MODELS
PERSONNEL MANLIFT

ANSI

SERVICE MANUAL

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MA0191-05
Japanese - Service Manual

JAPANESE MODELS

- ☐ P20AC/DC
- ☐ P25AC/DC
- ☐ P30AC/DC
- ☐ P35AC/DC
- ☐ P40AC/D

NO. _____

ISO 9001 BSI REGISTERED
Cert. N° FM 40826

MA0191-05

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CHAPTER I
GENERAL DESCRIPTION

CHAPTER II
DETAILED DESCRIPTION

CHANGE RECORD

Change N°	Effective date	Date entered	Entered by

FOREWORD

This manual has been compiled to assist you in properly operating and maintaining your JLG Aerial Work Platform.

The Work Platform has been designed for maximum performance with minimum maintenance. With proper care, years of trouble-free service can be expected.

Constant improvement and engineering progress makes it necessary that we reserve the right to make specification and equipment changes without notice.

This manual is divided into two chapters :

- Chapter I : General description: this section covers basic maintenance, generalities of the machine components and preventive maintenance.

- Chapiter II : Detailed description : this section is more technical and more complete. It helps you to maintain your machine by following the removal and installation, as well as setting procedures.

A CHANGE RECORD page is included as page 6 herein. It is intended that the recipient of the changes keeps this CHANGE RECORD updated as each change is received by him.

The definitions of DANGER, CAUTION and NOTE as used in this manual apply as follows :

DANGER

A DANGER IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE OR PRACTICE IS NOT FOLLOWED EXACTLY, DEATH OR INJURY TO PERSONNEL MAY RESULT.

CAUTION

A CAUTION IS USED TO EMPHASIZE THAT IF AN OPERATION, PROCEDURE, OR PRACTICE IS NOT FOLLOWED EXACTLY, EQUIPMENT DAMAGE MAY RESULT.

NOTE

A note is used to emphasize an important procedure or condition.

GENERAL WARNINGS

IT IS MANDATORY THAT ALL HYDRAULIC HOSES AND FITTINGS BE CORRECTLY TAGGED AND IDENTIFIED BEFORE THEY ARE DISCONNECTED TO EFFECT REPAIRS OR SERVICE. FAILURE TO CORRECTLY TAG AND IDENTIFY HOSES AND FITTINGS CAN CAUSE WRONG RECONNECTION, WHICH CAN RESULT IN DEATH OR INJURY TO PERSONNEL.

NOTICE TO OWNER/USER

Should this work platform become involved in a accident, please contact your local JLG distributor immediately and relate details of the incident so he can readily notify JLG.
If the distributor is unknown and/or cannot be reached, please contact :

USA :

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1 JLG Drive
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CORRECTIVE ACTION REQUEST

The following form is for the use of the Distributor, Customer, mechanic, and all other person who use this manual and recognize beneficial ways to improve its purpose as a worthy reference. SMCAR's are to be made in regards to, but not limited to : Safety, Operation Correctness, and Technical Content. All SMCAR's will be reviewed by the responsible Department at JLG. Approved SMCAR's will be distributed in a Service Bulletin immediately and then incorporated in the next scheduled change to the manual. An answer to the SMCAR, approved or disapproved, will be sent directly to the one submitting the SMCAR.

Date _____
Customer Name _____
Address _____
_____

Telephone _____

Service Manual
Affected _____

Page(s) Affected _____

Reason for submitting SMCAR (Use additional paper or back if necessary)

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Signature (Optional)

Adress SMCAR's to :

JLG FRANCE SAS
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CHAPTER I

GENERAL DESCRIPTION

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1.1 Description

This handbook provides important information for the operation and maintenance of JLG manually propelled elevating aerial work platform Models **P20DC/AC, P25DC/AC, P30DC/AC** and **P35DC/AC**.

The JLG (Aerial) Elevating Work Platform is a manually propelled type with an all welded steel frame. The hydraulic power unit is located on the side of the mast and provides hydraulic energy for the work platform operations. The electrical energy is provided by a 12 VDC battery or by 100 VAC electrical power source.

The work platform may be safely operated on firm, level and hard surfaces, when all four outriggers are properly in place and firmly supported. It can be operated with a weight equal to, but not exceeding the manufacturer's rated load in the platform with the mast in any position. The maximum rated load is indicated on the nameplate.

The work platform operations are primarily controlled from the Upper Control Box mounted on the platform. The Lower Control Box is located on the side of the machine.

1.2 Specifications

			P20 DC/AC	P25 DC/AC	P30 DC/AC	P35 DC/AC	P40 DC/AC
Performances	Max. working height		8,04 m	9,50 m	10,96 m	12,42 m	13,93 m
	Floor height	Mini	0,40 m				
		Maxi	6,24 m	7,70 m	9,16 m	10,62 m	12,10 m
	Rated load		120 kg AC models / 160 kg DC models			120 kg	
Dimensions	Total width		0,75 m				
	Total length		1,24 m		1,31 m	1,38 m	1,46 m
	Width with outriggers		1,28 m	1,44 m	1,67 m	1,88 m	1,86 m
	Length with outriggers		1,54 m	1,69 m	1,93 m	2,14 m	2,12 m
	Total lowered height		1,99 m				2,00 m
	Ground clearance		0,05 m				
	Platform dimensions		0,66 x 0,66 x 1,10 m				
Weight	Weight AC / DC		345 / 360 kg	365 / 380 kg	405 / 420 kg	435 / 450 kg	500 / 515 kg
Electrical system	Battery charger		Input : 100 V - 50/60 Hz - 1,6 A				
			Output : 12 V - 10 A				
Hydraulic system	Pressure		11 MPa	13,5 MPa	18 MPa	18,5 MPa	12 MPa

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2.1 Maintenance

These general suggestions should be helpful in following the instructions in this manual : In analyzing a system malfunction, use a systematic procedure to locate and correct the problem :

1- Determine the problem.
2- List all possible causes.
3- Devise checks.
4- Conduct checks in a logical order to determine the cause(s).
5- Consider the remaining service life against the costs of parts and labor to replace them.
6- Make the necessary repairs.
7- Recheck to ensure that nothing has been overlooked.
8- Functionally test the failed part in its system.

NOTE

Your safety and that of others is always the number one consideration when working around machines. Safety is a matter of thoroughly understanding the job to be done and the application of good common sense.
It is not just a matter of do's and don'ts. Stay clear of all moving parts.

2.2 Cleanliness

An important item in preserving the long life of the machine is keeping dirt out of working parts. Enclosed compartments seals, and filters have been provided to keep the supply of air and lubricants cleaned. It is important that these enclosures are maintained.

Whenever hydraulic and lubricating oil lines are disconnected clean the adjacent area as well as the point of disconnection. As soon as the disconnection is made, cap plug or tape each line or opening to prevent entry of foreign material. The same recommendations for cleaning and covering apply when access covers or inspection plates are removed.

Clean and inspect all parts. Be sure all passages and holes are open. Cover all parts to keep them clean. Be sure parts are clean when they are installed. Leave new parts in their containers until ready for assembly.

Clean the rust preventive compound from all machined sufaces of new parts before installing them.

2.3 Removal and Installation

When performing maintenance, do not attempt to manually lift heavy part when hoisting equipment should be used. Never locate or leave heavy parts in an unstable position. When raising a portion of a work platform or a complete work platform, ensure the work platform is securely blocked and the weight is supported by blocks rather than by lifting equipment.

When using hoisting equipment, follow the hoist manufacturers recommendations and use lifting devices that will allow you to achieve the proper balance of the assemblies being lifted and to ensure safe handling.

Unless otherwise specified, all removals requiring hoisting equipment should be accomplished using an adjustable lifting attachment. All supporting members (cables, chains) should be parallel to each other and as near perpendicular as possible to the surface of the top of the object being fitted.

If a part resists removal, check to be certain all nuts and bolts have been removed and that an adjacent part is not interfering.

2.4 Disassembly / Assembly

When assembling or disassembling a component or a system complete each step in turn. Do not partially assemble one part and start assembling some other part. Make all adjustments as recommended. Always check the job after it is completed to see that nothing has been overlooked. Recheck the various adjustments by operating the machine before returning it to the job.

Pressing parts

When pressing one part into another, use an anti-seize compound or a molybdenum disulfide base compound to lubricate the mating surfaces.

Parts which are fitted together with tapered splines or keys are always very tight. If they are not tight, inspect the tapered splines and discard the part if the spines or keys are worn.

Assemble tapered parts dry. Before assembling parts with tapered splines, be sure the splines are clean, dry, and free from burrs.

2.5 Locks

Lockwashers, flat metal locks or cotter pins are used to lock nuts and bolts.

Always use new locking devices on components which have moving parts.

2.6. Wires and Cables

DC Models : Batteries should always be disconnected and the charger plug disconnect from the electrical power source prior to working on the electrical system.
AC Models : The machine should always be disconnected from the electrical power source prior to working on the electrical system.

When removing or disconnecting a group of wires or cables, tag each one to ensure that they are connected properly during assembly .

2.7. Bearings

Antifriction bearings

When an antifriction bearing is removed, cover it to keep out dirt and abrasives. Wash bearings in non-flammable cleaning solution and allow them to drain dry. The bearing may be dried with compressed air **but** do not spin the bearing.

Discard the bearings if the races and balls or rollers are pitted, scored or burned. If the bearing is serviceable, coat it with oil and wrap it in clean waxed paper. Do not unwrap new bearings until time of installation.

The life of an antifriction bearing will be shortened if not properly lubricated. Dirt in antifriction bearing can cause the bearing to lock resulting in the shaft turning with the cage.

Sleeve bearings

Do not install sleeve bearing with a hammer. Use a press and be sure to apply the pressure directly in the line with the bore. If it is necessary to drive on a bearing, use a bearing driver or a bar with a smooth flat end.

2.8. Gaskets

Be sure the holes in the gaskets correspond with the lubricant passages in the mating parts. If it is necessary to make gaskets, select material of the proper type and thickness. Be sure to cut holes in the right places. A blank gasket can cause serious damage.

When removed, always install the cylinder head and manifold gasket using recommended gasket compound on head gaskets to allow uniform sealing.

2.9. Battery

Clean battery by scrubbing it with a solution of baking soda and water. Rinse with clear water. After cleaning, dry thoroughly and coat terminals and connections with an anti-corrosion compound or grease.

If the machine is to be stored or not used for an extended period of time, the battery should be removed. Store the battery in a warm, dry place preferably on wooden shelves. Never store on concrete. A small charge should be introduced periodically to keep the specific gravity rating at recommended level.

2.10. Hydraulic Systems

DANGER

Exercise extreme care around pressurized hydraulic systems. Do not work on a hydraulic system while it is in operation or until all pressure is released.

Cleanliness

Contaminants in a hydraulic system affect operation and will result in serious damage to the system components. Dirt in hydraulic system is the major cause of component failures.

Keeping the system clean

When removing components of a hydraulic system, cover all openings of the component.

If evidence of foreign particles is found, flush the system.

Disassemble and assemble hydraulic components on a clean surface.

Clean all metal parts in a nonflammable cleaning fluid. Then lubricate all components to aid in assembly.

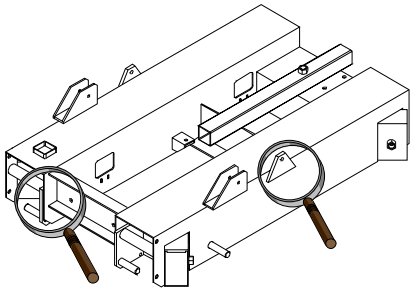
2.11. Fatigue of Welded Structure

Experience has shown that highly stressed welded structures when repeatedly subjected to varying stresses caused by twisting, shock bending and intentional and/or unintentional overloads often become subject to weld cracking which may be attributed to fatigue of the welded joint. This condition is not uncommon in the construction equipment.

Equipment should be periodically inspected for evidence of weld fatigue. The frequency of these inspections should commensurate with the age of the equipment, the severity of the applications and the experience of the operators and maintenance personnel.

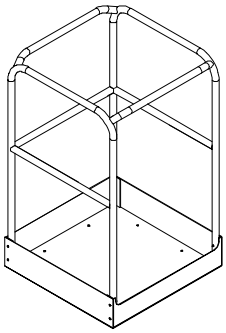
The following are known high stress areas applicable to JLG machines and a visual inspection should be made part of an owner's planned preventive maintenance program :

Base



- Inspect the strut mounting bracket.
- Inspect the mast mounting frame.

Platform



- Inspect all the weldments.

This information is provided only as a guide, and your inspection plan should not be limited to the areas listed. A thorough visual inspection of all weldments is a good practice.

Anyone requiring more detailed inspection instructions and / or repair procedures may request same by contacting your local JLG servicing distributor for assistance.

2.12.Welding from/on work platforms

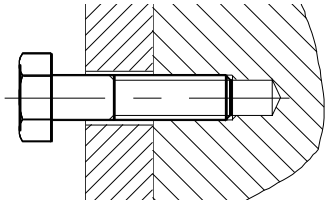
It is important, that when welding from or on work platforms, the following precautions must be observed:

1 - When welding from the work platform, always run the welder ground wire directly to the structure that is being welded. Do not allow any part of the platform to contact welding rods, holders, ground terminals or the structure being welded. Do not ground the welder through the machine as this can cause arcing inside the mast assembly.

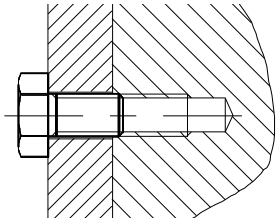
2 - When welding on the frame on work platform, connect the welder ground wire to the machine frame as closed to the area being welded as possible. Welding on masts is strictly forbiden.

2.13. Fasteners and torque values

Use bolts of the correct length. In a blind hole, a bolt too long may bottom before the head is tight against the part it is to hold.



If a bolt is too short, there may not be enough threads engaged to hold the part securely.



Thread can be damaged. Inspect them at each disassembly, and replace fasteners as necessary.

Torque values should correspond to the type bolts, studs and nuts used unless otherwise noted.

The torque tables are provided by JLG for reference when performing maintenance.

Use of proper torque values is extremely important. Improper torquing can seriously affect performance and reliability.

NOTE

Some special applications require variation from the standard torque values. Reference should always be made to component overhaul procedures for recommendations.

Special attention should be given to the existence of lubricant, plating, or other factors that might require variation from standard torque values.

When maximum recommended torque values have been exceeded, the fastener should be replaced. If installation is in a tapped hole, the thread shall be checked with a gage and the bolt replaced.

If reusing previously installed bolts that have not been over torqued, the bolts shall be visually inspected for cracks and thread damage, and replaced if discontinuities are found. Bolts are not to be rethreaded, rewelded or reworked.

All lower grade fasteners must be properly tightened to assure a good assembly. This tightening can be achieved by using a procedure such as the turn-of-the-nut or by applying a measured torque.

In order to respect proper torque values, lock nuts must be free from grease.

When referring to the applicable torque charts, use values as close as possible to the torque values shown to allow for wrench calibration tolerance. An erratic or jerking motion of the wrench can easily result in excessive torque. **Always** use a slow wrench movement and **stop** when the predetermined value has been reached.

Torque wrenches are precision instruments and are to be handled with care to ensure calibrated accuracy. Calibration checks should be made on a schedule basis. Whenever the wrench might be either overstressed or damaged, it should immediately be removed from service and recalibrated.

Know your torque wrench! Flexible beam type wrenches, even though they might have a preset feature, must be pulled at right angles and the force must be applied at the exact center of the handle. Force value readings must be made while the tool is in motion.

