeve the wire rope from the auxiliary winch through the end of the jib. Install the auxiliary hook and the hoisting limit switch.

DANGER

Do not stand under the jib during the swing operation!

The jib and other components – due to an assembly error – can fall down and cause fatal injuries.

7.17.2 CHANGE THE JIB OFFSET FROM 0° TO 30°

A. Fully retract the boom.
B. Make sure that the outriggers are fully extended.
C. Derrick the boom to 0° position.
D. Reeve the hoist wire-rope through the jib sheave.
E. Pull out the auxiliary hoist rope for 2 m to 3 m at low speed.
F. Remove the pins and retaining clips from the pull bracket of adapter at jib end.
G. Derrick the boom up slowly until the long groove of the pull bracket aligns with the pin bores for 30°.
H. Put the pins and retaining clips at the point for the required offset position.
I. Refer to Figure 7-45.

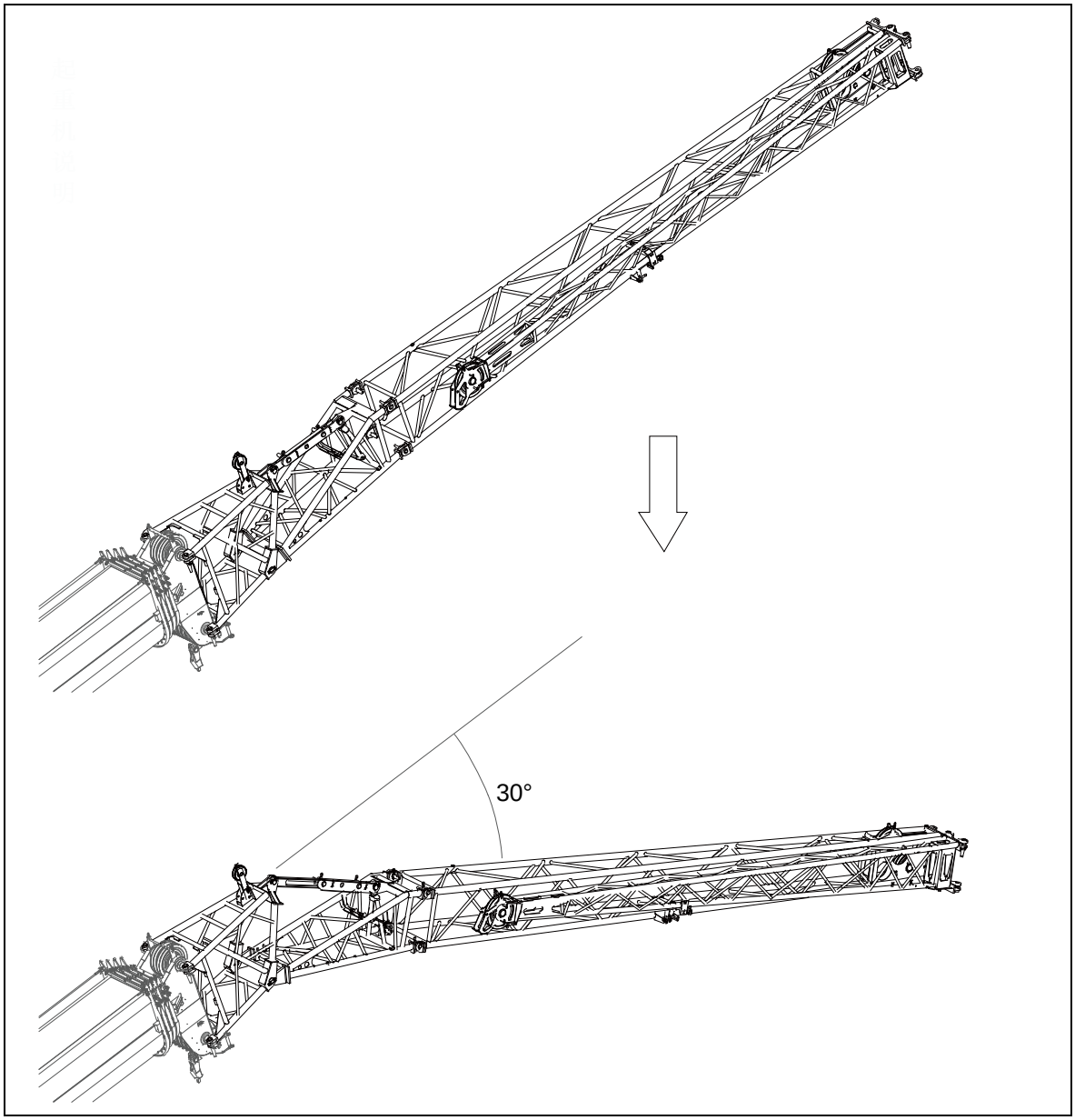


Figure 7-45 Offset positions

7.17.3 Dismantling

After you complete the jib operation, dismantle the jib in reverse order of the assemble steps.

CAUTION

- **Make sure that the area is clear of personnel and equipment before you move the jib around. Refer to Figure 7-46.**

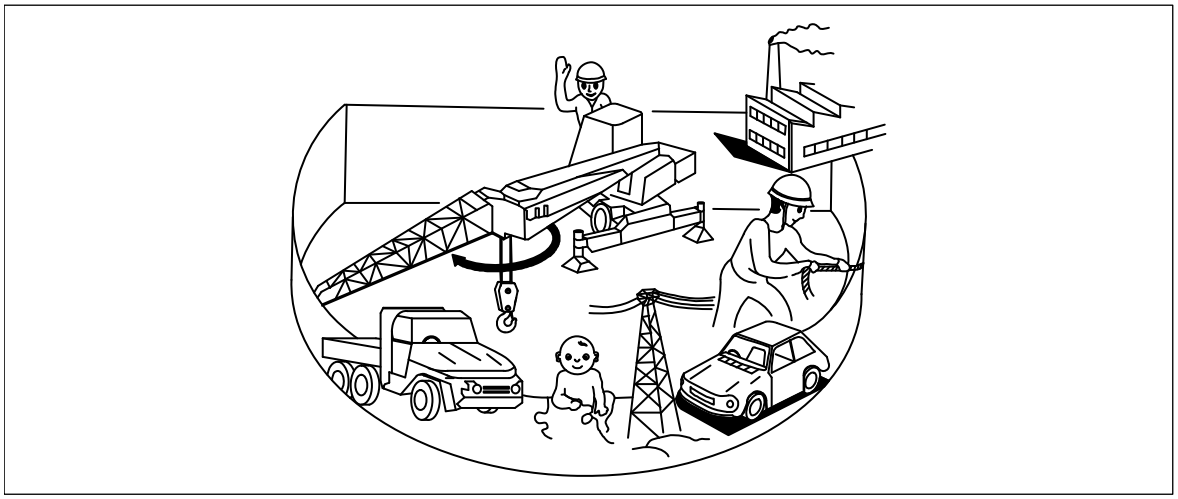


Figure 7-46 Hazard Area – Jib Swing

- **Fully extend the outriggers and move the jib to the front of the crane before you assemble or disassemble the jib.**
- **When you install the jib to the side of the boom, you must install all the pins. Do not operate or move the crane until all the jib pins are in position.**
- **When you use the jib in a lift operation, put the High / Low Speed Select Switch for Auxiliary winch in the high or low position.**
- **Fully retract the boom. Move the jib to the front of the crane and set the boom to the -3° position. You must use the correct work stands (ladders, stairs, etc.) when you assemble or disassemble the jib. Refer to Figure 7-47.**

