An Oshkosh Corporation Company

Service and Maintenance Manual

Models
X26JP Gen3
X770AJ Gen3

31215525

October 23, 2020 - Rev A

ANSI

CE

An Oshkosh Corporation Company

INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

GENERAL

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

⚠ WARNING

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

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

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

⚠ WARNING

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

HYDRAULIC SYSTEM SAFETY

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

MAINTENANCE

⚠ WARNING

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

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

REVISON LOG

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SECTION 1. SPECIFICATIONS

1.1 CAPACITIES

Table 1-1. Drive Hub Capacities

Machine	Type Drive Hub	Drive	Capacities
X26JP / X770AJ	BONFIGLIOLI 701 C2K + MAG18VP	AUTO 2 SPEED	0.16 gal (0,6 L)

Table 1-2. Hydraulic & Fuel Tank Capacities

MACHINE	HYDRAULIC OIL TANK CAPACITY	FUEL TANK CAPACITY (DIESEL)
X26JP / X770AJ	15.85 gal (60L)	10.56 gal (25L)

1.2 TRACK SPECIFICATIONS

Table 1-3. Track Specifications

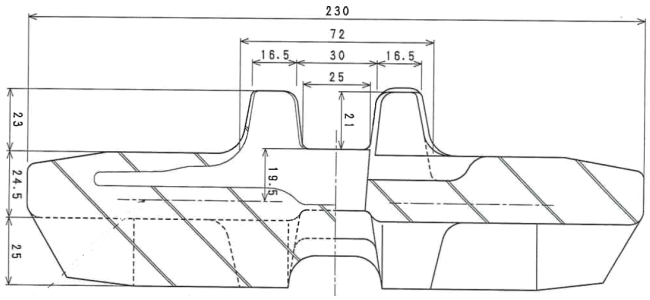
MACHINE MODEL	RUBBER BELT TRACK			
	TYPE	PART NUMBER	DIMENSIONS	DRAWING
X26JP X770AJ	HI PROFILE BLACK COLOR	27589900	Cm 230 X 26 X 96	
	HI PROFILE NON-MARK-ING	2758990B		

Table 1-4. Ground Bearing Pressure

MODEL	PRESSURES AND REACTIONS TO THE GROUND					
	ON TRACKS		ON OUTRIGGER			
	*Ground Bearing Pressure [daN/cm^2] - [PSI] * Average values on hard surface		Maximum Ground Bearing Pressure On Each Pad [daN] - [lbf]		Maximum Ground Bearing Pressure [daN/cm^2] - [PSI]	
X26JP-X770AJ	0,53 daN/cm^2	7.6 PSI	3124 daN	7023 lbf	4,42 daN/cm2	65 PSI

1.3 POWER SOURCE

Table 1-5. Power Configurations

	X26JP - X770AJ
Diesel Engine	Kubota D902 21.6 hp (16,1 Kw)
Lithium	100 Ah 83V
Bi-Energy	100 Ah 83V Lithium system combined with the Kubota D902 21.6 hp (16,1 Kw) diesel engine

Kubota Engine D902-E3B Specifications

Table 1-6. Specifications Kubota Engine D902-E3B

Model		D902-E3B
Emission Regulation		Tier 4
Type		Vertical 4-cycle Liquid Cooled Diesel
Number of Cylinders		3
Bore	mm (in)	72 (2.83)
Stroke	mm (in)	73,6 (2.9)
Displacement	L (cu.in)	0,898 (54.80)
Compustion System		IDI
Intake System		Naturally Aspirated
Maximum Speed	rpm	3200
Output: Gross Intermittent	KW	16.1
	hp	21.6
	ps	21.9
Direction of Rotation		Counterclockwise viewed on flywheel
Oil Pan Capacity	L (gal)	3,7 (0.98)
Starter Capacity	V-KW	12-1.2
Alternator Capacity	V-A	12-40
Lenght	mm (in)	467,1 (18.40)
Width	mm (in)	420,5 (16.6)
Height (1)	mm (in)	544,1 (21.42)
Height (2)	mm (in)	204,0 (8.03)
Dry Weight	KG (lb)	72,0 (158.8)

Lithium System Specifications

For detailed information on the Lithium system, refer to the Lithium Supplement manual, PN 31215460. This supplement manual can be downloaded from Online Express or www.jlg.com.

1.4 SPECIFICATIONS AND PERFORMANCE DATA

Reach Specifications

Table 1-7. Machine Reach Specifications

	X26JP CE	X770AJ ANSI
Working Height	25,70 m	N/A
Platform Height	23,60 m	77.42 ft
Horizontal Outreach	13,75 m	45.11 ft
Up & Over Height	10,1 m	33.13 ft
Swing (non - continuous)	360°	
Max gradeability allowed in drive	16° / 28.7%	
Max gradeability stabilization	16°	
Max Approach /Depart angles	22°	

Dimensional Data

Table 1-8. Machine Dimensional Data

	X26JP / X770AJ
Platform size (standard 2 persons)	27.16 in. x 52.56 in. (690 mm x 1335 mm)
Stowed width (with std. 2P platform)	52.56 in. (1335 mm)
Stowed width (without platform)	38.98 in. (990 mm)
Stowed height (on tracks)	78 in. (1981 mm)
Stowed length (on tracks)	250 in. (6347 mm)
Outrigger footprint (Between Center Plate)	160.59 in. x 156.61 in. (4079 x 3978 mm)
Outrigger footprint reduced stabilization area (Between Center Plate)	214.61 in. x 98.50 in. (5451 x 2502 mm)
Machine weight (with standard platform)	
Bi-Energy:	10000 lb. (4540 Kg)
Diesel:	9623 lb. (4365 Kg)
Lithium Battery:	9665 lb. (4384 Kg)

Function Speed Data

Table 1-9. Function Speed

MACHINE MODEL	X26JP / X770AJ		
POWER SYSTEM	Engine	Lithium	Bi-Energy
FUNCTION	TIME Sec		
TELESCOPE EXTEND	21'' - 30''	45'' - 60''	
TELESCOPE RETRACT	21'' - 30''	40'' - 50''	
TOWER BOOM UP	36'' - 42''	45'' - 60''	
TOWER BOOM DOWN	36'' - 45''	50'' - 65''	
UPPER BOOM UP	41'' - 52''	50'' - 70''	
UPPER BOOM DOWN	41'' - 52''	50'' - 70''	
BASKET ROTATE RIGHT	7'' - 15''	7'' - 15''	
BASKET ROTATE LEFT	7'' - 15''	7'' - 15''	
SWING LEFT	55'' - 65''	60'' - 80''	
SWING RIGHT	55'' - 65''	60'' - 80''	
JIB UP	7'' - 15''	10'' - 20''	
JIB DOWN	7'' - 15''	10'' - 15''	
BASKET LEVEL UP	33'' - 55''	33'' - 55''	
BASKET LEVEL DOWN	37'' - 50''	40'' - 65''	
DRIVE SPEED	0.68/1.24 mph (1,1/2 Km/h)	0.43/0.75 mph (0,7/1,2 Km/h)	

Machine Orientation When Performing Speed Tests

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

Test Notes:

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

1.5 HYDRAULIC PRESSURE SETTINGS - PSI (BAR)

Table 1-10. Pressure Settings

MODEL	UNDERCARRIAGE Left and Right Control Valve		TOWER Control Valve	
	BAR	PSI	BAR	PSI
X26JP - X770AJ	200	2900	200	2900

Table 1-11. Reduction Drive Speed Pressure Settings

MODEL	AUTOMATIC REDUCTIONS DRIVE SPEED	
	BAR	PSI
X26JP - X770AJ	26	380

1.6 MAJOR COMPONENT WEIGHTS

Table 1-12. Major Component Weights

MACHINE	X26JP - X770AJ	
DESCRIPTION	KG	LBS
Basket with Remote Control	43.0	94.7
Basket A-Frame Assembled	31	68.3
Basket Level Cylinder	8	17.6
Basket Rotator	17	37.4
Cylinder JIB	12	26.4
Upper JIB Link	10	22
Lower JIB Link	15	33
Arms JIB	24	52.9
Upper Boom	218.3	481.2
Telescope Cylinder	94.8	209
Upper Upright	83.3	183.6
Master Cylinder	7	15.4
Upper Lift Cylinder	69.7	153.6
Upper Boom Link	204	449.7
Upper Tower Boom	283.1	624.1
Upper Tower Cylinder	89.4	197
Lower Boom Link	27	59.5
Lower Upright	126.3	278.4
Tower Link	141	310.8
Lower Tower Boom	194.3	428.3
Tower	217.9	480.3
Undercarriage Assembled	2137.2	4711.7

1.7 LUBRICATION

Hydraulic Oil

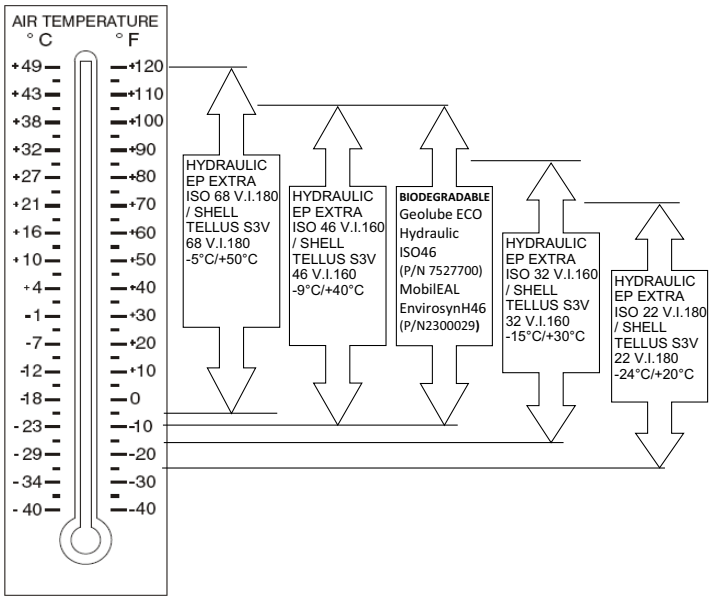


Figure 1-1. Hydraulic Oil Temperature Operating Range

FLUID	PROPERTIES		TYPE				CLASSIFICATIONS		
DESCRIPTION	Viscosity at 40°C (cst,Typical)	Viscosity Index	Mineral Oils	Vegetable Oils	Synthetic	Synthetic Polyol Esters	Readily Biodegradable*	Virtually Non-toxic**	Fire Resistant***
Pakelo Hydraulic EP Extra ISO 68	68	180	X						
Pakelo Hydraulic EP Extra ISO 46	46	160	X						
GeolubeECO HydraulicISO 46 (P/N 17527700)	47.3	144				X	X		
Pakelo Hydraulic EP Extra ISO 32	32	160	X						
Pakelo Hydraulic EP Extra ISO 22	22	180	X						
SHELL TELLUS S3V 68	68	180	X						
SHELL TELLUS S3V 46	46	160	X						
MobilEAL EnvirosynH46 (P/N2300029)						X	X		
SHELL TELLUS S3V 32	32	160	X						
SHELL TELLUS S3V 22	22	180	X						

Table 1-13. Hydraulic Oil Specifications

* Readily biodegradable classification indicates one of the following: CO2 Conversion > 60% per EPA 560/6-82-003 / CO2 Conversion > 80% per CEC-L-33-A-93

** Virtually Non-toxic classification indicates an LC50 > 5000 per OECD 203

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

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

1.8 SERIAL NUMBER LOCATION

A serial number plate is affixed on to the frame a frame. The following illustration showing the position.

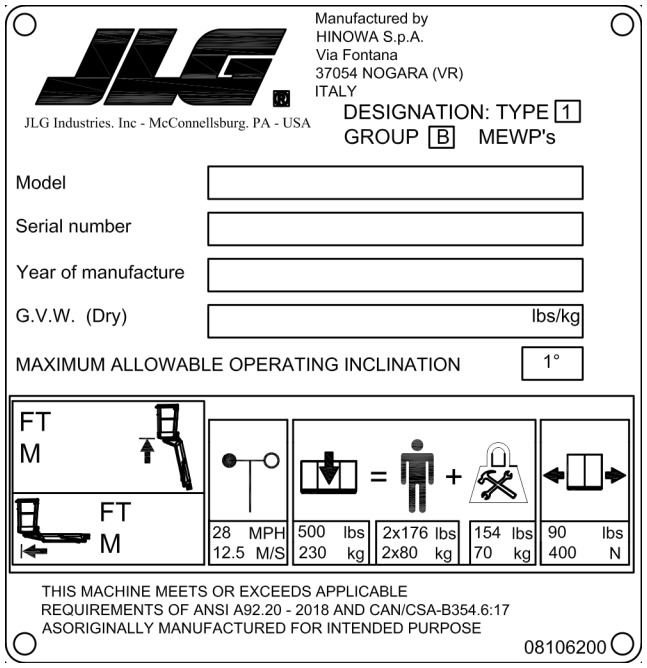


Figure 1-2. Serial Number Plate

Figure 1-3. X26JP / X770AJ Serial Number Plate Location
(on side of chassis rear compartment cover)

1.9 FASTENER TORQUE CHARTS

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)

Size	TPI	Bolt Dia.	Tensile Stress Area	Clamp Load	Torque (Dry)		Torque Lubricated		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)		Torque (Loctite® 262™ or Vibra-TITE™ 131)		Clamp Load	Torque (Dry or Loctite® 263) K= 0.20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
													SAE GRADE 5 BOLTS & GRADE 2 NUTS			SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*			
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	FT-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	8	0.9	6	0.7											
	48	0.1120	0.00661	420	9	1.0	7	0.8											
6	32	0.1380	0.00909	580	16	1.8	12	1.4											
	40	0.1380	0.01015	610	18	2.0	13	1.5											
8	32	0.1640	0.01400	900	30	3.4	22	2.5											
	36	0.1640	0.01474	940	31	3.5	23	2.6					1320	43	5				
10	24	0.1900	0.01750	1120	43	4.8	32	3.5					1580	60	7				
	32	0.1900	0.02000	1285	49	5.5	36	4					1800	68	8				
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12			2860	143	16	129	15		
	28	0.2500	0.0364	2320	120	13.5	86	10	135	15			3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	17	23	13	18	19	26	16	22	4720	25	35	20	25	20	25
	24	0.3125	0.0580	3700	19	26	14	19	21	29	17	23	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38	7000	45	60	40	55	35	50
	24	0.3750	0.0878	5600	35	47	25	34	40	54	32	43	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	6800	50	68	35	47	55	75	45	61	9550	70	95	65	90	50	70
	20	0.4375	0.1187	7550	55	75	40	54	60	82	50	68	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92	12750	105	145	95	130	80	110
	20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133	16400	155	210	140	190	115	155
5/8	18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148	18250	170	230	155	210	130	175
	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183	20350	210	285	190	260	160	220
	18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	21300	260	353	200		285	388	240	325	30100	375	510	340	460	280	380
	16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	29400	430	583	320	434	475	646	386	523	41600	605	825	545	740	455	620
	14	0.8750	0.5090	32400	470	637	350	475	520	707	425	576	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	38600	640	868	480	651	675	918	579	785	51500	860	1170	770	1045	645	875
	12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1768	1118	1516	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2380	1506	2042	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	78000	1940	2630	1460	1979	2025	2754	1755	2379	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676	142200	3555	4835	3200	4350	2665	3625

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

NO. 5000059 REV. K

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

Values for Magni Coating Fasteners (Ref 4150701)																				
				SAE GRADE 5 BOLTS & GRADE 2 NUTS							SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*									
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15		Clamp Load	Torque (Dry or Loctite® 263) K= 0.17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	7	0.8											
	48	0.1120	0.00661	420	8	0.9											
6	32	0.1380	0.00909	580	14	1.5											
	40	0.1380	0.01015	610	14	1.6											
8	32	0.1640	0.01400	900	25	2.8											
	36	0.1640	0.01474	940	26	2.9					1320	37	4				
10	24	0.1900	0.01750	1120	36	4.1					1580	51	6				
	32	0.1900	0.02000	1285	42	4.7					1800	58	7				
1/4	20	0.2500	0.0318	2020	86	9.7	80	9			2860	122	14	114	13		
	28	0.2500	0.0364	2320	99	11.1	95	11			3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	15	20	14	19	15	20	4720	20	25	20	25	20	25
	24	0.3125	0.0580	3700	15	20	15	21	15	20	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	34	7000	35	50	35	50	35	50
	24	0.3750	0.0878	5600	30	40	28	38	25	34	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48	9550	60	80	55	75	50	70
	20	0.4375	0.1187	7550	45	60	44	60	40	54	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75	12750	90	120	85	115	80	110
	20	0.5000	0.1599	10700	75	100	71	97	65	88	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109	16400	130	175	125	170	115	155
	18	0.5625	0.2030	12950	105	145	97	132	90	122	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156	20350	180	245	170	230	160	220
	18	0.6250	0.2560	16300	145	195	136	185	125	170	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272	30100	320	435	300	410	280	380
	16	0.7500	0.3730	23800	255	345	238	324	225	306	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435	41600	515	700	485	660	455	620
	14	0.8750	0.5090	32400	400	545	378	514	355	483	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	38600	545	740	515	700	480	653	51500	730	995	685	930	645	875
	12	1.0000	0.6630	42200	600	815	563	765	530	721	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	47500	755	1025	713	969	670	911	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	53800	955	1300	897	1219	840	1142	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	59600	1055	1435	993	1351	930	1265	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237	142200	3020	4105	2845	3870	2665	3625

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

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

SOCKET HEAD CAP SCREWS																				
Magni Coating (Ref 4150701)*												Zinc Yellow Chromate Fasteners (Ref 4150707)*								
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K = .17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15		Clamp Load See Note 4	Torque (Dry) K = .20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85®) K=0.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15			
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]		
4	40	0.1120	0.00604																
	48	0.1120	0.00661																
6	32	0.1380	0.00909																
	40	0.1380	0.01015																
8	32	0.1640	0.01400																
	36	0.1640	0.01474																
10	24	0.1900	0.01750																
	32	0.1900	0.02000																
1/4	20	0.2500	0.0318	2860	122	14	114	13			2860	143	16	129	15				
	28	0.2500	0.0364	3280	139	16	131	15			3280	164	19	148	17				
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]		
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25	4720	25	35	20	25	20	25		
	24	0.3125	0.0580	5220	25	35	20	25	20	25	5220	25	35	25	35	20	25		
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50	7000	45	60	40	55	35	50		
	24	0.3750	0.0878	7900	40	55	40	55	35	50	7900	50	70	45	60	35	50		
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70	9550	70	95	65	90	50	70		
	20	0.4375	0.1187	10700	65	90	60	80	60	80	10700	80	110	70	95	60	80		
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110	12750	105	145	95	130	80	110		
	20	0.5000	0.1599	14400	100	135	95	130	90	120	14400	120	165	110	150	90	120		
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155	16400	155	210	140	190	115	155		
	18	0.5625	0.2030	18250	145	195	135	185	130	175	18250	170	230	155	210	130	175		
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220	20350	210	285	190	260	160	220		
	18	0.6250	0.2560	23000	205	280	190	260	180	245	23000	240	325	215	290	180	245		
3/4	10	0.7500	0.3340	30100	320	435	300		280	380	30100	375	510	340	460	280	380		
	16	0.7500	0.3730	33600	355	485	335	455	315	430	33600	420	570	380	515	315	430		
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620	41600	605	825	545	740	455	620		
	14	0.8750	0.5090	45800	570	775	535	730	500	680	45800	670	910	600	815	500	680		
1	8	1.0000	0.6060	51500	730	995	685	930	645	875	51500	860	1170	775	1055	645	875		
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015	59700	995	1355	895	1215	745	1015		
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310	68700	1290	1755	1160	1580	965	1310		
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475	77000	1445	1965	1300	1770	1085	1475		
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855	87200	1815	2470	1635	2225	1365	1855		
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055	96600	2015	2740	1810	2460	1510	2055		
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430	104000	2385	3245	2145	2915	1785	2430		
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760	118100	2705	3680	2435	3310	2030	2760		
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225	126500	3165	4305	2845	3870	2370	3225		
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625	142200	3555	4835	3200	4350	2665	3625		

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

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

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)													
			CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS					CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*					
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™)	Torque (Lub)	Torque (Loctite® 262™ OR Vibra-TITE™ 131)	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.20	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.18	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15	
		Sq mm	KN	[N.m]	[N.m]	[N.m]	[N.m]	KN	[N.m]	[N.m]	[N.m]	
3	0.5	5.03	2.19	1.3	1.0	1.2	1.4	3.13				
3.5	0.6	6.78	2.95	2.1	1.6	1.9	2.3	4.22				
4	0.7	8.78	3.82	3.1	2.3	2.8	3.4	5.47				
5	0.8	14.20	6.18	6.2	4.6	5.6	6.8	8.85				
6	1	20.10	8.74	11	7.9	9.4	12	12.5				
7	1	28.90	12.6	18	13	16	19	18.0	25	23	19	
8	1.25	36.60	15.9	26	19	23	28	22.8	37	33	27	
10	1.5	58.00	25.2	50	38	45	55	36.1	70	65	55	
12	1.75	84.30	36.7	88	66	79	97	52.5	125	115	95	
14	2	115	50.0	140	105	126	154	71.6	200	180	150	
16	2	157	68.3	219	164	197	241	97.8	315	280	235	
18	2.5	192	83.5	301	226	271	331	119.5	430	385	325	
20	2.5	245	106.5	426	320	383	469	152.5	610	550	460	
22	2.5	303	132.0	581	436	523	639	189.0	830	750	625	
24	3	353	153.5	737	553	663	811	222.0	1065	960	800	
27	3	459	199.5	1080	810	970	1130	286.0	1545	1390	1160	
30	3.5	561	244.0	1460	1100	1320	1530	349.5	2095	1885	1575	
33	3.5	694	302.0	1990	1490	1790	2090	432.5	2855	2570	2140	
36	4	817	355.5	2560	1920	2300	2690	509.0	3665	3300	2750	
42	4.5	1120	487.0	4090	3070	3680	4290	698.0	5865	5275	4395	

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

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

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

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

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

SECTION 2. GENERAL

2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

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

Preparation, Inspection, and Maintenance

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

Pre-Start Inspection

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

Pre-Delivery Inspection and Frequent Inspection

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

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

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

Annual Machine Inspection

The Annual Machine Inspection must be performed by a Factory-Certified 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-Certified Service Technician as a person who has successfully completed the JLG Service Training School for the subject JLG product model. Reference the machine Service and Maintenance Manual and appropriate JLG inspection form for performance of this inspection.

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

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

Preventative Maintenance

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

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

Table 2-1. Inspection and Maintenance

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

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

1. The most important single item in preserving the long service life of a machine is to keep dirt and foreign materials out of the vital components. Precautions have been taken to safeguard against this. Shields, covers, seals, and filters are provided to keep air, fuel, and oil supplies clean; however, these items must be maintained on a scheduled basis in order to function properly.
2. At any time when air, fuel, or oil lines are disconnected, clear adjacent areas as well as the openings and fittings themselves. As soon as a line or component is disconnected, cap or cover all openings to prevent entry of foreign matter.
3. Clean and inspect all parts during servicing or maintenance, and assure that all passages and openings are unobstructed. Cover all parts to keep them clean. Be sure all parts are clean before they are installed. New parts should remain in their containers until they are ready to be used.

Components Removal and Installation

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

Component Disassembly and Reassembly

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

Pressure-Fit Parts

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

Bearings

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

Gaskets

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

Bolt Usage and Torque Application

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

Hydraulic Lines and Electrical Wiring

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

Hydraulic System

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

Lubrication

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

Battery

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

Lubrication and Servicing

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

2.3 LUBRICATION AND INFORMATION

Hydraulic System

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

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

Hydraulic Oil

Refer to Section 1 for recommendations for viscosity ranges.

Changing Hydraulic Oil

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

Lubrication Specifications

Specified lubricants, as recommended by the component manufacturers, are always the best choice, however, multi-purpose greases usually have the qualities which meet a variety of single purpose grease requirements. Should any question arise, regarding the use of greases in maintenance stock, consult your local supplier for evaluation. Refer to Section 1 for an explanation of the lubricant key designations appearing in the Lubrication Chart.

2.4 CYLINDER DRIFT TEST

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

Cylinder Drift

Table 2-2. Cylinder Drift

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

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

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

If the cylinder passes this test, it is acceptable.

2.5 PINS AND COMPOSITE BEARING REPAIR GUIDELINES

Filament wound bearings.

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

2.6 WELDING ON JLG EQUIPMENT

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

Do the Following When Welding on JLG Equipment

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

Do NOT Do the Following When Welding on JLG Equipment

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

NOTICE

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

SECTION 3. CHASSIS & TURNTABLE

3.1 RUBBER TRACK MAINTENANCE

Checking Track Tension

Stop the machine on firm, level surface. Lift the machine into safe conditions and place stable supports under the under-carriage frame for total support. Parallel with the central roller of the under-carriage, measure distance (A) from the bottom of the roller to the rigid inside of the rubber belt. Track tension is normal if measurement (A) is between 10 and 15 mm.

If track tension is not within the measurements specified above, loose or too taught, follow the procedures illustrated in the paragraph below.

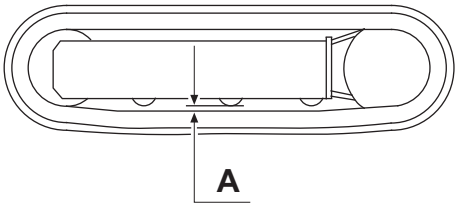


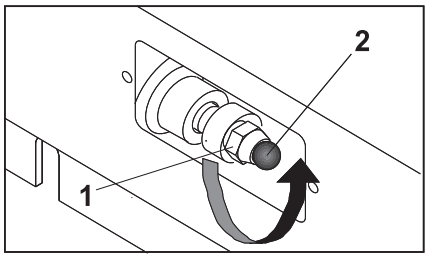
Figure 3-1.

Operations For Loosening/tightening The Track

The grease contained in the hydraulic track is pressurised. For this reason, do not loosen the greasing valve (1) by more than 1 turn; if the valve is loosened too much, it risks being expelled under the effect of the pressure of the grease, putting the safety of the operator at risk. Never loosen greaser (2).

When gravel or mud are blocked between the toothed wheel and the track links, remove it before loosening.

1. Remove the screws and take of adjustment access lid 3.
2. To loosen the track, slowly unscrew valve 1 in an anti-clockwise direction for no more than one turn. One turn of valve 1 is sufficient to loosen the track.
3. If the grease does not start to drain, turn the track slowly.
4. When correct track tension has been obtained, turn valve (1) in a clockwise direction and tighten it. Clean all traces of grease.



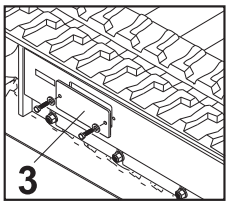


Figure 3-2.

5. To tighten the track, connect a grease gun to greaser (2) and add grease until belt tension is within the specified values.

⚠ DANGER

IT IS NOT NORMAL IF THE TRACK REMAINS TAUGHT AFTER HAVING TURNED VALVE (1) IN AN ANTI-CLOCKWISE DIRECTION OR IF THE TRACK IS STILL LOOSE AFTER HAVING PUT GREASE INTO GREASER (2). NEVER TRY TO REMOVE THE TRACKS OR DISASSEMBLE THE TRACK-TENSIONED CYLINDER BECAUSE THE GREASE PRESSURE INSIDE THE TRACK IS VERY DANGEROUS.

Checking The Rubber Tracks

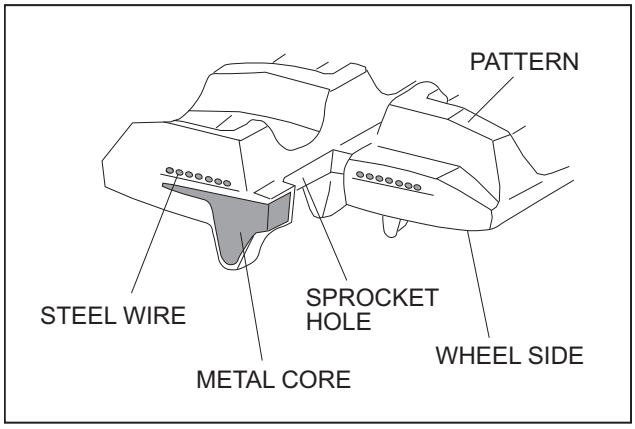


Figure 3-3. Rubber Track Structure

The structure of the rubber track is illustrated in Figure 3-3. The steel ropes and the metal core are imbedded into the rubber. The carved profiles are used to give traction when moving over loose land. They are situated in the lower part resting on the ground, while the wheel guides situated inside the track, prevent the track from escaping from the guide rollers.

CAUSES OF DAMAGE

1. Breakage of the steel ropes

   Excessive tension causes the steel ropes to break in the following conditions:

   a. when stones or foreign bodies accumulate between the track and the under-carriage frame;

   b. when the track escapes from its guide;

   c. in the case of strong friction such as rapid direction changes.

2. Wear and breakage of the metal cores

   As for breakage of the steel ropes, stated above, excessive tension may cause the metal cores to bend or break, as may the following causes:

   a. incorrect contact between toothed wheel and track;

   b. breakage of internal rollers;

   c. functioning on sandy land.

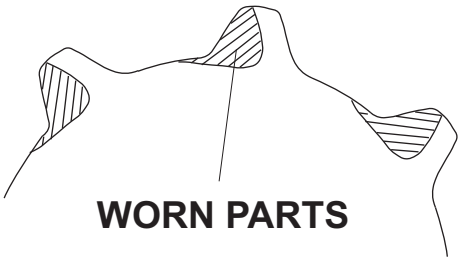


Figure 3-4.

3. Separation of the metal cores

   a. The metal core acts as a type of adhesive of the rubber between the core itself and the steel ropes. Separation may be caused by excessive tension as breakage of the ropes for the following reasons:

   b. The metal cores have been wound by the worn toothed wheel as indicated in the figure. When this wear and abrasion is detected, the toothed wheel must be replaced as soon as possible.

   c. If it breaks, as stated in item 2, "Wear and breakage of the metal cores", the track must be replaced because this damage leads to a complete loss of functions.

4. Abrasion and fatigue cracks

   a. The cracks at the base of the carved profile occur due to bending fatigue of the rubber caused by the toothed wheel and the track-tensioning wheel.

   b. The cracks and bends on the edge of the rubber are due to manoeuvres with the track in presence of cement kerbs and edges.

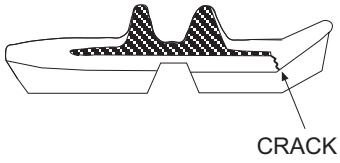


Figure 3-5.

   c. The cracks and abrasions in the rubber on the tracks of the roller guide originate from fatigue from the compression of the rubber by the weight of the wheel, together with functioning on sandy land, or repeated and abrupt changes of direction.

   d. Abrasion of the carved profiles may occur especially if slewing on concrete surfaces or on gravel or hard surfaces are carried out.

e. The damage indicated in paragraphs a, b, and c above, must not be considered fatal for the track and, even if in presence of gradual and progressive damage, they allow the track to continue working. The development of the damage indicated in point 3 leads to the exposure of the metal cores and if they are exposed for more than half of the track circumference, it means that it is time to replace them. It can however still be used.

5. Cracks due to external factors

Cracks on external track surfaces (those in contact with the ground) are often due to contact with gravel, sharp stones, sharp materials, nails, glass, which cause cuts. From the rubber properties point of view, this is inevitable although it does depend on service conditions. Cracks on the internal surface of the circumference and on the edge of the rubber originate from contact of the belt with the structure of the undercarriage or with sharp concrete edges. The increase in cracks is relatively small. Even if it does not appear to be in good condition the track can be used in heavy duty conditions.

Replacing The Rubber Tracks

⚠ DANGER

THE GREASE CONTAINED IN THE HYDRAULIC TRACK IS PRESSURISED. FOR THIS REASON, DO NOT LOOSEN THE GREASING VALVE (1) BY MORE THAN 1 TURN; IF THE VALVE IS LOOSENED TOO MUCH, IT RISKS BEING EXPELLED UNDER THE EFFECT OF THE PRESSURE OF THE GREASE, PUTTING THE SAFETY OF THE OPERATOR AT RISK. NEVER LOOSEN GREASER (2).

When gravel or mud are blocked between the toothed wheel and the track links, remove it before loosening.

Removing The Rubber Track

1. Stop the machine on solid, level land, lift it and support it in safe conditions, using the outriggers.

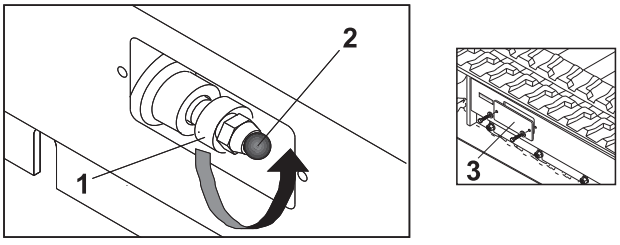


Figure 3-6.

2. Remove the screws and take of adjustment access lid 3.

3. To loosen the track, slowly unscrew valve 1 in an anti-clockwise direction for no more than one turn. One turn of valve 1 is sufficient to loosen the track.

4. If the grease does not start to drain, turn the track slowly.

5. Insert three steel pipes (4) inside the track in the space between the rollers. Turn the driving wheel backwards (5) in a way that the steel pipes proceed with the track and engage on the track-tensioning wheel. Apply force (6) laterally to allow the track to run and lift it from the track-tensioning wheel.

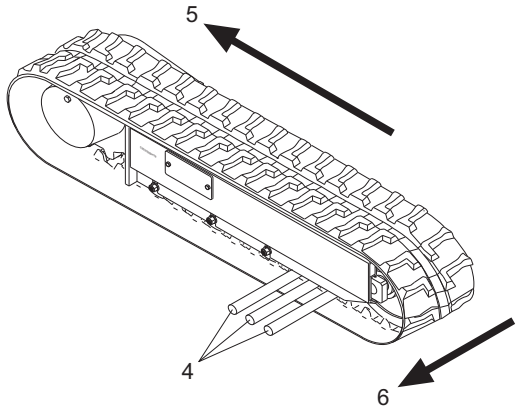


Figure 3-7.

Installing The Rubber Track

⚠ DANGER

ENSURE SAFE CONDITIONS WITH THE MACHINE LIFTED TO PROCEED WITH MOUNTING THE TRACKS.

1. Check that the grease contained in the hydraulic cylinder has been removed.

2. Engage the track links with the toothed wheel and position the other end of the track on the track-tensioning wheel.

3. Turn the driving wheel in reverse (7) pushing the track plate inside the frame (8).

4. Position the track using a steel pipe and turn the driving wheel again.

5. Ensure that the track links are correctly engaged in the toothed wheel and in the track-tensioning wheel.

6. Adjust track tension (see paragraph -Operations for loosening/tightening the track).

7. Rest the tracked under-carriage on the ground.

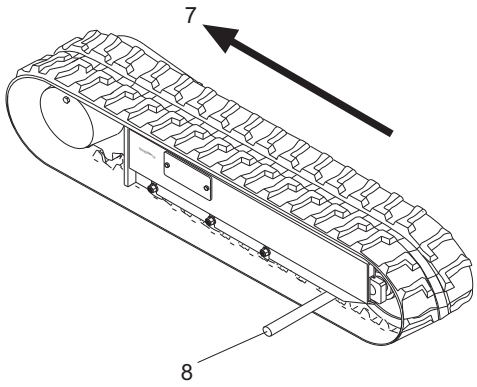


Figure 3-8.

Checking tightness of nuts and bolts

Depending on the use of the platform, it is indispensable to check the parts and the nuts and bolts in general, which are subject to loosening.

Pay particular attention to the frame components, such as track-tensioning wheels, traversing geared motors, driving wheels and guide rollers. Check that they are tightened sufficiently as indicated in the following table.

The values indicated are to be applied unless otherwise stated in this manual.

ilize the machine on level ground.

3.2 UNDERCARRIGE COMPONENTS

a. Fully extend the undercarriage.

b. Remove the tracks (see sub-section 3.1).

c. Remove the key ignition, and a tag with warning do not start the machine.

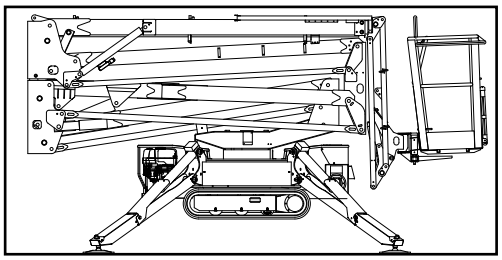


Figure 3-9.

Replacement roller lower wheel and tracks adjuster

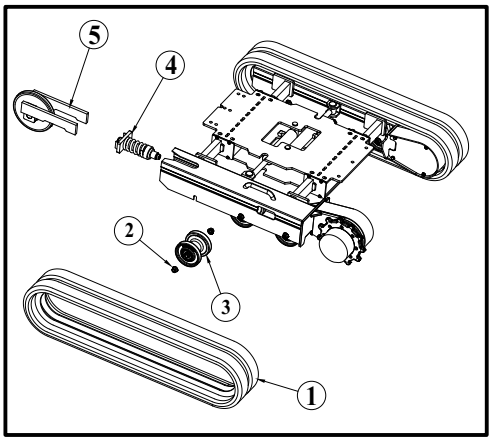


Figure 3-10.

Disassembly

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

Assembly

1. Fit the tracks adjuster 4.
2. Instal the front idler 5.
3. Instal the lower roller 3.
4. Apply loctite 243 and torque the nuts 2 on the lower roller at 125Nm.

Replacement sprocket and Gear Motor

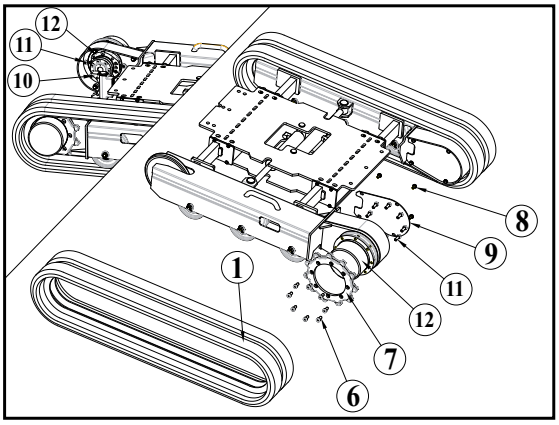


Figure 3-11.

Sprocket remove

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

Gear motor remove

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

Gear motor installation

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

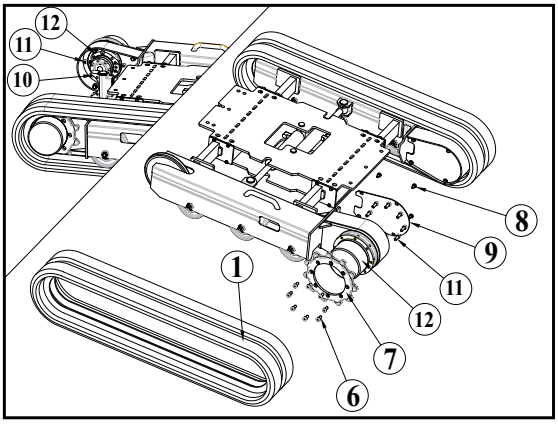


Figure 3-12.

Sprocket installation

1. Instal the sprocket
2. Instal the screws 6

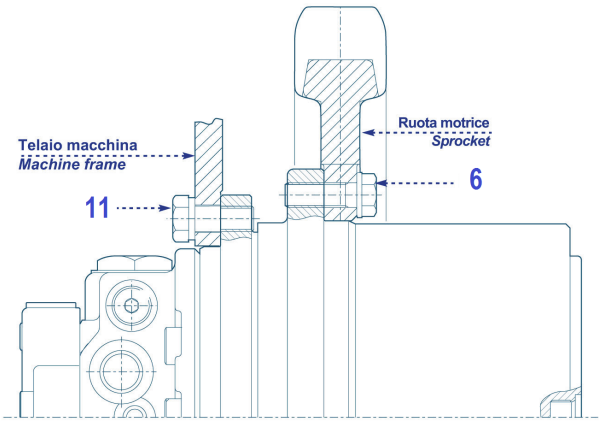


Table 3-1. Final Drive Torque Valves

MACHINE MODEL	SPROCKET SCREW N. 6 TORQUE VALUES	FINAL DRIVE SCREW N. 11 TORQUE VALUES
X17JP - X500AJ	M10x18 - Nm 50	M10x25 - Nm 50
X20JP - X600AJ	M10x25 - Nm 70	M10x30 - Nm 70
X26JP - X770AJ	M12x18 - Nm 86	M12x30 - Nm 86

3.3 AXLE EXTENSION REMOVAL

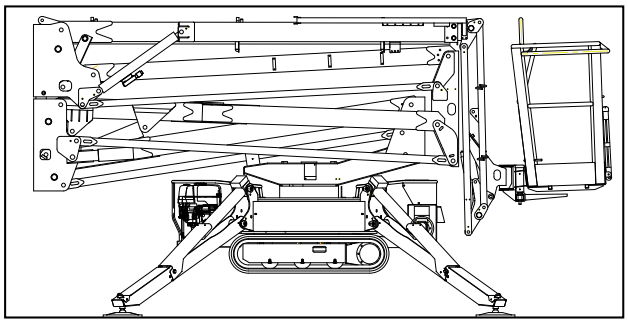


Figure 3-13.

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

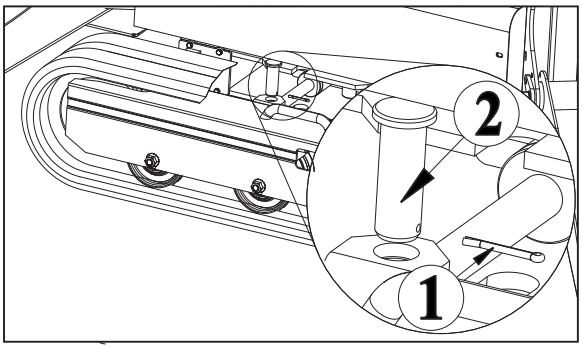


Figure 3-14.

6. Remove the cotter pin 1 - (figure 3-13)
7. Remove the pin 2

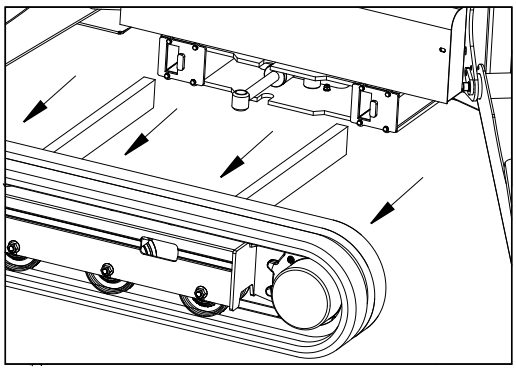


Figure 3-15.

8. Using a suitable lifting device (minimum 441 lb. (200kg) capacity) to remove the track frame.

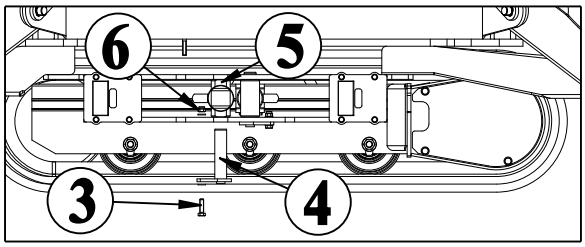


Figure 3-16.

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

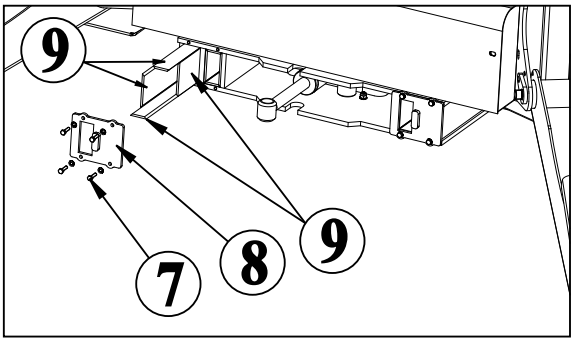


Figure 3-17.

12. Remove the cylinder.

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

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

3.4 FINAL DRIVE

Table 3-2. Final Drive Models

MACHINE	TYPE	SPEED
X26JP - X770AJ	701C2K+MAG18	AUTO TWO SPEED

Product Identification

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

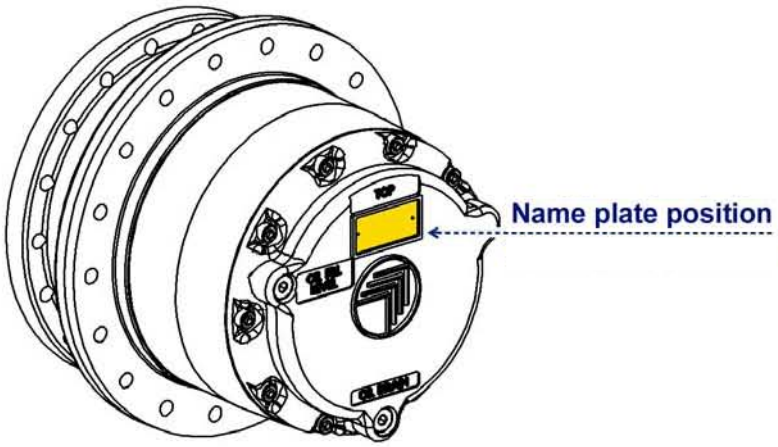
For all enquiries regarding general information on the product, spare parts, assistance etc, always give the identification data stamped on the ID plate.

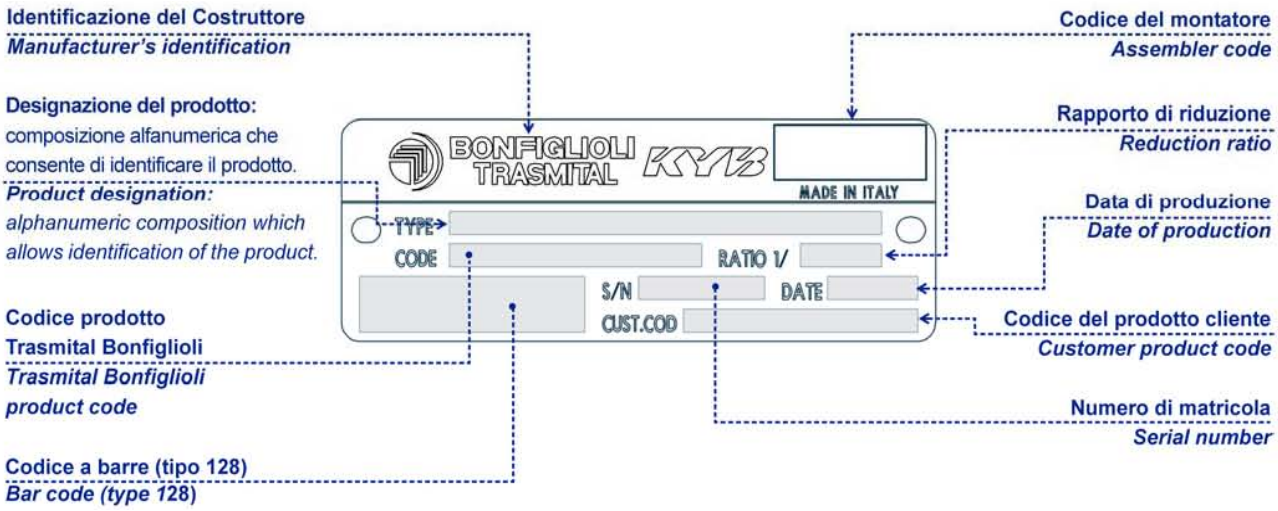
The gearmotor has two ID plates, one gives data on the gearbox and the other data on the hydraulic motor.

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

NOTE: *Note Refer to the supplier final drive applicable Service Manual - Bonfiglioli Trasmital MAN_serie 700CK_IS.doc. Rev17*

Information





3.5 SWING DRIVE (IMO)

Technical Data – Type Plate

Figure 3-18. Type plate

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

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

Structure and function

Brief description

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

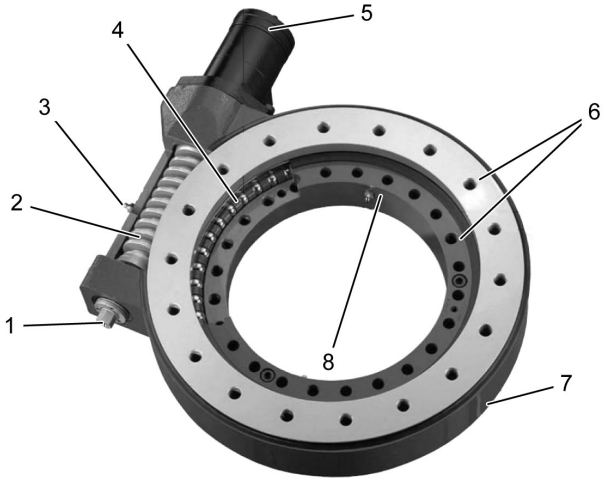


Figure 3-19. Slew drive WD-L

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

Transporting Unpacked Slew Drives

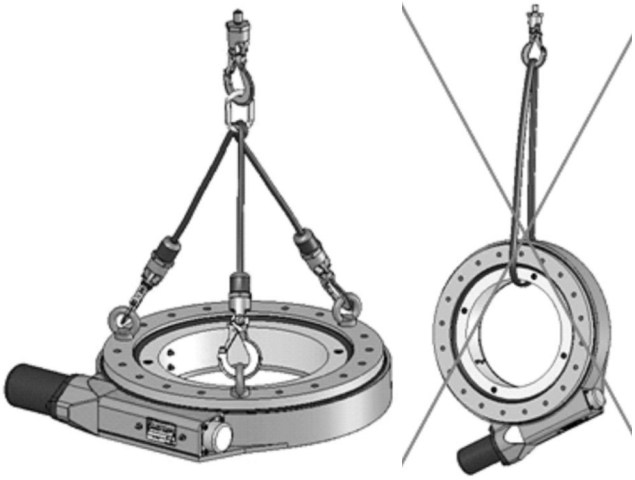


Figure 3-20. Use suitable lifting gear/never transport product vertically

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

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

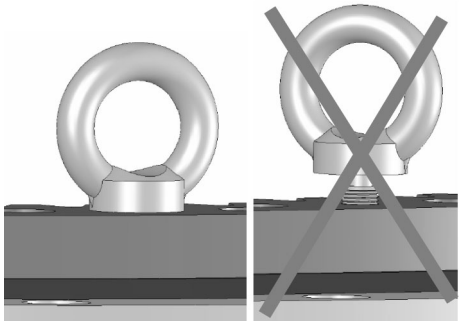


Figure 3-21. Always use the full length of the thread

Attachment:

1. Screw the 3 eye bolts into the 3 threads that are distributed uniformly on the circumference of the slew drive.

⚠ WARNING

SCREW IN THE EYE BOLTS TO THE FULL THREAD LENGTH! IMPROPERLY ATTACHED, UNSUITABLE, OR DAMAGED EYE BOLTS MAY CAUSE THE SLEW DRIVE TO FALL AND CAUSE LIFE-THREATENING INJURIES.

2. Attach lifting gear to the eye bolts.
3. Start the transport.

Positioning The Swing Drive

1. Determine the main load-carrying zone. The main load-carrying zone is that area of the slewing ring that is subject to the highest load, taking all aggressive forces and torques, and all occurring load cases into account.
2. Arrange the hardness gap of the bearing ring charged with point load so that it is offset by 90° relative to the main load-carrying zone. The main load- carrying zone is in the main slewing range.

⚠ CAUTION

THE HARDNESS GAP OR THE FILLING PLUG IN A SLEWING RING CONSTITUTE A ZONE OF DECREASED LOAD-CARRYING CAPACITY. THE SERVICE-LIFE OF THE SLEW DRIVE WILL BE REDUCED SIGNIFICANTLY, IF THE HARDNESS GAP IS IN THE MAIN SLEWING RANGE. FRACTURE OF BEARING RING FOR EXAMPLE MAY CAUSE SLEW DRIVE FAILURE. CONSEQUENTLY PLACE THIS MARKED POINT IN A REDUCED LOAD ZONE IF POSSIBLE.

3. Use a feeler gauge to check whether the support surface of the slew drive is completely supported by the mounting structure. If this is not the case, the support surface of the mounting structure must be reworked.

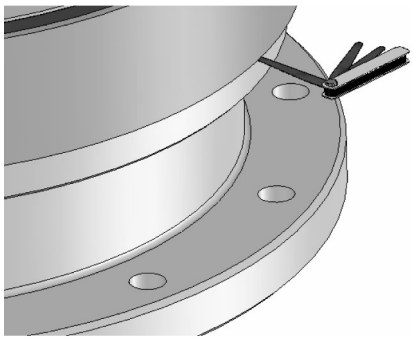


Figure 3-22. Check the support surface

Bolting The Slew Drive

⚠ WARNING

DO NOT USE IMPACT SCREWDRIVERS. USING AN IMPACT SCREWDRIVER MAY CAUSE IMPERMISSIBLE DEVIATIONS BETWEEN THE BOLT TIGHTENING FORCES. FAILURE OF THE BOLTED UNION WITH THE MOUNTING STRUCTURE MAY CAUSE SEVERE PERSONAL INJURY OR MATERIAL DAMAGE.

NOTICE

MOUNT THE SLEW DRIVE IN UNSTRESSED STATE.

Strictly comply with the procedure specified below to avoid impermissible deviations between the bolt tightening forces:

NOTICE

FIRST FASTEN THE HOUSING, THEN FASTEN THE TOOTHED BEARING RING!

1. Use medium strength Loctite (Loctite 243) on screws.
2. Pretension the bolts, with washers if required, crosswise in 3 steps, 30%, 80%, and 100% of the tightening torque, or the hydraulically applied pretension force.
3. In this process turn the unscrewed ring several times. Repeat the procedure for the bearing ring that has not yet been bolted.

If using a hydraulic bolt-tensioning cylinder the tensioning forces for the bolt pretension should not exceed 90% of yield strength.

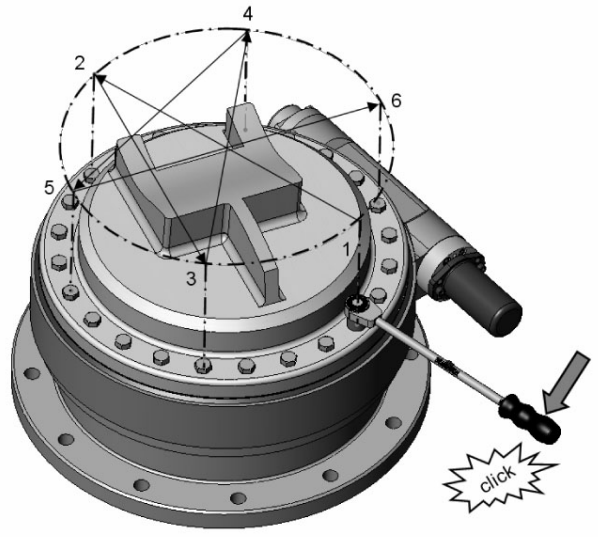


Figure 3-23. Tighten crosswise

Table 3-3.

MOUNTING BOLT DIMENSIONS	MOUNTING PRETENSION FORCE F_M [1] STRENGTH CLASS 10.9 in	
	kN	lbs
M24	282	63396
M27	367	82505
M30	448	100714
M33	554	124544
M36	653	146800
M42	896	201429
M45	1043	234476
M48	1177	264600
M52	1405	315857
M56	1622	364640
M60	1887	424215
M64	2138	480642
M68	2441	548759

[1] F_M for hydraulic bolt-tensioning cylinder pretension to 85% of yield strength.

Table 3-4.

MOUNTING BOLT DIMENSIONS	MOUNTING PRETENSION FORCE F_M [1] STRENGTH CLASS 10.9 in	
	kN	lbs
1 – 8 UNC	301	67668
1 1/8 – 7 UNC	379	85203
1 1/4 – 7 UNC	481	108133
1 3/8 – 6 UNC	573	128816
1 1/2 – 6 UNC	697	156692
1 5/8 – 6 UNC	832	187041
1 3/4 – 5 UNC	942	211770

[1] F_M for hydraulic bolt-tensioning cylinder pretension to 85% of yield strength.

Maintenance Schedule

Maintenance tasks are described in the sections below that are required for optimal and trouble-free operation.

If increased wear is detected during regular inspections, then reduce the required maintenance intervals according to the actual indications of wear.

If you have questions concerning maintenance tasks and intervals, please contact our customer service.

INTERVAL	MAINTENANCE TASK	TO BE EXECUTED BY
Weekly	Check seal	Qualified person
After 250 Operating Hours	Check tighten bolts	Qualified person
	Check tilting clearance	Qualified person
After Every Additional 500 Operating Hours Or At Least Every 6 Months	Check tighten bolts Reduce the inspection interval if there is heavy wear or continuous operation.	Qualified person
	Check tilting clearance Reduce the inspection interval to 200 operating hours if the detected increase in tilting clearance is approximately 75% of the permissible tilting clearance increase. After further increase reduce the interval between inspections to 50 - 100 hours.	Qualified person
	Check circumferential backlash Reduce the inspection interval to 200 operating hours if the detected increase in circumferential backlash is approximately 75% of the permissible circumferential backlash increase. After further increase reduce the interval between inspections to 50 - 100 hours.	Qualified person

Lubrication

General re-lubrication of slew drives:

- After each cleaning
- Before and after longer periods of standstill, e.g. for cranes and construction machines during the winter months.

NOTICE

THE MAIN CAUSE FOR SLEWING RING FAILURE IS INADEQUATE LUBRICATION. THE LUBRICATION INTERVALS ESSENTIALLY DEPEND ON EXISTING WORKING AND ENVIRONMENTAL CONDITIONS, AS WELL AS THE VERSION OF THE SLEW DRIVE. PRECISE LUBRICATION INTERVALS CAN ONLY BE DETERMINED BY TESTS UNDER NORMAL OPERATING CONDITIONS.

The specified values are valid for the following conditions:

- Operating temperature on the slew drive < 70° C (158° F).
- Circumferential speed < 0.5 m/s (1.64 ft/sec) for SP slew drives.
- Output speed < 5 rpm for WD slew drives.
- Low to moderate load.

NOTICE

COMPLY WITH THE INSTRUCTIONS IN THE OPERATING MANUAL PROVIDED BY THE MANUFACTURER, FOR LUBRICATION OF OPTIONAL INTERMEDIATE GEAR UNITS, BRAKES, AND MOTORS.

NOTICE

IF NECESSARY RE-LUBRICATE PERMANENT BRAKES. FOR THIS ONLY USE THE SPECIAL GREASE SHELL RETINAX HDX2.

If comparable results are not available, the following table can be used as a guide value:

WORK CONDITIONS	LUBRICATING INTERVAL	TO BE EXECUTED BY
Dry and clean workshop hall (rotary tables, robots, etc.)	Approx. every 300 operating hours, at least every 6 months	Specialist
Severe conditions on open terrain (cranes, excavators, etc.)	Approx. every 100 to 200 operating hours, at least every 4 months	Specialist
Aggressive climatic conditions, (ocean, desert, arctic climate, extremely polluted environment, ≥70 operating hours per week	Every 50 operating hours, at least every 2 months	Specialist
Extreme conditions (tunnel boring machines, steel works, wind turbines)	Continuous lubrication (through central lubrication or grease cups)	Specialist

Maintenance Tasks

Inspecting The Mounting Bolts

NOTICE

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

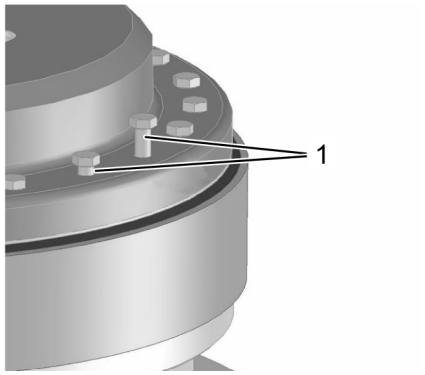


Figure 3-24. Inspecting the mounting bolts

1. Detached bolt

Execution only by a specialist.

