



# Service and Maintenance Manual

## *DSP Models*

31210300

Oct 03, 2022 - Rev. D





## SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

### A 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 OF THE MACHINE WITHOUT CERTIFICATION BY A RESPONSIBLE AUTHORITY THAT THE MACHINE IS AT LEAST AS SAFE AS ORIGINALLY MANUFACTURED, IS A SAFETY VIOLATION.**

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.**

### B 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.

### C MAINTENANCE

#### **⚠ WARNING**

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

- 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 DANGER, WARNING, CAUTION AND OTHER INSTRUCTIONS ON MACHINE AND IN SERVICE MANUAL.
- KEEP OIL, GREASE, WATER, ETC. WIPED FROM STANDING SURFACES AND HAND HOLDS.
- NEVER WORK UNDER AN ELEVATED STRUCTURE UNTIL STRUCTURE HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.
- 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.
- ENSURE REPLACEMENT PARTS OR COMPONENTS ARE IDENTICAL OR EQUIVALENT TO ORIGINAL PARTS OR COMPONENTS.

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## SECTION 1. OPERATING SPECIFICATIONS

## 1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Description		DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
Maximum Work Load	Platform	120 kg		100 kg
	Material Handling Tray	100 kg		80 kg
Occupant: (Persons allowed in Platform)		1		
Maximum Manual Side Force		200 N		
Maximum Operating Wind Speed		0 m/s (For indoor use only)		
Maximum Elevated Travel Grade	Longitudinal Slope	3°		
	Side Slope	1.5°		
Maximum Stowed Travel Grade (Gradeability and Side Slope)		10% (5.7°)		
Break Over Angle		10% (5.7°)		
Maximum Tire Load	Rear Wheels	450 kg	630 kg	780 kg
	Front Caster Wheels	240 kg	360 kg	430 kg
Gross Machine Weight (Platform Empty)		760 kg	915 kg	1150 kg

## 1.2 DIMENSIONAL DATA

Table 1-2. Dimensions

Description	DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
Machine height (Platform Stowed)	1.50 m	1.67 m	1.99 m
Machine Base - Overall: (Width x Length)	0.80 m x 1.54 m		0.86 m x 1.54 m
Platform Base - Overall: (Width x Length)	0.67 m x 0.54 m		
Wheel Base (Wheels straightened)	1.13 m		
Ground Clearance (chassis base plate)	5 cm		
Tray size - Standard: (Width x Length)	0.74 m x 0.50 m		

## SECTION 1 - OPERATING SPECIFICATIONS

### 1.3 PERFORMANCE DATA

Table 1-3. Performances

Description		DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
<b>Platform height</b> - (Platform floor to ground)	Stowed	0.20 m		0.30 m
	Raised	3.0 m	4.55 m	5.80 m
<b>Tray min height</b> – Machine stowed (Tray floor to ground)	Powered	0.61 m		0.71 m
	Manual	0.86 m		0.96 m
<b>Tray Max height</b> – Machine raised (Tray floor to ground)		4.1 m	5.65 m	6.90 m
<b>Turning Radius</b>	Outside	1.32 m		
	Inside	0		
<b>Maximum Stowed Travel Grade</b> (Gradeability and Side Slope)		10% (5.7°)		
<b>Elevating</b>				
<b>Mast time</b> – With one person (approx. 80kg) – Tray empty	Lift Up	12 to 14 seconds	18 to 22 seconds	23 to 28 seconds
	Lift Down	13 to 16 seconds	20 to 24 seconds	22 to 27 seconds
<b>Tray powered</b> – With 100 kg load	Lift Up	12 to 14 seconds		
	Lift Down	10 to 12 seconds		
<b>Drive</b> (Maximum speeds at specific set points (Software V2.0))				
<b>Drive with Platform height</b> < 0.5 m (course: 15 m)	Forward	6.5 to 8 seconds		6.7 to 8.4 seconds
	Reverse	12 to 14 seconds		
<b>Drive with Platform height</b> = 1.1 m (course: 15 m)	Forward	10 to 12 seconds		
	Reverse	15 to 17 seconds		
<b>Drive with Platform height</b> = 1.7 m (course: 10 m)	Forward	12 to 14 seconds		
	Reverse	17 to 19 seconds		
<b>Drive with Platform height</b> = 2.7 m (course: 5 m)	Forward	N/A	10 to 12 seconds	
	Reverse	N/A	15 to 17 seconds	
<b>Drive with Platform height</b> ≥ 2.7 m (course: 5 m)	Forward	10 to 12 seconds	N/A	
	Reverse	15 to 17 seconds	N/A	
<b>Drive with Platform height</b> ≥ 3.7 m (course: 5 m)	Forward	N/A	15 to 17 seconds	22 to 24 seconds
	Reverse	N/A	21 to 23 seconds	30 to 33 seconds

## 1.4 CAPACITIES

Table 1-4. Capacities

Component	DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
Hydraulic Tank	6l		
Hydraulic System (Including Tank)	8l	9l	10l

## 1.5 COMPONENTS DATA

### Batteries

Table 1-5. Battery Specifications

Description	DSP Series
Voltage (24V System – Series)	4 Packs of 6 Volts (AGM)
Amp Hour	24V DC - 200 Ah (20 Hr. rate)
Weight - Approx	115 kg

### Electric Pump / Electric Motor Assembly

Table 1-6. Hydraulic Unit Specifications

Description	DSP Series	
<b>Motor</b>	Power	2 kW
	Voltage	24VDC
<b>Pump (Gear pump)</b>	Flow Rate	10l/mn
	Displacement	3.8 cc/rev
<b>Max. Operating Pressure</b>	13.5 MPa	

### Drive Motor Assembly

Table 1-7. Drive Motor Specifications

Description	DSP Series	
<b>Motor</b>	Power	0.4 kW
	Voltage	15VAC
<b>Brake</b>	Supply Voltage	24V Nominal
<b>Sensor Bearing</b>		64 Impulses per rev.

## SECTION 1 - OPERATING SPECIFICATIONS

### Steer Drive

**Table 1-8. Steer Drive Specifications**

Description	DSP Series
Motor Type	Orbital
Displacement	31.6 cc

### Mast Cylinder

**Table 1-9. Cylinder Specifications**

Description		Stroke		
		DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
<b>Mast Cylinder (Single Action)</b> <b>Bore Dia. : 40 mm (1.57 in)</b> <b>Rod Dia. : 30 mm (1.18 in)</b>	Stage #1	941 mm (37.05 in)	1095 mm (43.11 in)	1357 mm (53.43 in)
	Stage #2	917 mm (36.10 in)	1065 mm (41.93 in)	1376 mm (54.17 in)
	Stage #3	939 mm (36.97 in)	1088 mm (42.83 in)	1382 mm (54.41 in)
	Stage #4	N/A	1100 mm (43.31 in)	1385 mm (54.53 in)

### Wheels

**Table 1-10. Wheels Specifications**

Description	Sizes (mm/in)	Torque
Rear Wheels	D254x74 / D10x3	N/A
Caster wheels	D125x50 / D5x2	40 Nm / 29.5 lb.ft
Drive Wheel	D230x70 / D9x2.75	120 Nm / 88.5 lb.ft

### Powered Tray

**Table 1-11. Hydraulic Unit Specifications**

Description	DSP Series
Power	0.2 kW
Voltage	24 VDC
Stroke	680 mm

## 1.6 MAJOR COMPONENTS WEIGHTS

Table 1-12. Major Components Weights

Description	DSP S (CE/UKCA) DSPi-S (CE Only)	DSP M (CE/UKCA) DSPi-M (CE Only)	DSP L (CE/UKCA)
Platform (*)	62 kg / 136 lbs		
Platform Support	12 kg / 26 lbs		
Gate	3 kg / 7 lbs		
Tray Powered (Option)	25 kg / 55 lbs		
Tray Manual	15 kg / 33 lbs		
Tray Electrical Actuator	5 kg / 11 lbs		
Tray Trolley	2.1 kg / 4.6 lbs		
Platform Station	3 kg / 7 lbs		
Platform Rear Lower Shield	7 kg / 15 lbs		
Mast Cylinder	45 kg / 100 lbs	65 kg / 143 lbs	79 kg / 175 lbs
Mast Assembly	94 kg / 207 lbs	127 kg / 280 lbs	153 kg / 337 lbs
Power Unit	13.5 kg / 30 lbs		
Power Unit Support Shield	25 kg / 55 lbs		
Chassis	190 kg / 420 lbs		480 kg / 1060 lbs
Drive Motor (*)	40 kg / 88 lbs		
Drive Motor Support	12 kg / 26 lbs		
Battery (each) (*)	29 kg / 64 lbs		
Counterweight (*)	NONE	102 kg / 225 lbs	NONE
Rear Wheel (*) (each)	9 kg / 20 lbs		
Caster Wheel (*) (each)	2 kg / 4.4 lbs		
Frame Cover Middle	10 kg / 22 lbs		
Frame Cover Rear	7 kg / 15 lbs		

(\*) Items critical for stability

**⚠ WARNING**

DO NOT REPLACE ITEMS CRITICAL TO STABILITY, SUCH AS BATTERIES OR SOLID TIRES, WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION. DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.

1.7 LUBRICATION

Hydraulic Oil

Table 1-13. Hydraulic Oil Specifications (Standard)

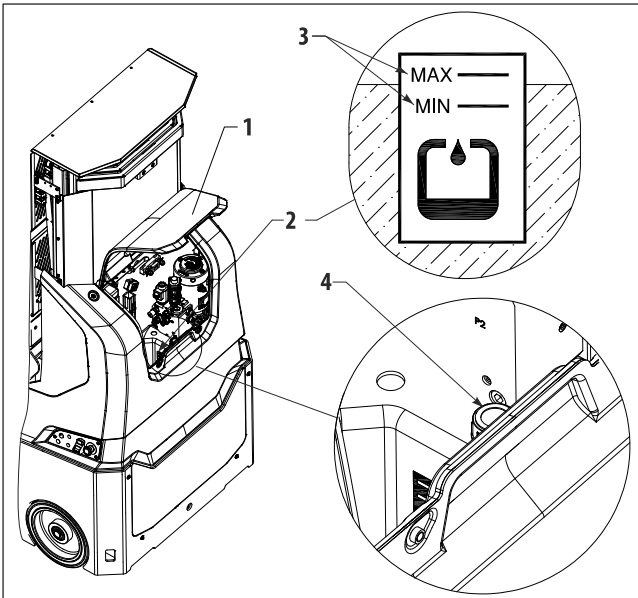
Specifications	NERVOFLUID 15	MOBIL DTE 10XL 15
ISO Viscosity Grade	15	15
Cinematic Viscosity @ +40°C [104°F]	14.9 mm <sup>2</sup> /s (cSt)	15.8 mm <sup>2</sup> /s (cSt)
Cinematic Viscosity @ 0°C [32°F]	3.8 mm <sup>2</sup> /s (cSt)	4.07 mm <sup>2</sup> /s (cSt)
Pour Point, Max.	-40°C (-40°F)	-54°C (-65°F)
Flash Point, Min.	175°C (347°F)	182°C (359°F)
Viscosity Index	153	168
ISO 6743-4 Classification	HV	HV

**NOTE:** Hydraulic oils must have anti-wear qualities and sufficient chemical stability for mobile hydraulic system service. It is not advisable to mix oil of different brands or types, as they may not contain the same required additive or be of comparable viscosities.

Hydraulic Oil Check

1. Open the access door to the hydraulic power unit (1).
2. Locate the decal (2) on the tank.
3. The oil level in the tank must be within the MIN (minimum) and Max (maximum) markings (3) of the decal.

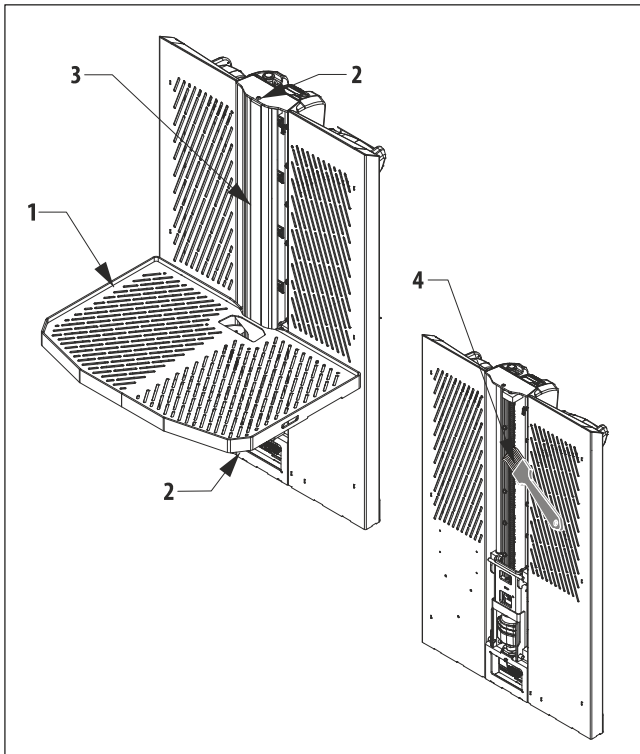
If additional oil is required, wipe all dirt and debris from the **filler/breather cap (4)** area, add proper grade of oil by using a funnel. Fill until oil level is between the MIN and MAX markings (3).



Lube Point - Hydraulic Tank  
 Reservoir Capacity: 8 liters  
 Lube - Hydraulic Oil (See Table 1-13)  
 Interval - Check Daily

**NOTE:** Check oil level with the mast fully lowered.

**Ball Screw (Powered Tray Option Only)**



Lube Points - Coat the ball screw

Capacity: A/R

Lube - MOBILUX EP2 / COMPLEX EP2

Interval - Once a year

1. Remove the tray (1) and the two screws (2) securing the cover (3).
2. Apply grease all along the ball screw using a brush (4).

## SECTION 1 - OPERATING SPECIFICATIONS

### 1.8 TORQUE REQUIREMENTS

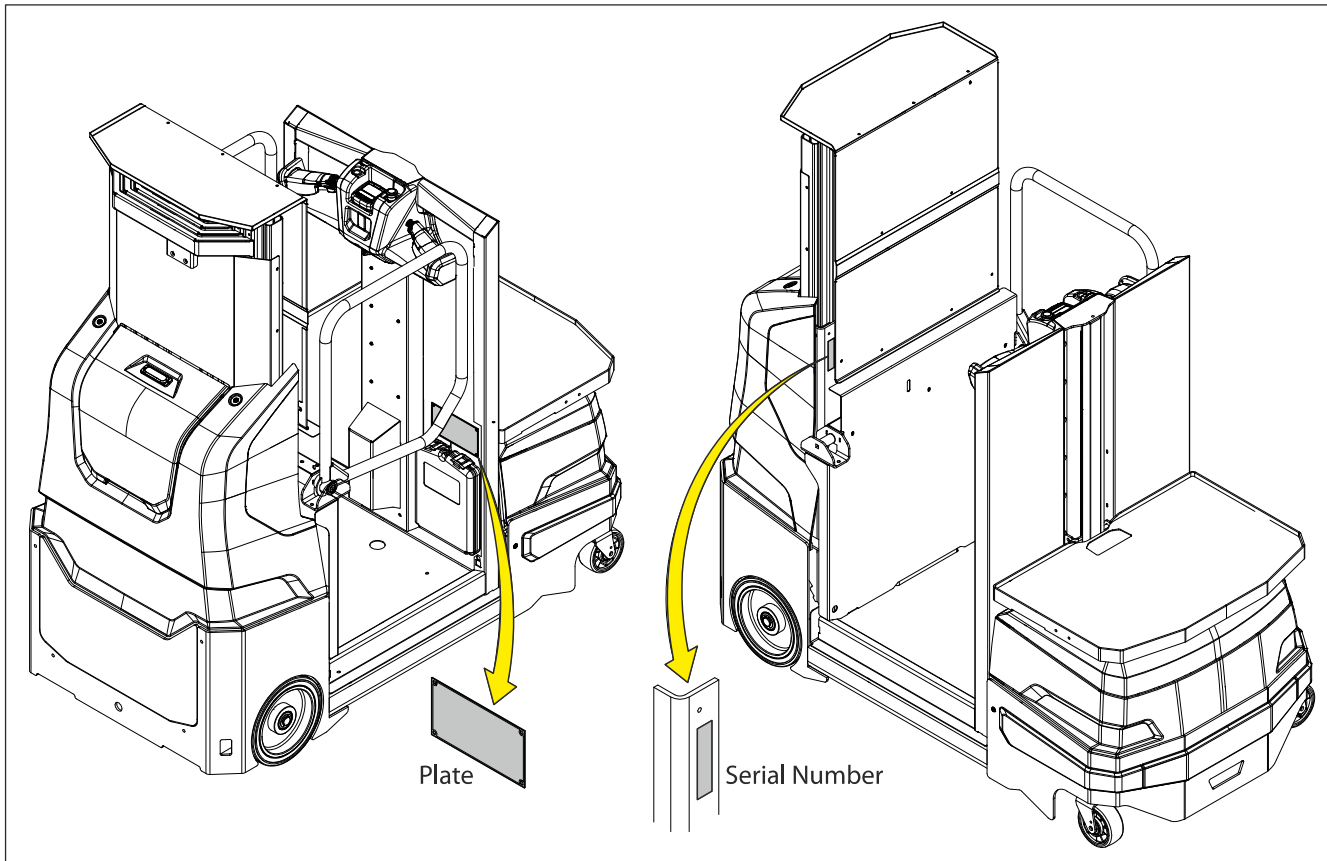
Unless specific torque requirements are given within the text, refer to the following torque chart to determine proper torque values.

**Table 1-14. Torque Chart**

Torque Values for Bolts, Nuts and Studs												
Grade	Unit	M4x70	M5x80	M6x100	M8x125	M10x150	M12x175	M14x200	M16x200	M20x250	M24x300	M30x350
<b>8.8</b>	N.m	2.7	5.2	9.1	22	44	76	121	189	370	637	1280
	lbf.ft	2	3.8	6.7	16.2	32.5	56	89.2	139	272	469	944
<b>10.9</b>	N.m	3.9	7.7	13.4	32	64	111	178	278	544	936	1880
	lbf.ft	2.9	5.7	9.9	23.6	47.2	81.9	131	205	408	690	1386
<b>12.9</b>	N.m	4.6	9	15.7	38	75	130	209	325	637	1095	2200
	lbf.ft	3.4	6.6	11.6	28	55.3	95.9	154	239	469	807	1622
Torque Values for Hydraulic Fittings												
Type	Unit	TORQUE FOR STEEL BODY		TORQUE FOR ALUMINUM BODY								
<b>JIC 9/16"-18</b>	N.m	31		-								
	lbf.ft	22.9										
<b>BSPP 1/4"-19</b>	N.m	35		25								
	lbf.ft	25.8		18.4								
<b>BSPP 3/8"-19</b>	N.m	70		50								
	lbf.ft	51.6		36.9								
<b>Metric M14x150</b>	N.m	45		32								
	lbf.ft	33.2		23.6								
<b>Metric M18x150</b>	N.m	70		50								
	lbf.ft	51.6		36.9								

### 1.9 SERIAL NUMBER LOCATIONS

For machines identification, a serial number plate is affixed into the Platform, above Manual Storage. If the serial number plate is damaged or missing, the machine serial number is stamped on the frame at location shown following.





## SECTION 2. GENERAL SERVICE INFORMATION

### 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.

#### 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 Operation 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 perfor-

mance 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 by a Factory-Trained Service Technician on an annual basis, no later than thirteen (13) months from the date of the prior Annual Machine Inspection. 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 Preventive Maintenance and Inspection 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.

## SECTION 2 - GENERAL SERVICE INFORMATION

---

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

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 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
Preventive Maintenance	At intervals as specified in the Service and Maintenance manual	Owner, Dealer or User	Qualified JLG Mechanic	Service and Maintenance Manual

**2.2 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE**

The preventive maintenance and inspection checks are listed and defined in Table 2-2. This table is divided into two basic parts, the "AREA" to be inspected and the "INTERVAL" at which the inspection is to take place. Under the "AREA" portion of the table, the various systems along with the components that make up that system are listed. The "INTERVAL" portion of the table is divided into six columns representing the various inspection time periods.

The numbers listed within the interval column represent the applicable inspection code for which that component is to be checked.

The checks and services listed in this schedule are not intended to replace any local or regional regulations that may pertain to this type of equipment nor should the lists be considered as all inclusive. Variances in interval times may occur due to climate and/or conditions and depending on the location and use of the machine.

**Table 2-2. Inspection and Preventive Maintenance Schedule**

AREA	INTERVAL					
	Pre-start <sup>1</sup> Inspection	Weekly preventive maintenance	Monthly preventive Maintenance	Pre-delivery <sup>2</sup> or Frequent <sup>3</sup> Inspection	Annual <sup>4</sup> (Yearly) Inspection	Every 2 Years
<b>PLATFORM ASSEMBLY</b>						
Platform	1-2				1-2	
Railing	2				2	
Gate	1-5				1-5	
Floor	7				2	
Lanyard Anchorage Points	2			2-9		
Platform Support	2			1-2-4	1-2-4	
<b>TRAY ASSEMBLY</b>						
Tray & Trolley	1-2				1-2-4	
Sliding Rails/Pads	1-3				1-2-3-7	
Gas Spring (Manual tray only)	1-2				1-2-7-8	
Bowden Cable (Manual tray only)	2				2	
Electric Cylinder (Powered tray only)	1-5			1-5	1-5-13	
<b>MAST ASSEMBLY</b>						
Mast Sections	2			2-4	2-3-4	
Plastic Wear Pad				12	3-12	
Rivets				2	2	
Cylinder Attachments				1-2	1-2	
Hose, Cables Installation, Power Track				1-2-8-11	1-2-8-11	
<b>CHASSIS ASSEMBLY</b>						
Chassis Weldment					4	
Rear Wheels	1-15	16		15-16-17	15-16-17	
Caster Wheels	1-15	16		15-16-17	15-16-17	
Drive Wheel	1-15	16		15-16-17	15-16-17	

## SECTION 2 - GENERAL SERVICE INFORMATION

**Table 2-2. Inspection and Preventive Maintenance Schedule**

AREA	INTERVAL					
	Pre-start <sup>1</sup> Inspection	Weekly preventive maintenance	Monthly preventive Maintenance	Pre-delivery <sup>2</sup> or Frequent <sup>3</sup> Inspection	Annual <sup>4</sup> (Yearly) Inspection	Every 2 Years
Drive Wheel Bolts	1	14		14	14	
Steer Components			1			
Drive Motor Brake					7	
Drive Motor Gearbox				8	8	
Hoods, Hood Props				5	1-2-5	
<b>FUNCTIONS/CONTROLS</b>						
Platform Controls	5-6-9			5-6-9	5-6-9	
Ground Controls	5-6-9			5-6-9	5-6-9	
Manual/Breakdown Controls	5-9			5-9	5-9	
Emergency Stop Switches (Ground & Platform)	5			5	5	
Functions Limit or Cutout Switch Systems	5			5	5	
<b>POWER SYSTEM</b>						
Batteries	18	18		1-19		
Electrical Connections		1		20	20	
Battery Charger				5	5	
<b>HYDRAULIC/ELECTRIC SYSTEM</b>						
Hydraulic Power Unit	8		1-8	1-8		
Hydraulic Cylinder	8	1-7-8	2	1-2-8	1-2-8	
Hydraulic Hoses, Lines and Fittings	8	1-8	11	1-2-8-11	1-2-8-11	
Hydraulic Tank/Hydraulic Fluid	10					
Hydraulic Fluid Replacement						22
Electrical Connections		1		20	20	
Instruments, Switches	5	1		5	5	
Lights, Horn	5			5	5	
Electric Motor Brushes (Hyd. Power Unit)						7-12
<b>GENERAL</b>						
Operation and Safety manuals in Storage Box	21			21	21	
ANSI and EMI Manuals/Handbooks Installed (ANSI Market)					21	
Capacity Decals Installed, Secure, Legible	21			21	21	

**Table 2-2. Inspection and Preventive Maintenance Schedule**

AREA	INTERVAL					
	Pre-start <sup>1</sup> Inspection	Weekly preventive maintenance	Monthly preventive Maintenance	Pre-delivery <sup>2</sup> or Frequent <sup>3</sup> Inspection	Annual <sup>4</sup> (Yearly) Inspection	Every 2 Years
All Decals/Placards installed, Secure, Legible	21			21	21	
Walk-Around Inspection Performed	21					
Annual Machine Inspection Due				21	21	
No Unauthorized Modifications or Additions				21	21	
All Relevant Safety Publications Incorporated				21	21	
General Structural Condition and Welds				2-4	2-4	
All Fasteners, Pins, Shields and Covers				1-2	1-2	
Grease and Lubricate to Specifications				22	22	
Function Test of All Systems	21			21	21-22	
Paint and Appearance				7	7	
Stamp Inspection Date on Mast Section #1					22	
Notify JLG of Machine Ownership					22	

**Maintenance and Inspection Table Codes:**

1. Check for proper and secure installation.
2. Visual inspection for damage, cracks, distortion and excessive wear.
3. Check for proper adjustment.
4. Check for cracked or broken welds.
5. Operates properly.
6. Returns to neutral or "off" position when released.
7. Clean and free of debris.
8. Check for sign of leakage.
9. Decals installed and legible.
10. Check for proper fluid level.
11. Check for chafing and proper routing.
12. Check for proper tolerances.
13. Properly lubricated.
14. Torqued to proper specification
15. No worn edges, excessive wear or distorted profiles.
16. Properly seated around the rim.
17. Proper and authorized components.
18. State of charge.
19. Check/record tension.
20. No loose connections, corrosion or abrasion.
21. Verify.
22. Perform.

**Footnotes:**

<sup>1</sup>: Prior to use each day; or at each operator change.

<sup>2</sup>: Prior to each sale, lease or delivery.

<sup>3</sup>: In service for 3 months or 125 hours; or out of service for 3 months or more; or purchased used.

<sup>4</sup>: Annually, not later than 13 months from the date of prior inspection.

### 2.3 SERVICING AND MAINTENANCE GUIDELINES

#### General

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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

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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 object to rest in an unstable position. When raising a portion of the equipment, ensure that adequate support is provided.

#### **WARNING**

**NEVER WORK UNDER AN ELEVATED PLATFORM UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING.**

#### Cleanliness

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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 the wheel bearings, mast sections and oil supply clean; however, these items must be maintained on a scheduled basis in order to function properly.

At any time when hydraulic oil lines are disconnected, clean adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all opening to prevent entry of foreign matter.

Contaminants in the hydraulic system will affect operation and will result in serious damage to components working parts. Every precaution must be taken to keep hydraulic oil clean, including reserve oil in storage. If the oil must be poured from the original container into another, be sure to clean all contaminants from the service container.

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

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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.

Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting

structure and the component becomes less than 90 degrees.

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 ensure that nothing has been overlooked. Do not make any adjustments, other than those recommended, without obtaining proper approval.

#### Pressure-Fit Parts

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

#### Bearings

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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.

Discard bearing if the races and balls (or rollers) are pitted, scored or burned.

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 bearing until they are ready to be installed.

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.

#### Care and Installation of Teflon Coated Bushings

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##### Bushings:

No jiffy wheels or reaming of any kind can be used on teflon coated bushings.

Once the coating on the bushing is damaged, it cannot be used any more and must be replaced.

##### Pins:

Any rough or damaged surface on a pin will cause the teflon coating of the bushing to be damaged.

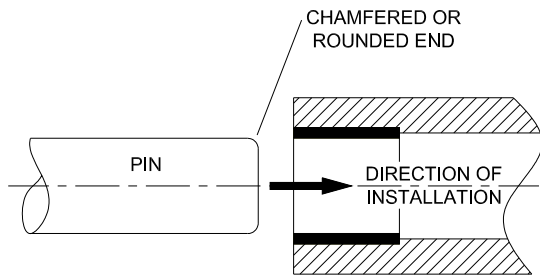
All rust or masking residue must be cleaned from the pin prior to assembly.

Never dry (black colored) "Arcor" treated pins (hot washing, vapor...). This will reduce corrosion resistance property of pin coating.

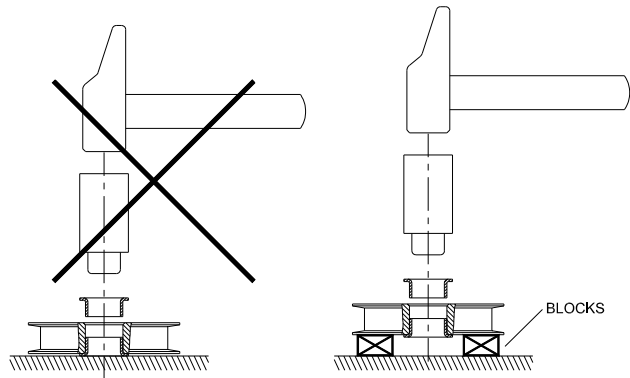
##### Bushings and Pin:

1. Coat inside diameter of bushing with specified lubricant prior to pin installation.
2. Properly align pin and bushing so that the coating does not get damaged when installing the pin.

3. Pins have chamfered or rounded end to prevent damage to the coating of the bushing during pin installation.

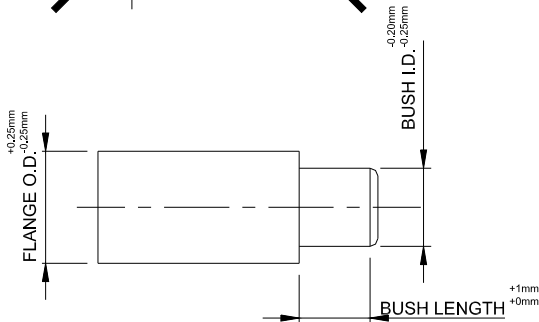
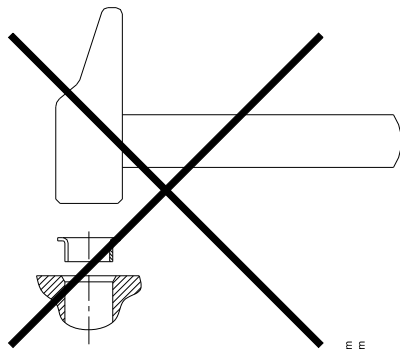


4. Blocking must be used on parts that will receive two flange bushings to prevent damage to the lower bushing flange.



**Bushing Installation:**

1. Use an appropriate driver (soft steel) to insert bushing in its housing.



2. Slightly oil the outside diameter of the bushing to facilitate insertion.
3. Keep driver, bushing and housing correctly aligned during assembly.

**Bolt Usage and Torque Application**

**NOTICE**

SELF LOCKING FASTENERS, SUCH AS NYLON INSERT AND THREAD DEFORMING LOCKNUTS, ARE NOT INTENDED TO BE REINSTALLED AFTER REMOVAL.

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.

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 or the Torque Chart in Section 1 of this Service Manual.

**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.

Coat contacts of electrical connectors with silicone dielectric compound (Refer to Section 11).

Always disconnect battery plug (located in the battery compartment) prior to working on the electrical system.

**Hydraulic System**

**WARNING**

EXERCISE EXTREME CARE AROUND PRESSURIZED HYDRAULIC SYSTEMS WHILE IN OPERATION OR UNTIL ALL PRESSURE IS RELEASED.

### **⚠ WARNING**

HIGH PRESSURE OIL COULD PENETRATE SKIN AND CAUSE INJURIES OR BURNS. LOOSEN FITTINGS OR COMPONENTS SLOWLY TO ALLOW OIL PRESSURE TO DROP GRADUALLY.

When servicing the hydraulic system, use a container to collect the oil from hydraulic lines or components and prevent it from spilling on the work platform or on the ground.

**NOTE:** *Used oils and filter cartridges must be disposed of according to regulation in force.*

Before disconnecting a hydraulic line or removing a component, clean fittings and adjacent area. As soon as a line or component is disconnected, cap or cover all opening to prevent entry of foreign matter.

Disassemble and reassemble hydraulic parts on clean work surface. Clean all metal parts with non-flammable cleaning solvent. Lubricate components, as required, to aid assembly.

Keep the system clean. Hydraulic system filter should be replaced at the specified intervals. Examine filter cartridge for evidence of metal or rubber particles. If evidence of metal or rubber particles is found, drain and flush the entire system.

### **Welding on Work Platform**

---

When welding on the work platform, disconnect battery plug and ALL electronic components. When welding on the chassis, connect the welder ground wire to the machine chassis as close as possible to the area being welded. When welding on the superstructure, connect the welder ground wire to the machine superstructure as close as possible to the area being welded. This is to prevent arcing inside the swing bearing, the lifting chains or the cylinders.

### **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.).**

### **Lubrication**

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Components and assemblies requiring lubrication and servicing are shown in Section 1.7. Service applicable components with the amount, type, and grade of lubricant are 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**

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Clean and dry battery top. Ensure all connections are clean and correctly tight. Coat terminals with a silicone dielectric compound.

## 2.4 LUBRICATION INFORMATION

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### **Hydraulic System**

---

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.

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.

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.

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 of new machines due to the wear-in of meshing components.*

### **Lubrication Specifications**

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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 1.7 of this Service Manual for an explanation of the lubricant key designations appearing in the Lubrication Chart.

### **Hydraulic Oil**

---

For best performance, JLG recommends the use of ISO VG 15 oil with a viscosity about 15 cSt at 40 °C. Refer to Section 1.7 of this Service Manual for recommended hydraulic oils.

### **Changing Hydraulic Oil**

---

Use of any of the recommended hydraulic oils eliminates the need for changing the oil on a regular basis. 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 syn-

thetic base oils. JLG Industries recommends changing the hydraulic oil at least every 2 years.

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.

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.

---

### 2.5 PRESSURE RELIEF VALVE

Pressure relieving in the hydraulic circuit is achieved by three relief valves installed on the power unit valve body. The valves are adjusted by a manual process : refer to section 9-9 and 9-10 respectively for the Main relief valve and for the Steer relief valves.

Pressure relief values of machine functions can be checked by connecting a pressure gauge at port "MP1" on the hydraulic main manifold. Before checking pressure relief values, operate the machine a few minutes to warm the hydraulic oil.

Refer to Sections 7 and 9-9, 9-10 of this manual for further information.

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### 2.6 HYDRAULIC CARTRIDGE INSTALLATION

Before install a new cartridge, ensure that no external contaminant is present. Inspect O-rings and back-up rings to ensure there is no damage such as cuts or nicks.

Lubricate all seals of the cartridge with a small amount of the same oil that is used on the work platform (Refer to Section 1-7). If the seals are too dry, the back-up ring could spin out of the cage groove and cause seal damage.

Insert the cartridge into the cavity and tighten by hand in a clockwise manner. Continue to screw in the cartridge with a torque wrench and tighten to the specific torque. It is important to use the specified torque for each valve to ensure optimal performance of the cartridge.

Insert the coil and use the specified torque when tightening the coil nut. It is important to use the specified torque for each coil nut to ensure the stainless steel tube is not stretched.

If the valve requires two coils, install them separately. Place the washer on top of first coil then install the second coil. Finally, install and tighten the coil nut to the specified torque.



## SECTION 3. THEORY OF OPERATION

### 3.1 OVE33RVIEW

The control system is composed of four electronic Modules (five with the powered tray version).

All modules are communicating through a bus CAN.

The Power Module, located on the left side of the chassis is the master system controller.

Most functions are dispatched and coordinated from this module, all other system modules handle sub-tasks.

**NOTE:** *The master module computes and stores battery level indication and hourmeter.*

All characterized information (values) are stored into the Master Controller (i.e., Personalities, Machine Setups or Calibrations).

If the master module is reprogrammed, this information is lost. The technician should record Personalities and Machine Setups before programming so they can be restored afterwards. Otherwise, default values can be used as a starting point to restore previous configuration.

The Master Controller enables machine movements by controlling the main contactor and the load holding valve.

This module controls the drive motor and its brake and the hydraulic pump motor. It also reads chassis based switches and sensors.

The Platform Display module (facing the operator in the platform), consists of an LCD display, a red LED indicator, and three push buttons. It also controls the platform buzzer. The LCD display and the push buttons are primarily used to indicate the machine status (battery level, hourmeter, steering wheel orientation and operating faults or DTCs as necessary) and adapt machine performance to the operator's need (platform height, driving speed selectable with the buttons). The Platform Display module also serves as system Analyzer (refer to §9 for detailed information). The Display module stores all the menus and icons, manages the access codes (Immobilizer, Analyzer access levels) but does not store any Personalities, Machine Setups or Calibrations).

The Platform Module reads linked switches, sensors and joysticks positions and relays that information to the Master Controller. Following the Master Controller commands, it controls the platform beacon. It also reports faults pertaining to devices in the Platform Control Station and devices connected to the Platform Control Station.

The Ground Module, located at the rear of the machine, reads ground console switches and relays that information to the Master Controller. Upon Master Controller

commands, it controls the hydraulic powerpack valves and ground LSS indicator. It also reports faults pertaining to these devices.

The machine can be fitted with an optional Powered Tray module. This module, located in the platform structure, reads the tray sensors and relays that information to the Master Controller. It controls the tray actuator via commands from the CAN bus. It also measures current applied to the electric motor of the actuator and input voltage for fault protection and reporting.

For safe operation of the vehicle, the control system will not allow certain functions under certain conditions. These are called interlocks. Specific interlocks are discussed below. The interlocks discussed assume that all control system devices are functioning properly unless indicated.

Fault conditions will generate Diagnostic Trouble Codes and additional interlocks.

Some faults only show up at power-up when the control system performs a self-test. All controls should be left alone during this test.

Note that the market and model of the machine affects what personalities and setups are. The appropriate information is displayed for the given model and market. The market and model must be set properly for safe and lawful operation of the machine.

### 3.2 MODES OF OPERATION

#### Ground Mode

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When the Ground Mode is selected, only the functions at the Ground control station are operational.

The Platform/Ground mode selector is also the ground controls enable: It must be in Platform mode position at machine power-up.

Once toggled to Ground mode, ground controls must be used within 10 seconds.

Functions are controlled by membrane switches (buttons).

#### Platform Mode

---

This is the mode selected by default.

In platform mode the Platform Control Console is enabled. It is the primary control station for the vehicle. At power-up, all indicators illuminate for a lamp check.

### 3.3 CAN COMMUNICATIONS

The communications between the different modules is done through a bus CAN.

CAN (Controller Area Network) is the type of two-wire differential serial communication link used for control of the vehicle. This type of network has matured since its invention in 1986 and is used extensively in many kinds of machines.

**Two-Wire Differential:** The signal meaning is derived from the difference in voltage between two wires, usually twisted together in a common "jacket". This jacket can also contain a shield surrounding the wires inside for noise protection. Any noise that does penetrate the shield will affect both wires the same. However, the difference in voltage stays the same, therefore signal meaning is not corrupted. This differs from one-wire signals in that one wire signals derive the signal meaning from the difference between the signal wire and system ground wire. The system ground is the ground for many signals, as well as power. Any noise on either wire will change the signal and may corrupt it.

**Serial Communication Link:** Modules on the link send messages digitally, bit by bit along the wires where different voltage levels represent a "1" or a "0". The 1's and 0's are assembled by the receiver according to the protocol used to determine the messages meaning. Using serial communication allows two wires to replace many more. It also allows use of sensor and switch information in multiple places without duplicating those sensors and switches.

**CAN:** On a bus, all modules on the bus are connected to the same wires. A CAN bus could be represented on a schematic by a long pair of straight lines with multiple modules connected to them by short pairs of lines. It has a termination resistor at both ends of the long lines placed between the two wires. These resistors are approximately 120  $\Omega$ . On a JLG aerial work platform, this is typically in the platform and in the chassis. These resistors may be in the harness or in the module. A complete CAN circuit measures approximately 60  $\Omega$  between the two wires and these wires are open to the shield. Each module on the CAN bus broadcasts its messages according to a priority assigned to the message. All the other modules will receive the message and determine if it is important to them. Typical message traffic is 300 - 500 messages per second. The high bus speed allows all modules to be constantly updated around 20 times per second. A CAN network also has error detection and handling for robust communications.

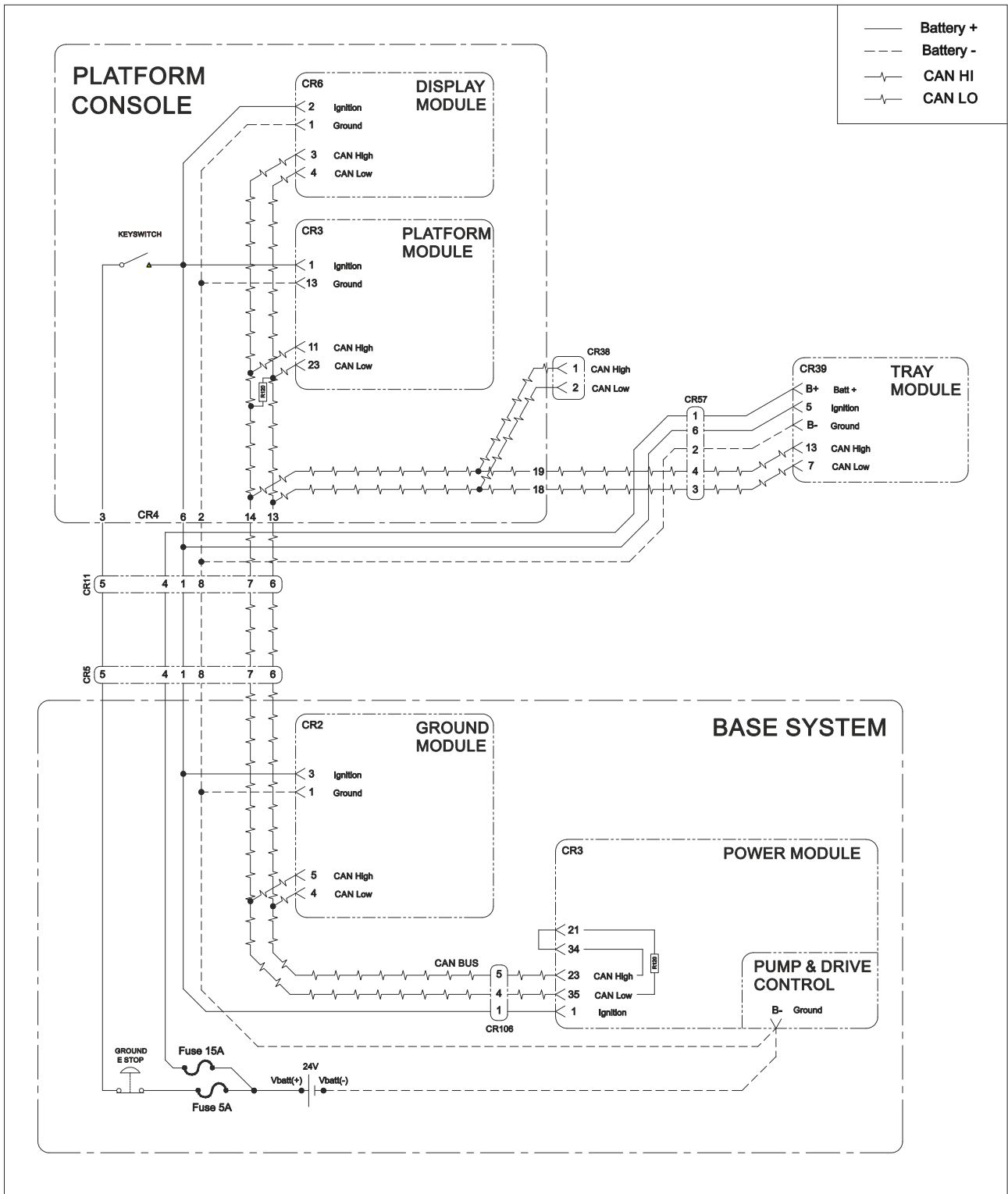


Figure 3-1. Basic Electronic Module Connections

### 3.4 PLATFORM CONTROLS

#### Emergency Stop

The platform emergency stop is managed by the Master Controller. It does not shut the system off (System needs to be shut off by the key switch). The emergency stop consists of a NO contact switch, which is read by the Platform Module, and a NC contact switch that is read by the Master Controller. The consistency between both switches state is monitored.

#### Control Handles

Each control handle incorporates a presence detection, a joystick and a push button.

##### Operator Presence Detection:

Movements can be operated after presence detector(s) is (are) triggered. The following rules apply.

Movement control must occur within 3 seconds after presence is detected;

Movements requiring both detectors to be triggered:

- Drive,
- Mast lift Up and Down;

Movements requiring either a single detector or both to be triggered:

- Steering,
- Wheel centering (homing);

Movement requiring a single detector to be triggered:

- Tray lift Up and Down.

##### Joysticks:

The joysticks are used to "command" drive and steer. Those commands may be modified by the control system based on interlocks and personalities. The joystick control handle sensors are not simple potentiometers. There is a position sensing element, and signal conditioning circuitry in them to generate the position signal.

They are powered by 5VDC supplied from the platform module. When centered a joystick will output approximately 2.5VDC. Fully forward or left, it will output approximately 0.5V DC. Fully backward or right, it will output approximately 4.5V DC. Joystick personalities to define the centered position, minimum and maximum forward, as well as minimum and maximum reverse can be altered by performing a calibration of the joysticks.

##### Push buttons

The push buttons are used to "command" mast lift up and down. These buttons are mechanical switches.

**NOTE:** *To pass start-up tests all controls must be released: push button switches in open state and joysticks centered.*

*No operation from the platform console is possible until the controls are released.*

*If one of the operator presence detectors (enable device) is found triggered at power-up, the key switch must be re-cycled to clear the fault.*

### 3.5 TRACTION

The traction or drive system, moves the vehicle along the ground by electric asynchronous motors.

The power controller is an inverter which transforms the battery DC voltage in AC voltage, to power the three phases drive motors. The motors are wired in triangle configuration.

The rotating speed is directly linked to the voltage frequency applied. The voltage supplied to the motor is modulated below approx. 3500 rpm; above 3500 rpm, nominal voltage is applied. The nominal voltage between two motor phases is approx. 15 Vrms (will vary depending on battery status and driving conditions). The default motor rotation speed range is 0rpm to 5650rpm which approximately corresponds to a driving speed of 0km/h to 8km/h.

The actual rotating speed of the motor is measured by the encoder; for a proper motor operation, the difference between the actual speed and the inverter output speed has to be maintained within few rpm. When a motor is driving the machine, Inverter Speed > Encoder Speed; when the motor is braking, Inverter Speed < Encoder Speed.

The parking and emergency brake is released by the controller: voltage is approx. 24V at driving start (for 1second) and approx. 16V after.

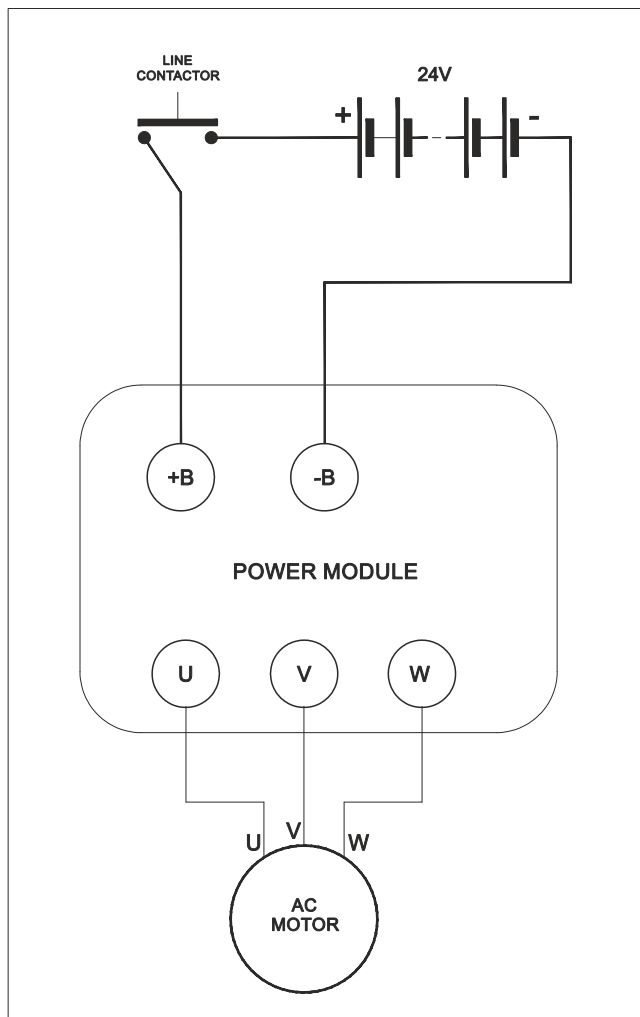


Figure 3-2. Drive Motor Schematic

**3.6 PUMP/STRUCTURE MOVEMENTS**

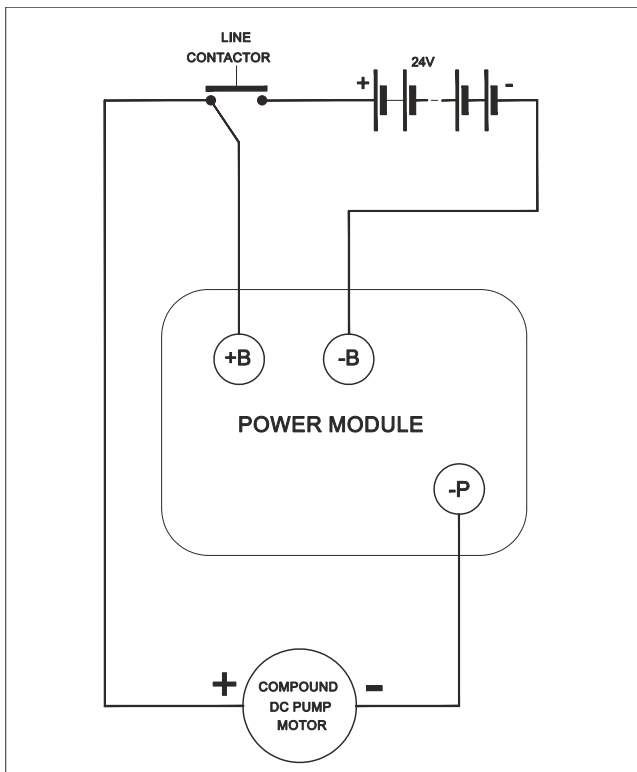
An electrically driven hydraulic pump provides hydraulic pressure to actuate the steering and mast lift up movements.

The Power Module is essentially a "low-side" switch for the pump motor. The positive terminal of the pump is tied to Battery Positive (+B) after the Line Contactor. The negative terminal of the pump connects to the (-P) Terminal of the Power Module, which switches current through MOSFET transistors to the Battery Negative.

For variable speed pump operation, the MOSFET transistors switch On and Off at high frequencies. The Duty Cycle is varied to control the voltage applied to the pump motor. When the MOSFET's spend 50% of the period On and 50% Off, approximately half of the available Battery power will be applied to the pump motor. Similarly, the MOSFET are On continuously (100% Duty Cycle) to apply all available Battery power to the pump motor (i.e. Mast Lift Up at full speed from Platform Mode).

When the Control System is energized, the voltage at the (- P) Terminal will be approximately +24V (referenced to - B) when the pump is static.

The (-P) Terminal will be approximately at +1V (referenced to -B) when the pump is running at full speed (i.e. Mast Lift Up from Platform Mode).



**Figure 3-3. Hydraulic Pump Electric Schematic**

### Mast Lift Up/Down

The lift actuators are single acting hydraulic cylinders. Lift down is "powered" by gravity.

To lift the mast up, the pump is ramped up and the mast up valve solenoid is energized. Then, after a short delay, the load holding valve solenoid energizes and fully opens the valve.

The pump speed is set by the control system, depending on the working condition:

- Pump is ramped up at movement start, and ramped down at stop,
- Pump is ramped down to a reduced speed when approaching mast end of stroke,
- Pump is run at 100% in normal condition; at reduced speed when the mast is lifted while driving.

Fluid flows into the mast cylinder and extend the rods. The mast cylinder is composed of 3 or 4 (depending on the model) single acting cylinders which are mechanically and hydraulically connected. Each mast section is linked to a corresponding mast cylinder stage: the mast sections elevate independently from each other.

To bring the mast down, appropriate signal is sent for the proportional load holding valve for proper flow control.

The load holding valve solenoid current is set by the control system, controlling the flow, depending on the working condition:

- Current is ramped up at movement start, and ramped down at stop,
- Current is ramped down to a reduced value when approaching mast full retraction,
- Current is nominal (approximately 1.45A, equivalent to 100%) in normal condition (valve allows full flow in the cylinder);
- Current is reduced when the mast is lifted down while driving.

Fluid flows back to the tank, allowing the mast to retract by gravity.

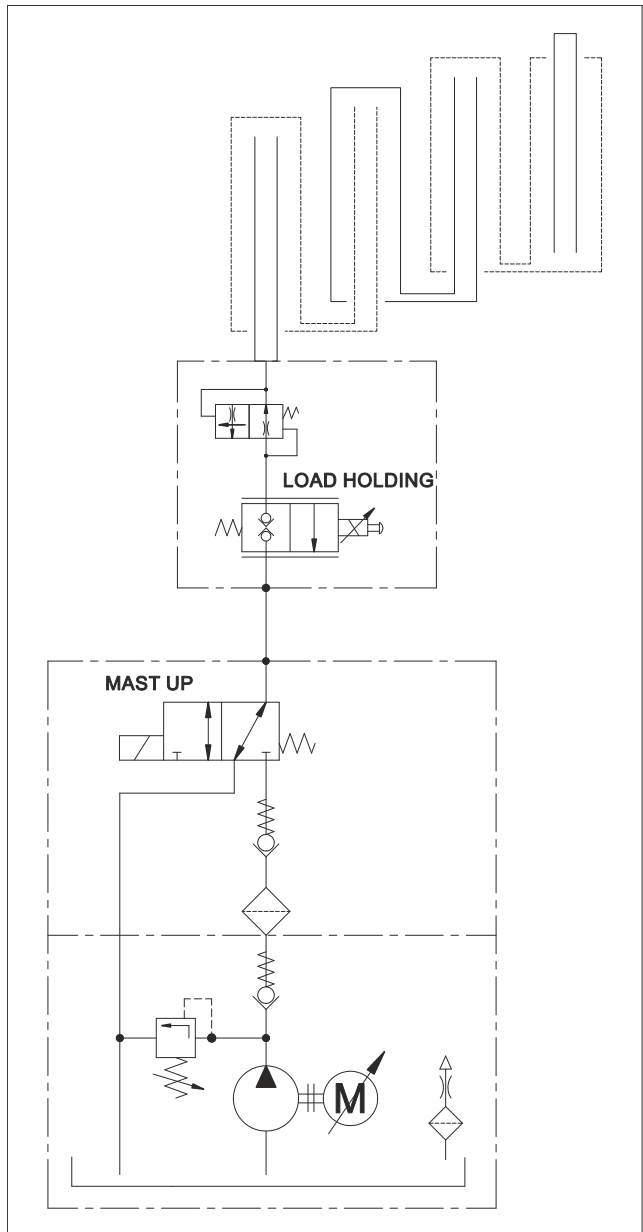


Figure 3-4. Mast Lift/Lower System - Basic Schematic

**Steer**

Steering is actuated by a hydraulic motor connected to the drive wheel casing by a gear.

To steer, solenoids of the steer valve energize (right one to steer to the right and left one to steer to the left), and the pump is run.

The rate of steering angle change is adjusted:

- Proportional to joystick position,
- Based on the drive speed,
- Nominal rate when driving only, reduced rate when driving and lifting simultaneously.

The control system adjusts the rate of steering angle change:

- By modulating the pump speed when driving only or driving and lifting down,
- By sending appropriate signal to the steer valve solenoid when driving and lifting up.

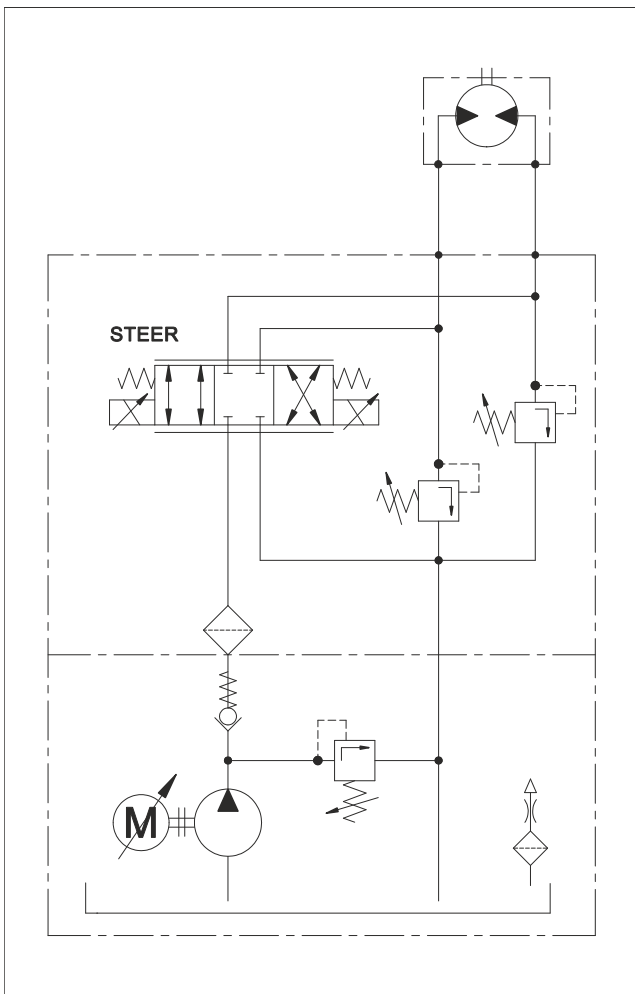


Figure 3-5. Steer System - Basic Schematic

**3.7 INTERLOCKS**

Interlocks are system inputs (limit switches, sensors or internal controller measurement) which affect the system functions.

**NOTE:** For more detailed information concerning system adjustment and operation, refer to section 8 Control Components.

**Wheel Position Sensor**

The wheel position sensor is attached to the steering motor gear. This is a multiturn hall effect sensor: there is a position sensing element and a signal conditioning circuitry in it to generate the position signal (i.e. the wheel steering angle). It is powered by 5 VDC supplied from the master controller. When the wheels are fully steered to the left, it will output approximately 0.3 VDC. When the wheels are fully steered to the right, it will output approximately 4.7 VDC. When the wheels are straight, it will output approximately 2.5 VDC. Refer to section 8 for detailed characteristics.

The wheel position information is computed to:

- Adapt the drive speed and deceleration for controlled drive-ability and limited dynamic effects,
- Make corrections to the tilt sensor readings,
- Allow for wheel self-center,
- Stop steer command at +90° and -90° (before reaching mechanical stops).

**Overload Switch**

The overload switch senses platform and tray load. In order to avoid false trip, the switch input is delayed.

- The switch must be tripped for more than 2s to consider the platform overloaded.
- The switch must be released for more than 2s to consider the platform not overloaded.

When the platform overloaded:

- All the movements are cut out from both the platform console and the ground console if the MACHINE SETUP, LOAD SYSTEM is set to CUTOUT ALL;
- All the movements are cut out from the platform console if the MACHINE SETUP, LOAD SYSTEM is set to CUTOUT PLATFORM;
- All the movements can be performed at normal speed if the MACHINE SETUP, LOAD SYSTEM is set to NOT INSTALLED;

### **Tilt Sensor**

A dual axis tilt sensor is installed on the chassis. When the platform is in transport position (platform height below 0.5m), if the machine is tilted:

- Mast lift up is disallowed (A visual alarm is displayed if the movement is commanded by the operator);
- The drive speed is restricted, depending on the chassis angle in the longitudinal direction and on the travel direction;
- Other functions are not affected.

