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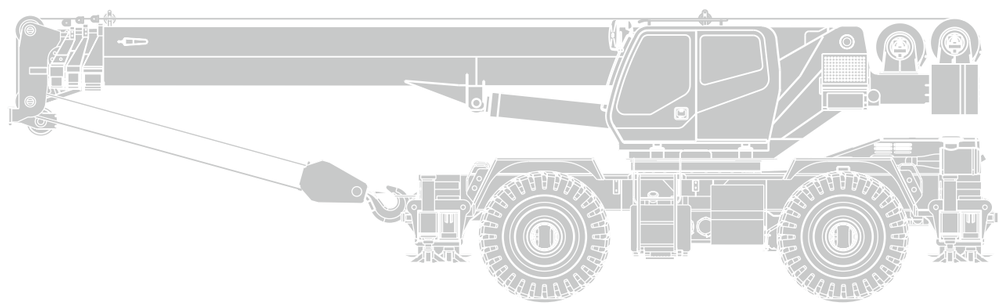
MAINTENANCE MANUAL FOR ROUGH TERRAIN CRANE



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ZOOMLION HEAVY INDUSTRY SCIENCE AND TECHNOLOGY CO.,LTD

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MAINTENANCE MANUAL

Edition 1

Dec 2013

Dec 2013

(Thank you letter)

Owners, Users and Operators:

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

No one should do the maintenance/service tasks to the crane unless they read and know the data in this manual and the other technical documents supplied with the crane.

The Maintenance and Service Manual provides periodic inspections, maintenance and service procedures that are necessary to make sure the performance, safety and reliability are at the highest level. They can also increase the service life of the crane.

When you follow the instructions in this manual, your crane can operate at MAXIMUM EFFICIENCY.

To look after your rights & interests and safety, you must obey all safety data in the Maintenance and Service Manual. Only approved personnel can disassemble and adjust hydraulic system components during maintenance. When a hydraulic component malfunctions or is damaged, tell the local repair facility.

You do not have to keep the Maintenance & Service Manual in the cab of the crane. The Maintenance & Service Manual must be with the crane if it is sold.

If there is something in the manual that you do not understand, speak with us. We (Zoomlion Cranes) are NOT responsible for damages from an operator or service technician who does not obey the instructions in the Maintenance and Service Manual.

THANK YOU!

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

Contents

About This Manual

General

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

This manual is for maintaining and servicing the RT 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 end 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 and service technicians 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 and service technicians** - 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 the factory approved parts to service or repair the crane.

If you make modifications/additions which affect the safe operation of the equipment to the crane before you use it, the crane owner must make sure that the modifications/additions agree with OSHA 1926:1412.

Speak with us if special data is necessary for the maintenance or operation of your RT 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:

Rough Terrain Crane R & D Institute
Zoomlion Mobile Crane Branch Company
Quantang Industrial Park, 2nd Yuanda Road,
Economic and Technological Development Zone,
Changsha, Hunan Province, China, 410131

You can also speak to us by telephone at 0086-84671997 (international), 0731-84671997 (in China).

Thank You!

Safety

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.

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.

HAZARD INDICATORS

DANGER, WARNING, CAUTION and NOTE labels are on signs and decals and as you read this manual to show important instructions. In this manual, DANGER, WARNING and CAUTION labels are before the paragraph or item to which they apply. NOTEs follow the paragraph or item they apply to. The labels 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.

Note

Refers to a tip or hint in the instructions.

INTENDED USE

Scope

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. 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 this 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 periodic inspections regularly because the equipment wears during operation. 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.

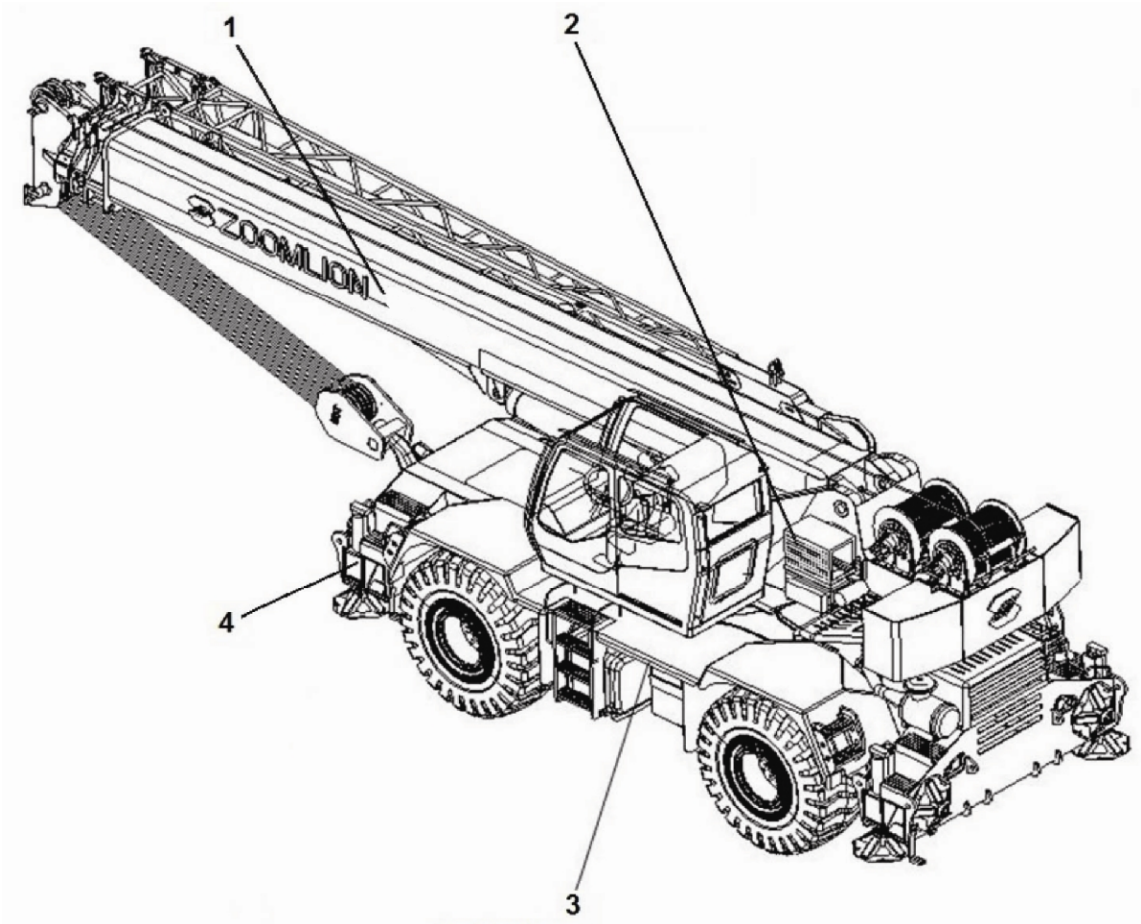
Correct training and inspection procedures are necessary to prevent injury to persons, property damage and high maintenance costs.

Read and understand the data that comes with this crane. Help is available from the distributors of your ZOOMLION crane and from the ZOOMLION manufacturing facility.

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

Nomenclature

To help you understand the contents of this manual, refer to the figure below. Each numbered term can represent several components of the same main part.



LEGEND

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, airconditioning 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.

CRANE PERIODIC INSPECTION CHECKLIST

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

Component Inspected	Interval	Function	Adjusting Condition	Maintenance Condition	Component Inspected	Inspection Code	Function	Adjusting Condition	Maintenance Condition

MAINTENANCE LOG

Item	Adjusting Condition	Date

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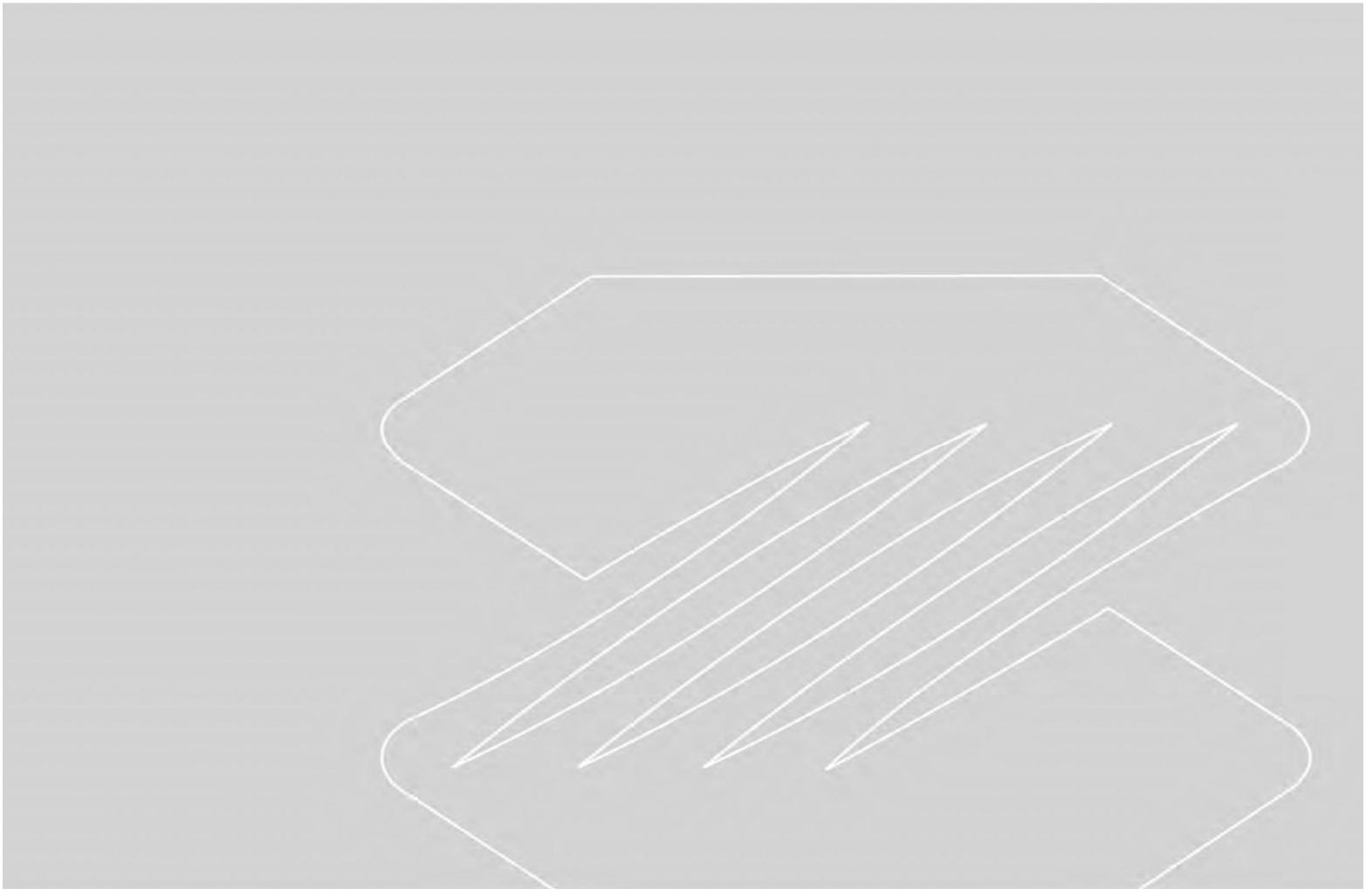
MAINTENANCE AND SERVICE MANUAL FOR ROUGH TERRAIN CRANE

Chapter 1 Maintenance and Service



Introduction

1.1 INTRODUCTION

A set of preventive maintenance tasks is necessary to extend the serviceable life of the crane. The tasks can help to maximize efficient service and decrease the time the crane is at the repair facility. This section has checks and procedures which you are to do on daily, weekly, monthly and semi-annual intervals. These intervals are specified in conditions of calendar and hours of operation.

The checks for long intervals include all the checks that you do in the shorter intervals. Thus, the weekly check includes all items in the daily check. The monthly check includes the weekly and the daily checks. The semi-annual check includes the quarterly, monthly, weekly and daily checks.

The chart makes it possible for you to record the preventive maintenance tasks that you complete. It also supplies you with a tool to find the problem areas and to examine the value of the maintenance tasks. The items in each check interval on the chart are assembled by their applicable headings and explained in this chapter.

This maintenance schedule is a procedure to make sure that basic preventive maintenance tasks are completed in the usual conditions that you operate. The conditions which increase wear, loads or strain on the crane, usually make it necessary to decrease the interval time. Before you change the maintenance schedule, examine your operation and the maintenance records of the crane. Think about all the factors involved and make a new schedule that is sufficient to align the usual maintenance tasks.

As a part of each preventive maintenance check, refer to the *Engine Manufacturer's Manual* for engine maintenance tasks. When you do the servicing of the engine, use the data in the engine manual if this chapter has data that is different.

1.2 OPERATOR OBSERVATION

A. Do a visual inspection for:

(1) Unusual conditions

(2) Hydraulic system leaks or damage.

B. Examine the area around the engine for:

(1) Belts (tension and wear)

(2) Coolant level

(3) Engine oil level

(4) Hydraulic transmission oil level

(5) Air cleaner vacuum actuated indicator

(6) Air inlet

(7) Silencer and exhaust device.

C. Examine the condition of each battery.

D. Examine the boom for:

(1) Sheave (wear or damage)

(2) The function of the anti-two block system

(3) Wire-rope on the winches (wear and breaks)

(4) Wear of the cylinder pin.

E. Tires, axles and drivelines (wear or damage).

F. Examine the cab for:

(1) Gauge and indicator functions

(2) Function of the switches and joysticks

(3) Clear windows

(4) Safety device in position

(5) Each light operates

(6) Cleanliness: free from dirt, mud and waste material.

1.3 WIRE-ROPE INSPECTION RECORD

WIRE-ROPE INSPECTION RECORD
(See pages 1-37 and 1-38)

Place of inspection _____ Date _____

DESCRIPTION OF CRANE

Make _____Model_____ Serial No. _____

Type and Arrangement of Attachments_____

Date of Last Rope Inspection _____

Hours and Time of Service Since Last Inspection _____

RESULT OF INSPECTION

Rope Inspected	Type and Size	Conditions noted	Recommendations

_____ Inspector:

1.4 ENGINE MAINTENANCE

For Cummins engine maintenance, refer to *the EngineManufacturer's Manual.*

Engine productivity, longevity and low-cost performance depend on a regular program of periodic maintenance. The materials presented here are listed in accordance with the *EngineManufacturer's Manual*. Consideration may dictate a revision in scheduling for the periodic checks.

A good periodic preventive maintenance program can increase the productivity, longevity and low-cost performance of the engine. The data, in this section of the manual, is from the data in the *EngineManufacturer's Manual*. You can change the interval or schedule of the preventive maintenance program because of the area and the types of operations you do.

A. Daily Inspections:

(1) Fuel Level

(a) You can find the fuel tank on the left side of the crane (Figure 1-1). If you keep the tank full of fuel, in cold weather, you can decrease the quantity of condensation.

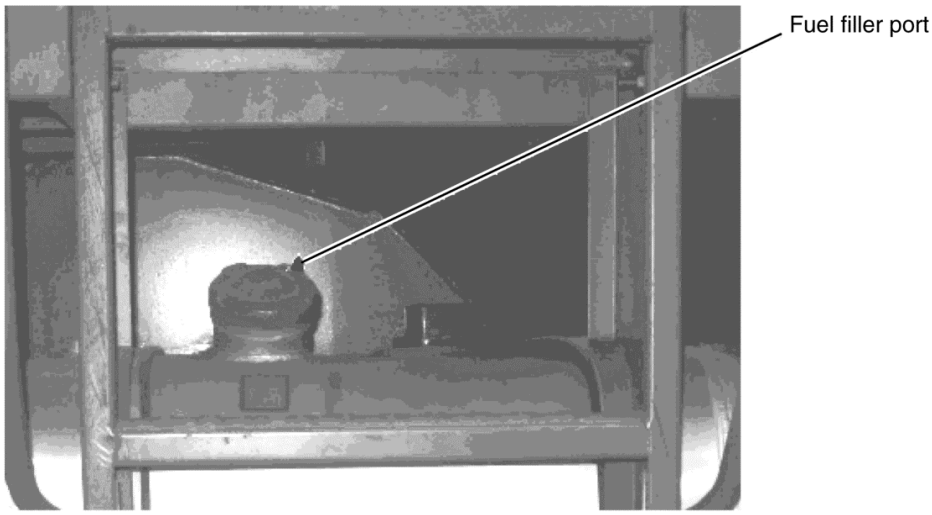


Figure 1-1 Fuel Tank Cap

(b) Use a good grade of diesel fuel. The tank capacity is 79 gal. (300 l).

(2) Engine Oil Level

(a) You can measure the level of oil in the engine by a dipstick. The dipstick is on the right side of the engine (aft end of the crane). The engine must be OFF and sit for a short time before you can measure the oil level. Wait for 15 minutes, after you stop the engine, to measure the level. Adjust the level of oil to the full mark.

(b) Do not overfill!

CAUTION

Do not operate the crane if the level of engine oil is too low or too high.

(3) Water Separator

(a) The fuel line contains a water separator. It removes the condensation and contamination from the fuel before it goes into the engine. You must examine the water separator before you operate the crane to drain the condensation and contamination.

(b) Do not let the water separator fill more than 1/2 full.

(4) Air Filter

(a) Examine the air filter and its connections for leaks, dents and damage (See Figure 1-2).

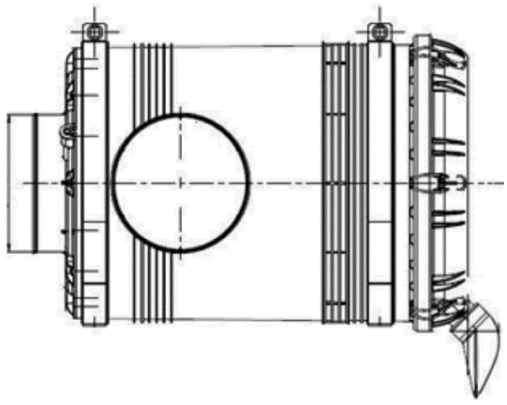


Figure 1-2 Air Filter

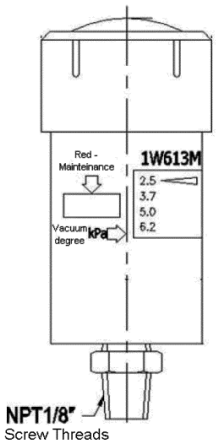


Figure 1-3 Indicator

(b) A vacuum actuated indicator (See Figure 1-3) is attached on the side of the air filter assembly. Its gives you an indication of restricted airflow through the air filter. The quantity of airflow shows on the indicator at three different levels. When the light is in the green area, the air filter is good. If the light is in the yellow area, you need to clean or replace the filter cartridge. If the light is in red area, do not operate the engine. Replace or clean the filter cartridge. Examine the intake screen and cartridge area.Make sure that they are clean.

CAUTION

When you use a degreasing agent to clean the engine, make sure that you put a protective material around the vacuum actuated indicator (filter minder). The polycarbonate base of the engine degreasing solvents can damage or destroy the indicator.

(c) Reset the air cleaner indicator each time after the filter element is replaced to assure proper function.

(d) After you do the servicing on the air filter assembly, reset the indicator.

(5) Engine Belts

(a) Examine the engine belts for condition and correct adjustment. Refer to the *Engine Manufacturer's Manual* for the belt tension and the correct procedure to make the belts tight.

B. Quarterly Inspection

(1) Fuel Tank

(a) Drain the collected water and sediment from the fuel tank.

- Remove the drain plug and let the tank drain.
- Stop the flow when the fuel is clear of water and sediment.

(b) If the tank has a large quantity of sediment, do the task that follows:

- Fully drain the tank.
- Flush the tank with kerosene until you remove all the sediment.
- Fully drain the kerosene and refuel the tank.

C. Semi-Annually Inspection

(1) Crankcase Breather

To do servicing on the crankcase breather, follow the procedure in the *Engine Manufacturer's Manual.*

1.5 ENGINE RADIATOR MAINTENANCE

A. Daily / 8 Hours:

(1) Coolant Level

(a) Insert the engine radiator coolant level and add coolant to adjust the level. You can see the level of coolant in the sight gauge near the top of the radiator tank. A solution of 50% ethylene glycol by volume is the recommended year-round coolant mixture. If necessary, refill the corrosion inhibitor. Refer to the engine manual or the servicing facility to pick the correct coolant and corrosion inhibitor.

(b) If you operate in an area that does not freeze, use a solution of clean water with a corrosion inhibitor. This gives you the best performance.

B. Monthly / 160 Hours:

(1) Radiator Exterior

Clean the radiator fins and through-core cooling passages. Use compressed air and water in the opposite direction of usual air flow to push the unwanted material out of the radiator core.

C. Quarterly:

(1) Corrosion Inhibitor

Adjust the cooling system corrosion inhibitor to the correct level after 500 hours of operation.

CAUTION

Do not use a chromate based corrosion inhibitor when the coolant in the system contains ethylene glycol. Only use non-chromate based inhibitors. The chromate base inhibitorreacts with ethylene glycol to make hydroxide. This you know as Green Slime. The slime decreases the heat movement rate and can cause the engine to be too hot.

D. Semi-Annually:

(1) Cooling System

Clean the cooling systemat 1000 hours or semi-annually whichevercomes first. Use a radiator cleaning compound and follow the instructions on the container. Flush the system with clean water and fill it with an ethylene glycol solution of 50% by volume.

1.6 TRANSMISSION MAINTENANCE

A. Daily Maintenance Check

(1) Before you move the crane, make sure that the level of oil in the transmission is correct.

(2) Start the engine and let it idle at 1000 to 1500 rpm until the transmission increases to a temperature of 180° F to 200° F (82.2° C to 93.3° C). When the engine is at the correct temperature, slowly move the shift lever through all the gear positions. This moves oil to all parts of the system. Set the shift lever to the neutral position and set the engine speed at idle rpm.

B. Service the Transmission After Overhaul

When you service the crane for the first time after vehicle installation and / or after repair, fill the unit as follows:

(1) Fill the transmission with recommended lubricant.

(2) Start the engine and set the speed at idle to let oil fill the torque converter and lines. Stop the engine after 3 minutes.

(3) Adjust the level of transmission oil as follows:

(a) Find and remove the oil level plugs on the lower part of the transmission case on the right side of the crane.

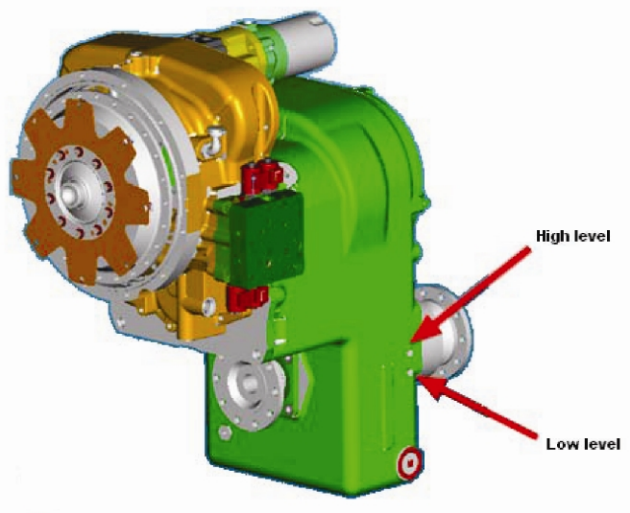


Figure 1-4 Low and High Level Plugs

NOTE

There are two taper pipe thread oil level holes. One is the low level plug and the other one is the full level plug.

(b) Add the transmission oil until it flows out of the low level plug hole.

(c) Start the engine at idle speed to let the oil flow through the torque converter, oil cooler and lines. Check the oil level. Add transmission oil until it flows out of the low level plug. Install the low level plug.

(d) Let the oil temperature increase to between 180° F and 200° F (82.2° C and 93.3° C). Add oil until it flows out of the full level plug. Install the full level plug.

(e) Always do the transmission oil level checks with the speed of the engine at idle. The transmission must be in the neutral position and the transmission temperature between 180° F and 200° F (82.2° C and 93.3° C).

(4) Do not put too much fluid in the transmission!

C. Lubricant and Filter Change Interval

(1) Refer to Section 1.13 for the lubrication schedule.

(2) Use the Dana-Clark Filter.

(3) Change the hydraulic transmission oil and filter after the first 50 hours of transmission operation. After the first transmission oil and filter change, the change interval is 500 hours or 3 months of operation. Change the lubricant at the 1000 hours or 6 months of operation point.

NOTE

When you operate in cold weather areas or at the initial startup, the transmission oil is cold and thick. This can cause the oil to intermittently bypass the filter.

1.7 AXLE MAINTENANCE CHECK

A. Monthly

(1) Examine the wheel end oil level as follows:

(a) Move each wheel until the planet gear cover is at the position in Figure 1-5. The arrow on the planet gear cover points horizontally when the cover is at the correct position. Make sure that the oil is at the correct level.

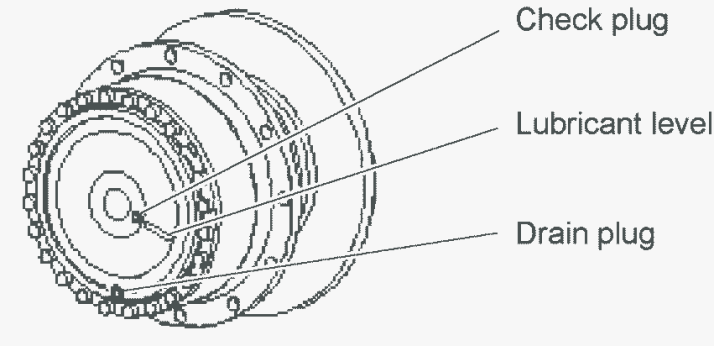


Figure 1-5 Wheel End

(b) Check the differential oil level by removing the filler and check plug indicated in Figure 1-6. Add oil as necessary to bring the oil level to the bottom of the hole.

(2) Do a check of the level of differential oil as follows:

(a) Remove the fill plug.

(b) Make sure that you can see oil at the bottom of the plug hole.

(c) If necessary, add oil until it comes out of the fill plug hole.

(d) Install the fill plug.

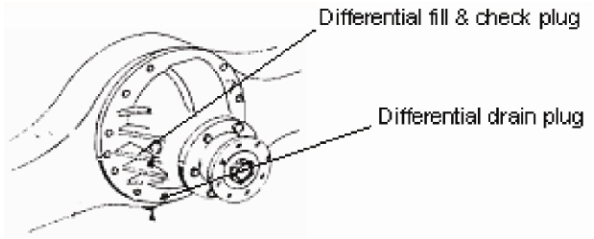


Figure 1-6 Differential Plugs

B. Annually

(1) Remove and replace the oil in the differential as follows:

(a) Remove the fill plug and the check plug to drain the oil. Refer to Figure 1-6.

(b) Make sure that you can see oil at the bottom of the plug hole.

(c) If necessary, add oil until it comes out of the fill plug hole.

(d) Install the fill plug.

1.8 TIRE MAINTENANCE CHECK

A. Weekly

(1) Examine the tires and rims for the items that follow:

(a) Damage

(b) Cuts and bruises

(c) Cracks

(d) Punctures

(e) Abrasion.

