



Maintenance Manual

A13JE/A13JE-Li Articulated Boom Mobile Elevating Work Platform



WARNING

Before operation and maintenance, the drivers and service personnel shall always read and thoroughly understand all information in this manual. Failure to do so may result in, fatal accidents or personal injury.

This manual must be kept with this machine at all times.

Articulated Boom Mobile Elevating Work Platform Maintenance Manual

880*1230 mm 16 format 8 printed sheets

Fourth edition and printed for the first time in May 2023

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Foreword

Thank you for choosing to use this Mobile Elevating Work Platform from LGMG. This machine is designed according to BS EN280-1:2022. The information specified in this manual is intended for the safe and proper operation of this machine for its' intended purpose.

For maximum performance and utilization of this machine, thoroughly read and understand all the information in this manual before starting, operating, or performing maintenance on this machine.

Due to continuous product improvements, LGMG reserves the right to make specification changes without any prior notifications. For any updated information, contact LGMG.

Ensure all preventive maintenance to the machine is performed according to the interval specified in the maintenance schedule.

Keep this manual with this machine for reference at all times. When the ownership of this machine is transferred, this manual shall be transferred with this machine. This manual must be replaced immediately if it is lost, damaged, or becomes illegible.

This manual is copyrighted material. The reproduction or copy of this manual is not allowed without the written approval of LGMG.

The information, technical specifications and drawings in this manual are the latest available when this manual is issued. Due to continuous improvement, LGMG reserves the right to change the technical specifications and machine design without notice. If any specifications and information in the manual are not consistent with your machine, please contact the service department of LGMG.

WARNING

Only personnel who have been properly trained and qualified to operate or maintain this machine can operate, repair and maintain this machine.

Improper operation, maintenance, and repair are dangerous and can cause personal injury and death.

Before any operation or maintenance, the operator shall thoroughly read this manual. Do not operate, perform any maintenance or make any repairs on this machine before reading and understanding this manual.

The user shall load the platform strictly according to the load rating of the platform. Do not overload the platform or make any modifications to the platform without permission from LGMG.

The operation regulations and preventions in this manual are only applicable for the specified use of this machine.

Safety Precautions

The operator of this machine shall understand and follow the existing safety regulations of state and local governments. If these are unavailable, the safety instructions in this manual shall be followed.

To help prevent accidents, read and understand all warnings and precautions in this manual before operation or performing maintenance.

It is impossible to foresee every possible hazard and the safety instructions in this manual may not cover all safety prevention measures. Always ensure the safety of all personnel and protect the machine against any damage. If unable to confirm the safety of some operations, contact LGMG.

The operation & maintenance prevention measures listed in this manual are only applicable to the specified uses of this machine. LGMG assumes no responsibility if this machine is used beyond the range of this manual. The user and the operator shall be responsible for the safety of such operations.

Do not perform any operation forbidden in this manual in any situation.

The following signal words are applicable for identifying the level of safety information in this manual.

 **DANGER:**

An imminent situation, that if not avoided, will result in severe injuries or death. This is also applicable to situations that will cause serious machine damage, if not avoided.

 **WARNING:**

A potentially dangerous situation, that if not avoided, may result in severe injuries or death. This is also applicable to situations that may cause serious machine damage, if not avoided.

 **NOTICE:**

A situation, that if not avoided, may result in minor or intermediate injury. This is also applicable to situations that may cause machine damage or shorten machine service life.



**Maintenance Manual of Articulated Boom
Mobile Elevating Work Platform**

Chapter 1 Maintenance

1.1 Compliance and Obedience

- 1) You are properly trained and qualified to operate and maintain the machine safely.
- 2) All safety regulations in this manual, workplace safety regulations and applicable government laws and regulations must be read, understood and complied.
- 3) Equipped with PPE, such as helmet, seat belt, safety shoes, goggles, protective clothing, insulating gloves, insulating shoes, etc., and in good physical condition.
- 4) When maintenance and repair procedures are being performed, many dangers indicated in the Operation Manual will also become potential safety hazards.
- 5) Scheduled maintenance and repair can only be completed by trained and qualified maintenance technician.
- 6) Dispose of waste materials in accordance with government regulations and workplace regulations.
- 7) Only parts and consumables approved by the LGMG can be used.
- 8) Always perform functional tests after maintenance.


1.2 Checking the Safety Manual

It is necessary for safe equipment operation to keep the Operator and Safety Manual in good condition. The manual shall be stored in a container in the working platform provided by each machine. An illegible or missing manual will not provide the necessary safety and operation information for safe operation.

- 1) Check that the storage container is on site and in good condition.
- 2) Check that the Operator, Responsibility, and Safety Manual is complete in the

storage container on the work platform.

- 3) Check that each page of the manual is identifiable and in good condition.
- 4) Put the manual in the storage file box after use.


 **If you need to replace the manual, please contact the company's service personnel.**

1.3 Check the Labels and Signs

It is necessary for safe operating equipment to keep all safety and instructions labels and signs in good conditions. Labels are used to remind operators and staff of the possible hazards when operating this equipment. User operation and maintenance information is also provided. An illegible label does not remind the staff of steps or hazards, and may also result in unsafe operating conditions.

Refer to the label section in this manual and use the label menu and instructions to check whether all labels are in place.

Check all the labels for clarity and damage and immediately replace any damaged or illegible ones.

 **If you want to replace the label, please contact the company's service personnel.**

1.4 Every Day or every 8 Hours

1.4.1 Check for Damaged, Loose or Missing Parts

This step is performed every 8 hours or every

day, whichever comes first.

Carrying out daily equipment status check is necessary for ensuring safe equipment operation and maintaining good equipment performance. Incorrect positioning, repairing damaged equipment, and loose or missing parts may result in unsafe operating conditions.