When the machine is tilted and above elevation:

- The drive functions are cut-out;
- Mast lift up is disallowed;
- Other functions are not affected.

### **Door Switches**

Each platform door is fitted with limit switch actuated by a cam at its articulation point. The switch contact is opened by the opening of the door. When one of the door switches is tripped:

- All the movements are cut out from the platform console, with the exception of the tray lift Up/Down if the platform is fully lowered,
- The ground alarm sounds if the MACHINE SETUP, GATE ALARM is set to YES and the platform is out of transport position.

### **Electronic Toe Boards**

The electronic toe boards consist of two infrared barriers, located 35mm above platform floor at each platform entry.

The emitters are attached to the front platform tubes; the receivers are mounted on dedicated brackets at the rear of the platform.

The sensor outputs battery voltage when its beam is not interrupted. The information from the sensors is interpreted as door switch information.

### **Mast Sensor**

The mast sensor is attached to the platform, placed between the platform and the mast structure. This is a laser telemeter (class 1 laser) that continuously measure the distance between the platform and the chassis.

The sensor outputs a current signal: from 4mA to 20mA corresponding to a raw distance range of 0.2m to 6.5m. A shunt resistor in the platform console translates the 4-20mA signal into approximately 2.4V to 12.4V, which is the voltage read and interpreted by the control system.

The mast sensor information is computed to:

- Restrict drive speed (continuous speed variation, 5 thresholds),
- Determine when the platform is in/out of Transport position,
- Allow for platform height limitation (operator's assistance),
- Vary mast lift speeds at both mast end of strokes for operator's comfort.

### **Battery Charger Interlock**

When the battery charger is connected to the mains, the information is sent to the control system. If the battery

charger is connected to the mains: all the movements are cut out from the platform console.

### **Battery Discharge Indication**

The battery status is continuously monitored. Indication is given to the operator through the platform display.

Functions limitations are applied depending on three status: charged, discharged (which corresponds to 70% discharge) and deeply discharged (which corresponds to 80% discharged).

If the battery is charged, no function limitation is applied.

If the battery is discharged:

- The max. driving speed, is restricted to approximately 2.8km/h,
- Other movements can be operated at normal speed.

If the battery is deeply discharged:

- Mast Lift Up is cut out;
- Tray Lift Up and Down are cut out;
- The max. driving speed is limited at 0.7 km/h, whatever the platform position is;
- Mast Lift Down (If elevated) can be operated at normal speed.

### **Obstruction sensor (sensitive cover on the chassis under platform - option)**

---

The sensitive cover consists of a spring suspended cover that senses weight placed on the cover.

An inductive sensor is placed on the right and left sides of the cover. The sensor sends battery voltage without detection and is open when weight is detected.

When one of the sensors is triggered, all the movements controlled from the platform console are stopped.

### **Personality Settings and Calibration**

---

Functions performances may be altered by changing the applicable personality settings or calibrating different elements of the control system.

Refer to Section 9 of this manual for the applicable procedures.

## SECTION 4. CHASSIS MOUNTED COMPONENTS

## 4.1 WHEELS

This machine is equipped with 2 rear wheels, 2 front caster wheels and 1 drive wheel between the 2 caster wheels.

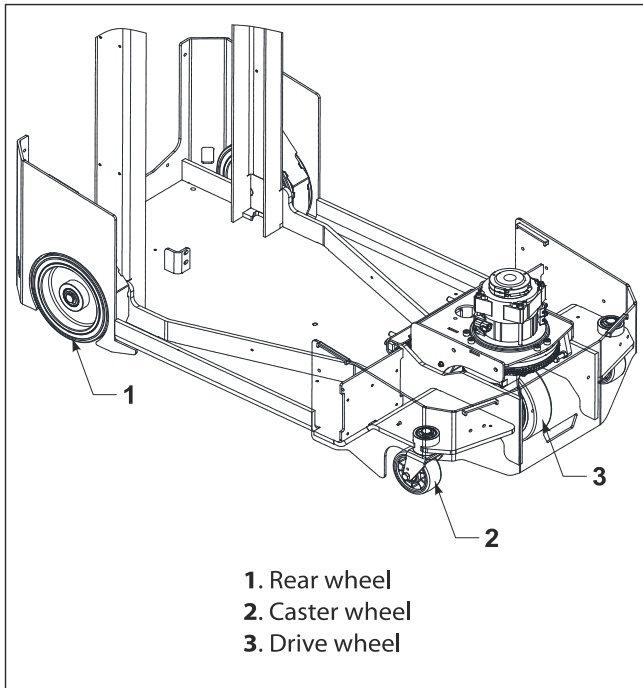


Figure 4-1. Wheels Location

## Tire Wear and Damage

The tire and rim assemblies installed on machines have been approved by the tire manufacturer for applications in which those products are intended to be used. The tire and rims installed on each product model have been designed for stability requirements, which consist of track width, tire compound, and load capacity. Tire changes such as rim width, centerpiece location, larger or smaller diameter, tire compound, etc., without written manufacturers approval, could result in an unsafe condition regarding stability.

The tires and rims installed on machines are to be inspected daily as part of the daily walk-around inspection. JLG requires that the daily walk-around inspection be performed at each operator change during a shift and at each shift change.

## Wheel and Tire Replacement

JLG recommends that any replacement tire be the same size and brand as originally installed on the machine or offered by JLG as an approved replacement. Please refer

to the JLG Parts Manual for the part number of the approved tires for a particular machine model.

If any of the following is discovered during tire inspection, measures must be taken to remove the JLG product from service immediately. Arrangements must be made for replacement of the tire(s) or tire assembly(s). Both tires/wheels on the same axle must be replaced:

- If the overall diameter of the tire is less than one of the following:

Rear Wheel  $\text{Ø}254$  - Minimum  $\text{Ø} 245$  mm (9.6 in)

Caster Wheel  $\text{Ø}125$  - Minimum  $\text{Ø} 120$  mm (4.7 in)

Drive Wheel  $\text{Ø}230$  - Minimum  $\text{Ø} 220$  mm (8.7 in)

$\text{Ø} 220$  minimum is reached when dimension H= 316 mm (12.4 in)

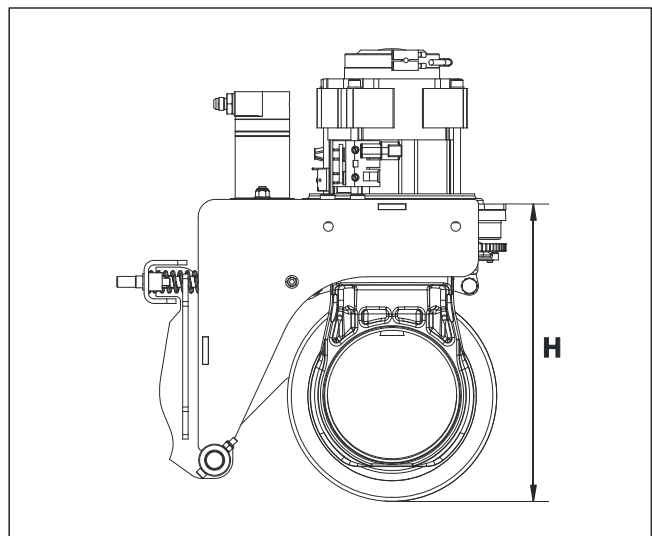
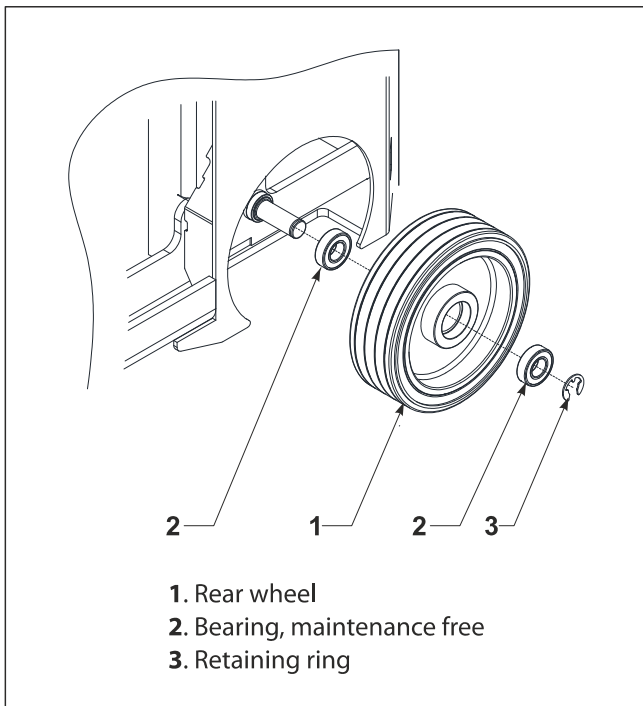


Figure 4-2. Drive Wheel

- If any uneven wear is discovered.  
A tire with significant damage in the tread area or sidewall requires immediate evaluation before placing the machine into service. If a cut, tear, chunk, or other discrepancy exceeds any one or more of the following dimensions, the tire must be replaced:  
3.0 in. (76 mm) long  
0.75 in. (19 mm) wide  
0.75 in. (19 mm) deep
- If the metal wheel is visible at any point through the tread area of the tire.
- If more than one discrepancy exists in any quadrant of the wheel (within 90 degrees of one another).

**Wheels Installation**

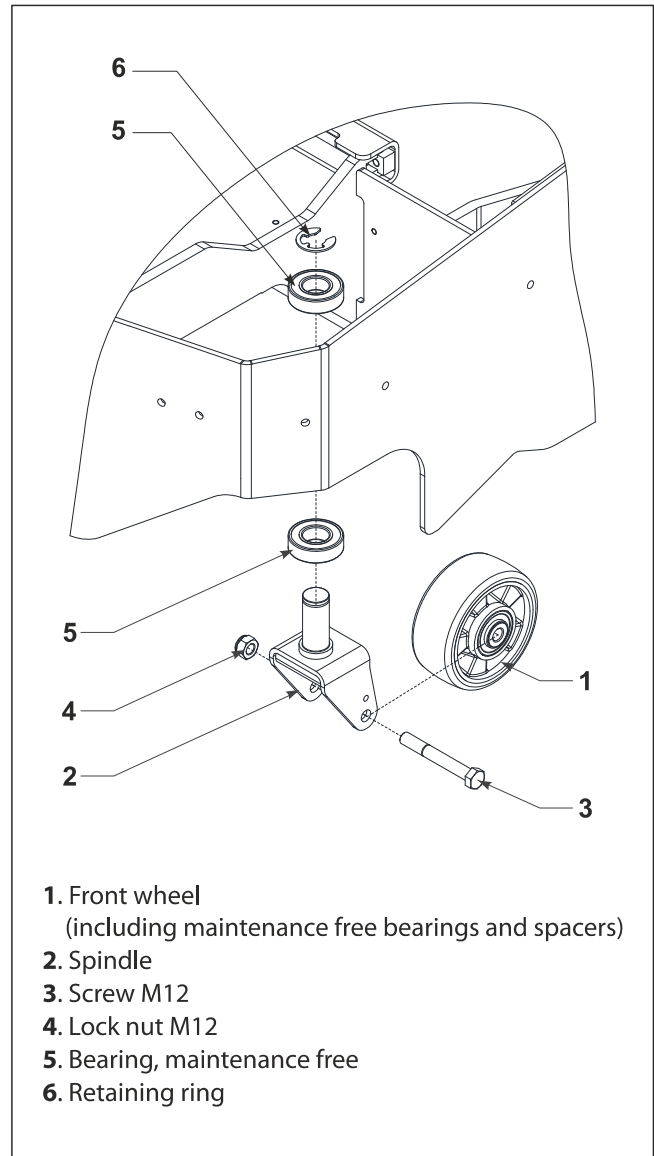
**Rear Wheels**



**Figure 4-3. Rear Wheels**

Ensure retaining ring is properly installed and secured. Apply anticorrosive coating on bearings and pins after installation.

**Caster Wheels**

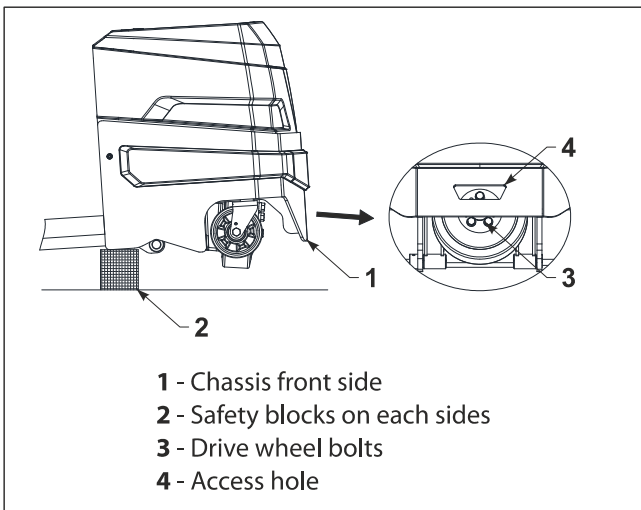


**Figure 4-4. Front Caster Wheel**

Ensure retaining ring is properly installed and secured. Tightening torque for M12 screw is 40 N.m (29 lb.ft). Apply anticorrosive coating on bearings and pins after installation.

**Drive Wheel**

1. Fully steer the drive wheel to the right.



- 1 - Chassis front side
- 2 - Safety blocks on each sides
- 3 - Drive wheel bolts
- 4 - Access hole

**Figure 4-5. Wheel Bolts Access**

2. Raise the chassis front side with a floor jack. Insert 2 safety blocks, height 10 cm, as shown.
3. Release the jack for the chassis to rest on safety blocks.
4. Remove the drive wheel mounting bolts and remove the wheel.

**NOTE:** It is possible to access to the drive wheel bolts from underneath the chassis or through the access hole. If some bolts are not easily reachable, slowly command a drive movement from the control box to rotate the drive wheel.

It is extremely important to apply and maintain proper wheel mounting torque.

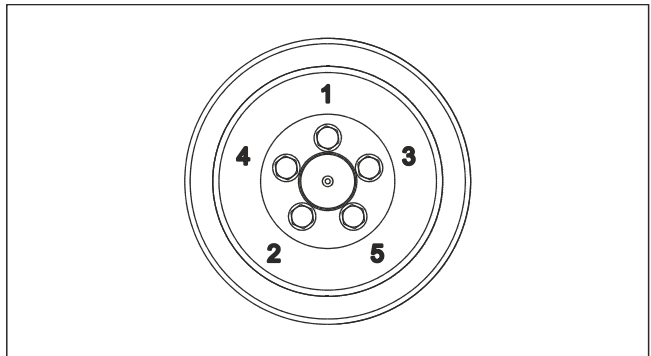
**⚠ WARNING**

**WHEEL BOLTS MUST BE INSTALLED AND MAINTAINED AT THE PROPER TORQUE TO PREVENT LOOSE WHEELS, BROKEN WHEEL BOLTS, AND POSSIBLE SEPARATION OF WHEEL FROM THE AXLE. BE SURE TO USE ONLY THE WHEEL BOLTS MATCHED TO THE CONE ANGLE OF THE WHEEL.**

Tighten the wheel bolts to the proper torque to prevent wheels from coming loose. Use a torque wrench to tighten the fasteners. If a torque wrench is unavailable, tighten the fasteners with a lug wrench, then immediately have a service garage or dealer tighten the wheel bolts to the proper torque. Over-tightening will result in breaking the wheel bolts or permanently deforming the mounting holes in the wheels. The proper procedure for attaching wheels is as follows:

1. Start all wheel bolts by hand to prevent cross threading. DO NOT use a lubricant on threads or bolts.

2. Tighten wheel bolts in the following sequence.



**Figure 4-6. Wheel Bolt Tightening Sequence**

3. The tightening of the wheel bolts should be done in stage. Following the recommended sequence, tighten wheel bolts per wheel torque.

**Table 4-1. Wheel Torque Chart**

TORQUE SEQUENCE	
1 <sup>st</sup> Stage	2 <sup>nd</sup> Stage
55-65 N.m (40-48 ft lb)	110-130 N.m (81-96 ft lb)

4. Wheel bolts should be torqued after the first 50 hours of operation and after each wheel removal. Check torque every 3 months or 150 hours of operation.

## 4.2 DRIVE MOTOR

The drive motor, located under the front cover, consists of a 15V AC asynchronous electric motor driving a gear box.

The assembly also includes a friction disk parking brake assembly. This brake assembly is mounted on the top of the drive motor assembly.

### Brake

#### Electrical Characteristics

Coil, nominal voltage: 24 VDC

Coil, resistance: 17 Ω

#### Removal

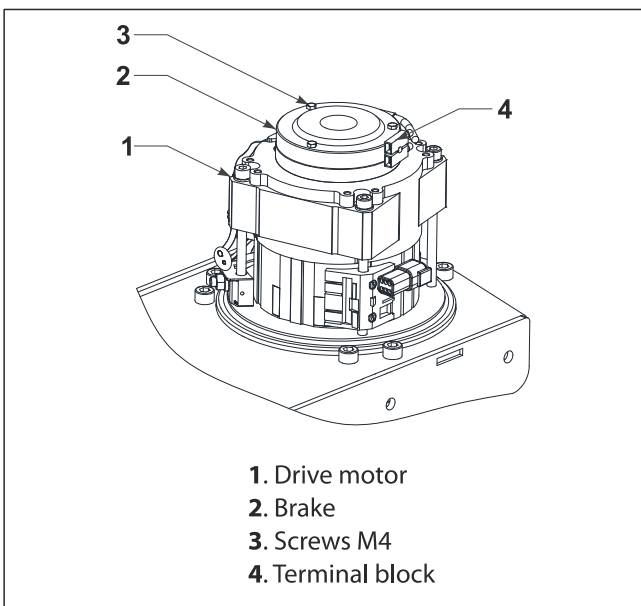


Figure 4-7. Brake Disassembly

1. Place the machine on a flat and level surface.
2. Elevate the platform to gain access to front covers.
3. Remove front top cover.
4. Disconnect electric cables from brake terminal block.
5. Loosen the 3 screws securing brake assembly.
6. Remove the brake.

#### Installation

**NOTE:** The brake is only suitable for dry operation. All parts must be free from grease, oil, water or other substances that could affect braking efficiency.

1. Repeat all removal steps in reverse order.
2. Route carefully the cable as it was to avoid damage.  
Tightening torque for M4 screws is 3N.m (2,2lb.ft).

## Speed Sensor (Encoder)

### Removal

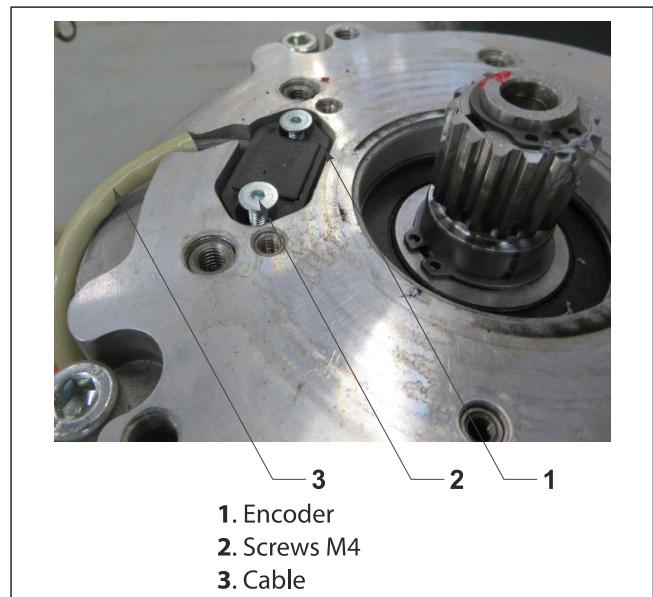


Figure 4-8. Sensor Removal

1. Remove the brake to access to the encoder.

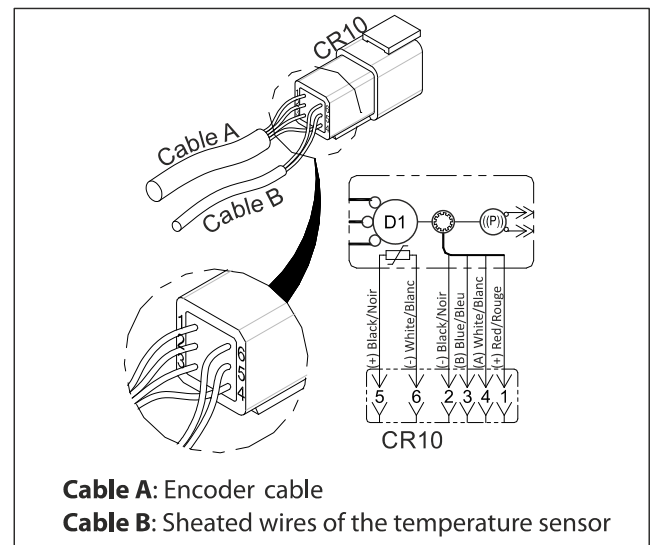


Figure 4-9. Motor Connectors

2. Disconnect the encoder cable from the 6 points connector.  
(See Section 11 for general information on connectors).
3. Remove the screw and the encoder from motor housing.

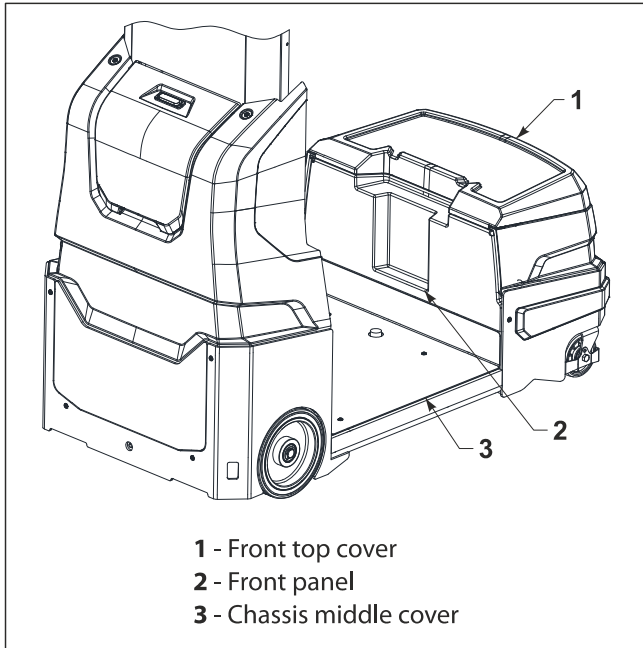
### Installation

1. Repeat all removal steps in reverse order.
2. Carefully route the cable as it was to avoid damage.  
Tightening torque for M4 screws is 2 N.m (1.5 lb.ft).

**Drive motor subassembly removal**

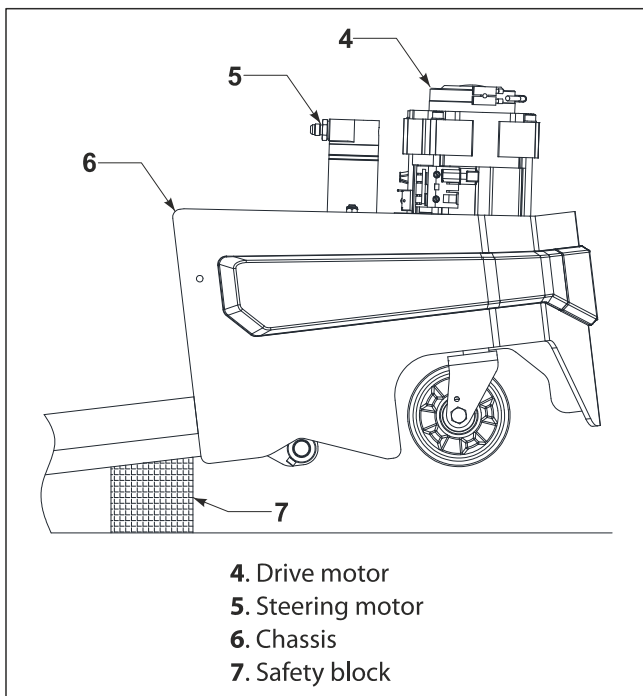
The machine is equipped with an articulated and spring loaded drive motor support to ensure permanent contact between the drive wheel and the ground .

1. Elevate the platform to gain access to front covers.



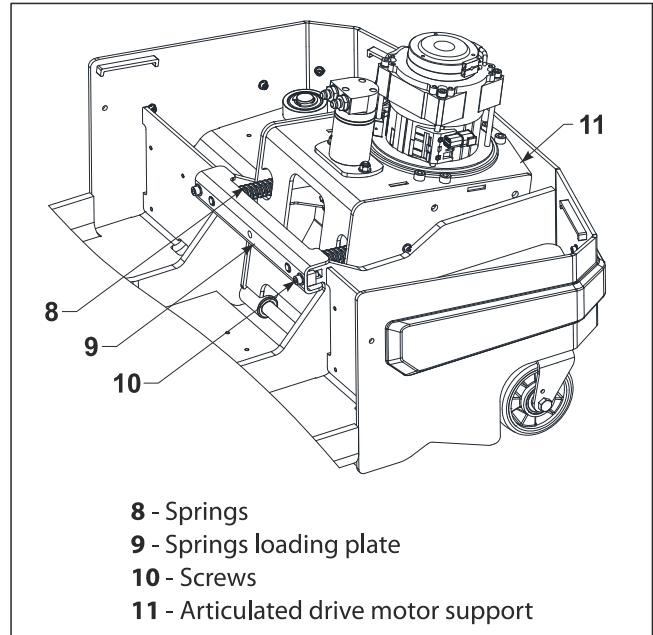
**Figure 4-10. Covers Removal**

2. Remove front top cover, front panel and chassis middle cover.



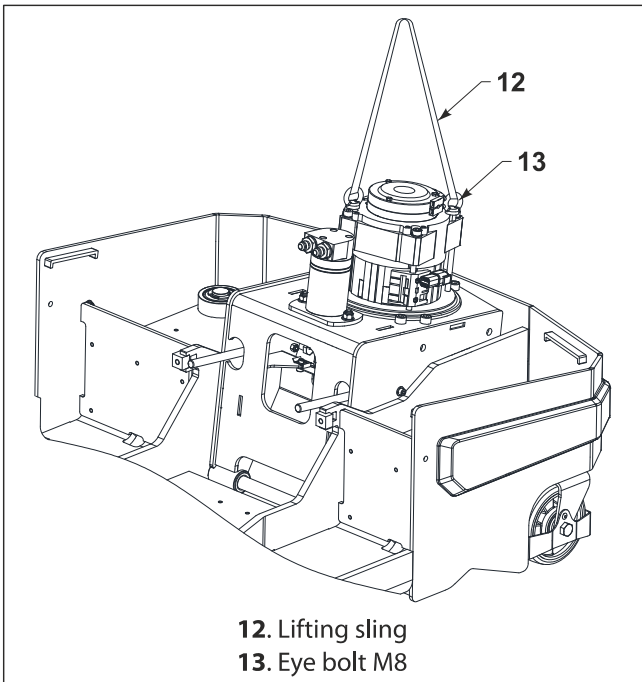
**Figure 4-11. Frame Chocking**

3. Tag and disconnect steering motor hydraulic lines, steer sensor and drive motor electrical connections.
4. Raise the chassis front side with a floor jack until drive wheel is 10 cm (4") off the ground.
5. Place a safety block under the chassis to secure next operations.



**Figure 4-12. Spring Tension Release**

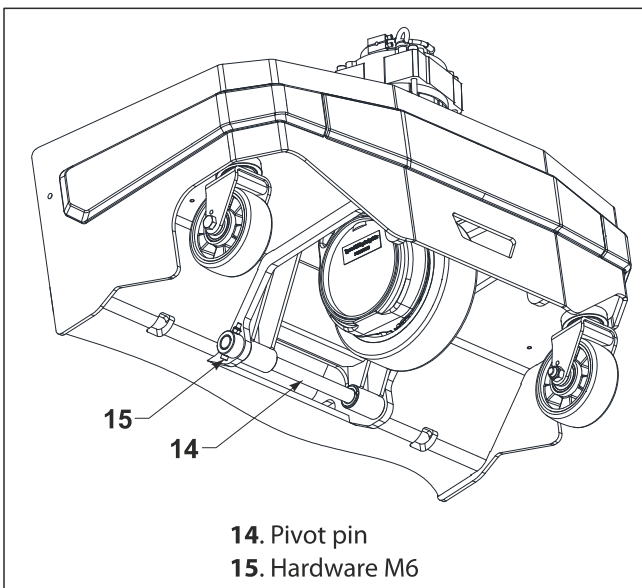
6. Remove the screws and the spring loading plate to completely release spring tension on drive motor support.



12. Lifting sling  
13. Eye bolt M8

**Figure 4-13. Drive Motor Subassembly Handling**

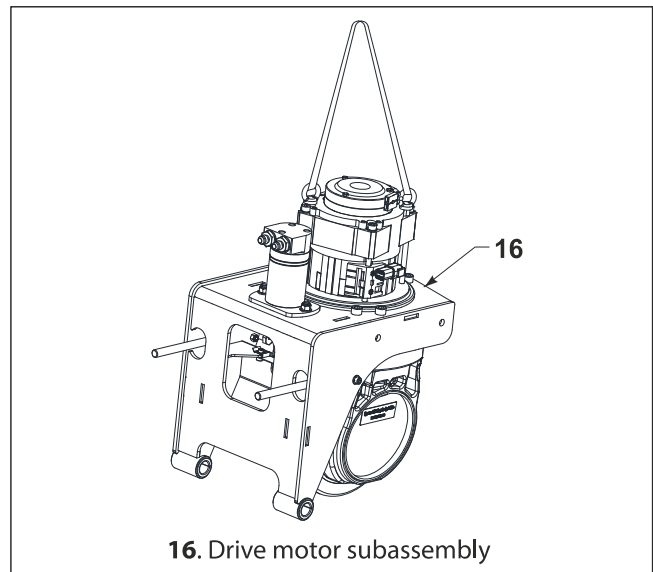
7. Install 2 eye bolts M8 and a lifting sling as shown. Remove slack with adequate lifting device.



14. Pivot pin  
15. Hardware M6

**Figure 4-14. Pivot Pin Removal**

8. Remove the hardware M6 and the pivot pin to release the drive motor support from the chassis.

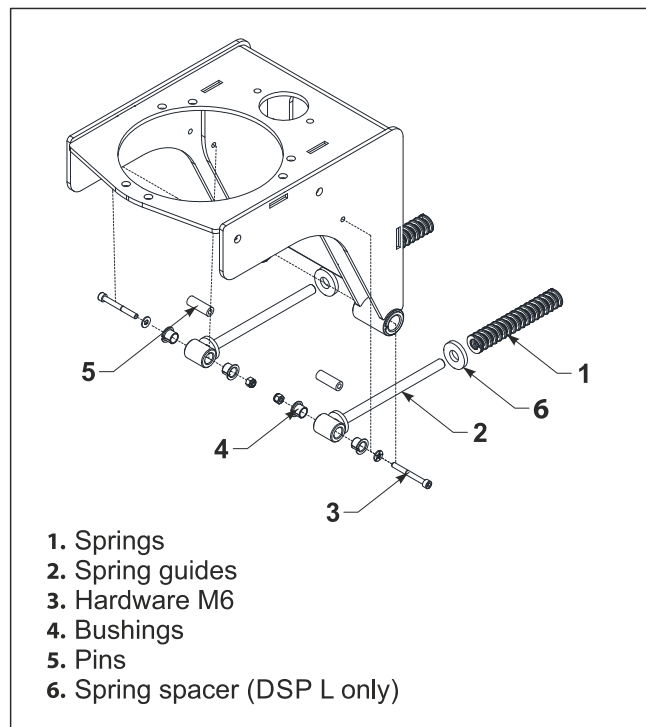


16. Drive motor subassembly

**Figure 4-15. Drive Motor Subassembly Removal**

9. Remove the drive motor subassembly from the chassis.

### Spring Guide



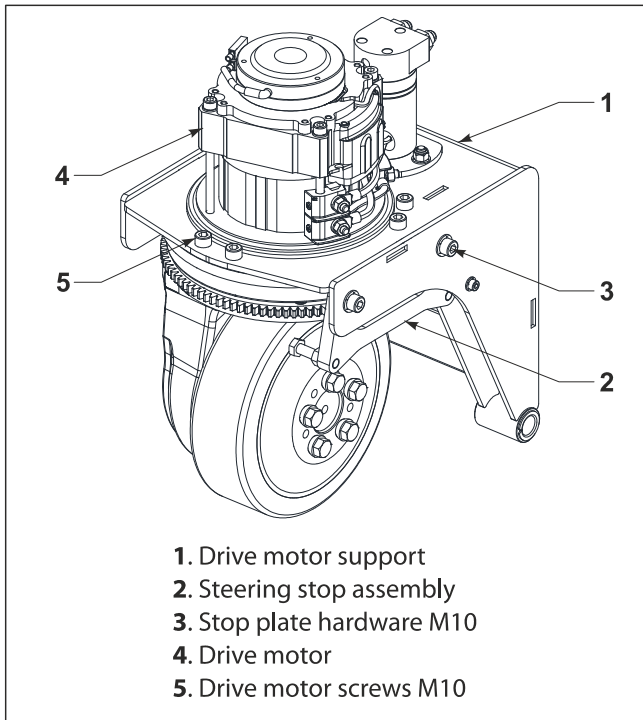
1. Springs  
2. Spring guides  
3. Hardware M6  
4. Bushings  
5. Pins  
6. Spring spacer (DSP L only)

**Figure 4-16. Spring Guide**

**NOTE:** The spring guide is designed to be maintenance free throughout its service life. However, should it need to be serviced, add multi purpose grease:

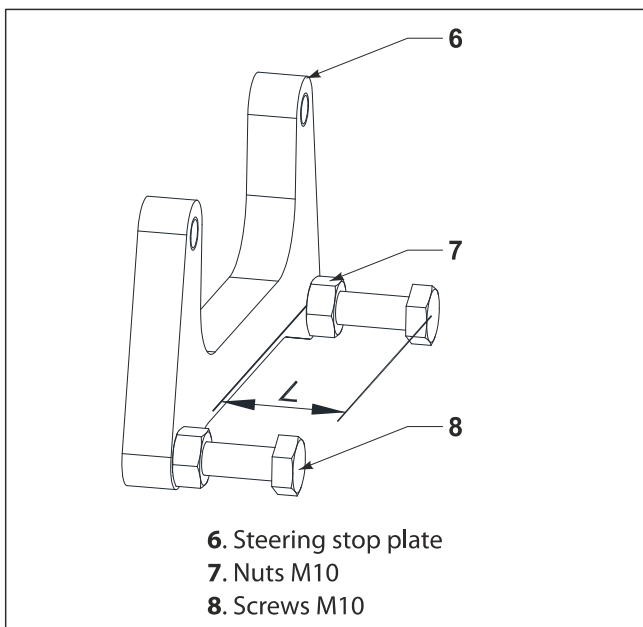
- between bushings and pins
- between springs and spring guide rod.

**Drive Motor Removal**



**Figure 4-17. Drive Motor Removal**

1. Remove the screws and the steering stop assembly from the drive motor support.

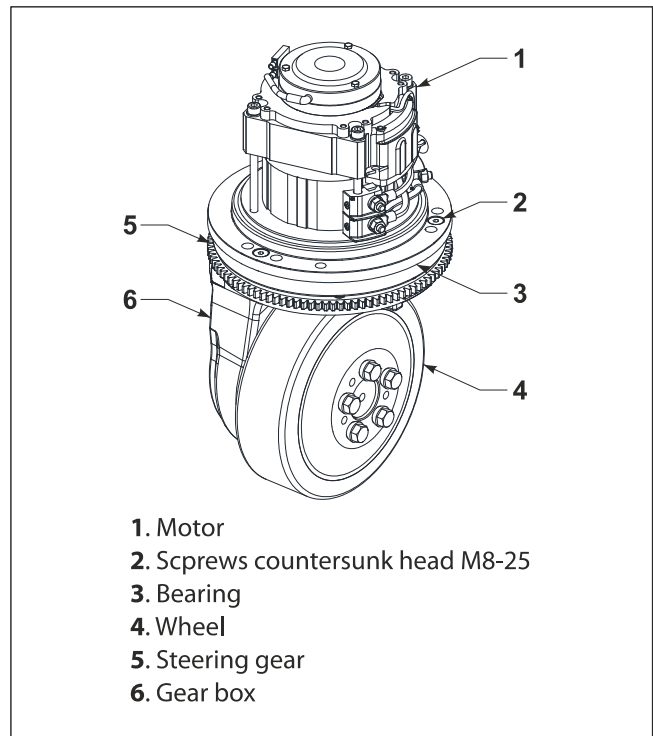


**Figure 4-18. Steering Stop Assembly**

Do not change the screws setting: dimensions L=37 mm.

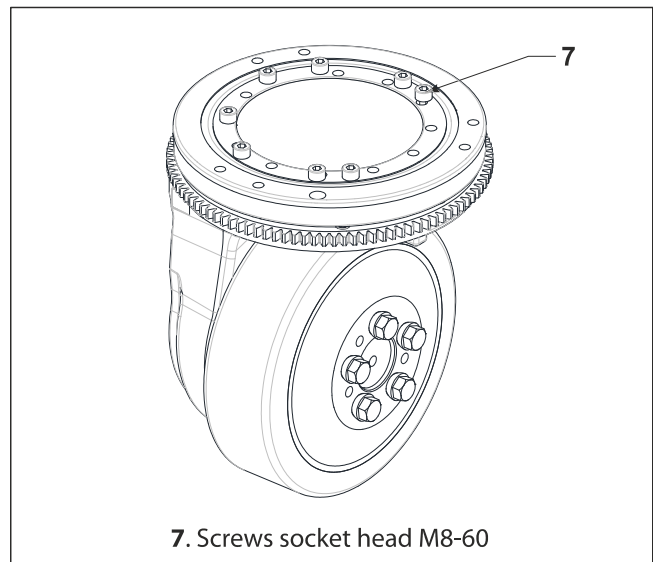
2. Remove the screws and the drive motor from the drive motor support.

**Drive Motor Disassembly**



**Figure 4-19. Motor Removal**

1. Remove the 3 screws M8-25 to remove the motor from the bearing.



**Figure 4-20. Bearing Removal**

2. Remove the 8 screws M8-60 to remove the bearing from the gear box.

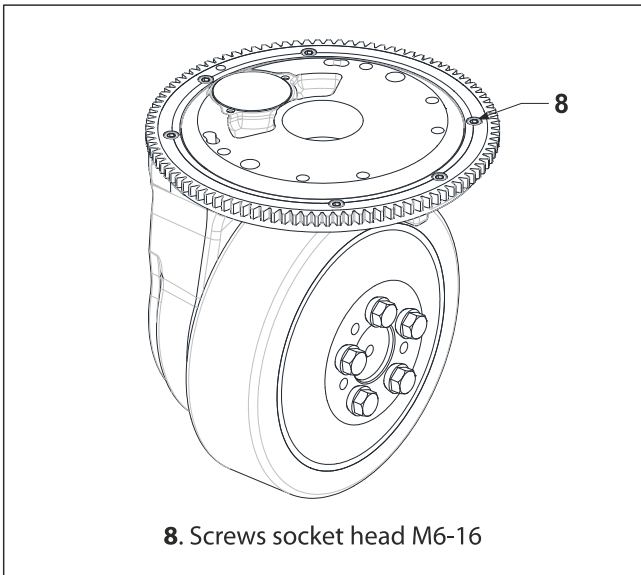


Figure 4-21. Steering Gear Removal

3. Remove the 6 screws M6-16 to remove the steering gear from the gear box.

**Drive Motor Assembly**

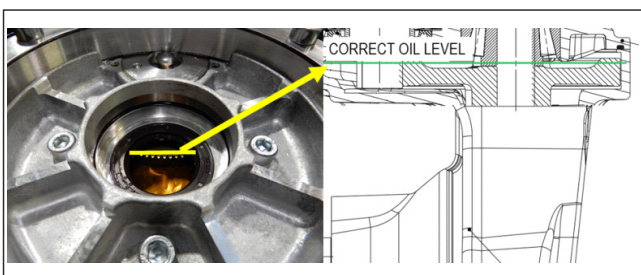
**Oil Type and Capacity**

The gear box unit is designed to utilize the same oil throughout its service life.

However, should it need to be serviced, the oil could need to be drained and replaced.

When serviced, fill the unit with 1 liter (0.26 Gal) of ISO VG220 oil.

**Oil Filling**



Gearbox oil filling and control are only possible at motor entry.

Correct oil level is middle of wheel, maximum is top of wheel.

Wait for 3 min after filling to control level.

**Components Assembly**

1. Repeat all removal steps in reverse order.

**NOTE:** When installing the motor on the bearing, proceed carefully to avoid damage teeth on motor pinion and gear box wheel.

2. Tighten screws following the recommended torques:  
Tightening torque for motor and bearing M8 screws is 25N.m (18 lb.ft).  
Tightening torque for steering gear M6 screws is 10N.m (7 lb.ft).

**Drive Motor Install**

1. Install the drive motor on the drive motor support.
2. Install the 6 screws M10-35 and tighten to 49N.m (36lb.ft).
3. Install the screws and the steering stop assembly on the drive motor support.

**Drive Motor Subassembly Install**

1. Repeat all removal steps in reverse order.

**NOTE:** The pivot of the drive motor support is designed to be maintenance free throughout its service life.

However, should it need to be serviced, add multi purpose grease between the drive motor support bushings and the pivot pin.

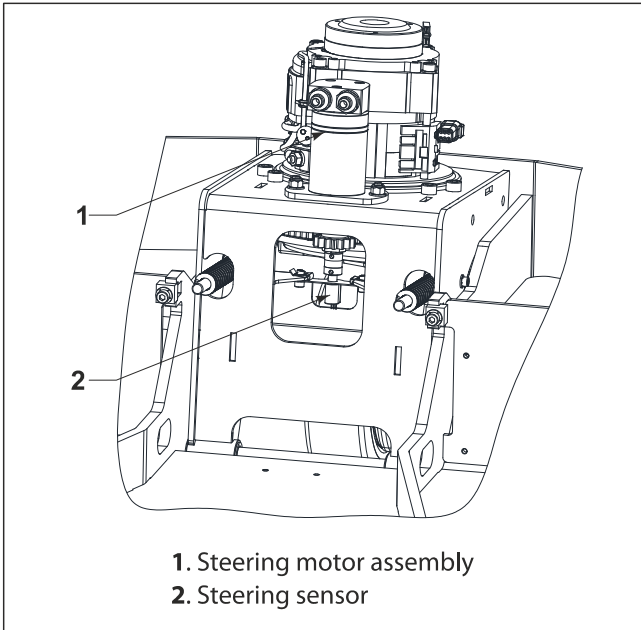
2. Route carefully hydraulic lines and electrical connections to avoid damage.

### 4.3 STEERING

The steering system, located under the front cover, close to the drive motor consists of an hydraulic motor driving a gear.

#### Steering Access

1. Put the driving / steering wheel in line with the chassis.

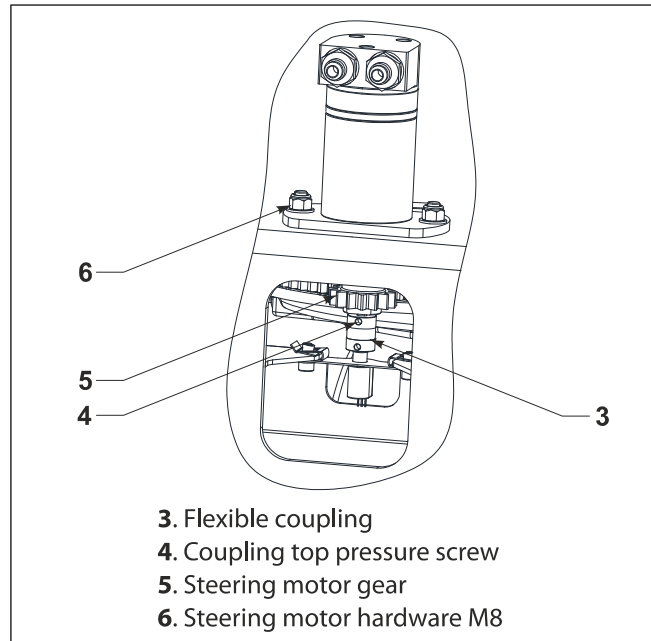


**Figure 4-22. Steering Access**

2. Remove the spring loading plate to gain access to the steering motor and sensor. (Refer to Section 4.2, § "Drive motor subassembly removal", steps 4,5 and 6).

#### Steering Motor

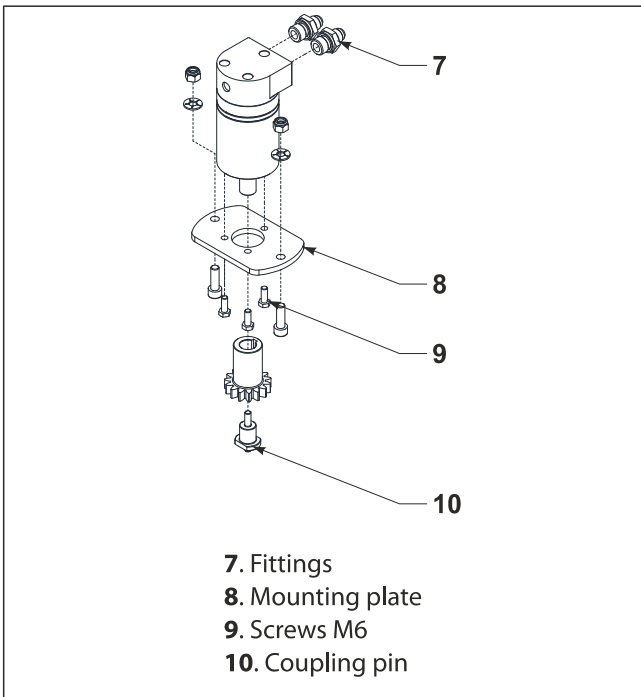
##### Removal



**Figure 4-23. Steering Motor Removal**

1. Tag, disconnect and cap steer motor hydraulic lines and ports.
2. Loosen top pressure screw on flexible coupling between steering sensor and steering motor gear. Slightly turn the gear to align the coupling screw with the access window if necessary.
3. Remove steering motor hardware and steering motor assembly from drive motor support.

**Disassembly**



**Figure 4-24. Steering Motor Disassembly**

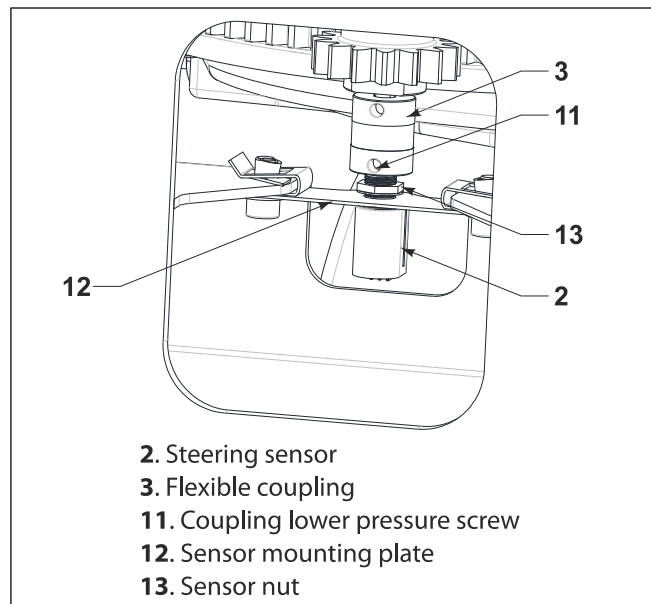
1. Remove coupling pin to remove gear.
2. Remove hardware M6 to remove steering motor from the mounting plate.

**Installation**

1. Repeat all removal steps in reverse order.
2. Secure the M6 screws and coupling pin with thread locking compound Loctite 243.
3. Perform a few steering movements to check for proper operation.
4. Check hydraulic level and adjust accordingly.

**Steering Sensor**

**Removal**



**Figure 4-25. Steering Sensor**

1. Loosen lower pressure screw on flexible coupling between steering sensor and steering motor gear. Slightly turn the gear to align the coupling screw with the access window if necessary.
2. Remove sensor nut and sensor from its mounting plate.

**Installation**

1. Ensure drive wheel is straight (in line with chassis)
2. Prepare steering sensor to have its output voltage in the middle of its working range.

**NOTE:** The sensor has a mechanical range of 10 turns and a 4 turns electrical working range. Several turns with no signal change is normal at both mechanical stops.

Read the sensor voltage using the integrated analyzer (Enter Diagnostic->Inputs->WheelPosSensor – refer to section 9.1)

Turn sensor pin to adjust voltage between 2.45V and 2.55V.

3. Repeat all removal steps in reverse order.
4. Route carefully the cable as it was to avoid damage.

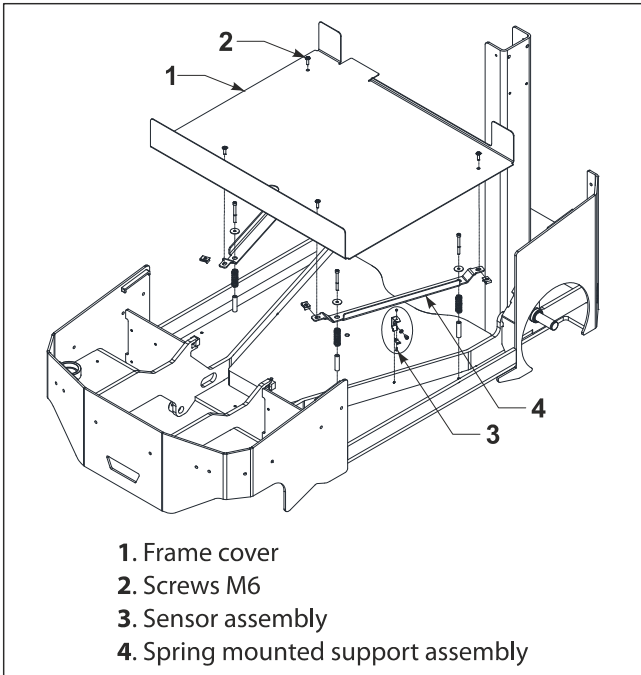
**NOTICE**

**IF STEERING SENSOR WAS REMOVED/REPLACED, IT IS MANDATORY TO PERFORM A STEERING SENSOR CALIBRATION PROCEDURE. REFER TO SECTION 9.7.**

#### 4.4 SENSITIVE FRAME COVER

The machine is equipped, in option, with a safety device for object detection beneath the platform. The assembly includes a spring mounted frame cover and 2 inductive sensors.

##### Frame Cover Removal

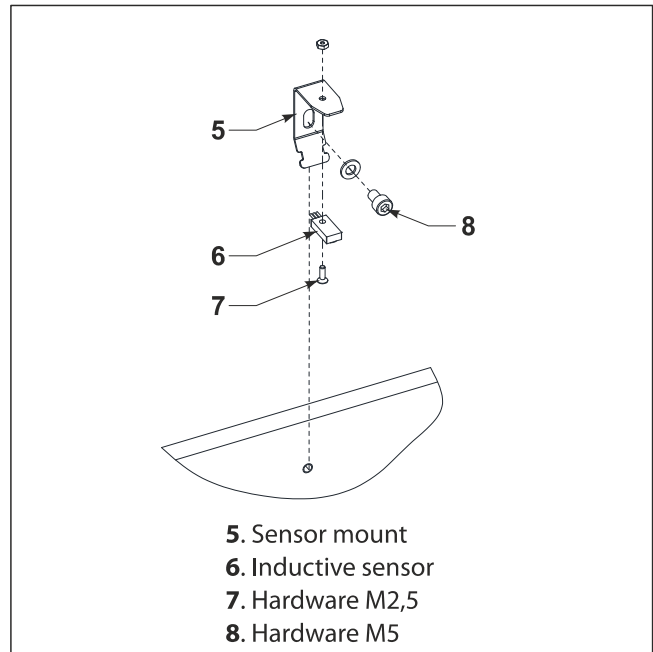


- 1. Frame cover
- 2. Screws M6
- 3. Sensor assembly
- 4. Spring mounted support assembly

**Figure 4-26. Frame Cover**

1. Elevate the platform to gain access to frame cover.
2. Remove the 4 screws and the frame cover to access to sensors and spring mounted supports.

##### Sensor Removal

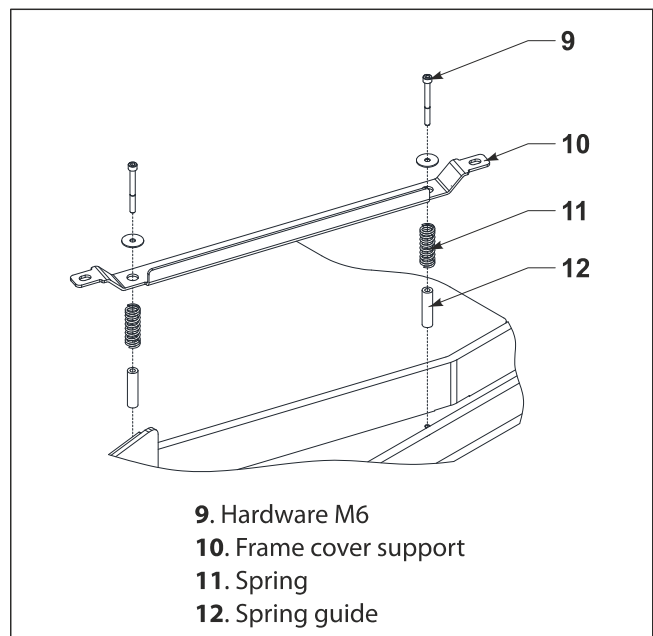


- 5. Sensor mount
- 6. Inductive sensor
- 7. Hardware M2,5
- 8. Hardware M5

**Figure 4-27. Sensor**

1. Remove the screw M5 to remove the sensor and its mounting plate from the frame.
2. Remove hardware M2,5 to remove the sensor from its mounting plate.

##### Spring mounted cover support removal

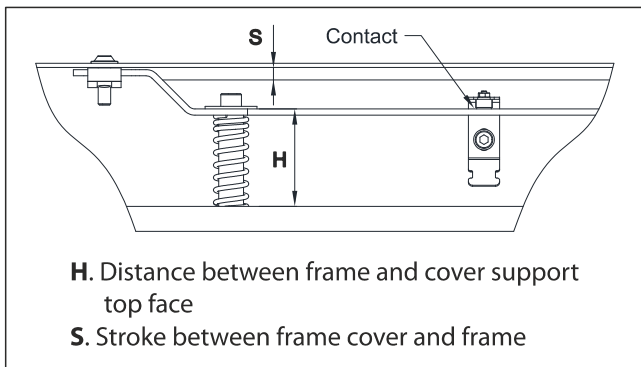


- 9. Hardware M6
- 10. Frame cover support
- 11. Spring
- 12. Spring guide

**Figure 4-28. Spring Mounted Cover Support**

1. Remove the hardware M6 to remove the springs, the spring guides and cover supports from the frame.

### Spring Mounted Cover Support Installation



**Figure 4-29. Support Cover And Sensor Adjustments**

1. Repeat all removal steps in reverse order.
2. Tighten screws M6 to have distance between frame and cover support top face  $H=47$  mm.
3. Verify, by pushing downward, that the spring mounted assembly is working properly without jamming during release.

### Sensor Installation

1. Install the sensor on its mounting plate with M2,5 hardware.  
Secure the M2,5 assembly with thread locking compound Loctite 243.
2. Install the sensor and its mounting plate on frame with M5 hardware.  
Secure the M5 screw with thread locking compound Loctite 243.  
Route carefully the cable to avoid crushing under the washer.
3. Adjust the sensor mounting plate to have sensor in contact with the cover support.  
For information, sensor rated operation distance = 1,5 mm (Object detection if  $\text{gap} > 1,5\text{mm}$ ).

### Frame Cover Installation

1. Install the frame cover and the 4 screws M6.
2. Check that stroke between frame and sensitive frame cover  $S > 5$  mm.
3. Check proper functioning  
Platform red light indicator flashes and buzzer sounds when pressing down the frame cover.

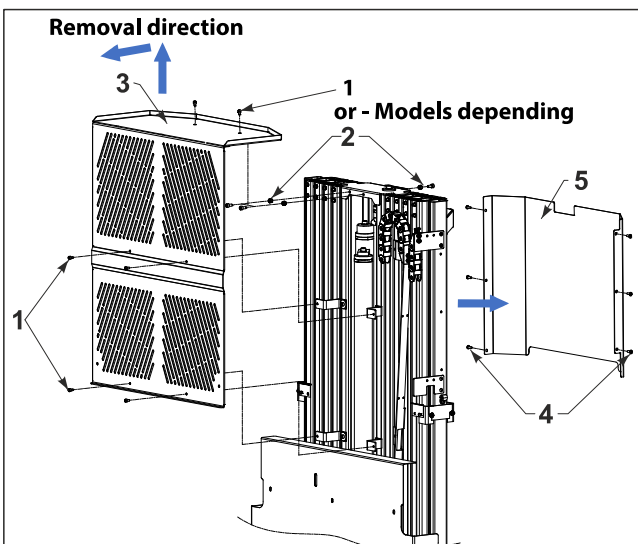
## SECTION 5. VERTICAL MAST

**⚠ WARNING**

IT IS MANDATORY TO SECURE MAST SECTIONS BEFORE ANY SERVICING OPERATION ON THE MAST ASSEMBLY THAT REQUIRES THE PLATFORM TO BE RAISED. EACH INDIVIDUAL MAST SECTION MUST BE SECURED BY INSTALLING A WOODEN BLOCK BETWEEN ITS LOWER END AND THE CHASSIS. FOR MORE INFORMATION, SEE ILLUSTRATION IN SECTION 7.5.

**5.1 MAST COVERS****Mast Covers Removal**

1. Remove the 4 screws (1)
2. Remove the 3 screws and nuts (2)
3. Remove the front mast cover (3)
4. Remove the 6 rivets (4)
5. Remove the rear mast cover (5)

**Mast Covers Installation**

1. Repeat all removal steps in reverse order.

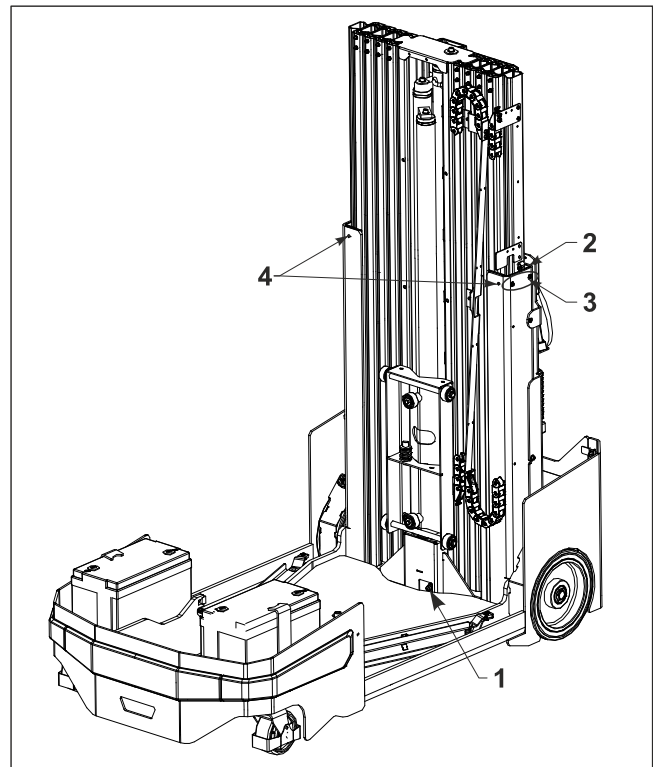
**5.2 MAST ASSEMBLY****Mast Assembly Removal**

1. Place the machine on a flat an level surface. Elevate the mast approximately 1 meter, then remove the following components:
  - front and rear hoods
  - platform assembly (refer to section 6.2)
  - mast covers (refer to section 5.1).