- Special tools required:

  Torque wrench

  Hydraulic clamping fixture

- Replace loose and detached bolts or nuts and washers with new bolts, nuts and washers.
- Use the same bolt size and bolt quality.

NOTICE

IF A HYDRAULIC CLAMPING FIXTURE WAS USED TO TIGHTEN THE BOLTS, THEN A HYDRAULIC CLAMPING FIXTURE MUST ALSO BE USED TO CHECK THE BOLT PRETENSION. ALWAYS USE THE SAME TIGHTENING PROCEDURE AS SPECIFIED FOR INSTALLATION OF THE SLEW DRIVE WHEN CHECKING THE BOLTED UNION.

Lubricating The Slew Drive

NOTICE

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

NOTICE

ALWAYS USE THE LUBRICANTS SPECIFIED IN THE ORDER DRAWING. IF USING OTHER LUBRICANTS PAY ATTENTION TO THE RELATIVE MIX ABILITY OF THE SUBSTANCES. THE STANDARD LUBRICANTS USED ARE "R.TECC NORPLEX LKP2" FROM RHENUS, OR THE GREASE "OPTIMOL LONGTIME PD0" FROM CASTROL. IF IN DOUBT, OR IF THERE IS NO SPECIFICATION ON THE DRAWING, CONSULT WITH OUR CUSTOMER SERVICE. USING THE WRONG LUBRICANT MAY CAUSE DAMAGE TO THE SLEW DRIVES AND REDUCE THE SERVICE LIFE. IN THIS CASE, ANY WARRANTY SHALL BE EXCLUDED. COMPLY WITH THE INSTRUCTIONS PROVIDED BY THE LUBRICANT MANUFACTURER!

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

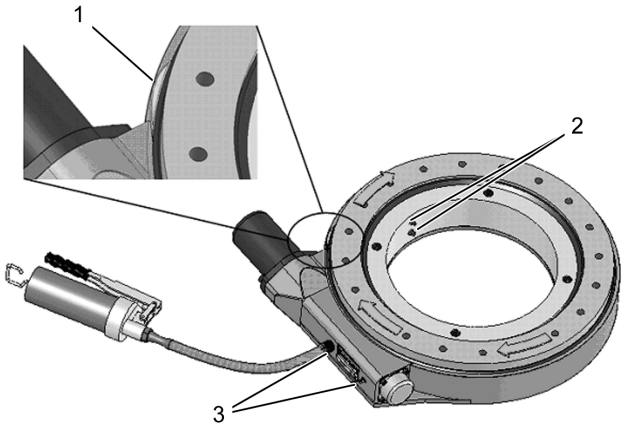


Figure 3-25. Lubricating the slew drive

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

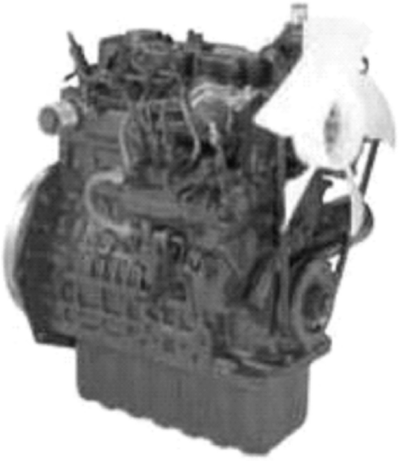
Inspecting The Seals

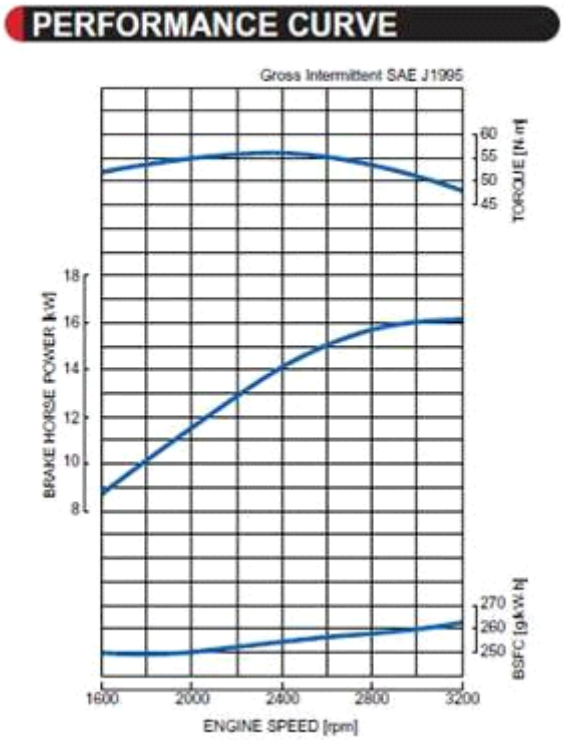
NOTICE

DAMAGED SEALS MUST BE REPLACED IMMEDIATELY. IF THERE IS CORROSION DAMAGE OR FUNCTIONAL IMPAIRMENT A CONSEQUENCE OF DAMAGED SEALS NOT BEING REPLACED AT THE PROPER TIME, ANY WARRANTY SHALL BE EXCLUDED. PENETRATING MOISTURE MAY QUICKLY CAUSE CORROSION IN THE BEARING RING AND IMPAIRS SAFE OPERATION. NOTE THAT THE FACTORY-INSTALLED SEAL ONLY OFFERS PROTECTION AGAINST DUST AND SPLASHING WATER.

If damage is detected on a seal, contact the customer service organization without delay.

3.6 KUBOTA DIESEL ENGINE MODEL D902





Type	Vertical 4-Cycle Liquid Cooled Diesel
Combustion System	IDI
Intake System	Naturally Aspirated
Diesel fuel intake system	Electric Pump
Number of cylinders	3
Power	16,1 Kw (21.6 Hp) / 3200 rpm
Max rpm	3200 rpm
Direction of rotation	Counter clockwise Viewed on Flywheel
Max torque	56 Nm / 2400 rpm
Displacement	898 cm^3
Bore	72 mm (2.83 in)
Stroke	73,6 mm (2.9 in)
Fuel tank capacity	40 L
Emission Regulation	Tier 4 F
Dry Weight (according to Kubota's standards)	72 Kg (158.8 Lbs)

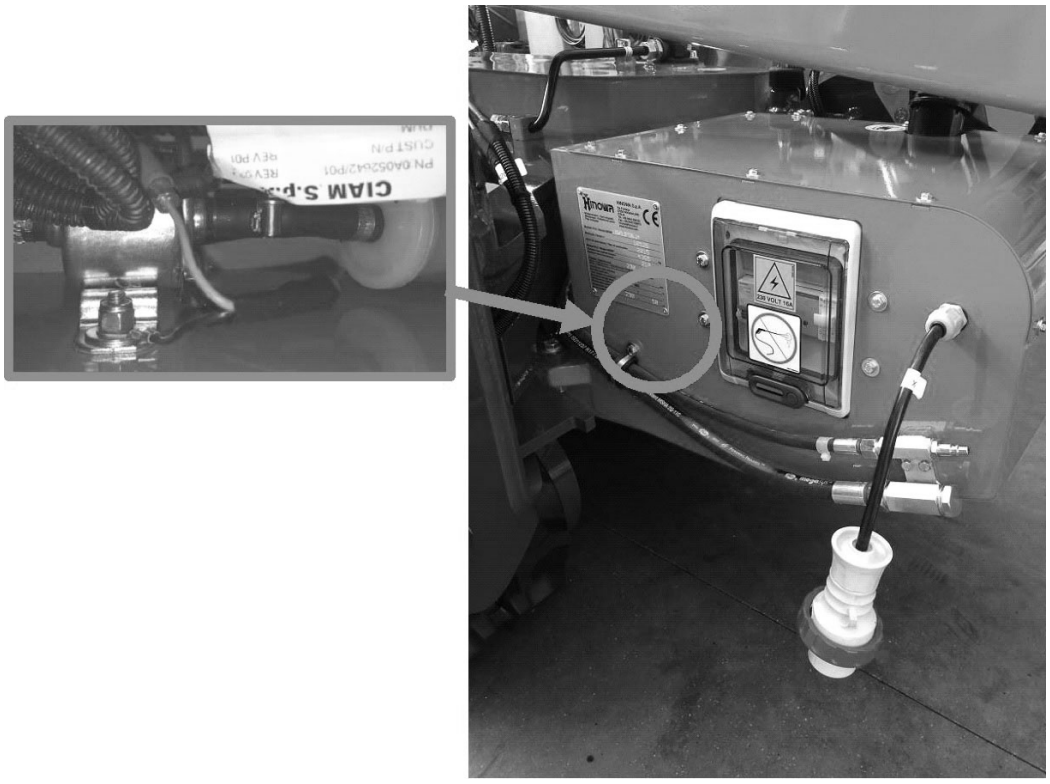
Engine Plate

The engine plate with serial number is placed on the engine head close to muffler collector and includes the following engine information:

1. Engine model
2. Engine serial number
3. Engine code No

The information shown above is necessary for any engine spare parts or information required.

The fuel system of the diesel engine is fed by an electric fuel pump mounted beside the fuel tank as indicated by picture below.



Troubleshooting

Those Instructions valid for all machines serial number

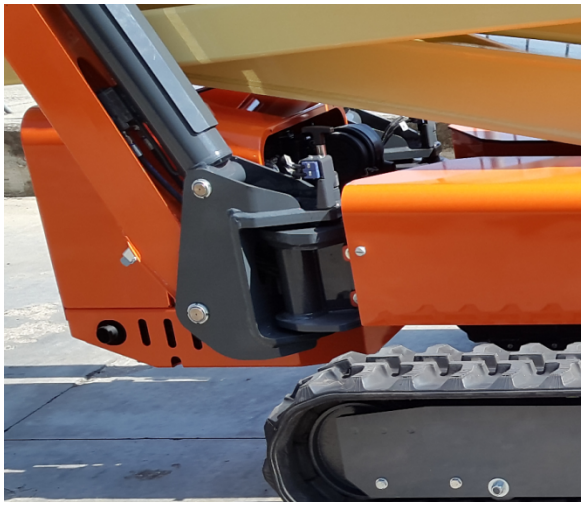


Figure 3-26.

On engine left side remove the engine hood and cut the strap to access to the harness, plug.

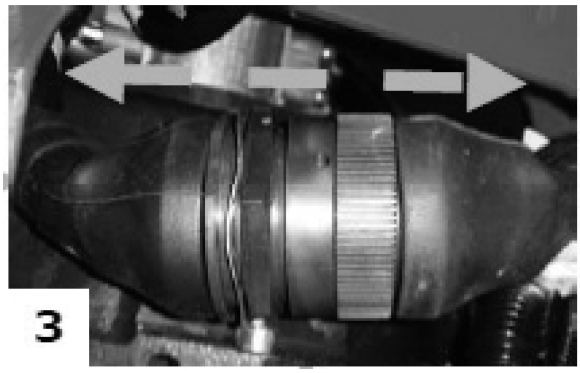


Figure 3-27.

Disconnect the plug harness

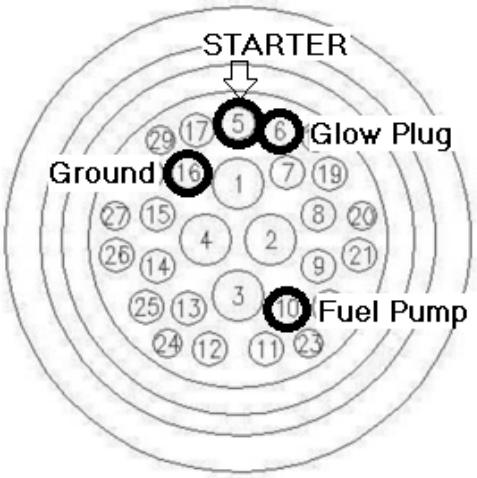


Figure 3-28. Female Connector

On Female connector jump the follows wires:

- Pin 16 (Ground) to battery negative terminal.
- Pin 10 (fuel pump) to battery positive terminal.
- Pin 6 (Glow plugs) hook up if necessary for few second only.
- Pin 5 (Starter) For a moment utilize hook up this pin for as key starter .

To shutdown the engine disconnect wire of Pin 10. The engine wills continue to run for a while until it ends the fuel on the line.

Engine Speed Sensor

A sensor in the diesel engine detects the engine rpm's and communicates this data to the master controller.

Figure 3-29.

Speed Sensor Hatz 1B40

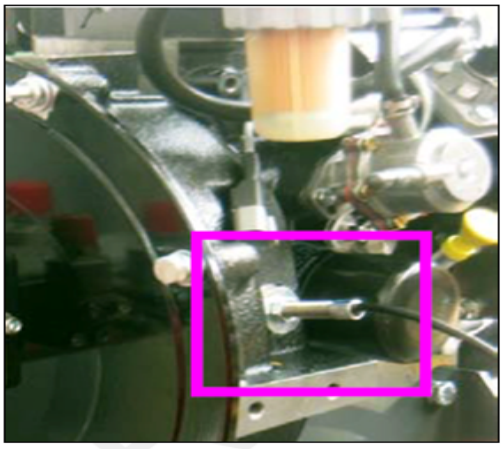


Figure 3-30.

Speed Sensor on Perkins 402.05

Figure 3-31.

Speed Sensor on Kubota D902

Speed Sensor Installation and Adjustment

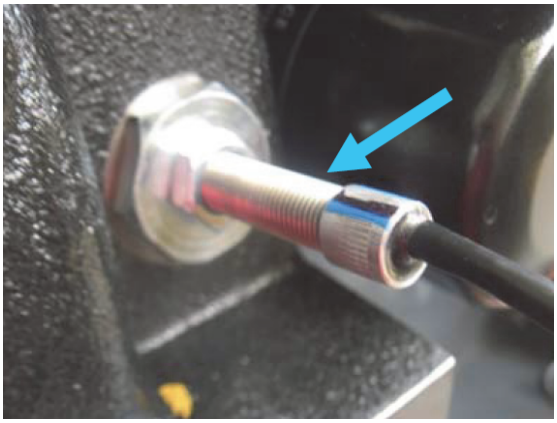


Figure 3-32.

1. Install the speed sensor into the housing until it contacts the flywheel.
2. Back the sensor out 1 turn.
3. Tight the nut.

Diesel Engine RPM control

On Diesel powered units a throttle actuator controls the fuel to manage the engine speed based on operating conditions.

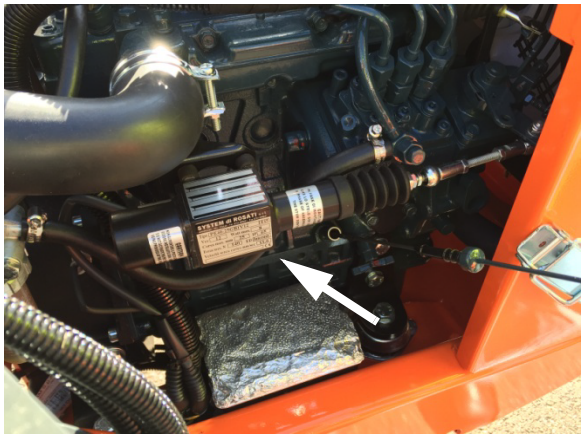


Figure 3-33.

Throttle actuator on Kubota D902

Diesel Actuator Rod Travel Adjustment

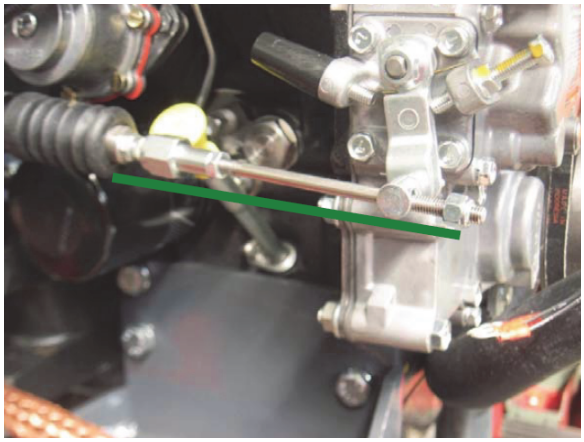


Figure 3-34.

With the control linkage pushed against the idle stop, adjust the lock nut.

3.7 THERMIC ENGINE REPLACEMENT

1. Place and stabilize the machine on a flat and level surface.
2. Turn machine OFF and remove the key ignition, and a tag with warning do not start the machine.
3. Remove the cover 1.

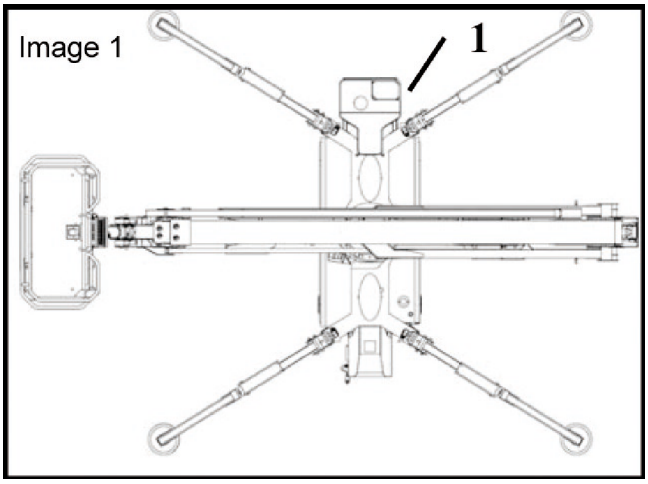


Figure 3-35. Engine cover

4. Disconnect, tag and isolate the wires from the engine.
5. Disconnect the oil pipes and cooling lines, then drain the 2 circuits.

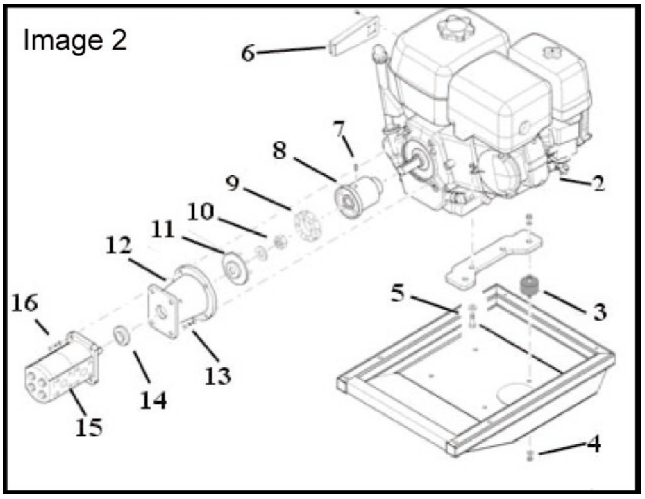


Figure 3-36. Image 2

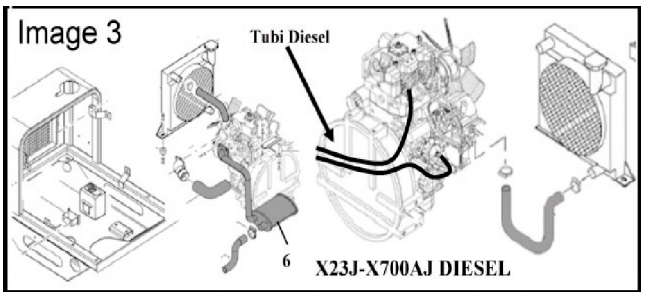


Figure 3-37. Image 3

1. Remove the screws (items 13 and 5 - image 2).
2. Remove the engine, remove the joint (items 8 and 9 - Image 2) .
3. Remove the muffler (item 6 - Image 2).
4. Replace the engine and tighten the screws (items 13 and 5 - Image 2). Torque screws to 16.2 ft. lb. (22N-m) and 18.5 ft. lb. (25Nm) respectively.
5. Connect the wires to the motor.
6. Replace guard on motor (1) and test the machine.

3.8 ELECTRIC MOTOR REPLACEMENT (LITHIUM)

1. Place and stabilize the machine on a flat and level surface and keep the machine in stowed position.
2. Turn machine OFF and remove the Key switch, make sure that plug connector is disconnect, and the machine is isolate from any electrical power supply.
3. Remove the cover.

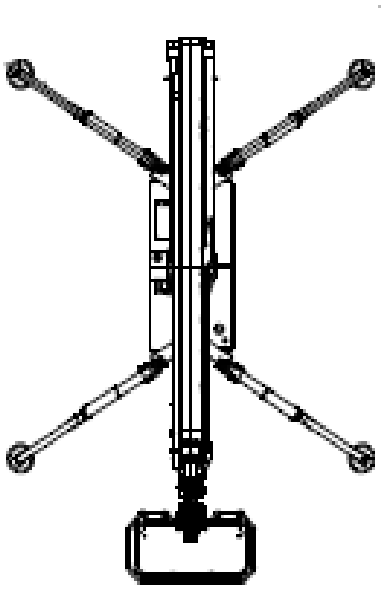


Figure 3-38. Cover position engine X26JP/X770AJ

4. Open the cover of the electrical box (7), label and disconnect the wires attached to the electrical motor and isolate the wires end
5. Remove the four bolts that attach the pumps adapter to the electrical motor.
6. Remove the four mounts bolts (2) that attach the electrical motor to the frame.
7. Carefully lift, remove the electrical motor and separate from the pumps adapter.
8. After the electrical motor has been removed, loosen the screw (3) and pull off the coupler (4)

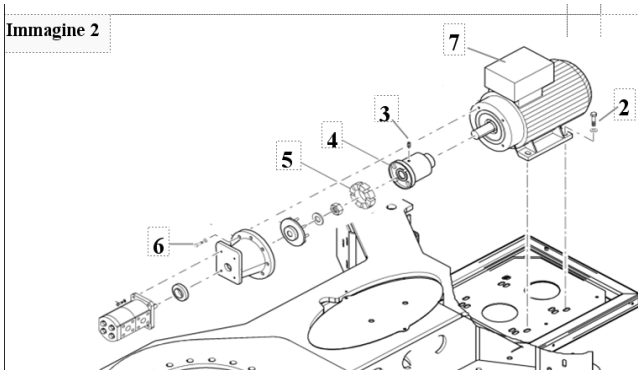


Figure 3-39.

9. For the electrical motor installation follow the procedure in opposite order from step 5 to step 8
10. After mounting the electrical motor, tighten four mounts bolts (item 2) to 29.5 ft. lb. (40N-m) while the bolts (6) of the pumps adapter to 16.23 ft. lb. (22N-m).
11. Reattach the previously labelled electrical wires to the electrical motor and close the cover of the electrical box (item 7).

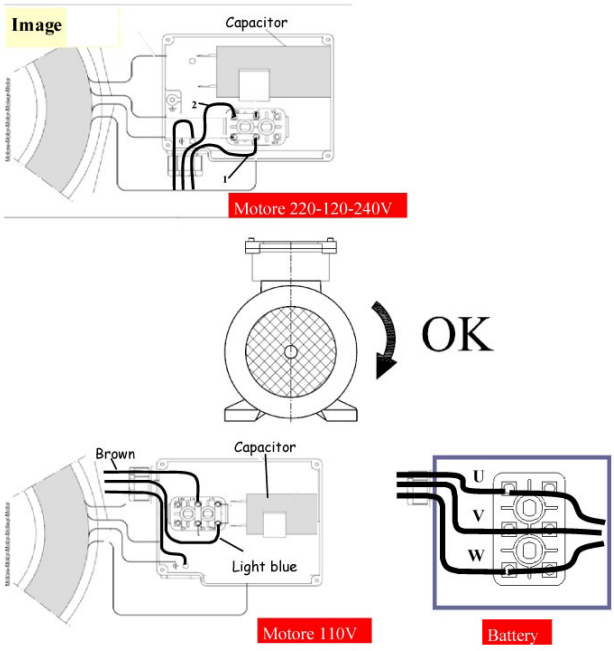
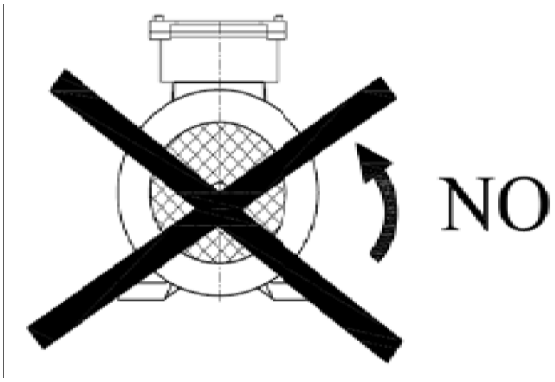


Figure 3-40.

12. Energize the system and start the electrical motor
13. Check from the fan side, if the electrical motor run in correct CW direction, otherwise swap the wires connected as shown on (Figure 3-41.).



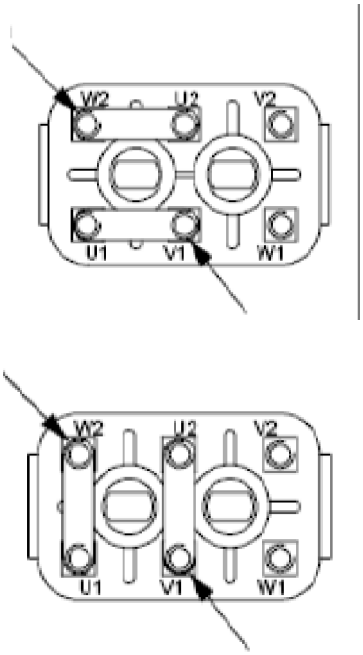


Figure 3-41.

14. Install cover and test the machine.

3.9 LITHIUM MACHINE WITH 76V LITHIUM BATTERY SYSTEM (S/N C170001340 TO PRESENT)

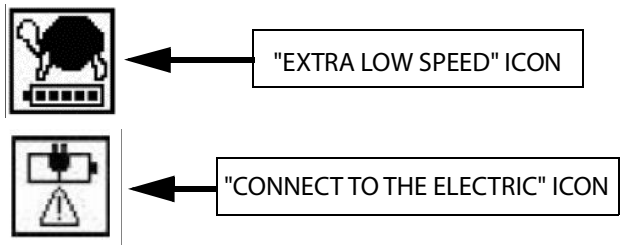
Charge Information

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

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

When SOC is lower than 11%, inverter feeds electric motor with an half of the standard speed.

When SOC is lower than 6%, inverter feeds electric motor with an extra low speed, and the following icon are displayed.



When SOC is 0%, machine could not be moved and the icon “CONNECT TO THE ELECTRIC NETWORK” is displayed in the middle of the display.

Lithium Cells

Number of cells in the battery pack	48 cells, 24 couples of cells connected in series
Nominal voltage of each cell	3 Volt
Capacity of one cell	50 Amps/h
Nominal features of the complete pack	76 Volt –100 Amps/h
Max cell nominal voltage	3.7 Volt
Min cell operating voltage	2.5 Volt
DOD	90%
Charge cycles	3000 full cycles
Memory effect	NO

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

Battery Charger

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

DC-DC Transformer

A part for Lithium system that works at 76 nominal Volt, the rest of the machine electronic boards and components still work at 12 / 5 Volt, so Lithium system includes a DC-DC transformer that convert the 76 Volt into 12 Volt.

Machine is equipped with 12 Volt battery necessary to switch ON Lithium system.

Electric Motor

Type	Three-phase
Nominal tension	80 Volt
Nominal Power	3500 Watt

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

RPM Regulation System

RPM regulation is carried out by the following components:

- Master board (ECM1)
- Inverter
- Electric motor

Inverter is parameterized to feed the electric motor with a pre-determinate selection of frequencies, corresponding to a nominal rpm configurations, in case of inverter replacement is required a new parameterization.

NOTE: *The set-point rpm could be different from the nominal rpm configuration depending on the electric load.*

RPM Setting

ECM1 through its internal contacts communicates the required rpm selection to the inverter, which will feed the electric motor with the relevant frequency in order to achieve the nominal rpm selected, the actual rpm depends also on the machine working conditions.

Here below is listed the rpm setting according to the movement required and to the speed selected.

LITHIUM SYSTEM RPM SETTING		
TURTLE	NORMAL/ HARE	MOVEMENT (*)
1500	1500 + double pump	1st and 2nd booms UP
900	1950	1st and 2nd booms DOWN
900	1950	3rd boom UP
900	1500	3rd boom DOWN
1500	1950 + double pump	Telescope OUT
1500	1950	Telescope IN
900	1050	Turret rotation
900	900	Basket rotation
900	900	Basket levelling
900	1050	Jib UP
900	900	Jib DOWN
1500	3000	Tracks forward or backward
1500	3000	Tracks opening or closing
3000	3000	Auto stabilization with maximum one outrigger on the ground
1500	1500	Auto stabilization with two or three outriggers on the ground
3000	3000	Auto stabilization with all outrigger on the ground
3000	3000	Outriggers Auto retraction with all outrigger lifted from the ground
1500	1500	Outriggers Auto retraction with at least one outrigger on the ground

NOTE: *Outriggers rpm depends on the machine condition.*

NOTE: *Tracks opposite rotation is carry out with lower speed.*

NOTE: *Aerial contemporary movements including jib, basket leveling or rotation are carry ion at minimum rpm.*

NOTE: *Double pump valve is not activated with movements together.*

Temperature Ongoings (Heaters And Fans)

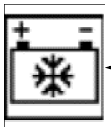
Lithium battery pack discharge and/or recharge, with positive lithium battery level (SOC>0), is possible over -10°C.

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

In case of battery charger is connected, till 0°C it supplies only 5A in order to surely feeds only the heaters, waiting positive temperatures to recharge the cells.

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

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



"BATTERY COLD/HEATER ACTIVATED" ICON

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

Diagnostics And Fault Codes

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

Self-diagnosis is carry out by:

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

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

SECTION 4. BOOM & PLATFORM

4.1 BOOM MAINTENANCE

NOTICE

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

Removal of the Boom Assembly

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

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

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

NOTICE

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

   - **b.** Tag and disconnect hydraulic lines from boom to control valve. Use a suitable container to retain any residual hydraulic fluid. Cap all hydraulic lines and ports.
   - **c.** Using a suitable lifting equipment, adequately support boom weight along entire length.
   - **d.** Remove the bolts and keeper pins securing the lift cylinder pivot pin. Using a suitable brass drift and hammer, remove the pivot pin from the lower boom.
   - **e.** Remove hardware securing the level link pivot pin. Using a suitable brass drift and hammer, remove the pin from the level link and turntable.
   - **f.** Remove hardware securing the lower boom pivot pin. Using a suitable brass drift and hammer, remove pin from the turntable.
   - **g.** Using all applicable safety precautions, carefully lift boom assembly clear of turntable and lower to ground or suitable supported work surface.

Disassembly of the Main Boom

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

NOTICE

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

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

Inspection

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

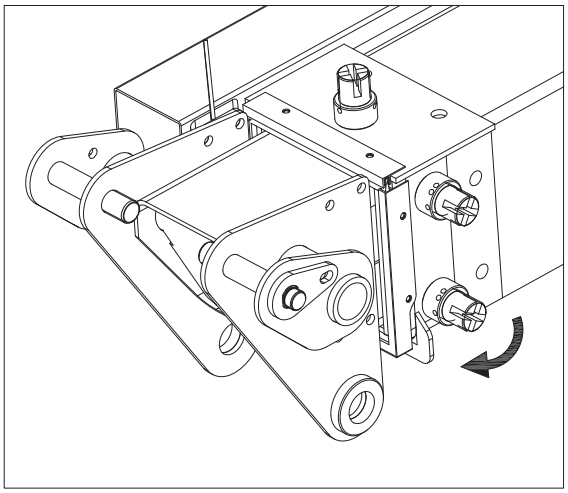
Assembly of the Main Boom

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

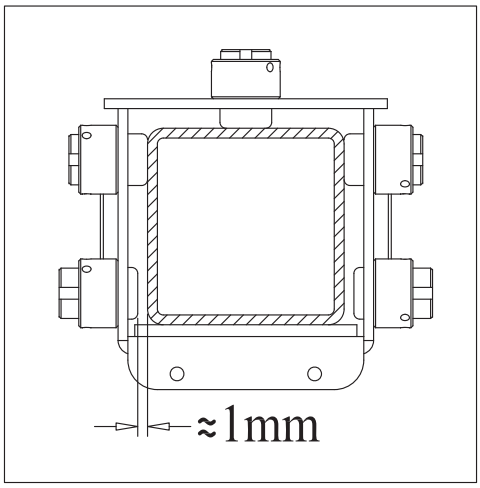
NOTICE

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

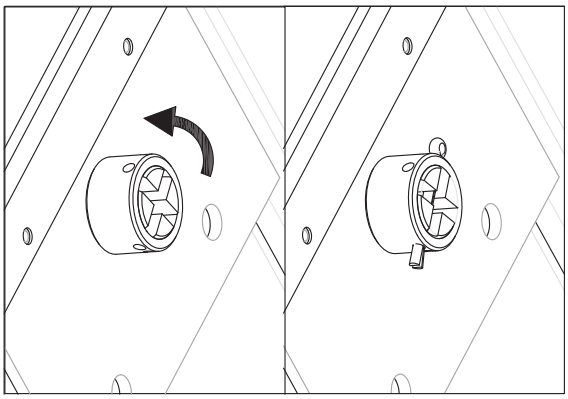
11. Slowly slide the telescope cylinder into boom assembly, align rod end with attach point in fly section. Insert pin and secure with retaining ring.
12. Slowly slide the telescope cylinder into boom assembly, align barrel end with attach point in fly section. Insert pin and secure with retaining ring.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



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



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



16. Disconnect auxiliary power source from telescope cylinder.

Installation of the Boom Assembly

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

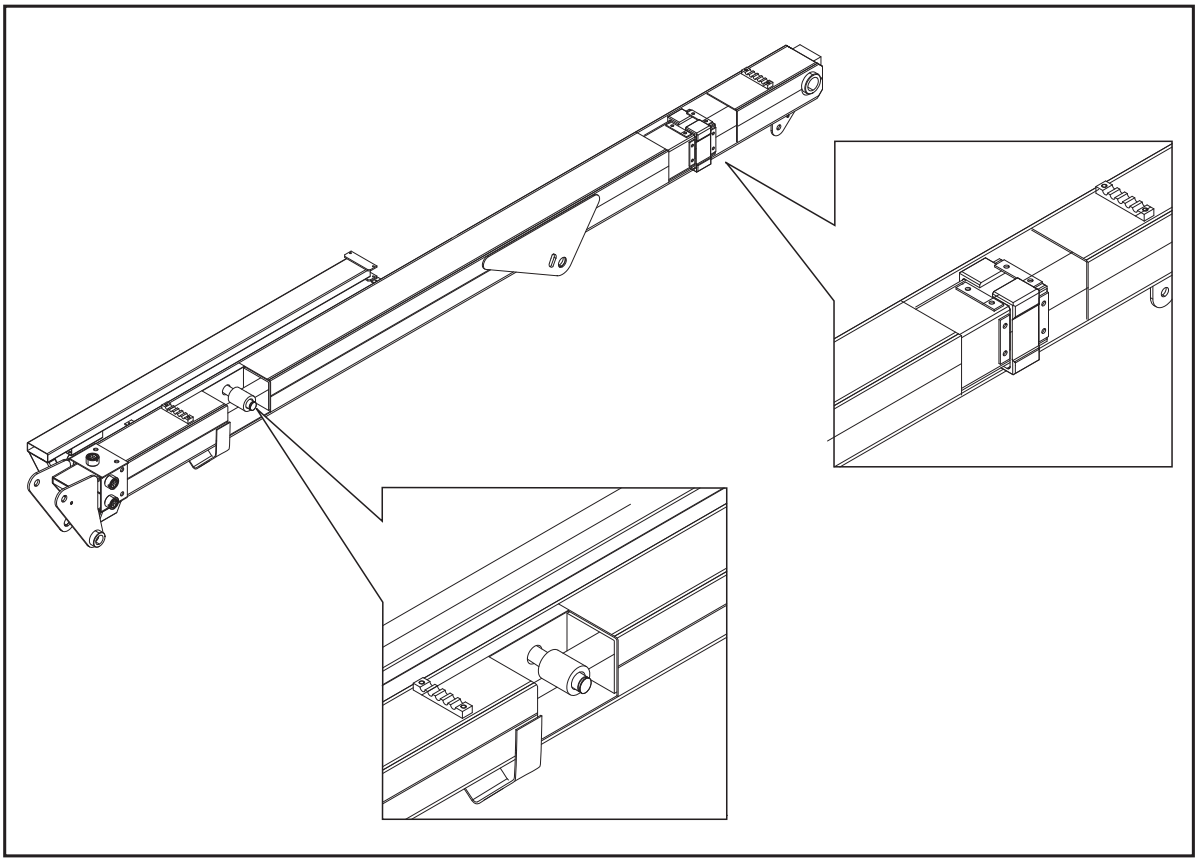


Figure 4-1.

4.2 BOOM DISASSEMBLY

NOTE: *The following procedure assumes the boom is removed from the machine.*

1. Extend the boom approximately 2 feet (0.6 m). This will enable access to the bolts that secure the cable mount block to the boom fly section.
2. Remove hardware securing the telescope cylinder.

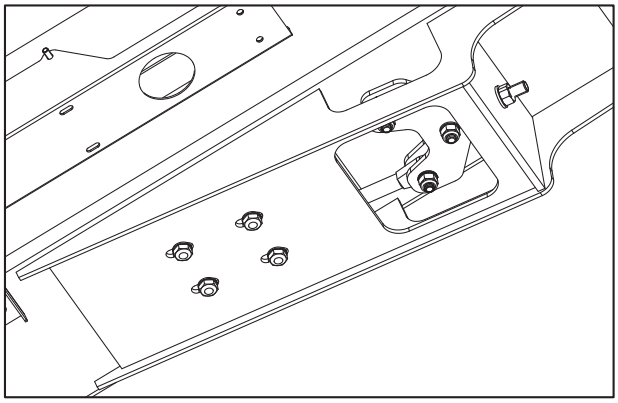


Figure 4-2.

NOTE: *Do not allow wire rope to rotate. This may damage the wire rope.*

3. Clamp both threaded ends of wire rope to prevent rotation. Note: Do not clamp on threads. Remove jam nuts and nuts which secure the wire rope adjustments to the bottom front of the base boom section.
4. Using a M6 drive extension approximately 4 feet (1.2 m) long, remove the bolts and washers securing the cable mount block to the boom fly section.

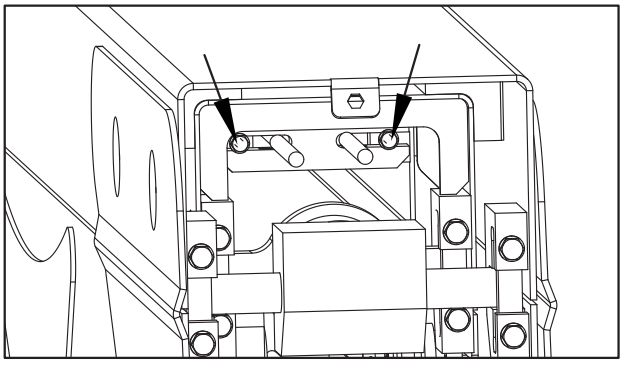


Figure 4-3.

5. Remove the four bolts, shims, and attachment blocks that secure the telescope cylinder barrel to the boom mid section.

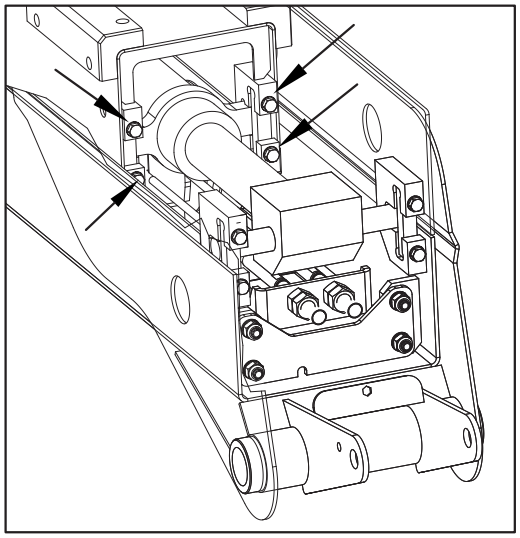


Figure 4-4.

6. Remove the four bolts, shims, and mounting blocks that secure the telescope cylinder rod to the boom base section.

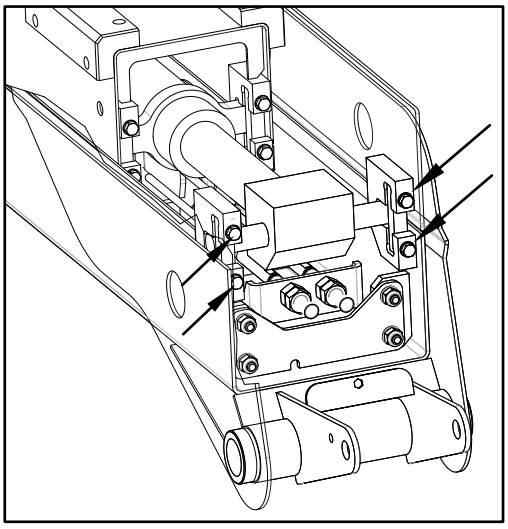


Figure 4-5.

NOTICE

WHEN REMOVING THE TELESCOPE CYLINDER FROM THE BOOM, IT MAY BE NECESSARY AT SOME POINT TO TURN THE CYLINDER SLIGHTLY IN ORDER TO CLEAR ASSEMBLIES MOUNTED WITHIN THE BOOM. CARE MUST BE TAKEN TO MOVE THE CYLINDER SLOWLY FROM THE BOOM. DAMAGE TO COMPONENTS MAY RESULT FROM FORCIBLE IMPACT WITH THESE ASSEMBLIES.

NOTE: *The telescope cylinder weighs approximately 600 lbs. (275 kg).*

1. Using overhead cranes or other suitable lifting/supporting devices, carefully pull the telescope cylinder out from the back of the boom. At the same time, also pull the cable mount block out so the extension cables come out with the telescope cylinder and do not bind. The lifting/supporting devices will have to be repositioned to support the weight of the cylinder as it is drawn out of the boom.

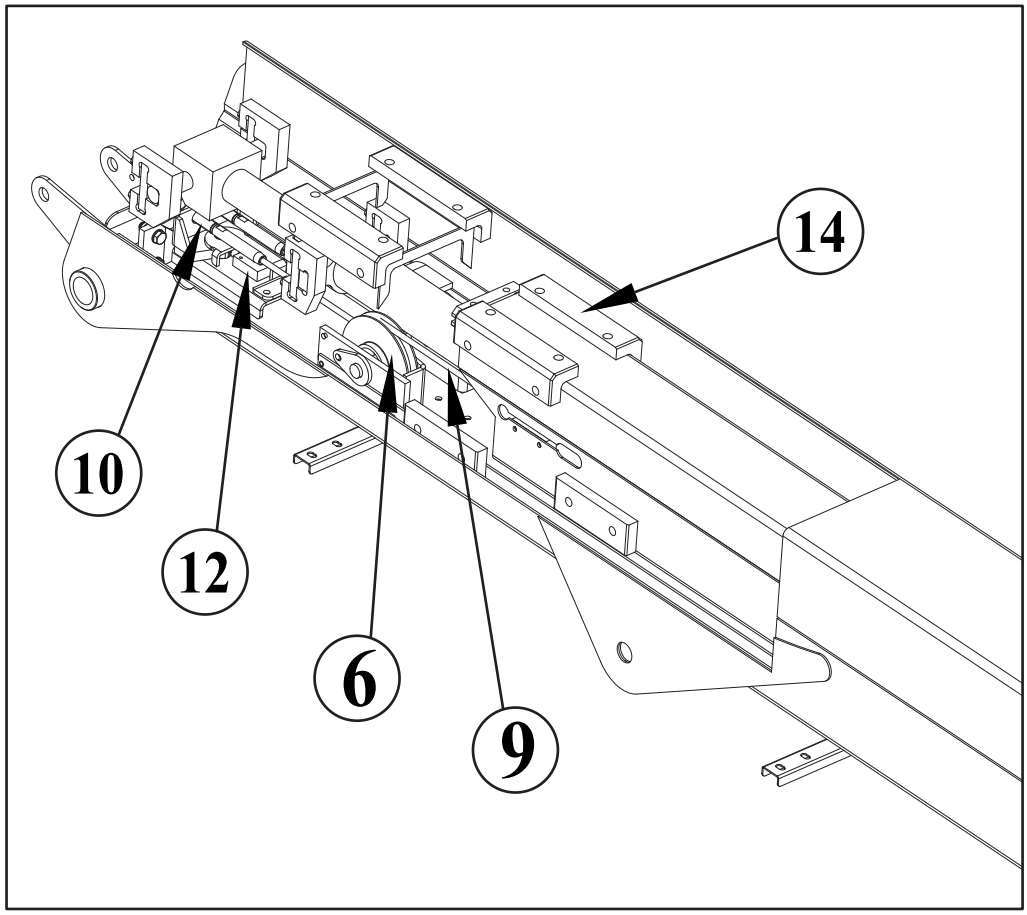


Figure 4-6.

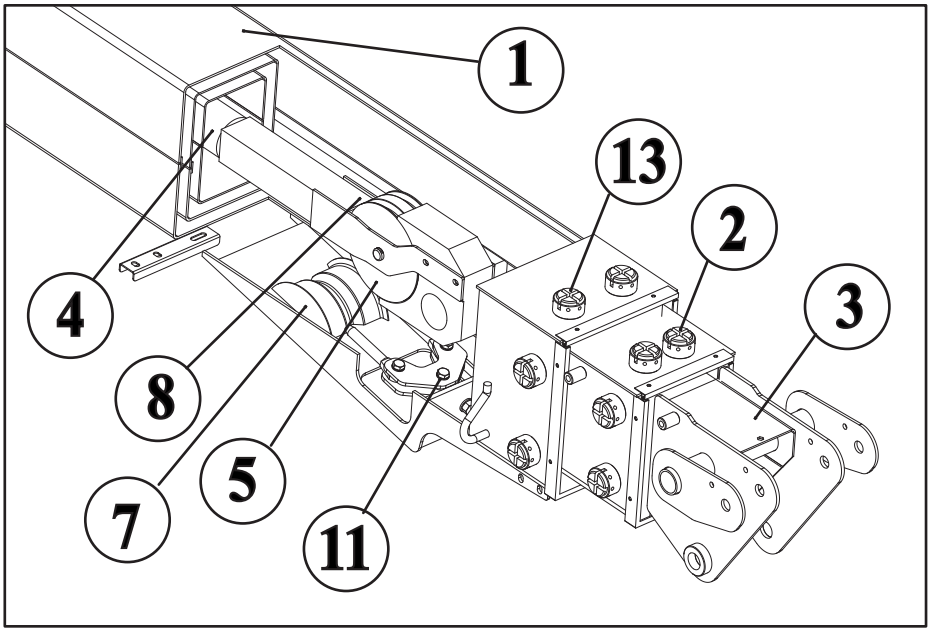


Figure 4-7.

1. Base Boom
2. Mid Boom
3. Fly Boom
4. Telescope Cylinder
5. Extend Sheave
6. Retract Sheave
7. Sheave Block
8. ExTend Cable
9. Retract Cable
10. Extend Cable Adjustment
11. Retract Cable Adjustment
12. Proximity Switch
13. Wear Pad
14. Wear Pad

8. Carefully remove the telescope cylinder and sheave assembly. Place telescope cylinder on a suitable trestle.

- **a.** Remove hardware from the wear pads; remove wear pads from cylinder.
- **b.** Remove hardware from the wire rope guard; remove guard from cylinder.
- **c.** Remove hardware from the sheave pin; remove pin and sheave from cylinder.

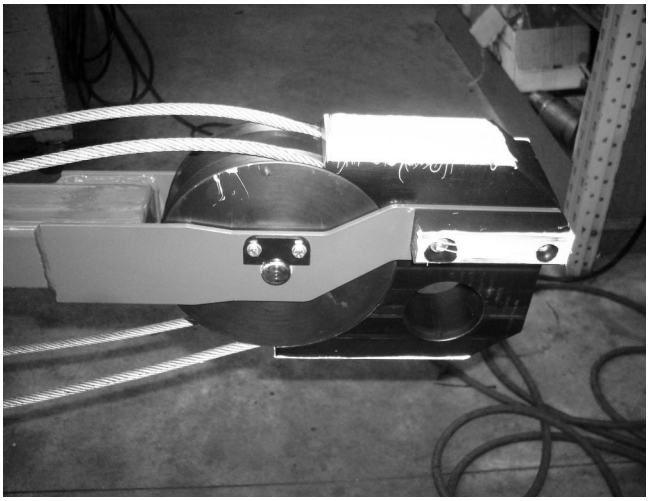


Figure 4-8.

9. Remove hardware which secures the wear pads to the front of base boom section; remove wear

pads from the top, sides and bottom of the base boom section.

10. Using an overhead crane or suitable lifting device, remove mid and fly boom sections from base section. Note: When removing mid and fly boom sections from base boom section, retract wire rope must be dragged along with boom sections.
11. Remove hardware which secures the wear pads to the rear end of mid boom section; remove the wear pads from the top, sides and bottom of the mid boom section.
12. Remove hardware which secures the sheave guards and sheave assemblies to mid boom section, remove sheave assemblies from mid boom section.
13. Remove hardware which secures the wear pads to the front of mid boom section; remove wear pads from the top, sides and bottom of the mid boom section.
14. Using an overhead crane or suitable lifting device, remove fly boom section from mid section. Note: When removing fly boom section from mid boom section, retract wire rope must be dragged along with fly boom section.
15. Remove hardware which secures the wear pads to the rear end of fly boom section; remove wear pads from the top, sides and bottom of the fly boom section.
16. When removing wire rope from fly boom section, push the cable into fly boom. Route wire rope back through holes in the side of the fly boom section.

Figure 4-9.

4.3 INSPECTION

Checking Wear And Deformation Of Ropes And Pulleys

If only one of the following situations is detected the ropes or pulleys must be replaced.

1. Check that there are no broken threads on the surface of the rope, in the internal area or in correspondence with the cable socket.

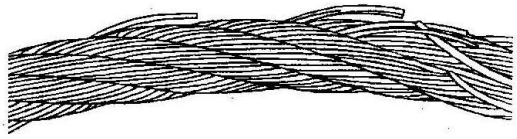


Figure 4-10.

2. Check that there are no signs of corrosion on the rope.
3. Check that there are no signs of kinking, crushing or deformations of any type on the rope.

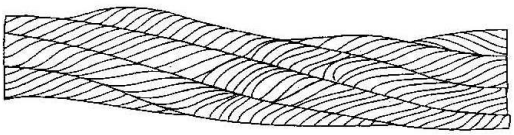


Figure 4-11.

4. Check the condition of the fixing pins of the outlet pulley and extensions return.
5. Check the wear of the pulley grooving using a profile comparator. As indicated in the figure it is necessary to check that the outline of the comparator corresponds with the base of the grooving.

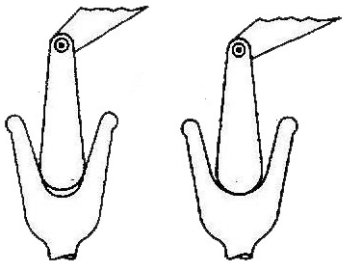


Figure 4-12.

6. Check that there are no signs of ovalisation, wear or any other type of deformation on the pulleys.

Assembly

NOTE: *When installing fly section wear pads, install same number and thickness of shims as were removed during disassembly.*

1. Measure inside dimensions of the base and mid sections to determine the number of shims required for proper lift.
2. Measure inside dimensions of the mid section to determine the number of shims required for proper lift.
3. Install side, top and bottom wear pads to the rear end of fly section; shim evenly to the measurements of the inside of mid section.
4. Install retract wire ropes into rear end of fly section, route wire ropes thru holes in side of fly boom section and pull into slot.

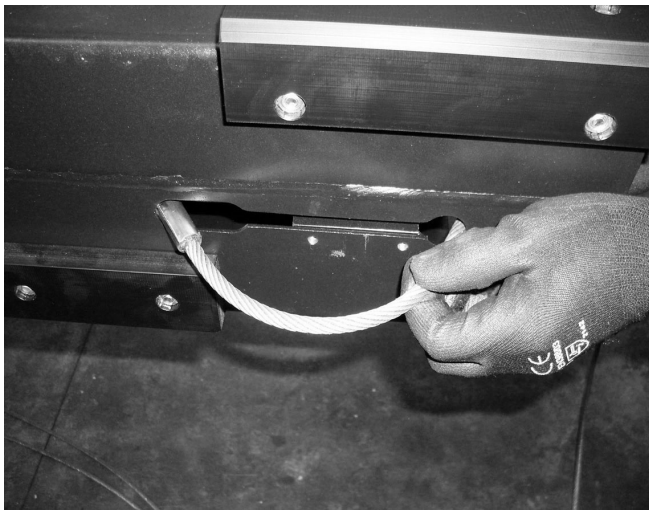


Figure 4-13.

5. Install side, top and bottom wear pads to the rear end of mid section.

NOTICE

WHEN ASSEMBLING BOOM SECTIONS, ENSURE THAT THE BOOM SLIDING TRAJECTORIES HAVE BEEN CLEARED OF CHAINS, TOOLS, AND OTHER OBSTRUCTIONS.

6. Slid fly boom section into the mid boom section. Adjust boom, if necessary, for a total of 1/16 inch (0.062) clearance.
7. Install wear pads into the forward position of the mid boom section. Adjust boom, if necessary, for a total of 2/10 inch (5.08mm) clearance.
8. Properly position the retraction wire rope sheaves assemblies at the rear end of the mid boom section; ensure all sheave-to-mounting block attachment holes align. Install the sheave pins and secure them with mounting hardware. Position retract wire ropes onto the sheaves.
9. Install sheave guards to rear end of mid boom section and secure with mounting hardware.
10. Slide mid boom section into the base boom section. Allow the retraction wire ropes to trail between the bottom surfaces of boom sections. Adjust boom, if necessary, for a total of 1/16 inch (0.062) clearance.
11. Install wear pads into the forward position of the base boom section. Adjust boom, if necessary, for a total of 2/10 inch (0.20) clearance.
12. Install sheave block to bottom of base boom section and adjust block so that retract wire ropes do not come into contact with boom surfaces.
13. Install wire rope threaded ends thru attachment holes in the bottom of base boom section. Loosely install nuts and jam nuts onto the threaded ends of wire ropes.
14. Pull the boom sections out to approximately where they were extended to for telescope cylinder removal.
15. Install a new extend sheave on the end of the telescope cylinder.
16. Route new extend cables around the telescope cylinder. Loosely fasten the threaded end of the cables to the rod end of the telescope cylinder with the adjusting nuts and lock nuts. Install the opposite end of the cables in the cable mount block.
17. Use tape or tie straps to fasten the cables to the telescope cylinder assembly. It is important that the tape or straps be strong enough to hold the cable in place yet weak enough to break and fall away when the cables are adjusted.

NOTICE

WHEN PUSHING THE TELESCOPE CYLINDER INTO THE BOOM, IT MAY BE NECESSARY AT SOME POINT TO TURN THE CYLINDER SLIGHTLY IN ORDER TO CLEAR ASSEMBLIES MOUNTED WITHIN THE BOOM. CARE MUST BE TAKEN TO MOVE THE CYLINDER SLOWLY INTO THE BOOM. DAMAGE TO COMPONENTS MAY RESULT FROM FORCIBLE IMPACT WITH THESE ASSEMBLIES.

NOTE: *The telescope cylinder weighs approximately 600 lbs. (275 kg).*

18. Using adequate lifting equipment, carefully push the telescope cylinder assembly and cables back into the boom.

19. Apply Loctite #242 to the bolts and fasten the telescope cylinder rod to the boom base section with the bolts, shims, mounting blocks.

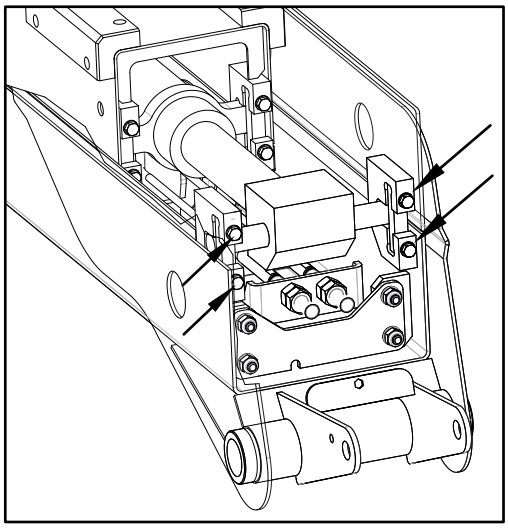


Figure 4-14.

20. Apply Loctite #242 to the bolts and fasten the telescope cylinder barrel to the boom mid section with the bolts, shims, mounting blocks.

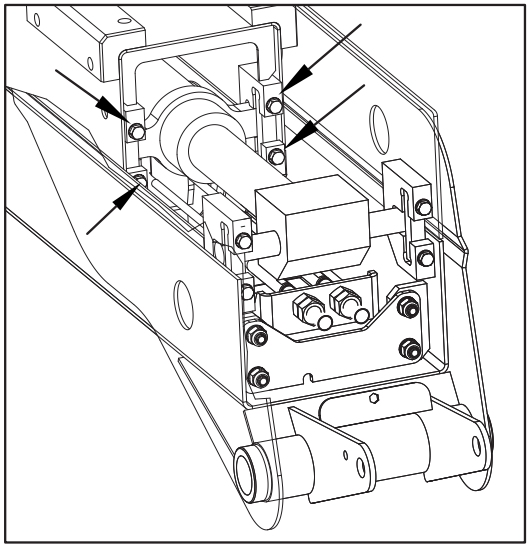


Figure 4-15.

21. Using a 3/8 drive extension approximately 4 feet (1.2 m) long, install the bolts and washers securing the cable mount block to the boom fly section. Tape the bolts to the socket at the end of the extension to prevent it from coming out of the socket before it engages the mounting threads.

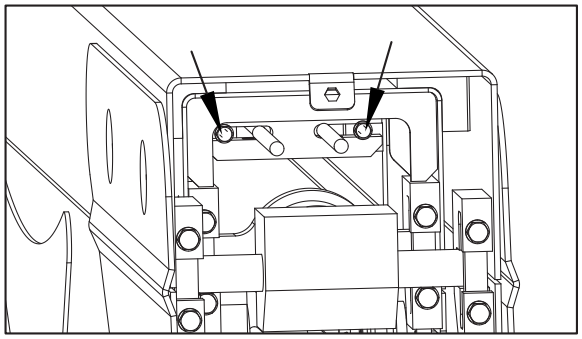


Figure 4-16.

22. Connect all the hydraulic lines to the cylinder as tagged during the removal procedure.

23. Adjust the boom cables as outlined under Section 4.4, ROPES TENSION ADJUSTMENT PROCEDURE.

Installation To Machine

1. Using a suitable lifting device, position boom assembly on upright so that the pivot holes in both boom and upright are aligned.

2. Install boom pivot pin, ensuring that location of hole in pin is aligned with attach point on upright.

3. If necessary, gently tap pin into position with soft headed mallet. Secure pin mounting hardware.

4. Connect all wiring to the ground control box.

5. Connect all hydraulic lines running along side of boom assembly.

6. Using all applicable safety precautions, operate lifting device in order to position boom lift cylinder so that holes in the cylinder rod end and boom structure are aligned. Insert the lift cylinder pin, ensuring that location of hole in pin is aligned with attach point on boom.