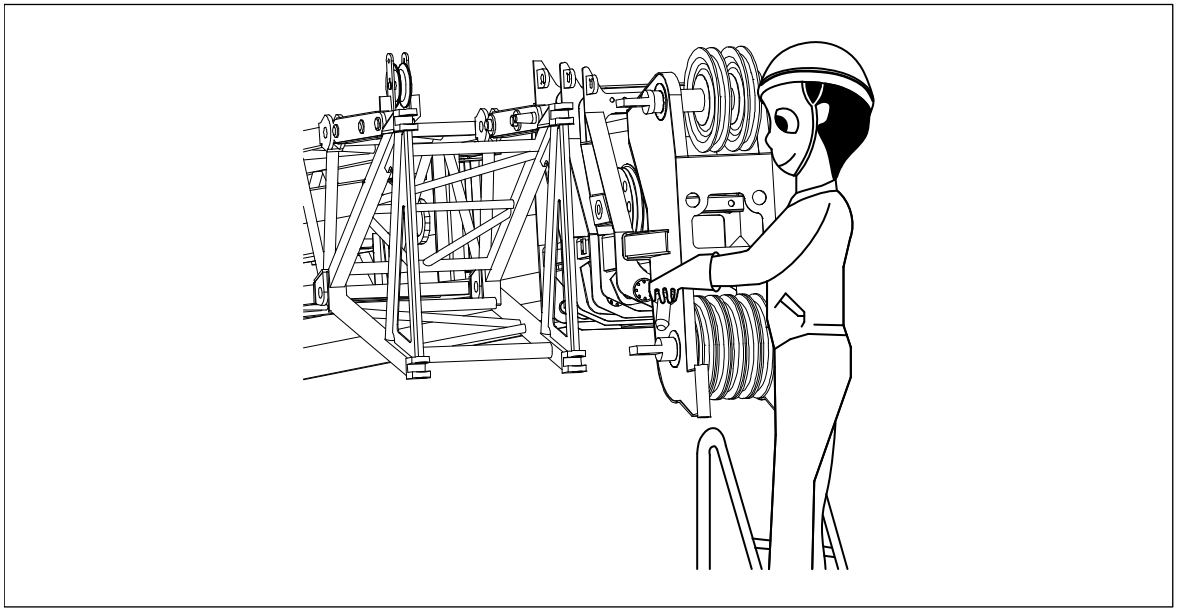


Figure 7-47 Use a Stand

- **When you remove the jib, carefully attach it to the side of the boom.**

- **When you remove the auxiliary hook and put it in the stow position, obey the hand signals from the signal personnel. Refer to Figure 7-48.**

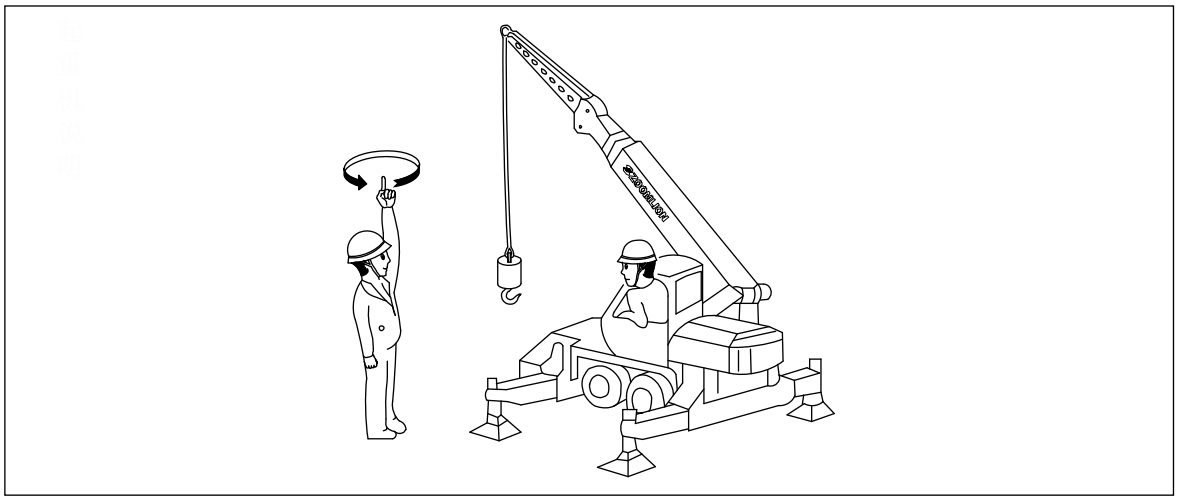


Figure 7-48 Signal Personnel

7.18 ROOSTER SHEAVE

A. The components of the rooster sheave are as follows:
   - Bracket
   - Sheave Spindle
   - Sheave
   - Pins.

B. When it is not necessary to use the rooster sheave, make sure that it is attached to the side of the boom. Refer to Figure 7-49.

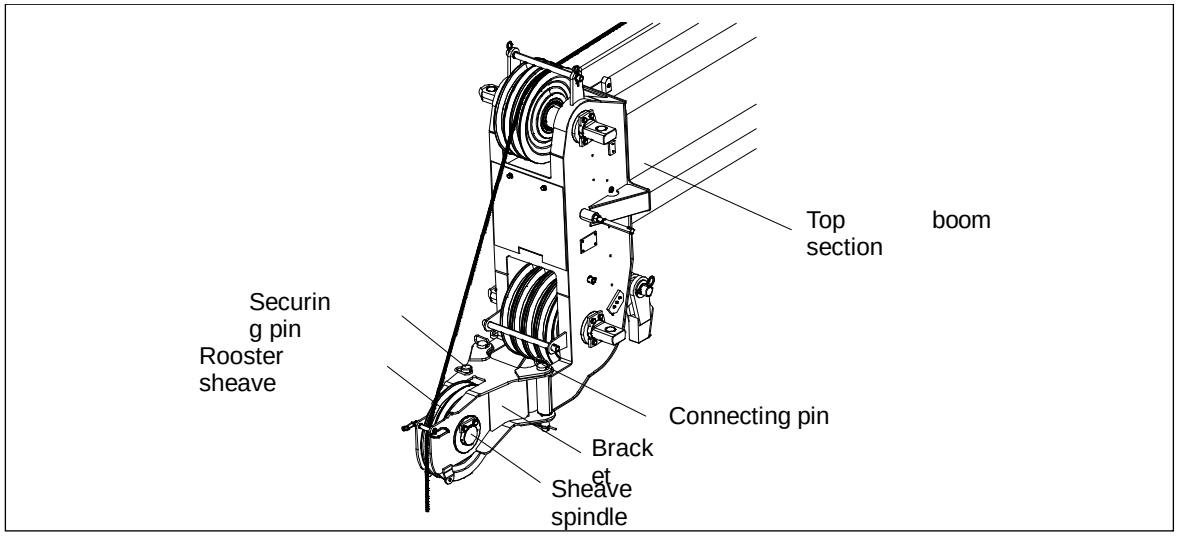


Figure 7-49 Rooster Sheave

C. When the crane is to lift a light load (≤ 5.5 T), use the rooster sheave. It is the most efficient procedure to move a lighter load.

7.18.1 ASSEMBLY

A. Fully retract the boom.

B. Move the boom over rear and over side and set the boom to the -3° position.

C. Remove the securing pin and move the bracket to the front of the boom. Align the connection points. Install the connecting pin.

