



An Oshkosh Corporation Company



www.Discount-Equipment.com

---

# Service and Maintenance Manual

## Models

**X13JP - X370AJ**

**X15JP - X430AJ**

**3121774**

June 29, 2018 - Rev C

**ANSI**

**CE**



An Oshkosh Corporation Company

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for manuals and parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

SEARCH

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information:

Manufacturer:

Model:

Description:

Quantity:

Part Number:

Part Name:

Part Description:

Part Location:

Part Condition:

Part Status:

Part Price:

Part Weight:

Part Dimensions:

Part Material:

Part Color:

Part Finish:

Part Notes:

Part Images:

Part Attachments:

Part Specifications:

Part Certifications:

Part Compliance:

Part Safety:

Part Environmental:

Part Performance:

Part Reliability:

Part Durability:

Part Efficiency:

Part Cost:

Part Lead Time:

Part Availability:

Part Stock:

Part Location:

Part Contact:

Part Reference:

Part Comments:

Part Status:

Part Action:

Part Date:

Part Time:

Part User:

Part IP:

Part Agent:

Part Agency:

Part Country:

Part City:

Part State:

Part Zip:

Part Phone:

Part Fax:

Part Email:

Part Website:

Part Social:

Part Other:

Part Submit:

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on one of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

### GENERAL

This section contains the general safety precautions which must be observed during maintenance of the aerial platform. It is of utmost importance that maintenance personnel pay strict attention to these warnings and precautions to avoid possible injury to themselves or others, or damage to the equipment. A maintenance program must be followed to ensure that the machine is safe to operate.

#### **⚠ WARNING**

**MODIFICATION OR ALTERATION OF AN AERIAL WORK PLATFORM SHALL BE MADE ONLY WITH WRITTEN PERMISSION FROM THE MANUFACTURER.**

The specific precautions to be observed during maintenance are inserted at the appropriate point in the manual. These precautions are, for the most part, those that apply when servicing hydraulic and larger machine component parts.

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

#### **⚠ WARNING**

**SINCE THE MACHINE MANUFACTURER HAS NO DIRECT CONTROL OVER THE FIELD INSPECTION AND MAINTENANCE, SAFETY IN THIS AREA IS THE RESPONSIBILITY OF THE OWNER/OPERATOR.**

### HYDRAULIC SYSTEM SAFETY

It should be noted that the machines hydraulic systems operate at extremely high potentially dangerous pressures. Every effort should be made to relieve any system pressure prior to disconnecting or removing any portion of the system.



### MAINTENANCE

#### **⚠ WARNING**

**FAILURE TO COMPLY WITH SAFETY PRECAUTIONS LISTED IN THIS SECTION COULD RESULT IN MACHINE DAMAGE, PERSONNEL INJURY OR DEATH AND IS A SAFETY VIOLATION.**

- ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.
- NO SMOKING IS MANDATORY. NEVER REFUEL DURING ELECTRICAL STORMS. ENSURE THAT FUEL CAP IS CLOSED AND SECURE AT ALL OTHER TIMES.
- REMOVE ALL RINGS, WATCHES AND JEWELRY WHEN PERFORMING ANY MAINTENANCE.
- DO NOT WEAR LONG HAIR UNRESTRAINED, OR LOOSE-FITTING CLOTHING AND NECKTIES WHICH ARE APT TO BECOME CAUGHT ON OR ENTANGLED IN EQUIPMENT.
- OBSERVE AND OBEY ALL WARNINGS AND CAUTIONS ON MACHINE AND IN SERVICEMANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- USE CAUTION WHEN CHECKING A HOT, PRESSURIZED COOLANT SYSTEM.
- NEVER WORK UNDER AN ELEVATED BOOM UNTIL BOOM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR BOOM SAFETY PROP HAS BEEN ENGAGED.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

## **REVISION LOG**

Original Issue	A - August 4, 2017
Revised	B - March 27, 2018
Revised	C - June 29, 2018 - Revised Covers

Go to [Discount-Equipment.com](http://Discount-Equipment.com) to order your parts

TABLE OF CONTENTS

SUBJECT - SECTION, PARAGRAPH		PAGE NO.
<b>SECTION - INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS</b>		
	GENERAL.....	A
	HYDRAULIC SYSTEM SAFETY.....	A
	MAINTENANCE.....	A
<b>SECTION 1 - SPECIFICATIONS</b>		
1.1	CAPACITIES .....	1-1
1.2	CAPACITIES TRACK SPECIFICATIONS .....	1-1
1.3	POWER SOURCE .....	1-2
	Hatz Engine 1B40 Specifications .....	1-3
1.4	SPECIFICATIONS AND PERFORMANCE DATA .....	1-4
	Reach Specifications .....	1-4
	Dimensional Data .....	1-4
	Function Speed Data .....	1-5
	Machine Orientation When Performing Speed Tests .....	1-6
1.5	HYDRAULIC PRESSURE SETTINGS - PSI (BAR) .....	1-6
1.6	LUBRICATION .....	1-7
	Hydraulic Oil .....	1-7
1.7	SERIAL NUMBER LOCATION .....	1-9
1.8	FASTENER TORQUE CHARTS .....	1-10
<b>SECTION 2 - GENERAL</b>		
2.1	MACHINE PREPARATION, INSPECTION, AND MAINTENANCE .....	2-1
	General .....	2-1
	Preparation, Inspection, and Maintenance .....	2-1
	Pre-Start Inspection .....	2-1
	Pre-Delivery Inspection and Frequent Inspection .....	2-1
	Annual Machine Inspection .....	2-1
	Preventative Maintenance .....	2-1
2.2	SERVICE AND GUIDELINES .....	2-2
	General .....	2-2
	Safety and Workmanship .....	2-2
	Cleanliness .....	2-2
	Components Removal and Installation .....	2-2
	Component Disassembly and Reassembly .....	2-2
	Pressure-Fit Parts .....	2-2
	Bearings .....	2-3
	Gaskets .....	2-3
	Bolt Usage and Torque Application .....	2-3
	Hydraulic Lines and Electrical Wiring .....	2-3
	Hydraulic System .....	2-3
	Lubrication .....	2-3
	Battery .....	2-3
	Lubrication and Servicing .....	2-3
2.3	LUBRICATION AND INFORMATION .....	2-3
	Hydraulic System .....	2-3
	Hydraulic Oil .....	2-4
	Changing Hydraulic Oil .....	2-4
	Lubrication Specifications .....	2-4
2.4	CYLINDER DRIFT TEST .....	2-4
	Cylinder Drift .....	2-4

## TABLE OF CONTENTS

---

2.5	PINS AND COMPOSITE BEARING REPAIR GUIDELINES .....	2-5
2.6	WELDING ON JLG EQUIPMENT .....	2-5
	Do the Following When Welding on JLG Equipment .....	2-5
	Do NOT Do the Following When Welding on JLG Equipment .....	2-5

### SECTION 3 - CHASSIS & TURNTABLE

3.1	RUBBER TRACK MAINTENANCE/REPLACEMENT .....	3-1
	Checking Track Tension .....	3-1
	Tensioning Rubber Track .....	3-1
	Removing Rubber Track .....	3-1
	Installing Rubber Track .....	3-2
3.2	UNDERCARRIGE COMPONENTS .....	3-3
	Machine Positioning .....	3-3
	Replacement Roller Lower Wheel and Tracks Adjuster .....	3-3
	Disassembly .....	3-3
	Assembly .....	3-3
	Replacement Sprocket and Gear Motor .....	3-3
	Sprocket Removal .....	3-3
	Gear Motor Removal .....	3-3
	Gear Motor Installation .....	3-4
	Sprocket Installation .....	3-4
3.3	TRACKS EXTENSION REMOVAL .....	3-5
3.4	TRACK DRIVE .....	3-6
	Product Identification .....	3-6
3.5	SWING DRIVE (IMO) .....	3-7
	Technical Data – Type Plate .....	3-7
	Structure and Function .....	3-7
	Structure and Function .....	3-8
	Maintenance Tasks .....	3-8
	Lubricating The Slew Drive .....	3-9
3.6	POWER SYSTEM X15JP - X430AJ .....	3-10
	Electric Motor Function System .....	3-11
	Engine RPM Control System .....	3-11
	Twin Power Unities With Gasoline Engine Honda IGX390 .....	3-12
	Twin Power Unities With Diesel Engine Hatz 1B40 .....	3-15
	Lithium Powered Unities .....	3-18

### SECTION 4 - BOOM & PLATFORM

4.1	BOOM MAINTENANCE .....	4-1
	Removal of the Boom Assembly .....	4-1
	Disassembly of the Main Boom .....	4-1
	Inspection .....	4-3
	Assembly of the Main Boom .....	4-3
	Installation of the Boom Assembly .....	4-4
4.2	PROXIMITY SENSOR ADJUSTMENT .....	4-5
4.3	PLATFORM REMOVAL/INSTALLATION .....	4-5
	Removal .....	4-5
	Installation .....	4-5

4.4	SKYGUARD INSTALLATION - ONE PERSON PLATFORM .....	4-6
	Options/Accessories Prohibited When Installing This Kit: .....	4-6
	Tools & Equipment Required: .....	4-6
	Personnel Required: .....	4-6
	Parts List: .....	4-6
	Procedure: .....	4-6
	For Reference: .....	4-7
	Installation: .....	4-7
	SkyGuard System .....	4-10
4.5	SKYGUARD INSTALLATION - TWO PERSON PLATFORM .....	4-11
	Options/Accessories Prohibited When Installing This Kit: .....	4-11
	Tools & Equipment Required: .....	4-11
	Personnel Required: .....	4-11
	Parts List: .....	4-11
	Procedure: .....	4-11
	For Reference: .....	4-12
	Installation: .....	4-12
	SkyGuard System .....	4-15

**SECTION 5 - HYDRAULICS**

5.1	HYDRAULIC SYSTEM .....	5-1
	Main Components Identification And Location .....	5-1
	Hydraulic Diagram .....	5-3
	Pumps and Hydraulic Lines System .....	5-6
	Ground Part Hydraulic System .....	5-10
	Outriggers .....	5-11
	Driver Gear Motors .....	5-12
	Tracks Widening .....	5-14
	Aerial Part Hydraulic System .....	5-15
5.2	CYLINDER REPAIR .....	5-19
	Specification - Cylinders Overview .....	5-19
	Hydraulic Cylinders Torque Specifications .....	5-23
	Cylinder Assembling .....	5-24
	Cylinder Repair Without Sensor .....	5-24
	Piston With Nut Disassembling .....	5-25
	Cylinder Assembly .....	5-25
	Seals Head Replacing .....	5-26
	Cylinder Inspection .....	5-26
	Bushes Replacement .....	5-27
	Emptying Of The Cylinder .....	5-28
5.3	REPLACEMENT HYDRAULIC PUMP .....	5-28
	Pump Removal .....	5-28
	Pump Installation .....	5-28
5.4	HYDRAULIC SCHEMATICS .....	5-29
	X13JP-X370AJ .....	5-29
	X15JP-X430AJ .....	5-31

**SECTION 6 - JLG CONTROL SYSTEM**

6.1	INTRODUCTION .....	6-1
6.2	PLATFORM - REMOTE CONTROL STATION .....	6-2
	LCD Display Screen .....	6-3
	LCD Display Icon Description .....	6-6
	Only Lithium Icons .....	6-7

**TABLE OF CONTENTS**

---

6.3 DIAGNOSTIC BY SERVICE MENU ..... 6-7  
    Menu Input ..... 6-8  
    Only Lithium Input ..... 6-11  
    Language Menu ..... 6-12  
    Error Menu ..... 6-12  
    Working Hours Menu ..... 6-14  
    Joystick Menu ..... 6-14  
6.4 MACHINE SETUP MENU ..... 6-15  
    Setup - Version ..... 6-16  
    Setup - Time ..... 6-16  
    Setup - Password ..... 6-16  
    Setup - Date ..... 6-16  
    Setup - Load Cell Board (ECM3) Calibration ..... 6-17  
    Setup - Acceler (Calibrating Tilt Sensor) ..... 6-17  
    Setup - Extra ..... 6-18  
6.5 MASTER BOARD (ECM1) REPLACEMENT AND SETTING ..... 6-22  
    New Master Board ..... 6-22  
    Already Initialized Master Board ..... 6-23  
    Software Recovery By Modem ..... 6-24  
6.6 CODE MENU ..... 6-24

**SECTION 7 - GENERAL ELECTRICAL INFORMATION & SCHEMATICS**

7.1 GENERAL ..... 7-1  
7.2 MULTIMETER BASICS ..... 7-1  
    Grounding ..... 7-1  
    Backprobing ..... 7-1  
    Min/Max ..... 7-1  
    Polarity ..... 7-1  
    Scale ..... 7-1  
    Voltage Measurement ..... 7-2  
    Resistance Measurement ..... 7-2  
    Continuity Measurement ..... 7-3  
    Current Measurement ..... 7-3  
    Continuity Measurement Over Long Distances ..... 7-4  
    Requirements: ..... 7-4  
    Procedure ..... 7-4  
7.3 ELECTRICAL SCHEMATICS MANUALS ..... 7-4



# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter the brand and model of your equipment to search our manual library for parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information to request help finding a part or manual.

Manufacturer:

Model:

Description:

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## SECTION 1. SPECIFICATIONS

### 1.1 CAPACITIES

Table 1-1. Drive Hub Capacities

Machine	Type Drive Hub	Drive	Capacities
X13JP-X370AJ	700 C1H40	STANDARD SPEED	0.13 gal (0,5 L)
X15JP-X430AJ	700 C2K	AUTO 2 SPEED	0.10 gal (0,4 L)

Table 1-2. Hydraulic & Fuel Tank Capacities

MACHINE	HYDRAULIC OIL TANK CAPACITY	GASOLINE	DIESEL
X13JP-X370AJ X15JP-X430AJ	6.34 gal (24 L)	1.40 gal (5,3 L)	1.3 gal (5 L)

### 1.2 CAPACITIES TRACK SPECIFICATIONS

Table 1-3. Track Specifications

MACHINE MODEL	RUBBER BELT TRACK			
	TYPE	PART NUMBER	DIMENSIONS	DRAWING
X13JP-X370AJ X15JP-X430AJ	LOW PROFILE BLACK COLOR	053715L0	Cm 180 X 37 X 72	
	LOW PROFILE NON-MARKING	053715LB		

Table 1-4. Ground Bearing Pressure

PRESSURES AND REACTIONS TO THE GROUND ON OUTRIGGER				
MODEL	Maximum Ground Bearing Pressure On Each Pad [daN] - [lbf]		Maximum Ground Bearing Pressure [daN/cm <sup>2</sup> ] - [PSI]	
X13JP-X370AJ X15JP-X430AJ	1670 daN	3754 lbf	2,36 daN/cm <sup>2</sup>	34,2 PSI

1.3 POWER SOURCE

Table 1-5. Power Configurations

	X13JP-X370AJ X15JP-X430AJ
Gasoline Engine	Honda iGX390 11.7 hp (8,7 kW) / 3600 RPM
Diesel Engine	Hatz 1B40 10 hp (7,5 kW)
Lithium	100Ah 36V
AC Electric Motor	110V 50 Hz (2,2 kW) 120V 60 Hz (1,2 kW) 230V 50 Hz (2,2 kW) 230V 60 Hz (2,2 kW)
<b>NOTE:</b> RPM Tolerances are $\pm 50$ .	

Honda Engine iGX390 Specifications

Table 1-6. Specifications Honda Engine iGX390

Model	iGX390
Engine type	Air cooled 4-stroke OHV petrol engine, 25° inclined cylinder, horizontal shaft, cast iron sleeve
Bore x stroke	88 x 64 mm
Displacement	389 cm <sup>3</sup>
Compression ratio	8.2 : 1
Net power	8.6 HP (6,4 kW) / 3000 rpm 9.4 HP (7,0 kW) / 3600 rpm
Max. net torque	26.5 Nm / 2.7 kgfm / 2500 rpm
Ignition system	Digital CDI with variable ignition timing
Starting system	Recoil starter, Electric starter
Choke	Automatic
Fuel tank capacity	6.1 l
Fuel cons. at cont. rated power	3.5 l/hr - 3600 rpm
Engine oil capacity	1.1 l
Dimensions (L x W x H)	409 x 484 x 448 mm
Dry weight	37 kg

## Hatz Engine 1B40 Specifications

Table 1-7. Specifications Hatz Engine 1B40

Type	1B40
Design	Air-cooled four-stroke diesel engine
Combustion system	Direct injection
Number of cylinders	1
Bore / stroke	88 / 76 mm
Displacement	462 cm <sup>3</sup>
Lubricating oil capacity without oil sump: with oil sump:	1.5 <sup>1)</sup> l, approx. 3.2 <sup>1)</sup> l, approx.
Difference between "max" and "min" levels without oil sump: with oil sump:	0.8 <sup>1)</sup> l, approx. 2.2 <sup>1)</sup> l, approx.
Lubricating oil consumption (after running in)	1% of fuel consumption at full load (max.)
Lubricating oil pressure (oil temperature 100 °C)	2.5 bars at 3000 r.p.m. (approx.)
Direction of rotation, power take-off end	anti-clockwise
Valve clearance 10 - 30 ° C - Inlet and exhaust valve	0.10 mm or automatically <sup>2)</sup>
Max. tilt angle in operation, in direction	Flywheel 25° down <sup>3)</sup> all other directions 35° <sup>3)</sup>
Weight (incl. fuel tank, air-cleaner, exhaust silencer, recoil starter and electric starter)	55 kg approx.
Battery capacity	max. 12 V / 60 Amp/h
Footnotes:	
<sup>1)</sup> These values are intended as an approximate guide. The max. marking on the dipstick is the determining Factor. <sup>2)</sup> Depending on model. <sup>3)</sup> Exceeding these limits causes engine breakdown.	

1.4 SPECIFICATIONS AND PERFORMANCE DATA

Reach Specifications

Table 1-8. Machine Reach Specifications

	X13JP CE	X370AJ ANSI	X15JP CE	X430AJ ANSI
Max. working Height (inclusive operator)	13,30 m	N/A	15,40 m	N/A
Max. Height (basket floor)	11,20 m	36,74 ft	13,30 m	59,21 ft
Max working Horizontal Outreach	7,08 m	23,22 ft	6,60 m	31,82 ft
Up & Over Height	4,90 m	16,07 ft	7,00 m	26,90 ft
Swing (non - continuous)	360°			
Max slope allowed in travel direction	16° / 28,7%			
Max stabilization slope	15°			
Max Approach angles	20°/36°			

Dimensional Data

Table 1-9. Machine Dimensional Data

	X13JP X370AJ	X15JP X430AJ
Platform size (standard 2 persons)	1305 X 690 mm (51,38 X 27,17 in.)	1335 X 690 mm (52,56 X 27,17 in. )
Stowed width (with std. 2P platform)	3900 mm (153,54 in.)	4020 mm (158,26 in.)
Stowed width (without platform)	3280 mm (129,13 in.)	3400 mm (133,85 in.)
Stowed height (on tracks)	1995 mm (78,54 in.)	1990 mm (78,34 in.)
Stowed length	-	4020 mm (158.26 in.)
Outrigger footprint (Disc Center)	2800 mm X 2800 mm (110,23 in. X 110,23 in.)	
Outrigger footprint reduced stabilization area (Disc Center)	NA	
Gross machine weight		
Gasoline:	2185 Kg (4817,00 lb)	1940 Kg (4277 lb.)
Diesel:		1960 Kg (4321 lb.)
Lithium Battery:	2220 Kg (4894,26 lb)	1992 Kg (4392 lb.)

## Function Speed Data

Table 1-10. Function Speed

FUNCTIONS SPEED RANGE		
MACHINE MODEL	X15JP / X430AJ	
POWER SYSTEM	Engine	Lithium
FUNCTION	TIME Sec	
TELESCOPE EXTEND	12" - 17"	23" - 32"
TELESCOPE RETRACT	12" - 17"	23" - 32"
TOWER BOOM UP	16" - 23"	16" - 23"
TOWER BOOM DOWN	20" - 28"	24" - 34"
UPPER BOOM UP	21" - 28"	27" - 37"
UPPER BOOM DOWN	22" - 30"	26" - 36"
BASKET ROTATE RIGHT	7" - 15"	7" - 30"
BASKET ROTATE LEFT	7" - 15"	7" - 30"
SWING LEFT	38" - 48"	45" - 55"
SWING RIGHT	38" - 48"	45" - 55"
JIB UP	7" - 15"	15" - 25"
JIB DOWN	7" - 15"	10" - 20"
BASKET LEVEL UP	33" - 55"	33" - 55"
BASKET LEVEL DOWN	37" - 50"	37" - 50"
MAX DRIVE SPEED (with auto two speed)	0.87/1.62 mph (1,4/2,6 Km/h)	0.24/0.50/0.99 mph (0,4/0,8/1,6 Km/h)

Table 1-11. Function Speed

MACHINE MODEL	X13JP / X370AJ		
MOVEMENT	JOYSTICK	T. Lim.	Tempo [Time]
SFL OUT	J4 UP	11	12" - 17"
SFL IN	J4 DW	11	12" - 17"
1E2 UP	J2 UP	10	15" - 23"
1E2 DW	J2 DW	10	15" - 23"
3E4 UP	J3 UP	20	21" - 28"
3E4 DW	J3 DW	20	22" - 30"
RT AE UP (1/2 CYCLE)	J7 UP	30	38" - 48"
RT AE DW (1/2 CYCLE)	J7 DW	30	38" - 48"
JIB UP	J6 UP	5,5	7" - 15"
JIB DW	J6 DW	5,5	7" - 15"
LIV UP	J9 UP	-	33" - 55"
LIV DW	J9 DW	-	37" - 50"

**Machine Orientation When Performing Speed Tests**

- **Lift:** Boom Retracted. Telescope Retracted. Lift Up, Record Time, Lift Down, Record Time.
- **Swing:** Machine stabilized, upper Boom at Full Elevation. Telescope Retracted. Swing the Turntable to the end stop. Swing the Opposite Direction, Record Time.
- **Telescope:** Boom at Full Elevation; Telescope Retracted; Telescope Out, Record Time. Telescope In, Record Time.
- **Drive:** Test to be done on a smooth level surface. Drive Select Switch should be set at 2WD High Engine. Start approximately 25 ft. (7.62 m) from starting point so that the unit is at maximum speed when starting the test.
- **Platform Rotate:** Platform level and completely rotated one direction. Rotate the opposite direction, Record Time. Rotate the other direction, Record Time.

- **Articulating Jib:** Platform level and centered with the boom. Start with the Jib down. Jib Up, Record Time. Jib Down, Record Time.
- **Lower Lift:** Upper Boom horizontal. Telescoped In. Lower Lift Up, Record Time. Lower Lift Down, Record Time.

**Test Notes:**

1. Stop watch should be started with the function, not with the controller or switch.
2. All speed tests are run from ground with remote control connected on the basket.
3. Function speeds may vary due to cold, thick hydraulic oil. Test should be run with the oil temperature above 100° F (38° C).

**1.5 HYDRAULIC PRESSURE SETTINGS - PSI (BAR)**

**Table 1-12. Pressure Settings**

MODEL	UNDERCARRIAGE Left and Right Control Valve		TOWER Control Valve	
	BAR	PSI	BAR	PSI
X13JP-X370AJ X15JP-X430AJ	180	2610	165	2393

**Table 1-13. Reductions Drive Speed Pressure Setting**

MODEL	AUTOMATIC REDUCTIONS DRIVE SPEED	
	BAR	PSI
X13JP-X370AJ X15JP-X430AJ	30	427

## 1.6 LUBRICATION

### Hydraulic Oil

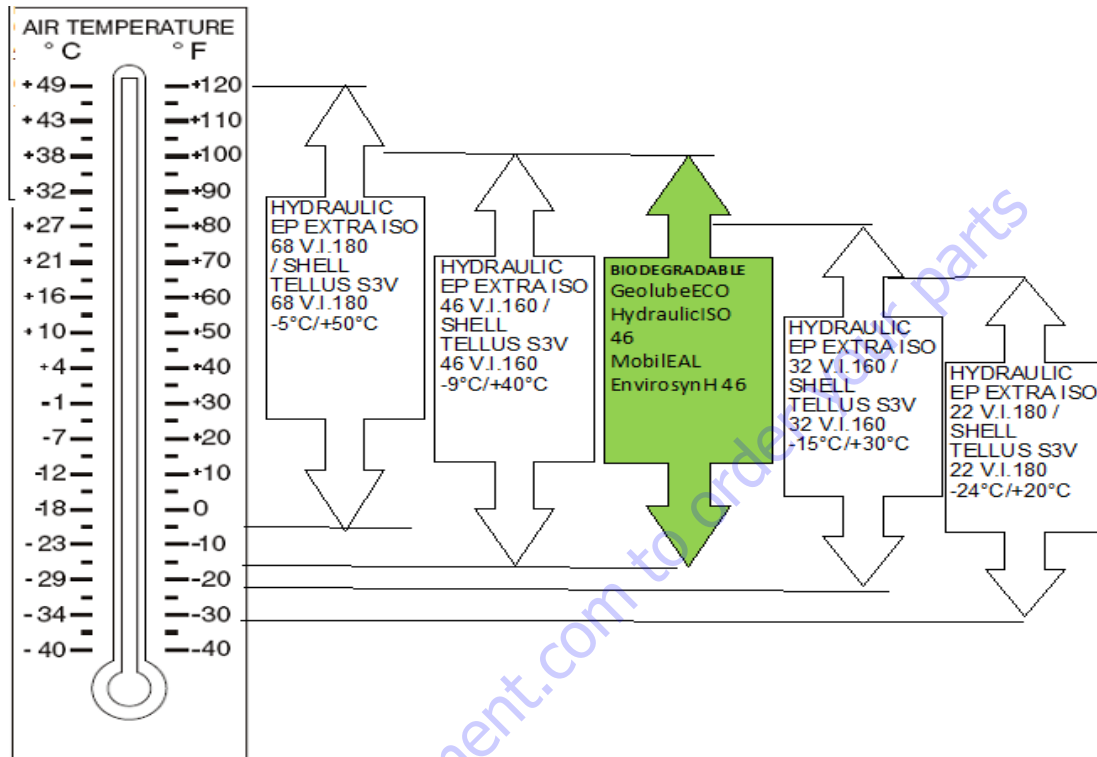


Figure 1-1. Hydraulic Oil Temperature Operating Range



## SECTION 1 - SPECIFICATIONS

FLUID	PROPERTIES		TYPE				CLASSIFICATIONS		
DESCRIPTION	Viscosity at 40°C (cst, Typical)	Viscosity Index	Mineral Oils	Vegetable Oils	Synthetic	Synthetic Polyol Esters	Readily Biodegradable*	Virtually Non-toxic**	Fire Resistant***
Pakelo Hydraulic EP Extra ISO 68	68	180	X						
Pakelo Hydraulic EP Extra ISO 46	46	160	X						
GeolubeECO Hydraulic ISO 46 (P/N 17527700)	47.3	144				X	X		
Pakelo Hydraulic EP Extra ISO 32	32	160	X						
Pakelo Hydraulic EP Extra ISO 22	22	180	X						
SHELL TELLUS S3V 68	68	180	X						
SHELL TELLUS S3V 46	46	160	X						
MobilEAL EnviroSynH46 (P/N2300029)						X	X		
SHELL TELLUS S3V 32	32	160	X						
SHELL TELLUS S3V 22	22	180	X						

**Table 1-14. Hydraulic Oil Specifications**

\* Readily biodegradable classification indicates one of the following: CO<sub>2</sub> Conversion > 60% per EPA 560/6-82-003 / CO<sub>2</sub> Conversion > 80% per CEC-L-33-A-93.

\*\* Virtually Non-toxic classification indicates an LC<sub>50</sub> > 5000 per OECD 203.

\*\*\* Fire Resistant classification indicates Factory Mutual Research Corp. (FMRC) Approval

Flash point (C.O.C) for 68-46-32-22: 210°C.

### 1.7 SERIAL NUMBER LOCATION

The serial number plate is fastening onto the frame on fork lifting pockets on X15JP/X430AJ and X13JP/X370AJ.

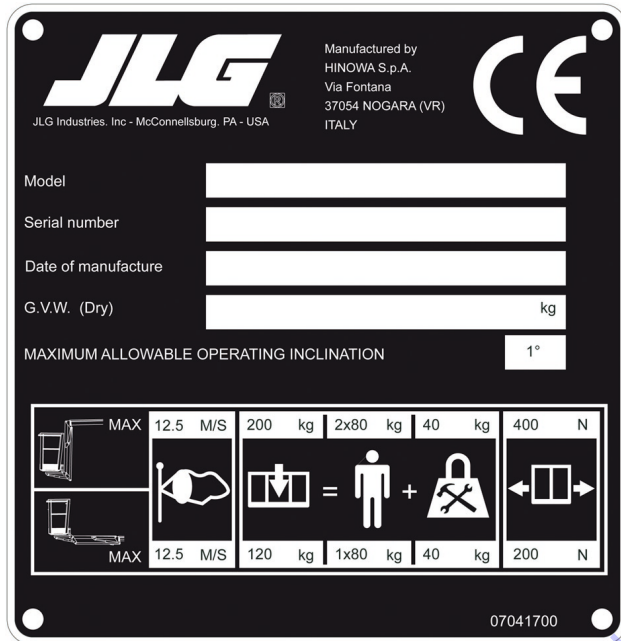


Figure 1-2. Serial Number Plate



Figure 1-3. Serial Number Plate Location

1.8 FASTENER TORQUE CHARTS

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)															
Size	TPI	Bolt Dia	Tensile Stress Area	SAE GRADE 5 BOLTS & GRADE 2 NUTS			SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*								
				Torque (Dry)	Torque Lubricated	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)	Clamp Load	Torque (Dry or Loctite® 263) K= 0.20	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or K= .18 140)	Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15					
		In	Sq In	IN-LB	IN-LB	IN-LB	FT-LB	IN-LB	IN-LB	FT-LB	IN-LB	IN-LB	FT-LB	IN-LB	IN-LB
4	40	0.1120	0.00604	8	9	0.9	6	0.7							
48	0.1120	0.00661	420	9	1.0	0.8									
6	32	0.1380	0.00909	580	16	1.8	12	1.4							
40	0.1380	0.01015	610	18	2.0	1.5									
8	32	0.1640	0.01400	900	30	3.4	22	2.5							
36	0.1640	0.01474	940	31	3.5	2.6									
10	24	0.1900	0.01750	1120	43	4.8	32	3.5							
20	0.1900	0.02000	1285	49	5.5	36	4								
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12					
28	0.2500	0.0364	2320	120	13.5	86	10	135	15						
		In	Sq In	LB	FT-LB	IN-LB	FT-LB	IN-LB	FT-LB	IN-LB	FT-LB	IN-LB	FT-LB	IN-LB	FT-LB
5/16	18	0.3125	0.0624	3340	17	23	13	18	19	26	16	22	35	20	25
24	0.3125	0.0660	3700	19	26	14	14	19	21	29	17	23	35	20	25
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38	45	60	55
24	0.3750	0.0878	5600	35	47	25	34	40	44	54	32	43	7900	50	35
7/16	14	0.4375	0.1063	6900	50	68	35	47	55	75	45	61	9550	70	95
20	0.4375	0.1187	7550	55	75	40	54	54	60	82	50	68	10700	80	110
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92	12750	110	150
20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108	133	14400	120	165
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133	16400	155	210
18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148	18250	170	230	
5/8	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183	20350	210	285
18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207	23000	240	325	
3/4	10	0.7500	0.3340	21300	260	353	200	285	368	240	325	30100	375	510	
16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363	33600	420	570	
7/8	9	0.8750	0.4620	29400	430	583	320	434	646	388	523	41600	605	825	
14	0.8750	0.5090	32400	470	637	350	475	550	707	425	576	45800	670	910	
1	1.0000	0.6060	38600	640	868	480	651	675	918	579	785	51500	860	1170	
12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858	59700	955	1355	
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968	68700	1290	1755
12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087	77000	1445	1965	
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368	87200	1815	2470
12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1788	1118	1516	96600	2015	2740	
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792	104000	2385	3245
12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2330	1506	2042	118100	2705	3660	
1 1/2	6	1.5000	1.4050	76000	1940	2630	1460	1979	2025	2754	1755	2379	126500	3165	4305
12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676	142200	3555	4835	

NO. 5000059 REV. K

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS  
 2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%  
 3. \* ASSEMBLY USES HARDENED WASHER

Figure 1-4. Torque Chart - Sheet 1 of 5 - (SAE Fasteners)

Values for Magni Coating Fasteners (Ref 4150701)												
Size	TPI	Bolt Dia	Tensile Stress Area	SAE GRADE 5 BOLTS & GRADE 2 NUTS				SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*				
				Clamp Load	Torque (Dry) K=0.17	Torque (Locite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.16	Torque (Locite® 262™ or TITE™ 131) K=0.15	Clamp Load	Torque (Dry or Locite® 263) K=0.17	Torque (Locite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.16	Torque (Locite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	380	7	0.8						
	48	0.1120	0.00661	420	8	0.9						
6	32	0.1380	0.00909	580	14	1.5						
	40	0.1380	0.01015	610	14	1.6						
8	32	0.1640	0.01400	900	25	2.8						
	36	0.1640	0.01474	940	26	2.9						
10	24	0.1900	0.01750	1120	36	4.1						
	32	0.1900	0.02000	1285	42	4.7						
1/4	20	0.2500	0.0318	2020	86	9.7	80	9	114	13		
	28	0.2500	0.0364	2320	99	11.1	95	11	131	15		
		In	Sq In	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	3340	15	20	14	19	20	25	20	25
	24	0.3125	0.0580	3700	15	20	15	21	20	25	20	25
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	35	20	25
	24	0.3750	0.0878	5600	30	40	28	38	25	34	20	25
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48	40	55
	20	0.4375	0.1187	7550	45	60	44	60	40	54	40	55
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75	60	80
	20	0.5000	0.1599	10700	75	100	71	97	65	88	60	80
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109	100	120
	18	0.5625	0.2030	12950	105	145	97	132	90	122	100	120
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156	145	175
	18	0.6250	0.2560	16300	145	195	136	185	125	170	160	190
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272	205	280
	16	0.7500	0.3730	23800	255	345	238	324	225	306	230	310
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435	355	485
	14	0.8750	0.5090	32400	400	545	378	514	355	483	370	500
1	8	1.0000	0.6060	38600	545	740	515	700	480	653	515	730
	12	1.0000	0.6630	42200	600	815	563	765	530	721	570	795
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809	680	965
	12	1.1250	0.8560	47500	755	1025	713	969	670	911	770	1085
1 1/4	7	1.2500	0.9690	53800	965	1300	897	1219	840	1142	870	1245
	12	1.2500	1.0720	59600	1055	1435	993	1351	930	1265	960	1365
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496	1040	1510
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707	1180	1785
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992	1265	2030
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237	1420	2265

NO. 500059 REV. K

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS  
 2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%  
 3. \* ASSEMBLY USES HARDENED WASHER

Figure 1-5. Torque Chart - Sheet 2 of 5 - (SAE Fasteners)

SECTION 1 - SPECIFICATIONS

SOCKET HEAD CAP SCREWS													
Magni Coating (Ref 4150701)*							Zinc Yellow Chromate Fasteners (Ref 4150707)*						
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K = .17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.15		Clamp Load See Note 4	Torque (Dry) K = .20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.15	
					IN-LB	[N.m]	IN-LB	[N.m]		IN-LB	[N.m]	IN-LB	[N.m]
		In	Sq In	LB	FT-LB	[N.m]	IN-LB	[N.m]	LB	FT-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604										
	48	0.1120	0.00661										
6	32	0.1380	0.00909										
	40	0.1380	0.01015										
8	32	0.1640	0.01400										
	36	0.1640	0.01474										
10	24	0.1900	0.01750										
	32	0.1900	0.02000										
1/4	20	0.2500	0.0318	2860	122	14	114	13	2860	143	16	129	15
	28	0.2500	0.0364	3280	139	16	131	15	3280	164	19	148	17
5/16	18	0.3125	0.0524	4720	20	25	20	25	4720	25	35	20	25
	24	0.3125	0.0580	5220	25	35	20	25	5220	25	35	25	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	7000	45	60	40	55
	24	0.3750	0.0878	7900	40	55	40	55	7900	50	70	45	60
7/16	14	0.4375	0.1063	9550	60	80	55	70	9550	70	95	65	80
	20	0.4375	0.1187	10700	65	90	60	80	10700	80	110	70	95
1/2	13	0.5000	0.1419	12750	90	120	85	110	12750	105	145	95	130
	20	0.5000	0.1599	14400	100	135	95	130	14400	120	165	110	150
9/16	12	0.5625	0.1820	16400	130	175	125	170	16400	155	210	140	190
	18	0.5625	0.2030	18250	145	195	135	185	18250	170	230	155	210
5/8	11	0.6250	0.2260	20350	180	245	170	230	20350	210	285	190	260
	18	0.6250	0.2560	23000	205	280	190	260	23000	240	325	215	290
3/4	10	0.7500	0.3340	30100	320	435	300	380	30100	375	510	340	460
	16	0.7500	0.3730	33600	355	485	335	455	33600	420	570	380	515
7/8	9	0.8750	0.4620	41600	515	700	485	620	41600	605	825	545	740
	14	0.8750	0.5090	45800	570	775	535	730	45800	670	910	600	815
1	8	1.0000	0.6060	51500	730	995	685	930	51500	860	1170	775	1055
	12	1.0000	0.6630	59700	845	1150	795	1080	59700	995	1355	895	1215
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	68700	1290	1755	1160	1580
	12	1.1250	0.8560	77000	1225	1665	1155	1570	77000	1445	1965	1300	1770
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	87200	1815	2470	1635	2225
	12	1.2500	1.0730	96600	1710	2325	1610	2190	96600	2015	2740	1810	2460
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	104000	2385	3245	2145	2915
	12	1.3750	1.3150	118100	2300	3130	2165	2945	118100	2705	3680	2435	3310
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	126500	3165	4305	2845	3870
	12	1.5000	1.5800	142200	3020	4105	2845	3870	142200	3555	4835	3200	4350

NO. 5000059 REV. K

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS  
 2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%  
 \*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM  
 4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

Figure 1-6. Torque Chart - Sheet 3 of 5 - (SAE Fasteners)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)											
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS					CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*						
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™)	Torque (Lub)	Torque (Loctite® 262™ OR VIBRA-TITE™ 131)	Torque (Loctite® 242™ or 271™ OR VIBRA-TITE™ 111 or 140)	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.20	Torque (Lub OR Loctite® 242™ or 271™ OR VIBRA-TITE™ 111 or 140) K = 0.18	Torque (Loctite® 262™ OR VIBRA-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]	[N.m]	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.3	1.0	1.2	1.4	3.13			
3.5	0.6	6.78	2.95	2.1	1.6	1.9	2.3	4.22			
4	0.7	8.78	3.82	3.1	2.3	2.8	3.4	5.47			
5	0.8	14.20	6.18	6.2	4.6	5.6	6.8	8.85			
6	1	20.10	8.74	11	7.9	9.4	12	12.5			
7	1	28.90	12.6	18	13	16	19	18.0	25	23	19
8	1.25	36.60	15.9	26	19	23	28	22.8	37	33	27
10	1.5	58.00	25.2	50	38	45	55	36.1	70	65	55
12	1.75	84.30	36.7	88	66	79	97	52.5	125	115	95
14	2	115	50.0	140	105	126	154	71.6	200	180	150
16	2	157	68.3	219	164	197	241	97.8	315	280	235
18	2.5	192	83.5	301	226	271	331	119.5	430	385	325
20	2.5	245	106.5	426	320	383	469	152.5	610	550	460
22	2.5	303	132.0	581	436	523	639	189.0	830	750	625
24	3	353	153.5	737	553	663	811	222.0	1065	960	800
27	3	459	199.5	1080	810	970	1130	286.0	1545	1390	1160
30	3.5	561	244.0	1460	1100	1320	1530	349.5	2095	1885	1575
33	3.5	694	302.0	1990	1490	1790	2090	432.5	2855	2570	2140
36	4	817	355.5	2560	1920	2300	2690	509.0	3665	3300	2750
42	4.5	1120	487.0	4090	3070	3680	4290	698.0	5685	5275	4395

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS  
 2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%  
 \*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM  
 4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

NO. 500059 REV. K

Figure 1-7. Torque Chart - Sheet 4 of 5 - (METRIC Fasteners)

Values for Magni Coated Fasteners (Ref 4150701)										
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS					CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE*					
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™) K=0.17	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.16	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.15	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.17	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.16	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.1	1.1	1.0	3.13			
3.5	0.6	6.78	2.95	1.8	1.7	1.5	4.22			
4	0.7	8.78	3.82	2.6	2.4	2.3	5.47			
5	0.8	14.20	6.18	5.3	4.9	4.6	8.85			
6	1	20.10	8.74	9	8.4	7.9	12.5	13	12	11
7	1	28.90	12.6	15	14	13	18.0	21	20	19
8	1.25	36.60	15.9	22	20	19	22.8	31	29	27
10	1.5	58.00	25.2	43	40	38	36.1	61	58	55
12	1.75	84.30	36.7	75	70	66	52.5	105	100	95
14	2	115	50.0	119	110	105	71.6	170	160	150
16	2	157	68.3	186	175	165	97.8	265	250	235
18	2.5	192	83.5	256	240	225	119.5	365	345	325
20	2.5	245	106.5	362	340	320	152.5	520	490	460
22	2.5	303	132.0	494	465	435	189.0	705	665	625
24	3	353	153.5	627	590	555	222.0	905	850	800
27	3	459	199.5	916	860	810	286.0	1315	1235	1160
30	3.5	561	244.0	1245	1170	1100	349.5	1780	1680	1575
33	3.5	694	302.0	1694	1595	1495	432.5	2425	2285	2140
36	4	817	355.5	2176	2050	1920	509.0	3115	2930	2750
42	4.5	1120	487.0	3477	3275	3070	698.0	4985	4690	4395

NO. 500059 REV. K

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

\*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM

4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

Figure 1-8. Torque Chart - Sheet 5 of 5 - (METRIC Fasteners)

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for manuals and parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

SEARCH

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information:

Manufacturer:

Model:

Description:

Quantity:

Part Number:

Part Name:

Part Description:

Part Location:

Part Condition:

Part Status:

Part Color:

Part Material:

Part Weight:

Part Dimensions:

Part Price:

Part Notes:

Submit

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on one of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar



## SECTION 2. GENERAL

### 2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

#### General

This section provides the necessary information needed by those personnel that are responsible to place the machine in operation readiness and maintain its safe operating condition. For maximum service life and safe operation, ensure that all the necessary inspections and maintenance have been completed before placing the machine into service. With proper care, maintenance and inspections performed per JLG's recommendations with any and all discrepancies corrected, this product will be fit for continued use.

#### Preparation, Inspection, and Maintenance

It is important to establish and conform to a comprehensive inspection and preventive maintenance program. The following table outlines the periodic machine inspections and maintenance recommended by JLG Industries, Inc. Consult your national, regional, or local regulations for further requirements for aerial work platforms. The frequency of inspections and maintenance must be increased as environment, severity and frequency of usage requires.