(2) If necessary, make sure that you repair these items.

(3) Replace or repair the wheels if they are bent, contain a crack or are loose.

(4) Make sure that the wheel nuts are correctly tightened.

B. Tire Pressures

(1) Always keep the correct tire pressure in all the tires.

(2) Friction makes heat that increases the pressure in the tires when you move the crane. Movement at high speeds also increases the pressures in the tires. Do not deflate the tires if these conditions occur. Decrease your speed or stop until the pressure decreases.

(3) Always use an accurate tire pressure gauge. You must measure the tire pressure when the tires are cool. Do a check of the pressures at regular intervals.

CAUTION

Because of the explosive nature (high temperature and high pressure) of the tire and rim it is dangerous to change a tire if you are not trained. Death or personal injury can occur while you touch or do the maintenance work on these tires. You must follow special procedures and use special tools to safely change the tires. If it is possible, let your repair company do this work. If you must change a tire, follow the step by step instructions in a *Tire Repair Manual*. If you must add air because of low pressure, do not be adjacent to the tire tread. Use a long extension hose to be behind the tire tread. Always use a tire cage or equivalent protection when you add air.

(4) Do not deflate air from a hot tire. The pressure lowers but the temperature increases when the tire continues to move. This increase in temperature causes the tire to malfunction.

(5) Under Inflation

The tires that do not have a sufficient quantity of pressure in them cause them to wipe and scuff over the road. Strain on the tire increases the chance to bruise.

(6) Correct Inflation

When the tires have the correct pressure in them, they do not wear too quickly.

(7) Over Inflation

When the tires have too much pressure in them, they do not touch the surface of the ground correctly. When this occurs, the tires touch the ground on the crown of the tires and quickly wear in the middle.

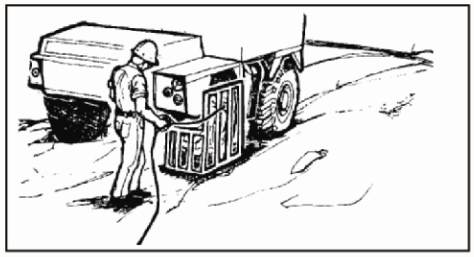


Figure 1-7 Correct Way

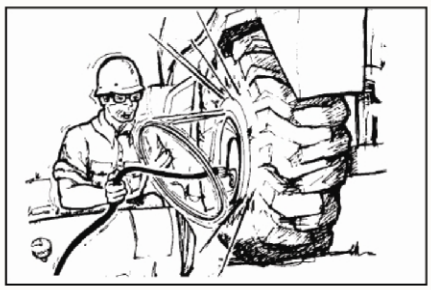


Figure 1-8 Wrong Way

C. Tire Change Safety Precautions

When you must make the repair on a wheel (demount and mount the rim and tire), follow these precautions:

DO:

(1) Follow the procedures (assemble and disassemble) that you find in the tire change safety guidelines or other instruction manual.

(2) Before you start to disassemble the wheel, fully deflate the tire.

(3) Replace the parts with damage, cracks, signs of wear and corrosion.

(4) Before you inflate the tire, make sure that you examine the removable ring. It must be seated correctly.

(5) Examine the side ring and make sure that it is not too loose. This is an indication of parts that do not match correctly.

(6) Do not inflate the tire until the safety cage is in position.

(7) After you inflate the tire, make sure that the rim ring clearance is between 0.06 in. to 0.25 in. (1.6 mm to 6.3 mm).

(8) After you complete the repair, examine the wheel nuts and rim clamps for wear, corrosion, proper centering and the correct torque.

DO NOT:

(1) Mix the parts. This is a dangerous condition. Make sure that the side ring and lock ring agree with the identification marks on the base.

(2) Lift a load or move a load that is above the capacity of the crane.

(3) Inflate a tire if it is fully flat or near flat. You must first disassemble and examine the tire and rim assembly.

(4) Use a tire and rim configuration that is not approved by the Tire & Rim Association (TRA).

1.9 BRAKE SYSTEM MAINTENANCE

A. Brake Pedal

(1) Routine Maintenance

(a) Usually the brake pedal is a maintenance free part.

(b) Make sure that the brake pedal moves freely before you move the crane.

(c) Examine the brake pedal annually and replace the parts that show wear or damage.

NOTE

If you push the service brake pedal and the distance to stop is more than usual, the system can have a malfunction. When the service brake indicator illuminates, the pressure in the system can be low. In that condition, do the necessary steps to correct the condition or send the crane to the repair facility. Do not move the crane if the indicator stays illuminated.

B. Park Brake

(1) Routine Maintenance

Usually the park pedal is a maintenance free part.

1.10 AIR SYSTEM MAINTENANCE

When the air system does not supply the usual quantity of air, look at the items that follow to correct the condition:

- Defective components
- System leak
- Blocked lines
- Moisture and sediment in the system.

A good preventive maintenance program is a necessary part of the air system operation. Refer to the maintenance schedule in this manual. You can change the interval between checks if the conditions and weather are hard on the equipment.

1.11 BATTERY MAINTENANCE

A. Examine the batteries and the area around the batteries as follows:

(1) Make sure that the terminal connections are tight.

(2) Remove dirt and corrosion from the wires and terminals.

(3) Clean the battery area with soda water or pure water. When the terminals dry, apply Vaseline to them.

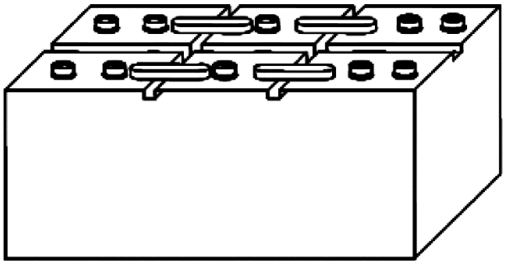


Figure 1-9 Battery

1.12 FUEL, COOLANT AND TORQUE CONVERTER HYDRAULIC TRANSMISSION OIL

A. Fuel Selection

(1) 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.

(2) Refer to the *Operator's Manual* for the fuel sulfur content standards.

(3) Refer to the *Service and Maintenance Manual* for the Engine when it is necessary to put oil into the engine.

WARNING

Do not use fuel which is mixed with lubricant or other chemicals.

CAUTION

Make sure that the fuel you use in the crane has the correct thickness. Make your selection on the lowest temperature you operate in.

Make sure that the fuel tank is full. Condensation, rust and sediment can freeze and cause a blockage in the flow of fuel. The engine cannot start if the fuel does not flow or flows too slowly.

B. Coolant Selection

We recommend that you use ethylene glycol coolant. It is all-season, all-purpose and continues to cool for long intervals of time. You can use other types of antifreeze if it continues to cool for long intervals of time and has:

- High boiling point
- Low freezing point
- Correct PH-value.

C. Torque Converter Hydraulic Transmission Oil Selection

CAUTION

For torque converter hydraulic transmission oil selection and change interval, refer to the *Operating Instructions for the Torque Converter*.

1.13 LUBRICATION

You can increase the service life of the crane if you obey the preventive maintenance schedule and use the correct lubricants. When you decrease the effects of friction on the parts that move, you can prevent unusual malfunctions. Refer to Figure 1-10.

A. Chassis Lubrication

Make sure that you obey the lubrication types and intervals in Table 1-1.

Lubrication method: grease or inject with grease pump.

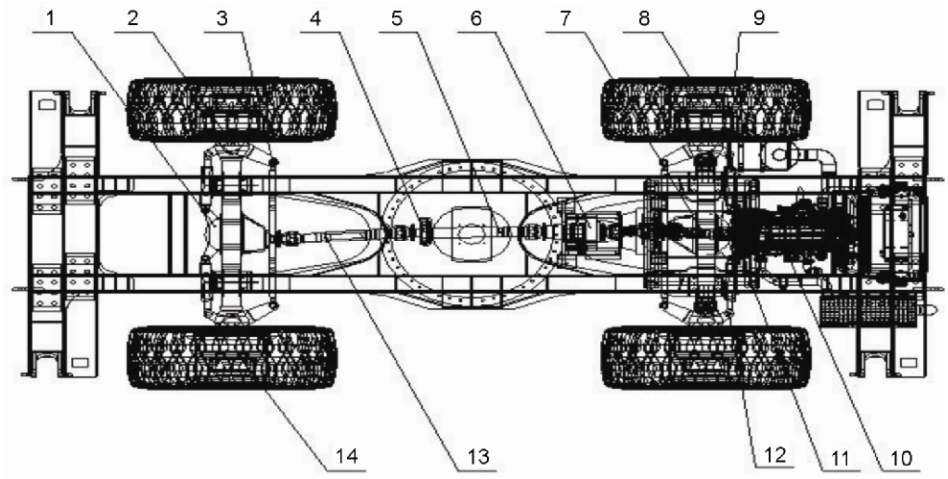


Figure 1-10 Crane Chassis Lubrication Points

Table 1-1 Lubrication

Ser. No.	Description	Number of Lubricating Point	Lubricating Intervals	Lubricating Method	Lubricating Grease Type
1	Central reducer for front axle	1	3106 miles (5000 km)	Add grease	GL-5 80W/90
			6213 miles (10000 km)	Change the grease	
2	Steering knuckle of front and rear axles	4	3106 miles (5000 km)	Inject with grease pump	ZL-2 lithium base grease
3	Tie-rod ball pin of front and rear axles	4	3106 miles (5000 km)	Inject with grease pump	ZL-2 lithium base grease
4	Intermediate bearing for drive lines	1	932 miles (1500 km)	Inject with grease pump	ZL-2 lithium base grease
5	Sliding fork for intermediate drive lines	2	3106 miles (5000 km)	Inject with grease pump	ZL-2 lithium base grease
6	Transmission	1	6213 miles (10000 km)	Add grease	Great Wall # 8 hydraulic transmission oil
			31065 miles (50000 km)	Change the grease	
7	Sliding fork for rear drive lines	1	3106 miles (5000 km)	Inject with grease pump	ZL-2 lithium base grease
8	Wheel ends for rear axle	2	3106 miles (5000 km)	Add grease	GL-5 80W/90
			6213 miles (10000 km)	Change the grease	
9	Central reducer for rear axle	1	3106 miles (5000 km)	Add grease	GL-5 80W/90
			6213 miles (10000 km)	Change the grease	
10	Engine oil underpan	1	250 hours	Add grease	10W/40 CH-4 engine oil
			500 hours	Change the grease	
11	Sliding fork for front drive lines	1	3106 miles (5000 km)	Inject with grease pump	ZL-2 lithium base grease
12	Wheel ends for front axle	2	3106 miles (5000 km)	Add grease	GL-5 80W/90
			6213 miles (10000 km)	Change the grease	

CAUTION

The engine oil add or change interval (in your preventive maintenance schedule) cannot be more than the interval you find in the diesel engine maintenance specifications in the *Engine Manufacturer's Manual*.

When you add or change grease, you must clean the grease off and around the plug (grease nipple) and check for leaks.

B. Monthly Lubrication

(1) Do a check of the level of oil in the transmission.

(a) You can find the transmission oil change interval in Section 1.6. If you do work in harsh conditions, you can decrease the interval between oil changes.

(b) The oil changes can become more frequent if the crane operates in rough conditions.

(2) Do a check of the gear oil level in the front and rear axles. Refer to Figure 1-11.

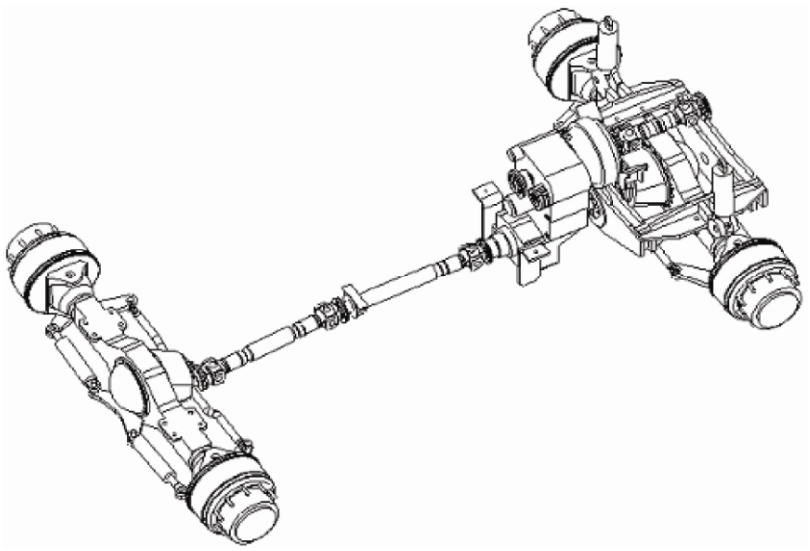


Figure 1-11 Front and Rear Axles

CAUTION

When you change the gear oil, only drain the remaining gear oil while it is warm.

(3) The first time you replace the middle and rear axle gear oil (after the break-in period) of a new crane:

(a) Drain the gear oil and add engine oil to the axle to the correct level.

(b) Lift the axles off the ground (support with jack stands). Start the engine and set the transmission in gear.

(c) Allow the wheels to turn for five minutes and then drain the oil.

(d) Add new gear oil to the correct level.

(4) Add grease to the main reducer and wheel ends until the grease comes out of the oil filler.

(5) Add grease to the oil cup.

CAUTION

When you add or change grease, you must clean the grease off and around the plug (grease nipple) and check for leaks.

(6) Add grease to the drive lines. Refer to Figure 1-12.

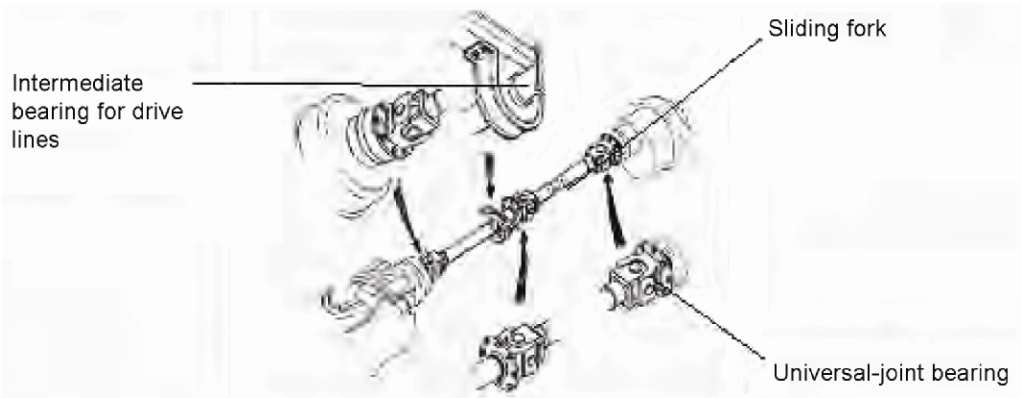


Figure 1-12 Drive Line Lubrication Points

(7) Lubricate the rear suspension. Refer to Figure 1-13.

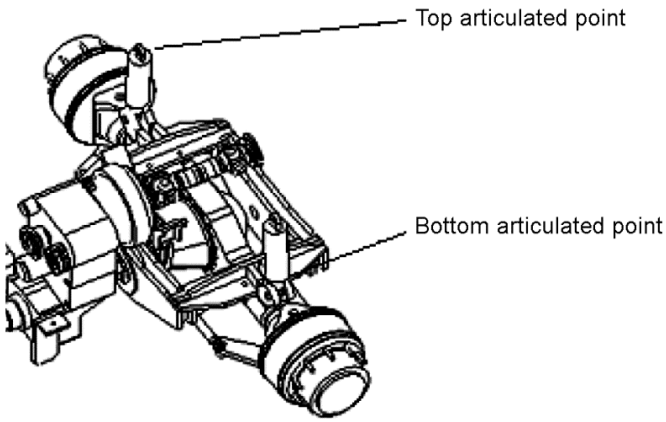


Figure 1-13 Rear Suspension Points

(8) Lubricate the steering system. Refer to Figure 1-14.

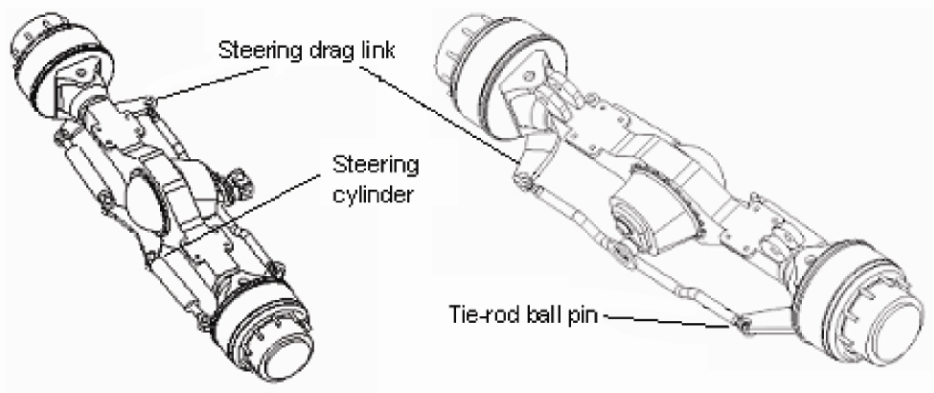


Figure 1-14 Steering System Lubrication Points

C. Lubrication – 500 Hours

(1) Change engine oil.

(a) On a warm engine, remove the oil pan drain plug and drain the oil from the engine and oil filter assembly.

(b) Replace the oil filter.

NOTE

Always replace the oil filter when you replace the engine oil.

(c) Install the oil pan drain plug and add oil to the engine through the oil filler port. Refer to Figure 1-15.

NOTE

The weather in the area that you operate the crane determines what type of oil to use in the engine. The oil viscosity decreases in areas of heat and increases in areas of cold. As a result, incorrect engine oil can cause the crane to be hard to start in a cold area. Use Table 1-2 to make a selection of the correct type of oil for the engine.

(d) Install the oil filler cap.

(e) Operate the engine, without a load, for approximately three minutes. Examine the area below the engine for leaks.

(f) Stop the engine and let it stand for 30 minutes. Measure the level of oil with the dipstick. Add oil until it increases to the full mark on the dipstick. Do not add too much oil in the engine.

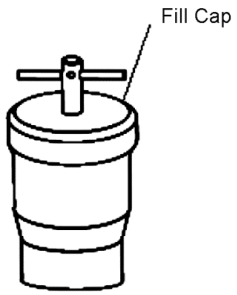


Figure 1-15 Oil Fill Port

Table 1-2 Engine Oil Viscosity

Ambient Temperature	Oil Viscosity
Above 104° F (40° C)	20W/40
104° F to 14° F (40° C to -10° C)	10W/40
Below 14° F (-10° C)	5W/30or 10W/30

NOTE

- The service life of the engine decreases when you operate the engine at high speeds or the operating load is high for long intervals.
- When the crane is new, change the engine oil after the engine operates between 30-50 hours.

(2) Change gear oil in the transmission.

(a) When the transmission is warm, remove the drain plug.

(b) Clean the drain plug and install it onto the transmission.

(c) Add gear oil to the transmission.

NOTE

When the crane is new, change the transmission gear oil after the crane travels the first 1242-3106 miles (2000-5000 km).

D. Lubrication Every 3 Months

Do a check of the level of gear oil in the front and rear axles as follows:

(1) Remove the fill plug.

(2) Make sure that you can see oil at the bottom of the plug hole.

(3) If necessary, add oil until it comes out of the fill plug hole.

(4) Install the fill plug.

E. Lubrication Every 6 Months

Remove and replace the oil in the front and rear axles as follows:

NOTE

Only do this procedure when the oil is warm.

(1) Remove the drain and fill plugs to drain the oil.

(2) Install the drain plug.

(3) Add oil (specified on the lubrication chart) until it comes out of the fill plug hole.

(4) Replace the fill plug.

NOTE

When the crane is new, change the gear oil after the crane operates the first 250 hours.

1.14 HYDRAULIC OIL

When the crane comes out of the factory, the hydraulic tank is topped up with hydraulic oil.

⚠ CAUTION

The controls on the crane are hydraulically operated.

The most important item for the usual operation of the crane is the quality viscosity of the hydraulic oil used in the crane. Also important is how clean you keep the oil.

A lack of knowledge of (ignorance to) the hydraulic oil replacement schedule can cause different components to malfunction and greatly decrease the service life of the crane.

Zoomlion cannot be legally responsible for the damage you cause when you do not obey the data in this manual with reference to: oil and oil filter change.

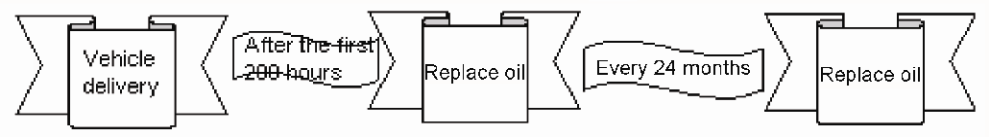


Figure 1-16 Filtering – Changing Intervals

A. Changing Steps

(1) Remove and replace the hydraulic oil in the hydraulic tank as follows:

(a) Remove the drain plug at the bottom of the tank.

(b) Remove the master oil return pipe.

(c) Carefully clean the oil tank and filter with a chemical cleaning agent (solid particle pollution grade ≤ 18/15).

(d) After the tank is dry, clean the tank with new hydraulic oil (solid particle pollution grade ≤ 18/15).

(e) Drain the oil used to clean the tank.

(f) Fill the tank with new hydraulic oil.

(g) Screw down the plug fitted on the brake disc to drain the hydraulic oil in brake return lines every 6 months.

(2) Flush the expired (initial) oil out of the system as follows:

NOTE

The function of this procedure is to remove all the initial oil out of the system.

(a) Start the engine and operate it at a low speed.

(b) Start the hydraulic system pump.

(c) Operate all the hydraulically controlled functions.

- Make sure that you fully move the items through the full travel of operation.
- Make sure that you add new oil into the tank as the expired oil flows out.
- Do not let the initial oil go back into to the oil tank.
- Do not stop the system pump until the new oil flows out of the master oil return pipe.

(3) Connect master oil return pipe to the oil tank. Move all the hydraulically controlled functions through the full travel and monitor the level of oil in the tank. If necessary, add oil.

(4) You must monitor (interval set by management) the quality of the oil. Change the oil when the number of particles is greater than the number in the chart.

Change the oil when:

Particle Size	Number of particles / ounce (milliliter)
≥ 10 μ	3000
≥ 20 μ	300
≥ 30 μ	100
≥ 40 μ	30
≥ 50 μ	10
≥ 100 μ	1

CAUTION

Change the oil when the oil is found to be contaminated. Do not wait for the scheduled service.

Always use the correct oil for the temperature the crane operates in.

You cannot mix oil of different brands (specifications) or types.

You must change the oil every 24 months.

Figure 1-17 Liquid Level Gauge

B. Hydraulic Oil Temperature

(1) Examine the hydraulic oil temperature through the liquid level gauge.

(2) When the crane is in operation, the oil temperature cannot be more than 176° F (80° C).

C. Hydraulic Oil Level

(1) When the crane travels between locations, monitor the level of hydraulic oil through the liquid level gauge.

NOTE

Retract cylinders when you do an oil level check.

(2) If the oil level is below the low mark, add oil to the tank until the oil level is between the low and full marks.

D. Hydraulic Oil Performance and Type

The selection of the type of oil you use in the crane must align with the data found in Table 1-3.

Table 1-3 Hydraulic Oil Performance and Type

Item	Ambient Temperature Above 104° F (40° C)	Ambient Temperature -4° F - 104° F (-20° C - 40° C)	Ambient Temperature- 22° F - -4° F (-30° C - -20° C)	Ambient Temperature Below -22° F (-30° C)
Reference standard	GB11118.1-94	GB11118.1-94	GB11118.1-94	SH 0358-95
Type	L-HM	L-HV	L-HS	Aviation hydraulic oil
Viscosity grade	68	32	22	10
Min. flash point (split) ° F (° C)	356 (180)	320 (160)	284 (140)	198 (92)
Kinematic viscosity at 104° F in²/s (40° C mm²/s)	61.2-74.8	28.8-35.2	19.8-24.2	More than 10 at 50° C
Max. temperature when kinematic viscosity at 59 in²/s ° F (1500 mm²/s ° C)		-0.4 (-18)	-22 (-30)	-58 (-50)
Min. viscosity index	95	130	130	
Max. pour point (° C)	15.8 (-9)	-27 (-33)	-49 (-45)	

1.15 GEAR OIL

A. Always use the correct gear oil (type and viscosity) in the crane.

B. When the crane comes out of the factory, the gear oil level is full. You must use the data from Table 1-4 when you choose the type of oil for the crane.

Table 1-4 Gear Oil Performance

Kinematic viscosity at 212° F (100 °C) mm²/s	Minimum flash point (split) ° F (° C)	Ingredients
56.3 (13.5) ～<24.0	329 (165)	Organic acid fat, phosphoric acid fat, silicic acid fat, fluorin oil, silicon oil, polyphenylene oxide + addictive

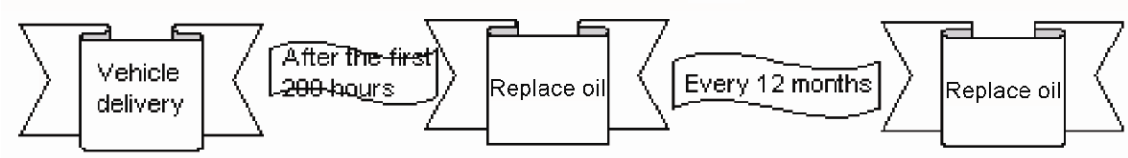


Figure 1-18 Changing Intervals

CAUTION

When there is contamination in the gear oil, change the oil immediately.

Monitor the oil level regularly and add oil if it is below the low mark.

You cannot mix oil of different brands (specifications) or types.

Always use the correct oil based on the temperature the crane operates in. If you use the incorrect oil (type or viscosity) in the reducer mechanism, you can damage it.

C. Oil Change Parts

(1) Winch Reducer

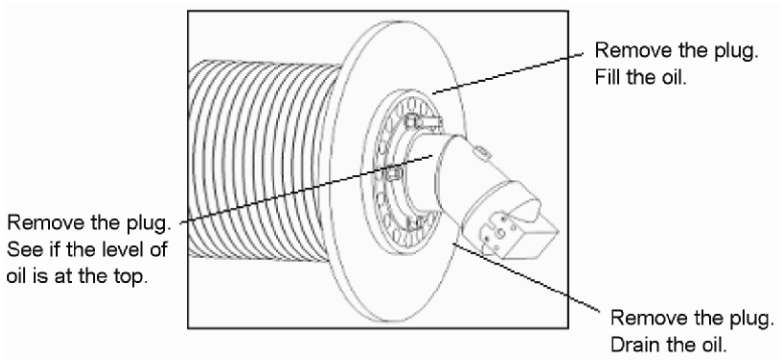


Figure 1-19 Fill, Check and Drain Ports

NOTE

Fill the gear oil to the top.

(2) Swing Reducer

(a) Fill oil after removing the plug of oil fill aperture.