7. Align holes in boom structure with hole in master cylinder. Insert the master cylinder pin, ensuring that location of hole in pin is aligned with attach point on boom.

8. Adjust retract and extend cables to the proper torque. Refer to Section 4.4, ROPES TENSION ADJUSTMENT PROCEDURE.

9. Using all applicable safety precautions, operate machine systems and raise and extend boom fully, noting the performance of the extension cycle.

10. Retract and lower boom, noting the performance of the retraction cycle.

Three month inspection

1. Remove all protection sumps from the third arm and the two extensions. Use a flashlight torch to visually check the state of the ropes and the extension pulleys.
2. Check the correct rope tension, trying to bend them manually. If they are pulled correctly they should not be able to move more than a few millimeters.
3. Check that in the extension arms exit phase the return ropes are sufficiently in traction in a way not to allow relative contact with the third arm.
4. Vice versa in the extension return phase, check that the outlet ropes are subject to a tension that allows them not to come into contact with the second extension or the cylinder.
5. Use a torque wrench to check the correct torque of all rope fixing nuts and the respective rocker arms; recommended torque 10 Nm.

If the tension of the ropes should not be adequate the conditions for use must be restored by scrupulously following the Ropes Tension Adjustment procedure reported following.

4.4 WIRE ROPE TENSION ADJUSTMENT PROCEDURE

NOTE: *Do not clamp on threads.*

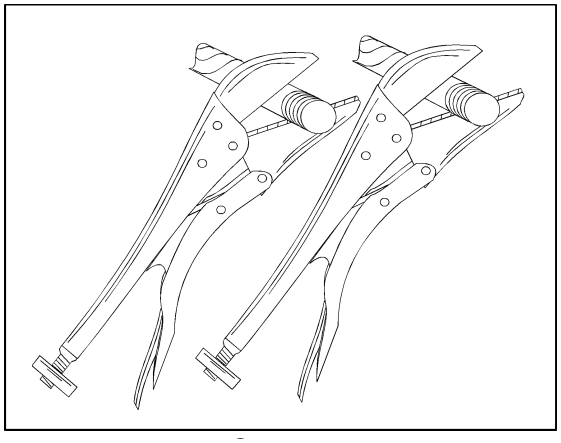


Figure 4-17. Clamping Wire Ropes

1. Loosen the register counter-nuts by a few turns, position them in a way to access the adjustment nuts in order to make the adjustment. (two nuts with relative counter-nut for extend ropes and one nut with relative counter-nut for retract ropes rocker arm).
2. Completely retract both extendible arms and make them escape for about 30-40cm.
3. Tighten the nut for the traction of the fixing rocker arm of the return ropes to a torque of 10Nm.

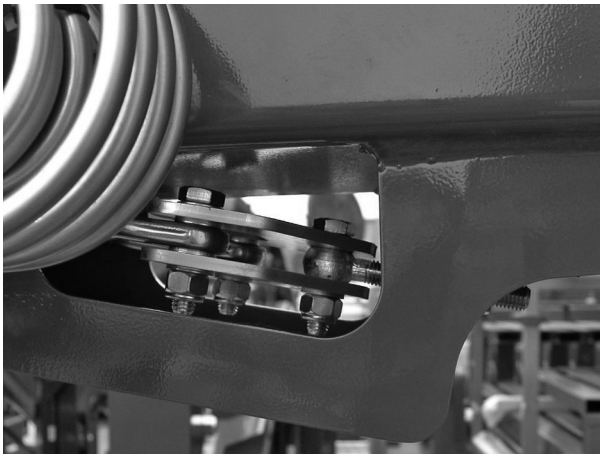


Figure 4-18. Return ropes fixing rocker arm

4. Completely extend the extensions and retract them by about 30-40cm.
5. Tighten the bolts of the two output cables so that the threaded terminals come out of 65±3 mm from the rocker arm. During adjustment

keep the ropes blocked to prevent them turning with the nuts. Make use of the relevant seat for the wrench on the cable socket.

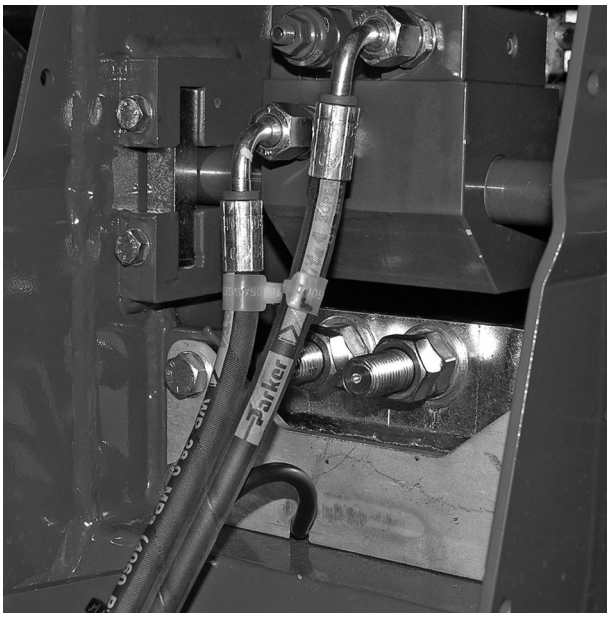


Figure 4-19. Nuts for exit cables stop

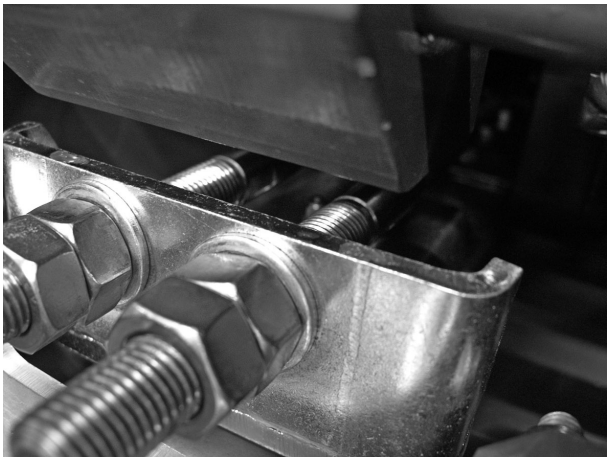


Figure 4-20. Terminal with seat for anti-rotation key

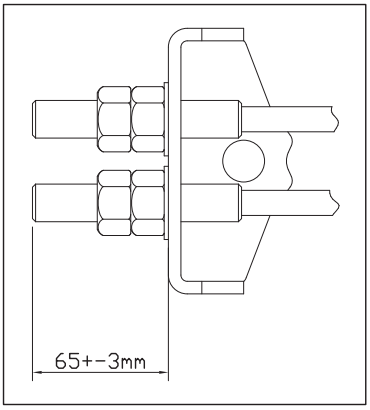


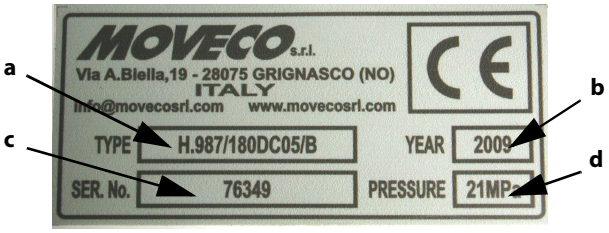
Figure 4-21.

6. Activate the movement of the extendible arms several times and check that the residual loads on the ropes are 10Nm.
7. This procedure could require several attempts before it is completed correctly.
8. The adjustment is correct when the ropes do not emit any noise during extension or return and the torque value prescribed is reached on all of the ropes.
9. Once calibration has been concluded, tighten the counter-nuts and re-mount the sump.

4.5 ROTARY ACTUATOR

ARP Series

Technical Data



- **a.** Rotary actuator model.
- **b.** Construction year.
- **c.** Serial number. Please refer to this number in order to obtain every further details from our technical department.
- **d.** Max working pressure.

Technical Data	Actuator Model
	RP.17/L25H1D2VPH
Rotation Angle	124°
Displacement (cm^3)	~ 81
Weight (kg)	~ 16
Ports	¼G
Working temperature (°C)	-20 / + 80
Max. torque at 210bar (Nm)	505
Max. working pressure (bar)	210
Max. Capacity straddle mount / cantilever mount (Nm)	2800 / 1400
Max. capacity: thrust / radial (N)	5000 / 14000

For more information and other details see technical drawing.

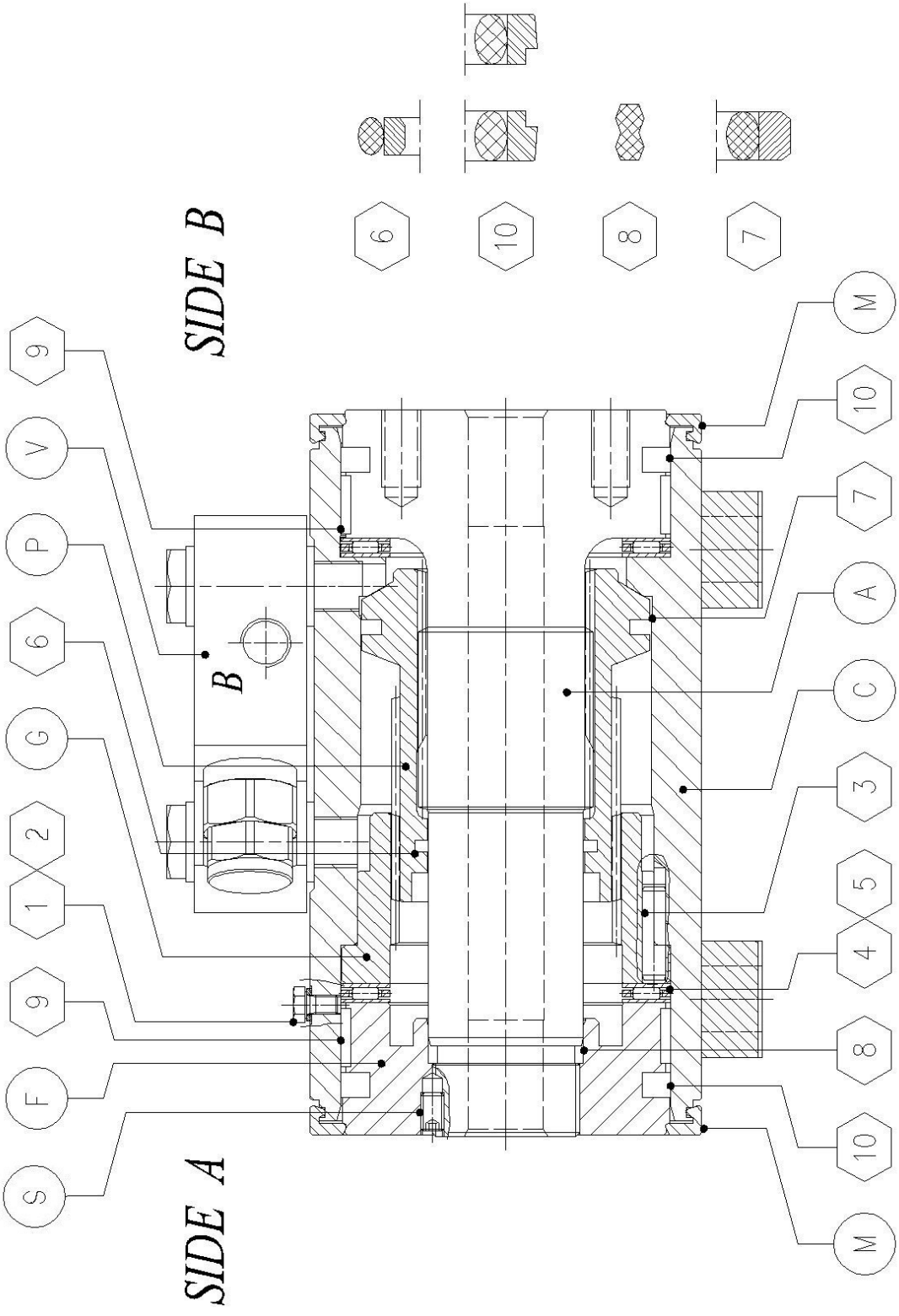


Figure 4-22.

H.987/124DC01/C – H.987/124DC07/C		
POS.	**QTY**	**DEFINITION**
SPECIAL INTERNAL PRODUCTION MOVECO		
A	1	TOOTHED SHAFT D85/D40X187.5 THROUGH HOLE
C	1	WELDED BODY CYLINDER ASSEMBLY X ...DC01/C
	1	WELDED BODY CYLINDER ASSEMBLY X ...DC07/C
	2	BUSHING D28XD20X40 X H.987/124DC01/C
	2	BOX SUPPORT
	4	HEX.HEAD SCREW M6X20
	4	FLAT WASHER D6XD18X2
	4	SELF LOCKING NUT M6
F	1	REAR FLANGE D84.4X35.5-124°
G	1	TOOTHED GEAR RING
M*	2	WIPER RING D101XD81X7.5
P	1	TOOTH PISTON D75XD40X86
S*	3	PIN D6X12
V	1	DOUBLE OVERCENTER VALVE
SEALS KIT (includes the particulars marked by *)		
NOTE: Units (A, C, F, P) are exchangeable only by MOVECO		
SPARE-PARTS		
1*	2	BONDED SEAL D5
2	2	HEX.HEAD SCREW M5X8
3	4	PIN D6X24 - UNI 6364 A
4	4	THRUST RING D60XD85X1
5	2	THRUST BEARING D60XD85X3
6*	1	INT.PTFE SEAL D40
7*	1	EXT.PTFE SEAL D75 - 0750/A
8*	1	SEAL RING OP D40XD35.5X4.5
9*	2	GUIDE RING I 80/E85X14.8 RF
10*	2	EXT.PTFE SEAL D85 PROF. B

Disassembly

⚠ CAUTION

THE SEALS MUST BE REMOVED USING APPOSITE TOOLS, SEALING SURFACES MUST NOT BE DAMAGED.

1. After disassembly all parts must be cleaned and degreased.
2. Clean all parts with compressed air.
3. Lubricate all sealing surfaces.
4. Make sure that the seals are not damaged during disassembly and assembly.

NOTICE

REMOVE ONLY WHEN THE ACTUATOR IS UNINSTALLED FROM THE MACHINE/EQUIPMENT.

5. Fix the actuator to the bench.
6. Remove valve V, plugs and any bleeder screws on the body (eg 1, 2).

NOTE: *Place a suitable container below the actuator to collect oil.*

7. Remove protection ring M.
8. Remove the locking pins S.
9. Loosen flange F from shaft A using hole Ø6 and using an appropriate wrench. We recommend make equipment to facilitate the operation.

NOTE: *Before unscrewing, make a reference between shaft and flange and measure the gap between them on side A.*

10. Now carefully remove bearing 5 and thrust ring 4 .

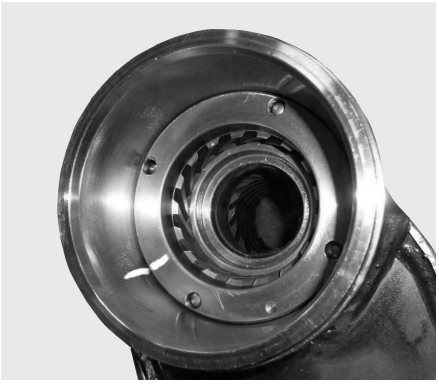
11. Using holes Ø6 on the head of shaft and using a proper wrench, rotate shaft A clockwise to bring piston P to touche against the stop on body C.
12. With the piston stop, rotate the shaft anti-clockwise and this will march by the body.

NOTE: *On gear teeth of shaft and piston (before disengaging the same) make a reference, marking a tooth for every detail on which engages with reciprocal.*

Detail 8, remove before removing shaft!

13. Now carefully remove shaft A,bearing 5 and thrust ring 4.

14. Make a reference between actuator body C and gear ring G (on side A), so as to reposition it properly during assembly.



15. Push piston toward the side A, when it is stopping on gear ring G, make an effort to remove it from mounting pins 3, push out the two details from actuator body and remove pins.

NOTE: *On gear teeth of piston and gear ring (before disengaging the same) make a reference, marking a tooth for every detail on which engages with reciprocal.*

16. Remove all elements sealing by the particular.

⚠ CAUTION

THE SEALS MUST BE REMOVED USING APPOSITE TOOLS, SEALING SURFACES MUST NOT BE DAMAGED.

17. After disassembly all parts must be cleaned and degreased.

18. Clean all parts with compressed air.

19. Lubricate all sealing surfaces.

20. Make sure that the seals are not damaged during disassembly and assembly.

Assembly

1. Fix the actuator in a proper way to the bench
2. Reinstall all sealing elements on their particulars paying attention to mounting direction (see drawing). If you have difficulty use appropriate bushings cone.

NOTE: *For easy mounting, it is recommended to heat up the elements of PTFE details 6, 7 and 10 in hot water at 70/80 ° C.*

3. Put piston P, complete with seals 6 and 7 in actuator body C.
4. Engage gear ring G with piston P referring to the previously marked position.
5. Turn gear ring G and match references between this and body (made during removal) and insert mounting pins 3 until it is under the level of gear ring.
6. Place bearing 5 and thrust ring 4 (4+5+4) on side B.

NOTE: *Lubricate with grease the bearing and thrust ring. Use grease EP 0 (NLGI consistency 0; soap type Lithium; base oil Mineral).*

7. Insert shaft A from side B, complete with seals 8 and 10 and guide ring 9, engage it with piston P by referring to previously marked tooth.

NOTE: *During this operation pay attention to the sealing elements between the shaft A and piston P.*

8. Place bearing 5 and thrust ring 4 (4+5+4) on side A.
9. Screw flange F, with seal 10 and guide rings 9, until the reference and the gap between shaft and flange do not match (clamp the shaft using the holes Ø6 on the head).
10. Put the pins S.
11. Install any plugs and bleeder screws on the body (eg: 1, 2).
12. Install valve V and details M.
13. Check that there isn't air inside the actuator. To get out any internal air put the actuator in horizontal position with the axis of rotation, with the attacks facing up and make several rotations (10/20).
14. To assure the oil exchange within the system during the work the volume of the connecting pipes must be lower than the actuator displacement.
15. Align the fixing holes of structure/machine to those of structure/actuator flange and lock this position by pins/screws of suitable torque.
16. Connect the rotary actuator as per layout on the drawing.

Installing Counterbalance Valve

Refer to Figure 4-23., Rotator Counterbalance Valve.

1. Make sure the surface of the actuator is clean, free of any contamination and foreign debris including old Loctite.
2. Make sure the new valve has the O-rings in the counter bores of the valve to seal it to the actuator housing.
3. The bolts that come with the valve are grade 8 bolts. New bolts should be installed with a new valve. Loctite #242 should be applied to the shank of the three bolts at the time of installation.
4. Torque the 1/4-inch bolts 110 to 120 inch pounds (12.4 to 13.5 Nm). Do not torque over 125 inch pounds (14.1 Nm). Torque the 5/16-inch bolts 140 inch pounds (15.8 Nm). Do not torque over 145 inch pounds (16.3 Nm).

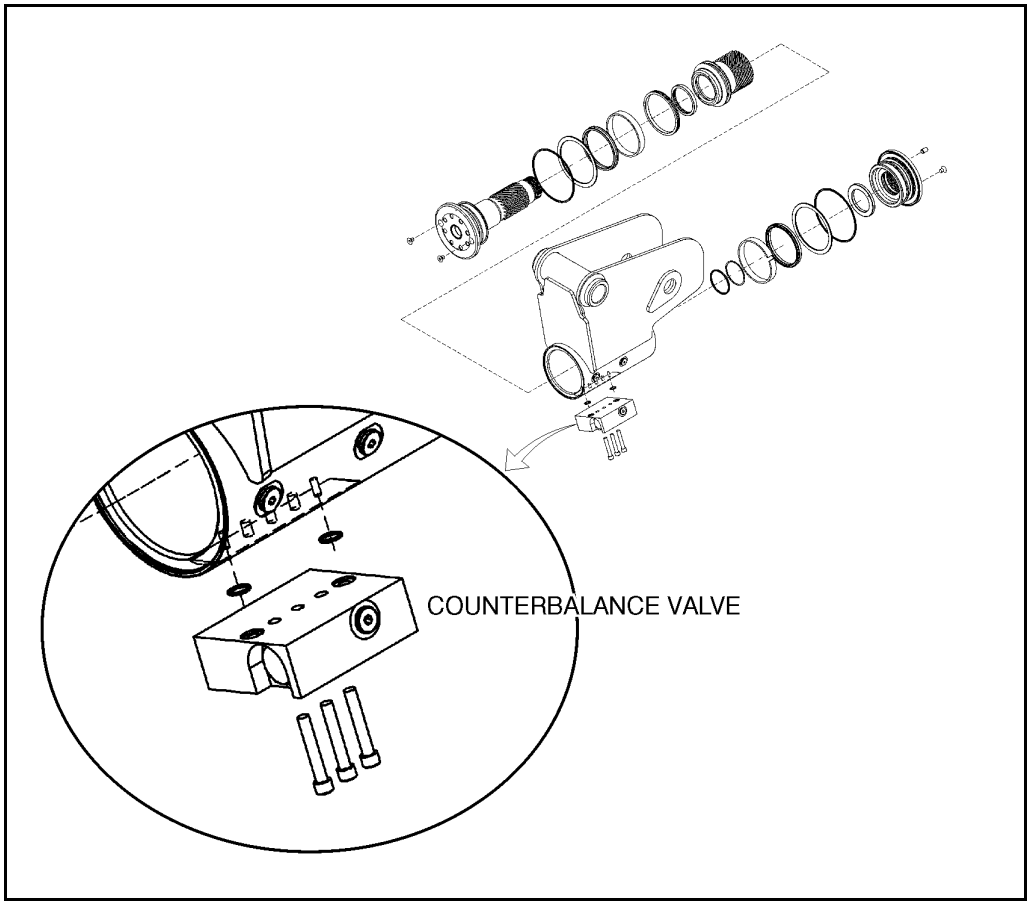


Figure 4-23. Rotator Counterbalance Valve

4.6 BOOM ROTATION SENSOR ASSEMBLY

1. Assemble the end couplings (p/n-26741500) using the hex galvanized screws (p/n-BV013000) to the extension pipe (p/n-06745900).

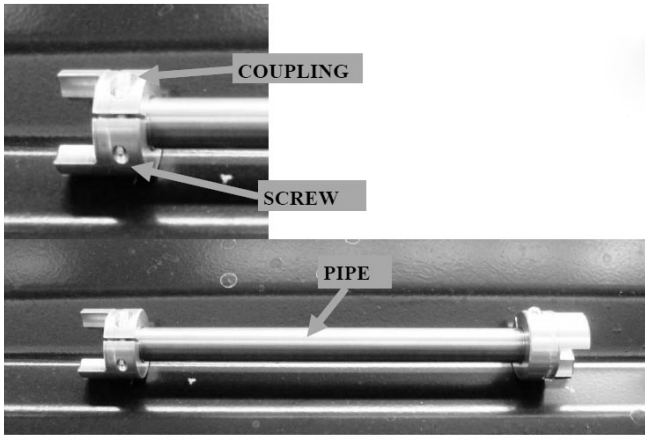


Figure 4-24.

2. Locate the rotation sensor (encoder) (p/n-0660400) and encoder coupling (p/n-26741500).

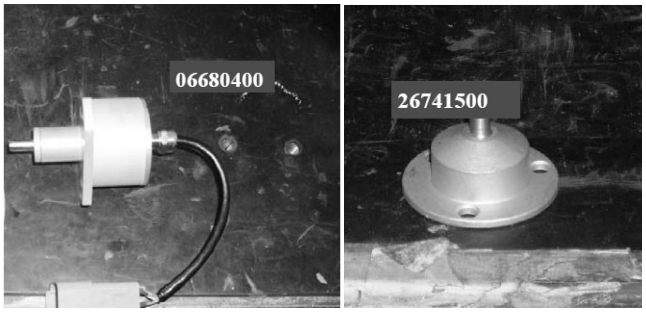


Figure 4-25.

3. Mount the rotation sensor (encoder) to the crossmember under the turntable bearing using 3 - 6 x 12M screws with threadlocker. Connect the rotation sensor electrical connector to the connector coming from the electrical box. *See Figure 4-26.*

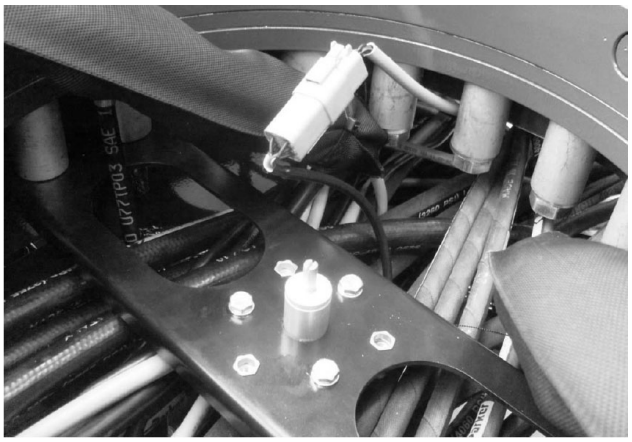


Figure 4-26.

4. Route the rotation sensor electrical cable inside the frame as shown below.

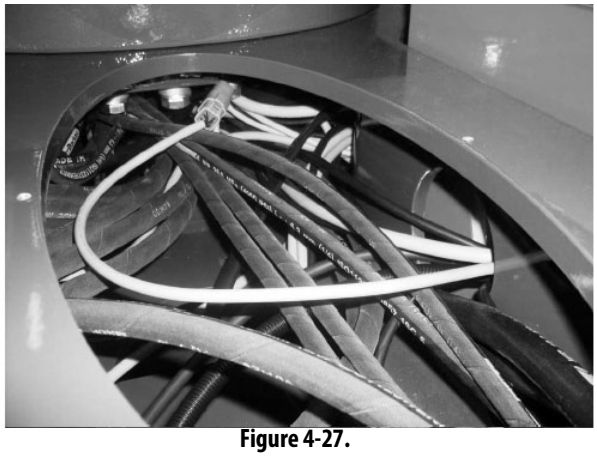


Figure 4-27.

5. Install a coupling onto the rotation sensor shaft using 1 - 3x12M screw (p/n-BV013000).

Figure 4-28.

6. Install the protective cover over the rotation sensor assembly using 3-6x16M TE screws and washers. Install cover with the open slot facing the engine end of the machine. *See Figure 4-29.*

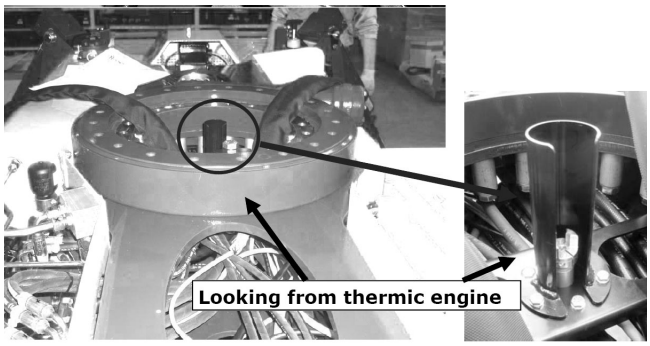


Figure 4-29.

7. Install the sensor extension pipe with couplings assembled in step 1, onto the sensor coupling at the bottom of the protective cover. Install a rubber coupling *(blue arrow)* into the metal coupling *(red arrow)* at each end of the extension pipe *(green arrow)* before installing.

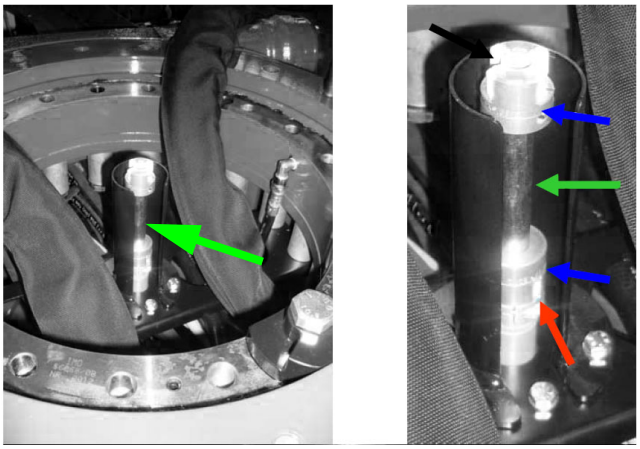


Figure 4-30.

8. Measure with a caliber the distance between the coupling top and the surface of the first boom support where the rotation marker will be mounted. *See Figure 4-31.*

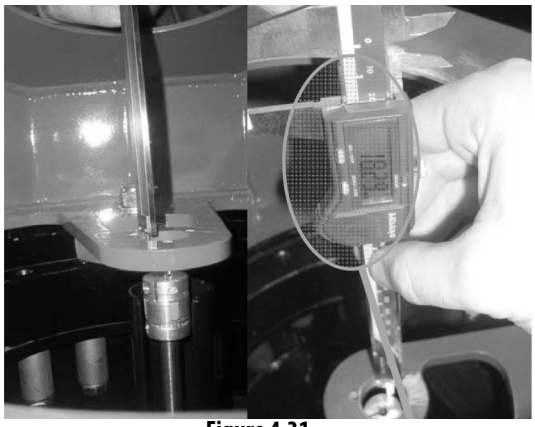


Figure 4-31.

9. Make the difference between this distance and the rotation marker size (15mm), then add at least 0.02 in. (0,5mm) to have an interference fit (but not more than 0.06 in. (1,5mm). Adjust to the right measure shifting the two couplings on the pipe to achieve 0.63 in. (16mm).
(Example 18,29-16= 2,29mm)
In this case it's necessary to elongate the distance between the two couplings to 0.09 in. (2,29mm).

NOTE: *The rotation sensor will need calibrated. See Section 6 for calibration details.*

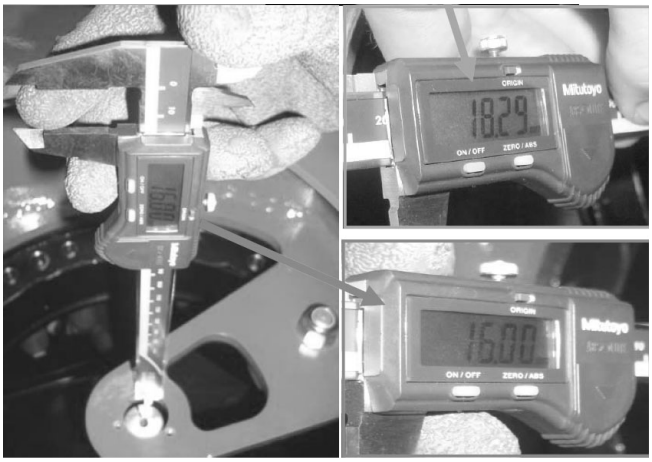


Figure 4-32.

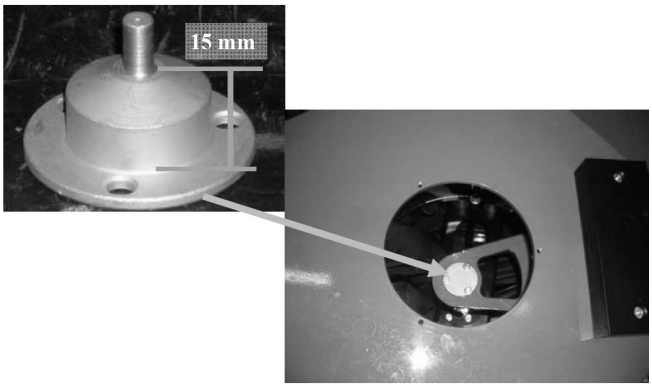


Figure 4-33.

4.7 PLATFORM REMOVAL/INSTALLATION

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

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

Platform Installation

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

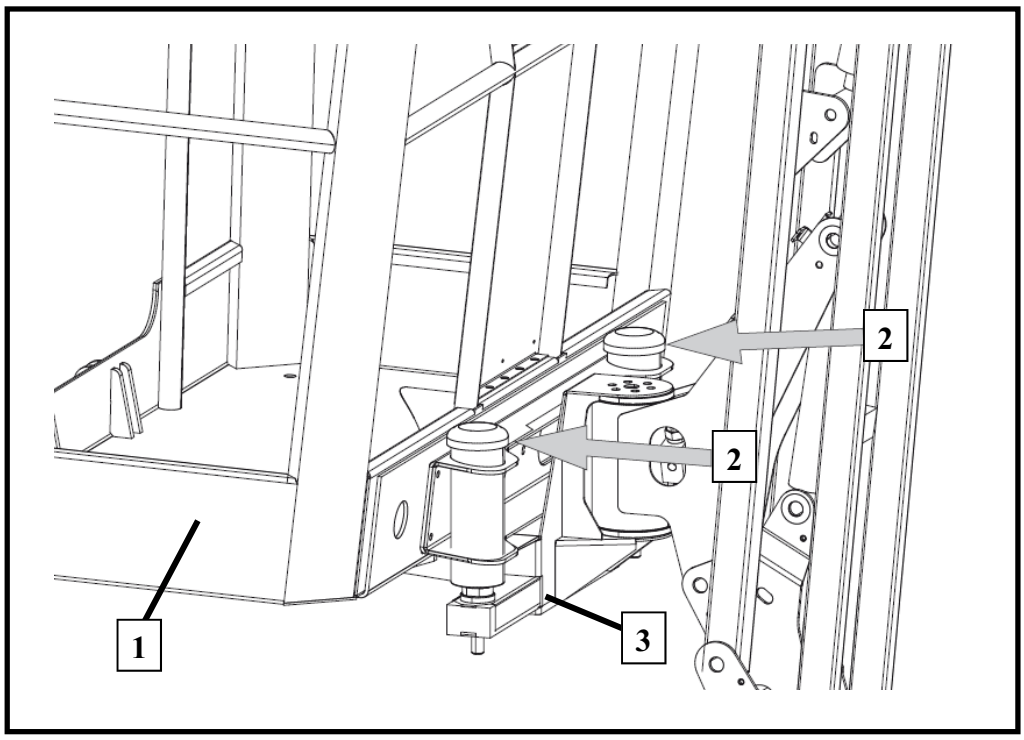


Figure 4-34.

4.8 LOAD CELL AND FOOTSWITCH REMOVAL/ INSTALLATION

Removing Load Cell

1. Turn the machine off and unplugged from the power supply.
2. Remove the basket of the machine (see dismantling basket).
3. Remove screws (2) and remove cover (3).
4. Remove the load cell (4) by disconnecting the wiring from ECM3.

Installing Load Cell

1. Install the load cell (4) and stop with cover (3) and secure with screws (2).
2. Remount the load cell (4) connecting the electrical wiring to ECM3.
3. Reinstall the basket. (See section basket installation)

NOTE: *Load cell will need to be calibrated. See Section 6 for details on calibration.*

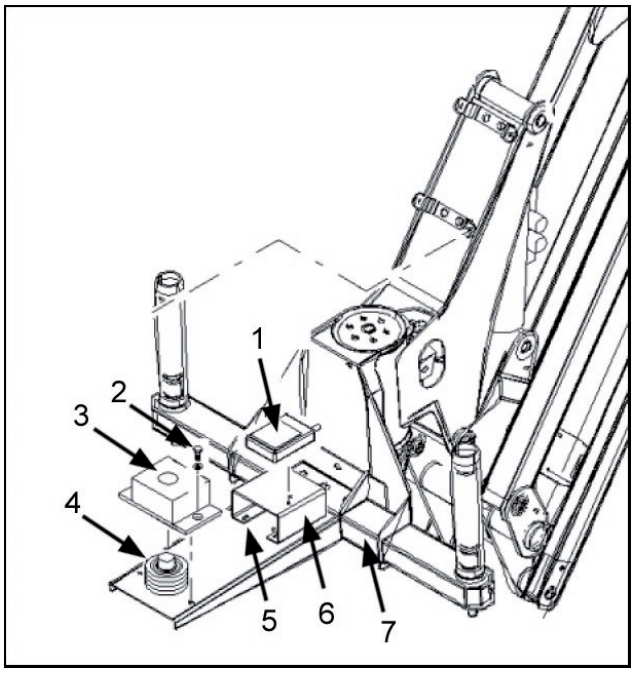


Figure 4-35.

Removing Footswitch

1. Turn the machine off and unplugged from the power supply.
2. Remove the basket of the machine. (See paragraph basket removal).
3. Remove screws (5) securing support footswitch (6).
4. Loosen the fixing screw foot (1).
5. Remove the footswitch (1) disconnecting the wiring from ECM3.

Installing Footswitch

1. Fit and secure with screw the the footswitch (1) to the support footswitch (6).
2. Secure with screws (5) footswitch support (6) to the basket support(7).
3. Connect the wiring to ECM3.
4. Reinstall the basket. (See paragraph basket installation).

4.9 SKYGUARD INSTALLATION - ONE PERSON PLATFORM

The purpose of this instruction is to install a SkyGuard system on JLG X770AJ/X26JP Compact Crawler Boom (platform capacity of one person) models listed below and with below pictured SkyGuard Bracket.

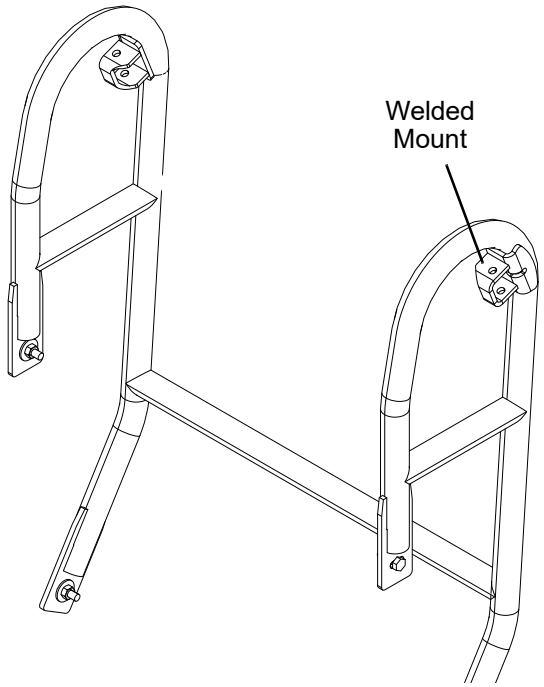


Figure 4-36. SkyGuard Bracket with Mount

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

NOTICE

Use all applicable Safety precautions while working on, around or under any machinery.

Options/Accessories Prohibited When Installing This Kit:

- None

Tools & Equipment Required:

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

Personnel Required:

- Qualified JLG equipment mechanic

Parts List:

ITEM	PART NUMBER	DESCRIPTION	QTY
1	0641414	Bolt, 1/4-20 x 1 3/4 LG	2
2	0700812	Bolt (Metric), 8 x 25 LG	4
3	3290801	Nut, M8 x 1.25	4
4	3300430	Nut, Acorn 1/4- 20	2
5	3931424	Bolt, 1/4-20x1 1/2 LG	2
6	4711400	Washer, 1/4 DIA Plain Steel, Narrow	4
7	4811902	Washer, 8mm LG OD	4
8	37675400	Bracket, SkyGuard Support	1
9	1001186517	Cover, Platform Sensor	2
10	1001188889	Support, Shear Block	2
11	1001213890	Switch, SkyGuard	1
12	1001213891	Mount, Platform Sensor	1

Procedure:

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

For Reference:

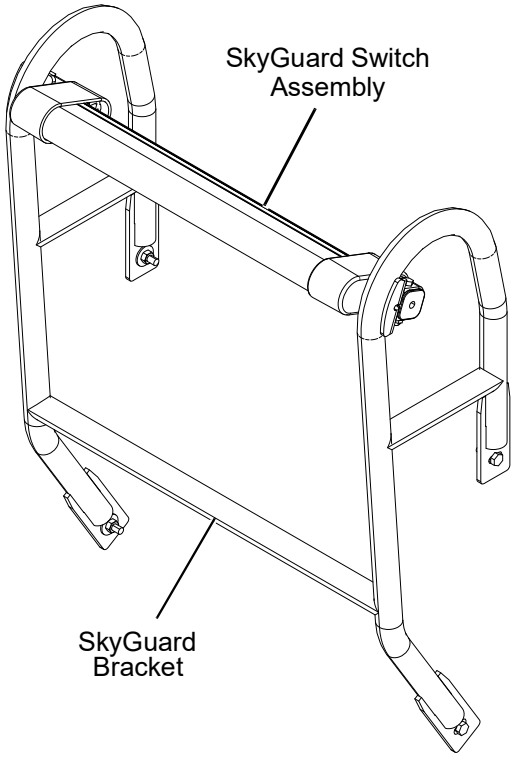


Figure 4-37. SkyGuard Bracket with SkyGuard

Installation:

1. Install the SkyGuard Support Bracket **(8)** onto the welded mounts on platform rails. Secure the support bracket using four Bolts **(2)**, relevant Washers **(7)** and Nuts **(3)**. *See Figure 4-38.*

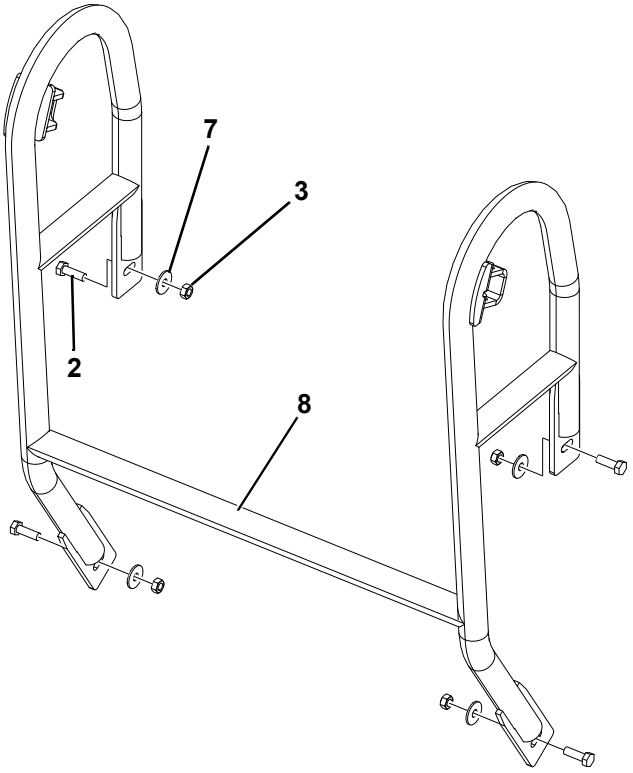


Figure 4-38.

2. Align and attach Platform Sensor Mount **(12)** onto the SkyGuard Switch **(11)** as shown in *Figure 4-39*.
3. Attach Platform Sensor Covers **(9)** to SkyGuard switch assembly at both ends. *See Figure 4-39.*

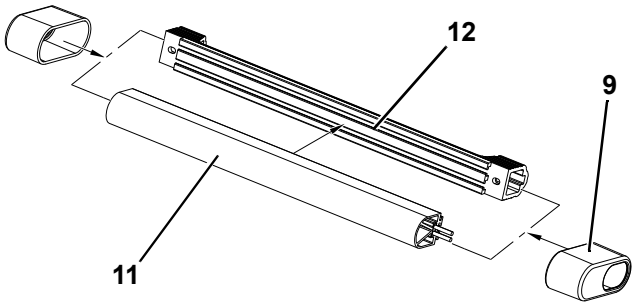


Figure 4-39.

4. Position SkyGuard switch assembly with sensor cover onto the SkyGuard Support Bracket **(8)** as shown in *Figure 4-40*..

5. Insert a Shear Block Support **(10)** through shear block housing on the SkyGuard support bracket and into the platform sensor mount. *See Figure 4-40.*

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

6. Secure the shear block on welded mount of SkyGuard support bracket using Bolt **(1)**, relevant Washer **(6)** and Acorn Nut **(4)** as shown in *Figure 4-40.*
7. Secure the SkyGuard switch assembly using Bolt **(5)** and relevant Washer **(6)** on platform sensor mount. *See Figure 4-40.*

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

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

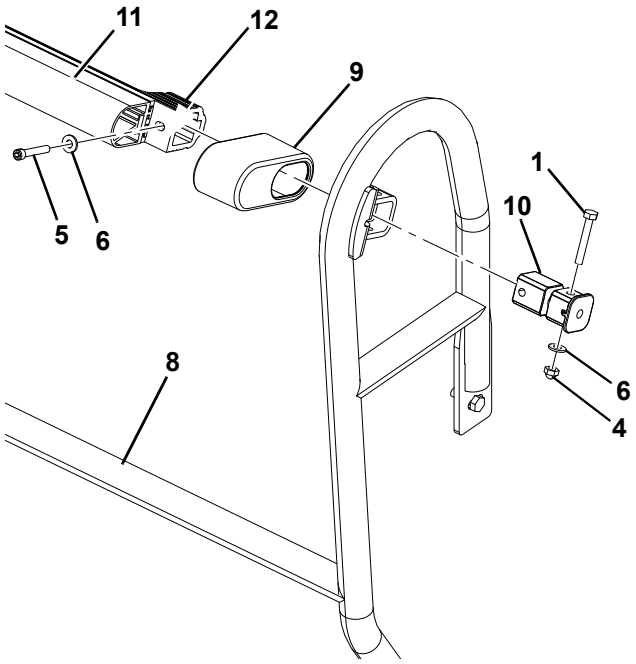


Figure 4-40.

9. Route the SkyGuard switch harness along SkyGuard support bracket (right side) and under the platform control box. Secure the harness using tie straps. *See Figure 4-41.*

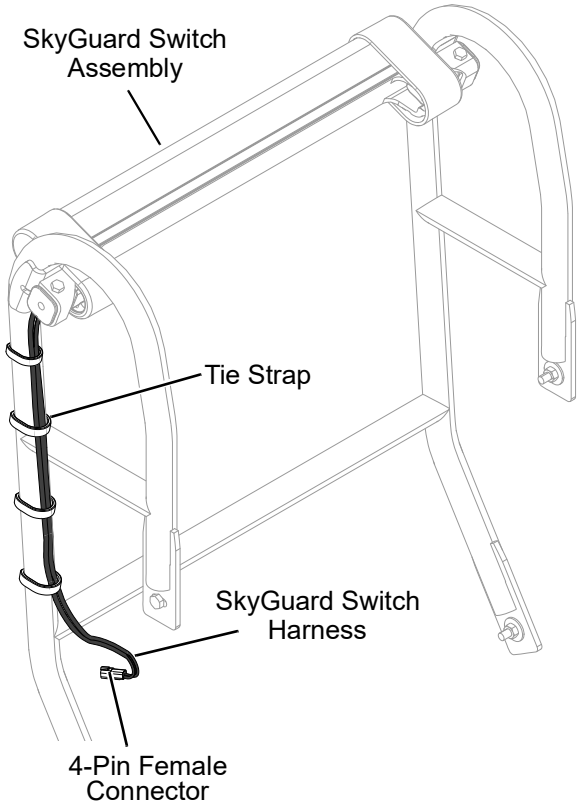


Figure 4-41.

10. Connect Sky Guard connector to the one on the machine located under load cell box. *See Figure 4-42..*

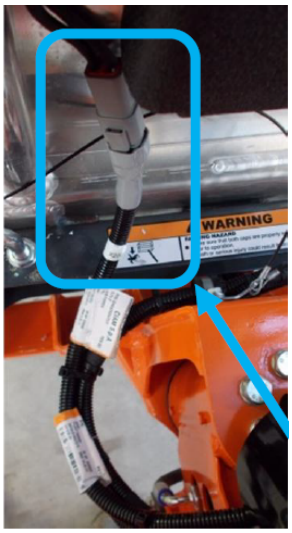


Figure 4-42.

⚠ CAUTION

WHEN THE SKYGUARD IS PUSHED WITH EXCESSIVE FORCE THE SENSOR SUPPORTS *(ITEM 10 - FIGURE 4-40.)* WILL BREAK. REPLACE WITH NEW SENSOR SUPPORTS BEFORE CONTINUING OPERATION OF THE MACHINE.

11. Reconnect the battery power to the machine.

12. Check for the proper functioning of SkyGuard system.

13. POWER ON the machine.

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

Asterisk must show next to the ON position

Figure 4-43.

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

NOTICE

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

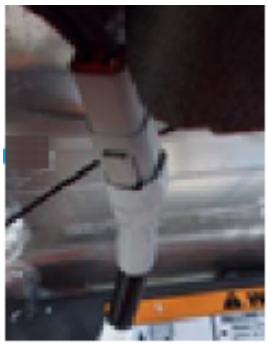


Figure 4-44.

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

SkyGuard System

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

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

Figure 4-45. SkyGuard Function Table

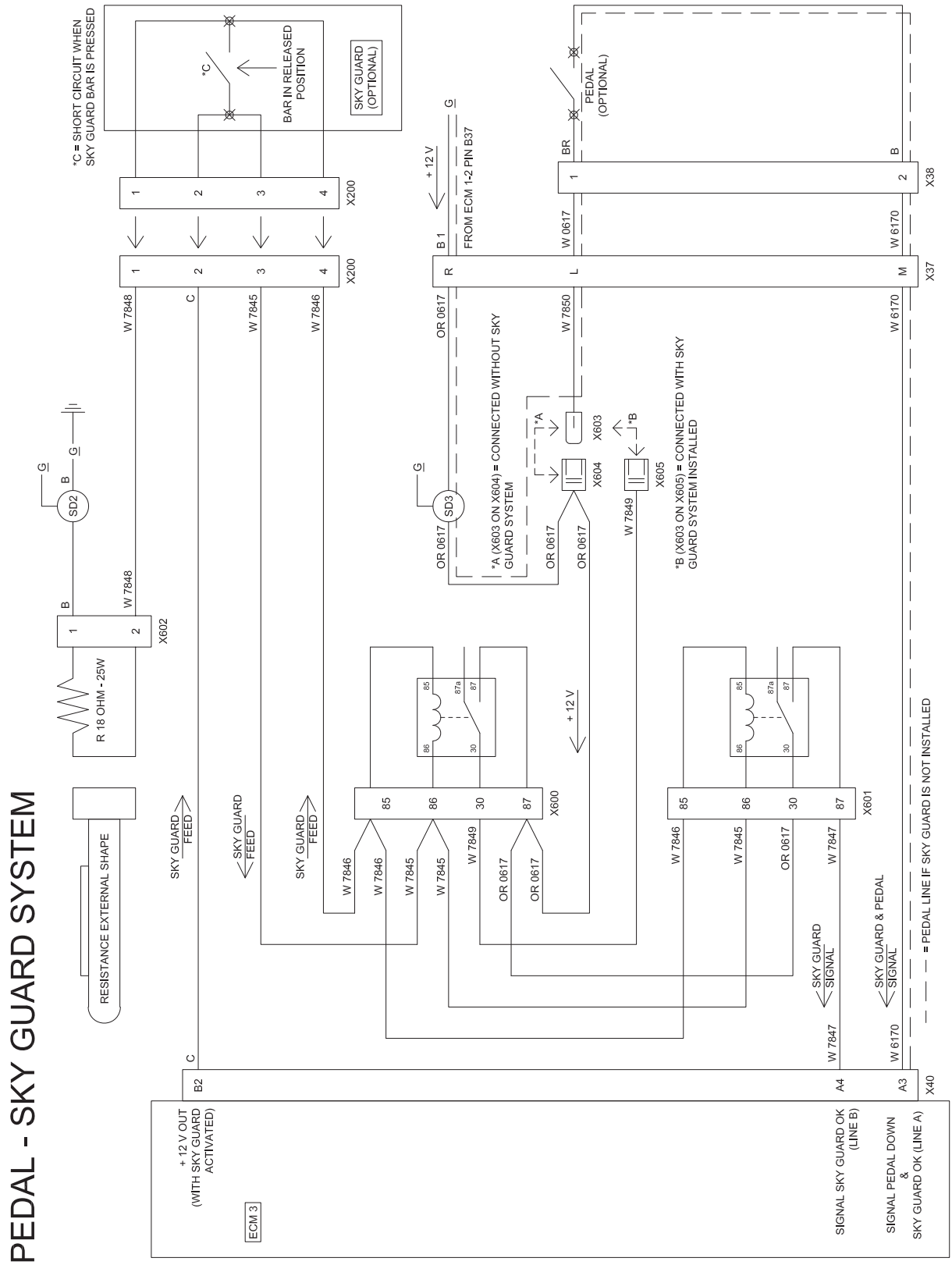


Figure 4-46. Pedal - Sky Guard System Schematic

4.10 SKYGUARD INSTALLATION - 2 PERSON PLATFORM

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

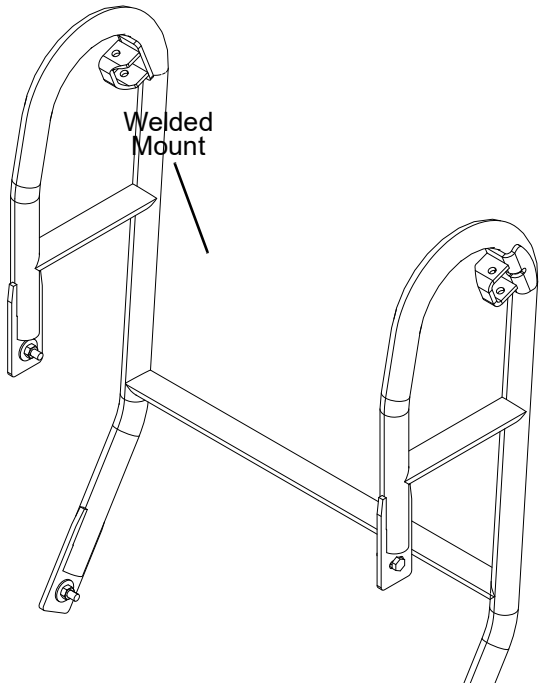


Figure 4-47. : SkyGuard Bracket with Mount

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

NOTICE

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

Options/Accessories Prohibited When Installing This Kit:

- None

Tools & Equipment Required:

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

Personnel Required:

- Qualified JLG equipment mechanic

Parts List:

ITEM	PART NUMBER	DESCRIPTION	QTY
1	0641414	Bolt, 1/4-20 x 1 3/4 LG	2
2	0700812	Bolt (Metric), 8 x 25 LG	4
3	3290801	Nut, M8 x 1.25	4
4	3300430	Nut, Acorn 1/4- 20	2
5	3931424	Bolt, 1/4-20x1 1/2 LG	2
6	4711400	Washer, 1/4 DIA Plain Steel, Narrow	4
7	4811902	Washer, 8mm LG OD	4
8	37609800	Bracket, SkyGuard Support	1
9	1001186517	Cover, Platform Sensor	2
10	1001188889	Support, Shear Block	2
11	1001213890	Switch, SkyGuard	1
12	1001213891	Mount, Platform Sensor	1

Procedure:

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

For Reference:

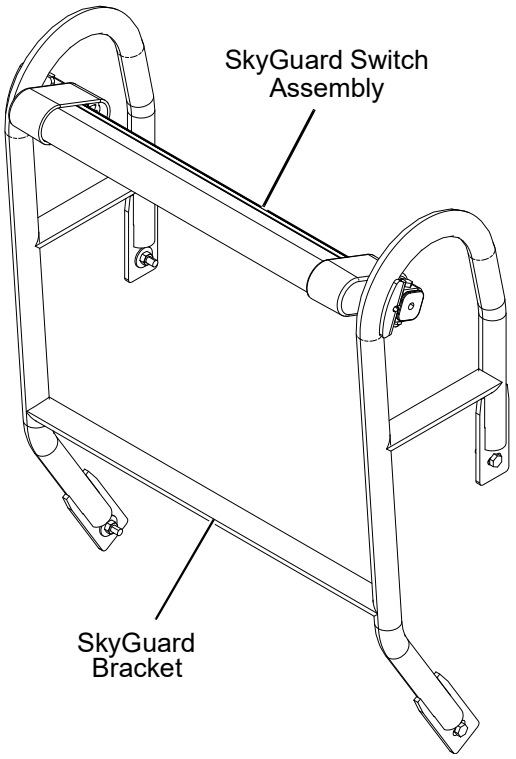


Figure 4-48. SkyGuard Bracket with SkyGuard

Installation:

1. Install the SkyGuard Support Bracket **(8)** onto the welded mounts on platform rails, secure the support bracket using four Bolts **(2)**, relevant Washers **(7)** and Nuts **(3)**. *See Figure 4-49.*

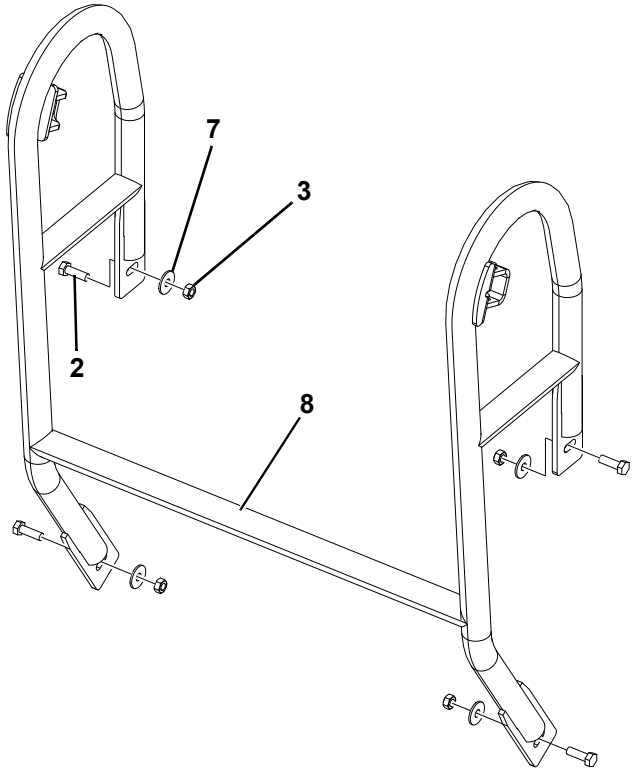


Figure 4-49.

2. Align and attach Platform Sensor Mount **(12)** onto the SkyGuard Switch **(11)** as shown in *Figure 4-50.*
3. Attach Platform Sensor Covers **(9)** to SkyGuard switch assembly at both ends. *See Figure 4-50.*

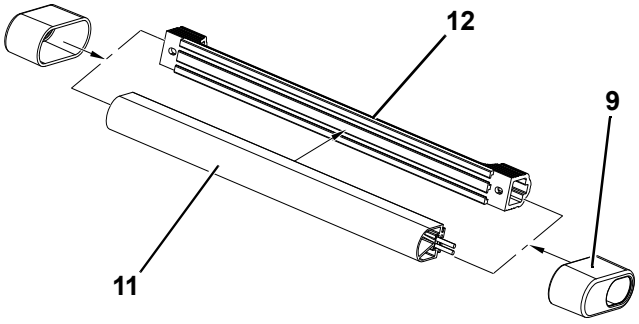


Figure 4-50.