#### Pre-Start Inspection

It is the User's or Operator's primary responsibility to perform a Pre-Start Inspection of the machine prior to use daily or at each change of operator. Reference the Operator's and Safety Manual for completion procedures for the Pre-Start Inspection. The Operator and Safety Manual must be read in its entirety and understood prior to performing the Pre-Start Inspection.

#### Pre-Delivery Inspection and Frequent Inspection

The Pre-Delivery Inspection and Frequent Inspection shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

The Pre-Delivery Inspection and Frequent Inspection procedures are performed in the same manner, but at different times. The Pre-Delivery Inspection shall be performed prior to each sale, lease, or rental delivery. The Frequent Inspection shall be accomplished for each machine in service for 3 months or 150 hours (whichever comes first); out of service for a period of more than 3 months; or when purchased used. The frequency of

this inspection must be increased as environment, severity and frequency of usage requires.

Reference the JLG Pre-Delivery and Frequent Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of these inspections. Reference the appropriate areas of this manual for servicing and maintenance procedures.

#### Annual Machine Inspection

The Annual Machine Inspection must be performed on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. JLG Industries recommends this task be performed by a Factory-Trained Service Technician. JLG Industries, Inc. recognizes a Factory-Trained Service Technician as a person who has successfully completed the JLG Service Training School for the subject JLG product model. Reference the machine Service and Maintenance Manual and appropriate JLG inspection form for performance of this inspection.

Reference the JLG Annual Machine Inspection Form and the Inspection and Preventative Maintenance Schedule for items requiring inspection during the performance of this inspection. Reference the appropriate areas of this manual for servicing and maintenance procedures.

For the purpose of receiving safety-related bulletins, it is important that JLG Industries, Inc. has updated ownership information for each machine. When performing each Annual Machine Inspection, notify JLG Industries, Inc. of the current machine ownership.

#### Preventative Maintenance

In conjunction with the specified inspections, maintenance shall be performed by a qualified JLG equipment mechanic. JLG Industries, Inc. recognizes a qualified JLG equipment mechanic as a person who, by possession of a recognized degree, certificate, extensive knowledge, training, or experience, has successfully demonstrated the ability and proficiency to service, repair, and maintain the subject JLG product model.

Reference the Preventative Maintenance Schedule and the appropriate areas of this manual for servicing and maintenance procedures. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.

**Table 2-1. Inspection and Maintenance**

TYPE	FREQUENCY	PRIMARY RESPONSIBILITY	SERVICE QUALIFICATION	REFERENCE
Pre-Start Inspection	Prior to use each day; or At each Operator change.	User or Operator	User or Operator	Operator and Safety Manual
Pre-Delivery Inspection	Prior to each sale, lease, or rental delivery.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Frequent Inspection	In service for 3 months or 150 hours, whichever comes first; or Out of service for a period of more than 3 months; or Purchased used.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Annual Machine Inspection	Annually, no later than 13 months from the date of the prior inspection.	Owner, Dealer, or User	Factory-Trained Service Technician (Recommended)	Service and Maintenance Manual and applicable JLG inspection form.
Preventative Maintenance	At intervals as specified in the Service and Maintenance Manual.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual

## 2.2 SERVICE AND GUIDELINES

### General

The following information is provided to assist you in the use and application of servicing and maintenance procedures contained in this book.

### Safety and Workmanship

Your safety, and that of others, is the first consideration when engaging in the maintenance of equipment. Always be conscious of weight. Never attempt to move heavy parts without the aid of a mechanical device. Do not allow heavy objects to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

### Cleanliness

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when air, fuel, or oil lines are disconnected, clear adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.

3. Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

### Components Removal and Installation

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eye-bolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90 degrees.
3. If a part resists removal, check to see whether all nuts, bolts, cables, brackets, wiring, etc., have been removed and that no adjacent parts are interfering.

### Component Disassembly and Reassembly

When disassembling or reassembling a component, complete the procedural steps in sequence. Do not partially disassemble or assemble one part, then start on another. Always recheck your work to assure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

### Pressure-Fit Parts

When assembling pressure-fit parts, use an anti-seize or molybdenum disulphide base compound to lubricate the mating surface.

## Bearings

1. When a bearing is removed, cover it to keep out dirt and abrasives. Clean bearings in nonflammable cleaning solvent and allow to drip dry. Compressed air can be used but do not spin the bearing.
2. Discard bearings if the races and balls (or rollers) are pitted, scored, or burned.
3. If bearing is found to be serviceable, apply a light coat of oil and wrap it in clean (waxed) paper. Do not unwrap reusable or new bearings until they are ready to install.
4. Lubricate new or used serviceable bearings before installation. When pressing a bearing into a retainer or bore, apply pressure to the outer race. If the bearing is to be installed on a shaft, apply pressure to the inner race.

## Gaskets

Check that holes in gaskets align with openings in the mating parts. If it becomes necessary to hand-fabricate a gasket, use gasket material or stock of equivalent material and thickness. Be sure to cut holes in the right location, as blank gaskets can cause serious system damage.

## Bolt Usage and Torque Application

1. Use bolts of proper length. A bolt which is too long will bottom before the head is tight against its related part. If a bolt is too short, there will not be enough thread area to engage and hold the part properly. When replacing bolts, use only those having the same specifications of the original, or one which is equivalent.
2. Unless specific torque requirements are given within the text, standard torque values should be used on heat-treated bolts, studs, and steel nuts, in accordance with recommended shop practices. (See Torque Chart Section 1.)

## Hydraulic Lines and Electrical Wiring

Clearly mark or tag hydraulic lines and electrical wiring, as well as their receptacles, when disconnecting or removing them from the unit. This will assure that they are correctly reinstalled.

## Hydraulic System

1. Keep the system clean. If evidence of metal or rubber particles are found in the hydraulic system, drain and flush the entire system.
2. Disassemble and reassemble parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

## Lubrication

Service applicable components with the amount, type, and grade of lubricant recommended in this manual, at the specified intervals. When recommended lubricants are not available, consult your local supplier for an equivalent that meets or exceeds the specifications listed.

## Battery

Clean battery, using a non-metallic brush and a solution of baking soda and water. Rinse with clean water. After cleaning, thoroughly dry battery and coat terminals with an anti-corrosion compound.

## Lubrication and Servicing

Components and assemblies requiring lubrication and servicing are shown in the Lubrication Chart in Section 1.

## 2.3 LUBRICATION AND INFORMATION

### Hydraulic System

1. The primary enemy of a hydraulic system is contamination. Contaminants enter the system by various means, e.g., using inadequate hydraulic oil, allowing moisture, grease, filings, sealing components, sand, etc., to enter when performing maintenance, or by permitting the pump to cavitate due to insufficient system warm-up or leaks in the pump supply (suction) lines.
2. The design and manufacturing tolerances of the component working parts are very close, therefore, even the smallest amount of dirt or foreign matter entering a system can cause wear or damage to the components and generally results in faulty operation. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. Hydraulic system filters should be checked, cleaned, and/or replaced as necessary, at the specified intervals required in the Lubrication Chart in Section 1. Always examine filters for evidence of metal particles.
3. Cloudy oils indicate a high moisture content which permits organic growth, resulting in oxidation or corrosion. If this condition occurs, the system must be drained, flushed, and refilled with clean oil.
4. It is not advisable to mix oils of different brands or types, as they may not contain the same required additives or be of comparable viscosities. Good grade mineral oils, with viscosities suited to the ambient temperatures in which the machine is operating, are recommended for use.

**NOTE:** *Metal particles may appear in the oil or filters of new machines due to the wear-in of meshing components.*

**Hydraulic Oil**

Refer to Section 1 for recommendations for viscosity ranges.

**Changing Hydraulic Oil**

1. Filter elements must be changed after the first 50 hours of operation and every 300 hours (unless specified otherwise) thereafter. If it is necessary to change the oil, use only those oils meeting or exceeding the specifications appearing in this manual. If unable to obtain the same type of oil supplied with the machine, consult local supplier for assistance in selecting the proper equivalent. Avoid mixing petroleum and synthetic base oils. JLG Industries recommends changing the hydraulic oil annually.
2. Use every precaution to keep the hydraulic oil clean. If the oil must be poured from the original container into another, be sure to clean all possible contaminants from the service container. Always clean the mesh element of the filter and replace the cartridge any time the system oil is changed.
3. While the unit is shut down, a good preventive maintenance measure is to make a thorough inspection of all hydraulic components, lines, fittings, etc., as well as a functional check of each system, before placing the machine back in service.

**Lubrication Specifications**

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose grease requirements.

Should any question arise, regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Section 1 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

**2.4 CYLINDER DRIFT TEST**

Maximum acceptable cylinder drift is to be measured using the following methods.

**Cylinder Drift**

**Table 2-2. Cylinder Drift**

CYLINDER BORE DIAMETER		MAX ACCEPTABLE DRIFT IN 1 MINUTE	
INCHES	MM	INCHES	MM
2.1	55	0.02	0.53
2.3	60	0.021	0.54
2.5	65	0.013	0.35
2.7	70	0.026	0.68
2.9	75	0.013	0.35
3.1	80	0.011	0.29
3.7	95	0.009	0.23
3.9	100	0.007	0.2
4.5	115	0.005	0.15
4.9	125	0.004	0.12
6.1	155	0.002	0.07

Drift is to be measured at the cylinder rod with a calibrated dial indicator. The cylinder oil must be at ambient temperature and temperature stabilized.

The cylinder must have the normal load, which is the normal platform load applied.

If the cylinder passes this test, it is acceptable.

## 2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

1. Pinned joints should be disassembled and inspected if the following occurs:
  - a. Excessive sloppiness in joints.
  - b. Noise originating from the joint during operation.
2. Filament wound bearings should be replaced if any of the following is observed:
  - a. Frayed or separated fibers on the liner surface.
  - b. Cracked or damaged liner backing.
  - c. Bearings that have moved or spun in their housing.
  - d. Debris embedded in liner surface.
3. Pins should be replaced if any of the following is observed (pin should be properly cleaned prior to inspection):
  - a. Detectable wear in the bearing area.
  - b. Flaking, peeling, scoring, or scratches on the pin surface.
  - c. Rusting of the pin in the bearing area.
4. Re-assembly of pinned joints using filament wound bearings.
  - a. Housing should be blown out to remove all dirt and debris...bearings and bearing housings must be free of all contamination.
  - b. Bearing / pins should be cleaned with a solvent to remove all grease and oil...filament wound bearing are a dry joint and should not be lubricated unless otherwise instructed (i.e. sheave pins).
  - c. Pins should be inspected to ensure it is free of burrs, nicks, and scratches which would damage the bearing during installation and operation.

## 2.6 WELDING ON JLG EQUIPMENT

**NOTE:** This instruction applies to repairs, or modifications to the machine and to welding performed from the machine on an external structure, or component.

### Do the Following When Welding on JLG Equipment

- Disconnect the battery.
- Disconnect the moment pin connection (where fitted).
- Ground only to structure being welded.

### Do NOT Do the Following When Welding on JLG Equipment

- Ground on frame and weld on any other area than the chassis.
- Ground on turntable and weld on any other area than the turntable.
- Ground on the platform/support and weld on any other area than the platform/support.
- Ground on a specific boom section and weld on any other area than that specific boom section.
- Allow pins, wear pads, wire ropes, bearings, gearing, seals, valves, electrical wiring, or hoses to be between the grounding position and the welded area.

### NOTICE

**FAILURE TO COMPLY WITH THE ABOVE REQUIREMENTS MAY RESULT IN COMPONENT DAMAGE (I.E. ELECTRONIC MODULES, SWING BEARING, COLLECTOR RING, BOOM WIRE ROPES ETC.).**

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for manuals and parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

SEARCH

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information:

Manufacturer:

Model:

Description:

Quantity:

Part Number:

Part Name:

Part Description:

Part Location:

Part Condition:

Part Status:

Part Price:

Part Weight:

Part Dimensions:

Part Material:

Part Color:

Part Finish:

Part Coating:

Part Treatment:

Part Protection:

Part Packaging:

Part Labeling:

Part Marking:

Part Identification:

Part Tracking:

Part Inventory:

Part Control:

Part Management:

Part Optimization:

Part Innovation:

Part Research:

Part Development:

Part Production:

Part Distribution:

Part Sales:

Part Marketing:

Part Customer Service:

Part Support:

Part Training:

Part Education:

Part Certification:

Part Accreditation:

Part Registration:

Part Licensing:

Part Compliance:

Part Standards:

Part Best Practices:

Part Innovation:

Part Research:

Part Development:

Part Production:

Part Distribution:

Part Sales:

Part Marketing:

Part Customer Service:

Part Support:

Part Training:

Part Education:

Part Certification:

Part Accreditation:

Part Registration:

Part Licensing:

Part Compliance:

Part Standards:

Part Best Practices:

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## SECTION 3. CHASSIS &amp; TURNTABLE

## 3.1 RUBBER TRACK MAINTENANCE/REPLACEMENT

## Checking Track Tension

Stop the machine on a flat and solid ground. Raise the machine off the ground safely and, if needed, support it by applying stable blocks or jack stands under the undercarriage frame. In correspondence with the undercarriage central roller, measure distance "A" of the bottom of the roller to the hard internal part of the rubber belt. Track tension is normal if measure "A" is between 10 and 15 mm. If the tension is not within the above measure, or too tight, please follow the procedure illustrated in the following paragraph.

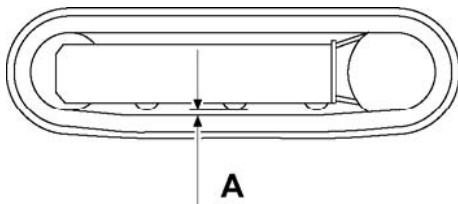


Figure 3-1. Tensioning Check 1

As an alternative to the above-mentioned procedure, you can follow the procedure below. In this case, the check is less accurate and precise. However, effective for evaluating if the rubber track is too slack.

Stop the machine on a flat and solid ground. In correspondence of the upper skid of the carriage, measure distance of the bottom of the skid to the hard internal part of the rubber belt, lifting the belt manually. The track tension is normal if measure "A" is between 10 and 15 mm. If the tension is not within the above measure, or too tight, please follow the procedure illustrated in the following paragraph.

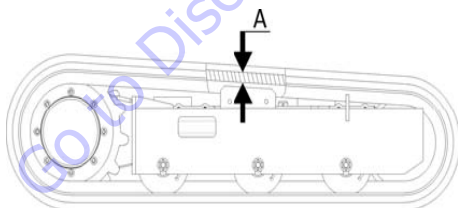


Figure 3-2. Tensioning Check 2

## Tensioning Rubber Track

**⚠ DANGER**

**THE GREASE CONTAINED IN THE HYDRAULIC TRACKS IS UNDER PRESSURE. IF THE VALVE TRACK TENSION IS TOO LOOSE, IT COULD BE EXPELLED UNDER THE EFFECT OF THE PRESSURE OF GREASE, SERIOUSLY ENDANGERING THE SAFETY OF THE OPERATOR.**

**WHEN GRAVEL OR MUD IS STUCK BETWEEN THE SPROCKET TEETH AND TRACK LINKS, REMOVE IT BEFORE TIGHTENING THE TRACKS.**

To tighten the tracks, connect a grease gun to grease fitting 2 and add grease until the track tension reaches the indicated values (preferably use a pneumatic pump with 100 bar operating pressure). Before start the machine clean up any grease spillage.

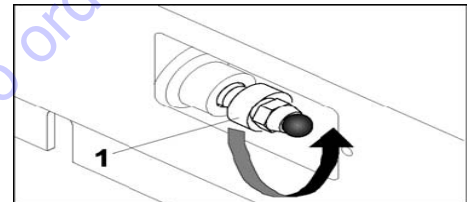


Figure 3-3. Tensioning Valve

## Removing Rubber Track

Stop the machine on a flat and solid ground. Raise the machine off the ground safely and, if needed, support it by applying stable blocks or jack stands under the undercarriage frame.

1. To loosen the track, slowly unscrew grease release valve (1) counterclockwise for no more than a turn. If the grease does not start drain, slowly rotate the track. If also in this case the grease not emerges repeat the rotation of a lap of the valve and then slowly rotate the track. Repeat these steps until the grease begins to drain by unscrewing the valve of not more than one turn at a time.

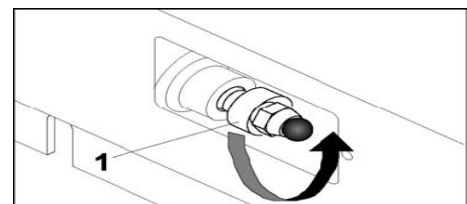


Figure 3-4. Draining Valve

**⚠ DANGER**

THE GREASE CONTAINED IN THE HYDRAULIC TRACKS IS UNDER PRESSURE. IF THE VALVE TRACK TENSION IS TOO LOOSE, IT COULD BE EXPULSED UNDER THE EFFECT OF THE PRESSURE OF GREASE, SERIOUSLY ENDANGERING THE SAFETY OF THE OPERATOR.

2. Use a pry bar (4) of adequate length to force a tooth of the central wheel out of the idler, then rotate the track slowly (5) using the pry bar to help it out, if necessary. Force (6) sideways to slide the track and lift it from the idler.

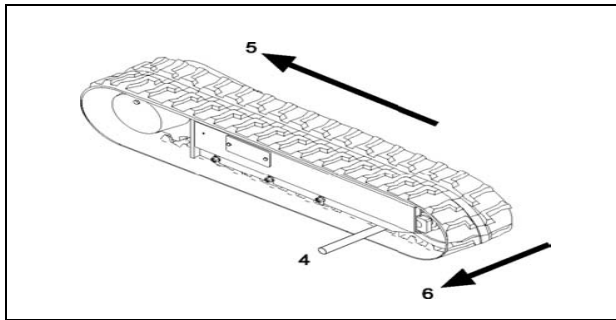


Figure 3-5. Removing Rubber Track Example

### Installing Rubber Track

1. Starting with the machine undercarriage raised in conditions of safety provided of suitable supports stable below the undercarriage frame to support the machine.

**⚠ DANGER**

BEFORE INSTALLING THE RUBBER TRACKS, MAKE SURE THAT YOU ARE ALWAYS IN SAFE CONDITIONS WITH THE MACHINE SUSPENDED FROM THE GROUND.

2. Check that the grease contained in the hydraulic cylinder has been removed.
3. Mesh the track links with the track teeth of sprocket wheel and place the other end of the track on the idler.
4. Rotate the drive wheel to reverse slowly (7) pushing into the frame. If necessary, help yourself with a pry bar (8), especially to "walk" the first teeth in past the idler.

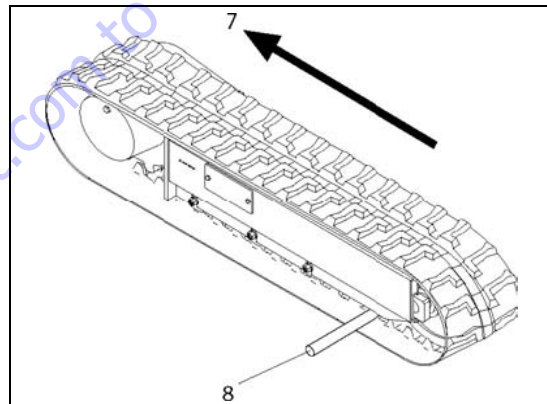


Figure 3-6. Rubber Track Installation Example

5. Make sure that the track links are properly meshed in the sprocket and idler.
6. Adjust the track tensioning "Tensioning rubber track".
7. Lower the undercarriage down to the ground.



## 3.2 UNDERCARRIGE COMPONENTS

### Machine Positioning

1. Stabilize the machine on level ground.
2. Fully extend the undercarriage.
3. Remove the tracks (see sub-section 3.1).
4. Remove the key ignition, and a tag with warning do no start the machine.

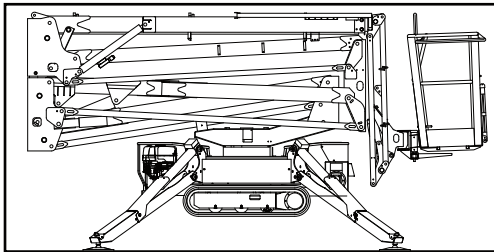


Figure 3-7. Machine Positioning

### Replacement Roller Lower Wheel and Tracks Adjuster

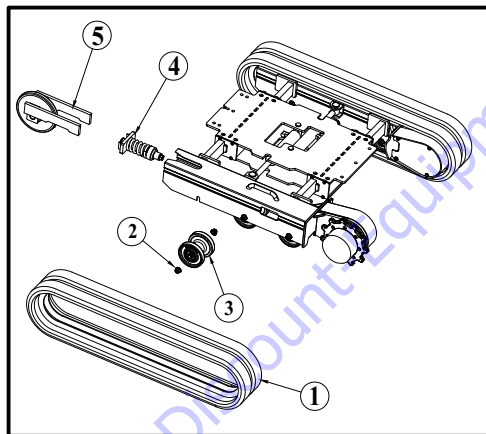


Figure 3-8. Replacement Roller Lower Wheel And Tracks Adjuster

### Disassembly

1. Remove the nuts 2 on the lower roller.
2. Remove the lower roller 3.
3. Remove the front idler 5.
4. Remove the tracks adjuster 4.

### Assembly

1. Fit the tracks adjuster 4.
2. Install the front idler 5.
3. Install the lower roller 3.
4. Apply loctite 243 and torque the nuts 2 on the lower roller at 125 Nm (92 ft. lbs.).

### Replacement Sprocket and Gear Motor

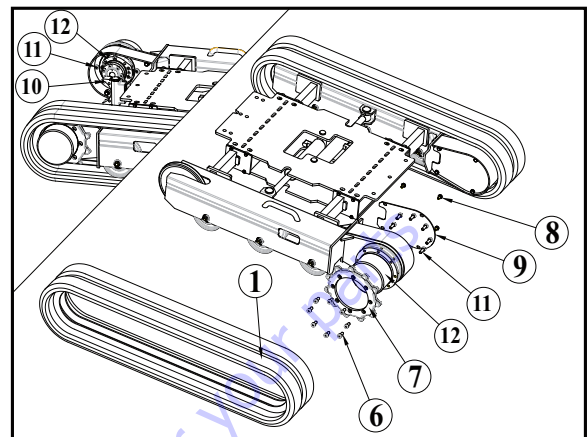


Figure 3-9. Replacement Sprocket And Gear Motor

### Sprocket Removal

1. Fully extend the undercarriage.
2. Remove the tracks (see sub-section 3.1).
3. Remove the key ignition, and a tag with warning do not start the machine.
4. Remove screws 6.
5. Remove the sprocket 7.

### Gear Motor Removal

1. Remove cover 9.
2. Disconnect and tag the hydraulic hoses from the gear motor.
3. Remove the valve 10 to access all the screws 11 (on single speed versions only).
4. Remove the screws 11.
5. Remove the gear motor 12.

### Gear Motor Installation

1. Fix the screws 11.
2. Instal the valve 10.
3. Connect the Hydraulic hoses.
4. Instal the cover 9.

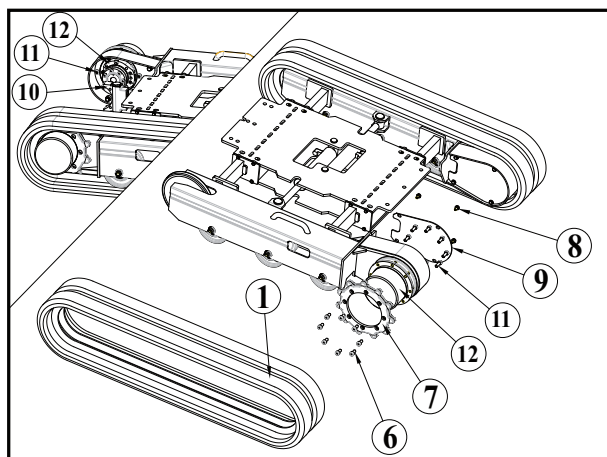


Figure 3-10. Gear Motor Installation

### Sprocket Installation

1. Instal the sprocket.
2. Instal the screws 6.

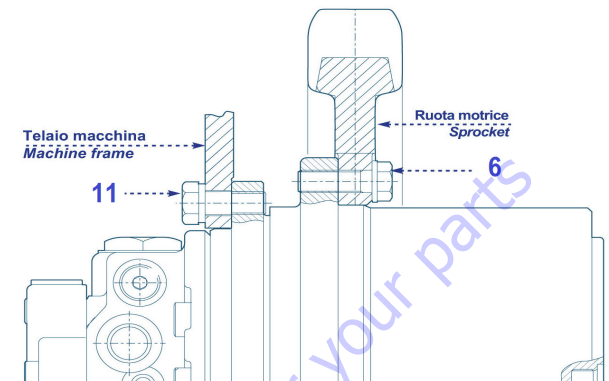


Figure 3-11. Sprocket Installation

Table 3-1. Final Drive Torque Values

MACHINE MODEL	SPROCKET SCREW N. 6 TORQUE VALUES	FINAL DRIVE SCREW N. 11 TORQUE VALUES
X13JP-X370AJ X15JP-X430AJ	M10x18 - Nm 50	M10x25 - Nm 70

### 3.3 TRACKS EXTENSION REMOVAL

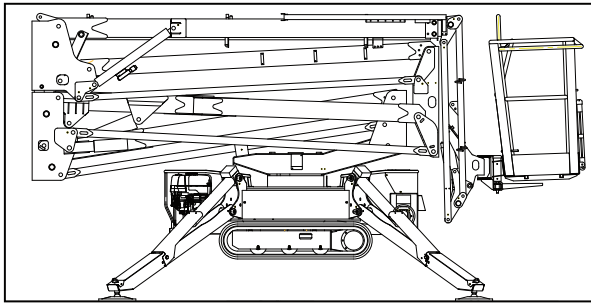


Figure 3-12. Sprocket Installation

1. Stabilize the machine on level surface.
2. Fully extend the undercarriage.
3. Turn OFF the machine.
4. Remove the key ignition, and a tag with warning do not start the machine.
5. Open the hydraulic cap, and operate the function undercarriage extend/retract to discharge any residual pressure in the system.

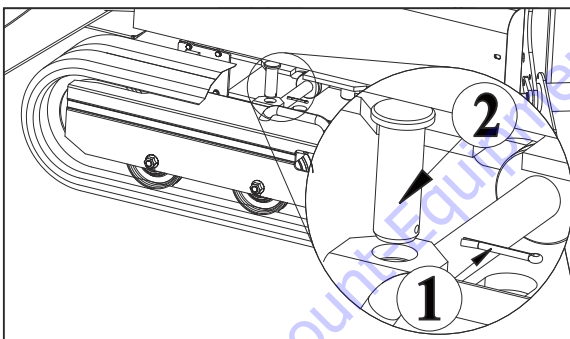


Figure 3-13.

6. Remove the cotter pin 1 - Figure 3-13.
7. Remove the pin 2.

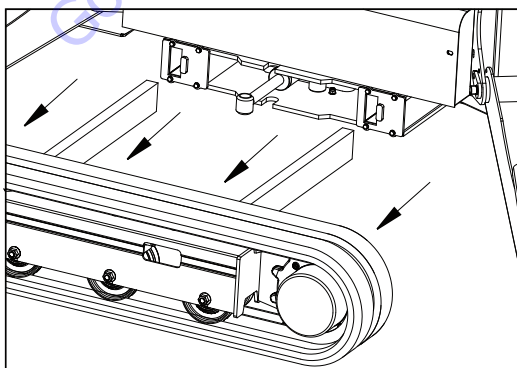


Figure 3-14.

8. Using a suitable lifting device to remove the track frame.

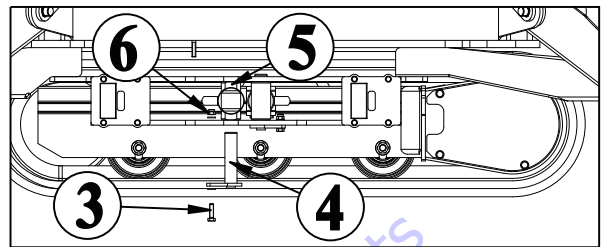


Figure 3-15.

9. Remove screw and nut 3 and 6.
10. Remove the pin 4.
11. Disconnect, tag and plug the hydraulic hoses from the cylinder extension.

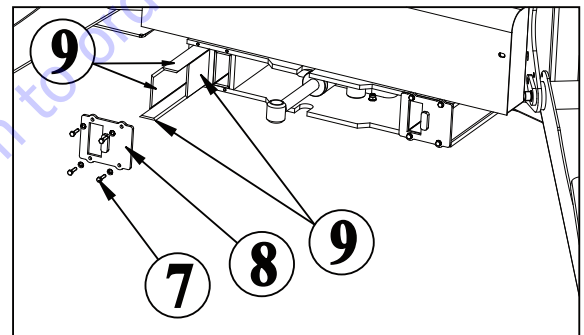


Figure 3-16.

12. Remove the cylinder.

**NOTE:** Before to install the undercarriage frame inspect the slide guides 9.

- a. Unscrew the screws 7.
- b. Remove the stop slide guides 8.
- c. Remove the slide guides 9.
- d. Check the thickness of slide guides, if less than 3.5 mm, damage, with deep scratches or with deformation, replace it. Otherwise clean them and install by adding Grease GR MU EP1 before to install the track guides.
- e. Use medium strength Loctite (Loctite 243) on screws 7 and tightening torque of 10 Nm (7 ft. lbs.).

### 3.4 TRACK DRIVE

Table 3-2. Final Drive Models

MACHINE	TYPE	SPEED
X13JP-X370AJ X15JP-X430AJ	700C1H40 C/F	STANDARD SPEED
X13JP-X370AJ X15JP-X430AJ	700C2K1:32	AUTO TWO SPEED

#### Product Identification

The data to identify the product are shown on the identification plate.

#### Information

For all enquiries regarding general information on the product, spare parts, assistance etc, always give the identification data stamped on the ID plate.

The gear motor has two ID plates; one gives data on the gearbox and the other data on the hydraulic motor.

The plates must not be removed or damaged during the life of the product. The following illustration shows how the data is set out.

**NOTE:** Refer to the supplier final drive applicable Service Manual - Bonfiglioli Trasmital MAN\_serie 700CK\_IS.doc. Rev17.

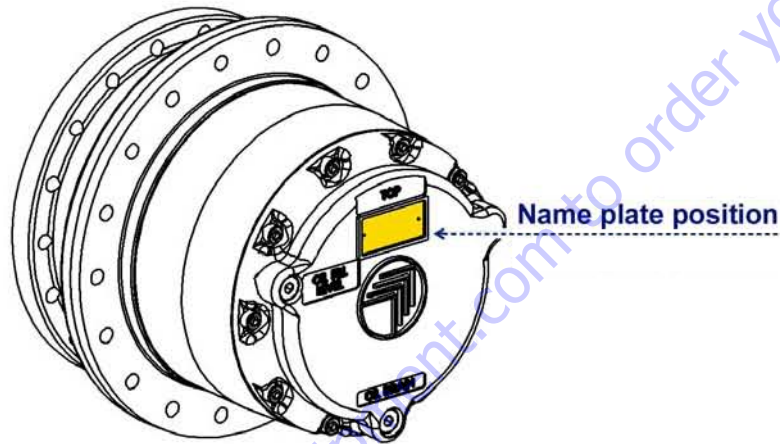


Figure 3-17. Name Plate Position

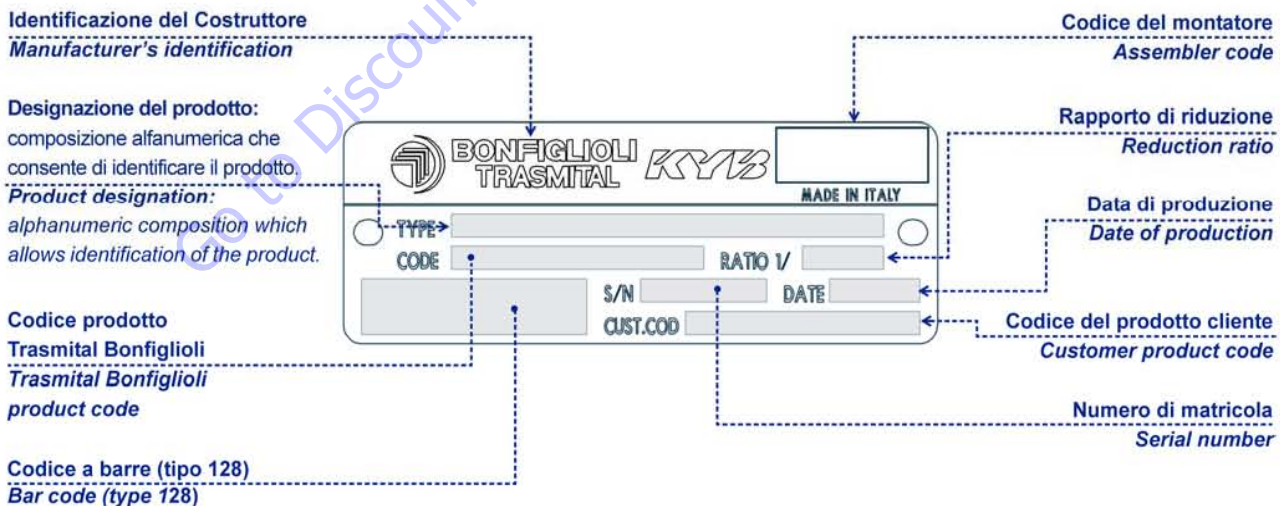


Figure 3-18. Plate

### 3.5 SWING DRIVE (IMO)

#### Technical Data – Type Plate

**IMO ANTRIEBSEINHEIT**

Drawing No.

Identification - Code

Module

**www.imo.de**

**Figure 3-19. Type Plate**

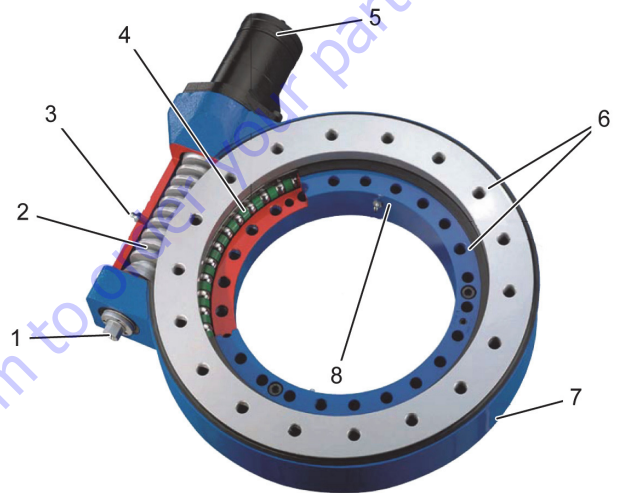
The type plate is on the housing and contains the following information:

- Manufacturer
- Drawing no./type
- Identification code consisting of: Order number, year of manufacture and consecutive number
- Module
- Web address

#### Structure and Function

##### Brief description

Slew drives are used for concurrent transmission of axial and radial forces, as well as transmission of tilting moments. Slew drives consist of a ball or roller slewing ring, hydraulic or electric drives, and a completely enclosing housing. Force is transmitted to the mounting structure through bolts. For this purpose through holes or threads are provided in the inner and outer ring.



**Figure 3-20. Slew Drive WD-L**

1. Connection for options: Potentiometer, permanent brake or front-end brake
2. Worm shaft
3. Lubricating nipple
4. Ball slewing ring
5. Option: Drive motor
6. Bolted unions for the mounting structure
7. Housing
8. Lubricating nipple

## Structure and Function

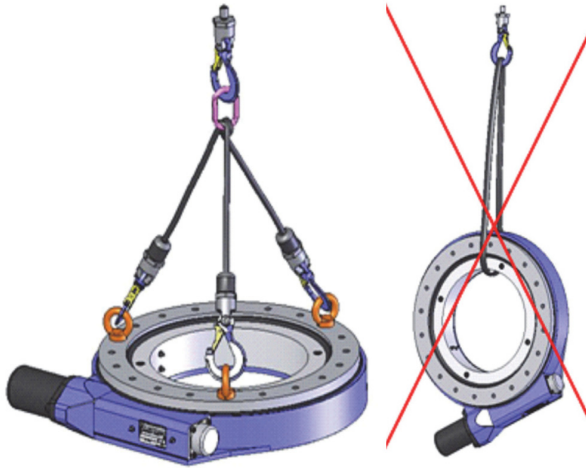


Figure 3-21. Use Suitable Lifting Gear - Never Transport Product

Unpacked sleew drives can be transported with lifting gear when using eye bolts under the following conditions.

- The lifting gear must be configured appropriately for the weight of the transport units.
- The ring bolts must be configured appropriately for the weight of the transport unit.
- The sleew drive shall only be transported by itself, without attached parts.
- Maintain the insertion depth prescribed by the manufacturer.
- If insertion depth is not prescribed, then a minimum insertion depth of 1.5 x the bolt diameter must be selected.
- Transport within the company shall only be executed horizontally.

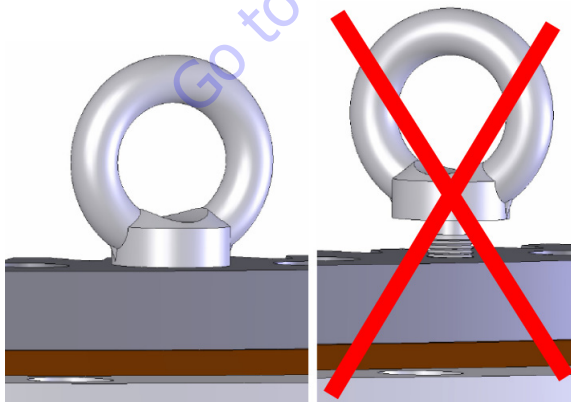


Figure 3-22. Always Use The Full Length Of The Thread

## Maintenance Tasks

### Inspecting The Mounting Bolts

#### NOTICE

TO COMPENSATE FOR SETTLING, THE BOLTS MUST BE RETIGHTENED WITH THE PRESCRIBED TIGHTENING TORQUE. RETIGHTENING MUST BE EXECUTED WITHOUT EXERTING ADDITIONAL EXTERNAL STRESS ON THE BOLTED UNION.

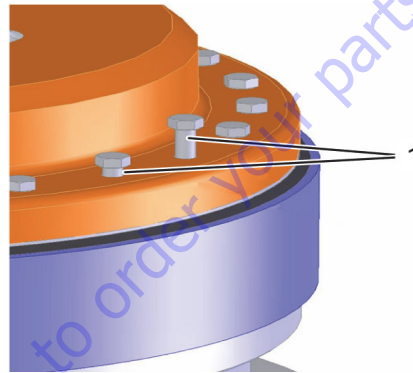


Figure 3-23. Inspecting The Mounting Bolts

1. Detached bolt

Execution only by a specialist.

- Special tools required:
  - Torque wrench
  - Hydraulic clamping fixture
- Replace loose and detached bolts or nuts and washers with new bolts, nuts and washers.
- Use the same bolt size and bolt quality.

## Lubricating The Slew Drive

### NOTICE

REGULARLY LUBRICATE THE SLEW DRIVES TO PROLONG THEIR SERVICE LIFE AND ENSURE SAFE OPERATION.

### NOTICE

ALWAYS USE THE LUBRICANTS SPECIFIED IN THE ORDER DRAWING. IF USING OTHER LUBRICANTS PAY ATTENTION TO THE RELATIVE MIX ABILITY OF THE SUBSTANCES. THE STANDARD LUBRICANTS USED ARE "R.TECC NORPLEX LKP2" FROM RHENUS, OR THE GREASE "OPTIMOL LONGTIME PDO" FROM CASTROL. IF IN DOUBT, OR IF THERE IS NO SPECIFICATION ON THE DRAWING, CONSULT WITH OUR CUSTOMER SERVICE. USING THE WRONG LUBRICANT MAY CAUSE DAMAGE TO THE SLEW DRIVES AND REDUCE THE SERVICE LIFE. IN THIS CASE, ANY WARRANTY SHALL BE EXCLUDED. COMPLY WITH THE INSTRUCTIONS PROVIDED BY THE LUBRICANT MANUFACTURER.

- If possible, use a central lubrication system to lubricate the raceway system. In this regard ensure that the hoses are filled with grease at commissioning and that the storage tanks are regularly topped up with grease.
- An automatic re-lubricating system significantly facilitates re-lubrication for the raceway system and the toothing. Functional safety as well as wear behavior are improved.
- Comply with the instructions in the operating manual provided by the respective manufacturer for lubrication of optional intermediate gear units, brakes, and motors.
- If it is evident that moisture has penetrated into the slew drive, or has been absorbed by the grease, you must re-lubricate more intensively.

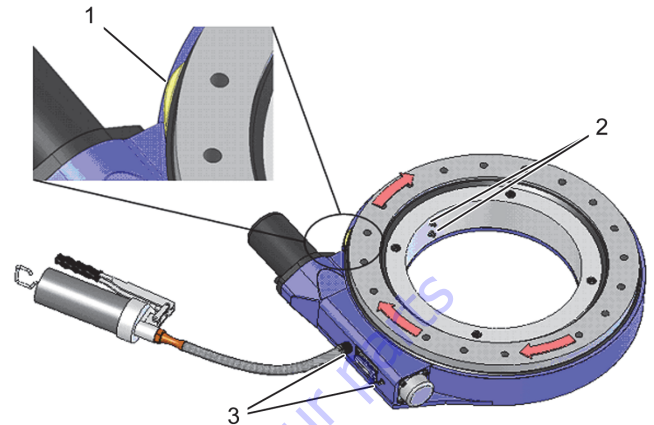


Figure 3-24. Lubricating The Slew Drive

1. Fresh lubricant.
2. Lubricating nipple, bearing ring.
3. Lubricating ring housing.
4. In succession, press grease into all lubricating nipples while simultaneously turning the slew drive all the way through, until a continuous collar of grease forms under at least one seal.
5. Ensure that old lubricant can escape without obstruction.

**3.6 POWER SYSTEM X15JP - X430AJ**

The X15JP - X430AJ can be configured as twin powered, which include an engine Gasoline or Diesel and a fixed speed electric motor single phase, or electrical Lithium battery pack. On the twin-powered models, the engine or electric motor cannot be switched ON simultaneously.

The Lithium powered, have a battery pack that command a variable speed electric motor three-phases.

The Table 3-3 (below) shows the engine speeds of the twin powered according to the function activated:

**NOTE:** For the outriggers function, the engine revs will automatically regulate follow the position of the outriggers. With all outriggers lift from the ground, the engine run at max rpm, with one or more outriggers in contact to the ground, the engine run at min rpm.

For the functions set with the summing oil flow, the sum of the oil flow is feasible while operating the function only and not in combine with other functions at the same moment.

For the time of activation of multiple areal functions at the same moment with jib, basket rotation and basket leveling, the engine will run at min rev.

Summing oil flow<sup>(1)</sup> - Functions in which both of the hydraulic pumps send the oil flow in the same function circuit.