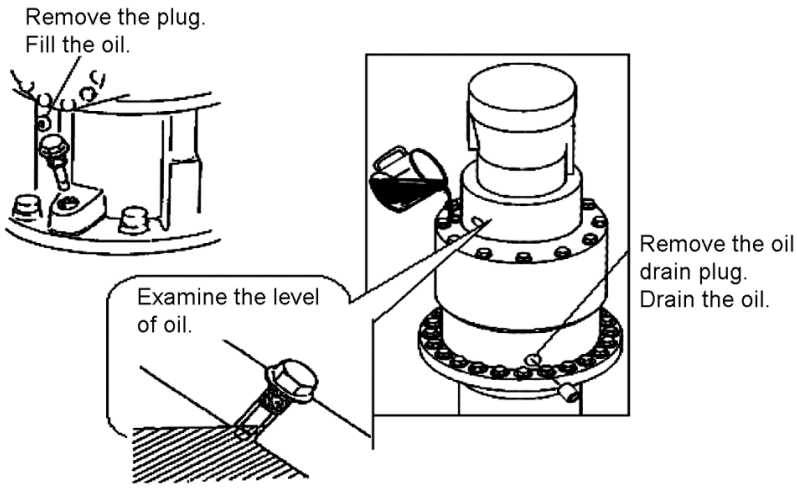


Figure 1-20 Swing Reducer Fill and Drain Ports

NOTE

Fill the gear oil to the top.

1.16 LUBRICATING GREASE

When you lubricate the crane, use only ZL-2 or ZG-3 types of grease. There are two procedures to lubricate the crane:

- Use a grease pump to put (inject) lubricant through a grease fitting (nipple).
- Apply the grease directly to the part by hand.

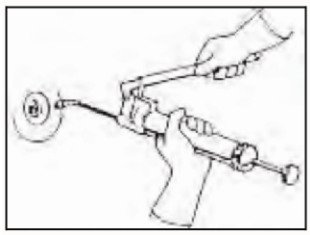


Figure 1-21 Grease Pump

Table 1-5 Types of Grease

Type of Grease	Parameters			
	Appearance	Drop point °F (°C)	Cone penetration (in)	Maximum moisture (%)
ZL-2	Smooth inunctum with the color from light yellow to brown.	347 (175)	1	——
ZG-3	Equal inunctumwith the color from light yellow to dark brown.	194 (90)	1	2.5

1.17 LUBRICATING POINTS

A. You can use Table 1-6 and Figure 1-22.

Table 1-6 Lubrication Intervals and Points

No.	Description	Intervals	Method	Lubricant Type
1	Upper pulley block (shaft) on main boom	10 Days	Grease	ZL-2
2	Slider pads of main boom	10 Days	Grease or inject with grease pump	ZL-2
3	Lower pulley block (shaft) on main boom	10 Days	Inject with grease pump	ZL-2
4	Sliding surfaces of the main boom	10 Days	Grease	ZL-2
5	Upper articulated-point shaft of derricking cylinder	Monthly	Inject with grease pump	ZL-2
6	Pulley block (shaft) on main / auxiliary hook	10 Days	Inject with grease pump	ZG-3
7	Drive lines of oil pump	Daily	Inject with grease pump	ZL-2
8	Lower articulated-point shaft of derricking cylinder	Monthly	Inject with grease pump	ZL-2
9	Outrigger slider pads	10 Days	Grease or inject with grease	ZL-2
10	Main / auxiliary winch	Semi-annual	Directly pour	90# industrial gear oil
11	Main boom main shaft	Daily	Grease or inject with grease pump	ZL-2
12	Swing reducer	Semi-annual	Directly pour	90# industrial gear oil
13	Wire-rope	10 Days	Grease	ZG-3
14	Pulley block (shaft) on jib	10 Days	Inject with grease pump	ZL-2

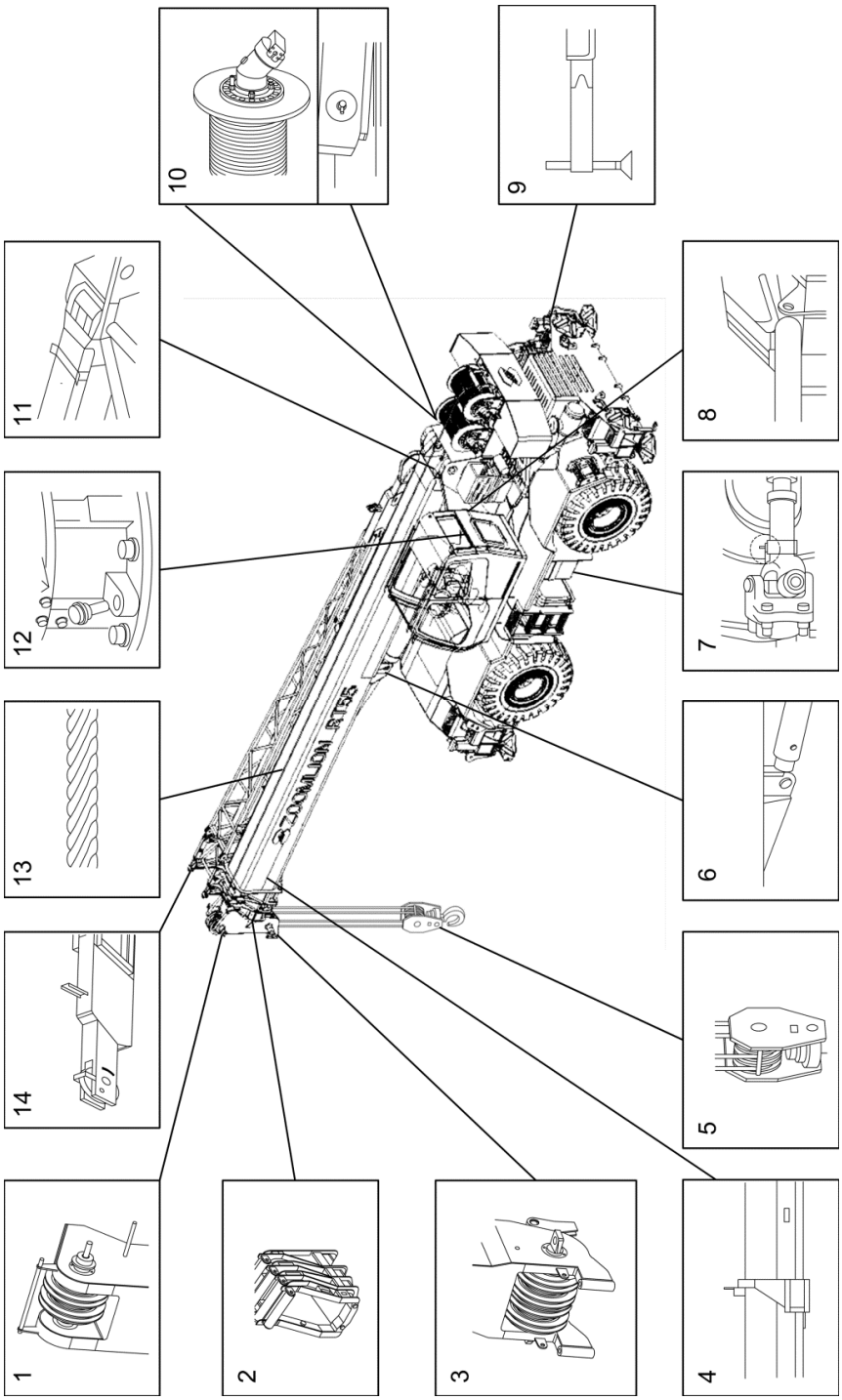


Figure 1-22 Crane Lubrication Points

NOTE

Before you put lubricant (grease) on a part by hand, clean the part then add the lubricant.

Clean and lubricate all the sliding surface areas (bare metal, includes cylinder pistons), not in the table, at a regular interval.

You cannot mix grease of different brands (specifications) or types.

When you inject lubricant (grease) with a grease pump, continue the procedure until you see old grease come out of the joints.

1.18 ADJUST, CLEAN AND REPLACE THE PARTS

A. Adjustments

Table 1-7 Adjustments

Item	Monthly	Quarterly	Semi-Annual	Yearly
Adjust the adjusting bolt under the brake pedal to make sure that the free stroke varies from 0.4 to 0.86 in. (10 to 22 mm).	●			
Adjust the limit screw on the steering knuckle of front axles to ensure that the limit screws on steering axles reach their limit position at the same time.		●		
Adjust engine fan, air compressor and generator belts to between 0.4 to 0.6 in. (10 to 15 mm).			●	

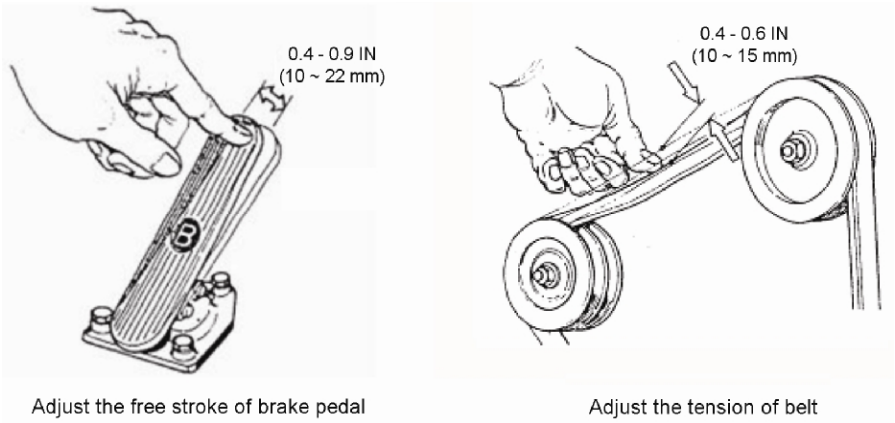


Figure 1-23 Adjustments

B. Clean the Chassis

(1) Intervals

Table 1-8 Intervals

Item	Daily	Monthly	Quarterly	Semi-Annual	Yearly
Drain brake system. Pull the draw ring of manual water drain valve downwards to drain water.	●				
Clean the fuel filter.			●		
Clean the water tank.			●		
Clean the air cleaner filter element with compressed air from the inside.			●		
Clean the air cleaner filter element.				●	

C. Clean the Diesel Fuel Filter

(1) Clean the diesel fuel filter as follows:

(a) Put a container below the fuel filter drain plug.

(b) Loosen the air relief cock and remove the drain plug to drain fuel and unwanted material from the filter bowl.

(c) Remove the long central treaded bolt and washer from the fuel filter assembly. Remove the parts that follow:

- Fuel filter bowl
- Spring
- Spring seat
- Filter element
- Washer.

(d) Clean the parts from step (c) but do not clean the filter element.

CAUTION

Do not wash the filter element!

(e) Examine the filter element. If it is dirty or full of contamination, discard it. If this is a 1000 hours inspection, discard the element.

NOTE

If you install a new filter element, replace the washer and O-ring.

(f) Assemble the fuel filter in sequence as follows (See Figure 1-24):

- Long central treaded bolt
- Washer (new)
- Fuel filter bowl
- Spring
- Spring seat
- Filter element (new)
- O-ring (new).

(g) Remove the air with manual oil pump.

(h) Examine the filter assembly for leaks.

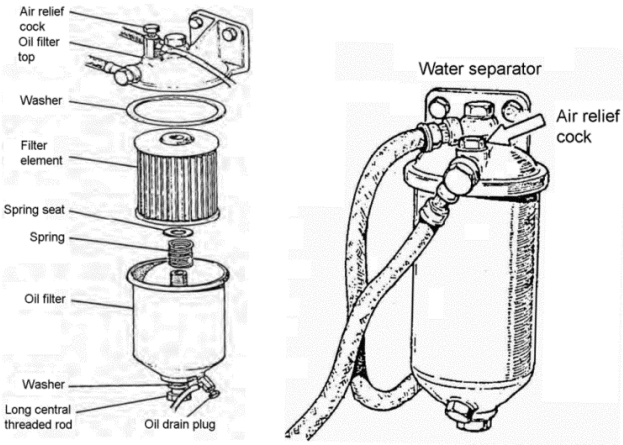


Figure 1-24 Fuel Filter and Water Separator

D. Clean the Cooling System

Operate the engine until it increases to the usual temperature of 185° F (85° C). If the water temperature is too low, the thermostat cannot open and the coolant cannot flow through the radiator. Clean the cooling system as follows:

(1) Loosen the radiator drain cock to fully drain the engine coolant. Operate the engine at idle speed (as you remove the engine coolant) for five seconds.

(2) Close the radiator drain cock and remove the radiator cap. Fill the radiator with a fluid to clean the engine coolant system and tap water. Install the radiator cap.

(3) Operate the engine until it increases to the usual temperature 185° F (85° C). Set the heater control to full heat and the blower to ON.

(4) Operate the engine for 30 minutes at idle speed with no load.

(5) Stop the engine and drain the coolant system.

(6) Add tap water and operate the engine to flow through the system, then stop the engine and drain the coolant system. Do this step again 2 or 3 times.

(7) Add the correct quantity of antirust, antifreeze and tap water to fill the system.

(8) Operate the engine until it increases to the usual temperature 185° F (85° C). Remove the air from the system.

(9) Stop the engine and make sure that the level of fluid in the system is at the correct level. If necessary, add tap water to fill the system.

E. Clean the Air Cleaner

Clean the air cleaner as follows:

(1) Remove the clamp from the air cleaner and remove the rear end cover.

(2) Remove the filter element.

(3) Clean the contaminations from the inner side of the air cleaner and cover. Make sure that the air filter element is free of contamination. If necessary, replace the element.

(4) Install the element and cover. Tighten the clamp.

F. Chassis Parts – Replacement Intervals

Table 1-9 Replacement Intervals

Item	Every 1 year	Every 2 years	Every 4 years
Diaphragm and rubber parts of pressure regulating valve of air dryer	●		
Air cleaner filter element	●		
Shims and rubber parts of service brake valve	●		
Hose connecting the air compressor and pressure regulating valve	●		
Shim and rubber parts of the relay valve	●		
Shims and rubber parts of quick release valve	●		
Shims and rubber parts of park brake valve	●		
Shims and rubber parts of tee clack	●		
Air cleaner filter element	●		
Diesel fuel hose inside the engine hood		●	
Diesel fuel hose outside the engine hood			●

G. Wire-RopeMaintenance

CAUTION

When the wire-rope is on the crane for a long interval, it can become weak and can cause a dangerous condition.

(1) Wire-Rope Inspection

CAUTION

Replace the wire-rope if you find one of the items that follow:

- Steel wire breaks: six on one rope layer or three on one rope strand.

- Torsion resistant wire-rope breaks: two steel wires of rope diameter in less than 0.2 in. (6 mm) or four steel wires of rope diameter in less than 1.2 in. (30 mm).
- A break in the wire-rope on the external rope layer at the core position (causes rope core to extrude or in circle).
- The thickness (diameter) of one wire-rope on the external layer is less than 2/3 of its usual thickness (diameter).
- Wire-rope that is not usual: distortion, flattened or broke wire nests etc.
- Wire-rope with an area of damage because of too much heat.
- If the wire-rope has an area that you think is not as thick as it must be, you must replace the rope. Use the data that follows to examine the rope:

Inches		**Millimeters**	
Rope Thickness D	**Maximum Loss**	**Rope Thickness D**	**Maximum Loss**
≤ 0.3	0.02	≤ 8	0.4
0.4 to 0.5	0.03	9.5 to 13	0.8
0.6 to 0.7	0.05	14.5 to 19	1.2
0.9 to 1.1	0.06	22 to 29	1.6
1.3 to 1.5	0.09	32 to 38	2.4

- Wire strand breaks: two out of the rope connection or one at the rope connection.

(2) Wire-Rope Replacement

(a) Make the crane level on a hard surface.

(b) Fully retract the boom.

(c) Lower the main hook and set it on the ground.

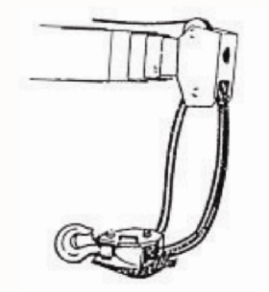


Figure 1-25 Hook on the Ground

CAUTION

Operate carefully to avoid the rope from disordering on the drum.

(d) Remove the press nipple from the boom (top section) or the main hook.

1 Tools necessary: Wrench.

2 Set the parts to the side until they are necessary.

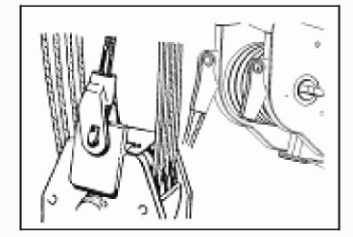


Figure 1-26 Main Hook and Nipple

(e) Remove the wire-rope from the press nipple.

1 Tools necessary: Steel rod (punch), hammer and wrench.

2 Set the parts to the side until they are necessary.

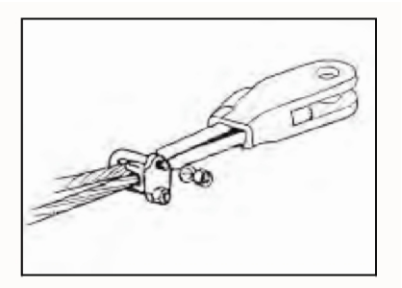


Figure 1-27 Wire-Rope Nipple

(f) Manually pull all the wire-rope from the drum.

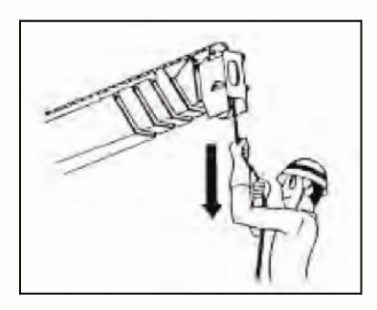


Figure 1-28 Pull Wire-Rope

CAUTION

The 3rd wrap warning alarm comes ON when only 3 hoist rope wraps are left on the main winch. Push the bypass key switch until the wire-rope stops.

(g) Remove the wire-rope from the main winch drum.

1 Tools necessary: Steel rod (punch) and hammer.

2 You must be careful when you remove the chock.

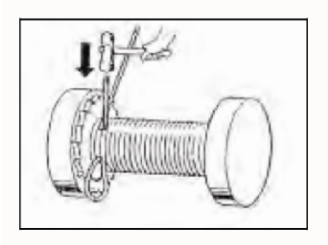


Figure 1-29 Wire-Rope Off the Drum

(h) Reeve the new wire-rope through the boom sheave.

1 Tools necessary: Thin steel wire or ethylene plastic strap.

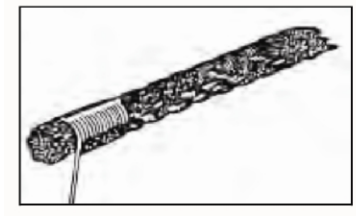


Figure 1-30 The End of the New Wire-Rope

CAUTION

Put thin steel wire or ethylene plastic strap on the end of the wire-rope.

(i) Install the new wire-rope onto the main winch drum with the chock.

1 Tools necessary: Hammer.

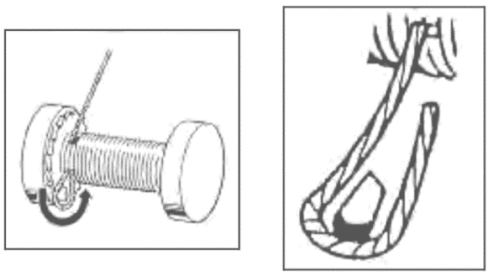


Figure 1-31 New Wire-Rope on the Drum

CAUTION

- **Make sure that the chock is in the correct position before you make the wire-rope tight.**
- **Make sure that the end of the wire-rope does not go fully through the drum. The wire-rope must extend more than the surface of the drum.**

(j) Spool-up the wire-rope.

1 Tools necessary: Thin steel wire or ethylene plastic strap.

Figure 1-32 Monitor the Rope (Must Lay Flat and Evenly)

CAUTION

Do not spool-up the wire-rope too quickly. Make sure that the rope collects on the drum correctly.

(k) Reeve the wire-rope through the top boom head sheave and hook pulley block in the related line parts.

CAUTION

Make sure that you attach the wire-rope in the correct sequence.

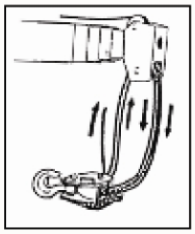


Figure 1-33 Wire-Rope Wrap Sequence

(l) Install the becket and wedge onto the wire-rope.

1 Tools necessary: Wrench and hammer.

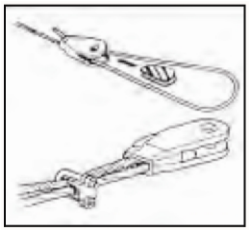


Figure 1-34 Becket and Wedge

CAUTION

Make sure that the tapered (beveled) end of the becket is in the same direction as the end of the wire-rope.

(m) Install the becket to the end of the boom or to the main hook.

1 Tools necessary: Wrench.

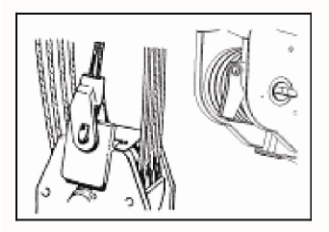


Figure 1-35 Becket Attachment

(n) Derrick the boom and fully extend the boom. Reel-off the wire-rope from the main winch until the 3rd wrap alarm sounds.

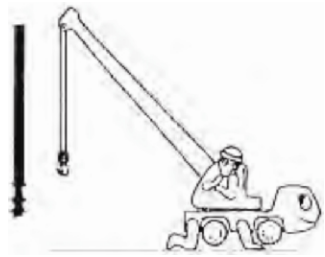


Figure 1-36 Boom Extended and Elevated

CAUTION

Do not let the main hook hit the ground or move too quickly to prevent rope damage or an accident.

(o) Attach a load to the main hook and spool-up the wire-rope. The load must not be more than 30% of the maximum lift capacity for each wire strand. For example:

1 Weight of the load: W = 0.3 x NP

2 Line parts: N

3 Max. permissible lift capacity per strand: P

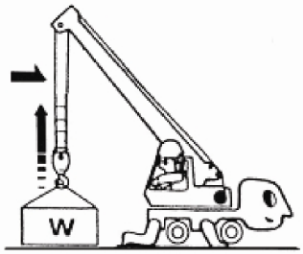


Figure 1-37 Spool-Up Wire-Rope

CAUTION

Do not lift more than the lift capacity of the wire-rope.

(p) Remove the load from the main hook.

H. Hook Inspection

(1) Do an inspection on the hook. Replace the hook if you find one of the items in the next step.

NOTE

Do not weld the hooks to repair the disfigurements.

(a) A crack and crevasse on the surface of the hook.

(b) The split degree of the hook cannot be more than 10% of the usual distance.

(c) An abrasion of the dangerous sectional plane cannot be more than 10% of the usual thickness.

(d) The wear extent of the sectional plane in point where wire-rope suspended exceeds 10% of original height.

(e) The torsion and deformation of hook exceeds 10°.

(f) There is plastic deformation in dangerous sectional plane such as the tail of hook, the screw threaded part and hook web.

I. Replace the Return-Line Filter Element

The hydraulic tank (reservoir) has a return-line filter on the input connection (return-line). The filter stops contamination of the hydraulic fluid, such as particles of metal and rubber. Make sure that you are careful when you add fluid to the system.

The filter element in the filter stops the particles that are more than 1 um in dimension. It can decrease the number of magnetized and non-magnetized particles. The filter increases the quality of the hydraulic fluid which increases the service life of all the components in the system.

The texture of the filter is a non-woven chemical fabric which can stop the flow of contamination and let a large quantity of fluid go through. The usual system pressure does not decrease. Its filter precision is calibrated by the absolute filter precision. Its filter ratio and efficiency align with the requirements of ISO.

To replace the filter, the top cover is the only part you must remove.

When the system is open (top cover off), the contamination that is caught by the filter cannot go into the system because of the internal fluid openings.

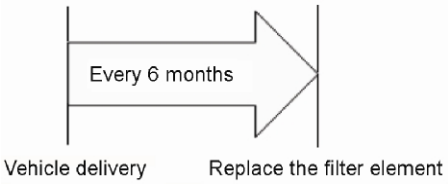


Figure 1-38 Filter Change Interval

CAUTION

Do not replace the filter element if the hydraulic system is pressurized.

J. Filter Replacement

(1) Remove the four bolts and top cover.

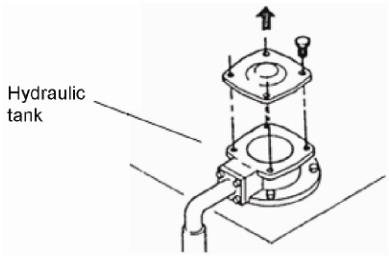


Figure 1-39 Top Cover

(2) Remove the spring and the permanent magnetunit.

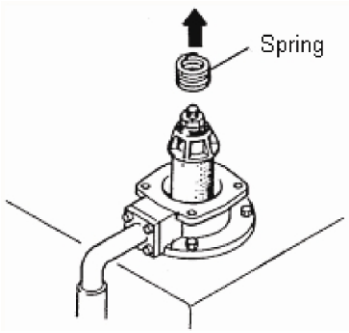


Figure 1-40 Disassemble

(3) Remove and replace the filter element.

Figure 1-41 Filter Element

(4) Install thepermanent magnetunit and spring.

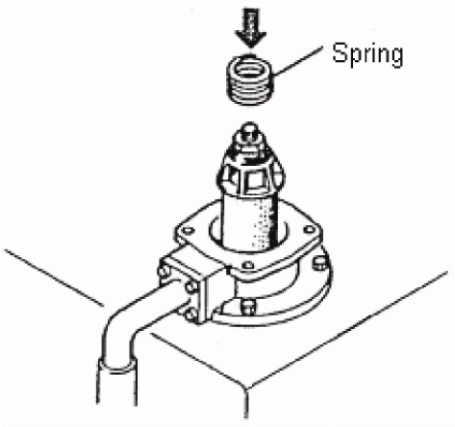


Figure 1-42 Assemble

(5) Install the top cover with the four bolts.

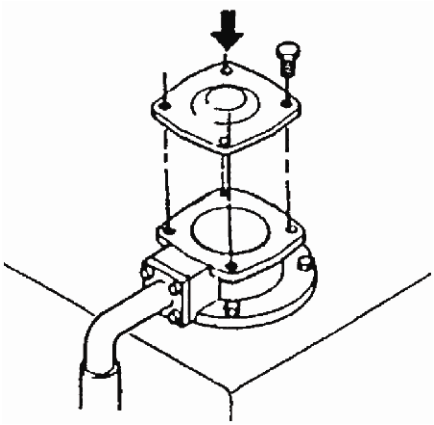


Figure 1-43 Top Cover Assembly

K. Boom Extend / Retract

(1) Troubleshoot

Problem: The top boom section does not fully retract.

Cause: The boom extend / retract rope is not at the correct length.

Correction: Adjust the rope.

(2) Adjust the retract rope top section of the boom as follows:

(a) Remove the access panel on top boom section to get access to the nut at the head of the boom retraction rope.

(b) Loosen the lock nut, then turn the adjustment nut to tighten the extend rope. Make sure that the rope is not loose. Do not make the rope too tight.

Tools necessary: Socket wrench.