**⚠ CAUTION**

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

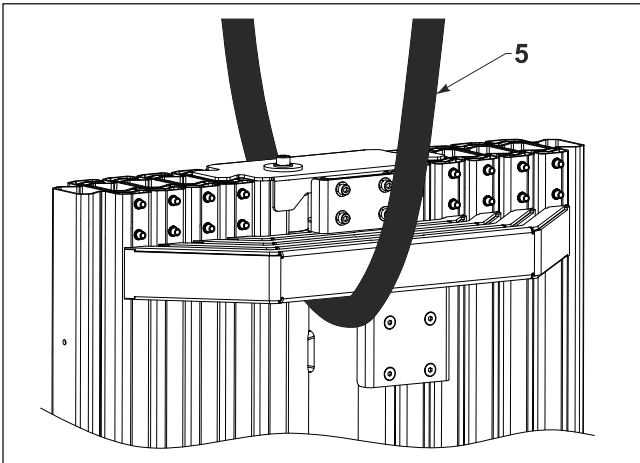
2. Once these components have been removed, lower the mast completely.
3. Disconnect and cap the hydraulic line (1) at the bottom of the cylinder.
4. Unplug electrical connector (2) from power track cables located at the rear of front mast section, near the battery charger.
5. Remove both screws and rivet (3) on each side of the frame.
6. Remove both rivets (4) on each side of the frame.



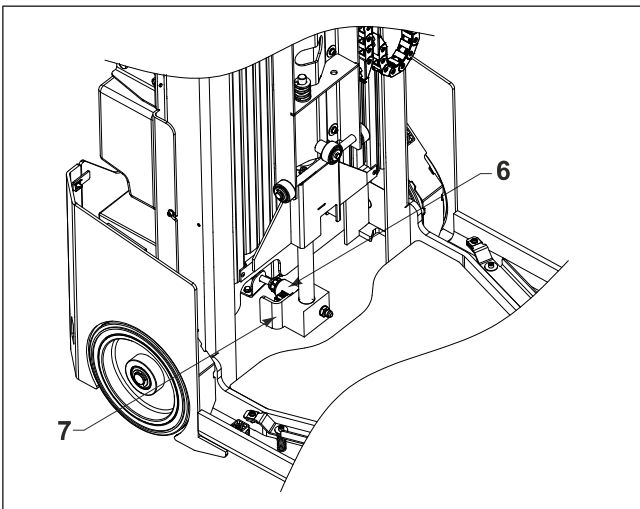
7. Using a suitable lifting device capable of supporting the weight of the mast assembly, attach a sling

## SECTION 5 - VERTICAL MAST

strap (5) through the five mast sections (upper side).



8. Carefully lift the mast assembly off the frame by 250mm.
9. Unplug electrical connector (6) from mast cylinder valve.
10. Remove both screws with washers (7) securing the mast cylinder to the frame.
11. Carefully lift the mast assembly off the frame and place it on a suitable work surface.



**NOTE:** - When lifting the mast assembly out of the base frame, identify and get back shims between first mast section and frame to aid in reassembly (longitudinal and lateral, on both sides).  
- When lifting the mast assembly out of the base frame, be careful with the rod of the mast cylinder (not to damage it and be sure it does not go out of the barrel).

### Mast Assembly Installation

1. Reverse the mast assembly removal instructions to install the mast.  
When connecting the hydraulic line (step 3 of mast

assembly removal), torque hydraulic fitting to 35 Nm and hydraulic hose to 31 Nm.

2. Once assembly is complete, cycle the mast up and down several times, then check proper working (no mast sections jamming must appear) and the oil level in the hydraulic reservoir.

### **⚠ CAUTION**

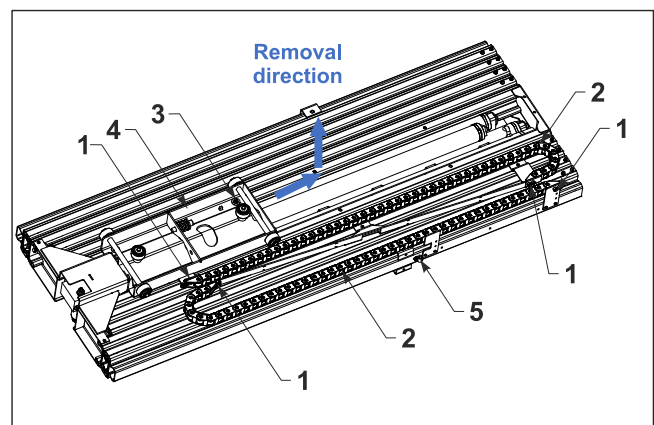
**USE ALL APPLICABLE SAFETY PRECAUTIONS WHILE WORKING ON, UNDER OR AROUND ANY MACHINERY.**

## 5.3 MAST CYLINDER

**NOTE:** - When moving the cylinder, be careful not to jam fingers or hand between barrels and rods of the cylinder.  
- When sliding cylinder out or in the mast assembly, be careful not to scratch or score the chromeplated rods of the cylinder.

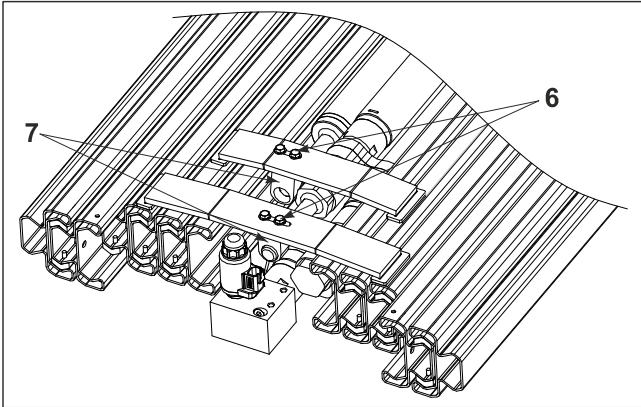
### Mast cylinder removal

1. Remove the mast assembly from the machine (refer to section 5.2).
2. Lay the mast assembly down on a suitable work table with the platform support on top, facing up.
3. Remove bolts (1) securing both power tracks (2) on mast sections.  
Remove plastic collar securing cables to the first mast section.  
Remove cable clamp (5).  
Remove both power tracks with cables inside.
4. Remove the six screws with washers (3) securing platform support (4) on last mast section.  
Remove platform support with its components, following the direction shown below.

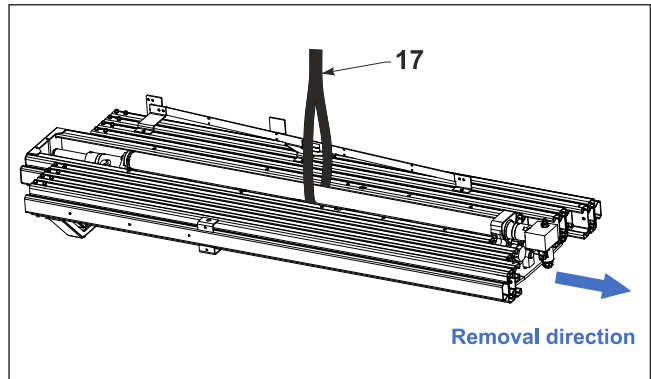


5. Using a suitable lifting device capable of supporting the weight of the mast cylinder, attach a sling strap through the four stages of the cylinder. Carefully use the lifting device until the sling strap be taut.

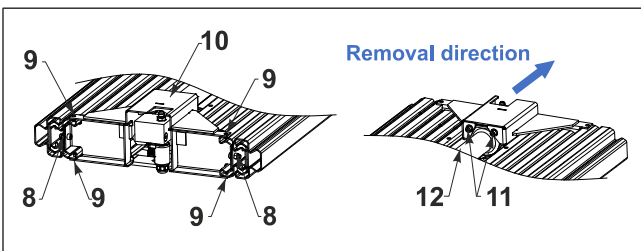
- On the bottom face of the mast assembly, remove the two bolts (6) securing cylinder anti buckling bracket (7). Repeat this operation for both brackets (7) and remove them.



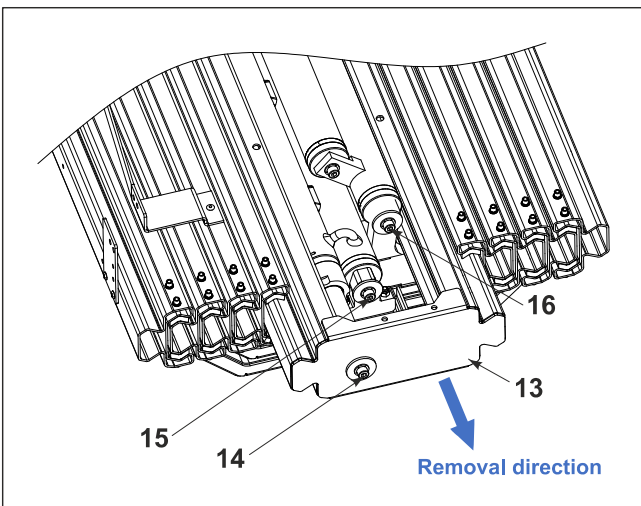
- Carefully use the lifting device (17) to remove the cylinder from the mast assembly, following the direction shown below.



- Remove the two bolts (8) and the four rivets (9) securing mast section #2 cylinder bracket (10). Remove the two bolts with washers (11) securing mast section #2 cylinder bracket (10) on cylinder. Manually extend cylinder stage (12) about 100mm following the direction shown below, then remove the cylinder bracket (10).



- Manually extend last mast section (13) about 100mm following the direction shown below. Remove screws with washers (14) (15) (16) securing mast sections to the cylinder.



**Mast Cylinder Installation**

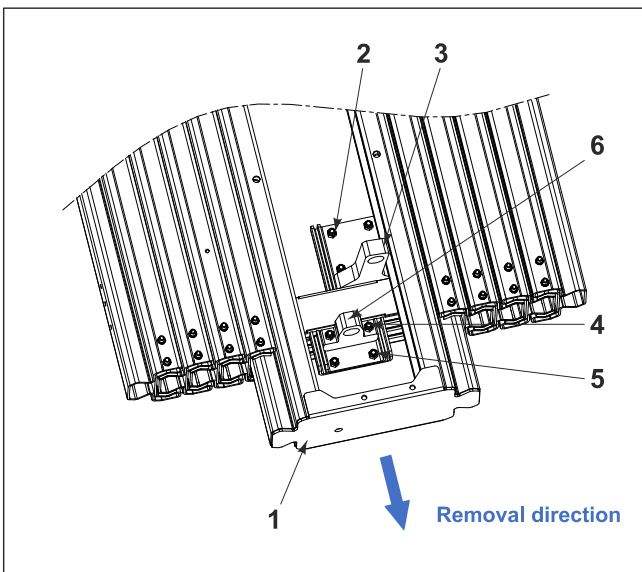
- Reverse the mast cylinder removal instructions to install the cylinder.  
When installing power tracks (step 3 of mast cylinder removal), torque the bolts **(1)** to 6 Nm.  
When installing platform support (step 4 of mast cylinder removal), secure the screws **(3)** with thread locking compound Loctite 243 and torque them to 9,5 Nm.  
When installing anti buckling brackets (step 6 of mast cylinder removal), secure the screws **(6)** with thread locking compound Loctite 243.  
When installing cylinder attachments (step 8 of mast cylinder removal), secure the screws **(14)** **(15)** **(16)** with thread locking compound Loctite 270.

**5.4 MAST SECTIONS**

**Mast Sections Removal**

Mast Sections Equipment

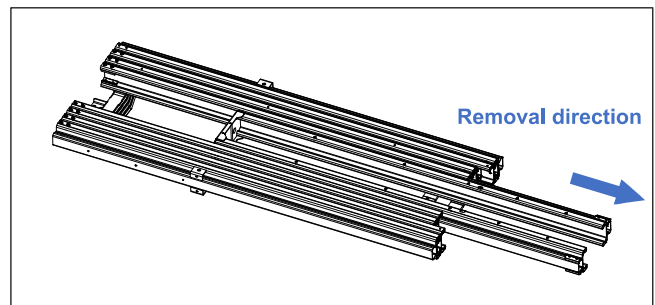
- Remove the mast assembly from the machine (refer to section 5.2).
- Remove the mast cylinder (refer to section 5.3).
- Lay the mast assembly down on a suitable work table with the platform support side on top, facing up.
- Manually extend last mast section **(1)** about 100mm following the direction shown below. Remove the four bolts **(2)** securing mast cylinder bracket **(3)** to the mast sections, then remove bracket **(3)**.
- (Except for DSP S)* Remove both bolts **(4)** and **(5)** securing mast cylinder bracket **(6)** to the mast sections, then remove bracket **(6)**.



- NOTE:**
- Mast sections are numbered from 1 to 4 (DSP S), 1 to 5 (DSP M and DSP L), from the widest (secured to the frame) to the narrowest (secured to the platform).
  - For each mast section handling, use a suitable lifting device capable of supporting the weight of the mast section.
  - When sliding mast sections apart and when removing rivets, be careful not to scratch or score the painted sliding surfaces for wearpads.
  - During mast sections removal, if a wearpad needs to be removed, its marking must be identified before (refer to wearpads inspection section). It will help for the installation.

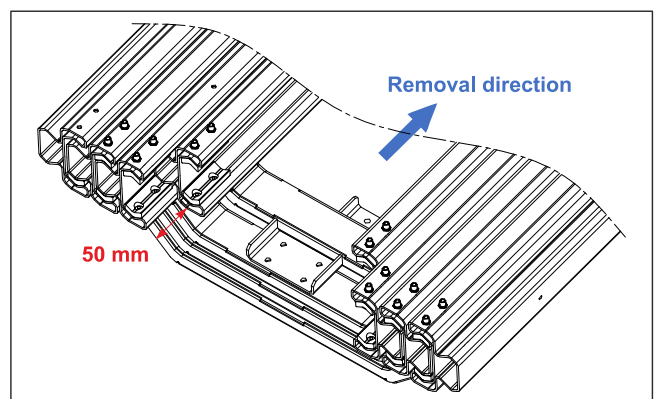
Mast Section 5 (Platform mount)

- Mast section 5 is equipped with 4 lower wearpads, on the bottom.
- Carefully slide the mast section 5 downward until it is completely extracted from other mast sections.
- Disassemble lower wearpads only if necessary (refer to section 5.5).



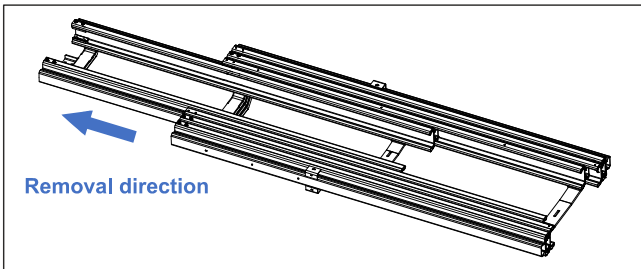
Mast Section 4

- Mast section 4 is equipped with 4 lower wearpads on the bottom and 4 upper wearpads on the top.
- Carefully slide the mast section 4 downward by 50 mm, as shown below.



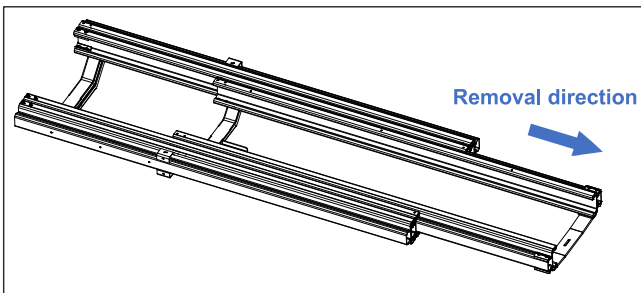
- Remove the four upper wearpads secured on mast section 3 (refer to section 5.5).
- Carefully slide the mast section 4 upward until it is completely extracted from other mast sections.

5. Disassemble lower and upper wearpads only if necessary (refer to section 5.5).



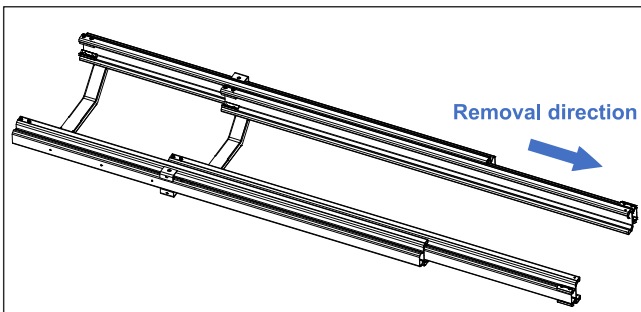
**Mast Section 3**

1. Mast section 3 is equipped with 4 lower wearpads on the bottom and 4 upper wearpads on the top. Upper wearpads have been removed during the previous step (mast section 4).
2. Carefully slide the mast section 3 downward until it is completely extracted from other mast sections.
3. Disassemble lower wearpads only if necessary (refer to section 5.5).



**Mast Section 2**

1. Mast section 2 is equipped with 4 lower wearpads on the bottom and 4 upper wearpads on the top.
2. Carefully slide the mast section 2 downward until it is completely extracted from other mast section.
3. Disassemble lower and upper wearpads only if necessary (refer to section 5.5).



**Mast Section 1**

1. Mast section 1 is equipped with 4 upper wearpads on the top.
2. Disassemble upper wearpads only if necessary (refer to section 5.5).

**Mast Sections Installation**

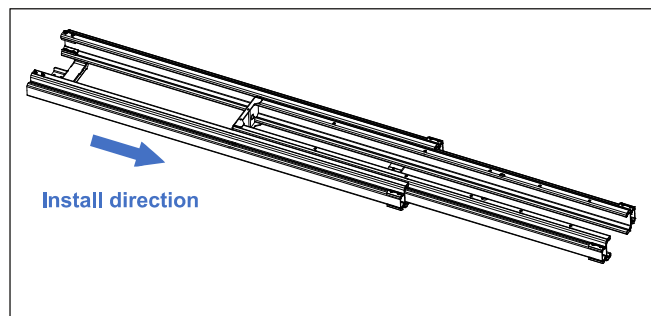
Before install mast sections, be certain sliding surfaces of every mast sections profiles are clean and free of any metal chips or debris.

**Last Mast Section (Platform mount)**

1. Lay the last mast section down on a suitable work table with the platform support side on top, facing up.
2. Check that the last mast section is equipped with 4 lower wearpads, on the bottom. If not, install missing wearpads (refer to section 5.5).

**Mast Section 4 (Except for DSP S)**

1. Check that the mast section and mast section 3 are equipped with 4 upper wearpads on the top and with 4 lower wearpads on the bottom. If not, install missing wearpads (refer to section 5.5).
2. Carefully slide the mast section from top of the last mast section, until it is completely aligned.

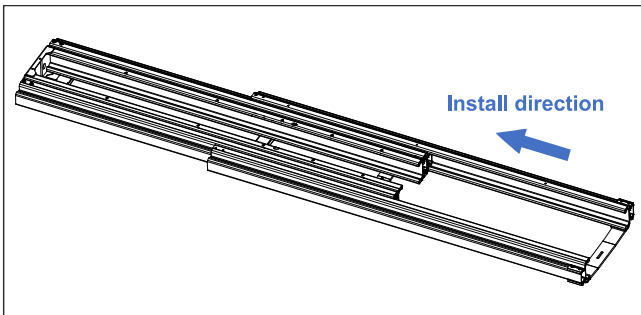


**Mast Section 3 (Except for DSP S)**

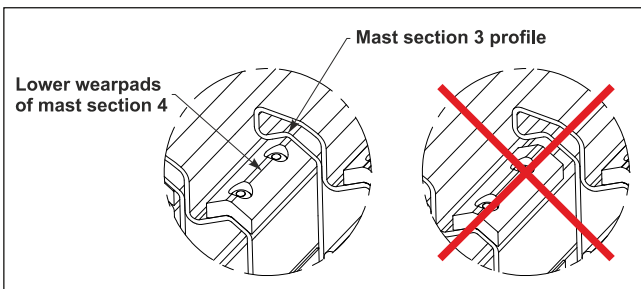
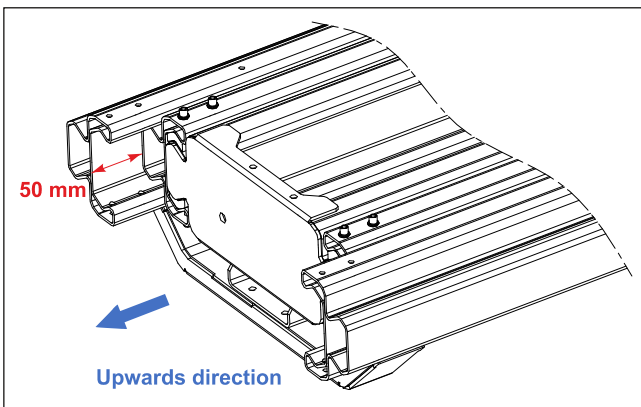
1. Check that the mast section 3 is equipped with 4 lower wearpads, on the bottom. If not, install missing wearpads (refer to section 5.5).
2. Check that the mast section 3 is not equipped with 4 upper wearpads, on the top. If upper wearpads are installed, remove them (refer to section 5.5).

## SECTION 5 - VERTICAL MAST

- Carefully slide the mast section 3, from bottom of other mast sections until it is completely aligned with them.



- Carefully slide the mast section 3 by 50 mm upwards. Be careful not to slide it more than 50 mm because lower wearpads of mast section 4 must remain into mast section 3 profile.

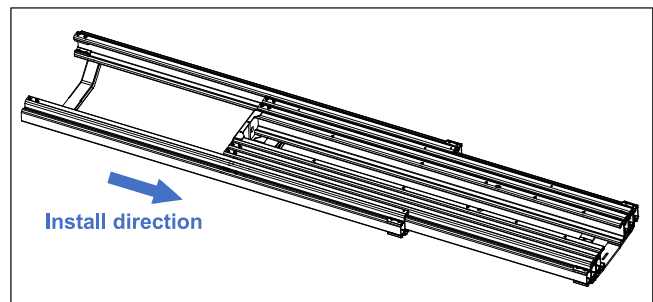


- Install upper wearpads on mast section 3 (refer to section 5.5).
- Carefully slide the mast section 3 downwards until it is completely aligned with other mast sections.

### Mast Section 2

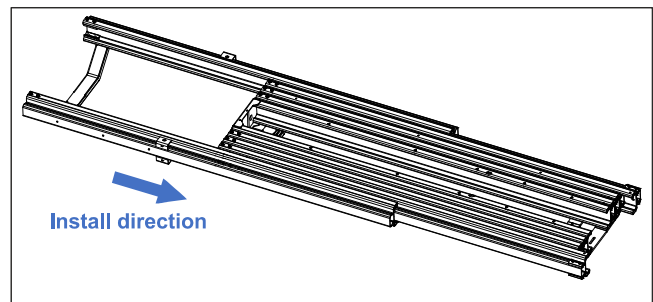
- Check that the mast section 2 is equipped with 4 lower wearpads on the bottom, and 4 upper wearpads on the top. If not, install missing wearpads (refer to section 5.5).

- Carefully slide the mast section 2, from top of other mast sections until it is completely aligned with them.



### Mast Section 1

- Check that the mast section 1 is equipped with 4 upper wearpads, on the top. If not, install missing wearpads (refer to section 5.5).
- Carefully slide the mast section 1, from top of other mast sections, until it is completely aligned with them.



### Mast Sections Equipment

- Reverse the mast sections equipment removal instructions to install the mast sections equipment.

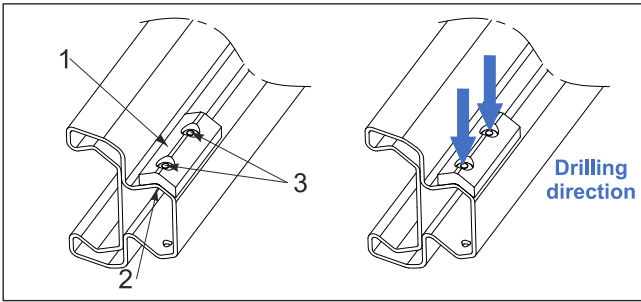
## 5.5 WEARPADS

- NOTE:**
- Mast wearpads can not be removed one by one without dismounting the mast sections of the mast assembly.
  - Mast wearpads thickness can not be controlled without removal of the wearpad from the mast section.
  - Mast wearpads marking must be identified before removal.

### Lower Wearpads Removal

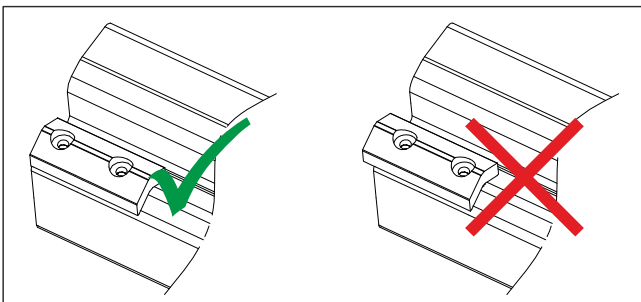
- Lower wearpads (1) are located on the convex shape (2) of the mast section profile. They are secured on the profile by two blind rivets (3).
- To remove blind rivets (3), drill a diameter 4,8 mm hole in the center of each rivet, as shown below.

3. Remove wearpad.



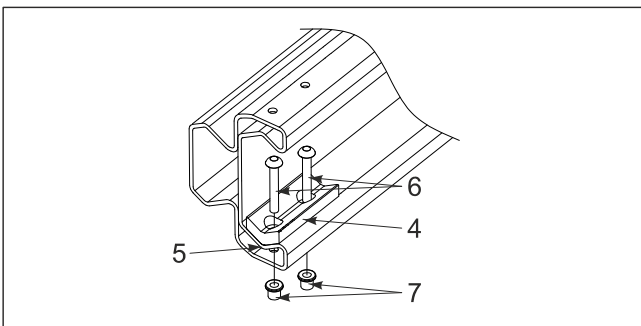
**Lower Wearpads Installation**

1. Wearpad is a non-symmetrical part. Install wearpad on the convex shape of the mast profile so that it does not exceed the end of the profile.
2. Insert two blind rivets (3) through the wearpad (1) and the profile.
3. Crimp the two blind rivets with an appropriate tooling, according to the manufacturer's instructions.



**Upper Wearpads Removal**

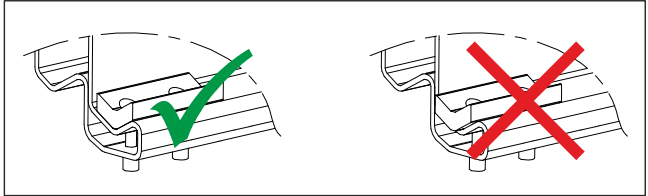
1. Upper wearpads (4) are located on the concave shape (5) of the mast section profile. They are secured on the profile by two rivets (6) with collars (7).
2. To remove rivets (6), grind the collar of each rivet then drive the rivets out of the profile.
3. Remove wearpad.



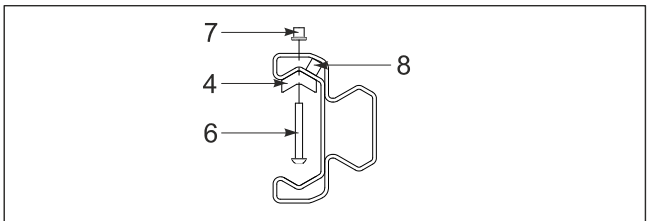
**NOTE:** - When grinding the collar of a rivet, be careful not to scratch or score the painted sliding surfaces for wearpads and the profile shapes.

**Upper Wearpads Installation**

1. Wearpad is a non-symmetrical part. Install wearpad on the concave shape of the mast profile so that it does not exceed the end of the profile.



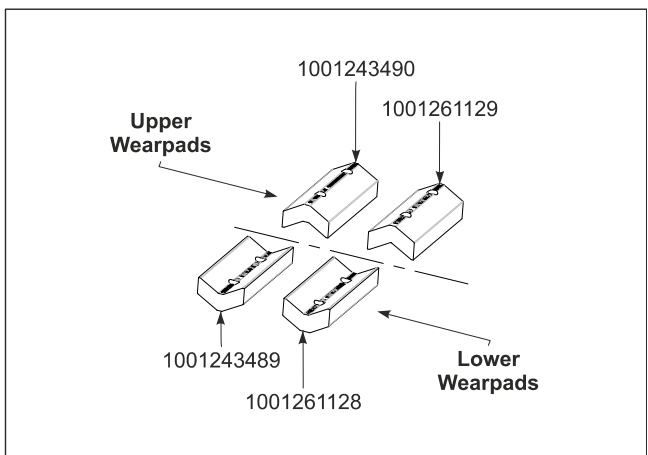
2. Insert two rivets (6) through the wearpad (4) and the profile, then install both collar (7).
3. Re-use a shim (8) in the profile (refer to parts manual for reference), as shown below.
4. Crimp the two rivets and collars with an appropriate tooling, according to the manufacturer's instructions.



**NOTE:** It is strictly prohibited to crimp rivet and collar if the shim (8) has not been inserted in the profile.

**Wearpads Inspection**

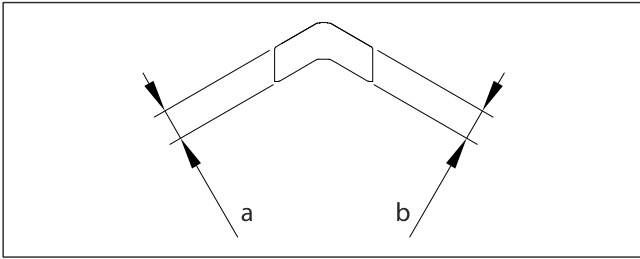
1. Remove each mast section (refer to section 5.4).
2. Remove the wearpad to be inspected (refer to section 5.5).
3. Wearpad identification. There are different kinds of marking on the wearpads, as shown below. Identify the marking on the wearpad to be controlled.



## SECTION 5 - VERTICAL MAST

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4. Measure the thickness of both wings of the wearpad (a and b).



According to wearpad identification, compare measured values with values in the table below. If one of the measured values (a or b) is lower than table value, the wearpad must be replaced.

UPPER WEARPADS	
<b>Marking</b>	1001243490
<b>Thickness (a or b)</b>	6.9

LOWER WEARPADS	
<b>Marking</b>	1001243489
<b>Thickness (a or b)</b>	6.9

5. Install a new wearpad, if needed (refer to section 5.5).
6. Reassemble each mast section (refer to section 5.4).

## SECTION 6. PLATFORM AND TRAY

## 6.1 OVERLOAD SYSTEM

## 6.1.1 Overload System Verification

Interval: At least every 6 months of operation.

1. The control station selector switch on the ground control station must be set for Platform control mode.
2. The main power switch (key) must be set to ON.
3. Both emergency stop switches, ground and platform control must be in the RESET position (out).  
Lift the platform 5cm.
4. Place a load (**L1**) evenly distributed on platform floor.
5. Place a load (**L2**) evenly distributed on tray.
6. Lift the platform with your hands to apply a small upwards force (**F**), then remove the force to let the platform fall.  
- No alarm should be triggered.

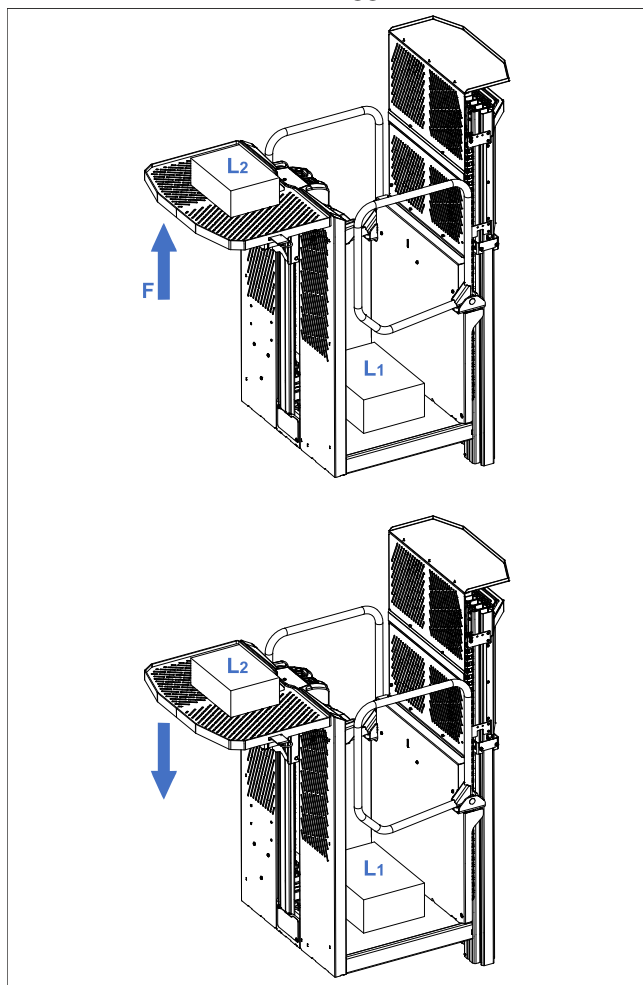


Figure 6-1. Platform Loads

Model	L1	L2
S(*) & M(*)	120kg	100kg
L(*)	100kg	80kg

S(\*)= DSP S (CE/UKCA) & DSPi-S (CE Only)

M(\*)= DSP M (CE/UKCA) & DSPi-M (CE Only)

L(\*)= DSP L (CE/UKCA)

7. Add an additional weight of **11 kg (24 lbs)** to the load (**L1**).
8. Lift the platform with your hands to apply a small upwards force (**F**), then remove the force to let the platform fall.  
- RED light indicators at both the ground and the platform control stations flash.  
- An audible alarm sounds.
9. Remove the **11 kg (24 lbs)** additional load.
10. Lift the platform with your hands to apply a small upwards force (**F**), then remove the force to let the platform fall.  
- No alarm should be triggered.

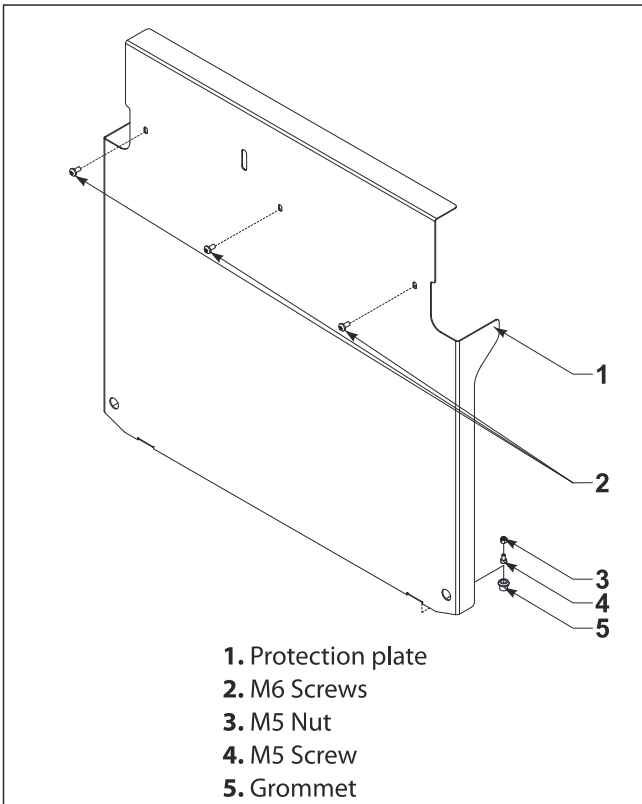
## 6.1.2 Overload System Setting

Refer to § 8.2.9.

**6.2 PLATFORM**

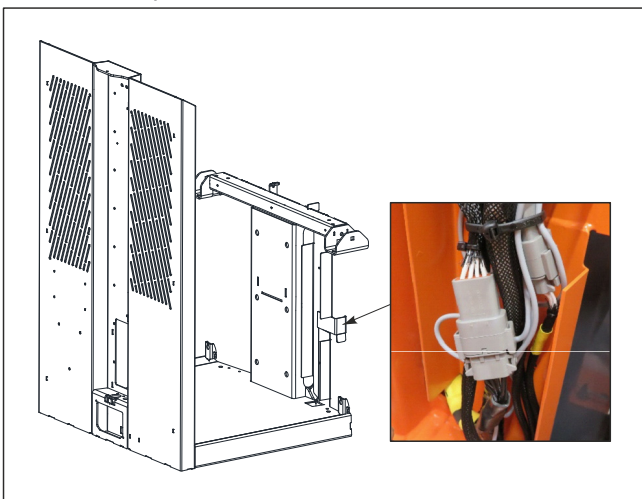
**6.2.1 Platform Removal**

1. Place the machine on a flat and level surface. Raise the mast around 1m (3 ft) height and disconnect batteries on hydraulic pump location.
2. Remove screws (2) and the rear lower protection shield (1) to access the Overload Switch and bearings.



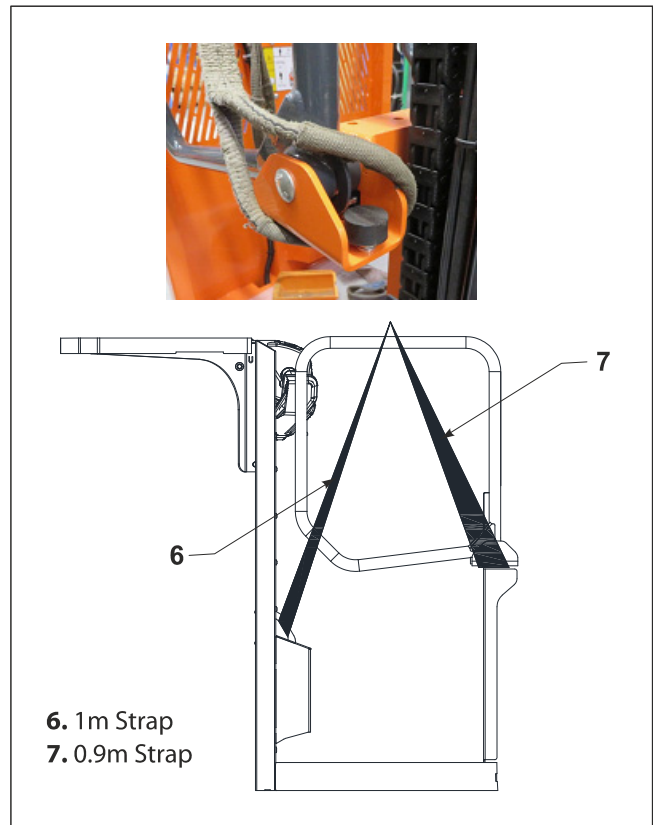
**Figure 6-2. Rear protection removal**

3. Unplug connector CR11 (located on the cable tray - See Fig. 6-3.) coming from the power track to allow platform removal. Cut collars if needed.



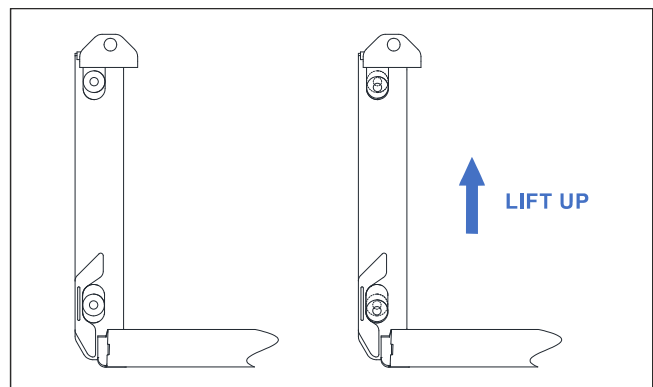
**Figure 6-3. Platform removal**

4. To remove overload switch support, remove the 2 tightening horizontal screws (7) see Fig. 8-12, then remove the vertical setting screw (3). Refer to §8.2.9 for more information.
5. Place straps (7) see fig.6-4 (length 900mm (35")) around the two gates pins as show below. Then place strap (6) (length 1m (40")) on the harness attachment ring.



**Figure 6-4. Platform strapping**

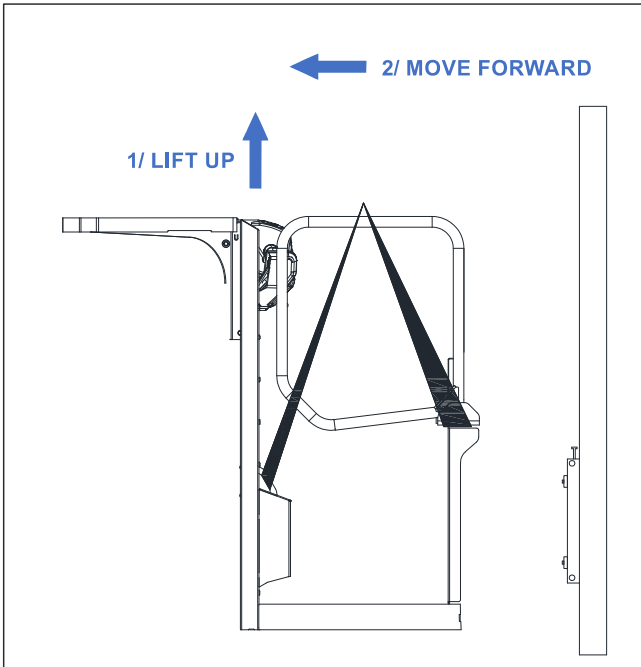
6. Using a crane, raise the 3 straps to lift the platform/ tray assembly about few millimeters. This will necessary to remove bearings and axles.



7. Using a flat screwdriver, unclip retaining E-rings (5) see Fig. 6-6 on the left side of the platform (operator view). Then, remove washers (4) and bearings (3). Refer to § 6.2.3 for more information.

On the right side of the platform, remove the axles (2), washers (4) and bearings (3) by pulling on.

8. Platform assembly can now be disassembled. Follow the 2 indicated below directions to remove it.



**Figure 6-5. Platform disassembly**

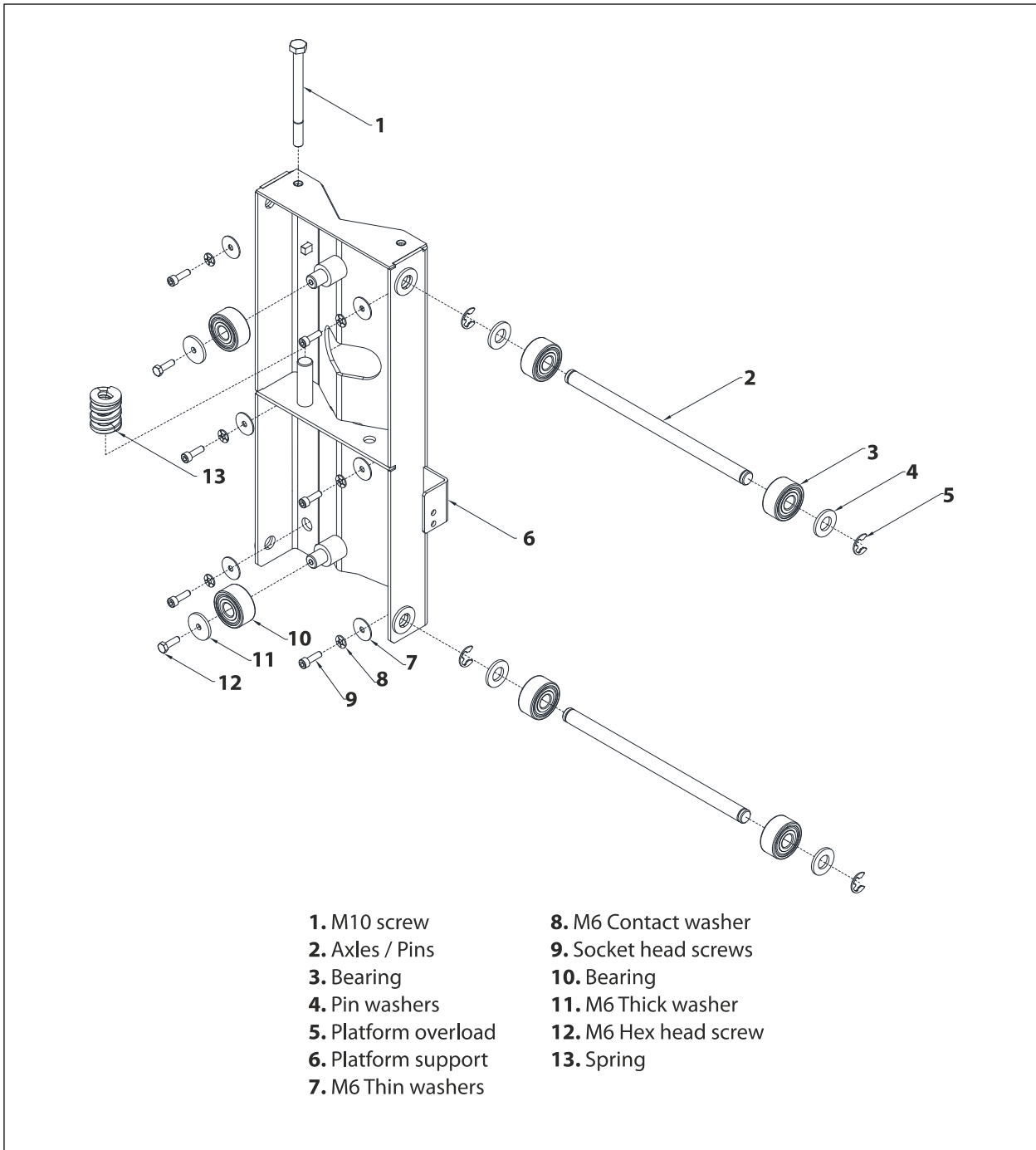
During removal, be careful about the M10 overload screw (1) see fig.6-6 passing through the platform hole and about connector CR11 previously unplugged see Fig. 6-3.

### **6.2.2 Platform Installation**

1. Repeat all removal steps in reverse order.

**6.2.3 Overload Device Replacement**

To access bearings (3) see Fig. 6-6, spring (13) or M10 screw mechanical stop overload (1), remove the platform (Refer to §6.2.1). All screws must be mounted with LOCTITE 243.



- |                      |                       |
|----------------------|-----------------------|
| 1. M10 screw         | 8. M6 Contact washer  |
| 2. Axles / Pins      | 9. Socket head screws |
| 3. Bearing           | 10. Bearing           |
| 4. Pin washers       | 11. M6 Thick washer   |
| 5. Platform overload | 12. M6 Hex head screw |
| 6. Platform support  | 13. Spring            |
| 7. M6 Thin washers   |                       |

**Figure 6-6. Overload device disassembly**

### 6.2.4 Cable Tray Replacement

Cable tray (1) see Fig. 6-7 allows cables, wires and connexions protection. This ensure also power track guiding.

To remove this part, unplug and remove all cables located on it, remove the platform (Refer to § 6.2.1), then use a drill to replace rivets (2).

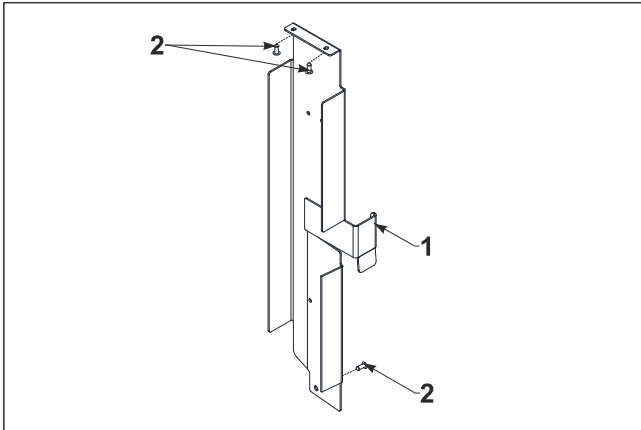


Figure 6-7. Cable tray replacement

### 6.2.5 Gates

Platform gates (1) see Fig. 6-8 are mounted on flanged bushes (2). To dismount a gate, remove gate switch, then loosen M10 nut (5). Refer to § 8.2.6 for more information.

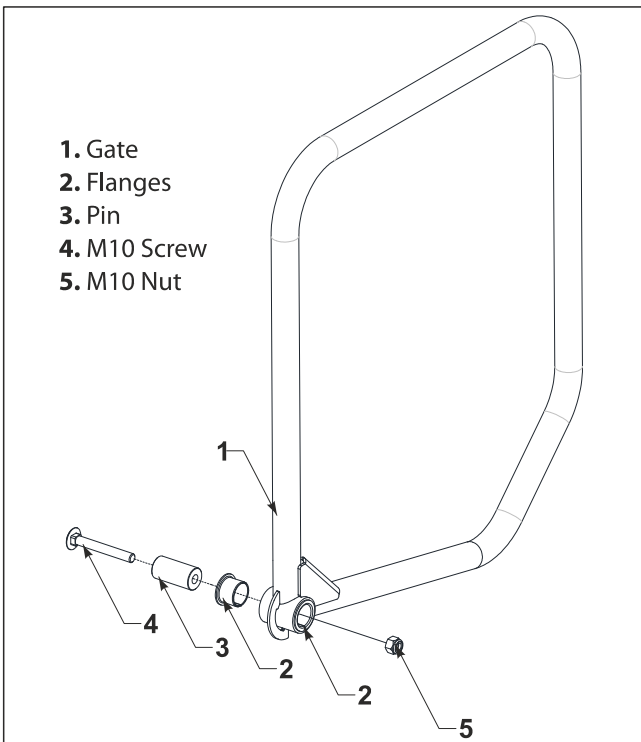


Figure 6-8. Gate disassembly

## 6.3 MANUAL TRAY

### 6.3.1 Manual Tray Assembly

Manual tray (1) see Fig. 6-9 is mounted on pads (6) and linked with spacer (5) to the gas spring (8) see fig.6-10.

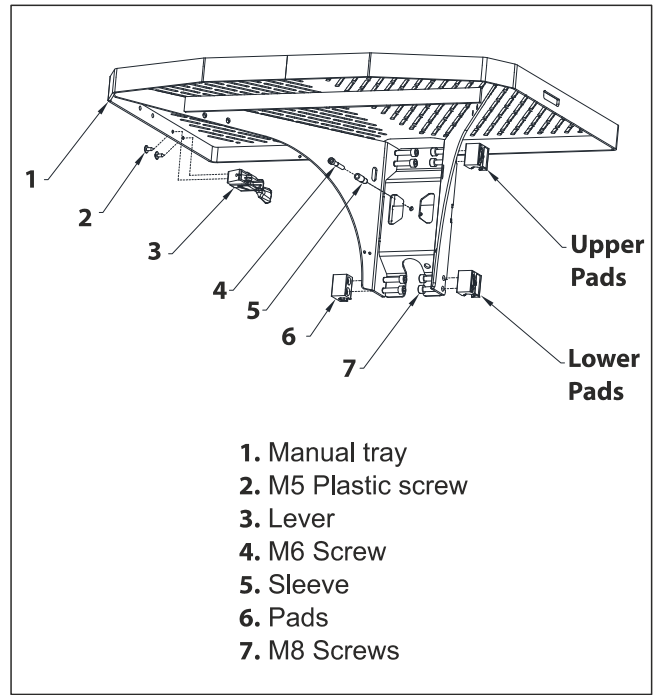


Figure 6-9. Manual Tray Disassembly

### 6.3.2 Gas spring assembly

Gas spring (8) see Fig.6-10 is mounted on a fixing plate (9). It is actuated by bowden cable (12) using a lever (3) see Fig.6-9.

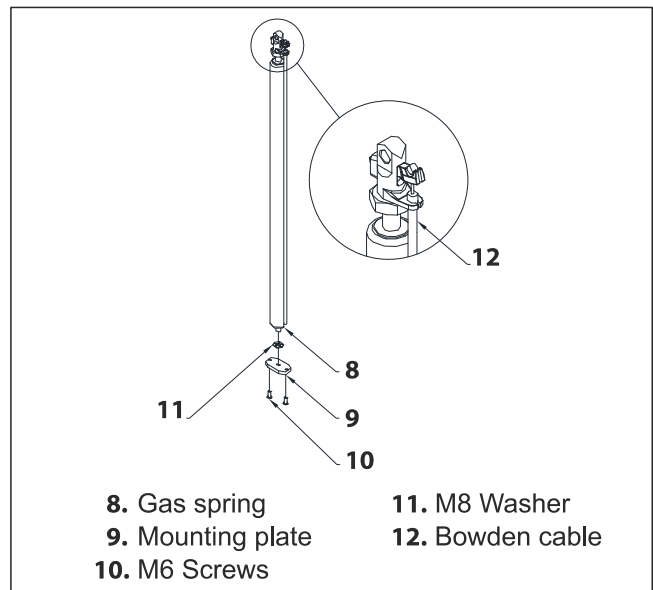


Figure 6-10. Gas Spring Assembly

### 6.3.3 Manual Tray Device Disassembly

1. Lower manual tray to end of stroke.
2. Raise the platform up to 500mm height (20").
3. Turn off the machine and disconnect the battery connector.
4. Disconnect platform control station (14) and remove it by loosening the upper screws (13) and the lower M5 screws (15).

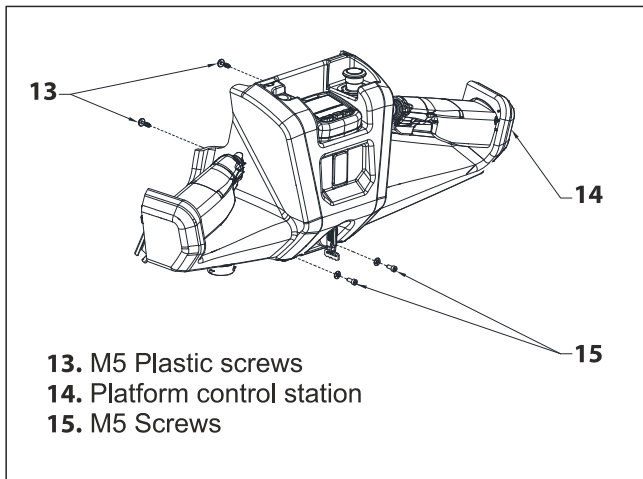


Figure 6-11. Platform Station Removal

5. Secure the manual tray by using a crane, see Fig. 6-12.

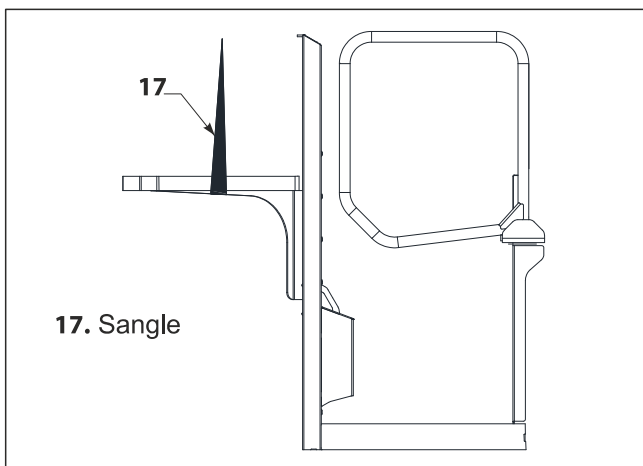


Figure 6-12. Securing Manual Tray

6. Disconnect and remove Bowden cable (12) attached to the gas spring actuator (8) by passing into the hole provided on tray by using a screwdriver.
7. Loosen the M6 screw (4) to separate tray for gas spring (8). Then, lift the crane to separate tray.
8. Loosen gas spring (use a clamp without degrade the barrel gas spring) and remove it.
9. Loosen M8 screws (7) from tray's upper pads (6).

10. Lower the crane to remove the tray from aluminum rails being attentive to tray fall.
11. To replace a rail (18), loosen screws (21), nuts (20) and washers (19).

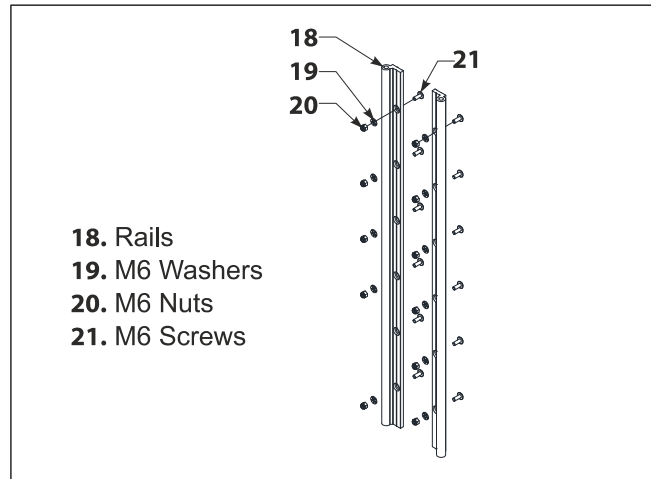


Figure 6-13. Rails Removal

### 6.3.4 Manual Tray Device Installation

1. On manual tray rails (18) see Fig. 6-13 (768 mm long): insert 1 pad per rail (UPPER PADS) and install it on platform with M6 screws (21), washers (19), and nuts (20). Do not tighten nuts at this step (to allow adjustment).
2. On tray (1) see Fig. 6-9, mount the 2 LOWER PADS (6) with 2 M8 screws (7) per pads. Do not tighten screws. Then insert the tray on rails and fit pads using M8 screws (7). Tighten all M8 pads' screws using LOCTITE 243.
3. Slide the tray from up to down by tightening rails' screws/nuts. First, tighten upper screws/nut when the tray is up, then tighten middle screws/nuts when the tray is on the middle of stroke, and to finish tightening the lower screws/nuts when the tray is on lower position. Then, keep up the tray/pads assembly to mount gas spring.
4. Compress the gas spring (8) with lever (3) ensuring the actuator is on the TOP side. See Fig. 6-10.

### **⚠ WARNING**

**STAY AWAY TO THE GAS SPRING'S ROD WHEN ACTUATE IT.**

5. Dismount the end of bowden cable (12) fitted on actuator with a flat screwdriver.
6. Install mounting plate (9) on the platform using M6 screws (10).
7. Insert gas spring (8) (without the Bowden cable) into platform's hole to screw it on the mounting plate (9) using LOCTITE 243 (use a clamp without degrade the barrel gas spring see Fig. 6-10).

8. Insert sleeve (5) on gas spring's head.
9. Low the tray to insert M6 screw (4) and assemble the tray with the gas spring using LOCTITE 243.
10. Tighten gas spring's lever (3) with screws (2) and root the bowden cable on tray's hole. Then, fit the end of bowden cable on the gas spring's actuator.
11. Test the device actuating the lever and performing a upward and downward movement. Then, place a 100 kg (220 lbs) load on tray 1 hour long. The tray may compress the gas spring for 40 mm (1 in) max during the test. If the tray is below this distance after the test, perform a setting of the Bowden cable of the gas spring.