4. Position SkyGuard switch assembly with sensor cover onto the SkyGuard Support Bracket **(8)** as shown in *Figure 4-49.*

5. Insert a Shear Block Support **(10)** through shear block housing on the SkyGuard support bracket and into the platform sensor mount. *See Figure 4-51.*

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

6. Secure the shear block on welded mount of Sky-Guard support bracket using Bolt **(1)**, relevant Washer **(6)** and Acorn Nut **(4)** as shown in *Figure 4-51.*
7. Secure the SkyGuard switch assembly using Bolt **(5)** and relevant Washer **(6)** on platform sensor mount. *See Figure 4-51.*

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

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

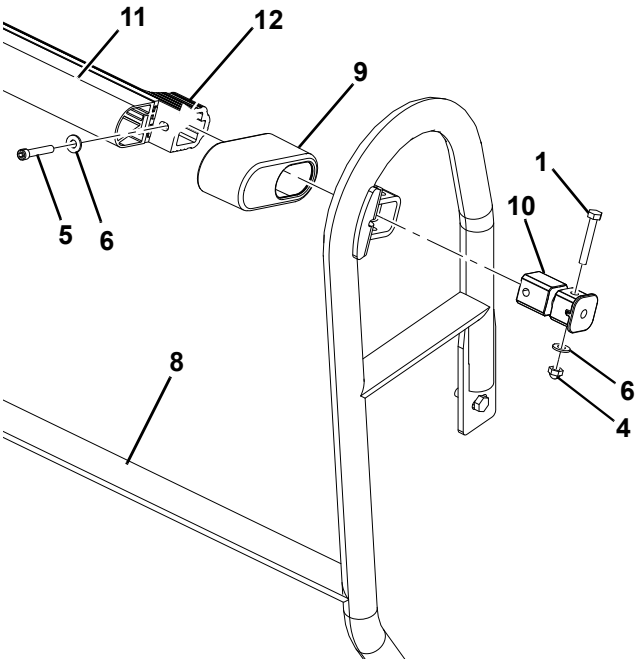


Figure 4-51.

9. Route the SkyGuard switch harness along Sky-Guard support bracket (right side) and under the platform control box. Secure the harness using tie straps. *See Figure 4-52.*

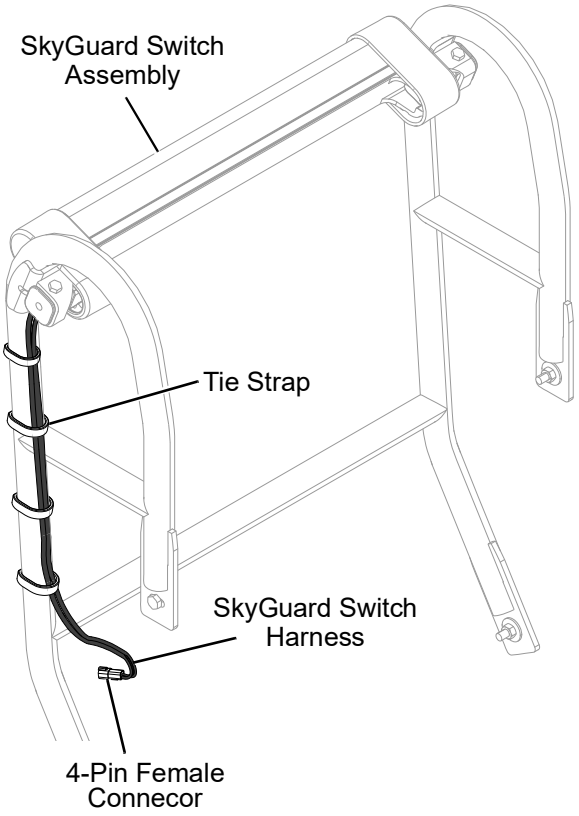


Figure 4-52.

10. Connect Sky Guard connector to the one on the machine located under load cell box. *See Figure 4-53.*

Figure 4-53.

11. Open load cell board (ECM3) box, locate connectors X604 and X603, then disconnect them. *See Figure 4-54.*

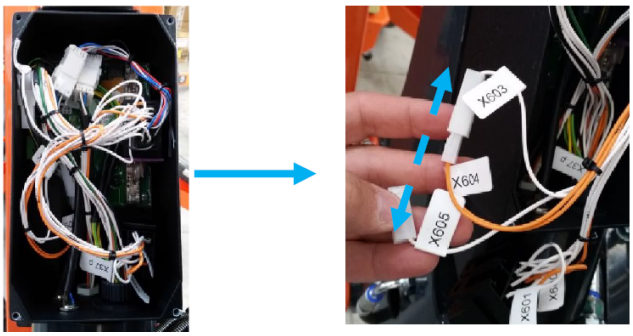


Figure 4-54.

12. Connect connector X603 to connector X605. *See Figure 4-55.*

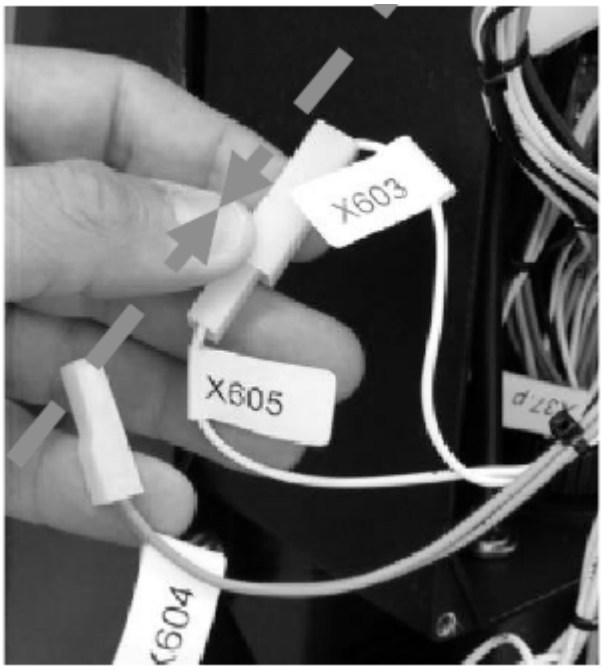


Figure 4-55.

⚠ CAUTION

WHEN THE SKYGUARD IS PUSHED WITH EXCESSIVE FORCE THE SENSOR SUPPORTS *(ITEM 10 - FIGURE 4-51.)* WILL BREAK. REPLACE WITH NEW SENSOR SUPPORTS BEFORE CONTINUING OPERATION OF THE MACHINE.

13. Reconnect the battery power to the machine.
14. Check for the proper functioning of SkyGuard system.

15. POWER ON the machine.
    - Press button 6 (service) on the remote control
    - Press button 7 (set up)
    - Press button 5 (password)
    - Enter password “4 7 7 1” then press button 9 (OK)
    - Press button 3 (extra)
    - Press button 1 (optional)
    - Press button 8 (next)
    - Press button 4 (skyguard)
    - Press Button 1 (ON)

Asterisk must show next to the ON position

Figure 4-56.

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

NOTICE

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

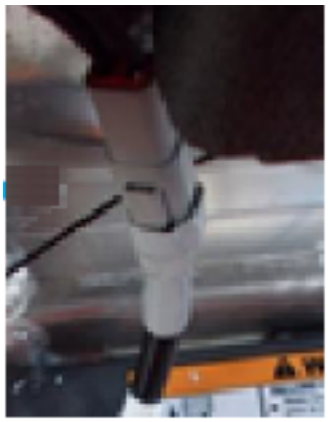


Figure 4-57.

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

Skyguard System

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

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

Figure 4-58. SkyGuard Function Table

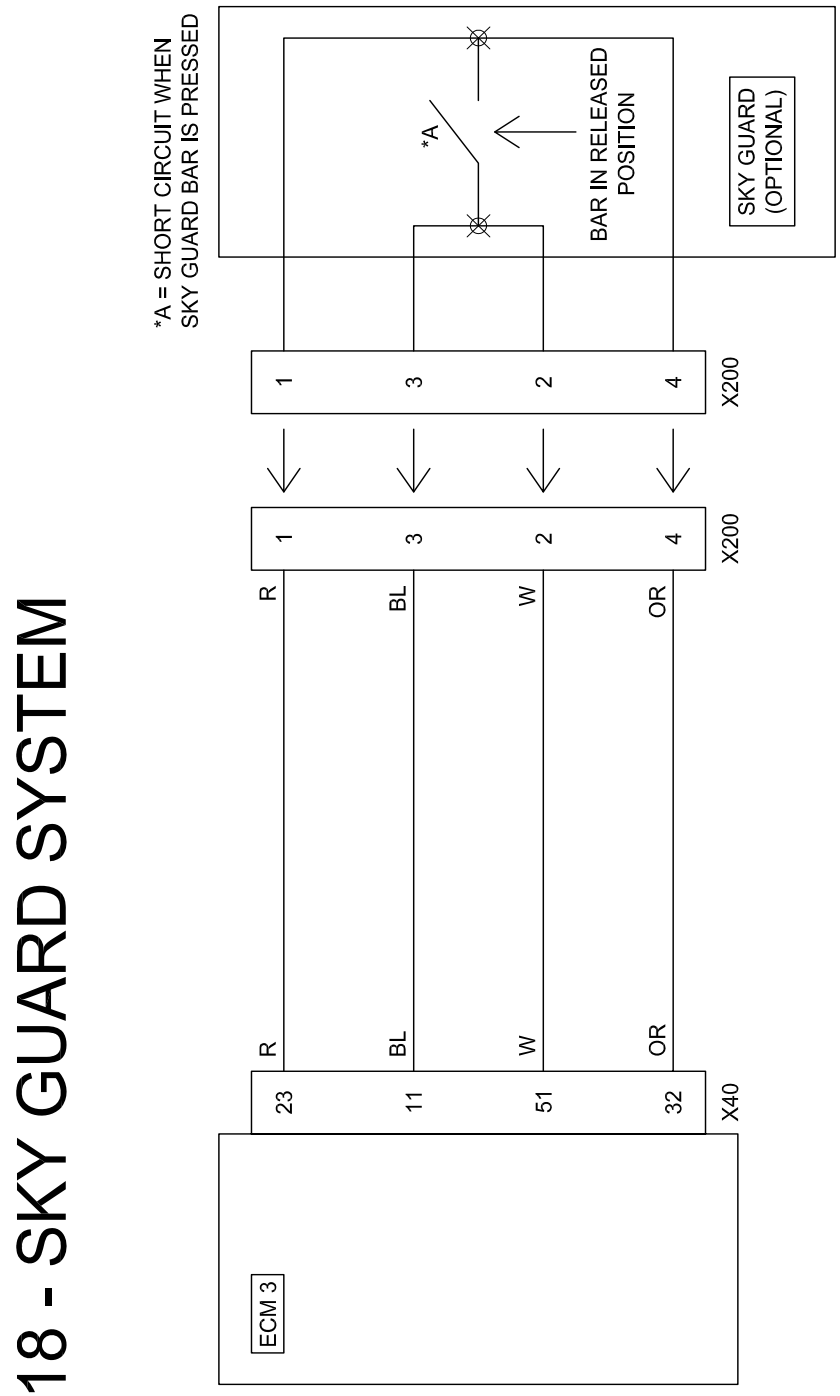


Figure 4-59. Pedal - Sky Guard System Schematic

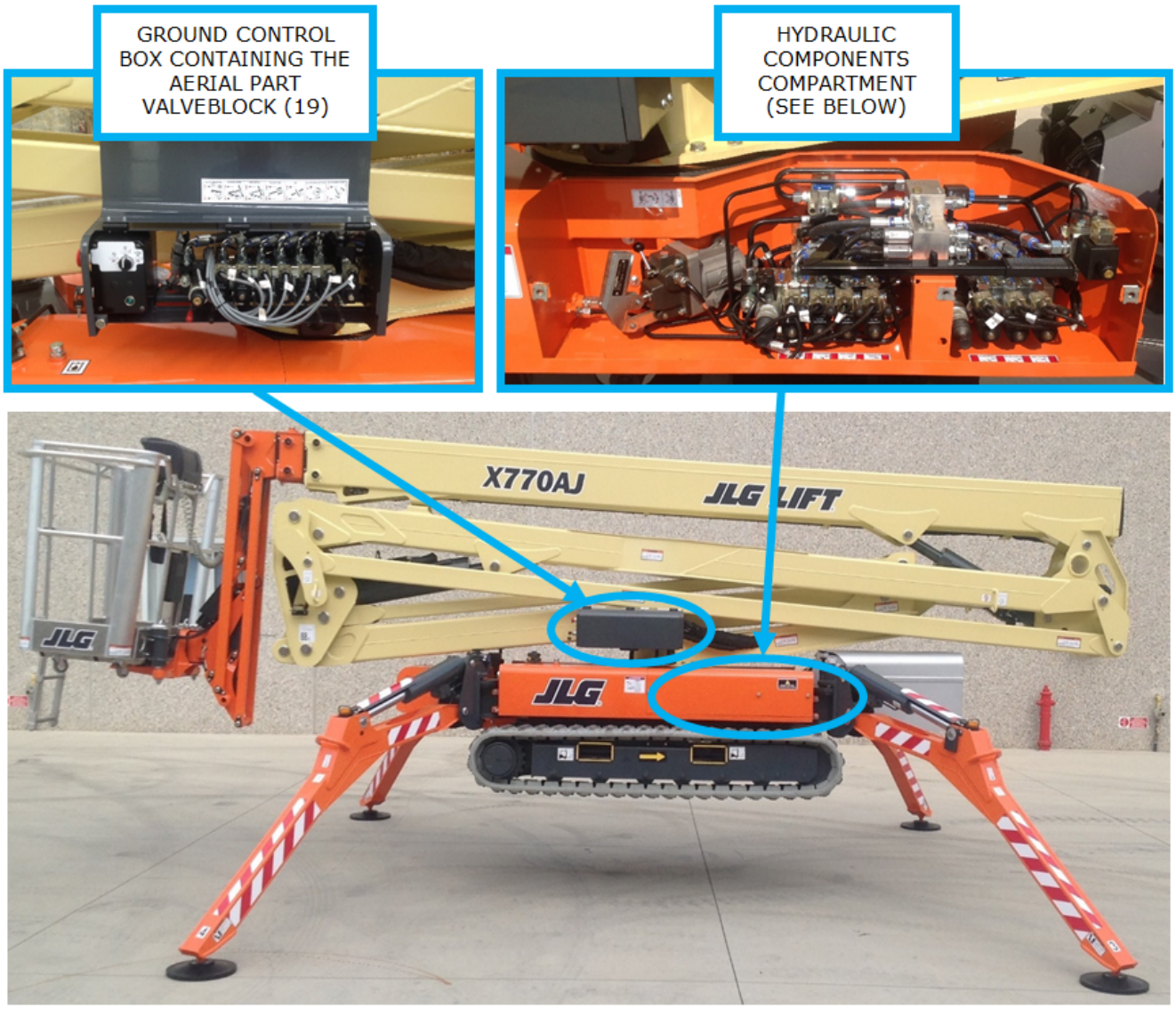
SECTION 5. HYDRAULICS

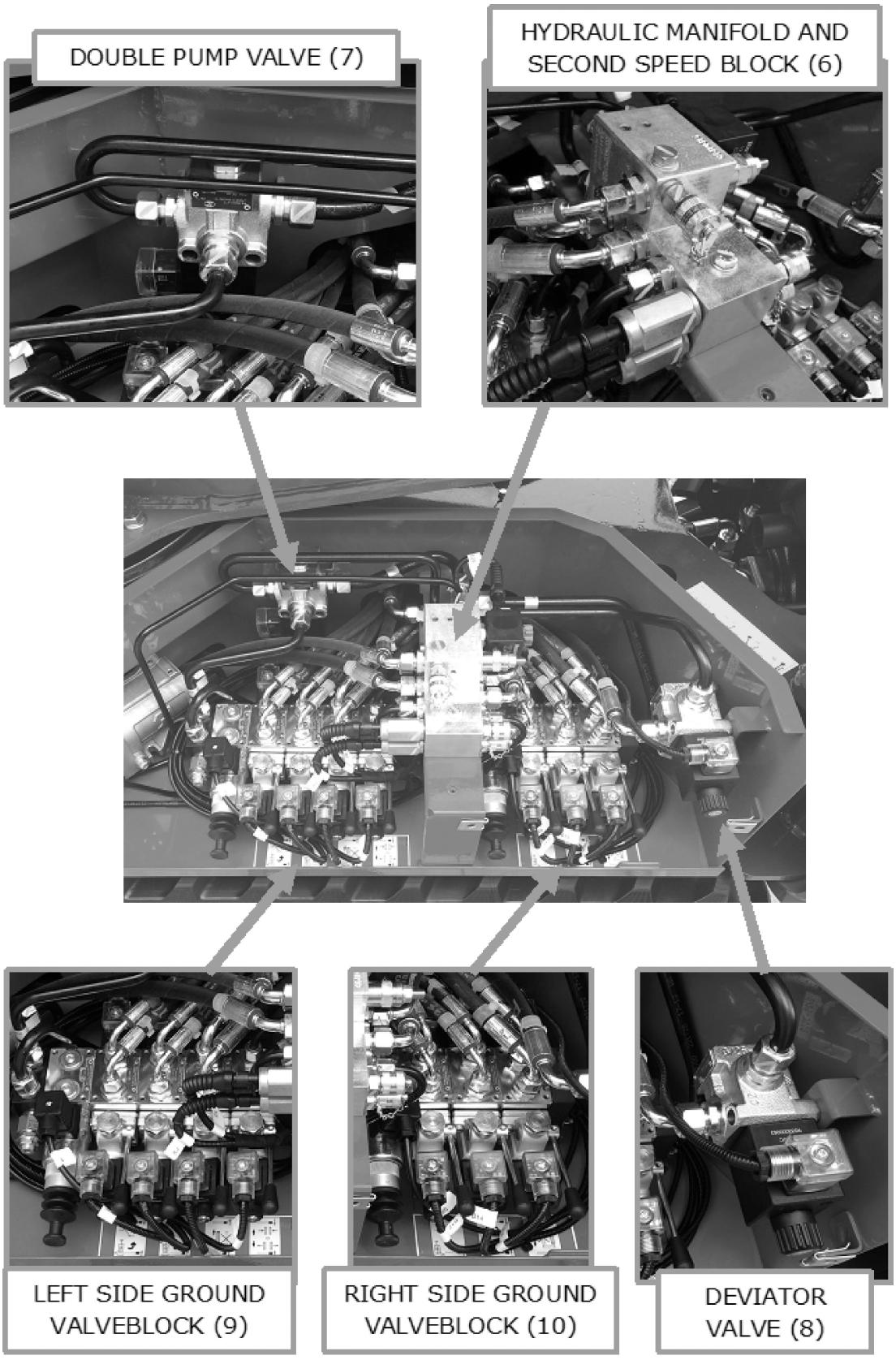
5.1 MAIN COMPONENTS IDENTIFICATION AND LOCATION

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

The hydraulic components compartment on the right side inside the bonnet contains the ground valveblocks, the hydraulic manifold, the deviator valve, the double pump valve and the hand pump.

Together with hydraulic components is indicated in brackets the relevant number on hydraulic diagram.




DOUBLE PUMP VALVE (7)
HYDRAULIC MANIFOLD AND SECOND SPEED BLOCK (6)
LEFT SIDE GROUND VALVEBLOCK (9)
RIGHT SIDE GROUND VALVEBLOCK (10)
DEVIATOR VALVE (8)

5.2 BLEEDING THE HYDRAULIC TANK

To bleed the pressure from the hydraulic tank, follow the steps below:

1. With the machine switched OFF, loosen and unscrew the pressure cap two or three full turns.

   Loosening the pressure cap by two or three turns will allow the built up pressure to dissipate from the hydraulic tank.

5.3 PRESSURIZING THE HYDRAULIC TANK

To pressurize the hydraulic tank, follow the steps below:

1. Tighten the pressure cap on the hydraulic tank.
2. Start the machine.
3. Let the machine idle for approximately 15 minutes to build sufficient hydraulic tank pressure.

5.4 HYDRAULIC SYSTEM PUMP AND PRESSURE LINES

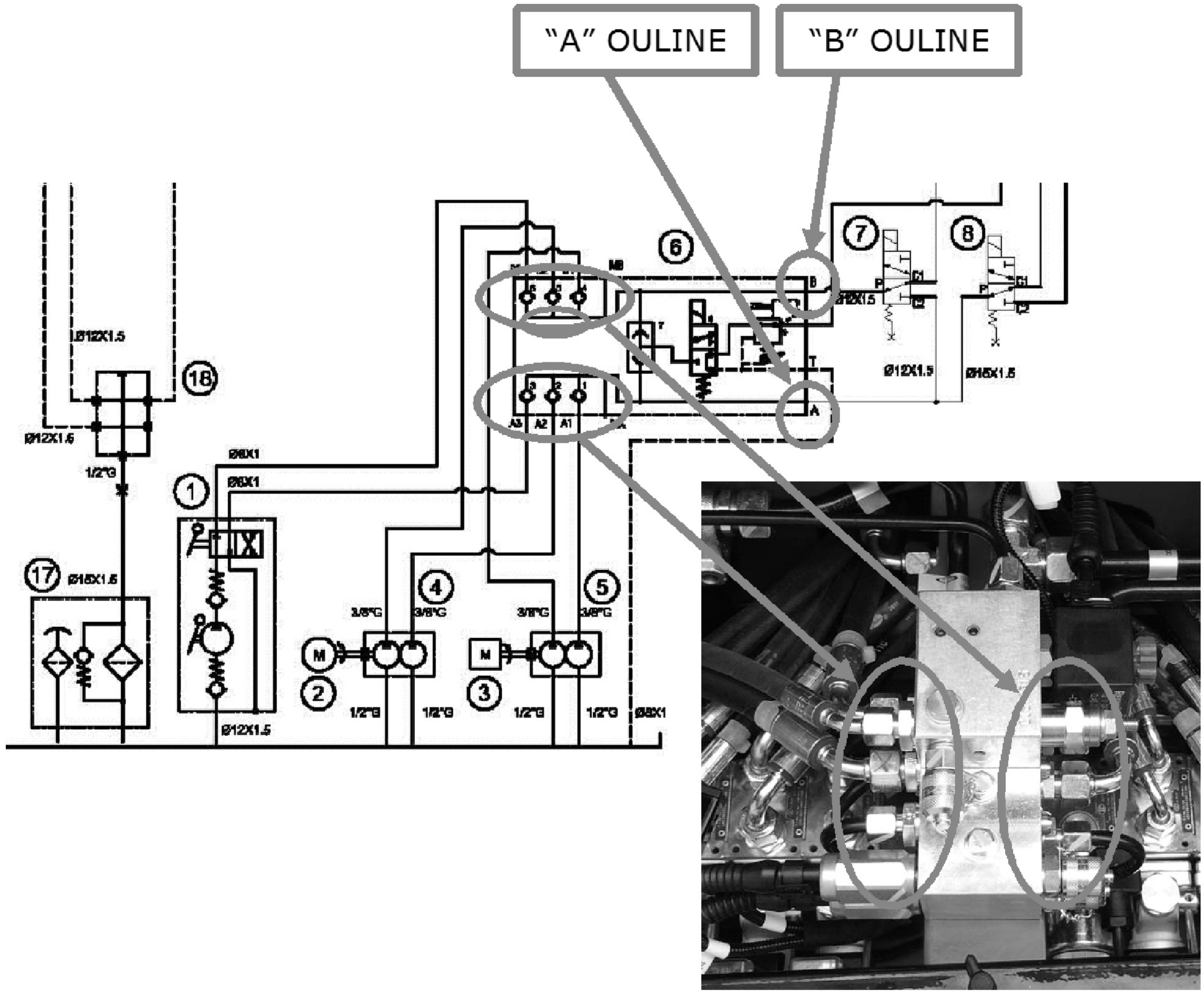
The machine hydraulic system is powered by n.3 pumps units:

- Pumps unit connected to the diesel engine, n.2 pumps 6,67cc/rev each, diesel engine is calibrated at maximum 3200 rpm
- Pumps unit connected to the electric motor, n.2 pumps 2,15 cc/rev each, electric motor is calibrated at 1500 rpm
- Emergency hand pump, this has only one outlet line but it's equipped with a deviator to select which one of the two lines should be fed

NOTE: *Lithium machine are equipped only with n.2 pumps unit, one connected to the electric motor with n.2 pumps 3,15 cc/rev each and the hand pump.*

All of the pump unit pressure lines are conveyed through the hydraulic manifold into two pressure lines A and B. Six one-way valves avoid oil under pressure to flow back to the tank through an unused pump unit.

Every time the hydraulic tank is opened (example, hydraulic oil filter replacement) it must be pressurized again to avoid cavitation.


"A" OULINE
"B" OULINE
6
7
8
18
17
1
2
3
4
5
Ø12X1.5
Ø15X1.5
Ø6X1
3/8"G
1/2"G
A3
A2
A1
A
B
T
M
P
C1
C2

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

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

Its coil is not energized (oil to the aerial part) only when machine is OFF or when machine is stabilized.

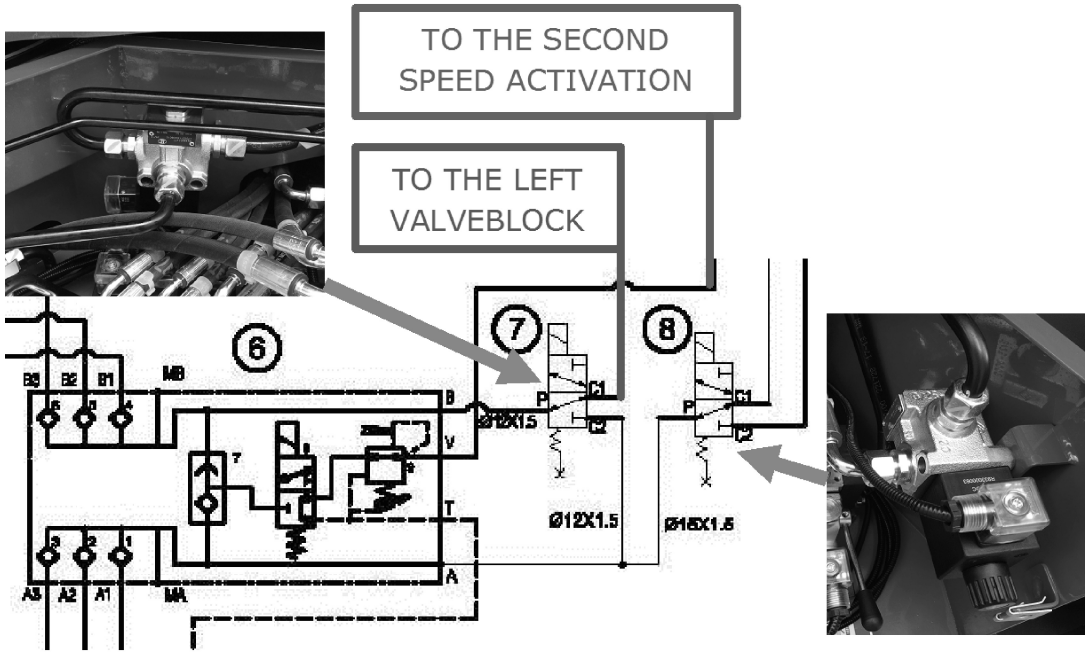
"B" pressure line sends oil under pressure to the double pump valve that normally feeds the left side ground valve-block.

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

While "N" or "RABBIT" speed are selected, when some boom manifold movement is in progress, double pump valve is fed by the control module in order to feed also with the second pump the boom manifold valve-block, increasing the movement speed even without increasing the RPM.

Which movement are speed up by this way depends on which power system is used on that moment, diesel engine, electric motor or lithium electric motor for lithium machines, they are those movements that are better performed with an higher oil rate, for instance telescope opening is always carried out with both the pumps.

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

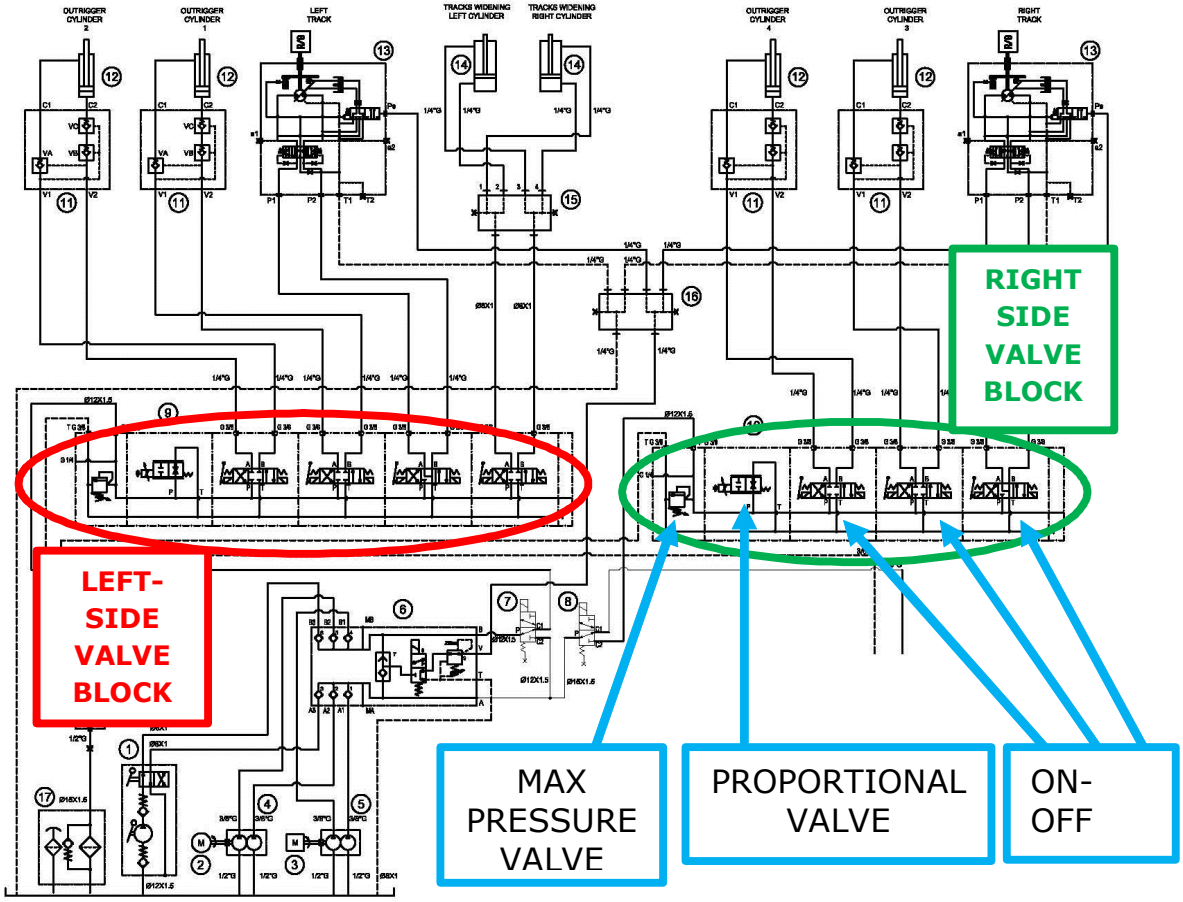


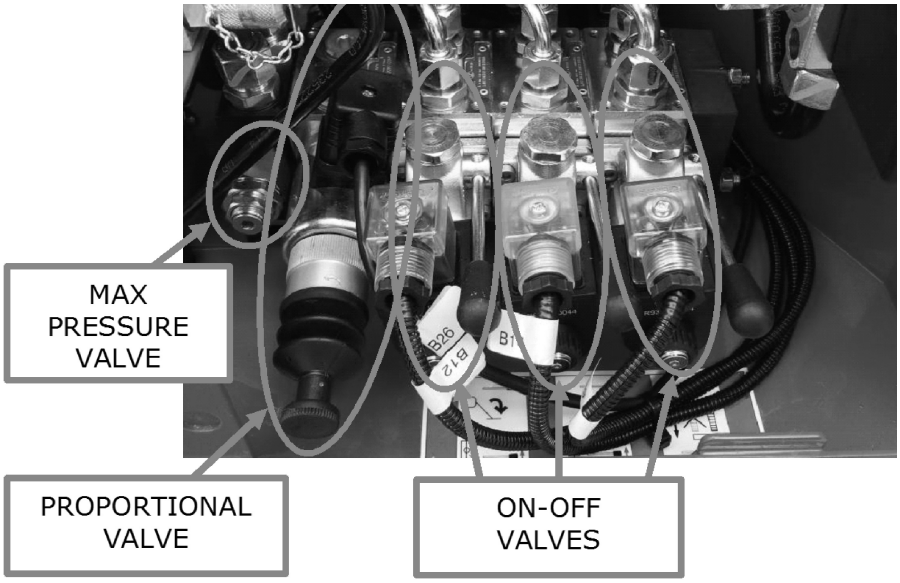
From the three valve-blocks the outgoing oil is collected by the blow-off manifold to the tank filter.

5.5 GROUND COMPONENT HYDRAULIC SYSTEM

The ground control manifold valves control, outriggers, left and right track drive, and track widening.

The ground control valves are controlled by two hydraulic valve-blocks (right side and left side), both equipped with one maximum pressure valve, one proportional valve and an ON-OFF valve for each ground control movement.





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

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

Ground manifold maximum pressure valve has to be calibrated as indicated on use and maintenance manual, at 200 bar with Diesel engine or 180 bar with electric motor (185 bar for lithium machine).

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

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

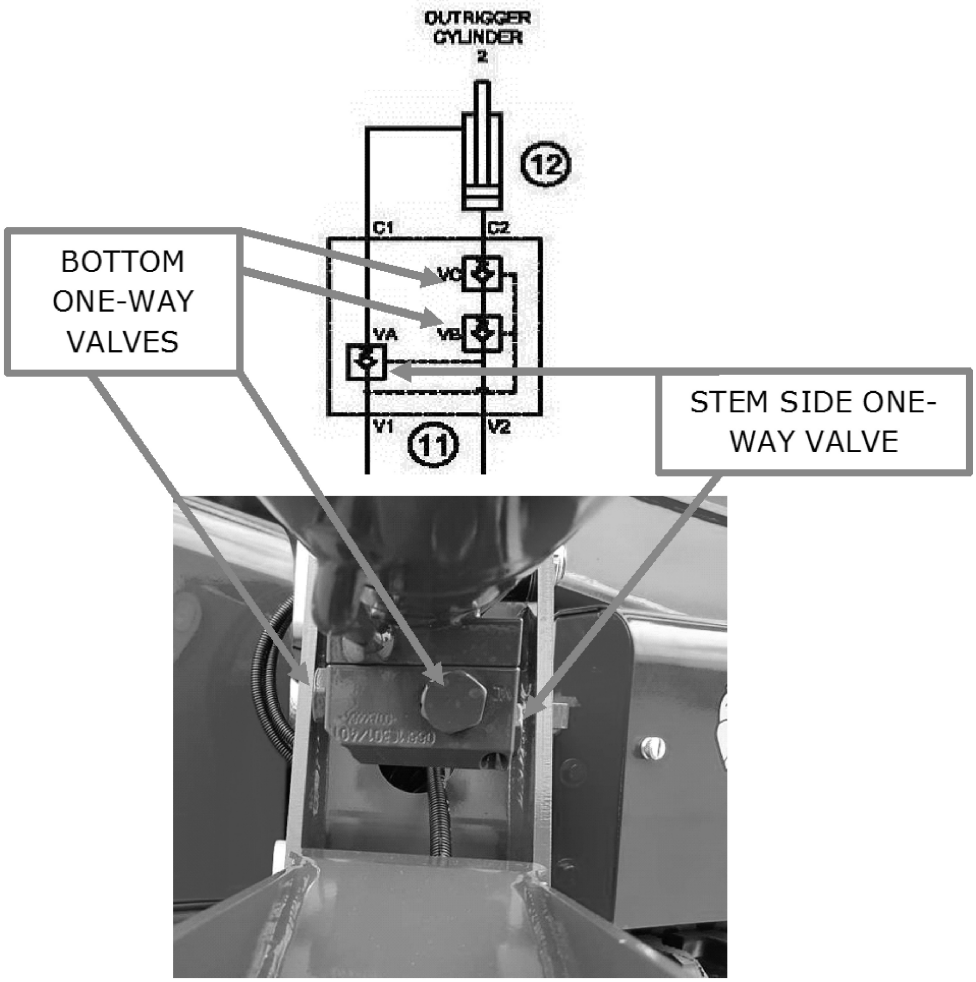
Right side ground valve-block controls the two right side outriggers (n.3 and n.4) and the right track drive gear motor.

5.6 OUTRIGGERS

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

Another piloted one-way valve is installed on the stem side.

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



5.7 DRIVE GEAR MOTORS

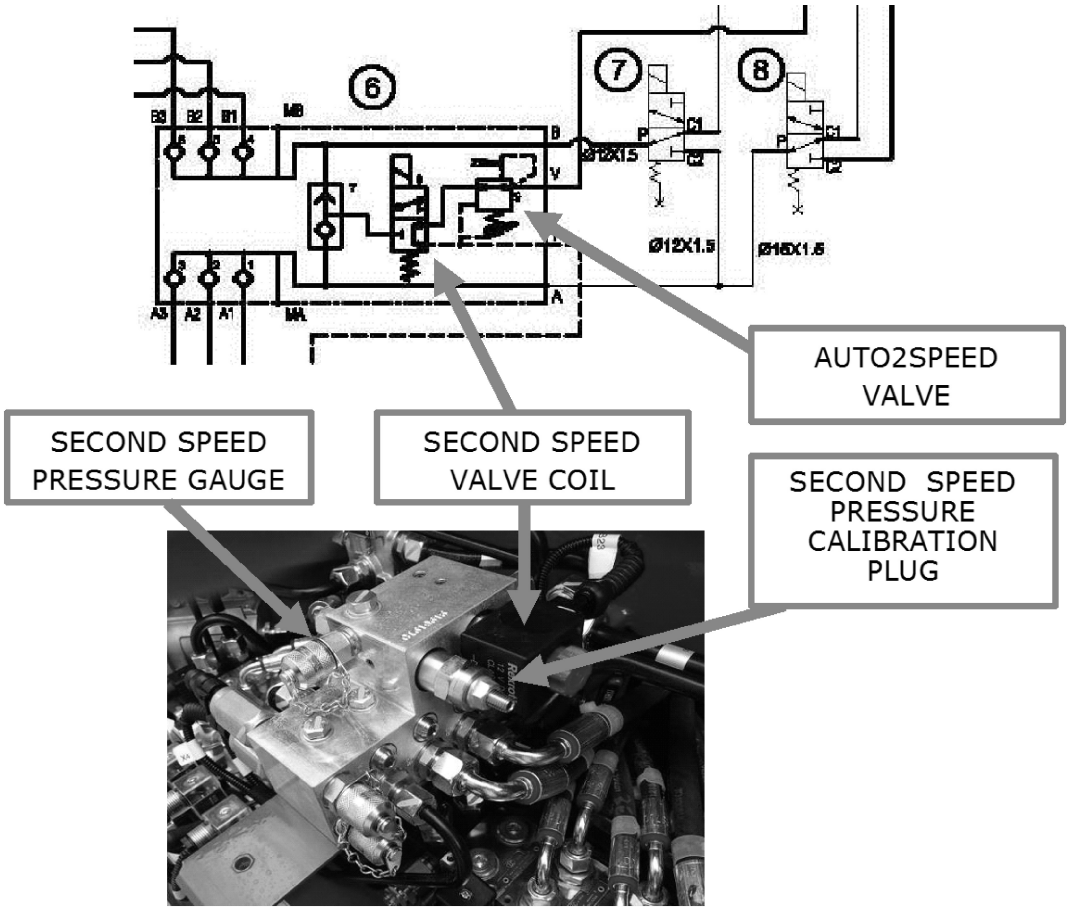
Each drive gear motors runs forward or backward independently, it's so possible to turn the machine. Drive gear motors are controlled by the ground valve-blocks and each one is equipped with an automatic brake that is hydraulically deactivated only while it runs.

Drive gear motors are equipped with a second speed system, indeed they are variable capacity so that they can perform two different hydraulic speeds in order to change tracks speeds further that rpm regulation.

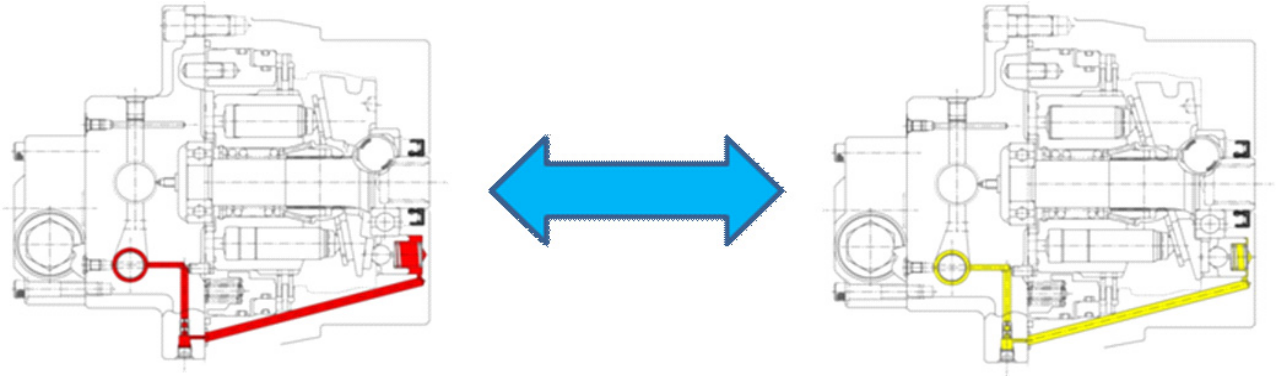
The second speed block contains the coil in charge to activate the second speed, selecting RABBIT from remote control button the control module will energize that coil.

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

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



This second speed system is also controlled by an auto2speed valve, in case of an higher torque is required to the drive gear motors, such as driving uphill, the second speed line pressure will raise and if it overcomes the calibrated maximum pressure (26 bar) it will automatically open the auto2speed valve reducing the gear rate and the tracks speed.



SMALLER CHAMBER:

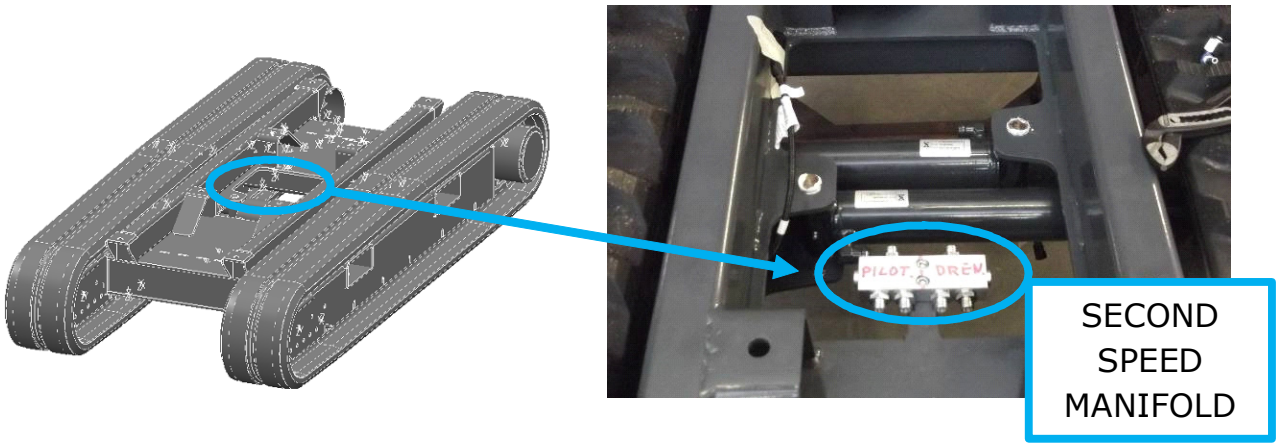
- FASTER SPEED
- SMALLER TORQUE

BIGGER CHAMBER:

- SLOWER SPEED
- HIGHER TORQUE

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

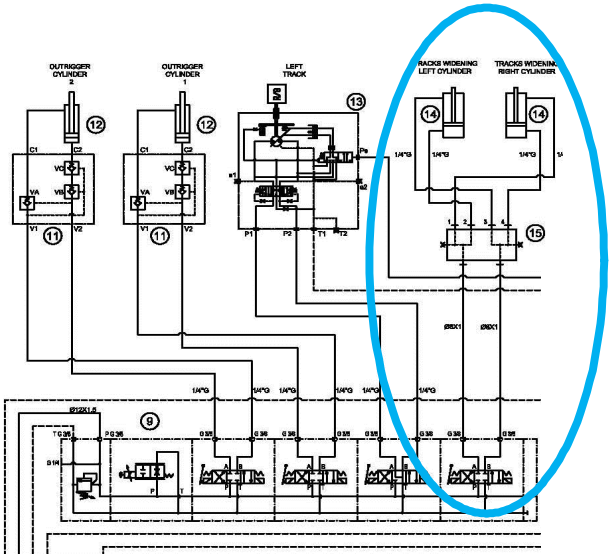
Second speed activation oil, coming from second speed valve coil, is sent to both drive gear motors through the second speed manifold.



SECOND SPEED MANIFOLD

5.8 TRACKS WIDENING

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

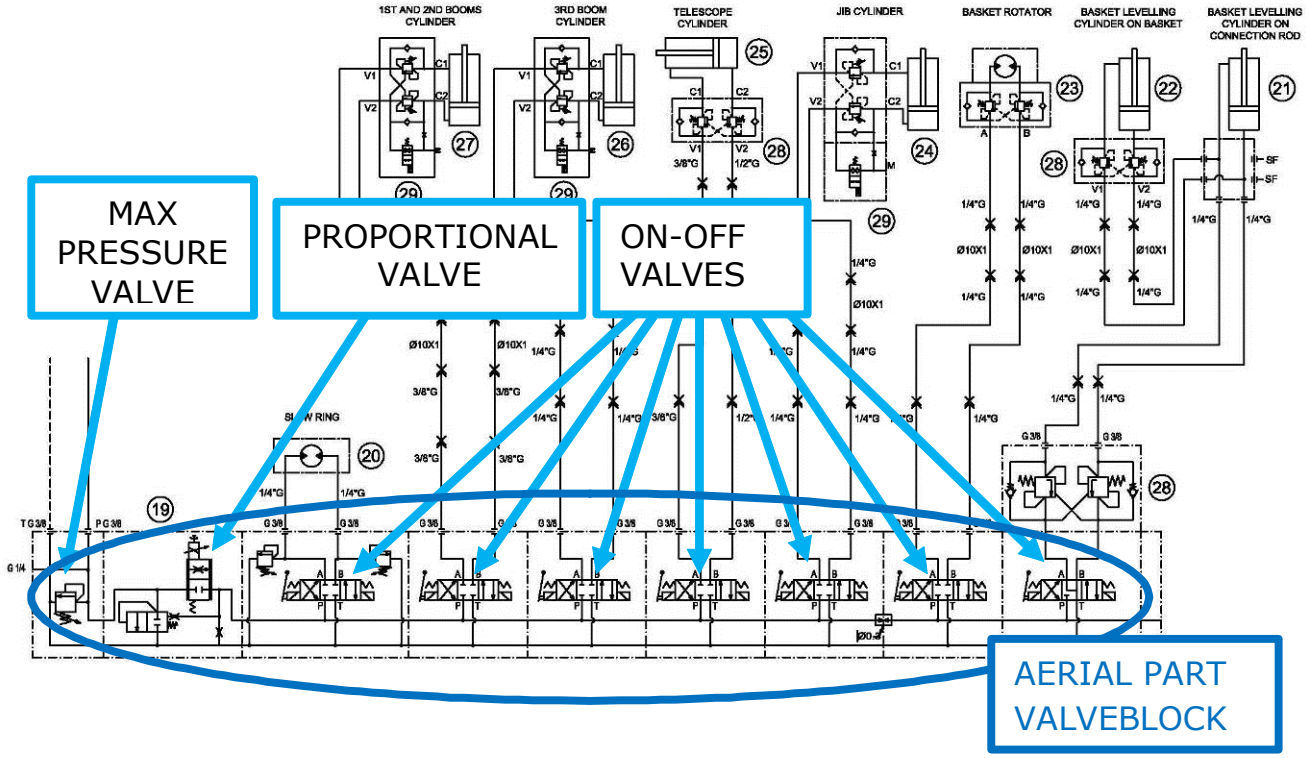


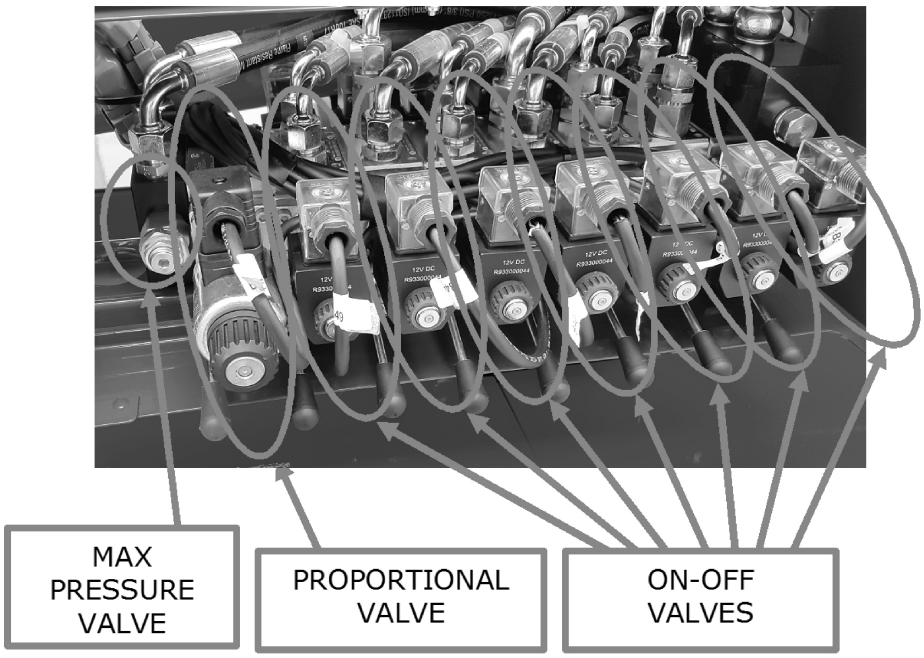
Track widening system oil is sent to both cylinders through the track widening manifold that is installed on hydraulic components compartment just below the hydraulic manifold close to blow-off manifold.

5.9 BOOM COMPONENT HYDRAULIC SYSTEM

The boom components controlled by the boom control manifold valve are, 1st/2nd boom cylinder, 3rd boom cylinder, telescope cylinder, jib cylinder, platform rotator, and platform leveling cylinders.

The boom components are controlled by an hydraulic manifold valve equipped with one maximum pressure valve, one proportional valve and an ON-OFF valve for each aerial part movement.





Boom component manifold valves are fed by pressure line "A" through deviator valve and oil rate is controlled through the proportional valve managed by the control module.

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

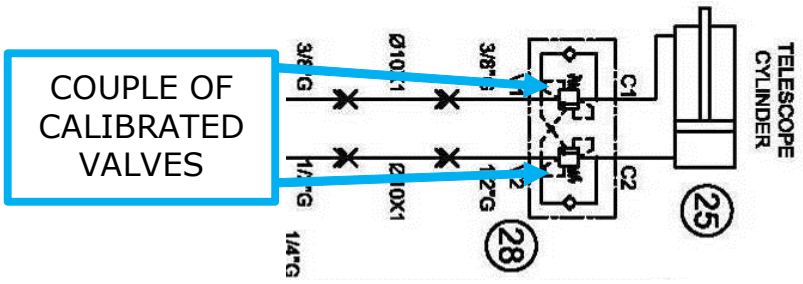
When the proportional valve coil is not fed, oil is sent to the drainage and then to the tank.

The maximum pressure valve has to be calibrated as indicated on use and maintenance manual at 200 bar with Diesel engine or 180 bar with electric motor (185 bar for lithium machine).

Through boom component manifold valves feed the turret rotation motor, the cylinder for moving 1st and 2nd booms, the cylinder for moving the 3rd boom, the telescope cylinder, the jib cylinder, the basket rotation actuator and the basket levelling circuit.

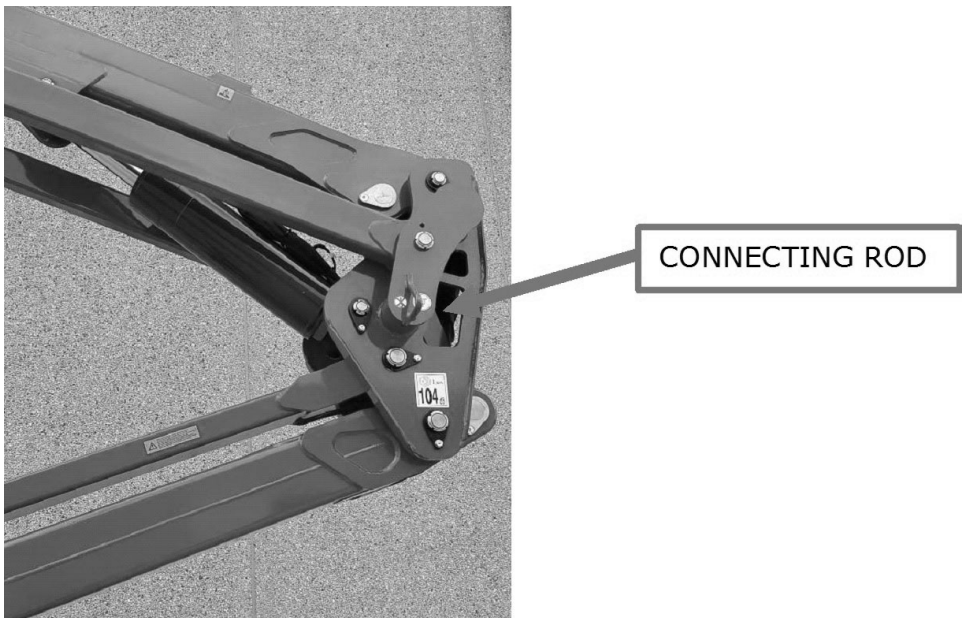
On each cylinder an actuator is installed a couple of calibrated valves, one each direction, when movement is in progress on one direction the opposite valve is piloted to open letting oil flow back to the manifold valve block.

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



First And Second Booms

1st and 2nd booms are moved together by one cylinder through the connection rod designed to obtain a double parallelogram system, this cylinder is equipped with an internal sensor that measures its opening position.



Third Boom

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

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

Telescope

Telescope system is composed by three parts, the third boom that contains a first telescope and a second telescope, they are all opened or closed together by an unique internal cylinder and a system of ropes and pulleys.

A microswitch is in charge to detect an eventual anomalies about the ropes positions.

More details about ropes system and their maintenance are indicate on use and maintenance manual.

Jib

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

Basket Leveling

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

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

Of course is possible to adjust basket leveling acting on its joystick.

Basket Rotation

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

Two black arrows show the basket aligned position.

Turret Rotation

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

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

Emergency Gravity Descent System

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

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

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

Hydraulic System Sections

The hoses that start from the boom component manifold valves and go through the booms are sectionized with fittings inside the second boom where is indicated by the blue arrow here below.

Other sectioning points are on the catenary, at the beginning and at the end of the rigid pipes and are attached to the hoses coming from the lower booms and the hoses going to the jib arm.