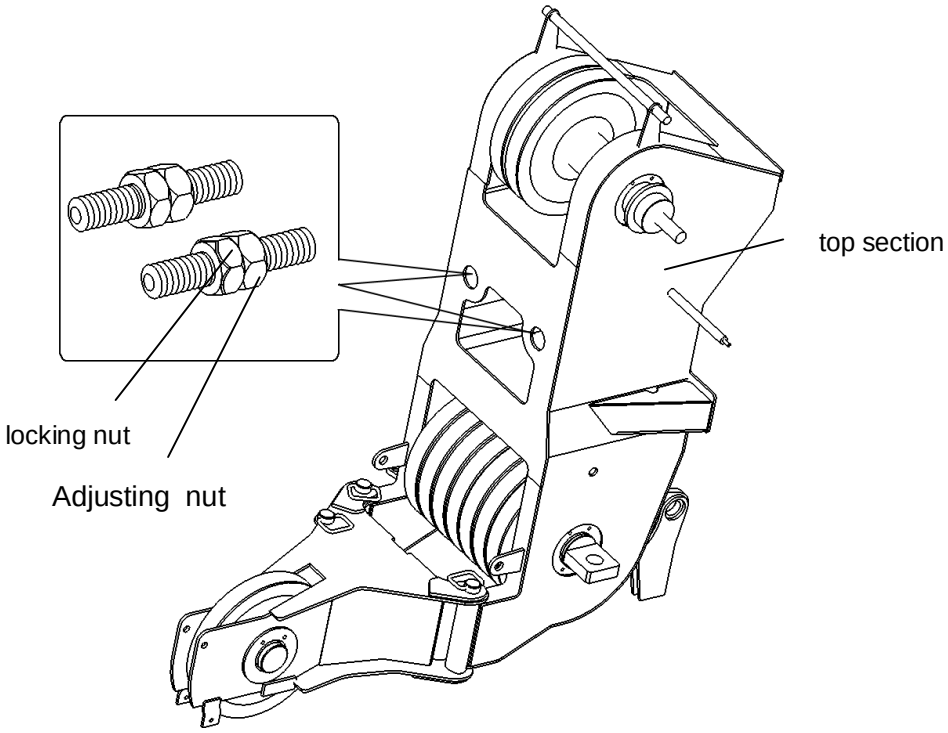


Figure 1-44 Adjust and Lock nuts

(3) Adjust the retract rope on the boom section 2 as follows:

Use the same procedure that you used to adjust the top section retract rope. The adjustment nut is on the side of the boom head.

CAUTION

- **Make sure that the crane is on a hard surface.**
- **The boom extend rope is not adjustable.**
- **Do not make the adjustment nut too tight. Make sure that the lock nut is tight after you adjust the wire-rope.**

L. Swing Bearing Bolts – Inspection and Torque

It is important to do an inspection on the swing bearing bolts. The interval of the inspection is set to make sure that the crane operates in a safe manner.

Make sure that the bolts are tight with the specified torque.

After the break-in period, examine the bolts semi-annually or after 1000 hours.

Torque sequence:

When you do a check of the torque on the bolts, follow the sequence in Figure 1-45.

(1) Tighten the bolts on the inner ring (chassis frame).

(2) Tighten the bolts on the outer ring (superstructure).

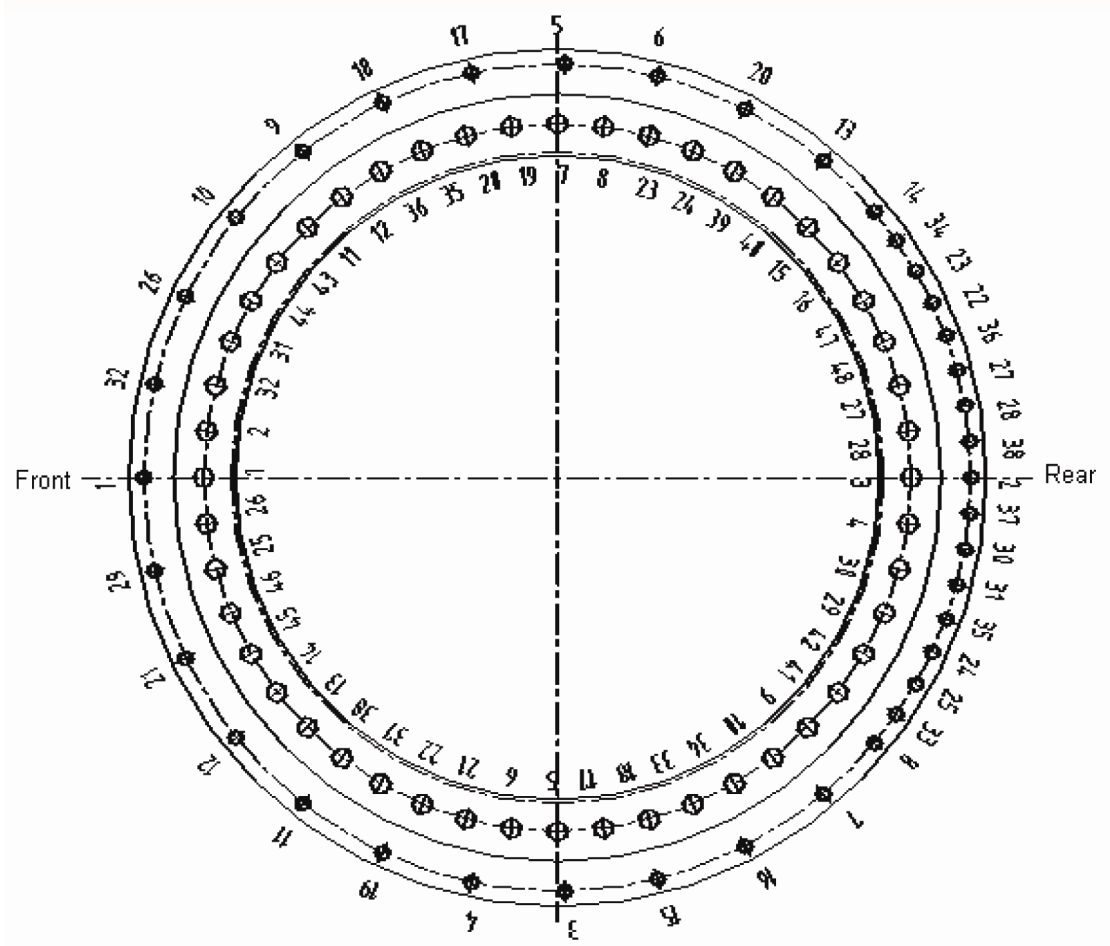


Figure 1-45 Torque Sequence

1.19 BATTERY MAINTENANCE AND SERVICE

The batteries in the crane align with national standard GB/T 5008.1 - 2005. If the electrical system is free of malfunctions, keep the batteries fully charged. If the batteries do not charge or cannot hold voltage, examine the generator and voltage regulator for malfunction.

Do an inspection of the batteries and the battery storage area as follows:

A. When the batteries are fully charged, make sure that the acid level is between 0.4 and 0.6 in (10 and 15 mm) above the top edge of the battery plates.

B. Examine the battery cell caps as follows:

- The caps are tight and air vents are not blocked.
- The batteries and the storage area are dry.

C. Usual charge refers to the charge of battery after use. When you measure the level of charge on a battery, the voltage on a usual charged battery is 1.2 - 1.5 times that of a discharged one. When you find a battery that is too low, measure the voltage level of each cell. If you find a cell that has less than 1.75 volts, stop the check and charge the battery.

D. Charge a usual charged battery as follows:

(1) Make sure that the charger power is OFF and put the charger power plug into the power socket. If the charger has a voltage selector switch, set it to the correct voltage of the battery/batteries you charge. When you charge two batteries (batteries in series) at the same time, set the voltage selector switch to 24 V.

(2) Connect the positive (+) and negative (-) clips to the battery terminals. Adjust the time to charge interval by the charger operating manual. Do not do a rapid charge on the batteries.

(3) Set the charger power switch to ON and adjust the current selector (below 20 A). When the battery electrolyte temperature increases to 113° F (45° C), immediately stop charge.

(4) The battery charge can continue for approximately 5 - 10 hours. When the battery/batteries are fully charged, use a voltmeter to measure the voltage. The voltage in the battery must be > 15 volts or electric eye is in good condition.

(5) Set the current rotary switch and the charger power switch to OFF.

(6) Disconnect the positive (+) and negative (-) clips from the battery terminals.

(7) Remove the charger power plug.

E. Do an equalizing charge procedure if one of the items that follows occurs:

- Monthly, when the crane operates in usual conditions.
- When the battery charge interval is too long or unusually high loss of power in the battery.
- The battery voltage is too low or it fails to charge.
- If you find a battery cell with a voltage level of < 1 volt or three cells that are < 1.5 volts.

(1) Equalizing charge procedure:

(a) When the battery has a usual charge do not move it for one hour.

(b) Charge the battery (at 10 amp setting) until the battery electrolyte starts to bubble. Do not move it for one hour.

(c) Do step 2 again until the electrolyte starts to bubble. Make sure that the level of electrolyte and the voltage are at the correct level.

F. If you do not operate the crane for a long time, remove the battery from the crane and charge it. Do a usual charge two times each month. Do a full discharge and charge four times each year.

G. Examine the batteries and the area around the batteries as follows:

- Make sure that the terminal connections are tight.
- Remove dirt and corrosion from the wires and terminals.

1.20 BATTERY MAINTENANCE – WINTER

When you operate the crane in cold conditions, you use more electricity more than in other season. Battery maintenance before winter is very important for the battery and crane operation.

A. Make sure that the acid level is between 0.4 and 0.6 in (10 and 15 mm) above the top edge of the battery plates. If necessary, add distilled water.

B. Adjust the electrolyte ratio (acid to distilled water) determined by the area and time of year.

C. Make sure that you install the fluid air plugs correctly. The vent holes must be clean, dry and have no blockage.

D. Make sure that the battery terminals are clean (corrosion free), dry and connected correctly and tight. Add a small quantity of Vaseline to prevent corrosion.

E. If you do not operate the crane for a long time, remove the battery from the crane and make sure that it is charged at all times.

F. Before you start the engine, make sure that all items that use battery power are in the OFF position.

G. If the engine does not start after 15 seconds, do not continue to apply power to the starter. Wait for 2 minutes before you start the engine again.

H. When a battery is bad, replace it. Make sure that the new battery has the same power capacity.

CAUTION

When the temperature is lower than 22°F (-30° C), make sure that you protect the battery to prevent loss of heat.

1.21 OPERATION IN WINTER

When you operate the crane in the winter, the fluids in the crane become thick. Make sure that all the fluids are the correct type for the area time of year. Good maintenance and correct operations are very important for safety operation and can prevent many crane malfunctions.

Make sure that you prepare the crane correctly when you operate the crane in cold area. Decrease the speed of the crane when you move. If it is necessary, stop the crane at a flat, dry and sunny area.

A. Chassis Maintenance

(1) The engine oil must be the correct grade to operate in cold weather. When the temperature decreases, the viscosity of the oil decreases. If it is too low, the oil cannot move to all the inner parts of the engine. You can cause damage to the engine.

CAUTION

- **Do not mix the engine oil of different brand and different type.**
- **Make sure that you always use the correct oil type and grade of oil. Multi-grade oils let the engine to operate in a wide range of temperatures.**

(2) Add / change the coolant. Clean the engine cooling system and add the coolant. You can get the best system performance (all-seasons and all-purpose) when you use a long-acting coolant.

CAUTION

If you find that the coolant is bad, make sure that you follow the procedure(Clean the Cooling System).

(3) Always use the correct type of diesel fuel. For more data on the correct fuel to use, refer to *the Engine Manufacturer'sManual*. The fuel must be winterized when the crane operates in a cold area. Change the diesel fuel filter at the interval in this manual.

(4) Replace the air cleaner filter element to increase the quantity and quality of the air that goes into the engine. This can increase the fuel efficiency and increase the power output of the engine.

(5) Check tires and their pressure. The road can be slippery in cold weather. Tire pressures that are too high or too low cause dangerous conditions (low temperature, fragile tire and low pressure of tire knead tire badly and accelerate aging). Rotate the tires at the correct interval.

(6) Make sure that the fan operates correctly and that there are no leaks in the heater lines.

CAUTION

Frequently clean the oil tank lines and brake lines so they do not freeze. Drain the water and the contaminations from the air filter assembly and the water in water separator before you park or move the crane.

1.22 OPERATION IN SUMMER

If the highest daily temperature is frequently higher than 95° F (35° C), the engine can get too hot. To prevent this and make sure that the crane can operate safely and satisfactorily, you must do the maintenance below on the chassis:

A. Make sure that the oil is the correct grade if the crane operates in a hot area. Frequently make sure that the quantity and quality of lubricants used on the crane are at the correct level. Replace the lubricant if it has contamination.

B. Make sure that the engine thermostat operates correctly. Replace the thermostat if it does not open at the correct temperature.

C. Make sure that the coolant in the engine is at the correct level and mixture. If necessary, add water and coolant.

D. Make sure that the engine cooling system functions correctly.

E. Keep the surface of the water tank clean so it can remove the heat.

F. When you move the crane, make sure that the coolant temperature is not more than 203° F (95° C). If the temperature is too high, stop the crane to decrease the coolant temperature.

CAUTION

In special conditions, you can open the engine hood to help decrease the temperature. Make sure that the air conditioner is in the OFF position.

G. Do not stop the engine immediately when the coolant is too hot. Stop the crane and keep the engine ON at idle speed. Open the engine hood fully to increase air flow at the same time. After the coolant is cool, you can continue to move the crane.

WARNING

If the coolant boils, do not stop the engine immediately. Permanent damage to the engine can occur.

CAUTION

Do not directly face the water fill port when you remove the water cap. Hot water can spray from the port.

H. If there is antifreeze in the expansion tank, fill it with distilled or deionized water (instead of tap water).

WARNING

Damage to the engine occurs if you put cold water onto the engine when the temperature is too high.

I. Monitor the tire temperature and pressure while you move.

CAUTION

Do not put water on or deflate the tire if the pressure or temperature is too high. Stop the crane in a cool area to lower the temperature and pressure naturally. If you must go through water, make sure that the tire temperature is in the correct range before you go.

ZOOMLION

MANUAL FOR ROUGH TERRAIN CRANE

Chapter 2 Troubleshooting

Troubleshooting

2.1 ELECTRICAL SYSTEM

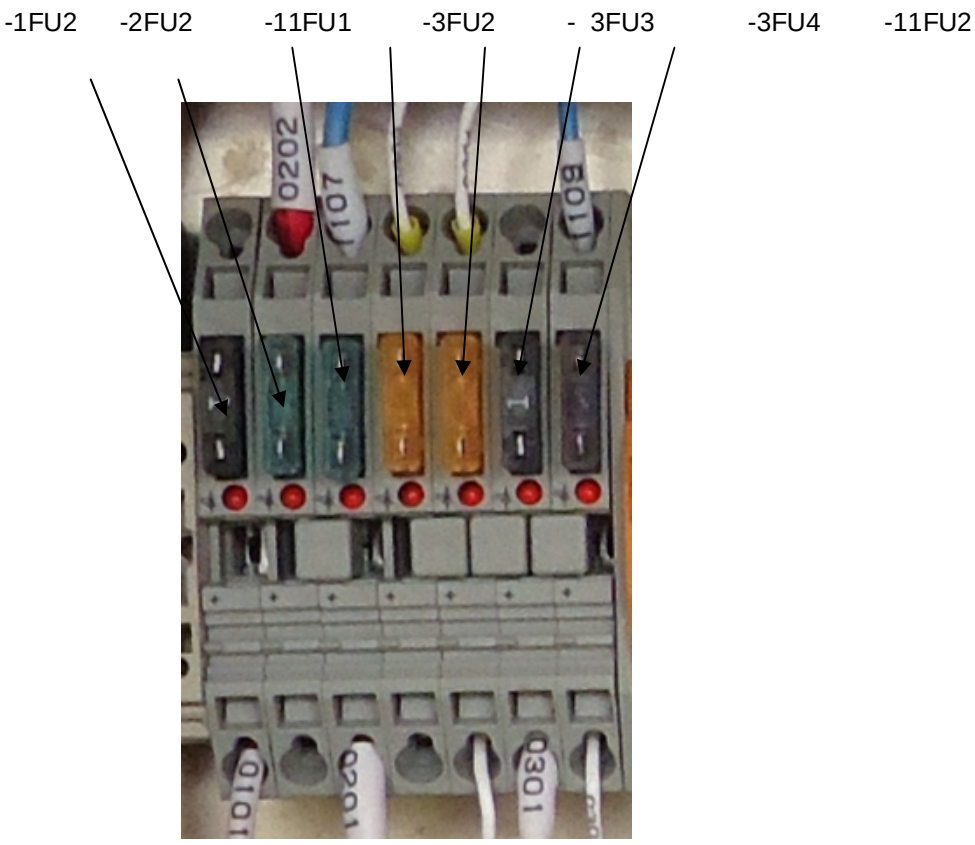
Table 2-1

Part	Problem	Cause	Remedy
Electrical System	Work light does not illuminate	a) Bulb damaged b) FU811 burnt out c) Poor grounding d) Conducting wire broke e) Switch defective	Replace Repair Repair Repair Replace
	Vehicle length indicator does not illuminate	f) Bulb damaged g) Switch defective h) Conducting wire broke	Replace Repair Replace
	Interior light does notilluminate	a) Bulb damaged b) Switch defective c) Conducting wire broke d) FU85 burnt out	Replace Replace Repair Replace
	Instrument lights do not illuminate	a) Bulb damaged b) Switch defective c) Conducting wire broke d) FU811 burnt out	Replace Replace Repair Replace
	Combination instruments do not illuminate	a) Conducting wire broke b) FU66 burnt out c) FU61 burnt out d) Instruments damaged	Repair Replace Replace Replace
	Windshield wiper does not operate	a) FU86 burnt out b) Switch defective c) Damage to the motor	Replace Replace Replace
	Horn does not operate	a) FU87 burnt out b) Switch defective c) Relay defect d) Conducting wire broke e) Horn damaged	Replace Replace Replace Repair Replace
	Anti-two block switch does not operate	a) See the error codes that the RCI display shows b) Winding reel defective c) Conducting wire broke d) Anti-two block switch defective	Repair Repair or replace Repair Replace

Part	Problem	Cause	Remedy
		e) Rope for counterweight attached to the switch broke	Replace
		f) Solenoid valve defective	Repair or replace
		g) Solenoid valve is not grounded correctly	Repair
	Crane cannot move	a) Inspect FU12, FU13 and FU14	Replace or notify the manufacturer
		b) Controller burnt out	Replace the controller
	RCI defective	a) FU64 burnt out.	Replace
		b) See the error codes that the RCI display shows	Repair
	Indicator for Anti-two block switch / 3rd wrap activated stays on	a) Anti-two block switch / 3rd wrap defective	Repair

A. Fuse

Electrical movement mechanisms are equipped with individual fuse which all been placed in fuse terminal for convenient searching and maintenance. The fuse terminal comprises of two parts: fuse terminal of chassis control ; fuse terminal of superstructure control . Layout of fuse terminal demonstrates as follows:



-1FU1: Fuse for control box light power supply

-2FU2: Fuse for engine ECU power supply

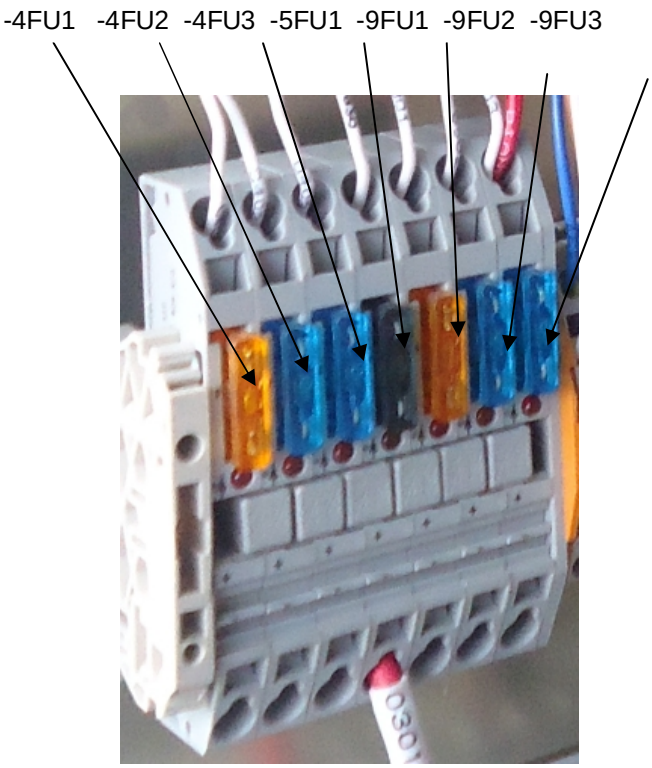
-11FU1:Fuse for hydraulic fan power supply

-3FU2: Fuse for engine ignitionpower supply

-3FU3: Fuse for desiccatorspower supply

-3FU4: Fuse for incline sensor power supply

-11FU2: Fuse for vehicle flexible valve power supply



-4FU1: Fuse forchassis controller CPU1 VBB_S

-4FU2:Fuse forchassis controller CPU1 VBB_O

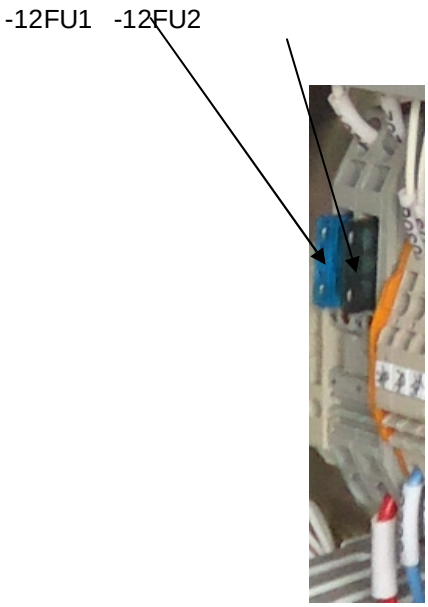
-4FU3:Fuse forchassis controller CPU1 VBB_R

-5FU1: Fuse for sensor power supply

-9FU1: Fuse forchassis controller CPU2 VBB_S

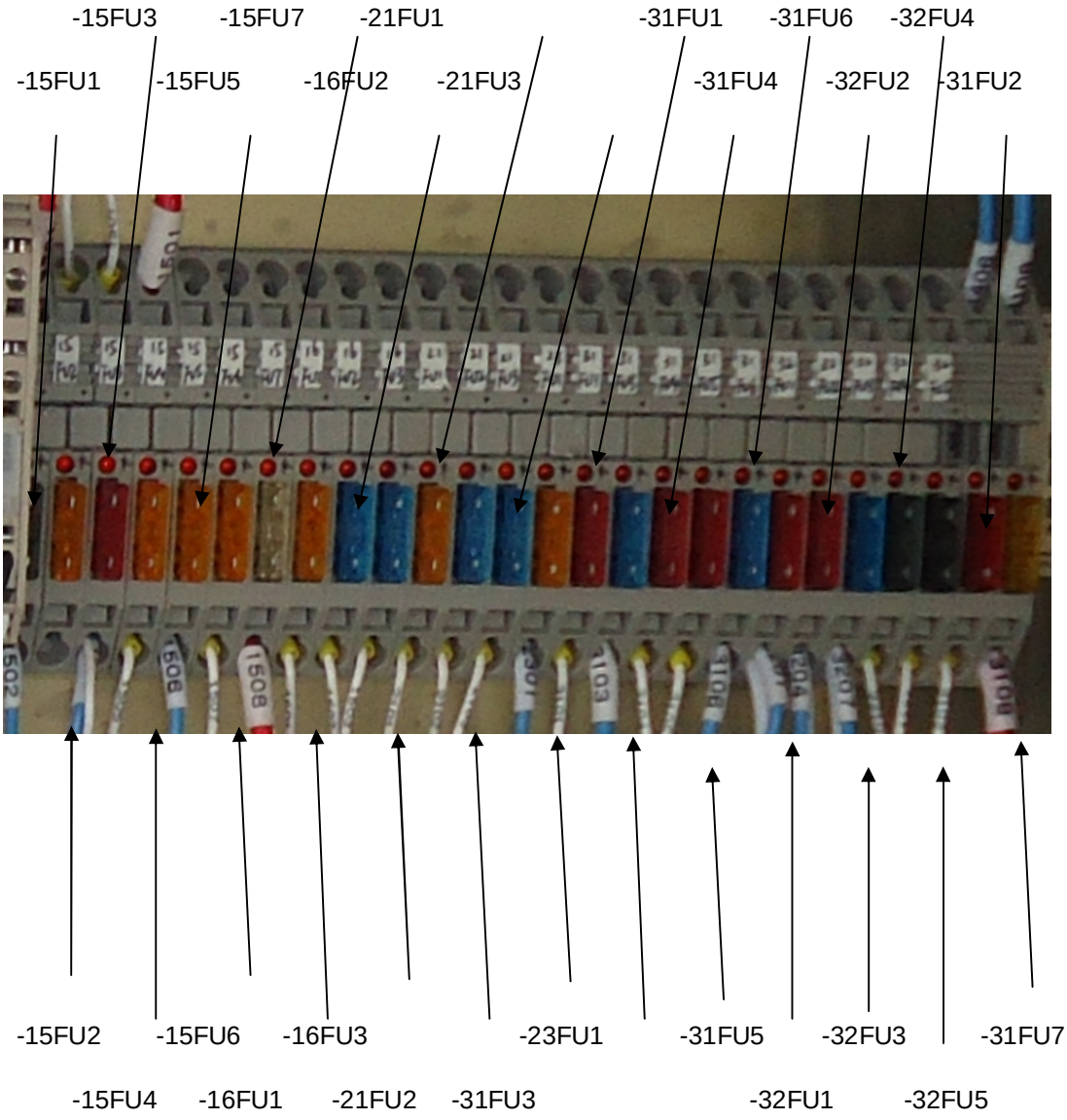
-9FU2: Fuse forchassis controller CPU2 VBB_O

-9FU3: Fuse forchassis controller CPU2 VBB_R



-12FU1: Fuse one for Transmission controller power supply

-12FU2:Fuse two for Transmission controller power supply



-15FU1: Fuse for superstructure power supply

-15FU2:Fuse for COBO system power supply

-15FU3:Fuse for moment limiter power supply

-15FU4: Fuse for display power supply

-15FU5: Fuse for joystick power supply

-15FU6: Fuse for camera power supply

-15FU7: Fuse for air conditioner system

-16FU1:Fuse forsuperstructure controller CPU1 VBB_S

-16FU2: Fuse forsuperstructure controller CPU1 VBB_O

-16FU3: Fuse forsuperstructure controller CPU1 VBB_R

-21FU1:Fuse forsuperstructure controller CPU2 VBB_S

-21FU2: Fuse forsuperstructure controller CPU2 VBB_O

-21FU3: Fuse forsuperstructure controller CPU2 VBB_R

-23FU1: Fuse for inductive switch power supply

-31FU1: Fuse for fan of operation cabpower supply

-31FU3: Fuse for on-board battery (24V/12V)