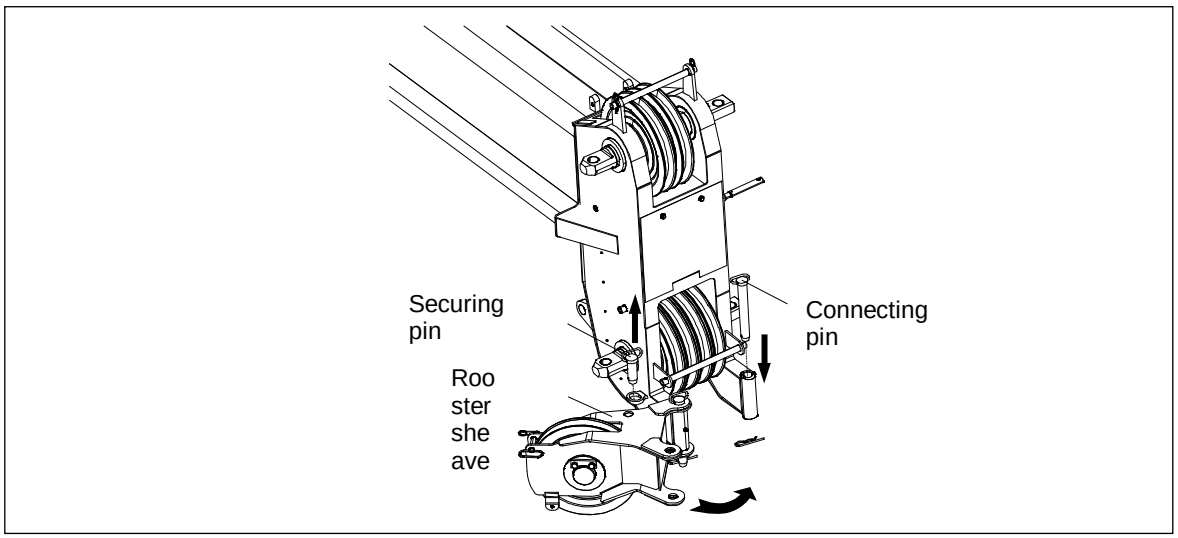


Figure 7-49 Rooster Sheave Assembly

D. Reeve the auxiliary wire-rope through the rooster sheave. Install the auxiliary hook and the anti-two block switch. Make sure that all connections are tight.

7.18.2 DISASSEMBLY

When it is not necessary to use the rooster sheave, make sure that it is attached to the side of the boom. Disassemble it in the reverse order of the assembly procedure.

CAUTION

- **When it is not necessary to use the jib, make sure that it is attached to the side of the boom. You cannot use rooster sheave when the jib is attached to the front of the boom. Refer to Figure 7-50.**

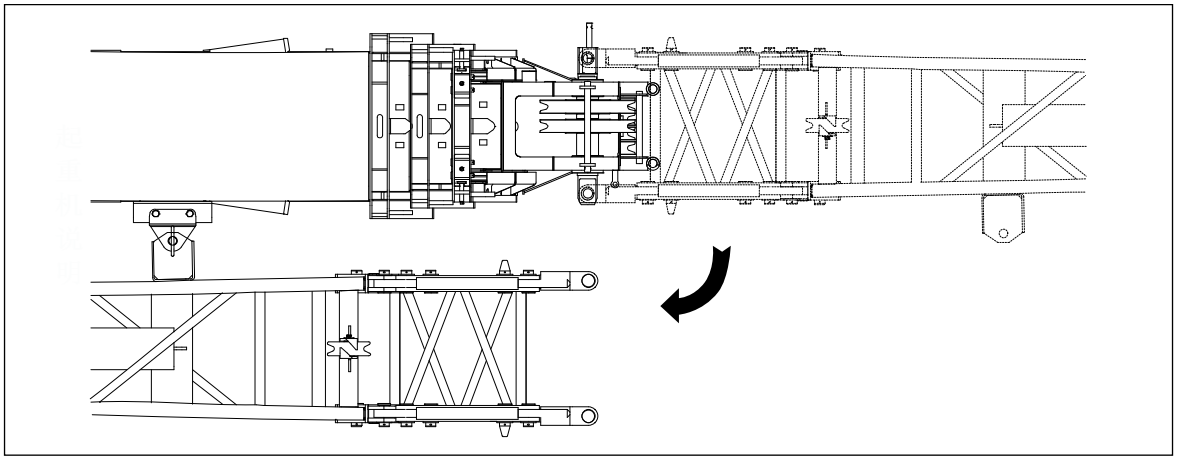


Figure 7-50 Attach the Jib to the Side of the Boom

- **When you remove the auxiliary hook and put it in the stow position, obey the hand signals from the signal personnel. Refer to Figure 7-51.**

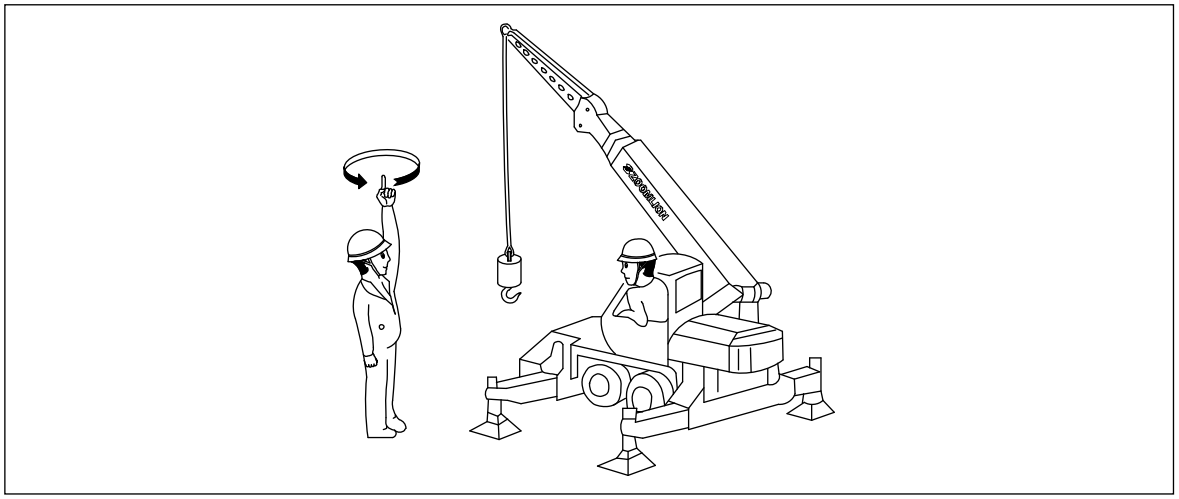


Figure 7-51 Hand Signal – Stow Position

7.19 VEHICULAR OPERATION

A. The Rough Terrain Crane can move off-road and a short distance of on-road travel.

B. Before you move the crane, think about the distance and type of terrain that you must move on. Plan your moves carefully to prevent all dangerous conditions.

C. Pre-Move Checklist

Before you move the crane to and from the job-site, make sure that you do the safety items that follow:

Set the park brake. Always put chocks before and behind the wheels when you park on a slope.

(1) Engage the swing lock.

(2) Attach the main hook block to the front of the crane.

Do not move the load hook when it is near the head of the boom. You can cause damage to the boom head, rooster sheave and anti-two block switch.

(3) Make sure that the outriggers are fully retracted and the retaining pins are installed.

(4) When you move the crane more than 2 mi. (3.22 km), make sure that the main pump and PTO are disengaged.

(5) If necessary, put the transmission into the high-speed range, 2-wheel drive mode.

(6) Make sure that tire pressure is correct.

(7) Before you move the crane, adjust the seat and mirrors.

(8) Make sure that the transmission oil pressure (250 psi to 300 psi (17.2 bar to 20.7 bar)) and oil temperature (180°F to 199.4°F (82.2°C to 93.3°C)) are in the correct range when the engine is running at idle speed.

Do not move the crane if the transmission oil pressure is less than 240 psi (16.5 bar). You can cause damage to the transmission.

7.19.1 MOVE THE CRANE TO A JOB-SITE

A. Do the items that follow before you move the crane:

(1) Start the engine.

(2) Idle the engine for at least 5 minutes.

(3) Engage the swing lock.

(4) Apply the service brake.

(5) Release the park brake.

(6) Move the gear selector to the "F1" position.

Note:

Make sure that you use the correct transmission gear when you move on rough terrain.

B. The crane operates in the off-road conditions. If necessary, you can move the crane on general roadways. Under this condition, you must obey the traffic regulations set by the government for heavy-duty equipment driving on the public roads. The crane must hold the items that follow:

- Lights
- Flares
- Flags
- Safety equipment.

When you move the crane on hard surfaces, shift the transmission to high-speed range (2-wheel drive). If not, the crane can be damaged.

When you move the crane, make sure that you are in the correct gear for the type of travel. When you use the incorrect gear, you put too much load on the crane. The transmission oil temperature must be between 180°F and 199.4°F (82.2°C and 93.3°C).