**Table 3-3.**

FUNCTION	Gasoline & Diesel Speed Selection		
	TURTLE	NORMAL	HARE
TRACKS	MIN	MAX	MAX + SECOND SPEED
TRACKS WIDENING	MED	MAX	MAX
1-2 BOOMS UP Summing oil flow <sup>(1)</sup>	MIN	MED	MED
1-2 BOOMS DOWN	MIN	MED	MED
3 BOOM UP	MIN	MED	MED
3 BOOM DOWN	MIN	MIN	MIN
1-2 AND 3 BOOMS TOGETHER WITH AT LEAST ONE UP	MIN	MAX	MAX
1-2 AND 3 BOOMS TOGETHER, NONE UP	MIN	MED	MED
TELESCOPE OUT Summing oil flow <sup>(1) (2)</sup>	MIN	MAX	MAX
TELESCOPE IN	MIN	MAX	MAX
SLEW ROTATION	MIN	MED	MED
JIB	MIN	MIN	MIN
BASKET ROTATION	MIN	MIN	MIN
BASKET LEVELLING	MIN	MIN	MIN



### Electric Motor Function System

Operating with the electric motor, there is unique functions speed.

Summing oil flow <sup>(2)</sup> - Operating with the electric motor the sum of the oil flow is feasible for telescope function only.

### Engine RPM Control System

The demand of the appropriate pre set engine rev come from the Master board (ECM1) and signal is sent through the Engine relays board, Engine bridge box 1 and 2 to the electronic board (Honda Engine) or to the piston actuator for the Diesel engines.

The Engine relays board is the same for gasoline or diesel machines, even some relay has different functions. The Engine relays board and the bridge boxes 1 and 2 are mounting in the electric components compartment, on machine rear side.

See Figure 3-25. Engine relays board mount below the Modem board.

See Figure 3-26. Engine bridge boxes 1 and 2 mounted at the side of the hydraulic pumps coupling.

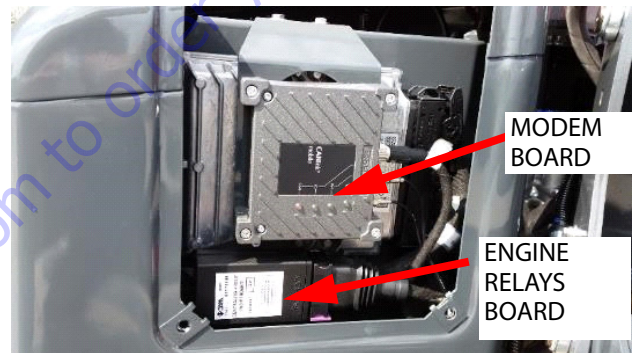


Figure 3-25.

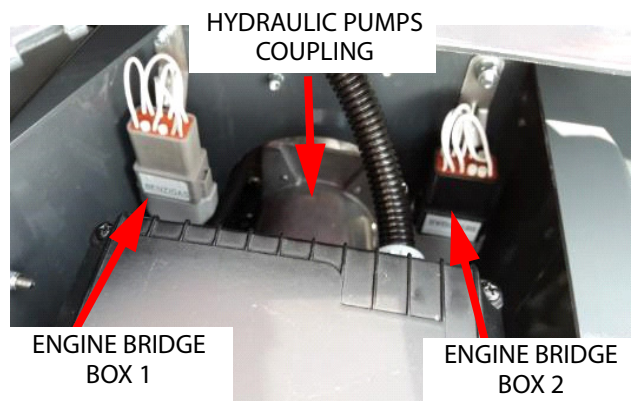


Figure 3-26.

**Twin Power Units With Gasoline Engine Honda IGX390**

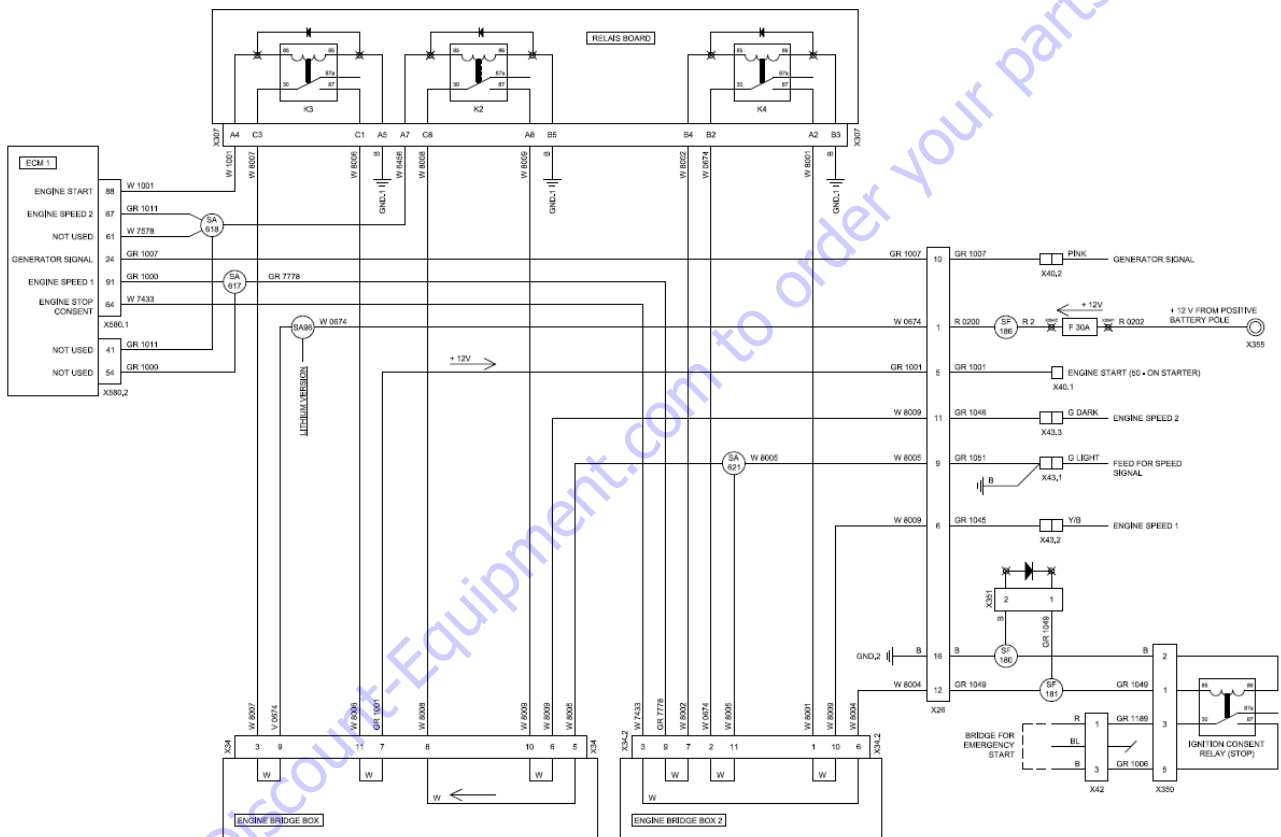


Design	4 strokes, overhead camshaft
Ignition system	CDI
Ignition timing	variable ignition timing
Number of cylinders	single cylinder inclined by 25°
Displacement	389 cm <sup>3</sup>
Bore per Stroke	88/64 mm
Cooling system	forced air
Net power	8,7 kW at 3600 rpm
Continuous net power	7,0 kW at 3600 rpm
Maximum net torque	26,4 N*m at 2500 rpm
Fuel consumption at continuous net power	3,5 L/h at 3600 rpm
Compression ratio	8,2:1
Lubricating system	butterfly valve type
Oil capacity	1,1 l
Starting system	Recoil and starter motor
Stopping system	Ignition primary circuit open
Carburetor	Floating valve type
Air cleaner	Dual element type
Governor	STR (self turning regulator) governor

The ECM1 module correspond to the Honda electronic unit control by two contacts through which are prearranged preset the rpm's. The two contacts in the ECM1

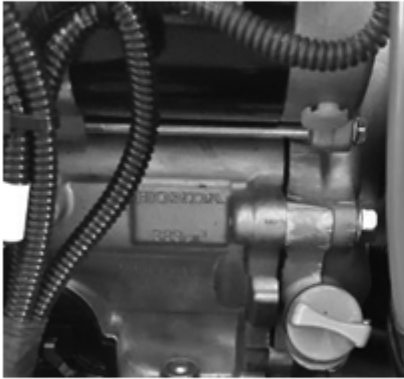
module are the "ENGINE SPEED 1" and "ENGINE SPEED 2", and the engine rpm's regulate as the following conditions:

ENGINE SPEED 1	ENGINE SPEED 2	RPM
OFF	OFF	MIN
ON	OFF	MED
OFF	ON	MAX

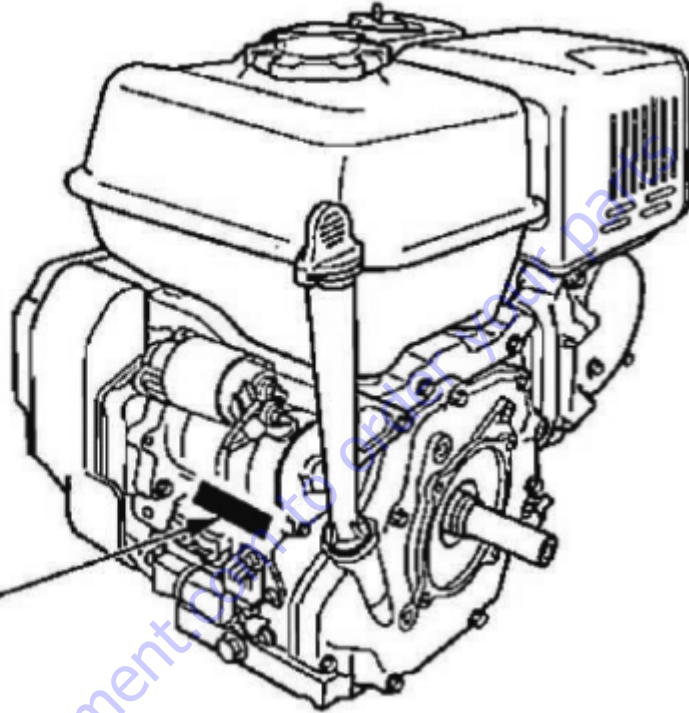


**Serial Number Location**

The serial number is stamped on the cylinder block.  
Refer to this when ordering parts or making technical inquiries.



SERIAL NUMBER  
LOCATION

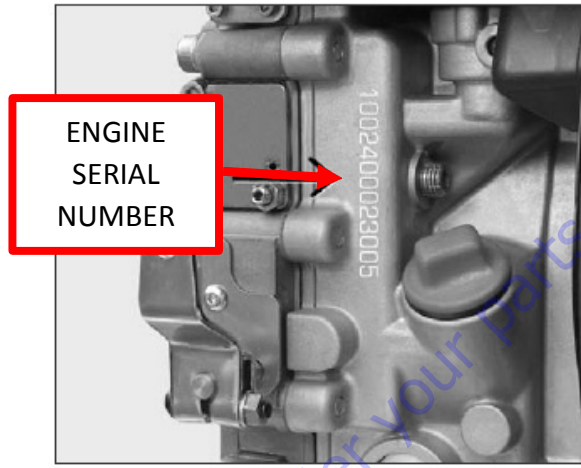


Go to Discount-Equipment.com

**Twin Power Unities With Diesel Engine Hatz 1B40**

Design	4 stroke
Injection	Direct
Number of cylinders	1
Displacement	462 cm <sup>3</sup>
Bore/Stroke	88/76 mm
Fuel tank capacity	5 l
Cooling system	Air
Lubricating oil pressure (oil temperature 100C)	2,5 bars at 3000 rpm
Lubricating oil capacity (with oil sump)	3,2 l
Max lubricating oil consumption (after running in)	1% of fuel consumption at full load
Direction of rotation, power take-off end	Anti-clockwise
Valve clearance 10-30C	0,10 mm
Weight (incl. fuel tank, air cleaner, exhaust silencer, recoil starter and electric starter)	Approx. 55 Kg

**Type Plate**



The type plate is placed on the cylinder head insulating hood and includes the following details:

1. Engine type
2. Code (only for special equipment)
3. Engine serial number (stamp on the cylinder block)
4. Max. Engine speed  
For spare parts orders it is necessary to mention these data (also see spare parts list).

Go to Discount-Equipment.com to order your parts



## Lithium Powered Unities

### 36V Lithium Battery System



#### System Function

The level of charge of the lithium pack is shown by the icon on the right lower corner of the display, while more detail are reachable in service menu input SOC (State Of Charge).

With the State of Charge (SOC) lower than 21%, the remote control beeper is activated to inform the operator that battery pack need to be charged.

When SOC is lower than 11%, inverter feeds the electric motor to run at half of the usual revs speed.

When SOC is lower than 6%, inverter feeds the electric motor to run at lowest rev speed, and the following icon are displayed o remote control display:



“EXTRA LOW SPEED” ICON



“CONNECT TO THE ELECTRIC GRID” ICON

With SOC at 0%, the machine could not be operate and the icon "CONNECT TO THE ELECTRIC GRID" is displayed in the middle of the remote control display.

## Lithium Cells

Number of cells in the battery pack	24 cells, 12 couples of cells connected in series
Nominal voltage of each cell	3 Volt
Capacity of one cell	50 Amps/h
Nominal features of the complete pack	36 Volt -100 Amps/h
Max cell nominal voltage	3,7 Volt
Min cell operating voltage	2,5 Volt
DOD	90%
Charge cycles	2000 full cycles
Memory effect	NO

Lithium cells are managed by BMS (Battery Management System) that continuously manages charge and discharge operations, monitors cells parameters including their tensions and their temperatures, while in case of failure opens the internal contactor insulating the Lithium pack.

#### Battery Charger

The on-board battery charged is activated when its plugged, if present it has to be used the plug fitted on the lithium pack, otherwise the one close to the magneto-thermal switch.

#### DC-DC Transformer

The Lithium system works at 36 nominal Volt, while the machine electrical components and electronic system electronic boards are feed at 12 Volt, so Lithium system includes a DC-DC transformer that convert the 36 Volt into 12 Volt.

Machine is equipped with a lead battery 12 Volt required to switch ON the Lithium system.



**Electric Motor**

Three-phase
36 Volt
2000 Watt

Electric motor is fed through an inverter that converts the lithium pack direct current (DC) into alternative three-phase current.

**Electric Motor Three-Phase Control Speed System**

ECM1 module communicates the required preset rpm revs to the inverter, then the inverter feed the electric motor with the correct frequency in order to achieve the nominal revs selected.

The ECM1 module, by the speed sensor placed on the electrical motor verify that the revs are those expect.

The Table 3-4 (below) shows the range electric motor revs according to the function activated:

**Table 3-4.**

Function	electric motor revs (Rpm)		
	TURTLE	NORMAL	HARE
TRACKS	1500	2100	2100 + SECOND SPEED
TRACKS WIDENING	1500	2100	2100
1-2 BOOMS DOWN (Summing oil pumps flow)	750	1500	1500
1-2 BOOMS DOWN	750	1500	1500
3 BOOM UP	750	1800	1800
3 BOOM DOWN	750	1500	1500
1-2 AND 3 BOOMS TOGETHER WITH AT LEAST ONE UP	1500	1800	1800
1-2 AND 3 BOOMS TOGETHER, NONE UP	1050	1500	1500
TELESCOPE OUT (Summing oil pumps flow)	1500	1800	1800
TELESCOPE IN	1500	1800	1800
SLEW ROTATION	750	1500	1500
JIB	750	1050	1050
BASKET ROTATION	750	1050	1050
BASKET LEVELLING	750	1050	1050

**NOTE:** For the outriggers function, the electric motor revs will automatically adjusted follow the position of the outriggers. With all outriggers lift from the ground, the electric motor run at max revs, with one or more outriggers in contact to the ground, the electric motor run at min revs. Operating the counter clocking turn of the tracks the electric motor revs are set at lower speed.

For the time of activation of multiple areal functions at the same moment with jib, basket rotation and basket leveling, the engine will run at min rev.

For the functions set with the summing oil flow, the sum of the oil flow is feasible while operating the function only and not in combine with other function/s at the same moment.

### Temperature Ongoings (Heaters and Fans)

Lithium battery pack discharge and/or recharge, with positive lithium battery level (SOC>0), is possible over -10°C.

In cold environmental temperature (not lower than -25°C), the on-board electric heaters automatically warm up the cells, they are activated by the BMS when the minimum cell temperature goes down 0°C, they are automatically switched off when the minimum cell temperature raises over the 2°C.

In case of battery charger is connected, till 0°C it supplies only 3A in order to surely feeds only the heaters, waiting positive temperatures to recharge the cells.

In cold environmental temperature (from -25°C to 0°C), with null lithium battery level (SOC = 0), the heaters work only while the cable is plugged to the electric network (battery charger activated).

While heaters are working on the display will appear the icon batteries cold, and machine could be moved only in lower speed (turtle).



“BATTERY COLD / HEATER ACTIVATED” ICON

In hot environmental temperature, the fans system automatically cool down the cells, they are automatically activated by the BMS when cells temperature raises over 37°C, they are automatically switched off when cells temperature goes down the 35°C.

### Diagnostics and Fault Codes

The main devices composing the lithium batteries system are able to carry out self-diagnosis informing the operator by the remote control display, in particular they eventually display informative icons and provide fault codes.

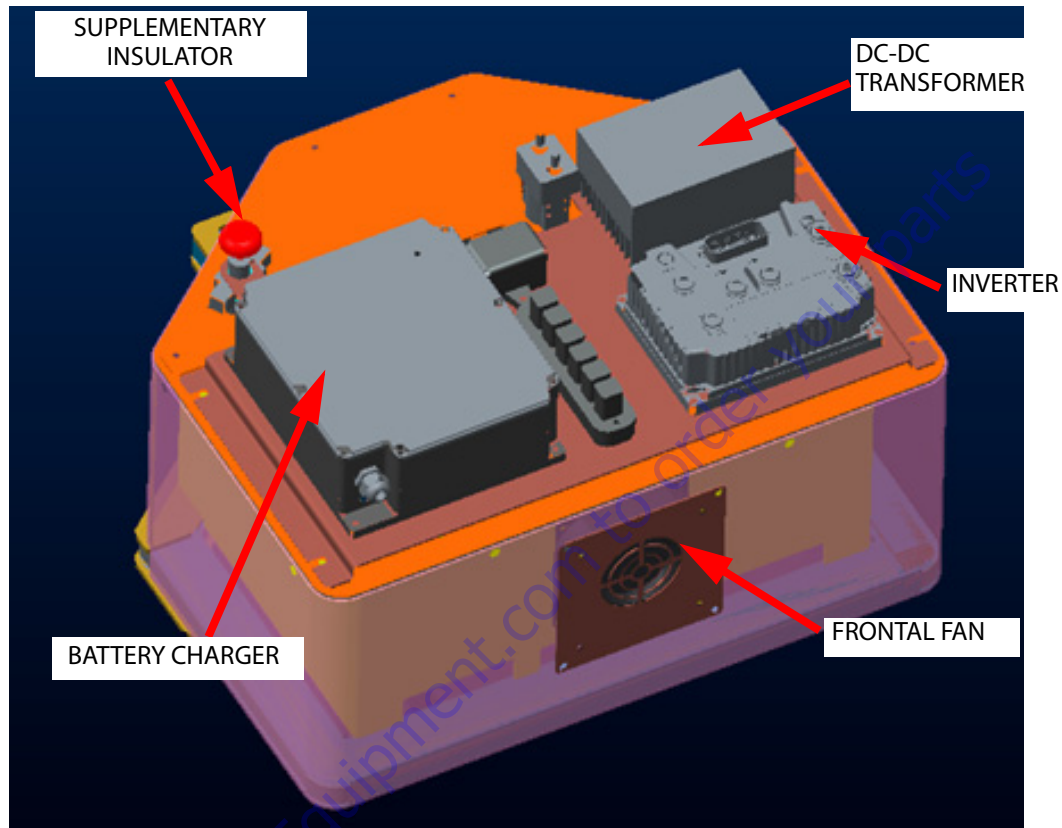
Self-diagnosis is carry out by:

- BMS (Battery Management System)
- Battery charger
- Inverter

Further information about Lithium system, fault codes and diagnose are detailed by Lithium system specific manual.

**Lithium System Components Location**

**Upper Layer**



**SECTION 3 - CHASSIS & TURNTABLE**

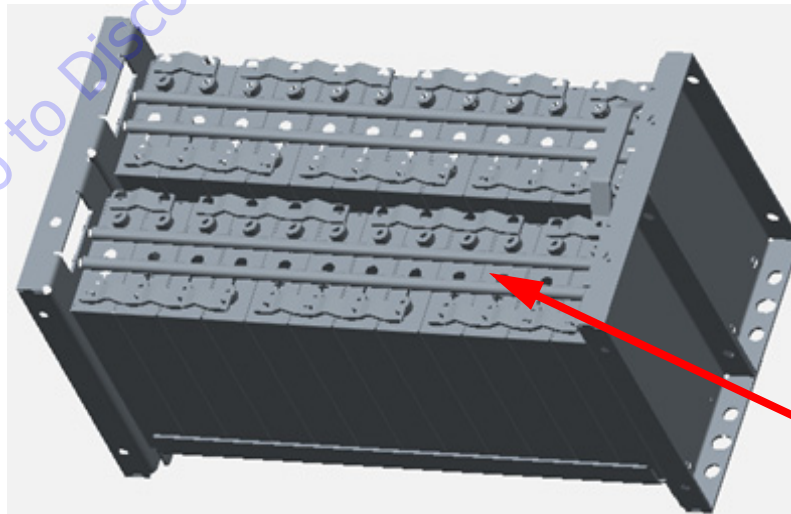
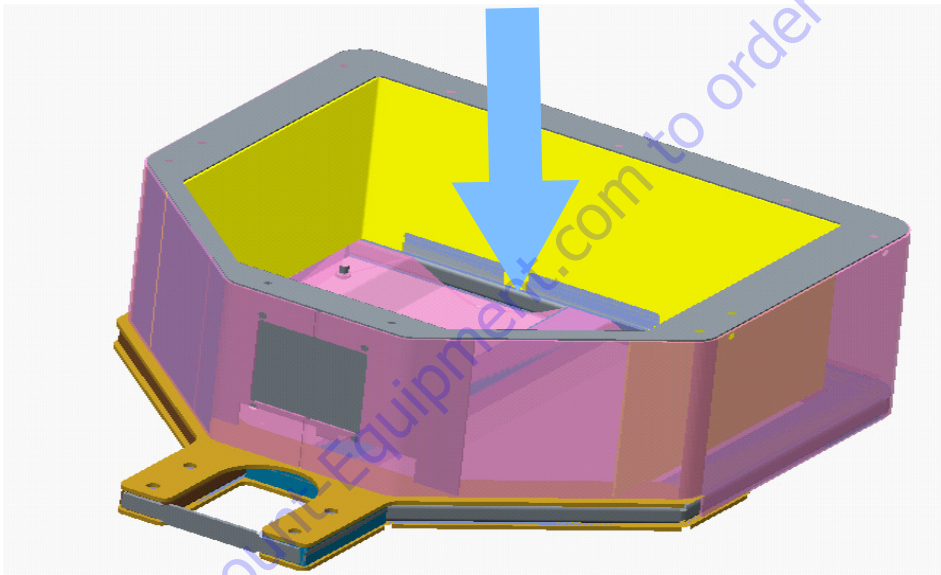
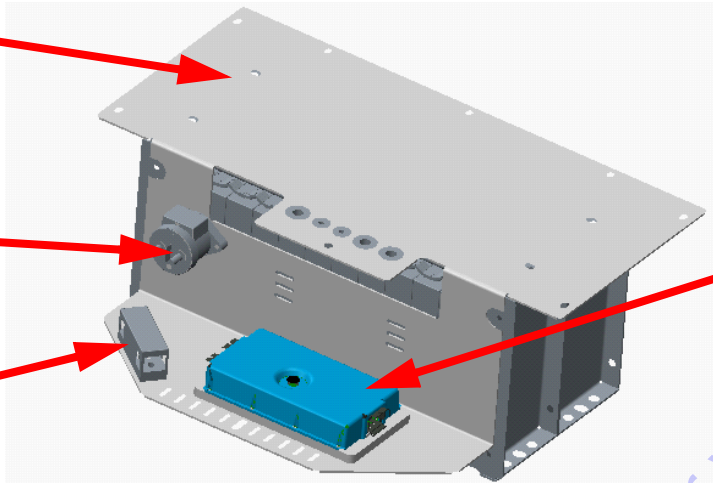
**Lower Layer**

CELLS PACK

INTERNAL CONTACTOR

MAIN FUSE

BMS



CELLS PACK  
WITHOUT COVER

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for manuals and parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

SEARCH

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information:

Manufacturer:

Model:

Description:

Quantity:

Part Number:

Part Name:

Part Description:

Part Category:

Part Location:

Part Status:

Part Condition:

Part Material:

Part Color:

Part Weight:

Part Dimensions:

Part Price:

Part Notes:

Submit

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## SECTION 4. BOOM & PLATFORM

### 4.1 BOOM MAINTENANCE

#### NOTICE

**IF PERFORMING MAINTENANCE ON THE BOOM, DO NOT USE A LIFTING DEVICE TO LIFT THE BOOMS UNLESS THE HOLDING VALVES HAVE BEEN REMOVED FIRST. FAILURE TO DO SO WILL RESULT IN SEVERE DAMAGE TO THE BOOM.**

#### Removal of the Boom Assembly

1. Remove the platform and platform support as follows:
  - a. Disconnect electrical cable from control console.
  - b. Tag and disconnect the hydraulic lines running to the rotate cylinders. Cap the hydraulic lines and ports.
  - c. Using an overhead crane or suitable lifting device, use nylon support straps to support the platform/support.

**NOTE:** *When removing the retaining pin from the rod end of the level cylinder, make sure the cylinder is properly supported.*

- d. Remove bolts and keeper pins that secures the retaining pins. Using a suitable brass drift and hammer, remove the retaining pins from the platform support.
2. Remove the boom from the turntable as follows:
  - a. Disconnect wiring harness from ground control harness connector.

#### NOTICE

**HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.**

- b. Tag and disconnect hydraulic lines from boom to control valve. Use a suitable container to retain any residual hydraulic fluid. Cap all hydraulic lines and ports.
  - c. Using a suitable lifting equipment, adequately support boom weight along entire length.
  - d. Remove the bolts and keeper pins securing the lift cylinder pivot pin. Using a suitable brass drift and hammer, remove the pivot pin from the lower boom.
  - e. Remove hardware securing the level link pivot pin. Using a suitable brass drift and hammer, remove the pin from the level link and turntable.

- f. Remove hardware securing the lower boom pivot pin. Using a suitable brass drift and hammer, remove pin from the turntable.
  - g. Using all applicable safety precautions, carefully lift boom assembly clear of turntable and lower to ground or suitable supported work surface.

#### Disassembly of the Main Boom

1. Loosen jam nuts on aft end of fly boom wear pad adjustment and loosen adjustments.
2. Using a portable power source, attach hose to telescope cylinder port block. Using all applicable safety precautions, activate hydraulic system and extend cylinder to gain access to cylinder rod retaining pin. Shut down hydraulic system.
3. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port.
4. Remove hardware securing telescope cylinder to the fly boom section, then remove pin from fly.
5. Remove hardware securing telescope cylinder to the base boom section.

#### NOTICE

**WHEN REMOVING TELESCOPE CYLINDER FROM BOOM SECTIONS. CARE SHOULD BE TAKEN NOT TO LEAVE CYLINDER REST ON POWERTRACK WHICH COULD CAUSE DAMAGE TO POWERTRACK.**

6. Using a suitable lifting device, remove telescope cylinder from boom sections.
7. Using a piece of tape, mark the length of hoses and wires from front of fly boom and bottom of base boom for reassembly.
8. Remove hardware securing the front wear pads on base boom section, remove wear pads.
9. Remove hardware securing the powertrack to the aft end of the fly boom section.
10. Using a suitable lifting device, remove fly boom from boom section.
11. Remove hydraulic lines and electrical cables from powertrack.
12. Remove hardware securing powertrack to the base boom section. Remove powertrack.

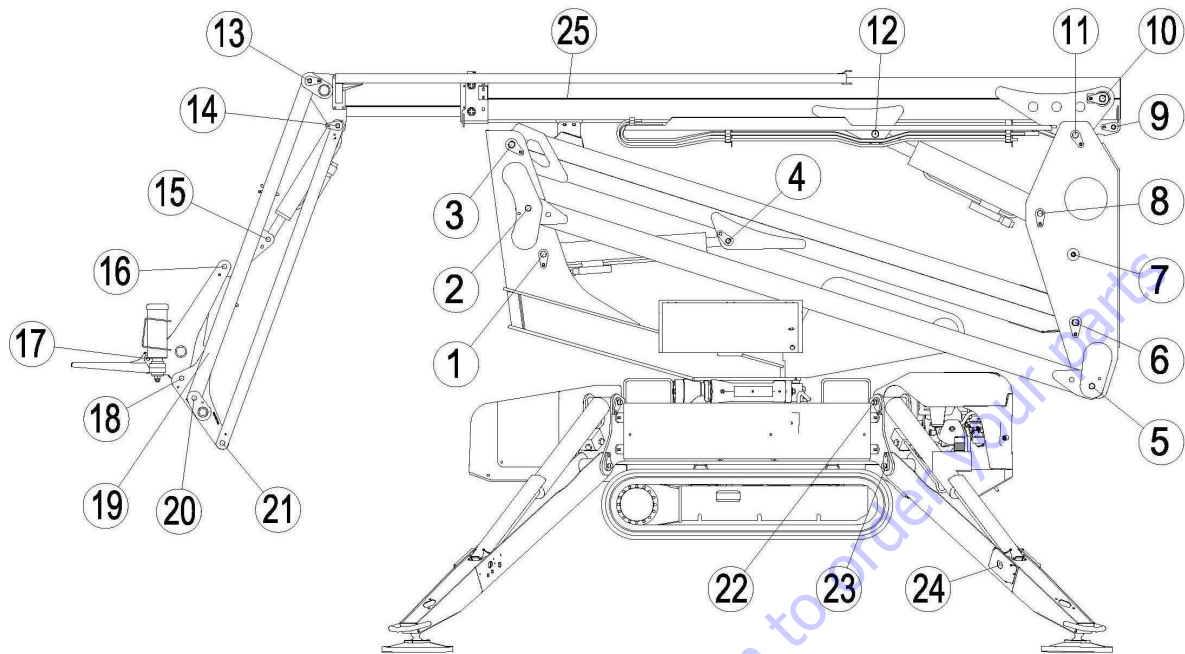


Figure 4-1. Position Pins X13JP-X370AJ

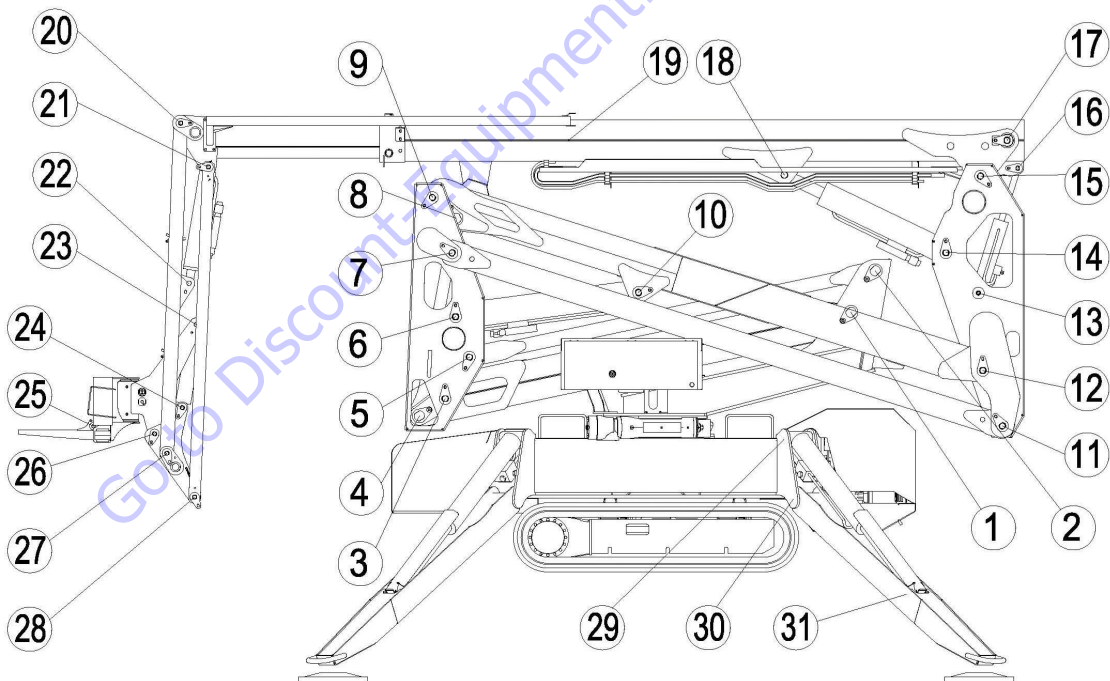


Figure 4-2. Position Pins X15JP - X430AJ

## Inspection

1. Inspect all boom pivot pins for wear, scoring or other damage, and for tapering or roundness. Replace pins as necessary.
2. Inspect lift cylinder pins for wear, scoring or other damage, and for tapering or roundness. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.
3. Inspect telescope cylinder rod attach pin for wear, scoring or other damage. Replace pin as necessary.
4. Inspect inner diameter of boom pivot bushings for scoring, distortion, wear or other damage. Replace bushings as necessary.
5. Inspect wear pads for wear.
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
7. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

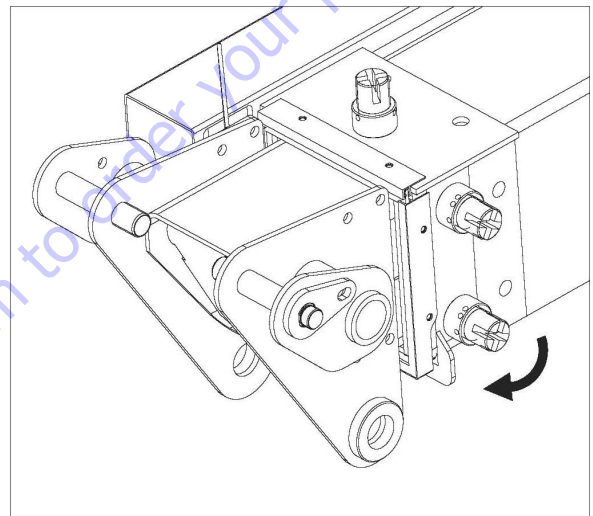
## Assembly of the Main Boom

1. Install powertrack to the attach point on the base boom section. Secure powertrack with the attaching hardware.
2. Install hydraulic lines and electrical cables into the powertrack.
3. Install wear pads to the aft end of the fly section.
4. Using suitable lifting equipment, slide fly section into the base section until powertrack attach point aligns with holes in side of base section.
5. Attach the powertrack to the aft end of fly boom section. Secure powertrack with the attaching hardware.
6. Using suitable lifting equipment, slide fly boom section out to gain access to telescope cylinder attach pin hole.
7. Measure the distance between the telescope cylinder port block attach point on base boom section and the attach point on fly boom section.
8. Connect a suitable auxiliary hydraulic power source to the telescope cylinder port block.
9. Extend the telescope cylinder the distance of the two attach points.
10. Secure the sling and lifting device at the telescope cylinder's approximate center of gravity, and lift the cylinder to the aft end of the boom assembly.

## NOTICE

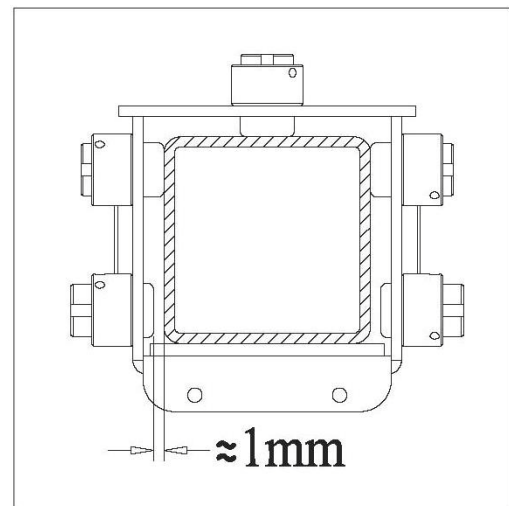
**WHEN INSERTING THE TELESCOPE CYLINDER INTO THE BOOM, CARE MUST BE TAKEN NOT TO DAMAGE THE POWERTRACK ASSEMBLY.**

11. Slowly slide the telescope cylinder into boom assembly, align rod end with attach point in fly section. Insert pin and secure with retaining ring.
12. Slowly slide the telescope cylinder into boom assembly, align barrel end with attach point in fly section. Insert pin and secure with retaining ring.
13. Install wear pads at front of base boom section. Adjust the wear pads to zero clearance.



**Figure 4-3. Adjustment Wear Pads**

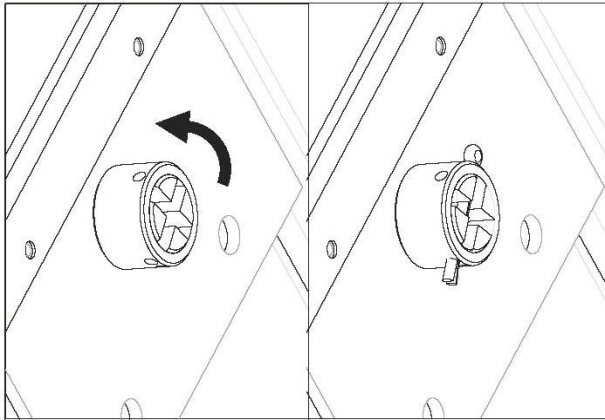
14. Adjust pads alternately side to side, so that fly boom section is centered in base boom section (lower wear pad with 1 mm gap).



**Figure 4-4. Adjustment Wear Pads**



15. Turn the wear pad to expose the groove on the head to insert the cotter.

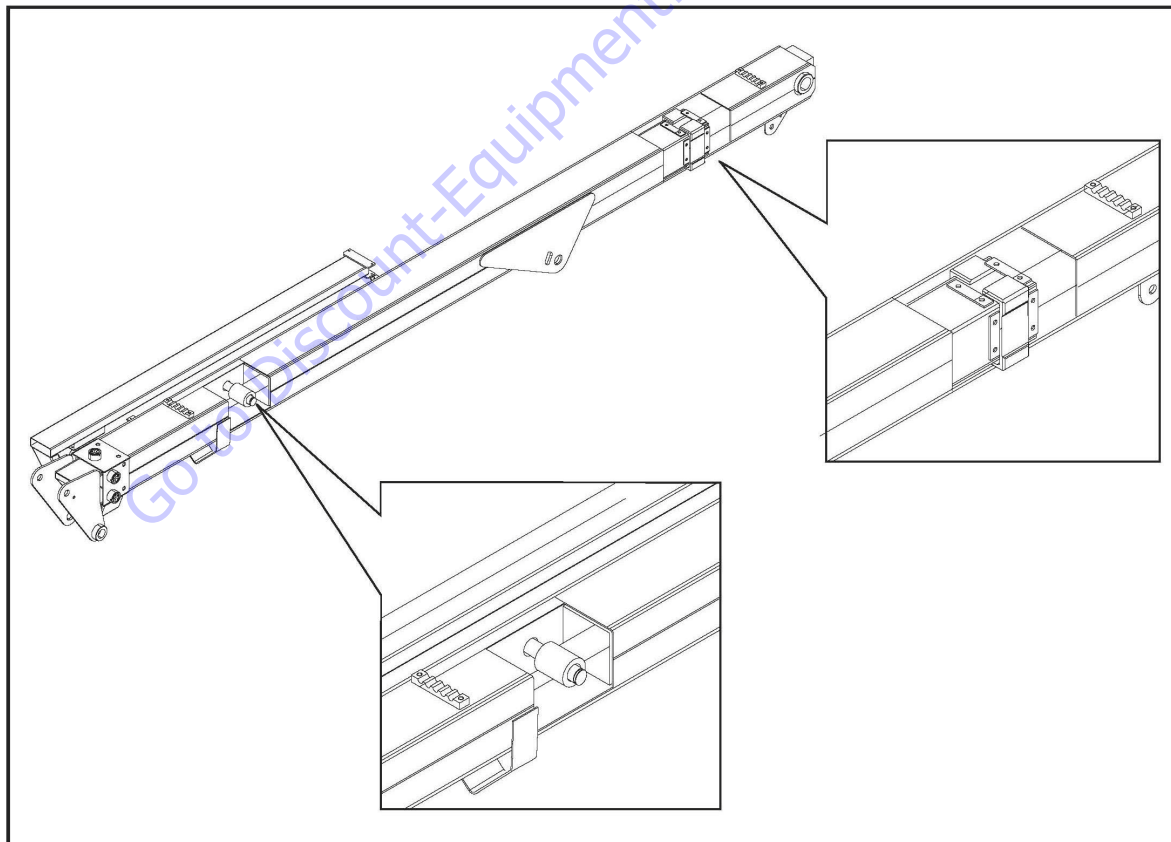


**Figure 4-5. Groove on the Head**

16. Disconnect auxiliary power source from telescope cylinder.

### Installation of the Boom Assembly

1. Using suitable lifting equipment, position boom assembly on turntable so that boom pivot holes in both boom and turntable are aligned.



**Figure 4-6. Boom Assembly**

2. Install boom pivot pin, ensuring that location of the hole in pivot pin aligns with attach point on upright.
3. Using all applicable safety precautions, operate lifting equipment in order to position boom lift cylinder and level link so that holes in cylinder rod end and level link are aligned with the one in the turntable. Insert cylinder pins.
4. If necessary, gently tap pins into position with a soft headed mallet, ensuring that attach holes in pins are aligned with attach holes in boom structure. Secure with hardware.
5. Connect all hosing and wiring.
6. Install the platform to the boom assembly.
7. Connect all hosing and wiring at platform control station.
8. Using all safety precautions, operate machine systems and extend and retract boom for four or five cycles.
9. Shut down machine systems and check for leakage.

## 4.2 PROXIMITY SENSOR ADJUSTMENT

Adjust the proximity sensor in order to obtain a gap of 2 mm between the sensor and the undercarriage ring plate.



Figure 4-7.

## 4.3 PLATFORM REMOVAL/INSTALLATION

### Removal

**NOTE:** If the platform is removed only track movement is allowed.

1. Remove the platform/remote control box from the mounting support.
2. Loosen and remove the aluminium caps that secure the platform to the jib platform mounting posts.
3. Lift the platform off the mounting posts in an upward direction. Place platform aside for later installation.

### Installation

1. Lift the platform and align the platform mounts with the jib mounting posts and lower until seated.
2. Secure the platform to the jib mounting posts with the aluminum threaded caps. Do not over-tighten.
3. Re-install the platform/remote control box into the mounting support on the platform.