1) Check for damaged parts for the whole platform, and check for incorrect installation or missing parts and components, including:

- Electrical components, wirings and cables
- Hydraulic hoses, connectors, valve blocks and hydraulic cylinders
- Hydraulic tanks
- Wear-resistant pads
- Tires and wheels
- Limit switch and horn
- Nuts, bolts and other fasteners
- Platform entrance door
- Indicators and alarms
- Platform controller

2) Check the entire machine for:

- Cracks in welds or structural components
- Whether the platform, boom and chassis are deformed or have cracked weld joints.
- Indentation or damage to the machine

Ensure that all structural components and other key components are complete and all relevant fasteners and pins are in the correct position and tightened.

1.4.2 Check the Hydraulic Oil Level and Leakage

Inspect hydraulic oil level every 8 h or every day.

Maintaining the hydraulic fluid at the proper oil level is essential for machine operation. If the hydraulic oil is at an unsuitable oil level, the hydraulic components may be damaged.

Through daily inspections, the inspector can determine changes in the hydraulic oil level which can indicate problems with the hydraulic system.

⚠ CAUTION: This step should be performed when the platform is in the retracted state.

- Park the vehicle on the flat site.
- Fully retract the boom.

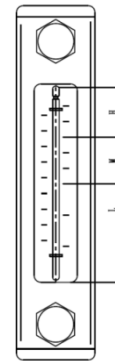


Figure 1-1 Oil Level Sight Gauge

- Examine the oil level on the hydraulic oil tank, i.e., level shall fall within the “M” range shown as Figure 1-1, and in the case of level lower than “M”, it is necessary to add hydraulic oil.

Grade	Brand
Rando MV32	Chevron

⚠ CAUTION: Do not top off with

incompatible hydraulic fluids. Hydraulic fluids may be incompatible due to the differences in base additive chemistry. When incompatible fluids are mixed, insoluble materials may form and deposit in the hydraulic system, plugging hydraulic lines, filters, control valves and may result in component damage.

Inspect hydraulic oil leakage every 8 h or daily.

⚠ CAUTION: Personal injury danger,

leaking hydraulic oil can penetrate or burn skin. Wear goggles and protective

gloves.

- Leakage of high-pressure oil may be invisible to eyes, use cardboard or wooden boards as a search tool for hydraulic oil leakage. Hands shall be prohibited from being used for leakage confirmation. Inspect oil drops or residual oil on the following components:
- Hydraulic oil tank, filter, pump, hydraulic oil cylinder, motor, valve block and hydraulic tubing.
- Inspect oil drops or residual oil at the following areas:
- Rear of boom, fly jib, upper side of turntable, upper and lower sides of chassis, and ground underneath equipment.

1.5 Every 100 Hours

1.5.1 Maintenance of worm-Type Slewing Drive

Check lubrication in the turntable bearing and the swing gearbox at intervals of 100 hours. It is necessary for maintaining performance and maintenance life to lubricate the turntable bearing frequently. Incorrect lubrication will cause damage to components.

There are three positions to be lubricated on the worm-type slewing drive assembly, i.e., lubrication of the roller path (Position I), lubrication of the engaging position (Position II) between the worm and the slewing bearing, and lubrication of the tapered roller bearing (Position III). The specific lubrication positions are shown as below:

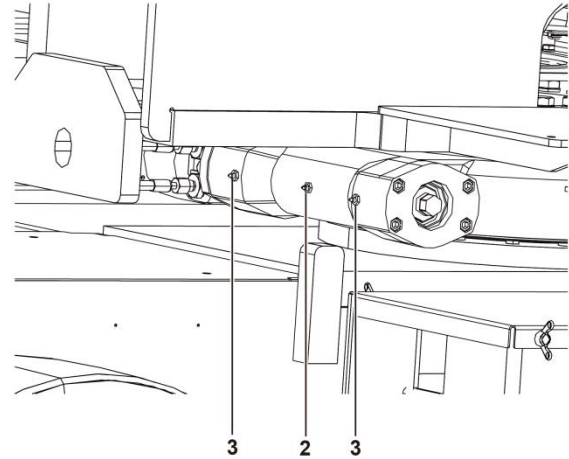
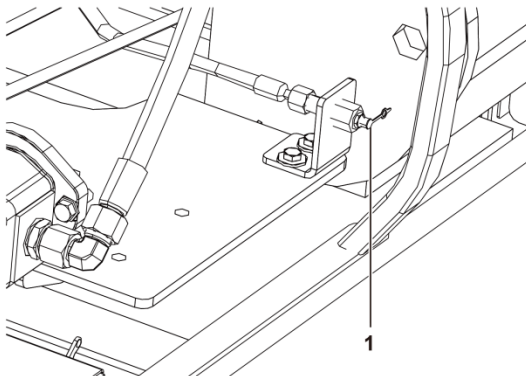


Figure1-2 worm-Type Slewing Drive

Position I: Lubrication of the roller path:

- Lubrication method: Continuously inject lubricating grease into the injection port of lubricating grease while rotating the slewing reducer
- Model of the lubricating grease: 3# lubricating grease

Position II: Lubrication of the engaging position between the worm and the slewing bearing

- Lubricating method: Continuously inject lubricating grease into the injection port of lubricating grease while rotating the slewing reducer
- Model of the lubricating grease: 3# lubricating grease

Position III: Lubrication of the tapered roller bearing:

- Lubricating method: Direct lubrication
- Model of the lubricating grease: 3# lubricating grease

⚠ CAUTION: In the case of an

extremely dirty working environment, increase the oil filling frequency.