5.10 CYLINDER REPAIR

Specification - Cylinders Overview

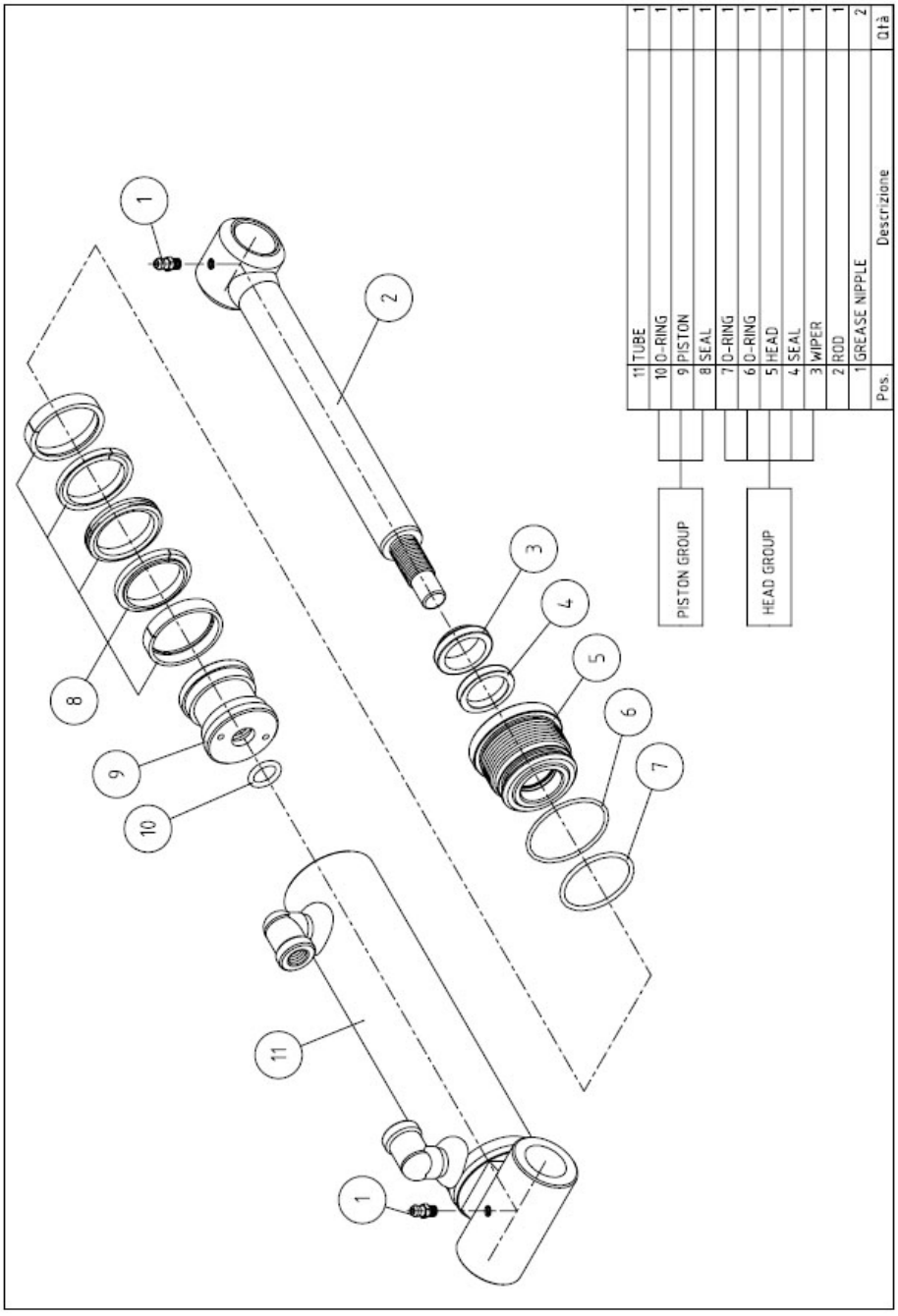


Figure 5-1. Piston Thread

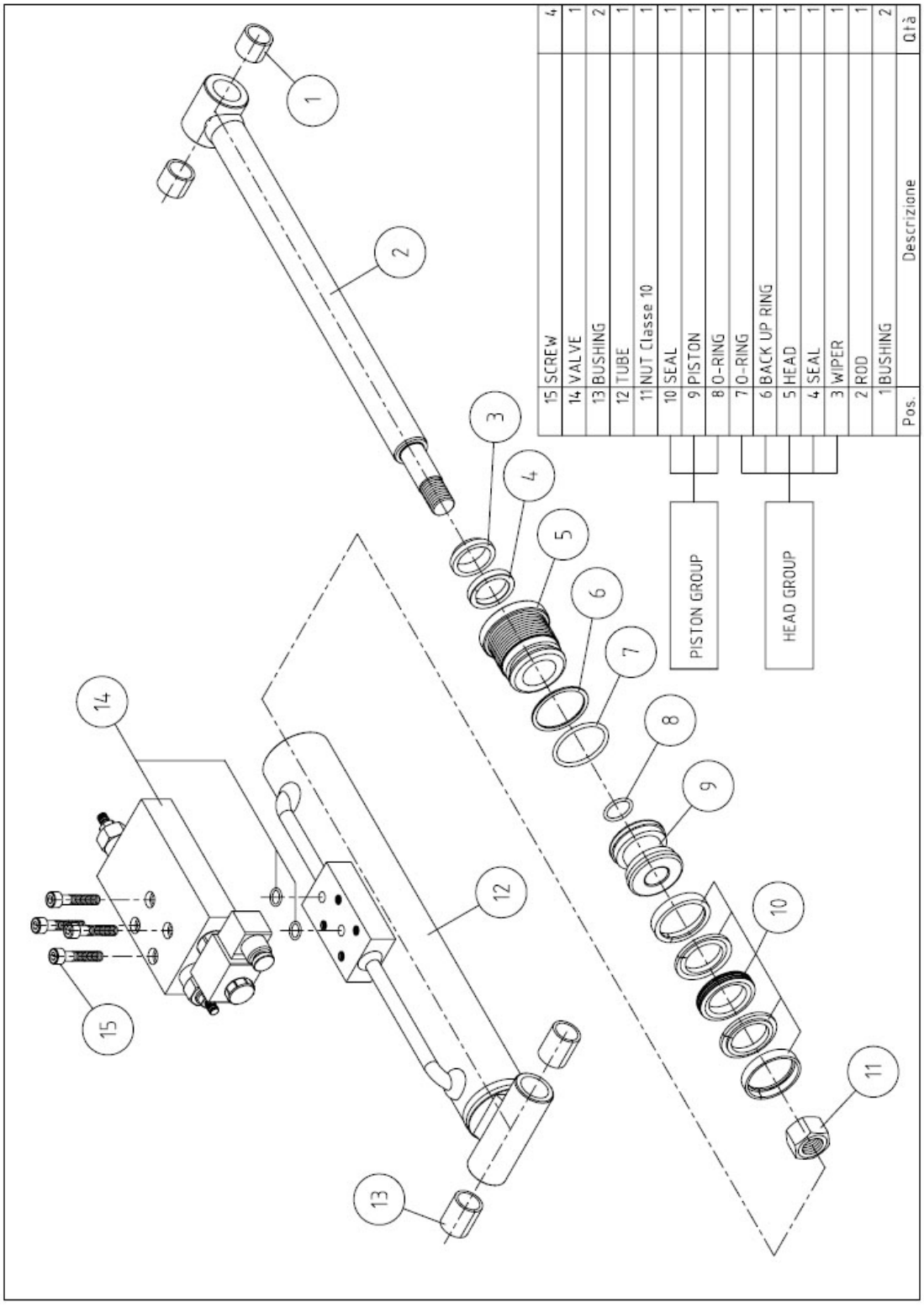


Figure 5-2. Piston With Nut Thread

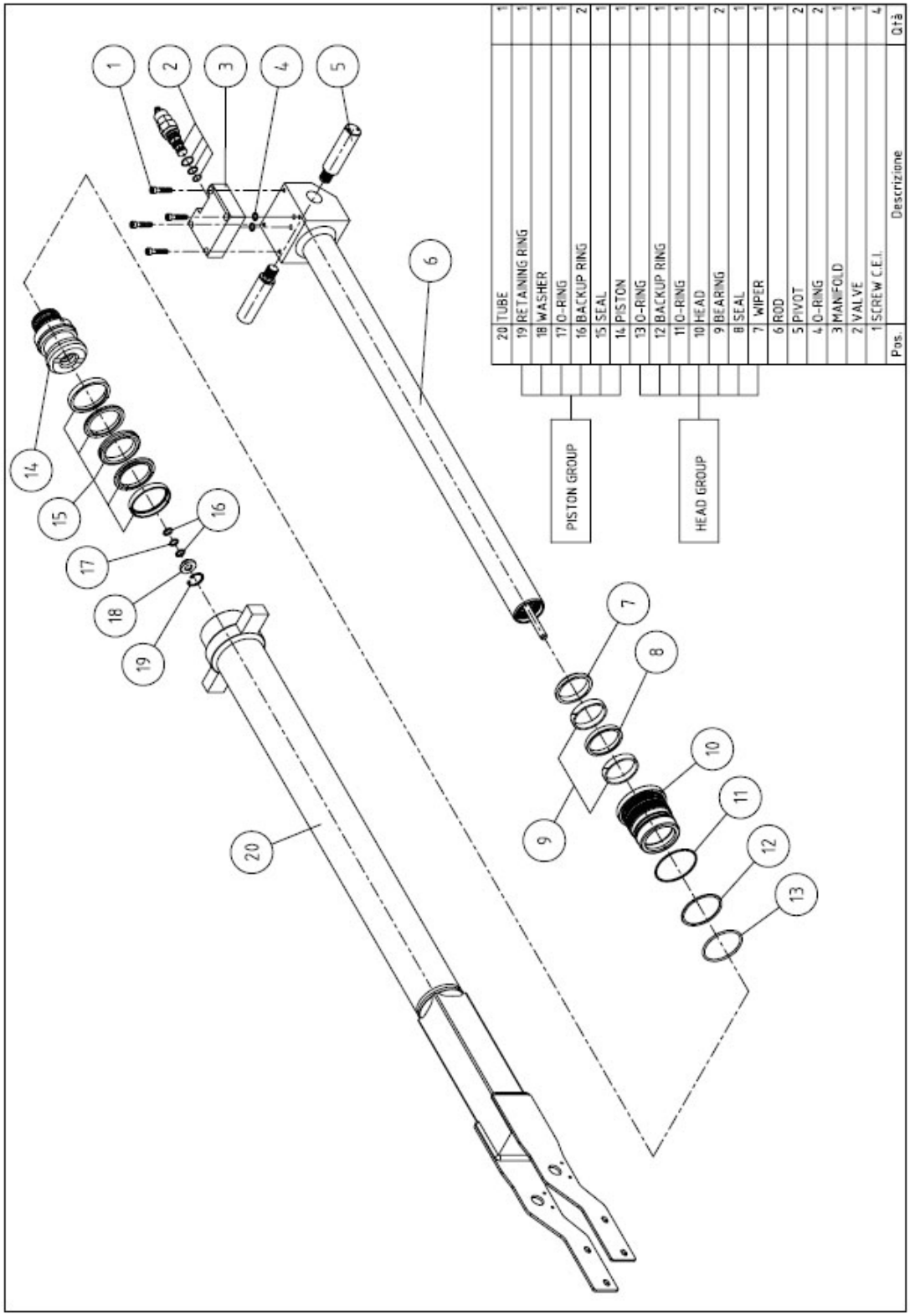


Figure 5-3. Telescope Cylinder

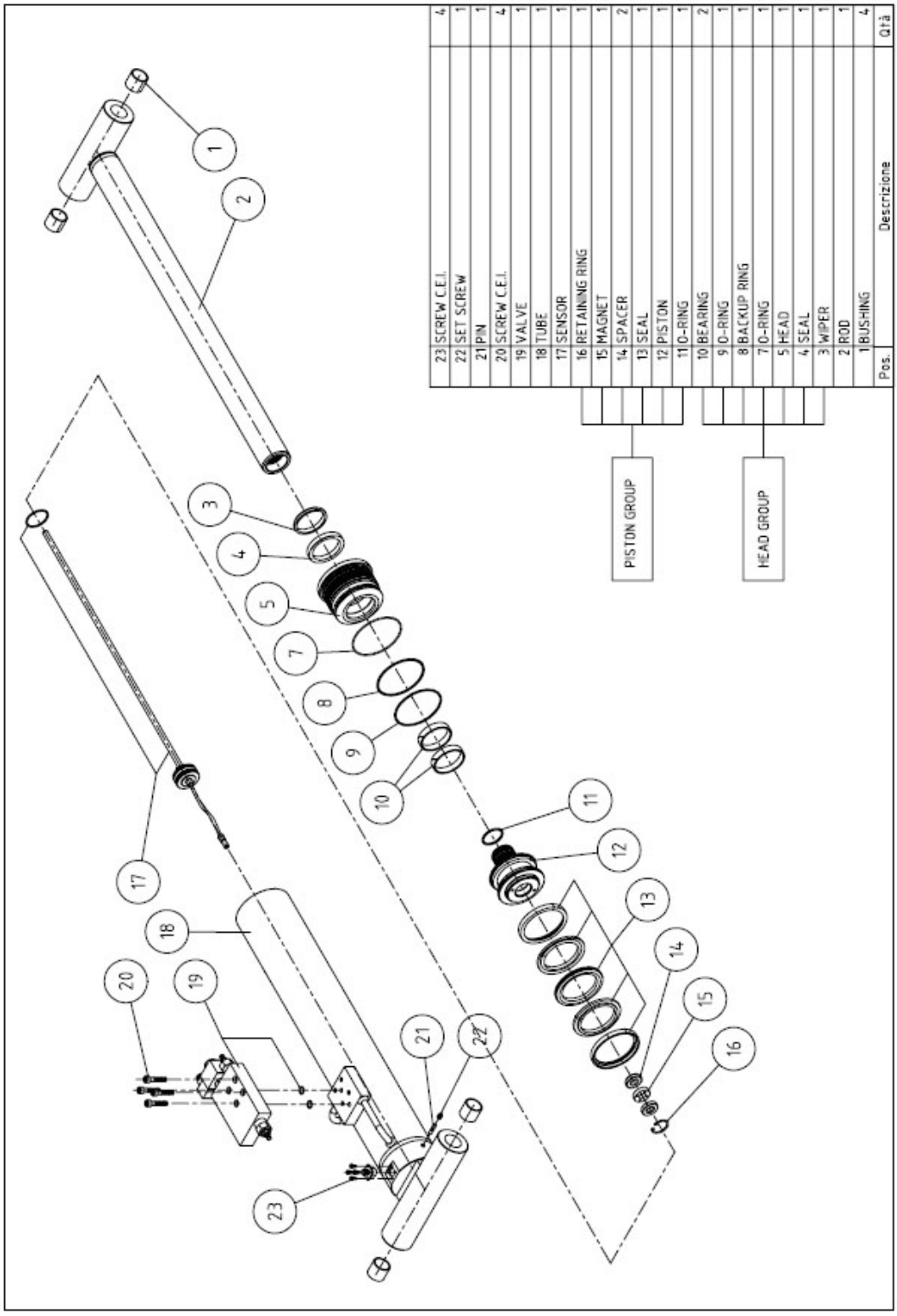


Figure 5-4. Cylinder With Sensor

Hydraulic Cylinders Torque Specifications

Screws Torque Specifications

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

Hose Connections Torque Specifications

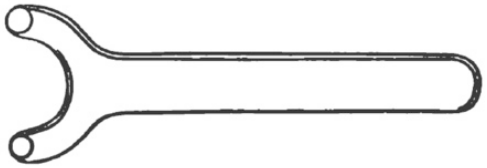
JUNCTION		
Ø HOSE	METRIC THREAD	TORQUE VALUE (N/m)
6	M12x1.5	20
8	M14x1.5	25
10	M16x1.5	30
12	M18x1.5	40
15	M22x1.5	60
18	M26x1.5	90
22	M30x2	170
28	M36x2	210
35	M45x2	360
42	M52x2	490

Cylinders Head Torque Specification

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

Equipment And Product List

- Spanner Wrench



NOTE: *The following are general procedures that apply to all of the cylinders with sensor. Procedures that apply to a specific cylinder will be so noted.*

Cylinder With Sensor - General Cylinder Disassembly

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

NOTICE

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

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

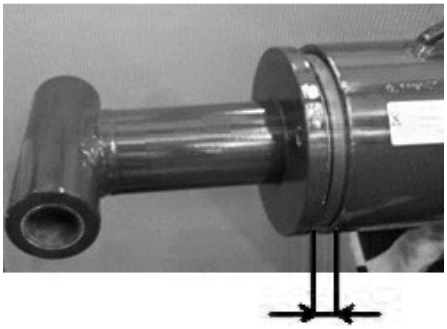
NOTICE

CYLINDER ARE UNDER PRESSURE.

NOTICE

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

4. Partially extend the rod ~ 15mm and unscrew the head about ~ 15mm.

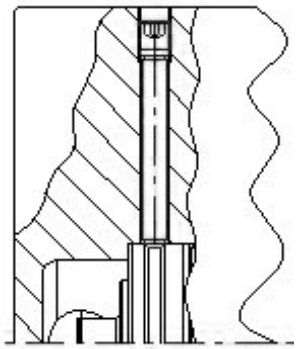


5. Remove 4 screws of the sensor

6. Unhook the connector from the base making pressure on 2 wing signed in the picture.

7. Push the connector inside the hole and fix the plate again.

8. Unscrew the setscrew and remove the pin. Use a magnet to pull out the pin.

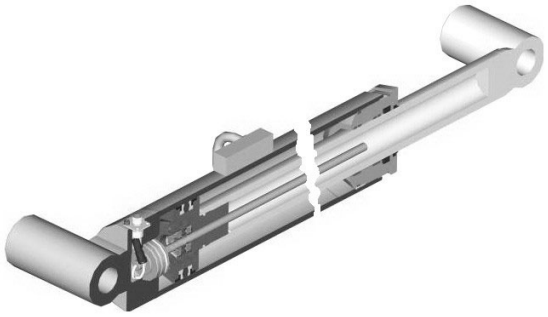


9. Secure the setscrew in order to keep the air pressure.

10. Blow pressurized air with caution on the connection in order to push the sensor out of the hosing.

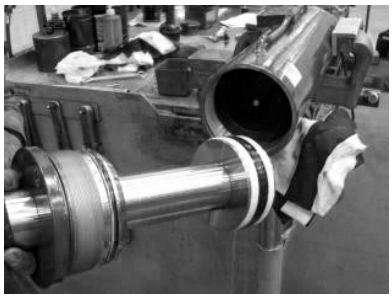
NOTICE

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



NOTICE

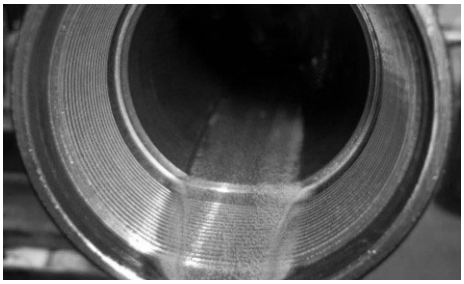
BE CAREFUL IN THIS OPERATION IN ORDER TO AVOID TO BREAK THE WIRE OR DAMAGE THE SENSOR.



Cleanness And Inspection

Cylinder Cleaning Instructions

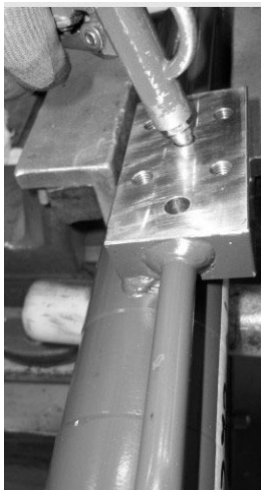
1. Discard all seals, back-up rings and o-rings. Replace with new items from complete seal kits to help ensure proper cylinder function.



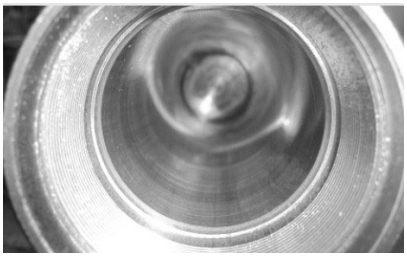
2. Clean all metal parts with an approved cleaning solvent such as trichlorethylene. Carefully clean cavities, grooves, threads, etc.

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

3. Blow pressurized air on the connection of the manifold for cleaning.

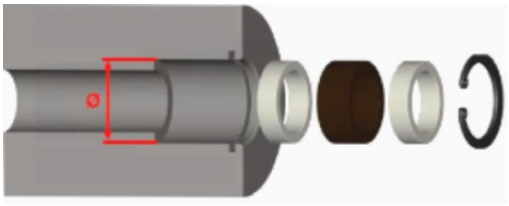


4. Verify the integrity of the tube checking that the surface doesn't present scratches.

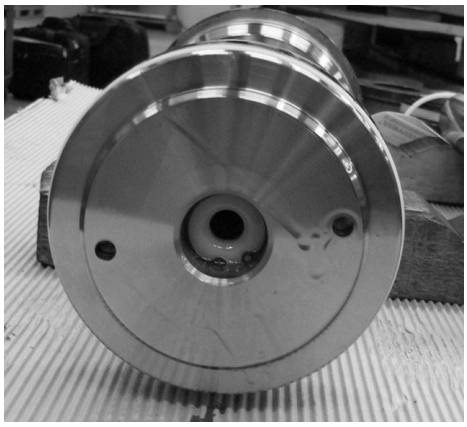


Magnetic Sensor Removal

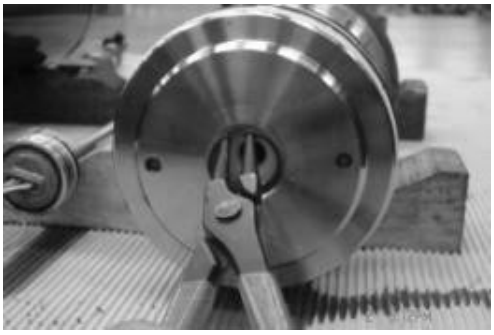
1. Pull out retain clip with pliers.



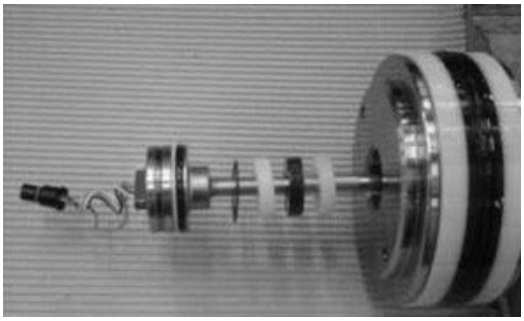
2. Pull out the spacer.



3. Pull out the magnet.



4. Pull out the other spacer.



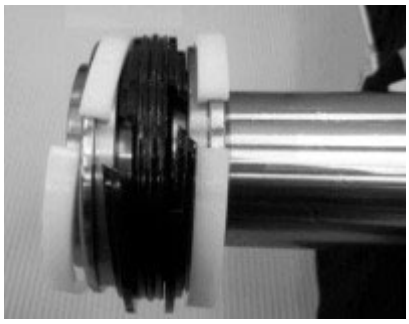
Threaded Piston Disassembly

NOTICE

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

Fix the rod into the vice.

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



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

⚠ CAUTION

WARM THE SURFACE INDICATED MAX 572°F (300°C).

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

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

General Cylinder Assembly

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

Seals Head Replacing

Remove all seals, back-up rings and o-rings from the piston head and all seals, back-up rings and orings.

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

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

Cylinder Mounting

Cylinder Inspection

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

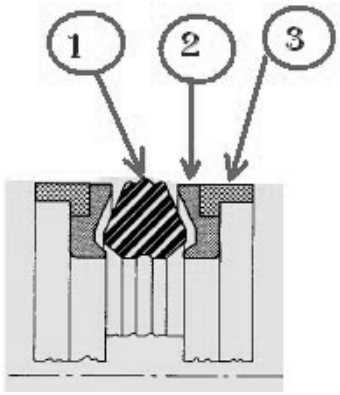
8. Replace the seals on the piston. **DO NOT** attempt to salvage cylinder seals, sealing rings or o-rings. ALWAYS use a new, complete seal kit when rebuilding hydraulic components. Consult the parts manual for ordering information.

Mount the seals in the following order:

9. Seal

10. Support bearing

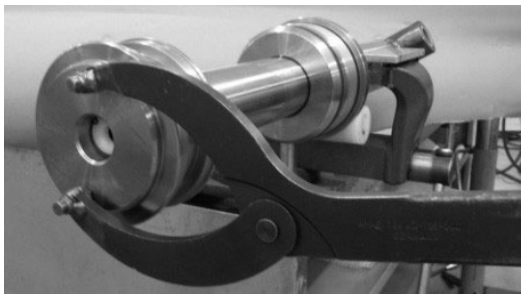
11. Bearing



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

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

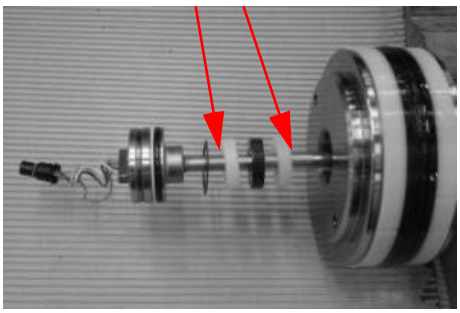
Refer to "Hydraulic Cylinder Torque Specifications," for tightening guidelines for the piston.



Sensor Assembling

Spacer has chamfer.

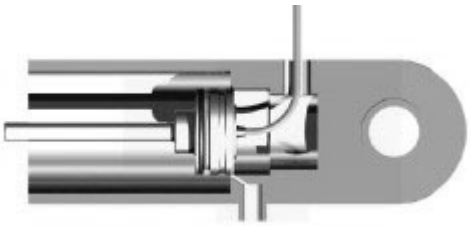
12. Mount spacer with chamfer face outside.



13. Lubricate the o-ring

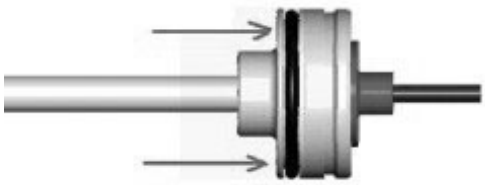
14. Joint the sensor pin with a guidance cable.

15. Insert sensor with a cable pass



16. Use plastic tool to insert the sensor

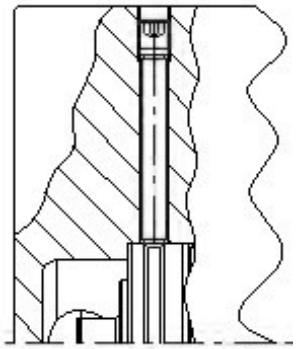
17. Push the tool carefully



18. Remove the set screw, insert the pin and than fix the set screw.

Pay attention do not overtighten the set screw because the sensor could be damaged.

Tightening torque 5 Nm seal with AREXON 35A77.



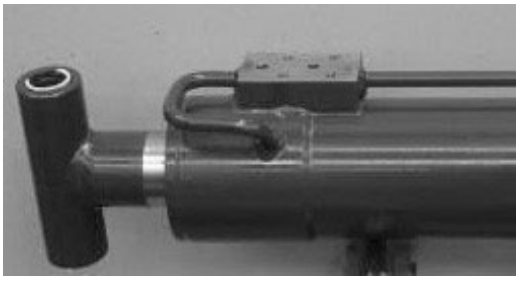
Cylinder Assembling

Pay attention to not damage the sensor

NOTICE

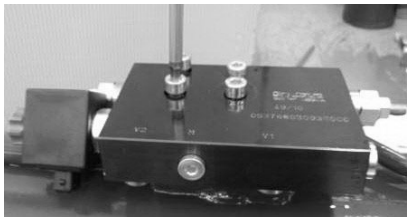
WHEN SLIDING THE ROD AND PISTON ASSEMBLY OUT OF THE TUBE, PREVENT THE THREADED END OF THE TUBE FROM DAMAGING THE PISTON. KEEP THE ROD CENTERED WITHIN THE *TUBE TO HELP PREVENT BINDING.*

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



2. Thread the counterbalance valve into the block on the cylinder barrel.

   Refer to Section 3.2 "Hydraulic Cylinder Torque Specifications".



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

Cylinder Repair Without Sensor

Rod Removal

General Cylinder Disassembly

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

NOTICE

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

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

NOTICE

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

NOTE: *Cylinder can have residual pressure inside.*

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

NOTICE

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

Piston With Nut Disassembling

NOTICE

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

1. Fix the rod into the vice.

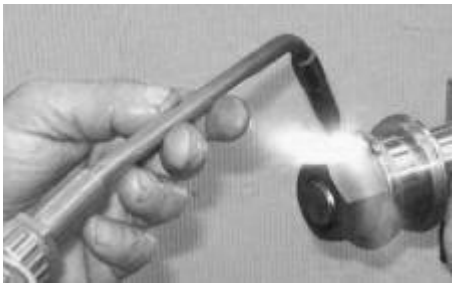
NOTE: *Before attempting to disassemble the piston remove any accessible seals.*

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

⚠ CAUTION

WARM THE SURFACE INDICATED MAX 572°F (300°C).

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



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

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

Cylinder Assembly

General Cylinder Assembly

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

Seals Head Replacing

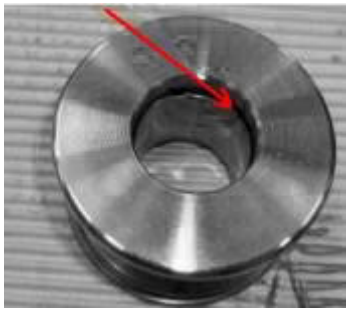
1. Remove all seals, back-up rings and o-rings from the piston head and all seals, back-up rings and orings

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

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

Cylinder Inspection

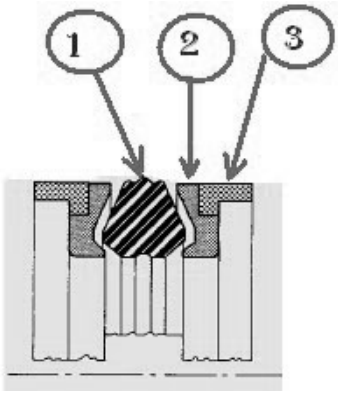
1. Inspect internal surfaces and all parts for wear, damage, etc. If the inner surface of the tube does not display a smooth finish, or is scored or damaged in any way, replace the tube.
2. Remove light scratches on the piston, rod or inner surface of the tube with a 400-600 grit emery cloth. Use the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



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

Mount the seals in the following order:

4. Seal
5. Support bearing
6. Bearing



NOTICE

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

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

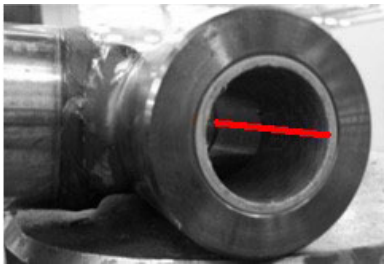
7. Install the piston on to the end of the cylinder rod. Loctite® 270TM.

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

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

Bushing Replacement

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



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

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

Cylinders Bleeding

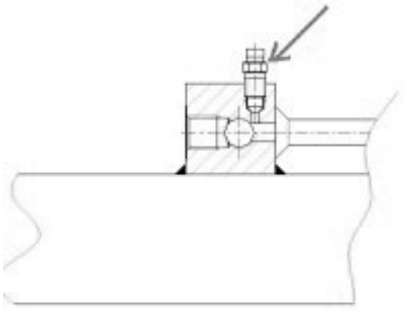
Vent Valve

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

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

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

Bleeder screw



⚠ CAUTION

LOOSEN BLEEDER SCREW TO LET AIR ESCAPE RE-TIGHTENING TORQUE 6 FT. LB. (8 Nm).

5.11 REPLACEMENT HYDRAULIC PUMP

Pump removal

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

Pump installation

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

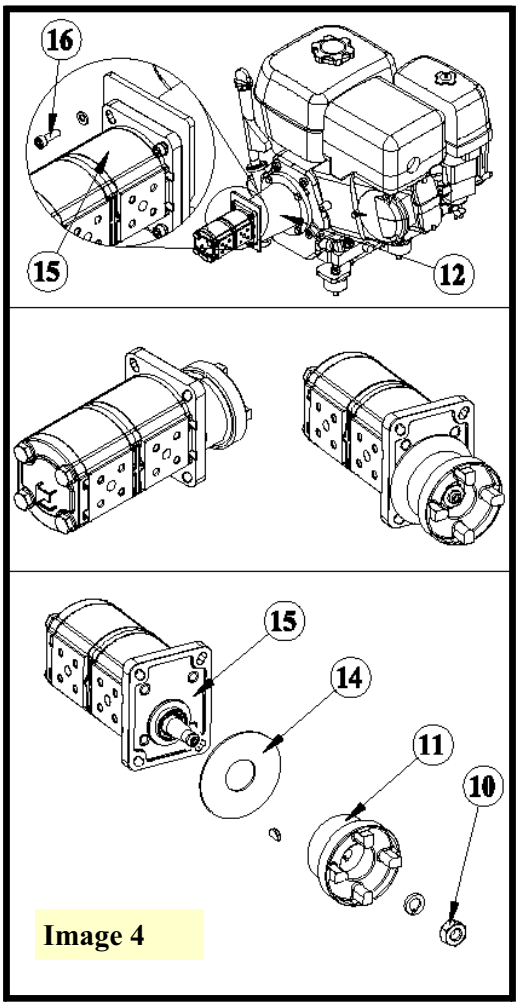
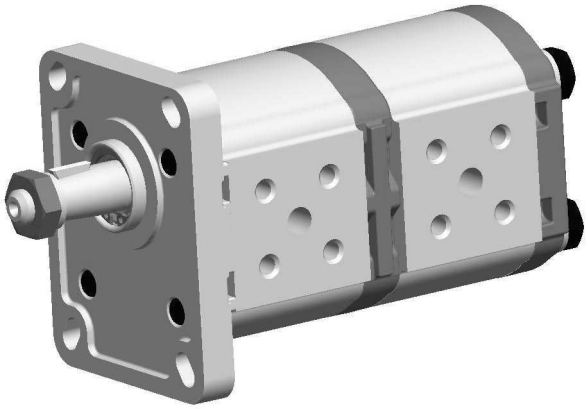


Image 4

5.12 HYDRAULIC PUMP REPAIR

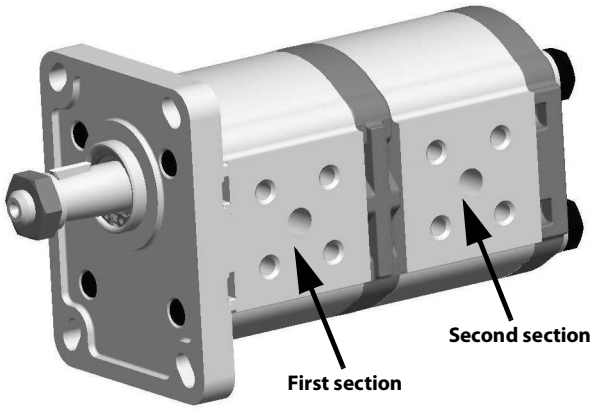
Seal Kit Replacement Instruction



General Suggestions

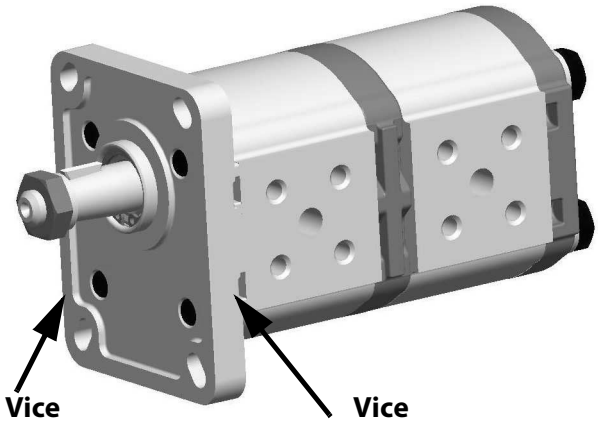
1. Check the parts have not been damaged during the shipment.
2. Work in a clean area.
3. Clean with solvent (except the seals) and air dry all components before assembling.
4. Pay attention not to damage the machined surfaces.
5. The components need to be fitted in place without forcing them. If too much force is required, it is due a bad clearances issues.
6. When hand pressure is not enough, use only mallet and never hammer.
7. Respect the tightening torque for bolts.

External Components Disassembly

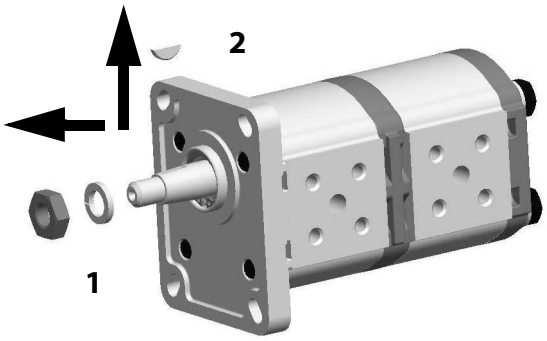


⚠ CAUTION

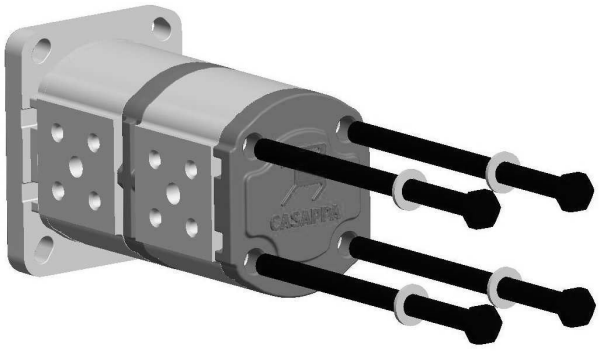
USE SOME ALUMINIUM PROTECTION ON THE VICE TO NOT DAMAGE THE MACHINED SURFACES. PUT THE PUMP IN HORIZONTAL POSITION AND BLOCK THE COVER IN THE VICE'S JAWS. LOOSEN THE BOLTS.

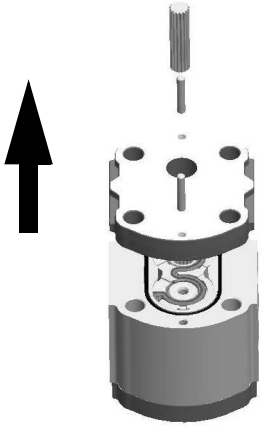


1. Unscrew the nut and remove the nut and washer (1).
2. Take out the shaft key (2).



3. Put the pump on the work bench and remove the bolts and the washers.

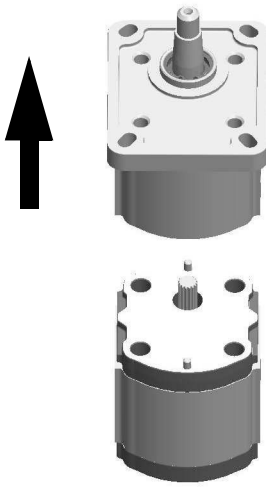




3. Remove the rear cover.

Components disassembly

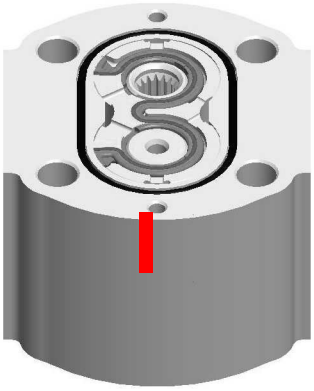
1. Remove the first section from the second section.



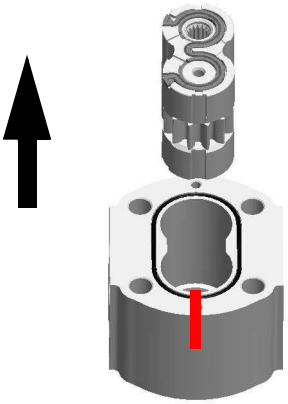
2. Remove the connecting hub and the dowel pins.

Second Section Components Disassembly

1. Using a marker draw a reference mark on the plate and the body. It will be used later during reassembly.

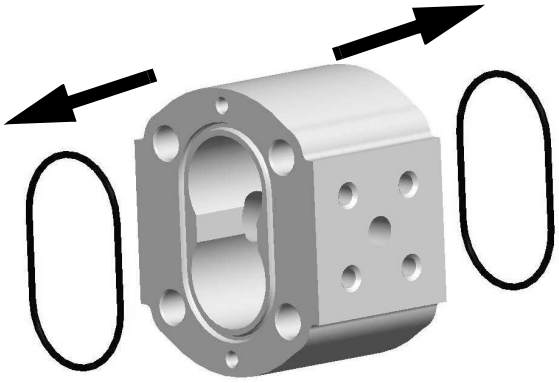


2. Remove the gears and the pressure plates.

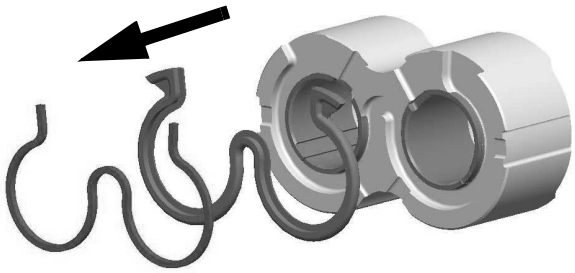


Second Section Seals Disassembly

1. Remove the seals from the body.

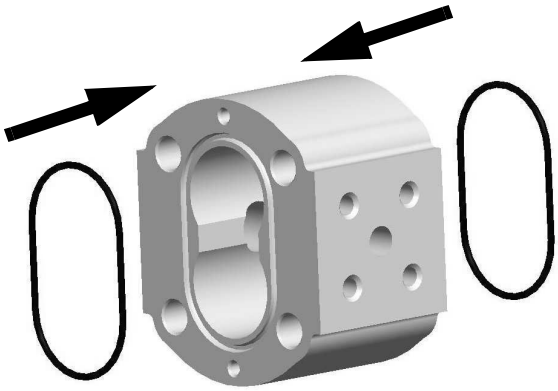


2. Remove from the plate the back-up ring (1) and the seal (2).

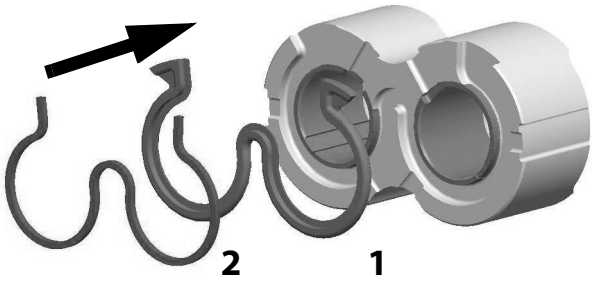


Second Section Seals Replacement

1. Place on the body the new seals. Use clean grease to keep the seal in place.

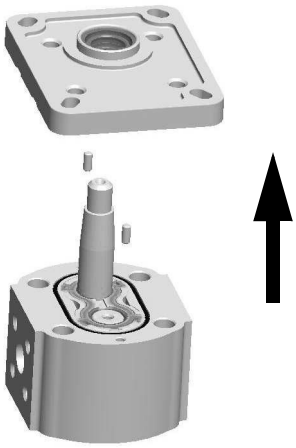


2. Fit the new seal (1) and back-up ring (2) on the plate.

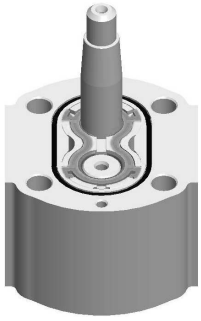


First Section Seals Disassembly

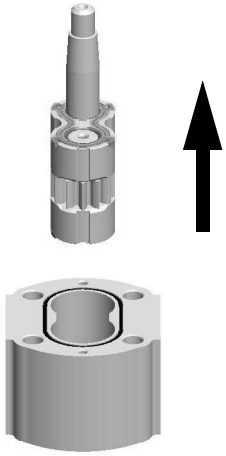
1. Remove the front cover.



2. Using a marker draw a reference mark on the plate and the body. It will be used later during reassembly.

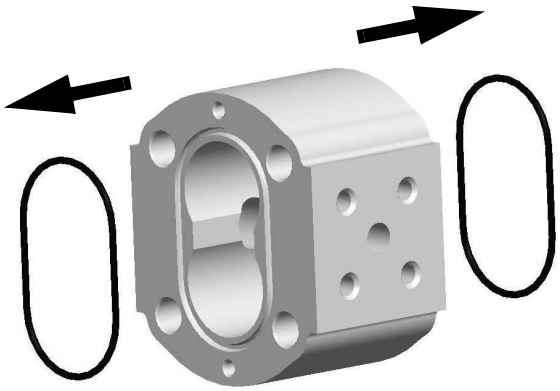


3. Remove the gears and the pressure plates.

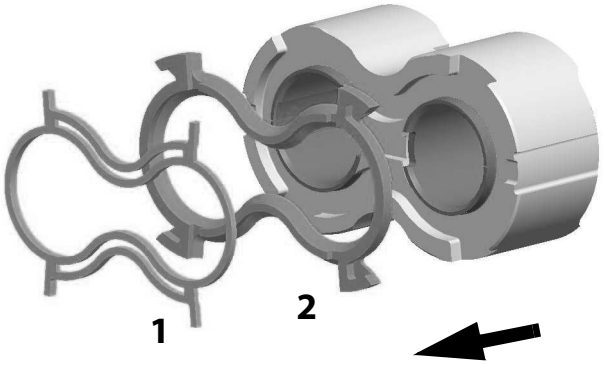


First Section Seals Disassembly

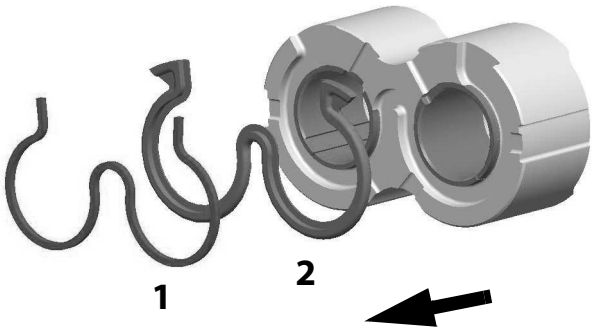
1. Remove the seals from the body.



2. Remove from the plate the back-up ring (1) and the seal (2).



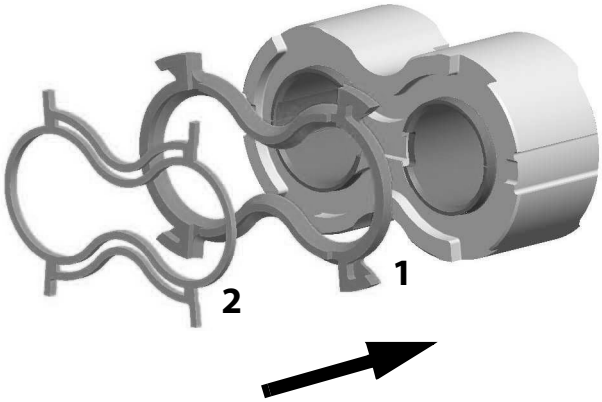
3. Remove from the plate the back-up ring (1) and the seal (2).



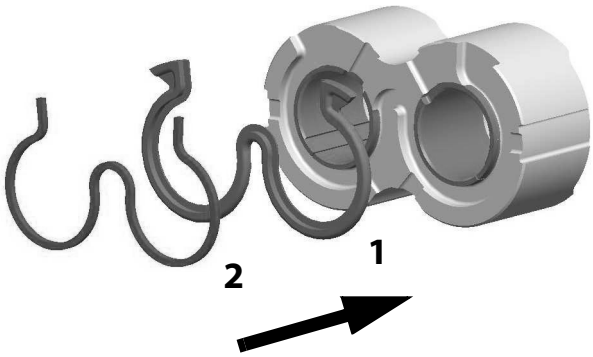
First Section Seals Replacement

1. Use clean grease on the pressure plate to help the seals stay in place before fitting them.

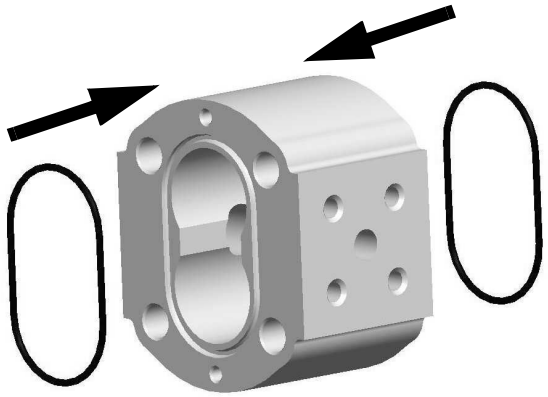
2. Fit the new seal (1) and back-up ring (2) on the plate.



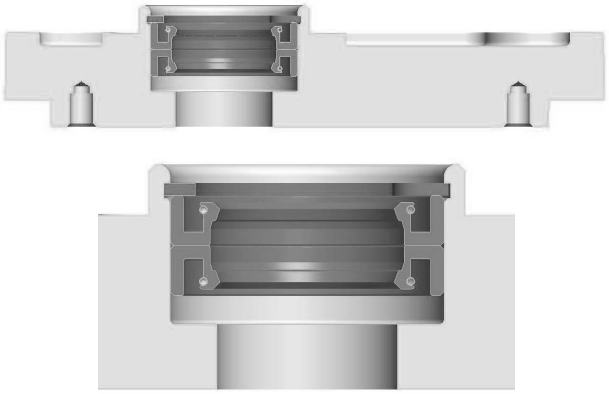
3. Fit the new seal (1) and back-up ring (2) on the plate.



4. Place on the body the new seals. Use clean grease to keep the seal in place.

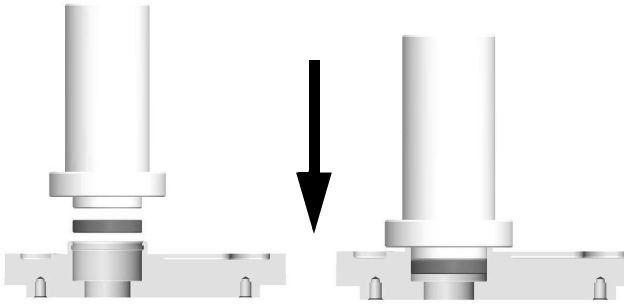


Cover Seals Replacement

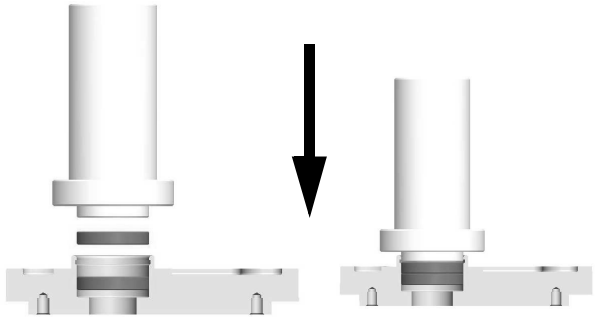


1. Put the cover on the working bench.
2. Remove the snap ring (1).
3. Paying attention not to damage the seat remove with a screw driver (flat head) the shaft seals.(2 - 3)
4. Put some clean grease into the seat seal.

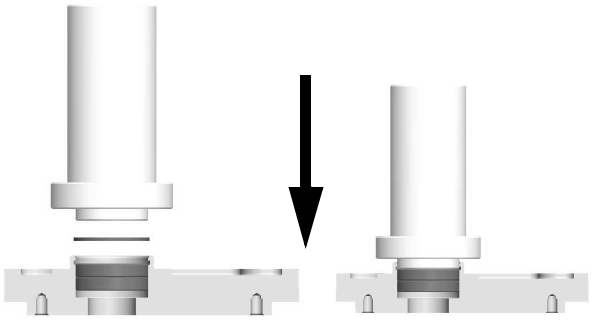
5. Insert the shaft seal. Pay attention to the assembling direction of the shaft seal (see section). Using a mallet push all the way down the CASAPPA tool pn. 06100091.



6. Insert the second shaft seal. Pay attention to the assembling direction of the shaft seal (see section). Using a mallet push all the way down the CASAPPA tool pn.06100091

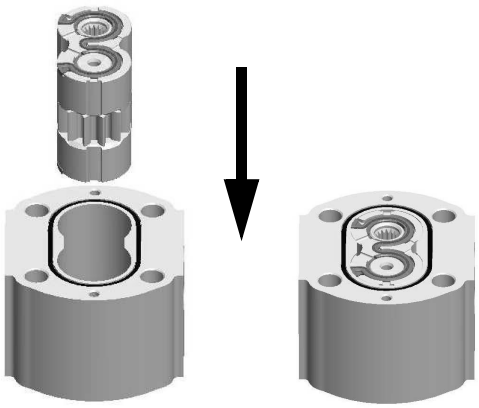


7. Insert the back-up ring.
8. Using a mallet push all the way down the CASAPPA tool pn. 06100091.

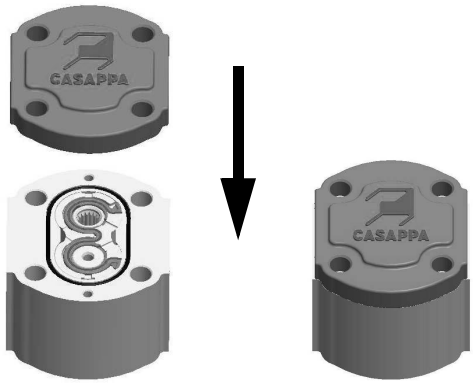


Second Section Components Reassembly

1. Reassemble the gears and the plates. Use as reference the mark made previously.

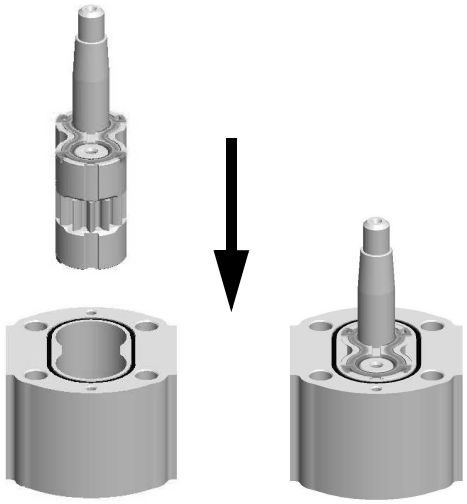


2. Reassemble the rear cover.



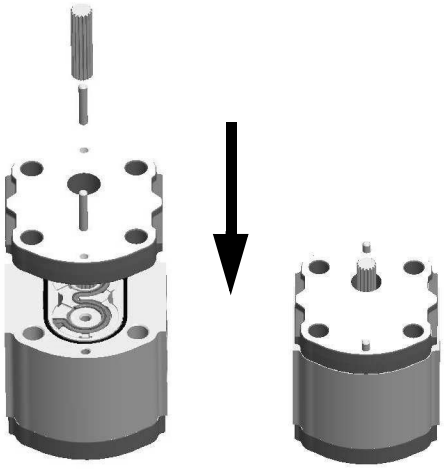
First Section Components Reassembly

Reassemble the gears and the plates. Use as reference the mark made previously.

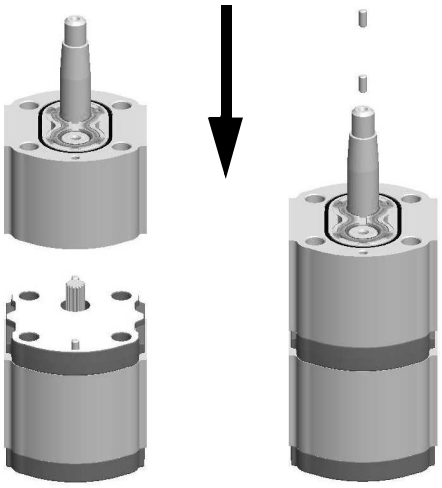


Components Reassembly

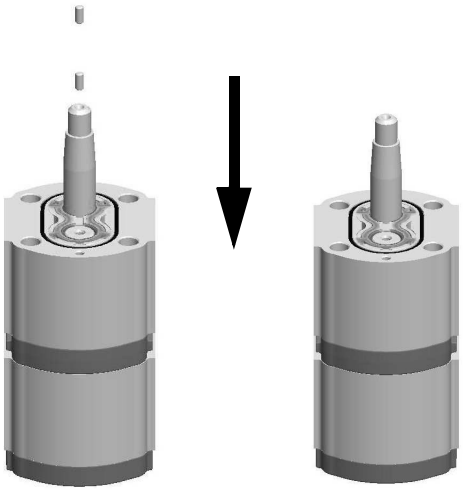
1. Put back the flange and the pins. Put the connecting hub into the second section shaft.



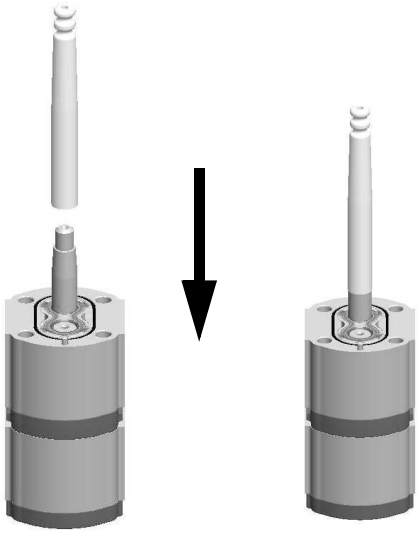
2. Put back the first section.



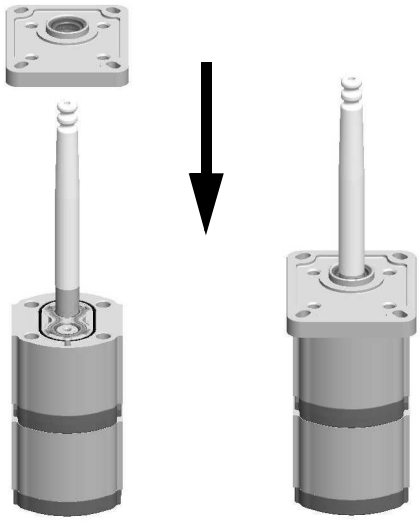
3. Put back the dowel pins.



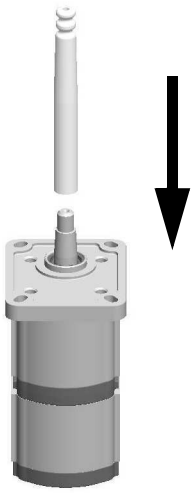
4. Put the appropriate CASAPPA tool pn 06100090 on the drive shaft or protect with adhesive tape to avoid damaging the shaft seal.



5. Use grease on the CASAPPA tool. Assemble the cover on the pump.

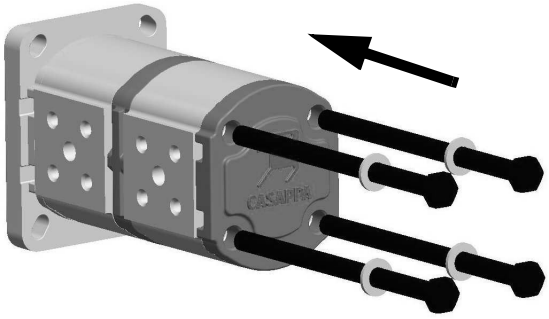


6. Remove the CASAPPA tool pn 06100090.



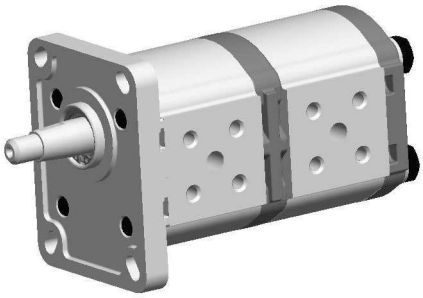
Final Assembly And Check

1. Put the pump in the vice and tighten the bolts with a torque wrench. Tightening torque 30 Nm.

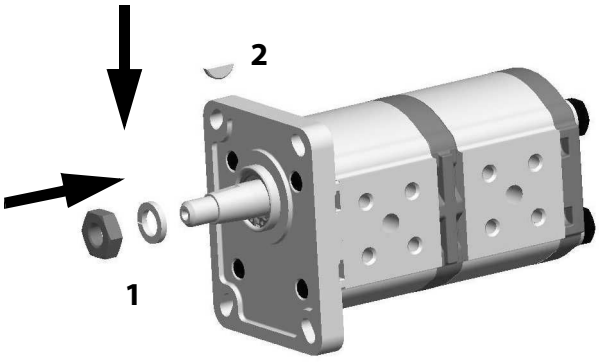


NOTICE

WITH A CLAMP VERIFY THAT THE SHAFT OF THE PUMP CAN ROTATE AFTER THE OPERATION IN BOTH DIRECTIONS. THE SHAFT MUST EASILY ROTATE. IF THE SHAFT IS LOCKED THIS MEANS THAT SOME OF THE SEALS HAVE COME OUT OF THEIR SEATS DURING ASSEMBLY. IF THIS HAPPENS THE WHOLE OPERATION MUST BE DONE AGAIN AND THE DAMAGED SEALS REPLACED.



2. Put back the shaft key (2). Insert the washer and tighten the nut (1). Tightening torque 10 Nm.



5.13 HYDRAULIC COMPONENT START-UP PROCEDURES AND RECOMMENDATIONS

From a hydrostatic component standpoint, the goal at system start up is to put into functional operation, the hydrostatic system in such a way as to preserve the designed life span of the system. The following start-up procedure should be adhered to whenever a new pump or motor is initially installed into a machine, or a system is restarted after either a pump or motor has been removed and/or replaced.

⚠ WARNING

THE FOLLOWING PROCEDURE MAY REQUIRE THE MACHINE TO BE DISABLED (WHEELS RAISED OFF THE GROUND, WORK FUNCTIONS DISCONNECTED, ETC.) WHILE PERFORMING THE PROCEDURE IN ORDER TO PREVENT INJURY. TAKE NECESSARY SAFETY PRECAUTIONS BEFORE MOVING THE VEHICLE/MACHINE.

Prior to installing the pump and/or motor, inspect the unit(s) for damage that may have been incurred during shipping and handling. Make certain that all system components (reservoir, hoses, valves, fittings, heat exchanger, etc.) are clean prior to filling with fluid.

1. Fill the reservoir with recommended hydraulic fluid. This fluid should be passed through a 10 micron (nominal, no bypass) filter prior to entering the reservoir. The use of contaminated fluid will cause damage to the components, which may result in unexpected vehicle/machine movement.

NOTE: *If a pump or motor is being replaced due to internal-damage, the remaining units (pump or motors) need to be inspected for damage and contamination, and the entire hydraulic system will need to be flushed and the fluid replaced. Failure to do so may cause considerable damage to the entire system.*

2. The inlet line leading from the reservoir to the pump must be filled prior to start-up. Check the inlet line for property tightened fittings and make sure it is free of restrictions and air leaks.

NOTE: *In most cases, the reservoir is above the pump inlet so that the pressure head created by the higher oil level helps to keep the inlet pressures within an acceptable range and prevent high vacuum levels. However, due to hose routing or low reservoir locations, there may be air trapped within this line. It is important to assure that the air is bled from this line.This can be accomplished by loosening the hose at the fitting closest the pump. When oil begins to flow, the line is full, the air has been purged, and the fitting can be retightened to its specified torque. If the tank needs to be pressurized in order to start the flow of oil, a vacuum reading should be taken at the inlet of the pump during operation in order to verify that the pump is not being asked to draw an inlet vacuum higher than it is capable of.*

3. Be certain to fill the pump and/or motor housing with clean hydraulic fluid prior to start up. Fill the housing by pouring filtered oil into the upper case drain port.

NOTE: *It is highly recommended to use the highest possible case drain port, this ensures that the housing contains as much oil as possible and offers the greatest amount of lubrication to the internal components.*

NOTE: *In initial start-up conditions, it may be convenient to fill the housing, just prior to installing the case drain line. Component, (especially motor), location may be such that access to the case drain port after installation is not realistic.*

NOTE: *Make certain that the oil being used to fill the component housing is as clean as possible, and store the fill container in such a way as to prevent it from becoming contaminated.*

4. Install a 60 bar (or 1000 psi) pressure gauge in the charge pressure gauge port in order to monitor the charge pressure during start-up.

5. It is recommended that the external control input signal, (electrical connections for EDC), be disconnected at the pump control until after initial start-up. This will ensure that the pump remains in its neutral position.

⚠ WARNING

DO NOT START THE ENGINE UNLESS PUMP IS IN THE NEUTRAL POSITION (0 DEGREES SWASHPLATE ANGLE). TAKE PRECAUTIONS TO PREVENT MACHINE MOVEMENT IN CASE PUMP IS ACTUATED DURING INITIAL START-UP.