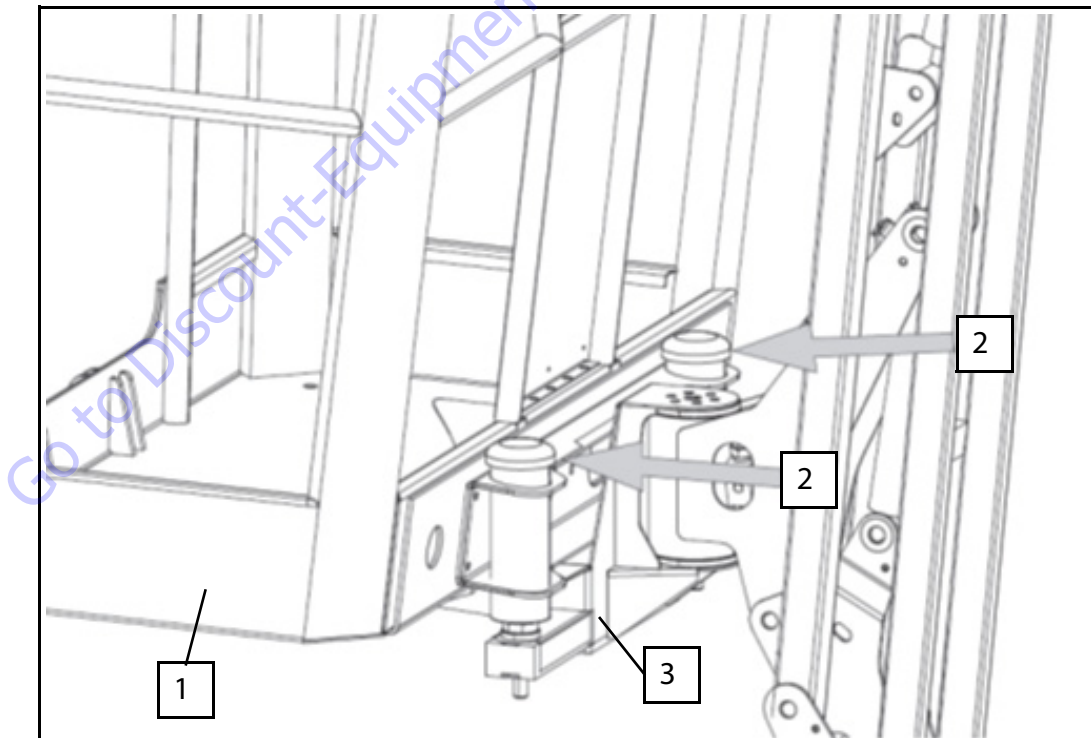


Figure 4-8.

#### 4.4 SKYGUARD INSTALLATION - ONE PERSON PLATFORM

The purpose of this instruction is to install a SkyGuard system on JLG Compact Crawler Boom (platform capacity of one person) models listed below and with below pictured SkyGuard Bracket.

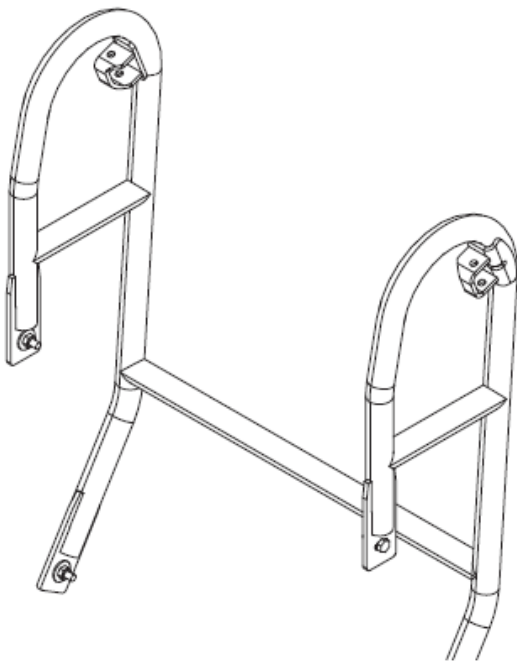


Figure 4-9. SkyGuard Bracket with Mount

It is recommended that you read and thoroughly understand these instructions before starting this procedure.

**NOTICE**

**USE ALL APPLICABLE SAFETY PRECAUTIONS WHILE WORKING ON, AROUND OR UNDER ANY MACHINERY.**

#### Options/Accessories Prohibited When Installing This Kit:

- None

#### Tools & Equipment Required:

- Standard mechanic tools including 5/16 in. & 7/32 in. Allen Wrenches
- Tie Straps

#### Personnel Required:

- Qualified JLG equipment mechanic

#### Parts List:

ITEM	PART NUMBER	DESCRIPTION	QTY
1	0641414	Bolt, 1/4-20 x 1 3/4 LG	2
2	0700812	Bolt (Metric), 8x25 LG	4
3	3290801	Nut, M8 x 1.25	4
4	3300430	Nut, Acorn 1/4- 20	2
5	3931424	Bolt, 1/4-20x1 1/2 LG	2
6	4711400	Washer, 1/4 DIA Plain Steel, Narrow	4
7	4811902	Washer, 8mm LG OD	4
8	37675400	Bracket, SkyGuard Support	1
9	1001186517	Cover, Platform Sensor	2
10	1001188889	Support, Shear Block	2
11	1001213890	Switch, SkyGuard	1
12	1001213891	Mount, Platform Sensor	1

#### Procedure:

1. Park the machine on the firm level surface, fully retract & lower the boom.
2. Extend all the four outriggers, set them to the auto levelling mode and set the machine to rest position.
3. Remove the key and shut the engine OFF.
4. Allow the machine and system fluids to cool.
5. Disconnect the battery power from the machine.

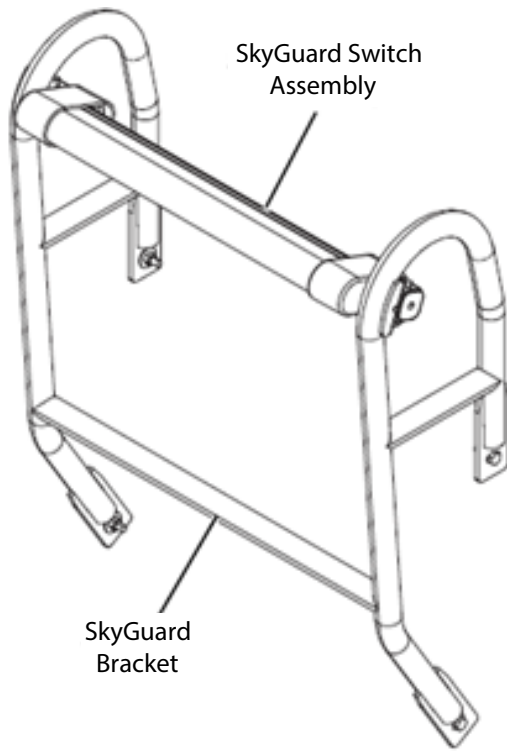
**For Reference:**

Figure 4-10. SkyGuard Bracket with SkyGuard

**Installation:**

1. Install the SkyGuard Support Bracket (8) onto the welded mounts on platform rails. Secure the support bracket using four Bolts (2), relevant Washers (7) and Nuts (3). See Figure 4-11.

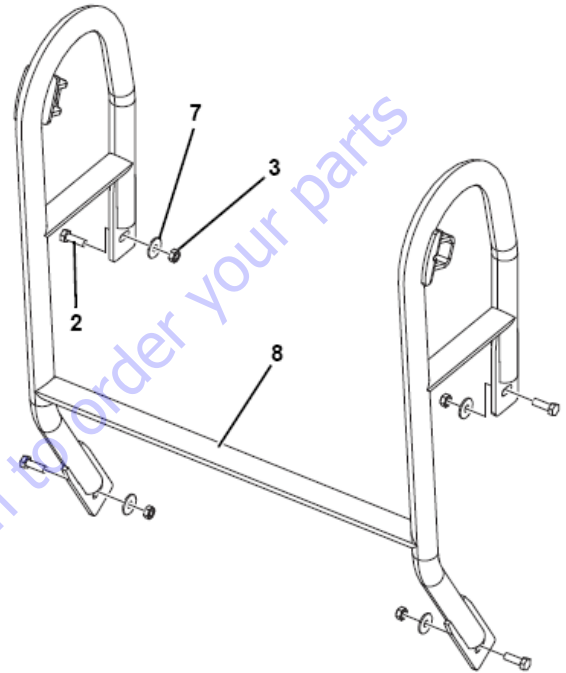


Figure 4-11.

2. Align and attach Platform Sensor Mount (12) onto the SkyGuard Switch (11) as shown in Figure 4-12.
3. Attach Platform Sensor Covers (9) to SkyGuard switch assembly at both ends. See Figure 4-12.

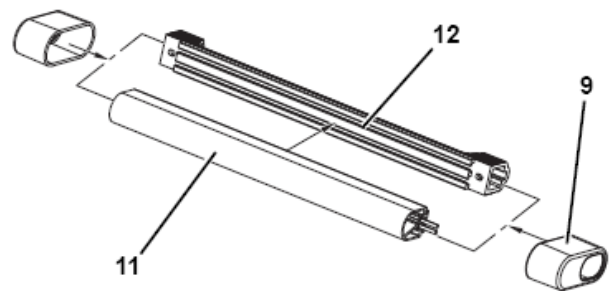


Figure 4-12.

## SECTION 4 - BOOM & PLATFORM

4. Position SkyGuard switch assembly with sensor cover onto the SkyGuard Support Bracket (8) as shown in Figure 4-13.
5. Insert a Shear Block Support (10) through shear block housing on the SkyGuard support bracket and into the platform sensor mount. See Figure 4-13.

**NOTE:** Ensure the correct position of Shear Block Support (10) before installation.

6. Secure the shear block on welded mount of SkyGuard support bracket using Bolt (1), relevant Washer (6) and Acorn Nut (4) as shown in Figure 4-13.
7. Secure the SkyGuard switch assembly using Bolt (5) and relevant Washer (6) on platform sensor mount. See Figure 4-13.

**NOTE:** Tighten the Bolt (5) using appropriate allen wrench.

8. Repeat Steps 4 through 7 to secure SkyGuard switch assembly on the other side of the SkyGuard support bracket ensuring correct position of the shear block support before installation.

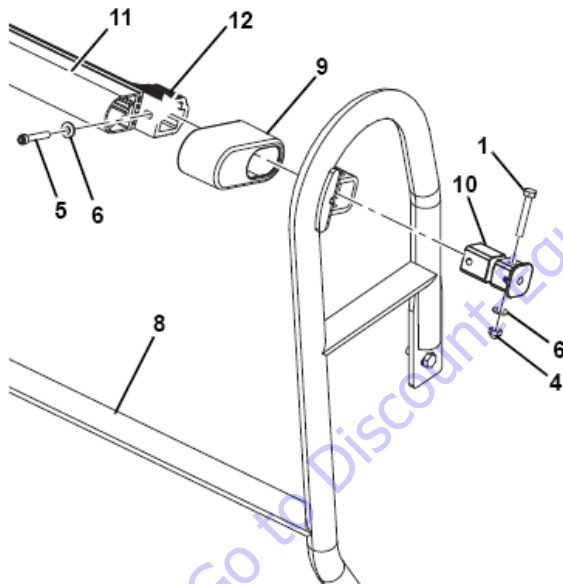


Figure 4-13.

9. Route the SkyGuard switch harness along SkyGuard support bracket (right side) and under the platform control box. Secure the harness using tie straps. See Figure 4-14.

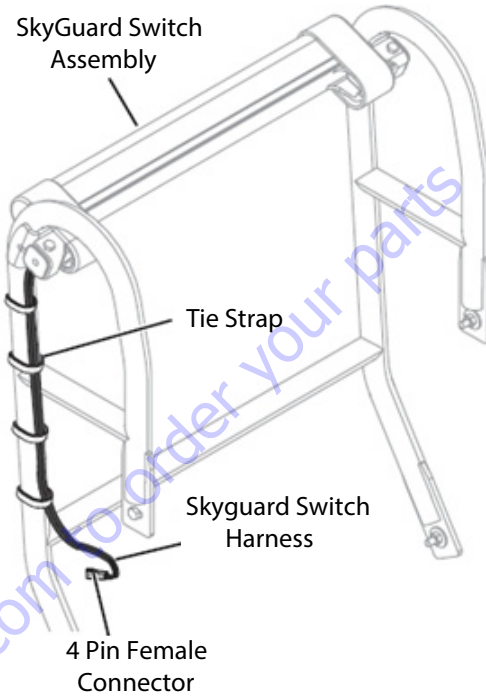


Figure 4-14.

10. Connect Sky Guard connector to the one on the machine located under load cell box. See Figure 4-15.



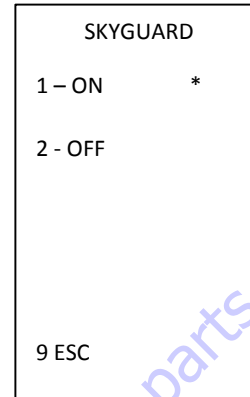
Figure 4-15.

**CAUTION**

**WHEN THE SKYGUARD IS PUSHED WITH EXCESSIVE FORCE THE SENSOR SUPPORTS (ITEM 10 - FIGURE 4-13.) WILL BREAK. REPLACE WITH NEW SENSOR SUPPORTS BEFORE CONTINUING OPERATION OF THE MACHINE.**

**11. POWER ON** the machine.

- Press button 6 (service) on the remote control
- Press button 7 (set up)
- Press button 5 (password)
- Enter password "4 7 7 1" then press button 9 (OK)
- Press button 3 (extra)
- Press button 1 (optional)
- Press button 8 (next)
- Press button 4 (SkyGuard)
- Press Button 1 (ON)



**Figure 4-16. Asterisk must show next to the ON position**

- Press button 9 (esc)
  - Press button 9 (esc)
  - Press button 9 (esc)
  - Press button 9 (esc)
  - Remote control screen should be on main icon page
- 12.** Check for the proper functioning of SkyGuard system.

**NOTICE**

**IF PLATFORM REMOVAL WILL BE NECESSARY, SKY GUARD EXTERNAL CONNECTOR HAS TO BE DISCONNECTED. THEN RECONNECTED WHEN THE PLATFORM IS INSTALLED ON THE MACHINE.**

**NOTE:** *If further information is required, please contact the JLG Service Department.*

## SECTION 4 - BOOM & PLATFORM

### SkyGuard System

When the SkyGuard sensor is activated, functions that were in use at the time of actuation will reverse or cutout. The table below outlines these functions.

Main Lift (3 Boom) Up	Main Tele (Extension) In	Main Tele (Extension) Out	Main Swing	Drive Forward	Drive Reverse	Tower Lift (1 Boom) Up	Tower Lift (1 Boom) Down	Basket Level	Basket Rotate	Jib Lift
R	C	R	R	C	C	R	C	C	C	C
R= Indicates Reversal is Activated										
C= Indicates Cutout is Activated										

Go to Discount-Equipment.com to order your parts

#### 4.5 SKYGUARD INSTALLATION - TWO PERSON PLATFORM

The purpose of this instruction is to install a SkyGuard system on JLG Compact Crawler Boom (platform capacity of one person) models listed below and with below pictured SkyGuard Bracket.

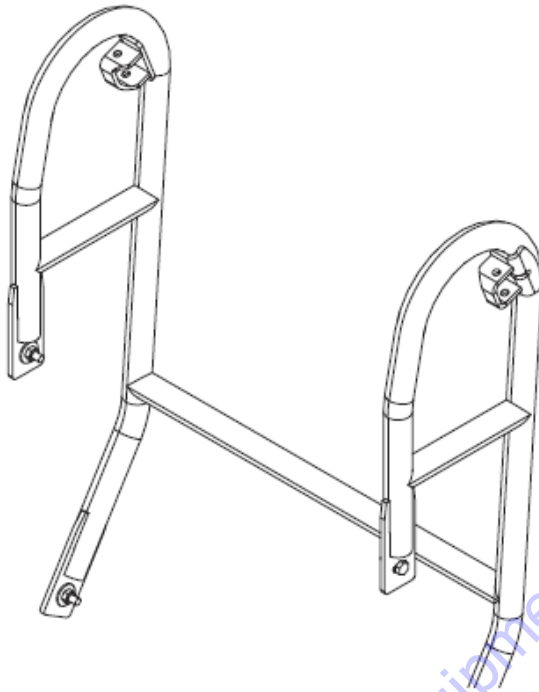


Figure 4-17.

It is recommended that you read and thoroughly understand these instructions before starting this procedure.

#### NOTICE

**USE ALL APPLICABLE SAFETY PRECAUTIONS WHILE WORKING ON, AROUND OR UNDER ANY MACHINERY.**

#### Options/Accessories Prohibited When Installing This Kit:

- None

#### Tools & Equipment Required:

- Standard mechanic tools including 5/16" & 7/32" Allen Wrenches
- Tie Straps

#### Personnel Required:

- Qualified JLG equipment mechanic

#### Parts List:

ITEM	PART NUMBER	DESCRIPTION	QTY
1	0641414	Bolt, 1/4-20x1 3/4 LG	2
2	0700812	Bolt (Metric), 8x25 LG	4
3	3290801	Nut, M8x 1.25	4
4	3300430	Nut, Acorn 1/4- 20	2
5	3931424	Bolt, 1/4-20x1 1/2 LG	2
6	4711400	Washer, 1/4 DIA Plain Steel, Narrow	4
7	4811902	Washer, 8mm LG OD	4
8	37675400	Bracket, SkyGuard Support	1
9	1001186517	Cover, Platform Sensor	2
10	1001188889	Support, Shear Block	2
11	1001213890	Switch, SkyGuard	1
12	1001213891	Mount, Platform Sensor	1

#### Procedure:

1. Park the machine on the firm level surface, fully retract & lower the boom.
2. Extend all the four outriggers, set them to the auto levelling mode and set the machine to rest position.
3. Remove the key and shut the engine OFF.
4. Allow the machine and system fluids to cool.
5. Disconnect the battery power from the machine.



**For Reference:**

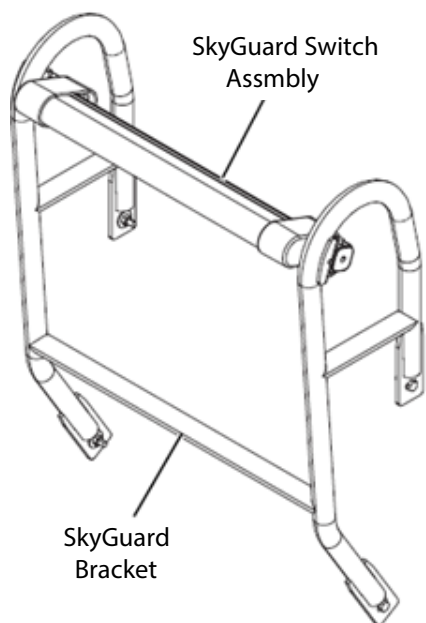


Figure 4-18.

**Installation:**

1. Install the SkyGuard Support Bracket (8) onto the welded mounts on platform rails. Secure the support bracket using four Bolts (2), relevant Washers (7) and Nuts (3). See Figure 4-19.

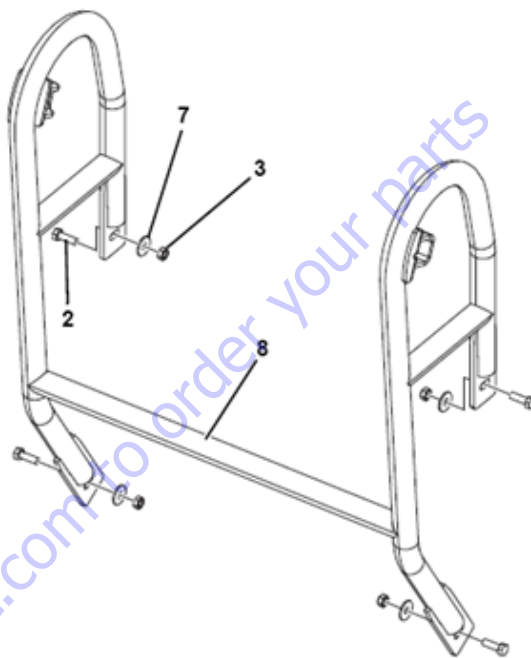


Figure 4-19.

2. Align and attach Platform Sensor Mount (12) onto the SkyGuard Switch (11) as shown in Figure 4-20.
3. Attach Platform Sensor Covers (9) to SkyGuard switch assembly at both ends. See Figure 4-20.

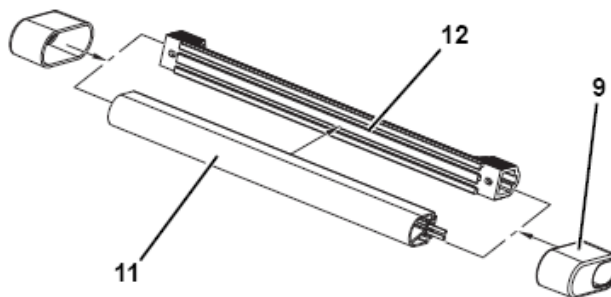


Figure 4-20.

4. Position SkyGuard switch assembly with sensor cover onto the SkyGuard Support Bracket (8) as shown in Figure 4-21.
5. Insert a Shear Block Support (10) through shear block housing on the SkyGuard support bracket and into the platform sensor mount. See Figure 4-21.

**NOTE:** Ensure the correct position of Shear Block Support (10) before installation.

6. Secure the shear block on welded mount of SkyGuard support bracket using Bolt (1), relevant Washer (6) and Acorn Nut (4) as shown in Figure 4-21.
7. Secure the SkyGuard switch assembly using Bolt (5) and relevant Washer (6) on platform sensor mount. See Figure 4-21.

**NOTE:** Tighten the Bolt (5) using appropriate allen wrench.

8. Repeat Steps 4 through 7 to secure SkyGuard switch assembly on the other side of the SkyGuard support bracket ensuring correct position of the shear block support before installation.

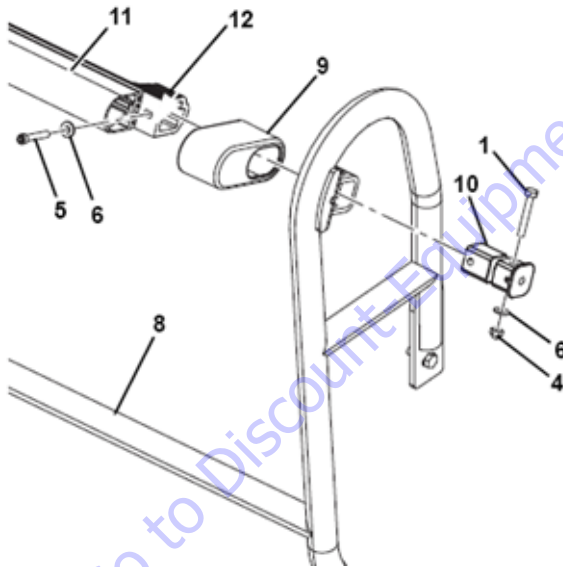


Figure 4-21.

9. Route the SkyGuard switch harness along SkyGuard support bracket (right side) and under the platform control box. Secure the harness using tie straps. See Figure 4-22.

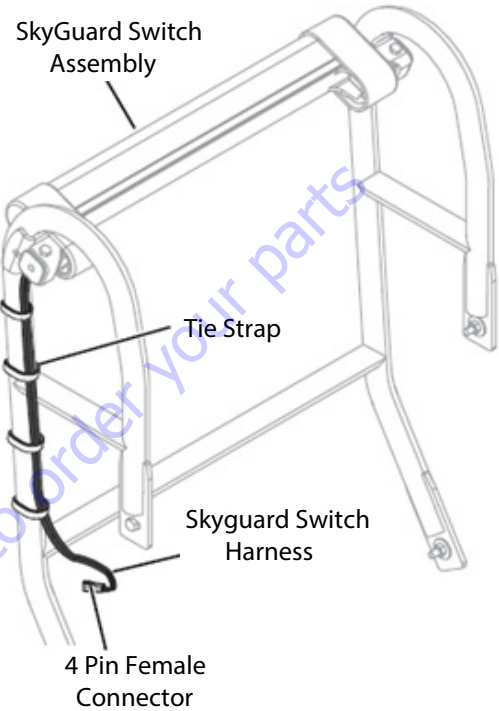


Figure 4-22.

10. Connect SkyGuard connector to the one on the machine located under load cell box. See Figure 4-23.



Figure 4-23.

### **CAUTION**

WHEN THE SKYGUARD IS PUSHED WITH EXCESSIVE FORCE THE SENSOR SUPPORTS (ITEM 10 - FIGURE 4-21.) WILL BREAK. REPLACE WITH NEW SENSOR SUPPORTS BEFORE CONTINUING OPERATION OF THE MACHINE.

#### 11. POWER ON the machine.

- Press button 6 (service) on the remote control
- Press button 7 (set up)
- Press button 5 (password)
- Enter password "4 7 7 1" then press button 9 (OK)
- Press button 3 (extra)
- Press button 1 (optional)
- Press button 8 (next)
- Press button 4 (SkyGuard)
- Press Button 1 (ON)

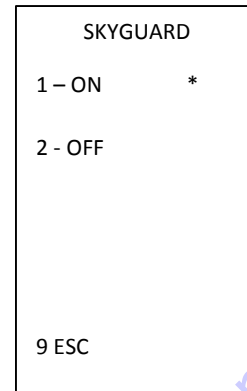


Figure 4-24. Asterisk must show next to the ON position

- Press button 9 (esc)
- Press button 9 (esc)
- Press button 9 (esc)
- Press button 9 (esc)
- Remote control screen should be on main icon page

#### 12. Check for the proper functioning of SkyGuard system.

### **NOTICE**

IF PLATFORM REMOVAL WILL BE NECESSARY, SKY GUARD EXTERNAL CONNECTOR HAS TO BE DISCONNECTED. THEN RECONNECTED WHEN THE PLATFORM IS INSTALLED ON THE MACHINE.

**NOTE:** If further information is required, please contact the JLG Service Department.

## SkyGuard System

When the SkyGuard sensor is activated, functions that were in use at the time of actuation will reverse or cutout. The table below outlines these functions.

Main Lift (3 Boom) Up	Main Tele (Extension) In	Main Tele (Extension) Out	Main Swing	Drive Forward	Drive Reverse	Tower Lift (1 Boom) Up	Tower Lift (1 Boom) Down	Basket Level	Basket Rotate	Jib Lift
R	C	R	R	C	C	R	C	C	C	C
R= Indicates Reversal is Activated										
C= Indicates Cutout is Activated										

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for a manual or part number. You can also search for parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

\* Category:

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the information below to request help finding a part or manual.

Manufacturer:	<input type="text"/>
Model:	<input type="text"/>
Description:	<input type="text"/>
Part Number:	<input type="text"/>
Serial Number:	<input type="text"/>
Category:	<input type="text"/>
Quantity:	<input type="text"/>
Notes:	<input type="text"/>
Requester Name:	<input type="text"/>
Requester Email:	<input type="text"/>
Requester Phone:	<input type="text"/>
Company Address:	<input type="text"/>
City/State/Zip:	<input type="text"/>
Country:	<input type="text"/>
Part Number:	<input type="text"/>
Serial Number:	<input type="text"/>
Category:	<input type="text"/>
Quantity:	<input type="text"/>
Notes:	<input type="text"/>
Requester Name:	<input type="text"/>
Requester Email:	<input type="text"/>
Requester Phone:	<input type="text"/>
Company Address:	<input type="text"/>
City/State/Zip:	<input type="text"/>
Country:	<input type="text"/>

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on once of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

### SECTION 5. HYDRAULICS

#### 5.1 HYDRAULIC SYSTEM

##### Main Components Identification And Location

The ground control box located on the right side of the machine contains the aerial part valve block.

The hydraulic components compartment on the right side inside the bonnet contains the ground valve blocks, the hydraulic manifold, the deviator valve, the double pump valve, the blow off manifold, the second speed manifold and the hand pump.

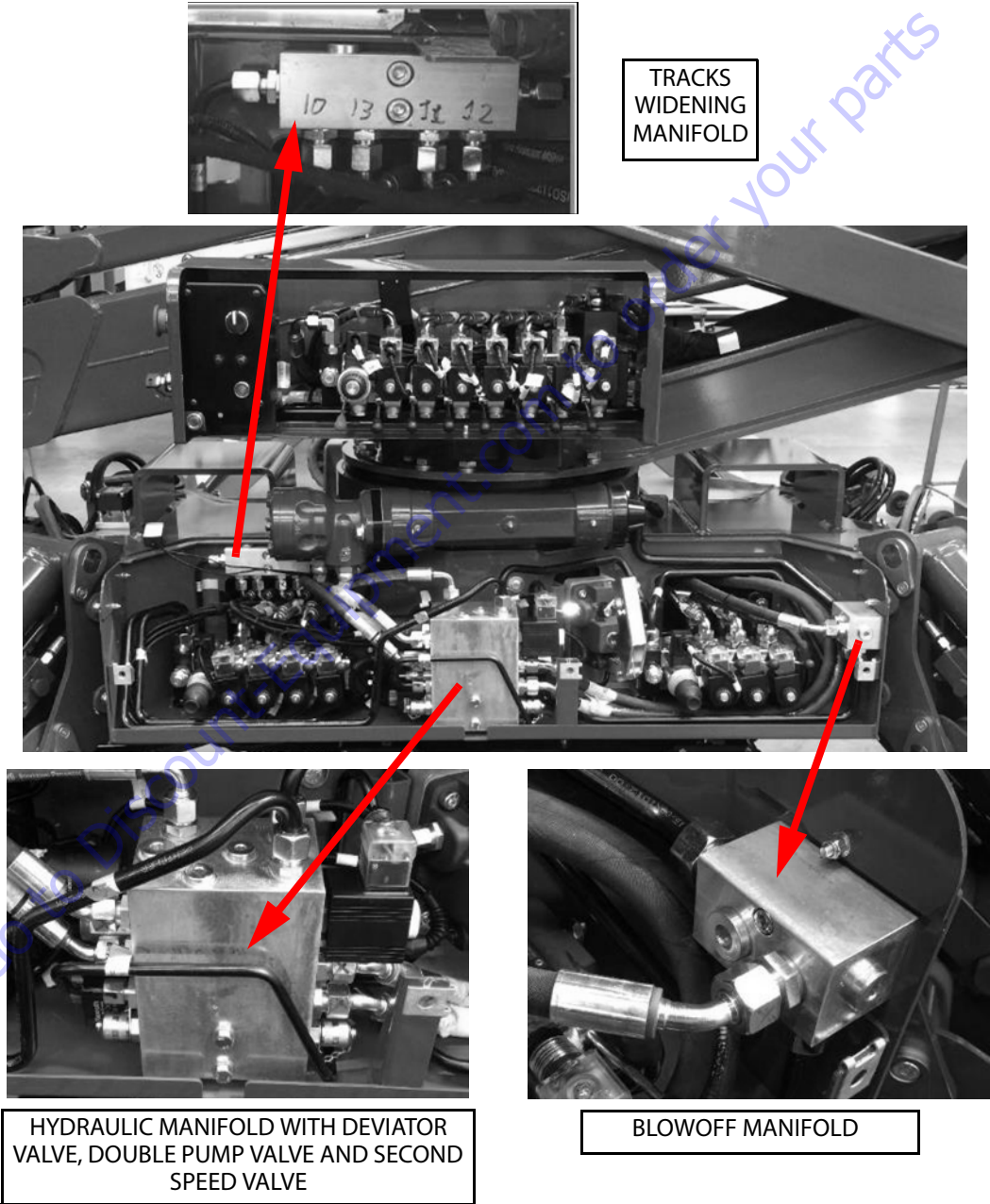
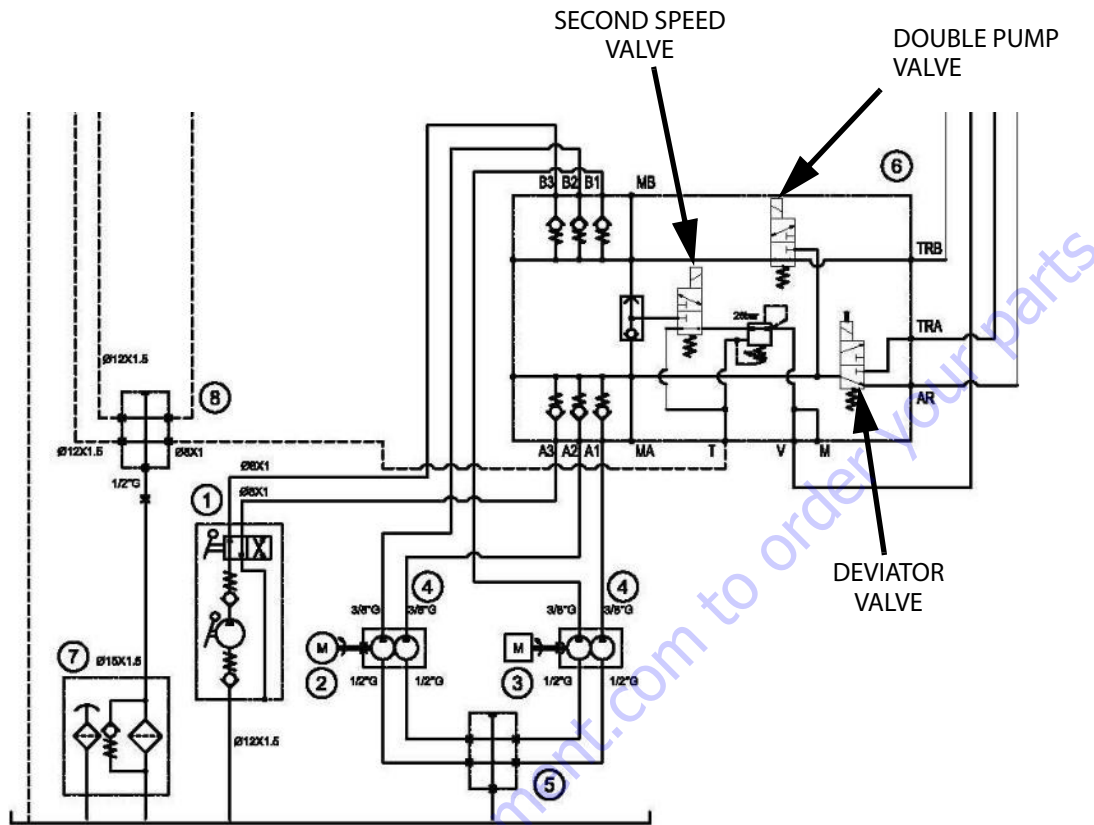


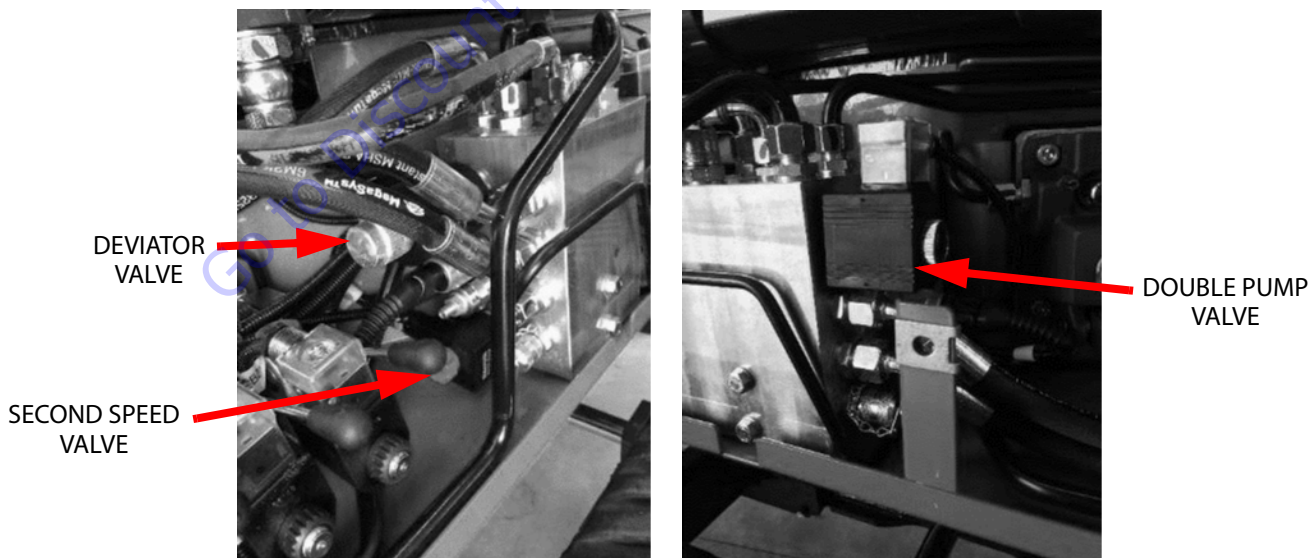
Figure 5-1. Identification And Location Components

**SECTION 5 - HYDRAULICS**

Hydraulic manifold aluminium block contains deviator valve, double pump valve and second speed valve.



**Figure 5-2. Valve Diagram**



**Figure 5-3. Valve**

## Hydraulic Diagram

**Table 5-1. Hydraulic Diagram Index**

POS.	DESCRIPTION
1	HAND PUMP
2	ELECTRIC MOTOR
3	GASOLINE/DIESEL ENGINE
4	DOUBLE GEAR PUMP
5	PUMPS SUCTION COLLECTOR
6	HYDRAULIC MANIFOLD WITH INTEGRATED PUMP OUTLET BLOCK
7	HYDRAULIC OIL FILTER
8	BLOWOFF MANIFOLD
9	LEFT SIDE UNDERCARRIAGE VALVE BLOCK (4 ELEMENTS)
10	RIGHT SIDE UNDERCARRIAGE VALVE BLOCK (3 ELEMENTS)
11	OUTRIGGER VALVES BLOCK
12	OUTRIGGER CYLINDER
13	DRIVE GEAR MOTOR
14	TRACKS WIDENING CYLINDER
15	MANIFOLD
16	AERIAL PART VALVE BLOCK (7 ELEMENTS)
17	TURRET ROTATION HYDRAULIC MOTOR
18	DOUBLE BALANCING VALVE FOR BASKET LEVELLING
19	BASKET LEVELLING CYLINDER ON CONNECTION ROD
20	BASKET LEVELLING CYLINDER ON BASKET
21	DOUBLE BALANCING VALVE FOR BASKET LEVELLING ON BASKET
22	BASKET ROTATOR
23	JIB CYLINDER
24	DOUBLE BALANCING VALVE FOR BOOMS WITH ELECTROVALVE
25	TELESCOPE CYLINDER
26	DOUBLE BALANCING VALVE FOR TELESCOPE
27	3RD BOOM CYLINDER
28	1ST AND 2ND BOOMS CYLINDER



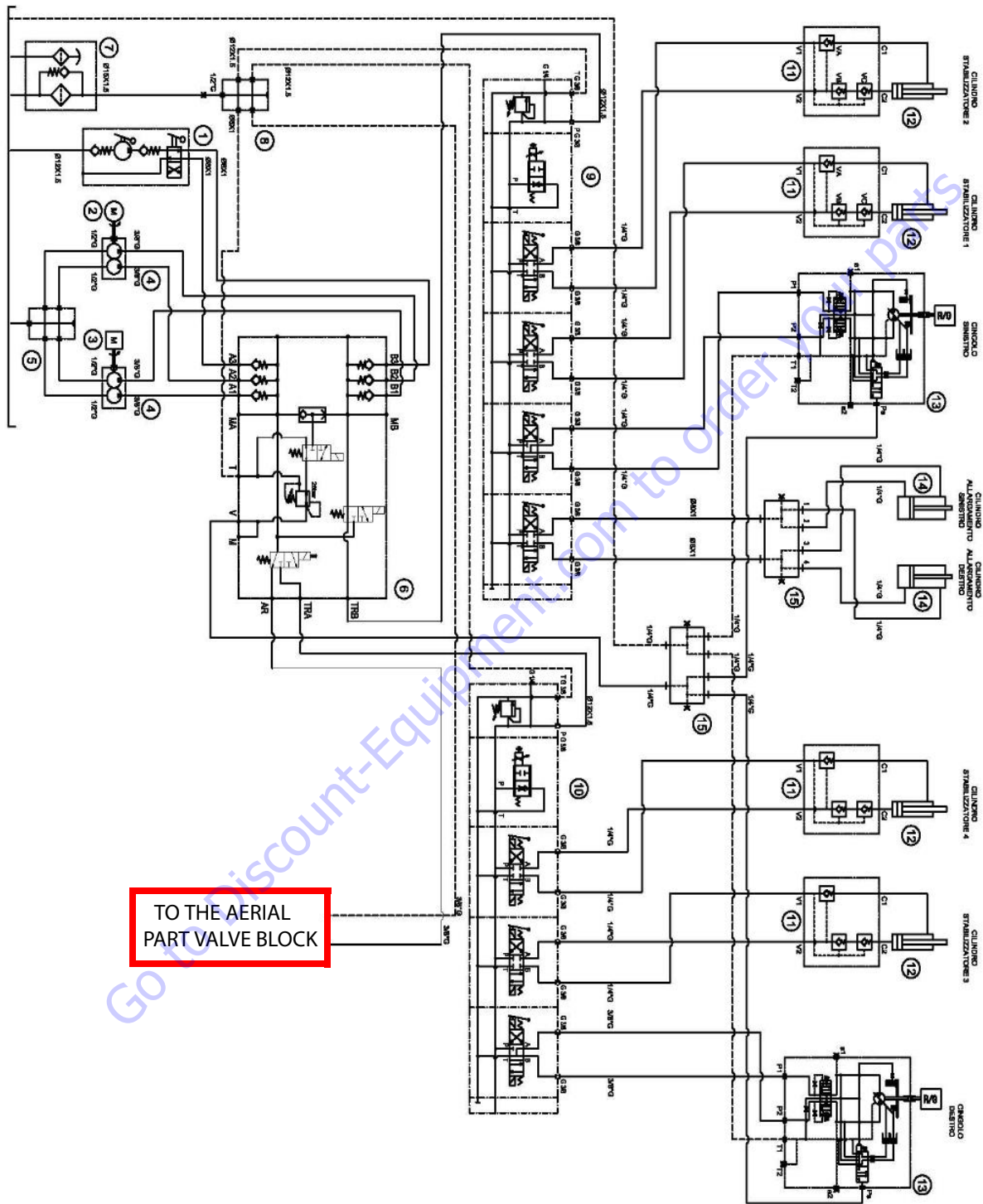


Figure 5-4. Pumps and Undercarriage Part Hydraulic Diagram

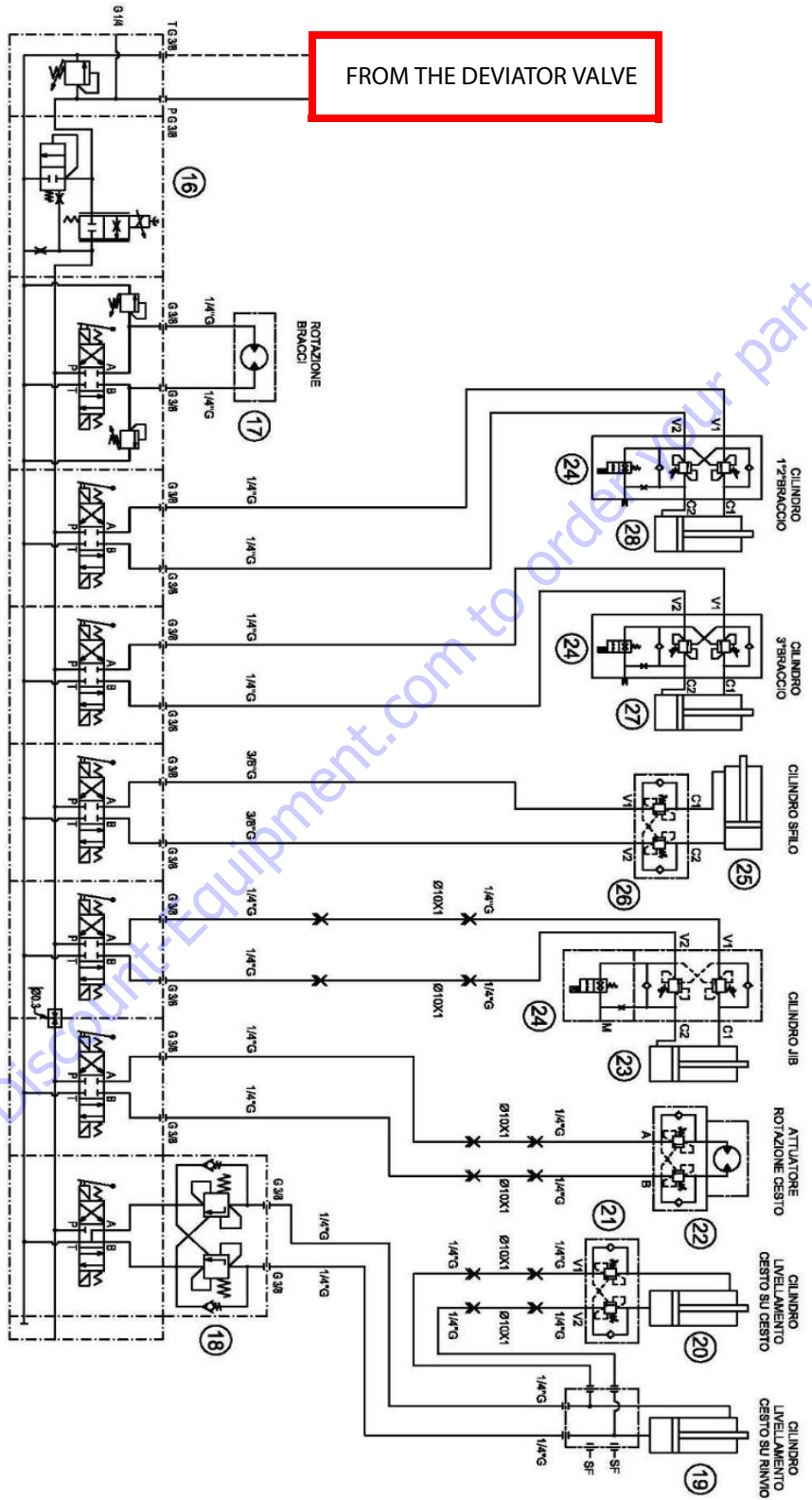


Figure 5-5. Aerial Part Hydraulic Diagram

### Pumps and Hydraulic Lines System

The machine hydraulic system is powered by n.3 pumps units:

1. Pumps unit connected to the engine, n.1 double tandem pump 3,15cc/rev each.
2. Pumps unit connected to the electric motor, n.1 double tandem pump 3,15 cc/rev.
3. Emergency hand pump, this has only one outlet line but it's equipped with a deviator to select which one of the two lines should be fed.