1.5.2 Grease the Exposed Piston Rod

If storing the machine for a long time with the piston rod exposed, carry out the maintenance monthly; if not, carry it out quarterly.

Component requiring maintenance:

still for at least 6h (preferably 24h).

Tower boom lift cylinder.

Grease specification:

Lithium-based grease and hydraulic oil mix, with the ratio of lithium-based grease to hydraulic oil as 3:1.

Maintenance procedure:

- 1) Apply the mix evenly onto lint-free wipers.
- 2) Fully raise the tower boom and apply the mix evenly to the surface of the exposed piston rod using lint-free wipers.
- 3) Fully lower the tower boom and fully raise it. Then wipe the residual mix off the piston rod using lint-free wipers.

1.6 Every 250 Hours

1.6.1 Check the Batteries

This check should be performed every 250h or three months, whichever comes first.

Good battery condition is critical to normal vehicle performance and safe operation. Improper electrolyte levels or damaged cables and wires may result in component damage and dangerous situations.



Risk of electric shock

Any live operation can cause serious personal injury or death. Remove all rings, watches and other accessories before operation.



Risk of bodily injury

The battery electrolyte is corrosive. Avoid contact with spilled electrolytes on your hands or other parts of your body for fear of injury. The spilled electrolyte can be neutralized with soda and water.

- 1) Wear protective clothing and goggles.
- 2) Make sure the battery cable is securely wired and not corroded.
- 3) Charge the battery in a balanced way or fully charge the battery and stay the battery



CAUTION: This check is not required for machines that are equipped with sealed or maintenance-free batteries.

- 4) Remove the battery vent cap, check the specific weight with a specific gravity hydrometer and make the record.
- 5) Check the ambient temperature and adjust the specific liquid gravity of each battery according to the instructions below:

Increase the specific liquid gravity by 0.004 per 5°C, if the temperature is higher than 27°C.

Decrease the specific liquid gravity by 0.004 per 5°C, if the temperature is lower than 27°C.

Result: the specific liquid gravity of each battery is greater than 1.277 after the adjustment. Fully charge the battery and turn to Step 9.

Result: the specific liquid gravity of more than one battery cell is less than 1.217, turn to Step 6.

- 6) Charge the battery in a balanced way or fully charge the battery and stay the battery still for at least 6h (preferably 24h).
- 7) Open the battery cover, check the specific weight with a specific gravity hydrometer and make the record.
- 8) Check the ambient temperature and adjust the specific liquid gravity of each battery according to the instructions below:

Increase the specific liquid gravity by 0.004 per 5°C, if the temperature is higher than 27°C.

Decrease the specific liquid gravity by 0.004 per 5°C, if the temperature is lower than 27°C.

Result: the specific liquid gravity of each battery is greater than 1.277 after the adjustment. Fully charge the battery and

turn to Step 9.

Result: the specific liquid gravity difference between the battery cells is greater than 0.1 or the specific liquid gravity of more than one battery cell is less than 1.217. In such case, please replace the battery.

- 9) Check the battery electrolyte height. If necessary, add the distilled water to the highest liquid level indicator and do not add the excessive distilled water.
- 10) Close the battery cover and neutralize the spilled electrolyte with the sodium bicarbonate solvent.

⚠ CAUTION: Adding terminal

protectors and anti-corrosion sealants will help eliminate corrosion on battery terminals and cables.

Check the system/emergency pump battery (If equipped).

- 1) Check whether the battery lock lever is stable.
- 2) Check the wiring of the battery cable, which shall be secure and uncorrosive.
- 3) Check whether the electrolyte is leaking and whether the battery is dry and clean.
- 4) Check electric eye status.



Hydrometer

Color of electric eye	Meaning and processing method
White	Insufficient electrolyte. Please shut down the machine and stop using it.
Black	Under voltage or damage
Green	Measure the voltage of each battery. If the voltage is lower than

	11 V, it indicates that the battery is damaged (open circuit or short circuit); The voltage is between 12.4 V-12.7 V, indicating that the battery is in good condition
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If the battery hydrometer color is green and the voltage is above 12V, but it cannot work normally, please ask the trained maintenance personnel who have obtained the corresponding qualifications to further test the battery.

1.6.2 Check the Wires

This check should be performed every 250 h or quarterly, whichever comes first.

It is important for safe operation and good machine performance to keep the wires in good conditions. Failure to find and replace the burn-out, scratched, corroded or bent wires will result in unsafe operating conditions and damage to the parts.

Risk of electric shock/explosion

Contact with live circuits may cause serious injury or death. Do not wear rings, watches or other jewelry.

- 1) Check if the ground wire under the chassis is missing or damaged.
- 2) Check the following areas for burn-out, scratched, corroded, bent or loose wires:
 - Rear axle: Drive motor, limit switch
 - Under the hatch cover: Ground control unit inside, wire harness connection
 - Under the rear cover of chassis: motor control unit
 - Main contactors
 - Battery box: Battery
 - Machine: Platform, platform control unit, wire harness connection
- 3) Check whether all wire harness connectors are coated with insulating grease:
 - Ground control unit
 - Platform control unit
 - Motor Control unit

- Valve component
- Limit switch
- Sensor

1.6.3 Check the Electrical Contactors

This check should be performed every 250 h or quarterly, whichever comes first.

It is important for safe operation of the machine to keep the electrical contactor in good condition. Failure to find the worn or damaged contactors in a timely manner may endanger the work conditions and cause component damage.

- 1) Find the electrical contactor.
- 2) Visually check the following aspects of the contactor:
 - Transitional burning
 - Transitional bending
 - Transitional pitting



WARNING: Risk of burn. Contact with an electrical circuit may result in death or serious personal injury. Remove all rings, watches or other accessories.