**⚠ WARNING**

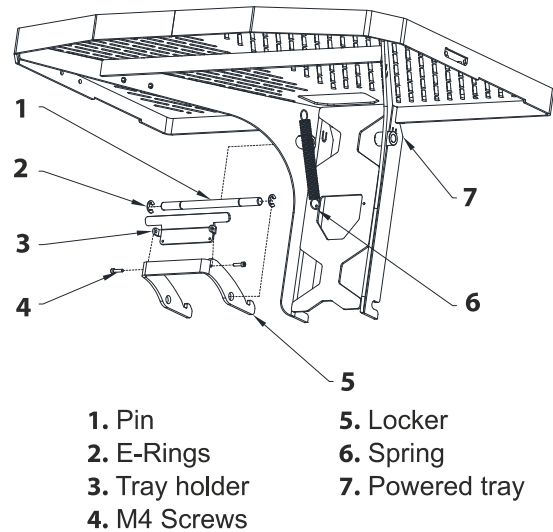
**DO NOT ACTUATE LEVER WHEN TRAY IS LOADED.**

12. Mount platform station using M5 screws (13) and M4 screws (15), plug 20 pts connector and reconnect the battery.

**6.4 POWERED TRAY (OPTION)**

**6.4.1 Tray Assembly**

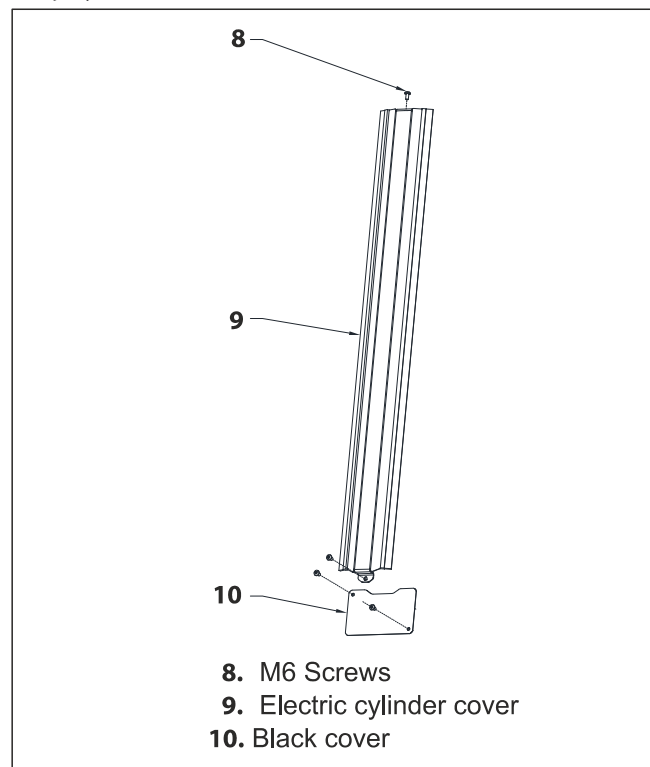
Powered tray (7) see Fig. 6-14 is a removable tray locked with a lever device (3) and (5).



**Figure 6-14. Tray Assembly**

**6.4.2 Covers Assembly**

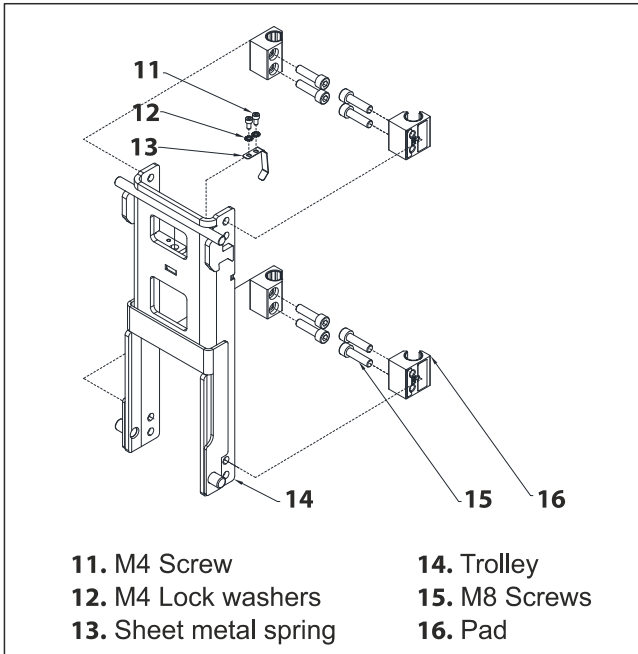
Front black cover (10) see Fig. 6-15 shields the powered tray module. Brush support (9) shields operators from injury.



**Figure 6-15. Covers Assembly**

**6.4.3 Trolley Assembly**

Trolley (14) see Fig. 6-16 supports the removable tray and is equipped with spring sheet (13) for end of stroke system.



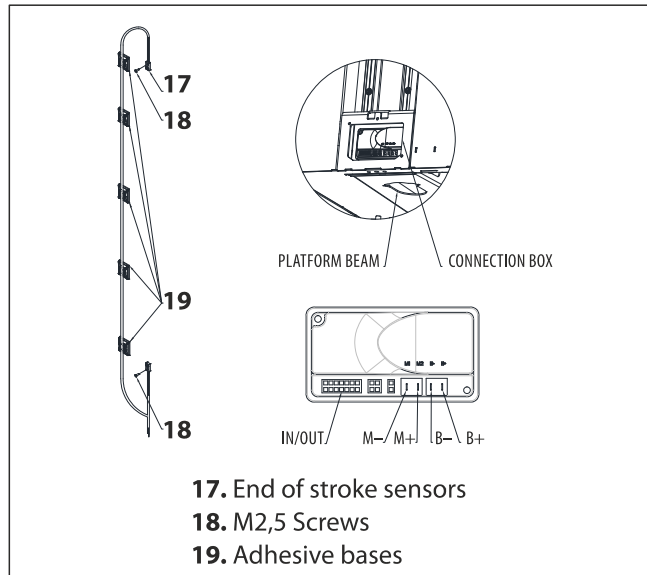
- |                        |               |
|------------------------|---------------|
| 11. M4 Screw           | 14. Trolley   |
| 12. M4 Lock washers    | 15. M8 Screws |
| 13. Sheet metal spring | 16. Pad       |

**Figure 6-16. Trolley Assembly**

**6.4.4 Powered Tray Device Disassembly**

1. Remove the tray as explained on Operator Manual § 5.4.
2. Lift the platform at 500mm (20") height.
3. Turn the machine off, unplug the battery and unplug the 20pts connector of platform control station (14) see Fig. 6-11.
4. Remove platform station loosening upper M5 screws (13) see Fig. 6-11 and M4 lower screws (15) see Fig. 6-11.
5. Remove covers (9) and (10) by loosening M6 screws (8) see Fig. 6-15.
6. Unplug CR1 connector located on platform beam, on the bottom of the platform. Loosen M2.5 screws (18) Fig.6-17 that support end of stroke sensors (17) and remove the harness. Then unplug

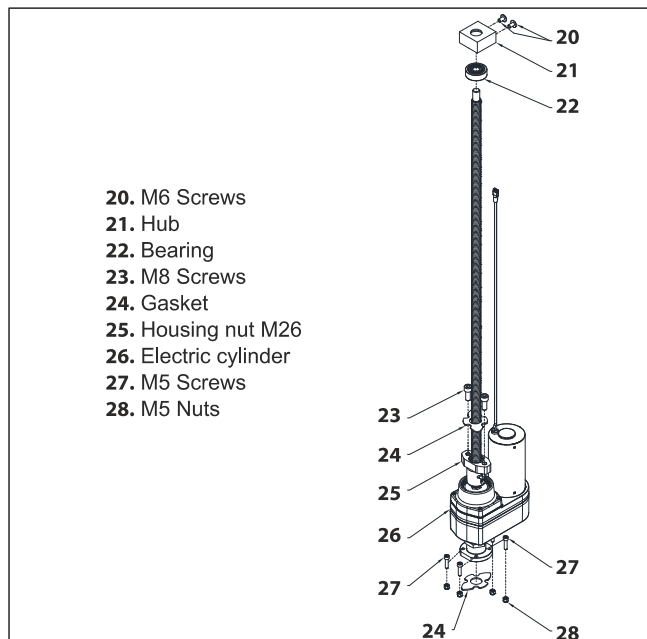
module see Fig. 6-17 and remove it to access M5 electric cylinder foot's screws (27) and nuts (28).



- 17. End of stroke sensors
- 18. M2,5 Screws
- 19. Adhesive bases

**Figure 6-17. Harness Removal**

7. To remove electric cylinder assembly, loosen all M8 pads screws (15) see Fig. 6-16, all M5 screws (27) on electric cylinder's foot and then the M6 screws' hub (20) see Fig. 6-18.



- 20. M6 Screws
- 21. Hub
- 22. Bearing
- 23. M8 Screws
- 24. Gasket
- 25. Housing nut M26
- 26. Electric cylinder
- 27. M5 Screws
- 28. M5 Nuts

**Figure 6-18. Trolley/Cylinder Removal**

8. To replace a pad, loosen screws (32) see Fig. 6-19, nuts (31) and washers (30).

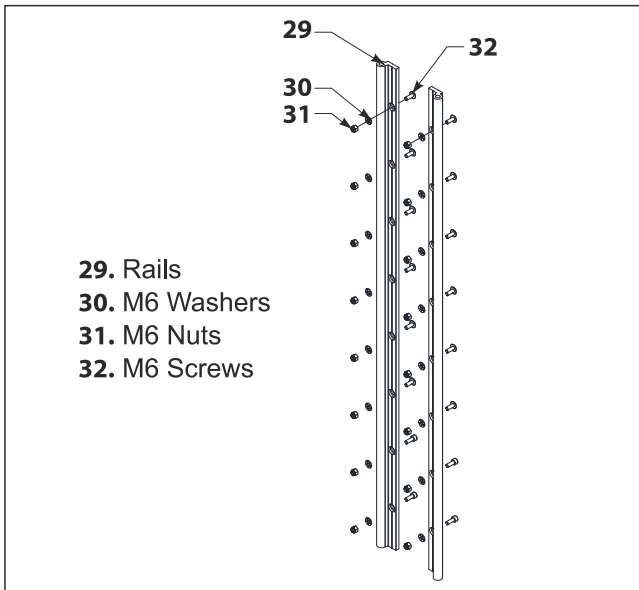


Figure 6-19. Pad Replacement

#### 6.4.5 Powered Tray Device Installation

9. On powered tray rails (29) (1008 mm long): insert 2 pads (16) per rail and install it on platform using M6 screws (32), washers (30) and nuts (31). Do not tighten nuts at this step (to allow adjustment).

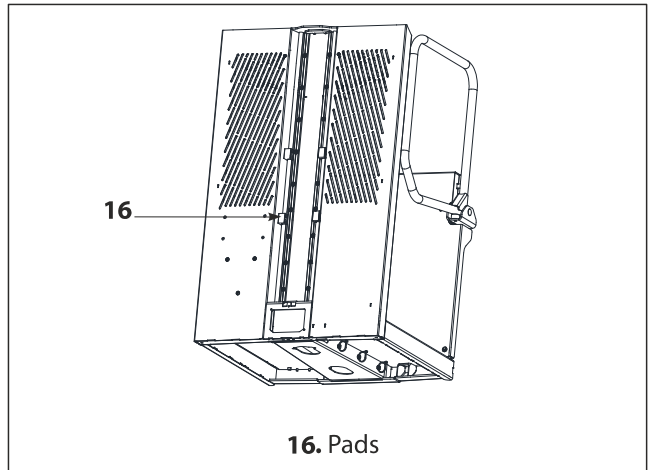


Figure 6-20. Trolley Installation

10. On trolley (14), mount spring sheet (13) with washers (12) and M4 screws (11).
11. To perform rails parallelism, mount trolley on rails by tightening 1 screw per pad.
12. Slide the trolley from up to down by tightening rails' screws/nuts. First, tighten upper screws/nut when the trolley is up, then tighten middle screws/nuts when the trolley is on the middle of stroke, and to finish tightening the lower screws/nuts when the trolley is on lower position.

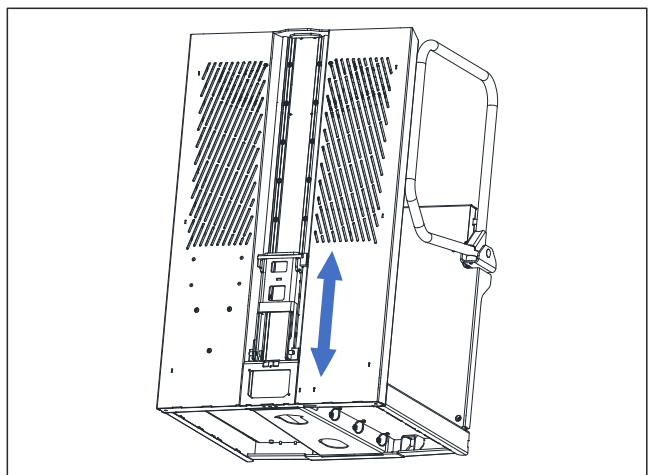


Figure 6-21. Trolley Removal

13. Once the setting achieved, remove the trolley.
14. Passing by tray module box, set up the electric harness (17) see Fig. 6-17 and maintain it using adhesive bases (19). Place green sensors on platform

## SECTION 6 - PLATFORM AND TRAY

with the M2.5 screws (18) and slightly tighten. Connect the CR57 connector on platform beam see Fig. 6-17, on the bottom of the platform.

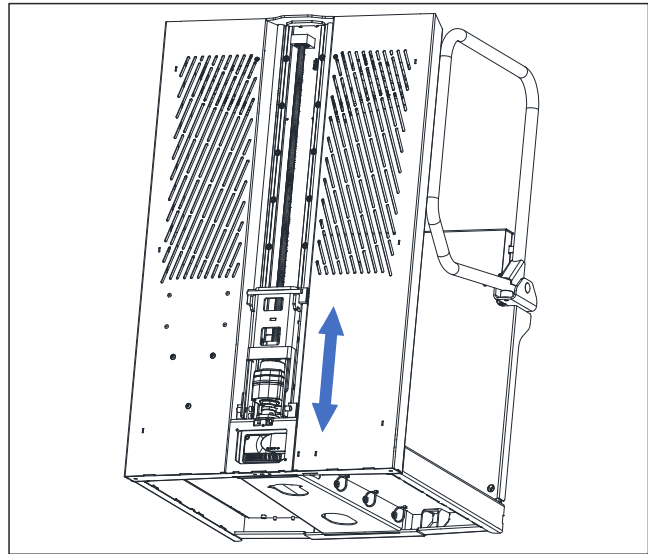
15. On electric cylinder, tighten the housing (25) see Fig. 6-18 on ball nut using LOCTITE 243.

### **⚠ CAUTION**

#### **DO NOT REMOVE THE BALL NUT.**

16. Place the gasket (24) between housing (25) and trolley (14) previously assembled with spring sheet (13). Then tighten M8 screws (23) using LOCTITE 243.
17. Insert the provided bearing (22) on the hub (21) and mount them on the electric cylinder assembly see Fig. 6-18.
18. Set up the electric cylinder assembly (with trolley mount on it) on the platform and place M6 screws (20) on bearing hub without tighten (to allow adjustment).
19. Insert the second gasket (24) between electric cylinder foot and platform. Then insert M5 screws (27) and nuts (28) without tighten (to allow adjustment).
20. Insert electric cylinder wires on connection box to connect them according to Fig. 6-17.
21. Insert M8 screws (15) to fit trolley on pads (16). Use LOCTITE 243 to tighten it.
22. Mount the powered tray module and plug all connectors according to Fig. 6-17.
23. Apply grease (MOBILUX EP2) on ball nut screw.
24. Connect platform control station plugging 20pts connector.
25. Plug the battery and turn the machine on.
26. Perform a complete stroke raising and lowering the trolley. Tighten M8 housing screws (23) on the endless screw nut. Next, low the trolley at lower position, tighten M5 electric cylinder screws (27),

To finish, raise the trolley at upper position and tighten M6 hub screws (20).



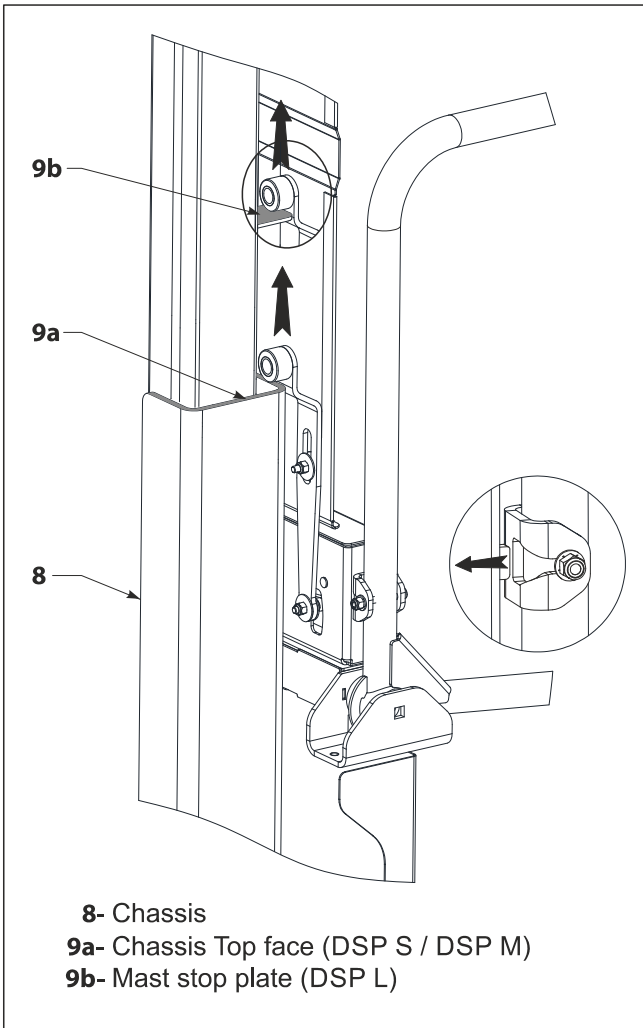
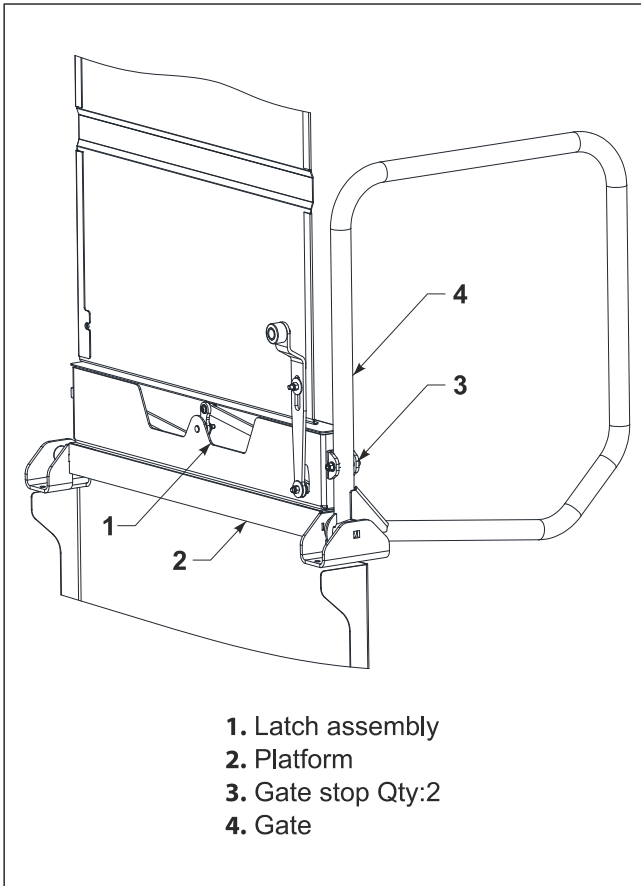
**Figure 6-22. Trolley Installation**

27. Mount cover protection (9) and black cover plate (10) using M6 screws (8).
28. Mount platform control station.
29. Mount the tray as explained on Operator Manual § 5.4, test it placing a 100kg (220 lbs) load on tray. Actuate upward and downward to finish verification.

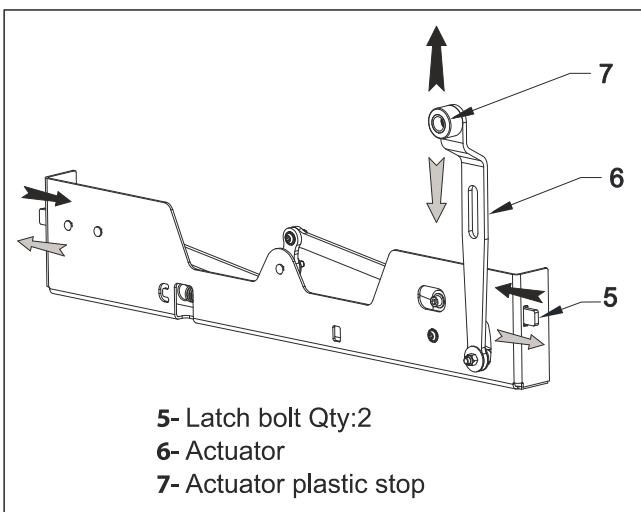
### 6.5 GATE LATCH (IF EQUIPPED)

The machine is equipped, in option, with a latch to prevent gate opening when the platform is raised.

It includes a latch assembly installed on the platform and 2 stops installed on the gates.



#### 6.5.1 Functioning Control and Settings

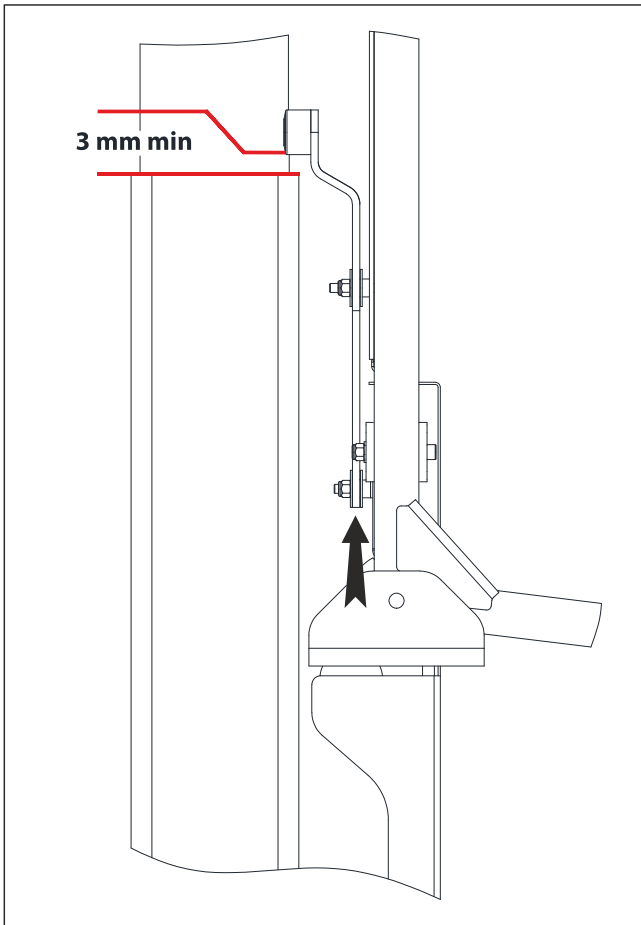


1. Fully lower the platform.
2. Check for proper contact between the chassis and the actuator plastic stop.  
The actuator must be pushed upward and the plastic stop must rest on:  
DSP S and DSP M, chassis top face.  
DSP L, mast 1 stop plate.
3. Ensure Latch bolts come in enough to allow gates opening.

Action on actuator upward: Latch bolts come in.  
Action on actuator released: Latch bolts come out.

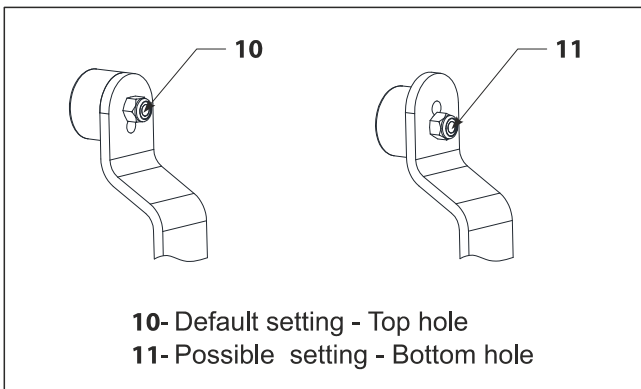
## SECTION 6 - PLATFORM AND TRAY

4. Ensure that no excessive stress appears on the mechanism.



When the platform is completely lowered, it must be possible to manually push the actuator minimum 3 mm upward.

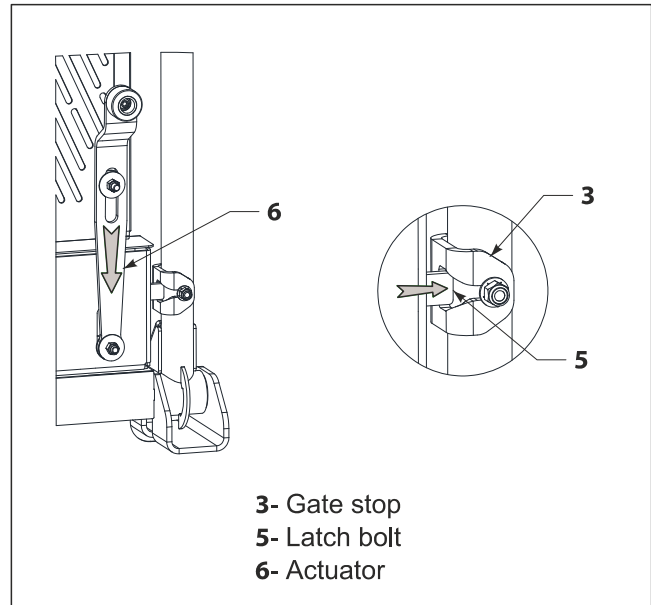
**NOTE:** If latch bolts don't come in enough to properly release the gates, it is possible to change the setting of the plastic stop.



10- Default setting - Top hole  
11- Possible setting - Bottom hole

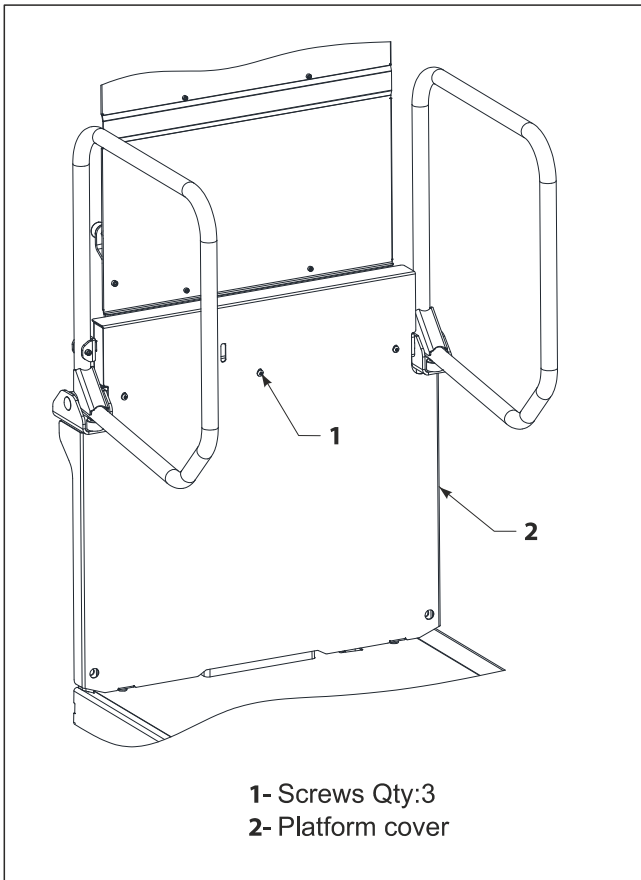
In case of setting in the bottom hole, it is necessary to repeat Point 4 to ensure no excessive stress appears on the mechanism.

5. Raise the platform 0.1 m minimum.



6. Ensure gate latch actuator is released and pulled downward.
7. Ensure latch bolts come out enough in gate stop to prevent the gates opening.
8. Ensure the gate latch mechanism works properly without jamming.  
Manually push the actuator 30 mm upward and let it fall.  
Check the latch bolts come out freely without interference with the gate stops borders.

**6.5.2 Latch Assembly Removal**

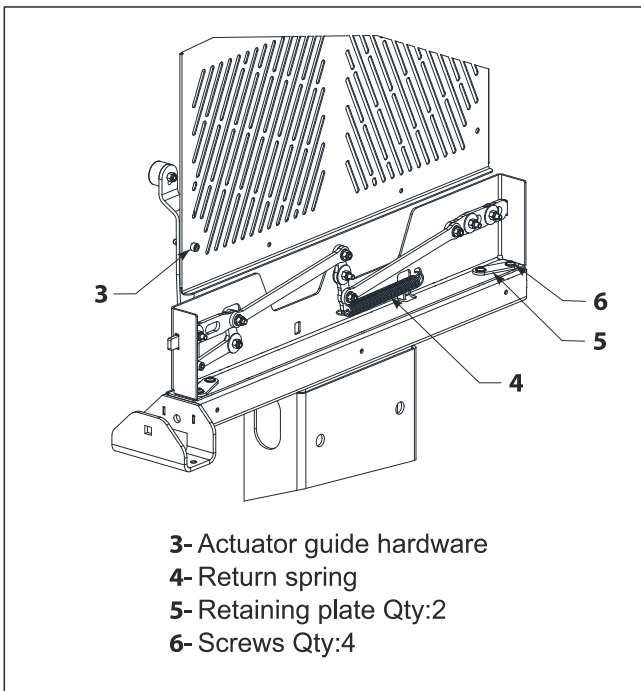


11. Remove the guide hardware to disconnect the actuator from the platform.
12. Remove the screws and the retaining plates to disconnect the latch assembly from the platform.

**6.5.3 Latch Assembly Installation**

13. Before installation, check latch assembly is working properly without jamming or hard spot.
14. Repeat all removal steps in reverse order.
15. Check proper functioning as described in preceding paragraph.

9. Remove the 3 screws and the platform cover.



10. Remove the return spring to release the mechanism



## SECTION 7. HYDRAULICS

## 7.1 HYDRAULIC TANK

Tank Capacity: 6 liters (1.59 gallons)

Hydraulic System Capacity: approximately 7 liters (1.85 gallons)

**Oil Level**

Oil level should be checked daily. Hydraulic oil should be changed every 1000 hours of machine operation or at least every 2 years.

1. Open the access door to the hydraulic power unit (1).
2. Locate the **decal** (2) on the **tank** (3).
3. The oil level in the tank must be within the MIN (minimum) and the MAX (maximum) **markings** (4) of the decal.

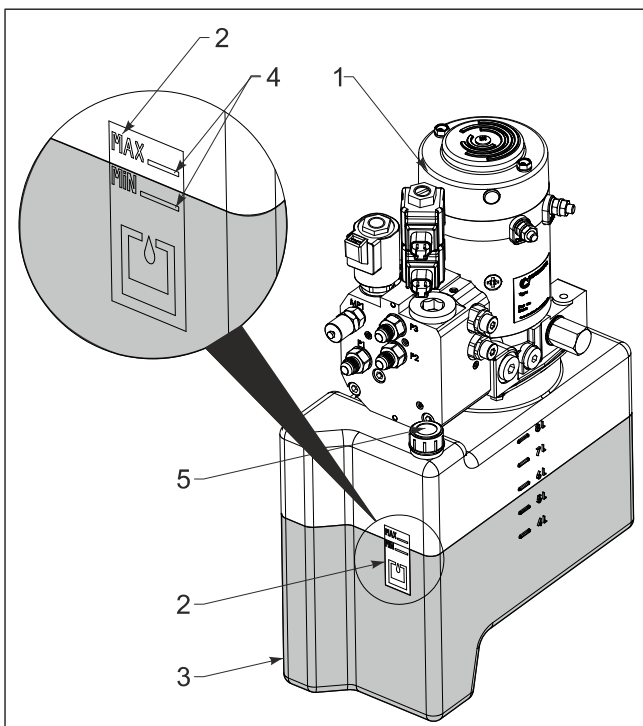


Figure 7-1. Oil Level

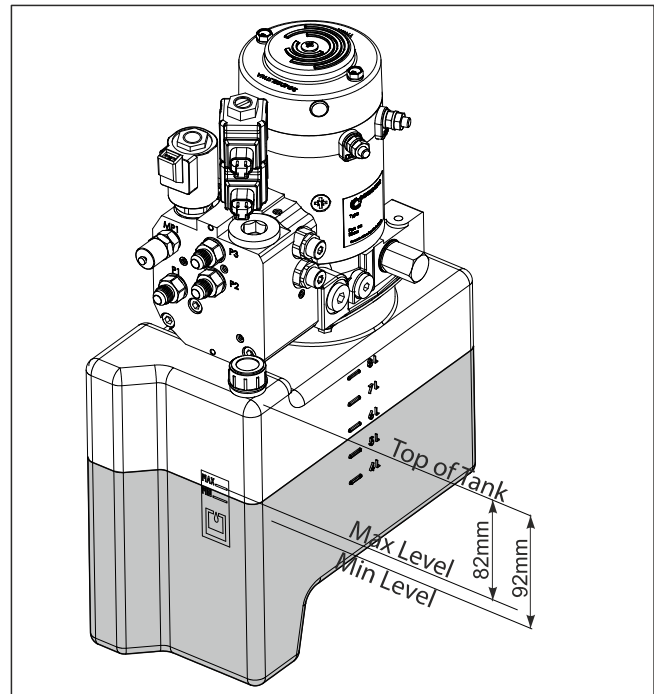
**Oil Level If Decal Is Missing**

Figure 7-2. Oil Level if Decal is Missing

**Adding Oil to The System**

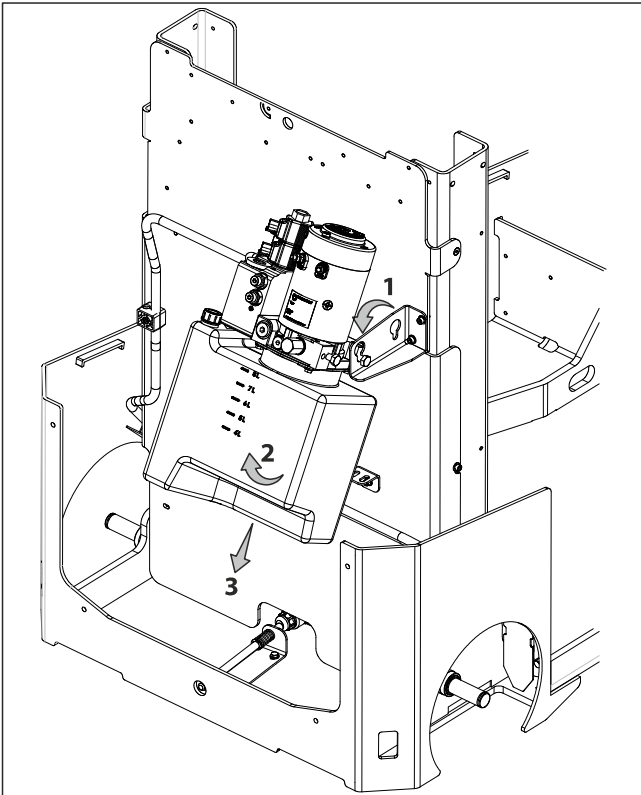
**NOTE:** Care should be taken not to introduce any impurities (dirt, water, etc...) while cap or plug is removed.

1. Wipe all dirt and debris from the **filler/breather cap** (5).
2. Remove (pull) the **filler/breather cap** (5).
3. Add proper grade of oil by using a clean funnel. Fill until oil level is between the MIN and MAX **markings** (4). Replace the cap.

**Tank Draining/Cleaning**

1. Remove rear cover and frame cover.
2. Using the ground controls, fully raise the masts.
3. Disconnect hydraulic line from port P1 of the hydraulic power unit.
4. Place the hose in a collecting tank.
5. Using the manual descent, fully lower the mast to collect oil from the circuit.
6. Cap/Plug hydraulic line and valve body port.
7. Loosen the two bolts securing the hydraulic power unit around 9mm (6 rev.) to allow power unit and its tank collar to move up.

8. Lift, slide and tilt the power unit.

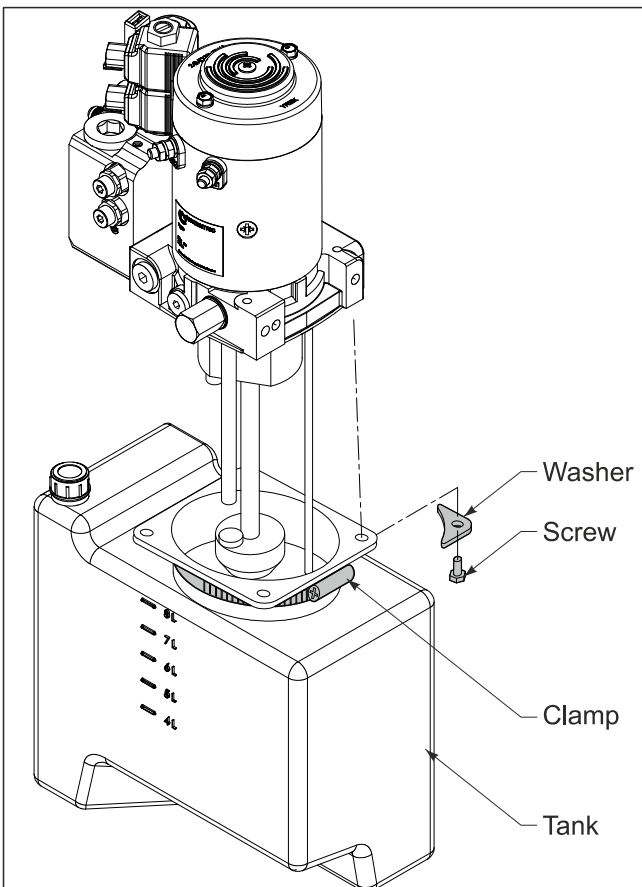


**Figure 7-3. Power Unit Removal**

9. Loosen the tank clamp screw. Remove the hardware securing the tank. Remove the tank.
10. Drain and wipe the tank.
11. Remove and wipe the oil strainer.
12. Install the oil strainer on the suction pipe. Install and secure the tank to the power unit. Secure the hydraulic power unit to the machine (torque Max = 40Nm / 29.5 lb.ft).
13. Replace the hydraulic filter. Refer to Section 7-2.
14. Connect hydraulic line to port P1.

### Tank Filling

1. Remove the filler/breather cap and fill the tank up to the MAX level marking.
2. Using the ground controls, fully raise and lower the mast to bleed the air from the circuit.
3. Bleed the proportional pressure relief valve. Refer to Chapter 7-3 of this manual.
4. Check hydraulic fluid level and adjust accordingly.

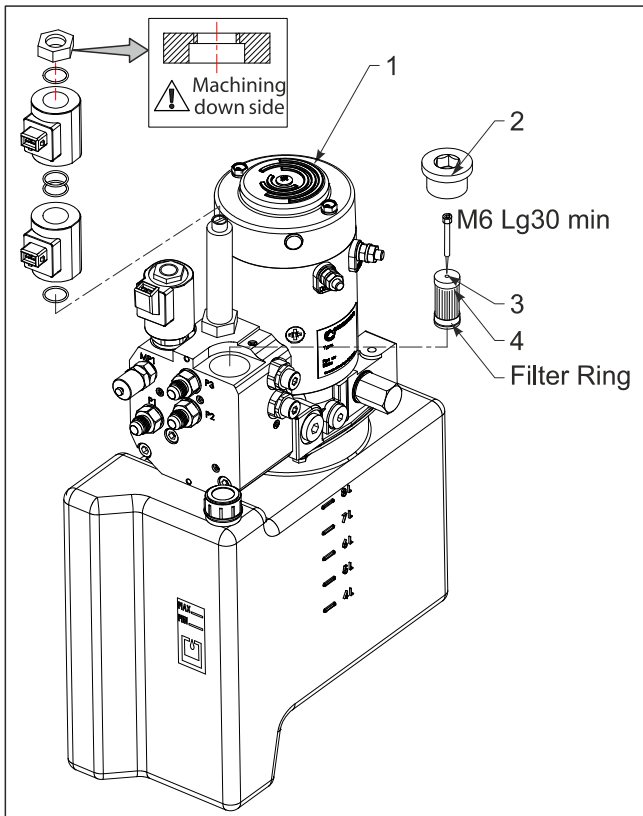


**Figure 7-4. Tank Disassembly**

## 7.2 HYDRAULIC FILTER REPLACEMENT

Lube Point: Replaceable Element.

Interval: After first 50 hours of operation and every 250 hours thereafter.



**Figure 7-5. Hydraulic Filter Replacement**

1. Turn machine power off at ground control station.
2. Open the access door to the **hydraulic power unit (1)**.
3. Remove both steering coils to gain access to filter plug.

### **⚠ CAUTION**

**WHEN REMOVING, BE CAREFUL NOT TO LOOSE THE 4 O-RINGS, ON BOTH SIDES OF THE COILS.**

4. Wipe all dirt and debris from the filter plug (2) area.
5. Unscrew the filter plug (2).
6. Install a screw (M6) in the threaded hole (3) of the filter and extract the filter (4).
7. Install a new filter (oil the filter O-ring before insertion) and the filter plug (torque 70-80 Nm/52-59 lb.ft).
8. Install removed coils with their rings. Secure with nut (machined hole downside, see Picture).

9. Turn machine power on and perform a few steering movements from the ground control station to bleed the air from the circuit.

7.3 HYDRAULIC POWER UNIT

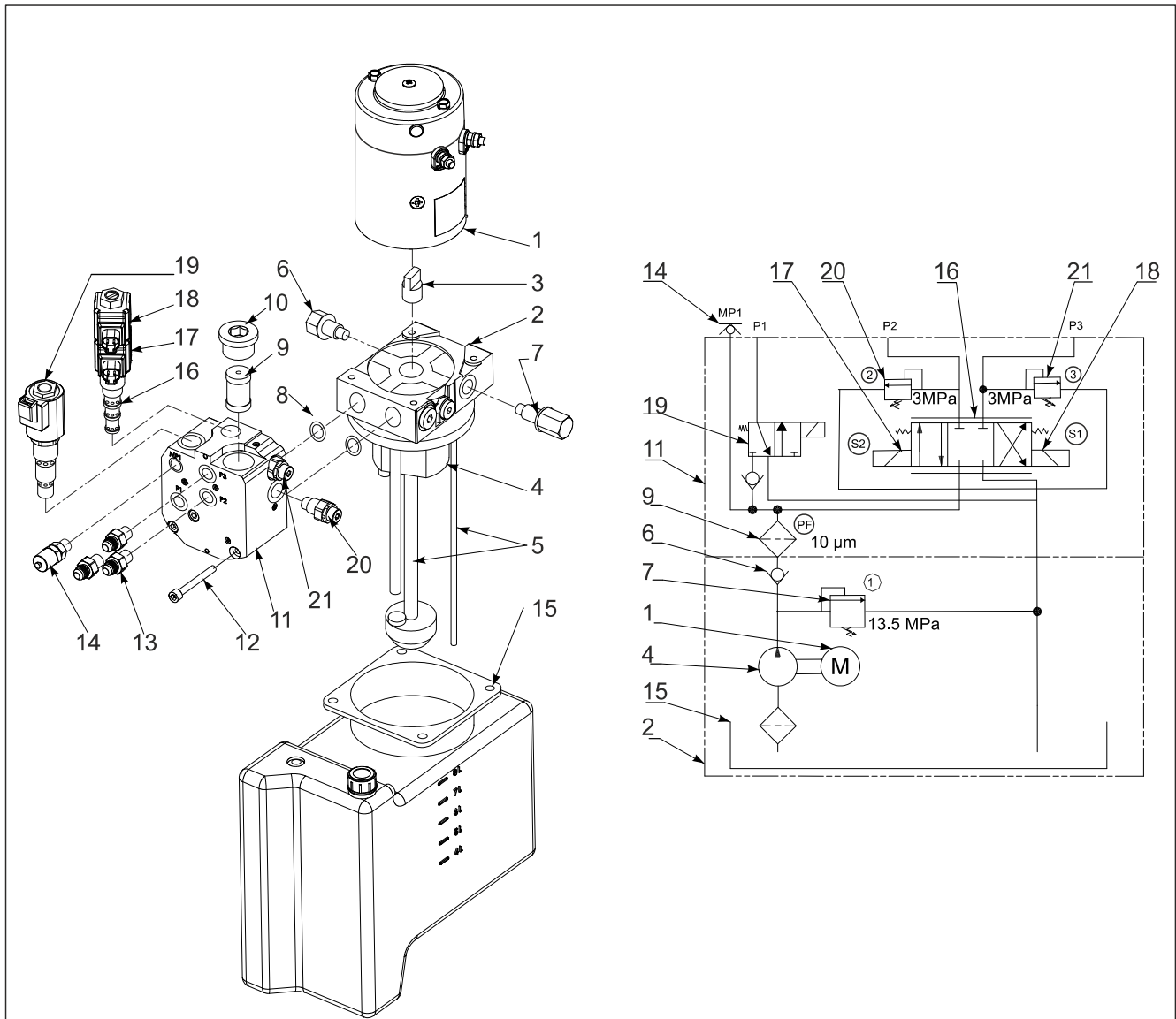
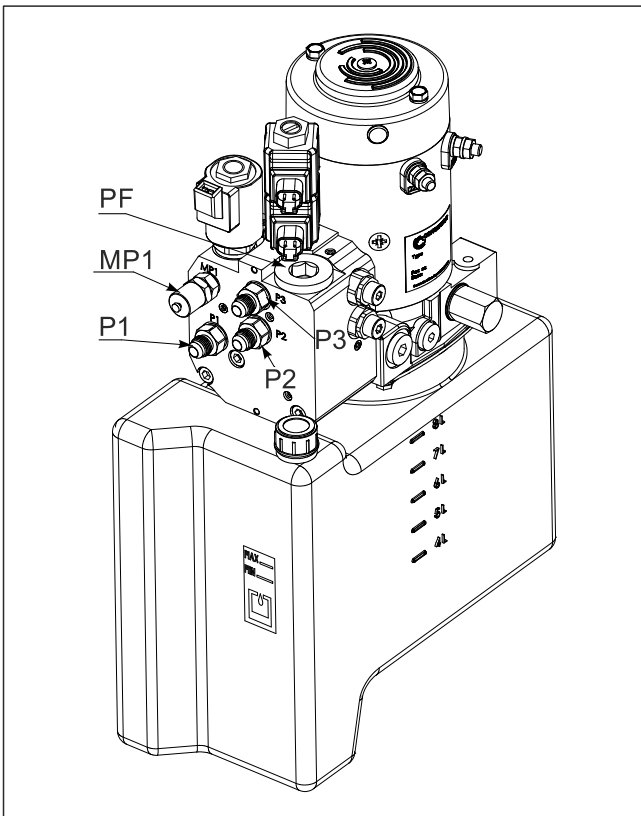


Figure 7-6. Hydraulic Power Unit

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1. Electric Motor 24VDC - 2 kW</li> <li>2. Pump adaptor kit</li> <li>3. Coupling</li> <li>4. Pump kit 3.8cc</li> <li>5. Pump tube kit</li> <li>6. Check valve</li> <li>7. Pressure relief valve 13,5MPa</li> <li>8. O Ring 17.3 x 2.4</li> <li>9. High pressure filter (PF) 10µm</li> <li>10. Filter cap</li> <li>11. Valve Body</li> <li>12. Valve screw</li> </ul> | <ul style="list-style-type: none"> <li>13. Adaptor 7/16 JIC</li> <li>14. Measuring adaptor (MP1)</li> <li>15. Tank</li> <li>16. Proportional steering valve 4/3</li> <li>17. Right steering coil 28Ω (S2)</li> <li>18. Left steering coil 28Ω (S1)</li> <li>19. Valve 3/2 with coil 24Ω - Mast Up</li> <li>20. Right steering Pressure relief valve 3MPa</li> <li>21. Left steering Pressure relief valve 3MPa</li> </ul> |
|---|---|

## Ports Identification



**Figure 7-7. Ports Identification**

- Port 1:** Mast Lift Up/Down
- Port 2:** Steer Left
- Port 3:** Steer Right
- Port MP1:** Pressure Plug

## Pressure Relief Valve

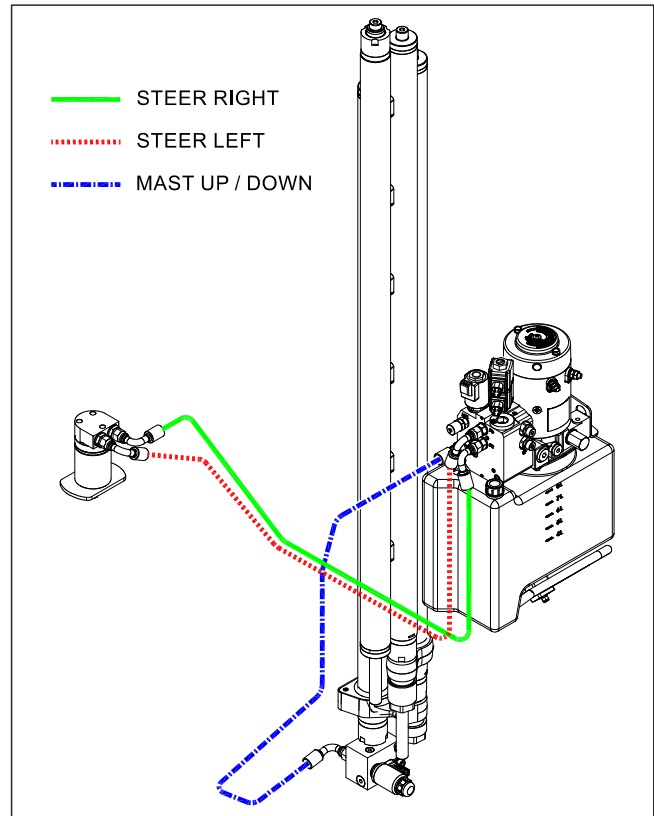
The pressure Relief Valve (7) (Refer to Figure 7-6.) limits the pressure in the circuit (Refer to Section 9.9 for proper values).

### NOTICE

**AFTER THE PRESSURE RELIEF VALVE, HYDRAULIC MANIFOLD OR POWER PACK REPLACEMENT, THE PRESSURE RELIEF VALVE MUST BE CALIBRATED.**

Refer to Section 9-9 for proper pressure Relief Valve calibration procedure.

## Hydraulic Lines Connections



**Figure 7-8. Hydraulic Lines Connections**

## Proportional Steering Flow Control Valve

This three stages spool type 4/3 proportional valve (16) (Refer to Figure 7-6.) is controlled by a PWM signal delivered by the Ground Module. As a function of the electrical control signal, the flow value changes. When a steering movement is performed, the valve is controlled with a signal corresponding to the appropriate flow.

### NOTICE

**AFTER REPLACEMENT OF THE PROPORTIONAL RELIEF VALVE AND/OR THE PROPORTIONAL COIL, FLOW VALUES MUST BE CHECKED AND ADJUSTED ACCORDINGLY.**

Refer to Section 9.10 for proper proportional valve adjustment procedure.

## Air Bleeding

Air entrapped in the valve pole tube can cause noisy operation of the valve when relieving the pressure. This can be due to an insufficient fluid level in the hydraulic reservoir.

Check oil level as previously indicated. This can also appear after the hydraulic circuit has been serviced.

## SECTION 7 - HYDRAULICS

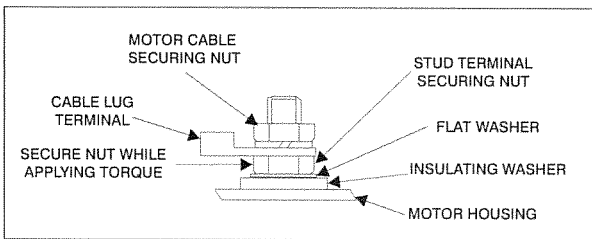
1. Using a screw driver of appropriate dimension, loosen the bleeding screw from about 3 turns (located on the top of the steering valve (16)). Do not remove the screw.
2. Perform a steering function and continue operation with steer fully turned. Once a continuous and regular oil flow comes out from the valve bleeding orifice, tighten the bleeding screw (torque 1 N.m / 0.7 lb.ft).

### Mast Up Valve

This 3-Way, 2-Position 3/2 Mast Up Valve (19) (Refer to Figure 7-6.) is supplied each time a Mast up is controlled. When released valve is open to allow mast oil return to reservoir (see holding valve section for mast stop and down).

### Electric Motor

#### Terminal Tightening:



#### Brush Wear Check (Qty 4):

Replace brushes that are worn below their usable length (10 mm (0.40 in.)), show signs of uneven wear or signs of overheating, such as discolored brush shunts and brush springs.

Brushes should always be replaced in complete sets of four. Use identical replacement parts; do not substitute brush grades as the brushes are matched to the motor type and application to provide the best service.

Substituting brushes of the wrong grade can cause premature commutator failure and excessive brush wear.

#### Dust Cleaning:

When checking the Brushes perform a clean in the motor.

Due to a possible built-up of dust from brush wear inside the pump motor cover around the brushes, it is recommended to perform this dust cleaning task. Use clean, oil free, compressed air.

#### Brush Removal:

**NOTE:** No hydraulic power unit connections, hydraulic or electrical need to be disconnected.

1. Disconnect battery plug.
2. Loosen the two bolts securing the hydraulic power unit around 9mm (6 rev.) to allow power unit and its tank collar to move up.
3. Lift, and slide the power unit.
4. Unscrew the bolts securing the motor top cover, mark the cover and the stator (blue part) to be sure of the angle when reassembling..
5. Maintaining the stator in place try to remove the top cover. Due to the magnets, the cover will resist a little, you can insert a screw driver between the stator and the cover to help the disassembly.
6. Remove the brush terminal screw.
7. Lift the spiral spring and remove the brush from its housing.
8. Repeat previous steps for each brush (Qty: 4).

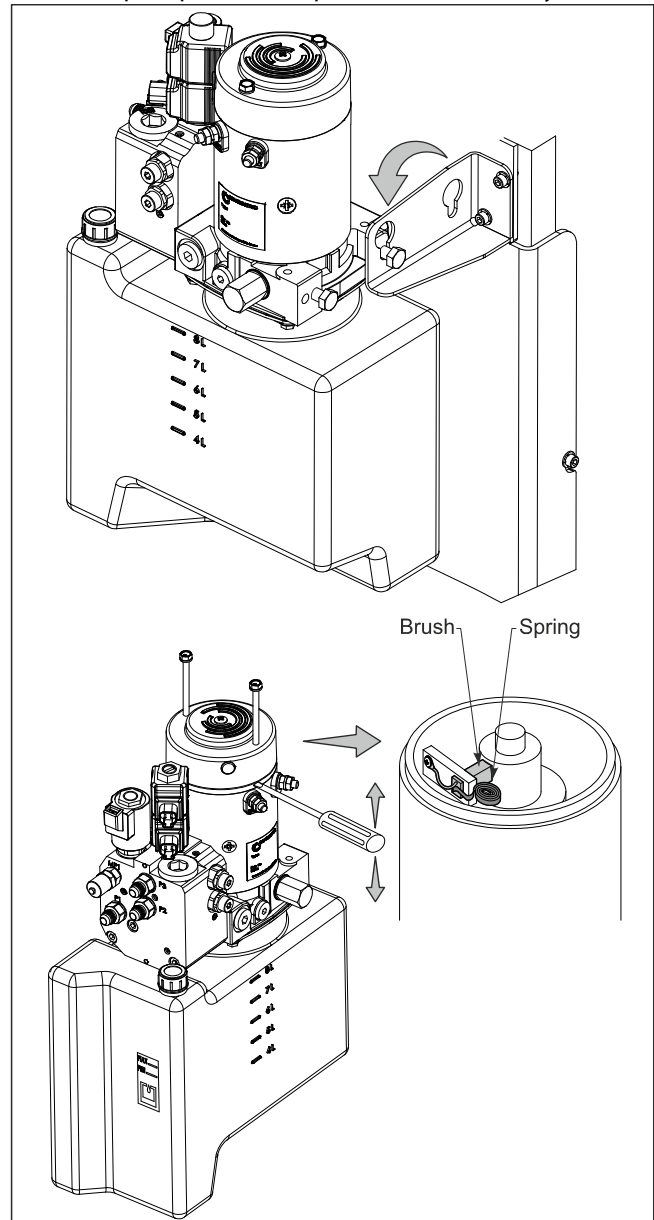


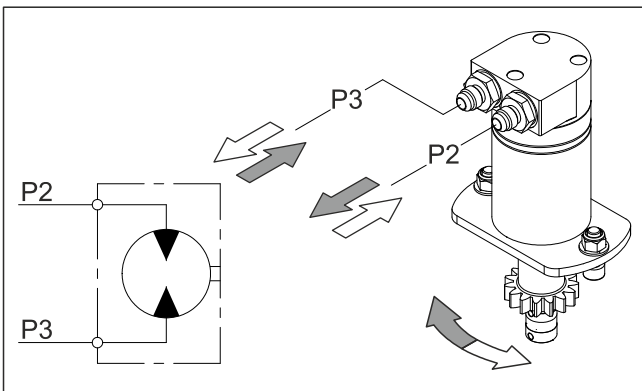
Figure 7-9. Brush Removal

**Brush Installation:**

1. Lift the spiral spring and slide the brush into its housing.
2. Attach the brush terminal end to the terminal post using the terminal screw.
3. Repeat previous steps for each brush.
4. Install and secure the protection cover (1) respecting the angle mark done previously.
5. Secure the hydraulic power unit to the machine, as originally installed (torque Max = 40Nm/29.5 lb.ft).
6. Connect battery plug and check for proper operation of the machine.