**NOTE:** *Lithium machine is equipped with only one double tandem pump unit 3,15 cc/rev each, connected to the three-phase electric motor, and the hand pump.*

All of the pumps units outlines are conveyed through the hydraulic manifold into two lines A and B. Six one-way valves avoid oil under pressure to flow back to the tank through an unused pump unit. The position of the pumps arrivals to the hydraulic manifold is described here below.

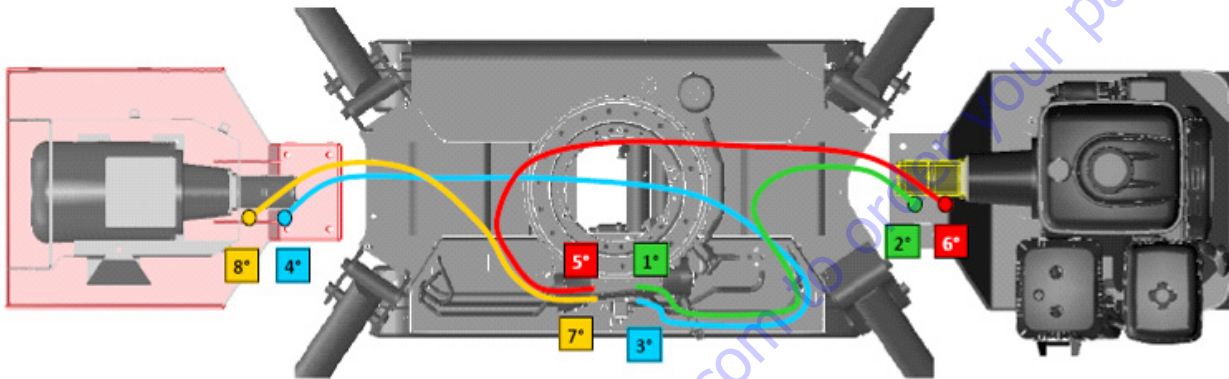


Figure 5-6. Hydraulic Lines System

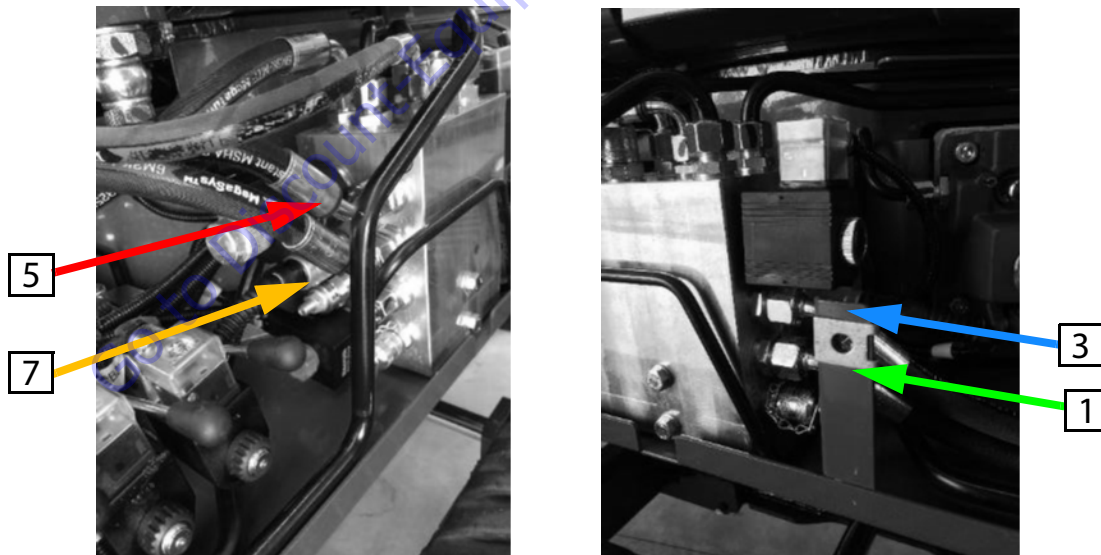


Figure 5-7. Hydraulic System

The hydraulic tank is pressurized type.

Every time that hydraulic oil tank is opened (depressurized), such as in case of hydraulic oil filter replacement, it

must be pressurized again (with cork screwed) fully extending outriggers and then the booms at turtle mode, to avoid cavitation.

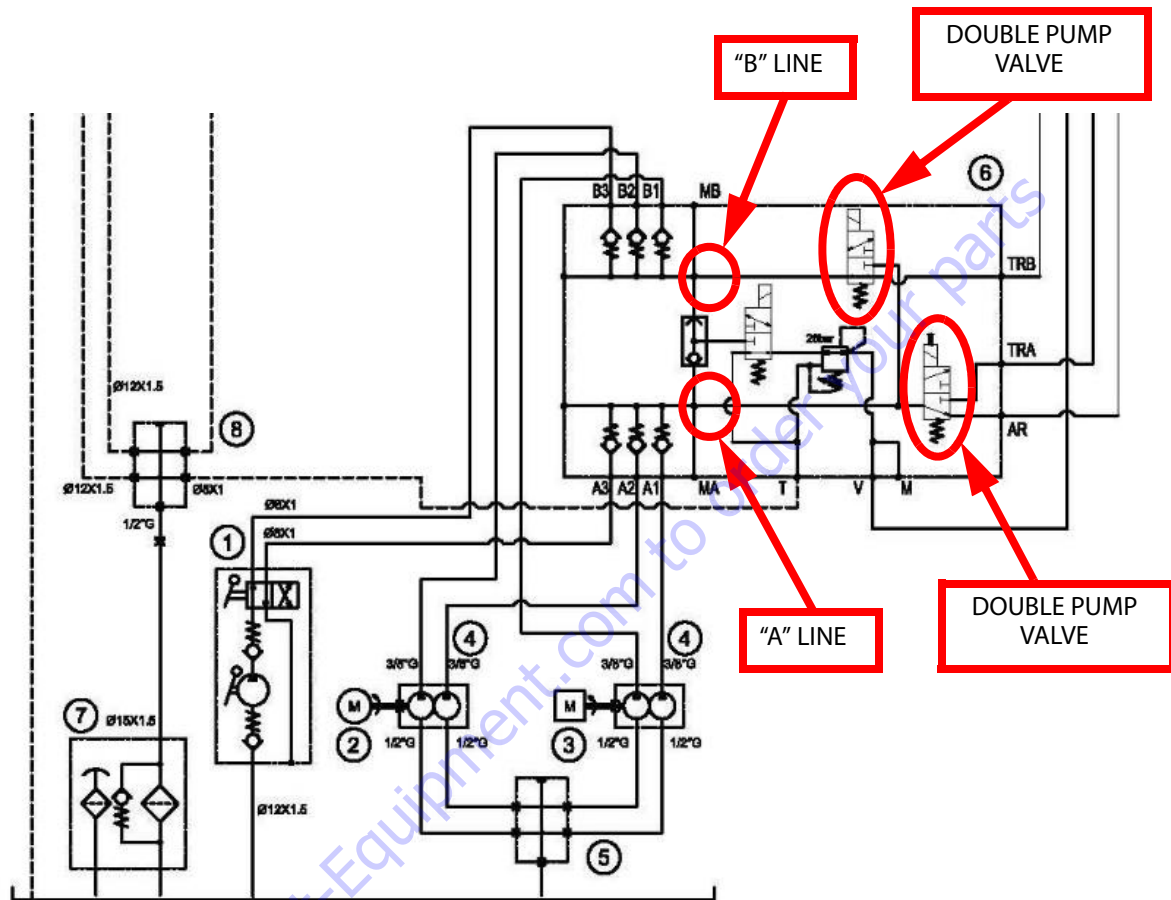


Figure 5-8. Hydraulic System Diagram

"A" line sends oil under pressure to the deviator valve, that is physically included into the hydraulic manifold, this valve is commanded directly by the control module to feed right side ground valve block or to aerial part valve block.

Deviator valve normally (when not fed) sends oil to aerial part valve block, so that it feeds right side ground valve block only when its coil is energized.

Its coil is energized (oil to the right side ground part) when machine is ON but not stabilized (or not respecting all the conditions to allow aerial part movements) and with engine/electric motor running.

For instance, deviator coil is energized when, with engine or electric motor running, all outriggers are touching the ground but remote control is not placed on its support.

**NOTE:** On lithium machine deviator coil is always energized when machine is ON and not stabilized (or not respecting all the conditions to allow aerial part movements), doesn't matter if engine/electric motor are running or not.

"B" line sends oil under pressure to the double pump valve, that is physically included into the hydraulic manifold, and that normally feeds left side ground valve block.

Double pump valve normally (when not fed) sends oil to left side ground valve block, so that it sends oil to the deviator only when its coil is energized.

While "N" or "HARE" speed is selected, when some aerial part movement are in progress, double pump valve is fed by the control module in order to feed also with the second pump the aerial part valve block, increasing the movement speed even without increasing the rpm.

## SECTION 5 - HYDRAULICS

Telescope opening and first and second booms lifting are speed up by this way both with diesel engine and electric motor.

Double pump valve is not fed with contemporaneously movements and is not fed at minimum speed "TURTLE".

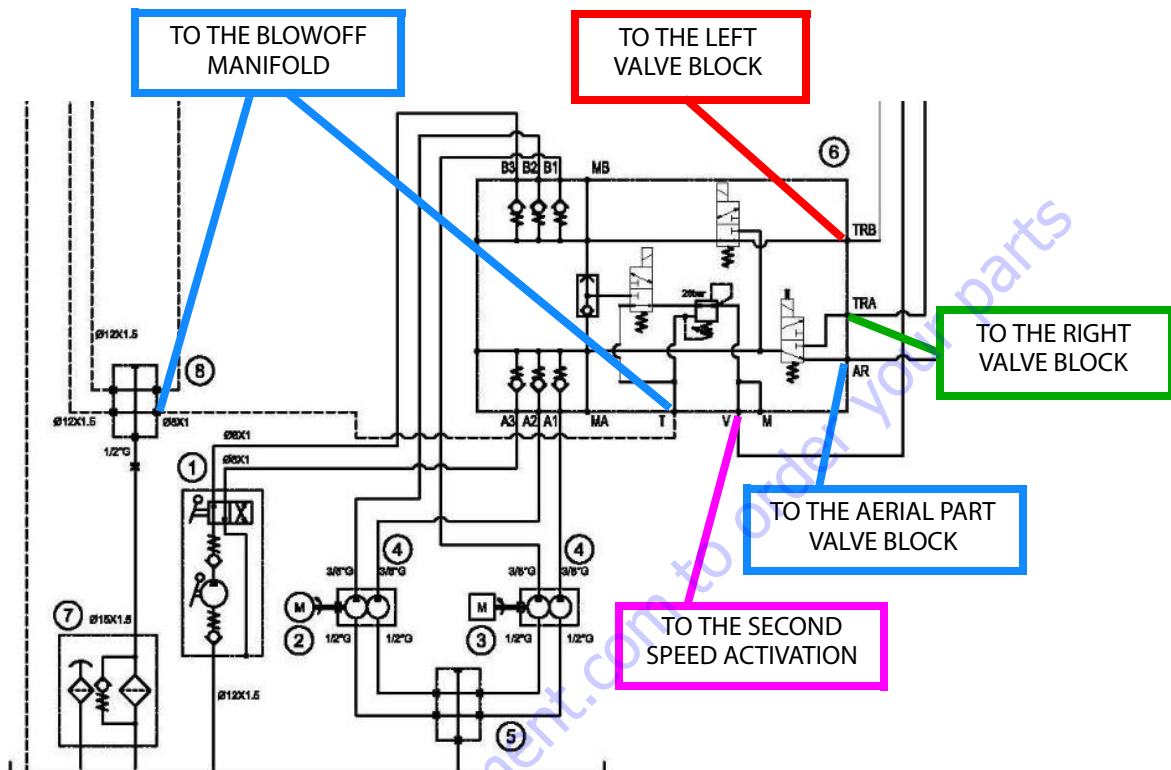


Figure 5-9. Hydraulic System Diagram

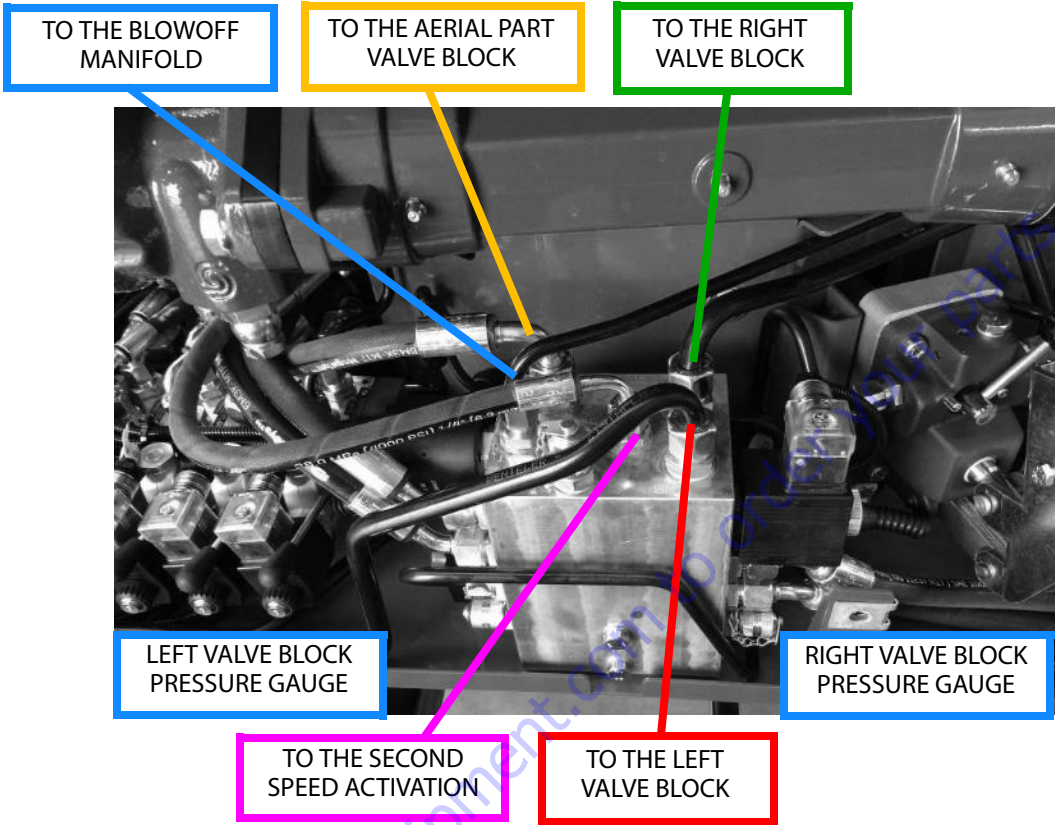


Figure 5-10. Hydraulic System

From the three valve blocks (two for ground part and one for aerial part) the outgoing oil is collected by the blowoff manifold to the tank filter.

**Ground Part Hydraulic System**

The ground part is controlled by two hydraulic valve blocks (right side and left side), both equipped with one

maximum pressure valve, one proportional valve and an ON-OFF valve for each ground part movement.

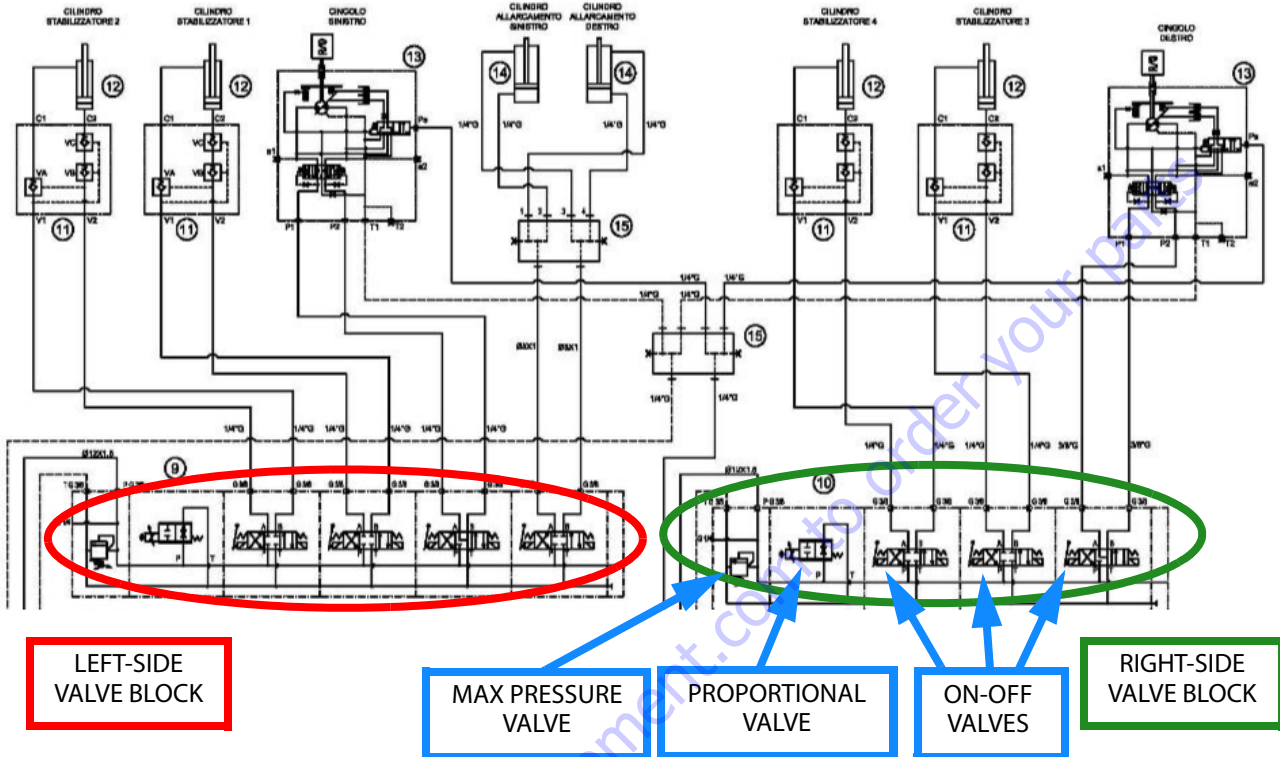


Figure 5-11. Ground Part Hydraulic System Diagram

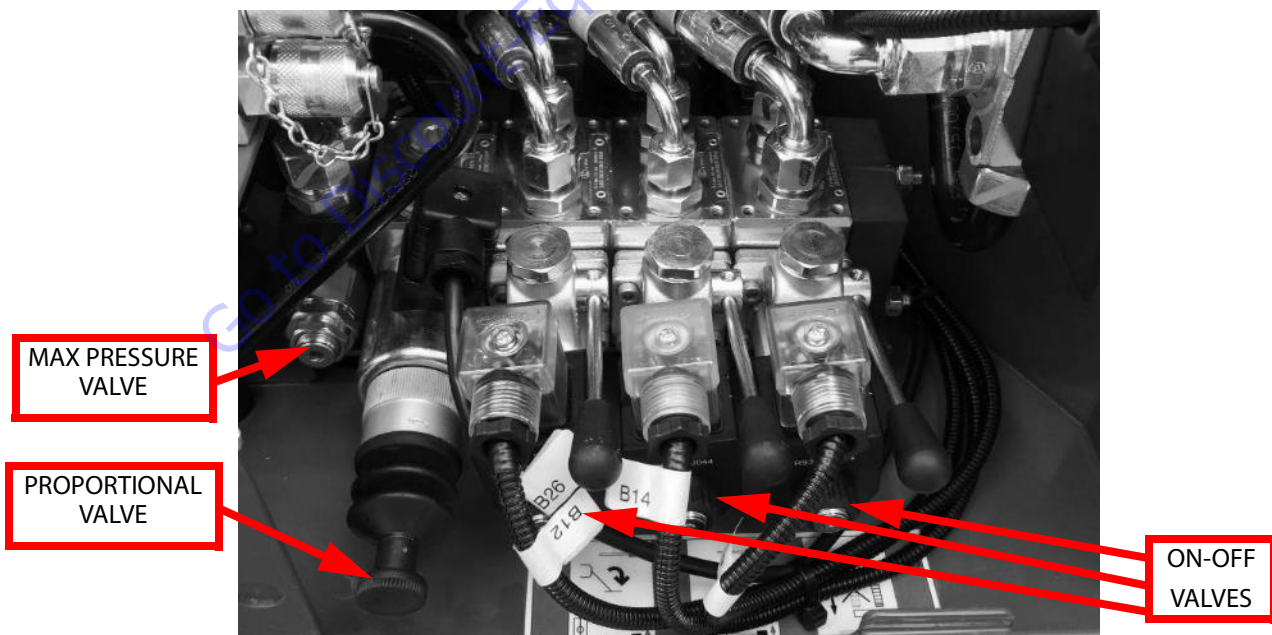


Figure 5-12. Right Side Valve Block

On each ground valve block oil rate is controlled through the proportional valve managed by the control module.

Depending on the movement required, proportional valve will open accordingly regulating the oil rate, at the same time the relevant ON-OFF valves (one each movement) will open feeding the relevant cylinder or drive gear motor.

Ground valve blocks maximum pressure valve has to be calibrated at 180 bar with engine running at max speed.

When the proportional valve coil is not energized, oil flows back to the tank.

Left side ground valve block controls the two left side outriggers (n.1 and n.2), the left track drive gear motor and the tracks widening cylinders.

Right side ground valve block controls the two right side outriggers (n.3 and n.4) and the right track drive gear motor.

## Outriggers

Outrigger cylinders are controlled by the cylinder valves block that is screwed on the cylinder, when machine is setup on outriggers oil is kept under pressure on the cylinder bottom side, against machine weight, by two piloted one-way valves installed in series on the cylinder valves block. Another piloted one-way valve is installed on the stem side.

While cylinder movements are in progress the opposite/s one-way valves is/are piloted to open letting oil flow back to the valve block.

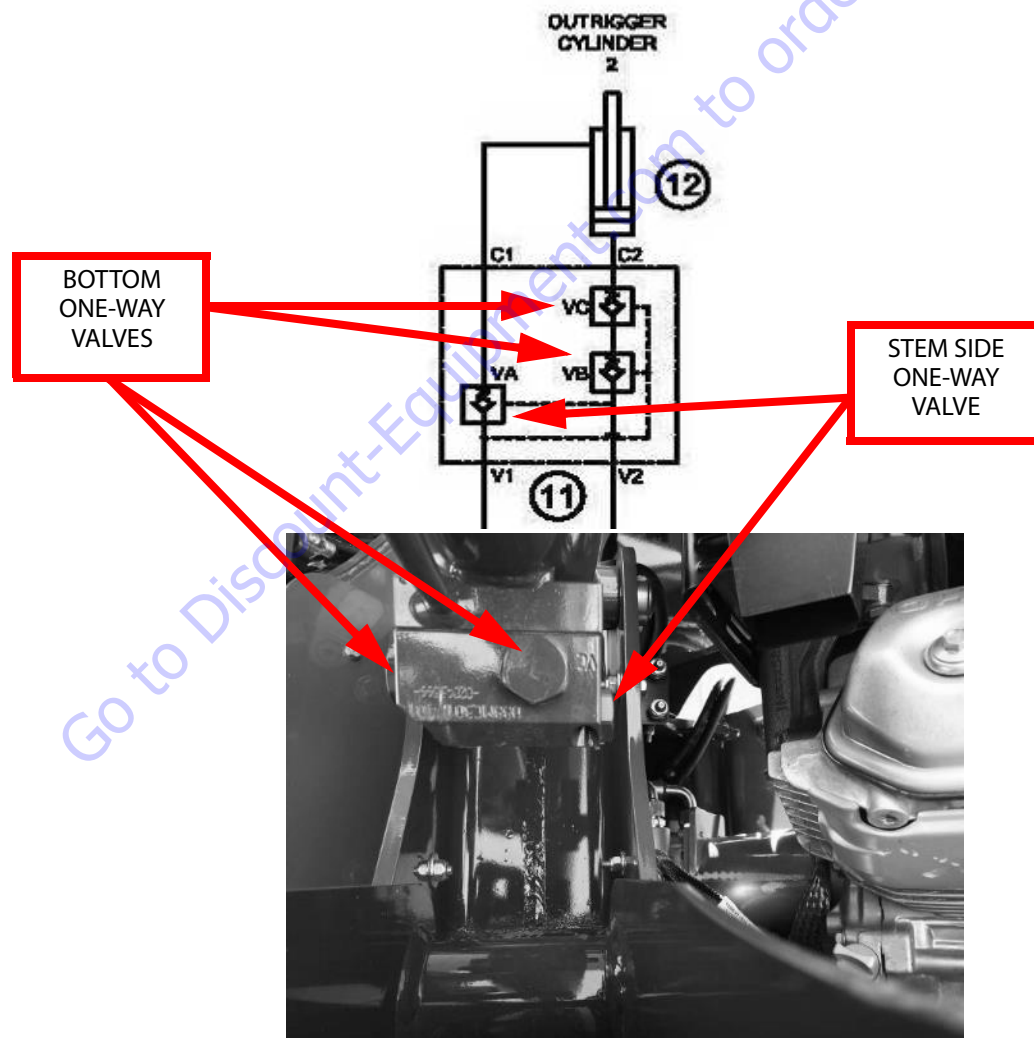


Figure 5-13. Outrigger Cylinder Valve



**Driver Gear Motors**

Each drive gear motors runs forward or backward independently, it's so possible to turn the machine. Drive gear motors are controlled by the ground valve blocks and each one is equipped with an automatic brake that is hydraulically deactivated only while it runs.

On the machine equipped with "second speed", drive gear motors are equipped with a second speed system, indeed they are variable capacity so that they can perform two

different hydraulic speeds in order to change tracks speeds further that rpm regulation.

When that coil is energized oil is sent to both drive gear motors to move their plate so that their chamber capacity will be reduce.

With reduced capacity the gear rate is increased so that the tracks speed is increased too.

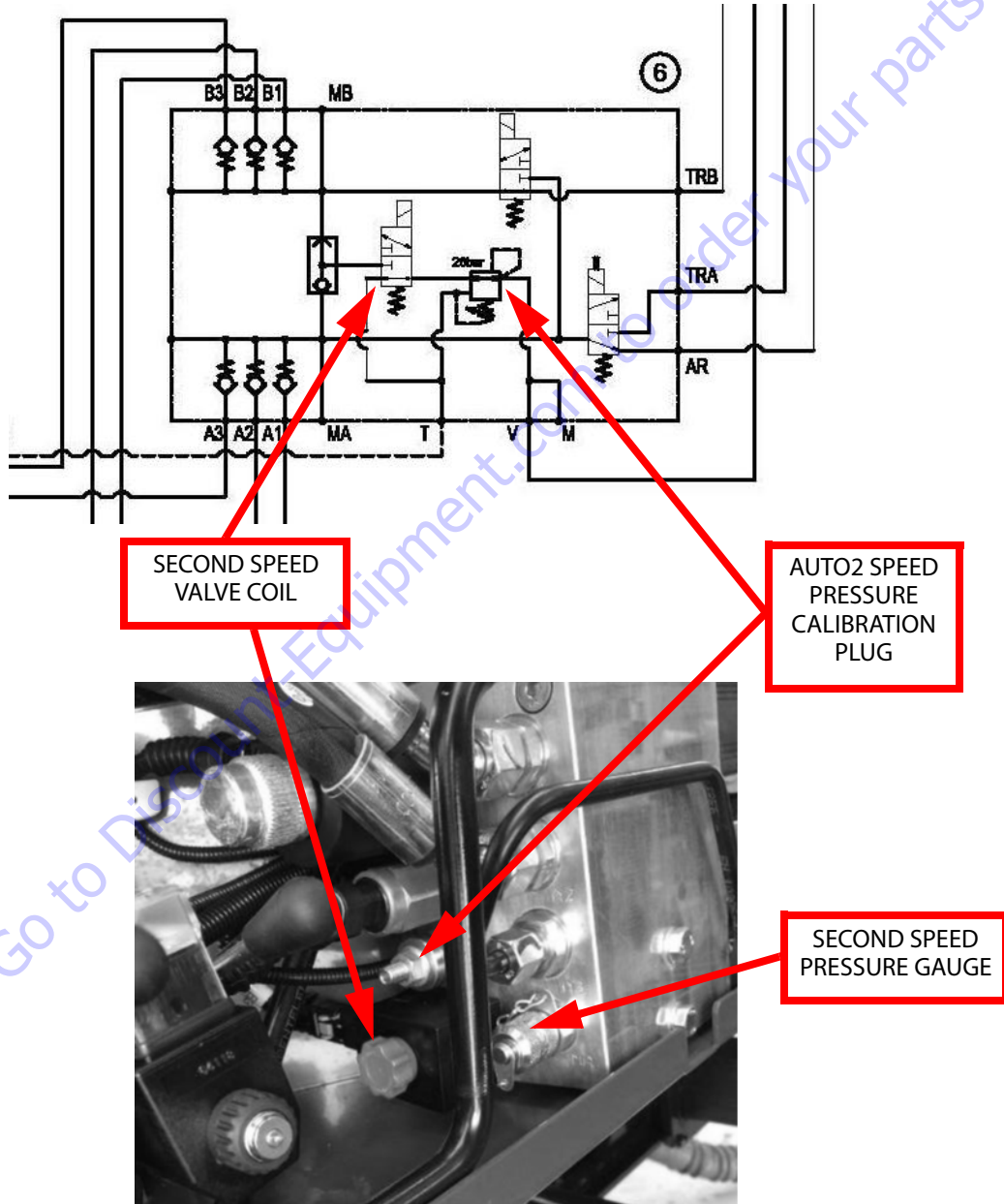


Figure 5-14. Second Speed System

This second speed system is also controlled by an auto2speed valve, in case of a higher torque is required to the drive gear motors, such as driving uphill, the second speed line pressure will raise and if it overcomes the cali-

brated maximum pressure (30 bar) it will automatically open the auto2speed valve reducing the gear rate and the tracks speed.

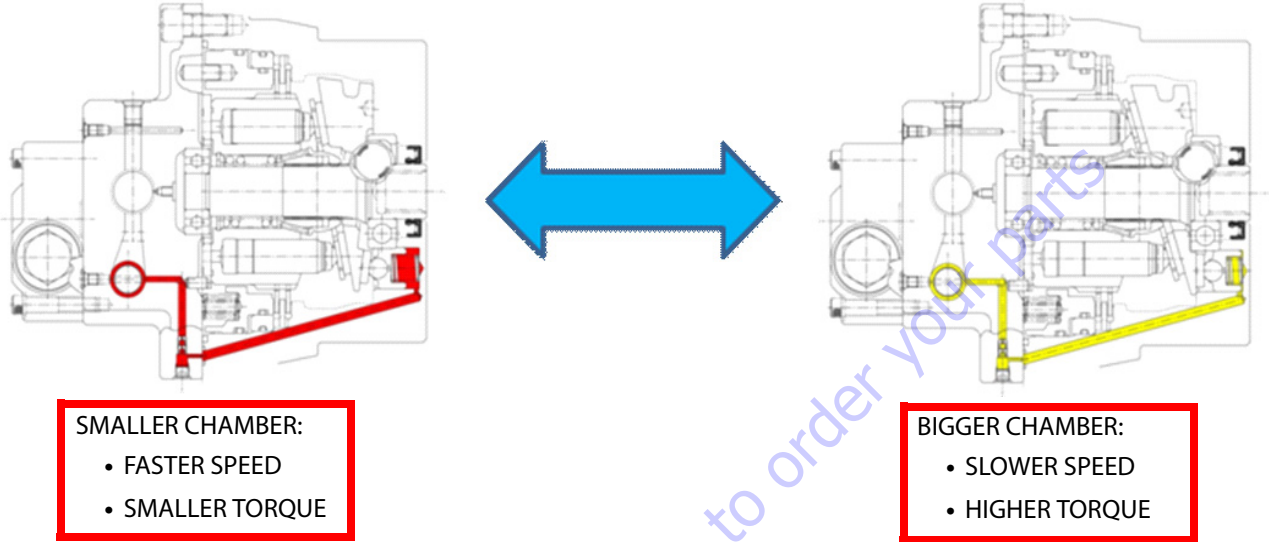


Figure 5-15. Drive Gear Motors

Auto2speed allows to manage automatically the available power, providing on demand a higher torque (with a slower speed) or faster speed (with a lower torque).

Second speed activation oil, coming from second speed valve coil, is sent to both drive gear motors through the second speed manifold, that is installed on the undercarriage base.



Figure 5-16. Second Speed Manifold

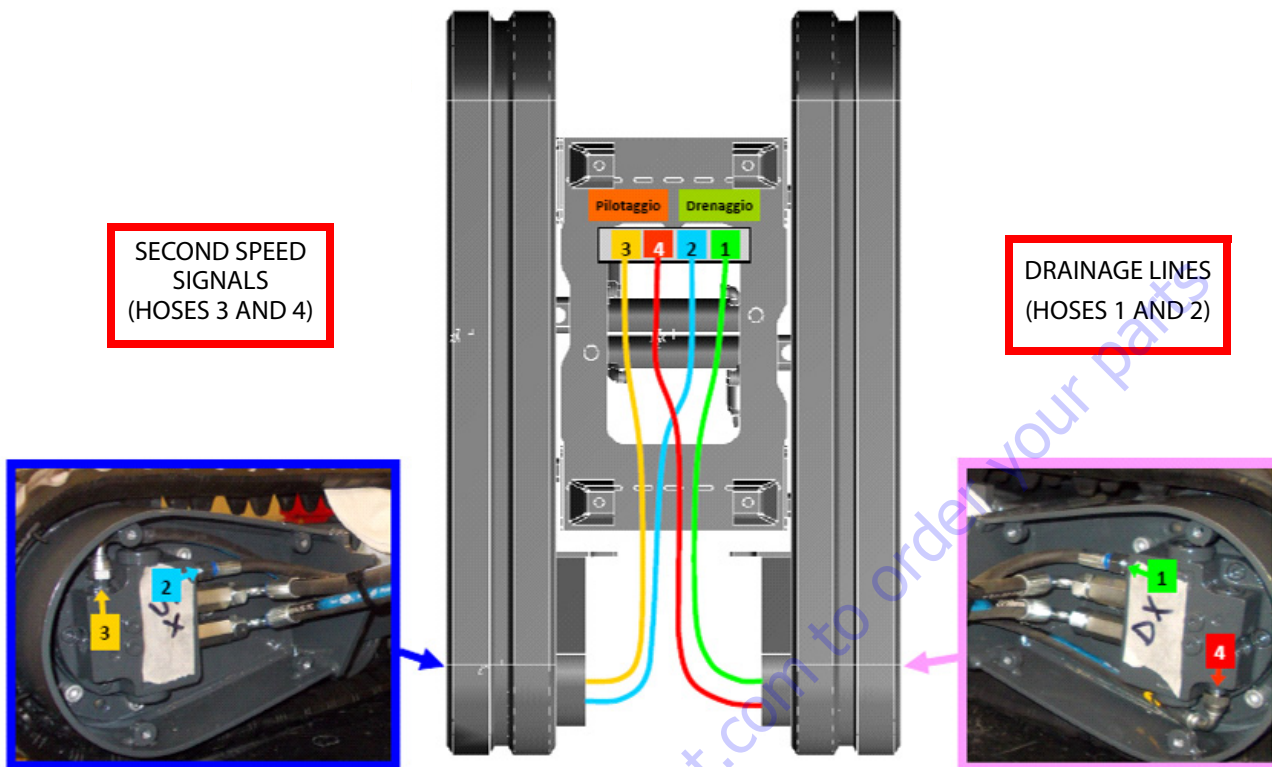


Figure 5-17. Second Speed Signals And Drainage

### Tracks Widening

Tracks widening or narrowing is carried out by two cylinders controlled together in parallel by the same valve block element on the left side valve block.

Track widening system oil is sent to both cylinders through the track widening manifold that is installed on hydraulic components compartment.

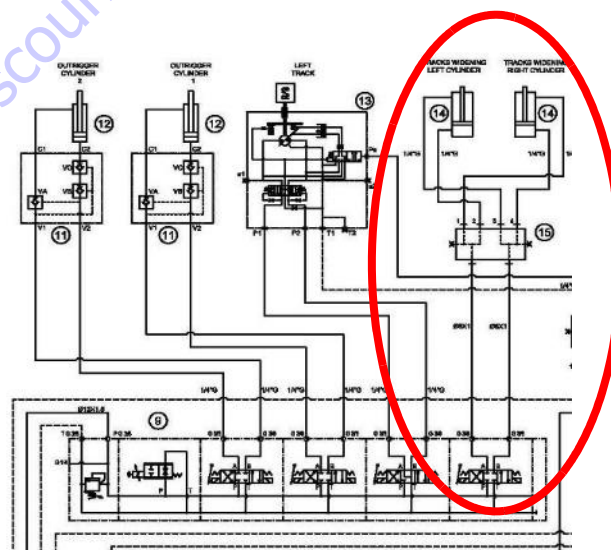


Figure 5-18. Tracks Widening Diagram

### Aerial Part Hydraulic System

The conditions while aerial part could be moved is detailed on chapter 5.

The aerial part is controlled by an hydraulic valve blocks equipped with one maximum pressure valve, one proportional valve and an ON-OFF valve for each aerial part movement.

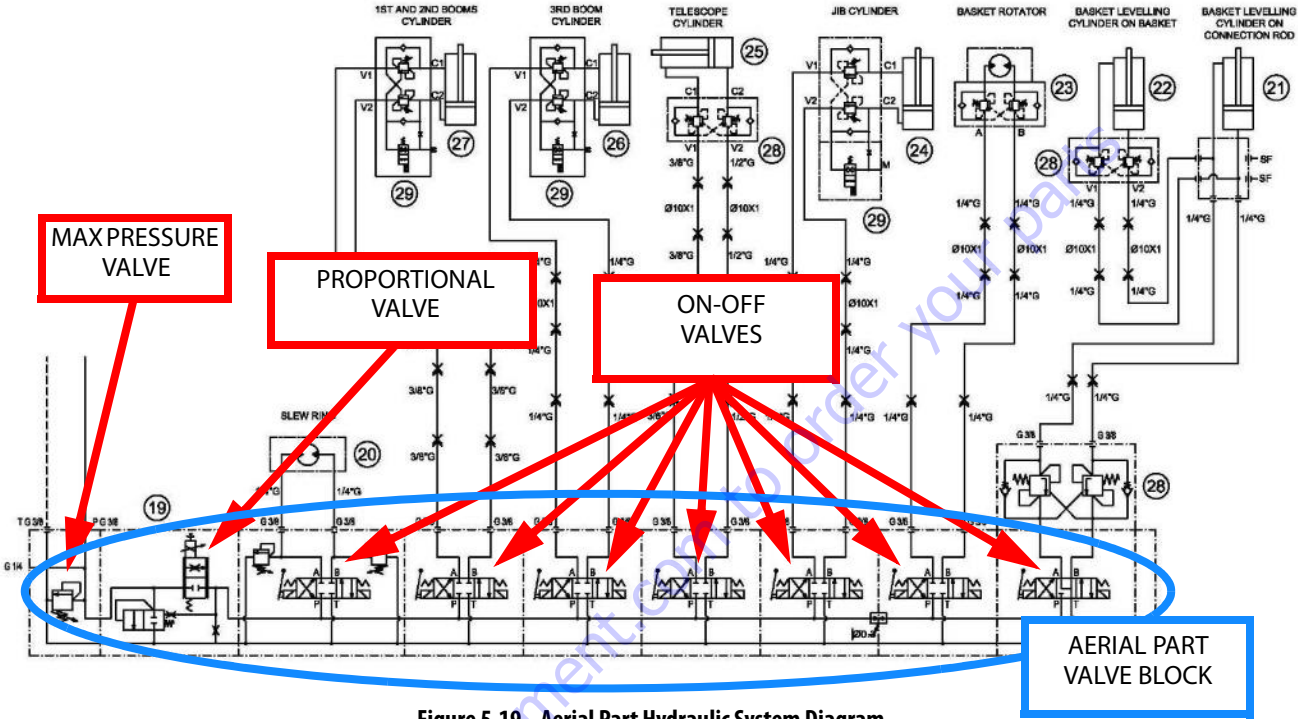


Figure 5-19. Aerial Part Hydraulic System Diagram

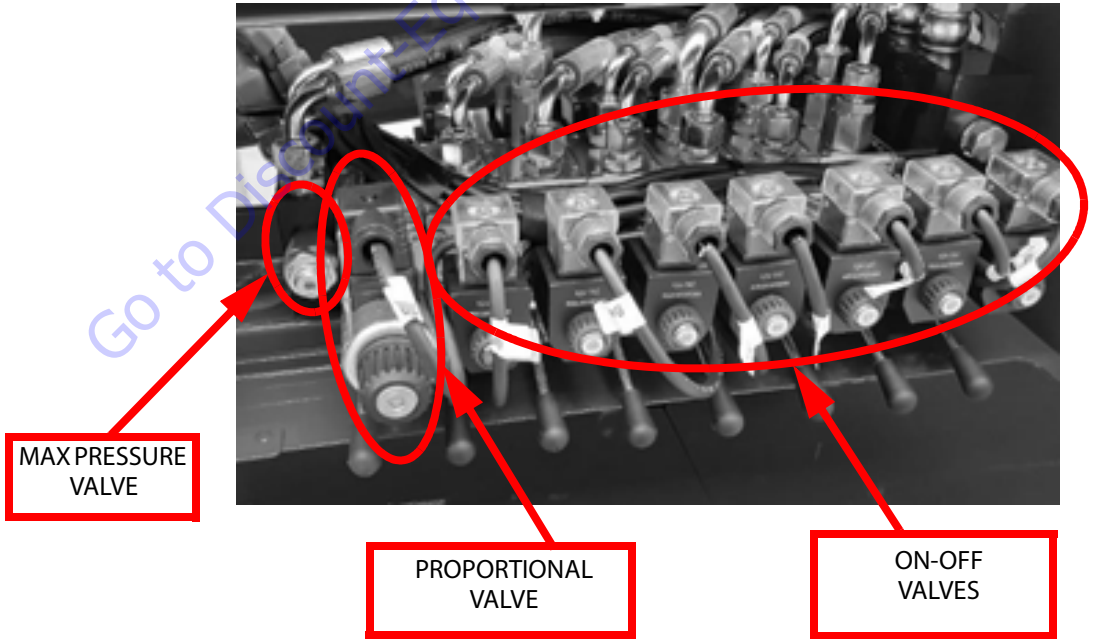


Figure 5-20. Aerial Part Hydraulic System

## SECTION 5 - HYDRAULICS

Aerial part valve block is fed by line "A" through deviator valve and oil rate is controlled through the proportional valve managed by the control module.