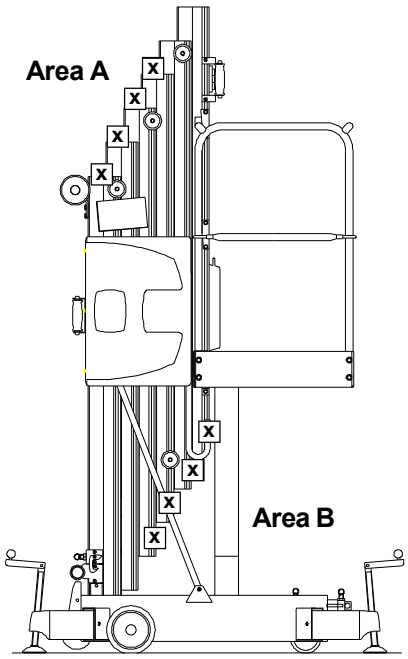
NOTE

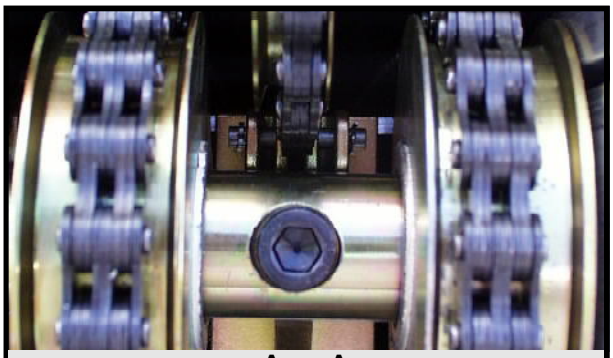
When multipliers and/or special tools are used to reach hard to get at spots, ensure torque readings are precisely calculated. Identification of fastener grade is always necessary. When marked as a high strength bolt (i.e. grade 8.8, 12.9, etc.), the mechanic must be aware that he is working with highly stressed component and the fastener should be torqued accordingly.

2.14 Chain attachments inspection

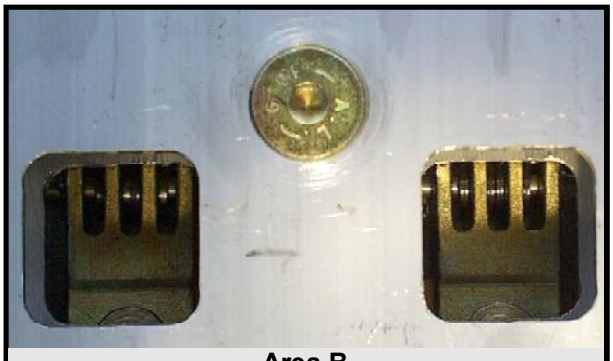
Raise the platform by 2 m after setting and stabilization of the platform.
Check the presence of the clevis pins and of the cotter pins for clevis pins.

☒ = Inspection areas location





Area A



Area B

2.15. Values Table

Unless otherwise indicated, torque values to be applied must correspond to the grade of bolts, studs and nuts used.

The values in the charts below correspond to the use of galvanised fasteners in their delivery condition: no grease, nor degreaser. These value are for torquing using a torque wrench (precision higher than 10% : covers all hand tools).

			Torque values for bolts, nuts and studs													
Grade	Tensile strength N/mm²	Unit	M4 x70	M5 x80	M6 x100	M8 x125	M10 x150	M12 x175	M14 x200	M16 x200	M18 x250	M20 x250	M22 x250	M24 x300	M27 x300	M30 x350
8.8	785	N.m	2,66	5,2	9,1	22	44	76	121	189	261	370	509	637	944	1280
10.9	981	N.m	3,91	7,7	13,4	32	64	111	178	278	384	544	748	936	1386	1880
12.9	1177	N.m	4,57	9	15,7	38	75	130	209	325	449	637	875	1095	1622	2200

Torque values for fittings					
JIC	N.m	BSPP	N.m	Metric	N.m
JIC 7/16	15	BSPP 1/4	20	M14x150	38
JIC 9/16	30	BSPP 3/8	34	M18x150	51
JIC 3/4	50	BSPP 1/2	60		
JIC 7/8	69	BSPP 3/4	115		

CHAPTER II

DETAILED DESCRIPTION

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II
1

Description

The work platform is controlled from the upper control box in the platform or from the lower control box located on the side of the mast. The upper control box is mounted to the last mast, platform side. The controls are used to control the electrical and hydraulic functions of the work platform.

It is mandatory that before operating the work platform, the operator is thoroughly familiar with the operation of the controls.

1.1. Platform Controls

NOTE

The following paragraphs describe the controls located in the platform.

The Upper Control Box is located in the platform. It contains the electrical and safety controls of the work plaform.

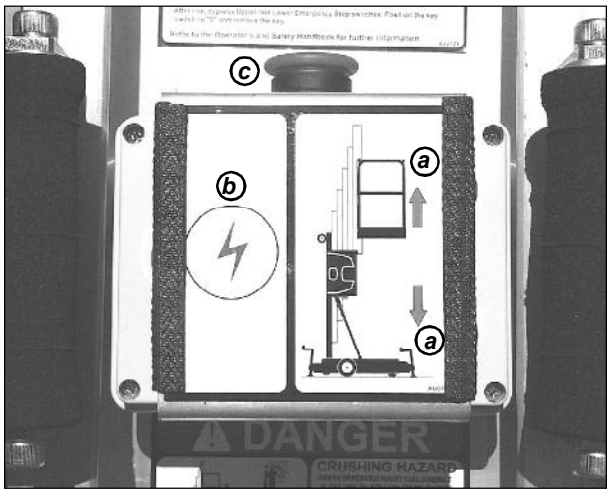


Fig 1.1 - Upper Control Box

a . Masts Raising / Lowering switches.
b . Pump / Motor Enable switch.
c . Emergency Stop switch.

Masts Raising and Lowering Control switches

They are located on the right hand side of the Upper Control Box. These switches act through the power unit to the mast cylinder. Push on the DOWN switch to lower the platform or on the UP switch to raise the platform.

Pump / Motor Enable Switch

The pump / motor enable switch is located on the left hand side of the Upper Control Box. It must be used together with the masts control switches. Pushing the switch in activates the pump / motor.

NOTE

If the DOWN, UP and ENABLE switches are depressed at the same time, the masts will be lowered.

Emergency Stop Switch

It is a push button switch located on top of the upper control box. Pushing the switch in removes all electrical power from the platform controls, stopping all work platform functions (ground controls remains operationnal). The switch must be pulled out to resume operations.

1.2. Ground Controls

The ground controls are used to control the machine in case of breakdown or emergency.

NOTE

The following paragraphs describe the ground controls and indicators.

1.2.1. Platform Emergency Lowering Valve.

DANGER

Stay clear of the path of lowering platform when using the manual emergency lowering valve. Failure to do so may result in death or serious injury.

DANGER

Depress the Emergency Stop switch on the Lower Control Box before using the platform Emergency Lowering Valve. Failure to do so may result in death or serious injury.

The Platform Emergency Lowering Valve is located at the front bottom of the machine base. Pull out the valve knob to lower the platform.

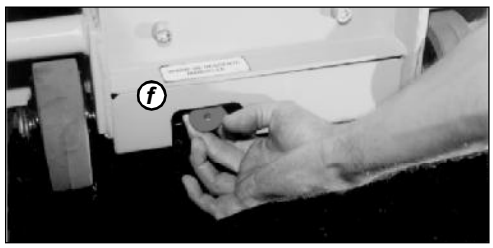


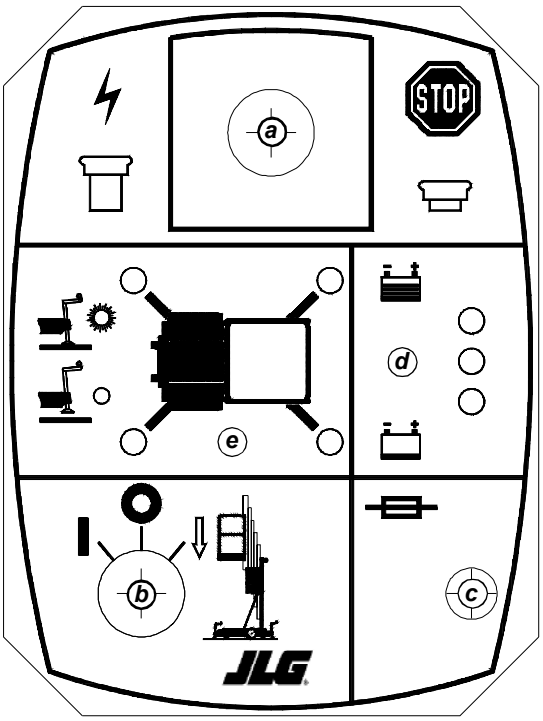
Fig 1.2 - Platform Emergency Lowering Valve.

II 1

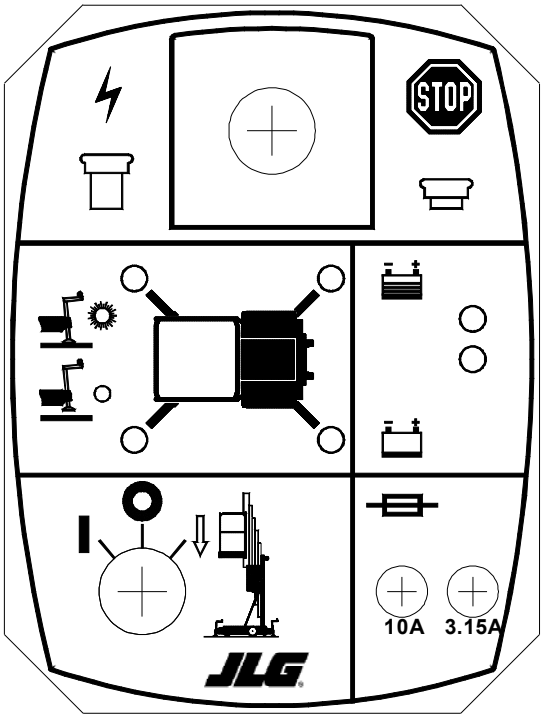
1.2.2. Lower Control Box.

The Lower Control Box is located on the side of the machine.

DC models



AC models



a - Emergency Stop Switch.
b - Ignition Key Switch.
c - Fuse (s).
d - Battery Discharge Indicator.
e - Outriggers Indicator Lights.

Emergency Stop Switch

It is a push button switch located at the top center of the Lower Control Box. Pushing the switch in removes all electrical power from the ground controls, stopping all work platform functions. To resume operation, turn the Ignition key switch to "**0**", pull out the switch and turn the Ignition Key switch to "**I**".

Ignition Key Switch

The Ignition Key switch is located at the bottom left hand side of the Lower Control Box. It is a 3 position key operated switch :

Left position: Position the Ignition Key switch to left position to operate the Upper Control Box.

Center position: Position the Ignition Key switch to center to remove all electrical power to the Upper Control Box and Lower Control Box. The key can be removed in this position

Right position: Turn and hold the Ignition Key switch to right position to lower the platform.

Fuses

They are located on the right hand side of the Lower Control Box.

For AC models:

- The 10A fuse protects the power unit motor (100V).
- The 3.15A fuse protects the control system (12V).

They are both contained in fuse holders unlockable by a quarter turn.

Fuse type : Ø5 - Lg20 - P3.15A. P/N : 260006.
Fuse type : Ø5 - Lg20 - P16A. P/N : 260175.

For DC models:

The fuse protects the machine electrical system. It is contained in a fuse holder unlockable by a quarter turn.
Fuse type: Ø5 - Lg20 - P3.15A. P/N: 260006.

II
1

Battery Discharge Indicator

⚠ CAUTION

Failure to properly maintain the battery charge, i.e., exceeding 80% of discharge, will result in damage of battery and pump / motor assembly.

DC models : **DC Models** : Start up as soon as the emergency stop on the emergency and breakdown control panel is released. Check the battery discharge indicator on the lower control box regularly :

- **Green :** The battery is between full charge and 70% discharge,
- **Orange :** The battery is between 70% and 80% discharge. The battery must be charged.
- **Red :** The battery is below 80% discharge. The battery must be charged. Do not use the machine as it will result in damage to the battery elements.

Green: the battery is between full charge and 70% of discharge.

Orange : the battery is between 70% and 80% of discharge.The battery must be recharged before resuming operation.

Red: the battery's discharge exceeds 80% of its capacity. Continuing to use the machine will result in damage to the battery.

AC Models : Check the condition of the emergency battery when connecting the machine to the power supply.

- **Green :** Sufficient autonomy to perform a complete platform lowering in case of power supply cut-off.
- **Red :** Insufficient autonomy (the platform lowering is disabled in case of power cut-off). Charge the battery (24h for a complete charge) keeping the lower emergency push button pulled.

Outriggers Indicator Leds

They are located at the center left hand side of the Lower Control Box. They indicate if each outrigger is properly locked and under load. If either one of the outrigger indicator leds is not lit, the platform cannot be raised.

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II 2

2.1. Mast to chassis installation

Maintenance

DANGER

The platform must be fully lowered before removing the mast assembly from the chassis.

Removal

1. Place the machine on the workbench as shown on fig. 2.1 (refer to § 6.1. in the "Operator and Safety Handbook").

CAUTION

Check the capacity of the workbench. Ensure the workbench is level.

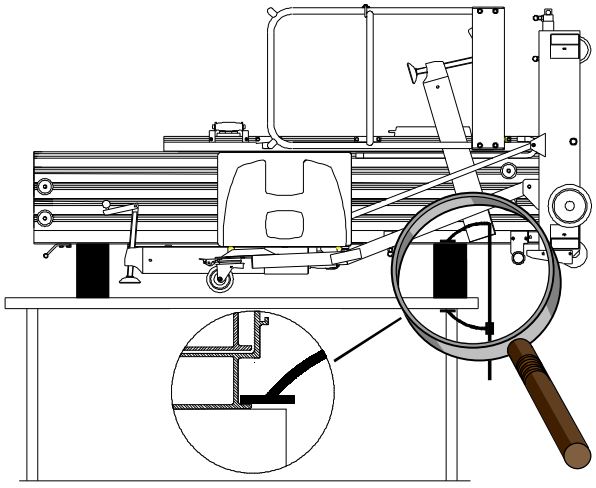


Fig 2.1. Positioning the machine.

2. Secure the chassis with straps as shown in Fig.2.2 and lift the machine until you can place wooden blocks at the bottom of the masts as shown in Fig. 2.1.
3. Place the strap at the top of the masts and lift the machine until you can place the last wooden block under the mast assembly as shown in Fig. 2.1.
4. Secure the chassis with straps as shown in Fig.2.2 and secure with C-Clamp to stabilize the machine during maintenance procedures.
5. Remove all outriggers from the machine.
6. For machines equipped with Tilt Back frame only : remove bolts and nuts securing the Tilt Back frame to the chassis.
7. Remove the bolts securing the cylinder protection cover and remove the cover.
8. Disconnect the outriggers' electrical plug from the electrical system.
9. Remove bolts and nuts securing the two mast struts (P40 : 4 mast struts) to the chassis.