When the oil temperature is more than 250.3°F (121.1°C), stop the crane immediately. To decrease the temperature: move the gear selector to the "N" position. Operate the engine at an RPM range between 1000 r/min. to 1200 r/min. In this way, the oil temperature will decrease in a short interval of time immediately. If it does not, you must examine the crane for different malfunctions. DO NOT stop the engine when the transmission oil temperature is too high.

CAUTION

Do not move the gear selector between forward and reverse when the crane is in motion.

C. Full power shifts, with a load, are permitted. Damage to the transmission or drive components is not likely to occur. When you move the crane at a high speed, do not move the gear selector to a lower gear. This can cause the transmission to go too fast and can cause damage to the drive train.

D. Obey the items in the table. Stop the crane when you are at one of the limits in the table.

Table 7-1 Limits

Running Interval	4 Hours	2 Hours
Cooling Time	1 Hour	30 Minutes

7.19.2 CHARGE THE BATTERY BEFORE YOU STOP THE ENGINE

Before you stop the engine, idle the engine for an interval of time. Stop the engine when the battery has a full charge.

7.19.3 STOPPING THE ENGINE

When it is necessary to stop the engine, operate the engine at idle speed (with no load on the engine), for minimum 5 minutes. This lets the engine coolant temperature decrease gradually before the engine stops. Move the ignition switch to the "OFF" position.

7.19.4 MOVE THE CRANE AT THE JOB-SITE

Before you move the crane on the job-site, make sure that there is clearance to prevent injury to personnel or damage to the crane and other objects. Obey the items that follow before you move the crane:

A. The boom must be in the front of the crane.
B. Engage the swing lock.
C. Secure the main hook to the bumper loop or put the hook block near the boom head sheaves.
D. Make sure that you fully retract the outriggers.
E. Do not move with the boom above horizontal unless the surface is hard, level and smooth.
F. Look for overhead blockages such as trees, power lines or bridges.
G. When the terrain is not smooth, move at a slow speed.
H. Do not side move the crane on a slope that is more than 15°.
I. Can be done within permissible angles with caution.
   (1) The engine and transmission lubricant in the tanks moves to one side. You can cause damage to the engine or transmission.
   (2) You can tip over.

You can side move the crane on hard surfaces with a slope less than 15%. When on rough terrain surfaces, the slope angle must not be more than 5%. The boom must be in the front, at 0° to -3°.

7.20 ON TIRES LIFTS (CREEPING A LOAD)

Special precautions for On Tires lifts when moving a load.

A. The boom must be in the forward position.
B. Move the load at a slow speed (≤ 1.6 km/h).
C. Make sure that the tire pressure is at the correct level.
D. Do not make sudden stops or starts.
E. Use tag lines. Do not let the load move around.
F. Keep the load near the ground.
G. Engage the swing lock.
H. You must only move the crane on a hard surface. It must hold the weight of the crane and the load. The travel surface must also be free of holes or unwanted material that can cause the crane to tilt.

Note:

These precautions are necessary to prevent the pendulum effect. This can cause the

crane to tilt.

CAUTION

- **Obey all the safety precautions. Do not move a load in the "ON TIRE" mode if the pressure in the tires is not correct. When the pressure in the tires is low, you must decrease the load. You can cause damage to the tires and wheels, or tilt the crane, if you try to lift a load that is too heavy.**
- **Hydraulic oil temperatures that are too high cause rubber components (hose, O-rings, etc.) to fail. If the temperature of hydraulic oil in the tank increases to 176°F (80°C), decrease the time of the lift. Decrease or stop the operation to prevent a rise in the hydraulic oil temperature.**
- **When you move a load in the "Creep" mode, the maximum speed is 1 mph (1.6 km/h). Stop 30 minutes after you move 60 ft. (18 m) to prevent over-heating the tires.**

7.21 UNUSUAL OPERATING CONDITIONS

You must use caution when you operate in the conditions that follow:

A. Extreme Cold
B. Extreme Heat
C. High Humidity and Saltwater
D. High Altitudes
E. Storms.

7.21.1 EXTREME COLD

A. If you operate in very cold areas, lubrication and battery malfunctions are usual. Make sure that the crane is winterized by the service facility.
B. Before you operate the crane, you should use fluid and oil of recommended brand, type and quantity.
C. Keep the battery fully charged. Keep the battery in the building, if necessary.
D. Drain the water from the cooling system.

CAUTION

Do not engage the PTO until the hydraulic oil is warm. If the oil is too cold it does not flow correctly.

E. You must know that the hydraulic oil becomes thick when you operate in very cold weather. If you operate the crane and the hydraulic oil does not flow correctly, you can damage the system. When the oil is warm, you can slowly move parts of the crane to help increase the temperature of the oil. Do not try to operate the cylinders quickly.
F. At the end of the work period, park the crane in an area (wood, concrete, asphalt, or mat) where it cannot freeze to the ground.

7.21.2 EXTREME HEAT

When you operate in an area that is too hot, examine the indicators and gauges frequently. Follow these precautions:

A. Examine the engine oil frequently. If the engine is too low on the oil level, the engine cannot cool correctly. If it is necessary to add oil to the engine, make sure that you add the correct type of oil.
B. Make sure that the engine coolant is at the correct level. Do not try to add water in the coolant if the engine is hot. Do not add salt water to the coolant system.
C. If the engine becomes too hot because of coolant loss, slowly add coolant while the engine operates at fast idle.
D. Make sure that the air flowing around the engine and battery is not blocked.
E. Keep the engine clean. Dirt, grease and other materials can prevent the heat dissipation.
F. Use sound judgment in operating the engine. Avoid the two extremes of racing and lugging.
G. Do not operate the crane at a high level if it is not necessary.
H. Do not operate the crane engine too slowly. The engine fan speed cannot be too slow.

7.21.3 SANDY OR DUSTY JOB-SITES

You must keep the air filter clean at all times. A large quantity of sand and/or dust at the job-site can increase wear on the components. Make sure that the lubrication schedule increases to a more frequent interval.

A. Make sure that all filler caps (fuel, oil, coolant, hydraulic oil) are in position and tight.
B. When you lubricate the crane fittings, make sure that you clean all the fittings. Add a large quantity of grease to all points.
C. Make sure that the outrigger floats are on a stable surface.
D. Make sure that the scheduled servicing intervals are adjusted when the job-site conditions are not usual.

7.21.4 HIGH HUMIDITY OR SALTWATER

When you operate the crane near the coast, salt and moisture can change the operation of the crane. Follow these precautions:

A. Examine all metal surfaces for corrosion. Remove the moisture when you can. Make sure that all exposed areas are lubricated and/or painted.
B. Make sure that the bearing and bearing surfaces are lubricated.
C. Make sure that you clean and lubricate the wire-rope.

7.21.5 HIGH ALTITUDES

When you operate the crane in a high altitude, the mixture of fuel-air can change. There is a decrease in the oxygen for the engine to burn.

A. Examine the air filter frequently. Make sure that the air to the filter is not blocked.
B. Examine the engine temperature gauge frequently. Make sure that the engine cannot get too hot.

7.21.6 STORMS

If there is a bad weather condition, do the items that follow:

A. Set the load on the ground and fully retract the boom.
B. Stop the crane and go into a shelter if conditions are dangerous because of lightning.
C. If lightning hits the crane, make sure that it is safe to operate before you try to start it.
D. Always be aware for a quick change in the weather.

ZOOMLION

Rough Terrain Crane Operator'S Manual

Chapter 8 Transportation and storage

CHAPTER 8 TRANSPORTATION AND STORAGE

8.1 TRANSPORTATION

Transport the Crane

A. Train or Ship

(1) You can move the crane by its power for a short distance or by other carriers for a long distance (train or ship). If you move the crane, chock the wheels and make the crane safe with wire-rope. Fully close the windows and door to keep rain and moisture out of the cab. Lock the door and windows. Follow the protection procedures to prevent corrosion and rust if you move the crane by sea.

(2) The positions to lift the crane are in the Figure 8-1. Follow applicable rules while you lift.