CAUTION: In the event of any damage, the contactor should be replaced.

1.6.4 Check the Tires and Wheels

This check should be performed every 250 h or quarterly, whichever comes first.

It is important for safe operation and good performance to keep the tires and wheels in good conditions. Failure of the tires and wheels may cause the machine to roll over. Failure of finding and repairing the problem in time may cause damage to the machine.

- 1) Check the tire treads and sides for scratches, cracks, punctures or other abnormal wear.
- 2) Check the wheels for damage, bending or

cracking.

- 3) Check each lug nut for proper torque: $305 \pm 25 \text{ N.m}$.

1.6.5 Check the Drive Hub Oil Level

Inspect the oil level of the drive hubs every 250 h or quarterly, whichever comes first.

Improper oil level will result in reduced performance. Continuous use will result in damage to components.

Inspect oil level



Figure 1-3 Traveling slowdown
1. Oil filler 2. Viewing port

- Drive the machine until one plug is located at the horizontal position as shown as shown in Figure.
- Remove the viewing port plug at the horizontal position, and inspect oil level.
- Result: Oil level shall be flush with the bottom of the viewing port.
- If necessary, add oil at the oil filler until the oil level is flush with the bottom of the viewing port, select gear oil by referring to Machine Specifications section.
- Coat the plugs with pipe thread sealant and install the plugs.

Repeat this step for every drive hub

1.6.6 Check for Exhaust Cover of Hydraulic Oil Tank

This check item shall be conducted every 250 hours or quarterly, whichever comes first.


An unobstructed hydraulic oil tank cap is essential for good mechanical performance and long service life of the platform. A dirty or clogged exhaust cover may result in poor

platform performance. Given harsh working environment, more frequent check is required.

- ① Remove the exhaust cover from the hydraulic oil tank cap.
- ② Check for ventilation.

Result: Air can pass through the exhaust cover.

Result: If air does not pass through the exhaust cover, continue with Step 3.

 **NOTICE: Air is supposed to pass freely while checking ventilation of the oil tank cap.**

- ③ Carefully clean the tank exhaust cover with mild solvent and dry it with low pressure compressed air. Repeat Step 2.

Install the exhaust cover of the hydraulic oil tank.

1.6.7 Visual Inspection of the Hydraulic Oil

This check item shall be conducted every 250 hours or quarterly, whichever comes first.

Collect a sample of hydraulic oil and place in a clear container. Visually inspect the hydraulic oil for the following:


- Color: oil should be a clear, light-honey colored.
- Appearance: oil should be clear and not cloudy or visibly distorts the view through the sight glass or container.
- Contains no particles, foreign objects, or other contamination.
- The hydraulic oil can be inspected by smell (can smell “hot” but not “burnt”) or rubbing between fingers (should feel viscous and free of any rough feel due to particles) If the hydraulic oil passes all of the above inspections, continue the scheduled maintenance intervals. If the hydraulic oil fails any of the above inspections, the hydraulic oil must be tested by an oil distributor or replaced.


Note: If the hydraulic oil has not been replaced for two years, the oil must be tested every quarter by an oil distributor until the oil fails the test and is replaced. After the oil has been replaced, continue the scheduled quarterly maintenance inspection.

Note: When replacing the hydraulic oil, it is recommended that all hydraulic filters be replaced at the same time.

1.7 Every 500 Hours

1.7.1 Replace Hydraulic Oil Filter

 **Risk of personal injury. Be careful of hot oil. The contact with hot oil will cause severe burns.**

 **In a dusty working environment, this step should be performed more frequently.**

Perform this step once every 500 h or every six months, whichever comes first.

Replacing the hydraulic return filter and high pressure filter is crucial for superior performance and service life of the machine. Dirty or clogged filter may affect the performance of the machine, and if not replaced, may cause damage to the parts. The filter shall be replaced frequently in a harsh working environment.

Park the machine on a solid and level ground. Lower the arm rod and make the machine retracted.

Replace hydraulic return filter

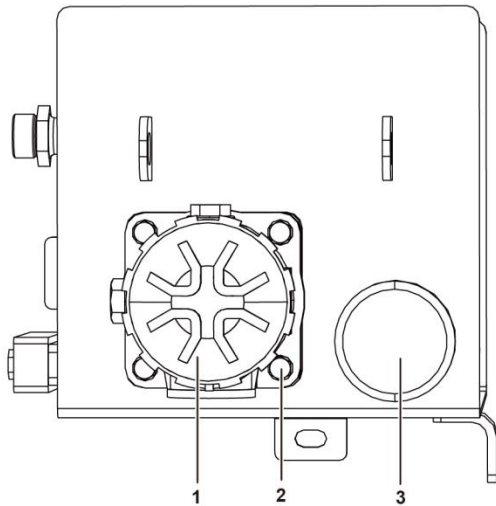
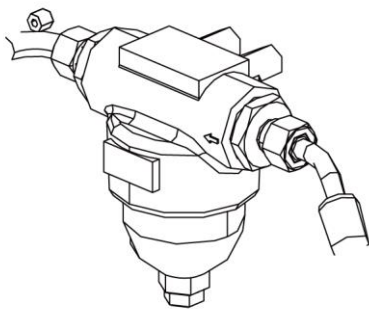


Figure 1-4 Hydraulic oil tank

No.	Description	Tightening torque
1	Air cleaner	
2	Connecting bolt between filter and tank	25±3N.m
3	Return filter	-

- 1) Disconnect the oil return pipe from the return filter.
- 2) Remove the plug on the return filter.
- 3) Disconnect the return filter from the hydraulic tank.
- 4) Remove the old filter and install a new one.
- 5) Refit the oil return pipe and the plug.
- 6) Use a marker to write down the replacement date on the filter replacement record.