-31FU4: Fuse for roof windshield wiperpower supply

-31FU5: Fuse for top light on operation cabpower supply

-31FU6: Fuse for syringepower supply

-32FU1: Fuse for horn power supply

-32FU2: Fuse for warning lamp power supply

-32FU3: Fuse for Working light power supply

-32FU4: Fuse for auxiliary winch speed inductorpower supply

-32FU5: Fuse for main winch speed inductorpower supply

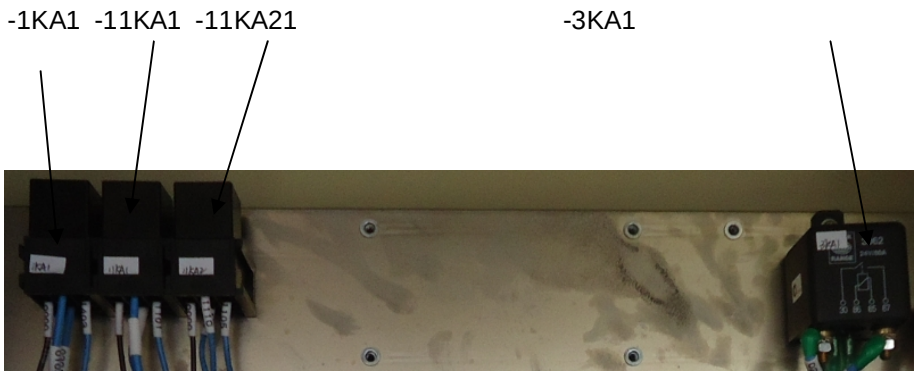
-31FU2: Fuse for radio power supply

-31FU7: Fuse forcigarette lighterpower supply

B. Relay

Electrical movement mechanisms are equipped with individual relay which all been placed in relay terminal for convenient searching and maintenance. The relay terminal comprises of two parts: relay terminal of chassis control ; relay terminal of superstructure control . Layout of relay terminal demonstrates as follows:

Relay terminal of chassis control

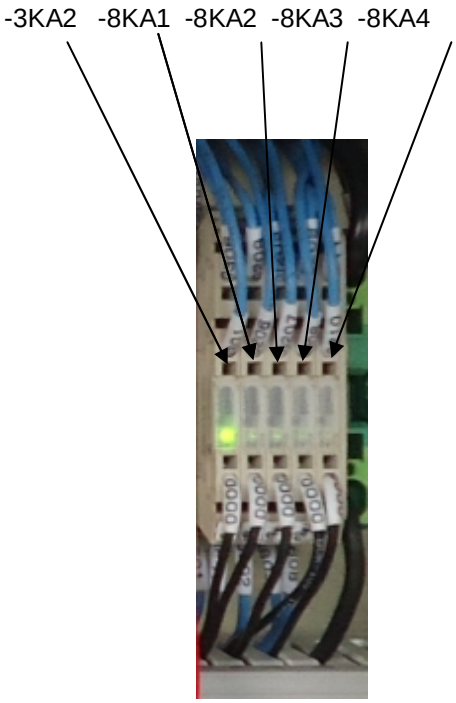


-1KA1: Relay for engine portfire

-11KA1: Relay for hydraulic fan

-11KA2: Relay for vehicle flexible valves

-3KA1: Relay for chassis power control



-3KA2: Relay for transmission controller power control

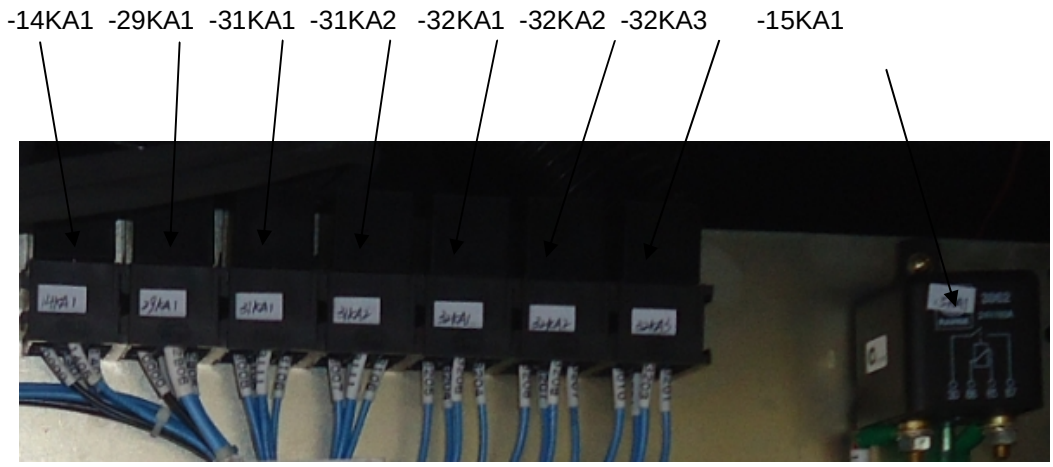
-8KA1: Relay for engine diagnose

-8KA2: Relay for engine diagnose page up

-8KA3: Relay for engine diagnose page down

-8KA4: Relay for low engine coolant level warning

Relay terminal of superstructurecontrol



-14KA1: Relay for emergency stop

-29KA1:Relay for air-condition

-31KA1:Relay for windshield wiper low speed

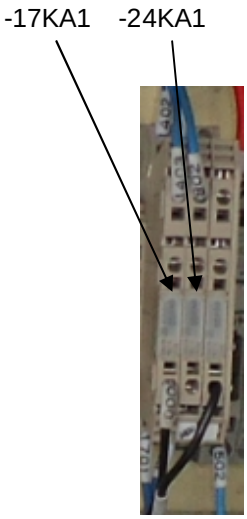
-31KA2: Relay for windshield wiper high speed

-32KA1: Relay for warning lamp

-32KA2: Relay for working lights

-32KA3: Relay for horn

-15KA1: Relay for superstructure power control



-17KA1: Relay for engine start

-24KA1:Relay for dead man valve

2.2 HYDRAULIC SYSTEM

Table 2-2

Part	Problem	Cause	Remedy
Electrical System	System pressure does not increase	a) The fluid level in the hydraulic tank is too low	Add hydraulic oil
		b) Blockage in the relief valve	Clean the valve element
		c) Central revolving joint leaks	Inspect the joint and seal ring
		d) The pressure gauge is not accurate	Repair or replace
		e) Hydraulic oil is too old (decomposed) or dirty	Replace oil and filter
	Hydraulic pump makes unusual noises	a) The fluid level in the hydraulic tank is too low	Add hydraulic oil
		b) Air is in the suction union	Repair the seal ring
		c) Mounting bolts loose	Tighten bolts
		d) Hydraulic oil is too old (decomposed) or dirty	Replace oil and filter element.
		e) Drive shaft shaken	Repair
		f) Universal joint worn	Replace
		g) Hydraulic pump defective	Replace
	Hydraulic pump unusually hot	a) The fluid level in the hydraulic tank is too low	Add hydraulic oil
		b) Hydraulic oil is too old (decomposed) or dirty	Replace oil and filter
		c) Hydraulic pump defective	Repair or replace
		d) Radiator defective	Examine
		e) Temperature of the hydraulic system is too high	Decrease the temperature manually or stop the engine

2.3 EXTEND / RETRACT SYSTEM

Table 2-3

Part	Problem	Cause	Remedy
Electrical System	Boom cannot retract	a) Balance valve defective	Repair
		b) Electrical system defective	Repair
		c) Main valve leaks internally	Repair
		d) Pilot control valve defective	Repair solenoid coil
		e) Retraction rope and fittings defective	Examine
	Boom cannot extend	a) Relief valve pressure is set too low	Adjust or replace
		b) Main boom length detector is not adjusted correctly	Adjust or repair
		c) Electrical system defective	Repair
		d) Foot valve defective	Repair
		e) Pilot control valve defective	Repair solenoid coil
		f) Extension rope and fittings defective	Examine
	Boom retracts automatically during operation (will not hold its position)	a) Cylinder internally leaks	Repair the seal ring
		b) Balance valve defective	Repair
		c) O-ring for the balance valve worn	Replace the O-ring
		d) Oil cylinder, valves or fittings leak	Repair

2.4 DERRICKING MECHANISM

Table 2-4

Part	Problem	Cause	Remedy
Derricking Mechanism	Cylinder cannot extend	a) Main relief valve pressure is set too low	Adjust
		b) Main valve leaks internally	Repair
		c) Cylinder leaks internally	Repair the seal ring
	Cylinder cannot retract	a) Derricking-control balance valve defective	Repair or replace
		b) Electrical system defective	Repair
	Cylinder retracts automatically during operation (will not hold its position)	a) Cylinder leaks internally	Repair
		b) Derricking-control balance valve defective	Repair
	Cylinder vibrates when the boom is lowered	a) The right joystick moves to the neutral position too quickly	Move the joystick to the neutral position slowly
		b) Opening pressure of the derricking-control balance valve is not constant.	Examine the accumulator of pilot control valve block for functional work
		c) Blockage in the derricking-control balance valve core	Clean or replace the valve core
		d) Blockage in the derricking-control main valve core	Clean or replace the valve core

2.5 SWING MECHANISM

Table 2-5

Part	Problem	Cause	Remedy
Electrical System	Brake defective.	Brake pad is worn.	Adjust or replace
	Superstructure cannot move left or right	a) Relief pressure of outrigger control valve is too low	Adjust
		b) Relief valve pressure for swing valve is set too low	Adjust
		c) Swing valve defective	Repair or replace
		d) Hydraulic motor damaged	Replace
		e) Swing reducer defective	Repair
	Superstructure moves too slow	a) Relief valve pressure for the chassis multiple unit valve is set too low	Adjust
		b) Relief valve pressure for the swing valve is set too low	Adjust
		c) Swing valve defective	Repair
		d) Swing cushion valve defective	Repair
		e) Hydraulic motor defective	Repair
	Free swing function defective	a) Switch defective	Repair or replace
		b) Conducting wire broke	Repair
		c) Solenoid controlled swing valve defective	Repair or replace
		d) Swing cushion valve defective	Repair or replace
		e) Swing brake does not engage	Repair the oil pipeline
		f) Swing lock disengaged	Engage

2.6 HOIST MECHANISM

Table 2-6

Part	Problem	Cause	Remedy
Electrical System	Hook cannot go up	a) Relief valve pressure for the main valve is set too low.	Set the pressure to 27 MPa.
		b) Hydraulic motor defective	Replace
		c) Main valve defective	Repair
		d) Electrical system defective	Repair
		e) Winch reducer does not turn	Examine the pilot valve and the brake valve
	Hook cannot go down	a) Relief valve pressure for the main valve is set too low	Adjust or repair
		b) Hydraulic motor defective	Repair
		c) Main valve defective	Repair
		d) Electrical system defective	Repair
		e) Balance valve defective	Replace
		f) Winch reducer does not turn	Repair
	Brake defective	a) Brake cannot engage or disengage (Pilot oil source pressure for the main valve is set too low).	Set the pressure to 3 MPa
		b) Brake pad is seriously worn.	Replace
		c) Air in the brake system	Bleed the system
		d) Hydraulic motor defective (pump volume is too low, not enough oil flow to do multiple tasks).	Repair or replace

2.7 OUTRIGGERS

Table 2-7

Part	Problem	Cause	Remedy
Outriggers	Do not move	a) Relief pressure of outrigger control valve is not adjusted correctly. b) Solenoid coil of outrigger control valve defective	Adjust the pressure Replace the solenoid coil
	Move too slow	a) Chassis multiple unit valve leaks internally b) Relief valve pressure for the chassis multiple unit valve is set too low.	Repair Adjust
	Vertical cylinder retracts automatically during operation (will not hold its position)	a) Bidirectional hydraulic lock defective b) Cylinder leaks internally	Remove sewage or replace valve. Replace the seal ring
	Vertical cylinder extends automaticallyduring travel (will not hold its position)	a) Bidirectional hydraulic lock defective. b) Cylinder leaks internally c) Cylinder leaks externally	Remove sewage or replace valve Replace the seal ring Repair

2.8 TRANSMISSION

Table 2-8

Part	Problem	Cause	Remedy
Transmission	Control pressures in the full gear range are low	a) Pressure gauge defective	Replace the pressure gauge
		b) Control oil pipeline leaks	Examine oil pipeline and replace control valve
		c) Oil pump pressure is not sufficient	Repair or replace oil pump
		d) The control valve mount bolts are loose.	Tighten bolts
	Transmission overheating	a) Oil pump pressure is not sufficient due to oil level to high or too low, or incorrect oil type	Examine and adjust oil quality & level to the requirements.
		b) Traveling on a slope over 12° for a long period of time or exposed to high ambient temperature	Stop the engine and lower the oil temperature.
		c) Traveling slow for a long period of time	Stop at an interval to let the engine and transmission temperatures adjust.
		d) Engine RPM is too high.	Examine and control the engine control to make the highest engine RPM agree with the requirements.
	Unusual transmission noise	Knocking Sound: a) Caused by bumping between gear and tooth face in the gear box which could be verified by sparkle generated by tooth face compressing test. When the gear is bearing load, the noise could be more extreme. It shows that the gear is defected if you can hear noise when the gear is engaged.	Use whetstone and manual grinding wheel to smooth out rough spots.

Part	Problem	Cause		Remedy
			b) If the balls or rollers in the bearingsare damaged, there can be spots and scale on the roller bed, which causes noise when each gear is at low rotational speed.	Replace
			c) A knocking sound (at low turning speed) and screaming sound (at high turning speed) can be heard if the gear cracks at an impulsive load or when the component was assembly.	Replace
		Screaming sound	a) Caused by normal abrasion of the gears, including spots generated after long-period application and screaming sound before being damaged.	Replace
			b) Caused by incorrect engagement of gears which could be verified by unevenly tooth face abrasion.	Replace
	Backup light illuminates all the time or does not illuminate.	a) No electricity		Examine power supply and repair
		b) No supply of electricity to the reverse gear of the gear selector		Examine corresponding lines and Repair.
		c) The control pin for reverse gear of the gear selector is stuck or the reverse gear is on or off all the time		Replace related component
	The ignition switch cannot turn.	a) No electricity		Examine power supply and repair
		b) Air is in the oil pipeline		Bleed the air from the system
	Stages I and II of ignition switch do not function.	The switch to stop the current of solenoid valve does not operate		Replace the defected solenoid valve

Part	Problem	Cause	Remedy
Part	**Problem**	**Cause**	**Remedy**
	Loss of traction force or increase in oil temperature	a) Head pressure of torque converter is low	Adjust the opening pressure of the safety valve for torque converter.
		b) Pressure of the fuel supply system for the engine is low	Clean or replace the fuel filter
	Pressure boosting time in the full gear range is short	Blockage of the pressure control valve	Clean the pressure control valve
	All the gear positions do not operate	a) Fuel level low	Fill the fuel tank to correct level
		b) Components that connect the engine and torque converter defective	Examine or repair the components
		c) The control valve has no electricity	Examine the fuse in the gear selector cable and test the output voltage of the connector.

2.9 BRAKE SYSTEM

Table 2-9

Part	Problem	Cause	Remedy
Brake System	Brake deviation	a) Brake force is not even	Examine and adjust the brakes (clearance between brake disc and brake caliper around 0.020 - 0.028 in (0.5 - 0.7 mm)).
		b) Different tire inflation pressures for different tires	Inflate the tires to the correct pressure
		c) The power to stop is not equal at each wheel (unsynchronized brake disc abrasion). Brake pads wear is unusual (some pads wear much more that others).	Examine or replace brake pads
	Brake locked up	a) Small clearance between brake disc and brake caliper	Examine and adjust the brakes (clearance between brake disc and brake caliper around 0.020 - 0.028 in (0.5 - 0.7 mm)).
		b) Brake system pressure is not sufficient.	Adjust the relief valve pressure or repairthe master brake valve and pre-fill valve.
		c) Park brake will not disengage.	Examine and disengage
	Brake system does not stop the crane at a usual distance (stopping distance too long)	a) Brake system pressure is not sufficient.	Adjust the relief valve pressure or repairthe master brake valve and pre-fill valve.
		b) Accumulator on the master brake valve defective	Replace or supply hydraulic oil
		c) Incorrect clearance between brake disc and brake caliper	Adjust clearance
		d) Defective brake disc	Replace

2.10 STEERING SYSTEM

Table 2-10

Part	Problem	Cause	Remedy
Steering System	Hard steering	a) Oil level in the hydraulic system is too low or the oil has a low viscosity (causes low pressure or air in the system (cavitations)).	Examine oil level in hydraulic tank, add oil as necessary. Use the correct type. Examine sealing performance of pipe fittings
		b) Park brake is engaged	Examine and disengage the park brake
		c) Steering system pressure is not sufficient.	Make sure that the relief valve pressure is not too low
		d) Relief valve core blocked	Clean valve core
		e) Priority valve defective	Clean valve core
		f) Oil pipe fittings leak, pipeline blocked or twisted	Examine, clean or replace pipelines and fittings
		g) Filter blockage, causing unsatisfactory cleanliness and decreased flow	Clean filter and filter element,replace oil
		h) Dangerous leaks and damage in the steering gear	Repair or replace seal ring
		i) Steering cylinder leaks internally	Replace seal ring
	Hard rapid steering	a) Oil supply from the oil pump is not sufficient (low flow)	Repair oil pump
		b) Oil pump suction pipeline weak and collapsed (flat)	Replace pipelines
		c) Heavy oil leaks at the two sides of piston in the steering gear caused by oil damage or too much abrasion	Replace oil seal
		d) Air is inhaled	Examine all pipe fittings

Part	Problem	Cause	Remedy
	Steering sometimes hard or sometimes uncontrolled	a) Floating brass bush of steering pump is blocked and does not touch the wheel end-face all the time.	Repair oil pump
		b) Hydraulic oil is seriously polluted or air is inhaled into the system	Replace oil or remove air from the system
		c) Priority valve core blocked	Clean valve core
		d) Steering gear defective	Repair or replace
	Left steering is uncontrolled while right steering is hard and vice versa	a) Not even oil leaks occurred at the two sides of the piston in the steering gear.	Replace seal ring
		b) Air is inhaled into one side of the cylinder	Remove air from the system
		c) Too much clearance between ball pins of drive rod	Repair or replace
	Traveling deviation	a) Tire inflation pressure in tires on left / right steer axles does not agree with the requirements (extremely inconsistent).	Examine and inflate the tires to the correct pressure
		b) One of the steer axles always in brake status	Adjust or repair the brake
		c) Inconsistent clearance of the bearings in left / right steer axle (one is too loose, while the other is too tight or blocked).	Adjust bearing clearance or replace bearing
		d) Steer axles are blocked.	Examine where it is blocked and examine the input shaft bears radial resistance.
		e) Bubbles are in the oil and travel direction is not stable	Examine and eliminate
		f) Uneven steer axle abrasion	Tire rotation
		g) Front axles are not aligned with the rear axles or incorrectly seated.	Examine and adjust
	Steering gear oil leaks	a) Oil seal	Examine and replace oil seal
		b) O-rings	Examine and replace O-ring
		c) Oil pipes damaged	Examine or replace oil pipelines

		d) Oil pipe fittings	Look for connection that leaks, tighten fitting
		e) Low oil viscosity	Replace oil
		f) Joint face of hydraulic elements loosen	Examine and tighten
	Unusual noise while you steer	a) Oil pipe of hydraulic pipeline twisted	Examine and replace
		b) Unstable oil pump displacement	Replace oil pump

2.11 FRONT / REAR AXLES

Table 2-11

Part	Problem	Cause	Remedy
Front / Rear Axles	Unusual noise	a) Noise sounds like (si) during speed increase or decrease. Gears do not interconnect correctly(clearance of gears too small or poorly aligned).	Adjust the clearance or alignment
		b) New gear poorly meshed	Monitor after breaking-in
		c) Noise sounds like clash on descending gradients or while speed changes quickly. The Noise fades away or decreases during usual movement: clearance between gears too large.	Adjust or replace gear
		d) Continuous noise when the crane is in motion. The noise increases with the speed. But when noise fades away or decreases during sliding: the bearings (hub, main reducer or differential) are worn or too loose.	Adjust or replace bearings
		e) Gear oil level too low or oil viscosity does not agree with requirements.	Add oil to the correct level or replace the oil with the correct type
		f) No noise during straight traveling, but the noise sounds during turning caused by excessively large clearance of bearings on both sides of reducer or worn differential gear or thrust bearing shim.	Adjust or replace
	Heat generation	a) Bearing installed too tightly. Meshing clearance too small.	Adjust
		b) Oil level too low	Add oil to the correct level
		c) Lubricant viscosity too low	Replace with the correct type
	Oil leaks	a) Oil seal defective	Replace
		b) Axle journal worn	Replace the damaged one

Part	Problem	Cause	Remedy
		c) Oil level too high	Drain oil to the correct level
		d) Seal gasket damaged	Replace
		e) Bolts loose	Tighten
		f) Vent cap soiled	Clean

2.12 DRIVE SHAFT

Table 2-12

Part	Problem	Cause	Remedy
Drive Shaft	Unusual noise when the crane begins to move, increase speed and decrease speed.	a) Universal joint cross trunnion, needle roller worn and loosen or needle roller broken.	Replace the universal joint
		b) Drive shaft spline and expansion joint splineway are at the wear limit.	Replace
	Periodical noise during traveling. The noise increases with speed. In the worst case condition, the vehicle shakes and steering wheel does not move.	a) Drive shaft bent or drive shaft flange is not welded correctly to the axle tube.	Replace drive shaft
		b) Retaining bolts at central bearing stand loosen and deflected.	Screw down or replace
		c) Loose or missing bolts between the two drive shafts (adjacent drive connecting shafts).	Tighten or replace
		d) Drive shaft balance block falls off	Replace (balance the shaft)
	Unusual noise during movement. The noise level increases as the speed increases.	a) Central bearing is defective and is at its wear limit.	Adjust or replace
		b) Roller comes off from central bearing	Replace bearing
		c) Inadequate lubricant for central bearing	Add #2 lithium grease

2.13 TIRES

Table 2-13

Part	Problem	Cause	Remedy
Tires	The inner part of tires on the two steer axles have the same quantity of wear.	Toe-in too small or in negative value	Adjust the tie rods of front steer axles along the stretching direction and increase the toe-in value to the specified one.
	The outer part of tires on the two steer axles have the same quantity of wear.	Toe-in too big	Adjust the tie rods of front steer axles along the retraction direction and decrease the toe-in value to the specified one.
	The inner part of the tire on one steer axle is seriously worn, while the outer part of the tire on the other steer axle is seriously worn.	a) Steer axles and drive axles are not aligned or the axles are incorrectly seated.	Adjust the axles in proper position
		b) One steer axle is in straight-line traveling, while the other steer axle is not.	Adjust the tire rods and drag links of front steer axles to make the two axles drive in straight line
	Saw-tooth wear	a) Tires are standing wave: wheels damaged	Remove and install the wheels again or replace
		b) Tires have standing wave (the tire is out-of-balance)	See if there is too much harden talcum powder in the tires
	Tires on one side of the front and rear axles seriously worn	a) Wheels on this side are braked or semi-braked for a long time.	Adjust the brake clearance to specified one
		b) The specification and dimension of the tires on one side do not agree with the requirements.	Replace
	Tires on drive axles are seriously worn.	Drive axles are not aligned to the maximum length.	Adjust
	Tire blow-out	a) Overload: too much weight on the crane when it is in	Decrease load, move slower. Replace tire

Part	Problem	Cause	Remedy
		motion.	
		b) Tires damaged	Replace
		c) Tires reach the wear limit	Replace

2.14 ENGINE ERROR CODE

Engine abnormity would be displayed via fault code through inspection switch,increase, and decrease bottoms on bus gauge in driving room, meaning convied by code as follows:
Engine fault code meaning
(0001)------ Exhaust pressure sensor 1 circuit- voltage above normal value, or shorted to high source
(0002)------ Exhaust pressure sensor 1 circuit- voltage below normal value, or shorted to low source
(0003)------ Exhaust pressure sensor 1 circuit- Data erratic, intermittent or incorrect
(0004)------ Exhaust pressure sensor 1 circuit- Data erratic, intermittent or incorrect
(0005)------ Exhaust pressure sensor 1 circuit- voltage below normal value, or shorted to low source
(0006)------ Exhaust pressure sensor 1 circuit- voltage above normal value, or shorted to high source
(111)------ Engine Control Module Critical internal failure – Bad intelligent Device or Component
(115)------ Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor – Data Erratic, Intermittent, or incorrect
(122)------ Intake Manifold Pressure Sensor Circuit – Voltage above Normal, or Shorted to High Source
(123)------ Intake Manifold Pressure Sensor Circuit – Voltage below Normal, or Shorted to Low Source
(124)------ Intake manifold pipe 1 pressure- data valid but above normal working range-moderate severe level
(131)------ Accelerator Pedal or Lever Position Sensor Circuit - Voltage above normal, or Shorted to High Source
(132)------ Accelerator Pedal or Lever Position Sensor Circuit - Voltage below normal, or Shorted to Low Source
(133)------ Remote Accelerator Pedal or Lever Position Sensor 1 Circuit -Voltage above Normal, or Shorted to high Source
(134)------ Remote Accelerator Pedal or Lever Position Sensor 1 Circuit -Voltage below Normal, or Shorted to Low Source
(135)------ Oil Pressure Sensor selection
(135auto)------ Oil Pressure Sensor Circuit - Voltage above Normal, or Shorted to High Source
(135mar)------ Oil Pressure Sensor Circuit - Voltage above Normal, or Shorted to High Source
(141)------ Oil Pressure Sensor selection
(141auto)------ Oil Pressure Sensor Circuit - Voltage below Normal, or Shorted to Low Source
(141mar)------ Oil Pressure Sensor Circuit - Voltage below Normal, or Shorted to Low Source
(143)------ Oil Pressure selection
(143b)------ Oil Pressure Low – Data Valid but below Normal Operational Range -Moderately Severe Level
(143bm)------ Oil Pressure Low – Data Valid but below Normal Operational Range -Moderately Severe Level
(144)------ Coolant Temperature Sensor Circuit selection
(144b)------ Coolant Temperature Sensor Circuit – Voltage above Normal, or Shorted to High Source
(144bm)------ Coolant Temperature Sensor Circuit – Voltage above Normal, or Shorted to High Source
(145)------ Engine Coolant Temperature Sensor Circuit selection