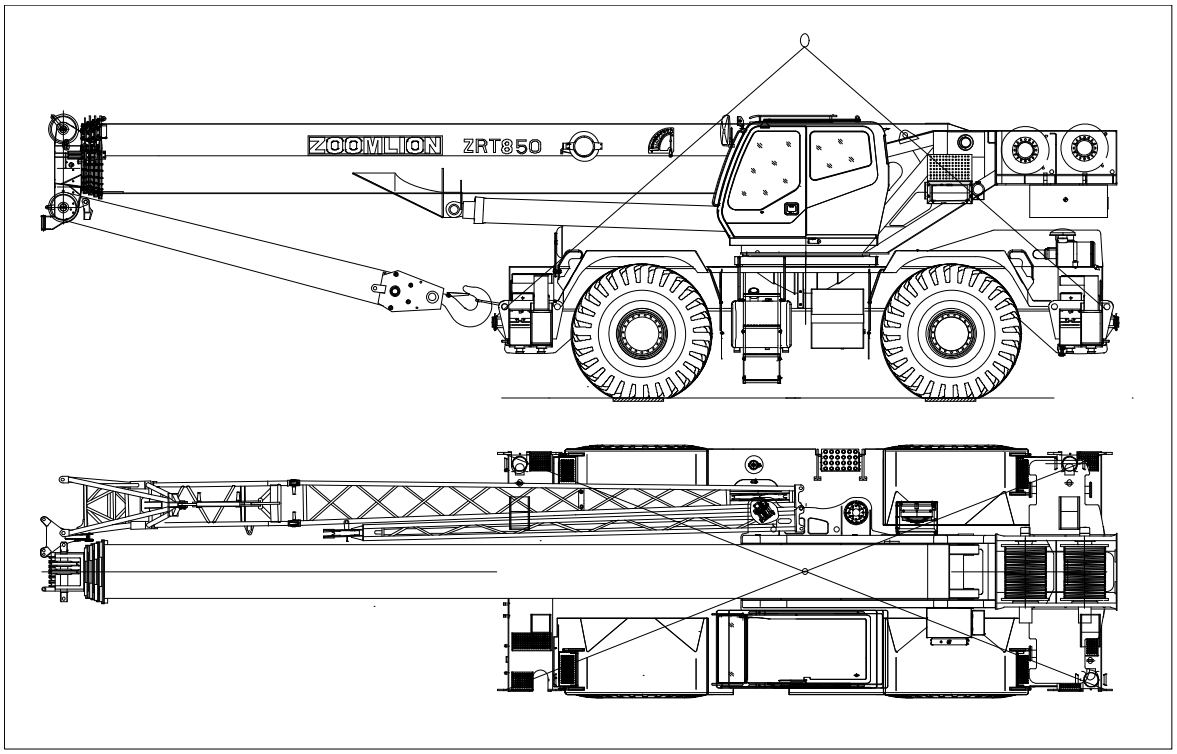


Figure 8-1 Crane Lift Points

WARNING

Before you lift, make sure that the sling has sufficient strength to hold the crane.

B. Trailer

You can move the crane on a trailer for long distances.

CAUTION

Before you operate the crane, read the manuals that come with the crane. Read and follow all general safety rules.

1) Prepare Trailer.
   Make sure that ramps are in position and the path of travel is clear while you load.
2) Pre-Start Inspection.
   Refer to the *Operator's Manual* for a Pre-Start Inspection procedure.
3) Pre-Move Checklist.
   Refer to the *Operator's Manual* for a Pre-Move Inspection procedure.
4) Load the Crane.
   (a) Use the reverse gear if you back the equipment onto the trailer. Use the forward gear if you move forward onto the trailer.
   (b) If the crane has a 4-wheel drive mode, use the low range to engage it.
   (c) To move the crane onto the trailer, apply the service brake and then set the parking brake switch to OFF. Move the gear selector to the "F1" position. Slowly release the service brake. Use the throttle pedal to increase speed. When you move up the ramp, keep the speed of the crane slow. Use the steering-wheel to control the direction of the front tires. Push the service brake to stop.
   (d) When the crane is in position, move the front tires to the middle position. Move the gear selector to the neutral position. Apply the parking brake and release the service brake. Turn the engine to OFF.
5) Secure the Crane.
   To prevent the crane from movements, make sure that the tires are chocked and attach the chains.
6) Unload the Crane.
   To unload the crane, do the "Load the Crane" task in the opposite sequence.

8.2 STORAGE

Do the steps that follow if you do not use the crane for more than 6 months:

A. Clean contamination off the crane.

B. Fully retract all the cylinder pistons.

C. Fully extend the outriggers to lift the tires away from the ground. Inflate the tires to specified pressure and put wooden wedges below the tires.

The wooden wedges cannot touch the tires.

D. Remove the battery and keep it in a dry location with good airflow. Charge it (once every half month) and discharge it (every three months) in regular intervals.

E. Fill the fuel tank with oil.

F. Fill the coolant tank.

G. You must lubricate the surfaces of all the exposed metal components to prevent corrosion.

H. Remove all contamination (dust and sand) from the wire-ropes and lubricate them with ZG-3 (a calcium based graphite grease).

I. Keep the crane in a garage. If not, put a water-proof cloth on it to prevent corrosion. In rainy season areas, examine the crane frequently to prevent corrosion. Protect the crane from very cold weather conditions.

J. Operate the engine for 15 to 30 minutes each month. Examine the mechanisms at idle speed to make sure that they operate correctly.

K. Make sure that one person keeps the crane prepared for operation.

L. If you do not operate the crane for more than three months:
Operate the engine at idle speed for one hour in the three month interval.

M. If you do not operate the crane for more than 18 months:

- Keep the crane clean and do the usual maintenance.
- Replace aged seal components.
- Do a general inspection of the engine to see if you must replace the coolant, diesel oil, and air filters.

ZOOMLION

Rough Terrain Crane Operator'S Manual

Chapter 9 Specifications

CHAPTER 9 SPECIFICATIONS

9.1 CONVERSION TABLES

Table 9-1 Decimal and Metric Equivalents of Fractions of an Inch

FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLIMETERS	FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLIMETERS
1/64	0.0156	0.397	33/64	0.5156	13.097
1/32	0.0313	0.794	17/32	0.5313	13.494
3/64	0.0469	1.191	35/64	0.5469	13.891
1/16	0.0625	1.588	9/16	0.5625	14.287
5/64	0.0781	1.985	37/64	0.5781	14.684
3/32	0.0938	2.381	19/32	0.5938	15.081
7/64	0.1094	2.778	39/64	0.6094	15.478
1/8	0.1250	3.175	5/8	0.6250	15.875
9/64	0.0406	3.572	41/64	0.6406	16.272
5/32	0.1563	3.969	21/32	0.6563	16.688
11/64	0.1719	4.366	43/64	0.6719	17.085
3/16	0.1875	4.762	11/16	0.6875	17.462
13/64	0.2031	5.159	45/64	0.7031	17.859
7/32	0.2188	5.556	23/32	0.7188	18.256
15/64	0.2344	5.953	47/64	0.7344	18.653
1/4	0.2500	6.350	3/4	0.7500	19.050
17/64	0.2656	6.747	49/64	0.7656	19.447
9/32	0.2813	7.144	25/32	0.7813	19.843
19/64	0.2969	7.541	51/64	0.7969	20.240
5/16	0.3135	7.937	13/16	0.8125	20.637
21/64	0.3281	8.334	53/64	0.8281	21.034
11/32	0.3438	8.731	27/32	0.8438	21/430
23/64	0.3594	9.128	55/64	0.8594	21/827
3/8	0.3750	9.525	7/8	0.8750	22.224

Table 9-1 Decimal and Metric Equivalents of Fractions of an Inch (Continued)

FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLIMETERS	FRACTIONS OF AN INCH	DECIMALS OF AN INCH	MILLIMETERS
25/64	0.3906	9.922	57/64	0.8906	22.621
13/32	0.4063	10.319	29/32	0.9063	23.018
27/64	0.4219	10.716	59/64	0.9219	23.415
7/16	0.4375	11.12	15/16	0.9375	23.812
29/64	0.4531	11.509	61/64	0.9531	24.209
15/32	0.4688	11.906	31/32	0.9688	24.606
31/64	0.4844	12.303	63/64	0.9844	25.003
1/2	0.5000	12.700	1	1.0000	25.400