Replace high pressure filter



- 1) Place a suitable container under the filter.
- 2) Remove the nut at the bottom of the filter cover with the wrench and remove the filter

cover.

- 3) Remove the filter element from the filter cover.
- 4) Check the seal of the filter cover and replace it if necessary.
- 5) Install new high pressure filter element and tighten it.
- 6) Scrub off any oil droplets splashed during installation.
- 7) Use the marker pen to note the replacement date on the Filter Replacement Record.
- 8) Use GCU to operate any boom function.
- 9) Check the filter components for oil leakage.

1.8 Every 1000 Hours

1.8.1 Replace the Reducer Gear Oil

The first maintenance should be performed after 150 h, and thereafter should be performed at an interval of 1000 h or annually, whichever comes first.

Changing the gear oil of the under is necessary to maintain good equipment performance and long service life. Failure to change the gear oil each year may result in performance degradation and continuous operation may result in component damage.

- 1) Select the reducer to be serviced and drive the equipment till one of the two plugs is at the lowest point.
- 2) Remove the two plugs and drain the oil completely in a suitable container.
- 3) Rotate the drive unit until one plug is at the highest position and has an angle of 90 degrees with the other plug.
- 4) Fill the oil from the reducer's filler hole at a high point till the oil level is the same as that

in the side hole at the bottom. Install the plug.

- 5) Repeat this step for oil filling of each reducer.

1.8.2 Replace the Air Cleaner

Perform this step once every 1000 h or every year, whichever comes first.

In a dusty working environment, this step should be performed more frequently.

! This step shall be performed

when the machine is stopped.

- 1) Remove the old air cleaner.
- 2) Install a new air cleaner.

1.8.3 Check the Boom Wear-resistant Slider

Check the fixing and wearing of the wear-resistant slider once every 1000 hours or every year, whichever comes first.

- 1) The slider is located on the surface and inner wall of the arm rod housing to reduce friction and keep the arm rod slider in good condition, which is necessary for safe machine operation. Improper padding or continuous use of extremely worn wear gaskets could lead to component damage and unsafe operating conditions.
- 2) Extend the boom to check whether the slider is loose. If the slider is loose, please tighten the fixing bolt. Check the clearance between the slider and the boom. If the clearance between the slider and the boom is greater than 1 mm, increase the gasket to obtain zero clearance and zero resistance, and replace the slider if necessary. As for the part number of the slider gasket, please refer to the Parts Catalog and select the slider gasket according to the actual situation. After adding gaskets, extend and retract the boom several times to eliminate potential dead points.

1.9 Every 2000 Hours

1.9.1 Test or Change of Hydraulic Oil

Test or replace hydraulic oil every 2,000 h or two years.

It is necessary to replace the hydraulic oil and suction filter to maintain performance and service life of the machine. Dirt or a clogged filter may cause performance degradation of hydraulic components, and continuous use will cause damage to components. In dirty work environments it is necessary to increase the change intervals.

The hydraulic oil grade is shown in Table.

Grade	Brand
Rando MV32	Chevron

! CAUTION: If the oil isn't replaced after the two year interval, it must be tested quarterly and replaced when it no longer passes the testing.

! CAUTION: The hydraulic suction filter should be replaced when the hydraulic oil is changed.

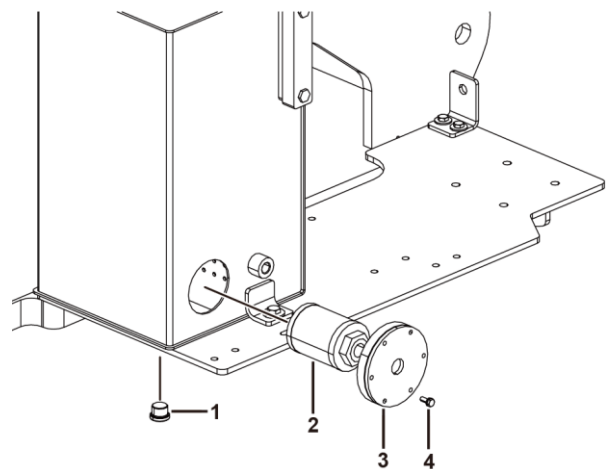



Figure 1-5 Hydraulic oil tank

No.	Name
1	Drain plug
2	Suction oil filter
3	Suction oil flange
4	Bolt and gasket

Park the vehicle on a level ground so that the vehicle is in the stowed position.

- 1) Remove the drain plug from the hydraulic tank.
- 2) Completely drain the hydraulic oil from the hydraulic tank into a suitable container. To speed up the oil drain, remove the tank vent cap.
- 3) Remove the suction filter from the hydraulic tank.
- 4) Install a new suction filter.
- 5) Install the drain plug.
- 6) Add the hydraulic oil into the hydraulic tank until the liquid level is at the specified position of the sight gauge, and it is strictly prohibited to overflow.
- 7) Scrub off hydraulic oil that may be splashed out.
- 8) Check the function of all machines and check for oil leakage through one full cycle.
- 9) After a working cycle, recheck the tank level and add oil to the specified position.

 **CAUTION: When installing drain plug and filter, be sure to apply pipe thread sealant.**

1.10 Regular maintenance

- 1) Maintenance work on a quarterly, annual and biennial basis must be performed by those who are trained and qualified in the vehicle maintenance according to the procedures specified in this manual.
- 2) If a machine has been idle for more than three months, a quarterly maintenance

must be performed before it is operated.