(145b)------ #1 engine Coolant Temperature Sensor Circuit – Voltage below Normal, or Shorted to Low Source
(145bm)------ #1 engine Coolant Temperature Sensor Circuit – Voltage below Normal, or Shorted to Low Source
(146)------ Engine Coolant Temperature selection
(146b)------ Coolant Temperature High - Data Valid but above Normal Operational Range - Moderately Severe Level
(146bm)------ Coolant Temperature High - Data Valid but above Normal Operational Range - Moderately Severe Level
(147)------ Accelerator Pedal or Lever Position Sensor Circuit frequency– data correct but below normal working range-most severe level
(148)------ Accelerator Pedal or Lever Position Sensor Circuit frequency– data correct but below normal working range-most severe level
(151)------ Engine Coolant Temperature selection
(151b)------ Coolant Temperature Low - Data Valid but above Normal Operational Range - Most Severe Level
(151bm)------ Coolant Temperature Low - Data Valid but above Normal Operational Range - Most Severe Level
(153)------ Intake Manifold Air Temperature Sensor Circuit -Voltage above Normal, or Shorted to High Source
(154)------ Intake Manifold Air Temperature Sensor Circuit -Voltage below Normal, or Shorted to Low Source
(155)------ Intake Manifold Air Temperature selection
(155b)------ Intake Manifold Air Temperature High – Data Valid but above Normal Operational Range - Most Severe Level
(155bm)------ #1 engine coolant temperature sensor circuit- voltage above normal value or shorted to high source
(187)------ Sensor Supply Voltage #2 Circuit selection
(187b)------ Sensor Supply Voltage #2 Circuit – Voltage below Normal, or Shorted to Low Source
(187bm)------ Sensor Supply Voltage #2 Circuit – Voltage below Normal, or Shorted to Low Source
(195)------ Coolant Level Sensor Circuit
(195-2wire)------ Coolant Level Sensor Circuit - Voltage above Normal, or Shorted to High Source
(195-3wire)------ Coolant Level Sensor Circuit - Voltage above Normal, or Shorted to High Source
(196)------ Coolant Level Sensor Circuit
(196-2wire)------ Coolant Level Sensor Circuit - Voltage below Normal, or Shorted to Low Source
(196-3wire)------ Coolant Level Sensor Circuit - Voltage below Normal, or Shorted to Low Source
(197)------ Coolant Level - Data Valid but below Normal Operational Range – Moderately Severe Level
(221)------ Barometric Pressure Sensor Circuit – Voltage above Normal, or Shorted to High Source
(222)------ Barometric Pressure Sensor Circuit – Voltage below Normal, or Shorted to Low Source
(227)------ Sensor Supply Voltage #2 Circuit

(227b)------ Sensor Supply Voltage #2 Circuit – Voltage above Normal, or Shorted to High Source
(227bm)------ Sensor Supply Voltage #2 Circuit – Voltage above Normal, or Shorted to High Source
(234)------ Engine Speed/position selection
(234b)------ Engine Speed High - Data Valid but Above Normal Operational Range – Most Severe Level
(234bm)------ Engine Speed High - Data Valid but Above Normal Operational Range -Most Severe Level
(235)------ Coolant Level Low - Data Valid but below Normal Operational Range – Most Severe Level
(237)------ External Speed Input (Multiple Unit Synchronization) -Data Erratic, Intermittent,or Incorrect
(238)------ Sensor Supply Voltage #3 Circuit – Voltage below Normal, or Shorted to Low Source
(241)------ Vehicle Speed Sensor Circuit - Data Erratic, Intermittent, or Incorrect
(242)------ Vehicle Speed Sensor Circuit tampering has been detected – Abnormal Rate of Change
(245)------ Fan Control Circuit - Voltage below Normal, or Shorted to Low Source
(253)------ Engine oil level- data valid but below normal value- most severe level
(268)------ #1 Oil sprayer calculate oil flow track pressure - Data Erratic, Intermittent, or Incorrect
(269)------ Password accurate indicator of theft prevention, data erratic, intermittent or incorrect.
(271)------ High Fuel Pressure Solenoid Valve Circuit
(271b)------ High Fuel Pressure Solenoid Valve Circuit – Voltage below Normal, or Shorted to Low Source
(271cl)------ High Fuel Pressure Solenoid Valve Circuit – Voltage below Normal, or Shorted to Low Source
(272)------ High Fuel Pressure Solenoid Valve Circuit
(272b)------ High Fuel Pressure Solenoid Valve Circuit – Voltage above Normal, or Shorted to High Source
(272cl)------ High Fuel Pressure Solenoid Valve Circuit – Voltage above Normal, or Shorted to High Source
(275)------ Fuel Pumping Element (Front) – Mechanical System Not Responding Properly or Out of Adjustment
(281)------ High Fuel Pressure Solenoid Valve #1 – Mechanical System Not Responding Properly or Out of Adjustment
(284)------ Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit – Voltage below Normal, or Shorted to Low Source
(285)------ SAE J1939 Multiplexing PGN Timeout Error -Abnormal Update Rate
(286)------ SAE J1939 Multiplexing Configuration Error – Out of Calibration
(287)------ SAE J1939 Multiplexing Accelerator Pedal or Lever Sensor System Error -Received Network Data In Error
(288)------ SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Data Error -Received Network Data In Error
(291)------ Data Datalink error (OEM/vehicle Datalink) - abnormal update speed
(292)------ Auxiliary Temperature Sensor Input 1 – Special Instructions
(293)------ Auxiliary Temperature Sensor Input # 1 Circuit -Voltage above Normal, or Shorted to High Source
(294)------ Auxiliary Temperature Sensor Input # 1 Circuit -Voltage below Normal, or Shorted to low Source
(295)------ Barometric Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect

(296)------ Auxiliary Pressure Sensor Input 1 – Special Instructions
(297)------ Auxiliary Pressure Sensor Input # 2 Circuit – Voltage above Normal, or Shorted to High Source
(298)------ Auxiliary Pressure Sensor Input # 2 Circuits – Voltage below Normal, or Shorted to low Source
(319)------ Real Time Clock Power Interrupt - Data Erratic, Intermittent, or Incorrect
(322)------ Injector Solenoid Cylinder #1 Circuit – Current below Normal, or Open Circuit
(323)------Injector Solenoid Cylinder #5 Circuit – Current below Normal, or Open Circuit
(324)------ Injector Solenoid Cylinder #3 Circuit – Current below Normal, or Open Circuit
(325)------Injector Solenoid Cylinder #6 Circuit – Current below Normal, or Open Circuit
(331)------ Injector Solenoid Cylinder #2 Circuit – Current below Normal, or Open Circuit
(332)------ Injector Solenoid Cylinder #4 Circuit – Current below Normal, or Open Circuit
(334)------ Engine Coolant Temperature – Data Erratic, Intermittent, or Incorrect
(341)------ Engine Control Module data lost - Data Erratic, Intermittent, or Incorrect
(342)------ Electronic Calibration Code Incompatibility - Out of Calibration
(343)------ Engine Control Module Warning internal hardware failure - Bad Intelligent Device or Component
(351)------ Injector Power Supply - Bad Intelligent Device or Component
(352)------ Sensor Supply Voltage #1 Circuit – Voltage below Normal, or Shorted to Low Source
(386)------ Sensor Supply Voltage #1 Circuit – Voltage above Normal, or Shorted to High Source
(387)------ Accelerator Pedal or Lever Position Sensor Supply Voltage Circuit – Voltage above Normal, or Shorted to High Source
(412)------ SAE J1939 Datalink- can not delivery
(415)------ Engine Oil Pressure selection
(415sn)------ Oil Pressure Low – Data Valid but below Normal Operational Range – Most Severe Level
(415sw)------ Oil Pressure Low – Data Valid but below Normal Operational Range – Most Severe Level
(418)------ Water in Fuel Indicator High - Data Valid but above Normal Operational Range– Least Severe Level
(426)------ SAE J1939 Datalink- can not delivery
(427)------ SAE J1939 Datalink –Abnormal Update Rate
(428)------ Water in Fuel Sensor Circuit - Voltage above Normal, or Shorted to High Source
(429)------ Water in Fuel Sensor Circuit - Voltage below Normal, or Shorted to low Source
(431)------ Lever Idle Validation Circuit
(431iss)------ Accelerator Pedal or Lever Idle Validation Circuit -Data Erratic, Intermittent,or Incorrect
(431niss)------ Accelerator Pedal or Lever Idle Validation Circuit -Data Erratic, Intermittent,or Incorrect
(431sss)------ Accelerator Pedal or Lever Idle Validation Circuit -Data Erratic, Intermittent,or Incorrect
(432)------ Accelerator Pedal or Lever Idle Validation Circuit -Out of Calibration
(433)------ Intake Manifold Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect
(434)------ Power Lost without Ignition off - Data Erratic, Intermittent, or Incorrect
(435)------ Oil Pressure Sensor Circuit - Data Erratic, Intermittent, or Incorrect
(436)------ #1 intake manifold pipe temperature- data erratic, intermittent or incorrect
(441)------ #1 accumulator pressure- data valid but below normal value (moderate severe level)
Battery #1 Voltage Low - Data Valid but below Normal Operational Range – Moderately Severe Level

(442)------ Battery #1 Voltage Low - Data Valid but below Normal Operational Range – Moderately Severe Level
(443)------ Accelerator Pedal or Lever Position Sensor Supply Voltage Circuit – Voltage below Normal, or Shorted to Low Source
(449)------ Fuel Pressure High
(449b)------ Fuel Pressure High - Data Valid but Above Normal Operational Range – Most Severe Level
(449cl)------ Fuel Pressure High - Data Valid but Above Normal Operational Range – Most Severe Level
(451)------Injector Metering Rail #1 Pressure Sensor Circuit -Voltage above Normal, or Shorted to High Source
(452)------Injector Metering Rail #1 Pressure Sensor Circuit -Voltage below Normal, or Shorted to low Source
(471)------ Engine Oil Level- Data Valid but Below Normal Operational Range – Least Severe Level
(488)------ Intake Manifold 1 Temperature - Data Valid but above Normal Operational Range - Moderately Severe Level
(497)------ Multiple Unit Synchronization Switch Circuit – Data Erratic, Intermittent, or Incorrect
(498)------ Engine Oil Level Sensor Circuit - Voltage above Normal, or Shorted to high Source
(499)------ Engine Oil Level Sensor Circuit - Voltage below Normal, or Shorted to Low Source
(523)------ OEM Intermediate (PTO) Speed switch Validation -Data Erratic, Intermittent, or Incorrect
(527)------ Auxiliary Input/Output 2 Circuit - Voltage above Normal, or Shorted to High Source
(528)------ Auxiliary Alternate Torque Validation Switch – Data Erratic, Intermittent, or Incorrect
(529)------Auxiliary Input/Output 3 Circuit - Voltage above Normal, or Shorted to High Source
(545)------ Turbocharger 1 exhaust bypass valve control- error or maladjustment of machinery system response
(551)------ Lever Idle Validation Circuit
(551iss)------ Accelerator Pedal or Lever Idle Validation Circuit -Voltage below Normal, or Shorted to Low Source
(551niss)------ Accelerator Pedal or Lever Idle Validation Circuit -Voltage below Normal, or Shorted to Low Source
(551sss)------ Accelerator Pedal or Lever Idle Validation Circuit -Voltage below Normal, or Shorted to Low Source
(553)------ Injector Metering Rail #1 Pressure High – Data Valid but Above Normal Operational Range – Moderately Severe Level
(554)------ Fuel Pressure Sensor Error - Data Erratic, Intermittent, or Incorrect
(559)------ Fuel pump transfer Pressure Low
(559b)------Injector Metering Rail #1 Pressure Low – Data Valid but below Normal Operational Range – Moderately Severe Level
(559cl)------Injector Metering Rail #1 Pressure Low – Data Valid but below Normal Operational Range – Moderately Severe Level
(584)------ Starter Relay Circuit - Voltage above Normal, or Shorted to High Source
(585)------ Starter Relay Circuit - Voltage below Normal, or Shorted to Low Source
(595)------ Turbocharger #1 Speed High
(595b)------ Turbocharger #1 Speed High -warning Level
(595cl)------Turbocharger #1 Speed High - Data Valid but Above Normal Operational Range – Moderately Severe Level
(596)------ Electrical Charging System Voltage High – Data Valid but Above Normal Operational Range – Moderately Severe Level

(597)------ Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
(598)------ Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range - Most Severe Level
(599)------ Auxiliary Commanded Dual Output Shutdown –Special Instructions
(649)------ Change Lubricating Oil and Filter – Condition Exists
(687)------ Turbocharger Speed sensor
(687b)------ Turbocharger speed sensor- Below Normal Operational Range
(687cl)------ Turbocharger #1 Speed Low - Data Valid but Below Normal Operational Range – Moderately Severe Level
(688)------ Engine Oil Level- Data Valid but Above Normal Operational Range – Most Severe Level
(689)------ Primary Engine Speed Sensor Error – Data Erratic, Intermittent, or Incorrect
(691)------ Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
(692)------Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
(731)------ Engine Speed/Position sensor
(731b)------Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
(731bm)------Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors - Mechanical System Not Responding Properly or Out of Adjustment
(757)------ Electronic Control Module data lost - Condition Exists
(778)------ Engine Speed Sensor (Camshaft) Error – Data Erratic, Intermittent, or Incorrect
(779)------ Warning Auxiliary Equipment Sensor Input # 3 (OEM Switch) - Original Cause Not Known
(784)------ Adaptive Cruise Control Mode - Incorrect
(951)------ Cylinder Power Imbalance Between Cylinders – Data Erratic, Intermittent, or Incorrect
(957)------ EGR valve position- data erratic, intermittent or incorrect
(958)------ VGT location sensor- data erratic, intermittent or incorrect
(1117)------ Power Lost With Ignition On
(1117auto)------ Ignition power deficiency - Data Erratic, Intermittent, or Incorrect
(1117mar)------ Ignition power deficiency - Data Erratic, Intermittent, or Incorrect
(1139)------ Injector Cylinder #1 - Mechanical System Not Responding Properly or Out of Adjustment
(1141)------ Injector Cylinder #2 - Mechanical System Not Responding Properly or Out of Adjustment
(1142)------ Injector Cylinder #3 - Mechanical System Not Responding Properly or Out of Adjustment
(1143)------ Injector Cylinder #4 - Mechanical System Not Responding Properly or Out of Adjustment
(1144)------ Injector Cylinder #5 - Mechanical System Not Responding Properly or Out of Adjustment
(1145)------ Injector Cylinder #6 - Mechanical System Not Responding Properly or Out of Adjustment
(1228)------ EGR valve position- data erratic, intermittent or incorrect
(1229)------ VGT location sensor- data erratic, intermittent or incorrect
(1239)------ Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage Above Normal,or Shorted to High Source

(1241)------ Accelerator Pedal or Lever Position Sensor 2 Circuit -Voltage below Normal,or Shorted to Low Source
(1242)------ Accelerator Pedal or Lever Position Sensor1 and 2 – Data Erratic, Intermittent,or Incorrect
(1633)------ Komnet Datalink can not be delivered- data erratic, intermittent or incorrect
(1639)------ #3 auxiliary equipment sensor input (OEM switch)- original cause uncertain
(1654)------ Engine1 cylinder misfire- problem exists
(1655)------ Engine 2 cylinder misfire- problem exists
(1656)------ Engine 3 cylinder misfire- problem exists
(1657)------ Engine 4 cylinder misfire- problem exists
(1658)------ Engine 5 cylinder misfire- problem exists
(1659)------ Engine 6 cylinder misfire- problem exists
(1663)------ Aftertreatment Exhaust Gas Temperature 1 Swapped -Condition Exists
(1664)------ Catalyst Missing- Condition Exists
(1665)------ Aftertreatment Exhaust Gas Temperature 1 Circuit – Voltage below Normal, or Shorted to Low Source
(1666)------ Aftertreatment Exhaust Gas Temperature 1 Circuit – Voltage Above Normal,or Shorted to low Source
(1667)------ Aftertreatment Exhaust Gas Temperature 1 - Data Erratic, Intermittent, or Incorrect
(1668)------ Catalytic cylinder level sensor circuit- voltage below normal value or shorted to low source
(1669)------ Catalytic cylinder level sensor circuit- voltage above normal value or shorted to high source
(1671)------ Catalytic cylinder level- data valid but below normal operation scopemoderate severe level
(1673)------ Catalytic cylinder temperature- data erratic, intermittent or incorrect
(1674)------ Aftertreatment Exhaust Gas Temperature 2 Circuit – Voltage Below Normal,or Shorted to Low Source
(1675)------ Aftertreatment Exhaust Gas Temperature 2 Circuit – Voltage Above Normal,or Shorted to Low Source
(1676)------ Aftertreatment Exhaust Gas Temperature 2 - Data Erratic, Intermittent, or Incorrect
(1677)------ Catalytic cylinder temperature- voltage below normal value or shorted to low source
(1678)------ Catalytic cylinder temperature- voltage above normal value or shorted to high source
(1679)------ Catalytic cylinder temperature- data erratic, intermittent or incorrect
(1681)------ Ration oil supply controller- intelligence device or components defect
(1682)------ Input route of catalyst ration charge sector- condition exists
(1683)------ Catalytic cylinder heater circuit- voltage above normal value or shorted to high source
(1684)------ Catalytic cylinder heater circuit- voltage above normal value or shorted to high source
(1687)------ Catalytic device overheat- data valid but above normal operational scope (most severe level)
(1689)------ Real time lock power off- data erratic, intermittent or incorrect
(1692)------ Aftertreatment outlet nitroxygen compound sensor circuit- voltage below normal value or shorted to low source
(1694)------ Aftertreatment outlet nitroxygen compound sensor-data erratic, intermittent or incorrect
(1697)------ Aftertreatment #1 air activator- voltage above normal value or shorted to high source

(1698)------ Aftertreatment #1 air activator- voltage below normal value or shorted to low source
(1699)------ Catalytic cylinder level sensor- data erratic, intermittent or incorrect
(1711)------ Dose control sector Datalink- abnormal update rate
(1712)------ Catalytic cylinder heater circuit- data valid but below normal operational scope (moderate severe level)
(1713)------ Catalytic cylinder heater circuit- data valid but above normal operational scope (moderate severe level)
(1716)------ Auxiliary temperature sensor input 1 circuit- original cause uncertain
(1717)------ Exhaust temperature 1- data valid but above normal value- least severe level
(1718)------ Multiple air cylinder of engine misfire- problem comes out
(1848)------ Intake manifold 1 temperature- abnormal diversification speed
(1849)------ Exhaust temperature 1- abnormal diversification rate
(1851)------ Exhaust temperature 2- abnormal diversification rate
(1892)------ Vehicle speed refers to wheel- data valid but above normal driving scope (moderate severe level)
(1911)------ Injector Metering Rail 1 Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
(2183)------ Engine Brake Actuator Driver 1 Circuit – Voltage below Normal, or Shorted to Low Source
(2185)------ Sensor Supply Voltage #4 Circuit – Voltage above Normal, or Shorted to High Source
(2186)------ Sensor Supply Voltage #4 Circuit – Voltage below Normal, or Shorted to Low Source
(2215)------ Fuel Pump Delivery Pressure low
(2215b)------ Fuel Pump Delivery Pressure low - Data Valid but Below Normal Operational Range - Moderately Severe Level
(2215cl)------ Fuel Pump Delivery Pressure low - Data Valid but Below Normal Operational Range - Moderately Severe Level
(2216)------ Fuel Pump Delivery Pressure high
(2216b)------ Fuel Pump Delivery Pressure - Data Valid but above Normal Operational Range – Moderately Severe Level
(2216cl)------ Fuel Pump Delivery Pressure - Data Valid but above Normal Operational Range – Moderately Severe Level
(2217)------ ECM Program Memory (RAM) Corruption – Condition Exists
(2249)------ Injector Metering Rail 1 Pressure - Data Valid but Below Normal Operational Range - Most Severe Level
(2265)------ Fuel Priming Pump Control Signal Circuit – Voltage above Normal, or Shorted to High Source
(2266)------ Fuel Priming Pump Control Signal Circuit – Voltage below Normal, or Shorted to Low Source
(2271)------ EGR Valve Position Circuit -Voltage above Normal, or Shorted to high Source
(2272)------ EGR Valve Position Circuit -Voltage below Normal, or Shorted to Low Source
(2273)------ Exhaust Gas Recirculation Valve Delta Pressure Sensor Circuit – Voltage above Normal, or Shorted to High Source
(2274)------ Exhaust Gas Recirculation Valve Delta Pressure Sensor Circuit – Voltage below Normal, or Shorted to Low Source
(2292)------ Fuel Inlet Meter Device - Data Valid but above Normal Operational Range - Moderately Severe Level
(2293)------ Fuel Inlet Meter Device flow demand lower than expected - Data Valid but Below Normal Operational Range - Moderately Severe Level

(2311)------ Fueling Actuator #1 Circuit Error – Condition Exists
(2321)------ Engine Speed / Position Sensor #1 - Data Erratic, Intermittent, or Incorrect
(2322)------ Engine Speed / Position Sensor #2 - Data Erratic, Intermittent, or Incorrect
(2345)------ Turbocharger speed
(2345b)------ Turbocharger rotate speed- invalid change of speed is inspected
(2345cl)------ invalid change of speed is inspected- abnormal speed change rate
Turbocharger speed invalid rate of change detected - Abnormal Rate of Change
(2346)------ Outlet temperature
(2346b)------ Outlet temperature-data above normal value
(2346cl)------ Turbocharger Turbine Inlet Temperature (Calculated)- Data Valid but Above Normal Operational Range – Least Severe Level
(2347)------ Turbocharger compressor outlet temperature
(2347b)------ Turbocharger compressor outlet temperature-data above normal value
(2347cl)------ Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid but Above Normal Operational Range – Least Severe Level
(2348)------ EGR valve can not demarcate automatically
(2349)------ EGR Valve Control Circuit - Current below Normal, or Open Circuit
(2351)------ EGR Valve Control Circuit - Voltage below Normal, or Shorted to Low Source
(2352)------ EGR Valve Control Circuit - Voltage above Normal, or Shorted to high Source
(2353)------ EGR Valve Control Circuit - Voltage above Normal value or circuit grounding.
(2357)------ EGR Valve Control –machinery system respond incorrect or maladjustment
(2359)------ Exhaust Gas Recirculation Valve Delta Pressure – Data Valid but above Normal Operational Range –Moderately Severe Level
(2362)------ Engine Brake Actuator Circuit #1 – Voltage below Normal, or Shorted to Low Source
(2363)------ Engine Brake Actuator Circuit #2 – Voltage below Normal, or Shorted to Low Source
(2366)------ Engine Brake Actuator Circuit #1 – Voltage above Normal, or Shorted to High Source
(2367)------ Engine Brake Actuator Circuit #2 – Voltage above Normal, or Shorted to HighSource
(2373)------ Air exhausting pressure sensor circuit- high voltage shorted
(2374)------ Air exhausting pressure sensor circuit- low voltage shorted
(2375)------ Exhaust recirculation temperature sensor circuit- voltage above normal value or shorted to high source
(2376)------ Exhaust recirculation temperature sensor circuit- voltage below normal value or shorted to low source
(2377)------ Fan Control Circuit - Voltage above Normal, or Shorted to High Source
(2381)------ Turbocharged location sensor circuit- HV shorted
(2382)------ Turbocharged location sensor circuit- LV shorted
(2383)------ Exchangeable section type turbocharged actuator circuit- current below normal value or open circuit
(2384)------ VGT Actuator
(2384b)------ VGT Actuator- Voltage below Normal, or Shorted to Low Source
(2384cl)------ VGT Actuator Driver Circuit - Voltage below Normal, or Shorted to Low Source
(2385)------ VGT Actuator
(2385b)------ VGT Actuator - Voltage above Normal, or Shorted to High Source
(2385cl)------ VGT Actuator Driver Circuit - Voltage above Normal, or Shorted to High Source
(2386)------ Turbocharged actuator motor circuit- current above normal value
(2387)------ Turbocharged actuator motor circuit- abnormal mechanical system responding
(2388)------ Location of exchangeable section type turbocharged actuator can not demarcate automatically- beyond calibration scope
(2554)------ Exhaust Gas Pressure – Data Erratic, Intermittent, or Incorrect

(2555)------ Intake Air Heater #1 Circuit - Voltage above Normal, or Shorted to High Source
(2556)------ Intake Air Heater #1 Circuit - Voltage below Normal, or Shorted to Low Source
(2557)------ Auxiliary PWM Driver #1 - Voltage above Normal, or Shorted to High Source
(2558)------ Auxiliary PWM Driver #1 - Voltage below Normal, or Shorted to Low Source
(2771)------ Aftertreatment outlet nitroxygen compound sensor- abnormal update rate
(2772)------ Aftertreatment outlet nitroxygen compound-data valid but above normal valueleast severe level
(2773)------ Aftertreatment outlet nitroxygen compound-data valid but above normal valuemost severe level
(2961)------Exhaust Gas Recirculation Temperature - Data Valid but above Normal Operational Range – Least Severe Level
(2962)------ Exhaust Gas Recirculation Temperature - Data Valid but above Normal Operational Range –Moderately Severe Level
(2963)------ Engine Coolant Temperature High - Data Valid but above Normal Operational Range – Least Severe Level
(2964)------ Intake Manifold Temperature High - Data Valid but above Normal Operational Range – Least Severe Level
(2973)------ Intake Manifold Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect
(2976)------ Dose controller temperature- data erratic, intermittent or incorrect
(9121)------ EGR Valve actuator temperature high (calculated) - data above normal scope

(9122)------ Exchangeable section type turbocharged actuator temperature too high.

2.15 TRANSMISSION ERROR CODE

Lighting up of H4 red light indicates transmission fault, fault codes shows in table below

Fault code	**Causes**	**Reaction**	**Remedies**
DANA	**Causes**	**Reaction**	**Remedies**
00.1F	Input number 'O' might attributes error to ECONA program which should not be resumed until this problem is rectified.	Input number 0, display pin 59: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
01.1F	Input number '1' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 1, display pin 58: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
02.1F	Input number '3' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 2, display pin 57: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
03.1F	Input number '3' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 3, display pin 56: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
04.1F	Input number '4' might attribute error to ECONA program which	Input number 4, display pin	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired

	should not be resumed until this problem is rectified.	55: failure exists.	information: operate available basic program or correct error manually.
05.1F	Input number ‘5’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 5, display pin 54: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.