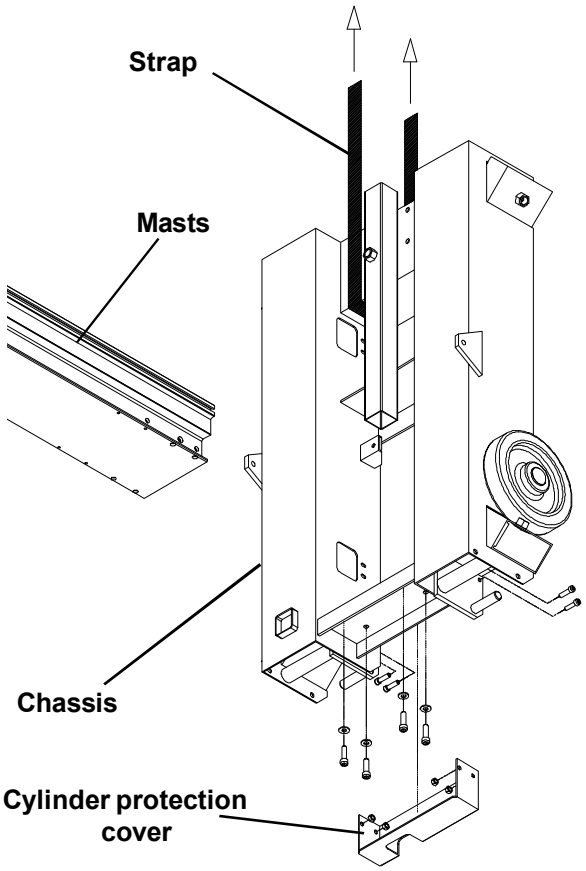


Fig 2.2. Chassis removal.

CAUTION

It is recommended to use appropriate lifting equipment to remove the chassis from the mast assembly.

10. Remove the 4 bolts and washers securing the mast assembly to chassis and remove the chassis with appropriate lifting equipment.
11. Remove the screws securing the mast covers and remove the covers.

Installation

1. Using appropriate lifting equipment, lift the chassis to the mast.
2. Install the 4 bolts and washers securing the mast assembly to the chassis.
3. Secure the two mast struts (P40 : 4 mast struts) with nuts and bolts.
4. Remove the straps.
5. Install the mast covers with screws.
6. Connect the outriggers' plug.
7. Install the cylinder protection cover with bolts.
8. For machines equipped with Tilt Back frame : secure the Tilt Back frame on the chassis with nuts and bolts.
9. Remove the C-clamp and remove the wooden blocks under the mast assembly.
10. Stand the machine upright (refer to § 6.1. in the "Operator and Safety Handbook).

2.2. Slide Blocks

Description

The slide blocks are mounted onto the mast and ride on the inside walls of the adjacent mast.

Maintenance

To remove the slide blocks from each mast section the mast assembly must be removed from the chassis (see Section 2.1).

NOTE

It is recommended to have all new slide blocks replaced at the same time.

NOTE

The elements mounted on both sides of the mast are secured with nuts which turn automatically to their lock/unlock position when screwing / unscrewing.
When removing one of these elements loosen the screws without removing them.

Removal and Disassembly

1. Remove the mast covers.
2. Disconnect and cap the hydraulic line and cylinder ports.
3. Disconnect the connector from the cylinder.

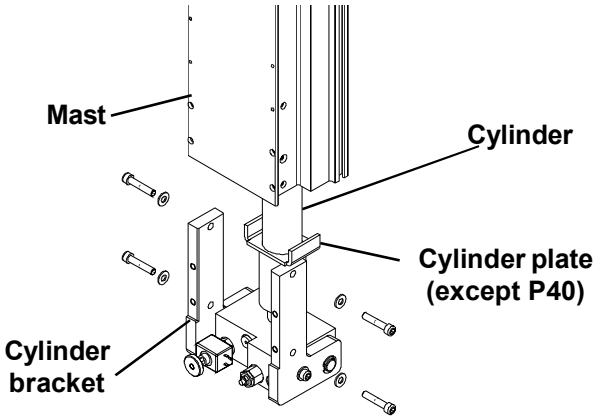


Fig. 2.3 Cylinder removal

4. Remove the screws and washers securing the cylinder brackets to the mast.
5. To facilitate removal of the cylinder, loosen the bolts securing the cylinder to the cylinder brackets.
6. Remove the cylinder, cylinder brackets and cylinder plate (no cylinder plate on P40 : steel structure attached to aluminium mast).

⚠ CAUTION

It is recommended to have more than one person to remove the cylinder.

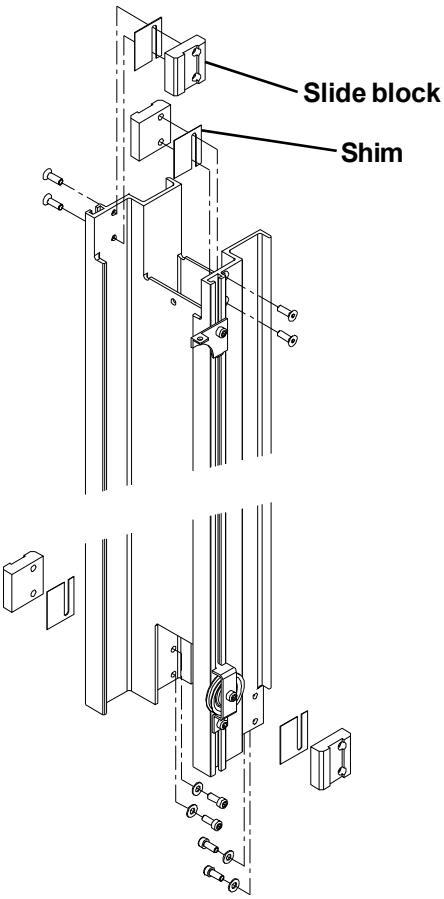


Fig. 2.4 Slide Blocks removal

7. Position masts as shown in Fig 2.5 (1).
8. Remove the nuts securing the chain equalizers to the mast assembly (Fig 2.7).
9. Remove the screws securing the equalizer brackets to the mast assembly, and remove the equalizer brackets (Fig 2.7).
10. Position masts as shown in Fig. 2.5 (2).

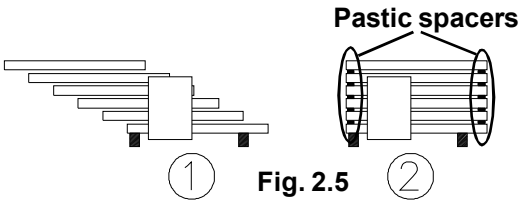


Fig. 2.5

11. Place plastic spacers (thickness: 3mm) between the adjacent masts to which the slide blocks need to be replaced.
12. Loosen the screws securing the upper electrical cable pulleys to the top of the mast and remove all the pulleys.

NOTE

Before removing the slide blocks, note their markings (577 , 579 , 581 or 583) and location. This information will be required when ordering new blocks.

13- Remove the 4 slide blocks and and their shims (Fig 2.4).

Assembly and installation

⚠ CAUTION ⚠ The torque value and the Loctite change depending on the serial number	Type	Serial number
	P20	26171
	P25	31604
	P30	36306
	P35	42240
	P40	46097
	Serial N° <	Serial N° ≥
Torque value	5 N.m	7,5 N.m
Loctite	222	243

1. Install the new slide blocks with the shims as previously installed respecting their locations and markings (as noted during removal), and torque screws.
2. Check with gauge shims that the play between the masts is 0.2 mm to 0.3 mm. If less or more, change the shims.

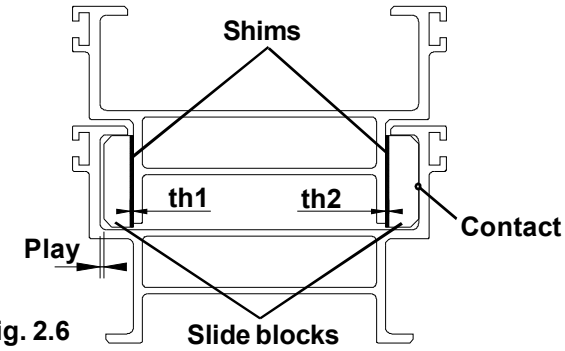


Fig. 2.6

⚠ CAUTION

Ensure an equal thickness of shims is placed on both sides of the slide blocks (th1 must be near to th2).

3. Repeat steps 10 to 12 in Removal and Disassembly section and steps 1 to 2 in Assembly and Installation section to remove and replace other slide blocks.
4. Install and secure the equalizer brackets to the mast using "Loctite 243" on the screw thread.
5. Remove the plastic spacers.
6. Ensure the cylinder plate is on the cylinder as shown in Fig. 2.3.
7. Install the cylinder assembly to the mast, turning (if necessary) the cylinder barrel to position the cylinder bleeder screw as shown on Fig. 3.3 Section II-3 Mast cylinder.
8. Secure the cylinder brackets to the mast with bolts and washers.
9. Ensure the cylinder is secured to the cylinder brackets with the bolts.
10. Tighten new lock nuts on chain equalizer to adjust the tension of the lifting chains (refer to section 2.3 paragraph "chain adjustments").
11. Install the mast covers.
12. Uncap and install the hydraulic line.
13. Reconnect the connector to the cylinder solenoid.
14. Install the chassis to the mast assembly as indicated in Section 2.1 "Mast to Chassis Installation".
15. Stand the machine upright (refer to § 6.1. in the "Operator and safety handbook).
16. Bleed air from the cylinder, see section 3.1 Mast Cylinder - Installation.
17. Grease areas of the mast where the slide blocks slide on (refer to section II-5 "Lubrication").

2.3. Lifting chains

Description

The masts are connected together with lifting chains. There are two lifting chains per mast. The lifting chains are always under tension. The tension forces are equalized by a chain equalizer, located at the chains' ends. The chains ride on sheaves mounted on the top of the masts. When the mast lifting function is actuated, the lifting chains pull the masts up.

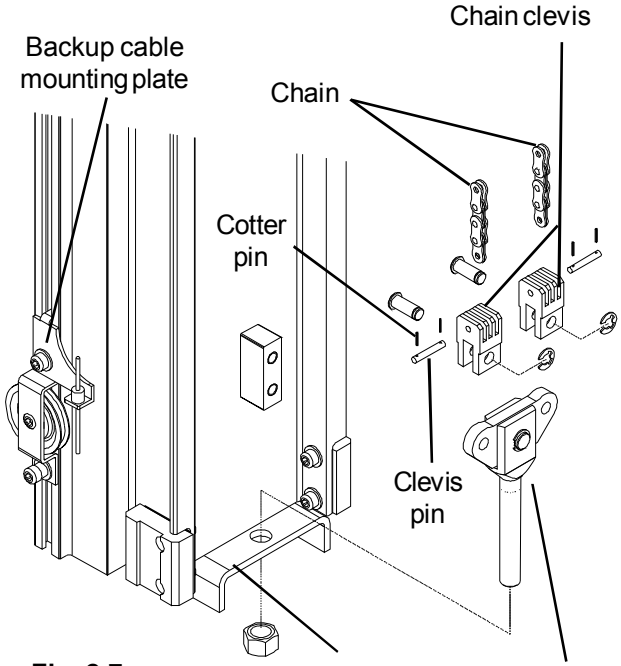


Fig. 2.7

NOTE

There are between 5 and 9 mast sections depending on the machine model. For ease of description, every mast section will be attributed with a number in order starting from bottom mast to top mast.

Maintenance

NOTE

The elements mounted on both sides of the mast are secured with nuts which turn automatically to their lock/unlock position when screwing/ unscrewing.
When removing one of these elements loosen the screws without removing them.

NOTE

Check the capacity of the workbench and ensure the workbench is level.

NOTE

Beware, the removal of the lifting chains is a delicate operation and requires certain precautions. The platform must be fully lowered and empty. The machine must be parked in an open area.

Removal and disassembly

1. Remove the chassis from the mast assembly as indicated in Section 2.1 "Mast to Chassis Installation".
2. Remove the cylinder from the mast as indicated in section 2.2 steps 1 to 6.

NOTE

Always start with the top mast section and follow in successive order to remove the lifting chains.

3. Mark on the masts the position of the mounting plate of back up cable located on the side of the masts. Remove the backup cable mounting plates located at the bottom of the masts, to loose the tension in the cable, see Fig.2.7.
4. Remove the electrical cable from the pulleys.
5. Remove locknuts securing the chain equalizers to the bottom of masts.
6. Remove the accessible chain equalizer bracket.
7. Position the masts as shown in Fig 2.9 (1) by sliding the top mast towards the top of mast assembly.
8. Remove the retaining rings and pins securing the chain clevis to chain equalizer, and remove the chain clevis.
9. Repeat steps 5 to 7 to remove the chain equalizers by positioning the masts as shown in :

P20 AC/DC :	fig.2.9 (2) and (3)
P25 AC/DC :	fig.2.9 (2) (3) and (4)
P30 AC/DC :	fig.2.9 (2) (3) (4) and (5)
P35 AC/DC :	fig.2.9 (2) (3) (4) (5) and (6)
P40 AC/DC :	fig.2.9 (2) (3) (4) (5) (6) and (7)

10. Position mast assembly as shown in Fig 2.9 (2) and remove the pulley pin on the greyed mast.
11. Position the mast assembly as shown in Fig. 2.9. (15) by sliding the mast sections one by one towards the bottom of the mast assembly.

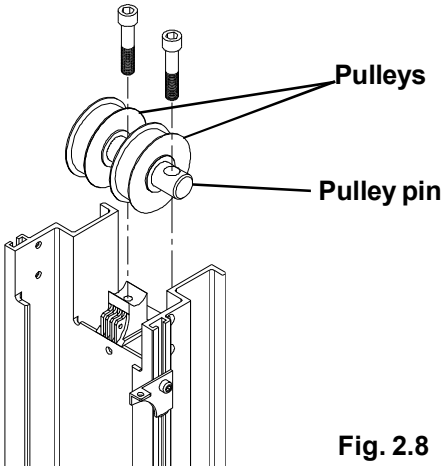
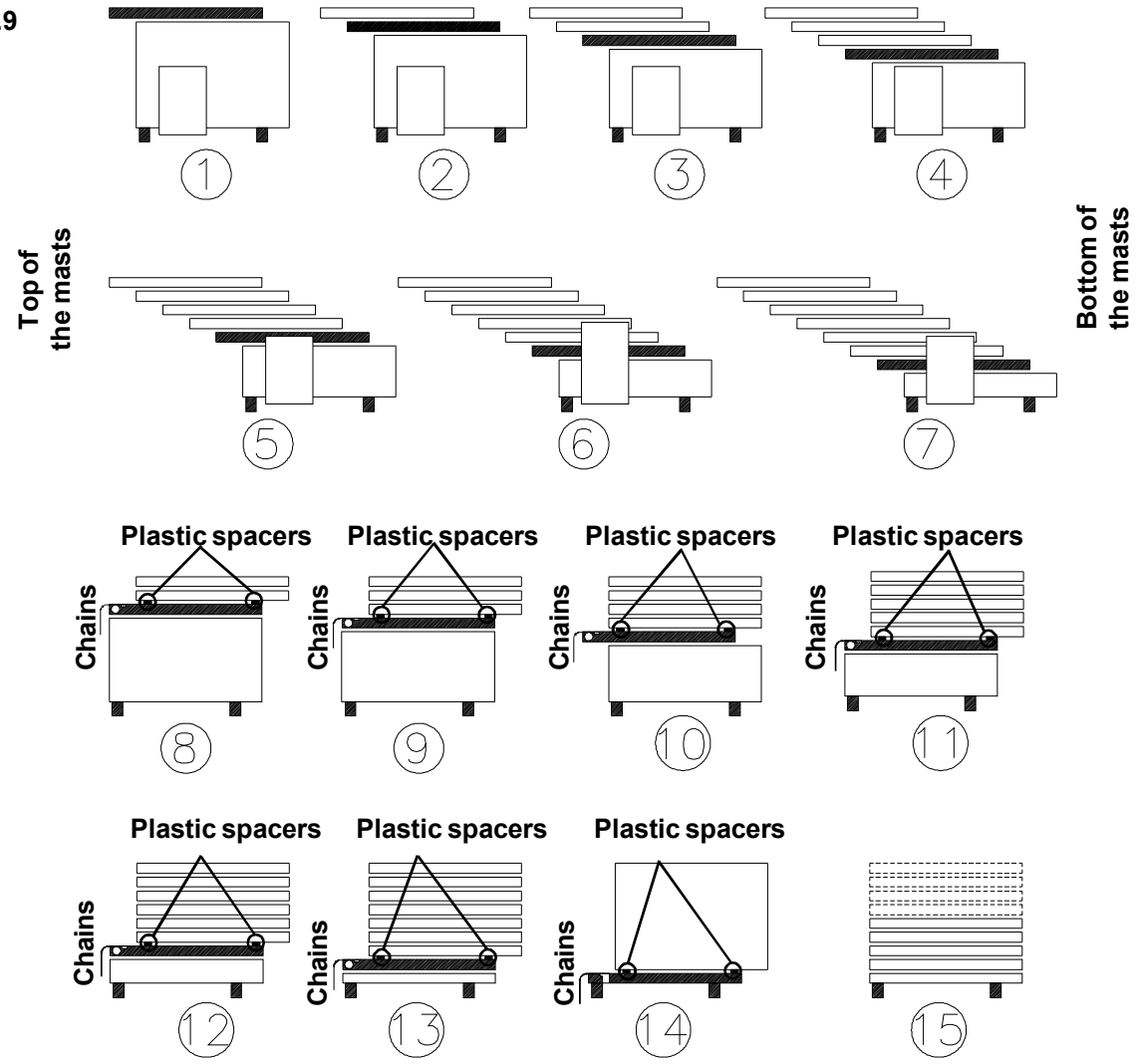