1.11 Introduction to Thermal Management Strategy of Lithium-ion Battery

1.11.1 Introduction

The working principle of lithium-ion battery is that, the battery electrolyte produces a potential difference between the positive and negative electrodes through the change of chemical reaction to generate current. The electrolyte moves quite slowly in a low temperature environment, which will affect the transfer activity of lithium ions between the positive and negative electrodes, and thereafter result in a decrease in the battery charging/discharging performance.

Factors restricting the low temperature performance of lithium-ion battery are as follows:

- The lithium-ion battery electrolyte incurs viscosity increase and may even solidify partially in a low temperature environment, resulting in a decrease in the conductivity of the lithium-ion battery.
- The compatibility between the electrolyte, the negative electrode and the diaphragm is degraded in a low temperature environment.
- The precipitation of lithium ions at the negative electrode will become serious in a low temperature environment, and the precipitated metal lithium will react with the electrolyte and produce deposits, causing an increase in the thickness of the solid electrolyte interface (SEI).

- The diffusion of lithium ions in the active material will decrease systematically and the charge transfer resistance (R_{ct}) will increase significantly in a low temperature environment.

When the temperature is low, the activity of the electrolyte will be such decreased that the transmission of lithium ions will be affected (i.e., the charging and discharging ability of the battery will be affected), and the battery capacity will be reduced. Generally speaking, the allowed working temperature of lithium-ion battery is $-20\text{--}60^{\circ}\text{C}$, and if the battery is used in a temperature out of this range, its performance will degrade substantially.

1.11.2 Thermal Management Strategy

Working temperature: -30°C – 60°C

Storage temperature: -30°C – 60°C

1.11.2.1 Introduction of Heating Strategy

The running state of the vehicle will be detected, and if charging is required, the charging & heating mode will be activated; or the driving & heating mode will be activated if the vehicle is in driving (discharging) state.

1.11.2.2 Charging & Heating Mode

1. In case of T_{\min} (minimum cell temperature) $\leq -30^{\circ}\text{C}$, the heating & charging mode will be disabled, and a low temperature fault will be reported.
2. In case of $T_{\min} \geq 16^{\circ}\text{C}$, the charging will be started directly.
3. In case of $-30 < T_{\min} < 16^{\circ}\text{C}$, the heating film will be turned on for heating. In case of $T_{\min} < 2^{\circ}\text{C}$, heating-only mode will be

activated, and in case of $T_{\min} \geq 2^{\circ}\text{C}$, charging & heating mode will be activated. When T_{\min} stays $\geq 18^{\circ}\text{C}$ for 1min, the heating function will be turned off, and the charging-only mode will be activated.

4. When T_{\min} drops below 0°C , the heating-only mode will be activated again, and when T_{\min} becomes $\geq 2^{\circ}\text{C}$ after heating, the charging & heating mode will be activated.

1.11.2.3 Driving (Discharging) & Heating Mode

1. When T_{\min} stays within $-30^{\circ}\text{C} \sim 2^{\circ}\text{C}$ for 10s during driving (discharging), the heating will be activated, and will be turned off when T_{\min} stays $\geq 7^{\circ}\text{C}$ for 1min.
2. Requirement in the process of driving (discharging) & heating: when the battery SOC drops below 25%, the discharging & heating mode will be disabled.

1.11.2.4 Exception Handling and Warning

1. If T_{\max} (maximum cell temperature) stays $\geq 40^{\circ}\text{C}$ for 10s in the process of charging & heating, a high cell temperature warning will be activated, the heating will be stopped, and the charging mode will be activated.
2. If T_{\max} (maximum cell temperature) stays $\geq 40^{\circ}\text{C}$ for 10s in the process of driving & heating, a high cell temperature warning will be activated, and the heating will be stopped.

3. When the temperature rise is too slow, a heating fault will be determined and reported, and the heating will be stopped.
4. Requirement in the process of driving (discharging) & heating: when the battery SOC drops below 25%, the discharging & heating mode will be disabled.
6. If for all battery packs, $(T_{\min} - T_{\text{initial}})$ is $< 2^{\circ}\text{C}$ during the heating test, the test will be stopped, and a message for normal heating function will be reported.
7. If no enable signal is detected after bms power-on, but the condition for starting low temperature heating is met, the heating process will be interrupted forcibly and the heating test process will be started when the enable signal is detected during the heating process; if low temperature heating is not started after bms power-on, the heating test process will be started when the enable signal is detected.


Parameter description:

- Maximum cell temperature: T_{\max}
- Minimum cell temperature: T_{\min}
- Initial cell temperature: T_{initial}
- Total system heating time: $t(\text{min})$

NOTE:

1. Start condition: The main control starts the heating test after detecting a 24V high level signal that lasts for 5s.
2. T_{initial} is the minimum cell temperature at the initial stage of heating, and in case of $t=0$, $T_{\text{initial}} = T_{\min}$.
3. If T_{\max} is $\geq 45^{\circ}\text{C}$ during the preparation for heating test, the heating test will be stopped, the heating function test will be disabled, and a high initial temperature warning will be reported.
4. If T_{\max} is $> 50^{\circ}\text{C}$ during the heating test, the test will be stopped, the heating relay will be disconnected, and a heating fault will be reported.
5. When t is > 15 min and in any battery pack, $(T_{\min} - T_{\text{initial}})$ is $< 2^{\circ}\text{C}$, the test will be stopped, and a heating function fault will be reported.
8. The thermal management strategy threshold of the battery pack depends on its brand and model.

1.12 Routine Inspection and Maintenance Intervals

 **NOTE:** The working hours are based on the hourmeter, and the operation cycle is calculated from the date of production.