Table 9-2 Metric Conversions

LIQUID MEASURE		
4 gills	equals	1 pint
2 pints	equals	1 quart
4 quarts	equals	1 gallon
7.48 gallons	equals	1 cu. ft.
240 gallons of water	equals	1 ton
340 gallons of gasoline	equals	1 ton
1 litre	equals	0.353 cu. ft.
1 litre	equals	0.2642 gallon
1 litre	equals	61.023 cu. inch
1 litre	equals	2.202 lbs. of water (62°F)
1 cu. ft.	equals	28.32 litres
1 gallon	equals	3.785 litres
1 cu. inch	equals	0.0164 litre

Table 9-2 Metric Conversions (Continued)

MEASURES OF WEIGHTS		
16 ounces	equals	1 pound
2000 pounds	equals	1 short ton
2240 pounds	equals	1 long ton
100 cu. ft.	equals	1 register ton
40 cu. ft.	equals	1 U. S. shipping ton
1 gram	equals	0.0353 ounce
1 kilogram	equals	2.205 lbs.
1 ounce	equals	28.35 grams
1 pound	equals	0.454 kilogram
1 ton	equals	0.907 metric ton
CIRCULAR MEASURE		
60 seconds	equals	1 minute
60 minutes	equals	1 degree
90 degrees	equals	1 quadrant
360 degrees	equals	circumference
ELECTRICAL UNITS		
1 kilowatt	equals	1.34 horsepower
1 horsepower	equals	746 watts
SURVEYOR'S MEASURE		
7.92 inches	equals	1 link
100 links	equals	66 feet or 4 rods or 1 chain
80 chains	equals	1 mile

9.2 AVERAGE WEIGHT OF MATERIALS

Table 9-3 Average Weight of Materials

(Kilogram per Cubic Meter)

METALS, ALLOYS, ORES			
Aluminum, cast-hammered	2675.31	Manganese	7701.65
Brass, cast-rolled	8658.276	Mercury	13733.258
Bronze	8252.926	Nickel	8706.918
Copper, cast-rolled	9014.984	Steel	7798.934 – 7928.646
Gold, cast-hammered	19537.87	Tin, cast-hammered	7442.226
Iron, gray-cast	7166.588	Tungsten	19456.8
Iron slag	2788.808	Zinc, cast-rolled	7134.1
Lead	11511.94		
EARTH			
Clay, dry	1021.482	Earth, mud flowing	1751.112
Clay, damp, plastic	1783.54	Earth, mud packed	1864.61
Clay & gravel, dry	1621.4	Riprap, limestone, sandstone & shale	1297.12 – 1702.47
Earth, dry loose	1232.264	Sand, gravel, dry loose	1459.26 – 1702.47
Earth, dry packed	1540.3395	Sand, gravel, dry packed	1621.4 – 1945.68
Earth, moist loose	1264.692	Sand, gravel, wet	2042.964
Earth, moist packed	1556.544		

Table 9-3 Average Weight of Materials (Continued)

(Kilogram per Cubic Meter)

MASONRY			
Ashlar masonry*	2318.602 – 2626.668	Concrete masonry	1621.4 – 2075.392
Rubble masonry*	2221.318 – 2529.384	Portland cement	3177.944
Dry rubble masonry*	1783.54 – 2107.82	Portland cement, loose	1524.116
Granite, Syenite, Gneiss, Limestone, Sandstone, Bluestone Brick Masonry	1670.042 – 2075.392	Lime, gypsum, loose	859.342 – 1037.696
Brick Masonry	1670.042 – 2075.392	Mortar, lime, set	1670.042
WOOD			
Cedar	356.708	Pine, southern	616.132 – 680.988
Fir, Douglas	518.848	Spruce	453.992
Oak	680.988 – 875.556	Black walnut	599.918
Pine, Oregon	518.848		
EXCAVATIONS IN WATER			
Sand or gravel	972.84	River mud	1459.26
Sand or gravel & clay	1053.91	Soil	1134.98
Clay	1297.12	Stone riprap	1053.91
STONE, QUARRIED, PILED			
Basalt, granite, gneiss	1556.544	Shale	1491.688
Limestone, marble, quartz	1540.33	Greenstone, hornblende	1734.898
Sandstone	1329.548		
MISCELLANEOUS			
Water, 4°C	1011.7536	Petroleum	729.63 – 875.556
Water, 100°C	969.5972	Coal, anthracite	762.058 – 875.556
Paper	940.412	Coal, bituminous	648.56 – 875.556
Glass, common	2626.668	Coal, coke	372.922 – 518.848

9.3 TORQUE VALUES

Table 9-4 Torque Values for Dry & Uncoated Fasteners (All Figures in N·m)

NOMINAL DIAMETER (MM)	GRADE 5.6	GRADE 8.8	GRADE 10.9	GRADE 12.9
6	5.1 – 7.0	9.1 – 12.0	13.1 – 16.0	16.1 – 21
8	10.5 – 12.3	26.2 – 30.0	36.9 – 42.2	44.3 – 50.6
10	25.0 – 32.0	45.0 – 59.0	65.0 – 78.0	75.0 – 100.0
12	36.4 – 42.4	90.6 – 103.5	127.3 – 145.5	152.8 – 174.6
16	58.2 – 67.8	224.5 – 256.6	315.7 – 360.8	378.8 – 432.9
20	176.2 – 205.5	438.5 – 501.1	616.6 – 704.7	739.9 – 845.6
24	304.4 – 355.1	757.6 – 865.8	1065.4 – 1217.3	1278.5 – 1461.1
30	605.1 – 706.0	1506.1 – 1721.3	2118.0 – 2420.5	2541.6 – 2904.6
36	1057.9 – 1234.3	2633.1 – 3009.3	3702.8 – 4231.8	4443.4 – 5078.1
42	1694.0 – 1976.3	4216.1 – 4818.4	5928.9 – 6775.9	7114.7 – 8131.0
48	2544.3 – 2968.3	6332.4 – 7237.0	8904.9 – 10177.1	10685.9 – 12212.5
56	4090.5 – 4772.2	10180.7 – 11635.1	14316.6 – 16361.9	17179.9 – 19634.2

Note:

This table does not apply to hydraulic connections.

The table includes the bolts with "coarse threads".

The torque tolerance is ± 5%.

The above values are suitable for the bolts lubricated. For the bolts without lubrication, the tightening torque is 133% of the corresponding one shown in the above table.

9.4 TECHNICAL SPECIFICATIONS

9.4.1 CRANE DESCRIPTION

A. ZRT850 rough terrain crane has the qualities below:
- Wide Tread
- Short Wheelbase
- Very Stable
- Small Turn Radius
- 360° Swing Movement.

B. It can do "On Tires" lifts in areas where there is a small area of space for movement and can pick-and-carry loads.

C. You can use the crane at the below locations to lift heavy items in short distances.
- Construction Sites
- Oil Fields
- Warehouses
- Freight Yards
- Logistics Bases.

D. ZRT850 rough terrain crane has the components below:
- Power System
- Drive System
- Suspension System
- Steering System
- Brake System
- Hoist Mechanism
- Derricking Mechanism
- Swing Mechanism
- Boom System
- Superstructure
- Chassis Frame
- Outriggers
- Hydraulic System
- Electrical System
- Cab.

E. Characteristics:

(1) Four steering modes: 2-wheel steer (front wheel), 2-wheel steer (rear wheel), 4-wheel steer and Crab steer

(2) Max. rated lift capacity: 85 t at 2.5 m (93.6 tn at 8.2 ft.) radius

(3) Max. lift height: 65.7 m (214.84 ft.)

(4) Max. travel speed: 36 km/h (22.37 mph)

(5) Overall dimensions: 14460 mm × 3400 mm × 3850 mm (47.28 ft. × 11.12 ft. ×12.59 ft.) (Refer to Figure 9-1.)