6. "Jog" or slowly rotate the engine until charge pressure starts to rise. Start the engine and run at the lowest possible RPM until charge pressure has been established. Excess air should be bled from the system lines as close to the motors as possible.

NOTE: *With the engine on low idle, "crack", (loosen-don't remove), the system lines at the motor(s). Continue to run the engine at low idle and tighten the system lines as soon as oil is observed to leak from them. When oil is observed to "leak" at the motor the line is full, the air has been purged, and the system hoses should be retightened to their specified torque.*

7. Once charge pressure has been established, increase speed to normal operating RPM. Charge pressure should be as indicated in the pump model code. If charge pressure is inadequate, shut down and determine the cause for improper pressure.

⚠ WARNING

INADEQUATE CHARGE PRESSURE WILL AFFECT THE OPERATOR'S ABILITY TO CONTROL THE MACHINE.

8. Shut down the engine and connect the external control input signal. Also reconnect the machine function(s), if disconnected earlier.
9. Start the engine, checking to be certain the pump remains in neutral. With the engine at normal operating RPM, slowly check for forward and reverse machine operation.
10. Charge pressure may slightly decrease during forward or reverse operation. Continue to cycle slowly between forward and reverse for at least five minutes.
11. Shut down engine, remove guages, and plug ports. Check reservoir level and add filtered fluid if needed.

The machine is now ready for operation.

5.14 PRESSURE SETTING PROCEDURE

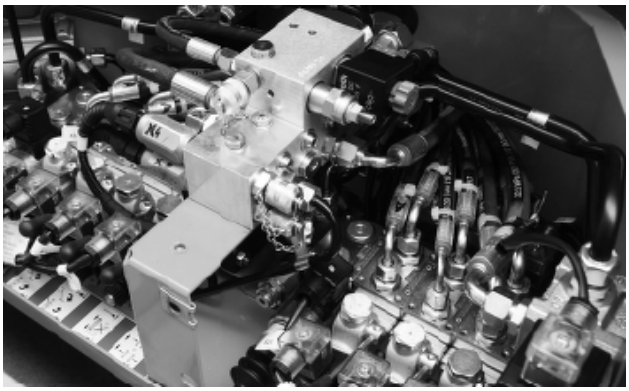
Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends operating the machine until the hydraulic system has warmed to normal operating temperatures prior to checking pressures. JLG Industries Inc. also recommends the use of a calibrated gauge. Pressure readings are acceptable if they are within ± 5% of specified pressures.

Check Operating Pressure in the Hydraulic System

⚠ WARNING

MAKE SURE THAT THE MACHINE IS CLOSED AND IN THE RESTING POSITION. MAKE SURE THAT NO ONE IS STANDING WITHIN THE MACHINE OPERATING RANGE. ALL THE SPECIFIED CHECKS MUST BE CARRIED OUT FROM THE CONTROL POSITION IN THE PLATFORM.

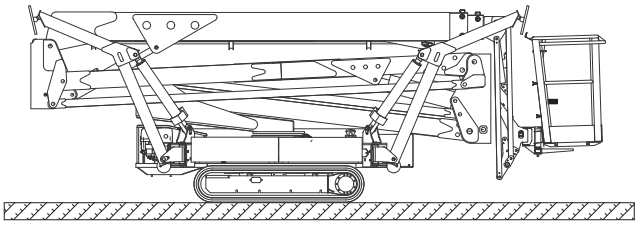
NOTE: *Use a pressure gauge with a minimum scale of 250 bar.*



1. Connect the pressure gauge to the pressure intake on the aluminum delivery manifold block. First, connect the pressure gauge to the fitting on the upper pressure intake.
2. Switch the machine ON.
3. Close one of the two right stabilizers completely. Keep this function active a record the pressure reading. This value relates to the right track distributor.
4. Switch the machine OFF.
5. Connect the pressure gauge to the fitting on the lower pressure intake.
6. Switch the machine ON.
7. Close one of the two left stabilizers completely. Keep this function active a record the pressure reading. This value relates to the left track distributor.
8. Level the machine with the outriggers.
9. Set the second boom cylinder to the FOLDING mode. Keep this function active a record the pressure reading. This value relates to the aerial distributor.

Control Valve (Chassis functions)

1. Machine completely closed.



2. Install the pressure gauge at the port marked MA.
3. Activate the function outrigger IN on remote control.
4. Verify that the pressure is as on Table below.

CONTROL VALVE LEFT SIDE (CHASSIS FUNCTIONS)			
MODEL	PRESSURE PORT	PRESSURE SETTING	
		BAR	PSI
X26JP / X770AJ	MA	200	2900

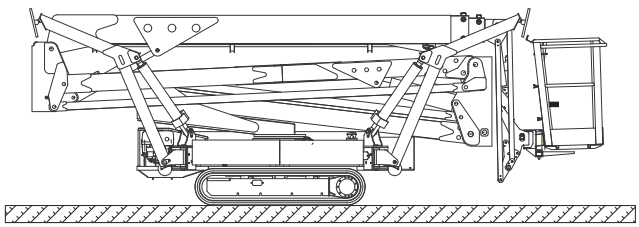
Figure 5-5.

To adjust the relief valve, turn clockwise to increase, turn counterclockwise to decrease the pressure.

Automatic Reductions Drive Speed

Adjust pressure reducing valve.

1. Adjust the pressure when the machine is completely closed.

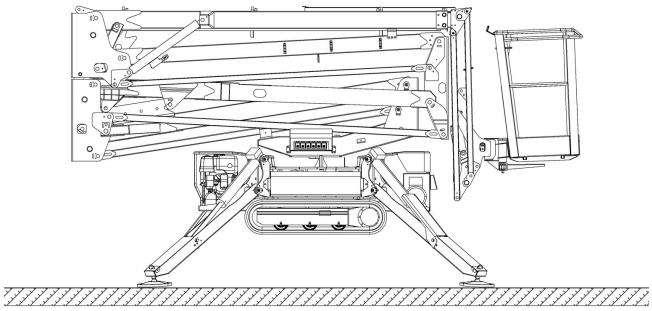


2. Install the pressure gauge at the port 5.
3. Activate the function outrigger IN on remote control 1.
4. Verify that the pressure is as on Table below.
5. Pressure adjust on relief valve point 6

AUTOMATIC REDUCTIONS DRIVE SPEED				
MODEL	PRESSURE PORT	FUNCTION	PRESSURE SETTING	
			BAR	PSI
X26JP / X770AJ	MA	Function Outrigger IN	26	380

Control Valve Turntable Functions

1. Machine with outrigger fully extended.



2. Install the pressure gauge at the port marked MB.

3. Activate the function Telescope IN on remote control.

NOTE: *The calibration must be made with oil hot and speed setting to RABBIT.*

4. Verify that the pressure is as on Table below.

CONTROL VALVE TURNTABLE FUNCTIONS				
MODEL	PRESSURE PORT	FUNCTION	PRESSURE SETTING	
			BAR	PSI
X26JP / X770AJ	MB	Telescope IN	200	2900

5.15 OUTRIGGERS AUTO-RETRACTION

To be able to automatically retract the outriggers the machine must be closed and aligned and outriggers must be all opened as the previous paragraph describes.

To automatically retract the outriggers you have to press and hold remote control button n.1 "AUTOMATIC OUTRIGGERS RETRACTION", the display will shows "DEST".

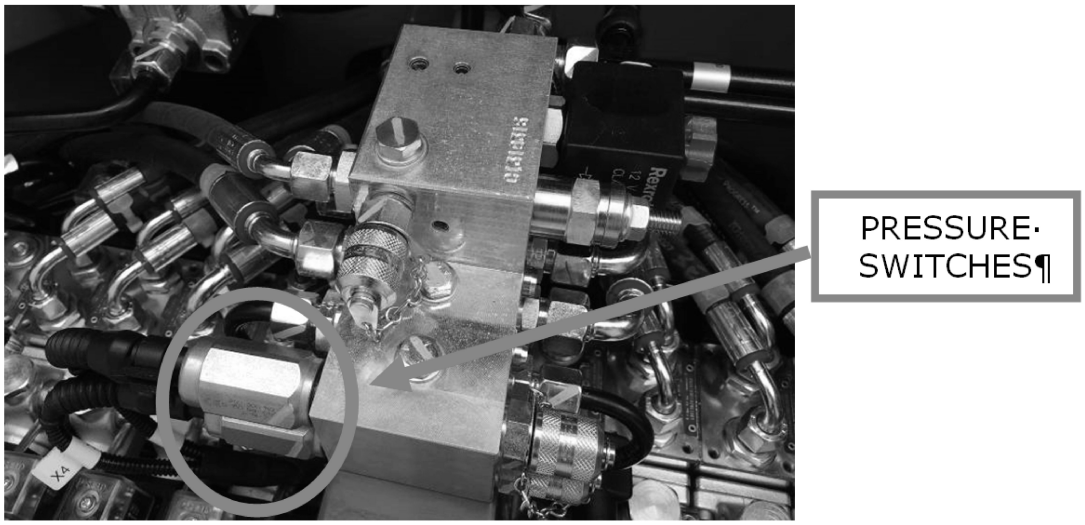
Figure 5-6. Outriggers Auto-Retraction In Progress

It's possible to keep automatic outriggers retraction running till outriggers are completely lifted up.

To achieve the stowed condition outriggers must be completely lifted up till the end of their stroke and have to be manually rotated while unlocked with their pivot.

The machine is equipped with two pressure switches on the hydraulic manifold, one for the right side and one for the left side. When both the same side outriggers are at end of the stroke, the hydraulic oil pressure reaches the maximum value so that the pressure switch informs the ECM1-2 that outriggers are completely lifted up. When ECM1-2 senses that all the four outriggers are completely lifted up starts to feed one side outriggers at a time, this will help when outriggers need more power to be lifted up, for instance in case of cold hydraulic oil.

NOTE: *During the intermediate steps of auto-stabilization and outriggers auto-retraction, while two or three outriggers are touching the ground, the engine automatically runs at minimum RPM to ensure smooth movements.*



SECTION 6. JLG CONTROL SYSTEM

6.1 INTRODUCTION

NOTICE

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

NOTICE

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

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

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

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

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

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

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

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

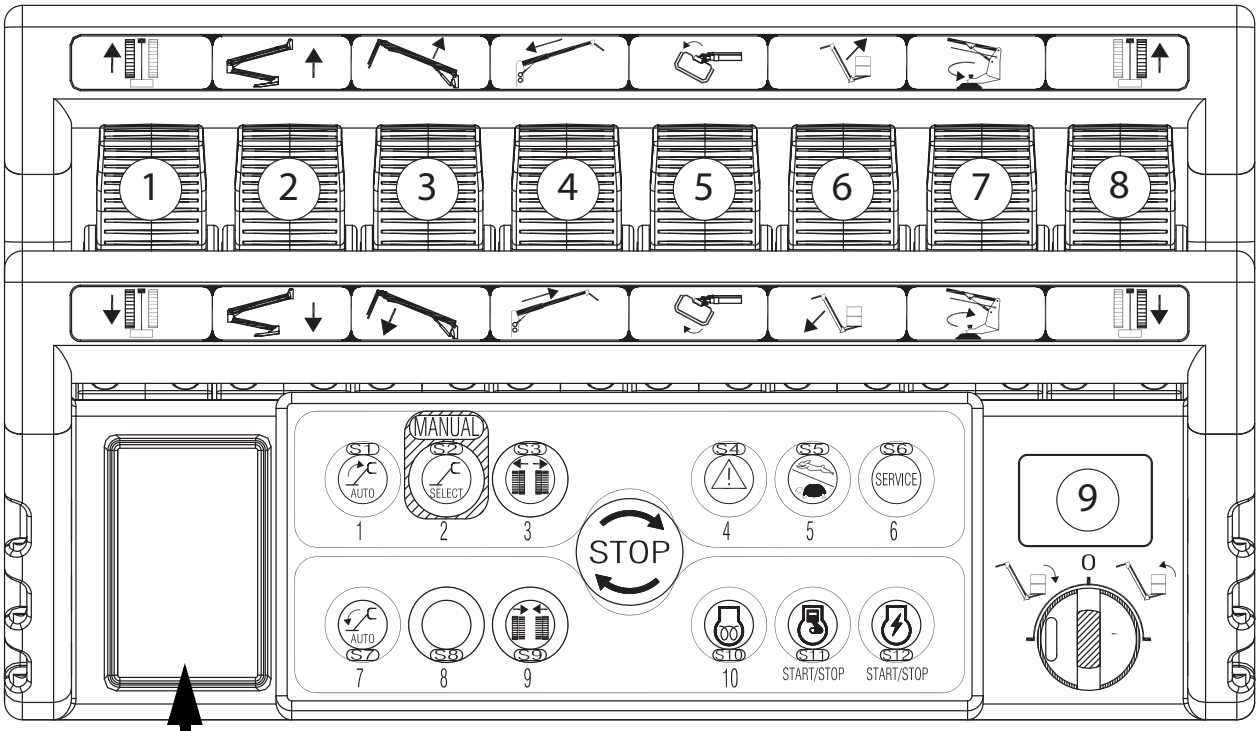
CE - X26JP

ANSI - X770AJ

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

6.2 PLATFORM - REMOTE CONTROL STATION

Remote Control Station (Prior to SN C170002458)



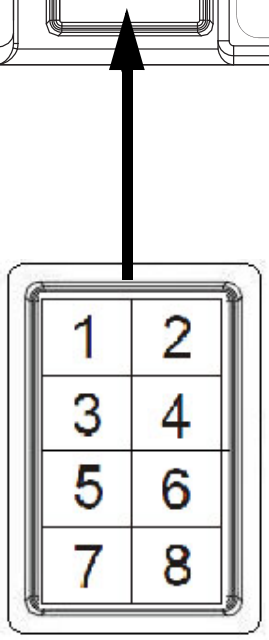


Figure 6-1. Remote Control

At machine start-up and during machine operation the main LCD display screen (Figure 6.1) is activated. There are eight (8) display positions which indicate machine status during various stages of operation.

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

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

When the machine's main control board is powered via the engine key, the information to be shown on the display is sent to the remote control.

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

NOTE: *The X770AJ remote control station is fully backward and forward compatible as ling as the unit has the latest master software update.*

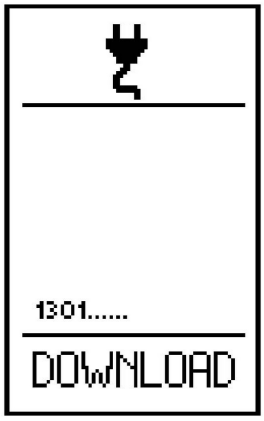


Figure 6-2.

In this case about 5-10 minutes are needed to send all the information from the main board to the remote control. The machine cannot work during this period.

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

NOTE: *The numbers shown above DOWNLOAD are the data transferred. The Download will be completed when about more that 24000 steps are transferred.*

LCD Display Screen

When the machine is started, the main screen is displayed, giving a general overview of the machine status. For the sake of simplicity and clarity a layout is provided with 8 icon display positions.

Example of the main screen:

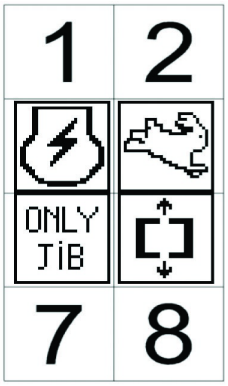


Figure 6-3.

Icon position diagram:

Figure 6-4.

POSITION 3:

Position 3 displays the engine/motor selection and the engine status.

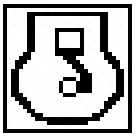


Figure 6-5. Petrol/diesel engine

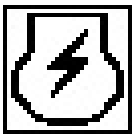


Figure 6-6. Electric motor

An X on the icon indicates that the engine/motor is off, no X indicates that it is on.

POSITION 4:

Position 4 displays the selected speed or the reduced speed for the Lithium:

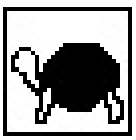


Figure 6-7. Slow

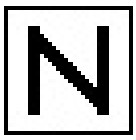


Figure 6-8. Normal

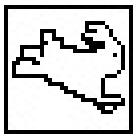


Figure 6-9. Fast

Figure 6-10. Reduced

POSITION 5:

Position 5 displays the icon confirming that overhead movements are enabled.

Figure 6-11.

This icon means that all conditions for using the overhead movements have been checked and the aerial part can be lifted. No icon on means that the aerial part cannot be lifted.

In place of this icon, the basket overload icon may be shown.

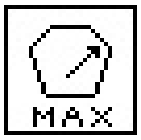


Figure 6-12.

When the load sensor measures a load exceeding the allowed work load - 230 kg - the main screen disappears for three seconds, replaced by the overload error display, the audible warning is activated, then the overload icon appears in position 5 in place of the icon enabling the overhead movements.

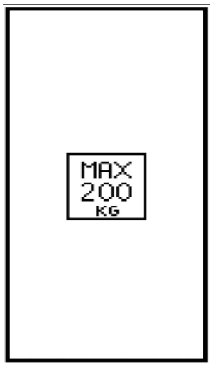


Figure 6-13. Overload error display

POSITION 6:

Position 6 displays the icon confirming that track movements (stabilizers, tracks, track extension) are enabled.

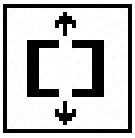


Figure 6-14.

This icon means that all conditions for operating the track movements have been checked. No icon on means the stabilizers cannot be used and the track cannot be extended. The machine, however, can travel even when the icon is off, as long as all 4 stabilizers are lifted from the ground.

POSITION 7:

Position 7 is used for functional signals:

Emergency STOP pressed

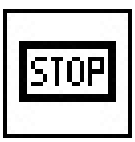


Figure 6-15.

Signals that one of the emergency stop buttons on the machine has not been released.

Battery Voltage Below Minimum Limit.

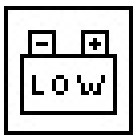


Figure 6-16.

Indicates that the battery charge level is below the minimum limit allowed. If this message appears, it is advisable to recharge the battery, either by keeping the diesel or petrol engine on, or by connecting to the network.

Figure 6-17.

Figure 6-18.

Signals an error in the battery management system of Lithium version.

In this position also other functional signals can be displayed that are useful for machine diagnostics.

Figure 6-19.

The machine has a CANBUS line connection fault.

Figure 6-20.

A faulty or incorrect electronic board (card) has been installed, or alternatively an incorrect software version has been loaded.

POSITION 8:

Position 8 displays the battery charge status or the icon indicating the battery is being recharged in the Lithium version.

Figure 6-21.

Figure 6-22.

Position 8 is used to show the selection of the emergency descent operation from the basket with solenoid valves on the cylinders.

Figure 6-23.

In addition to the main screen described above, there are other functional displays that will be described successively.

Remote Control Station (SN C170002458 to Present)

Figure 6-24. Remote Control

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

When the machine's main control board is powered via the engine key, the information to be shown on the display is sent to the remote control.

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

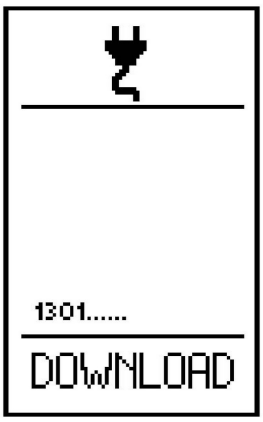
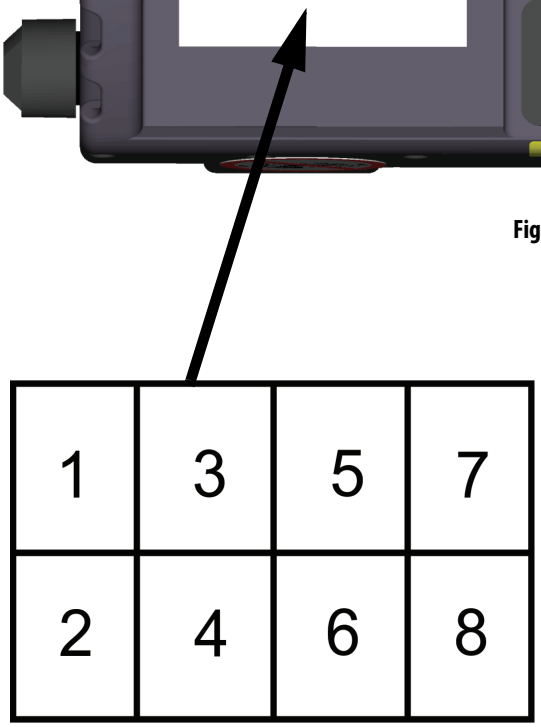


Figure 6-25.



At machine start-up and during machine operation the main LCD display screen (Figure 6.1) is activated. There are eight (8) display positions which indicate machine status during various stages of operation.

In this case about 5-10 minutes are needed to send all the information from the main board to the remote control.

The machine cannot operate within this period.

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

NOTE: *The numbers shown above DOWNLOAD are the data transferred. The Download will be completed when about more than 29000 steps are transferred.*

LCD Display Screen

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

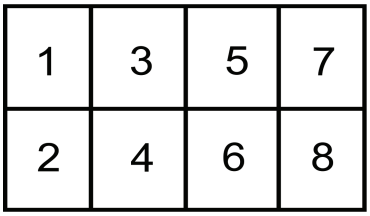


Figure 6-26.

POSITION 1:

Reduced operating area if all outriggers are not fully deployed.

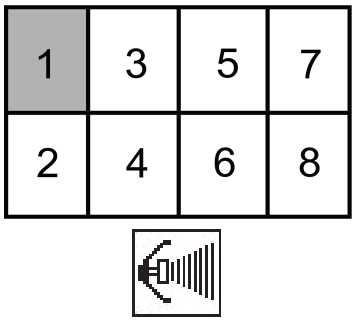


Figure 6-27.

POSITION 2:

Currently unused

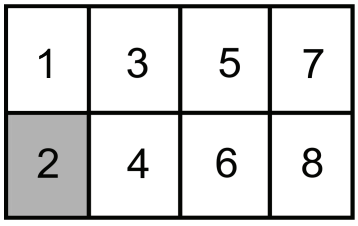


Figure 6-28.

POSITION 3:

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

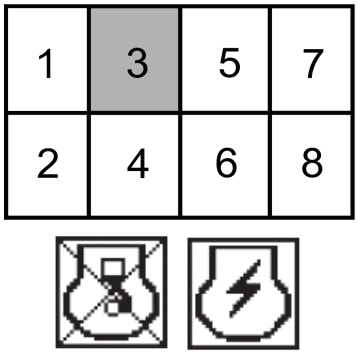


Figure 6-29.

POSITION 4:

Displays selected engine speed.

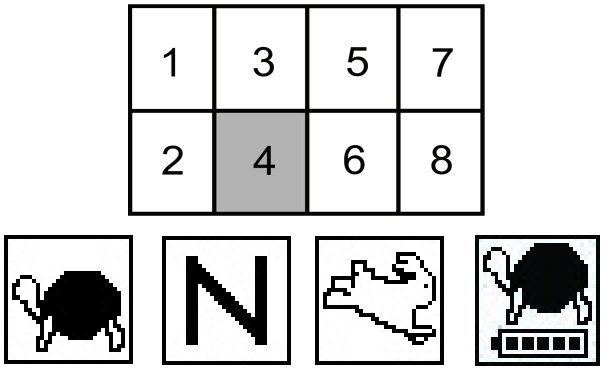


Figure 6-30.

POSITION 5:

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

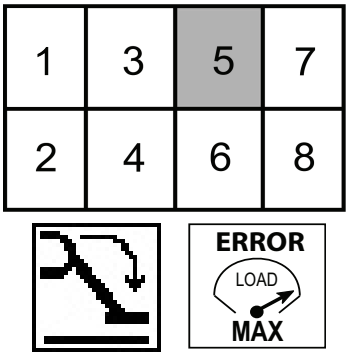


Figure 6-31.

POSITION 6:

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

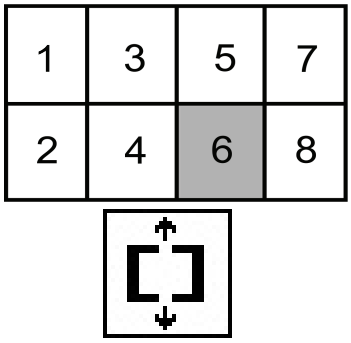


Figure 6-32.

POSITION 7:

Can indicate any of the following situations:

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

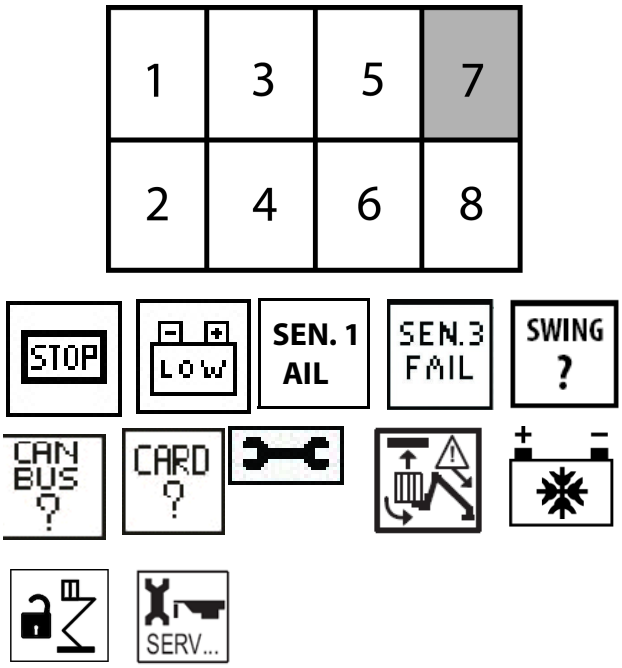


Figure 6-33.

POSITION 8:

- Indicates emergency lowering has been selected.
- Lithium ION - Battery Charge Status and Battery Charger Plugged In.

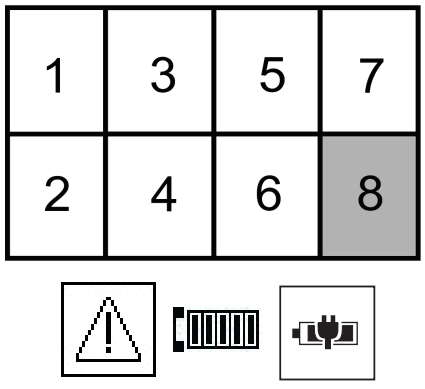


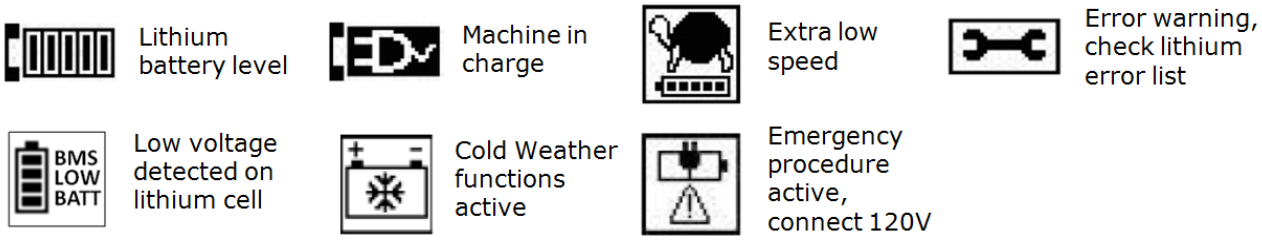
Figure 6-34.

LCD Display Icon Description

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

Figure 6-35. LCD Display Icon Description

Lithium Only Icons



Joystick Controls

Using the joysticks the operator selects the movement to be performed, the direction and the speed. The direction of the joystick determines the direction of the movement. The degree of movement of the joystick determines the speed. The more the joystick is moved away from the central neutral position, the faster the movements obtained.

The following table shows the movement controlled and its direction depending on the joystick shifting direction.

Table 6-1.

JOYSTICK	JOYSTICK SHIFTING DIRECTION	MOVEMENT CONTROLLED AERIAL MOVEMENTS ENABLED
1	FORWARDS	LEFT TRACK FORWARDS
	BACKWARDS	LEFT TRACK BACKWARDS
2	FORWARDS	1st-2nd ARM UP
	BACKWARDS	1st-2nd ARM DOWN
3	FORWARDS	3rd ARM UP
	BACKWARDS	3rd ARM DOWN
4	FORWARDS	EXTENSION ARM IN
	BACKWARDS	EXTENSION ARM OUT
5	FORWARDS	BASKET ANTICLOCKWISE ROTATION
	BACKWARDS	BASKET CLOCKWISE ROTATION
6	FORWARDS	JIB OPENING
	BACKWARDS	JIB FOLDING
7	FORWARDS	ANTICLOCKWISE ROTATION
	BACKWARDS	CLOCKWISE ROTATION
8	FORWARDS	RIGHT TRACK FORWARDS
	BACKWARDS	RIGHT TRACK BACKWARDS
9	R	CLOSE BASKET LEVELLING
	L	OPEN BASKET LEVELLING

Tilt Conditions Drive Cut-out

The machine is provided with a special system that automatically reduces tracks speed or stops the movement in case of stability risks.

This control depends automatically on different factors:

- Weight in the basket
- Jib opened or closed
- Tracks widened or not
- Slope inclination gradient in axles X and Y

The consequence of a stability emergency is, with increasing severity:

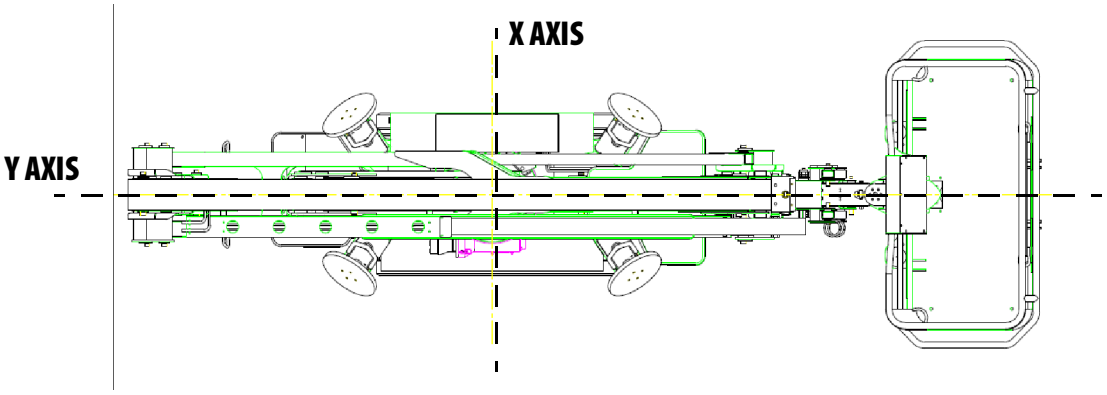
a. Track speed reduction.

b. Tracks movement stopped, display icon -->

Also the buzzer on the remote control could be activated.

⚠ WARNING

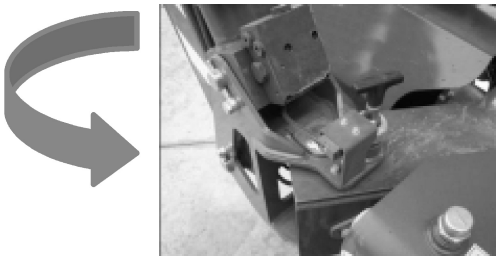
TO MOVE THE TRACKS WHEN THE MACHINE IS STOPPED BY THOSE CONDITIONS IT'S NECESSARY TO PRESS BUTTON 8 ON REMOTE CONTROL, A COUNTER-DOWN OF 10 SECONDS WILL BE ACTIVATE ON THE DISPLAY AND IN THE MEANTIME TRACKS MOVEMENT IS ALLOWED IN TURTLE SPEED WITH BEEPER ON. DURING THAT BY-PASS THE OPERATOR CAN BRING MACHINE BACK TO STABILITY CONDITION.



Speed Control Possible Conditions on the X26JP - X770AJ

JIB OPEN (HARE NOT AVAILABLE)	Y>6° BASKET ON LOWER SIDE	TURTLE
	Y>13°	TURTLE + BEEPER
	Y>20° BASKET ON LOWER SIDE Y>16° BASKET ON UPPER SIDE	BEEPER + STOP + ALARM ICON
JIB CLOSED WITH <=120Kg	Y>6° BASKET ON LOWER SIDE	TURTLE
	Y>13°	TURTLE + BEEPER
	Y>20° BASKET ON LOWER SIDE Y>16° BASKET ON UPPER SIDE	BEEPER + STOP + ALARM ICON
JIB CLOSED WITH <=230Kg (HARE NOT AVAILABLE)	Y>6°	TURTLE
	Y>10°	TURTLE + BEEPER
	Y>15°	BEEPER + STOP + ALARM ICON

Speed Control Conditions On X Axle



ALWAYS	X>6°	TURTLE
TRACKS NOT OPENED	X>10°	TURTLE+BEEPER
	X>13°	BEEPER + STOP + ALARM ICON
TRACKS OPENED	X>15°	TURTLE+BEEPER
	X>18°	BEEPER + STOP + ALARM ICON

Push Buttons

The buttons have a dual function: they can be used to select machine functions or as numerical keys in the service submenus.

They in fact feature an icon that represents their meaning and a number for use as a numerical keypad.

An emergency STOP button is also available which, when pressed, stops the motor and brings the machine to a standstill.

The pressed position of the emergency STOP button is represented on the display in position 7.

To make the machine operational again, the button must be turned and released.

For the description of the individual functions, see paragraph 6 Using the machine.

BUTTON 1:

Figure 6-36. Used to automatically raise the stabilizers.

BUTTON 2:

Figure 6-37. Enters the menu for the manual movements of the individual stabilizers.

BUTTONS 3-9:

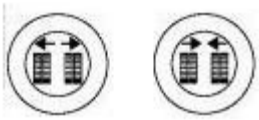


Figure 6-38. Used to extend and narrow the tracked undercarriage.

BUTTON 4:

Figure 6-39. Used to enable control of the emergency descent from the basket. Confirmation that the operation is enabled is displayed on the screen in position 8.

BUTTON 5:

Figure 6-40. Used to select the travel speed and the engine/motor speed.

There are three speeds available:

- SLOW: engine at idle for the operation of the aerial part, at medium for the operation of the drive. Lowest drive speed.
- NORMAL: variable rpm according to the selected movement. Travel motors always with maximum displacement, therefore medium travel speed
- FAST: variable rpm according to the selected movement. Travel motors in automatic displacement variation mode, therefore maximum travel speed.

The three speeds are selected by pressing button 5 in sequence, with a cyclical routine. The selected speed is displayed on the screen in position 4.

BUTTON 6:

Figure 6-41. Enters the auto service menu

BUTTON 7:

Figure 6-42. Used to automatically lower the stabilizers.

BUTTON 10: (Prior to SN C170002458)

Figure 6-43. Preheating

PETROL ENGINE

Allows the preheating of the petrol engine. One pressure on the button sets the engine at 2200 rpm for 20 seconds, in order to heat the engine and improve the initial phases of use.

DIESEL ENGINE

Enables the activation of the glow plugs preheating. One pressure on the button causes a preheating equal to 10 seconds. In case of anticipated starting, the preheating ends when starting.

BUTTON 11: (SN C170002458 to Present)

Figure 6-44. Allows the engine to be switched on/off. If the button is pressed with the engine on, this will be stopped.

Enables the activation of the glow plugs preheating. Press and hold until the glow plug icon goes away. Press again to start diesel engine.

BUTTON 12:

Figure 6-45. Allows the electric motor to be switched on/off. If the button is pressed with the engine on, this will be stopped.

If the start buttons are pressed with an emergency STOP button pressed, starting will be impossible.

This condition is indicated by the icon STOP in position 7.

If the operator attempts to start one of the two motors while the other is already running, starting will be impossible and the icon showing the motor already on will appear at the center of the screen.

NOTE: *Buttons 5 and 6 when pressed simultaneously also activate the horn (optional).*

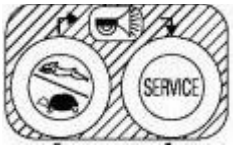


Figure 6-46.

6.3 CANBUS COMMUNICATIONS

The electrical system works with a CAN BUS system, where:

CAN = Control Area Network

BUS = Channels for peripherals

CANbus: CAN (Control Area Network) is a two wire differential serial link between the, Ground Module ECM1; the Remote Control; the LSS ECM3, the Cylinders position sensors and the Rham Modem Module providing bi-directional communications.

Two-wire: One wire (White; Black or Black with numbers) is driven high (5v) and the other low (Gray; Brown or Black with number) (0v) to send a signal; both wires "float" (2.5v) when no signal is being sent.

Differential: Any electrical line noise can affect the high or the low wires but never both, so communications is not corrupted.

Serial Link: Messages are being sent bit by bit along the wires; the high bus speeds allow all modules to be constantly updated around 20 times per second. Typical traffic is 300 - 500 messages per second.

A complete CANbus circuit is approximately 60 ohms,

Each individual circuit from the modules is approximately 120 ohms.

The GROUND MODULE ECM1 is the master system controller.

Most functions are dispatched and coordinated from this module, all other system modules; Remote Control; LSS ECM3; Cylinders position sensors; Rham Modem.

Fundamental characterized information (values) are stored into the ground module ECM1 (i.e., Personalities or Calibrations), while on the LSS ECM3 the basket load setting.

Lift, Tele, Swing & Drive:

The GROUND MODULE ECM1 stores default values, handles interlocks and calibration information.

Lift, Telescope Swing and Drive commands are dependent upon interlocks through out the machine that enables the power supply of the ON -OFF proportional coils after verification of the safety conditions by handles interlocks.

The safety control functioning ECM1 can be by - passed by the key selector switch (spring return) "safety device by-pass key".

The circuit board ECM1 record any by-pass event by date, time and duration of the "safety device by-pass key" action.

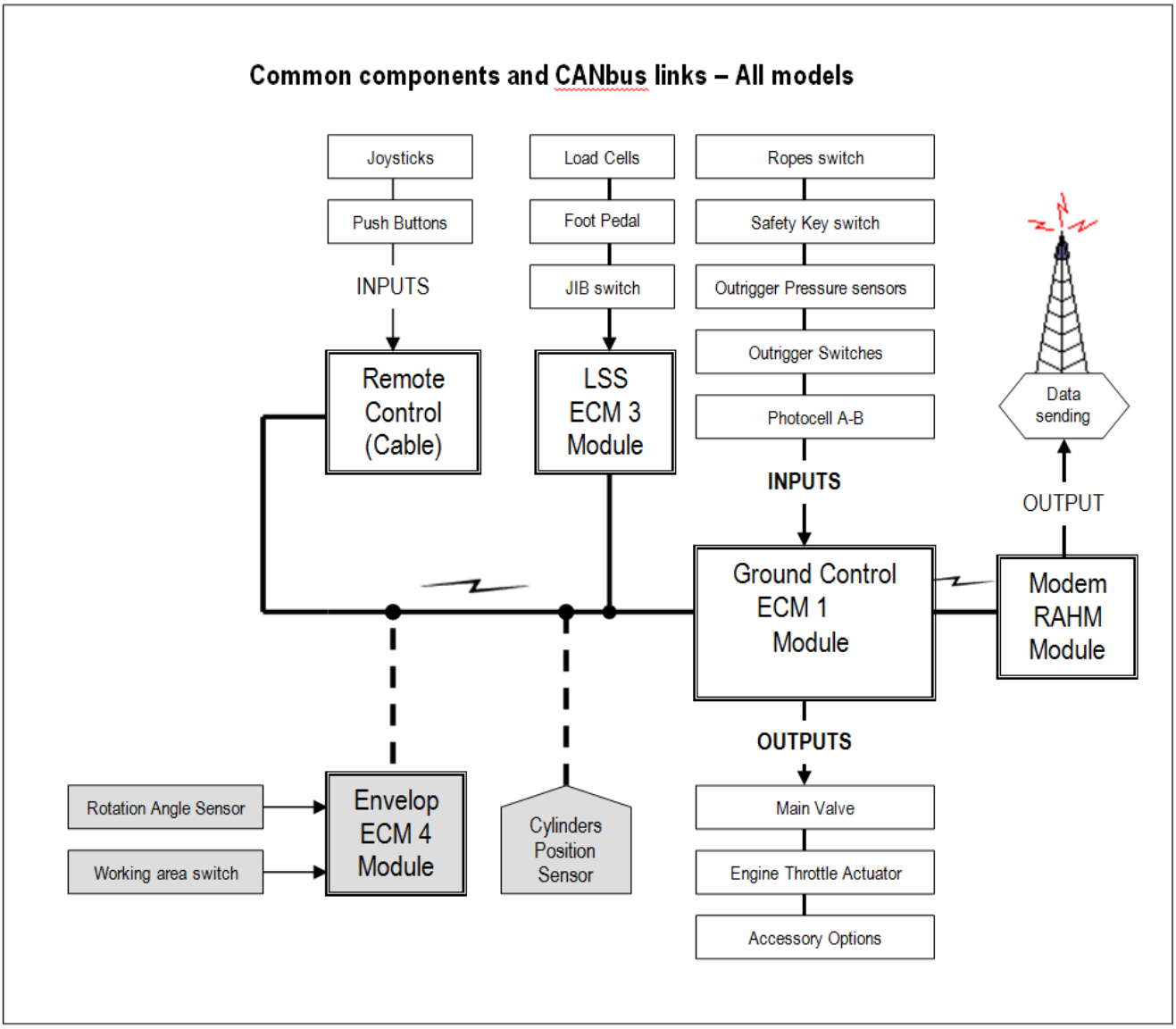


Figure 6-47. Common Components And Canbus Links

Can Bus Device Positions

X26JP-X770AJ

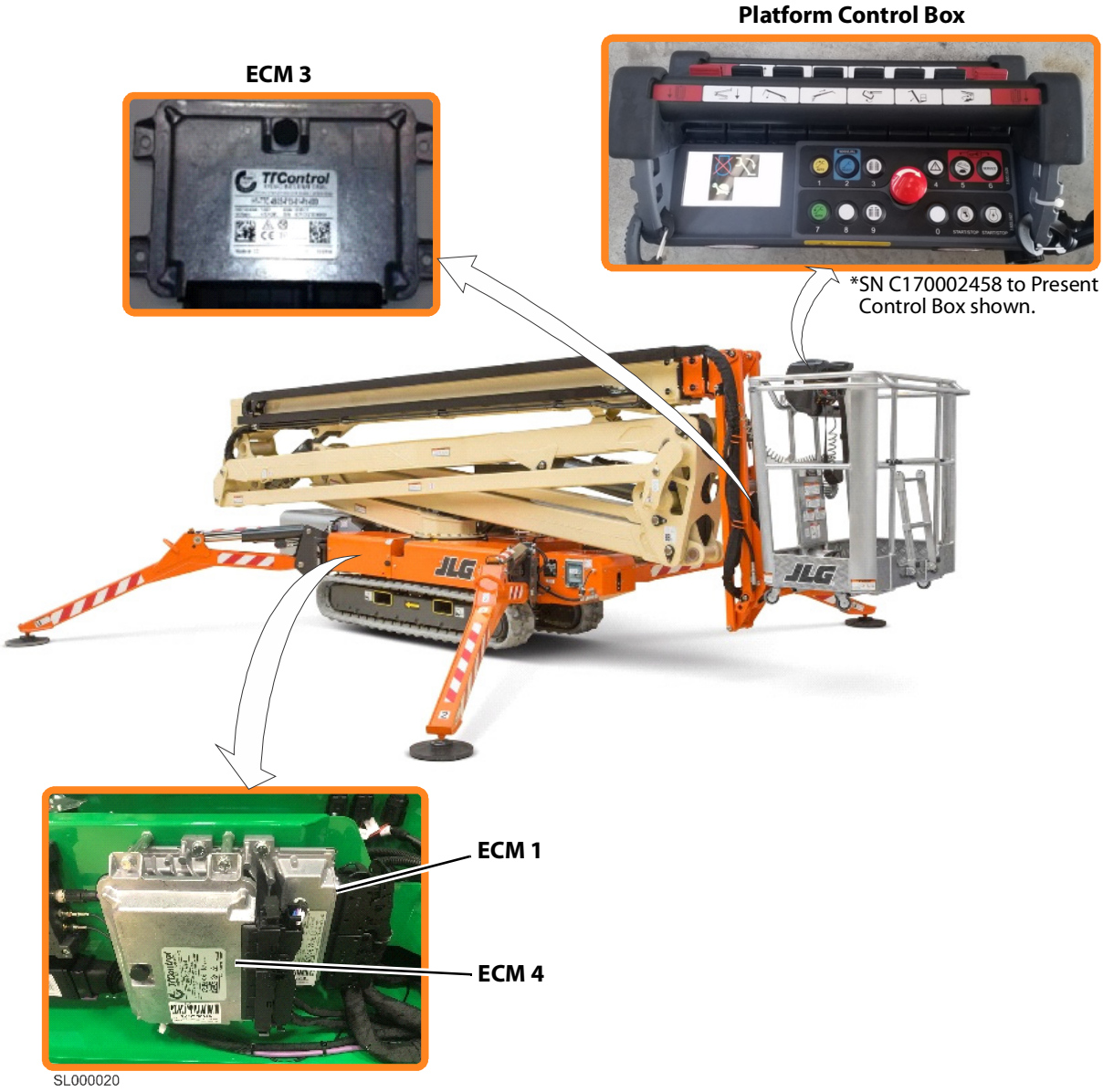


Figure 6-48. Can Bus Device Location - X26JP-X770AJ

CAN-BUS Diagnostics

DISPLAYED ICONS

If an icon of the followings appears on the display check as indicated here below.

THIS IS NOT A CAN-BUS ERROR Control error menu: check from the display into the ERROR MENU pushing 6 – MENU and then 3 – ERRORS, then skipping the pages it will be showed the devices error status, where there's a NO means that the signal from two lines of that device are not according each other, so check it and check its connections	
Electronic board or software wrong: check if the platform's devices are compatibles with installed software, if necessary contact JLG with the serial number and the release number of the installed software	
CAN BUS signal missing: check the connection as indicated at the step 4 of the present procedure	
2° cylinder sensor missing: check the connector of the position sensor on 3° arm cylinder and the sensor itself check also the battery charge level, in case of low battery level let the engine run for some minutes, then check if this alarm disappear.	
Battery low charge alarm: it could appear especially after the engine start, check the charge level and eventually recharge.	

CAN Timeout Menu

As soon as you have CAN BUS error shown on the display, check the error list on page 4, pushing the buttons 6 – MENU --> 3 – ERRORS and then pushing 2 times NEXT till page 4 CAN TIMEOUT, the display will show the following screen on (left side) with the followings meaning (right side).

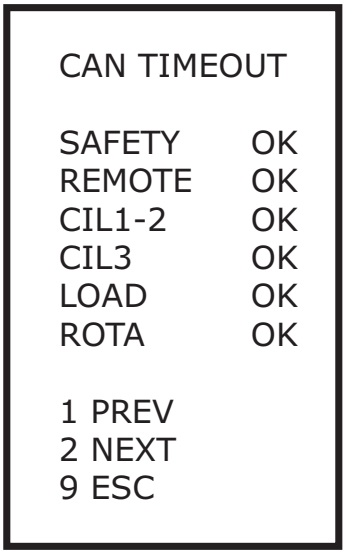


Figure 6-49.

Table 6-2. CAN-Message

SAFETY	Master board (ECM1) Safeties lines
REMOTE	Remote control
CIL 1-2	1st and 2nd booms cylinder position sensor
CIL 3	Third boom cylinder position sensor
LOAD	Load cell board (ECM3)
ROTAT.	Reduced area board (ECM4)

This page with OK indicates the correct presence of the signals in the CAN BUS line of the different connected devices. The indication shall always be OK, if the indication is NO it means that the device is not communicating by CAN BUS line and therefore it is not considered in function by the other devices.

If it results some NO within this error page, try to check the connection, afterward if it doesn't fix the problem check and eventually replace the device, if otherwise there are only YES it's requires to go on with a software check.

Software Check

Only ff the problems occurred after a software updating, check if the platform's devices are compatibles with the new software, in this case, if necessary contact JLG with the serial number and the release number of the software install.

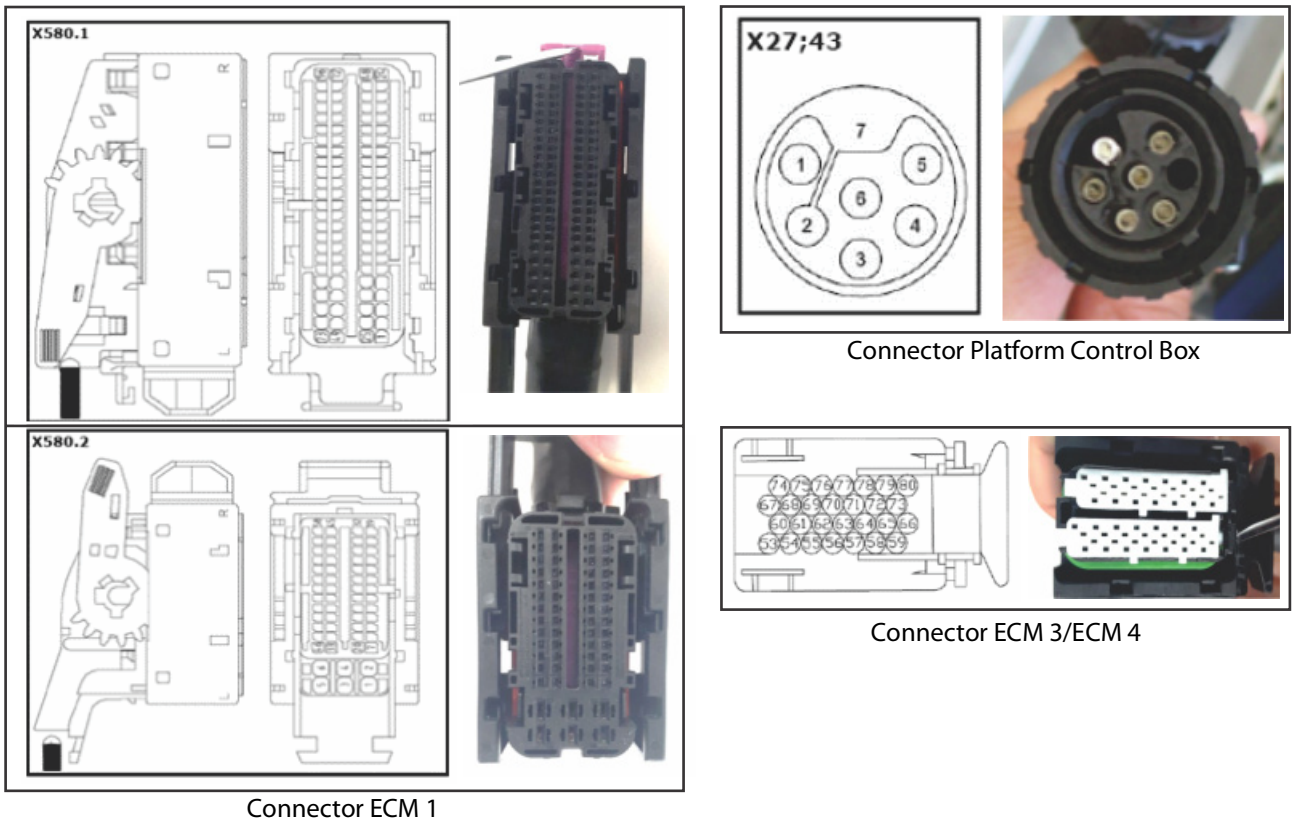
CAN BUS Devices And Connections

If you didn't fix the problem it's requires going on with CAN BUS devices and connections check that requires the following schematics:

1. CAN BUS DEVICES CONNECTIONS (here below).
2. CAN BUS DEVICES LAY-OUT (here below).
3. CAN NETWORK sheet on the electric wiring diagram ("E3").

Proceed step by step as follows:

4. DEVICES CHECK: Always with ignition switch turned OFF and the battery cutter disconnected, disconnect one by one every CAN BUS devices, the blue lines indicated in the CAN BUS devices connections here below, starting with the modem and continue with load cell board (ECM3) on the jib arm and so on. Anytime that you have disconnected one device, connecting the battery cutter and turning ON ignition switch, check if CAN BUS error disappears. To know which are the CAN BUS contacts on the devices, consult the relative page on the electric wiring diagrams
5. CONNECTIONS CHECK: Always with ignition switch turned OFF and the battery cutter disconnected, connect 2 external wires to create an alternative CAN BUS line from green connectors (example picture here below) of ECMs and disconnect the original wires. To know which are the CAN BUS contacts on the devices, consult the relative page on the electric wiring diagrams.



Connector ECM 1

Connector Platform Control Box

Connector ECM 3/ECM 4

Figure 6-50.

Anytime that you have replaced a connection, connecting the battery disconnect and turning ON ignition switch, check if CAN BUS error disappears. This operation is necessary to check not only the continuity of the wires but also the status, because it could happen that a wire is scratched so even maintaining the continuity it introduces a disturb into the signal.

PROCEEDING EXAMPLE: Always changing the connections configuration with battery disconnect disconnected, connect two external wires (red lines here below) between ECM1 and ECM3, disconnecting the original wires on this tract, then check the status: if with this configuration the error doesn't disappear means that the failure is on a device, otherwise if the error disappears it means that the failure was in the original connections (it could be possible that it appears "SEN 3 FAIL" 2nd cylinder sensor missing). Then, in case we detected the problem on the connection, replacing the original connections and substituting only the connection between ECM and the JIB CONNECTOR SCHEDULE with and external couple of wires (green lines here below), check the status, if the error appear it means that the failure was on this tract original connection, otherwise if the error disappear check the other possible tracts.

After checking, if the device is defective, change the device, if the problem is the connection it's required to repair or replace the wires.

NOTE: *Evaluate that if you have already changed more than one spares of the same device, in this case the problem could be caused for example by water going inside the box, so take a look to possible traces of oxidation on the contacts, in this case isolate better the box. Be careful that the jib box cover has a direction to be assembled, if assembled in the wrong direction water goes inside.*

Resistence Check

WITHOUT FEEDING THE SYSTEM, looking into the electric diagram of your platform (as the example here below), check the remote control/receiver and ECM1 CAN BUS resistances (in the red round) on page CAN NETWORK (page "E"), i.e. test the resistance measured within the cable H and L that should be about 120 Ohm with the device disconnected from the other and 60 Ohm with the device connected each other, (always with FEED OFF)

X26JP - X770AJ - CAN BUS Device Layout

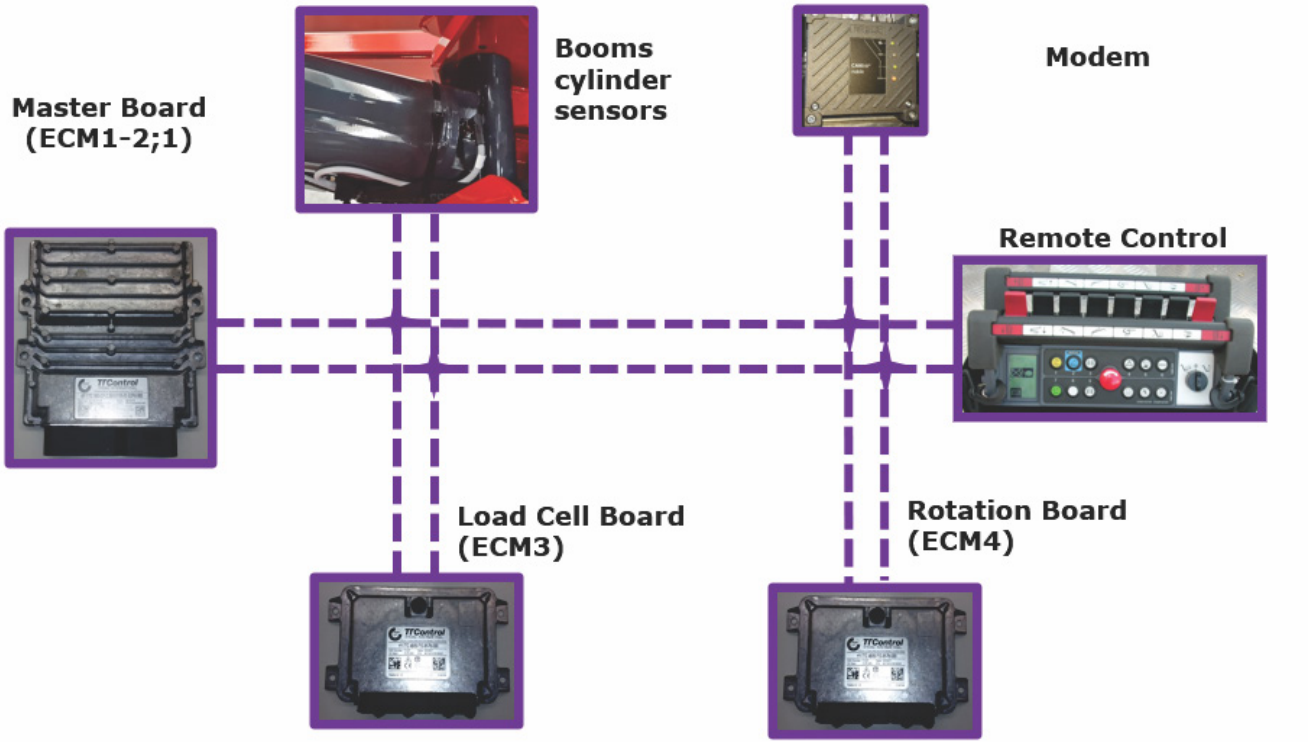


Figure 6-51.

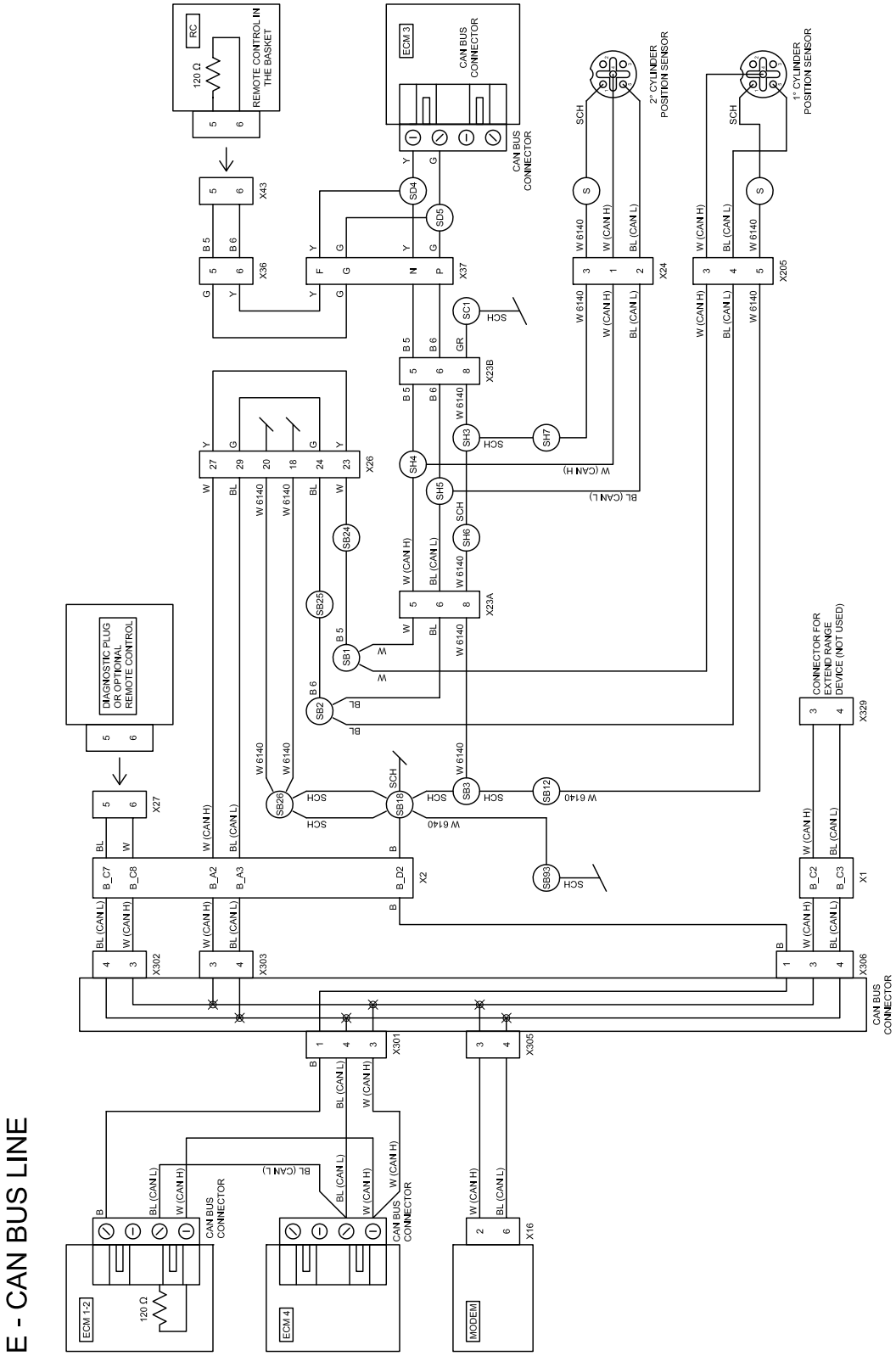

E - CAN BUS LINE
RC
120 Ω
REMOTE CONTROL IN THE BASKET
ECM 3
CAN BUS CONNECTOR
2° CYLINDER POSITION SENSOR
1° CYLINDER POSITION SENSOR
DIAGNOSTIC PLUG OR OPTIONAL REMOTE CONTROL
CONNECTOR FOR EXTEND RANGE DEVICE (NOT USED)
ECM 1-2
ECM 4
MODEM
W (CAN H)
BL (CAN L)
SCH
W 6140

Figure 6-52.