Maintenance period

Maintenance level	Routine inspection	Level 1	100h	Level 2 maintenance	Level 3 maintenance	Level 4 maintenance	Level 5 maintenance
Maintenance period	Daily	50h	100h	250h	500h	750h	1000h

Table of Maintenance Inspection Items

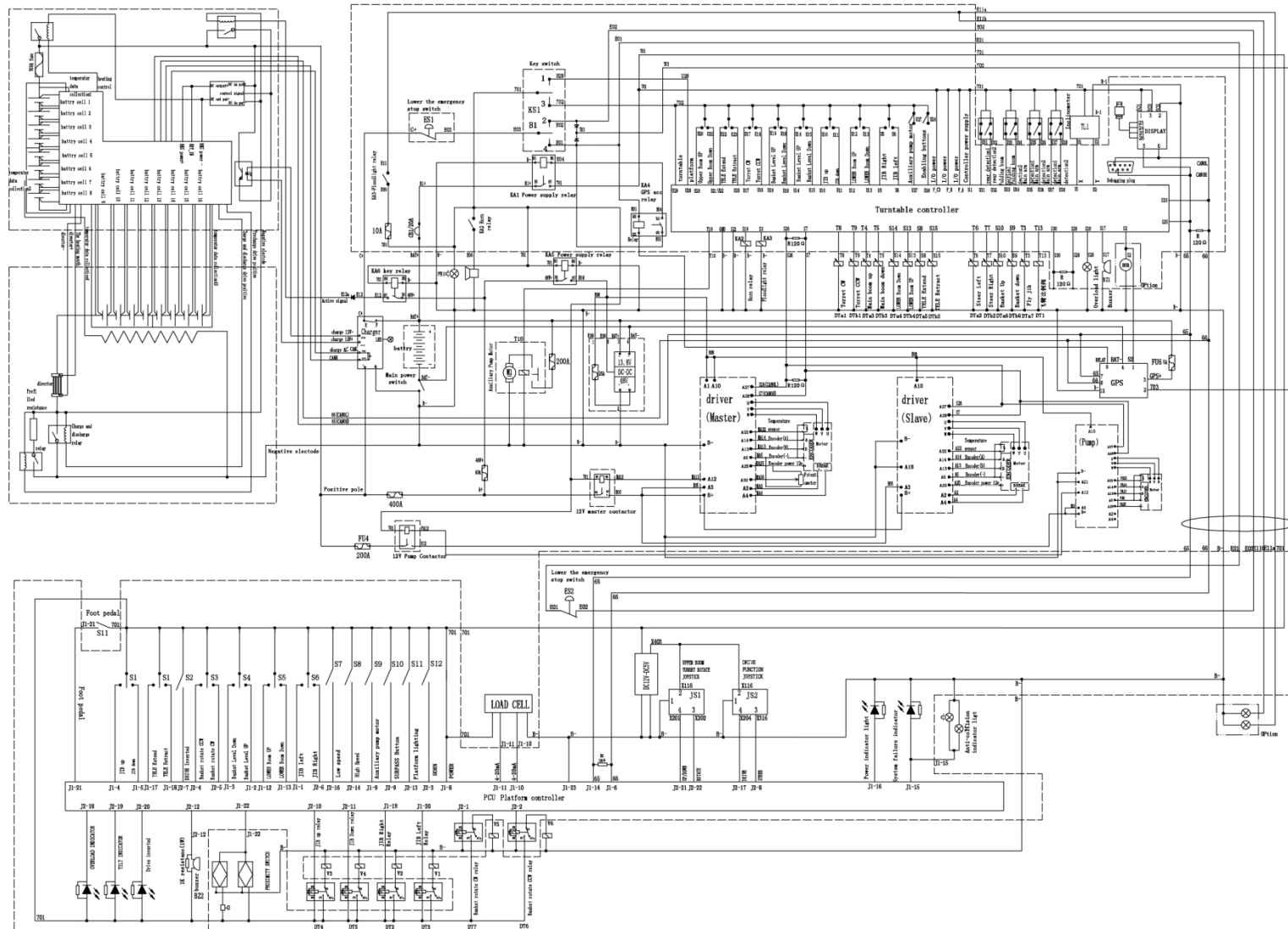
System	Operation	Maintenance level							Remarks
		Routine inspection	Level 1 maintenance	100h maintenance	Level 2 maintenance	Level 3 maintenance	Level 4 maintenance	Level 5 maintenance	
Electrical system	Check the battery for undervoltage	•							
	Check if the battery terminals are loose or rusted	•							
	Check if buttons on the PCU panel operate normally	•							
	Check if the PCU harness connector is connected firmly	•							
	Check if the PCU harness connector is stained	•							
	Check if the PCU harness is extruded or broken	•							
	Check the position of the limit switch rocker arm and if it is wired loosely	•							
	Check if the motor is wired normally	•							
	Check if buttons on the ground control panel operate normally	•							
	Check if the warning lamp and horn function normally	•							
	Check if the solenoid valve coils of main valve block are wired normally or loose	•							
	Check for wear, loose or damaged harness	•							
	Check the electrolyte level of battery				•	•	•	•	This item is not apply to