Fault code	**Causes**	**Reaction**	**Remedies**
DANA	**Causes**	**Reaction**	**Remedies**
06.1F	Input number ‘6’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 6, display pin 53: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
07.1F	Input number ‘7’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 7, display pin 52: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
10.03	Input analog quantity O might receive value beyond max. measurement range and input voltage of high	Input analog quantity 0, display pin 25-24: voltage surpass normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected

	electric level.	value or high electric level	program (component)
10.04	Input analog quantity O might receive value below min. measurement range and input voltage of low electric level.	Input analog quantity 0, display pin 25-24: voltage below normal value or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
10.0D	Function input from sensor to instrument is calibrated rather than sensor.	Input analog quantity 0, display pin 25-24: count surpassed quantity	Calibrate sensor output function. Refer to other error reports to determine effected program (component)
10.10	Input analog quantity 0 might receive value beyond standard max. measurement range. Sensor broken or installation defects.	Input analog quantity 0, display pin 25-24: Data valid but beyond max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)

Fault code	**Causes**	**Reaction**	**Remedies**
DANA			

06.1F	Input number ‘6’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 6, display pin 53: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
07.1F	Input number ‘7’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input number 7, display pin 52: failure exists.	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
10.03	Input analog quantity O might receive value beyond max. measurement range and input voltage of high electric level.	Input analog quantity 0, display pin 25-24: voltage surpass normal value or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
10.04	Input analog quantity O might receive value below min. measurement range and input voltage of low electric level.	Input analog quantity 0, display pin 25-24: voltage below normal value or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
10.0D	Function input from sensor to instrument is calibrated rather than sensor.	Input analog quantity 0, display pin 25-24: count surpassed quantity	Calibrate sensor output function. Refer to other error reports to determine effected program (component)

10.10	Input analog quantity 0 might receive value beyond standard max. measurement range. Sensor broken or installation defects.	Input analog quantity 0, display pin 25-24: Data valid but beyond max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
11.10	Input analog quantity 1 might receive value beyond standard max. measurement range. Sensor broken or installation defects.	Input analog quantity 1, display pin 27-26: Data valid but beyond max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)
11.12	Input analog quantity 1 might receive value below standard min. measurement range. Sensor broken or installation defects.	Input analog quantity 1, display pin 27-26: Data valid but below max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)
11.1F	Input analog quantity ‘1’ might attribute error to ECONA program which should not be resumed until this	Input analog quantity 1, display pin 27-26, failure exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct

	problem is rectified.		error manually.
12.03	Input analog quantity 2 might receive value beyond max. measurement range and input voltage of high electric level.	Input analog quantity 2, display pin 29-28: voltage surpass normal value or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
12.04	Input analog quantity 2 might receive value below min. measurement range and input voltage of low electric level.	Input analog quantity 2, display pin 29-28: voltage below normal value or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)

Fault code DANA	**Causes**	**Reaction**	**Remedies**
12.0D	Function input from sensor to instrument is calibrated rather than the sensor.	Input analog quantity 2, display pin 29-28: count surpassed quantity	Calibrate sensor output function. Refer to other error reports to determine effected program (component)
12.10	Input analog quantity 2 might receive value beyond standard max. measurement range. Sensor broken or installation defects.	Input analog quantity 2, display pin 29-28: Data valid but beyond max. operational	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)

		value	
12.12	Input analog quantity 2 might receive value below standard min. measurement range. Sensor broken or installation defects.	Input analog quantity 2, display pin 29-28: Data valid but below max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)
12.1F	Input analog quantity '2' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input analog quantity 2, display pin 29-28, failure exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
13.03	Input analog quantity 3 might receive value beyond max. measurement range and input voltage of high electric level.	Input analog quantity 3, display pin 14-13: voltage surpass normal value or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
13.04	Input analog quantity 3 might receive value below min. measurement range and input	Input analog quantity 3, display pin 14-13: voltage below normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected

	voltage of low electric level.	value or low electric level	program (component)
13.0D	Function input from sensor to instrument is calibrated rather than the sensor.	Input analog quantity 3, display pin 14-13: count surpassed quantity	Calibrate sensor output function. Refer to other error reports to determine effected program (component)
13.10	Input analog quantity 3 might receive value beyond standard max. measurement range. Sensor broken or installation defects.	Input analog quantity 3, display pin 14-13: Data valid but beyond max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)
13.12	Input analog quantity 3 might receive value below standard min. measurement range. Sensor broken or installation defects.	Input analog quantity 3, display pin 14-13: Data valid but below max. operational value	Inspect sensor and its installation. Calibrate sensor output value. Refer to other error reports to determine effected program (component)
13.1F	Input analog quantity ‘3’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input analog quantity 3, display pin 14-13, failure exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
1A.05	Speed sensor value below normal value, joint loosing or low electric	Input Speed rate 0, display pin 10-09, current below normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other

	level	value or open circuit	error reports to determine effected program (component)

Fault code DANA	Causes	Reaction	Remedies
1A.06	Speed sensor value above normal value, high electric level	Input Speed rate 0, display pin 10-09, current below normal value or short circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
1A.0A	Circuit joint with speed sensor stays functioning though sending abnormal signals. According to respond from speed sensor, it might be circuit juncture fault or machinery defects.	Input Speed rate 0, display pin 10-09, frequency abnormal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
1A.1F	Input speed vector 'O' might attributes error to ECONA program which should not be resumed until this problem is rectified.	Input Speed rate 0, display pin 10-09, error exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
1B.05	Speed sensor value below normal value, joint loosing or low electric	Input Speed rate 1, display pin 12-11, current below normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other

	level	value or open circuit	error reports to determine effected program (component)
1B.06	Speed sensor value above normal value, high electric level	Input Speed rate 1, display pin 12-11, current below normal value or short circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)
1B.0A	Circuit joint with speed sensor stays normal though sending abnormal signals. According to respond from speed sensor, it might be circuit juncture fault or machinery defects.	Input Speed rate 1, display pin 12-11, frequency abnormal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor. Refer to other error reports to determine effected program (component)

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
1B.1F	Input speed vector '1' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Input Speed rate 1, display pin 12-11, error exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
20.03	When the power output stays 0, high electric level is detected by ECONA dynamic examine.	Power output volume 0, display pin 33-34, voltage surpass normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

		value or high electric level	
20.04	When the power output stays 0, low electric level is detected by ECONA dynamic examine.	Power output volume 0, display pin 33-34, voltage below normal value or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
20.05	When the power output stays 0, open circuit is detected by ECONA dynamic examine.	Power output volume 0, display pin 33-34, voltage below normal value or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
20.1F	Input number 'O' might attributes error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 0, display pin 33-34, error exist	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
21.03	When the power output stays 1, high electric level is detected by ECONA dynamic	Power output volume 1, display pin 31-32, voltage surpass normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

	examine.	volume or high electric level	
21.04	When the power output stay 1, low electric level is detected by ECONA dynamic examine.	Power output volume 1, display pin 31-32, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
21.05	When the power output stays 1, open circuit is detected by ECONA dynamic examine.	Power output volume 1, display pin 31-32, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
21.1F	Input power output volume ‘1’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 1, display pin 31-32, error exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
22.03	When the power output stays 2, high electric level is detected by ECONA dynamic examine.	Power output volume 2, display pin 48-49, voltage surpass normal volume or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

Fault code DANA	Causes	Reaction	Remedies
22.04	When the power output stays 2, low electric level is detected by ECONA dynamic examine.	Power output volume 2, display pin 48-49, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
22.05	When the power output stays 2, open circuit is detected by ECONA dynamic examine.	Power output volume 2, display pin 48-49, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
22.1F	Input power output volume '2' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 2, display pin 48-49, error exist	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
23.03	When the power output stays 3, high electric level is detected by ECONA dynamic examine.	Power output volume 3, display pin 18-19, voltage surpass normal volume or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

23.04	When the power output stays 3, low electric level is detected by ECONA dynamic examine.	Power output volume 3, display pin 18-19, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
23.05	When the power output stays 3, open circuit is detected by ECONA dynamic examine.	Power output volume 3, display pin 18-19, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
23.1F	Input power output volume ‘3’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 3, display pin 18-19, error exist	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
24.03	When the power output stays 4, high electric level is detected by ECONA dynamic	Power output volume 4, display pin 46-47, voltage surpass normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

	examine.	volume or high electric level	
24.04	When the power output stays 4, low electric level is detected by ECONA dynamic examine.	Power output volume 4, display pin 46-47, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
24.05	When the power output stays 4, open circuit is detected by ECONA dynamic examine.	Power output volume 4, display pin 46-47, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
24.1F	Input power output volume ‘4’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 4, display pin 46-47, error exist	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
25.03	When the power output stays 5, high electric level is detected by	Power output volume 5, display pin 17-16,	Check circuit connection between ECONA system and sensor. Inspect installation and operation

	ECONA dynamic examine.	voltage surpass normal volume or high electric level	status of sensor.
25.04	When the power output stays 5, low electric level is detected by ECONA dynamic examine.	Power output volume 5, display pin 17-16, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
25.05	When the power output stays 5, open circuit is detected by ECONA dynamic examine.	Power output volume 5, display pin 17-16, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
25.1F	Input power output volume '5' might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 5, display pin 17-16, error exist	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
26.03	When the power output stays 6, high	Power output	Check circuit connection between

	electric level is detected by ECONA dynamic examine.	volume 6, display pin 25-50, voltage surpass normal volume or high electric level	ECONA system and sensor. Inspect installation and operation status of sensor.
26.04	When the power output stays 6, low electric level is detected by ECONA dynamic examine.	Power output volume 6, display pin 25-50, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
26.05	When the power output stays 6, open circuit is detected by ECONA dynamic examine.	Power output volume 6, display pin 25-50, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
26.1F	Input power output volume ‘6’ might attribute error to ECONA program which should not be resumed until this problem is rectified.	Power output volume 6, display pin 25-50, error exists	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired information: operate available basic program or correct error manually.
27.03	When the power output stays 7, high electric level is detected by ECONA dynamic	Power output volume 7, display pin 01-02, voltage surpass normal	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

	examine.	volume or high electric level	

Fault code DANA	Causes	Reaction	Remedies
27.04	When the power output stays 7, low electric level is detected by ECONA dynamic examine.	Power output volume 7, display pin 01-02, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
27.05	When the power output stays 7, open circuit is detected by ECONA dynamic examine.	Power output volume 7, display pin 01-02, voltage below normal volume or open circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
27.06	When the power output stays 7, the practical current is tested beyond permitted maximum.	Power output volume 7, display pin 01-02, voltage below normal volume or short circuit	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
27.1F	Input power output volume ‘7’ might attribute error to ECONA	Power output volume 7, display pin 01-02,	Refer to other error reports to obtain more relevant information. Rectify problem according to acquired

	program which should not be resumed until this problem is rectified.	error existed	information: operate available basic program or correct error manually.
28.03	When the power output stays 8, high electric level is detected by ECONA dynamic examine.	Power output volume 8, display pin 03-04, voltage surpass normal volume or high electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
28.04	When the power output stays 8, low electric level is detected by ECONA dynamic examine.	Power output volume 8, display pin 03-04, voltage below normal volume or low electric level	Check circuit connection between ECONA system and sensor. Inspect installation and operation status of sensor.
28.05	When the power output volume is 8, output is detected of open circuit via ECON.A dynamic examination.	Power output 8, display pin 03-04: voltage is below normal level or in open circuit	Check line connection between ECON.A and sensor. Check installation and operation of sensor and each component.
28.06	When the power output volume is 8, current	Power output 8, display pin 03-04: voltage	Check line connection between ECON.A and sensor. Check installation and operation of

	observed feedback value exceeds the Max. permissible effective value.	exceeds normal level or in short circuit	sensor and each component.
28.1F	Input power output volume 8 will result in ECON.A application program failure. ECON.A program can not resume working until this problem is rectified.	Power output 8, display pin 03-04: failure exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
30.09	No clutch disengagement information is obtained from CAN system after time out.	Digital input function: clutch disengagement: abnormal correction rate	Check whether the clutch disengagement related input included in CAN information is transmitted to the CAN bus. Check CAN system for refresh speed.

Fault code DANA	**Causes**	**Reaction**	**Remedies**
30.13	No information can be obtained from CAN system or clutch	Digital input function: clutch disengagement:	Check whether the CAN system related source information about clutch disengagement is valid.
30.1F	Digital input function: clutch disengagement, resulting in ECON.A application program failure	Digital input function: clutch disengagement: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the

31.09	No information “Switch between manual / automatic mode” is obtained from CAN	Digital input function: switch between manual / automatic	Check whether the clutch disengagement related input included in CAN information is transmitted to the
31.13	No information can be obtained from CAN system or the information “Switch	Digital input function: switch between manual / automatic	Check whether the CAN system related source information about switching between manual / automatic mode is valid.
31.1F	Digital input function: switching between manual / automatic mode, resulting in ECON.A application	Digital input function: switch between manual / automatic mode: error	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the

Fault code DANA	Causes	Reaction	Remedies
32.09	No downshift information is obtained from	Digital input function: downshift:	Check whether the downshift related input included in CAN information is transmitted to the CAN
32.13	No information can be obtained from CAN system or downshift	Digital input function: downshift: error	Check whether the CAN system related source information about downshift is valid.
32.1F	Digital input function: downshift, resulting in ECON.A application program failure. ECON.A program can	Digital input function: downshift: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the
33.09	No information “Neutral position is locked” from CAN system is	Digital input function: Neutral position is locked:	Check whether the locking the neutral position related input included in CAN information is
33.13	No information can be obtained from CAN system or the	Digital input function: Neutral position is locked:	Check whether the CAN system related source information about locking the neutral position is valid.

Fault code	Causes	Reaction	Remedies

DANA			
33.1F	Digital input function: neutral position is locked, resulting in ECON.A application program failure.	Digital input function: Neutral position is locked: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to
34.09	No idle-speed information is obtained from	Digital input function: idle-speed:	Check whether the idle speed related input included in CAN information is transmitted to the CAN
34.13	No information can be obtained from CAN system or idle-speed	Digital input function: idle-speed: error	Check whether the CAN system related source information about idle speed is valid.
34.1F	Digital input function: idle-speed, resulting in ECON.A application program failure.	Digital input function: idle-speed: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to
35.09	No full-speed information is obtained from	Digital input function: full-speed:	Check whether the full speed related input included in CAN information is transmitted to the CAN

Fault code DANA	Causes	Reaction	Remedies
35.13	No information can be obtained from CAN system or full-speed	Digital input function: full-speed: error	Check whether the CAN system related source information about full speed is valid.
35.1F	Digital input function: full-speed, resulting in ECON.A application program failure.	Digital input function: full-speed: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to
39.09	No parking brake information is obtained from	Digital input function: parking brake: abnormal	Check whether the parking brake related input included in CAN information is transmitted to the CAN

39.13	No information can be obtained from CAN system or the parking	Digital input function: parking brake: error	Check whether the CAN system related source information about parking brake is valid.
39.1F	Digital input function: parking brake, resulting in ECON.A application program failure. ECON.A program can	Digital input function: parking brake: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the

Fault code DANA	Causes	Reaction	Remedies
3A.09	No information “Start the vehicle at gear 1 / 2” is obtained from CAN	Digital input function: start the vehicle at gear 1 /	Check whether starting the vehicle at gear 1 / 2 related input included in CAN information is
3A.13	No information can be obtained from CAN system or the information “Start the	Digital input function: start the vehicle at gear 1 / 2: abnormal	Check whether the CAN system related source information about starting the vehicle at gear 1 / 2 is valid.
3A.1F	Digital input function: start the vehicle at gear 1 / 2, resulting in ECON.A application program failure	Digital input function: start the vehicle at gear 1 / 2: error exists	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the
3D.09	No information “Transmission in the Neutral position overtime” from	Digital input function: transmission in the Neutral	Check whether “Transmission in the Neutral position overtime” related input included in CAN information is transmitted to the CAN
3D.13	No information can be obtained from CAN system or the information	Digital input function: transmission in the Neutral	Check whether the CAN system related source information “Transmission in the Neutral position overtime” is valid.

Fault code DANA	Causes	Reaction	Remedies

3D.1F	Digital input function: transmission in the Neutral position overtime, resulting in ECON.A application	Digital input function: transmission in the Neutral position overtime	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the
40.09	No abnormal running speed information is obtained from CAN	Digital input function: abnormal running	Check whether abnormal running speed related input included in CAN information is transmitted to the
40.13	No information can be obtained from CAN system or abnormal running speed	Digital input function: abnormal running speed: error	Check whether the CAN system related source information about abnormal running speed is valid.
40.1F	Digital input function: abnormal running speed, resulting in ECON.A application program failure.	Digital input function: abnormal running speed: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the
41.09	No seat direction information is obtained from CAN	Digital input function: seat direction:	Check whether seat direction related input included in CAN information is transmitted to the CAN

Fault code DANA	**Causes**	**Reaction**	**Remedies**
41.13	No information can be obtained from CAN system or seat direction	Digital input function: seat direction: error	Check whether the CAN system related source information about seat direction is valid.
41.1F	Digital input function: seat direction, resulting in ECON.A application program failure. ECON.A program can	Digital input function: seat direction: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the
42.09	No acceleration prevention information is obtained from CAN	Digital input function: acceleration	Check whether acceleration prevention related input included in CAN information is transmitted to the

42.13	No information can be obtained from CAN system or acceleration prevention information	Digital input function: acceleration prevention: error	Check whether the CAN system related source information about acceleration prevention is valid.
42.1F	Digital input function: acceleration prevention, resulting in ECON.A application program failure.	Digital input function: acceleration prevention: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information; make the

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
5F.02	Indefinite signals are detected among the signals input into ECON.A from the joystick.	Joystick: irregular and intermittent signals. Error exits.	Check line connection between joystick and ECON.A. Check installation and operation of joystick and its components.
5F.09	No joystick information is obtained from CAN system after time out.	Joystick: abnormal correction rate.	Check whether joystick related input included in CAN information is transmitted to the CAN bus. Check CAN system for refresh speed.
5F.13	No information can be obtained from CAN system or joystick information obtained from CAN system invalid.	Joystick: error exists in the received network data.	Check whether the CAN system related source information about joystick is valid.
5F.1F	Digital input function: joystick, resulting in ECON.A application program failure.	Joystick: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to

	ECON.A program can not resume working until this problem is rectified.		obtained information: make the feasible fundamental programs in operation or rectify the program manually.
60.02	Analog quantity input: air door pedal. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the air door pedal.	Analog quantity input: air door pedal: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and air door pedal sensor. Check installation and operation of sensor and each component.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
60.09	No analog quantity input: air door pedal information is obtained from CAN system after time out.	Analog quantity input: air door pedal: abnormal correction rate.	Check whether analog quantity input: air door pedal input included in CAN information is transmitted to the CAN bus. Check CAN system for refresh speed.
60.13	No information can be obtained from CAN system or analog quantity input obtained from CAN system: air door pedal information invalid.	Analog quantity input: air door pedal: error exists in the received network data.	Check whether the CAN system related source information about analog quantity input: air door pedal is valid.

60.1F	Analog quantity input: air door pedal, resulting in ECON.A application program failure. ECON.A program can not resume working until this problem is rectified.	Analog quantity input: air door pedal: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
61.02	Analog quantity input: brake pedal. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	Analog quantity input: brake pedal: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and brake pedal sensor. Check installation and operation of sensor and each component.
61.09	No analog quantity input: brake pedal information is obtained from CAN system after time out.	Analog quantity input: brake pedal: abnormal correction rate.	Check whether analog quantity input: brake pedal input included in CAN information is transmitted to the CAN bus. Check CAN system for refresh speed.

Fault code DANA	**Causes**	**Reaction**	**Remedies**
61.13	No information can be obtained from CAN system or analog quantity input: brake pedal	Analog quantity input: brake pedal: error exists in the received network	Check whether the CAN system related source information about analog quantity input: brake pedal is valid.

	information obtained from CAN system invalid.	data.	
61.1F	Analog quantity input: brake pedal, resulting in ECON.A application program failure. ECON.A program can not resume working until this problem is rectified.	Analog quantity input: brake pedal: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
62.00	Transmission oil tank temperature exceeds the Max. permissible value. It is possibly caused by excessively frequent vehicle operation.	Analog quantity input: transmission oil tank temperature: information is effective but exceeds the Max. permissible value.	Stop the vehicle to cool down the transmission oil tank. If the problem still exits, check transmission oil tank cooler.
62.02	Analog quantity input: transmission oil tank temperature. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	Analog quantity input: transmission oil tank temperature: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and transmission oil tank oil temperature sensor. Check installation and operation of sensor and each component.

Fault code DANA	Causes	Reaction	Remedies
62.10	Transmission cooler temperature exceeds the Max. Permissible value. It is possibly caused by excessively frequent vehicle operation.	Analog quantity input: transmission temperature: information is effective but exceeds the Max. permissible value.	Stop the vehicle to cool down the transmission oil tank. If the problem still exits, check transmission cooler.
62.1F	Analog quantity input: transmission cooler temperature, resulting in application program error. ECON.A program can not resume working until this problem is rectified.	Analog quantity input: transmission temperature: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
63.00	Transmission cooler temperature exceeds the Max. Permissible value. It is possibly caused by excessively frequent vehicle operation or cooling system hydraulic circuits failure.	Analog quantity input: transmission cooler temperature: information is effective but exceeds the Max. permissible value.	Stop the vehicle to cool down the transmission. If the problem still exits, check transmission cooler.

63.02	Analog quantity input: transmission cooler temperature. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	Analog quantity input: transmission cooler temperature: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and transmission cooler temperature sensor. Check installation and operation of sensor and each component.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
63.10	Transmission cooler temperature exceeds the Max. Permissible value. It is possibly caused by excessively frequent vehicle operation or cooling system hydraulic circuits failure.	Analog quantity input: transmission cooler temperature: information is effective but exceeds the Max. permissible value.	Stop the vehicle to cool down the transmission. If the problem still exits, check transmission cooler.
63.1F	Analog quantity input: transmission oil tank temperature, resulting in ECON.A application program failure. ECON.A program can not resume working	Analog quantity input: transmission cooler temperature: error exits.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program

	until this problem is rectified.		manually.
7A.02	Speed sensor input function: engine RPM. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	Speed sensor input function: engine RPM: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and engine RPM sensor. Check installation and operation of sensor and each component.
7A.09	No speed sensor input function: engine RPM information is obtained from CAN system after time out.	Speed sensor input function: engine RPM: abnormal correction rate.	Check whether speed sensor input function: engine RPM input included in CAN information is transmitted to the CAN bus. Check CAN system for refresh speed.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
7A.13	No information can be obtained from CAN system or speed sensor input function: engine RPM information obtained from CAN system invalid.	Speed sensor input function: engine RPM: error exists in the received network data.	Check whether the CAN system related source information about speed sensor input function: engine RPM is valid.
7A.1F	Speed sensor input function: engine RPM, resulting in ECON.A	Speed sensor input function: engine RPM:	Refer to other error reports to obtain information about this program.

	application program failure. ECON.A program can not resume working until this problem is rectified.	error exists.	Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
7C.02	Speed sensor input function: speed ratio. Electrical errors occur during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	Speed sensor input function: speed ratio: irregular and intermittent signals. Error exits.	Refer to other error information to find out failures in the electrical line. Check voltage input on the line between ECON.A and speed ratio sensor. Check installation and operation of sensor and each component.
7C.1F	Speed sensor input function: speed ratio, resulting in ECON.A application program failure. ECON.A program can not resume working until this problem is rectified.	Speed sensor input function: speed ratio: error exists.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
7D.02	Speed sensor input function: output speed. Electrical errors occur	Speed sensor input function: output speed:	Refer to other error information to find out failures in the electrical

	during inputting signal into ECON.A. As a result, ECON.A can not determine effective value of the brake pedal.	irregular and intermittent signals. Error exits.	line. Check voltage input on the line between ECON.A and output speed sensor. Check installation and operation of sensor and each component.
7D.1F	Speed sensor input function: input speed, resulting in ECON.A application program failure. ECON.A program can not resume working until this problem is rectified.	Speed sensor input function: output speed: error exits.	Refer to other error reports to obtain information about this program. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
90.00	Permanent power supply for controller exceeds the Max. permissible value. The closed item is activated so as to prevent damages to electrical system.	Controller permanent power supply – pin 45: information is effective but exceeds the Max. permissible value.	Check power supply for functional work.
90.01	Permanent power supply for controller is below the Min. permissible value. ECON.A can not work normally that the closed item is activated.	Controller permanent power supply – pin 45: information is effective but is below the Min. permissible value.	Check power supply for functional work.

Fault code DANA	Causes	Reaction	Remedies
90.10	Permanent power supply for controller exceeds the Max. permissible value.	Controller permanent power supply – pin 45: information is effective but exceeds the Max. permissible value.	Check power supply for functional work.
90.12	Permanent power supply for controller is below the Min. permissible value.	Controller permanent power supply – pin 45: information is effective but is below the Min. permissible value.	Check power supply for functional work.
91.00	Permanent power supply for controller exceeds the Max. permissible value. The closed item is activated so as to prevent damages to electrical system.	Controller permanent power supply – pins 20 - 60: information is effective but exceeds the Max. permissible value.	Check power supply for functional work.
91.01	Permanent power supply for controller is below the Min.	Controller permanent power supply – pins 20 -	Check power supply for functional work.

	permissible value. ECON.A can not work normally that the closed item is activated.	60: information is effective but is below the Min. Permissible value.	

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
91.10	Power supply for controller switch is exceeds the Max. permissible value.	Controller permanent power supply – pins 20 - 60: information is effective but exceeds the Max. permissible value.	Check power supply for functional work.
91.12	Power supply for controller switch is below the Min. permissible value.	Controller permanent power supply – pins 20 - 60: information is effective but is below the Min. permissible value.	Check power supply for functional work.
92.00	External power supply for controller exceeds	External 5V power supply for	Refer to other error information to determine the affected analog

	the Max. permissible value.	controller - pin 15: information is effective but exceeds the Max. permissible value.	quantity input function. Check all the components between ECON.A and power supply electrical lines. Check installation and operation of all the components connected to the power supply electrical lines.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
92.01	External power supply for controller is below the Min. permissible value. Load on the electrical line of power supply is excessively high.	External 5V power supply for controller - pin 15: information is effective but is below the Min. permissible value.	Refer to other error information to determine the affected analog quantity input function. Check whether the Max. load value of power supply electrical lines is exceeded. Check installation and operation of all the components between ECON.A and power supply electrical lines.
92.10	External power supply for controller exceeds the Max. permissible value.	External 5V power supply for controller - pin 15: information is effective but exceeds the Max. permissible value.	Check all the components between ECON.A and external power supply. Check installation and operation of all the components connected to the external power supply.

92.12	Power supply for controller switch is below the Min. permissible value.	External 5V power supply for controller - pin 15: information is effective but is below the Min. permissible value.	Check all the components between ECON.A and external power supply. Check installation and operation of all the components connected to the external power supply.
93.00	Controller inner sensor exceeds the Max. permissible value. ECON.A can not work normally.	Controller inner sensor: information is effective but exceeds the Max. ermissible value.	If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
93.01	Controller inner sensor is below the Min. permissible value. ECON.A can not work normally.	Controller inner sensor: information is effective but is below the Min. permissible value.	If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.
93.10	Controller inner sensor exceeds the Max. permissible value.	Controller inner sensor: information is effective but exceeds the Max.	Check whether the problem is permanent or temporary. If the problem can not be rectified, ECON.A is permanently

		permissible value.	damaged: replace ECON.A.
93.12	Controller inner sensor is below the Min. permissible value.	Controller inner sensor: information is effective but is below the Min. permissible value.	Check whether the problem is permanent or temporary. If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.
94.00	ECON.A surface temperature exceeds the Max. permissible value. ECON.A is switched off to cut off load on the electric power, so as to prevent damage or hazard response.	Controller surface temperature: information is effective but exceeds the Max. permissible value.	Check application program to ensure that the Max. permissible electric power consumption of ECON.A is not exceeded. Check ECON.A.
94.10	ECON.A surface temperature exceeds the Max. Permissible value.	Controller surface temperature: information is effective but exceeds the Max. permissible value.	Check application program to ensure that the Max. permissible electric power consumption of ECON.A is not exceeded. Check ECON.A.

Fault code	**Causes**	**Reaction**	**Remedies**
DANA			

9A.0C	Data damaged during initialization. ECON.A is switched off.	Seriously confused controller data: intelligent elements or equipment damaged.	If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.
9A.1F	Part or all of data damaged during initialization. ECON.A can not be started until the problem is rectified.	Seriously confused controller data: error exists.	If the failure is caused by the component which supplies information for ECON.A, the problem can be rectified by decreasing the fundamental power of ECON.A. If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.
9B.1F	Data application part damaged during initialization. ECON.A can not be started until the problem is rectified.	Controller application data； error exists.	Use correct and compatible tools for DANA to download effective and compatible data documents. If the problem can not be rectified, ECON.A data defected: replace ECON.A.
9C.1F	Input data damaged during initialization. All the input data recorded as wrong and cleared.	Controller input data；error exists.	If the failure is caused by the component which supplies information for ECON.A, the problem can be rectified by decreasing the fundamental power of ECON.A. If the problem can not be rectified, ECON.A is permanently damaged: replace ECON.A.