**7.4 STEERING MOTOR**

**NOTE:** Refer to Section 4-3 of this manual for steering motor removal procedure.

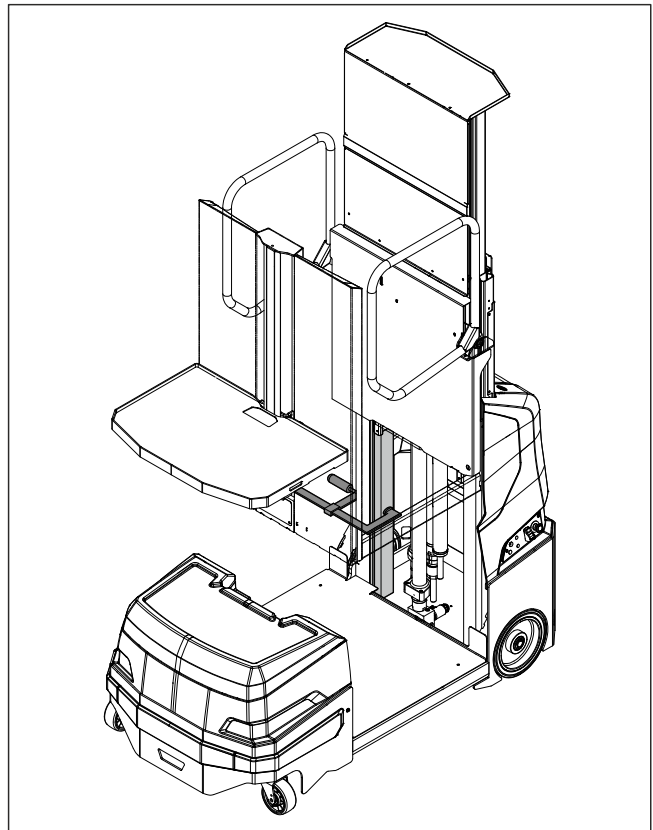


**Figure 7-10. Ports Identification**

**Port P2:** Swing Right  
**Port P3:** Swing Left

**7.5 CYLINDERS HOLDING VALVES****Mast Cylinder Holding Valve****Valve Removal****⚠ WARNING**

**ENSURE THAT THE MAST IS SAFELY SUPPORTED BEFORE DISMOUNTING THE VALVE. DISCONNECT BATTERY PLUG UNTIL THE REPAIRS ARE COMPLETED.**



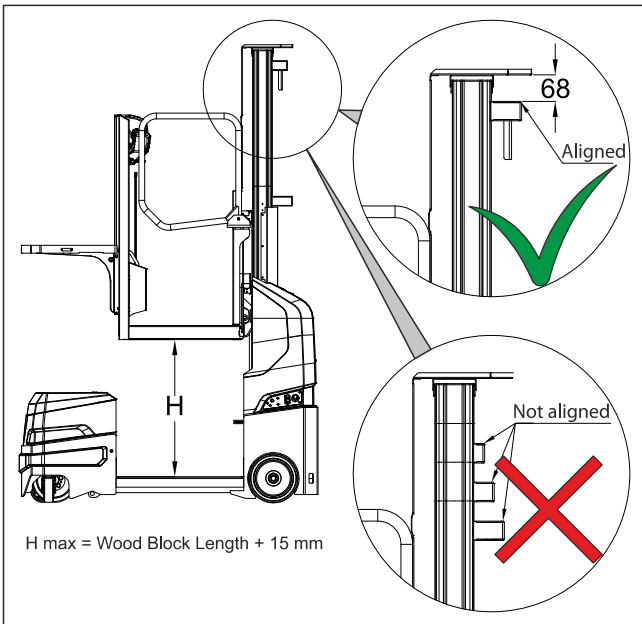
1. Raise the mast until a wooden block 70cm height can be insert bellow mast 2 (secure the block with a clamp). Lower the mast until mast section #2 rests on blocking and maintain the lowering until all the masts are on its stops. Turn power off at ground controls. Disconnect battery plug.

**⚠ WARNING**

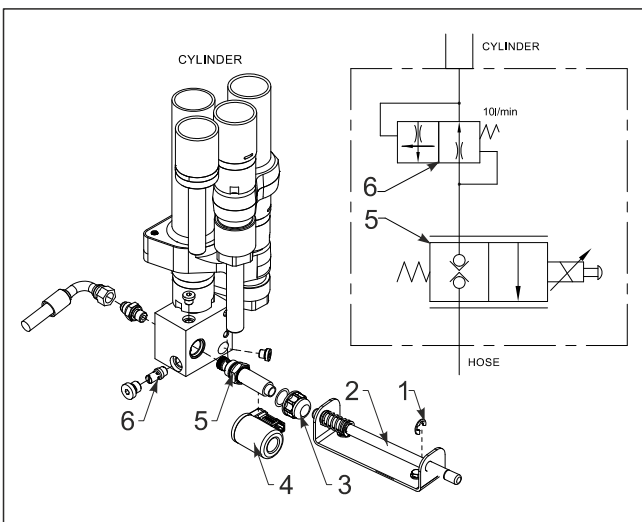
**MAST ARE NOT SYNCHRONIZED; BE SURE ALL THE MASTS ARE ON THEIR LOWER POSITION (SEE DRAWING BELOW). MAST 2 AND FOLLOWING MUST BE ALIGNED. TRANSVERSAL TUBE OF EACH MAST MUST BE LEVELLED AROUND 68MM FROM THE TOP. SPACE BETWEEN PLATFORM BOTTOM AND FRAME MUST NOT EXCEED 15MM MORE THAN WOODEN BLOCK LENGTH.**

**Valve Installation**

1. Install the valve (5) onto the cylinder (torque 25-30 Nm/19-22 lb.ft).
2. Install the coil (4), its O-ring and tighten the coil nut (3) (torque 3- 5 Nm/2.2-3.7 lb.ft).
3. Install the retaining ring (1) to the actuator.
4. Connect battery plug. Using ground controls, raise the mast, check the holding valve prevents mast lowering and remove wood block.
5. Perform a few mast raising/lowering movements to bleed air from the circuit and to check for proper operation.
6. Check the mast manual descent for proper operation.
7. Install rear frame plate.
8. Check hydraulic fluid level and adjust accordingly.

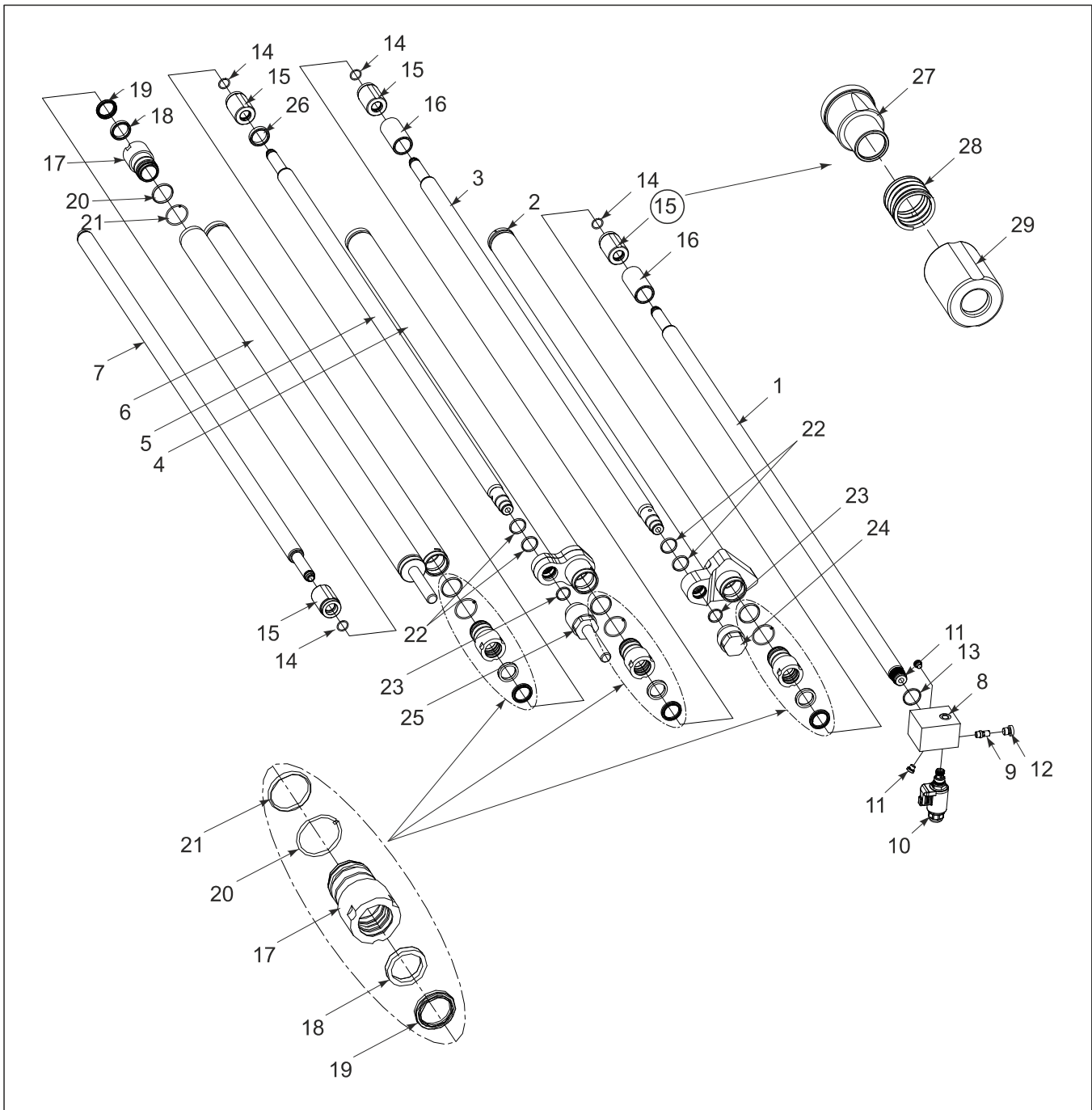


2. Remove the rear frame plate to gain access to the manual descent valve actuator (2).
3. Remove the retaining ring (1) from the actuator (2) to allow coil removing.
4. Unscrew coil nut (3) and remove the coil (4).
5. Unscrew the valve (5) and plug the cylinder port.



- 1: E-Ring
- 2: Actuator
- 3: Coil Nut
- 4: Coil
- 5: Valve
- 6: Flow regulator (10l/mn)

7.6 MAST CYLINDER REPAIR



- |   |   |
|---|---|
| <p>1. Rod #1<br/>(Tightening torque : 200 Nm)</p> <p>2. Barrel #1</p> <p>3. Rod #2<br/>(Tightening torque : 200 Nm)</p> <p>4. Barrel #2</p> <p>5. Rod #3<br/>(Tightening torque : 200 Nm)</p> | <p>6. Barrels #3</p> <p>7. Rod #4</p> <p>8. Valves Block</p> <p>9. Flow Regulator<br/>(Tightening torque: 3-5 Nm)</p> <p>10. Proportional Valve<br/>(Tightening torque: 25-30 Nm)</p> |
|---|---|

11. Plug 1/8" BSP  
(Tightening torque: 10 Nm)
12. Plug 1/4" BSP  
(Tightening torque: 35 Nm)
13. O-Ring
14. Wire Ring
15. Cushion Device
16. Spacer 72 mm
17. Wire Ring Gland
18. Seal Gland
19. Seal Wiper
20. Gland Wire Retaining Ring
21. O-Ring
22. O-Ring
23. O-Ring
24. Blanking Cap  
(Tightening torque : 200 Nm)
25. Blanking Cap  
(Tightening torque : 200 Nm)
26. Spacer 9 mm
27. Cushioning Bush
28. Compression Spring
29. Cast Piston Head

**Mast cylinder disassembly**

**NOTICE**

**NEVER USE COMPRESSED AIR TO EXTRACT THE ROD FROM THE BARREL OR TO CYCLE THE CYLINDER.**

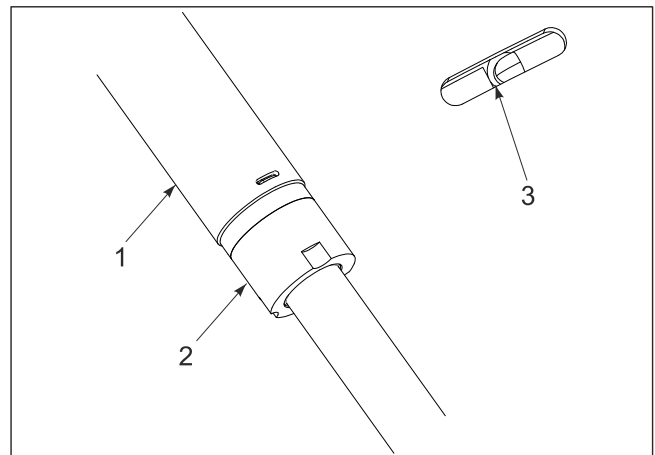
**NOTICE**

**DISASSEMBLY OF A CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.**

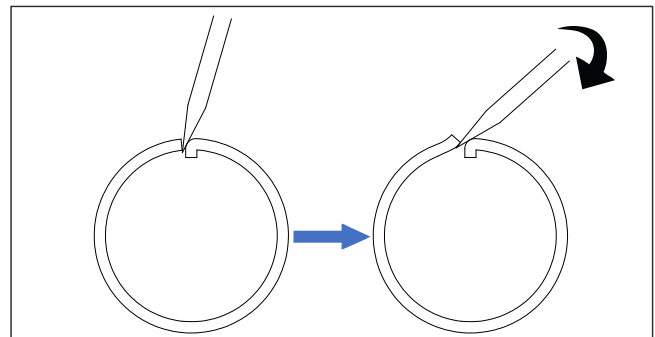
**NOTICE**

**IF USING A VISE TO HOLD CYLINDER BARREL, NEVER CLAMP THE BARREL TUBE WITH THE VISE'S JAWS.**

1. Drain oil from the cylinder.
2. Locate rod and barrel of the last stage of the cylinder (Rod #4 and Barrels #3).
3. Using an appropriate tool, turn the wire ring gland (2) until the end of the gland wire retaining ring (3) appears in the slot of the barrel (1).



4. Using an appropriate tool, carefully raise the straight end of the gland wire retaining ring.



5. During the straight end of the gland wire retaining ring is raised, using an appropriate tool, turn the wire ring gland (2) clockwise until the gland wire retaining ring (3) moved out of the barrel (1).

6. Withdraw the gland wire retaining ring (3).
7. Remove the wire ring gland (2) from the barrel (1) taking care not to damage the chrome-plated surface of the rod.
8. Remove the rod #4 from the barrel #3 then from the wire ring gland.
9. In the same way, remove the second wire ring gland from the barrel #3 taking care not to damage the chrome-plated surface of the rod. Refer to previous instructions, from step 3 to step 6.
10. Remove the rod #3 from the second barrel #3 then from the wire ring gland.
11. Loosen the rod #3 from its blanking cap to remove it.
12. Remove the wire ring gland from the barrel #2 taking care not to damage the chrome-plated surface of the rod. Refer to previous instructions, from step 3 to step 6.
13. Remove the rod #2 from the barrel #2 then from the wire ring gland.
14. Loosen the rod #2 from its blanking cap to remove it.
15. Remove the wire ring gland from the barrel #1 taking care not to damage the chrome-plated surface of the rod. Refer to previous instructions, from step 3 to step 6.
16. Remove the rod #1 from the barrel #1 then from the wire ring gland.
17. Loosen the rod #1 from the valves block to remove it.
18. Remove and discard seals and O-rings from rods, barrels, wire ring glands and valves block. Remove cushions and spacers from rods by removing wire rings. Align all removed parts in the order of disassembly as reminder for new parts installation.

**NOTE:** When removing the old seals, use only blunt tools. Be sure there are no sharp edges that may damage the seals grooves during removal.

### Mast Cylinder Inspection

1. Clean all parts thoroughly with an approved cleaning solvent.
2. Inspect the cylinder rods for scoring, tapering, ovality or other damage. If necessary, dress rods with Scotch Brite or equivalent. Replace cylinder if necessary.
3. Inspect threaded portion of the rods for excessive damage. Dress threads as necessary.
4. Inspect the inner surface of the cylinder barrels tubes for scoring or other damage. Check inside diameter for tapering or ovality. Replace cylinder if necessary.
5. Inspect threaded portion of the barrels tubes for damage. Dress threads as necessary.
6. Inspect cylinder wire ring glands inside diameter for scoring or other damage and for ovality and tapering. Replace cylinder if necessary.
7. Inspect threaded portion of cylinder blanking caps for damage. Dress threads as necessary.
8. Inspect seals grooves in barrels tubes, wire ring glands and blanking caps for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect the cushion devices for scoring or other damage. Check inside and outside diameters for tapering or ovality. Replace as necessary.
10. Inspect the oil ports (valves block and rods) for blockage or the presence of dirt or other foreign material. Repair as necessary.

### Mast cylinder assembly

#### NOTICE

**ASSEMBLY OF THE CYLINDER SHOULD BE PERFORMED ON A CLEAN WORK SURFACE IN A DIRT FREE WORK AREA.**

#### NOTICE

**IF USING A VISE TO HOLD CYLINDER BARREL, NEVER CLAMP THE BARREL TUBE WITH THE VISE'S JAWS.**

**NOTE:** Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. See your JLG Parts manual. Apply a light film of hydraulic oil to all components prior to assembly.

1. Install new seals and O-rings into the applicable cylinder barrel, wire ring gland, blanking cap grooves and valves block.
2. Use a small mallet to tap a new wiper seal into the applicable cylinder wire ring gland (the flat part of the seal must be facing into gland).
3. Use a small mallet to tap a new seal gland into the applicable cylinder wire ring gland (the flat part of the seal must be facing outside gland).
4. Install spacer and cushion device (the cushioning bush must be facing the wire ring) on rods #1, #2 and #3. Secure this assembly with a new wire ring.
5. Install cushion device (the cushioning bush must be facing the wire ring) on rod #4. Secure this assembly with a new wire ring.

#### NOTICE

**EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, BARRELS AND WIRE RING GLANDS. AVOID PULLING THE ROD OFF CENTER, WHICH COULD CAUSE DAMAGE TO THE WIRE RING GLANDS AND CYLINDER BARREL SURFACES.**

## SECTION 7 - HYDRAULICS

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6. Insert the rod #1 into the valves block and screw it fully (tightening torque: 200 Nm). Ensure that O-ring is not damaged.
7. Position the barrel #1 in a suitable holding fixture.
8. With the barrel #1 clamped securely, insert the rod #1 into a wire ring gland, then into the barrel #1. Ensure that seals are not damaged.
9. Continue pushing the rod into the barrel until the wire ring gland can be inserted into the barrel.
10. Secure the wire ring gland by installing a new gland wire retaining ring (reverse the mast cylinder disassembly instructions, from step 3 to step 6).
11. After the wire ring gland be installed, the rod #1 should be pushed all the way (fully retracted).
12. Insert the rod #2 into the bracket of the barrel #1, then into the corresponding blanking cap. Fully screw the blanking cap (tightening torque: 200 Nm). Ensure that O-rings are not damaged.
13. Insert the rod #2 into a wire ring gland, then into the barrel #2. Ensure that seals are not damaged.
14. Continue pushing the rod into the barrel until the wire ring gland can be inserted into the barrel.
15. Secure the wire ring gland by installing a new gland wire retaining ring (reverse the mast cylinder disassembly instructions, from step 3 to step 6).
16. After the wire ring gland be installed, the rod #2 should be pushed all the way (fully retracted).
17. Insert the rod #3 into the bracket of the barrel #2, then into the corresponding blanking cap. Fully screw the blanking cap (tightening torque: 200 Nm). Ensure that O-rings are not damaged.
18. Insert the rod #3 into a wire ring gland, then into the barrel #3. Ensure that seals are not damaged.
19. Continue pushing the rod into the barrel until the wire ring gland can be inserted into the barrel.
20. Secure the wire ring gland by installing a new gland wire retaining ring (reverse the mast cylinder disassembly instructions, from step 3 to step 6).
21. After the wire ring gland be installed, the rod #3 should be pushed all the way (fully retracted).
22. Insert the rod #4 into a wire ring gland, then into the second barrel #3. Ensure that seals are not damaged.
23. Continue pushing the rod into the barrel until the wire ring gland can be inserted into the barrel.
24. Secure the wire ring gland by installing a new gland wire retaining ring (reverse the mast cylinder disassembly instructions, from step 3 to step 6).
25. After the wire ring gland be installed, the rod #4 should be pushed all the way (fully retracted).

SECTION 8. CONTROL COMPONENTS

8.1 CONTROL COMPONENTS OVERVIEW

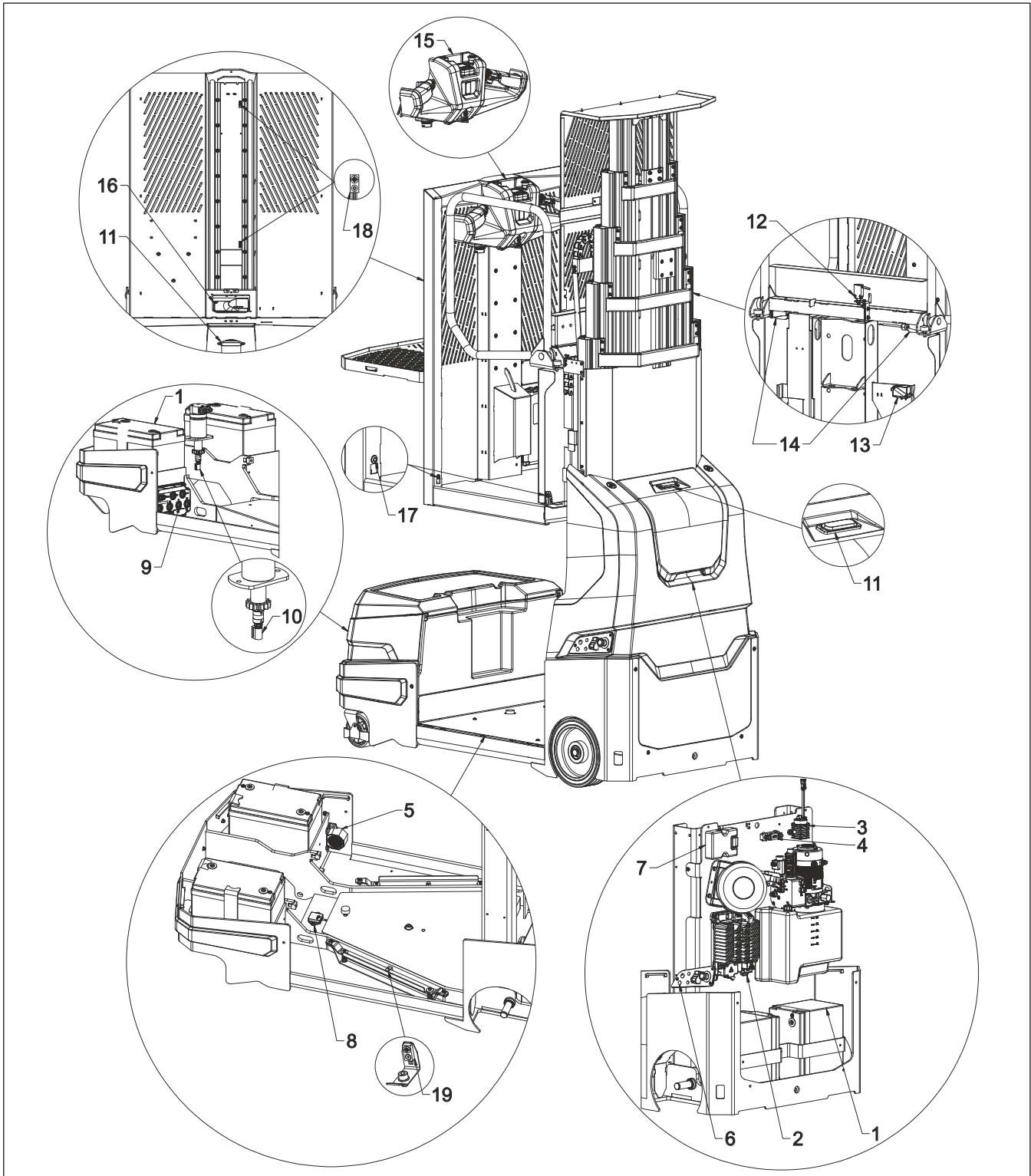


Figure 8-1. Control Components Location

1. Batteries
2. Battery Charger
3. Main Contactor Power Relay
4. Power Fuse
5. Ground Alarm
6. Ground Control Station
7. Ground Module
8. Tilt Sensor
9. Main Power Module
10. Wheel Position Sensor
11. Warning Beacon
12. Overload Switch
13. Mast Sensor
14. Gates Switches
15. Platform Control Station
16. Power Tray Module (If equipped)
17. Virtual Toeboards Sensors
18. Electric Tray Sensors (If equipped)
19. Sensitive Frame Cover Sensors (If equipped)

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### 8.2 CONTROL COMPONENTS SERVICE

#### **NOTICE**

**BEFORE REMOVING ANY COMPONENT FROM THE ELECTRICAL SYSTEM, DISCONNECT THE BATTERIES USING THE QUICK-DISCONNECT LOCATED IN THE REAR COMPARTMENT.**

#### **⚠ WARNING**

**RINGS, WATCHES OR ANY OTHER JEWELRY MUST BE REMOVED DURING MAINTENANCE OR ANY SERVICING OPERATION ON THE BATTERY.**

**DO NOT REPLACE ITEMS CRITICAL TO STABILITY, SUCH AS BATTERIES, WITH ITEMS OF DIFFERENT WEIGHT OR SPECIFICATION. DO NOT MODIFY UNIT IN ANY WAY TO AFFECT STABILITY.**

#### **8.2.1 Batteries**

2 batteries are located on the front side of the machine, inside the traction/motor assembly compartment. 2 batteries are located on the rear side of the mast, inside the hydraulic pump/motor assembly compartment, behind the rear shield/accessibility plate.

Total Minimal Batteries Weight: 110 kg

Type: AGM

Nominal voltage: 6 V DC

Nominal capacity: 200 Ah

Charging profile: #43

#### **Use of a Battery in a Cold Chamber or in a Cold Climate:**

Low temperatures decrease battery capacity. The battery must be fully charged when the machine is operated in a cold chamber or in cold weather condition.

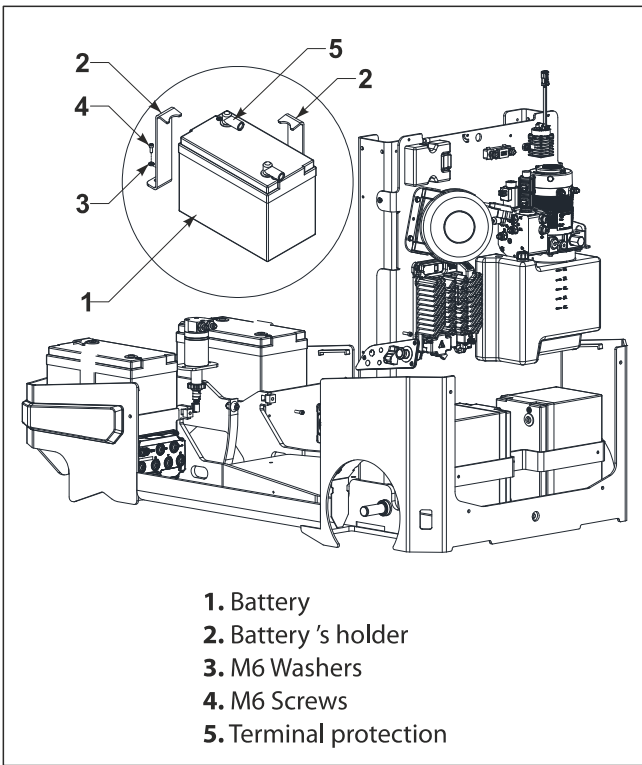
#### **Battery Not Working Continuously or Inactive Battery:**

A battery that is not used or used intermittently must be stored charged in a dry area away from freezing temperatures. A charge must be performed once a month.

- Disconnect the battery to insulate it electrically.
- Keep the top of the battery clean and dry to prevent self-discharge.

**NOTICE**

IF THE BATTERY IS NOT USED CONTINUOUSLY, IT MUST BE RECHARGED BEFORE USE AND AT LEAST ONCE A MONTH.

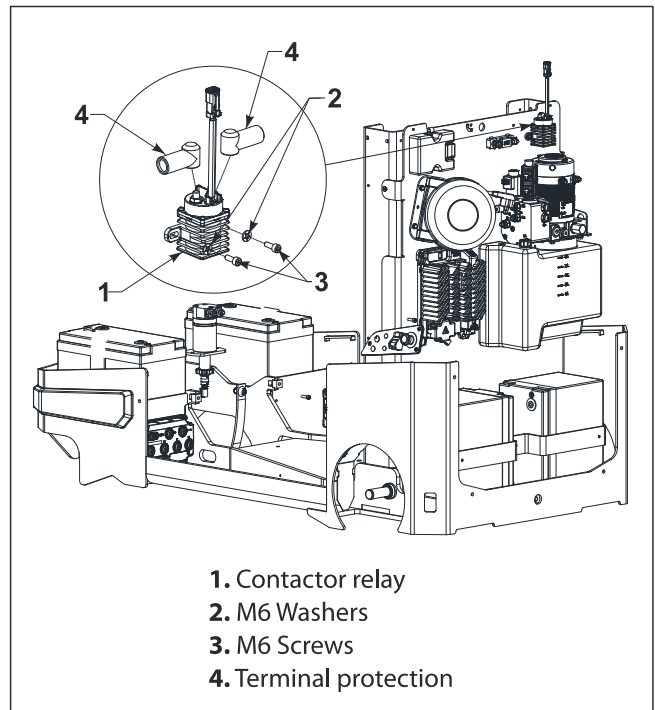


**Figure 8-2. Batteries Location**

**8.2.2 Main Power Contactor Relay**

The main power contactor relay is located on the rear side of the mast, inside the hydraulic pump/motor assembly compartments as shown following.

Nominal voltage: 24 V DC  
Coil resistance: 49.7 Ω

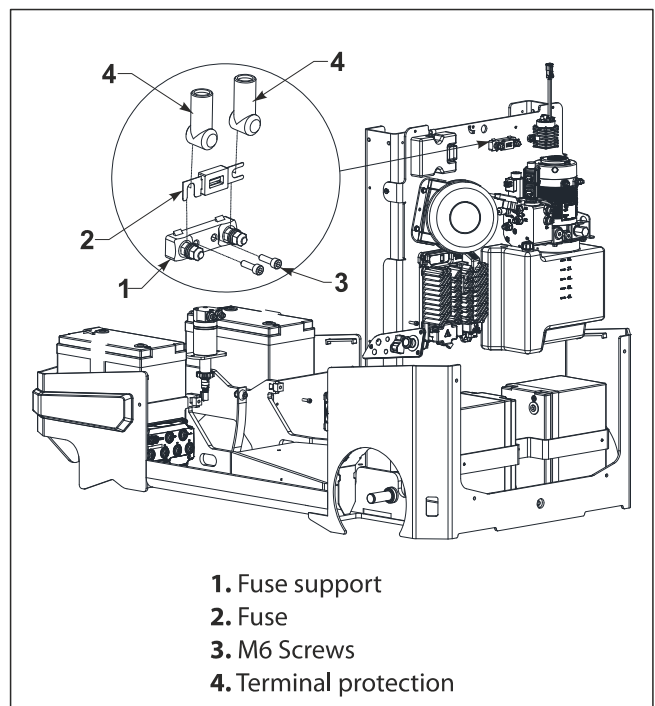


**Figure 8-3. Main Power Contactor Relay**

**8.2.3 Power Fuse**

The power fuse is located on the rear side of the mast, inside the hydraulic pump/motor assembly compartments as shown following.

Amp. Rating: 160 A  
Type: C20 (DIN 43560)



**Figure 8-4. Power Fuse Location**

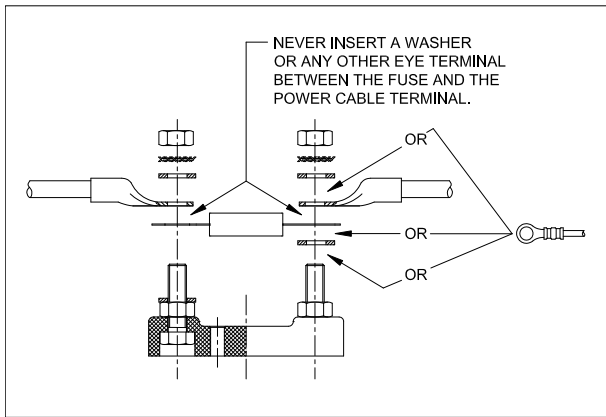


Figure 8-5. Power Fuse

**8.2.4 Wheel Position Sensor**

Wheel Position Sensor monitors position of drive wheel. Wheel position angle range is: -90° to +90°.

Wheel position is displayed on platform display, and used to adapt Max Driving Speed, Accel and Decel.

The sensor is mounted inside traction motor support coupled to the hydraulic steering motor. Reduction gear ratio between hydraulic motor pinion and drive wheel gear is r=6.7.

Effective Electrical Angle: 1440° (4 turns)

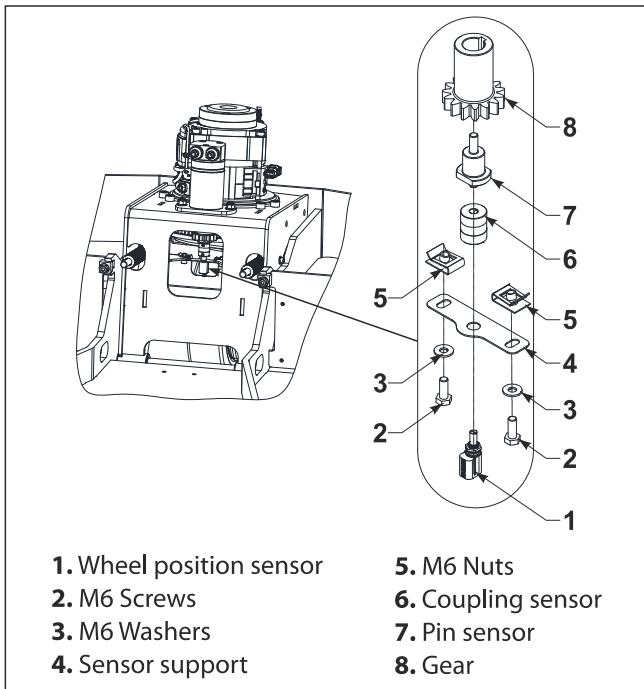


Figure 8-6. Steer Sensor

Pin #	Function	Voltage Left -90°	Voltage Straight	Voltage Right +90°
1	Power (+)	4.75V - 5.25V		
2	Power (-)	0V		
3	Output	0.2V - 0.5V	2.5V ± 0.1	4.5V - 4.8V

Table 8-1. Steer Sensor Connections

Refer to § 4.3 for installation procedure. After installation, calibration is necessary (refer to § 9.7 for procedure).

**Sensor Calibration Verification**

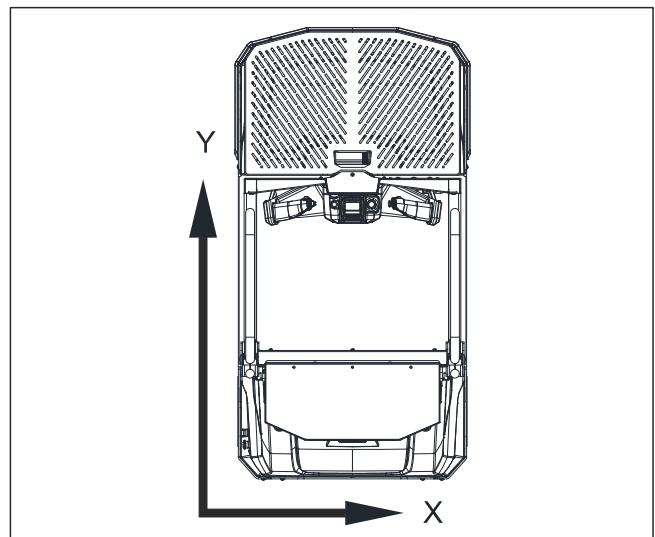
Display Analyzer monitors drive wheel angle and voltage in live.

1. Enter Diagnostics > Inputs > Steer Sensor.
2. Actuate steer joystick up to left end and up to right end and refer to Table 8-1 values.

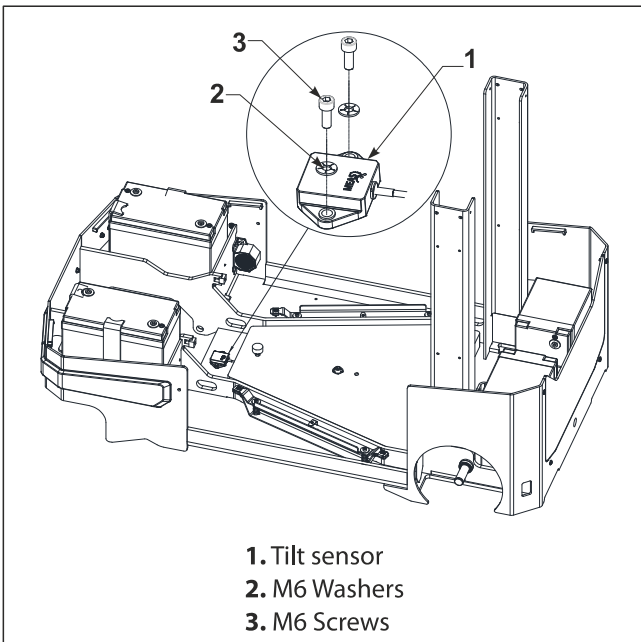
**8.2.5 Tilt sensor**

The control system monitors the tilt sensor to determine if the vehicle is tilted excessively. If the vehicle tilt angle, in X axis direction, is greater than 1.5 degrees and in Y axis direction, is greater than 3 degrees, the control system considers the machine tilted.

Tilt sensor is located on the chassis base plate, behind the drive wheel, at the machine center.



**Figure 8-7. Tilt Axle Direction**



**Figure 8-8. Tilt Sensor Location**

Pin#	Wire Color	Function	Voltage
1	White	Power (+)	4.75V - 5.25V
2	Yellow	Power (-)	0V
3	Brown	Output X	0.5V - 4.5V
4	Green	Output Y	0.5V - 4.5V

**Table 8-2. Tilt Sensor Connections**

**Tilt Sensor Calibration Verification:**

1. Power the machine up and raise the platform floor between 0.5m and 0.7m.
2. After removing the frame cover plate, place a spirit level (digital display) longitudinally on the chassis (front - rear direction).
3. Using a jack of appropriate capacity, slowly and carefully lift the front of the chassis. Jack up by steps after reaching 2.5° as the warning alarm is triggered approximately 1 second after tilt limit detection. Proceed in the same manner lifting the rear of the chassis. If the alarm triggered before 2.6 degrees or after 3.0 degrees, perform a new calibration.
4. Place a spirit level (digital display) transversely on the chassis (left - right direction).
5. Using a jack of appropriate capacity, slowly and carefully lift the left of the chassis. Jack up by steps after reaching 1.0° as the warning alarm is triggered approximately 1 second after tilt limit detection. Proceed in the same manner lifting the right side of the chassis. If the alarm triggered before 1.2 degrees or after 1.5 degrees, perform a new calibration.

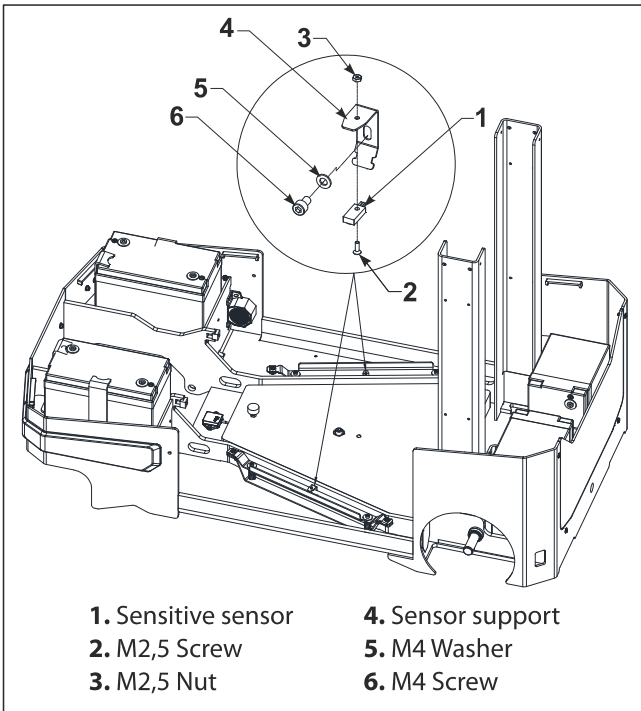
**8.2.6 Sensitive Frame Cover (If equipped)**

When an obstacle is detected by this device, frame cover lower with the load and trigger contact loss between inductive sensor and cover support. When one of the two sensors are triggered, all machine functions are disabled.

The two sensors are located under the frame cover plate.

## SECTION 8 - CONTROL COMPONENTS

Sensor detection range: 0mm to 1.2mm  
 Operating voltage: 5V to 30V DC  
 Refer to § 4.4 for installation procedure.



**Figure 8-9. Sensitive Frame Cover Sensors Location**

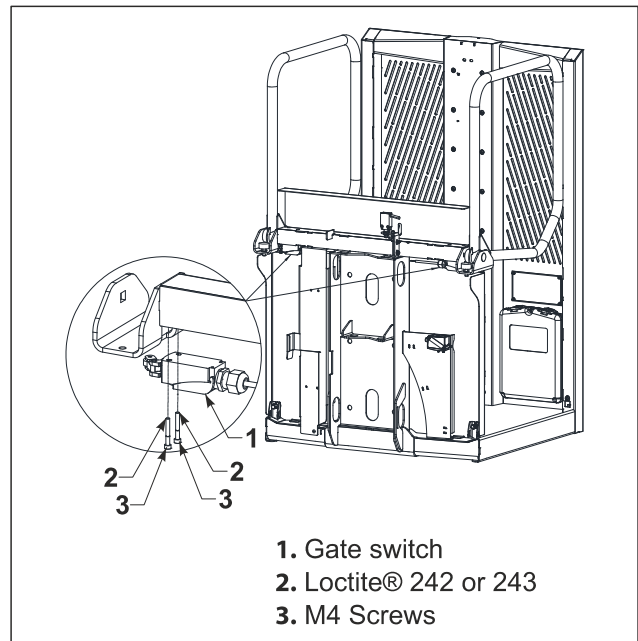
Pin#	Wire Color	Function	Voltage	
			No detection	Obstacle detected
1	Brown	Power(+)	+V Batt	
2	Black	Output	(+Vbatt-1,5V) to +Vbatt	0V
3	Blue	Power(-)	0V	

**Table 8-3. Frame Cover Sensitive Sensor Connections**

### 8.2.7 Gates Switches

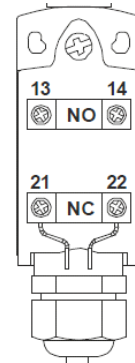
Each gate switch is actuated by a cam on the gate pivot, when the gate is opened. Functions operated from the platform console are disabled when a gate switch is actuated.

Switches are attached to platform, behind the lower protection plate as shown following.



**Figure 8-10. Gates Switches Location**

**Gates switch conditions:**



Pin#	Function	Voltage Gates Closed	Voltage Gates Opened
1	Contact NC (Right Switch Terminal 21)	+V Supply	+V Supply
2	Contact NC (Right Switch Terminal 22)	+V Supply	0V
3	Contact NC (Left Switch Terminal 21)	+V Supply	+V Supply
4	Contact NC (Left Switch Terminal 22)	+V Supply	0V

**Table 8-4. Gates Switches Connections**

+V Supply: Voltage supplied by right/left virtual toe-board sensor (sensor output: refer to §8.2.7 for expected voltage) to right/left gate switch.

### 8.2.8 Virtual Toe-boards Sensors

Toe-boards are made of Infrared barriers sensors. When the machine is operated from platform console and an obstacle intercepts signal sensor, all machine functions are disabled.

Emitters (1) are located at the front of the platform and receivers (2) at the rear of the platform, behind the rear protection plate.

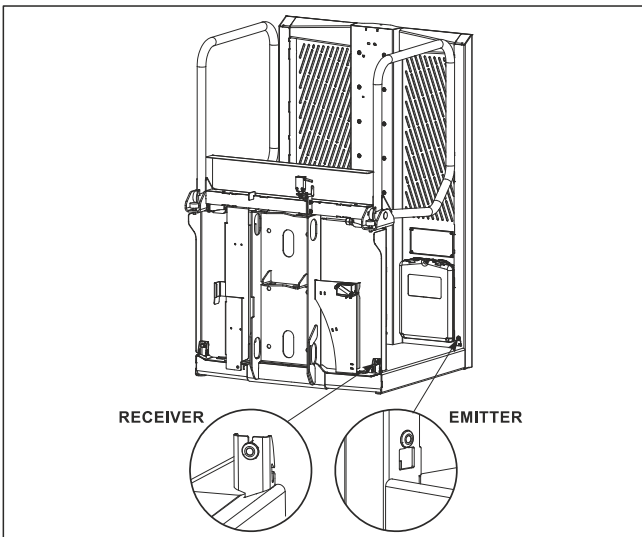


Figure 8-11. Infrared Sensors Location

Pin#	Wire Color	Function	Voltage
1	Brown	Power (+)	+VBatt
2	Blue	Power (-)	0V

Table 8-5. Infrared Emitter Connections

Pin#	Wire Color	Function	Voltage	
			No detection	Detection
1	Brown	Power (+)	+Vbatt	
2	Blue	Power (-)	0V	
3	Black	Output	(+Vbatt-1,5V) to +Vbatt	0V

Table 8-6. Voltage According to Sensor Status

The status of black sensor is visible with the red-light indicator embedded at the rear of the receiver.

- OFF: emitter light not received (detection).
- Solid ON: emitter light received (No detection).
- Flashing: intermittent reception of emitter light.

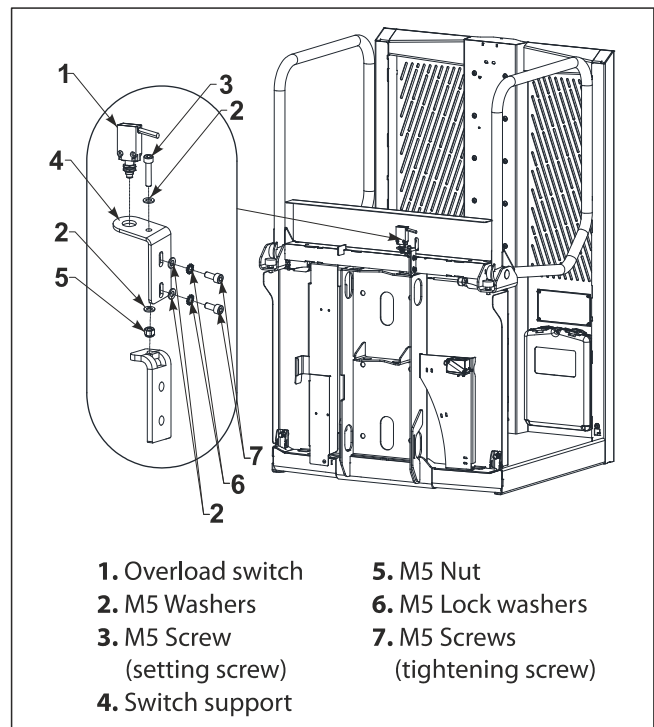
**NOTE:** Intermittent reception of emitter light may be caused by:  
 - Mistake alignment between emitter and receiver.  
 - Important contamination on emitter or receiver.

**TIP:** Infrared beam is visible with digital cameras. Point your cell phone camera toward the emitter at a close distance, a purple point indicates the emitter works.

### 8.2.9 Overload Switch

When the maximum rated load in the platform is exceeded, the switch is actuated, and all machine functions are disabled. The platform must be unloaded until the alarm stops.

Overload sensor is located at the rear of the platform, behind the protection plate.



- 1. Overload switch
- 2. M5 Washers
- 3. M5 Screw (setting screw)
- 4. Switch support
- 5. M5 Nut
- 6. M5 Lock washers
- 7. M5 Screws (tightening screw)

Figure 8-12. Overload Switch Location

## SECTION 8 - CONTROL COMPONENTS

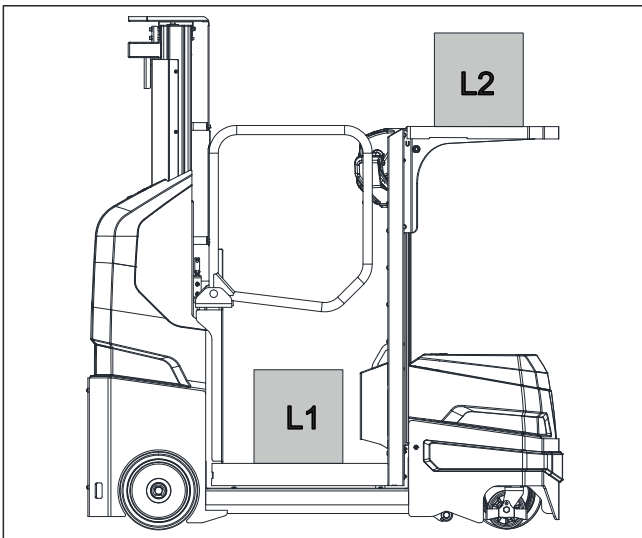
### Overload Switch Setting:

1. Position the machine on a flat level ground. Turn the machine on and ensure Emergency Switches are pulled out.
2. Lift the tray at maximum height.
3. Lift the platform around 30 cm (1ft) height from the floor.
4. Place a load (**L1**) centered into the platform floor and a load (**L2**) centered into the platform tray.

Model	L1	L2
S(*) & M(*)	120kg	100kg
L(*)	100kg	80kg

**Table 8-7. Loads Chart**

**S(\*)= DSP S (CE/UKCA) & DSPi-S (CE Only)**  
**M(\*)= DSP M (CE/UKCA) & DSPi-M (CE Only)**  
**L(\*)= DSP L (CE/UKCA)**



**Figure 8-13. Overload System verification**

1. Slightly lift up the platform with the hands then let it falls.
2. Loosen the 2 horizontal screws by half a turn.
3. Slightly tighten the vertical setting screw until the sensor is activated and the acoustic alarm sounds.

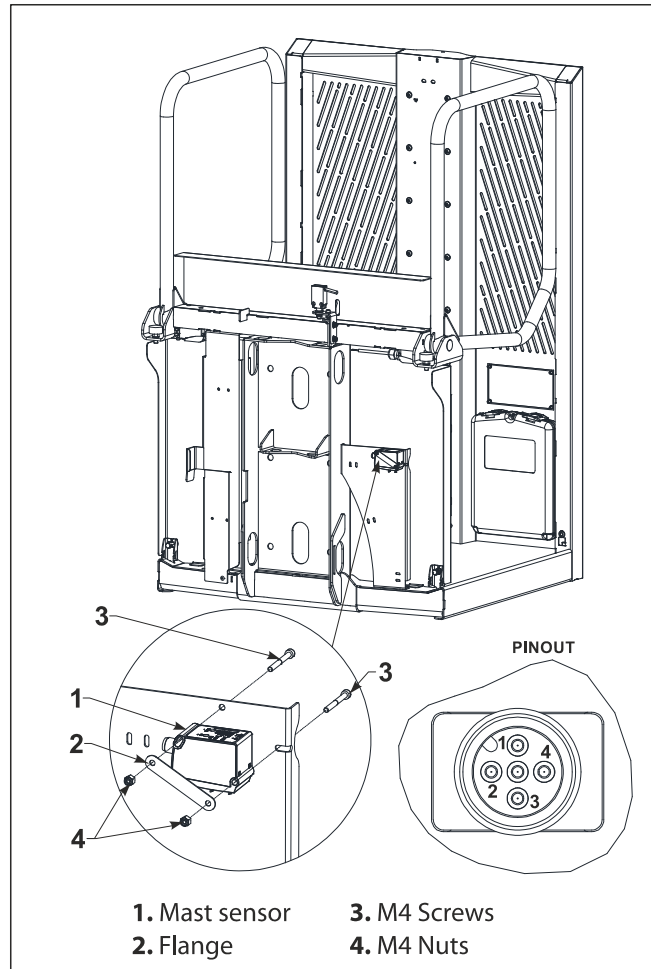
**NOTE:** *The acoustic alarm is delayed around 1 second.*

4. Once the sensor is activated, loosen the vertical setting screw until alarm stops.
5. Tighten the 2 horizontal screw to maintain the current setting.
6. Refer to the Operation and Safety Manual to verify the Overload System Setting.

### 8.2.10 Mast Sensor

The mast sensor is a laser telemeter, measuring platform height.

The mast sensor is mounted on the platform assembly, behind the protection plate.



**Figure 8-14. Mast Sensor Location**

Pin#	Wire Color	Function	Voltage
1	Brown	Power (+)	+VBatt
2	White	Output	4-20mA on 620Ω shunt resistor (~2.5V-12.4V)
3	Blue	Power (-)	-VBatt
4	Black	Not Used	Supply (0V)
5	Grey	Not Used	N/A

**Table 8-8. Mast Sensor Connections**

## Troubleshooting Help

Typical output values (translated in Voltage)

- Platform fully lowered (all models): 2.70V  $\pm$ 0.15V
- Platform fully raised (DSP S): 7.10V  $\pm$ 0.30V
- Platform fully raised (DSP M): 9.50V  $\pm$ 0.30V
- Platform fully raised (DSP L): 11.30V  $\pm$ 0.30V
- Typical Output variation (all models): 1.57V/m

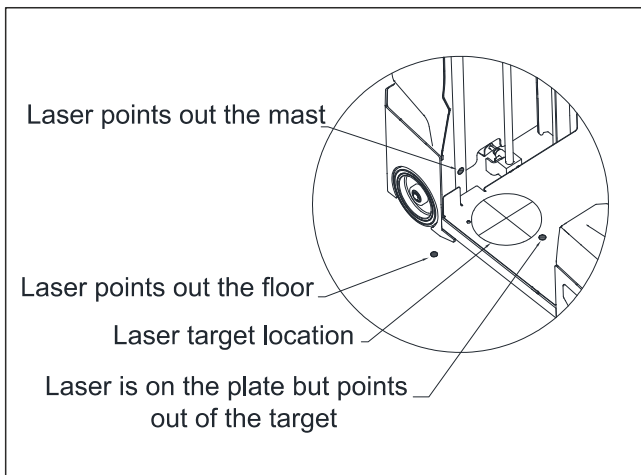
Acceptable range for calibration

- DSP S: 2.55V to 7.40V
- DSP M: 2.55V to 9.80V
- DSP L: 2.55V to 11.60V

External fault causes and effects

- Contamination on sensor lens (moisture, dust, grease...):
  - Output is to be expected 2.0V to 2.4V (clear, mostly reflective contaminant)
  - Output is to be expected 12.5V to 13V (dark, mostly absorber contaminant)
- Large laser target offset (Laser points out the floor, the mast or is out of the target (See Large Laser Target Offset Large Laser Target Offset):
  - Output is to be expected 12.5V to 13V

**NOTE:** In case of DTC, interpreted height is 4.53m; sensor voltage remains uninterpreted (follows sensor's actual output).



**Figure 8-15. Large Laser Target Offset**

**NOTE:** Sensor is factory pre-set. Setting cannot be altered with the sensor control panel; calibration must be performed via the machine Control System.

**NOTE:** The mast sensor is an optical device, as such it is sensitive to any form of contamination on the lens. Clean sensor lens after installation and before calibration.

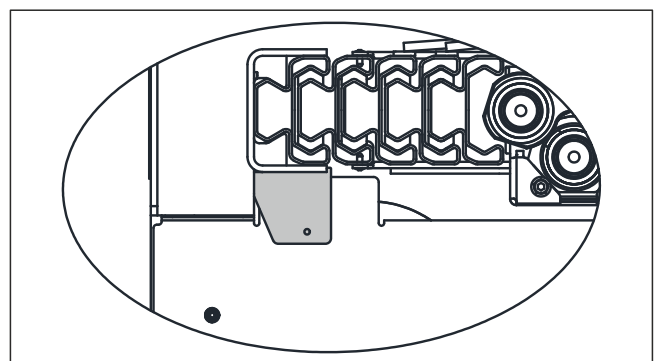
## ⚠ WARNING

**DO NO LOOK INTO THE LASER BEAM. LOOKING DIRECTLY INTO THE LASER BEAM MAY RESULT IN EYE INJURY.**

### Mechanical Mast Sensor Setting:

**NOTE:** During the setting, do not pass hands in front of the laser sensor.

1. Position the machine on a flat level ground and open area.
2. Lift the platform around 70 cm (2.3ft) height from the floor.
3. Verify there is no DTC displayed then turn the machine off.
4. Place the mast sensor setting tool against the chassis (JLG P/N 1001265673) as showed Figure 8-16.
5. First, loosen screw (1) to allow red laser point movement on (A) direction.
6. Turn the machine on.
7. Place the red laser point on the Laser Line as shown in figure 8.18.
8. Tighten screw (1) while maintaining the sensor bracket in position.
9. Then, slightly loosen bolts (2) to place the red laser point into the tool's hole.
10. Tighten bolts (2) while maintaining the sensor in position.
11. If the red laser point is not on the tool's hole, begin from step 7.
12. Perform a new calibration (refer to § 9.6).



**Figure 8-16. Mast Sensor Setting Tool Location**

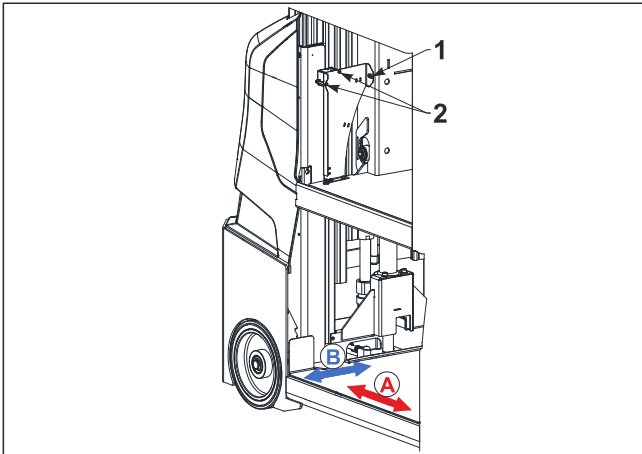


Figure 8-17. Mast Sensor Setting

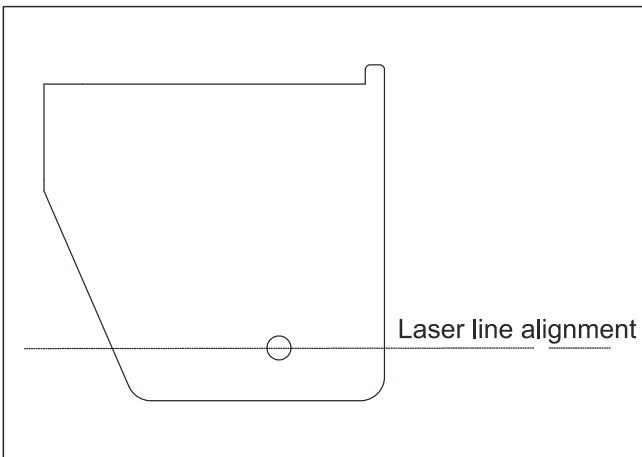


Figure 8-18. Mast Sensor Laser Alignment

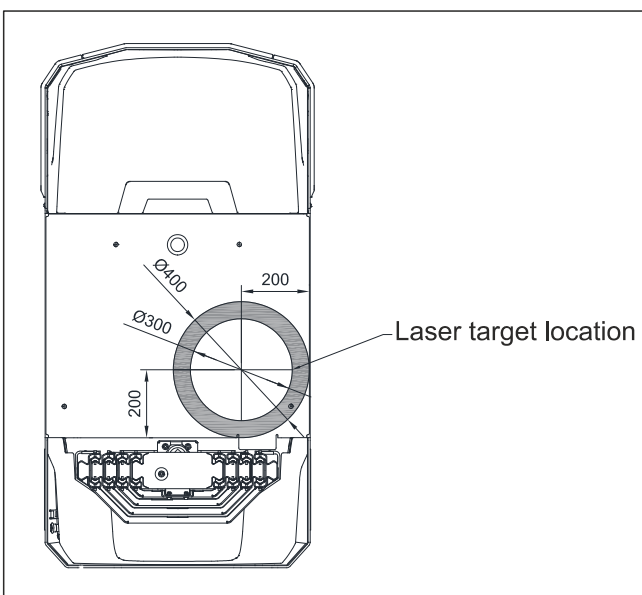


Figure 8-19. Mast Sensor Target

### Mast Sensor Setting Verification

Laser pointing shall be located into the  $\text{Ø}300\text{mm}$  target when platform is fully elevated. If laser pointing is located into the  $\text{Ø}400\text{mm}$  disc or over, perform a new mechanical mast sensor setting.