Fig. 2.8

Fig. 2.9



12. Perform the procedures per machine using the corresponding figures and procedures

P20 AC/DC :
Fig. 2.9.8. Procedure "A".
Fig. 2.9.9. Procedure "A".
Fig. 2.9.14. Procedure "D"

P25 AC/DC :
Fig. 2.9.8. Procedure "A".
Fig. 2.9.9. Procedure "A".
Fig. 2.9.10. Procedure "B".
Fig. 2.9.14. Procedure "C".

P30 AC/DC :
Fig. 2.9.8. Procedure "A".
Fig. 2.9.9. Procedure "A".
Fig. 2.9.10. Procedure "B".
Fig. 2.9.11. Procedure "A".
Fig. 2.9.14. Procedure "C".

P35 AC/DC :
Fig. 2.9.8. Procedure "A".
Fig. 2.9.9. Procedure "A".
Fig. 2.9.10. Procedure "B".
Fig. 2.9.11. Procedure "A".
Fig. 2.9.12. Procedure "A".
Fig. 2.9.14. Procedure "C".

P40 AC/DC :
Fig. 2.9.8. Procedure "A".
Fig. 2.9.9. Procedure "A".
Fig. 2.9.10. Procedure "B".
Fig. 2.9.11. Procedure "A".
Fig. 2.9.12. Procedure "A".
Fig. 2.9.13. Procedure "A".
Fig. 2.9.14. Procedure "C".

Removal Procedure "A"

1. Place plastic spacers (thickness: 3mm) as indicated on the corresponding figure.
2. Position mast assembly as shown in corresponding figure.
3. Pull out the chains connected to the greyed mast section.
4. Remove the pulley pin from the greyed mast.
5. Remove cotter pins and pins securing the chains to the chain clevis and remove the chains.
6. Position mast assembly as shown in Fig. 2.9.(15).
7. Remove the plastic spacers.

Removal Procedure "B"

1. Place plastic spacers (thickness: 3mm) as indicated on the corresponding figure.
2. Position mast assembly as shown in corresponding figure.
3. Pull out the chains connected to the greyed mast section.
4. Remove the pulley pin from the greyed mast section.

5. Remove the pulley support from the greyed mast.
6. Remove cotter pins and pins securing the chains to the chain clevis and remove the chains.
7. Position mast assembly as shown in Fig. 2.9 (15).
8. Remove the plastic spacers.

Removal Procedure "C"

1. Place plastic spacers (thickness: 3mm) as indicated on the corresponding figure.
2. Position mast assembly as shown in corresponding figure.
3. Pull out the chains connected to the greyed mast section.
4. Remove cotter pins and pins securing the chains to the chain clevis and remove the chains.
5. Position mast assembly as shown in Fig. 2.9.(15).
6. Remove the plastic spacers.

Removal Procedure "D"

1. Place plastic spacers (thickness: 3mm) as indicated on the corresponding figure.
2. Position mast assembly as shown in corresponding figure.
3. Pull out the chains connected to the greyed mast section.
4. Remove the chain clevis from the greyed mast section.
5. Remove cotter pins and pins securing the chains to the chain clevis and remove the chains.
6. Position mast assembly as shown in Fig. 2.9.(15).
7. Remove the plastic spacers.

Assembly and installation

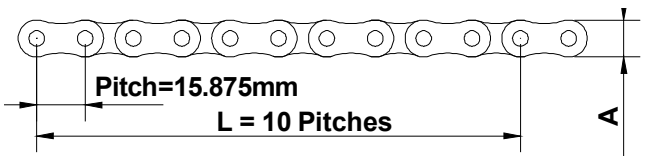


Fig. 2.10

	LL 10-22 LL 10-44 LL 10-66	LH 10-44
L Maxi	163.5 mm	163.5 mm
A Mini	11.5 mm	13.8 mm

1. Check the condition of all lifting chains. If a chain link appears to be faulty, replace both chains on the mast in question with new chains.
2. Check the condition of the pulleys and of pulley's pins and the correct rotation of the pulleys on the pulley pins. Replace bushings, pulleys or pins if necessary.

NOTE

When assembling chain clevis and double strand chains, insert a 1.5 mm shim between the chain clevis and double strand chains (type LL 10-44), as shown in Fig. 2.11, to prevent deformation of the chain leaf.

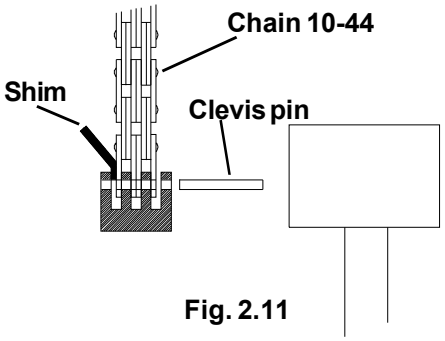


Fig. 2.11

3. Lubricate all chains (see section 5 "Lubrication").

NOTE

During chains installation, ensure two lifting chains are separated on both sides of the chain separator located at the center and bottom of the mast before installing chain equalizers.

NOTE

Use only new clevis pins, cotter pins and retaining rings during chain installation once they were removed.

4. Install lifting chains in reverse order of chain removal and disassembly (previous paragraph).

NOTE

Install and tighten all chain equalizers to masts with new locknuts.

NOTE

Use "Loctite 243" to install screws securing equalizer brackets to the masts, and screws securing pulley pins.

5. Adjust chains' tension (Refer to Chain Adjustments procedure in this section).

NOTE

Ensure the back up cables and the electrical cable are properly seated in the pulleys.

Chain adjustments

1. Inspect the cleanliness of the lifting chains.
2. Adjust the tension of all chains until the masts reach the position as shown in drawing below with the chains under tension and in horizontal position.

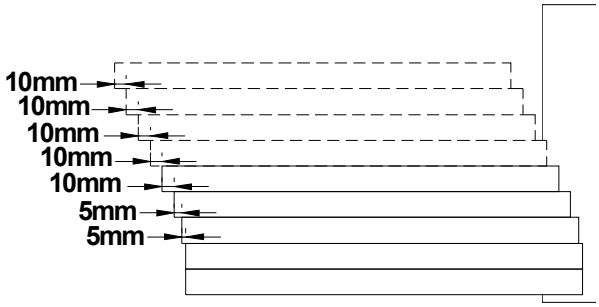


Fig. 2.12

NOTE
Since the chain equalizer provides equal tension on both lifting chains, the lifting chains cannot have any slack.

2.4. Wheels

Caster wheel

To remove the caster wheel, unscrew the four bolts securing the base plate to the chassis and remove the assembly (the wheel cannot be dissasembled).

Wheels with cap stop

1. Remove the blocking cap from the wheel by forcing with two screwdrivers diametrically opposite, between the cap and the washer.
2. Replace the wheel and the cap.

NOTE
Do not forget to install the washer between the Ø200mm wheel and the cap.

II 2

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II 3

3.1. Mast Cylinder

Removal

1. Remove mast assembly from the chassis as explained in Section 2.1 "Mast to Chassis Installation."
2. Disconnect and cap the hydraulic line and cylinder ports.
3. Disconnect the connector from the cylinder solenoid.
4. Remove the screws and washers securing the cylinder to the cylinder brackets.
5. Remove one of the two retaining rings from the cylinder locking pin and drive the pin out.
6. Remove the cylinder (and cylinder plate except for P40 models).

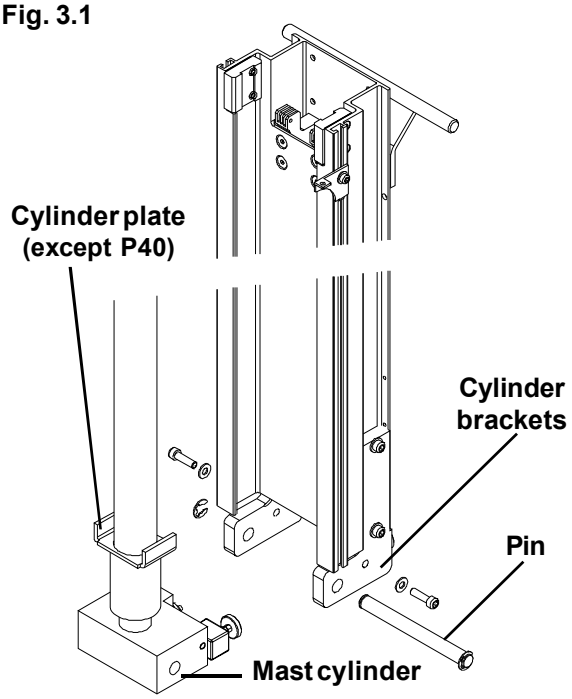
DANGER

It is recommended to have more than one person to remove the cylinder (especially for P40 models).

NOTA

Cylinder weight (except P40 model) = 33 kg
Cylinder weight P40 model = 58.5 kg

Fig. 3.1



Disassembly

NOTE

Any maintenance requiring disassembly of the cylinder should include replacement of seals and rings.

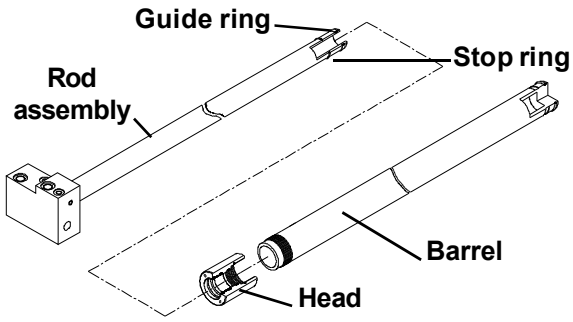


Fig. 3.2 - Mast cylinder for PM models (except P40)

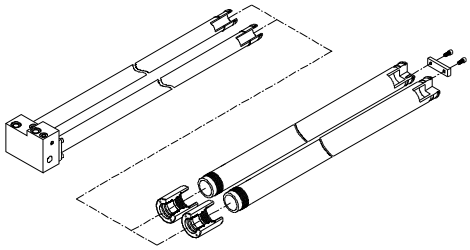


Fig. 3.3 - Mast cylinder for P40

1. Drain all hydraulic oil from the cylinder.
2. P40 only :
   a. Remove the link between barrels.
   b. Disassembly both cylinder barrels from manifold.
3. Using a spanner wrench, unscrew the cylinder head until it clears the barrel.

DANGER

Do not use air pressure to remove the cylinder rod assembly. Use only a source of controlled hydraulic oil pressure if the rod assembly is hard to remove.

4. Withdraw the cylinder barrel from the cylinder rod assembly and move it to a clean work area.

CAUTION

Exercise extreme care when handling or setting down the cylinder rod. Do not damage the chrome surface.

NOTE

It is advisable to cover the cylinder barrel opening to avoid contamination.

NOTE

Aligning discarded seals and rings in the order of disassembly will facilitate installation of new seals and rings.

5. Remove the guide ring and stop ring from the rod.
6. Remove the cylinder head.
7. Remove seals, wiper ring from the cylinder head.

Inspection

1. Clean all parts with solvent and dry with compressed air. Inspect all parts for serviceability.

⚠ CAUTION

Before installing new seals and rings, clean all surfaces and carefully remove burrs and nicks. Parts displaying excessive wear or damage should be replaced.

2. Stone out minor blemishes and polish with a fine crocus cloth except on polished surfaces.
3. Clean with solvent and dry with compressed air any parts that have been stoned and polished.
4. Inspect the barrel carefully for scoring.

Assembly

⚠ CAUTION

When installing new seals and rings, avoid stretching seals or scratching the grooved or gland surfaces.

NOTE

Lubricate new seals and rings with new hydraulic oil.

⚠ CAUTION

Avoid stretching the seals and rings, ensure the seals and rings are installed in the proper order. Ensure all components are clean prior to and during assembly.

1. Install the wiper ring into the inside of the cylinder head.
2. Install the seals and rings into the cylinder head.
3. Install the cylinder head on the cylinder rod.
4. Install the rings onto the rod.
5. Lubricate the rod with new hydraulic oil.
6. Remove the cover from the barrel. Ensure the barrel is clean.
7. Lubricate the wear ring with new hydraulic oil and install the rod assembly into the barrel with a slight twisting motion.

⚠ DANGER

Do not use air pressure to cycle or pressurize the cylinder.

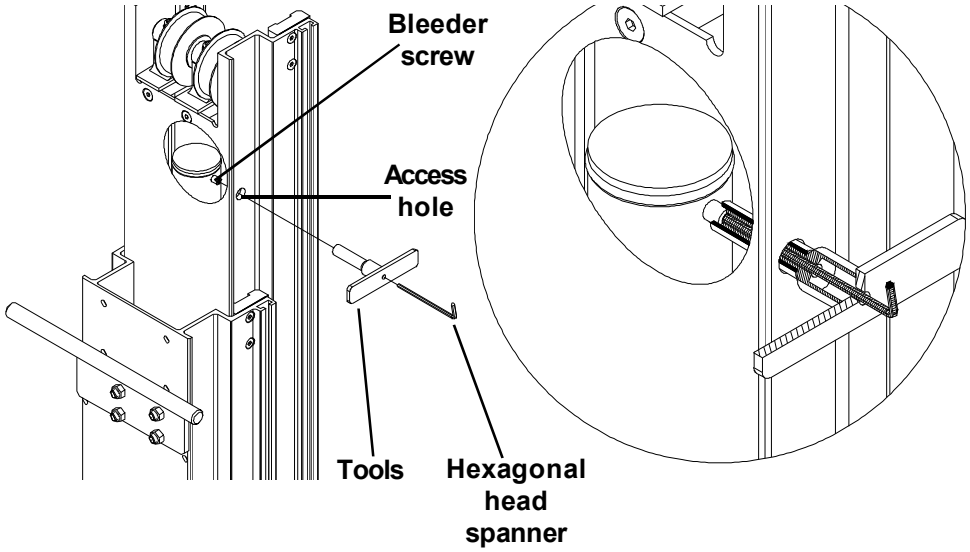
8. Lubricate, pressurize and cycle the cylinder. Check for proper operation and any leakage.