Fault code DANA	Causes	Reaction	Remedies
A0.1F	Components are not compatible. ECON.A can not be started until the problem is rectified.	Configuration error: unmatched components: error exists.	Use correct and compatible tools for DANA to download effective and compatible data documents. If the problem can not be rectified, ECON.A program and / or data defected: replace ECON.A.
A1.1F	Data and anticipated components not compatible. ECON.A can not be started until the problem is rectified.	Configuration error: incompatible data: error exists.	Use correct and compatible tools for DANA to download effective and compatible data documents. If the problem can not be rectified, ECON.A program and / or data defected: replace ECON.A.
A2.1F	ECON.A configuration failure occurs during initialization, as two or more functions are distributed to the same input / output. ECON.A can not be started until the problem is rectified.	Configuration error: I/O function combination: error exists.	Refer to other error information to determine category of the erroneous configuration. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
A3.1F	ECON.A configuration failure occurs during initialization, as an inaccessible function is distributed to the input / output. ECON.A can	Configuration error: inaccessible I/O function combination: error exists.	Refer to other error information to determine category of the erroneous configuration. Rectify the problem according to obtained information: make the feasible fundamental programs in

	not be started until the problem is rectified.		operation or rectify the program manually.

Fault code **DANA**	**Causes**	**Reaction**	**Remedies**
A4.1F	ECON.A configuration failure occurs during initialization caused by invalid function combination. ECON.A can not be started until the problem is rectified.	Configuration error: impossible I/O function combination: error exists.	Refer to other error information to determine category of the erroneous configuration. Rectify the problem according to obtained information: make the feasible fundamental programs in operation or rectify the program manually.
C1.09	System-CAN information can't be transmitted and received; failure after timeout.	CAN information: CVC_to_TC_1: abnormal correction rate.	Check whether CAN information has be input into CAN bus. Check CAN information repetition rate.
C2.09	System-CAN information can't be transmitted and received; failure after timeout.	CAN information: CVC_to_TC_2: abnormal correction rate.	Check whether CAN information has be input into CAN bus. Check CAN information repetition rate.
C3.09	System-CAN information can't be transmitted and received; failure after timeout.	CAN information: CVC_to_TC_3: abnormal correction rate.	Check whether CAN information has be input into CAN bus. Check CAN information repetition rate.
C5.09	System-CAN information can't be transmitted	CAN information: EEC1:	Check whether CAN information has be input into CAN bus.

	and received; failure after timeout.	abnormal correction rate.	Check CAN information repetition rate.
C6.09	System-CAN information can't be transmitted and received; failure after timeout.	CAN information: EEC2: abnormal correction rate.	Check whether CAN information has be input into CAN bus. Check CAN information repetition rate.

ZOOMLION

MAINTENANCE AND SERVICE MANUAL FOR ROUGH TERRAIN CRANE

Chapter 3 Inspection

Inspection

3.1 PRE-START INSPECTION

The following items should be checked each day before start-up and the start of operations.

Examine the items below each day before you start or operate the crane.

ENGINE OIL	The level must be at the full mark.
COOLANT	The level must be near the top of the radiator tank.
LEAKAGE	Do a ground below the crane for signs of leaks.
FUEL	Engine fuel and propane / diesel for the top unit heater must be sufficient for sustained operations.
LUBRICATION	Do the daily lubrication as necessary in the Lubrication Recommendations.
HYDRAULIC SYSTEM	Examine hoses, tubes, components, reservoir sight gauge, valves, pumps, motors, connections, reservoir oil temperature, cylinder mount bushings and pins.
WIRE-ROPES AND HOOK BLOCK	Examine the hoist wire-ropes, main hook, auxiliary hook and the crane attachments for wear and damage.
TIRES	Examine the tires for correct pressure before you move the crane. Only examine the tires when they are cold. Refer to the *Tire Pressure Chart* on the *Load Rating Chart*.
WHEEL NUTS	When the crane is new (first 50 miles (80 km) of service) or after a tire change, tighten the nuts daily. Tighten the nuts in a pattern.
GENERAL CONDITIONS	Examine the crane for wear, leaks and damage.
TRANSMISSION OIL	Measure the level of transmission oil. The oil must be warm (180 - 200° F (82.2 - 93.3° C)) and the engine at idle speed. Make sure that the fluid level is at the HI mark.
FUEL FILTER	Daily: drain the water from the fuel water separator and fuel filters.
SAFETY EQUIPMENT	Examine the safety equipment (lights, brakes and hazard warning devices).

Table 3-1 Maintenance Checklist

DAILY (8 HOURS)

- ▪▪ Do daily lubrication tasks
- ▪▪ Examine the hydraulic reservoir fluid level
- ▪▪ Fill fuel tank
- ▪▪ Examine engine oil level
- ▪▪ Examine coolant level
- ▪▪ Examine hydraulic cylinder mounting bushings and pins
- ▪▪ Examine hydraulic components
- ▪▪ Examine transmission oil level
- ▪▪ Examine lockout system of front and rear axles
- ▪▪ Drain the fuel filters or water separator
- ▪▪ Examine boom front slider pads
- ▪▪ Drain the air reservoir of moisture
- ▪▪ Examine the wire-ropes and related components
- ▪▪ Examine the air cleaner, the air intake pipelines and clamps
- ▪▪ Inspect the controls
- ▪▪ Examine instruments, gauges and safety equipment
- ▪▪ Make overall visual inspection
- ▪▪ Examine the torque of swing bearing bolts*
- ▪▪ Examine the torque of wheel nuts for the first 300 km*
- ▪▪ Examine anti-two block system
- ▪▪ Examine *Engine Manufacturer's Manual* for more maintenance requirements
- ▪▪ Make sure that the swing brake is able to hold against the full torque of the swing motor

WEEKLY (40 HOURS)

- ▪▪ Do the daily check
- ▪▪ Do the weekly lubrication
- ▪▪ Examine the level of oil in the swing motor
- ▪▪ Do an initial axle oil change
- ▪▪ Examine the wire-ropes
- ▪▪ Replace the hydraulic return line filter*
- ▪▪ Visually examine all structural members and welds for cracks, alignment and wear
- ▪▪ Examine the boom for wear, cracked welds, alignment and missing or illegible decals

- Examine the level of axle oil (after initial change)
- Examine the battery condition
- Inspect the tire pressure and condition
- Examine the air system safety valve
- Examine the *Engine Manufacturer's Manual* for additional maintenance requirements
- Examine the hydraulic cylinders and piston rods
- Clean the crane weekly if it has salt on it to prevent rust and corrosion

* Interval applies only to initial period of operation (break-in)

MONTHLY (100 – 200 HOURS)

- Do the daily and weekly checks
- Do the monthly lubrication
- Examine the engine belts
- Replace the engine oil
- Clean the radiator exterior
- Examine the *Engine Manufacturer's Manual* for more maintenance requirements
- Drain the hydraulic reservoir of moisture and sediment

QUARTERLY (500 HOURS)

- Do the daily, weekly and monthly checks
- Do the quarterly lubrication
- Drain the fuel tank of water and sediment
- Replace the transmission filter
- Make sure that coolant system corrosion inhibitor is full
- Examine the *Engine Manufacturer's Manual* for more maintenance requirements
- Clean and wax all exterior painted surfaces
- Replace the hydraulic return-line filters

SEMI-ANNUAL (1000 HOURS)

- Do the daily, weekly, monthly and quarterly inspections
- Clean the crankcase breather
- Replace the oil in winches
- Replace the transmission oil
- Examine the brake disk for wear condition
- Examine safety valve pressure settings
- Examine the *Engine Manufacturer's Manual* for more maintenance requirements
- Replace the oil in the swing reducer

ANNUAL (1500 – 2000 HOURS)

- Clean the radiator clean and replace the coolant
- Replace the oil in the hydraulic reservoir
- Get a sample of the hydraulic oil for analysis
- Replace the oil in the differential and wheel ends
- Disassemble the winch and examine all the components for wear

3.2 NEW CRANE SPECIAL BREAK-IN REQUIREMENTS

8 HOURS - During the first 185 miles (300 km) of travel or after a tire is changed, make sure that the wheel nuts are tight.

40 HOURS - Make sure that the swing bearing bolts are tight. If you tighten some of the bolts, do this inspection after one more 40 hour period. When you do a 40 hour inspection and do not find bolts that are loose, change the inspection period to semi-annual.

80 HOURS - After 80 hours of travel, replace the transmission fluid.

100 HOURS - Replace the oil in the winches.

Keep all contamination (grease, oils, fuel, mud, snow, ice) off the handles, steps, walkways and platforms.

Replace the grit type anti-slip surfaces when they start to show wear.

3.3 PERIODIC INSPECTIONS AND SERVICE

A. Periodic Inspections – Chassis

Examine the vehicle in regular intervals to prolong its life and increase the safety and comfort of its operation.

The components in the table below are for cranes that operate in areas with no dirt for 250 hours per month in temperatures between 14° F and 95° F (-10° C and 35° C). When you use the crane in harsh conditions (coastal, desert, cold regions), increase the inspections and decrease the maintenance intervals.

Table 3-2

Component Inspected	Periodic Inspection Interval								
	NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
	60 h	250 h							
ENGINE									
Examine each part of engine for air, water and oil leaks	•	•	•						
Examine the engine starting state and unusual sound	•	•	•						
Examine the engine RPM and exhaust state	•	•	•						
Tighten the air cylinder lid and manifold	•					•			
Examine the valve clearance	•					•			
Tighten the engine the mount bolts						•			
Clean the fuel filter screen		•		•					
Drain the condensation and sediment from the fuel tank				•					
Replace the coolant					•				
Make sure that the radiator cover is tight			•						
Make sure that the engine belts are tight and not damaged		•	•						

Component Inspected		Periodic Inspection Interval								
		NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
		60 h	250 h							
CAUTION										
For maintenance and service of parts for engine, refer to related chapters in *Engine Manufacturer's Manual.*										
Antifreeze, anti-rust and anti-corrosion additives, which are toxic, are added in the engine coolant and engine oil. Do not contact with skin repeatedly for a long time. Dispose of them in accordance with local environmental laws and regulations.										
Air cleaner	Clean or wash		●					●		
	Replace									●
Replace the air filter element			●						●	
Fuel filter	Drain sediments		●		●					
	Replace the filter element									●
Water separator	Drain sediments		●		●					
	Replace the filter element									●
Engine oil	Examine quality and polluted state			●						
	Replace		●						●	
POWER SYSTEM										
Examine each part for air and oil leaks		●	●	●						

Component Inspected		Periodic Inspection Interval								
		NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
		60 h	250 h							
Examine the transmission control system			●				●			
Examine the parts that connect the drive lines for correct connection			●		●					
Examine the drive lines for swing and the spline for vibration					●					
Examine the drive line bearings for vibration			●		●					
Examine the intermediate drive line bearings for proper seating					●					
Examine rear axle flange for the correct seating						●				
Gear oil for transmission	Examine the oil quantity	●		●						
	Replace		●						●	
Gear oil for rear axle	Examine the oil quantity	●			●					
	Replace		●			●				

DRIVE SYSTEM

Examine each part of the front axles and rear axles for correct seating, crack, damage and deformation							●			
Examine wheel nuts for proper seating		●	●	●						

Component Inspected	Periodic Inspection Interval								
	NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
	60 h	250 h							
Examine the front wheel hub bearing for vibration				●					
Examine the rear wheel hub bearing for vibration						●			
Examine the pressure, tire tread depth, look for unusual abrasions, metal, stones and foreign matter in the tread			●						
Rotate the wheels					●				
Examine the wheel rim for damage	●	●	●						
Replace lubricating grease and oil seal for wheel hub bearing						●			
STEERING SYSTEM									
Examine the steering system for oil leaks	●	●	●						
Examine the play and movement of steering-wheel	●	●	●						
Examine the performance of the power steering gear						●			
Make sure that the wheel can move in both directions to the limit						●			

Component Inspected	Periodic Inspection Interval								
	NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
	60 h	250 h							
BRAKE SYSTEM									
Examine each part of the brake system for air and oil leaks	●	●	●						
Examine each part of the brake system for the correct seating and abrasion	●	●	●						
Examine the play of brake pedal	●	●	●						
Brake performance	●	●	●						
Measure the depth of brake linings		●	●						
Examine the brake linings for abrasion				●					
Examine the performance of park brake and control reliability of park brake switch	●	●	●						
Measure the depth of the park brake linings						●			
SUSPENSION SYSTEM									
Examine each part of the suspension system for correct seating and damage	●	●	●						
Examine the shock-absorbing cylinder for oil leaks and damage		●		●					
ELECTRICAL SYSTEM									

Component Inspected	Periodic Inspection Interval								
	NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
	60 h	250 h							
Examine the level of battery acid	●	●	●						
Measure the proportion of acid in the battery				●					
Examine the starter commutator and electrical brush					●				
Examine the generator						●			

CAUTION

Disassemble the starter and generator. Look for worn and damaged components. Replace damaged components and then assemble the units.

These tasks must be done by certified mechanics.

Examine the electrical wiring connections for tight fit and damage			●						
CHASSIS ACCESSORIES									
Examine the lighting system for its function and damage		●	●						
Examine the horn, air conditioning, heater and defroster for their functions	●	●	●						
Examine the wiper, windshield, water-injector for their functions and liquid level	●	●	●						
Examine the function of each gauge, instrument and indicator		●	●						

Component Inspected	Periodic Inspection Interval								
	NewVehicle		Monthly	Quarterly	Semi-Annual	Yearly	Every 250 h	Every 500 h	Every 1000 h
	60 h	250 h							
Examine the function of all switches			●						
Examine the PTO switch and indicator function	●		●						
Replace lubricating grease for PTO								●	

CAUTION

If you replace the PTO, drain and replace the lubricant after 20 hours of operation.

Examine the exhaust pipe and silencer for proper seating and damage		●		●					
Examine the exhaust silencer for functional work				●					
Examine the door locks for functional work			●						
Examine the cab and baffle, etc. for correct seating and damage		●		●					
Lubricate the chassis		●	●						

3.4 PERIODIC CRANE INSPECTIONS

A. Keep the mechanisms of the crane in satisfactory condition to make sure that it can operate safely.

B. Examine the items in Table 3-3. Do the necessary repairs. Before you lift a load, do an inspection on the parts that follow:

- Outriggers
- Swing and derrick functions, extend / retract and hoist mechanisms
- Brake system in each mechanism
- Indicators, gauges and lift management system (cab electronics)
- Safety devices.

Table 3-3

Parts	Inspected items	Parts	Inspected items
DrivingEquipment	Examine the function of the left and right joysticks.	Derricking Mechanism	Derricking cylinder • Examine the articulated pin spindle for wear and damage. • Examine the lock bolt of articulated pin spindle for tight fit. • Examine it for leaks. • Examine it for abnormal unusual vibration and noise. • Make sure that the cylinder retracts. • Examine the hoses for aging, distortion and deformation.
	PTO • Examine it for tight fit and leaks. • Examine it for abnormal unusual noise and heating.		
	Drive lines • Examine the flange and connectors for a tight fit. • Examine it for vibration, scrape and wear.		
Hydraulic System	Hydraulic reservoir • Examine it for tight fit and damage. • Examine it for cracks and leaks. • Examine the oil level, pollution grade and viscosity.		Balance valve • Examine it for leaks. • Examine the pipe fittings for correct seating.
	Hydraulic pump • Examine it for tight fit and damage. • Examine it for abnormal unusual noise, vibration and heating. • Examine it for leaks. • Make sure that the suction pipe inhales air. • Make sure that the output	Boom Extend / Retract Mechanism	Boom (4 sections) • Examine it for cracks, bends and damage. • Examine the lock bolts of the articulated pin spindle for tight fit. • Examine the sliding surface for scrapes. • Examine the articulated pin spindle liner for wear and damage. • Make sure that the sliding surfaces

Parts	Inspected items	Parts	Inspected items
	pressure is correct. • Examine the pipe fittings for correct seating and leaks.		have lubricant on them. • Examine the boom support for deformation and crack.
Swing Mechanism	Examine thesuperstructure for cracks and distortion.		Cylinder • Make sure it works correctly. Inspect it for pulse, noise and smooth movement. • Examine it for leaks. • Make sure that the balance valve works correctly. • Examine the oil pipe fittings for correct seating. • Examine the hose for aging, distortion and damage.
	Reducer and swing bearing • Examine the oil level and pollution grade. • Examine the case for cracks, deformations and leaks. • Examine it for unusual noise and vibration. • Examine the mount parts and bolts for tight fit. • Make sure thatthe working pressure of hydraulic motor is correct. • Examine the pipe fittings for tight fit and leaks.		Jib • Examine the jib for bends, cracks and deformations. • Make sure that the connecting pin spindle and pin spindle liner are lubricated.
Boom Extend / Retract System	Rooster sheave • Examine it for bends, cracks and deformations. • Make sure that the connecting pinand pin liner are lubricated.	WinchMechanism	Wire-rope • Diameter. • Broken wire. • Kinks. • Deformation. • Rust. • Examinethe press nipple and chock for proper seating. • Examine the connectionbetween the wire-rope end and press nipple. • Examine the shaft pin and pin sleeve
	Wire-rope • Diameter • Broken wire • Kinks • Deformation • Rust		

Parts	Inspected items	Parts	Inspected items
	• Lubrication state • Tension state.		of press nipple for wear and cracks. • Make sure thatthewire-rope reeves over the sheave correctly.
WinchMechanism	Hydraulic motor • Examine it for tight fit and cracks. • Examine it for leaks. • Examine the housing for deformation and cracks. • Examine it forunusualnoise and vibration. • Examine the oil pipe fittings for tight fit and leaks.		Wire-rope guard • Examine the clearance between the wire-rope guard and the hook. • Examine it for damage and deformation.
	Reducer • Examine it for tight fit. • Examine it for abnormal noise. • Examine the case for cracks and deformation. • Examine the bearing for wear. • Examine the lubricate level. • Examine it for leaks.	Hydraulic Elements	Control valve • Examine it for functional work. • Examine it for leaks. • Examine the bolts for tight fit.
			• Make sure that the setting pressure of the relief valve is correct.
	Balance valve • Examine it for leaks. • Examinethe oil pipe fittings for tight fit and leaks. • Examine it for pulse.		Main oil cylinder • Make sure it works correctly. • Examine it for leaks.

Parts	Inspected items	Parts	Inspected items
	Drum • Examine it for cracks. • Make sure that the wire-rope on the drum winds uniformly.		Pipeline • Examinethe pipe fittings for tight fit. • Examine it for leaks. • Examine the pipe clamp for tight fit and cracks. • Examine the hose for aging, deformation and damage.
	Hook and sheave • Make sure that the hook rotates easily. • Examine it for deformation. • Make sure it sways freely. • Examine the hoist wire-rope guide device for bends. • Examinethe sheave rotation for unusual noise. • Examine the sheave for cracks and wear. • Examine the sheave bracket and the cover for bends and damage. • Make surethat it is lubricated properly.	Operating System of Crane	The joysticks and pedals • Make surethey work correctly. • Examine them for play.
			Work lights • Examine them for functional work. • Examine them for damage. • Examine them for correctseating.
Operating System of Crane	Boom head lamp • Examine it for functional work. • Examine it for proper seating.	Outriggers	Vertical jack cylinders • Make sure that they retract correctly. • Make surethat they extend correctly. • Examine it for leaks. • Examine the bidirectional hydraulic lock for functional work.
	Wiper • Examine it for functional work. • Examine the blade for wear and damage.		

Parts	Inspected items	Parts	Inspected items
	Examine the interior illumination for functional work.		• Examine the pipe fittings for tight fit. • Examine it for unusual noise and vibration. • Examine the outrigger floats for deformation and damage.
	Cab • Examine the bolts and nuts for tight fit. • Examine the windows and door for functional work.		Outrigger box, outrigger beam and cylinders • Examine them for deformation and damage. • Examine the securing pins for the outrigger beam for damage. • Examine the bracket for deformation and crack. • Examine them for unusual noise and vibration. • Examine the fittings of the oil pipe and the hose for proper seating. • Examine for leaks.
	Ignition switch • Examine it for functional work. • Examine it for proper seating. • Examine if the indicators work normally.		Control valve • Examine it for functional work. • Examinethe pipe fittings for tight fit. • Examinethe bolts for tight fit. • Examine for leaks.
Safety Devices	Rated capacity indicator • Examine it for functional work. • Examine the precision.		Bubble indicator • Examine the appearance of the bubble indicator for scrapes and deformation. • Make sure that it is installed correctly and is tight.
	Anti-two block system • Examine it for functional work. • See ifthere is damage to the counterweight that attaches to the anti-two block switch.		

Parts	Inspected items	Parts	Inspected items
	• Examine it for proper seating. • Examine the contact switch for functional work.		• Examine the state of the bubble.
	3rd wrap indicator • Examineit for functional work. • Make surethat the solenoid valve and switches function correctly.	Others	Examine the chassis frame for deformation, bends and cracks.
			Examine the accessories for damage and missing parts.
	Boom angle indicator • Examine it for functional work. • Examine the precision.		

3.5 INSPECTIONS AND MAINTENANCES DURING BREAK-IN PERIOD

A. Do these inspection and maintenance tasks after 200 hours of lift operations.

- Examine the hoist and swing mechanism gear meshing. Replace the grease and clean the case.
- Drain and flush the hydraulic tank. Replace the filter element and hydraulic oil.

NOTE

You can use the hydraulic oil again if it is correctly filtered before you put it back into the system.

- Clean the dust, dirt and collected oil from each part of the crane. Examine the assemblies for leaks of oil, water, air and electricity. Make the repairs as necessary.
- Make sure that all the hardware on the crane is tight.
- Make sure that all safety devices are set correctly in position.
- Do an inspection (semi-annually) of all the slider pads. If they show unusual wear, replace them.

B. If you operate the crane in an area that has wide weather changes (usually cold or hot temperatures), make sure that you do the servicing of the items that follow:

- Change the lubricant in the engine, transmission, steering gear, winch reducer and swing reducer.
- Drain and flush the cooling system.
- Examine and adjust the level of electrolyte (battery acid) in the batteries.

3.6 FILTER ELEMENTS LISTS

	RT35			RT55			RT60		
Ser. No.	**Code**	**Description**	**QTY.**	**Code**	**Description**	**QTY.**	**Code**	**Description**	**QTY.**
1	1010600308	Hydraulic oil filter	2	1010600308	Hydraulic oil filter	2	1010600308	Hydraulic oil filter	2
2	1010600444	Return-line filter element	2	1010600444	Return-line filter element	2	1010600444	Return-line filter element	2
3	1010600414	Transmission oil filter element	1	1010600302	Transmission oil filter element	2	1010600302	Transmission oil filter element	2
4	1010600459	High-pressure hydraulic oil filter element	1	1010600459	High-pressure hydraulic oil filter element	1	1010600459	High-pressure hydraulic oil filter element	1
5	1010500102	Air filter	1	1010500102	Air filter	1	1010500102	Air filter	1
6	1000400002	Fuel filter element	1	1000400002	Fuel filter element	1	1000400002	Fuel filter element	1
7	1010600306	Fuel filter	1	1010600306	Fuel filter	1	1010600306	Fuel filter	1
8	1010600305	Engine oil filter element	1	1010600305	Engine oil filter	1	1010600305	Engine oil filter	1
9	1010600311	Fuel-water separator element	1	1010600311	Fuel-water separator element	1	1010600311	Fuel-water separator element	1

	RT75			RT100					
Ser. No.	Code	Description	QTY.	Code	Description	QTY.			
1	1010600308	High-pressure hydraulic oil filter element	2	1010600308	Hydraulic oil filter	2			
2	1010600444	Return-line filter element	2	1010600444	Return-line filter element	2			
3	1010600302	Transmission oil filter element	2	1010600302	Transmission oil filter element	2			
4	1010600413	High-pressure hydraulic oil filter element	1	1010600459	High-pressure hydraulic oil filter element	1			
5	1010500102	Air filter element	1	1010500102	Air filter element	1			
6	1000400002	Fuel pre-filter element	1	1000400001	Fuel pre-filter element	1			
7	1010600306	Fuel filter element	1	1000400003	Fuel filter element	1			
8	1010600305	Engine oil filter element	1	1009900005	Engine oil filter element	1			
9	1010600311	Fuel-water separator element	1	1010600430	Fuel-water separator element	1			
10	1010600459	High-pressure hydraulic oil filter element	1						

3.7 FLUID VOLUME REQUIREMENTS

Engine oil type and volume

Ser. No.	Crane series	Oil type	Volume (L)	Remarks
1	RT35	SAE 15W-40/CH-4	20	
2	RT55	SAE 10W-40	20	
3	RT60	SAE 10W-40	20	
4	RT75	SAE 10W-40	20	
5	RT100	SAE 15W-40/CH-4	20	

Engine coolant type and volume

Ser. No.	Crane series	Fluid type	Volume (L)	Remarks
1	RT35	CC2889	30	
2	RT55	CC2889	50	
3	RT60	CC2889	50	
4	RT75	CC2889	50	
5	RT100	CC2889	60	

Transmission oil type and volume

Ser. No.	Crane series	Oil type	Volume (L)	Remarks
1	RT35	8# Great Wall hydraulic oil	45	
2	RT55	8# Great Wall hydraulic oil	50	
3	RT60	8# Great Wall hydraulic oil	50	
4	RT75	8# Great Wall hydraulic oil	60	
5	RT100	8# Great Wall hydraulic oil	50	

Drive axle gear oil type and volume

Ser. No.	Crane series	Oil type	Volume (L)		Remarks
1	RT35	SAE 80W/90 API GL-5	Main reducer	Approx.20.8	
			Hub reducer	Approx.3.1	
2	RT55	SAE 80W/90 API GL-5	Main reducer	Approx.23.5	
			Hub reducer	Approx.1.4	
3	RT60	SAE 80W/90 API GL-5	Main reducer	Approx.23.5	
			Hub reducer	Approx.1.4	
4	RT75	SAE 80W/90 API GL-5	Main reducer	Approx. 24.6	
			Hub reducer	Approx.6.6	
5	RT100	SAE 80W/90 API GL-5	Main reducer	Approx.34	
			Hub reducer	Approx. 14.2	

Winch reducer gear oil type and volume

Ser. No.	Crane series	Oil type	Volume (L)	Remarks
1	RT35	L-CKD220	1.5	
2	RT55	L-CKD220	1.5	
3	RT60	L-CKD220	1.5	
4	RT75	L-CKD220	1.8	
5	RT100	L-CKD220	3.6	

Swing reducer gear oil type and volume

Ser. No.	Crane series	Oil type	Volume (L)	Remarks
1	RT35	L-CKD220	4.5	
2	RT55	L-CKD220	4.5	
3	RT60	L-CKD220	4.5	
4	RT75	L-CKD220	5.5	
5	RT100	L-CKD220	4.5	