Depending on the movement required, proportional valve will open accordingly regulating the proper oil rate, then the relevant ON-OFF valves (one each movement) will open addressing the oil to the relevant cylinder or actuator.

When the proportional valve coil is not fed, oil is sent to the drainage and then to the tank.

The maximum pressure valve has to be calibrated as indicated on use and maintenance manual at 165 bar with engine running at maximum speed.

Through aerial part valve block are fed the turret rotation motor, the cylinder for moving 1<sup>st</sup> and 2<sup>nd</sup> booms, the cylinder for moving the 3<sup>rd</sup> boom, the telescope cylinder, the jib cylinder, the basket rotation actuator and the basket levelling circuit.

On each cylinder and actuator is installed a couple of calibrated valves, one each direction, when a movement is in progress on one direction the opposite valve is piloted to open letting oil flow back to the valve block.

When these valves are not piloted oil flow is avoided so that they keep the cylinder and actuator position against external forces or in case of an hose damage.

Those valves also help contemporaneity for the main movements.

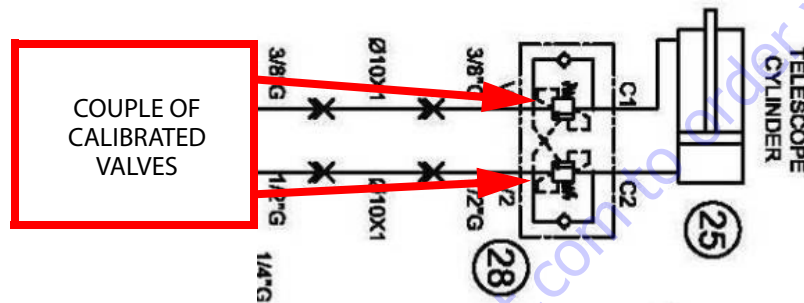


Figure 5-21. Telescope Cylinder Diagram

### First And Second Boom

1<sup>st</sup> and 2<sup>nd</sup> booms are moved together by one cylinder through the connection rod designed to obtain a double parallelogram system.

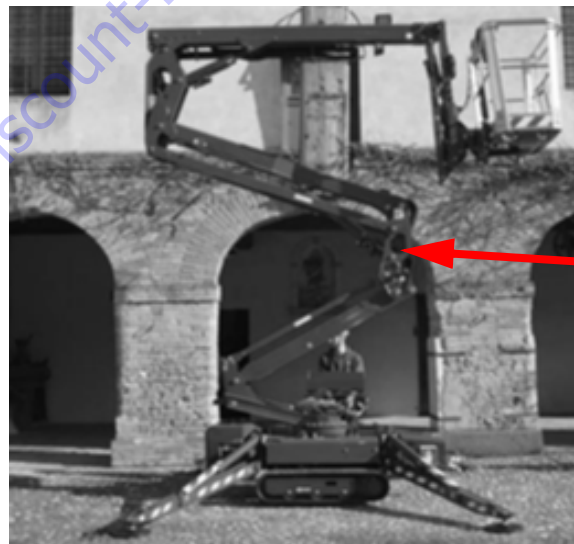


Figure 5-22. Connecting Rod

### Third Boom

Third boom is moved by one cylinder, this cylinder is equipped with an internal sensor that measures its opening position.

While lifting third boom, when it's going to reach its end of the stroke, in order to achieve a smoother machine handling, movement is automatically hydraulically decelerated by reducing the opening of proportional valve.

### Telescope

Third boom contains the telescope boom and the telescope cylinder.

### Jib

Jib is moved by one cylinder, while moving jib the basket is kept level thanks to the parallelogram system.

### Basket Levelling

Basket levelling close circuit is composed by two cylinders, one on the basket and one on the third boom connection rod, basket is automatically kept leveled while third boom is moving because of the basket cylinder is moved by connection rod cylinder.

In particular, while third boom is opening, the connection rod cylinder will be closing so that its oil will be send to the basket cylinder achieving the automatic basket levelling.

Of course is possible to adjust basket levelling acting on its key.

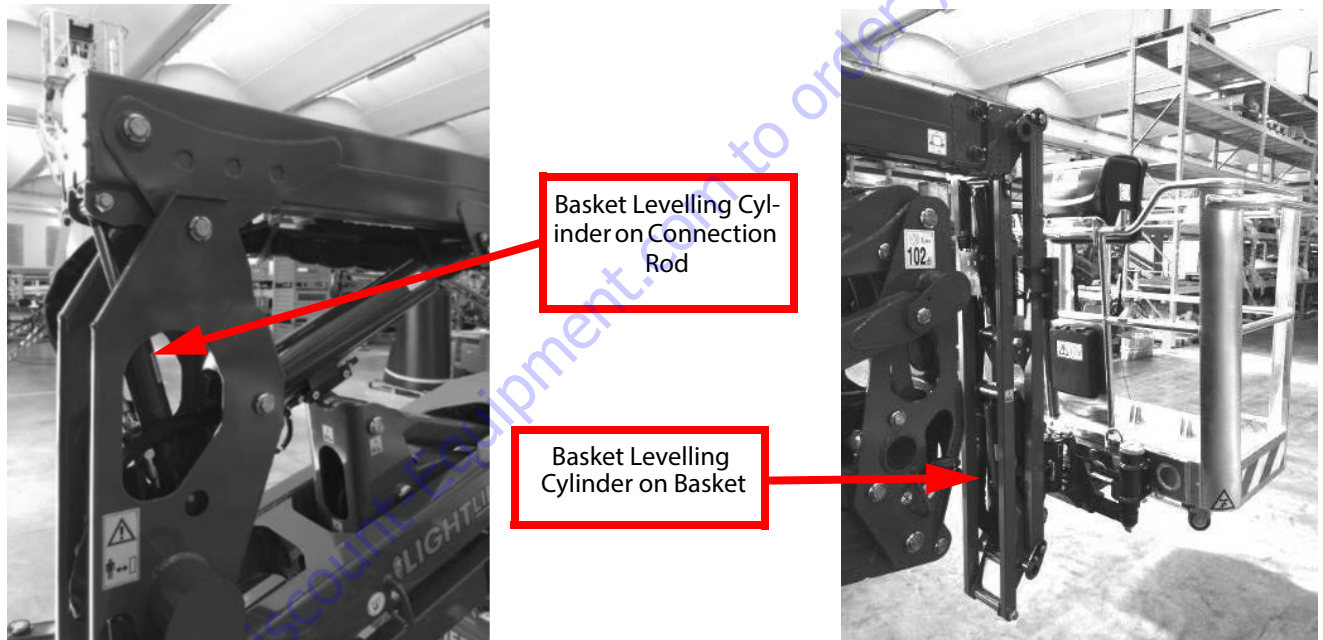


Figure 5-23. Basket levelling Cylinder On Second-third Rod Connector

### Basket Rotation (X15JP - X430AJ Only)

Basket rotation is carried out by the basket rotation actuator composed by two chambers, the maximum rotation possible is 62° on both directions achieving a total of 124°.

Two black arrows show the basket aligned position.

**Turret Rotation**

Turret rotation is carried out by a rotation hydraulic motor moved by a worm screw on a bearing ring.

Turret could be rotated 180° each side till a mechanical block, achieving a total rotation.

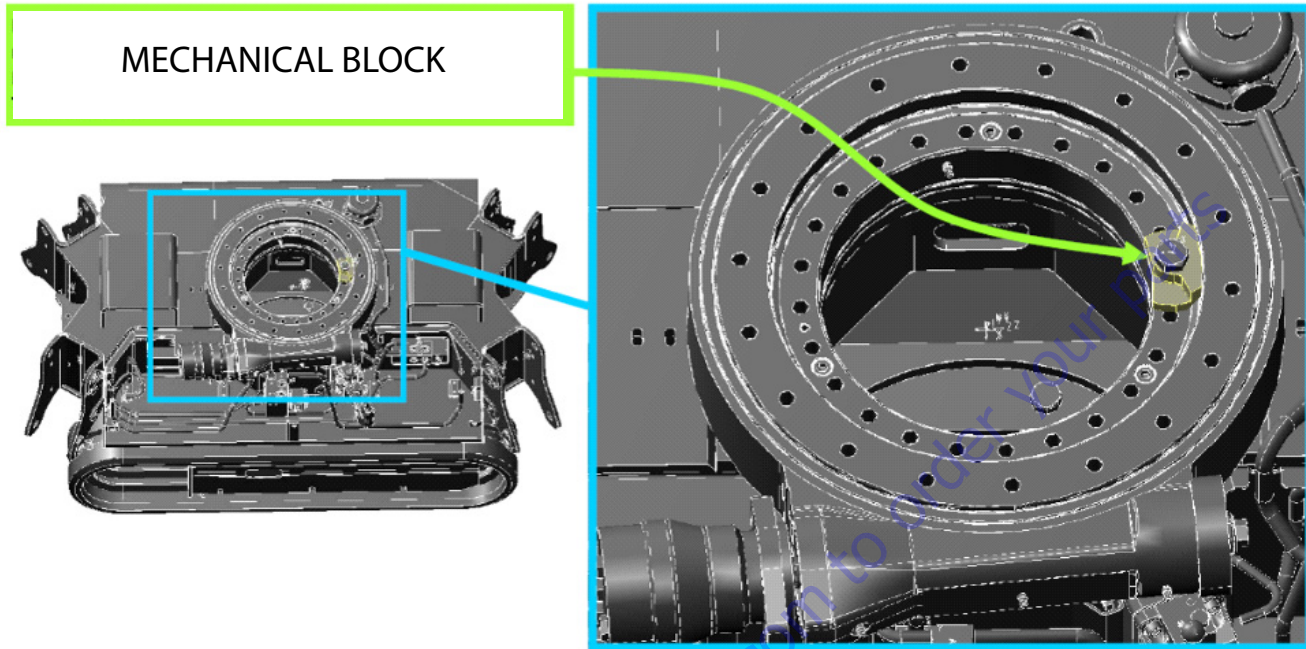


Figure 5-24. Mechanical Block

**Emergency Gravity Descent System**

Cylinders for 1<sup>st</sup> and 2<sup>nd</sup> booms, 3<sup>rd</sup> boom and jib are equipped with a coil valve for gravity emergency descent, they are controlled by the control module when the remote control button "gravity emergency descent" is pressed.

When they are fed they open a calibrated passage and under the gravity effect (weight) they will allow oil to get out from the bottom of the cylinder flowing back to the tank (through the ON-OFF valves), so that booms will slow down.

The coil valve for gravity emergency descent has a blue cap.



Figure 5-25. Valve for Gravity Emergency

5.2 CYLINDER REPAIR

Specification - Cylinders Overview

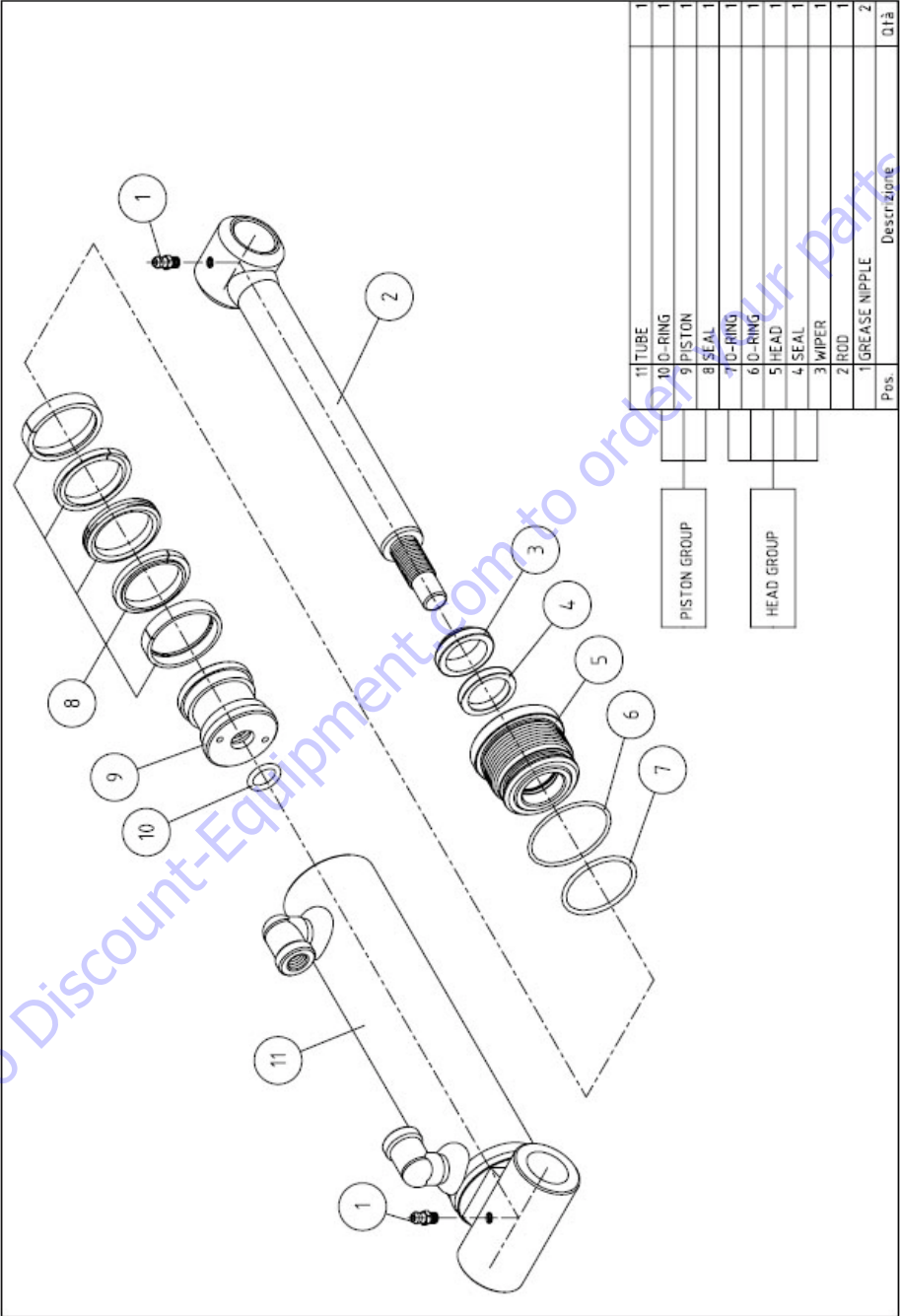


Figure 5-26. Piston Thread



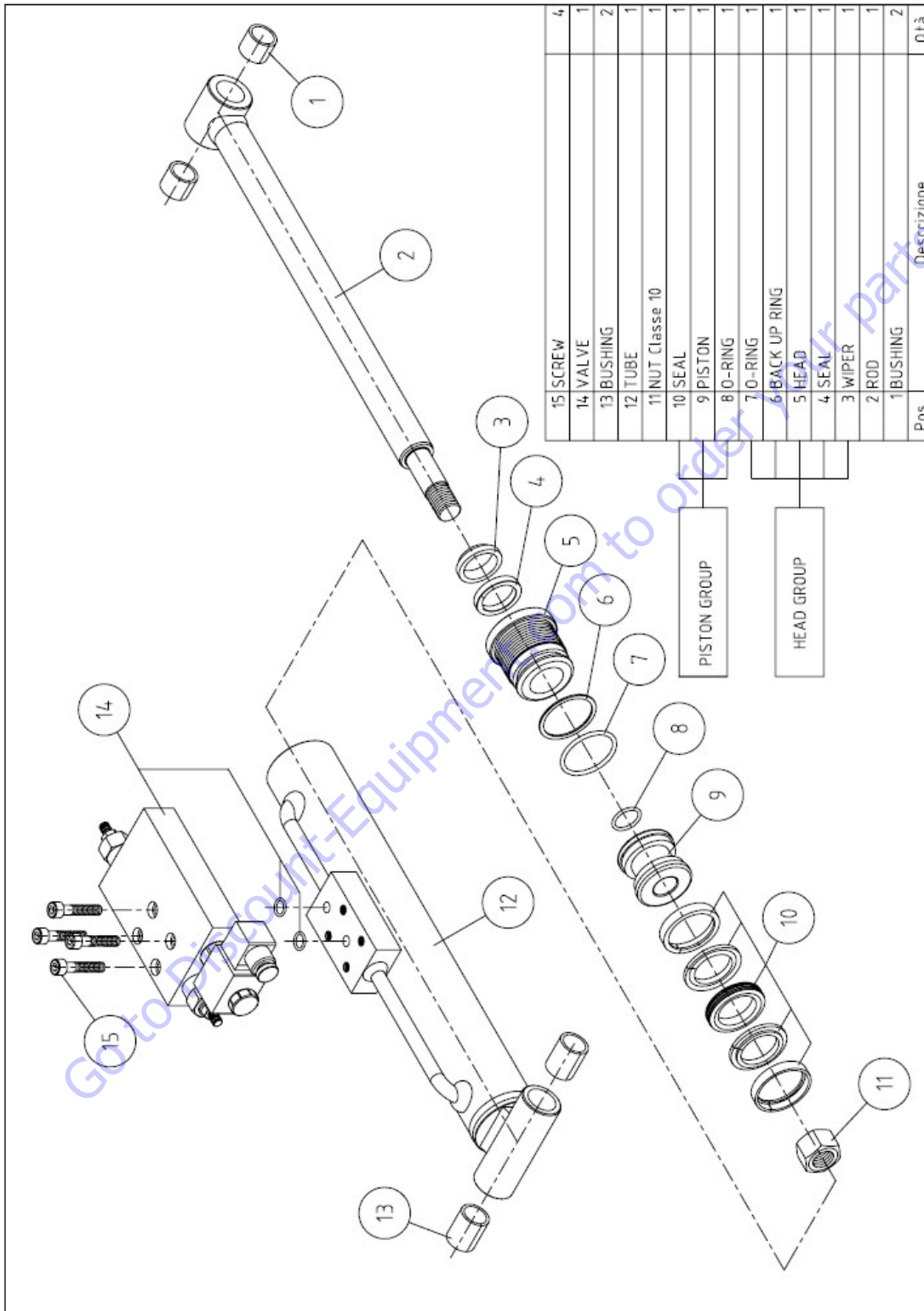


Figure 5-27. Piston With Nut Thread

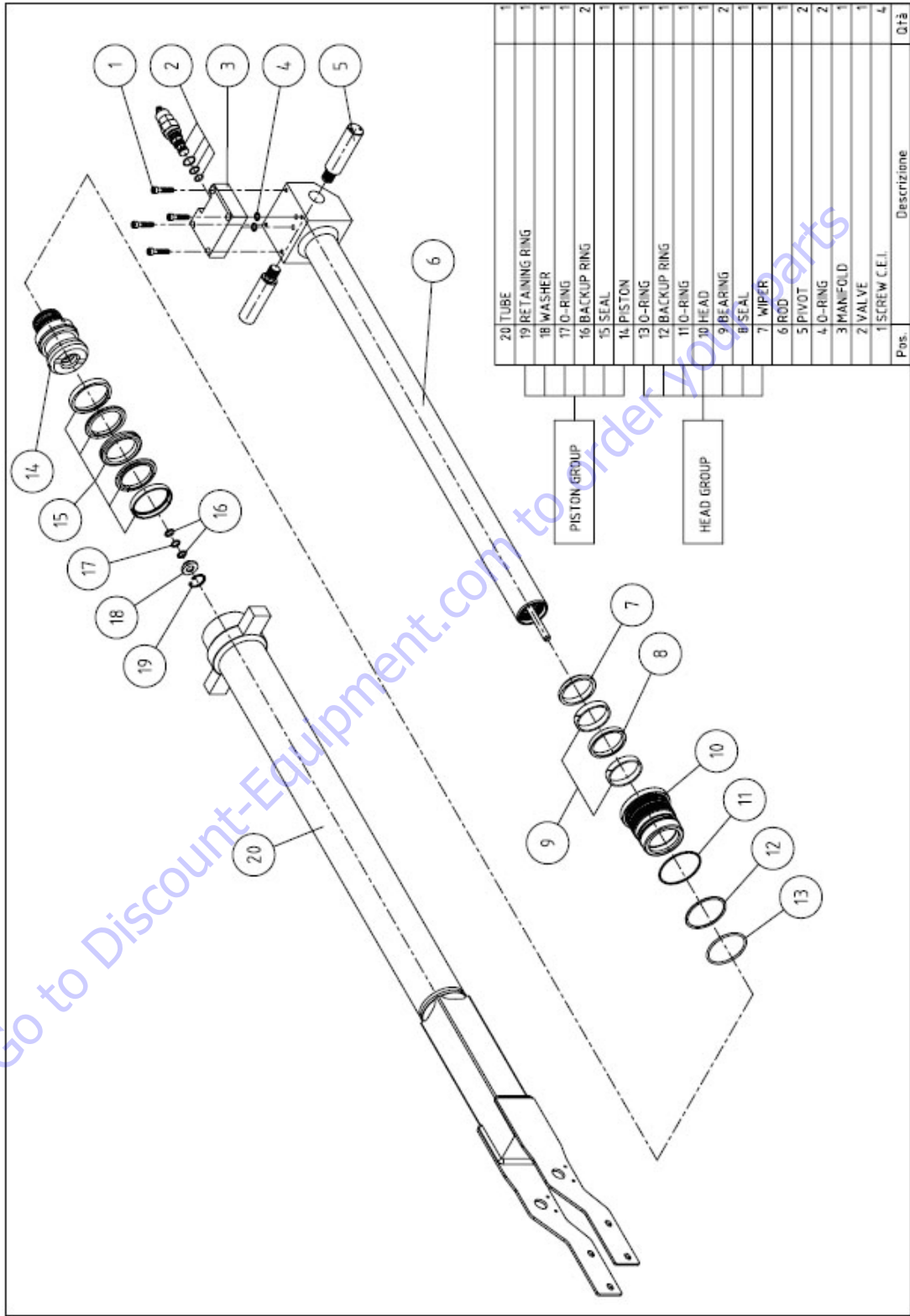


Figure 5-28. Telescope Cylinder

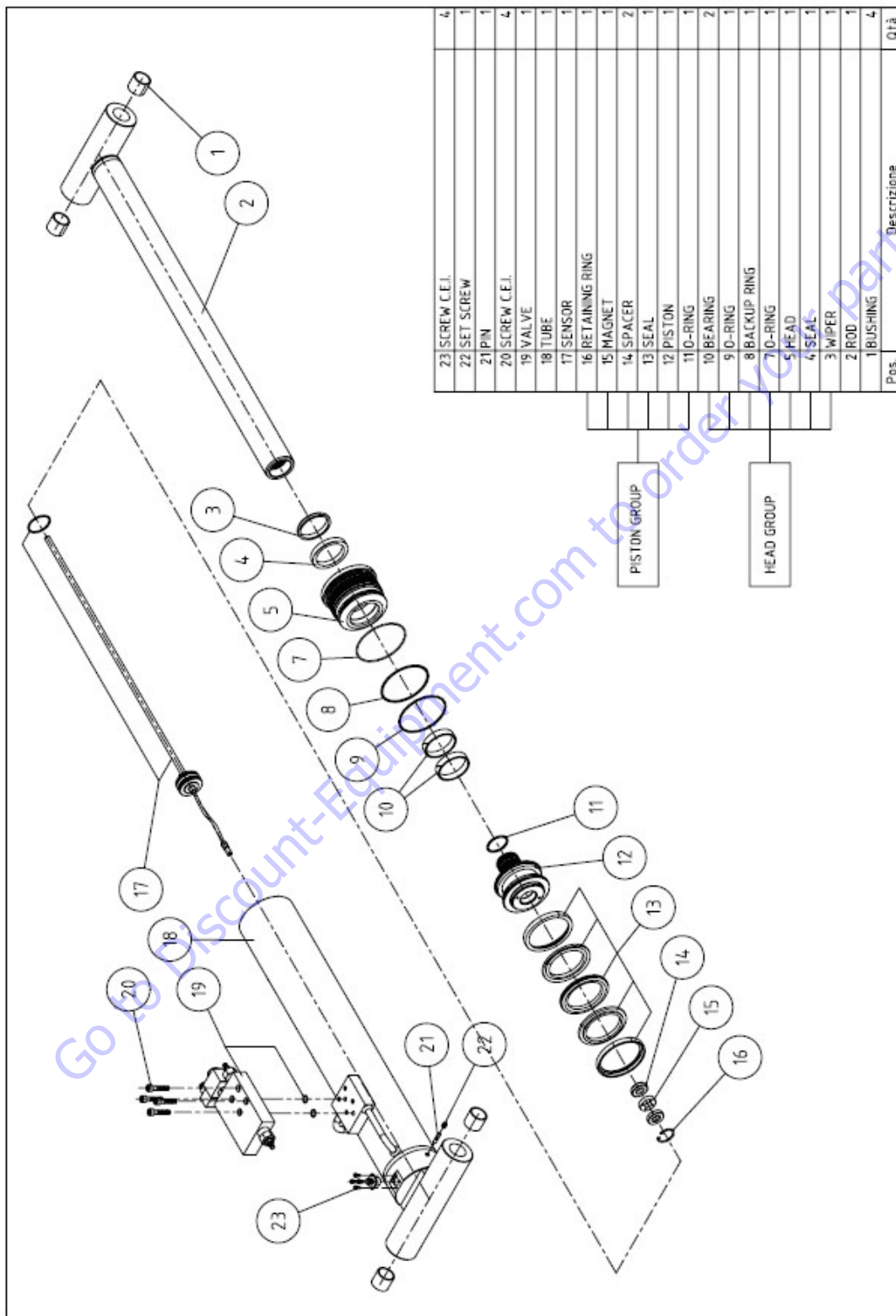


Figure 5-29. Cylinder With Sensor

## Hydraulic Cylinders Torque Specifications

### Screws Torque Specifications

CYLINDER SCREWS	TORQUE VALUE
DRILLED SCREW 3/8"	70N/m
SCREW M8	25N/m
SCREW M6	11N/m
SCREW M4	3N/m
CAP 1/4"	30N/m
PURGE SCREW	8N/m
GREASE NIPPLE	2N/m
SENSOR SETSCREW	0.5N/m

JUNCTION		
Ø TUBE	METRIC THREAD	TORQUE VALUE (N/m)
6	M12x1.5	20
8	M14x1.5	25
10	M16x1.5	30
12	M18x1.5	40
15	M22x1.5	60
18	M26x1.5	90
22	M30x2	170
28	M36x2	210
35	M45x2	360
42	M52x2	490

TIGHTENING TORQUE HEAD		
HEAD DIAMETER (mm)	TORQUE [Nm]	
	MIN	MAX
30	50	100
35	50	100
40	100	150
45	100	150
50	150	200
55	150	200
60	200	250
65	200	250
70	250	300
75	250	300
80	300	350
90	350	400
100	400	450
110	450	500
120	500	550
130	500	550
140	500	550
150	500	550
160	550	600
170	550	600
180	550	600
190	550	600
200	600	650
210	600	650
220	600	650
230	600	650
240	600	650
250	700	750

## Cylinder Assembling

Pay attention to not damage the sensor



### NOTICE

WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE TUBE TO HELP PREVENT BINDING.

1. Screw the head into the cylinder barrel and tighten with a spanner wrench. Refer to "Hydraulic Cylinder Torque Specifications" for tightening guidelines for the head.



2. Thread the counterbalance valve into the block on the cylinder barrel. Refer to "Hydraulic Cylinder Torque Specifications".

**NOTE:** The following are general procedures that apply to all of the cylinders without sensor. Procedures that apply to a specific cylinder will be so noted.

## Cylinder Repair Without Sensor

### Rod Removal

General Cylinder Disassembly

1. Clean the cylinder with a suitable cleaner before disassembly. Remove all dirt, debris and grease from the cylinder.
2. Clamp the barrel end of the cylinder in a soft-jawed vise or other acceptable holding equipment if possible.



### NOTICE

AVOID USING EXCESSIVE FORCE WHEN CLAMPING THE CYLINDER IN A VISE. APPLY ONLY ENOUGH FORCE TO HOLD THE CYLINDER SECURELY. EXCESSIVE FORCE CAN DAMAGE THE CYLINDER TUBE.

3. Remove the counterbalance valve from the side of the cylinder barrel.

### NOTICE

DO NOT TAMPER WITH OR ATTEMPT TO ADJUST THE COUNTERBALANCE VALVE CARTRIDGE. IF ADJUSTMENT IS NECESSARY, REPLACE THE COUNTERBALANCE VALVE WITH A NEW PART.

**NOTE:** Cylinder can have residual pressure inside.

4. When the cylinder has been emptied pull out the rod ~ 15mm and loosen the head until ~ 15mm.



### NOTICE

WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE TUBE TO HELP PREVENT BINDING.

## Piston With Nut Disassembling

### NOTICE

**PROTECT THE FINISH ON THE ROD AT ALL TIMES. DAMAGE TO THE SURFACE OF THE ROD CAN CAUSE SEAL FAILURE.**

1. Fix the rod into the vice.

**NOTE:** Before attempting to disassemble the piston remove any accessible seals.



**NOTE:** Apply heat to break the bond of the sealant between the piston and the rod before the piston can be removed.

### CAUTION

**WARM THE SURFACE INDICATED MAX 300°C**

2. Avoid overheating, or the parts may become distorted or damaged.



Apply sufficient torque for removal while the parts are still hot. The sealant often leaves a white, powdery residue on threads and other parts, which must be removed by brushing with a soft brass wire brush prior to reassembly.

3. Remove the piston head from the rod and carefully slide the head gland off the end of the rod.



## Cylinder Assembly

### General Cylinder Assembly

1. Use the proper tools for specific installation tasks. Clean tools are required for assembly.
2. Install new seals, backup rings and o-rings on the piston and the head.
3. Fasten the rod eye in a soft-jawed vise, and place a padded support under and near the threaded end of the rod to prevent any damage to the rod.
4. Lubricate and slide the head over the cylinder rod. Install the piston head on to the end of the cylinder rod. Loctite® 243TM and install the set screw in the piston head. Refer to "Hydraulic Cylinder Torque Specifications" for tightening guidelines for the piston, head and the set screws.

### Seals Head Replacing

1. Remove all seals, backup rings and o-rings from the piston head and all seals, backup rings and o-rings.



N.	DESCRIPTION	Qty.
1	O-RING	2
2	BEARING	2
3	BACK UP RING	1
4	SEAL	2

2. Install new seals, backup rings and o-rings on the piston and the head using the proper tool.



### Cylinder Inspection

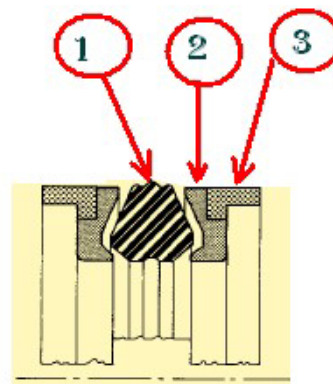
1. Inspect internal surfaces and all parts for wear, damage, etc. If the inner surface of the tube does not display a smooth finish, or is scored or damaged in any way, replace the tube.
2. Remove light scratches on the piston, rod or inner surface of the tube with a 400-600 grit emery cloth. Use the emery cloth in a rotary motion to polish out and blend the scratch(es) into the surrounding surface.
3. Check the piston rod assembly for run-out. If the rod is bent, it must be replaced.



Replace the seals on the piston. DO NOT attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.

Mount the seals in the following order:

1. Seal
2. Support bearing
3. Bearing



**NOTICE**

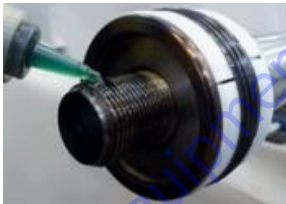
**PROTECT THE FINISH ON THE ROD AT ALL TIMES. DAMAGE TO THE SURFACE OF THE ROD CAN CAUSE SEAL FAILURE.**

Replace the seals on the piston. DO NOT attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.



- 4. Install the piston on to the end of the cylinder rod. Loctite® 270TM.

**NOTE:** If a white powdery residue is present on threads and parts, it can be removed. Clean the residue away with a soft brass wire brush prior to reassembly, and wipe clean before reinstallation.

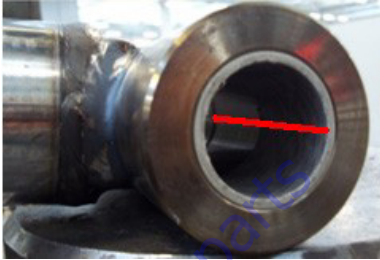


Refer to "Hydraulic Cylinder Torque Specifications" for tightening guidelines for the piston.



### Bushes Replacement

- 1. Carefully grind the bush with a milling cutter for plastic.



- 2. After that the bushing has been removed inspect the internal surface.



- 3. Replace the bush with a new one and put it inside with a press.





## Emptying Of The Cylinder

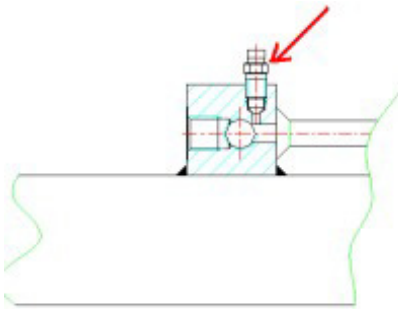
### Vent Valve

Air inside the circuit has to be removed in order to avoid vibration and irregular motion of the cylinder, vent valves are apply to make this kind of operation.

Failure to remove air from the circuit can cause diesel effect with consequent damage of the seals.

Be sure that there is no presence of air inside the cylinder before it start working.

### Purge screw



**⚠ CAUTION**

LOOSEN PURGE SCREW TO LET AIR ESCAPE RE-TIGHTENING TORQUE 6 ft. lbs. (8 Nm).

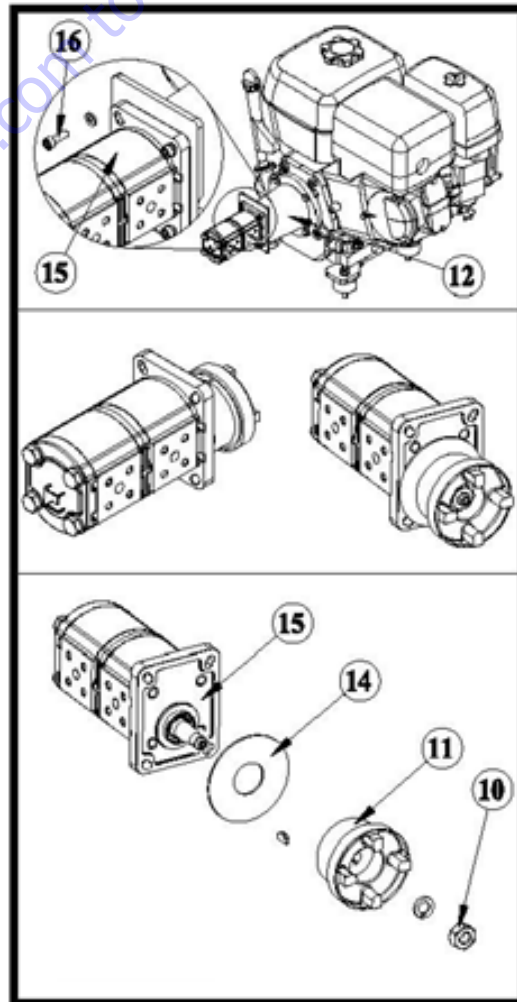
## 5.3 REPLACEMENT HYDRAULIC PUMP

### Pump Removal

1. Open the top cap of the hydraulic oil tank.
2. Tag & disconnect the hoses from the pump 15.
3. Loose screws 16.
4. Remove from the pump 15 from the adapter 12.
5. Loosen nut 10 and remove the coupling 11 and plate 14 from the pump shaft 15.
6. Move the new pump the particular 14.

### Pump Installation

1. Install the plate 14, coupling 11, and the nut 10 on the pump.
2. Tighten the nut 10 at (15Nm).
3. Fit the pump 15 on the coupling 15 with screw 16.
4. Connect the hoses to the pump 15.