									maintenance free batteries and sealed batteries	
	Check for electric contactor				•	•	•	•		
	Check the insulating grease layer of the harness				•	•	•	•		
	Load cell calibration				•	•	•	•		
Hydraulic system	Check if the system pressure is normal			•	•	•	•	•		
	Check if the steering system pressure is normal			•	•	•	•	•		
	Check the gear oil level of reducer				•	•	•	•		
	Check if the oil pipes and joints are loose	•								
	Check if the oil cylinder leaks oil	•								
	Check if the valve spools leak oil	•								
	Check if the walking oil pipe fixing clip is loose	•								
	Check the oil level in the hydraulic tank	•							Add hydraulic oil RandoMV32 when the oil level is lower	
	Check the permeability of the hydraulic oil tank exhaust cap			•	•	•	•	•		
	Grease the exposed piston rod			•	•	•	•	•		
	Replace the hydraulic oil	Every 2,000h or every two years, whichever comes first. Replace it, if it fails to the test.								Hydraulic oil RandoMV32
	Replace the suction filter	Every 2,000h or every two years, whichever comes first								
	Check the hydraulic tank vent cap for leakage	Daily								
	Replace the air cleaner	Every 1,000 hours or every year, whichever comes first								
Check the reducer for oil leakage	Daily									
Change the reducer gear oil	First 150h, thereafter every 1,000h or every year, whichever comes first.									
Replace the return oil filter element	Every 500h or every six months, whichever comes first.									
Replace the high pressure filter element	Every 500h or every six months, whichever comes first.									
Machine	Check if the attached documents are complete, easy to read, and if they are in the file box	Daily								

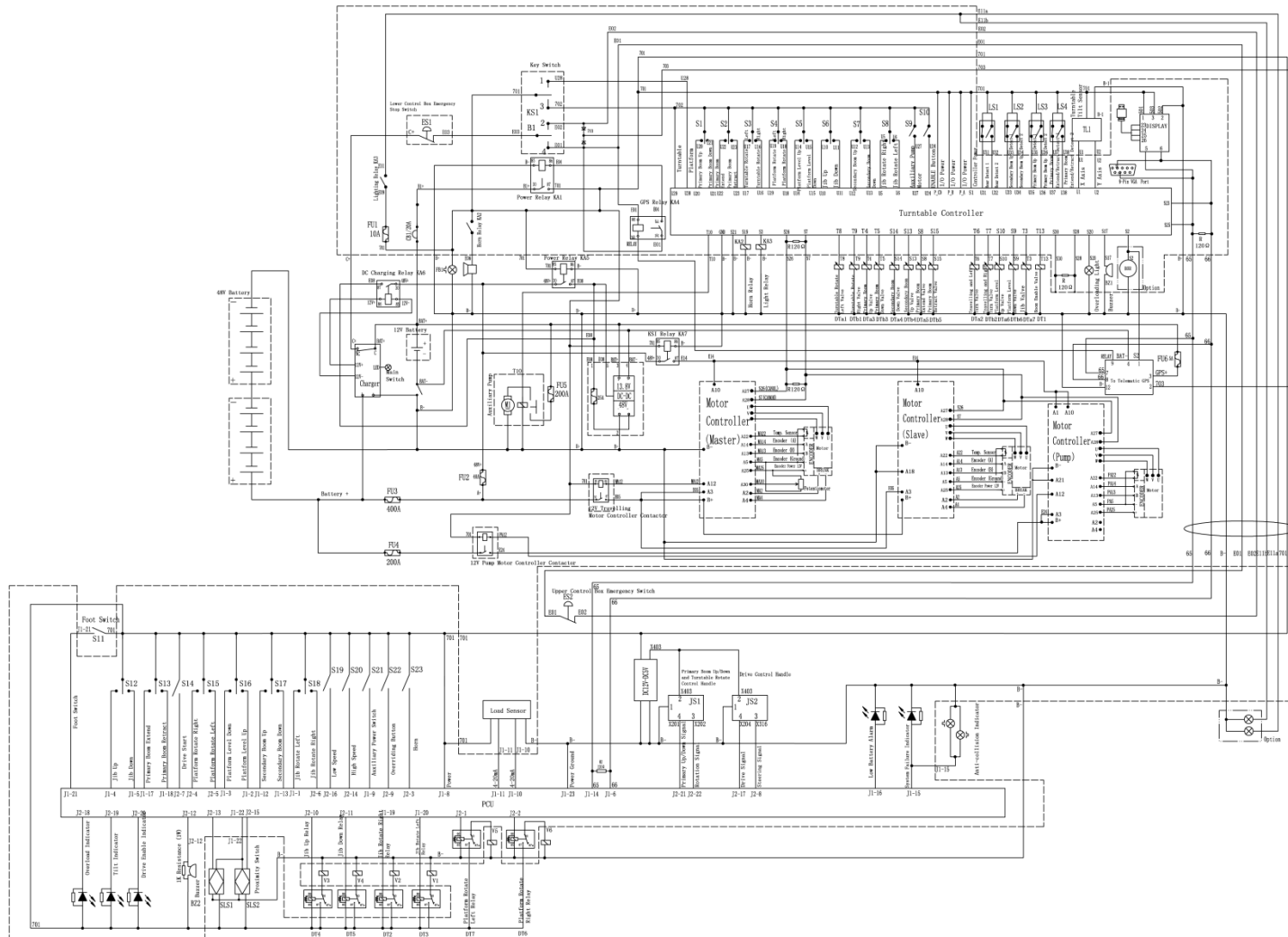
	Check if the safety identification is correct or stained	Daily							
	Check the machine bolts, nuts and other fasteners for looseness or abnormal noise	Daily							
	Check the structural parts of the machine for cracks and if there is any open weld	Daily							
	Check if the machine paint for falling off, serious rust, corrosion or oxidation	Daily							
	Check if the slider is loose and if there is zero clearance between the slider and the boom							•	
	Check for tires and hubs				•	•	•	•	
	Check the turntable rotation bearing bolts							•	Torque:305 ± 25N.m
Lubrication	Grease the slewing bearing and the gears of the slewing mechanism			•	•	•	•	•	Lithium-based grease

Chapter 2 Schematic Diagram

A13JE-Li Electrical schematic diagram



A13JE Electrical schematic diagram



A13JE/A13JE-Li Hydraulic schematic diagram