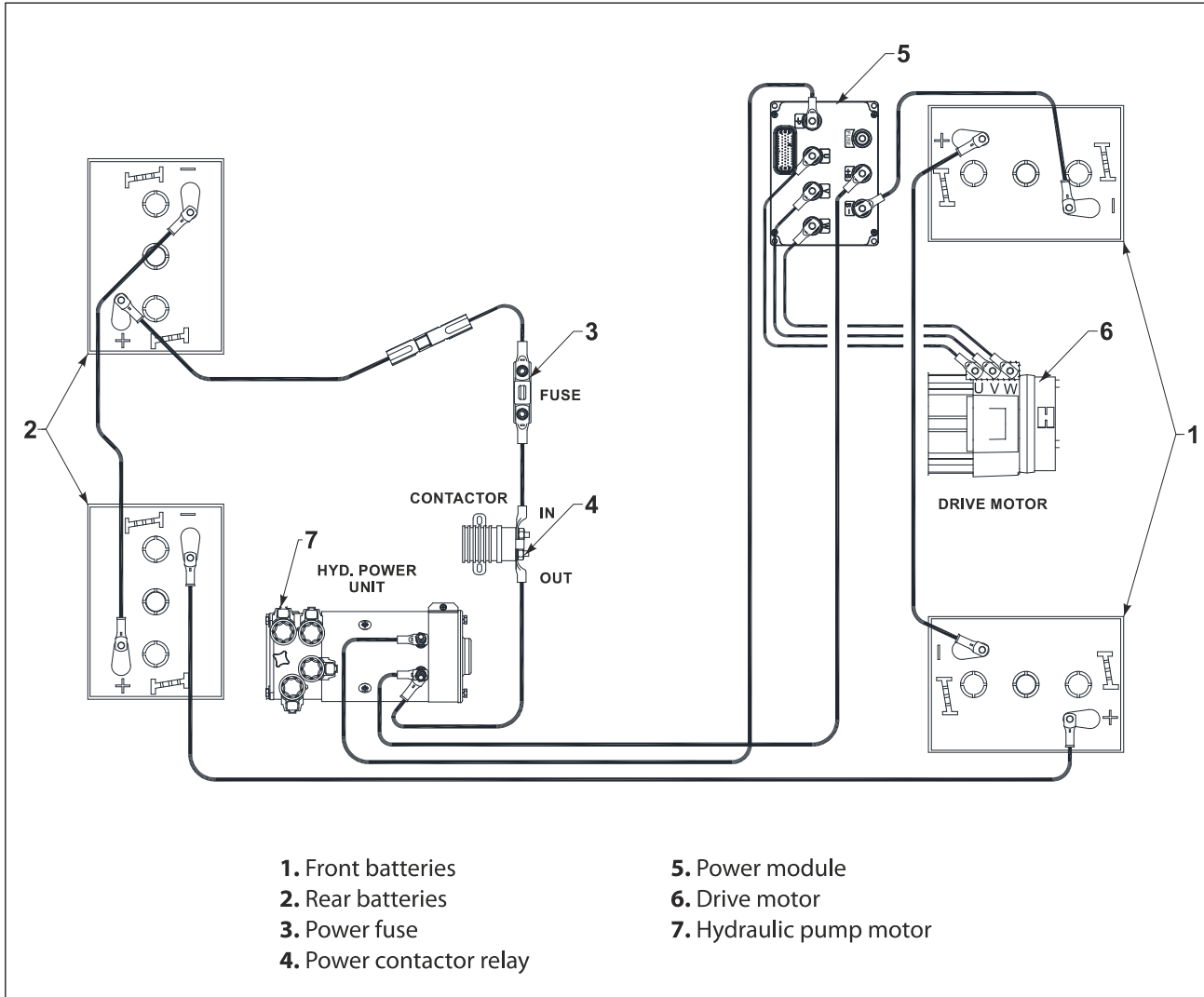
### Mast Sensor Calibration Verification

Display Analyzer monitors platform height and voltage in live.

1. Enter Diagnostics > Inputs > Mast Sensor.
2. Low the platform until the lower end. It should be displayed 0.20m (0.66ft).
3. Lift the platform around 1m (3.3ft).
4. Measure the platform height using a tape measure.
5. The error between display value and measured value shall not exceed 5cm (2in). If the error is over the limits, perform a new calibration.

**8.3 TRACTION SYSTEM**

Refer to Section 3 TRACTION – Theory of Operation for more detailed information on Traction System.



**Figure 8-20. Cable Wiring**

8.4 POWER MODULE

Power Module

The Power Module contains the machine software and controls the drive motor. It communicates modules' data such as Ground Module, Platform Control Module and Display, Power Tray Module... The connector pin #1 is energized at power-up.

Power Module is located at the front of the machine, it can be accessed by removing frame cover refer to Power Module Location

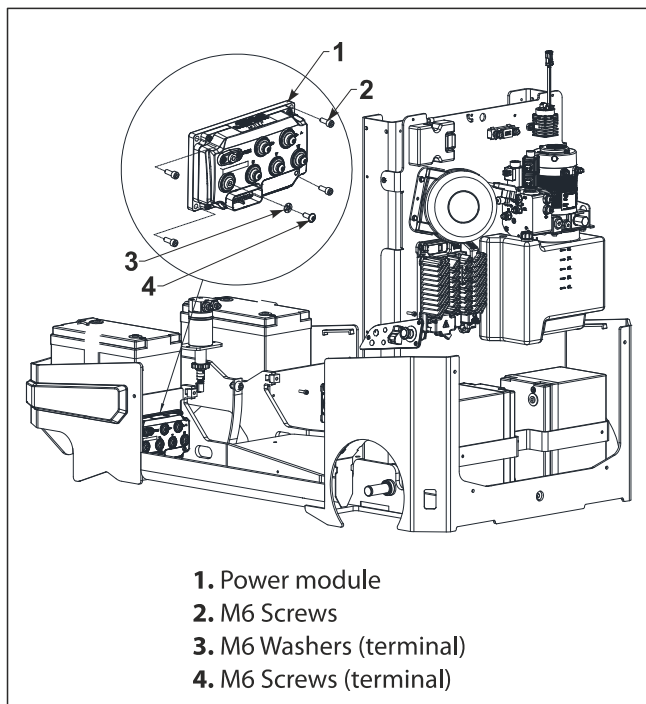


Figure 8-21. Power Module Location

**CAUTION**

PRIOR TO ANYSERVICING OPERATION ON POWER MODULES, DISCONNECT BATTERY PLUG.  
AFTER MACHINE OPERATION, EVEN WITH THE POWER TURNED OFF AND THE BATTERY DISCONNECTED, INTERNAL CAPACITORS OF THE POWER MODULES MAY REMAIN CHARGED FOR SOMETIMES. REFER TO THE FOLLOWING PROCEDURE TO DISCHARGE THOSE CAPACITORS.

Installation:

**NOTE:** Power module shown as installed on the machine (AMP connector Downward).

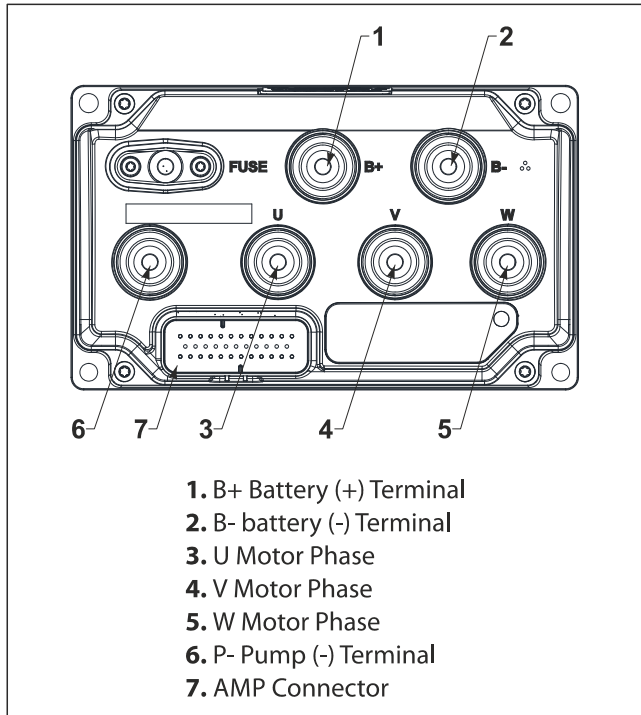


Figure 8-22. Power Module Terminals Connections

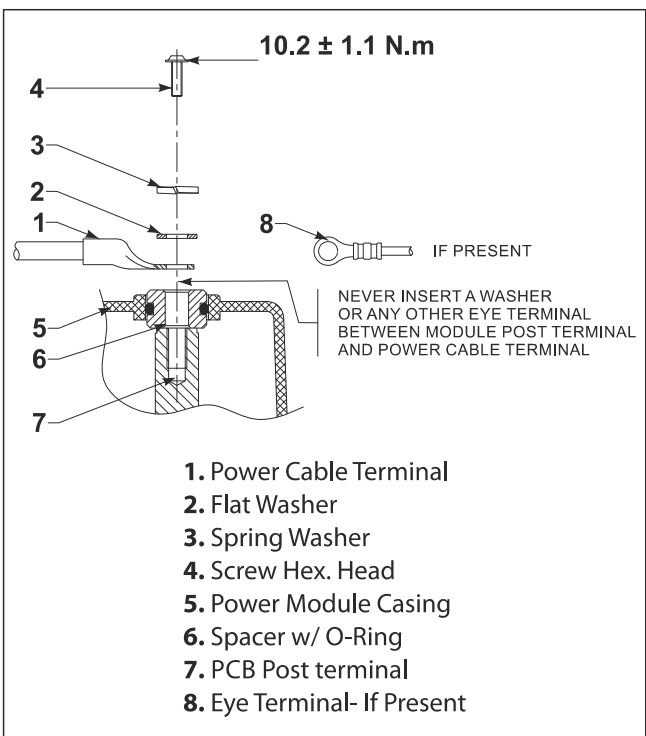


Figure 8-23. Cables on Power Module

**Power Module Inputs / Outputs List:**

Pin#	Function	Type	
1	Key Switch	Power (+)	
2	Load Holding Valve	Output	
3	Beacon Control	PWM	IN
4	Horn Signal	PWM	OUT
5	Electro Brake Driver	PWM	OUT
6	Main Line Contactor Coil	PWM	OUT
7	Tilt Sensor Ground	PWM	OUT
8	Drive Motor Temperature	PWM	OUT
9	Tilt Angle Signal X-Axis	Power	OUT
10	Overload Switch – NC Contact	Analog	IN
11	Left Obstacle Detection Sensor	Analog	IN
12	Unused	Digital	IN
13	Valve Coil Power Supply	Digital	IN
14	Unused		
15	Unused	Power	OUT
16	Wheel Angle Position Sensor		
17	Unused		
18	Drive Sensor Ground	Analog	IN

**Table 8-9. Inputs Characteristics**

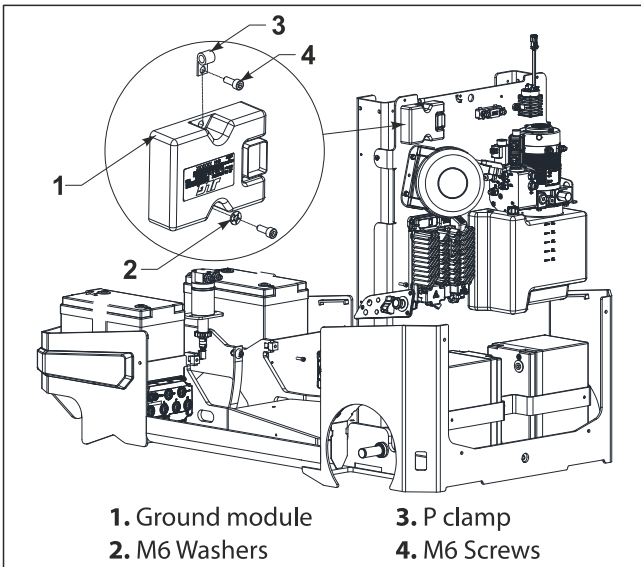
Pin#	Function	Type	
19	Unused		
20	Unused		
21	Jumper CAN1 Termination High	Digital	Com
22	Right Obstacle Detection Sensor	Digital	IN
23	CAN1 High	Digital	Com
24	Tilt Angle Signal Y-axis	Analog	IN
25	Encoder Power Supply	Power	OUT
26	Sensor Power Supply	Power	OUT
27	Charger Interlock Switch	Digital	IN
28	CAN2 High	Digital	Com
29	CAN2 Low	Digital	Com
30	Unused		
31	Motor Encoder Phase A	Digital	IN
32	Motor Encoder Phase B	Digital	IN
33	Platform EMS - NO Contact	Digital	IN
34	Jumper CAN1 Termination Low	Digital	Com
35	CAN1 Low	Digital	Com

**Table 8-10. Outputs Characteristics**

## SECTION 8 - CONTROL COMPONENTS

### 8.5 GROUND MODULE

Ground Module is located at the rear of the machine, it can be accessed by removing rear cover refer to Figure 8-22.



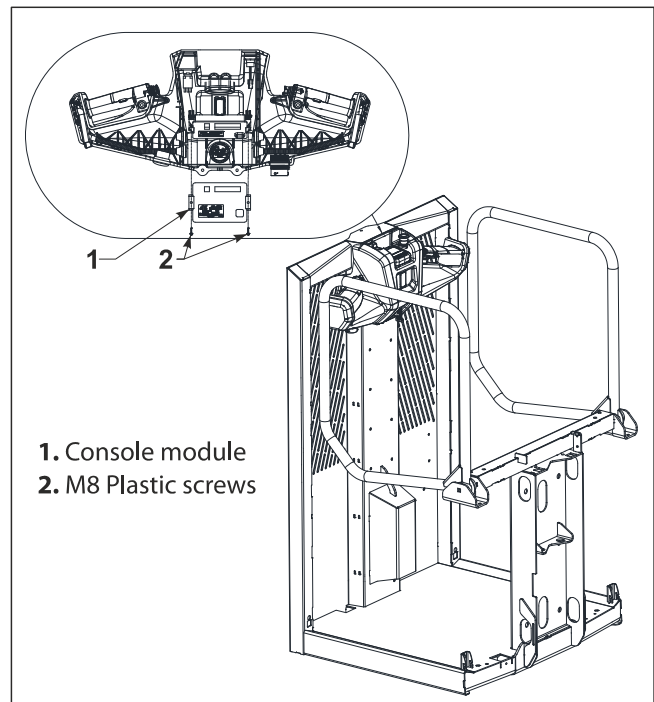
**Figure 8-24. Ground Module Location**

#### Ground Module Inputs / Outputs List:

Pin#	Function	Type	
1	Module Ground	Power	IN
2	Unused		
3	KeySwitchc	Power	IN
4	CAN1 L	Digital	Com
5	CAN1 H	Digital	Com
6	Mast Lift UP Switch	Analog	IN
7	Mast Lift DN Switch	Analog	IN
8	Platform Controls Selection Switch	Analog	IN
9	Steer Left Prop Valve Solenoid	PWM	OUT
10	Ground Control Selection Switch	Digital	IN
11	Overload Indication Light	PWM	OUT
12	Mast Lift UP Valve Solenoid	Digital	OUT
13	Manual Brake Release Switch	Digital	IN
14	Steer Right Prop Valve Solenoid	PWM	OUT

**Table 8-11. Outputs Characteristics**

### 8.6 PLATFORM CONSOLE MODULE



**Figure 8-25. Platform Console Module**

#### Platform Console Module Inputs / Outputs List:

Pin#	Function	Type	
1	Key Switch	Power	
2	Beacon Control	PWM	3A
3	Mast Lift UP Switch	Digital	
4	Mast Lift DN Switch	Digital	
5	Left Gate Switch	Digital	
6	Right Gate Switch	Digital	
7	Overload Switch – NO Contact	Digital	
8	Platform EMS – NO contact	Digital	
9	Steering Joystick	Analog	0.5-4.5V
10	Unused	Analog	0-15V
11	CAN1 H	Digital	
12	Joystick Power Supply	Power	5V
13	Module Ground	Power	
14	Unused	PWM	1A
15	Tray Level DN	Digital	

**Table 8-12. Inputs Characteristics**

Pin#	Function	Type	
16	Horn Switch	Digital	
17	Right Hand Presence Detection Switch	Digital	
18	Tray Level UP	Digital	
19	Left Hand Presence Detection Switch	Digital	
20	Drive Joystick	Analog	0.5 - 4.5V
21	Mast Elevation Sensor	Analog	0 - 15V
22	Unused	Analog	0 - 15V
23	CAN1 L	Digital	
24	Joystick Ground	Power	

Table 8-12. Inputs Characteristics

## 8.7 GROUND CONSOLE STATION

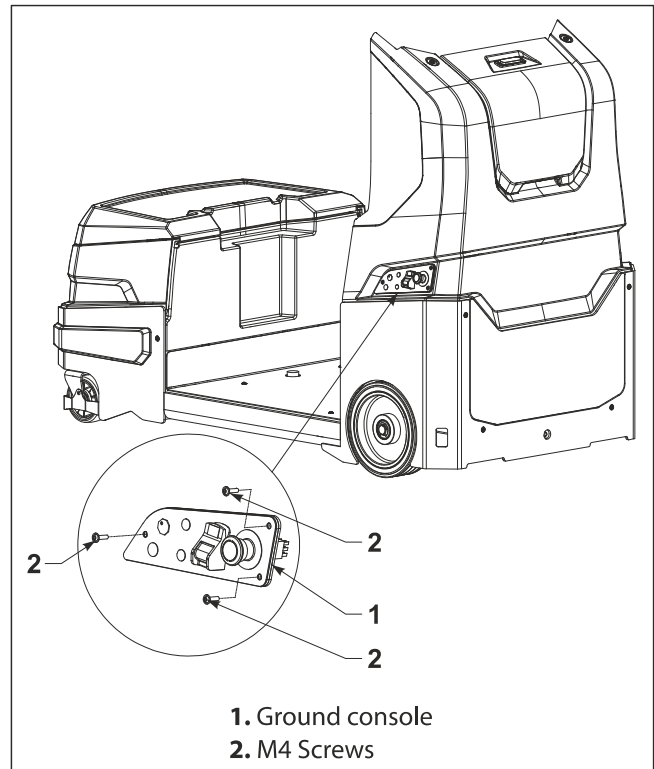


Figure 8-26. Ground Console Module

### Electrical Evaluation

The membrane panel integrates two functions:

- Indicator LED: this is surface mount components with standard LED characteristics.
- Push buttons: each push button is a SPST (Single Pole Single Throw) switch; switch ON = 20 to 40  $\Omega$  (circuit impedance measured on the ribbon connector).

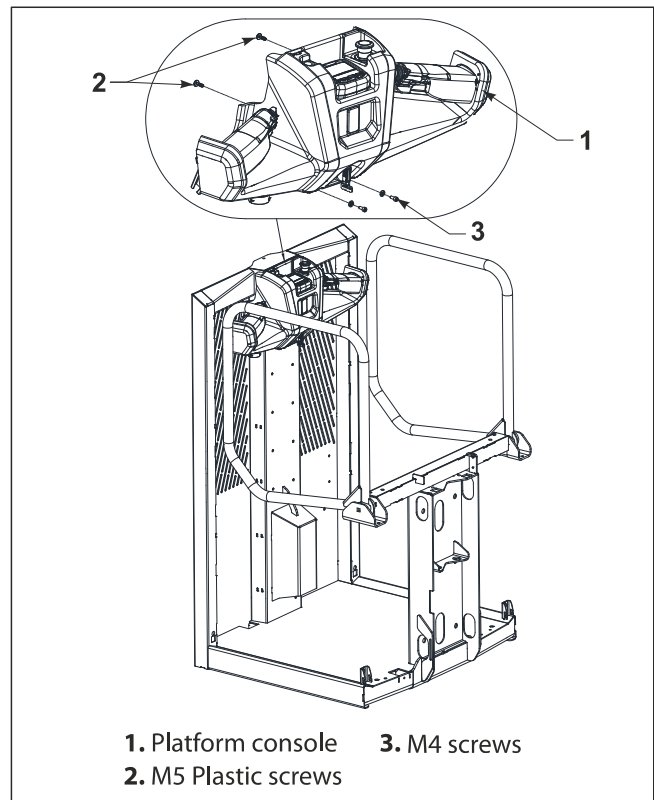
### Membrane Panel Replacement

1. Turn machine power down and disconnect battery plug.
2. Remove the control box panel assembly. Unplug both the ribbon cable and the connector.
3. Remove the following elements from the panel assembly: E-Stop and Panel Selector Button.
4. Cut the collar that maintain ribbon cable.
5. Peel the membrane panel.
6. Clean the black plate surface from glue residues.
7. Install the new membrane panel on the back plate, considering the following:
  - Insert the ribbon cable into the plate slot.

## SECTION 8 - CONTROL COMPONENTS

- Adjust the membrane panel position to align the other cut out on the corresponding holes on the back plate.
8. Re-install the components on the panel, re-connect the connectors, maintain the ribbon cable using a collar and re-install the panel assembly.

### 8.8 PLATFORM CONSOLE STATION



**Figure 8-27. Platform Station Assembly**

#### Replacement

1. Turn the machine power down and disconnect battery plug.
2. Disconnect the round connector.
3. Remove the control box.

#### 8.8.1 Drive & Steer Joysticks

Two single axis mini-joysticks are used for the Drive and Steer functions. They both have the same characteristics.

##### Electrical Characteristics:

Output voltage range: 0.5V – 4.5V.

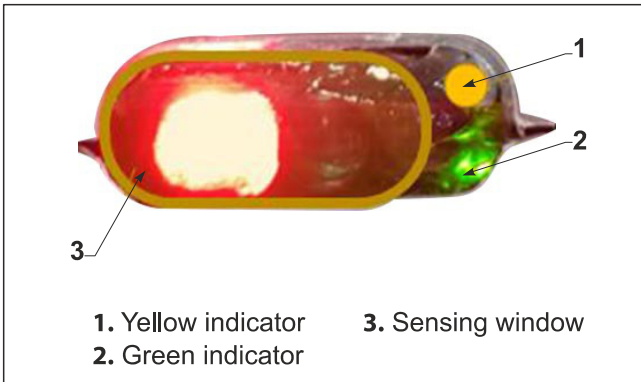
Pin#	Wire Color	Function
1	Blue	Output (0.5V – 4.5V)
2	Red	Supply (+5V)
3	Black	N/A
4	N/A	N/A

**Table 8-13. Joysticks Connections**

### 8.8.2 Right & Left Presence Detection:

Operator Presence Detection is achieved by red light triangulation sensors installed inside each handle.

The status of each handle is visible with embedded light indicators:



Indicator	Indicator's state	
	Solid ON	Flashing
Green	Sensor is Powered	Output Short Circuit
Yellow	Detection	-

Table 8-14. Presence Detection Sensor Status

#### Electrical Characteristics:

Pin #	Function	Voltage No Detection	Voltage If Detection
1	Output	0V	Vbatt-1.5V to Vbatt
2	N/A		N/A
3	Power (-)		Supply (0V)
4	Power (+)		+Vbatt

Table 8-15. Electrical Characteristics

#### Troubleshooting Help

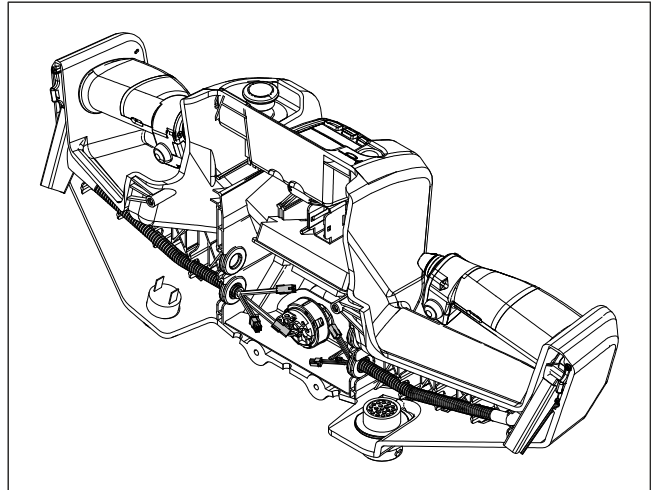
External fault causes and effects

- Contamination on sensor lens (moisture, dust, grease ..):
  - DTC229 at machine power up
  - No handle detection

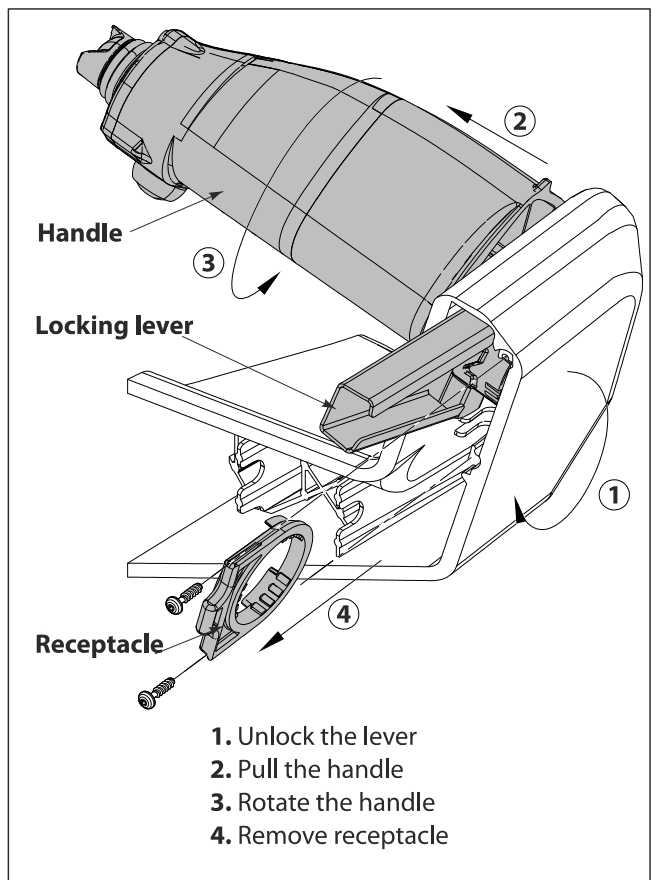
**NOTE:** The presence detection sensor is an optical device, as such it is sensitive to any form of contamination on the lens. Clean sensor lens after installation.

### 8.8.3 Control Handle Opening & Replacement

1. Remove platform control station (refer to §6.3.3 with figure 6-11. Platform station removal). Disconnect the 3 connectors.

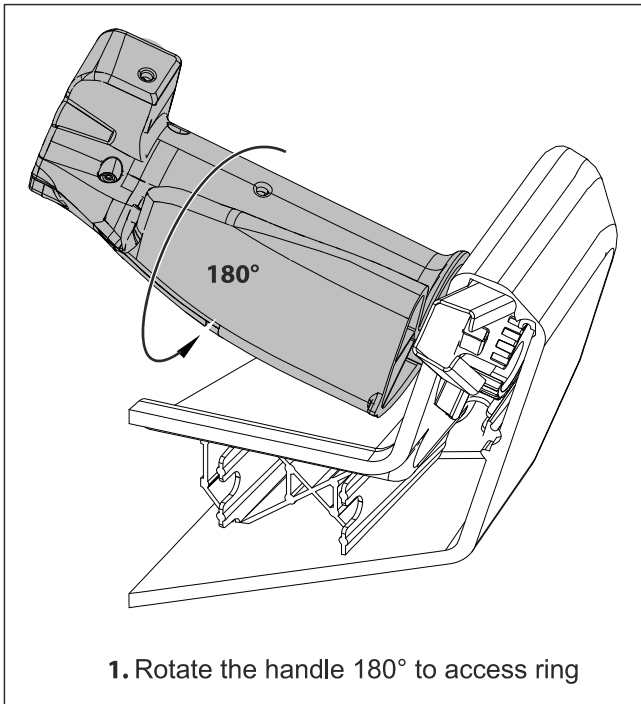


2. Unlock the locking lever and unscrew both screws maintaining the receptacle. Remove the receptacle on platform control station located at the rear of the handle by pulling on the handle.

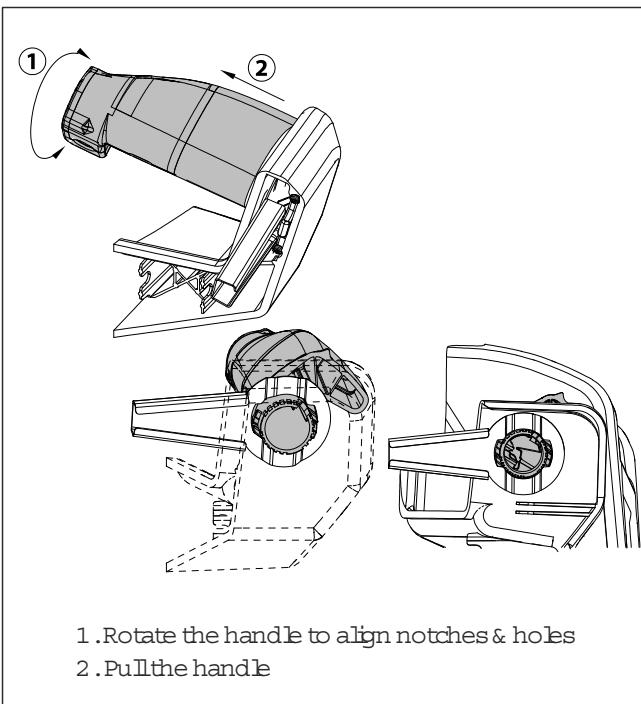


## SECTION 8 - CONTROL COMPONENTS

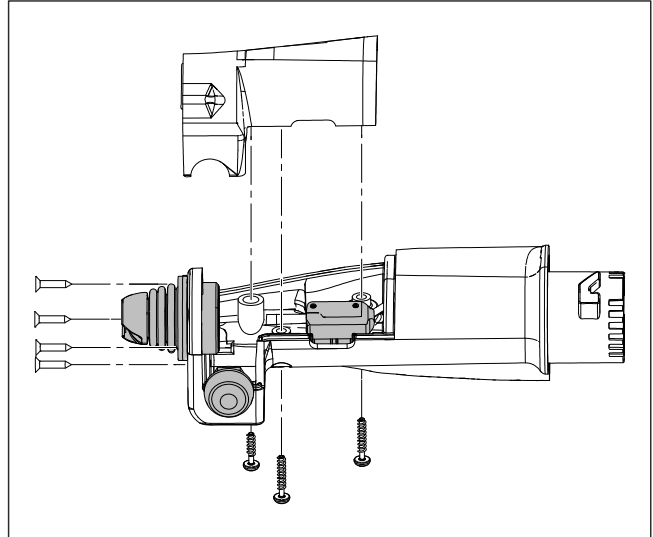
3. IF NOT EQUIPPED WITH, GO TO THE NEXT STEP.  
Rotate the handle 180° counterclockwise direction, to access the slot hole.  
Remove steel ring using needle-nose pliers to help passing on the slot hole.



4. To remove the handle: rotate it in order to have hole and notches aligned. Then, pull it.

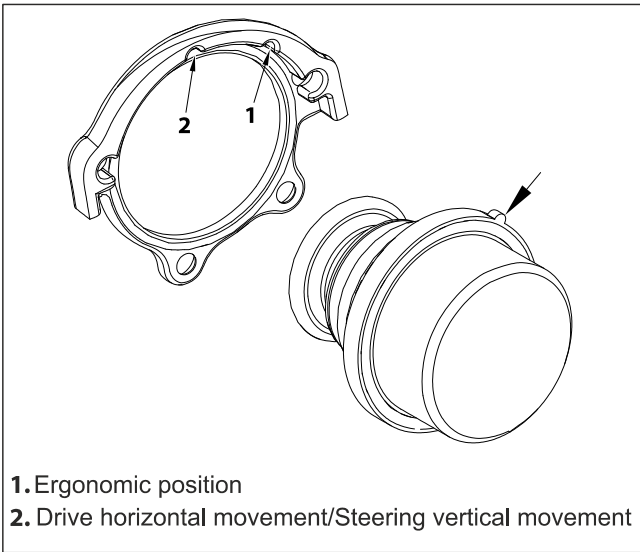


5. Unscrew the 4 Philips screws securing the joystick at the end of the handle and unscrew the 3 Torx screws to open the handle cover and access the buttons and the sensor.

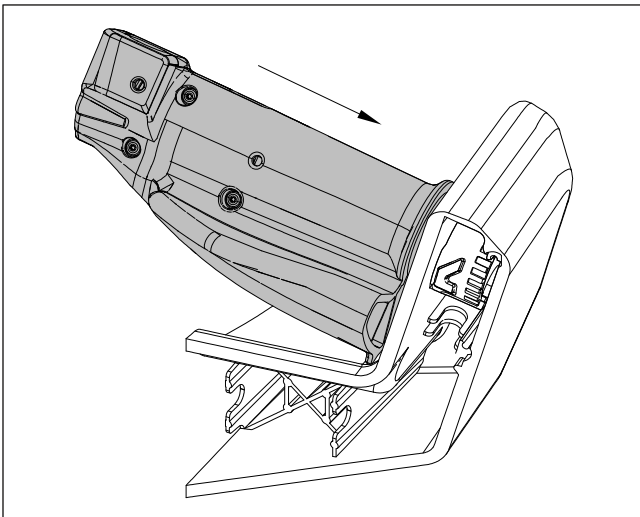


6. Locate the connector corresponding to the harness to be changed:
- Connector 4 pins 3 colored wires for the Joystick.
  - Connector 4 pins 3 white wires for the mini optical sensor.
  - Connector 2 pins 2 white wires for the Push button.
7. Cut the wires near the connector, attach a wire 400mm mini to the old harness to allow a pull back with the new.
- Pull out the old harness and the back wire until it is just out of the sheath.
  - Attach the new harness to the back wire pull it into the sheath until it is in place.
  - Connect the connector included in the plastic bag following the drawing on the decal of the bag.

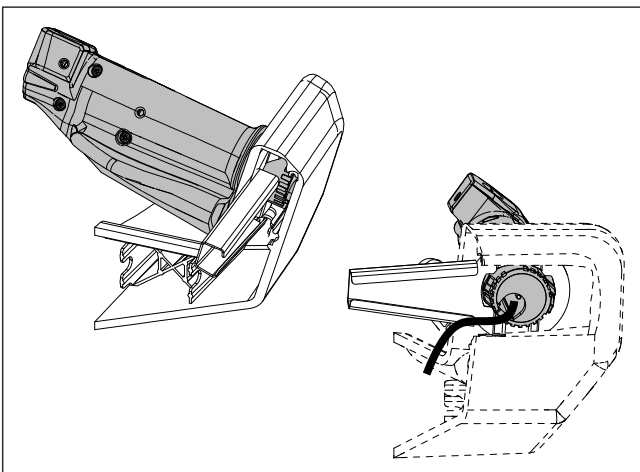
- 8.** For Joysticks install, there is an index around the base which must match with the notch into the clamp.



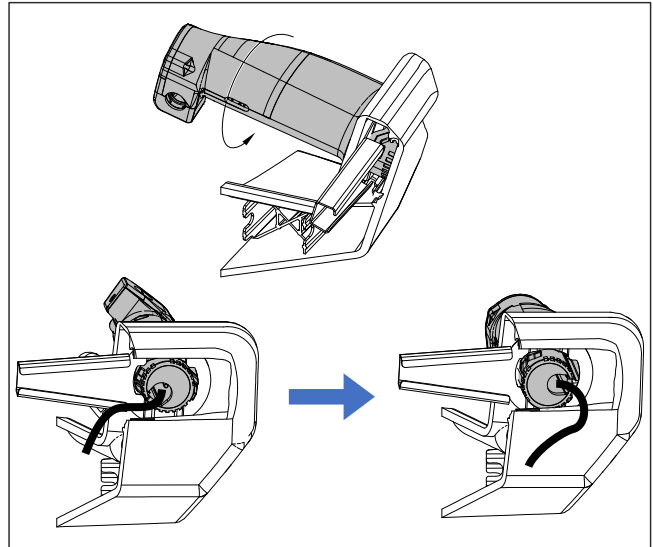
- 9.** Pass new handle's pins/lugs into the platform control station (slot hole towards the outside).



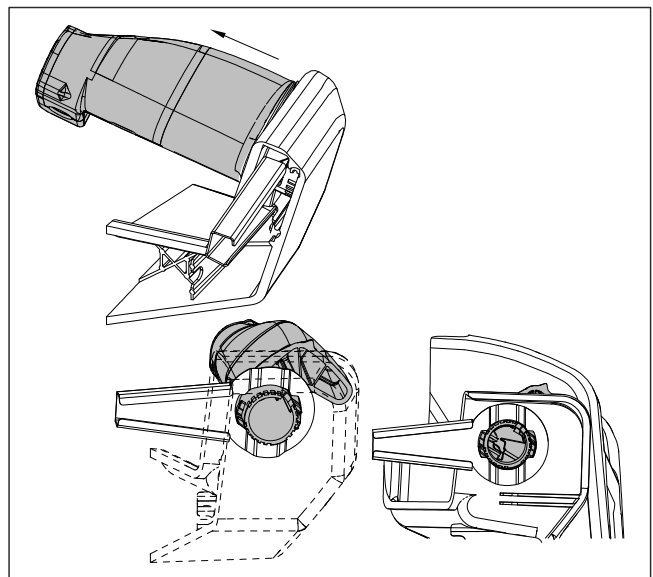
- 10.** Pass locking lever on pins/lugs and sheath in the handle slot hole.



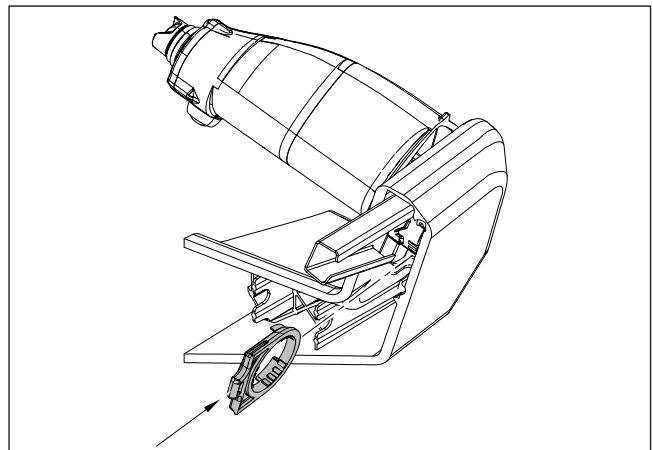
- 11.** Turn the handle half a turn to route the sheath underneath.



- 12.** Unlock and slightly pull the handle ensuring pins/lugs are aligned.



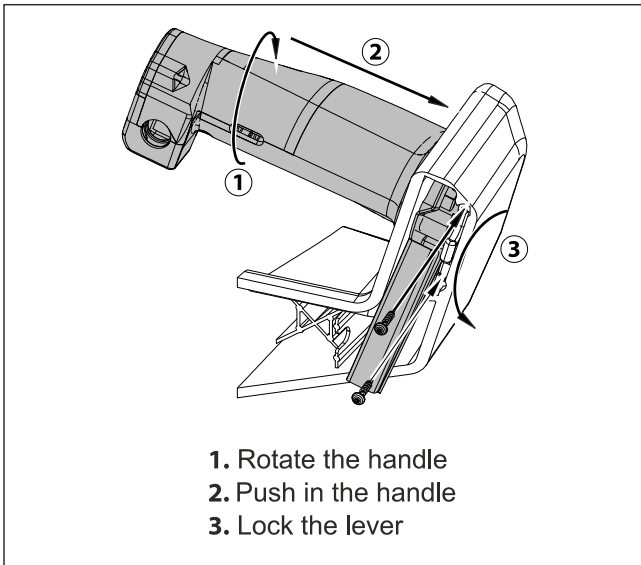
- 13.** Install the receptacle on the platform control station located at the rear of the handle.



## SECTION 8 - CONTROL COMPONENTS

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14. Lock the locking lever and secure screws to maintain the receptacle.



15. All internal connectors must be greased with ELECTROLUBE® type CTG.

### 8.8.4 Components Replacement on Main Control Station

For components replacement such as Emergency Switch, Horn Switch or Key Switch, use needle-nose pliers or socket and apply JELT® RED BLOCJELT after installation.

8.9 PLATFORM CONSOLE DISPLAY

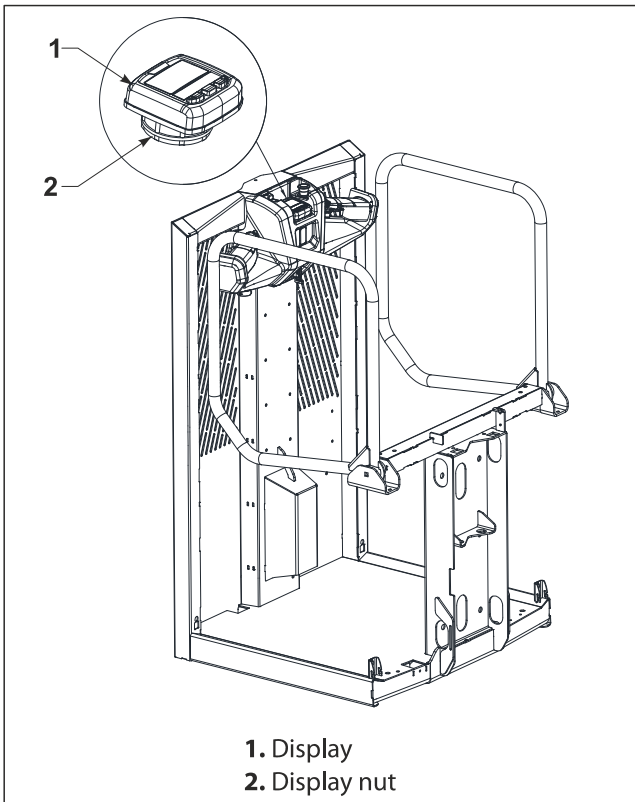


Figure 8-28. Platform Console Display Location

The platform console display module communicates with the power controller via Bus CAN. It serves as operator interface and service interface.

The display unit powers the platform console buzzer.

Electrical characteristics:

Pin#	Function	Voltage
1	Power(-)	0V
2	Power(+)	+Vbatt
3	CAN H	-
4	CAN L	-
5	Alarm output	Open circuit in the absence of alarm 0V in case of alarm
6	N/A	N/A

Table 8-16. Electrical Characteristics

8.10 TRAY MODULE

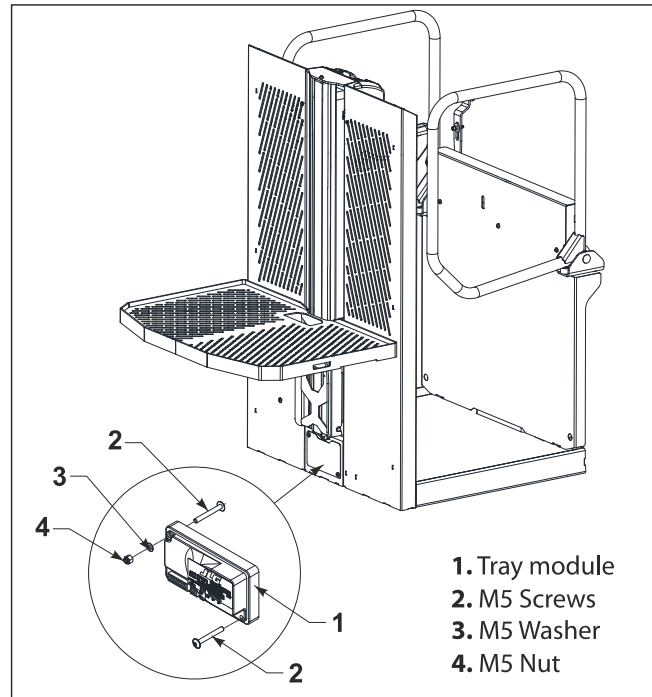


Figure 8-29. Tray Module Location

8.10.1 Tray Module Inputs/Outputs List:

Pin#	Function	Type	
1	Unused	-	-
2	Unused	-	-
3	Unused	-	-
4	EOS Hight	Digital	IN
5	Key Switch	Power	IN
6	EOS Low	Digital	IN
7	CAN1L	Digital	Com
8	Unused	-	-
9	Unused	-	-
10	Unused	-	-
11	Unused	-	-
12	Unused	-	-
13	CAN1H	Digital	Com
14	Unused	-	-

Table 8-17. Tray Module Inputs/Outputs List

## SECTION 8 - CONTROL COMPONENTS

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### 8.10.2 End Of Stroke Sensors:

#### Electrical characteristics:

**Table 8-18. Electrical Characteristics**

Color Wire	Function	Voltage No Detection	Voltage If Detection
BRN	Power (+)	0V	Vbatt-1.5V to Vbatt
BLK	Output	Supply (+5V)	
BLU	0V	Supply (0V)	

## SECTION 9. JLG CONTROL SYSTEM

### 9.1 SYSTEM ANALYZER

The Control System may be accessed by the onboard Analyzer, using the Platform Display.

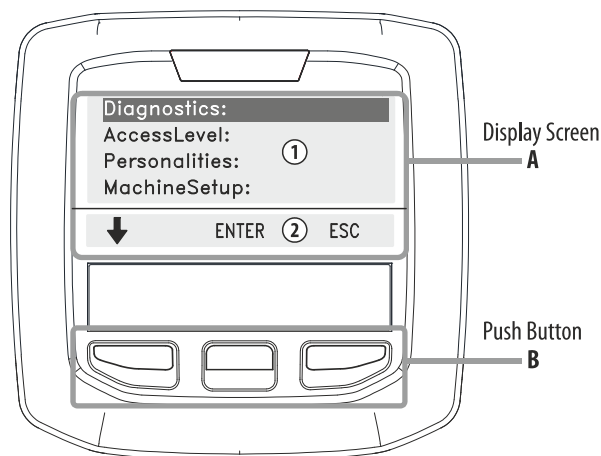
The Analyzer interface is accessed by pressing the center button of the display unit for more than 1 second.

The display is returned to the operator's interface by pressing ESC at the main menu level or in case of inactivity on the display buttons for more than 1 minute.

**NOTE:** Always cycle power after accessing the Analyzer interface.

The screen **(A)** is divided in two zones:

1. The top of the screen **(1)** (up to 4 lines) to display information and menus;
2. The bottom of the screen **(2)** (single line) to display the push button **(B)** functions:
  - a. Down arrow to scroll down menus or to decrement numerical values,
  - b. Up arrow to increment numerical values,
  - c. ENTER to enter sub-menu or to validate data entry,
  - d. ESC to exit sub-menu or to cancel data entry



**Figure 9-1. Analyzer**

#### Analyzer Menu Structure

There are five levels within the Analyzer menu structure and they are as follows:

1. **DIAGNOSTICS**  
This menu provides real-time status information about the control system as a diagnostic aid.
2. **ACCESS LEVEL**  
This menu allows the technician to navigate between access levels; Operator Access or Service Access. To enter the Service access level, a five-

digit code must be entered. Powering down returns the Analyzer to Operator Access.

#### 3. PERSONALITIES

This menu contains performance settings specific to the machine. These settings are necessary to maintain functions such as solenoid breakpoints and joystick engagement percentages and are organized in an outline format (see Table 9-7, Analyzer Personalities Menu). These settings can be modified in the Service access level.

#### 4. MACHINE SETUP

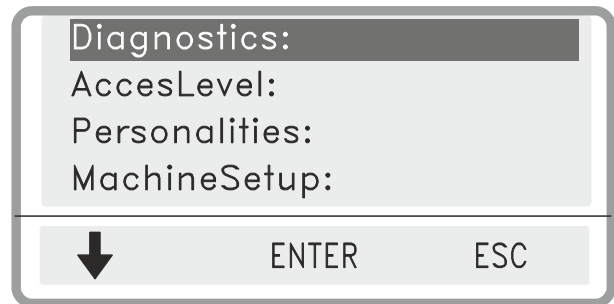
This menu contains machine configuration information for the JLG Control System. Selections in this menu can change interlock functionality and cause some Personality and Machine Setup entries to be visible or hidden. These settings can be modified in the Service access level.

#### 5. CALIBRATIONS

This menu allows the operator to interact with the sensors on the machine. These settings can be modified in the Service access level.

#### Using the Analyzer

With the machine power on, depress the center button of the platform display unit and the display screen will display the following:



**Figure 9-2. Analyzer, Top Level Menu**

The top level menus are as follows:

#### DIAGNOSTICS

#### OPERATOR ACCESS

#### PERSONALITIES

#### MACHINE SETUP

#### CALIBRATIONS (Service Access only)

When a top level menu is selected, a new set of menu items may be offered: (for example):

#### DRIVE

#### STEER

#### MAST

.....

.....

Pressing **ENTER** with any of the above displayed menus, will display additional submenus within the selected menu. In some cases, such as **DRIVE**, the next level is the parameter or information to be changed. Refer to the flow chart for what menus are available within the top level menus. You may only view the personality settings for selected menus while in Operator Access level. Remember, you may always cancel a selected menu item by pressing the **ESC** key.

### Access Level: Changing the Access Level of the Analyzer

---

Each time the Analyzer is accessed, you will be in Operator Access level which enables you to only view most settings which cannot be changed until you enter a password to advance to a lower level. This ensures that a setting cannot be accidentally altered. To change the access level, the correct password must be entered. To enter the password, scroll to the **AccessLevel** level menu and press **ENTER**. The screen will display:

**Access Level**

— — — — —

Using the **UP** arrow key, enter the first digit of the password. Then, using the **ENTER** key, position the cursor to the right one dash to enter the second digit of the password. Proceed in the same way for the remaining digits. Use the **ENTER** key to enter the last digit and validate the password.

The access level should display the following, if the password was entered correctly:

**Access Level**

**Service**

Use the **ENTER** key to accept the access level and exit to the top level menu.

Repeat the above steps if the correct access level is not displayed or you can not adjust the personality settings.

**NOTE:** Password 33271 will give you Service Access, which will permit you to change machine personality settings and setup.

### Personalities: Adjusting Parameters

---

Once you have gained Service Access, and a personality item is selected, press the UP and Down arrow keys to adjust its value, for example:

**Drive: Mode1 :MaxSpeed**

**100%**

Use **ENTER** key when the adjustment of the value is completed. Use **ENTER** key on the confirmation screen to validate the modification, hit **ESC** key to ignore the modification.

There will be a minimum and maximum for the value to ensure efficient operation. The Value will not increase if the **UP** arrow is pressed when at the maximum value nor will the value decrease if the **DOWN** arrow is pressed and the value is at the minimum value for any particular personality. If the value does not change when pressing the up and down arrow, check the access level to ensure you are at Service Access.

### Machine Setup

---

When a machine item is selected, the Analyzer displays its value. Press the **ENTER** key to show the list of available values; then use the **DOWN** arrow key to adjust its value. The selected value is highlighted. For example:

**Ground Alarm:**

**NO**

**DRIVE**

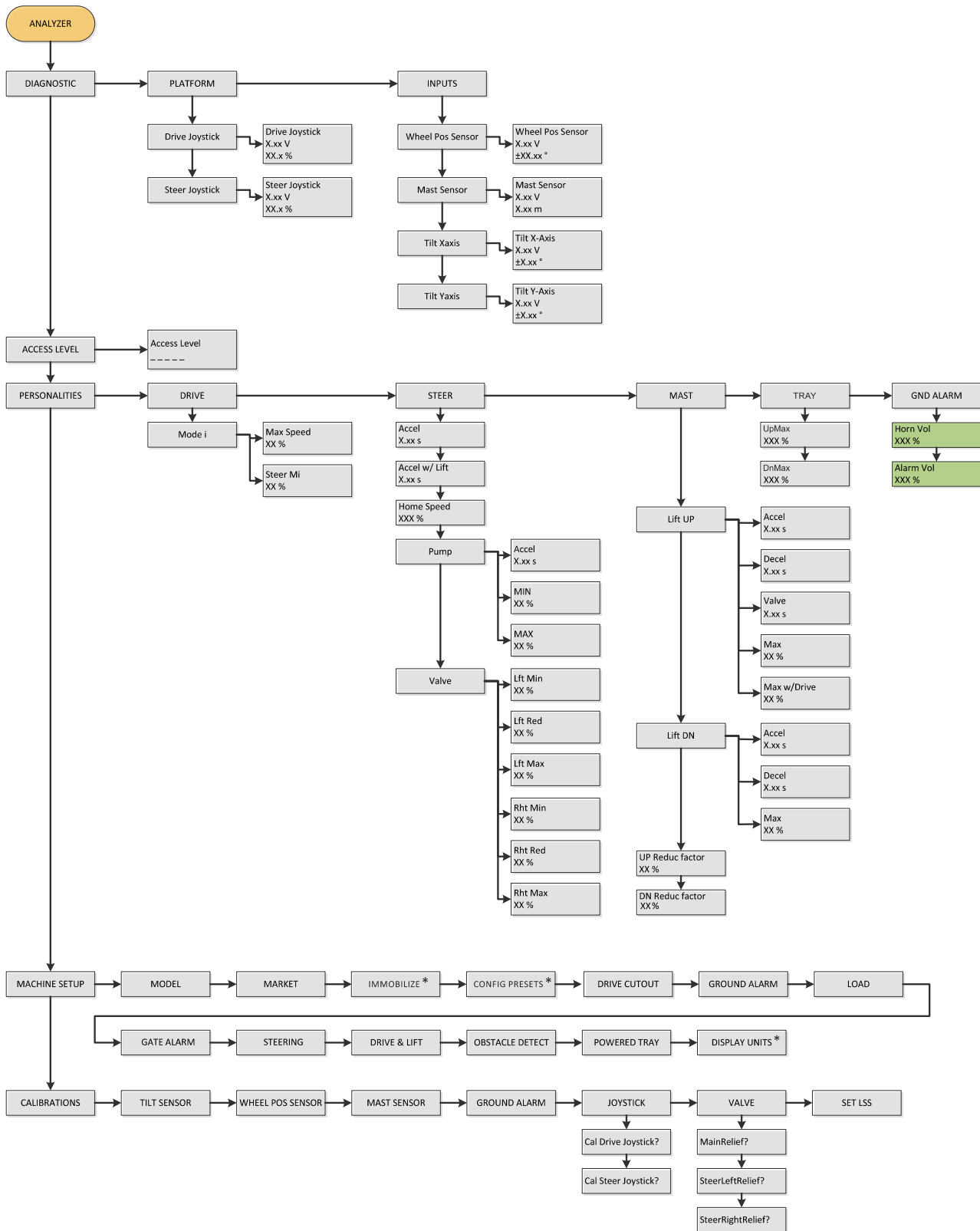
**DESCENT**

The above display would be selected if the machine was equipped with a ground alarm and you wanted it to sound when driving. Use the **ENTER** key to validate your choice. There are certain settings allowed to install optional features or select the machine model.

When selecting machine model ??? before the selection of the model that match the type of the machine, the personality settings will all default to the factory recommended settings.

**NOTE:** Refer to Table 9-1, Machine Personality Adjustments for the recommended factory settings.

9.2 ANALYZER SCREEN LAYOUT



\* IMMOBILIZE and CONFIG PRESETS integrated at P1.1 update.  
 DISPLAYS UNITS not present since P1.1 update.

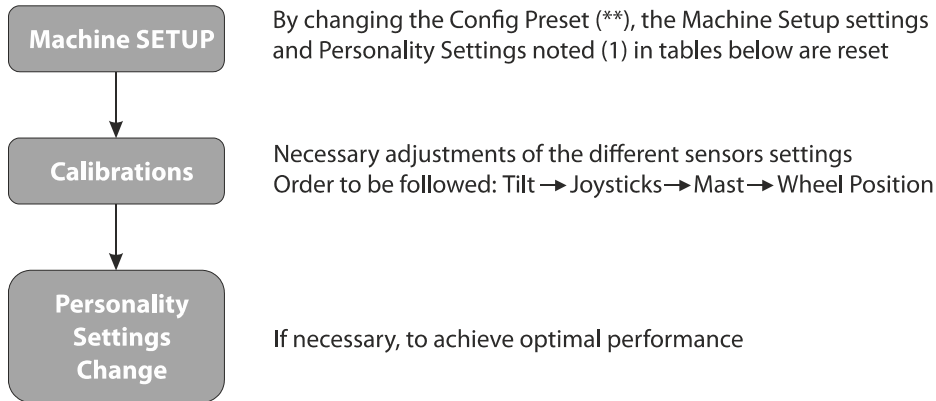
Figure 9-3. Analyzer Flow Chart

**9.3 MACHINE SETUP PROGRAMMING INFORMATION**

WHEN INSTALLING A NEW POWER MODULE CONTROLLER ON THE MACHINE, IT WILL BE NECESSARY TO PROGRAM THE CONTROLLER FOR THE PROPER MACHINE CONFIGURATION, INCLUDING OPTIONS.

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 50 BAR (750 PSI) AT A MINIMUM DISTANCE OF 30CM (12 INCHES) 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 following logic shall be followed:



Shaded entries are not available for the selected market.

Configuration Digit	Setting Range	Description	Default Number
MODEL NUMBER 1	0 1 2 3	??? DSPS (DSPiS) DSPM (DSPiM) DSP L	0
MARKET 2	0 1 2 3 4	CE ANSI USA ANSI EXPORT CSA AUSTRALIA	0
IMMOBILIZE** 3	0 1	YES = 4 digits code to be entered at machine power-up NO = No code at power-up	0
CONFIG PRESETS** 4	0 1	STANDARD PRESET 1	0
DRIVE CUTOUT 3-5***	0 1	0 = NO - Drive NOT PREVENTED while elevated 1 = YES - Drive Prevented while elevated	0
STEERING 3-6***(1)	0 1	STANDARD SELF CENTER - Automated return in center position of the steering wheel	0
DRIVE & LIFT 4-7***(1)	0 1	NO YES	0

Table 9-1. Machine Setup Programming Information

Configuration Digit	Setting Range	Description	Default Number
LOAD 5-8***	1  2	1=CUTOUT PLATFORM – Load sensing system (LSS) is fitted, and Platform Controls are prevented in the event of an overload. Ground Controls remain functional. 2=CUTOUT ALL – Load sensing system (LSS) is fitted. Platform and Ground Controls are prevented in the event of an overload.	2
* Certain market selection will limit load sensing options or alter default setting.			
GROUND ALARM 6-9***(1)	0 1 2 3	0=NO 1=DRIVE - Vehicle alarm will function during drive. 2=DECENT - Vehicle alarm will function during lift down motions. 3=MOTION - Vehicle alarm will function during drive and all motions.	0
GATE ALARM 7-10***(1)	0 1	0=NO 1=YES – Vehicle alarm will function if gate is opened or toe board detection is active when platform is elevated.	1
OBSTACLE DETECTION 8-11***	0 1	0=NO - Standard frame cover fitted to the vehicle. 1=YES - Sensitive frame cover is fitted to the vehicle. In the event of device actuation, all motion is prevented from platform controls.	0
POWERED TRAY 9-12***	0 1	0=NOT INSTALLED - Manual tray is fitted to the platform. 1=INSTALLED - Powered tray is fitted to the platform.	0
DISPLAY UNITS 10-13***	0 1	0=METRIC 1=IMPERIAL	0
* Certain market selection will limit load sensing options or alter default setting. ** IMMOBILIZE and CONFIG PRESETS integrated at P1.1 update. DISPLAY UNITS not present at P1.1 update. *** Software version will alter config digit.			