(6) Deadweight: 52 t (57.3 tn)

(7) Ability to pick-and-carry loads

(8) Rough terrain travel performance.

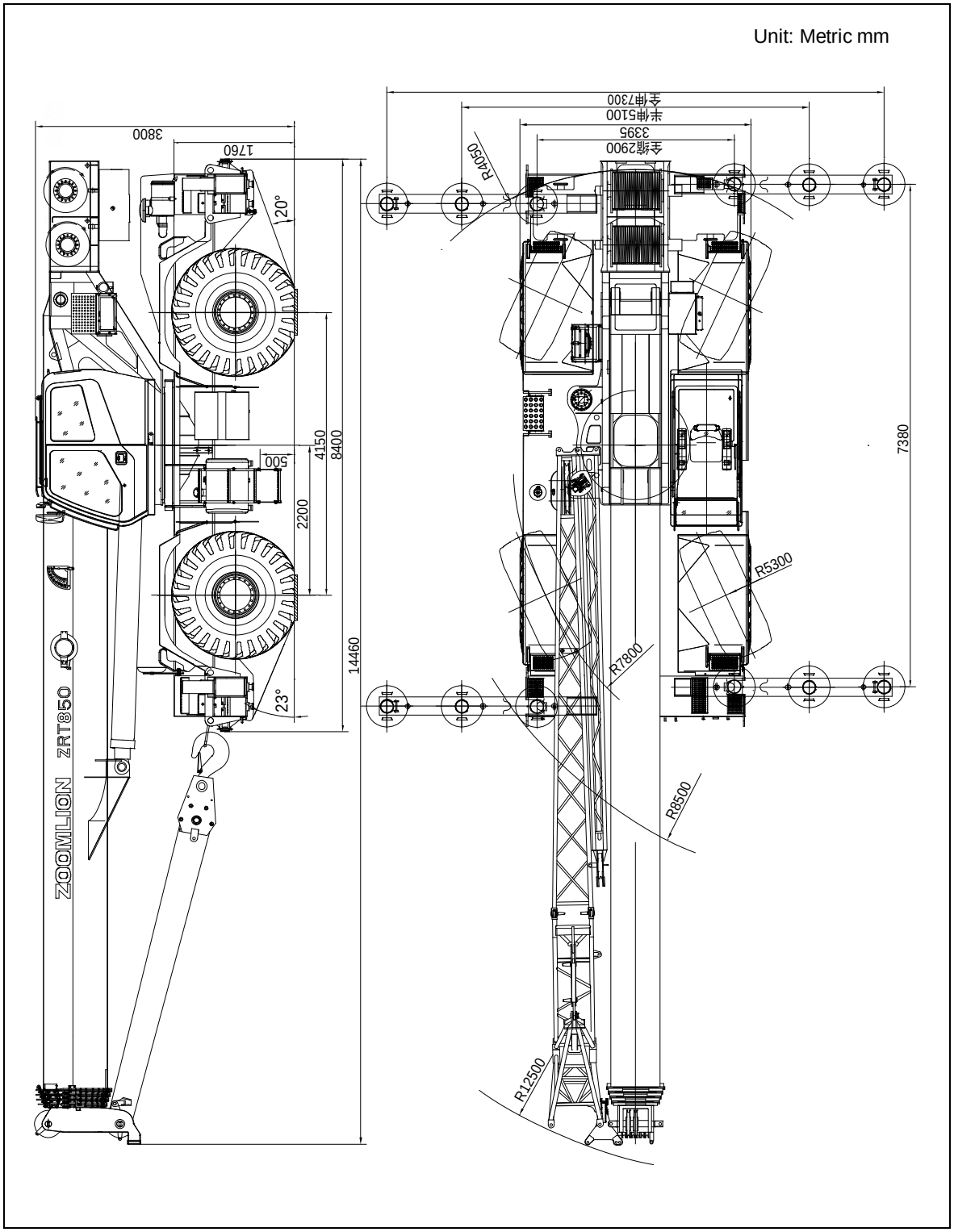


Figure 9-1 Overall View – ZRT850 Rough Terrain Crane

Table 9-5 Main Technical Data

TYPE	ITEM	UNIT	VALUE
Work performance	Max. rated lift capacity × work radius	lb.ft kg.m	165946 × 8.2 75000 × 2.5
	Max. load moment of basic boom	lbf.ft kN.m	1991510 2700
	Max. load moment of max. length main boom	lbf.ft kN.m	944123 1280
	Max. lift height of max. length main boom	ft m	163.38 49.8
	Max. lift height of jib	ft m	215.55 65.7
Dimensions	Overall dimensions (L × W × H)	in mm	569.3 × 133.9 × 151.6 14460 × 3400 × 3850
	Outrigger spread (L × W)	in mm	290.5 × 287.4 7380 × 7300
	Main boom length (Fully retracted – fully extended)	in mm	476.4 – 1850.3 12100 – 47000
	Jib lengths (Jib section 1, jib sections 1 + 2)	in mm	374.0 – 629.9 9500 – 16000
	Boom angle	°	-2 – 80
	Swing range		360° unlimited swing (Full range)
Work speeds	Max. hoist rope speed (Main winch)	ft/min m/min	427 130
	Boom extend time	s	120
	Boom retract time	s	130
	Boom derrick up time	s	46
	Boom derrick down time	s	105
	Swing speed	r/min	0 – 2
Hydraulic system	Rated work pressure	psi MPa	4568 31.5
	Rated work oil flow	gal./min L/min	74 280

TYPE	ITEM	UNIT	VALUE
	Hydraulic oil tank capacity	gal. L	264.2 1000
Mass	Complete vehicle mass	lbs kg	114640 52000
	Front axle load	lbs kg	59525 27000
	Rear axle load	lbs kg	55116 25000
Travel	Max. travel speed	mph km/h	22.3 36/36
	Wheelbase	in mm	163.4 4150
	Treads (Front / rear)	in mm	103.6 2632
	Max. gradeability	%	75

9.4.2 SPECIFICATIONS – UPPERSTRUCTURE

A. Main Boom and Extend / Retract Mechanism

(1) The main boom has 5 U-shaped boom sections (1 basic boom and 3 telescopic sections) made of high strength steel.

(2) The main boom head has 6 sheaves. You do not have to remove wedges when you change line parts. A rooster sheave can be mounted at the boom head.

(3) The boom sections extend / retract by two hydraulic cylinders and two sets of boom extension / retraction ropes. The cylinder has a balance valve.

Min. main boom length (with sections fully retracted): 12100 mm (39.7 ft.)
Max. main boom length (with sections fully extended): 47000 mm (154.2 ft.)
Extend time: 0 – 120 seconds

B. Jib

(1) The crane has a 2-section jib. Section 1 is a quadrilateral lattice structure and section 2 is a triangle lattice structure.

(2) The jib section 2 is secured into jib section 1, and the whole jib is secured onto the right side of main boom via moveable pins during traveling. Meanwhile, the jib section 2 can also be secured onto the right side of main boom independently.

(3) A sheave is assembled at the jib head.

Offset: 0°, 15° and 30°
Jib lengths: 9.5 m – 16 m (31.2 ft. – 52.5 ft.)

C. Derricking Mechanism

Front-mounted single derricking cylinder with balance valve

Derrick angle: -2°– 80°

Derrick speed (-2° – 80°): 0 – 46 seconds

D. Winch Mechanism

(1) Main and Auxiliary Winches

(a) Main and auxiliary winches have the same parts, which include:

- Variable-displacement hydraulic motor, with axial plunger
- Planetary reducer.

(b) The hydraulic motor drives the winch with a planetary reducer. When the winch turns (rotates), the wire rope reels off or spools on to the winch.

Table 9-7 Winch Speed Table

LAYER	ROPE SPEED (M/MIN.)
1	104
2	112
3	121
4	130

(2) Wire-Rope

Torsion resistant hoist rope

Max. hoist rope strength: 90 kN (20232.8 lbf)

Max. hoist rope speed: 130 m/min. (427 ft/min.) (At the 4th layer)

Rope diameter: Φ20 mm (Φ0.07 in)

Rope length: 220 m + 140 m (722 ft. + 459 ft.)