5.4 HYDRAULIC SCHEMATICS

X13JP-X370AJ

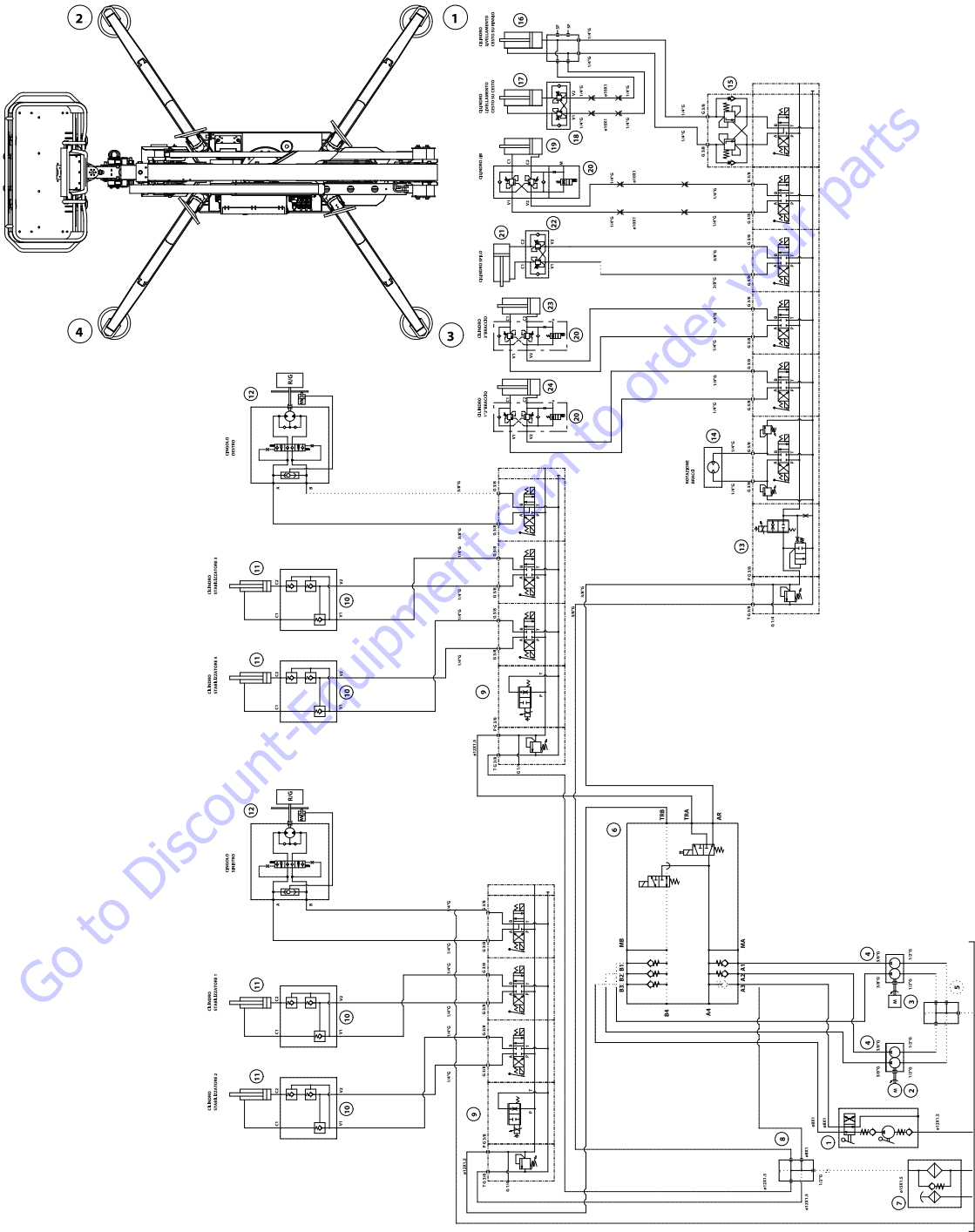


Figure 5-30. X13JP-X370AJ - Hydraulic Schematic - Fixed Undercarriage

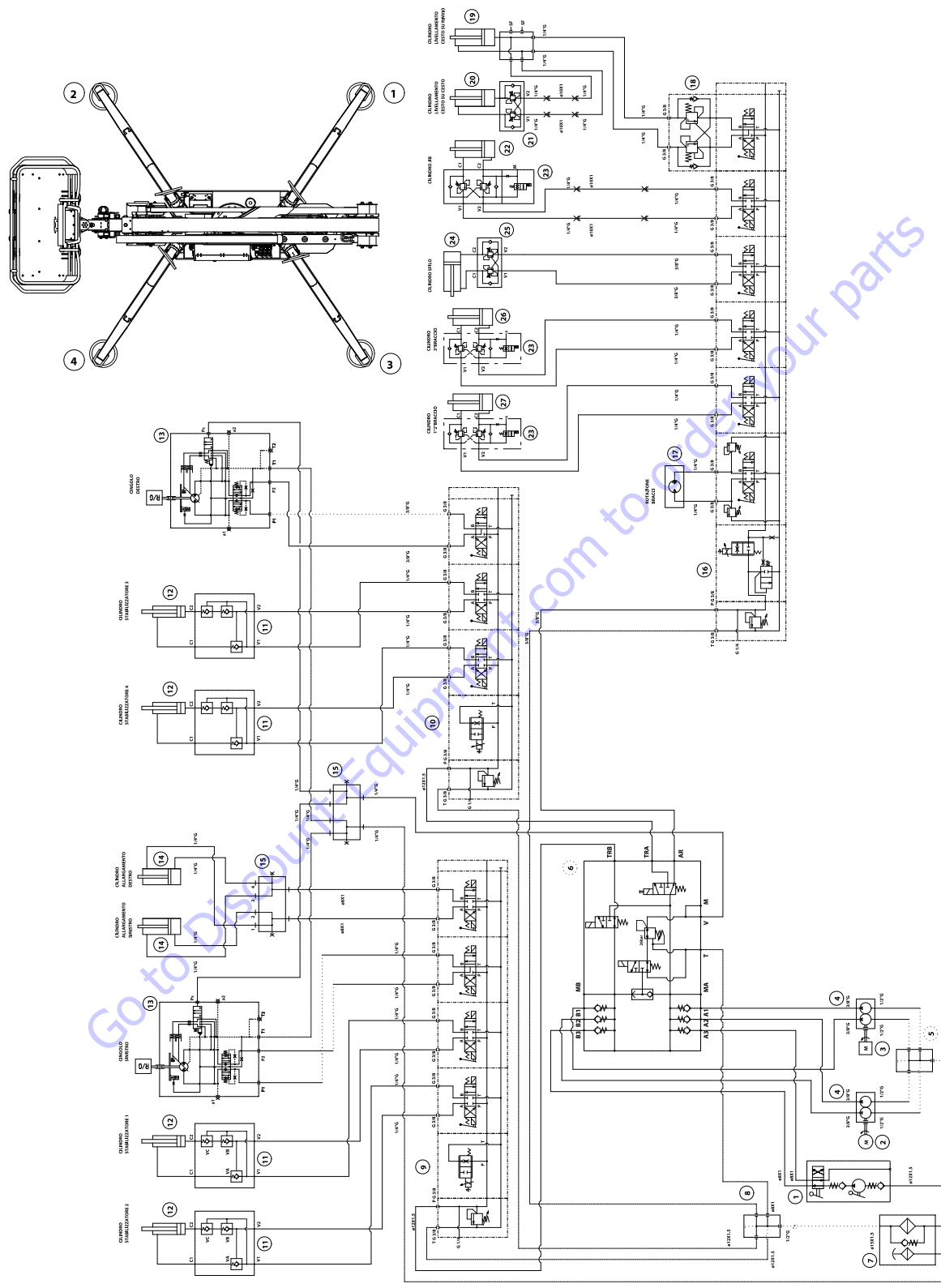


Figure 5-31. X13JP-X370AJ - Hydraulic Schematic - Extendable Undercarriage

X15JP-X430AJ

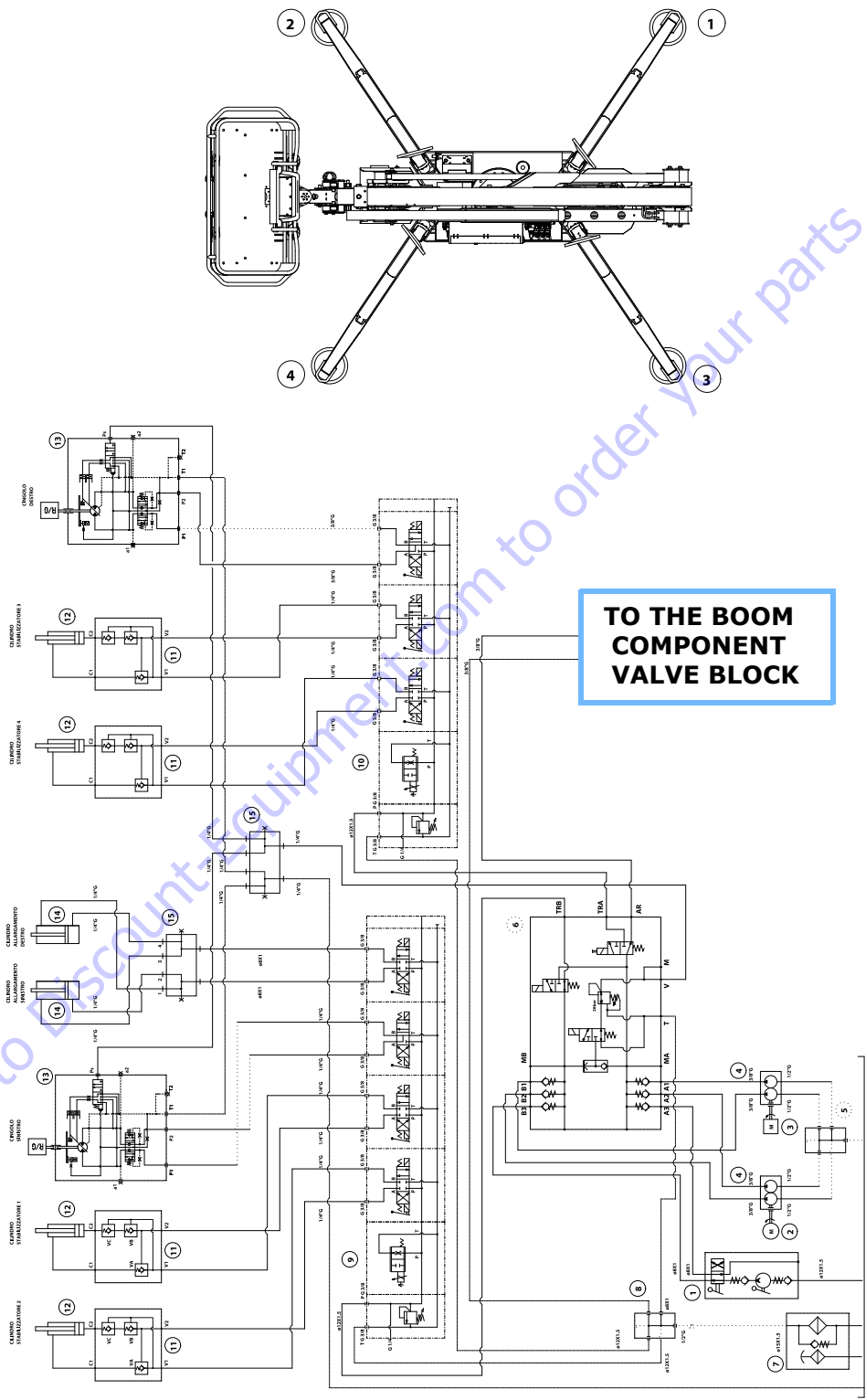


Figure 5-32. X15JP/X430AJ - Hydraulic Schematic - 1 of 2

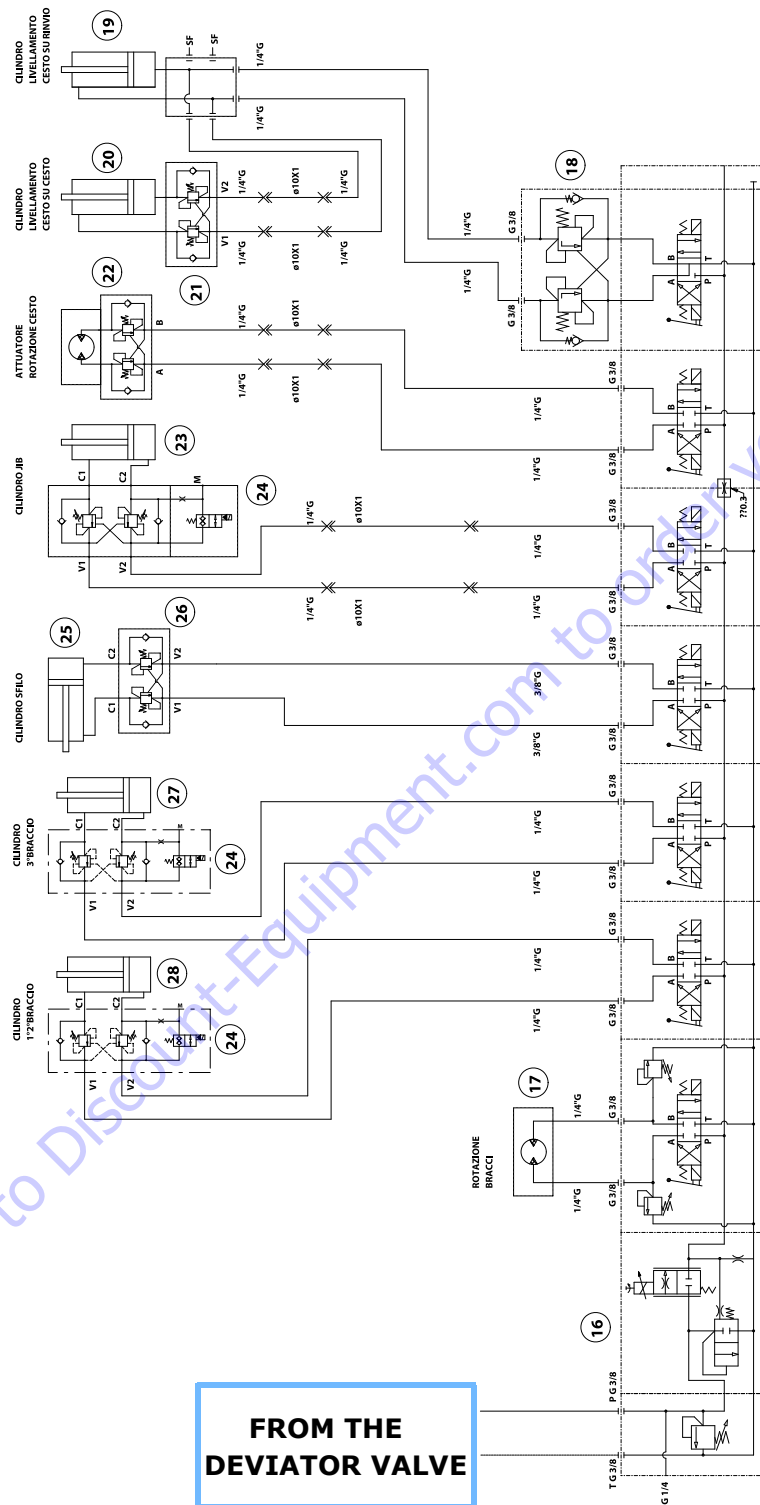


Figure 5-33. X15JP/X430AJ - Hydraulic Schematic - 2 of 2

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

**Search Manuals**

Enter your information to search for manuals and parts.

\* Brand:

\* Model:

\* Serial:

\* Part Number:

SEARCH

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

**Parts Order Form**

Please fill in the following information:

Manufacturer:

Model:

Description:

Quantity:

Part Number:

Part Name:

Part Description:

Part Category:

Part Location:

Part Status:

Part Condition:

Part Material:

Part Color:

Part Weight:

Part Dimensions:

Part Notes:

Submit

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on one of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## SECTION 6. JLG CONTROL SYSTEM

### 6.1 INTRODUCTION

#### NOTICE

WHEN INSTALLING ANY NEW MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS AND PROPERLY CALIBRATE THE TILT SENSOR.

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSUREWASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

The JLG Control System is a 12 volt based control unit installed on the compact crawlers boom lift.

The JLG Control System has reduced the need for exposed terminal strips, diodes and trim pots and provides simplicity in viewing and adjusting the various personality

Settings for smooth control of: acceleration, deceleration, creep, min speed, and max. speed for all boom, and drive functions.

The main lift, swing, and drive are controlled by individual Joysticks. To activate Drive, Lift, and Swing move the joystick into the direction desired.

The control system will control the voltage output to the valves, as programmed for smooth operation and maximum cycle time.

The JLG Remote Control has a built in Display and by a push buttons, could show any present faults.

The Remote Control is connected by cable on the following models:

CE - X13JP – X15JP

ANSI -X370AJ – X430AJ

The system can be accessed for troubleshooting even by the analyzer RamHino; kit JLG part no.17162400.

6.2 PLATFORM - REMOTE CONTROL STATION

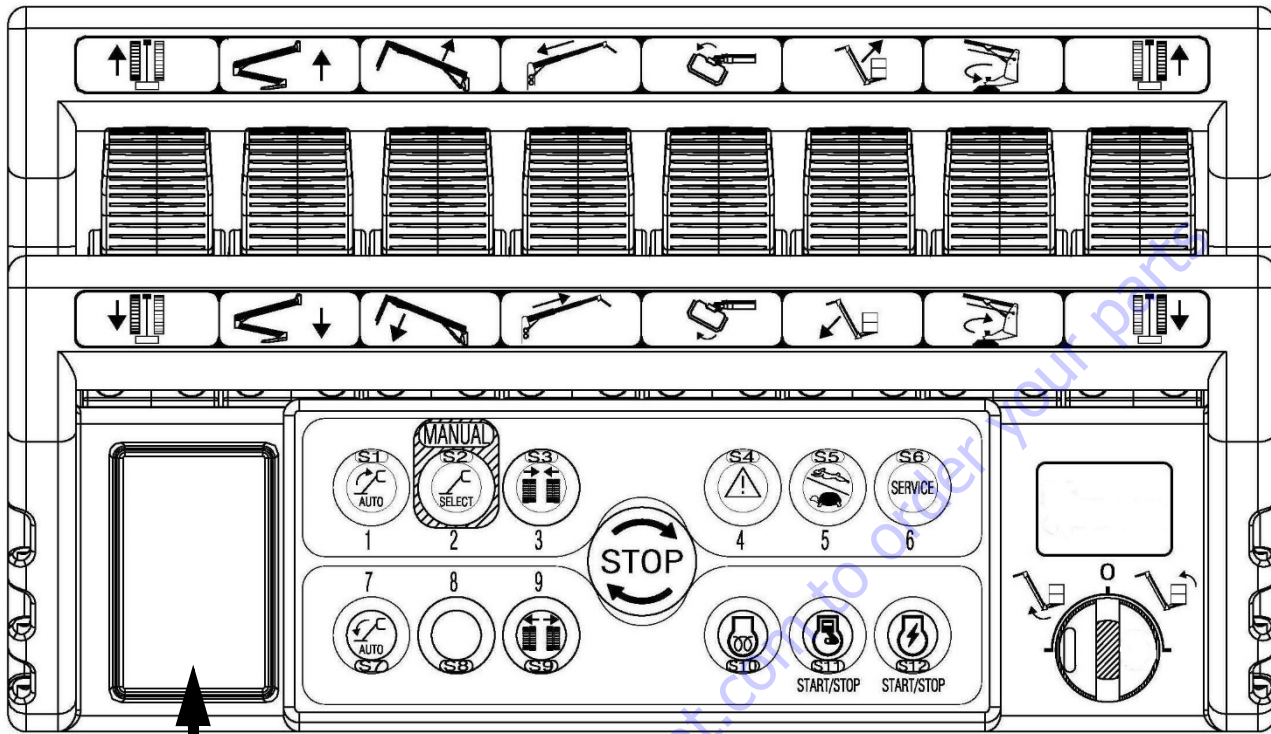
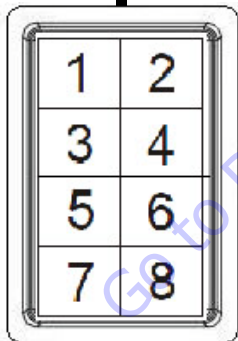


Figure 6-1. Remote Control



Turning on the machine and within the operation, the main LCD display screen (Figure 6.1) is activated. There are eight (8) display positions which indicate machine status during various stages of operation.

The remote control is made up of buttons, joysticks, a key selector switch and a display.

The display is used to view the status of the machine and the operating information necessary or useful for the operator.

When the machine's main control board is powered, the data are continually sharing between the ECM1 and remote control through the ECM3.

**NOTE:** *Disconnected the remote control only with machine OFF.*

Replacing the remote control, the ECM1 board or flashing software, starting machine ON for the first time, the data exchange could take almost one to ten minutes (depending of the software remote control release).



This operation has a variable duration. Normally a few seconds are sufficient, however the following screen may appear on the display:

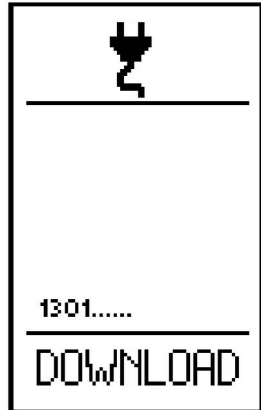


Figure 6-2.

The machine cannot work during this period.  
Do not stop the machine or operate it during this period.

**NOTE:** The numbers shown above DOWNLOAD are the data transferred. The Download will be completed when about more than 20000 steps are transferred.

**LCD Display Screen**

At machine start-up and during machine operation the main LCD display screen is activated. There are eight (8) display positions which indicate machine status during various stages of operation.

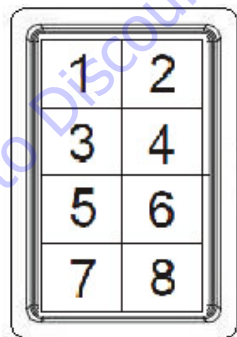


Figure 6-3.

POSITION 1:

Reduced operating area if all outriggers are not fully deployed.

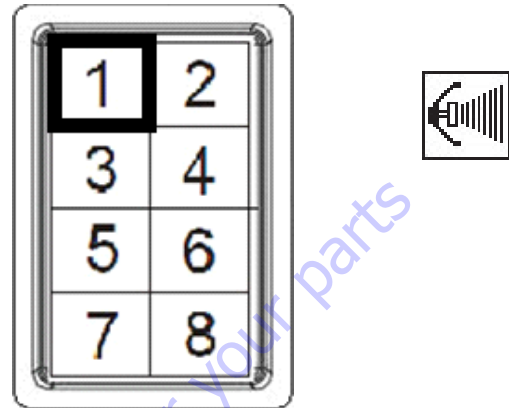


Figure 6-4.

POSITION 2:

Currently unused

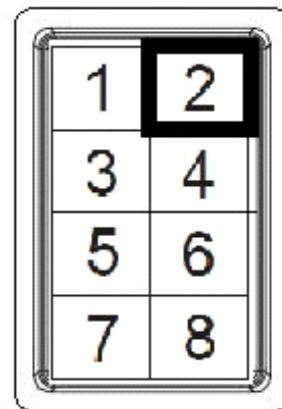


Figure 6-5.

**SECTION 6 - JLG CONTROL SYSTEM**

**POSITION 3:**

Displays if selected engine (diesel or electric) is on or off. The X on the icon indicates the engine is off.

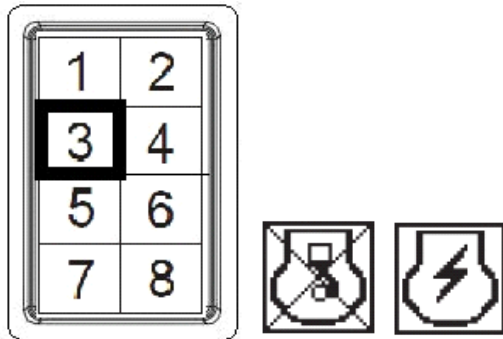


Figure 6-6.

**POSITION 5:**

Displays outriggers are properly set and boom functions are allowed. No display indicates outriggers are not properly set and boom functions are not allowed.

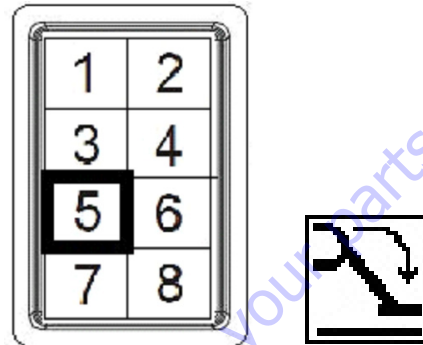


Figure 6-8.

**POSITION 4:**

Displays selected engine speed.

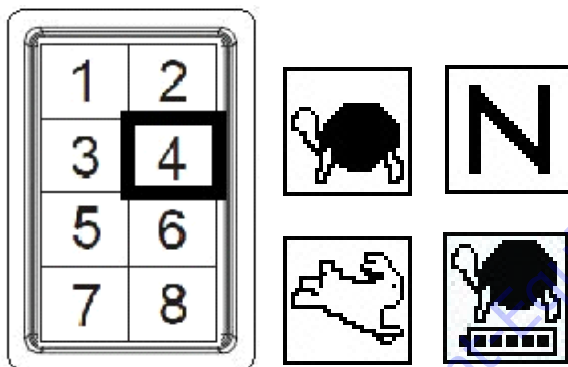


Figure 6-7.

**POSITION 6:**

Indicates boom, jib, turntable, and base are aligned. Drive, steer, track width adjustment and outrigger functions are operational if this symbol below is present. No symbol indicates these functions are not operational. Drive and steer are operational if all 4 outriggers are not contacting the ground.

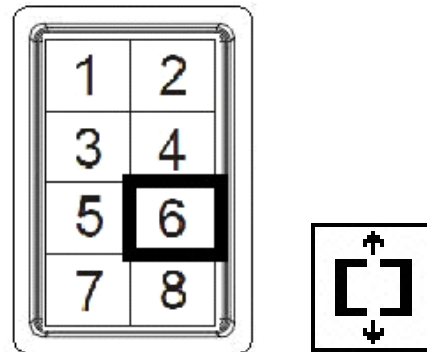


Figure 6-9.

POSITION 7:

Can indicate any of the following situations:

- An emergency stop is pushed in (off).
- A low battery. Batteries need charging by running the gas/diesel engine or connecting to a power source.
- Tower boom sensor is faulty.
- Main boom sensor is faulty. Boom functions are cut out.
- Swing sensor is faulty.
- CANBUS communication is faulty.
- Electronic fault.
- Lithium ION - Signals an error in the BMS - Battery Management System.
- Skyguard System enabled.
- Service Interval.

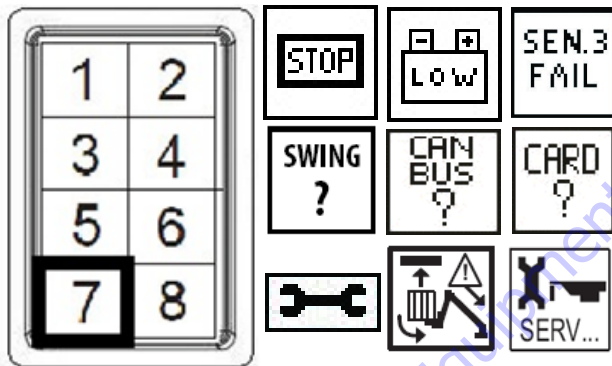


Figure 6-10.

POSITION 8:

Indicates emergency lowering has been selected.

Lithium ION - Battery Charge Status and Battery Charger Plugged In.

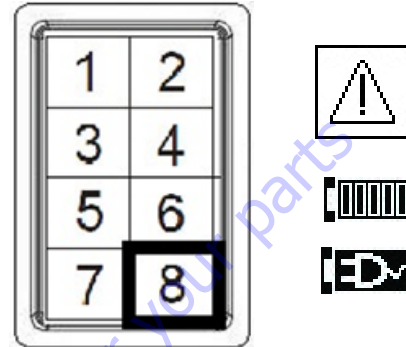


Figure 6-11.

### LCD Display Icon Description

The display indicates machine conditions and eventual errors occurred in order to help operator and to have a quick diagnose, here follows icons meanings:



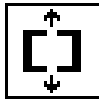










































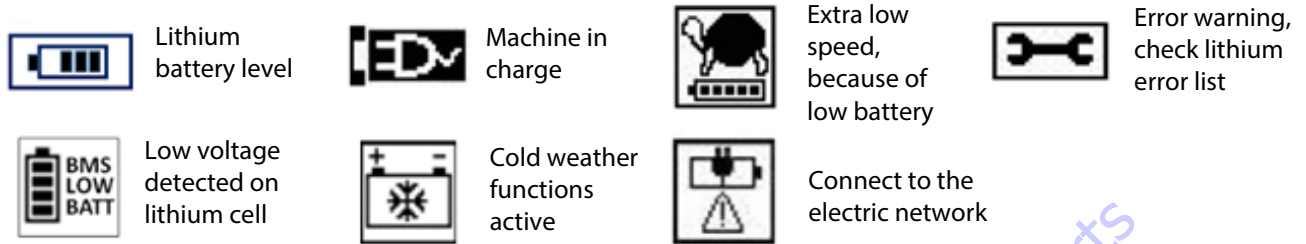
	Safety state, press and release the remote control stop		Both motors not running		Machine closed and aligned		Close and align the machine
	Engine running		Electric motor running		Lift outrigger from the round		Max tilt angle reached while driving
	Rotate aerial part on the opposite side		Lift 1 <sup>st</sup> -2 <sup>nd</sup> booms		Machine stabilized		Max tilt angle reached while stabilizing
	Minimum speed		Standard speed		Maximum speed for tracks		Select which outrigger to move
	Stop button pressed		Unload the basket from its support		Only jib movement allowed		Engine preheating active
	Basket overload		Basket underload		Gravity emergency descent		Movement not allowed by gravity emergency descent
	Machine stabilize error list (*)		12V battery voltage low		Press pedal		Double line sensor error, check error menu
	Error on board input or output, check CODE menu		Software updating in progress		CAN BUS error, check CAN TIME CUT menu		12V battery down or 3 <sup>rd</sup> boom cable sensor anomaly
	Safeties by-pass activated		Aerial part movements safeties by-pass activated		Undercarriage part movement safeties by-pass activated		Machine fully rotated, rotate few degrees back
	Remote connection in progress		Software updates available		Automatic periodical service reminder		Main key off
	Tilt sensor calibration required		Load cell sensor calibration required		SkyGuard bar pressed		Wrong remote control connection on the basket, at the ground)
	Wrong model elected, the aerial part is not fed						

Figure 6-12. LCD Display Icon Description

### Only Lithium Icons



### 6.3 DIAGNOSTIC BY SERVICE MENU

Further that the icons by the display it's possible to get into diagnostic menus. It's possible to select several languages, the indication here following are for English language.

By diagnostic menus it's only possible to visualize the machine condition, it's not possible to carry out operations such as to modify calibrations or safety parameters of the machine if not after having insert the relevant password.

Pressing button no.6 one time display will show the SERVICE menu.



Software version	→ 1.2
Machine model	→ LL1570 D.RPM = X15JP/X430AJ Diesel RPM

The here above picture shows the SERVICE menu main display, by the lower row it's possible to identify the installed software version and the machine model settled (Gasoline, Diesel or Lithium).

**NOTE:** While into the SERVICE menu it's possible to use all of the joysticks and motors buttons, it's not possible to use outriggers and tracks widening buttons.

From SERVICE menu pressing button from n.1 to n.8 it's possible to enter into several menus as for instance pressing button n.1 display will show the INPUT menu. Pressing button n.9 (ESC) brings back to the main display.

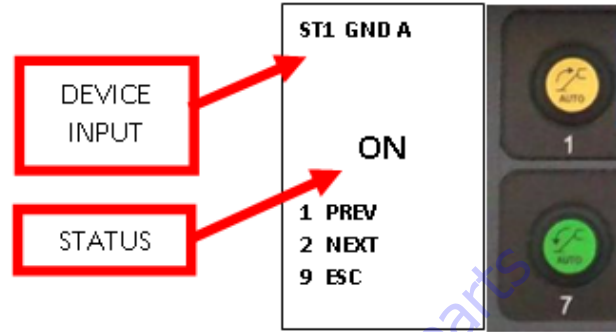
From SERVICE menu it's possible to enter into other menu and under menus.

**Menu Input**

This menu visualizes the current status of all the devices giving an input signal to the ECM1, it's so possible to check eventual changes of status.

The device status visualized depends on the signal received by the ECM1 so that it depends on the device itself but also on the connections.

The picture aside shows for instance the status of the first device of INPUT menu. Pressing button n.1 (PREV) brings back to the previous device of the list, pressing button n.2 (NEXT) brings to the next one. Pressing button n.9 (ESC) brings back to the SERVICE menu main display.



Here follows the INPUT list with their meanings.

ST1GND AB	DOWN DOWN	Outrigger n.1 on the ground - the switch is released, line A is open and line B is closed
	UP UP	Outrigger n.1 lifted - the switch is pressed, line A is closed and line B is open
ST2GND AB	DOWN DOWN	Outrigger n.2 on the ground - the switch is released, line A is open and line B is closed
	UP UP	Outrigger n.2 lifted - the switch is pressed, line A is closed and line B is open
ST3GND AB	DOWN DOWN	Outrigger n.3 on the ground - the switch is released, line A is open and line B is closed
	UP UP	Outrigger n.3 lifted - the switch is pressed, line A is closed and line B is open
ST4GND AB	DOWN DOWN	Outrigger n.4 on the ground - the switch is released, line A is open and line B is closed
	UP UP	Outrigger n.4 lifted - the switch is pressed, line A is closed and line B is open
BYPASAE AB	OFF OFF	The aerial part safeties are deactivated through the safeties by-pass key switch (emergency condition) - line A is closed and line B is open
	ON ON	The aerial part safeties are activated (normal working condition) - line A is open and line B is closed
BYPASCB AB	OFF OFF	The ground part safeties are deactivated through the safeties by-pass key switch (emergency condition) - line A is open and line B is closed
	ON ON	The ground part safeties are activated (normal working condition) - line A is closed and line B is open
EM. GRND AB	ON ON	Stop button on the ground is pressed - line A is closed and line B is open
	OFF OFF	Stop button on the ground is released - line A is open and line B is closed

EMRC GND AB	ON ON	Stop button on the remote control ground connected on the ground is pressed - lines A and B of the stop button are open
	OFF OFF	Stop button on the remote control ground connected on the ground is released - lines A and B of the stop button are closed
EM.BASK.AB	ON ON	The stop button on remote control is pressed - lines A and B of the stop button are open
	OFF OFF	The stop button on remote control is released - lines A and B of the stop button are closed
FOTO AB	ON ON	Photocells are aligned with the reflector (machine is closed and aligned) - Photocell A contact is open and photocell B contact is closed
	OFF OFF	Photocells are not aligned with the reflector (machine is not closed and aligned) - Photocell A contact is closed and photocell B contact is open
ST12 CLOSED	ON	Pressure switch of outriggers n.1 and n.2 closes the contact - the outriggers are at end run and the max pressure valve is opened
	OFF	Pressure switch contact of outriggers n.1 and n.2 is opened - the outriggers are open, partially open or already closed
ST34 CLOSED	ON	Pressure switch of outriggers n.3 and n.4 closes the contact - the outriggers are at end run and the max pressure valve is opened
	OFF	Pressure switch contact of outriggers n.3 and n.4 is opened - the outriggers are open, partially open or already closed
TEMP. ALRMA Optional	ON	Temperature external probe reached the maximum value, the temperature probe is closed
	OFF	Temperature external probe hasn't reached the maximum value, the temperature probe is open
GENERATOR (Only for gasoline machine)	ON	Engine is running
	OFF	Engine is not running
EMRG. COMM	ON	The control position selector for aerial part operation from the ground is activated (emergency condition)
	OFF	The control position selector for aerial part operation is released (normal working condition)
START M.TE	ON	The ground button for engine start is pressed
	OFF	The ground button for engine start is released
MOTOR TEMP (Only for Diesel machine)	ON	The engine reached the max functioning temperature (emergency condition)
	OFF	The engine maintains the correct functioning temperature (normal working condition)
MOTOR PRES (Only for Diesel machine)	ON	The engine oil pressure is inadequate (emergency condition)
	OFF	The engine oil pressure is OK (normal working condition)
START M.EL	ON	The ground button for electric motor start is pressed
	OFF	The ground button for electric motor start is released
GND BAS	ON	The control position selector is positioned on "basket"
	OFF	The control position selector is positioned on "ground"

## SECTION 6 - JLG CONTROL SYSTEM

MICROJIB AB	DOWN DOWN	The JIB is closed - the control switch is released, line A is open and line B is closed
	UP UP	The JIB is open - the control switch is pressed, line A is closed and line B is open
PEDAL AB	ON ON	The pedal is pressed- the pedal electric line A is open and line B is closed
	OFF OFF	The pedal is released - the pedal electric line A is closed and line B is open
R.C. BASKET	ON	The remote control is in the support in basket
	OFF	The remote control is not in the support in basket
TRACK OPEN A	ON	Left track is fully widened. Widening cylinder of left track contact is closed
	OFF	Left track is not fully widened. Widening cylinder of left track contact is open
TRACK OPEN B	ON	Right track is fully widened. Widening cylinder of right track contact is closed
	OFF	Right track is not fully widened. Widening cylinder of right track contact is open
INCLIN. X	0.05	Indicates the inclination of the machine on the X axis in degrees
INCLIN. Y	0.3	Indicates the inclination of the machine on the Y axis of degrees
LOAD AB	134 133	Indicates the weight of the basket (about 50 Kg) plus the weight into the basket in Kg measured by A and B lines
POS. 3 ARM	2073	Indicates the opening of the 3rd boom cylinder in tenths of a millimeter
PROXIMITY	ON	Turret is not almost completely rotated, contact is close, 1st-2nd booms are not above the engine
	OFF	Turret is almost completely rotated, contact is open, 1st-2nd booms are above the engine
MICR. BR. 1-2	ON	Indicates that 1st boom is not opened enough to rotate above the engine carter
	OFF	Indicates that 1st boom is opened enough to rotate above the engine carter
SKYGUARD	ON	Indicates that Skyguard bar has been pressed.
	OFF	Indicates that Skyguard bar has not been pressed.
MOTOR RPM (Only for Diesel machine)	2220	Indicates the Diesel engine rpm
TEMPERAT.	37,62	Indicates the temperature of the ECM1 in °C
SUPPLY (V)	12,15	Indicates the batteries voltage, or the output voltage from the battery charger



## Only Lithium Input

SOC	89	Indicates the charge level of the battery pack, 100% is the maximum, 0% is the minimum
V LITHIUM	40	Indicates the total voltage of the lithium pack. When the cells are not under charge or under discharge, it tends to the nominal value that is around 40 Volt, it doesn't matter their charge status.
A BATTERY	0	Indicates the value of the current (Amp) measured by the LEM sensor. With sign "-" the current is going out from the battery pack (discharge), if there is no sign, the current is going inside the pack (charge)
BMS STATE	1	Indicates the bms status
V MAX CELL	3317	Indicates the voltage at the lowest cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3,3 Volt
	2	Indicates the number of the lowest cell
V MED CELL	3316	Indicates the average voltage of the cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3,3 Volt
V MIN CELL	3315	Indicates the voltage at the lowest cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3,3 Volt
	12	Indicates the number of the lowest cell
BMS A CHG	25	Indicates the maximum current (Amp) that BMS requires to the battery charger (with lithium pack not fully charge)
T MAX CELL	23	Indicates the highest temperature (°C) detected among the cells
	2	Indicates the number of the temperature sensor with the highest temperature detected
T MED CELL	23	Indicates the average temperature (°C) detected among the cells
T MIN CELL	23	Indicates the lowest temperature (°C) detected among the cells
	1	Indicates the number of the temperature sensor with the lowest temperature detected
T BMS	27	Indicates the temperature (°C) detected on the BMS
SOH	98	Indicates the state of health of the battery pack; it indicates how much the battery pack could perform
B CAPACITY	80	Indicates the remaining capacity (Ah)
R MAX CELL	1	Indicates the highest resistance (mOhm) of the cells
	1	Indicates the number of the cell with the highest resistance
R MED CELL	1	Indicates the average resistance (mOhm) of the cells
R MIN CELL	1	Indicates the lowest resistance (mOhm) of the cells
	1	Indicates the number of the cell with the lowest resistance
HOURS INV	27	It counts the working hours with engine running
RPM INV	0	Indicates the engine rpm read by the engine rpm sensor. At a certain rpm setting, the rpm read depends also on the electric load

### Language Menu

Through this page it is possible to select the visualization language among ITALIAN, GERMAN, ENGLISH, FRENCH and SPANISH. To change the language has to be press the relevant button number and button n.9 to come back to the SERVICE menu main display



ERROR menu is composed by the following 5 different pages selectable by buttons n.1 and n.2, it's always possible to come back to the SERVICE menu main display pressing button n.9.

When a device reference is marked with a "NO" that means there's an error and that device has one line signal not coherent with the other.

### PAGE 1

ERRORS	
ST1 GND	OK
ST2 GND	OK
ST3 GND	OK
ST4 GND	OK
1 PREV	
2 NEXT	
9 ESC	

### Error Menu

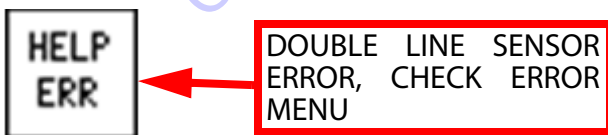
By ERROR menu pages are displayed the eventual current errors, an error occurs when a double line device has one line signal not coherent with the other.

The most of the machine double line devices, all except remote control emergency stop button have one line closed (NC) and one line opened (NO).

A part for the remote control emergency stop button, when the two lines are both opened or both closed, there's an error in progress and the icon HELP ERROR will appear on the display.

In that case into the ERROR menu the involved device reference will be marked aside with a "NO" instead of an "OK".

<b>ST1 GND</b>	Outrigger n.1 on the ground switch
<b>ST2 GND</b>	Outrigger n.2 on the ground switch
<b>ST3 GND</b>	Outrigger n.3 on the ground switch
<b>ST4 GND</b>	Outrigger n.4 on the ground switch



PAGE 2

ERRORS	
BYPASA	OK
BYPASC	OK
EM.GRN	OK
EM. RC B	OK
EM. RC G	OK
FOTO	OK
PEDAL	OK
SKYGUARD	OK
1 PREV	
2 NEXT	
9 ESC	

<b>BYPASA</b>	Aerial part safeties by-pass switch
<b>BYPASC</b>	Ground part safeties by-pass switch
<b>EM. GRN</b>	Stop button on the ground
<b>EM. RC B</b>	Remote control stop button on the basket
<b>EM. RC G</b>	Remote control stop button on the ground
<b>FOTO</b>	Photocells
<b>PEDAL</b>	Pedal
<b>SKYGUARD</b>	SkyGuard system

PAGE 3

ERRORS	
MICRJIB	OK
INCL	OK
LOAD	OK
CODE	OK
1 PREV	
2 NEXT	
9 ESC	

<b>MICRJIB</b>	Jib opening switch
<b>INCL</b>	Machine inclination sensors
<b>LOAD</b>	Basket load cell sensor
<b>CODE</b>	Do not consider

PAGE 4

The fourth and fifth pages inform about an eventual error on CAN BUS system indicating the component involved. All of the components should be marked with an "OK", in case of a "NO" it means that component it's not properly communicating through CAN BUS.

CAN TIMOUT	
REMOTE	OK
CIL3	OK
INCL	OK
48XS B	OK
MODEM	OK
1 PREV	
2 NEXT	
9 ESC	

<b>REMOTE</b>	Remote control
<b>CIL3</b>	3RD boom cylinder position sensor
<b>INCL</b>	Machine inclination sensors
<b>48XS B</b>	Load cell board (ECM3)
<b>MODEM</b>	Modem
<b>SKYGUARD</b>	SkyGuard system

PAGE 5

LITH ERR	
BATT:	0
INVER:	0
CARIC:	0
1 PREV	
2 NEXT	
9 ESC	

The fifth page has to be considered only for Lithium machines, BATT, INVER and CARIC are indicated as "0" otherwise it means there's a Lithium error in progress.

More information about those data are detailed on the Lithium Manual.

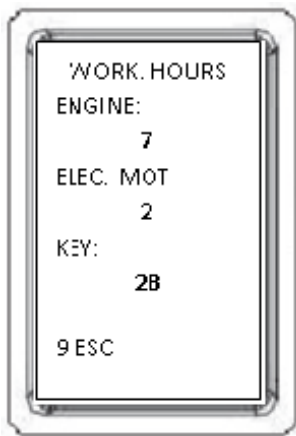
### Working Hours Menu

This page indicates the machine working hours displaying engine working hours and electric motor working hours.

On Lithium machines have to be considered only the electric motor hours.

For both models "KEY" indicates the hours with main key switched ON.

Press button 6 "W.HOURS".



#### Working hours to reset/modify:

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".  
Using the remote control buttons to enter the password 7385.

**NOTE:** Passwords allow changing the Working Hours of Engine and Electrical Motor.

Once the correct password is accepted the display showed "OK".

3. Press button 9 "ESC" two times.

**NOTE:** Repeat the above steps if "NO" appear on the display.

4. Press button 6 "W:HOURS".  
KEEPING PRESSED the button 6 use the button 1 "T+" to increase and button 2 "T-" to decrease the working hours of the ENGINE.

KEEPING PRESSED the button 6 use the button 7 "E+" to increase and button 8 "E-" to decrease the working hours of the Electric Motor.

KEEPING PRESSED the button 6 and then button 3 to set zero the working hours of Engine and Motor.

5. Press button 9 ESC 3 times to escape.

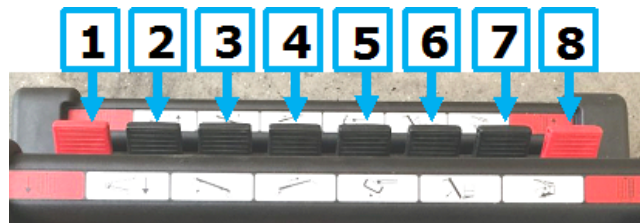
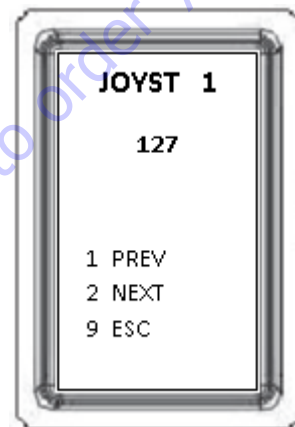
On Lithium models the Engine working HOURS will stay always 0.

The procedure to view or change the working Hours of the electrical motor are the same as per double powered models.

### Joystick Menu

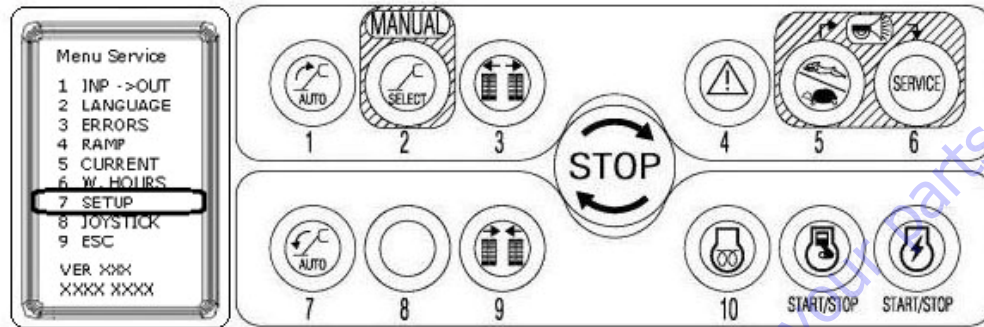
By this page it's possible to verify the proper functioning of the joysticks, once selected one joystick by buttons n.1 and n.2, joystick enumeration is indicated here below, the display will show its position, expressed in step from 0 (rest position) to 127 (joystick fully pressed up or down).

Moving the selected joystick it's so possible to check its proportionality and its end of the stroke (about 127 steps) both forward and backward.