**Table 9-1. Machine Setup Programming Information**

(1): Standard values. Values are reset by selecting a preset. See Table 9.8 for Preset Configurations.

**9.4 CALIBRATION INSTRUCTIONS**

All calibration procedures are menu driven through the use of the onboard JLG analyzer. The user is prompted to exercise the machine in a specific order to use the machines physical properties to consistently establish sensor response and the interaction of valves, pump and motors.

The chart below lists the calibrations required and potential reasons for re-calibration.

**NOTE:** *If the system is reset (by changing the machine model), the steer sensor, the joysticks and the pressure relief valve must be re-calibrated.*

Calibration Procedure	Reasons for Re-calibration
Tilt Sensor	Power module replacement Sensor removal or replacement System parameters reset Tilt readings inaccuracy
Mast Sensor	Power module replacement Platform module replacement Platform console replacement Sensor removal or replacement System parameters reset Platform height readings inaccuracy
Wheel Position Sensor (includes steering valve calibration)	Power module replacement Wheel position sensor removal or replacement Steering motor assembly removal or replacement Steering valve / hydraulic manifold or power-pack replacement Drive speeds out of tolerances
Joysticks	Power module replacement Joysticks replacement Platform console inoperative
Relief Valves	Pressure relief valve replacement Hydraulic manifold or powerpack replacement Movement speeds out of range low

**9.5 CALIBRATING TILT SENSOR**

1. Pull out both Platform and Ground Emergency Stop switches.
2. Turn keyswitch ON.
3. Position the machine on flat level ground.
4. Ensure the ground is level ( $\pm 0.1^\circ$ ), using a spirit level (digital display), both longitudinally and transversely.
5. Ensure the mast is fully retracted.
6. Enter Service Access and scroll to the CALIBRATION/TILT SENSOR screen.
7. Hit ENTER to calibrate the tilt sensor.
8. Calibration is automatically completed within 2s to 3s.

Should the calibration fail, diagnose and repair per table below.

Message	Probable Cause	Remedy
CAL FAILED	Communication problem between systems	1. Restart calibration 2. Inspect & repair CAN cables and connections
CAL FAILED: SENSOR FAULT	Vehicle is moving	Perform calibration on even ground
	Sensor is faulty	Change tilt sensor
	Poor connections	Inspect & repair sensor cable and connections
CAL FAILED: OUT OF LEVEL	Vehicle is out of level	Perform calibration on level ground
	Sensor is tilted	Inspect & fix sensor set-up (tolerance $\pm 3^\circ$ )

**Table 9-2. Tilt Sensor Calibration Faults**

9. Check that the tilt sensor is properly calibrated (refer to Section 8-2).

**9.6 CALIBRATING MAST SENSOR**

**NOTE:** Refer to Section 8-2-10 for proper sensor installation.

1. Pull out both Platform and Ground Emergency Stop switches.
2. Turn keyswitch ON.
3. Position the machine on flat level ground.
4. Ensure that overhead room is sufficient to elevate the platform to full height.
5. Enter Service Access and scroll to the CALIBRATION/MAST SENSOR screen.
6. Hit ENTER to calibrate the mast sensor.
7. Follow display instructions:
  - a. PERFORM MAST LIFT DOWN: perform mast lift down from Platform controls until the next instruction appears;
  - b. EXIT PLATFORM. FROM GROUND STATION: PERFORM MAST LIFT UP TILL STOP: exit the platform, close the door and raise the mast from the Ground controls until the buzzer sounds and the platform beacon flashes indicating process completion (platform will need to be fully elevated)
  - c. After the sound and light indications, fully lower the mast from the Ground controls; check the end of calibration message.

Should the calibration fail, diagnose and repair per table below.

Message	Probable Cause	Remedy
CAL FAILED	Communication problem between systems	1. Restart calibration 2. Inspect & repair CAN cables and connections Inspect & fix sensor set-up.
	Partial mast elevation	Ensure top and bottom positions of the platform are reached during the process
C/F: TILT NOT CALIBRATED	Tilt sensor has not been calibrated	Proceed to Tilt sensor calibration
CAL FAILED: OUT OF LEVEL	Vehicle is out of level	Perform calibration on level ground (tolerance $\pm 0.5^\circ$ )
C/F: TIME OUT	Time delay expired before required lift up/down functions are completed	Restart calibration Inspect & fix sensor set-up.
CAL FAILED SENSOR FAULT:	Sensor beam is not pointing chassis cover	Inspect & fix sensor set-up.
	Sensor is faulty	Change mast sensor
	Poor connections	Inspect & repair sensor cable and connections

**Table 9-3. Mast Sensor Calibration Faults**

9. Check that the mast sensor is properly calibrated (refer to Section 8-2).

**9.7 CALIBRATING WHEEL POSITION SENSOR**

**NOTE:** Refer to Section 4-3 for proper sensor installation.

1. Pull out both Platform and Ground Emergency Stop switches.
2. Turn keyswitch ON.
3. Position the machine on flat level ground.
4. Jack the driving wheel off the ground.
5. Enter Service Access and scroll to the CALIBRATION/WHEEL POSITION SENSOR screen.
6. Hit ENTER to calibrate the wheel position sensor.
7. Follow display instructions:



**WARNING**

**THE WHEEL WILL MOVE - ENTER:OK, ESC:ABORT.**

Acknowledge to start calibration. The wheel will steer automatically to the right, then to the left few times. Calibration is automatically completed within approximately 45s.

Should the calibration fail, diagnose and repair per table below.

Message	Probable Cause	Remedy
CAL FAILED	Communication problem between systems	1. Restart calibration 2. Inspect & repair CAN cables and connections
	Partial steer angle achieved	Clear the path of the wheel from objects Ensure steering gear is free of debris
	Sensor is not correctly set	Inspect & fix sensor set-up (Sensor center point $\pm 45^\circ$ shall align with wheel straight)
C/F: MAST NOT CALIBRATED	Mast sensor has not been calibrated	Proceed to Mast sensor calibration
C/F: OUT OF TRANSPORT	Vehicle is not in transport position	Perform calibration platform lowered (below 0.5m)
CAL FAILED: SENSOR FAULT	Steering wheel is on the ground	Jack the wheel off the ground and restart calibration
	Sensor is faulty	Change wheel position sensor
	Poor connections	Inspect & repair sensor cable and connections

**Table 9-4. Wheel Position Sensor Calibration Faults**

8. After calibration, proceed with a verification of homing function:
  - a. Set the driving wheel on the ground,

- b. Position the machine on a ground representative of the normal working surface (tarmac, concrete, tiles ...),
- c. Actuate homing function,
- d. If the wheel steers back and forth before stopping, decrease Home Speed percentage ( go to Personalities > Steer > HomeSpeed),
- e. If the wheel stops before reaching the center point, with the pump running, increase Home Speed percentage (go to Personalities > Steer > HomeSpeed).

**NOTE:** Off-center tolerance is about 5°.

**9.8 CALIBRATING THE JOYSTICKS**

- 9. Pull out both Platform and Ground Emergency Stop switches.
- 10. Turn keyswitch ON.
- 11. Enter Service Access and scroll to the CALIBRATION/JOYSTICKS screen.
- 12. Choose joystick to calibrate and Hit ENTER to calibrate the Drive Joystick (Steer Joystick).
- 13. Follow display instructions:  
Drive Joystick
  - a. FWD TO MAX: push the drive joystick forward and maintain steadily until next message;
  - b. CENTER: release joystick and wait for next step;
  - c. REV TO MAX: pull the joystick in reverse and maintain steadily until next message;
  - d. CENTER: release joystick.

Steer Joystick

- a. RHT TO MAX: push the steer joystick down (steer right command) and maintain steadily until next message;
- b. CENTER: release joystick and wait for next step;
- c. LFT TO MAX: pull the joystick up (steer left command) and maintain steadily until next message;
- d. CENTER: release joystick.

Should the calibration fail, diagnose and repair per table below.

Message	Probable Cause	Remedy
CAL FAILED	Communication problem between systems	1. Restart calibration 2. Inspect & repair CAN cables and connections
	Joystick is moved before required by the system	Ensure to maintain joystick position during each calibration step
	Poor connections	Inspect & repair joystick cable and connections
	Joystick is faulty	Replace joystick
CAL FAILED: JOYSTICK FAULTY	Play in the center (neutral) position is too important	Replace joystick
	Max position cannot be reached	Ensure free movement of the joystick
	Joystick is faulty	Replace joystick

**Table 9-5. Joysticks Calibration Faults**

**9.9 CALIBRATING THE MAIN RELIEF VALVE**

1. Pull out both Platform and Ground Emergency Stop switches.
2. Turn keyswitch ON.
3. Install a pressure gauge capable of measuring 20MPa at gauge port.
4. Enter Service Access and scroll to the CALIBRATION/VALVES/MAIN RELIEF screen.
5. Hit ENTER : the pump will run for 60s maximum to allow for pressure check and adjustment.
6. Adjust the Main relief until pressure is within tolerances specified in Table 9-6.
7. Press on ESC key to stop the pump when done (Acknowledge CAL FAILED -system indication- by pressing ENTER key).

**NOTE:** *Pressure Relief valve calibration process can be interrupted at any time by pressing ESC key or pushing on any of the Emergency stops.*

**9.10 CALIBRATING STEER RIGHT (LEFT) RELIEF VALVE**

1. Pull out both Platform and Ground Emergency Stop switches.
2. Turn keyswitch ON.
3. Install a pressure gauge capable of measuring 20MPa at gauge port.
4. Enter Service Access and scroll to the CALIBRATION/VALVES/STEER RIGHT RELIEF (STEER LEFT RELIEF) screen.
5. Hit ENTER: the pump will run for 60s maximum to allow for pressure check and adjustment.



**WHEEL IS FULLY STEERED TO THE RIGHT (LEFT) AS SOON AS PROCESS IS STARTED**

6. Adjust the STEER RIGHT (LEFT) relief until pressure is within tolerances specified in Table 9-6.
7. Press on ESC key to stop the pump when done (Acknowledge CAL FAILED -system indication- by pressing ENTER key).
8. Proceed with homing function to center the wheel.

**NOTE:** *Pressure Relief valve calibration process can be interrupted at any time by pressing ESC key or pushing on any of the Emergency stops.*

Relief Valve	Pressure Settings	
	DSP Series	
Main	11.5 – 13.5 MPa	1670 – 1960 psi
Steer Right	2.5 – 4.0 MPa	350 – 580 psi
Steer Left	2.5 – 4.0 MPa	350 – 580 psi

**Table 9-6. Pressure Settings**

**9.11 MACHINE PERSONALITY - ADJUSTMENT SETTINGS**

Personality settings adjustments shall be done when the system is idle (none of the power components, drive or pump motor, is running).

When battery or main controller is replaced see procedure below the table.

**Table 9-7. Machine Personality Adjustment**

FUNCTION	DESCRIPTION	ADJUSTMENT RANGE	MODEL NUMBER DEFAULT VALUES (0)		
			DSP S, DSPi-S	DSP M, DSPi-M	DSP L
<b>DRIVE</b>					
<b>MODE 1</b>					
MAX SPEED (1) (4)	Displays/adjusts drive maximum drive speed in the considered driving mode	60–100 %	100	100	100
STEER M1 (1) (4)	Displays/adjusts maximum steer speed in the considered driving mode	50–100 %	68	68	68
<b>MODE 2</b>					
MAX SPEED (1) (4)	Displays/adjusts drive maximum drive speed in the considered driving mode	60–100 %	100	100	100
STEER M2 (1) (4)	Displays/adjusts maximum steer speed in the considered driving mode	50–100 %	75	75	75
<b>MODE 3</b>					
MAX SPEED (1) (4)	Displays/adjusts drive maximum drive speed in the considered driving mode	60–100 %	100	100	100
STEER M3 (1) (4)	Displays/adjusts maximum steer speed in the considered driving mode	50–100 %	100	100	100
<b>STEER</b>					
ACCEL	Displays/adjusts steer acceleration	0.01–2.00 Sec	0.01	0.01	0.01
ACCEL W/ LIFT	Displays/adjusts steer acceleration when steering simultaneously with lifting the platform up	0.01–2.00 Sec	0.50	0.50	0.50
HOME SPEED	Displays/adjusts steer speed for homing operation	1–100 %	55	55	55
<b>PUMP</b>					
ACCEL	Displays/adjusts steer acceleration	0.01–2.00 Sec	0.10	0.10	0.10
MIN	Displays/adjusts pump minimum speed when steering	5–25 %	13	13	13
MAX	Displays/adjusts pump maximum speed when steering	35–70 %	50	50	50
<b>VALVE</b>					
LFT MIN (2)	Displays/adjusts left steer valve minimum opening	1–100 %	55	55	55
LFT RED (2)	Displays/adjusts left steer valve maximum opening when steering simultaneously lifting the platform up	1–100 %	80	80	80

Table 9-7. Machine Personality Adjustment

FUNCTION	DESCRIPTION	ADJUSTMENT RANGE	MODEL NUMBER DEFAULT VALUES (0)		
			DSP S, DSPi-S	DSP M, DSPi-M	DSP L
LFT MAX	Displays/adjusts left steer valve maximum opening when steering	1–100%	100	100	100
RHT MIN (2)	Displays/adjusts right steer valve minimum opening	1–100%	55	55	55
RHT RED (2)	Displays/adjusts right steer valve maximum opening when steering simultaneously lifting the platform up	1–100%	80	80	80
RHT MAX	Displays/adjusts right steer valve maximum opening when steering	1–100%	100	100	100
<b>MAST</b>					
UP REDUC FACTOR	Displays/adjusts mast lift up speed reduction at top end of stroke	1–50%	35	35	35
DN REDUC FACTOR	Displays/adjusts mast lift down speed reduction at bottom end of stroke	1–50%	28	28	28
<b>LIFT UP</b>					
ACCEL	Displays/adjusts mast lift up acceleration	0.1–2.00 Sec	2.00	2.00	2.00
DECEL	Displays/adjusts mast lift up deceleration	0.1–2.00 Sec	1.00	1.00	1.00
MAX	Displays/adjusts mast lift up maximum speed	70–100%	100	100	100
MAXW/DRIVE	Displays/adjusts mast lift up maximum speed when operated simultaneously with drive	50–70%	70	70	70
<b>LIFT DN</b>					
ACCEL	Displays/adjusts mast lift down acceleration	0.1–5.0 Sec	3.0	3.0	3.0
DECEL	Displays/adjusts mast lift down deceleration	0.1–5.00 Sec	0.7	0.7	0.7
MAX	Displays/adjusts mast lift down maximum speed	50–100%	100	100	100
<b>TRAY</b>					
UP MAX	Displays/adjusts tray lift up maximum speed	50–100%	100	100	100
DN MAX	Displays/adjusts tray lift down maximum speed	50–100%	100	100	100
<b>GROUNDALARM (3)</b>					
HORN VOL (1)	Displays/adjusts horn sound volume	25–100%	75	75	75
ALARM VOL (1)	Displays/adjusts alarm sound volume	25–100%	55	55	55

- NOTE:** (0) These settings may change in order to achieve optimal performance on a machine by machine basis.  
(1) Values are reset by selecting a preset. See Table 9.8 for Preset Configurations.  
(2) These personalities are automatically set when the wheel position sensor is calibrated.  
(3) Alarm volumes are adjustable at operator's level.  
(4) These personalities are a percentage of the maximum speed setting of the considered movement.

## SECTION 9 - JLG CONTROL SYSTEM

### Battery discharge Indicator setting.

This setting adapts the discharge indicator to the age of the battery (*only available since V2.0 update*).

**NOTE:** *Battery Setting is required ONLY in case of replacement of the main controller or Battery.*

During the configuration phase:

a. do not activate emergency stop.

b. do not open gates.

c. do not activate hand detection.

d. do not activate door step.

e. do not turn key to OFF.

All the above will cause the exit of the process without setting change.

1. Enter the Battery Setting by pushing simultaneously on the Lift Up switch and the Lift Down switch for more than 1 second. It is recommended to position your hands as per the picture below (only with index finger), to avoid hand detection. Display red indicator will flash to confirm that Battery Setting is entered.



2. One push on lift up switch increase one year the age of battery.  
One push on lift down switch decrease one year the age of battery.
3. Check your setting before validation by counting the flashes of the red led (you will not be able to verify the setting after validation):

New battery	1 flash
1 year old	2 flashes
2 years old	3 flashes
3 years old	4 flashes
4 years old and over	5 flashes

4. To validate the setting, push simultaneously lift up switch and lift down switch with index fingers until red led of display freezes for 2 seconds and then lits off.

**NOTE:** *If red led of display does not freeze before lits off the setting change is cancelled.*

## 9.12 PRESET CONFIGURATIONS

Table 9-8. Preset Configurations

PERSONALITY	UNIT	STANDARD	PRESET 1
M1 Max Speed	%	100	70
M2 Max Speed	%	100	65
M3 Max Speed	%	100	60
Steer Command Reduction M1	%	68	68
Steer Command Reduction M2	%	75	68
Steer Command Reduction M3	%	100	68
Motion Alarm PWM	%	55	40
Horn PWM	%	75	55
<b>MACHINE SETUP</b>			
Steering Auto Center		Standard	Standard
Drive & Lift		NO	NO
Ground Alarm		NO	Motion
Gate Alarm		YES	YES

Individuals settings can be changed after selecting a configuration.

**NOTE:** Changing the configuration overwrites any individual settings.



## SECTION 10. DIAGNOSTIC TROUBLE CODES

## 10.1 INTRODUCTION

This section provides a reference for Diagnostic Trouble Codes (DTC) read from the analyzer. DTCs are also displayed on the Multi Display Indicator (MDI, Ground Console) and on the face of the platform console. For more information on any sensors or indicators, refer to the appropriate section for the machine area. Many of the checks below require configuring and using a multimeter. Refer to Section 11, GENERAL ELECTRICAL INFORMATION & SCHEMATICS for multimeter basics. DTCs are sorted in groups by the first two digits, which are also the system distress lamp flash code. To troubleshoot multiple DTCs, start with the DTC with the higher first two digits. To view all active DTCs on the analyzer, view logged help before the first power cycle. The machine is powered by a nominal 48 Volts battery pack, the control system is powered by a 12 V converter.

Some procedures below refer to these nominal voltages: VBatt for the battery; VSupply for the converter. Actual voltage measurements may differ based on the charge of the batteries. **If a correction is made during a check, conclude the check by cycling the machine power, using the emergency stop switch.** It may also be helpful to run a system test, ANALYZER -> SYSTEM TEST for intermittent or difficult problems.

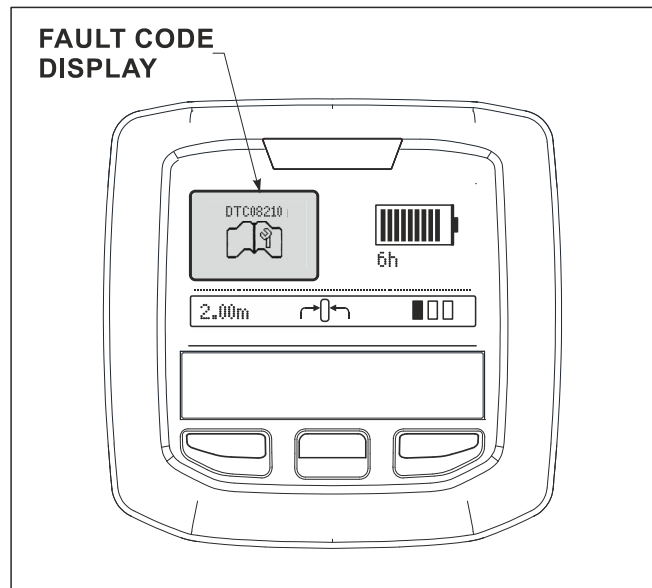


Figure 10-1. DTCs Displays

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## SECTION 10 - DIAGNOSTIC TROUBLE CODES

### 10.3 DTC CHECK TABLES

#### Power-Up

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics"	Corrective Action: Advanced Diagnostic"
212	KEYSWITCH FAULTY	Both Platform and Ground modes are selected simultaneously. Defaults to Ground Mode.		Check if the selector switch is damaged, obstructed or jammed.	Check selector switch function output voltages; Check Ground Module corresponding inputs (CR2(8): Platform; CR2(10): Ground) +Vbatt on selected station, 0V on unselected station.

#### Platform and Ground Controls

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
221	FUNCTION PROBLEM - HORN PERMANENTLY SELECTED	The horn switch was closed during power-up in platform mode.	Release the switch.	Check if the horn switch is damaged, obstructed or jammed.	Check the horn push button output: CR3(16), wire 406
108502	STEER JOYSTICK FAULTY - WIPER OUT OF RANGE	The Steer joystick wiper signal input is outside the acceptable voltage range.	Release joystick and allow to center.	Check if the joystick is obstructed or jammed. Perform a joystick calibration	Check joystick wiper voltage: CR3(9). Acceptable range: 0.5V - 4.5V
108102	FUNCTION LOCKED OUT - STEER JOYSTICK NOT CENTERED	The Steer joystick was not centered during power-up in platform mode.	Release joystick and allow to center. Cycle power.	Check if the joystick is obstructed or jammed. Proceed with a joystick calibration.	Check platform console harness (continuity of wires 500, 606 and 006): replace/repair where necessary Check the joystick voltages: @ +5V (power): CR3(12), wire 500 @ 0V (pwr gnd): CR3(24), wire 006 @ 2,2V to 2,8V: CR3(9), wire 606 if the power is not correct, replace the Platform console module; if the output is not correct, replace the joystick.
226	ACCELERATOR FAULTY - WIPER OUT OF RANGE	The Drive joystick wiper signal input is outside the acceptable voltage range.	Release joystick and allow to center.	Check if the joystick is obstructed or jammed. Proceed with a joystick calibration.	Check joystick wiper voltage: CR3(20). Acceptable range: 0.5V - 4.5V
228	FUNCTION LOCKED OUT - ACCELERATOR NOT CENTERED	The Drive Joystick was not centered at power-up in platform mode.	Release joystick and allow to center. Cycle power.	Check if the joystick is obstructed or jammed. Proceed with a joystick calibration.	Check platform console harness (continuity of wires 500, 605 and 006): replace/repair where necessary Check the joystick voltages: @ +5V (power): CR3(12), wire 500 @ 0V (pwr gnd): CR3(24), wire 006 @ 2,2V to 2,8V: CR3(20), wire 605 if the power is not correct, replace the Platform console module; if the output is not correct, replace the joystick.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

<b>DTC</b>	<b>Help Message</b>	<b>Condition Producing DTC</b>	<b>Corrective Action: Operator</b>	<b>Corrective Action: Service Basics</b>	<b>Corrective Action: Advanced Diagnostic</b>
229	FUNCTION PROBLEM - TRIGGER PERMANENTLY CLOSED	The right or left presence detection was closed during power-up in platform mode.	Check the absence of foreign object in the right / left sensor detection zone; Check right / left presence sensor lens for cleanliness (refer to section 8 for cleaning precautions). Cycle power.	Check sensor indicators to identify which of right or left sensor detects presence (refer to section 8 for indicators identification)	Check platform console harness (continuity of wires 300-2, 300-3, 002-16 and 405 or 415 depending on the faulty detection): replace/repair where necessary Check the sensor voltages: @ +VBatt (power): wires 300-2, 300-3 @ 0V (pwr gnd): 002-16 @ 0V (open circuit) in case of NO detection: Left CR3(19), wire 405, Right CR3(17), wire 415 @ +VBatt in case of detection: Left CR3(19), wire 405, Right CR3(17), wire 415"
2235	FUNCTION PROBLEM - LIFT PERMANENTLY SELECTED	The Mast Up or Mast Down Switch was closed during power-up in platform mode.	Release Mast Up / Down switch.	Check if the Right (Mast Up) or Left (Mast Down) push button switch is obstructed or jammed. Clean or replace faulty push button where necessary.	Check the Mast Up CR3(3) and Down CR3(4) outputs to identify faulty function Check if corresponding switch contact is shorted Check harness for damage (wire 403:lift Up, 404:lift Down)
108107	FUNCTION PROBLEM - TRAY LIFT UP/DOWN PERMANENTLY SELECTED	The Tray Lift Up or Down Switch was closed during power-up in platform mode.	Release Tray control switch.	Check if the Tray Lift Up or Down switch is obstructed or jammed.	Check the Tray Lift Up CR3(18) and Down CR3(15) outputs to identify faulty function. Check if corresponding switch contact is shorted Check harness for damage (wire 424:tray Up, 425:tray Down)
109803	STEER JOYSTICK - NOT CALIBRATED	The Steer joystick has not been calibrated.		Proceed with a joystick calibration	If the joystick can not be calibrated: Check platform console harness (continuity of wires 500, 606 and 006): replace/repair where necessary Check the joystick voltages: @ +5V (power): CR3(12), wire 500 @ 0V (pwr gnd): CR3(24), wire 006 @ 2,2V to 2,8V : CR3(9), wire 606 if the power is not correct, replace the Platform console module; if the output is not correct, replace the joystick.
109802	DRIVE JOYSTICK - NOT CALIBRATED	The Drive joystick has not been calibrated.		Proceed with a joystick calibration	If the joystick can not be calibrated: Check platform console harness (continuity of wires 500, 605 and 006): replace/repair where necessary Check the joystick voltages: @ +5V (power): CR3(12), wire 500 @ 0V (pwr gnd): CR3(24), wire 006 @ 2,2V to 2,8V : CR3(20), wire 605 if the power is not correct, replace the Platform console module; if the output is not correct, replace the joystick.
233	FUNCTION PROBLEM - BRAKE RELEASE PERMANENTLY SELECTED	The Brake Release switch was closed during power-up in ground mode.		Check if the concerned switch is damaged, obstructed or jammed.	Disconnect the membrane panel ribbon cable : replace the membrane panel if DTC is no longer present. Check the switch line voltage : CR33(7) and CR2(13)

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
2310	FUNCTION PROBLEM - GROUND ENABLE PERMANENTLY SELECTED	The Ground Selection / Enable switch was closed during power-up.	Release Ground Enable switch and cycle power.	Check if the concerned switch is damaged, obstructed or jammed.	Check if Selector switch contact is shorted. Check switch line voltage: CR33(3) and CR2(10)



### Function Prevented

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
No DTC Display with No Wheel Position Indication	FUNCTION PREVENTED - CHARGER CONNECTED	Functions from platform are prevented while the vehicle is charging. Ground console is operational	Disconnect charger from mains power source.	Check that interlock relay wire is properly connected: CR(30).	Check interlock relay wiring: @ +Vbatt when the battery is Not charging CR1(27), wire 401 @ 0V when the battery is charging CR1(27), wire 401
107301	FUNCTION PREVENTED - PROTECTED PARAMETER CHANGE	One or several Safety-based parameters have been changed. All vehicle functions are prevented.	Cycle Power to clear the fault.		Reinstall the most current Production software for the Master Controller. Reinstall the most current Production software for the Display Module.
2547 (108800)	MACHINE SETUP FAULT - MODEL MODEL HAS NOT BEEN SELECTED. ALL VEHICLE FUNCTIONS ARE PREVENTED.	Model has not been selected. All vehicle functions are prevented.		Check Analyzer: Machine Setup: Model	Refer to Section 9 for proper personality settings and calibrations.

 **Line Contactor**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
311	OPEN CIRCUIT LINE CONTACTOR	The main contactor is not closing the power circuit properly.		<p>Check the line contactor contacts</p> <p>Check the line contactor coil</p> <p>The fault appears at start up or during standby:</p> <p>Check that no external device is connected to the batteries.</p> <p>Refer to a qualified JLG mechanic to know the approved options on the machine.</p>	<p>Check the line contactor [KM] coil voltage: @+Vbatt : CR105(1), wire 301-3.</p> <p>Coil voltage when a function is controlled CR105(1)-CR105(2)=24V (for 1s), then approx. 16V</p>
321	LINE CONTACTOR MISWIRED OR WELDED	The main contactor contact is miswired or welded.		<p>Check the contact of the line contactor.</p> <p>Replace the line contactor if necessary.</p>	Refer problem to a qualified JLG mechanic.
322	CONTACTOR DRIVER PERMANENTLY ON	The main contactor driver output is shorted.	Cycle power to clear the fault	<p>Check the main contactor harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the contactor coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(6), wire 806 for a short circuit to +Vbat.</p> <p>Check the main contactor coil for correct impedance (refer to section 8).</p> <p>Reinstall the most current Production software for the Master Controller.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
104902	MAIN CONTACTOR - DRIVER OVERCURRENT	The main contactor coil is shorted or coil impedance is too low.		<p>Check the main contactor harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the contactor coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(6), wire 806 for a short circuit to +Vbat.</p> <p>Check the main contactor coil for correct impedance (refer to section 8).</p> <p>Reinstall the most current Production software for the Master Controller.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
3119	MAIN CONTACTOR COIL - SHORT TO BATTERY OR OPEN CIRCUIT	The main contactor coil is shorted to battery positive or coil is open.		<p>Check the main contactor harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the contactor coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(6), wire 806 for a short circuit to +Vbat.</p> <p>Check the main contactor coil for correct impedance (refer to section 8).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
3120	MAIN CONTACTOR COIL - SHORT TO GROUND OR OPEN CIRCUIT	The main contactor coil is shorted to battery negative or coil is open.		<p>Check the main contactor harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the contactor coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(6), wire 806 for a short circuit to 0V.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
3117	MAIN CONTACTOR COIL - OPEN CIRCUIT	The main contactor coil or coil harness is open.		<p>Check the main contactor coil harness for signs of damage</p> <ul style="list-style-type: none"> <li>Check the contactor coil connections and wiring for interruptions.</li> </ul>	<p>Check the contactor coil for correct impedance (refer to section 8).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>

### Brake

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
331	BRAKE - SHORT TO BATTERY	The brake positive output supply is detected at high level while no drive function is controlled.		<p>Check the brake harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the brake coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(5), wire 803 for a short circuit to +Vbat.</p> <p>Check the brake coil for correct impedance (refer to section 4).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

<b>DTC</b>	<b>Help Message</b>	<b>Condition Producing DTC</b>	<b>Corrective Action: Operator</b>	<b>Corrective Action: Service Basics</b>	<b>Corrective Action: Advanced Diagnostic</b>
332	BRAKE - OPEN CIRCUIT	There is no negative supply to the brake while a drive function is active.		<p>Check the brake harness for signs of damage</p> <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for interruptions.</li> </ul>	<p>Check the brake coil for correct impedance (refer to Section 4).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
3361	BRAKE - SHORT TO GROUND	The brake positive output supply is detected shorted to battery negative.		<p>Check the brake harness for signs of damage:</p> <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(5), wire 803 for a short circuit to 0V.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
105001	BRAKE - DRIVER PERMANENTLY ON	The brake driver is shorted.	Cycle power to clear the fault	<p>Check the brake harness for signs of damage:</p> <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(5), wire 803 for a short circuit to +Vbat.</p> <p>Check the brake coil for correct impedance (refer to section 4).</p> <p>Reinstall the most current Production software for the Master Controller.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
105002	BRAKE - DRIVER OVERCURRENT	The brake coil is shorted or coil impedance is too low.		<p>Check the brake harness for signs of damage:</p> <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for insulation interruption and possible cross connections between conductors. "</li> </ul>	<p>Check the Master Controller output CR1(5), wire 803 for a short circuit to +Vbat.</p> <p>Check the brake coil for correct impedance (refer to section 4).</p> <p>Reinstall the most current Production software for the Master Controller.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

### Ground Output Drivers

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
33208	HORN - SHORT TO BATTERY	The horn control is shorted to battery positive.		<p>Check the horn harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the horn connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(4), wire 800 for a short circuit to +Vbat.</p> <p>Check the horn signal input for correct impedance (CR12(A)-CR12(B) &gt; 1kW).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
33209	HORN - SHORT TO GROUND	The horn is shorted to battery negative.		<p>Check the horn harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the horn connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(5), wire 803 for a short circuit to 0V.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
33207	HORN - OPEN CIRCUIT	The horn circuit is open.		<p>Check the horn harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the horn connections and wiring for interruptions.</li> </ul>	<p>Check the horn signal input for correct impedance (CR12(A)-CR12(B) &lt; 1,5kW).</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
116301	HORN - DRIVER PERMANENTLY ON	The horn driver is shorted or the horn is faulty.	Cycle power to clear the fault		Refer problem to a qualified JLG mechanic.
33363	MAST VALVE - SHORT TO BATTERY	The Load Holding valve (mast valve) is shorted or the corresponding controller output is shorted to battery positive.		<p>Check the Load holding valve harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the Load holding valve coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(2), wire 807 for a short circuit to +Vbat.</p> <p>Check the load holding valve coil for correct impedance (refer to section 7).</p> <p>Reinstall the most current Production software for the Master Controller.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>
33469	MAST VALVE - SHORT TO GROUND	The Load Holding valve (mast valve) is shorted or the corresponding controller output is shorted to battery negative.		<p>Check the Load holding valve harness for signs of damage:</p> <ul style="list-style-type: none"> <li>Check the Load holding valve coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	<p>Check the Master Controller output CR1(2), wire 807 for a short circuit to 0V.</p> <p>Replace the Master Controller if the coil and its harness are correct.</p>

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

<b>DTC</b>	<b>Help Message</b>	<b>Condition Producing DTC</b>	<b>Corrective Action: Operator</b>	<b>Corrective Action: Service Basics</b>	<b>Corrective Action: Advanced Diagnostic</b>
33365	MAST VALVE - OPEN CIRCUIT	The Load holding valve (mast valve) is faulty or disconnected or the coil driver is faulty.		Check the Load holding valve harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for interruption.</li> </ul>	Check the Load holding valve coil for correct impedance (refer to Section 7). Replace the Master Controller if the coil and its harness are correct.
116101	MAST VALVE - DRIVER PERMANENTLY ON	The Load holding valve (mast valve) driver is shorted.	Cycle power to clear the fault	Check the Load holding valve harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the brake coil connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	Check the Master Controller output CR1(2), wire 807 for a short circuit to +Vbat. Check the load holding valve coil for correct impedance (refer to section 7). Reinstall the most current Production software for the Master Controller. Replace the Master Controller if the coil and its harness are correct.
33383	BEACON LIGHT - OPEN CIRCUIT	The Beacon light is faulty or disconnected or the coil driver is faulty.		Check the beacon harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the beacon connections and wiring for interruption.</li> </ul>	Check the Master Controller output CR1(3), wire 801 for an open circuit. Replace the beacon. Replace the Master Controller if the beacon and its harness are correct.
33384	BEACON LIGHT - SHORT TO GROUND	The Beacon light driver is shorted or the beacon is faulty (open) or disconnected.		Check the beacon harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the beacon connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	Check the Master Controller output CR1(3), wire 801 for a short circuit to ground (0V). Replace the beacon. Replace the Master Controller if the beacon and its harness are correct.
33562	BEACON LIGHT - SHORT TO BATTERY	The Ground Beacon Light is shorted or the corresponding controller output is shorted to battery positive.		Check the beacon harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the beacon connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	Check the Master Controller output CR1(3), wire 801 for a short circuit to +Vbat. Replace the Master Controller if the beacon and its harness are correct.
116401	BEACON LIGHT - DRIVER PERMANENTLY ON	The ground Beacon light driver is shorted or the beacon is faulty.	Cycle power to clear the fault.	Check the beacon harness for signs of damage: <ul style="list-style-type: none"> <li>• Check the beacon connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	Refer problem to a qualified JLG mechanic.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
33388	OVERLOAD LIGHT – OPEN CIRCUIT	The Overload Light is faulty or disconnected.	Cycle power to clear the fault	Check the ground panel harness for signs of damage: • Check the overload indicator connections and wiring for interruption.	Check the Ground membrane panel Replace the Ground module if the membrane panel and its harness are correct.
116901	VALVE COIL SUPPLY - SHORT TO GROUND	A short circuit is detected on the valves and alarms supplied by the Master Controller: Main contactor, Brake, Load Holding valve, Beacon light (ground), Horn.		Check the chassis harness for signs of damage.	Check valve power supply for short to ground: CR1(13), CR100(1), CR12(A), CR105(1), CR17(1), CR20(1); wires 301, 301-1, 301-2, 301-3 & 301-4. Check impedance of Main contactor, Brake, Load Holding valve coils and Ground Beacon and Horn. Cycle power to clear the fault. Change the Master Controller.
116902	VALVE COIL SUPPLY - DRIVER PERMANENTLY ON	A short circuit, internal to the Master Controller is detected (valves and alarms power supply circuit).	Cycle power to clear the fault		Change the Master Controller. Refer problem to a qualified JLG mechanic.
116903 116904	VALVE COIL SUPPLY - STARTUP CHECKS FAULT	Startup check on valves and alarms power supply failed.	Cycle power to clear the fault		Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation: CR1(13), CR1(5), CR1(6), CR1(4), CR1(3), CR1(2); CR100, CR105, CR12, CR17 & CR20. Cycle power to clear the fault. Change the Master Controller.
33823 (33824)	POWER MODULE MOTOR CURRENT – OUT OF RANGE	The Master Controller determines that current (RMS) to the drive motor is too high.		Check for jammed or obstructed drive motor. Check harnesses between Power module and drive motor for signs of damage Ensure that all power connections are properly tightened and crimping in good condition.	Check the drive motor encoder wiring and connections: ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check drive motor power wiring for short circuit on phases U, V, W. Replace the Master Controller.

### Platform Output Drivers

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108333 (108233)	BEACON LIGHT PLATFORM - OPEN CIRCUIT	The Platform Beacon Light is faulty or disconnected or the coil driver is faulty.		Check the beacon harness for signs of damage: • Check the beacon connections and wiring for interruption.	Check the Platform console output CR4(11), wire 804 for an open circuit. Replace the beacon Replace the Platform module if the beacon and its harness are correct.

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108331 (108231)	BEACON LIGHT PLAT- FORM - SHORT TO BATTERY	The Platform Beacon Light is shorted or the corresponding controller output is shorted to battery positive.		Check the platform beacon harness for signs of damage: <ul style="list-style-type: none"> <li>Check the beacon connections and wiring for insulation interruption and possible cross connections between conductors.</li> </ul>	Check the Platform console output CR4(11), wire 804 for a short circuit to +Vbat. Replace the Platform module if the beacon and its harness are correct.

### Thermal Limit

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
426	MASTER MODULE TEMPERATURE - OUT OF RANGE	The Master Controller temperature sensor is out of the permitted range (-40°C to +95°C)		Bring the Master Controller temperature within acceptable range. Cycle power to clear the fault.	Change the Master Controller
428	MASTER MODULE TOO HOT - PLEASE WAIT	The Master Controller has reached thermal cutout.	Power down and allow to cool Do not operate in ambients over 50°C.	Check the Master Controller for proper installation (refer to § 8-4).	<ul style="list-style-type: none"> <li>Check for excessively high drive motor current consumption while driving on the level (over 60A).</li> <li>Check for excessively high pump motor current consumption while raising the platform empty (battery output current over 95A).</li> <li>If the module is cold when the fault appears: replace the module.</li> </ul>
424	DRIVE MOTOR TOO HOT - PLEASE WAIT	The Master Controller determines that the drive motor temperature > 140°C or determines that motor temperature sensor is disconnected or reporting > 150°C	Power down and allow to cool Do not operate in ambients over 50°C.	Check battery charge and recharge if necessary. Check for damaged battery, power cables and connections."	Check for excessively high drive motor current consumption while driving on the level (over 60A). Check the sensor wiring and connections - CR10(5), CR10(6) & CR1(8), CR1(18)-. Check the sensor for correct impedance (refer to Section 8). If sensor and wiring are correct, and fault still present when motor is cold: Replace the Module.
4212	DRIVE MOTOR TEMPERATURE - OUT OF RANGE	The Master Controller reports that motor temperature sensor is out of range due to open circuit or damage.			Check the sensor wiring and connections - CR10(5), CR10(6) & CR1(8), CR1(18)-. Check the sensor for correct impedance (refer to Section 8). If sensor and wiring are correct, and fault still present when motor is cold: Replace the Module.
108223 108224	GROUND MODULE - TEMPERATURE OUT OF RANGE	Ground module temperature out of range.	Power down and allow to cool. Do not operate in ambients over 50°C.	Check the Ground module for proper installation.	Replace the Ground Module.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108622 108623 108624	POWER TRAY MODULE - TEMPERATURE OUT OF RANGE	Power tray controller temperature out of range	Power down and allow to cool. Do not operate in ambients over 50°C.	Check the Power tray controller for proper installation.	Replace the Power tray module.

### Battery Supply

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
441	BATTERY VOLTAGE TOO LOW - SYSTEM SHUTDOWN	A problem has been detected with the batteries or power module. Voltage on power connections is too low under operation.		Check battery charge and recharge if necessary. Check power fuse condition, replace if necessary.	Check for appropriate charging setting (refer to section 8). Check for damaged battery, power cables and connections. Check main contactor contact impedance (refer to section 8).
442	BATTERY VOLTAGE TOO HIGH - SYSTEM SHUTDOWN	A problem has been detected with the batteries or power module. Voltage on power connections is too high under operation.		Check power fuse condition, replace if necessary.	Check for appropriate charging setting (refer to section 8). Check for damaged battery, power cables and connections. Check main contactor contact impedance (refer to section 8).
4418	MASTER MODULE VOLTAGE OUT OF RANGE	The controller detects an overvoltage or undervoltage condition, on power connections or on keyswitch. Overvoltage threshold is 36V, undervoltage threshold is 8V.		Check battery charge and recharge if necessary. Check power fuse condition, replace if necessary. Check main system fuse condition, replace if necessary. the fault appears at start up or during standby: check that no external device is connected to the batteries. Refer to a qualified JLG mechanic to know the approved options on the machine.	Check for appropriate charging setting (refer to section 8). Check for damaged battery, power cables and connections. Check main contactor contact impedance (refer to section 8). Check keyswitch input voltage - CR1(1)- and wire 300 to 300-30.
4420	BATTERY DEEPLY DISCHARGED	The batteries are deeply discharged Indicated by empty battery symbol or DTC depending on software version.	Recharge the batteries Check battery charger function. Be sure to observe indicators for at least 30 seconds.	Check for damaged batteries, battery cables or connections.	Refer problem to a qualified JLG mechanic.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108321 (108221) 108322 (108222)	PLATFORM MODULE - VOLTAGE OUT OF RANGE	Platform module voltage out of range	Cycle power to clear the fault.		Check voltage on CR3(1) to see if voltage is within range of +Vbatt <ul style="list-style-type: none"> <li>• Charge machine batteries.</li> <li>• Replace the Platform Module.</li> </ul>
108221 108222	GROUND MODULE - VOLTAGE OUT OF RANGE	Ground module voltage out of range	Cycle power to clear the fault		Check voltage on CR2(3) to see if voltage is within range of +Vbatt <ul style="list-style-type: none"> <li>• Charge machine batteries.</li> <li>• Replace the Platform Module.</li> </ul>
108625 108626 108627 108628	POWER TRAY MODULE - VOLTAGE OUT OF RANGE	Power tray controller voltage out of range	Cycle power to clear the fault.		Replace the Power tray module.
108700	POWER TRAY - LOW BATTERY	The Power tray controller battery discharge indicator is Low.		Check Power Tray fuse condition, replace as necessary. Check harness for signs of damage.	Replace the Power tray module. Refer problem to a qualified JLG mechanic.

 **Transmission and Drive System**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
4610	SPEED SENSOR – NOT RESPONDING PROPERLY	A problem has been detected with the drive motor speed sensor (encoder).	Cycle power to clear the fault	Check the harness for proper installation (refer to section 11)	Check the drive motor encoder wiring and connections . @12V: CR10(1), CR1(25), wire 505 @0V: CR10(2), CR1(18), wire 005 Continuity to be checked: CR10(3) to CR1(32), CR10(4) to CR1(31), wires 429 & 430. If voltages and signal continuity are correct, Replace sensor.
469	VEHICLE OVERSPEED	Machine overspeed has been detected on the the drive motor.	The machine should be driven at limited speed in ramps.		Refer problem to a qualified JLG mechanic.
4615	SPEED SENSOR – INVALID READING	A problem has been detected with the drive motor speed sensor (encoder).	Cycle power to clear the fault.		Refer problem to a qualified JLG mechanic.
4616	BRAKES DID NOT LOCK	The vehicle control system detects machine roll back after drive motor brake is applied.		Check the brake assembly for external damage.	Dismount the brake assembly: Check the brake disc thickness Check if brake disc and plates are damaged, obstructed or jammed.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
115401 115402 115403 (115101 115102 115103)	DYNAMIC BRAKING FAIL	The vehicle control system detects incorrect speed or braking time during dynamic braking phase.	Cycle power to clear the fault.		Refer problem to a qualified JLG mechanic.

### Communication

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
662 (108200)	CANBUS FAILURE - PLATFORM MODULE	The control system failed to receive messages from the Platform Module. Communication failure may be permanent or intermittent.		Check if platform is powered on Check if connector CR4 is properly connected to the platform console	Check harnesses for signs of damage. Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check impedance between CAN High and CAN Low on CAN channel 1: Disconnect CR4 from platform console. Measure impedance on platform console connector and on harness connector separately. Impedance for each branch: 120 Ω + 5% Check if voltage on CAN High or CAN Low exceeds 5V Check power to module: @+VBatt: CR3(1), wire 300-20 @0V: CR3(13), wire 002-13 Replace the Platform Module.
6631 (108200)	CANBUS FAILURE - GROUND MODULE	The control system failed to receive messages from the Ground Module. Communication failure may be permanent or intermittent.		Check if Ground Module is powered on (yellow / red light indicator on the module is flashing) Check if connector CR2 is properly connected to the Ground Module.	Check harnesses for signs of damage. Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check impedance between CAN High and CAN Low on CAN channel 1: Disconnect CR2 from Ground Module. Measure impedance on CR2. Impedance: 60 Ω + 5% • Check if voltage on CAN High or CAN Low exceeds 5V  Check power to module: @+VBatt: CR2(3), wire 300-5 @0V: CR2(1), wire 002-1 • Replace the Ground Module.
No DTC but partial information on display: Battery empty, No hourmeter, No center button icon.	CANBUS FAILURE - PLATFORM DISPLAY	The control system failed to receive messages from the Platform Display. Communication failure between the control system and the Platform Display is permanent.		Check if connector CR4 is properly connected to the platform console	Check harnesses for signs of damage. Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check impedance between CAN High and CAN Low on CAN channel 1: Disconnect CR4 from platform console. Measure impedance on platform console connector and on harness connector separately. Impedance for each branch: 120 Ω + 5% Reconnect CR4, disconnect CR6 (Display Module connector). Measure impedance on CR6: Impedance: 60 Ω + 5% • Check if voltage on CAN High or CAN Low exceeds 5V • Replace the Display Module.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
6667 (110000)	CANBUS FAILURE - PLATFORM DISPLAY	The control system failed to receive messages from the Platform Display. Communication failure is intermittent or Display does not send messages.		Check if connector CR4 is properly connected to the platform console.	<p>Check harnesses for signs of damage. Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check impedance between CAN High and CAN Low on CAN channel 1: Disconnect CR4 from platform console. Measure impedance on platform console connector and on harness connector separately. Impedance for each branch: 120 Ω + 5% Reconnect CR4, disconnect CR6 (Display Module connector). Measure impedance on CR6: Impedance: 60 Ω + 5%</p> <ul style="list-style-type: none"> <li>• Check if voltage on CAN High or CAN Low exceeds 5V</li> <li>• Replace the Display Module.</li> </ul>
108600 108632	CANBUS FAILURE - POWER TRAY CONTROLLER	The control system failed to receive messages from the Power Tray Controller.		"Check Power Tray fuse condition, replace as necessary. Ensure Machine Setup; Powered Tray is set to NO if not installed."	<p>Check harnesses for signs of damage. Ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check impedance between CAN High and CAN Low on CAN channel 1: Disconnect CR39 from Tray Module. Measure impedance on CR39: 60 Ω + 5%</p> <ul style="list-style-type: none"> <li>• Check if voltage on CAN High or CAN Low exceeds 5V</li> </ul> <p>Check power to module: @+VBatt, permanent: B+ fast-on terminal, wire 204 @+VBatt, Key ON: CR39(5), wire 300-13 @0V: B- fast-on terminal, wire 002-8</p> <ul style="list-style-type: none"> <li>• Replace the Power Tray Controller.</li> </ul>

 **Accessory**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108618 108620	POWER TRAY - MOTOR SHORT CIRCUIT	The Power tray controller detects that the motor is shorted or current is too high	Do not overload the tray.	<p>Check for jammed or obstructed tray linear guides. Check harnesses between Power tray module and tray motor for signs of damage. Ensure that all power connections are properly tightened and crimping in good condition.</p>	Replace the Power tray controller.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108619	POWER TRAY - MOTOR OPEN CIRCUIT	The Power tray controller detects that the motor is disconnected/open.		Check harnesses between Power tray controller and tray motor for signs of damage Ensure that all power connections are properly tightened and crimping in good condition.	Replace the Power tray controller.

### Electric Motor

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
771	OPEN CIRCUIT DRIVE MOTOR WIRING	The Master Controller detects that a motor phase is disconnected/open.		Check harnesses between Power module and drive motor for signs of damage Ensure that all power connections are properly tightened and crimping in good condition.	Replace the Master Controller.
772	STALLED TRACTION MOTOR OR POWER WIRING ERROR	The drive motor has been detected stalled: Motor is effectively stalled or motor speed detection is incorrect.		Check for jammed or obstructed drive motor. Check harnesses between Power module and drive motor for signs of damage Ensure that all power connections are properly tightened and crimping in good condition.	Check the drive motor encoder wiring and connections @12V: CR10(1), CR1(25), wire 505 @0V: CR10(2), CR1(18), wire 005 Continuity to be checked: CR10(3) to CR1(32), CR10(4) to CR1(31), wires 429 & 430. If voltages and signal continuity are correct, Replace sensor. If voltages are not correct (encoder disconnected) and harness in good condition: Replace the Module.
7721	MASTER MODULE CAPACITOR BANK FAULT	The power capacitor bank of the power module is not charging properly at startup.	Cycle power to clear the fault.	Check that no external device is connected to the batteries. Refer to a qualified JLG mechanic to know the approved options on the machine.	Check battery, power cables and connections. Refer problem to a qualified JLG mechanic.
7725	PUMP MOTOR - NOT RESPONDING	The Master Controller detects that the pump motor feedback is not responding when the pump is being commanded.		Check the pump motor power wiring and connections.	Check the pump motor for proper impedance. Refer problem to a qualified JLG mechanic.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
7737	PUMP MOTOR AT CURRENT LIMIT	The Master Controller detects that the pump motor current is too high.	Check oil level.	Allow motor to cool down if motor is hot. • Check to see if mast is obstructed.	Check to see if Pump is obstructed. Refer to Section 7-2 for servicing the pump Check the pump motor power wiring and connections for signs of damage • Replace the Master Controller.
7775	POWER MODULE MOTOR WIRING-ISSUE	The Master Controller detects that a motor phase current is too high.		Check the drive motor sensor harness routing.	Check the drive motor encoder wiring and connections: ensure that all the connectors pins are properly in place and the connectors are free of moisture or oxidation. Check drive motor power wiring for short circuit on phases U, V, W. Replace the Master Controller.

 **Mast Sensor**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
109804	MAST SENSOR NOT CALIBRATED	The Mast sensor has not been calibrated		Proceed with a sensor mechanical setting and a calibration.	If the sensor can not be calibrated: Check the sensor voltages (refer to section 8 for detailed information) @ +VBatt (power): CR13(1), wire 300-11 @ 0V (pwr gnd): CR13(3), wire 002-6 @ Variable (refer to section 8 for typical values): CR3(21), wire 604 If power is not correct, check platform harness for continuity (wires 002-6 and 300-11): repair / replace where necessary; If the output is not correct, check platform harness and platform console harness for continuity (wires 604): repair / replace where necessary; if harness is correct, check resistor value (620Ω ±1%) and connections to CR3(13) and CR3(21). If harness and resistor are correct, replace sensor and proceed with a sensor mechanical setting and a calibration.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108901	MAST SENSOR OUT OF RANGE	Mast sensor output voltage is out of range.	Proceed with a sensor cleaning; Fully lower the platform; Turn keyswitch Off; Clean the sensor lens with optical wipe and dry with a microfiber cloth.	Check sensor lens condition: inner and outer surfaces are free of moisture, outer surface is clean and not scratched. Check that laser beam reflects on the chassis cover (no obstruction or debris on the beam path) Check that the sensor bracket is undamaged. If the sensor or its bracket need replacement or reinstallation: • Proceed with a sensor mechanical setting and a calibration If sensor is in good condition and installation is correct: • Check sensor voltage with Analyser (go to Diagnostic>Inputs>Mast Sensor); if voltage is within acceptable range (refer to section 8 for detailed information), proceed with a sensor calibration; otherwise go to Advanced Diagnostic	If the sensor can not be calibrated: Check the sensor voltages (refer to section 8 for detailed information) @ +VBatt (power): CR13(1), wire 300-11 @ 0V (pwr gnd): CR13(3), wire 002-6 @ Variable (refer to section 8 for typical values): CR3(21), wire 604 If power is not correct, check platform harness for continuity (wires 002-6 and 300-11): repair / replace where necessary; If the output is not correct, check platform harness and platform console harness for continuity (wires 604): repair / replace where necessary; if harness is correct, check resistor value ( $620\Omega \pm 1\%$ ) and connections to CR3(13) and CR3(21). If harness and resistor are correct, replace sensor and proceed with a sensor mechanical setting and a calibration.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108902	MAST SENSOR STAGNANT	Mast sensor output voltage is detected constant while Mast lift up command is in progress.	<p>If the platform is effectively lifting, Proceed with a sensor cleaning: Fully lower the platform; Turn keyswitch Off; Clean the sensor lens with optical wipe and dry with a microfiber cloth. If the pump is running and platform is Not lifting, Check oil level.</p>	<p>Check sensor lens condition: inner and outer surfaces are free of moisture, outer surface is clean and not scratched. Check that laser beam reflects on the chassis cover (no obstruction or debris on the beam path) Check that the sensor bracket is undamaged. If the sensor or its bracket need replacement or reinstallation: • Proceed with a sensor mechanical setting and a calibration If sensor is in good condition and installation is correct: • Cycle power to clear the fault, check height reading with Analyser (go to Diagnostic&gt;Inputs&gt;Mast Sensor) for actual platform height of approx. 1m; if Analyzer reading is Not accurate (refer to section 8 for detailed information), proceed with a sensor calibration; otherwise go to Advanced Diagnostic</p>	<p>If the platform lifts without any visible external defect on sensor and bracket: Check the sensor voltages (refer to section 8 for detailed information) @ +VBatt (power): CR13(1), wire 300-11 @ 0V (pwr gnd): CR13(3), wire 002-6 @ Variable (refer to section 8 for typical values): CR3(21), wire 604 If power is not correct, check platform harness for continuity (wires 002-6 and 300-11) : repair / replace where necessary; If the output is not correct, check platform harness and platform console harness for continuity (wires 604) : repair / replace where necessary; if harness is correct, check resistor value (<math>620\Omega \pm 1\%</math>) and connections to CR3(13) and CR3(21). If harness and resistor are correct, replace sensor and proceed with a sensor mechanical setting and a calibration.</p> <p>If the platform is not lifting (before the fault is being triggered): Check if the mast is obstructed, damaged or jammed. Go to Analyzer and check Mast Lift Up Personality settings; Reset to default where necessary. Install gauge and check hydraulic pressure (refer to section 9): If pressure is low: adjust pressure setting; check hydraulic system for internal / external leaks If pressure is correct: 1/ check that Load Holding valve works properly (requires assistant to push and hold manual descent while Mast Lift Up is commanded) : a/ if mast raises, check that Load Holding valve (CR17) is powered during lift Up command: a1/ if coil is powered and no switching : change and replace as necessary (coil or complete valve) a2/ if coil is not powered: check harness (@+Vbat: wire 301-6, @switched 0V: wire 807), change / repair harness as needed; if harness is correct, change the Master Controller b/ if the mast does not raise: 2/ check that Mast Up valve (CR14) is powered during lift Up command: a/ if coil powered and no switching of valve: check and replace as necessary (coil / complete valve or valve body after inspection) b/ if coil is not powered: check harness (@+Vbat: wire 300-9, @switched 0V: wire 701), change / repair harness as needed; if harness is correct, change the Ground module</p>

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108903	MAST SENSOR INCORRECT RESPONSE	The Master Controller determines that mast raising speed is too low while pump is running at nominal speed.	"Check oil level Proceed with a sensor cleaning: Fully lower the platform; Turn keyswitch Off; Clean the sensor lens with optical wipe and dry with a microfiber cloth."	Check sensor lens condition: inner and outer surfaces are free of moisture, outer surface is clean and not scratched. Check that laser beam reflects on the chassis cover (no obstruction or debris on the beam path) Check that the sensor bracket is undamaged. If the sensor or its bracket need replacement or reinstallation: • Proceed with a sensor mechanical setting and a calibration If sensor is in good condition and installation is correct: • Cycle power to clear the fault, check height reading with Analyser (go to Diagnostic>Inputs>Mast Sensor) for actual platform height of approx. 1m; if Analyzer reading is Not accurate (refer to section 8 for detailed information), proceed with a sensor calibration; otherwise go to Advanced Diagnostic	Check platform lifting speed. If the platform lifts at normal speed without any visible external defect on sensor and bracket: Proceed with a sensor mechanical setting and a calibration. If calibration fails or does not solve the issue: Check the sensor voltages (refer to section 8 for detailed information) @ +VBatt (power): CR13(1), wire 300-11 @ 0V (pwr gnd): CR13(3), wire 002-6 @ Variable (refer to section 8 for typical values): CR3(21), wire 604 If power is not correct, check platform harness for continuity (wires 002-6 and 300-11): repair / replace where necessary; If the output is not correct, check platform harness and platform console harness for continuity (wires 604): repair / replace where necessary; if harness is correct, check resistor value (620 Ω ±1%) and connections to CR3(13) and CR3(21). If harness and resistor are correct, replace sensor and proceed with a sensor mechanical setting and a calibration.  If the platform is not lifting at correct speed: Check if the mast is obstructed, damaged or jammed. Go to Analyzer and check Mast Lift Up Personality settings; Reset to default where necessary. Install gauge and check hydraulic pressure (refer to section 9): If pressure is low: adjust pressure setting; check hydraulic system for internal / external leaks If pressure is correct, 1/ check that Load Holding valve works properly (requires assistant to push and hold manual descent while Mast Lift Up is commanded): a/ if mast raises at normal speed, check the current to Load Holding valve (CR17) during lift Up command (1,4A-1,5A): a1/ if coil power is correct and no switching: change and replace as necessary (coil or complete valve) a2/ if coil is underpowered: check harness (@+Vbat: wire 301-6, @switched 0V: wire 807), change / repair harness as needed; if harness is correct: Reinstall the most current Production software for the Master Controller / Change the Master Controller b/ if the mast does not raise at normal speed: b1/ check that Mast Up valve (CR14) and replace as necessary (coil / complete valve or valve body after inspection); b2/ check voltage & current applied to pump motor.