II 3

Installation

1. Ensure the cylinder plate is on the cylinder (see Fig. 2.3 paragraph 2.2 "slide blocks").
2. Install the cylinder, cylinder plate and locking pin onto the cylinder brackets turning if necessary the cylinder barrel. Lock by installing a new retaining ring. Ensure the bleeder screw is aligned with the access hole of the 2nd mast section (Fig 3.4).
3. Install both screws and lock washers.
4. Uncap and connect the hydraulic line.
5. Connect the connector.
6. Install and secure the base on the mast assembly as described in Section 2.1 "Mast to Chassis Installation".
7. Bleed the air from the cylinder (refer to paragraph "Bleeding" below). Check for proper operation and any leakage. Fill tank with new hydraulic oil to proper level with the platform fully lowered.

Bleeding



II 3

Fig. 3.4

1. Raise the platform so that the access hole of the bleeder screw (located approx. 200 mm from the top of 2nd mast section) is about 200 mm above mast 1.
2- Slip and turn the tool (ref. 990010) onto the bleeding device to block it.

NOTA

You can use a hose (inside Ø 10 mm - length 90 mm) if adequate tooling is not available.

3- Loosen the bleeding screw by ½ a turn maximum using a hexagonal head spanner (3) inside the tool.
- This device allows collection of the oil seeping out of the bleeding screw without spilling it on the machine and on the ground.

⚠ DANGER

During bleeding operation, the mast may lower. Ensure there are no obstacles under the platform.

4. If necessary tighten the bleeder screw during operation, raise the platform and repeat steps 1 to 2.
5. P40 : Repeat the operation for the second cylinder rod.
6. A platform not moving with the bleeder screw loosened indicates the air has been completely bled from the cylinder. Tighten the bleeder screw.
7. Clean all parts with solvent and dry with compressed air.

3.2. Manifold

Description

The manifold is located between the front wheels of the machine. It contains a pressure relief valve (protection against overpressures due to overheating), a pressure compensated flow regulator valve, and a lowering valve solenoid with manual override.

Maintenance

DANGER

Before performing any maintenance on the manifold, disconnect the machine from the electrical power sources, disconnect the battery charger plug for DC machines, and ensure the pump-motor is shut off. Failure to comply could result in serious injury or death.

NOTE

Maintenance of the manifold assembly is limited to replacement of O-ring.

Disassembly and Assembly

1. Remove the cylinder protection cover.
2. Disconnect the connector.
3. Remove the nuts securing the coil to the solenoid, and remove the coil. Ensure you do not lose the rings located on each side of the solenoid.
4. Remove the solenoid valve.
5. Remove the plug and the pressure compensated flow regulator valve.
6. Remove the pressure relief valve.
7. Clean all disassembled parts and replace seals.
8. Reassemble the cylinder block assembly.

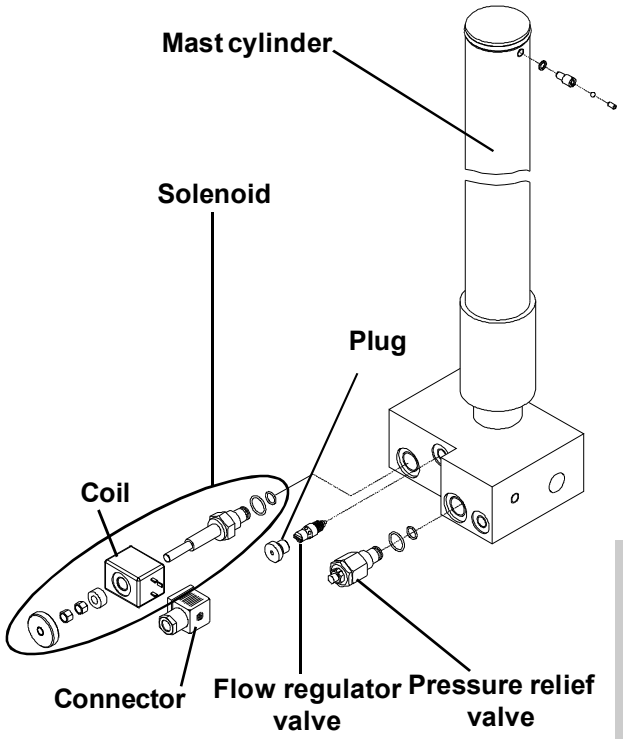


Fig 3.5

3.3. Power Unit

Description

A fully self contained pump-motor assembly consisting of a section pump and driven by a 12VDC or 100VAC motor, is installed on the side of the mast. The pump-motor assembly provides hydraulic pump power to activate the work platform functions.

Maintenance

Removal

DANGER

Before performing any maintenance on the power unit, disconnect the machine from the electrical power source, disconnect the battery charger plug for DC machines, and ensure the pump-motor is shut off. Failure to comply could result in serious injury or death.

1. Remove the covers.
2. Drain the oil from the reservoir (refer to Section 3.4 "Oil change and Oil filter cleaning")
3. DC Models : disconnect the charger from the electrical power source, tag and disconnect the cables from the battery.

AC Models :disconnect from the electrical power source.

4. Tag and disconnect the electrical leads and the connector from the pump-motor assembly.
5. Disconnect and cap the hydraulic line from the pump-motor assembly.
6. Remove the pump-motor assembly and place it on a clean work area. It is not necessary to remove the fittings if there is no leakage.

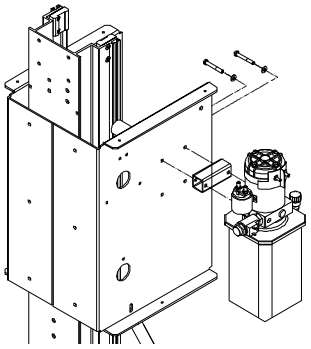


Fig. 3.6 Pump-motor assembly

Disassembly and Assembly

1. Remove the reservoir by removing the clips.
2. Remove the bolts securing the pump section and remove the pump.
3. Remove pressure relief valve.
4. Remove check valve (torque value 2±0.2 daN.m).
5. Remove solenoid valve (torque value 3±0.5 daN.m).
6. Loosen the nut securing the solenoid to the solenoid vave and remove the solenoid (torque value 0.5 daN.m)
7. Clean all disassembled parts.
8. Replace seals, filter and reassemble the pump-motor respecting the torque values indicated above.

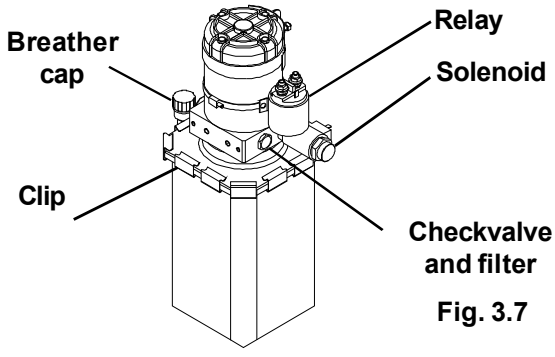


Fig. 3.7

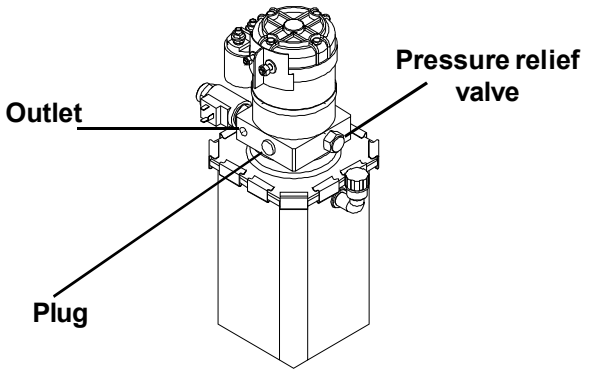


Fig. 3.8

8. Install the reservoir onto the pump-motor with the clips.

NOTE
Check that the breather cap is positioned opposite the solenoid valve.

Installation

1. Install the pump-motor assembly.
2. Fill the reservoir with new hydraulic oil to the proper level (refer to Section 3.4 "Oil change and oil filter cleaning").
3. Connect the hydraulic lines and electrical leads to the pump-motor assembly, as tagged during removal.
4. DC models : Connect the cables on the battery as tagged during removal and connect the charger to the battery

AC Models connect the electrical power plug.

5. Set the machine up to perform tests (raise the platform several times to 2 meters maximum). Bleed the cylinder if necessary (refer to Section 3.1 paragraph "Bleeding").
6. Check for proper functioning and any leakage.
7. Install the covers.

General Service Information

Gear type hydraulic pumps can be relied on to deliver reliable performance over a long period of time when operating in a properly maintained system. This includes using clean oil of the correct grade, regular filter cleaning, and frequent inspections of system components. However, if a pump fails, it is important to determine all the causes and to eliminate them to prevent repeated failure.

There are several causes for gear pump failure. The following are the most common causes of pump failures.

1. Abrasive wear caused by fine particles.

Abrasive wear caused by fine particles is the most frequent cause of pump failure. Its symptom is usually a gradual decrease in power and speed of the hydraulic system. Fine particles of dirt or other foreign matters circulating through the system cause wear on all components, and damage is especially noticeable on pressure plates, housing bores and in the shaft bearing area.

Dirt can enter the system through worn seals, especially on dirty equipment. Always clean tank caps, funnels and other areas around the filler neck before opening the tank. Immediatly cover all disconnected lines, fitting and openings.

The fine particles that cause abrasive wear are usually not visible to the eye ; the size of these particles is about 125 microns. Oil containing particles of this size can actually look clean while having enough abrasive particles to cause failure. A dull sandblasted area may appear near the face of the gear. This is caused by contaminated oil flowing through the lubrication grooves.

2. Abrasive wear caused by metal particles.

Metal contaminants usually result from components wear in the hydraulic system which was insufficiently flushed after a previous failure. Metal particle damage may be gradual or fairly sudden, depending on the quantity and size of the particles. Metal particle damage is indicated by surface scratches on the pressure plates.

A pressure plate will have several circular scratches if particles of more than 125 microns are present. If exposed to particles of this size long enough, the entire surface will be rough and heavily grooved.

With abrasive wear from metal particles, the shaft's bearing area will have many small grooves. The severity of damage will depend on the amount of contamination in the system and on operating pressure.

A worn housing will have grooves in the gear track, caused by large particles being caught between tips of the gear teeth and body. This usually results from the failure of another component.

3. Incorrect Installation

Incorrect installation can create external loads on the pump which can result in various types of failures.

4. Aeration or Cavitation

Aeration and cavitation act very much alike in the system. This type of failure is rare, and careful investigation is required to pinpoint it.

Aeration occurs when air mixes with the oil. Air may enter the system through a small suction leak or by agitation of the surface of the oil in the tank. Surface agitation occurs when return oil is dumped back above the surface of the oil. This can occur when the oil level is too low.

Cavitation is the formation and collapse of vapour bubbles in the oil. This is usually the result of restricted pump suction. Cavitation occurs more readily when the oil is cold.

Aeration and cavitation erode and pit the pressure plates and pump housing.

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A pump that is either cavitating or operating on aerated fluid is usually noisy, and the system operates in a spongy or jerky manner.

If erosion is evident on the suction side in the gear rack, the cause was due either to air bubbles in the oil or starved suction.

5. Lack of Oil

When failure due to lack of oil occurs, deterioration is usually rapid. This type of failure can occur from either of two conditions : (a) oil level is low in reservoir, or (b) there's an air leak in the suction line.

6. Excessive Heat

Excessive heat will harden O-rings and seals.

Excessive heat usually results from a relief valve set too low. If a relief valve is set too low, part of the oil will be dumped across the relief valve. In this instance, the machine will be very slow.

7. Oil Pressure

There can be two reasons for overpressure ;

(a) the relief valve fails to function, which produces one extreme surge and immediate failure, or
(b) the relief valve setting is too high, which results in repeated pressure peaks.

Damage to the pump looks very similar for both types.

8. Incorrect Assembly

This type of failure is self explanatory ; either the components were faulty, or parts were not assembled properly.

Pinching of the O-ring seal will occur if it is not properly placed in its groove. If the O-ring is installed incorrectly, the surface of the housing will show a depressed area (especially if the part is made of aluminium).

Troubleshooting

NOTE

Use vacuum gauge on the rapid fitting, near the pump, to isolate problem.

1. If the pump is noisy (cavitation), the possible causes could be : low oil supply, heavy oil, wrong oil, dirty suction strainer, relief valve open, restriction in suction line, air in the system, stuck pump part, or worn or broken parts.

Solutions are as follows :

a. If low oil supply, fill to the proper level.

b. If heavy oil, change to proper oil. Refer to Section II-5 . *"Lubrication"*.

c. If wrong oil, change to proper oil.

d. If dirty suction strainer, clean it.

e. If relief valve is open, adjust it, if necessary. Refer to *"Settings"* in Section 3.5.

f. If restriction in suction line, change with pump assembly.

g. If air in the system, bleed air from the system. Refer to Section 3.1 "Mast Cylinder".

h. If stuck pump part, check for solid contaminants or burrs on parts. If parts have burrs, replace the pump assembly. If contaminated, thoroughly clean system and refill with proper oil.

i. If the pump is worn or broken, repair or replace the pump assembly.

2. If the pump takes too long to respond or fails to respond, the probable causes could be : low oil supply, insufficient relief valve pressure, pump worn or damaged, or air in the cylinder.

Solutions are as follows :

a. If low oil supply, fill to the proper level.

b. If insuficient relief valve pressure, use gauge to reset pressure. Refer to *"Settings"* in Section 3.5.

c. If pump worn or damaged, repair or replace the pump assembly.

d. If air in the cylinder, bleed the air. Refer to Section 3.1, paragraph "Bleeding".

3. If the oil is heating up; the probable causes could be : contamination in relief valve, oil too light or dirty or relief valve too high or too low.

Solutions are as follows :

a. If contamination in relief valve, remove and clean it.

b. If oil is too light or dirty, drain and refill with proper oil.

c. If relief valve pressure is too low or too high, use gauge and reset pressure. Refer to "*Settings*" in Section 3.5.

4. If the oil is foaming, the problable causes could be: air leaking into the suction line, wrong kind of oil, or oil level too low.

Solutions are as follows :

a. If air is leaking into the suction line, tighten the clamps and change with pump assembly if necessary.

b. If wrong kind of oil, drain and refill with proper oil.

c. If oil level is too low, fill to the proper level.

5. If the pump doesn't deliver fluid, the probable causes could be : fluid in the reservoir too low, restriction in pump inlet line, air leak in the pump inlet line, sludge or dirt in the pump, fluid viscosity too high, broken or worn parts inside the pump or fluid recirculating back to the reservoir.

Solutions are as follows :

a. If the fluid in the reservoir is too low, refill with the proper grade and type of fluid and check for external fluid. Refer to Section II-5 . *"Lubrication"*.

b. If the pump inlet line is clogged, remove and clean. Check the filters and reservoir for other possible obstructions.

c. If air leak in the pump inlet line, locate and repair leak.

d. If sludge or dirt in the pump, remove and clean the pump. Check the system and fill with proper fluid.

e. If fluid viscosity is too high, check manufacturer's recommendation and refill.

f. If broken or worn part inside the pump, determine the cause of failure, repair parts or change pump assembly.

g. If fluid recirculating back to the reservoir, check the voltage to the solenoid. If no voltage, refer to electrical troubleshooting. If voltage, replace solenoid or the assembly if necessary. Check also pressure relief valves for contamination. If contaminated, clean and check fluid in the system.