## 6.4 MACHINE SETUP MENU

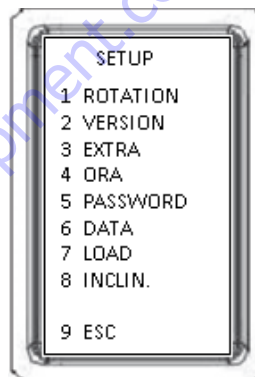
From the SERVICE menu, pressing button 7 "SETUP" accesses the menu SETUP to adjust the parameter settings in order to achieved proper machine performance.



When selection the machine model to match the size of the machine, the personality settings will all default to the factory recommended setting.

**NOTE:** Passwords will give you access to level, which will permit you to change all machine settings.

**NOTE:** Refer to the following steps in this Service Manual for the recommended factory settings.



### Setup - Version

By this page is visualized the currently installed machine model and power supply version.

After having inserted the relevant password "3684" by this page it's possible to set machine model pressing button n.1, and to set power supply version pressing button n.7.

After this setting machine need to be REBOOT by the main key reset

```
VERSION
MODEL:
LL1570
ENGINE:
G.13L

1 MODEL
7 ENGINE
3 SAVE
9 ESC
```

### Setup - Password

Some setting requires a password, some passwords are relevant to more than one setting, some other passwords are dedicated to only one setting.

By PASSWORD page it's possible to insert the password required pressing the keyboard buttons, password are composed by 4 numbers, if password is accepted display will visualize an "OK".

```
PASSWORD

0
0
0
0
9 ESC
```

### Setup - Time

By this page is visualized the settled time, after having inserted the relevant password "8262" it's possible to choose the time-zone pressing buttons n.1 or n.2, ZONE: 0 is the time in meridian "0".

```
TIME

8 : 34 : 05

ZONE: 2

1 ZONE. +
7 ZONE. -

9 ESC
```

### Setup - Date

By this page is visualized the settled time, after having inserted the relevant password "1468" it's possible to adjust it, pressing buttons n.1 to modify the day, buttons n.2 to modify the month and n.3 or n.4 to modify the year.

```
DATE

5 11
2016

9 ESC
```

### Setup - Load Cell Board (ECM3) Calibration

After having replaced the master board (ECM1) or the load cell board (ECM3) or having replaced the load cell sensor it's necessary to calibrate the "0" of the load cell system, by this procedure the calibration parameters relevant to the load cell sensor installed will be memorized on the ECM1.

Being possible difference between one load cell sensor and another it's necessary to calibrate ECM1 with the load cell sensor installed on the machine and not with another.

The load sensor system reset must be done with the basket unloaded from its support.

The reset the load sensor system consist into saving the value "0", done without the basket, here follows the calibration procedure:

1. Turn ON the main key and stay out from the basket with remote control on hands.
2. Press button n.6 (SERVICE) and then press button n.7 (SETUP).
3. Press button n.5 (PASSWORD). The display will ask for the password.
4. Inserting password 6138 the display will confirm with "OK".
5. Press button n.9 (EXIT) and then button n.7 (LOAD SENS), the display will than visualize the page here below:

LOAD SENS. CALIBRATI ON
MACCHINA: NOT READY
3 CALIB.
9 ESC

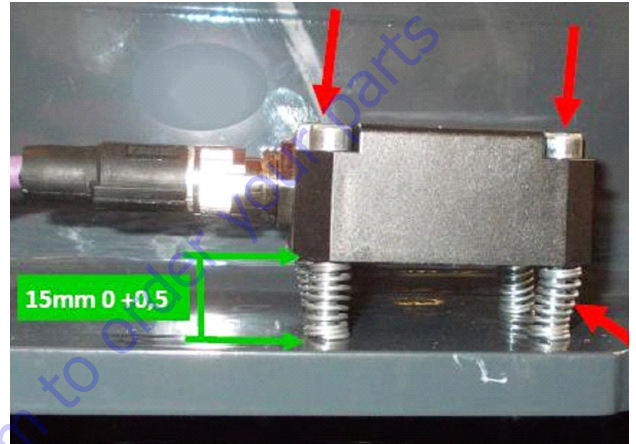
6. With the basket unloaded from its support press button n.3 (CALIB) and verify that display indicates "OK". In case of the basket is still loaded on its support this page will display "NOT READY" instead of "READY" and reset will not be possible.
7. Press button n.9 (ESC) and then turn OFF the main key.
8. Turn ON again the main key and verify by INPUT "LOAD A" and "LOAD B" that calibration is correct by checking the variation at several basket loading condition, the difference between LOAD A and LOAD B values should be less than a certain value.

### Setup - Acceler (Calibrating Tilt Sensor)

This menu allows the calibration of the tilt sensor.

After replaced the master board (ECM1) or the tilt sensor it's necessary to calibrate the tilt levelling system.

**NOTE:** Ensure the tilt switch is mounted at distance of 15 mm and securely attached on the bracket plate, with the screws 5x45 TCEI and Loctite.



#### NOTICE

A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

#### ⚠ WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT WITH A MACHINE LEVELLED. PLACE THE MACHINE ON OUTRIGGERS, WITH BOOMS IN STOWED POSITION AND ALIGNED WITH THE PHOTOCELLS AND THE BASKET EMPTY. ENGINE AND ELECTRICAL MOTOR MUST BE SWITCHED OFF (AVOIDING VIBRATIONS).

Start of the calibration procedure:

1. Turn ON the main key and wait for display switching ON.
2. Press button n.6 (SERVICE) and then press button n.7 (SETUP).
3. Press button n.5 (PASSWORD). The display will ask for the password.
4. Inserting password 2857 the display will confirm with "OK".
5. Press button n.9 (EXIT) and then button n.8 (INCLIN.), the display will than visualize the page here below.

```

INCLINATION
SENS. CA
LIBRATION

MACCHINA: NOT
READY

3 CALIB.

9 ESC
    
```

Press button n.3 (CALIB) and verify that display indicates "OK". In case of outriggers are not touching the ground, or photocells are not aligned, engine or electrical motor is switched on, this display will show "NOT READY" instead of "READY" and reset will not be possible.

6. Press button n.9 (ESC) and then turn OFF the main key.
7. Turn ON again the main key and verify at INPUT "INCLIN. X" and "INCLIN. Y".  
To verify the calibration is accurate, test out the values at different machine gradient position.

**Setup - Extra**

EXTRA menu gives the access to other settings and under menus.

The here aside picture shows the EXTRA menu display, from EXTRA menu pressing button from n.1 to n.6 it's possible to enter into further pages. Pressing button n.9 (ESC) brings back to the SETUP menu.

```

EXTRA

1 OPTIONAL
2 FIRMWARE
3 CARDS
4 MODEM
5 GPS

9 ESC
    
```

**Setup - Extra - Modem**

This page could be used in case of RAHM difficult connection; the meanings of the parameters shown by this page are the followings.

- STATUS: INIT. --> Initialization, modem is not ready to communicate.  
READY --> Modem is ready to communicate
- SIM: NO --> SIM CARD not present (STATUS will be INIT.)  
OK --> SIM CARD present
- OPERATOR: Shows the network operator, for instance TIM
- RSSI: 0 - 100 --> SIM CARD operator signals, need to be over 50 to have a good connection
- BER: 0 - 100 --> network line signals
- GPRS: Ok --> GPRS signal available

```

MODEM

STATUS :
READY
SIM OK
OPERATOR
I TIM
RSSI : 75
BER : 70
GPRS: Ok

9 ESC
    
```

**Setup - Extra - GPS**

This page shows RAHM references, the position availability, latitude and longitude, date and hours references

```

GPS

FIX: OK
LATIT.:
45,20
LONGI.:
11,03

9 ESC
    
```



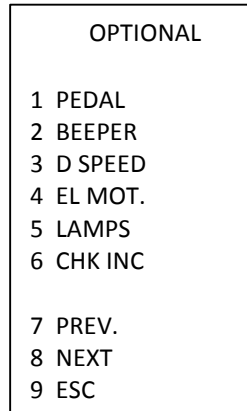
**Optional (Page1)**

OPTIONAL menu gives the access to other settings.

The here aside picture shows the OPTIONAL menu first page display, from which pressing button from n.1 to n.6 it's possible to enter some settings.

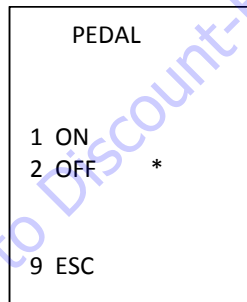
Pressing button n.8 it's possible to enter into a second page of settings, shown below.

Pressing button n.9 (ESC) brings back to the EXTRA menu.



**Pedal**

By this page it's possible to set the pedal, after having inserted the relevant password "4771", pressing button n.1 "ON" pedal will be activated, pressing button n.2 "OFF" pedal will be deactivated.



**Beeper**

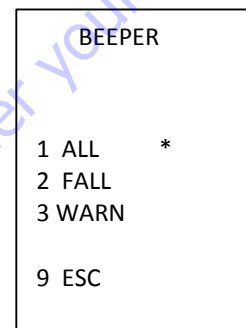
By this page, if is installed the optional warning buzzer, it's possible to set the motion alarm, after having inserted the relevant password "8365".

The motion alarm is activated depending on the BEEPER menu setting.

If it's selected ALL the warning buzzer is activated at all the machine movements, both aerial part and ground part.

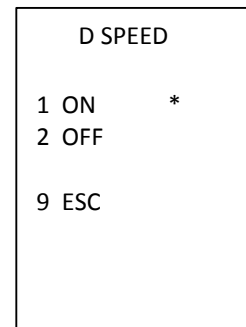
If it's selected FALL the warning buzzer is activated at the aerial part lowering moment and telescope retraction.

If it's selected WARN the warning buzzer is activated in the same condition or the remote control beeper.



**Second Speed**

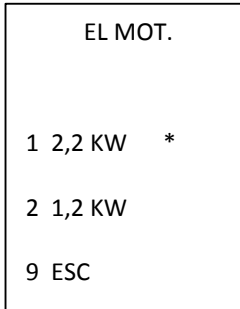
By this page it's possible to set the second speed (Hare), after having inserted the relevant password "5216", pressing button n.1 "ON" second speed will be activated, pressing button n.2 "OFF" second speed will be deactivated.



**Electric Motor**

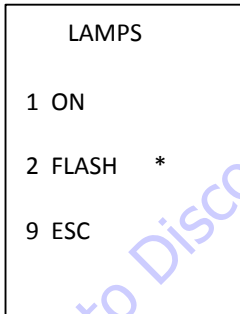
By this page it's possible to set the electric motor power setting, after having inserted the relevant password "3522", pressing button n.1 "2.2 KW" machine will be set for 2.2 KW electric motor, pressing button n.2 "1.2 KW" it will be set for 1.2 KW electric motor.

The main difference between the two settings is in the auto-stabilization procedure steps timing.



**Lamps**

By this page it's possible to set the outriggers lights, after having inserted the relevant password "6661", pressing button n.1 "ON" outriggers lights will be steady on while they are touching the ground, pressing button n.2 "FLASH" outriggers lights will be flashing while they are touching the ground.

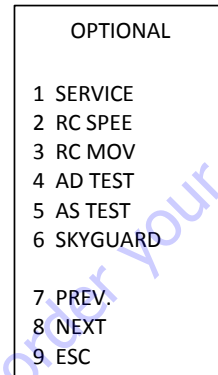


**Optional (Page 2)**

The here aside picture shows the OPTIONAL menu second page display.

Pressing button n.7 it's possible to come back to the first page of settings.

Pressing button n.9 (ESC) brings back to the EXTRA menu.

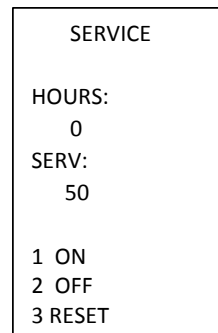


**Service**

By this page it's possible to set the service reminder, after having inserted the relevant password "4538", pressing button n.1 "ON" service reminder will be activated, pressing button n.2 "OFF" it will be deactivated.

The amount of hours considered is the sum of engine and electric motor ones.

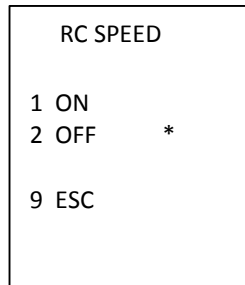
Pressing button n.3 "RESET" those hours counter is reset, keeping pressed button n.5 with buttons n.7 and n.8 it is modified. Instead keeping pressed button n.6 with buttons n.7 and n.8 is modified the service hours amount.



**RC Speed**

By this page it's possible to set the RC SPEED function, when it is activated it avoids to operate tracks maximum speed when operator is not into the basket.

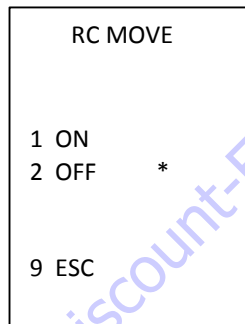
After having inserted the relevant password "4771", pressing button n.1 "ON" second speed will be activated, pressing button n.2 "OFF" it will be deactivated.



**RC Move**

By this page it's possible to set the RC MOVE function, when it is activated it binds the operator standing out from the basket to press button n.8 to move tracks

After having inserted the relevant password "4771", pressing button n.1 "ON" second speed will be activated, pressing button n.2 "OFF" it will be deactivated.



**AD Test**

Not consider.

**AS Test**

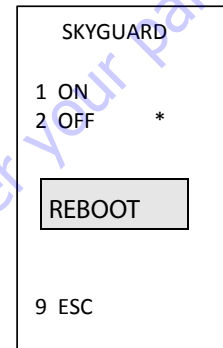
Not consider.

**Skyguard**

By this page it's possible to set the Skyguard function, when it is activated, by pressing on Skyguard bar it stops certain movements.

After having inserted the relevant password "4771", pressing button n.1 "ON" and restarting by the main key it will be activated, pressing button n.2 "OFF" and restarting by the main key it will be deactivated.

"REBOOT" indication means that the machine has to be restarted by the main key to activate the function.

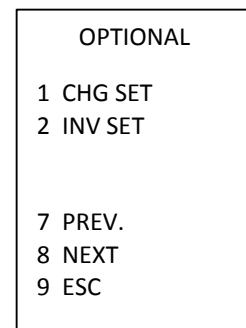


**Optional (Page 3)**

The here aside picture shows the OPTIONAL menu third page display.

Pressing button n.7 it's possible to come back to the second page of settings.

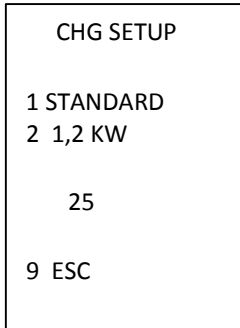
Pressing button n.9 (ESC) brings back to the EXTRA menu.



### CHG Set

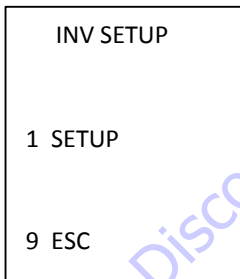
For a lithium machine, by this page it's possible to set the maximum charging current, after having inserted the relevant password "1138", pressing button n.1 it will be settled 25 Amp, pressing button n.2 it will be settled 18 Amp.

This setting, considering the transformation rate, has to respect the maximum current available on local electric plug.



### INV Set

For a lithium machine, by this page it's possible to setup the rpm setting for a new inverter, pressing button n.1 the rpm setting will be settled according to the machine model settled by the relevant menu, check chapter 10.1.9.2.



**NOTE:** Some pages are not accessible, or could not show same information, if not after having inserted the relevant password.

## 6.5 MASTER BOARD (ECM1) REPLACEMENT AND SETTING

Machine software contains the software for all the TTC JLG machine models produced till that moment, so that when a new master board (ECM1) is installed on a machine, the machine model need to be selected.

### New Master Board

When a new master board (never used) is fitted on the machine, the remote control need to be connected to its ground cable and the control position selected accordingly by the control position selector switch.

Then, turning on the main key, it will require the setting of the machine model and version, as indicated by the here below procedure.

To set the master board, machine must be closed and aligned, it has to be make sure that battery is charged enough or machine need to be plugged to the electric network.

Here follows the calibration procedure:

1. Connect the remote control at its ground cable and select the control position accordingly by the control position selector switch.



CONNECTOR ON  
REMOTE  
CONTROL THE  
GROUND CABLE

2. Turn ON the main key and select the correct machine model with button n.1 (VERSION), the display shows the machine model selected. If it appears "MOD.CODE FAIL!", it means that the machine model selected is not correct, even if that alarm does not appear on the display the machine model selected need to be check.

Here below the example shows on the image A the case of machine model selected is wrong, and on image B the case of machine model selected is the right one.

**A**

VERSION  
MODEL:  
LL1570  
ENGINE  
D.RPM

MOD. CODE  
FAIL!

1 VERSION  
7 MOTOR  
3 SAVE  
9 ESC

MACHINE MODEL  
SELECTED IS WRONG

**B**

VERSION  
MODEL:  
LL1570  
ENGINE  
D.RPM

1 VERSION  
7 MOTOR  
3 SAVE  
9 ESC

MACHINE MODEL  
SELECTED IS OK

3. In case of the engine model selected is not correct with button n.7 (MOTOR) select the correct one (for instance "D.RPM" is the diesel Hatz 1B40 and "G.13L" is the gasoline Honda iGX390).
4. Press button n.3 (SAVE) to save the setting.
5. Switch the main key OFF and ON again to restart it.
6. Press and release the remote control emergency button to esc the SAFETY STATE.
7. The display will show "LOAD CAL" and "INCL CAL", following the procedures of appendixes 2 and 1 calibrate the load cell system and the tilt sensor.
8. Following the relevant procedures set the other settings, as ramps and currents.

PERSONALITY SETTING		
MACHINE	MODEL	ENGINE
X13JP X370AJ	LL1370	D.RPM
		B.13I
		LITH.
X15JP X430AJ	LL1570	D.RPM
		B.13I
		LITH.

### Already Initialized Master Board

The machine system in some cases, specifically for machine models different on a safety point of view, is able to recognize if the machine model selected is not correct.

This verification is possible because on the load cell board (ECM3) a series of contacts input depends on the machine model.

As soon as another master board, already initialized on another machine, is connected to its connectors, as well as when the contacts on the load cell board (ECM3) have been changed, machine will check if the machine model selected on the master board corresponds to the machine model where it is fitted on.

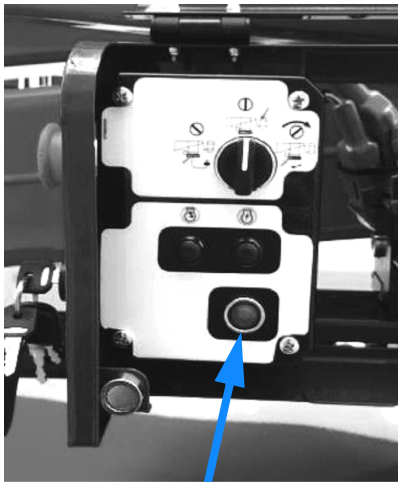
If the machine model selected on the master board does not correspond to the machine model, the correct machine model must be selected by the VERSION menu.

### Software Recovery By Modem

In case of main machine software in the master board software is corrupted or missing, if the modem contains the main machine software it is able to install the software in the master board.

When the modem installs the main machine software on the master board, the first part of the installing process is the erasing of the eventual software on master board, so that the remote control display will show wrong images.

While the installing process is in progress the machine must be left switched on for 10-15 minutes, till the ground green light comes on flashing.



GREEN LIGHT

### 6.6 CODE MENU

The machine diagnostic system identify faulty as short circuits and missing connections to the valve coils, furthermore monitoring the circuit load.

For some faulty affecting on aerial part valve coils, which include the gravity emergency descent valves, the summing oil pump valve, the functions could be prevented.

To restart the functions have to turn OFF (ground key OFF) and then ON the machine, as a result all the function are then active with exception the faulty one.

For some faulty affecting on ground part valve coils, which include outrigger movements, track widening, the functions could be prevented.

To restart the functions have to turn OFF (ground key OFF) and then ON the machine, as a result all the function are then active with exception the faulty one.

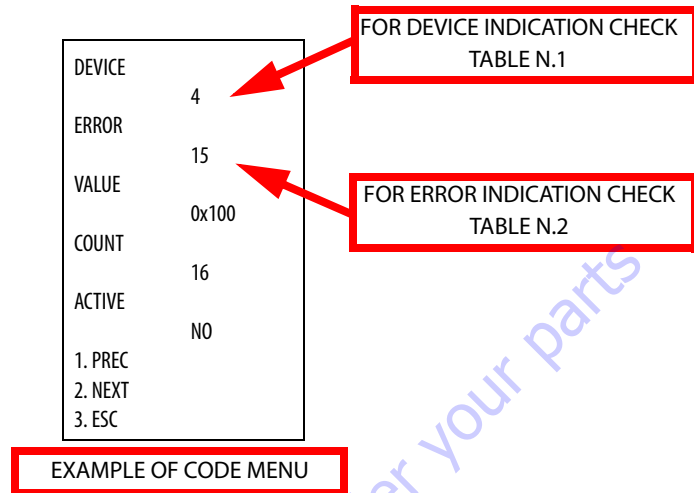
In case of the display shows the icon FAIL INPUT OUT, as shows here below, it means a faulty issue present on the electric connection.



ELECTRIC CONNECTION ANOMALY IN PROGRESS

**NOTE:** On X13JP – X370AJ with fix undercarriage (without tracks widening system), the icon FAIL INPUT OUT could appear also when the tracks widening buttons are pressed.

By the remote control, pressing button 6 - SERVICE and then keeping pressed button 3 - ERR --> COD, it will be displayed the CODE MENU, that is a list of DEVICE with potentially anomalous signal.



**NOTE:** By CODE MENU, not all the DEVICES signed with an ERROR and "ACTIVE YES" have to be considered as an anomaly, only in case of the icon FAIL INPUT OUTPUT is displayed there's an anomaly in progress.

Here follows the list of the main DEVICES that could be affected by that kind of anomalies, not all the DEVICES are listed.

**Table 6-1. DEVICES**

DEVICE CODE	DEVICE DESCRIPTION
22	Ground part right side proportional valve coil
23	Ground part left side proportional valve coil
24	Right track forward valve coil
25	Left track forward valve coil
26	Right track backward valve coil
27	Left track backward valve coil
28	Outrigger n.1 lowering valve coil
29	Outrigger n.2 lowering valve coil
30	Outrigger n.3 lowering valve coil
31	Outrigger n.4 lowering valve coil
32	Outrigger n.1 lifting valve coil
33	Outrigger n.2 lifting valve coil
34	Outrigger n.3 lifting valve coil
35	Outrigger n.4 lifting valve coil
36	1-2 booms lifting valve coil
37	3 boom lifting valve coil
38	1-2 booms lowering valve coil
39	3 boom lowering valve coil
40	Telescope extraction valve coil
41	Telescope retraction valve coil

**Table 6-1. DEVICES**

DEVICE CODE	DEVICE DESCRIPTION
42	Jib opening valve coil
43	Jib closing valve coil
44	Basket levelling up valve coil
45	Basket levelling down valve coil
46	Turntable right rotation valve coil
47	Turntable left rotation valve coil
48	Basket right rotation valve coil
49	Basket left rotation valve coil
50	Aerial part proportional valve coil
51	Pumps sum valve coil
52	Tracks second speed valve coil
53	Tracks widening valve coil
54	Tracks closing valve coil
55	1-2 booms gravity descent valve coil
56	3 boom gravity descent valve coil
57	Deviator (aerial part/ground part) valve coil

**NOTE:** On X13JP – X370AJ the DEVICES 48 and 49 are marked with error 7 because the basket rotation is not available. On LL13.70 with fix undercarriage (without tracks widening system), the DEVICES 53

and 54 are marked with error 2 because the track widening is not available.

Here follows the list of the main ERRORS, not all the ERRORS are listed.

**Table 6-2. ERRORS**

ERROR CODE	ERROR DESCRIPTION
0	No error
1	Initialization error
2	Open load error (charge disconnected)
3	Open load error (short circuit)
4	Short circuit to ground
5	Short circuit to battery plus
7	Safety deactivation
8	Out of range error
9	Timeout error
12	Reading error
14	Selection error
15	Occupied
16	Default value not valid



**EXAMPLES**

Here follow some examples of what could be displayed on CODE menu.

EXAMPLE OF A CODE MENU INDICATION WITH NO ERROR IN PROGRESS

STOWED MACHINE WITH NO ERROR		
DEVICE CODE	ERROR CODE	ACTIVE
11	12	NO
12	9	YES
64	2	YES
65	9	NO
66	9	NO
67	4	YES
73	2	NO
89	12	YES
133	1	YES
145	2	YES
154	8	NO
155	8	NO
166	9	YES

**NOTE:** Some different indications on CODE menu could occur depending on the machine conditions (stabilized, aligned, etc.).

**EXAMPLE OF MACHINE WITH A COIL CONNECTION ERROR**

In case of the coil of the ON-OFF valve for third boom lifting is disconnected from its cabling or in case of its cable is ripped, when pushing one of the black joysticks, the aerial

part movement will not be carried out and the icon FAIL INPUT OUTPUT will be displayed.

On this case on the CODE MENU at the DEVICE 37 the ERROR 2 (Open load error) or ERROR 5 (Short circuit to battery plus), will be displayed as "ACTIVE YES", while some other DEVICE between the 36 and the 56 will be displayed with ERROR 7 (Safety deactivation).

COIL CONNECTION ERROR EXAMPLE			
DEVICE CODE	ERROR CODE	ACTIVE	
12	9	YES	
<b>36</b>	<b>7</b>	<b>YES</b>	1-2 booms lifting valve coil
<b>37</b>	<b>5</b>	<b>YES</b>	<u>3 boom lifting valve coil</u>
<b>38</b>	<b>7</b>	<b>YES</b>	1-2 booms lowering valve coil
<b>39</b>	<b>7</b>	<b>YES</b>	3 boom lowering valve coil
<b>40</b>	<b>7</b>	<b>YES</b>	Telescope extraction valve coil
<b>41</b>	<b>7</b>	<b>YES</b>	Telescope retraction valve coil
<b>42</b>	<b>7</b>	<b>YES</b>	Jib opening valve coil
<b>43</b>	<b>7</b>	<b>YES</b>	Jib closing valve coil
<b>44</b>	<b>7</b>	<b>YES</b>	Basket levelling up valve coil
<b>45</b>	<b>7</b>	<b>YES</b>	Basket levelling down valve coil
<b>46</b>	<b>7</b>	<b>YES</b>	Turntable right rotation valve coil
<b>47</b>	<b>7</b>	<b>YES</b>	Turntable left rotation valve coil
<b>48</b>	<b>7</b>	<b>YES</b>	Basket right rotation valve coil
<b>49</b>	<b>7</b>	<b>YES</b>	Basket left rotation valve coil
64	2	YES	
65	9	NO	
66	9	NO	

## SECTION 6 - JLG CONTROL SYSTEM

COIL CONNECTION ERROR EXAMPLE		
DEVICE CODE	ERROR CODE	ACTIVE
67	4	YES
73	2	NO
89	12	YES
133	1	YES
145	2	YES
154	8	NO
155	8	NO

### EXAMPLE OF MACHINE WITH A COIL CONNECTION ERROR AFTER KEY RESET

From the software release 2.0, resetting the machine by the main key the aerial part movements will be re-acti-

vated, except for the third boom lowering that will be re-activated only after its coil anomaly is restored.

COIL CONNECTION ERROR AFTER KEY RESET EXAMPLE		
DEVICE CODE	ERROR CODE	ACTIVE
12	9	YES
<b>37</b>	<b>2</b>	<b>YES</b>
64	2	YES
65	9	NO
66	9	NO
67	4	YES
73	2	NO
89	12	YES
133	1	YES
145	2	YES
154	8	NO
155	8	NO

3 boom lifting valve coil

# PARTS FINDER

**Search Website  
by Part Number**



**Search Manual  
Library For Parts  
Manual & Lookup Part  
Numbers – Purchase  
or Request Quote**

A screenshot of the "Search Manuals" form. The form has a title "Search Manuals" and a subtitle "Please provide information to help us locate the manual and/or parts you need." It includes several input fields: "Brand" (a dropdown menu), "Serial Number" (a text field), "Model" (a dropdown menu), "Serial" (a text field), "Part Number" (a text field), and "Quantity" (a text field). There is also a "Submit" button at the bottom.

**Can't Find Part or  
Manual? Request Help  
by Manufacturer,  
Model & Description**

A screenshot of the "Parts Order Form". The form has a title "Parts Order Form" and a subtitle "Please fill in as much information as possible." It includes a "Manufacturer" dropdown menu, a "Model" dropdown menu, and a "Description" text field. There are also several empty rows for additional information, each with a "Quantity" column on the right. A "Submit" button is located at the bottom right.

Discount-Equipment.com is your online resource for quality parts & equipment.

Florida: **561-964-4949** Outside Florida TOLL FREE: **877-690-3101**

**Need parts?**

Click on this link: <http://www.discount-equipment.com/category/5443-parts/> and choose one of the options to help get the right parts and equipment you are looking for. Please have the machine model and serial number available in order to help us get you the correct parts. If you don't find the part on the website or on one of the online manuals, please fill out the request form and one of our experienced staff members will get back to you with a quote for the right part that your machine needs.

We sell worldwide for the brands: Genie, Terex, JLG, MultiQuip, Mikasa, Essick, Whiteman, Mayco, Toro Stone, Diamond Products, Generac Magnum, Airman, Haulotte, Barreto, Power Blanket, Nifty Lift, Atlas Copco, Chicago Pneumatic, Allmand, Miller Curber, Skyjack, Lull, Skytrak, Tsurumi, Husquvarna Target, , Stow, Wacker, Sakai, Mi-T- M, Sullair, Basic, Dynapac, MBW, Weber, Bartell, Bennar Newman, Haulotte, Ditch Runner, Menegotti, Morrison, Contec, Buddy, Crown, Edco, Wyco, Bomag, Laymor, Barreto, EZ Trench, Bil-Jax, F.S. Curtis, Gehl Pavers, Heli, Honda, ICS/PowerGrit, IHI, Partner, Imer, Clipper, MMD, Koshin, Rice, CH&E, General Equipment, ,AMida, Coleman, NAC, Gradall, Square Shooter, Kent, Stanley, Tamco, Toku, Hatz, Kohler, Robin, Wisconsin, Northrock, Oztec, Toker TK, Rol-Air, Small Line, Wanco, Yanmar

## SECTION 7. GENERAL ELECTRICAL INFORMATION & SCHEMATICS

### 7.1 GENERAL

This section contains schematics to be used for locating and correcting most of the operating problems which may develop. If a problem should develop which is not presented in this section or which is not corrected by listed corrective actions, technically qualified guidance should be obtained before proceeding with any maintenance.

#### NOTICE

IT IS A GOOD PRACTICE TO AVOID PRESSURE-WASHING ELECTRICAL/ELECTRONIC COMPONENTS. SHOULD PRESSURE-WASHING BE UTILIZED TO WASH AREAS CONTAINING ELECTRICAL/ELECTRONIC COMPONENTS, JLG INDUSTRIES, INC. RECOMMENDS A MAXIMUM PRESSURE OF 750 PSI (52 BAR) AT A MINIMUM DISTANCE OF 12 INCHES (30.5 CM) AWAY FROM THESE COMPONENTS. IF ELECTRICAL/ELECTRONIC COMPONENTS ARE SPRAYED, SPRAYING MUST NOT BE DIRECT AND BE FOR BRIEF TIME PERIODS TO AVOID HEAVY SATURATION.

### 7.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. A digital meter with reasonable accuracy (within 7%) is recommended for the measurements in these procedures. This section shows diagrams of a common, digital VOM configured for several different circuit measurements. Instructions for your VOM may vary. Please consult the meter operator's manual for more information.

#### Grounding

"Grounding the meter" means to take the black lead (which is connected to the COM (common) or negative port) and touch it to a good path to the negative side of the voltage source.

#### Backprobing

To "backprobe" means to take the measurement by accessing a connector's contact on the same side as the wires, the back of the connector. Readings can be done while maintaining circuit continuity this way. If the connector is the sealed type, great care must be taken to avoid damaging the seal around the wire. It is best to use probes or probe tips specifically designed for this technique, especially on sealed connectors. Whenever possible insert probes into the side of the connector such that the test also checks both terminals of the connection. It is possible to inspect a connection within a closed connector by backprobing both sides of a connector terminal and measuring resistance. Do this after giving each wire a gentle pull to ensure the wires are still attached to the contact and contacts are seated in the connector.

#### Min/Max

Use of the "Min/Max" recording feature of some meters can help when taking measurements of intermittent conditions while alone. For example, you can read the voltage applied to a solenoid when it is only operational while a switch, far from the solenoid and meter, is held down.

#### Polarity

Finding a negative voltage or current reading when expecting a positive reading frequently means the leads are reversed. Check what reading is expected, the location of the signal and that the leads are connected to the device under test correctly. Also check that the lead on the "COM" port goes to the ground or negative side of the signal and the lead on the other port goes to the positive side of the signal.

#### Scale

M = Mega = 1,000,000 \* (Displayed Number)

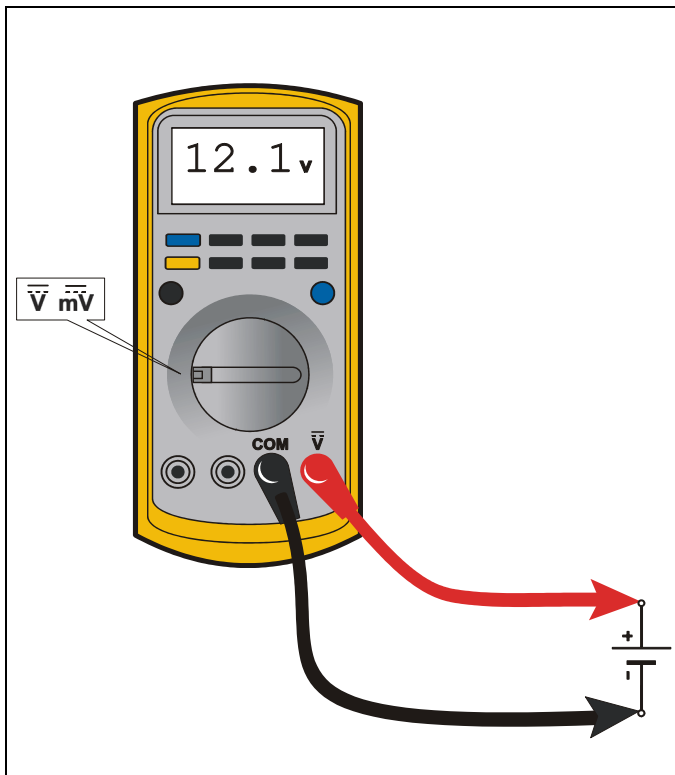
k = kilo = 1,000 \* (Displayed Number)

m = milli = (Displayed Number) / 1,000

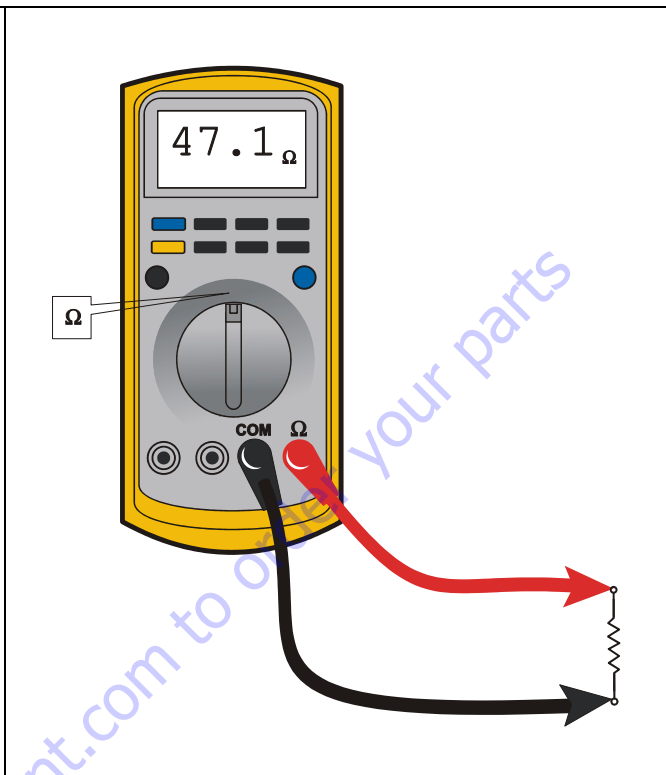
$\mu$  = micro = (Displayed Number) / 1,000,000

Example: 1.2 k $\Omega$  = 1200  $\Omega$

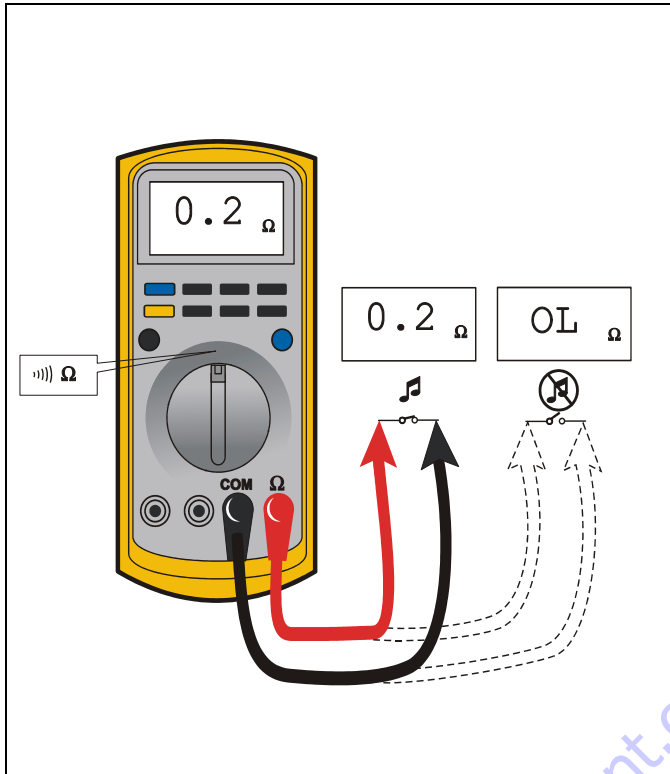
Example: 50 mA = 0.05 A

**Voltage Measurement****Figure 7-1. Voltage Measurement (DC)**

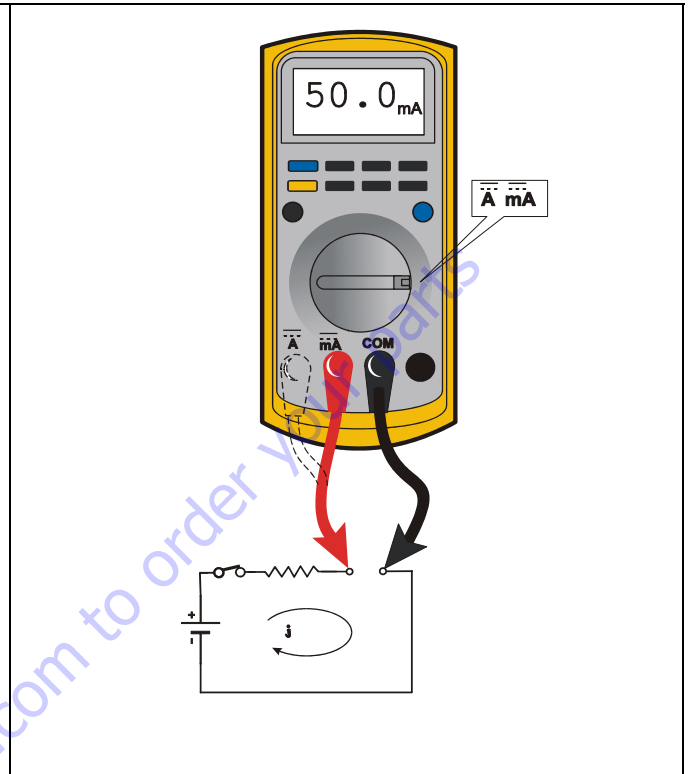
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual).
- Use firm contact with meter leads.

**Resistance Measurement****Figure 7-2. Resistance Measurement**

- First test meter and leads by touching leads together. Resistance should read a short circuit (very low resistance).
- Circuit power must be turned OFF before testing resistance.
- Disconnect component from circuit before testing.
- If meter is not auto ranging, set it to the correct range (See multimeter's operation manual).
- Use firm contact with meter leads.

**Continuity Measurement****Figure 7-3. Continuity Measurement**

- Some meters require a separate button press to enable audible continuity testing.
- Circuit power must be turned OFF before testing continuity.
- Disconnect component from circuit before testing.
- Use firm contact with meter leads.
- First test meter and leads by touching leads together. Meter should produce an audible alarm, indicating continuity.

**Current Measurement****Figure 7-4. Current Measurement (DC)**

- Set up the meter for the expected current range.
- Be sure to connect the meter leads to the correct jacks for the current range you have selected.
- If meter is not auto ranging, set it to the correct range (See multi meter's operation manual).
- Use firm contact with meter leads.

### **Continuity Measurement Over Long Distances**

When trying to determine continuity of a harness or wire, longer than the reach of standard instrument leads, is possible to perform the check without excessively long leads. Using the other wires in the harness one can determine the condition of a particular wire in the harness.

#### **Requirements:**

- Harness with at least three separate wires including the wire under test.
- These wires must be able to be isolated from other wires, etc.
- Jumper or method to connect contacts on one side of harness.
- Meter that can measure resistance or continuity.

#### **Procedure**

Test multimeter leads resistance. Subtract this value from the measured resistance of the wires to get a more accurate measurement.

Consult the circuit schematic to determine which wires to use in addition to wire under test, here called wire #1 and wire #2, and how to isolate these wires. These wires should appear in the same connectors as the wire under test or are within reach of the jumper.

1. Disconnect all connections associated with the wire under test and the two additional wires. If harness is not completely isolated disconnect battery terminals also, as a precaution.
2. Measure continuity between all three wires, the wire under test, wire #1 and wire #2. These should be open. If not, repair the shorted wires or replace the harness.

3. On one side, jumper from contact of wire #1 and wire #2.
4. Measure continuity between wire #1 and wire #2. If there is continuity, both wires are good and can be used for this test. If there is not continuity, either wire could be bad. Check connections and measurement setup. Redo measurement. If still no continuity, repair wires or consult schematic for other wires to use for test.
5. Jumper from wire under test to wire #1.
6. Measure continuity. If there is continuity, the wire under test is good. Resistance of a wire increases as the length increases and as the diameter decreases.

One can find the continuity of two wires, here #1 and #2, at once by following steps 1 through 4. If there is a problem the third wire is used to troubleshoot the other wires. To find the problem, start at step 1 and use the entire procedure.

### **7.3 ELECTRICAL SCHEMATICS MANUALS**

The electrical schematics manuals are separate from this manual. They are available online (Online Express or [www.jlg.com](http://www.jlg.com) - Manuals) in the same folder where this Service Manual was found.

Here is a listing of the schematic manuals available:

X13JP-X370AJ & X15JP-X430AJ.....3121779







3121774



An Oshkosh Corporation Company



[www.Discount-Equipment.com](http://www.Discount-Equipment.com)

Go to [Discount-Equipment.com](http://Discount-Equipment.com) to order your parts