Electronic Module LED Flashing Codes

MODEM LED CODE

DL1 green LED steady ON: power ON

DL2 blue LED flashing each 1 second: Network signal searching

DL2 blue LED flashing each 3 seconds: Line ready

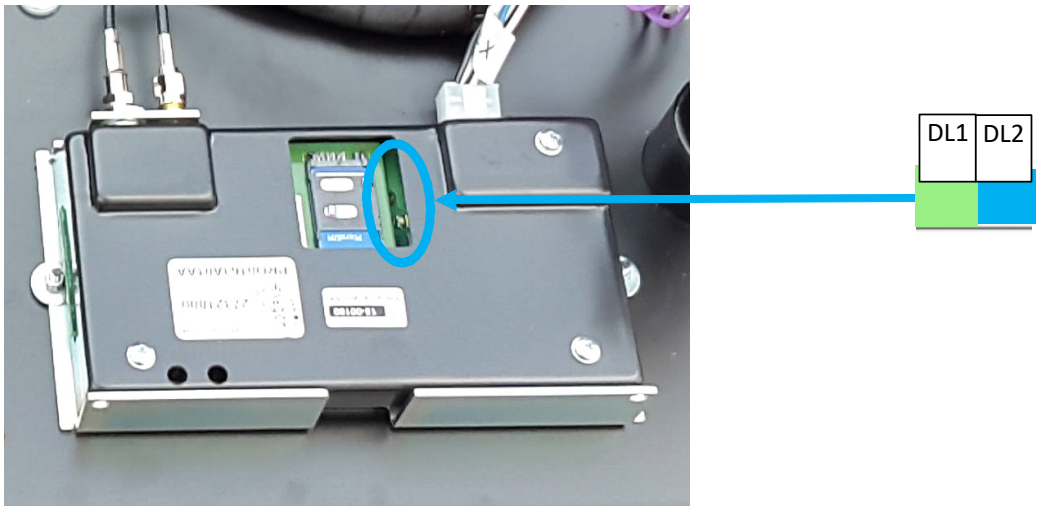
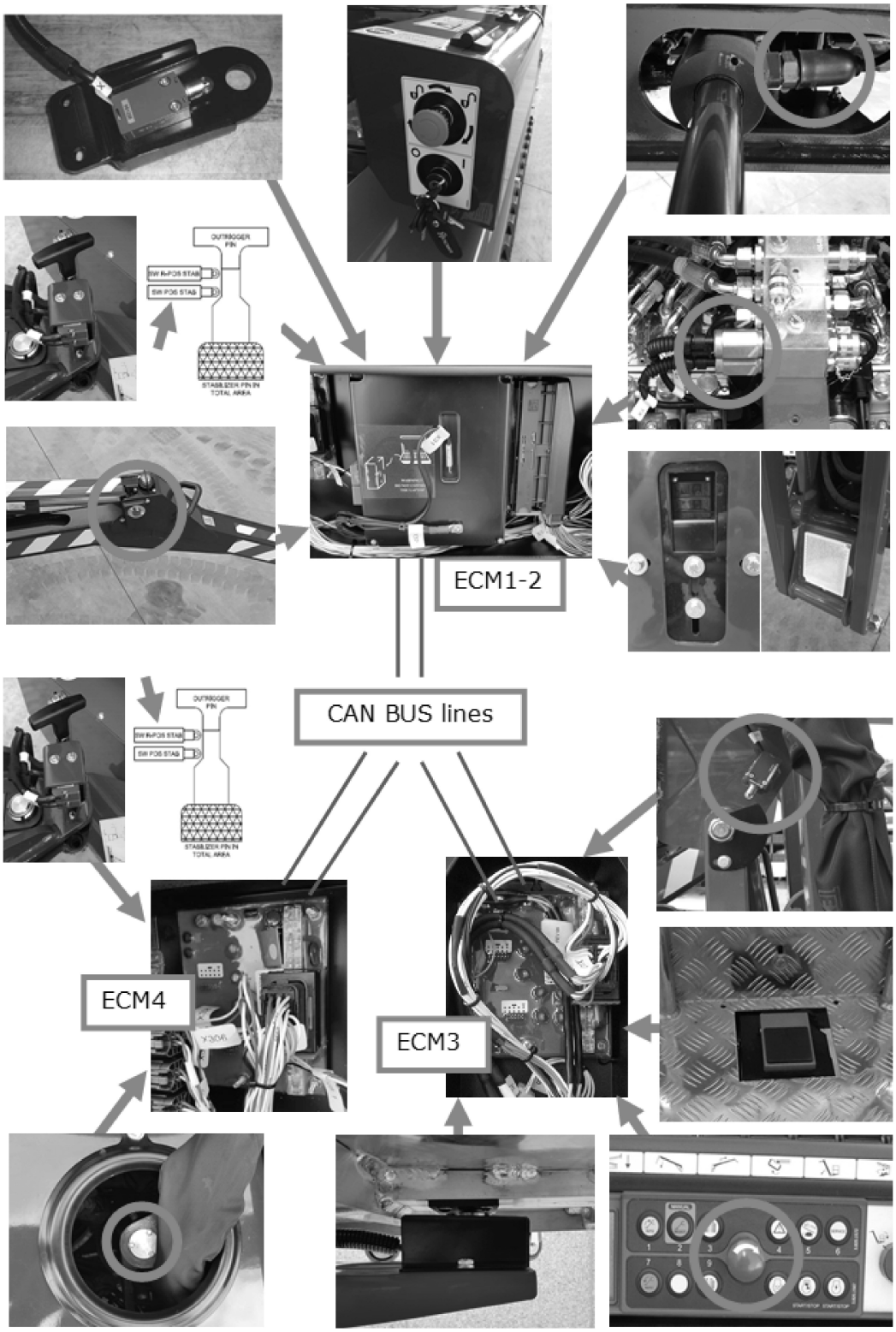


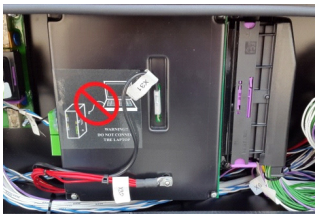
Figure 6-53.

6.4 SENSORS AND DEVICES NOT COMMUNICATING THROUGH CAN-BUS



The following devices **not** communicating through CAN BUS system are or directly connected to the ECM or indirectly through ECM3 or ECM4 that communicate through CAN BUS their conditions.

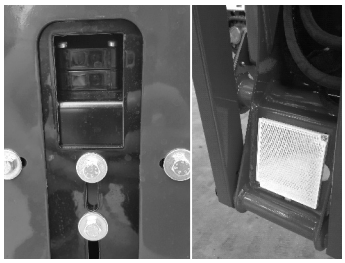
Inclinometers: they are two accelerometers sensors (one each axles) welded on the ECM. They detect the machine inclination on both axles, each one works with a double line. EMC1 accelerometers have to be calibrated once it's installed on the machine.



Load sensor: it's an extensimeter sensor that sends a double electric signal to the ECM3. These signals are compared and transduced by ECM3 that communicates the load measured through CAN BUS to the ECM1. EMC3 has to be calibrated with load cell sensor.

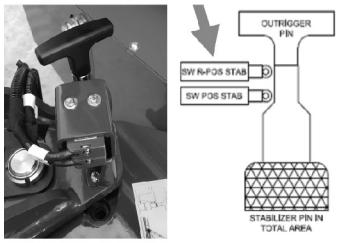
Turret rotation position sensor: it's an encoder sensor that sends a double electric signal to the ECM4. These signals are compared and transduced by ECM4 that communicates the rotation angle measured through CAN BUS to the ECM1. EMC4 has to be calibrated with turret rotation position sensor.

Photocells: they are installed on machine rear side interacting with the reflector installed on the bottom of jib, when they receive back the reflector signal it means that machine is closed and aligned. They are normally opened (NO) and are closed when the machine is closed and aligned. They are directly connected to the ECM1 working in parallel as a double line sensor.

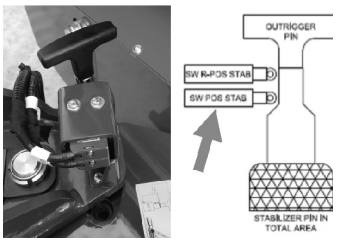


Outriggers ground microswitches: they are four switches (one each outrigger) that detect if the outrigger is touching the ground or not. They are normally closed (NC) and are released when the outrigger is touching the ground. Each one is directly connected to the ECM1 with a double line.

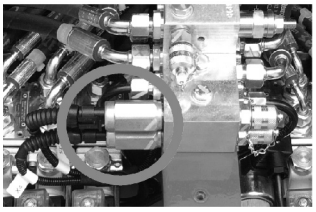
Outrigger reduced area microswitch (the upper one): they are four switches (one each outrigger) that detect if the outrigger is opened (at least half-way) or closed. They are normally closed (NC) and are released when the outrigger is opened. Each one is connected to the ECM4 with a double multiplex line (different frequencies).



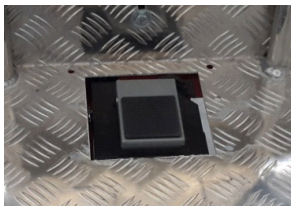
Outrigger completely opened microswitch (the lower one): they are four switches (one each outrigger) that detect if the relevant outrigger is completely opened or not. They are normally closed (NC) and are released when the outrigger is completely opened. Each one is directly connected to the ECM1 with a double line.



Pressure sensors: they are two pressure sensors installed on each hydraulic line that give the signal to the ECM1 when an high pressure value is reached. They are normally opened (NO), released when the pressure is lower than that value. They are directly connected to the ECM1 as two single lines.



Pedal: it's an OPTIONAL that could be activated by the service menu, if activated operator must press it to move the machine from the basket, preventing unintentional movements. It is normally opened (NO) and when is pressed it sends the signal to the ECM3 by a single line.

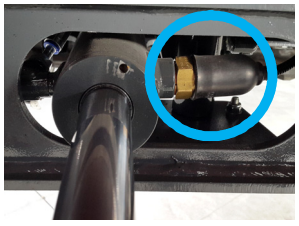


Emergency stop button on the remote control: it's a switch inside the remote control that through ECM3 and ECM4 is connected to the ECM1 with a double line. It is normally closed (NC) and it is released when the red button is released. When the remote control is connected to the ground optional cable, its emergency stop button is directly connected to the ECM1 with a single line.

Emergency stop button on the ground: it's a red button switch installed on the ground controls box directly connected to the ECM1 with a double line. It is normally closed (NC) and it is released when the red button is released.

Jib microswitch: it's used for the AUTOMATIC SPEED CONTROL function and it is installed on the upper part of jib detecting if the jib is completely closed or not. It is normally closed (NC) and is released when the jib is closed. It is connected to the ECM3 with a double line.

Tracks widening sensor switches: they are two sensors used for the AUTOMATIC SPEED CONTROL function. They are installed on the two tracks widening cylinders and detect the position of tracks completely widened or not. They and normally opened (NO) and they are connected in series directly to the ECM1.

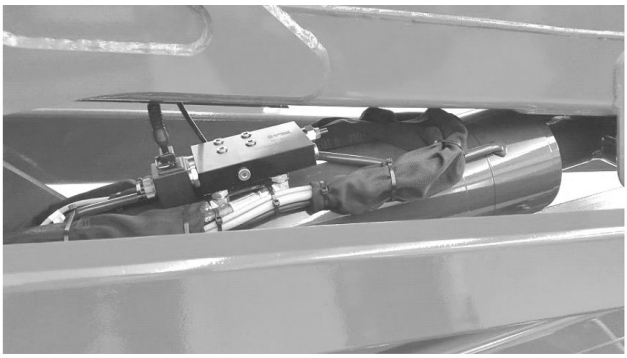


Ropes sensor switch: It's a microswitch installed inside the third boom bottom side that detect the ropes integrity. It is normally closed (NC), it would be pressed in case of the ropes will move. It is directly connected to the ECM1 with a single lines.

NOTE: *Some other devices not listed here above, such as the ones for the emergency procedures, are indicated by the wiring diagrams.*

Electrical System Sections

The cables that starting at the base going through the booms are sectionized with connectors on the 1st and 2nd booms cylinder inside the sock.



Inclination Sensor System

The inclinometers system is composed by two sensors (one each axles) welded on the master board (ECM1-2) that gives a double signal each one translated into and "X" inclination and "Y" inclination by the master board (ECM1-2).

Each double signal and compared verifying their coherency (same values within a certain tolerance).

In same case, depending on the machine condition, if an inclination is exceeding the limit or in case of anomalies such as a discordance between the two lines machine will avoid the movements showing an error message.

EMC1-2 accelerometers must be calibrated once ECM1-2 is installed on the machine, the calibration must be carried out as indicated by the APPENDIX 2.

Load Cell System

The load cell system has two components, load cell board (ECM3) and the load cell sensor.

The load cell sensor is located under the basket and it is has two extensimeters so that send a double signal to the ECM3.

ECM3 is located into the jib arm box and it elaborates that double signal communicating it translation in "Kg" or "Lbs" to the master board (ECM1) through CAN-BUS line.

ECM3 also compares the double signal verifying their coherency (same values within a certain tolerance).

In case of an overcharge (more than 230 Kg for CE system, more than 500 Lbs in ANSI system) or in case of anomalies such as a discordance between the two lines machine will avoid the aerial part movements showing an error message.

ECM3 must be calibrated with the load cell sensor, in case of one of these components need to be replaced the calibration must be carried out as indicated by the APPENDIX 4.

Rotation Sensor System

The rotation sensor system, has two components, the reduced area board (ECM4) and the turret rotation sensor.

The turret rotation sensor is installed in the centre of the turret slew ring and it is an encoder sensor that sends a double signal to the ECM4.

ECM4, located into the electric components compartment, elaborates that double signal translating it into a rotation angle and communicating it to the master board (ECM1) through CAN-BUS line.

ECM4 also compares the double signal verifying their coherency (same values within a certain tolerance).

In case of turret rotation angle is not compatible with a machine safe condition concerning variable area system and anti-collision system or in case of anomalies such as a discordance between the two lines, machine will act accordingly in case avoiding the aerial part movements and showing an error message.

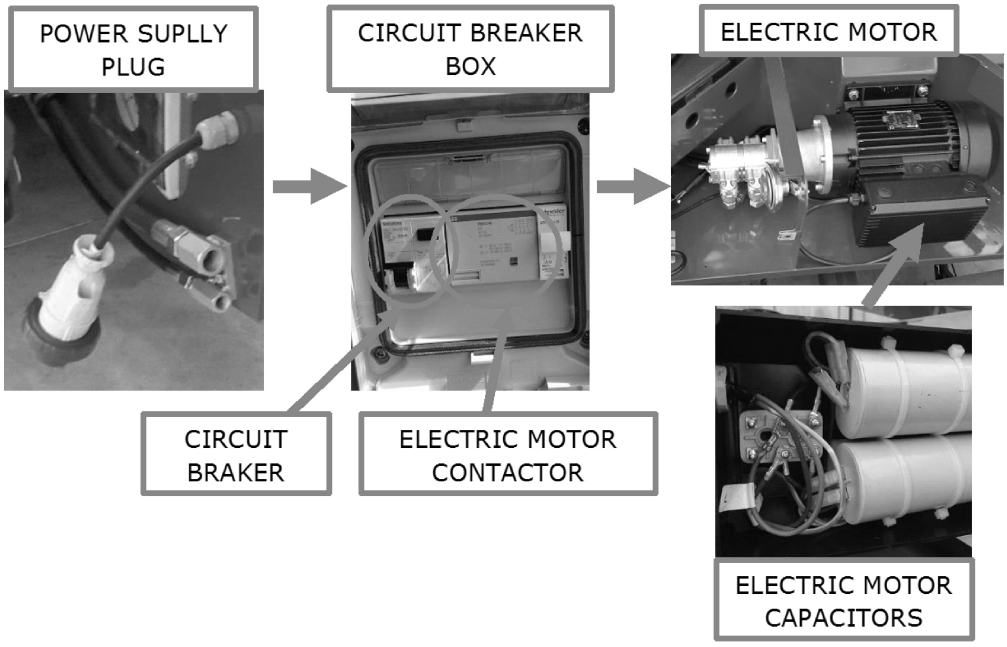
ECM4 must be calibrated with the rotation sensor, in case of one of these components need to be replaced the calibration must be carried out as indicated by the APPENDIX 5.

Electric Motor (Not For Lithium Version)

Electric motor works only when the machine is connected to the electric network (110÷230 V). To start the electric motor it is necessary to:

- connect the 110÷230V plug of the machine to the electric network
- activate the circuit breaker
- start the motor by pressing the electric motor start button (on the remote control or at the ground control box) so that its contactor is closed

Electric motor runs always at minimum speed 1500 rpm, it is equipped with two capacitors in order to limit the absorption during the motor starting.



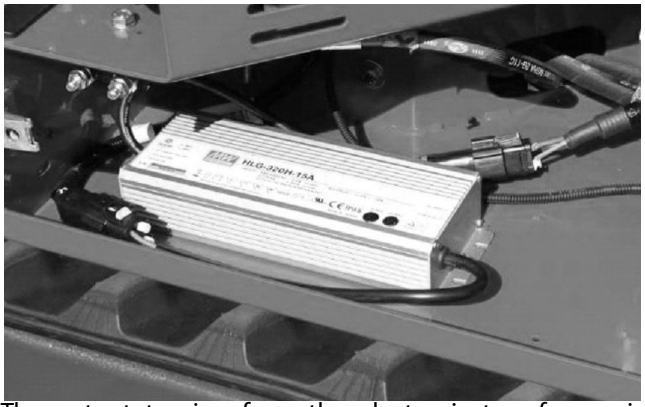
12 Volt Battery

The machine electric system works at 12 Volt, the accumulation system is composed by an AGM start&stop battery with a capacity of 70 Ah.

12 Volt battery is feed by the engine generator while engine is running or by the battery charger described by the following chapter while machine is plugged to the electric network.

Battery Charge System

The battery charge is carried out by the electronic transformer located under the base bonnet aside the electric motor.



The output tension from the electronic transformer is fixed at 14 Volt DC and it does not depend on the electric network tension or frequency.

The output current is automatically regulated at a maximum of 19 Amp.

6.5 CALIBRATION REQUIREMENT

This machine incorporates a variety of sensors and a high degree of function interaction. For safety and proper machine functionality, the calibration procedures must be repeated for any control module replacement, system calibration related fault, or removal or replacement of any sensors, valves, coils.

The chart below lists the calibrations required and potential reasons for recalibrating.

All calibration procedures are menu driven through the REMOTE CONTROL.

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, pumps, and motors.

NOTICE

A REPLACEMENT OF A NEW ECM 1AND 3 REQUIRE TO FLASH THE PROPER MACHINE MODEL SOFTWARE AND TO ADJUST THE MACHINE SETTINGS. A REPLACEMENT OF A NEW ECM 1 DOES NOT REQUIRE THE CALIBRATION OF ECM 3 AND THE JOYSTICKS.

Table 6-3. Calibration modules

CALIBRATION PROCEDURE	REASONS FOR RE-CALIBRATION
LOAD Cell Calibration	LSS Module ECM3 replacement LSS Sensor removal or replacement
Joystick Calibration	Joystick replacement
Chassis Tilt Calibration	Master Board ECM1 removal or replacement Tilt indication inaccuracy
Rotator Sensors Calibration	Board ECM4 rotator sensor replacement Rotator sensor removal or replacement

6.6 PLATFORM REMOTE CONTROL SERVICE

Service Button

A SERVICE button is present on the remote control which allows to view the status of the machine parameters and is an aid in the safety checks of the machine.

With machine power on, by pressing the SERVICE button a numerical menu is displayed on the LCD display, each of these menu items can be accessed by pressing the corresponding platform/remote control buttons.

To navigate through the menu use the Buttons Numbered 1 Thru 9.

The top level menus are as follows:

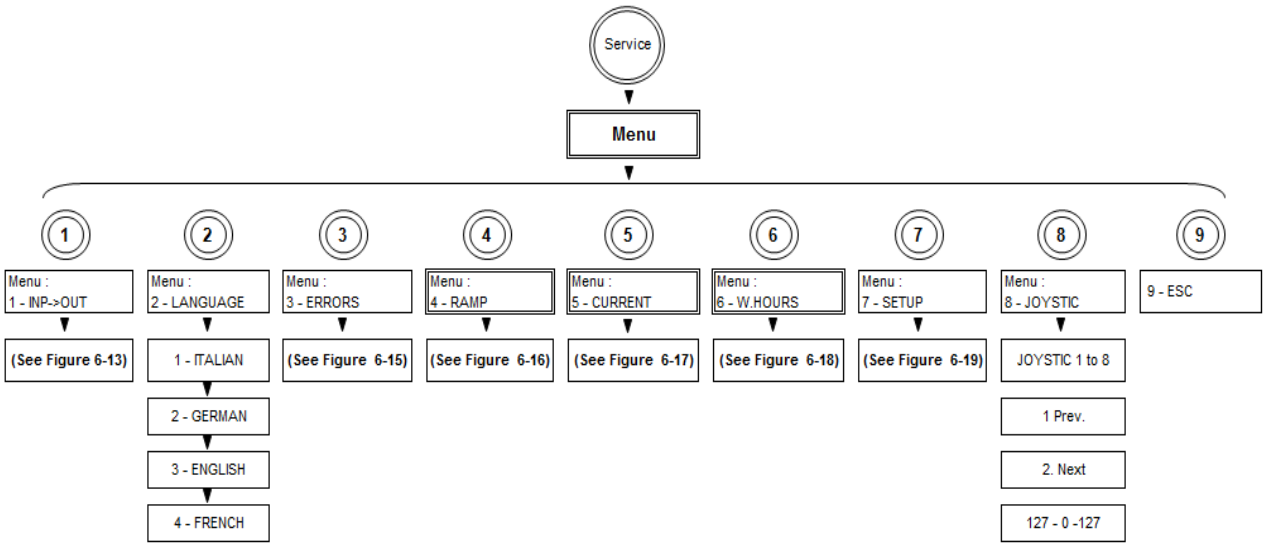


Figure 6-54. Menu Services

NOTE: *The layout shown includes all possible analyzer screens. Please note that some screens may not be available or with different description depending upon machine configuration or language set-up.*

Using The Service Program

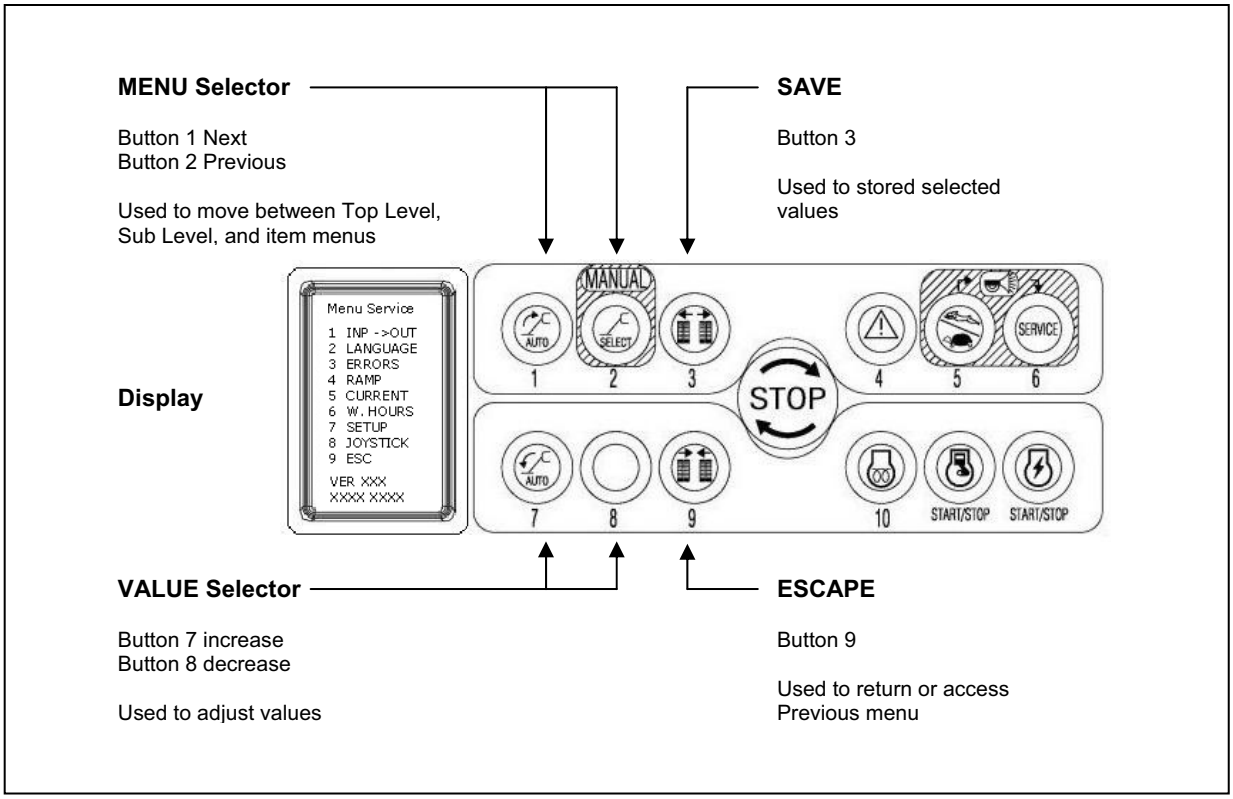
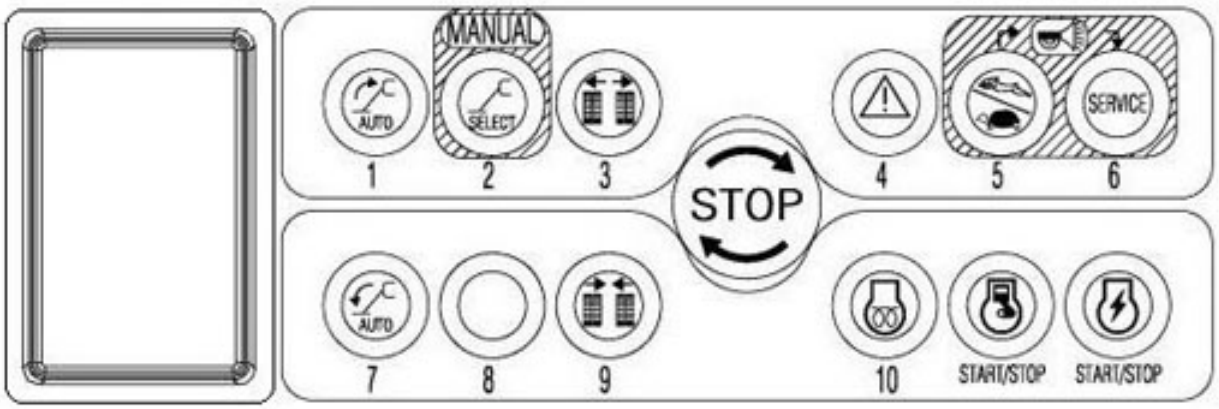


Figure 6-55. Service Mode Button Use

- To select a displayed menu item, press button 6 - **SERVICE**.
- To cancel a selected menu item, press button 9 - **ESC**, to escape.
- From the SERVICE menu use the buttons 1-2-3-7-8 to navigate through the menu, as noted in illustration above.
- From the SERVICE menu, use button selection “7 Setup”, the button “5 Password” then enter a proper password (by using buttons 1 to 9) to advance to a lower level.
- Once OK is displayed, press button “9 ESC”, MENU should display and then press the button for proper MENU, which will permit to change machine settings.



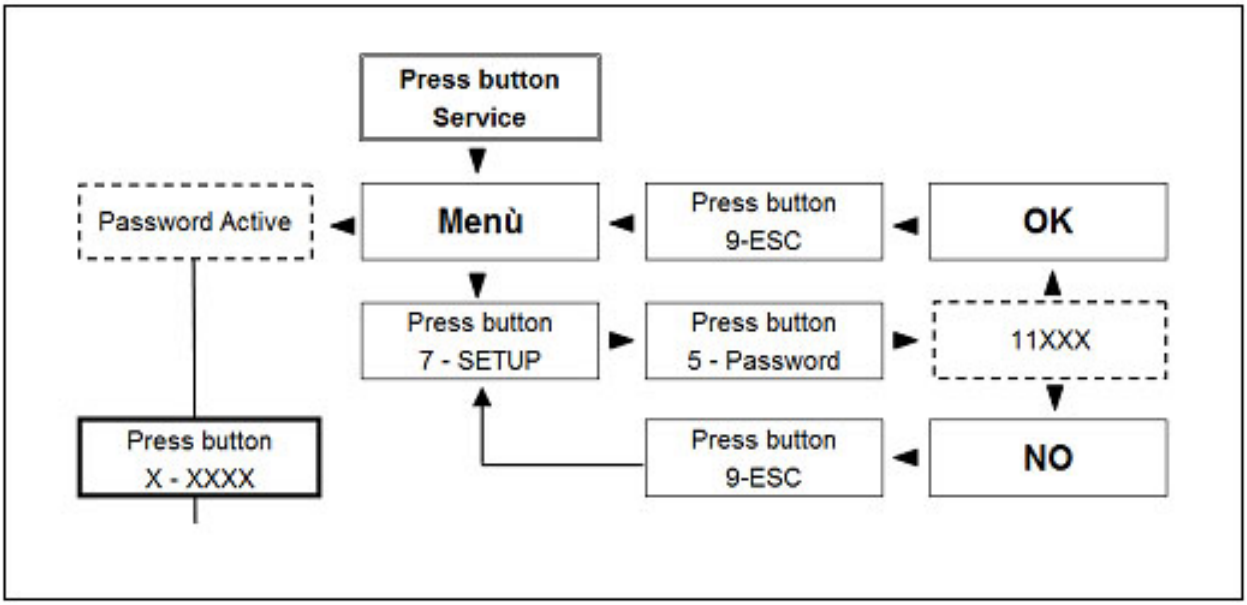


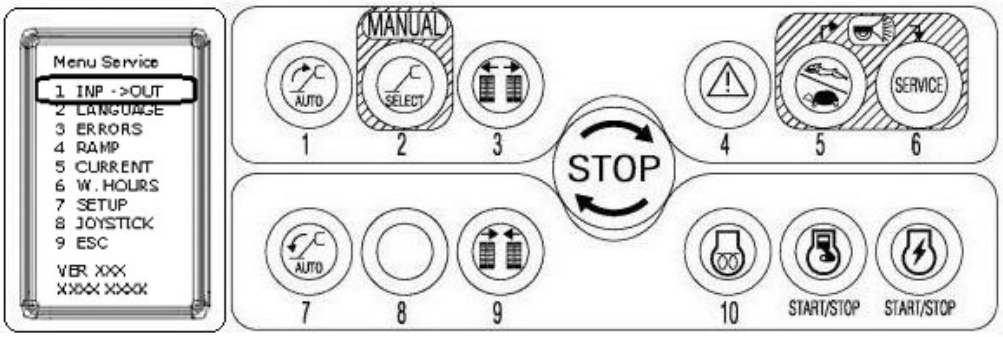
Figure 6-56. Password Use

NOTE: ***If NO*** *is displayed, after digit the password, press button "9 Esc" to return to Menu, and repeat the procedure.*

NOTE: *Password will remain active if Key Switch is left ON, even if "9 - Esc" is pressed from the service menu.*

Input Menu

From the SERVICE menu, pressing button 1 "INPUT" to accesses menu INPUT.



The menu INPUT allows you to visualize the status (or changes of status) of all the devices connected to the main control module. Machine diagnostic devices status or values are shown on the display

Use the buttons 1 "PREV." and 2 "NEXT" to choose the device.

Press button 9 "ESC" to Esc from menu.

ANSI-SPEC - X770AJ
CE-SPEC - X26JP

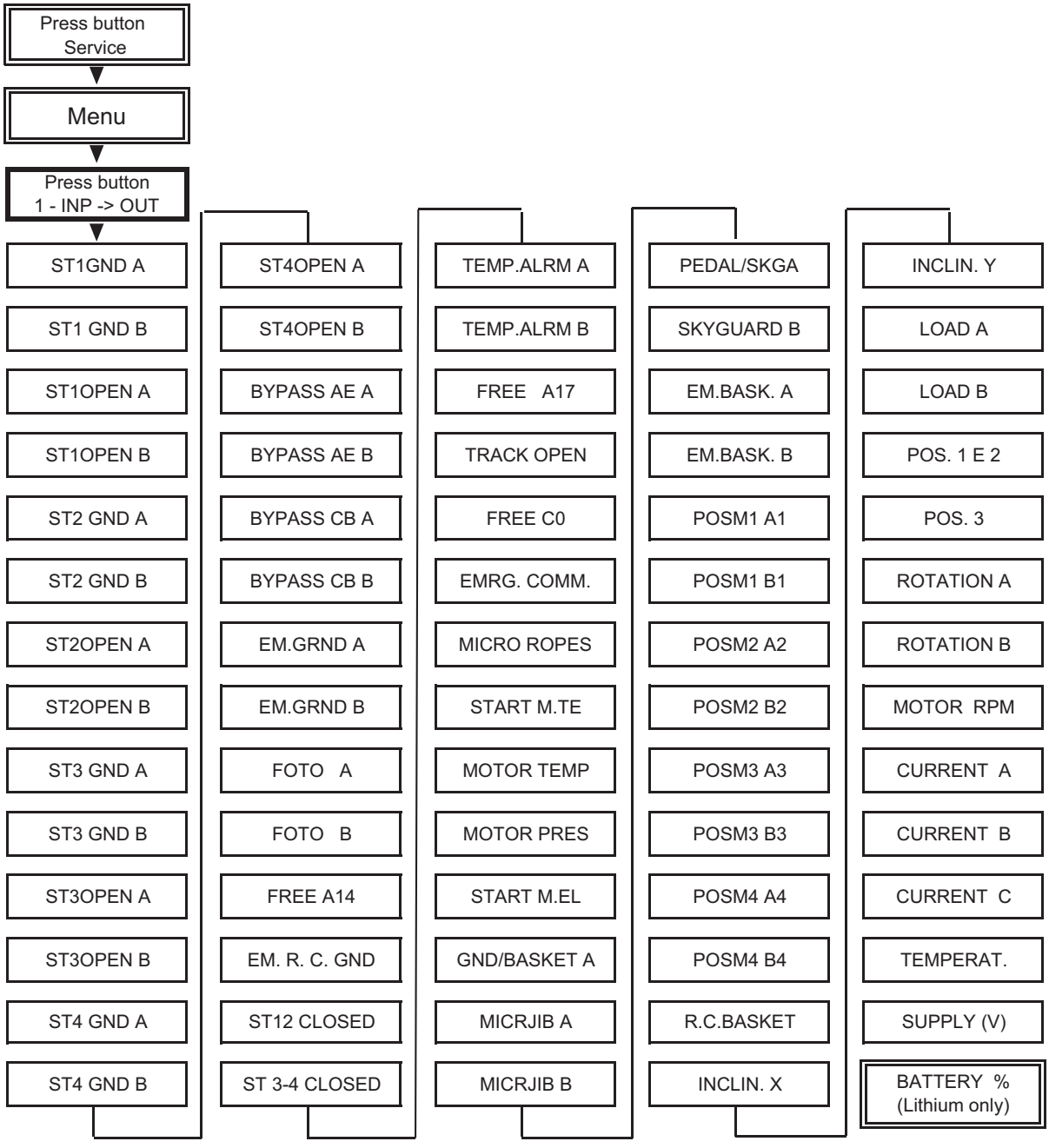


Figure 6-57. Input Menu Flow Chart

Table 6-4.

Table 6-5. Input Menu Item - Explanation

X26JP - X770AJ (S/N C170001340 to Present)

ST1 GND AB	DOWN DOWN	Outrigger n.1 on the ground – the switch is released, line A is open and line B is closed
	Up UP	Outrigger n.1 lifted – the switch is pressed, line A is closed and line B is open
ST1 OPEN AB	ON ON	Outrigger n.1 is opened, half-way or completely - the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.1 is closed – the switch is pressed, line A is closed and line B is open
ST1 TOT	ON ON	Outrigger n.1 is completely opened – the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.1 is closed or only half-way opened – the switch is pressed, line A is closed and line B is open
ST2 GND AB	DOWN DOWN	Outrigger n.2 on the ground – the switch is released, line A is open and line B is closed
	Up Up	Outrigger n.2 lifted – the switch is pressed, line A is closed and line B is open
ST2 OPEN AB	ON ON	Outrigger n.2 is opened, half-way or completely - the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.2 is closed – the switch is pressed, line A is closed and line B is open
ST2 TOT	ON ON	Outrigger n.2 is completely opened – the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.2 is closed or only half-way opened – the switch is pressed, line A is closed and line B is open
ST3 GND AB	DOWN DOWN	Outrigger n.3 on the ground – the switch is released, line A is open and line B is closed
	UP UP	Outrigger n.3 lifted – the switch is pressed, line A is closed and line B is open
ST3 OPEN AB	ON ON	Outrigger n.3 is opened, half-way or completely - the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.3 is closed – the switch is pressed, line A is closed and line B is open
ST3 TOT	ON ON	Outrigger n.3 is completely opened – the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.3 is closed or only half-way opened – the switch is pressed, line A is closed and line B is open
ST4 GND AB	DOWN DOWN	Outrigger n.4 on the ground – the switch is released, line A is open and line B is closed
	Up UP	Outrigger n.4 lifted – the switch is pressed, line A is closed and line B is open

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ST4 OPEN AB	ON ON	Outrigger n.4 is opened, half-way or completely - the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.4 is closed – the switch is pressed, line A is closed and line B is open
ST4 TOT	ON ON	Outrigger n.4 is completely opened – the switch is released, line A is open and line B is closed
	OFF OFF	Outrigger n.4 is closed or only half-way opened – the switch is pressed, line A is closed and line B is open
BYPASAE AB	ON ON	The aerial part safeties are deactivated through the safeties by-pass key switch (emergency condition) – line A is open and line B is closed
	OFF OFF	The aerial part safeties are activated (normal working condition) – line A is closed and line B is open
BYPASTR AB	ON ON	The track safeties are deactivated through the safeties by-pass key switch (emergency condition) – line A is open and line B is closed
	OFF OFF	The track safeties are activated (normal working condition) – line A is closed and line B is open
STOP GND AB	ON ON	Stop button on the ground is pressed – line A is closed and line B is open
	OFF OFF	Stop button on the ground is released – line A is open and line B is closed
STOP RC DW	ON ON	Stop button on the remote control ground connected on the ground is pressed – lines A and B of the stop button are open
	OFF OFF	Stop button on the remote control ground connected on the ground is released – lines A and B of the stop button are closed
STOP RC UP	ON ON	The stop button on remote control is pressed – lines A and B of the stop button are open
	OFF OFF	The stop button on remote control is released – lines A and B of the stop button are closed
PHOTO AB	ON ON	TPhotocells are aligned with the reflector (machine is closed and aligned) – Photocell A (the lower one) contact is open and photocell B (the upper one) contact is closed
	OFF OFF	Photocells are not aligned with the reflector (machine is not closed and aligned) – Photocell A (the lower one) contact is closed and photocell B (the upper one) contact is open
ST12 CLOSED	ON	Pressure switch of outriggers n.1 and n.2 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	Pressure switch contact of outriggers n.1 and n.2 is opened – the outriggers are open, partially open or already closed
ST34 CLOSED	ON	Pressure switch of outriggers n.3 and n.4 closes the contact – the outriggers are at end run and the max pressure valve is opened
	OFF	Pressure switch contact of outriggers n.3 and n.4 is opened – the outriggers are open, partially open or already closed
TEMP ALRM A Option reserved for some markets	ON	Temperature external probe reached the maximum value, the temperature probe is closed
	OFF	Temperature external probe hasn't reached the maximum value, the temperature probe is open

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GENERATOR (Only for gasoline machine)	ON	Engine is running
	OFF	Engine is not running
GND CTRL	ON	The control position selector for aerial part operation from the ground is activated (emergency condition)
	OFF	The control position selector for aerial part operation is released (normal working condition)
ROPES	ON ON	The cables of the extension are OK. The control switch of the cables on extension is released and the line is closed (normal working condition)
	OFF OFF	At list one cable on the extension is out of order. The control switch of the cables on extension is pressed and the line is open (emergency condition)
ENGINE ON	ON	The ground button for engine start is pressed
	OFF	The ground button for engine start is released
MOTOR TEMP. (Only for Diesel machine)	ON	The engine reached the max functioning temperature (emergency condition)
	OFF	The engine maintains the correct functioning temperature (normal working condition)
MOTOR PRES. (Only for Diesel machine)	ON	The engine oil pressure is inadequate (emergency condition)
	OFF	The engine oil pressure is OK (normal working condition)
ELE MOT ON	ON	The ground button for electric motor start is pressed
	OFF	The ground button for electric motor start is released
RC UP CTRL	ON	The control position selector is positioned on “basket”
	OFF	The control position selector is positioned on “ground”
MICROJIB AB	DOWN DOWN	The JIB is closed – the control switch is released, line A is open and line B is closed
	UP UP	The JIB is open – the control switch is pressed, line A is closed and line B is open
PEDAL AB (Option)	ON ON	The pedal is pressed– the pedal electric line A is open and line B is closed
	OFF OFF	The pedal is released – the pedal electric line A is closed and line B is open
RC BASKET	ON	The remote control is in the support in basket
	OFF	The remote control is not in the support in basket
TR.OPEN LFT	ON	Left track is fully widened. Widening cylinder of left track contact is closed
	OFF	Left track is not fully widened. Widening cylinder of left track contact is open
TR.OPEN RGT	ON	Right track is fully widened. Widening cylinder of right track contact is closed
	OFF	Right track is not fully widened. Widening cylinder of right track contact is open
INCLIN. X	0, 05	Indicates the inclination of the machine on the X axis in degrees
INCLIN. Y	0, 30	Indicates the inclination of the machine on the Y axis of degrees

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LOAD AB	133 134	Indicates the weight of the basket (about 50 Kg) plus the weight into the basket in Kg measured by A and B lines
SEN CYL 1-2	2073	Indicates the opening of the 1st-2nd boom cylinder in tenths of a millimetre
SEN CYL 3	2073	Indicates the opening of the 3rd boom cylinder in tenths of a millimetre
ROTATION AB	180 181	Indicates the turret rotation angle (0°÷360°) measured by lines A and B, 180° indicates the aligned position
SKYGUARD	ON	Indicates that Skyguard bar has been pressed.
	OFF	Indicates that Skyguard bar has not been pressed.
MOTOR RPM. (Only for Diesel machine)	2220	Indicates the Diesel engine rpm
TEMP.	37, 62	Indicates the temperature of the ECM1 in °C
SUPPLY (V)	12, 15	Indicates the batteries voltage, or the output voltage from the battery charger
V HIGH CEL	3317	Indicates the voltage at the lowest cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3.3 Volt
	2	Indicates the number of the lowest cell
V AVG CELL	3316	Indicates the average voltage of the cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3.3 Volt
V LOW CELL	3315	Indicates the voltage at the lowest cell. When the cells are not under charge or under discharge, it tends to the nominal value that is around 3.3 Volt
	12	Indicates the number of the lowest cell
CHG SETUP	30	Indicates the maximum current (Amp) that BMS requires to the battery charger (with lithium pack not fully charge)
T HIGH CEL	23	Indicates the highest temperature (°C) detected among the cells
	2	Indicates the number of the temperature sensor with the highest temperature detected
T AVG CEL	23	Indicates the average temperature (°C) detected among the cells
T LOW CEL	23	Indicates the lowest temperature (°C) detected among the cells
	1	Indicates the number of the temperature sensor with the lowest temperature detected
T BMS	27	Indicates the temperature (°C) detected on the BMS
REM CAP AH	80	Indicates the remaining capacity (Ah)
R HIGH CELL	1	Indicates the highest resistance (mOhm) of the cells
	1	Indicates the number of the cell with the highest resistance
R AVG CELL	1	Indicates the average resistance (mOhm) of the cells
R LOW CELL	1	Indicates the lowest resistance (mOhm) of the cells
	1	Indicates the number of the cell with the lowest resistance

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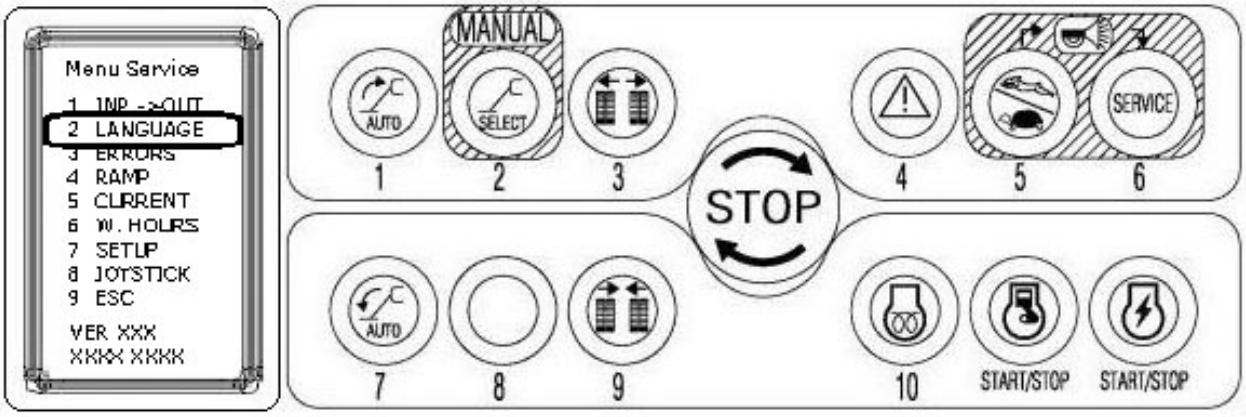
HOURS INV	27	It counts the working hours with engine running
RPM INV	0	Indicates the electric motor rpm read by the engine rpm sensor. At a certain rpm setting, the rpm read depends also on the electric load
CONTACTOR	ON	Indicates that internal contactor is closed by bms (no error in progress)
	OFF	Indicates that internal contactor is opened by the bms
HEATER	ON	Indicates that lithium pack heaters are working to heat the cells, they are automatically activated
	OFF	Indicates that lithium pack heaters are off
COOLING	ON	Indicates that lithium pack fans of cooling system are running to cool the lithium pack, they are automatically activated
	OFF	Indicates that lithium pack fans of cooling system are not running
SOC (%)	89	Indicates the charge level of the battery pack, 100 % is the maximum, 0 % is the minimum
BAT PACK V	79	IIndicates the total voltage of the lithium pack. When the cells are not under charge or under discharge, it tends to the nominal value that is around 40 Volt, it doesn't matter their charge status.
CURRENT A	0	Indicates the value of the current (Amp) measured by the LEM sensor. With sign "–" the current is going out from the battery pack (discharge), if there is no sign, the current is going inside the pack (charge)
BMS STATUS	1	Indicates the bms status ("1" is the nominal condition)

Language Menu

From the SERVICE menu, pressing button 2"LANGUAGE" to accesses menu language.

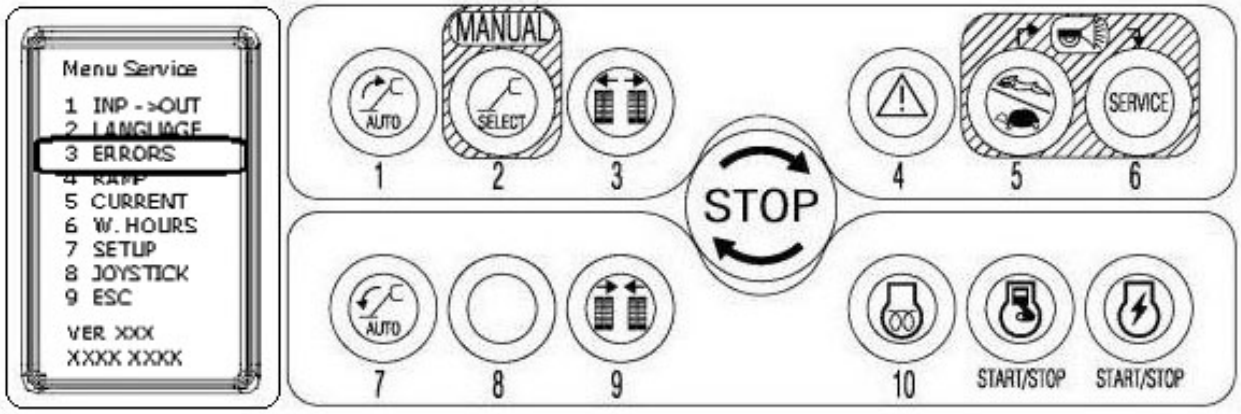


Using the buttons 1 to 4 to select the language desired.
Press button 9"ESC" to save the change.

The languages available are:
Button 1 - Italian
Button 2 - German
Button 3 - English
Button 4 - French
Button 5 - Spanish

Errors Menu

From the SERVICE menu, pressing button 3"ERROR" accesses the menu of errors to identification of malfunctioning of some devices.

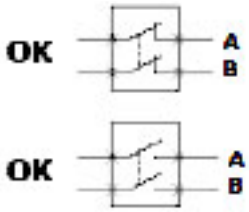


The faults highlighted by this list refer to devices with two safety lines, where the signal of the two lines is not coherent.

Errors menu underlines only the non-concordance between two safety lines (A and B) monitoring the same control, gives OK or NO in the errors menu.

OK

- Indication the signals agree.

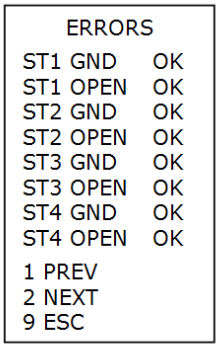


NO

- Indication the signals have a discordant value, in this case the icon HELP ERROR may automatically appear on the display.

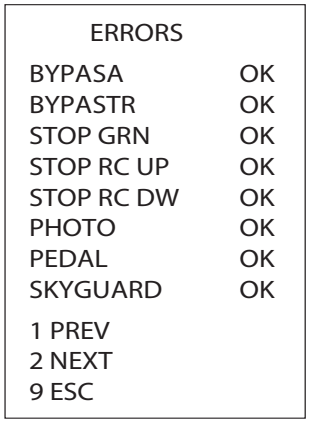
Table 6-6. Error Manu Flow Chart

Errors 1 - SCREEN



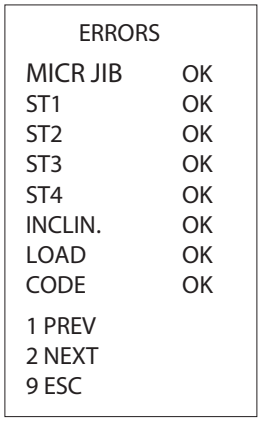
ST1 GND	Outrigger n.1 on the ground switch
ST1 OPEN	Outrigger n.1 opened (at least half-way) switch (Only X26JP-X770AJ)
ST2 GND	Outrigger n.2 on the ground switch
ST2 OPEN	Outrigger n.2 opened (at least half-way) switch (Only X26JP-X770AJ)
ST3 GND	Outrigger n.3 on the ground switch
ST3 OPEN	Outrigger n.3 opened (at least half-way) switch (Only X26JP-X770AJ)
ST4 GND	Outrigger n.4 on the ground switch
ST4 OPEN	Outrigger n.4 opened (at least half-way) switch (Only X26JP-X770AJ)

Errors 2 - SCREEN
(S/N C170001340 to Present)



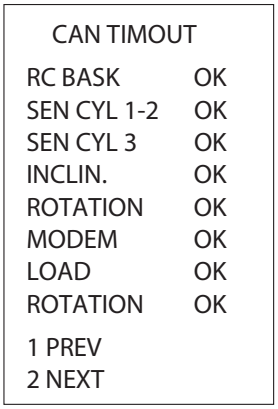
BYPAS AE	Aerial part safeties by - pass switch
BYPAS TR	Ground part safeties by - pass switch
STOP GRN	Stop button on the ground
STOP RC UP	Remote control stop button on the basket
STOP RC SW	Remote control stop button on the ground
PHOTO	Photocells
PEDAL	Pedal
SKYGUARD	Anti - entrapment system

Errors 3 - SCREEN
(S/N C170001340 to Present)



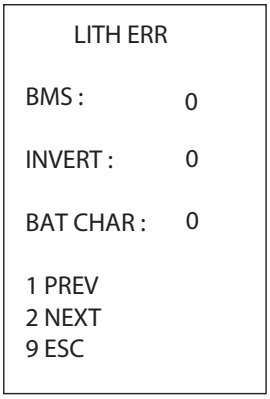
MICR JIB	Jib opening switch
POSM1	Outrigger n.1 completely opened switch
POSM2	Outrigger n.2 completely opened switch
POSM3	Outrigger n.3 completely opened switch
POSM4	Outrigger n.4 completely opened switch
INCLIN.	Machine inclination sensors
LOAD	Basket load cell sensor
CODE	Do not consider

CAN MESSAGE - SCREEN
(S/N C170001340 to Present)



RC BASK	Remote control
SEN CYL 1-2	1 st – 2 nd boom cylinder position sensor
SEN CYL 3	3 RD boom cylinder position sensor
INCLIN.	Machine inclination sensors
ROTATION	Do not consider
MODEM	Modem
LOAD	Load cell board (ECM3)
ROTATION	Reduced area board (ECM4)

Lithium Powered Model - SCREEN
(S/N C170001340 to Present)

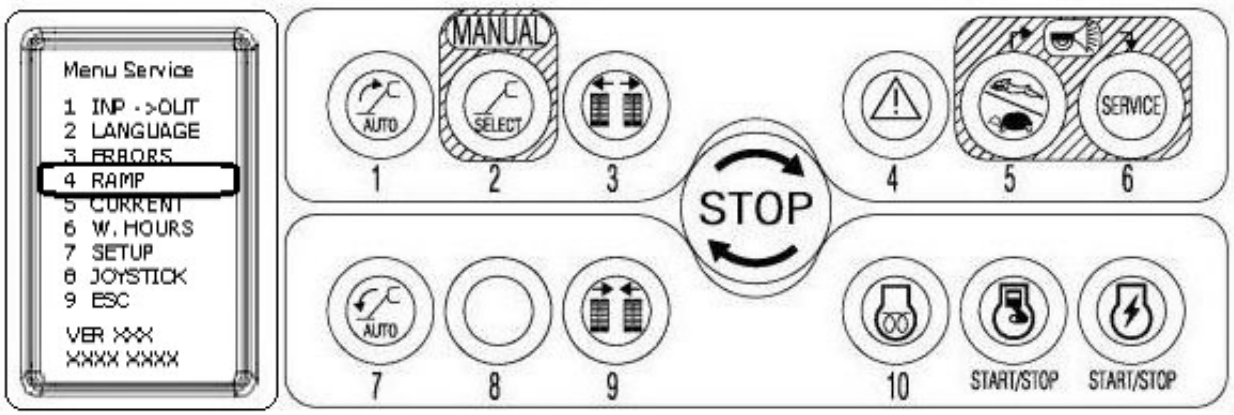


The fifth page has to be considered only for Lithium machines, BMS, INVERT and BAT CHAR are indicated as "0" otherwise it means there's a Lithium error in progress.

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

RAMP Menu

From the SERVICE menu, pressing button 4"RAMP" accesses the menu RAMP to adjust the parameter settings in order to achieved optimum machine performance.



1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".

   Using the remote control buttons to enter the password 1883.

NOTE: *password permit to change all RAMP Settings.*

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

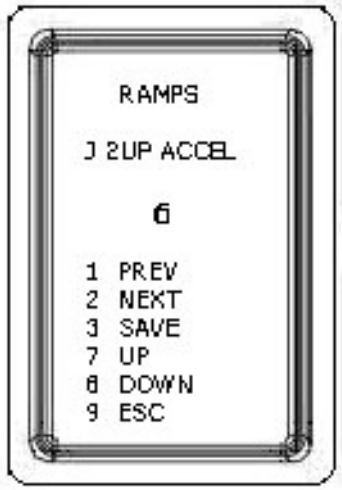
3. Press button 9 "ESC" two times.

   Repeat the above steps if "NO" appear on the display.

4. Press button 4 "RAMP" to enter in menu ramps setting.

   Use buttons 1"PREV." and 2"NEXT" to scroll the various functions.