6. If low or erratic pressure, the probable causes could be : incorrect fluid viscosity, restriction or air leak in the inlet line, internal pump parts blocked, distance between internal parts increased due to wear.

Solutions are as follows :

a. If incorrect fluid viscosity, replace with fluid of recommended grade.

b. If air leak or restriction in the inlet line, repair or clean.

c. If internal pump parts are blocked, check the parts for burrs or for metal particles in the fluid. Clean and fill with correct fluid.

d. If distance between internal parts has increased due to wear, replace the pump assembly.

e. Check if pressure relief valve in the power unit is contaminated. If so, clean, check its setting and check the fluid in the system.

7. If excessive wear, the probable causes could be: dirt in the fluid, viscosity of fluid too low or too high, sustained high pressure above maximum pump rating, air leaks or restriction in inlet line causing cavitation.

Solutions are as follows :

a. If dirt in the fluid, check the cause of contamination. Clean filter and repair worn parts. Replace if necessary with new pump assembly. Replace fluid with recommended grade.

b. If viscosity of fluid too low or too high, replace with recommended fluid.

c. If sustained high pressure above maximum pump rating, check for possible relief valve malfunction.

d. If air leaks or restriction in system causing cavitation, eliminate any leaks in the system, check parts for degree of wear and replace the pump assembly if necessary.

8. If internal parts are broken, the probable causes could be : excessive pressure above maximum limits for pump, seizure due to lack of fluid, or abrasive contaminants in fluid getting past the filter;

Solutions are as follows :

a. If excessive pressure above maximum limits for pump, check for parts malfunction and repair.

b. If seizure due to lack of fluid, check reservoir fluid level, as well as fluid inlet line for restriction or plugged filter.

c. If abrasive contaminants in fluid are getting past the filter, check the reservoir fluid and inspect the fluid inlet line for restriction or plugged filter.

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3.4. Oil Change and Oil Filter Cleaning

The first oil change and oil filter cleaning is to be made after the first **6 months** of operation. Afterwards, the service interval is every **2 years.** It is advisable to change oil and to clean oil filter when the machine oil temperature is warm.

Hydraulic oil recommendations

Refer to section II-5 : *"Lubrication"*, for hydraulic oil specifications.

Draining and flushing

NOTE

The platform must be fully lowered.

NOTE

Two people are recommended to install or remove the reservoir from the pump-motor

1. Install the four outriggers.
2. Remove the cover.
3. Remove the quick pressure plug.
4. Install a hose in place of the pressure plug.
5. Depress both ENABLE and UP switches until the oil level is as shown in Fig. 3.9.

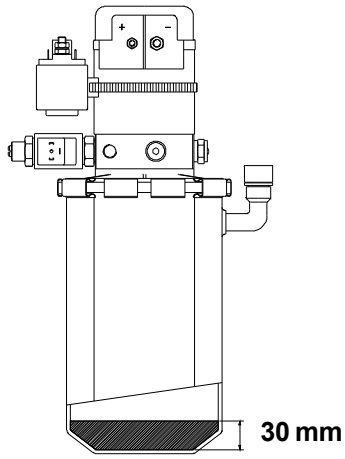
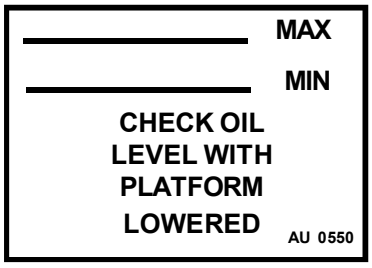


Fig. 3.9

6. Remove the hose and reinstall the pressure plug.
7. Remove the oil filter.
8. Clean the oil filter.
9. Install the oil filter (torque value 2±0.2 daN.m).
10. Remove the breather cap and the plug (next to the outlet (Fig 3.7).
11. Fill the reservoir with new hydraulic oil. The reservoir must be filled to the appropriate level, do not overfill.
12. Install breather cap and plug.
13. Set the machine up to perform tests.Bleed the cylinder as per section 3.1 "Bleeding".
14. Raise the platform several times up to 2 meters maximum to check the machine proper operation and absence of leaks.
15. Add hydraulic oil, if necessary, without going over the maximum indicated level. Reservoir capacity is 5.3 liters.



16. Install the cover.

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3.5. Relief valve settings

Description

Relief valves are used to protect the hydraulic system from excessive pressure. They return oil to the reservoir when their pressure setting is exceeded, therefore relieving pressure within the circuit in which they are used.

Maintenance

Relief valves are checked and adjusted by causing the circuit to reach its prescribed pressure limit (stall). At this point, the relief valve opens, returning oil to the reservoir. Cylinder circuit may be adjusted by extending the cylinder to its limit of travel.

The indicated values correspond to the setting to be obtained with the gauge plugged in the pressure plug on the power unit. Connecting the gauge to another point of the circuit presents risks of setting the relief valve too high. This can result in serious injuries or equipment damage.

Correct relief valve adjustment is mandatory if any hydraulic circuit is to function properly. Settings must be within tolerances. Therefore, adjustment should be performed only by qualified mechanics using the correct equipment and after the need for adjustment has been established.

The following text lists the main and circuit relief valve settings. If pressure setting of any relief valve is not ± 5% of that setting listed in the tables, adjust as necessary.

DANGER

Do not overtighten the adjustment screw or locknut.

DANGER

Do not hold the relief valve open for more than one minute at a time.

NOTE

To adjust a relief valve, turn the adjustment screw (in to increase or out to decrease) until the proper setting is reached.

CAUTION

Do not set the hydraulic system pressure above the relief valve setting. Increase pressure may damage the hydraulic components.

DANGER

Do not attempt to loosen fittings in pressurized lines or while the pump/motor is in operation. Failure to comply could result in death or serious injury to personnel.

NOTE

To obtain precise readings, the batteries must be fully charged

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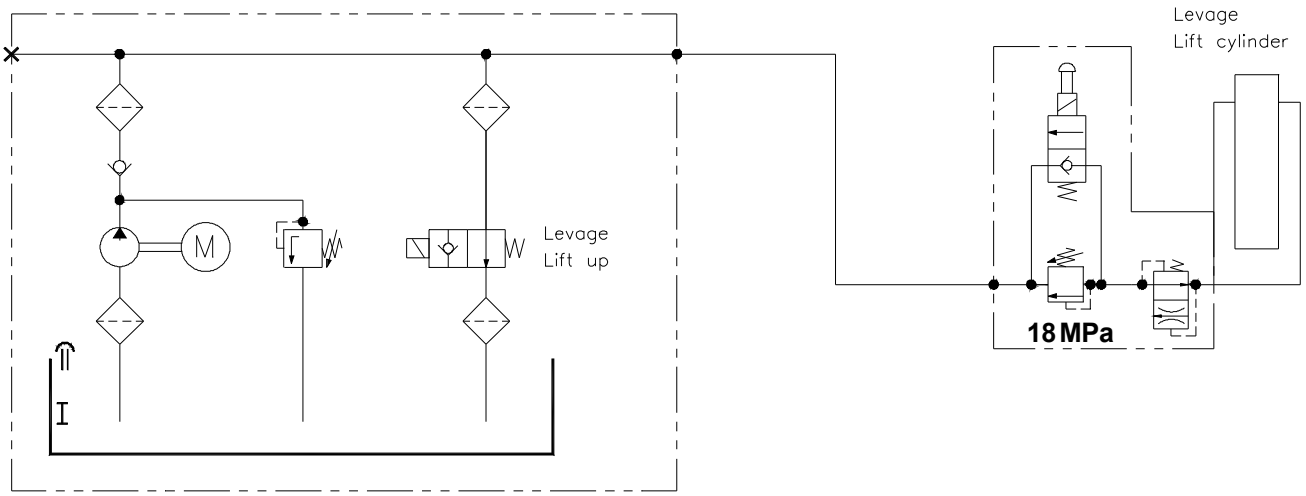

3.5.1. System Pressure Relief Valve.

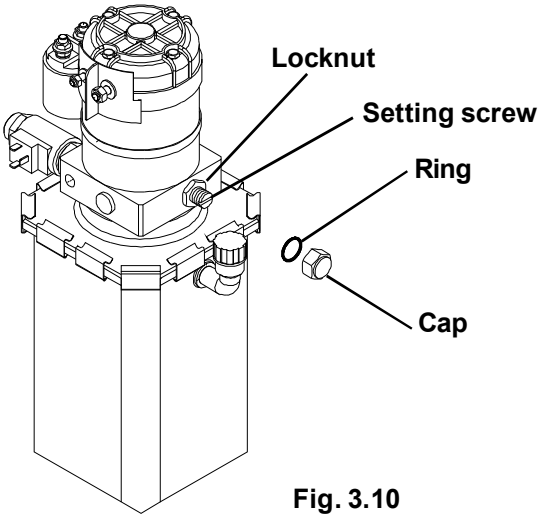

Fig. 3.10

1. Remove the cap.
2. Unscrew the locknut while maintaining the setting screw in its position.
3. Set the setting screw to :

	DC	AC
P20	11 MPa	9.5 MPa
P25	13.5 MPa	11.00 MPa
P30	18 MPa	15.5 MPa
P35	18.5 MPa	18.5 MPa
P40	12 MPa	12.0 MPa

4. Tighten the locknut (torque value 16±1 Nm) while maintaining the setting screw in its position to preserve the setting.
   Torque value : 16 ± 1 Nm
5. Install the ring.
6. Install the cap (torque value 11 ±1 Nm).

3.5.2. Mast cylinder pressure relief valve.

The pressure relief valve (protection from overpressure due to overheating) on the mast cylinder is factory preset at **18 MPa** and cannot be adjusted on the machine.

II
3

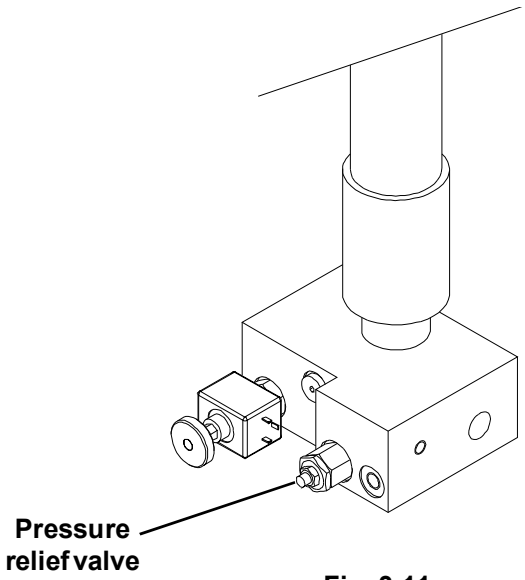

Fig. 3.11

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4.1. 12VDC model

4.1.1. Battery.

Description

The electrical system is 12 volts. A complete electrical system wiring diagram is provided at the back of the Operator's and Safety Handbook.

DANGER

If it should become necessary to perform electrical maintenance on live or hot circuits, remove all rings, watches, and other jewelry before performing maintenance. Failure to comply could result in death or injury to personnel.

DANGER

Ensure the battery charger plug is disconnected before performing any maintenance on an electrical circuit. Failure to do so could result in death or injury to personnel.

CAUTION

Never replace original wiring with wiring of a smaller gauge.

4.1.1.1. Battery replacement.

DANGER

Because of explosive hydrogen gas, allow no open flames or smoking while servicing the battery.

DANGER

Severe arcing or battery explosion may occur should battery cables be disconnected at random. When servicing components, use insulated tools and always disconnect and connect battery connection decal, and according to the removal and installation procedures in this section.

CAUTION

Continous operation of machine with low battery voltage may result in damage to battery and electrical motor-pump.

CAUTION

Two persons are recommended to remove the battery : one to hold it the other to remove the link.

Procedure to follow :

1. The platform must be fully lowered.
2. Remove the battery cover.
3. Disconnect and insulate the cables from batteries following the order indicated on the decal (First : negative, Second : positive).
4. Remove the battery fixation.
5. Remove the battery away from the machine.
6. Proceed in reverse order to reinstall the battery. Use "Loctite 243" to lock the battery fixation.

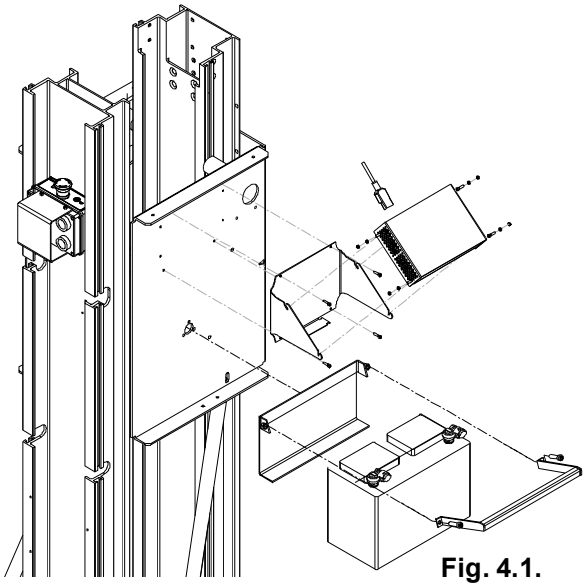


Fig. 4.1.

4.1.1.2. Filling of battery cells.

DANGER

Battery electrolyte may cause painful burns if allowed to contact the hands or other parts of the body. To avoid such an accident, goggle, rubbers gloves and a rubber apron should be worn. Failure to do so could result in death or injury to personnel.

NOTE

Check the electrolyte level, and fill the battery cells to the correct level after the charge if necessary .

NOTE

It is recommended to fill the battery with distilled water in ambient temperature between 10 and 40° C.

1. Uncap the cells.
2. Fill the battery cell with distilled water.

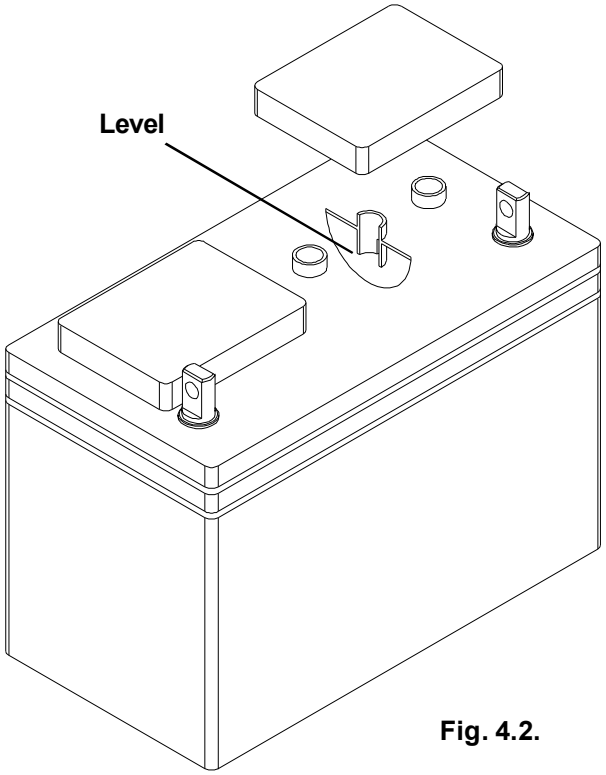


Fig. 4.2.