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108904	MAST SENSOR MEASURE JUMP	The Master Controller determines that height measure rapid change is incompatible with mast lifting speeds.	'Check that no object or person is present under the platform; Fully lower the platform and maintain the lowering control until the Red indicator light goes OFF. Operate the machine normally; proceed with a sensor cleaning in case of recurrence of the DTC: Reset DTC (see above); Turn keyswitch Off; Clean the sensor lens with optical wipe and dry with a microfiber cloth.	Check sensor lens condition: inner and outer surfaces are free of moisture, outer surface is clean and not scratched. Check that laser beam reflects on the chassis cover (no obstruction or debris on the beam path) Check that the sensor bracket is undamaged. If the sensor or its bracket need replacement or reinstallation: • Proceed with a sensor mechanical setting and a calibration If sensor is in good condition and installation is correct: • Go to Advanced Diagnostic.	Proceed with a sensor mechanical setting and a calibration. If calibration fails or does not solve the issue: Proceed with a sensor mechanical setting and a calibration. If calibration fails or does not solve the issue: Check the sensor voltages (refer to section 8 for detailed information) @ +VBatt (power): CR13(1), wire 300-11 @ 0V (pwr gnd): CR13(3), wire 002-6 @ Variable (refer to section 8 for typical values): CR3(21), wire 604 If power is not correct, check platform harness for continuity (wires 002-6 and 300-11): repair / replace where necessary; If the output is not correct, check platform harness and platform console harness for continuity (wires 604): repair / replace where necessary; if harness is correct, check resistor value ( $620\ \Omega \pm 1\%$ ) and connections to CR3(13) and CR3(21). If harness and resistor are correct, replace sensor and proceed with a sensor mechanical setting and a calibration.

 **Tilt Sensor**

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
813	CHASSIS TILT SENSOR NOT CALIBRATED	The Tilt sensor has not been calibrated or sensors are being calibrated before Tilt sensor.		Proceed with a tilt sensor calibration.	If Calibration fails: Check that calibration is performed with machine on stable and level ground; Check that sensor is properly installed Check Tilt sensor reading (Analyzer, Diagnostic section): $2,5V \pm 0,25V$ Check chassis harness for continuity (power: wires 004-1 & 504-3; signal: wires 600 & 601): repair / replace where necessary; Replace the tilt sensor Replace the Master Controller.
814	CHASSIS TILT SENSOR OUT OF RANGE	The Tilt sensor signal is out of the permitted range (0,5V to 4,5V).	Check to see that the vehicle is on a level surface	Check to see that the tilt sensor is mounted properly to the chassis.	Check chassis harness for continuity (power: wires 004-1 & 504-3; signal: wires 600 & 601): repair / replace where necessary; Replace the tilt sensor Replace the Master Controller.
818	TILT SENSOR STAGNANT	Tilt sensor does not respond when vehicle is driven.	Cycle power to clear the fault.		Replace the tilt sensor Replace the Master Controller.

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

### Platform Load Sense

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
8210	OVERLOAD SENSOR ERROR	Inconsistency in the overload sensor information.	Unload the platform.	Check if the overload switch is obstructed or jammed.	Check harnesses for signs of damage. Check voltages: @ +VBat: CR24(1) & CR24(2), wire 300-12 When Platform is not overloaded: @ +VBat: CR24(4), wire 426, CR1(10) @ 0V: CR24(3), wire 416, CR3(7) When Platform is overloaded: @ +VBat: CR24(3), wire 416, CR3(7) @ 0V: CR24(4), wire 426, CR1(10).

### Platform Emergency Stop

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
108402	PLATFORM EMERGENCY STOP ERROR	Platform emergency stop is Not healthy. Inconsistency between the switch signals.		Check if the platform emergency stop switch is obstructed or jammed. Ensure the switch is properly tightened.	Check harnesses for signs of damage Check voltages: @ +VBat: wires 300-10 & 300-14 When Platform EStop is not pushed in: @ +VBat: CR4(1), wires 302 & 302-1, CR1(33) @ 0V: CR3(8), wire 400 When Platform EStop is depressed: @ +VBat: CR3(8), wire 400 @ 0V: CR4(1), wires 302 & 302-1, CR1(33).

### Steering

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
109901	STEER VALVE - UNCOMMANDED MOVEMENT	The Master Controller determines that wheel position is changing by more than 5° without being commanded.	Check oil level.	Check the steering system assembly and hydraulic motor. Check the steering sensor assembly. Check that hoses connections are tight.	Check steering pressure relief valves setting (refer to Section 9-7, Calibration) and reset where necessary. If pressure is low / can not be set in a single steering direction: - Check if corresponding relief valve is contaminated, obstructed or jammed: clean or replace valve where necessary; If pressure is low / can not be set in both steering direction: - Check if steering valve is contaminated, obstructed or jammed: clean or replace valve where necessary; - Replace steering motor.
109902	STEER RIGHT VALVE - STUCK OPEN	The Master Controller determines that wheel position is changing to the Right while Left steering is commanded.		Check valve harness for proper connections Check the hydraulic connections between powerpack and steering motor.	Check if steering valve is contaminated, obstructed or jammed: clean or replace valve where necessary.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

<b>DTC</b>	<b>Help Message</b>	<b>Condition Producing DTC</b>	<b>Corrective Action: Operator</b>	<b>Corrective Action: Service Basics</b>	<b>Corrective Action: Advanced Diagnostic</b>
109903	STEER LEFT VALVE - STUCK OPEN	The Master Controller determines that wheel position is changing to the Left while Right steering is commanded.		Check valve harness for proper connections Check the hydraulic connections between powerpack and steering motor.	Check if steering valve is contaminated, obstructed or jammed: clean or replace valve where necessary.
8639	STEER LEFT VALVE - OPEN CIRCUIT	The Left Steer valve coil is faulty or disconnected or the coil driver is faulty.		Check the valve harness for signs of damage. • Check the valve coil connections and wiring for interruptions.	<ul style="list-style-type: none"> <li>• Check the valve coil for correct impedance (refer to Section 7-4).</li> <li>• Replace the Ground Module if the coil and its harness are correct.</li> </ul>
8640	STEER LEFT VALVE - SHORT TO BATTERY	The Left Steer valve coil is shorted or the corresponding controller output is shorted to Battery positive.		Check the valve harness for signs of damage. • Check the valve coil connections and wiring for insulation interruption and possible cross connections between conductors.	Check the ground module output CR2(9), wire 809 for a short circuit to +Vbat. Check the valve coil for correct impedance (refer to section 7). Replace the ground module if the coil and its harness are correct.
8642	STEER RIGHT VALVE - OPEN CIRCUIT	The Right Steer valve coil is faulty or disconnected or the coil driver is faulty.		Check the valve harness for signs of damage. • Check the valve coil connections and wiring for interruptions.	<ul style="list-style-type: none"> <li>• Check the valve coil for correct impedance (refer to section 7).</li> <li>• Replace the Ground Module if the coil and its harness are correct.</li> </ul>
8643	STEER RIGHT VALVE - SHORT TO BATTERY	The Right Steer valve coil is shorted or the corresponding controller output is shorted to Battery positive.		Check the valve harness for signs of damage. • Check the valve coil connections and wiring for insulation interruption and possible cross connections between conductors.	Check the ground module output CR2(14), wire 808 for a short circuit to +Vbat. Check the valve coil for correct impedance (refer to section 7). Replace the ground module if the coil and its harness are correct.
108503	STEER SENSOR - OUT OF RANGE	The Wheel position sensor signal input is outside the acceptable voltage range.	Cycle power to clear the fault.	Check the steering sensor assembly.	Check sensor harness for damage (CR8, wires 504-4, 005-3 & 603), repair or replace as necessary; Replace the sensor.
8667	STEER SENSOR - NOT RESPONDING	Invalid signal from the steer (wheel position) sensor. This fault appears when steering is controlled but the sensor output remains unchanged for more than 1 second.	Cycle power to clear the fault Ensure that no obstacle prevents the wheel from rotating and that machine is operating on a firm level ground. Check oil level.	Check the hydraulic connections between powerpack and steering motor.	If steering operates at normal speed: Check that the sensor is properly installed (refer to section 4 for installation and mechanical setting of the sensor); if correct: replace the sensor. If pump is running but steering does not operate or operates at low speed: Check steering pressure relief valves setting and adjust as necessary (refer to section 9) Check / reset following personalities as needed (refer to section 9 for nominal values): Drive: Steer Valve: Steer min, max Proceed with a wheel position sensor calibration, including steering valves

## SECTION 10 - DIAGNOSTIC TROUBLE CODES

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
8668	STEER SENSOR - NOT CALIBRATED	The steering (wheel position) sensor has not been calibrated.		Ensure that Tilt sensor and Mast sensor are properly calibrated and: Proceed with a wheel position sensor calibration.	Check that Wheel position sensor output is within acceptable range (refer to section 8) from left to right stop using Diagnostic function. If sensor output is @ 0V or @ +5V: check sensor harness for damage (CR8, wires 504-4, 005-3 & 603), repair or replace as necessary; replace sensor; If sensor output is within range but * constant throughout the wheel movement range: sensor not driven by the gear; or * changing on a portion of the wheel movement range only: incorrect mechanical sensor setting; or * with sporadic changes: mechanical connection to the gear becoming loose Check that the sensor is properly installed (refer to section 4 for installation and mechanical setting of the sensor); if correct: replace the sensor.

### Hardware

DTC	Help Message	Condition Producing DTC	Corrective Action: Operator	Corrective Action: Service Basics	Corrective Action: Advanced Diagnostic
9914 (9920)	PLATFORM MODULE SOFTWARE UPDATE REQUIRED	Platform module software needs update following flash issue.			Reinstall the most current Production software for the Platform Module. Replace the Platform Module.
9920	PLATFORM SENSOR REF VOLTAGE OUT OF RANGE	Platform module 5V voltage supply is out of range.	Cycle power to clear the fault.	Check Platform console harnesses for signs of damage: repair / replace where necessary.	Disconnect Drive and Steer joysticks and check voltages: @ +VBat: CR3(1) @ 5V: CR3(12) @ 0V: CR3(13) If voltages are out of permitted range: Replace the Platform Module. If voltages are correct, Reconnect the joysticks one by one and check 5V line: replace joystick(s) where necessary.
9978	EEPROM VALUE – OUT OF RANGE	Master Controller determines that an EEPROM value is out of the permitted range.	Cycle power to clear the fault.		Reinstall the most current Production software for the Master Controller. Replace the Master Controller.
9996	MASTER MODULE EEPROM FAILURE	Master Controller determines at Startup that an internal EEPROM error exists.	Cycle power to clear the fault.		Reinstall the most current Production software for the Master Controller. Replace the Master Controller.
99168	MASTER MODULE – CURRENT MEASUREMENT ERROR	Master Controller determines during Drive that the current feedback sensors are out of the permitted range and may cause incorrect data acquisition values.	Cycle power to clear the fault.		Check that drive motor phases (U, V, W) are insulated from the vehicle frame: Insulation failure can come from U, V, W cables or Motor stator: replace where necessary. Replace the Master Controller.
99288	GROUND MODULE – INTERNAL ERROR	Ground module reports internal fault or EEPROM fault.	Cycle power to clear the fault.		Reinstall the most current Production software for the Ground Module. Replace the Ground Module.

**SECTION 10 - DIAGNOSTIC TROUBLE CODES**

<b>DTC</b>	<b>Help Message</b>	<b>Condition Producing DTC</b>	<b>Corrective Action: Operator</b>	<b>Corrective Action: Service Basics</b>	<b>Corrective Action: Advanced Diagnostic</b>
108311 (108211) 108344 (108244)	PLATFORM MODULE- INTERNAL ERROR	Platform Module reports Internal fault or EEPROM fault.	Cycle power to clear the fault.		Reinstall the most current Production software for the Platform Module. Replace the Platform Module.
111900 112100	MASTER MOD- ULE - SUPER- VISION ERRORS	Master Controller internal error.	Cycle power to clear the fault.		Replace the Master Controller.
110400	MASTER MOD- ULE - EXECU- TION ERROR	Main vehicle program fault.	Cycle power to clear the fault.		Reinstall the most current Production software for the Master Controller. Replace the Master Controller.
9950	MASTER MOD- ULE - INTER- NAL ERROR	Master Controller internal error.	Cycle power to clear the fault.		Replace the Master Controller.



## SECTION 11. GENERAL ELECTRICAL INFORMATION &amp; SCHEMATICS

## 11.1 GENERAL

This section contains basic electrical information and 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, technical qualified guidance should be obtained before proceeding with any maintenance.

## 11.2 MULTIMETER BASICS

A wide variety of multimeters or Volt Ohm Meters (VOM) can be used for troubleshooting your equipment. 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**

Getting 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 x (Displayed Number)

k = kilo = 1 000 x (Displayed Number)

m = milli = (Displayed Number) / 1 000

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

Example: 1.2 kW = 1200 W

Example: 50 mA = 0.05 A

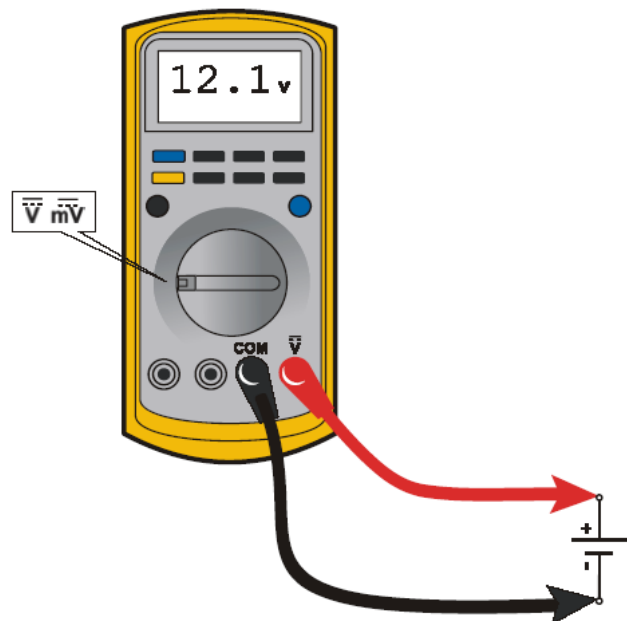
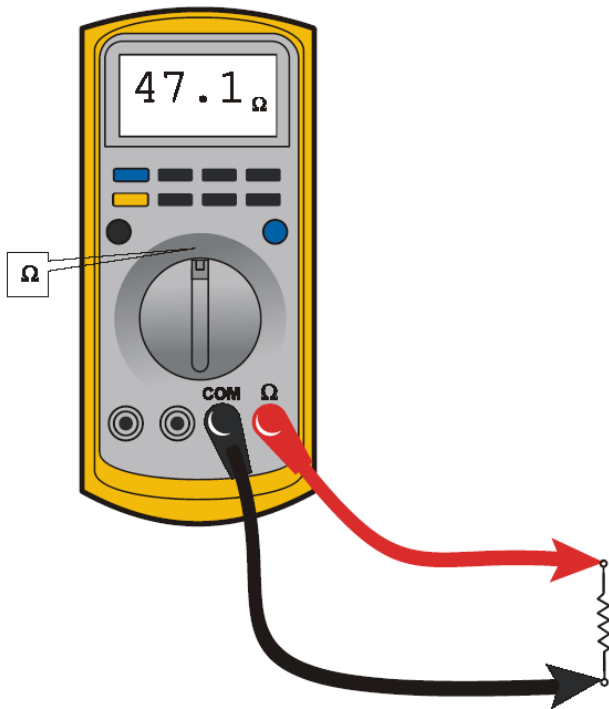
**Voltage Measurement**

Figure 11-1. 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.

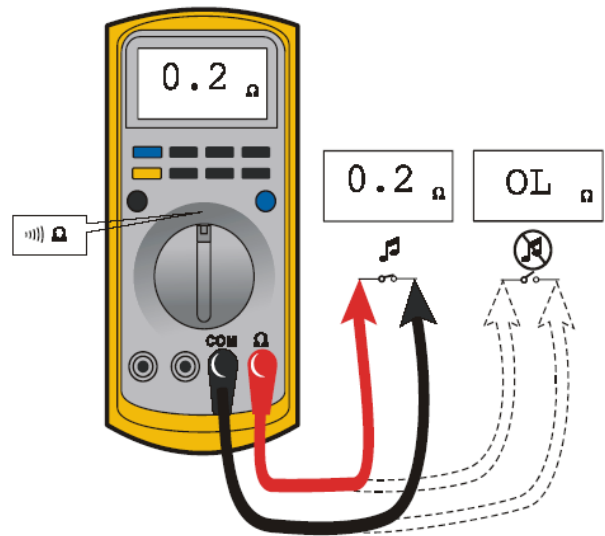
**Resistance Measurement**



**Figure 11-2. 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 contacts with meter leads.

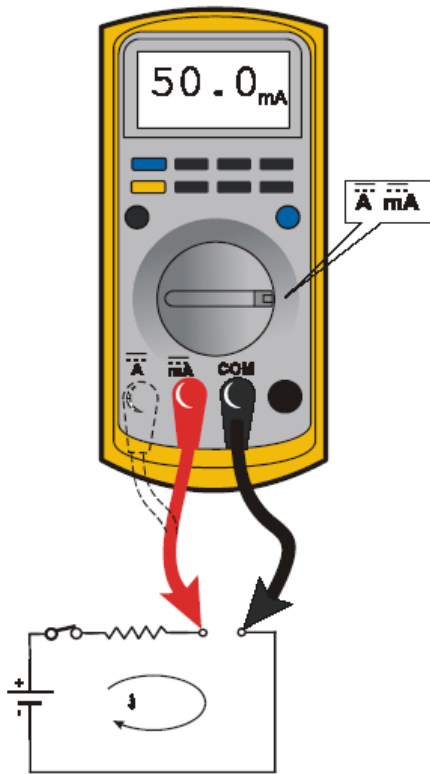
**Continuity Measurement**



**Figure 11-3. Continuity Measurement**

- Some meters require a separate button 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 11-4. Current Measurement (DC)**

- Set up 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 multimeter's operation manual).
- Use firm contact with meter leads.

## 11.3 CHECKING SWITCHES

### Basic Check

The following check determines if the switch is functioning properly, not the circuit in which the switch is placed. A switch is functioning properly when there is continuity between the correct terminals or contacts only when selected.

1. De-energize the circuit.
2. Isolate the switch from the rest of the circuit if possible; If not possible, keep in mind it may affect readings.
3. Access the terminals to the switch.
4. If the switch has two terminals:

- a. Measure resistance across the terminals.
  - b. Change the switch position.
  - c. Measure resistance again with the leads in the same positions. If the meter was reading short, it should read an open. If the meter was reading open it should read short.
5. If the switch has more than two terminals, consult the schematic or switch diagram to determine what terminals will be connected. The test is similar to testing a switch with two terminals.
    - a. Place one meter lead on the common contact and the other on a different contact in the same circuit.
    - b. Cycle through all positions of the switch. The meter should read short only when the switch connects the two terminals and open otherwise.
    - c. If the switch has more than one common contact repeat the process for that circuit.

### Limit Switches

Limit switches are used to control movement or indicate position. Mechanical limit switches are just like manually operated switches except that the moving object operates the switch. These switches can be tested the same way as a standard switch by manually operating the sensing arm.

Another type of limit switch used by JLG is the inductive proximity switch, also referred to as a "prox switch". Inductive proximity switches are actuated only by ferrous metal (metal that contains Iron, such as steel) near the switch. They do not require contact, and must be energized to actuate. These types of switches can be used to detect boom or platform position, for example. These switches have a sensing face where the switch can detect ferrous metal close to it. To find the sensing face, take note how the switch is mounted and how the mechanisms meet the switch. Test this type of switch as follow:

1. Remove prox switch from its mount.
2. Reconnect harness if it was disconnected for step a, and turn on machine.
3. Hold switch away from metal and observe switch state in the control system diagnostics using the Analyzer. See vehicle or control system documentation on how to do this.
4. Place sensing face of switch on the object to be sensed by the switch. If that is not available, use a piece of ferrous metal physically similar to it. The switch state in the control system diagnostics should change.
5. When reinstalling or replacing switch be sure to follow mounting instructions and properly set the gap between the switch and object sensed.

### Automatic Switches

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If the switch is actuated automatically, by temperature or pressure for example, find a way to manually actuate the switch to test it. Do this either by applying heat or pressure, for example, to the switch. These switches may need to be energized to actuate.

1. Connect instrumentation to monitor and/or control the parameter the switch is measuring.
2. Observe switch state in control system with the Analyzer. See vehicle or control system documentation on how to do this.
3. Operate system such that the switch actuates. This could be going over a certain pressure or temperature, for example. The state indicated in the control system should change.

### Switch Wiring - Low Side, High Side

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When controlling a load, a switch can be wired between the positive side of the power source and the load. This switch is called a "high side" switch. The switch supplies the power to the load. When a switch is wired between the negative side of the power source and the load, it is a "low side" switch. The switch provides the ground to the load.

A low side switch will allow voltage to be present on the load. No power is applied because the switch is stopping current flow. This voltage can be seen if the measurement is taken with one test lead on the load and the other on the battery negative side or grounded to the vehicle. What is actually being measured is the voltage drop across the switch. This could mislead a technician into thinking the load is receiving power but not operating. To produce an accurate picture of power or voltage applied to the load, measure voltage across the load's power terminals. Also the technician can measure the voltage at both power terminals with respect to battery ground. The difference between those two measurements is the voltage applied to the load.

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### 11.4 APPLYING CONTACT GREASE TO ELECTRICAL CONNECTIONS

Contact Grease must be used on all electrical connections for the following reasons:

- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Contact Grease to the electrical connectors. This procedure applies to all plug connections not enclosed in a box. Contact Grease should not be applied to connectors with external seals.

1. To prevent oxidation, Contact Grease must be packed completely around male and female pins on the inside of the connector prior to assembly. This is most easily achieved by using a syringe.

**NOTE:** *Over a period of time, oxidation increases electrical resistance at the connection, eventually causing circuit failure.*

2. To prevent shorting, Contact Grease must be packed around each wire where they enter the outside of the connector housing. Also, Contact Grease must be applied at the joint where the male and female connectors come together. Any other joints (around strain reliefs, etc...) where water could enter the connector should also be sealed.

**NOTE:** *This condition is especially common when machines are pressure washed since the washing solution is much more conductive than water.*

3. Anderson connectors for the battery boxes and battery chargers should have Contact Grease applied to the contacts only.

**NOTE:** *Curing-type sealants might also be used to prevent shorting and would be less messy, but would make future pin removal more difficult.*

**11.5 AMP CONNECTOR**

**Applying Contact Grease to AMP Connectors**

Contact Grease must be used on the AMP connections for the following reasons:

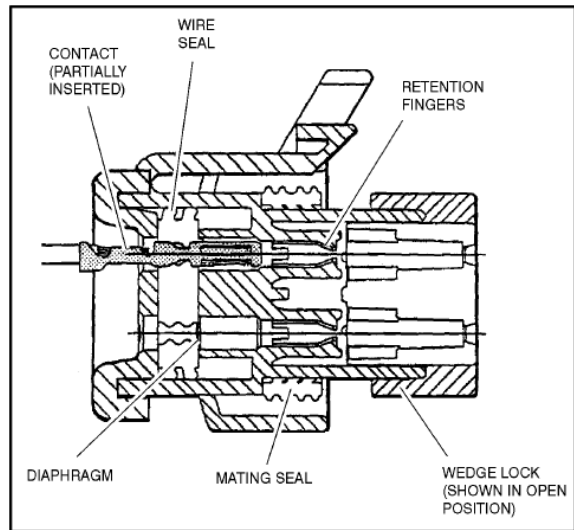
- To prevent oxidation at the mechanical joint between male and female pins.
- To prevent electrical malfunction caused by low level conductivity between pins when wet.

Use the following procedure to apply Contact Grease to the electrical connectors.

1. To prevent oxidation and low level conductivity, Contact Grease must be packed completely around male and female pins on the inside of the connector after the mating of the housing to the header. This is easily achieved by using a syringe to fill the header with Contact Grease, to a point just above the top of the male pins inside the header. When assembling the housing to the header, it is possible that the housing will become air locked, thus preventing the housing latch from engaging.
2. Pierce one of the unused wire seals to allow the trapped air inside the housing to escape.
3. Install a hole plug into this and/or any unused wire seal that has Contact Grease escaping from it.

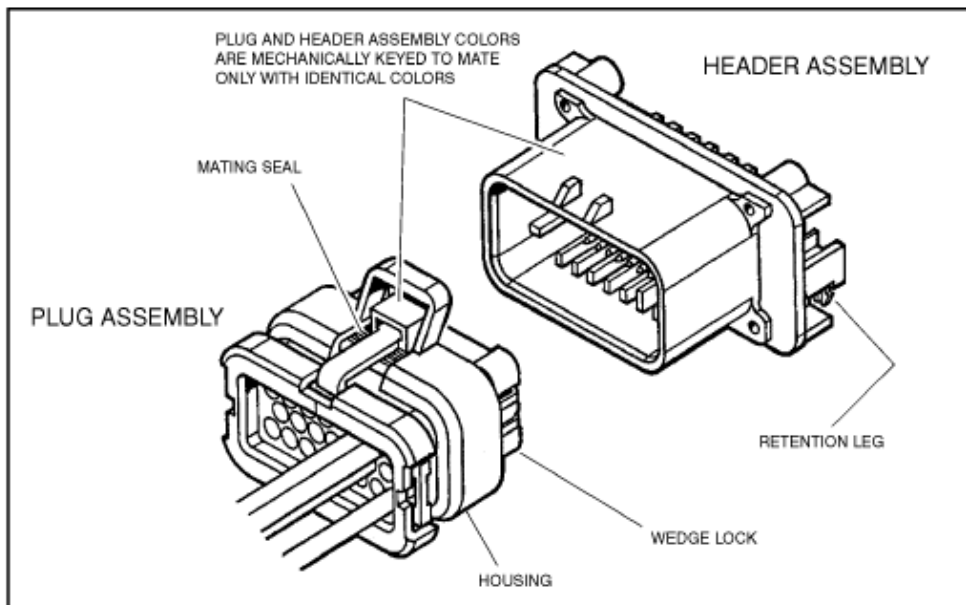
**Assembly**

Check to be sure the wedge lock is in the open, or asshipped, position (See Figure 11-5). Proceed as follow:



**Figure 11-5. Connector Assembly Figure 1**

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 11-7).
2. Pull back on the contact wire with a force of 1 or 2 lbs. to be sure the retention fingers are holding the contact (See Figure 11-7).



**Figure 11-6. AMP Connector**

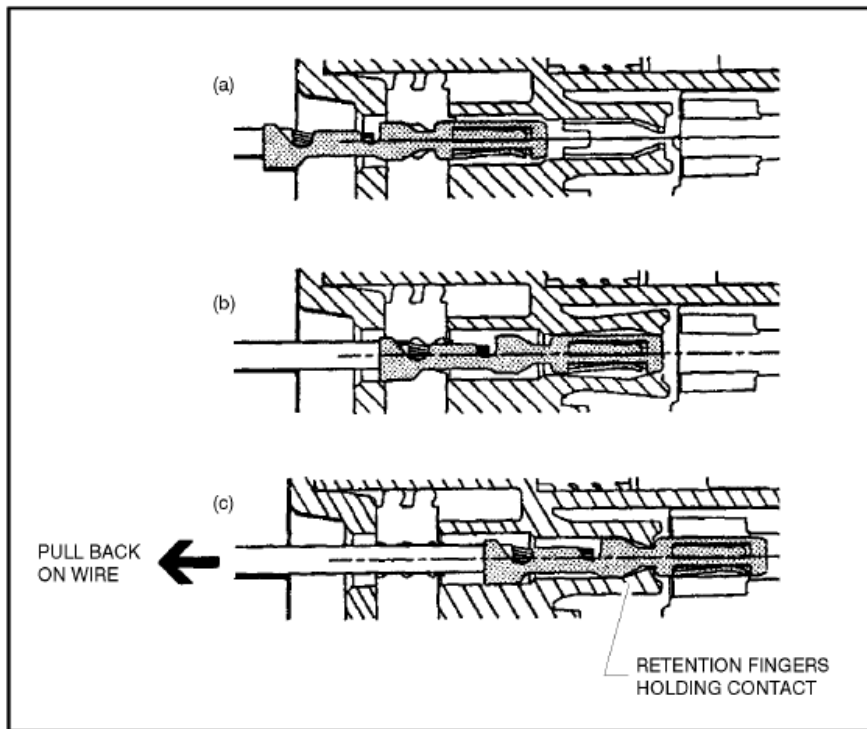


Figure 11-7. Connector Assembly Figure 2

3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 11-8).

4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 11-9).

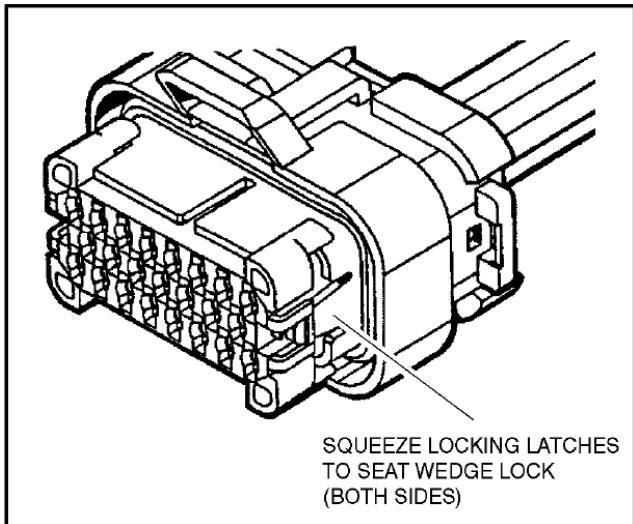


Figure 11-8. Connector Assembly Figure 3

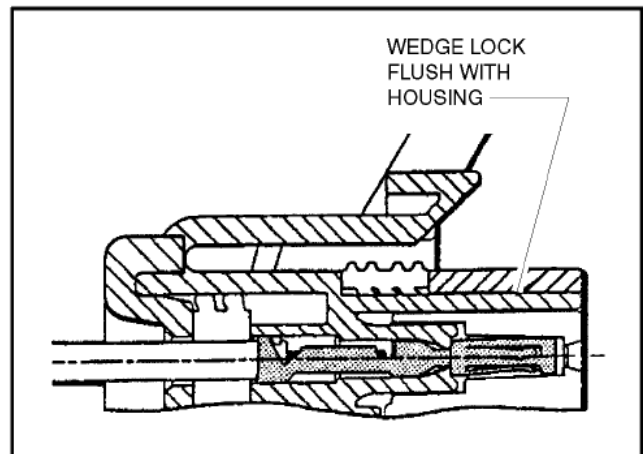


Figure 11-9. Connector Assembly Figure 4

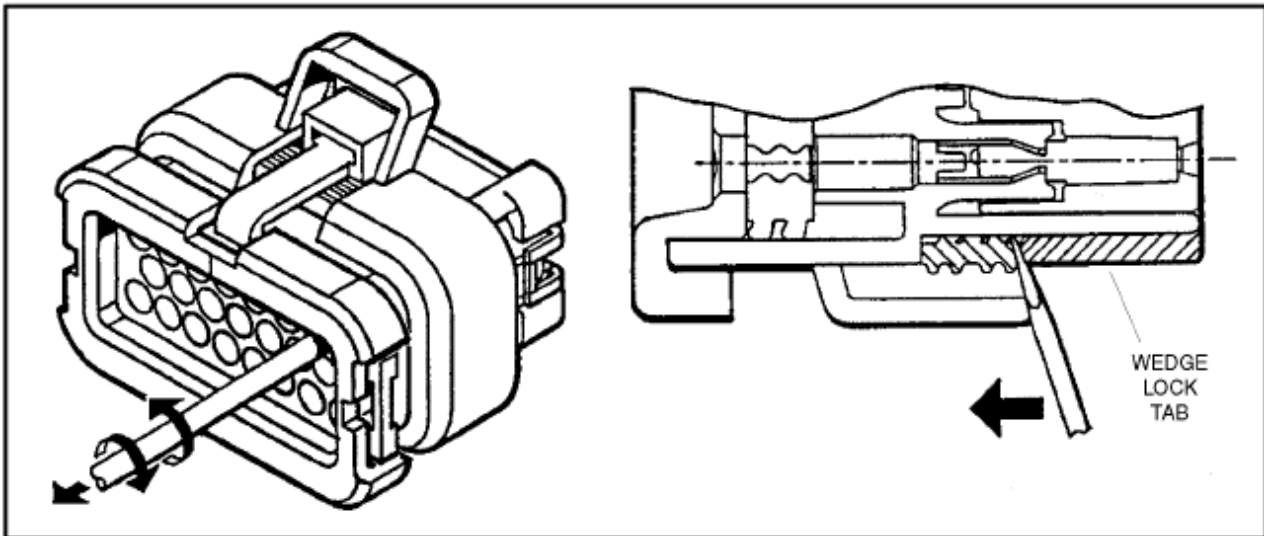


Figure 11-10. Connector Disassembly

### Disassembly

1. Insert a 4.8 mm (3/16") wide screwdriver blade between the mating seal and one of the red wedge lock tabs.
2. Pry open the wedge lock to the open position.
3. While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.

**NOTE:** *The wedge lock should never be removed from the housing for insertion or removal of the contacts.*

### Wedge Lock

The wedge lock has slotted openings in the forward, or mating end. These slots accommodate circuit testing in the field, by using a flat probe such as a pocket knife. DO NOT use a sharp point such as an ice pick.

### Service - Voltage Reading

#### **⚠ CAUTION**

**DO NOT PIERCE WIRE INSULATION TO TAKE VOLTAGE READINGS.**

It has been common practice in electrical troubleshooting to probe wire by piercing the insulation with a sharp point. This practice should be discouraged when dealing with the AMPSEAL plug assembly, or any other sealed connector system. The resulting pinholes in the insulation will allow moisture to invade the system by traveling along the wire strands. This nullifies the effectiveness of the connector seals and could result in system failure.

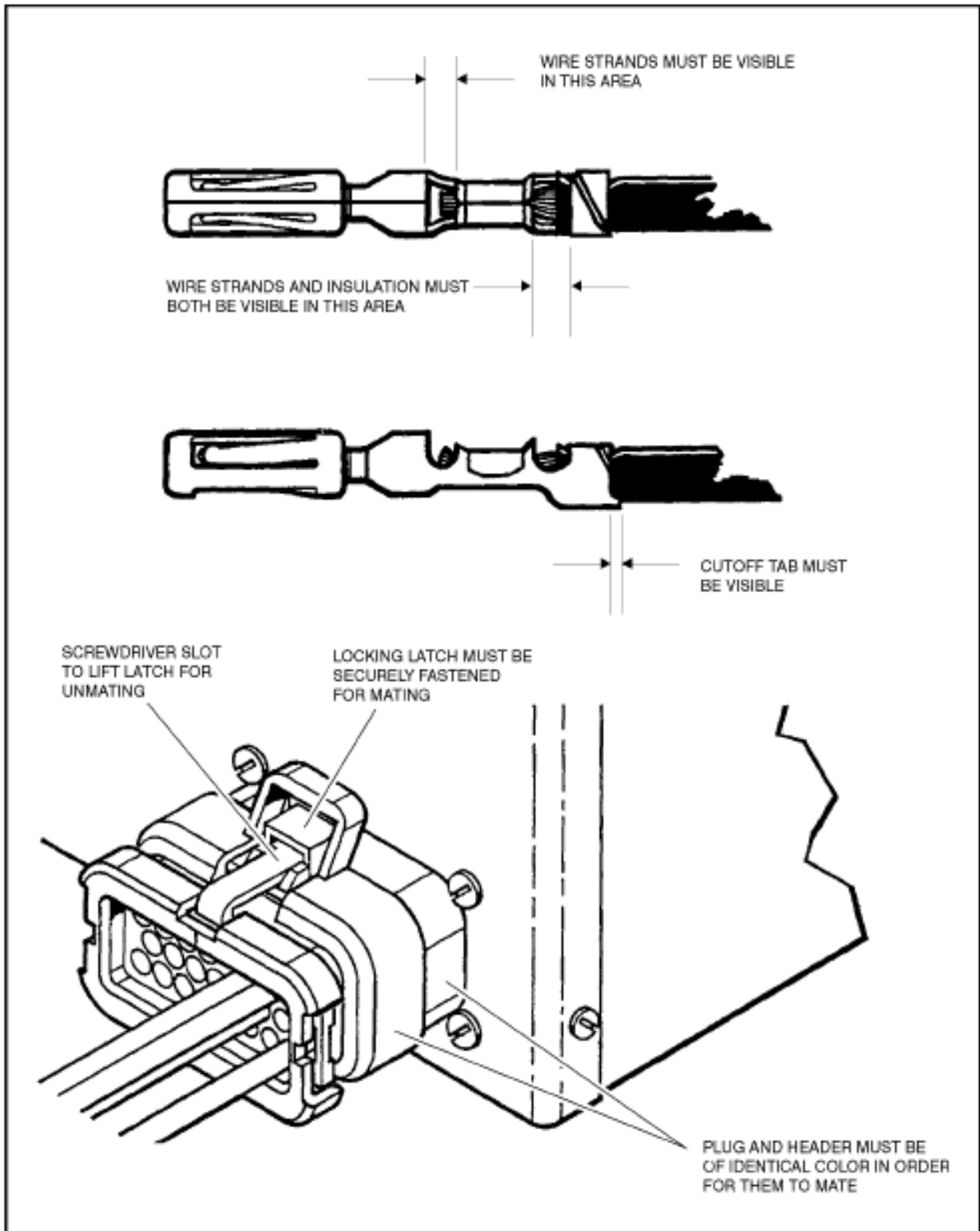
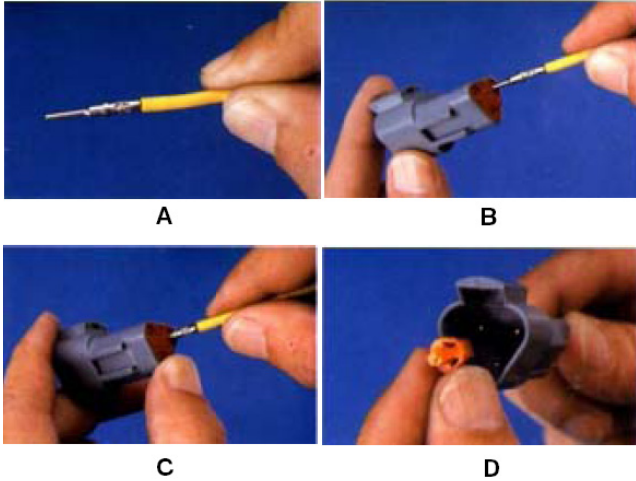


Figure 11-11. Connector Installation

## 11.6 DEUTSCH CONNECTORS

### DT/DTP Series Assembly

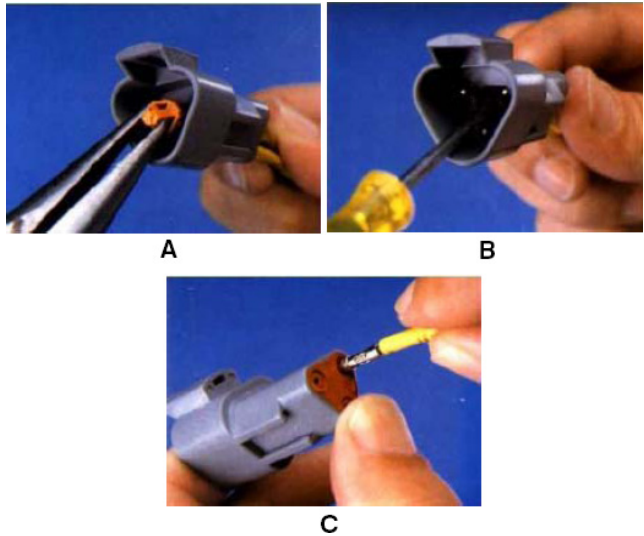


**Figure 11-12. DT/DTP Contact Installation**

1. Grasp crimped contact about 25 mm behind the contact barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a click is felt. A slight tug will confirm that it is properly locked in place.
4. Once all contacts are in place, insert wedgelock with arrow pointing toward exterior locking mechanism. The wedgelock will snap into place. Rectangular wedges are not oriented. They may go in either way.

**NOTE:** The receptacle is shown - use the same procedure for plug.

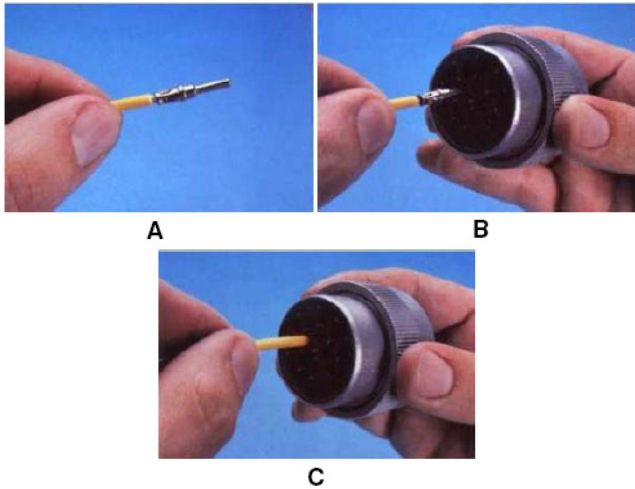
### DT/DTP Series Disassembly



**Figure 11-13. DT/DTP Contact Removal**

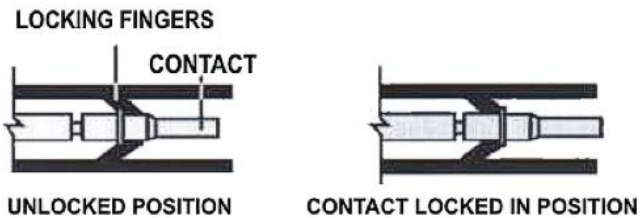
1. Remove wedgelock using needle-nose pliers or a hook shaped wire to pull wedge straight out.
2. To remove the contacts, gently pull wire backwards, while at the same time releasing the locking finger by moving it away from the contact with a screwdriver.
3. Hold the rear seal in place, as removing the contact may displace the seal.

**HD30/HDP20 Series Assembly**



**Figure 11-14. HD/HDP Contact Installation**

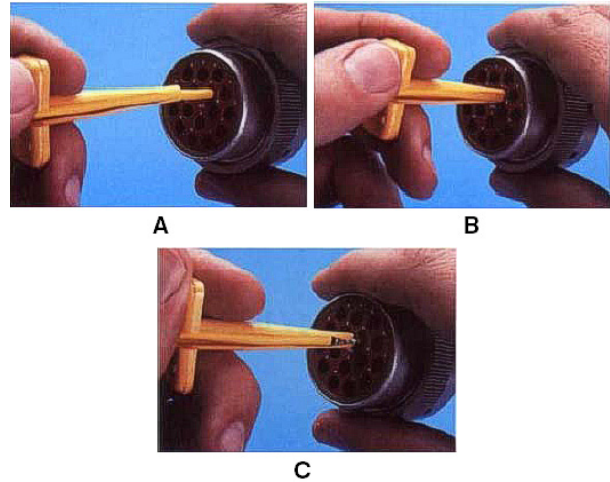
1. Grasp contact about 25 mm behind the contact crimp barrel.
2. Hold connector with rear grommet facing you.
3. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.



**Figure 11-15. HD/HDP Locking Contacts Into Position**

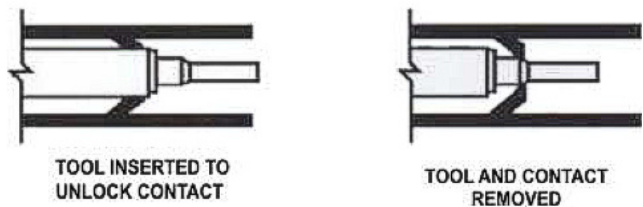
**NOTE:** For unused wire cavities, insert sealing plugs for full environmental sealing.

**HD30/HDP20 Series Disassembly**



**Figure 11-16. HD/HDP Contact Removal**

1. With rear insert toward you, snap appropriate size extractor tool over the wire of contact to be removed.
2. Slide tool along into the insert cavity until it engages contact and resistance is felt.
3. Pull contact-wire assembly out of connector.



**Figure 11-17. HD/HDP Unlocking Contacts**

**NOTE:** Do not twist or insert tool at an angle.

11.7 CONNECTORS IDENTIFICATION

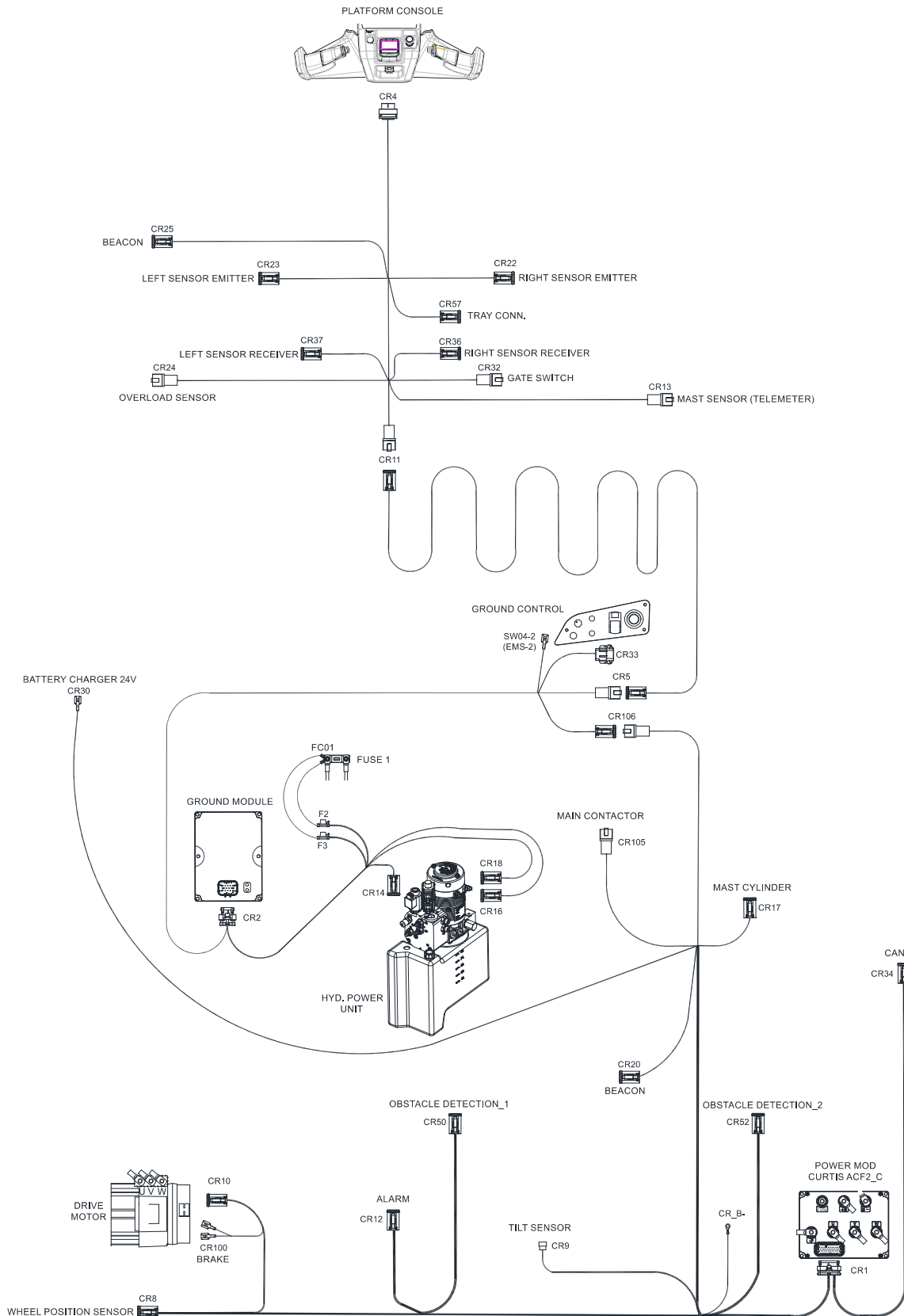


Figure 11-18. Control Cables

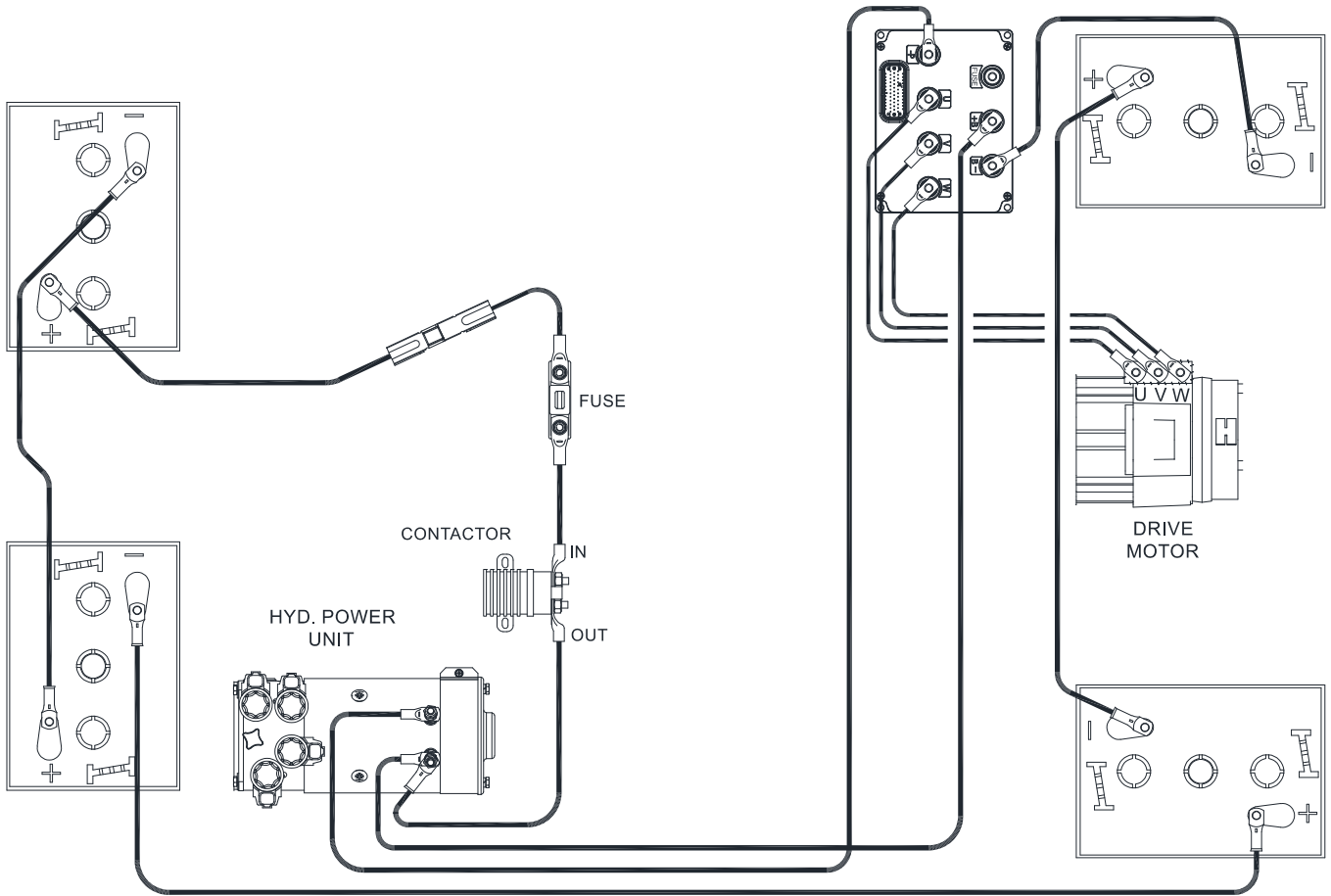


Figure 11-19. Power Cables

11.8 ELECTRICAL SCHEMATIC

Ref: 1001245304\_C

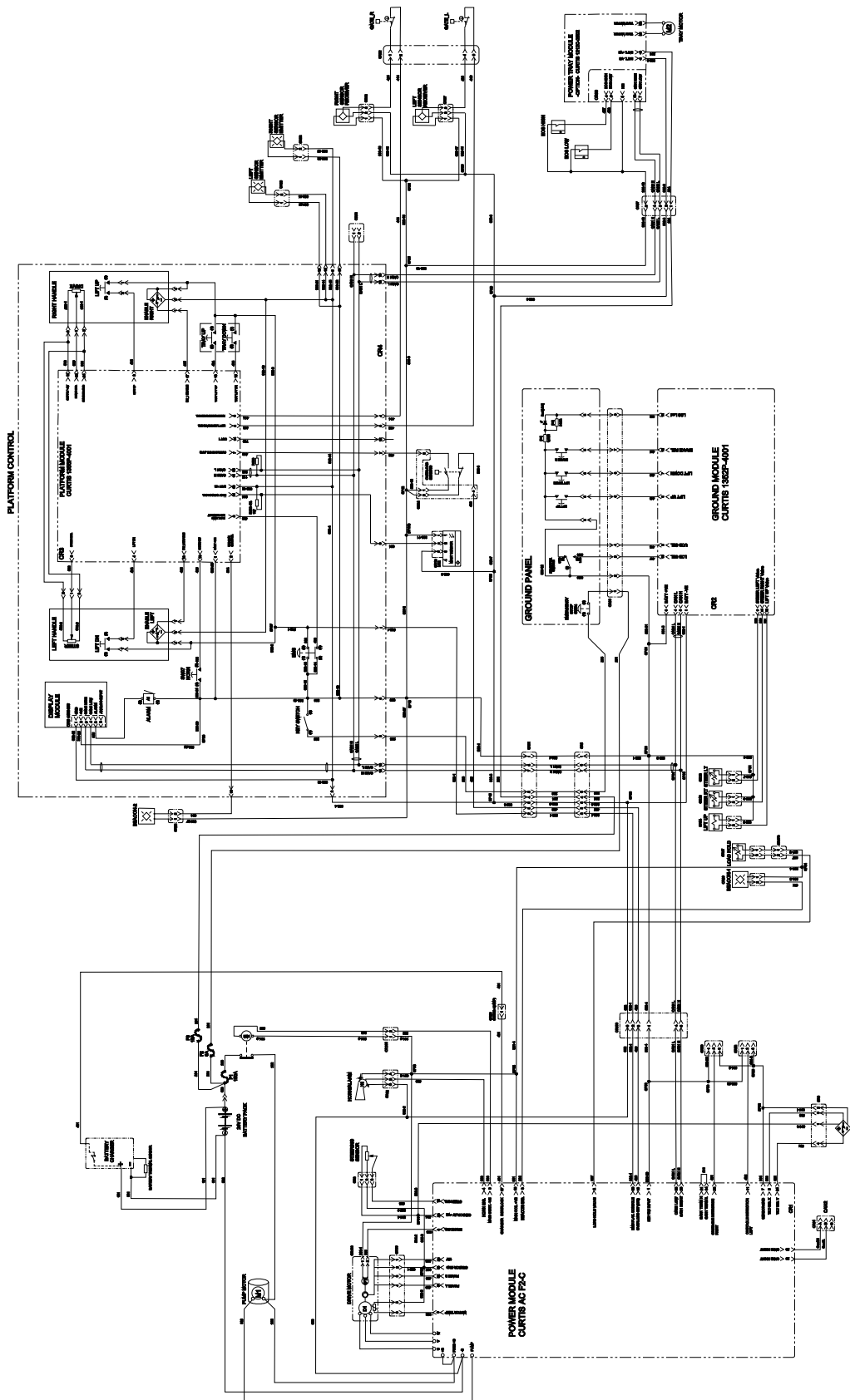
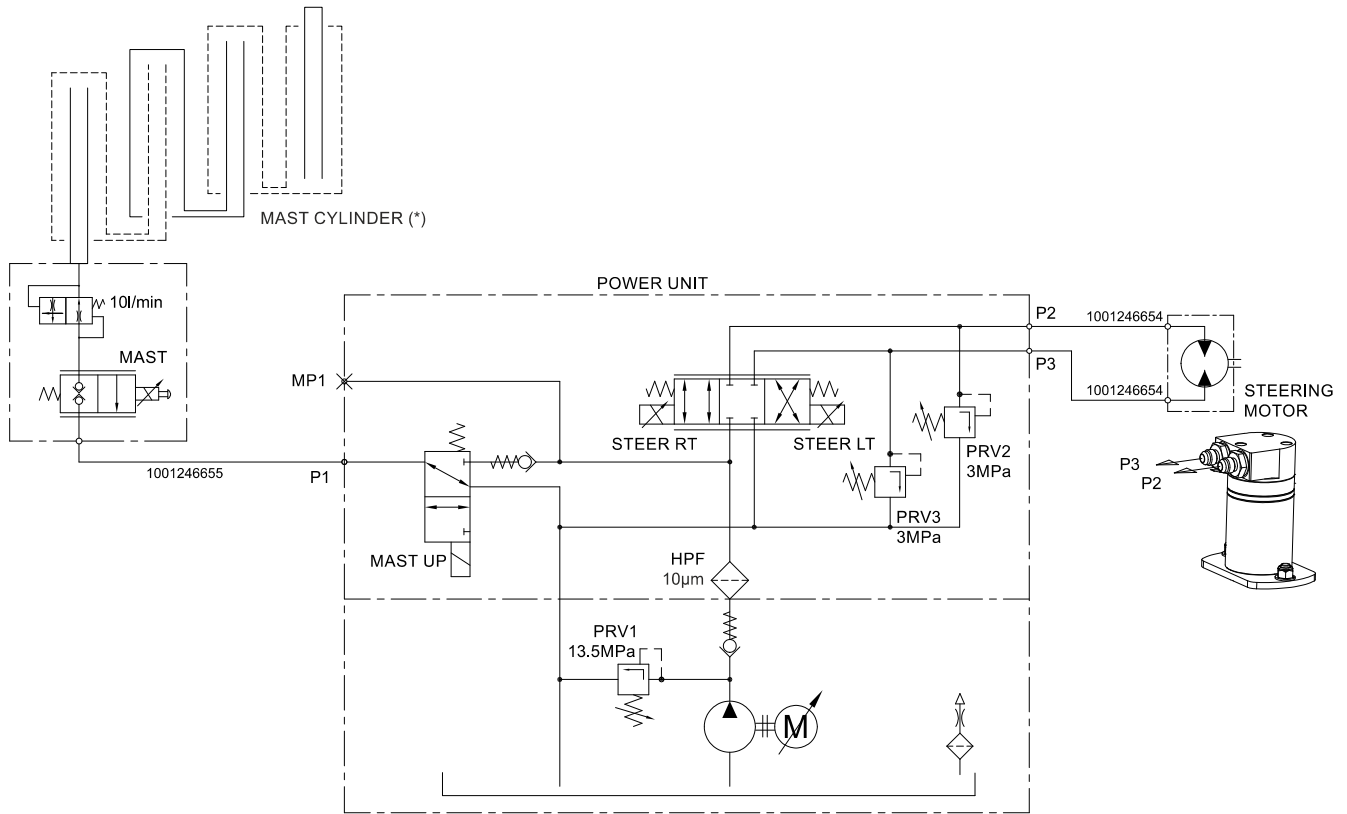


Figure 11-20. Electrical schematic

11.9 HYDRAULIC SCHEMATIC

Ref: 1001248254\_A



(\*) Cylinder stage number depending on model

Figure 11-21. Hydraulic schematic





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