5. Use buttons 7"UP" and 8"DOWN" to adjust the values.
6. Press button 3"SAVE" to save.



NOTE: *Every time the ramp value gets modified button 3 to save must be pressed, otherwise the modification is not activated.*

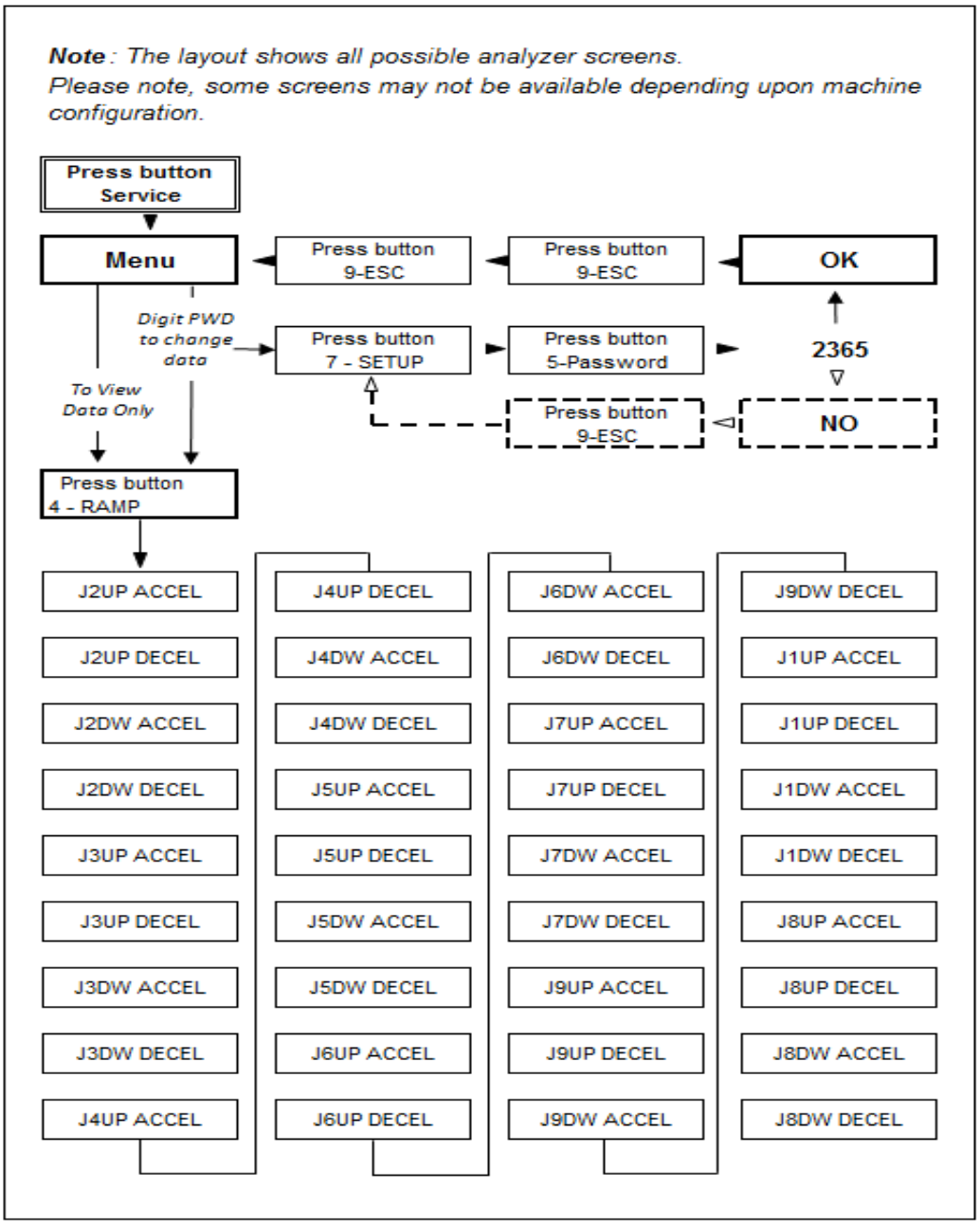
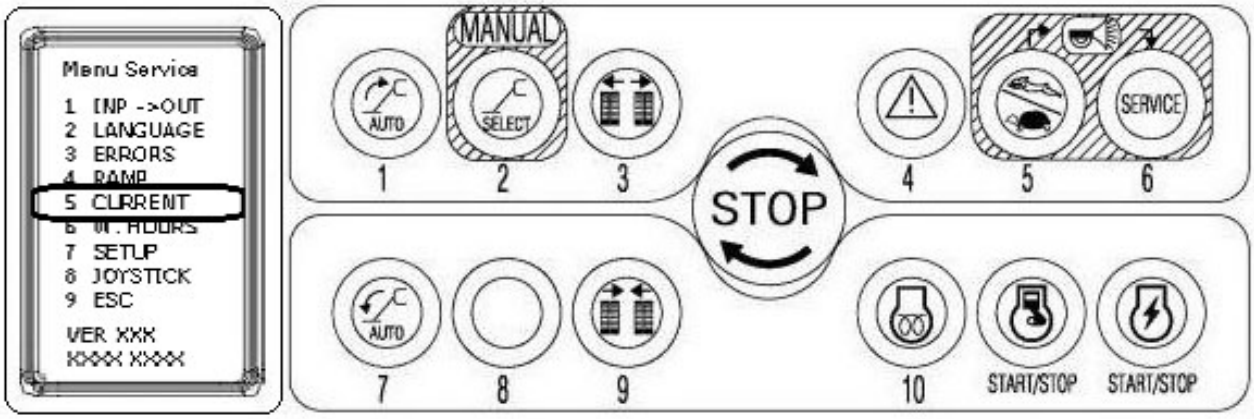


Figure 6-58. RAMP Menu Flow Chart

CURRENT Menu

From the SERVICE menu, pressing button 5 "CURRENT" accesses the menu CURRENT to adjust the parameter settings in order to achieved optimum machine performance.



1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".

   Using the remote control buttons to enter the password 1883.

NOTE: *password permit to change all CURRENT Settings.*

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

3. Press button 9 "ESC" two times.

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

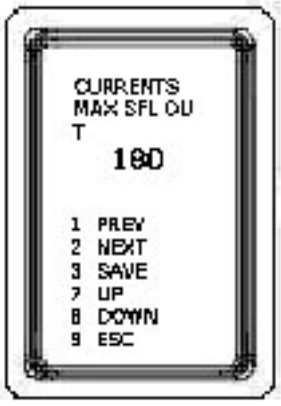
4. Press button 5 "CURRENT" to enter in menu current setting.

   Use buttons 1 PREV. and 2 NEXT to scroll the various functions.

5. Use buttons 7 UP and 8 DOWN to adjust the values.
6. Press button 3 SAVE to save

NOTE: *Every time the ramp value gets modified button 3 to save must be pressed; otherwise the modification is not activated.*

NOTE: *Personality settings can be adjusted within the adjustment range in order to achieve optimum machine performance.*



NOTE: *Refer to Table 6.8, Time range (sec) for recommended settings.*

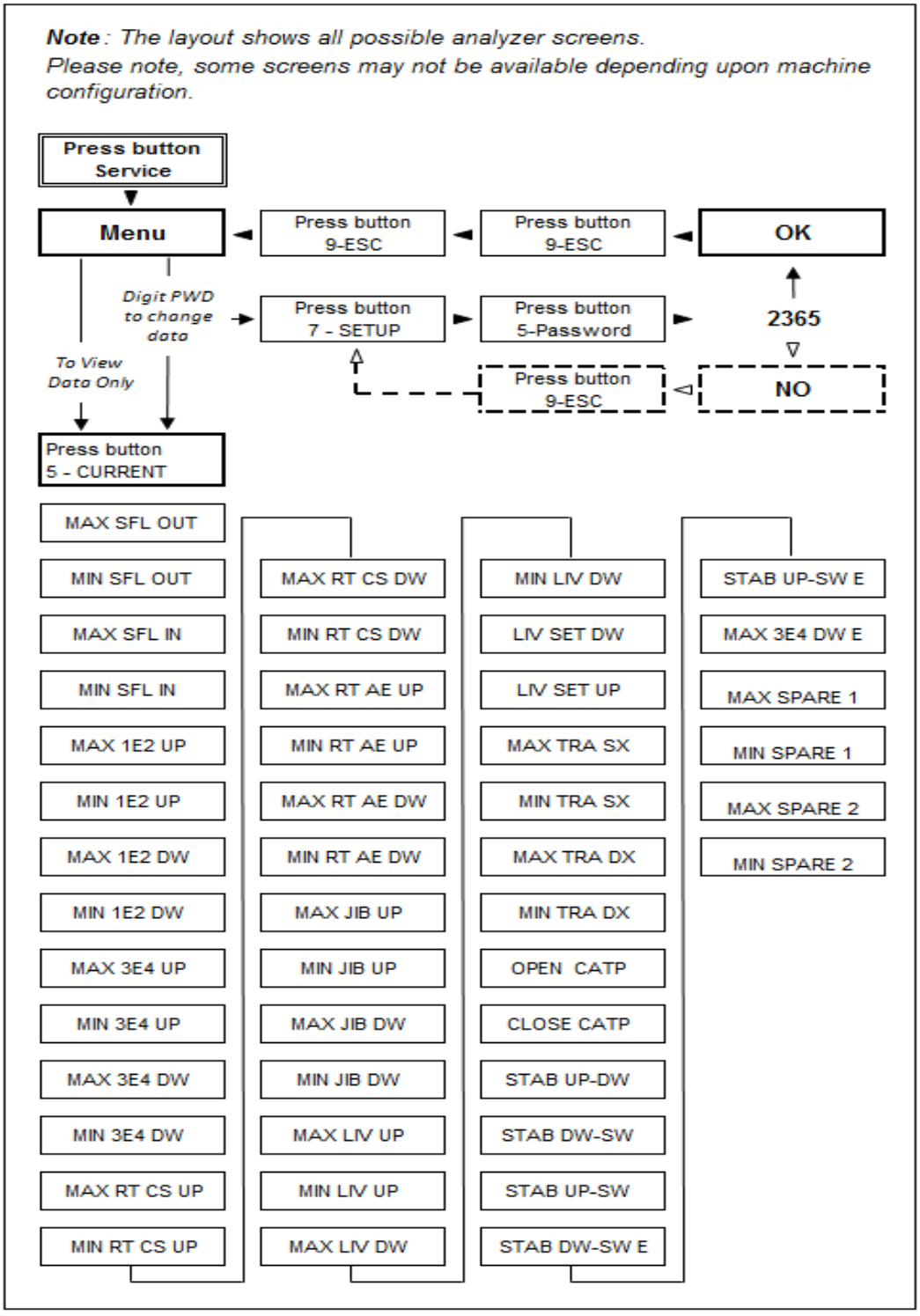
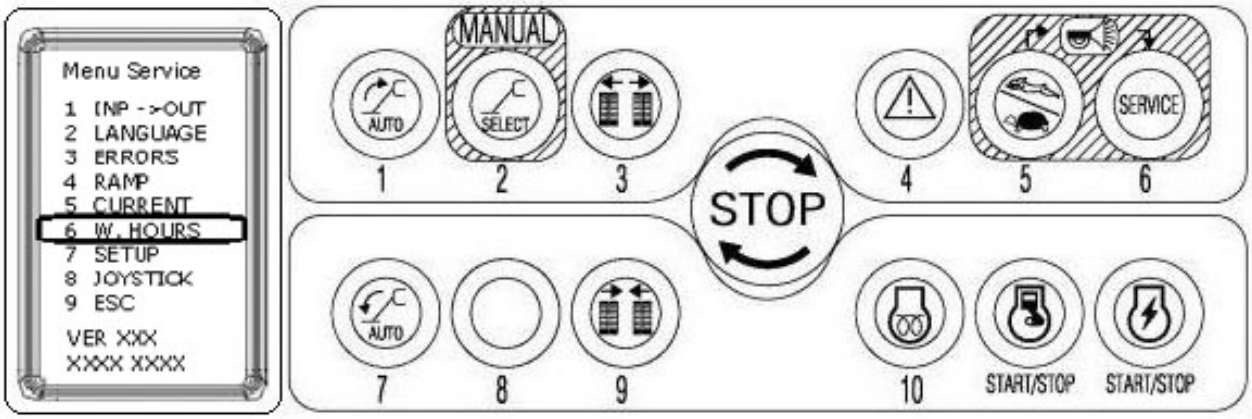


Figure 6-59. CURRENT Menu Flow Chart

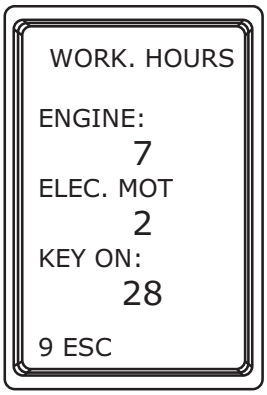
Working Hours Menu

From the SERVICE menu, pressing button 6 "W.HOURS" accesses the menu Working Hours.
This menu allows viewing the working hours of the thermic engine and the electrical motor.
On lithium models, machine hours only.



To view the working hours of the Engine or Electrical motor.
Press button 6"W.HOURS".

(Prior to SN C170001340)



MAF00890

(SN C170001340 to Present)

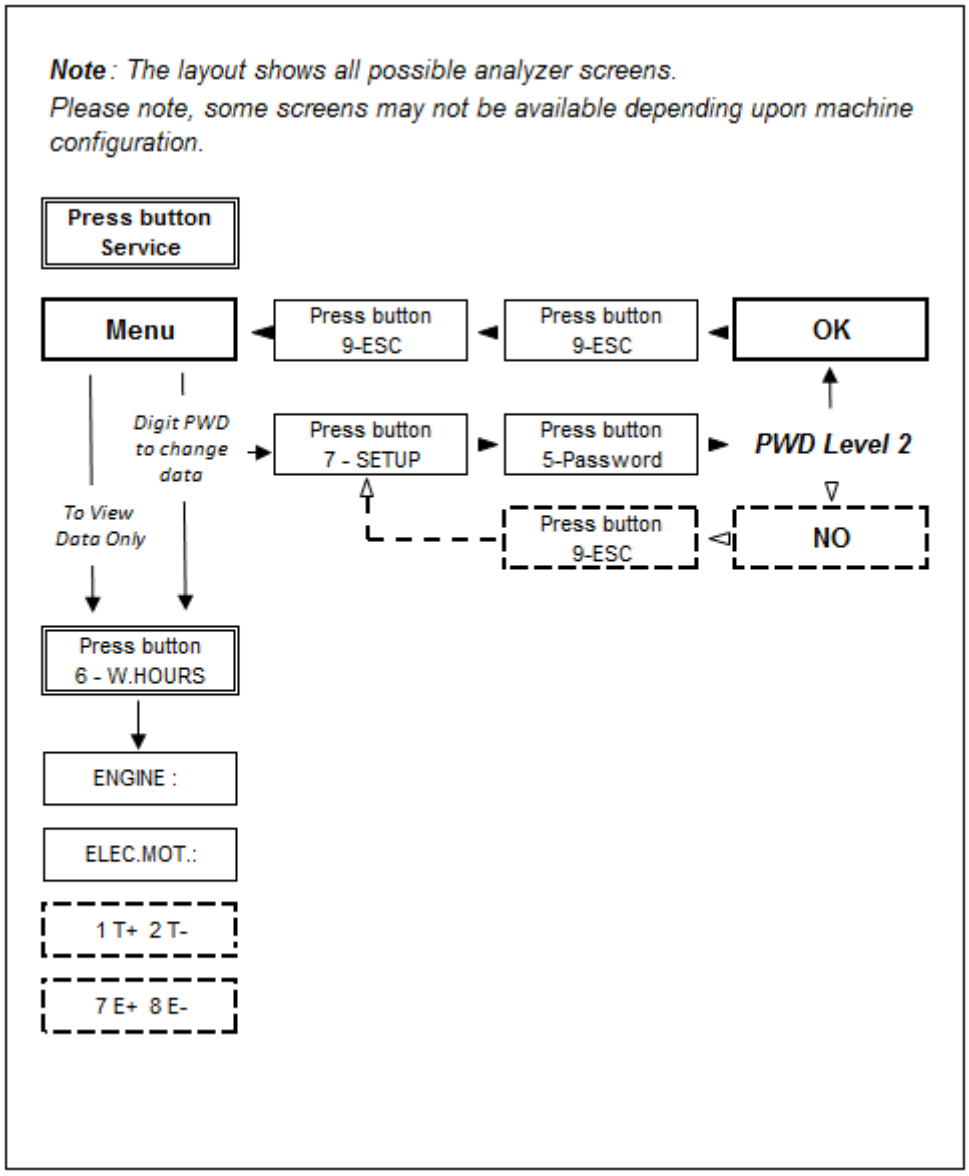
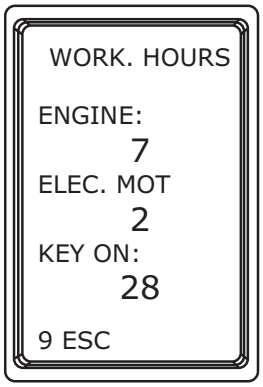


Figure 6-60. Working Hours Menu Flow Chart

To change the working hours of the Engine or Electrical Motor.



MAF00890

(SN C170001340 to Present)

1. Press button 7 "SETUP".
2. Press button 5 "PASSWORD".

   Using the remote control buttons to enter the password 7385.

NOTE: *password allow to change the Working Hours of Engine and Electrical Motor.*

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

3. Press button 9 "ESC" two times.

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

4. Press button 6"W:HOURS".

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

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

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

5. Press button 9 ESC 3 times to escape.

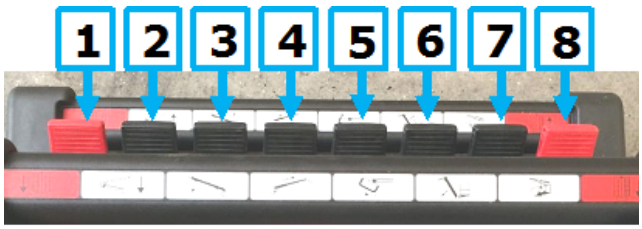
On Lithium models the Engine working HOURS will stay always 0.

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

Joystick Menu
(S/N C170001340 to Present)

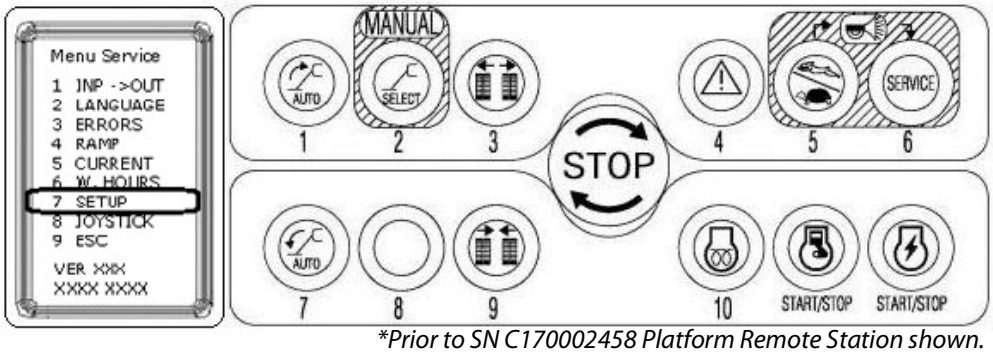
By this page it's possible to verify the proper functioning of the joysticks, once selected one joystick by buttons n.1 and n.2, joystick enumeration is indicated here below, the display will show its position, expressed in step from 0 (rest position) to 127 (joystick fully pressed up or down).

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



6.7 MACHINE SETUP MENU

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



**Prior to SN C170002458 Platform Remote Station shown.*

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

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

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

Password	Function
1883	RAMPS, CURRENTS, FIRMWARE
2857	ROATION, CHARGER, INVERTOR SETUP, TILT/ACCEL
7385	WORKING HOURS MODIFICATION
6138	LOAD
1468	DATE AND TIME MODIFICATION
3684	VERSION
4771	PEDAL, RC SPEED, RC MOV, SKYGUARD
8365	BEEPER
5216	DOUBLE SPEED
3522	ELECTRICAL MOTOR
6661	LAMPS, CHECK INCL
1138	LITHIUM SETTINGS ("BMS TEST E SERIAL NUMBER")
4538	RESET SERVICE

Table 6-7. Service Passwords

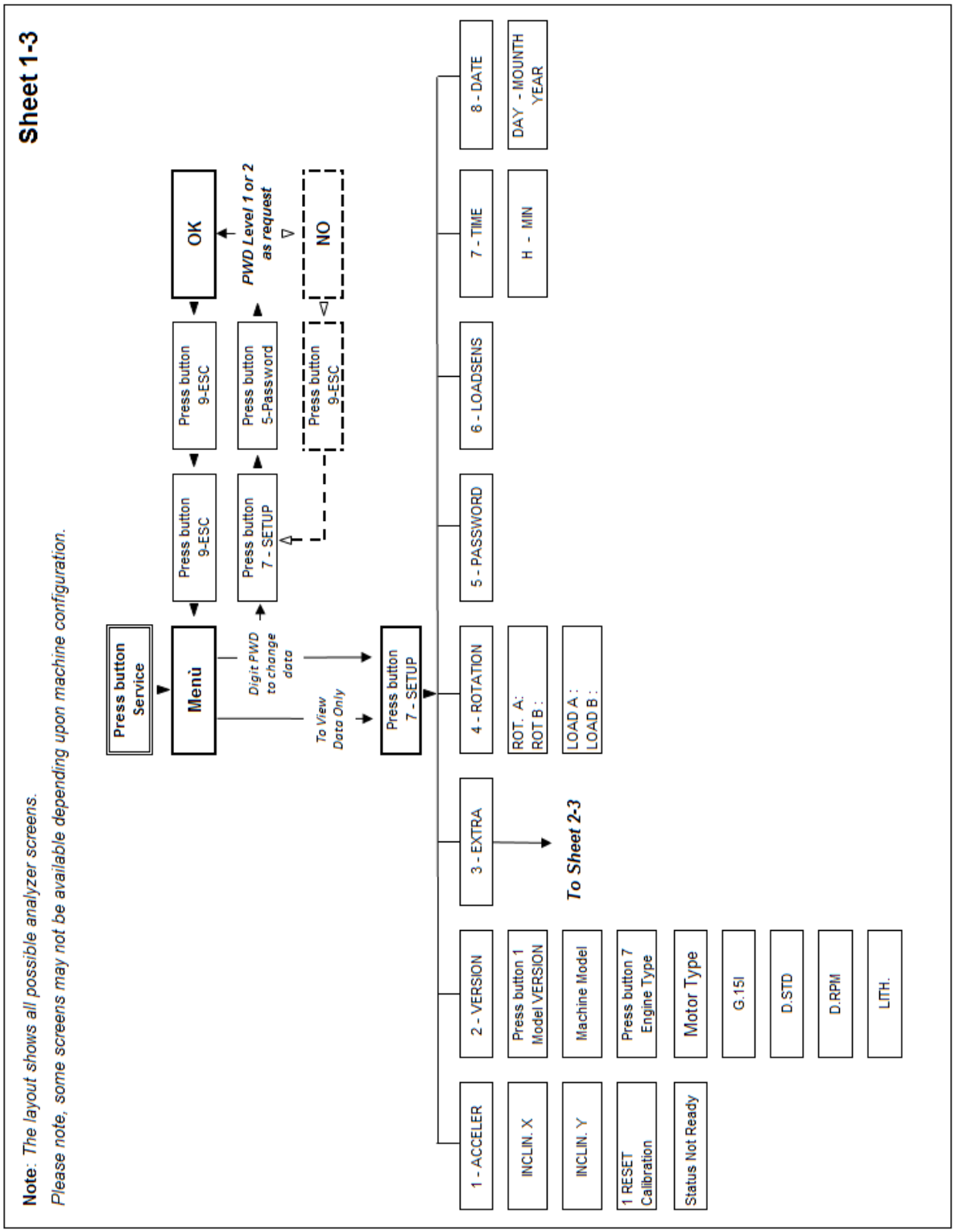


Figure 6-61. Machine Setup Flow Chart - 1 of 3

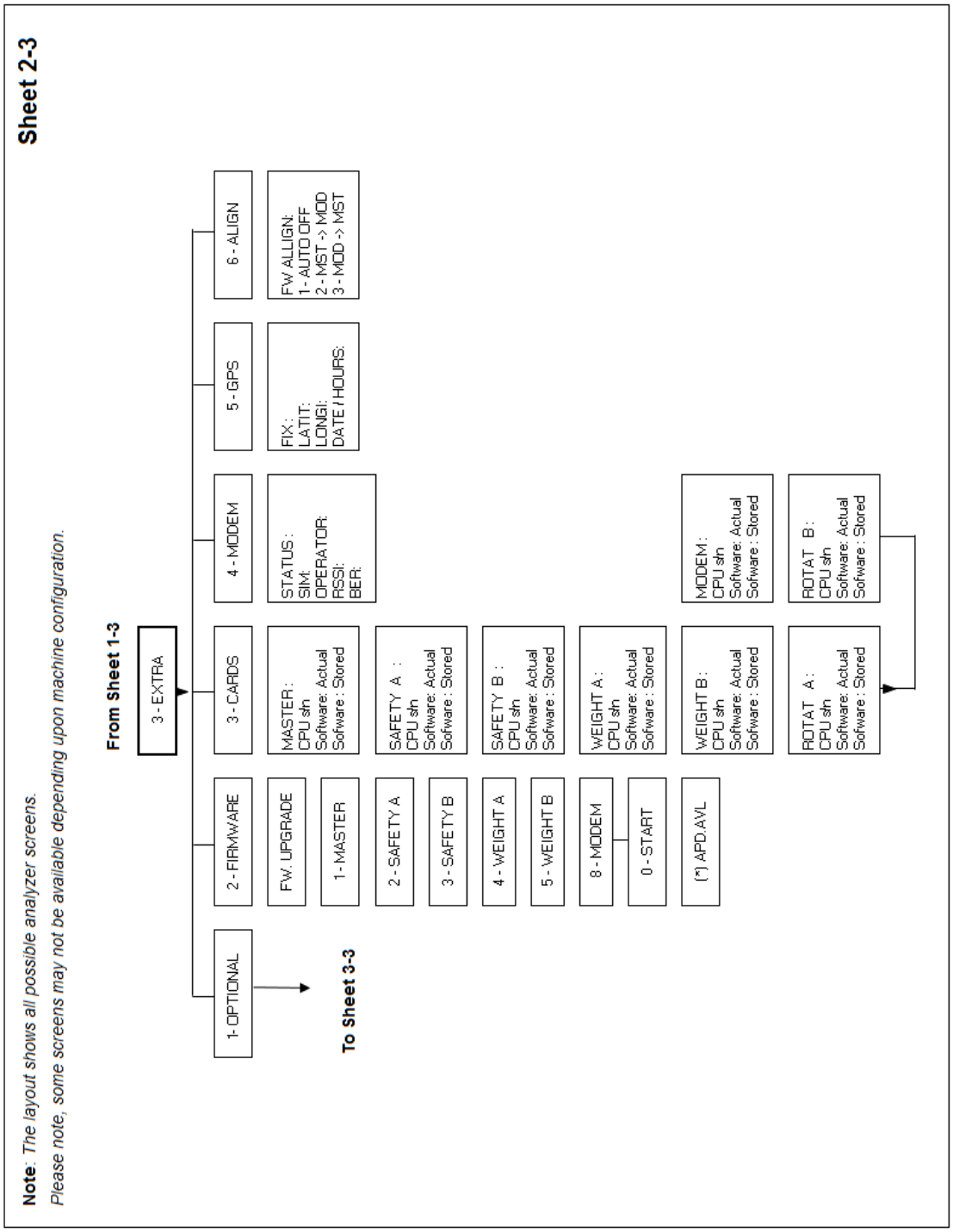


Figure 6-62. Machine Setup Flow Chart - 2 of 3

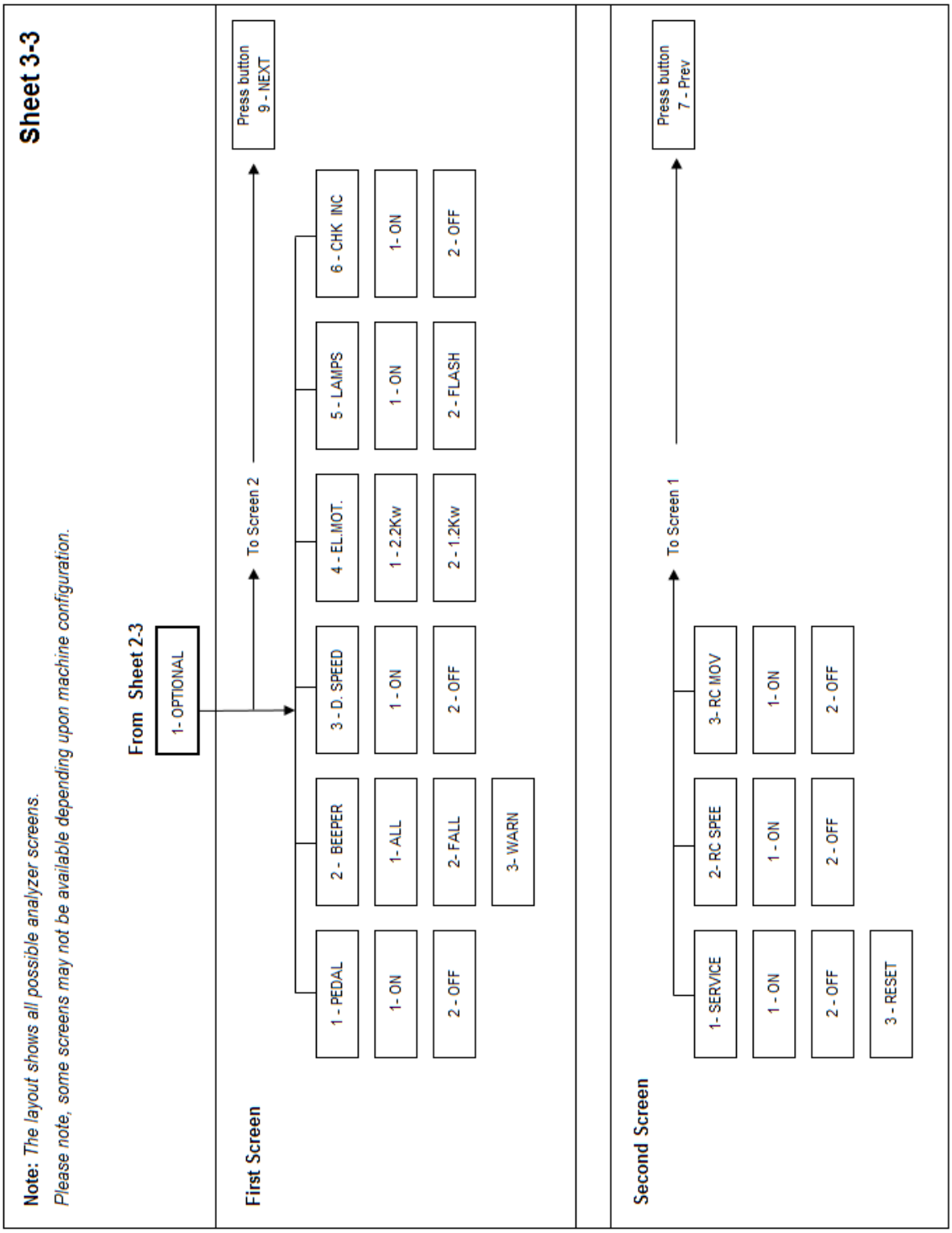


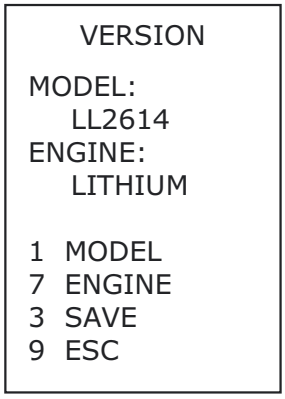
Figure 6-63. Machine Setup Flow Chart - 3 of 3

Setup - Version

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

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

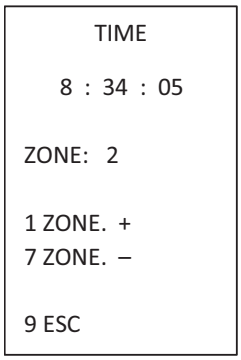
After this setting machine need to be REBOOT by the main key reset



MAF00640

Setup - Time

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

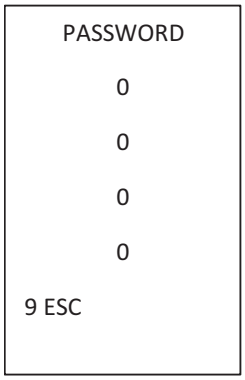


MAF00650

Setup - Password

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

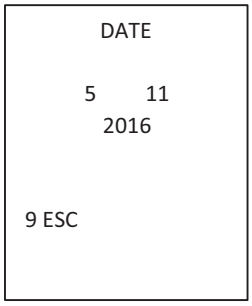
By PASSWORD page it's possible to insert the password required pressing the keyboard buttons, password are composed by 4 numbers, if password is accepted display will visualize an “OK”.



MAF00660

Setup - Date

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



MAF00670

Setup - Load Cell Board (ECM3) Calibration

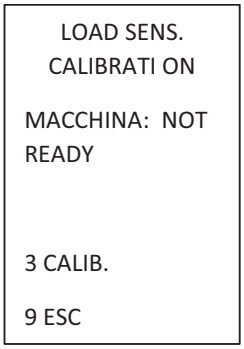
After having replaced the master board (ECM1) or the load cell board (ECM3) or having replaced the load cell sensor it's necessary to calibrate the "0" of the load cell system, by this procedure the calibration parameters relevant to the load cell sensor installed will be memorized on the ECM1.

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

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

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

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



MAF00680

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

Setup - INCLIN (Calibrating Tilt Sensor)

This menu allows the calibration of the tilt sensor.

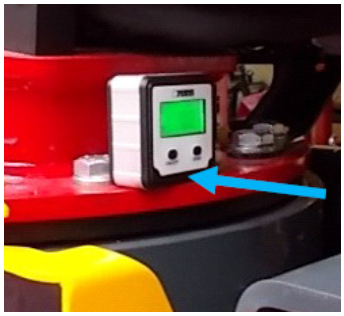
NOTICE

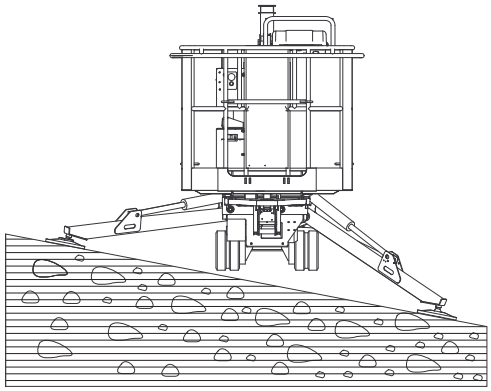
A NEW TILT MODULE WILL ACT AS IF IT IS TILTED ALL OF THE TIME UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

⚠ WARNING

DO NOT CALIBRATE THE LEVEL SENSOR EXCEPT WITH THE UNIT LEVELED ON BOTH AXIS.

1. Place a calibrated level on the slew ring surface.
2. Deploy the outriggers and level the machine using the calibrated level.





3. Enter "SERVICE" menu on the platform control station.
4. Press button 7 "SETUP"
5. Press button 5 "PASSWORD"

   Using the remote control buttons to enter the password "Level 2": 2857.

NOTE: *Password above allow to calibrate the TILT SENSOR.*

6. Press button 9 "ESC".
7. Press button 8 "INCLIN" to enter in SETUP TILT SENSOR.
8. Press Button 3 "SET" to set the TILT.

9. Switch the machine OFF.
10. Switch the machine ON, go back into the "INCLIN" menu and verify the value was set.

Tilt sensor slow response message

If you receive an error while calibrating Tilt sensor, repeat procedure. Replace Tilt sensor if error persists.

Setup - ROTATION (Calibrating Rotation Sensor)

This menu allows the calibration of the rotation sensor.

⚠ WARNING

DO NOT CALIBRATE THE ROTATION SENSOR EXCEPT WITH THE MACHINE LEVEL, OUTRIGGERS IN THE STOWED POSITION, AND THE BOOM INLINE WITH THE MACHINE.

1. Place the machine on a firm level surface.
2. Ensure boom is in alignment with machine.
3. Ensure outriggers are in stowed position.
4. Enter "SERVICE" menu on the platform control station.
5. Press button 7 "SETUP“
6. Press button 5 “PASSWORD”

   Using the remote control buttons to enter the password "Level 2": 2857.

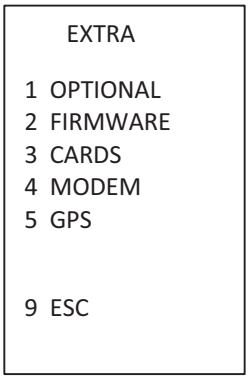
NOTE: *Password above allow to calibrate the ROTATION SENSOR.*

7. Press button 9 “ESC”.
8. Press button 1 “ROTATION” to enter in SETUP ROTATION SENSOR.
9. Press Button 1 "RESET" to set the ROTATION.
10. Switch the machine OFF.
11. Switch the machine ON, go back into the "ROTATION" menu and verify the value was set. Both values should now read 180°.

Setup - Extra

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

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

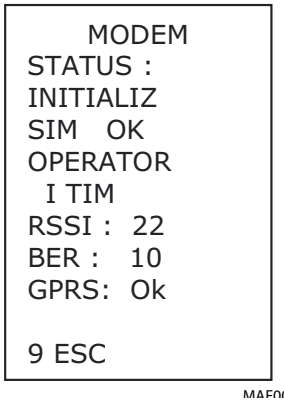


MAF00700

Setup - Extra - Modem

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

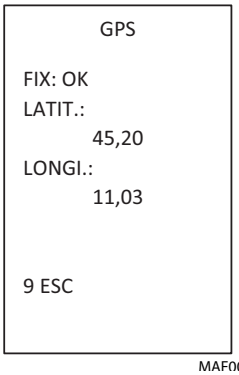
STATUS:	INIT. --> Initialization, modem is not ready to communicate. READY --> Modem is ready to communicate
SIM:	NO --> SIM CARD not present (STATUS will be INIT.) OK --> SIM CARD present
OPERATOR:	Shows the network operator, for instance TIM
RSSI:	0 - 100 --> SIM CARD operator signals, need to be over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



MAF00710

Setup - Extra - GPS

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



MAF00720

Optional (Page1)

OPTIONAL menu gives the access to other settings.

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

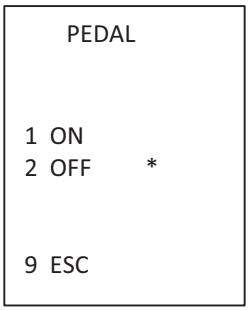
Pressing button n.8 it's possible to enter into a second page of settings, shown below.

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

MAF00730

Pedal

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



MAF00740

Beeper

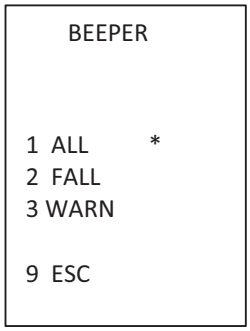
By this page, if is installed the optional warning buzzer, it's possible to set the motion alarm, after having inserted the relevant password "8365".

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

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

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

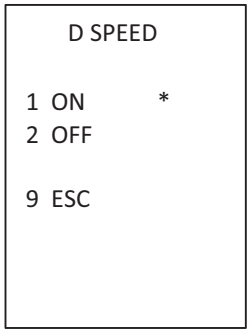
If it's selected WARN the warning buzzer is activated in the same condition or the remote control beeper.



MAF00750

Second Speed

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

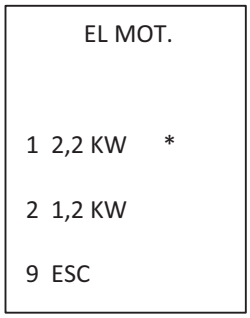


MAF00760

Electric Motor

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

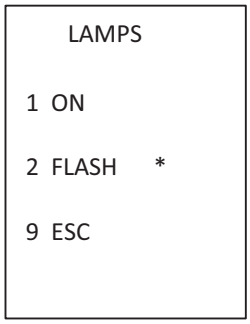
The main difference between the two settings is in the auto-stabilization procedure steps timing.



MAF00770

Lamps

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



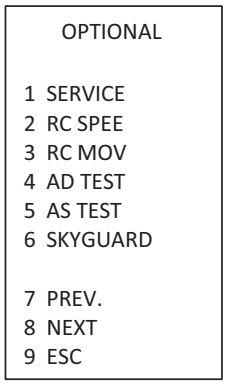
MAF00780

Optional (Page 2)

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

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

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



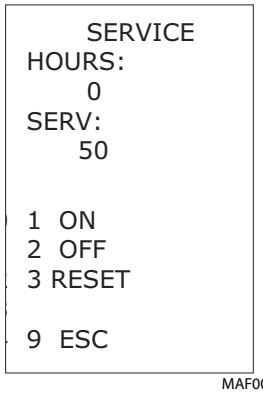
MAF00790

Service

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

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

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

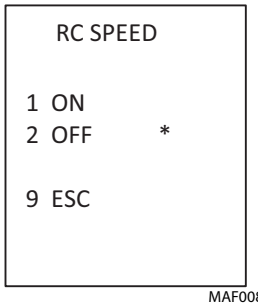


MAF00800

RC Speed

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

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

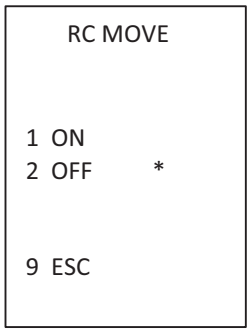


MAF00810

RC Move

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

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



MAF00820

AD Test

Not consider.

AS Test

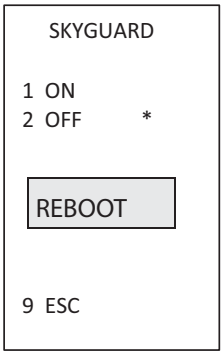
Not consider.

Skyguard

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

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

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



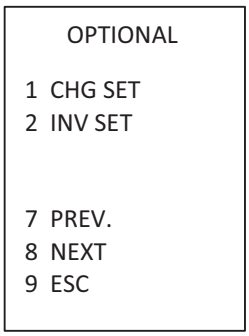
MAF00830

Optional (Page 3)

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

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

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

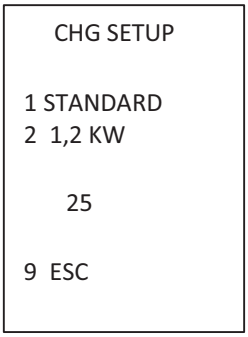


MAF00840

CHG Set

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

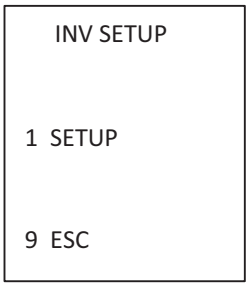
This setting, considering the transformation rate, has to respect the maximum current available on local electric plug.



MAF00850

INV Set

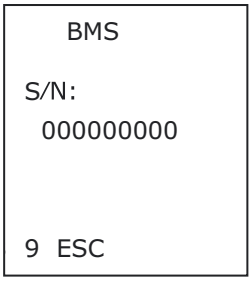
For a lithium machine, by this page it's possible to setup the rpm setting for a new inverter, pressing button n.1 the rpm setting will be settled according to the machine model settled by the relevant menu, check chapter 10.1.9.2.



MAF00860

BMS Set

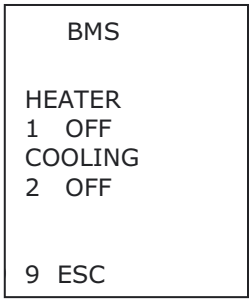
For a lithium machine, by this page it's possible to set the bms serial number, it has to be done in case of bms replacement.



MAF00870

BMS TST

For a lithium machine, by this page it's possible to test the lithium cells heaters by pressing button n.1, and test the fans of cooling system by pressing button n.2, in both the cases they will be working with a countdown of 30 seconds.

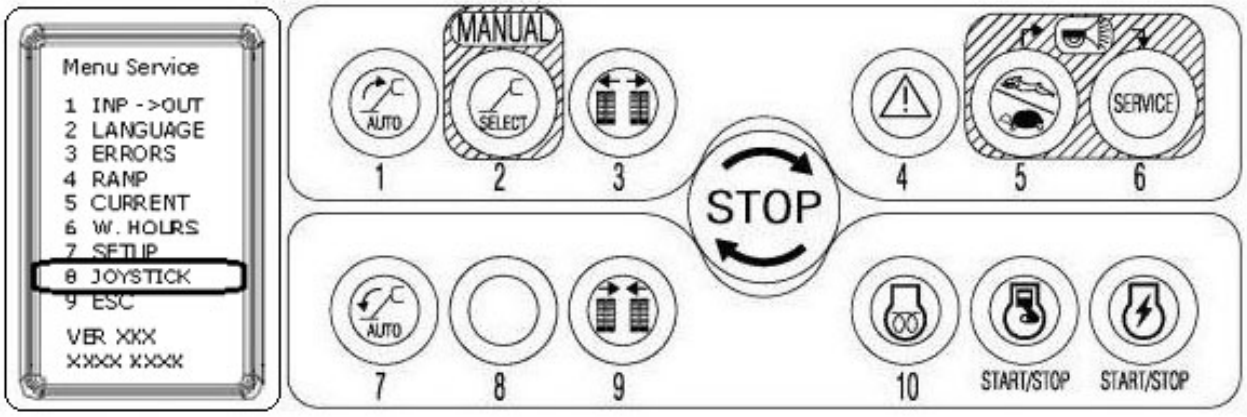


MAF00880

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

6.8 JOYSTICK

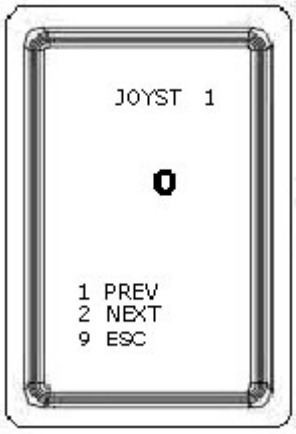
From the SERVICE menu, pressing button 8 "JOYSTICK" accesses the menu JOYSTICK to visualize the numeric values.



Engine Key Switch ON.

USE Buttons 1 or 2 to choose the JOYSTICK.

Joystick Neutral position
Value = 0



Joystick Fully stroking (both direction)
Value = 127

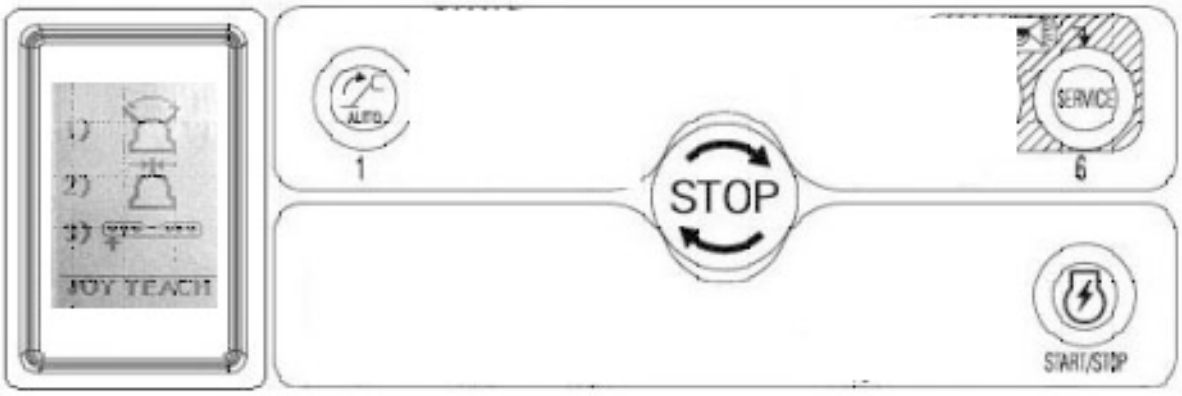
6.9 CALIBRATING JOYSTICK

This menu allows the calibration on Joystick replacement.

NOTICE

A NEW JOYSTIC WILL ACT AS IT IS AWAITING UNTIL THE FOLLOWING PROCEDURE IS PERFORMED.

1. Turn Engine and Electrical Motor OFF.
2. Press at the same time the 3 buttons below for at least 7 seconds, until "JOY TEACH" appears.
3. Move each Joystick fully stroking on both direction.
4. Press Button 7 to escape.



SECTION 7. GENERAL ELECTRICAL INFORMATION & SCHEMATICS

7.1 GENERAL

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

NOTICE

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

7.2 MULTIMETER BASICS

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

Grounding

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

Backprobing

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

Min/Max

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

Polarity

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

Scale

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

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

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

µ = micro = (Displayed Number) / 1,000,000

Example: 1.2 kΩ = 1200 Ω

Example: 50 mA = 0.05 A

Voltage Measurement

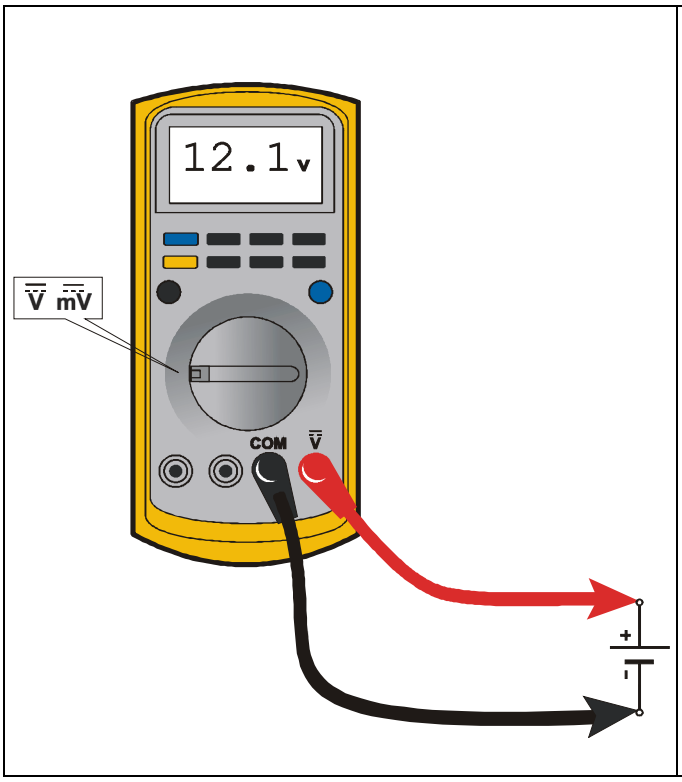


Figure 7-1. Voltage Measurement (DC)

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

Resistance Measurement

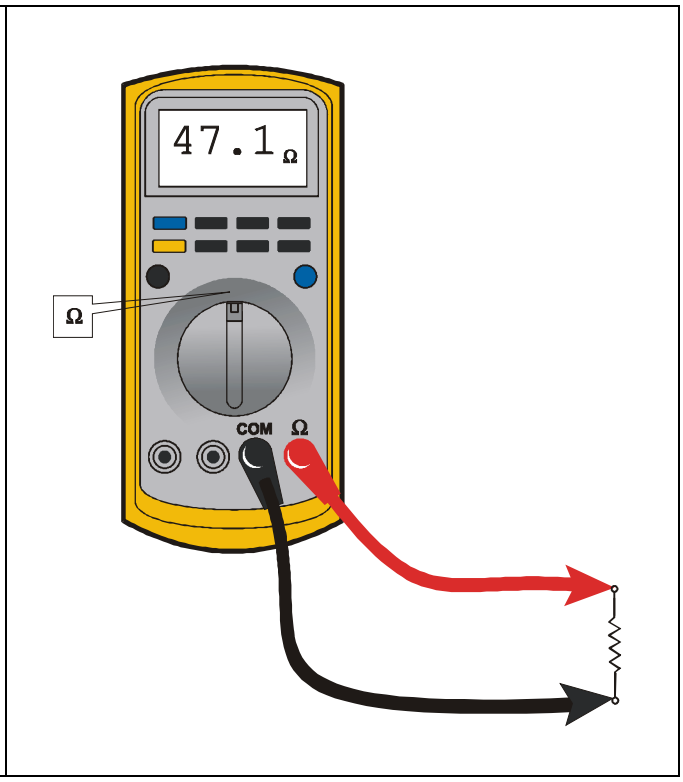


Figure 7-2. Resistance Measurement

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

Continuity Measurement

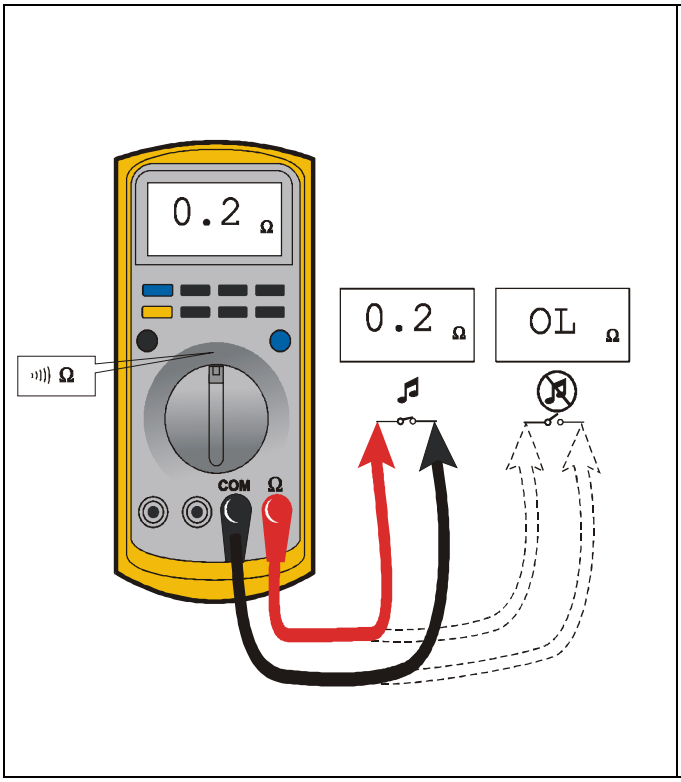


Figure 7-3. Continuity Measurement

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

Current Measurement

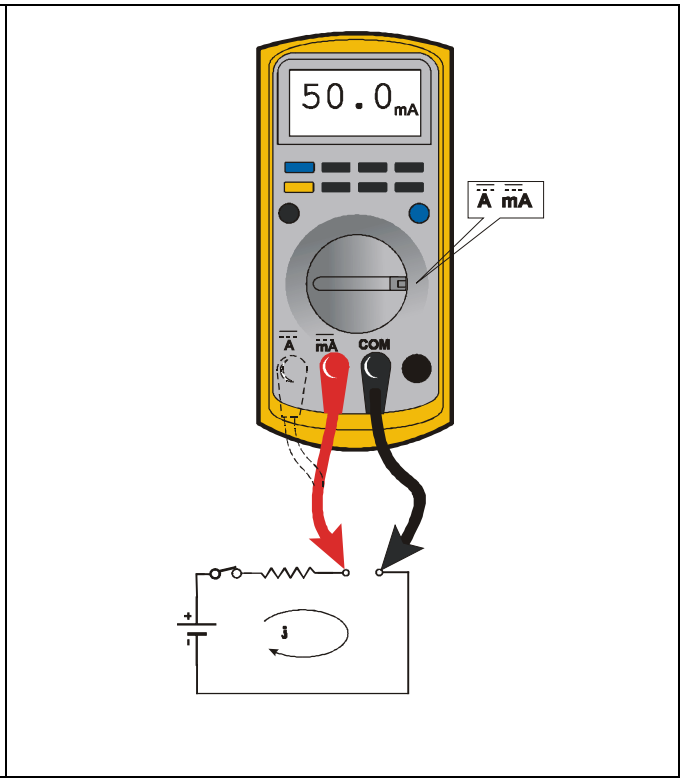


Figure 7-4. Current Measurement (DC)

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

Continuity Measurement Over Long Distances

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

Requirements:

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

Procedure

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

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

1. Disconnect all connections associated with the wire under test and the two additional wires. If harness is not completely isolated disconnect battery terminals also, as a precaution.
2. Measure continuity between all three wires, the wire under test, wire #1 and wire #2. These should be open. If not, repair the shorted wires or replace the harness.
3. On one side, jumper from contact of wire #1 and wire #2.
4. Measure continuity between wire #1 and wire #2. If there is continuity, both wires are good and can be used for this test. If there is not continuity, either wire could be bad. Check connections and measurement setup. Redo measurement. If still no continuity, repair wires or consult schematic for other wires to use for test.
5. Jumper from wire under test to wire #1.
6. Measure continuity. If there is continuity, the wire under test is good. Resistance of a wire increases as the length increases and as the diameter decreases.

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

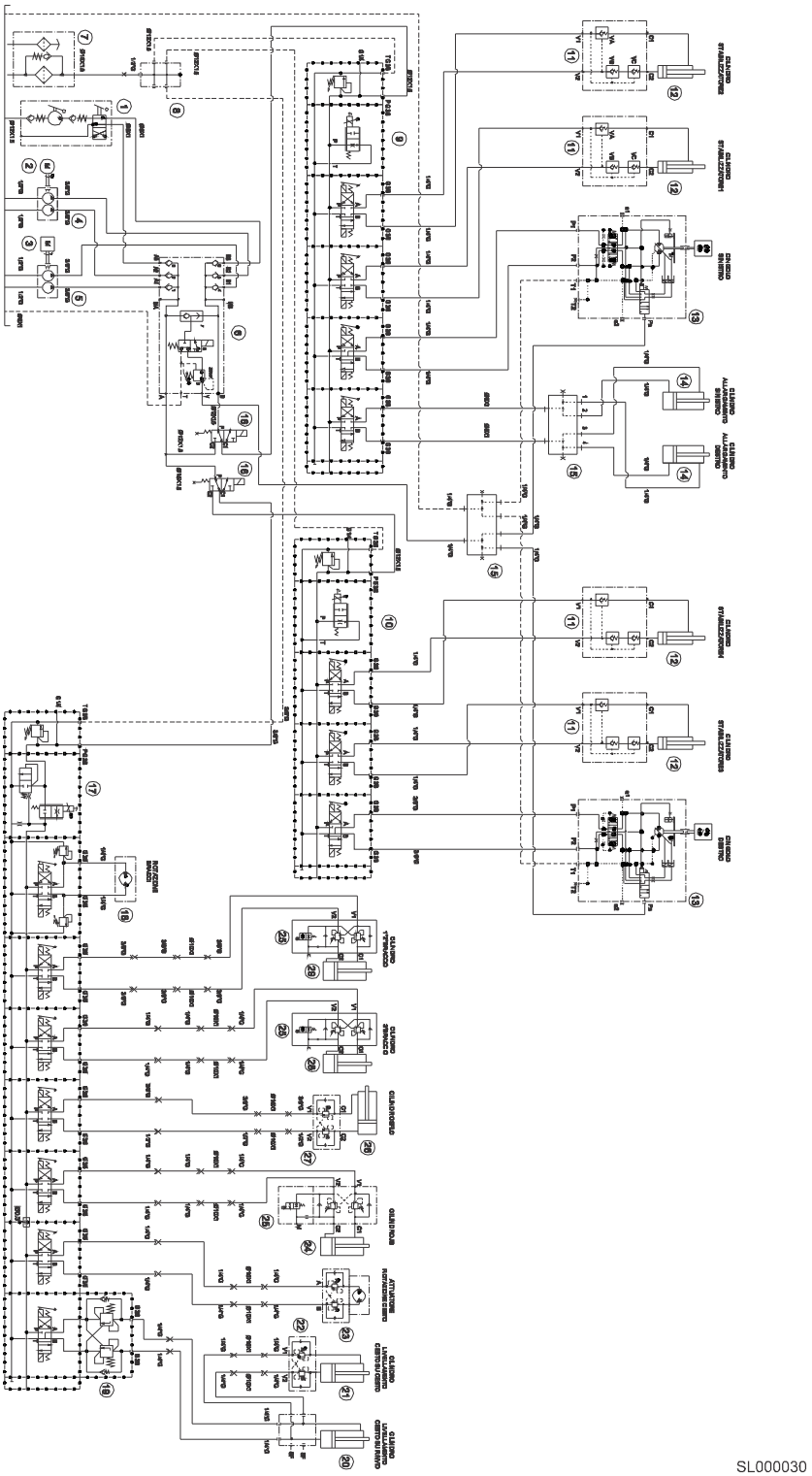
7.3 ELECTRICAL SUPPLEMENT MANUALS

The electrical supplement manuals are separate from this manual. They are available online (Online Express or www.jlg.com - Manuals).

Here is a listing of the supplement manuals available:

Lithium Supplement Manual - 31215460

7.4 HYDRAULIC SCHEMATIC



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Corporate Office
JLG Industries, Inc.
1 JLG Drive
McConnellsburg, PA 17233-9533 USA
(717) 485-5161 (Corporate)
(877) 554-5438 (Customer Support)
(717) 485-6417

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