3. Cap the cells.
4. Clean the battery.

4.1.1.3. Cleaning of the battery.

It is mandatory to clean the battery to prevent salt formation and current arcing, which increases self discharge and damage to the battery.

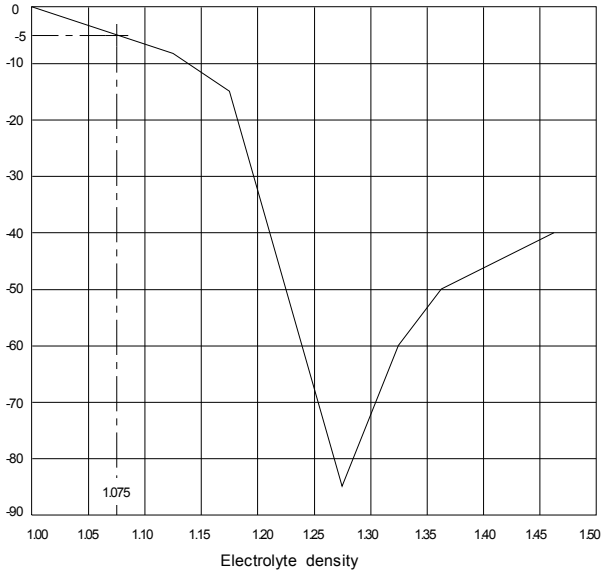
Allow the battery cells to dry and clean them with a dry cloth.

4.1.1.4. Outside storage.

When the batteries are not used, it is imperative to store them charged in a clean and dry area, away from cold environment. The batteries can be stored at ambient temperature of 30° C without any maintenance.

For an outside storage, at temperature below 0°C, check the density of the electrolyte to prevent damage to the battery through freezing of the electrolyte.

4.1.1.5. Electrolyte freezing point function of the density.



Ex : When the battery contains electrolyte of a density of 1.075, its freezing point is -5°C.

The batteries fully charged correspond to an electrolyte density of around 1.28, meaning that the battery's freezing point is -85°C.

NOTE

It is imperative that the battery is fully charged when you work in refrigerated chamber. This also applies when they are stored outside.

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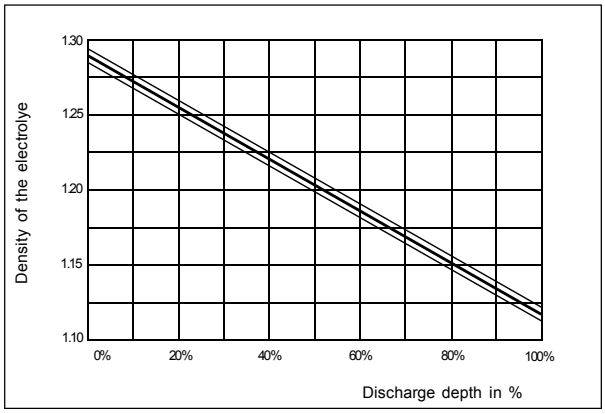
Recommendations

- Never add pure acid. Use distilled or demineralised water.

- Never leave the machine unoperational with discharged battery.

- Make sure that the battery temperature is not higher than 45 °C during the charge. A thermal runaway may result in battery damage.

- Record the tensions and electrolyte densities at least once a month. A correct reading should take place right after charging. The electrolyte density allows to determine the state of charge of the battery.



Discharge depth in relation to the electrolyte density .

- The battery should not be at a charge below 20% of their rating.(Density : 1.15).

- The battery will reach its maximum capacity only after four or five charge-discharge cycles. During this period, it is recommended not to go beyond discharge depths superior to 70% of their rating.

- The battery emit hydrogen. Never leave incandescent objects on or near the batteries or approach a flame near the battery to avoid any explosion risk.

II 4

4.1.1.6. Troubleshooting

When small problems encountered on a battery in use are rapidly and correctly determined, the life of the battery is improved.

PREVENTION = AUTONOMY AND LONG LIFE

Symptoms	Probable causes	Solutions
Overflow	Elements overfilled.	Never fill over maximum level.
	The battery gimbal mouting does not worl properly.	Check and replace, if necessary the ball bearing and/or the rollers.
	Overload.	Check the charger good working order : the red led (battery charge) should not remain lit continuously more than 14 hours.
	Overload.	Never charge the battery if the density is superior to 1.230.
Densities too low	Fillong done before the charge.	Fill after the charge.
	Loss of electrolyte due to overflow.	Check the level, charge the battery and fill afterwards.
	Stratification of the electrolyte.	If after the charge the density is still too low, contact Product Support.
Low density of the battery	Densities too low.	See above.
	Short-circuits.	Clean the battery top.
Temperature of the elements too high	The charger is too strong for the battery.	Check the capacity of the charger.
	Bad air circulation during charge.	Ventilate the room.
Battery incapable of supporting regular operation	Battery under charged.	Increase charging time and have the charger checked by a technician.
	Cable or connection faulty or incorrect.	Replace either the cable or the connection.
	Battery at the end of its service life.	Replace the battery.

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4.1.2. Charger.

4.1.2.1. Components.

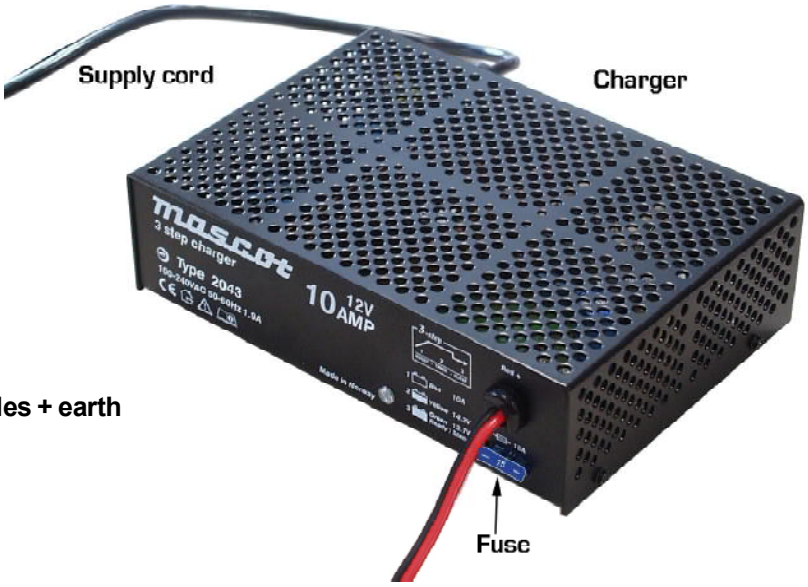


Fig. 4.3

- **Supply cord with charger plug 2 poles + earth IEC 320 (or CEE 22)**
- **Automotive type fuse**

4.1.2.2. Operation.

The charger can be supplied from 100 V to 240V in 50Hz or 60Hz monophased. The supply voltage is selected automatically. It operates in ambiant temperatures ranging from –25°C to + 40°C.

DANGER

Ensure the battery charger plug and the battery's wires are disconnected before performing any maintenance on the charger. Maintenance can only be performed by qualified personnel.
Do not operate the charger without its cover.

Charging

a. Connect the charger to a grounded power supply.
- If the charge condition indicator is not lit, unplug the charger from the power supply and refer to the chart below for necessary repairs.
- The charge condition indications are :

- **red led** : 1st charge cycle.

- **yellow led** : 2nd charge cycle.
Duration of the cycle : approximately 4 hours.
Battery charge > 80%.

- **green led** : battery fully charged. This indicator stays lit as long as the charger is connected to the power supply (a maintenance charge occurs).

Faults

Condition indicator	Probable Cause	Action
Off	charger disconnected or faulty	Check the power supply and the supply cord
Yellow from ignition on	Battery connection faulty	Check the cables and connections between the battery and the charger. Check the fuse.
		Replace the faulty parts
Flashing	Power supply voltage too low	Check the power supply voltage and the condition of the supply cord.

4.1.3. Power fuse.

It is located above the lower control box, inside the power unit cover. It protects the entire electrical circuit. Fuse type : 160A.

DANGER

Severe arcing or battery explosion may occur should battery cables be disconnected at random. When servicing components, use insulated tools and always disconnect and connect battery connection decal, and according to the removal and installation procedures in this section.

DANGER

Ensure the battery charger plug and battery's wires are disconnected before performing any maintenance on the power fuse. Failure to do so could result in death or serious injury.

4.2. 100 VAC model

Description

The electrical system is 100 V 50/60 Hz. A complete electrical system wiring diagram is provided at the back of the Operator's and Safety Handbook.

DANGER

If it should become necessary to perform electrical maintenance on live or hot circuits, remove all rings, watches, and other jewelry before performing maintenance. Failure to comply could result in death or injury to personnel.

CAUTION

Never replace original wiring with wiring of a smaller gauge.

4.2.1. Circuit breaker.

The circuit breaker is located under the cover on the right hand side of the machine. In case of a short circuit it cuts the power off from the machine. The problem must be determined and corrected before switching it back on.

Connect the circuit breaker to a grounded 100V 50/60 Hz 15A electrical power supply. Test the circuit breaker before each use :

1. Press the reset button
2. Press the test button. A red indicator light should appear. If not do not use the machine.
3. Press reset button again to use the machine

4.2.2. Auxiliary battery.

The auxiliary battery is located under the lower control box. (To reach the battery, remove the corresponding cover).

If the autonomy is not sufficient, charge the battery (for 24h for a complete charge) with the lower emergency stop button pulled.

The auxiliary battery is used to lower the machine from the upper control box in case of a power cut.

4.3. Control system (all models)

4.3.1. Fuses

AC models ***DC models***

1	Fuse 5x20 - 3,15A	Protection of the control circuit
2	Fuse 5x20 - 10A	Protection of the power unit motor
3	Fuse 5x20 - 2A	Protection of the primary circuit for the transformer of the control circuit

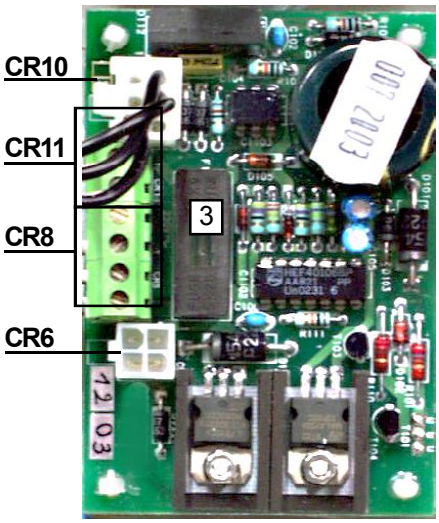
4.3.2. Electronic cards

4.3.2.1. Supply card *(AC models only)*

FUNCTIONS :

- Auxiliary battery charge. The auxiliary charge comes in 30s after the machine is connected to the power supply (whatever the positions of the emergency stops and of the key selector)
- Supply to the control circuit.

⚠ CAUTION
Power supply voltage present on this card.



CONNECTIONS :

	Contact n°	Signal
CR6 **Control circuit supply**	1	15 Vcc - Control circuit supply
	2	12 Vcc - Auxiliary battery charge
	3	Signal start of discharge indicator
	4	0 V

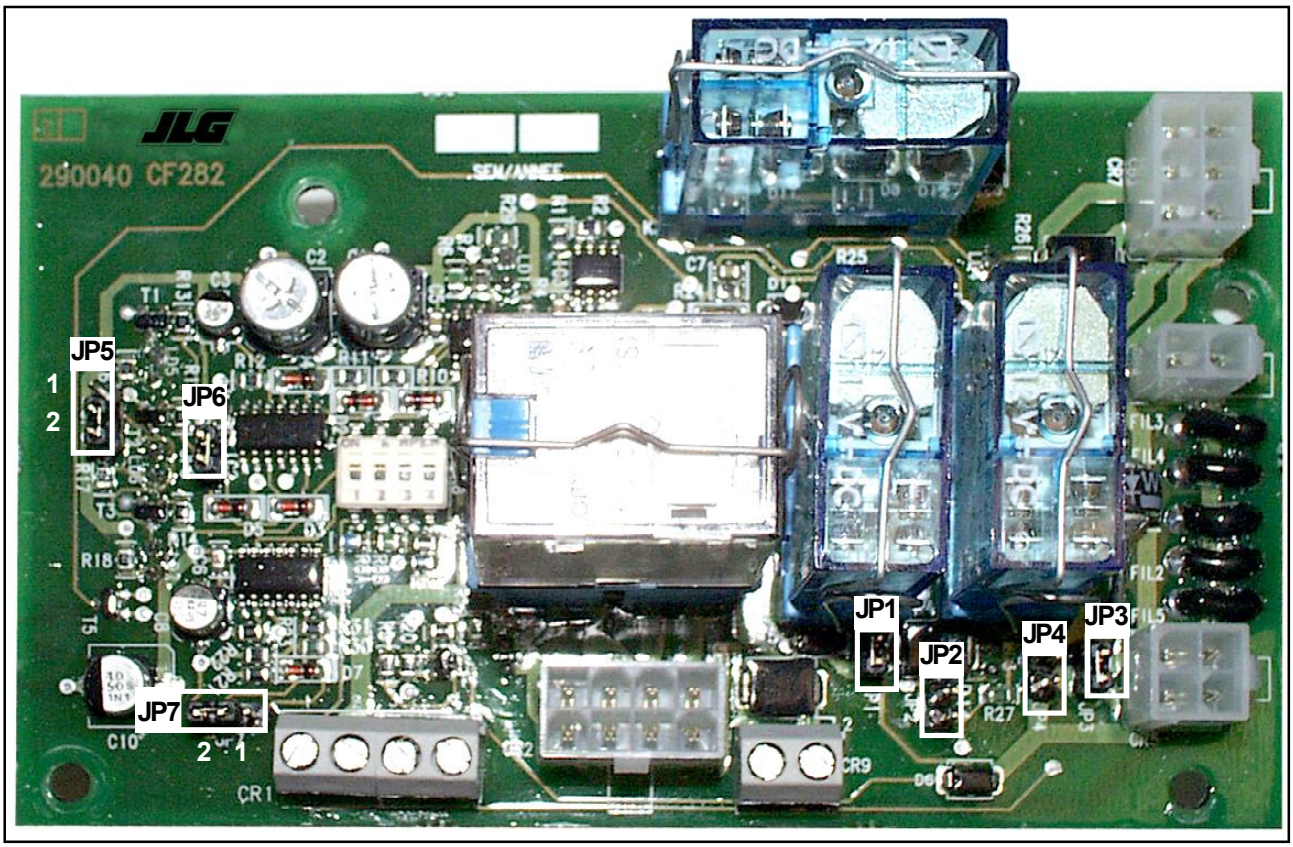
	Contact n°	Signal
CR8 **Power supply**	1	Neutral
	2	Earth
	3	Phase

CR10 **Transformer connections**	1	Transformer secondary coil (15 Vca)
	2	
	5	Transformer primary coil (115 - 230 Vca)
	6	
	3 - 4	Not used

CR11 **Supply to platform socket**	1	Phase
	2	Earth
	3	Neutral

4.3.2.2. Control circuit card

Management card of the control circuit. Includes the battery discharge indicator and the indicator for the outrigger installation. The same card can be configured for AC and DC versions.



JPxx : Card configuration jumpers. R8 : Discharge indicator settings.

CARD CONFIGURATION :

AC		DC	
JP1 : **M**	JP5 : **M2**	JP1 : **NM**	JP5 : **M1**
JP2 : **NM**	JP6 : **M**	JP2 : **M**	JP6 : **NM**
JP3 : **NM**	JP7 : **NM**	JP3 : **M**	JP7 : **M1**
JP4 : **NM**		JP4 : **M**	

M : Installed
NM : Not installed
M1 : Instaled in position 1
M2 : Installed in position 2

⚠ CAUTION
Do not mix both configurations to prevent malfunction.