(3) Hook Block

(a) Rotatable main hook: 60 t (66.1 tn), with 6 sheaves and hook latch, attached at the chassis frame in front of the superstructure

(b) Rotatable auxiliary hook: 5.5 t (6.1 tn), with hook latch, in the auxiliary hook holder on the chassis frame, used for with the rooster sheave and jib.

E. Swing Mechanism

(1) The swing mechanism includes these components:

- Hydraulic Motor
- Planetary Gear Reducer
- Pinion Gear
- Swing Bearing.

(2) Through the planetary gear reducer, the hydraulic motor causes the pinion gear to turn. This causes the swing bearing outer ring to turn around its inner toothed ring which sets on the chassis frame of the crane. This makes a superstructure with 360° unlimited swing.

(3) Hydraulically controlled normally-closed brake, with a swing function that you can control and a hydraulic swing lockout device.

(4) Swing speed: 0 – 2 r/min.

F. Superstructure

A high strength steel structure with integral mounting for two winches and counterweight assembly & disassembly system

G. Hydraulic system

(1) Oil pump

- The dual gear pumps supply oil for the below uses:
  - Boom Extend / Retract
  - Derrick
  - Hoist.
- The dual gear pumps supply oil for the below uses:
  - Outriggers
  - Swing Mechanism
  - Steering System.
- The gear pump supplies oil for the below uses:
  - Brake System
  - Optional equipment (such as air conditioner).

(2) Control valve

Two groups of duplex hydraulic, hydraulic, pilot-operated proportional valve, with relief valve

(3) Hydraulic lines

Tubes and hoses make up the hydraulic lines. The hydraulic lines go through a central rotating joint.

There is an air-cooled hydraulic cooler driven by an electric motor on the chassis.

There is a pressure tap in the hydraulic pipeline. And the system pressure can display on the instrument console.

(4) Hydraulic oil tank

Capacity: 1000 L (264.2 gal.)

(5) Filter

The return line filters supply can give 10 micron filtration.

H. Crane controls

(1) The two hydraulic, pilot-operated joysticks (on the sides of the seat of the operator) control the superstructure movements (comply with ISO standard requirements). The left joystick controls the swing and auxiliary winch movements. The right joystick controls the derricking and main winch movements. The boom extend / retract pedal controls the boom extension and retraction.

(2) The joysticks and the boom extend / retract pedal allow for combinations of multifunction operations for any of the items that follow:

- Spool-up / Reel-off
- Derrick
- Boom Extend / Retract
- Swing.

(3) The switches found on the dash control the outriggers movements.

I. Cab

(1) There is one cab on this rough terrain crane. You can use it as the cab for the operator and for the driver. The cab attaches on the left side of the crane and has a seat for the operator.

(2) The crane uses an EATON (Ji'ning) hydraulic steering gear. It uses Yuxin (He'nan) special air conditioner and a Jingwei (Beijing) special cab heater for the vehicle.

(3) The air conditioner and heater emission comply with the Europe Environment Protection Agency.

(4) Either side of the operator seat has a joystick control box. The left side control box pivots up to allow for easy entry / egress from the cab. The controls of the superstructure are set to agree with ASME B30.5-2007 standard and with ISO (International Organization for Standardization) standards.

(5) Cab dimensions:

Length: 90.6 in ± 0.2 in (2300 mm ± 5 mm)

Width: 41.7 in ± 0.2 in (1060 mm ± 5 mm)

Height: 65.6 in ± 0.2 in (1665 mm ± 5 mm)

J. Load moment indicator

(1) Refer to the technical documents for load moment indicator supplied with the crane to understand operation, maintenance and troubleshooting.

(2) If the actual load comes near the rated one, the buzzer sends out a warning that you can see and hear.

(3) If the actual load reaches the rated one, all dangerous movements switch OFF automatically.

(4) The load moment indicator also can control the working range (including load radius, boom angle, lift height and swing range etc.).

(5) The data below displays on the screen:

- Boom angle or moment ratio
- Boom length or default hook weight
- Actual work radius or swing angle
- Actual lift capacity
- Max. permitted lift capacity
- Offset or line parts
- Boom status indication
- Outrigger status (fully extended, intermediately extended or fully retracted or "On Tires" indication)
- A bar graph.

Note:

The bar graph shows the percentage of actual lift capacity to the rated one or the hydraulic system pressure.

K. Outriggers

(1) You can operate the H-type outriggers (hydraulic control) in the cab at the same time or independently.

(2) Each vertical jack cylinder has a two-way hydraulic lock to make sure that outriggers attach safely while you do the work and move.

(3) The outrigger boxes are directly welded onto the crane chassis frame.

(4) You can fully and intermediately extend and fully retract the outriggers for crane operation.

Outrigger spread (L): 7380 mm (24.2 ft.)

Outrigger spread (W):

- Fully extend: 7300 mm (23.95 ft.)
- Intermediately extend: 5100 mm (16.7 ft.)
- Fully retracted: 2900 mm (9.5 ft.)

9.4.3 SPECIFICATIONS – SPECIAL PURPOSE CHASSIS FOR ROUGH TERRAIN CRANE

A. Type

(1) Rear-mounted engine, left-hand drive type

(2) Drive mode: 4 x 2 and 4 x 4

B. Chassis Frame

High-tensile steel, welded integral box-type construction

C. Engine

(1) Model

CUMMINS QSB6.7

(2) Type

Four stroke cycles, 6-cylinder direct injection, water-cooled, turbocharged, diesel engine

(3) Performance

Max. output power: 194 kW / 2400 r/min.

Max. output torque: 990 N·m / 1500 r/min.

D. Drive system

(1) Electrically controlled automatic hydraulic transmission with two modes: 2-wheel drive and 4-wheel drive

(2) Several forward gears and reverse gears, electro-hydraulic power shift, and with automatic controlled locking mechanism.

(3) The engine and transmission supply the power to drive the hydraulic oil pump and steering system.

E. Axle

(1) Front axle

Steer and drive axle rigidly attach to the chassis frame, with planetary reducer and brakes

(2) Rear axle

Full-float steer and drive axle, with planetary reducer and brakes

F. Steering system

(1) Full hydraulic steering gear

(2) The steering wheel controls the cylinder to turn the wheels.

(3) 4 steering modes:

2-wheel steer – front wheel steer

2-wheel steer – rear wheel steer

4-wheel steer – crab steer (all wheels turn at the same angle)

4-wheel steer – all-wheel steer (front and rear wheels turn in opposite directions).

G. Suspension system

(1) Front axle: rigidly mounted to the crane chassis frame

(2) Rear axle: oscillation axle with hydraulic suspension cylinder

Oscillation automatically locks if superstructure is swung more than 3 degrees past boom over the front. Oscillation also locks when park brake is engaged.

H. Brake system

(1) Service brake

Hydraulically controlled disc brakes on four wheels

(2) Park brake

Spring applied, hydraulically released park brake is mounted to the input shaft of the front axle.

I. Electrical system

24 Volt DC

2 batteries with 12 V rated voltage and 120 Ah rated current

J. Fuel tank

Capacity: 79 gal. (300 L)

K. Tire

Size: 29.5-25-34PR

For the recommended tire pressure, refer to Figure 9-7.

Table 9-7 Recommended Tire Pressure

STATIONARY	CREEP 1 MPH (1.6 KM/H)	TRAVEL
525 kPa (77 psi)	525 kPa (77 psi)	525 kPa (77 psi)

9.4.4 SAFETY DEVICES

This rough terrain crane has the safety devices that follow:

- Load Moment Indicator (LMI)
- Rotating Beacon and Horn
- Anti-Two Block Devices
- 3rd Wrap
- Balance Valve
- Hydraulic Lock
- Hydraulic Safety Valve
- Swing Brake
- Swing Lockout Device
- Boom Angle Indicator
- Outrigger Beam Retaining Pin
- Emergency Stop
- Winch Speed Sensor.