NOTE

JP7 sets the temporisation for the starting up of the power unit motor (useful only on AC models). If the power supply is fluctuating, it is possible to remove the JP7 jumper, the start up temporisation is then maximum.

BATTERY DISCHARGE INDICATOR SETTINGS :

AC models			
1	2	3	4
OFF	OFF	OFF	OFF

DC models				
	1	2	3	4
P20 - P40	OFF	OFF	ON	OFF
P21 - P25	OFF	OFF	ON	ON
P30 - P35	OFF	ON	OFF	OFF

4.4. Electrical system troubleshooting

CONDITION	SYMPTOMS	ACTION
1. Outrigger malfunction	**A.** A led is lit when the corresponding outrigger is not properly locked and under laod.	**a.** Check the outrigger switch setting and reset it if necessary. **b**. Check and replace, if necessary, the corresponding outrigger switch.
	B. A led is not lit when the corresponding outrigger is properly locked and under load.	**a.** Check that the contact plate is not dirty or oxidized. Clean or replace if necessary. **b.** Test the corresponding outrigger switch, by carefully making a contact with a metal tool through its storage socket, avoiding contact with the chassis and replace **c.** Try to raise the platform. If you can, the led is faulty, it must be imperatively replaced.
	C. A led is on when no outrigger is installed.	**a.** Check the relay K1 and replace it if necessary. **b.** Check the wiring from the lower control box to the outrigger switch.
	D. The outrigger indicator led does not correspond to the outrigger under load.	**a.** Check the correct connection of the outrigger plugs.
2. Raising or lowering malfuction	**A.** Raising function not available from upper controls, lowering function available and the outrigger indicator system is working.	**a.** The relay K1 or K2 is faulty. **b.** The battery is too discharged. Charge it.
	B. The motor is not running when the raising function is activated. The outrigger indicator system is working correctly.	**a.** The relay K1 or K2 is faulty. **b.** The battery is too discharged. Charge it.
	C. Raising function not available but the motor is working. The outrigger indicator system is worling correctly.	**a.** The solenoid on the motor is faulty. **b.** The relay K4 or its control module is faulty.
	D. Lowering and raising function available from the upper control box, but the outrigger inidcator system is not working.	**a.** Relay K1 is sticking.
	E. Raising function automatic, lowering function available from the emergency and breakdown control panel only.	**a.** Relay K2 is sticking.

CONDITION	SYMPTOMS	ACTION
3. No electrical power for the 12 VDC model	**A.** The battery discharge indicator light is off.	**a.** Check that the emergency stop on the emergency and breakdown control panel is pulled out. **b.** Check the voltage at the ignition switch in the emergency and breakdown control panel. **c.** Check and replace, if necessary, the 3.15A fuse in the emergency and breakdown control panel. **d.** If the 3.15A fuse is correct, check and replace the 160A fuse after the necessary repairs have been performed.
	B. The battery discharge indicator light is green.	**a.** Check the position of the ignition switch in the emergency and breakdown control panel. **b.** Check that the emergency stop switch on the upper control box is pulled out. **c.** Check and replace the key switch if necessary. **d.** Check the voltage at the ignition switch in the emergency and breakdown control panel.
	C. The battery discharge indicator light is red.	**a.** The battery is above 80% of discharge. It must be immediatly recharged.
4. No electrical power for the 100 VAC model	**A.** The electrical power plug is disconnected.	**a.** Connect the electrical power plug.
	B. The power plug is conected.	**a.** Check the circuit breaker. **b.** Check the plug to the electrical power supplyt. **c.** Check and replace, if necessary the fuses in the emergency and breakdown control panel. **d.** Check the position of the ignition key in the emergency and breakdown control panel. **e.** Check that the emergency stop switches in the upper and lower control boxes are pulled out. **f.** Check and replace, if necessary the enable switch. **g.** Check the voltage at the ignition switch in the emergency and breakdown control panel.
	C. The platform cannot be lowered.	**a.** The auxiliary battery is discharged or faulty. Charge or replace.
5. Pump/motor malfunction	**A.** The electrical motor runs permanently.	**a.** Check and replace, if necessary the pump/motor solenoid relay.
	B. The platform raises with enable switch depressed only.	**b.** Check and replace, if necessary the UP switch in the upper control box.
	C. The platform lowers with enable switch depressed only.	**c.** Check and replace, if necessary the DOWN switch in the upper control box.
	D. The platform raises or lowers with UP or DOWN switches depressed only.	**d.** Check and replace, if necessary the enable switch.

4.5. Outrigger system

Description

The outriggers switches are located inside each outrigger socket on the frame. The outrigger contact plates are located inside each outrigger. The outrigger led indicators are located on the lower control panel. The leds are actuated by the outrigger switches. When an outrigger is under load, the outrigger switch is activated and lights its corresponding led. The four leds must be on for the machine to be operational.

Switch removal and installation

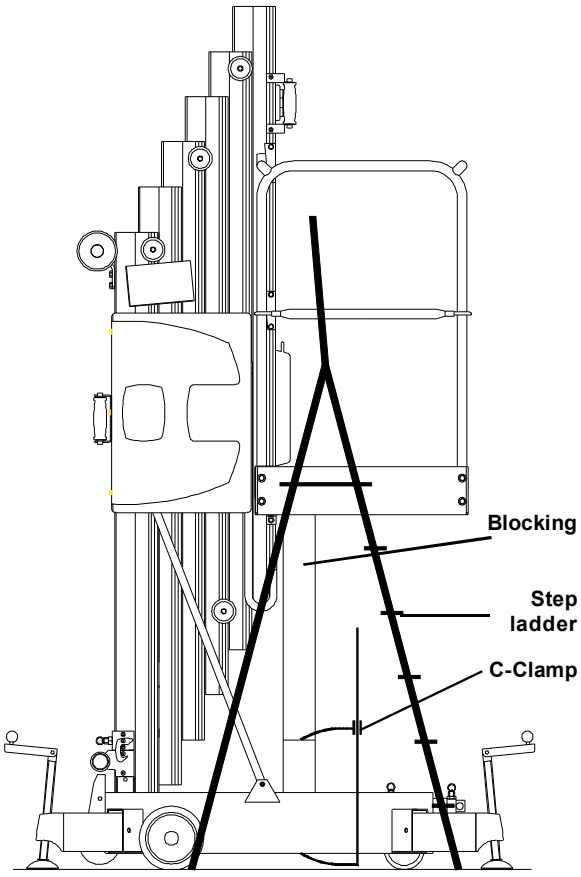


Fig.4.4.

1. Install and lock the outriggers into their sockets.
2. Raise the platform by 1 meter.
3. Exit the platform using the step ladder.
4. Block the mast with blocking of 87cm high and lock in place with C-clamp.
5. Lower the platform to rest on the blocking using the lower control panel.

NOTE

After replacement of each sensor, the corresponding outrigger must be locked in place in its socket.

NOTE

Mark the position of the switch before removal to facilitate its installation in its original position.

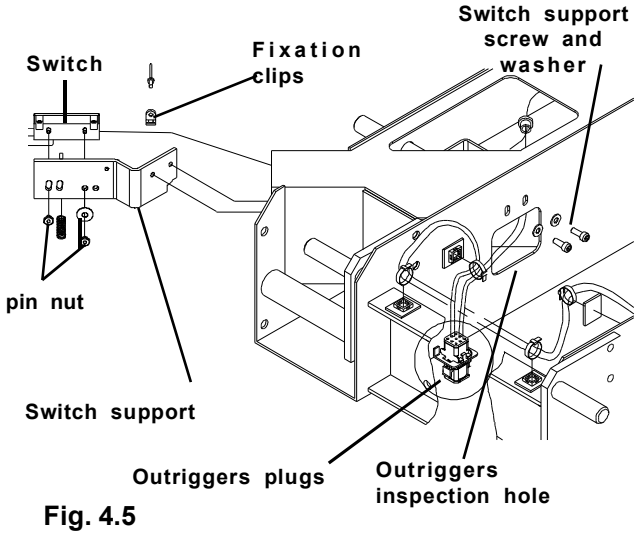


Fig. 4.5

6. Remove the switch support screws and washers.
7. Pull out the switch support assembly.
8. Remove the switch.
9. Proceed in reverse order for installation of the switch. Do not forget to set it, refer to section below "Switch setting".

NOTE

Switch support screw and pins nuts must be installed with Loctite 243.

Switch setting

1. Follow steps 1 to 5 from previous section "Switch removal and installation".
2. Loosen both switch support screws.

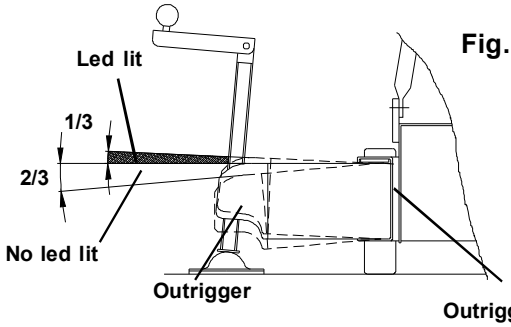
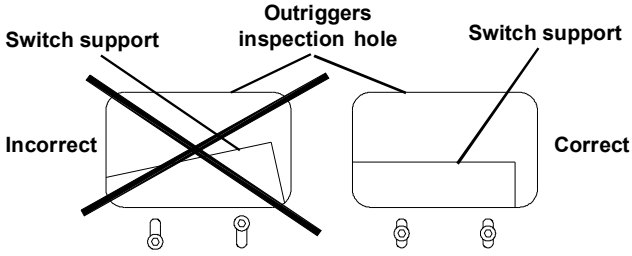


Fig. 4.6.



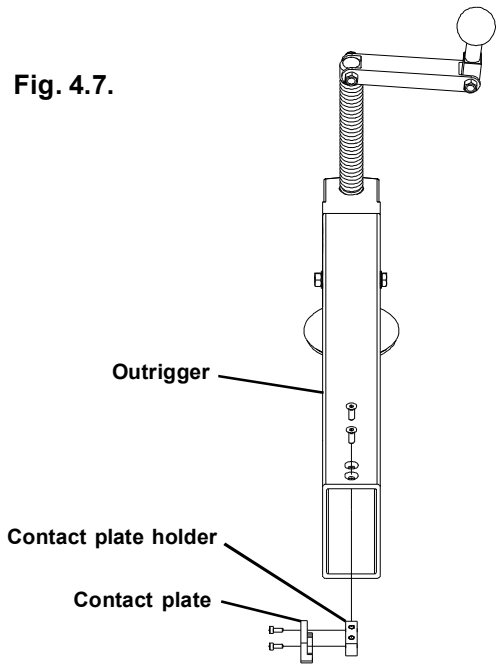
⚠ CAUTION

Failure to respect the above mounting may cause damage and malfunction of the outrigger indicator system.

3. Slide the switch support assembly until the correct setting has been reached :
   - When the outrigger is not under load, the led must not be lit (during the 2/3 from start of stroke).
   - When the outrigger is under load, the led must be lit (during the last 1/3 of end of stroke).
4. Tighten both switch support screws.

Contact plate removal and installation

Fig. 4.7.



1. Remove the contact plate holder screw.
2. Pull out the contact plate holder assembly.

NOTE

Mark the position of the contact plate before removal to facilitate its installation in its original position.

3. Remove the contact plate.
4. Proceed in reverse order for installation.

NOTE

Contact plate screws and contact plate holder screws must be installed with "Loctite 243".

TABLE OF CONTENTS

5.1 General

Following the designated lubrication procedures is important in ensuring maximum machine life.time and utilization. The procedures and lubrication charts in this section include information on the types of lubricants used, the location of the lubrication points, the frequency of lubrication, and other information.

The service intervals specified are for normal operation where moderate temperature, humidity, and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions.

5.2 Lubricants

⚠ CAUTION

The multiporpose grease installed during manufacture is of lithium base. Use of a non-compatible grease could result in damage to equipment.

⚠ CAUTION

Never use ATF Dexron fluid. Use of a non-compatible fluid could result in damage to equipment.

Specific recommendations of brand and grade of lubricants are not made here due to the regional availability, operating conditions, and the continual development of products. Where questions arise, refer to the component manufacturer manual and a reliable supplier.

5.3 Symbol description

EP-MPG Extreme Pressure Multipurpose Grease.

This is a lithium soap base grease with a high carrying capacity. The following properties are recommended:

Timkin OK load	16kg. (35 Lb.) minimum.
Dropping point	177° C (350° F) minimum.
Oil viscosity	14 cst minimum at 99° C (75 ssu minimum at 210° F).
Water resistance	10% maximum loss.

Under normal operating conditions, the following consistency grades are recommended:

NLGI No. 0 or 00 for sub-zero Fahrenheit (below -18° C) temperatures.

NLGI No. 2 or No. 3 for normal ambient temperatures.

Unless otherwise specified, an EP-MGP containing Molybdenum disulfide may be used.

HYDO-32 Hydraulic Oil.

Oil in a hydraulic system serves as the power transmission medium, system lubricant, and coolant. Selection of the proper oil is essential to ensure satisfactory performance and life.

Viscosity :	
ISO Viscosity Grade	32
cst at 40° C	32.4
cst at 100° C	6.3
Viscosity index :	153
Pour point :	-43° C

HYDO-68 Hydraulic Oil.

For these machines this hydraulic oil is only used for chain lubrication. Selection of the proper oil is essential to ensure satisfactory performance and life.

Viscosity :	
ISO Viscosity Grade	68
cst at 40° C	67.1
cst at 100° C	8.7
Viscosity index :	102
Pour point :	-5° C

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5.4 Lubrication points

1. Masts

Lube type : EP-MPG (USA)
MOBILUX EP2 (Europe)
COMPLEX EP2

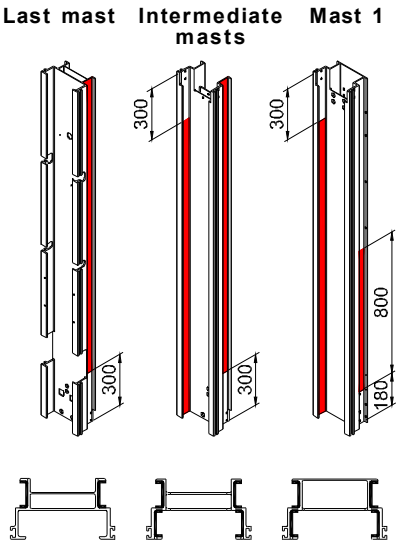
Lube areas : Inside wall of the masts

Application : Brush on

Lube quantity : Thin layer

Lubrication interval : Every year for normal operation

Occasional lube : After every pressure wash



2. Chains

Lube type : HYDO-68 (USA)
MOBIL DTE 16M (Europe)
CHAINE FILANTE

Lube areas : Chains
Application : Brush on
Lube quantity : Apply lightly on the chains, on whole lenght
Lubrication interval : Every year for normal operation
Occasional lube : After every pressure wash.

3. Hydraulic reservoir

Oil type : HYDO-32 (USA)
MOBIL DTE 13M (Europe)
NERVOFLUID VG 32
NERVOFLUID DVG 32

Circuit amount :

P20	5.5 liters
P25	5.5 liters
P30	5.5 liters
P35	5.5 liters
P40	9.4 liters

Reservoir capacity : 5.3 litres.

Oil change interval : Check daily and drain as necessary

- First oil change after **6** months
- Oil change interval : every **2** years

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NOTES